The Long-Term Effect of Natural Disasters on Conflict Onset in Sub-Saharan African Nations: How One Variable Can Create Two Conflicting Consequences

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Table of Contents

Introduction and Literature Review

This thesis will study the effect extreme weather conditions have on the emergence of group conflict. Climate change is a topic of large concern this day and age, but there is more to it than just the depletion of the ozone layer. According to the Fifth Assessment by the IPCC, human-induced climate change will leave a great impact on natural systems, which can create a larger likelihood for natural disasters such as flooding.[1] With the world facing a greater risk in extreme weather conditions, it is important to study what further consequences can follow at a sociopolitical level, as opposed to simply a materialistic level. There are many studies that take a look at lower levels of analysis such as poverty or government regime being a cause of conflict, but it is also important to to take a step back and look at an even bigger picture. By studying something much more exogenous, such as weather conditions and its relationship with conflict onset, we may gain a better understanding of how conflicts come about as well as how they may change when climate change takes an even bigger toll. My paper will focus on showing that countries that face generations of extreme weather conditions will produce more cooperative tendencies and thus, be less likely to have conflict. Studies that take a similar stance, fail to recognize the importance of how long it may take for cooperative tendencies to form. Thus, my study will contribute a more deep-rooted and a more broad view of this topic.

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[1]Pachauri, R. K., and L. A. Meyer. "IPCC Fifth Assessment Report: Climate Change Synthesis Report." *Intergovernmental Panel on Climate Change*, 2013, 8.
https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf

Literature Review

There are quite a few studies on the relationship between the environment and conflict onset. However, large scale-N and more qualitative studies only began around the 1990s. Previous to then, there were many case-by-case studies which focused quite narrowly on specific nations or areas. While this contributes specific evidence to academia, these studies are unsystematic and unscientific. Therefore, my research will mostly take a look at previous literature from 1990 and onwards.

There are essentially two opposing positions in the current literature. For clarity sake, I will divide and label these two as the 'More Conflict' side and the 'Less Conflict' side. The More Conflict side argues that areas subjected to harsh environmental conditions can make conflict more likely. Less Conflict argues that being subjected to such conditions, instead, facilitates cooperation and, thus, are not more prone to more conflict. However, many studies limit their frame to only a few years or a couple decades, as opposed to multiple generations. Each study varies in what type of environmental conditions are studied such as rainfall variation, natural disasters, land degradation, deforestation and others, demonstrating that there is a considerable variety of weather conditions that can be studied to determine effects on conflict.[2] The choice in what type of weather condition I study as my independent variable will be specified in the Research Design.

The More Conflict side is backed by numerous different works. As but one example, a study on social conflict in Africa and its connection to climate change and rainfall concluded that deviations from normal rainfall patterns can increase the likelihood of disruptive activities and/or

[2] Hendrix 2000, Slettebak 2012, Hauge & Ellingsen 1998

organized rebellions.[3] Specifically, the study identified rainfall levels to have an effect on civil war and insurgency; more specifically, extremely wet conditions tend to lead to more violence than extremely dry conditions. It was also found that nations subjected to land degradation are more prone to civil conflict.[4]

On the other side, the Less Conflict side, studies on water resources and conflict onset have argued that water as a resource can instead facilitate cooperation. In a study of international waterways and shared rivers, it was agreed that there is less of an incentive to fight over water as a resource because the benefits would not outweigh the costs.[5] Water, being a natural resource controlled by weather conditions that cannot be entirely controlled nor facilitated by institutions, makes it difficult to "win". This coincides with Fearon's argument on war, where rational actors would rather not go to war than go to war if the costs outweigh the benefit; Fearon points out that many times countries still do end up going to war, regardless of whether the costs outweigh the benefits, due to inability to confirm their opponents commitment and credibility.[6] Yet, with the spoils being difficult to control, Wolf also points out how, when it comes to water, everyone has aligned interests: to have a healthy stream-system and/or high water quality.[7] When both parties have aligned interests, again as Fearon points out, it is best to compromise as opposed to the alternative of conflict. Thus, it is unsurprising that there have been significantly more water dispute resolutions as opposed to conflicts. The UN Food & Agriculture Organization identified

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[3] Hendrix, Cullen S, and Idean Salehyan. "Climate Change, Rainfall, and Social Conflict in Africa." *Journal of Peace Research* 49, no. 1 (2012): 35-50. http://www.jstor.org/stable/23141278.

[4] Wenche Hauge, and Tanja Ellingsen. "Beyond Environmental Scarcity: Causal Pathways to Conflict." *Journal of Peace Research* 35, no. 3 (1998): 299-317. Accessed December 9, 2017. http://journals.sagepub.com/doi/pdf/10.1177/0022343398035003003#articleCitationDownloadContainer.

[5] Wolf 1998, Toset, Gleditsch & Hegre 2000

[6] Reiter, Dan. "Exploring the Bargaining Model of War." *Perspectives on Politics* 1, no. 1 (2003): 27-43. http://www.jstor.org/stable/3687811.

[7] Wolf, Aaron T. "Conflict and Cooperation Along International Waterways." *Water Policy*. Vol. 1, no. 2 (1998): 7. http://cawater-info.net/bk/water_law/pdf/wolf_e.pdf

3600+ treaties in relation to international water resources from 805-1984 and since 1814, 300 treaties have been negotiated. Whereas only about seven "water war" incidences have been identified in modern history.[8]

While these cases have provided significant findings in support of natural environmental factors affecting social conflict, there lacks a more sociological argument ,such as what is found by RT Slettebak. Slettebak's study integrates sociological findings into this field of study which argues that post-disaster behavior leads to lower antisocial behavior during as well as after disasters, thus, promoting the hypothesis that countries who face climate-related natural disasters have a lower risk of civil war.[9] So what exactly about these environmental conditions causes people to have less conflict? How can the natural world change the behavior of people overtime?

