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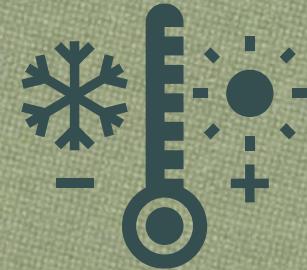
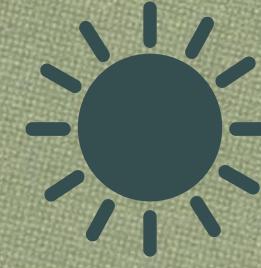
# Habitats as predictors in species distribution models: *Shall we use continuous or binary data?*



PRESENTED BY LUKÁŠ GÁBOR

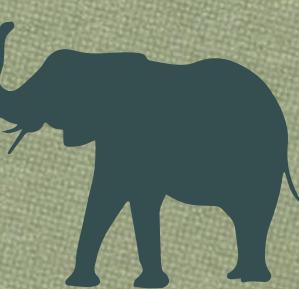
# Species Distribution Models

Environmental variables



SDM Algorithm

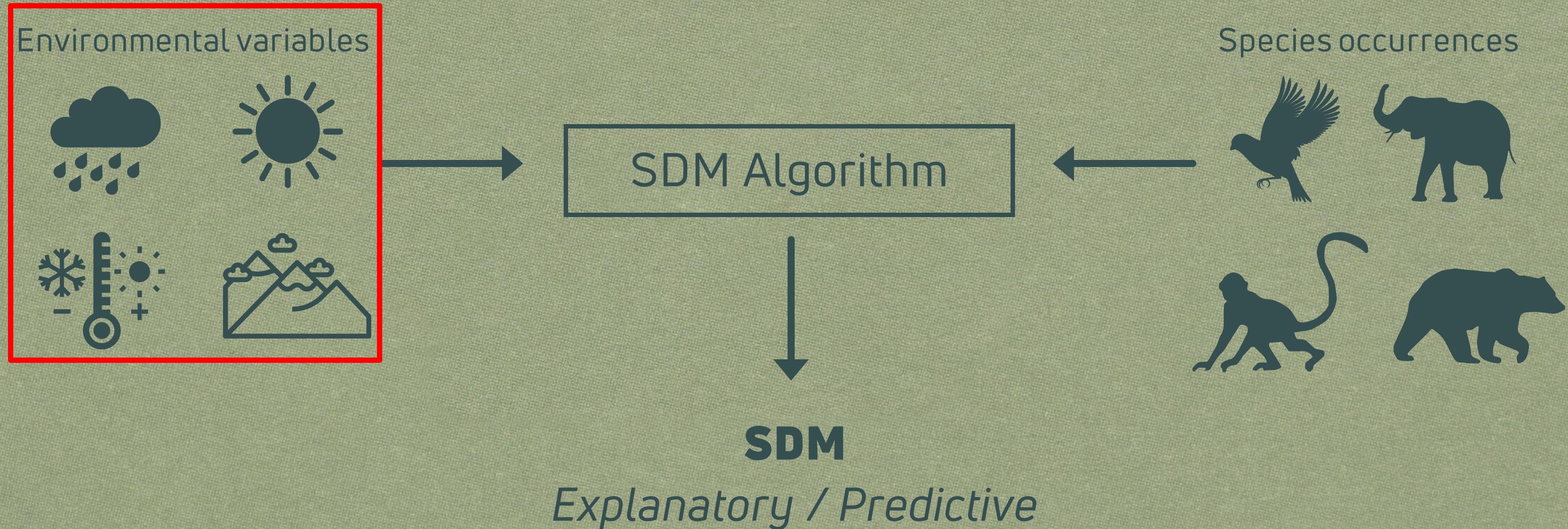
Species occurrences



**SDM**

*Explanatory / Predictive*

# Species Distribution Models



# Environmental variables

Environmental variables, such as landcover or habitat type, are most often included in SDMs as the area or percentage of a particular land cover type within the grid cell.



