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Analysis of the Implementation Status and Characteristics of Ecological Restoration Projects in Korea: Ecosystem Conservation Charge Return Projects

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Abstract: Research on the Ecosystem Conservation Charge Return Project (ECCRP), a restoration initiative guided by the polluter-pays principle, is limited. Moreover, certain projects lack location analyses and specific restoration goals. Here, we examined the ecological restoration trends in South Korea based on the ECCRP. We collected data from 277 projects completed between 2003 and 2022 and explored project characteristics, site types, locations, and restoration target species trends. Wetlands and urban areas were frequently targeted, with forestry as the primary land category. Such projects prioritize restoration in areas with a potential for increased biodiversity. Small-scale projects were the most common, likely because of budget constraints and site selection challenges. The establishment of guidelines in 2010 resulted in considerable changes in restoration projects. Forested areas and parks close to species supply sources became important, and specifying target species for restoration was emphasized. Target species primarily included birds, amphibians, and insects. From a sustainability perspective, it is crucial to consider post-monitoring. Species of high restoration value and animals with a small habitat must be selected as performance indicators of restoration outcomes. Our results can help the ECCRP to strengthen the ecological restoration approaches to better achieve sustainability goals—improving biodiversity and conserving and restoring ecosystems.

Keywords: polluter-pays principle; biodiversity offset; target species; sustainable utilization; site selection; location type; Red List; endangered species

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1. Introduction

Development projects and continuous city expansion lead to environmental pollution, ecosystem fragmentation, ecosystem degradation, and biological habitat destruction. These issues are becoming critical environmental concerns as they lead to a decline in biodiversity [1–5]. The international community has developed the polluter-pays principle [6–10], according to which the costs of damage caused by environmental pollution and its amelioration should be borne by those responsible for it. Several countries have implemented biodiversity offsets [11,12] and wetland mitigation banking systems to ensure sustainable use of the natural environment and restore areas damaged by developmental projects. Alternatively, as an economic incentive [13], funds collected from environmental taxes, subsidies, and levies are used to support conservation and restoration projects. Policies for offsetting biodiversity losses are used in at least 33 countries worldwide, cumulatively restoring and protecting 8.3 million hectares of land [14]. These policies are related to Goal 11: Sustainable Cities and Communities, Goal 15: Life On Land, and Goal 17: Partnerships to achieve Sustainable Development Goals [15]. In South Korea, an initiative known as the "Ecosystem Conservation Charge Return Project" (ECCRP) has been implemented to collect ecosystem conservation charges from businesses that substantially affect the natural environment and ecosystems and decrease biodiversity. Indeed, the ECCRP is one of the most prominent ecological restoration programs in South Korea. The charges are calculated

based on the damaged area, with a unit charge of 300 KRW per square meter multiplied by regional coefficients. These coefficients are based on ecological landscape zones, regions, and land use categories, permitting a maximum surcharge of four times the base rate. In the case of a similar system, the "German Impact Mitigation Regulation" charges can be levied up to 175 times the value per square meter, with a rate of 1600 KRW per square meter. Compared with similar international systems, the charged amount is relatively low, prompting numerous policy research efforts focused on improving the system, including levy imposition and collection [16–18]. However, compared with the level of research focusing on policy, there is a substantial lack of comprehensive research on the status, performance, and process of preparing and implementing these projects.

Previous research has focused on post-construction monitoring, design indicator selection, project types, target species, and related aspects of design and construction [19–22]. Studies on the locations and types of ECCRP projects have generally categorized them into seven types: wetlands, rivers, coastal, forests, grasslands, rural, and urban [23]. Furthermore, as of 2013, the ECCRPs can be categorized into three sub-ecosystems: urban, forestry, and wetland [20]. These studies have analyzed the classification of ecological restoration direction, sub-ecosystem type, project scale, and regional distribution. However, there is a lack of research on the current status of project site location. Therefore, in this study, we subdivided the project sites into wetlands (protected lowland) and rivers (riverside land) to analyze sites at risk that are closely related to the effects of flooding when selecting project sites and separately classified waste facility utilization projects that are frequently used as restoration project sites as facility sites that are not in use and are being neglected.

Similarly, Cho and Kim [19] analyzed 35 ECCRPs that began in 2003 after the introduction of the system and focused on the business type, location type, project size, and regional distribution. However, their analysis was conducted at the initial stage of the ECCRP and was thus limited by a small sample. Moreover, as several projects have been undertaken since 2003, further analyses are required. The ECCRPs consist of a business plan preparation, submission, and selection process via a demand survey in the first year; project approval, authorization, construction, and completion in the second year; and maintenance and monitoring in the third year [24].

While preparing the business plan during the demand survey, research on the target site and in-depth analysis of the location characteristics are limited. Consequently, even if a project is approved, the target site of the ECCRP will still require approval and permit administrative procedures depending on the land category, zoning district, and area in the land use plan. Therefore, the conditions of the target site locations have become a critical factor owing to the nature of the project, which must be completed in the given year. Among the 35 ECCRPs selected in 2022, five were not completed because of the approval process and were carried over to 2023. Therefore, the Ministry of Environment is pursuing measures to administratively accelerate the timing of demand surveys for projects in 2024.

As the return projects were prepared and submitted in a short period, sufficient ecological surveys were not performed, which limited the establishment of specific goals and target species and the planning, design, and verification of the effectiveness of post-monitoring. Moreover, certain project areas are deficient in habitat and diversity promotion owing to the lack of location analysis for the target area [17]. Therefore, here, we aimed to analyze the current status of land use in the target area, and this is an essential factor in business plan preparation. We classified and analyzed the location and type of 277 return project sites from 2003 to 2022, as well as the "land category" according to the Act on the Establishment and Management of Spatial Data and the "use area" according to the National Land Planning and Utilization Act. This study will provide insights regarding the tendencies related to the target site selection of ECCRPs, and the associated data can serve as a reference for future restoration projects.

