

Climate Change and National Security

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Contents

Introduction	3
Elements of Potential Threat to Security	7
Possible Threats for Pakistan	9
Agriculture	10
Water	15
Conclusion.....	19
REFERENCES.....	21

Introduction

Traditionally, national security has been analyzed through the lens of physical threats from extremist groups, whether within or outside of the country, and social or political unrest which may lead to destabilization. Historical evidences confirm this argument through a chain of events right from the beginning of civilization. A number of examples can be quoted on this front and the most recent are the terrorist attacks on the United States of America (USA), the wave of terrorism in Pakistan and the Naxal movement in India. For traditional threats, traditional mechanisms were and are used to tackle the issue of national security.

Now, in addition to the above mentioned threats, the world is witnessing a new threat to global and national security in the form of climate change. The global community is therefore working on different aspects of climate change. In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was created to look after the climate change debate and to devise a policy to combat it. Unfortunately, UNFCCC could not produce any substantial results and extremely vulnerable countries and communities are still waiting for the right interventions.

The Inter-government Panel on Climate Change (IPCC) was created in 1988 by UNEP and WMO to provide world government clear scientific views on climate change. IPCC has predicted that climate change will have severe impacts on all aspects of life on the planet. In its 4th Assessment Report in 2007, the IPCC categorically listed potential impacts and threats of climate change. Some of those impacts can be seen now in different parts of world. Areas such as Water, Health, Food and Ecosystems will be affected severely(Table 1).(Inter governmental panel, Fourth Assessment Report,2007)

Poorer regions, countries and communities will be more vulnerable to climate change, even though these groups have a relatively smaller share in contributing to it. Historically developing and poor countries were not big consumers of fossil energy and have least share in development. The IPCC report further identified the main cause of climate change as unsustainable or irrational use of energy in developed countries during the course of history. During the age of the industrial revolution, industrialized countries used fossil fuels to achieve their development targets. However, this process affected the environment resulting in huge changes in climate, which are threatening the very existence of the planet.

Table 1: Potential impacts and threats of Climate Change

WATER	Increased water availability in moist tropics and high latitudes	Decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes	Hundreds of millions of people exposed to increased water stress
ECOSYSTEMS	Increased coral bleaching	Up to 30% of species at increasing risk of extinction	Significant ⁺ extinctions around the globe
	Most corals bleached	Widespread coral mortality	
	Increasing species range shifts and wildfire risk	Terrestrial biosphere tends toward a net carbon source as: ~15%	~40% of ecosystems affected
		Ecosystem changes due to weakening of the meridional overturning circulation	
FOOD	Complex, localised negative impacts on small holders, subsistence farmers and fishers	Tendencies for cereal productivity to decrease in low latitudes	Productivity of all cereals decreases in low latitudes
		Tendencies for some cereal productivity to increase at mid- to high latitudes	Cereal productivity to decrease in some regions
COASTS	Increased damage from floods and storms		About 30% of global coastal wetlands lost ⁺
		Millions more people could experience coastal flooding each year	
HEALTH	Increasing burden from malnutrition, diarrhoeal, cardio-respiratory and infectious diseases		
	Increased morbidity and mortality from heat waves, floods and droughts		
	Changed distribution of some disease vectors		
			Substantial burden on health services

Source: Intergovernmental Panel, Fourth Assessment Report, 2007

While the IPCC report, and other research material, extensively studies the impacts of climate change on different areas including water, health, and agriculture, one area where little research has been done is the impact of climate change on national security. The IPCC report has completely missed this aspect. However, recently, researchers and experts, especially from the field of security and defense started to discuss climate change as a potential threat to national and global security. National Intelligence Agencies (NIAs) of different countries, such as CIA, MI6 and others, are amongst the main bodies that are actually working on this aspect of climate change impacts. The Pentagon and MI6 have already produced reports on the potential threat of climate change to national security. The Deputy Chief of the National Intelligence of USA unequivocally supports the view that climate change will have severe impacts on multiple sectors of the country, and ultimately it will also threaten national security (July 2008). Rep. Anna Eshoo (D-CA), chair of the House Subcommittee on Intelligence Community Management, said, *“From this day forward, the words ‘climate change’ and ‘national security’ will be forever linked* (June 25, 2008). (Russell and Morris, 2006). John Reid MP, then British Secretary of State for Defense and later on, Home Secretary, shared the view that climate change is a latent danger to security. (Vogel, 2007) John Ashton, the UK Foreign Secretary's Special Representative for Climate Change stated that if states failed to address climate change with the necessary seriousness it requires, it then people would die. David King, the UK Government's chief scientific adviser, considers climate change a bigger threat than terrorism to national security (Brauch, 2002). A report was also published by the German Ministry for the Environment, Nature Conservation and Nuclear Safety to look into the

relationship between climate change and security.(BBC, 2007) The Institute for Global Communications has developed a matrix of possible interaction between climate and security (table-2)(Wisner,2007).

