

Examination of extinction risk  
and factors linked to local extinction in  
*Parahucho perryi*,  
with focus on the species range in Japan

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Hokkaido University

# INTRODUCTION

Sakhalin taimen (*Parahucho perryi*)

Russian Far East and Japan

Maximum record >130 cm, >21 kg

Regionally anadromous

Iteroparous

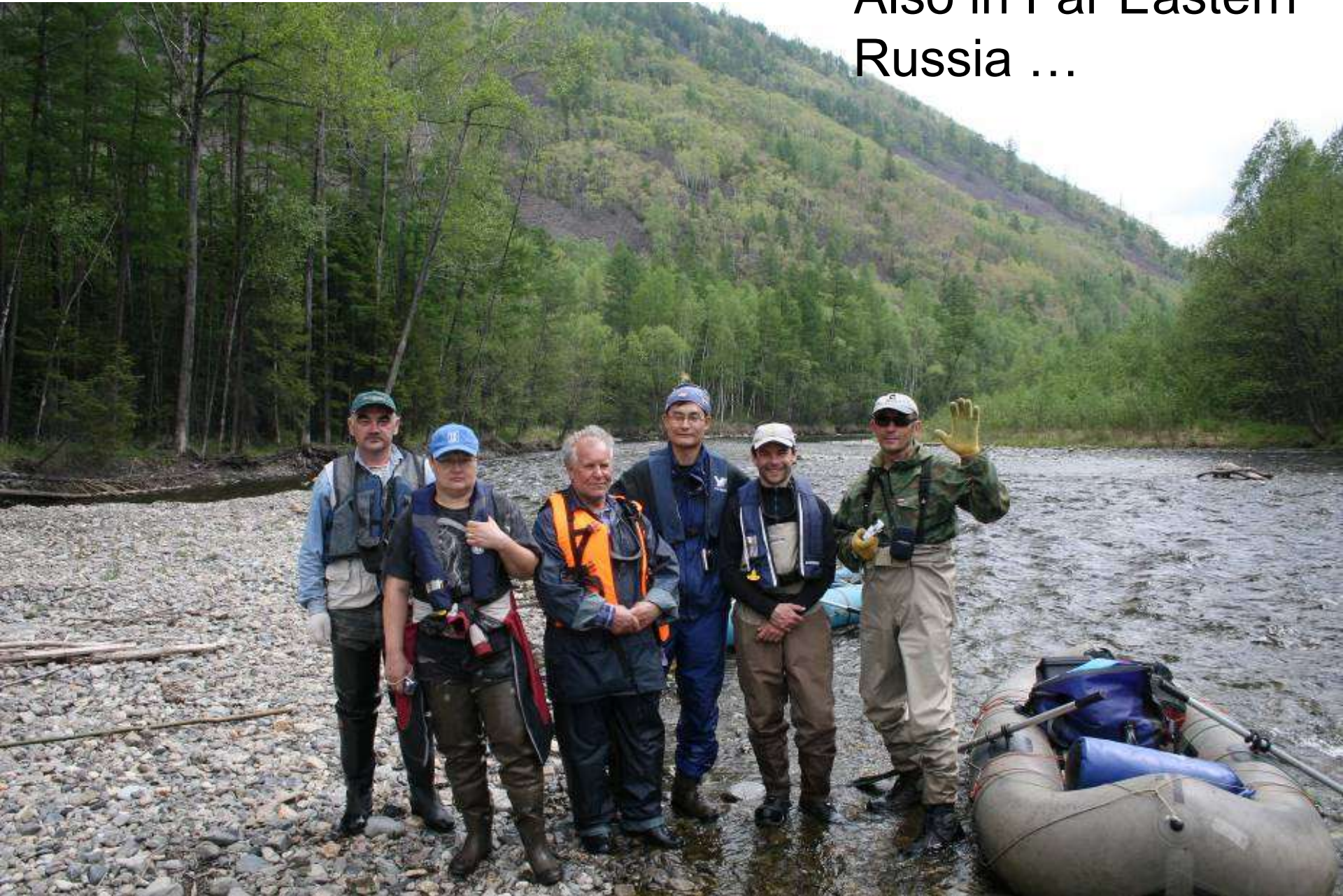
Critically Endangered,  
IUCN (2006)



Collaborative  
Research by US,  
Russian and  
Japanese  
Researchers in  
Hokkaido, Japan



Also in Far Eastern  
Russia ...

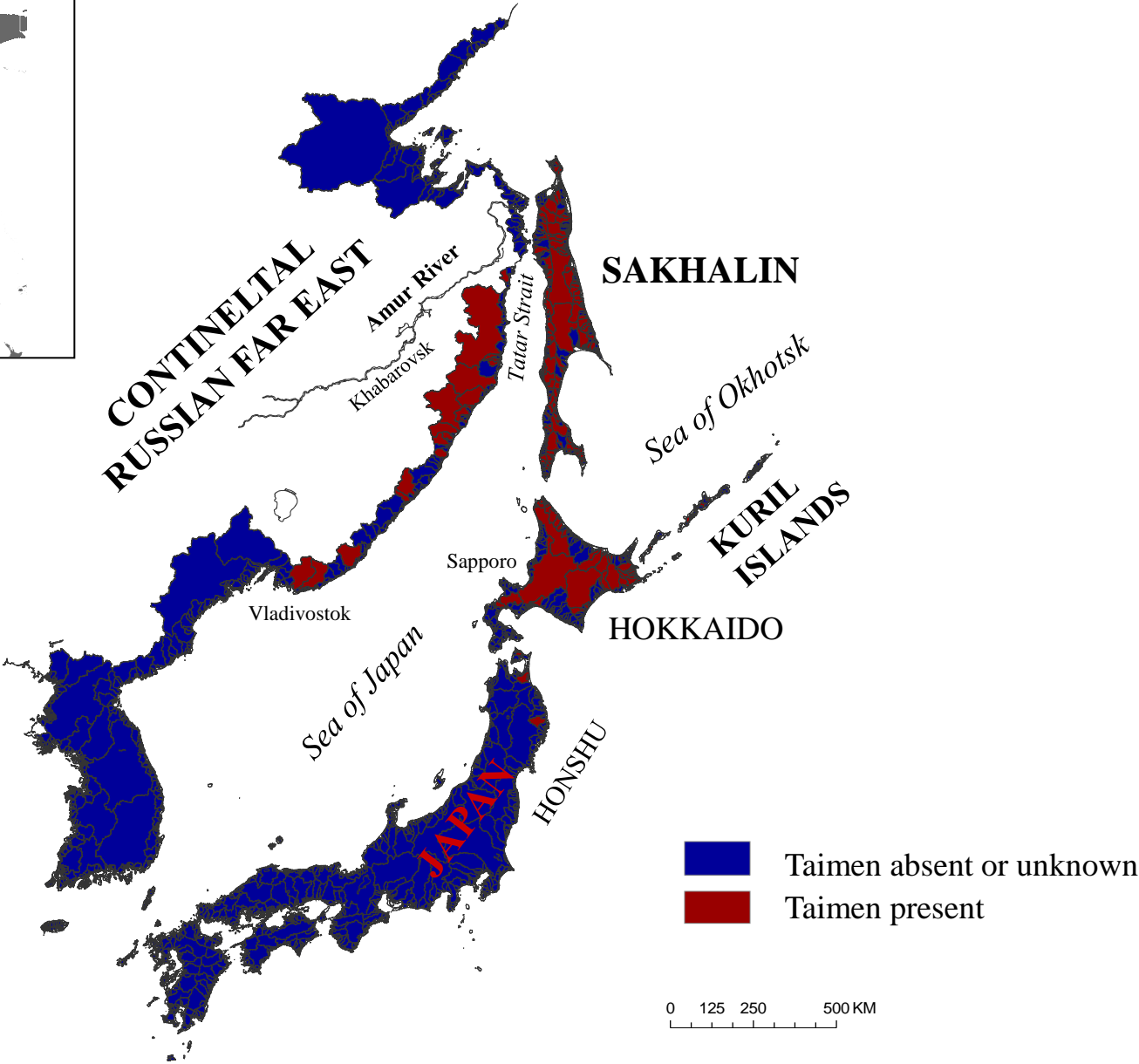
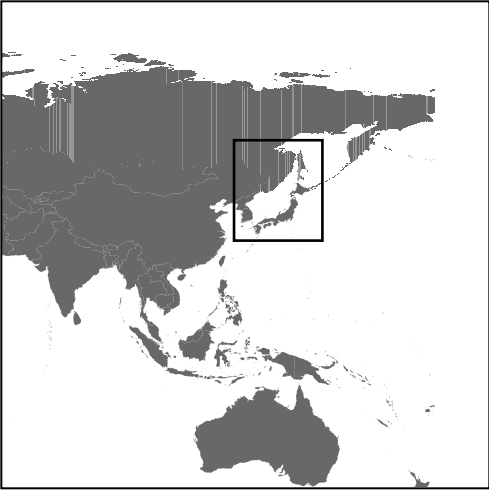