Amount of Forest Habitat

12 %	25 %	38 %	63 %
9 %	56 %	43 %	70 %
7 %	41 %	17%	0 %
0 %	0 %	0%	0 %

# But What If...

For some species, the total area of habitat is less relevant than the simple fact that a particular habitat is present or absent?

Amount of Forest Habitat

12 %	25 %	38 %	63 %
9 %	56 %	43 %	70 %
7 %	41 %	17%	0 %
0 %	0 %	0%	0 %

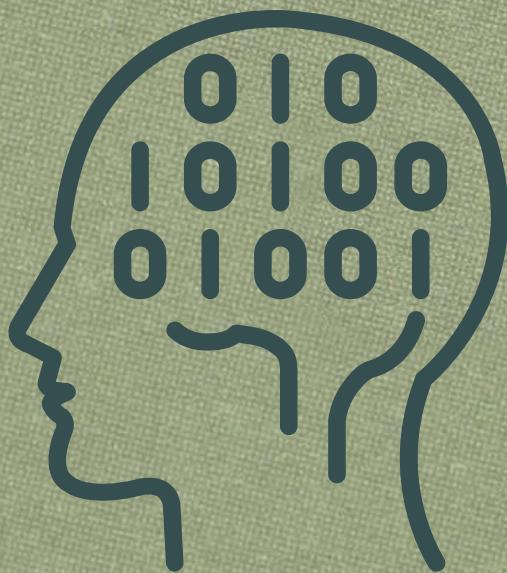


Binary information of  
Forest Habitat

1	1	1	1
1	1	1	1
1	1	1	0
0	0	0	0

# Continuous or Binary habitat data?

- This has been considered neither theoretically, nor empirically.
- A guideline on whether habitat predictors should be included as continuous or binary variables would be directly applicable in ecology.



# Study



**Is it possible that a simple binary information of the suitable habitat could be the most important determinant of the presence/absence of some species?**

Amount of Water Habitat

12 %	25 %	38 %	63 %
9 %	56 %	43 %	70 %
7 %	41 %	17%	0 %
0 %	0 %	0%	0 %

VS

Binary information of Water Habitat

1	1	1	1
1	1	1	1
1	1	1	0
0	0	0	0

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# Hypotheses

**Hypothesis 1:** Assumes that species presence is driven by continuous areas.



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**Hypothesis 1:** Assumes that species presence is driven by continuous areas.

**Hypothesis 2:** Assumes that presence is driven by the binary presence or absence of a habitat.



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# H1: P is driven by continuous areas

## **Reasoning:**

- Larger habitat areas support larger populations due to their carrying capacity and food and shelter availability.
- Larger habitat areas can support larger populations of habitat specialists, which can then outcompete less abundant species due to the competitive exclusion principle.
- Larger habitat areas are bigger targets for colonizing individuals from the surrounding habitat matrix.

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# H1: P is driven by continuous areas

- Most common habitat types.
- Species specializing in these common habitats, to habitats with strong inter-specific competition, or habitats with strong edge effects in small habitat fragments.
- In Central Europe, forests can be considered an example of such habitats, with forest specialist species such as the Long-tailed tit, the Goldcrest or the Crested tit.



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# H2: is driven by the binary information

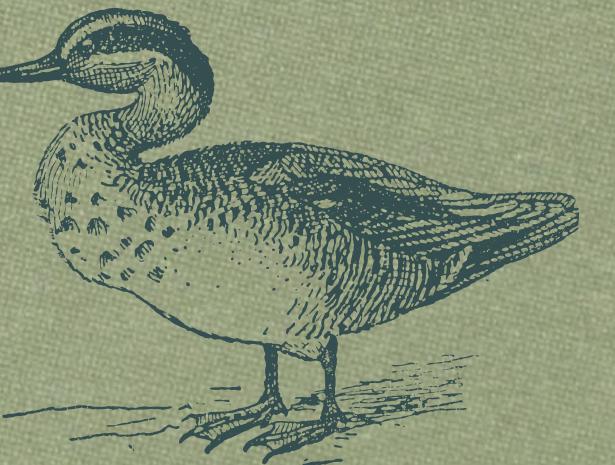
## **Reasoning:**

- Habitat is simply there or not.
- Even a small fragment of the particular habitat would be sufficient.
- A special case of this hypothesis is that there is a threshold of habitat amount.



