한국조경학회지 48(3) : 45~53, 2020. 6.
J. KILA Vol. 48, No. 3, pp. 45~53, June, 2020

pISSN 1225-1755 eISSN 2288-9566
https://doi.org/10.9715/KILA.2020.48.3.045

생태성 평가를 통한 토지매수시스템 개발†
- 동강유역을 중심으로 -

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Development of Land Purchase System by Ecological Evaluation
- Focusing on the Donggang Basin -

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ABSTRACT

With the increasing attention of the international community on climate change and biodiversity promotion programmes, the Korean government and public agencies are trying to protect and restore the ecosystem of areas protected by law, such as waterfronts, by acquiring private land. However, the inadequate purchase system has caused various problems. In this study, an efficient and systematic land purchase system was developed through ecological evaluation, focusing on the ecological and landscape conservation areas of the Donggang basin. The ecological evaluation was developed by integrating parcel-level evaluation and regional-specific evaluation, and the overall level of ecological function was established and finalized through on-site verification. As a result of verifying the purchase land of 88 parcels, it showed a relatively high agreement of more than 85.2%, and the rest of parcels (non-agreement) were considered to have had an impact on vegetation, crop harvesting, etc. due to seasonal differences in ecological evaluation and field verification. The purchasing system was ranked according to the ecological evaluation grade based on the endangered species and the distance from the core ecosystem. As a result, the purchase priority was systematically drawn up to the 5th rank for a total of 68 parcels for the private lands of Geoeun-ri, Munsan-ri, Deokcheon-ri, Unchi-ri, Gumam-ri, and Suji-ri. This study is expected to contribute to the preservation, restoration and ecological management of purchased land in the protected area in the future by establishing and proposing a systematic land purchase system based on ecological evaluation.

Key Words: Parcel-Based Evaluation, Zone-Based Evaluation, Priority Purchase, Ecological Landscape Conservation Area

† : The Development of Doctoral Dissertations

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국문초록

국제적으로 기후변화에 대한 대응 및 생물다양성 증진 방안이 대두되면서 국내 정부 및 공공기관에서는 수변구역 등 법정 보호지역 내 생태계를 보전하고 수질개선을 위해 사유지를 매수하여 보전·복원사업을 추진하고 있으나, 매수시스템 체계가 미흡하여 다양한 문제점을 초래하고 있다. 이에 본 연구에서는 동강유역 생태·경관보전지역을 중심으로 생태성 평가를 통한 효율적이고 체계적인 토지매수시스템을 개발하였다. 생태성 평가는 필지단위의 평가와 권역별 평가를 통합하여 생태성 평가모형을 개발하고, 생태기능 종합등급을 설정함과 동시에 현장검증을 통해 최종 등급화 하였다. 88필지의 매수토지에 대해 검증한 결과, 85.2%이상의 비교적 높은 일치성을 보였으며 불일치한 필지는 생태성 평가와 현장검증 시 계절의 차이로 식생 고사, 경작물 수확 등 영향이 있었던 것으로 나타났다. 매수시스템은 멸종위기종과 핵심생태계에서의 거리를 기준으로 생태성 평가등급에 따라 1순위에서 9순위까지 순위를 선정하였으며, 동강유역 거운리, 문산리, 덕천리, 운치리, 귤암리, 가수리의 사유지를 대상으로 총 68필지에 대해 현장 검증 결과, 5순위까지 매수 우선순위가 체계적으로 도출되었다. 본 연구는 생태평가에 기반한 체계적인 토지매수시스템을 구축 및 제안함으로써 향후 보호지역 내 매수토지의 보전과 복원 및 생태적 관리에 일조할 것으로 기대된다.

주제어: 필지별 평가, 권역별 평가, 우선매수, 생태경관보전지역

Ⅰ. Introduction

1. Bacground

Recently, the importance of ecological value has been raised, and various studies have been conducted to preserve and restore ecosystems and promote biodiversity. Countries around the world designate and manage protected areas to promote conservation of biodiversity, natural resources, cultural resources, and ecological and cultural values. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has designated biosphere conservation zones to conserve natural ecosystems and genetic resources, and some national and public institutions have purchased land to preserve ecosystems in the protected areas.

