

비무장지대의 습지생태계 보전방안

—철원지방을 중심으로—

The Conservation strategy of DMZ wetland in Cheolwon, Korea

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:: 요 지 ::

우리나라의 비무장지대는 북위 38도를 중심으로 동서로 띠 모양을 이루고 있으며 총 면적이 907.3km²에 이른다. 비무장지대외곽에는 민통선이 비무장지대의 남쪽 5-20km 아래에 위치하고 있으며 이곳에는 15개의 시, 군, 98개 읍, 면이 있다. 또한 동해에서 서해로 이르는 내륙의 접경지역은 약 248km에 이르며 이곳에는 2,800여종의 동식물과 146종의 희귀 동식물이 다양하게 분포하는 우수한 생태계를 이루고 있다. 하지만 이 지역은 남북교류 및 협력의 강화로 인해 향후 남북교류와 통일을 위한 전략지역으로 활용되기 위한 방안이 논의되고 있다. 그 결과 남북접경지원법(2000)이 제정되었고 각종 개발사업의 시행이 이 지역의 우수한 생태계를 훼손하려하고 있다. 철원의 비무장지대를 비롯한 습지지역은 세계적인 희귀 철새이며 우리나라의 멸종위기종인 두루미의 서식지공간으로 활용되고 있다. 철원지방의 두루미서식지 보전을 위해 벼농사 추수 후 농경지를 그대로 유지하는 것이 중요하다. 우리나라 비무장지대의 보전을 위해 유네스코의 접경지원보전방안의 도입이 필요하다. 보전계획을 수립한 후, 보전지역 확보를 위한 자금이 조성되어야 하며, 지역주민의 참여를 유도하는 생태관광의 도입이 필요하고, DMZ를 교육 및 연구의 중심지역으로 발전시키는 방안이 강구되어야 한다. 국제사회의 주목을 받고 있는 자연생태계우수지역의 유지, 발전을 위해 정부, 학계는 같이 노력하여야 한다.

핵심용어: DMZ, Cranes, TBR, wetland, Cheorlwon county, migratory birds

I. Introduction

Demilitarized Zone (DMZ) has been preserved for the last 50 years in which represents biological diversity in Korea peninsula(Kim and Wilson 2002). This

region is also known internationally as an excellent nature preservation areas.

Demilitarized Zone that separated two Koreas has been undeveloped since 1953 harbored numerous endangered plant and animal species. Rare and endangered animal

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and plant species, controversially leopards (*Panthera pardus orientalis*) and tigers (*Panthera tigris*) have increased in population (Archibald 1981). Furthermore this area provide home for endangered migratory birds including white-naped (*Grus vipio*) and red-crowned cranes (*Grus japonensis*) (Higuchi 1996) and black-faced spoonbills (*Platalea minor*). Migratory birds most concentrated on low hills and meadows with natural vegetation and agricultural paddies. Migratory birds utilized not only Civilized Control Zone (CCZ) but DMZ for their roosting and resting activities.

The importance of conservation is often magnified by recent warm atmosphere among two Koreas. The potential reunification will open the possibility to swift development. The master plan for DMZ has been proposed as a development center for housing, water resources, increasing infrastructure (Lee and Jung 2002). This paper thus aims to analyze current status of DMZ and set up conservation strategies in accordance with UNESCO Transboundary Biosphere Reserve (TBR) program.

II. Current Status of Demilitarized Zone and Civilian Control Zone, and Transboundary in Korea

1) Geographical sketch

The borderline of North-South Korea is

composed of Demilitarized Zone, CCZ, and transboundary zone (Fig. 1). DMZ is 907.3km², and 2 km each of North and South of 38th parallel with 248km stretch from the west to east coastal line. Those areas included regions around transboundary areas that are supported by the Transboundary Supporting Act article 2, item 1. Civilian Control Zone is 1,369.6km² and 5-20 km apart from the southern borderline of DMZ. Outside of CCZ there is Transboundary with 8,097km² including 15 small cities and counties and 98 eup, myun and dong (small town).

