Identifying Priority Ecoregions for

Amphibian Conservation

in the U.S. and Canada

Tree Walkers International Special Report

Acknowledgements

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I would also like to extend a special thank you to Aaron Bloch for compiling conservation status data for amphibians in the United States and to Joe Milmoe and the U.S. Fish and Wildlife Service, Partners for Fish and Wildlife Program for supporting Operation Frog Pond.

Photo Credits

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Introduction

One of my earliest memories occurred following a spring rain on my uncle's dairy farm in southeastern Kansas when I was only three or four years old. I ventured down the long, muddy driveway to a large puddle where I found a most amazing sight that I will never forget. Ringed around the edge of the puddle and submerged in the murky waters with only eyes and noses revealing their presence were a dozen or so young leopard frogs seeking refuge from the emerging sun. I don't know if these were the first frogs I had ever seen, but I do know they had a profound effect on my life. Motionless, their crisply patterned skin glistened like glazed ceramic. Each black leopard spot was separated from an olive green background by a thin yellow edge as if painted by the steadiest of hands with a fine detail brush. Their eyes, fixed and alert, stared blankly but ready to trigger their thick hind legs into action if the grubby little kid watching them came any closer. The only motion of these frogs was the steady pulse of their pearl white throats, looking soft and flexible like oiled rubber. Of course I had to catch one, so the frogs all dove into the puddle and I dove in after them. After many failed attempts, I managed to catch a frog, and the tactile sensation was just as incredible as their appearance. This frog was moist and slick but kicked powerfully with its strong hind limbs. Its belly and throat were just as soft as they looked; they really were like soft rubber. And the frog's eyes protruded when it was relaxed but closed and sunk into its skull as it struggled. Eventually, my aunt came to the rescue of the frogs and took me inside to clean the mud off. But that moment had sealed my future as an ecologist and wildlife biologist.

From that point on, amphibians had a major influence on my life. I could not venture near a pond, stream or woodland without embarking on a search for amphibians, reptiles, and other wonders of nature. I would spend cold spring evenings silently in icy marshes just to witness the raspy croak of chorus frogs and hot summer days swimming among cricket frogs at Blackburn's pond. I would be scolded for digging holes and filling them with water to attract frogs to our suburban lot, and chased out of the pond of a new apartment complex for swimming with the frogs. My career would lead me to study everything from cockroaches and cicadas, to bison and wolverines, but it all started with a chance encounter with frogs in a muddy puddle on a dreary Kansas day.

Amphibians in Decline

Sadly, encounters with amphibians such as the one that so profoundly impacted my life are becoming increasingly rare. Amphibians are experiencing a crisis unprecedented in their 370 million year history on Earth. Of the approximately 6,000 amphibian species currently described by science, 33% are known to be threatened with extinction.[1] A recently published study estimates that the rate of extinction for amphibians could be 211 times higher than the background extinction rate estimated from the fossil record over the past 2.5-2.75 million years.[2] In the New World, which contains 53% of all known amphibian species, two out of five species (39%) are threatened with extinction.[3] If species that are believed to be threatened with extinction, but there is insufficient data to know for sure, are included, the percentage of amphibian species threatened by extinction climbs to an astonishing 50% globally.

The causes for these declines are many. Habitat loss and degradation is the leading threat, affecting nearly 4,000 species.[1] Pollution is the next major threat affecting more than 1,000 species. And recently, disease caused by chytrid fungus has emerged as a significant threat to amphibians, including those living far from humans in areas relatively safe from habitat loss and pollution. The greatest number of threatened amphibian species is found in Central and South America, in part because those areas harbor the largest concentration of the world's amphibian diversity.

Declines in North America

But the amphibian crisis is not limited to the biodiversity-rich tropics. Amphibian declines have been documented on every continent where amphibians live, including North America. Amphibian declines in the United States struck a personal note when I recently visited a city park near the home where I grew up. A large naturalistic water garden and formal lily garden remain, and look just as I remember them in my youth. But gone were the steady drone of American bullfrogs (*Rana catesbeiana*), the soft cluck of plains leopard frogs (*Rana blairi*), and the tick tick tick of Blanchard's cricket frogs (*Acris crepitans blanchardi*). In their place were only the sounds of the wind and traffic. After an hour long search, I finally located a single small bullfrog, but in the 1970s, these ponds teemed with hundreds upon hundreds of frogs and the shallows writhed with thousands of tadpoles wriggling among water lily stems. It

Number of Amphibian Species "At Risk"[1]

	Total	Global* (%)	National* (%)	State/Province* (%)	ESA/COSEWI†
United States	277	120 (43.3%)	128 (46.2%)	246 (88.8%)	22 (7.9)
Canada	46	1 (2.2%)	16 (34.8%)	29 (63.0%)	16 (34.8%)

[1]Includes species with a moderate to severe risk of extirpation or extinction (NatureServe conservation status ranks 1-3) as well as species already presumed to be extirpated or possibly extirpated (status ranks H and X). NatureServe. 2007. NatureServe Explorer: An online encyclopedia [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available *http://www.natureserve.org/explorer*. (Accessed: October 10, 2007).

*Global rankings refer to a species' extinction risk over its entire range, national rankings refer to a species' risk within a given country, and state/provincial ranks refer to risk within a particular U.S. state or Canadian province.

†Species currently listed, candidates for listing, or proposed for listing, under the U.S. Endangered Species or species listed by the Committee on the Status of Endangered Wildlife in Canada excluding those designated "Not at Risk."

seems tragic that the thousands of children who visit this park each month cannot experience the abundance of amphibian life that I enjoyed in my youth.

Stories such as these are being repeated all over North America and they do not just occur in urban areas. At my home in southwest Montana, I am fortunate enough to live in some of the most pristine country left in the lower 48 states. Nearly all wildlife species that were present when Europeans first visited this area over 200 years ago are still here. Even such wilderness icons as gray wolves and grizzly bears still roam the forests and valleys around my home, and are on the increase. But our local amphibians have not fared as well. Of four species of frogs and toads native to our valley, only the Columbia spotted frog (*Rana lutiventris*) remains common. Boreal chorus (*Pseudacris maculates*) frogs have been reduced to only one or two lonely voices on a cold spring night. Boreal toads (*Bufo boreas boreas*), once the most abundant amphibian in these mountains, and northern leopard frogs (*Rana pipiens*), largely extirpated west of the Continental Divide, are gone. When an area that still contains large carnivores that have been extirpated from most of their former ranges cannot support its native amphibians, there is clearly a problem.

Statistics for the United States derived from the NatureServe database reveal cause for concern. Of the 277 species currently listed as U.S. native amphibians, about 43% are considered "at risk" globally,[a] 46% are considered "at risk" within the U.S., and 89% are considered "at risk" in at least one U.S. state. Only 8% of amphibians native to the U.S. have any legal status under the Endangered Species Act, leaving 92% with no protection, or consideration for protection, under the Act. Of 46 native Canadian amphibians, 2% are considered globally "at risk", 35% are at risk of extinction within Canada, and 63% are listed as "at risk" in at least one province. However, 35% of Canadian amphibian species have some form of legal status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are, therefore, being reviewed for protection under the Species at Risk Act (Canada's version of the U.S. Endangered Species Act). Thus, nearly one half of all amphibian species are at risk of being lost in the U.S. In addition, 9 out of 10 species in the U.S., and more than one third of all Canadian amphibians, face a moderate to severe risk of being extirpated from portions of their ranges within these two countries.

As in other regions, amphibians in North America are declining due to multiple threats. Habitat loss is the leading threat with 70% of all U.S. species and 56% of Canadian species threatened by habitat loss[1]. The major causes of habitat loss are mining and timber extraction, development, and agriculture. In fact, habitat loss affects, or has affected, over 90% of all U.S. and Canadian amphibians known to have any major threats. However, amphibians in North America are affected by additional threats such as pollution, invasive species, and disease. Although the number of species affected by these additional threats is much lower than the number affected by habitat loss, the impact of these other threats are more severe for many species.

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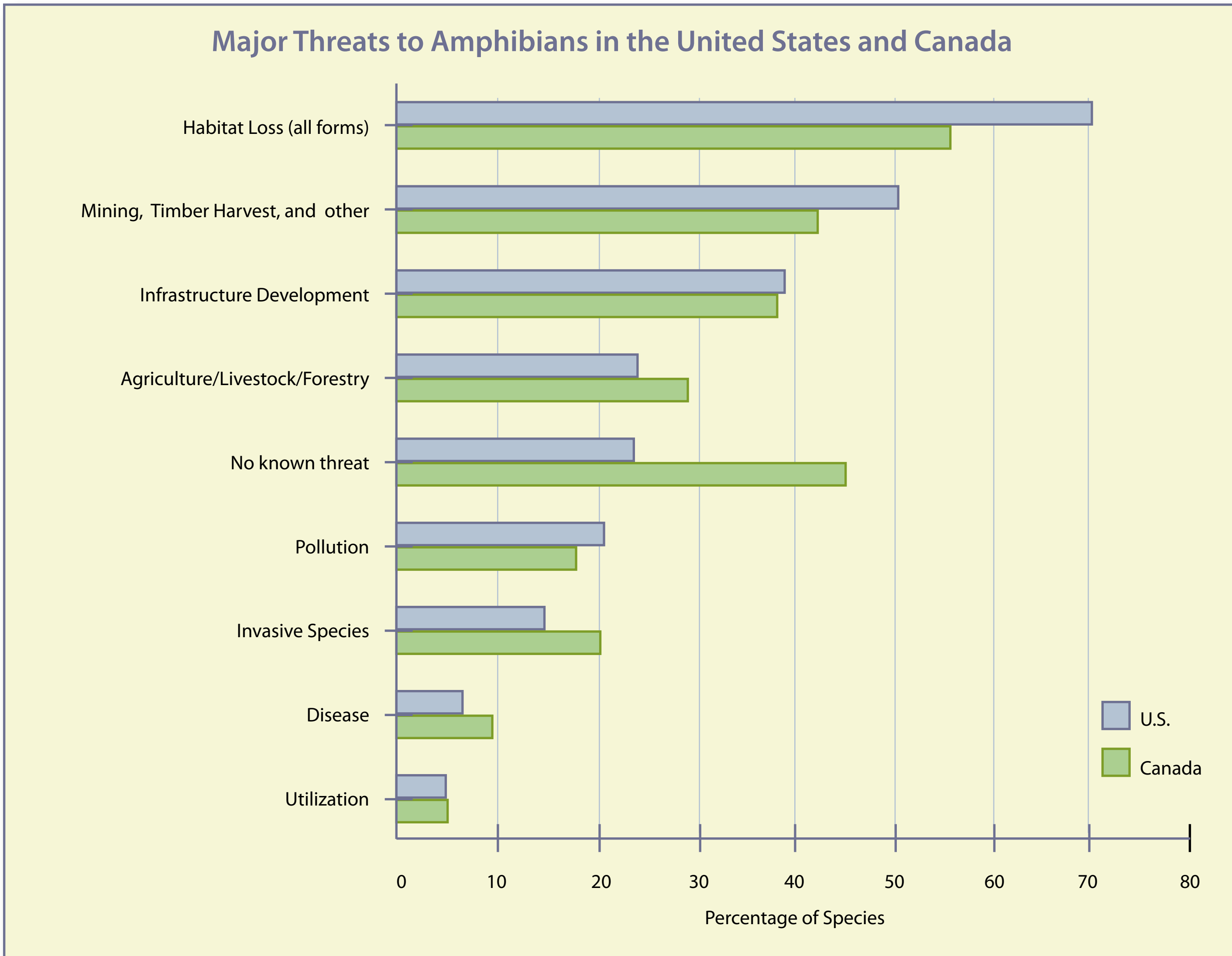
a Species "at risk" are species with a moderate to severe risk of extirpation or extinction (NatureServe conservation status ranks 1-3) as well as species already presumed to be extirpated or possibly extirpated (status ranks H and X). Global rankings refer to a species' extinction risk over its entire range, national rankings refer to a species' risk within a given country, and state/provincial ranks refer to risk within a particular U.S. state or Canadian province. For more information about conservation status rankings, visit the NatureServe web site at: *www.natureserve.org*.



Opportunities for Action

Although the statistics look grim, there is some cause for optimism. Compared with many wildlife species, most amphibians have relatively small home ranges, often remaining within a few hundred yards of breeding sites and rarely venturing more than a few miles from them. Within suitable habitat, amphibians often occur in very high densities and may even be the most abundant vertebrates in some ecosystems.[5] In many cases, amphibian habitat loss may be limited to loss of suitable breeding sites which are often very small, and often ephemeral, pools of water. These characteristics provide tremendous opportunities for small groups and individuals to make significant contributions to their local amphibian populations. Unlike grizzly bears that require millions of acres of habitat to support a single population, a single person can realistically create or restore high quality habitat to support a thriving population of amphibians in a backyard or community. Working together, a relatively small number of people could significantly mitigate the single major threat affecting the majority of amphibians in North America by replacing, restoring, or reconnecting lost and fragmented habitat.

A Need for Planning

Although individuals can create or restore amphibian habitat, their efforts will be most effective with careful planning. Indeed, action with a lack of planning could prove counterproductive. Small-scale habitat restoration needs to consider the “where” and “how” of conservation. Habitat projects should be targeted to provide appropriate habitat for local species of interest, but not create vectors for transmission of chytrid and other diseases into new areas. Projects must also avoid creating corridors for expansion of invasive species like American bullfrogs, which have been implicated in amphibian declines where this species has been introduced outside its natural range. In order to accomplish this goal, projects should be coordinated using Geographic Information Systems (GIS) and other conservation tools to guide appropriate actions. Because conservation resources are limited, coordinated efforts must be targeted to those areas where habitat enhancement projects are likely to have the greatest positive impact per unit of resources expended.

About this Report

This report is intended as the first step toward determining where small-scale habitat projects should be targeted within the U.S. and Canada. The analyses presented here provide maps of species distributions and the severity of threats facing amphibian communities across the U.S. and Canada. Because this assessment is intended specifically for guiding small-scale habitat projects likely to be implemented by individuals or small groups, special attention is paid to the impact of infrastructure development, which is the type of threat most likely to be prevalent in areas where such projects would be built. To enhance the utility of this report as a priority setting tool, results have been summarized by ecoregion. Amphibian communities and appropriate conservation methodology will likely remain consistent within a given ecoregion but not necessarily between dissimilar regions. As mentioned previously, this report is intended as only the first step for prioritizing habitat improvement projects. Because it encompasses nearly an entire continent, the resolution of these analyses is necessarily coarse and is appropriate only for selecting ecoregions for targeting conservation activities. Once these targets are selected, finer scaled analyses are needed to develop effective plans for amphibian habitat projects within a given region.

This water garden provides amphibian habitat in a busy urban setting.

Methods

Data Sources and Processing

Spatial analyses of amphibians native to the U.S. and Canada were conducted using *Digital Distribution Maps of the Amphibians of the Western Hemisphere*[6] developed as part of the Global Amphibian Assessment and provided by the IUCN World Conservation Union, Conservation International, and NatureServe. This dataset includes GIS layers of distributions for 265 amphibian species native to the U.S. and Canada which includes 94 anurans (frogs and toads), and 171 caudates (salamanders and newts).

Amphibian taxonomy has undergone considerable revision since the *Digital Distribution Maps of the Amphibians of the Western Hemisphere* were developed which created problems with combining data from sources that follow different taxonomic schemes. To rectify these differences, I consulted the concept references in NatureServe[4] and synonymy and taxonomic descriptions in Amphibians of the World to attribute additional data sources to appropriate distribution maps as the taxonomy appeared in 2004 when they were created.

Amphibian distribution maps were processed and analyzed using a GIS.[8] Analyses were restricted to native amphibians within their natural range of distribution. Prior to analysis, maps were modified to remove those areas of a species' distribution where it has been introduced outside its known natural range. For example, *Bufo marinus* occurs naturally in extreme southern Texas but has been introduced and formed feral populations in Florida and Hawaii. Therefore, the Florida and Hawaii portions of this species' distribution were removed. An exception was made for the tiger salamander (*Ambystoma trigrinum*) because this species has been widely translocated between populations within the species natural range due to its use as bait for recreational fishing. Therefore, many populations have been infused with genes from non-native populations but this could not be delineated on maps for the purposes of this assessment.

Quantifying Risk

Amphibian distribution maps were converted to 1km x 1km grid cells, subdivided into State and Province regions[9, 10] and assigned risk severity scores according their NatureServe Conservation Status[4]. These status scores assess each species' stability, or risk of extirpation, at the global (across the species' entire range), national (across a species' range within a specific country), and sub-national (State or Province) level. Each level is assigned a numeric rank indicating the severity of risk of extirpation within the scope of that level. Ranks with the lowest number represent the highest risk of extirpation. Ranks less than 4 are considered "at risk" and range from moderate to high risk of extirpation (rank = 3), to extremely high risk of extirpation (rank = 1). Thus, a species with a G5N3S1 ranking would be considered at the least risk of extinction globally, at moderate risk of extirpation nationally, and at extreme risk of extirpation within a given state or province and would only be considered "at risk" at the national and sub-national levels. At risk status also includes ranks that indicate the species is presumed, or probably, extirpated within a given area (rank = X or H). Only status levels within the "at risk" were used for assigning risk severity scores for these analyses.

Conversion of NatureServe Ranks to Risk Severity Scores

NatureServe Conservation Status[1]			
Global	National	State/Province	Risk Severity Score
G1, GX, GH	N1, NX, NH	S1, SX, SH	6
G1G2	N1N2	S1S2	5
G2	N2	S2	4
G2G3	N2N3	S2S3	3
G3	N3	S3	2
G3G4	N3N4	S3S4	1
Other	Other	Other	0

[1]Data developed as part of the Global Amphibian Assessment and provided by the IUCN World Conservation Union, Conservation International, and NatureServe.

Each species distribution map was assigned risk severity scores by converting the NatureServe Conservation Status ranks to a numeric scale and applying those scores to appropriate areas of each species' distribution. Global scores were applied across the species entire range, while national and sub-national scores were applied only to areas within the country, state, or province where they applied. Scores for each of the three levels were summed to combine them into a total severity score for each location within a species range. This method automatically applies the highest weighing to global scores and the lowest weighting to State and Province scores because by default, ranks at lower levels of evaluation are never lower than the ranks at levels above. For example, a species with a G1 ranking will automatically receive N1 and S1 rankings throughout its range because a species cannot be globally imperiled but secure within portions of its range. In this example, the species would receive a risk severity score of 18 (6+6+6) throughout its range. In contrast, a species ranked G5N5S2 (0+0+4) would receive a much lower score of four which would only apply within the state or province where the S2 rank is assigned.

Identifying Priorities

To identify priority areas for conservation, grids of individual species' risk severity scores were combined to calculate the combined severity of risks across the U.S. and Canada and these results were summarized by ecoregion. Two types of combined risk maps were produced. The first type represents cumulative risk which was calculated by stacking all species grids on top of each other, and adding up the combined risk severity scores for each 1km^2 grid cell. Because cumulative risk is strongly influenced by the number of species (or species richness) found at a particular location, it is a good metric to use for determining where conservation should be applied to help the maximum number of amphibian species that are facing the most severe threats. The second type of risk map represents the proportional risk experienced at a location. The proportional risk is the total combined risk score divided by the maximum potential risk score. This produces an index with range 0-1 where zero indicates that no species at a given location are "at risk" and one indicates that all species at a given location are critically imperiled at the global level. This proportion of risk severity index provides a good indicator of overall ecosystem health with respect to amphibians. Areas with a high percentage of amphibian species having high risk severity scores are likely to be areas where ecosystems have been degraded to a point where they no longer sustain healthy amphibian populations in general. In contrast, areas with a low percentage of species "at risk" are likely providing adequate habitat and ecosystem function to support most of its native amphibians and threats to the few "at risk" amphibians are likely to be species specific. For both types of risk maps, calculations were made for all anurans (frogs and toads), all caudates (salamanders and newts), and all amphibians combined.

A combined conservation value index was calculated for each $1km^2$ grid cell that balances the importance of biodiversity, threats, and ecosystem function into a single metric. This index was calculated by rescaling the mean number of species/$1km^2$ and cumulative risk index to a range of 0-1 (matching the range of the proportional risk index) and averaging these three metrics. As with other metrics, conservation value was calculated separately for anurans, caudates, and all amphibians combined.

To further aid in identifying priority areas for amphibian conservation, all results were summarized by ecoregion. Ecoregions are areas that contain distinct assemblages of species and natural plant communities. These regions are convenient for setting conservation priorities because habitats, ecological processes, and species found at different locations within an ecoregion are much more similar than those found between different ecoregions. Thus, conservation tools can often be applied effectively across entire ecoregions whereas different ecoregions often will require different tools or methods. For this assessment, I used *Terrestrial Ecoregions of the World*[11] developed by the World Wildlife Fund which divides the world into 867 distinct ecoregion units. Combined risk calculations were summarized by calculating the average combined scores of $1km^2$ grid cells by ecoregion boundary. The resulting maps display the average combined score for each ecoregion. Species richness was similarly summarized by totaling the number of species expected in each $1km^2$ grid cell and averaging these values by each ecoregion to provide an estimated average number of species/$1km^2$.

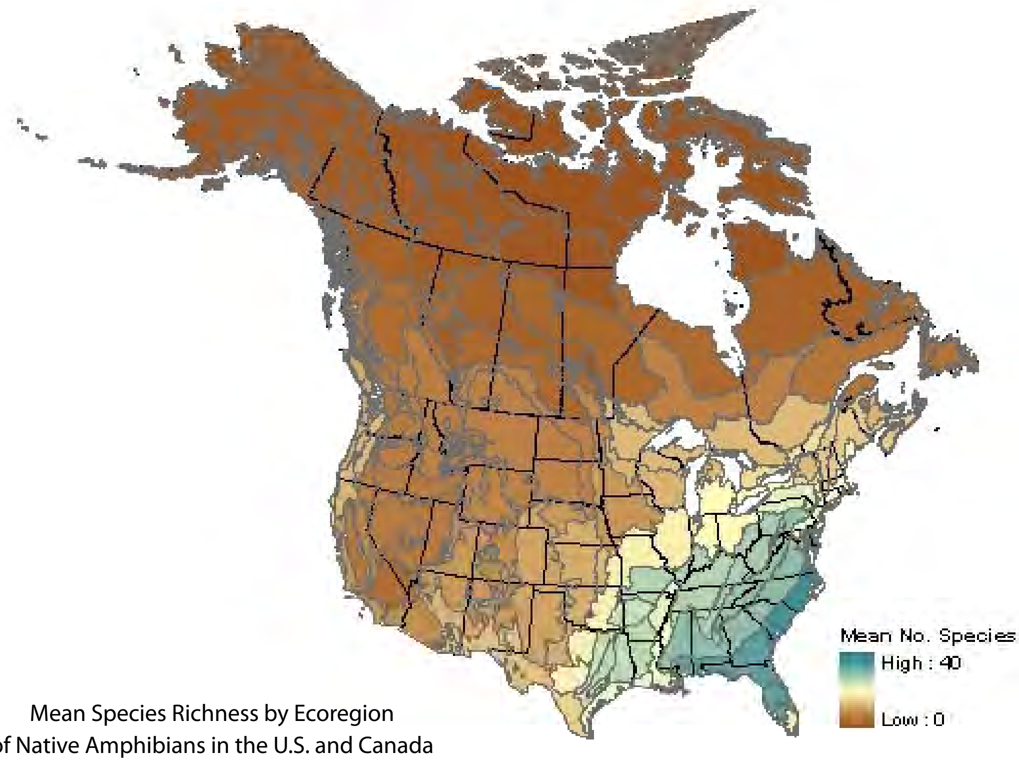
Results

Setting priorities for conservation requires determining which areas are likely to provide the greatest positive return on conservation efforts. The two most common criteria for setting priorities are biodiversity and threats.[12] One conservation approach is to focus on areas containing high biodiversity with the idea of conserving the greatest number of species possible for unit of conservation effort. Areas containing high biodiversity are often found in relatively remote or pristine areas with high ecological integrity. Securing such areas to protect them from threats before those threats become severe can be very cost effective since it is often easier to protect high quality habitat than to attempt to restore habitat that has already been degraded. Another approach to conservation is to focus on those areas facing the greatest or most urgent threats to prevent further habitat degradation and possibly initiate restoration efforts. Most often these two approaches are combined to attempt to balance an area's biodiversity value against threats to set conservation priorities.

