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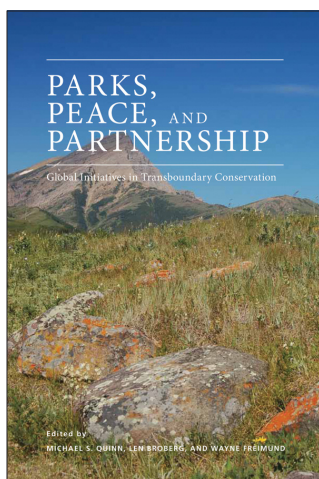
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PARKS, PEACE, AND PARTNERSHIP: GLOBAL INITIATIVES IN TRANSBOUNDARY CONSERVATION

Edited by Michael S. Quinn, Len Broberg,
and Wayne Freimund

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Korean Demilitarized Zone Peace and Nature Park

Hall Healy

INTRODUCTION

With the idea of dividing Korea into spheres of influence in 1896, Japan and Russia conducted negotiations that almost resulted in the partition of the country along a mid-peninsula boundary line, though not at the 38th parallel, where the Demilitarized Zone (DMZ) now is nominally situated (Cumings 1997). A division was not to take place until more than fifty years later, and then as a consequence of World War II and the Korean War. Subsequently, the DMZ became a symbol of the United States' Cold War containment policy. Now it is a stark remnant of that standoff, but at the same time a reminder of nature's tremendous resilience and the hope which that affords (Map 1).

Since the end of the Korean War in 1953, the DMZ has been essentially off limits to all but a few residents living in two showcase villages, one in North Korea and one in South Korea in the heart of the DMZ near Panmunjom. It has been part of a geopolitical vacuum and memory of

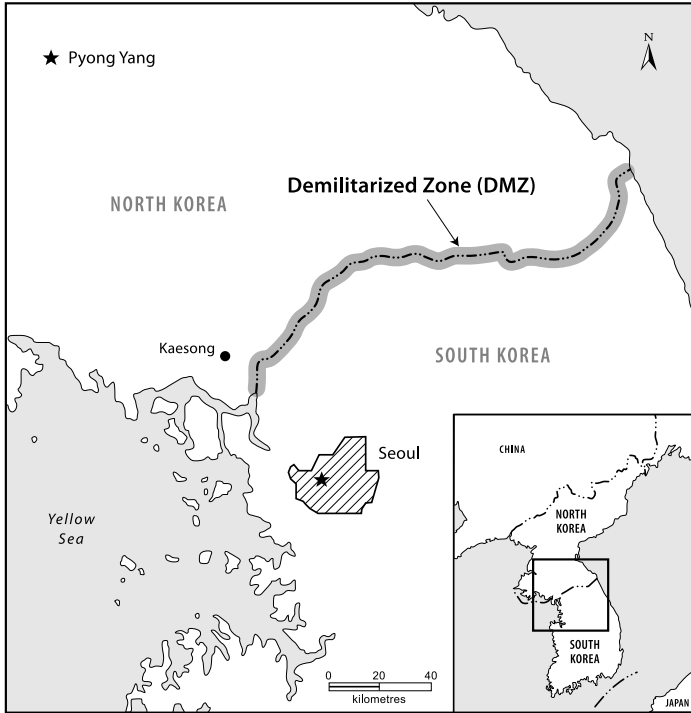
war. The DMZ and Civilian Control Zone (CCZ) on the south side also have been occupied by approximately one million land mines, reinforcing the zone's barbed wire perimeter extending along much of its length. But, within the forbidden zone, nature has staged a renaissance during the last fifty-plus years. The natural resources contained in the DMZ and CCZ represent millions of years of evolution, some of its species being found nowhere else in the world, and thousands of years of human history, about five thousand of which have been with a people identified as distinctly Korean. The two zones offer an urgent and unique opportunity for dialogue between the Koreans and other regional stakeholders that can assist in creating peace on the peninsula. Properly managed for sustainability, these same resources also can garner billions of dollars for both Koreas and one day provide help for a re-united peninsula. This chapter will address: (1) the importance of the DMZ from multiple perspectives; (2) threats to conserving it; (3) current initiatives to preserve it; and (4) other potential steps to conserve its resources.

IMPORTANCE AND VALUE OF THE DMZ

The Demarcation Line created at the end of the Korean War to separate the two Koreas was 248 kilometres [154 miles] long, bisecting the DMZ 4 kilometres [2.5 miles] wide – the established DMZ covering an area of 99,200 hectares [383 square miles]. An informal and contiguous CCZ was established in the Republic of Korea (ROK)/South Korea, that averaged 5.5 kilometres [3.4 miles] in width; a CCZ of similar width is said to exist immediately north of the DMZ. Thus, the combined area of the DMZ and two associated buffer zones is perhaps 367,000 hectares [1,417 square miles] in size. The buffer zone contains rivers and many ecosystem types, supporting thousands of species.

Biological Resources

There are reportedly upwards of 4,000 species – up to 1,597 plants, 66 mammals, hundreds of bird species, and almost one hundred fish species – in the DMZ and CCZ. By one count, the species there represent



MAP 1. LOCATION OF THE KOREAN DEMILITARIZED ZONE (M. CROOT).

