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Categorizing Types of Transition Areas in Biosphere Reserves: a Case Study of the Baekdudaegan Mountain Ranges in South Korea

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Abstract: The biosphere reserves (BRs) of the UNESCO's Man and the Biosphere Programme (MAB) aim at the successful coexistence of humans and nature. The existing BRs have worked with local people to create culture landscapes and conserve natural resources. The ideal BR models for areas undergoing climate change are cities within nature, and the areas that can be designated as BRs have natural and cultural landscapes. BRs comprise three areas, the core, buffer, and transition, in order to efficiently perform three functions, which are conservation, development, and logistical support. A transition area is where people earn an income from local businesses while effectively preserving their natural surroundings. When this area has a role in meeting the communal goals of residents by providing local resources and landscapes, it is appropriately managed and maintained. In addition, local products produced in BRs, which UNESCO believes are generated in excellent ecosystems, can be sold under the BR brand, contributing to residents' incomes and local image. The Baekdudaegan mountain range (BDDG) is traditionally cherished as a symbol of the Korean peninsula and has enormous scientific value as an ecological repository. Additionally, the BDDG is considered a unique geographical recognition system referred to as sanjabunsuryung by the local area districts where Korean people have lived following a unique religious and historical culture. This study categorized types of transition areas in targeted areas with high potential for designation as a BR based on geographical characteristics. The developed index was supported by the Analytical Hierarchy Process method proposed by experts, and zoning of the BR was performed. Among the areas of the BR, the transition area was the focus of this study. This area was classified into three types, which were then subdivided. The watershed types were self-managed, neighborhood, and cooperative; the resident types were urban, relatively rural, and rural; and the local resources types were natural-scenery and historical-cultural. A management plan is suggested regarding administrative districts, an urban BR, and relationships to other protected areas in the BDDG. In conclusion, the transition area of the BR was recognized as urban via the categorization process, and management of the BDDG should take a long-term approach.

1. INTRODUCTION

1.1 Background and Purpose

About one half of the global population lives in urban areas, and the urban population is expected to increase in proportion to the global population's growth rate (United Nations Department of Economic and Social Affairs (UNDESA), 2012). Some studies have reported that populations will be more concentrated in urban areas and that cities will continue to grow Owing to this sudden influx to urban areas, unplanned city expansion could have an impact on the natural environment. The number and extent of policies for environmental, economic and social sustainability are going to be increasing along with the populations (Alfsen-Norodom, 2004), but urban areas are not considered to currently comply with sustainable environmental policies (Antrop, 2006). There should be a focus on politics, societies, and economies related to the environment, especially in regard to how they influence citizens' lives (Uchiyama & Mori, 2017).

Biosphere reserves (BRs) have been recognized as a type of city. They were designated as international protected areas according to the Man and the Biosphere Programme (MAB) of the United Nations Education, Scientific and Cultural Organization (UNESCO). The aim for BRs is the coexistence of nature and humans, working for successful natural and cultural landscapes and conservation of natural resources at the local level. Interdependency of landscapes and resources as well as economic development for human well-being is the key theme of BR principles (UNESCO, 2008).

Moreover, BRs provide an adequate policy and conceptual basis for binding between the local groups and their demands (Schmidt, Busse, & Nuriyev, 2017). Some governments have noted that it is an urban model in which people can live with nature and face the emerging environment worldwide (Iida & Nakamura, 2016).

UNESCO has recommended and promoted related projects since 2015. In addition, BRs worldwide have exchanged and communicated information about their respective areas via a global network and regional collaboration, aiming to be sub-regional and biosphere-smart. There were 669 BRs in 120 countries as of May 2017, of which 105 are in the mountains in 22 European countries (Wicher, 2015). Many member states around the world are trying to attain BR designations.

A BR has three areas, the core, buffer, and transition, that have three functions, conservation, development, and logistical support. The core area performs the function of conserving, and it is the most important for preserving natural resources. The buffer area performs conservation and logistical support functions that conserve the core area and buffer it from external damage. The transition area performs development and logistical support functions to conserve the core and buffer areas and create sustainable development with and for the residents. The transition area is where people live, and it can be developed through local products or resources from the core area. The roles of the local communities and residents, in collaboration with experts, for maintenance and management, are of vital importance in the transition area and BR overall (Iida & Nakamura, 2016).

The purpose of this study was to categorize types of transition areas by zoning the Baekdudaegan mountain ranges (BDDG). The BDDG has a high likelihood of being designated as a BR. The BDDG is a huge corridor in Korea with many areas protected by national laws, such as national parks, ecological landscape conservation areas, and cultural heritage protection areas. Although

most of these areas are forested, many people have been living there since the 1970s to exploit the forest resources.

As a result of the construction of roads, railways, and agricultural facilities, the precious forest ecology of the BDDG has been damaged and disturbed and, in response, it was designated a protected area in 2005 by the Korean government (Miller & Kim, 2010). Although the BDDG has been under development pressure from residents near the BDDG, the BR designation should help the local people reconcile with nature. According to a survey by the Korea Forest Service, 1,800 people reported that the BDDG is a priority policy area owing to its importance as an eco-axis. Furthermore, many officials and residents agreed with the BR designation (Korea Forest Service, 2015). The results of that study are shown in *Figure 1*. Thus, the Korean government is trying to use BR designation to sustain the Korean peninsula.