# H2: is driven by the binary information

- Species specializing in rare (i.e. less prevalent) habitats.
- If a fragment of suitable habitat appears in the landscape, it will quickly attract a population of the species.
- In Central Europe, water bodies can be considered an example of such habitat for water specialist species such as the Common teal, the Great-crested grebe, or the Whiskered tern.



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# Methods



Czech Republic, a central European country covering almost 79,000 km<sup>2</sup>.



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66 water and forest bird species obtained from the Third Atlas of Breeding Bird Distribution in the Czech Republic.



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66 water and forest bird species obtained from the Third Atlas of Breeding Bird Distribution in the Czech Republic.



Agricultural areas , artificial surfaces, continuous area of water bodies and area of forest, binary information of water bodies and of forest, mean temperature and mean precipitation.

# SDMs

## Water bird species

*glm (occurrences ~ water bodies (**continuous**) + temp + prec + agri... )*

*glm (occurrences ~ water bodies (**binary**) + temp + prec + agri... )*

## Forest bird species

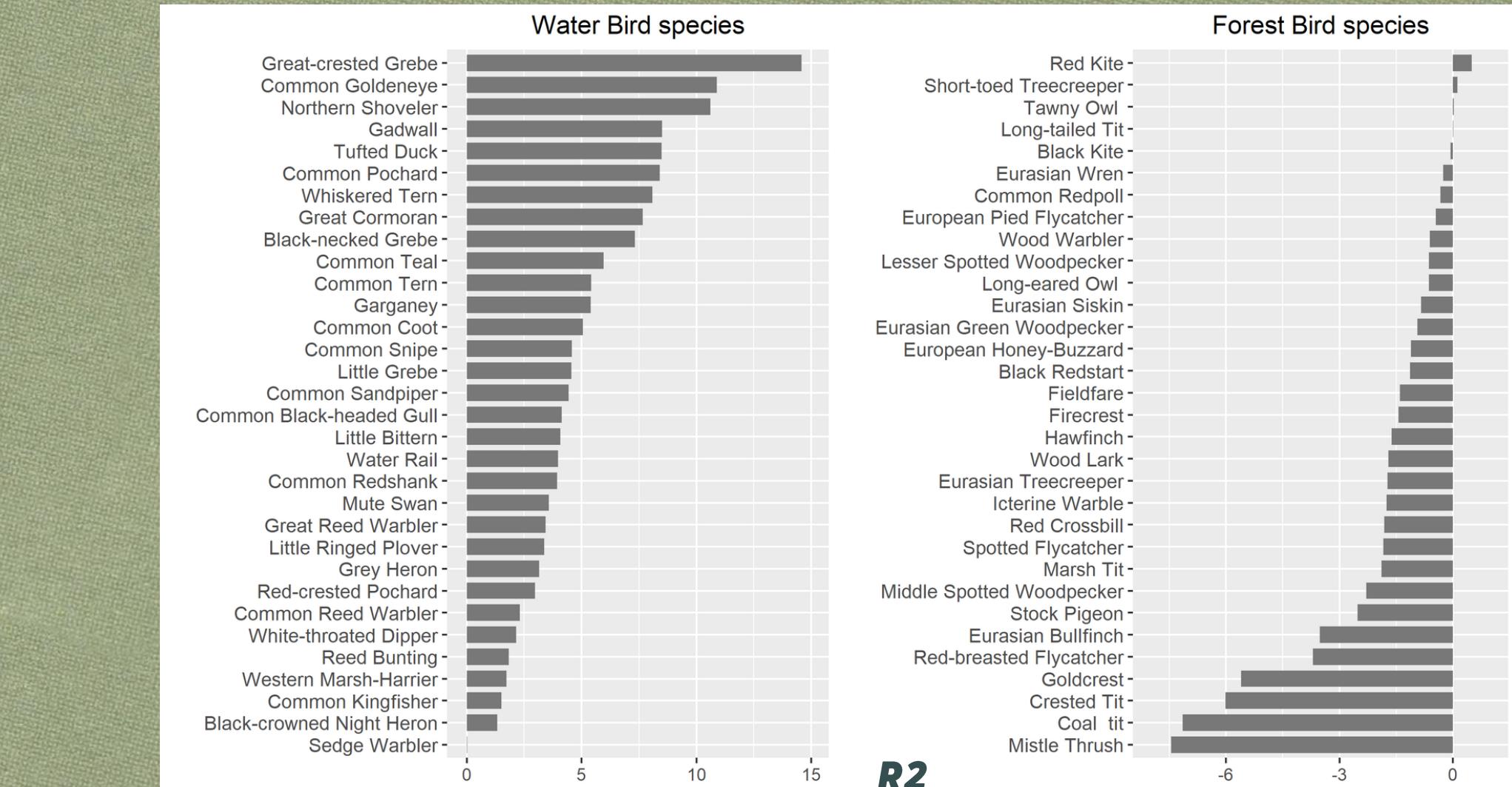
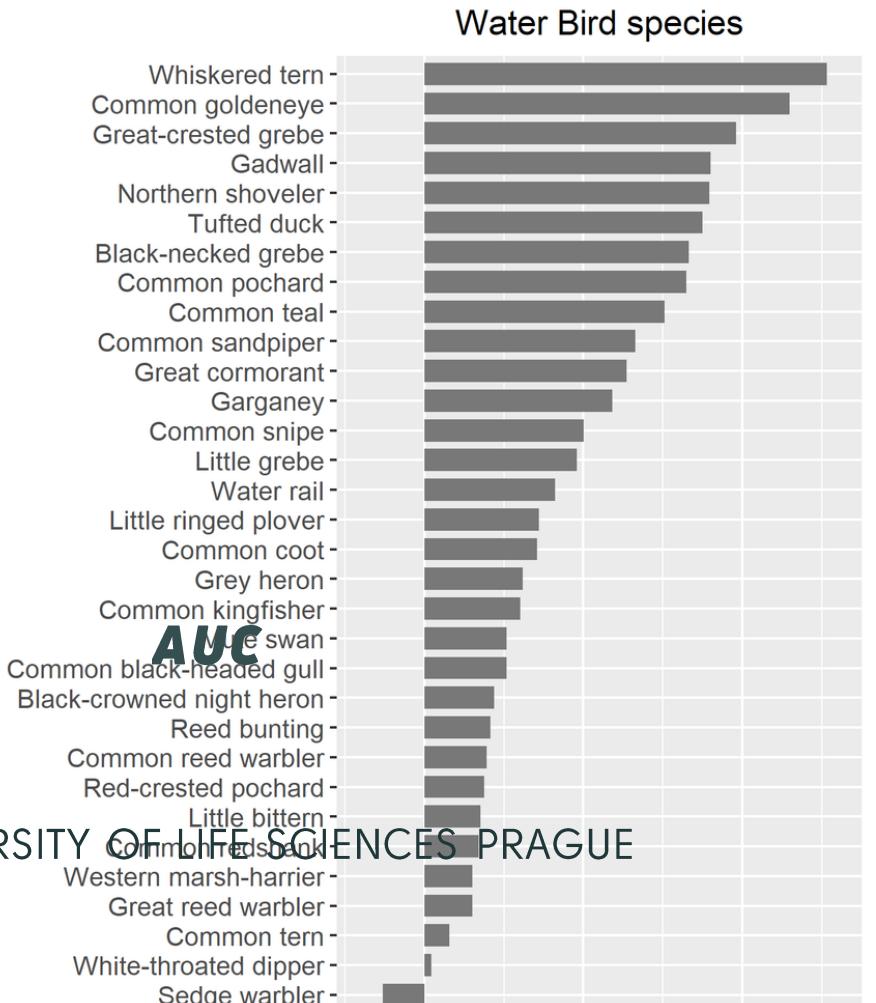
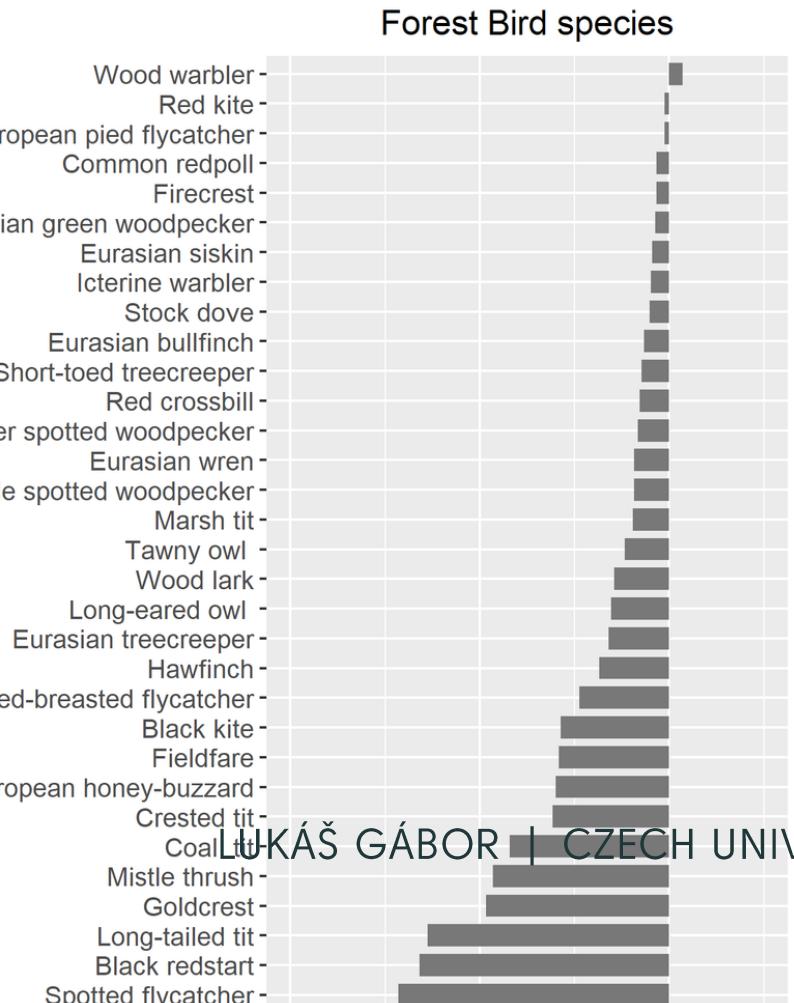
*glm (occurrences ~ area of forest (**continuous**) + temp + prec + agri... )*

