

Natural Resource Management Model in the Transboundary Areas between South and North Korea

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1 Introduction

Conflicts over natural resources emerged and increased including the issues such consumption of minerals, water, forest, and land; growing populations; climate change; and technological development (Brown and Keating, 2015; Green, 2005). Conflicts over natural resources take different forms based on the intensity, duration, and scope of the dispute (Hellström, 2001). Globally, more than 70 million people have been affected by their interconnections with nature conservation across the conflict life cycle, involving war itself and pre- and post-war processes (IUCN, 2021). Specifically, developing countries have faced challenges in managing their natural resources in terms of social restriction, unstable government states, and economic growth (Bavinck et al., 2014; Hailu et al., 2011).

A borderland is the point where one country's sovereignty ends and another country's sovereignty begins, indicated by a line on the map. Most of the border areas are not subject to management due to lack of access from the central government. Border areas, particularly in low- and middle-income countries, lag behind in infrastructure and institutional development. According to UN WATER, there are 263 rivers and lakes flowing in border areas around the world, 37 serious conflicts since 1948, and about 295 international water conventions to resolve conflicts. International and transboundary disputes over the use of water resources mainly involve various issues such as inland canals, water quality management, agricultural water use, dam construction and hydroelectric power generation (Abu-Zeid, 2001). In particular, more conflicts and extreme relationships are formed in places where there is no dialogue and cooperation system between countries (Caponera, 1985). The most frequently cited cause of water resource conflict is the asymmetry between countries upstream and downstream of rivers. Due to the nature of water, upstream countries can preoccupy the benefits compared to downstream countries, and it also affects pollution (Ahn et al., 2011). Conflicts over resource use, such as illegal harvesting, hunting, and poaching, are intensifying in border areas due to various stakeholders. Voices supporting peaceful coexistence among stakeholders through conservation of natural resources are growing internationally (Muboko, 2017). Recently, the role of global actors acting on the basis of international agreements to protect the environment and biodiversity is growing. Due to the importance and vulnerability of border areas, international movements to protect them from external threats have become active, and various stakeholders in addition to the state and local residents have appeared in border area

management. Accordingly, the need for border area management governance including various stakeholders is emerging (de Jong et al., 2012). Based on this context, this study focuses on characteristics of natural resource management conflicts on borderlands. It will suggest ways to manage natural resources between the two Koreas by drawing implications through the analysis of cases of conflict management of natural resources on borderlands.

2 Literature Review¹⁾

2.1 Definition of border regions

Academic discussions on borders are often ambiguous because of the lack of conceptual consensus (Baud and Van Schendel, 1997). Boundaries, frontiers, borders, and borderlands are terms explaining the marginal lines defining a country's sovereignty or territories (Table 1). Among various terminologies, this study adopts the concept of a "borderlands" to deal with circumstances cross-cutting or surrounding a country's natural resources. Cultural anthropologists define borderlands as regions where new societies emerge or have emerged with current international borders (Alvarez Jr, 1999; Donnan, 1998; Pavlakovich-Kochi and Morehouse, 2017).

Table 1. Definitions of border regions

Term	Definition	Reference
Boundary	A comprehensive term describing a division between territorial, demographic, economic, political, and cultural groups. Thus, it is more distinctive than "frontier" and "border"	Parker (2002)
frontier	A softer-defined place or shift zone located between two opposing political, institutional, or ethnic units, or between one such unit and a hinterland, where no other policies exist or where such polities do not come into physical interaction	Prescott (2014)
Border	A permanent dividing line in a specific place that is intended to identify the distinction between political and/or administrative units	Prescott (2014)
Borderlands	Areas surrounding or between political or cultural entities where physical, governmental, sociological, historical, and economic factors or processes combine to form borders or frontiers	Parker (2006)

1) This Chapter is a part of the thesis by one of authors (Lee., 2022).



2.2 Transboundary natural resources conflict and management

Conflicts rooted in natural resources in the transboundary region have been the subject of systematic reviews and meta-analyses in several studies. Some studies focus on one natural resource. For example, Schillinger et al. (2020), through a systematic review of the scientific literature, determined the impact of armed conflicts on water resources. Their results indicate the vulnerability of water resources to the impacts of conflicts (Schillinger et al., 2020). Llamosas and Sovacool (2021) conducted a systematic review of the literature on dams in a transboundary region to better understand the characteristics of transboundary hydropower. In addition, other studies focus on other issues and/or regions. Vesco et al. (2020) investigated the link between conflict and natural resources through a meta-analysis. Their results demonstrated a higher possibility of conflict in cases of resource scarcity and abundance. Muboko (2017) assessed the contribution of trans-frontier conservation areas (TFCAs) and a framework thereof for cooperation and peace in the Southern African Development Community (SADC). The results highlight the relevance of institutional frameworks of TFCAs and SADC's efforts for peace and cooperation (Muboko, 2017). Cuvelier et al. (2014) studied the effects of natural resource governance on populations in fragile and conflict areas in Central Africa and the Sahel region. Furthermore, through a meta-analysis, Rutte (2011) noted potential conflicts regarding maintaining sacred natural sites and institutional arrangements to resolve these. The research highlighted the importance of strategies strengthening local community rights to manage sacred natural sites (Rutte, 2011). Also, through a meta-analysis, Andrade and Rhodes (2012) identified key factors that can improve compliance with conservation policies on protected areas. The findings indicate a beneficial relationship between community engagement in decision-making and compliance with guidelines for protected areas (Andrade and Rhodes 2012). Recently, Lee et al. (2023) analyzed the characteristics of natural resource conflicts and management in border regions worldwide by five spheres of earth system including the atmosphere, lithosphere, hydrosphere, biosphere and anthroposphere.