67 per cent of all those found in Korea (Kim 1997), and the DMZ is the only place where many of them still reside, having been extirpated from the rest of the peninsula due to development and industrialization in the south and deforestation in the north. From 1995 to the present, field and literature surveys have been conducted to assess biological resources of the area. Reports detail a broad range in the numbers of species: 256–1,597 plants, 4–66 mammals, 143–939 animals other than mammals, 49–233 birds, 6–46 amphibians and reptiles, 13–98 freshwater fish and 50,000–51,000 insects (Kim and Cho 2005; Shin 2007; Kim 2007). These estimates poignantly portray the vast richness of the area. Their wide disparity is symptomatic of the lack of direct access to the DMZ itself, which is beginning to change. Until recently, data has been collected mainly from observations inside the CCZ, without the ability to enter the DMZ. The

variety of species that studies have identified are described below. The lists illustrate and underscore the importance and breadth of flora and fauna diversity existing within the DMZ and CCZ and what an unusual treasure trove it is.

Mammals

Many charismatic mammal species, including Asiatic black bear (*Selenarctos thibetanus*), musk deer (*Moschus moschiferus*), spotted seal (*Phoca largha*), and leopard (*Panthera pardus*) are reported to inhabit and depend on the DMZ and CCZ. The Cultural Heritage Administration of South Korea has designated several DMZ species as “natural monuments,” including:

- Korea-Okhotsk gray whale (*Eschrichtius robustus*), in waters off the DMZ’s east coast;
- Chinese water deer (*Hydropotes inermis*);
- Amur goral (*Naemorhedus caudatus raddeanus*), a rare type of goat;
- otter (*Lutra lutra*), re-introduced just south of the DMZ in Hwacheon County;
- leopard cat (*Prionailurus bengalensis*); and
- Korean yellow-necked marten (*Martes flavigula koreana*).

Reportedly, in the late twentieth century there were even tigers in the mountains around Seoul, the capital of South Korea; and there has been anecdotal evidence of tigers in the DMZ, CCZ area since that time. However, to date, no scientifically based studies have been conducted to verify their presence.

Birds

The DMZ forms a vital link between ecosystems throughout Northeast Asia. Hundreds of bird species migrate twice a year through the DMZ

going to and from Mongolia, China, Russia, Vietnam, Japan, the Philippines, and Australia, essentially from the top to the bottom of the planet! If the DMZ green belt were destroyed, what would happen to this globe-spanning chain? Species include many that, according to IUCN (International Union for Conservation of Nature), are endangered. For example, most of the Black-faced Spoonbills (*Platalea minor*), with a total estimated world population of 1,679, breed on the western coastal islands off the DMZ (Yu and Wong 2006; Coulter 2007). Two former DMZ inhabitants, the Oriental White Stork (*Ciconia boyciana*) and the Crested Ibis (*Nipponia nippon*), are potential candidates to re-introduce into the area.

Spending part of their life cycle here are other species, many of which also are already endangered, including:

- Black Vulture (*Aegypius monachus*);
- Stellar's Sea Eagle (*Haliaeetus pelagicus*);
- White-tailed Sea Eagle (*Haliaeetus albicilla*);
- Mandarin Duck (*Aix galericulata*);
- Broad-billed Sandpiper (*Limicola falcinellus*);
- Bean Goose (*Anser fabalis*);
- Swan Goose (*Anser cygnoides*);
- Great Bustard (*Otis tarda*);
- Whooper Swan (*Cygnus cygnus*);
- Chinese Egret (*Egretta eulophotes*);
- Tristram Woodpecker (*Dryocopus javensis*);
- Ruddy Shelduck (*Tadorna ferruginea*); and
- White-fronted Goose (*Anser albifrons*).

Red-crowned Cranes have a special place in Korean culture as symbols of long life and good luck and are frequently depicted in folklore and art. In historic times, Red-crowned Cranes (*Grus japonensis*), White-naped Cranes (*Grus vipio*), and Hooded Cranes (*Grus monacha*) wintered at

many widespread lowland sites. Today the DMZ and CCZ provide a resting area for White-naped Cranes migrating to Japan. Satellite telemetry studies of these cranes have shown that during their long journey from wintering grounds in southern Japan to breeding grounds in northern China and southeast Russia, the DMZ is their major resting area. From October through March, the DMZ is a winter home for Red-crowned Cranes and for other White-naped Cranes that end their passage on the peninsula. Approximately one-third of the world's 2,500 Red-crowned Cranes and half of the world's White-naped Cranes depend on the wetlands and agricultural fields in and near the DMZ. The most important areas are the Han River estuary in the west and the Cheorwon [sometimes spelled "Ch'olwon"] Basin in the central highlands. Hooded Cranes are now only found wintering at Sunch'ŏn Bay in the far south end of South Korea and in southern Japan (Archibald 2007; Chong and Pak 1994; Higuchi et al. 1996).

Freshwater Fish, Amphibians, Reptiles, and Insects

By current estimates, almost a hundred freshwater fish species, some of which are endangered, inhabit DMZ and CCZ rivers and their tributaries. These include perch, shiners, dace, Golden Mandarin (*Siniperca scherzeri*), Bitterling (*Rhodeus uyekii*), Asian Gudgeon (*Pseudorasbora parva*), and Manchurian Trout (*Brachymystax lenok* (Pallas)). At least eighteen of them are endemics – found nowhere else in the world (Kim 2004). The Chinese mitten crab (*Eriocheir sinensis*), now causing significant issues as an exotic species in San Francisco Bay, also naturally resides there. With the area's many waterways, lakes, and reservoirs and relatively low levels of pollution, there are estimated to be up to forty-six amphibians and reptiles, including the narrow-mouthed frog (*Kaloula borealis*), Korean fire-bellied toad (*Bombina orientalis*), Asian keelback snake (*Amphiesma vibakari*), rat snake (*Elaphe schrenckii*), Korean magpie viper (*Agkistrodon saxatilis*), and a freshwater turtle.