*glm (occurrences ~ area of forest(**binary**) + temp + prec + agri... )*



## Model Performance ->AUC / R2

# Results



R2

AUC

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# Conclusions

- The importance of selecting meaningful habitat variables cannot be overstated.
- The relevance of our study is beyond simple species distribution models.
- Epidemiology, metacommunity ecology...
- Conservation relevance cannot be overstated.



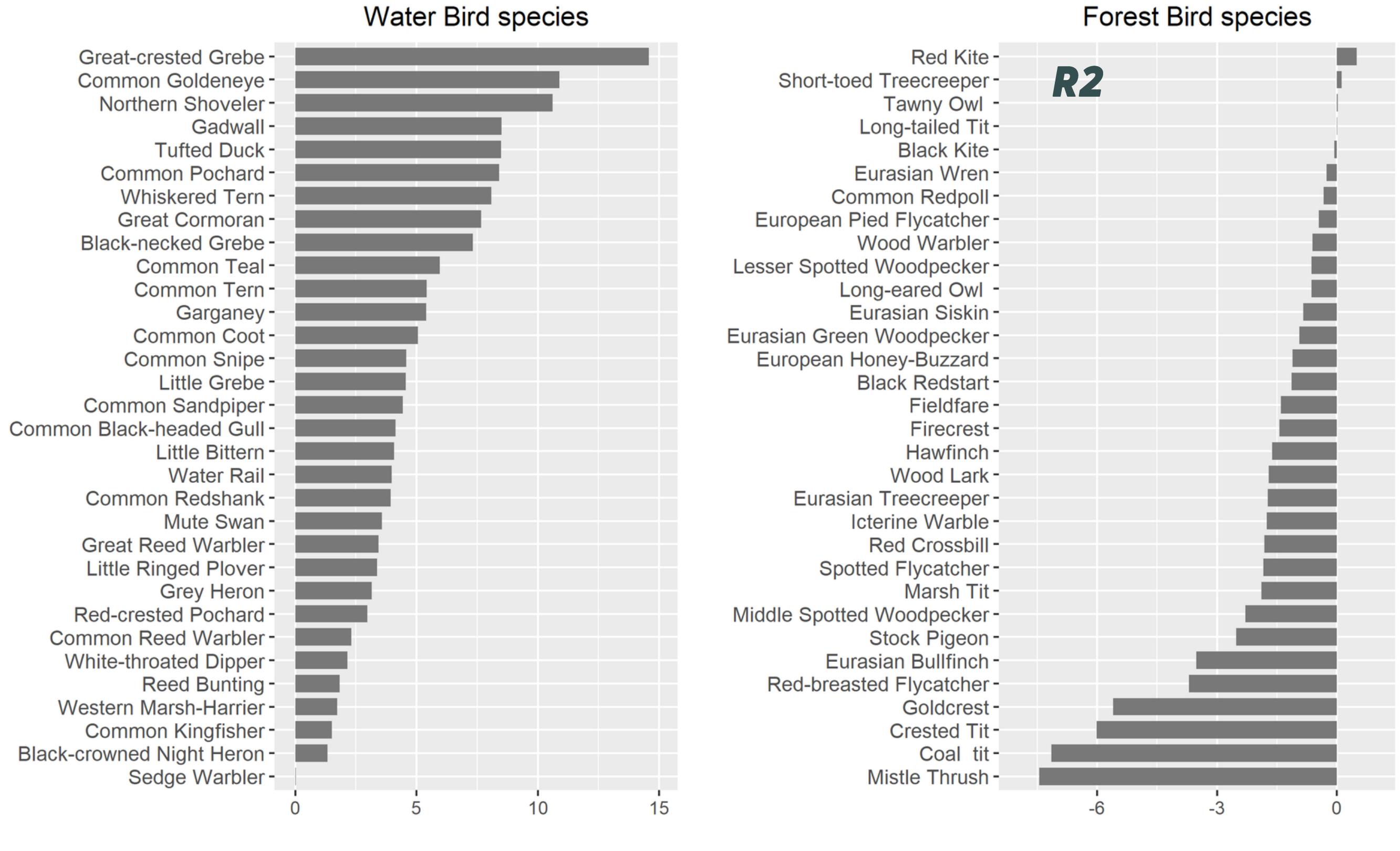
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Thank you