Table 2: Possible Interaction between Climate and Security

	Direct impact	Indirect Consequences					Slow-onset
	Water	Food	Health	Mega-projects	Disasters	Bio-fuel	Sea level
Short term (2007-2020)	Local conflict over water	Failure to meet MDGs	Failure to meet MDGs	Long history of development-induced displacement from 1950s	Nation states begin to lose credibility due to inability to prevent large disasters	Isolated food – fuel competition & price spikes	Small number of displacements
Medium term (2021-2050)	Increased local & some international conflict over water	Significant displacement due to famine	Interacts with food production problems	Displacement of rural poor due to CDM & large scale dams & other state based mitigation & adaptation projects	Significant political unrest due to failure of DRR & inadequate recovery in many countries	Food-fuel competition increases & biodiversity erosion	Increasing displacement & national/international tension
Long term (2051-2100)	Major international conflict over water	Major displacement & political upheaval	Major displacement due to epidemics	Major urban upheaval and other political fall out from mega-project displacement	Major upheaval with international implications due to unattended weather catastrophes	Major discontent due to food-fuel competition	Major international tensions due to population displacement

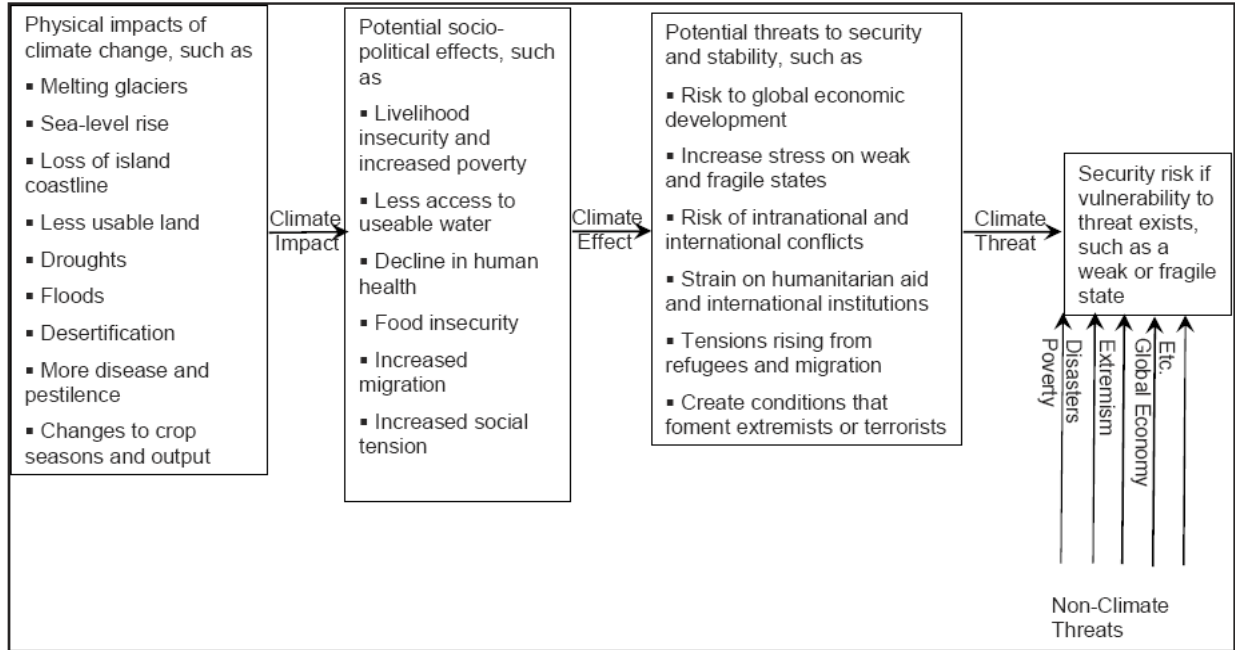
Source: (Wisner,2007).

The Congress Research Services of USA also developed a framework to illustrate the relationship between climate change and national security. Both frameworks focus on climate change and national security through the lens of fundamental elements of water, health, food , disasters .Ben Winser divides impacts into three categories direct impacts, indirect impacts and a slow onset of change. They tried to build connections in the short, medium and long term. It is clearly indicated in table above that climate change will impact national security in the medium and long term.

The Congress Research Report(Congress Research Report, 2011) (See table 3)indicates that water and water related outcomes e.g. droughts, flood, sea level rise etc, would become a major area of concern for national security. They would induce many socio-economic and socio-political issues e.g. livelihood

insecurity, migration, health etc. These would lead to instability of the state resulting in a danger to security at the regional and international level. The table below illustrates the dangers of climate change in this sense.

Table 3: Water related Outcome: A Major Concern for National Security



Source: Congress Research Report, 2011

The Central Intelligence Agency (CIA) in 2009 opened a specialized center on Climate Change and National Security. The Center was created to look into the context of climate change and security and provide information to policy makers for better policy formulation, negotiations and international agreements (CIA, 2009). Although some intelligence agencies, researchers and scientists are working on the subject and have built a clear relation between CC and national security, international support is missing to a large extent. UNDP Administrative Kemal, at the launch of 2007 Development Report said, “Climate change is a threat to humanity, especially for those people living in poor regions (CIA, 2009).” Despite this fact, the UNFCCC and IPCC did not take the security perspective into negotiations and findings respectively. In the presence of the many reasons discussed above, there is a firm need to work on these, heretofore, neglected security aspects of climate change.

Elements of Potential Threat to Security

In the first section of this paper, table -1 & 2 (identify which of the tables) shows the sectors vulnerable to climate change and their potential impact on national and global security. In this section, we will review some historical events related to climate change which had an impact on the general well-being of populations and on national security of several countries.