An integral component in the overall biologic system, according to a 1992–93 survey, insect phyla in the DMZ and CCZ (Table 1) encompass up to 1,000 insect species, some of which are protected (Kim 2001).

Table 1. Arthropods (insects) in the DMZ, CCZ (Kim 2007).

Phylum	
Mantodea (mantids)	4
Dermaptera (earwigs)	9
Isoptera (termites)	1
Orthoptera (grasshoppers, crickets)	65
Phasmida (leaf and stick insects)	2
Hymenoptera (bees, wasps)	12
Blattaria (cockroaches)	4
Neuroptera (net-winged insects)	13
Diptera (true flies)	38
Lepidoptera (butterflies, moths)	78
Total	226

Plants and Fungi

Most numerous are the vascular plants with estimates up to almost 1,600 species in the many and varied DMZ and CCZ ecosystems. Included are iris, violet, peony, and lily, with many native Korean species. One variety of trillium has rounded leaves as opposed to their normally pointed ones. Research on another plant, *Epimedium koreanum Nakai*, has uncovered the fact that its extracts may have a potential salutary effect on osteoporosis (Li et al. 2005). Perhaps this is a portent of what Edward O. Wilson (2003) refers to as part of the substantial potential for pharmaceutical revenues from the world's plants. Some of the lily, iris, and trillium species are rare and endangered plants and are protected by South Korean law. Distribution of the rare plants is mainly at Daeam Mountain and Yanggu in the mid-eastern mountainous area, Cheorwon in the mid-western region, and Kanghwa Island on the west coast. In most regions, oak and pine are the dominant forest type, with oak second growth on the west coast, on islands and in the mid-west region, with Mongolian Oak (*Quercus mongolica*) in the mid-eastern mountains (Shin 2007). A total of 282 species of mushrooms and fungi and 55 species of lichens have been surveyed in the DMZ and CCZ (Shin 2007).

Physical Resources

The total land area of the DMZ is fairly evenly divided between North Korea and South Korea. Forest occupies about 75 per cent, grasslands about 20 per cent, agricultural land about 3 per cent, wetlands 1 per cent, with water bodies and 'bare land' taking up the remainder (Shin, JH, 2007, VI-6). The DMZ and CCZ can be grouped into four regions: (1) east coast, including lagoons, wetlands, and lowlands/valleys; (2) mid-eastern mountains and highland moors; (3) mid-west inland with the upper Han River watershed, farmland, and a lava plateau; and (4) west coast and islands with hills and wetlands, although the islands are not, strictly speaking, part of the DMZ (Shin 2007). A more detailed view of habitats is seen in Table 2.

Five major rivers and their watersheds run through the DMZ and CCZ: on the west side are the Imjin, Han, Bukhan, with Soyang and Nam to the north. Most tributaries and the main stems of these rivers run north to south and empty into the West or Yellow Sea. The Han and Nam rivers originate in the DMZ. The Nam goes south through the DMZ and CCZ and finally flows into the East or Japan Sea. These rivers are "first quality streams," with low levels of dissolved oxygen, at 11.0 milligrams/litre, and suspended solids, at 2.5 milligrams/litre. Average pH is 7.26 (Kwon and Song 2007).

Table 2. Habitat Types in the DMZ and CCA (Kim and Cho 2005).

Coastal
<ul style="list-style-type: none"> • Open sea, sub tidal • Islands • Rocky shore • Sandy shore, estuary • Lagoon • Sand-dune • Salt marsh • Sea cliff
River
Lake, reservoir
Farmland
Wetland
<ul style="list-style-type: none"> • Forested • Reed bed • Peat land
Grassland
Woodland
<ul style="list-style-type: none"> • Coniferous • Deciduous
Coppice (young tree stems, small/short growth)
Scrub succession
Urban areas

Mountains, Forests and Grasslands

Mountain ranges include the Taebaek on the east end of the DMZ. As part of that range are the fabled Diamond Mountain, called Keumgang, in the north, and Mount Seorak in the south. Both Keumgang and Seorak have been placed on the “Tentative List” of the United Nations by their respective countries for possible designation as UNESCO World Heritage Sites. Forests occupy an estimated 68,000 hectares (263 square miles), with distribution considered poor in some areas due to frequent disturbances from military operations. Forest types include coniferous, deciduous, mixed, and shrub forests. There are forest ecosystems in the western end of the DMZ and CCZ near Panmunjom, Dora, and Baekhak Mountain and in Cheorwon. Mongolian Oak dominates these areas and can be seen

at Keumgang Mountain, just north of the DMZ, as well. Some pine species in the DMZ and CCZ appear to have been deliberately planted. In the Cheorwon area of the CCZ, intentional fires have been set to maintain visibility for military exercises. The result is domination of these areas by broad-leaved shrubs. Grasslands exist in low, flat areas, on rice paddy levees, and at the edges of agricultural areas in the west, on hill and mountain sides on the eastern side and in bottom lands in the central and eastern portions of the DMZ and CCZ. Some of these areas have been subjected to significant numbers of purposeful and natural fires. On sloping lowlands are geranium among other species (Kim and Cho 2005).