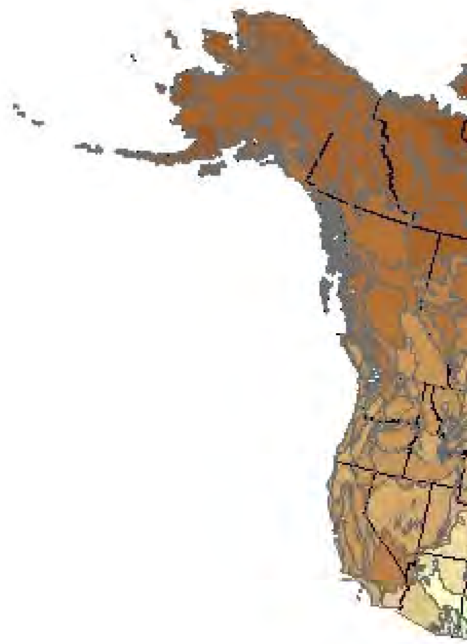
This section presents maps of species richness, cumulative risk, proportional risk severity, and combined conservation value of amphibians native to the U.S. and Canada, and summarized by ecoregion. Results are presented for frogs and toads, salamanders and newts, and all amphibians combined. A table is also provided that summarizes each of these metrics by ecoregion. Because one objective of this assessment is to prioritize areas for small scale habitat improvement projects, all of the above metrics were also calculated for the subset of species that face infrastructure development as a major threat, because those are the species most likely to benefit from backyard and small community projects.

Data Limitations

These results were derived from *Digital Distribution Maps of the Amphibians of the Western Hemisphere*[4], NatureServe[1], and the Global Amphibian Assessment[6] and are subject to limitations inherent to those data. In addition, these results are intended for regional analysis at a broad scale only. Species range maps provide only a general approximation of a species' geographic distribution. However, such maps are not intended to indicate actual occupation of a species at a specific location. Actual occupation depends on the distribution of suitable habitat within a species' geographic range and many other factors. The results presented here are calculated with



Mean Species Richness by Ecoregion of Native Amphibians in the U.S. and Canada



Mean Species Richness by Ecoregion of Native Frogs and Toads in the U.S. and Canada

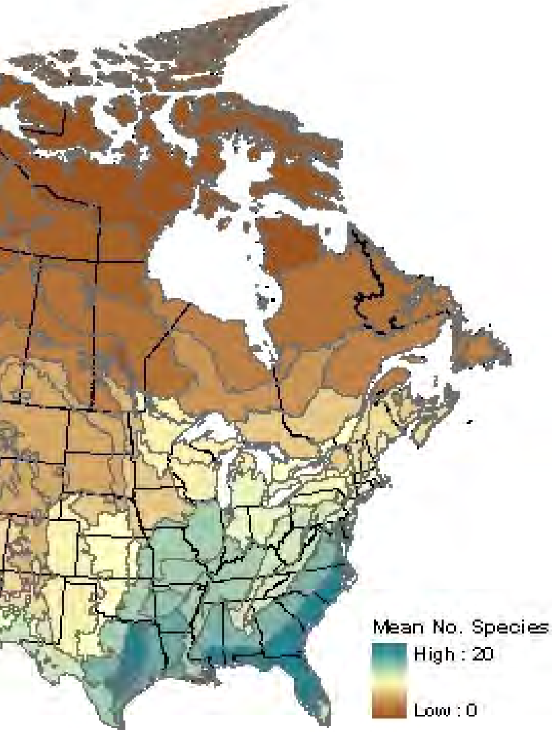
the assumption that every species is present in every 1km² within its mapped range. However, it is certain this assumption is not true for most species, as it is highly unlikely that suitable habitat will occur across every square kilometer of any species' range. In other words, there are gaps in the actual occurrence of any given species within its mapped range of distribution. Therefore, values calculated for individual 1km² grid cells should be interpreted with caution. However, when viewed across large areas or aggregated into regions, these results provide a reasonable representation of the spatial trends for the metrics presented here.

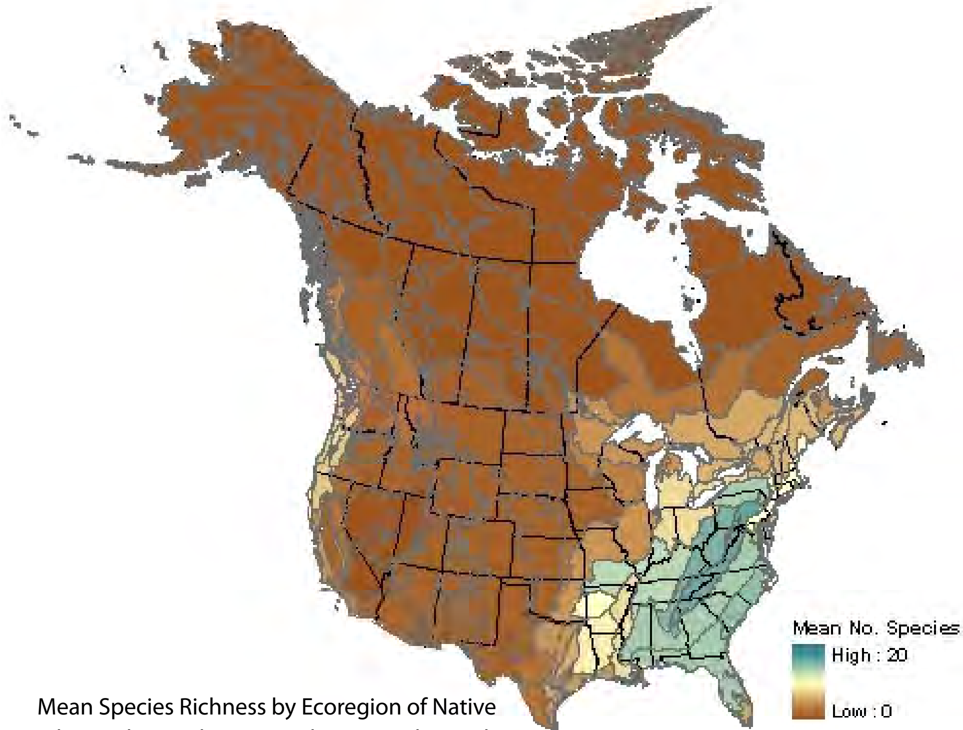
Analysis of Amphibians at Risk

Species Richness

Species richness is simply the number of species occurring within a given area and is an indicator of general biodiversity value. Amphibian species richness in North America generally follows the patterns of temperature and moisture, creating increasing concentrations of species as one approaches the southeastern U.S., particularly along the southeastern Coastal Plain and Gulf coast. Species richness declines with increasing latitudes and towards the relatively dry continental interior.

However, the distributions of species richness are different between frogs and toads, and salamanders and newts. Frog and toad species richness follows the same patterns as total amphibian species richness, except that frogs and



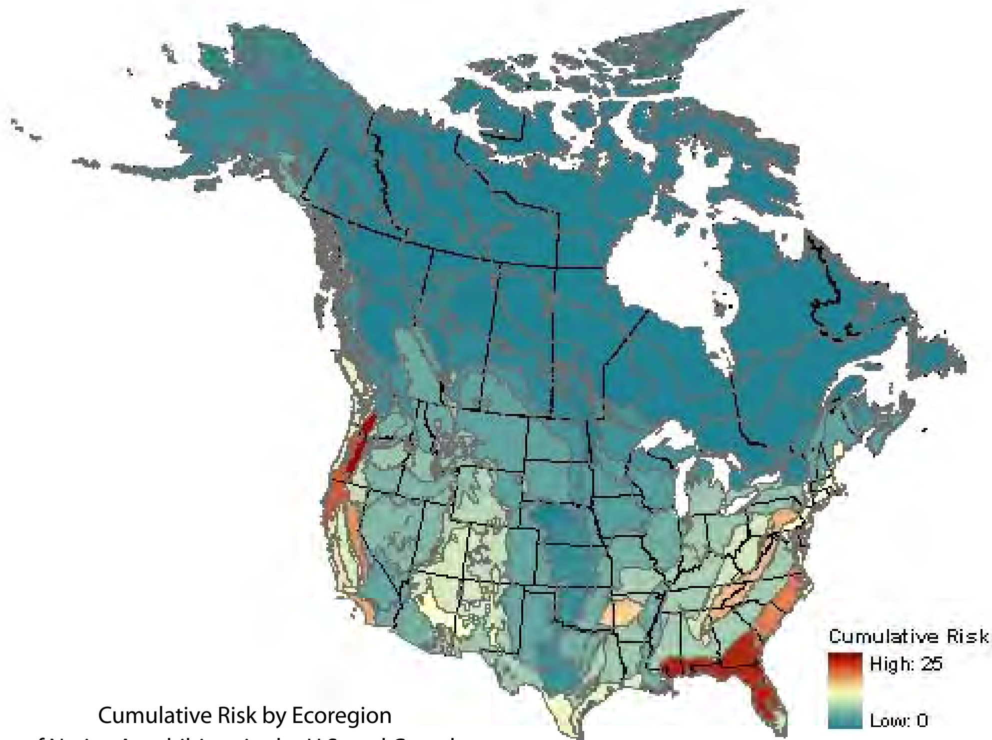


Mean Species Richness by Ecoregion of Native Salamanders and Newts in the U.S. and Canada

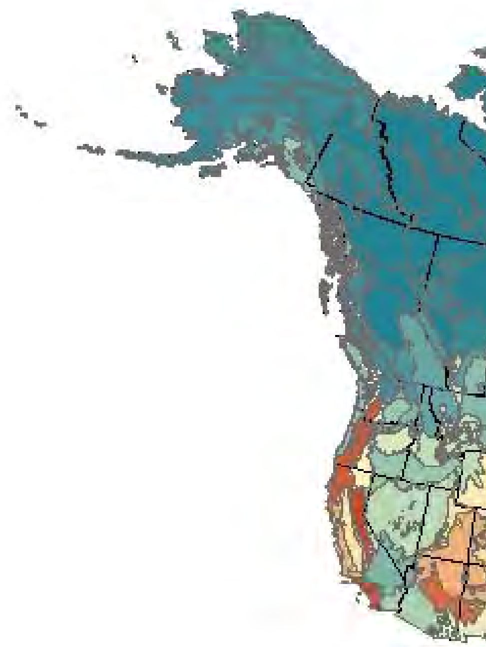
toad species are more concentrated along the southeastern coastline of the U.S. and through the east Central Texas forests and Blackland prairies. In contrast, salamander and newt species are concentrated in moist, but slightly cooler regions compared with frogs and toads. As a result, the majority of salamanders and newt species are found in the U.S. east of the Mississippi River, with the highest concentrations in the Appalachian Mountains. There is also a secondary concentration of salamander species found in the cool, moist climate of the Pacific Northwest coastline, while the remainder of the continent supports relatively low species richness. This is particularly significant because the United States contains 32% of all known caudata species in the world. Thus, the Appalachians and the Pacific Northwest are extremely important areas for conservation of salamanders and newts globally, and these are the only general regions that contain more salamander and newt species than frogs and toads.

Cumulative Risk

Cumulative risk represents the combined risk severity of all species potentially present at a given location. These scores are derived from conservation status at three geographic scales (global, national, local (state or province))[4]. The rating system presented here sums threats across all three geographic scales and, therefore, places the highest weight on global conservation status and the lowest weight on local conservation status. Cumulative risk is the sum of risk severity scores for all species and is,



Cumulative Risk by Ecoregion
of Native Amphibians in the U.S. and Canada



Cumulative Risk by Ecoregion of
Native Frogs and Toads in the U.S. and Canad

therefore, heavily influenced by the number of species present at a location. Therefore, this metric is useful where preserving biodiversity value is a priority because it gives the highest priorities to areas with the most species facing the most severe risk.

All Amphibians

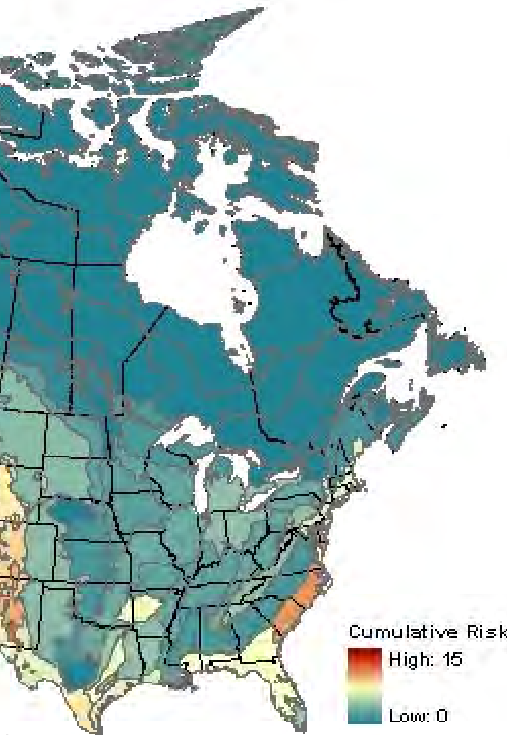
Despite the strong influence of species richness, observed patterns of cumulative risk differ dramatically from patterns of species richness. Combined cumulative risk for all species is highest in the south and central Cascades of the Pacific Northwest and the Southeastern conifer forests. Other areas of high cumulative risk occur in other ecoregions of the Pacific Northwest extending into the Sierra-Nevada, along the Middle Atlantic coast, the Appalachians, and the Ozark Mountains.

Frogs and Toads

Cumulative risk for frogs and toads is much higher in the western United States, particularly throughout the west coast states, the desert southwest, and the central and southern Rocky Mountains. However, cumulative risk remains high in the Middle Atlantic forests and moderately high in the Tamaulipan mezquital of south Texas and the southeastern conifer forests.

Salamanders and Newts

Areas of high cumulative risk for salamanders and newts are much more concentrated than for frogs and toads, with the highest cumulative risk



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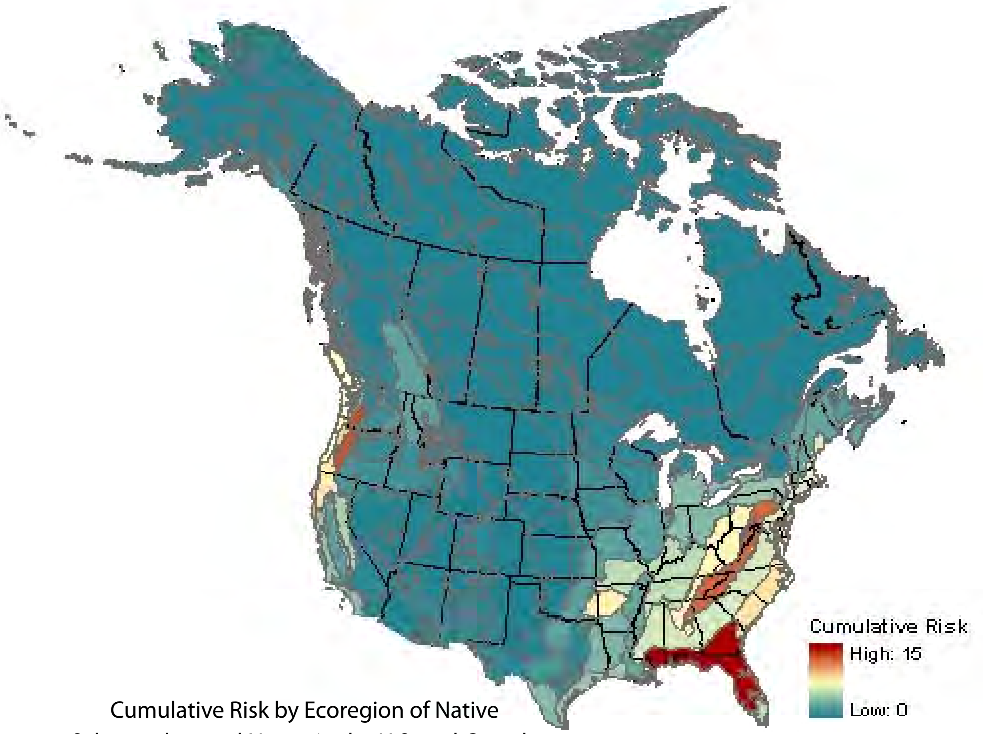


Cumulative Risk by Ecoregion of Native Salamanders and Newts in the U.S. and Canada

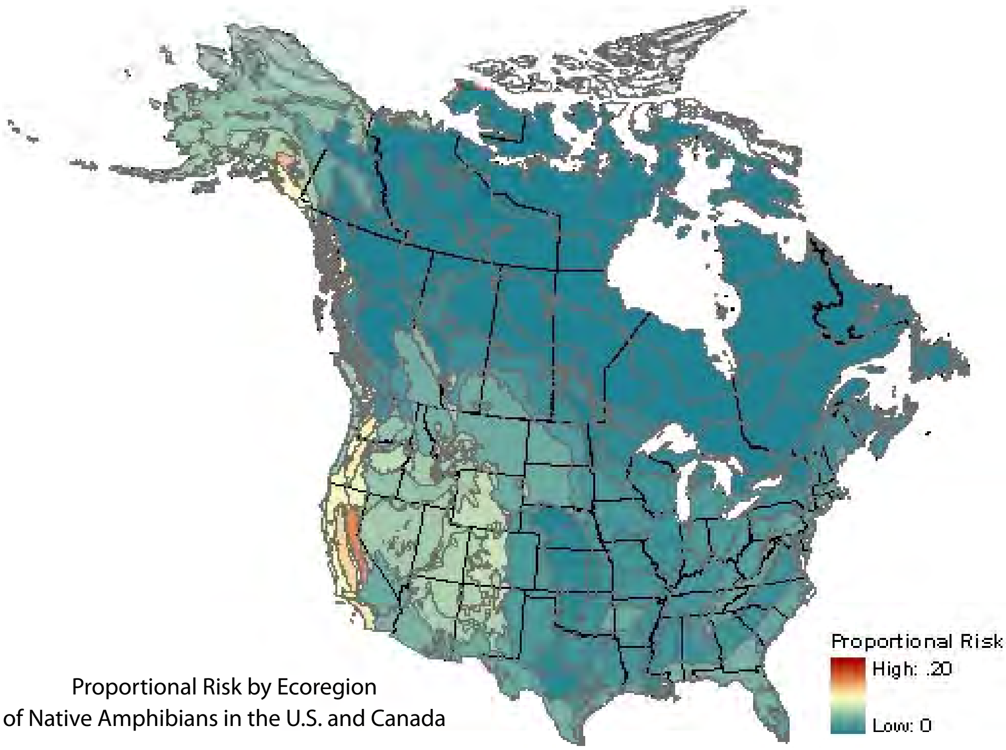
occurring in species inhabiting the southeastern conifer forest ecoregion. However, the southern and central Cascades and the Blue Ridge-Appalachian forests also show high cumulative risk scores which are only slightly below those of the southeastern forests.

Proportional Risk

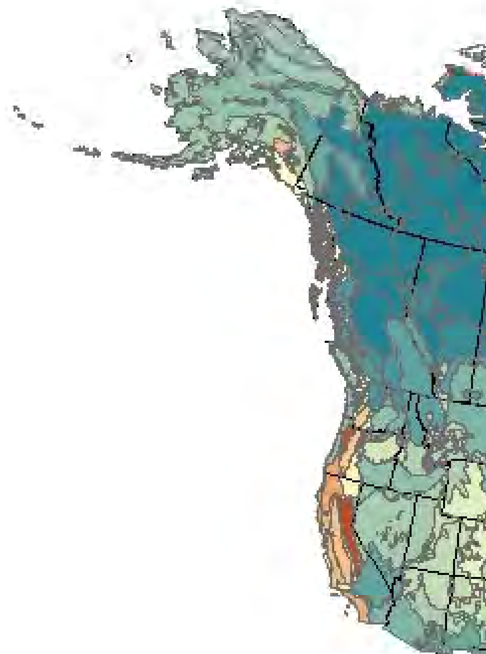
Proportional risk is an indicator of overall ecosystem health. Healthy ecosystems are capable of supporting all of their native species such that populations persist over evolutionary timescales (the time needed for species to evolutionarily adapt to changing conditions). In contrast, areas suffering from widespread habitat loss or decline in ecosystem function are no longer capable of supporting healthy populations of many native species. Therefore, the proportion of species within an ecosystem suffering declines, and the severity of those declines, provides a useful indicator for determining where ecosystem integrity is at risk.

Interpreting Proportional Risk

Proportional risk is the proportion of cumulative risk of an area in relation to the maximum potential risk that could occur. Maximum potential risk is reached if all species expected to occur at a given location are critically imperiled at the global (and, therefore, also at the national and state/province) level. If no species at a location is considered at risk at any level, the proportional risk equals zero. However, it is important to understand that areas that naturally support low species richness are more sensitive to changes



Proportional Risk by Ecoregion
of Native Amphibians in the U.S. and Canada

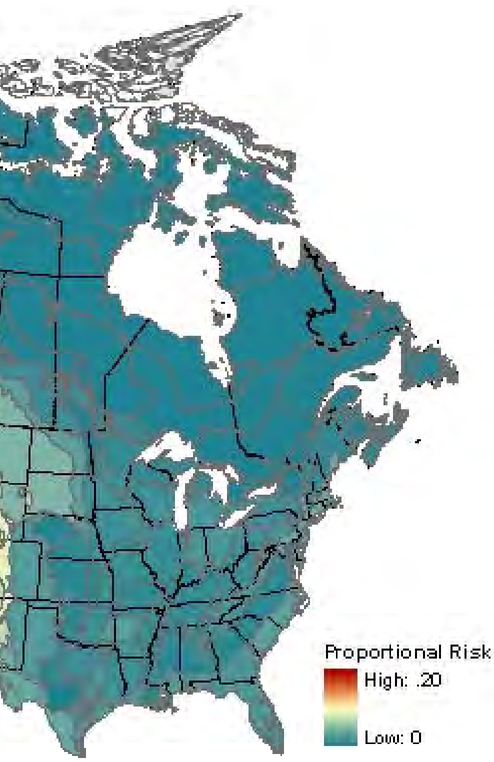


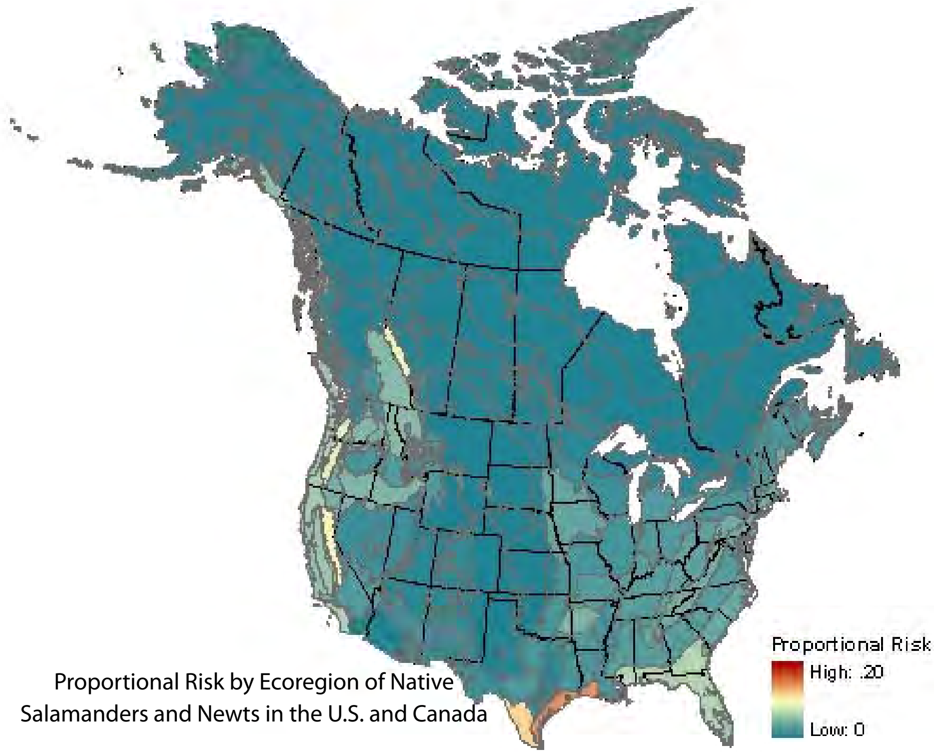
Proportional Risk by Ecoregion of
Native Frogs and Toads in the U.S. and Canada

in proportional risk than areas that support a large number of species. This is because declines in only one or two species in areas of low natural species richness represent a large proportion of all species present, and can, therefore, drastically influence the proportional risk value of the area. On the other hand, areas of natural low species richness are typically harsh environments where only very robust generalist species (species that can occupy a wide range of habitats) or very specialized species (those that have very narrow habitat requirements) can live. In both cases, proportional risk may be very important because habitat specialists tend to be very sensitive to rather modest changes in their environment, and habitat generalists can often tolerate fairly large alterations of their environment. Therefore, a high proportional risk value in areas of naturally low species richness could indicate even relatively small changes to highly sensitive ecosystems or very large changes to naturally robust ecosystems.

