California Amphibian and Reptile Species of Future Concern: Conservation and Climate Change

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Bufo exsul, the Black Toad

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Abstract

Ecological niche models for all 153 reptile and amphibian species in California were built using Maxent to forecast the distribution of climatically suitable habitat under four future climate scenarios and eleven general circulation models for 2050. Risk was measured as both the percentage of currently occupied localities remaining suitable in the future (Point Ranking), and the change in suitable area within a minimum convex polygon of currently occupied localities (Area Ranking). The Point Ranking is based on the Distribution Trend metric from the Amphibian and Reptile Species of Special Concern (ARSSC) document and was designed to measure historical habitat loss. The Area Ranking metric is from NatureServe's Climate Change Vulnerability Index, and the results from this study can be directly incorporated into other projects using that assessment tool. Depending on ranking metric, approximately 60-75% of reptile and amphibian species were predicted to experience little (<20%) direct loss of climatically suitable habitat by 2050. Reductions in climatic habitat suitability were predicted to be largest for reptiles in the southern mountains and deserts, with reductions for amphibians occurring statewide. The species ranked highest for risk include many that are already of conservation concern and tend to be endemic species with small ranges, such as the black toad, *Bufo exsul*. The modeled predictions for future habitat suitability presented in this study can be used to inform conservation of California's reptile and amphibian diversity under climate change, particularly by prioritizing species and regions for monitoring and additional research.

Introduction

A significant, recent development in both the academic and resource management communities is the acknowledgement that climate change may have a profound effect on species, including amphibians and reptiles (Araujo et al. 2006, Blaustein et al. 2010, Milanovich et al. 2010, Sinervo et al. 2010, Hof et al. 2011, Moreno-Rueda et al. 2011). Basic information and guidance related to climate change is therefore essential to conservation efforts. The California Department of Fish and Wildlife (CDFW) partnered with the University of California, Davis for this climate change analysis to better inform the community and taxon level management decisions made by CDFW and other resource managers.

Ecological niche models, also known as species distribution models, are one tool for assessing conservation risk under climate change. This approach combines geographical information on species occurrences with climatic conditions at those sites. Models of the association between occurrence and climate can then be projected across a range of potential future climate conditions. These projections show how the distribution of climatically suitable habitat may shift in the future, allowing managers to evaluate the potential for habitat loss and degradation due to climate change. The methods used to build and evaluate ecological niche models are developing rapidly (Elith and Leathwick 2009). Although current modeling methods have limitations and should be interpreted cautiously, they are often the only quantitative tools available for making conservation decisions in the absence of detailed field ecological data. This may be particularly true in the case of reptiles and amphibians, which are often rare, cryptic, and poorly studied.

Here we assessed the conservation risk posed by climate change for all 153 species of reptiles and amphibians in California. We used the species distribution modeling program Maxent (Phillips et al. 2006) to build models based on rangewide, presence-only locality data, which were then projected onto different climate scenarios for 2050. From these projections, we calculated the percentage of habitat predicted to remain suitable in the future, and identified the species most and least vulnerable to climate shifting away from conditions that we know they can currently tolerate. These results provide a starting point for conserving and managing California's reptile and amphibian diversity under climate change.

Methods

Reptile and Amphibian Species
We assessed future climate change impacts at the species level. The draft California Amphibian and Reptile Species of Special Concern (ARSSC 2013) document identified 218 amphibian and reptile taxa that occur in California, including species, subspecies, and distinct population segments. These 218 taxa translate into 153 species-level entities that were assessed in the present study (Appendix III).

Climate Data
Nineteen bioclimatic variables at 1 km resolution were downloaded from Worldclim (www.worldclim.org) for current climate (representative of 1950-2000). Future climate data were obtained from the fifth phase of the Coupled Model Intercomparison Project (CMIP5, http://cmip-pcmdi.llnl.gov/cmip5/). We used data from eleven general circulation models (GCMs) projected into 2050 under four representative concentration pathways (RCPs; Tables 1&2). GCMs are similar to the models used by meteorologists to forecast weather, and RCPs are plausible future conditions described by different greenhouse gas concentration trajectories (Moss et al. 2008). Thus, GCMs are used to model how climate will respond to different RCPs. RCPs were developed as a part of the forthcoming 2014 Intergovernmental Panel on Climate Change Fifth Assessment Report, and are intended to replace the emissions scenarios (A2, B1, etc.) used in previous work. Many GCMs exist, and GCMs give different predictions even under the same RCP. This could be for many reasons, such as different GCMs emphasizing particular phenomena like cloud cover more than others. Climate modelers are actively working to update GCMs and predictions under the RCPs and make these datasets publicly available. For this analysis, choice of GCM was based on data availability at the beginning of the study. We downscaled GCMs from CMIP5 by computing the difference between the average climate for modeled future climate conditions and the current climate computed by the same GCM. We then used smooth splines to interpolate these differences to a higher spatial resolution. Finally, we applied these differences to a high-resolution estimate of the current climate such that all datasets are bias-corrected in the same manner (Leemans and Solomon 1993).

Table 1. Representative Concentration Pathways (RCPs, after Table 1 in Moss et al. 2008)

Name	Radiative Forcing in ~ Year 2100	CO_2-equivalent Concentration in ~ Year 2100
RCP 8.5	>8.5 Watts/m^2	> ~1370 ppm
RCP 6.0	~6 Watts/m^2	~850 ppm
RCP 4.5	~4.5 Watts/m^2	~650 ppm
RCP 2.6	peak at ~3 Watts/m^2 then decline	peak at ~490 ppm before 2100 then decline

Table 2. General Circulation Models (GCMs) used in this study

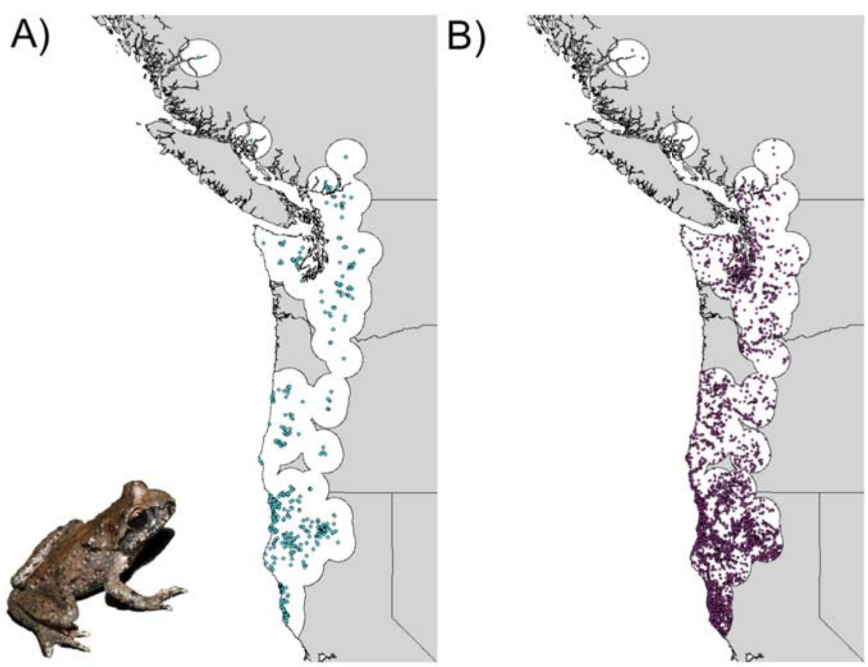
Model	Institution
BCC-CSM1-1	Beijing Climate Center, China Meteorological Administration
CanESM2	Canadian Centre for Climate Modeling and Analysis
GISS-E2-R	NASA Goddard Institute for Space Studies
HadGEM2-A0	Met Office Hadley Centre
HadGEM2-ES	Met Office Hadley Centre
IPSL-CM5A-LR	Institut Pierre-Simon Laplace
MIROC5	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology
MIROC-ESM-CHEM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MIROC-ESM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MRI-CGCM3	Meteorological Research Institute
NorESM1-M	Norwegian Climate Centre

