

Climate Change and the Terminal Decay of the North Korean Regime

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Abstract

Literature on regime stability in North Korea has reached a consensus Kim Jong-il's regime will maintain power by "muddling through," making ad hoc adjustments as localised problems arise. Climate change is a new variable that will disrupt regime perpetuation. Climate hazards are likely to disrupt the North's agricultural sector and the country's food security, leading to erosion of the state's institutions. This paper is unique in combining analysis of climate change impacts with the literature on regime stability in North Korea, identifying specific threats to continued regime perpetuation. The regime is vulnerable to socio-economic hazards developing from the erosion of the country's food security by climate change. In the medium term, predicted climate change impacts on North Korea include decreasing crop yield from the agricultural sector, changing precipitation cycles, and increasing incidence of extreme weather events. North Korea has limited capacity to absorb and adapt to climate hazards. The state is already weakened from ten years of famine and economic isolation, and is inhibited by a rigid totalitarian political system, crumbling infrastructure and reliance on external aid. Over time, increasing food shortage will lead to greater reliance on external aid, increased corruption, internal displacement of people, refugee exodus into China, rejection of official ideology, erosion of coercive institutions and even withdrawal of elite support for the regime. Climate change hazards could thus push the North Korean regime into terminal decay and destabilise the wider strategic environment of Northeast Asia.

Introduction

This paper examines the vulnerability of North Korea's agricultural sector to climate change and assesses its likely impact on regime stability during the coming two decades. There is a need to expand the extensive literature on regime stability in North Korea to take account of climate change as an important new variable interacting with the existing weaknesses of the country's institutions and political economy. Sustained climate hazards will profoundly influence North Korea's agricultural system and food distribution mechanisms, with flow-on effects in the command economy, state ideology and the regime's totalitarian social controls. Should decay in these areas become terminal, the Kim Jong-il regime may fail.

The longevity of the regime has been a topic of conjecture since Kim Jong-il's rise to power in 1994. Kim Kyung-won and Nicholas Eberstadt, among others, believed that the primary driver of the regime's collapse would be its economic weakness. North Korea was in "a spiral of economic degradation"; the collapse of the Soviet Union, famine brought on by climatic disasters, systemic political inefficiency, Kim Jong-il's tenuous grip on power during the early years of his reign, and his apparent unwillingness to embrace economic reform, were cited as indications that regime

collapse was imminent.¹ In the North Korean case, collapse would be caused by the convergence of input limitations—such as food shortages, restricted income streams and energy bottlenecks—along with the rejection of official ideology and the inability of state institutions to carry out their assigned functions. Kim and Eberstadt's collapse predictions proved premature; the DPRK weathered the late-1990s famine period and Kim Jong-il remains in power.

State collapse results from a complex interplay of local and global economic, political, social and environmental factors culminating in the implosion of government structures. Security can no longer be provided for by state institutions as law and order dissolves into a Hobbesian state of anarchy.² The collapsist thesis of Eberstadt and Kim bears more resemblance to the theory of *state failure*, which is a functional failure of state institutions from which recovery is possible.³ In these cases the institutions of the state ceased to function and were replaced by new regimes, which reorganized the institutional structures. A failing regime will not necessarily endanger the integrity of the state, though collapse remains a possibility if the new leadership and its reconstituted governing institutions remain weak.⁴

In contrast to those espousing state failure or collapse, Marcus Noland wrote that Kim Jong-il's regime would "muddle through," making ad hoc adjustments to fix specific problems in relation to changing circumstances.⁵ These adjustments have included limited economic reforms in 2002, *de facto* marketisation through the growth of farmers' markets, and changes to agricultural practices. The regime has defied expectations of its demise to continue functioning in spite of adverse circumstances. In the absence of some kind of hard external pressure—such as crippling economic sanctions, foreign military intervention or a series of natural disasters—the muddle through thesis assumes that the Kim regime will retain power for some time to come.

Climate change is an exogenous variable that is likely to render that assumption redundant. The predicted impacts of climate change are now well understood in the scientific community. In its most recent report, the Intergovernmental Panel on

¹ K Kim, "No Way Out: North Korea's Impending Collapse," *Harvard International Review* 18, no. 2 (1996); N Eberstadt, "Hastening Korean Reunification," *Foreign Affairs* 76, no. 2 (1997), p. 81.

² See: R Bates et al., "Political Instability Task Force Report: Phase IV Findings," (Arlington: Political Instability Task Force, George Mason University, 2003), p. 9. Examples of *state collapse* include Somalia and the Democratic Republic of the Congo during the early 1990s. See also: J Milliken and K Krause, "State Failure, State Collapse, and State Reconstruction: Concepts, Lessons and Strategies," *Development and Change* 33, no. 5 (2002), p. 765; A Yannis, "State Collapse and Its Implications for Peace-Building and Reconstruction," *Development and Change* 33, no. 5 (2002), p. 822.

³ Bates et al., "Political Instability Task Force Report: Phase IV Findings.", p. 9. Examples of *state failure* include Cuba in 1959 and Iran in 1979.

⁴ C Moon and Y Kim, "The Future of the North Korean System," in *The North Korean System in the Post Cold War Era*, ed. S Kim (New York: Palgrave, 2001), p. 228.

⁵ See: M Noland, "Why North Korea Will Muddle Through," *Foreign Affairs* 76, no. 4 (1997), p. 105-18.

Climate Change (IPCC) identified climate hazards, including land degradation due to forest loss, changes in precipitation cycles, decreased crop yields due to changing local temperature regimes, and extreme weather events, which are likely to decrease food security for vulnerable populations.⁶ The timeframes over which such hazards will take effect are a point of debate, ranging from the present time to the end of this century. Other analysts suggest that climate change is occurring much faster, citing evidence that climate hazards are taking effect now and are intensifying because of positive feedback loops in the Earth's climate system.⁷

The interaction of climate change with the existing weaknesses of the DPRK state is a field of inquiry ripe for further study. The literature on regime stability in North Korea has yet to include analysis of climate change as a key variable. This paper aims to initiate inquiry to fill this void. The first section of the paper uses Hans-Martin Füssel's vulnerability assessment methodology to deduce North Korea's vulnerability to climate change hazards. The second section draws on the work of Mohan Munasinghe and Rob Stewart to assess the North's capacity to adapt to these climate impacts, while the third section outlines the dangers of climate hazards to North Korea's political economy.

The North Korean state is a system under stress, brought to the brink of state failure in the late-1990s because of extreme weather events in drought and flooding. Despite a limited recovery, the North's agriculture and food distribution mechanisms remain stretched. Climate change hazards are likely to further exacerbate North Korea's food security problems by increasing the incidence and intensity of the very weather events that triggered the famine period during the 1990s.

North Korea's Vulnerability to Climate Change Impacts

The task of conducting a climate vulnerability assessment for North Korea's agricultural sector is hampered by the deep opacity of the North Korean state. Obtaining data on its social systems is extremely difficult. The task is often a deductive one; it is necessary to gather information from a variety of secondary sources to correlate with information compiled by international agencies working within North Korea and observational evidence gathered by foreign visitors. This obstacle adds an element of imprecision to the task of assessing North Korea's climate vulnerability.

⁶ The IPCC encompasses the work of thousands of scientists from around the world in many disciplines to compile its reports. See: "Working Group III Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report: Summary for Policymakers" (paper presented at the 9th Session of Working Group III of the IPCC, Bangkok, Thailand, 30 April – 4 May 2007), p. 2-5.

⁷ R Garnaut, "Garnaut Climate Change Review: Interim Report to the Commonwealth, State and Territory Governments of Australia," (Melbourne: Garnaut Climate Change Review, 2008), p. 21-2; D Spratt and P Sutton, "Climate 'Code Red': The Case for a Sustainability Emergency," (Melbourne: Friends of the Earth, 2008), p. 1; J Hansen, "Scientific Reticence and Sea Level Rise," *Environmental Research Letters* 2, no. 024002 (2007), pp. 1-6.

On the other hand, the great famine of the 1990s provides an insight into the likely consequences of climate change hazards. The famine was triggered by flooding and drought over a three year period—extreme weather events now identifiable as climate change hazards—crippling a state already vulnerable after losing its superpower benefactor. The root of the crisis lay in the North's agricultural system, which was overly reliant on inputs and technologies sourced from other socialist bloc countries.⁸ Agricultural output began to decline from 1987 as subsidised imports dropped away. Initially the regime was able to cope with the loss by bartering rice in exchange for cheaper grain imported from the Soviet Union, while also drawing heavily on the national food stockpile and by advising the public to consume only 'two meals a day' in a concerted propaganda campaign.⁹ Then, in 1990, the Soviet Union rejected the barter system and requested that North Korea pay for goods in hard currency at international market prices. The North lacked the foreign exchange needed to purchase imports at market prices because of its minimal export income. As a result, the total trade volume between North Korea and the Soviet Union declined steeply from US\$3.2 billion in 1990 to US\$360 million in 1991.¹⁰

The regime teetered on the brink during the late-1990s as a confluence of natural disasters, withdrawal of support from the Soviet Union and crippling energy shortages led the state to the edge of failure. The natural disasters of 1995-97 over-extended this already stretched system beyond the limits of its ability to cope. These events provide a preview of the impact that climate change hazards are likely to have on the North Korean state. The DPRK agricultural system was already stressed when the series of natural disasters pushed the country into famine. Today, the agricultural system remains under pressure, beset by the same root causes that contributed to the famine. A climate vulnerability assessment can thus be carried out with some confidence, based on evidence from the recent past.

