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# EcoBank: A flexible database platform for sharing ecological data

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## Abstract

### Background

Environmental crisis challenges the human race harder than ever before. Ecologists have produced a massive amount of data to cope with the crisis. Accordingly, many national scale ecological database systems have been developed worldwide to manage and analyze these datasets. However, in Korea, ecological datasets produced by different research institutes for different purposes have not been integrated or serviced due to the lack of a well-designed information infrastructure. To address this obstacle, we present EcoBank (www.nie-ecobank.kr), an open, web-based ecological database platform designed to play an important role in ecosystem analysis not only in Korea but also worldwide.

### New information

The architecture of EcoBank comprises core technologies of WebGIS, Application Programming Interface (API), responsive web, and open-source software (OSS). Huge ecological datasets from 3 different sources, including the National Institute of Ecology (NIE) in Korea, related domestic and international platforms and repositories, pass through the three conceptual modules in EcoBank: data management, analysis, and service. Diverse potential stakeholders of EcoBank can be classified into three groups: researchers, policymakers, and public users. EcoBank aims to expand its horizons through mutual communication between these stakeholders. We opened and launched EcoBank service from December 2019, and now began to broaden its network by linking to other data platforms and repositories over the globe to find possible solutions to ecological issues in Korea.

## Keywords

EcoBank, ecological database platform, responsive web, WebGIS, stakeholders

## Introduction

The ultimate goal of ecological studies is to understand and quantify ecological associations in different spatiotemporal scales (Kissling et al. 2012, Stephens et al. 2019). However, issues in ecology are becoming complicated due to various and deleterious anthropogenic effects such as land cover change, global warming, and environmental pollution (Araújo and Rahbek 2006, de Chazal and Rounsevell 2009). Thus, it is essential to secure accurate and up-to-date knowledge of the ecosystem to resolve the issues.

Ecologists have collected data through various methods in different fields of ecology to address complex environmental problems (Kim et al. 2012Nadkarni 1981, Park 1990, Thuiller 2004). The world of big data has arrived in ecology and other branches of the environmental sciences (Farley et al. 2018) with increased quantity, speed, and variety of data streams for ecological information (Hampton et al. 2013). In the field of ecological informatics, various ecological data platforms have been developed worldwide to collect and manage ecological information efficiently.

Although a few web-based platforms have been designed for biodiversity conservation plans and biological resource management in Korea, significant challenges in addressing ecological issues remain. As there is no integrated platform for comprehensive utilization and one-point access to environmental data, these data are scattered throughout individual institutions, producing a particular type of data without consistent format or retrieval capability (Youn 2014). In Korea, existing platforms do not use standardized ecological metadata for sharing or organizing ecological information. Additionally, many platforms have difficulties in providing user-oriented data due to the lack of open space and systems for quality control (i.e., BES-NET) (Ruckelshaus et al. 2020).

New challenges for managing ecological data require improved interoperability, integration, and sharing (Frehner and Brändli 2006). An integrative and comprehensive data platform is strongly recommended in Korea. To settle this need, we present EcoBank in three sections (background, conceptual architecture, and implementation) to show its extendible framework for exploration, modeling, and analysis of distributed ecological data in a Web-based environment (Table 1). In the background section, EcoBank's developmental phases and core technologies are described. In the architecture section, the conceptual design of EcoBank is described, and functions related to exchanging, sharing, and analyzing spatial data through the internet are discussed. The following implementation section describes functions and services, mainly for target stakeholders. This paper ends with the main conclusions and an outlook for future directions.

## Project description

**Title:** EcoBank

**Design description: development processes, core technologies and their integrations**

**Development processes:** We developed EcoBank through three developmental process phases (Fig. 1). In the first phase (2014-2018), EcoBank development began with information strategy planning, which emphasized long-term management of its data, information, and knowledge. Target audience analysis was also conducted with various internal and external expert groups to investigate the opportunities of EcoBank as an international platform in the global market. The main system, including a web geographic information system (WebGIS) and a policy support tool, was developed. Integration of refined and standardized domestic databases into EcoBank began in this phase. In the second phase (2019-2020), EcoBank was officially launched and widely accepted by target stakeholders. EcoBank provides open API services for application to any data platform. EcoBank has broadened its connections to the East Asian region with various cooperative projects. Additionally, EcoBank developers have suggested an ecological metadata standard based on Data Catalog Vocabulary (DCAT). In the third phase (2021~), EcoBank is expected to gain more advanced functions and analysis tools in communication with its stakeholders. International ecological data standards can be derived from its experience and expertise in ecological data management.

