Estimating the Effect of the Conservation Reserve Program on Endangered, Threatened, and Candidate Wildlife Species

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Provided by NatureServe to the USDA Farm Services Agency.

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1.0 Introduction and Project Description

Under the U.S. Department of Agriculture's Conservation Reserve Program (CRP), environmentally sensitive cropland is retired into conserving uses such as introduced and native grasses, trees, restored wetlands, riparian buffers, and grass filters. These uses provide multiple benefits including the reduction of water runoff, the improvement of lakes, ponds, and streams, and the creation of habitats for a wide set of wildlife species.

The USDA Farm Service Agency (FSA), which administers the CRP, has asked NatureServe to help gauge the effect of CRP on endangered, threatened and candidate (ETC) wildlife species nationwide. NatureServe, a scientifically credible and objective organization with access to wildlife diversity data and expertise that is locally precise and nationally consistent, worked under this project to estimate how land use changes associated with maintaining land in the CRP and enrolling new land into CRP affect ETC wildlife. NatureServe staff accomplished this by integrating FSA common land unit (CLU) data and NatureServe geospatial data; using the integrated dataset to identify land currently enrolled in CRP which supports critical ETC wildlife habitat.

Over the last thirty-five years NatureServe and its network of natural heritage programs have developed and aggregated a national dataset of the most precise locational data available, which includes more than 850,000 documented species population locations.This data is especially focused on vulnerable species, including all federally listed threatened and endangered species. Using this national resource, as well as other relevant species distribution and habitat requirement data, NatureServe conducted GIS analyses to identify ETC species currently or potentially impacted by CRP practices based on the known presence or likely presence of those species on or near cropland fields. The spatial extent of the croplands was informed by the FSA Common Land Unit (CLU) data, the national Croplands Data Layer (CDL), CRP enrollment data, and CRP eligibility policy. The GIS analyses formed the first and final steps in this project: first to create a list of ETC animal species that occur on currently enrolled CRP lands, and last to create a list of ETC animal species that occur on croplands not currently enrolled in CRP, but that could potentially benefit if these lands were enrolled in the program. A national map was produced highlighting counties that contain ETC wildlife that could benefit from CRP enrollment.

As a second step in this project, NatureServe science staff reviewed a full list of the CRP Conservation Practices (CPs) to group together those with similar impacts on wildlife. This grouping enabled the development of a Conservation Effects Matrix, which describes the expected effects of the resulting Conservation Practice groups on ETC wildlife species based on the intersection of the CRP Conservation Practice groups and the wildlife species. Since conservation practices may have different effects on wildlife species in different geographic contexts, this analysis was completed for a series of

ecological divisions of the United States, giving us a national scale approach, but allowing for variation in response in different geographies. For each practice group and species, a positive, negative, or neutral designation was assigned based on the likely impact of the conservation practice group on the wildlife species

2.0 GIS Analyses

2.1 Methods for GIS Analyses

The following metadata supports the two GIS analyses completed for FSA for federal status species and G1-G2 bird species:

1) Lists of species on CRP-enrolled lands by NatureServe Ecodivision, and

2) Density of species on non-CRP croplands by county, and an overall list of those species for the contiguous U.S.

This dataset was prepared and provided by NatureServe for the USDA-Farm Services Agency (FSA) for the purpose of assessing the effect of CRP on endangered, threatened and candidate (ETC) wildlife species. The project will provide a tool and supporting data that FSA can use to enhance CRP impact on ETC wildlife populations. The results can be used to communicate with decision makers and policy makers concerning the CRP benefits and program priorities.

The species distributions on CRP lands by Ecodivision were generated by overlaying the national CRP boundary layer, the national Ecodivision boundary layer, and the precise Element Occurrence (EO) species location data that NatureServe aggregates from its network of natural heritage member programs. Similarly, the species density on non-CRP croplands were generated by overlaying the national county boundary layer, a vectorized version of the national Croplands Data Layer (CDL), and the precise Element Occurrence species location data that NatureServe aggregates from its network of natural heritage member programs.

This analysis was conducted using both global level (range-wide) tracking data developed centrally at NatureServe as well as state level tracking data, including the Element Occurrence dataset, provided by natural heritage programs across the United States. This document contains an overview of NatureServe's Natural Heritage Methodology and details of the data and analysis to aid FSA in proper interpretation and representation of the information provided for this effort.

Background and Definitions

Biodiversity Data Methodology

NatureServe is a non-profit organization dedicated to developing and providing information about the world's plants, animals, and ecological communities. NatureServe works in partnership with 70 independent Natural Heritage programs and Conservation Data Centers that gather scientific information on rare species and ecosystems in the United States, Latin America, and Canada (the NatureServe network). NatureServe is a leading source for biodiversity information that is essential for effective conservation action.

The information NatureServe supplies is valuable is because it has been developed centrally at NatureServe and within the network programs using a common methodology. This document will discuss the main components of the Natural Heritage Methodology that are significant contributions to conservation and directly applicable to this analysis.

Elements of Biological Diversity

The natural heritage member programs function to inventory each state or subnation (e.g. Navajo Nation or Tennessee Valley Authority) for biological features in need of conservation attention. Because these features may include more than just the locations of individual species, the inclusive phrase 'Elements of natural diversity' was put into use with the creation of the first heritage program in 1974. The concept and term 'Element' still remains in use today and will be used in this document.

An Element is defined as a unit of natural biological diversity, representing species (or infraspecies taxa), ecological communities, or other non-taxonomic biological entities, such as migratory species aggregation areas. For the purposes of this analysis, an Element refers to species only.

Data Exchange Cycle and Data Upload

NatureServe is linked to the network programs through a process of regular data exchanges conducted between the NatureServe Central Databases and each of the individual heritage programs in the U.S. and Canada approximately every 12 to 18 months. Each month a series of programs send their data to NatureServe for upload of the past year's updates to status ranking and inventory work. The exchange process includes both taxonomic and status reconciliation. New or updated species location data is uploaded to NatureServe and in return centrally developed scientific information is distributed to the state and provincial programs.

FSA Analyses and Data Description

The GIS analyses completed for FSA are based both on global level (range-wide) tracking data developed centrally at NatureServe as well as state level tracking data provided by natural heritage programs across the United States. The results of these analyses have been provided as a series of tables, charts, and maps showing and comparing distribution of ETC wildlife species on CRP-enrolled lands and non-CRP croplands across the U.S.

Element Occurrence

The Element Occurrence is the mapping unit developed by Natural Heritage Member Programs for documenting the distribution of species populations. Formally defined as "an area of land and/or water in which a species or natural community is, or was, present," an Element Occurrence ideally reflects species population units; either a distinct population, part of a population (subpopulation), or a group of populations (metapopulation).

Data Completeness

The completeness of these data varies between species. The Network is particularly strong and very complete in tracking the terrestrial and freshwater vertebrate species, vascular plants and entities with federal status under the Endangered Species Act (ESA). Some invertebrate groups are well tracked, but there are many that are not, and the same is true for non-vascular plants and fungi. Marine species, even in coastal areas, are not consistently tracked, varying by program. NatureServe has included in the FSA analysis all available species populations that are being tracked by the network that meet the criteria of the project.

NatureServe performs a data exchange with each member program in the U.S. on an approximate 12-18 month cycle, but NatureServe cannot guarantee the currentness or completeness of any data provided. Because data is constantly being revised and new data is constantly being developed, for ongoing analyses NatureServe recommends this dataset be refreshed on an annual basis.

NatureServe's species location database, including the data used in this analysis, is generally considered "complete" for all species with a global rank of G1/T1 – G2/T2 or that have U.S. ESA status. By "complete" this means that all member programs actively track locations of these species within their jurisdictions.

However, regardless of whether a species falls into the category of having "complete" location data, the absence of data for a particular species in a particular area does not

necessarily mean the species does not occur there – it could also mean the area has not yet been inventoried, or a certain program may not yet have developed data for a certain species group (especially invertebrates and non-vascular plants). Any question as to the presence or absence of a particular species in a particular location should be addressed to the appropriate natural heritage member program. A directory of contact information for all network programs in the U.S. and Canada can be found at the following locations on NatureServe's homepage: http://www.natureserve.org/visitLocal/index.jsp and http://connect.natureserve.org/.

Program-Specific Data Gaps

Appendix 6.1 below contains known Element Occurrence data gaps that natural heritage member programs have provided to NatureServe during the regular data exchange cycle. In addition to the overall data completeness issues noted above, these data are also known to be missing in NatureServe's Central Databases and the EO dataset used in this analysis. Fields that are gray mean that there are no gaps in a state's documentation that was provided to NatureServe during our most recent exchange that apply to this dataset; however, it does not necessarily mean that no data gaps exist. If there is any question about the completeness of data in a particular area of a state, the appropriate member program can be contacted directly for further information.

If not mentioned specifically in the table in Appendix 6.1, it is also generally true that location data is missing for many tribal lands, and for most marine species.

2.2 Results for GIS Analyses

GIS Analysis Results – Field Definitions

Definitions for fields provided in the GIS Analysis results tables are described in Appendix 6.2.

GIS Analysis 1 Results – Species on CRP Lands by NatureServe Ecodivision

The Element Occurrence dataset used for this analysis included the following criteria:

- Any animal species with U.S. federal ESA listed, threatened, candidate, or proposed status.
- Occurs in the U.S. in the contiguous 48 states.
- EOs known to have been incorrectly identified were excluded.
- The EO polygon shapes intersect with the CRP land vector boundaries provided by FSA that were buffered to 1 km and defined as currently enrolled (see below).

The processing steps performed to complete this analysis were as follows. (All input GIS layers were re-projected to North America Albers Equal Area Conic as necessary.)

- The CRP boundary polygons were buffered to 1 km and output as a new layer.
- The buffered CRP boundary polygons were labeled as either "Currently Enrolled" (i.e. having an expiration date of July 1, 2012 or later) or "Expired" (i.e. having an expiration date earlier than July 1, 2012).
- The buffered CRP polygons were dissolved into single part polygons based on their current or expired status so that overlapping portions of buffered parcels of the same type would be merged together.
- The subsets of current and expired buffered parcels were saved as new separate GIS layers, and only the current parcels were used in the remaining steps of this analysis (the expired parcels were included in the non-CRP croplands analysis described in GIS Analysis 2 below).
- To reduce the size of the dataset, current buffered CRP parcels from the step above were overlain with the EO layer, and the subset of CRP parcels that intersected with EO records were saved as a new layer.
- The buffered and dissolved current CRP polygons containing EO data were unioned with a GIS layer of NatureServe's Ecodivisions in the U.S. In the output layer, portions of Ecodivisions that are outside of the CRP boundaries were deleted. For any CRP boundaries that were outside of the Ecodivision boundaries, these were reviewed, and an Ecodivision value was manually assigned based on the closest Ecodivision to the record. (Note – these tended to be nearshore areas where coastlines between the Ecodivisions and CRP boundaries had slight differences). The resultant layer of this step consisted of buffered and dissolved currently enrolled CRP boundaries (i.e. footprints), that contain EO data,merged and subdivided by the NatureServe Ecodivisions within which they occur.
- A spatial join was performed between the CRP layer from the step above with the layer of EOs meeting the project criteria. The output resulted in a layer with an attribute table containing a separate row for each species EO that intersected with currently enrolled CRP lands buffered to 1 km within each Ecodivision. This attribute table was output as a .dbf file and imported into Microsoft Access.
- In Access, the output of the GIS analysis was summarized to create a table with a unique list of every species meeting the project criteria that intersected with the buffered, currently enrolled CRP lands within each Ecodivision. This table was then provided to the lead zoologist for assignment of the species response scores for each Conservation Practice grouping.

GIS Analysis 2 Results – Species on Non-CRP Croplands

The Element Occurrence dataset used for this analysis included the following criteria:

- Any animal species with U.S. federal ESA listed, threatened, candidate, or proposed status.
- Occurs in the U.S. in the contiguous 48 states.
- EOs known to have been incorrectly identified were excluded.
- The EO polygon shapes intersect with the non-CRP land vector boundaries generated by NatureServe using the national Croplands Data Layer raster coverage and the CRP land vector boundaries provided by FSA that were buffered to 1 km (see below).

The processing steps performed to complete this analysis were as follows. (All input GIS layers were re-projected to North America Albers Equal Area Conic as necessary.)

- A copy of the national 2011 Croplands Data Layer (CDL) 30-meter raster coverage was downloaded from http://www.nass.usda.gov/research/Cropland/Release/.
- Based on the full range of values in the downloaded CDL layer, a new raster layer was calculated consisting only of the subset of pixels representing "croplands" as defined by NatureServe for the purpose of this analysis. Please see Appendix 6.3 for a full list of values that appeared in the original layer and how they were categorized.
- The layer of buffered, current CRP boundary polygons was converted to raster format at the same 30 meter resolution cells and snapped to the CDL layer described above.
- The rasterized version of buffered currently enrolled CRP lands was used to mask the croplands raster and create a new raster coverage of only cropland cells that do not overlap with pixels representing the buffered currently enrolled CRP lands.
- The output CDL raster from the step above was converted to vector format.
- The layer of expired CRP polygons created as part of the Ecodivision analysis was merged with the vectorized CDL layer, creating a final layer representing croplands that are not enrolled in the CRP program (i.e. Non-CRP croplands).
- Records in the Non-CRP croplands layer that intersected with records in the EO layer were selected and saved as a new Non-CRP subset.
- The Non-CRP polygons were then unioned with a GIS layer of U.S. counties. In the output layer, portions of counties that are outside of the CRP boundaries, and portions of CRP boundaries that are outside of the county layer were deleted.
- A spatial join was performed between the Non-CRP croplands layer from the step above with the layer of EOs meeting the project criteria. The output of this

resulted in a layer with an attribute table containing a separate row for each species EO that intersected with Non-CRP croplands within each county. This attribute table was output as a .dbf file and imported into Microsoft Access.

- In Access, the output of the GIS analysis was summarized to create a table with a total count of species that intersect with Non-CRP croplands in each county, and an overall list of those species nationwide. The counts of species by county excluded species records that were last observed previous to 1970, or that were flagged as historic or extirpated populations. The counts of species by county was then exported and joined with a county layer in ArcMap to generate a map of the density of species intersecting with Non-CRP croplands by county.

3.0 Conservation Practice Groupings

3.1 Methods for Conservation Practice Groupings

In order to assess the effects of conservation practices on ETC wildlife species, we began by compiling the full list of active Conservation Reserve Program (CRP) conservation practices (CPs) along with the full list of federally endangered, threatened, candidate, and proposed animal species occurring within reasonable geographic proximity of CRP lands. We determined there were approximately 50 active CPs and 240 federal status species. Our goal was to address the positive or negative impact of CPs on species. The large number of CPs coupled with the large number of potential species made one to one comparisons computationally prohibitive. It became necessary to group the Conservation Practices based on those with similar impacts on wildlife in order to effectively assess this interaction.

Key NatureServe personnel analyzed descriptions of all active conservation practices and created a matrix to better understand CP purposes, management actions required as part of the CPs, andwhat specific effects the management actions involved in each CP might have on our target species. We combined information from this matrix with previous work completed by NatureServe partners in Missouri (Comer et al. 2007). From there, the team added CPs that were not included in the pilot analysis and regrouped based on our interpretation of each CPs primary management activities combined with input from the literature, the FSA Handbook, and staff familiar with the CRP program. We created a draft set of CP "groups" that shared similar management actions and thereby, potential similar effects on habitat for wildlife species.

These initial groupings were presented to FSA staff for review. Since FSA staff understand unique aspects of the conservation practices that outside reviewers cannot easily recognize, they were able to suggest a number of changes to the groupings to make them more meaningful. These changes were accepted in order to create a final set of conservation practices.

The product of this effort is a set of groupings that capture similar conservation practices together in categories and potentially allow us to look at the group effects on each species or species assemblage.

Our final CP groupings are listed at the end of this section. Note that our system is hierarchical and nested, so that all groups (with 5 exceptions) "nest" into headings and more specific subheadings. At the coarsest level of the hierarchy, we split CPs into six high level groups. These groups are: 1) CPs that primarily involve tree/shrub establishment, 2) CPs that primarily involve existing forests and their management, 3) CPs that primarily involve herbaceous/grassland establishment, 4) CPs that primarily involve aquatic habitat and open wetland creation/restoration, 5) CPs that primarily

involve creating habitat to support biodiversity conservation, and 6) CPs that primarily involve improving water quality and decreasing sedimentation.