Occurrence and Background Locality Data

We created a data set of localities for all 153 reptile and amphibian species identified in the ARSSC that occur in California. Our dataset includes the entire range of each species inside and outside of California. We first generated a list of synonyms to search for each species to capture name changes and taxonomic rearrangements, which have become relatively common in these groups (e.g., approximately 30% of the taxa in the 1994 ARSSC underwent name changes by 2013). We then downloaded locality data from the Global Biodiversity Information Facility (www.gbif.org) and HerpNet (www.herpnet.org), which are databases of museum specimen collections. We also included the locality data compiled for the ARSSC project (CDFW Biogeographic Information and Observation System dataset ds644). Additional localities were included from the primary literature, particularly for recently described species (e.g., *Contia longicaudae*, Forest Sharp-tailed Snake described in 2010, *Batrachoseps altasierrae*, Greenhorn Mountains Slender Salamander described in 2012). We mapped all of the localities for each species and visually compared them to range maps from field guides, the International Union for Conservation of Nature (www.iucnredlist.org), and the California Wildlife Habitat Relationships project (http://www.dfg.ca.gov/biogeodata/cwhr/). Localities that were clearly outside of described ranges were evaluated for accuracy on a case by case basis, and all verifiable records were retained. In addition, we visually inspected the current climate conditions (mean annual temperature and mean annual precipitation) for all localities. Any obvious outliers in this climate space (e.g., points that were much colder than other points occupied by a species) were evaluated for accuracy. Locality data were trimmed to retain a single record per 1 km^2 because this is the resolution at which climate data were available. Starting from an initial data set of over a million records, our data-cleaning and trimming process resulted in a data set of approximately 120,000 localities. We refer to our locality data as representing current conditions (e.g. as “currently occupied localities”), although it is important to note that our data set includes historic localities, some of which may be extirpated. This is appropriate as long as extirpations were due to factors other than climate change. For example, if a species no longer occurs at a site because it has been lost to urban development or agriculture, we assume that the climate conditions at that site are still suitable and therefore informative for our models. Maps of California and range-wide localities used can be found in Appendix VI.

Ideally, climate conditions at sites where a species is present would be compared to climate conditions at sites where the species is absent. However, documenting absence is difficult, and as a result most multi-species conservation assessments using ecological niche models are based largely on presence data from museum databases. When only presence data is available, conditions at known occupied localities are compared to conditions at background localities. Background localities represent the range of conditions likely available to a species. How to determine the geographic extent of the area over which background localities are sampled is an area of active research (Anderson and Raza 2010, Barbet-Massin et al. 2010). For this study, we used a 50 km buffered area around known occurrences as the geographic extent for each species. Typical methods draw background data randomly from the geographic extent. However, because our locality data are based on haphazard sampling, there are likely spatial biases in how these data were collected. For example, localities along roads are likely overrepresented, whereas those in steep terrain lacking trail access are likely underrepresented. To reduce some of the effects of spatial sampling bias on model results, for each species we chose as background localities all 1x1 km cells that 1) occurred within that species' buffered area and 2) contained an occurrence record for any of the other species—reptile or amphibian—in our data set. This is known as the "target-group background" method (Phillips et al. 2009, Figure 1). The numbers of occurrence and background localities for each species are provided in Appendix III. The number of background records varied by species according to range size (larger buffered areas will include more localities on average for other taxa) and the availability of locality data for other herpetofauna within each species buffered area. Background records were trimmed to retain a single record per 1 km^2 as for the occurrence data.

Figure 1. Example locality data.



A) Occurrence data for Ascaphus truei, *the Tailed Frog, range-wide, trimmed to 1 record per 1x1 km cell. White area represents a 50 km buffer around occurrences. B) Background data for* A. truei *range-wide. Points represent all of the occurrence data for species other than* A. truei *that occur within the buffered (white) area. These species are reptiles and amphibians with at least part of their range in California. Background records were trimmed to 1 per 1x1 km cell. Maps of occurrence data used for each species are in Appendix VI. Frog image used with permission (Gary Nafis, californiaherps.com).*