[8] Wolf, "Conflict and Cooperation Along International Waterways.": 1.
[9] Slettebak, Rune T. "Don't Blame the Weather! Climate-related Natural Disasters and Civil Conflict." *Journal of Peace Research* 49, no. 1 (January 31, 2012): 163-76. Accessed December 9, 2017. http://journals.sagepub.com/doi/abs/10.1177/0022343311425693#articleCitationDownloadContainer.

Theory and Hypothesis

I hypothesize that exposure to extreme weather conditions over a lengthy period of time will lower the risk of conflict for two distinct reasons. The first reason follows from the idea that conflict is very costly, and so for a group to go into conflict with another group when extreme weather conditions have already presented high costs seems unlikely. In nations that are subject to disruptive weather conditions, non-state conflict will be less likely to occur because it will be too costly given the strains of weather-caused damage. Instead, such countries will find it more beneficial to cooperate with others or to simply abstain from conflict. This reasoning would therefore, not include state conflicts. Governments hold the duty of promoting welfare during times of normalcy and especially, in times of crisis. During times of instability where the government fails to relieve, groups would have more to gain in fighting their government since they would have nothing to lose. Riots and conflicts against a government hold a more valid reason to sacrifice since the government holds responsibility to people. Yet, with other groups, this obligation does not exist. Therefore, it seems more rational for groups to not conflict with other groups since the natural disasters has created enough costs. This opposes my reasoning in that the choices presented to groups post-disaster make it more costly than conflict with others than to not conflict. Yet, in the case of state conflicts, sometimes it may be more beneficial to a group to engage with a government than to not.

The second reasoning behind my hypothesis is that nations who have faced extreme weather conditions numerous times over generations would develop more cooperative cultures and thus, be less prone to conflict. This reasoning follows the idea that in times of need people are more likely to be able to put aside differences and work together. From these moments of

cooperation that result from natural disasters, it would create better relations amongst different groups, therefore, make non-state wars less likely. While it may have been found that natural disasters create instability in the economy and therefore, makes the outbreak of conflict more likely, other studies have found that the long-run result indicates that natural disasters actually promote capital accumulation and economic growth.[10] Also, there are many psychological studies that show warmer weather results in greater life satisfaction, more pleasant moods and other more positive ramifications.[11] That being so, it seems reasonable to assume that droughts, while they can be devastating to economies, may also bring people together. My study will differ from other studies in that it will look at a longer time frame of environmental conditions in order to test for a long-run effect rather than a short-run effect. Most studies look at environmental conditions for fifteen, thirty or fifty year periods; in this time frame, natural disasters appear to have a positive correlation with conflict onsets. However, I believe that in taking more of a long-run approach to this study, it will result in a negative correlation with conflict onset. In order to gauge how weather conditions can have an overall long-term effect on a group's habits in collaboration, a historical viewpoint is required. This historical method will likely show that groups will learn to cooperate with one another and be able to compromise more than groups that have not faced such disasters, resulting in fewer conflicts than the latter.

Extreme weather conditions such as flooding and drought that are highly impacted by climate change can cause large enough disruptions in society to promote political unrest. Yet, sociologist David Durkheim argued that greater social disturbances actually tend to increase

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[10] Skidmore, Mark, and Hideki Toya. "Do Natural Disasters Promote Long-Run Growth?" *Economic Inquiry* 40, no. 4 (2002): 664-87. Accessed February 8, 2018. https://econpapers.repec.org/article/oupecinqu/v_3a40_3ay_3a2002_3ai_3a4_3ap_3a664-687.htm.

[11] Kasper & Borgerhoff Mulder 2015, Schmiedeberg & Schroeder 2013, Keller 2005

social integration.[12] Studies on the aftermath of the Halifax explosion as well as the WWII bombing found that there is an increase in social cohesion and that people commonly identify as sufferers together, therefore creating a "community of sufferers".[13] Because natural disasters are one-sided, meaning there is no belligerent that chooses to inflict the disaster upon an area, it is seen as an unfortunate event rather that could not be helped. People cannot help but come together in the midst of their misfortune and try to ameliorate the situation.

I am hoping to reveal that prolonged exposure to variation in weather conditions can have a long-term effect on groups, creating a culture of cooperation amongst affected groups. The term 'culture' must be used very loosely, however, as it is difficult to prove that a culture has formed because there are many elements that can affect it. Thus, it cannot be easily argued that a single factor like floods or droughts caused such a culture to blossom, rather just an influence. For the sake of clarity in this study, however, I will use the term culture to describe the tendencies a group may develop in terms of their approach to conflict and cooperation.

[12] Slettebak, "Don't Blame the Weather! Climate-related Natural Disasters and Civil Conflict.": 164.
[13] Ibid., 164.

Research Design

Floods and droughts are among the most frequent as well as devastating natural disasters to occur in Sub-Saharan Africa. It is important to limit this study to focus on third world nations such as Sub-Saharan Africa because while many may see natural disasters as being random, the reality is that natural disasters affect poorer places more than the wealthy. Gleditsch also points out how it is important to specifically focus this subject on the "third world where climate change matters the most".[14] In Sub-Saharan Africa, there is a large amount of economic and population growth occurring alongside a great dependence on "variable and unpredictable rainfall patterns".[15] If such growth is not met with equal resource maintenance, water can become scarce as a resource for food and energy. Hauge and Ellingsen's study concluded that scarcity of fresh water supply creates more risk for low-level domestic conflict.[16] Yet, Humphreys' study on the relationship between resource dependency and violence reveals that when natural resources are threatened, there is a greater incentive to end conflict rather than for wars to be prolonged or negotiations to be made more difficult.[17] Whichever may turn out to be true through this study, it is important to study the impact a history of rain-related disasters can have on ethnic conflict. If such an impact does create more conflict, one must strive towards preventative measures; but if it, instead, has an opposite impact where there tends to be more cooperation than conflict, then

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[14] Gleditsch, Nils Petter. "Whither the Weather? Climate Change and Conflict." *Journal of Peace Research* 49, no. 1 (January 31, 2012): 3-9. Accessed December 9, 2017. http://journals.sagepub.com/doi/abs/10.1177/0022343311431288.