In some instances (like the existing forest management group, the biodiversity conservation group, and the water quality/sedimentation group), further subdividing the groups gave us no useful new information on potential effects on species. However, we felt a need to further subdivide some of the groups into sub-groups to better understand specific species level effects. For instance, it may be important to know whether the forest being created in some CPs is in an upland or wetland to best understand its potential positive or negative effect on species habitat. For the tree/shrub establishment group, we further split CPs into: 1) forest creation, 2) creation of rows of narrow strips of trees/shrubs, and 3) wetland forest habitat. For the herbaceous/grassland establishment category, we split groups into the following subgroups: 1) grass/forb establishment, 2) wildlife habitat creation, 3) rows/strips of forbs/grasses, and 4) food plot creation. Furthermore, we split the grass/forb establishment into two categories, one for native species establishment and one for non-native species establishment. Finally, we split the aquatic habitat and open wetland creation/restoration group into four sub-groups: 1) wetland restoration, 2) farmable wetlands/restoration, 3) upland buffer adjacent to wetlands, and 4) wildlife habitat. In all cases, we only split into subgroups when we felt that it would benefit the final interpretation of the effects of CP actions on species. When including both groups and subgroups, we created 14 discrete units to populate a potential matrix of species vs. CPs for the final analysis.

Our classification reflects an effort to group CPs that share key management activities that, when implemented, would potentially affect guilds of species in the same way. For instance, we grouped all CPs whose primary goal is to establish forest cover since forest creation would have similar effects on forest-interior loving passerines (potentially neutral or positive) and grassland-dependent raptors (potentially neutral or negative).

Since conservation practices vary in their implementation and since CPs can often be comprised of multiple competing management actions, it is important to use the CP groupings with the following caveats in mind:

1) Conservation practices may change over time as technical standards maintained by NRCS are refined and policy shifts occur. Although most CPs maintain their overall practices, some CPs may be refined, which can change their potential impact on target species' habitats. We interpreted the most recent versions of each CP (from the 2008 farm bill) as part of this work.
2) Each CP is established at the national level but interpreted and more fully fleshed out by state and local officials. Because of this, CPs can vary greatly in their implementation from state to state. Where possible, we attempted to look at a variety of state level documents for each CP in order to capture the best overall concept of each CP when grouping them.

3) Most CPs involve multiple management actions. We have attempted to group by the primary management action of each CP, but a deeper analysis of the effects of CPs on species might require a more in-depth look at secondary and tertiary management actions.
4) CP30 and CP40 both show up in more than one grouping below since farmers may use these CPs to create either herbaceous/grass-dominated areas or tree/shrub-dominated areas. All other CPs are only found in one group.

3.2 Results: Conservation Practice Groupings

Tree/Shrub Establishment (Mostly Uplands but can include Wetlands)
Conservation practice's main impact on habitat involves turning row cropped or fallow fields into forest. Practices may apply to uplands or wetlands:

Forest Creation
- CP3 Tree Planting (Pine)
- CP3A Hardwood Tree Planting
- CP36 Longleaf Pine - Establishment
- CP38C SAFE - Trees
- CP38D SAFE – Longleaf Pines

Creation of Rows Or Narrow Strips of Trees/Shrubs
- CP5A Field Windbreak Establishment, Noneasement
- CP16A Shelterbelt Establishment, Noneasement
- CP17A Living Snow Fences, Noneasement

- CP30 Marginal Pastureland Wetland Buffer (both tree and non-tree cover allowed – work done on non-wetland areas to benefit wetlands)**
- CP22 Riparian Buffer**

Wetland Forest only
- CP31 Bottomland Timber Establishment on Wetlands
- CP40 Farmable Wetlands Program Aquaculture Wetland Restoration (both tree and non-tree cover allowed)**
- CP23 Wetland Restoration (This CP is in this category for the following ecodivisions: 201, 202, 203, 205, and some Eastern sections of 303)

Existing Forest Management
Conservation practice's main impact on habitat involves maintaining existing forested land. Practice may apply to uplands or wetlands.

- CP11 Vegetation Cover – Trees – Already Established
- CP35A Emergency Forestry – Longleaf - New
- CP35B Emergency Forestry – Longleaf - Existing
- CP35C Emergency Forestry – Bottomland - New
- CP35D Emergency Forestry – Bottomland - Existing
- CP35E Emergency Forestry – Softwood - New
- CP35F Emergency Forestry – Softwood - Existing
- CP35G Emergency Forestry – Upland Hardwood - New
- CP35H Emergency Forestry – Upland Hardwood - Existing
- CP35I Emergency Forestry – Mixed Trees

Herbaceous/Grassland Establishment

Conservation practice's main impact on habitat involves converting row crops to herbaceous or grassland-dominated communities. Practice may apply to uplands or wetlands.

Grass/Forb Establishment

Blocks of Native Grass/Forb Establishment Only

CP2 Establishment of Permanent Native Grasses

Non-native or Native Grass/Forb Establishment

CP1 Establishment of Permanent Introduced Grasses and Legumes
CP10 Vegetation Cover – Grass – Already Established
CP18B Establishment of Permanent Vegetation to Reduce Salinity, Noneasement
CP18C Establishment of Permanent Salt Tolerant Vegetative Cover, Noneasement

Wildlife Habitat Creation

CP4D Permanent Wildlife Habitat, Noneasement
CP29 Marginal Pastureland Wildlife Habitat Buffer (both tree and non-tree cover allowed)
CP33 Habitat Buffers for Upland Birds
CP38A SAFE- Buffers
CP38E SAFE - Grass
CP42 Pollinator Habitat

Rows/Strips of Forbs/Grasses

CP4B Permanent Wildlife Habitat (Corridors), Noneasement
CP8A Grass Waterways, Noneasement**
CP15A Establishment of Permanent Vegetative Cover (Contour Grass Strip), Noneasement
CP21 Filter Strips**
CP24 Establishment of Permanent Vegetation Cover as Cross Wind Trap Strips
CP15B Establishment of Permanent Vegetative Cover (Contour Grass Strips) on Terraces
CP30 Marginal Pastureland Wetland Buffer (both tree and non-tree cover allowed – work done on non-wetland areas to benefit wetlands)**

Food Plot Creation

CP12 Wildlife Food Plot

Aquatic Habitat and Open Wetland Creation/Restoration (Herbaceous/Shrubland only)

Wetland Restoration

CP23 Wetland Restoration (includes upland buffer (1:3 wetland to upland minimum) (CP23 is in this category in all ecodivisions except 201, 202, 203, 205, and some Eastern sections of 303)
CP23A Wetland Restoration, Non-Floodplain (includes upland buffer (1:3 wetland to upland minimum)

Farmable Wetlands/Restoration
(http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=fwp)
CP27 Farmable Wetlands Pilot Wetland (CP28 required for this CP)
CP39 FWP Constructed Wetland (OIder farm bill associated this with CP28, newer farm bill did not but required a buffer similar to CP28)
CP40 Farmable Wetlands Program Aquaculture Wetland Restoration (both tree and non-tree cover allowed)**
CP41 Flooded Prairie Wetland (Only Prairie Pothole region, CP28 required for this CP)

Upland Buffer Adjacent to Wetland
CP28 Farmable Wetlands Pilot Buffer (required CP to conduct CP27, CP41, & most CP39s)
CP30 Marginal Pastureland Wetland Buffer (both tree and non-tree cover allowed – work done on non-wetland areas to benefit wetlands)**

Wildlife Habitat
CP9 Shallow Water Areas for Wildlife
CP37 Duck Nesting Habitat (requires upland buffer)
CP38B SAFE – Wetlands (requires upland buffer)

Biodiversity Conservation
CP25 Rare and Declining Habitat

Water Quality/Sedimentation
CP21 Filter Strips**
CP22 Riparian Buffer**
CP8A Grass Waterways, Noneasement**

** = Conservation Practice in more than one CP grouping

References:

Other useful References for looking at specific impacts of different Conservation Practices can be found at: http://www.fwrc.msstate.edu/pubs/farmbill.pdf

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FSA Handbook

4.0 Conservation Effects Matrix

4.1 Methods for ETC Wildlife Conservation Effects Analysis

We used NatureServe's major ecological divisions of North America as the framework for our analyses (Fig. 1). Our study focused on the contiguous United States, within which eleven of the ecological divisions include Conservation Reserve Program parcels. These divisions included: Laurentian and Acadean, Central Interior and Appalachian, Gulf and Atlantic Coastal Plain, Eastern Great Plains, Western Great Plains, Rocky Mountain, Inter-Mountain Basins, North American Pacific Maritime, Mediterranean California, North American Warm Desert, and Madrean Semidesert. Each of these divisions has a fundamentally unique landscape, a different suite of species of conservation concern, and different array of important conservation practices, and so they potentially provide a good analytical framework for determining whether the effects of conservation practices vary among different geographical regions. Assessing each division separately allowed us to identify more precisely the conservation practices that are most beneficial and most detrimental to federally listed endangered, threatened, and candidate (ETC) species. For example, we anticipated that native grass/forb establishment might be highly beneficial in one region but not in another. To provide a broader overview we also summarized data for the contiguous United States, encompassing all eleven ecological divisions combined. This proved to be the most useful framework for summarizing our findings, given the uneven distribution of ETC species among the eleven ecological divisions (see 4.2, Results).

We grouped CRP conservation practices (CPs) into major categories that included practices with similar activities and features (see Section 3, above). For example, the various conservation practices that involve forest creation were grouped into a single category. This facilitated the discovery of major patterns while keeping the time and cost of the analyses within reason.

Our analyses included ETC animal species (as defined under the U.S. Endangered Species Act; thus including listed or candidate species, subspecies, distinct population segments, and evolutionarily significant units) that occur on or within 1 kilometer of CRP parcels (see Section 2, above, for details of the GIS analysis). Note that some species are listed in only a portion of their geographic range; these were removed from our species lists for the ecological divisions in which the species does not have federal status. Federal "Species of Concern" were not included in our analyses. Additionally, we removed the shovelnose sturgeon (*Scaphirhynchus platorynchus*) from the lists because it is federally listed solely on the basis of its "similarity of appearance" to another federally listed species.

Although we initially thought it would be possible to score the effects of CRP CPs only for groups of ETC species, it turned out that we were able to score each individual species. We were able to indicate the effects at a very specific level, and we also "rolled

up" the species data and summarized the effects for groups of particular interest. For each species in each ecological division, we scored the effect of each CP group as positive, negative, or neutral, or (when appropriate) as a combination of two or all of these categories. We used the following definitions and codes: Positive (P): the usual or most common effect of the conservation practice is known or likely to be beneficial for the species or species group. For example, wetland restoration is beneficial to bog turtles. Negative (N): the usual or most common effect of the conservation practice is known or likely to be detrimental to the species of species group. For example, forest creation, or creation of rows or strips of trees or shrubs, may be detrimental to certain grassland birds. Neutral (O): the usual or most common effect of the conservation practice is known or likely to be neither beneficial nor detrimental; the conservation practice generally does not affect the species or species group. For example, wetland restoration has no effect on the upland-associated giant kangaroo rat (*Dipodomysingens*). In some cases, the effect of the conservation practice depends on the details of the situation and may be difficult to categorize as exclusively positive, negative, or neutral. For these, we indicated these multiple effects or uncertainty by scoring the practice in multiple categories (e.g., positive-neutral; PO), and an explanatory note was added.

It is important to bear in mind that we scored the *direct* effects of the CP groups. Also, we assigned some specific conservation practices to more than one CP group. For example, herbaceous/grassland establishment (CP group 4) has effects on the upland landscape and also may indirectly result in changes in water quality and sedimentation. We scored in CP group 4 only the effects of the practice on the upland areas under treatment, whereas effects related to water quality or sedimentation were scored under CP group 7. Consequently, under our scoring method, CP group 4 may benefit upland birds but not completely aquatic freshwater mussels. The effects of herbaceous/grassland establishment on freshwater mussels were scored under CP group 7.

4.2 Results of Conservation Effects Analysis

We determined that 232[1] listed or candidate (ETC) animal species occur on or near CRP parcels (Table 1). Taxonomic groups represented by at least 10 species include freshwater mussels (77 species), freshwater and anadromous fishes (58 species), mammals (23 species), birds (22 species), reptiles (14 species), and amphibians (11 species). Thus, 58 percent of the ETC species occurring on or near CRP lands are aquatic freshwater mussels or fishes, and more than two dozen additional species in other groups also are strongly aquatic. Across taxonomic groups, nearly 70 percent of ETC species on or near CRP parcels are completely or strongly aquatic. The results of our analysis of CRP CPs are strongly driven by this habitat relationship of the ETC species.

The Central Interior and Appalachian (125 species) and the Gulf and Atlantic Coastal Plain (99 species) ecological divisions had by far the largest number of ETC species occurring on or near CRP parcels (compare tabs in Table 2; see also Table 3). The Eastern Great Plains and Western Great Plains (33 species and 26 species, respectively) had the next highest species totals.

Overall, considering all Ecological divisions and all ETC species occurring on or near CRP parcels, most CPs have neutral (neither positive nor negative) effects (Tables 1-3; see especially top of Table 3). Very few CPs have negative effects, and those negative effects, upon close examination, turn out to be relatively inconsequential (e.g., loss of secondary foraging habitat for a few bird species). A modest number of CPs have positive scores, and an even smaller number of CPs may have either positive or inconsequential effects on ETC, with the effect depending on the details of the situation and the specific CPs employed. This applies particularly to the CPs that we included under Biodiversity Conservation (CP group 6). In most instances, given sufficient details on the specific situation, the effect (positive or neutral) could be determined by referring to the notes we have added to the scoring data (i.e., see the rightmost column in each tab in Table 2).

Among the CP groups, CP group 7 (Water Quality/Sedimentation) and to a much lesser degree CP 6 (Biodiversity Conservation) have the greatest positive effects on ETC species (Table 3). In contrast, for CP groups 1-5 (Tree/Shrub Establishment, Wetland Forest Creation, Existing Forest Management, Herbaceous/Grassland Establishment, Aquatic Habitat and Open Wetland Creation/Restoration), 91-93 percent of the scores were neutral. Although these CPs undoubtedly benefit a large number of nonlisted animal (and plant) species, their positive effects on listed or candidate species are relatively small. The importance of CP group 7 clearly reflects the predominance of aquatic species in the data set.

[1] For the purposes of the CP scoring, a small number of species infrataxa that were in the GIS analysis results were grouped together, such as certain salmon populations. As a result, the total numbers of species reported in the CP scoring dataset may be slightly different than the totals based on the GIS analysis reported in the charts in Section 5.

Each of the major taxonomic groups (i.e., those represented by at least 10 ETC species) includes species that benefit to some degree from certain CRP CPs, but—as expected—the different groups benefit from different CPs (Table 3, Tab 1). For example, freshwater mussels benefit exclusively from CPs related to Water Quality/Sedimentation (CP group 7), whereas birds and mammals benefit more from CPs that change the characteristics of uplands.

Major geographic differences (i.e., differences among ecological divisions) in the effects of the various CPs on ETC species are not readily apparent in our data. However, meaningful quantitative comparisons are difficult to make because of the very uneven distribution of ETC species among the ecological divisions and because the taxonomic composition of ETC species in each ecological division often is quite different. For example, the Central Interior & Appalachian ecological division has a very large number of freshwater mussels and fishes whereas the Western Great Plains has no ETC freshwater mussels and relatively few fishes.

In doing the scorings for the CPs, we found that the fundamental effect (i.e., P, O, or N) of a CP group did not change among different ecological divisions. Thus, Tree/Shrub Establishment has the same effect on a particular species regardless of the ecological division. This reflects each species' fundamental habitat requirements and responses, which do not change very much among different regions.