The portions of land greatly affect water quality and need to recovery. The land acquisition has been done at the national level to improve water quality and preserve the environment in the surrounding watershed and protected areas. In case of South Korea, this kind of system is initially enacted in the "Agricultural Land Act" in December 22, 1994. The main statutes relevant to land acquisition are recorded in the special measures law, which dictates the designation and management of development restricted area, and forest protection law.

Korea Environment Institute (KEI) created the "land and environment evaluation map" for preserving, developing, and utilizing the homeland strategically and ecologically. The map is used to assess the environmental value based on the basic law of environmental policy. Evaluation indicators can be divided into statutory and ecological environment. The statutory indicator has 3 departments (natural environment, water environment, and others) and 56 indicators. The ecological environment indicator, reflecting the concept of natural resources, involves 8 departments (nature, diversity, richness, rarity, weakness, community structure stability, potential value, and connection) and 11 indicators.

The Korean Ministry of Environment (KME)(2007) classified the feasibility of specifying the environmental protection zone using four main parts: naturality, biological diversity, ecological system, and academic value in its objective research on the specified criteria for ecological protection zone. According to KME (2013), the list used for evaluating biotope type includes the naturality, biological diversity, rarity, scale, ability of restoration, ecological function and function of urban environment. Koo (2009) used the rapid assessment methods (RAM) and hydrogeomorphic evaluation methods (HGM) to assess the value of wetland conservation. In one of the previous studies on land evaluation of landscape ecology, Park (2014) developed an evaluation outline around the acquisition of land in protected areas.

According to a research on the evaluation criteria of land environment (KME, 2001), a suitable land that should be preserved is graded to propose a management principle and plan for each grade of land type. The value of land conservation can be divided into five grades: the first and second

grades are areas of conservation, the third and fourth grades are areas of management, and the fifth grade is the development area.

2. Problem Statement

According to the literature review on the purchase and use of domestic and foreign land, and the guidelines for buying land business provided by the land acquisition system, land acquisition mainly targets the ecologically important areas, such as water source protection areas, waterfront areas, and protected areas, and aims to eliminate pollution sources, improve water quality, and conserve and restore the ecosystems. Priority selection is implemented based on the location characteristic of each land. In general, the detailed criteria are set according to usage areas, such as factories and barns, and restricted areas, such as protected and waterfront areas. In the case of a waterfront area, the score table is calculated based on the distance from the river boundary. In addition, if a point or non-point source is adjacent to the purchased land, then additional points are given, which indicate the characteristics of the current buying process. Existing purchased land is sporadically distributed as a result of purchases by local residents, resulting in administrative problems. In addition, the criteria for the comprehensive standard of distance or pollutant allocation at the purchase stage do not fully reflect the essential unit ecology and spatial ecological connectivity of the land. Therefore, this study aims to solve the practical problems of land acquisition and develop an acquisition system to export systematic priority selection through an ecological evaluation. The land purchase system of this study was developed by integrating the parcel evaluation of the land and the spatial evaluation of the zone based on the ecological evaluation. It is expected that this ecological evaluation method and land purchase system will be useful for restoration of purchased land and establishment of ecological management in the future.