**Core technologies:** In this section, core technologies, including WebGIS, Open Source Software (OSS), open API, and responsive web to operate EcoBank properly and efficiently are briefly explained. In the next section, how these technologies are integrated into EcoBank will be discussed.

Research efforts of the geographic information science community have been made to integrate ecological data (Frehner and Brändli 2006). Considering the massive increase of internet users, the traditional GIS paradigm on spatial data handling from a single database has gradually shifted toward a distributed GIS paradigm through physically distributed database systems or geospatial services (Preston et al. 2003). The technology of web services and open standards has provided the basis for distributed geoprocessing or distributed GIS. A step toward distributed GIS is establishing so-called geoportals that offer gateways to discover and access geographic web services (Maguire and Longley 2005). However, an examination of several existing geoportals has shown that the available functionality is restricted to searching, mapping, publishing, and limited querying of distributed geodata (Tait 2005). A missing feature is the availability of comprehensive analysis tools. WebGIS, also known as Web-based GIS or Internet GIS (Peng and Tsou 2003), provides additional means for spatial data analysis as an alternative.

OSS is a type of computer software in which the source code is released under a license in which the copyright holder grants users the rights to study, change, and distribute the

software to anyone for any purpose (Lakhani and Von Hippel 2004, Steiniger and Hay 2009). Almost all software packages used in EcoBank are based on open-source.

API is an intermediary medium that helps our services use features and programs provided by individual developers, businesses, and organizations. If the user interface (UI) connects users and objects (hardware or software) to be handled by users, the API connects the program to another program. API is used in almost all ecological data platforms worldwide (Frehner and Brändli 2006, Michener et al. 2012, Stephens et al. 2019), and is also used in EcoBank.

Optimizing any web-based information for various devices is no longer an option but a necessity. Due to increasingly diverse smart devices, it is impossible to provide an appropriate service to customers with a desktop-version website alone. Responsive web design is a method to effectively enable the use of various devices (Gardner 2011). EcoBank takes advantage of responsive web design. Layouts are instantly transformed into the best design for many different web circumstances, such as mobile phones, tablets, and desktops. It not only provides adjustable sizes for webpages but also optimizes components for their own operational principles.

**Integration of core technologies:** All core technologies were successfully integrated into EcoBank. WebGIS (Fig. 2) allows visualization of all spatial data (raster and vector) from three input data sources: NIE, other environmental institutes in Korea, and international platforms and repositories. WebGIS functions in EcoBank are composed of Geoserver for mapping service, OpenLayers for implementing map service, PostGIS for spatial operation and spatial quarry, and PostgreSQL for managing and storing spatial data. The WebGIS solution in EcoBank first collects various ecological information with diverse file formats such as shape (SHP), comma-separated values (CSV), and text-only (TXT), and loads them into PostgreSQL using PostGIS after diagnosis, transformation, and processing to meet ecological spatial data standard. These loaded spatial data are registered and issued in GeoServer and provided as a map service of the Ecobank using OpenLayers technology. With this distributed GIS, EcoBank intends to have more user-centered functions that will present processed results and provide a chance to overlap data in EcoBank for its own purpose.

Almost all software packages applied in EcoBank (Fig. 3) are based on the open-source architecture. For example, Red Hat Enterprise Linux is mounted on a physical web server, a web application server, and a linked server. The database server uses PostGIS, PostgreSQL, and Selenium, a suite of tools for automating web browsers. KoNLPy, a Python package for processing information in the Korean language, is also applied in EcoBank for web crawling. Other software packages for ETL, Web server and GIS server, and Web Client are also OSS packages. EcoBank utilizes generalized and OSS packages to eliminate its dependence on software packages of specific companies and observes open standards.