2) Current status of natural environment

The North-South borderline is 248 km that stretches from east to west coastal areas. In the East there are Baekdu-daegan (mountains), rivers, wetlands and plateaus whereas in the West various types of habitat for animals and plants. In the borderline there are 2,800 species of flora and fauna including 146 species of endangered or protected (Byun 2002). Especially Cheolwon and Hyangrobong in DMZ are important habitat for migratory birds. Yong wetland at Daeam mountain is also listed as RAMSAR site. DMZ is especially protected for many decades due to strict entrance so that they preserve primitive natural habitat and providing places that are worth monitoring (Table

1). Important counties that harbor many endangered species and habitat are Gangwha county (mullet goby, Mugilogobius abei and rare fishes, hawk breeding), Gimpo county(wetlands for wintering birds, crane species), Paju county(wintering habitat for migratory birds), Yunchun country(Korean bittering and other rare fishes, endemic fish species), Yanggu county(Amur goat, *Naemorhedus goral raddeanus* and flying squirrels, *Pteromys volans aluco*, Manchurian trout, *Brachymystax lenok*, rare birds and butterflies), and Gosung county(prominent valleys and virgin forests, southern limit for black star minnow, *Moroco semotilus*, whooper swan, *Cygnus cygnus* and mute swan, *C. olor*) (MOE 2000).

III. Cheolwon as important wetlands for wintering cranes

Cheolwon county is composed of 70% mountainous areas which connected to Gwangju mountains in northeast. In northwest there is a plateau made of explosion by basalt, and in southeast is there above 1000 m that connects to Taebaek mountains which are a part of Baekdudaegan. Cheolwon plains are famous of rice production that is most suitable for soil and geological composition. The plains are also surrounded by numerous mountains that make plains more prominent. Streams in Cheolwon county flow through the center of county and the branch stream is connected to Namdae stream and finally makes a big

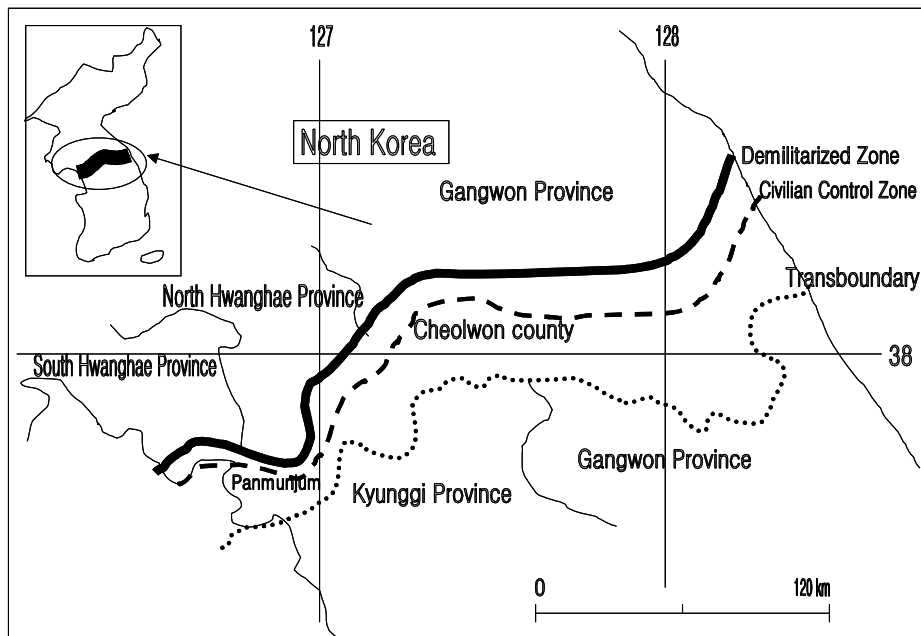


Fig 1. Demilitarized zone centered around 38th parallel, Civilian Control Zone, and Transboundary