[15] WWAP (United Nations World Water Assessment Programme). "The United Nations World Water Development Report 2015: Water for a Sustainable World." Paris, UNESCO. Assessed December 10, 2017.

[16] Wenche Hauge, and Tanja Ellingsen. "Beyond Environmental Scarcity: Causal Pathways to Conflict.": 303.

[17] Humphreys, Macartan. "Natural Resources, Conflict, and Conflict Resolution: Uncovering the Mechanisms." *The Journal of Conflict Resolution* 49, no. 4 (2005): 508-37. http://www.jstor.org/stable/30045129.

this cooperative proclivity can be studied and used towards other issues such as resource distribution or improvement of infrastructure.

In addition to looking at a longer time frame of historical weather data, I am also focusing on conflicts at the group level or, in other words, conflicts that do not involve governments. By looking at the behavior and tendency of non-governmental groups, it will reveal the mannerism of the group towards discords. My hypothesis is limited to non-state conflicts because those conflicts involving the government do not follow the logic of a formed cooperative culture reducing conflict propensity. Governments, while they are affected by community culture, are also subject to more factors such as administrative logistics, outside influence and pressure, and so forth. Also, if state conflicts were to be included, it would show a great frequency of conflicts, that may skew the data from representing my theory. As mentioned before, when a group faces immense losses due to extreme weather conditions, they likely have more to gain in going against the government in pursuit of improvement of conditions since they have little to nothing to lose. Also, state conflicts can involve interstate affairs, global economics or international affairs, which involve much more complex factors that can hinder or obstruct cultural traits from holding influence. State conflicts do not pertain to my theory because I am making a cultural argument. This culture does not materialize the same way in governments as it does in groups because government are affected by many other elements that may hinder the cultural aspect.

However, in terms of non-state conflicts, which is defined by Uppsala Conflict Data Program dataset as conflicts involving “communal and organized armed conflict where none of the parties is the government of a state”, groups that have little to no power in improving the

conditions damaged by weather would have no concern in fighting amongst one another.[18] CS Hendrix's study in 2000 found that changing weather patterns increases the likelihood of disruptive activities such as "demonstrations, riots, strikes, communal conflict and anti-government violence".[19] Since most of these are disruptive acts against the government, it does not address my hypothesis. Therefore, I believe if the experiment was adjusted to look at the effect on non-state conflicts, a relationship between weather variability and conflict would be negative, rather than positive. Another reason to look at the group-level is that it will provide me with more data than looking at the country-level since Sub-Saharan Africa would only include about forty countries. By expanding to the group level this would provide more variation compared to only looking by country.

Independent Variable

The independent variable in this study is the total amount of floods and droughts that have occurred in a country from 1900-1989. I use the EM-DAT International Disaster Database created by the Center for Research on the Epidemiology of Disasters (CRED). It has compiled data on two generic categories of disasters, natural and technological. For my research, I will focus on natural disasters. EM-DAT is structured so that in order to classify as a natural disaster, one must meet at least one of four criterias: ten or more people reported killed, one hundred or more people reported affected, declaration of a state of emergency, or call for international assistance.[20] Affected is defined as "people requiring immediate assistance during a period of

[18] Uppsala Conflict and Data Program. "UCDP Non-State Conflict Dataset". Sundberg, Ralph, Kristine Eck and Joakim Kreutz (2012), Allansson, Marie, Erik Melander & Lotta Themnér (2017). *Journal of Peace Research 49.* Uppsala University.
[19] Hendrix, "Climate Change, Rainfall and Social Conflict in Africa.": 1.
[20] D. Guha-Sapir, R. Below, Ph. Hoyois. "Explanatory Notes." EM-DAT: The CRED/OFDA International Disaster Database. Université Catholique de Louvain. Brussels, Belgium.

emergency, i.e requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance".[21] The types of natural disasters I will be looking at include flood, which includes coastal floods, flash floods and riverine floods, and drought. Droughts are difficult to measure because of they usually take place over extended periods of time. However, EM-DAT resolves this difficulty through defining drought by "the degree of precipitation reduction" which varies by locality, climate and environmental sector.[22] The total amount of floods, flash floods and droughts will be measured throughout 1900-1989 because this will reveal the long-term effect. If one were to look at the annual amount of disasters, this would reveal more of a short-term effect.

The reasoning behind the time frame of 1900-1989 is because I wanted to go as far back as possible into the past so that I can test whether a "culture" of cooperation develops. Cultures take a very long time to form. Therefore, my independent variable must develop for many years to see if there is a long-term effect on my dependent variable. Also, very few datasets provide as extensive information as EM-DAT and none go back further than 1900.

A difficulty in the independent variable was finding weather disaster data at the regional level. Most databases offer worldwide/Africa-wide historical data only at the country level. Those that do disaggregate to the sub-national level, only do so for some regions and is limited to thirty years of information. While it would be of more help to look at weather from the regional

[21] Ibid. EM-DAT also reveals the estimated damage by a specific natural disaster and so this may be an interesting addition to take a look at for further expansion.
[22] D. Guha-Sapir, R. Below, Ph. Hoyois. "Glossary." EM-DAT: The CRED/OFDA International Disaster Database. Université Catholique de Louvain. Brussels, Belgium.

perspective, it would limit not only my sample size but also my desire to look at a longer, historical time frame.[23]

Dependent Variable

The dependent variable will be measured through Uppsala Conflict and Data Program's data on non-state conflicts as well as UCDP Georeferenced Event Dataset (GED) from 1989-2016. The total amount of non-state conflicts will be recorded once again, as opposed to annual or any average because the amount of non-state conflict is quite small compared to other types of conflicts. I will record the raw amount of conflicts that occurred in the time period because I want to measure how many conflicts occur throughout my whole specified time period. Taking the average or looking at annual measures would be unnecessary, since I only want to see the amount of conflicts that result. Since I am taking a more long-term approach to this study, I believe it is important to take a look at the entirety of my conflict period. Breaking the period down by year may compromise the bigger picture I am trying to discern. The conflicts are classified by not just the involved parties but also a minimum of twenty five battle related deaths in a year. The GED will be utilized to access longitudes and latitudes of where conflicts had occurred.