Hurricane Katrina in New Orleans, 2005 was a natural disaster, which cannot be connected directly to climate change. However, it may be used to exemplify the havoc that climate change can bring about in future, as IPCC, 2007, established that most of the disasters will be water related. Nearly 270,000 people were displaced, while 1800 died. People lost their livelihoods, their homes and property, and the state sustained losses estimated at US\$8 billion. The United States had to mobilize a huge number of soldiers; approximately 70,000 soldiers (20,000 active duty, 50,000 national guards), to assist in rescue and relief activities. These soldiers also helped to maintain the law and order situation and protection of national assets (Busby, 2007).

The tsunami of 2004 can be quoted as another example of a natural disaster, which resulted in the death of 300,000 people in East Asia.

In 2004, Haiti and the Dominican Republic were hit by torrential rains and mudslides, due to which about 1700 people lost their lives. In 2004-2005 Florida was hit by four hurricanes which cost about 44 billion dollars. The Governor of State had to call a state of emergency to control the law and order situation which resulted from this disaster. (Richard, 2005) In 2003 heat waves in Europe killed 38,000 people. The Hadley Center of UK conducted a study on these heat waves, which concluded that the excessive use of fossil fuels can exacerbate the situation in the future and Europe may have to face similar heat waves in the future (Peter and Stone, 2004). In 2002 hundreds of thousands people faced problem of starvation due to a persistent drought in North Korea. In 1998, Hurricane Mitch claimed about 10,000 lives and caused a massive destruction of infrastructure and displacement of people (Richard, 2005). From 1995 to 1997, almost 3 million North Koreans died due to famine which emerged because of the consistent flooding in North Korea in 1995 & 1996 (The Economist, 1999). The continuous drought in Darfur, Sudan worsened the situation and thousands of people died painful deaths from 80s onward (New York Times, 2004).

There have been many floods, droughts and extreme weather situations in recent history of which some examples are given above. Moreover, the IPCC report has predicted that extreme events will increase in the 21st century and the future of the world will be at stake (Box-2). Since the start of the 21st century, the frequency and intensity of disasters has increased (Table-4&5) (World Disaster Report, 2010).

By 2020, between 75 and 250 million people are projected to be exposed to an increase of water stress due to climate change. If coupled with increased demand, this will adversely affect livelihoods and exacerbate water-related problems (IPCC 2007: 10).

Towards the end of the 21st century, a projected sea-level rise will affect low-lying coastal areas with large populations. The cost of adaptation could amount to at least 5-10% of GDP. Mangroves and coral reefs are projected to be further degraded, with additional consequences for fisheries and tourism. (IPCC 2007: 10)

Where extreme weather events become more intense and/or more frequent, the economic and social costs of those events will increase, and these increases will be substantial in the areas most directly affected. Climate change impacts spread from directly impacted areas and sectors to other areas and sectors through extensive and complex linkages (IPCC 2007:16).

Table 4: Reported Disasters

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total ¹
Droughts/food insecurity	43	43	40	23	19	28	20	14	20	23	273
Earthquakes/tsunamis	31	25	37	40	42	25	24	21	23	22	290
Extreme temperatures	31	23	15	26	19	29	32	25	11	26	237
Floods ²	158	157	171	160	132	195	229	218	169	150	1,739
Forest/scrub fires	30	14	22	14	8	13	9	18	5	9	142
Insect infestation	2	2	n.d.r.	n.d.r.	12	n.d.r.	n.d.r.	n.d.r.	n.d.r.	1	17
Mass movement: dry ³	1	n.d.r.	1	n.d.r.	1	n.d.r.	1	n.d.r.	3	1	8
Mass movement: wet ⁴	28	24	20	21	15	12	20	10	12	31	193
Volcanic eruptions	5	6	7	2	5	8	12	6	7	3	61
Windstorms	102	108	124	86	127	130	76	105	111	85	1,054
<i>Subtotal climato-, hydro- & meteorological disasters</i>	394	371	392	330	332	407	386	390	328	325	3,655
<i>Subtotal geophysical disasters</i>	37	31	45	42	48	33	37	27	33	26	359
Total natural disasters	431	402	437	372	380	440	423	417	361	351	4,014

Source: World Disaster Report, 2010

Table 5: People Killed by Disasters

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Droughts/food insecurity	76,379	76,476	76,903	38	80	88	208	n.a.	6	3	230,181
Earthquakes/tsunamis	216	21,348	1,636	29,617	227,290	76,241	6,692	780	87,918	1,815	453,553
Extreme temperatures	941	1,787	3,019	74,748	556	814	5,104	1,044	1,608	1,122	90,743
Floods ¹	6,025	5,014	4,236	3,772	7,100	5,764	5,863	8,565	4,037	3,419	53,795
Forest/scrub fires	47	33	6	47	14	50	13	150	86	190	636
Insect infestation	n.a.	n.a.	n.d.r.	n.d.r.	n.a.	n.d.r.	n.d.r.	n.d.r.	n.d.r.	n.a.	n.a.
Mass movement: dry ²	11	n.d.r.	60	n.d.r.	44	n.d.r.	11	n.d.r.	120	36	282
Mass movement: wet ³	1,012	786	1,089	706	313	646	1,638	271	504	658	7,623
Volcanic eruptions	n.a.	n.a.	200	n.a.	2	3	5	11	9	n.a.	230
Windstorms	1,354	1,914	1,475	1,031	6,653	5,250	4,329	6,035	140,985	3,308	172,334
<i>Subtotal climato-, hydro- & meteorological disasters</i>	<i>85,758</i>	<i>86,010</i>	<i>86,728</i>	<i>80,342</i>	<i>14,716</i>	<i>12,612</i>	<i>17,155</i>	<i>16,065</i>	<i>147,226</i>	<i>8,700</i>	<i>555,312</i>
<i>Subtotal geophysical disasters</i>	<i>227</i>	<i>21,348</i>	<i>1,896</i>	<i>29,617</i>	<i>227,336</i>	<i>76,244</i>	<i>6,708</i>	<i>791</i>	<i>88,047</i>	<i>1,851</i>	<i>454,065</i>
Total natural disasters	85,985	107,358	88,624	109,959	242,052	88,856	23,863	16,856	235,273	10,551	1,009,377

