Habitat Dependency Index (HDI)

The habitat dependency index (HDI) was devised for a habitat impact estimation procedure. The HDI is the degree of the dependency of a species (or a species group) on the habitat in the study area. It represents the rarity of the habitat of the species in the study area. The HDI of the *i*th species (D_i) is calculated from the following equations.

$$D_i = \frac{R_i}{\sum_{i=1}^{k} R_i} \quad (1)$$

$$R_i = \left(\frac{V_i}{\sum_{i=1}^{k} V_i} \right)^{-1} \quad (2)$$

$$V_i = \sum_{j=1}^{n} a_j N_j \quad (3)$$

where R_i is the reciprocal of the ratio of the total habitat value of the *i*th species (V_i) to the total habitat value of all the species ($\sum_{i=1}^{k} V_i$); k is the number of species. For the *i*th species, the total habitat value (V_i) is calculated from the assigned number to the *j*th habitat-value level at the step 5 (a_j) in the estimation procedure and the counted number of the grid cells with the *j*th habitat-value level (N_j); n is the number of the levels of habitat value.

The HDI was intended to have the characteristic that the summation of D_i equals 1.

$$\sum_{i=1}^{k} D_i = 1 \quad (4)$$

Therefore, the HDI can be used as an objective weight number for the integration of the habitat impact layers of the different species that have different life strategies and habitat dependencies.

The figure in the later part explains the process of the HDI calculation. Although the equations look complicated, it is relatively straightforward if one follows the process in the figure.

Suggested Citation

Imanishi, J. and Morimoto, Y. 2002. An estimation procedure of habitat impacts of highways as a general guide for an initial route selection. Proceedings for the 5th International Landscape Architectural Symposium of China, Japan and Korea, 2002, Beijing, China. 100-107.

	habitat value			
	marginal	small	moderate	great
	0.0000	0.3333	0.6667	1.0000
species A	1	3	6	15
species B	15	6	3	1

assigned habitat value numbers

number of grid cells

e.g. species A (0.000 X 1) + (0.333 X 3) + (0.667 X 6) + (1.000 X 15) = 20.000 (eq.(3))

species A	20.000
species B	5.000
total	25.000

sum of the habitat value for species A

sum of the habitat value for all the species

Species A have more habitat (20.000/25.000) than species B (5.000/25.000).
In other words, species A is the species that is able to use greater part of the study area.
However, species B is the species that is able to use limted part of the study area.
Therefore, it is fair to weight the habitat value of species B four times as much as species A because the available habitat of species B is a quarter of species A.

species A	20.000/25.000
species B	5.000/25.000

make them inversed (eq.(2))

species A	25.000/20.000 = 1.250
species B	25.000/5.000 = 5.000
total	6.250

The ratio of the inversed numbers is 1.250 : 5.000 = 1 : 4 and can be used for the weight.
Note that HDI is intended to produce the weight numbers that equal 1.000 in total using eq. (1).

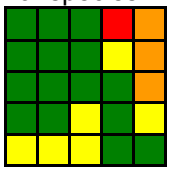
species A	1.250/6.250 = 0.2
species B	5.000/6.250 = 0.8

HDI for species B

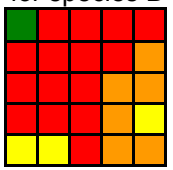
The reasonable weights on species A and B are 0.2 and 0.8, respectively.
HDI enables us to fairly weight habitat values of different species in terms of the rarity of the habitat in the study area.

Example:

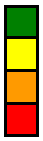
a habitat-value map for species A



a habitat-value map for species B



legend
habitat values



great
moderate
small
marginal