

SPECIES SELECTION WITH TYPES OF IMPACT & STRUCTURAL NEEDS

1.a. Decide on **priority species** (e.g., threatened, heavily traded/poached, important for local culture or ecotourism, specific impact intervention targets)

For general impact assessments, select species based on a variety of responses and guilds

1.b. Determine species' **behavioral response** to roads (Table 1 in Jacobson et al. 2016). See Table S1.

1.c. Determine species' **crossing guilds** (decision framework in Kintsch et al. 2015). See Table S1.

PRIORITY SITES FOR MITIGATION

2.a. **EXPERT-BASED CONNECTIVITY MODEL** (in case of limited or no local data)
Note: possible to model hypothetical situations, such as new roads, urbanization associated with roads, etc. by adding these to the layers

Core habitat raster layer (e.g., forest patches > 2,050 ha – or preferred habitat)

Select habitat variables (expert, literature); create raster layers

Resistance weights & scores (expert, literature)

Resistance raster layer

Species connectivity model using CIRCUITSAPE software

2.b. **IDENTIFY MAIN CROSSING SITES**

= sites where (planned) road passes through high connectivity zones - per species & all species combined

Define detection variables (e.g., sampling effort)

Habitat variables from 2.a.

Repetitive observation data (e.g., detection history)

2.c. **OPTIONAL - VERIFY VARIABLES & SPECIES OCCURRENCE: OCCUPANCY** (if species occurrence data are available)

Identify important habitat variables using occupancy models implemented in "unmarked" package in R. Option: Bayesian occupancy model using "JAGSUI" package in R

Predictive species habitat-use raster layer based on mean coefficient estimates from the Bayesian occupancy model

2.d. Review variables used in connectivity model; ensure that priority sites from connectivity model fall within habitat zone of occupancy model. Adjust variables in connectivity model if this is not the case.

2.e. **OPTIONAL - (Roadkill data, GPS data)**

Roadkill sites may be considered priorities. Evaluate with Table 2 in Jacobson et al. 2016. GPS data can also be considered in evaluating priority sites. See discussion.

2.f. **Map priority sites for mitigation**

(If based only on the expert model, this is identical to 2.b)

MITIGATION STRATEGY

3.a. Determine **location and type of engineering** requirements for existing or planned **bridges and culverts** at identified priority sites (2.f.)

3.b. **Evaluate designs for priority sites** based on priority species needs (**crossing guilds – see 1.c**); recommend structural changes to height, length, width, bottom surface, potential for vegetation growth (Table 2, Table 4).

3.c. Discuss potential for crossing structures at priority sites where **no bridges/culverts are planned/existing**.

3.d. Recommend **post-construction management** (habitat on roadside, human activity, fencing needs,...) based on behavioral response framework (see 1.c.)

RECOMMENDED: POST-CONSTRUCTION SPECIES MONITORING

4.a. Evaluate priority species use of underpasses at identified priority sites

4.b. Evaluate roadkill in terms of danger to drivers and high roadkill number that may threaten populations

4.c. Reevaluate measures based on 4.a and 4.b. and considering step 1, 2 and 3.