Principles of Wildlife Corridor Design

Monica Bond

Center for Biological Diversity

October 2003

Summary

Wildlife corridors have been proposed as a means to moderate some of the adverse ecological effects of habitat fragmentation. This document discusses principles of evaluating and designing wildlife corridors to facilitate use by target species.

Introduction

Habitat fragmentation affects numerous ecological process across multiple spatial and temporal scales, including changes in abiotic regimes, shifts in habitat use, altered population dynamics, and changes in species compositions (Schweiger et al. 2000). Patch size has been identified as a major feature influencing the plant and small mammal communities, and some wildlife populations are vulnerable to collapse in habitat fragments. The composition, diversity, and spatial configuration of patch types, distances from sources, edge-to-area ratios, and ecotonal features may also structure the plant and animal communities. For example, Bolger et al (1997) found that canyon coastal sage scrub and chaparral fragments under about 60 acres in San Diego County that had been isolated for at least 30 years supported very few populations of native rodents.

Wildlife movement corridors, also called dispersal corridors or landscape linkages as opposed to linear habitats,[1] are linear features whose primary wildlife function is to connect at least two significant habitat areas (Beier and Loe 1992). These corridors may help to reduce or moderate some of the adverse effects of habitat fragmentation by facilitating dispersal of individuals between substantive patches of remaining habitat, allowing for both long-term genetic interchange and individuals to re-colonize habitat patches from which populations have been locally extirpated. Many natural areas are critical core habitat, and are therefore inappropriate for <u>any</u> human development; thus the preservation of corridors will not mitigate against additional loss of core habitat (Beier 1993, Rosenberg 1997). In cases where some development may be acceptable, corridors can be incorporated into the design of a development project by conserving an existing landscape linkage or restoring habitat to function as a connection between larger protected areas.

The level of connectivity needed to maintain a population of a particular species will vary with the demography of the population, including population size, survival and birth

[1] Linear habitats (such as fencerows in an agricultural landscape or streamside buffers) are valued primarily as habitat (Beier and Loe 1992)

rates, and genetic factors such as the level of inbreeding and genetic variance (Rosenberg et al. 1997). These demographic parameters are important baseline data to determine the efficacy of a corridor. In addition, there are a number of general principles for designing and monitoring the effectiveness of wildlife corridors, which are described below.

Corridor Evaluation

Beier and Loe (1992) outlined a six-step "checklist" for evaluating corridors:

Step 1: Identify the habitat areas the corridor is designed to connect.
Step 2: Select several target species for the design of the corridor (i.e., select "umbrella species")[2].
Step 3: Evaluate the relevant needs of each target species[3].
Step 4: For each potential corridor, evaluate how the area will accommodate movement by each target species.
Step 5: Draw the corridor on a map.
Step 6: Design a monitoring program.

Evaluating how the potential corridor will accommodate movement by each species (*Step 4*) is a critical step in the process. This evaluation includes the consideration of how likely the animal will encounter the entrance to the corridor, actually enter the corridor, and follow it to the end. Additionally, it is important to consider whether there is sufficient concealing cover, food, and water within the corridor for the animal to reach the full length of the corridor, or whether such elements need to be created and maintained. Finally, specific impediments to movement within the potential corridor must be assessed, including topography, roads and type of road crossing, fences, outdoor lighting, domestic pets, noise from vehicle traffic or nearby buildings, and other human impacts.

Specifics of Corridor Design

Corridor Features

- The corridor should be as wide as possible. The corridor width may vary with habitat type or target species, but a rule of thumb is about a minimum of 1,000 feet wide (but larger if possible).
- Maintain as much natural open space as possible next to any culverts to encourage the use of the culverts.
- Maximize land uses adjacent to the corridor that reduce human impacts to the corridor (Beier and Loe 1992). Isolation effects along corridors can be offset by

[2] Because vegetative or topographic structures that facilitate movement for one species may inhibit movement for another, the selected species should cover a range of habitat associations and vagilities (Beier and Loe 1992).
[3] Identify the movement and dispersal patterns of selected species, including seasonal migrations (Beier and Loe 1992).

having surrounding habitat similar to that found within corridors (Perault and Lomolino 2000).