Table 1. Current status of natural resources in DMZ and the surrounding areas

Areas	Status of Natural Resources
Whajin estuary and Songji lake	-High in biological diversity, and wintering sites for mute and trumpet swans(natural monument no.201)
Mt. Gunbong, Hangro, Gachil, Daeam	-High in biological diversity -unique areas for wetlands in high altitude(avifauna not much studied)
Cherlwon plains	-wintering sites for red-crowned cranes, white-naped cranes that constitutes 6.5% of world population, and stop over for over 20% of world population. -Mallards(<i>Anas platyrhynchos</i>), great egrets(<i>Egretta alba</i>), grey-herons (<i>Ardea cinerea</i>), Spot-billed ducks(<i>A. poecilorhyncha</i>)
Mt. Chunbul, Cherlwon	-residential areas for kestrel(<i>Falco tinnunculus</i> , natural monument). In north wetland species abundant, high in biodiversity
Mt. White-rock, Mt. Jukgeun	-well preserved forest areas, high in biodiversity, habitat for forest birds
Chunmi-ri, Dutayeon, Yanggu	-great tits(<i>Parus major</i>) are dominant, mandarin ducks(<i>Aix galericulata</i> , natural monument 327), Golden eagle(<i>Aquila chrysaetos</i>)
Panmunjum, Daesung-dong	-Bean goose(<i>Anser fabalis</i>), white-fronted goose(<i>A. albifrons</i>), spot-billed ducks, whistling swan(<i>Cygnus columbianus</i>), red-crowned cranes, white-naped crane, golden eagles, black vultures(<i>Aegypius monachus</i>), habitat for rare species
Han river	-Wintering sites for white-naped cranes and swan goose(<i>Anser fabalis</i>)
Kimpo, Yoo-islands	-Large rookeries for great-egrets(<i>Egretta alba</i>), little egrets(<i>E. garzetta</i>), cattle egret(<i>Bubulcus ibis</i>), wintering sites for Spoon-bills(<i>Platalea leucorodia</i>) in 25% world populations
Gangwha island, Yeocha-ri, Gillsang-myun, Sundoo-ri	-Dunlin(<i>Calidris alpina</i>), Kentish plover(<i>Charadrius alexandrinus</i>), black-tailed gull(<i>Larus crassirostris</i>), greenshank(<i>Tringa nebularia</i>). Habitat for black-faced spoonbills(<i>Platalea minor</i>), red-crowned cranes, marsh sandpiper(<i>T. stagnatilis</i>), Saunder's gull(<i>L. saundersi</i>), Osprey(<i>Pandion haliaetus</i>). Artificial fish ponds and surrounding tidal flats are habitat for black-faced spoonbills
Sukmo-island, Daesong-island	-Oystercatcher(<i>Haematopus ostralegus</i>), Spot-billed ducks
Gyodong-island	-Rare species of night herons(<i>Nycticorax nycticorax</i>), mallards, natural monuments(kestrel, Saunder's gulls, spoonbills, Chinese egrets(<i>Egretta eulophotes</i>) etc
Youngjong-island, Sammok-island	-Sammok-island is habitat for dunlin, black-faced gulls, Kentish plover(<i>C. alexandrinus</i>), grey plover(<i>Pluvialis squatarola</i>), Curlew(<i>Numenius arquata</i>). Youngjong-island are dominated by sandpiper species, marsh sandpiper(<i>Tringa stagnatilis</i>), -Roosting sites for Saunder's gull(internationally protected species)
Kimpo land reclamation sites	-Mallards, spot-billed ducks, black-tailed gulls, Great egrets, Natural monuments (red-crowned, Saunder's gulls). streams and reeds, west wetlands served as resting and feeding sites
Shin-island, Woongjin county	-Large number of Chinese egrets, roosting sites for black-tailed gulls
Baekryung-island	-Cliffs in Doomu-jin and Yonggi-po are home for cormorant species and stopover for hawks, sparrow hawks(<i>Accipiter nisus</i>), Chinese sparrow hawks(<i>A. soloensis</i>), Hodgson's hawk eagle(<i>Spizaetus nipalensis</i>), Grey-faced buzzard eagle(<i>Butastur indicus</i>), Red-breasted flycatcher (<i>Ficedula parva</i>), Narcissus flycatcher(<i>F. narcissina</i>), Pallas' willow warbler(<i>Phylloscopus proregulus</i>)

river of Imjin. The highest point in Cheolwon county is Baekam peak with 1179 m.