Wetlands

Due to the presence of lowlands, there are extensive wetlands at the western end of the DMZ and CCZ, especially in the Cheorwon Plain, which serves as a wintering site for globally endangered Red-crowned and White-naped Cranes. Riverine wetlands are present near the Imjin, Han, and Sachon rivers on the west coast, along with palustrine – generally small, shallow and inland – wetlands near Yeoncheon. At the eastern end are valley and lacustrine wetlands, those that are located at the same elevation as a lake and influenced by lake water levels. Extensive tidal flats exist on the western coast, near Kanghwa Island and Gimpo. Tidal flats, a unique type of habitat, are under pressure to be developed, with some being transformed at the present time. At the summit of Mount Daeam, there is a high moor, the Yongneub peat land, reportedly the only one in Korea (Kim 2001). It is a registered Ramsar Convention (an international treaty to protect wetlands) site and has been designated a wetland protection district, an ecosystem conservation area, and a natural monument by the ROK Ministry of Environment.

Cultural Resources

The DMZ area contains numerous historically and archeologically significant locations. On the east and just above the DMZ, Mountain Keumgang has four Buddhist temples, including the remains of one from 519 CE. Kaesŏng on the west, at the northern border of the DMZ in North Korea, which was the capital of the Koryŏ dynasty (918–1392 CE) and has numerous archeological sites. It is now the scene of a large development being established to create an estimated 600,000 to 700,000 jobs for North Koreans. On the southern side of the DMZ is Panmunjom, where armistice negotiations took place at the end of the Korean War. Battle sites like ‘Ice Cream Mountain’ and the ‘Iron Triangle’ graveyards and museums dedicated to commemorating war dead are plentiful throughout the region and attract thousands of visitors annually. In recent years, military-based Missing in Action (MIA) searches also have drawn significant attention to the area.

Ecosystem/Economic Services

Ecosystem services are defined as any service or product of nature that benefits humans. There are numerous techniques for placing a monetary value on those services, including travel cost, contingent valuation, contingent choice or conjoint analysis, hedonic pricing, market price, and the productivity method (Pagiola et al. 2004). The above discussion of DMZ and CCZ biodiversity emphasizes the resources that are clearly available and that, when managed sustainably, could generate billions of dollars to the Korean people far into the future (Healy 2007). These ecosystem services can include: food, ecotourism, water purification, carbon sequestration, and many more. Table 3 depicts some of the services the DMZ and CCZ can, and to some extent already do, provide. Tangible and monetarily significant values can be attached to and derived from them.

Table 3. DMZ Ecosystem Services and Ecosystem Types.

Ecosystem Service	Ecosystem Types									
	Coastal, Marine	Island	Mountain	River, inland Water	Wetland	Grassland, dryland	Farmland, cultivated	Forest	Urban	
Freshwater			+	+	+		+	+		
Food	+	+	+	+	+	+	+	+	+	
Timber, fuel, fibre	+		+			+	+	+		
Products	+			+		+	+	+		
Biodiversity regulation	+	+	+	+	+	+	+	+	+	
Nutrient cycling	+			+	+	+	+	+		
Air quality, climate	+	+		+	+	+	+	+	+	
Human health	+			+	+	+	+	+	+	
Detoxification	+			+	+	+	+	+	+	
Natural hazard regulation	+		+	+	+	+	+	+		
Cultural, amenity	+	+	+	+	+	+	+	+	+	

Table 4. Ecosystem Service Features Already in South Korea and North Korea.

Ecosystem Service Feature	South Korea	North Korea
Exhibits, museums	x	x
Observation towers, decks	x	x
Sports facilities	x	x
Resorts, hotels	x	–
Archeological, historical sites	x	x
Souvenir shops	x	Unknown
Underground tunnels	x	x
Cruises	x	–
Agriculture	x	x
Local conservation groups	x	Unknown
Parks	x	Unknown
Local nature and wetland centers used for education, outreach, training	x	Unknown

Table 4 demonstrates other services also being provided currently by the DMZ and CCZ.

One way to visualize potential of the DMZ is to look at it as a mosaic of uses, something like a Central Park in New York City, including woodlands, sport facilities, restaurants, walking and running paths, and more, to serve a wide variety of needs and interests. Another way to see its potential is through the example of a park like Yellowstone in the United States, where for an annual budget in the tens of millions of dollars, it is conservatively estimated that over \$1 billion is generated each year by the area around the park in ecotourism and related activities.

Laboratory

A significant benefit of the DMZ and CCZ can be seen by examining the effects of leaving such a large area virtually untouched for about sixty years. In how many other places in the world, where humans have been present

for thousands of years, are we able to determine what such a lengthy hiatus can do to help restore the land and its inhabitants? In *The World without Us*, author Alan Weisman suggests just that kind of importance be given the DMZ and CCZ (Weisman 2007). Habitats and species of the DMZ can be destroyed or preserved. It is our choice. Either way we decide, this area is a window to what our future as a species might be. One way to posit a world without humans is to study what the natural succession process is when left largely uninterrupted, as it has been in the DMZ. In this ‘laboratory,’ of course, there could be numerous schools and universities for research, training and educating of Koreans and people from all around the globe, as is being done in transboundary parks of South Africa and its neighbours.

Tension Reduction, Improved Relations

A major potential benefit of devising ways to sustainably manage the DMZ and CCZ is reduction of tension between the two Koreas and other nations with a stake in the region, such as those that have been involved with North and South Korea in the Six Party Talks – the United States, China, Russia, and Japan. In the context of these talks and their Working Groups, or through a separate set of discussions, conservation of DMZ and CCZ habitats and species would be a constructive topic to address collaboratively, with identifiable economic, social, cultural, and biological benefits for all Koreans. In fact, these talks and working groups have addressed economic issues. Including discussion of impacts on the peninsula’s environment, inside and outside of the DMZ and CCZ, could help ameliorate negative effects of existing environmental conditions in the two Koreas.