Open API is also efficiently used in connecting and sharing data with other platforms and repositories worldwide. EcoBank provides various ecological spatial information in Web

Map Service (WMS) and Web Feature Service (WFS). The WMS service allows one to use map images with diverse formats such as Portable Network Graphics (PNG), Joint Photographic Experts Group (JPG), and Graphics Interchange Format (GIF) generated from geographic data. The WFS service makes it possible to utilize geographic feature data with vector figures and attributes. To use the OpenAPI of the EcoBank system, an authentication key is needed for each layer to be used. It can be used immediately after obtaining approval from the administrator. Also, EcoBank supports the use of OpenAPI more easily by providing sample codes of programming languages such as Java, JavaScript, Hypertext Preprocessor (PHP), and Python to use ecological spatial information. Through the API service, EcoBank has already begun linking its data to the biggest data repository in Korea's public sector (Public Data Portal, www.data.go.kr) without any extra processes. Data from EcoBank have been directly transferred and embodied in a different framework. API is a powerful tool for activating EcoBank's vision of facilitating data use in any other platform in the world. Anyone interested in developing ecological applications using features and datasets in EcoBank can freely utilize the API services of EcoBank.

Responsive web design is also applied to EcoBank. The design concept in the EcoBank website is grouping visual images, infographics, and corresponding contents that can be perceived intuitively. The layout of EcoBank's main page has a vertical grid structure. A content group is deployed according to the access frequency of the user. The EcoBank layout was optimized for 1600 pixels. Meanwhile, the responsive web design leads us to create a UI for accessibility from all devices by focusing on aesthetics and convenience as much as possible.

Based on core technologies briefly explained above, EcoBank eliminates dependencies and complies with open standards utilizing open-source based, generalized, and open technologies. It guarantees interoperability by providing standards that can be linked to commercial solutions. EcoBank aims for national standardization. It can be replaced by modularizing each service, enabling flexible responses to changes and supporting convenient and diverse environments, such as Eclipse-based modeling, editing, compilation, and debugging environments.

**Conceptual Architecture of EcoBank**

In this section, the conceptual architecture of EcoBank is presented (Fig. 4). One of the primary goals of EcoBank is to function as the main access point for data and data resources from the National Institute of Ecology (NIE), domestic, and international databases (Table 2). NIE itself already has a huge amount of heterogeneous datasets such as the National Ecosystem Survey (NES), the Ecosystem and Nature Map (ENM), the Intensive Ecological Survey (IES), the current status of invasive and ecosystem-disturbing species, and results from the National Long-Term Ecological Research projects. The NES, the largest survey project in Korea, has been conducted by the Korean Ministry of Environment for the mainland of South Korea since 1986. ENMs are graded (1–3 grades and separate management areas) for the natural environment based on ecological and landscape values for mountains, rivers, inland wetlands, lakes, farmland, and cities. The

Korean Ministry of Environment commissioned NIE to conduct IES to scrutinize biodiversity in national protected areas such as Ecosystem & Landscape Protection Areas and specific areas including some islands and coastal dunes. These datasets are sent to EcoBank after a rigorous quality control process.

EcoBank is exchanging ecological data with other environmental institutes in Korea, such as the National Institute of Biological Research (NIBR), to support the implementation of national policies on biological resources. EcoBank is also linked to a public data portal (www.data.go.kr), which integrates the Korean government's open data by providing access points on a web-based platform. Thus, the link with PDP can give people more opportunities to access NIE's ecological data. EcoBank is using API services provided by Vworld (www.vworld.kr), an open platform service on spatial information operated by the Spatial Information Industry Promotion Institute in Korea. Regarding areas in Korea, EcoBank can promote GIS services due to higher resolution and more up-to-date spatial information of Vworld maps compared to Google Maps.

EcoBank began to link with international platforms and repositories to boost international stakeholders' participation in finding possible solutions to Korea's ecological issues. Ecological data from Kasetsart University in Thailand and Nong Lam University in Vietnam were stored in EcoBank recently, and other repositories in Asian countries and global data platforms such as GBIF will also be connected soon. Data collected from these three routes will be linked to the main server of EcoBank through WebGIS or open API. To handle this diverse and complex stream of incoming data, EcoBank has applied three separate modules. The compositions and purpose of each module are described in the following sections.