To achieve effective ecological restoration, the use of native plant species is recommended, with a focus on habitat restoration for target species [25]. Cho [26] analyzed the current status of plant species selection for 58 ECCRPs and reported that indigenous plants

accounted for 76% and cultivated plants accounted for 24%. Hence, although indigenous plants are most commonly selected, cultivated plants are also widely used.

To prioritize native plant-centered species selection, minimizing the use of cultivated plants is necessary. The target species are selected from biological species that are either historically or currently present in the target area, with consideration given to keystone, umbrella, and flagship species.

In the present study, we sought to identify key target species for ecological restoration projects. To this end, data on the current status of target species selection in implemented projects were collected and analyzed based on various criteria, such as the Korean Red List and the list of endangered species. This research can guide the selection of target species in ecological restoration projects. However, additional studies might be necessary to develop representative habitat models for restoration projects based on the results of this study.

2. Materials and Methods

2.1. Research Scope

The temporal scope of this study was from 2003 to 2022. The spatial scope covered 277 return projects completed by 16 metropolitan cities, 131 basic local governments, and 7 basin and regional environmental offices nationwide. In the case of the ECCRP, because of the nature of the public offering, the business plan, design documents, and monitoring reports are not publicly available; therefore, there are limitations in accessing detailed information regarding a project unless the project is performed directly or the completed project site is visited. Therefore, in this study, we referred to the "Status of ECCRP" of the Korea Ecological Restoration Association and the ECCRP Casebook of the Ministry of Environment [27,28]. Furthermore, we referred to data obtained by directly participating in the project or visiting the site.

2.2. Analyzing the Location and Type of Project Sites

The ECCRP Guidelines presented by the Ministry of Environment [29] divide the project types into eight categories: vegetation and animal ecosystems, grassland, urban, rural, forest, wetland, river, and coastal. For the location and type analysis in this study, the project sites were reclarified into seven categories (Table 1): urban, rural, wetland, river, forest, abandoned facility site, and others, based on the classification of previous studies. The purpose was to investigate the location characteristics of the target area where the project was performed. For the classification by ecosystem type, we summarized the predominant ecosystem type in the vicinity based on the project boundary.

Table 1. Analysis of location types for the ECCRPs [1].

Category	Types	Spatial Range
Urban	Urban forests, ecological forests, urban parks, school forests, housing sites, green spaces, and sub-ecosystems	Urban centers with high floating population, municipal areas, and neighborhood parks
Rural	Village forest, village sub-ecosystem, idle land, and bare land	Spaces in the outskirts that are relatively rural compared with the city
Wetland	Reservoirs, lakes, tractional ponds, detention reservoirs, ponds, abandoned paddy fields, mountain streams, mountain wetlands, coastal areas, peatlands, and dams	Various wetland spaces
River	Low waterways, flood plains, fishways, waterfront ecosystems, high-flow plains, and islands (alluvial islands)	Separation of spaces in riverside land among wetlands and differentiation of maintenance during flood cycles

Table 1. *Cont.*

Category	Types	Spatial Range
Forestry	Forests, ecological corridors, species restoration, tunnels, forest valleys, and trails	Restoration of sites in forests relative to urban areas, Baekdudaegan, and deforested areas
Abandoned facility sites	Abandoned railroad sites, abandoned roads, abandoned sports facilities, abandoned schools, abandoned fish farms, and abandoned quarries	Spaces in abandoned facility sites that are reused in various ways
Others	Species restoration projects, guiding fences, and landfills; civilian-access control lines	Intangible businesses, services, current school sites, and special areas whose locations are difficult to specify

[1] ECCRP: Ecosystem Conservation Charge Return Project.

The wetland or forest type was classified as "urban" if the surrounding environment was predominantly urban. If the environment inside the project site was a wetland ecosystem and the surrounding environment was not urban, it was classified as a "wetland" [22]. Rivers broadly classified as wetlands were reclassified because rivers (riverside land) are reviewed in the project site selection process based on their difficulty of maintenance after restoration; therefore, the selection status can be analyzed by classifying them separately. The classification of urban and rural areas is based on the boundaries of the urban fringe, which has excellent environmental conditions in terms of biodiversity. Projects in urban forests, urban parks, green spaces, and neighborhood parks were classified as urban. In addition, village forests, village sub-ecosystems, and open lands located in counties and below were classified as rural. In the suburban areas, ecological corridors, species restoration project sites, and Baekdudaegan restoration projects were targeted for project content. However, urban neighborhood parks, which are frequently selected as return project sites, were classified as urban despite being forests. In addition, various water ecological spaces, such as reservoirs, lakes, retention ponds, and ponds, were classified as wetlands. Among wetlands, areas in the riverside land, such as reservoirs, floodplains, fishways, and high-water areas, were classified separately as rivers. The separate classification of rivers, which can also be classified as wetlands, was analyzed independently when selecting project sites because of their specificity as areas affected by maintenance and flooding. Abandoned railways, roads, sports facilities, schools, fish farms, and stone mountains, among others, were classified as abandoned facility sites, with the intention of reusing and restoring abandoned facilities. Other projects classified as abandoned facilities included projects that are difficult to identify, such as sites with induction fences, which are linear spaces, creating urban ecological status maps, and projects within the civilian-access control line, which is a unique area.

2.3. Analysis Type According to Land Use Plan

For the ECCRP, the administrative procedures of licensing and permitting, as well as the functional aspects of the biological habitats of the target species, are considered essential in the project site selection process. In this respect, we analyzed the items related to the restrictions of the project site on the land use plan. Owing to the nature of the ECCRP, which must be completed in the corresponding year, the approval and administrative procedures are crucial to the project implementation process. For each project site selected by the Ministry of Environment, the first step is to identify land use-related information, and the second step is to determine the laws and regulations on which the project is authorized. The third step is to review and implement the administrative procedures for project approval

and permit. The use area and land category are closely associated with the approval process of the return project.

The use areas were identified according to the Enforcement Decree of the National Land Planning and Utilization Act and other laws and regulations. The classification by use area was categorized as urban, management, rural, and natural environment conservation areas. Thus, 247 projects with verifiable addresses and land use information were analyzed.

