

# Climate Change Impact Assessment using the MOTIVE Ecosystem



**Changwan Seo**

*Chief Researcher / National Institute of Ecology  
South Korea*

[dharmascw@nie.re.kr](mailto:dharmascw@nie.re.kr)

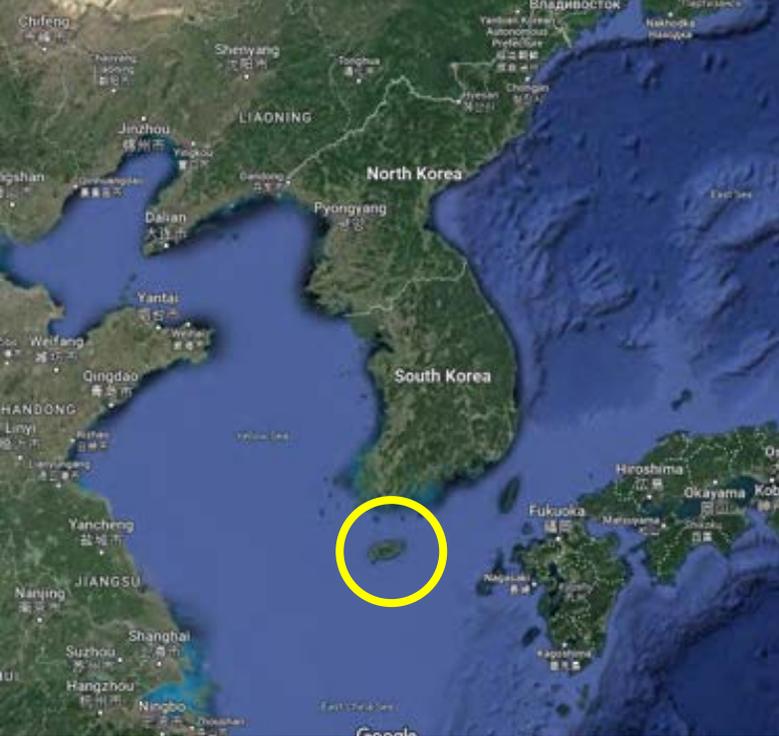
[www.nie.re.kr](http://www.nie.re.kr)



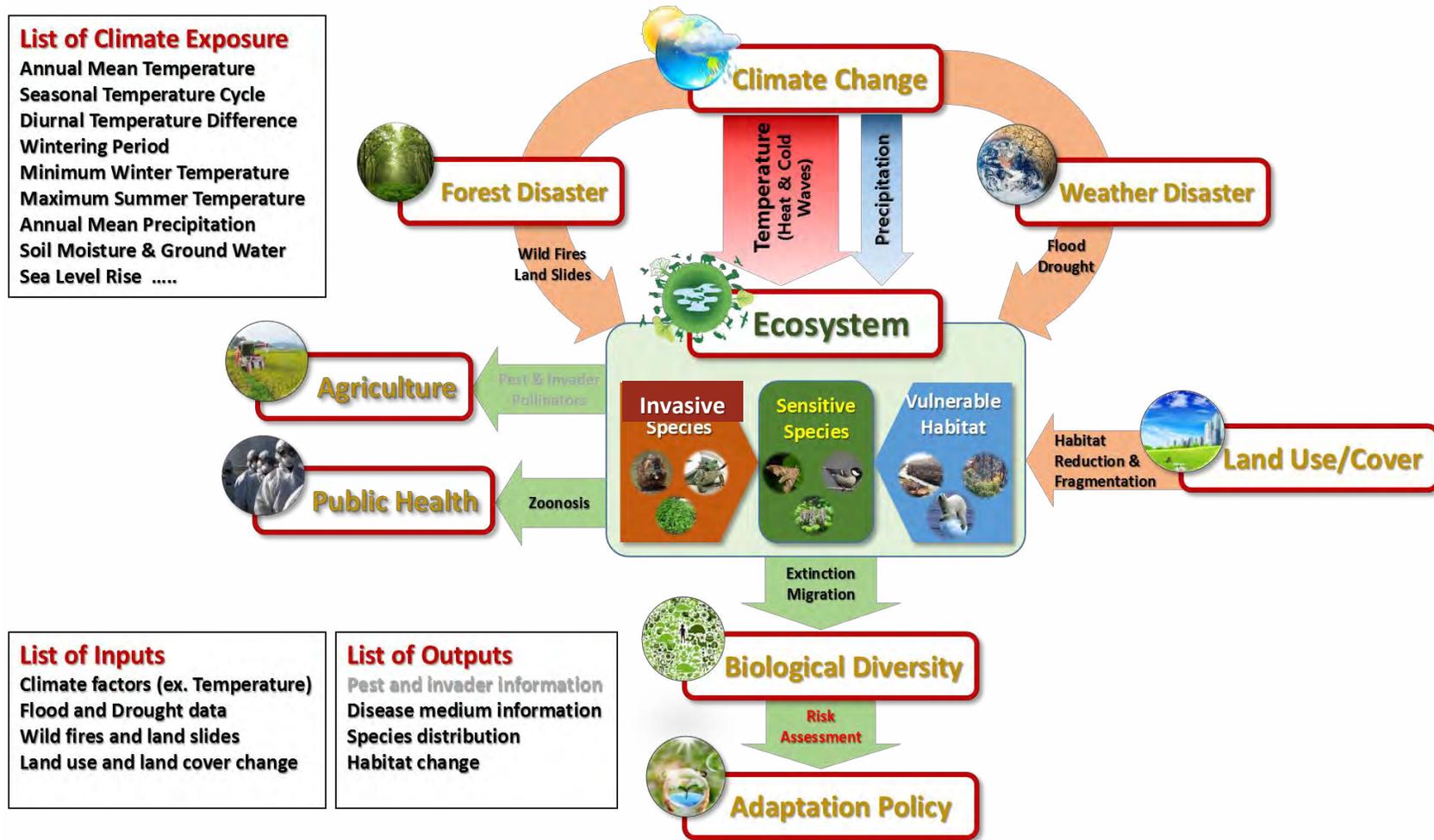


South Korea have adopted a **climate change impact assessment** in EIA process to figure out its resilience to climate change and to reduce the impact of development under climate change.

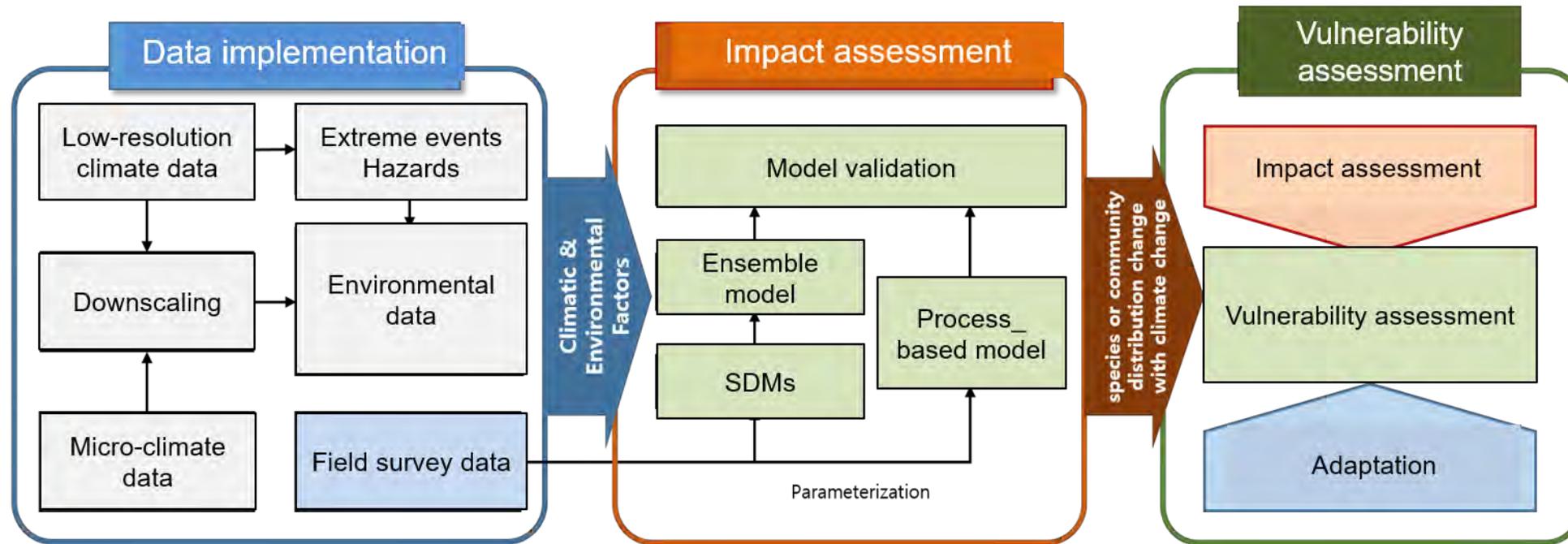
- To apply the developed a **climate change impact assessment model for ecosystem** (the MOTIVE Ecosystem) to **Climate Change Impact Assessment (CCIA)** process in South Korea
- ❖ **The MOTIVE Ecosystem** is a climate change impact and vulnerability assessment model for ecosystem such as climate sensitive species, invasive species and vulnerable habitats.