Table 2. Literature Review regarding transboundary natural resources conflict and management

Case No.	Title	Authors	Highlighted points
1	Water in war: Understanding the impacts of armed conflict on water resources and their management	Schillinger et al. (2020)	Effects of armed conflict on water resource management
2	Natural resources and conflict: A meta-analysis of the empirical literature	Vesco et al. (2020)	The correlation between natural resources and conflict occurrence
3	Critical natural resources: Challenging the current discourse and proposal for a holistic definition	Schellens and Gisladdottir (2018)	The criticality of natural resources
4	The role of transfrontier conservation areas and their institutional framework in natural resource-based conflict management: A review	Muboko (2017)	The impact of TFCA and institutional basis of natural resources in southern Africa on peace and regional cooperation
5	Resources, conflict and governance: A critical review	Cuvelier et al. (2014)	Effect of resource governance on people in conflict and vulnerable areas
6	The sacred commons: Conflicts and solutions of resource management in sacred natural sites	Rutte (2011)	The value and conflict elements of the sacred natural landscape area as a conservation area
7	Protected areas and local communities: An inevitable partnership toward successful conservation strategies?	Andrade and Rhodes (2012)	Key factors influencing compliance with the protected area (PA) policy in the community.
8	The future of hydropower? A systematic review of the drivers, benefits and governance dynamics of transboundary dams	Llamosas and Sovacool (2021)	Literature analysis surrounding water resources (dams) in the border area: Focusing on causes, benefits, and governance.
9	Transborder governance of forests, rivers and seas.	de Jong et al. (2012)	The governance of the border region surrounding forests, rivers, and seas (case studies)
10	Natural Resources Conflicts on Borderlands Considering the Five Spheres of Earth System	Lee et al. (2023)	Characteristics of natural recourse conflicts by the five spheres of earth system



3 Contextual Background

The Han River estuary, the border area between South and North Korea, is an exit through which the Han and Imjin Rivers flow into the West Sea. Due to the military confrontation between the two Koreas after the Korean War, normal use and utilization have been impossible for the past 60 years. The Han River estuary is an area that can bring significant benefits to both South and North Korea in terms of transportation, tourism, and ecosystem preservation. It also helps to control and prevent floods in the water system if the two Koreas mutually cooperate in the restoration and utilization of the estuary (Kim, 2019).

Figure 1. North-South shared river and dams



Source: Kim (2019)

There are seven shared rivers in the Han River basin, and among them, the Imjin River and the Bukhan River are key rivers for water management in the Han River basin. The total length of the Imjin River is 254 km, and the basin area is about 8110 km². Of the

total basin area, South Korea accounts for about 3,000 km² and North Korea accounts for 5,110 km². Seven Dams, including April 5th Dams 1 to 4, Hwanggang Dam, Naepyeong Dam, and Guryong Dam, have been built in North Korea upstream of the Imjin River. However, due to the lack of negotiation with North Korea, basic data on dams are lacking and it is difficult to manage them according to plans (Lee, 2022).

The Baekdudaegan Mountains are the core mountain range of the Korean peninsula, starting from Mt. Baekdu, passing Mt. Geumgang, Mt. Seorak, Mt. Taebaek, Mt. Cooperation is needed to manage rare flora and fauna and forest resources, but access to the Demilitarized Zone (DMZ) is blocked. For sustainable forest management on the Korean

Figure 2. Baekdudaegan as a key ecological axis of the Korean peninsula



Source: Lim (2020)



Peninsula, it is important to preserve and manage the Baekdudaegan, a key ecological axis.

South and North Korea has experiences of cooperating forest resource management. Gangwon province has collaboratively controlled forest diseases and insect pests (Park, 2015). In accordance with agreements for cooperation between South-North Gangwon Province, Southern Gangwon Province provided chemicals and equipment, and Northern Gangwon Province provided skilled forest technicians for the control of pine needle gall midge (*Thecodiplosis japonensis*) and black-tipped sawfly (*Acantholyda posticalis posticalis*). Since 11,100 ha of the Kumkang Mountain area have seen pine needle gall midge control operations since June 2001. South-North Gangwon Province provided co-monitoring for more than 92 percent of the regulated regions. Up until 2008, South Gangwon Province controlled black-tipped sawfly throughout 8500 ha of North Gangwon Province, including in the cities of Wonsan, Tongcheon, and Anbyeol, in response to a request from North Gangwon Province.