II. Data and Methods

1. Study Area

Among the ecological landscape conservation areas, the Donggang Basin is selected as the study area because of its vast preserved area of natural environment. This watershed has a larger number of lands to purchase than other watersheds, and the distribution types are diverse, making it suitable for analysis by separating into forest type, cultivation type, facility type, and wetland type. This area is located at a longitude of 128°29' - 128°40' and latitude of 37°12' - 37°22', which includes Yeongwol-gun, Pyeongchang-gun, and Jeongseon-gun (Refer to Figure 1). It's not only the ecological landscape conservation area of the Donggang Basin that reflect all kinds of land acquisition, such as terrestrial ecosystem and settlement

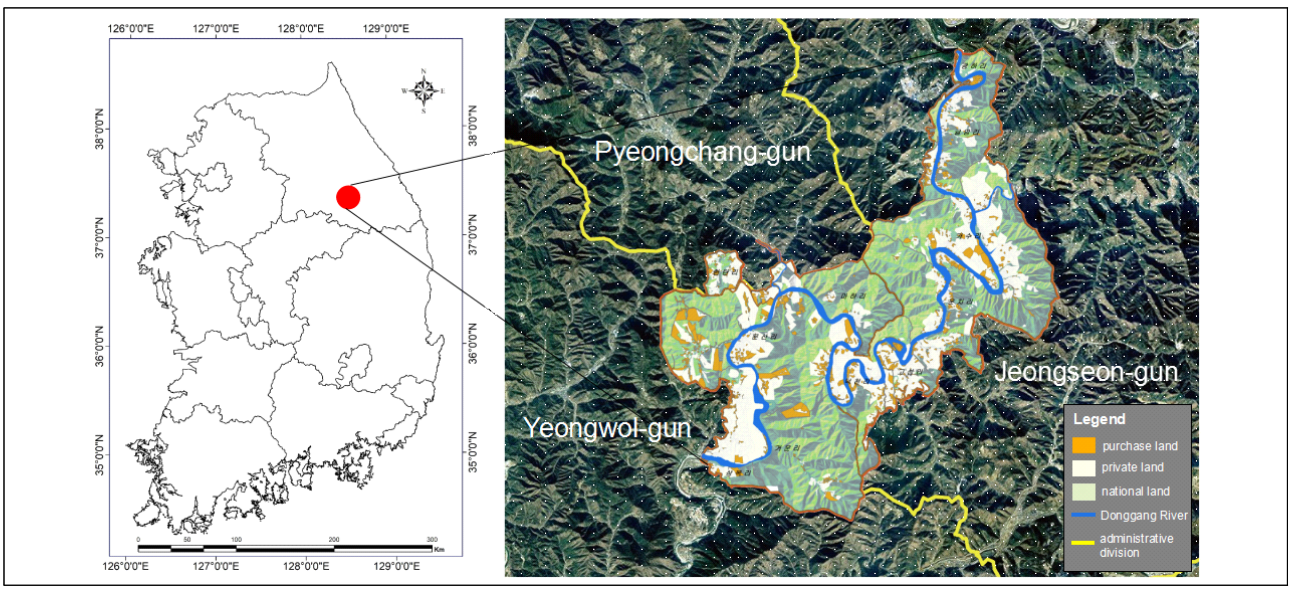

Figure 1. Geographical location of the Donggang Basin (deliniated by ArcGIS)

(or urban) ecosystems, but also the aquatic ecosystem is selected. The land acquisition includes a total of 1,470 parcels that corresponds to 7,242,547m^2 in which the 4,492 (31,580,338m^2) and 1,602 (70,875,051m^2) parcels belong to private and national lands, respectively. A total of 1,470 parcels were purchased until August 2014, with which the field survey is implemented to all these locations(Li, 2015). Four types of lands were categorized according to the land cover and land use: forest, cultivation, facility, and wetlands.

2. Evaluation System

Evaluation system is divided into ecological evaluation of parcel-based and zone-based. The comprehensive grade of ecological evaluation is established according to the comprehensive evaluation criteria.

