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Getting to Know the SDGs in the Mount Arrowsmith Biosphere Region

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ABSTRACT: This pilot project worked to review how the Mount Arrowsmith Biosphere Region (MABR) is contributing to the United Nations Sustainable Development Goals (SDGs) at the local level. It is crucial that the SDGs are met locally, nationally, and internationally to achieve a sustainable future for all. Through a qualitative approach, this study explored the how groups within the region are contributing to each Goal. Results found that each of the 17 SDGs are being contributed to in the MABR, though some Goals, including Goal 15, receive more support than others.

Keywords: UNESCO, Biosphere Reserve, Sustainable Development Goals

INTRODUCTION

Adopted in 2015 by the United Nations, the Sustainable Development Goals (SDGs) (Figure 1)

aim to transform the world by 2030 through a holistic approach to sustainable development (United Nations, 2020). The SDGs call all world nations to action - regardless of their economic status - to achieve a more sustainable future for all, leaving no one behind (United Nations, 2020). SDG progress can be tracked by the targets and indicators for each Goal, which act as measurement tools (United Nations, 2020).



Figure 1. The United Nations 17 Sustainable Development Goals (United Nations, 2020).

Although the SDGs were developed for nations, their achievement requires collaboration and solutions from all levels, including the local level (United Nations, 2016). As a United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve, the Mount Arrowsmith Biosphere Region (MABR) plays a significant role in promoting and contributing to the SDGs locally. Biosphere Reserves are areas that model solutions for a sustainable future, celebrate cultural and biological diversity, and empower positive relationships between humans and nature (UNESCO, 2019). Located on eastern Vancouver Island, British Columbia, Canada, the MABR involves partnerships between community members, stakeholders, and organizations (Mount Arrowsmith Biosphere Region, 2021). Through these partnerships and its role as a UNESCO Biosphere Reserve, the MABR is situated to make meaningful local contributions to the SDGs.

Through a bottom-up approach, this project's objectives were to raise awareness of the SDGs, and determine how community groups in the MABR are currently contributing to the SDGs. Ideally this approach will initiate momentum within the community for the future SDG project work.

METHODS

Through a qualitative approach, methods for this project included preliminary data collection,

semi-structured interviews, and qualitative data analysis. First, online websites and resources of 36 community groups (non-profits, charities, non-governmental organizations, and businesses) in the MABR were reviewed to determine how their work contributes to the SDGs. Second, the semi-structured interviews allowed for a stronger connection to be made between the community groups and the SDGs. Questions were drafted based on data collected in the preliminary review. In total, 36 groups were invited to participate in interviews and 11 groups accepted. All interviews were held virtually via Zoom, or by phone. The interviews were transcribed using Otterly.ai. Last, the qualitative analysis for the project was conducted using NVivo. Using the SDGs as nodes and SDG clusters (groups of similarly themed targets) as sub nodes, data was coded to the associated SDGs. Once coded, each SDG was analyzed to determine the level of contribution across the MABR.

RESULTS

All 17 SDGs are currently being contributed to within the MABR; however, some receive more support and contributions than others (Figure 2). Goal 15 is the SDG most contributed to, with 18 groups engaging in initiatives to support and protect ecosystems and biodiversity. For example, four groups engage in invasive species removal. Other groups contribute to SDG 15 through sustainable and regenerative forest management.

Mosaic Forest Management, for example, is committed to sustainable forest management practices, which are ensured through their Sustainable Forestry Initiative certification.

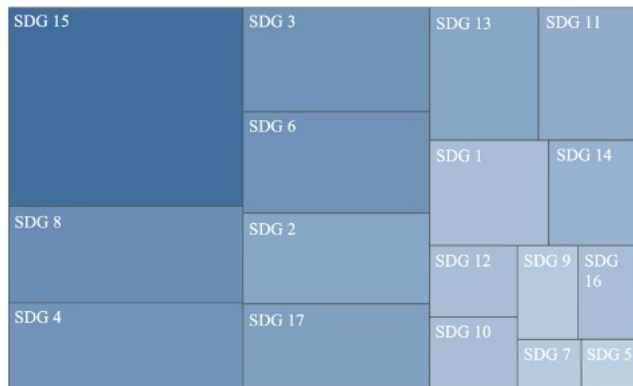


Figure 2. SDG code hierarchy chart showing contributions to each Goal.

Following SDG 15, the Goals most contributed to in the MABR include SDGs 8, 4, 3, and 6, respectively. Contributing to SDGs 8 and 4, many groups in the MABR offer educational programming for youth as well as job opportunities. For example, Oceanside Building Learning Together’s Words on Wheels (WOW) bus offers transportable educational materials to communities around Parksville. A handful of groups in the MABR promote healthy lifestyles and wellness through community programs, advancing SDG 3. Many groups within the MABR are contributing to SDG 6 by lobbying and working towards the protection of ecologically important freshwater ecosystems.

SDGs 5 and 7 were the least contributed to. Only

one group, the Haven House, offers programs addressing violence and discrimination against women and children, which contributes to SDG 5. Two groups contributing to SDG 7 are focused on changing their operational practices to feature renewable energy technologies. For example, Morningstar Farm plans to capture waste products from their cattle, such as methane, to convert into usable energy.

DISCUSSION

Through a review of online resources and interviews, this study found that initiatives taking place within the MABR are contributing to each of the SDGs. These initiatives were not developed for the SDGs, but rather they inherently contribute to them. Local initiatives are developed to address issues that may be overlooked or under prioritized by other sectors. Awareness of the SDGs is also crucial for their implementation (United Nations, 2016). By connecting local initiatives to the Goals, this project increased awareness of the SDGs.

Rationalizing why the level of contribution varies for each SDG was not the focus of this project. However, it could be speculated that Goal 15 was the most contributed to due to the social climate of the MABR and Vancouver Island. Passion for the environment is evident through communities across the island. This dates back to the early 1900s as there were many environmental groups

in the MABR (QB Museum, personal communication, January 19, 2021). Additionally, factors that may restrict contribution to other SDGs may include a lack of financial resources, limited work force, existing expectations of governmental action, and limited awareness or knowledge of the SDGs.

Moving forward we intend to continue this review and expand the research, as a limitation to this study was sample size. Not all groups within the MABR were interviewed due to limited resources, time, and a low response rate within the project timeframe. More interviews could shift the SDG hierarchy in the region.

Groups that participated in interviews are optimistic for the future development of the SDGs within the MABR, which shows potential for further promotion and contribution to the Goals moving forward.

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Wetland Mapping and Monitoring in the Regional District of Nanaimo

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ABSTRACT: Wetlands play a pivotal role within the Regional District of Nanaimo (RDN), including the Mount Arrowsmith Biosphere Region (MABR), providing ecosystem services and significant value to the region. Wetlands in this region face threats including climate change, hydrological changes, urban development, and resource extraction; therefore, it is important that we have a more in-depth understanding of their local roles. This study looks at what part wetlands play in groundwater recharge or discharge. Instrumentation was installed at three sites within the MABR, collecting water levels in three piezometers installed at different depths, precipitation, and daily site photos, with data downloaded every three months and compared to data from the nearest climate, hydrometric, and observation well stations. Data interpretation is still in the initial stages and more data is required in order to

confidently conclude the role these selected wetlands have with regards to their connection to the underlying aquifers of the region.

Keywords: wetlands; groundwater; aquifer recharge

Introduction

Within the Mount Arrowsmith Biosphere Region (MABR), the Regional District of Nanaimo (RDN) exhibits diverse climatic conditions, plant communities, and ecosystems, including a variety of wetland types (MacKenzie & Moran, 2004). It has been recognized that there are significant data gaps regarding where wetlands in the RDN are located, how they are classified, and what role they play in groundwater recharge. All types of wetlands provide ecosystem services, including both physical goods and services, as well as critical regulating services like flood mitigation and

carbon sequestration (International Union for Conservation of Nature, 2020; Were et al., 2019). Additionally, wetlands are a vital habitat for numerous species and hold important regional cultural, spiritual, educational, scientific, and recreational values (Olewiler, 2004).

Wetlands in the RDN face a variety of threats, including impacts from climate change, hydrological changes, urban development, and resource extraction. Thus, it is important to gain a better understanding of the local wetlands in order to prioritize wetlands for future monitoring, enhancement, and restoration activities. The Wetland Mapping in the RDN project was brought to fruition in response to the need to fill these data gaps. The project was facilitated by the Mount Arrowsmith Biosphere Region Research Institute (MABRRI), in partnership with the RDN's Drinking Water and Watershed Protection Program. Initially, the project focused on where wetlands were located and their classification. Now, the project and this study is focused on the role wetlands play in groundwater recharge.

Methods

In order to identify priority sites for the pilot project, which would work to evaluate what role wetlands play in groundwater recharge, an analysis was run using Esri's ArcMap 10.5.1 Model-builder tool. This analysis identified wetlands that were previously mapped in the initial stages of this project that were in close proximity to:

observation wells monitoring surficial aquifers; existing climate and hydrometric stations; and fish-bearing streams. The concentration of groundwater wells and concentration of water rights licenses were incorporated in the analysis, as well. To begin the pilot project, one priority site was selected to install instrumentation and assess the proposed methods. The research team installed three piezometers, a rain gauge, and three trail cameras. The piezometers measure subsurface water level fluctuations, recording every hour. Each piezometer was installed at different depths to help indicate if water is moving vertically, either recharging or discharging the aquifer system. To correct for topographic variation, the absolute heights of the piezometers relative to one another was measured using a handheld laser range finder and the horizontal distance between each piezometer. From these measurements, a corrected value was applied to each piezometer's collected data. The rain gauge collects on-site precipitation values. HOBOWare software and data loggers were used in the piezometers and rain gauges. The trail cameras provide visuals for the data collected, with photos taken 4 times a day at 11:00, 12:00, 13:00, and 14:00.

Figure 1. The three types of instrumentation installed: (a) piezometer, (b) rain gauge, and (c) trail camera.



All data from each piezometer and the rain gauge were downloaded during periodic field visits, in addition to data from the nearest climate station, hydrometric station, and observation well. Based on the initial analysis of this data, it was decided that the instrumentation set-up would not change. However, there were minor modifications to the piezometer installation methods used and which wetlands were selected for instrumentation. Instrumentation was installed in two more priority sites. All priority sites fall within two of the MABR's five watersheds. Every three months, data is downloaded from the instrumentation at all three sites, corrected for errors, graphically represented, and analyzed in comparison to nearby climate station, hydrometric station, and observation well data to determine if there is a correlation between what is occurring in the wetland and what is being observed in these other data sets.

Preliminary Interpretations

To account for sources of error introduced by variation in the vertical and horizontal distances between each piezometer, the data analysis method was adjusted. After initial review, data analysis focused on how water levels respond to rainfall events in combination with patterns and trends seen between piezometers rather than looking

explicitly at the water level values within each piezometer. Based on initial interpretations, it is likely that two of the sites have minimal to no connection to groundwater, while the other site may be connected, with variation across the wetland. However, further data collection and interpretation is required in order to make conclusive interpretations.

