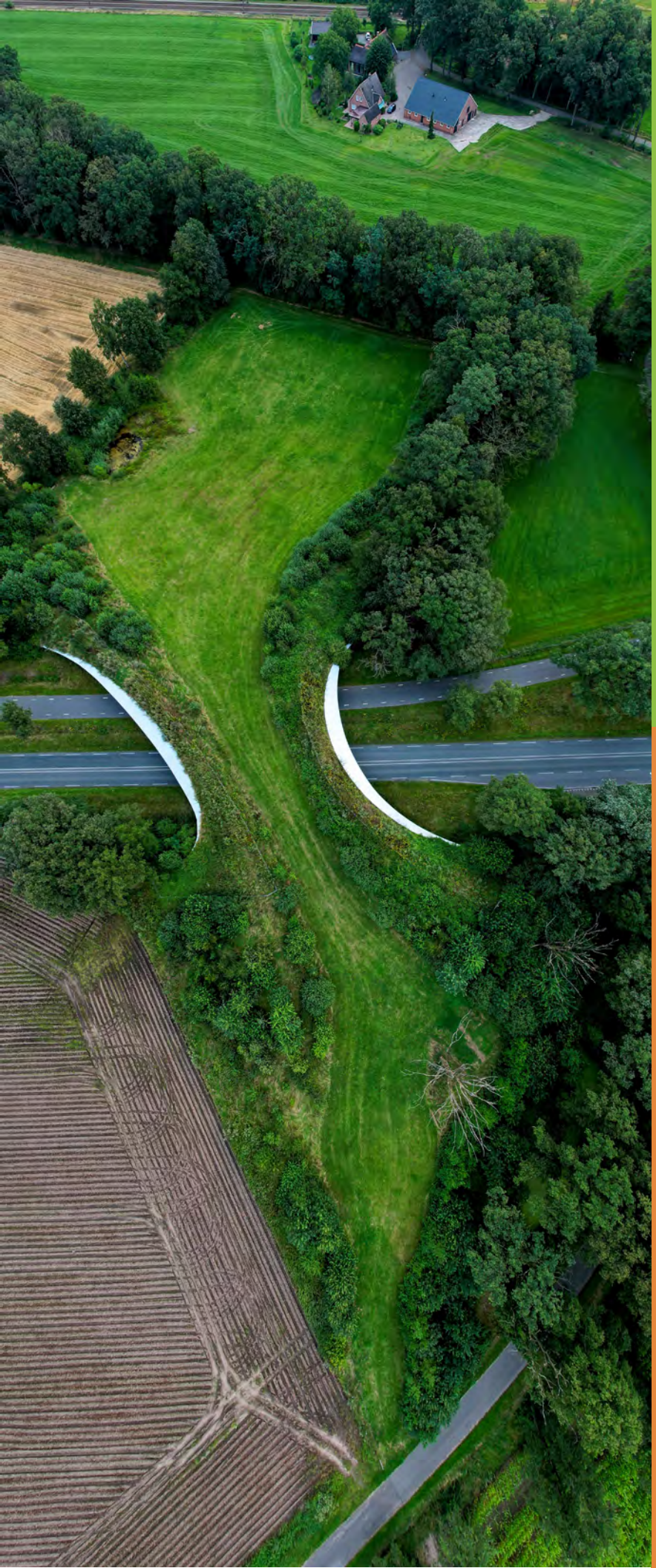


Land Trusts and Wildlife Crossing Structures

A Toolkit Detailing How Land Trusts Can Contribute to Highway Infrastructure Projects for Wildlife

February 2023

CENTER for LARGE LANDSCAPE CONSERVATION

By:

Kylie Paul, Road Ecologist
kylie@largelandscapes.org

Abigail Breuer

Anna Wearn

This resource is a compilation of lessons learned and best practices in action by land trusts engaged in wildlife crossing structure projects. This toolkit has the intention to inform and support land trusts that are less familiar with connectivity and wildlife crossing efforts. It is geared for those interested in better understanding the critical role that land trusts play in increasing wildlife crossings across the nation and in how land trusts already work with transportation-related projects. The document includes many diverse examples and links to allow for further examination. It emerges from review of and interactions with land trusts and leans on the Center for Large Landscape Conservation's organizational expertise around planning, science, and implementation of wildlife crossings.

Document Summary:

Land trusts play a vital role in wildlife crossing projects. They can help to facilitate wildlife crossing structure projects in the following ways: hold conservation easements or own land; serve as interim landholders; find conservation buyers; design conservation easements for land adjacent to wildlife crossings; cultivate relationships with private landowners and local government agencies; steward the management of private land for wildlife habitat; and help steward private land management for wildlife habitat.

The following are recommendations provided at the bottom of each section in this document. *Land trusts can get further involved in wildlife crossing projects.* They can:

- Find out if there is a state or regional wildlife crossing or connectivity coalition near you and join—or initiate one if not yet in existence.
- Identify and develop a relationship with key Department of Transportation (or equivalent agency) staff. Take the first step to meet them.
- Examine existing habitat connectivity mapping or undertake new connectivity mapping. Examine where pinch point locations occur across roadways that could be addressed with protected private land and wildlife crossing structures.
- Find and examine existing reports or take part in developing plans. If such an analysis has not occurred in the land trust's focal area, advocate to initiate one in the state or region.
- Look at future transportation projects in transportation agency planning documents to see if they overlap with land trust priority areas or parcels.
- Consider prioritizing habitat connectivity and wildlife crossings in organizational strategic planning and other visioning opportunities.
- Incorporate wildlife connectivity and crossing priorities into existing relevant programs in the organization.
- Learn about existing connectivity and wildlife crossings-related policies in the land trust's state or in other states, or in federal policies. Share examples with relevant decision-makers and stakeholders. Advocate for or initiate policies.
- Learn about existing local government policies related to habitat connectivity and wildlife crossings. Share examples with relevant decision-makers and stakeholders. Advocate for or initiate policies.

Recommended citation: Paul, K., A. Breuer, A. Wearn. 2023. Land trusts and wildlife crossing structures: A toolkit detailing how land trusts can contribute to highway infrastructure projects for wildlife. Center for Large Landscape Conservation, Bozeman, MT, USA. https://doi.org/10.53847/QVRJ9595

Layout and design: Kendra Hoff, Center for Large Landscape Conservation

All photos Adobe Stock

Table of Contents

Acknowledgements

Many people were interviewed, responded to inquiries, or helped improve this document. Thank you to (in alphabetical order): Five Valleys Land Trust, Heart of the Rockies Initiative, Land Trust of Santa Cruz County, Mojave Desert Land Trust, North Florida Land Trust, Peninsula Open Space Trust, Southern Oregon Land Conservancy, Staying Connected Initiative, Tall Timbers Research Station & Land Conservancy, Teton Regional Land Trust, The Nature Conservancy New York, Trust for Public Land - Vermont, VT Fish & Wildlife Department, and the Vital Ground Foundation.

Habitat Connectivity and Private Land Protection

Ecological connectivity can be defined as the degree to which landscapes allow species to move freely and ecological processes to function unimpeded.[1] As human development fragments landscapes, species become increasingly isolated in islands of remaining suitable habitat. Habitat fragmentation significantly contributes to increased species mortality and population declines, a troubling trend that has created a national and global biodiversity crisis.

Reconnecting habitats requires maintaining or restoring landscape features that facilitate species movement, as well as mitigating barriers to species movement, such as roads and fences. Increasing the permeability of landscapes not only increases biodiversity and climate resilience, but also directly benefits communities.[2] Connectivity conservation enhances roadway safety, improves access to nature, and provides valuable ecosystem services, such as carbon sequestration, clean water, and crop pollination.

As wildlife move about in their daily lives and life cycles, they often cut through landscapes made up of parcels with different land management objectives on a mix of public and private land. Whether these landscapes are made up of large blocks of public lands split by a few private inholdings or a patchwork of landowners and parcel sizes, efforts to protect wildlife movement pathways (sometimes called corridors or linkages)—and the larger landscapes that surround them—require the engagement of private landowners.

Land trusts play a vital role in habitat connectivity. Many land trusts contribute to reconnecting habitat through conservation easements or acquisitions in key landscape linkages and through land stewardship efforts that facilitate the movement of native species (for example, by modifying fences to make them less of an impediment). Private land conservation and stewardship efforts are especially important where there are existing structures or potential/proposed wildlife crossing structures (or "wildlife crossing," used interchangeably) to help wildlife safely cross roads that bisect habitat.