All Amphibians

The sensitivity of areas with naturally low species richness to proportional risk is reflected in the observed patterns for all amphibians. By far, the highest proportional risk is concentrated along the west coast of North America with the highest values found to the north along the coasts of Alaska and British Columbia. These northern ecoregions have naturally low amphibian species richness, ranging from six species in the Northern Pacific coastal forests and Pacific Coastal Mountain ice fields and tundra to as little as two potential





Proportional Risk by Ecoregion of Native Salamanders and Newts in the U.S. and Canada

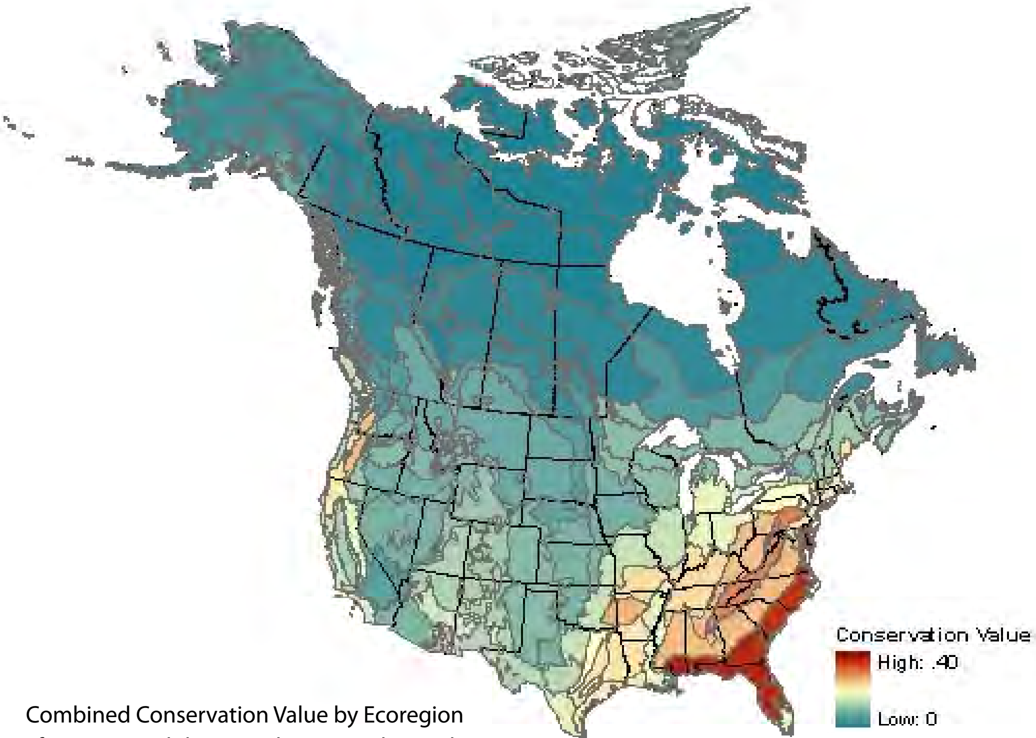
species in the Copper Plateau taiga of Alaska. However, not all areas with high proportional risk are in areas of naturally low species richness. High proportional risk is indicated throughout the Pacific Northwest and most of California (particularly the Sierra-Nevada) in areas with moderate levels of amphibian species richness.

Frogs and Toads

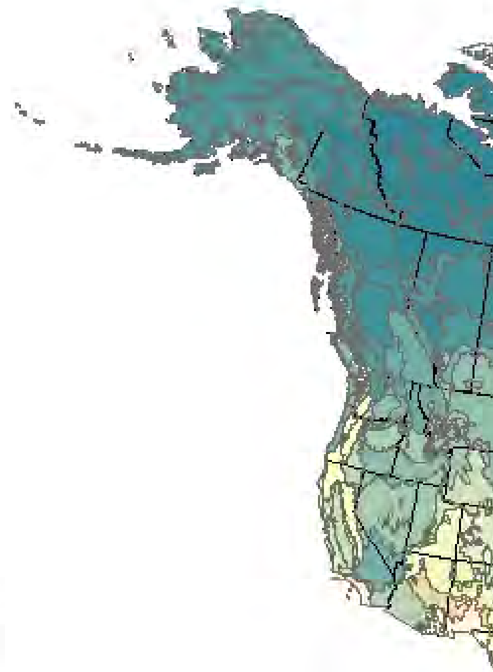
Patterns of proportional risk for frogs and toads are similar to those for all amphibians combined, with highest risks associated with species along the west coast of North America but with risk values considerably higher for frogs and toads in the Pacific Northwest and California compared with those in the northern ecoregions in Alaska and British Columbia. In addition, frogs and toads in the central and southern Rocky Mountains, particularly in the Arizona Mountain forests of the Southwest, have moderately high values and proportional risk in the American West in general is higher than found in the eastern half of the continent.

Salamanders and Newts

Salamanders and newts show a very different pattern of proportional risk with areas of high risk concentrated in a few, widely dispersed ecoregions. Highest proportional risk values are associated with salamanders found in the Western Gulf coastal prairies of Texas and Louisiana, the Northern Pacific coastal forests of British Columbia, the Tamaulipan mezquital of south Texas,



Combined Conservation Value by Ecoregion of Native Amphibians in the U.S. and Canada



Combined Conservation Value by Ecoregion of Native Frogs and Toads in the U.S. and Canada

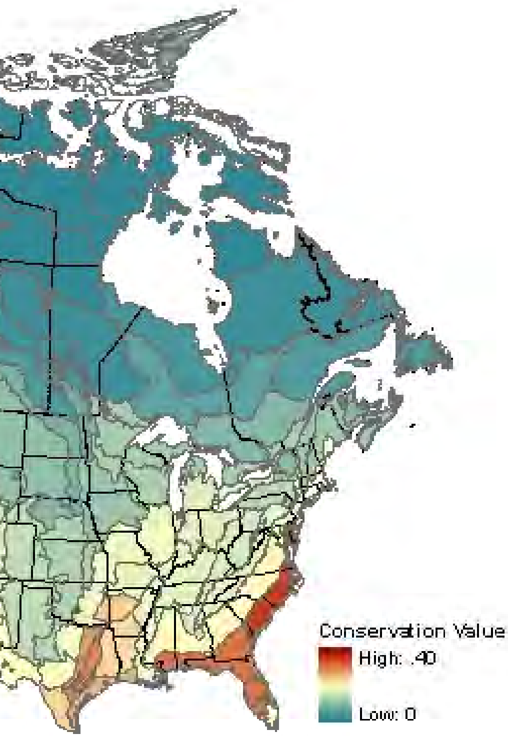
and the Sierra-Nevada of California. In addition, moderately high proportional risk values occur in the Central and Southern Cascade forest of Washington and Oregon, and the Alberta Mountain forest of southwest Alberta.

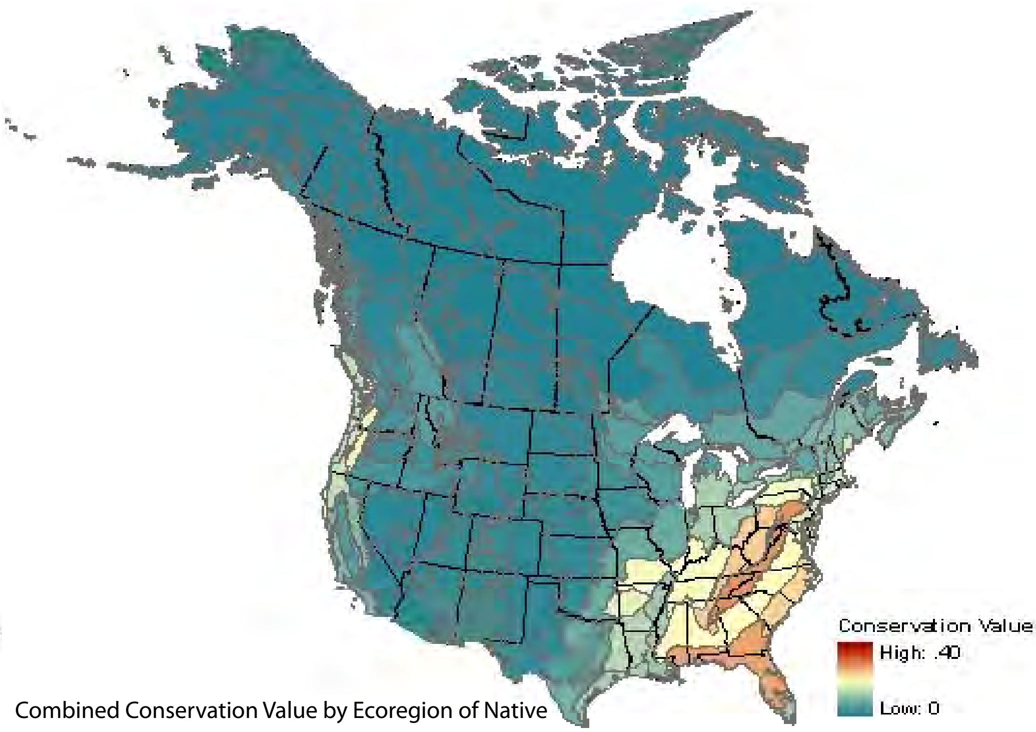
Combined Conservation Value

Setting conservation priorities often means striking a balance among a number of conservation targets. Each of the metrics previously presented in this report address different conservation targets. These metrics provide information about where the most amphibian species occur, which areas contain species associated with the greatest total severity of risk or decline, and which ecosystems appear in danger of losing significant portions of their amphibian communities. The combined conservation value index is an average of the three prior metrics to help set priorities that strike a balance between the three targets.

All Amphibians

Four general regions stand out as high conservation value for all amphibian species combined. The highest conservation value is found along the Middle Atlantic coast and extending into the southeastern Gulf coast states. Another area of high conservation value occurs along the Blue Ridge-Appalachian Mountains, which is surrounded by a region of moderately high conservation value. The Ozark Mountains of Arkansas and Oklahoma create another region of high conservation value. The Pacific Northwest; particularly





Combined Conservation Value by Ecoregion of Native Salamanders and Newts in the U.S. and Canada

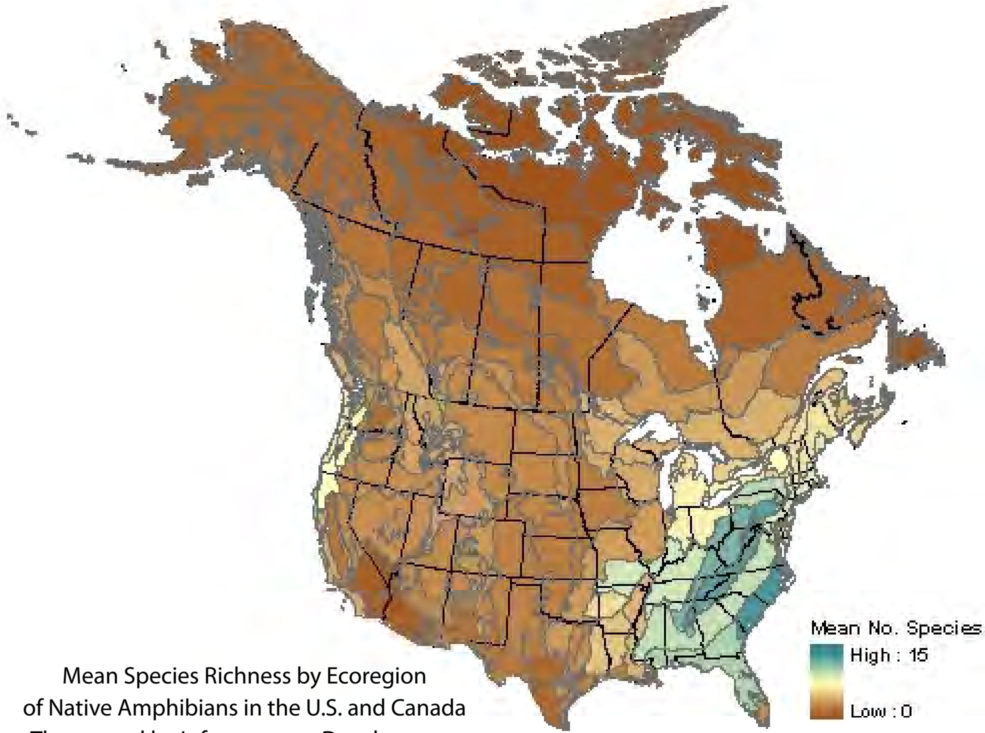
the Central and Southern Cascades forests, the Northern California coastal forests, and the Willamette Valley; comprise a fourth area of high combined conservation value.

Frogs and Toads

Areas of high conservation value for frogs and toads are widely dispersed. The highest conservation values are found along the Middle Atlantic coast and the southeastern conifer forests. Eastern and southern Texas, particularly the East Central Texas forests, Texas Blackland prairies, Western Gulf coastal grasslands, and Tamaulipan mezquital forms another region of high conservation value. This region is adjacent to the Piney Woods and Ozark Mountains, which also have high conservation value. Remaining areas of high combined conservation value for frogs and toads are scattered among the Arizona Mountains forests, the Sierra Madre Occidental pine-oak forests, and the Atlantic coastal pine barrens.

Salamanders and Newts

Predictably, combined conservation value for salamanders and newts is highest in the Appalachian, Southeastern, and Middle Atlantic coast forest regions with moderately high conservation values in adjacent forest ecoregions. Areas of moderately high conservation value outside this region include the Ozark Mountains and Central U.S. hardwood forests and the Pacific Northwest.

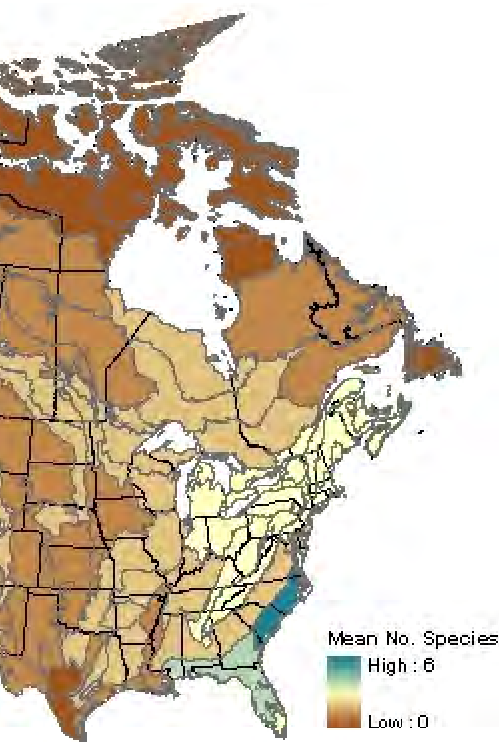


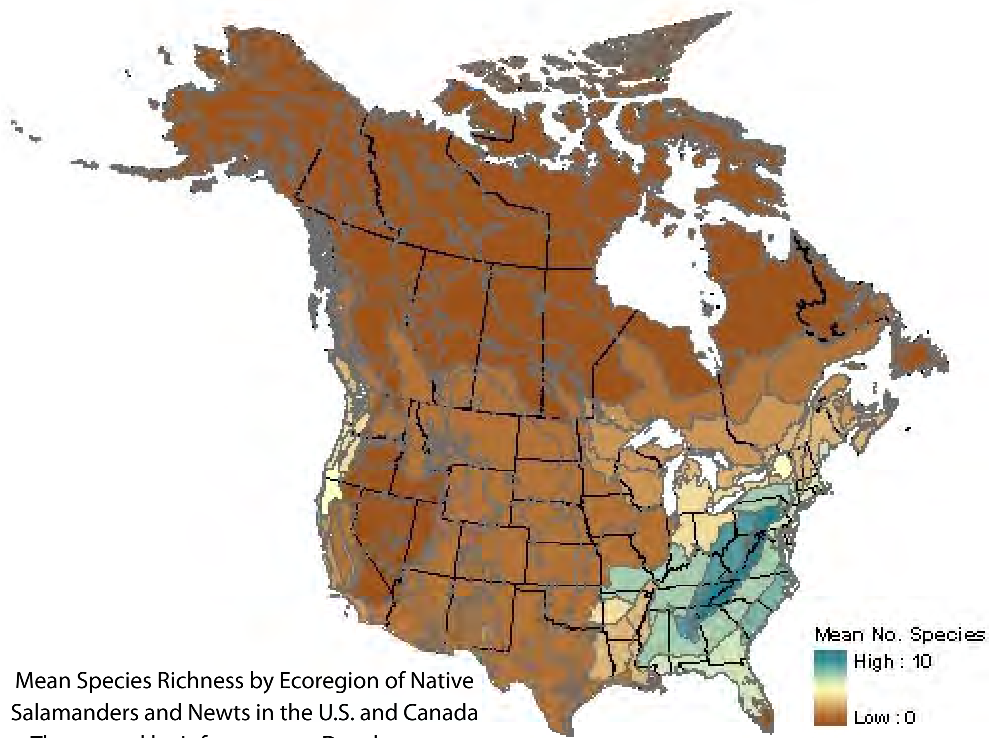
Mean Species Richness by Ecoregion of Native Amphibians in the U.S. and Canada Threatened by Infrastructure Development

Mean Species Richness by Ecoregion of Native Frogs and Toads in the U.S. and Canada Threatened by Infrastructure Development

Analysis of Amphibians Threatened by Infrastructure Development

To assess conservation priorities for amphibians most likely to benefit from backyard and other small-scale habitat projects, I repeated the above analyses on the subset of amphibians which have infrastructure development listed as a major threat in the Global Amphibian Assessment database[6]. Because backyard and small-scale projects are most likely to occur in urban, suburban, or rural residential areas, it is reasonable to assume that species most likely to benefit from such projects are those experiencing, or likely to experience, habitat loss due to development. It is important to understand, however, that these analyses do not pinpoint areas where habitat destruction by development is actually occurring. Rather, these analyses are intended as a coarse filter to identify areas of high conservation value for species that appear to be suffering from infrastructure development over significant portions of their range. The results provide a good first step in narrowing the focus to general areas where projects that offset habitat loss to development are likely to bear fruit. Finer-scale analyses are required to pinpoint the actual patterns of infrastructure development, and severity of its impacts on amphibians, in order to develop effective strategies to offset these losses within a particular area.

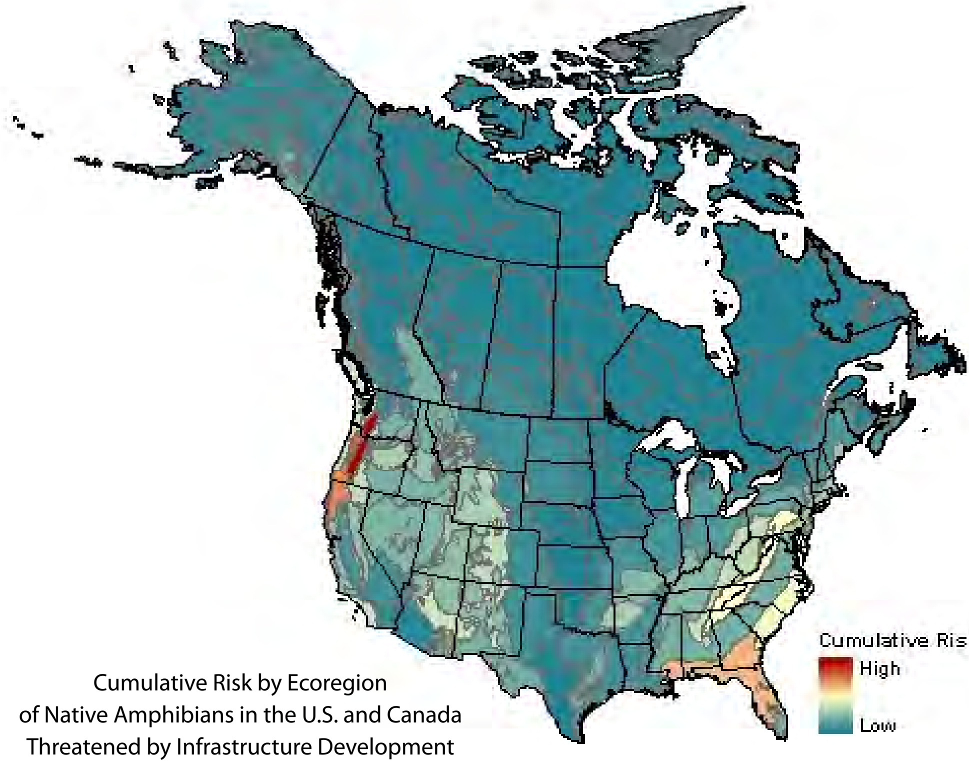




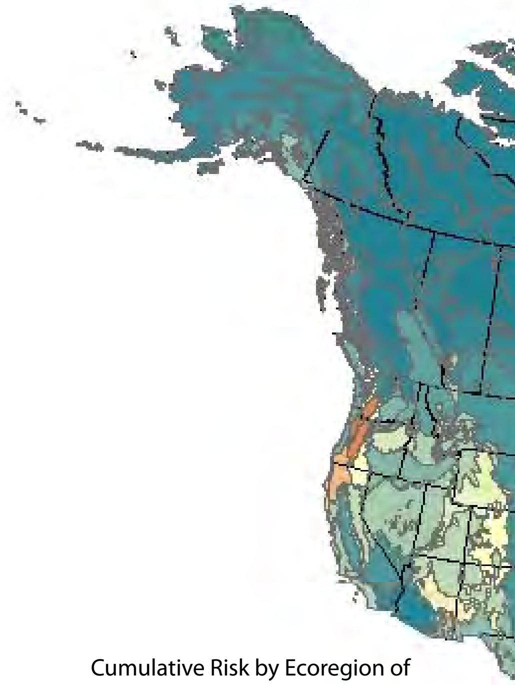
Mean Species Richness by Ecoregion of Native Salamanders and Newts in the U.S. and Canada Threatened by Infrastructure Development

Species Richness

Of 265 amphibian species analyzed in this report, 49% (130 species) have infrastructure development listed as a major threat. The pattern of species distributions is similar to that of all native amphibians, except there is a higher concentration of species along the Middle Atlantic coast and the Appalachian regions compared with general amphibian species distributions. However, frogs and toads threatened by development are much more concentrated along the Middle Atlantic and Gulf coasts but have a moderate to relatively low species richness elsewhere. The distribution of salamanders and newts threatened by development is nearly identical to the distribution of all salamanders and newts in the U.S. and Canada.