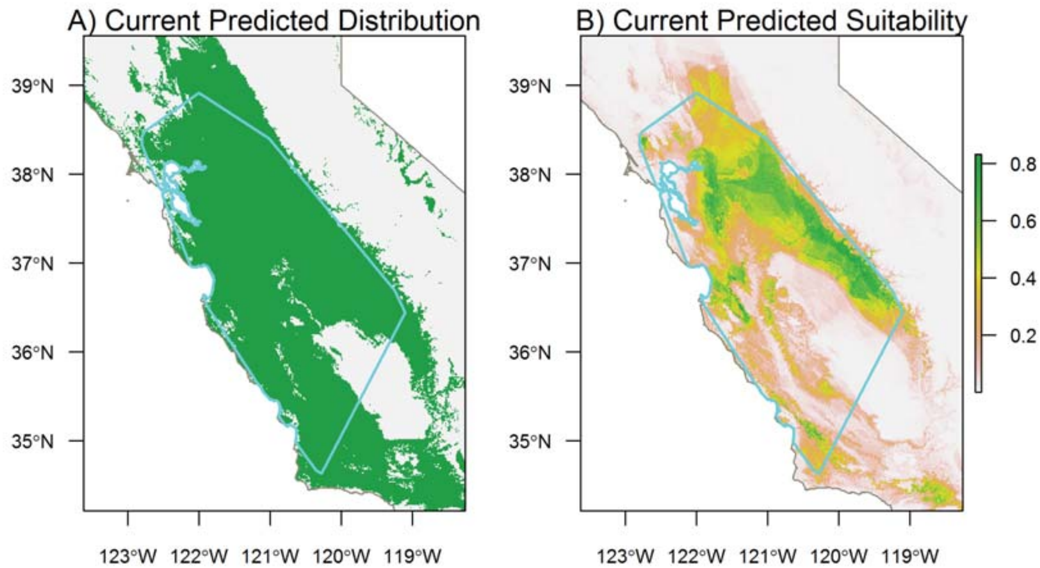
Modeling

We used Maxent (Phillips et al. 2006) to build ecological niche models for each species as implemented via the 'dismo' package in R version 2.15.3 (Hijmans et al. 2013, R Core Team 2013). Range-wide occurrence and background data were used to build models under current climate, and then these models were projected onto future climate predictions for California. We did not use cross-validation metrics such as the area under the receiver operating curve, AUC, to evaluate models, because these approaches have come under increasing scrutiny (e.g. Lobo et al. 2008, Hijmans 2012). Instead, our approach focused on building a single model for each species based on well-curated locality data and constraining model complexity through two main mechanisms: tuning the Beta multiplier and reducing collinearity among climate variables (Warren and Seifert 2011). The Beta multiplier is a parameter in Maxent that controls over-parameterization, which is important because Maxent can fit models that are extremely complex. Overly complex models can perform poorly at prediction because they are too specific to the training data used to build the model. This problem of overfitting can be especially acute in applications such as forecasting responses to climate change which require transferability of models through time. While most users do not alter the default parameter settings in Maxent, we used a procedure developed by Warren and Seifert (2011) for species-specific tuning of the Beta multiplier in order to build models that are appropriately complex. In addition to setting the Beta multiplier parameter for each species, we also used model selection to choose which climate variables to include. For each species, initial models were built with all 19 bioclimatic variables and with Maxent's Beta multiplier varying from 0 to 20. The Sample size corrected Akaike information criterion (AICc) was used to select the best model from this set, and the variable contribution scores from this best model were then used to reduce the number of bioclimatic variables by dropping highly correlated variables (Pearson's correlation > 0.70). We then built another set of models using the trimmed set of climate variables for each species while again varying the Beta multiplier. The end result was a single best model for each species with species-specific Beta multiplier value and species-specific climate layers (Appendix V).

Many conservation applications of ecological niche models require converting model output from a continuous prediction of habitat suitability to a binary prediction of which areas are relatively suitable versus unsuitable. Several different methods have been developed to select threshold values above which the habitat is deemed suitable, though many of these may only be appropriate for models built using presence-absence data (Liu et al. 2005, Liu et al. 2013, Peterson et al. 2010). Choice of threshold is important because it affects the geographic range of predictions and thus conservation assessments (Nenzen and Araujo 2011). We used a threshold value known as the "lowest presence threshold" which is commonly used with presence-only models (Figure 2, Phillips et al. 2006, Pearson et al. 2007, Peterson et al. 2011). The lowest presence threshold is the lowest suitability score predicted from all currently occupied sites. In other words, this approach defines all cells as suitable if they are at least as good as the lowest quality site that the species currently uses. The lowest presence threshold is intuitive and results in no errors of omission (i.e., all known localities are identified as suitable). However, relative to other, less inclusive thresholds, it defines the greatest range of climate conditions as suitable. As a result, the analyses reported here may be more optimistic than analyses where a more conservative threshold is used.

To explore how sensitive our results are to using the lowest presence threshold, we also calculated a threshold-free metric of future shifts in habitat suitability, the anomaly score, which was recently described in a CDFW report on California rare plants (Anacker and Leidholm and 2012). To calculate the anomaly score, the current predicted suitability for each known occurrence was subtracted from the future predicted suitability for that cell, and the average of these differences across all occurrences is the anomaly score. If the mean anomaly score is negative, it indicates an overall reduction in climatic habitat suitability, and vice versa.

Figure 2. Example model outputs for Ambystoma californiense*, the California Tiger Salamander under current climate conditions.*

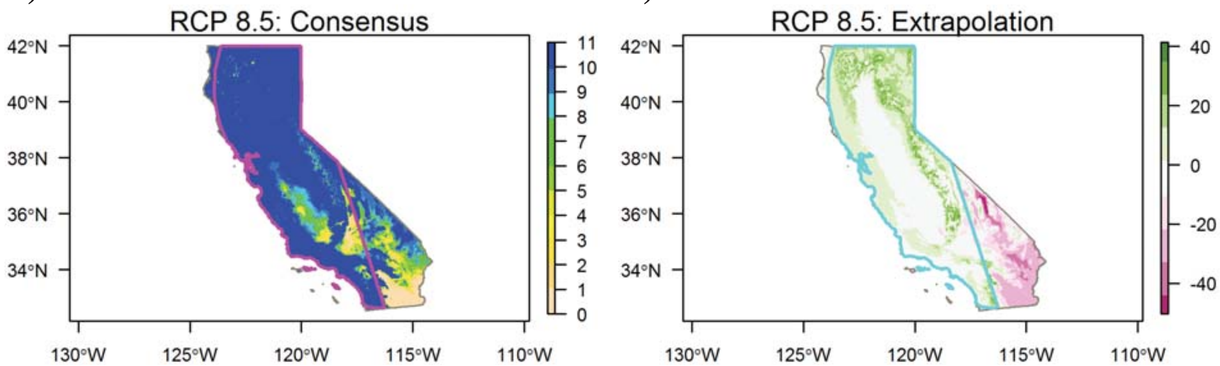


The light blue line represents a minimum convex polygon around occurrences. A) Predicted distribution of suitable habitat. Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell (lowest presence threshold). Light gray areas are cells where predicted suitability is below the threshold. B) Maxent continuous logistic output of predicted suitability. Higher values represent more suitable habitat. The map in panel A is made by coloring green those cells in B that have greater or equal suitability to the lowest presence threshold. Similar maps for all species are in Appendix VI.

The ecological niche model for each species built under current climate conditions was projected onto every combination of future greenhouse gas trajectory (RCP) and future climate model (GCM) across the state of California for the year 2050 (153 species x 4 RCPs x 11 GCMs = 6,732 projections). The lowest presence threshold was then applied to each projection, creating a map where cell values are either 0 for unsuitable habitat or 1 for suitable habitat. For each RCP, we created a consensus map by stacking and summing the lowest presence threshold maps for all 11 GCMs (Figure 3A). The cell values in the consensus maps range from 11, where all GCMs agree that a cell will be suitable in the future, to 0, where all GCMs agree that a cell will be unsuitable in the future. Intermediate cell values represent disagreement among GCMs. For example, a cell value of 3 means that three GCMs predict that a cell will be suitable while eight predict that same cell will be unsuitable.

Figure 3. Example consensus and extrapolation maps for the snake Coluber constrictor*, the yellow-bellied racer, under RCP 8.5.*

A) B)



A) The consensus map shows the number of general circulation models (0-11) that predict a cell to be suitable in 2050. B) The extrapolation map shows areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. Extrapolation maps were created for each GCM and averaged to produce the map shown here. The polygons outlined in magenta (A) and turquoise (B) show the minimum convex polygon containing currently occupied cells in California. Similar maps for all species are in Appendix VI.

Future conditions may contain novel or non-analog climates, which are climate conditions that do not occur in the data used to build niche models. As a consequence, predicting habitat suitability in these sites requires extrapolation from the conditions represented in the current climate data. For each RCP we calculated ensemble maps to show the potential degree of extrapolation occurring (Figure 3B). Extrapolation maps are Multivariate Environmental Similarity Surface maps (Elith et al. 2010) averaged across GCMs for each RCP. Positive values indicate no extrapolation is occurring, while negative values indicate extrapolation is occurring. Maxent has built-in features to cope with extrapolation, but caution should be used in interpreting results from areas where extrapolation is occurring. For example, in Figure 3B the consensus map for 2050 shows that some GCMs predict that habitat in the southeastern part of the state is suitable. However, given that extrapolation is occurring in that region we have less confidence in that prediction compared to predictions from a non-extrapolated part of the range. Maps of predicted currently suitable habitat, future consensus maps, and extrapolation maps can be found in Appendix VI. It is important to keep in mind that these maps reflect suitability in climate space and not other important habitat attributes such as land cover types, presence of appropriate prey, etc.

