



Security and the Environment in Pakistan

Bruce Vaughn

Specialist in Asian Affairs

Nicole T. Carter

Specialist in Natural Resources Policy

Pervaze A. Sheikh

Specialist in Natural Resources Policy

Renée Johnson

Specialist in Agricultural Policy

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Summary

This report focuses on the nexus between security and environmental concerns in Pakistan that have the potential to affect American security and foreign policy interests. Environmental concerns include, but are not limited to, water and food scarcity, natural disasters, and the effects of climate change. Environmental stresses, when combined with the other socio-economic and political stresses on Pakistan, have the potential to further weaken an already weak Pakistani state. Such a scenario would make it more difficult to achieve the U.S. goal of neutralizing anti-Western terrorists in Pakistan. Some analysts argue that disagreements over water could also exacerbate existing tensions between India and Pakistan. Given the importance of this region to U.S. interests for many reasons, the report identifies an issue that may be of increasing concern for Congress in the years ahead.

The report examines the potentially destabilizing effect that, when combined with Pakistan's demographic trends and limited economic development, water scarcity, limited arable land, and food security may have on an already radicalized internal and destabilized international political-security environment. The report considers the especially important hypothesis that the combination of these factors could contribute to Pakistan's decline as a fully functioning state, creating new, or expanding existing, largely ungoverned areas. The creation, or expansion, of ungoverned areas, or areas of limited control by the government of Pakistan, is viewed as not in U.S. strategic interests given the recent history of such areas being used by the Taliban, Al Qaeda, and other terrorist groups as a base for operations against U.S. interests in the region. In this sense, environmental stress is viewed as a potential "threat multiplier" to existing sources of conflict.

Environmental factors could also expand the ranks of the dispossessed in Pakistan, which could lead to greater recruitment for radical Islamist groups operating in Pakistan or Afghanistan. Larger numbers of dispossessed people in Pakistan could also destabilize the current political regime. This could add pressure on the Pakistani political system and possibly add impetus to a return to military rule or a more bellicose posture towards India. This issue has added significant importance to regional security and American interests in Afghanistan.

The potential for environmental factors to stoke conflict between the nuclear armed states of India and Pakistan is also a concern. These two historical enemies have repeatedly fought across their international frontier and have yet to resolve their territorial dispute over Kashmir. Further, a longstanding dispute over cross-border water resource sharing between India and Pakistan has resurfaced, possibly exacerbating existing tensions between the two states. Should the two countries wish, however, this dispute also offers a renewed opportunity for cooperation, as has been seen in past negotiations.

Preliminary findings by experts seem to indicate that existing environmental problems in Pakistan are sufficiently significant to warrant a close watch, especially when combined with Pakistan's limited resilience due to mounting demographic stresses, internal political instability, security challenges, and limited economic resources. For more detailed information on Pakistan see the work of Alan Kronstadt and others including CRS Report RL33498, *Pakistan-U.S. Relations*, and CRS Report RL34763, *Islamist Militancy in the Pakistan-Afghanistan Border Region and U.S. Policy*.

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Introduction

This report explores the nexus between the environment and security in Pakistan in order to assess how environmental stress in Pakistan can lead to security issues that affect American security and foreign policy interests in the region. Environmental crises such as water scarcity, soil depletion, and natural disasters can intensify conflict or stress within a country and potentially contribute to national security issues.¹ Climate change can fuel these crises and exacerbate them, leading some analysts to characterize it as a potential threat to national security. Others temper this characterization by noting that the potential effects of climate change could act as a *threat multiplier* to national security. In other words, the effects of climate change might exacerbate existing threats to national security such as weak governance, poverty, and armed insurgents.

The security environment within and around Pakistan is of significant concern to the United States. During the Cold War, the United States worked with Pakistan to meet common security challenges in Afghanistan and the region. Today's security threats to the United States from Pakistani territory and the region emanate from sub-national radical Islamist groups that oppose the United States and its allies. Pakistan's limited and tenuous control of much of its territory, the growing strength of radical Islamist groups in Pakistan, the poor state of Pakistan's economy, and ongoing political turmoil among Pakistani political elites all undermine Pakistan's ability to effectively control radical Islamist elements and to ameliorate growing environmental, economic, and other stresses. Pakistan's status as a nuclear weapon state, its traditional enmity with India, and proximity to Afghanistan all heighten its importance to U.S. strategic interests.

The environment and natural resources within Pakistan are also under stress. Once abundant water supplies are dwindling due to an increase in demand and drought. This is, in part, affecting crop production and reducing the area of arable land in the country. Pakistan has one of the highest deforestation rates in the world and currently has approximately 4% of its original forested area intact. Loss of forests has led to soil erosion and altered ecosystems in the region. The projected effects of climate change in Pakistan range from increased periods of drought and low water supplies to sea-level rise and associated saltwater intrusion. Many of these environmental stressors have potential socio-economic and political consequences for Pakistan. For example, drought can stress water supplies along the Indus River and potentially exacerbate tensions between Pakistan and India. Drought can further lead to reduced hydropower supplies and catalyze protests in areas experiencing rolling blackouts, and of course contribute to economic stresses in Pakistan's agricultural regions, where the majority of Pakistanis live.²

Existing environmental stress and potential future stress from climate change in Pakistan may undermine American interests in the region by leading to further socio-political instability in Pakistan. Alone, environmental stress might not become a geopolitical concern, but when added to existing political and socio-economic stresses, it has the potential to be geopolitically important due to the instability that it could create. Congress could be interested in this connection because of its role in authorizing and appropriating funds for Pakistan.³

¹ National Security and the Threat of Climate Change, Center for Naval Analysis, <http://securityandclimate.cna.org/>.

² Cuts in electricity have led to several protests in Lahore and Karachi, among other regions.

³ The Obama Administration sought nearly \$1.6 billion specifically for Pakistan. Highlighted program areas to receive (continued...)

Context for Environment and National Security

Theoretical and empirical work on the relationship between the environment and security, which can help us better understand how environmental stress may affect Pakistan, has been expanding for decades. This report touches briefly on just a few of these sources to provide a sense of this growing body of knowledge and set a theoretical context for our analysis of Pakistan's water resources and food security.

J.R. McNeill, in an historical analysis of natural shocks to societies, has observed that such shocks have proved to be both unifying and divisive, that social conflict has been routine during and after natural disasters, that minorities or foreign groups are often blamed, and that government authorities have often been the target of popular wrath for failing to minimize or prevent damage. McNeill further points out that "Societies with little in the way of safety net ... easily succumb to banditry, ethnic and religious violence, and even outright civil war under the stress of acute drought. Restraint and civility can quickly perish when people are confronted with imperious necessity."⁴

Given this perspective, the fragility of the ecosystem and political structure of Pakistan may mean that it is more likely to be depleted or degraded due to environmental stress than more resilient states subject to the same pressures. Pakistan is subject to both demand-induced scarcity and structural scarcity.⁵ Demand-induced scarcity stems from Pakistan's growing population and per capita use of resources. Structural scarcity stems from the inequitable distribution and use of natural resources in Pakistan, stemming from social inequality.⁶

Thomas Homer Dixon describes the dynamic of how environmental factors interact in a security context:

If market failure, social friction, and capital availability prevent a society from supplying the amount of ingenuity that it needs to adapt to environmental scarcity, then five kinds of social effect are likely: constrained agricultural productivity, constrained economic productivity, migration, social segmentation, and disruption of legitimate institutions. Environmental scarcity is not the sole or sufficient cause of these social effects. Contextual factors range from the nature of relations among ethnic groups to the state's degree of autonomy from outside pressure groups.⁷

One can see how the above statement may relate to Pakistan when considering the threat multipliers at play in Pakistan today.