Source: (World Disaster Report, 2010)

This list does not include the disasters of 2010 and 2011. In 2010 & 2011, the world witnessed the aforementioned disasters of the earthquake in Haiti, floods in Pakistan, China and Australia, as well as the heat wave in Russia.

Possible Threats for Pakistan

Pakistan is, at present, facing multi-dimensional and multi-faceted challenges including terrorism, fiscal crisis, food insecurity, shortage of energy, climate change, etc. Terrorism has affected all sectors of the economy and individual security has become a serious concern for the citizens of Pakistan. Due to its geographical position, Pakistan is a frontline ally in the war on terror and is bearing huge losses. Pakistan's army, intelligence agencies and civilian institutes are actively involved in curbing terrorism. Successful operations were carried out in Swat and FATA, and a large number of soldiers remain in these areas. In addition to these issues, Pakistan is also facing unrest in Baluchistan and target killing in Karachi, and sustaining huge losses, both economically and in terms of human life. According to rough estimates, Pakistan has suffered losses worth almost US\$45 billion and thousands of lives, both military and civilian.

Owing to the war on terror, Pakistan's fiscal situation has also deteriorated. Although this war on terror is not the single reason for the country's deterioration, it has played a huge role in weakening the economy. Mismanagement, corruption and poor governance are other reasons for the poor state of the economy. Presently, Pakistan is being granted huge loans from IMF to fill the gap created by the budget deficit. The price hike of 2007 has led to the food crisis becoming even more severe. Energy availability and prices of energy is another area of concern.

In addition to these, Pakistan is now facing the most severe challenge created by climate change. Pakistan has a very diverse geography. From the long range of mountains, glaciers, deserts, to the plain areas and hundreds of miles of coastal line, Pakistan has a highly diverse topography which makes it vulnerable to all types of impacts resulting from climate change. Moreover, Pakistan is situated in a semi-arid to hyper-arid region which further increases its vulnerability. As water is already scarce erratic climatic conditions will make water more scarce. However, at present, Pakistan does not have any policies to combat the negative effects of climate change. One of the main reasons is the dearth of reliable data, which is fundamental for devising well crafted policies and implementation plans. Even in cases when data is available, researchers do not have access to it. In the absence of reliable data on climate change and an understanding its impacts, Pakistan will not be able to prepare itself for the changes that will occur in the context of climate changes, and the major sufferers of this negligence would be poor communities, subsistence farmers, fisher folk, women, and landless peasants.

Although every area of the economy is important, this paper has chosen to focus on the following two:

1. Agriculture
2. Water (including glaciers, fresh water for drinking, agriculture, sea level rise, inundation of sea and so on)

Agriculture

Agriculture is and the source of livelihood for millions of people. The country's major exports are dependent on agriculture, both directly and indirectly. It is also a source of employment and earning for the majority of the population. Any change in the agricultural system of the country can shake the foundations of the country. The agriculture sector's performance depends on following;

- CO₂
- Temperature
- Solar Radiation
- Precipitation
- Others (wind speed and direction, soil moisture, water vapour, etc.)

These are also indicators of climate change one way or another. A higher concentration of CO₂ in the atmosphere leads to arise in temperature, which impacts precipitation and moisture, etc.

Plant science tells us that CO₂ is an essential component for plant growth and photosynthesis. On the basis of this, some researchers have predicted that productivity of agriculture will increase in the coming year. However, higher temperature will be a hindrance and an excessive amount of CO₂ will impact productivity in a negative way (Rosenzweig and Hillel, 1995).

Moreover, the rise in temperature will not have similar impacts everywhere. Countries with a higher will benefit from it, as the productivity of crops will increase in those areas, but productivity will start to decline after the 3C increase in temperature. On the other hand, lower altitude countries will suffer losses in productivity even at 1C increase in temperature (FAO, 2008). Pakistan is not only amongst the latter, but is also located in a semi-arid to hyper-arid region- meaning that the increase in temperature will be higher as compared to the rest of world, reducing the productivity of crops (table-6).

Table 6: Wheat yields in different agro-climatic zones of Pakistan

Region	% Share in National Production	Baseline Yield (kg ha ⁻¹)	% Change in yield in 2085	
			A2 Scenario	B2 Scenario
Northern Mountainous	2	2658	+50	+40
Northern Sub-mountainous	9	3933	-11	-11
Southern Semi arid Plains	42	4306	-8	-8
Southern Arid Plains	47	4490	-5	-6
Pakistan	100	4326	-5.7	-6.4

Source: (Global Change Impact Study Centre,2010)

The growing season will be shortened due the lack of available days (table-7).