Wildlife Crossings and Their Benefits

Conflicts between vehicles and wildlife are an increasingly urgent public safety, wildlife conservation, and economic issue. Each year in the U.S., wildlife-vehicle collisions kill more than one million large mammals, cause hundreds of human fatalities, and result in over 26,000 injuries[3]—all at a cost to Americans of nearly $10 billion annually.[4]

Roads not only cause direct mortality but also create a barrier that can deter wildlife from attempting to reach habitat on the other side, impeding the daily and seasonal movements necessary for wildlife to find food, water, and mates. Over time, roads can fragment ecosystems so severely that only a disconnected patchwork of habitat remains. This isolation of wildlife populations can result in a combination of impacts—such as loss of genetic diversity, disease outbreaks, and an inability to adapt to climate change—that can lead to local extinction.

Wildlife crossing structures, combined with proper fencing to guide animals to safe crossing routes, can reduce wildlife-vehicle collisions by 86-97%.[5] Wildlife crossing structures include overpasses, underpasses, bridges, culverts, and tunnels that allow wildlife to move through them. Existing culverts and bridges can also be modified to encourage increased wildlife use and keep them off roads in a cost-effective manner.

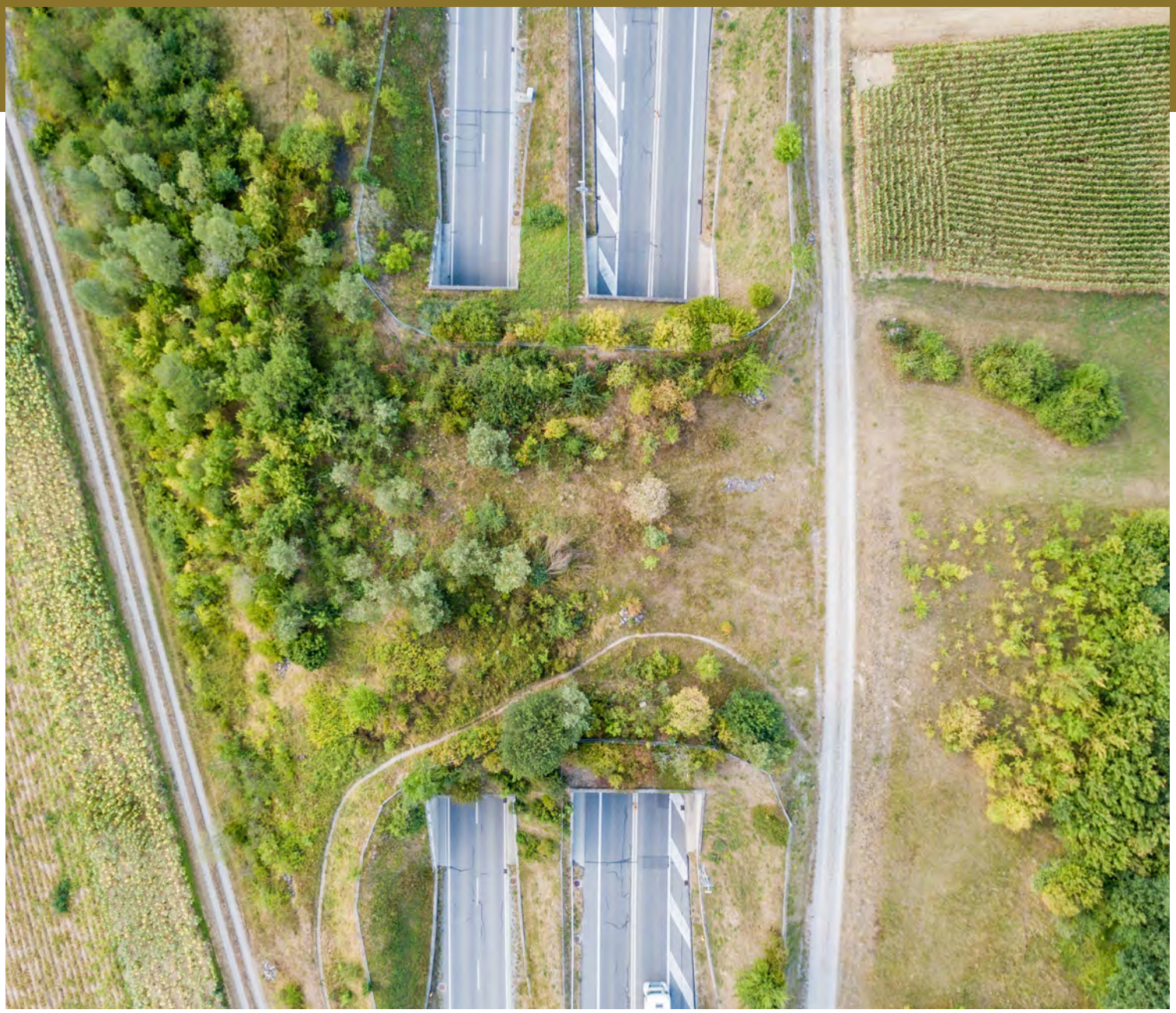
The success of these projects—from small tunnels for amphibians in Vermont to overpasses for panthers in Florida and big game in the West—prove that wildlife crossing projects generate an impressive return on investment. Research shows these structures pay for themselves relatively quickly by preventing costly and devastating accidents.[6]

These efforts are important no matter what part of the country a land trust works within, and the likelihood is there are steps that can be taken to help humans and wildlife, large and small, move more safely and freely.

The Need for Private Land Protection Adjacent to Wildlife Crossings

When determining where to invest in and build wildlife crossing structures, decisionmakers prefer and may require that land on either or both sides of the proposed site is protected in a way that will allow it to continue to serve as long-term wildlife habitat. If the land adjacent to the site is private land that is not protected (e.g., through a conservation easement or acquisition), decisionmakers worry that the land may be developed, wildlife will eventually not be able to access the proposed wildlife crossing structure, and the investment will be for naught.

Areas where public land abuts both sides of the road are often considered ideal locations for wildlife crossing structures, but key pinch points for habitat connectivity and/or roadkill hotspots often occur where private land is found—in valley bottoms, riparian areas, and other desirable or easily developed areas. If these areas are protected or very likely to be protected, a proposed wildlife crossing structure is much more likely to be considered a sensible public investment. If land trusts are working to conserve key linkages on private land, this can increase the viability of a wildlife crossing structure project.



Land Trusts Play a Vital Role in Wildlife Crossing Projects

The examples below illustrate how land trusts can help to facilitate wildlife crossing structure projects.

01 Hold conservation easements or own land

Land trusts operate in various ways to own and secure land for conservation purposes: some land trusts acquire and manage their own lands; some acquire and transfer ownership to land management agencies; others focus on acquiring and stewarding conservation easements on private land. Each of these approaches can be valuable for wildlife crossing projects.

The following examples demonstrate specific land trusts easement and acquisition activities that have been essential to wildlife crossing projects:

- The Land Trust of Santa Cruz County has permanently secured several properties totaling 460 acres on both sides of Highway 17, collected data, and raised funds as a partner with CalTrans, Santa Cruz County Regional Transportation Commission, and others to construct a wildlife underpass at Laurel Curve.[7] [8] [9]
- The Mojave Desert Land Trust has acquired land on both sides of a highway, and Caltrans plans include a potential wildlife crossing structure in the area.[10] [11]
- The New Mexico Land Conservancy served as a member of the Tijeras Canyon Safe Passage Coalition when land parcels in an important location for wildlife crossing opened for development and the Land Conservancy facilitated their purchase by the City of Albuquerque.[12]

Below is a partial list of land trusts in the United States working on conservation easements or acquisitions associated with wildlife crossing structure projects. *If you are part of a land trust working on these issues that is not listed, please connect with us! We'd love to add your project to the list.*

- Land Trust of Santa Cruz County - Gabilan Wildlife Corridor[13]
- Peninsula Open Space Trust – Hwy 17[14]; Coyote Valley[15]; Hwy 152 Pacheco Pass[16]
- Sonoma Land Trust – Sonoma Valley wildlife corridor[17]
- Southern Oregon Land Conservancy – Colestin-Siskiyou Summit Focus Area[18]
- The Nature Conservancy – CA - I-15 Santa Ana to Palomar Mountains Linkage[19] [20]
- Santa Monica Mountain Conservancy – US-101- Liberty Canyon[21] (state conservancy)

02 Serve as interim landholders

Land trusts can step in to serve as an interim landowner to hold the property until a transfer can occur to convey the property to the final intended landowner/manager. Land trusts may also have access to funding options such as bridge loans that other entities may not be able to access.[22] Land trusts are often nimbler than government agencies in situations where land may need to be purchased quickly or may have access to funding sources not directly available to government agencies.

03 Find conservation buyers

Land trusts can help agencies and other partners find conservation buyers to purchase important parcels that are restricted by conservation easements, or buyers willing to donate a conservation easement. Land trusts have the expertise to help negotiate final sale agreements and other complex real estate transactions.

04 Design conservation easements for land adjacent to wildlife crossings

While drafting a conservation easement, if the land is adjacent to a roadway, it is helpful to consider whether a wildlife crossing structure may be desired, warranted, or proposed in the area in the future. Conservation easement language can be crafted so that habitat connectivity conservation is recognized as a purpose of the easement and use limitations can ensure future activities will not negatively impact the easement's purposes.