# OBJECTIVES

1. To model and reconstruct the historical distribution of Sakhalin taimen based on observed presence and absence data by river basin
2. To model causes for local extinction of Sakhalin taimen subpopulations in Japan

# Modelling Historical Distribution

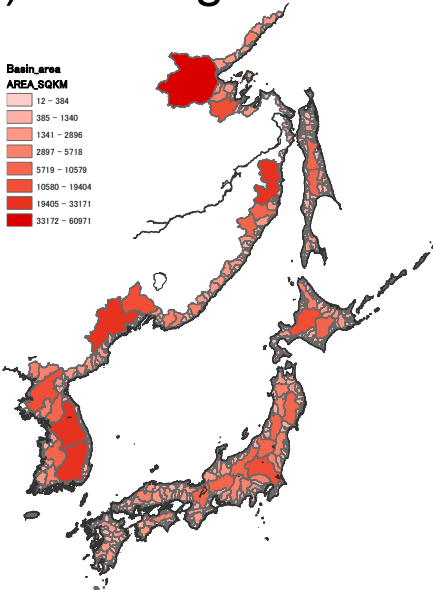
# Historical Records of Sakhalin Taimen Occurrence



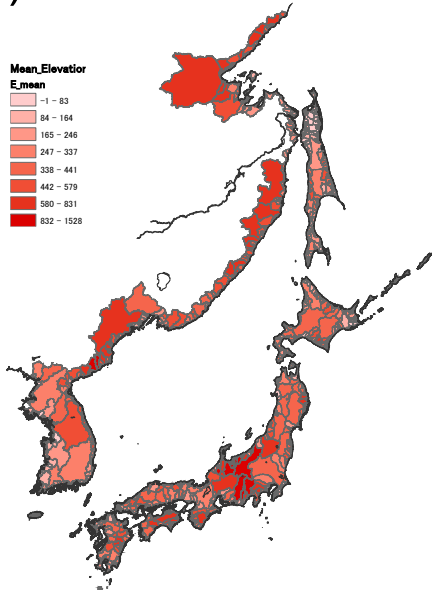
# Taimen Records by Region and River Basin

<i>Occurrence</i>	<i>Sakhalin</i>	<i>CRFE</i>	<i>Japan</i>	<i>Kurils</i>	<i>Total</i>
Present	110	20	46	6	182
Absent	93	640	794	0	1527
Unknown	177	218	303	86	784
Total	380	878	1143	92	2493

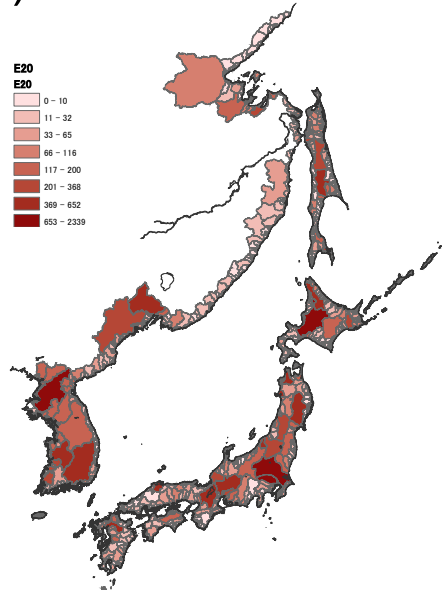
### 1) Drainage Area



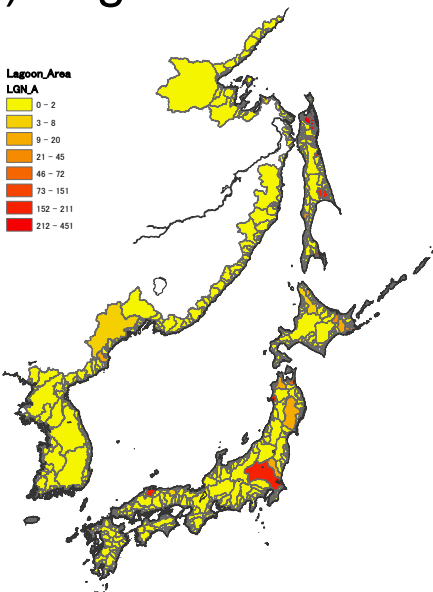
### 2) Mean Elevation



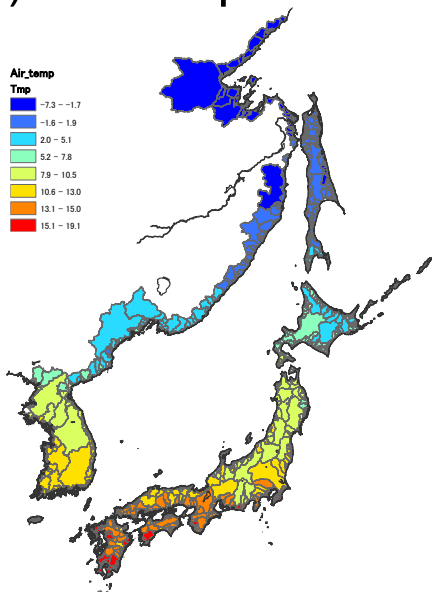
### 3) Area < 20 m a.s.l.