Ranking Species by Risk Level

To synthesize the future projection results into a common framework, we calculated two metrics of conservation risk: Point Ranking and Area Ranking. These two metrics capture perceived vulnerability along the lines frequently used by ecologists (e.g., see Thomas et al. 2004 on extinction risk from climate change). If we assume that species have very limited dispersal abilities, then our primary concern should be loss of currently occupied habitat. This is represented by the Point Ranking. In contrast, if species are very good dispersers, then we would be interested in potential suitable habitat at a much larger scale, which is better captured by the Area Ranking. Most species fall somewhere between these extremes. Hence vulnerability is a combined metric of numerous attributes including sensitivity to climate changes, dispersal ability, and the distribution of available future habitat. For both the Point and Area metrics, we only ranked species based on changes occurring in the California part of their range. For each RCP, point and area rankings were calculated separately for each of the 11 GCMs, and then the rankings were averaged across GCMs.

The Point Ranking is based on the Distribution Trend metric from the ARSSC, which was developed to capture historical range loss. The Point Ranking uses the same percentage cutoffs to capture future habitat loss by calculating how many currently occupied 1x1 km cells remain suitable (based on the lowest presence threshold) in 2050 (Table 3). This metric can be thought of as a “No Dispersal” scenario—it quantifies those areas where the species currently occurs in California that are predicted to maintain climate conditions in 2050 that we know the species can tolerate based on its current distribution.

The Area Ranking is NatureServe’s Climate Change Vulnerability Index (CCVI) metric “D2 Modeled future (2050) change in range or population size” (Table 4; Young et al. 2011). A key difference between the Point and Area rankings is that calculating change in suitable area allows for both decreases and increases in habitat, while a point ranking only documents habitat loss. The CCVI metric defines the area to be evaluated as a minimum convex polygon that encompasses current localities. For each species we constructed minimum convex polygons around locality data from California only using the ‘adehabitat’ package in R version 2.15.3 (Calenge 2006, R Core Team 2013). Two species (*Bogertophis rosaliae*, Baja Rat Snake and *Xantusia gracilis*, Sandstone Night Lizard) had too few localities to calculate minimum convex polygons with this software package, and therefore were excluded from the Area Rankings. We calculated the change in suitable area as the (# of future cells suitable - # of current cells suitable)/(# of current cells suitable).

Table 3. Point Rankings

ARSSC Distribution Trend	Point Ranking
Severely (>80%) reduced	Rank 5: Less than 20% currently occupied cells remaining
Greatly (>40-80 %) reduced	Rank 4: 20% to 60% currently occupied cells remaining
Moderately (>20-40%) reduced	Rank 3: 60% to 80% currently occupied cells remaining
Slightly (< 20%) reduced or suspected of having been reduced but trend unknown	Rank 2: > 80% currently occupied cells remaining
Stable (~0% reduced) or increasing	Rank 1: 100% currently occupied cells remaining

Table 4. Area Rankings

CCVI D2 Modeled Future Change in Range Size	Area Ranking: Change in Suitable Area
Greatly Increase Vulnerability: Predicted future range disappears entirely	Rank 6: -100%
Increase Vulnerability: Predicted future range represents 50-99% decrease	Rank 5: -50% to -99%
Somewhat Increase Vulnerability: Predicted future range represents a 20-50% decrease	Rank 4: -20% to -50%
Neutral: Predicted future range represents no greater than a 20% change	Rank 3: -20% to + 20%
Somewhat Decrease Vulnerability: Predicted future range represents a 20-50% increase	Rank 2: +20% to +50%
Decrease Vulnerability: Predicted future range represents a > 50% increase	Rank 1: Greater than +50%

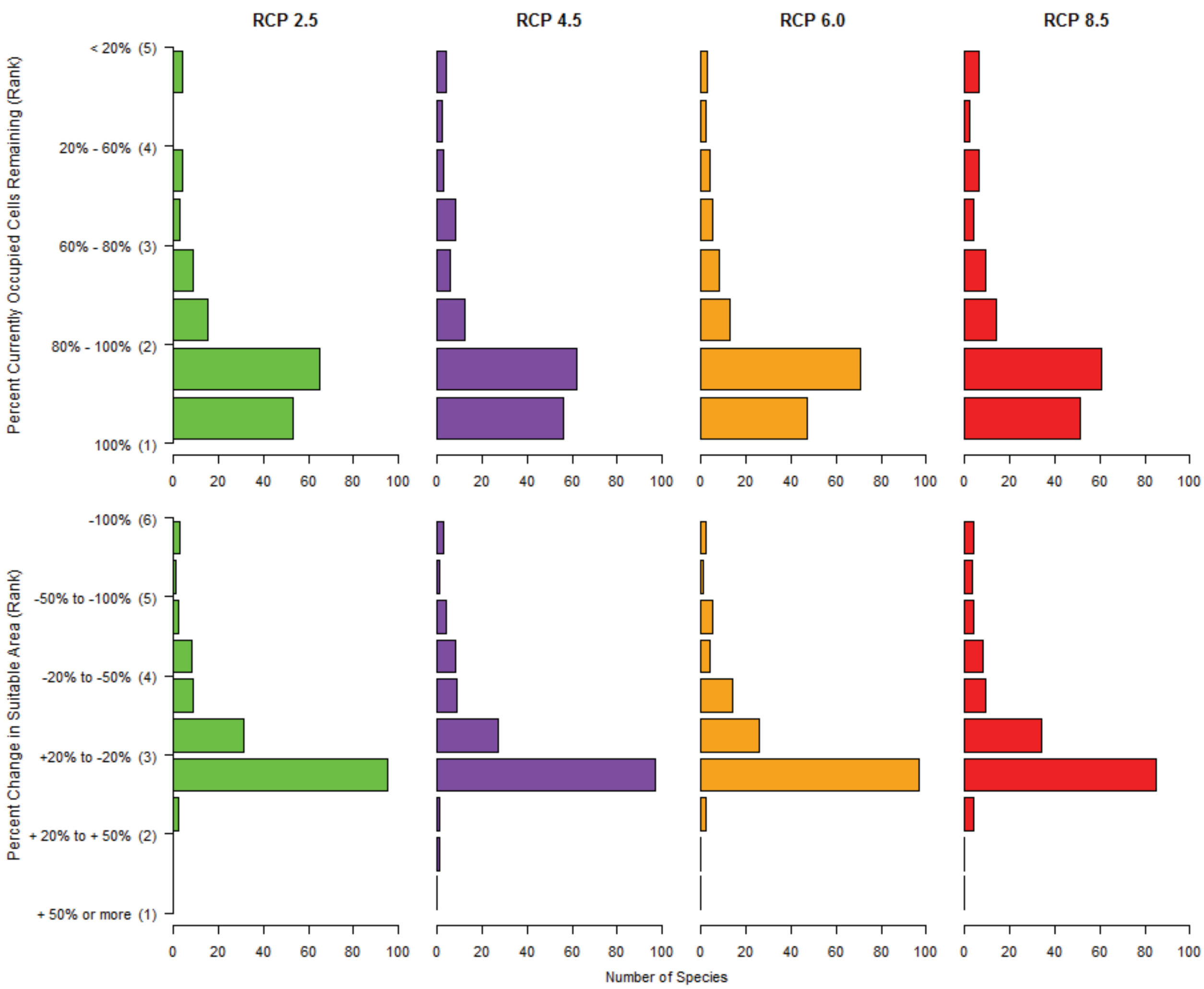
Comparison to ARSSC "Vulnerability to Climate Change" Metric