(...continued)

major funding increases include education (\$364 million in FY2010); health care (\$180 million); private sector competitiveness (\$129 million); economic growth in the agriculture sector (\$124 million); and rule of law and human rights (\$39 million). See CRS Report RL33498, *Pakistan-U.S. Relations*, by K. Alan Kronstadt, for more information.

⁴ J.R. McNeill, "Can History Help Us With Global Warming?" p. 35 in Kurt Campbell ed. *Climatic Cataclysm: The Foreign Policy and National Security Implications of Climate Change* (Washington: Brookings Institution Press, 2008).

⁵ Thomas Homer-Dixon ed. *Ecoviolence: Links Among Environment, Population and Security* (Boulder: Rowman and Littlefield Publishers, 1998).

⁶ For more detailed information on Pakistan water issues see Michael Kugelman and Robert Hathaway, eds., *Running on Empty: Pakistan's Water Crisis*, Woodrow Wilson Center, 2009.

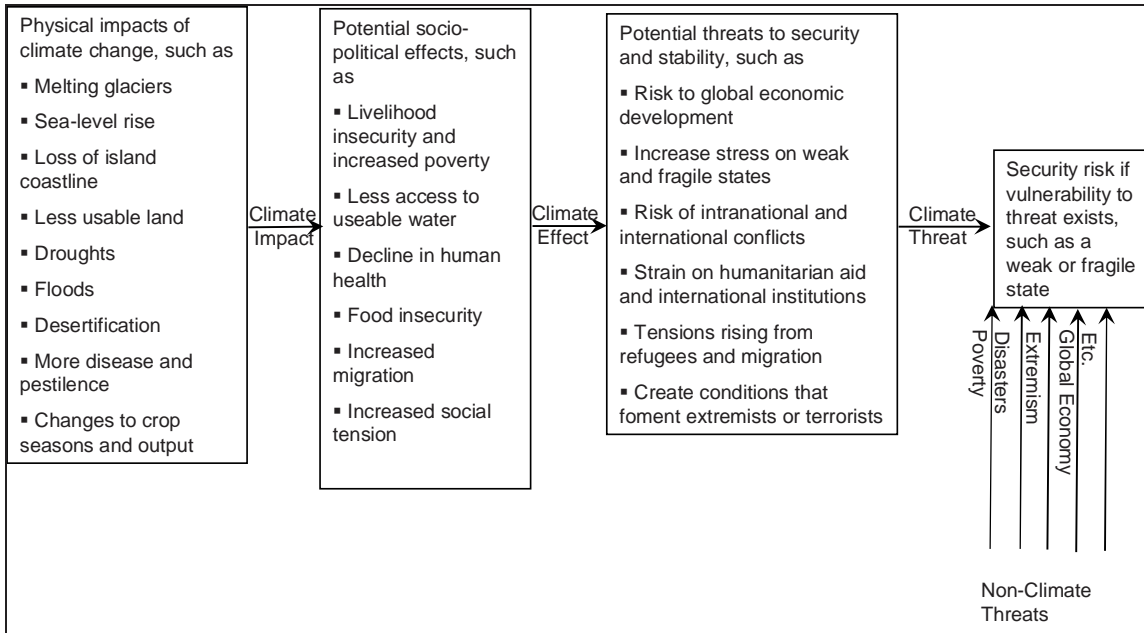
⁷ Thomas Homer-Dixon ed. *Ecoviolence: Links Among Environment, Population and Security* (Boulder: Rowman and Littlefield Publishers, 1998), p. 9.

In his book *Collapse: How Societies Choose to Fail or Succeed*, Jared Diamond found that societies do not collapse due “solely to environmental damage: there are always other contributing factors.” Diamond identifies a five-point framework of such contributing factors including: environmental damage, climate change, hostile neighbors, friendly trade partners, and the society’s response to its environmental problems. Diamond found that this fifth factor, the society’s response to environmental factors, “always proves significant.”⁸

As the potential effects of environmental degradation and climate change on Pakistan’s and many other nations’ security become better understood, there may be greater impetus for the United States to assess international climate change mitigation and adaptation frameworks. The combination of environmental degradation, anticipated future impacts of climate change, and increasing demographic pressure are likely to place significant stress on many developing nations across the globe in the years ahead. Security, however, is complex, and climate change is but one threat among many security threats. Moreover, the security concern (e.g., failed states, rise of terrorists groups and unfriendly regimes, global economic and financial security, humanitarian and human development disasters) varies depending on the nation at risk (e.g., Pakistan) and the perspective of those affected by the risk (e.g., United States).

Figure 1 is an illustration of how the physical impacts of climate change may lead to socio-economic effects, which may contribute to a threat to security and stability.

Figure 1. Illustrative Pathway of How Climate Change May Affect Security



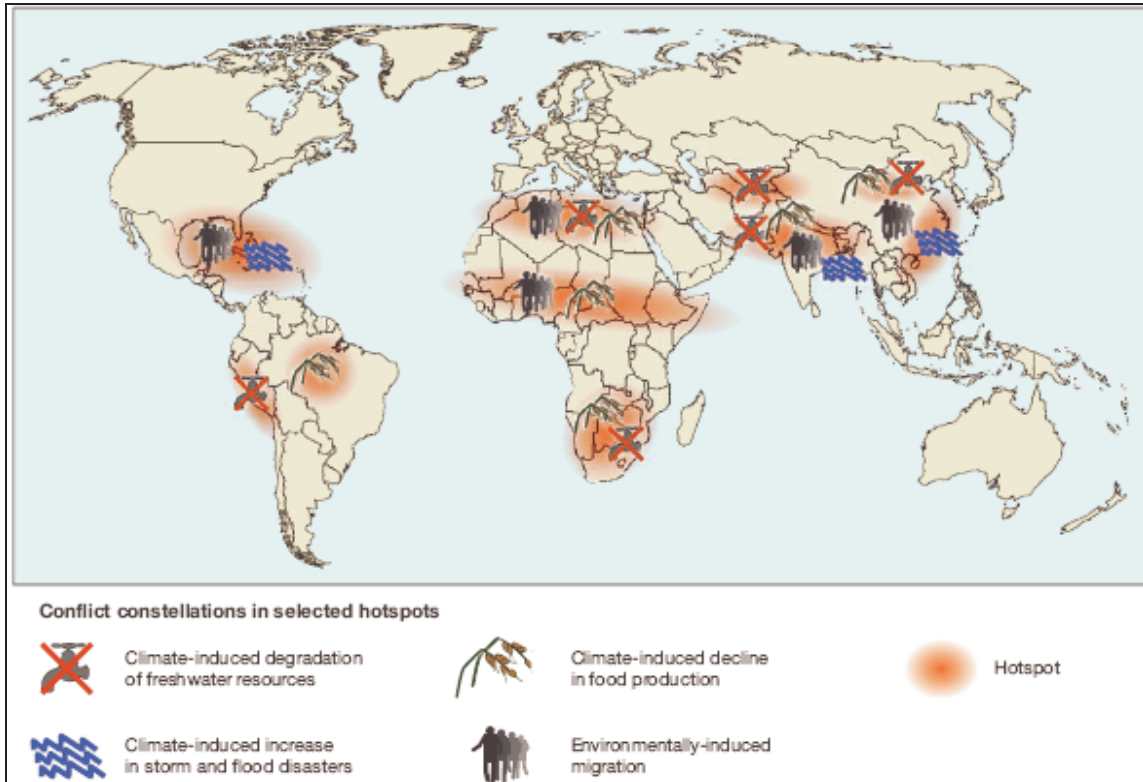
Source: CRS.