Table 3. Collaborative control of diseases and insect pests

Date	Controlled Area (ha)		Number of Participants	
	<i>Thecodiplosis japonensis</i>	<i>Acantholyda posticalis posticalis</i>	South	North
June 8, 2001	1000	0	8	20
June 4, 2002	2000	0	13	14
July 29, 2003	0	1,000	11	12
June 3, 2004	1,000	1,000	15	11
July 17, 2005	1,500	1,000	14	10
July 20, 2006	1,500	1,000	10	12
July 18, 2007	1,500	1,000	6	9
July 3, 2008	1,600	1,100	-	-

4 Research Design and Method

This study has two phases (Figure 3). The first phase is to analyze the characteristics of natural resource management on borderlands. The second phase is to develop natural resource management model in border areas between South and North Korea using the results of the first step. Based on previous research including meta-analysis and systematic reviews, this study selected four cases on natural resource management conflicts on borderlands (Table 2), especially including biosphere and hydrosphere as dominant spheres of natural resource management conflicts (Lee et al. 2023).

Figure 3. Research phases

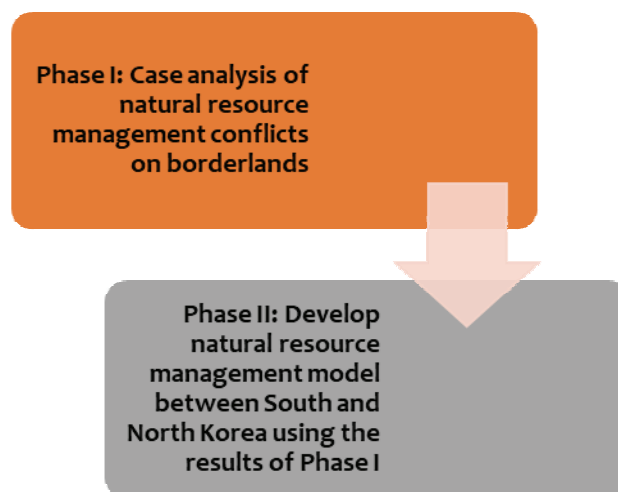


Table 4. Selected cases

No.	Title	Countries	Region
1	Bialowieza Forest World Heritage	Poland and Belarus	Europe
2	Bosques de Paz Transboundary Biosphere Reserve	Peru and Ecuador	South America
3	Indus Water Treaty	Pakistan and India	Asia
4	Great Limpopo Transfrontier Park	South Africa, Zimbabwe, Mozambique	Africa



5 Cases of Natural Resource Management Conflicts on Borderlands

5.1 Bialowieza Forest World Heritage: Poland and Belarus²⁾

The Bialowieza Forest is located in borderland between Poland and Belarus. Following the Second World War, the forest was divided by state borders (Perkowski et al., 2018:71). It contains primary lowland and mixed lowland forests that once covered the area from the Atlantic Ocean to the Ural Mountains. During World War I and II, the Bialowieza Forest was destructed by logging activities. The Bialowieza Forest has, nevertheless, retained a substantial portion of its original primeval forests. Currently, the Bialowieza Forest has a wide range of species, about 4500 plant species, about 3000 mushroom species and nearly 10,000 animal species, including rare large mammal such as moose, wolf, lynx, and European bison (Perkowski et al., 2018: 73).

The Polish-Belarusian border has become more "sealed up" since Poland joined the North Atlantic Treaty Organization (NATO) in 1999, and much more so since Poland joined the European Union (EU) in 2004 and the Schengen area in 2007. This has posed a significant obstacle to cross-border communication. In addition, the boundary divides the Bialowieza Forest, a valuable natural property. In the Bialowieza Forest, both classical cross-border cooperation³⁾, including a wide range of entities (local and regional self-government, forest administration, etc.), as well as inter-state cooperation (in bilateral and multilateral forms, e.g. UNESCO). From the point of view of European Union policy, cross-border cooperation is not about unification of cross-border areas, but about their sustainable development based on the cooperation of equal actors. In the text of the Agreement concluded between the Government of the Republic of Poland and the Government of the Republic of Belarus on the Principles of Cross-Border Cooperation of 24 April 1992, Both in the preamble and in Article 10 of the European Outline Convention on Transfrontier Cooperation between Territorial Communities or Authorities, the parties make reference to the convention. They advise the joint

2) This case is summarized with the article written by Perkowski et al. (2018).