# Concept of Ecosystem Model



# Assessment Process



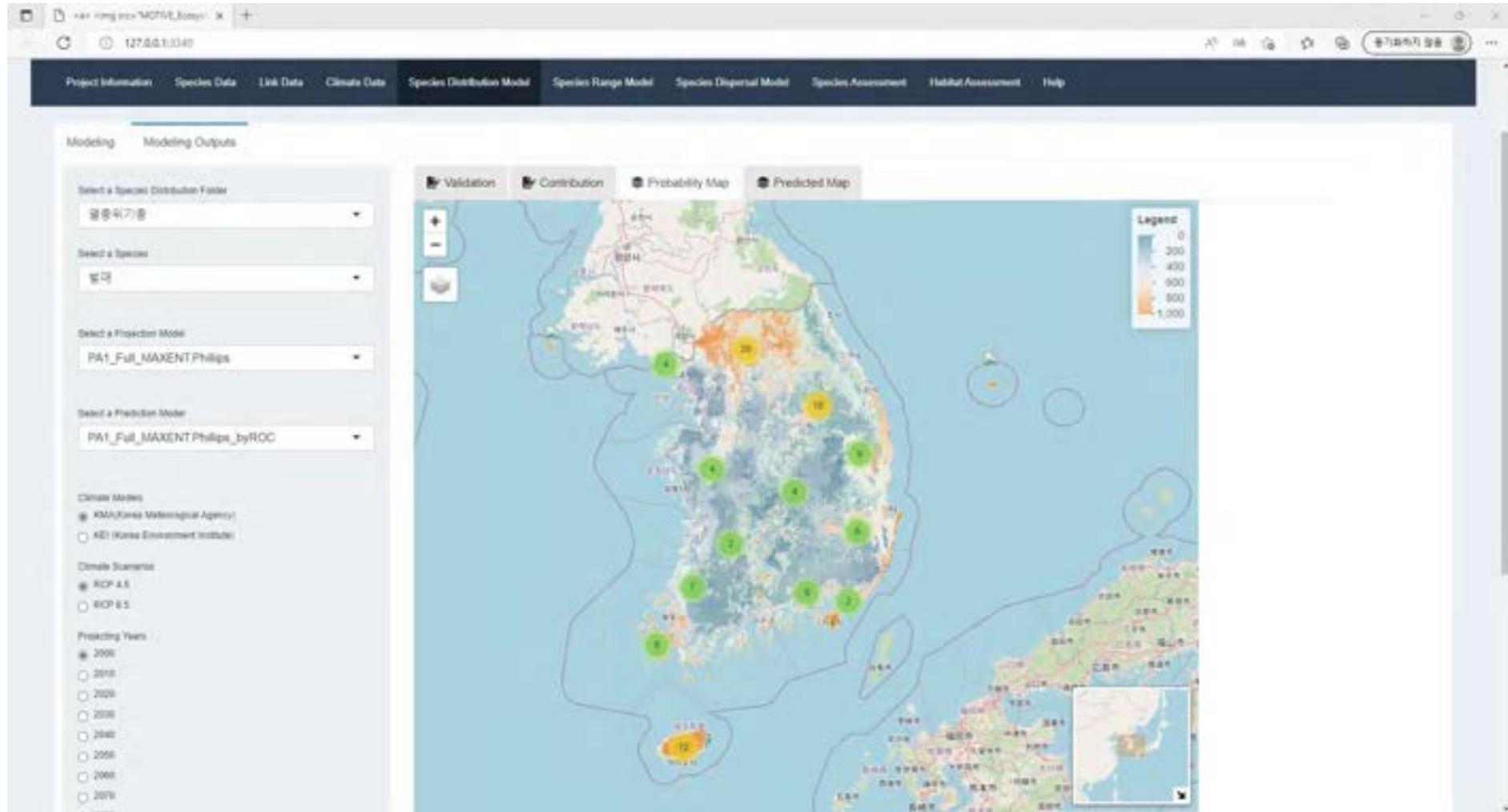
# MOTIVE Ecosystem

The screenshot displays the MOTIVE Ecosystem web application interface. The browser address bar shows the URL `http://127.0.0.1:3340`. The application header includes the MOTIVE Ecosystem logo and the text "Climate Change Impact and Vulnerability Assessment for Ecosystems". A navigation menu lists various modules: Project Information, Species Data, Link Data, Climate Data, Species Distribution Model (selected), Species Range Model, Species Dispersal Model, Species Assessment, Habitat Assessment, and Help. The main content area is titled "Modeling" and "Modeling Outputs". It features three tabs: "Species selection", "Variable selection", and "SDM selection". The "SDM selection" tab is active, showing several configuration panels:

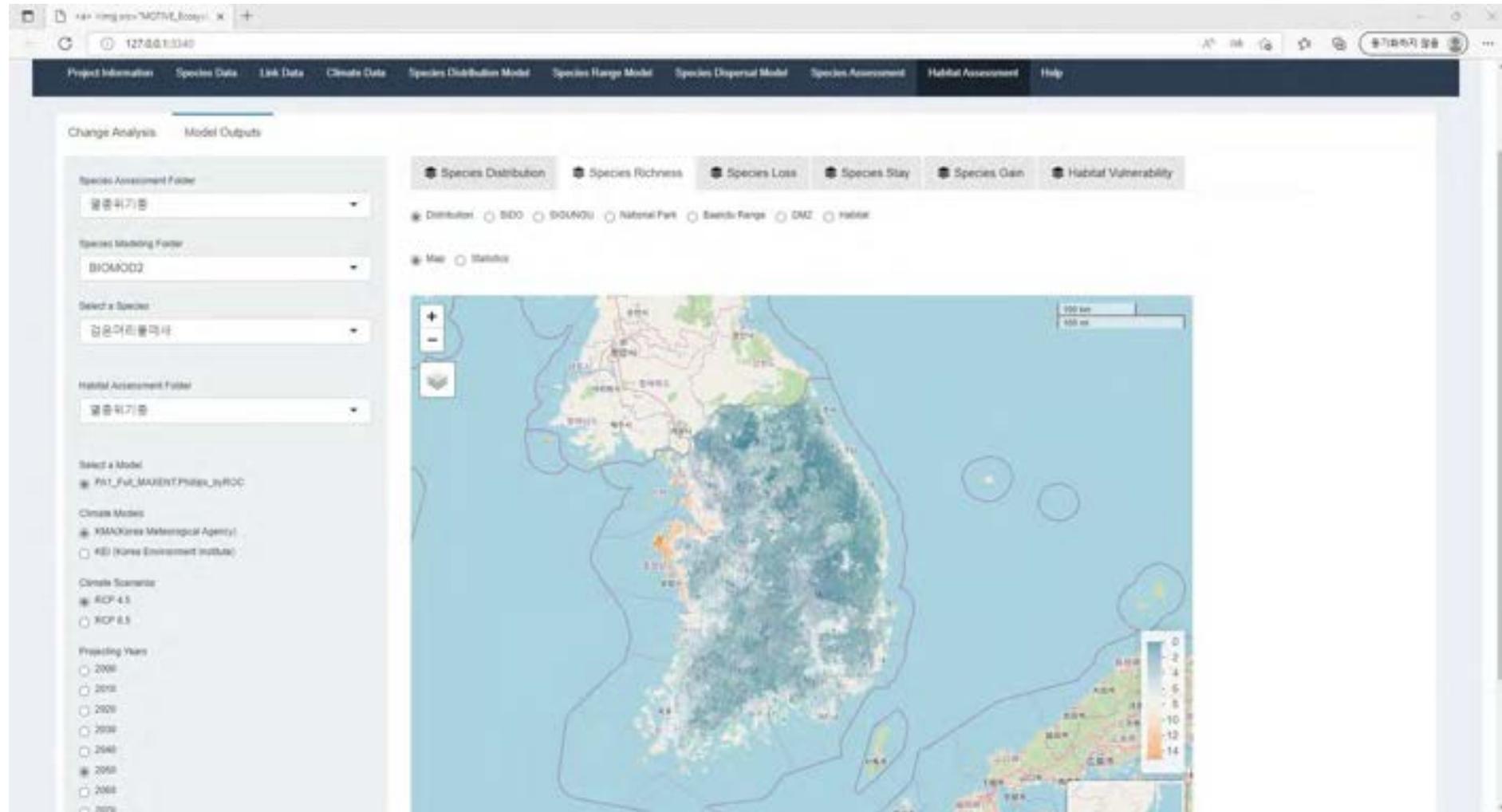
- Data Options:** Includes dropdown menus for "BIOMOD\_eval resp var", "BIOMOD\_eval expl var", and "BIOMOD\_eval resp cv".
- SDM Modeling Options:** Includes sliders for "BIOMOD\_weightEval" (set to 0), "BIOMOD\_Weight" (set to 100), and "BIOMOD\_weight". It also has a dropdown for "BIOMOD\_weight" and checkboxes for "BIOMOD\_models eval meth" (ROC, TSS, KAPPA) and "BIOMOD\_save file" (checked).
- Ensemble Modeling Options:** Includes dropdowns for "EM\_chosen models" (set to "all"), "EM\_eval meth" (set to "PA\_dataset+repet"), and "EM\_eval metric" (set to "all"). It also has a dropdown for "EM\_eval metric quality threshold".
- Model type:** A list of model types with checkboxes: GLM (Generalized Linear Model), GAM (Generalized Additive Model), GBM (Generalized Boosting Model), CTA (Classification Tree Analysis), ANN (Artificial Neural Networks), SRE (Surface Range Envelopes), PDA (Flexible Discriminant Analysis), MARS (Multiple Adaptive Regression Splines), RF (Random Forest), and MAXENT/Phillips (checked). There is also an "Ensemble" checkbox.

At the bottom right, there is a "SDM Output Folder" field and a large "Run" button.