Cheolwon is best known as a wintering migration site for crane species(Fig. 2), and red-crowned crane, white-naped crane(*G. vipio*) are two most common; hooded crane(*G. monacha*) and common crane(*G. grus*) are rare visitors. Cranes make biannual migrations during which they use wetland, grassland, or agricultural areas as stopover sites (Archibald 1981). Crane species in East Asia many of which are endangered, migrate between southeastern Russia and northern China to central China and Japan.

Cheolwon, located 75km north-northeast of Seoul is a wide basin spanning the DMZ. It was abandoned by people at the end of the Korean War and reverted to grasslands and marshes during that time. It was discovered to be a wintering site for white-naped and red-crowned cranes in the 1970s, but it was reclaimed for agriculture in the 1980s(MoE 2000, 2001).

The red-crowned crane of east Asia is listed as an endangered species by Ministry of Environment in Korea (Lee et al, 1998). It is closely associated with wetlands, which are being converted for agricultural use at a rapid rate throughout Asia. Red-crowned cranes breed only in north-east Asia, where they have two separate populations. Red-crowned

cranes migrate from two breeding sites in continental Asia during their autumn migrations. It was revealed the timing of their movements and the exact locations of stopover sites by satellites(Higuchi and Minton 2000).

The cranes moved among Cheolwon, Anbyon and Kumya, and showed similar patterns of site choices and timing(Higuchi 1996). After arriving at Cheolwon on 18 November, the cranes stayed 3-4 days before moving to Anbyon, where they stayed for 6 days. Then they moved to the Rhonhung River mouth in Kumya, staying for 6 days. They then returned to Anbyon and continued to move between there and Kumya, spending between 3 and 8 days at each site. The wintering sites of Cheolwon, Kumya and Anbyon are within 125km of each other and their proximity apparently allows cranes to make these local movements(Fig. 2)(Higuchi 1996).

The daily movements on wintering grounds of the eastern route showed a clear pattern only at Cheolwon(38.18 to 38.37N, 127.40 to 127.42E). The site can be divided into two sections. The DMZ and the CCZ. The DMZ is off-limits to regular human activities, while the CCZ is a buffer zone which is used only for agriculture and military installations. Additionally there is a difference in habitat types. The DMZ is an area of

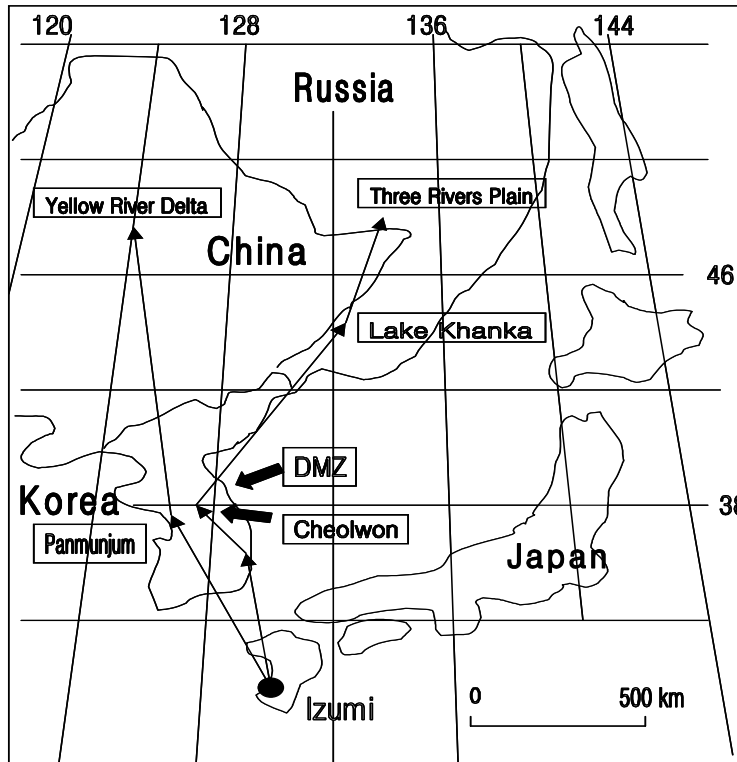


Fig. 2. Migration routes of white-necked cranes satellite-tracked from Izumi, Kyushu, Japan in 1993. The stopover sites in Korea are Panmunjum in the east and Cheolwon in the west

low hills and meadows with natural vegetation, and ice-free stream due to the presence of hot springs. The CCZ is a developed area of irrigated agricultural fields (Table 2).