- Do not allow housing or other impacts to project into the corridor to form impediments to movement and increase harmful edge effects.
- If housing is to be permitted next to the corridor, put conservation easements on adjacent lots to prohibit structures nearest the corridor.
- Develop strict lighting restrictions for the houses adjacent to the corridor to prevent light pollution into the corridor. Lights must be directed downward and inward toward the home.

Culvert Design

- Bridged undercrossings are preferable.
- If a bridge is not possible, use a 12-foot by 12-foot box culvert or bigger for larger animals.
- Install a small, one-foot diameter tube parallel to the large box culvert for small animals. The upstream end of the small tube should be a few inches higher than the bottom of the upstream end of the box culvert, so that it will stay dry and free of debris (P. Beier, personal communication).
- The culvert bottoms should be as close as possible to any canyon bottom and not be perched up a fill slope.
- Use natural substrate on the bottom of the culvert, such as dirt with pebbles. Underlay the natural substrate with cobbled concrete. Replace the dirt when necessary (i.e., if it is washed out).
- On the road above the culverts, install speed bumps and wildlife crossing signs to slow the cars, and prohibit street lighting to facilitate use of the crossing.
- Plant and maintain lots of vegetative cover (shrubs and low cover) near the entrance-exits of the culverts, without visually or physically blocking the entries.
- Install appropriate fencing (at least six feet in height) to funnel animals towards the culverts.

Vegetation Restoration

- Require maintenance or restoration of native vegetation, and long-term management.
- Provide an adequate endowment for restoration and management of the corridor.
- Plant native trees, shrubs, and other plants to provide food and cover, as well as nesting opportunities for birds.

Management and Enforcement

- If housing is to be permitted adjacent to the corridor, require the Home Owner's Association or each homeowner to maintain -- on their own property -- a mowed, 30-foot to 60-foot buffer along a flat or slightly sloped grade between the native vegetation in the corridor and each adjacent lot, for fire abatement.

- No wood fences should be allowed in the corridor and along any of the lots adjacent to the corridor.
- No domestic pets are to be allowed in the corridor. Cats and dogs should be trapped and returned to owners if they have a collar, or brought to the animal shelter if they have no identification tags.
- No feeding of wild animals, other than bird feeders, should be allowed.
- Educate each landowner adjacent to the corridor about the regulations (lighting, mowing the buffer, no trespass, etc.) and ask each of them to watchdog the corridor for trespass. Develop a pamphlet and convene a meeting. In appropriate locations, install educational signs about the corridor and the species that could potentially use the corridor.
- Any violations should be strictly enforced and citable.

Conclusion

Wildlife corridors are not proposed as mitigation for loss of core habitat. However, with careful planning and design, wildlife corridors can help reduce the negative effects of habitat fragmentation by allowing dispersal of individuals between large patches of remaining habitat. While additional study on the efficacy of wildlife corridors is necessary, some general principles of evaluation and design are available and should be implemented. Monitoring the use of corridors by target wildlife species is an important step in corridor planning, to allow for adaptive management.

Citations

Beier, P. 1993. Determining minimum habitat areas and habitat corridors for cougars. Conservation Biology 7:94-108.

Beier, P. and S. Loe. 1992. A checklist for evaluating impacts to wildlife movement corridors. Wildlife Society Bulletin 20:434-440.

Bolger, D. T., A. C. Alberts, R. M. Sauvajot, P. Potenza, C. McCalvin, D. Tran, S. Mazzoni, and M. E. Soule. 1997. Response of rodents to habitat fragmentation in coastal Southern California. Ecological Applications 7:552-563.

Perault, D. R. and M. V. Lomolino. 2000. Corridors and mammal community structure across a fragmented, old-growth forest landscape. Ecological Monographs 70:401-422.

Rosenberg, D. K, B. R. Noon, and E. C. Meslow. 1997. Biological corridors: Form, function, and efficacy. BioScience 47:677-687.

Schweiger, E. W., J. E. Diffendorfer, R. D. Holt, R. Pierotti, and M. S. Gaines. 2000. The interaction of habitat fragmentation, plant, and small mammal succession in an old field. Ecological Monographs 70:383-400.