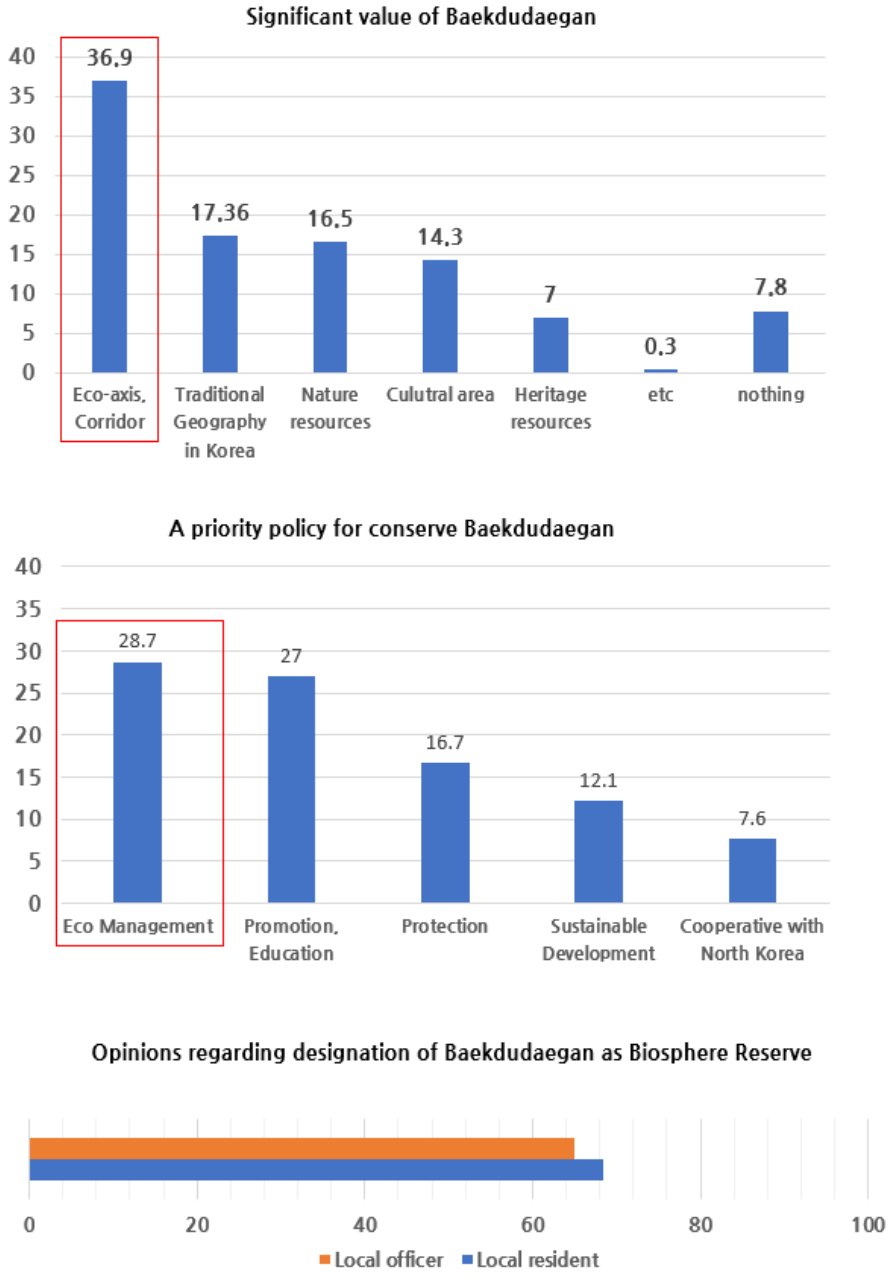

Figure 1. Questionnaire results

1.2 Methods

The research methods in this study constitute three processes. First, data was collected on indicators of BRs and their related protected areas in Germany and Japan. Germany provides an excellent example of a BR similar to Japan's. Duplicate indicators were reclassified considering a BR's functions after arranging the indicators for the two countries with some indicators of Korean areas protected by law. These were arranged using rules of selection. Second, thematic maps were established via scoring, and an Analytical Hierarchy Process (AHP) survey of experts conducted with 10 individuals engaged in national institutions and universities regarding the BDDG to identify the most important indicators. The final index was then developed and was applied to the AHP values. Lastly, three areas were designated using the final index and types of transition areas categorized. *Figure 2* presents a flowchart of the study's methodology.

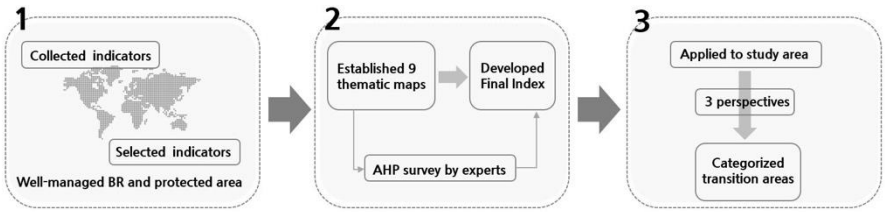

Figure 2. Flowchart

2. THE BAEKDUDAEGAN MOUNTAIN RANGDES (BDDG)

2.1 Principle of Baekdudaegan

The BDDG is a series of continuous mountain groups that plays an important role as a huge eco-axis on the Korean peninsula. It runs from Mt. Baek-du to Mt. Ji-ri, and it stretches about 1,500 km (about 684 km in the South Korean section). The BDDG is a gigantic white mountain range that has no streams or valleys (Miller & Kim, 2010). The four big rivers of Korea's territory originate in these mountains. The BDDG is recognized as a symbol of Korea's historical and cultural landscape and it has significant ecological value in its diverse fauna and flora (Jung, H.-C. et al., 2005). Although the precious values of the BDDG have been unknown to the world for more than 1,100 years, it has been revered as a symbol to Koreans (World Tourism Organization (UNWTO), 2011).

The Korean term "*daegan*" was traditionally used, but the term "range" is the modern way of describing the BDDG. Focusing only on the branches of the mountains, it is enough to describe it as a range. On the other hand, *daegan* includes the idea of a natural perception of the landscape, including the geographical and cultural features of the Korean peninsula (Choi, 2004).

Several previous studies have explained the principle of the BDDG. The Honil Gangri Yeok Jido (the picture on the left in *Figure 3*) is the oldest existing map of Korea, and it is believed to have been drawn during the mid-1700s. It remarkably depicts the major rivers and mountains of the BDDG. The Sejong Silok Jiriji, which geographically chronicles King Sejong's reign in 1454, referred to the BDDG as a recognized system of Mt. Baek-du and its connected branches, and that concept spread during the late Joseon Dynasty

(Choi, 2004). The BDDG was reflected geographically as flowing from Mt. Baek-du. Its great significance has largely influenced the political, cultural, and social aspects of the Korean Peninsula. In addition, the mountainous districts, based on the geologically traditional system, have been worthy of note because of the established residences in Korea and the rivers (Choi, 2004). *Figure* 3 shows the BDDG on maps. The Dae Dong Yeo Jido map was created by Jung-ho Kim, who was a geographer in the 19th century (the picture on the right in *Figure 3).*

