Action: Natural Corridor and Animal Movement and Dispersal

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December 5, 2019

Key Messages

A total of six studies examined animal movements in natural habitat corridors. Five found positive effect of corridors and one found no effect.

One study in Australia found that corridors facilitate both one-way and two-way movements and subsequent residency in patches connected to corridors of small mammals in narrow remnant strips.

One replicated study in Germany found that corridor width affect voles' movements in corridors, and voles' personality, or exploration scores, do not affect movements in the same corridor.

One study in North Dakota found that birds traveled and occurred more frequently in patches connected by habitat corridors in a riparian remnant landscape within farmland.

Two studies examined the impact of corridor structure on animal movements. One study in Canada found that mice preferred corridors that are structurally complex in a natural forest landscape within farmland. The other study in Australia found that arboreal mammals preferred floristically diverse remnants.

One last study in Finland found no effect of corridors on the movements of flying squirrels, as compared to the role of patch quality.

Background Information

The destruction of native landscape and fragmentation of continuous vegetation is evident through a series of human activities (Bennet & Saunders, 2010). The demand for land resources for conversion into agricultural and residential purpose drives habitat loss and isolation for species across the globe (Collinge, 1996). Existing studies have found that human infrastructure construction and agricultural production can lead the lack of connectivity and result in the shrinking range for vulnerable species (Vos & Chardon, 1998). As such, road as a means of transportation can divide a continuous landscape completely. As roads become wider and carry more traffic, the noise and danger deters species from getting close to the roads or result in road kills. In the meantime, agricultural production takes place in landscapes that are

traditionally categorized as species habitat. The homogeneous and dense growing of non-native vegetation also posts threat to endemic species.

One stream of literature has assessed potential pathways to reconnect divided habitat patches using a narrow linear landscape called corridor. The narrow linear strip connecting to two patches of habitat in a matrix can facilitate animal movements between patches (Beier & Noss, 1998). This role of the strip of landscape characterizes the fundamental function of a habitat corridor. Corridors can be replanted trees or the remains of native landscapes that are not disturbed. The remnants of native landscapes, or natural corridors that usually distinguish themselves from other types of features under anthropogenic stress, can be extremely valuable to the conservation of species, particularly for connecting populations (Bennet & Saunders, 2010). Therefore, to help conserve biodiversity, the identification and protection of the remnants of native forests or low vegetation can be a cost-effective conservation tool.

Existing studies have examined different characteristics of natural corridors. Most found the effectiveness of natural corridors in facilitating movements or dispersal. These studies can be grouped into two parts. The first sub-group of studies compare different types of corridors, with thresholds on the width or internal tree species diversity. The second sub-group of studies adopt uniformly wide and complex corridors but observe how movements can be different. Movements can be unidirectional travels from one patch to another, but one study found that two-way travels are also of interest. Overall, five out of six reviewed studies found concrete evidence that natural corridors have facilitated animal movements. One study found no effect. These studies have been summarized grouped based on different topics.

Supporting Evidence from Individual Studies

1. Types of Movements

Title: Habitat corridors and the conservation of small mammals in a fragmented forest environment.

One study conducted between March 1980 and March 1982 in Naringal, Australia found that narrow remnant natural forest strips as habitat corridors facilitated the movements of both small native and non-native mammals. Natural corridors are between 20 and 30 meters wide and 0.25 kilometers long situated at roadside sites. Using wire-mesh cage traps, this study tracks three types of movement of eight small mammals, including six native species and two

introduced species. This study measures the occurrence of the small mammals traveling in the natural forest corridors on roadside. The results show that natural corridors composed by remnant forests in the study area facilitate both single-direction movement and a series of movements that ultimately led to temporary residency in patches connected by natural corridors. In addition, natural corridors contribute to the genetic flow through a series of movements during a breeding season or intergenerational movements.

2. Corridor Width

Title: Does Animal Personality Affect Movement in Habitat Corridors? Experiments with Common Voles (Microtus arvalis) Using Different Corridor Widths.

A replicated study between July and October 2017 at an ecological research station with natural grassland of the University of Potsdam, Germany found that habitat corridor width, not animal personality, affected voles' movements in grassland corridors, with longer time spent in wider corridors. This study replicated a research design of corridors with 1m and 3m in width and added a personality component using the behavior-based exploration score derived from the voles' decisions to enter safe or unsafe zones. The exploration score did not indicate any direct correlation with movement variables of voles. But less bold voles tended spend less time in a patch when corridor was wide. Bold voles tended to spend more time in a patch when corridor was narrow. Voles also entered narrow corridor faster and spent less time than wider corridors. Regarding the design of corridors, the authors found that personality of rodents is not a factor for movement in corridors. The critical threshold of corridor width at 1 meter determines the animal movements through natural grassland corridors.

3. Corridor Connectivity

Title: Dispersal and use of corridors by birds in wooded patches on an agricultural landscape.

A study conducted between 1985 and 1988 at natural riparian woodlands and shelterbelts within farmlands in Sioux County, North Dakota found that three migratory bird species, including American Robins, Brown Thrasher, and Loggerhead Shrike, had movements with shorter distances more frequently and occurred more frequently at sites connected by woody corridors. Using capture and release method, the researcher and assistants mist netted and marked organisms with bands and government-issued aluminum rings and recaptured birds.

