

**Political and Economic Implications Associated with Climate Induced Migration
from Central America**

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I certify that I have read this thesis and that, in my opinion, it is satisfactory in scope and quality as a thesis for the degree of Bachelor of Science in Global Environmental Science.

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For my parents, Elbi Balmaceda and Frank Arnade, because they sacrificed everything
for my education.

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ABSTRACT

The Socioeconomic Implications of Climate Induced Migration from Central America

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Human migration has been an integral form of adaptation for centuries due to resource availability on Earth being relatively variable. However, current time periods are characterized by government agencies and powerful individuals establishing immigration laws within their own borders that discourage the incentive to migrate. When changes in resource availability and climate occur, human inclinations to migrate will challenge locations, such as Central America and the United States, in different ways. The main question of this study is to identify how significant of a factor climate change has on Central American socioeconomic structures and migration. A preemptive hypothesis does not identify climate as a direct factor of migration, but rather a mode of magnification. Analyses were conducted to discover patterns of unemployment in conjunction with climate and social instability affecting emigration from Central America. Furthermore, United States policy and economic aid became a subject of critique to find what developments could be possible in the future. Statistical analyses show a correlation between decreasing agricultural employment with increasing temperatures, which affects employment factors in addition to patterns of migration. Moreover, reevaluations in policy and foreign aid are needed in the United States to synthesize a solution that is justified and cost effective.

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1.0 INTRODUCTION

As global temperatures continue to fluctuate across Earth, the landscape of ecosystems are changing at unprecedented rates. Climate change is attributed by disparities such as sea level rise, rising greenhouse gas concentrations, drought, etc. but the human impacts of these issues are often ignored [Wilson et al., 2013]. This study seeks to identify how significant of a factor climate change is in Central American socioeconomic structures in addition to migration. Regions such as Central America have been facing the consequences of climate change for decades with desertification, record droughts, and increasing frequencies of extreme weather events [Milan et al., 2014]. Although these drivers do not account for a majority of migration efforts, climate is an additional layer to the socioeconomic disparities of the past in the region. It is important to inform the general public on these issues and convey that solutions do not only require developments in scientific technology, but reconstructions in political theory and economics as well.

To fully understand the scope of the issues in Central America, it is imperative to examine its history and identify major drivers of climate induced migration [Klepp, 2020]. This includes geological/atmospheric phenomena—erosion, nutrient loss, reduced water retention, etc.—and associated socioeconomic impacts. Furthermore, current political theory and economic distribution can be cross referenced with science to reveal dilemmas that exist within domestic governments and international cooperation.

2.0 BACKGROUND

2.1 Central American Political and Economic History

Before analyzing the current socioeconomic issues exacerbated by climate in Central America, it is important to study the history that produced the dynamics people see today. The power structures of Central America were and continue to be tied to many of the political regimes and conflicts that occurred during the 20th century. The United States (U.S.) has a long history of intervening in Central American policy, mainly due to the close proximity of the region, which sparked violent encounters in addition to polarization between social classes. Initially, Franklin D. Roosevelt developed the Good Neighbor Policy, which limited the U.S. from intervening in Central American affairs; however, the policy quickly subsided when Central American officials broke mutual treaties allowing U.S. agencies to develop an economic market [Grandin, 2007]. Following World War II, the idea of democratic populism—progressing mutual benefit while forgoing individual independence—had been adopted by many grassroots political organizations in Central America [Grandin, 2012]. Democratic populism began to extend into economic and governmental programs, which encouraged the formation of countless political parties ranging from pro-communism to pro-democracy. With the Cold War on the horizon, fear over communism grew in the U.S., encouraging the federal government to make substantial efforts in implementing market democracies in nearby regions—including Central America [Grandin, 2012].

Following the presidential election of Ronald Reagan in 1980, many U.S. policies were implemented by his administration to promote a new political and economic market

in Central America. Some notable motivations include establishing a free government, a free market, and diminishing trade barriers for multiple industries—especially agriculture [Lafeber, 1984]. In addition, successful implementation of American values would reestablish power that was lost due to the devastating conclusion of the Vietnam War [Lafeber 2, 1984]. Despite the Reagan Administration justifying their actions as humanitarian efforts against communism, a majority of foreign policy was instigated through military force and militia training [Grandin, 2010; Lafeber, 1984]. This led to violent encounters in many countries, many of which persist in large city centers today.

Many countries in Central America were heavily influenced by U.S. economic intervention, but the amount of resources expended in Nicaragua cannot be understated. Sizable intervention in Nicaragua is mainly due to the anti-free market economic decisions made by a pro-communist revolutionary group, the Sandinistas; with the support from communist nations such as Cuba, the Sandinistas gained substantial amounts of economic power across Central American borders [LaFeber 2, 1984]. When Sandinistas took control of Nicaragua in 1979, leaders of the organization pursued a government run economy while promoting cheap labor [Lafber, 1984]. This not only grew polarities between Nicaraguan social classes, but forced many foreign businesses—primarily American—into alternative markets. The limitations of foreign establishments in Nicaragua caused the Reagan Administration to retaliate with more military force, which strengthened active civil wars that were occurring between authoritarian and totalitarian regimes [LaFeber 2, 1984]. Nicaragua is only one example of U.S. economic intervention in Central America, but the everlasting effects are widespread throughout the region. It is important to realize that the substantial diversity of cultures within a relatively close

proximity allows Central American economies to conform with each other and decisions made by powerful leaders.

In addition to economics, the U.S. promoted democratic government structures to aid domestic interests of policy and business [Grandin, 2007]. One of the most notable tactics was interference in Central American government elections. The United States sponsored many authoritarian electoral candidates to protect foreign investments and reduce trade barriers; however, a significant majority of them lost due to citizens fearing the threat of totalitarian death squads if votes were cast for authoritarian leaders [LaFeber 2, 1984]. Due to the failure of implementing market democracy within Central America, the United States withdrew foreign aid [Grandin, 2010]. This reduction in aid caused wheat stocks to diminish which eventually led to famine, unequal land distribution, and poverty of common citizens. On the contrary, Central American politicians gained more power which further diverged income classes [LaFeber, 1984].