- When land trusts design a conservation easement with a purpose of facilitating wildlife movement, they can include relevant and appropriate references to habitat connectivity and wildlife crossings in the easement language. Clauses in agreements can clearly establish the property's connectivity values for species movement as a purpose of the easement, and future uses of the property can be evaluated for consistency with this purpose.
- Conservation easements can include buffer zones of reduced human activity near areas important for wildlife movement such as near existing crossing structures, or along riparian corridors, hedgerows or other landscape elements that provide cover and passage for wildlife.
- If a future wildlife crossing structure makes sense for a parcel but there are none planned, generic language can/should be included such as 'Improvements can be made to provide secure wildlife movement.'
- If a landowner and land trust are not interested or able to take an active part in future wildlife crossing projects, it is still beneficial to ensure easement language does not inadvertently prevent a future project or otherwise hinder wildlife movement across a property.
- If an existing conservation easement has language that may be construed to impede the construction of an adjacent proposed wildlife crossing structure (such as with language prohibiting development or ground-disturbing activities), an administrative amendment to the conservation easement can be considered.
- Typically, state Departments of Transportation (DOTs) are sensitive to potential landowner concerns regarding impacts of a wildlife crossing structure to a property. For instance, Florida DOT has guidelines that ensure a wildlife crossing structure will not restrict access to adjacent property owners, negatively impact adjacent properties (e.g., provide access for people and/or wildlife to private properties where none presently exist), or have the potential to negatively impact existing drainage patterns or to flood off-site properties.[23]

Two resources for guidance on inclusion of habitat connectivity in conservation easement language are:

- Staying Connected Initiative created a document called Potential Conservation Easement Provisions Designed to Explicitly Address Connectivity in the Northern Appalachians.[24]
- Connecticut offers a drafting model or template for a Forever Wildlife Conservation Easement that is 'ideal for wildlife corridors.'[25]

If you are a land trust that has written wildlife crossing provisions into conservation easements, please contact us. We would be glad to include your experience in future versions of this guide.

05 Cultivate relationships with private landowners and local government agencies

Early and frequent engagement of land trusts and landowners in early phases of wildlife crossing structure project consideration is invaluable.[26] Land trusts tend to have closer relationships with landowners than other partners or agencies.

Land trusts also often have close relationships with local governments. These relationships can help to facilitate county or municipal ownership of open lands in locations key for wildlife crossing structures or tap into local open space bonds to help with funding of land ownership or conservation easement for wildlife crossing projects. Land trusts may have close relationships with state or federal government agencies to partner on projects where a land trust serves as an interim landowner with land later conveyed to an agency.

06 Steward private land management for wildlife habitat

Many landowners undertake management actions that help maintain or enhance habitat connectivity. Habitat improvements such as wildlife-friendly fencing, sustainable forest management, and riparian conservation and restoration on private land can help wildlife move more safely through a landscape. Other actions or stipulations in key wildlife areas or near potential wildlife crossing structures can help reduce the effects of human activities, including low or no outdoor lights at night, protection of domestic animals at night (via shelters, electric fencing or other measures for livestock and secure housing for pets), and use of native plants in landscaping. Avoiding recreational activities near existing wildlife crossing structures or other critical movement areas is also essential, as many species are negatively impacted by human recreation.[27]

In addition to numerous agencies and programs such as the Natural Resource Conservation Service[28], many resources exist to help landowners enhance wildlife habitat quality, such as:

- Staying Connected Initiative and Tug Hill Tomorrow Land Trust management recommendations guide for landowners for habitat management strategies to enhance wildlife movement[29]
- Sonoma Land Trust brochure for landowners[30]
- Wildlife-friendly fencing booklet for landowners[31]
- Southern Oregon Land Conservancy fences blog post[32]
- Best management practices for wildlife corridors journal article[33]
- Maine Department of Inland Fisheries & Wildlife's Beginning with Habitat program For Land Trusts page[34]

07 Help steward adjacent improvements to culverts and bridges on protected private land

Existing bridges, culverts, and tunnels installed for purposes such as hydrological flow can also serve as wildlife crossing structures. Wildlife use of existing structures can be significantly increased with appropriate management and modifications nearby and within the structure. Doing so reduces the barrier effect of a roadway without the cost associated with constructing new structures.

If a landowner with a conservation easement has an existing bridge or culvert in the DOT right-of-way next to their property, they may be able to help undertake one or more modifications. Modification projects generally require cultivation of a relationship with a transportation agency.

Modifications can include:

- Vegetation management near structure to increase visibility of structure and removal of invasive plants while maintaining security for wildlife
- Addition of and/or repairing fencing to funnel wildlife to a structure
- Removal of fencing or other obstacles blocking entrance or pathways to a structure
- Removal of silt or debris buildup
- Providing hiding cover such as continuous woody debris within a structure to attract smaller-bodied species
- Adding a dry shelf, 'critter shelf', or bench within a structure, particularly one that contains flowing water at least seasonally
- Making a suitable travel path for hooved mammals or other species under a bridge by adding soil or other easily trodden substrate on top of previously placed riprap (rocky material placed along shorelines or steep slopes)
- Replacement of a smaller culvert with a larger culvert or bridge to improve wildlife and hydrological flow passage. Updated designs can be more resilient to extreme weather events and better allow for fish and wildlife movement. States such as New Hampshire[35] and Oregon[36] have databases of culverts with barriers to fish passage that land trusts can access to support their efforts to improve passage. Resources for modification recommendations include:
    - Technical guidance and best management practices report for large animals[37]
    - Book chapter on modifying existing structures to enhance wildlife passage through them[38]
    - Assessment report to determine wildlife movement permeability of existing structures[39]

Examples of land trusts engaging in enhancements of existing culvert or bridge infrastructure are:

- Sonoma Land Trust partnered with Sonoma Water to clear an existing highway underpass to improve safe passage for wildlife and worked with four landowners to modify fences at structures in order to increase passage for wildlife.[40]
- The Adirondack Chapter of The Nature Conservancy (TNC), Adirondack Land Trust, and New York State Department of Transportation installed New York's first critter shelf inside a large culvert to help wildlife safely cross underneath a road.[41] The culvert is between private lands protected by conservation easements, and TNC monitored the culvert with wildlife cameras. The work is supported by a report on applying data collected by partner groups such as land trusts to mitigate barriers to wildlife.[42]
- Vermont Land Trust and Northeast Wilderness Trust are working to further protect lands near a wildlife shelf/bench built by the Vermont Agency of Transportation under an existing highway bridge.
- The Vermont Chapter of The Nature Conservancy has been working with the Staying Connected Initiative and Vermont Fish & Wildlife to deploy 130 wildlife cameras to track animal movement and capture data to track animals' passage in a variety of structures, which is informing best practices for creating wildlife friendly infrastructure.[43] [44]

Opportunities for Land Trusts to Engage in Wildlife Crossing Projects

Land trusts may get involved in wildlife crossing projects for any number of reasons, from long-term strategy to opportunistic easements or acquisitions, to involvement in a regional connectivity coalition. The information below describes best practices for planning, prioritizing, and funding a potential wildlife crossing project. For information on designing, constructing, monitoring, and maintaining a wildlife crossing structure for a range of species, consider exploring other resources (such as these endnotes).[45] [46] [47]

Below are some best practices and resources for getting involved:

01 Join or initiate a coalition

Coalitions focused on wildlife connectivity and crossing projects bring together multiple stakeholders to help identify and implement coordinated actions that address wildlife-vehicle collision and connectivity problems in pinch point locations. They bring together groups and agencies that have a mixture of skillsets and knowledge, leading to unique, forward-thinking, shared visions. Partnerships can help with data collection (such as roadkill hotspot mapping, monitoring wildlife use of existing structures, or winter snow tracking to assess species movement relative to roads) and data analyses (such as connectivity mapping). Projects benefit by capitalizing on the nimbleness of non-profits in matters of funding and timing, and partnerships may help leverage a variety of funding sources to make a project viable.

Land trust involvement in wildlife connectivity and crossing coalitions is highly important; land trust organizations understand land markets and local sentiment and can provide useful information for identifying land parcels to maximize conservation outcomes. With land trust involvement, a coalition is usually better prepared to act on unique private land conservation opportunities as they arise. Having more than one land trust in a coalition can be valuable; land trusts have different capacities, expertise, focal areas, and preferred transaction types (acquisitions, conservation easement, etc.). A project may end up having a combination of easements and acquisitions, held by different entities.

Landscape conservation partnerships that focus on wildlife connectivity and crossings can include: state wildlife agencies, Tribal governments, county open space programs, state conservancies, open space authorities, metropolitan planning organizations, foundations, nonprofit partners that focus on wildlife conservation, fishing and hunting organizations, and others.