**Data management module:** Incoming datasets from the aforementioned three different routes arrive first in a data management module. These datasets need to be organized with standardized metadata for quality assurance and quality control. Due to the absence of any ecological metadata standards in Korea to manage domestic and foreign ecological data in an integrative way, we proposed a metadata schema to manage and share ecological data with the Korean Telecommunications Technology Association (TTA). This schema will be useful for efficient data management and interoperability both inside and outside ecological fields. Digital object identifiers (DOI) will be first assigned to data produced from NIE's research projects. DOI enables permanent access, precise identification, and reliable citation of data through EcoBank. DOI will be then assigned to ecological data published by GEO DATA (geodata.kr), the first data journal on earth science, ecology, ocean, aerospace, and polar research in Korea.

**Analysis module:** The analysis module is implemented within EcoBank with visualized statistical results and Web GIS-based analysis tools. After passing through the quality control process in the management module, datasets are used for analyzing biodiversity and modeling species distribution in the Analysis module. Some data produced can be used to evaluate the ENM. Basic ecological analyses on biodiversity, species distribution, and population density can be performed with the collected information. Also, researchers can conduct species distribution modeling (SDM) studies using EcoBank data with well-

known SDM models such as MaxEnt, the Generalized Additive Model (GAM), and Gap Analysis Program (GAP). EcoBank enables a nationwide distribution of species occurrence points to be checked. It also provides data on the ecological status of each branch for each species. These biodiversity datasets can be used to predict species distribution and habitat suitability.

**Service module:** EcoBank's various services for its users are categorized into data-sharing, public participation, and policy decision-making support. Open data sharing occurs between citizens through various data boards and Open API services. Furthermore, each open dataset that can be identified by DOI is permanently citable and trackable for users. EcoBank specifies multiple user groups to grant access to data containing sensitive information such as endangered species, natural reserves, and roadkill photos. These layered services meet the needs and usage objectives of various stakeholders in a data platform (Michener et al. 2012). To promote public participation, EcoBank has built discussion boards for ecological topics and uploaded species observation data. Currently, the NES research project actively supports ecological expertise to improve the quality of data collected by citizen scientists. Similarly, ecological experts can broaden their ideas or insights regarding ecological issues by discussing with citizens on EcoBank. Policymakers who have the same interests can plan environmental policies by exchanging ecological information through assigned EcoBank functions. Policy decision support services include opening data produced from environmental policies to the public and getting citizens' feedback.

## Web location (URIs)

**Homepage:** https://www.nie-ecobank.kr/cmmn/Index.do?lang=en

**Download page:** https://www.nie-ecobank.kr/rsrch/doi/selectDoiRsrchDtaListVw.do

## Technical specification

**Interface language:** English, Korean

## Usage licence

**Usage licence:** Creative Commons Public Domain Waiver (CC-Zero)

## Implementation

### Implements specification

We presented possible implementations for each stakeholder. However, those examples are not strictly limited to individual categories but integrative to each other. For example,

researchers and policymakers have raised the need to study the distribution of herptile (including reptile and amphibian) species with multi-scale regarding ecosystem conservation (Fig. 5). Studies have highlighted that the distribution of herptile species can be the key to develop a universal ecological index (EI) for evaluating the ecological health of aquatic and terrestrial ecosystems (Ali et al. 2018). Also, research on the detrimental effects of American bullfrogs (Kang et al. 2019) has addressed the spatial distribution of this frog species (Fig. 6). EcoBank is an excellent information source for this purpose as it provides spatial information of diverse organisms, including herptiles with multi-scale from nationwide to smaller administrative units in Korea.

With ecotourism in the spotlight recently, Jeju Island, where the tourism industry accounts for more than a quarter of its total economic production, might highly depend on extraordinary ecosystems comprising numerous rare, protected flora and fauna (Kim et al. 2013). ENM gives land use status and improves our general understanding of natural environments in Jeju island (Fig. 7a). By selecting areas of high ecological value, it is possible to maintain and increase ecosystem services and obtain economic benefits from natural asset use. Therefore, ecological grade information in ENM can be utilized by policymakers to prepare a land-use plan that regulates excessive developments. Public users will be able to predict and plan for land-use projects where development can be restricted in a similar way (Ahn et al. 2015).