Although this violent history occurred nearly 40 years ago, many citizens of Central America still experience the hardships of these historical trajectories. Unequal land distribution and poverty persist for many economic groups, especially for those in the agricultural sector [Milan et al., 2014]. Socioeconomic adversity lay the foundation for issues such as famine and poor education, which are likely outcomes at the cost of unemployment; moreover, climate is another factor that must be considered as time persists.

2.2 Central American Economic History: Deeper Dive

In addition to the political power structures of Central America, there were many changes in domestic economies that catalyzed the hardships present in past and current job markets; most notably in agriculture. To start, technological development in the 1970s played a significant role in many of the economic issues seen in Central America today. The most notable change in production comes by the way of the Green Revolution, which is a series of technological developments in synthesizing atmospheric nitrogen as fertilizer and using genetically high yielding crops [Eliazar et al., 2019]. Due to agricultural developments of the Green Revolution in 1973, cash crops such as maize, beans, sorghum, etc., dramatically decreased in price leading many farmers to overproduce to make up the difference [Arizpe, 1981]. This mass cultivation had many consequences on the landscape including land degradation, soil erosion, and desertification in extreme cases. Furthermore, decreasing prices reduced the potential for local farmers to generate sufficient profit for their families.

In conjunction to the inflated market supply and plunging prices, distribution of wealth in Central America displayed negative impacts as well with the top 0.5% of the population owning 28.3% of arable land [Arizpe, 1981]. This means that a substantial majority of common citizens could not produce a sufficient yield due to diminishing soil quality. Moreover, governments had redistributed tax incomes into industrial development to compete in the international market, which reduced the capital available for agriculture [Arizpe, 1981]. Small farmers were impacted the hardest with workers falling into poverty who were forced to seek alternative means of income, which usually resulted in migration into city centers or foreign countries [Milan et al., 2014].

While Central American economics in the 1970s initiated migration patterns, current numbers have grown exponentially by the proceedings of international trade agreements such as the North American Free Trade Agreement (NAFTA). Put simply, NAFTA removes the duties and trade barriers between major nations in the North American continent [Feng et al., 2010]. Despite the decreasing prices for consumers, the agricultural industry could not supply a sufficient income to Central American farmers, which induced rapid industrialization [Johnson III, 2011]. Labor markets crashed, cheap imports caused local businesses to fail, and the U.S. federal government had adopted strict immigration restrictions to limit Central Americans from American job markets [Johnson III, 2011]. In spite of safeguarded borders, Central American migrants are increasing in numbers due to the limited employment opportunities available in their home nation.

2.3 Impacts of Climate Change

In conjunction to the repercussions of Central America's history, there are other issues, such as climate, that are relevant to recent timescales [Warner et al. 2, 2014]. The state of the Earth's fluctuating climate is common knowledge in the scientific and popular field of media. Although there are many nuances on how climate changes based on geological location and environment, the overall consensus displays an increasing trend of temperature [IPCC, 2018]. Furthermore, a substantial majority of warming is dictated by anthropogenic carbon emissions via industrial and urban development with carbon dioxide being the most notable greenhouse gas. The Intergovernmental Panel on Climate Change (IPCC) has noted a 1°C increase in average global temperatures since the

introduction of the fossil fuel industry with a substantial portion of warming occurring over ocean surfaces [IPCC, 2018]. Current goals set by Paris Climate Agreement [2015] aim to mitigate average global temperature below a pre-industrial 2°C threshold while maintaining similar rates of consumption. Failure to remain below 2°C can induce irreversible damage to natural ecosystems in addition to anthropogenic communities; some of which are already present in developing nations. Vectors of damage include increasing frequencies of extreme weather events (droughts/rainfall) and 0.26 to 0.77 meters of sea level rise [IPCC, 2018]. These sorts of impacts will be felt by every community across Earth.

In relation to Central America, climate has changed drastically over the past decade. Increasing global temperatures have exacerbated issues such as drought and flash flooding events [Milan et al., 2014]. Furthermore, climate variability has made it difficult to anticipate rain patterns, which has negatively affected industries such as agriculture where water is essential for cultivation [Warner et al. 2, 2014]. Central American agricultural communities also face a greater risk of climate distress due to their occupation relying on predictable weather patterns [IPCC, 2018]. Without necessary global emission reduction, inflated temperatures could cause irreversible damage in Central America, which has major implications on the success of future agricultural industries. The success of agricultural industries also has an effect on revenue distribution as increasing temperatures can impact the crop yield, therefore income, of individual families [Feng, et al., 2010]. A combination of environmental and economic failures could lead individuals searching for employment and alternative means of sustenance

away from their homes [Nawrotzki et al., 2016]. These disparities together influence decisions made by citizens to migrate into a favorable region in order to work.

2.4 Regional Population Impacts of Climate Change – Exploring the Drivers of Central American Migration

The state of Central American migration has many complexities that are dictated by a variety of factors and combinations. As stated previously, the history of politics and economics have a substantial impact on how communities are structured today. Decisions to emigrate are rarely based on preference, but rather a necessity for survival [Warner et al., 2014]. Drivers such as food insecurity and poverty are attributed by lack of success in agriculture, politics, and economics [Milan et al, 2014]. These drivers are ultimately motivated by shortcomings in income and unemployment, especially in the agricultural sector.

With agricultural failure—aggravated by extreme weather—producing food insecurities and unemployment, Central Americans must pursue alternative methods to secure a livelihood which leads to three options: no action, stationary adaptation, or migration [Reuveny, 2007]. These three options are important to relevant time scales since the pattern of migration follows specific models. The first model comprises of disasters leading an entire household to instantaneously migrate. This action is mainly due to household adaptation strategies being unattainable or causing more harm [Nawrotzki et al., 2016]. The second model demonstrates a delayed response to a climate disaster with migration efforts increasing over time. Delayed migration responses are usually attributed by families attempting to adapt by selling assets or utilizing new

agricultural methods [Nawrotzki et al., 2016]. Despite the willingness for Central Americans to remain in their home territory, this scenario results in failure and ultimately makes migration a form of adaptation. For instance, migrants move from their rural origins into productive countries—such as the U.S.—to earn an income that is remitted back home to support their families. In fact, some villages in Mexico collect 50% of their income from remittance which is used for food, housing, and minimal standards of living [Donato, 1999]. The final model shows a variance of the previous where adaptation strategies are successful. However, it is important to note that these strategies only work for temporary time periods until another extreme event occurs [Nawrotzki et al., 2016].