3) Cross-border cooperation: local and regional government structures "unite their efforts to solve common problems, despite the national border dividing them" / The European Outline Convention on Transfrontier Cooperation between Territorial Communities or Authorities (=Madrid Convention), signed in Madrid on 21 May 1980, defines the notion of 'transfrontier cooperation', here referred to as cross-border cooperation as: any concerted action designed to reinforce and foster neighbourly relations between territorial communities or authorities within the jurisdiction of two or more Contracting Parties. Also the conclusion of any agreement and arrangement necessary for this purpose.

coordination bodies of Poland and Belarus to use the agreement and statute templates that are annexed to the Convention of May 21, 1980, which demonstrates that the Belarussian party (at the time, its authorities) accepted the standards introduced by the Convention and was interested in implementing them.

Timeline

- 1979: 50 km² of the Bialowieza National Park (Poland) was included in the UNESCO World Heritage List.
- 1991: Declaration on Good Neighbourhood, Mutual Understanding and Cooperation between the Republic of Poland and the Republic of Belarus (10 October)
- 1992: UNESCO List was extended to the part of the Forest located in Belarus
- 1992: Agreement concluded between the Government of the Republic of Poland and the Government of the Republic of Belarus on the Principles of Cross-Border Cooperation in Warsaw (24 April)
- 1992: Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on International Road Transport, signed in Minsk (20 May)
- 1992: Treaty between the Republic of Poland and the Republic of Belarus on Good Neighbourliness and Friendly Cooperation, signed in Warsaw (23 June)
- 1993: Poland joined The Madrid Convention
- 1995: Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on Cooperation in the Field of Culture, Science and Education, signed at Warsaw (27 November)
- 2002: Agreement establishing the international association of local community 'Bialowieza Forest EUROREGION' concluded in Hajnowka (25 May)
- 2004: Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on Economic Cooperation, signed in Warsaw (30 April)
- 2007: Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on Border Traffic (20 December)
- 2009: Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on cooperation in the field of



- environmental protection, signed in Bialowieza (12 September)
- 2010: Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on the Principles of Local Border Traffic (12 February)
 - 2014: UNESCO List was extended to the whole area of the Bialowieza Forest on the Polish side
 - 2015: Agreement between the Government of the Republic of Belarus and the Government of the Republic of Poland on cooperation in the field prevention of calamities, natural disasters, other serious accidents and eliminating their consequences, concluded in Bialystok (23 April)

5.2 Bosques de Paz Transboundary Biosphere Reserve: Ecuador & Peru

There was an armed conflict between Ecuador and Peru in 1981, but a peace treaty has been signed in 1998 (Varas, 2019). The Tumbesian Region of southwestern Ecuador and western Peru is a hotspot worldwide, along with the northwest. Particularly high endemism rates lead to the arrival of four of the world's most important avian endemic zones (59 out of 80 endemic species). Fifteen species of birds in the region are endangered, and only 5% of their original habitat remains. Also references and interpretations are in dry forest format. Ecuador and Peru registered the conservation farmland including this area as a Biosphere Reserve in 2014 and 1977, respectively. Later, in 2017, the two countries jointly registered the area as a biological reserve Bosques de Paz. Ecuador and Peru in the region share the Catamayo-Chira and Puyango Tumbes rivers, which provide resources for farming and pastoralism for the local population. The climate and frontline determine cropping and cattle breeding. The main economic activities are fishing, pastoralism, tourism, agriculture, and the cultivation of medicinal plants. Currently, in the Tumbesian region between two countries, human-wildlife conflicts (Iñiguez-Gallardo et al., 2021), tourism industry and mining (Barriga, 2017) are becoming issues.

Timeline

- 1977: Designation of Noroeste Amotapes-Manglares Biosphere Reserve of Peru
- 1981: Ecuador-Peru armed conflict
- 1998: Ecuador-Peru Peace Agreement
- 2014: Designation of Bosque Seco Biosphere Reserve of Ecuador
- 2016: Extension of Noroeste Amotapes-Manglares Biosphere Reserve of Peru
- 2017: Designation of Ecuador-Peru Biosphere Reserve “Bosques de Paz” (UNESCO 2017)

