

## PART THREE: CLIMATE CHANGE & THE HOMELAND

America's national security leaders agree that climate change is a threat to national security, because it will affect global stability and humanitarian crises around the world. However, American policymakers often overlook that the U.S. should lead in climate change adaptation and mitigation because the U.S. homeland is directly threatened by climate change as well.<sup>1</sup>

Climate change will harm America's infrastructure, agriculture, economy and population; these directly affect America's homeland and the security of its citizens.

Our country is large and the consequences of warming will vary dramatically across regions and sectors.

Despite the variations in its effects, we must understand its impact on homeland security.

### In Brief

- Climate change will threaten the security of the American Homeland. The effects will be different across the country because of regional climate variations.
- Extreme weather – including storms, droughts, floods, or heat waves – across the U.S. is likely to be the most acute threat to infrastructure and to the livelihoods of American citizens.
- America's military bases, both at home and abroad, are directly threatened by the extreme weather that will be more likely because of a changing climate.
- Less acute changes in climate – a gradual warming or a slow change in weather patterns – could harm human health and reduce economic activity in traditional jobs.
- The U.S. government has begun the process of preparing for climate change, but a lack of political consensus and long-term foresight is holding back efforts to strategically prepare for the long-term effects of climate change.

*“There will be costs to our economic security from climate change — and significant ones at that — if we do nothing but continue business as usual. We are seeing all sorts of issues that come from climate change and we must adapt to them.”*

*“This summer’s drought throughout the Midwest is just the tip on the kind of changes we can expect from a rapidly (in nature’s terms) changing climate.”*

**Governor Christine Todd Whitman**  
ASP Board Member

Over the past few decades, scientists observed trends like rising temperatures, increasing heavy downpours, rising sea level, harm to agricultural productivity and reductions in snow and ice cover.

These trends will continue or worsen as greenhouse gas emissions increase.<sup>2</sup> Although policymakers are often warned that no one event can be attributed to climate change, new research is changing this calculus - giving conclusive evidence of the links between extreme weather and man-made carbon emissions.

## **2012 as an Example of Future Events**

The first six months of 2012 should act as an example. 2012 brought unprecedented weather to millions of Americans. In March alone, 15,000 warm weather records were broken.<sup>3</sup> The first quarter of 2012 was the warmest on record and of more than 1,400 months (117+ years) since the climate records began, only one month (January 2006) has seen a greater departure from its average temperature than March 2012.<sup>4</sup>

A rare “derecho” storm tore through the Mid-Atlantic area in late June, ripping down trees and utility poles. The storm left approximately 1.2 million homes without power and killed at least 5 people.<sup>5</sup> Many still without power from the storm were further pressured by a massive heat wave which brought record highs to the eastern half of the U.S. in early July, breaking records in a dozen states from the Midwest to the East Coast and causing at least 74 deaths.<sup>6</sup>

By July 10, 61% of the country was in moderate to extreme drought conditions, which devastated corn crops and put pressure on food prices.

According to a recent NASA study, extreme conditions such as these are directly linked to climate change.<sup>7</sup>

## Regional Climate Change Impacts in the U.S.



This year's events show that understanding the impacts of climate change in the U.S. is much more complicated than a simple rise in temperatures.

Each region will be impacted differently; understanding these regional consequences is important to policymakers because it will allow planning for response and adaptation.

*For a further, state-by-state analysis of the effects of climate change on the U.S. economy, public health, security and competitiveness, please refer to the 2011 American Security Project report, "Pay Now, Pay Later".<sup>9</sup>*

## Northwest



Washington  
**Oregon** Idaho

The Northwest is split down the middle by the Cascade Mountain Range, and this divide creates different climates on either side. The western side of the Cascades, bordering the Pacific Ocean, faces increased rainfall and coastal erosion over the coming decades. The Puget Sound Region around Olympia, Tacoma and Seattle is highly populated and is the most sensitive region in the Northwest to coastal erosion.<sup>10</sup>

This area could see a sea level rise of about 13 inches by 2100, though some areas could experience up to 50 inches.<sup>11</sup> This, combined with heavier rainfalls will contribute to higher risk of landslides along the highly populated coast.

On the eastern side of the Cascades, scientists expect summers to become dryer and hotter, contributing to higher wildfire risk and increased beetle attacks on trees.

The Northwest's water resources are extensively utilized for energy production (70% of electricity production in the region is from hydroelectric dams), agriculture, and fisheries. The majority of the region's water is stored in winter snowpack in the mountains.<sup>12</sup>

"Pay Now, Pay Later" notes that by the 2040s, the higher winter temperatures are expected to decrease snowpack in the Cascade Mountains by up to 40%, leading to potential water shortages in the summer months that harm agriculture and energy production.



*Irrigated farmland in the Cascade Mountains*

## Southwest



Colorado  
Utah  
Nevada  
New Mexico  
California  
Arizona

The Southwest is the driest region in the United States and it is becoming more arid and warmer as temperatures rise globally. The population has grown faster than the national average in this region between 2000 and 2010, putting pressure on already scarce water resources.<sup>13</sup>

Warmer temperatures have led to a decrease in spring snowpack and Colorado River flows, important sources of water for the region. Due to the full utilization of the river's flow for both agriculture and municipal water across the Southwest, the Colorado River seldom reaches the sea anymore – this means there is little margin for error when the river's flow decreases. As temperatures increase and droughts become more lengthy, these water supplies will come under stress.<sup>14</sup>

The Colorado River is a key source of irrigation for agriculture across most of the Southwest; it is a \$2.4 billion industry in Arizona. As underground wells become depleted faster than they can be replenished, the region's agriculture is at risk.<sup>15</sup>

Droughts have already ravaged the region, sparking wildfires which can last for months throughout the Rocky Mountains. In 2012, Colorado had the hottest June on record<sup>16</sup> and suffered from wildfires which destroyed over 600 homes and caused at least \$449.7 million worth of damage.<sup>17</sup>

As droughts become more pervasive across the region, already over-utilized water sources will become over-stressed and wildfires will be more frequent.