1) Deriving Items and Grades for Parcel-based Evaluation

The ecosystem has a variety of functions including wildlife habitat, plant habitat, water purification, underground water storage and filling, and recreational sites, and is also valuable in response to climate change. Research on evaluation criteria for protected areas began in the late 1960s and there have been studies to identify evaluation factors from the early 1970s (Ra *et al.*, 2001). Most of the studies on the designation factors and criteria of the protected area were based on the evaluation items proposed by Ratcliff. This study select seven items (sources of point and non-point pollution, vegetation diversity, landscape diversity, exotic plants, view on waterside and road, connectivity, and possibilities of wildlife habitats) based on the previous evaluation items and models of ecological protection areas proposed by the Ministry of Environment (KME, 2007), the Ministry of Environment (KME, 2007), and Park (2014), which provides better accessibility for an on-site inspection(Refer to Table 1). The seven evaluation items were finally selected as the most suitable and easy to evaluate items for the Donggang basin. (Li, 2015).

Several evaluation methods are used to set the conservation grade: 1) emergency management accreditation program (EMAP) evaluation system introduced by the Environmental Protection Agency of the United States; 2) pressure - state - response (PSR) evaluation system by OECD (1993); and 3) driving force - PSR evaluation system by OECD (2004). Among them, KEI used the PSR evaluation system to develop the evaluating indicators. As such, there are many cases in which an ecological evaluation is graded on a five-point scale or three-point scale. The evaluation grade provides a three-scale of general ecological evaluation grade based on previous research, such as UNESCO MAB, biotope type evaluation (Kim, 2012; Cheonan City, 2008), the water ecological health evaluation grade (KME, 2008), the evaluation level of ecological preservation management(Kang, 2008.) and Seoul Metropolitan city(SMG, 2005) wetland evaluation system. Three points are given to the condition of high- ecological value, two to the middle, and one to the low- ecological value. Ecological evaluation is implemented by summarizing the aggregate score of evaluation items and the evaluation results of each item applied to the Koo (2009).

Table 1. Ecological evaluation table by site of purchased land

Evaluation items	Criteria	Reference literature
Point and non-point pollutions	High: none / Middle: 1to2 / Low: three or more	Park(2014)
Vegetation diversity	High: more than 60 species/ha / Middle: 31-69 species/ha / Low: less than 30 species/ha	Ra *et al.* (2001), Adamus and Clough (1978), Freeman (1999)
Landscape diversity	High: more than 5 patches / Middle: 3-5 patches / Low: less than 3 patches	DDI (2013)
Exotic plants	High: No invasive alien species and dangerous plants / Middle: 1-2 species of invasive alien species or advantages of dangerous plants and vines / Low: 3 or more species of invasive alien species or advantages of dangerous plants and vines	Kang (2008), SMG (2005), SDI (2010)
View on waterside and road	High: complete opening / Middle: a little opening / Low: closed	Landscape guideline of urban regeneration project of Korea
Connectivity	High: less than 150m / Middle: 150m-1km / Low: more than 1km	Tilton *et al.* (2001)
Possibilities of wildlife habitats	High: 3 or more forest and wetland / Middle: 1 to 2 forest and wetland / Low: no forest and wetland	Kim (2012)

2) Deriving Items and Grades for Zone-based Evaluation

Zone evaluation is implemented using the distance standard of key ecosystem and national environment evaluation in order to establish ecological network and enhance biodiversity of the ecological landscape conservation areas. According to the standard of the ministry of environment, the river, lake, and first-grade areas in the ecological zoning map are selected as a key ecosystem, and the distance standard considers moving the distance of small and medium animals. According to the ecological channel settings and management guidelines (KME, 2010), the eco bridge of wildlife is specified to more than 30m (or 100m). The national environmental evaluation is a process that evaluates the physical and environmental value of a land to improve its health and comfort of land ecology (and environment) through a sustainable preservation of environmental resources. Moreover, this evaluation is a process that determines the ecological value of a land and assesses the development induced by the environmental impact to a specific land.

The distance standard evaluation of key ecosystem evaluates the land acquisition located in the inner 30 m from the key ecosystem to the top class of ecological function due to its high ecological value; thus, the acquisition buffer zone from 30m to 100m is assessed as a middle class, and acquisition buffer zone farther than 100 m is defined as the transition area assessed as a low class. In Korea, the national ecological evaluation assesses various environmental factors of territory and classifies five grades based on the ecological value. In this study, the first and second grades refer to the top class, the third and fourth grades refer to the middle class, and the fifth grade refers to the low class of the ecological evaluation.