Next Steps

There are three main next steps that will be undertaken over the next two years, including data collection, trialing a new method to determine the absolute height difference between piezometers, and refining the data interpretation process. Data collection will continue to occur every three months at each of the sites, ensuring that the equipment is maintained and working appropriately. This portion of the project will now be conducted with the help of local volunteers, accompanying the MABRRI team to download data and record site characteristics. Instrumentation data collection will continue until at least two years of data has been collected and analyzed, as current data trends should be compared to another seasonal cycle. Additionally, the research team will be trialing a new method of measuring the absolute height difference of piezometers relative to one another to provide more accurate values to correct water levels in the piezometers to the same datum. By establishing more accurate correction values, the interpretation process will become refined, making it possible for the team to

more precisely say if water is moving vertically in the system, either recharging or discharging the underlying aquifer.

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Plant phenology research and monitoring pilot project at Milner Gardens & Woodland

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ABSTRACT: Global climate is changing and its impacts can be seen throughout Vancouver Island. This research studies the relationships between climate and coastal plant phenological development in order to build our understanding of how individual species and ecosystems on Vancouver Island are currently responding to climate. In 2016, a pilot project was initiated at Milner Gardens & Woodland in the Mount Arrowsmith Biosphere Region to establish field data collection and management protocols contributing to plant phenology research and monitoring on southeastern Vancouver Island. Data collection methods included both in-person and field camera observations of phenophases throughout the growing season. Data management tasks included the development of a photo observation database and contribution to an international online phenology observation network. Over time, we expect that the data collected will illustrate shifts in the timing of both the growing season and plant development phases on southeastern Vancouver

Island, as well as shifts in climatic trends in the study area. Increased understanding of species and ecosystem shifts will contribute to land management and ecosystem conservation in the future.

Keywords: phenology; climate change; conservation

INTRODUCTION

Studying plant phenology, the timing of cyclic biological changes, and the relationships between climate and phenological development builds our understanding of how individual species and ecosystems respond to climate. Climate, photoperiod, and other seasonal changes trigger the initiation of species' phenophases, but they are also controlled by each species' sensitivity to environmental factors (Ide & Oguma, 2010). Numerous studies have shown that increasing global temperature is advancing the overall initiation of spring phenophases and delaying autumn

phenophases (Cleland et al., 2007). Large spatial scale green-up and senescence patterns can be demonstrated using satellite imagery and correlated with homogenous climate averages; however, remote sensing can only represent the phenology of vegetation communities (Studer et al., 2007).

This study was initiated to evaluate the vulnerability of plant species and ecosystems on Vancouver Island to climate change. It aims to fill the site-level knowledge gap to assist site and stand level management planning. Additionally, it is understood that mid-latitude, highly seasonal, temperate regions like British Columbia have the most potential for “long-term shifts in phenology” due to climate variability (Fitchett et al., 2015). Therefore, conducting phenology research in this area is necessary to better understand the potential effects of climate change on our local ecosystems.

The project was piloted in 2016 to establish field data collection and management protocols contributing to plant phenology research and monitoring on southeastern Vancouver Island. Data collection methods included both in-person observations and field camera observations of various phenophases throughout the growing season (including bud break, leaf, flower, and fruit development, and fall senescence). Data management tasks include the development of a photo

observation database and contribution to an international online phenology observation network (USA National Phenology Network, n.d.). Data collection and management protocols were developed and piloted at Milner Gardens & Woodland (Milner G&W) forested sites within the Mount Arrowsmith Biosphere Region.

Staff and volunteers at Milner G&W, staff from the Mount Arrowsmith Biosphere Region Research Institute (MABRRI), and a research ecologist from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) initiated a phenology research and monitoring project strategy combining MFLNRORD research and Milner G&W monitoring goals. Work completed to date at Milner G&W includes the selection of 44 observable native specimens (12 different species in total), which are distributed throughout three forested study sites (Figure 1).



Figure 1. Study sites at Milner G&W, highlighting specimen distribution at Study Site 1 (inset map).

Milner G&W is located within the Coastal Douglas-fir moist maritime (CDFmm) biogeoclimatic (BEC) subzone (Green & Klinka, 1994). BEC is a hierarchical system that describes sites within a subzone using relative soil moisture and soil nutrients. The three sites at Milner G&W span a range of site conditions: from the zonal site type (i.e., average soil moisture and nutrients for that BEC unit) to the we-rich soil site type. Species at the study sites were chosen to be representative of the CDFmm BEC subzone plant association, as well as of the non-timber forest product values of the site (e.g., wildlife foraging and cultural values). The research team also installed a weather station at the site to collect baseline microclimate data and to research the relationship between forest microclimate and plant phenology.

METHODOLOGY

In-Person Observations

At Milner G&W, in-person observations have been collected since the project was initiated in 2016 by a group of citizen scientists, Vancouver Island University students, and staff of both MABRRI and MFLNRORD. Capturing the exact date of phenophase initiation requires daily

observations, but studies have found that fortnightly observation sessions will generate reasonably accurate results (Crimmins & Crimmins, 2008; Morellato et al., 2009). In-person observations are scheduled based on the seasonal magnitude of activity observed; sessions are conducted weekly in spring and summer, fortnightly in autumn, and monthly in winter. Observations are made collaboratively in order to reduce bias and inconsistencies (Benton, 2009). Data collection guides and detailed definitions derived from the National Phenology Network's Nature's Notebook (USA National Phenology Network, n.d.) were created for each phenophase and species, and corresponding photographs were taken as examples of each phenophase identified to guarantee correct identification. Nature's Notebook's in-situ monitoring protocols are standardized across taxonomic groups to facilitate collaborative research by using consistent definitions for phenophase status (Denny et al., 2013). Site specific data collection forms were developed based on Nature's Notebook tablet app and are used to monitor not only the date of initiation of each phenophase, but also the intensity and abundance. Phenophase statuses are tracked individually to allow simultaneous measurement of several stages. Every observation is recorded using either a data collection form or the Nature's Notebook tablet app (USA National Phenology Network, n.d.). All field observations are submitted to Nature's Notebook's open online database.

Field Camera Observations

Since 2017, the research team has trialed field camera observation techniques at Milner G&W. Field cameras are deployed and directed at each specimen to capture daily phenophase development. The time-lapse field cameras are set to face each specimen at the optimal focal distance (approximately one metre) (Figure 2). They are programmed to capture multiple photos every day during optimal light times, to ensure a backup photo would be available if one was impacted by poor lighting or other quality issues. As opposed to the coarse in-person data collected, the field cameras provide continuous daily phenophase development data throughout the growing season.

Each camera hosts an SD card that stores the series of photos and their accompanying metadata. All data captured during the growing season are entered into a photo data capture database. Student researchers from Vancouver Island University are hired to manually assess each photo and identify all visible phenophases using the same definitions and abundance or intensity measures as are used for the in-person observations. During this process some gaps in the image database might occur due to missing or poor-quality photos on those days. Missing photos can occur if camera batteries die, and poor-quality photos can occur during poor weather (e.g., cloud cover, heavy rain).

To date, we have tested three different camera models. A published study by Xie, Civo, and Silander (2018), recommends using Moultrie Wingscape trail cameras (Moultrie, moultriefeeders.com) and had positive results utilizing these cameras for phenology analysis. Wingscape cameras are designed to take gallery quality photos using time lapse technology for bird enthusiasts, whereas other cameras we have tested, such as Reconyx Hyperfire™ (Reconyx, reconyx.com) and Bushnell Trophy Cam (Bushnell, bushnell.com), designed for wildlife research, primarily to locate game for hunting. Due to their focus on time lapse and high-resolution imagery, we found that Wingscape cameras are better suited for this project.



Figure 2. Wingscape timelapse field camera capturing data on a red huckleberry specimen.

Microclimate Station

A microclimate station was installed to establish baseline microclimate data at the study site (Figure 3). The Onset HOBO (Onset, onset-comp.com) station measures ground surface and air temperature, relative humidity, solar radiation, wind speed and direction, and precipitation, in addition to both soil moisture and temperature at 30cm below surface. This will allow us to examine relationships between microclimate and plant phenological development at our study site. Temperature influences the timing of phenophase development (Allstadt et al., 2015; Cleland et al., 2007) while soil moisture functions as a proxy variable for understanding the interaction between land surface and atmospheric conditions and evaluating patterns of climate change (Entin et al., 2000). The dynamics of soil moisture play a dominant role in vegetation stress and suitability of vegetation to climate and soil conditions (Guswa, 2002), though this is not as well linked with phenophase development in current literature. We are exploring air and soil temperature, as well as soil moisture as potential triggers to developmental and reproductive plant phenophases, such as bud break and berry production.

The microclimate data will later be coupled with modelled climate change projections, allowing us to examine potential future impacts to species productivity and ecosystem composition over time.



Figure 3. Microclimate station at the Milner G&W study site.

NEXT STEPS

As a result of the pilot project, the team was able to determine the feasibility and scope of this long-term research project, including evaluation of the utility of field cameras to capture plant phenophase on remote research sites. Staff of MABRRI and MFLNRORD developed a research program to expand the study of microclimate and plant phenology across elevational and latitudinal transects on southeastern Vancouver Island, from the Bowser to Victoria area. After testing both in-person and field camera techniques, we decided to move forward with the field camera observation technique for all subsequent sites. In 2017, we established two more study sites distributed within two BEC subzones: Thetis Lake Regional Park (CDFmm) and Mount

Arrowsmith Massif Regional Park (Mountain Hemlock moist maritime (MHmm)). In 2020, we were awarded funding from the BC Parks Living Lab for Climate Change and Conservation Program to establish additional zonal sites within the Coastal Western Hemlock very dry maritime (CWHxm) subzone at Bowser Ecological Reserve and Koksilah River Provincial Park. Sites within CWHxm provide us with data between the low elevation (CDFmm) and high elevation (MHmm) study areas, which will allow an analysis of shifts in plant survival and productivity across latitudinal and regional climatic gradients on the east coast of Vancouver Island. Findings from all sites will be integrated to contribute to both site- and landscape- level understandings of baseline plant phenology and microclimate relationships and understanding of potential impacts of climate change to the growth and productivity of species and plant communities.

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The spotlight on youth: Young people as key stakeholders in Biosphere Reserves and the Man and the Biosphere Programme

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ABSTRACT: Sustainable development has at his heart the mission to make our planet a life-sustaining place for future generations. Young stakeholders are key to sustainability transformations, both as active participants that push them forward but also as actors vulnerable to being left behind. As testing sites for sustainable development, Biosphere Reserves (BRs) are home to millions of young people in over 124 countries. Very little research or knowledge exists on how young people experience living in BRs, how they contribute towards BRs' goals, or how they see BRs moving forward under global change. To increase young stakeholder's visibility and inclusion in the MAB programme, UNESCO-MAB has organized two MAB Youth Forums attended by over 300 youth, one in Italy in 2017 and one in China in 2019. Here we present a short commentary on what we believe were the main take-away's generated

during these events and the research that followed them. Firstly, we present a research note of the first global-level study on young stakeholder's perspectives of BR implementation, discussing a thematic analysis of the results generated during the MAB-Youth Forum workshops and surveys. Secondly, we present an overview of the "MAB Youth Declaration", a collaborative text which was generated over the course of four days and which distils the main messages young people living in BRs wish to convey to the MAB community and beyond. Our paper highlights the important role young stakeholders play in BRs, whose understandings reflect the social, economic and ecological complexity in which BRs are embedded. Their concerns span a diversity of topics, from the relevance of fair conservation practices and respect for biocultural diversity, to the importance of sustainable livelihood

opportunities and fair youth representation in decision-making bodies. Thus, we highlight research findings on the need to increase young stakeholder integration and participation within environmental governance. Finally, we urge the BR research community to practice youth-inclusive research that helps generate knowledge to support evidence-based decision making in BRs.