Notes: First two boxes were adapted from S. Smith and J. Vivekananda, *A Climate of Conflict* (International Alert, Nov. 2007), pp. 10-11, available at http://www.international-alert.org/pdf/A_Climate_Of_Conflict.pdf.

⁸ Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking Press, 2005), p. 11.

Figure 2 shows a map produced by the German Advisory Council on Global Change that overlays regional hot spots with anticipated climate change impacts in those areas. This demonstrates that the issues under consideration in this report on Pakistan are in various ways relevant to other parts of the globe as well.

Figure 2. Select Security Hot Spots and Their Climate Threats



Source: R. Schubert, et al., *Climate Change as a Security Risk* (German Advisory Council on Global Change, May 2007), p. 4, available at http://www.wbgu.de/wbgu_jg2007_engl.pdf.

Water Resources

Climate Change and Pakistan’s Water Resources

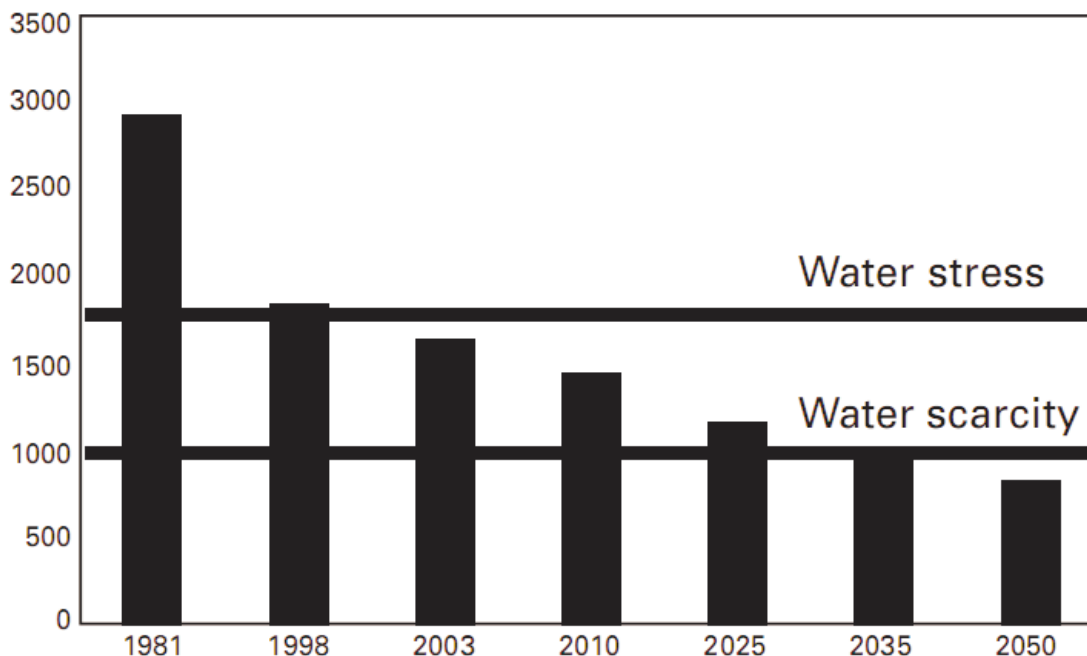
Pakistan, which depends heavily on the Indus River system, is a water-stressed country. That is, most of the surface and groundwater resources are nearly fully exploited or are being used at an unsustainable rate. Water allocations among Pakistanis are highly inequitable.⁹ **Figure 3** provides data on the past and anticipated per capita water supply in Pakistan; the illustration shows the declining availability of water which affects both human health and livelihoods, and ecosystem

⁹ See M. Kugelman in the introduction to *Running on Empty: Pakistan’s Water Crisis* (2009), published by the Woodrow Wilson International Center for Scholars.

The paucity of water rights law in Pakistan means that landowners have better defined rights to water than do the landless; similarly, large wealthy farmers often receive more irrigation water than small, poorer farmers. The report is available at http://www.wilsoncenter.org/topics/pubs/ASIA_090422_Running%20on%20Empty_web.pdf.

health and the services provided by those ecosystems. Most Pakistani households do not have access to adequate potable or shallow water; 65% of households get their water from a pump.¹⁰

Figure 3. Declining Per Capita Water Availability in Pakistan
(cubic meters per person annually)



Source: World Bank 2005 data adapted by F. Khan, “Water, Governance, and Corruption in Pakistan,” in *Running on Empty: Pakistan’s Water Crisis* (Woodrow Wilson International Center for Scholars, 2009), p. 83.

Only a few decades ago, Pakistan was considered to have an abundance of water. The change results largely from the increased demand for water by expanded irrigation, population growth, less than optimal water use practices, and economic development. The near- and long-term effects of climate change on Pakistan’s water-resources will further challenge the country’s water sector, resources, and regional and ethnic tensions.

¹⁰ Government of Pakistan, Federal Bureau of Statistics, *Pakistan Social and Living Standards Measurement Survey 2005-06*, available at http://www.statpak.gov.pk/depts/fbs/statistics/pslm2005_06/water_supply_sanitation.pdf. Thirty percent of households have no toilet facilities. Sanitation coverage varies largely between rural and urban areas, with only 3% of urban households not having toilets, and 44% of rural households.

Figure 4. Map of Pakistan



Water resource development for agriculture contributed to Pakistan's economic growth and rise as a regional food basket. Agriculture represents almost 97% of the water withdrawals in Pakistan. This is a very high percentage and leaves little for other uses. Pakistan now has the world's largest contiguous irrigated area, which is fed by surface water from the Indus River system and from groundwater wells. The irrigation network alone contributes to nearly a quarter of the country's gross domestic product and meets most of its food and fiber requirements. The livelihood of many families and the economy of the country, therefore, is sensitive to the availability of water and to reductions in availability that climate change may cause.

The growing imbalance between Pakistan's water supply and demand has led to shortages, regional competition, conflicts between stakeholders, and constraints on economic development. The tools available to address the imbalance range from trying to develop new supplies to improving the efficient use of existing supplies. Developing new sources through additional

storage has been controversial. Improving water efficiency requires political will and significant investment. Determined efforts to strengthen institutional capacities in the water sector at all levels of government and to change behaviors of farmers have not been sufficient to effectively deal with the problem. The poor state of government finances limits the options available to the government.