Extreme events occur sporadically, and it is difficult for families to predict when a strategy must be utilized in the event of financial hardship. The absence of opportunities are strongly influenced by climate disparities, which could lead to migration as a form of adaptation [Warner et al., 2014]. Furthermore, increasing populations coupled with climate shocks reduce the resources available to sustain Central American citizens; in urban centers, this has induced the growth of slums where gang brutality is becoming a normal [Lustgarten, 2020]. Constituents of the agricultural industry often face dilemmas on whether to remain in an unsustainable farming community or move into city centers where violence is apparent. Since both choices rarely lead to successful outcomes, migration becomes the most viable option.

2.5 Central American Drought and Agriculture

There are many climatic conflicts that have encouraged Central Americans to seek better opportunities, but drought has become one of—if not—the leading factor. It is

imperative to emphasize that nearly 24% of Central American citizens rely on agriculture as a major source of income [Reuveny, 2007]. Without arable land areas, crop yields are dramatically reduced from the breakdown of biological/geological systems. It is essential for farming lands to have sufficient water concentrations for many reasons, but it ultimately relates to preventing land degradation and desertification. More specifically, land degradation refers to decreasing the carbon content in soils which causes issues such as water retention reduction, upsurged greenhouse gas concentrations, and losing the ability to use land for agriculture [Hobley, 2018]. If all three of the effects were to reach extremities, desertification would be a viable consequence. Furthermore, desertified lands increase the risk of erosion, loss of organic matter, and limited nutrient availability [Hobley, 2018]. Although desertification is not a permanent geologic status, ramifications are felt by farming communities immediately and returning to an original state prior to anthropogenic offenses require over-expenditure of resources or long time scales.

Prolonged droughts in Central America hinder the ability for farming communities to sustain a household while reducing livelihood potentials. Despite a quarter of the population working in agriculture, 66% of the economy in locations such as Guatemala, are dictated by the success of major crops including maize, beans, and sorghum [Milan et al., 2014]. Crop yields highly influence the decision for Central Americans to migrate or remain in their current residence. Studies by Feng show that a 10% reduction in crop yield roughly leads to a 2% increase in emigration from Mexico [Feng, 2010]. In relation to natural resources, rivers are also facing extensive droughts periods, which reduces a potential source of water for agriculture. Furthermore, corporations fund large construction projects that pollute flowing rivers, which inherently

makes the water unusable as well [Allard et al., 2019]. Combining anthropogenic degradation of ecosystems with historical socioeconomic failures leads to unemployment which causes debt, malnutrition, and food insecurity; this increases the likelihood for families to emigrate [Milan et al, 2014]. Ultimately, Central Americans are pursuing to secure a livelihood and without sufficient resources, migration becomes a last resort.

3.0 METHODS

3.1 Literature Review

A significant portion of this thesis has utilized primary and secondary source publications to identify how significant of factor climate change has on migration efforts. Primary source information is mainly focused on immigration statistics, unemployment figures, economic spending, and politics. Policy becomes a topic of discussion by building recommendations off of current political frameworks. Examples include the Paris Climate Agreement, the Green New Deal, U.N. Universal Declaration of Human Rights, etc. These works demonstrate current political structures that guide international and domestic policy. Secondary source information was mainly found from scientific journals and outlined interpretations of primary source publications. Furthermore, secondary source information was used to develop a thorough background of policy, economics, landscape analyses, and the overall environment. Synthesizing all forms of publications helps to build base knowledge of past political/economic structures and how they progressed into current socioeconomic frameworks.

3.2 Central American Employment Dynamics

Employment dynamics of Central America were broken down into 3 different analyses; all 3 utilized a similar time scale with 1995 being the initial condition and 5 year intervals continuing until 2015. Additional data from 2019 was inputted to show the most recent update. Data used to compare agricultural employment, average global temperatures, and total Central American unemployment came from two sources: NASA, and the World Bank.

The first analysis focused on agricultural employment of the 8 Central American countries: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. This was done to show country specific trends and display the importance of agriculture in their respective region. Statistics from the World Bank provided the percentage of citizens working in agriculture from 1995 to 2019. Total Central American agricultural employment was then found by averaging country percentages for the respective 5-year interval.

The second analysis compared the total Central American agricultural employment with average global temperatures. Average global temperatures were found at the courtesy of NASA and followed the same 5 year interval scale. Both parameters were then cross referenced and plotted on Google Sheets.

The final analysis compared total agricultural employment and total unemployment in Central America over the same 5 year time scale. Averages from the 2 previous analyses were used for the agricultural employment parameter. In order to find total Central American unemployment, country specific unemployment rates were multiplied by their respective populations for each of the 8 Central American countries.

This provided the number of persons unemployed for each country which was then summed to give the total Central American unemployment for each year. The mathematical process can be seen with equation below:

U_n = unemployment rate of each Central American country

P_n = population of each Central American country

T = Total unemployment for Central America (%)

$$(U_1 \times P_1) + (U_2 \times P_2) + (U_3 \times P_3) + (U_4 \times P_4) + (U_5 \times P_5) + (U_6 \times P_6) + (U_7 \times P_7) + (U_8 \times P_8) = T$$

This process was then repeated for each 5-year interval. This analysis was conducted to find trends between work specific categories and general population ventures.

3.3 Immigrants and Emigration Data

Statistical results regarding Central American immigration were broken up into two categories. The first category compares population and immigration statistics over time; the same 5 year interval time scale from 1995-2019 was used to synthesize these findings, which came from preexisting data courtesy of the World Bank and United Nations. The second category breaks down the 2019 population, estimated emigrants, and emigrants residing in the United States for each of the 8 Central American nations. This data allows the formulation of relationships between countries and their associated disparities. Population statistics were provided by the World Bank while emigrant and U.S. migrant estimates were provided by the Migration Policy Institute.

3.4 United States Fiscal Distribution

Analyses of U.S. government fiscal spending demonstrates how resources are being allocated in relation to climate induced migration. To show how much money is being allocated towards foreign aid, statistical figures were taken from the 2015 fiscal period. Numerical evidence, utilized from existing data [National Priorities Project, n.d.], was inputted into an excel sheet which was then converted into a pie chart.