Regardless of the difficulties, the effort is an important one because none of the neighbouring states in Northeast Asia wish to see further social breakdown and regime failure in North Korea. The Chinese government would like to avoid the large social and economic costs of absorbing a significant refugee influx from a collapsed North Korea. Strategically, the Chinese prefer an evolutionary reunification scenario that leads to the incorporation of a united Korea into the Chinese orbit as a vassal

⁸ "Starved of Rights: Human Rights and the Food Crisis in the Democratic People's Republic of Korea (North Korea)," (London: Amnesty International, 2004), p. 6-7. These imported inputs included machinery, petroleum, fertilizers and spare parts needed for irrigation, for agricultural chemical plants and for power supply. See also: H Smith and Y Huang, "Achieving Food Security in North Korea," in *Promoting International Scientific, Technological and Economic Cooperation in the Korean Peninsula: Enhancing Stability and International Dialogue* (Rome, Italy: Istituto Diplomatico Mario Toscano and the Italian Ministry of Foreign Affairs, 2000), p. 201-2.

⁹ "Starved of Rights: Human Rights and the Food Crisis in the Democratic People's Republic of Korea (North Korea)", p. 9; Smith and Huang, "Achieving Food Security in North Korea", p. 202.

¹⁰ Smith and Huang, "Achieving Food Security in North Korea", p. 205.

state.¹¹ The South Korean government is concerned about the exorbitant cost of incorporating the North into a unified Korean state. Estimates range from US\$250 million to US\$3.5 trillion.¹²

As a rule, vulnerability is a measure of a system's exposure to hazard, in relation to the underlying social processes of that system and its capacity to cope with hazard.¹³ This paper uses a methodology devised by Hans-Martin Füssel to assess the vulnerability of North Korea's agricultural system to climate change hazards.¹⁴ It consists of five elements from which a fully qualified vulnerability evaluation can be developed: (1) temporal reference, (2) the vulnerable system, (3) the sphere, which encapsulates the internal properties and external influences on the vulnerable system, (4) the attribute of concern, which is the component of the vulnerable system that is exposed to hazard, and (5) the hazard that will affect the vulnerable system.¹⁵

Temporal Reference

The *temporal reference* is the timescale over which vulnerability is measured. Defining a timescale is important because the magnitude and nature of the hazard may change over time, as will the characteristics of the vulnerable system.¹⁶ This study uses a temporal reference of twenty years. A longer period of interest would be impractical, as no political system remains static. Because the regime is muddling through on the back of a weak economy, rigid institutions and a faltering agricultural sector, it would be unwise to project too far into the future. Due to Kim Jong-il's advancing age, a leadership transition will also occur during this period, the predicted outcome of which remains unclear.

¹¹ D Shambaugh, "China and the Korean Peninsula: Playing for the Long Term," in *Reshaping Rogue States: Preemption, Regime Change, & Us Policy toward Iran, Iraq, & North Korea*, ed. A Lennon and C Eiss (Cambridge, Massachusetts: MIT Press, 2004), p. 182.

¹² S Kim, "The Mirage of a United Korea," *Far Eastern Economic Review* 169, no. 9 (2006), p. 12; A Scobell and M Chambers, "The Fallout of a Nuclear North Korea," *Current History* 104, no. 683 (2005), p. 292; T Carpenter and D Bandow, *The Korean Conundrum: America's Troubled Relations with North and South Korea* (New York: Palgrave Macmillan, 2004), p. 35.

¹³ D Smith and J Vivekanandar, "A Climate of Conflict: The Links between Climate Change, Peace and War," (London: International Alert, 2007), p. 10; WJ Han, SE Ahn, and EA Lee, "Climate Change Impact Assessment and Development of Adaptation Strategies in Korea," (Seoul: Korea Environment Institute, 2005), p. 175; "Dpr Korea: Common Country Assessment 2002," (New York: United Nations, 2003), p. 13.

¹⁴ See: H Füssel, "Vulnerability: A Generally Applicable Conceptual Framework for Climate Change Research," *Global Environmental Change* 17 (2007).

¹⁵ *Ibid*, p. 158. Füssel's methodology contains a sixth element—knowledge domain—which refers to the body of knowledge from which the vulnerability statement derives its assessment. In this case study on North Korea will integrate data on biophysical processes with sources describing socio-economic conditions within the country.

¹⁶ Füssel, "Vulnerability: A Generally Applicable Conceptual Framework for Climate Change Research", p. 157; F Tol *et al.*, "Distributional Aspects of Climate Change Impacts," *Global Environmental Change* 14 (2004), p. 266-7.

Vulnerable System

The *vulnerable system*—the system of analysis, the core unit that is the focus of the vulnerability assessment—is North Korea's ruling regime, headed by Kim Jong-il.¹⁷ The regime can be divided conceptually into three primary interlinked components: the physical base, the idea of the state, and its institutions. A state's physical base includes the population and resources within its defined territory, including the agricultural sector.¹⁸ The idea of the state is the distinctive idea—the legitimising paradigm—that lies at the heart of the regime's political identity.¹⁹ In North Korea, *Juche* and the Kim Il-sung personality cult (Kimism) are the legitimising paradigms. The institutions of the state comprise the machinery of government, including the executive, legislative, administrative and judicial bodies.²⁰ The institutions maintain dominion over its population and territory, a control materially subsidised by the physical base and legitimised by an overarching ideational framework. North Korea is a unique case in which the ruling regime has become synonymous with the state itself through the close-knit integration of its constituent dimensions under the personalised leadership of Kim Jong-il.²¹ States within which all three components are well developed and inter-connected are usually stronger than states—such as North Korea—in which the three primary components are weak.²²

Stress in one interlinked dimension can weaken the others as well. During the North Korean famine, weakness in the physical base—such as food and energy shortages—placed enormous stress on the state's institutions and ideational base. A runaway positive feedback loop was not created because of the timely supply of international aid, in come derived from parallel illicit and military economies, and the continued strength of the military and coercive institutions. The famine period demonstrates that the decay of one attribute of a vulnerable system can bring that system to the brink of collapse. In the North Korean case, each of its interlinked dimensions needs to be in mutually reinforcing terminal decay for regime collapse to occur.²³

¹⁷ Füssel, "Vulnerability: A Generally Applicable Conceptual Framework for Climate Change Research", p. 157.

¹⁸ B Buzan, *People, States and Fear: An Agenda for International Security Studies in the Post-Cold War Era*, 2nd ed. (Boulder: Lynne Rienner Publishers, 1991), p. 90.

¹⁹ *Ibid.*, p. 70.

²⁰ *Ibid.*, p. 82-3.

²¹ C Armstrong, "The Nature, Origins, and Development of the North Korean State," in *The North Korean System in the Post Cold War Era*, ed. S Kim (New York: Palgrave, 2001), p. 57.

²² K Holsti, *The State, War, and the State of War* (Cambridge: Cambridge University Press, 1996), p. 84.

²³ For a detailed discussion by the author of key leverage points for change within the three components of the DPRK state, see: B Habib, "Another Perfect Storm? Predictors of Radical Change in North Korea," *Security Challenges* 4, no. 1 (2008), pp. 21-42.

Sphere

Füssel has labelled the internal factors and external influences on the vulnerable system as the *sphere*. The internal factors refer to endogenous properties of the system itself. In the North Korean case, these include the totalitarian political system, centralised decision-making, the large bureaucracy, heavy information controls and public indoctrination. Key external influences on North Korea are its reliance on external inputs of energy, food and other aid from foreign sources; isolation from the global economy; and the continued environment of confrontation on the Korean peninsula.

Internal Influences: Stability and Social Control

North Korea has the characteristics of a typical totalitarian state. It is ruled by an absolute dictator in Kim Jong-il, with the backing of the Korean Workers' Party (KWP). Kim Jong-Il presides over a vast web of bureaucratic institutions that make up the North Korean state. As trusted deputies, the leadership core gets to share in the spoils of totalitarian rule and thus has a vested interest in regime perpetuation.²⁴

Kim Jong-Il has consolidated his power over the KWP by assuming leadership of the Central Committee and thus the Politburo and the Secretariat, the three key organisations within the party. Han S. Park describes Kim Jong-il's ascendancy over the Party, which in turn penetrates the entire public sphere, as a "natural organismic" authority structure. Kim Jong-il is the organism's brain, whilst the Party is its body, the functional arm conveying Kim's will to the public.²⁵ As mere "body parts," local nodes of the bureaucracy are dependent on directives from the "brain" and are incapable of autonomous action. This is problematic when local crises occur, such as the flooding events of August 2007.²⁶

The leader and the party maintain power through a personality cult based on the revolutionary leader Kim Il-sung (Kimism), and the utopian transformational ideology of *Juche*. Kimism is based heavily on Kim Il-sung's exploits as an anti-Japanese guerrilla leader during the Japanese occupation.²⁷ It superimposes the ideological core of communism with Confucian ideas of political centralisation and obedience to authority.²⁸ The core goals of *Juche* are the maintenance of a thriving self-reliant national economy operating in a secure environment, guarded by indigenous defence forces.²⁹ To these ends, *Juche* has legitimised the continued operation of the North's

²⁴ C Friedrich and Z Brzezinski, *Totalitarian Dictatorship & Autocracy*, 2nd ed. (New York: Frederick A. Praeger Publishers, 1966), p. 35-7. This is a key feature of totalitarian regimes as defined by Friedrich & Brzezinski.