Under climate change predictions, the eventual loss of glacier storage may significantly alter water available in the Indus River for use in Pakistan. Western Himalayan glaciers are projected to continue their retreat for the next half century, increasing Indus River flows and flooding. These initial increases in river flows will likely be followed by decreased river flows as the glacial melt decreases as the glaciers disappear.¹¹ A 2010 Dutch study found that melt water from the Himalaya accounts for 60% of the water in the Indus river. The study also found that projected temperature, rainfall, and snow projections would likely lead to a 8.4% decrease in upstream water flow into the Indus by 2050 which would threaten the food security of those dependant on the river for irrigation.¹² This is despite a projected increase in rainfall in the area. The change in the glacial melt is not the only water-related effect on Pakistan anticipated under climate change. Climate change has been projected to increase the variability of monsoons, decrease the predictability of precipitation, exacerbate water-stress in arid and semi-arid regions, and further salt-water intrusion of coastal freshwater supplies.¹³

Agricultural Production and Food Security

Pakistan's agriculture sector is a major part of its economy, contributing to about 20%-30% of the country's Gross Domestic Product (GDP), with about 70% of the population dependent on agriculture.¹⁴ Roughly 45% of the working population is employed in agriculture, forestry, and fishing. As illustrated by statistics reported by the Food and Agriculture Organization (FAO) of the United Nations (U.N.), however, expected water shortages and soil degradation for Pakistan, among other sectoral factors, may effectively constrain expansion of its agricultural resources and production.

Pakistan's agricultural production includes both food and cash crops. Major food crops are cereal grains (mostly wheat and rice, and also barley, corn, millet, and sorghum) and milk products (buffalo, cow, and goat). Other commodities include other products such as fruits, vegetables, cattle, mutton, and eggs. Most livestock (60%-90%, depending on the area) are pasture- or rangeland-fed and are not generally fed cereal grains which are needed for human consumption.¹⁵ Most food production is centered in the Punjab and Sindh provinces, which are the center of the country's wheat and rice production. (See **Figure 4.**) Mixed crop production areas are more

¹¹ While there has been a degree of controversy over the exact number of years that it will take for Himalayan glaciers to melt, there is general agreement among scientists that they are melting at an alarming pace.

¹² "Himalayan Glacial Melting Still a Threat," *United Press International*, <http://www.upi.com/science>.

¹³ "Global Climate Change: The Current and Future Consequences of Global Change," NASA, <http://climate.nasa.gov/effects/>, and Intergovernmental Panel on Climate Change (IPCC), "Moving Toward the Fifth Assessment Report," <http://www.ipcc.ch/>.

¹⁴ U.N., "Pakistan, Country Profile," 2002, <http://www.un.org/esa/agenda21/natinfo/wssd/pakistan.pdf>; and FAO, "Food and Agriculture Indicators," 2006, http://www.fao.org/es/ess/compendium_2006/pdf/PAK_ESS_E.pdf. GDP estimates may vary depending in part on the inclusion of cotton production and fisheries.

¹⁵ Muhammad, D., "Pakistan, Country Pasture/Forage Resource Profile," 1998 (data last updated in October 2006), <http://www.fao.org/ag/AGP/AGPC/doc/Counprof/Pakistan/Pakistan.htm>.

prevalent in the Northwest Frontier Province (NWFP) areas; Baluchistan is characterized by mostly arid/sparse production, along with limited pasture-based livestock production.

Pakistan's major agricultural cash crops are cotton, sugarcane, and tobacco. Cotton serves as an important input into Pakistan's textile and apparel industry, and competes for available land, waters, and other resources and production inputs.¹⁶

Declining Agricultural Production

In the last decades of the 20th Century, Pakistan's agricultural production grew sharply, increasing by an average of 4% per year, in large part due to the use of high-yielding crops, increased government prices for crops, and subsidies for irrigation water, fertilizer, and other inputs.¹⁷ In recent years, however, agricultural production has been declining. Among the many reasons cited for this decline are:¹⁸

- shortage of irrigation water and deterioration in the irrigation network, including severe drought conditions in 2000-2001;
- soil degradation from fertilizers and other chemical inputs, and low efficiency from most farm inputs;
- low technology use, and lack of farmer knowledge of operating and technological characteristics within the agricultural sector;
- large differences in yields among provinces;
- uncertain land tenure;
- poor government investment in agricultural research and marketing;
- domination of large landowners and other vested interests, including price control by cartels;
- lack of crop diversification and focus on wheat production, particularly by some donor organizations; and
- poor governance and corruption.

The U.N. reports that although Pakistan was a net exporter of wheat and other cereal grains in the 1980s and 1990s, Pakistan became a large net importer of food products during the 2001-2003 period.¹⁹

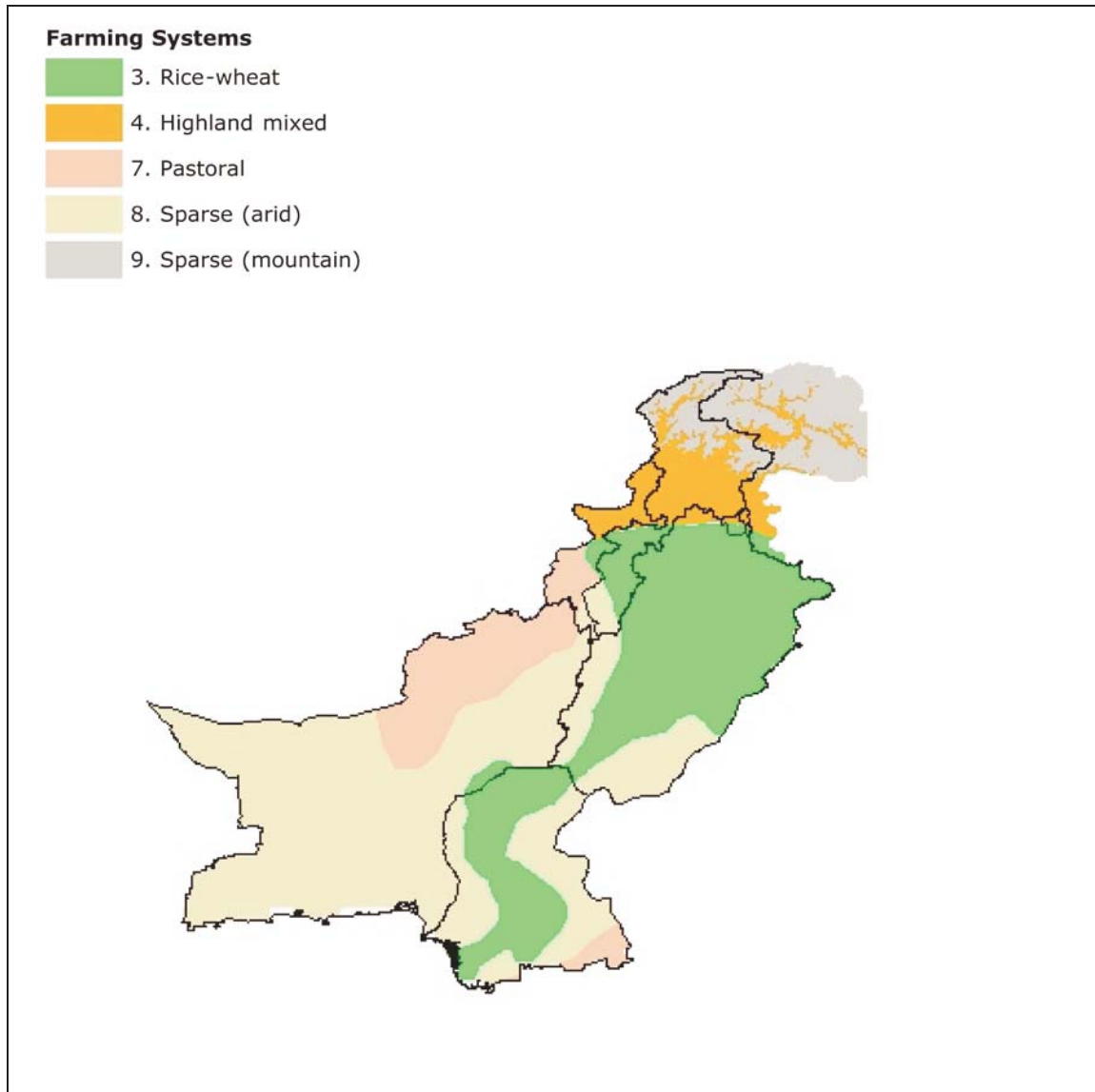
¹⁶ Comments from presenters at "Hunger Pains: Pakistan's Food Insecurity," Woodrow Wilson International Center conference, Washington, DC, June 3, 2009.