3) Overall Rating Settings

In this study, the ecological evaluation is implemented to establish the efficient use and management system of land acquisition. The overall rating is graded in the direction of low ecological evaluation rating to characterize the priority of land acquisition and restoration, and management plan setting(Refer to Table 2). The reason for rating the ecological evaluation grade in the lower direction is to improve the ecology of the land as much as possible by restoring the priority of the low ecological grade in the case of future ecological restoration.

Table 2. Criteria of comprehensive grade

Category	Parcel evaluation	Zone evaluation	Comprehensive grade
1	Upper	Upper	Upper
2	Upper	Middle	Middle
3	Upper	Lower	Middle
4	Middle	Upper	Middle
5	Middle	Middle	Middle
6	Middle	Lower	Lower
7	Lower	Upper	Middle
8	Lower	Middle	Lower
9	Lower	Lower	Lower

3. Weight Analysis of Evaluation Items

This study conducted literature surveys and expert questionnaires to develop an ecological evaluation model for each parcel. The evaluation model derived items and criteria that can be evaluated in the field, and a questionnaire survey is conducted among 30 experts for weight analysis. We refer to the previous research on ecological land evaluation methods to develop a reliable evaluation model (Park, 2014). For the analysis, we use Analytic Hierarchy Process (AHP) technique to estimate the weight of the evaluation items. The AHP technique is an evaluation technique that is commonly used in weight analysis of evaluation items, and it can derive relatively objective ecological evaluation results by sufficiently reflecting the importance of each evaluation item through expert surveys.

4. Acquisition System

In this study, the items for the acquisition system were set up based on the literature on land purchase and use, and the guidelines for the land purchase. Consequently, the distribution area of endangered species or point and nonpoint was selected as the first, and then the priority was placed on the site where the ecological rating of the private land. Developed land acquisition evaluation system mainly involves 1) ecological and comprehensive evaluation based on land type, 2) final review by performing a feedback process through an on-site verification, and 3) establish GIS DB by completing the grade setting for each land type. The overall land purchase process is shown in Figure 2.

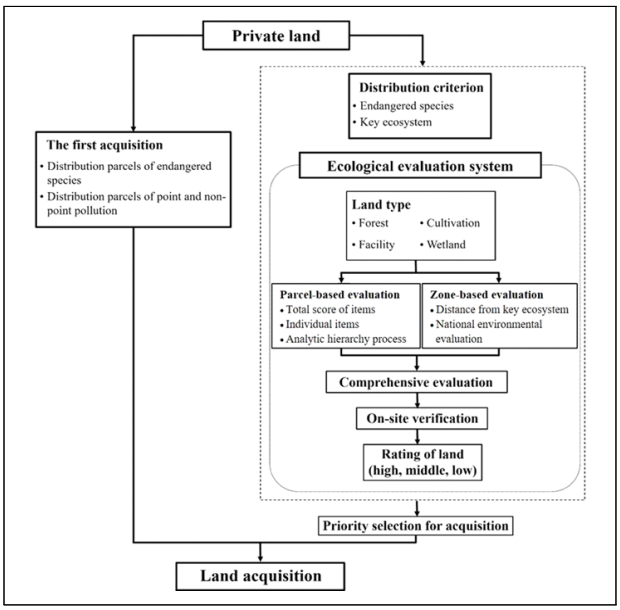

Figure 2. Overall flowchart from the ecological evaluation to the final purchase

III. Results and discussion

1. Ecological Evaluation

As a result of ecological evaluation for whole parcels (Refer to Table 3), the average score of connectivity is the highest at 0.455, followed by 0.379 at point and non-point source, 0.359 at wildlife habitability, 0.357 at vegetation diversity, 0.301 at landscape diversity, 0.256 for exotic plants, and 0.187 for viewing from the waterside or road. In terms of acquisition type, the average score of forest type is the highest with 0.373 points, and the facility type is the lowest with 0.303. The high score in the forest type is the inaccessibility and relatively less human interference in a well-preserved forest.