Table 7: The Growing Season Length

Temperature °C (increase over baseline)	Growing Season Length (Days)			
	Northern Pakistan		Southern Pakistan	
	Mountainous Region (Humid)	Sub-Mountainous Region (Sub-humid)	Plains (Semi- arid)	Plains (Arid)
Baseline	246	161	146	137
1	232	155	140	132
2	221	149	135	127
3	211	144	130	123
4	202	138	125	118
5	194	133	121	113

Source: (Global Change Impact Study Centre, 2010)

Incidences of pestilence and disease attacks will also increase manifold, as well as a movement of such diseases across borders. This trans-boundary movement will emerge as a big threat to agricultural production and therefore relations between countries (see figure-1)



Figure 1: Pictorial description of Trans-boundary Disease

Both water availability and land fertility, discussed later in the paper, will be degraded due to climate change, and both remain fundamental factors for agricultural production.

The impacts of climate change will worsen the existing poor state of this sector. The agricultural sector has suffered from a number of shortcomings, from the highest level i.e. policy making to the grass root level in Pakistan. Prior to the freedom of Pakistan, present day Punjab was known as the “food basket” of the sub-continent. However, after partition the pace could not be maintained and now we are witnessing sharp decreases in food production due to numerous reasons e.g. governance, market failures, skewedness of land etc. The Green Revolution in 1960 gave a boost to agriculture from 1960 by the introduction of high yielding crops, chemical inputs and modern technology. Pakistan continued to reap the benefits of the Green Revolution but growth rate of productivity is decreasing with every year lack interest of government.

The status of land degradation in Pakistan is already a cause for alarm, and with climate change, the situation is steadily deteriorating (table-8). Fertile land will become non-productive or suffer reduced productivity.

Table 8: Status of Land Degradation in Pakistan

Water Erosion	17%
Wind Erosion	8%
Salinity and Sodidity	9%
Water Logging	5%
Low Organic Matter, less than 1	96%

Source: (Global Change Impact Study Centre, 2010)

It is predicted that, due to climate change, salinity and water logging will also increase. Floods and droughts will also impact soil fertility in the short, medium and long term, by depleting the available organic nutrients of the soil. Moreover, a higher temperature will also make a number of crops unsuitable in certain areas. Therefore, there would be a shift in crops from one area to another area. There would be a need to develop new varieties of crops which can be grown in saline water logged areas and high temperature zones. However Pakistan has a very limited base in the agricultural research and development sector. In the last 64 years Pakistan was only able to develop a few varieties, due to the usage of conventional methods to produce new varieties. Although some resources have been allocated to genetic research and genetically modified organisms, these remain limited and Pakistan has not been able to achieve any tangible success. Micro and macro-analysis of the past and current situation reveals that there are two main reasons for this; firstly, the lack of trained resources and secondly, the in availability of modern facilities and technology.

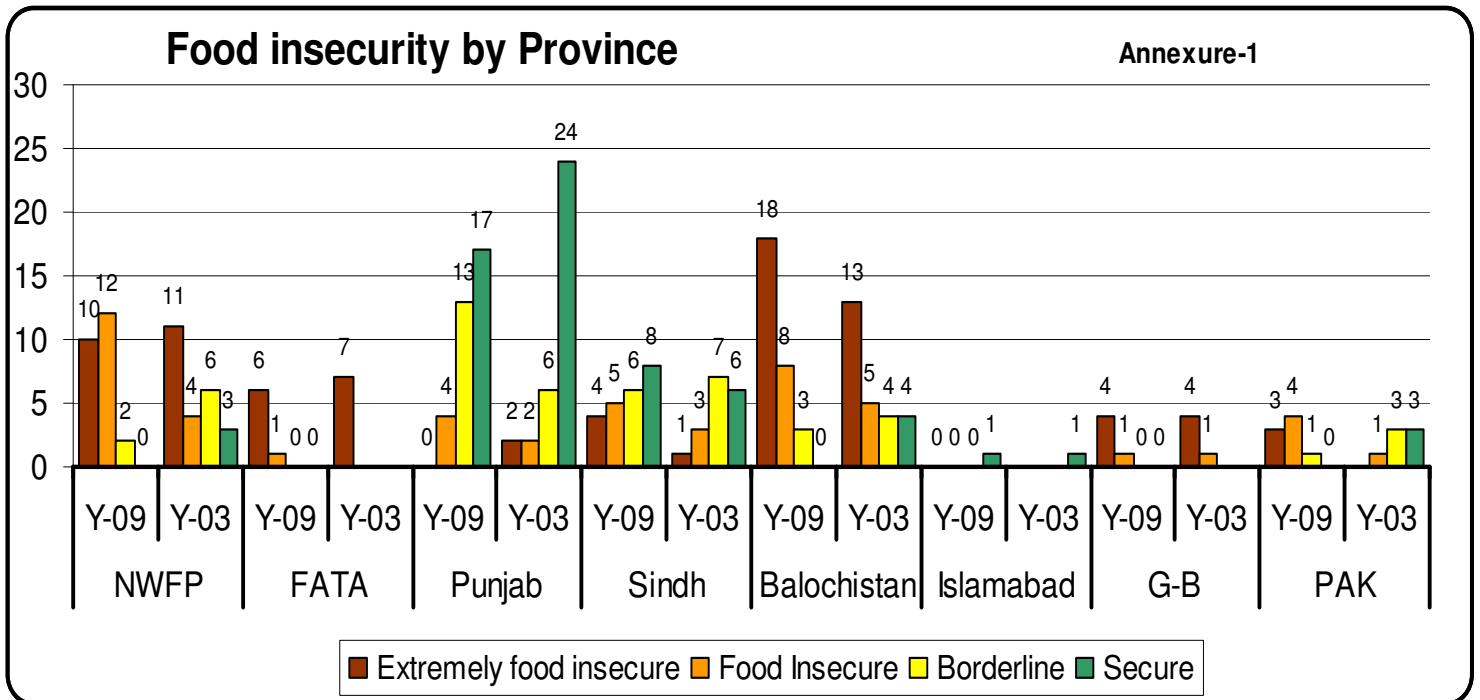
Climate change requires immediate investment in infrastructure and research in order to adapt and combat it. However, as has been discussed, for various reasons Pakistan will not be able to invest in these areas, as they will cause further harm.