*Wildfire in Colorado*

## Great Plains



North Dakota  
 South Dakota  
 Nebraska  
 Kansas  
 Oklahoma  
**Texas**  
 Montana  
 Wyoming

The Great Plains region is known for its cold winters and hot summers, with many parts of the region experiencing 70-100 days over 90°F (32.2°C) each year.

The northern part of the region typically has freezing cold winters, but they have moderated over the past 30 years. During this time, winter temperatures have risen up to 7°F (3.9°C) above historical averages.<sup>18</sup>

Warmer winter temperatures are making the northern part of the region wetter, with increased risk of flooding, while warmer weather overall is causing intense droughts in the southern half of the region. Unpredictability and fluctuation in weather patterns mean that droughts can be followed by torrential rains – both of which harm agriculture upon which the region depends. For example, according to “Pay Now, Pay Later”, with a possible 9°F (5°C) increase in temperature and 1% decrease in precipitation, western Kansas could see \$290 million in crop losses by 2035, with a rippling effect costing an additional \$169 million and 1,400 jobs elsewhere in the economy.<sup>19</sup>

This area, sometimes called the Corn Belt, is the agricultural hub of the United States. Droughts will get worse as temperatures rise and precipitation patterns change. Droughts in this region affect surface water supplies, while the Ogallala aquifer, which provides water to 80% of the population and millions of acres of farmland, comes under increased pressure. Groundwater pumping from this ancient store of water trapped underground is extracting water faster than the aquifer’s replacement rate.

Higher temperatures coupled with droughts caused by decreased precipitation will further increase pressure on that water supply.<sup>20</sup>

## Climate Change's Threats to America's Military Bases

Climate change not only affects our security through its impacts on the economy and our physical infrastructure (roads, bridges, airports, etc.); it also can also affect domestic and international military bases as flooding, drought and extreme weather events intensify. Physical changes to the environment may disrupt U.S. military capabilities and facilities, such as military training ranges or bases.<sup>1</sup> According to the U.S. Department of Defense (DoD) 2010 Quadrennial Defense Review, there are a number of US military installations that are already at risk.

The report says: *"In 2008, the National Intelligence Council [NIC] judged that more than 30 U.S. military installations were already facing elevated levels of risk from rising sea levels. DoD's operational readiness hinges on continued access to land, air, and sea training and test space."*<sup>2</sup>

Although sea-level rise is a major concern, other environmental threats must be taken into consideration in order to keep our military installments safe and secure. We tend to look at environmental threats on an individual, case-by-case basis, which does not take the plethora of threats into account. According to Cleo Paskal, "The NIC's 2008 focus was primarily sea level rise. However, considering flooding threats alone, coastal sites may be affected by sea level rise, but also subsidence, river flooding, unusually heavy rainfall, and dam bursts."<sup>3</sup> In order to prepare our military installments for the effects of climate change, we must not make a one-dimensional risk assessment but instead, prepare for multiple types of environmental threats such as flooding from extreme weather, droughts and civil unrest related to food and water insecurity.



*Damage to Homestead Air Force Base after Hurricane Andrew*

According to the U.S. Department of Defense 2012 Base Structure Report, the United States military manages property in all 50 states, 7 U.S. territories and 40 foreign countries, comprising almost 300,000 individual buildings around the globe.<sup>4</sup> These buildings are valued at \$590 billion. The Army alone has over 14 million acres of property, 2000 installations and 12,000 historical structures.<sup>5</sup> As the effects of climate change increase in many parts of the world, our investments and structures may be at risk of severe damage.

Environmental threats to domestic U.S. military bases pose as much of a physical threat as they do an economic threat. In 1992, Hurricane Andrew nearly wiped out Homestead Air Force Base in Florida and Hurricane Katrina destroyed 95% of Keesler Air Force Base in Mississippi. Both of these bases were rebuilt, but it took millions of dollars to do so. Military bases in the U.S. are important for driving local economies and when they are destroyed by natural disasters, there is a ripple effect economically in the region.

Environmental threats to international U.S. military installments have more strategic implications. For example, the island of Diego Garcia in the Indian Ocean is a critical logistics hub for US and British forces in the Middle East. It also houses Air Force Satellite Control Network equipment that is used to control the

GPS constellation.<sup>6</sup> The island is extremely vulnerable to the effects of climate change because it is just one meter above sea-level. If the island is flooded or inundated completely, the US will lose a strategically vital installation in the most tumultuous region in the world.

Climate change poses costly threats to our domestic installations and potentially destabilizing threats to our international installations that hold strategic importance to the U.S. military. In order to prepare for these changes and to secure our military investments worldwide, the U.S. must invest in low-cost adaptation options, which are effective and multidimensional.

The Department of Defense must make it a priority to understand the effects of climate change on both its operations and fixed installations as changes to environmental resources and man-made infrastructure intensify. In order to understand these effects, the Department of Defense must complete a comprehensive assessment of the potential impacts of climate change on its installations and missions globally.

### **Top 5 Most Vulnerable Military Installations**

The following bases are strategically important for the US and are also extremely vulnerable to extreme weather, rising sea-levels, coastal erosion and other effects of climate change.

1. Diego Garcia-As mentioned, Diego Garcia is a critical logistics hub for the US and UK militaries in the Middle East. However, the island is a coral atoll encompassing 67 square miles, of which only 10 square miles is dry land.<sup>7</sup> Due to its exposure to the extreme weather in the Indian Ocean, changing temperatures and increasing rainfall, Diego Garcia faces the threat of coastal erosion and flooding. The highest point above sea-level is 22 feet, but the island's mean height above sea-level is 4 feet. Most areas do not exceed 6.5 feet (2 meters). A sea-level rise of a several feet would force the US military to undertake a costly and difficult military relocation process; in addition, the military would lose a geographically strategic outpost in the Indian region.
2. Military installations out of Bahrain, including U.S. "floating bases"- The U.S. military has built up military reinforcements into the Persian Gulf, many based out of Bahrain, to deter Iranian military from any possible attempt to shut the Strait of Hormuz (a key oil shipping route for the U.S.). The most visible presence are U.S. "floating bases," including the USS Ponce, which are used to support missions in areas where ground base action is not available.<sup>8</sup> Since Bahrain is an archipelago with many coastlines, sea-level rise and extreme weather are pressing issues for the country and for our military installments in the region.
3. Guam- The military installation on the island of Guam is one of the most strategically important US bases in the Western Pacific Ocean. Military presence on Guam allows the US access to China and the rest of East Asia by air and sea to the West and Hawaii and North America to the East.<sup>9</sup> It has a protected harbor and sufficient land for airports and military installations. It is also the largest of the Mariana Islands, an archipelago in Micronesia. Because Guam is exposed in the open ocean, it is susceptible to extreme storms, sea-level rise and erosion. If the ocean rises significantly, U.S. strategic interests on the island of Guam will be at risk.



