Finding the corridor more traveled

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As wildlands give way to an expanding human footprint, scientists and land managers have struggled to develop land conservation strategies that protect biodiversity. A favored strategy is to connect large habitat areas with landscape corridors (1–3). Yet, the scientific question remains: Do corridors actually work to promote dispersal and conserve biodiversity? In this issue of PNAS, Gillies and St. Clair's (4) answer this question with a clever behavioral experiment that offers new insights into the circumstances under which corridors benefit species.

Gillies and St. Clair get at the crux of corridor usefulness. To work, corridors must provide a path directing plants and animals to higher quality habitat. In doing so, corridors would help to overcome negative demographic and genetic effects found in small and isolated populations, and so reduce the risk of extinction (5, 6). If corridors do not promote movement, then other strategies might more effectively conserve biodiversity.

Gillies and St. Clair's research (4) combines well-established techniques, telemetry, and translocation to show that some bird species really do prefer to move through corridors. They moved birds as far as 1.9 km from their territories and released them into pastures, corridors of forest, or fencerows of trees connected to their territory (Fig. 1).

If a translocated bird did not return to its territory, finding it would be like looking for a needle in a haystack. Even when birds do return, their path can only be inferred. However, by using radio telemetry to follow translocated birds, Gillies and St. Clair (4) were able to specifically identify the habitats and barriers that birds would cross during their return journey (Fig. 1). This enabled them to pinpoint the effects of fragmentation and the role of corridors.

Other studies have shown that many animals and plants disperse preferentially through corridors (7, 8), but Gillies and St. Clair's study (4) goes on to provide answers to 3 critical questions about corridor effectiveness. First, do corridors work in large landscapes? Previous studies have typically been in small or experimental settings (7). This study shows how experimental approaches can be brought to real landscapes of high conservation concern, in this case fragmented tropical forest. It is one of the largest to demonstrate corridor effects, and their techniques could be deployed in even larger landscapes.

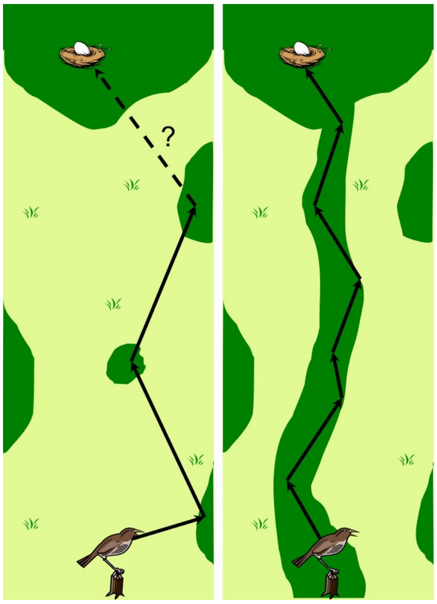

Fig. 1. On the left, barred antshrikes translocated to pasture were forced to take longer routes crossing pasture, and were less likely to return to territories (represented by nest). On the right, barred antshrikes translocated to forested corridors were likely to travel through corridors and were more likely to return to territories.

Second, what aspects of habitat quality within corridors are most important to conserve or restore? Gillies and St. Clair provide a partial answer: for 1 of 2 bird species, wider, forested corridors were better than narrow fencerows with little understory vegetation. These same techniques could be used in other landscapes to answer more general questions about corridor quality. For example, determining the optimal width of corridors may be the aspect of corridor quality most urgently needed by land managers, and it could be addressed by the methods of Gillies and St. Clair in a wide variety of landscapes.

Third, for what groups of species do corridors work? When first proposed, corridors were assumed to benefit most species in a landscape. This is simply not true (7, 8). Of most immediate interest is whether corridors are used by species of conservation concern. Because of the difficulty in measuring dispersal, corridor studies are typically conducted on a narrow range of (usually common) species (8). Gillies and St. Clair test corridor use by a taxon of high conservation interest, and their methods could be used for rarer species.

More generally, Gillies and St. Clair show that a habitat specialist favors corridors. This follows on other studies that have identified behaviors (9) and life histories (10) as strong predictors of corridor use. Scientists will never be able to individually evaluate corridor use by all species; the coming years should see synthesis that provides practical guidance to land managers about what types of species are likely to benefit from corridors.

The approach used by Gillies and St. Clair also points one way forward to resolve *the* key question about corridors: do they help to prevent species extinctions? This is, after all, the ultimate reason for most corridor projects. There are hints regarding how Gillies and St. Clair's approach could be used to answer parts of this question. Birds released in pasture were forced to cross gaps between forested areas. These gaps are presumably risky, because they expose birds to predation and have fewer food resources. Barred antshrikes released in pasture were less likely to return to their territories, and thus settled in less desirable forest areas. Follow-up studies might directly evaluate costs of these behaviors for survival.

Could these same approaches be used to address the value of corridors in a changing climate? Corridors are frequently promoted as a conservation strategy to protect species as their ranges shift in response to warming. Yet, there is virtually no science on this topic (but see ref. 11). Perhaps translocation studies can be conducted where corridors currently cross climatic gradients. This is trickier, because the timescales of behavioral studies are shorter than that of climate change. However, answers may be found where behavioral studies are combined with methods that study dispersal at larger scales, such as global positioning system (GPS) tracking, stable isotopes, or genetics.

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Translocation is not without problems. In particular, it is not clear how behaviors after translocation compare with natural behaviors during dispersal. Still, combining telemetry and translocation serves to focus studies of movement in fragmented landscapes. Along with others (e.g., refs. 12–14), this type of study moves us closer to realizing the promise of behavioral ecology for landscape conservation (15, 16).

As corridor implementation has burgeoned in cities and states, countries and continents, conservation biologists have come to recognize how difficult it is to design, implement, and assess corridors (1–3). Progress is emerging on all these fronts, most notably in recent syntheses by Beier and colleagues (17, 18). Yet, in many practical applications of corridors, the scientific question about whether corridors work remains unanswered. Studies like the work of Gillies and St. Clair (4) that provide flexible, practical ways to evaluate corridors will lead to better landscape management for biodiversity conservation.

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