¹⁷ U.N., "Pakistan, Country Profile," 2002, <http://www.un.org/esa/agenda21/natlinfo/wssd/pakistan.pdf>; and Library of Congress, "Country Profile: Pakistan," February 2005, <http://lcweb2.loc.gov/frd/cs/profiles/Pakistan.pdf>.

¹⁸ Comments from presenters at "Hunger Pains: Pakistan's Food Insecurity," Woodrow Wilson International Center conference, Washington, DC, June 2009; U.N., "Pakistan, Country Profile," 2002, <http://www.un.org/esa/agenda21/natlinfo/wssd/pakistan.pdf>.

¹⁹ FAOSTAT, "Food and Agriculture Indicators," 2006, http://www.fao.org/es/ess/compendium_2006/pdf/PAK_ESS_E.pdf. Data are reported for 2004.

Figure 5. Pakistan Farming Systems



Source: U.N. FAO, « Pakistan, Agriculture Sector, » <http://www.fao.org/countryprofiles/index.asp?lang=en&iso3=PAK&subj=4>.

Notes: FAO study, “Farming Systems and Poverty: Improving Farmers Livelihoods in a Changing World,” 2001, <http://www.fao.org/farmingsystems>.

Land Use and Irrigation

Less than 30% of Pakistan’s total land area (about 21.3 million hectares) is under cultivation and can be intensively farmed.²⁰ Most arable land and land under cultivation is in the densely

²⁰ FAO, *FAO Statistical Yearbook*, 2004, http://www.fao.org/es/ess/yearbook/vol_1_2/pdf/Pakistan.pdf. Total land area is about 77.1 million hectares.

populated Punjab and Sindh provinces. This coincides with data showing that these same two provinces account for nearly 90% of Pakistan's irrigated agriculture.

Nearly all available water in Pakistan is used for agriculture. As mentioned above, Pakistan's agriculture sectors rely heavily on irrigation, given its generally arid climate and low soil moisture. About 10% of Pakistan's cultivated area is classified as "semi-arid," with the majority of cultivated land classified as either "arid" (48% of total) or "hyper-arid" (37%).²¹ By major province/region, about 60% of the arable land in both Baluchistan and NWFP is considered to consist of dry areas, with about 50% of the arable land in both Sindh and Pakistan's Federally Administered Tribal Areas (FATA) bordering Afghanistan classified as dry. The share of dry areas in Punjab is lower at 23% of all cultivated land. The major factor attributed to land degradation in Pakistan is low organic matter in soils, estimated at less than 1%.²² Other factors include soil erosion, underuse of organic fertilizers and overuse of synthetic chemicals, salinity and sodicity, and waterlogging.²³ Overly extensive cultivation in rainfed areas is common.

Pakistan has one of the world's largest irrigation systems. Irrigation covers an estimated 83% of all cultivated land in the country. About 72% of irrigated agriculture is centered in the Punjab region, the principal food production region in the country, with about 10.3 million hectares under irrigation. The Sindh province accounts for another 2.5 million hectares (17%) of irrigated agriculture. Comparable estimates for Baluchistan and the North-West Frontier Province (NWFP) are about 700,000 hectares under irrigation, or about 5% each of Pakistan's total irrigated area.²⁴

²¹ FAO Terrastat and 2000 World Soil Resources Report, Table A3d, <ftp://ftp.fao.org/agl/agll/docs/wsr.pdf>; and Iqbal, M.M., and A.M. Khan, "Climate Change Challenges faced by Agriculture in the Punjab," August 30, 2008. Based on the Aridity Index (AI), the U.N. Environment Programme's (UNEP) classification of climatic zones quantifies precipitation deficit over atmospheric water demand. AI equals the ratio between mean annual precipitation and mean annual potential evapotranspiration (or the amount of water that would be lost from water-saturated soil by plant transpiration and direct evaporation from the ground).

²² Organic matter (OM) is an important measure of soil health. About 3%-4% OM is typical for cultivated, temperate-region soils.

²³ U.N., "Pakistan, Country Profile," 2002, <http://www.un.org/esa/agenda21/natlinfo/wssd/pakistan.pdf>; and Pakistan Mission to the United Nations, "Pakistan Country Profile," April 1997.

²⁴ Iqbal, M.M., and A.M. Khan, "Climate Change Challenges faced by Agriculture in the Punjab," Seminar presentation, August 30, 2008, http://cmsdata.iucn.org/downloads/pk_cc_mohsin.pdf.

Table I. Distribution of Irrigated Area, Pakistan
by Federal State Territory

Federal state territory	Irrigated area (hectares)	Irrigation (percent)
Baluchistan	767,120	5%
North-West Frontier Province (NWFP)	719,152	5%
Punjab	10,325,678	72%
Sindh	2,515,050	17%
Northern Territories	90,464	1%
Pakistan, total	14,417,164	100%

Source: U.N. FAO, Aquastat, "Global Map of Irrigation," <http://www.fao.org/nr/water/aquastat/irrigationmap/pk/index.stm>. Estimates have origin in 1990 Census.

Notes: Areas equipped with irrigation infrastructure. Does not include other irrigated or rainfed areas, which total another roughly 8 million hectares.

Food Security and Nutrition

The UN notes that fluctuations in the availability of food is among the "factors responsible for the micronutrient deficiency disorders observed in Pakistan."²⁵ For the 2001-2003 period, the U.N. reports that energy supplied from wheat and other cereals accounted for about 38% of total dietary intake, along with milk products (11%) and sugar products (10%).²⁶ Still, more than 20% of Pakistan's population is reported to suffer from food deprivation.²⁷

The U.N. reports that the nutritional status of Pakistani children under five years of age is "extremely poor."²⁸ At a national level almost 40% of children under five years are underweight; about 37% of children are affected by stunting and about 13% by wasting.²⁹ Moreover, the U.N. reports that there are significant variations in malnutrition rates among provinces. For example, "The prevalence of stunting appears to be associated with the overall level of development of the provinces, being lowest in Punjab and highest in Baluchistan, the least developed province."³⁰ Baluchistan, NWFP, and the FATA areas, along with areas with large numbers of internally displaced persons (IDPs), are among the most food insecure in Pakistan.³¹

²⁵ FAO, "Nutrition and Consumer Protection, Pakistan," http://www.fao.org/ag/AGN/nutrition/PAK_en.stm. Based on surveys of average daily requirements during 1984-1985 and 1987-1988. No recent nationwide food consumption surveys or information on the adequacy of present food consumption are available.

²⁶ FAOSTAT, "Food and Agriculture Indicators," 2006, http://www.fao.org/es/ess/compendium_2006/pdf/PAK_ESS_E.pdf. Data are reported for 2004.