It is a well-established fact that agriculture is the main source of livelihood and employment in Pakistan. Owing to the negative effects of climate change, people will lose earning sources in agriculture. It will have two categories of impacts; food insecurity and the migration of people. The former will cause an immediate conflict and struggle between people. As we witnessed in 2007-08, in certain parts of the world riots out broke due to higher prices of food and non-availability of food e.g. Philippines, Egypt and Haiti, India and Vietnam (The Financial Times, 2008).

Pakistan is already going through a very severe food insecurity crisis. SDPI conducted a study in 2010, which indicates that food insecurity is increasing in Pakistan (Figure-2)(Food Insecurity in Pakistan,2009). According to the study, about 48.7% of the population is food insecure and the 2010 floods have added more numbers to this category.

Future floods will further complicate the situation. SDPI’s study also tried to find the link between food security and peace, but concluded that although there is no empirical evidence available to establish the link between food security and peace, the most food insecure areas are also the most disturbed areas in Pakistan, e.g. North, South Waziristan, Dera Bughati etc.

Figure 2: Food Insecurity in Pakistan



Source: (Food Insecurity in Pakistan, SDPI, 2009)

The impacts of climate change will also force people to look into different ways of employment and livelihoods. People will migrate in search of better ways of life and this will bring additional stress on cities, as cities are considered the best places for employment. People will also migrate in search of new cultivable lands. It will create friction among different sectors and communities which may lead to conflicts at local levels. These local level conflicts may multiply, depending on the scale of displacement and migration. These conflicts will put a strain on national security of the country especially in the present scenario of the war on terror.

Water

Agricultural production and productivity depends on the availability, quantity and quality of water. Water is also very important for the sustainability of the environment and biodiversity. However, at the same time water can also be the source of destruction in the form of floods.

Water resources in Pakistan are very scarce due to its semi- to hyper-arid location. Availability and access to safe drinking water for humans and animals as well as for agriculture and other competing sectors is a major concern for the country. Despite the vital importance of water for sustainable development in the country, mismanagement and wastage of scarce and precious water resources is an unfortunate reality in Pakistan. It is shocking to note that due to weak water governance and unavailability of storage facilities, Pakistan is wasting two thirds of its stock of this absolutely essential resource annually(National Water Policy,2002). The per capita availability of water in Pakistan has decreased from 5600 cm in 1947 to 1200 cm in 2005. It is also predicted that the per capita availability will touch the threshold level of 1000cm and Pakistan will become a water scarce country, as both the population and hence the demand for water increase(National Water Policy,2002). Existing water resources will not be able to fulfill this future demand. The depletion of water resources will further complicate the whole scenario. The World Bank estimated that Pakistan will need 1 billion US\$ investment every year to sustain this precious resource (PIICA, 2007).

The productivity of water use is very low in Pakistan at the farm level. Farmers remain unaware as to the efficient and judicious use of available water resources, and this ignorance, in conjunction with obsolete irrigation techniques, further aggravates the situation. Land leveling can help to improve the efficiency of water use at the farm level. But farmers have neither the required resources, nor the willingness to opt for land leveling. The government has attempted to tackle this issue and in its second, third and fourth 5-year plans, the government gave special attention towards the improvement of the efficiency of water use. Water is also lost during conveyance due to unlined water courses and canals. The fifth 5-year plan specifically talked about reduction of conveyance losses. Poor infrastructure, policy and governance of water have further complicated the situation in Pakistan. Pakistan has a plethora of acts e.g. Pakistan Penal Code 1860, Factories Act of 1934, The Indus River System Authority (IRSA) Act, The Canal and Drainage Act 1873, and provincial irrigation acts. However, the majority of acts are outdated and do not serve the needs of today. There will be immense competition among different sectors for scarce water in the future which may lead to conflicts in the coming years, thus threatening the security of the country.

Pakistan's agriculture is dependent on artificial irrigation systems. Agriculture consumes about 93 percent of available water. The main contributors to irrigation systems are the Indus river system, monsoon rain and ground water. While initially the Indus river system was the major supplier, in recent years ground water utilization has also increased tremendously. At present, about 40 percent of the nation's irrigation requirements are met from underground water. One of the reasons for the increase in ground water usage is unavailability of water at critical times from the river system. Water is also a good source of clean energy and hydroelectricity, on which some countries are heavily dependent. In 1998, Norway and the Democratic Republic of the Congo produced almost 99 percent electricity from water. In the same year, Brazil accounted for about 91 percent of domestic electricity from its hydro sector (Arthur, 2011). The history of hydroelectricity in Pakistan begins after independence, when Pakistan invested heavily on hydro-electricity and built large dams for electricity. These dams were also used to store water for agriculture and other uses. However, after the 1993 Power Policy, Pakistan took a U-turn and shifted the focus on electricity production from thermal production. Climate change impacts are becoming more severe. Examples are melting glaciers, deteriorating water basins and uncertain and erratic rains. A higher rate of melting in Himalaya, Karakoram, and Hindu Kush will introduce flash floods and contribute towards the depletion of resources. However, some hydrologists believe differently, such as David Archer, a hydrologist at Newcastle University in the United Kingdom who stated that their studies have revealed "a downward trend in summer temperatures and lower melting rates". While this is a surprising fact in the context of Pakistan, the debate on melting rates still needs more research. However, the availability of water will be uncertain in the coming years. Either there will be floods or droughts. Pakistan has a history of floods and droughts, most notably, from the 1990s to 2010, affecting Pakistan's economic and social life leading to the suffering of millions.

