# Spatial conservation priorities using species occurrence data and species distribution model against climate change

Yongwon Mo[1], Hyeyeong Choe[2], Giyeong Jeong[1], Jin-Woo Jeong[3], Jae-Hwa Tho[3]

National Institute for Environmental Studies,Japan

1) Department of Landscape Architecture, Yeungnam University, Republic of Korea, 2) Department of Agriculture, Forestry and Bioresources, Seoul National University, Republic of Korea, 3) Endangered Species Recovery Center, National Institute of Ecology, Republic of Korea

** This presentation is based on the part of "the Survey to improve measures for Wildlife Protection Areas(야생생물 보호구역 개선방안 마련을 위한 실태조사, NIE-수탁연구-2023-104))" supported by the Ministry of Environment in 2023-2024.

Contact: csmo12@yu.ac.kr, webzin12@gmail.com

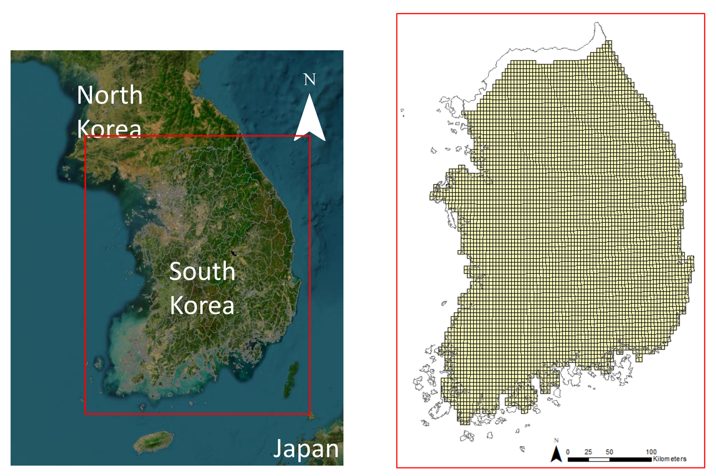
## Main Conclusions

- Depending on the conservation target (input data), different conservation priority areas can be derived.
- It is necessary to understand the characteristics of the input data. Furthermore, agreement is required on the representativeness of species location information (location of species occurrence point, suitable habitat area).
- Consideration is needed on appropriate spatial planning units to establish systematic conservation plans to effectively respond to climate change.

## Objectives

- The goal by GBF (Kunming-Montreal Global Biodiversity Framework) must be achieved by designating at least 30% of all land, inland water, and marine areas as protected areas by 2030. As of 2024, 17.45% of South Korea's land and inland water areas and 1.81% of marine areas are managed as protected areas for biodiversity conservation, so additional designation is necessary in the future.
- When exploring conservation priorities for the selection of additional protected areas, the type of species occurrence information can have a significant impact on the results. Studies considering the impact of climate change on species mainly used species distribution models (SDMs). For the current distribution, occurrence point data is used.
- Therefore, we try to find out how different conservation priority areas derive when the types of input data are different and how to use these two data together.

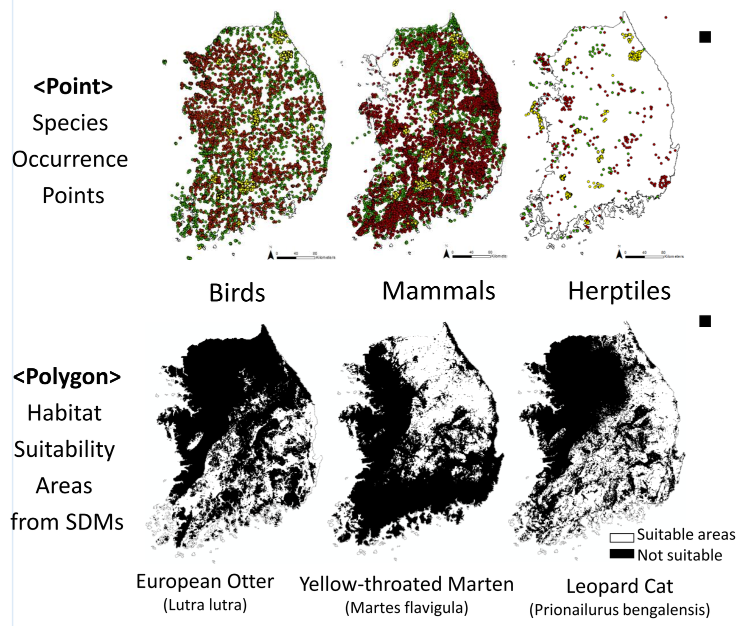
## Study sites




< Study site >

- Terrestrial areas in South Korea. The total 5,572 of grids were made in the study site.
- The grids are same with the species survey unit for the 3rd and 4th National Nature Ecosystem Survey.