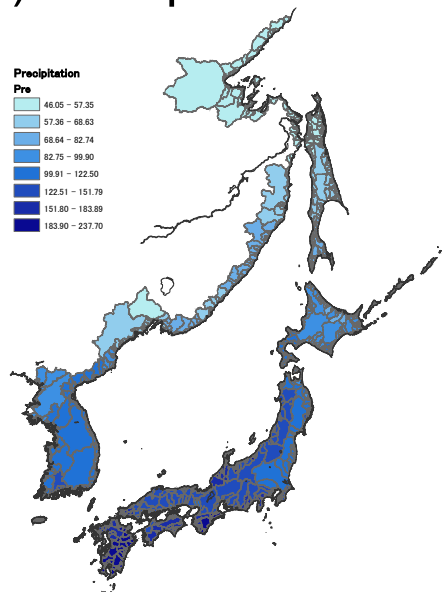
### 4) Lagoon Area



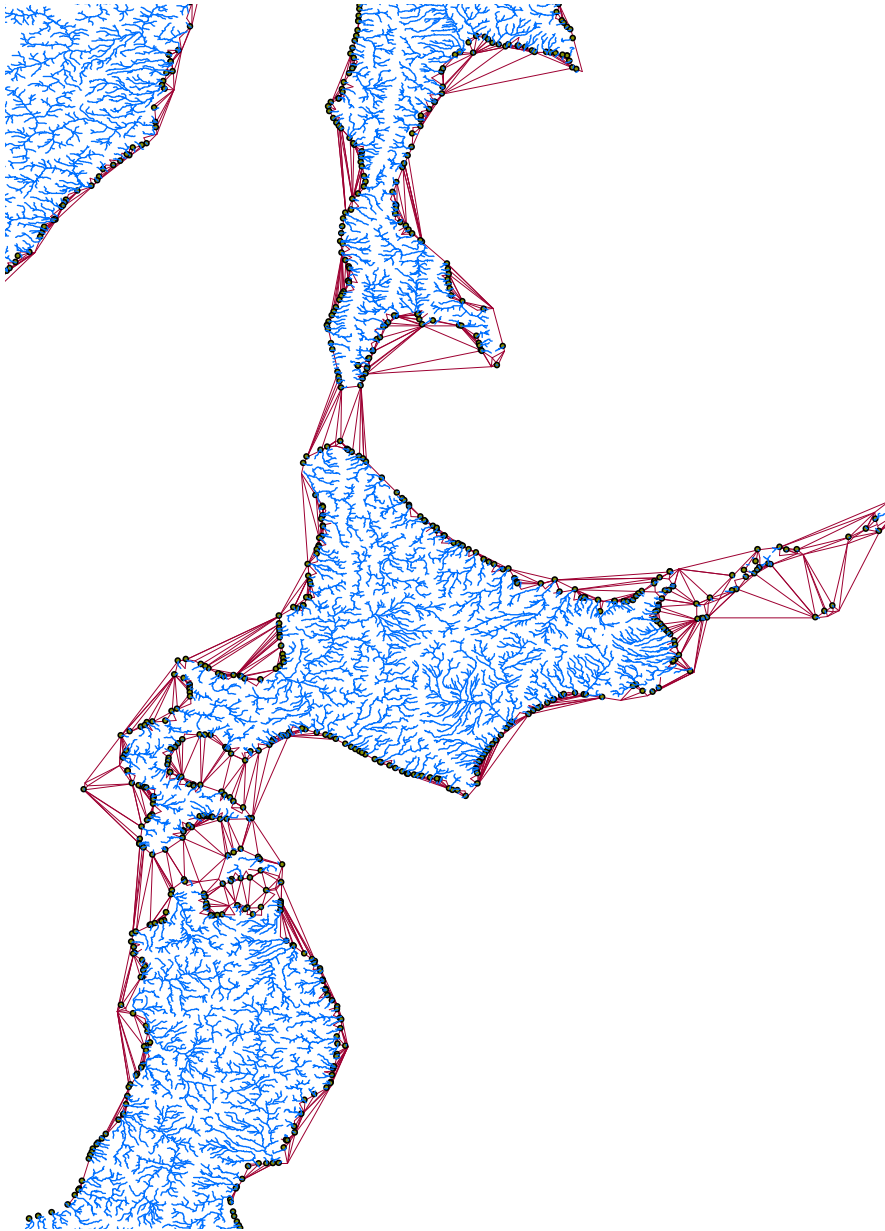
### 5) Air Temperature



### 6) Precipitation



## 7) Spatial Autocorrelation

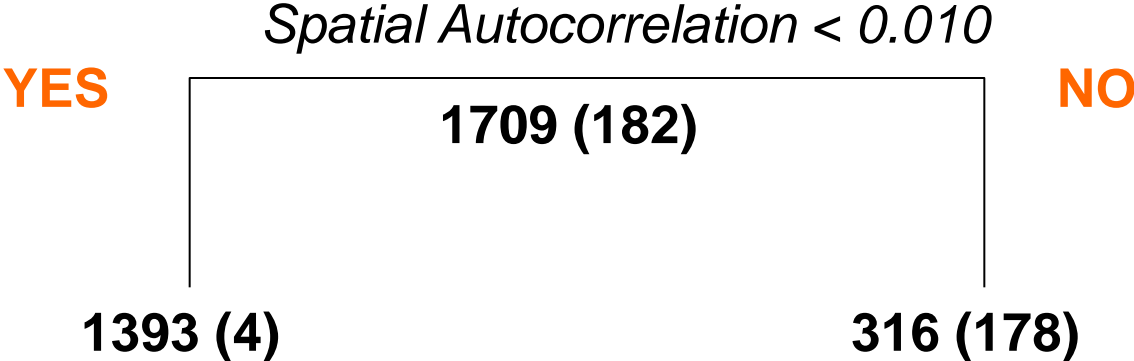


$$autocor_f = \sum_{j=1}^{n-1} w_{ij} y_j$$

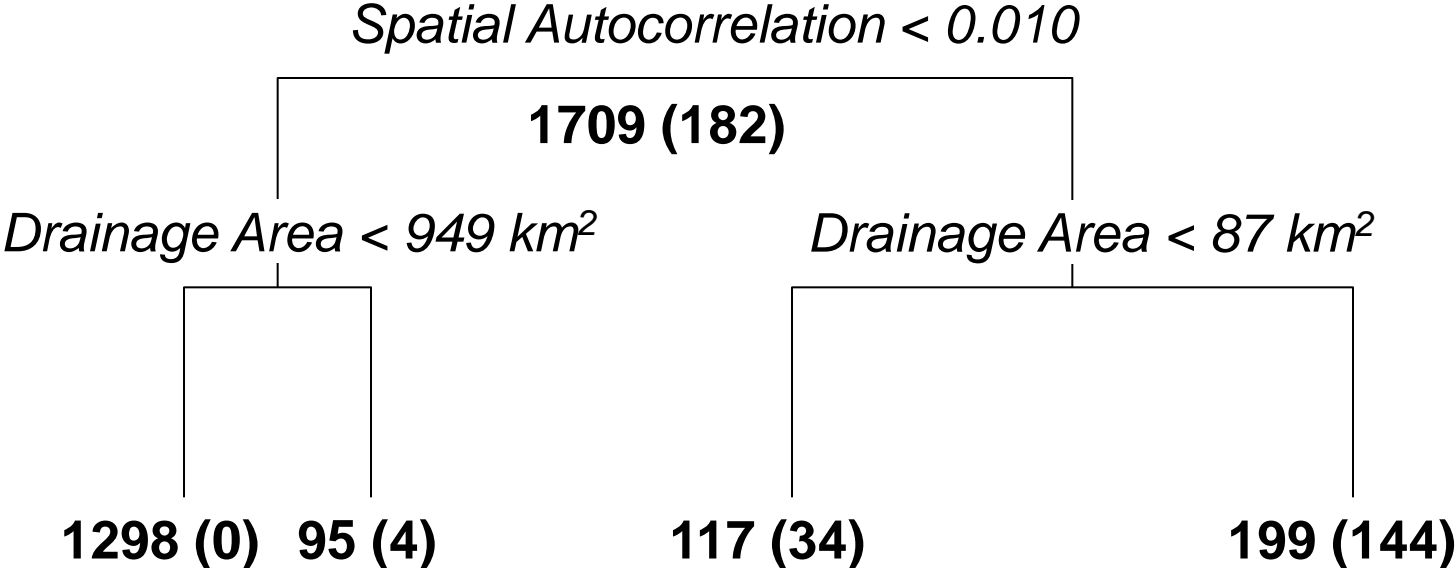
