Systematic conservation planning for conserving amphibians considering bioenergy potential and climate change

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Main Conclusions

- Since the distribution of potential habitats of amphibians and high bioenergy potentials is similar, it is necessary to consider the conflict between the two factors when we establish the conservation planning against climate change.
- In addition, to conserve biodiversity it is not enough to just predicting changes in the distribution of species due to climate change. It is necessary to identify conservation priority areas, taking into account the secondary impacts of climate change and the impact of efforts to respond to climate change.

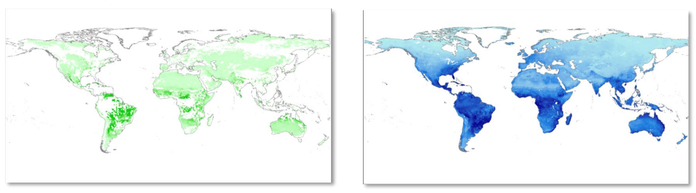
Objectives

- Prioritizing areas is the one of the crucial parts in systematic conservation planning (SCP) because it enables effective and efficient conservation implementations to protect biodiversity or ecosystems.
- There are several factors that need to be taken into account for future biodiversity conservation. The biggest impact among them is climate change. Increases in temperature and extreme weather events due to climate change cause the species to migrate from their current habitat. In addition, expansion of bioenergy production, an effort to mitigate climate change, could be another threat to habitats.
- In order to select a conservation priority in consideration of future climate change, it is necessary to consider not only climate change but also response to climate change or secondary effects.
- **Objective: Finding priority areas for conservation of Amphibians, taking into account areas where there is a conflict between amphibian distribution change and bioenergy potential from climate change.**

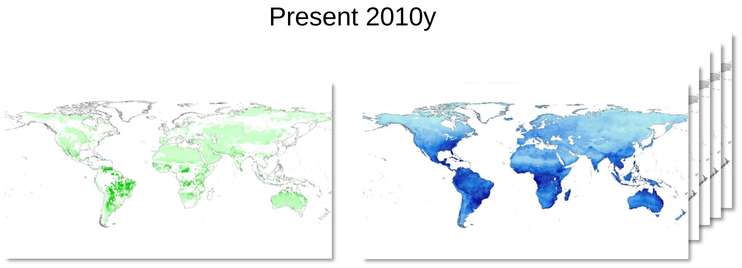
Methods

Input data

Bioenergy potential (Wu et al., 2019) Potential habitats (Ohashi)



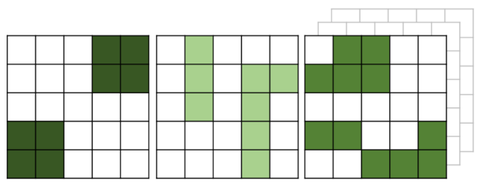
Present 2010y



Future 2050y

GCM : GFDL-CM3, HadGEM2-ES, IPSL-CM5A-LR
MIROC-ESM-CHEM, NorESM1-M
Resolution : 0.5 degrees

Marxan



Potential habitats fo Amphibians (n=533)

35	20	20	30	80
150	35	25	50	50
200	150	300	40	20
100	80	90	30	0
30	40	20	15	20

Bioenergy potential

Objective function

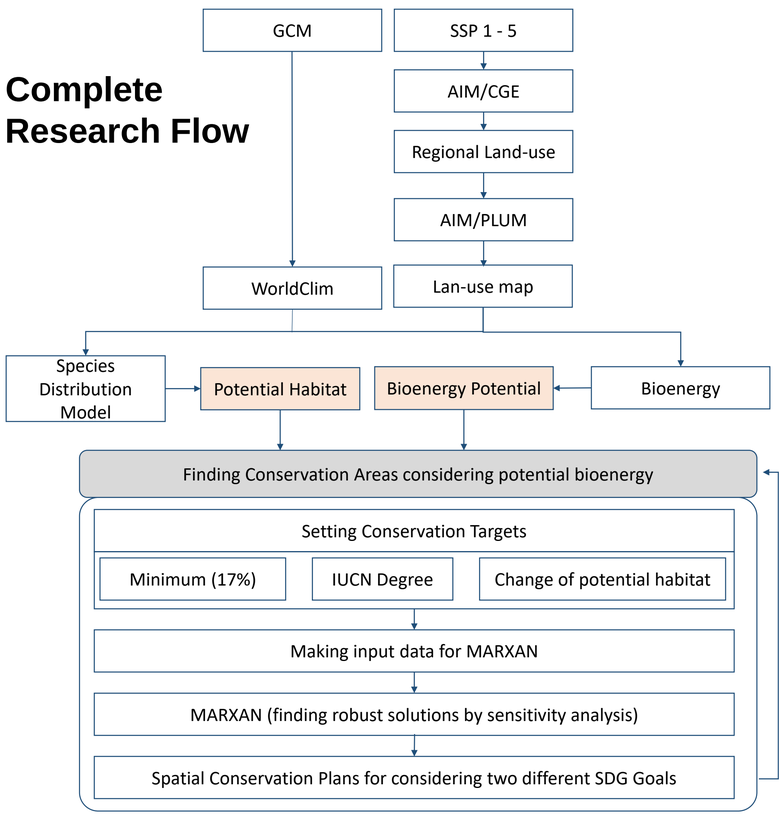
$$Total\ cost = SPF \sum \text{Conservation Fail Penalty} + \sum \text{Total Bioenergy Potential} \ (+ \text{BLM} \sum \text{Boundary length})$$