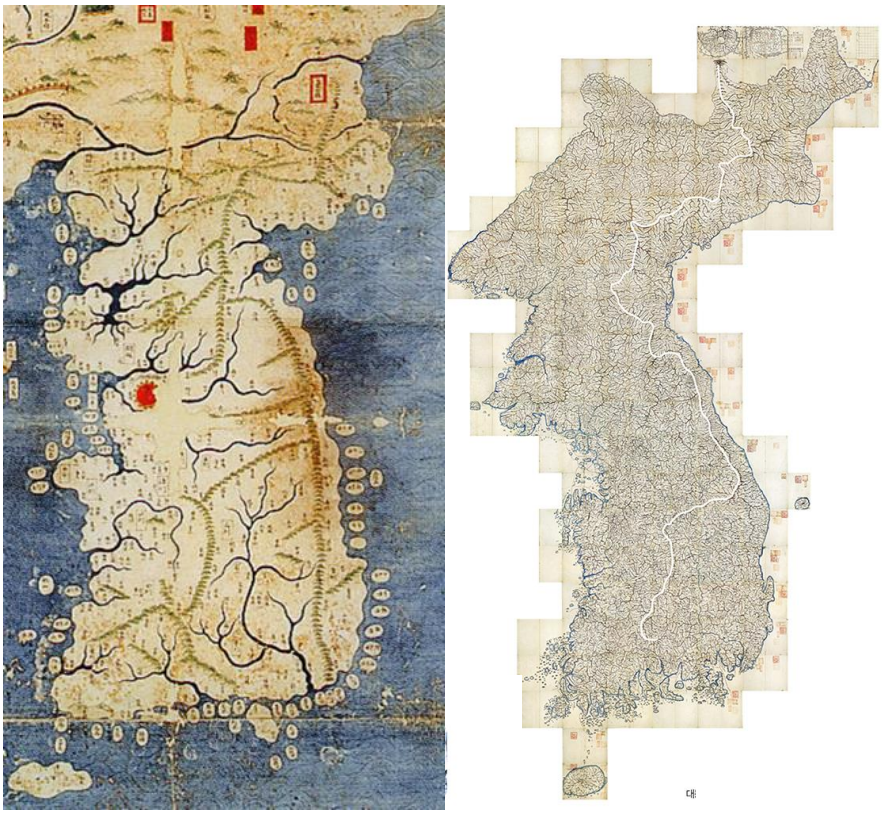

Figure 3. The old maps of the BDDG (left: Honil Gangri Yeik Jido Map, right: Dae Dong Yeo Jido Map)

The basic principle of the BDDG was explained as the relationship between human geography and the natural environment applied to the "*sanjabunsuryung"* (Korean term for a watershed based on a mountain), which is a mountain that does not cross rivers or streams, noting that rivers cannot run over mountains (Choi, 2004). In other words, a stream is formed by a mountain range. A living zone for residents was located in the watershed, and a provincial area was formed by the boundary of the mountain. Each province has unique cultural-linguistic characteristics (Ministry of Environment, 2001). The BDDG became the foundation of folk religion and local culture by restricting human activities. Precious tangible and intangible cultural assets and oral literature exist in the BDDG. Among them, the Korean terms *sunghwangdang* (holy tree) (or *sunangdang* (holy stone tower)) and *sansingak* (mountain temple) reflect shamanistic folk beliefs as a socio-cultural value.

The *sunghwangdang* is a shrine to village deities, such as guardian or fertility gods, for ancestor worship, which has transformed into a complex local religion. The *sunghwangdang* varies in form and it is mainly located where each region connects to the BDDG. Only a few remain extant because of construction or road networks, but those that do are important indicators of local folk beliefs (Korea Forest Service, 2006). The *sansingak* is a cultural

heritage associated with folk beliefs that was created when Buddhism spread to Korea. It is deeply related to the traditional mountain worship beliefs, such as the myth of *Danguan* (first founder), which is the oldest written story about the establishment of the first dynasty on the Korean peninsula. It is a place to worship a mountain god for protection from a disaster when climbing up a rugged mountain of the BDDG, where traffic is difficult. It is mainly located on a hill in the high mountains at a high altitude (Korea Forest Service, 2006). In addition, it is a unique type of Korean temple and evidence of the process of indigenization of Korean Buddhism. Thus, the BDDG is an object of worship that deeply influences the people of the Korean Peninsula, which is mostly mountainous. The range's geographical characteristics have created a role for Korean spirits, becoming the foundation of cultural development (Choi, 2004). In addition, numerous dialects continue to exist in each area, and the locality of each area is clearly delineated. The conceptual description of *sanjabunsuryung* is shown in *Figure 4.*

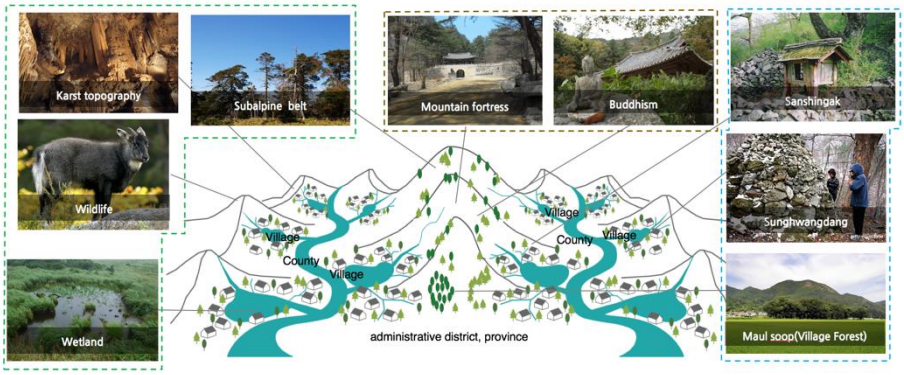

Figure 4. The Conceptual description of Sanjabunsuryung (the pictures were used by Korean Forest Service)

2.2 Baekdudaegan Protected Area

The BDDG in South Korea is adjacent to 32 municipalities (12 cities and 20 counties) in six provinces and some protected areas. The Korean government was concerned because of severe damage in the mountain range, and thus enacted the BDDG Protection Law (enacted by Ministry of Environment in 2005), followed by designation of the mountain ranges as protected areas protecting the top ridgeline, called "*marugum"* in Korean, which is a line connecting the summit of the mountain ridges in Korea and nearby areas. The areas adjacent to the *marugum* provide corridors and habitats for wildlife. However, despite the significant ecological value of the wide range of areas, the BDDG Protection Law considers only the mountain ridges as priority when designating the protected areas. Application of this criterion as a priority has caused unreasonable restrictions on nearby residents and a broad range of conflicts related to poor government management. In other words, the BDDG protected area is being improperly managed with respect to its actual purpose.

The BDDG protected area has a core area and a buffer area (*Figure 5*). Although the functions of these areas can be likened to the BR core and buffer, some areas without a buffer have been exposed to damage. In the entire protected area, an overall buffer area (about 1,800 km^2; 65%) has had less of a conserving role than the core area (about 960 km^2; 35%). In addition, some of the core area provides easy human access to the *marugum*. The BDDG has been essential to other tools that protect the *marugum* and associated natural resources.

Figure 5. The BDDG protected area

3. FUNCTIONAL INDICATORS

Before categorizing the types of transition areas, the process of developing final indicators was performed. Many indicators were collected for the studied BRs and their related protected areas in Germany and Japan through a literature review. The investigated areas were (1) nature reserves, (2) landscape protected areas, (3) natural monuments and natural parks in Germany, (4) wildlife areas, (5) natural conservation areas, (6) natural parks including special zones, (7) Satoyama (Japanese landscape type), (8) forest ecosystem protected areas, and (9) an unused artificial plantations in Japan. The indicators were classified as (1) natural-ecological landscapes, (2) socio-cultural landscapes, and (3) extent of urbanization as a function of the BR. The highest frequency indicators were (1) natural landscapes, watersheds, and biotopes in natural-ecological landscapes, (3) local cultural landscapes and recreational cultural landscapes in socio-cultural landscapes, and (3) population density in the extent of urbanization. The frequencies in Germany and Japan are shown in *Figure 6.*