²⁵ H Park, *North Korea: The Politics of Unconventional Wisdom* (Boulder: Lynne Rienner, 2002), p. 88.

²⁶ "DPRK Hit by Unceasing Torrential Rain," Korean Central News Agency, <http://www.kcna.co.jp/item/2007/200708/news08/14.htm#11>

²⁷ "Unique Theory on People's Guerrilla War in World History of War," Korean Central News Agency, <http://www.kcna.co.jp/item/2006/200612/news12/18.htm#15>. Official propaganda regularly features heroic stories of the feats of Kim's partisans in Manchuria, as this excerpt from a KCNA news article (16 December 2006) shows: "The theory on the people's guerrilla warfare reflected the unswerving will of the President to defeat the Japanese imperialists with the united strength of the Korean people and achieve the liberation of the country at any cost."

²⁸ A Buzo, *The Guerrilla Dynasty: Politics and Leadership in North Korea* (Sydney: Allen & Unwin, 1999), p. 48.

²⁹ H Park, *North Korea: The Politics of Unconventional Wisdom*, p. 20-7.

centrally planned economy, isolated from the global marketplace, around which a garrison state has developed. This image contrasts starkly with North Korea's present reality: a floundering economy propped up by aid from foreign donors.

Centralised power is exercised through the Korean Workers' Party (KWP). The party penetrates the various social subgroups via guidance committees, which occur at all levels of society and always feature a local cadre as a key member.³⁰ The Party representative, referred to as the secretary, is responsible for transmitting policy directives from the Party, evaluating the job performance of bureaucrats, and reporting back to the Party.³¹ The committees function as an arm of bureaucratic action and as a mechanism of surveillance to ensure that there is virtually no organised collective unit or activity that is beyond party oversight.

The regime maintains a monopoly of communications technologies to ensure that the people receive little information about the outside world other than party propaganda. Lack of exposure to new ideas has prevented citizens from forming a basis for comparison with their own society.³² Along with strict restrictions on collective activities, information controls have stifled the development of visible opposition movements, despite extreme hardship.³³ People may have doubts about the system, but have no outlet to discuss their thoughts with others. Information sharing is thus stifled, reducing the capacity of individuals, communities and ultimately the state to react appropriately to crisis situations.

Active social controls are maintained by the internal security services, who report directly to Kim Jong-Il. Internal security comes under the rubric of the Ministry of People's Security, which is responsible for internal surveillance, social control, basic police duties, and border control.³⁴ Should an individual be arrested for political crimes against the state, their entire family may be incarcerated in "re-education" camps to weed out ideological impurity and to deter others from engaging in anti-regime behaviour.³⁵

³⁰ "Country Study - North Korea," US Library of Congress, <http://lcweb2.loc.gov/frd/cs/kptoc.html>

³¹ H Park, *North Korea: The Politics of Unconventional Wisdom*, p. 88-90.

³² L Festinger, *A Theory of Cognitive Dissonance* (Stanford: Tavistock Publications, 1962), p. 2. Cognitive dissonance occurs where a person encounters new information about a given topic that cannot be rationalised away by currently held belief and ideas, causing psychological discomfort. This discomfort leads the person to seek or develop new paradigms for interpreting that topic.

³³ K Oh and R Hassig, *North Korea: Through the Looking Glass* (Washington DC: Brookings Institution Press, 2000), p. 37; S Snyder, "North Korea's Challenge of Regime Survival: Internal Problems and Implications for the Future," *Pacific Review* 73, no. 4 (2000), p. 527-8; C Kang and P Rigoulot, *The Aquariums of Pyongyang: Ten Years in a North Korean Gulag* (New York: Basic Books, 2001), p. 141.

³⁴ "North Korea: Human Rights Concerns," Amnesty International, <http://news.amnesty.org/index/ENGASA240022006>; "World Report 2007," (New York: Human Rights Watch, 2007), p. 297; "Country Profile: North Korea," (Washington DC: US Library of Congress, 2007), p. 19-20.

³⁵ A Lankov, "Koreia: Vchera I Segodnia (the Repressive System and Political Control in North Korea)," *Vostochnaia literature*, http://www.fortunecity.com/meltingpot/champion/65/control_lankov.htm. For an eyewitness account of North Korea's gulag system and collective punishment, see:

The effect of socialisation pressures, informational controls and outright coercion have sapped the intellectual vitality of the party and of the wider society as a whole, discouraging the propagation of new ideas and the development of more efficient practices in industry and agriculture. This passivity is a direct obstacle to innovation and the country's capacity to adapt to climate change hazards.

External Influences

External influences are exogenous factors affecting the vulnerable system. With regard to North Korea, this includes the country's heavy reliance on external energy supplies and foreign aid. North Korea's dependency on external inputs has existed for decades, because the population has exceeded the limited carrying capacity of the land. The DPRK had become dependent on Soviet food and energy subsidies and for some time prior to 1991, it was unable to fully feed its population due to declining returns on agricultural production caused by cessation of key agricultural inputs, grinding inefficiencies and technological decrepitude throughout the economy.³⁶ The situation has become acute since the cessation of subsidies provided by the Soviet Union. Despite efforts to increase crop yields, shortfall in agricultural output remains a problem today.

Massive injections of foreign aid during the late-1990s were significant in heading off the total failure of state institutions and preventing the North's collapse. Kim Kyung-Won has argued that cash payments made by the Hyundai group to the regime during 1999-2000 amounted to approximately twenty percent of its total foreign exchange earnings, a timely injection of funds as the regime struggled to overcome the famine period.³⁷ The World Food Program has budgeted for 149,998 metric tons of food aid, at a cost of US\$70.96 million.³⁸ South Korea sent over US\$3.2 billion in aid and cash payments to the DPRK between 1995 and 2004, with the United States contributing US\$1.1 billion over the same period. China is likely to continue its annual cereal concession of 250,000 metric tons.³⁹ Yet despite these efforts, almost 6.5 million North Koreans are still reliant on food aid to survive.⁴⁰

Kang and Rigoulot, *The Aquariums of Pyongyang: Ten Years in a North Korean Gulag*.

³⁶ Smith and Huang, "Achieving Food Security in North Korea", p. 201-5; A Lankov, "North Korea Hungry for Control," Asia Times Online, <http://www.atimes.com/atimes/Korea/GI10Dg01.html>.

³⁷ K Kim, "Downfall Delayed: Endgames for the North Korean Regime," *Harvard International Review* (2005), p. 58; P Rigoulot, "Crimes, Terror, and Secrecy in North Korea," in *The Black Book of Communism: Crimes, Terror, Repression*, ed. S Courtois, et al. (London: Harvard University Press, 1999), p. 563.

³⁸ "Protracted Relief and Recovery Operation—Democratic People's Republic of Korea," (Rome: World Food Program, 2006), p. 16.

³⁹ J Pollack, "The Strategic Futures and Military Capabilities of the Two Koreas," in *Strategic Asia 2005-06: Military Modernization in an Era of Uncertainty*, Ed. A Tellis and M Wills (Seattle & Washington DC: National Bureau of Asian Research, 2005), p. 147-8. See also "Protracted Relief and Recovery Operation—DPRK", p. 7.

⁴⁰ "North Korea: Can the Iron Fist Accept the Invisible Hand?" (Brussels: International Crisis Group, 2005), p. 4.

Surviving the Famine: Coping Mechanisms Become Permanent

That the famine did not bring down the regime is a product of coping mechanisms developed outside of regime control. Restrictions on freedom of movement were circumvented as people foraged for food in surrounding regions. Private home garden plots became a key source of food. Underground farmers markets sprung up around the country, where people could sell food they had grown in private plots or expropriated from collective farms and aid shipments. Small farmers' markets were initially established in the mid-1950s as an outlet for the sale of surplus produce from the collectivised farms. In the early-1980s they became more common and since 1991 have mushroomed into busy bazaars where all manner of goods, legal and illegal, can be bought, sold and bartered.⁴¹

Parallel economies developed that operate outside the official central planning mechanism, which generated income for the regime and ensured the continuation of important services. The military economy is by far the most important parallel economy, encompassing all economic activities related to the production, distribution and consumption of materials within the military sphere.⁴² Contributions from state-sanctioned criminal enterprises represent another income source. The regime has been implicated in a number of illicit activities, including the production and distribution of narcotics, counterfeiting, smuggling, and money laundering.⁴³

The regime's dilemma now is that, despite a number of ad hoc adjustments, the country's continued functioning relies on these same coping measures that prevented collapse during the famine period. Coping measures are something to fall back on in times of immediate crisis. When they become permanent, there is no further slack in the system to buffer against exposure to new hazards. Without any slack in the system, North Korea's ability to cope with another series of hazardous events is extremely limited.