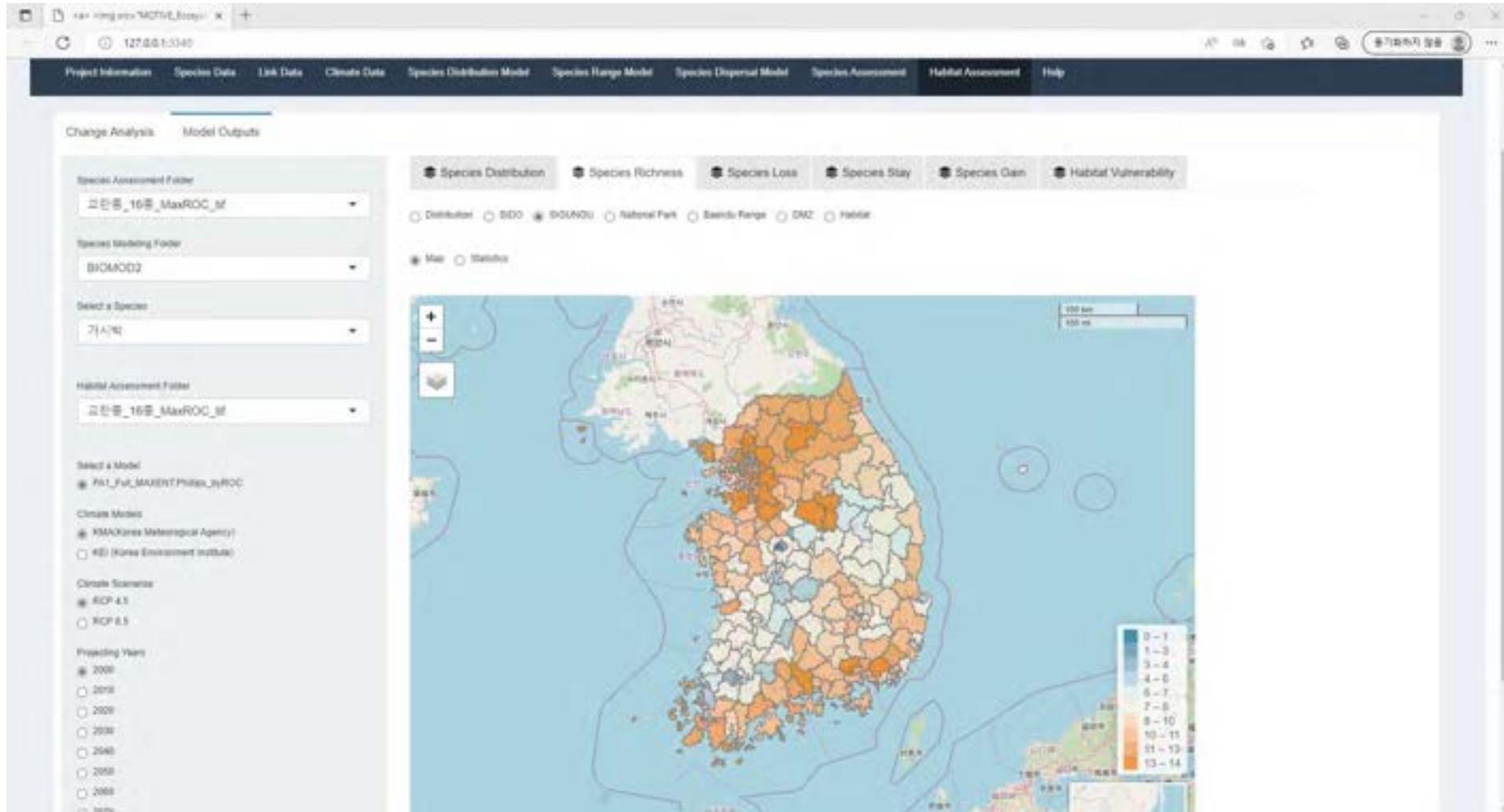
# MOTIVE Ecosystem



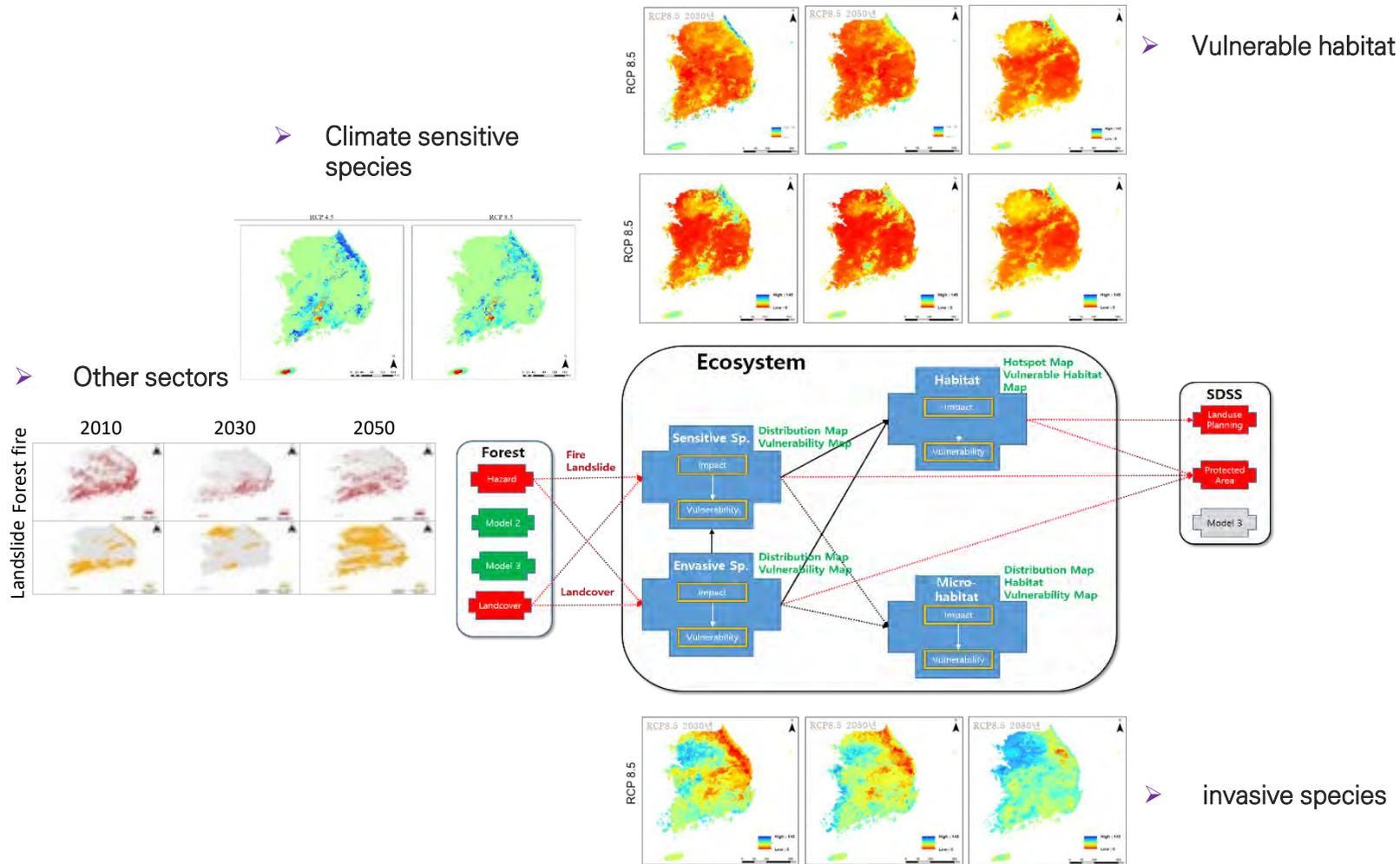
# MOTIVE Ecosystem



# MOTIVE Ecosystem

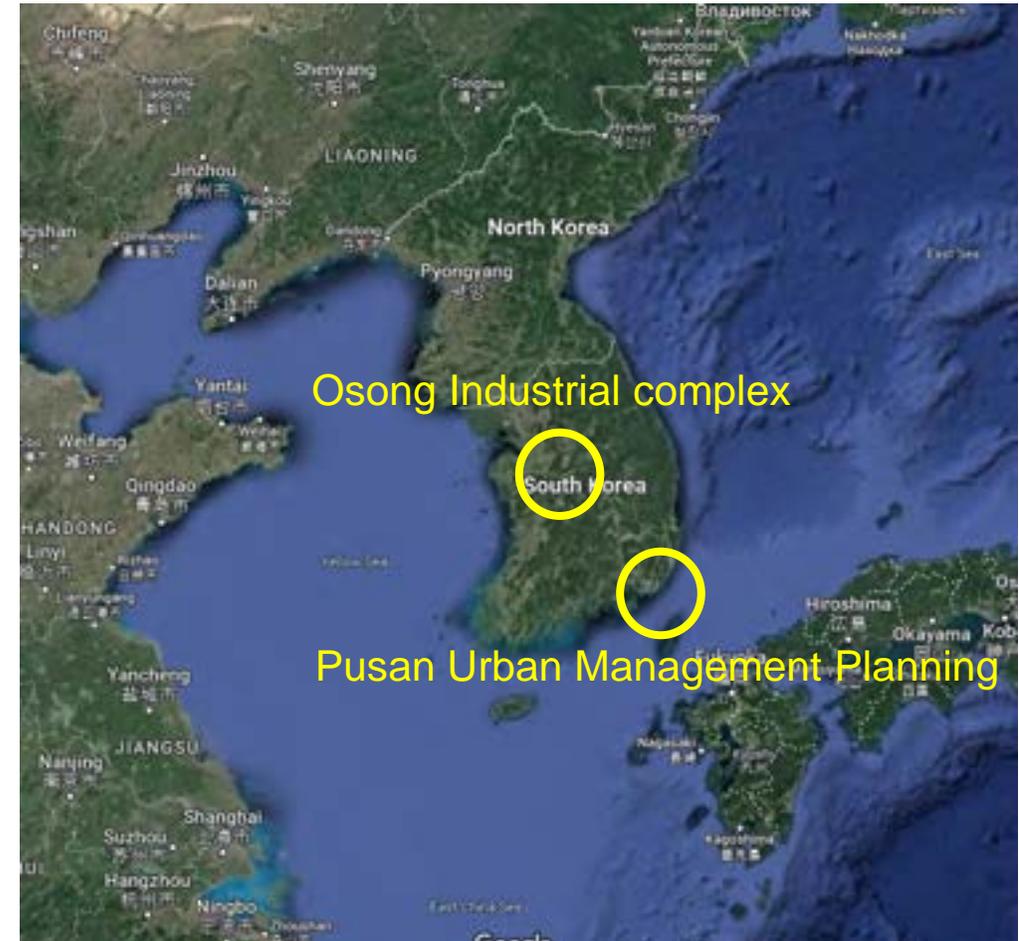


# MOTIVE Ecosystem



# Applications of the System

- Endangered Species
- Invasive Species
- Habitat

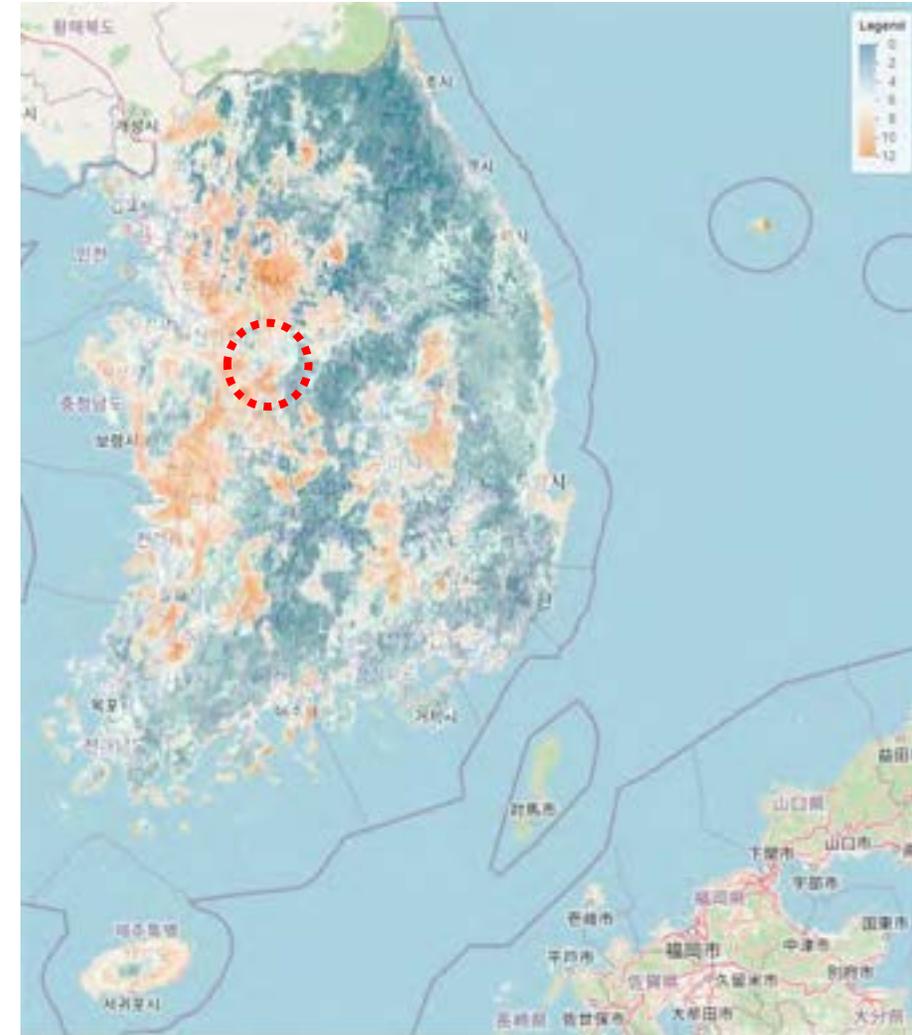


## Species Richness

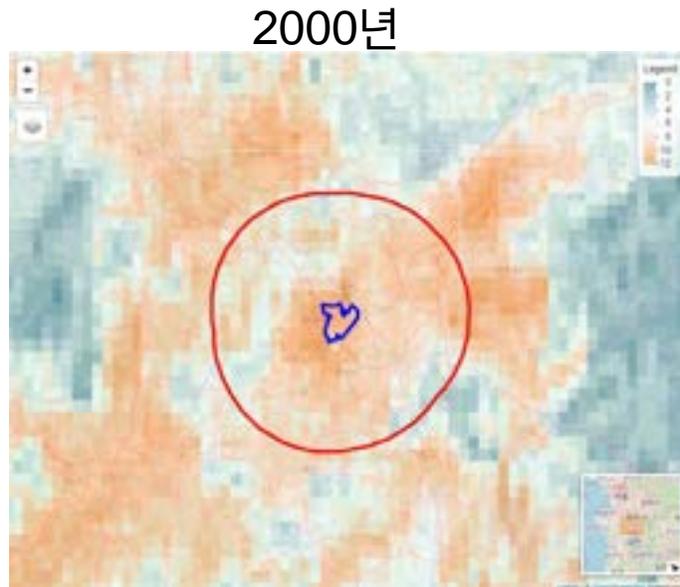
### ➤ Endangered Species

#### 18 Species

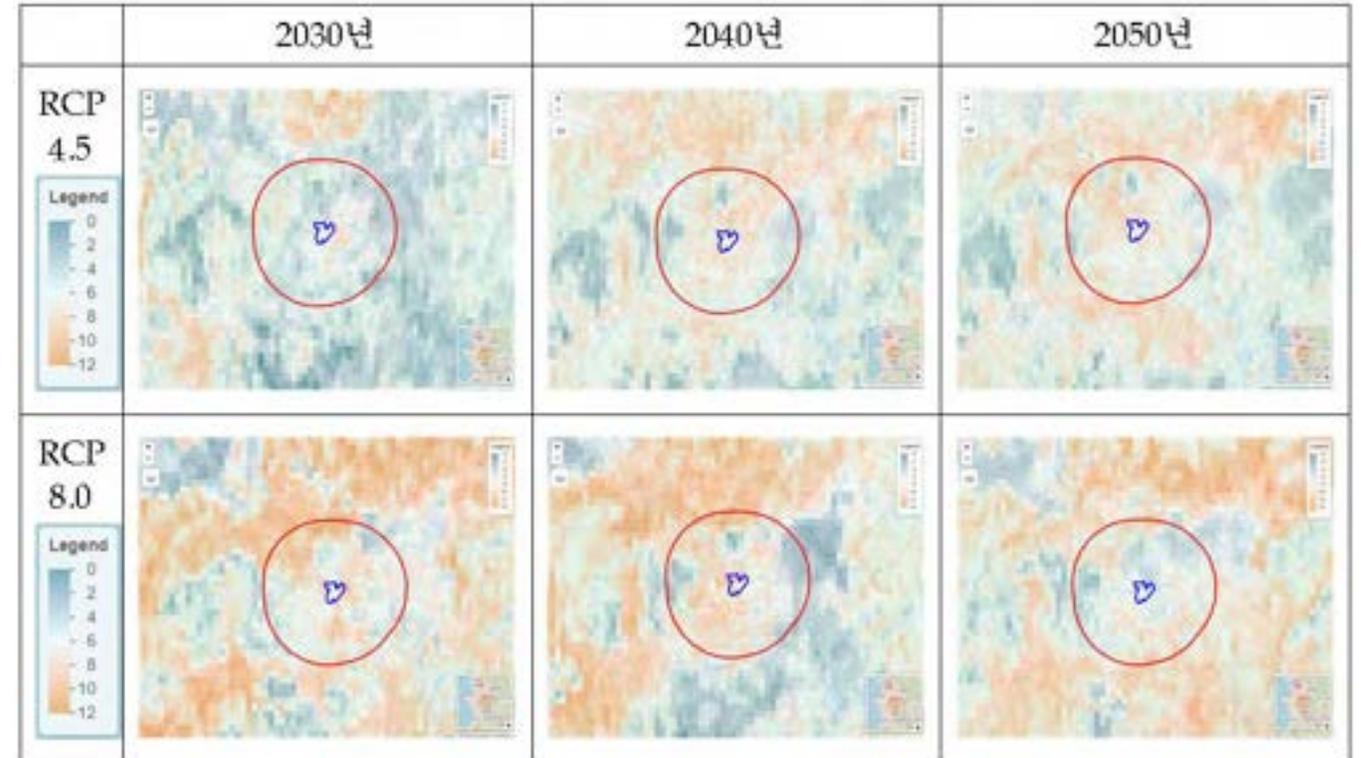
- ✓ Mammal
  - ❖ *Lutra lutra* (Linnaeus, 1758)
  - ❖ *Prionailurus bengalensis* (Kerr, 1792)
- ✓ Plant
  - ❖ *Aix galericulata* (Linnaeus, 1758)
  - ❖ *Anser fabalis* (Latham, 1787)
  - ❖ *Cygnus cygnus* (Linnaeus, 1758)
  - ❖ *Accipiter gentilis* (Linnaeus, 1758)
  - ❖ *Accipiter nisus* (Linnaeus, 1758)
  - ❖ *Accipiter soloensis* (Horsfield, 1822)