Regarding the classification of land category, the land status of the project site was divided into 28 land category types according to the regulations under the Act on the Establishment and Management of Spatial Data. Regarding the classification by land category, we analyzed 259 projects where the land category was identified.

We also analyzed the land ownership status of the project site into state-owned, military-owned, city-owned, or province-owned, and privately owned lands for the 258 projects in which the owner could be identified. As the current and future land use status of the project site is closely related to the project implementation process, in this study, we analyzed comprehensive information on the project site land.

Information on the location, land number, land category, owner status, and region/district of the project site was analyzed using the comprehensive real estate information site operated by the Korea Land and Housing Corporation. In addition, the type of project site was analyzed via frequency analysis using Excel (Microsoft 365, Microsoft Corporation, Redmond, WA, USA).

2.4. Analysis of Target Species

Species such as endangered wildlife, endemic species, those on the Red List, natural monuments, and climate change indicator species were selected as important species within the target area. The ECCRP, initiated in 2003, identified target species from 2009. In this analysis, 217 projects were conducted between 2009 and 2022 in which target species were identified and examined. The target species were categorized as mammals, birds, amphibians, reptiles, fish, insects, plants, and others (benthic invertebrates). The target species were analyzed using the Korean Red List and the list of endangered species. The National Institute of Biological Resources [30] established the Korean Red List by excluding commonly observed species in Korea from the International Union for Conservation of Nature (IUCN) Red List and including unique Korean species not listed in the IUCN Red List. It is periodically revised and currently includes 1 extinct species, 0 extinct in the wild, 12 regionally extinct, 58 critically endangered, 169 endangered, 306 vulnerable, 268 near-threatened, 1760 least concern, and 1484 data-deficient species. Endangered wildlife refers to wild species that face imminent extinction because of natural and anthropogenic threats; these are designated by law for protection and management as nationally protected species; 68 species are classified as level 1 and 214 as level 2 among endangered wildlife in Korea. Level 1 endangered species are facing extinction because of a marked decline in population caused by natural or artificial factors. Level 2 species are those at risk of extinction if current threats, whether natural or artificial, are not alleviated, leading to a substantial reduction in population. The analysis of target species involved data collection, categorization, and frequency analysis using Excel.

3. Results

3.1. Project Status by Local Government, Basin, and Regional Environmental Office

We conducted a frequency analysis of 277 ECCRPs completed before 2022 by local governments. Accordingly, Gyeonggi had 67 projects (24.2%), Seoul had 35, Chungnam and Chungbuk had 22 each, and Gyeongbuk had 20, showing a high proportion of projects in the capital area (Figure 1).

As of November 2022, there were 61 natural environment conservation project agents, with 17 (27.8%) in Seoul and 20 in Gyeonggi (Table 2). Although Chungnam, Chungbuk, and Gyeongbuk had fewer companies, they were selected for more projects because the natural environment conservation project agents can apply for projects from other local

governments instead of selecting only projects from their local government. Moreover, the changes in selection criteria were evenly distributed by the local governments.

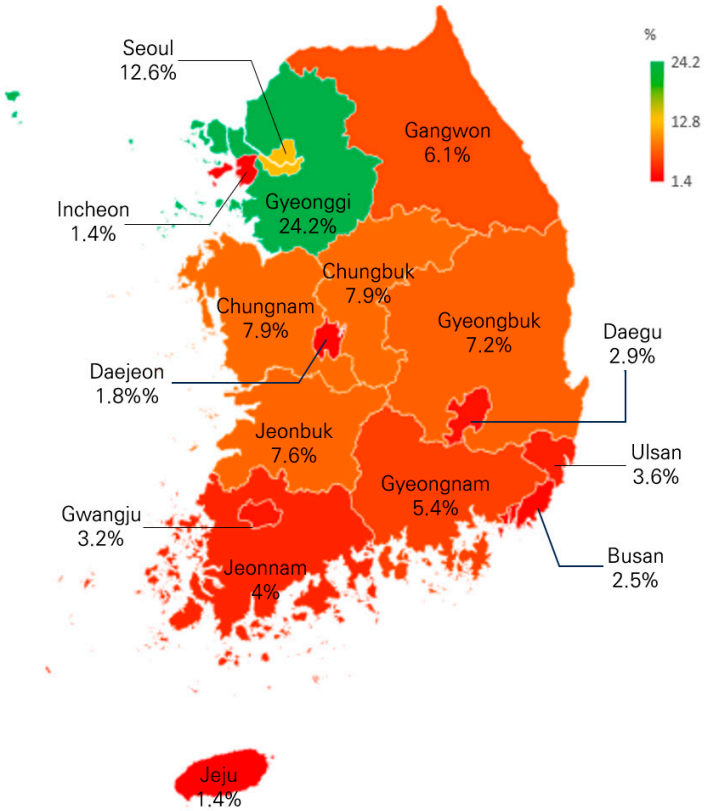


Figure 1. Status of ECCRPs by local governments (2003–2022) in South Korea. ECCRP: Ecosystem Conservation Charge Return Project; higher numbers of projects are shown in green, and lower numbers in red.

After analyzing the selected projects by basin and regional environmental offices, the Han River Basin Environmental Office (REO) had the most projects with 105 (27.9%), followed by the Geum River Basin Environmental Office (41), Daegu Regional Environmental Office (30), and Nakdong River Basin Environmental Office (28; Table 3).

Table 2. Number of natural environment conservation project agents by region.

Classification	No. of Companies	%
Seoul	17	27.9
Busan	3	4.9
Incheon	2	3.3
Daegu	-	-
Daejeon	2	3.3
Gwangju	1	1.6
Ulsan	-	-
Gangwon	-	-
Gyeonggi	20	32.8
Gyeongnam	5	8.2
Gyeongbuk	2	3.3
Jeonnam	7	11.5
Jeonbuk	1	1.6
Chungnam	-	-
Chungbuk	1	1.6
Jeju	-	-
Total	61	100

Table 3. Project selection status by basin and regional environmental office (2003~2022).