4. Eglin Air Force Base, FL- Located on the Gulf of Mexico, Eglin Air Force Base is the largest Air Force base in the world. It encompasses 724 square miles of land and occupies the majority of the northwest Florida panhandle. It serves as the focal point for all Air Force armaments and is home to the Air Force Armament Center (AAC), one of three product centers in the Air Force Material Command. The AAC develops, tests and deploys many critical air-delivered weapons.<sup>10</sup> It is a very important base not only for the US military but also for the local Florida economy. Since it is located on the coast in the Gulf of Mexico, it faces storm surges, sea-level rise and saltwater infiltration, which causes problems with freshwater resources in the area. With the increase of extreme weather, Eglin Air Force Base may face costly damages in the future.
5. Norfolk Naval Air Station, Norfolk, VA- Naval Base Norfolk is one of the largest naval complexes in the world, situated on the souther coast of Virginia in an area commonly known as Hampton Roads. The Naval Station houses US Atlantic Fleet, Commander Navy Region Mid-Atlantic and the Navy's largest supply center. The nearby Newport News shipyard is also the only yard in the U.S. that builds aircraft carriers.<sup>11</sup> Because of its location on the southern tip of Virginia, it is at risk of sea-level rise and storm surge, but it may also face threats from hurricanes in the Atlantic. As the effects of climate change become more pronounced, Norfolk Naval Air Station may be effected more acutely, putting strategic naval resources at risk.

(Endnotes)

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## Midwest



Minnesota Wisconsin Michigan  
Iowa Illinois Ohio  
Missouri Indiana

The Midwest is home to 66 million people. Its climate is marked by hot, humid summers and very cold winters, though the coldest periods of winter have become less frequent over the past few decades, as snow and ice arrive later in the fall and melt earlier in the springtime. Average temperatures could increase up to 3°F (1.7°C) in the next few decades and may increase up to 10°F (5.6°C) by the end of the century.<sup>21</sup> The increase in temperature is likely to cause the northernmost forests of many tree species to shift further north, damaging the region's forestry industries, most notably Wisconsin's \$18 billion forestry industry that supports 74,000 jobs.<sup>22</sup>

Climate change will affect the Midwest through its effects on human health and water availability. Heat waves will cause more heat-related deaths as well as harm public health. For example, the Midwest heat wave of June and July of 2012 saw 10 consecutive days over 100°F (37.8°C) in St Louis<sup>23</sup> - causing at least 13 heat-related deaths in that city alone.

Air quality will be harmed in cities like Chicago and St Louis as higher temperatures increase ozone formation, leading to respiratory disease. Insect and waterborne diseases such as Lyme disease and West Nile Virus will increase as warmer winters fail to kill diseased ticks and mosquitoes that normally die off as cold weather begins.<sup>24</sup>



*Corn crops affected by the drought of 2012*

Heavy downpours now occur twice as frequently as a century ago across the region – leading to flooding damage to property and infrastructure. The drainage and wastewater systems in the region have been strained by the increased heavy downpours and flooding and will be overwhelmed if not replaced in the next few decades.

## Southeast



Kentucky Virginia  
Arkansas North Carolina  
Tennessee South Carolina  
Mississippi Georgia  
Louisiana Alabama Florida

The Southeast of the United States contains 29,000 miles of coastline, making it vulnerable to extreme weather, sea-level rise and erosion. Since 1970, average annual temperatures in the region have risen about 2°F (1.1°C) and precipitation has increased.

Coastal hurricanes and sea-level rise are threats to coastal communities and ecosystems.<sup>25</sup> Cities such as New Orleans and others in the lower Mississippi Delta are experiencing subsidence (sinking of the land) due to erosion.

Flooding and storms have begun to erode sediment upon which vital infrastructure is built, making coastal areas vulnerable to increasingly intense storms.

The detrimental effects of climate change will be exacerbated by poverty. Roughly 80 percent of all U.S. counties that experience persistent poverty (defined as a county in which at least 20 percent of the population experiences poverty for three decades or more) lie in this region. This makes the region's population less able to prepare for and recover from severe weather or heat.<sup>26</sup>

Energy costs could rise by almost \$60 billion by 2100 as a result of increasing temperatures, which will put financial pressure on those who are already economically stressed.<sup>27</sup>



*New Orleans after Hurricane Katrina, 2005*

The combination of persistent rural poverty and geography makes the population of the Southeastern United States the most vulnerable to a changing climate in the country.<sup>28</sup>

## Northeast



New Hampshire  
Vermont  
New York  
Pennsylvania  
West Virginia  
Maine  
Massachusetts  
Rhode Island  
Connecticut  
New Jersey  
Delaware  
Maryland

The climate of the American Northeast features all four seasons: crisp falls, very cold winters, pleasant springs and hot summers. Over the past four decades, temperatures have been rising 0.5°F (0.3°C) per decade, with winter temperatures rising faster at 1.3°F (0.7°C) per decade. These changes have affected the length and depth of seasons, along with the economy in the Northeast.

Over the last 20 years, features of seasons have changed. The majority of winter precipitation now falls as rain instead of snow. Summer days have become hotter, as the number of days over 90°F (32.2°C) have doubled over the past 45 years.<sup>29</sup> Spring arrives sooner and fall is warmer.

New Hampshire's \$4.3 billion tourism industry relies on snow for skiing and other winter sports. As temperatures rise, the winter sports season could shrink by up to 50%, which will have ripple effects on hotel, food service, transportation, retail and other industries in the region that depend on tourism.<sup>30</sup>

As temperatures increase, a small example shows how climate change is affecting the broader economy. Maple syrup production – which had been a mainstay of late winters across New England for generations – may only be possible in very small areas of Northern New England, putting many out of business.