Young Stewards in Biosphere Reserves Matter

Biosphere stewardship has become a common term used to refer to relationships between people and nature that are based on caring, knowledge and action (Peçanha-Enqvist et al. 2018). As we enter the Anthropocene (Malhi 2017) the emergence of biosphere stewardship is a key step towards organizing action for sustainability transformation (Chapin et al. 2010). Young stakeholders have an essential role to play in this transformation. They have the capacity to be agents of change in creating more sustainable societies. However, despite the focus on “future generations” in sustainable development, young actors are at high risk of exclusion in sustainability challenges (Ruesga-Benito et al. 2018), and they continue to be strongly underrepresented in governance bodies that make decisions about their future (Sundström and Stockemer 2020). In addition, young actors are rarely mentioned in the sustainability literature (Barraclough et al. 2021), with very little research aimed at understanding how young people affect and are affected by our

efforts to move towards sustainable development, with few exceptions (Treude et al. 2017, Ruesga-Benito et al. 2018).

Biosphere Reserves (BRs) were conceived as sites for learning for sustainable development 50 years ago, and the network currently counts 714 sites in 129 countries all over the world, at the front lines of sustainability practice (Reed and Price 2019). Within the Man and the Biosphere (MAB) programme, efforts to account for young stakeholders in BRs have been made to meet the targets of the Lima Action Plan (2015–2025), which explicitly refers to consideration of young people in “equitable and participatory planning for sustainable development in biosphere reserves” (UNESCO 2016). These efforts, spearheaded by the two MAB Youth Forums in 2017 and 2019, have increased the visibility of young people as important stakeholders in BRs (UNESCO 2019, Donnellan-Barraclough unpubl.).

Over the course of three years the MAB Youth Forums have brought together more than 300 young people from all around the world (in Delta Po BR in Italy 2017, and in Changbaishan BR in China 2019). The Youth Forums are melting pots of exchange and learning, resulting in the creation of youth networks in each of the five BR World Regions (Africa, Arab States, Asia and the Pacific, Europe and North America, and Latin

America and the Caribbean). The forums' workshops also generated vast amounts of information about how young stakeholders see BR implementation, both now and going forward. These opinions and perceptions are a valuable source of knowledge that can inform a more inclusive management of BRs (Bennett 2016), whilst also increasing recognition, opportunities and integration of young actors.

Recent work on this topic (Donnellan-Barracough et al. unpubl.) has made steps towards compiling this knowledge, filling a gap in the sustainability literature in which investigation of young stakeholder understandings and roles as biosphere stewards is notably absent (Donnellan-Barracough et al. 2021). In the following commentary we wish to close the gap between research and practice related to young stakeholders in BRs. To do this, we reflect on the main findings of the recent research on youth in BR conducted by the main author, whilst also providing a platform for youth voices to speak for themselves, by presenting the BR youth declaration co-produced by young attendees during the latest MAB Youth Forum in 2019.

Capturing the Opinions of Young Stewards

A SWOT (Strengths Weaknesses Opportunities and Threats) analysis conducted during the participatory workshops at the MAB Youth Forum of 2019 has formed the basis of the first comprehensive study of young people's understandings

of BRs worldwide (UNESCO 2019, Donnellan-Barracough et al. unpubl). This first insight into young stakeholder's perceptions of BR implementation shows what factors are considered by youth to influence the successes and failures of BRs (UNESCO 2019, Donnellan-Barracough et al. unpubl). Some of these factors are novel and some fit with the existing literature (Van Cuong et al. 2017), showing that young stakeholders understand the full social and ecological complexity in which BRs are immersed. Thus, their realms of action and knowledge go well beyond just "youth concerns". Their reflections span topics which are at the forefront of environmental governance research and practice, such as the adoption of adaptive and participatory approaches to conservation management (Mohedano Roldán et al. 2019) or the challenges of building BR resilience to global change (Schultz et al. 2018). The wide breadth of topics which arose during the MAB Youth Forum workshops (Donnellan-Barracough et al. unpubl) is shown in Figure 1.

A key novel finding is the significance of sustainable livelihood opportunities for BR communities and their younger members (Figure 1). MAB Youth thought generating sustainable livelihood options in BRs was key to help both avoid environmental degradation and an unfavourable demographic shift in their home territories due to a lack of opportunities. Governance concerns (Figure 1) also dominated the youth conversation, showing participants were fully aware of the

practical implementation challenges BRs face in the real world. Thus, lack of legal or institutional frameworks to implement the MAB goals was considered an important obstacle for BRs, as well as difficulties in implementing management plans that combine development and conservation objectives whilst involving local communities in a fair and equitable way. Political instability, corruption, and lack of political will were also some of the top threats to BRs identified during the workshops, together with major global change drivers, such as land-use and climate change, and overexploitation. Land use change was one of the top threats identified by young stakeholders, fitting within the evaluation of the importance of this threat by the Global Assessment (IPBES 2020).

Ways forward identified by young stakeholders included adaptive and collaborative approaches to conservation management, with a focus on education, capacity building, collaboration, and local community participation within all levels of governance, as well as opportunities for identifying sustainable directions of local livelihoods and tourism (Figure 1). Thus, many young stakeholders believed that biodiversity conservation should be in synergy with local development, ensuring fair benefit sharing and local community wellbeing, particularly of at-risk groups such as women and children. The key importance ascribed by youth to local communities fits within the trend observed in the MAB programme over the last 20

years, where there has been a clear shift towards a “People AND nature” conservation paradigm (Mace 2014). This paradigm places emphasis on the conservation of ecological and biocultural biodiversity together, through, for example, increased community participation within management and sustainable use of natural resources (Schliep and Stoll-Kleemann 2010, Baird et al. 2018, Winkler 2019).

This research has also revealed the diverse ways in which young stakeholders engage in BRs, spanning all levels of participation, from engaging in governing bodies and management, to working with conservation, entrepreneurship or education (Donnellan-Barraclough et al. unpubl.). The collaboration, outreach and learning functions of BRs were some of the areas where youth were most present, participating in educational or exchange activities and networks. Young stakeholders were also active in conservation, such as in restoration or monitoring initiatives, and in sustainable livelihood projects, such as agroforestry. In addition, young people were active advocates for increasing youth representation in decision-making bodies at all scales, working for more meaningful and recognized forms of participation within governance.

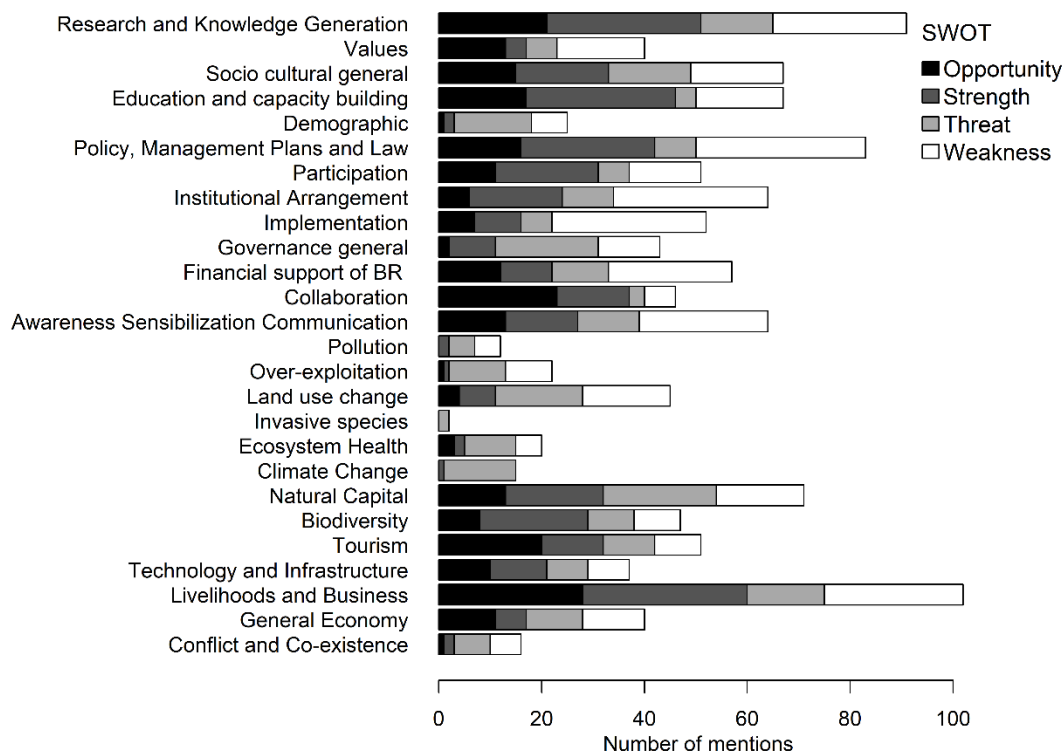


Figure 1. Topics emerging from a SWOT (Strengths, Weaknesses, Threats and Opportunities) workshop conducted at the MAB Youth Forum in 2019 Changbaishan Biosphere Reserve, China. Workshop content was coded and analyzed in NVIVO Software and main themes are represented along the y-axis (Donnellan-Barracough, unpubl).

A Declaration from MAB Youth

Over the course of four days, 171 young people gathered in the interactive workshops at the MAB Youth Forum 2019 in China. These sessions focused on how BRs can reach their goals and be arenas for implementing international environmental agreements such as the Convention on Biological Diversity (CBD) post-2020 biodiversity framework. In addition to the workshop SWOT analysis presented in the previous section, the discussions produced a collaborative text, “The MAB Youth Declaration 2019”, meant to distil the key messages which young BR stakeholders

wish to transmit. In view of the Fifteenth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP15) in Kunming (postponed to 2022 because of the SARS-CoV-2 crisis) the declaration also contains specific points addressed to the Conference of the Parties. These we have included, in view of the role BRs are meant to play in the implementation of multilateral environmental agreements.

*The MAB Youth Declaration**

Youth are an integral part of the MAB Programme and its World Network of Biosphere Reserves:

We welcome the MAB Youth Forum Declarations of 2017 and 2019 and the IberoMAB Youth Forum declaration (MAB Youth 2017) and are aware of the progress that is being made in the inclusion of young people's voice in the MAB Programme and in the World Network of Biosphere Reserves, following the organization of the 1st and 2nd MAB Youth Forum. However, we are conscious that we must continue our hard work to ensure that the requests reflected in the previous declarations can come to reality, believing in the importance to:

1. Ensure the participation of young people in the governance and management of BRs and MAB national committees, through the appointment of young representatives who can take part in decision-making processes at a local, national and international level (e.g., International Coordinating Council of the MAB Programme, Regional Networks). This should include fluent communication of youth with the MAB Programme, receiving support, technical advice and the most up-to-date information, in addition to facilitating the access to financial support for the youth community.
2. Provide training and capacity building activities to improve management abilities of BR, as tools for sustainable socio-economic development of the local population, and request to create attractive and long-term employment opportunities linked to the values of BRs (in particular conservation of biodiversity and habitat

restoration), involving local enterprises and cooperating with local stakeholders.