Some existing partnerships have developed from state wildlife and transportation summits, which have been effective at energizing efforts (i.e., CO, MT, NM, WY). Other types of partnerships initiated under federal or other programs can also help lead engagement in this area, such as Natural Resource Conservation Service's (NRCS) Local Working Groups[48] and the Regional Conservation Partnership (RCP) Network in New England, with several RCPs focusing on connectivity.[49]

Funding for coalitions may be found from sources like the Landscape Conservation Catalyst Fund[50] managed by the Network for Landscape Conservation.[51]

Coalitions exist in many regions and often include land trusts. Some examples are:

- Colorado Wildlife & Transportation Alliance whose land trust partner is the Rocky Mountain Elk Foundation[52]
- Ecologicalconnectivity.com is a web platform sharing connectivity projects and coalition work in Eastern Canada and New England[53]
- Ocala-to-Osceola (O2O) Partnership includes North Florida Land Trust, Alachua Conservation Trust, Conservation Florida, Putnam Land Conservancy, The Conservation Fund, and The Nature Conservancy[54]
- Southern Oregon Wildlife Crossing Coalition includes Southern Oregon Land Conservancy and Pacific Forest Trust[55]
- Safe Passage I-40 Pigeon River Gorge Wildlife Crossing Project includes The Conservation Fund[56]
- Staying Connected Initiative includes numerous land trusts throughout several states in northern New England[57]
- Summit County Safe Passages includes Continental Divide Land Trust[58]
- Virginia Safe Wildlife Corridors Collaborative includes Valley Conservation Council and The Nature Conservancy Virginia[59]

Find out if there is a state or regional wildlife crossing or connectivity coalition near you and join—or initiate one if not yet in existence.

02 Leverage or initiate relationships with transportation agencies

While coalitions are valuable, a coalition is not essential to implement wildlife crossing projects; many projects have resulted from partnerships between land trusts or conservation groups and state departments of transportation (DOTs).

Transportation projects need considerable long-term planning so building relationships prior to development of a potential project is helpful. Many DOTs desire connections with land trusts to help achieve wildlife crossing structure projects but may not have yet reached out or found the relevant land trust. It can be helpful for a land trust to take the first step to meet DOT staff. There may be one or more key DOT staff members who are champions of wildlife crossing structures in an area. DOTs tend to be split into districts responsible for different parts of each state. Relevant DOT employees may hold titles such as: District Environmental Permits Coordinator, District Biologist, District Drainage Design Engineer, District Preconstruction Engineer, Environmental Services Bureau Chief, Wildlife Program Manager, and Environmental Manager. Some states have a transportation liaison position(s) that works between its DOT and state fish and game agency.[60]

Jurisdiction of a roadway may also fall under an agency other than a DOT, such as a county, city, or municipality. In these cases, land trusts can establish relationships with the relevant transportation authority or public works staff.

Identify and develop a relationship with key DOT (or equivalent agency) staff. Take the first step to meet them.

03 Examine or initiate habitat connectivity/linkage mapping and planning

Broader scale mapping and habitat connectivity assessments are invaluable. Such assessments can illustrate priority needs, develop and promote a common vision among stakeholders, and help focus energy and funding for connectivity conservation efforts.[61] They can help indicate where pinch points across highways may warrant private land conservation and wildlife crossing projects. Climate adaptation strategies can be incorporated into connectivity planning, as well (and vice versa, as maintaining adequate habitat connectivity is a key need for wildlife to adapt to climate change).[62] [63]

Land trusts can undertake their own wildlife connectivity assessments or can partner with others to help develop an analysis and implementation strategy using modeling tools.[64] [65] Or rather than doing their own analyses, land trusts can use existing mapping to help identify parcels at important habitat connectivity pinch points. There are many examples of habitat connectivity or linkage mapping, such as:

- California Essential Habitat Connectivity Project [66]
- New Hampshire Wildlife Corridors[67]
- Oregon Connectivity Assessment and Mapping Project[68]
- South Coast Missing Linkages Project[69]
- The Nature Conservancy's Resilient and Connected Landscapes mapping project[70]
- DataBasin (a science-based mapping and analysis platform that includes connectivity mapping)[71]
- State Wildlife Action Plans[72]

Some efforts have focused specifically on mapping to determine the location of future conservation easements or acquisitions, in order to conserve habitat connectivity:

- Staying Connected in the Northern Green Mountains: Identifying Structural Pathways and other Areas of High Conservation Priority Report[73]
- Wyoming Open Spaces Initiative: Targeting Conservation Easement Purchases to Benefit Wildlife Report[74]
- Wolverine habitat connectivity and private land parcel mapping framework[75]

It should be kept in mind that private landowners may not want their lands highlighted publicly on maps; caution and conscientiousness should reign, in that regard.

Examine existing habitat connectivity mapping or undertake new connectivity mapping. Examine where pinch point locations occur across roadways that could be addressed with protected private land and wildlife crossing structures.

04 Examine or initiate wildlife crossing priority or action plans

Some state departments of transportation (DOTs), state departments of wildlife, and/or partners have undertaken identification and prioritization analyses to determine data-driven locations for future wildlife crossing structure projects. These assessments and plans help ensure that the state and its partners work toward a common goal and that resources are used as effectively and efficiently as possible. Some examples of wildlife crossing assessment reports are:

- Arizona Statewide Wildlife-Vehicle Conflict Study (2021)[76]
- Blackfeet Nation Animal-Vehicle Collision Reduction Master Plan (2019)[77]
- British Columbia - Hwy 3 Transportation Mitigation for Wildlife and Connectivity (2019)[78]
- Colorado - Eastern Slope and Plains Wildlife Prioritization Study (2022)[79]
- New Jersey - Connecting Habitat Across New Jersey (CHANJ) (2019)[80]
- Wyoming - Teton County Wildlife Crossings Master Plan (2018)[81]

These analyses and prioritization efforts can help land trusts work on land protection in the vicinity of potential wildlife crossing structures by increasing understanding of the most important areas. They are also helpful for land trusts to use in grant writing and other fundraising as they provide a strong rationale for conservation investment.

Some land trusts have been active as initiators or members of research, analysis, and planning efforts for wildlife crossing structure improvements or development:

- Peninsula Open Space Trust: recommendation report on Monterey Road in California[82]; linkage vision and design report for Coyote Valley landscape[83]; connectivity and safe passage assessment[84]
- Sonoma Land Trust: management and monitoring strategy report for Sonoma Valley wildlife corridor[85]

Find and examine existing reports or take part in developing plans. If such an analysis has not occurred in the land trust's focal area, advocate to initiate one in the state or region.

05 Examine future transportation projects

One way to engage with state departments of transportation (DOTs) and wildlife crossing projects can be to look at their long-range transportation plans (LRTPs) and short-term plans (called statewide transportation improvement programs or STIPs) to get a sense of where transportation projects are anticipated and whether they may overlap with current or future land trust projects. These plans may be found on a state DOT's website and may include interactive maps. Note where and how any upcoming transportation projects or activities will impact areas of interest. Compare the LRTP and STIP to existing conservation, land-use, and habitat connectivity plans, and look for overlaps, potential conflicts, and projects that could include habitat connectivity or wildlife crossing structure considerations.[86] It is more effective to work at the LRTP time period scale, as STIP time periods may be too short to influence. If an area of land trust interest may have a transportation project where a wildlife crossing structure may be appropriate, reach out to the DOT district engineer and biologist/ environmental lead to initiate a conversation.

Look at future transportation projects in transportation agency planning documents to see if they overlap with land trust priority areas or parcels.

06 Prioritize habitat connectivity and wildlife crossings in land trust strategic plans

Land trusts may integrate goals related to improving habitat connectivity and reducing wildlife-vehicle collisions in strategic plans and other planning documents. Land trusts can include habitat connectivity as a criterion for acquisition of easements or fee property, as an integral part of its mission and core values, and/or as a large-scale vision for conservation.

Some land trusts with habitat connectivity and safe wildlife movement across roadways in their mission, vision, initiatives, or programs are:

- The Heart of the Rockies Initiative is a land trust partnership with a mission "to ensure connected habitat and working lands for people and wildlife by increasing the pace of durable conservation in the Central Rockies of North America." They strive to keep important fish and wildlife habitats connected.[87]
- Southern Oregon Land Conservancy includes habitat connectivity and wildlife corridors in their 2022-2024 strategic plan[88] and specifically work on connectivity in one of their focus areas. They are a member of the Southern Oregon Wildlife Crossing Coalition.[89]
- Vital Ground Foundation has a One Landscape Initiative, with a goal of protecting 188,000 key acres on private lands that link habitats in the Northern Rockies.[90] They also frequently include wildlife crossing structures in their social media messaging.

Consider prioritizing habitat connectivity and wildlife crossings in organizational strategic planning and other visioning opportunities.

07 Connect overlapping priority issues

Habitat connectivity and wildlife crossing structure projects can be key tools to help land trusts and partners address overlapping goals of climate-informed land conservation, climate habitat resilience, community adaptation to climate impacts, and 30x30 goals.