In Southeastern Massachusetts, a major part of the agricultural economy might be cut out as cranberries may no longer be able to grow.

Hot summer days also affect air pollution in populated urban areas. Precipitation has increased up to 20% in some parts of the region, putting highly populated coastal cities at risk.<sup>31</sup> As sea levels rise, important infrastructure, businesses and landmarks on the coast will be at risk of severe flooding and damage.



*Vermont after Hurricane Irene, 2011*

## U.S. Climate Security Issues

Ensuring America's national security does not just involve protecting our borders from outside physical threats. Non-traditional threats, like climate change, are also important aspects of homeland security.

Climate change poses a direct threat to U.S. national security, through its effects on critical infrastructure, the lives of citizens, the economy, and energy security.

The discussion below gives an idea of the threats that the U.S. homeland faces from a changing climate.

They are not exhaustive. The greatest threat comes not from a single one of these factors, but from an overlapping, iterative process that dampens security.

### *Increased Intensity of Extreme Weather*

- The U.S. military may be required to respond to natural disasters as they continue to destabilize infrastructure, food security and water security.
- Increased natural disasters will negatively affect the U.S. economy through the potential disruption of energy infrastructure, both in the Gulf of Mexico from extreme storms and power plants across the nation due to droughts affecting needed water supplies.
- Coastal flooding from increased storms may cause large amounts of damage to homes, businesses and military bases, and may leave thousands homeless.

Twenty three states have a coastline with either the Atlantic or Pacific Ocean. Although coastal counties account for only 17% of U.S. land area, 50% of the U.S. population (excluding Alaska) lives in that small area. This puts pressure on coastal ecosystems and places millions of people in danger of extreme weather.<sup>32</sup>

In addition, the majority of our domestic military bases are located near our coastlines, putting them in danger as sea levels rise and storms become more dangerous.<sup>33</sup>

By 2020, 14.9 million more people are expected to move to the coast; this coastal development could further decrease coastal areas' abilities to withstand flooding and drought as well as make coastal regions more vulnerable to erosion.

These natural barriers and ecosystems have evolved to survive extreme weather – in their absence, the developed coast becomes more vulnerable to extreme weather events, putting the coastal population at risk.

According to a March 2012 report from the Intergovernmental Panel on Climate Change (IPCC), extreme weather events will increase as the global climate warms due to higher greenhouse gas emissions.

The IPCC says, "Evidence suggests that climate change has led to changes in climate extremes such as heat waves, record high temperatures and, in many

*"We need to end the conspiracy of silence. The costs of inaction get more and more expensive the longer we wait—and the longer we wait, the less likely we are to avoid the worst and leave future generations with a sustainable planet."*

**Senator John Kerry**  
ASP Board Member

regions, heavy precipitation in the past half century... Climate extremes, or even a series of non-extreme events, in combination with social vulnerabilities and exposure to risks can produce climate-related disasters”.<sup>34</sup>

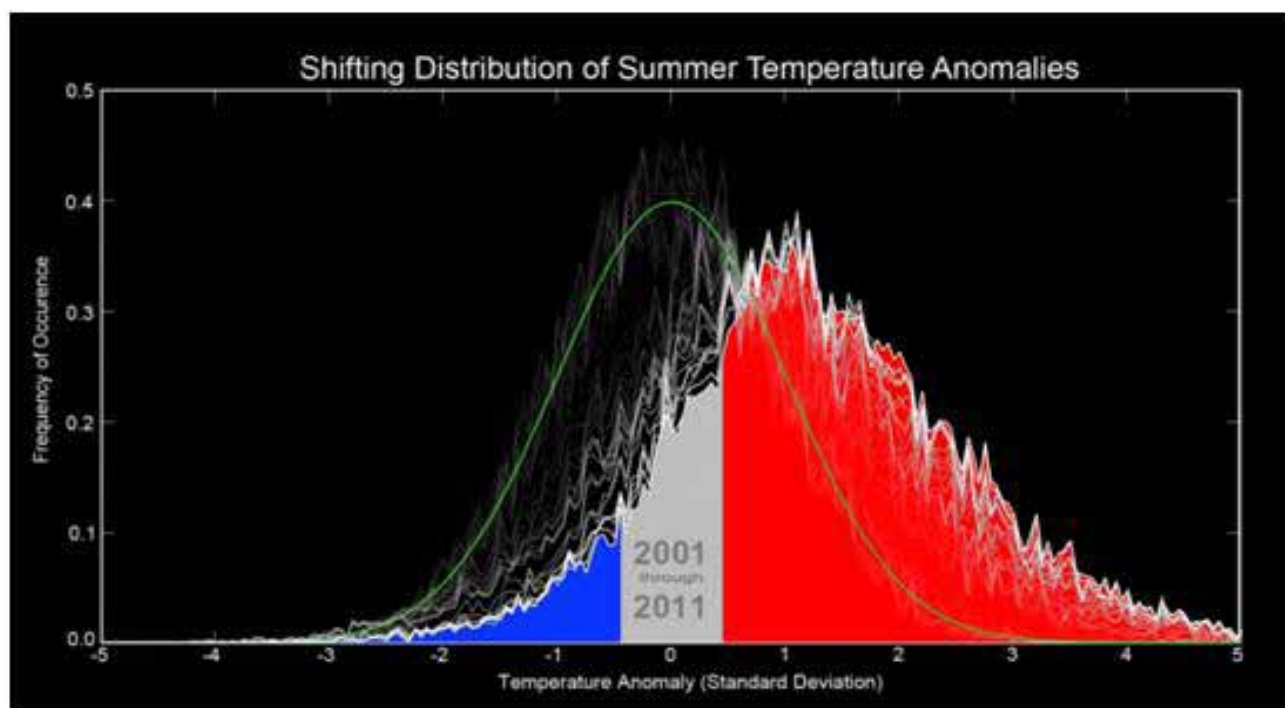
A NASA study released on August 6, 2012 finds a direct correlation between climate change and extreme hot weather events.

The authors of the report created a bell curve to show the shifting distribution of summer temperature anomalies by plotting data over the last 30 years.

They found that as time passes and the planet gets warmer, the bell curve moves to the right, including more ‘hot’, ‘very hot’ and ‘extremely hot’ events.