⁴¹ A Scobell, "Kim Jong Il and North Korea: The Leader and the System," (Strategic Studies Institute, 2006), p. 35; Snyder, "North Korea's Challenge of Regime Survival."; Oh and Hassig, *North Korea: Through the Looking Glass*, p. 67.

⁴² D Pinkston, "Domestic Politics and Stakeholders in the North Korean Missile Development Program," *The Nonproliferation Review* 10, no. 2 (2003), p. 9. Daniel Pinkston has estimated that the military economy may account for up to seventy percent of North Korea's domestic economic output, far outstripping the contribution of the civilian economy. See also: C Moon and H Takesada, "North Korea: Institutionalized Military Intervention," in *Coercion and Governance*, ed. M Alagappa (Stanford: Stanford University Press, 2001), p. 377.

⁴³ See: D Asher, "The North Korean Criminal State, Its Ties to Organized Crime, and the Possibility of WMD Proliferation," The Nautilus Institute for Security and Sustainable Development, <http://nautilus.org/fora/security/0592Asher.html>. Economic weakness has left the regime dependent on other sources of income. David Asher suggests that illicit exports may account for 35-40 percent of the North's total exports, contributing to an even larger slice of total earnings. Profit margins on illegal activities are far beyond those earned by conventional trade, often as high as five hundred percent, which is one of the reasons why criminal activity is so lucrative and has become an important prop for the regime.

Attribute of Concern

In a vulnerability analysis, the attribute of concern is the component of the vulnerable system that is threatened by exposure to hazard.⁴⁴ In assessing the regime's vulnerability to climate change impacts, the attribute of concern is the country's agricultural sector, the crucial node in the North's political economy. Food production in North Korea is hampered significantly by geography and climate, with only a few regions suitable for large-scale agriculture due to mountainous topography and harsh winters.⁴⁵ The large temperature variation between winter and summer limits the length of the growing season.⁴⁶ For these reasons periodic famine has been a feature of life on the Korean peninsula for many centuries.

Kim Il-Sung attempted to address this problem through the *Chollima* movement in 1954, a "grand plan to remake nature" featuring an enormous land reclamation campaign to increase the North's stock of arable land and bring the country into agricultural self-sufficiency.⁴⁷ Mountain sides were terraced, land was reclaimed from the sea, and over forty thousand kilometres of irrigation canals were cut to augment the stock of available land. Unfortunately, terraces were cut into mountains too steep to support them, contributing to soil erosion that denuded the hills and severely reduced their water catchment capacity, leading to increased intensity of flooding events in the land below. Land reclaimed from the sea suffered from high salinity and would not support food crops, despite the massive use of chemical fertilisers.⁴⁸

A major limit on cultivation in North Korea is its generally poor soil fertility. Soil analyses conducted by the Food and Agriculture Organisation (FAO) have discovered that soil pH in cultivated regions of the North are highly acidic. Acidic soils tend to

⁴⁴ Füssel, "Vulnerability: A Generally Applicable Conceptual Framework for Climate Change Research", p. 157.

⁴⁵ Gunjal et al., "Fao/Wfp Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 6. In 2004 the total area of cultivated land in North Korea was estimated at 17-18 percent of the total land area. See also: D Pinkston and P Saunders, "Seeing North Korea Clearly," *Survival* 45, no. 3 (2003), p. 84-5; K Walters and K Traxler, "North Korea—a Climatological Study," (USAF Environmental Technical Applications Center, 1994), p. 1.2.

⁴⁶ K Gunjal et al., "Fao/Wfp Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea," (Rome: Food and Agriculture Organization of the United Nations, 2004), p. 5. Average temperatures range from -19°C during winter to 25°C in summer.

⁴⁷ B Martin, *Under the Loving Care of the Fatherly Leader: North Korea and Kim Dynasty* (New York: St. Martin's Press, 2004), p. 161; B Martin, "Pyongyang Watch: All the Winged Horses . . ." Asia Times Online, <http://www.atimes.com/koreas/BA08Dg01.html>.

⁴⁸ "Protracted Relief and Recovery Operation—DPRK", p. 5; Gunjal et al., "Fao/Wfp Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 8; A Natsios, *The Great North Korean Famine* (Washington DC: United States Institute of Peace Press, 2001), p. 12; Noland, "Why North Korea Will Muddle Through", p. 108-9.

inhibit nutrient uptake in plants and thus produce lower crop yields.⁴⁹ The traditional solution has been to use large amounts of fertilisers. After 1991, the DPRK's large indigenous fertiliser industry was decimated imports of fossil fuel feed stocks for fertiliser production ceased. Plummeting fertiliser use since 1991 has resulted in much lower crop yields. By growing crops with no or significantly less fertiliser inputs, North Korea's farms have effectively been mining nutrients from the soil, continually decreasing the possible yield that those soils can produce.⁵⁰

During the 1960s Kim Il-Sung announced a new framework for the agricultural development of North Korea based on four principles: mechanisation, chemicalisation, irrigation, and electrification. Coupled with his land reforms, Kim desired to use mechanised farming to turn the country's farms into collectives more akin to factories, staffed by a salaried proletariat with no property ties to the land and thus no bourgeois sympathies.⁵¹ Over time the industrial scale mechanisation and use of chemicals in agriculture have yielded declining returns as soils became exhausted and agricultural machinery fell into decrepitude. Declining energy supplies resulted in power cuts that prevented the pumping of water for irrigation and curtailed the production of fertilisers, pesticides and herbicides, all of which are derived from fossil fuels.⁵²

North Korea's state-run collective farms currently run a rotation of winter, spring and summer crops. Wheat is the main cereal crop cultivated during the winter, along with a small proportion of winter barley, which are sown from late-September to mid-October. These were the two cereals introduced in a double cropping program instituted in 1996 as a partnership between the North Korean government and the FAO.⁵³ Barley is the primary spring cereal crop, with some spring wheat, which is sown in March and harvested in June along with the winter wheat crop. A double-

⁴⁹ Gunjal et al., "Fao/Wfp Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea.", p. 10. The pH of soils in North Korea range between pH 4.5-5.5. High soil acidity influences soil properties such as movement of air and water through the soil, plant nutrient uptake, microbial activity, and breakdown of soil contaminants. At a pH of less than 5.0, many of the thirteen nutrients essential to healthy plant growth become unavailable. See also: N Ramankutty et al., "The Global Distribution of Cultivable Lands: Current Patterns and Sensitivity to Possible Climate Change," *Global Ecology & Biogeography* 11 (2002), p. 378, 382.

⁵⁰ "Fertilizer Use by Crop in the Democratic People's Republic of Korea," (Rome: Food and Agriculture Organisation of the United Nations, 2003), p. 2, 5-7.

⁵¹ Natsios, *The Great North Korean Famine*, p. 13-4. The micro-management of agriculture became institutionalised in February 1964 as the *Chongsan-ri* method of agriculture, so named after a small collective west of Pyongyang where Kim spent two weeks making ideological corrections to the farmers' cultivation methods.

⁵² Natsios, *The Great North Korean Famine*, p. 14; "Can the Iron Fist Accept the Invisible Hand?" p. 3.

⁵³ "Second Thematic Roundtable on Agricultural Recovery & Environmental Protection – DPRK," (New York: United Nations Development Program, 2000), p. 7.

crop of potato is also grown in the spring and again in the summer.⁵⁴ The primary summer cereal crops under cultivation are rice and maize.⁵⁵ Rice cultivation occurs primarily in the southern portion of the country—North Korea's "cereal bowl"—in North and South Pyongan, Pyongyang, Kangwon and South Hwanghae provinces. Maize cultivation has decreased in recent years in favour of less moisture-demanding cereal crops. Other crops produced during the summer include sorghum, millet, soybean, buckwheat, vegetables such as cabbage, spinach, radish, cucumber, eggplant, tomato, and fruits such as pears, peaches, apricots and apples.⁵⁶

The double cropping program has to contend with significant obstacles. It puts considerable strain on farm labourers and mechanised farming hardware, due to the short time interval between the winter crop harvest and planting of the summer crop. Due to energy shortages, farm machinery can be used only sparingly, while electric-powered irrigation systems operate sporadically at the mercy of the intermittent power supply. Much of heavy farm labour must be done by humans and draught animals.⁵⁷ This limits the rate at which harvested land can be turned over for fresh cultivation.⁵⁸ Heavy and continuous crop rotation also increases the risk of crop losses from pests and diseases.⁵⁹ Because of these factors it is likely that double cropping in North Korea has reached its maximum extent.