Organization	No. of Projects	%
Han River Basin Environment Office	105	37.9
Nakdong River Basin Environment Office	28	10.1
Yeongsan River Basin Environment Office	26	9.4
Geum River Basin Environment Office	41	14.8
Wonju Regional Environment Office	26	9.4
Daegu Regional Environment Office	30	10.8
Jeonbuk Regional Environment Office	21	7.6
Total	277	100

The budget and number of ECCRPs have steadily increased. Simultaneously, the business plans directly submitted to the Ministry of Environment have been redirected to the basin and regional environmental offices under the Ministry of Environment since 2021. From 2007 to 2021, 196 projects and business plans involving the natural environment conservation project agents were submitted to the basin and regional environmental offices. For the projects from 2021 to 2022, the number of projects submitted to the Han River Basin Environment Office slightly increased (from 37.8% to 46.9%), whereas that of projects submitted to the Wonju, Daegu, and Jeonbuk Regional Environment Offices decreased. Moreover, the Nakdong and Yeongsan River Basin Environment Offices received six projects each (9.4%). In contrast, the Wonju, Daegu, and Jeonbuk Regional Environment Offices received four projects (4.4%), demonstrating a more balanced regional distribution (Table 4).

Table 4. Project selection status by basin and regional environmental office (2007~2022).

Project Period		Han River Basin Environment Office	Nakdong River Basin Environment Office	Yeongsan River Basin Environment Office	Geum River Basin Environment Office	Wonju Regional Environment Office	Daegu Regional Environment Office	Jeonbuk Regional Environment Office	Total
2007–2020	No. of Projects	74	15	19	30	22	22	14	196
	%	37.8	7.7	9.7	15.3	11.2	11.2	7.1	100
2021–2022	No. of Projects	30	6	6	10	4	4	4	64
	%	46.9	9.4	9.4	15.6	6.3	6.3	6.3	100

3.2. Classification of Project Site Types

Of the 277 total projects, 83 were located in wetland areas, 69 in urban areas, and 47 in forestry areas (Table 5).

Table 5. Percentage of projects by location type.

Classification	No. of Locations	%
Urban	69	24.9
Rural	14	5
Wetland	83	30
River	22	7.9
Forestry	47	17
Abandoned facility sites	29	10.5
Others	13	4.7
Total	277	100

In rivers, 22 projects (7.9%) were implemented, including 17 high-flow plains, 2 fishways, and 2 alluvial islands. Rivers classified as riverside land accounted for a small proportion of the total projects (22), owing to the risks regarding maintenance after ecological restoration projects. However, 11 river sites were selected from 2018 to 2022. The

selection rate increased because of the shift in awareness related to wetlands with high biodiversity (Figure 2). Furthermore, the unification of water management by the government led to the active inclusion of rivers as ECCRP sites, as rivers have been unified under the Ministry of Environment.

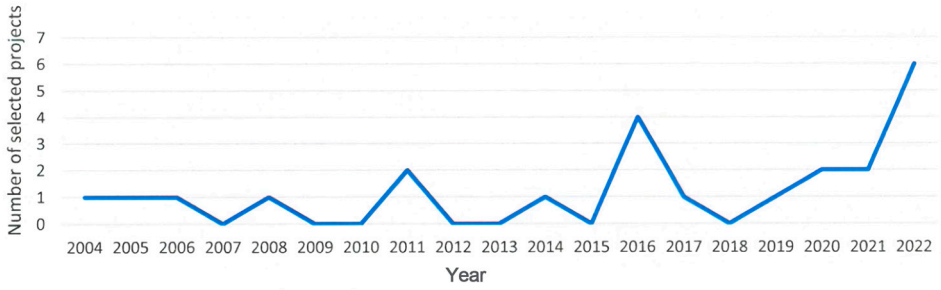


Figure 2. Change in the number of the selected ECCRPs in rivers (riverside lands) between 2004 and 2022. ECCRP: Ecosystem Conservation Charge Return Project.

The high proportion of sub-ecosystem creation projects by project type can be attributed to the limited budget allocated for ECCRPs and the difficulty in selecting locations; therefore, the projects that can maximize ecological functions on a small scale were selected [17]. Furthermore, among the related projects of the Ministry of Environment, nature conservation use facilities and ecological corridors are promoted as separate projects. Therefore, the proportion of these types was low. Abandoned facilities, such as roads and railways, are relatively narrow linear spaces disconnected from the surrounding natural environment, with numerous cases of neglected management and pollution once facility utilization ceases. Projects for restoring abandoned facilities as natural environments to revitalize ecological functions on a small scale with a limited budget, such as the ECCRP, are important. There were various types of abandoned roads, railways, schools, sporting facilities, and fish farms. Among them, the number of abandoned railroad sites (including stations and platforms) was the highest (17 sites), followed by abandoned roads (5 sites).

Regarding the location characteristics of the 54 return projects up to 2011, before the establishment and distribution of the ECCRP Guidelines [29] of the Ministry of Environment, schools and public facilities were the most selected areas (15 sites), followed by rivers (11 sites), forests (11 sites), roadsides (9 sites), and wetlands (e.g., ponds and reservoirs; 2 sites) [17]. Compared with the 277 projects completed by 2022, the number of school sites decreased, whereas the number of urban public facilities, such as parks, increased. Until 2007, return projects were performed in small habitats in schools and public facilities where land ownership and consent could be easily obtained [17]. According to location and type, 22 and 47 projects were in rivers and forests, respectively. The number of projects in rivers that were difficult to maintain because of flooding tended to decrease, whereas those in wetlands increased to 83. This trend can be attributed to the increase in the proportion of wetlands (such as ponds and reservoirs) with high biodiversity via the knowledge and expertise accumulated since the introduction of the Natural Environment Conservation Project Agent policy in 2007. The high proportion of wetlands is also reflected in the selection of target species for ecological restoration projects. Regarding the ecosystem types of the project site, 105 projects included wetlands and rivers (Table 5).