The forthcoming ARSSC (2013) report includes a metric to capture vulnerability to climate change. Taxa were scored under four levels of risk (unlikely to be sensitive = 0, slightly sensitive = 3, moderately sensitive = 7, highly sensitive = 10). These scores were based on regional predictions for future climate changes in California (California Climate Action Team assessments, e.g. Cayan et al. 2008) and expert biological opinions on how individual taxa were likely to respond given their life histories and habitat requirements. Seventy-two candidate taxa were scored for this metric (note 30% of these taxa were at the subspecies or population levels, rather than full species). To compare the ARSSC score to the results in this study, we calculated an expected score by rounding the average Point Ranking under RCP 8.5 to the nearest whole number and assigning the following scores on the same scale as the ARSSC metric: Point Rank 1 = ARSSC 0, Point Rank 2 = ARSSC 3, Point Rank 3 = ARSSC 7, Point Ranks 4 or 5 = ARSSC 10. We chose RCP 8.5 because current greenhouse gas concentrations are most similar to this trajectory at the present time (Peters et al. 2012). We evaluated whether the niche modeling results agreed with, predicted more risk, or predicted less risk than the ARSSC metric, and the implications of these differences for evaluating special concern status.

Results and Discussion

The distribution of species rankings for each RCP averaged across GCMs is shown in Figure 4, and rankings for individual species are in Appendices IV & VI. Patterns were very similar across different RCPs. Approximately 75% of species were predicted to be stable or slightly reduced in terms of currently occupied localities (Point Rankings 1 and 2, 80-100% remaining) while approximately 60% of species are predicted to experience neutral changes in suitable area (Area Ranking 3, ± 20%). The point and area ranking metrics were highly correlated ($R^2 > 0.78$), indicating that a species ranked highly by one metric tended to rank high for the other metric. A handful of species were predicted to experience increases in suitable area of greater than 10% within a minimum convex polygon of California localities (Figure 4). They are *Batrachoseps diabolicus* (Hell Hollow Slender Salamander), *Plethodon elongatus* (Del Norte Salamander), *Heloderma suspectum* (Gila Monster), and *Rana yavapaiensis* (Lowland Leopard Frog), the latter two of which are Species of Special Concern. Nineteen species were predicted to have all current localities remain suitable in the future (average Point Ranking of 1 for at least one RCP), including several species of conservation concern (Table 5). Some of these lowest-risk species occur in multiple ecoregions (Appendix I) indicating relatively large ranges and presumably relatively broad climatic tolerances. Lowest-risk species that do not occur in multiple ecoregions tend to occur in desert ecoregions, the Klamath Mountains, or the Sierra Nevada and foothills ecoregions. Several snakes occur in the lowest-risk group, while only a single snake (*Contia longicaudae*, Forest Sharp-tailed Snake) falls into the highest-risk group.

Figure 4. Distribution of Point and Area Rankings



Point Rankings show the percentage of currently occupied localities predicted to remain suitable in 2050. Area Rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon encompassing current localities in California. "Current" here refers to all locality data available, as defined in the text. Rankings are split into non-integer categories because they are averaged across different general circulation model projections for each plausible future greenhouse gas trajectory (RCP). Individual species results are in Appendices IV & VI.

Table 5. Lowest-risk species. These species all received an average Point Ranking of 1 (100% of localities predicted to remain suitable in 2050) for at least one RCP. Table continues on following page).

Scientific Name, Common Name (Status[1])	**Ecoregion[2]**
Salamanders	
Aneides ferreus, Clouded Salamander	Klamath Mountains
Batrachoseps diabolicus, Hell Hollow Slender Salamander (SA)	Sierra Nevada, Sierra Nevada Foothills
Batrachoseps relictus, Relictual Slender Salamander (SA)	Sierra Nevada, Sierra Nevada Foothills
Hydromantes brunus, Limestone Salamander (T)	Sierra Nevada, Sierra Nevada Foothills
Taricha granulosa, Rough-skinned Newt	Central California Coast, Klamath Mountains, Northern California Coast, Northern California Coast Ranges, Northern California Interior Coast Ranges, Sierra Nevada, Sierra Nevada Foothills, Southern Cascades
Frogs	
Bufo alvarius, Sonoran Desert Toad (SSC)	Colorado Desert, Mojave Desert, Sonoran Desert
Rana pretiosa, Oregon Spotted Frog (SSC)	Modoc Plateau, Northwestern Basin and Range, Southern Cascades
Turtles	
Kinosternon sonoriense, Sonoran Mud Turtle (SSC)	Colorado Desert, Sonoran Desert
Lizards	
Coleonyx switaki, Barefoot Gecko (T)	Colorado Desert, Southern California Mountains and Valleys
Coleonyx variegatus, Western Banded Gecko (SSC[3])	Colorado Desert, Mojave Desert, Mono, Sierra Nevada, Sierra Nevada Foothills, Sonoran Desert, Southeastern Great Basin, Southern California Coast, Southern California Mountains and Valleys
Sceloporus magister, Desert Spiny Lizard	Central California Coast Ranges, Colorado Desert, Great Valley, Mojave Desert, Mono, Sierra Nevada, Sierra Nevada Foothills, Sonoran Desert, Southeastern Great Basin, Southern California Mountains and Valleys
Xantusia gracilis, Sandstone Night Lizard (SSC)	Colorado Desert
Snakes	
Coluber constrictor, Yellow-bellied Racer	Central California Coast, Central California Coast Ranges, Great Valley, Klamath Mountains, Modoc Plateau, Mono, Northern California Coast, Northern California Coast Ranges, Northern California Interior Coast Ranges, Northwestern Basin and Range, Sierra Nevada, Sierra Nevada Foothills, Southern California Coast, Sonoran Desert, Southern California Mountains and Valleys, Southern Cascades
Crotalus atrox, Western Diamond-backed Rattlesnake	Colorado Desert, Mojave Desert, Sonoran Desert, Southern California Mountains and Valleys
Masticophis taeniatus, Striped Whipsnake	Mojave Desert, Mono, Northwestern Basin and Range, Sierra Nevada, Southeastern Great Basin, Southern Cascades
Tantilla hobartsmithi, Southwestern Black-headed Snake	Great Valley, Mojave Desert, Mono, Sierra Nevada, Sierra Nevada Foothills, Southeastern Great Basin, Southern California Mountains and Valleys
Thamnophis marcianus, Checkered Garter Snake	Colorado Desert, Sonoran Desert

Table 5. Lowest-risk species continued

Scientific Name, Common Name (Status[1])	Ecoregion[2]
Thamnophis ordinoides, Northwestern Garter Snake	Klamath Mountains, Northern California Coast
Trimorphodon lambda, Sonoran Lyre Snake	Colorado Desert, Mojave Desert, Sonoran Desert

[1] Status codes: SA = Special Animals list; SSC = Species of Special Concern; T = CESA Threatened
[2] A map of the ecoregions used can be found in Appendix I. All ecoregions that contain localities are included in this list.
[3] SSC status is for the subspecies *C. v. abbotti*, the San Diego Banded Gecko

Tables 6 and 7 identify the species most at risk of climate shifting away from the range of conditions that they can tolerate based on current distributions. The species at highest risk in this analysis are listed in Table 6, most of which are endemic species (except *Plethodon dunni*, Dunn's salamander) with small ranges in California, and all but two are already of conservation concern. All of these species have for at least one RCP a Point Ranking greater than or equal to 4 (<60% currently occupied cells remaining) and/or an Area ranking greater than or equal to 5 (50%-99% decrease, Table 6). Species of intermediate rank and therefore also at risk are listed in Table 7. These are species that have for at least one RCP a Point Ranking greater than or equal to 3 and less than 4 (20-80% remaining) and/or an Area Ranking greater than or equal to 4 and less than 5 (20-99% decrease).