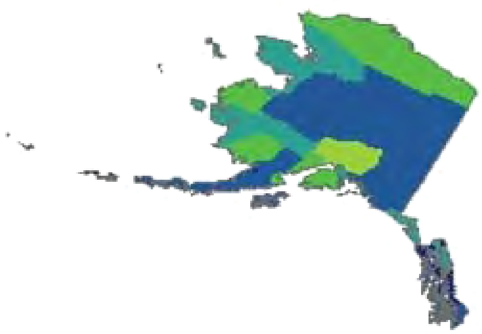
Cumulative Risk by Ecoregion
of Native Amphibians in the U.S. and Canada
Threatened by Infrastructure Development

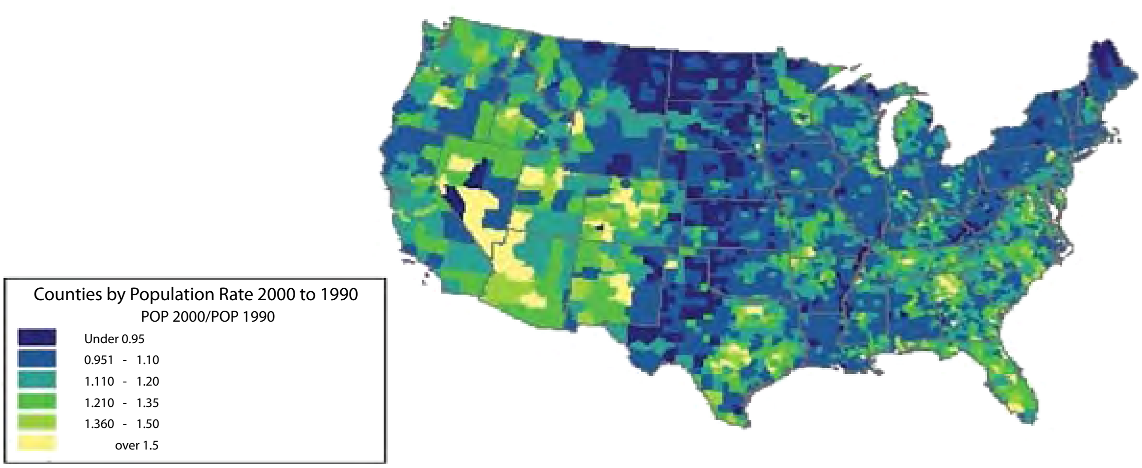


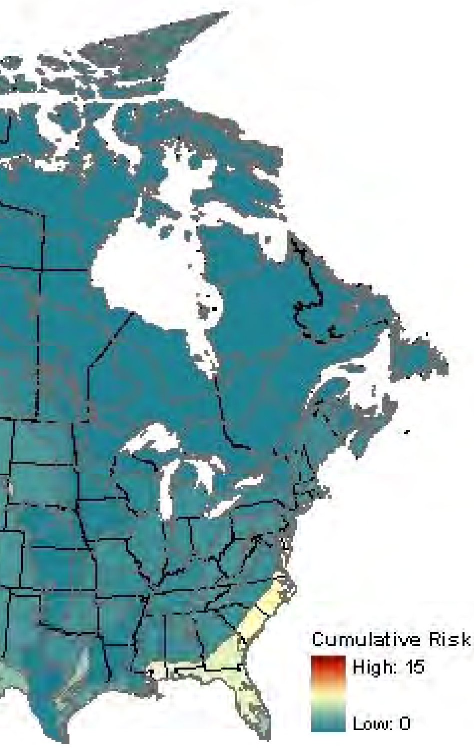
Cumulative Risk by Ecoregion of
Native Frogs and Toads in the U.S. and Canada
Threatened by Infrastructure Development

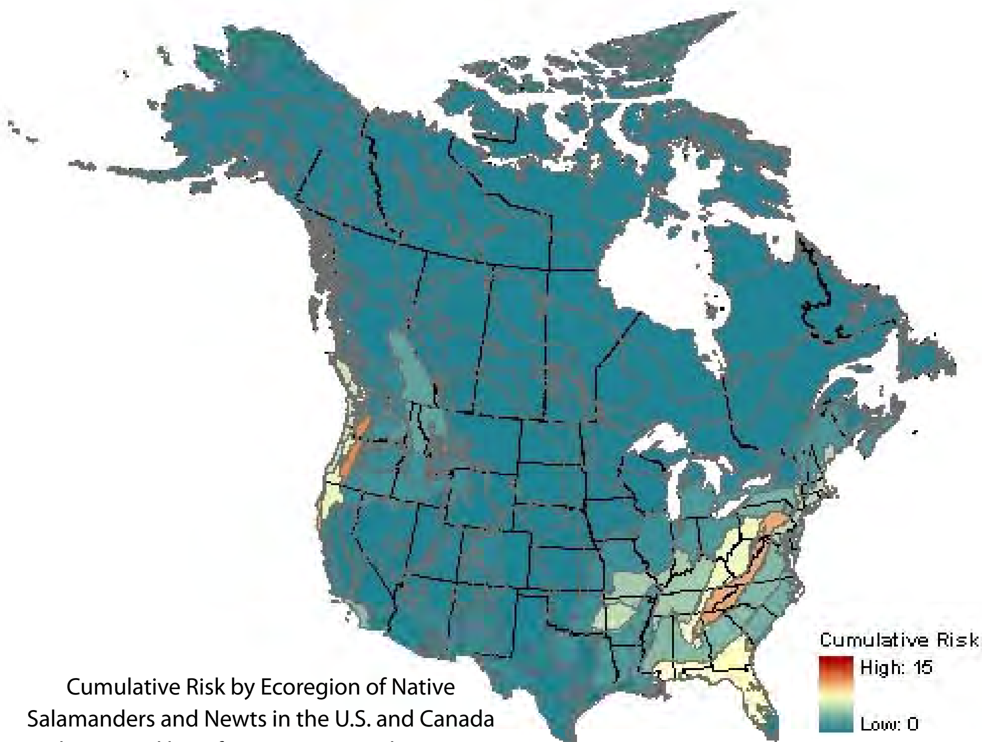
U.S. Census Data
Ratio of Population Growth by County
1990-2000

ESRI. 2004.Data and maps from U.S. Census Bureau data.[9]





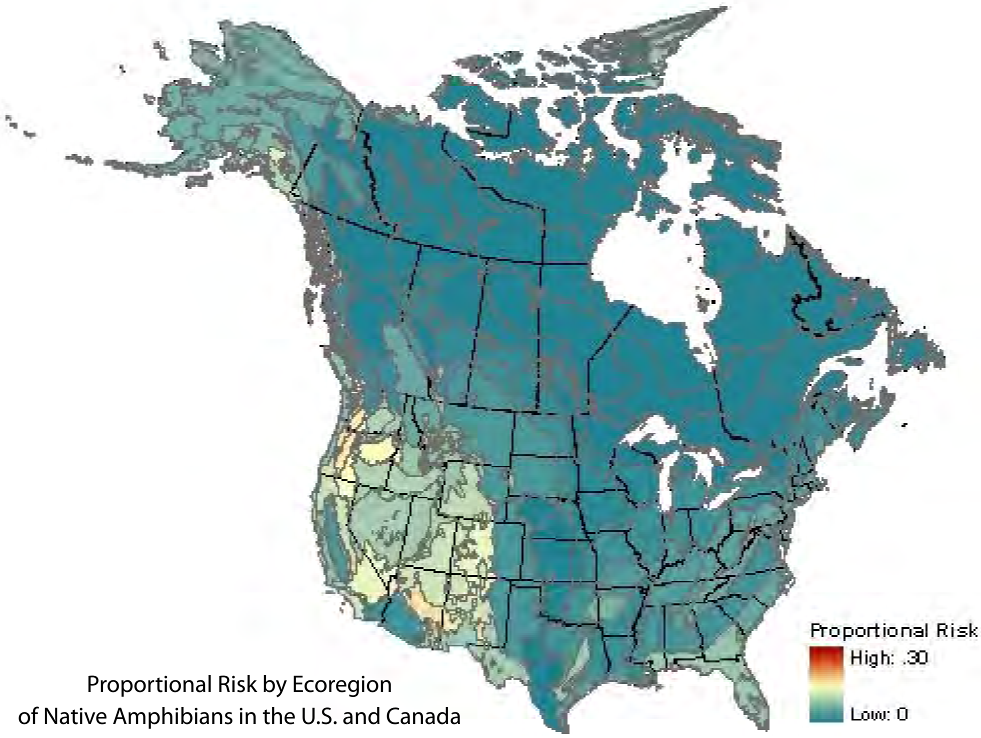




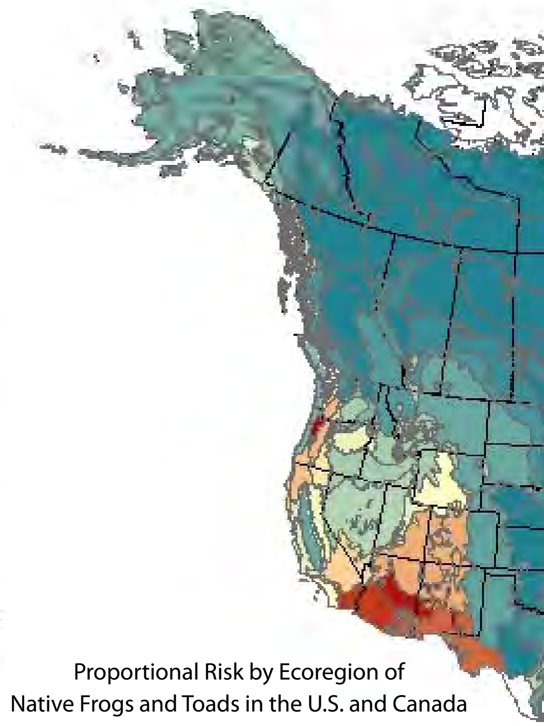
Cumulative Risk by Ecoregion of Native Salamanders and Newts in the U.S. and Canada Threatened by Infrastructure Development

Cumulative Risk

The highest cumulative risk for amphibians threatened by development is associated with species living in the Central and southern Cascades forests, followed by other areas of the Pacific Northwest and the Florida and Gulf coast areas of the extreme southeastern U.S. Cumulative risk is, likewise, highest in the Cascades and Pacific Northwest regions, with moderate risk associated with species in the Rocky Mountains, Southwest, and Mid-Atlantic to Gulf coast regions. Cumulative risk for salamanders and newts is concentrated in the Cascades and surrounding areas of the Pacific Northwest and in the Blue Ridge-Appalachian Mountains and surrounding regions. Moderately high risk is also associated with salamanders in the Gulf coast regions.



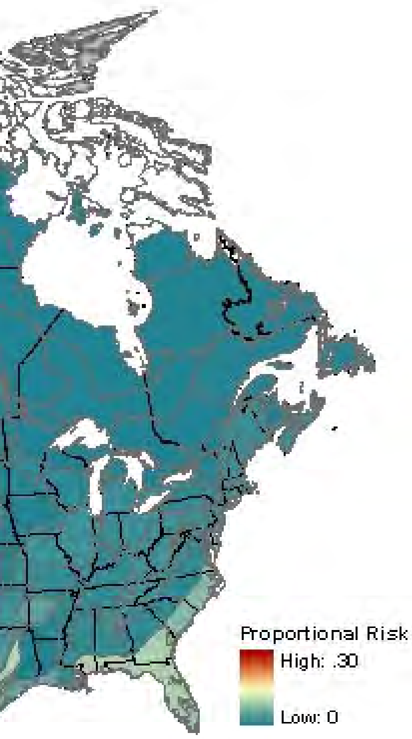
Proportional Risk by Ecoregion
of Native Amphibians in the U.S. and Canada
Threatened by Infrastructure Development

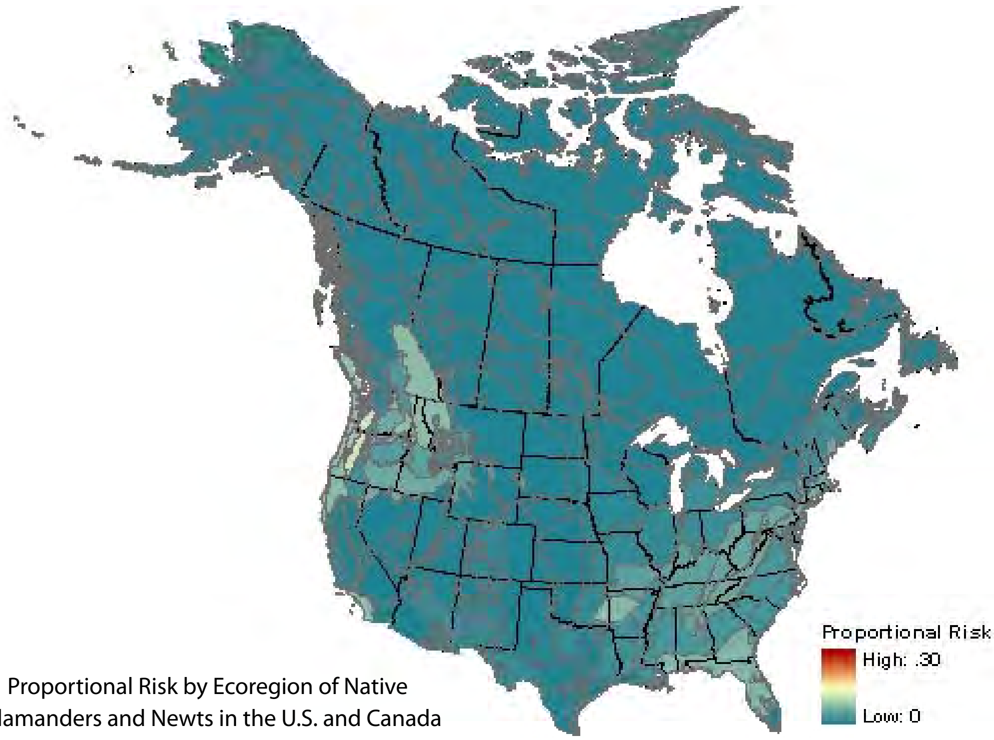


Proportional Risk by Ecoregion of
Native Frogs and Toads in the U.S. and Canada
Threatened by Infrastructure Development

Proportional Risk

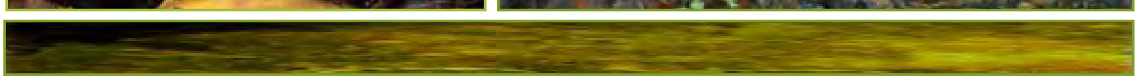
There is a strong prevalence of amphibian species threatened by infrastructure development associated with high proportional risk in the western United States, beginning approximately along the Rocky Mountain Front Range and extending to the Pacific coast. This region has experienced the highest rate of increase in human population in the country in recent decades. Proportional risk for frogs and toads is particularly strong in the extreme desert Southwest (likely due to a number of endemic habitat specialists in the region) and the Willamette Valley. Moderately high risk is associated with frogs and toads in the southern Rocky Mountains and Colorado Plateau, and generally in the Pacific Northwest. Proportional risk for salamanders and newts is highest in the southern and central Cascades forests. Proportional risk for salamanders is generally lower (mean = 0.005) than for frogs and toads (mean = 0.022, $p < 0.0001$).

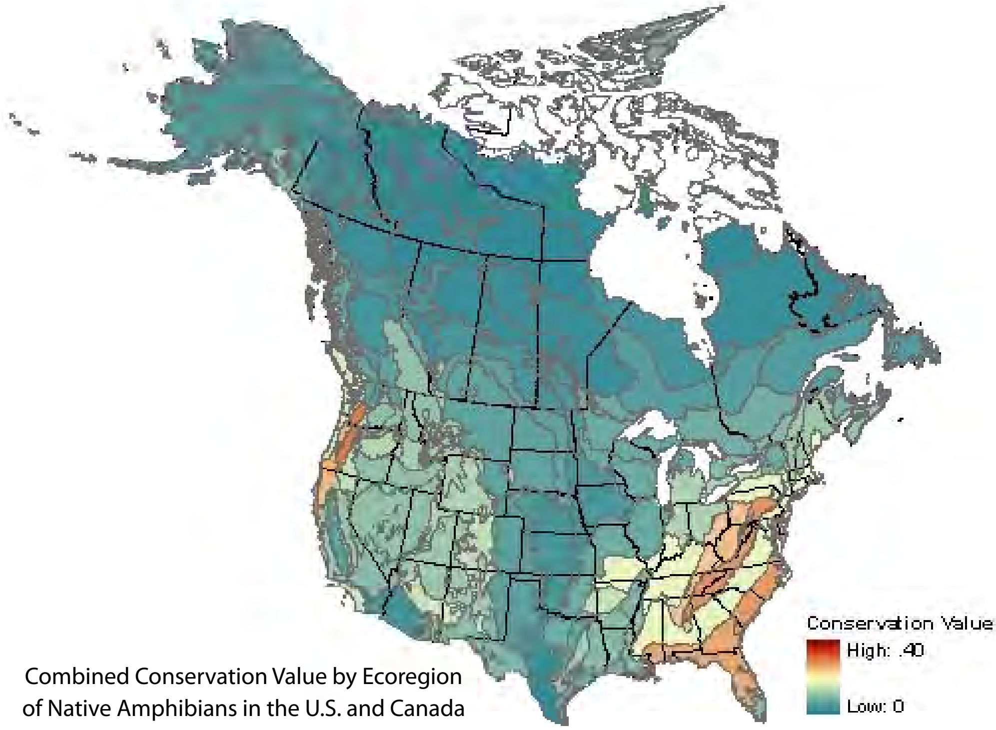




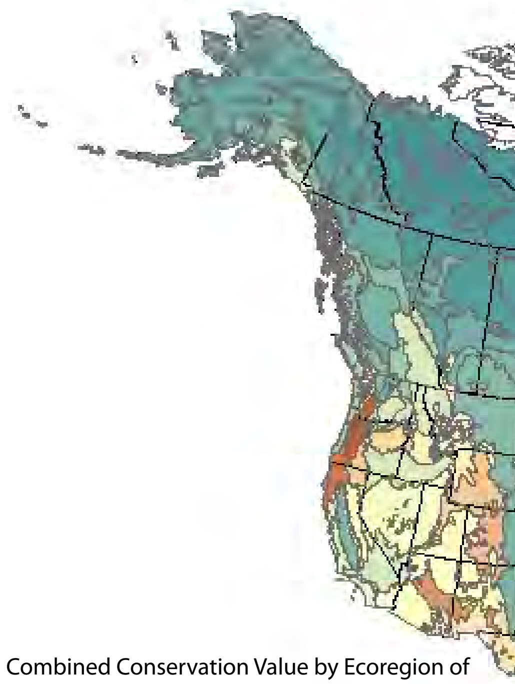
Proportional Risk by Ecoregion of Native Salamanders and Newts in the U.S. and Canada Threatened by Infrastructure Development

Clockwise from upper left: *P Lethodon elongatus, Ensatina escholtzi*, and *Aneides lugubris* with eggs. *Photos courtesy of Tim Paine*



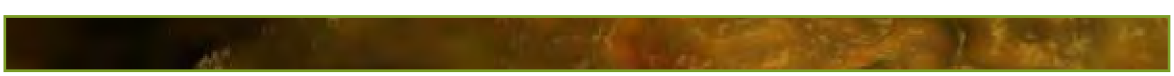


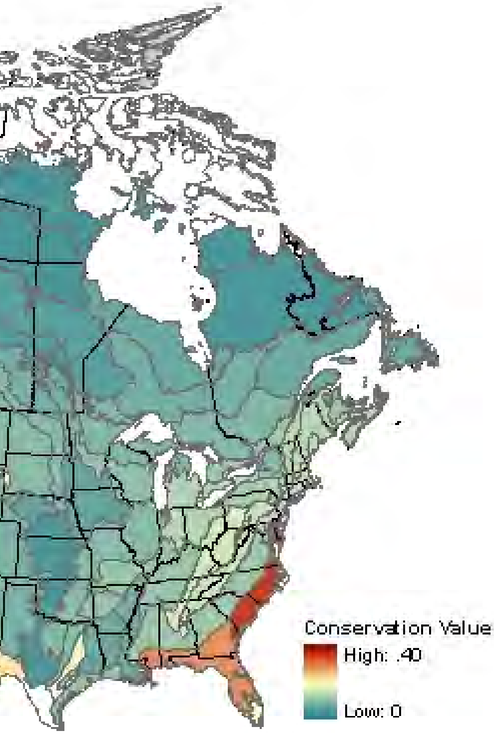
Combined Conservation Value by Ecoregion of Native Amphibians in the U.S. and Canada Threatened by Infrastructure Development

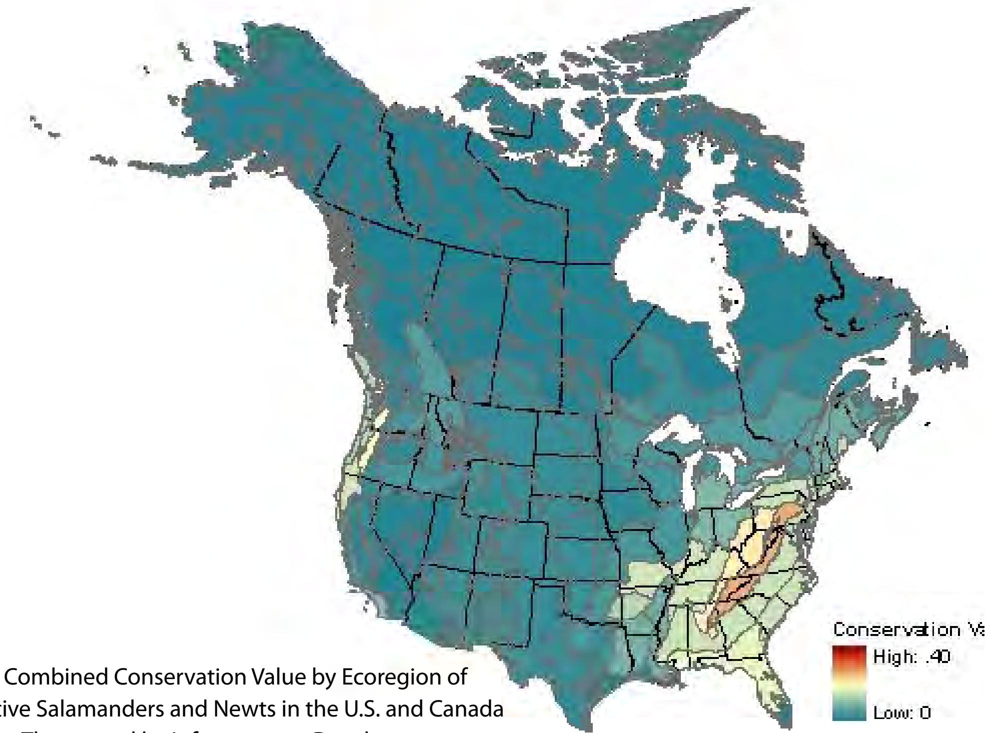


Combined Conservation Value by Ecoregion of Native Frogs and Toads in the U.S. and Canada Threatened by Infrastructure Development

Clockwise from above left: *Aneides flavipunctatus*, *Taricha granulosa*, immature *Bufo (species not identified),* and *Rana boylii. Photos courtesy of Tim Paine*



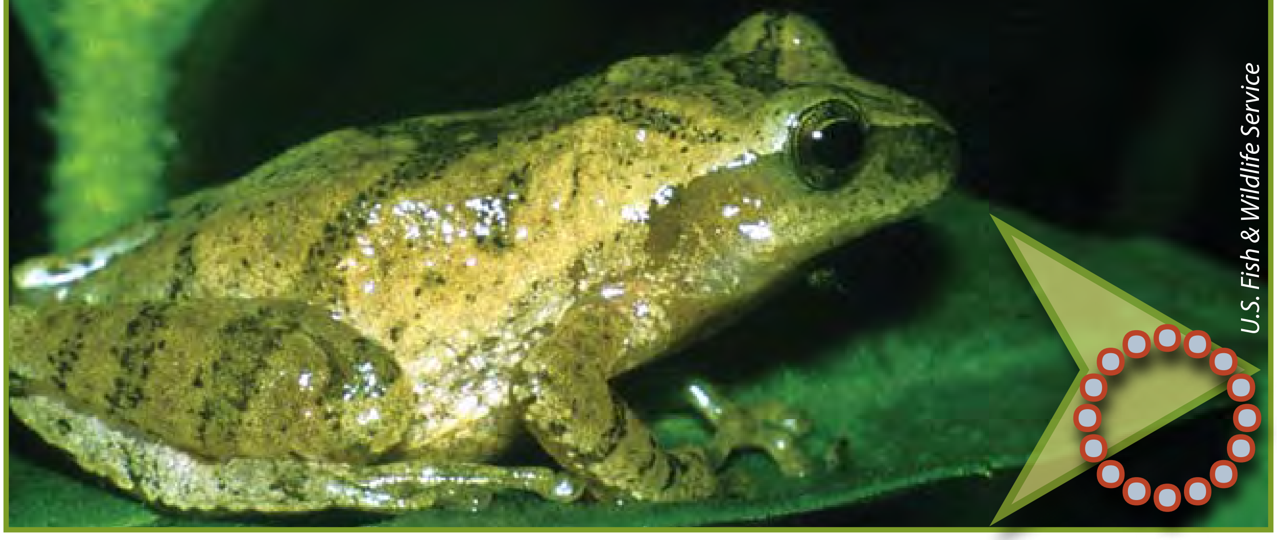




Combined Conservation Value by Ecoregion of
Native Salamanders and Newts in the U.S. and Canada
Threatened by Infrastructure Development

Combined Conservation Value

Combined conservation value for amphibians threatened by development is concentrated in three regions. The highest values are found in the Pacific Northwest, from the Cascades to Northern California. In addition, the entire Appalachian region and the Middle Atlantic and southeastern coast regions have high conservation value for amphibians threatened by development. These same Pacific Northwest, Middle Atlantic, and southeastern forest regions also rank high when considering only frogs and toads, but the Appalachians do not. The Arizona Mountains and Colorado Rockies also rank high for frogs and toads, and the entire western interior of the U.S. has moderate conservation value. For salamanders and newts, the Appalachian forests and Northern California coastal forests rank at the top of all ecoregions. The Pacific Northwest, Middle Atlantic and Southeastern forests in general rank in the top 10% of conservation scores as well, but these scores are only moderate compared with the Appalachians.