3.3. Land Use Plan Types

3.3.1. Owner Status

Most project sites were owned by the military or the state. The corporation-owned lands were owned by public corporations, including K-water, Korea Rural Community Corporation, KORAIL, and SH Corporation. The projects for the two privately owned land sites were performed in 2010 (Gangwon Taebaek) and 2011 (Jeonnam Suncheon), and the project for the clan-owned land was performed in 2007 (Chungnam Dangjin). At the beginning of the policy, project sites that were not state-owned or publicly owned

lands were also selected. However, the ECCRP was not actively utilized owing to a lack of understanding of its purpose and the low participation of local governments, businesses, and agencies due to complex procedures [29]. Therefore, only state-owned or publicly owned lands have been selected and implemented since the 2011 project, after the distribution of the "ECCRP Guideline" of the Ministry of Environment. Meanwhile, no privately owned lands have been selected as project sites (Table 6).

Table 6. Status of landowners for the project sites between 2003 and 2022.

Classification	No. of Project Sites	%
Military-owned land	110	39.7
State-owned land	78	28.2
City- or province-owned land	45	16.2
Corporation-owned land	22	7.9
Privately owned land	2	0.7
Clan-owned land	1	0.4
Other	19	6.9
Total	277	100

3.3.2. Project Site Classification according to Area and District

According to the National Land Planning and Utilization Act, the use areas are classified into urban, management, rural, and natural environment conservation areas. Furthermore, the administrative procedures for approvals and permits include a review of development-restricted areas, the River Act, the Cultural Heritage Protection Act, the Protection of Military Bases and Installations Act, and the Mountainous Districts Management Act. The analysis of areas and districts under the Enforcement Decree of the National Land Planning and Utilization Act and areas and districts under other laws was based on 247 projects, with use areas identified for 277 implemented projects. Consequently, 180 sites (72.9%) were urban, 37 (15.0%) were management, 20 (8.1%) were rural, and 10 (4.0%) were natural environment conservation (Table 7) areas.

Table 7. Status of the ECCRPs [1] by use area between 2003 and 2022.

Classification		No. of Locations		%
Urban areas	Residential areas	20	180	72.9
	Commercial areas	2		
	Industrial areas	4		
	Green areas	154		
Management areas	Conservation management areas	14	37	15.0
	Production management areas	3		
	Planning management areas	20		
Agriculture and forestry areas		20		8.1
Natural environment conservation areas		10		4.0
Total		247		100

[1] ECCRP: Ecosystem Conservation Charge Return Project.

3.3.3. Classification by Land Category

By classifying land categories, the relationship between current land use and project site selection can be established. Among the 277 projects, excluding 18 in the land category that could not be identified, 259 were located in forests (18.9%), parks (18.5%), or marshes (14.3%). In contrast, project sites in functional and economically used land categories (i.e., orchards, recreation areas, embankments, cemeteries, and schools) comprised approximately 0.4% each (Table 8). The relatively high selection rate of forestry and marsh habitats is attributable to their favorable ecological conditions as biological habitats. The

high selection rate of park sites reflects the numerous cases of improving sub-ecosystem creation projects in locations where the function of existing parks has deteriorated or where unauthorized occupation, such as illegal cultivation, occurs. Moreover, there were cases where publicly owned lands purchased by local governments under the park sunset policy were selected. School sites were selected seven times from 2003 to 2009; however, since then, such sites have only been selected once each in 2014, 2018, and 2022. The first seven school site restoration projects included creating small-scale biological habitat spaces based on ecological ponds, which were observed until 2009. Certain projects conducted at a later stage on school grounds were performed in green spaces or neighborhood parks owned by school foundations. Accessing abandoned school facilities as sites for ecological restoration projects will become increasingly difficult owing to the diversity of uses, including small museums and alternative schools in connection with the buildings.

Table 8. Status of the ECCRPs [1] by land category (2003–2022).

Classification	No. of Project Sites	%
Forestry	49	18.9
Park	48	18.5
Marsh	37	14.3
Dry paddy field	24	9.3
Paddy field	18	6.9
River	16	6.2
Railway site	15	5.8
Miscellaneous land	12	4.6
School site	10	3.9
Road	8	3.1
Site	7	2.7
Water supply site	4	1.5
Ditch	3	1.2
Graveyard	3	1.2
Bank	2	0.7
Orchard	1	0.4
Recreation area	1	0.4
Gymnastic site	1	0.4
Total	259	100.0

[1] ECCRP: Ecosystem Conservation Charge Return Project.

3.3.4. Classification by Other Laws

Among the 277 targeted projects completed by 2022, 25 were in development-restricted areas, and 70 were in other conservation, protection, and management areas. The preservation, protection, and management areas included rivers and small rivers, as well as cultural property, agricultural, Baekdudaegan, water supply, historical and cultural environments, (provincial) wildlife, waterfront, and water resource protection areas. The development-restricted areas refer to low-density land use zones established to restrict development activities around large cities, such as Seoul and Gyeonggi metropolitan areas, Busan, Daegu, Daejeon, and Ulsan. In contrast, development-restricted areas in cities are frequently damaged by illegal activities, including cultivation and littering, which aligns with the purpose of the return project. In contrast, parks are frequently represented in the land category, with 48 sites (18.7%). When the scope of parks was expanded to land use planning, the selection rate increased, with 110 sites (39.7%; Table 9). Among them, neighborhood parks were the most common (69, 62.7%), and the proportion of projects involving urban parks, such as children's, national, metropolitan, military, theme parks, and recreational areas, was high.

Reservoirs (e.g., reservoirs, ponds, and dams) and wetlands (including rivers) accounted for 50 sites (18.1%), with a high proportion of aquatic organisms as the target

species. There were two projects with dams as project sites: Daecheong Lake (restoration of a firefly habitat) and Andong Lake (creation of an artificial sand island for little terns).

Table 9. Status of project sites by other laws (including duplicates).