The report links the deadly European heat wave of 2003, the Russian heat wave of 2010 (which led to food price shocks and thousands and deaths), and the droughts in Texas and Oklahoma in 2011 to climate change.<sup>35</sup>

James Hansen, lead author on the report and head of the NASA Goddard Institute for Space Studies said, “For the extreme hot weather of the recent past, there is virtually no explanation other than climate change.”<sup>36</sup>



## U.S. Infrastructure and Climate Change

- U.S. homeland security, public health and safety, economic vitality and our way of life all rely on physical and virtual infrastructure.
- The effects of climate change may destroy or temporarily debilitate critical energy infrastructure, physical infrastructure such as roads, airports and bridges and virtual infrastructure through the loss of electricity.
- The effects of climate change on infrastructure will not only be costly to our nation's economy, they will also make us less secure as a nation.
- The military and government rely on physical infrastructure to protect our nation from outside threats and virtual infrastructure to maintain a strong homeland, both of which are threatened by extreme weather caused by climate change.

America's infrastructure includes highways, bridges and dams; it includes the electricity grid and nuclear energy infrastructure; it also includes drainage and sewer systems.

These structures are vulnerable to the effects of climate change because they were designed for a climate that is different from the one they will face in the 21<sup>st</sup> Century.

Increased disruptions from extreme weather events may weaken physical infrastructure, causing damage to highways and bridges or decreased water flow to dams that serve as large sources of energy for entire regions.

America's highway network makes up 4 million miles and roads and over 600,000 bridges; 25% of the bridges need repair and a third of the roadways in substandard condition.<sup>37</sup> The biggest challenge to the U.S. infrastructure is its lifespan; the majority of the current U.S. infrastructure was built in the post World War II period, with an expected lifespan of 50-100 years, depending on the specific type of program. The Hoover Dam was built in 1935 and remains important for generating hydroelectric power in the United States today, but its assumptions about water flow are based upon a climate of long ago.

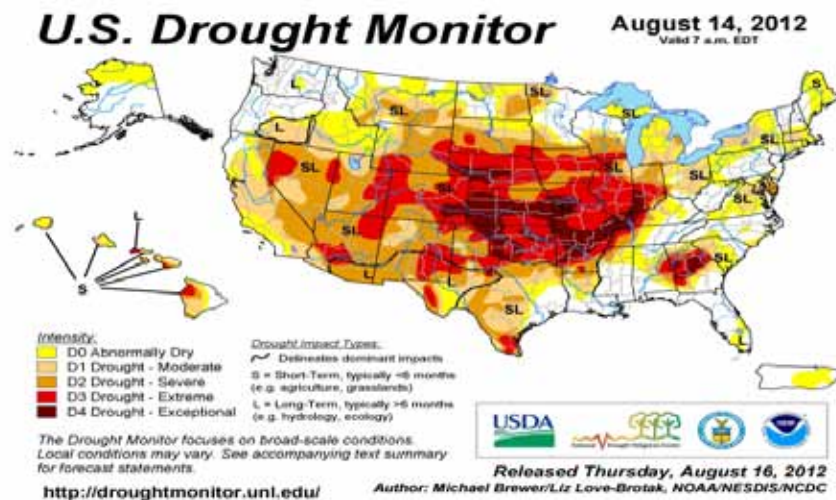
When U.S. infrastructure was developed in the last century, climate change was not understood or factored into building plans.<sup>38</sup> Highways and other major infrastructure investments were built for local climates, taking temperature and rainfall into account. They were built to absorb extreme weather events, but not the unprecedented changes that are expected.

Infrastructure also includes America's energy generating infrastructure: excessive heat and droughts have caused power plants to shut-down, just as their generating capacity is needed most. The Braidwood nuclear power station in the Chicago area, for example, needed special permission to keep running because the pond it uses for cooling rose to 102°F (38.9°C). The maximum water temperature allowed is 100°F (37.8°C). This shows that the calculations for the climate of 1986, when the plant was first operated, are not sufficient today.<sup>39</sup>

Extreme weather can harm electricity infrastructure by knocking out power lines more frequently and by causing a surge in peak demand higher.<sup>40</sup>

## U.S. Agriculture and Climate Change

- U.S. agricultural exports are a major part of the U.S. economy and as climate change threatens crop yields, exports may decrease and domestic food prices may rise.
- Our nation's food security may be at risk if droughts like the most recent summer 2012 drought become more persistent. The cost of food will increase, putting economic pressure on the poor in the U.S.
- Rising temperatures cause fisheries, livestock and crops to be more vulnerable to invasive species that cause the outbreak of disease, which may have negative health and economic impacts.



Warming already underway in the U.S. is neither moderate nor helpful to agriculture in the U.S. Agriculture (including fisheries and livestock), and industries related to it, is one of the biggest contributors to the U.S. economy, adding \$200 billion annually.<sup>41</sup>

The U.S. is the world's largest producer of corn in the world, supplying much of the world with grains for livestock and food. Agriculture is intertwined not only with food security and with the livelihoods of millions of farmers and food producers. These are threatened by droughts and extreme weather.

The most recent 2012 drought in the Corn Belt has affected the majority of the landmass of the contiguous United States, according to the August 14, 2012 National Drought Monitor. NASA scientist James Hansen, author of the aforementioned report on extreme weather, claims that 2012's record temperatures are likely to be linked to man-made climate change.<sup>42</sup>

The extreme heat wave of 2012, coupled with decreased rainfall, has had devastating effects on the corn and soybean crops. According to the National Drought Monitor, 87% of U.S. corn crops, 85% of soybeans, 63% of hay and 72% of cattle areas are experiencing drought.



USDA has declared natural disaster areas in more than 1,000 counties and 26 drought-stricken states, making it the largest natural disaster in American history.<sup>43</sup>

A report from the USDA on August 10, 2012 outlines the world agricultural supply and the effects of the drought on corn and soybean crops. According to the report, the latest forecasts expect a large drop in U.S. feed grain supplies, projected to be 2.2 billion bushels lower in 2012/13. If the drought continues to affect corn and soybean crops at the levels forecast, corn yield will be the lowest since 1995/96, even though the amount of corn planted this year was the highest in history.