Table 9: History of Disasters in Pakistan

<u>Disaster</u>	<u>Location</u>	<u>Date</u>	<u>Affected</u>	<u>Death Toll</u>
Earthquake/Tsunami	<u>Makran</u>	325 BCE		
Earthquake	<u>Quetta</u>	31-May-35		60,000
Earthquake/Tsunami	<u>Makran</u>	27-Nov-45		4,000
Flood		1950		2,900
Wind storm		15-Dec-65		10,000
Flood		Aug-73	4,800,000	
Earthquake	<u>Northern Areas</u>	28-Dec-74	97,000	5,300
Flood		2-Aug-76	5,566,000	
Flood		Jun-77	1,022,000	10,354
Flood		Jul-78	2,246,000	
Flood		Aug-88	1,000,000	
Extreme Temperature		11-Jun-91		961
Flood		9-Aug-92	6,184,418	
Flood		Sep-92	12,324,024	1,334
Wind storm		14-Nov-93		609

Flood		22-Jul-95	1,255,000	
Flood		24-Aug-96	1,186,131	
Flood		3-Mar-98		1,000
Drought		Mar-00	2,200,000	
Earthquake	<u>Muzarffarabad</u>	8-Oct-05	2.5 million	78,000
Flood		Jul/Aug-2010	20,000,000	

Source: (NDMA, 2011)

Pakistan witnessed one of the worst floods of human history in 2010. According to the government, about 20 million people were displaced. The World Bank and the Asian Development Bank Assessment Report stated that Pakistan faced costs worth almost 10 billion US dollars as given in Table 10(World Bank and ADB, 2010). However, these assessments did not include the livelihood cost of people, which would automatically increase the cost further.

Table 10 Assessment of Costs Faced by Pakistan after 2010 Flood

Province / Region	Damage Costs		Reconstruction Option 1		Reconstruction Option 2		Reconstruction Option 3	
	PKR millions	USD millions	PKR millions	USD millions	PKR millions	USD millions	PKR millions	USD millions
AJK	7,303	86	13,190	155	13,886	163	16,009	188
Balochistan	52,676	620	27,258	321	34,359	404	58,116	684
FATA	6,271	74	7,595	89	7,873	93	9,544	112
Gilgit-Baltistan	4,165	49	6,627	78	6,893	81	10,027	118
Khyber Pakhtunkhwa	99,625	1,172	105,957	1,247	109,942	1,293	179,844	2,116
Punjab	219,272	2,580	93,521	1,100	107,903	1,269	117,650	1,384
Sindh	372,341	4,380	227,850	2,681	253,791	2,986	269,704	3,173
Federal / Cross Cutting Sectors	93,117	1,095	95,911	1,128	95,911	1,128	96,866	1,140
National Total	854,771	10,056	577,908	6,799	630,556	7,418	757,760	8,915

Source: (World Bank and ADB, 2010)

Apart from the cost, there is another dimension that must be noted. The security dimension was missing from all the assessments made by the government of Pakistan. Loss of livelihood opportunities, houses, basic services, food and so on inevitably lead to social unrest and even violence and can ignite riots and conflicts in the short term. Crimes, e.g. robberies increase reflected by some media reports that highlighted these crimes. This can eventually lead to severe controversy, especially due to migration and limited resources and can threaten national peace and security. During the floods, the government had to move a large number of troops for rescue and relief efforts in all provinces of the country. Troops

were moved right into the middle of the war on terror. The international media also reported that due to a shift of forces, the Taliban gained an opportunity to regroup and garner support for themselves among people through relief activities (UPI, 2010). While there is no concrete evidence available to support this argument, it still cannot be ignored.

Moreover, there exists deep concern regarding river flows and intrastate and interstate issues. Pakistan's rivers flow from India, a country with which there is a long history of bitter relations. Since the inception of the country, Pakistan-India relations have never been smooth, but fraught with problems, including water conflicts – a severe bone of contention between the two countries. In 1960, Pakistan and India signed the Indus Water Treaty. The Indus Water Treaty (IWT) aided both countries in easing tensions over water issues. IWT granted the rights of Indus, Jhelum and Chenab rivers to Pakistan. Yet once again, problems have started to surface, compelling Pakistan to ask for support from the World Bank to intervene and appoint a neutral *ex parte*. Resultantly India has begun the construction of different dams on Indus, Jhelum and Chenab rivers. In its 12th five-year plan, India clearly showed intentions to invest in hydro-electricity along the three rivers. Pakistan has attempted to solve the issue at a bilateral level, and then registered serious concern by seeking the World Bank's mediation as mentioned above. India is not willing to accept the claim that Pakistan's water is blocked, and blames the latter for mismanagement of water resources.