As an evaluation result of an individual item by parcels, a total of 225 parcels have high-ecological function, 418 parcels have middle, and 55 parcels have low- ecological function. No parcel is evaluated in the forest and wetland types with low-level ecological functions, which can be illustrated as well as managed in these areas.

According to the overall rating result by zones (Refer to Table 4), 174 parcels are evaluated to have the high-level ecological function, 399 parcels are evaluated to have the middle level, and 112 parcels are evaluated to have the low level. In terms of type, most parcels of forest are evaluated to have high and middle levels; whereas most parcels (448 parcels in total) of cultivation type are classified into middle and low levels and should therefore be prioritized for restoration in the future. In addition, waste building and waste materials are considered to be the factors of landscape degradation in the ecological aspect of the facility and wetland types. Hence, priority restoration is necessary. Another 772 parcels are areas where accessibility is difficult or impossible, and other measures are needed to be developed for the area when establishing ecological restoration and management plans.

According to distance assessments from key ecosystems (zone-based evaluation), the number of the parcels located within 30m (high-ecological function) is 231; whereas the parcels located within 30-100m (middle level) are 129, and those located >100m (low level) are 338. As results of national land environmental evaluation by zones, 424 (occupying 61%), 208, and 66 parcels are evaluated to have high, middle, and low level of ecological function, respectively. In the case of comprehensive rating evaluation by zones, 202, 270, and 226 parcels are evaluated to have high, middle, and low level of ecological function, respectively. In general, the ecological rating by zone is similar, which indicates a widespread distribution of land acquisition in ecological landscape preservation areas. In terms of type, 168 parcels of farmland are evaluated to have high-ecological function, which occupies 7% of the

Table 3. Evaluation of item score by parcels

Category	Forest	Cultivation	Facility	Wetland	Average score
Point and non-point pollutions	0.421	0.367	0.352	0.374	0.379
Vegetation diversity	0.483	0.326	0.343	0.276	0.357
Landscape diversity	0.376	0.263	0.260	0.304	0.301
Exotic plants	0.256	0.232	0.246	0.291	0.256
View on the waterside and road	0.193	0.165	0.182	0.208	0.187
Connectivity	0.468	0.456	0.422	0.472	0.455
Possibility of wildlife habitats	0.411	0.316	0.318	0.389	0.359
Average	0.373	0.304	0.303	0.331	-

Table 4. Overall rating of the parcel-based evaluation results

Type	Ecological function	Number of parcels	Area (m^2)	Ratio (%)
Forest	High	22	134,511	1.9
	Middle	13	32,942	0.5
	Low	1	5,578	0.1
	Unmeasurable area	206	3,615,399	49.9
Cultivation	High	143	418,255	5.8
	Middle	347	1,006,071	13.9
	Low	101	286,478	4.0
	Unmeasurable area	529	1,667,672	23.0
Facility	High	7	8,986	0.1
	Middle	46	26,129	0.4
	Low	9	4,719	0.1
	Unmeasurable area	37	19,237	0.3
Wetlands	High	2	5,597	0.1
	Middle	6	6,867	0.1
	Low	1	4,107	0.1
	Unmeasurable area	0	0	0.0
Total		1,470	7,242,547	100.0

total land acquisition.

As a result of the ecological comprehensive evaluation to land acquisition in the ecological landscape area of the Donggang Basin, 50 parcels are evaluated to have a high level of ecological function; whereas 440 parcels are classified into middle level, and 208 parcels have a low level (Refer to Table 5). The overall rating shows distinct differences compared to ecological function evaluation by parcels (or by zones). Areas with a high-ecological function decrease by more than half in the comprehensive evaluation result due to the final evaluation implemented in the direction of low- ecological function, thereby lowering the overall grade.