$$w_{ij} = \frac{1}{l_{ij}}$$

$$y_j = \begin{cases} 0 \\ 1 \end{cases}$$

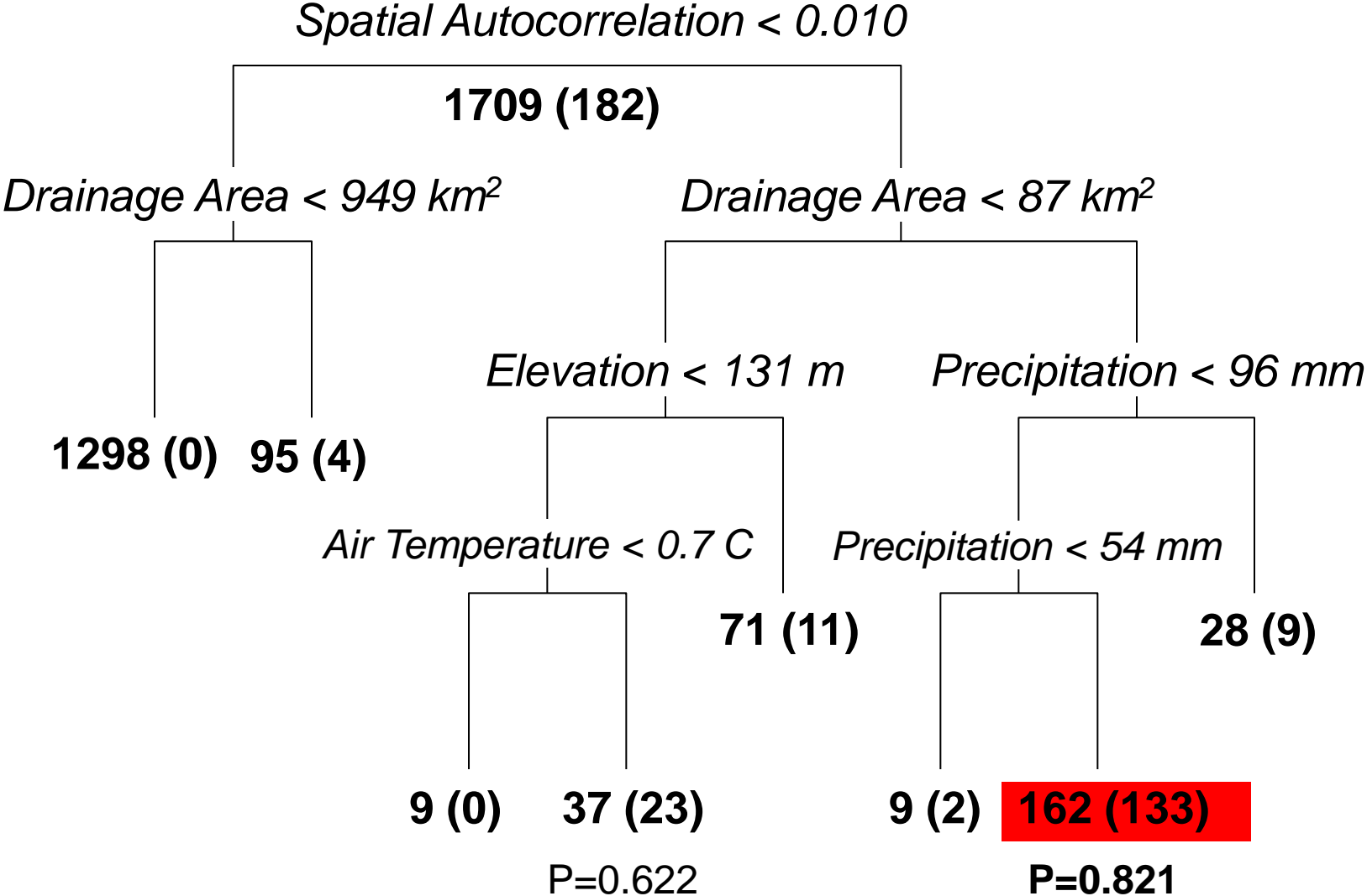
# Historical Taimen Distribution Model



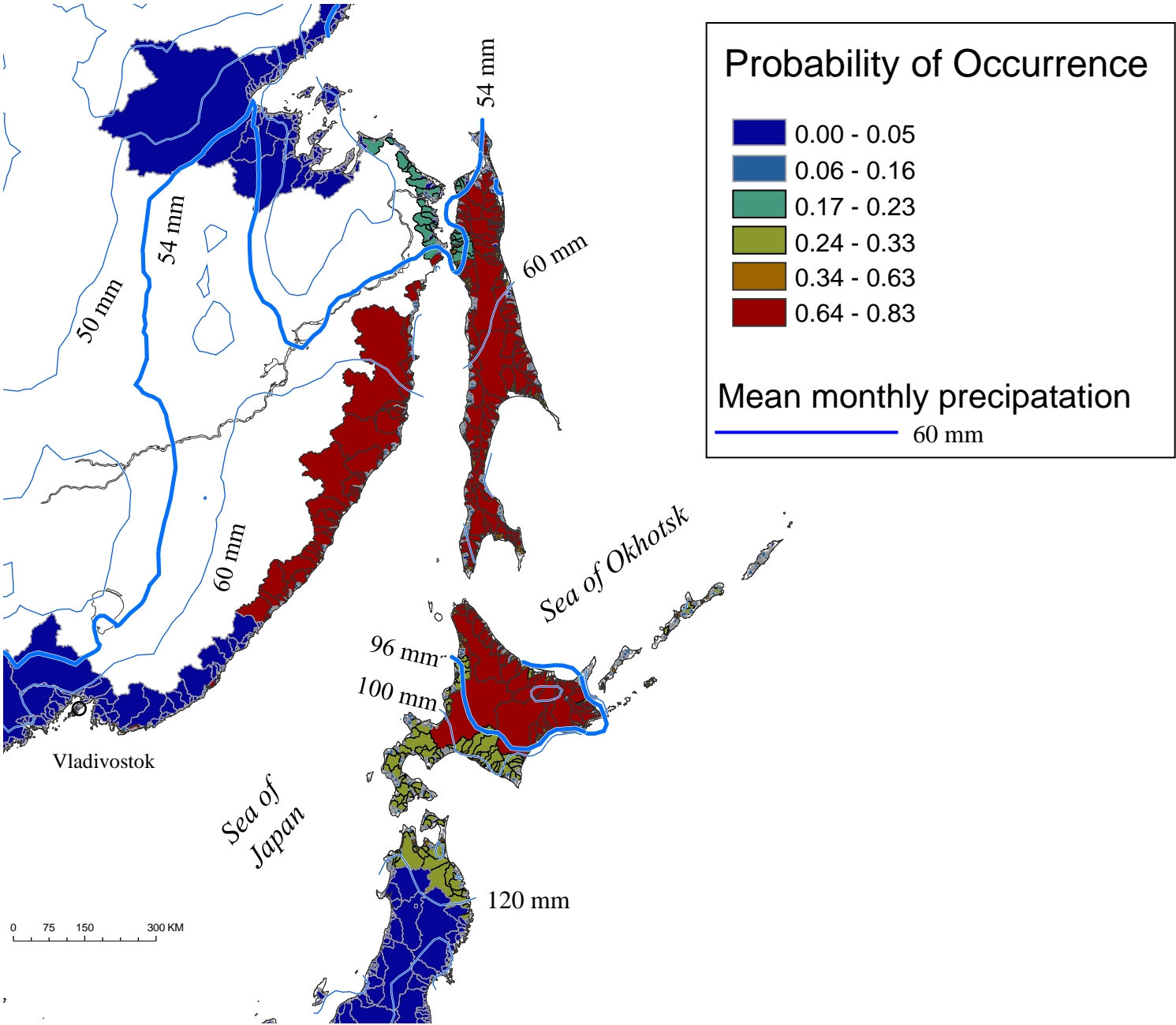
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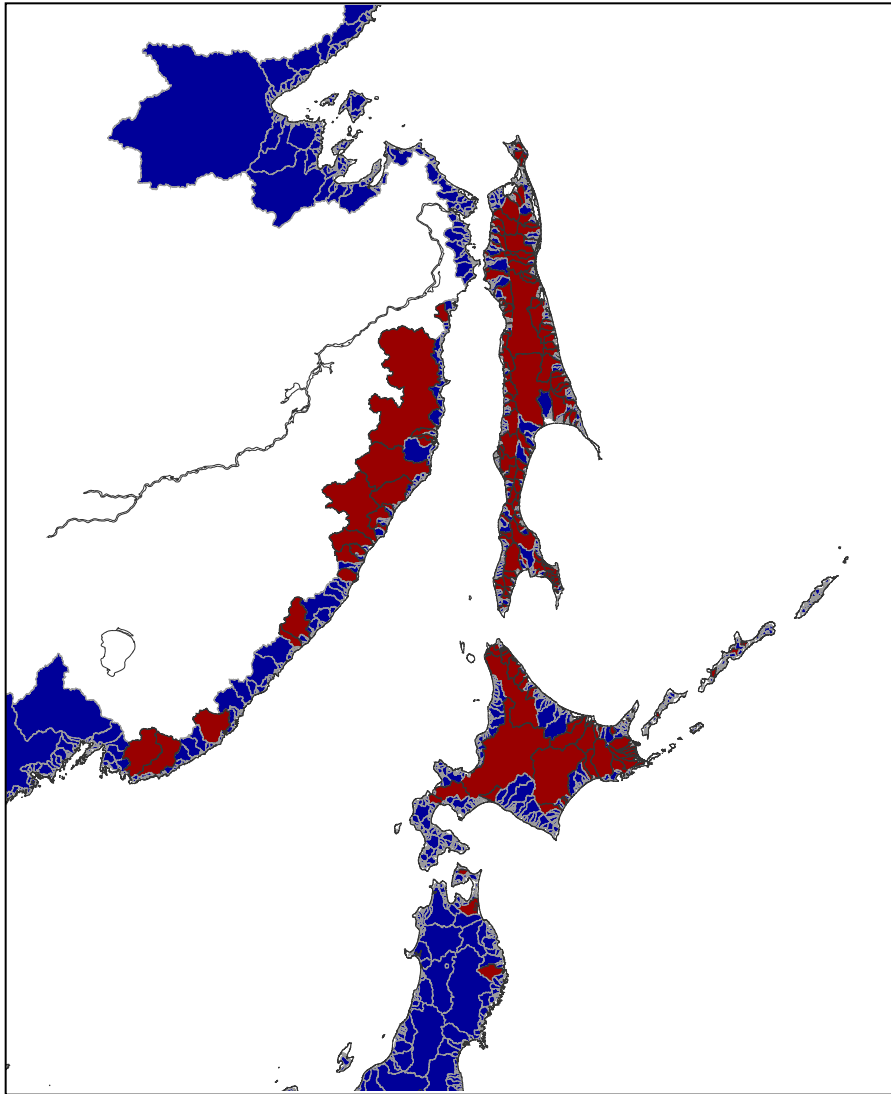
# Historical Taimen Distribution Model