While both countries have previously ignored climate change and its impact on the river flow, India now uses this argument in its favor. In the case of Baglihar, India justified the design of the dam on the basis of environmental degradation. However, when taking into account the bigger picture, it is clear that the main cause for this degradation in Kashmir is military intervention from India. The Indian army had cleared large forest areas during this war.

There is an urgent need to understand and fully comprehend the dimensions of climate change and its implications on water availability in the future. In the 21st century, climate change will deplete water resources and the population of this region will increase, enhancing the demand for water. This will increase competition between Pakistan and India over scarce resources. It will in all certainty lead to a greater divergence between the two countries and possibly a war over water.

Water availability will also impact relations between the provinces of Pakistan. Water issues are already causing fractures between the provinces, in the future limited available of water will further enhance the problem.

However, water related disasters and scarcity of water may also be used as an instrument of conflict resolution and peace building. For example, after the tsunami, in Indonesia, rebels in Aceh joined the political set-up, and the former rebel leader is now in control of the provincial government. Amongst other concerns, he pressurizes the national government and international community to provide financial resources to save forests and prevent rebels from creating a separatist movement once more.

Conclusion

Security can be measured at four different levels individual security, national security, regional security and global security, according to relevance of the situation and the subject. Global leaders are concerned about global security and in the same way regional leaders are concerned about regional security. National leaders are concerned about national security. Consequently most of the time individual security is compromised. Although all four levels of security are important, individual security is fundamental for ensuring the other three types of security. As discussed earlier security is directly linked to climate change. Climate change will impact security at all levels, individual, national, regional and global security(Wisner, 2007).

In the context of Pakistan for the purposes of this paper, we looked into two potential threat areas, water and agriculture. However, we did not discuss the potential threat of migration¹ due to climate change and its potential threat on national security. This is another area which needs close attention. Water availability variability and water related disasters will increase manifold as IPCC predicted and water availability will be impacted by variability in climate. In the short run glaciers will melt with more speed, which can lead to floods. In addition to that erratic rain falls can also increase the incidence of floods in the near future. The flood in 2010 in Pakistan can be quoted as a major example of floods caused by erratic rainfalls. The Glacial Lake Outburst Flood (GLOF)can also create severe problems, as Atta Abad lake is another prominent example.

As discussed earlier in the paper both floods and droughts will impact the productivity of agriculture and livestock. Productivity and production of the sector will decrease. As IPCC predicted in Asia productivity of agriculture will decrease by 2.5 to 10 percent until 2030. Lower production and productivity of food crops will rapidly diminish food availability. Lower availability of food alone as an indicator of food security, keeping all other indicators constant, is a terrifying prospect. There will be less food available for the increasing population which will give rise to clashes and violence among communities.

Food insecurity alone will shake the country. The food crises of 2008 led to riots that spread across many countries and in Pakistan many people lost lives in Karachi during the distribution of flour. Food insecurity also breeds other types of insecurity. Although there is no empirical evidence available but the SDPI Food Insecurity 2003 and 2009 reports indicate that the most food insecure districts of Pakistan e.g. North Waziristan, South Waziristan, Kohlo, DeraBhugati etc, are the hub of conflicts and extremism. Pakistan has had to engage a large number of army personals and immense resources to handle the situation in these areas. This connection shows that there is indeed a link between food insecurity and violence.

In spite of these clear evidences Pakistan had not invested much on building the capability and capacity of national institutes to cater to the challenge of climate change related disasters and its impacts on national security. Unfortunately, the capability and capacity of the government of Pakistan to tackle climate change related disasters is very limited. Although Pakistan created NDMA, its capacity and

¹ Migration is a huge area and it needs separate and detailed study. Therefore, in this paper we did not discuss migration.

capability is very limited. The flood of 2010, 2011 and Atta Abad Lake incidents exposed the incapability and incapacity of NDMA and other disaster related institutes. Right from inception of Pakistan, the Pakistan Army has been the only reliable institution to cope with the challenge of disasters. In 2010 and 2011 the Army was the main institute that could rescue and provide relief to people. The main reason for this is the incapability of other institutes like NDMA, Flood Commission of Pakistan etc. These institutions could not flourish due to lack of investment in human capital and non-availability of required financial resources. Although it is not desirable to engage the military in relief activities Pakistan has no other option. Army is the only the well organized and functional institute which can deliver on time and with efficiency. A weak governance system and corruption weakens the capability of civil institutes to deliver the desired results. If the army is involved it will have to compromise on other fronts e.g. war on terror. Furthermore, the army can only intervene at the time of a disaster not in the process of preparedness. Therefore, the government should develop civil institutes, so that the impact of disasters can be minimized. The government should also create institutes to ensure food security despite the unpredictability of climate change. Otherwise it would be extremely difficult to control the situation and it may lead to conflicts and instability in the country as discussed above.

In addition the government must plan according to the future and take some innovative steps to tackle climate change. Pakistan should not wait for consensus at the international level. In the absence of accurate and efficient policies, Pakistan will not able to tackle climate change.

Climate change is uncertain and uncertainty requires preemptive steps to control and minimize the loss. If we wait for too long, hoping for conformity of the effects, then it may be too late. As General Gordon Sullivan, former Army Chief of Staff, USA, talking on the uncertainty of climate change, and Climate Change and National Security said, *“Speaking as a soldier, we never have 100 percent certainty. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield.”*

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