  - ❖ *Aegypius monachus* (Linnaeus, 1766)
  - ❖ *Haliaeetus albicilla* (Linnaeus, 1758)
  - ❖ *Haliaeetus pelagicus* (Pallas, 1811)
  - ❖ *Falco subbuteo* Linnaeus, 1758
  - ❖ *Falco tinnunculus interstinctus*
  - ❖ *Charadrius placidus* J.E.Gray & G.R.Gray, 1863
  - ❖ *Bubo bubo* (Linnaeus, 1758)
- ✓ Raptile.Amphibian
  - ❖ *Kaloula borealis* (Barbour, 1908)
  - ❖ *Pelophylax chosenicus* (Okada, 1931)
  - ❖ *Polyphylla laticollis manchurica* Semenov, 1900



## ➤ Endangered Species



## Species Richness



구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
종수	12	10	11	11	12	12	11

## ➤ Invasive Species

### 8 Species

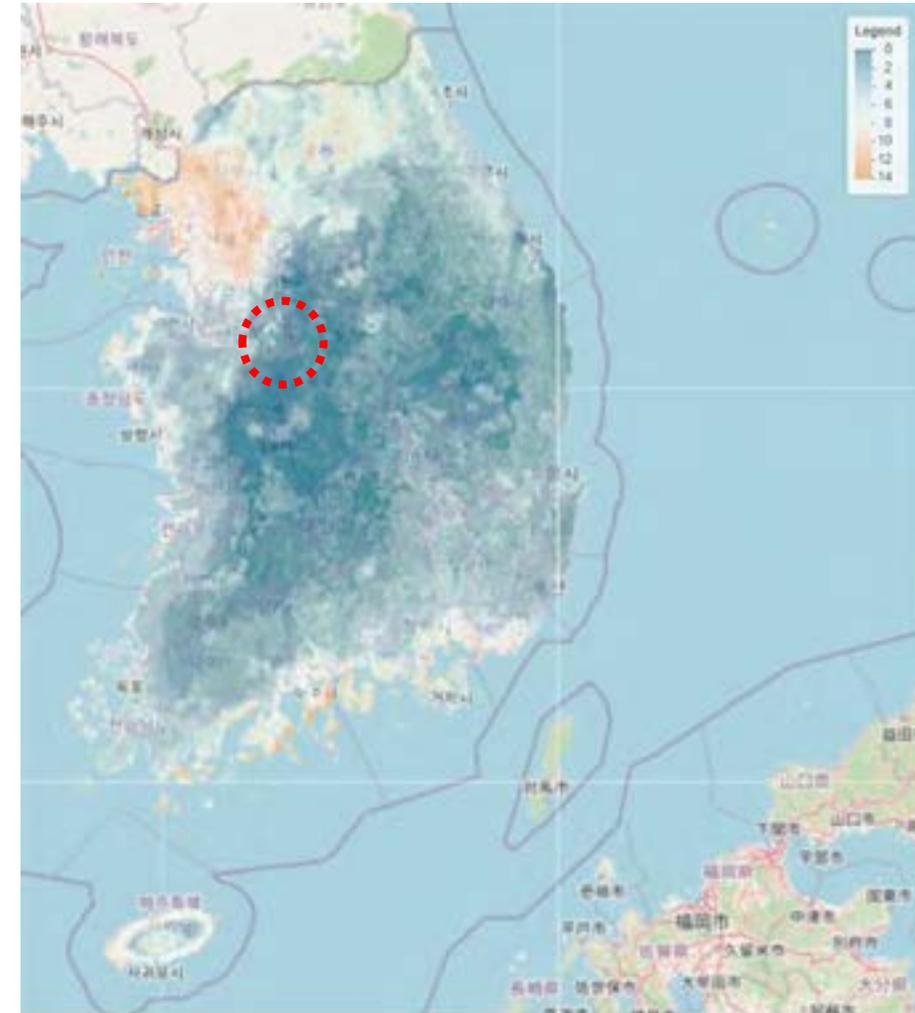
#### ✓ Plant

- ❖ *Sicyos angulatus* L.
- ❖ *Ambrosia trifida* L.
- ❖ *Ambrosia artemisiifolia* L.
- ❖ *Lactuca scariola* L.
- ❖ *Humulus japonicus* Siebold & Zucc.
- ❖ *Rumex acetosella* L.

