

# Predicting the tree frog distribution for conservation planning in Japan

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Wildlife distribution is regulated by large-scale environment variables but often disturbed by temporal environment changes. In planning habitat conservation, potential habitats must be considered by elucidating relationships between large-scale environment variables and real distribution. Species-environment relationships in an extended area are usually nonlinear and involve interactions. The commonly used regression models are not capable of explaining such relationships however there are no standardized modeling method.

Forest green tree frogs are widely distributed in Japan. Since the tree frogs adults stay in a forest and breed in an adjacent wetland, they are considered as an indicator species of forest-wetland ecotone. I used this species to 1) predict the distribution of the tree frog potential habitats in Japan, 2) evaluate the anthropogenic effects by quantifying habitat fragmentation within the potential habitats.

Percentage of forest cover, amount of actual rainfall, maximum depth of snow, percentage of gradual slope area and annual maximum temperature were used as environment variables. Known distribution points of the tree frog and these environment variables were calculated and mapped by using GIS. Potential habitats were predicted by a rule-based regression tree model (Fig.1) that involves hierarchical structure. The thresholds for each environment variable were obtained by using Jacobs' Electivity Index. According to the degree of preference to the environment (expressed by the Electivity Index), suitable habitats (higher preference) and possible habitats were modeled (Fig.2).

For suitable habitats, all environment variables were used and about 65% of the current distribution was explained. Four environment variables were used for extracting potential habitats and explained 89% of the current distribution. However, these models could not explain the absence in southern part of Shikoku district. I hypothesized that a limiting factor in this area is human-induced habitat fragmentation and developed a method for considering both habitat density and organisms' dispersal ability to quantify the amount of connected habitats. The result showed that the percentage of forest cover within radius 5km exceeds 85% best explains the absence of the tree frogs in this district. ( $F = 15.9, p = 0.0001$ )

The distribution of the potential habitats suggests: 1) it is unlikely the tree frogs inhabit in southeastern part of Kanto district, Shikoku, Kyushu districts and Kii Peninsula; 2) southern part of Shikoku district is highly affected by anthropogenic fragmentation and 3) there is a trend toward isolation in suitable habitat in Tohoku district.

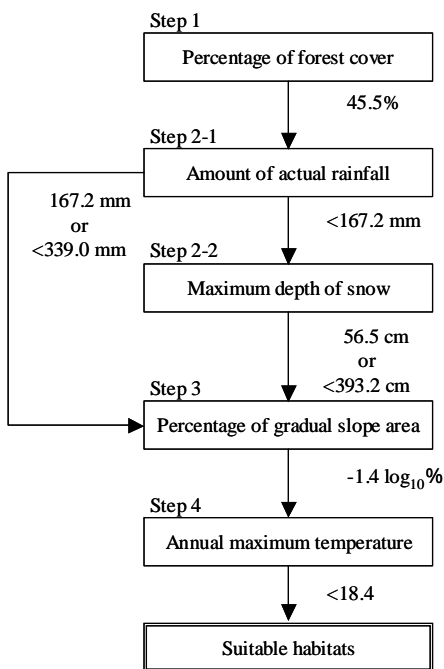


Fig.1 Tree Model for suitable habitats

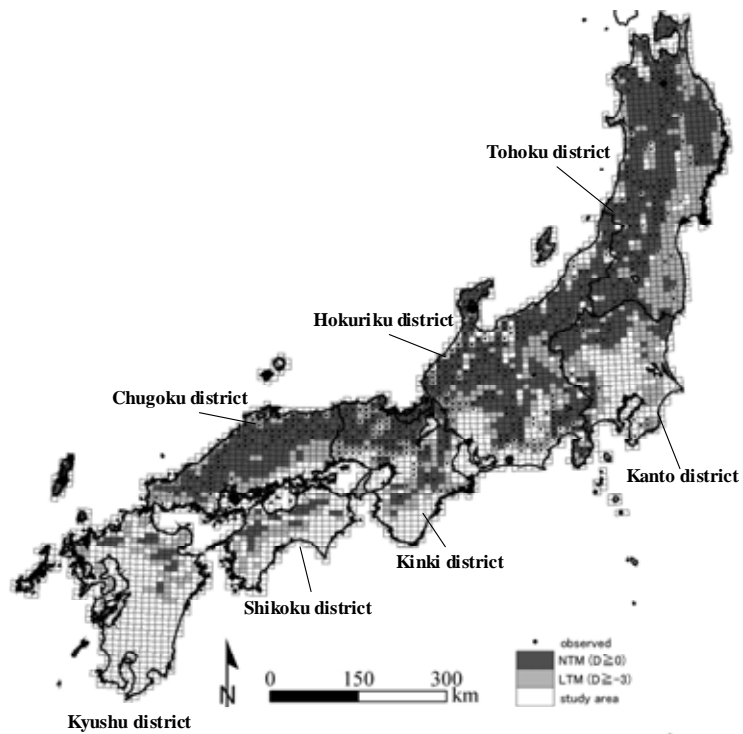


Fig.2 Potential habitats for the tree frog