Household gardens have become an important component of the North Korean food system. Small private gardens proved to be the difference between sustenance and starvation for many North Koreans through the famine period. Each household on the collective farms, of which there are about 1.67 million, is allowed a private garden of approximately 100 square metres. Urban households are also entitled to garden plots, though these are much smaller. Private gardens typically produce an early crop of potatoes and maize, followed by vegetables such as cabbage, radish, peppers and

⁵⁴ "Fertilizer Use by Crop in the Democratic People's Republic of Korea," p. 13.

Potato was introduced in the late-1990s in an attempt to boost carbohydrate production in all major agricultural areas.

⁵⁵ "Fertilizer Use by Crop in the Democratic People's Republic of Korea," p. 13. The average annual yields for all cereal crops cultivated in North Korea during the period 2002-04 fell well below expected yield potentials for those crops under normal weather conditions. Expected potential yield for winter wheat is 3 tons per hectare, 3 tons/hectare for spring barley and 6.5 tons/hectare for rice. North Korea achieved yields of 1.02-1.85 tons/hectare for winter wheat, 0.59-1.63 tons/hectare for spring barley, and 3.2 tons/hectare for rice respectively over the 2002-04 period.

⁵⁶ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 6-8, 13-19.

⁵⁷ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 11. In 2003, North Korea had an inventory of 64,062 tractors, of which 36,836 (57.5%) were operational.

⁵⁸ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 4; "Fertilizer Use by Crop in the Democratic People's Republic of Korea", p. 4; "Second Thematic Roundtable on Agricultural Recovery & Environmental Protection – DPRK", p. 7.

⁵⁹ "Fertilizer Use by Crop in the Democratic People's Republic of Korea", p. 23-24. These include threats to wheat and barley fields from armyworm infestation and the endangering of the potato crop to blight.

garlic. As private plots are usually well cared for, crop yields have tended to be higher than on the collective farms.⁶⁰

Hazard: Climate Change Impacts on Agriculture

A hazard is a process or event that may adversely affect the valued attribute of the system under analysis. Climate change creates a series of inter-linked hazards that have the potential to create loss in the attribute of value.⁶¹ Analysis of hazard requires definition of the range of potentially damaging events, along with an estimation of the human social and economic tolerance of these events within the system of study.⁶² Specific climate hazards identified for North Korea's agricultural system include changes to local precipitation and water cycles, increased incidence of extreme weather events, climate change-related land degradation, and decreased crop yields due to rising average temperature.⁶³

Rising Average Temperatures

Rising average temperatures are predicted to depress crop yields. The key imperative is whether crops grown in a given area can tolerate a changing temperature regime for that location. Grain crops are particularly susceptible to climate variations. A 3-4^o Celsius rise in temperature above 1990 levels is predicted to reduce maize and rice production in East Asia by 10-20 percent by 2100.⁶⁴ The direct impact on the temperature tolerance of crops is compounded by changes to precipitation patterns, length of the growing season, the intensity and timing of extreme weather events, and increased exposure to plant pests, weeds and diseases.⁶⁵ Whilst laboratory experiments have demonstrated a small increase in crop yield due to carbon dioxide fertilisation, field tests have shown significantly smaller yield gains, which are cancelled out by the negative elements of increased temperature.⁶⁶

⁶⁰ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea.", p. 8. Urban household plots range in size from 59-73 square metres.

⁶¹ Füssel, "Vulnerability: A Generally Applicable Conceptual Framework for Climate Change Research", p. 157-8; K Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster*, 2nd ed. (London: Routledge, 1996), p. 5; P Blaikie et al., *At Risk: Natural Hazards, People's Vulnerability, and Disasters* (London: Routledge, 1994), p. 21.

⁶² Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster*, p. 12.

⁶³ This list is somewhat arbitrary, with hazards chosen on the basis of predictions of their direct specific impact on agriculture.

⁶⁴ R Warren et al., "Understanding the Regional Impacts of Climate Change," (Norwich: Tyndall Centre for Climate Change Research, 2006), p. 30; "DPR Korea: Common Country Assessment 2002", p. 9.

⁶⁵ ML Parry et al., eds., *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Intergovernmental Panel on Climate Change, 2007), p. 483.

⁶⁶ Warren et al., "Understanding the Regional Impacts of Climate Change", p. 36.

Extreme Weather Events

Wildly fluctuating weather and extreme weather events are a key climate hazard, becoming more frequent globally. They are a high risk hazard because of their immediacy and the enormous damage they can cause in a short timeframe. Agricultural systems are particularly at risk to extreme weather events during certain stages of the crop cycle. For example, wheat is vulnerable to high temperature and drought just before flowering, while maize crop yields can be affected by excessive exposure to moisture from heavy rains and flooding.⁶⁷ North Korea is susceptible to torrential rain and flooding, typhoons, drought, and acute cold weather.⁶⁸ Since 1991, large-scale flooding events have occurred in 1995, 1996, 2001-02, and 2004-07, punctuated by drought years in 1997 and 2000.⁶⁹ The IPCC has predicted that higher sea surface temperatures caused by climate change will increase the incidence of typhoons, leading to heavy precipitation events and storm surges affecting coastal areas.⁷⁰ In the longer term, sea level rise will also threaten coastal areas in North Korea, which will jeopardise the agricultural viability of land reclaimed from the sea.⁷¹

Changing Precipitation Patterns

North Korea's precipitation regime is dictated by the East Asian monsoon. Approximately 85 percent of the North's rainfall occurs during the spring and summer months, concentrated primarily between June and September. Typhoons also occur during this period at an average of one typhoon per year.⁷² However, in recent years, variability in rainfall patterns has been recorded across East Asia. Annual precipitation on the Korean peninsula has increased, but the characteristics of summer

⁶⁷ Warren et al., "Understanding the Regional Impacts of Climate Change", p. 35-6; "The Regional Impacts of Climate Change: An Assessment of Vulnerability," (Geneva: Intergovernmental Panel on Climate Change, 1997), p. 4.

⁶⁸ Gunjal et al., "FAO/WRP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 3-4.

⁶⁹ A Mansourov, "Disaster Management and Institutional Change in the DPRK: Trends in the Songun Era," (Washington DC: Korea Economic Institute, 2007), p. 4-8; "Country Profile: North Korea", p. 9.

⁷⁰ Parry et al, eds., *Climate Change 2007: Impacts, Adaptation and Vulnerability*, p. 476-9.

⁷¹ Parry et al, eds., *Climate Change 2007: Impacts, Adaptation and Vulnerability*, p. 484. For a one metre sea-level rise with high tide and storm surge, the maximum inundation area is estimated to be 2,643 square kilometers, which is approximately 1.2 percent of total area of the Korean Peninsula. For images detailing the geographic location of low lying areas on the Korean peninsula susceptible to sea level rise, see: CRISIS, "Sea Level Rise Maps and Gis Data > East Asia," in *Centre for Remote Sensing of Ice Sheets* (2008).

⁷² Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea.", p. 5. Average annual rainfall varies from 600-980 millimetres in the north to 880-1300 in the centre and south of the country, where key agricultural areas are located. See also: "DPR Korea: State of the Environment 2003," (Pathumthani: United Nations Environment Programme, 2003), p. 11-13; Walters and Traxler, "North Korea—a Climatological Study", p. 4.1, 4.4, 5.1, & 6.1

monsoon rains have changed. The usual 4-6 weeks of steady and prolonged monsoonal rains have given way to sporadic episodes of concentrated heavy showers and scattered storms, particularly in July and August.⁷³ While regular flooding is not a new phenomenon on the Korean peninsula, the magnitude of flooding events appears to be worsening. The North's water system can handle long periods of consistent steady rain, but cannot cope with bursts of heavy precipitation, which overwhelm ordinary flood defences.⁷⁴

Deforestation

Increasing annual temperatures caused by climate change are having an impact on forests. The rate of change of average temperatures is becoming faster than the speed at which forests grow. As climate is a driver of the flora that grows in a specific location, the geographic shift of climate zones toward the poles is changing local climate conditions and altering the species composition of forests.⁷⁵ The changing temperature regime is likely to weaken established forests in North Korea.

Deforestation in North Korea is being accelerated by land clearing to increase land area under cultivation and a growth in collection of forest wood to meet energy demand in lieu of scarce alternative sources. These denuded landscapes offer a limited capacity to absorb water when heavy precipitation events occur, which exacerbates flooding and leads to soil erosion of both marginal and arable land.⁷⁶ Korean Central News Agency reported that floods in August 2007 "left tens of thousands of hectares of farmland inundated, buried under silt and washed away."⁷⁷ In July 2006, torrential rain caused severe flooding that left large tracts of agricultural land under water, destroying crops.⁷⁸ The flooding events of 1995-96 were even more disastrous. Consecutive years of monsoonal flooding caused widespread crop loss

⁷³ Parry *et al*, eds., *Climate Change 2007: Impacts, Adaptation and Vulnerability*, p. 472-5; YS Chung, MB Yoon, and HS Kim, "On Climate Variations and Changes Observed in South Korea," *Climatic Change* 66 (2004), p. 155.