Similarly, organizations focused on working with agricultural landowners with livestock may find opportunity to develop crossing structures not only for wildlife but for livestock as well, especially when farms or ranches are bisected by a roadway. Wildlife-friendly fences can allow seasonal livestock use of pastures while facilitating wildlife use of a crossing structure. This overlap of agricultural and wildlife uses can occur when a structure built for livestock is modified to better include wildlife[91] as well as when a new structure is built to accommodate both livestock and wildlife.[92] However, it is important to consider that some research shows that at times when cattle use is most prevalent within a wildlife crossing, the effectiveness of structures for wildlife is decreased.[93]

Incorporate wildlife connectivity and crossing priorities into existing relevant programs in the organization.

08 Take advantage of or support relevant state or federal policies

Many state and federal policies are catalyzing habitat connectivity and wildlife crossing projects.[94] For instance, the states of California, Colorado, Florida, Massachusetts, New Hampshire, New Mexico, Oregon, Utah, Vermont, and Virginia have each enacted legislation related to wildlife crossings and/or connectivity, and the governors of Colorado, Nevada, Washington, and Wyoming have all enacted executive orders protecting wildlife movement or migration. [95] [96]

It is important for land trusts to identify and take advantage of opportunities to engage and share information with elected officials, agencies, and other stakeholders about the role of private land conservation in habitat connectivity. Ultimately, outreach can help ensure that important private land connectivity considerations, funding opportunities, and private land conservation incentives are integrated into state, regional, and local plans and policies.[97]

Below are several examples of policies that promote voluntary habitat connectivity efforts on private land:

- Department of the Interior Secretarial Order 3362 established the Western Big Game Seasonal Habitat and Migration Corridors Fund, which has provided funding for voluntary habitat connectivity projects on private land. Projects include conservation easements, invasive weed and conifer removal treatments, grazing and wildlife management plans, and making fencing wildlife friendly.[98]
- The Biden administration's America the Beautiful Challenge provides funding for voluntary, community-driven conservation, restoration, and stewardship projects that span public and private land.[99] Numerous groups have submitted proposals for projects to collaboratively identify and prioritize locations for wildlife crossing structures or to plan and implement other habitat connectivity measures.
- New Mexico's Wildlife Corridors Act (2019)[100] directed the New Mexico Department of Transportation (NMDOT) and the New Mexico Department of Game and Fish to develop a Wildlife Corridors Action Plan[101] for NMDOT roads statewide, which has led to prioritizing wildlife crossing structure projects across the state. Land trusts are offering key potential partnership opportunities in some priority locations with private land.
- The Florida Wildlife Corridor Act (2021)[102] sets aside $400 million to protect and connect public and private land[103] within the state-designated Florida Wildlife Corridor, which was developed through a coordinated effort of the Florida Wildlife Corridor Coalition.[104] Funds can be used for fee simple or conservation easement acquisitions by the Department of Environmental Protection, which works with land trusts and other partners in its Florida Forever program.[105]
- California Senate Bill 790, passed into law in 2021, sets up a compensatory mitigation credit scheme that allows the California Department of Fish and Wildlife to grant Caltrans credits for crossings that can be used for future transportation projects requiring environmental mitigation.[106] The Land Trust of Santa Cruz County was a key champion for the bill with the state legislature.

Learn about existing connectivity and wildlife crossings-related policies in the land trust's state or in other states, or in federal policies. Share examples with relevant decision-makers and stakeholders. Advocate for or initiate policies.

09 Take advantage of or support relevant local and regional government policies

Policies at the local and regional levels can also catalyze efforts to improve habitat connectivity and reduce wildlife-vehicle collisions.[107] For instance, local and regional development and land use plans offer critical opportunities to address habitat fragmentation and wildlife conflicts on roadways.

Additionally, open space programs can provide funding for connectivity, especially if they incorporate habitat connectivity goals into their planning documents. For example, in Colorado, Douglas County's Comprehensive Master Plan[108] includes priority areas for connectivity and goals, objectives, and policies[109] relating to wildlife movement corridors. Wildlife crossing structure projects have been built or are planned in some of these protected areas near the highway, with private landowner and county government engagement.

Learn about existing local government policies related to habitat connectivity and wildlife crossings. Share examples with relevant decision-makers and stakeholders. Advocate for or initiate policies.

Relevant Funding Opportunities

Local and regional land trusts are highly attuned to private land conservation funding opportunities but may be less familiar with federal funding for habitat connectivity, including specific funding opportunities for wildlife crossing structures. Land trusts may be eligible as direct or sub-recipients of these funds and can be a part of public-private partnerships for grant programs that require non-federal dollars to match federal investments.

01 State and local funding

In addition to the funding opportunities mentioned in the federal, state, and local policy overview above, state and local governments may fund habitat connectivity and wildlife crossing projects through Special Purpose Excise Taxes, general funds, wildlife stamps, lotteries, sales taxes, real estate transfer taxes, deed recording fees, severance taxes, and business taxes.[110] For instance, Colorado Parks and Wildlife's (CPW) Colorado Wildlife Habitat Program provides millions of dollars to help fund conservation easements, public access easements, and fee title acquisition by CPW.[111] This program funds conservation easements held by open space agencies, land trusts, and CPW. Additionally, in 2022 the Colorado legislature passed House Bill 22-1072, which expands the scope of the state's Habitat Partnership Program to include "private land conservation and wildlife migration corridor efforts."[112]

In addition to governmental sources, unique partner-based options may be available for funding work on connectivity. For example:

- The Nature Conservancy of New York has a Climate Resilience Grant Program[113] that offers flexible grants up to $50,000 to land trusts to increase the pace and scale of protecting lands identified in TNC's resilient Land Mapping Tool.[114] The grants support land acquisition and planning, capacity, and strategy work.
- The Heart of the Rockies Initiative's (HOTR) Keep It Connected program[115] offers a searchable portfolio that highlights one active project from each of the 26 land trusts (in 5 states and 2 provinces) in the HOTR network. It is designed to help find the funding necessary to move each project to completion and bring the next project into the spotlight. Some projects include transportation-related efforts.

02 Federal funding

Federal funding, such as the Land and Water Conservation Fund, U.S. Department of Agriculture's Farm Bill programs, and the aforementioned Big Game Migration and America the Beautiful Challenge grants from the National Fish and Wildlife Foundation, can be used for habitat connectivity and wildlife habitat land conservation.[116] Many land trusts are already well-versed in those opportunities. These funding opportunities may be best used for land acquisition projects in conjunction with infrastructure funding opportunities to plan and complete wildlife crossing structure projects.

The 2021 Infrastructure Investment and Jobs Act, also known as the *Bipartisan Infrastructure Law*, has created unprecedented funding opportunities for projects that reduce wildlife-vehicle collisions and improve habitat connectivity.[117] [118] [119] [120] The *Wildlife Crossings Pilot Program*—a $350 million competitive grant program—is the first-ever *dedicated* pot of federal funding to complete these projects.[121] Land trusts can participate as project partners through agreements with grant recipients (state transportation agencies, federal land management agencies, tribal agencies, metropolitan planning organizations, local governments, and regional transportation authorities). The Federal Highway Administration will evaluate grant proposals in part on the ability of project partners to leverage non-federal funds, especially through public-private partnerships.

Land trusts play a crucial role in forging such private-public partnerships, due to their connections with donors, foundations, landowners, and others who wish to provide the private match to public investments. Land trusts may also be helpful in ensuring that a project is designed to support local economic development, incorporate innovative technologies, provide opportunities for education and outreach, and include monitoring and evaluation—all of which are additional Wildlife Crossings Pilot Program grant evaluation criteria.

In addition to *dedicated* funding under the Wildlife Crossings Pilot Program, projects that improve habitat connectivity and reduce wildlife-vehicle collisions are eligible for a range of other federal transportation programs under the Bipartisan Infrastructure Law. This expanded eligibility means billions of federal dollars are potentially available for such projects. Most of these programs require non-federal matching dollars, which creates opportunity for land trusts to facilitate public-private partnerships.

Programs with expanded eligibility for projects that improve habitat connectivity and reduce wildlife-vehicle collisions include: the Federal Lands Transportation program, the Federal Lands Access program, the Surface Transportation Block Grants program, the Nationally Significant Freight & Highways Projects program, the Nationally Significant Federal Lands & Tribal Projects program, the Rural Surface Transportation Grants program, the Tribal Transportation program, the Highway Safety Improvement program, the Promoting Resilient Operations for Transformative, Efficient & Cost-Saving Transportation program, the Bridge Investment program, Bridge Formula program, the National Culvert Removal, Replacement & Restoration Grants program, the Rebuilding American Infrastructure with Sustainability and Equity program, the Collaborative-based, Aquatic-focused, Landscape-scale Restoration Program, and the Forest Service Legacy Roads & Trails Remediation Program.[122]

How Partner Groups and Departments of Transportation Can Work with Private Landowners and Land Trusts

While this document is intended for use by land trusts, it is also important for other groups to consider how they can work with land trusts.