Summary of Priorities

The results of these analyses reveal general patterns of native amphibian biodiversity and vulnerability in the U.S. and Canada. These patterns provide useful information for setting conservation priorities to address amphibian declines. It is important to remember, however, that these results do not necessarily indicate where threats to amphibian populations occur. Rather, they reveal where amphibian species that are "at risk" are concentrated. Identifying these areas of at-risk species is the first step in formulating a comprehensive conservation strategy. Additional, more detailed analyses are needed within priority areas to determine the actual patterns of available habitat and threats to develop effective plans for safeguarding amphibians in those areas.

Broad Geographic Trends

The patterns of amphibian risk do not follow the patterns of amphibian species richness. Species richness of amphibians is generally highest in the southeastern U.S. and decreases toward the Northwest of the continent. However, even cumulative risk severity, which is influenced by species richness, has a split distribution with highest values distributed in the southeastern and northwestern U.S. This indicates that threats to amphibians in the U.S. and Canada are not uniform across the continent, and amphibians in some parts of the continent are experiencing higher pressure from threats than amphibians in other areas.

In addition, frogs and toads in the western interior of the continent are experiencing higher risk than those living in most areas that support a greater number of species. This is cause for concern, particularly considering the relatively high proportional risk across this region, which may signal a systemic and widespread decline in ecosystem function. In these areas, proportional risk averages 10%-20%, which is the equivalent of having up to 20% of all local species globally threatened with extinction, but it is more often the result of a much higher percentage of local species being at least moderately at risk of extinction. This is a region of naturally low species richness for amphibians, but the few species that occur were often historically abundant and important components of the region's ecosystems.

Priority Areas

All Amphibians

There are four areas that stand out as important for amphibian conservation in general. These areas are the Middle Atlantic and Southeastern coastal areas, the Pacific Northwest, the Appalachian Mountains, and the Ozark Mountains. Although these areas are already well known for being centers of amphibian biodiversity or conservation concern, these analyses indicate the relative importance of biodiversity, cumulative threats, or ecosystem function within these priority areas.

- **The Middle Atlantic to southeastern coastal areas** – This area boasts the highest number of amphibian species overall, and these areas are rich in both frogs and toads and salamanders and newts. These areas also contain a relatively high human population, which puts pressures on these biologically rich ecoregions.
- **Pacific Northwest** – While not as species rich as the southeastern U.S., the region provides areas of abundant moisture to support the richest assemblage of amphibians west of the Rocky Mountains.
- **Ozark Mountains** – This region stands out because it supports moderately high numbers of both anurans and caudates with a moderately high cumulative risk of being lost. This is due, in part, to a number of locally endemic species found in the region.
- **Appalachian Mountains** – As mentioned previously, this area contains the largest assemblage of salamander and newt species found on the planet. For this reason alone, the area is important for amphibian conservation, but this region also supports a relatively high number of frog and toad species, which makes it important for amphibians in general.

Frogs and Toads

In addition to areas important for all amphibians, a few additional areas are important primarily for frogs and toads.

- **Eastern and southern Texas** – A band of high species richness from the southern tip of Texas extending through the eastern third of the state toward the Ouachita Mountains of Oklahoma contains a particularly diverse assemblage of frogs and toads, many of which are considered at risk.
- **Arizona Mountains** – The Arizona Mountains ecoregion contains fourteen species of frogs and toads, putting it on par with many areas of the amphibian rich Southeast. However, many of these species have extremely restricted ranges and several are critically imperiled globally.
- **West Coast** – The greatest proportional risk for frogs and toads is found along the entire western coast. Some of these areas naturally support extremely low numbers of species and these high proportional risk values may be an artifact of the few native species being considered “at risk” elsewhere. But, other areas, such as throughout most of California and the Pacific Northwest, are under pressure due to large human populations and other factors, resulting in a high proportion of “at risk” species.

Salamanders and Newts

- **Appalachian Mountains** – Salamanders and newts reach their zenith in the Appalachian Mountain regions. This area supports more species of caudates then anywhere else on Earth. Although this area ranks high as a priority for amphibians in general, it is particularly critical for salamanders and newts, of which several species are found nowhere else.
- **Pacific Northwest** – The moist mountain and lowland regions of the West Coast support a number of moderately high number or species of caudates. Although the species richness of this area does not match the abundant richness of the eastern United States, the species found in the west tend to be distinct from those on the other side of the continent. The numbers of species found along the West Coast reach their peak in the Pacific Northwest from northern California to southern British Columbia. This region has experienced significant growth in human population, as well as degradation of aquatic habitats from logging and grazing, resulting in an increase in cumulative and proportional risk in the region.
- **Ozark Mountains** – The Ozark Mountains form a relatively isolated mountain plateau within eastern hardwood forest. This area supports an abundance of cool mountain streams and limestone caves that provide habitat for a diversity of salamanders and newts. Because of its relatively small size, and the high number of endemic species found in the area, this area contains a relatively large number of "at risk" species.
- **Extreme southern and southeastern Texas** –The Western Gulf coastal grasslands scored 15% proportional risk, which seems high for an area that supports a relative high diversity (18 species) of caudates. In addition, the Tamaulipan mezquital ecoregion of south Texas scored 12% proportional risk although this region supports only four native species of caudates. Because high proportional risk may indicate a widespread loss of ecosystem function, these areas deserve further investigation to discover why such a high proportion of salamanders are "at risk."

Infrastructure Development Priorities

When analyses are restricted to only amphibian species threatened by infrastructure development, clear patterns emerge. Three areas of overall high conservation value emerge and include three of the four overall conservation priorities for amphibians in general described above.

- **Pacific Northwest** – Although the Pacific Northwest ranks high as a conservation priority in general, it rises to the top of the heap for amphibians threatened by infrastructure development. As previously described, the Pacific Northwest supports the highest amphibian species richness in the western half of the continent. The area has also experienced rapid human population growth in recent decades. Seattle is ranked seventh in the list of 30 Most Sprawl-Threatened Cities published by The Sierra Club.[13]
- **Appalachian Region** – This region is another area of high species richness, supporting the world's largest assemblage of species of salamanders and newts. This region is bookended by Atlanta, Georgia, in the south and Washington,

D.C., in the north. These cities are ranked one and three respectively in the list of 30 most sprawl-threatened cities. It is estimated that 500 acres of habitat are lost each week due to sprawl in the Atlanta area alone. In addition, Raleigh, North Carolina, near the eastern flank of the Appalachian region, is listed as the second most sprawl-threatened small city in the U.S.

- **Middle Atlantic to southeastern coastal area** – This large swath of land from the Middle Atlantic to eastern Gulf coastal plains and extending down the Florida peninsula to the Everglades supports the highest richness of amphibian species in North America north of Mexico. It also contains the largest number of the 30 most sprawl-threatened species. At the north and south are Washington, D.C., and Fort Lauderdale, Florida, ranking three and nine respectively among the top 10 sprawl-threatened large cities. The area also includes Orlando and West Palm Beach, Florida, with rank one and four among medium-sized cities, and Raleigh, North Carolina; Pensacola, Florida; and Daytona Beach, Florida; ranking two, three, and four respectively.
- **Southwest** – The arid Southwest reveals alarmingly high proportional risk values for frogs and toads. In particular, the Arizona Mountains and Sonoran and Chihuahuan deserts have proportional risk values ranging from 24%-29%. Phoenix, Arizona, and San Diego, California, consistently rank high among sprawl-threatened cites and no doubt are having an impact on species in this region. But high proportional risk scores, and consequently moderate to high overall conservation value scores, are high across a broad region extending from the Texas panhandle to the Baja peninsula.
- **U.S. West** – The entire region from the Rocky Mountains to the U.S. Pacific coast ranks high to moderately high for combined conservation value for frogs and toads and deserves special consideration because of the apparent widespread decline of amphibians in this region. In addition to the Pacific Northwest and Desert Southwest, which are included in this broad region and are already described as priority areas, the Central and Southern Rockies stand out as areas of high conservation value. The U.S. West has experienced the highest rate of population growth in the country in recent decades and current trends in frog and toad declines are likely to continue without serious effort to reverse them. Of nine species of frogs and toads considered critically imperiled or extinct at the national level, six (67%) occur west of the 100th meridian. Much of the area supports some of the lowest amphibian species richness on the continent, yet even widespread species with flexible habitat requirements, such as northern leopard frogs, Columbia spotted frogs, and western toads, are in decline. The entire region may be suffering a systemic decline in ecosystem function, rendering it incapable of supporting amphibians. Infrastructure development is just one of many factors contributing to these declines. Chytrid fungus has been confirmed in many areas, and the widespread introduction of fish for sport fishing, as well as degraded wetlands from logging, mining, and grazing, are other contributing factors. However, efforts to offset habitat loss due to human population growth would raise awareness of the need to address the broader issue of amphibian decline in the region.

Recommendations

These results provide only a first step in setting priorities for amphibian conservation in the U.S. and Canada. They provide a quantitative approach for narrowing the focus on a relatively few priority areas, but more detailed analyses within these areas are needed to develop effective conservation strategies.

General Priority Areas

More detailed analyses that focus on community characteristics and patterns of threats could form the basis for a comprehensive conservation strategy. Community characteristics would include patterns of species distributions and niche breadths of species within a priority area.

- **Niche breadth** – This is important because species with narrow niches are often sensitive to relatively small changes in their environment and they often occur over a small geographic range, so threats that impact relatively small areas can have significant impacts on a species.
- **Species distributions** – Mapping and overlaying species distributions provides useful information for determining where conservation efforts can be targeted to protect the largest number of species. However, species range maps, such as those used in this report, are not sufficiently detailed to provide accurate mapping of species occurrence at an ecoregion scale. Such mapping typically requires habitat modeling to map areas with a suitable combination of characteristics needed to provide habitat for a given species.
- **Identifying Threats** – To develop effective conservation strategies, we need to know what threats need to be mitigated to achieve conservation goals. The Global Amphibian Assessment contains data about the major threats to amphibians at the species-, and sometimes population-, level. These data can provide a basis for analyzing threats and can provide useful information about the vulnerability of the amphibian community in an area to general types of threats. However, additional information about threats is required to adequately assess priority areas. For example, knowing that a species is threatened by mining may not be sufficient if the actual threat to the species is specifically mountain top removal mining. Having such additional information about threats can be critical in order to avoid wasting resources to mitigate types of mining activities that have relatively little negative impacts on amphibian species targeted.

- **Mapping Threats** – This is different from identifying threats because not all threats can be mapped. For example, threats like human prejudice may be ubiquitous across an entire priority area and impact amphibians in the area regardless of their location. But even these types of threats must be considered when developing conservation strategies, even if they cannot be spatially described on a map. Mapping threats is useful for focusing conservation actions precisely in those locations where threats are occurring. In addition, mapping often helps to eliminate threats which may affect one or more species but which are not significant within the priority area.
- **Synthesizing Information** – Combining information about community characteristics and threats provides a powerful tool for focusing conservation activities. Mapping species communities and threats allows us to focus activities where vulnerable species and their relative threats coincide. Community characteristics also provide guidance for developing general strategies to effectively address amphibian conservation challenges. Priority areas dominated by habitat specialists would indicate a need for targeted conservation actions that pinpoint small areas to protect vulnerable species' restricted habitats. But areas where declining species are predominantly habitat generalists would indicate a need for widespread action, such as changing human perceptions and attitudes or mitigating widespread land use practices such as pesticide use. Most areas will require a combination of strategies that are best revealed through detailed assessments of amphibian communities and threats.

Amphibian breeding habitat in Yellowstone National Park

Priorities for Infrastructure Development

A major objective of this assessment is to identify priority areas where small-scale or backyard habitat projects would most effectively mitigate habitat loss due to development and sprawl. The results indicate that the Pacific Northwest, the Appalachian Mountains area, and the U.S. Southeast would be good areas in which to focus these activities. Within these priority areas, more detailed analyses should be conducted on individual ecosystems. These analyses should include:

- **Mapping Amphibian Habitat** – Habitat maps should indicate areas of existing habitat as well as habitat that has been degraded and could potentially be restored.
- **Mapping Threats** – This should include maps of all threats currently or likely to impact amphibians in the region in the near future. Special attention should be given to patterns of housing sprawl, including recent development patterns as well as predicted patterns of development over the next 10 to 20 years.

- **Identify Priorities** – Using a similar overlay process as was used for this assessment, habitat and threat maps are overlaid to identify areas of high conservation value that would likely be maintained or restored through small-scale habitat projects.
- **Develop Habitat Guidelines** – Guidelines should be created that are specific to targeted priority areas. This is best accomplished by identifying breeding and general habitat requirements for all amphibians native to priority areas. Habitat requirements can then be lumped into categories such as ephemeral pool/ marshland margin breeders, stream breeders, etc. Guidelines should be developed to emulate habitat characteristics of those types of habitat found in the local area. Guidelines should be reviewed and revised periodically as experience with success in local projects is gained.
- **Form Stakeholder Partnerships** – Stakeholders should be recruited to implement projects within priority areas. In some cases, stakeholders may be recruited based on the location of their property within a particularly promising area. Other stakeholders will be recruited because of their interest in supporting amphibian conservation. Special effort should be made to include schools, youth groups, and local environmental and garden clubs in recruiting efforts.

Programs implemented to offset habitat loss due to development and sprawl need to incorporate landscape context. Landscape context means implementing projects that integrate seamlessly into the natural landscape without exacerbating existing threats. For example, projects should avoid creating traditional "backyard habitat oases." Such oases typically ignore the importance of landscape context and end up creating islands of habitat not normally found in the region. These habitat islands are often very attractive to wildlife, but they are often more attractive to non-native or aggressive species than they are to the local natives. A better approach is to attempt to replicate the types of natural amphibian habitat that already exists in the area or that has been recently lost.

Considering landscape context also means considering potential ripple effects (both good and bad) of habitat creation or restoration. Habitat fragmentation is a major consequence of urban sprawl and can cut animals off from access to needed habitat. For example, a major subdivision placed between a frog's breeding pond and the forests where it spends the rest of the year could render both areas useless for frogs. In other cases, habitat fragmentation can split habitat patches into pieces that are too small to support amphibians. Because of these issues, restoring habitat connectivity is generally desirable and small-scale habitat projects have the potential to restore such connectivity. However, landscape context must be considered beforehand to ensure that restoring connectivity does not open corridors of invasion for exotic species or disease. How small habitat projects might alter the patterns of existing threats must be considered when developing any comprehensive plan.

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Appendix 1: Table of Calculated Metrics for Amphibians Species Native to the U.S. and Canada

Eco Region	Number of Species			Mean Species/Km²			Cumulative Risk Severity			Proportional Risk Severity Index			Conservation Value Index		
	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined
Alaska Peninsula montane taiga	1	0	1	0.10	0	0.10	0.10	0	0.10	0.06	0	0.06	0.04	0	0.03
Alaska-St. Elias Range tundra	2	0	2	1.12	0	1.12	1.51	0	1.51	0.06	0	0.06	0.05	0	0.04
Alberta Mountain forests	3	1	4	2.78	0.88	3.66	1.48	1.63	3.11	0.03	**0.09**	0.04	0.05	0.05	0.06
Alberta-British Columbia foothills forests	3	1	4	1.58	0.12	1.69	0	0.05	0.06	0	0	0	0.02	0	0.01
Allegheny Highlands forests	14	**17**	28	9.43	13.65	**23.09**	2.11	3.93	6.04	0.01	0.02	0.01	0.13	**0.19**	0.20
Appalachian mixed mesophytic forests	**22**	**23**	**39**	11.85	16.02	**27.87**	2.22	**7.84**	10.06	0.01	0.03	0.02	0.16	**0.24**	**0.25**
Appalachian-Blue Ridge forests	**22**	**28**	**42**	12.25	17.48	**29.73**	3.75	**12.17**	**15.92**	0.02	0.04	0.03	0.18	**0.29**	**0.30**
Arctic coastal tundra	1	0	1	0.51	0	0.51	0.51	0	0.51	0.06	0	0.06	0.04	0	0.03
Arctic foothills tundra	1	0	1	0.96	0	0.96	0.96	0	0.96	0.06	0	0.06	0.04	0	0.03
Arizona Mountains forests	14	2	15	10.16	1.09	11.25	**11.89**	0.53	12.42	0.06	0.01	0.06	**0.23**	0.02	0.16
Atlantic coastal pine barrens	15	13	27	12.21	7.10	19.31	6.25	4.73	10.98	0.03	0.03	0.03	**0.21**	0.12	0.21
Beringia lowland tundra	1	0	1	0.43	0	0.43	0.43	0	0.43	0.06	0	0.06	0.04	0	0.03
Beringia upland tundra	1	0	1	0.66	0	0.66	0.66	0	0.66	0.06	0	0.06	0.04	0	0.03
Blue Mountains forests	6	3	8	4.21	1.08	5.29	6.15	0.64	6.78	0.08	0.02	0.07	0.12	0.02	0.10
British Columbia mainland coastal forests	6	8	13	2.32	2.61	4.93	0.98	0.41	1.39	0.02	0	0.01	0.04	0.03	0.05
Brooks-British Range tundra	1	0	1	0.84	0	0.84	0.83	0	0.83	0.06	0	0.06	0.04	0	0.03
California Central Valley grasslands	5	6	10	3.60	1.14	4.74	8.34	1.93	10.27	**0.12**	**0.06**	**0.12**	0.15	0.04	0.12
California coastal sage and chaparral	8	5	11	5.19	2.80	7.99	**13.00**	3.53	**16.54**	**0.13**	**0.07**	**0.11**	0.21	0.07	0.18
California interior chaparral and woodlands	6	11	15	4.12	4.04	8.16	**9.87**	4.22	**14.09**	**0.13**	0.05	**0.10**	0.17	0.09	0.16
California montane chaparral and woodlands	7	6	11	4.29	1.99	6.28	**9.76**	1.77	11.53	**0.11**	0.03	**0.09**	0.16	0.04	0.13
Canadian Aspen forests and parklands	8	2	9	2.72	0.33	3.05	0.60	0.02	0.62	0.01	0	0.01	0.04	0	0.03
Cascade Mountains leeward forests	5	6	10	2.78	1.52	4.30	1.06	0.35	1.41	0.02	0.01	0.01	0.05	0.02	0.04
Central and Southern Cascades forests	7	12	17	5.13	7.37	12.50	**12.58**	**12.78**	**25.36**	**0.12**	**0.08**	**0.11**	0.20	**0.18**	**0.25**
Central and Southern mixed grasslands	19	2	21	9.86	1.23	11.09	1.24	0	1.24	0.01	0	0.01	0.13	0.01	0.09
Central British Columbia Mountain forests	4	1	5	2.49	0.91	3.40	0	0	0	0	0	0	0.03	0.01	0.02
Central Canadian Shield forests	8	5	13	4.46	1.57	6.02	0	0	0	0	0	0	0.05	0.02	0.04
Central forest-grasslands transition	**24**	**16**	**36**	**13.57**	4.42	17.99	2.53	1.81	4.34	0.01	0.02	0.01	0.18	0.07	0.15
Central Pacific coastal forests	5	10	15	3.56	7.00	10.57	3.73	**7.54**	11.27	0.05	0.05	0.05	0.09	0.14	0.15
Central tall grasslands	14	5	17	7.47	1.03	8.49	1.93	0.96	2.89	0.01	0.03	0.02	0.11	0.03	0.08
Central U.S. hardwood forests	19	**21**	**37**	13.56	13.17	**26.73**	2.02	5.34	7.36	0.01	0.02	0.02	0.18	**0.19**	**0.23**
Chihuahuan desert	15	2	16	11.63	1.06	12.69	6.51	0.39	6.90	0.03	0.01	0.03	0.20	0.02	0.14
Colorado Plateau shrublands	12	2	13	7.51	1.02	8.53	**9.94**	0.14	10.07	0.07	0	0.06	0.19	0.01	0.13
Colorado Rockies forests	13	2	14	6.24	1.02	7.26	8.83	0.28	9.10	0.09	0.01	0.07	0.17	0.02	0.12
Cook Inlet taiga	2	0	2	1.01	0	1.01	1.06	0	1.06	0.06	0	0.06	0.04	0	0.03
Copper Plateau taiga	2	0	2	1.88	0	1.88	4.50	0	4.50	**0.13**	0	**0.13**	0.10	0	0.08

Boldface - Ecoregion ranks in the top ten percent of all scores

Appendix 1: Table of Calculated Metrics for Amphibians Species Native to the U.S. and Canada (continued)