The use of airspace has caused spatial conflict between birds and people. Bird collisions resulting from artificial structures are prime examples of this issue. Thus, researchers need scientific data to understand the status and annual mortality estimates of bird collision, which has been poorly understood in Korea (Seo 2020). Citizens frequently collect records of bird collisions can be retrieved from newspapers, verbal communication, online forums, and blog posts. These data can be analyzed to publish significant results regarding risk factors and bird collisions patterns in scientific journals (Basilio et al. 2020Rebolo-Ifrán et al. 2019). Although the quality of data produced from citizen scientist has long been a concern due to the lack of quality control process (Kosmala et al. 2016), Bird Window Collision data have been successfully collected within a research project through EcoBank (Fig. 7b). With the increasing need for big data, such collaborative projects are expected to deal with ongoing ecological problems.

## Audience

A data platform may sound much superior if it has target users as many as possible as it needs to encompass diverse stakeholder communities. Thus, Michener et al. (2012) have proposed one primary stakeholder (scientists), five science research environments including academia, government, private industry, non-profit, and community, and over 20 secondary stakeholders. However, DataONE is mainly focused on integrative biological and environmental research. Scientific research is only a small portion of the direction of EcoBank. If we follow a similar approach to DataONE with a wide variety of stakeholders, it may be too complicated and digressive. After consulting with data platform experts, we have realized that it is necessary to start with certain targets to kick off a new data

platform. Thus, we have decided to clarify target users into three groups: researchers, policymakers, and public users. It is possible to include more target users to meet the needs of the market in the future.

**Researchers:** Professional researchers can find diverse data from various datasets in EcoBank produced by many different research projects. It contains NES data, Ecological Corridor data, Long-Term Ecological Research data, Bird Window Collisions Data, and Wetlands Data in Korea. One advantage of EcoBank is that all these datasets are integrated into one platform and presented with spatial information, enabling further studies in many broad dimensions. EcoBank also benefits researchers by offering analysis tools on the website. Researchers can explore the data and simultaneously analyze and generate results in a report. Except for endangered species data, all data searchable in EcoBank are freely available to download and share.

Researchers may want to access data for a study species, learn about methods, run analyses, and share results with colleagues. With species occurrence data provided by EcoBank, researchers can carry out SDM studies, especially biodiversity changes influenced by climate changes, land-use changes, and environmental pollution. Data on ecological statuses can be downloaded and used for environmental impact assessment. Thus, it is possible to check the national distribution of species occurrence points and download ecological status data for each species in EcoBank. This information may be used to predict potential species distribution and study habitat suitability.

**Policymakers:** Ecological research has to include the complex nature of disturbances and stability. Results of such multidimensional approaches can inform policymakers (Donohue et al. 2016). EcoBank also provides important ecological information to support decision-making in a user-friendly interface. EcoBank presents its data according to Korea's administrative district so that policymakers can access important ecological information for the area of interest. Furthermore, the toolbar on the EcoBank website provides easily accessible and extra layers of information to gain scientific support during a policy-making process instantly.

Ecological data with high credibility and accessibility are essential in this process. EcoBank provides observation density information on target species to facilitate the establishment of biodiversity conservation areas and develop processes to help national environmental planning. EcoBank's biodiversity-related indices include Shannon-Wiener Biodiversity Index (Pielou 1969), Dominance Index (McNaughton 1967), Uniformity Index (Pielou 1975), and Abundance Index (Margalef 1958). For more information on biodiversity-related indices in EcoBank, see another article (Sung et al. 2018).

**Public users:** Public users of EcoBank can be divided into three groups: students, business owners, and citizen scientists. EcoBank is applicable as educational material. The curriculum for young students in Korea includes environmental education. However, few online materials have been developed for this subject. EcoBank allows free access to all ecological data that can be utilized for any purpose. For example, teachers can develop an educational program using ecological data to investigate the environmental impact of

human behaviors. Conversely, students can generate creative ideas from data simulations in EcoBank.