In regard to U.S. foreign aid, all statistics were provided by the World Bank for the 2019 fiscal period; categories were broken down based on the department and the respective region of aid in Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. Specific departments were selected for analysis based on relation to immigration in addition to climate impact; this includes the Department of Agriculture, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of Labor, Department of State, Environmental Protection Agency, International Development, and the Peace Corps. Totals were found for each Central American country and percentages are ratios between department specific aid and total foreign aid for the respected region

4.0 RESULTS

4.1 Employment Dynamics of the Central American Region

4.1.1 Regional Analysis of Central American Agricultural Employment

The percentage of populations employed in agriculture varies between the 8 Central American countries. Guatemala, Honduras, and Nicaragua display the highest percentage of citizens working in land cultivation with nearly a third contributing to the sector. Contrarily, Costa Rica demonstrates the lowest percentage of agricultural employees, which persists through the entirety of the 24 year timescale. Despite the differences of agricultural employment constituency between the 8 Central American countries, all exhibit a decreasing trend of agricultural employment from 1995 to 2019. A detailed numerical breakdown can be seen on TABLE 1.

Year	Belize (%)	Costa Rica (%)	El Salvador (%)	Guatemala (%)	Honduras (%)	Mexico (%)	Nicaragua (%)	Panama (%)	Central America (%)
1995	27.15	17.67	26.77	38.42	37.42	23.48	33.63	20.8	28.17
2000	25.95	16.29	21.61	39.77	35.92	17.41	31.53	16.97	25.68
2005	19.55	15.24	19.99	34.74	33.11	15.03	28.89	15.68	22.78
2010	18.94	11.40	20.77	33.50	36.45	13.92	29.41	17.42	22.73
2015	18.08	12.30	18.11	31.88	28.72	13.43	30.98	14.67	21.02
2019	16.84	12.10	16.28	31.49	30.26	12.61	30.65	13.952	20.52

Table 1: Agricultural employment of each Central American country from 1995 to 2019. Data from each country is courtesy of the World Bank 1 (2019).

From a country specific analysis, all regions showed a similar trend with an overall decrease in agricultural employment from 1995 to 2019. Total Central American agricultural employment averages from the year 1995 shows 28.17% of citizens employed in the agricultural sector, which has since decreased to 20.52% in 2019.

4.1.2 Total Employment Trends in Central America

In order to demonstrate the relationship between climate change and migration, it is important to analyze a specific driver such as employment. Cross referencing Total Central American Agricultural Employment (TCAAE) with average global temperatures—over a 24 year time period—demonstrated an indirect relationship with can be seen on FIGURE 1. However, it is important to remember that changes in temperature do not *directly* cause employment shifts; rather, climate change induces alterations in related socioeconomic factors, which will be later discussed.

Total Central American (CA) Agricultural Employment (%) vs. Temperature Increase (°C)

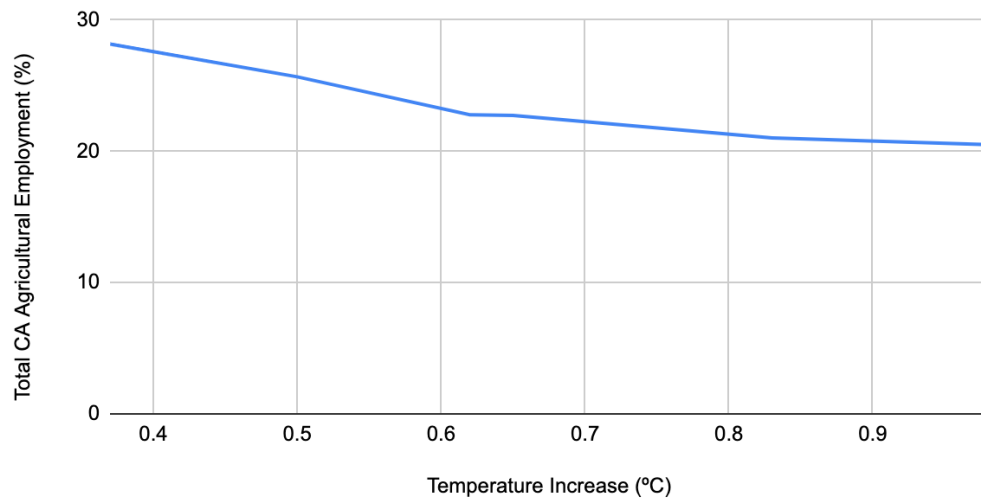


Figure 1: Total Central Agricultural Employment versus temperature from 1995 to 2019. Average global temperature data is courtesy of NASA (2020).

At the beginning of 1995, average global temperatures were measured to be 0.37° C above pre-industrial levels while TCAAE was at a high of 28.17% [NASA, 2020]. However, as average temperatures increased to 0.98°C in 2019, TCAAE decreased along with it reaching a low of 20.52%. An important factor to note is that the 2005 through

2010 time period only showed a 0.03°C increase in average global temperatures, which is the smallest documented change on the 24 year time scale. Furthermore, this time period also displayed the smallest decrease in TCAAE with a difference of 0.03% from 2005 to 2010 marking a potential relationship.

When comparing Total Central American Unemployment (TCAU) to temperature or TCAAE, little to no relationships are found. TCAU fluctuates independently from temperature and TCAAE, which indicates other factors are at play. The most substantial change occurs between 1995 and 2000 where TCAU decreases by a total of 3.186%. The 2005 through 2015 period also shows a substantial change with TCAU reaching a high of 5.178% in 2010, and decreasing to 3.5% in 2015. Comparisons between TCAU, TCAAE, and average global temperatures are best summarized by TABLE 2.

Year	Average Global Temperatures (°C)	Total Central American Agricultural Employment (%)	Central America Total Unemployment (%)
1995	0.37	28.17	6.325
2000	0.50	25.68	3.139
2005	0.62	22.78	3.904
2010	0.65	22.73	5.178
2015	0.83	21.02	3.500
2019	0.98	20.52	3.842

Table 2: Average global temperatures, total agricultural employment, and total unemployment from 1995 to 2019. Average global temperature data is courtesy of NASA (2020) while employment figures were gathered from the World Bank 1 and 2 (2019).