3. Improve cooperation among youth, BRs, NGOs, private sector, and scientists at the local, national and international levels. Create a platform for exchange among young people and BRs and explore more possibilities of international networking of BRs to share best practices and build cooperation.
4. Increase the communication and visibility of the MAB Programme and develop accessible and comprehensible BR materials.
5. Commit to a zero tolerance policy on all forms of harassment based on race, colour, religion, sex (including pregnancy), gender/gender identity, nationality, age or disability.
6. Refine certain terminologies of the MAB Programme to the 21st century. The name 'Man' and the Biosphere Programme and the term Biosphere 'Reserve' should be adapted to avoid negativity and gender discrimination.
7. We commit to diversifying communication methods and promote BRs through the use of creative, artistic and cultural means to engage all audiences.
8. Advocate within the MAB and UNESCO communities for an effective implementation and assessment of all existing and applicable non-harassment guidelines and policies.

Youth in the Midst of the Biodiversity and Climate Change Crisis

The MAB Youth Community recognize the absolute urgency to address both biodiversity loss and climate change as issues of ultimate global importance, both within and outside of BRs. We are concerned about the lack of political will and corruption, particularly from decision makers within the BRs, to implement concrete actions that address climate change. The lack of climate action, communication and networks among BRs and all stakeholders are of particular concern, as is the lack of understanding of the value of BRs to humans and other living organisms that we share the planet with. We are worried about potential false solutions in impact mitigation such as carbon offsetting, biodiversity offsetting and geo-engineering, which we see as a threat to climate action. We are also concerned by the lack of multiple strategies such as concrete legislation, Environmental Impact Assessments (EIAs), Nature-based Solutions (NBS), use of technology and the Polluter Pays Principle (PPP) in response to the Climate Crisis.

As MAB Youth Community, we demand:

1. Scientists, the private sector, governments, NGOs and the communities to address climate change and its impacts on BRs.
2. UNESCO to take the MAB Youth into consideration in all the MAB Program activities related to climate change and beyond. We recognize that accessible funding for climate action and

biodiversity protection is a major challenge for youth in the MAB community to address these issues.

3. MAB Programme to increase efforts to effectively engage marginalised communities especially vulnerable to the impacts of climate change, including women, indigenous people, youth and elderly.
4. MAB Programme to promote incentives for MAB Youth developing good practices in response to the Climate Crisis.
5. And we further commit to create a MAB Youth networking platform to foster collaborations and dialogue on biodiversity conservation and climate change related issues.
6. Participate in the decision-making processes at the local, national and international levels.
7. Promote the potential of BRs playing a key role in climate change adaptation, mitigation and resilience.

Youth are Actors of Change in the Post-2020 Biodiversity Framework:

The theme of COP15 - "Ecological Civilization: Building a Shared Future for All Life on Earth" is very closely aligned with the core values of the MAB Programme, and we recognize that BRs and their actors play a key role in conserving biodiversity around the world and in achieving the objectives of the CBD. To achieve the objectives of the CBD, which are closely linked to the objectives and vision of the MAB Programme, there

is a need to acknowledge the linkages between nature and culture and conserve biodiversity and cultural diversity together (Box 1). We believe that for the post-2020 Global Biodiversity Framework to be truly transformative, a fundamental shift of values in society is of critical importance, including addressing our unsustainable consumption and production habits and existing power inequalities. Similarly, nature conservation is not efficient without ensuring intergenerational equity, gender equality, respect for human rights and the recognition of the rights of indigenous peoples and local communities. Young actors have a key place in the Post-2020 Biodiversity Framework. Children and youth are among the most vulnerable groups to the effects of environmental degradation and our voice needs to be

heard in decision-making processes on the environment. Currently, support for youth participation is still very limited, and that more substantial support is needed to ensure meaningful participation. We as MAB Youth in the Post-2020 Framework will have a crucial role in the implementation of the Post-2020 Framework at the local levels. As young people, we have the tools and means to raise awareness on the targets of the Post-2020 Framework and to support with implementation, capacity building, and non-formal education. Thus, we want to be included in the consultation processes towards the COP15 and beyond at our local and national levels.

We, the MAB Youth Community commit to mobilize our networks to actively engage in the

Box 1. MAB-Youth recommendations for the CBD post-2020 biodiversity framework.

MAB-Youth call for a Post-2020 framework that:

1. *Is binding, realistic, science-based, and puts a strong emphasis on implementation, ensuring efficient implementation from the time of adoption.*
2. *Promotes biodiversity and heritage education, such as through the integration of biodiversity into school curricula at all levels, including informal education; including through the promotion of interdisciplinary collaboration and exchange.*
3. *Promotes resource mobilization, knowledge-sharing, and technology transfer especially from developed countries to developing countries, many of which contain genetic resources.*
4. *Promotes good and equitable governance and legal frameworks in place to implement at all levels.*
5. *Promotes capacity-building and support for revising and updating NBSAPs at all scales.*
6. *Ensures fair and equitable benefit-sharing.*
7. *Is inclusive and participatory and in particular,*
8. *Empowers and engages indigenous peoples and local communities, women and youth in all phases of the planning and decision-making process.*
9. *Raises local community awareness and capacity to participate.*
10. *Appropriately recognizes and secures ICCAs - territories of life, as they are existing opportunities for CBD implementation. Acknowledges and protects the key role of indigenous and local knowledge in achieving the objectives of the convention.*
11. *Recognizes the common but differentiated responsibilities of state and non-state actors, taking into account the different levels of impact and capacities of countries.*
12. *Scales up communication efforts and prioritizes inclusive and timely communication through both traditional and new media channels, recognizing the role of new media for young people.*
13. *Places a particular focus on gender mainstreaming and the empowerment of women and girls.*
14. *Takes effective measures to ensure mainstreaming across all departments of government, economy, and civil society.*

development and implementation of the Post-2020 Global Biodiversity Framework. We commit to raise awareness about the importance of the Post-2020 Framework, and to take concrete actions and lead by example in support of COP15's goals and working constructively to ensure that COP15 will be a success. We welcome the partnership between the MAB Youth and the Global Youth Biodiversity Network that came about during the MAB Youth Forum 2019, and request UNESCO to facilitate the continuous collaboration, specifically with regard to enhance the role of MAB Youth in the CBD process. For the full set of demands on the Post-2020 framework please see the online version of the MAB Youth Declaration (MAB Youth 2019).

Conclusion

Young people are, quite literally, the future of BRs. Thus, if we are to understand how BRs will move forward as model places for sustainable development into a future under global change, we need to shine a light on young stakeholders. The MAB programme has already taken steps to increase participation of youth, in order to meet the goals set by the Lima Action plan. This has generated considerable insight into how young actors see themselves as active participants in BR implementation. In two Forums and two written declarations, youth have expressed their outlook on BRs and the MAB programme: BRs are key to tackling the biodiversity and climate crises and urgent action is needed to ensure BRs meet the

challenges of our times. However, young stakeholders are clear that local community wellbeing, especially of marginalized communities, should not be compromised in this effort. Thus, BRs should strive to improve equity and fair benefit sharing, in addition to biodiversity conservation, and youth are clear that they should be given access to the decision-making table to help make this happen.

It is important that policy and knowledge go hand in hand, and we wish to highlight that young people are conspicuously absent from sustainability research agendas (Barraclough et al. 2021).

Young stakeholders are key to regenerative development and, although they constitute the “future generations” that sustainability is meant to be for, there is much we don't know about youths' roles in sustainable development initiatives like BRs. We propose that transdisciplinary and interdisciplinary approaches are the way forward to producing the knowledge necessary for evidence-based decision making in BRs and other similar place-based conservation programmes. Thus, we recommend increasing research co-production practices that include young stakeholders, in addition to other BR actors, at different stages of the research process (Mauser et al. 2013). This will help complete the additional research that is required to understand the diversity in young stakeholders' perceptions and opinions of BR implementation. Youth is not a single political position and, therefore, closer

investigation is needed on how different socio-economic, cultural, and ecological contexts influence young stakeholder's understandings and roles within BR stewardship. Lastly, we believe this work also highlights recent calls on the need to investigate pathways for effective involvement of young stakeholders, not just in environmental governance, but in political life more broadly (Stockemer and Sundström 2018) across different socio-economic and cultural contexts.

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Author Contributions

Alicia Donnellan-Barraclough formulated and led the writing of the manuscript, Inger Måren funded, wrote and edited the manuscript and the MAB Youth Consortia wrote the Youth Declaration section of the manuscript.

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Notes

* For the original version of the MAB Youth Declaration please visit https://en.unesco.org/sites/default/files/2019_mab_youth_declaration_-_en.pdf

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PUBLIC OPINION ON DESIGNATION OF KOREA DMZ AS UNESCO BIOSPHERE RESERVE

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ABSTRACT: The Korean Demilitarized Zone (DMZ), which is home to numerous rare and endangered flora and fauna, has been protected from human interference and environmental disruption for almost 70 years. Several areas around the DMZ are designated as UNESCO Biosphere Reserves yet certain areas are not. This article hypothesized that there may be differences in the public opinion regarding the UNESCO Biosphere Reserves between the designated and non-designated DMZ areas. A survey of DMZ area residents was conducted to understand those differences. From July 26 to August 1, 2020, surveys were conducted with 410 residents in the DMZ area. Contrary to the initial hypothesis, there were no significant differences in the opinion or awareness in both areas. Both groups of residents cherished their natural environment and were positive towards protecting it through its designation as a UNESCO Biosphere Reserve. They also showed

a lot of similarities rather than differences in their opinion and awareness. Accordingly, factors other than residents' perception need to be explored to determine why certain areas around the DMZ are designated as UNESCO Biosphere Reserves while others are not. This article concludes that if residents in the DMZ area are given adequate information regarding UNESCO Biosphere Reserves, sustainable development will continue within designated areas and movement in support of designation as UNESCO Biosphere Reserves will likely occur in non-designated areas.

Keywords: UNESCO Biosphere Reserve, DMZ, Korea, Designation, Public Opinion, Resident, Survey

Introduction

The Korean Demilitarized Zone (DMZ) is a military buffer zone that spans approximately 250 km (156 miles) from east to west across the Korean peninsula. The DMZ was established after the Korean War to separate South and North Korea and comprises an area 2 km south and north of the military demarcation line. Military activity has been prohibited and civilian access has been strictly restricted in the DMZ since the Korean Armistice Agreement of 1953. With no human interference for almost 70 years, environmental pollution or degradation is negligible in the DMZ. As a result, the DMZ is home to a variety of protected, endangered, and rare species, making it one of the best well-conserved natural environments in the world (Paju Mayor, 1997).

As members of the SIS DMZ Eco Youth Club, the researchers have been exploring the natural environment within the western area of the DMZ and studying various biological conditions while learning to respect the biodiversity and ecological value of the DMZ by participating in research programme programs organized by the DMZ Ecology Research Institute. The designation of the DMZ border areas as the United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserves is environmentally and historically important to maintain the natural state of the DMZ.

UNESCO Biosphere Reserves were created to implement the Man and the Biosphere Programme (MAB) established in 1971 after the International Conference on Conservation of Biological Reserve held in 1968 by UNESCO. This program allows UNESCO to recognize outstanding terrestrial, coastal, or marine ecosystems around the world, seeking ways to reconcile human activity with the conservation of biodiversity through the sustainable use of natural resources (MAB Korea Committee, 2010).