## Materials




- For point data, the target biological taxa were selected as birds, mammals, amphibians, and reptiles. target species included in the 3rd and 4th National Natural Environment Survey and National Park Natural Resources Survey are 350 species of birds, 56 species of mammals, and 33 species of amphibian reptiles, for a total of 439 species.
- For polygon data, the habitat suitability area including common species was applied to the potential habitat area derived using SDMs from Choe et al. (2020). The target species were 132 species of birds, 34 species of mammals, and 31 species of amphibian reptiles, for a total of 197 species. Some specie were exclude because of the small number of occurrence points (under 8).

## Methods

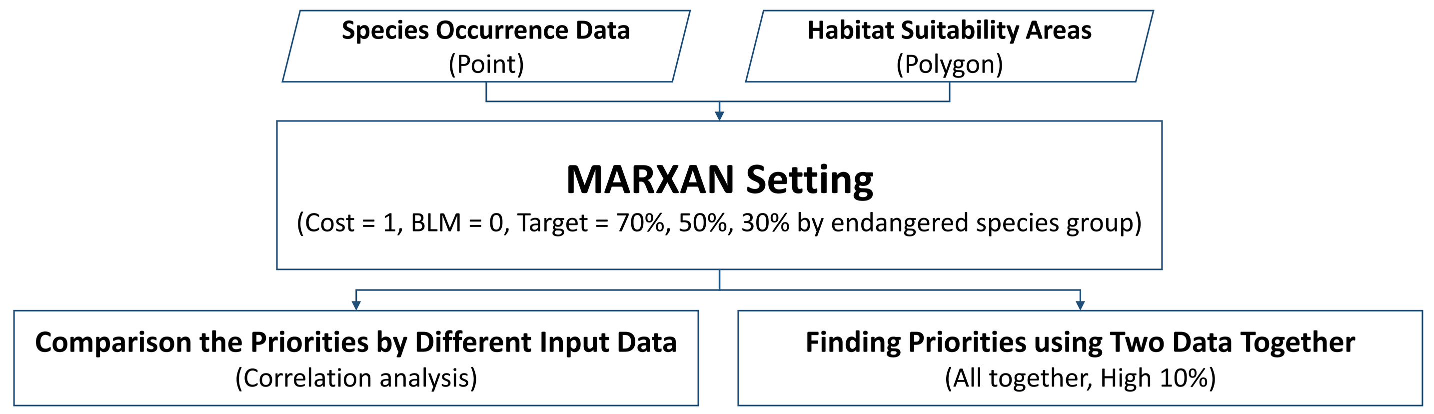
### MARXAN

- MARXAN is the most representative software for selecting conservation priorities for systematic conservation planning and is used by many researchers around the world. It is based on an algorithm that finds the optimal spatial conservation priority using Simulated Annealing among machine learning methods.
- MARXAN's ultimate goal is to achieve maximum conservation goals with minimum effort or cost. To achieve this, the objective function is consists of the cost that can be charged to each planning unit (Cost), the boundary distance between each planning unit (Boundary), and the penalty imposed when conserving the species is failed (Species Penalty Factor, SPF).

Objective Function =

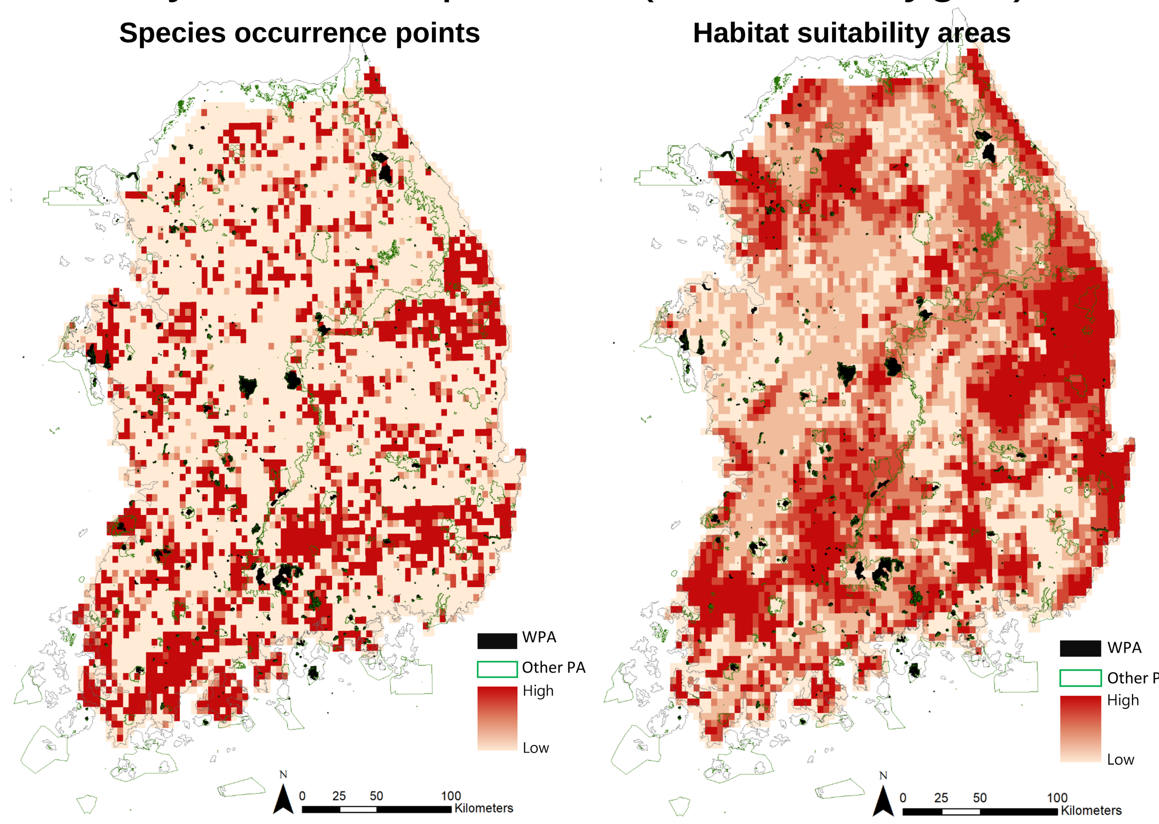
$$\text{Minimize}\ (\sum_{PUs} Cost\ + BLM \sum_{PUs} Boundary + \sum_{Con\ Value} SPF\ \times Penalty)$$