#### ✓ Wildlife(Fish)

- ❖ *Lepomis macrochirus* Rafinesque, 1819
- ❖ *Micropterus salmoides* (Lacepède, 1802)

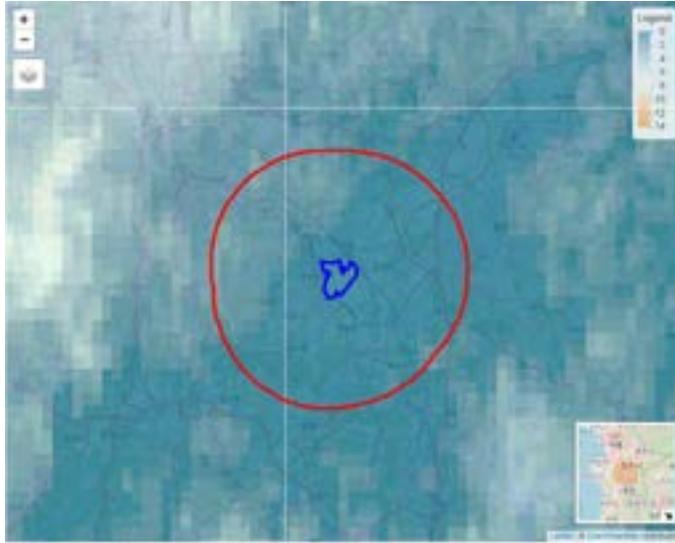
### Species Richness



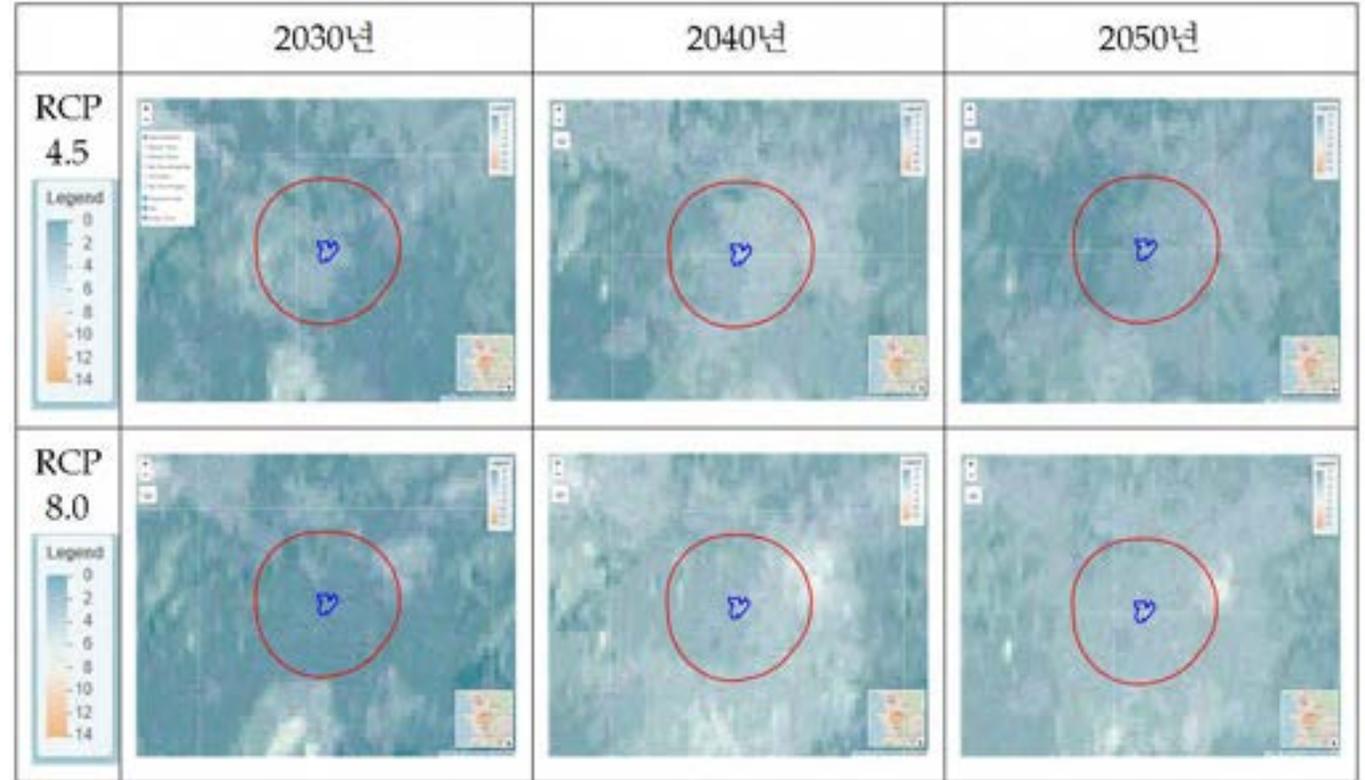
# Osong Industrial complex

## ➤ Invasive Species

2000년



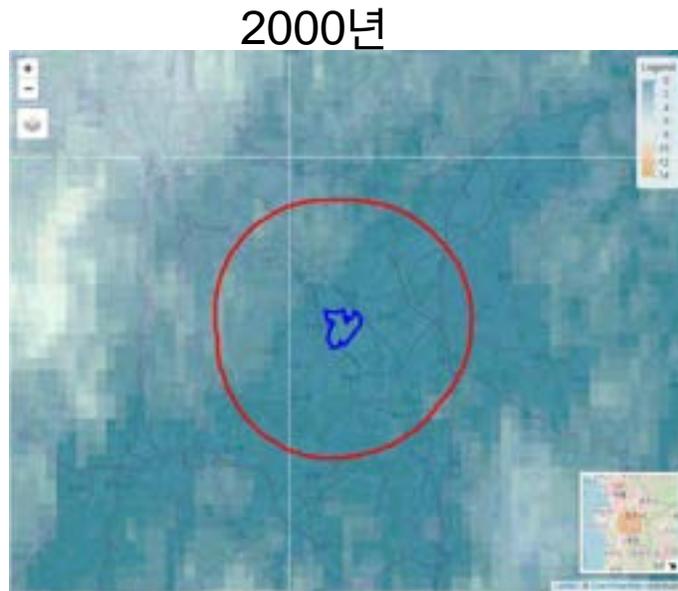
## Species Richness



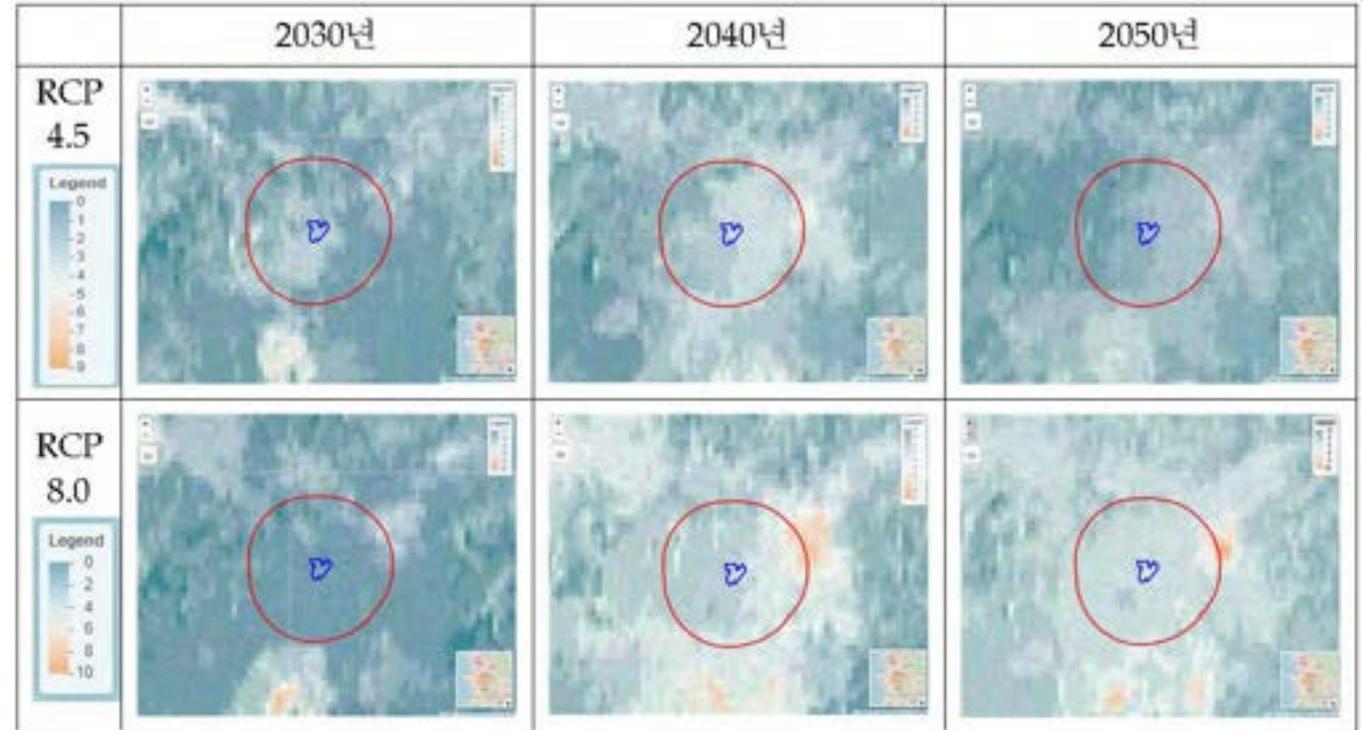
구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
종수	6	7	8	7	7	8	8

# Osong Industrial complex

## ➤ Invasive Species



## Species Reintroduction



구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
종수	-	5	6	6	4	6	6

## ➤ Endangered Species

### 18 Species

#### ✓ Mammal

- ❖ *Prionailurus bengalensis* (Kerr, 1792)