²⁷ FAOSTAT, "Food Security Statistics, Pakistan," http://www.fao.org/faostat/foodsecurity/Cous_en.htm. Data are reported for 2001-2003 period.

²⁸ FAO, "Nutrition and Consumer Protection, Pakistan," http://www.fao.org/ag/AGN/nutrition/PAK_en.stm.

²⁹ Ibid; and FAOSTAT, "Food Security Statistics, Pakistan," http://www.fao.org/faostat/foodsecurity/Cous_en.htm. Data are reported for 2001-2003 period.

³⁰ FAO, "Nutrition and Consumer Protection, Pakistan," http://www.fao.org/ag/AGN/nutrition/PAK_en.stm.

³¹ Comments from presenters at "Hunger Pains: Pakistan's Food Insecurity," Woodrow Wilson International Center conference, Washington, DC, June 3, 2009.

Natural Disasters

Pakistan is prone to certain types of natural disasters with significant impacts, especially earthquakes and floods. Pakistan has experienced major earthquakes that have caused considerable fatalities and damage to critical infrastructure. The last major earthquake in Pakistan with significant consequences was in northern Pakistan in October 2005.³² Over 73,000 people died as a result of the earthquake and over 5.0 million were displaced.³³ This disaster created issues related to food security, health and disease, water and sanitation, and infrastructure. It also had a large economic toll, causing some to estimate that recovery could cost over \$5.0 billion.

Pakistan is also subjected to flooding during the monsoon season, when flooding has the potential to displace tens of thousands of people, damage infrastructure, and destroy croplands. In relation to climate change, flooding patterns might follow changes in monsoon seasons. A World Bank study has stated that between 1990 and 2008 natural disasters killed 60,000 and affected 750 million people in South Asia with \$45 billion in damages.³⁴ In July and August of 2010, Pakistan experienced what have been described as the worst floods in the country's history. These floods reportedly killed over 1,100 and devastated large parts of the Swat Valley where the government of Pakistan is seeking to reassert its control after displacing Islamist militants. A Pew Research poll has found that only 17% of Pakistanis hold a favorable view of the United States.³⁵ In August 2010, the United States announced \$10 million in assistance to aid those affected by the flooding. Such assistance may help improve Pakistanis' perceptions of the United States. Melting glaciers might lead to glacial lake outburst floods,³⁶ which can affect communities and settlements downstream. A burst can discharge millions of cubic meters of water and debris in a few hours into downstream communities. There are over 2,500 glacial lakes in the Himalayan region of Pakistan; however, just a small fraction are considered dangerous.³⁷

Natural disasters often lead to displaced populations and damaged infrastructure in countries such as Pakistan. The response to these events can stress governments and lead to or exacerbate internal conflicts. These events can also provide radical groups an opportunity to help displaced people and recruit new members, when government responses are weak. The promptness and efficiency of militants in providing assistance to some of those affected by the 2005 earthquake in Azad Kashmir and the Northwest Frontier Province of Pakistan earned them a degree of legitimacy within communities affected by the quake.³⁸

³² It had a magnitude 7.6 on the Richter scale.

³³ U.S. Agency for International Development, South Asia Earthquake, Fact Sheet #44, at http://www.usaid.gov/our_work/humanitarian_assistance/disaster_assistance/countries/south_asia/fy2006/southasia_eq_fs44_08-25-2006.pdf.

³⁴ "Pakistan's Current Monsoon Leads to an International Emergency Appeal for Assistance," <http://www.examiner.com>.

³⁵ "Floods Ravage Pakistan Valley That Endured Taliban," *Associated Press*, August 1, 2010.

³⁶ Glacial Lake Outburst Floods results from glacial dams bursting. Glacial dams form when glaciers melt and leave pools of water behind dams formed from silt and debris. Melting glaciers and deforestation are thought to be main causes for glacial lake formation.

³⁷ European Commission on Humanitarian Aid, *Managing Climate Risk: Glacial Outburst Floods*, United Nations Development Program, 2010, http://www.managingclimaterisk.org/index.php?menu_id=2&submenu_id=102&pagetype_menu=2&content_id=SMN-2.

³⁸ Ashfaq Yusufzai, "Militants Gain legitimacy Through Quake Relief," <http://ipsnews.net>.

Environmental Stress as Threat Multiplier to Security in Pakistan

While much attention has been devoted to environmental stress that is anticipated due to climate change, existing environmental concerns already stress Pakistan. If these conditions worsen, they could act as a threat multiplier in combination with other threats to the state such as expanding population and food insecurity, strife among political-military elites, poor economic resources, Islamist extremism, secessionism, inter-provincial competition for resources, and/or cross border conflict with Afghanistan or India. Such stress could further weaken the state to the extent that it could fall to pressure by militants. Such a situation could also lead to a return to military rule.

Demographics and Food Insecurity

High population growth and density, low economic development, and resource scarcity may lead to increased risk of conflict. Pakistan contains all of these factors to certain degrees. Environmental stress can exacerbate these existing problems by increasing resource scarcity (i.e., limiting food production). Food production in Pakistan is a key factor for development because of the limited carrying capacity of arable land and state resources relative to Pakistan's population. Food production is not keeping pace with Pakistan's steadily increasing population. Pakistan's population almost quadrupled from 1960 to 2010, and is expected to grow by another 66 million in the next 15 years, thereby reaching 335 million by 2050.³⁹

A combination of increasing population size, limited arable land, and poverty put Pakistan at extreme risk of food insecurity, according to some studies. For example, in 2009, Pakistan ranked 11th on a list of the world's Food Security Risk Index which placed it in the category of states at extreme risk.⁴⁰ The number of people in Pakistan considered "insecure" in terms of their food needs reportedly increased from 35 million to 45 million in 2009. Some reasons for this status are economic. For example, the price of wheat flour in Pakistan increased 95% from May 2007 to October 2009 while overall food inflation increased prices 28% in the year preceding October 2009. An estimated 85% of Pakistanis live on two dollars a day or less and spend at least 50% of their income on food. Pakistan produces approximately 20 million tons of wheat while consuming 23 million tons, leading to the necessity of wheat imports.

"Without food, people do one of three things: revolt, migrate, or starve. When governments can no longer provide food security, states fail."⁴¹ From May 2007 to October 2009 (when wheat flour increased in price), riots in Pakistan reportedly led to the stealing of massive amounts of grain and flour. In January 2008, Pakistan deployed 6,000 soldiers to secure flour mills, food distribution centers, and to escort supply trucks.⁴² The food security situation is considered to be the worst in Pakistan's northern and western border areas.⁴³ In Baluchistan 20 of 25 districts were considered food insecure while all of the Federally Administered Tribal Areas were considered

³⁹ "Pakistan's Daunting—and Deteriorating—Demographic Challenge," January 18, 2010, <http://www.populationmedia.org>.

⁴⁰ "Pakistan at Extreme Food Security Risk," *Dawn*, September 8, 2009.

⁴¹ Josette Sherman, "How to End Hunger," *The Washington Quarterly*, April 2010.

⁴² Peiris, V., and K. Jones, "Pakistan Roiled by Flour and Electricity Shortages," <http://www.buzzvines.com>.

⁴³ Myra Imran, "Food Insecurity Haunts 45 Million in Pakistan," *The News*, October 16, 2009.

food insecure.⁴⁴ These areas are the same areas that are subject to much of Pakistan's internal strife.