DMZ THREATS AND OPPORTUNITIES

Numerous threats exist in the path of conserving DMZ and CCZ ecosystem service resources. But each threat can be treated as an opportunity to improve the situation. We will focus here on two of the highest priority threats, development and pollution. Some solutions to these and other threats can be leveraged and help address more than one area of concern.

Development

Development is the largest threat to sustainably conserving DMZ and CCZ natural and cultural resources. It comes in many forms and is already present. Much of the pressure to develop emanates from the fact that there are over twenty million people living in the Seoul metropolitan area. In recent years, plans have been announced to build several entirely new cities between Seoul and the CCZ and DMZ, one of which has been all but completed. These activities have led to increasing encroachment on the CCZ, with, for example, an ROK Ministry of Defence proposal to reduce the size of the CCZ by five kilometres, from twenty to fifteen.

In the transportation sector, on May 17, 2007 rail and road links were re-opened on both ends of the DMZ, after having been closed since the end of the Korean War. There is increased road-building in the area and throughout Korea. Before the Korean War, there were six national and six local roads and four important railways passing through the DMZ (Kwon and Song 2007). Now there is discussion of expanding Inch'ön International Airport. Plans are also afoot to build large ports on the Han and Imjin rivers, and work is underway to join the two rivers, which move has the potential to seriously impact water quality (through increased sedimentation), flow regimes and habitats for birds and other riverine species like otter. Dams are being planned on some rivers that run through the DMZ, with one near Yeoncheon.

While not in the DMZ, filling in the Saemangeum tidal flats, southwest of Seoul in the Yellow or West Sea, sets a potential precedent for, and is prompting discussion of, similarly filling in other tidal flats near the DMZ.

Unequivocally, these activities provide many benefits to the Korean people. But, much depends on *how* they are implemented. The opportunity comes in looking at development and conservation from a systems perspective, holistically, with an eye towards societal values. The Korean culture has always placed a high importance on nature and things natural with, for instance, “quite remarkable attachment to the pine tree and to the many pine-covered mountains that range across the peninsula.” King Wang Kōn, who re-united the country under the Koryō dynasty in 935 CE, is quoted as saying in one of his *Ten Injunctions*, “I carried out the

great undertaking of re-unifying the country by availing myself of the latent virtue of the mountains and streams.” Koryŏ, which Wang Kŏn shortened from Koguryŏ, means “high mountains and sparkling waters,” and this became the basis for the country’s name (Cumings 1997).

These long-standing values can be the foundation of planning that involves all stakeholders and a systems approach to find the right balance in important habitats between development and conservation. The ROK government used that tack when looking at the feasibility of the proposed Tong Dam and determined it was not economically feasible after conducting a contingent valuation of the project (Ministry of Environment, Republic of Korea 2003). Another opportunity to minimize harmful development effects is to require environmental impact assessments (EIA) before construction, as was done prior to rebuilding the rail lines and roads between North and South Korea. Also mitigating impacts of development is the use of structures to accommodate wildlife, exemplified by putting animal bridges over the western DMZ rail link. Additional approaches to manage and minimize detrimental development impacts can include:

- determining the most critical habitats to preserve through studies, some of which already have been initiated;
- conducting valuation studies like that of the Tong Dam and those in the United States and other countries to determine the value and extent of ecosystem services which the DMZ and CCZ can support sustainably;
- transparently involving all stakeholders in the area to ensure their voices are heard and needs responded to in the planning process;
- developing national, regional, and local legislation and regulations, including appropriate enforcement, to ensure preservation; and
- compensating local citizens for land put into conservation or crops impacted by wildlife use, as has been done in Cheorwon.

Pollution and Contamination

There are already numerous forms of pollution and contamination that have impacted or could adversely affect the DMZ and CCZ:

- over one million land mines present in the DMZ (970,000) and CCZ (38,000), though the south has begun to clear several areas of mines in the CCZ (Landmine Monitor Report, 2006);
- ordinance from military testing grounds and exercises in the CCZ;
- air emissions from nearby Inch'ŏn airport, cars from Seoul residents, and intentional and accidental fires;
- agricultural chemicals used in rice fields near the DMZ;
- deforestation, particularly in North Korea, that has caused extensive erosion and flooding in that country, with some serious effects also occurring in South Korea; and
- runoff into the East and West seas from agricultural operations.

According to the 2005 Yale University Sustainability Index, South Korea and North Korea ranked 122 and 146 respectively out of 146 countries (Yale University 2006). But, therein lies the opportunity presented by sustainably managing the DMZ and CCZ. Preserving critical habitats of these two areas can enhance linkages between other existing natural areas within Korea and North Asia, improving all of them in the process and enhancing ecosystem services available for the region. There is a South Korean government agreement to allow protection of the DMZ for two years after reunification. Planning now underway can optimize that agreement. Safeguarding the DMZ will depend on the political will to create and implement plans and to develop and enforce legislation and regulations governing use of the DMZ.

Developing baseline data will be of significant assistance in managing the effects of pollution, climate change, military operations, fires, and deforestation. These data will help determine changes that have taken place in the DMZ over about sixty years, *and* in assessing impacts from future changes. The installation of appropriately placed monitoring stations can facilitate data collection and could be done collaboratively between North Korea and South Korea. Other monitoring devices also could assist both countries in weather forecasting, predicting potentially disruptive storms and “yellow dust” from the Gobi Desert.