5.0 Summary Results

5.1 Maps and Figures

Figure 1: North American Ecological Divisions

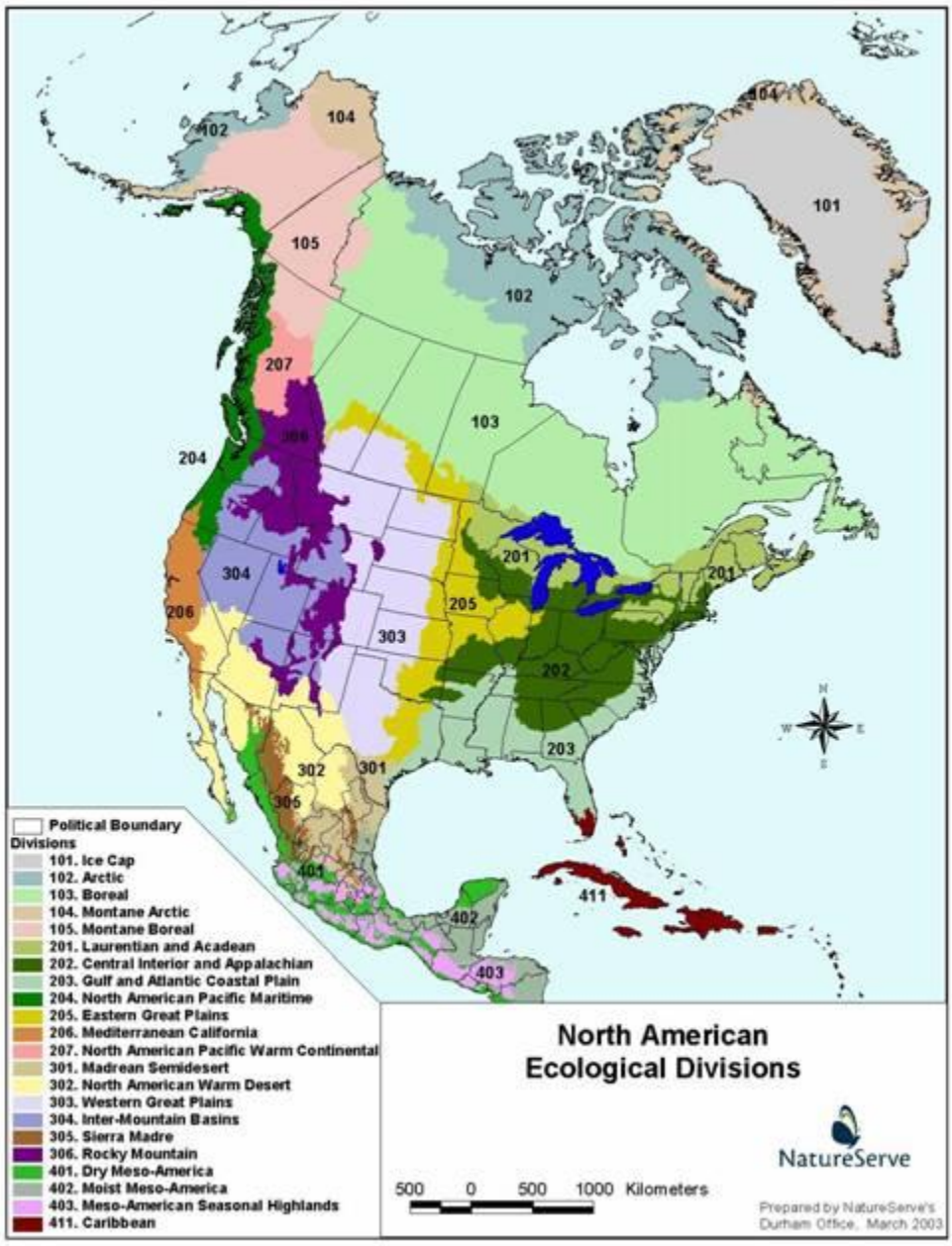


Figure 2: Number of Federal Status Animal Species on CRP Croplands

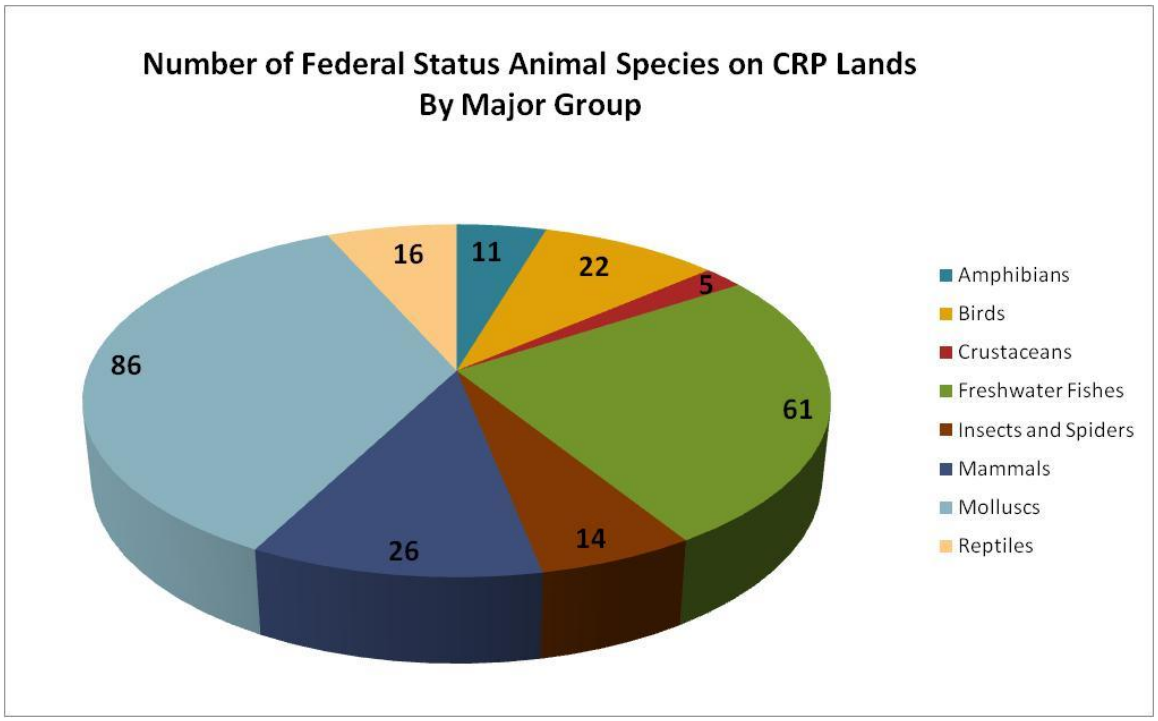


Figure 3: Number of Federal Status Animal Species on Non-CRP Croplands

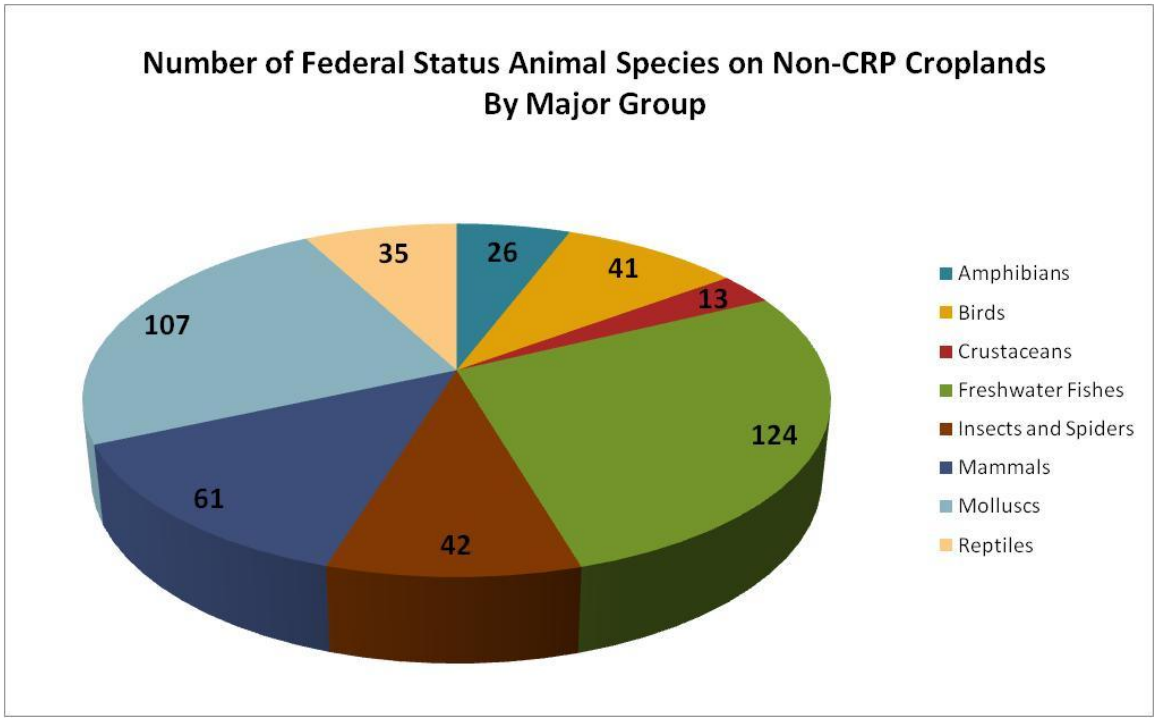


Figure 4: Map depicting the number of U.S. Federal Status Animal Species on Non-CRP Croplands, shaded by County

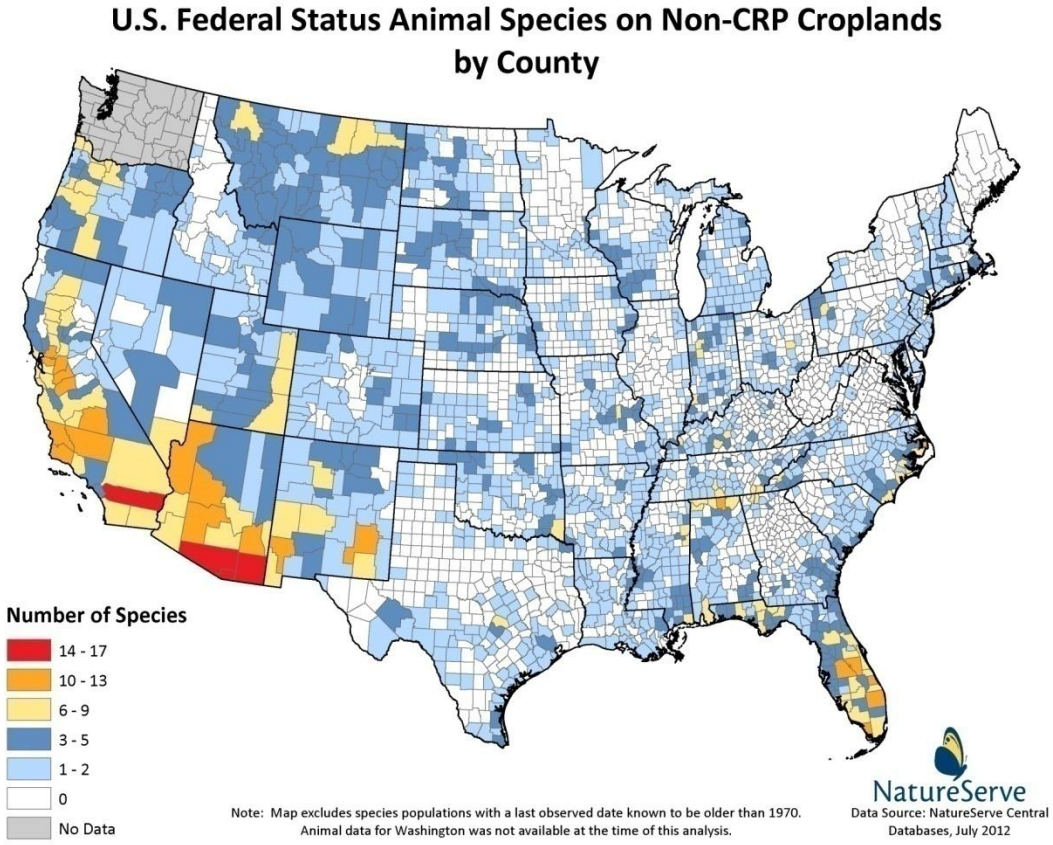
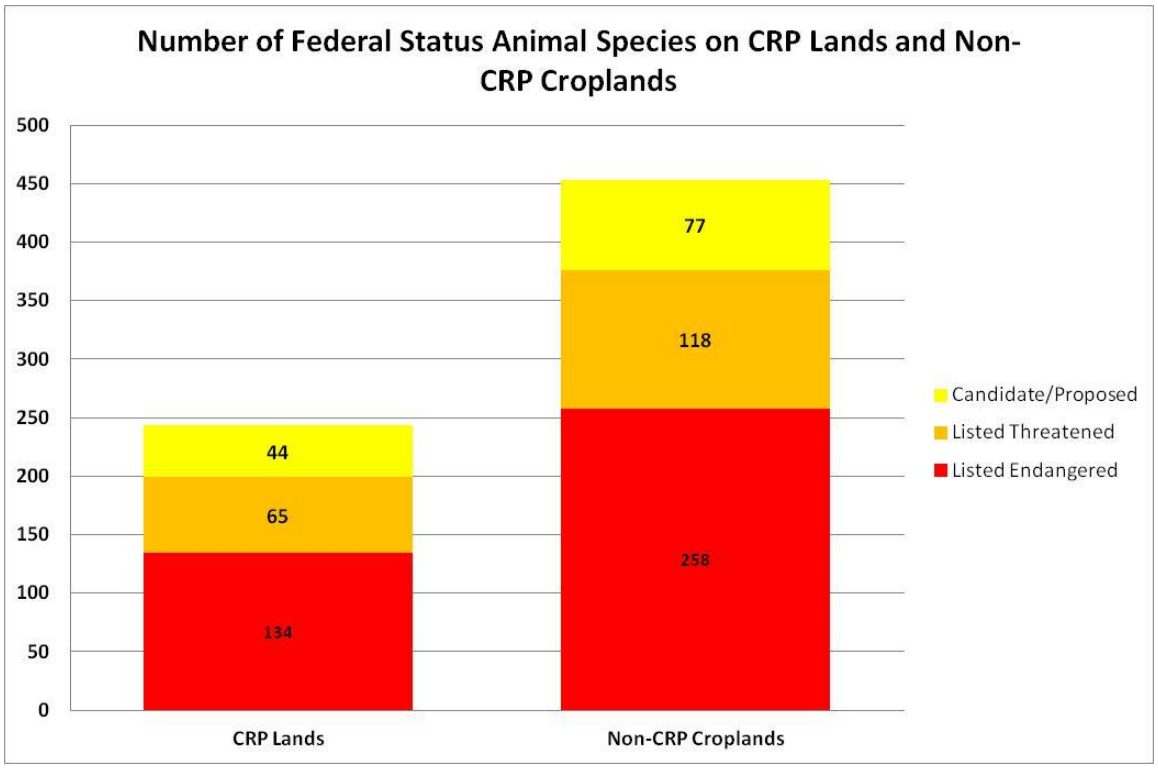
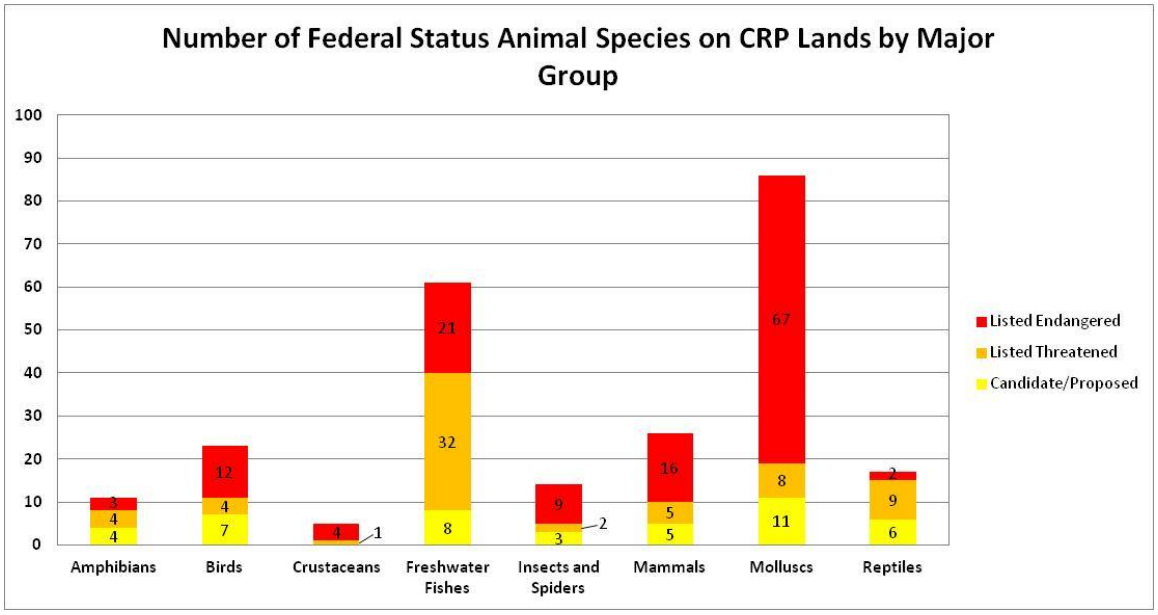