Refugees place added pressure on food security in Pakistan. Regional conflict in Afghanistan has made Pakistan one of the leading locations of refugees over the years. Millions of Afghans fled to Pakistan to avoid fighting during both the Soviet and American occupations of Afghanistan. Internal fighting between the Pakistan government and Taliban forces in northwest Pakistan in 2009 led to an estimated 3 million Internally Displaced Persons (IDPs).⁴⁵ Such dislocated populations lack the resources of more stable populations and can contribute to food scarcity and overtaxed infrastructure, among other things. Refugees have the effect of reducing the resilience of regional governments when facing environmental stress. Further, environmental stress, such as food scarcity and limited water supplies, exacerbates the effect of refugees and lead to protests, crime, and potentially recruiting by militants. Cross border migration appears to be less of an option for Pakistan's populations than in other states due to Pakistan's adversarial relationship with India and the ongoing conflict in Afghanistan.

Political-Military Elite Strife

Strife among the political-military elites of Pakistan is a key factor that prevents Pakistan's leadership from effectively deploying state resources for environmental and other issues. Changes made to the Constitution in 2010 are not thought likely to cure tri-partite conflict between the military, judiciary, and the government.⁴⁶ As a result, political infighting is expected to continue at the cost of effective governance.⁴⁷ Corruption remained a problem in 2009 as Pakistan ranked as the 42nd most corrupt of 180 states in a ranking by Transparency International.⁴⁸ Resource scarcity has also evidently led to elite's control of resources that has ecologically marginalized many of Pakistan's poor who are increasingly vulnerable.⁴⁹ Many of the urban poor are more vulnerable to price increases than the rural poor because they must buy all of their food. Pakistan is 36% urban with a 3% annual shift from rural to urban areas.⁵⁰

Federal Minister of Investment Waquar Ahmed Khan announced in April 2009 that the government of Pakistan has plans to sell or lease one million acres of farmland to foreign investors who are thought likely to be from the Persian Gulf. The Pakistani Taliban asserted control over the Swat Valley, about 100 km north of Islamabad, in 2008 before the government reasserted its influence in the region. There are plans to raise a special security force to protect foreign investment in Pakistani farmland. A further question is the extent to which such investment will compete with Pakistani agriculture for water resources.⁵¹ Food produced on such foreign-controlled farms may be exempt from export bans during times of shortage.

⁴⁴ "Urban Food Security Deteriorating," U.N. Office for Coordination of Humanitarian Affairs, IRIN, January 8, 2008.

⁴⁵ William Branigin, "U.S. to Provide Millions for Pakistani Refugees," *The Washington Post*, May 20, 2009.

⁴⁶ "Pakistan Politics: Power Shift," *Economist Intelligence Unit*, April 9, 2010.

⁴⁷ "Country Report: Pakistan," *Economist Intelligence Unit*, April 2010.

⁴⁸ "Pakistan Slips Five Places in Transparency International Corruption Index," *Pakistan Conflict Monitor*, November 18, 2009.

⁴⁹ Peter Gizewski and Thomas Homer-Dixon, "Environmental Scarcity and Violent Conflict: The Case of Pakistan," Occasional Paper, Project on Environment, Population and Security, April 1996.

⁵⁰ "Pakistan," *CIA World Factbook*, April 2010.

⁵¹ Ximena Ortiz, "Food Follies," *National Interest*, April 24, 2009.

The Economy⁵²

The effect of environmental stress on Pakistan can be, in part, related to the country's poor economic performance which limits Pakistan's resilience in dealing with environmental stress. Developed states with strong diversified economies are likely have greater resources to mitigate and adapt to environmental stress, such as climate change. Less developed states such as Pakistan might not effectively deal with environmental challenges. For example, a robust industrial sector could absorb excess workers from the agricultural sector should a decline in that area lead to its downsizing. Without alternative employment, potentially displaced agricultural workers could have difficulty finding work to buy food for their families.

The Pakistani economy has been hindered by decades of internal political conflict and low levels of foreign investment. Despite this, some gains have been made in poverty reduction, and GDP growth is forecasted to be 2.9% in 2010. Unemployment remains high at 15.2% in 2009. An estimated 24% of the country lives below the poverty line, and GDP per capita in purchasing power parity terms is \$2,600 per person per year. Inflation is expected to remain high in 2010 at 11.3% even as it has dropped from 20.3% in 2008 and 13.6% in 2009.⁵³ Pakistan received emergency funds from the International Monetary Fund (IMF) in late 2008 to help stabilize its economy. While the economy stabilized somewhat in 2009, the IMF warned in February 2010 that challenges to the economy remained. Some believe that domestic factors will hinder government efforts to further improve economic stability. The government's resources will be further strained when it has to repay the IMF loans.

Environmental stress such as low agricultural productivity, declining water supplies, and natural disasters can exacerbate economic problems. Low agricultural productivity could lower GDP, increase unemployment, and potentially raise prices for staple foods. Low water supplies could affect agriculture and industry dependent on water, as well as, directly affect the populace. Lastly, natural disasters can exact a financial burden on the government and lead to displaced people without jobs. The sum impact of these environmental stresses would be to exacerbate the existing problems in the Pakistani economy. The degree of their effect is related to the intensity and timing of the environmental stress. A poor economy limits Pakistan's ability to deal with security threats as it limits the state's resource base that it can deploy to address the threat.

Islamist Extremism

Islamist extremism in Pakistan is a direct security threat to the United States, Pakistan, and other countries.⁵⁴ Environmental stress in Pakistan can contribute to the growth and sustenance of Islamic extremism in the region. One documented example connecting environmental stress and Islamic extremism was the major earthquake in Pakistan in 2005. It was reported that militant groups in Pakistan played an active role in providing aid after the earthquake. These actions were done to bolster their image and possibly gain recruits. Natural disasters leading to a weak government response has the potential to create discord among displaced populations. In some

⁵² For further information see CRS Report RS22983, *Pakistan's Capital Crisis: Implications for U.S. Policy*, by Michael F. Martin and K. Alan Kronstadt.

⁵³ "Pakistan: Country Report," *The Economist Intelligence Unit*, April, 2010.

⁵⁴ The direct importance of Pakistan to American security was highlighted most recently in early May 2010 as it became apparent that an immigrant from Pakistan, Faisal Shahzad, had received training in Waziristan before he attempted to detonate a car bomb in Times Square, New York, on May 1, 2010.

cases, it might empower fringe, militant groups that pose a security threat to the country; whereas in other cases, it might result in protests and disassociation with the ruling party.

Pakistan's Periphery

Key existent stresses on the Pakistani state stem from autonomous and secessionist tendencies in Pakistan's western borderlands, particularly in the Federally Administered tribal Areas (FATA), Northwest Frontier Province (NWFP) (recently renamed the Kyber Pakhtunkhwa), and Baluchistan. Pakistan's central government has never extended the same degree of control over these areas that it does over its core in Punjab and Sindh. This was also the case under the previous British colonial administration. A deteriorating environment due to increased stress on the land that could come about as a result of potential demographic pressure could further weaken central government control over these areas. It was reported in April 2010 that militants were still using sanctuaries in Pakistan's FATA to strike U.S. and NATO forces in Afghanistan.⁵⁵ This is in addition to Waziristan having connections to recent failed attempts to attack the United States and its interests in the region. Baluchistan is an area where long standing tensions with the centre in Islamabad overlap with an area of current water stress.