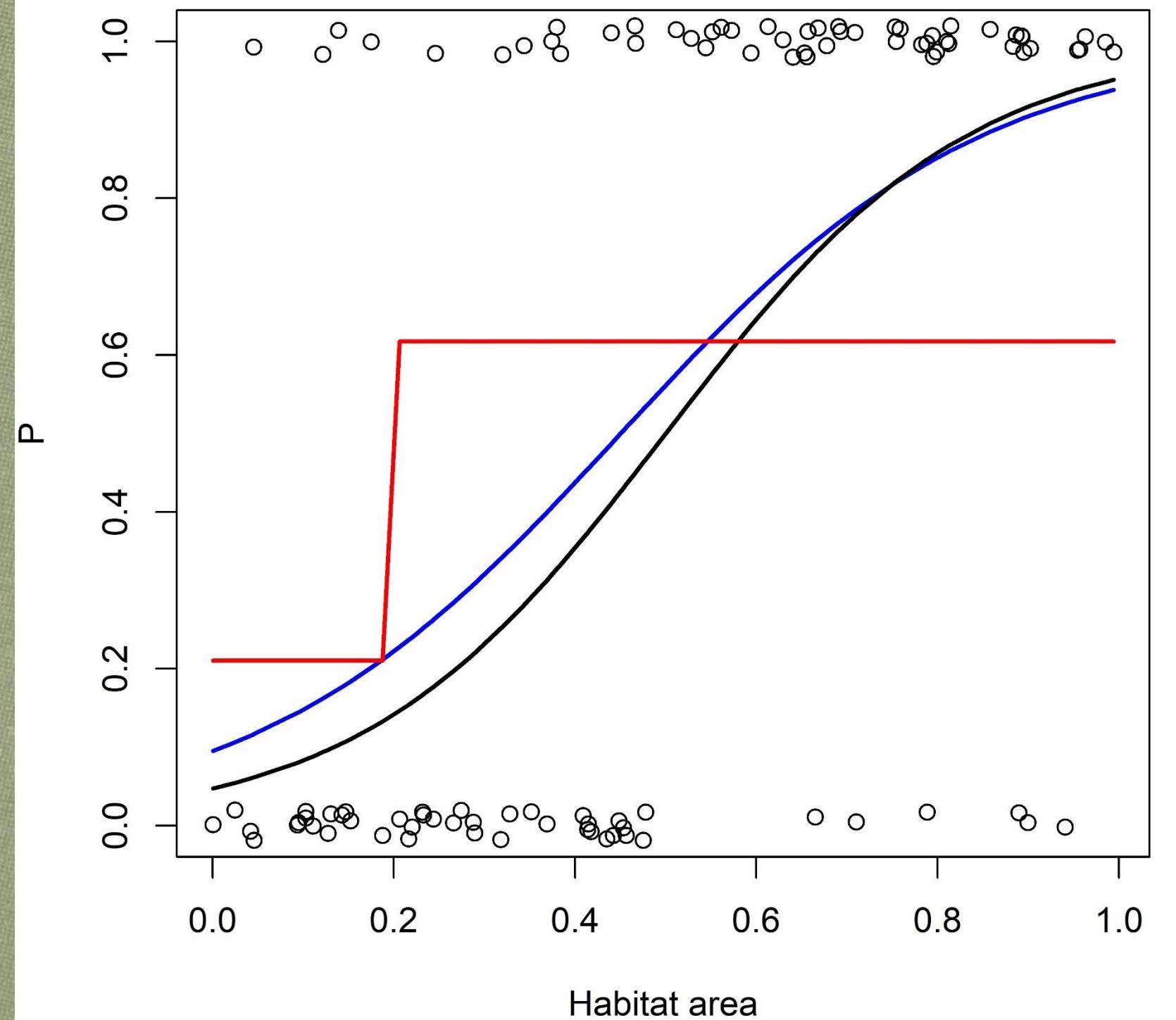


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# Results



**(a) P depends habitat area**



**(b) P depends on habitat pres/abs**