01 Connect to landowners via land trusts

Land trusts are community-oriented and develop close relationships with landowners that have formally protected their land or potentially may do so in the future. If a partner group or agency (that does not have its own agency-led conservation easement/acquisition program) desires to contact individual landowners regarding possible easements for future crossing structures, it may be best to confer with area land trusts to see if relationships have already been established with landowners in key locations. A valuable approach can be to collaborate with a land trust, share the scientific basis and reasoning for selecting certain locations/landowners, and help them with any further technical components.

02 Identify and prioritize projects

Land trusts take on risk when undergoing transactions acquiring properties on both sides of a highway for potential crossing structures. When departments of transportation (DOTs) have a list of prioritized areas for future crossing structures, this helps land trusts (and their funders) know their efforts are focused appropriately.

03 Share maps, reports, and plans

If an agency or organization has undertaken analyses, prioritization, or planning, make those documents available as a planning resource for public and private land managers, conservation groups, other agencies, and the public. Make plans readily accessible and understood. For instance, DOTs should make their STIPs and long-range transportation plans easily accessible and useful via interactive maps that can be examined at fine scales. As many agencies are familiar, however, it should be kept in mind that private landowners may not want their lands highlighted publicly on maps; caution and conscientiousness should reign in that regard.

04 Fund small parcels

It can be a challenge to spend the time and funding needed to conserve small parcels. Yet smaller parcels are sometimes key pinch points for wildlife connectivity and crossing structure projects, especially if they are connected to larger, high-priority wildlife habitat. If connectivity mapping and prioritization of locations for crossing structures are available to highlight parcels, funders are likely to be interested in their locations. Some funding opportunities such as county or state granting programs offer competitive grants for land conservation but may rank larger parcels higher than smaller parcels. Adding a criterion that weighs the importance of connectivity or removing a large parcel size criterion can be meaningful. Funding programs and foundations should consider the value of key locations rather than evaluation criteria that rate a project solely due to size.

If you are a partner group or agency that has worked with land trusts and private landowners on wildlife crossing structure projects, and you have suggested best practices, please contact us. We would be glad to include your experience in future versions of this guide.

Advice from Land Trusts

Here is (paraphrased) advice from land trusts engaged in habitat connectivity and wildlife crossings projects:

Approach these efforts with a learning mindset—don't shy away if you do not have the expertise, as most people or organizations do not have all the answers. But this kind of work needs to happen.

No one group or agency can do these projects alone. Coalitions and relationships are the key. We can learn from each other—try to find out what other land trusts have done in these efforts. Establish a network.

This is a long game—early involvement can pay off in the long run, and land trusts have an important role in different phases and different moments in the process.

Contact Us!

This resource was created to help land trusts start to, or further engage in, wildlife crossing structure projects by capturing lessons learned and best practices. ***We want to further understand what may help land trusts, road ecologists, and implementers better work together in these projects. Specifically, please let us know:***

- Whether your land trust:
    - engages in habitat connectivity or wildlife crossing structure projects
    - includes connectivity/crossing structure in easement language
    - does modification improvements for wildlife movement under bridges and/or through culverts
- Best practice recommendations gained from any experiences in these types of projects
- Impediments experienced in engaging or attempting to engage in these types of projects
- Further recommendations to road ecologists, DOTs, and other partners on how to engage with land trusts
- Further recommendations to road ecologists, DOTs, and other partners on how to engage with landowners on potential conservation easements and/or wildlife crossing structures

If you have any questions, comments, recommendations, suggested edits, or ideas as we update this "living document," please contact Kylie Paul, Road Ecologist with the Center for Large Landscape Conservation (kylie@largelandscapes.org).

References

1. UNEP. 2019. Frontiers 2018/19 Emerging Issues of Environmental Concern. United Nations Environment Programme, Nairobi. https://www.unep.org/resources/frontiers-201819-emerging-issues-environmental-concern

2. Heller, N.E., and E.S. Zavaleta. 2009. Biodiversity management in the face of climate change: A review of 22 years of recommendations. Biological Conservation 142, 14-32. https://arc-solutions.org/wp-content/uploads/2012/03/Heller-Zavaleta-2009-Biodiversity-management-in-the-face-of-climate-change.pdf

3. Huijser, M.P, P. McGowen, J. Fuller, A. Hardy, A. Kociolek, A.P. Clevenger, D. Smith, and R. Ament. 2008. Wildlife-vehicle collision reduction study. Report to Congress. No. FHWA-HRT- 08-034. U.S. Department of Transportation, Federal Highway Administration, Washington D.C., U.S. https://www.fhwa.dot.gov/publications/research/safety/08034/08034.pdf

4. https://largelandscapes.org/wp-content/uploads/2019/06/Roads-Infographic.pdf

5. Ament, R., S. Jacobson, R. Callahan, and M. Brocki, eds. 2021. Highway crossing structures for wildlife: opportunities for improving driver and animal safety. Gen. Tech. Rep. PSW-GTR-271. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA, U.S. https://largelandscapes.org/wp-content/uploads/2021/06/Highway-Crossing-Structures-for-Wildlife-Opportunities-for-Improving-Driver-and-Animal-Safety.pdf

6. Huijser M.P., J.W. Duffield, C. Neher, A.P. Clevenger, T. Mcguire, eds. 2022. Final Report 2022: Update and expansion of the WVC mitigation measures and their cost-benefit model. Transportation Pooled Fund Study, TPF-5(358). Nevada Department of Transportation, Carson City, NV. https://scholarworks.montana.edu/xmlui/handle/1/17509

7. https://www.landtrustsantacruz.org/wp/wp-content/uploads/2022/04/PR-HW17-DRAFT-4-29-FINAL.pdf

8. https://storymaps.arcgis.com/stories/40523de82f3042629f0e5f58112f3038

9. https://www.landtrustsantacruz.org/category/protected-lands/hwy17-wildlife-crossing/

10. https://www.mdlt.org/acquisitions-bolster-sand-to-snow-national-monument-wildlife-crossing-hopes/

11. https://www.desertsun.com/story/news/environment/2021/08/16/mojave-desert-land-trust-wants-wildlife-overpass-highway-62/8102951002/

12. http://www.safepassagecoalition.org/

13. https://www.landtrustsantacruz.org/1st-gabilan-wildlife-corridor-property-protected/

14. https://openspacetrust.org/blog/wildlife-crossings/

15. https://openspacetrust.org/blog/monterey-road-report/

16. Pathways for Wildlife. 2020. Wildlife permeability and hazards across Highway 152 Pacheco Pass: Establishing a baseline to inform infrastructure and restoration. Prepared for the Santa Clara Valley Habitat Agency. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=189189

17. https://sonomalandtrust.org/current-initiatives/sonoma-valley-wildlife-corridor/

18. https://www.landconserve.org/news/we-did-it-nov2019

19. Riley, S. P., T. Smith, and T. Vickers. 2018. Assessment of wildlife crossing sites for the Interstate 15 and Highway 101 freeways in southern California. March 2018. www.scienceforconservation.org/assets/downloads/SoCalLinkage_Report-2018.pdf

20. https://www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/land-and-water-stories/a-path-for-mountain-lions/

21. https://smmc.ca.gov/liberty-canyon-wildlife-corridor/

22. https://conservationtools.org/guides/123-bridge-loans-for-conservation-purchases

23. https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/environment/pubs/wildlifecrossingguidelines_2018revisions.pdf?sfvrsn=e84b7844_0

24. Staying Connected in the Northern Appalachians. 2012. Potential conservation easement provisions designed to explicitly address connectivity in the Northern Appalachians. https://stayingconnectedinitiative.org/wp-content/uploads/2022/08/connectivityconservationeasementlanguage_final.pdf

25. https://ctconservation.org/wp-content/uploads/CT-FOREVER-WILD-CONSERVATION-EASEMENT-1st-Ed.-2019-rev.-May-2022.pdf

26. Mahowald, H., J. Crowder, and L. Allison. 2019. Habitat conservation strategies for migrating wildlife: Supporting Landowners in the Upper Rio Grande. Western Landowners Alliance. https://westernlandowners.org/publication/habitat-conservation-strategies-for-migrating-wildlife/

27. Wisdom, M.J., K. Preisler, L. Naylor, R. Anthony, B. Johnson, and M. Rowland. 2018. Elk responses to trail-based recreation on public forests. Forest Ecology and Management 411: 223-233. https://doi.org/10.1016/j.foreco.2018.01.032.