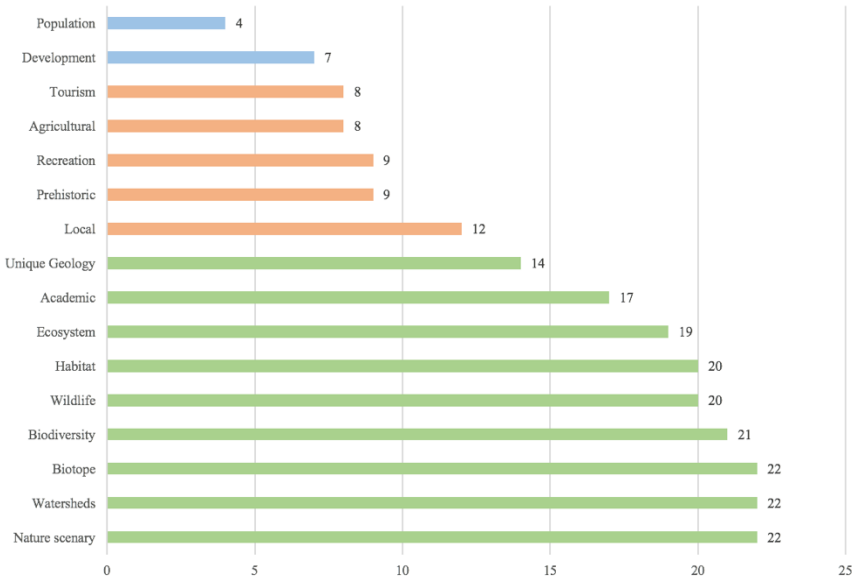

Figure 6. The frequency indicators in German and Japan

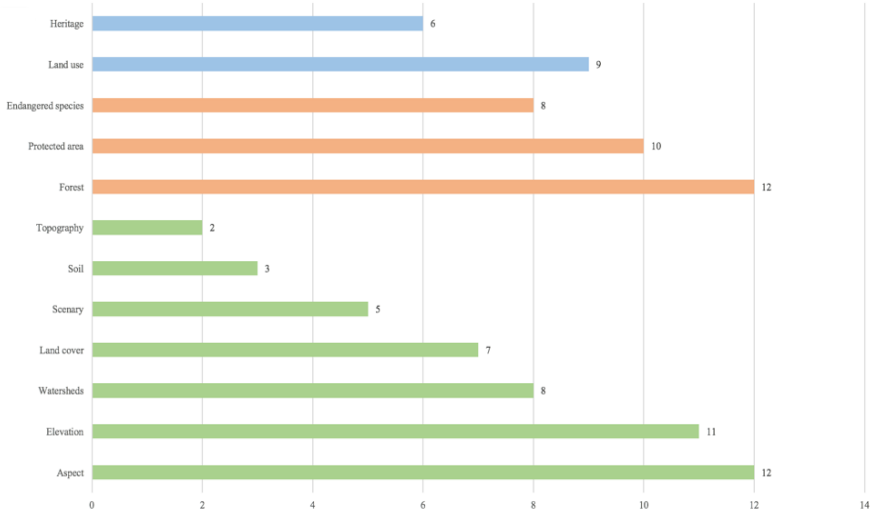

Figure 7. The frequency indicators in South Korea

The much studied and used indicators that focused on protected areas, such as natural parks, ecological landscape conservation, the BDDG protected areas, and so forth in South Korea, were (1) aspect, (2) elevation, (3) watersheds, (4) forest age, (5) land use, and (6) others (*Figure 7*).

The collected indicators combined the indicators of functions in Germany and Japan and the designation of area indicators in South Korea and were reclassified using the rule of indicator selection. In order of their application, they are (1) the priority indicator of high frequency or use in research, (2) the applicable indicator to the study area, (3) the indicator available as spatial data, and (4) each indicator with non-equivalent, but similar or duplicate meanings and their hierarchy was integrated.

As a result, the final indicators were arranged based on the rules. Nine indicators measured three factors. Elevation, aspect, and watersheds were physical factors; the ecological naturalness, forest density, and forest age were ecological factors; and the land cover, population density, and protected areas were management factors. From these nine indicators, nine thematic maps were produced via ratings on conservation (three points), buffer (two points), and development (one point) related to the BR's area. The standards used for

rating were derived from previous studies. The spatial data standards were obtained from the spatial information system webpage of the Korean government. All scoring processes were performed using a geographical information system (Arc GIS version 10.3.1).

However, there was a challenge because the indicators chosen from the literature review might not be realistic when applied to the BDDG because it is a huge area. Therefore, a questionnaire was conducted regarding the experts' opinions on the relative importance regarding indicators of the BR. The questionnaire was analyzed using the AHP method, and relative importance was derived by verifying the data by applying an inconsistency ratio of 0.1 during the analytical process. *Table 1* summarizes the results of the AHP analysis.

Table 1. Summarized results of AHP analysis

No.	evaluation standards	importance in hierarchy	general importance	inconsistency value	
				evaluation	alternative
	the relative importance of Baekdudaegan			0.0108	
1	Physical	10.01(%)	10.01(%)	0.0001	
1-1	elevation	15.31	1.53		0
1-2	slope	13.05	1.31		0
1-3	watershed	71.64	7.17		0
2	Ecological	42.64	42.64	0.0035	
2-1	ecological naturalness	55.22	23.55		0
2-2	forest crown density	12.34	5.26		0
2-3	forest ages	32.43	13.83		0
3	Management	47.36	47.36	0.0221	
3-1	land cover	32.96	15.61		0
3-2	population	21.44	10.51		0
3-2	protected area	45.60	21.60		0

The results of the comprehensive analysis found that the management factor was the highest, the ecological factor was similar to the management factor, and the physical factor was significantly lower than the other factors. Regarding the indicator evaluations, the watershed indicator of the physical factor, the ecological naturalness indicator of the ecological factor, and the protected area indicator of the management factor were highest. Among the indicators, ecological naturalness was highest and the aspect indicator was the lowest. All results were applied to the thematic maps. The final index was established by overlaying the nine thematic maps, which were organized by relative importance *(Figure 8)*. The range was from 0 to 4.2247, and it was derived by zoning the BR. The entire boundary of the study area, applied to the *sanjabunsuryung* principle, was defined by the standard watershed map from the Ministry of Land, Infrastructure and Transportation.