Even in places with adequate irrigation systems, expenses associated with watering thirsty crops multiply during droughts. As farming inputs become costlier and more intensive, so too will the price of food in the grocery store.

Wells Fargo & Co. agricultural economist, Michael Swanson, claims the adverse weather could cost the U.S. economy as much as \$50 billion.<sup>44</sup> According to USDA economist Richard Volpe, normal grocery price inflation is about 2.8% each year, with this year at an all-time high of 3-4%.<sup>45</sup>

Droughts have dire implications for food and financial security in the United States, as higher food prices put pressure on consumers' wallets. With a larger portion of consumer spending dedicated to food, expenditure on other goods and services weaken causing a slowdown across economic sectors. A drought of such sustained size and duration has clear economic consequences.

A drought in the United States is not an isolated incident; it has consequences all over the world, affecting developing countries that rely on our grain exports to support their agricultural needs.

A drought in the U.S. affects food security globally by pushing up prices in importing countries everywhere, potentially creating indirect destabilization in other nations that rely on agriculture for survival.

Although drought is the most pressing issue in U.S. agriculture today, rising temperatures will also affect fisheries and livestock by making them more vulnerable to invasive species. The same goes for crops; as temperatures rise, biodiversity is altered, allowing new weeds and pests to become more prevalent.



*Colorado Agriculture affected by the drought of 2012*

## Climate Change and Human Health in the U.S.

- Climate change directly impacts public health in the U.S. through its effects on ozone levels, air quality in cities and infectious diseases. As its impacts increase, our public health infrastructure will be pushed to its limits.
- Climate change will create more health problems, which will require more investment in public health infrastructure. Unfortunately, funding for public health has suffered since the economic crisis, which is a major concern as health problems increase due to climate change.
- Increased temperatures may lead to higher rates and ranges of infectious diseases carried by insects or in food and water, which may cause illness or death. It may also threaten the availability of food and water supplies.

Climate change will have direct and pressing impacts on human health. Increased occurrences of heat waves decrease air quality in cities all across the U.S., where populations are high and temperatures rise more quickly because of the amount of concrete to absorb sunlight.

Increased heat leads to higher ground level ozone formation, which can damage lung tissue, increase respiratory symptoms and aggravate asthma or other lung diseases. It is especially harmful to children, older adults, outdoor workers, and those with asthma and other chronic lung diseases.

If emissions of air pollutants remain fixed at today's levels until 2050, warming from climate change alone could increase the number of Red Ozone Alert Days (when the air is unhealthy for everyone) by 68% in the 50 largest eastern U.S. cities.<sup>46</sup>

According to "Pay Now, Pay Later", California has the worst air quality in the U.S., with 90% of the population living in areas in which the air does not meet current ozone state standards. The pollutants in the air cause an array of health problems, which contribute to 8,800 deaths and \$71 billion in healthcare costs.<sup>47</sup> As temperatures rise, air pollution will increase. This will have extreme consequences for public health and will put pressure on our health system.

Climate change has direct effects on deadly viruses such as West Nile Virus. In recent months, there has been a sharp escalation in the West Nile Virus, including 1100 reported cases and 42 deaths.<sup>48</sup> Though the cause of this specific outbreak is unclear, the extreme heat this summer has been cited as an explanation.

Mosquitoes do well in a drought because there are often standing pools of water in storm drains and catch basins, which allow the mosquitoes to thrive. After a drought, they repopulate more quickly than other insects (including their predators) and therefore can have free reign.<sup>49</sup>

Normally, cold winters kill off deadly strains of viruses in mosquitoes, but warmer winters are causing many of these viruses to survive. As temperatures continue to rise, West Nile Virus and other insect-borne illnesses will continue to be a major health concern in the U.S.

# Climate Change and the U.S. Economy

- Climate change will affect almost every sector of the U.S. economy, though some will feel the pressure more than others. In an already tight economic environment, the effects may be disastrous on our national security by weakening our global bargaining power.
- The U.S. is the strongest economic power in the world, with a preeminent military, strong agriculture and great human capital. However, climate change threatens to weaken military bases affected by natural disasters, cause major health concerns and potentially reduce food security.
- A robust economy is necessary for strong national security because it allows us to invest in the structures that keep people safe; climate change is already hitting the economy hard, which reduces our ability to invest in sound security infrastructure.

Climate change will harm the American economy – our status as the wealthiest country in the world means that we have more to lose.<sup>50</sup> The sectors of the economy that will be most affected by climate change are energy, agriculture and transportation.

It is estimated that a decaying transportation system costs our economy more than \$78 billion annually in lost time and fuel; climate change will exacerbate those effects. Railroads will need \$200 billion of investment over the next 20 years to support freight increases.

The United States must invest \$225 billion per year over the next 50 years to maintain and adequately enhance our surface transportation systems. Currently, we are spending less than 40% of that - and going down.<sup>51</sup>

Climate change is already affecting our infrastructure through its crippling effects on power plants and energy sources, and the effects of droughts on highways. These effects will only undercut budget problems even more in the years to come.

Wildfires in the West and Northwest are a costly side effect of rising temperatures and forestry regulations. For example, the 2012 wildfires in East Texas caused an estimated \$400 million worth of economic damage in the region.<sup>52</sup>

These fires, like others, destroyed homes, businesses and timber. Annual suppression costs of wildfires are estimated at \$1.3 billion or more, depending on the year. With the amount of wildfires occurring this year, it is likely the costs are even higher. The worst fires in Arizona's history occurred in 2002 and 2005.