Table 5. Overall rating of the zone-based evaluation results

Type	Ecological function	Number of parcels	Area (m^2)	Ratio (%)
Forest	High	16	116,205	1.6
	Middle	13	30,760	0.4
	Low	7	26,066	0.4
	Unmeasurable area	206	3,615,399	49.9
Cultivation	High	30	88,806	1.2
	Middle	393	1,197,471	16.5
	Low	168	424,526	5.9
	Unmeasurable area	529	1,667,672	23.0
Facility	High	2	1,966	0.0
	Middle	30	18,699	0.3
	Low	30	19,169	0.3
	Unmeasurable area	37	19,237	0.3
Wetlands	High	2	5,597	0.1
	Middle	4	7,840	0.1
	Low	3	3,134	0.0
	Unmeasurable area	0	0	0.0
Total		1,470	7,242,547	100.0

2. Results of Weight Analysis and on -Site Verification

A total of 28 of 30 valid samples are extracted from the questionnaire survey, from which we obtain a reliable consistency index (CI) value, which is less than 0.1 after implementing the weight analysis (Refer to Table 6). As a result, the weight of vegetation diversity is the highest at 0.191 among evaluation items, whereas the view on waterside (or road) is the lowest at 0.078.

A total of 180 parcels are included in the land acquisition in Gasu-ri, which is a region in Jeongseon-gun. Among these parcels, 92 are classified as separate management areas due to inaccessibility or restoration. Separate management areas are areas where human interference is low or artificial development is difficult. These areas are maintained with minimum management. On-site verification is performed for the other 88 parcels. The 75 parcels conform with one another, which represent more than the 85.2% consistency compared to the result of the evaluation.

On-site verification, which represents more than 85.2%, shows comparatively high. The 12 of 13 parcels are inconsistently evaluated in the type of cultivation, which is probably due to the difference in time. The ecological evaluation occurred mainly in autumn (from July to September), whereas the on-site verification is executed in November. In other words, evaluation is highly inconsistent because the seasonal vegetation growth and crop planting are actively performed during the ecological evaluation period; however, the vegetation has withered or the crops are harvested during the period of

Table 6. Weight of items by parcel

Evaluation item	Weight	CI
Point and non-point pollutions	0.153	0.065
Vegetation diversity	0.191	
Landscape diversity	0.152	
Exotic plants	0.097	
View on waterside or road	0.078	
Connectivity	0.170	
Possibility of wildlife habitats	0.159	

on-site verification. Therefore, the overall evaluation system is considered valid and reasonable.

3. Acquisition System

The ecological evaluation method and purchase system developed in this study were applied to the study area and were shown in Figure 3.

To verify the results of the study, the acquisition system is applied to some private sites in the ecological landscape conservation area of Donggang Basin. The field survey and ecological evaluation are conducted for 68 parcels with a good accessibility to show the characteristics of private land throughout the Donggang Basin. The evaluation results were set from 1st to 9th as shown in Table 7, and the top five grades are selected to complete the priority of acquisition based on the location characteristics of the private land. Based on the calculation of purchase priorities for some of the private land, the purchase was ranked fifth, but each site accurately reflected the ecological characteristics and the introduction of a system for ecological restoration and ongoing management. This proves that the acquisition system developed in this study is relatively systematic.