⁷⁴ Such short but intense bursts of rain were responsible for the flooding events of 2006 and 2007. For a description of the danger of increased flood magnitude, see: M Munasinghe and R Swart, *Primer on Climate Change and Sustainable Development: Facts, Policy Analysis, and Applications* (Cambridge: Cambridge University Press, 2005), p. 209.

⁷⁵ S Bickford, "Carbon Sequestration and Changes in Land Surface Albedo," Carbon Planet, http://www.carbonplanet.com/downloads/Climate_Effects_of_Forests_Full.pdf; "The Regional Impacts of Climate Change: An Assessment of Vulnerability", p. 3.

⁷⁶ "DPR Korea: State of the Environment 2003", p. 4-6; "DPR Korea: Common Country Assessment 2002", p. 49.

⁷⁷ "Huge Damage by Torrential Rain," Korean Central News Agency, <http://www.kcna.co.jp/item/2007/200708/news08/14.htm#11>; "South Korea to Send Emergency Aid to Flood-hit North," Reuters, <http://www.reuters.com/article/worldNews/idUSSEO20344620070817>.

⁷⁸ "The National Security Strategy of the United States of America," ed. United States Department of the Whitehouse (Washington DC: United States National Security Council, 2006).

and damage to farmland.⁷⁹ With a limited growing season and continued food shortfall, North Korea can ill-afford to have cropland decimated by flooding. If such events occur annually, as they have in July 2006 and August 2007, the food shortfall is likely to increase. Recent reports from North Korea suggest that food shortages have worsened as a result of harvest losses caused by the 2006-07 flooding events.⁸⁰

Final Hazard Assessment: Risk of Greater Food Insecurity

The direct consequence of climate hazards for North Korea's agricultural sector is declining food security. Food insecurity exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth, development and sustenance. It can be caused by inadequate access to food as well as insufficient and uncertain food supplies.⁸¹ Large segments of the North Korean population are already subject to food insecurity because the country does not produce enough food to feed itself and because certain social strata enjoy privileged access to existing food supplies at the expense of more vulnerable segments of the society. Those people experiencing food insecurity thus must develop coping mechanisms to secure subsistence or face malnutrition and death.

North Korea's Adaptive Capacity

The exposure of the North's agricultural system to hazard does not automatically translate into institutional failure and chaotic social breakdown. The level of harm suffered by the vulnerable system depends on its adaptive capacity, which is the ability of the vulnerable system to reduce exposure to hazards, moderate potential damages, recover from losses incurred, and cope with the consequences of the new environment.⁸² Mohan Munasinghe and Rob Stewart have outlined six key determinants of a vulnerable system's adaptive capacity: (1) Economic resources; (2) access to appropriate technology; (3) availability of information and skills; (4) infrastructure; (5) adequate institutions; and (6) equitable access to resources.⁸³ A system in which the key determinants are strongly positive will have a much higher adaptive capacity than one where the key determinants are weak.

Economic Resources

North Korea's economy remains in a decrepit state. The regime does not currently have the means to provide equitable food distribution and is reliant on foreign aid to

⁷⁹ Bruce Cumings, *North Korea: Another Country* (Melbourne: Scribe, 2004), p. 180-1.

⁸⁰ "N. Korea's Food Situation Hopelessly Bad: Aid Group," The Hankyoreh, http://english.hani.co.kr/arti/english_edition/e_northkorea/279706.html.

⁸¹ Smith and Vivekanandar, "A Climate of Conflict", p. 21-2; "DPR Korea: Common Country Assessment 2002", p. 13.

⁸² W Adger and K Vincent, "Uncertainty in Adaptive Capacity," *Comptes Rendus Geoscience* 337 (2005), p. 400; Munasinghe and Swart, *Primer on Climate Change and Sustainable Development: Facts, Policy Analysis, and Applications*, p. 175; Tol et al., "Distributional Aspects Of climate Change Impacts", p. 266.

⁸³ Munasinghe and Swart, *Primer on Climate Change and Sustainable Development: Facts, Policy Analysis, and Applications*, p. 187.

make up the shortfall.⁸⁴ The North is unable to generate funds by producing goods for export to access new agricultural technologies from abroad. What income it does derive comes from the export of mining commodities, from illicit sources such as drug running, and from weapons sales.⁸⁵ Whilst investment into North Korea is growing in its three special economic zones, these operations are run by foreign companies and do not produce direct export revenue.⁸⁶ This crisis originated in the 1970s when the North defaulted on its foreign debts after a period of excessive borrowing. Since this time the regime has been unable to access credit from foreign donors.⁸⁷ The situation became dire in 1991 when the collapse of the Soviet Bloc closed off markets for the North's sub-standard manufactured goods. Cessation of Soviet energy subsidies was a further blow leading to the North's deindustrialisation. To fund adaptation measures, the regime must reallocate scarce capital from other projects or obtain assistance from international organisations.⁸⁸

Access to Appropriate Technology

The adaptive capacity of the agricultural sector is dependent upon the technology at hand to buffer against crop yield loss. North Korea's economic problems have not helped in this regard. At present, farming is dependent on human and animal labour to compensate for aging and dilapidated mechanised farm equipment, which cannot be repaired or replaced due to economic sanctions and the inability of the regime to import new equipment and spare parts. Energy shortages compound the problem; even if the country's farm machinery was in optimal condition, there would not be enough fuel to power its tractor fleet.⁸⁹ Thus when extreme events do occur, such as

⁸⁴ "Can the Iron Fist Accept the Invisible Hand?", p. 4.

⁸⁵ S Chestnut, "Illicit Activity and Proliferation: North Korean Smuggling Networks," *International Security* 32, no. 1 (2007); B Lintner, "North Korea's Golden Path to Security," *Asia Times Online*, <http://www.atimes.com/atimes/Korea/IA18Dg01.html>; "The Estimate of North Korea's Foreign Trade in 2005 (May 15, 2006)," ed. ROK Ministry of Unification (ROK Ministry of Unification, 2006); Pinkston, "Domestic Politics and Stakeholders in the North Korean Missile Development Program", p. 9.

⁸⁶ There are three special economic zones in North Korea: Kaesong, in the south near the DMZ, in which many South Korean companies have set up manufacturing plants; Sinuiju, on the Yalu River border with China; and Rajin-Sonbong, in the northern coast near the Russian border.

⁸⁷ "Country Profile: North Korea", p. 11; C Armstrong, "'a Socialism of Our Style': North Korean Ideology in a Post-Communist Era," in *North Korean Foreign Relations in the Post-Cold War Era*, ed. S Kim (Oxford: Oxford University Press, 1998), p. 39; J Chung, "Foreign Trade of North Korea: Performance, Policy, and Prospects," in *North Korea in a Regional and Global Context*, ed. R Scalapino and HK Lee (Berkeley: Center for Korean Studies, University of California-Berkeley, 1986), p. 81.

⁸⁸ "FAO Technical Cooperation Department Field Programme Activities " Food and Agriculture Organization, <https://extranet.fao.org/fpmis/FPMISReportServlet.jsp?APD=&countryId=KP&div=&fundG=&type=countryprofileopen&lng=EN&qfirs=&UF=N&typeUF=&colororder=2345&pwb=&sorttype=1>. The Food and Agriculture Organization is engaged in a number of agriculture and water project in North Korea.

⁸⁹ French, *North Korea: The Paranoid Peninsula - a Modern History*, p. 100-1.

the floods of 2006 and 2007, it takes a great deal of time and human labour to restore farmland to full production.

Availability of Information and Skills

Planning for adaptation requires information about local vulnerability and options for increasing the resilience of the system. Indeed, adaptation is enhanced by good education and the provision of easy access to climate change-related information to at-risk groups.⁹⁰ North Korea is hamstrung in this regard because the intelligentsia has been continually purged since the 1950s, replaced instead by compliant sycophants. Intellectuals lost their high social status and were turned into working class functionaries, practitioners of *Juche*. The lionisation of *Juche* and Kimism devalued intellectual activity and stifled scientific innovation.⁹¹ The bureaucracy has become highly resistant to new ideas, capable only of applying a rigid dogma to a raft of complex practical problems. This does not bode well for the timely identification of vulnerable sectors and the development of appropriate adaptation strategies.

Infrastructure

Adaptive capacity is also dependent on the relative strength of the physical infrastructure of the vulnerable system. With no indigenous petroleum reserves, North Korea continues to be a net energy importer, with 90 percent of its oil coming from China and a smaller fraction from Russia.⁹² A large portion of farm irrigation is powered by electric pumps, which are vulnerable to blackouts.⁹³ The North's transportation infrastructure is heavily dependent on intermittent fuel supplies, caused by shortages of fuel acquired from China. This presents a critical problem for the distribution of food; even in a year of good harvests, food may not reach certain parts of the country because of difficulties with transportation.⁹⁴

Adequate Institutions

Strong and well-organised institutions are a key pillar of successful climate adaptation. In North Korea, food distribution has traditionally been carried out

⁹⁰ Parry et al., eds., *Climate Change 2007: Impacts, Adaptation and Vulnerability*, p. 490; Smith and Vivekanandar, "A Climate of Conflict", p. 33; Munasinghe and Swart, *Primer on Climate Change and Sustainable Development: Facts, Policy Analysis, and Applications*, p. 187.