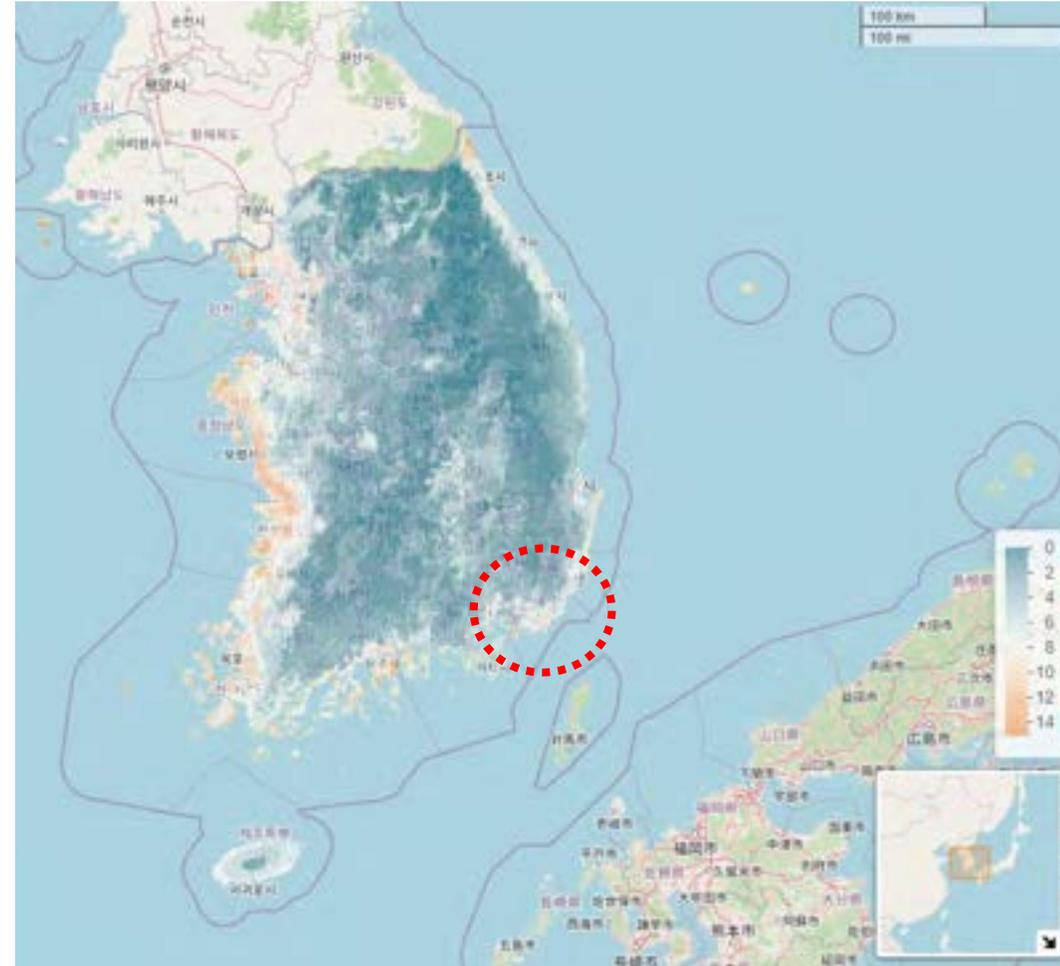
#### ✓ Bird

- ❖ *Terpsiphone atrocaudata* (Eyton, 1839)
- ❖ *Falco subbuteo* Linnaeus, 1758
- ❖ *Milvus migrans* (Boddaert, 1783)
- ❖ *Accipiter soloensis* (Horsfield, 1822)
- ❖ *Falco peregrinus* Tunstall, 1771
- ❖ *Accipiter nisus* (Linnaeus, 1758)
- ❖ *Platalea minor* Temminck & Schlegel, 1849
- ❖ *Cygnus cygnus* (Linnaeus, 1758)
- ❖ *Anser fabalis* (Latham, 1787)
- ❖ *Pandion haliaetus* (Linnaeus, 1758)
- ❖ *Haematopus ostralegus* Linnaeus, 1758
- ❖ *Platalea leucorodia leucorodia*
- ❖ *Numenius madagascariensis* (Linnaeus, 1766)
- ❖ *Pernis ptilorhynchus* (Temminck, 1821)

#### ✓ Raptile/Amphibian

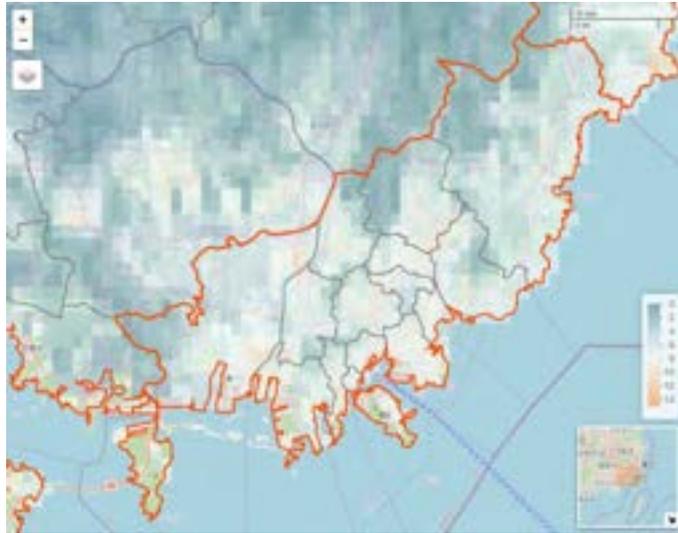
- ❖ *Hynobius yangi*
- ❖ *Kaloula borealis* (Barbour, 1908)
- ❖ *Eremias argus* (Peters, 1869)

## Species Richness

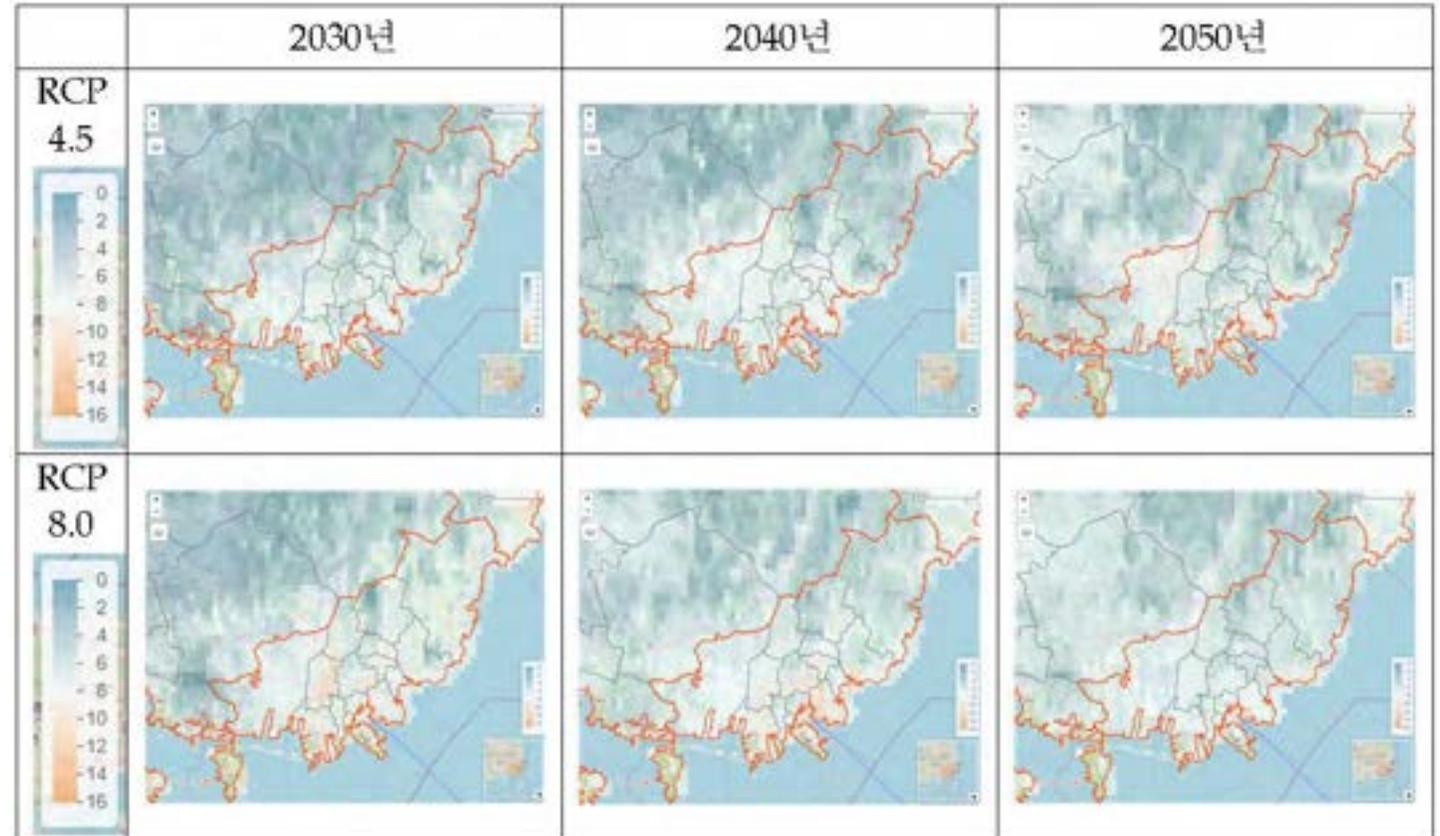


## ➤ Endangered Species

2000년



Species Richness



## Species Richness

### ➤ Endangered Species

구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
부산시	16	16	16	15	15	16	16
강서구	12	15	14	14	13	14	14
금정구	12	11	12	12	12	12	13
기장군	14	12	12	12	11	13	12
남구	9	10	9	8	12	11	8
동구	9	11	10	9	10	10	9
동래구	11	11	11	11	11	11	11
부산진구	10	11	11	12	12	13	11
북구	11	12	11	11	12	13	11
사상구	11	12	9	9	11	11	9
사하구	11	10	9	10	11	11	9
서구	11	11	11	11	12	12	10
수영구	11	10	10	9	10	11	9
연제구	10	11	10	8	11	10	9
영도구	9	8	9	8	10	11	9
중구	7	8	9	8	9	9	8
해운대구	12	11	11	11	11	13	12

## Species Richness

### ➤ Invasive Species

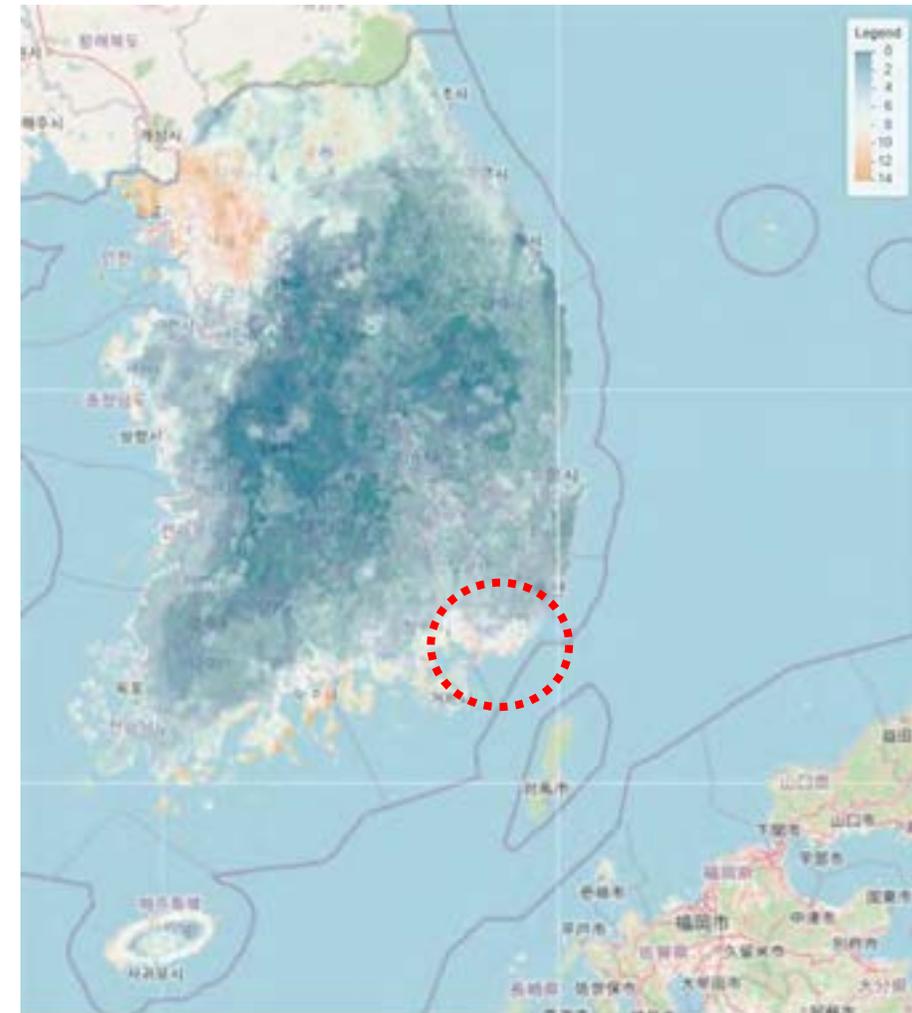
#### 16 Species

##### ✓ Plant

- ❖ *Sicyos angulatus* L.
- ❖ *Lactuca scariola* L.
- ❖ *Ambrosia trifida* L.
- ❖ *Solanum carolinense* L.
- ❖ *Ambrosia artemisiifolia* L.
- ❖ *Paspalum distichum* L.
- ❖ *Aster pilosus* Willd.
- ❖ *Hypochaeris radicata* L.
- ❖ *Ageratina altissima* (L.) R. M. King & H. Rob.
- ❖ *Rumex acetosella* L.
- ❖ *Solidago altissima* L.
- ❖ *Paspalum distichum* var. *indutum* Shinnars