Classification		No. of Locations	Remark
Park	Neighborhood parks	69	-
	Children's parks, national (provincial) parks, etc.	41	Amusement parks and theme parks
Water spaces	Low waterways, tractional ponds, ponds, and detention ponds	48	-
	Dams and lakes	2	Daecheong Dam and Andong Dam
Management areas	Development-restricted areas	25	-
	Conservation, protection, and management areas	70	-

3.4. Analysis of Target Species

Target species were identified in 217 of the 277 projects completed from 2003 to 2022 (78.3%). Approximately 1–5 species were selected per project. From 2003 to 2022, a total of 157 species were selected as target species in the ECCRP, resulting in a total of 405 occurrences, including duplicates. Among these, there were 73 species related to aquatic habitats, representing 46.5% of the total.

Insects accounted for 22 species, followed by birds with 20 species and amphibians with 13 species. The category of insects included semi-aquatic insects that inhabit water bodies during their larval stage. These results indicate that water bodies with generally higher biodiversity are easily approached as target sites for ecosystem and species restoration projects (Table 10). Among the target species, 36 were endangered, accounting for 22.9%. There were 12 endangered bird species, 7 insect and terrestrial plant species each, and 6 mammals (Tables 11 and 12). Among the 157 species, 57 were listed in the Korean Red List, representing 36.4%, with a high selection rate for species classified as "vulnerable" or "least concern" (Table 12). The selection rate for general species was higher than that for endangered species and those listed on the Korean Red List.

Table 10. Selection status of target species for the ECCRPs (2008–2022).

Classification	Target Species								
	Mammals	Birds	Amphibians	Reptiles	Fish	Insects	Plants	Other	Total
No. of target species selected	23	126	106	7	5	97	40	1	405
%	5.7	31.1	26.3	1.7	1.2	24.0	10.0	0.3	100
By species	10	47	13	4	4	51	27	1	157
%	6.2	29.5	8.2	2.7	2.7	32.5	17.5	0.7	100
Species in aquatic ecosystems	1	20	13	1	4	22	11	1	73
%	1.3	27.4	17.8	1.4	5.5	30.1	15.1	1.4	100
No. of endangered species	6	12	3	1	0	7	7	0	36
%	16.5	33.0	8.5	3.0	3.0	19.5	19.5	0	100

During the initial implementation of the project from 2003 to 2007, the concept of ECCRP was not clearly established, and the projects were conducted without clear target species selection. With the amendment of the Natural Environment Conservation Act in 2007 and the participation of environmental conservation project agents, professionalism was strengthened, and the selection of target species started. The process of selecting sites

was aligned with the project's purpose, often primarily determined by the chosen target species, thus becoming a characteristic feature of the ECCRP.

Table 11. Endangered species among the target species (2008–2022).

Classification	Endangered Species among Target Species
Mammals	*Martes flaviguls*, *Ursus thibetanus ussuricu*, *Naemorhedus caudatus*, *Prionailurus bengalensis*, *Lutra lutra*, *Vulpes vulpes peculiosa*
Birds	*Egretta eulophotes*, *Grus japonensis*, *Accipiter soloensis*, *Accipiter nisus*, *Grus vipio*, *Sterna albifrons*, *Platalea minor*, *Halcyon pileata*, *Cygnus cygnus*, *Anser fabalis*, *Grus monachal*, *Charadrius placidus*
Amphibians, Reptiles	*Pelophylax chosenicus*, *Kaloula borealis*, *Dryophytes suweonensis*, *Mauremys reevesii*
Insects	*Nannophya koreana*, *Libellula angelina*, *Cybister chinensis*, *Lethocerus deyrollei*, *Parnassius bremeri*, *Copris tripartitus*, *Argynnis nerippe*
Plants	*Euryale ferox*, *Nymphaea tetragona var. minima*, *Iris dichotoma*, *Cicuta virosa*, *Brasenia schreberi*, *Saururus chinensis*

Table 12. Status of the target species according to the Korean Red List (2009–2022).

Classification	Target Species								
	Mammals	Birds	Amphibians	Reptiles	Fish	Insects	Plants	Other	Total
Extinct	-	-	-	-	-	-	-	-	-
Extinct in the Wild	-	-	-	-	-	-	-	-	-
Regionally Extinct	-	-	-	-	-	-	-	-	-
Critically Endangered	-	-	-	-	-	-	-	-	-
Endangered	-	-	-	-	-	-	1	-	1
Vulnerable	2	3	1	-	-	1	3	-	10
Near-Threatened	5	6	2	1	-	3	4	-	21
Least Concern	-	6	8	3	-	2	2	-	21
Total	7	15	12	4	0	8	11	0	57

4. Discussion

The ECCRP, based on the polluter-pays principle, has been a representative restoration project in Korea since 2003, and it initially implemented approximately three projects per year. However, it has since expanded, partially because of continued budget expansion, and currently undertakes approximately 30 projects per year, with a total of 277 projects implemented by 2022. Despite its continuous financial growth, there is a substantial lack of academic research assessing the outcomes and the extent of ecosystem restoration for projects related to the ECCRP. Therefore, in this study, we collected and organized data on the performance of projects completed from 2003 to 2022. A common question faced by practitioners with limited budgets is where and how to prioritize the restoration efforts [31]. Analyzing past project outcomes and trends can contribute to the implementation and advancement of future restoration projects.

Since the revision of the Natural Environment Conservation Act in 2007, which introduced the natural environment conservation project agent system, and the creation of the ECCRP Guidelines [29] in 2010, the level of expertise in restoration projects has increased. This includes the establishment of target species and a higher rate of site selection focused on areas with high biodiversity. After the distribution of ECCRP Guidelines, the target species were set in 79.8% of cases, and the restoration project sites were selected by focusing on state-owned lands that pose minimal challenges for post-restoration maintenance. The successful establishment of target species can serve as a key indicator of ecosystem

health [32]. An increasing number of projects have defined the direction of restoration by proposing specific target species, which are frequently birds, amphibians, and invertebrates. Because the successful settlement of target species is a crucial issue [32,33], continuous monitoring is essential to determine whether they establish successfully.