The most recent year, 2019, shows TCAU rising in correspondence to the highest recorded average global temperature of 0.98°C, but more information is needed in the coming years to conclude a significant correlation.

4.2 Immigration Dynamics in Relation to Population

Conveying an analysis of Central American migration requires the dynamics of population and emigration over time, in addition to country specific figures. Using the same 5 year interval from 1995 to 2014, it is apparent that populations are increasing with time in Central America. According to figures at the World Bank [2019], all 8 countries totaled to 124,432,035 citizens in 1995. This figure increased by 142% in 2019 totaling to 176,609,077 citizens across the same region. Emigration figures show a similar trend over time with a 196% increase in magnitude from 1995 to 2019. However, a notable trend to consider is that the percentage of Central American emigrants relative to population is increasing with time which is shown on the fourth column of TABLE 3. This means that there are other contributors of increasing emigration independent of population growth.

Year	Central America Total Population (person)	Central American Emigrants (person)	Total Emigration/Total Population (%)
1995	124,432,035	8,422,181	6.77
2000	135,261,368	11,480,163	8.49
2005	145,802,812	13,103,628	8.99
2010	157,220,589	15,171,696	9.64
2015	168,164,181	15,663,155	9.31
2019	176,609,077	16,466,000	9.32

Table 3: Central American population and emigration from 1995 to 2019. Population statistics were courtesy of the World Bank 3 (2019) while emigrant data was gathered from the United Nations 3 (2019).

Population and immigration figures in 2019 varied greatly between the 8 Central American regions of Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. Belize is home to the smallest population in Central America with 390,350 individuals, but had the third highest percentage (17%) of emigrants, which

is an estimate of about 68,000 migrants. Costa Rica had the lowest emigration to population ratio at 2.97% while having a limited number of migrants in the United States as well. El Salvador experienced the largest percentage outflux of citizens (24.8%) with 1,601,000 of the 6,453,553 immigrating into other regions; a majority being the United States which can be seen on TABLE 4.

Country	Population (2019)	Estimated Emigrants (2019)	Estimated Emigrants in the United States (2019)
Belize	390,350	68,000	58,000
Costa Rica	5,047,561	150,000	99,000
El Salvador	6,453,553	1,601,000	1,429,000
Guatemala	16,604,026	1,206,000	1,071,000
Honduras	9,746,117	801,000	656,000
Mexico	127,575,529	11,796,000	11,490,000
Nicaragua	6,545,502	683,000	303,000
Panama	4,246,439	161,000	125,000
Central America Total	176,609,077	16,466,000	15,231,000

Table 4: Population, estimated emigrants, and estimated emigrants located in the United States for each Central American country in 2019. Population statistics were courtesy of the World Bank 3 (2019) while emigrant estimates were gathered from the Migration Policy Institute (2020).

With Guatemala being the second most populated Central American country, it was also home to the second highest emigration to population ratio at 18.7% making it a significant factor for future analysis. Despite Mexico having a relatively low emigrant to population ratio (9.2%), it contributed the highest magnitude of migrants with 97.4% of them residing in the U.S. Nicaragua is a region of interest in that it had the lowest

percentage of migrants moving to the U.S. (44.4%) which is uncommon among the other Central American regions. In total, there were 16,466,000 Central Americans that emigrated in 2019 with 92.4% of them residing in the United States.

4.3 United States Fiscal Distribution in Relation to Immigration

4.3.1 United States 2015 Total Spending

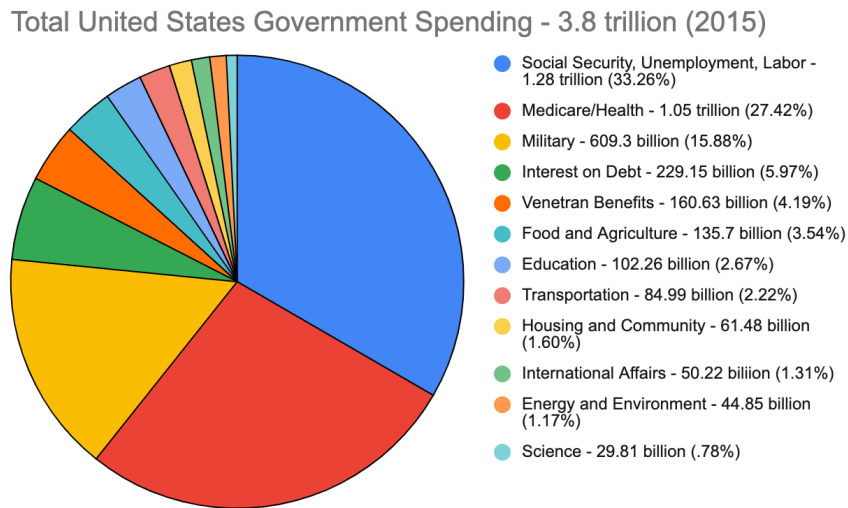


Figure 2: United States total spending in 2015. Data is courtesy of the National Priorities Project (2016).

Due to the close proximity of Central America and the number of migrants seeking refuge in the United States, it is important to identify how the U.S. federal government is addressing the incident. Total United States government spending totaled in an estimated 3.8 trillion dollars in the 2015 fiscal period. The largest portion of revenue was allocated towards government funded social programs (i.e. social security, unemployment, etcetera) at 1.28 trillion dollars, which accounts for 33.26% of the total spending. Medicare and military accounted for the next highest spending amounts at 1.05 trillion dollars (27.42%) and 609.3 billion (15.88%) respectively. In relation to climate

induced migration, international affairs, energy/environment, and science are all subjects of interests. These 3 programs were the least funded in relation to the 9 alternative categories with international affairs summing to 50.22 billion dollars (1.31%), energy/environment at 44.85 billion dollars (1.17%), and science totaling to 29.81 billion dollars (0.78%).