Table 6. Highest-risk species. These species have for at least one RCP an average Point Ranking ≥ 4 and/or an average Area Ranking ≥ 5. A Point Ranking ≥ 4 is when more than 40% of localities are predicted to be unsuitable in 2050. An Area Ranking ≥ 5 is when more than 50% of currently suitable area (defined within a minimum convex polygon of California localities) is predicted to no longer be suitable in 2050.

Scientific Name, Common Name (Status[1])	Ecoregions[2]
Salamanders	
Batrachoseps incognitus, San Simeon Slender Salamander (SA)	Central California Coast
Batrachoseps luciae, Santa Lucia Mountains Slender Salamander (SA)	Central California Coast, Central California Coast Ranges
Batrachoseps minor, Lesser Slender Salamander (SSC)	Central California Coast, Central California Coast Ranges
Batrachoseps stebbinsi, Tehachapi Slender Salamander (T)	Sierra Nevada, Sierra Nevada Foothills
Plethodon dunni, Dunn's Salamander	Northern California Coast
Frogs	
Bufo exsul, Black Toad (T)	Southeastern Great Basin
Lizards	
Elgaria panamintina, Panamint Alligator Lizard (SSC)	Southeastern Great Basin
Xantusia riversiana, Island Night Lizard (SSC)	Southern California Coast
Snakes	
Contia longicaudae, Forest Sharp-tailed Snake	Central California Coast, Klamath Mountains, Northern California Coast, Northern California Coast Ranges

[1] Status codes: SA = Special Animals list; SSC = Species of Special Concern; T = CESA Threatened
[2] A map of the ecoregions used can be found in Appendix I.

Table 7. Intermediate-risk species. These species have for at least one RCP an average Point Ranking between 3 and 4, and/or an average Area Ranking between 4 and 5. A Point Ranking between 3 and 4 is when 20% to 80% of localities are predicted to remain suitable in 2050. An Area Ranking between 4 and 5 is when 20% to 99% of currently suitable area (defined within a minimum convex polygon of California localities) is predicted to no longer be suitable in 2050.

Scientific Name, Common Name (Status[1])	**Ecoregions[2]**
Salamanders	
Ambystoma californiense, California Tiger Salamander (T)	Central California Coast, Central California Coast Ranges, Great Valley, Northern California Coast, Northern California Interior Coast Ranges, Sierra Nevada Foothills, Southern California Coast
Batrachoseps altasierrae, Greenhorn Mtns. Slender Salamander	Sierra Nevada
Batrachoseps bramei, Fairview Slender Salamander	Sierra Nevada, Sierra Nevada Foothills
Batrachoseps campi, Inyo Mountains Slender Salamander (SSC)	Southeastern Great Basin
Batrachoseps simatus, Kern Canyon Slender Salamander (T)	Great Valley, Sierra Nevada, Sierra Nevada Foothills
Hydromantes shastae, Shasta Salamander (T)	Klamath Mountains
Plethodon asupak, Scott River Salamander (T)	Klamath Mountains
Taricha rivularis, Red-bellied Newt (SSC)	Northern California Coast, Northern California Coast Ranges
Rhyacotriton variegatus, Southern Torrent Salamander (SSC)	Klamath Mountains, Northern California Coast, Northern California Coast Ranges
Frogs	
Ascaphus truei, Tailed Frog (SSC)	Klamath Mountains, Northern California Coast, Northern California Coast Ranges, Southern Cascades
Rana cascadae, Cascade's Frog (SSC)	Klamath Mountains, Sierra Nevada, Southern Cascades
Lizards	
Urosaurus nigricaudus, Baja California Brush Lizard	Colorado Desert, Southern California Mountains and Valleys
Xantusia sp. 'San Jacinto', San Jacinto Night Lizard	Colorado Desert, Southern California Mountains and Valleys

[1] Status codes: SA = Special Animals list; SSC = Species of Special Concern; T = CESA Threatened
[2] A map of the USDA Ecoregions used can be found in Appendix I. All ecoregions that contain localities are included in this list.

Many of the highest and intermediate ranking species have small ranges, and caution should be used when interpreting model results for species with fewer than 30 localities used to build models (Wisz et al. 2008, Appendix III). In some cases these small sample sizes reflect actual distributions (e.g., for some *Batrachoseps* spp.) and not just poor sampling. The fewer data points used to build models, the less information the model has to associate occurrence with climate conditions. As a result, species with very few localities tended to have very few climate variables retained—our model selection procedure resulted in models using from 1 to 12 climate variables (mean 6.8, Appendix V). These climate variables were chosen using a statistical procedure, and while they are informative for prediction, it is unknown to what degree this may be due to spurious correlations with other, unmeasured variables. In other words, just because a variable was selected to be included in a model does not necessarily mean that variable is important to the species biologically.

We used a very inclusive threshold for determining habitat suitability, the lowest presence threshold, and therefore the results reported here may be relatively optimistic compared to using a more conservative threshold. However, when we used a threshold-free metric of risk, the anomaly score, we found that it largely corroborated the relative rankings of species risk calculated using the lowest presence threshold. A boxplot of anomaly scores calculated for all combinations of RCP and GCM is shown for each species ordered by median value in Figure 5. The most negative anomaly scores indicate the greatest average reductions in habitat suitability, while positive scores indicate average increases in habitat suitability. Highest and intermediate risk taxa identified by the Point and Area Rankings mostly cluster in the part of the plot indicating greatest reductions in average suitability, showing that both approaches identify these species as being at greatest risk under future climate change. Some species are identified as being relatively high risk by the anomaly score but are not included in the Highest Risk and Intermediate Risk groups identified by the Point and Area Rankings (Table 8). These species were predicted to experience reductions in suitability on average, but the magnitude of these reductions were not large enough to drop suitability below the lowest presence threshold in many cells. Such reductions in overall suitability may still warrant conservation concern, however, and these species are therefore also of high priority for monitoring and additional studies. Similar to the threshold-based rankings, the anomaly score shows that most species are hovering around and below the zero-line, indicating slight to moderate reductions. The two approaches show less agreement with regards to which species are lowest-risk, with the threshold-identified lowest risk species occurring throughout the anomaly score plot (Figure 5). Thus, while choice of threshold may affect the predicted magnitude of loss in terms of percent of habitat change, the patterns in the anomaly score suggest that a similar set of species would be identified as most at risk.

Table 8. Additional species identified as at-risk by the Anomaly Score. These species have an anomaly score that indicates overall average reductions in habitat suitability larger than reductions for the High Risk species in Tables 6 and 7. See Figure 5. Table continues on next page.