Climate change will harm some of our nation's most historic economic sectors, like dairy, skiing, wine, or even

*“Climate Change poses a clear and present danger to the United States of America. National security, linked to energy security and economic growth, which undergird all of our nation’s power, can be achieved by taking action now to avert the worst consequences of climate change. The imperative, then, is for leadership and action on a global scale. The United States must act. The United States must lead.”*

**Vice Admiral Lee Gunn, USN (Ret.)**

ASP Board Member

maple syrup production. A study from the University of Maryland said,

*“In the Northeast, the maple sugar industry – a \$31 million industry – is expected to suffer losses of between 15 and 40% (\$5-12 million) in annual revenue due to decreased sap flow. The region can expect a decrease of 10-20% in skiing days, resulting in a loss of \$405-810 million per year. The dairy industry is also highly sensitive to temperature changes, since the dairy cows’ productivity starts decreasing above 77°F (25°C). In California, an annual loss of \$287-902 million is expected for this \$4.1 billion industry. Losses are expected to the \$3.2 billion California wine industry as well, since grape quality diminishes with higher temperatures. In each case, these may be considered small niche sectors in their respective economies – accounting for less than one-tenth of gross state product – yet they are an essential element of local employment, history, culture and landscape.”<sup>53</sup>*

Although some efforts have been made to adapt to climate change, America’s economy is already being affected by changes today. This will only grow worse in the future. Small sectors will be hit the hardest, putting many people out of jobs and placing further pressure on the U.S. budget.



*Louisiana fishing fleet after Hurricane Katrina, 2005*

# Addressing Climate Change: American Capabilities for Preparation and Response

Although the headlines of the last several years show that Congress has failed to pass legislation that would mitigate climate change in an effective manner, there are many government organizations working hard to put in place plans for adapting and responding to a changing climate.

The Environmental Protection Agency (EPA) has been working to help federal, regional and local networks adapt to the effects of climate change. For example, they released the “Excessive Heat Events Guidebook” to provide cities with strategies for protecting vulnerable populations during heat waves, which has been extremely important with the heat waves this summer.<sup>54</sup> The EPA has also developed two “Climate Ready” training programs: one called Climate Ready Estuaries,<sup>55</sup> which works on adaptation strategies with the National Estuary Programs (NEP), and the other called Climate Ready Water Utilities,<sup>56</sup> which works to plan and implement adaptation strategies for drinking supply, wastewater and storm water.

The government has acknowledged that water is the resource most impacted by the effects of climate change. Because of this, the Climate Change and Water Working Group (CCAWWG) was founded as a collaborative effort by NOAA, FEMA, the EPA, NASA, the United States Geological Survey (USGS), the Bureau of Reclamation and the United States Army Corps of Engineers (USACE). This working group, created in 2008, learns how climate change, variability and trends will affect future water demand and supply, identifies adaptation strategies across federal state and local agencies.

The U.S. Army Corps of Engineers is also working towards reducing the vulnerability of water infrastructure through their Response to Climate Change Program.<sup>57</sup> Adaptation measures such as these are necessary to preparing for the changes that are occurring at a rapid pace. Over the past few years as the effects of climate change have become increasingly apparent, NOAA, NASA, USACE and the National Weather Service (NWS) have collaborated to monitor and analyze the changes.

Although the economic downturn has caused large cutbacks in our nation’s public health sector, various programs have been created to develop strategies and plans to confront the health implications of climate change. The Centers for Disease Control and Prevention (CDC) have developed a framework called BRACE, which stands for Building Resilience Against Climate Effects. Through this framework, the CDC aims to support health departments to incorporate advanced climate models and atmospheric data into short and long-term planning and response activities.<sup>58</sup>

The Public Health Emergency section of the U.S. Department of Health & Human Services created the National Health Security Strategy (NHSS) in 2009 to ensure that the nation is prepared for, protected from, and resilient in the face of health threats or incidents with potentially negative health consequences.<sup>59</sup>

Climate change falls under this category because of its various negative health impacts. By attempting to incorporate all levels of the health system, the NHSS and BRACE offer strong strategies for planning for the health consequences of climate change.

## How to Improve American Capability to Address Climate Change

Although the U.S. has many programs and frameworks in place to respond to and prepare for the effects of climate change, there is still much more that can be done to protect our economy, our people, our crops and our infrastructure. Thinking ahead will allow us to prepare for the effects of climate change while also enhancing our national security.

According to ICLEI (Local Governments for Sustainability), American cities have the lowest rate of planning for adaptation in the world,<sup>60</sup> putting our nation at great risk of the effects of climate change. America's wealth gives it the capacity to afford adaptation measures, such as protecting coastal infrastructure by raising the levels of homes and preparing coastal utilities for changes in weather patterns and sea-level rise, but they are not yet being taken advantage of.

The U.S. could be the leader in adaptation measures but since the issue of climate change has fallen off many agendas, we have become less prepared and less competitive.

Individual cities like New York, Seattle and Boston are taking adaptation measures into their own hands and various government organizations have plans to help local and regional communities to adapt to the effects of climate change. However, the only way the work being done will truly be effective is if the individual government organizations collaborate their work with one another.

If many organizations are working towards the same goals without collaboration, their goals will be completely undermined. Executive branch input is necessary for successful adaptation and at this point, the issues of climate change still become lost in partisan politics.

The most effective way for the U.S. to prepare for the effects of climate change is with a nation-wide adaptation plan that takes regional geography and climate into account. Although this would be a large undertaking, it will make our nation more secure by pointing out areas where we are particularly vulnerable to the effects of climate change. Climate change and security are interlinked and the only way to assure a more secure future is to prepare for climate change because it will affect all sectors of our economy.

As our infrastructure ages, gets pushed to its limits by extensive over-use and crumbles from the effects of climate change, security will increasingly be a problem.

In order to enhance security, the U.S. should invest in strengthening infrastructure for increased energy demand due to climate change, especially for peak demand during heat waves. They should also invest further in physical infrastructure like highways, bridges and railways, which are susceptible to the effects of climate change and are vital to protecting our national security.

Although Hurricane Katrina was not definitively linked to climate change, it gave the U.S. an image of how extreme natural disasters (increasingly caused by climate change today) will appear, and how their effects will ripple across our nation. Natural disaster relief needs to be better coordinated between organizations.

Increasing citizens' awareness and education for dealing with natural disasters will ultimately aid in the post-disaster relief period.

## **Summation**

While America's national security leaders agree that climate change is a threat to national security, due to its effects on global instability and humanitarian crises around the world, it is time to address the threat that climate change poses to America's domestic security.

The threats to each region are real and could be severe.

Certain sectors of the American economy, notably energy and agriculture – the base of so much else – are at risk due to a warming climate.

The U.S. needs to further develop plans for responding to and preparing for the effects of climate change.