It is important that the conflict period is after the disaster period, therefore, conflicts will be observed after 1989. By creating such a continuation, I am hoping to see whether a pattern will occur in which a certain amount of conflicts occur from the independent variable's time frame that leads to a certain amount of conflicts in the following years. This organization will

[23] EM-DAT guidelines state the latitude and longitudes of disasters can be found, however, I was not been able to access such descriptions through the database. I had tried to get in contact with the Center for Research on the Epidemiology of Disasters in hopes of being able to access such information, but to no avail and so my data for the independent variable will have to remain at the country-level.

hopefully allow one to see a continuous stream of a developing (improving or worsening) sense of cooperation in terms of conflict onsets.[24]

Control Variables

Variables that will be controlled in this study will be quite limited. The reason for this is because in order for a variable to be considered an alternative factor, it must have an effect on both the independent and dependent variable. My independent variable is exogenous. However, there are a few exceptions. Economic development can have an effect on both weather conditions and conflict onset. Greater economic development can mean more industrialization, more emission of greenhouse gases as well as more political issues for groups to fight over, more money to pay the cost of war and more ability to mobilize. Therefore, I will be controlling for average GDP per capita from 1989-2016.[25] GDP per capita is measured by gross domestic product divided by midyear population.

Other controlled variables include urbanization and mountainous terrains. Urbanization will also be taken from the World Bank and averaged from 1989-2016. Urbanization is measured by growth of Urban population by annual percentage. Urban population is defined as "people living in urban areas as defined by national statistical offices. It is calculated using World Bank

[24] An interesting addition that may also be considered for future studies is taking a look at the organization level of the involved groups. There are three defined levels: formally organized groups, informally organized groups that are composed of supporters and affiliates to political parties and candidates, and informally organized groups that share a common identification.# However, for this thesis and its limits, I will stick to a single layer.

[25] GDP is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. "GDP per Capita (current US$)." The World Bank. Accessed December 11, 2017. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD.

population estimates and urban ratios from the United Nations World Urbanization Prospects."[26] Mountainous terrain is derived from Fearon and Laitin's data from 2003 which measures the percentage of the land that is made up by mountainous terrains.

Ethnic and cultural fractionalization are also included as controlled variables. While these factors may not have too large of a connection to natural disasters, I believe their strong connection to conflicts makes them important to include in this study. Perhaps including these factors can lead to a realization that ethnic and cultural fractionalization is influenced by natural disasters. Perhaps some ethnic or cultural groups reside in areas that are more prone to natural disasters. While these factors may not be as closely related to the IV and DP as the other controls are, I believe it would be satisfactory to include them in the control variables.

[26] "Urban Population Growth (annual %)." The World Bank. Accessed December 11, 2017. https://data.worldbank.org/indicator/SP.URB.GROW.

Results

In order to test the relationship between my independent and dependent variable, I ran simple regressions on R using data collected for 42 Sub-Saharan African countries. After the regression was ran for the dependent and independent variable, each control variable was added individually. One regression ran the dependent, independent and all controlled variables.

I believe mapping my data provides a useful visual aid when initially assessing my data. Conflicts are mapped according to the coordinates provided from UCDP using ArcMap (Figure 1). From this map, one is able to visually see regionally, where conflicts are concentrated. Then I display both the independent and dependent variables on a separate map by layering the same conflict coordinates over amount of natural disasters (Figure 2). Since natural disaster data is not provided for at the regional level and only the country level, I indicated the average natural disaster per year by color. If I were to have coordinates of natural disasters, I would be able to layer such information over the mapping of conflicts from UCDP GED. This is why I am unable to map both variables more precisely.