Within a network of 17 shelterbelts across an 8*11 km area, the movements of Robins and Thrashers between their nests within study areas are highly skewed towards shorter distances less than 200 meters. Among 238 adult robins, 279 thrashers, and 47 shrikes, robins flew a mean distance of 142 meters during a breeding season and a mean distance of 170 meters among years. Thrashers' movements have an average distance of 86 meters within a breeding season and 259 meters among years. Shrikes have not been recaptured in this study. Compared to shorter-distance travel, long-distance movements were occasional but occurred among nine robins switching sites and eight robins and four thrashers moving into woody draws not adjacent to their former breeding locations.

4. Corridor Complexity

Title: Corridor use by small mammals: field measurement for three experimental types of Peromyscus leucopus.

One study conducted between summer and fall in 1986 outside Ottawa, Canada in a farmland landscape with deciduous or mixed-wood forest fragments found that mice (Peromyscus leucopus) preferred corridors that are structurally complex. This study used radio-tagging method to track a total of 54 released mice in three types at six release sites. These mice were either residents in farmland or translocated individuals from the nearby forest. Mice have been radio-tapped before being released into the study site. The type of corridor studied is farmland fencerow characterized by different complexity patterns, including simple (less than 10% of length of structural elements and less than 1-meter of width), intermediate (unlimited amount of structural elements with less than 10% of tree cover greater than 10-meter of height and width less than 2 meters), and complex (more than 10% of tree cover and wider than 2 meters). Most recorded distances travelled by mice were in the structurally complex fencerows. Resident mice used 5.8% of simple fencerows, 9.3% of intermediate and 16.2% of complex fencerows. In comparison, translocated mice travelled 5.8% of simple fencerows, 11% of intermediate fencerows, and 24% of complex fencerows.

Title: Tropical wildlife corridors: use of linear rainforest remnants by arboreal mammals.

One study conducted in a 13-month period in 1994-1995 in Atherton Tableland plateau in Queensland, Australia found that arboreal mammals chose floristically diverse remnants with at

least 30-40m width as habitat and potential movement corridors. The forest remnants sampled include primary rainforest, mixed-regrowth, and Acacia-regrowth, each measured by floristic composition, width, canopy height, and other ecological attributes. The study used spotlighting method to sample species using corridors at night using a 30-watt spotlight equipment. The study used a robust ordination method to analyze floristic composition and the Best Subsets Regression to analyze the mammal sampling results. Among the studied mammals, one vulnerable species lemuroid ringtail possum (*Hemibelideus lemuroides*) was only found at three study sites (8% frequency) with moderate abundance (2-4.7 mammals per ha) in remnant corridors leading to to large tracts of continuous forest. Two other species, the Herbert River ringtail possum (*Pseudochirulus herbertensis*) and striped possum (*Dactylopsila trivirgata*), also chose remnant corridors that connected to forest tracts or fragments. Herbert River ringtails were found at 39% of sites and preferred high-diversity forest (primary forest or mixed regrowth) at higher elevations. Striped possum were found at only three sites that linked to large tracts of either rainforest or Acacia regrowth.

5. Corridor Has No Effect

Title: Movements of the flying squirrel (Pteromy solans) in corridors and in matrix habitat.

One study conducted in 1997-200 in Iitti and Anjalankoski in Southern Finland compared species movements of the Siberian flying squirrel (Pteromys volans) in patches, matrix, and corridors and found habitat quality instead of the use of ecological corridors is important to squirrel movements. Main tree species in the study areas are bruce- or pine-dominated forests with an average height less than 15m. Corridors are defined as narrow linear woodland strips connecting preferred habitat patches in a matrix landscape with an average width between 5m and 40m. Squirrels were captured, collared, released, and tracked in the study period. Using a logistic regression model, the study found a negative correlation between the probability of leaving spruce patches and characteristics of patch quality, such as the sizes. The study also found that corridor use was not significant across the study period, with 26 individuals using corridors for an average length between 70m and 480m. In comparison, patch quality is significant correlated with the length of movements in the habitat, indicating the deterministic role of patch quality, not ecological corridor, on animal movements.

Conclusion and Recommendations

To sum up, the six reviewed studies on the effectiveness of natural corridors provide concrete conservation evidence on the preferred characteristics of habitat corridors and how the reactions of species may differ as a result of the changes in characteristics. Overall, depending on different species, preferred corridors have moderate width, internal complexity, rich vegetation diversity, and connectivity to habitat patches. Also, the connected patches can have an impact on the use of corridors, since species movements through corridors may not occur if the quality of patches and matrix is optimal. These six pieces of evidence help to provide a holistic understanding of natural corridors and how they function on species movements. In the future, a potential gap emerged from the literature is that most research projects are observational and lack a control group. For example, the authors in the first study on different types of movements of small mammals in natural corridors in Australia acknowledged that there is no comparison group in a landscape with either no natural corridor or planted corridor. To fill this gap in research, future studies can focus on a comparison between the effectiveness of different types of corridors on species movements.

Supporting Studies

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