By examining the characteristics of the project sites, the ecosystem type and zoning district, selection status by local governments and basin and regional environmental offices, and owners and land categories of the target lands were analyzed. The ecosystem types of the sites were classified as urban, rural, wetland, river, forest, abandoned facility site, or others. The ecosystem types were in accordance with the National Land Planning and Utilization Act, as most of the project sites were urban.

Regarding land category, the proportion of forests, parks, and marshes was high, which can be interpreted as a trend toward selecting areas that are proximal to the species source [31] in terms of ecological connectivity [34]. This trend indicates that the ECCRPs have shifted toward the fundamental purpose of the program, which is to promote biodiversity via ecological restoration of degraded land. Furthermore, the proportion of neighborhood parks was also high as this enhanced biodiversity in urban areas or promoted ecosystem health. Therefore, these projects may also contribute to the role of species sources [31] in urban areas, as the restoration of ecosystems in these projects is based on urban-damaged or unused areas, and the restoration direction is determined based on the target species.

When collectively analyzed, wetland areas were the most commonly selected ecosystem location and project site type, urban areas were the most commonly selected use area, and forests were the most commonly selected land category. This observation reflects the goal of the restoration project site, which is to create sub-ecosystems that offer an alternative to natural habitats and restore damaged ecosystems. The effectiveness of restoring key ecological functions depends on the capacity of restored habitats to complement existing ones [35]. Thus, the areas predicted to have high biodiversity when restored, such as damaged wetlands in urban areas, were reviewed first. The findings of this study can be used to select and guide future restoration projects on a functional and efficient basis. However, this study was limited by the restricted access to detailed information, such as project plans and design documents, because the ECCRPs are conducted as a public competition. Moreover, although the ECCRPs are prominent restoration projects, analyzing the trends of ecological restoration projects in South Korea solely utilizing the ECCRP framework limits the application of the study results. Hence, subsequent research endeavors should aim for a more comprehensive analysis by including a diverse range of restoration projects.

5. Conclusions

In this study, we analyzed the performance data of ECCRPs by examining the types, characteristics, restoration directions, and restoration goals of projects. The results suggest the preferred types and outline the direction of conservation policies when selecting restoration target sites. When compared with similar cases abroad, such as Germany's "Impact Mitigation Regulation", the ECCRP tends to lack qualitative restorations because limited money has been collected, and the fee is calculated based on the area. Hence, offset activities should be carried out with the same scale and quality, aiming for no net loss and net gain to prevent net damage. Indeed, it is necessary to operate the system with a focus on ecological value rather than area, emphasizing the importance of carefully selecting restoration target sites and setting goals for restoration projects. The direction of the restoration project can be clarified by selecting target species in the ECCRP. However, owing to the project's characteristics, which typically have a short duration (1 year) and small-scale operation, incomplete alternative-habitat creation can occur. Hence, longer project periods are encouraged to achieve comprehensive restoration. Additionally, the lack of knowledge regarding target species, including those at risk of extinction, may lead to a discrepancy between the planned and actual habitats for target species. Therefore, a panel of experts should be consulted regarding the target species, ensuring a more in-depth

habitat creation plan. Currently, ecosystem restoration projects in Korea involve maintenance, management, and post-monitoring for 4 years after project completion. However, to assess the long-term effects of restoration projects, long-term monitoring should be conducted at 10-year intervals after completion. Furthermore, many restoration plans lack quantitative goals when formulated. The evaluation of the restoration effectiveness is pivotal to delineating the succession of degraded ecosystems and implementation of the subsequent recovery measures [36]. Using target species as indicators, establishing an evaluation system is essential for measuring the success of restoration projects. The results of the study can contribute to improving ecological restoration approaches to achieve sustainable development goals and may have value for not only domestic projects but also similar international restoration projects. A concentrated approach to specific species can guide the overall direction of restoration projects, serving as a valuable indicator of success and facilitating the use of performance metrics to gauge the success of restoration initiatives. Additionally, the results of this study, combined with monitoring outcomes, can contribute to the development of effective restoration projects, including research on habitat models for each target species.

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References

1. McKinney, M.L. Urbanization as a major cause of biotic homogenization. *Biol. Conserv.* **2006**, *127*, 247–260. [CrossRef]
2. McKinney, M.L. Effects of urbanization on species richness: A review of plants and animals. *Urban Ecosyst.* **2008**, *11*, 161–176. [CrossRef]
3. Faeth, S.H.; Bang, C.; Saari, S. Urban biodiversity: Patterns and mechanisms. *Ann. N. Y. Acad. Sci.* **2011**, *1223*, 69–81. [CrossRef] [PubMed]
4. Db Baan, L.; Alkemade, R.; Koellner, T. Land use impacts on biodiversity in LCA: A global approach. *Int. J. Life Cycle Assess.* **2013**, *18*, 1216–1230. [CrossRef]
5. Marcacci, G.; Westphal, C.; Wenzel, A.; Raj, V.; Nölke, N.; Tscharntke, T.; Grass, I. Taxonomic and functional homogenization of farmland birds along an urbanization gradient in a tropical megacity. *Glob. Chang. Biol.* **2021**, *27*, 4980–4994. [CrossRef] [PubMed]
6. Hunter, D.; Salzman, J.; Zaelke, D. *International Environmental Law and Policy*, 2nd ed.; New York Foundation Press: New York, NY, USA, 2002; p. 412.
7. De Sadeleer, N. *Environmental Principles: From Political Slogan to Legal Rules*; Oxford University Press: Oxfordshire, UK, 2002; pp. 21–60.
8. Sands, P. *Principles of International Environmental Law*, 2nd ed.; Cambridge University Press: Cambridge, UK, 2003; p. 279.
9. Park, B.D. Incorporation of polluter-pays principle in international environmental law into Korean environmental law. *Environ. Law Rev.* **2012**, *34*, 331–359.
10. Yirdaw, E.; Kanninen, M.; Monge, A. Synergies and trade-offs between biodiversity and carbon in ecological compensation. *Sustainability* **2023**, *15*, 11930. [CrossRef]
11. BBOP. *Standard on Biodiversity Offsets*; Business and Biodiversity Offsets Programme: Washington, DC, USA, 2012.
12. Koh, N.S.; Hahn, T.; Boonstra, W.J. How much of a market is involved in a biodiversity offset? A typology of biodiversity offset policies. *J. Environ. Manag.* **2019**, *232*, 679–691. [CrossRef] [PubMed]
13. OECD. *Saving Biological Diversity: Economic Incentives*; Organization for Economic Co-Operation and Development: Paris, France, 1996; p. 4.