Scientific Name, Common Name (Status[1])	**Ecoregions[2]**
Salamanders	
Ambystoma gracile, Northwestern Salamander	Klamath Mountains, Northern California Coast, Northern California Coast Ranges
Frogs	
Bufo californicus, Arroyo Toad (SSC)	Central California Coast, Central California Coast Ranges, Colorado Desert, Mojave Desert, Southern California Coast, Southern California Mountains and Valleys
Bufo cognatus, Great Plains Toad	Colorado Desert, Mojave Desert, Sonoran Desert, Southern California Mountains and Valleys
Rana draytonii, California Red-legged Frog (SSC)	Central California Coast, Central California Coast Ranges, Great Valley, Mojave Desert, Northern California Coast, Northern California Coast Ranges, Northern California Interior Coast Ranges, Sierra Nevada, Sierra Nevada Foothills, Southern California Coast, Southern California Mountains and Valleys

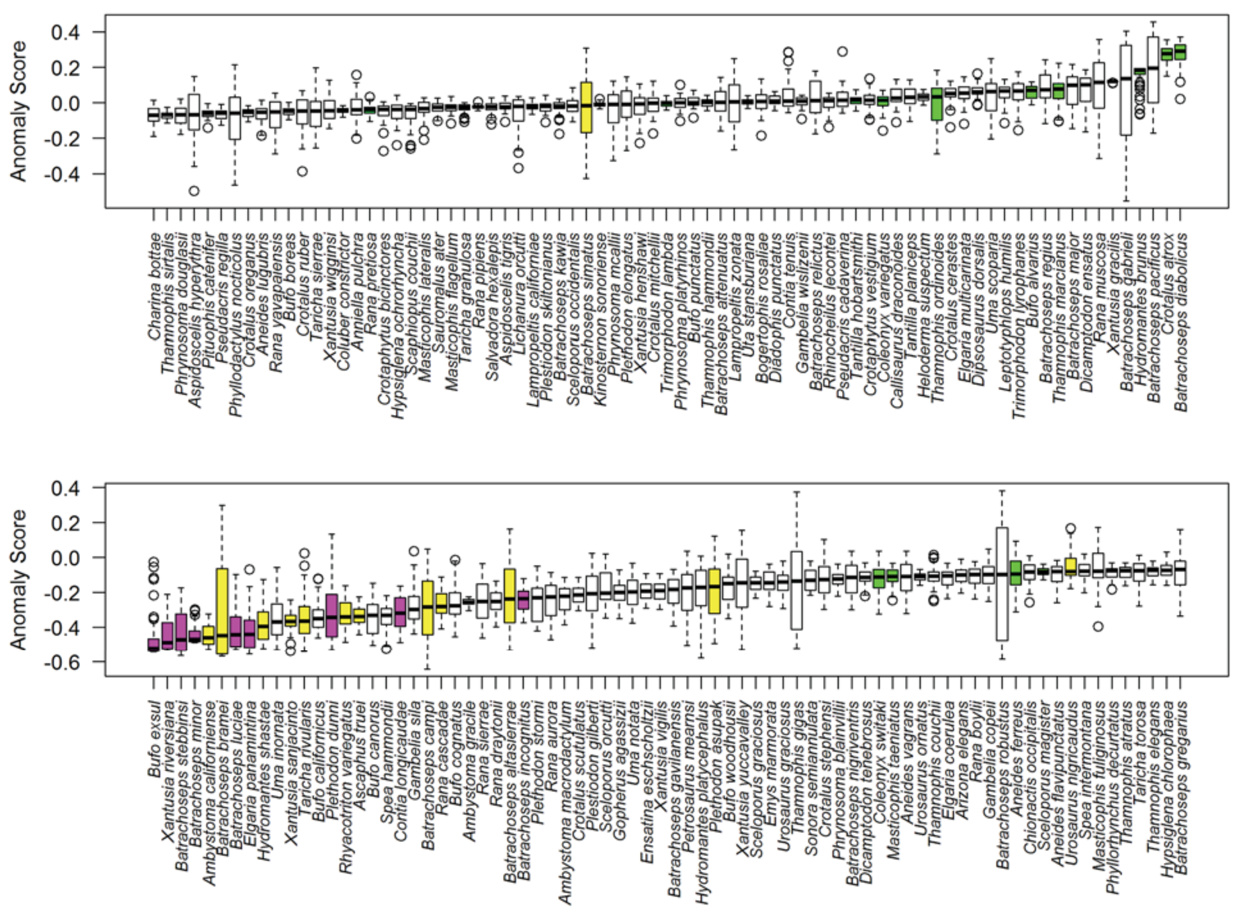
Table 8. Additional species identified as at-risk by the Anomaly Score continued

Scientific Name, Common Name (Status[1])	**Ecoregions[2]**
Rana sierrae, Sierra Nevada Yellow-legged Frog (T)	Mono, Sierra Nevada, Sierra Nevada Foothills, Southern Cascades
Spea hammondii, Western Spadefoot (SSC)	Central California Coast, Central California Coast Ranges, Colorado Desert, Great Valley, Northern California Interior Coast Ranges, Sierra Nevada Foothills, Southern California Coast, Southern California Mountains and Valleys
Lizards	
Gambelia sila, Blunt-nosed Leopard Lizard (E)	Central California Coast Ranges, Great Valley, Sierra Nevada Foothills, Southern California Mountains and Valleys
Uma inornata, Coachella Valley Fringe-toed Lizard (E)	Colorado Desert, Southern California Mountains and Valleys

[1] Status codes: SA = Special Animals list; SSC = Species of Special Concern; T = CESA Threatened, E = CESA Endangered

[2] A map of the ecoregions used can be found in Appendix I. All ecoregions that contain localities are included in this list.

Figure 5. Anomaly Score boxplots.



Anomaly scores for each species calculated for all combinations of RCP and GCM. Scores are calculated by comparing the average change in suitability over time across currently occupied cells. Negative values indicate overall reductions in habitat suitability, while positive values indicate overall increases in suitability. Species are ordered by median value from most negative *score (bottom left) to most positive (top right). Pink = highest risk taxa (Table 6), Yellow = intermediate risk taxa (Table 7), Green = lowest risk taxa (Table 5), White = all other taxa*