⁹¹ SC Kim, "Dynamism of Politics and Status of Intellectuals in North Korea," *Development and Society* 31, no. 1 (2002), pp. 79-106.

⁹² P French, *North Korea: The Paranoid Peninsula - a Modern History* (London: Zed Books, 2005), p. 100-1; W Brown, "Changes in the North Korean Economy and Implications for the Energy Sector: Is North Korea Really Short of Energy?" in *DPRK Energy Experts Working Group Meeting* (San Francisco: The Nautilus Institute for Security and Sustainable Development, 2006); D Li, "DPRK's Reform and Sino-DPRK Economic Cooperation," The Nautilus Institute for Security and Sustainable Development, <http://www.nautilus.org/fora/security/0670Li.html>.

⁹³ Natsios, *The Great North Korean Famine*, p. 14; "Can the Iron Fist Accept the Invisible Hand?", p. 3.

⁹⁴ "Protracted Relief and Recovery Operation—DPRK", p. 5-6.

through a rationing mechanism called the Public Distribution System (PDS). The PDS was established in 1957 to centralise the distribution of cereals, later encompassing a wider variety of foods and consumables.⁹⁵ The government was forced to decide how to distribute scarce commodities, because the fixed prices of goods distorted the balance of supply and demand. This was useful for social control, as the population became dependent on the state for nearly all daily necessities.⁹⁶

This system worked reasonably well during times of stability, but was ineffectual during the famine. Clearly dysfunctional, it was officially abandoned in 2002.⁹⁷ The collapse of the PDS was inevitable in the face of a combination of problems. What little food was available was distributed preferentially to elite members of the party and the military. Some regions and social groups missed out altogether, forcing affected individuals to develop their own survival strategies.⁹⁸

The PDS was revived in many areas in October 2005 offering a daily ration of 500 grams of cereal.⁹⁹ Distribution delays due to transportation deficiencies and administrative inertia have prevented PDS rations from becoming available in all counties.¹⁰⁰ Those living in or near the larger cities on the west coast have the greatest chance of accessing the revived PDS, while those in other areas continue to rely on coping mechanisms developed during the famine period.¹⁰¹

Equitable Access to Resources

Adaptive capacity is a function not only of the availability of resources, but of the equitable access to resources by all segments of the population. North Korea has a three-tiered social stratification which influences the access of individuals to food. The country is divided into a “central” class, which forms the core of society and from which the regime elite derive; an “uncertain” class of the families of former small businessmen and landholders, and a “hostile” class of officially designated enemies of the state, which includes approximately one-quarter of the North Korean population.¹⁰² There is considerable variation in rights and privileges of individuals between the strata. A person's fate is determined by what stratum and group they are attributed to. It influences their access to good jobs and higher education, of being

⁹⁵ Scobell, "Kim Jong Il and North Korea.", p. 34-5. To claim the PDS, a representative of each family unit would present identification and rationing coupons on the 15th day of each month in return for a ration of rice and a number of different grains. See also: "Starved of Rights: Human Rights and the Food Crisis in the Democratic People's Republic of Korea (North Korea).", p. 8-9.

⁹⁶ A Lankov, "North Korea's Antique Food Rationing," Asia Times Online, <http://www.atimes.com/atimes/Korea/GA15Dg01.html>.

⁹⁷ M Woo, "North Korea in 2005: Maximising Profit to Save Socialism," *Asian Survey* 46, no. 1 (2005), p. 55.

⁹⁸ Ibid, p. 5.

⁹⁹ "Protracted Relief and Recovery Operation—DPRK.", p. 5.

¹⁰⁰ Lankov, "North Korea Hungry for Control"

¹⁰¹ "Protracted Relief and Recovery Operation—DPRK", p. 6.

¹⁰² Lankov, "The Repressive System and Political Control in North Korea."

allowed to live in Pyongyang and other major cities, and, hence, their standard of living and access to food rations.¹⁰³

Informal Coping Mechanisms

The actions of individuals and social groups within a vulnerable system can play a large part in fortifying the system's adaptive capacity.¹⁰⁴ In North Korea, social networks and informal coping mechanisms have played an important role in sustaining at risk elements of the population through the famine period and through food shortages up to the present day. First, many non-agrarian households maintain small kitchen garden plots, cultivating common vegetable varieties.¹⁰⁵ Second, individuals have been able to sell crops siphoned from collective farms, as well as surplus from kitchen gardens and expropriated food aid in informal private farmers markets.¹⁰⁶ Third, households that are unable to provision their own food often receive support, mostly in the form of cereals and vegetables, from relatives in rural households.¹⁰⁷ Finally, where no other choice exists, people have been forced to forage for wild food. It has been estimated that 60-80 percent of citizens have supplemented their meagre rations with wild foods.¹⁰⁸

These informal coping mechanisms could not prevent widespread mortality during the famine period. Andrew Natsios has estimated that 2-3 million people succumbed to malnutrition and associated health complications during 1994-98.¹⁰⁹ Those who perished were likely those who were unable to grow their own food or produce other goods or services to barter for food. The coping mechanisms of the famine period remain today as standard food procurement practices. There is minimal buffering in the system to absorb the shock of future disasters. Clearly the adaptive capacity of a large portion of the North Korean population to an environment of food insecurity is extremely low.

¹⁰³ A Sen, *Poverty and Famine: An Essay on Entitlement and Deprivation* (Oxford: Clarendon Press, 1981). Amartya Sen has observed that uneven distribution of food among social strata in an affected area is a common feature of famines. See also: A Lankov, *North of the Dmz: Essays on Daily Life in North Korea* (Jefferson, NC: McFarland & Company, 2007), p. 66-9. For a description of differential food distribution in North Korea during the great famine, see: "The Invisible Exodus: North Koreans in the People's Republic of China," (Washington DC: Human Rights Watch, 2002), p. 19-20; Rigoulot, "Crimes, Terror, and Secrecy in North Korea", p. 560.

¹⁰⁴ W Adger, "Social Capital, Collective Action, and Adaptation to Climate Change," *Economic Geography* 79, no. 4 (2003), p. 15-6.

¹⁰⁵ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 20-1.

¹⁰⁶ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea", p. 21; Scobell, "Kim Jong Il and North Korea", p. 35.

¹⁰⁷ Gunjal et al., "FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea.", p. 20.

¹⁰⁸ Ibid, p. 20.

¹⁰⁹ Natsios, "The Politics of Famine in North Korea", p. 1.

Dangers to the Vulnerable System

The North Korean state is a system already under stress from food shortfalls, a weak economy and energy shortages. Its rigid political system is not equipped to deal with these problems. Climate change hazards of increasing intensity and frequency are likely to add to the pressure on this system by further exacerbating the country's food insecurity.¹¹⁰ Many of the political consequences of food insecurity have already been witnessed in North Korea through the famine period. The regime was able to muddle through and survive; however, the flow-on consequences of climate stress could disrupt the political economy of the state to a degree that pushes the Kim regime into terminal decline.

If climate change hazards adversely affect agricultural output, malnutrition and mortality will become more prevalent.¹¹¹ The margin between malnourishment and mortality is extremely tight in North Korea: Seoul-based organisation *Good Friends*, which provides support for North Korean defectors, reported that famine-related deaths recurred in North Korea during July 2007.¹¹² This demonstrates that even slight upward perturbations in the food shortfall will, and are, leading to higher rates of mortality.

Displacement and Migration

For those people experiencing acute malnutrition, migration to other regions in search of food may be their only option for survival. Migration may be driven in the short term by extreme weather events such as flooding and drought, and in the longer term by sea level rises as coastal residents are forced to relocate to higher ground.¹¹³ In any case, influxes of migrants to new areas place increased strain on the food security of receiving regions as displaced people compete with locals for limited food supplies.¹¹⁴

Migration has the further consequence of inviting official corruption. Low-level officials can take advantage of vulnerable displaced people. Bribery can be solicited or unsolicited, driven by both the illegality of unauthorised travel and the necessity of journeying to find food. North Koreans are subject to strict travel controls, which keep them isolated and make surveillance and social control easier for the coercive

¹¹⁰ N Hultman and A Bozmoski, "The Changing Face of Normal Disaster: Risk, Resilience and Natural Security in a Changing Climate," *Journal of International Affairs* 59, no. 2 (2006), p. 26.

¹¹¹ A Woodward, S Hales, and P Weinstein, "Climate Change and Human Health in the Asia Pacific Region: Who Will Be Most Vulnerable?" *Climate Research* 11 (1998), p. 32.

¹¹² "Deaths from Hunger Rise across N. Korea: Civic Group," Yonhap News Agency, <http://english.yonhapnews.co.kr/northkorea/2007/07/18/88/0401000000AEN20070718007600315F.HTML>.

¹¹³ N Gleditsch, R Nordås, and I Salehyan, "Climate Change and Conflict: The Migration Link," in *Coping with Crisis Working Paper Series* (New York: International Peace Academy, 2007), p. 4; Parry *et al.*, eds., *Climate Change 2007: Impacts, Adaptation and Vulnerability*, p. 488.