The following seven regional areas in the Republic of Korea (South Korea) have been designated as UNESCO Biosphere Reserves: Seoraksan (Seorak Mountains), Gangwon-do in 1982; Jeju Island in 2002; Shinan Dadohae, an archipelago in Jeollanam-do in 2009; Gwangneung Forest, Gyeonggi-do in 2010; Gochang, Jeollabuk-do in 2013; and Suncheon, Jeollanam-do in 2018. The following areas surrounding the DMZ have been designated in 2019: Cheorwon, Hwacheon, Yanggu, Inje, and Goseong in Gangwon-do designated as the Gangwon Eco-Peace Biosphere Reserve; and Yeoncheon, Gyeonggi-do designated as the Yeoncheon Imjin River Biosphere Reserve (MAB Korea Committee, 2010). At the time, some areas near the DMZ were excluded when applying for designation (Chang, M., 2019). The question of why not all but only

certain areas around the DMZ border are designated as UNESCO Biosphere Reserves was thus raised.

For a site to be designated as a UNESCO Biosphere Reserve, the national government or the national MAB Committee, where appropriate, reviews the application for nomination. Once it is nominated as a candidate for designation, the International Coordinating Council of the MAB Programme evaluates the nominated site. Finally, if it is successful in the designation process, the area is internationally recognized as a UNESCO Biosphere Reserve (UNESCO, 2019).

According to the designation process, representatives of the local communities are required to participate in the application process (UNESCO, 2019). UNESCO respects the opinions of residents, and if the residents oppose, it is difficult to become a UNESCO Biosphere Reserve.¹ Hence, cooperation from the local community is necessary for a successful designation by UNESCO. In the case of Gochang, Jeollabuk-do, an information session for residents was held in 2011 to gather the opinions of residents in 14 towns (eup and myeon) of Gochang, and a public hearing was held in 2012 (Park, J., 2013), resulting in the successful designation of Gochang in 2013. In the case of Yeoncheon, Gyeonggi-do, a “DMZ Residents Academy” was operated for three years

from 2013 to 2015 to raise the awareness and promote the understanding of the residents while preparing for UNESCO Biosphere Reserve designation and UNESCO Global Geopark certification, resulting in the successful designation of the Yeoncheon Imjin River Biosphere Reserve in 2019 and the certification of the Hantan River UNESCO Global Geopark in 2020 (Shin, M., 2020).

This article assumed that there are differences in the public opinion regarding the UNESCO Biosphere Reserves and environmental conservation between the designated and non-designated DMZ areas. The survey of residents was conducted to assess the hypothesis that the perception of the residents of the designated areas will be more favourable towards designation of UNESCO Biosphere Reserves than residents of the non-designated areas.

Research methodology

Survey questionnaire

The survey questionnaire was created by referencing online resources (Beusable, 2018), and separate versions were made for designated and non-designated areas. The survey questions were reviewed and revised in response to the comments provided by the researchers at the DMZ Ecology Research Institute. Common topics

covered include the basic demographic information of respondents and the respondents' understanding of the local natural environment and UNESCO. For designated areas, questions addressed the changes made since the designation; for non-designated areas, queries addressed the changes expected if the designation was achieved. The surveys focused on real, tangible changes that occurred after the designation in the designated areas and changes that residents expected to occur post-designation in the non-designated areas.

Survey area selection

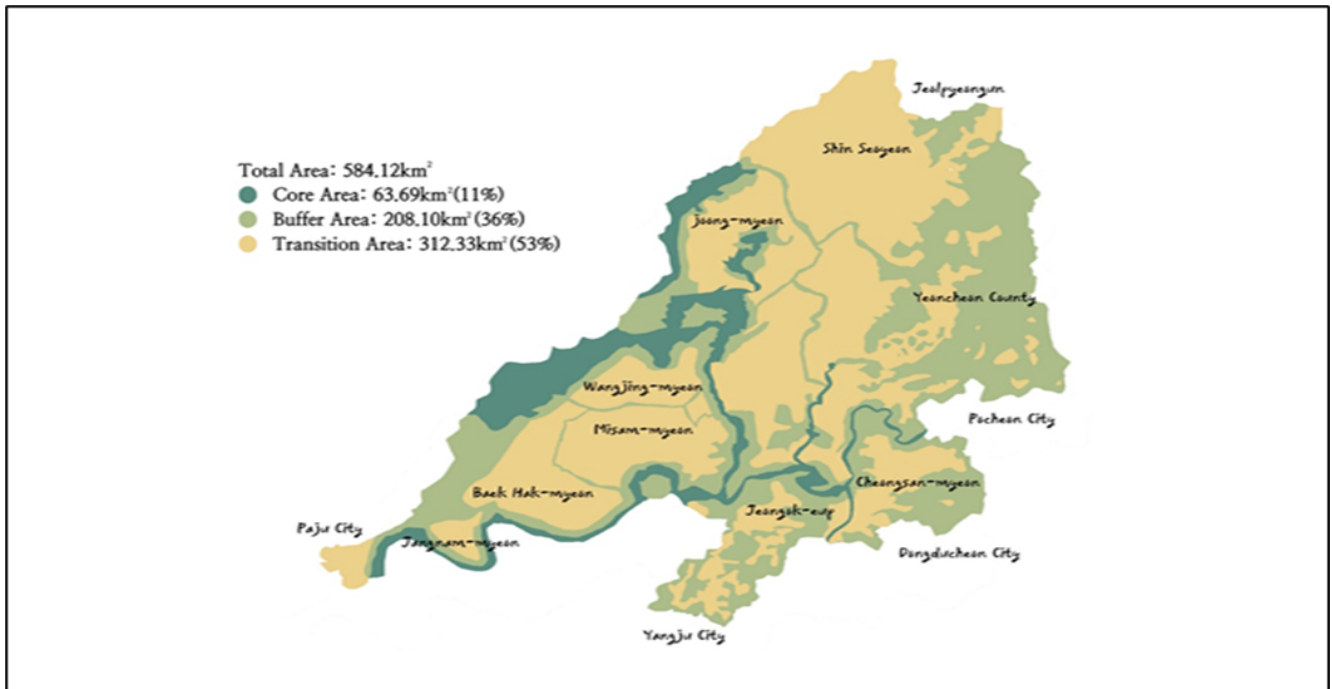
The survey was conducted in both designated and non-designated areas around the DMZ. This area can also be divided into sectors specified as Civilian Control Zones (CCZ) and those that are not. CCZs are sectors specified by the South Korean government to protect the secrecy of military operations and installations in areas south of the DMZ. CCZs span about 5 to 10 km south of the DMZ and civilian movement is restricted within them. Civilian Control Lines distinguish the CCZs from non-CCZ areas. Residents of towns within the CCZs in the Biosphere Reserve designated areas were surveyed; when CCZs could not be entered, towns that lay just beyond the Civilian Control Lines but within the Biosphere Reserve designated area were selected. For Paju City, which is a non-designated area, surveys

focused on areas near the Imjin River as it functions as a Civilian Control Line.

Map No. 1 shows the surveyed areas in the Gangwon Eco-Peace Biosphere Reserve, which include Cheorwon County (Cheorwon, Dongsong, Galmal, Gimhwa, Seo, and Gunnam townships), Hwacheon County (Sangseo and Hwacheon townships), Yanggu County (Bangsan, Dong, Haeon, and Nam townships), Inje County (Seohwa, Buk, and Inje township), and Goseong County (Hyunnae, Geojin, and Gansung townships). Map No. 2. shows the surveyed areas in the Yeoncheon Imjin River Biosphere Reserve, which include Yeoncheon County (Gunnam, Jangnam, Baekhak, Wangjing, and Shinseo townships). For non-designated areas, residents in Paju City (Tanhyun, Moonsan, Juksung, and Papyong townships) were surveyed.



Map No. 1. Gangwon Eco-Peace Biosphere Reserve



Map No. 2. Yeoncheon Imjin River Biosphere Reserve

Survey timeline

The survey was conducted between July 26 and August 1, 2020. Researchers travelled to the selected survey areas and surveyed residents who were willing to be surveyed. Surveys were conducted in person while adhering to COVID-19 social distancing and safety protocols applicable to South Korea during the survey period. Both the researcher and the survey participant wore masks during the surveys. As the DMZ area can at times be volatile due to the tensions between North and South Korea, researchers decided to conduct the survey in a compact seven-day period (Figure 1).

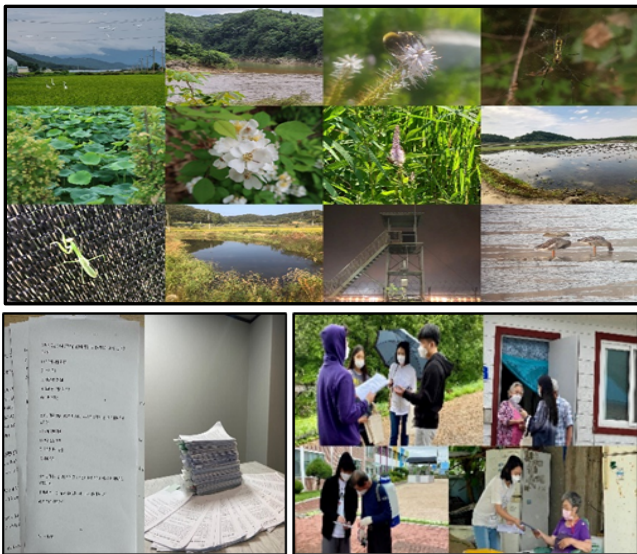


Figure No. 1. DMZ areas, survey questionnaires, and conducting resident survey

Key consideration

The surveys were given only to residents in the

chosen areas. Prior to conducting the survey, researchers asked potential survey participants about their residential status. Non-residents and civil servants (law enforcement or township administration officers), who most likely rotate to different regions every few years, were excluded from the survey. To collect unbiased answers from the residents, researchers did not mention whether their town was within a UNESCO Biosphere Reserve. Researchers did not share details about the UNESCO Biosphere Reserve or the MAB programme before the surveys were completed, nor provide additional explanation regarding the survey and had the participants answer the questions as is. Researchers also did not steer respondents to any specific answers, nor offer biased information. If the participants were in a group, to minimize potential impact by peers, distance was maintained so that they could not discuss among themselves. If a participant had difficulty reading the questions, the researcher read the questions out loud to them independently. After participants submitted their completed surveys, researchers checked to see if all the questions were answered. If all questions were not answered, the researcher gave the survey back to the participant for completion. Any incomplete surveys were discarded.

Number of survey responses

For this article, more than 410 residents from the selected survey area were surveyed; 354 respondents from designated area, 56 respondents from non-designated area. The number of surveys to be completed were allocated proportionally to each county or city by their population. The minimum number of surveys for each county or city was set at 50. All the completed surveys were gathered from each selected region; a total of 410 completed surveys were returned. The number of surveys that were taken in each region are shown in Table 1.

Table No. 1. Surveys taken by region.

Category	Undesignated Area	Designated Area						Total		
Survey Area (City/Gun)	Paju City	Cheonwon-gun	Hwacheon-gun	Yanggu-gun	Inje-gun	Goseong-gun	Yeoncheon-gun			
Survey Area (Eup/Myeon)	Munsan-eup	Galmal-eup	Sangseo-myeon	Nam-myeon	Buk-myeon	Ganseong-eup	Gunnam-myeon	410		
	Jeokseong-myeon	Ceunnam-myeon		Dong-myeon	Seohwa-myeon	Geojin-eup	Sinseo-myeon			
	Tanhyun-myeon	Gimhwa-eup	Bongsan-myeon	Inje-eup	Hyunnae-myeon	Wangjing-myeon	Jangnam-myeon			
	Papyeong-myeon	Dongsang-eup							Hwacheon-eup	Haean-myeon
		Seo-myeon								
	Survey Subjects (persons)	56	65	57	62	58	58		54	

Analysis of survey responses

The survey responses were analysed and the data was segmented by fields such as gender, age, level of education, and profession to find any trends and correlation. In cases where the respondents answered questions not relevant to them, the responses were tallied as “not applicable.”