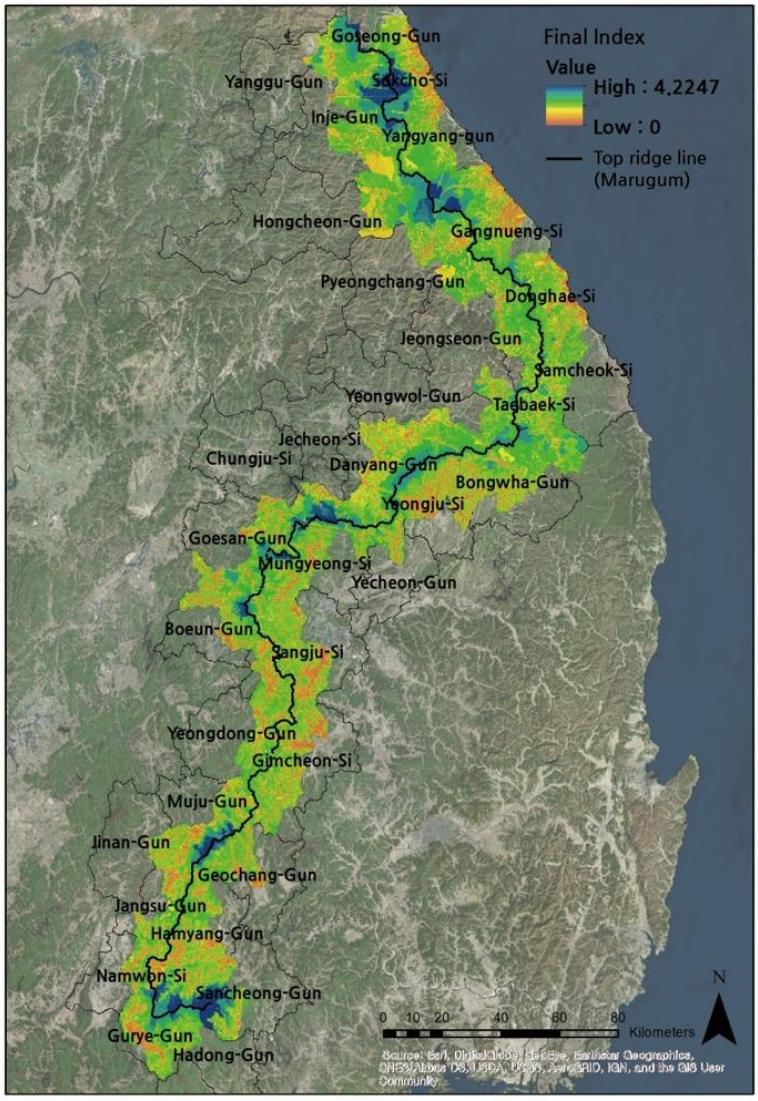

Figure 8. The final index of the biosphere reserve

4. RESULTS

4.1 Zoning of the BR

The zoning of the BR was implemented using the numerical values of the final index performed in ArcGIS. The conservation, buffer, and development functions were applied in order from highest to lowest value. The core area (3,206.15 km^2; 24,68%) was zoned from a value of 4.2247 to 1.93 in the highest numerical value. The buffer area (5,352.99 km^2; 41.20%) was applied from a value of 1.9299 to 1.6, and the remaining areas were in the zoned transition area (4,431.09 km^2; 34.12%) (1.5999 to 0). The analyzed areas of the BDDG had a core area distributed near the *marugum* and most areas were protected by law. The policy of the BDDG protected area currently was implemented with the aim of linking to *marugum*. The buffer area was near the core area, and most areas were outermost protected areas and forest areas. The habitats of many wildlife species were important as corridors. The transition areas where local people lived were mostly forests, agricultural villages, or villages adjacent to cities. The zoned map is shown in *Figure 9*.

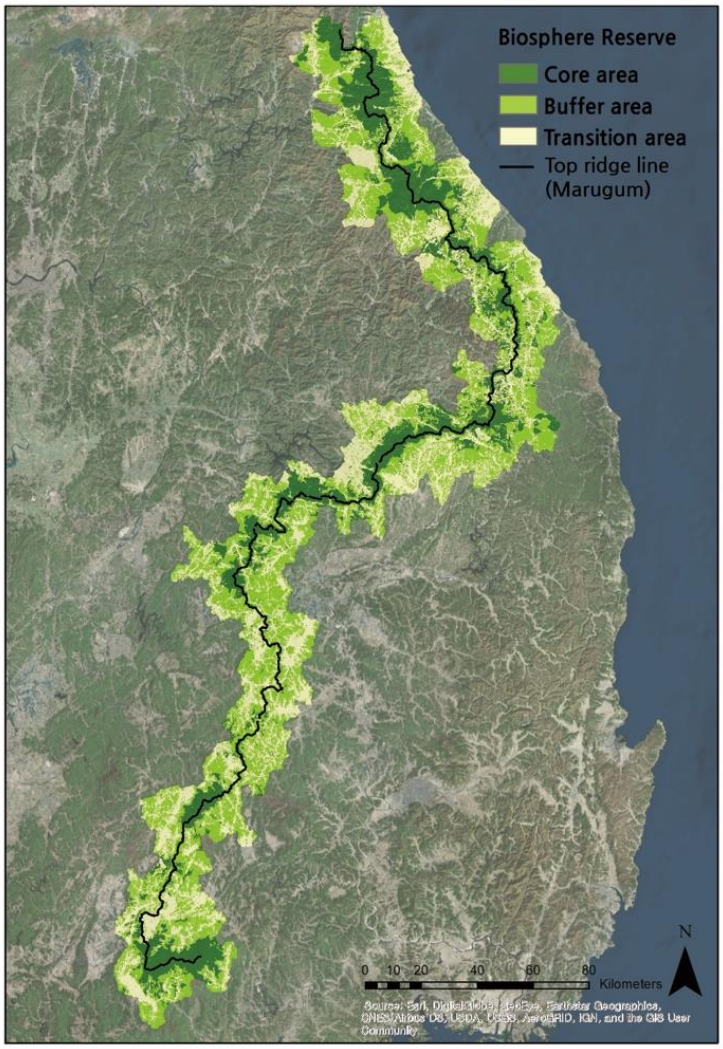

Figure 9. The zoning of the biosphere reserve

4.2 Categorizing Types of Transition Areas

Transition areas are sustainably developed in cooperation with local people using natural and cultural resources. The principle of the BDDG influences the localities of the Korean people. Because the BDDG is located on a border, many people in many municipalities live near the BDDG, and a lot must be considered for each area. Therefore, it is necessary to analyze transition areas from a variety of perspectives - because each area is different in terms of environment, scale, and products - to efficiently maintain and manage them. The biggest advantage of a transition area could be the marketable local products made from natural resources with attached labels, which UNESCO recognizes as BR products. Thus, local people can cooperate with each other and earn income and benefits.

4.2.1 From the Watershed Perspective

The original principle of the BDDG was *sanjabunsuryung*, which impacted Korean lifestyles nationally, and particularly at the local level, such as administrative districts, dialects, and food. The maintenance and management of these areas differ depending on the localities in the transition areas. The types of transition areas were classified by analyzing watershed

districts as (1) self-management, (2) neighborhood, and (3) cooperative. First, self-management was one municipality that was managed and maintained by one government. Because associations were comprised of local residents living in a transition area, the community leaders cooperated with the government. Second, each community cooperating with administrative systems, such as provinces, managed the neighborhood type. The communities could establish other associations through cooperation, with each of them exchanging information and local products, promoting tourism. Last, each community in one municipality managed the cooperative type, although one municipality was divided into two areas or more by the BDDG, which has geographical characteristics. Each transition area was differently managed depending on the area's environment. This applied to watersheds as shown in *Figure 10* [from left (1), (2) and (3)].