28. https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/wildlife-habitat

29. Rafferty, A. Management Recommendations for Landowners: Sustaining healthy, vibrant lands for people and wildlife. Staying Connected Initiative. https://stayingconnectedinitiative.org/wp-content/uploads/2022/08/Management-Recommendations-for-Landowners-small.pdf

30. https://sonomalandtrust.org/wp-content/uploads/2019/09/SLTWIldlifeBrochureforlandowners.pdf

31. Paige, C. 2015. A Wyoming landowner's handbook to fences and wildlife: Practical tips for fencing with wildlife in mind. Wyoming Community Foundation, Laramie, WY. 56 pp. https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Habitat Information/Grazing Management and Prescribed Burning/A-Wyoming-Landowner-s-Handbook-to-Fences-and-Wildlife_2nd-Edition_-lo-res.pdf

32. https://www.landconserve.org/news/wildlife-friendly-fences

33. Gregory, A, E. Spence, P. Beier, and E. Garding. 2021. Toward best management practices for ecological corridors. Land 10: 140. https://doi.org/10.3390/land 1002014

34. https://www.maine.gov/ifw/fish-wildlife/wildlife/beginning-with-habitat/land-trusts/index.html

35. http://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=21173c9556be4c52bc20ea706e1c9f5a

36. https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=fishbarrierdata

37. Donaldson, B. 2022. Large animal crash countermeasures in Virginia: Technical guidance and best management practices. Virginia Transportation Research Council, Virginia Department of Transportation. https://www.virginiadot.org/business/resources/LocDes/Large_Animal_Crash_Countermeasures_in_Virginia_April_2022.pdf

38. Smith, D. J., J. Kintsch, P. Cramer, S.L. Jacobson, and S. Tonjes. 2015. Modifying structures on existing roads to enhance wildlife passage. In: Andrews, K. M.; Nanjappa, P.; Riley, S. P. D., eds. Roads and Ecological Infrastructure: Concepts and Applications for Small Animals. Baltimore, MD: The Johns Hopkins University Press: 208-228. Chapter 10. https://www.fs.usda.gov/treesearch/pubs/56209

39. Kintsch, J. and P. Cramer. 2015. Permeability of existing structures for terrestrial wildlife: A passage assessment system. Research Report No. WA-RD 777.1. Washington State Department of Transportation, Olympia, WA, U.S. https://www.wsdot.wa.gov/research/reports/fullreports/777.1.pdf

40. https://sonomalandtrust.org/current-initiatives/sonoma-valley-wildlife-corridor/

41. https://www.nature.org/en-us/about-us/where-we-work/united-states/new-york/stories-in-new-york/critter-crossings/

42. The Nature Conservancy, Adirondack Chapter. 2012. Securing permeable roadways for wide-ranging wildlife in the Black River Valley. https://stayingconnectedinitiative.org/wp-content/uploads/2022/08/Securing-permeable-roadways-for-wide-ranging-wildlife-in-the-Black-River-Valley1.pdf

43. https://www.vermontpublic.org/vpr-news/2016-10-17/why-did-the-bear-cross-the-road-project-aims-to-create-safe-crossings-for-wildlife#stream/0

44. Marangelo, P. 2019. Reducing wildlife mortality on roads in Vermont: Determining relationships between structure attributes and wildlife movement frequency through bridges and culverts to improve related conservation investments. Research report for Vermont Agency of Transportation. https://vtrans.vermont.gov/sites/aot/files/planning/documents/research/publishedreports/2019-15_UVM-TNC-wildlife-game-camera-research-final-report-Marangelo.pdf

45. Clevenger, T. and M.P. Huijser. 2011. Handbook for design and evaluation of wildlife crossing structures in North America. U.S. Department of Transportation, Federal Highway Administration, Washington D.C., U.S. https://www.fhwa.dot.gov/clas/ctip/wildlife_crossing_structures/

46. Western Transportation Institute. 2022. Cost effective solutions for wildlife vehicle collision (WVC) reduction and habitat connectivity. Transportation Pooled Fund Study, TPF-5(358). Nevada Department of Transportation, Carson City, NV. https://westerntransportationinstitute.org/programs/road-ecology/tpf-5-358-wvc-study/

47. Langton, T.E.S. and A.P. Clevenger. 2020. Measures to reduce road impacts on amphibians and reptiles in California; Best management practices and technical guidance. Prepared by Western Transportation Institute for California Department of Transportation, Division of Research, Innovation and System Information. https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/ca20-2700-finalreport-a11y.pdf

48. https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=27718

49. https://wildlandsandwoodlands.org/RCPNetwork/ and https://wildlandsandwoodlands.org/specialties/connectivity-and-ecological-studies/

50. https://landscapeconservation.org/catalyst-fund/

51. https://landscapeconservation.org/

52. https://www.coloradowta.com/home/

53. https://ecologicalconnectivity.com/

54. https://www.nflt.org/ocala-to-osceola-wildlife-corridor/

55. https://www.myowf.org/sowcc

56. https://smokiessafepassage.org/learn-more-about-safe-passage/coalition/

57. https://stayingconnectedinitiative.org/who-we-are/sci-partners/

58. https://www.summitcountysafepassages.org/

59. https://vswcc.weebly.com/

60. https://www.environment.fhwa.dot.gov/env_initiatives/liaisonCOP/documents/Establishing_a_Transportation_Liaison_Program_Guidebook_UpdatedFinal.pdf

61. Keeley, A.T., P. Beier, T. Creech, K. Jones, R.H. Jongman, G. Stonecipher, and G.M. Tabor. 2019. Thirty years of connectivity conservation planning: An assessment of factors influencing plan implementation. Environmental Research Letters 14(10):103001. https://iopscience.iop.org/article/10.1088/1748-9326/ab3234

62. Albright, W., R. Ament, R. Callahan, M.W. Frantz, M.R. Grabau, M.E. Johnson, T. Jones-Farrand, K. Malpeli, M. Millmann, N. Muenks, and R. Quiñones. 2021. Connectivity and climate change toolkit. The Association of Fish and Wildlife Agencies. https://www.fishwildlife.org/application/files/9216/1582/0864/Connectivity_and_Climate_Change_Toolkit_FINAL.pdf

63. Connectivity and Climate Change Toolkit storymap. 2021. The Association of Fish and Wildlife Agencies. https://storymaps.arcgis.com/stories/c049df7355c648ceb132e4894be2fb0e

64. https://conservationcorridor.org/corridor-toolbox/programs-and-tools/

65. Ament, R., R. Callahan, M. McClure, M. Reuling, and G. Tabor. 2014. Wildlife connectivity: Fundamentals for conservation action. Center for Large Landscape Conservation: Bozeman, Montana. https://largelandscapes.org/wp-content/uploads/2019/05/Wildlife-Connectivity-Fundamentals-for-Conservation-Action.pdf

66. https://wildlife.ca.gov/Conservation/Planning/Connectivity/CEHC

67. https://www.wildlife.state.nh.us/nongame/corridors.html

68. https://oregonconservationstrategy.org/success-story/the-oregon-connectivity-assessment-and-mapping-project-ocamp/

69. South Coast Wildlands (SC Wildlands). 2008. South Coast Missing Linkages: A wildland network for the South Coast Ecoregion. Produced in cooperation with partners in the South Coast Missing Linkages Initiative. www.scwildlands.org/reports/SCMLRegionalReport.pdf#:~:text=The%20South%20Coast%20Missing%20Linkages%20project%20has%20developed,be%20greater%20than%20the%20sum%20of%20the%20parts

70. https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/Pages/default.aspx

71. https://databasin.org/

72. https://www.fishwildlife.org/afwa-informs/state-wildlife-action-plans

73. Hawk, R., C. Miller, C. Reining, and L. Gratton. 2012. Staying connected in the northern Green Mountains: Identifying structural pathways and other areas of high conservation priority. Staying Connected Initiative. https://stayingconnectedinitiative.org/wp-content/uploads/2022/08/ngm_structural_pathways_and_parcels_29oct12_final.pdf

74. Rashford, B. A. Scott, M. Hayes, and H. Sawyer. 2015. Targeting conservation easement purchases to benefit wildlife. Ruckelshaus Institute, Wyoming Open Spaces Initiative. http://www.uwyo.edu/haub/_files/_docs/ruckelshaus/open-spaces/2015-targeting-conservation-easements.pdf

75. Carroll, K.A, R.M. Inman, A.J. Hansen, R.L. Lawrence, and K. Barnett. 2021. A framework for collaborative wolverine connectivity conservation. iScience 24:8. https://www.sciencedirect.com/science/article/pii/S2589004221008087

76. Williams, T., N. Dodd, P. Cramer, S. Kundur, M. Gomez, and J. Rybczynski. 2021. Arizona statewide wildlife-vehicle conflict study. For Arizona Department of Transportation. https://azdot.gov/planning/transportation-studies/completed-transportation-studies/wildlife-vehicle-conflict-study