For business owners, ecological issues and interests have led to the formation of a commodity market in the ecological information field. The related industry, such as ecotourism, has been largely expanded. However, without an efficient sharing and management of ecological data and information, time and resources are unavoidably wasted constantly. EcoBank can benefit business owners by saving time and money to access data that they need through ENM.

EcoBank can promote citizen science within its function “Community.” EcoBank also provides a stable and reliable repository for citizen scientists because they can upload ecological survey data with high quality standards under the guidance of professional researchers at NIE. Citizen scientists have recorded their observations of the natural world, including species distribution, phenology, and climate data, for centuries (Miller-Rushing et al. 2012). As ecological research has grown into a relatively recent area of expertise, the contribution of citizen scientists to ecology is obviously apparent in history but easily overlooked. Researchers are currently reviewing numerous datasets collected by non-experts to identify long-term changes in the ecosystem. However, citizen science in Korea has remained very limited with a relatively low level of civic participation compared to that in European countries and the U.S. (Park 2018). EcoBank may play an integral role in getting amateur scientists involved in the field of ecology in Korea. For instance, citizens in Korea participating in any ecological data collection project may use EcoBank data as a reference before conducting field studies.

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## Author contributions

As the submitting author of this manuscript during peer-review process, Dr. Hyun Woo Kim developed the outline and wrote the draft. Mr. Sungsoo Yoon, Mrs. Mokyoung Kim, Mr. Manseok Shin, and Dr. Heenam Yoon contributed to converting the draft into this manuscript with the addition of invaluable comments and preparing figures and supporting information. As a principal investigator of EcoBank development project and the official corresponding author after the peer-review process is completed successfully, Kidong Kim formulated and coordinated the overall research. All authors have read and approved the final manuscript.

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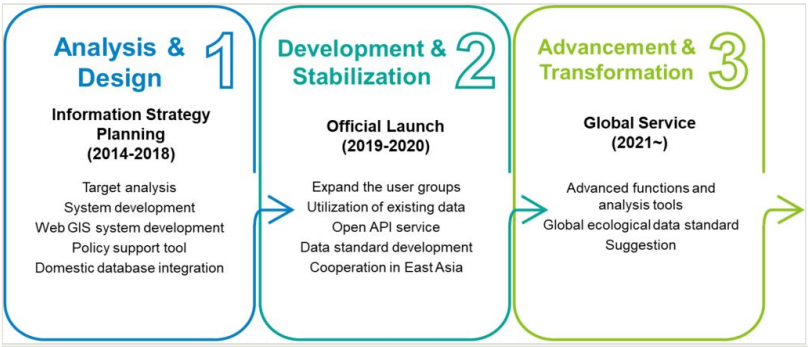


Figure 1.

Three phases of EcoBank development processes.

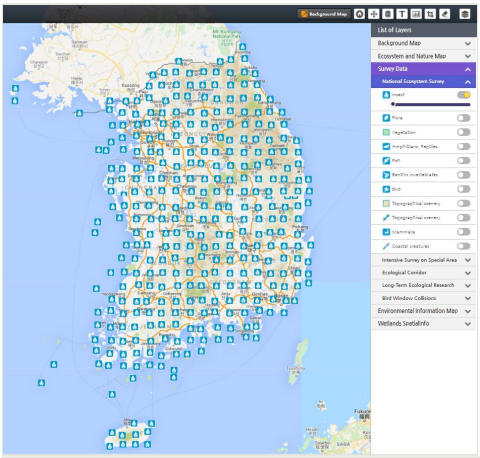


Figure 2.

Spatial distributions of insects in South Korea presented by WebGIS in EcoBank. Diverse WebGIS tools such as Geoserver, OpenLayers, PostGIS, and PostgreSQL are successfully integrated into EcoBank.