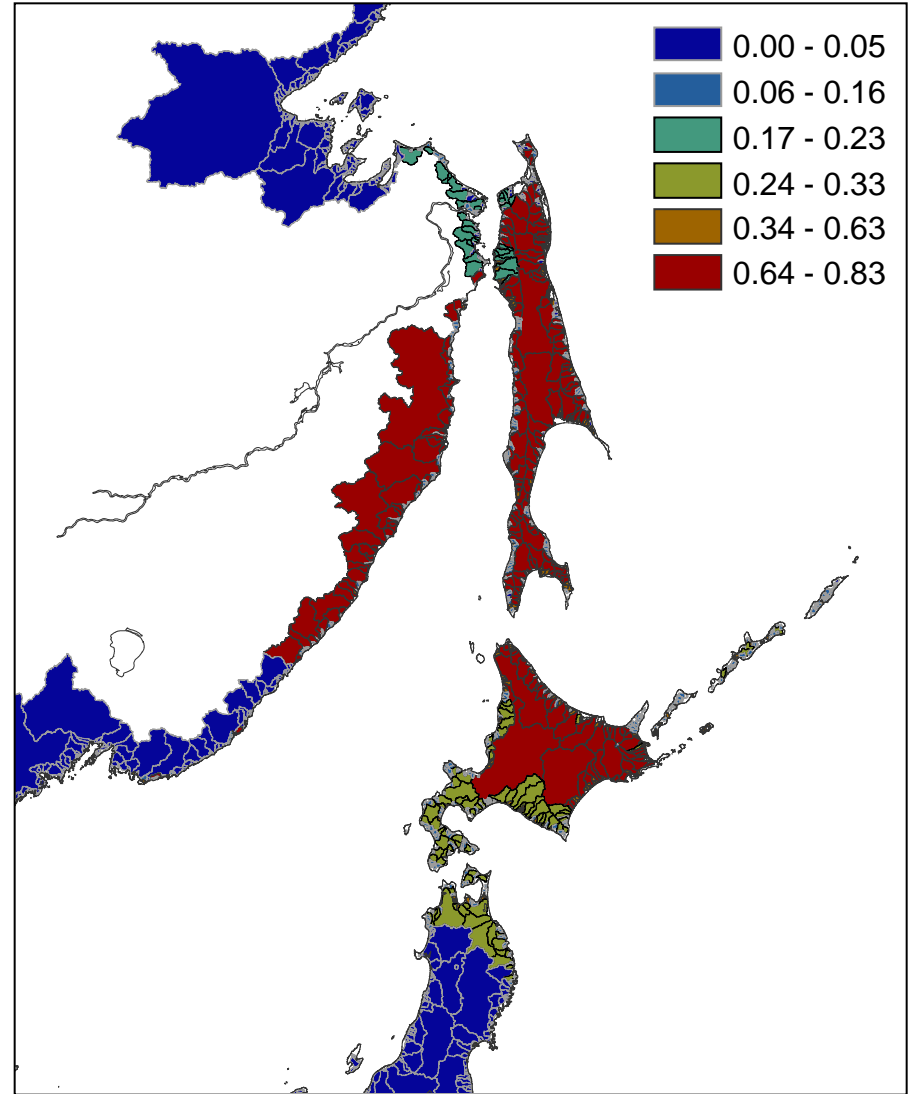
# Predicted Historical Distribution



# Observation



# Prediction



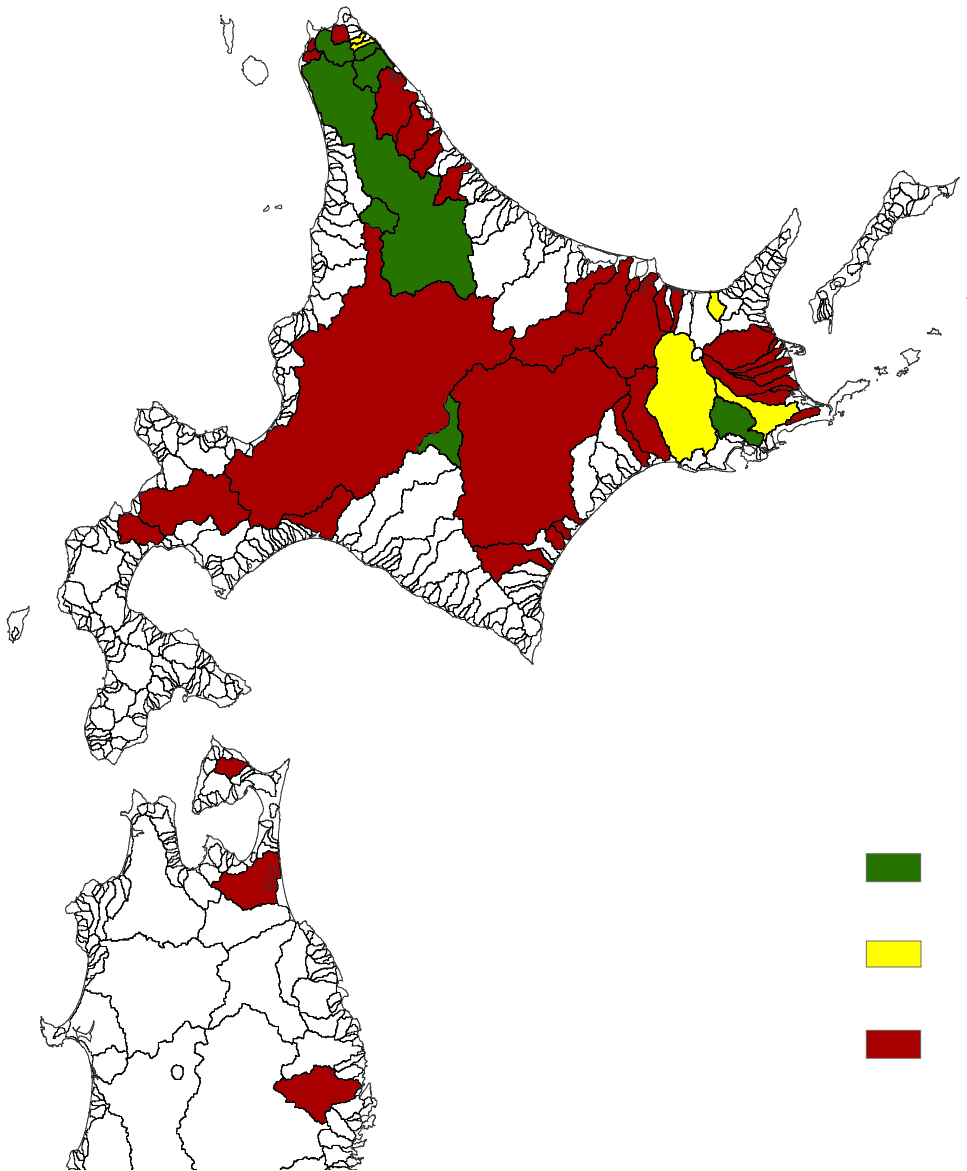
## Brief summary so far...

- 1) Distribution of Sakhalin taimen is highly contagious.
- 2) The species tends to occur in larger drainages.
- 3) The species might have had wider distribution in the past, especially in the northern part of Japan.

# Modelling Local Extinction

# Status of Sakhalin Taimen Subpopulations in Japan

“**Subpopulations** are defined as geographically distinct groups in the population between which there is little demographic or genetic exchange.” (IUCN 2001)



1 subpopulation = 1 river drainage

- Stable subpopulations (7)
- Endangered subpopulations (5)
- Extinct subpopulations (36)

## Extant Population Model

- Stable subpopulations (7)
- Endangered subpopulations (5)

VS.

- Extinct subpopulations (36)

## Stable Population Model

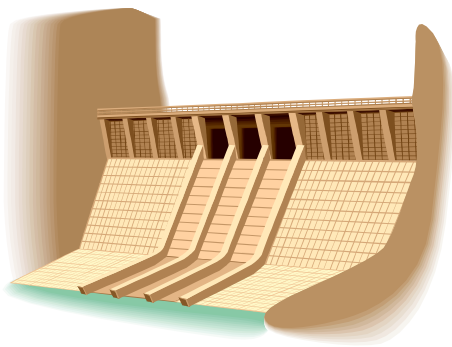
- Stable subpopulations (7)

VS.

- Endangered subpopulations (5)
- Extinct subpopulations (36)

# Possible Factors Explaining Extinctions

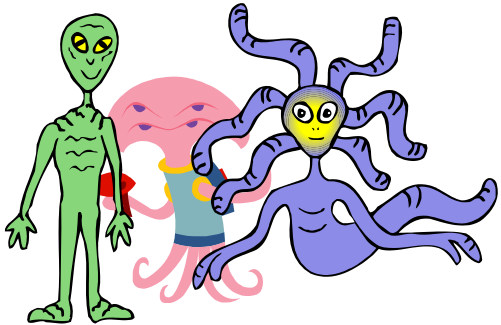
Number of dams



Human population



Number of alien species



Presence of rainbow trout



Deforestation



Agricultural development



Drainage area

Air temperature

Precipitation


Elevation


Percent lowland

Presence of lagoons


etc.

## Extant Population Model

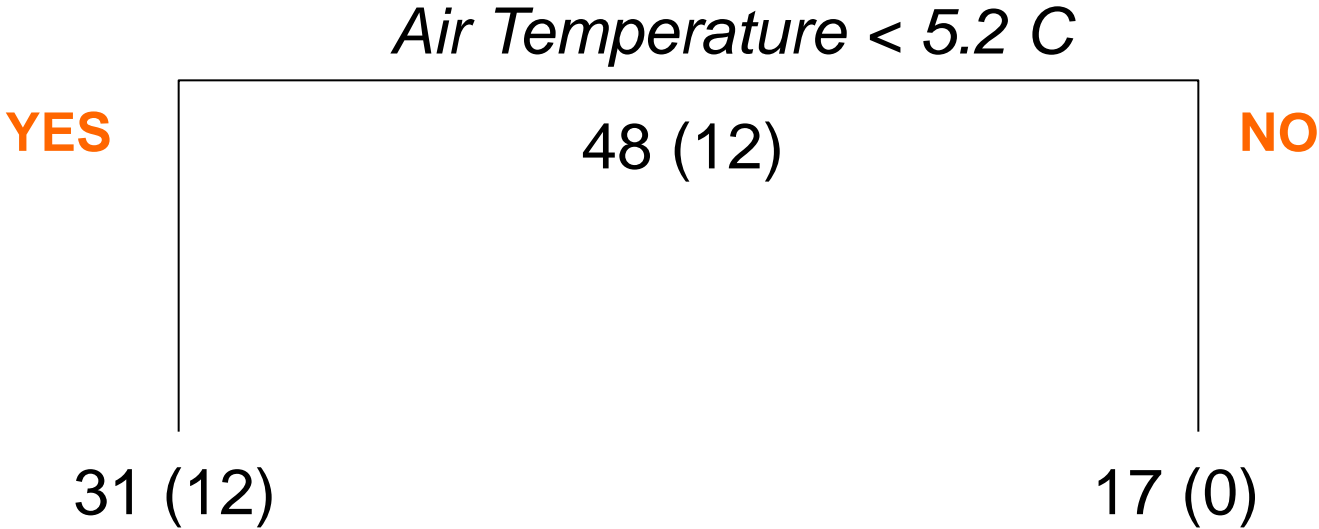
 Stable subpopulations (7)