¹¹⁴ Hultman and Bozmoski, "The Changing Face of Normal Disaster: Risk, Resilience and Natural Security in a Changing Climate", p. 29-30.

organisations. However, during the famine the regime was powerless to enforce travel restrictions because corrupt low-level officials took bribes to facilitate the movement of illegal travellers. Many were able to escape the country by bribing border guards and travel inspectors to reach and cross the Chinese border.¹¹⁵ Illegal travellers are also an easy extortion target for unscrupulous officials who demand payment in exchange for free passage. Those refusing to pay are turned in for punishment.¹¹⁶ Travel restrictions and border controls have since been reinforced. People caught attempting to cross the Chinese border, or even travelling outside of their residential district, are punished severely.¹¹⁷

The proliferation of internally displaced persons destabilised the strict system of travel restrictions which kept people rooted in one place. Domestic surveillance weakened because people were able to move around the country more freely. Intensification of food shortages will place tremendous pressure on the regime to again tolerate unrestricted travel, leading to deligitimised social controls and additional growth in official corruption. Legitimacy is threatened when public officials exploit their positions for personal gain and is often seen as a sign of state weakness.¹¹⁸ Once systematic corruption becomes the norm, it is exceedingly difficult for reformist leaders to dismantle it. Officials may now be willing to ignore regulations if they can enrich themselves in the process.¹¹⁹ If money and self-enrichment replace career advancement and fear of the coercive apparatus as behavioural motivators, the institutional strength of the regime may weaken beyond repair.

Undermining of State Institutions

During the famine, more fortunate North Korean citizens were able to fall back on coping mechanisms without having to move from their local area. People in this category were those who could grow food in private garden plots or offer some kind of service to barter for food. This black market has sparked a trend toward *de facto* marketisation of the North Korean economy. In 2002 state-owned enterprises began paying market prices for goods through their supply chains, while the price of merchandise in state-owned stores was adjusted to reflect the price of goods in the farmers markets.¹²⁰

115 HN Ji, "Testimony of Mrs. Hae-Nam Ji, North Korean Defector," (Washington DC: Senate Foreign Relations Committee Subcommittee on East Asian and Pacific Affairs, 2003). North Korean defector Ji Hae-nam recounts her use of bribes to escape the country: "I brought 200 won worth of food on top of 200 won in cash to a guard from National Border Patrol in Musan telling him that I will give him more when I come back from China after selling my merchandise. He believed me and let me pass and I arrived in China after crossing the Tuman River at 3:30 p.m. Even the soldiers are starving in North Korea that they would do anything for money and their goal is to accrue 500,000 won by the time they are dismissed from the military service." See also: Hwang, "Hwang Jangyop Holds Press Conference to Explain Why He Defected from North Korea".

¹¹⁶ "A Matter of Survival: The North Korean Government's Control of Food and the Risk of Hunger," (New York: Human Rights Watch, 2006), p. 29.

¹¹⁷ A Lankov, "North Korea Dragged Back to the Past," Asia Times Online, <http://www.atimes.com/atimes/Korea/JA24Dg01.html>.

¹¹⁸ Holsti, *The State, War, and the State of War*, pp. 93-4, 113-5.

¹¹⁹ Lankov, "North Korea Dragged Back to the Past."

¹²⁰ Woo, "North Korea in 2005: Maximising Profit to Save Socialism", p. 54; Li, "DPRK's Reform and Sino-DPRK Economic Cooperation."

Private farmers' markets weakened the primacy of the command economy. In effect this was a back-handed admission that central planning, embodied in the PDS, was an inefficient mechanism for distributing food. People stopped looking to the state to provide for them and instead learnt to take care of themselves; no longer could the regime be viewed by ordinary people as a paternal provider.¹²¹

Members of the elite live in a cloistered bubble of privilege, safely sequestered from the pervasive malnourishment afflicting the lower social strata.¹²² Kim Jong-Il may confront a scenario in which the agricultural and industrial capacity servicing the military and party elite—already weak, as evidenced by the annual food shortfall—is further undermined by climate change hazards or by international donor fatigue. It is not clear, however, what minimum level of resource procurement is necessary to sustain the elite and at what point of erosion a backlash against the leadership may occur.¹²³ Recent reports suggest that high-ranking residents of Pyongyang have had their ration substantially reduced.¹²⁴ The tipping point may come when mid- and high-ranking officers are confronted with severely reduced access to food. Should this tipping point be reached, key figures may begin to see support for the status quo as a losing gambit creating a disconnect between the leadership and its governing institutions.

Contradiction of State Ideology

Food insecurity is a further liability because it undermines *Juche* ideology. Continued reliance on foreign donors demonstrates the institutional weakness of its food distribution system. The image of North Korea's present reality—a floundering economy propped up by aid from the very enemies the regime is mobilised against—contrasts starkly with the core goals of *Juche*.¹²⁵ The presence of international aid organisations in North Korea is a direct challenge to *Juche* because it destroys the myth of national self reliance.

When official rhetoric and propaganda becomes increasingly divorced from reality, the ideational paradigms of the state are eroded and its institutions lose legitimacy. Barry Buzan states that the ideas and the institutions of the state are inseparably intertwined; thus the ideational pillars are useless without the institutions to put them

¹²¹ Lankov, "North Korea Dragged Back to the Past."

¹²² "A Matter of Survival: The North Korean Government's Control of Food and the Risk of Hunger.", p. 11. Even rations for even high-level officials fell slightly during the famine. Mr. Lim, who was a soldier at the time of his escape in March 2005, told Human Rights Watch that common soldiers also had faced hunger. His unit, which was assigned to work at a power plant in Hwanghae City, had a serious shortage of food. They received proper rations only on major holidays such as Kim Il Sung's and Kim Jong Il's birthdays. On other days, he received about "three spoonfuls" of grain per meal. See also: Lankov, *North of the DMZ*, p. 314.

¹²³ Snyder, "North Korea's Challenge of Regime Survival", p. 527-8.

¹²⁴ "N. Korea's Food Situation Hopelessly Bad: Aid Group".

¹²⁵ B Cumings, "The Corporate State in North Korea," in *State and Society in Contemporary Korea*, ed. H Koo (Ithaca, NY: Cornell University Press, 1993), p. 213-4; Park, *North Korea: The Politics of Unconventional Wisdom*, p. 20-7; French, *North Korea: The Paranoid Peninsula - a Modern History*, p. 30-1.

into practice, just as the institutions are pointless and even impossible without these ideas to give them definition and purpose.¹²⁶ Without *Juche* as a practical guide and legitimising paradigm, the institutions of the North Korean state will lose their *raison d'être*, the officials within the motivation to carry out their duties, and the citizenry the non-coercive stimulus for compliance.

The regime views aid from Western donors as a poisoned chalice. Foreign nationals representing international donor organisations are a possible conduit for information about the outside world, increasing the chance of ideological pollution and the leakage of dangerous information. Social discord could result if the North Korean public are able to make a comparison of their everyday lives with the economic and political realities of other countries.¹²⁷ Moon Chung-in and Kim Yong-ho note that exposure to new ideas could trigger “a shared feeling of cognitive dissonance and even relative deprivation,” leading to the expansion of dissident civil society beyond regime control.¹²⁸ Climate hazards thus raise the risk that increasing flows of information could unleash the mass mobilisation of previously isolated individuals.

Conclusion

The muddle through paradigm has allowed the development a false sense that the Kim regime can perpetuate itself indefinitely in the face of extreme obstacles. The advent of climate change has altered that equation. North Korea's agricultural sector is vulnerable to climate change impacts—including rising average temperatures, extreme weather events, changing precipitation patterns, and deforestation—over the coming two decades. North Korea does not have the adaptive capacity to buffer against greater food insecurity caused by exposure to climate hazards while simultaneously weakened by energy shortages, economic weakness, limited horizontal access to information, and its rigid political system.

North Korea's agricultural sector will be directly impacted by climate hazards, threatening the well-being of the people, the institutions of the state and regime ideology. Specifically, decreased food security is likely to displace North Korean citizens from their home districts in search of food, undermining social control mechanisms and inviting official corruption. State institutions will be eroded as citizens' fall back on non-state coping mechanisms to survive. Increasing food shortages will also undermine the North's official ideology because reliance on foreign food aid is incompatible with the *Juche* self-help paradigm.

These trends are mutually reinforcing and can function as positive feedback loops. If the degradation of the state damages the privileged position of the elite, high-ranking officials may see the leadership as a liability and withdraw their support for the status quo. There is a real danger that climate change may drive a food security crisis in North Korea, in which the effected dimensions of its political economy will coalesce into mutually re-enforcing terminal decay and regime failure.

¹²⁶ Buzan, *People, States and Fear: An Agenda for International Security Studies in the Post-Cold War Era*, p. 86.

¹²⁷ Natsios, *The Great North Korean Famine*, p. 218-24.

¹²⁸ Moon and Kim, "The Future of the North Korean System", p. 237.

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