The daily movement pattern of crane species were also monitored. Red-crowned crane species stayed CCZ for foraging and

feeding whereas stayed DMZ for roosting night time (Table 2). Their movement is limited between CCZ and DMZ which indicated that agriculture paddies are important requirement for habitat, and at the same time red-crowned cranes prefer restricted areas due to disturbance (Higuchi 1998).

Table 2. Activities of red-crowned crane around Civilized Control Zone (CCZ) and Demilitarized Zone (DMZ) wintering in Cheolwon. The data were collected from the satellite image of the Cheolwon wintering site with diurnal (9:00–15:00) and nocturnal (19:00–5:00) locations.

red-crowned cranes	Migration Period	CCZ	DMZ
species 1	6–8 Nov	foraging during the day	roosted during night
species 2	7–15 Nov	both feeding site and roost	–
species 3	18–24 Nov	–	foraging and roost

Pae and Won(1994) noted that the CCZ is used as a foraging site by wintering red-crowned cranes because of a low disturbance rate, and an abundance of rice grain remaining in the fields after harvest. They also reported that cranes can roost on frozen reservoirs in the CCZ as well as in ice-free streams on the DMZ, although they did not report on movement patterns of individuals. Although there are agricultural paddies outside of these areas cranes only stayed in this region reflecting disturbance is an important factor for site selection.

Particularly important for the migrating cranes on the Korean Peninsula are the DMZ and CCZ in Cheolwon area. The DMZ and CCZ areas were also frequently used by white-naped cranes as rest sites (Higuchi 1996). These areas do not presently have any wildlife protection status, and development plans for infrastructure are presently being conducted with industrial projects.

We must conserve these important areas as a network, not separately. The conservation of these areas must be approached from an international perspective because the migration routes themselves cross several national boundaries. Satellite tracking data should be useful to promote international cooperation for conservation of migrating cranes and their habitat (Higuchi 1998).

The total activity area of five

white-naped cranes which rested at this site ranged from 38.20. to 38.32. (21.7 km NS) and from 127.04. to 127.34. (61.6km EW). This area is located in Korea and included as a part of the DMZ. This is the only inland site among the important rest-sites. The cranes feed and roost in the arable fields (Chong et al., 1994)

Wintering migratory crane survey in Cheolwon also was conducted during 2001-2002 (Lee 2002). Total crane population was estimated over 400 individuals of red-crowned and white-naped together. Among the population, 65 groups of cranes were monitored that used agricultural rice paddies. Ploughed rice paddies also were limited to 7 groups of cranes. Each group was used most of their time for feeding (20/65, 36%) indicating cranes liked to feed left-over rice grains after harvest. While feeding cranes were locomoting (17/65, 26.1%) that indicates cranes cover a large area for their feeding and survival. Alert behavior also was reported(16/65, 24.6%) presumably because of road construction and tourism. It is recommended to preserve CCZ especially rice fields for crane(Lee 2003).

IV. Designation of UNESCO Trans-boundary Biosphere Reserve(TBR)

The potential reunification of DPRK

and ROK will open the possibility to swift development. In preparation for reunification the Korea Research Institute for Human Settlement (KRIHS) has proposed a plan for increasing infrastructure, water resources, and economic growth in 10 ROK counties that border the DMZ. A road through the Cheolwon basin is already under construction, and its impact on the cranes has been unmitigated.