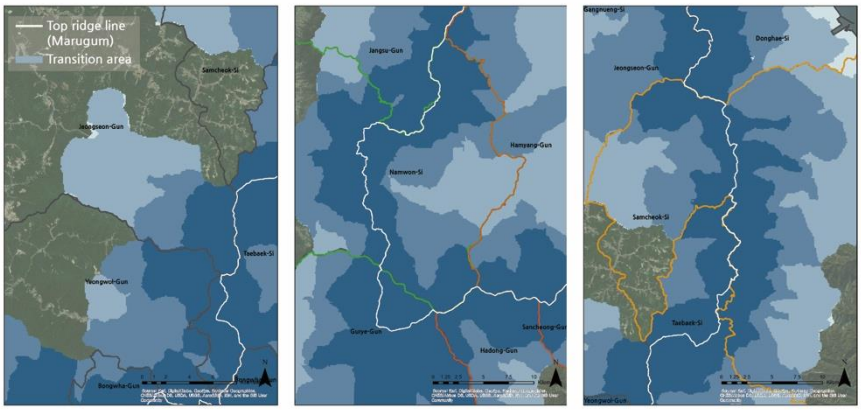

Figure 10. The types of watershed transition areas

4.2.2 From the Residents' Perspective

Cities with large populations usually have concentrated infrastructure, such as roads, railways, and facilities. However, most of all, natural resources are much less abundant than in rural areas. Although a few metropolitan cities are in the BDDG, the cities are small and medium sized. Natural resources were easily susceptible to urban and human impact. Thus, human distribution was important for analysis.

The types of transition areas were (1) urban, (2) relatively rural, and (3) rural. They were classified based on population per unit area following the United Nations Statistics Division (UNSD, 2014). The urban type had more than 1000 residents and various facilities were sufficiently close to be convenient for the local people. The urban type has an important role in protecting core and buffer areas and in suppressing city and population growth near the BR. In addition, the urban type was recently introduced in some studies focusing on existing BRs, including cities and towns, and has yet to be listed by UNESCO. The relatively rural type has 500 to 999 residents, mostly living in agricultural or forest villages. This type has some moderate infrastructure, between the urban and rural scales, and is not susceptible to urban influence. In other words, the relatively rural type is the ideal type because it is the best area for people to live. Efficient management and maintenance based on communities requires the residents' participation. The rural type has populations under 500 and most of the areas consist of agricultural or forest lands. In this case, organized communities have had many challenges because most residents are elderly, and it was also difficult to find an active young leader. To overcome these problems, programs, such

as for urban and rural interchange and eco-tourism, are essential. Otherwise, the transition area could be in an inappropriate condition. The types analyzed by residence are shown in *Figure 11* [from left (1), (2) and (3)]

4.2.3 From the Perspective of Local Resources

The local natural and cultural resources of a BR have been retained and continued. Generally, people have enjoyed the natural resources, such as natural parks, splendid landscapes, and rare or unique geographical features. Many people particularly enjoy the eco-tourism in natural parks, forest parks, and woodland parks and the cultural tourism in cultural heritage protected areas, such as temples and shrines, recreational forests, and *maulsoop* (Korean historical rural village forests). The cultural landscapes, containing abundant information regarding local history and land use management, have been cherished as a bearer (Antrop, 2006; Jung, H.-J. & Ryu, 2015). Natural and cultural landscapes have brought enjoyment to people who crave local resources in the BR. In addition, the interpretation of cultural, heritage, and natural landscapes have been the key subjects of interest for sustainable development and management (Nepal, 2009).

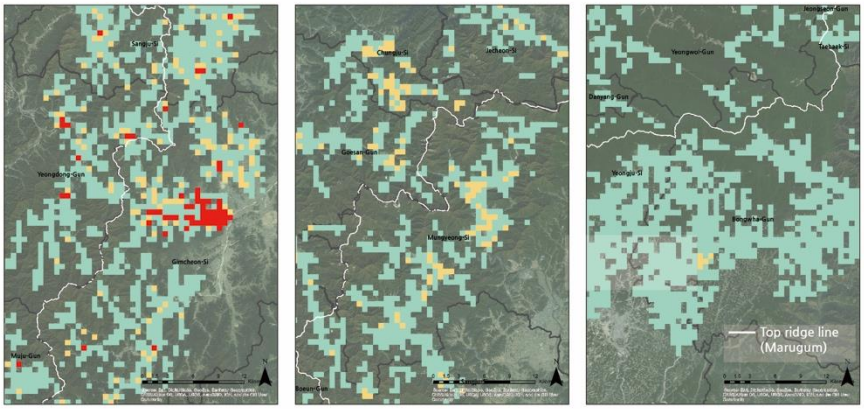

Figure 11. The types of residents' transition areas

The types of local resources were (1) natural-scenery resources and (2) historical-cultural resources. The first natural-scenery resource type was close to the forest and included a natural protected area because it was based on large-scale eco-tourism. Most areas were agricultural and forested areas where few people lived. These heavily forested areas were common because the BDDG is a mountain range. In particular, eight natural parks are concentrated in the BDDG. People can enjoy cultural resources at the same time. The historical-cultural resource type is small-scale or medium-scale. Because the sizes, types, and locations of each resource differ from the natural resources type, they need special management. In addition, continuous management is essential because of cherished intangible resources, such as dialects, dance, folk songs, and local traditional songs. The historical-cultural resource type is used with the natural landscape more than in medium-scale areas, such as temples, shrines, and cultural heritage protected areas. The local resources' types of transition areas are shown in *Figure 12* [from left (1) and (2)].

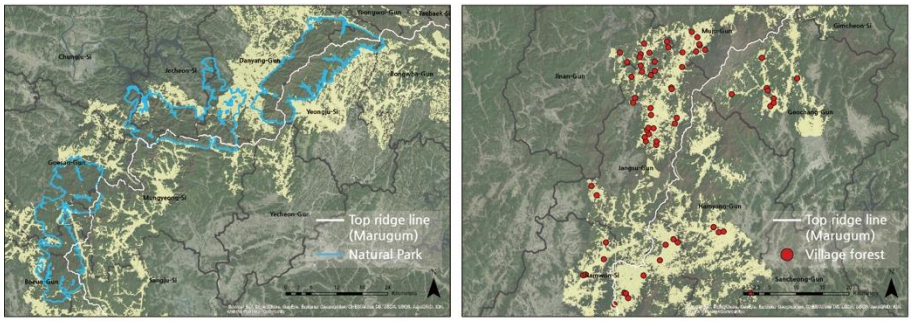

Figure 12. The local resources' types of transition areas

5. DISCUSSION

5.1 Management Systems Considering Boundaries

The BDDG's BR encounters large-scale challenges for maintenance and management of the entire BDDG and BR. Currently, the area is adjacent to or overlaps 32 municipalities in six provinces. A majority of the area is mountainous, and it is difficult to set precise boundaries and establish overall management plans. However, the transition areas are free in terms of the lack of regulations and laws (Schmidt, Busse, & Nuriyev, 2017), resident stakeholders would play a key role in development and in conserving the local ecosystem (Egoh et al., 2008). Well-managed core and buffer areas can provide some service to residents (Woodley et al., 2012), and the management system of transition areas that are impacted is very important.