14. Bennett, G.; Gallant, M.; Ten Kate, K. *State of Biodiversity Mitigation 2017: Markets and Compensation for Global Infrastructure Development*; Forest Trends Ecosystem Marketplace: Washington, DC, USA, 2017.
15. Hák, T.; Janoušková, S.; Moldan, B. Sustainable development goals: A need for relevant indicators. *Ecol. Ind.* **2016**, *60*, 565–573. [CrossRef]
16. Kwak, S.J.; Yoo, S.H. Redesigning a program of ecosystem conservation fund. *Environ. Resour. Econ. Rev.* **2000**, *9*, 563–587.
17. Kim, G.H. A Study on the Improvement of Ecosystem Conservation Fund. Ph.D. Dissertation, Policy Press, Hoseo University, Asan, Republic of Korea, 2012; pp. 78–94.
18. Han, E.M. Revitalization of Fund Return Project of Ecosystem Conservation Fund Policy in Accordance with the Institutional Changes. Master's Thesis, Dankook University, Yongin, Republic of Korea, 2013; pp. 40–57.
19. Cho, D.G.; Kim, S.W. A Study on current status and improvement plans of ecosystem conservation fund return projects. *J. Korean Soc. Environ. Restor. Technol.* **2010**, *13*, 63–72.
20. Kim, M.J. A Study on the Development of Evaluation Index for Biotope Planning and Design: Focused on Site of Ecosystem Conservation Fund Return Projects. Master's Thesis, Hanyang University, Seoul, Republic of Korea, 2015; pp. 69–99.
21. Kim, M.H. A Study on Monitoring Techniques for Adaptive Management of Ecological Restoration Sites: Focusing on Ecosystem Conservation Fund Return Projects. Master's Thesis, Sangmyung University, Seoul, Republic of Korea, 2017; pp. 39–116.
22. Lee, M.J. Ecological Connectivity Improvement of Cheonan City by the Urban Ecosystem Restoration Projects. Ph.D. Dissertation, Dankook University, Yongin, Republic of Korea, 2022; pp. 52–71.
23. Ministry of the Environment. *Research on the Systematic Restoration of Degraded Natural Environments*; Ministry of the Environment: Sejong, Republic of Korea, 2011; pp. 18–19.
24. Ministry of the Environment. *Revision of the Ecosystem Conservation Charge Return Project Guideline (Full Text)*; Ministry of the Environment: Sejong, Republic of Korea, 2020; pp. 6–7.
25. White, A.; Fant, J.B.; Havens, K.; Skinner, M.; Kramer, A.T. Restoring species diversity: Assessing capacity in the US native plant industry. *Restor. Ecol.* **2018**, *26*, 605–611. [CrossRef]
26. Cho, D.G. A Study on the current status of ecological restoration plant species use-focusing on the ecosystem conservation cooperation fund return projects. *Korean J. Environ. Ecol.* **2021**, *35*, 525–547. [CrossRef]
27. Ministry of the Environment. *Ecosystem Conservation Charge Return Project Cases, 2009–2013*; Ministry of the Environment: Sejong, Republic of Korea, 2014; pp. 1–210.
28. Ministry of the Environment. *Ecosystem Conservation Charge Return Project Cases, 2014–2020*; Ministry of the Environment: Sejong, Republic of Korea, 2022; pp. 1–552.
29. Ministry of the Environment. *Ecosystem Conservation Charge Return Project Guideline*; Ministry of the Environment: Sejong, Republic of Korea, 2010; pp. 65–82.
30. National Institute of Biological Resources. *Red Data Book of Korean*; Wildlife Communications and Plants; National Institute of Biological Resources: Incheon, Republic of Korea, 2011; pp. 1–202.
31. Gama, V.F.; Martensen, A.C.; Ponzoni, F.J.; Hirota, M.M.; Ribeiro, M.C. Site selection for restoration planning: A protocol with landscape and legislation based alternatives. *Nat. Conserv.* **2013**, *11*, 158–169. [CrossRef]
32. Fry, E.L.; Pilgrim, E.S.; Tallowin, J.R.; Smith, R.S.; Mortimer, S.R.; Beaumont, D.A.; Simkin, J.; Harris, S.J.; Shiel, R.S.; Quirk, H. Plant, soil and microbial controls on grassland diversity restoration: A long-term, multi-site mesocosm experiment. *J. Appl. Ecol.* **2017**, *54*, 1320–1330. [CrossRef]
33. Kiehl, K.; Kirmer, A.; Donath, T.W.; Rasran, L.; Hölzel, N. Species introduction in restoration projects–Evaluation of different techniques for the establishment of semi-natural grasslands in Central and Northwestern Europe. *Basic Appl. Ecol.* **2010**, *11*, 285–299. [CrossRef]
34. Martensen, A.C.; Pimentel, R.G.; Metzger, J.P. Relative effects of fragment size and connectivity on bird community in the Atlantic Rain Forest: Implications for conservation. *Biol. Conserv.* **2008**, *141*, 2184–2192. [CrossRef]
35. Lamb, D.; Erskine, P.D.; Parrotta, J.A. Restoration of degraded tropical forest landscapes. *Science* **2005**, *310*, 1628–1632. [CrossRef] [PubMed]
36. Bonari, G.; Padulles Cubino, J.; Sarmati, S.; Landi, M.; Zerbe, S.; Marcenò, C.; Scoppola, A.; Angiolini, C. Ecosystem state assessment after more than 100 years since planting for dune consolidation. *Restor. Ecol.* **2021**, *29*, e13435. [CrossRef]

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