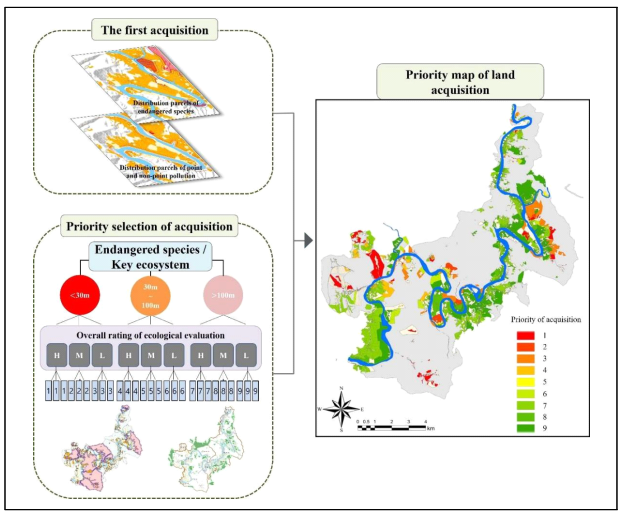

Figure 3. Diagram of the priority selection for land acquisition in Donggang Basin. H=High, M=Middle, L=Low

As described above, the ecological evaluation method and the purchase system developed in this study can be applied not only to the prioritization of land purchase in protected areas, but also to be useful in establishing strategies for restoring and managing purchase land. For example, it is possible to set the priority of the purchase land restoration according to the endangered species distribution standard, the core ecological distance standard, and the ecological evaluation grade, and establish short-term, medium-term, long-term restoration and management measures accordingly. It can be set as a short-term, medium-term, or long-term restoration area according to the ecological evaluation grade. As for the management plan, the ecological evaluation grade "Priority" establishes an adaptive management plan with the goal of restoring ecological resources and biodiversity, secures a biological habitat and induces and monitors vegetation natural transition; "Middle" induces an adaptive management method with the goal of improving ecological functions; and "Bottom" aims to enhance the maintenance of facilities and surroundings by restoring it to a hydrophilic complex with the goal of ecological use.

Table 7. Purchase priority of field verification

Ranking	Total parcels	Endangered species		Core ecosystem		Ecological evaluation		Final purchase rank	
		Distance	Parcel	Distance	Parcel			Ranking	Parcel
1	1	<30m	1	<30m	1	High			
2	36	<30m	8	<30m	36	Middle			
3	-	-	-	-	-	-		1	1
4	-	-	-	-	-	-			
5	25	30-100m	22	<30m	3	Middle	⇨	2	36
				30-100m	21				
		>100m	3	>100m	1			3	25
6	2	30-100m	1	30-100m	2	Low			
		>100m	1					4	2
7	-	-	-	-	-	-			
8	-	-	-	-	-	-		5	1
9	1	>100m	1	>100m	1	Low			

However, this study develops an acquisition system based on ecological evaluation and do not consider other aspects, such as economic benefits, which should be considered and be added as factors of acquisition. For instance, the geographical location, which is a significant factor for determining the economic and ecological environmental growth of valuable species, should be considered. Conversely, further study on the establishment of management system is necessary for sustainable preservation; because the value of land may depreciate, for example, due to the invasive species and pollutions without the appropriate strategy for continuous monitoring and management. The worse scenario may arise considering the issue of discontented neighbors to defend their living environment.

Ⅳ. Conclusions

Land acquisition is implemented to improve the water quality and preserve the environment of the surrounding watershed and protection areas. To some extent, land acquisition is mainly implemented through an agreement with the landowner; however, a systematic land acquisition is needed for sustainable preservation of the conservation and protected areas. Regarding this issue, this study develops a land acquisition system based on the ecological evaluation. In this study, a systematic and efficient land purchase system was established by developing an evaluation system by integrating parcel evaluation and zonal evaluation. The system was applied to the Donggang basin to prove its feasibility through on-site verification, and it compensated for various problems in the existing land purchase process.

This study does not consider aspects, such as economic benefits and strategy of management in the system of land acquisition. Although these aspects are important to establish a better system for achieving sustainable preservation, this study is significant due to the developed acquisition system, which utilizes an evaluation system considering the distribution of variance and ecological connectivity. Furthermore, the efficient ecological evaluation method and the basic guidelines of acquisition system are provided in this study, which are expected to be used as a fundamental material for further detailed study on acquisition system.

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Received : 08 June, 2020
Revised : 26 June, 2020 (1st)
Accepted : 26 June, 2020
3인익명 심사필