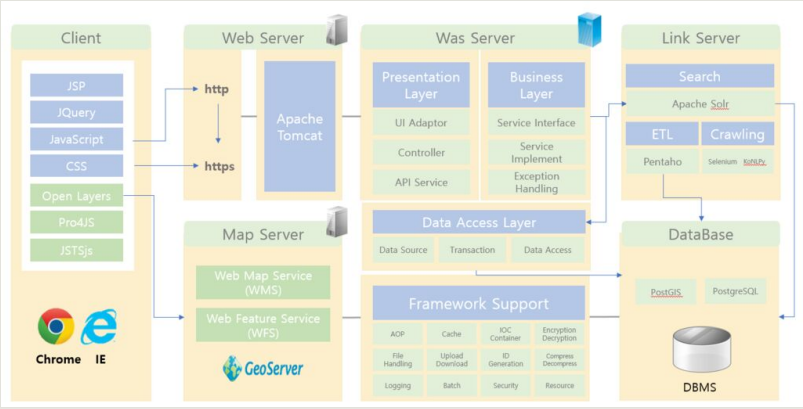


Figure 3.

Software packages in EcoBank. Almost all these packages used in the system architecture of EcoBank are open-source software.

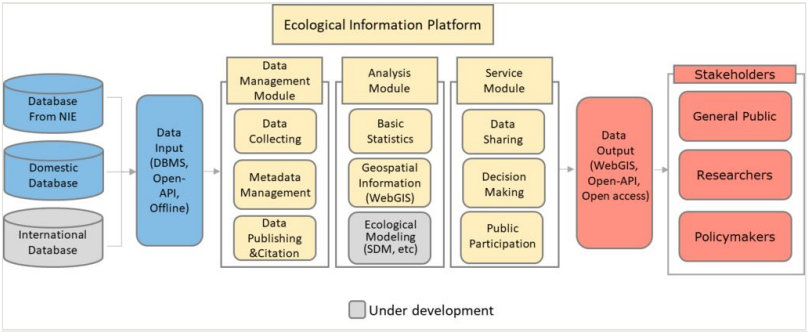


Figure 4.

Conceptual architecture in EcoBank.

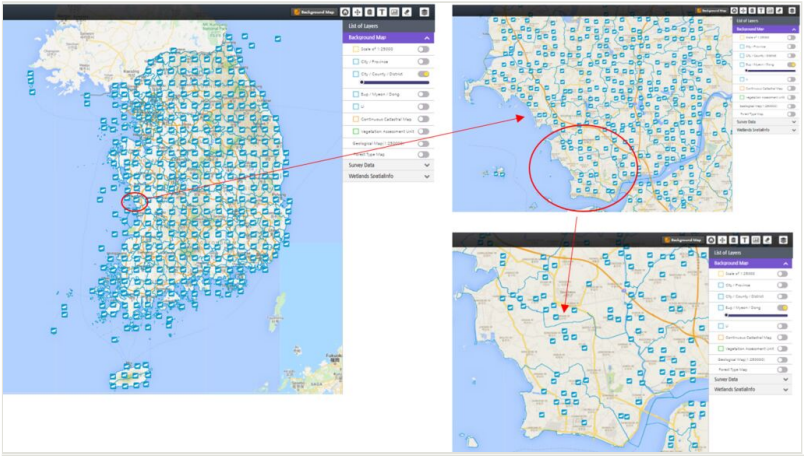

Figure 5.

Multiscale distribution of herptile species in Korea.

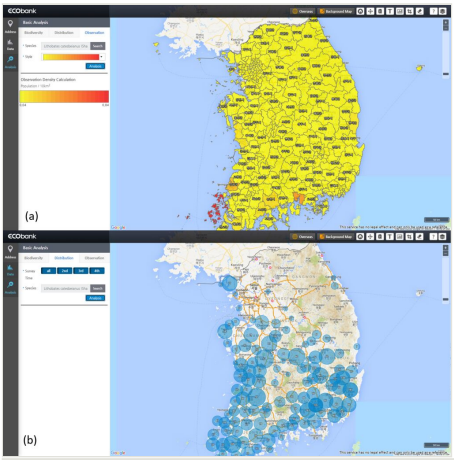


Figure 6.

Observation density and species distribution of American bullfrog (*Lithobates catesbeianus*) for policy makers. **a**) Observation density; **b)** Species distribution.