- Penalty threshold : 30% of potential habitats for each species
- SPF : 1000,000
- Cost : Bioenergy potential * 1000,000
- BLM : 0

Marxan running Deriving 100,000 solutions X 100times

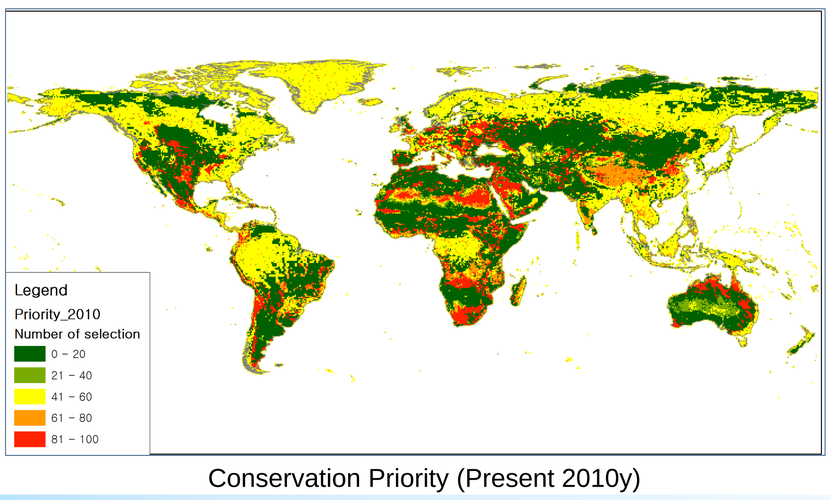
Summary results Accumulation of best solutions

Complete Research Flow



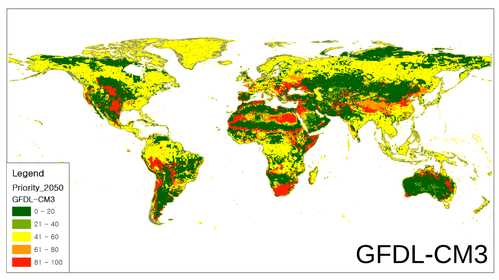
Results

- In Latin America and South Africa, bioenergy potential were higher than the other region as well as potential habitat of amphibians was widly distributed. Potential habitat also were many in South Asia and Australia, a part of North America.
- In 2010, Conservation Priorities were moderately important in North America and Central Asia, where bioenergy were not high. In Latin America and Africa, many regions of high importance were selected despite of high bioenergy potential.

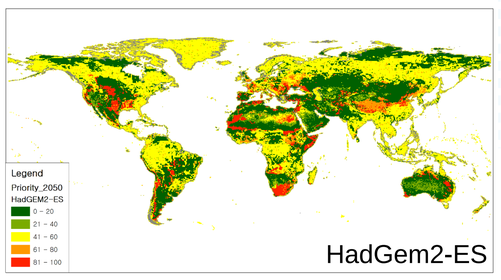


Conservation Priority (Present 2010y)

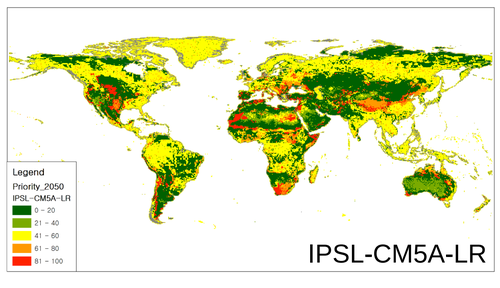
- In the future, even though by the scenarios the priorities were varied slightly, but it was higher in North America, Africa, and Central Asia.



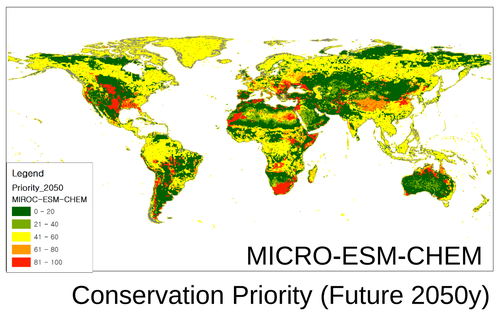
GFDL-CM3



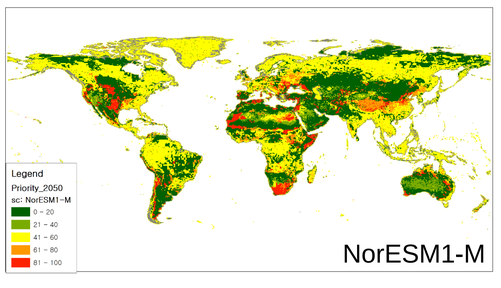
HadGem2-ES



IPSL-CM5A-LR



MICRO-ESM-CHEM



NorESM1-M

Conservation Priority (Future 2050y)

Discussions

- The amphibian distribution was similar to that of the bioenergy potential, so it was confirmed that there was a conflict between each other when selecting conservation priorities. It would be caused of the amphibians habitat preference (in or around cropland).
- Considering climate change, for the conservation of amphibians worldwide, it is important to establish conservation plans in Africa region.
- If we consider not only climate change, but also socio-economic changes such as SSP scenarios and land-use changes, we would be possible to derive more realistic conservation plans.

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