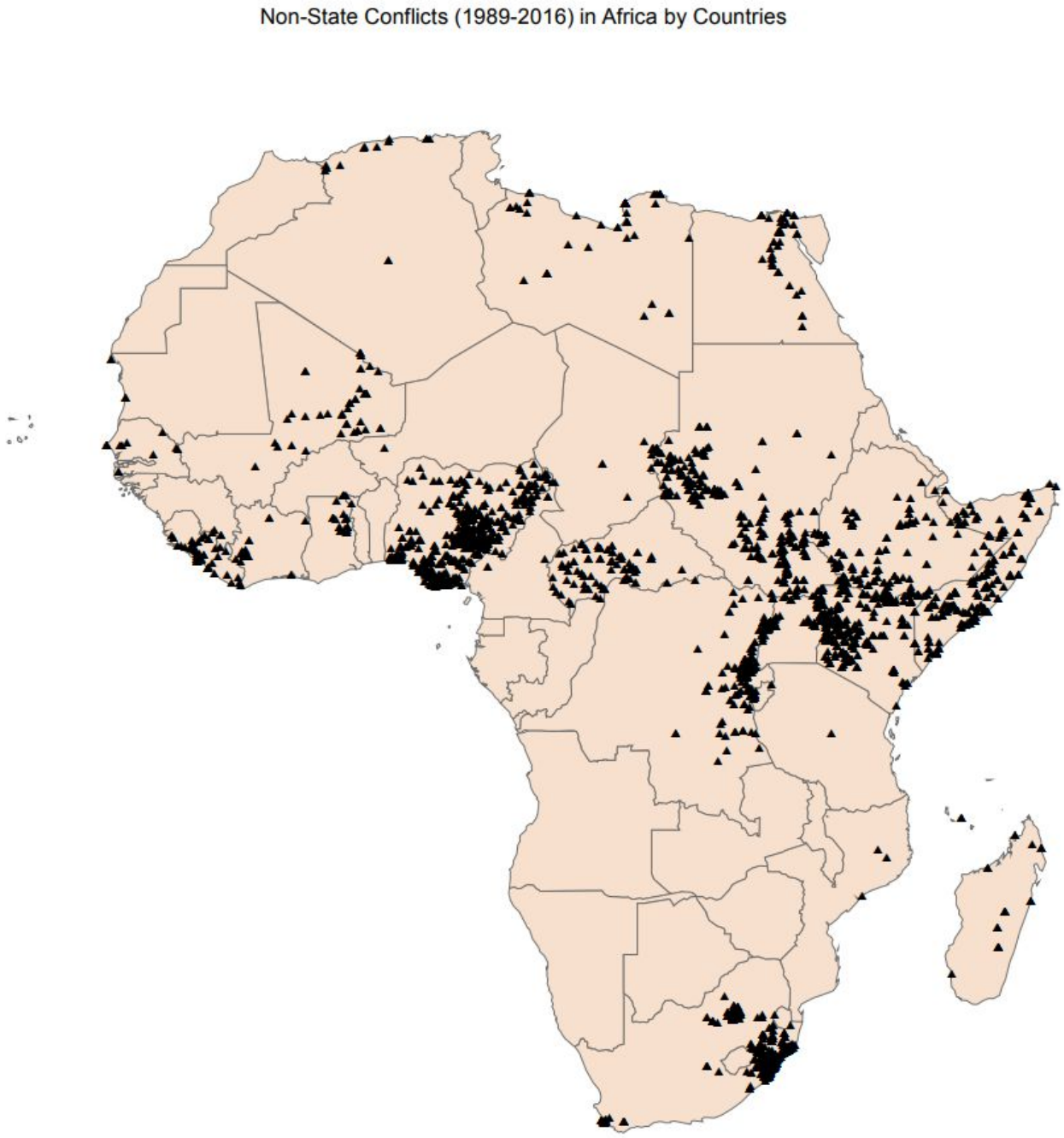

Figure 1

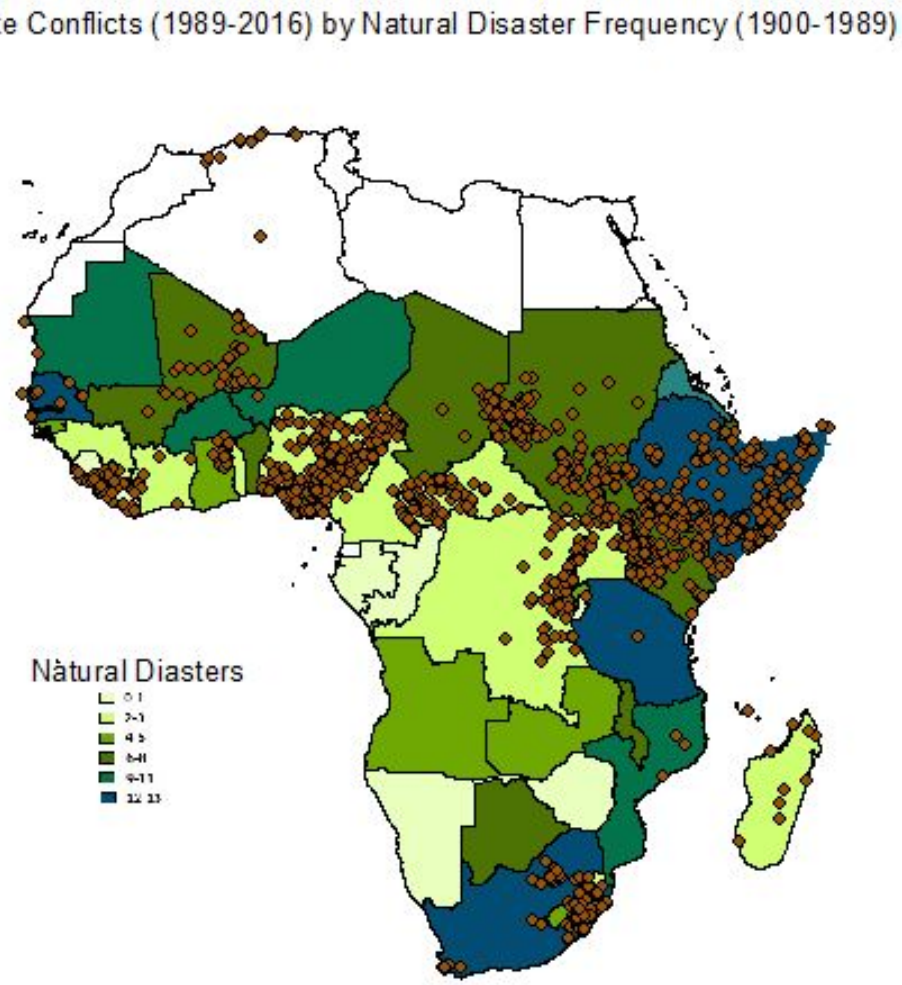

Figure - The colors of each country indicate the amount of conflict the nation has on average per year. This was calculated by taking the sum of conflict per annual year from 1900-1989 and dividing the total by 90. Converting this map hindered the visibility of the key. The should key read as so:

Average Natural Disasters per Year

- (lightest shade of green) 0-1
- 2-3
- 4-5
- 6-8
- 9-11
- (darkest shade of green) 12-13

One can see from Figure 2 that there is quite an even distribution of conflicts between lighter countries (less disasters) to darker countries (more disasters). When one compares this with the raw data translated into a raw scatter plot, one can see quite a similar pattern (Figure 3). While the correlation may not be too strong, there appears to be a very loose pattern that demonstrates that more disasters leads to more conflicts, but also a greater concentration of conflicts occurring in countries with less disasters, such as the DRC (see Figure 2).