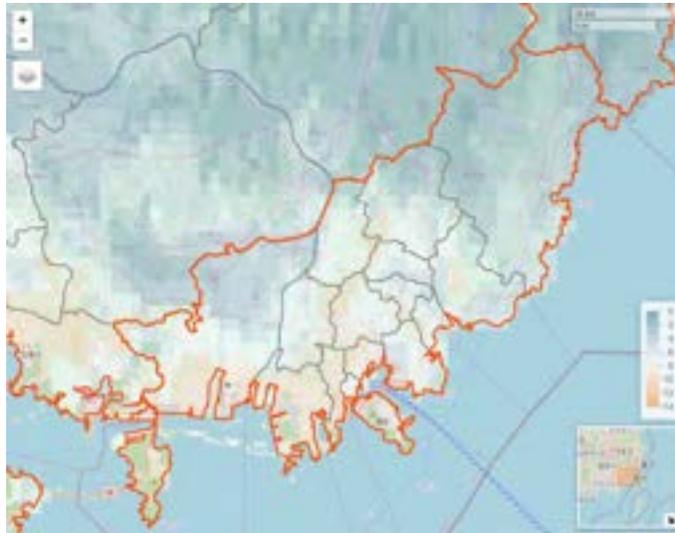
##### ✓ Wildlife

- ❖ *Lycorma delicatula* (White, 1845)
- ❖ *Myocastor coypus* (Molina), 1782
- ❖ *Trachemys scripta* (Schoepff, 1792)
- ❖ *Lithobates catesbeianus* (Shaw, 1802)

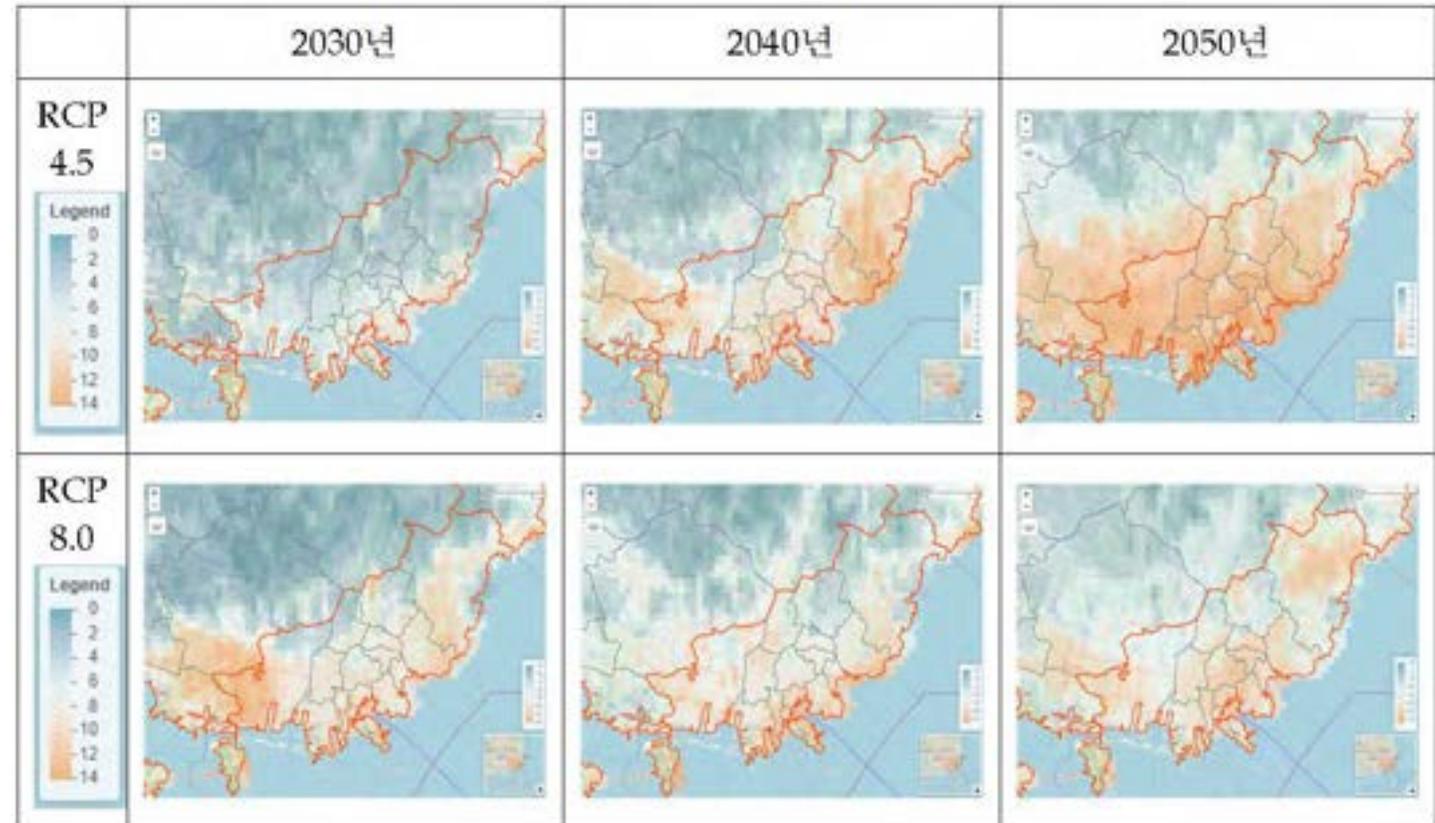


## ➤ Invasive Species

2000년



Species Richness



## Species Richness

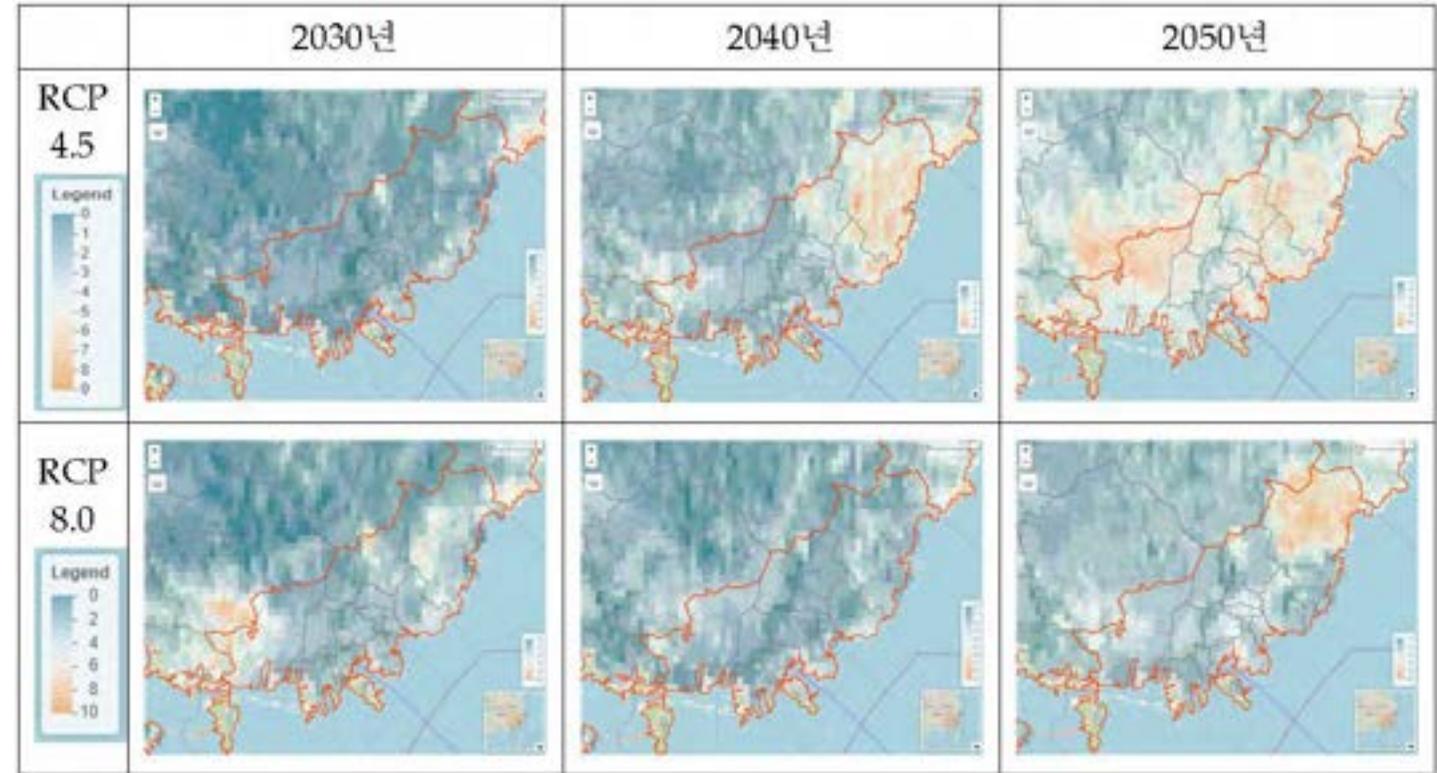
### ➤ Invasive Species

구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
부산시	10	12	14	14	14	12	14
강서구	9	11	13	14	14	12	14
금정구	10	11	12	13	12	10	12
기장군	8	11	13	13	12	10	13
남구	8	9	10	13	10	9	12
동구	8	9	10	14	9	10	11
동래구	8	10	12	13	10	10	12
부산진구	8	9	10	14	10	9	12
북구	9	9	10	13	10	11	12
사상구	8	8	9	12	9	9	10
사하구	8	10	10	13	10	11	11
서구	9	10	11	14	11	11	13
수영구	8	9	10	13	9	9	11
연제구	8	8	10	13	9	8	11
영도구	8	10	10	12	11	10	9
중구	7	7	10	13	9	9	10
해운대구	9	11	13	14	13	11	13