DMZ and CCZ land mines offer an opportunity to work with the world community towards a safer, more cost-effective solution to removing those mines that is not as destructive of surrounding habitat as conventional technology. Currently, mines can cost up to \$1,000 each to remove, which for the DMZ and CCZ would amount to about \$1 billion (UNICEF). Numerous organizations, like Roots of Peace in the United States, are dedicated to safe removal of mines in Afghanistan and other war-torn countries. Their assistance can be enlisted in this task.

Military operations also create the potential for contamination, with both exploded and unexploded ordinance. As has been the case with transboundary parks in South Africa and neighbouring countries, military personnel can be trained in conservation stewardship to provide future job opportunities as game wardens and guides. Such local jobs and a micro -oan program also could help alleviate income disparities for North Koreans near the DMZ.

Other potential threats to the DMZ and CCZ include: deforestation, legal claims to land, costs of implementing plans, river channelization, unsustainable farming practices, balance of power among stakeholders, increasing population, exotic species, and income disparities in and near areas being conserved.

INITIATIVES TO SAFEGUARD DMZ RESOURCES

A number of mechanisms to help preserve DMZ and CCZ species and habitats already have been suggested, including some studies to identify species and possible actions steps:

- In valuing the DMZ through the lens of the IUCN (International Union for Conservation of Nature) 1997 Red Data Book criteria for assessing sites, there are at least twenty species at risk of extinction, including the Red-crowned and White-naped Crane.
- The DMZ contains a number of resources that satisfy UNESCO World Heritage Site criteria, including: *endangered animals* like the Amur Goral; *natural habitats* like the wetlands; *earth's evolutionary processes* such as rice paddy wetlands, and peat lands; *physical and geological formations* such as the limestone caves in Cheorwon; and *reserves for large numbers of animals* like the Han, Imjin, and Nam rivers.
- According to criteria of the Ramsar Convention, there are numerous important wetland areas including: Yong neub area of Daeam Mountain – already a Ramsar designated site, wetlands in Paju and Cheorwon, and the island of Kanghwa with its adjoining tidal flats and estuary wetlands.
- The DMZ meets all UNESCO Transboundary Biosphere Reserve (TBR) program criteria: ecosystem representing a biogeographic region; containing a variety of species and habitats to be conserved; where sustainable development can be applied; and where public institutions, regional communities, and the private sector may participate (Kim and Cho 2005).
- Mt. Keumgang and Mt. Seorak of North Korea and South Korea respectively are on the “Tentative List” of UNESCO for potential designation as biosphere reserves under UNESCO’s World Heritage Site program.

- The DMZ possesses several features that would make it a candidate for the Man and Biosphere (MAB) program of UNESCO, whose “main lines of action” are: (1) *minimizing biodiversity loss* through research and capacity-building for ecosystem management, including research, training, and education; (2) *biosphere reserves*-promoting sustainability, including the concept of using biosphere reserves as a platform for conflict prevention, increasing knowledge of environmental sustainability, and involving young people; and (3) *enhancing linkages between cultural and biological diversity*, including local-level sustainable use of biodiversity and raising awareness of the role that cultural landscapes play in ecosystem management (UNESCO).
- A Green Belt like the one that replaced the Cold War wall between East and West Germany. A similar concept has been explored for East European borders with former Soviet bloc countries. A green belt was established in Kenya that has inspired similar efforts in other parts of Africa.

Numerous Korean non-governmental organizations (NGOs) are active in DMZ conservation, including the Korean Federation for Environmental Movement (KFEM) and Green Korea United. There also are numerous government initiatives, including:

- Korea Environment Institute (KEI), a government research organization, conducting research on the DMZ;
- National Institute of Environmental Science (NIES) work on DMZ species;
- National Museum of Biodiversity Resources;
- Forestry Administration;
- Presidential Commission on Sustainable Development, including work on a river estuary project;

- Gyeonggi and Gangwon Provinces – planning activities. In addition, individual counties that border the DMZ, such as Cheorwon, have been conducting their own planning activities.
- Ministry of Maritime Affairs and Fisheries – promoting designation of an international marine peace park in the marine borders of South Korea and North Korea;
- Ministry of Administration – conducting a land survey in the southern portion of and inside the DMZ;
- Ministry of Defense – creating and publicizing audiovisual materials on ecosystems for officer training programs; and
- Office for Government Policy Coordination – operating the National Council of the Master Plan for DMZ Ecosystem Conservation. (Lim 2007)

Dozens of conferences have been held on the subject in Korea and in the United States since the early 1990s. They have promoted dialogue on the global uniqueness of the DMZ and CCZ and on potential ways of preserving these habitats and species, including the possibility of designating the DMZ as a TBR under UNESCO. Participants, like the Peace Park Foundation of South Africa, have shared their experiences in creating such parks. Visionaries like Nelson Mandela and CNN founder Ted Turner, have lent their support. Mr. Turner and the Turner Foundation have helped to sponsor conferences and have travelled to North and South Korea to discuss DMZ preservation with high-ranking government officials.

The DMZ Forum, Inc. has conducted numerous conferences in the United States and Korea, twice with sponsorship from Gyeonggi Province. It also formed a DMZ Coalition, patterned after similar groups in the United States and elsewhere to provide assistance in preserving DMZ resources. The International Crane Foundation initiated a project in North Korea in 2008. Its purpose is to help local farmers improve their crop yield, provide more food for humans and cranes, and restore habitat

for migratory cranes. Significant progress has been made on this project. Examples include: designation of the Anbyon Plain nature reserve near the port of Wonsan, increased rice crop yields using organic fertilizer, and education and training of farmers and residents.