 Endangered subpopulations (5)

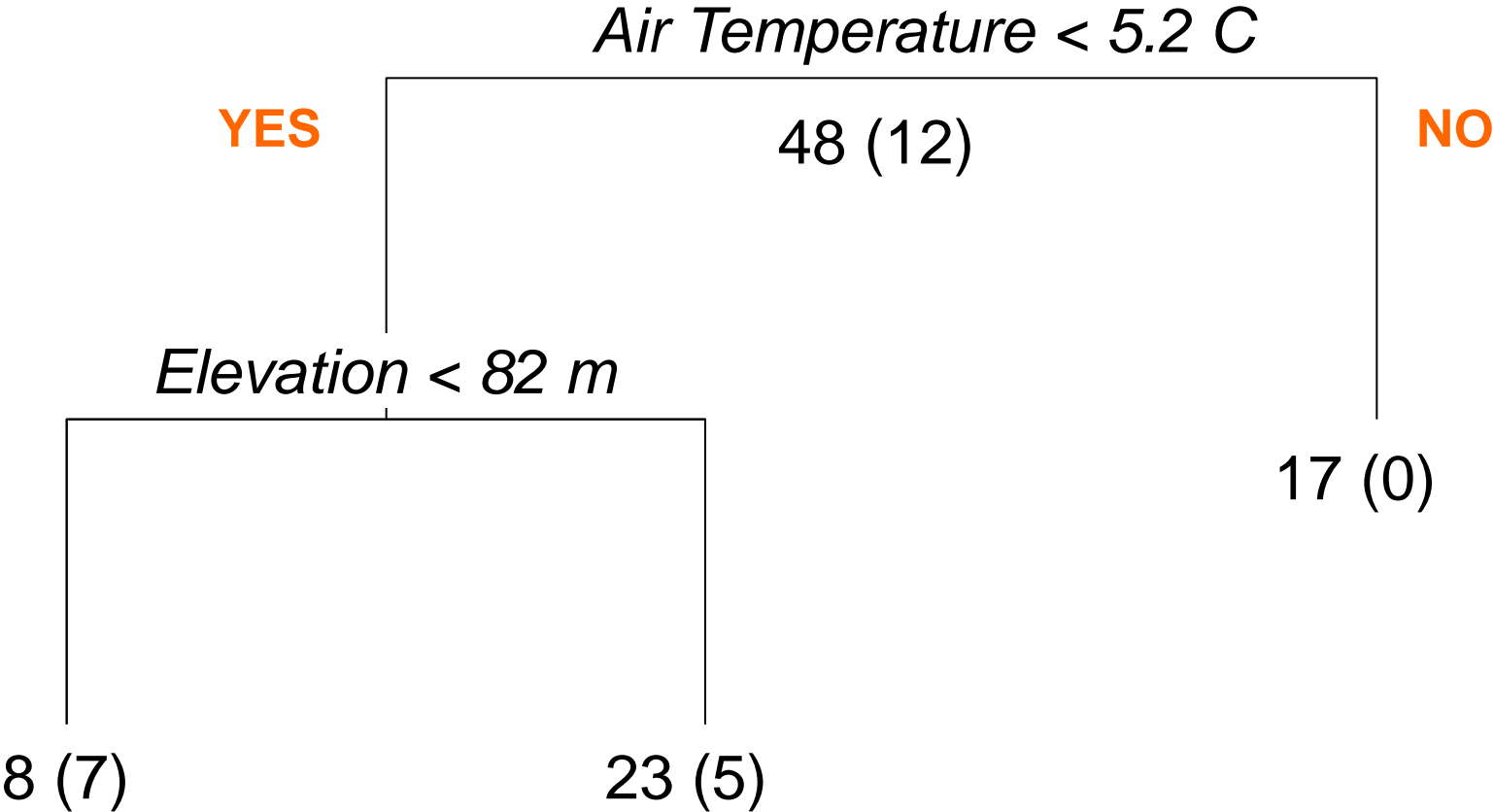
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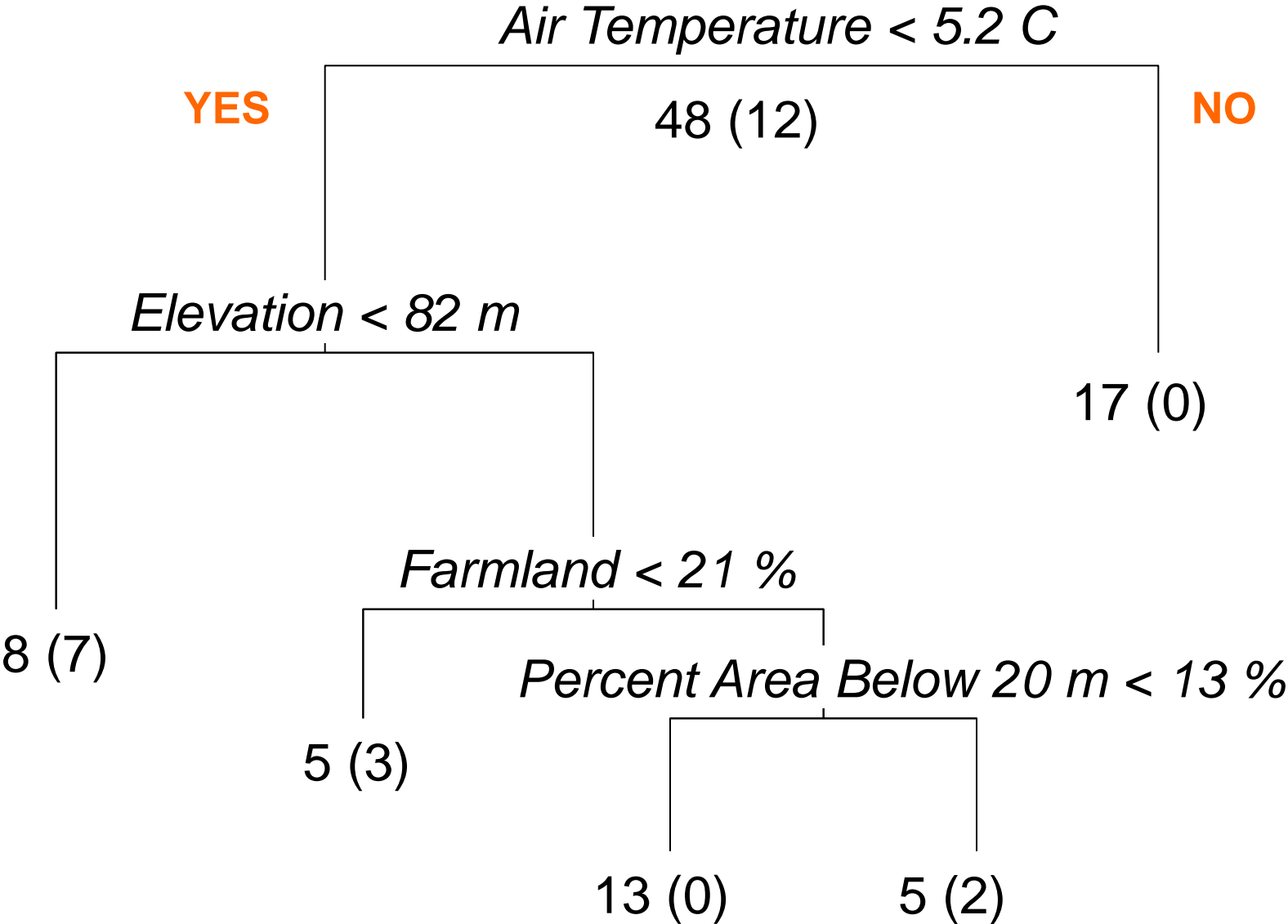
# Extant Population Model: (*Stable + Endangered*) vs. *Extinct*