5.3 Indus Water Treaty: India–Pakistan

The Indus River originates in the Tibet Autonomous Region in southwestern China, flows through the disputed region of Kashmir, India, and into Pakistan before exiting into the Arabian Sea. The new water system of the Indus Basin was designed during British rule and is a structure that originates in India and flows into the Pakistan Canal. After gaining independence from Britain, India cut off the water supply to Pakistan and later supplied water in return for an annual payment. Pakistan, which was at a disadvantage politically and topographically, tried to negotiate with India on water resource issues, but failed to reach a political agreement. From 1947 to 1960 both the countries expressed their own interests in this crucial issue, however the conflict couldn't be solved by way of mutual dialogue (Kokab & Nawaz, 2013). In 1960 a bilateral dialogue between the two countries started under the supervision of World Bank (WB) and both the countries agreed to solve the issue after nine years of negotiation based on a treaty known as Indus Water Treaty 1960. The treaty allocated the western rivers of the Indus Valley (Indus, Jhelum, Chenab) to Pakistan and the eastern rivers (Ravi, Beas, Sutlej) to India. This freed Pakistan from India's monopoly on water resources. According to the treaty, the Permanent Indus Commission, composed of selected members from both India and Pakistan, was established to be in charge of continuous exchange and cooperation of information on the use of national water resources. In addition, the treaty stipulates a resolution mechanism that varies in stages by dividing the severity of the problem into three levels when water resource-related problems occur. The weakest level, 'questions', is administered by the Permanent Indus Commission, the next level, 'differences', by Neutral Expert, and the final 'disputes' by the Court of Arbitration (World Bank 2018).



Figure 4. Rivers of Indus basin

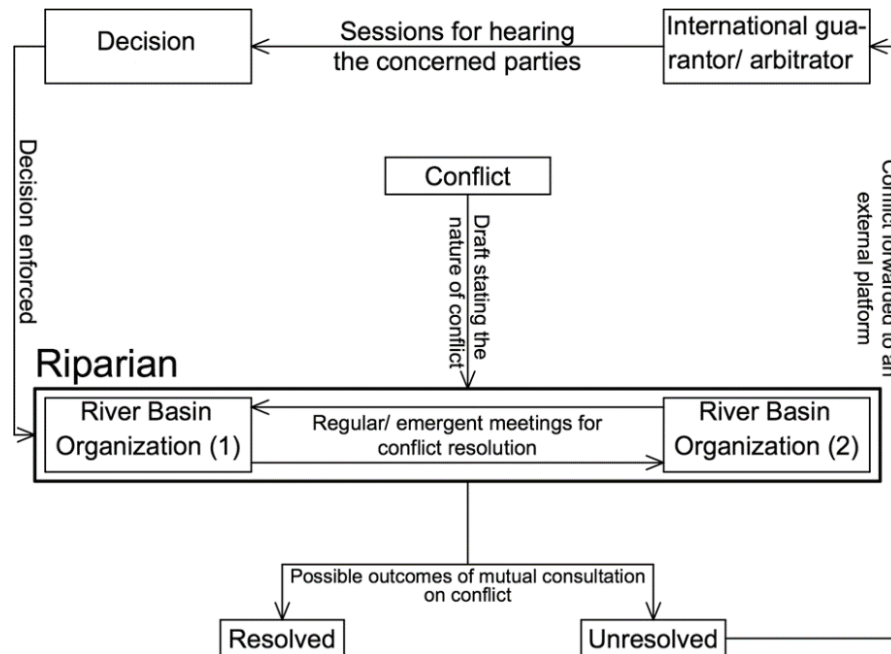


Source: <https://cdn.thewire.in/wp-content/uploads/2020/09/23185618/f107-indus-AGN.jpeg>

Since then, the two countries have solved most of the problems through the Commission, but as the climate crisis has become more serious, competition for water resources between the two countries has intensified again (Qamar et al., 2019). India's construction of Kishenganga hydroelectric power plant (opening in 2018) and Ratle hydroelectric power plant (scheduled to open in 2026) on the Jhelum and Chenab rivers, which Pakistan claimed violated the treaty. Accordingly, Pakistan asked the World Bank to establish an arbitration tribunal according to the treaty (recognized as a dispute), and India requested the appointment of a Neutral Expert (recognized as differences). The World Bank agreed to both sides' requests for 2022, and the dispute is still ongoing (World Bank, 2018).

The conflict-resolution method defined in the Figure 5 is followed by all the major treaties around the globe including (a) Indus Water Treaty between Pakistan and India on the Indus river; (b) Boundary Waters Treaty between Canada and U.S. on Columbia river; (c) the Jordan-Israel Peace Treaty on Yarmouk and Jordan rivers; and (d) Nile Agreement between Sudan and Egypt for utilization of the Nile waters (Qamar et al., 2019). The Indus Water Treaty was mediated and arbitrated by the World Bank.

Figure 5. General conflict-resolution method in international water treaties



Source: Qamar et al. (2019)

Timeline

- 1948: The Inter-Dominion Accord between India and Pakistan
- 1960: The Indus Water Treaty
- 2018: Opening of Kishenganga Hydro Power Plant in India
- 2022: World Bank appointed a Neutral Expert and a Chairman for the Court of Arbitration about the designs of the two hydroelectric power projects in India