Figure 5: Number of Federal Status Animal Species on CRP Lands and Non-CRP Croplands



Figures 6 and 7: Number of Federal Status Animals on CRP and Non-CRP Croplands, showing status, by major group



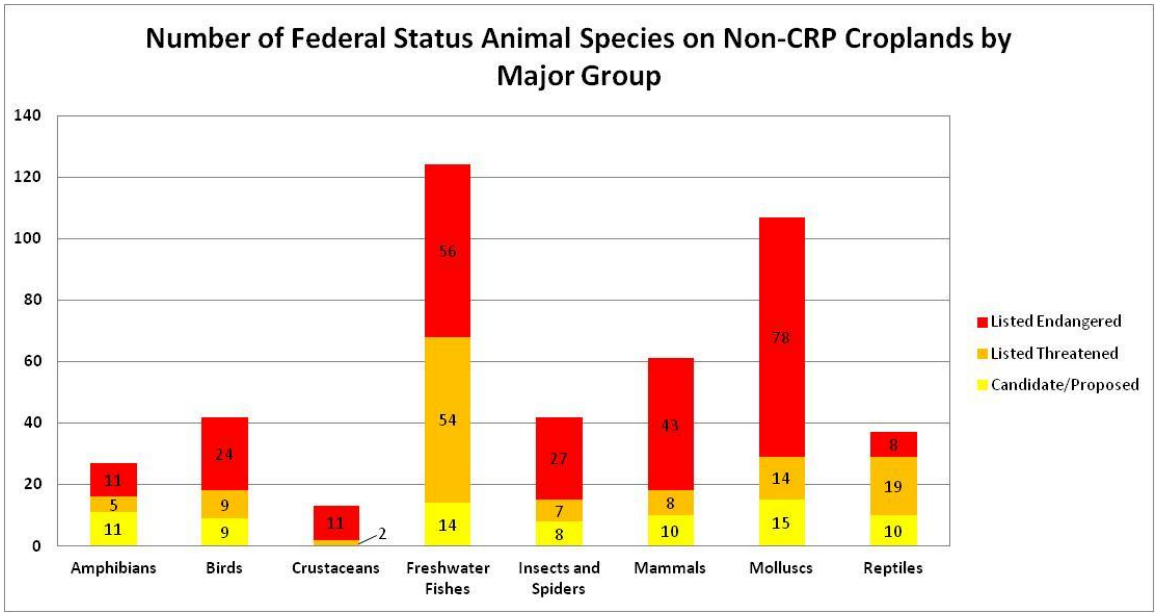


Figure 8: Number of Federal Status Animal Species on CRP Lands and Non-CRP Croplands

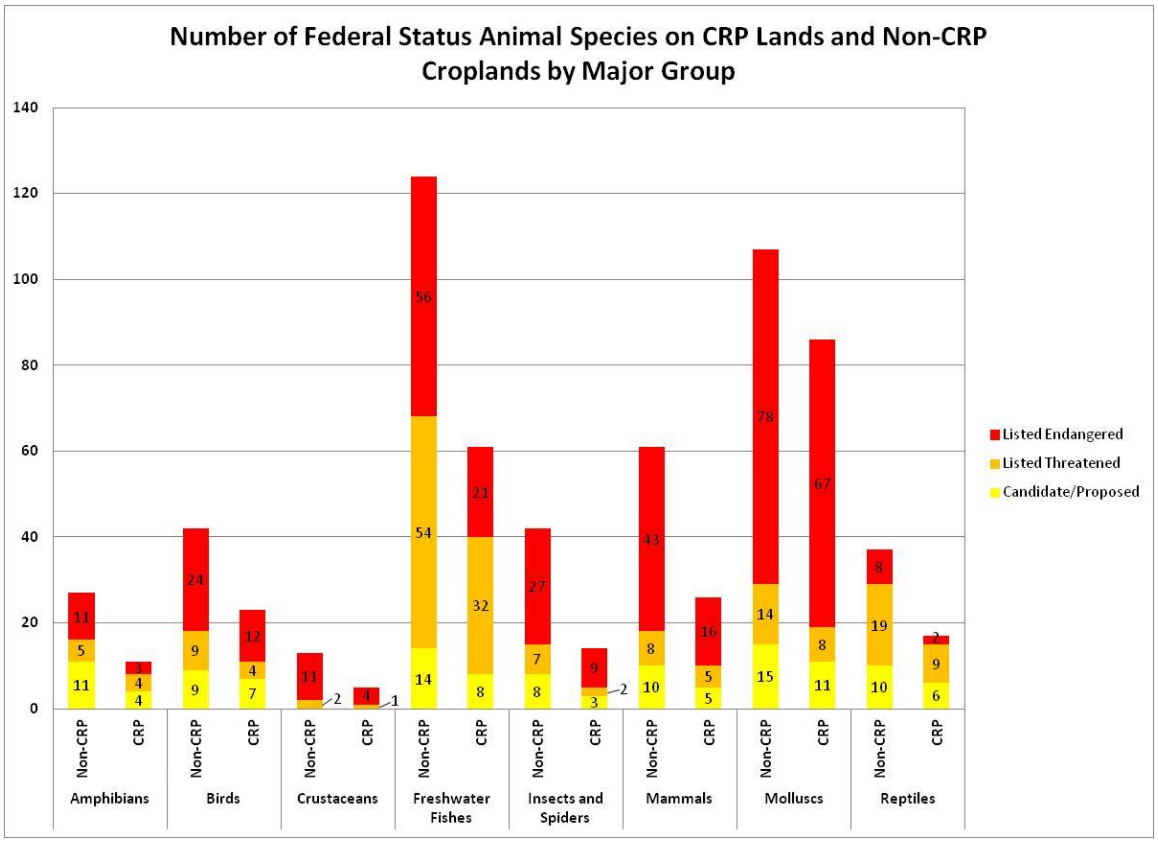


Figure 9: Number of Federal Status Animal Species on CRP Lands by Ecodivision

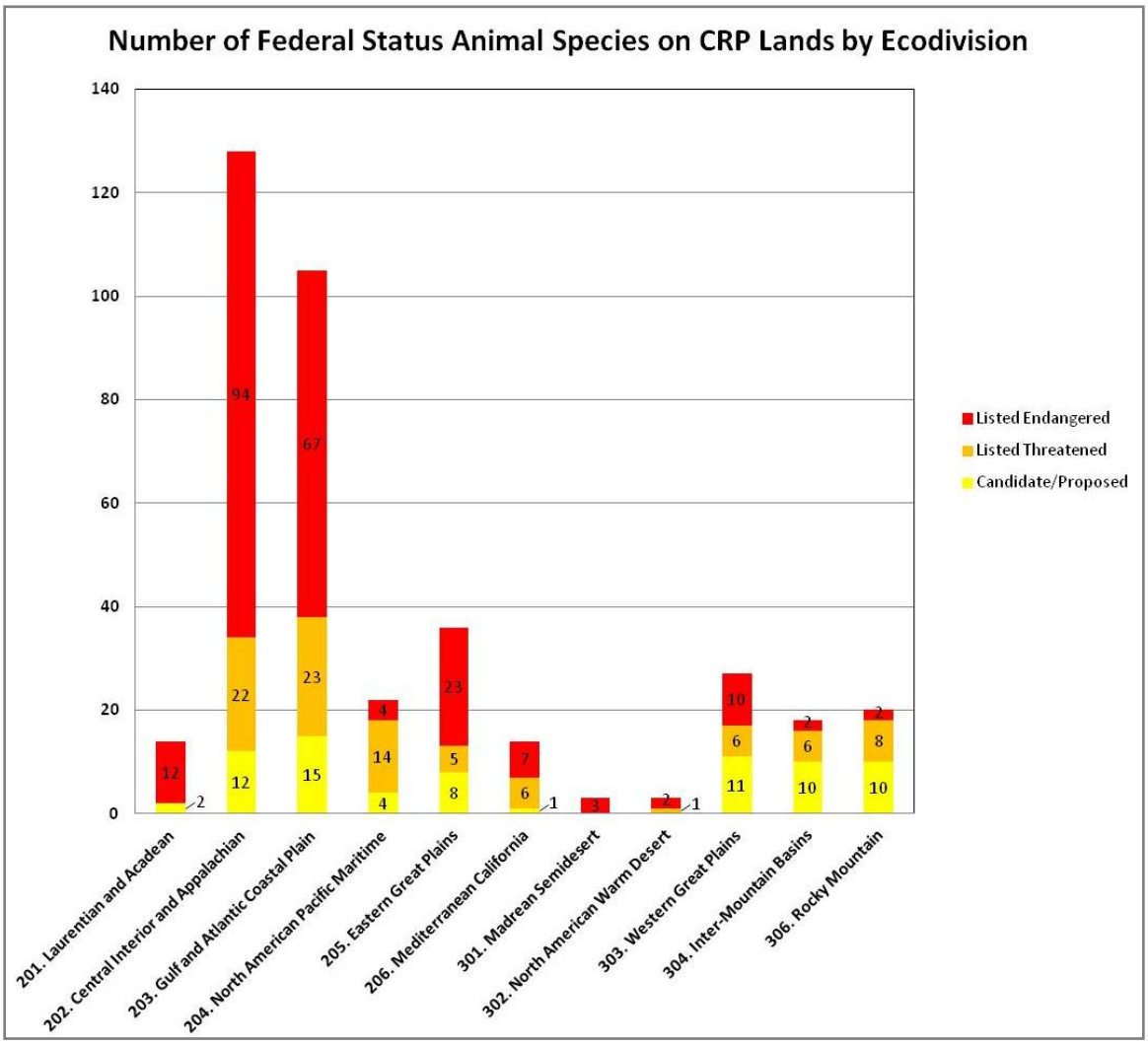


Figure 10: Number of Federal Status Amphibian Species on CRP Lands, showing status, by ecodivision

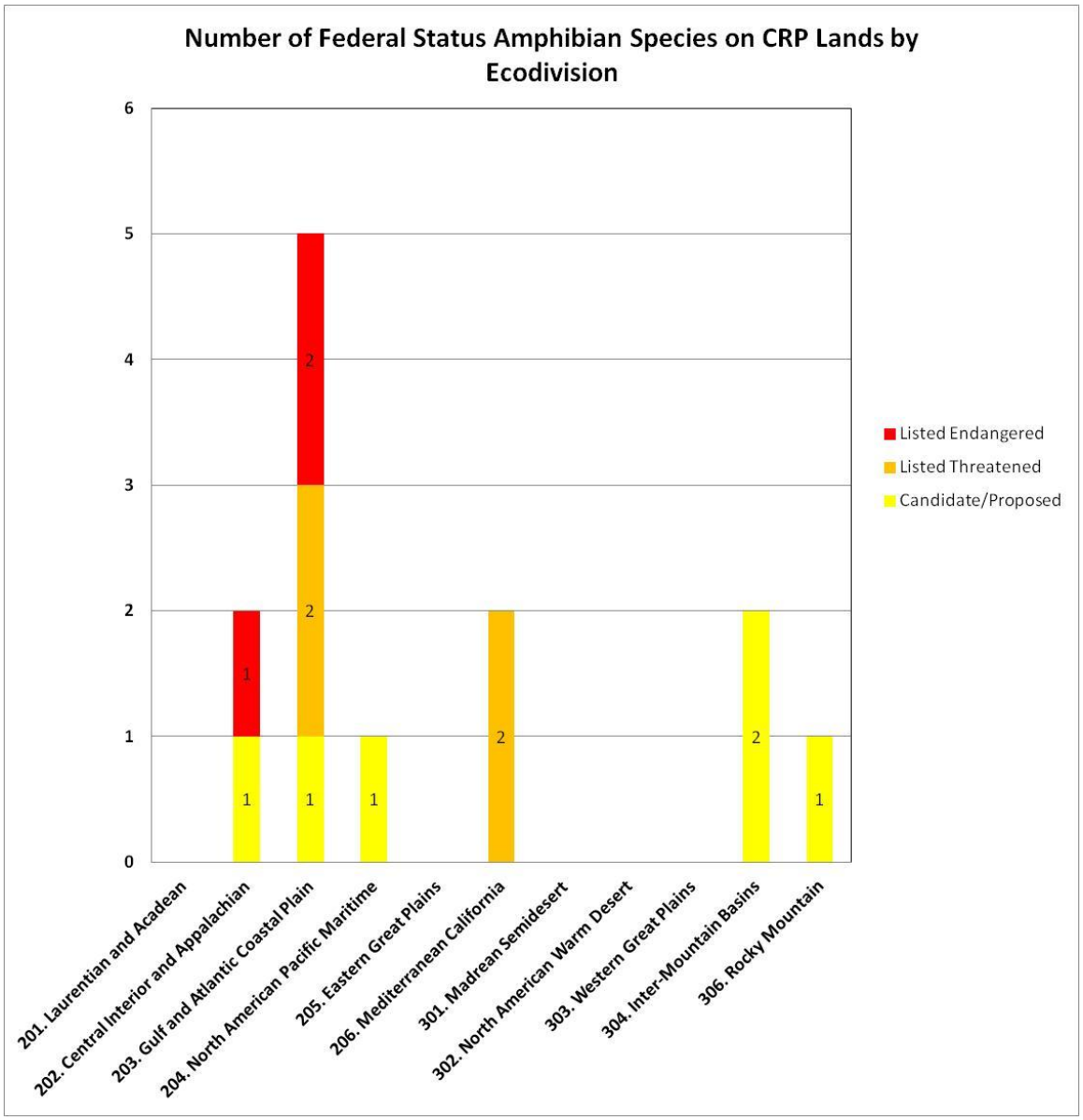


Figure 11: Number of Federal Status Bird Species on CRP Lands, showing status, by ecodivision