Results

Demographic results of survey respondents. The demographic results of the total respondents in the designated and non-designated areas are as follows:

Table No. 2. Demographic results of survey respondents.

	Designated		Non-designated		Total	
	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage
Gender						
Man	155	44 %	29	45%	184	45%
Woman	199	56 %	27	55%	226	55%
Overall	354	100%	56	100%	410	100%
Age						
10s	26	7%	0	6%	26	6%
20s	20	6%	1	3%	21	3%
30s	28	8%	1	7%	29	7%
40s	41	12%	8	12%	49	12%
50s	65	18%	12	19%	77	19%
60s	79	22%	15	23%	94	23%
70s	95	27%	19	28%	114	28%
Overall	354	100%	56	100%	410	100%
Education (Highest level completed)						
Elementary school graduates or lower	103	29%	15	29%	118	29%
Middle or high school graduates	156	44%	30	45%	186	45%
College graduates or higher	95	27%	11	26%	106	26%
Overall	354	100%	56	100%	410	100%
Occupation						
Agriculture/ livestock	79	22%	21	24%	100	24%
Company/ government employees	82	23%	9	22%	91	22%
Self-employed	46	13%	10	14%	56	14%
Housewives	34	10%	0	8%	34	8%
Students	63	18%	11	18%	74	18%
Others	50	14%	5	13%	55	13%
Overall	354	100%	56	100%	410	100%

Perception on the local natural environment. According to the survey results, 81 percent of the residents in the designated UNESCO Biosphere Reserves at the border areas of DMZ and 77 percent of the residents in the non-designated areas replied that their natural environment is special compared to that of other regions. Overall, 95 percent of the residents in the designated areas and 90 percent of those in the non-designated

areas answered that conservation of the natural environment in their current residential area is important (Figure 2 and Figure 3).

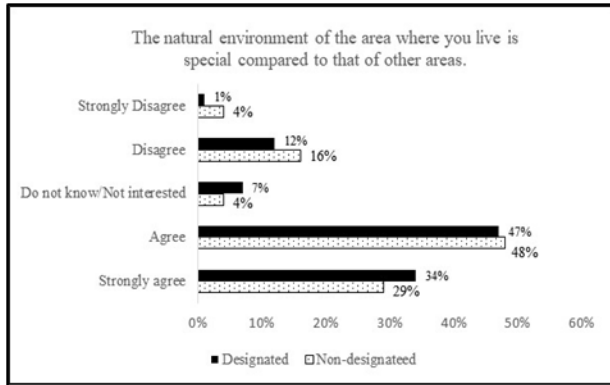


Figure No. 2. Perception on the natural environment: UNESCO Biosphere Reserve designated areas vs. non-designated areas.



Figure No. 3. Perception on the natural environment: UNESCO Biosphere Reserve designated areas vs. non-designated areas.

Awareness of UNESCO Biosphere Reserves. 46 percent of respondents in the designated areas and 43 percent in the non-designated areas had never heard of UNESCO Biosphere Reserves. Furthermore, 55 percent of the respondents in the

designated areas and 53 percent in the non-designated areas did not know about or were not interested in Biosphere Reserves (Figure 4 and Figure 5).

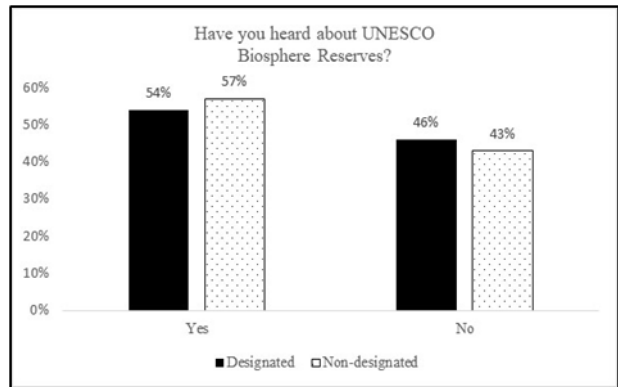


Figure No. 4. Awareness of UNESCO: UNESCO Biosphere Reserve designated areas vs. non-designated areas.

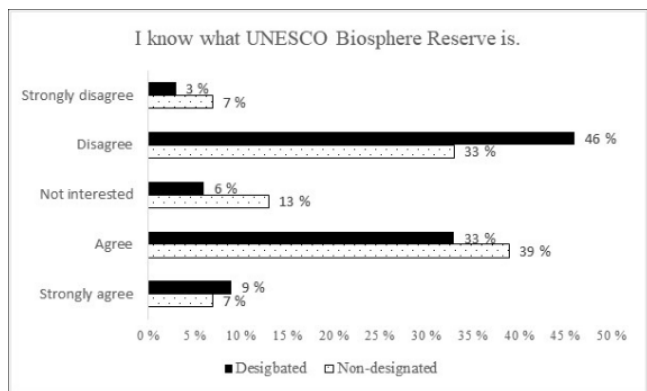


Figure No. 5. Awareness of UNESCO: UNESCO Biosphere Reserve designated areas vs. non-designated areas.

When asked whether they agreed with the designation as a UNESCO Biosphere Reserve, the proportion of residents who agreed in the designated areas was about 68 percent while 23 percent did

not know or were not interested and nine percent disagreed. Among those in the non-designated areas, 63 percent agreed, 23 percent did not know or were not interested, and 14 percent disagreed (Figure 6).

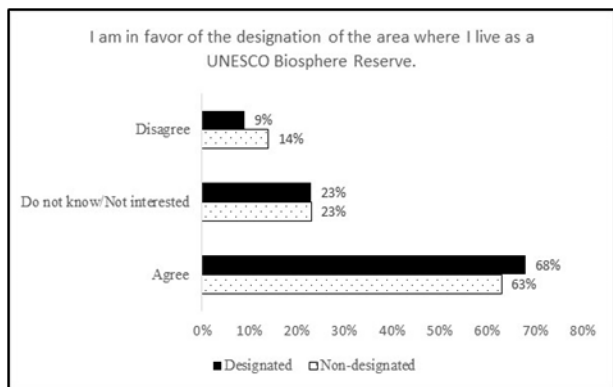


Figure No. 6. Awareness of UNESCO Biosphere Reserves: designated areas vs. non-designated areas.

Changes after UNESCO Biosphere Reserve designation: designated areas. In the results of the survey on the changes after designation, 47 percent of the residents in the designated areas responded positively (including very positive), 27 percent replied neutrally, 24 percent did not know or were not interested, and three percent responded negatively (including very negative). In other words, many residents positively accepted the changes after the designation (Figure 7).

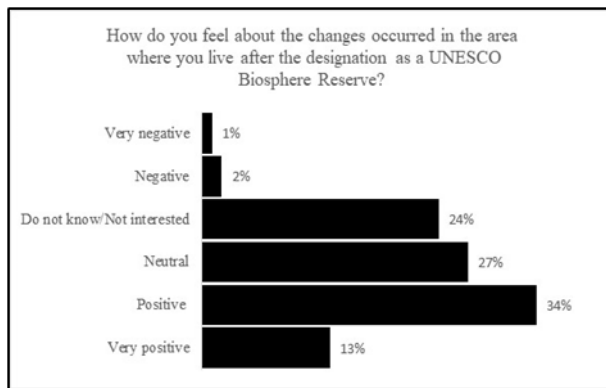


Figure No. 7. Changes after the designation of a UNESCO Biosphere Reserve: designated areas: experienced changes after designation (rounded off to the nearest integer).

When the survey respondents who answered positively (165 persons: 47 percent) were asked about the reason why they felt positive changes after the designation, they selected from a list of answers as follows: pride in their region (50 percent), revitalization of tourism (29 percent), improvement of infrastructure such as roads (10 percent), income growth (six percent), and other reasons (five percent) (Figure 8).

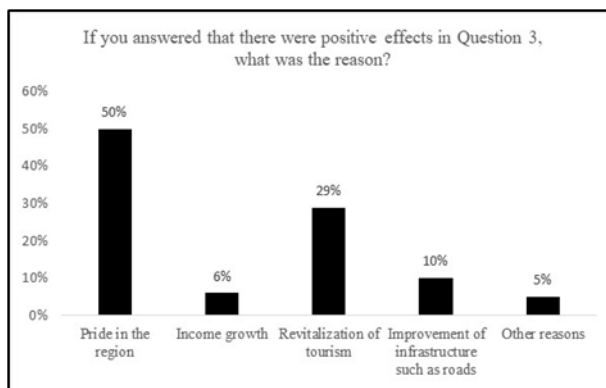


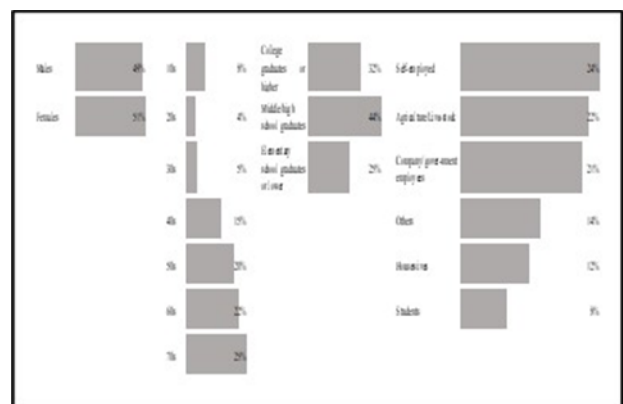
Figure No. 8. Changes after the designation of a UNESCO Biosphere Reserve: designated areas - positive effects after the designation (rounded off to the nearest integer).

Of the total respondents, 49 percent of men and 51 percent of women responded positively, which were five percentage points higher and five percentage points lower, respectively, than the total proportion of men (44 percent) and women (56 percent) in the total number of respondents. (Table 2). The occupations of the participants who responded positively were as follows: 24 percent self-employed, 22 percent agriculture/livestock, 21 percent company/government employees, 12 percent housewives, eight percent students, and 14 percent others. When compared to the occupation composition of all the respondents, there was no noticeable difference. The educational background composition of these respondents was as follows: 32 percent college graduates or higher, 44 percent middle or high school graduates, and 25 percent elementary school graduates or lower. When compared to the educational background composition of all the respondents, the proportion was five percentage points higher in the case of college graduates or higher (27 percent), no difference in the case of middle or high school and 25 percent elementary school graduates or lower. When compared to the educational background composition of all the respondents, the proportion

was five percentage points higher in the case of college graduates or higher (27 percent), no difference in the case of middle or high school graduates (44 percent), and four percentage points lower in the case of elementary school graduates or lower (29 percent).

The age group composition was as follows: eight percent in their 10s, four percent in their 20s, five percent in their 30s, 15 percent in their 40s, 20 percent in their 50s, 22 percent in their 60s, and 25 percent in their 70s; the difference was negligible when compared to the age group composition of all the respondents (Table 3).

Table. No 3. Changes after UNESCO Biosphere Reserve designation: designated areas - gender, age, education background, and occupation of positive respondents (rounded off to the nearest integer).



The reasons given by respondents who experienced negative changes (three percent: nine persons in total) were selected from a list of answers

as follows: difficulty in exercising property rights (33 percent), restriction on local development (33 percent), restriction on agricultural activities (22 percent), and restriction on agricultural activities (22 percent). Other reasons (11 percent) included damage caused by wild boars (Figure 9).