A BR based on a geographical system with inherent socio-cultural differences plays an important role to variable practitioner groups as a platform for participation (Coetzer-Hanack, Witkowski, & Erasmus, 2016; Reed et al., 2014). However, large differences of distance and culture lead to difficulties in communication between the practitioners, thereby restricting sustainable development and change (Reed et al., 2014). The performance of BR initiative strategies are also forced to an appropriate scale (Olsson et al., 2007). Due to various reasons, establishing boundaries for transition areas is the key.

5.1.1 Administrative Districts

The BDDG can be divided into the northern, central, and southern regions as administrative systems in South Korea. Although each region is adjacent to the BDDG, the extent to which development utilizes resources differs greatly by region. The government controls the management in cases of huge areas, and this system can be recognized as a new governmental policy, not a BR, regarding the local residents. In addition, establishing management and maintenance of the transition area is difficult and it could lead to regional imbalance. Creating a way for residents to participate is necessary because the managing body may in fact consist of residents in order to achieve efficient management. In large areas, the management boundaries are easy to identify, but the administrative lines do not necessarily coincide with residents' lives. Therefore, reorganization based on reality is essential.

5.1.2 Proximate Districts

Regardless of the administrative districts, proximate districts each manage one transition area. Because proximate districts were geographically close to each other, establishing an association for management was easier than in large regions. Each area in a transition area could promote participation and generate a different brand. A managing body could discuss development strategies of the transition area periodically through communication and cooperation. However, the subsidy received for participation in the local government may be uncertain when participants are in different administrative districts. In addition, it could cause a local imbalance and weaken the sense of belonging in an administrative district, as most of the concentrated policies are based in administrative areas.

5.1.3 One-District System

When the local participants reside in one administrative area, that area could be the ideal type of transition area. Most importantly, creating an association of residents would be easy and an agenda on the transition area could be discussed frequently. The residents could be more independent than those in other systems in terms of management and maintenance of the area, but the functions of local government are important.

This system could be restricted to residents who do not participate in the same districts, but expanded areas would receive promotional effects as different local brands. In addition, residents that participated could enhance the harmony and self-esteem of the district. This system could apply to the BDDG on a large scale, but it has not had a role as a BDDG BR in one area.

5.2 Urban BR

The "urban BR" was introduced to experts at the partnership of cities conference, concerning the urban biosphere and society in 2004, addressing the challenge of balancing development with economic and environmental conservation (Alfsen-Norodom, 2004). The MAB urban group recommended a model urban BR, which could reconcile the biodiversity and urban planning policies to urban sustainability (Caballero, 2016; UNESCO, 2010, 2012).

Several existing BRs around the world lie adjacent to urban areas, such as metropolitan areas, or are in cities or towns. An urban BR in a natural, cultural, and socioeconomic environment located in or adjacent to an urban area is formed by urban influences and the pressures of development (Dogsé, 2004). It could be incorporated into a separated area within an existing urban area, constituting core, buffer and transition areas similar to the BR (Eastman, 2002). The Urban Biosphere Initiatives such as CUBES (the Colombia University-UNESCO Joint Program on Biosphere and Society), URBIS (Urban Biosphere initiative) and NYUBG (the New York Urban Biosphere Group) aim to establish urban criteria, and develop indicators and strategies for local biodiversity and ecosystems, and enhance citizen participation and collaboration.

The possible types of urban BRs introduced by the MAB are (1) the urban green belt BR, (2) urban green corridor BR, (3) urban green area cluster BR, and (4) urban region BR. As in the case study, many isolated areas with natural and cultural resources have been controlled and protected by plans based on urban development. In the case of the BDDG, this can be explained by integrating types, and continuous research on the diverse types is necessary.

The Brighton and Lewes Downs BR in the United Kingdom was listed in 2014, and it includes the urban area of Brighton and Hove. UNESCO and urban BR working groups have been trying to establish these ecological principles for urban areas through international debate.

By 2050, about two-thirds of the global population will live in urban areas (UNESCO, 2004). The transition area boundaries will be uncertain, and a significant body of research will be needed. However, urban BRs would have the advantage over rural BRs of being able to sell local products under the BR brand. That resources and landscapes surrounding cities would be damaged has been indicated, and it has been recommended that urban BRs should control damage using mechanisms regarding green belt sprawl and unplanned urban expansion. Urban BRs would be recognized as international sites.

5.3 Relationships to other Protected Areas

A series of protected areas designated by law for protection are in the BDDG. The protected area zones in South Korea, such as the BR transition areas where people live, exist only in national parks. Conflicts have existed between the government and residents who have lived around protected areas according to strict regulations. The protected areas prohibit access to people, but the regulations of a BR are comparatively free. National law regulates only the BR's core area, but no law or policy would govern the buffer and transition areas. Relevant policies for transition areas can be established by stakeholders themselves, in accordance with the local environment and resources, or in cooperation with the local government. In addition, the collaboration between the protected area and the BR is required for balancing nature and people.

Cooperation among managing departments that implement BRs and protected areas is necessary to efficiently manage the areas. In Germany, the national natural landscape association has a brand identified with its BRs, and large national parks and nature parks were provided communal promotion and marketing to raise awareness of the protected areas (Engel & Zimmermann, 2007). In Japan, BRs fall under national or local policies, with branding recommended by the government (Okano, 2012). The policies relevant to the conservation protection areas within BRs should continue to be studied.

6. CONCLUSION

In the face of multifaceted challenges to urban areas with pressing needs for sustainable development. BRs, which conserve biological diversity, maintain cultural resources, and promote local development as one of the city, are suggested in this study. Given that the BDDG has been applied to the watershed under the traditional principle, internal natural and cultural resources should be researched and applied. The BDDG has been cherished in numerous ways as a city, identified as a city constructed under geographical principles and referred to as *sanjabunsuryung* in nature. This study established a new index of collected indicators for zoning transition areas. In the study area, the three types of transition areas were classified as watershed, residences, and local resources. The types of watershed were self-managed, neighborhood, and cooperative. The types of resident areas were urban, relatively rural, and rural. The types of local resources areas were natural-scenery and historical-cultural. It is suggested in this study that transition areas be managed as administrative districts and urban BRs, and through their

relationships with other protected areas. In conclusion, the transition area of BR in this study was identified as urban (through categorizing the typology), suggesting that management of the BDDG should take a long-term approach. Because the BDDG comprises many municipalities adjacent to urban areas, it was recognized as a BR in one area.