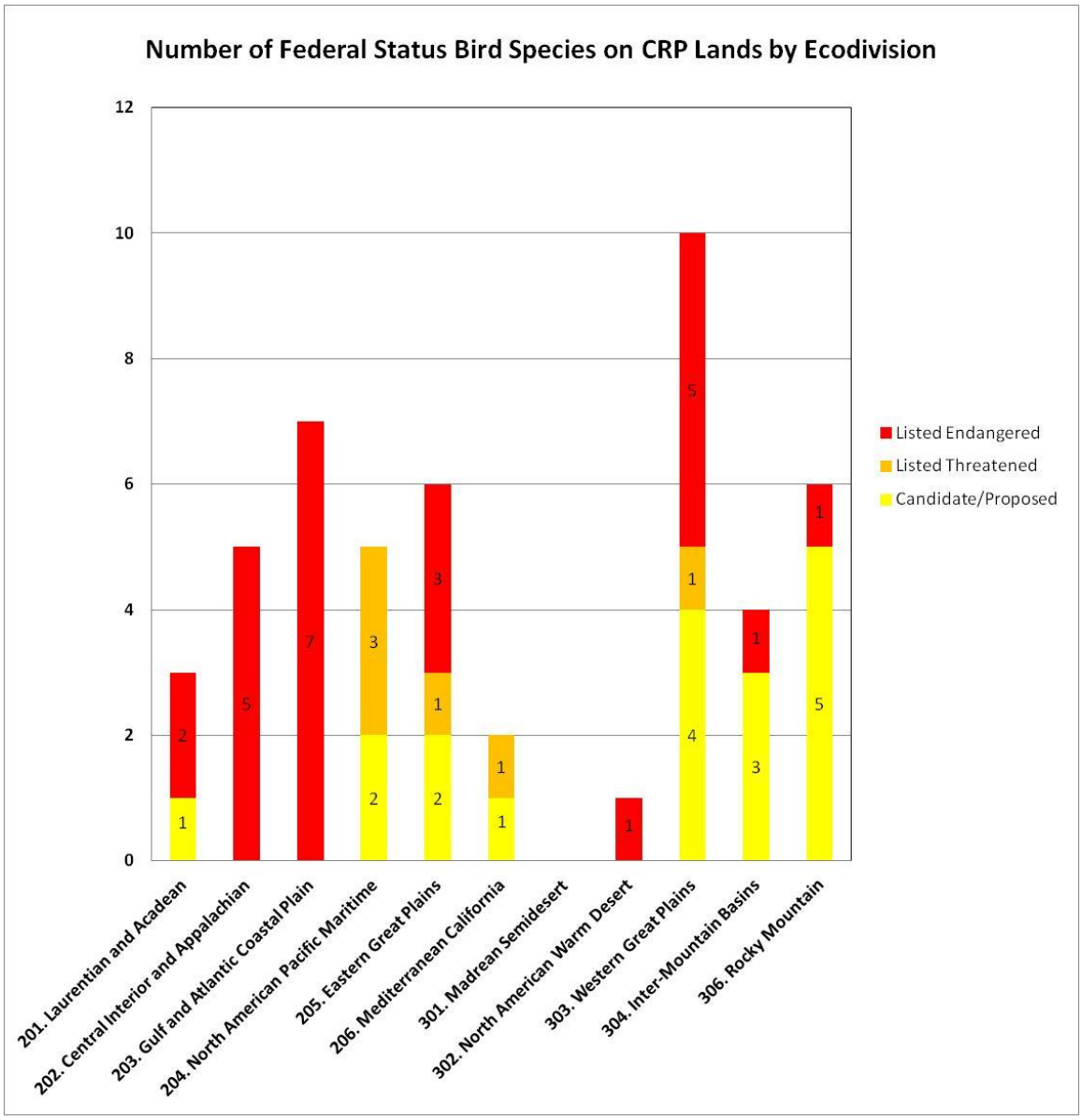


Figure 12: Number of Federal Status Crustacean Species on CRP Lands, showing status, by ecodivision

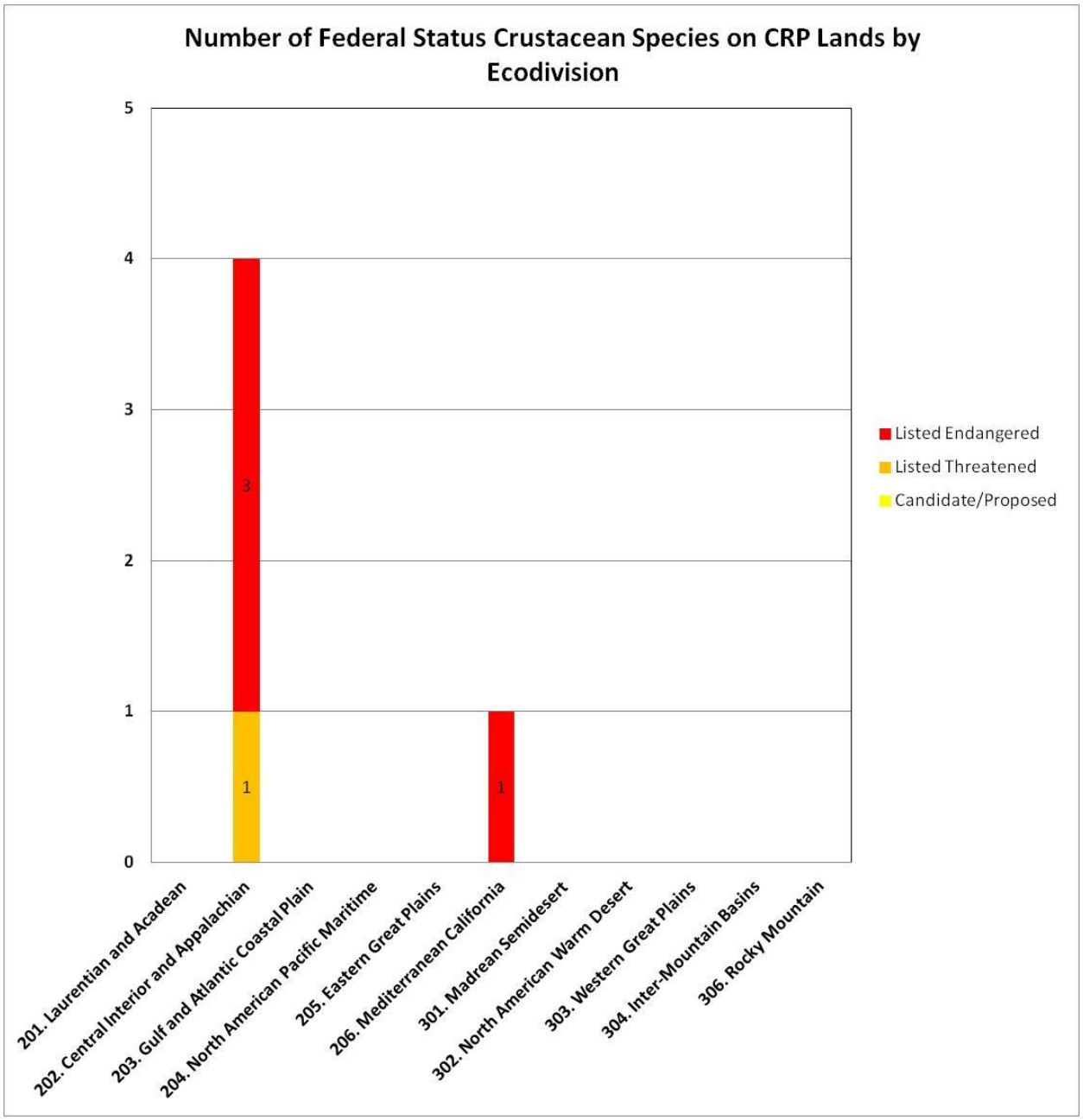


Figure 13: Number of Federal Status Freshwater Fish Species on CRP Lands, showing status, by ecodivision

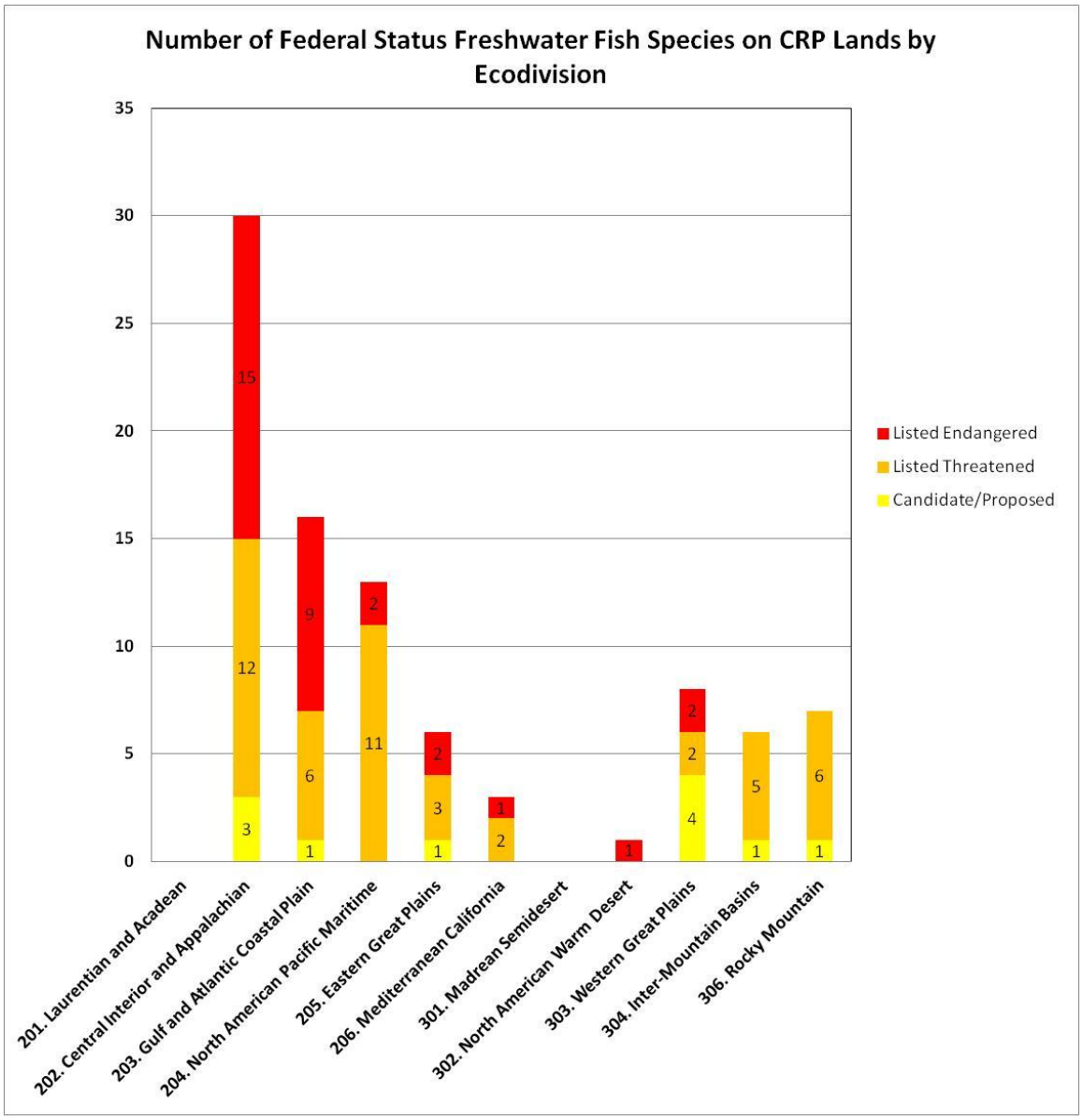


Figure 14: Number of Federal Status Insect and Spider Species on CRP Lands, showing status, by ecodivision

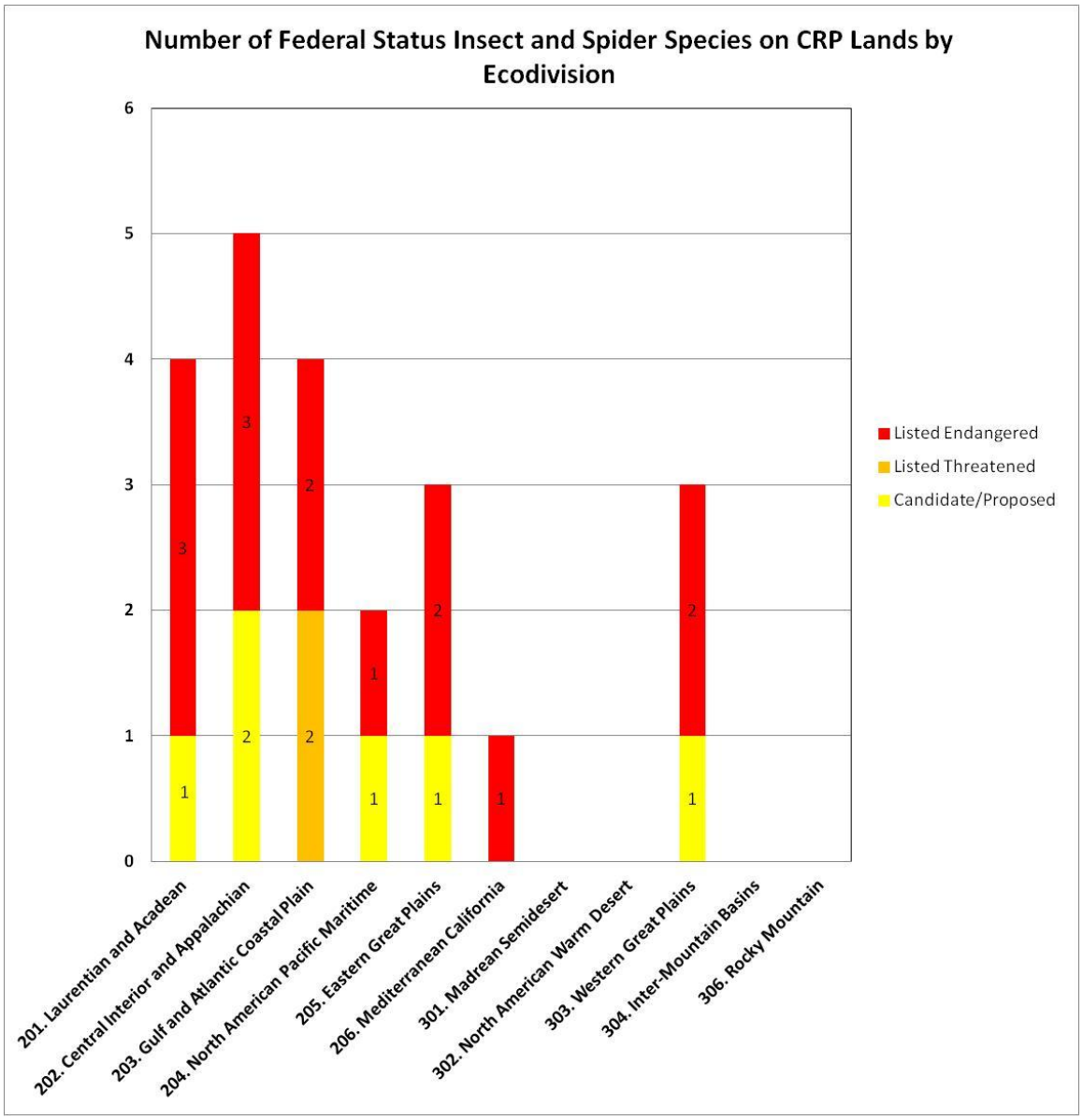


Figure 15: Number of Federal Status Mammal Species on CRP Lands, showing status, by ecodivision

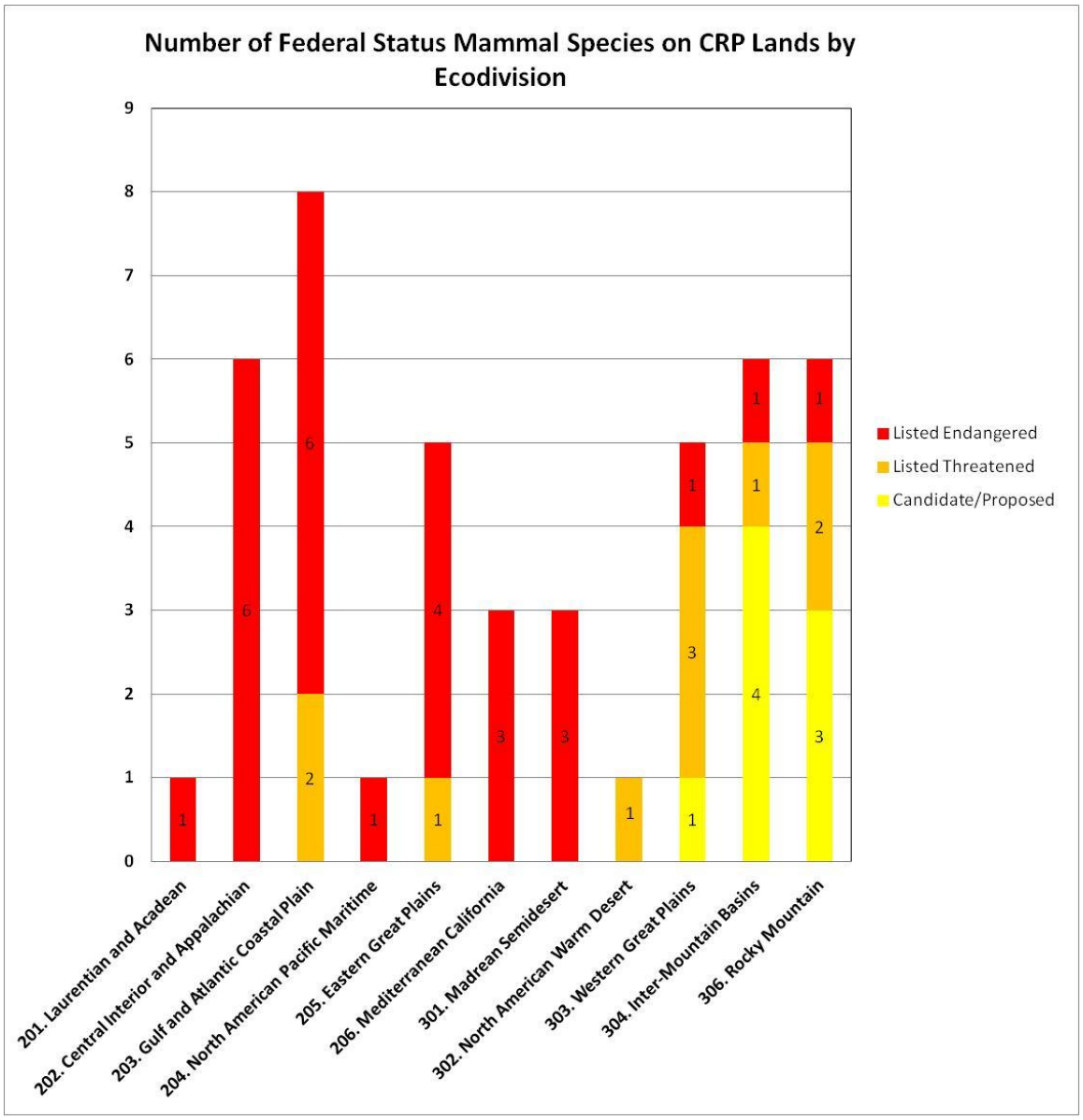


Figure 16: Number of Federal Status Mollusc Species on CRP Lands, showing status, by ecodivision