Eco Region	Number of Species			Mean Species/Km²			Cumulative Risk Severity			Proportional Risk Severity Index			Conservation Value Index		
	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined
East Central Texas forests	**25**	11	32	**20.11**	5.39	**25.51**	7.03	0.49	7.52	0.02	0	0.02	**0.30**	0.07	0.22
Eastern Canadian forests	8	6	13	3.00	1.07	4.07	0.04	0	0.05	0	0	0	0.04	0.01	0.03
Eastern Canadian Shield taiga	5	1	6	1.88	0.14	2.02	0.03	0	0.03	0	0	0	0.02	0	0.01
Eastern Cascades forests	7	10	15	3.78	1.55	5.33	7.91	1.33	9.24	**0.10**	0.04	**0.09**	0.14	0.04	0.11
Eastern forest-boreal transition	11	13	24	7.46	4.81	12.27	0.01	0.02	0.03	0	0	0	0.09	0.06	0.09
Eastern Great Lakes lowland forests	11	15	25	9.88	6.26	16.13	0.12	0.69	0.81	0	0	0	0.12	0.08	0.12
Edwards Plateau savanna	**24**	5	28	**16.30**	2.26	18.56	0.23	1.19	1.42	0	0.02	0	0.20	0.04	0.14
Everglades	15	5	20	13.24	4.90	18.15	4.23	4.99	9.23	0.02	0.06	0.03	0.20	0.10	0.18
Flint Hills tall grasslands	18	3	21	10.15	1.90	12.05	1.07	0.16	1.23	0	0	0	0.13	0.02	0.09
Florida sand pine scrub	20	12	32	**17.25**	7.65	**24.89**	6.00	**10.23**	**16.23**	0.02	**0.07**	0.04	**0.26**	**0.17**	**0.27**
Fraser Plateau and Basin complex	5	3	6	2.26	1.02	3.28	0.04	0	0.04	0	0	0	0.03	0.01	0.02
Great Basin montane forests	6	1	6	4.75	0.05	4.81	5.26	0.29	5.55	0.06	0.02	0.06	0.12	0.01	0.08
Great Basin shrub steppe	10	3	11	4.66	0.36	5.02	5.27	0.20	5.47	0.06	0.01	0.06	0.12	0.01	0.08
Gulf of St. Lawrence lowland forests	10	6	15	7.21	4.46	11.67	0.12	1.67	1.79	0	0.02	0.01	0.09	0.07	0.10
Interior Alaska-Yukon lowland taiga	1	0	1	0.90	0	0.90	0.82	0	0.82	0.05	0	0.05	0.04	0	0.03
Interior Yukon-Alaska alpine tundra	1	0	1	0.99	0	0.99	0.51	0	0.51	0.03	0	0.03	0.03	0	0.02
Klamath-Siskiyou forests	6	11	17	5.03	6.91	11.93	**12.49**	**8.18**	**20.67**	**0.14**	**0.06**	**0.09**	0.20	0.15	0.22
Low Arctic tundra	2	0	2	0.17	0	0.17	0	0	0	0	0	0	0.01	0	0.01
Mid-Continental Canadian forests	5	1	5	2.16	0	2.17	0.12	0	0.12	0	0	0	0.03	0	0.02
Middle Arctic tundra	1	0	1	0.03	0	0.03	0	0	0	0	0	0	0.01	0	0.01
Middle Atlantic coastal forests	**28**	**20**	**47**	**22.32**	15.03	**37.35**	**10.66**	**8.30**	**18.96**	0.03	0.03	0.03	**0.36**	**0.23**	**0.37**
Midwestern Canadian Shield forests	8	3	9	2.18	0.18	2.36	0.03	0	0.03	0	0	0	0.03	0	0.02
Mississippi lowland forests	**24**	**18**	**42**	**13.94**	8.17	22.11	2.16	2.19	4.35	0.01	0.01	0.01	0.19	0.11	0.18
Mojave desert	10	3	11	3.33	0.21	3.54	3.14	0.39	3.53	0.03	0.02	0.03	0.07	0.01	0.05
Montana Valley and Foothill grasslands	7	2	9	4.36	1.20	5.56	5.62	0.52	6.14	0.07	0.01	0.06	0.12	0.02	0.09
Muskwa-Slave Lake forests	2	0	2	1.10	0	1.10	0	0	0	0	0	0	0.01	0	0.01
Nebraska Sand Hills mixed grasslands	8	1	9	7.21	1.00	8.21	0.01	0	0.01	0	0	0	0.09	0.01	0.06
New England-Acadian forests	13	14	27	8.25	5.96	14.21	1.14	2.21	3.35	0.01	0.02	0.01	0.11	0.09	0.12
Newfoundland Highland forests	2	0	2	0.18	0	0.18	0.01	0	0.01	0	0	0	0.01	0	0.01
North Central Rockies forests	6	4	8	3.90	1.51	5.41	2.14	2.07	4.21	0.03	0.05	0.04	0.07	0.04	0.07
Northeastern coastal forests	15	15	29	11.39	9.95	21.34	6.49	**6.27**	12.76	0.03	0.03	0.03	0.20	**0.16**	**0.23**
Northern California coastal forests	5	12	17	4.63	9.81	14.44	**11.76**	**10.09**	**21.85**	**0.14**	0.06	0.08	0.19	**0.19**	**0.24**
Northern Canadian Shield taiga	3	0	3	0.69	0	0.69	0	0	0	0	0	0	0.01	0	0.01
Northern Cordillera forests	3	1	4	1.60	0.17	1.76	0	0	0	0	0	0	0.02	0	0.01
Northern mixed grasslands	12	2	13	4.74	1.05	5.79	1.85	0.09	1.93	0.02	0	0.02	0.08	0.01	0.06
Northern Pacific coastal forests	3	3	6	1.40	0.83	2.23	4.12	3.33	7.44	**0.17**	**0.13**	**0.18**	0.12	0.07	0.13
Northern short grasslands	11	2	12	4.97	1.00	5.97	3.51	0	3.51	0.04	0	0.03	0.10	0.01	0.07

Boldface - Ecoregion ranks in the top ten percent of all scores

Eco Region	Number of Species			Mean Species/Km²			Cumulative Risk Severity			Proportional Risk Severity Index			Conservation Value Index		
	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined
Northern tall grasslands	9	4	13	5.85	1.00	6.86	0.03	0.02	0.05	0	0	0	0.07	0.01	0.05
Northern transitional alpine forests	3	2	5	2.33	1.02	3.35	0.02	0	0.02	0	0	0	0.03	0.01	0.02
Northwest Territories taiga	1	0	1	0.72	0	0.72	0	0	0	0	0	0	0.01	0	0.01
Ogilvie-MacKenzie alpine tundra	1	0	1	1.00	0	1.00	0.05	0	0.05	0	0	0	0.01	0	0.01
Okanagan dry forests	5	3	7	4.00	1.25	5.25	1.32	0.51	1.83	0.02	0.01	0.02	0.06	0.02	0.05
Ozark Mountain forests	20	**17**	**37**	**15.15**	9.86	**25.01**	6.89	**8.04**	**14.93**	0.02	0.04	0.03	**0.24**	**0.17**	**0.26**
Pacific Coastal Mountain icefields and tundra	3	3	6	1.89	0.44	2.33	3.56	1.14	4.70	0.10	0.05	**0.10**	0.08	0.03	0.08
Palouse grasslands	7	4	9	4.04	1.60	5.65	3.13	1.70	4.83	0.04	0.04	0.05	0.08	0.04	0.08
Piney Woods forests	**22**	16	**36**	**16.66**	9.42	**26.08**	3.69	3.13	6.81	0.01	0.02	0.01	**0.23**	0.13	0.22
Puget lowland forests	6	8	14	3.85	5.05	8.90	6.52	4.07	10.59	0.09	0.04	0.06	0.13	0.09	0.14
Queen Charlotte Islands	2	0	2	1.32	0	1.32	0	0	0	0	0	0	0.02	0	0.01
Rock and Ice	3	3	6	0.25	0.05	0.31	0.42	0.09	0.51	0.08	0	0.08	0.07	0	0.06
Sierra Juarez and San Pedro Martir pine-oak forests	4	0	4	4.00	0	4.00	6.00	0	6.00	0.08	0	0.08	0.12	0	0.09
Sierra Madre Occidental pine-oak forests	14	1	15	11.09	1.00	12.09	**12.10**	0	12.10	0.06	0	0.05	**0.24**	0.01	0.16
Sierra Madre Oriental pine-oak forests	15	2	16	12.04	1.03	13.07	0.50	0.20	0.70	0	0.01	0	0.15	0.02	0.10
Sierra Nevada forests	7	6	11	3.92	2.44	6.35	**13.27**	4.78	**18.05**	**0.18**	**0.11**	**0.15**	0.21	0.09	0.19
Snake-Columbia shrub steppe	7	5	9	4.14	0.89	5.03	4.07	0.97	5.05	0.05	0.04	0.05	0.10	0.03	0.08
Sonoran desert	13	3	14	6.86	0.51	7.36	4.69	0.02	4.71	0.04	0	0.04	0.13	0.01	0.09
South Avalon-Burin oceanic barrens	1	0	1	0.82	0	0.82	0	0	0	0	0	0	0.01	0	0.01
South Central Rockies forests	7	3	8	4.53	1.16	5.69	5.33	0.89	6.22	0.06	0.02	0.06	0.12	0.03	0.09
South Florida rocklands	13	5	18	12.29	4.96	17.25	2.24	4.96	7.20	0.01	0.06	0.02	0.17	0.10	0.17
Southeastern conifer forests	**28**	**20**	**47**	**20.99**	13.71	**34.69**	7.37	**16.48**	**23.85**	0.02	**0.07**	0.04	**0.31**	**0.27**	**0.38**
Southeastern mixed forests	**28**	**23**	**46**	**16.46**	13.92	**30.38**	1.32	6.04	7.36	0	0.02	0.01	0.21	**0.21**	**0.26**
Southern Great Lakes forests	16	**21**	**33**	11.39	8.22	19.61	3.66	3.37	7.03	0.02	0.02	0.02	0.17	0.12	0.18
Southern Hudson Bay taiga	5	2	7	2.83	0.28	3.11	0	0	0	0	0	0	0.03	0	0.02
Tamaulipan mezquital	21	4	24	13.55	1.56	15.11	8.18	3.37	11.56	0.03	**0.12**	0.04	**0.23**	0.08	0.18
Texas blackland prairies	**25**	11	32	**20.94**	4.08	**25.02**	3.90	0.32	4.22	0.01	0	0.01	**0.28**	0.05	0.20
Torngat Mountain tundra	1	0	1	0.99	0	0.99	0	0	0	0	0	0	0.01	0	0.01
Upper Midwest forest-savanna transition	12	7	19	8.76	3.07	11.83	2.15	0.63	2.78	0.01	0.01	0.01	0.12	0.04	0.10
Wasatch and Uinta montane forests	10	1	11	5.92	1.00	6.92	8.37	0	8.37	0.07	0	0.06	0.16	0.01	0.11
Western Great Lakes forests	12	7	19	8.84	3.77	12.61	1.43	0.24	1.67	0.01	0	0.01	0.12	0.05	0.10
Western Gulf coastal grasslands	**24**	**18**	**42**	**17.09**	4.43	21.52	6.40	4.19	10.59	0.02	**0.15**	0.03	**0.26**	0.12	0.22
Western short grasslands	13	2	14	8.97	1.00	9.97	3.58	0	3.58	0.02	0	0.02	0.14	0.01	0.10
Willamette Valley forests	7	12	17	4.03	7.55	11.58	**12.48**	**8.99**	**21.47**	**0.17**	**0.06**	**0.10**	0.20	**0.16**	**0.22**
Wyoming Basin shrub steppe	8	1	9	5.29	1.00	6.29	8.15	0	8.15	0.08	0	0.07	0.15	0.01	0.11
Yukon Interior dry forests	3	0	3	1.26	0	1.26	0	0	0	0	0	0	0.01	0	0.01
Mean	9.47	5.83	14.35	6.24	2.98	9.22	3.54	1.96	5.50	0.04	0.02	0.04	0.12	0.05	0.11
Max	28.00	28.00	47.00	22.32	17.48	37.35	13.27	16.48	25.36	0.18	0.15	0.18	0.36	0.29	0.38

Appendix 2: Table of Calculated Metrics for Amphibians Threatened by Infrastructure Development

	Number of Species			Mean Species/Km2			Cumulative Risk Severity			Proportional Risk Severity Index			Conservation Value Index		
Eco Region	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**
Alaska Peninsula montane taiga	1	0	1	0.10	0	0.10	0.10	0	0.10	0.06	0	0.06	0.07	0	0.04
Alaska-St. Elias Range tundra	2	0	2	1.12	0	1.12	1.51	0	1.51	0.06	0	0.06	0.09	0	0.05
Alberta Mountain forests	3	0	3	2.78	0	2.78	1.48	0	1.48	0.03	0	0.03	0.15	0	0.06
Alberta-British Columbia foothills forests	3	0	3	1.55	0	1.55	0	0	0	0	0	0	0.06	0	0.02
Allegheny Highlands forests	4	10	14	2.72	7.16	9.89	0.61	2.73	3.33	0.01	0.02	0.02	0.13	0.15	0.18
Appalachian mixed mesophytic forests	5	14	17	3.36	8.77	12.13	1.15	6.91	8.05	0.02	0.04	0.04	0.16	0.22	0.25
Appalachian-Blue Ridge forests	5	19	22	3.20	10.01	13.22	1.19	10.05	11.24	0.02	0.05	0.04	0.16	0.26	0.29
Arctic coastal tundra	1	0	1	0.51	0	0.51	0.51	0	0.51	0.06	0	0.06	0.07	0	0.04
Arctic foothills tundra	1	0	1	0.96	0	0.96	0.96	0	0.96	0.06	0	0.06	0.07	0	0.04
Arizona Mountains forests	3	2	4	1.48	1.09	2.57	8.00	0.53	8.53	0.29	0.01	0.17	0.28	0.03	0.15
Atlantic coastal pine barrens	4	8	11	3.37	4.21	7.58	1.30	3.15	4.45	0.02	0.04	0.03	0.17	0.11	0.16
Beringia lowland tundra	1	0	1	0.43	0	0.43	0.43	0	0.43	0.06	0	0.06	0.07	0	0.04
Beringia upland tundra	1	0	1	0.66	0	0.66	0.66	0	0.66	0.06	0	0.06	0.07	0	0.04
Blue Mountains forests	4	2	6	2.51	0.11	2.61	6.06	0.64	6.70	0.14	0.03	0.14	0.23	0.02	0.13
British Columbia mainland coastal forests	4	5	7	1.88	0.90	2.78	0.98	0.11	1.10	0.03	0	0.02	0.11	0.02	0.06
Brooks-British Range tundra	1	0	1	0.84	0	0.84	0.83	0	0.83	0.06	0	0.06	0.07	0	0.04
California Central Valley grasslands	3	4	6	1.26	0.58	1.84	1.70	0	1.70	0.05	0	0.03	0.09	0.01	0.05
California coastal sage and chaparral	3	3	6	1.55	2.26	3.82	5.15	3.46	8.60	0.15	0.07	0.12	0.19	0.09	0.16
California interior chaparral and woodlands	3	8	10	1.71	2.07	3.78	4.86	0.64	5.50	0.13	0.01	0.07	0.18	0.04	0.12
California montane chaparral and woodlands	3	3	5	1.47	1.10	2.57	4.31	0.30	4.61	0.12	0.01	0.09	0.17	0.02	0.10
Canadian Aspen forests and parklands	3	1	3	1.57	0.27	1.84	0.54	0	0.54	0.01	0	0.01	0.08	0	0.04
Cascade Mountains leeward forests	4	3	5	1.67	0.38	2.05	0.40	0.29	0.68	0.01	0.01	0.01	0.08	0.01	0.04
Central and Southern Cascades forests	4	8	10	2.76	4.46	7.22	11.14	11.03	22.18	0.19	0.12	0.16	0.33	0.19	0.31
Central and Southern mixed grasslands	2	1	3	1.08	1.00	2.08	0	0	0	0	0	0	0.05	0.02	0.03
Central British Columbia Mountain forests	3	0	3	2.47	0	2.47	0	0	0	0	0	0	0.10	0	0.04
Central Canadian Shield forests	2	3	5	1.91	1.16	3.07	0	0	0	0	0	0	0.08	0.02	0.05
Central forest-grasslands transition	4	8	10	1.83	1.48	3.31	0.89	0.81	1.69	0.02	0.01	0.02	0.09	0.04	0.07
Central Pacific coastal forests	3	6	9	1.58	3.82	5.40	2.76	5.69	8.45	0.07	0.07	0.07	0.13	0.13	0.16
Central tall grasslands	4	2	5	1.47	0.62	2.09	0.12	0.19	0.31	0	0.01	0.01	0.06	0.01	0.04
Central U.S. hardwood forests	5	13	17	2.35	6.70	9.05	0.64	4.38	5.02	0.01	0.04	0.03	0.11	0.16	0.18
Chihuahuan desert	3	2	4	0.81	1.06	1.87	3.70	0.39	4.09	0.24	0.01	0.09	0.22	0.02	0.08
Colorado Plateau shrublands	3	2	5	1.47	1.02	2.49	5.20	0.14	5.33	0.20	0	0.12	0.20	0.02	0.11
Colorado Rockies forests	3	2	5	2.09	1.02	3.11	7.55	0.28	7.82	0.20	0.01	0.14	0.26	0.02	0.14
Cook Inlet taiga	2	0	2	1.01	0	1.01	1.06	0	1.06	0.06	0	0.06	0.08	0	0.04

Boldface - Ecoregion ranks in the top ten percent of all scores

Appendix 2: Table of Calculated Metrics for Amphibians Threatened by Infrastructure Development (continued)

	Number of Species			Mean Species/Km2			Cumulative Risk Severity			Proportional Risk Severity Index			Conservation Value Index		
Eco Region	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**	**Anura**	**Caudata**	**Combined**
Copper Plateau taiga	2	0	2	1.88	0	1.88	4.50	0	4.50	0.13	0	0.13	0.18	0	0.10
East Central Texas forests	3	5	7	1.74	1.21	2.95	4.23	0.02	4.25	0.1	0	0.09	0.19	0.02	0.11
Eastern Canadian forests	3	3	5	1.17	0.77	1.94	0.04	0	0.04	0	0	0	0.07	0.01	0.04
Eastern Canadian Shield taiga	2	1	3	0.71	0.14	0.85	0.03	0	0.03	0	0	0	0.04	0	0.02
Eastern Cascades forests	4	7	10	2.05	0.50	2.54	7.30	0.68	7.98	0.17	0	0.15	0.25	0.02	0.14
Eastern forest-boreal transition	3	7	10	2.20	2.37	4.57	0	0	0.01	0	0	0	0.09	0.04	0.07
Eastern Great Lakes lowland forests	3	8	10	2.78	2.70	5.48	0	0	0.37	0	0	0	0.12	0	0.09
Edwards Plateau savanna	2	2	3	0.31	0.89	1.20	0	0.03	0.03	0	0	0	0.04	0.02	0.02
Everglades	3	0	3	2.70	0	2.70	4.23	0	4.23	0	0	0	0.20	0	0.09
Flint Hills tall grasslands	1	1	2	1.00	1.00	2.00	0	0	0	0	0	0	0.04	0.02	0.03
Florida sand pine scrub	4	6	10	3.51	2.45	5.97	6.00	4.67	10.67	0	0.05	0	0.26	0.09	0.19
Fraser Plateau and Basin complex	3	1	3	2.04	0.02	2.06	0	0	0	0	0	0	0.09	0	0.03
Great Basin montane forests	3	1	3	2.46	0.01	2.47	4.67	0	4.67	0	0	0	0.22	0	0.11
Great Basin shrub steppe	3	1	4	2.35	0.33	2.68	4.54	0.02	4.56	0.10	0	0.09	0.20	0.01	0.10
Gulf of St. Lawrence lowland forests	3	3	6	2.83	2.24	5.07	0	0	0	0	0	0	0.12	0.04	0.08
Interior Alaska-Yukon lowland taiga	1	0	1	0.90	0	0.90	0.82	0	0.82	0.05	0	0.05	0.07	0	0.04
Interior Yukon-Alaska alpine tundra	1	0	1	0.99	0	0.99	0.51	0	0.51	0.03	0	0.03	0.06	0	0.03
Klamath-Siskiyou forests	4	9	12	2.80	5	7.65	9.60	7	16.42	0.19	0	0.11	0.31	0.15	0.26
Low Arctic tundra	1	0	1	0.01	0	0.01	0	0	0	0	0	0	0.04	0	0.02
Mid-Continental Canadian forests	2	1	3	1.18	0	1.19	0.12	0	0.12	0	0	0	0.05	0	0.02
Middle Atlantic coastal forests	8	10	17	5.49	7	12.82	8	3	10	0	0	0	0.36	0	0.28
Midwestern Canadian Shield forests	2	2	4	1.28	0	1.42	0	0	0	0	0	0	0.05	0	0.02
Mississippi lowland forests	4	8	12	1.44	3	4.46	0	1	2	0	0	0	0.08	0	0.09
Mojave desert	3	1	4	0.43	0.14	0.57	1.35	0	1.36	0.18	0	0.14	0.17	0	0.09
Montana Valley and Foothill grasslands	5	1	6	2.90	0.72	3.63	4.67	0	5.02	0	0	0	0.21	0	0.11
Muskwa-Slave Lake forests	2	0	2	1.10	0	1.10	0	0	0	0	0	0	0.05	0	0.02
Nebraska Sand Hills mixed grasslands	2	1	3	1.50	1.00	2.50	0	0	0	0	0	0	0.06	0.02	0.04
New England-Acadian forests	4	8	12	2.97	3.13	6.10	0.78	1.26	2.04	0.01	0.02	0.02	0.14	0.07	0.11
Newfoundland Highland forests	1	0	1	0	0	0	0	0	0	0	0	0	0.14	0	0.09
North Central Rockies forests	5	3	6	3.14	0.52	3.65	2.11	2	4.10	0	0	0	0.17	0.05	0.10
Northeastern coastal forests	4	9	13	3.04	5.48	8.51	1.10	4.99	6.09	0.02	0.05	0.04	0.15	0.15	0.18
Northern California coastal forests	3	10	13	2.63	8	10.18	8.80	10	18.73	0	0	0	0.29	0	0.31
Northern Canadian Shield taiga	2	0	2	0.66	0	0.66	0	0	0	0	0	0	0.04	0	0.02
Northern Cordillera forests	3	0	3	1.60	0	1.60	0	0	0	0	0	0	0.07	0	0.02
Northern mixed grasslands	4	1	5	1.75	1.00	2.75	0.92	0	0.92	0.03	0	0.02	0.09	0.02	0.05
Northern Pacific coastal forests	3	1	4	1.36	0	1.46	4	0	4	0	0	0	0.20	0	0.12