This study focused on the part of South Korea that is in the BDDG, which the government has been trying to get onto the UNESCO list. However, the natural ecosystem and cultural landscape of the Korean peninsula cannot be divided by the political border between South Korea and North Korea. The BDDG has long been cherished for its Korean values, which is enough to designate it as a BR and as a World Heritage Site. Furthermore, the urban BR is an ongoing process, and considerable research remains to be done on this area and its urban features.

REFERENCES

Alfsen-Norodom, C. (2004). "Urban Biosphere and Society: Partnership of Cities - Introduction". *Annals of the New York Academy of Sciences*, *1023*(1), 1-9.

Antrop, M. (2006). "From Holistic Landscape Synthesis to Transdisciplinary Landscape Management". In Tress, B., Tres, G., Fry, G., & Opdam, P. (Eds.), *From Landscape Research to Landscape Planning: Aspects of Integration, Education and Application* (pp. 27-50). Dordrecht, Netherlands: Springer Science & Business Media.

Caballero, G. V. (2016). "The Role of Natural Resources in the Historic Urban Landscape Approach". *Journal of Cultural Heritage Management and Sustainable Development*, *6*(1), 2-13.

Choi, Y.-K. (2004). "Baekdudaegan, the Central Axis of the Korean Peninsular: The Path toward Management Strategies Regarding to Its Concepts". In Hong, S.-K., Lee, J. A., Ihm, B.-S., Farina, A., Son, Y., Kim, E.-S., & Choe, J. C. (Eds.), *Ecological Issues in a Changing World: Status, Response and Strategy* (pp. 355-383). Dordrecht: Kluwer Academic Publishers.

Coetzer-Hanack, K. L., Witkowski, E. T. F., & Erasmus, B. F. N. (2016). "Thresholds of Change in a Multi-Use Conservation Landscape of South Africa: Historical Land-Cover, Future Transformation and Consequences for Environmental Decision-Making". *Environmental Conservation*, *43*(3), 253-262.

Dogsé, P. (2004). "Toward Urban Biosphere Reserves". *Annals of the New York Academy of Sciences*, *1023*(1), 10-48.

Eastman, J. L. (2002). "Urban Biosphere Reserves: Integrating Conservation, Community, and Sustainability". *William & Mary Environmental Law and Policy Review*, *27*(3), 707-753.

Egoh, B., Reyers, B., Rouget, M., Richardson, D. M., Le Maitre, D. C., & van Jaarsveld, A. S. (2008). "Mapping Ecosystem Services for Planning and Management". *Agriculture, Ecosystems & Environment*, *127*(1-2), 135-140.

Engel, S., & Zimmermann, M. (2007). "Environmental Institutions in Germany: Leader or Laggard?". In Breton, A., Brosio, G., Dalmazzone, S., & Garrone, G. (Eds.), *Environmental Governance and Decentralisation*. Cheltenham: Edward Elgar Publishing.

Iida, Y., & Nakamura, S. (2016). "Mountain Hakusan Biosphere Reserve: Creating a New Path for Communities and Nature". *UNU-IAS OUIK Biocultural Diversity Series*. Tokyo: United Nations University. Retrieved from https://collections.unu.edu/eserv/UNU:5612/Hakusan.pdf.

Jung, H.-C., Lee, D.-K., Jeon, S.-W., & Song, W.-K. (2005). "Analysis of Deforestation Patterns in the Baekdudaegan Preservation Area Using Land Cover Classification and Change Detection Techniques; the Feasibility of Restoration". *Landscape and Ecological Engineering*, *1*(2), 177-190.

Jung, H.-J., & Ryu, J.-H. (2015). "Sustaining a Korean Traditional Rural Landscape in the Context of Cultural Landscape". *Sustainability*, *7*(8), 11213-11239.

Korea Forest Service. (2006). "The Baekdu Daegan Mountain". *White paper*.

Korea Forest Service. (2015). "Designating as Unesco's Biosphere Zone in Korea Baekdudaegan Ridge". Korea Forest Service,.

Miller, K., & Kim, H. (2010). "Ecological Corridors: Legal Framework for the Baekdu Daegan Mountain System (South Korea)". *IUCN-EPLP No. 81*. Gland, Switzerland: IUCN. Retrieved from https://www.iucn.org/downloads/south_korea.pdf.

Ministry of Environment. (2001). "A Study on Efficient Management Policies of the Baekduaegan - Focusing on Establishment of Management Scope".

Nepal, S. K. (2009). "Traditions and Trends: A Review of Geographical Scholarship in Tourism". *Tourism Geographies*, *11*(1), 2-22.

Okano, T. (2012). "Japanese Activities in Biodiversity Conservation and Biosphere Reserves in Japan". *Japanese Journal of Ecology*, *62*(3), 375-385.

Olsson, P., Folke, C., Galaz, V., Hahn, T., & Schultz, L. (2007). "Enhancing the Fit through Adaptive Co-Management: Creating and Maintaining Bridging Functions for Matching Scales in the Kristianstads Vattenrike Biosphere Reserve, Sweden". *Ecology and Society*, *12*(1), 28.

Reed, M. G., Godmaire, H., Abernethy, P., & Guertin, M.-A. (2014). "Building a Community of Practice for Sustainability: Strengthening Learning and Collective Action of Canadian Biosphere Reserves through a National Partnership". *Journal of Environmental Management*, *145*, 230-239.

Schmidt, S., Busse, S., & Nuriyev, E. (2017). "Government and Biodiversity Governance in Post-Soviet Azerbaijan: An Institutional Perspective". *Environment, Development and Sustainability*, *19*(5), 1953-1980.

Uchiyama, Y., & Mori, K. (2017). "Methods for Specifying Spatial Boundaries of Cities in the World: The Impacts of Delineation Methods on City Sustainability Indices". *Science of the Total Environment*, *592*, 345-356.

UNESCO. (2004). "Biosphere Reserve Nominations and Urban Areas".

UNESCO. (2008). "Madrid Action Plan for Biosphere Reserves (2008-2013)".

UNESCO. (2010). "Urban Systems".

UNESCO. (2012). "Ecological Sciences". 1-2.

United Nations Department of Economic and Social Affairs (UNDESA). (2012). "World Urbanization Prospects: The 2011 Revision". (9211514932), New York: UNDESA Population Division.

Wicher, K. (2015). "Ensuring the Conservation Function of Biosphere Reserves in Mountain Areas in Europe". Inverness, Scotland: Centre for Mountain Studies, Perth College, University of the Highlands & Islands. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/small_MAB_national_report_UK_Annex_MABICC27_en2.pdf.

Woodley, S., Bertzky, B., Crawhall, N., Woodley, S., Bertzky, B., Crawhall, N., . . . Sandwith, T. (2012). "Meeting Aichi Target 11: What Does Success Look Like for Protected Area Systems?". *Parks*, *18*(1), 23-37.

World Tourism Organization (UNWTO). (2011). *Religious Tourism in Asia and the Pacific.* Madrid, Spain: World Tourism Organization.