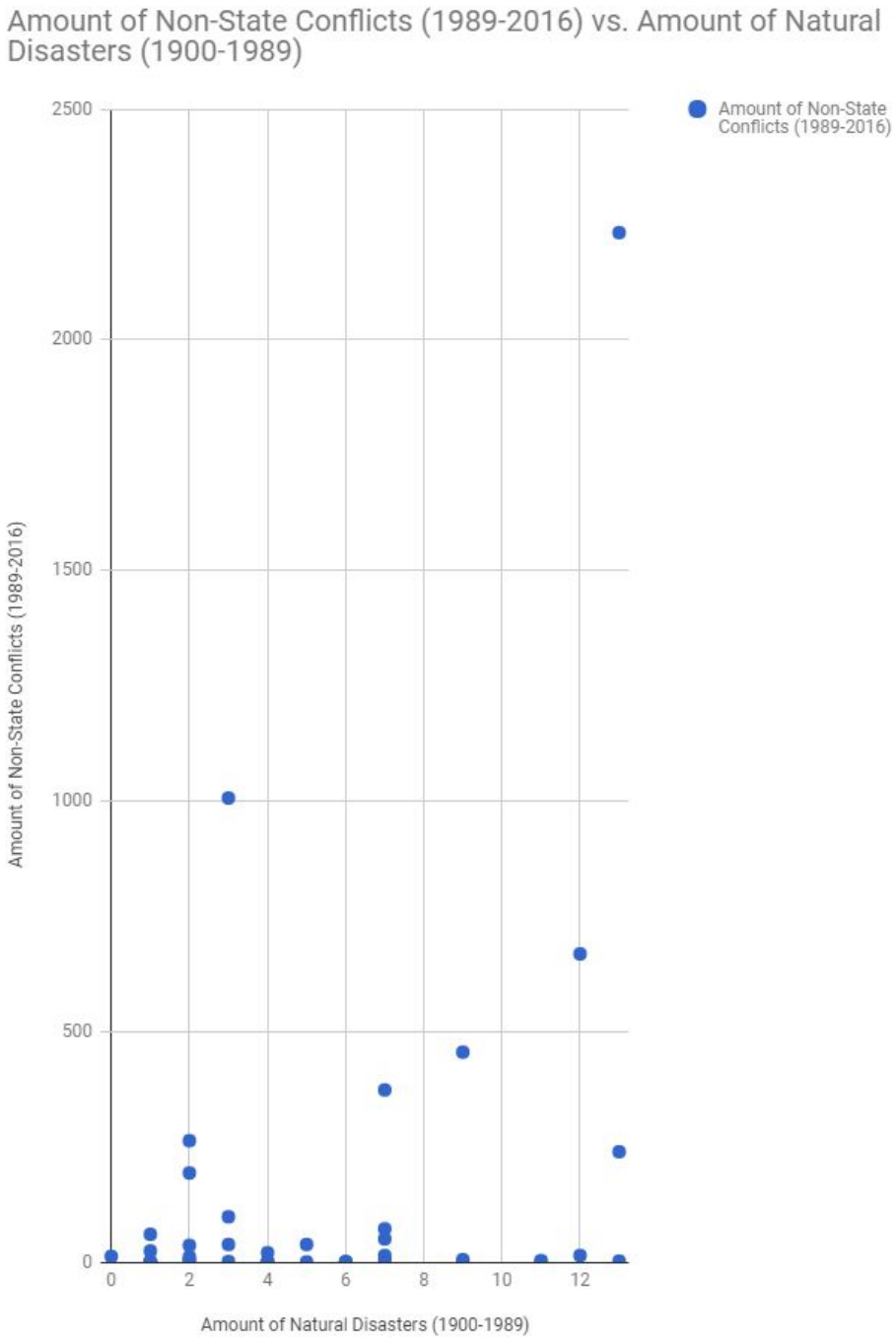
Amount of Non-State Conflicts (1989-2016) vs. Amount of Natural Disasters (1900-1989)
Amount of Non-State Conflicts (1989-2016)
2500
2000
1500
1000
500
0
Amount of Non-State Conflicts (1989-2016)
0
2
4
6
8
10
12
Amount of Natural Disasters (1900-1989)

Figure 3

Looking at the graph that was obtained using R (Figure 4), one can see a more specific relationship between my two variables by looking at the residuals vs. fitted. The line of regression appears to be reasonable with the exception of case 29 (Nigeria) and 34 (South Africa). If the regression is run without these two outliers, more outliers that replace them. Therefore, I believe these two outlier are not of large concern. Afterwards, each control variable was added individually as well as all control variables. There was a significant positive relationship between natural disasters and conflict in every test. GDP seemed to also have a significant P value.