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## Stable Population Model

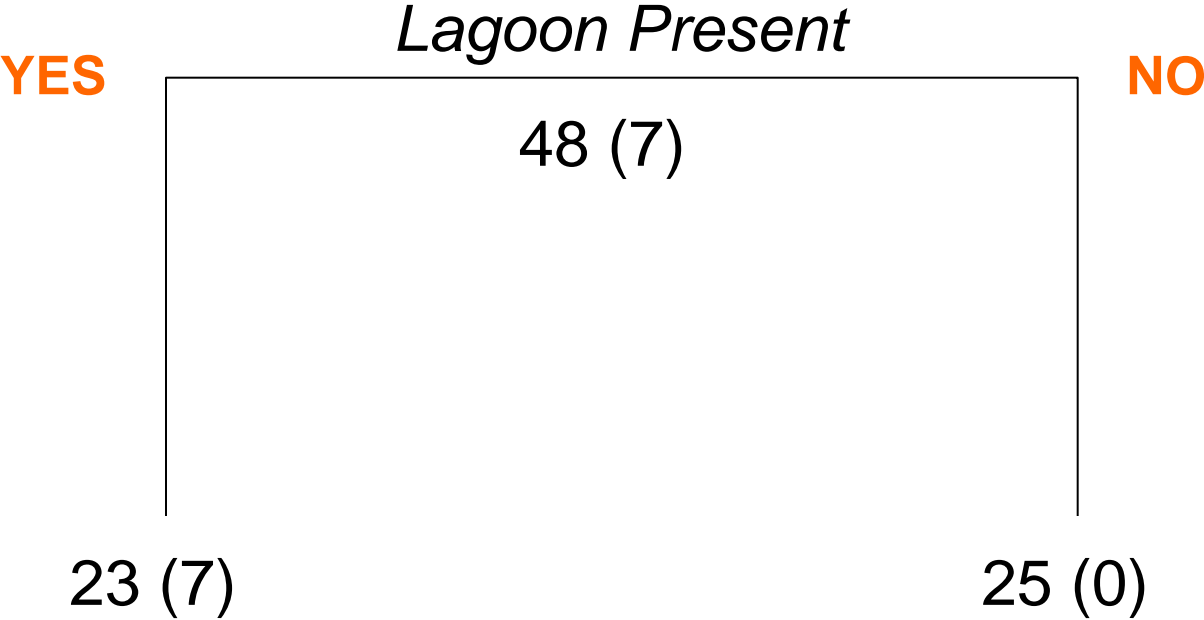
 Stable subpopulations (7)

VS.

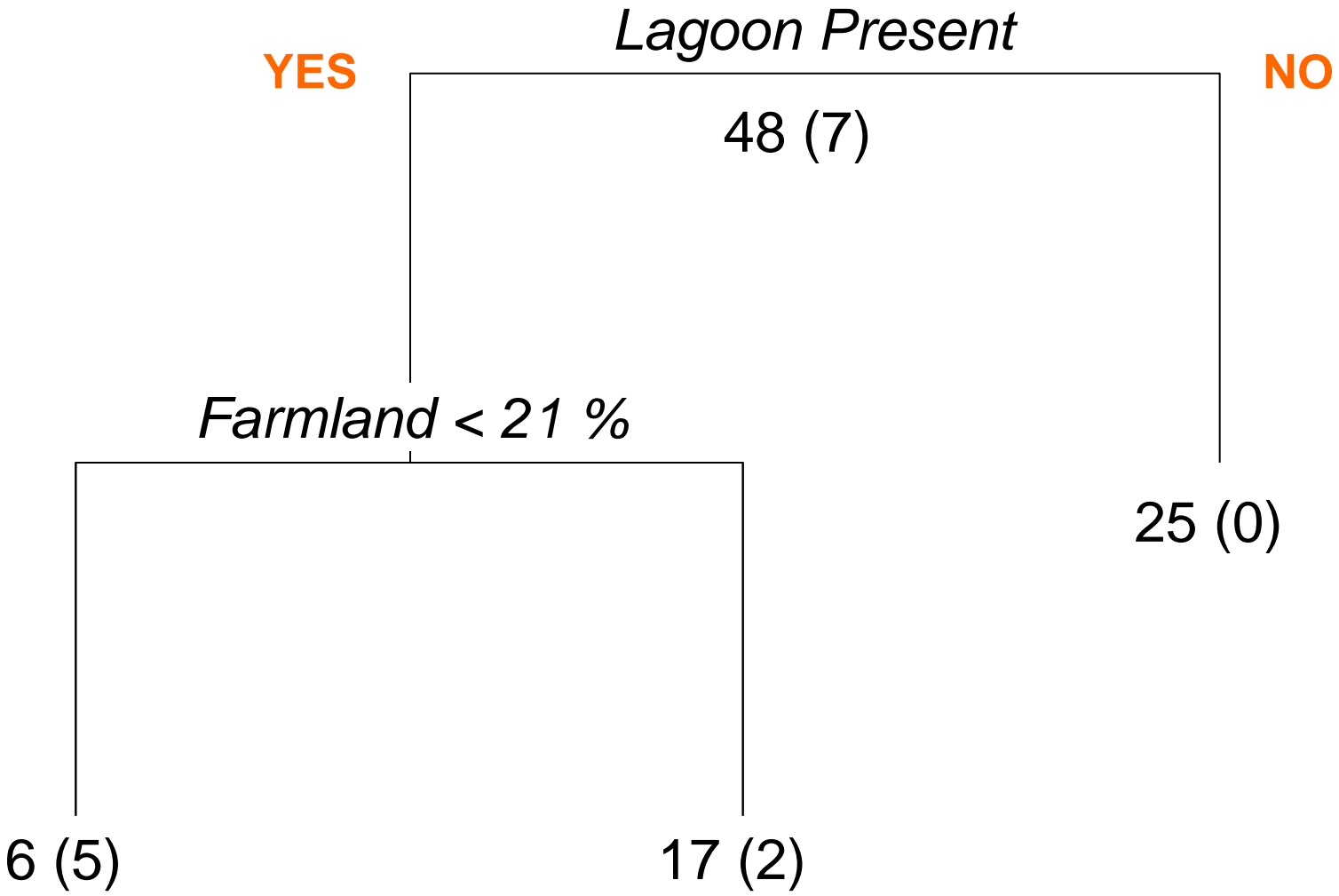
 Endangered subpopulations (5)

 Extinct subpopulations (36)

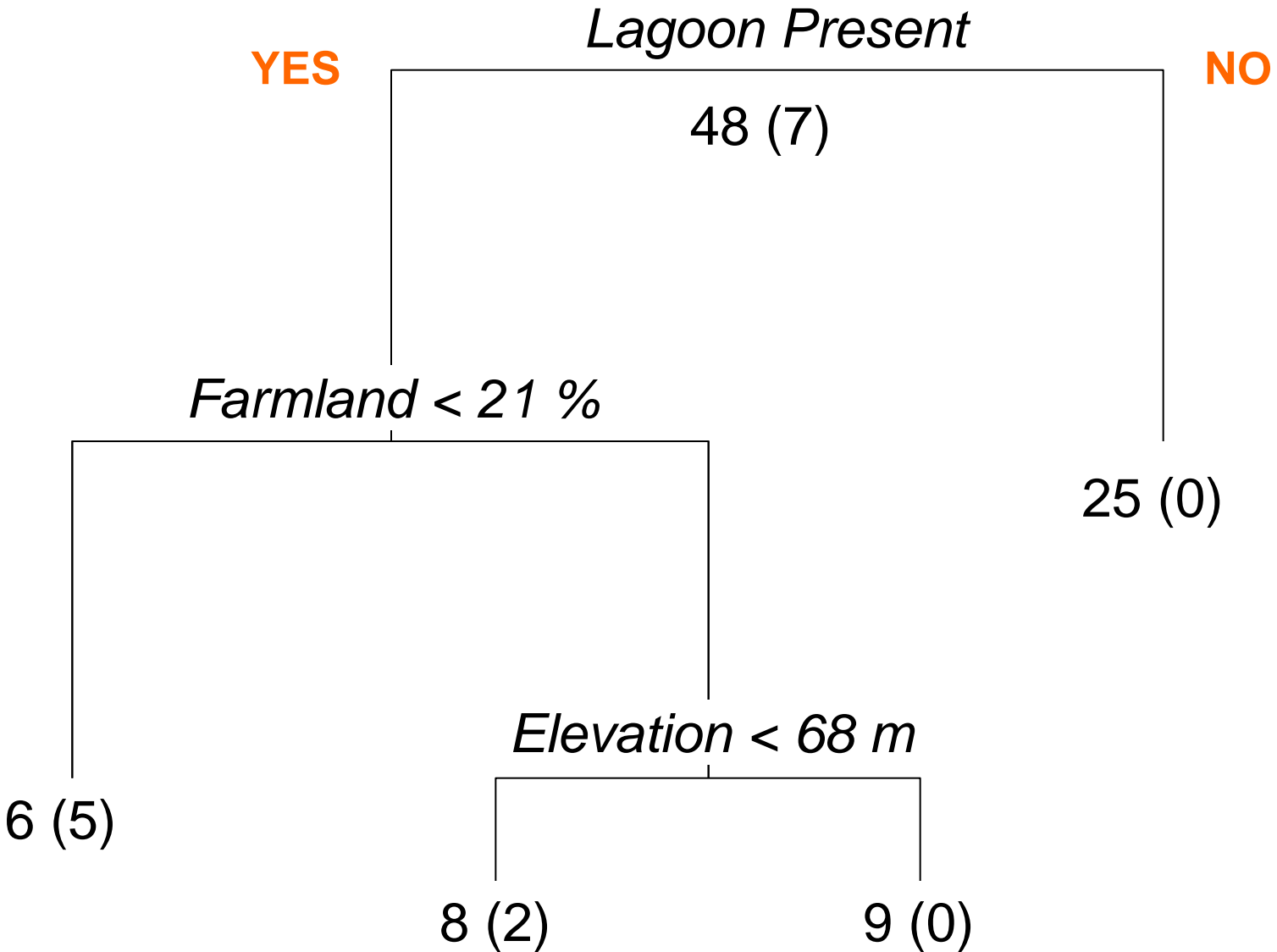
# Stable Population Model: *Stable* vs. (*Endangered* + *Extinct*)