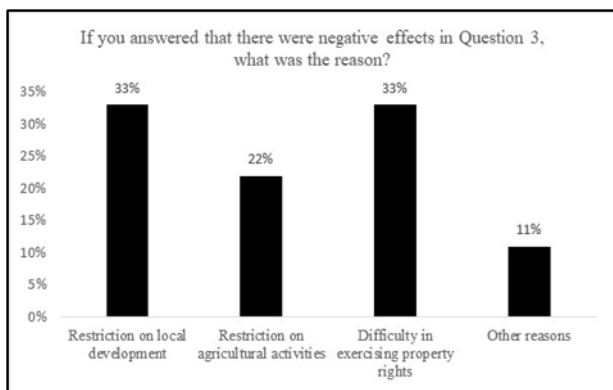


Figure No. 9. Changes after the designation of a UNESCO Biosphere Reserve: designated areas - negative effects after the designation. (rounded off to the nearest integer).

Expected Changes After UNESCO Biosphere Reserve designation: non-designated areas. When asked about the expected changes after designation as a UNESCO Biosphere Reserve, 54 percent answered positively, 11 percent negatively, 21 percent neutrally, and 14 percent did not know/were not interested (Figure 10).

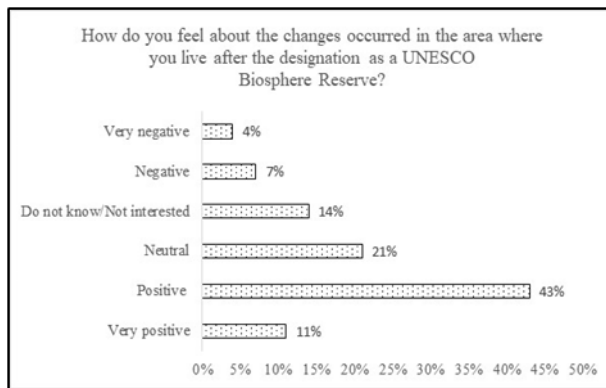


Figure No. 10. Expected Changes after UNESCO Biosphere Reserve designation: non-designated areas - expected changes after designation (rounded off to the nearest integer).

When those who expected positive changes were asked about the reasons by selecting from a list of answers, 67 percent picked pride in their region, 20 percent revitalization of tourism, seven percent improvement of infrastructure such as roads, and seven percent other reasons. Other reasons included that protection and conservation of nature is a positive factor, and so is the function of maintaining the peace in a special environment like the DMZ (Figure 11).

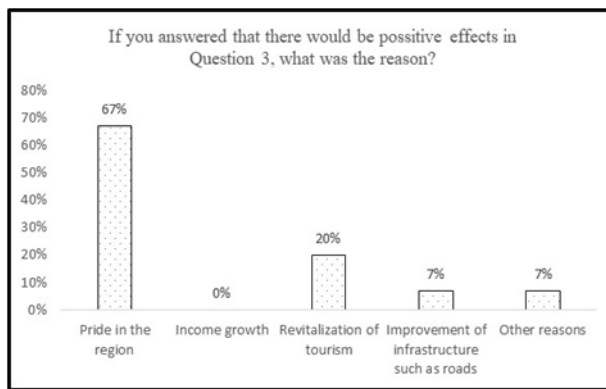
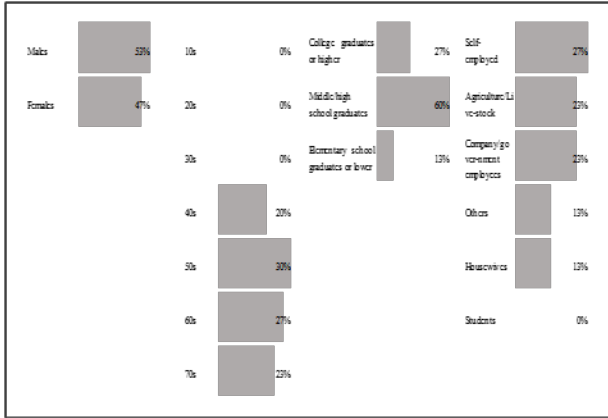


Figure No. 11. Expected changes after UNESCO Biosphere Reserve designation: non-designated areas - expected positive effects (rounded off to the nearest integer).

The proportions of men and women who gave positive responses were 53 percent and 47 percent, respectively, which were one percentage-point higher and one percentage point lower, respectively, than the proportions of men (52 percent) and women (48 percent) in the total number of respondents, thereby showing almost no difference. The occupations of these respondents were as follows: 27 percent self-employed, 23 percent agriculture/livestock, 23 percent company/government employees, 13 percent housewives, and 13 percent others. The proportions of self-employed, company/government employees, and others were five, four, and six percentage points higher, respectively, than those of all respondents. However, the proportions of the agriculture/livestock occupations and housewives in the positive respondents were 11 and five percentage points lower than those of all respondents, respectively. This implies that the residents who were self-employed, company/government employees, or belonging to the “other” category responded more positively to the designation as a Biosphere Reserve compared to those with the other surveyed backgrounds. The educational background composition of the positive respondents was as

follows: 27 percent college graduates or higher, 60 percent middle or high school graduates, and 13 percent elementary school graduates or lower. When compared to the educational background composition of all respondents, the proportion was seven percentage points higher in the case of college graduates or higher (20 percent), six percentage points higher in the case of middle or high school graduates (54 percent), and 13 percentage points lower in the case of elementary school graduates or lower education (27 percent). In other words, the respondents with middle/high school diplomas or college degrees or higher answered more positively to the designation as a Biosphere Reserve compared to the respondents with elementary school diploma or lesser education. As for the age group composition of the positive respondents, 20 percent was in their 40s, 30 percent in their 50s, 27 percent in their 60s, and 23 percent in their 70s, and the difference was negligible when compared to the age group composition of all respondents (Table 4).

Table. No 4. Expected Changes after UNESCO Biosphere Reserve designation: non-designated areas - gender, age, education background, and occupation of positive respondents (rounded off to the nearest integer).



The reasons given by respondents who expected negative changes (11 percent: six persons in total) were selected from a list of answers as follows: difficulty in exercising property rights (33 percent), restriction on local development (33 percent), restriction on agricultural activities (33 percent), and no other reason cited (Figure 12).

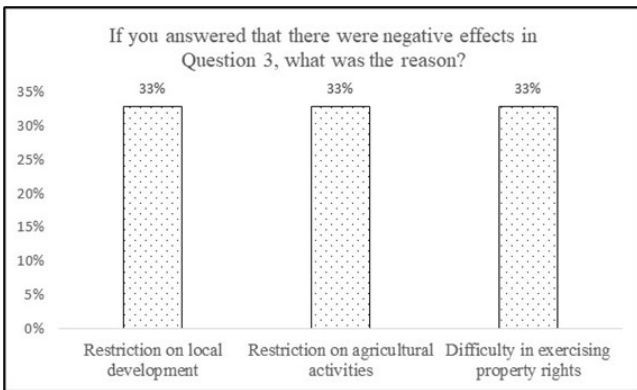


Figure No. 12. Expected Changes after UNESCO Biosphere Reserve designation: non-designated - expected negative effects (rounded off to the nearest integer).

Discussion

Designated areas

Most residents perceived the natural environment in the UNESCO Biosphere Reserves areas as special (81 percent). Furthermore, 95 percent of the respondents regarded the conservation of natural environment as important. However, the proportion of those who stated that they know the significance of the UNESCO Biosphere Reserve designation (34 percent), which aims to conserve special natural environments, and are aware of the designation of their residing area (34 percent) is relatively low. Therefore, it is necessary to publicize the fact that the special natural environment of the area, which most residents consider important, can be conserved through the Biosphere Reserve designation. However, this is meaningful because people who know the significance of the Biosphere Reserve designation are more likely to agree with the designation. Among 148 persons who answered that they knew the significance of the Biosphere Reserve designation, 77 percent (114 persons) agreed with the designation. Furthermore, among 173 persons who stated that they did not know the significance of the Biosphere Reserve designation, 62 percent (108 persons) agreed with the designation. Therefore, the approval rate for the designation was about 15 percentage points higher in the residents who stated that they knew the significance of designation than the residents who do not.

The proportion of those who had reservations (do not know/not interested) about the designation was compared between different groups. Results showed that the proportion of those who had reservations in the group that stated they knew the significance of designation was about 18 percentage points lower than that of the group that answered that they did not know. This implies that publicity and education help people to form clear opinions without taking a reserved stance.

The characteristics of the respondents (78 persons) who took a reserved stance about agreeing with the Biosphere Reserve designation were investigated to identify the people who should be targeted for public relations and education. First, among the respondents who took a reserved stance, 62 persons (79 percent) replied that they did not know or were not interested in UNESCO Biosphere Reserve. This implies that the biggest characteristic of the residents who take a reserved stance is that they do not know the significance of Biosphere Reserve. Second, the gender ratio was 35 percent men and 65 percent women, and it was peculiar that the proportion of women was high when compared to the gender ratio of the total respondents (44 percent men and 56 percent women).

Based on the respondents (148 persons) who knew about Biosphere Reserves and agreed with the designation of reserves, the type of media

from which they learned about Biosphere Reserves was investigated to identify which media forms were most influential. In the results, 38 percent was documentary videos, 31 percent public relations activities of local governments, 18 percent newspapers and books, eight percent local social gatherings, and five percent others (Figure 13). Therefore, it is expected that when public relations activities of local governments and documentary videos are used in parallel, the share of 69 percent in the total media will be achieved, indicating the most influential means of publicity and education.

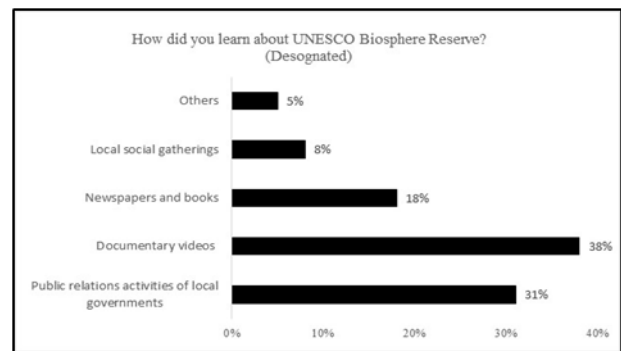


Figure No. 13. Method of learning about UNESCO Biosphere Reserve.

Non-designated areas

Most (77 percent) of the respondents had positive perceptions of the natural environment in the areas where the non-designated area residents lived, and 90 percent regarded the conservation of natural environment as important. These characteristics were similar to the perception levels of the designated area residents. Furthermore, the

proportion (46 percent) of respondents who knew about the significance of the UNESCO Biosphere Reserve designation, which aims to conserve special natural environments, was similar between the non-designated areas and the designated areas.

The results of analysing the effect of comprehending the Biosphere Reserve in the non-designated areas on agreeing/not agreeing with the Biosphere Reserve designation showed that the proportion of respondents who agreed with the Biosphere Reserve designation among the residents who answered that they knew about Biosphere Reserves was 63 percent. This was much higher than the proportion of respondents who agreed with the Biosphere Reserve designation among the residents who replied that they did not know about the reserves (45 percent). This implies that the respondents are more likely to agree with the Biosphere Reserve designation when they think they know about Biosphere Reserve. However, the proportion of residents who had reservations about the Biosphere Reserve designation among the residents who answered that they knew about Biosphere Reserve was 28 percent. This was lower than the proportion of residents who had reservations about the Biosphere Reserve designation among the residents who answered they did not know about Biosphere Reserve (41 percent). Furthermore, the means of publicity and

education for Biosphere Reserves in the non-designated areas was indirectly investigated through survey results on the media. The results show that the most efficient means in terms of influence power in the non-designated areas is documentary videos (54 percent), followed by public relations activities of local governments (19 percent), newspapers and books (19 percent), others (8 percent), and local social gatherings (0 percent) (Figure 14).

