Supplemental Material

Nature Divided, Scientists United: The U.S.-Mexico Border Wall Threatens Biodiversity and Binational Conservation

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Appendix S1. Species analyses.

Methods

To calculate the number of species with ranges extending across the U.S.-Mexico border, we first considered all animal species in the IUCN Red List that are native to and extant in both the nations (IUCN 2017). We refined this list by removing species with "Marine" listed in the Red List as one of their ecosystem types. The remaining 1,506 species use Freshwater and/or Terrestrial ecosystems only. For each of these species, we recorded its IUCN Red List conservation status (DD – "Data Deficient", LC – "Least Concern", NT – "Near Threatened", VU – "Vulnerable", EN – "Endangered", CR – "Critically Endangered"), population trend (unknown, decreasing, stable, or increasing), common name, and taxonomic classification data (Class, Order, and Family). See Supplemental File 2 for results.

We then examined which of these species would lose connectivity between the U.S. and Mexico in various proportions of their range due to the building of a barrier across the entire border. We limited this analysis to non-flying species to conservatively evaluate species that could not fly across a border wall. For each of the 399 species (26% of the total) with spatial data available for download (in bulk) from the IUCN Red List, we rasterized its geographic range at 1 km resolution (at the equator) in longitude/latitude form, considering only polygons with PRESENCE coded as 'Extant' or 'Probably Extant' and ORIGIN coded as 'Native.' For species for which the Red List listed lower and/or upper elevation limits, we then masked out regions below the lower limit and above the upper limit (if available) using the Global 30 Arc-Second Elevation map (GTOPO30) provided by the U.S. Geological Survey. Lower and/or upper altitude limits were available for 102 (26%) of the 399 species.

Using these species' range maps, we then determined each species' total range area. We used this information to calculate the percentage of its range south of the U.S.-Mexico border (i.e. the percentage of its range that could be cut off from the U.S.-based population(s) by a border wall). When summarizing our spatial analysis results, we focus on the 346 species that we identified as having at least some of their geographic ranges covering both the U.S. and Mexico. The other 399-346=53 species either have not yet had their complete ranges posted in spatial format, or there is a high degree of uncertainty about their ranges in one or both countries. Lastly, we calculated the percentage of species that have less than 20,000 km^2 range area north of the border. The 20,000 km^2 limit was used because it is the threshold for extent of occurrence (EOO) used in the IUCN Red List methodology to consider species for listing as Vulnerable under criterion B (geographic range; see http://www.iucnredlist.org/static/categories_criteria_3_1 for full details). While this

methodology was developed for global scale assessments, according to the IUCN National Red List guidelines, it can be applied at the regional scale, provided adjustments are made for potential source/sink effects (http://www.nationalredlist.org/support-information/the-process/red-listing/applying-the-iucn-categories-and-criteria-at-the-nationalregional-level/). The presence of a border wall would make such source/sink dynamics unlikely.

A general limitation of our analysis is that it is conducted entirely at the species level and thus does not account for variability among subspecies in terms of geographic ranges and conservation status. This is a potential issue because certain subspecies may have ranges entirely within either the U.S. or Mexico. Conversely, a species listed as Least Concern could have a highly endangered subspecies found on both sides of the border. The scale of analysis was motivated by the availability of suitable data. All results should be interpreted with this limitation in mind.

Results

See main paper for primary results. All together the 1,506 species span 18 taxonomic classes: birds (Aves): 449, dicotyledons (Magnoliopsida): 268, insects (Insecta): 178, reptiles (Reptilia): 169, mammals (Mammalia): 163, monocotyledons (Monocotyledons): 110, bony fish (Actinopterygii): 46, amphibians (Amphibia): 44, conifers (Pinopsida): 33, snails and slugs (Gastropoda): 11, leptosporangiate ferns (Polypodiopsida): 9, bivalves (Bivalvia): 9, gnetophytes (Gnetopsida): 7, malacostracans (Malacostraca): 5, branchiopods (Branchiopoda): 2, clubmosses (Lycopodiopsida): 1, stoneworts and brittleworts (Charophyaceae): 1, arachnids (Arachnida): 1.

Reference

IUCN. The IUCN Red List of Threatened Species, Version 2017-3. 2017. Available from: http://www.iucnredlist.org

Appendix S2. Protected areas analysis.

Methods

We obtained shapefiles of protected area in the United States and Mexico from the Protected Areas Database of the United States (PAD-US) and other sources listed below. We categorized protected areas into two categories based on the level of protection: (1) protected areas more strictly managed for biodiversity conservation, which were comparable to IUCN Protected Areas Categories I-IV, and (2) protected areas managed for sustainable multi-use, which were comparable to IUCN Protected Area Categories V-VI (Dudley 2013). PAD-US protected areas with the GAP Status Code of 1 or 2 were included in the first category (equivalent to IUCN Category 1-IV) whereas areas marked 3 were included in the second (equivalent to IUCN Category V-VI). All remaining unassigned protected areas were added to the first category. Examples of lands included in the first group include easements, national monuments, wildlife refuges, national and state wilderness areas and study areas, national and state parks, state wildlife management areas, biosphere reserves, and Flora & Fauna reserves. Examples in the second group include U.S. National Forest Service and Bureau of Land Management lands.

Using ArcGIS version 10.5.1, we calculated the number and acreage of protected areas in each group within 50 miles of the U.S.-Mexico border. Where protected areas abutted the U.S.-Mexico border to create cross-border, contiguous swaths of protected land, we calculated the number of border miles with adjacent protected areas (both categories combined).

References

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