DISCUSSION AND CONCLUSIONS

The following are some of the many potential steps that could assist in preserving the globally unique assets of the DMZ and CCZ:

Diplomacy

As has been done by South Korea in the case of migratory birds, it may be helpful to link into already existing international conventions and treaties, such as the Migratory Bird Treaty and the Ramsar Convention. These two and other instruments create an opportunity to develop common understanding and goals. Other nations and organizations like IUCN can facilitate collaboration and coordination between the two Koreas in creating conservation zones, procedures, and processes. These treaties provide examples of successfully implemented programs; they also can aid in establishing plans and standards, in obtaining funding and creating linkages with natural areas in the region, thus enhancing the ecosystem service and conservation values of these resources.

In recent years there has been the “Six-Party Talks” process amongst North Korea, South Korea, the United States, China, Russia, and Japan to deal with nuclear weapons issues in the DPRK. While these talks have a checkered history, they have at times improved dialogue between area stakeholders. They have provided a means for discussing issues of mutual interest and concern. The involved countries have conducted dialogue on additional topics of common interest, including a devastating flood in the summer of 2009 and periodic reunions between North and South Korean families separated by the Korean War. All of these activities provide the opportunity to build trust and to create a web of interdependence and a platform for talking about issues like DMZ conservation.

Education

In South Africa, the Peace Parks Foundation (PPF) and other organizations have established educational institutions to train people who will work in and benefit from sustainable use of their transboundary parks. These can serve as an example of what could be done in the DMZ and CCZ, including technical schools, a university/universities or a ‘virtual’ institution, like the “Great Rivers Partnership,” initiated with a grant from Illinois-based farm equipment manufacturer Caterpillar Inc. to bring together and disseminate information learned on four continents about protecting rivers, under auspices of The Nature Conservancy (TNC). Local schools, civil society organizations, churches, and governments can establish programs to increase awareness of DMZ resources and teach about values of protecting the DMZ. They also can offer job training programs in ecotourism and related fields. These classes would help offset the concern on the part of some communities near the DMZ that they don’t have enough trained workers to fill jobs created by DMZ conservation. Particularly in less-robust economic times, these jobs could be a boon to the local work force.

Also helpful would be the development of programs to enhance public and decision-maker awareness regarding values and benefits of DMZ and CCZ resources. These can create the foundation for other educational offerings and activities. Since the DMZ border area has been on a war footing for so long, an awareness-building program will help engender the basic values as to why the DMZ is important, how globally unique it is and why it is in people’s best interest to sustain it.

Legislative, Legal

One of the elements essential to conserving land is precise knowledge of who owns the land. This information facilitates appropriate compensation of present and past landowners and helps to ensure fairness for local land holders; it also encourages their buy-in to the conservation process when they know that they will be properly remunerated. The opposite also can be true – if they are not included or compensated, they could be a significant impediment to the process. Therefore, it is suggested that a study be

conducted of ownership claims for DMZ and CCZ lands, some of which predate the Korean War and are in various languages. Land claims may involve documents that have been destroyed or are in the possession of descendants no longer living in Korea.

As part of conserving the land, legislation and regulations will be required to keep it protected. The legal framework will need to include enforcement, monitoring, and appropriate levels of funding as well as clear and transparent standards of protection.

Planning

Planning at many different levels of society will be helpful in ensuring the sustainability of DMZ conservation. Through coordination of the planning process and including all stakeholders on an open and transparent basis with “free, prior and informed consent” future disputes, conflict, and disenfranchisement will be more manageable. Included in the process should be a method of dispute-resolution.

Suggested also is a plan for land mine removal, providing funding for experimental technology and research to identify or create lower-cost methods that do not destroy surrounding landscapes. Current estimates for removing land mines will make it beneficial and economically feasible to investigate and conduct research on lower-cost technologies. Minimally destructive land mine removal will help avoid destroying the natural resources around the mines that ultimately are to be protected.

Numerous species, like the Oriental White Stork and Crested Ibis, have been removed from the Korean peninsula over recent decades. Conserving the DMZ and parts of the CCZ provide an opportunity to reintroduce some of them. Conservation organizations within and outside Korea are working on these prospects. They can work together to develop re-introduction programs for species that once were prevalent in Korea and that could live successfully in the DMZ/CCZ.

When planning, it is suggested that a holistic approach be used in assessing DMZ and CCZ value by looking at the areas from a watershed and ecosystem or ecoregional point of view. Many species in the DMZ and CCZ live throughout Asia. Cranes migrate from Russia. Large fauna, such as leopard, travel throughout the peninsula. Tigers, once common in

mountains outside of Seoul, live in the Russian Far East. With a watershed and ecosystem-wide perspective, it also is easier to involve and motivate people living in the area.

Studies

Some species inventories already have been conducted within the DMZ and CCZ under auspices of the South Korean Ministry of Environment. Various academics and non-governmental organizations have participated in this work. Due to current controls on and landmines within the DMZ, it is difficult to carry out in-depth studies in that area. However, when possible, assessments of habitats and species and cultural assets are a first step essential to determining critical areas for conservation. Using Geographic Information Systems (GIS) and Global Positioning Systems (GPS) will help to create systematic and coordinated surveys; they also will facilitate making data available to the public and all other stakeholders for decision-making.