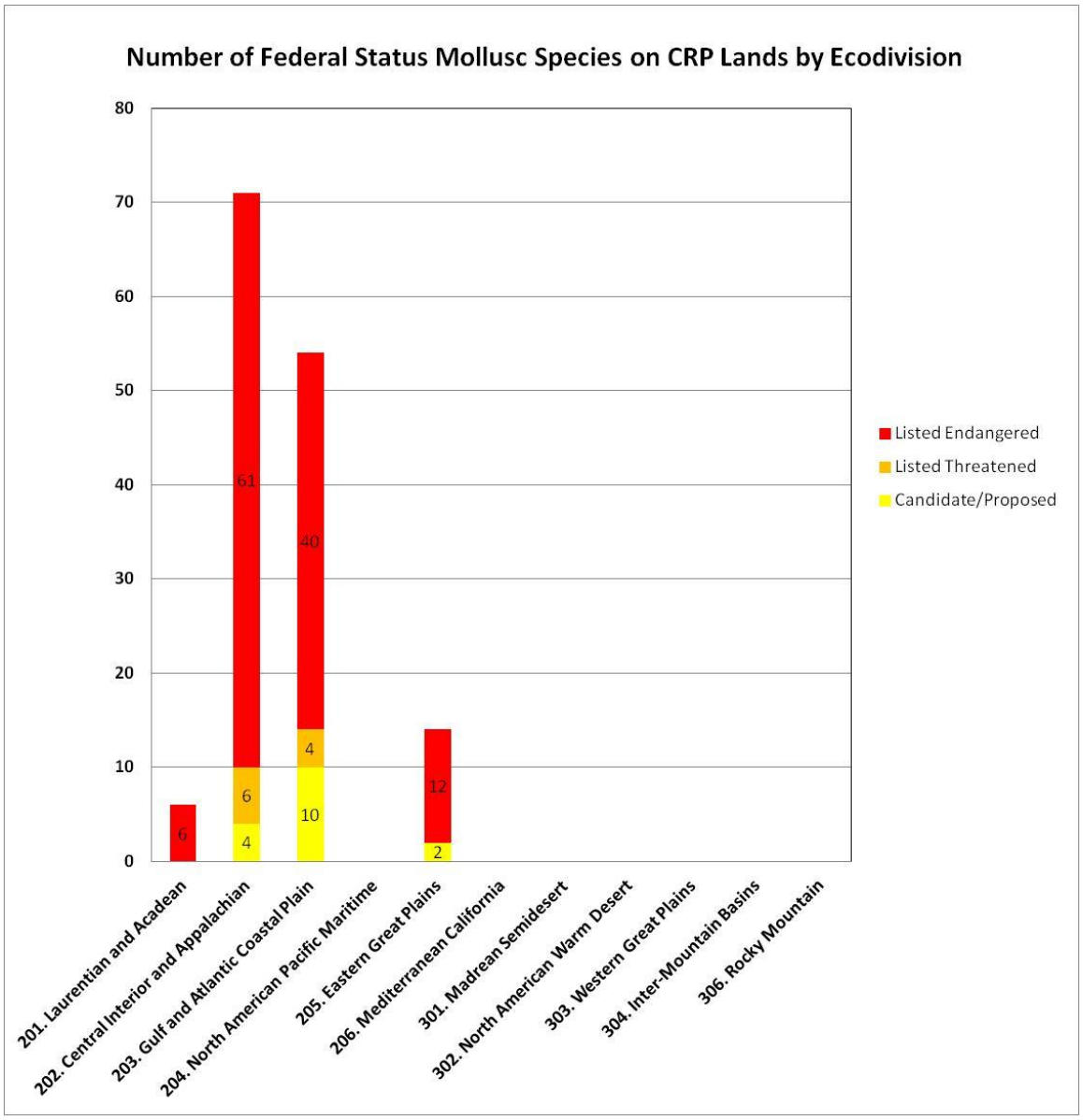


Figure 17: Number of Federal Status Reptile Species on CRP Lands, showing status, by ecodivision

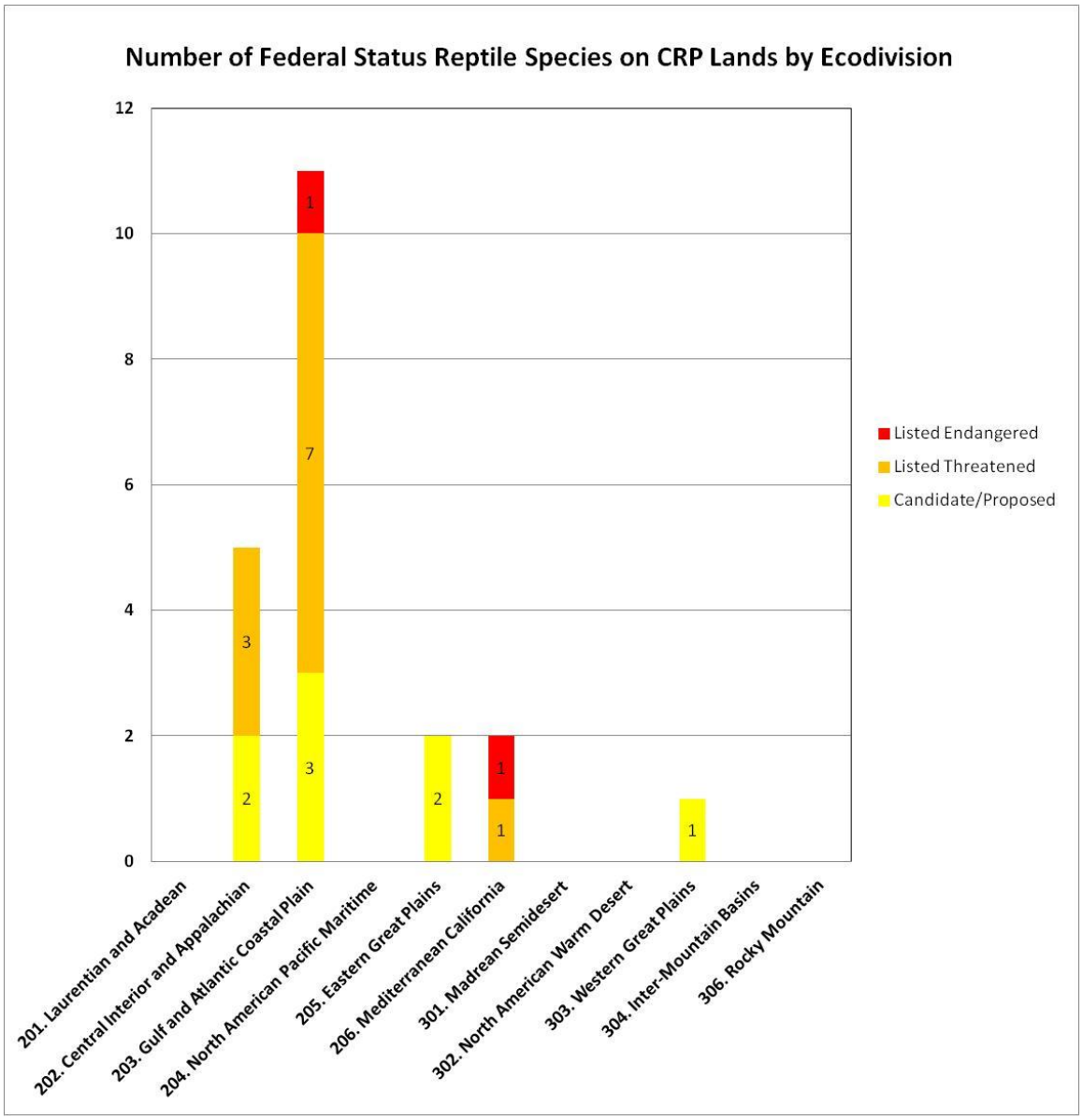


Figure 18: Total Acres of CRP Lands by Ecodivision

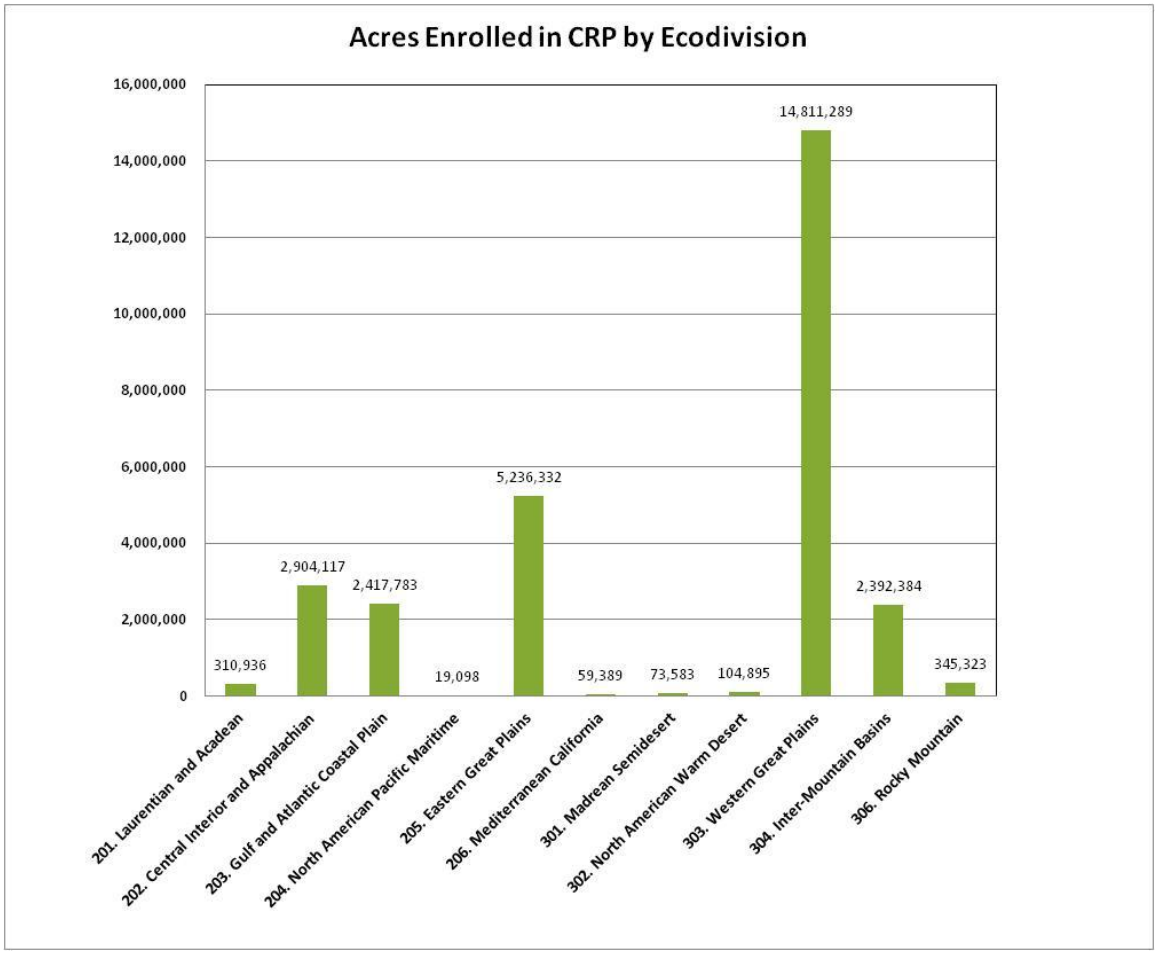
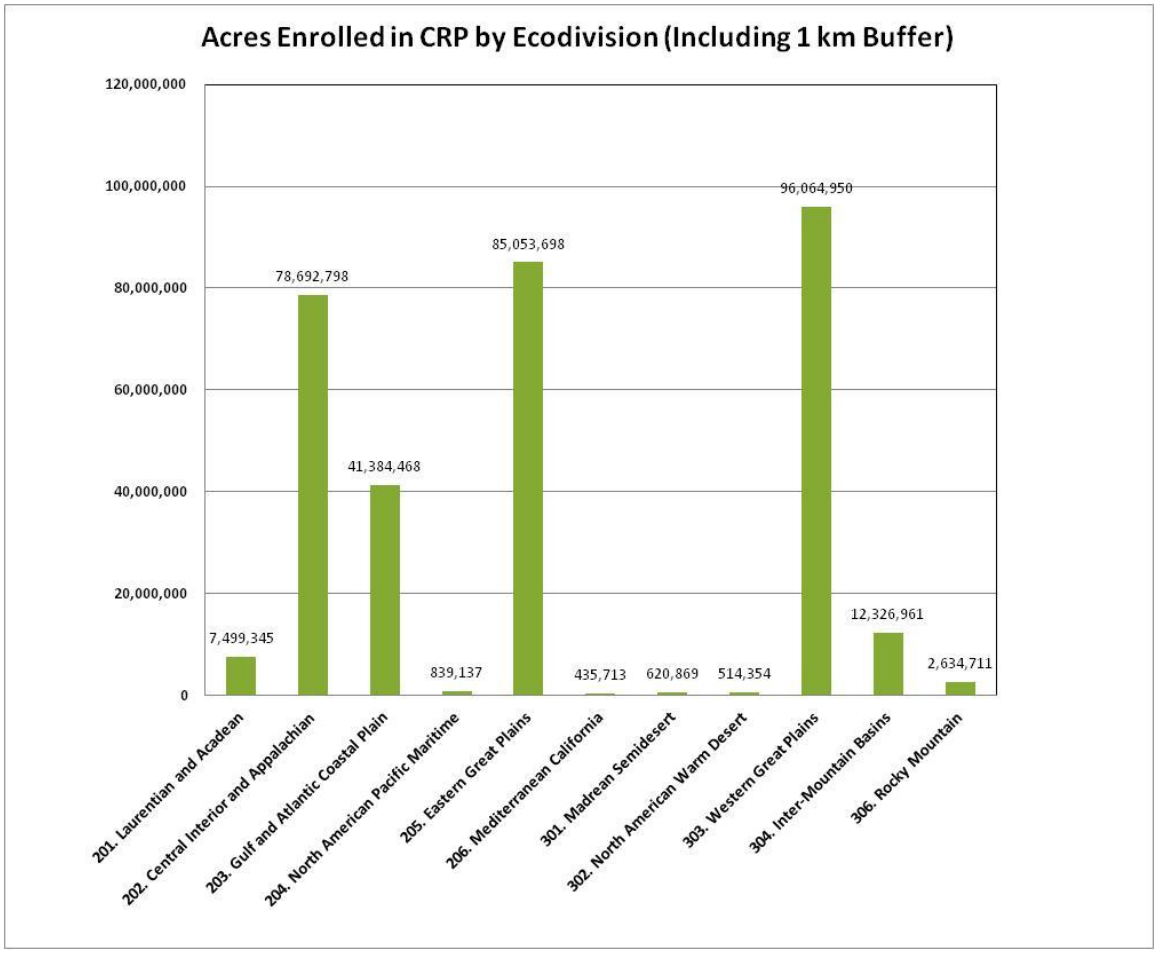


Figure 19: Total Acres of CRP Lands, buffered by 1 km, by Ecodivision



5.2 Tables

All Tables are attached to this report as separate documents, in Excel files. Field definitions for tables are defined below in Appendix 6.2: GIS Analysis Results – Field Definitions.

