

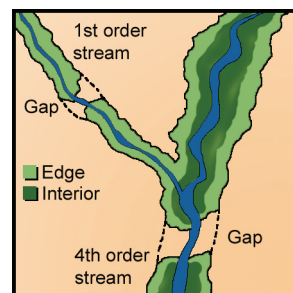
## 2.7 Stepping stones and gaps

Small patches can serve as stepping stones, allowing for species movement between large patches and are important in fragmented landscapes. However, the loss of a stepping stone can often inhibit movement, increasing patch isolation.

At some point, the distance between stepping stones or a gap in a continuous corridor will exceed a threshold at which a particular species will be unwilling or incapable of crossing. These critical gaps should often be restored.

### Key considerations for managing gaps

- The greater the contrast between the gap and the corridor plant community, the narrower the gap must be in order not to be a barrier.
- Smaller species will generally have smaller gap thresholds.
- Species requiring specialized habitats will have smaller gap thresholds.
- For visually-orientated species, gap thresholds may be determined by the ability to see the next stepping stone or across the gap.
- In riparian corridors, restore gaps in higher order streams first to provide the greatest benefit for biodiversity.



## 2.7 References

- Andreassen, H.P.; Ims, R.A.; Steinset, O.K. 1996. Discontinuous habitat corridors: effects on male root vole movements. *Journal of Applied Ecology*. 33: 555-560.
- Bakker, V.J.; Van Vuren, D.H. 2004. Gap-crossing decisions by the red squirrel, a forest-dependent small mammal. *Conservation Biology*. 18: 689-697.
- Baum, K.A.; Haynes, K.J.; Dilleuth, F.P.; Cronin, J.T. 2004. The matrix enhances the effectiveness of corridors and stepping stones. *Ecology*. 85: 2671-2676.
- Bennett, A.F. 1999. Linkages in the landscape: the role of corridors and connectivity in wildlife conservation. Gland, Switzerland: IUCN. 254 p.
- Boschieter, L.; Goedhart, P.W. 2005. Gap crossing decisions by reed warblers (*Acrocephalus scirpaceus*) in agricultural landscapes. *Landscape Ecology*. 20: 455-468.
- Bowman, J.; Fahrig, L. 2002. Gap crossing by chipmunks: an experimental test of landscape connectivity. *Canadian Journal of Zoology*. 80: 1556-1561.
- Bright, P.W. 1998. Behavior of specialist species in habitat corridors: arboreal dormice avoid corridor gaps. *Animal Behavior*. 56: 1485-1490.
- Brooker, L.; Brooker, M.; Cale, P. 1999. Animal dispersal in fragmented habitat: measuring habitat connectivity, corridor use, and dispersal mortality. *Conservation Ecology*. 3(1): 4. <http://www.consecol.org/vol3/iss1/art4> [Date accessed: July 18, 2007].
- Collinge, S.K. 1998. Spatial arrangement of habitat patches and corridors: clues from ecological field studies. *Landscape and Urban Planning*. 42: 157-168.
- Collingham, Y. C.; Huntley, B. 2000. Impacts of habitat fragmentation and patch size upon migration rates. *Ecological Applications*. 10: 131-144.
- Date, E.M.; Ford, H.A.; Recher, H.F. 1991. Frugivorous pigeons, stepping stones and weeds in northern New South Wales. In: Saunders, D.A.; Hobbs, R.J., eds. *Nature conservation 2: the role of corridors*. Chipping Norton, Australia: Surrey Beatty: 241-245.
- Davies, Z.G.; Pullin, A.S. 2007. Are hedgerows effective corridors between fragments of woodland habitat? An evidence-based approach. *Landscape Ecology*. 22: 333-351.
- Desrochers, A.; Hannon, S.J. 1997. Gap crossing decisions by forest songbirds during the post-fledging period. *Conservation Biology*. 11: 1204-1210.