Inter-Provincial Competition for Water Resources

An ongoing dispute over the construction of the Kalabagh Dam on the Indus River in the Pakistani Province of the Punjab highlights intra-Pakistani tensions over water resource sharing. The Pakistani provinces of Sindh, Baluchistan, and the Northwest Frontier Province oppose the dam's construction while the Punjab supports it as a means of solving both energy and water shortage problems. Pakistan's Federal Minister for Water and Power Raja Pervaiz Ashraf has stated that Pakistan is desperately in need of establishing new dams in order to overcome Pakistan's power crisis and overcome load shedding.⁵⁶ The Lahore Chamber of Commerce and Industry has estimated that the dam would produce enough energy to obviate the need to import 20 million barrels of oil a year.⁵⁷

Sindh, which is the lower riparian province, has been the most vocal opponent of the project for several reasons. Many in Sindh fear that the dam will irrigate land in the Punjab at the cost of irrigating land in Sindh. Sindh also fears that the dam will reduce Indus water flow to the Arabian Sea, which is essential in order to prevent salt water intrusion from destroying coastal mangrove stands and farm land. An estimated 85% of the Indus River Delta mangroves, which are important spawning grounds for fish and crustaceans, have been lost. Flow diversion, leading to increased salinity levels, as well as industrial pollution from Karachi and the local cutting of mangroves for fodder and fuel wood, is degrading the ecosystem.⁵⁸

If current water use plans proceed in the lower riparian area of the Indus, Sindh may be placed in extreme jeopardy. According to one expert, "If the Vision-2025 is implemented as planned, the lower basin will receive practically no water. If the situation is not reversed soon and the storage

⁵⁵ "Militancy and Conflict Across the FATA and NWFP," *New America Foundation*, April 19, 2010. <http://www.pakistanconflictmonitor.org>

⁵⁶ "Government Desperate to Construct New Dams," *The Nation*, May 7, 2010.

⁵⁷ "Kalabagh Dam May Help Save Rs33b a Year," *Euclid Infotech*, May 7, 2010.

⁵⁸ "Indus River Delta-Arabian Sea Mangroves," <http://www.worldwildlife.org>.

and diversion upstream continues, it is not farfetched to see an impending ecological disaster in the lower Indus basin that would eventually create a famine-like situation in Sindh.”⁵⁹ Salt water intrusion has been detected as far as 100 kilometers inland in Sindh. Reportedly hundreds of villages in the Badin and Thatta Districts have had to migrate to the interior of Pakistan as salt water intrusion has rendered their farmlands useless. Sea level rise associated with climate change is likely to exacerbate this already dire situation.⁶⁰

Cross-Border Dispute with India over Kashmir and Water Resources

Pakistan and India are historical enemies that have fought three wars and had numerous periods of heightened tension over their disputed line of control in Kashmir since their independence from British colonial rule in 1947. Pakistan and India most recently fought over the line of control in Kashmir near Kargil in 1999 after Pakistani forces crossed the de facto line of control in a failed attempt to occupy Indian-held territory.

The 1960 Indus Water treaty allotted the water from the Ravi, Sutlej, and Beas rivers to India and the water from the Jhelum, Chenab and Sindh rivers to Pakistan. India’s construction of a hydroelectric dam on the Chenab river, which flows from the Indian state of Jammu & Kashmir to Pakistan, has, according to Pakistani officials, reduced the water available for Pakistani agriculture.⁶¹ This is of concern and an item of contention for Pakistan.

The Indus Water Treaty has allowed water sharing between India and Pakistan for many years. Environmental changes brought on by climate change may either threaten this cooperation or may enhance it. There is concern by some in Pakistan that India will use its upstream dams to manipulate water flow to its advantage and to Pakistan’s disadvantage. It is thought that Himalayan glacier melt will increase flows of water in the nearer term and that this could lead to flooding in Pakistan if India does not use its upstream dams to mitigate this. It is also thought by some in Pakistan that after this period of thaw of Himalayan glaciers that there will be less water and that India may use its dams to hold back water from Pakistan.⁶²

Tensions over the water resources may place more emphasis on Pakistani support of insurgents that are trying to break Kashmir away from India, which could potentially escalate to war given the history of conflict between India and Pakistan. Conversely, they could also lead to enhanced cooperation. Pakistani President Asif Ali Zardari wrote in 2009 that “The water crisis in Pakistan is directly linked to relations with India. Resolution could prevent an environmental catastrophe in South Asia, but failure to do so could fuel the fires of discontent that lead to extremism and terrorism.”⁶³

⁵⁹ Altaf Memon, “Evaluation of Impacts on the Lower Indus River Basin Due to Upstream Water Storage and Diversion,” University of Maryland July 2004.

⁶⁰ Altaf Memon, “Evaluation of Impacts on the Lower Indus River Basin Due to Upstream Water Storage and Diversion,” University of Maryland July 2004.

⁶¹ “India and Pakistan: Troubled Water,” ISN Zurich, <http://www.isn.ethz.ch>.

⁶² Ali Khizar Aslam, “Politics of water Insecurity,” *Business Recorder*, April 21, 2010.

⁶³ Asif Ali Zardari, “Partnering with Pakistan,” *The Washington Post*, January 28, 2009.

Issues for Consideration

Pakistan is of great interest to the national security of the United States. U.S. interests are primarily focused on Pakistan's ability to control its territory to prevent it from being used as a haven for anti-American terrorists and prevent inter-state conflict with India that would be regionally destabilizing or worse, given their nuclear weapons.⁶⁴ As a result, a stable Pakistan that can extend its full writ throughout the land in order to prevent various regions of Pakistan from becoming ungoverned areas from which anti-Western terrorists can operate is of direct national security importance. To this end, U.S. assistance may increasingly take into consideration the potential negative impact that environmental stress, particularly water shortages and its impact on food security, may have as a threat multiplier.

There is a potential need to prevent these exacerbating environmental factors from becoming the tipping point leading to a more chaotic situation in Pakistan. In April 2010 Special Representative for Afghanistan and Pakistan Richard Holbrooke stated that the United States was indeed putting more emphasis on energy and water issues in its assistance programs with Pakistan.⁶⁵ (For an in-depth discussion of U.S. assistance to Pakistan see CRS Report RL33498, *Pakistan-U.S. Relations*, by K. Alan Kronstadt.) It has been argued by at least one source that because water shortages present the greatest future threat to the viability of Pakistan, U.S. development assistance would be best focused on the improvement of Pakistan's water infrastructure.⁶⁶

Author Contact Information

Bruce Vaughn
Specialist in Asian Affairs
bvaughn@crs.loc.gov, 7-3144

Nicole T. Carter
Specialist in Natural Resources Policy
ncarter@crs.loc.gov, 7-0854

Pervaze A. Sheikh
Specialist in Natural Resources Policy
psheikh@crs.loc.gov, 7-6070

Renée Johnson
Specialist in Agricultural Policy
rjohnson@crs.loc.gov, 7-9588

⁶⁴ For additional information see CRS Report RL34763, *Islamist Militancy in the Pakistan-Afghanistan Border Region and U.S. Policy*, by K. Alan Kronstadt and Kenneth Katzman.

⁶⁵ "Remarks by Richard Holbrooke, *Special Representative for Afghanistan and Pakistan*, *Federal News Service*, April 20, 2010.

⁶⁶ Anatol Lieven with John Hulsman, "Developmental Realism," *New America Foundation*, January 17, 2007.