Boldface - Ecoregion ranks in the top ten percent of all scores

Eco Region	Number of Species			Mean Species/Km2			Cumulative Risk Severity			Proportional Risk Severity Index			Conservation Value Index		
	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined	Anura	Caudata	Combined
Northern short grasslands	5	1	6	1.49	0.99	2.48	1	0	1	0	0	0	0.10	0	0.06
Northern tall grasslands	2	2	4	1.94	0.50	2.44	0.02	0	0.02	0	0	0	0.08	0.01	0.04
Northern transitional alpine forests	3	0	3	2.33	0	2.33	0.02	0	0.02	0	0	0	0.10	0	0.04
Northwest Territories taiga	1	0	1	0.72	0	0.72	0	0	0	0	0	0	0.04	0	0.02
Ogilvie-MacKenzie alpine tundra	1	0	1	1.00	0	1.00	0.05	0	0.05	0	0	0	0.04	0	0.02
Okanagan dry forests	4	1	4	2.73	0.24	2.96	0.26	0.51	0.77	0.01	0.03	0.01	0.12	0.02	0.05
Ozark Mountain forests	3	7	10	1.76	4.1	5.86	1.17	5.39	6.57	0.04	0.06	0.06	0.11	0.13	0.15
Pacific Coastal Mountain icefields and tundra	3	1	4	1.88	0.06	1.95	3.56	0.15	3.71	0.1	0.01	0.1	0.17	0	0.09
Palouse grasslands	4	3	6	2.22	0.60	2.83	2.86	2	4.56	0	0	0	0.16	0.05	0.10
Piney Woods forests	2	7	9	1.72	3	5.02	0	1	1	0	0	0	0.07	0	0.09
Puget lowland forests	4	5	8	1.95	2	4.12	6.38	2	8.16	0	0	0	0.23	0	0.15
Queen Charlotte Islands	1	0	1	0.66	0	0.66	0	0	0	0	0	0	0.04	0	0.02
Rock and Ice	3	1	4	0.25	0.01	0.26	0.42	0	0.42	0.08	0	0.08	0.14	0	0.07
Sierra Juarez and San Pedro Martir pine-oak forests	1	0	1	1.00	0	1.00	0	0	0	0	0	0	0.04	0	0.02
Sierra Madre Occidental pine-oak forests	2	1	3	1.11	1.00	2.11	6.86	0	6.86	0.35	0	0.16	0.28	0.02	0.13
Sierra Madre Oriental pine-oak forests	2	2	4	0.09	1.03	1.12	0.24	0.20	0.44	0.12	0.01	0.01	0.15	0.02	0.02
Sierra Nevada forests	3	2	5	1.87	0.54	2.41	5.42	0.03	5.46	0.14	0	0.11	0.20	0.01	0.11
Snake-Columbia shrub steppe	4	3	5	1.99	0	2.46	3	1	4	0	0	0	0.17	0	0.10
Sonoran desert	2	3	4	0.07	0.51	0.58	0.33	0.02	0.35	0.27	0	0.02	0.20	0	0.03
South Central Rockies forests	4	2	5	2.79	1	3.56	4.79	1	5.68	0.09	0	0.08	0.21	0	0.12
South Florida rocklands	3	0	3	2.36	0	2.36	2.24	0	2.24	0.04	0	0.04	0.14	0	0.06
Southeastern conifer forests	7	11	17	4.02	6.13	10.15	6.61	7.57	14.18	0	0.06	0	0.29	0.18	0.27
Southeastern mixed forests	8	16	18	2.47	7.03	9.50	0.77	3.24	4.01	0.01	0.02	0.02	0.12	0.15	0.18
Southern Great Lakes forests	4	13	17	2.79	4.07	6.86	0.95	1.45	2.40	0.02	0.02	0.02	0.14	0.09	0.13
Southern Hudson Bay taiga	2	1	3	1.70	0.28	1.98	0	0	0	0	0	0	0.07	0	0.03
Tamaulipan mezquital	0	1	1	0	1	0.88	0	0	0	0	0	0	0	0	0.02
Texas blackland prairies	3	5	7	1.46	0.88	2.34	1.42	0.07	1.49	0.03	0	0.03	0.10	0.02	0.06
Upper Midwest forest-savanna transition	3	4	7	2.29	1.73	4.03	0.39	0.03	0.42	0.01	0	0.01	0.10	0.03	0.07
Wasatch and Uinta montane forests	3	1	4	2.52	1.00	3.52	6.49	0	6.49	0.13	0	0.10	0.24	0.02	0.13
Western Great Lakes forests	3	4	7	2.18	2.17	4.35	0.05	0.02	0.07	0	0	0	0.09	0.04	0.07
Western Gulf coastal grasslands	4	8	12	1.20	0.82	2.02	1.84	0.12	1.95	0.04	0	0.04	0.11	0.02	0.07
Western short grasslands	3	1	4	1.24	1.00	2.24	1	0	1	0	0	0	0.08	0	0.05
Willamette Valley forests	4	8	10	1.97	3.81	5.78	11.46	6.50	17.96	0.33	0.08	0.17	0.35	0.14	0.26
Wyoming Basin shrub steppe	3	1	4	2.38	1.00	3.38	6.80	0	6.80	0.15	0	0.10	0.24	0.02	0.13
Yukon Interior dry forests	3	0	3	1.26	0	1.26	0	0	0	0	0	0	0.05	0	0.02
Boldface - Ecoregion ranks in the top ten percent of all scores															
Mean	**2.98**	**3.38**	**5.90**	**1.75**	**1.50**	**3.26**	**2.21**	**1**	**3.34**	**0.07**	**0**	**0.05**	**0.14**	**0.04**	**0.09**
Max	**8.00**	**19.00**	**22 .00**	**5.49**	**10.01**	**13.22**	**11.46**	**11.03**	**22.18**	**0.35**	**0**	**0.18**	**0.36**	**0.26**	**0.31**

Appendix 3: Table of amphibian species, and their conservation status, included in assessment

Order	Scientific Name	Common Name	Global Status*	US Status*	Canada Status*	State Status*
Anura	Acris crepitans	Northern Cricket Frog	G5		NH	Colorado (SH), District of Columbia (S3), Iowa (S3?), Minnesota (S1), New York (S1), Pennsylvania (S2), South Dakota (S1), West Virginia (S2)Ontario (SH)
Anura	Acris gryllus	Southern Cricket Frog	G5			
Anura	Ascaphus montanus	Rocky Mountain Tailed Frog	G4	N4	N1	Idaho (S3), Oregon (S2)British Columbia (S1)
Anura	Ascaphus truei	Coastal Tailed Frog	G4	N4	N3N4	California (S2S3), Oregon (S3)British Columbia (S3S4)
Anura	Bufo alvarius	Colorado River Toad	G5			California (SH), New Mexico (S2)
Anura	Bufo americanus	American Toad	G5			Louisiana (S3S4), Nebraska (S1), South Dakota (SU), Texas (S3)
Anura	Bufo baxteri	Wyoming Toad	G1	N1		Wyoming (S1)
Anura	Bufo boreas	Western Toad	G4			Alaska (S2?), Colorado (S1), Montana (S2), New Mexico (SH), Oregon (S3), Utah (S2S3), Washington (S3S4), Wyoming (S1)
Anura	Bufo californicus	Arroyo Toad	G2G3	N2N3		California (S2S3)
Anura	Bufo canorus	Yosemite Toad	G2	N2		California (S2)
Anura	Bufo cognatus	Great Plains Toad	G5	N5	N3	Missouri (SU), Montana (S2), Navajo Nation (S3), Nevada (S2), Utah (SH), Wyoming (S3)Alberta (S2), Manitoba (S2S3), Saskatchewan (S3)
Anura	Bufo debilis	Green Toad	G5			Arizona (S3), Colorado (S2), Kansas (S2), Oklahoma (S3)
Anura	Bufo exsul	Black Toad	G1Q	N1		California (S1)
Anura	Bufo fowleri	Fowler's Toad	G5	N5	N2	Iowa (S3), New Hampshire (S3), Pennsylvania (S3S4), Rhode Island (S3), Vermont (S1)Ontario (S2)
Anura	Bufo hemiophrys	Canadian Toad	G4			South Dakota (SU), Wyoming (S1)
Anura	Bufo houstonensis	Houston Toad	G1	N1		Texas (S1)
Anura	Bufo marinus	Giant Toad	G5	N2		Texas (S2)
Anura	Bufo microscaphus	Arizona Toad	G4	N3N4		Arizona (S3S4), California (S1?), Nevada (S2), New Mexico (S2?), Utah (S2)
Anura	Bufo nebulifer	Coastal Plain Toad	G5			Arkansas (S1), Mississippi (S3)
Anura	Bufo nelsoni	Amargosa Toad	G1G2	N1N2		Nevada (S2)
Anura	Bufo punctatus	Red-spotted Toad	G5			Kansas (S2), Oklahoma (S3)
Anura	Bufo quercicus	Oak Toad	G5			Louisiana (S3S4), North Carolina (S3), Virginia (S1S2)
Anura	Bufo retiformis	Sonoran Green Toad	G4	N3		Arizona (S3)
Anura	Bufo speciosus	Texas Toad	G5			New Mexico (S3), Oklahoma (S3S4)
Anura	Bufo terrestris	Southern Toad	G5			
Anura	Bufo woodhousii	Woodhouse's Toad	G5			Idaho (S3?), Iowa (S3), Oregon (S2), Washington (S3)
Anura	Eleutherodactylus augusti	Barking Frog	G5			Arizona (S1), New Mexico (S2?)
Anura	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	G4	N3		Texas (S3)
Anura	Eleutherodactylus guttilatus	Spotted Chirping Frog	G4	N3		Texas (S3)
Anura	Eleutherodactylus marnockii	Cliff Chirping Frog	G5			

*Conservation Status included for "at risk" species only

Appendix 3: Table of amphibian species, and their conservation status, included in assessment (continued)

Order	Scientific Name	Common Name	Global Status*	US Status*	Canada Status*	State Status*
Anura	Eleutherodactylus martinicensis		G4			
Anura	Eleutherodactylus planirostris	Greenhouse Frog	G5			
Anura	Gastrophryne carolinensis	Eastern Narrowmouth Toad	G5			Illinois (S2), Kansas (S1), Maryland (S1S2)
Anura	Gastrophryne olivacea	Great Plains Narrowmouth Toad	G5			Arizona (S3), Arkansas (S2), Colorado (S1), Nebraska (S2), New Mexico (S1)
Anura	Hyla andersonii	Pine Barrens Treefrog	G4			Alabama (S2), Florida (S3), New Jersey (S3), North Carolina (S3), South Carolina (S2S3)
Anura	Hyla arenicolor	Canyon Treefrog	G5			Colorado (S2), Utah (S3)
Anura	Hyla avivoca	Bird-voiced Treefrog	G5			Arkansas (S3), Illinois (S3), Kentucky (S3), Oklahoma (S2)
Anura	Hyla chrysoscelis	Cope's Gray Treefrog	G5			Delaware (S2), New Jersey (S2), South Dakota (S2)
Anura	Hyla cinerea	Green Treefrog	G5			Delaware (S3), District of Columbia (SH), Illinois (S3), Kentucky (S3), Missouri (S3S4), Oklahoma (S3)
Anura	Hyla femoralis	Pine Woods Treefrog	G5			
Anura	Hyla gratiosa	Barking Treefrog	G5			Delaware (S1), Kentucky (S3), Louisiana (S3S4), Maryland (S1), North Carolina (S3S4), Tennessee (S3), Virginia (S1)
Anura	Hyla squirella	Squirrel Treefrog	G5			
Anura	Hyla versicolor	Gray Treefrog	G5			Kentucky (S2S3), North Carolina (S1?), South Dakota (S2)New Brunswick (S3)
Anura	Hyla wrightorum	Mountain Treefrog	G4			New Mexico (S3)
Anura	Hypopachus variolosus	Sheep Frog	G5	N2		Texas (S2)
Anura	Leptodactylus fragilis	Mexican White-lipped Frog	G5	N1		Texas (S1)
Anura	Osteopilus septentrionalis	Cuban Treefrog	G5			
Anura	Pseudacris brachyphona	Mountain Chorus Frog	G5			Georgia (S2), Maryland (S2), Mississippi (S3), North Carolina (S1), Pennsylvania (S2)
Anura	Pseudacris brimleyi	Brimley's Chorus Frog	G5			Georgia (S1), North Carolina (S3S4)
Anura	Pseudacris cadaverina	California Treefrog	G4	N3N4		
Anura	Pseudacris clarkii	Spotted Chorus Frog	G5			
Anura	Pseudacris crucifer	Spring Peeper	G5			Kansas (S2)Labrador (S1S2)
Anura	Pseudacris feriarum	Southeastern Chorus Frog	G5			District of Columbia (S3), West Virginia (S2)
Anura	Pseudacris maculata	Boreal Chorus Frog	G5			Michigan (S1), Wisconsin (S3S4)Quebec (S2)
Anura	Pseudacris nigrita	Southern Chorus Frog	G5			Virginia (S2?)
Anura	Pseudacris ocularis	Little Grass Frog	G5			Alabama (S1), Virginia (S3)
Anura	Pseudacris ornata	Ornate Chorus Frog	G5			Louisiana (S1), Mississippi (S2S3), North Carolina (S3)
Anura	Pseudacris regilla	Pacific Chorus Frog	G5			Arizona (S2), Utah (SH)
Anura	Pseudacris streckeri	Strecker's Chorus Frog	G5			Kansas (S2), Louisiana (S1)
Anura	Pseudacris triseriata	Western Chorus Frog	G5			Arkansas (S3), Indiana (S3), Oklahoma (S3), Pennsylvania (S2), Vermont (S1)Quebec (S2)
Anura	Pternohyla fodiens (Smilisca fodiens)	Lowland Burrowing Treefrog	G4	N1N2		Arizona (S1S2)
Anura	Rana areolata	Crawfish Frog	G4			Iowa (S1), Kansas (S3), Kentucky (S3), Louisiana (S3?), Mississippi (S3), Texas (S3)
Anura	Rana aurora	Red-legged Frog	G4	N4	N3N4	California (S2S3), Oregon (S3S4)British Columbia (S3S4)
Anura	Rana berlandieri	Rio Grande Leopard Frog	G5			New Mexico (S3)

Anura	Rana blairi	Plains Leopard Frog	G5			Arizona (S1), Arkansas (S1), Colorado (S3), Indiana (S2), South Dakota (S3S4)
Anura	Rana boylii	Foothill Yellow-legged Frog	G3	N3		California (S2S3), Oregon (S2S3)
Anura	Rana capito	Carolina Gopher Frog	G3	N3		Alabama (S2), Florida (S3), Georgia (S3), North Carolina (S2), South Carolina (S1), Tennessee (S1)
Anura	Rana cascadae	Cascades Frog	G4	N3N4		California (S3), Oregon (S3)
Anura	Rana catesbeiana	Bullfrog	G5			Wisconsin (S3)
Anura	Rana chiricahuensis	Chiricahua Leopard Frog	G3	N3		Arizona (S3), New Mexico (S1)
Anura	Rana clamitans	Green Frog	G5			Kansas (S1)Manitoba (S2)
Anura	Rana fisheri	Vegas Valley Leopard Frog	GX	NX		Nevada (SX)
Anura	Rana grylio	Pig Frog	G5			Texas (S2)
Anura	Rana heckscheri	River Frog	G5			Alabama (S1), Mississippi (S1), North Carolina (SH)
Anura	Rana luteiventris	Columbia Spotted Frog	G4			Alaska (S2?), Idaho (S3S4), Nevada (S2S3), Oregon (S2S3), Utah (S1), Wyoming (S3)Alberta (S3)
Anura	Rana muscosa	Mountain Yellow-legged Frog	G2	N2		California (S2), Nevada (SH)
Anura	Rana okaloosae	Florida Bog Frog	G2	N2		Florida (S2)
Anura	Rana onca	Relict Leopard Frog	G1	N1		Arizona (SU), Nevada (S1), Utah (SX)
Anura	Rana palustris	Pickerel Frog	G5			Illinois (S3S4), Kansas (SH), Oklahoma (S2S3), Wisconsin (S3S4)Quebec (S3S4)
Anura	Rana pipiens	Northern Leopard Frog	G5			Arizona (S2), California (S2), Colorado (S3), Connecticut (S2), Idaho (S3), Indiana (S2), Kentucky (S3), Maine (S3), Missouri (S2), Montana (S3), Navajo Nation (S2), Nevada (S2S3), New Hampshire (S3), New Mexico (S1), Oregon (S1S2), Pennsylvania (S3), RhoAlberta (S2S3), British Columbia (S1), Labrador (S2S3), Saskatchewan (S3)
Anura	Rana pretiosa	Oregon Spotted Frog	G2	N2	N1	California (S1), Oregon (S2), Washington (S1)British Columbia (S1)
Anura	Rana septentrionalis	Mink Frog	G5			Michigan (S3S4), New Hampshire (S3S4), Wisconsin (S3S4)Manitoba (S3)
Anura	Rana sevosa	Dusky Gopher Frog	G1	N1		Alabama (SH), Louisiana (SH), Mississippi (S1)
Anura	Rana sphenocephala	Southern Leopard Frog	G5			District of Columbia (S2S3), New York (S1S2), Pennsylvania (S1)
Anura	Rana subaquavocalis	Ramsey Canyon Leopard Frog	G1Q	N1		Arizona (S1)
Anura	Rana sylvatica	Wood Frog	G5			Alabama (S2), Alaska (S3S4), Arkansas (S3), Colorado (S3), District of Columbia (S2?), Idaho (SH), Illinois (S3), Missouri (S3), South Carolina (S3), South Dakota (S1), Wyoming (S1)
Anura	Rana tarahumarae	Tarahumara Frog	G3	NX		Arizona (SX,S1)
Anura	Rana virgatipes	Carpenter Frog	G5			Delaware (S1), Florida (S2), Georgia (S3), Maryland (S2), Virginia (S3)
Anura	Rana yavapaiensis	Yavapai Leopard Frog	G4			California (SX), New Mexico (S1)
Anura	Rhinophrynus dorsalis	Mexican Burrowing Toad	G5	N2		Texas (S2)
Anura	Scaphiopus couchii	Couch's Spadefoot	G5			California (S2S3), Colorado (S1)
Anura	Scaphiopus holbrookii	Eastern Spadefoot	G5			Arkansas (S2), Connecticut (S1), District of Columbia (SH), Illinois (S3), Indiana (S2), Massachusetts (S2), Missouri (S2), New York (S2S3), Ohio (S1), Pennsylvania (S1), Rhode Island (S1), West Virginia (S1)
Anura	Scaphiopus hurterii	Hurter's Spadefoot	G5			Arkansas (S2), Oklahoma (S2S3)
Anura	Smilisca baudinii	Mexican Treefrog	G5	N3		Texas (S3)

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Appendix 3: Table of amphibian species, and their conservation status, included in assessment (continued)

Order	Scientific Name	Common Name	Global Status*	US Status*	Canada Status*	State Status*
Anura	Spea bombifrons	Plains Spadefoot	G5		N3N4	Arizona (S3), Arkansas (S1), Montana (S3), Utah (S1?)Alberta (S3), Manitoba (S3S4), Saskatchewan (S3)
Anura	Spea hammondii	Western Spadefoot	G3	N3		California (S3)
Anura	Spea intermontana	Great Basin Spadefoot	G5		N3	Arizona (S2), Colorado (S3), Wyoming (S3)British Columbia (S3)
Anura	Spea multiplicata	New Mexico Spadefoot	G5			Oklahoma (S3?), Utah (S2?)
Caudata	Ambystoma annulatum	Ringed Salamander	G4			Arkansas (S3), Missouri (S3), Oklahoma (S2S3)
Caudata	Ambystoma barbouri	Streamside Salamander	G4			Indiana (S3), Tennessee (S2), West Virginia (S1)
Caudata	Ambystoma bishopi (included in cingulatum)	Reticulated Flatwoods Salamander	G2	N2		
Caudata	Ambystoma californiense	California Tiger Salamander	G2G3	N2N3		California (S2S3)
Caudata	Ambystoma cingulatum	Flatwoods Salamander	G2	N2N3		Alabama (S1), Florida (S2S3), Georgia (S2), South Carolina (S1)
Caudata	Ambystoma gracile	Northwestern Salamander	G5			Alaska (S2?)
Caudata	Ambystoma jeffersonianum	Jefferson Salamander	G4		N2	Connecticut (S3), Illinois (S2), Maryland (S3), Massachusetts (S3), New Hampshire (S2S3), New Jersey (S3), Vermont (S2), West Virginia (S3)Ontario (S2)
Caudata	Ambystoma laterale	Blue-spotted Salamander	G5			Connecticut (S1), Illinois (S3), Indiana (S2), Iowa (S1), Massachusetts (S3), New Jersey (S1), Ohio (S1), Vermont (S3)Manitoba (S3S4)
Caudata	Ambystoma mabeei	Mabee's Salamander	G4			North Carolina (S3), Virginia (S1S2)
Caudata	Ambystoma macrodactylum	Long-toed Salamander	G5			Alaska (S2?), California (S3)Alberta (S3)
Caudata	Ambystoma maculatum	Spotted Salamander	G5			Delaware (S2), New Jersey (S3), Oklahoma (S3)
Caudata	Ambystoma opacum	Marbled Salamander	G5			Delaware (S3), District of Columbia (S3), Massachusetts (S2), Michigan (S1), New Hampshire (S1), New Jersey (S3), New York (S3), Pennsylvania (S3S4), Rhode Island (S2)
Caudata	Ambystoma talpoideum	Mole Salamander	G5			Arkansas (S3), Illinois (S3), Kentucky (S3), Missouri (S2), North Carolina (S2), Oklahoma (S1), Texas (S3), Virginia (S2)
Caudata	Ambystoma texanum	Smallmouth Salamander	G5		N1	Alabama (S3), Iowa (S3), Michigan (S1), Nebraska (S1), West Virginia (S1)Ontario (S1)
Caudata	Ambystoma tigrinum	Tiger Salamander	G5			Alabama (S3), Arkansas (S3), Delaware (S1), Florida (S3), Georgia (S3S4), Louisiana (S1), Maryland (S2), Michigan (S3S4), Mississippi (S1), New York (S1S2), North Carolina (S2), Ohio (S3), Oregon (S2?), Pennsylvania (SX), Virginia (S1), Washington (S3)British Columbia (S2), Ontario (SX)
Caudata	Amphiuma means	Two-toed Amphiuma	G5			Alabama (S3), Louisiana (S3S4)
Caudata	Amphiuma pholeter	One-toed Amphiuma	G3	N3		Alabama (S1), Florida (S3), Georgia (S1), Mississippi (S1)
Caudata	Amphiuma tridactylum	Three-toed Amphiuma	G5			Alabama (S3), Indiana (S1), Kentucky (S1), Missouri (S2), Oklahoma (S1)
Caudata	Aneides aeneus	Green Salamander	G3G4	N3N4		Alabama (S3), Georgia (S2), Indiana (S1), Maryland (S2), Mississippi (S1), North Carolina (S2), Ohio (S2), Pennsylvania (S1), South Carolina (S1), Tennessee (S3S4), Virginia (S3), West Virginia (S3)
Caudata	Aneides ferreus	Clouded Salamander	G3	N3		California (S2), Oregon (S3)
Caudata	Aneides flavipunctatus	Black Salamander	G4			Oregon (S2)
Caudata	Aneides hardii	Sacramento Mountain Salamander	G3	N3		New Mexico (S3)