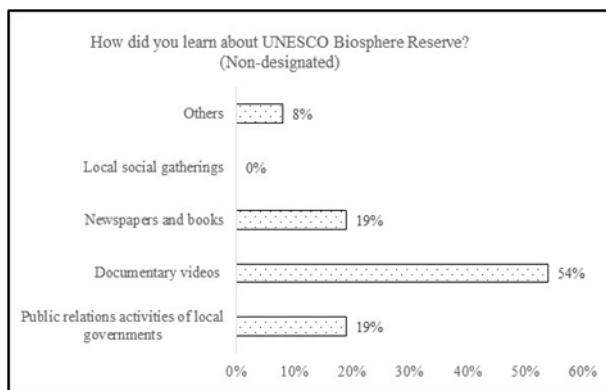


Figure No. 14. Method of learning about UNESCO Biosphere Reserve.

That is, the documentary videos and the public relations activities of local governments account for 73 percent of the total. This is similar to the survey results on the influence power of each media in the designated areas.

Designated and non-designated areas

The following is a summary of comparison between the designated and non-designated areas.

First, residents of both designated and non-designated areas valued the natural environment of the region and had a positive perception of its designation as a UNESCO Biosphere Reserve (Figure 2, Figure 4, and Figure 6). This result was contrary to our initial hypothesis that the two resident groups would have different perceptions on both the importance of protecting the natural environment and UNESCO's designation of their region.

Second, participants who think they know about the Biosphere Reserve showed a higher proportion of agreement regarding the region's designation than those who were less aware (15 percent higher in designated areas, 18 percent higher in non-designated areas) (Figure 5 and Figure 6). Also, those who were less aware provided a reserved response to their region's designation (18 percent more in designated areas, 13 percent more in non-designated areas) (Figure 5 and Figure 6). There was also a slightly higher representation of respondents with a college degree or higher who felt positive changes after UNESCO's designation (five percent higher in designated areas, seven percent higher in non-designated areas), and a lower representation of respondents with an educational background lower than elementary school (four percent lower in designated areas, 13 percent lower in non-designated areas) (Figure 7 / Figure 10 and Table 3 / Table 4) Regarding the occupational group

composition of positive respondents, self-employed and company/government employee groups responded more positively to the changes after designation (five percent and four percent higher in non-designated areas, respectively) while the agricultural and livestock industry workers responded more negatively (11 percent lower in non-designated areas) (Table 4).

Third, the survey data suggested that efforts to inform, promote and educate the UNESCO Biosphere Reserve to residents needed significant improvements in both regions. The proportion of respondents who had not heard about the UNESCO Biosphere Reserve was 46 percent in designated areas and 43 percent in non-designated areas (Figure 3). The proportion of respondents who did not know about the UNESCO Biosphere Reserve was 55 percent in designated areas and 53 percent in non-designated areas (Figure 5). Particularly in designated areas, 66 percent of respondents did not know that their region was a UNESCO Biosphere Reserve, even though more than a year had passed since the designation. The problem is that designation as a UNESCO Biosphere Reserve does not necessarily mean that the area will retain the designation. Every 10 years, reports must be submitted to prove that the region continues to meet the requirements of its designation, and the designation may be cancelled if the region no longer

qualifies. Active participation of residents is one of the most important criteria for continued designation². Therefore, it is crucial to continuously provide information about the UNESCO Biosphere Reserve and engage residents.

Fourth, the survey analysis showed that more publicity should be targeted toward those who take a reserved stance in both designated and non-designated areas. Although those who answered positively to the designation of UNESCO Biosphere Reserves outnumbered those who answered negatively, there was a significantly high proportion of respondents who answered “don’t know/not interested (Figure 6). Particularly, regarding the change after the designation, 51 percent of respondents in designated areas answered “neutral” or “don’t know/not interested” rather than positive or negative. The key to success in the UNESCO Biosphere Reserve will thus depend on generating more interest from these people by providing them with opportunities for positive experiences. One thing to note is that although only 47 percent of respondents in designated areas explicitly said that they felt positive changes after UNESCO’s designation, 68 percent of the respondents said that they would agree with their area continuing to be designated as a UNESCO Biosphere Reserve. Those who said they would agree with the designation again could have given this answer because they felt

positive changes, and the 21 percent difference between this group and those who answered explicitly that they felt positive changes could then be included somewhere in the group that responded “neutral” or “don’t know/ not interested”. Therefore, there could be a significant number of people among those who have responded “neutral” or “don’t know/ not interested” who could gain a positive perspective through effective publicity and education.

Fifth, the results showed that it was necessary to adapt promotion efforts according to regional characteristics or age group. Despite the rural nature of the area, where come-and-go between neighbours is relatively more active than cities, there were surprisingly few cases in which respondents learned about the UNESCO Biosphere Reserve through neighbours or local gatherings (Figure 13). Therefore, such channels need to be used more actively in the future. Also, many of the local survey respondents were people over the age of 60 years old, who may be less familiar with accessing information through the Internet (Table 2). As such, community-oriented education and offline publicity methods are more likely to be appropriate for them. However, existing publicity methods through documentary videos (TV/media) and local governments still appear to be the best channels for publicity regardless of

region or age group, and they should continue to be utilized (Figure 13 and Figure 14).

Sixth, it is necessary to promote that the UNESCO Biosphere Reserve program is not only for the conservation of biodiversity and natural environment, but also for their sustainable use that leads to economic development of the local community. While survey respondents in both designated and non-designated areas chose "(increased) pride in the region" as the most positive change (or the most expected positive change) after UNESCO's designation, very few respondents answered that the designation could also be linked to an increase in their income (Figure 7, Figure 8, Figure 10 and Figure 11). Therefore, it would be helpful to inform residents of good domestic and overseas cases that have successfully revitalized the local economy after being designated as a UNESCO Biosphere Reserve (Park, G., 2013).

Seventh, it is necessary to promote that the designation as a UNESCO Biosphere Reserve does not introduce additional regulations in buffer or transition areas (Nature Policy Division, 2012). Both residents of designated and non-designated areas were concerned that additional regulations would be introduced through the designation, and that these regulations could become an obstacle to local development, farming activities, and exercise of property rights (Figure 9 and Figure 12).

However, the UNESCO Biosphere Reserve program only recommends regulations for the preservation of the ecological environment in key areas, but not particularly in buffer areas or transition areas where residents are working. Rather, residents in UNESCO Biosphere Reserves can receive financial, administrative, and technical support from the federal and local governments if necessary (Gangwon Research Institute, 2014). Even so, it is still necessary to explain the fact that there might be a halt on activities that cause environmental damage, such as illegal farmland expansion or polluting methods of farming which are conducted in violation of current regulations (Nature Policy Division, 2012). Throughout this process, government ministries and local governments should carefully consider the special situations faced by the areas and the issues raised by the residents, seek solutions together, and consider what support or compensation is realistically possible.

From the survey analysis conducted above on designated and non-designated areas, the perceptions of the two resident groups regarding nature conservation and UNESCO Biosphere Reserve designation were clarified and the problems that need to be solved were specified. However, results did not show significant differences in perception between participants in designated and non-designated areas, which was the original

hypothesis. The following minor differences were identified. First, designated areas are slightly more positive regarding the natural environment of their areas than non-designated areas. Although people from both regions thought their natural environment was important, the percentage of people who answered positively was four percent higher in designated areas and those who answered negatively were seven percent lower in these areas (Figure 2). In addition, as a special feature of their local environment, “beautiful landscape” was most often selected in designated areas, whereas “historical meaning and value of DMZ” was selected more in non-designated areas (Figure 15).

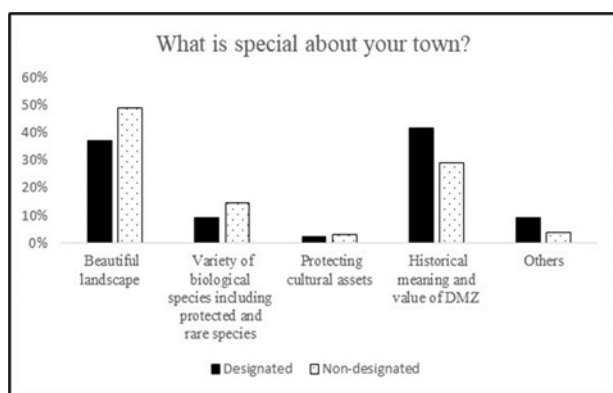


Figure No. 15. Perception on the natural environment: UNESCO Biosphere Reserve designated areas vs. non-designated areas.

The number of people who think it is important to preserve the natural environment of their region was also five percent higher in designated areas, and the approval rate for UNESCO designation was equally five percent higher (Figure 4 and 6).

Second, the tendency to think the relation between the designation of UNESCO Biosphere Reserve and economic aspects was also slightly higher in designated areas (Figure 8 and 11). Six percent of respondents from designated areas chose increased income as a positive change after designation while no one from non-designated areas expected it.

Conclusion

The results of our survey analysis as described above showed that, contrary to our initial hypothesis, there was no significant difference in perception between residents of the UNESCO Biosphere Reserves and those in non-designated areas. Both groups of residents valued the nature of their region and had a positive perception of protecting it through its designation as a UNESCO Biosphere Reserve. Their perception also showed a lot of similarities rather than differences. Therefore, the main factors that determined whether these two areas were designated as UNESCO Biosphere Reserves should be explored in other aspects, such as economic, political, and social, rather than differences in perception³.

Within the limit of the current article, the important result is that both regions need to be supplemented with proper information delivery and promotion. Due to a lack of adequate

information, residents in both designated and non-designated areas did not fully understand that the UNESCO Biosphere Reserve program pursues not only the conservation of nature but also the development of the community. Due to a lack of correct information, both groups were concerned that UNESCO's designation would bring about more restrictions on regional development, farming activities, and property rights. Due to a lack of publicity, more than half of the residents from designated areas did not know that their areas were already designated as UNESCO Biosphere Reserves. Therefore, these publicity issues will need to be addressed and factors that determine designation other than residents' perception will need to be found and resolved. When these issues are resolved, considering the high awareness of nature conservation and approval rate for UNESCO designation in both areas, non-designated areas are likely to support their designation as UNESCO Biosphere Reserves and designated areas will be able to achieve more active resident participation and efficient management.

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ENDNOTES

1. In the case of Ozark portions of Missouri and Arkansas in the United States, the residents did not receive any relevant information until the final selection stages in the designation process of UNESCO Biosphere Reserve and the project proceeded without proper participation of the residents. Consequently, the designation process which had continued for over nine years was unsuccessful due to the strong opposition of the residents (United States Department of State, 1998). In Uido, Jeollanam-do, the designation of UNESCO Biosphere Reserve was postponed due to the opposition of the residents (Moon, I., 2008).

2. The Statutory Framework of the World Network of Biosphere Reserves, Article 9.1, Article

9.6 and Article 4.6. (MAB Korea Committee, 2010).

3. As an example, refer to the characteristics of non-designated areas with many good development opportunities (Paju City, 2018).