List of Tables:

1) **Table 1**– FSA Table 1 CRP ETC Species with CP Scores US.xlsx

   This table includes the Conservation Effects Matrix as described in report Section 4. Table 1 includes the positive, negative, or neutral scores for all ETC species on CRP lands across the contiguous United States.

2) **Table 2** – FSA Table 2 CRP ETC Species with CP Scores Ecodivisions.xlsx

   This table includes the Conservation Effects Matrix as described in report Section 4. Table 2 includes the positive, negative, or neutral scores for all ETC species on CRP lands, divided by ecodivision.

3) **Table 3** – FSA Table 3 CRP CP scoring summary for US and Ecodivisions.xlsx

   This table summarizes the overall results of the Conservation Effects Matrix scores in Tables 1 and 2, for the United States and by ecodivision.

4) **Table 4** – FSA Table 4 CRP GIS ETC Animal Species List.xlsx

   This table lists all federally listed endangered, threatened, candidate animal species with occurrences on or near currently enrolled CRP lands in the U.S., from the GIS Analysis as described in report Section 2.

5) **Table 5** – FSA Table 5 Non-CRP GIS ETC Animal Species List.xlsx

   This table lists all federally listed endangered, threatened, candidate animal species with occurrences on or near non-CRP croplands in the U.S., from the GIS Analysis as described in report Section 2.

6.0 Metadata Appendices

Appendix 6.1: Program-Specific Data Gaps and Sensitivity Notes

The table below contains known Element Occurrence data gapsthat natural heritage member programs have provided to NatureServe during the regular data exchange cycle as well as any sensitivity notes related to this analysis. In addition to the overall data completeness issues noted above, this table documents other data that are known to be missing in NatureServe's Central Databases and the EO dataset used in this analysis. Fields that are gray mean that there are no gaps in a state's documentation that was provided to NatureServe during our most recent exchange that apply to this dataset; however, it does not necessarily mean that no data gaps exist. If there is any question as to the completeness of data in a particular area of a state, the appropriate member program can be contacted directly for further information.

If not mentioned specifically in the table, it is also generally true that location data is missing for many tribal lands, and for most marine species.

Program	Taxonomic Completeness/Data Sensitivity Notes	Geographic Completeness/Data Sensitivity Notes
AK		
AL	Vertebrate Animals: All currently accepted vertebrate species native to Alabama in the following taxonomic groups: mammals, birds, reptiles, amphibians, and freshwater fishes; selected marine fishes; selected native subspecies and populations including all those listed under the United States Endangered Species Act; selected exotic species and subspecies. Invertebrate Animals: All currently accepted species native to Alabama in the following taxonomic groups: freshwater mussels, freshwater and terrestrial snails, crayfishes, tiger beetles, all cave obligate species, and all those listed under the United States Endangered Species Act. Selected other species and subspecies from the following taxonomic groups: fairy, clam, and tadpole shrimps; butterflies and skippers; giant silkworm and royal moths; sphinx moths; Notodontid Moths; underwing moths; Papaipema moths; tiger moths; stoneflies; grasshoppers; mayflies; dragonflies and damselflies; caddisflies; worms; selected exotic species and subspecies.	
AR		No known gaps.
AZ	Invertebrate animals: Tracked species consist mostly of talus & spring snails, and several others. Fish: Only native species are tracked. Due to sensitivity concerns, NatureServe's copy of AZ Element Occurrence data has been fuzzed against a 1 square mile grid.	Barry M. Goldwater Range, DOD Air Force, SW AZ, Needs inventory Yuma Proving Ground, DOD Army, SW AZ, Needs Inventory Fort Huachuca, DOD Army, S AZ, Needs Inventory Native American Lands, all of state except SE, Needs Inventory Due to sensitivity concerns, NatureServe's copy of AZ Element Occurrence data has been fuzzed against a 1 square mile grid.
CA		

Program	Taxonomic Completeness/Data Sensitivity Notes	Geographic Completeness/Data Sensitivity Notes
CO	Do not track EOs in the following groups: Taxon_Rank_Name: Class Taxon_Rank_Value: Cephalaspidomorphi Taxon_Rank_Value: Elasmobranchiomorphi Taxon_Rank_Value: Myxin	No data for Navajo Nation. Likely other data gaps but hard to quantify; not all counties have been thoroughly inventoried.
CT		
DE		
FL	FNAI tracks vertebrates (amphibians, reptiles, fish, birds, and mammals), and invertebrates. All species federally listed as threatened or endangered are included. With the same exception, all NatureServe G1 and G2-ranked species are tracked, although some elements with questionable taxonomic status may be tracked under alternative names. Most Florida state-listed threatened and endangered species are tracked. All state listed (FFWCC) animal species are tracked, excluding the sei, fin, humpback, and sperm whales. Due to historical priorities and FNAI program resources, the invertebrate and fish (particularly marine and estuarine) components of biodiversity are less well represented than are the other element categories.	The inventory includes truly statewide coverage of both public and private lands. Some areas which have not been as thoroughly surveyed or researched due to access restrictions include some corporate timberlands, primarily across north Florida, and several large (over 10,000 acres) private ranches, mostly in central Florida. Aquatic areas in general, and in particular marine and estuarine habitats, have not been as extensively surveyed due in part to the historical mission of FNAI and a lack of funding support for work in these areas.
GA		
IA		
ID	1) The IDCDC tracks site-specific information on invertebrates (freshwater and terrestrial), and vertebrates. Exceptions are noted below. 2) The IDCDC tracks site-specific information on all federally listed Threatened, Endangered, Proposed, and Candidate species EXCEPT grizzly bear, woodland caribou, gray wolf, chinook salmon, steelhead, and bull trout. Gray wolf polygons are tracked based on wolf pack activity and on the movements of collared individuals. 3) The IDCDC tracks site-specific information on all State of Idaho Threatened and Endangered species EXCEPT fishes. For almost all animal species, locations are tracked as point observations only. These observations are converted to rudimentary EO polygons by NatureServe by appying a 3 meter radius buffer, but separation distances and locational uncertainty are not applied as in standard EO methodology. One result is that the number of EO records will be higher because there is no grouping of multiple observations of a single species in close proximity into single EO records.	In general, there are no geographic gaps except for a core area of wilderness in eastern Idaho County and extreme northern Lemhi County which is inconveniently accessed and poorly surveyed for most species that might occur there.
IL	1) Only track species on Illinois' official list of Endangered and Threatened Species, which includes any federally listed species that occur in the state. 2) Have no known major taxonomic data gaps for listed species.	No known major geographic data gaps.
IN		No known geographic data gaps.

Program	Taxonomic Completeness/Data Sensitivity Notes	Geographic Completeness/Data Sensitivity Notes
KS		Large areas of private land throughout the state have never been surveyed. Many publicly-owned lands also have not been surveyed (Corps of Engineers, Kansas Dept. of Wildlife and Parks).
KY		Limited access to much of Ft. Campbell military installation (~500ha in SW-Trigg, Christian Counties).
LA		No known geographic gaps within the state.
MA		
MD	Fish: Primarily freshwater fish.	
ME		
MI		
MN	The only federal or state listed species MN does not maintain EOs for is Gray Wolf.	No known geographic data gaps.
MO		
MS	Only track certain invertebrates. Tracked invertebrates are mainly mussels.	
MT	EO data are tracked for all imperiled (G1/T1 - G2/T2) species and all federally Threatened and Endangered Species found within Montana when data are available. EO data for Gray Wolf, Grizzly Bear, and Bull Trout may not be suitable for some analyses because it represents state range and not individual populations. For some animal species, locations are tracked as point observations only. These observations are converted to rudimentary EO polygons by NatureServe by appying a 3 meter radius buffer, but separation distances and locational uncertainty are not applied as in standard EO methodology. One result is that the number of EO records will be higher because there is no grouping of multiple overvations of a single species in close proximity into single EO records.	In general, data are state-wide. However, there are some areas of the state where data are sparse. There are several large parcels of tribal lands scattered across the state, and data are often not available from these areas. Also, some areas have high concentrations of private lands where access to land for data collection is restricted.
NC	Imperiled G1/G2: Some species are not tracked because: 1) all occurrences are protected 2) of taxomonic questions 3) of uncertain documentation 4) they are not native to the State 5) they are not yet rare enough 6) they are poorly known All extant, non-accidental federal E/T species are tracked.	The North Carolina Natural Heritage Program conducts county-by-county inventories. The following counties (out of 100) have not had systematic inventories: Cherokee, Clay, Graham, Swain, Mitchell, Alexander, Wilkes, Caswell, Tyrrell, Dare, Union The following counties (out of 100) have inventories in progress: Madison, Macon, Alleghany, Anson, Stanly, Robeson
ND	ND Natural Heritage Inventory tracks all imperiled or federally threatened and endangered species listed for North Dakota. NDNHI also tracks species found on the NDNHI Species of Concern List and the ND Game and Fish Department's Species of Conservation Priority List. There are no specific taxonomic exclusions to mention.	There are no known geographic gaps to mention.
NE		No known gaps.
NH		Various large private timber companies' lands have not been inventoried in Coos County.

Program	Taxonomic Completeness/Data Sensitivity Notes	Geographic Completeness/Data Sensitivity Notes
NJ		
NM	None known.	Because of data access constraints, EOs on Native American Tribal lands are not available through NatureServe (other than those provided by the Navajo Nation Natural Heritage Program). EOs on the lands of White Sands Missile Range and Fort Bliss Military Reservation are also not available through NatureServe.
NN	NNHP tracks all the Federally Threatened and Endangered species within the jurisdiction.	The Navajo Nation may cause some data gaps for Utah, Arizona, and New Mexico. The Hopi reservation within the boundaries of Navajo Nation, but does not constitute an overlap of area of responsibility.
NV		Bureau of Land Management lands sold to private developers in the Las Vegas Valley through the Southern Nevada Public Lands Management Act are not up to date. These are very small parcels (relatively speaking). In general there are no large gaps in our geographic data.
NY	All imperiled (G1/T1 - G2/T2) species are tracked except for some SX, SNA and SNR ranked species. All federally Threatened & Endangered Species are tracked except for some SX species, and for marine mammals and sea turtles which occur in NY offshore waters but do not have definable EOs. All state/province Threatened & Endangered Species are tracked except for some SX, SNA and SNR ranked species. The following invertebrate groups are tracked with EOs: land snails, freshwater mussels, crayfish, mayflies, dragonflies and damselflies, beetles (tiger and burying), moths, butterflies and skippers.	
OH	Do not necessarily track all G1/G2 species.	No known gaps.
OK		
OR	There are some species that have been assigned a G1/G2/T1/T2 for which Oregon may not feel confident about its rank, and these are placed on a review list. Oregon may not have EOs available for these, but do keep and retain information in manual files. Do not track marine mammals or those sea birds that do not actually land within the state (e.g. short-tailed albatross).	The following lands need inventory: Land Parcel Name; Owner; General location in state/province); Size (ha) Warm Springs Reservation; Confederated Tribe of the Warm Springs Nation; N central OR; 260618 Umatilla Reservation; Umatilla; NE OR; 70000 Grande Ronde Reservation; Confederated Tribes of the Grande Ronde; NW OR; 4800 Siletz Reservation; Siletz; Central coast; 2760 Burns Paiute Reservation; Burns Paiute; SE Oregon; 4600 Coquille Reservation; Coquille; SW Oregon; 2763 Other Indian Reservations; Various Indian Tribes or Confederations; Statewide; 2000 Private lands; Various; Statewide
PA		

Program	Taxonomic Completeness/Data Sensitivity Notes	Geographic Completeness/Data Sensitivity Notes
RI	The RINHP currently does not track the following federal status species: Carettacaretta (Atlantic Loggerhead), Cheloniamydasmydas (Atlantic Green Turtle), and Lepidochelyskempii (Atlantic Ridley).	
SC	All imperiled (G1/T1 - G2/T2) species: The majority of the species not tracked fall in the invertebrate category, where SC has not had experts in the program. All federally Threatened & Endangered Species: There are a few species (Puma concolor, Canis lupus) which are viewed as extirpated and are not tracked. There are also a few species (Nicrophorusamericanus, Balaenaglacialis) that were apparently overlooked in the past and not added to the database. All state/province Threatened & Endangered Species: Some species are tracked under different names than what is listed in the regulations, due to taxonomic changes that have not been corrected in the regulations.	A comprehensive survey of the South Carolina has never been done. The majority of the gaps fall on private lands, but there is some need for more complete surveys on public lands as well.
SD		Private land (statewide) and tribal lands (west and central) are inadequately surveyed. No statewide inventories have been done.
TN		Geographic gaps exist in the dataset for two of the national parks located in Tennessee. While some older data are mapped for these Parks, the Division of Natural Areas is aware of more recent observational data that the Park Service has not released because of data sensitivity. These parks are: 1. Big South Fork National River and Recreation Area located on the northern portion of the Cumberland Plateau in Tennessee, encompassing 195 square miles. 2. Great Smoky Mountains National Park located in southeastern Tennessee, encompassing 800 square miles in Tennessee and North Carolina.
TV	Records from TVA known to be duplicates of other program records in the same jurisdiction have been excluded.	Records from TVA known to be duplicates of other program records in the same jurisdiction have been excluded.
TX		Has extensive areas of privately owned land that have not been surveyed.
UT		No data for Tribal Lands.
VA		
VT		
WA	Animal data for WA was not available through NatureServe at the time of this analysis. Animal location data is managed by a separate agency in the state – the Washington Department of Fish and Wildlife - that is not a part of NatureServe's network and does not follow the same methodology. While this gap can sometimes be filled, it was not possible within the timeframe of the project. Alternatively, information can be obtained directly from the Washington Dept. of Fish and Wildlife (http://wdfw.wa.gov/conservation/phs/maps_data/).	Animal data for WA was not available through NatureServe at the time of this analysis. Animal location data is managed by a separate agency in the state – the Washington Department of Fish and Wildlife - that is not a part of NatureServe's network and does not follow the same methodology. While this gap can sometimes be filled, it was not possible within the timeframe of the project. Alternatively, information can be obtained directly from the Washington Dept. of Fish and Wildlife (http://wdfw.wa.gov/conservation/phs/maps_data/).

Program	Taxonomic Completeness/Data Sensitivity Notes	Geographic Completeness/Data Sensitivity Notes
WI	Vertebrates: Endangered, Threatened, or Special Concern are tracked. Invertebrates: Endangered, Threatened, or Special Concern are tracked. Fish: Endangered, Threatened, or Special Concern are tracked.	Private Land and Tribal Land inventories incomplete.
WV		Data gaps include: private land parcel, multiple owner, in western half of state, ha size of 3,650,000.
WY	For animals, true EO data is only tracked for federal status species. For all other animal species, locations are tracked as point observations only. These observations are converted to rudimentary EO polygons by NatureServe by appying a 3 meter radius buffer, but separation distances and locational uncertainty are not applied as in standard EO methodology. One result is that the number of EO records will be higher because there is no grouping of multiple observations of a single species in close proximity into single EO records. Imperiled species: There are some that may not be tracked. USFS and BLM "sensitive" species are tracked. Vertebrates: Only T&E species are tracked. No Invertebrates or fish are tracked.	Wind River meridian (T034N-T044N and R094W-R106W) - no access. Private lands, various townships, Mostly the eastern third of state, restricted access.