4.3.2 2019 U.S. Foreign Aid Distribution by Country and Department

U.S. Department	Belize	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama
Department of Agriculture (\$)	0	0	0	0	0	370,932 (0.27%)	5,954,103 (13.74%)	0
Department of Energy (\$)	0	0	0	0	0	130,000 (0.09%)	0	84,000 (0.67%)
Department of Health and Human Services (\$)	0	0	173,466 (0.21%)	12,641 (0.008%)	0	0	0	0
Department of Homeland Security (\$)	0	0	0	955 (0.0006%)	0	0	0	0
Department of Labor (\$)	0	0	0	0	0	0	0	656 (0.005%)
Department of State (\$)	2,046,320 (49.94%)	8,899,962 (48.74%)	545,750 (0.65%)	39,047,688 (24.97%)	80,000 (0.13%)	82,526,986 (59.13%)	0	6,776,664 (53.94%)
Environmental Protection Agency (\$)	0	0	0	0	0	0	0	0
International Development (\$)	0	5,242,304 (28.71%)	72,280,528 (86.53%)	111,894,781 (71.56%)	61,021,191 (97.59%)	48,496,994 (34.75%)	34,205,234 (78.94%)	148,502 (1.18%)
Peace Corps (\$)	1,437,680 (35.09%)	3,132,590 (17.15%)	0	3,589,283 (2.30%)	0	1,826,657 (1.31%)	1,346,859 (3.11%)	4,494,923 (35.78%)
Total (\$)	4,097,500	18,261,701	83,527,563	156,356,746	62,530,343	139,557,215	43,328,664	12,562,837

Table 5: 2019 United States foreign aid spending for each Central American country. Data is courtesy of the USAID (2020).

Each of the 8 Central American countries received U.S. foreign aid with allocation based specifically on department. The departments in question include the Department of Agriculture, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of Labor, Department of State, Environmental Protection Agency (EPA), International Development, and the Peace Corps. For a descriptive analysis on each department's function, refer to TABLE 5. In total, Belize received the least amount of aid with 49.94% of funding being distributed from the U.S. Department of State. This is likely due to its small population relative to the other 7 Central American countries. On the opposite end of the spectrum, Guatemala received the highest value of foreign aid at \$156,356,746 despite having less than 115 million more citizens than Mexico which received \$139,557,215 in total. A substantial majority of aid for Guatemala comes by the way of International Development (71.56%) with the Department of State (24.97%) coming in second. Mexico differs from Guatemala in that distribution is switched with the Department of State (59.13%) being the highest contributor while International Development follows behind. Other countries to consider are El Salvador and Honduras, which both receive a substantial amount of aid for International Development at 86.53% and 97.59% respectively. Another figure that requires attention is the absence of distribution from the EPA; across every Central American country the EPA provided exactly \$0 for the entirety of 2019. Furthermore, the Department of Homeland Security and Department of Labor showed a similar pattern with minimum contributions for single regions.

5.0 DISCUSSION

This thesis seeks to identify the socioeconomic implications of migration by investigating geologic changes in the Central American landscape, employment variability, and international socioeconomic interaction. By identifying scientific dilemmas and connecting them to socioeconomic counterparts, a true understanding can be developed to synthesize viable solutions.

5.1 The Dynamics of Employment Opportunities in Relation to Central American Migration

Accurate interpretation of employment dynamics require analyses in multiple sectors of the workforce. Agricultural employment provides a strong indicator of how changing landscapes can directly affect cultivators. Comparisons between TCAAE and average global temperatures show that the percentage of populations contributing to the agricultural sector are decreasing with increasing temperature. There are numerous reasons to why increasing temperatures could reduce TCAAE, but drought is likely the leading cause. Drought periods in Central America have increased in frequency over the past few decades, which limits water availability for the use of irrigation [Feng et al., 2010]. The inability to supplement crops with water ultimately reduces crop yield for small scale farmers; in turn, limited crop supply decreases the opportunity for profit, which encourages agricultural employees to seek alternative means of income. In addition to physical changes of the environment, economic proceedings of the past—the Green Revolution, NAFTA, land distribution, etc.—continue to limit the price of crops through overproduction and cheap import alternatives [Johnson III, 2011]. These

everlasting economic failures coupled with diminishing crop quality, as a result of drought, can act as strong drivers to the reduction in agricultural employment across all 8 Central American countries.

While agricultural employment shows a sustained decrease from 1995 to 2019 in all 8 Central American countries, total unemployment does not display any noticeable patterns. One of the notable outliers in unemployment data is the sudden increase in unemployment from 2005 to 2010, which is attributed by economic hardships of the Great Recession [Ocampo, 2009]. Other factors that limit substantial unemployment fluctuations are former agricultural employees seeking employment in nearby cities. As constituents of the agricultural community change their occupation, due to minimal success in cultivation, individuals migrate into industrial regions to earn an income [Milan et al. 2014]. Although the destination of prospective employment varies, unemployment figures do not show a predictable trend due to agricultural populations changing their occupation in regions away from home.

5.2 Population and Immigration Variability with the Changing Environment – Physical and Socioeconomic Factors

With time, the magnitude of Central Americans emigrating from their country has increased substantially. Although growing populations are an apparent contributor to the outflux of citizens, the ratio of emigrants to total population has increased as well. There are many drivers of migration with physical factors initiated by climate. As discussed previously, changing climate has negatively impacted agricultural regions with extended drought periods, unpredictable weather, and desertification in extreme cases [Warner, et

al. (Enhancing), 2014]. Agricultural failure, as a result of limited crop yield, reduces the profit potential for small scale farmers. Combining minimal crop yield and income leads to issues such as food insecurity and famine, which increases the likelihood for an individual to migrate; this is especially apparent in high emigration outflux regions such as Guatemala and El Salvador [Milan et al., 2014].

In addition to the physical factors, there are socioeconomic counterparts that further encourage citizens to migrate from their home country elsewhere. As discussed previously, a significant factor in agricultural disparity lies in unequal land distribution with the top 0.5% of income classes owning 28.3% of arable land [Arizpe, 1981]. With limited arable land availability to small scale farmers, the potential for income decreases and forces populations to search for alternative means of income. Migrations into nearby industrial cities are common, but farmers are often met by gang violence due to the vulnerability of lacking family and professional connections [Lustgarten, 2020]. Oppression is also apparent between Central American countries with Guatemalan and Salvadorian emigrants facing discrimination from Mexico. This is largely due to the increased competition for employment between Mexicans and other Central American migrants [Lustgarten, 2020]. Combining unequal distribution of income, internal affairs, and the socioeconomic history with the physical issues exacerbated by climate provides notable mechanisms of why citizens choose to migrate from Central America to other nations.