## ➤ Invasive Species

### Species Reintroduction

2000년



## Species Reintroduction

### ➤ Invasive Species

구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
부산시	-	9	12	12	12	11	13
강서구	-	6	8	10	10	8	10
금정구	-	7	9	10	8	7	10
기장군	-	8	12	12	10	9	12
남구	-	4	5	7	5	4	6
동구	-	4	5	8	4	5	5
동래구	-	5	6	8	5	5	7
부산진구	-	4	5	7	5	4	6
북구	-	4	5	8	5	6	6
사상구	-	3	4	7	4	3	4
사하구	-	5	5	6	5	5	4
서구	-	3	4	6	4	4	5
수영구	-	4	5	8	4	4	6
연제구	-	3	5	8	4	3	6
영도구	-	3	3	4	4	3	2
중구	-	1	3	6	3	3	3
해운대구	-	7	9	10	9	7	9

## Species Richness

### ➤ Habitat

「National Climate Change Indicator Species 100」 44 species

✓ Plant

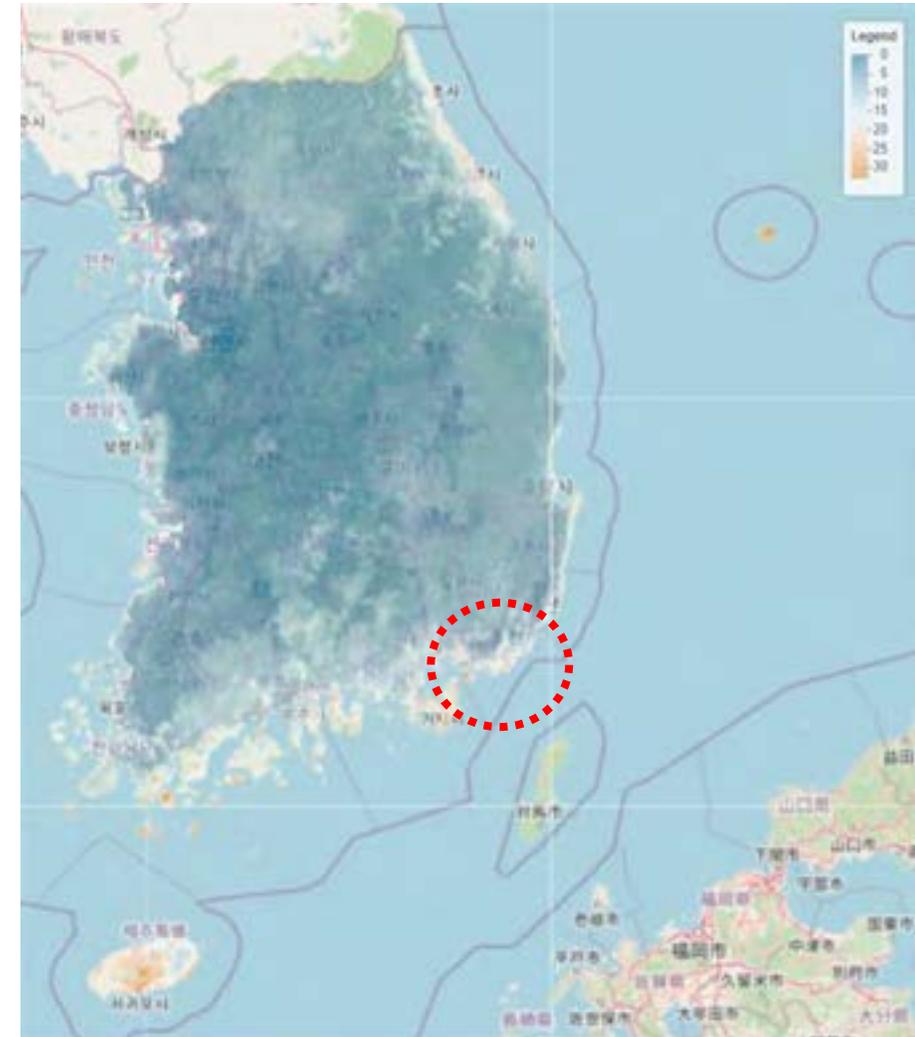
- ❖ *Abies koreana* E. H. Wilson
- ❖ *Daphniphyllum macropodum* Miq.
- ❖ *Litsea japonica* (Thunb.) Juss.  
etc. 30 species

✓ Insect

- ❖ *Camponotus kiusiuensis* Santschi, 1937
- ❖ *Sympetrum pedemontanum elatum* (Selys, 1872)
- ❖ *Eurema mandarina* (de l'Orza, 1869)  
etc. 12 species

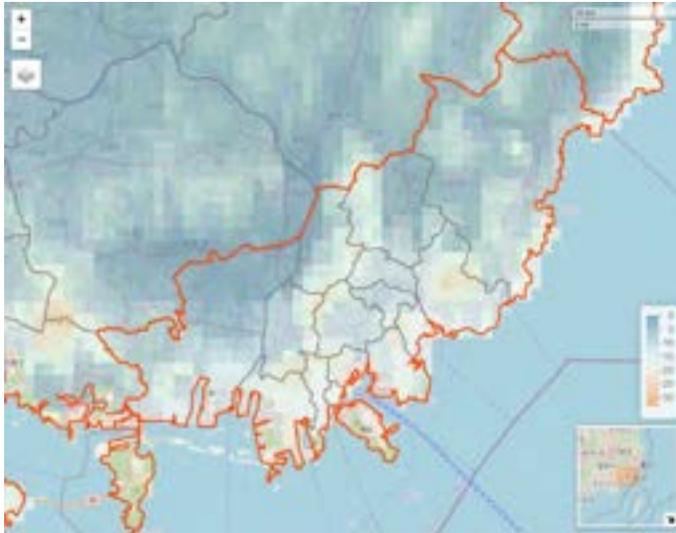
✓ Raptile/Amphibian

- ❖ *Kaloula borealis* (Barbour, 1908)
- ❖ *Rana temporaria dybowskii*

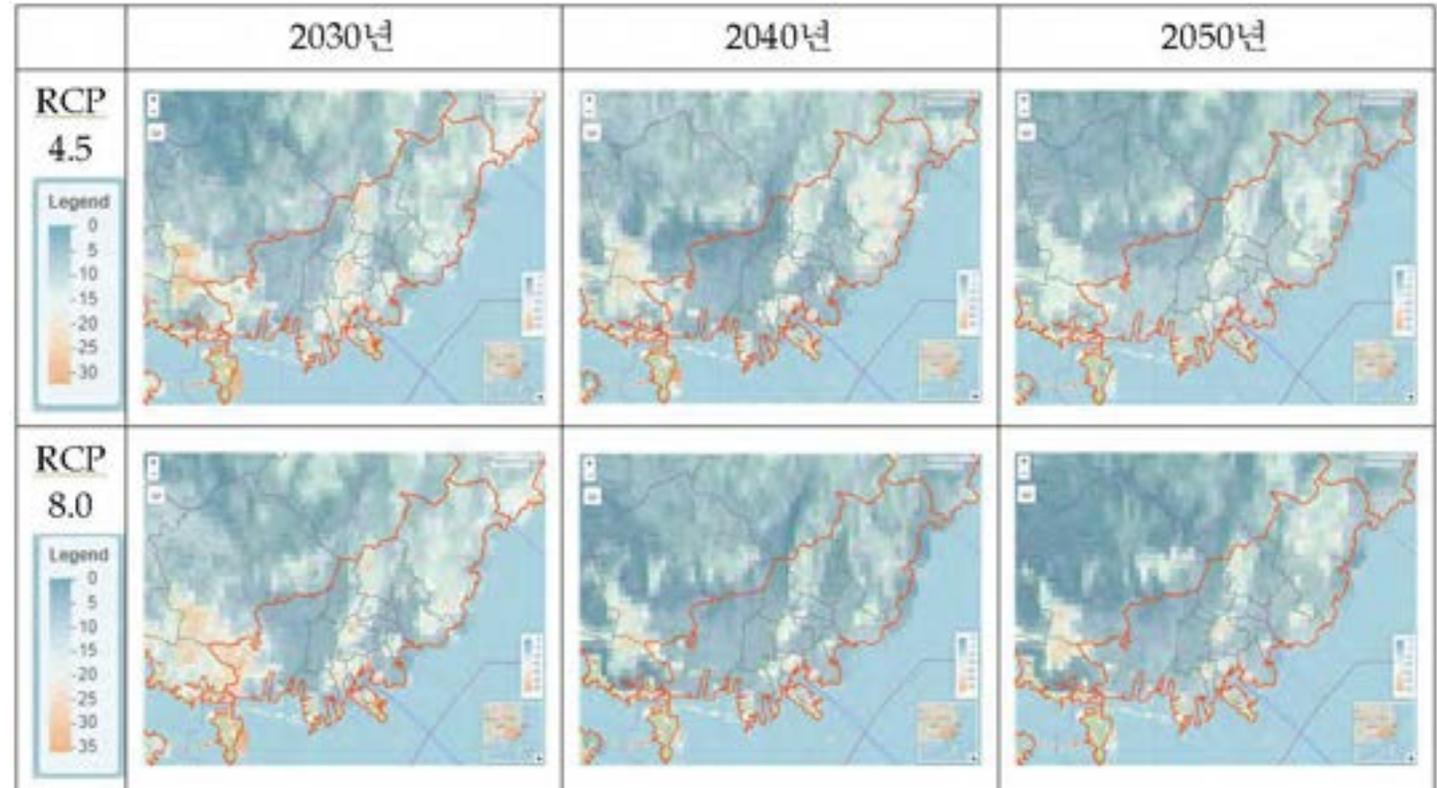


## ➤ Habitat

2000년



## Species Richness



## Species Richness

### ➤ Habitat

구 분	2000년	RCP 4.5			RCP 8.0		
		2030년	2040년	2050년	2030년	2040년	2050년
부산시	27	40	37	31	39	38	36
강서구	25	37	37	28	38	33	31
금정구	22	32	27	25	30	34	25
기장군	23	30	26	26	30	27	28
남구	20	22	20	20	21	17	13
동구	20	24	24	22	25	23	20
동래구	21	27	27	23	25	29	23
부산진구	21	28	27	25	30	23	30
북구	21	25	24	24	25	22	20
사상구	21	22	14	17	19	13	11
사하구	21	24	20	19	22	17	14
서구	22	29	27	20	27	21	23
수영구	21	22	20	21	23	19	16
연제구	19	20	19	21	19	17	17
영도구	20	30	24	16	30	13	12
중구	17	17	11	14	12	11	11
해운대구	23	28	24	23	27	25	24

- The results showed that species distribution was changed according to climate change scenarios. Therefore, we can make appropriate adaptation policies to conserve vulnerable species and habitats. We want to suggest **the MOTIVE system as a tool for EIA agencies.**

# Let's continue the conversation!

Post questions and comments in the IAIA23 app.



**Changwan Seo**

*Chief Researcher / National Institute of Ecology*

*South Korea*

[dharmascw@nie.re.kr](mailto:dharmascw@nie.re.kr)

[www.nie.re.kr](http://www.nie.re.kr)