Caudata	Aneides lugubris	Arboreal Salamander	G5			
Caudata	Aneides vagrans	Wandering Salamander	G4			
Caudata	Batrachoseps attenuatus	California Slender Salamander	G5			Oregon (S2)
Caudata	Batrachoseps campi	Inyo Mountains Salamander	G2	N2		California (S2)
Caudata	Batrachoseps diabolicus	Hell Hollow Slender Salamander	G2	N2		California (S2)
Caudata	Batrachoseps gabrieli	San Gabriel Slender Salamander	G2	N2		California (S2)
Caudata	Batrachoseps gavilanensis	Gabilan Mountains Slender Salamander	G4			
Caudata	Batrachoseps gregarius	Gregarious Slender Salamander	G3	N2		California (S2?)
Caudata	Batrachoseps incognitus	San Simeon Slender Salamander	G2G3	N2N3		California (S2?)
Caudata	Batrachoseps kawia	Sequoia Slender Salamander	G1G2	N1N2		California (S1S2)
Caudata	Batrachoseps luciae	Santa Lucia Mountains Slender Salamander	G3G4	N3N4		California (S2S3)
Caudata	Batrachoseps major (supsp aridus listed as CA S1)	Garden Slender Salamander	G4			California (S1)
Caudata	Batrachoseps minor	Lesser Slender Salamander	G2	N2		California (S1S2)
Caudata	Batrachoseps nigriventris	Blackbelly Slender Salamander	G4			
Caudata	Batrachoseps pacificus	Channel Islands Slender Salamander	G4			California (S2)
Caudata	Batrachoseps regius	Kings River Slender Salamander	G1	N1		California (S1)
Caudata	Batrachoseps relictus	Relictual Slender Salamander	G2	N2		California (S2)
Caudata	Batrachoseps robustus	Kern Plateau Salamander	G2	N2		California (S2)
Caudata	Batrachoseps simatus	Kern Canyon Slender Salamander	G2	N2		California (S2)
Caudata	Batrachoseps stebbinsi	Tehachapi Slender Salamander	G2	N2		California (S2)
Caudata	Batrachoseps wrightorum	Oregon Slender Salamander	G2G3	N2N3		Oregon (S2S3)
Caudata	Cryptobranchus alleganiensis	Hellbender	G3G4	N3N4		Alabama (S2), Arkansas (S2), Georgia (S2), Illinois (S1), Kentucky (S3), Maryland (S1), Mississippi (S1), New York (S2), North Carolina (S3), Ohio (S1), Pennsylvania (S3S4), Tennessee (S3), Virginia (S2S3), West Virginia (S2)
Caudata	Desmognathus abditus	Cumberland Dusky Salamander	G2G3	N2N3		Tennessee (S2S3)
Caudata	Desmognathus aeneus	Seepage Salamander	G3G4	N3N4		Alabama (S2), Georgia (S3), North Carolina (S3), Tennessee (S1)
Caudata	Desmognathus apalachicolae	Apalachicola Dusky Salamander	G3G4	N3N4		Alabama (S3), Florida (S3), Georgia (S3)
Caudata	Desmognathus auriculatus	Southern Dusky Salamander	G5			Alabama (S2), Florida (S3), Georgia (S2)
Caudata	Desmognathus brimleyorum	Ouachita Dusky Salamander	G4			Oklahoma (S3)
Caudata	Desmognathus carolinensis	Carolina Mountain Dusky Salamander	G4			North Carolina (S3S4), Tennessee (S2S3)
Caudata	Desmognathus folkertsi	Dwarf Black-bellied Salamander	G1G2	N1N2		Georgia (S2)
Caudata	Desmognathus fuscus	Dusky Salamander	G5		N3N4	Arkansas (S2)New Brunswick (S3), Ontario (S1), Quebec (S3)
Caudata	Desmognathus imitator	Imitator Salamander	G3G4	N3N4		North Carolina (S3), Tennessee (S3)
Caudata	Desmognathus marmoratus	Shovelnose Salamander	G4			Georgia (S3), South Carolina (S2), Virginia (S2)

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Appendix 3: Table of amphibian species, and their conservation status, included in assessment (continued)

Order	Scientific Name	Common Name	Global Status*	US Status*	Canada Status*	State Status*
Caudata	Desmognathus monticola	Seal Salamander	G5			Florida (S1)
Caudata	Desmognathus ochrophaeus	Allegheny Mountain Dusky Salamander	G5		N2	New Jersey (SH)Quebec (S1)
Caudata	Desmognathus ocoee	Ocoee Salamander	G5			Alabama (S2), North Carolina (S3S4), Tennessee (S2)
Caudata	Desmognathus orestes	Blue Ridge Dusky Salamander	G4			North Carolina (S3S4), Tennessee (S3?), Virginia (S3)
Caudata	Desmognathus quadramaculatus	Common Black-bellied Salamander	G5			West Virginia (S3)
Caudata	Desmognathus santeetlah	Santeetlah Dusky Salamander	G3G4Q	N3N4		North Carolina (S2S3), Tennessee (S3)
Caudata	Desmognathus welteri	Black Mountain Salamander	G4			Tennessee (S3), Virginia (S3), West Virginia (S2)
Caudata	Desmognathus wrighti	Pygmy Salamander	G3G4	N3N4		North Carolina (S3), Tennessee (S2), Virginia (S2)
Caudata	Dicamptodon aterrimus	Idaho Giant Salamander	G3	N3		Idaho (S3?)
Caudata	Dicamptodon copei	Cope's Giant Salamander	G3G4	N3N4		Oregon (S2), Washington (S3S4)
Caudata	Dicamptodon ensatus	California Giant Salamander	G3	N3		
Caudata	Dicamptodon tenebrosus	Pacific Giant Salamander	G5		N2	British Columbia (S2)
Caudata	Ensatina eschscholtzii	Ensatina	G5			
Caudata	Eurycea aquatica (E. bislineata)	Brown-backed Salamander	G3			
Caudata	Eurycea bislineata	Northern Two-lined Salamander	G5			
Caudata	Eurycea chamberlaini (included in E. quadrigidata)	Chamberlain's Dwarf Salamander	G5			Georgia (S1), North Carolina (S3S4)
Caudata	Eurycea chisholmensis	Salado Salamander	G1	N1		Texas (S1)
Caudata	Eurycea cirrigera	Southern Two-lined Salamander	G5			
Caudata	Eurycea guttolineata	Three-lined Salamander	G5			Kentucky (S2)
Caudata	Eurycea junaluska	Junaluska Salamander	G3	N3		North Carolina (S2), Tennessee (S2)
Caudata	Eurycea latitans	Cascade Caverns Salamander	G3	N3		Texas (S3)
Caudata	Eurycea longicauda	Longtail Salamander	G5			Delaware (S1), Kansas (S2), New York (S2S3), North Carolina (S1S2), Oklahoma (S2S3)
Caudata	Eurycea lucifuga	Cave Salamander	G5			Kansas (S1), Mississippi (S1), Ohio (S2), Oklahoma (S2S3), West Virginia (S3)
Caudata	Eurycea multiplicata	Many-ribbed Salamander	G4			Kansas (SH)
Caudata	Eurycea nana	San Marcos Salamander	G1	N1		Texas (S1)
Caudata	Eurycea naufragia	Georgetown Salamander	G1	N1		Texas (S1)
Caudata	Eurycea neotenes	Texas Salamander	G1	N1		Texas (S1)
Caudata	Eurycea pterophila	Blanco River Springs Salamander	G2	N2		Texas (S2)
Caudata	Eurycea quadridigitata	Dwarf Salamander	G5			Arkansas (S3), North Carolina (S2)
Caudata	Eurycea rathbuni	Texas Blind Salamander	G1	N1		Texas (S1)
Caudata	Eurycea robusta	Blanco Blind Salamander	G1Q	N1		Texas (S1)
Caudata	Eurycea sosorum	Barton Springs Salamander	G1	N1		Texas (S1)
Caudata	Eurycea spelaea (Typhlotriton spelaeus)	Grotto Salamander	G4			Arkansas (S3), Kansas (S1), Missouri (S2S3), Oklahoma (S3)

Caudata	Eurycea tonkawae	Jollyville Plateau Salamander	G1	N1		Texas (S1)
Caudata	Eurycea tridentifera	Comal Blind Salamander	G1	N1		Texas (S1)
Caudata	Eurycea troglodytes	Eurycea troglodytes Complex	G3	N3		Texas (S3)
Caudata	Eurycea tynerensis	Oklahoma Salamander	G3	N3		Arkansas (S3), Oklahoma (S3)
Caudata	Eurycea waterlooensis	Austin Blind Salamander	G1	N1		Texas (S1)
Caudata	Eurycea wilderae	Blue Ridge Two-lined Salamander	G5			Virginia (S2)
Caudata	Gyrinophilus gulolineatus	Berry Cave Salamander	G1Q	N1		Tennessee (S1)
Caudata	Gyrinophilus palleucus	Tennessee Cave Salamander	G2G3	N2N3		Alabama (S2), Georgia (S1), Tennessee (S2)
Caudata	Gyrinophilus porphyriticus	Spring Salamander	G5		N2	Connecticut (S2), Maine (S3), Massachusetts (S3), Mississippi (S1), Rhode Island (S1)Ontario (SX), Quebec (S3)
Caudata	Gyrinophilus subterraneus	West Virginia Spring Salamander	G1	N1		West Virginia (S1)
Caudata	Haideotriton wallacei	Georgia Blind Salamander	G2	N2		Florida (S2), Georgia (S1)
Caudata	Hemidactylium scutatum	Four-toed Salamander	G5			Alabama (S3), Arkansas (S3), Delaware (S1), District of Columbia (SH), Florida (S2), Georgia (S3), Illinois (S2), Indiana (S2), Louisiana (S1), Maine (S3), Massachusetts (S3), Minnesota (S3), Mississippi (S1S2), New Hampshire (S3S4), New Jersey (S3), NortNew Brunswick (S1?), Nova Scotia (S3), Quebec (S2)
Caudata	Hydromantes brunus	Limestone Salamander	G1	N1		California (S1)
Caudata	Hydromantes platycephalus	Mount Lyell Salamander	G3	N3		California (S3)
Caudata	Hydromantes shastae	Shasta Salamander	G1G2	N1N2		California (S1S2)
Caudata	Necturus alabamensis	Black Warrior Waterdog	G2	N2		Alabama (S2)
Caudata	Necturus beyeri	Gulf Coast Waterdog	G4			Alabama (SU), Georgia (S3), Texas (S3)
Caudata	Necturus lewisi	Neuse River Waterdog	G3	N3		North Carolina (S3)
Caudata	Necturus maculosus	Mudpuppy	G5 NAR			Georgia (S1), Indiana (S2), Iowa (S2), Maryland (S1), North Carolina (S1), Oklahoma (S3), South Dakota (SH), Vermont (S2), Virginia (S2), Wisconsin (S3S4)
Caudata	Necturus punctatus	Dwarf Waterdog	G4			Georgia (S2), Virginia (S2S3)
Caudata	Notophthalmus meridionalis	Black-spotted Newt	G1	N1		Texas (S1)
Caudata	Notophthalmus perstriatus	Striped Newt	G2G3	N2N3		Florida (S2S3), Georgia (S2)
Caudata	Notophthalmus viridescens	Eastern Newt	G5			Florida (S2S3), Georgia (S2)
Caudata	Phaeognathus hubrichti	Red Hills Salamander	G2	N2		Alabama (S2)
Caudata	Plethodon ainsworthi	Catahoula Salamander	GH	NH		Mississippi (SH)
Caudata	Plethodon amplus	Blue Ridge Gray-cheeked Salamander	G1G2	N1N2		North Carolina (S1S2)
Caudata	Plethodon angusticlavius	Ozark Zigzag Salamander	G4			Arkansas (S3), Missouri (S3S4), Oklahoma (S2)
Caudata	Plethodon asupak	Scott Bar Salamander	G1	N1		California (S1)
Caudata	Plethodon aureolus	Tellico Salamander	G2G3	N2N3		North Carolina (S2), Tennessee (S2S3)
Caudata	Plethodon caddoensis	Caddo Mountain Salamander	G2	N2		Arkansas (S3)
Caudata	Plethodon cheoah	Cheoah Bald Salamander	G2	N2		North Carolina (S2?)
Caudata	Plethodon cinereus	Redback Salamander	G5			Kentucky (S3)

*Conservation Status included for “at risk” species only

Appendix 3: Table of amphibian species, and their conservation status, included in assessment (continued)

Order	Scientific Name	Common Name	Global Status*	US Status*	Canada Status*	State Status*
Caudata	Plethodon dorsalis	Northern Zigzag Salamander	G5			
Caudata	Plethodon dunni	Dunn's Salamander	G4			California (S3), Washington (S2S3)
Caudata	Plethodon electromorphus	Northern Ravine Salamander	G5			Indiana (S2), Pennsylvania (S3)
Caudata	Plethodon elongatus	Del Norte Salamander	G4			California (S3), Oregon (S3)
Caudata	Plethodon fourchensis	Fourche Mountain Salamander	G2Q	N2		Arkansas (S2)
Caudata	Plethodon glutinosus	Slimy Salamander	G5			Connecticut (S2), New Hampshire (SH)
Caudata	Plethodon hoffmani	Valley and Ridge Salamander	G5			
Caudata	Plethodon hubrichti	Peaks of Otter Salamander	G2	N2		Virginia (S2)
Caudata	Plethodon idahoensis	Coeur d'Alene Salamander	G4	N3	N3	Idaho (S3), Montana (S2)British Columbia (S3)
Caudata	Plethodon jordani	Red-cheeked Salamander	G3	N3		North Carolina (S3?), Tennessee (S2), Virginia (S3)
Caudata	Plethodon kentucki	Cumberland Plateau Salamander	G4			Tennessee (S2), Virginia (S3), West Virginia (S3)
Caudata	Plethodon larselli	Larch Mountain Salamander	G3	N3		Oregon (S2), Washington (S3)
Caudata	Plethodon meridianus	South Mountain Gray-cheeked Salamander	G1G2	N1N2		North Carolina (S1S2)
Caudata	Plethodon metcalfi	Southern Gray-cheeked Salamander	G3	N3		Georgia (S2), North Carolina (S3?)
Caudata	Plethodon montanus	Northern Gray-cheeked Salamander	G3	N3		North Carolina (S3?), Tennessee (S3)
Caudata	Plethodon neomexicanus	Jemez Mountains Salamander	G2	N2		New Mexico (S2)
Caudata	Plethodon nettingi	Cheat Mountain Salamander	G2G3	N2N3		West Virginia (S2)
Caudata	Plethodon ouachitae	Rich Mountain Salamander	G2G3	N2N3		Arkansas (S2), Oklahoma (S2)
Caudata	Plethodon petraeus	Pigeon Mountain Salamander	G1	N1		Georgia (S1)
Caudata	Plethodon punctatus	White-spotted Salamander	G3	N3		Virginia (S2), West Virginia (S1)
Caudata	Plethodon richmondi	Ravine Salamander	G5			North Carolina (S3), Tennessee (S2)
Caudata	Plethodon serratus	Southern Redback Salamander	G5			Alabama (S2S3), Arkansas (S3), Louisiana (S1), Oklahoma (S3S4), Texas (S1)
Caudata	Plethodon shenandoah	Shenandoah Salamander	G1	N1		Virginia (S1)
Caudata	Plethodon sherando (P. cinereus)	Big Levels Salamander	G2	N2		Virginia (S2)
Caudata	Plethodon shermani	Red-legged Salamander	G2	N2		Georgia (S1), North Carolina (S2?), Tennessee (S2)
Caudata	Plethodon stormi	Siskiyou Mountains Salamander	G2G3	N2N3		California (S1S2), Oregon (S2)
Caudata	Plethodon teyahalee	Southern Appalachian Salamander	G3	N3		Georgia (S2), North Carolina (S3?), Tennessee (S3?)
Caudata	Plethodon vandykei	Van Dyke's Salamander	G3	N3		Washington (S3)
Caudata	Plethodon vehiculum	Western Redback Salamander	G5	N2N3		
Caudata	Plethodon ventralis	Southern Zigzag Salamander	G4			Mississippi (S2), North Carolina (S1), Virginia (S1)
Caudata	Plethodon virginia	Shenandoah Mountain Salamander	G2G3Q			Virginia (S2), West Virginia (S2)
Caudata	Plethodon websteri	Webster's Salamander	G3	N3		Alabama (S3), Georgia (S2), Louisiana (S1), Mississippi (S3), South Carolina (S2)
Caudata	Plethodon wehrlei	Wehrle's Salamander	G4			Kentucky (S1), Maryland (S2), New York (S3), North Carolina (S1), Ohio (SH), Tennessee (S1)
Caudata	Plethodon welleri	Weller's Salamander	G3	N3		North Carolina (S2), Tennessee (S1), Virginia (S2)
Caudata	Plethodon yonahlossee	Yonahlossee Salamander	G4			Tennessee (S3), Virginia (S3)

Caudata	Pseudobranchus axanthus	Southern Dwarf Siren	G4	N3	
Caudata	Pseudobranchus striatus	Northern Dwarf Siren	G5		South Carolina (S2)
Caudata	Pseudotriton montanus	Mud Salamander	G5		Delaware (S1), District of Columbia (S3), Louisiana (S1), Maryland (S2?), Mississippi (S2S3), Ohio (S2), Pennsylvania (S1), West Virginia (S1)
Caudata	Pseudotriton ruber	Red Salamander	G5		Delaware (S3), District of Columbia (S3), Louisiana (S2), Mississippi (S3), New York (S3S4), West Virginia (S3)
Caudata	Rhyacotriton cascadae	Cascade Torrent Salamander	G3	N3	Oregon (S3), Washington (S3)
Caudata	Rhyacotriton kezeri	Columbia Torrent Salamander	G3	N3	Oregon (S3), Washington (S3)
Caudata	Rhyacotriton olympicus	Olympic Torrent Salamander	G3	N3	Washington (S3)
Caudata	Rhyacotriton variegatus	Southern Torrent Salamander	G4	N3N4	California (S2S3), Oregon (S3)
Caudata	Siren intermedia	Lesser Siren	G5		Kentucky (S3S4), Michigan (SH), North Carolina (S3S4), Oklahoma (S2S3), Virginia (S2)
Caudata	Siren lacertina	Greater Siren	G5		Alabama (S3), District of Columbia (SH), North Carolina (S3?), Texas (S2?), Virginia (S3)
Caudata	Stereochilus marginatus	Many-lined Salamander	G5		Florida (S1), Georgia (S3), North Carolina (S3?), Virginia (S3)
Caudata	Taricha granulosa	Roughskin Newt	G5		Alaska (S2?)
Caudata	Taricha rivularis	Redbelly Newt	G4		
Caudata	Taricha torosa	California Newt	G5		

*Conservation Status included for “at risk” species only

Appendix 4: Table of amphibians introduced to the U.S. and Canada

Species	Country	Distribution - State or Province
Bufo marinus		
Giant Toad	USA: [1]	FL*, HI*, TX
Dendrobates auratus		
Poison Dart Frog	USA:*	HI*
Osteopilus septentrionalis		
Cuban Treefrog	USA:*	FL* , HI*
Eleutherodactylus coqui		
Coqui Frog	USA:*	FL* , HI* , LA*
*Eleutherodactylus cystignathoides**		
Rio Grande Chirping Frog	USA: [1]	LA*, TX
Eleutherodactylus planirostris		
Greenhouse Frog	USA:*	AL* , FL* , GA* , HI* , LA* , MS*
Xenopus laevis		
African Clawed Frog	USA:*	AZ* , CA*
*Rana catesbeiana**	CAN: [1]	BC, NB, NS, ON, QC
Bullfrog	USA: [1]	AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY
Rana rugosa		
Wrinkled Frog	USA:*	HI*
*Ambystoma tigrinum**	CAN:	AB, BC, MB, ON, SK
Tiger Salamander	USA: [2]	AL, AR, AZ, CO, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MD, MI, MN, MO, MS, MT, NC, ND, NE, NJ, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, WA, WI, WY
Pseudotriton ruber	CAN: *	ON
Red Salamander	USA:	AL, DC, DE, FL, GA, IN, KY, LA, MD, MS, NC, NJ, NY, OH, PA, SC, TN, VA, WV

*Exotic; [1]Native to country but has been introduced outside natural range; [2]Native to country but has been introduced to areas within natural range

Appendix 5: Map of Ecoregions of the U.S. and Canada

Terrestrial Ecoregions of the Continental United States and Canada

Created by World Wildlife Fund - US

Olson, D.M., E. Dinerstein, E.D. Wikramanayake, N.D. Burgess, G.V.N. Powell, E.C. Underwood, J.A. D'Amico, H.E. Strand, J.C. Morrison, C.J. Loucks, T.F. Allnutt, J.F. Lamoreux, T.H. Ricketts, I. Itoua, W.W. Wettengel, Y. Kura, P. Hedao, and K. Kassem. 2001. Terrestrial ecoregions of the world: A new map of life on Earth. BioScience 51(11):933-938.

Legend of Ecoregion Symbols

1. Alaska Peninsula montane taiga
2. Alaska St. Elias Range tundra
3. Alberta Mountain forests
4. Alberta-British Columbia foothills forests
5. Aleutian Islands tundra
6. Allegheny Highlands forests
7. Appalachian mixed mesophytic forests
8. Appalachian-Blue Ridge forests
9. Arctic coastal tundra
10. Arctic foothills tundra
11. Arizona Mountains forests
12. Atlantic coastal pine barrens
13. Baffin coastal tundra
14. Beringia lowland tundra
15. Beringia upland tundra
16. Blue Mountains forests
17. British Columbia mainland coastal forests
18. Brooks-British Range tundra
19. California Central Valley grasslands
20. California coastal sage and chaparral
21. California interior chaparral and woodlands
22. California montane chaparral and woodlands
23. Canadian Aspen forests and parklands
24. Cascade Mountains leeward forests
25. Central and Southern Cascades forests
26. Central and Southern mixed grasslands
27. Central British Columbia Mountain forests
28. Central Canadian Shield forests
29. Central forest-grasslands transition
30. Central Pacific coastal forests
31. Central tall grasslands
32. Central U.S. hardwood forests
33. Chihuahuan desert
34. Colorado Plateau shrublands
35. Colorado Rockies forests
36. Cook Inlet taiga
37. Copper Plateau taiga
38. Davis Highlands tundra
39. East Central Texas forests
40. Eastern Canadian forests
41. Eastern Canadian Shield taiga
42. Eastern Cascades forests
43. Eastern forest-boreal transition
44. Eastern Great Lakes lowland forests
45. Edwards Plateau savanna
46. Everglades
47. Flint Hills tall grasslands
48. Florida sand pine scrub
49. Fraser Plateau and Basin complex
50. Great Basin montane forests
51. Great Basin shrub steppe
52. Gulf of St. Lawrence lowland forests
53. Hawaii tropical dry forests
54. Hawaii tropical high shrublands
55. Hawaii tropical low shrublands
56. Hawaii tropical moist forests
57. High Arctic tundra
58. Interior Alaska-Yukon lowland taiga
59. Interior Yukon-Alaska alpine tundra
60. Klamath-Siskiyou forests
61. Lake
62. Low Arctic tundra
63. Mid-Continental Canadian forests
64. Middle Arctic tundra
65. Middle Atlantic coastal forests
66. Midwestern Canadian Shield forests
67. Mississippi lowland forests
68. Mojave desert
69. Montana Valley and Foothill grasslands
70. Muskwa-Slave Lake forests
71. Nebraska Sand Hills mixed grasslands
72. New England-Acadian forests
73. Newfoundland Highland forests
74. North Central Rockies forests
75. Northeastern coastal forests
76. Northern California coastal forests
77. Northern Canadian Shield taiga
78. Northern Cordillera forests
79. Northern mixed grasslands
80. Northern Pacific coastal forests
81. Northern short grasslands
82. Northern tall grasslands
83. Northern transitional alpine forests
84. Northwest Territories taiga
85. Ogilvie-MacKenzie alpine tundra
86. Okanagan dry forests
87. Ozark Mountain forests
88. Pacific Coastal Mountain icefields and tundra
89. Palouse grasslands
90. Piney Woods forests
91. Puget lowland forests
92. Queen Charlotte Islands
93. Rock and Ice
94. Sierra Juarez and San Pedro Martir pine-oak forests
95. Sierra Madre Occidental pine-oak forests
96. Sierra Madre Oriental pine-oak forests
97. Sierra Nevada forests
98. Snake-Columbia shrub steppe
99. Sonoran desert
100. South Avalon-Burin oceanic barrens
101. South Central Rockies forests
102. South Florida rocklands
103. Southeastern conifer forests
104. Southeastern mixed forests
105. Southern Great Lakes forests
106. Southern Hudson Bay taiga
107. Tamaulipan mezquital
108. Texas blackland prairies
109. Torngat Mountain tundra
110. Upper Midwest forest-savanna transition
111. Wasatch and Uinta montane forests
112. Western Great Lakes forests
113. Western Gulf coastal grasslands
114. Western short grasslands
115. Willamette Valley forests
116. Wyoming Basin shrub steppe
117. Yukon Interior dry forests

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