5.3 Economic Structures to Aid Existing Immigrants and Developing Nations

Looking at the current landscape of United States fiscal distribution, it is apparent that environmental and foreign developments are low in priority in comparison to domestic initiatives, such as Social Security, military, unemployment, etc. This is mainly attributed to the United States federal government delivering the demands of their constituents. Anti-immigration policy has become a popular subject within American households due to competition related fears for employment/decreasing wages or heavily funded programs such as Social Security and Medicare [Klepp et al., 2020]. However, it is important to note that immigrants from Central America have a low likelihood of competing for government aid and employment against American citizens. Due to the substantial majority of Central American emigrants entering the United States illegally, they are automatically disqualified from government programs, which reduces their fiscal impact on the American economy [Orrenius et al., 2012]. In relation to job markets, emigrants also have a minimal impact on American citizens because they often compete against fellow migrants. This is mainly due to limited educational opportunities and certifications offered to Central Americans prior to migration, which reduces the variety of jobs available [Orrenius et al., 2021]. Although a steady increase of migrants would likely have a low fiscal impact on the United States budget, reallocation of revenue into foreign aid would be far more beneficial.

With anti-immigration policies expanding the United States' military budget to fortify border security [Mcleman et al., 2019], distribution of aid has been insufficient for Central Americans in preventing migration from initially occurring. It is imperative to realize that a majority of Central Americans do not choose to migrate by choice, but

rather as an adaptation for survival. There are many negative implications associated with migration such as individuals leaving behind family members and/or losing their cultural identity when leaving their home nation [Klepp et al., 2020]. These reasons alone justify the redistribution of anti-immigration revenue into international development in Central America as a preventative measure of migration. Examples of emigration preventing initiatives include foreign investments into low-emission infrastructure or introducing sustainable development tactics to maximize the resiliency of Central Americans [IPCC, 2018]. If the United States were to redistribute revenue from border fortification into migratory preventative measures, additional revenue could be reallocated towards international development and allow developing countries, such as Central America, to become self-sustaining and contribute to the global economy [Paris, 2015].

5.4 Reinforcing and Building Political Structures

5.4.1 Reinforcing Current Climate Policy

Major developments in climate policy have been relatively limited in the past few years with developed nations choosing to honor international trade agreements in place of emission reduction [Burkett, 2018]. However, understanding and reinforcing current climate policy can be an important tool reduce the negative effects of climate change in Central American regions. Documents such as the U.N. Paris Climate Agreement (PCA) set international goals to limit warming to a pre-industrial 2°C threshold [Paris, 2015]. In addition to emission reduction, the PCA seeks to increase food security and mitigate malnutrition in regions that are highly affected by changing climate. This has substantial

relevance to Central America because limited food supply is one of the leading drivers of migration. Developing nations bear a substantial burden of the negative aspects aggravated by climate change despite being minimal emitters; therefore, developed nations are subject to take lead by incentivizing emission reduction and prioritize sustainable development [Paris, 2015]. Moreover, equitable technologic opportunity and resources should be integrated in developing nations, especially where migration to population ratios are rising.

While the PCA serves as an active international agreement in temperature reduction, there are many prospective legislative actions and political theories taking hold in the United States. The Green New Deal (GND) has generated considerable attention in the realm of climate policy by setting a 10 year period for the U.S.—but not limited—to reach 100% renewable energy, aiding agricultural markets with sustainable methods of farming, and generating renewable ecosystems for resource usability [Ocasio-Cortez et al, 2019]. Furthermore, domestic concerns are coupled with long term planning to ensure developing countries attain similar renewable energy goals and ensuring employment opportunities are not outsourced from the country of service. In relation to Central America, these types of transitions could alleviate physical disparities caused by climate change in addition to providing potential jobs for Central Americans in the short term.

5.4.2 The General Landscape of Immigration and Humanitarian Policy

There are many factors that lead Central Americans to migrate such as unemployment, food insecurity, or drought. As changing climate continues to multiply the severity of these drivers, the general scape of immigration law becomes an important

subject of analyses. One of the more recent issues is that United States Citizenship and Immigration Services (USCIS) ordinances often differ from international policy, especially when defining humanitarian/refugee displacement. Furthermore, issues related to climate induced migration are either ignored or undefined due to the recency of the occurrence. According to the current USCIS definition, refugees are any person outside of the U.S. facing a humanitarian conflict that relates to a domestic concern; this must include some sort of persecution related to race, religion, nationality, political association, or membership in specific groups [USCIS 1, 2020]. Defining what is a humanitarian concern is dictated by the executive branch of the federal government and any approved ordinances do not take effect for a full calendar year [USCIS 2, 2020]. Strictly under these stipulations, any relations to climate are undefined, especially with humanitarian concerns being dictated by the executive branch of government.

In spite of the strict definitions set by USCIS, analysis of international policy shows quite a different narrative in relation to immigration and climate. Building off of these recommendations could be valuable in generating a solution for struggling regions, such as Central America. The first document prospective document is the U.N. Declaration of Human Rights (UNDHR), which promotes general guidelines that all United Nations participants should follow. The following points have been hand selected and numbered in correlation to the original document to reflect potential benefits that could be applied in the sphere of climate migration [UNDHR, 1948].

- Preamble) Promoting social progress and better standards of life while providing the freedom of speech, belief, and freedom from fear.

- 5) Humans should be free from cruel, inhumane, or degrading treatment.
- 13) The ability to move and stay within the border of a state.
- 14) The ability to seek asylum in other countries to avoid persecution.
- 23) People have the right to work in a favorable condition
- 25) People have the right to sustainable living conditions which includes food, medicine, and clothing.