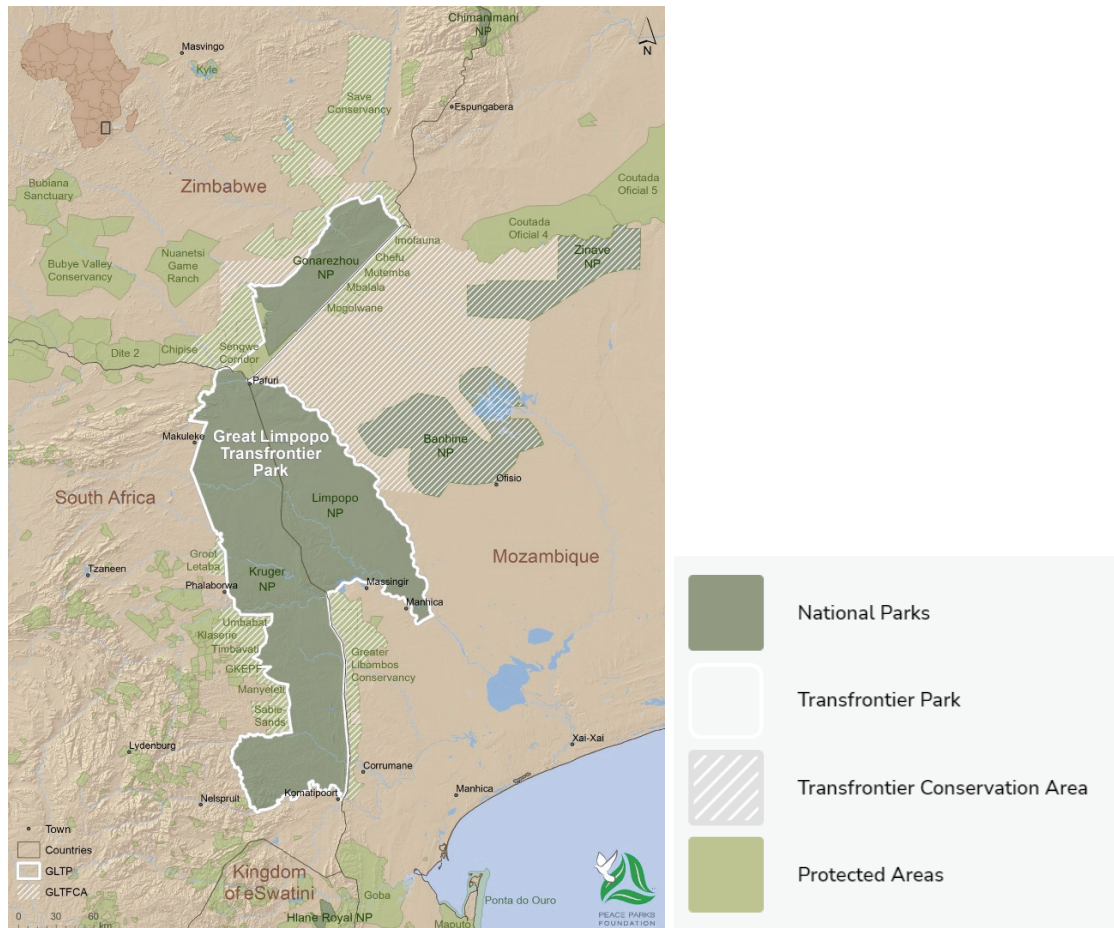
5.4 Great Limpopo Transfrontier Park: Mozambique, South Africa and Zimbabwe

The Great Limpopo Transfrontier Park was one of the first officially proclaimed peace parks in southern Africa. It is home to more than 850 animal species and 2000 plant species. This 35 000 km² park connects the national parks of the Gonarezhou in Zimbabwe, the Kruger in South Africa, and the Limpopo in Mozambique. The Park also links the Makuleke region in South Africa and the Sengwe communal land in Zimbabwe



that lies between the Gonarezhou and the Kruger parks. The larger Great Limpopo Transfrontier Conservation area (TFCA), which covers an area of nearly 100,000 km², includes the Banhine and Zinave National Parks, the Massingir and Corumana areas and surrounding Mozambican regions, as well as diverse privately and state-owned conservation areas in South Africa and Zimbabwe that border the transfrontier park. The Great Limpopo TFCA is managed as an integrated unit across the three international borders. The conservation area is led by a joint management board and various joint management committees with representatives from all three countries that focus on matters such as harmonisation and integration of policies and joint operations protocols, protection, conservation management, tourism development, community benefits, communication and fundraising. An International Coordinator, whose appointment is funded by Peace Parks Foundation, drives the TFCA development process. The Great Limpopo Transfrontier Park is an area that has become a center of tourism based on its rich biodiversity. However, it is also the region with the highest poverty rate. Many residents are reluctant to cooperate with park officials, recognizing that the designation of nature reserves threatens land ownership and livelihoods. In fact, some local communities were expelled from their existing dwellings during the process of designating protected areas and had to migrate without proper economic support. This case presents the violence of a protection system that prioritizes wild animals over residents (Chiutsi and Saarinen, 2019). High-yielding sources of income for tourism are photographic hunting safaris and game ranching. It is possible to provide more income and jobs compared to conventional livestock farming. Although community participation in transfrontier management of resources is widely recognized, actual engagement of community members is lacking. It is pointed out that partnership with residents is important for sustainable tourism.