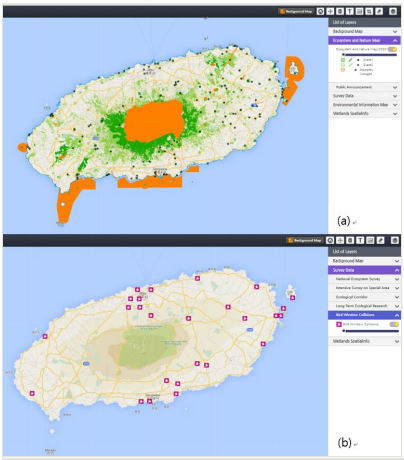


Figure 7.

EcoBank for public users. **a)** Ecology and Nature Map; **b)** Bird window collision data in Jeju Island for citizen scientists.

Table 1.

Comparison EcoBank among diverse repositories around the world. EcoBank does not contain datasets on marine biodiversity and does not cover wildlife trades and agricultural information. Except for those, however, EcoBank eventually provides all ecological datasets on terrestrial and freshwater systems in Korea.

| Main Resources | EcoBank | Terrestrial Biodiversity portals and repositories | Marine biodiversity portals and repositories | Wildlife trade monitoring network | IPBES portal |
|---|---|---|---|---|---|
| **Areas** | | | | | |
| Terrestrial | ○ | ○ | | ○ | ○ |
| Freshwater | ○ | ○ | | | ○ |
| Marine | | ○ | ○ | ○ | ○ |
| **Themes** | | | | | |
| Biodiversity | ○ | ○ | ○ | | ○ |
| Ecosystems | ○ | ○ | ○ | | ○ |
| Endangered species | ○ | | | ○ | |
| Protected areas | ○ | | | | |
| Wildlife trade | | | | ○ | |
| Climate related | ○ | ○ | | | |
| Agriculture | | ○ | | | |
| Forest | ○ | | | | |
| Indicators | ○ | | | | |
| Metrics | ○ | ○ | | | |
| Standards | ○ | | | | |
| Metadata | ○ | | | | |
| Taxonomic literature | ○ | | | | |
| Analysis | ○ | | | | |
| Partner network | ○ | ○ | ○ | ○ | ○ |

Table 2.

An overview of data in EcoBank. Data formatted as raster files and opened only in a test server were excluded from counting each database's number of rows. There are four types of data status: data stored in a database server (DB), data implemented through a linked server (Link), data implemented through a GIS server (GIS), and data opened in a test server (Test).

| Category | Database | Rows | Data status | Data producer |
|---|---|---|---|---|
| Domestic (Korea) | National Ecosystem Survey | 2,311,855 | DB | National Institute of Ecology |
| | Ecosystem Survey on Special Areas | 247,501 | | |
| | Ecosystem and Nature Map | 7,773,881 | | |
| | Bird Window Collision | 10,002 | | |
| | Road Kill Data | 24,983 | | |
| | Wetland Survey Data | 172,428 | | |
| | Endangered Species Data | 8,312 | | |
| | Alien Species Data | 1,110 | Link | |
| | Ecological Corridor Data | 2,209 | | |
| | Long-Term Ecological Research | 2,534,980 | | |
| | Species List Data | 159,320 | DB | National Institute of Biological Resources |
| | Winter Bird Census | 414 | | |
| | Environmental Conservation Value Assessment Map | - | DB | Korea Environmental Institute |
| | Environmental Impact Assessment Information | - | Link | |
| | Natural Resource Survey on National Parks | 28,836 | DB | Korea National Park Service |
| | Soil Phase Symbol | 1,098,628 | DB | National Academy of Agricultural Sciences |
| | Land Cover | 6,184,570 | DB | Ministry of Environment |
| | Forest Type Map | 37,352,848 | DB | Korea Forest Service |
| | DEM | - | GIS | National Geographic Information Institute |
| | Vworld | - | Link | Spatial Information Industry Promotion Institute |
| | Serial Cadastral Map | - | Link | Ministry of Land, Infrastructure and Transport |
| | Local Weather Forecast Information System | - | Link | Korea Meteorological Administration |
| International | Tree Distribution Data | - | Test | Kasetsart University (Thailand) |
| | Street Tree Data | - | Test | Nong Lam University (Vietnam) |
| | Land Cover Data | | | |