Appendix 6.2: GIS Analysis Results – Field Definitions

Definitions for the data fields provided in the results tables from report Section 5 are described below. (Not all fields are necessarily included in all tables)

Field Name	Definition
EO Total	The total number of Element Occurrences for the species that intersected with CRP or Non-CRP lands.
Element Global ID	Unique identifier code for the species in NatureServe's central database.
USFWS Synonym	U.S. FWS Synonym Names - Synonym names that the U.S. Fish and Wildlife Service has been known to use for the species.
Interpreted USESA Code	The current status of the taxon under the U.S. Endangered Species Act (USESA) as interpreted by NatureServe Central Sciences. This field does not contain the official status (if there is one) assigned by the regulating agency - that status is recorded in USESA Status. Interpreted status is determined from the taxonomic relationship of the Element to a taxon having USESA status, or its relationship to geopolitical or administratively defined members of a taxon having USESA status. The taxonomic relationships between species and their infraspecific taxa may determine whether a taxon has federal protection. Section 17.11(g) of the Endangered Species Act states, "the listing of a particular taxon includes all lower taxonomic units." Also, if an infraspecific taxon or population has federal status, then by default, some part of the species has federal protection. In cases where all infraspecific taxa of a species have status, the species also has status by default even if this status is not the same everywhere it occurs. Thus, an Element may have an interpreted USESA status value even though it may not be specifically named in the Federal Register.
Global Rank	The NatureServe Conservation Status of a species from a global (i.e., rangewide) perspective, characterizing the relative rarity or imperilment of the species or community. Definitions for specific ranks and more details about ranking can be found here: http://www.natureserve.org/explorer/ranking.htm
Global Common Name	The common name of an element adopted for use by NatureServe. Note: Names for some groups may be incomplete. Many elements have several common names, often in different languages. Spellings of common names follow no standard conventions and are not systematically edited.
Global Scientific Name	The standard global (i.e., rangewide) scientific name (genus and species) adopted for use by the NatureServe Central Databases based on selected standard taxonomic references.
Name Level	Indicates if the Global Scientific Name represents a full species or an infrataxa species.
Major Group 1	The common name of the major taxonomic group of the species adopted for use by NatureServe.
Major Group 2	The common name of the major taxonomic group of the species adopted for use by NatureServe; these are more finely divided groups that are used on NatureServe Explorer.
Reporting Group	The common name of the coarse taxonomic group the species belongs to used for the charts included in the report; some of these groups are broader than the groups in the Major Group 1 and Major Group 2 fields.

Field Name	Definition
Last Observed Null Flag	This field indicates if there are one or more location records for a species in the summarized results that do not have a Last Observed value. If the “Last Observed Year” field is blank, this field will always be "Y" indicating that all of the underlying Element Occurrences representing the species in the results do not have a Last Observed value. If the “Last Observed Year” field is NOT blank, and this field has a "Y" value, that means there are some Element Occurrences representing the species in the results s that do have a Last Observed value, and some that do not, and the value in “Last Observed Year” is the most recent date out of the ones that have one. This is helpful to know as an indicator that despite whatever the “Last Observed Year” value is, there are other records that do not have dates associated with them that could possibly be more recent than the year reported. For example, if there were 5 Element Occurrences that intersected with CRP lands for species in the results, and one has a Last Observed Year of 1905, and the other 4 have a blank Last Observed Date, there's a possibility one of those 4 blank records might be more recent than 1905. In this example, “Last Observed Year” would be "1905" and “Last Observed Null Flag” would be "Y".
Last Observed Year	The most recent year that the species was last observed to be extant based on all of the Element Occurrences in the analysis that intersected with CRP or Non-CRP lands.
Rounded Global Rank	The NatureServe Conservation Status (Global Rank) rounded to a single character. This value is calculated from the “Global Rank” field using a rounding algorithm to systematically produce conservation status values that are easier to interpret and summarize.
USESA Code	U.S. Endangered Species Act Status Code - Value that indicates the current status of the taxon as designated or proposed by the U.S. Fish and Wildlife Service (USFWS), and as reported in the U.S. Federal Register in accordance with the U.S. Endangered Species Act of 1973, as amended. Statuses include candidates for listing as reported by either of these agencies in the U.S. Federal Register. Definitions for specific status codes and more details can be found in the appendix of the report, or here: http://www.natureserve.org/explorer/statusus.htm. USESA status codes go in this field when the taxonomic treatment of the listed species is the same between NatureServe and U.S. FWS. When there is some type of taxonomic difference, or a status applies to certain geographic areas, the USESA status may appear in the “Interpreted USESA Code” field instead.
USESA Comments	Any comments necessary to explain the designated or interpreted status of the taxon under the U.S. Endangered Species Act (USESA).
USESA Date	U.S. Endangered Species Act Status Date - Publication date of the Federal Register notice containing the status of the taxon designated under the U.S. Endangered Species Act (USESA) (entered in the associated “USESA Code” field). Dates are entered only for taxa and populations that are specifically named in the Federal Register. When a taxon has multiple statuses, the date that corresponds to the first status that appears (not necessarily the most recent action) is entered. The USESA Comments field is used to provide a detailed explanation of multiple statuses and to list the dates associated with the other portions of the multiple statuses.
Extirpated/Historic Flag	Indicates if all available location records for the species in the resultsfor CRP or Non-CRP lands are flagged as historic or extirpated populations (independent of “Last Observed Year”).
NatureServe Explorer Link	A direct “deep link” to the full report, if available, for the species on the NatureServe Explorer website. These reports contain additional information, maps, and images about species that users may find useful. IMPORTANT NOTE: NatureServe Explorer only gets refreshed every 4 months, so if records are deleted or new records are added in between refreshes, they may not appear on the site. Also, these links are based on the “Element Global ID” value of a species, and if that ID changes over time, the links may get broken. For these reasons, there may be some records in this dataset which are not on NatureServe Explorer, and this link may not work. The format to create these links if any need to be repaired is as follows: http://www.natureserve.org/explorer/servlet/NatureServe?searchSpeciesUid=ELEMENT_GLOBAL.2.[insert Element Global ID here]

Appendix 6.3: GIS Analysis Results – Non-CRP Layer Criteria

As described in Section 2.2, one of the first steps in creating the Non-CRP croplands layer used in GIS Analysis 2 was calculating a new raster from the national Croplands Data Layer (CDL) containing only pixels defined as "croplands" for the purposes of this analysis (where all other pixels were set to "No Data"). Below is a list of all of the classes from the CDL that were included as croplands, and those that were excluded.

Included as Crops

(Note: Buckwheat and Chick Peas did not appear in the final layer used in the analysis because these classes were eliminated after the layer was masked against the buffered CRP lands layer):

Alfalfa
Almonds
Apples
Apricots
Aquaculture
Asparagus
Barley
Blueberries
Broccoli
Buckwheat
Cabbage
Camelina
Caneberries
Canola
Cantaloupes
Carrots
Cauliflower
Celery
Cherries
Chick Peas
Christmas Trees
Citrus
Clover/Wildflowers
Corn
Cotton
Cranberries
Cucumbers
Dbl Crop Barley/Corn
Dbl Crop Barley/Sorghum
Dbl Crop Barley/Soybeans
Dbl Crop Corn/Soybeans
Dbl Crop Durum Wht/Sorghum
Dbl Crop Lettuce/Barley
Dbl Crop Lettuce/Cantaloupe
Dbl Crop Lettuce/Cotton
Dbl Crop Lettuce/Durum Wht
Dbl Crop Oats/Corn
Dbl Crop Soybeans/Cotton
Dbl Crop Soybeans/Oats
Dbl Crop WinWht/Corn
Dbl Crop WinWht/Cotton
Dbl Crop WinWht/Sorghum
Dbl Crop WinWht/Soybeans
Dry Beans
Durum Wheat
Eggplants
Flaxseed
Garlic
Gourds
Grapes
Greens
Herbs
Honeydew Melons
Hops
Lentils
Lettuce
Millet
Mint
MiscVegs& Fruits
Mustard
Nectarines
Oats
Olives
Onions
Oranges
Other Crops
Other Small Grains
Other Tree Crops
Peaches
Peanuts
Pears
Peas
Pecans
Peppers
Pistachios
Plums
Pomegranates
Pop or Orn Corn
Potatoes
Prunes
Pumpkins
Radishes
Rape Seed
Rice
Rye
Safflower
Sod/Grass Seed
Sorghum
Soybeans
Speltz
Spring Wheat
Squash
Strawberries
Sugarbeets
Sugarcane
Sunflower
Sweet Corn
Sweet Potatoes
Switchgrass
Tobacco
Tomatoes
Triticale
Turnips
Vetch
Walnuts
Watermelons
Winter Wheat

Excluded, but potentially cropland:

(Note - extensive areas of the country were covered by these classes, which would have made vectorization of the raster problematic within the timeframe of the project.)

Fallow/Idle Cropland
Other Hay/Non Alfalfa
Pasture/Grass
Pasture/Hay

Excluded; not considered as cropland:

Background
Barren
Clouds/No Data
Deciduous Forest
Developed
Developed/High Intensity
Developed/Low Intensity
Developed/Med Intensity
Developed/Open Space
Evergreen Forest
Forest
Grassland Herbaceous
Herbaceous Wetlands
Mixed Forest
Nonag/Undefined
Open Water
Perennial Ice/Snow
Shrubland
Water
Wetlands
Woody Wetlands

Appendix 6.4: Conservation Status Definitions

Global Conservation Status Ranks

Listed below are definitions for interpreting the global (i.e., range-wide) conservation status ranks. Global ranks are assigned by NatureServe scientists, and more information about the ranks and ranking methodology can be found here: http://www.natureserve.org/explorer/ranking.htm#interpret.

Global Conservation Status Rank Definitions

Rank	Definition
GX	Presumed Extinct (species)— Not located despite intensive searches and virtually no likelihood of rediscovery.
GH	Possibly Extinct (species)—Known from only historical occurrences but still some hope of rediscovery. There is evidence that the species may be extinct, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species has been searched for unsuccessfully, but not thoroughly enough to presume that it is extinct or eliminated throughout its range.
G1	Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled—At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.
G3	Vulnerable—At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.
G4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure—Common; widespread and abundant.

Variant Global Ranks

Rank	Definition
G#G#	Range Rank-A numeric range rank (e.g., G2G3, G1G3) is used to indicate uncertainty about the exact status of a taxon. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible (when the range of uncertainty is three consecutive ranks or less), a range rank (e.g., G2G3) should be used to delineate the limits (range) of uncertainty.

Rank	Definition
GNA	Not Applicable-A conservation status rank is not applicable because the species is not a suitable target for conservation activities. A global conservation status rank may be not applicable for several reasons, related to its relevance as a conservation target. In such cases, typically the species is a hybrid without conservation value, of domestic origin, or non-native.
GNR	Unranked-Global rank not yet assessed.

Rank Qualifiers

Rank	Definition
?	Inexact Numeric Rank—Denotes inexact numeric rank
Q	Questionable taxonomy that may reduce conservation priority. Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.
C	Captive or Cultivated Only—Taxon at present is extinct in the wild across their entire native range but is extant in cultivation, in captivity, as a naturalized population (or populations) outside their native range, or as a reintroduced population not yet established. Possible ranks are GXC or GHC.

Infraspecific Taxon Ranks

Rank	Definition
T#	Infraspecific Taxon (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species (e.g., a G1T2 subrank should not occur). A vertebrate animal population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T rank to denote the taxon's informal taxonomic status.

Rounded Global Conservation Status Ranks

Rounded Global Ranks are generated by an algorithm in the database system. In general, the rounding algorithm eliminates range ranks, strips the qualifiers "?", "C", and "Q" off the G_RANK, and focuses on the "T" subrank for infraspecific taxa.

Appendix 6.5: United States Federal Status Listing Process and Definitions

The U.S. Fish and Wildlife Service (USFWS) and the U.S. National Marine Fisheries Service designate and/or propose federal status in accordance with the U.S. Endangered Species Act of 1973, as amended (U.S. ESA). Plant and animal species, subspecies (including plant varieties), and vertebrate populations are considered for Endangered or Threatened status according to the criteria established under the U.S. ESA.

Proposals and determinations to add taxa or populations to the Lists of Endangered and Threatened Wildlife and Plants are published in the Federal Register. Additionally, USFWS periodically publishes a Notice of Review in the Federal Register that presents an updated list of plant and animal taxa that are regarded as candidates or proposed for possible addition to the Lists of Endangered and Threatened Wildlife and Plants.

How NatureServe manages U.S. Federal Status Data

The U.S. Federal Status Date represents the date of publication in the Federal Register of notification of an official status for a taxon or population. Dates appear only for taxa and populations which are specifically named in a Federal Register Notice of Review Table or in the section of a Federal Register Proposed or Final Rule that proposes or declares an amendment to 50 CFR Part 17 Section 11 or 12 (i.e., changes to the Lists of Endangered and Threatened Wildlife and Plants).

Dates represent:

For listed endangered and threatened taxa and populations: the date recorded in the USESA Date field is the date of publication of the Federal Register "Final Rule" for the taxon or population. For proposed taxa and populations: the date of publication of the most recent Federal Register "Proposed Rule" for the taxon or population. For candidate taxa and populations: the date of publication of the most recent "Notice of Reclassification" or "Notice of Review" in which the candidate appears.

NatureServe's Central Database is updated by science staff with changes in status due to proposals and determinations to add taxa to the Lists of Endangered and Threatened Wildlife and Plants within two weeks of publication in the Federal Register. Addition and removal of candidates in Notices of Review are entered within four weeks of their publication.

Status Due to Taxonomic Relationship (Values in* INTERPRETED USESA Status *but not in* U.S. Endangered Species Act Status*)

The taxonomic relationships between species and their infraspecific taxa may determine whether a taxon has federal protection. Section 17.11(g) of the U. S. ESA states, "the listing of a particular taxon includes all lower taxonomic units." Also, if an infraspecific

taxon or population has federal status, then by default, some part of the species has federal protection. Some taxa show values indicating U.S. Federal Status even though the element may not be specifically named in the Federal Register. Where status is implied due to a taxonomic relationship alone, the status abbreviation appears only in theInterpreted USESA Status field but not in the USESA Code field and no date of listing is given.

Nomenclature for Taxa and Populations with U.S. Federal Status

For most species that have U.S. Federal Status, any available distribution, conservation, and management information is maintained in records under the same scientific name as the one used by USFWS (and printed in the Federal Register). For animal subspecies and populations that have U.S. Federal Status, most of this information is maintained in the species record associated with the subspecies or population. Where the names used by USFWS and NatureServe differ, data may be found using either name.

Basic U.S. Federal Status Designations and Definitions

Abbreviation	U.S. Federal Status
LE	Listed endangered
LT	Listed threatened
PE	Proposed endangered
PT	Proposed threatened
C	Candidate
PDL	Proposed for delisting
SAE or SAT	Listed endangered or threatened because of similarity of appearance
XE	Essential experimental population
XN	Experimental nonessential population
Combination values	The taxon has one status currently, but a more recent proposal has been made to change that status with no final action yet published. For example, “LE, PDL” indicates that the species is currently listed as endangered, but has been proposed for delisting.

Abbreviation	U.S. Federal Status
Values in Interpreted USESA Status Code field *but not in* USESA Code Field	The taxon itself is not named in the Federal Register as having federal status; however, it does have federal status as a result of its taxonomic relationship to a named entity. For example, if a species is federally listed with endangered status, then by default, all of its recognized subspecies also have endangered status. The subspecies in this example would have the value "LE" under the Interpreted USESA field. Likewise, if all of a species' infraspecific taxa (worldwide) have the same federal status, then that status appears in the record for the "full" species as well. In this case, if the taxon at the species level is not mentioned in the Federal Register, the status appears in Interpreted USESA in that record.
PS	Indicates "partial status" - status in only a portion of the species' range and only appears in Interpreted USESA. Typically indicated in a "full" species record where an infraspecific taxon or population has federal status, but the entire species does not.
Null value	Usually indicates that the taxon does not have any federal status. However, because of potential lag time between publication in the Federal Register and entry in NatureServe's database, some taxa may have a status that does not yet appear.