Figure 6. Location of The Great Limpopo Transfrontier Park



Source: Peace Parks Foundation homepage
https://www.peaceparks.org/wp-content/uploads/2018/07/gltfca_web_overview_a4_20180827_ah.jpg

Timeline

- 1926: Kruger National Park established in South Africa
- 1960s: Indigenous peoples of South Africa begin to fight for their rights internationally
- 1972: Mozambique's Banhine and Zinave areas changed from hunting zones to national parks
- 1975: Establishment of Gonarezhou National Park in Zimbabwe
- 1990: Meeting between the President of WWF South Africa and the President of Mozambique
- 1996: The 2nd meeting between the President of WWF South Africa and the



President of Mozambique

- 2001: Limpopo National Park changed from a hunting zone to a national park
- 2002: Heads of State of Mozambique, South Africa and Zambia signed an international treaty for establishing the Great Limpopo Transfrontier Park in Xai-Xai, Mozambique
- 2014: Mozambique and South Africa signed a memorandum of understanding (MoU) on biodiversity conservation and management to combat rhino poaching
- 2015: Peace Park Foundation and the Mozambican government signed a treaty for joint management of the Banhine National Park
- 2017: Establishment of Greater Lubombos Conservancy, first privately owned land included in Great Limpopo TFCA

6 Natural Resource Management Model between South and North Korea

The four cases from Chapter 5 indicate characteristics of on natural resource management on borderlands. The characteristics offer some lessons for developing natural resource management model between South and North Korea. Based on the four cases, this chapter develop a model for natural resource management between South and North Korea. The model adopts '**cross-border cooperation**' between South and North Korea. Cross-border cooperation is considered as a fundamental strategy or political procedure to promote territorial integration by exploiting the opportunities within the border regions (Wong Villanueva et al., 2020). Cross-border cooperation is not about unification of cross-border areas, but about their sustainable development based on the cooperation of equal actors. Unification is the future we are aiming for. However, we now need to implement cross-border cooperation between two Koreas. For cross-border cooperation in natural resource management, a guideline is suggested including four recommendations (Figure 7).

Figure 7. A guideline for natural resource management on borderlands



Supportive institutions

In cross-border cooperation, supportive institutions exist at any level of government, or outside government with institutions (Hataley and Leuprecht, 2018). Supportive institutions at the international level played a special role in the selected cases. In the case of Bialowieza Forest World Heritage in Poland and Belarus, the European Outline Convention on Transfrontier Cooperation between Territorial Communities or Authorities (Madrid Convention) give recommendation for joint coordination between Poland and Belarus. The Madrid Convention provides a legal framework for the establishment of cross-border regions in Europe. Poland ratified the Madrid Convention, but Belarus didn't. However, the Convention works as a guideline for cooperation between two countries. In the case of protection of Bialowieza Forest in Poland and Belarus, the cross-border UNESCO World Heritage Site 'Bialowieza Forest' worked as a cooperation system. Polish side was designated as UNESCO World Heritage Site in 1979 and Belarussian side was designated in 1992. There is a gap between two countries. However, each side managed Bialowieza Forest as national parks.

In the case of Indus Water Treaty between India and Pakistan, World Bank played the role as a mediator or arbitrator to resolve the transboundary water conflict between India and Pakistan. The importance of mediator and its role to resolve the transboundary conflict between the two countries totally depends on its neutrality and the confidence shown by both the countries on its fairness as a mediator. This case indicates that intergovernmental organizations as supportive institutions play an important role in resolving the transboundary natural resource conflicts.



In the case of Bosques de Paz Transboundary Biosphere Reserve in Ecuador and Peru, Biosphere Reserve worked as a cooperation system. Noroeste Amotapes-Manglares Biosphere Reserve of Peru was originally designated in 1977 and expanded in 2016. Bosque Seco Biosphere Reserve of Ecuador was originally designated in 2014. Designation of Bosques de Paz Transboundary Biosphere Reserve was designated in 2017. Each side managed Biosphere Reserve separately in the different period. Then two Biosphere Reserves were merged as a Transboundary Biosphere Reserve. Bosques de Paz Transboundary Biosphere Reserve is a good model Two Koreas can manage borderlands separately, although they have different supervision including costs and time. Not now, but later two separate regions can be combined as one management area for environmental protection including biodiversity conservation.