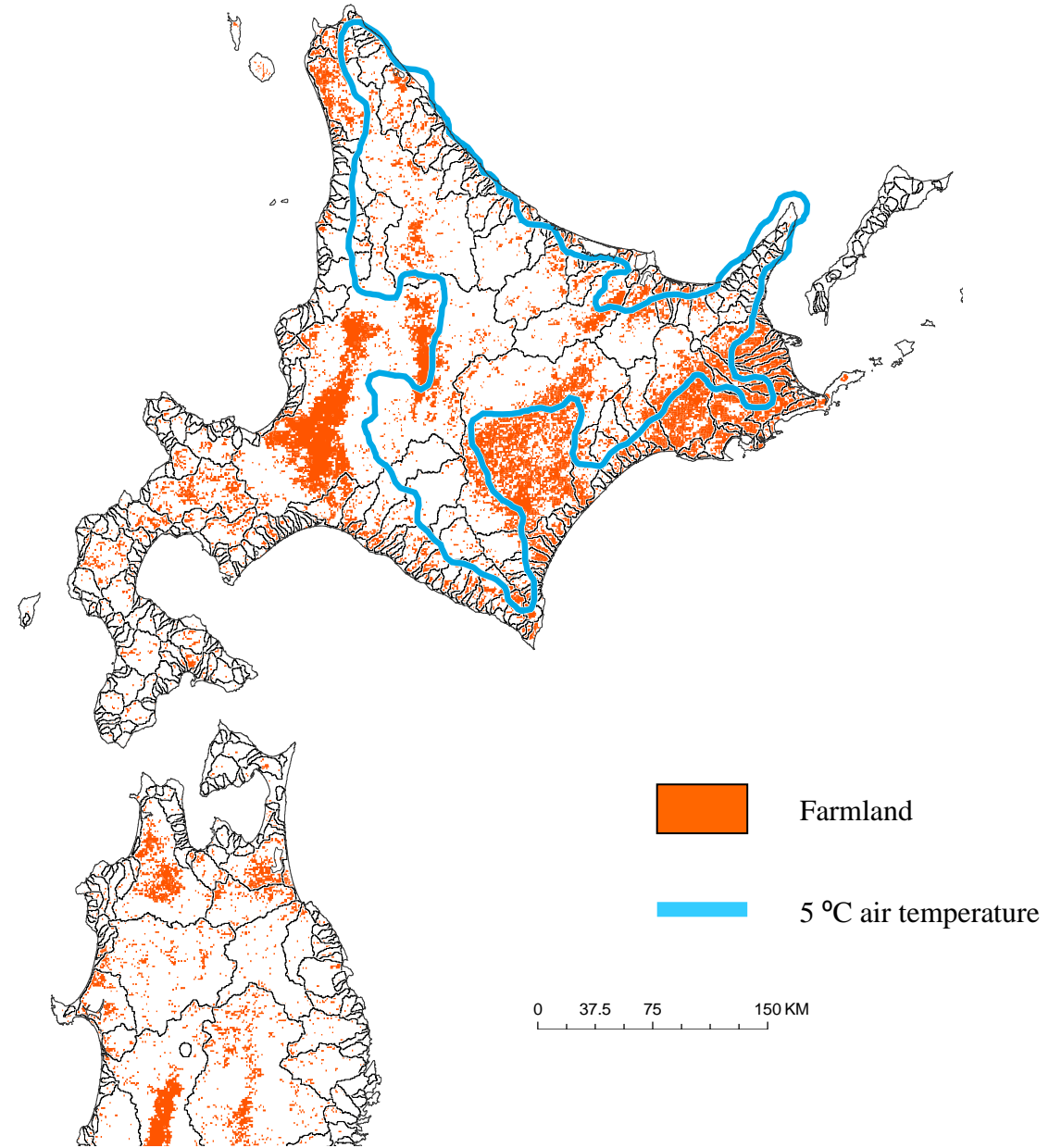
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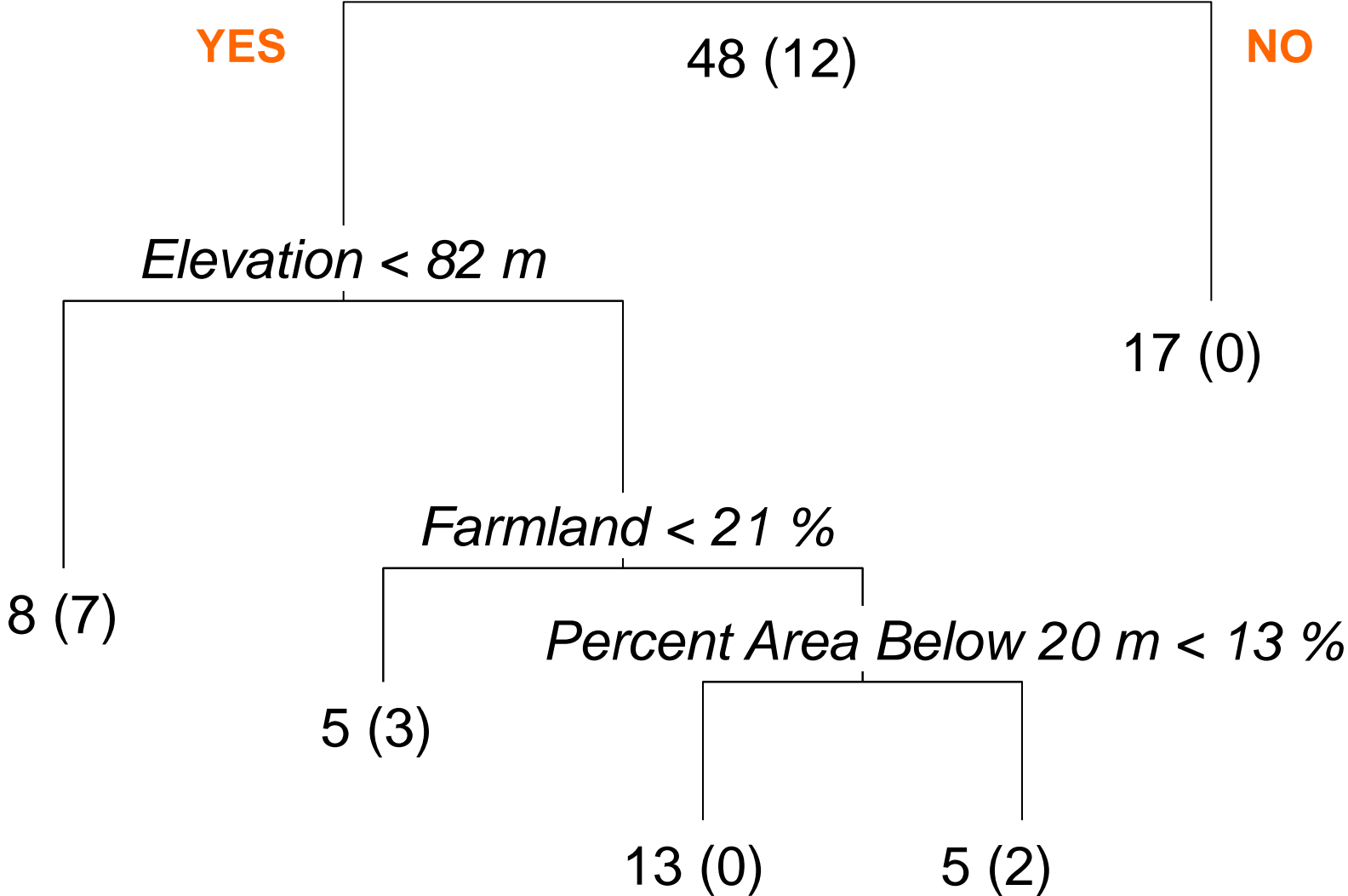
# Farmland Distribution and 5 °C Air Temperature Contour



# Extant Population Model: (*Stable + Endangered*) vs. *Extinct*

*Regional-scale agricultural development is minimal*

~~== Air Temperature < 5.2 C ==~~



**Agricultural development**



**Channelization, bank revetment,  
and construction of dams and weirs**



**Destruction of taimen habitats**

# CONCLUSIONS

- 1) Levels of agricultural development both at regional and watershed scales are an important determinant for the persistence of the Sakhalin taimen subpopulations,
- 2) Drainage basins with lower elevations tend to support extant and stable Sakhalin taimen subpopulations,  
and
- 3) Lagoons play an important role in sustaining stable subpopulations of Sakhalin taimen, perhaps due to their function as rearing and refuge habitats.

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Reconstructing Sakhalin Taimen *Parahucho perryi*  
Historical Distribution and Identifying Causes for  
Local Extinctions

DOI: 10.1080/00028487.2011.544999  
Michio Fukushima, Hiroto Shimazaki, Peter S. Rand & Masahide  
Kaeriyama  
pages 1-13



*Thank you!*