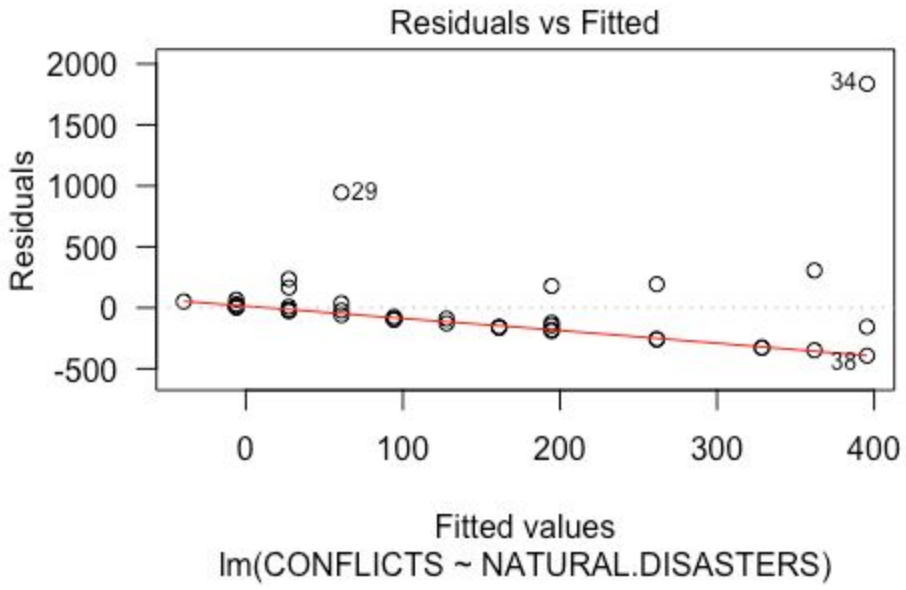

Figure 4

Table 1: Historic Natural Disasters and Conflict

	Dependent variable: Number of Conflicts						
	Conflicts						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Historic Natural Disasters	33.459**	36.179**	34.013**	37.324**	31.872**	33.345**	36.605**
	(14.787)	(13.966)	(15.189)	(14.705)	(15.593)	(15.468)	(14.600)
GDP Per Capita		0.101**					0.109**
		(0.041)					(0.043)
Mountainous Terrain			−0.744				5.069
			(2.695)				(3.208)
Urbanization				−80.650			−78.021
				(50.338)			(54.706)
Ethnic Frac.					361.514		380.568
					(302.387)		(428.076)
Cultural Frac.						358.027	337.742
						(291.766)	(395.088)
Constant	−39.503	−159.938	−30.101	266.924	−287.596	−191.467	−334.794
	(98.112)	(104.412)	(104.728)	(214.108)	(230.078)	(159.882)	(326.309)
Observations	42	42	41	42	40	40	40
R^2	0.113	0.234	0.117	0.168	0.146	0.148	0.352
Adjusted R^2	0.091	0.194	0.071	0.126	0.100	0.102	0.235
Residual Std. Error	368.821	347.253	377.484	361.802	375.652	375.279	346.446
F Statistic	5.120**	5.949***	2.519*	3.944**	3.167*	3.210*	2.991**
Note:							*p<0.1; **p<0.05; ***p<0.01

Figure 5 - A regression was ran with each control variable as well as with all control variables. Natural disasters maintained significance throughout each test. GDP also proved to have a significant relationship. From this, one can conclude that the amount of natural disasters that occur over a period of time will have a positive effect on the amount of conflicts that occur.

After seeing these results, I realized that the natural disasters that I measured from 1900-1989, did not stop when I measured conflict from 1989-2016. Natural disasters are still ongoing in 1989-2016. So, I created a variable “Recent Disasters” which is the same method of measurement for natural disasters of 1900-1989 and took a look at the disasters that occurred in

the period of 1989-2016. When this variable was added to the independent, the regression showed a lowering in P value for the Natural Disasters variable, as shown below.

Table 2: Historic and Recent Natural Disasters and Conflict

	Dependent variable: Number of Conflicts			
	Conflicts			
	(1)	(2)	(3)	(4)
Historic Natural Disasters	33.459**	36.605**	20.778	17.258
	(14.787)	(14.600)	(19.252)	(18.704)
GDP Per Capita		0.109**		0.127***
		(0.043)		(0.043)
Mountainous Terrain		5.069		4.055
		(3.208)		(3.199)
Urbanization		−78.021		−82.476
		(54.706)		(53.531)
Ethnic Fractionalization		380.568		255.480
		(428.076)		(425.560)
Cultural Fractionalization		337.742		312.525
		(395.088)		(386.399)
Recent Disasters			10.203	16.882
			(9.929)	(10.555)
Constant	−39.503	−334.794	−133.483	−391.469
	(98.112)	(326.309)	(134.081)	(320.829)
Observations	42	40	42	40
R^2	0.113	0.352	0.137	0.400
Adjusted R^2	0.091	0.235	0.093	0.269
Residual Std. Error	368.821 (df = 40)	346.446 (df = 33)	368.564 (df = 39)	338.545 (df = 32)
F Statistic	5.120** (df = 1; 40)	2.991** (df = 6; 33)	3.091* (df = 2; 39)	3.051** (df = 7; 32)
Note:				*p<0.1; **p<0.05; ***p<0.01

Figure 6 - The new variable “Recent Disasters” was tested with the not only with the independent, but also along with all the other control variables. After doing so, the significance of the independent variable lowered quite dramatically from column 1 to column 4. While this may indicate that disasters occuring between 1989-2016 have some significant effect on the positive relationship shown before, it is also important to realize that significance may have lowered simply due to the introduction of more numbers.

Figure 7 - This map of conflicts is layered on top of a map of African ethnic groups, which indicates that conflicts tends to concentrate by ethnic groups. The ethnic group data was provided by ArcMap as a pre-existing template map. Unfortunately, I was unable to work with ethnic group data in my statistical analysis. However, I believe this could be a potentially interesting point to study in future research to see why certain ethnic groups may be more prone to conflict than others in terms of weather conditions.

Discussion

While I hypothesized that with a time period of more natural disasters (1900-1989), there would follow a time period of less conflict (1989-2016), the data has clearly shown the opposite of my hypothesis, as it demonstrated a significantly positive relationship. I argued in my theory section that natural disaster shocks would create instability that would make conflict too costly to occur. I also argued that my cultural argument would most likely overpower any desire or need to have conflict. My hypothesis followed the reasoning that exposure to natural disasters would ultimately create a cooperative culture within the area. This required me to measure long-term susceptibility to conflict in relation to weather. Yet, what I failed to recognize throughout the process of my thesis was that in the time period of 1989-2016, natural disasters are still ongoing. While this may seem obvious, it was something that didn't seem to be of great significance until I realized that there were two separate effects of natural disasters and that the two contradict one another, with the short term apparently overpowering the long term.

Because the natural disasters are still ongoing, there still lies a short-term susceptibility to conflict. Therefore, while my data analysis may suggest that the natural disasters from 1900-1989 were causing the conflicts that occured in 1989-2016, instead, it could have been the natural disasters occuring during the 1989-2016 period. Essentially what is happening is the long-term effects and the short-term effects of natural disasters go hand-in-hand as displayed by the diagram below (Figure 8). My theory argued that the short-term effects would be overpowered by the long-term effects, and thus was mistaken in that part. While natural disasters could cause long-term changes in culture that will reduce conflict onset, it can likewise cause short terms weather shocks which reduce stability and increase conflict onset. It seems my

argument regarding increased instability lowering the likelihood of conflict was flawed. Regardless of whether instability makes conflict far too costly, conflict can still occur. Yet, my hypothesis, while not proven correct, is also not proven incorrect, per se. Perhaps more natural disasters do cause a decrease in conflict, but the short term effects may be sufficiently larger that it overwhelms the negative. This issue may be something that can be resolved in research design that is discussed in the conclusion. With a more narrowed research design and my results in mind, a different type of study may shed better light as to whether conflict can have a negative impact on conflict. Some examples of possible studies are discussed in the conclusion.