### Research Flow




## Results

### Priorities by different input data (Point & Polygon)

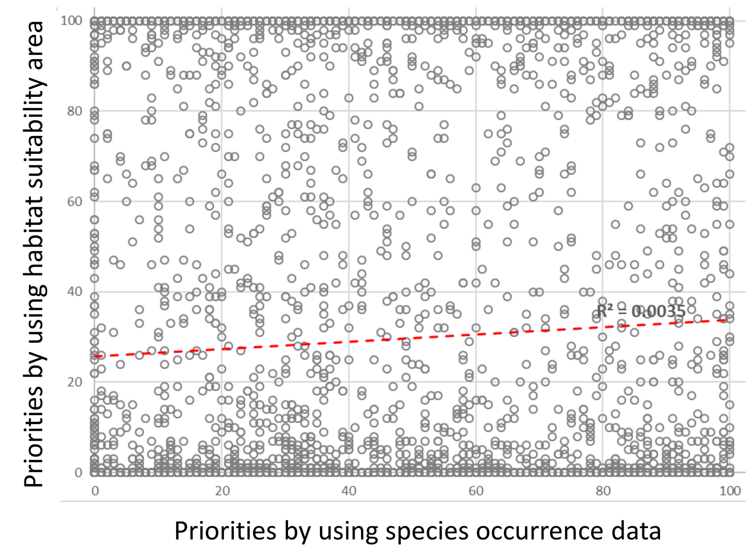



< Priorities using different input data (Left : Point, Light : Polygon) >

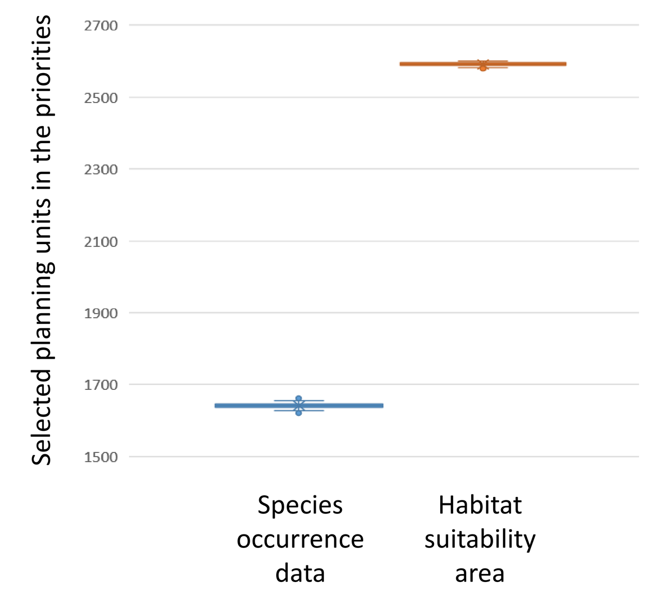
- Conservation priority areas using different input data appeared quite different. It is expected that the location of the occurrence points of endangered species would have an influence on the change in conservation priority areas.
- Comparing the clustering of planning units with high conservation priority shown in the two results, it can be seen that the results using the species distribution model show a higher clustering.