Fischer, J.; Lindenmayer, D. 2002. The conservation value of paddock trees for birds in a variegated landscape in southern New South Wales. 2. paddock trees as stepping stones. *Biodiversity and Conservation*. 11: 833-849.

Freeman, R.E.; Stanley, E.H.; Turner, M.G. 2003. Analysis and conservation implications of landscape change in the Wisconsin River Floodplain. *Ecological Applications*. 13: 416-431.

Gilpin, M.E. 1980. The role of stepping-stone islands. *Theoretical Population Biology*. 17: 247-253.

Grubb, T.C.; Doherty, P.H. 1999. On home-range gap-crossing. *Auk*. 116: 618-628.

Haddad, N. 2000. Corridor length and patch colonization by a butterfly, *Junonia coenia*. *Conservation Biology*. 14: 738-745.

Jordán, F. 2000. A reliability-theory approach to corridor design. *Ecological Modelling*. 128: 211-220.

Kennedy, C.; Wilkinson, J.; Balch, J. 2003. Conservation thresholds for land use planners. Washington, DC: Environmental Law Institute. 55 p.

Law, B.S.; Anderson, J.; Chidel, M. 1999. Bat communities in a fragmented forest landscape on the south-west slopes of New South Wales, Australia. *Biological Conservation*. 88: 333-345.

Loehle, C. 2007. Effect of ephemeral stepping stones on metapopulations on fragmented landscapes. *Ecological Complexity*. 4: 42-47.

MacArthur, R.M.; Wilson, E.O. 1967. The theory of island biogeography. Princeton, NJ: Princeton University Press. 224 p.

Machtans, C.S.; Villard, M.V.; Hannon, S.J. 1996. Use of riparian buffer strips as movement corridors by forest birds. *Conservation Biology*. 10: 1366-1379.

Nève, G.; Barascud, B.; Hughes, R. [and others]. 1996. Dispersal, colonization power and metapopulation structure in the vulnerable butterfly *Proclissiana eunomia* (Lepidoptera: Nymphalidae). *Journal of Applied Ecology*. 33: 14-22.

Potter, M.A. 1990. Movement of North Island Brown Kiwi (*Apteryx australis mantelli*) between forest remnants. *New Zealand Journal of Ecology*. 14: 17-24.

Rail, J.F.; Darveau, M.; Descrochers, A.; Huot, J. 1997. Territorial responses of boreal forest birds to habitat gaps. *Condor*. 99: 976-980.

Rich, A.C.; Dobkin, D.S.; Niles, L.J. 1994. Defining forest fragmentation by corridor width: the influence of narrow forest-dividing corridors

on forest-nesting birds in southern New Jersey. *Conservation Biology*. 8: 1109-1121.

Ruefenacht, B.; Knight, R.L. 1995. Influences of corridor continuity and width on survival and movement of deer mice *Peromyscus maniculatus*. *Biological Conservation*. 71: 269-274.

Selonen, V.; Hanski, I.K. 2003. Movements of the flying squirrel *Pteromys volans* in corridors and in matrix habitat. *Ecography*. 26: 641-651.

Shirley, S.M. 2006. Movement of forest birds across river and clearcut edges of varying riparian buffer strip widths. *Forest Ecology and Management*. 223: 190-199.

Simberloff, D.; Cox, J. 1987. Consequences and costs of conservation corridors. *Conservation Biology*. 1: 63-71.

Skagen, S.K.; Melcher, C.P.; Howe, W.H.; Knopf, F.L. 1998. Comparative use of riparian corridors and oases by migrating birds in southeast Arizona. *Conservation Biology*. 12: 896-909.

Strong, A.M.; Bancroft, G.T. 1994. Postfledging dispersal of white-crowned pigeons: implications for conservation of deciduous seasonal forests in the Florida Keys. *Conservation Biology*. 8: 770-779.

van der Ree, R.; Bennett, A.F.; Gilmore, D.C. 2003. Gap-crossing by gliding marsupials: thresholds for use of isolated woodland patches in agricultural landscapes. *Biological Conservation*. 115: 241-249.