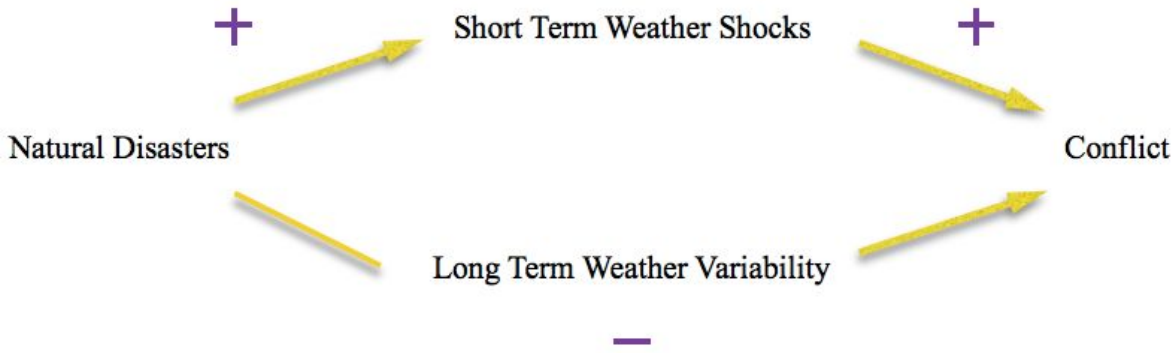

Figure 8

This diagramed occurrence is not mentioned nor clearly stated in existing literature. While some studies may recognize this and therefore use the method of research I have utilized to study short term weather effects, this double effect is important to mention either in the introduction of their study. If not mentioned, it can be incorrectly assumed that extreme weather conditions always have a positive effect on conflict, whereas, it has not been disproved that it can also have a negative effect. Although, my research does not support the negative relationship between long term weather variability and conflict, I believe this study has taught me what may

be necessary in order to investigate such a relationship. Whether it is known in academia or not, this two-part effect that natural disasters can have on conflicts is not stated clearly enough and so I hope that my thesis can reconcile this deficiency.

In a broader sense, if climate change were to create a dramatic change in extreme weather conditions, it will important to realize what social implications it may have. If extreme weather conditions do somehow improve tendencies to cooperate, this will be important to study in detail in order to know what factors can help resolve conflicts, so that those factors can be expanded upon and developed further. If extreme weather conditions encourage conflict onset, it will be important to study what factors are within our control to try and discourage such an effect. Climate change or other natural phenomenons, such as weather conditions, are often studied with a very technical point of view. I believe that the social sciences, humanities and the natural and physical sciences should encourage more studies that cross these boundaries and fuse together different fields. I hope that this study was able to catch a glimpse of what may result when done so. Even if the results were not too significant, I believe what was learned was of great value.

Conclusion

One aspect of my research design that could have been different to better measure the long-term effect was to have my independent variable face a significant change from the time period before the time period of conflicts, to the time period of conflicts. Ideally, weather conditions would have significantly changed in 1989. A good example of this would be, if the data was available, the independent variable would have been measured in the time period of the Ice Age and the dependent variable would have been measured in the time period post-Ice Age. While this may seem difficult and perhaps even impossible to do now, given the lack of data, there are other methods that can measure similar results that are more available to the present. Immigrants who once lived in a very disaster prone area who has moved to a less disaster prone area could be tested for their tendencies to cooperate. This can be tested through similar methods in psychological experiments of Rosanna Yin-mei Wong and Ying-yi Hong, who primed and tested participants to see their cooperative tendencies when facing a Prisoner's Dilemma.[27] Subjects could also be surveyed on interest-free monetary loans, food sharing programs and what advice they would give out to others. This type of study would face problems in isolating variables and gathering data from the same subjects from both places of residency, yet it seems much more attainable than awaiting a significant enough change in climate data.

These are all points for moving forward with this paper. In the end, I discovered that my attempt at a long-term study to see if one time period causes an phenomenon in the next was flawed in that there was no significant change in the independent variable from the first time

[27] Wong, Rosanna Yin-Mei, and Ying-Yi Hong. "Dynamic Influences of Culture on Cooperation in the Prisoner's Dilemma." *Psychological Science* 16, no. 6 (2005): 429-34. http://www.jstor.org/stable/40064244.

period to the next. The type of research design I follow was more configured to study short-term effects. Ideally, there would have been some drastic change in weather conditions and natural disaster patterns in 1989. Yet, I believe this adds significant findings to existing literature in that most studies that look at the correlation between weather conditions and conflict, fail to point out that there exists the two possible effects of natural disasters that can occur at the same time. Either long term weather variability leading to less conflict or short term weather shocks leading to more conflict may be implied in existing literature, but very few point out that the two may coexist and could hinder the other's statistical significance. In addition, the method of study that is typically used to measure such a relationship often looks at years of natural disasters as well as years of conflict. However, this method is not conducive in looking at long-term, cultural effects and this was also not stated in existing literature. Looking back, I believe I should have done more research outside of the political science field. Since I was so fixated on writing a work of political science, I failed to look at other fields of study that could have helped me realize my conclusion a lot sooner. Nonetheless, out of this I have learned a valuable lesson that political science, even when doing empirical research, is far beyond just data and analysis. Instead, it requires a multidisciplinary outlook which in my case included aspects of anthropology, sociology and psychology.

I see my thesis as a foundational stepping stone towards my hypothesis. I am not convinced that my hypothesis is incorrect. In fact, I feel more knowledgeable on how to go about studying it after this whole process. In the end, I am glad that my outcome resulted the way it did because I feel I learned much more extensively about research and political science than I would

have if my hypothesis was confirmed. My research leaves open many new paths to take and I believe that is just as important of a contribution than seeing one's hypothesis manifest.

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