In addition to the U.N. Declaration of Human Rights, the U.N. Sustainable Development Goals (UNSDG) has become quite popular as ambitions are set high to mitigate drastic issues by 2030. Goals that relate to the sphere of climate induced migration include following [U.N. 1, 2020]:

- 1) Zero poverty.
- 2) Zero hunger by encouraging sustainable agriculture, equal land access, and technological development.
- 3) Quality education which can contribute to the goal of zero poverty.
- 7) Affordable and clean energy by investing in renewable energy sources.
- 8) Promoting economic growth through entrepreneurship and technological development.
- 10) Reducing inequalities while allowing safe migration.
- 11) Building sustainable communities.
- 13) Acknowledging issues exacerbated by climate as a source for socioeconomic change.

Lastly, the U.N. Global Compact Agreement for Migration (UNGCAM) outlines *non-legally binding* political frameworks that should be followed by all participants. What is unique about the UNGCAM, is that it directly correlates migration to climate. There are clauses that state how poverty and food insecurity are a result of climate change which ultimately become motivations for emigration [U.N. 2, 2018]. Furthermore, there is a large emphasis on following goals addressed in the PCA, since climate could become a major force of future migration efforts. Much of the UNGCAM also concentrates on how abnormal immigration patterns must be addressed by all nations rather than a single one to create a cost effective solution [U.N. 2, 2018]. This diction reinforces the idea that forced migration patterns can be prevented through international cooperation, which requires solutions from nations with surplus resource availability. Although there are helpful concepts in the UNDHR, UNSDG, and UNGCAM, it is imperative to emphasize that the policies are *non-legally binding* meaning that there are no international entities that require nations to follow them.

5.4.3 Improvements in Socioeconomic Theory

Future immigration policy requires an integration of climate and socioeconomic theory. On the basis of political theory, adaptations must be made through socio-political relationships rather than expanding the control of physical land ordinances. The borderless nature of global economies makes it difficult to place blame on specific groups that are impeding climate sensitive policies [Burkett, 2018]. This requires government entities to change their relationship with the environment and rethink the current economic system and hold corporations accountable when international expansion

becomes an option. It is important to remember that a majority of climatic burden is placed on populations, such as Central Americans, who emit the least [Paris, 2015]. In spite of land based disproportion in climate equality, countries in the northern hemisphere continue to impose anti-immigration policies on groups in the south where climate migration is increasing in frequency [Klepp, 2020]. Furthermore, political inequality exists today due to past establishments of international law being imposed during periods of imperialism and rapid economic growth [Burkett, 2018]. Redistribution of power and capital are required to alleviate the misrepresentation of dated political structures to further accelerate climate policy.

In addition to climate and socioeconomic theory, suitable adaptations are needed in the realm of immigration law and international relationships. The current practice of immigration sets strict restrictions on prospective migrants while the economy has little to no boundaries of integration and expansion [Burkett, 2018]. This recommendation in no way advocates for borderless nations, but hefty restrictions imposed on struggling regions should reduce in commonality to mitigate the socioeconomic hardships intensified by climate change.

Another factor to consider is that climate refugees tend to receive more restrictions compared to political refugees by the way of limited protection from entities imposing oppression, and minimal aid to solve liability disputes of natural resources [Burkett, 2018]. This distinction makes it difficult to identify climate as a base driver of migration because immigrants will pursue the most beneficial outcome to survive. To combat these issues, the term “climate refugees” should be replaced with an alternative title due to the connotation associated with the term, “refugee” [Klepp et al., 2020]. The

word “refugee” mainly coincides with the idea that a population group faces discrimination from the malpractice of a home nation. However, in the case of Central America, much of the violation derives from international disputes of climate, which is mainly at the fault of developed nations [Paris, 2015]. The current political system also diffuses responsibility into large groups which makes it difficult to define a single imposer [Burkett, 2018]. Therefore, it is necessary to redefine the definition of climate migrants to better represent drivers induced by a multinational misbehavior.

5.4.3 Policy Recommendations

Central American migration has a greater effect on established North America societies—such as the U.S. and Canada—solely due to the close proximity and continental binding legislations such as NAFTA [Johnson III, 2011]. This means that meaningful actions of assistance require multinational cooperation through politics and economics. As discussed previously, strict immigration guidelines have made it to the forefront of U.S. political agendas; however, analyses show that this yields more incidents of violence abroad due to the vulnerability of unemployed migrants when they are forced into city centers. [Johnson III, 2011]. Instead of pursuing an agenda of hardened borders, a more effective solution would be to redistribute foreign aid into distraught Central American regions to preemptively reduce the need for migration [Nawrotzki et al., 2016]. In spite of the efficacy of foreign aid being unknown, risks must be taken to identify potential factors of improvement. A possible opportunity would be to implement renewable energy jobs—i.e. solar farming, wind energy, etc.—in Central America so citizens can contribute to a sustainable ecosystem and economy. In addition, creating more opportunities in

education and the job market would grant more spending power which could lead to green technological development that could be used abroad [U.N. 2, 2018]. This would ensure that Central Americans are not outcasted and improve the capability for citizens to sustain their culture, without the urgency of migration.

At the international level, there are many prospective policies that look to improve the status of refugees, the environment, and climate induced migration. Some of the most notable, that were previously mentioned, include the U.N. Sustainable Development Goals, PCA, and various COMPACT Agreements. Despite the dutiful recognition of conflicts in theory, these policies lack a mechanism of accountability [McLeman, 2019]. Without legal obligation to carry out duties, countries lack incentives to fulfill their roles. An effective solution to this problem—although highly unlikely—would be the integration of a global judiciary system through the United Nations. Having an international entity that upholds agreements made through global compacts would ensure nations are meeting established criteria.

6.0 CONCLUSION

As global landscapes continue to change as a result of changing climate, there are many effects that could change the way people live and thrive. While climate is not perceived as an inherent mechanism of migration, increasing temperatures have an effect on geologically dependent economies such as agriculture. Reduced agricultural yield changes employment dynamics and forces individuals to choose a method of adaptation, which can come in the form of migration. In relation to Central America, the disparities of past socioeconomic failures—U.S. intervention, civil war, and the Green Revolution—

provide a baseline incentive for migration patterns while climate change acts as an accelerator to the process. Through thoughtful planning and international aid, Central America could potentially transition from a region of digression into a positive contributor of the global economy, politics, and sustainable development. Looking towards the future, it is essential to present more evidence on climate's effect on migration and synthesize humanitarian/cost-effective solutions between academia, economists and politicians

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