### Comparison the priorities by different input Data

- Checking the scatter plot, it is difficult to identify a correlation between the two priorities.
- It was confirmed that there was a significant difference in the number of planning units requiring conservation between the two results. The results using the occurrence points among a total of 5,572 planned units showed that the conservation goal was achieved when an average of 1,641 planned units were conserved, and the results using the SDMs showed that the conservation goal was achieved when an average of 2,591 planned units are conserved.



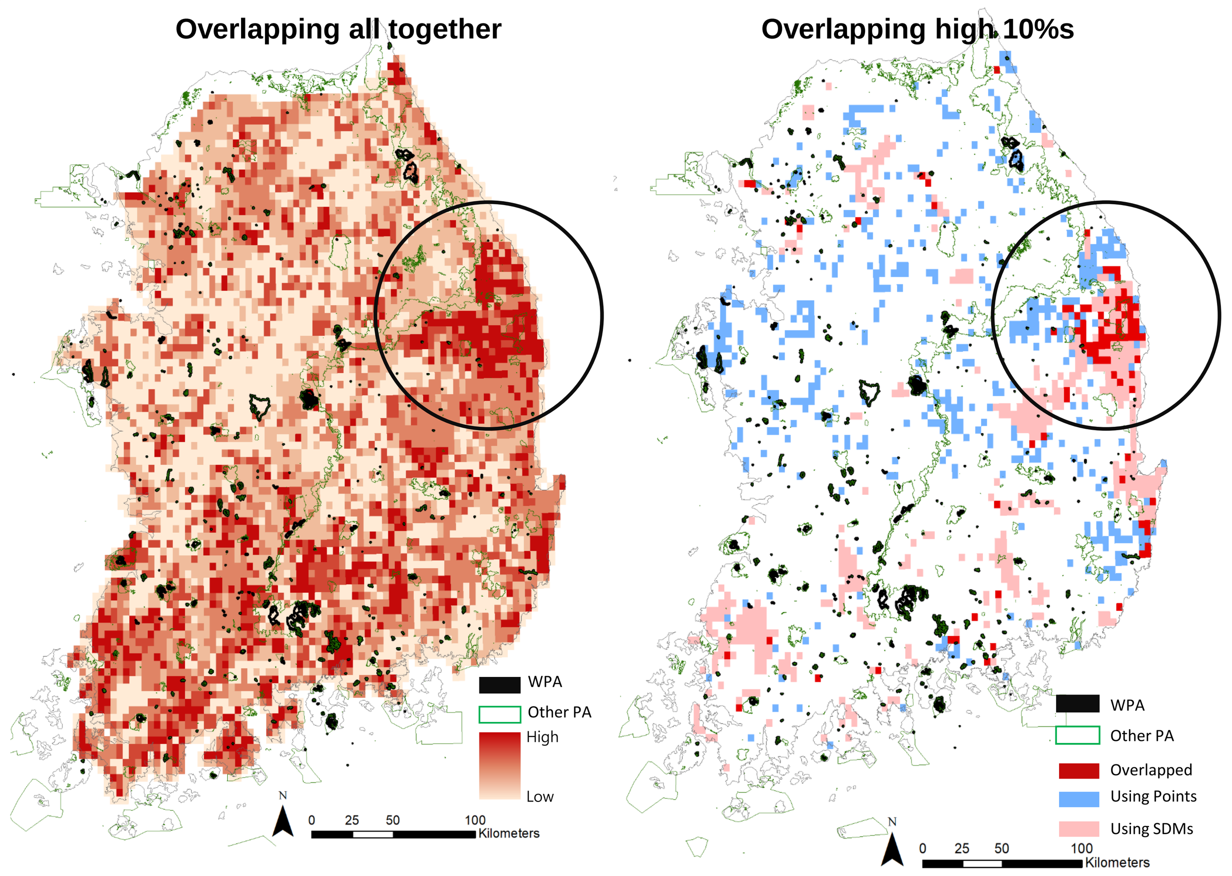

< Scatter plot with the two priorities >




< The number of selected PUs in the priorities >

### Finding Priorities using Two Data Together

- When only the top 10% were overlapped, the results using two different types of data were different.
- Even though the method of overlapping the two conservation priorities was different, it was confirmed that the Gyeongbuk region (Black circle) had the same high priority. When exploring additional protected areas, it is necessary to check these areas in detail.




< Overlapped two priorities using different methods >

## Discussions

- The correlation between conservation priorities using different data was found to be low. This means that different regions can be considered important depending on the type of input data.
- Different types of input data may result in differences in the target amount to be conserved. Therefore, it is expected that conservation target correction work may be necessary to similarly match the number of planning units required for conservation.
- In order to effectively protect species in response to climate change, it is necessary to select conservation priorities using various input data. Results of SDMs using climate change scenarios can be changed in various forms to identify the impact of input data type.