U.S. government capability will also greatly benefit from the development of an open, honest dialogue about the facts surrounding climate change and how it will affect our country and our national security.

By discussing it in a non-partisan, open manner, the U.S. will be able to move past the partisan debate and towards an open dialogue about what is happening and how we can fix it.

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# ABOUT THE AUTHORS

## Catherine Foley



Catherine is an Adjunct Fellow for Energy and Climate at the American Security Project, focusing primarily on climate security.

A Boston area native, Catherine received her B.A. from the College of the Holy Cross in 2010 in French and Peace and Conflict Studies, focusing on the correlation between climate change and security. She studied abroad for a year in Strasbourg, France where she interned at the International Institute of Human Rights.

In 2011, she completed her Masters in Peace and Conflict Studies at the University of St Andrews in Scotland.

Her primary areas of research included the links between climate change, development and conflict, leading her to write her dissertation on the geopolitical consequences of climate change in Bangladesh. The title of her dissertation was, “Heating Up: Climate Change, Migration and Violent Conflict in Bangladesh; An Analysis of the Interplay Between Human Insecurity and Climate Change”.

Previous to joining ASP, Catherine lived in Edinburgh, Scotland and worked for the Edinburgh Centre for Carbon Innovation. She co-authored a paper for Scotland’s 2020 Climate Group called “2020 Climate Group: Leading by Example Initiative on Transport”. This paper analyzed best practice and challenges in sustainable transport among the members of the 2020 Group.

Catherine is currently studying at the University of Edinburgh for an LLM in Global Environment and Climate Change Law.

## Andrew Holland



Andrew Holland is the American Security Project’s Senior Fellow for Energy and Climate. He is a Washington-based expert on energy, climate change, and infrastructure policy. He has over seven years of experience working at the center of debates about how to achieve sustainable energy security and how to effectively address climate change. He is an experienced writer and strategic analyst. He has spoken about energy security, Arctic policy, and water resources at high-level events in South Korea, Brussels, Washington, London, Geneva, and China.

In 2009 and 2010, he was the manager of the Transatlantic Dialogue on Climate Change and Security for the London-based International Institute for Strategic Studies (IISS). Through this dialogue he developed a close relationship with a diverse group of energy, security, and environmental experts from around the world.

Prior to joining the IISS, he was a Legislative Assistant on Energy, Environment, and Infrastructure for United States Senator Chuck Hagel of Nebraska from 2006 through 2008. He also has experience working in the US House of Representatives for the House Ways and Means Committee and the Office of Congresswoman Roukema.

He holds a Master's Degree in International Strategy and Economics from the University of St. Andrews in Scotland and a Bachelor's Degree in History and Economics from Wake Forest University in North Carolina.

He is originally from New York City, grew up in New Jersey, and currently resides in Washington DC.

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# FURTHER READING

## Reports and Papers of the American Security Project about Climate Change and Energy Security

### [America's Energy Choices: 2012 Edition](#)

March, 2012

*The report sets out how a range of energy options for America's future contributes to U.S. energy make-up and how our business and political leaders should weigh the competing priorities of energy security, economic stability, and environmental sustainability when making decisions.*

### [Pay Now, Pay Later: A State-by-State Assessment of the Costs of Climate Change](#)

May, 2011

*The American Security Project released a series of 50 reports which analyze and project possible economic losses—or in some cases, gains—on a state-by-state basis as a result of unmitigated climate change.*

### [Ending Our Dependence on Oil](#)

May, 2010

*The report argues that to stop oil dependence, we must invest in infrastructure that gives Americans safe and convenient alternatives to driving, improve the fuel economy of our cars, and develop the next generation of advanced biofuels.*

### [Offshore Oil Drilling in the Arctic](#)

August, 2012

*This paper evaluates several reasons why the rush by oil companies into the Arctic should be considered more closely.*

### [Counteracting Chinese Hegemony in the South China Sea](#)

August, 2012

*This ASP "Perspectives" paper highlights the reasons for increased Chinese involvement in the region, and the diplomatic and military strategies being implemented satiate its economic demands.*

## **Cause and Effect: U.S. Gasoline Prices**

April, 2012

*This ASP “Perspectives” paper examines the causes of America’s soaring gasoline prices and underscores that the price of gas is intimately interconnected with crude oil prices, which are set by global markets.*

## **Climate Change and Immigration: Warnings for America’s Southern Border**

September, 2010

*This ASP “Perspectives” paper highlights the likely effects of climate change on immigration along the US southern border.*

## **FACT SHEETS**

### **Arctic Climate and Energy**

August, 2012

*This Fact Sheet summarizes key developments in the Arctic, and discusses all aspects of Arctic energy development.*

### **A New Discourse: Climate Change in the Face of a Shifting U.S. Energy Portfolio**

August, 2012

*This Fact Sheet summarizes key developments to the natural gas industry, and clarifies what they mean for climate change discourse and mitigation.*

### **Bio Fuels and National Security**

March, 2012

*This Fact Sheet shows the importance of the U.S. Department of Defense’s investment in developing a domestic biofuels industry that can compete with oil.*

## ABOUT THE AMERICAN SECURITY PROJECT

The American Security Project (ASP) is a nonpartisan initiative to educate the American public about the changing nature of national security in the 21st century.

Gone are the days when a nation's strength could be measured by bombers and battleships. Security in this new era requires a New American Arsenal harnessing all of America's strengths: the force of our diplomacy; the might of our military; the vigor of our economy; and the power of our ideals.

We believe that America must lead other nations in the pursuit of our common goals and shared security. We must confront international challenges with all the tools at our disposal. We must address emerging problems before they become security crises. And to do this, we must forge a new bipartisan consensus at home.

ASP brings together prominent American leaders, current and former members of Congress, retired military officers, and former government officials. Staff direct research on a broad range of issues and engages and empowers the American public by taking its findings directly to them.

We live in a time when the threats to our security are as complex and diverse as terrorism, the spread of weapons of mass destruction, climate change, failed and failing states, disease, and pandemics. The same-old solutions and partisan bickering won't do. America needs an honest dialogue about security that is as robust as it is realistic.

ASP exists to promote that dialogue, to forge consensus, and to spur constructive action so that America meets the challenges to its security while seizing the opportunities the new century offers.



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