The relevant factors for UNESCO TBR designations are : 1) population, geological information, historic sites, eco-tourist areas, land use policy for fundamental inventories, 2) case study for TBR in foreign countries and their management plan, 3) land use policy for regional characteristics(core, buffer, and transition areas), 4) sustainable use for environmental conservation and management policy for local residents, 5) public participation, and cooperation for nature preservation, incentive system for involving conservation activities.

Most of the threats to rest-sites are human disturbance or inappropriate land use development. For example a land reclamation project on the west coast of the DPRK to make agricultural areas has been under way. This makes trans-boundary region degraded and destroys the rest-sites of the west coast around Mundok (Chong et al. 1994). The largest problem is for the rest-sites in Pan-

munhom and Cheolwon. Because those are adjacent to both ROK and DPRK thus being prime areas for development in preparation for any reunification of the two countries which may come about. KRIHS has proposed a plan for increasing infrastructure, water resources and economic growth in the ten ROK counties which border the DMZ. Field biologists and nature conservation organizations of DPRK and ROK have not cooperated on research or measures for nature conservation, though they have each conservation efforts using the results of their own research. The conservation of cranes will make great strides forward if we establish a common reserve, at least in DMZ, and make cooperative research projects between the two nations(Chong et al., 1994).

Currently Ministry of Environment and other related environmental organization are launching the designation of UNESCO TBR (Transboundary Biosphere Reserve). The habitat will be categorized into four groups (Table 3).

Even though MOE divided trans-boundary areas for 4 categories, the criteria are not so clear enough to separate the areas into development and conservation. For example, in Cheolwon most areas are used by wintering crane species and at the same time agricultural activities are under way. Based on the categories, most areas in Cheolwon must

Table 3. Four habitat categories of transboundary region(TBR) for future land planning in Republic of Korea (ROK)

Habitat Categories	Transboundary	Contents
Reserve habitat	DMZ	designation of core habitat in TBR for 2 years after becoming property of ROK
Conservation areas	1st degree of degree of ecological naturality(DEN)	major habitat for endangered and protected fauna and flora
semi-conservation areas	2nd degree of DEN	colonization habitat used for ecotourism, education, research, etc
Reclamation areas	3rd degree of DEN	-development project after EIA process -planning first and development followed -agricultural and residential areas

be designated as natural reserve due to uniqueness of habitat used by red-crowned and white-naped crane species. I believe, before too late, MOE(2001) should designate areas for natural reserve and areas for development. In a near future areas in transboundary will face increased development pressure.

Transboundary Support Act was activated in 2000 stating that government will support necessities to transboundary region for economic development and welfare for residents, systematic preservation of natural environment, and foundation of peace unification. Experts are expecting that transboundary will face an increased infrastructure such as roads, railways, and other facilities for transportation, education including major national universities, factories, sports and other recreational purposes. These development projects will allow degradation of wetland and forests resulted in the loss of ecosystem in transboundary.

V. Conclusions

We should discuss seriously how to use lands in preservation and management systematically. First, a comprehensive preservation plan is needed based on the diverse natural, geographical and economic characteristics. This plan should also consider the networks for greenness, wildlife corridor, wetland connectivity with other invaluable natural resources around DMZ.

Second, accumulation of funding is important to save transboundary. Based on our experiences in previous economic development during 1960-80s residents and local people usually are against designation of natural reserve or preservation. In this regard we should compensate the economic loss to local residents whose properties will be limited.

Third, ecotourism should be activated for prominent natural resources. In transboundary there are natural habitat for wintering migratory birds inter-

nationally rare and endangered species. For example in Cheolwon wintering habitat is used to gather bird watchers from other countries. This area is one of unique migratory habitat in the world to harbor two different crane species (red-crowned and white-naped) at the same time in the wild. Ecotourism will provide economic gain with local residents to understand that preservation and economic gain can be achieved at the same time. This also increase eager participation on the community side. For example rice in Cheolwon area is highly priced only due to the "clear" image as crane protection. It is local farmers who actively involve in conservation efforts to crane.

Finally, in DMZ a visitor center for advertisement and natural environment education should be established. This area can provide beauty of natural environment to visitors and scientists can monitor and investigate valuable flora and fauna. Government in Korea should implement the concrete planning and projects how to manage transboundaries.

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