Coordinating Committee

For cross-border cooperation, coordinating committee between countries is necessary. In the case of Great Limpopo Transfrontier Park in Mozambique, South Africa and Zimbabwe, an Interim International Technical Committee was set up, consisting of government officials of the three states for creating a conservation area including a vast conservation area, that would include the Kruger National Park in South Africa, Gonarezhou National Park in Zimbabwe, Banhine and Zinave National Parks, and Coutada Sixteen (a wildlife utilisation area) in Mozambique, in addition to a number of communal areas in Zimbabwe and Mozambique (Spierenburg et al., 2008). This committee had a role in developing the draft of the plan and trilateral agreement and implementing a joint management for the park. For natural resource management between South and North Korea, establishment and management of coordinating committee consisting of government officials of two Koreas is needed. The committee can lead cooperation activities in practice.

Local cooperation

Cross-border cooperation is implemented at the local level. In the case of protection of Bialowieza Forest in Poland and Belarus, the Governor of the Podlaskie Voivodeship

of Poland and the Governor of the Grodno Region of Belarus signed a letter of intent to strengthen and develop good neighbourly contacts between the Podlaskie Voivodeship and the Grodno Region. This cooperation works within the framework of the Polish-Belarusian Intergovernmental Coordination Commission on Cross-Border Cooperation (Perkowski et al., 2018).

In inter-Korean forest cooperation, there is a successful experience of collaborative control of diseases and insect pests in Gangwon province (Park, 2015). Based on the experiences, local governments between South and North Korea can cooperate for natural resource management.

Community rights and development

The case of Great Limpopo Transfrontier Park in Mozambique, South Africa and Zimbabwe indicate consideration of land ownership and community property in the process of designation and management of peace park. In the Great Limpopo Transfrontier Park the Makuleke community entered into a 25-year contractual national park agreement with South Africa National Parks Service (Spierenburg et al., 2008: 92). Some peace parks in Southern Africa have experiences of unsuccessful management due to erosion of property rights and community land rights including the Gariiep Peace Park in Namibia and South Africa (Lenggenhager and Ramutsindela, 2021).

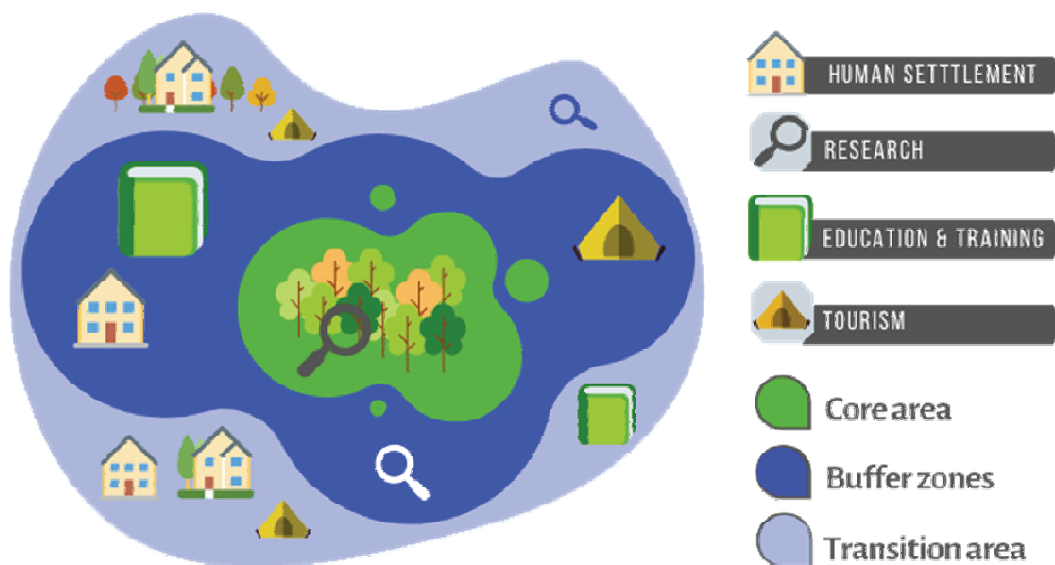
The case of Bosques de Paz Transboundary Biosphere Reserve follows the rule of biosphere reserve by UNESCO. The Biosphere Reserves have three main zones; core areas, buffer zones and transition area. Transition area is where communities accommodate economic and human activities that are both ecologically and socioculturally sustainable. Biosphere Reserve focuses on economic development that is socio-culturally and environmentally sustainable.

Two cases indicate importance of institutional support of community rights and development in managing natural resources on borderlands.

In the process of designing natural resource management between South and North Korea, not only ecosystem but also community rights and development including economic benefits should be considered and institutionally supported.



Figure 8. The Biosphere Reserves' three main zones



Source: https://en.unesco.org/sites/default/files/detail_map4.png

7 Conclusion

This study described characteristics of four cases of natural resource management on borderlands. The characteristics give some lessons for developing a model for natural resource management between South and North Korea. Based on the lessons, a guideline was developed for natural resource management between South and North Korea including five recommendations: supportive institutions, coordinating committee, local cooperation and community rights & development.

In this study, limited number of the cases on natural resource management on borderlands was dealt with. More cases are need to be interpreted for understanding natural resource management conflicts on borderlands in the future.

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