One tool that can assist decision-makers in conserving DMZ resources will be ecosystem services studies to value resources on a sustainable basis. By valuing the resources in financial terms, it will be possible to create a common framework understandable to everyone. There are some ecosystem service experts within South Korea who can collaborate with others elsewhere in the world. One centre of this expertise now exists at Stanford University, California, where a study of “natural capital” is being sponsored jointly by Stanford, the World Wildlife Fund, and TNC.

Numerous techniques from around the globe exist for conserving large tracts of land such as the DMZ. For many years, TNC, one of the world’s largest conservation organizations, has successfully employed debt-for-nature swaps, conservation easements, and trade lands to name a few. Increasingly, partnerships between the public and private sectors are facilitating the preservation of land for ecological purposes while also allowing landowners to fulfill their goals. Debt-for-nature swaps have helped countries like Costa Rica reduce their national debt and at the same time save large amounts of land for conservation, and in the process attract unprecedented revenues from ecotourism.

CONCLUSIONS

It is important in any of these efforts to obtain the perspective of all stakeholders, especially the Korean people. North Koreans do not want to “protect the DMZ” in its present state. It is a symbol of war, suffering, and separation. The emphasis here is on *preserving* the natural and cultural resources *in* the DMZ and CCZ that are irreplaceable and globally unique for the ecosystem service and intrinsic benefits to Koreans and people around the world.

Extremely important cultural, biological, and financial benefits can accrue to the Korean people and the world by preserving natural and cultural resources of the DMZ and CCZ. Due to a host of potential threats to these areas, there is obvious urgency to the preservation process. In Korea vital initiatives already are underway to assist preservation. More steps can and will be taken to ensure future sustainability of DMZ and CCZ resources as well as the people who depend on them.

REFERENCES

- Archibald, G. 2007. Co-founder, International Crane Foundation, conversation, 4 September 2007.
- Chong, J. R., and H. H. Pak. 1994. “The migration routes and important rest-sites of cranes on the Korean Peninsula.” In *The Future of Cranes and Wetlands*, ed. H. Higuchi and J. Minton, 41–50. Tokyo: Wild Bird Society of Japan.
- Coulter, M. 2007. Co-Chair-IUCN Specialist Group of Storks, Ibises and Spoonbills, conversation, 4 September 2007.
- Cummings, B. 1997. *Korea's Place in the Sun, A Modern History*. New York: W. W. Norton.
- Ministry of Environment, Republic of Korea. 2003. “Guidelines of benefit-cost analysis of environmental policy.” Seoul, South Korea.
- Healy, H. 2007. “Korean Demilitarized Zone: Opportunity to help reduce economic asymmetries on the Korean Peninsula.” *Journal of Economic Asymmetries* 4(1): 99–110.

- Higuchi, H., K. Ozaki, G. Fujita, J. Minton, M. Ueta, M. Soma, and N. Mita. 1996. "Satellite tracking of white-naped crane migration and the importance of the Korean Demilitarized Zone." *Conservation Biology* 10(3): 806–12.
- Kim, K. C. 1997. "Preserving biodiversity in Korea's Demilitarized Zone." *Science* 278: 242–43.
- . 2001. "A study on the feasibility as well as an operational strategy to develop DMZ transboundary biosphere reserve between DPR Korea and Republic of Korea – Final Report." A research report submitted to the UNESCO Jakarta Office under the Special Agreement Contract #850.
- . 2007. "The DMZ conservation in global climate change." Paper presented at *International Conference on Korea's DMZ Conservation: Science and Impact Assessment*, 4 June 2007, Seoul, Korea.
- Kim, K., and D.-G. Cho. 2005. "Status and ecological resource value of the Republic of Korea's De-militarized Zone." *Landscape and Ecological Engineering* 1(1): 3–15.
- Kwon, Y.H., and Y.I. Song. 2007. "EIA and economic cooperation for conservation of the DMZ region-Pan-Korea's perspective." Paper presented at *International Conference on Korea's DMZ Conservation: Science and Impact Assessment*, 4 June 2007, Seoul, Korea.
- Li, F. M., J. ZhiMing, M. FanHao, and X. ZhiLi. 2005. "Osteoblastic proliferation stimulating activity of *Epimedium koreanum* Nakai extracts and its flavonol glycosides." *Pharmaceutical Biology* 43(1): 92–95.
- Lim, C. 2007. "Master Plan for DMZ Ecosystem Conservation." Paper presented at *International Conference on Korea's DMZ Conservation: Science and Impact Assessment*, 4 June 2007, Seoul, Korea.
- Pagiola, S., K. von Ritter, and J. Bishop. 2004. *Assessing the Economic Value of Ecosystem Conservation*. Washington, D.C. The World Bank Environment Department.
- Shin, J. H. 2007. "Unique Biodiversity and Landscapes of Korea's Demilitarized Zone (DMZ): Overviews." Paper presented at *International Conference on Korea's DMZ Conservation: Science and Impact Assessment*, 4 June 2007, Seoul, Korea.
- Weisman, A. 2007. *The World without Us*. New York: Thomas Dunne.
- Wilson, E. O. 2003. *The Future of Life*. New York: First Vintage.
- Yale University. "Pilot 2006 Environmental Performance Index (EPI), Appendix C, Country Profiles." <http://www.yale.edu/epi/>
- Yu, Y., and C. Wong. 2006. *The International Black-faced Spoonbill Census: January 2006*. Hong Kong: Hong Kong Bird Watching Society.

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