77. Fairbank, E.R., A.R. Callahan, T. Creech, M.P. Huijser, and R. Ament. 2019. Blackfeet Nation animal-vehicle collision reduction master plan. Center for Large Landscape Conservation, Bozeman, MT, USA. https://largelandscapes.org/wp-content/uploads/2021/04/Blackfeet-Nation-Animal-Vehicle-Collision-Reduction-Master-Plan.pdf

78. Lee, T., A.P. Clevenger, and C. Lamb. 2019. Amendment: Highway 3 transportation mitigation for wildlife and connectivity in Elk Valley of British Columbia. Miistakis Institute. Calgary, Alberta, Canada. https://www.roadwatchbc.ca/files/Hwy 3_Lee et al._ReportAmendment_2019_Final.pdf

79. Kintsch, J., P. Basting, T. Smithson, and G. Woolley. 2022. Eastern Slope and Plains wildlife prioritization study. Report to Colorado Department of Transportation and Colorado Parks and Wildlife. Denver, CO, USA. https://www.codot.gov/programs/research/pdfs/2022/wildlife-prioritization/eswps-report

80. New Jersey Division of Fish and Wildlife. 2019. Connecting Habitat Across New Jersey (CHANJ): Guidance document, Version 1.0. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Nongame Species Program. https://dep.nj.gov/njfw/conservation/tools-of-chanj/

81. Huijser, M.P., C. Riginos, M. Blank, R. Ament, J.S. Begley, and E.R. Jenne. 2018. Teton County wildlife master plan. Western Transportation Institute, Montana State University, Bozeman, Montana, USA. https://westerntransportationinstitute.org/wp-content/uploads/2016/10/4W6376-Huijser-et-al-Report-Teton-County-20180531-LR.pdf

82. Santa Clara County Wildlife Corridor Technical Working Group, Coyote Valley Subcommittee. 2019. Recommendations to reduce wildlife-vehicle collisions on the Monterey Road corridor in Coyote Valley, Santa Clara County. Santa Clara County Wildlife Corridor Technical Working Group, San Jose, CA. https://openspacetrust.org/blog/monterey-road-report/

83. Santa Clara Valley Open Space Authority and Conservation Biology Institute. 2017. Coyote Valley landscape linkage: A vision for a resilient, multi-benefit landscape. Santa Clara Valley Open Space Authority, San José, CA. https://www.openspaceauthority.org/system/documents/Coyote%20Valley%20Landscape%20Linkage%20Report_Final_lowres.pdf

84. Diamond, T., A. Sandoval, N. Sharma, M. Vernon, P. Cowan, A. Clevenger, and S. Lockwood. 2022. Enhancing ecological connectivity and safe passage for wildlife on highways between the southern Santa Cruz Mountains, Gabilan Range, and Diablo Range in California. Pathways for Wildlife and Peninsula Open Space Trust, Palo Alto, CA. https://openspacetrust.org/connectivity-study-download/

85. Sonoma Land Trust. 2014. Sonoma Valley wildlife corridor project: Management and monitoring strategy. Santa Rosa, CA. https://sonomalandtrust.org/wp-content/uploads/2018/11/Management-Monitoring-Strategy-FINAL-INHOUSE-010414.pdf

86. White, P.A., A. Adler, S. Albert, P.J. Baicich, B. Branch, A. Burnham, J. Burnim, C. Campbell, B. Charry, and G. Chavarria. 2007. Getting up to speed: A conservationist's guide to wildlife and highways. Defenders of Wildlife. https://defenders.org/sites/default/files/publications/getting_up_to_speed.pdf

87. https://heart-of-rockies.org/

88. Southern Oregon Land Conservancy. 2022. Strategic Plan 2022-2024. https://www.landconserve.org/s/SOLCStrategicPlan2022-24-WEB.pdf

89. https://www.myowf.org/sowcc

90. https://www.vitalground.org/mapping-one-landscape-for-wildlife-and-people/

91. Huijser, M.P., A. Warren, and E.R. Fairbank. 2019. Preliminary data on wildlife use of existing structures along I-25, Kaycee, Wyoming, USA. Interim Report 1. Report 4W7020. Western Transportation Institute, Montana State University, Bozeman, Montana, USA. https://westerntransportationinstitute.org/wp-content/uploads/2019/08/4W7020_Huijser-Warren-Fairbank-Report-I25-Kaycee-Buffalo-interim-report1-FINAL-190801.pdf

92. https://www.trapperspoint.com/about.htm

93. Loberger, C., J. Gagnon, H. Nelson, C. Beach, and S. Sprague. 2021. Determining effectiveness of wildlife-vehicle collision mitigation projects: Phase One. A Report on Research Sponsored by New Mexico Department of Transportation Research Bureau in Cooperation with the U. S. Department of Transportation Federal Highway Administration. https://wildlifeactionplan.nmdotprojects.org/wp-content/uploads/sites/39/2021/09/NM17ENV-01_PhaseOne_FinalReport_20210308.pdf

94. Breuer, A., B. Hance, R. Callahan, R. Ament, Z. Wurtzebach, and A. Wearn. 2022. Ecological connectivity policy compendium: U.S. policies to conserve ecological connectivity, 2007-2021. Center for Large Landscape Conservation: Bozeman, MT, U.S. https://doi.org/10.53847/KBWT3277

95. https://largelandscapes.org/news/state-xing-legislation/

96. https://www.ncelenviro.org/issue/wildlife-connectivity-and-crossings/

97. Ament, R., R. Callahan, L. Maxwell, G. Stonecipher, E. Fairbank, and A. Breuer. 2019. Wildlife connectivity: Opportunities for state legislation. Center for Large Landscape Conservation: Bozeman, Montana. https://largelandscapes.org/wp-content/uploads/2019/03/Wildlife_Connectivity_Opportunities_for_State-Legislation_2019.pdf

98. https://www.nfwf.org/programs/rocky-mountain-rangelands/western-big-game-seasonal-habitat-and-migration-corridors-fund

99. https://www.nfwf.org/programs/america-beautiful-challenge

100. https://www.wildlife.state.nm.us/wpfb-file/11-wildlife-corridors-act-pdf/

101. Cramer, P., J.L. Cartron, K. Calhoun, J. Gagnon, M. Haverland, M. Watson, S. Cushman, H.Y. Wan, J Kutz, J. Romero, T. Brennan, J. Walther, C. Loberger, H. Nelson, T. Botkin, and J. Hirsch. 2022. New Mexico wildlife corridors action plan. New Mexico Department of Transportation and New Mexico Department of Game & Fish. https://wildlifeactionplan.nmdotprojects.org/

102. https://www.flgov.com/2021/07/19/governor-ron-desantis-celebrates-the-signing-of-senate-bill-976-creating-the-florida-wildlife-corridor-act/

103. https://floridadep.gov/lands/lands/documents/florida-wildlife-corridor

104. https://floridawildlifecorridor.org/

105. https://floridadep.gov/lands/environmental-services/content/florida-forever

106. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB790

107. Breuer, A., B. Hance, R. Callahan, R. Ament, Z. Wurtzebach, and A. Wearn. 2022. Ecological connectivity policy compendium: U.S. policies to conserve ecological connectivity, 2007-2021. Center for Large Landscape Conservation: Bozeman, MT, U.S. https://doi.org/10.53847/KBWT3277

108. https://www.douglas.co.us/planning/master-plans/comprehensive-master-plan/

109. https://www.douglas.co.us/documents/cmp-section-9.pdf/

110. Ament, R., R. Callahan, L. Maxwell, G. Stonecipher, E. Fairbank, and A. Breuer. 2019. Wildlife connectivity: Opportunities for state legislation. Center for Large Landscape Conservation: Bozeman, Montana. https://largelandscapes.org/wp-content/uploads/2019/03/Wildlife_Connectivity_Opportunities_for_State-Legislation_2019.pdf

111. https://cpw.state.co.us/cwhp

112. https://leg.colorado.gov/bills/hb22-1072

113. https://www.nature.org/en-us/newsroom/ny-2022-resilient-and-connected-network-grant-program/

114. https://maps.tnc.org/resilientland/

115. https://keepitconnected.org/

116. https://wildlandsnetwork.org/resources/beyond-roads

117. https://www.fhwa.dot.gov/bipartisan-infrastructure-law/

118. https://arc-solutions.org/article/dedicated-funding/

119. https://largelandscapes.org/bipartisan-infrastructure-law/

120. https://wildlandsnetwork.org/news/demystifying-wildlife-crossing-projects

121. Paul, K., A. Wearn, R. Ament, E. Fairbank, and Z. Wurtzebach. 2021. A toolkit for developing effective projects under the federal wildlife crossings pilot program. Center for Large Landscape Conservation: Bozeman, MT, U.S. https://doi.org/10.53847/PZNN2279

122. https://largelandscapes.org/wp-content/uploads/2022/08/Federal-Funding-for-Wildlife-Crossings-CLLC-July-2022.pdf

CENTER
for
LARGE LANDSCAPE
CONSERVATION

largelandscapes.org