Comparison to ARSSC

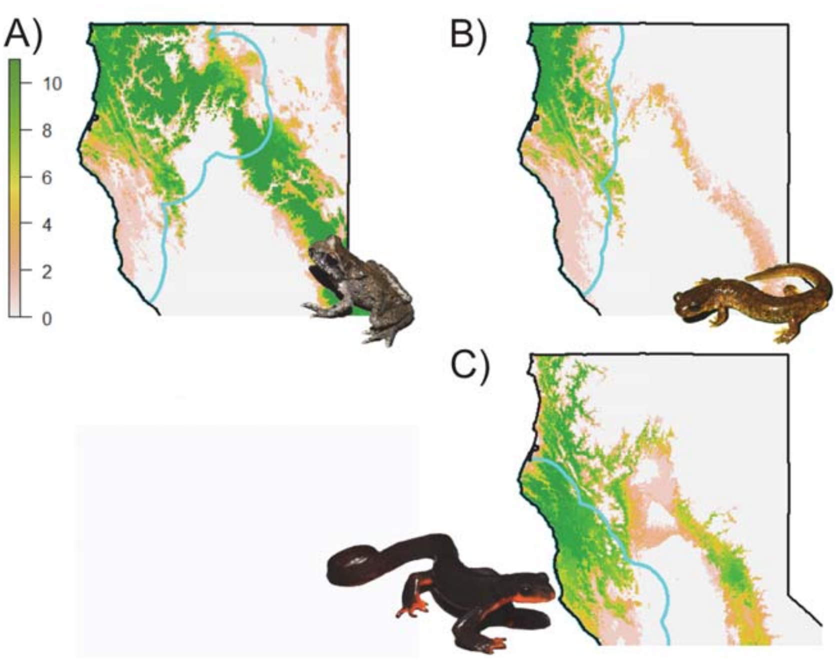
By comparing the niche model results to the ARSSC vulnerability score, we found that the two approaches agreed on the score for 25 species (35%), while the ARSSC score was higher for 35 species (49%), and lower for 11 species (15%; Appendix II). Thus, expert opinion tended to estimate higher risk levels than niche models. In some cases, the expert score may be higher because it refers to a taxon below the species level; in such cases, the subspecies or population has a more limited distribution than the more inclusive full species assessed by the niche model. For example, the subspecies *Diadophis punctatus regalis* (Regal Ring-necked Snake) is an SSC and occurs in only a few desert spring localities in California. The species *D. punctatus* is widespread, however, and is scored as relatively low risk by niche models: mean Point Ranking for RCP 8.5 is 2 (>80% remaining). If we just consider the part of the range where *D. p. regalis* occurs, we see that there is disagreement among model predictions in this part of the state, which means that some GCMs predict higher risk for the subspecies (Appendix VI). Experts are also taking into account not just direct changes in climate, but indirect effects. For example, groundwater depletion due to increased human use could be influenced by climate change, negatively affect spring habitat, and yet not be captured by niche models.

Regardless of the cause of differences between expert assessments and niche model predictions, the exercise of re-calculating overall scores to reflect the niche modeling results had very little effect on special concern designation because climate change was just one of eight metrics used to determine SSC status. Of the SSC whose vulnerabilities were estimated to be lower by niche models, most did not drop in overall score enough to warrant reconsideration (Appendix II). Possible exceptions include *Xantusia vigilis sierrae* (Sierran Night Lizard) and *Heloderma suspectum* (Gila Monster). For *X. v. sierrae*, SSC status would be maintained because it has a set of characteristics independent of vulnerability to climate change that support SSC status, including extremely small range, extreme ecological specialization, and high projected future impacts. *Heloderma suspectum* shares two of these three traits—and is data deficient for projected future impacts—and therefore would likely retain SSC status barring additional research. For the candidate species where vulnerability was estimated as higher by niche models, none increased in overall rank enough to merit elevation to SSC status.

The comparison between expert opinion and niche model predictions underscores the importance of evaluating model outputs critically in terms of species biology where possible as the rankings can both over- and underestimate risk. Rankings may be an overestimate of risk if species are actually able to tolerate a broader range of conditions than reflected by current distribution. Adaptation to changing environments may also mitigate risk (Schwartz 2012). Conversely, local adaptation could lead to population-level tolerances that are narrower than those for the species as a whole, leading to rankings that underestimate risk. We modeled responses at the species level, which assumes that all populations possess the climate tolerances reflected across the entire range. The benefit of this approach is that it provides the broadest range of climate variation for building models, which can reduce the likelihood of extrapolation into novel climates. However, if this assumption is false, then these results will underestimate risk by ascribing greater tolerances than appropriate (Atkins and Travis 2010, Kelly et al. 2012). In addition, changes in biotic conditions that occur with changing climates such as shifts in vegetation structure, competitors, predators, and pathogens may impact risk in either direction and in unexpected ways. Thus our analysis highlights particular species likely to be at risk as an important first step in prioritization across the entire California herpetofauna, but further assessment of individual species would benefit from consideration of additional factors besides direct climate shifts.

In addition to ranking species by overall risk level, the maps produced for this project can be used in other conservation planning efforts. Current species distribution maps can be used to prioritize areas for new surveys where habitat is predicted to be highly suitable, yet few or no localities are available from the region. Comparing consensus future prediction maps across species can also help identify priority areas for monitoring, particularly in regions where there is high disagreement among GCMs for multiple species (Figure 6). For example, the central portion of the Northern California Coast ecoregion is an area of high disagreement in model predictions for three Species of Special Concern that are also at intermediate-risk under future climate change (*Ascaphus truei* Tailed frog, *Rhyacotriton variegatus* Southern torrent salamander, and *Taricha rivularis* Red-bellied newt; Figure 6). Monitoring in this region would help catch declines early if they occur as predicted by several models, or verify that declines are unlikely, as predicted by several other models.

Figure 6. Consensus maps for three Species of Special Concern. A) Ascaphus truei *Tailed Frog B)* Rhyacotriton variegatus *Southern Torrent Salamander C)* Taricha rivularis *Red-bellied Newt.*

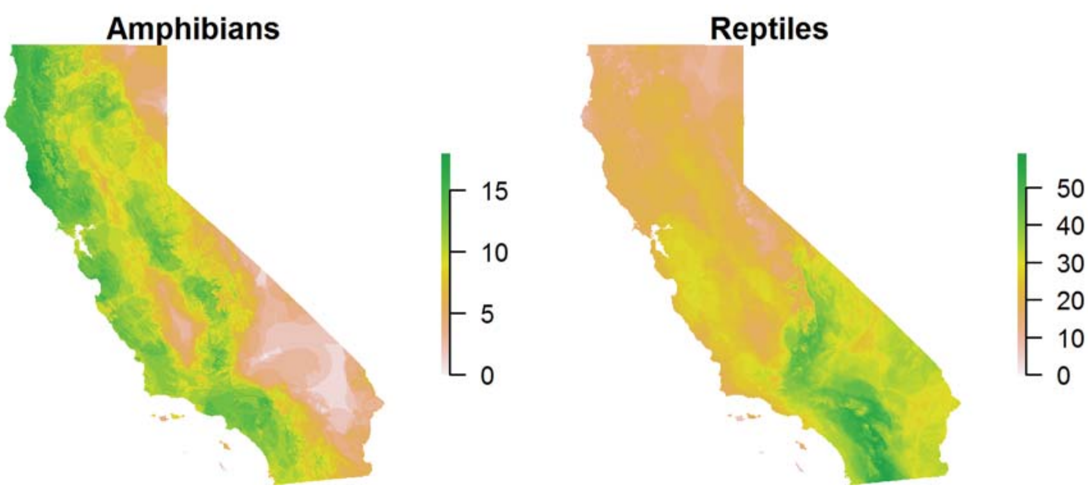


Consensus maps show for each 1x1 km cell the number of GCMs that predict it will be suitable in 2050. Dark green regions are areas where all 11 GCMs predict a cell will be suitable. For all three species, most GCMs predict the southerly coastal area mapped will be unsuitable habitat in 2050. However, some GCMs predict this area will be suitable, making this region a candidate for long-term monitoring. The light blue line represents a 50 km buffer around California localities. Photos used with permission (Gary Nafis, californiaherps.com).

By combining species maps we can visualize the distribution of climatically suitable habitat for reptiles and amphibians across the state (Figure 7), and how this distribution may shift in the future (Figure 8). The maps of predicted current distribution show that coastal and mountain areas of the state provide climatically suitable habitat for the highest diversity of amphibians, while the arid parts of the state are climatically suitable for relatively few amphibians. The southern mountains and deserts are climatically suitable for the greatest number of reptiles (Figure 7).

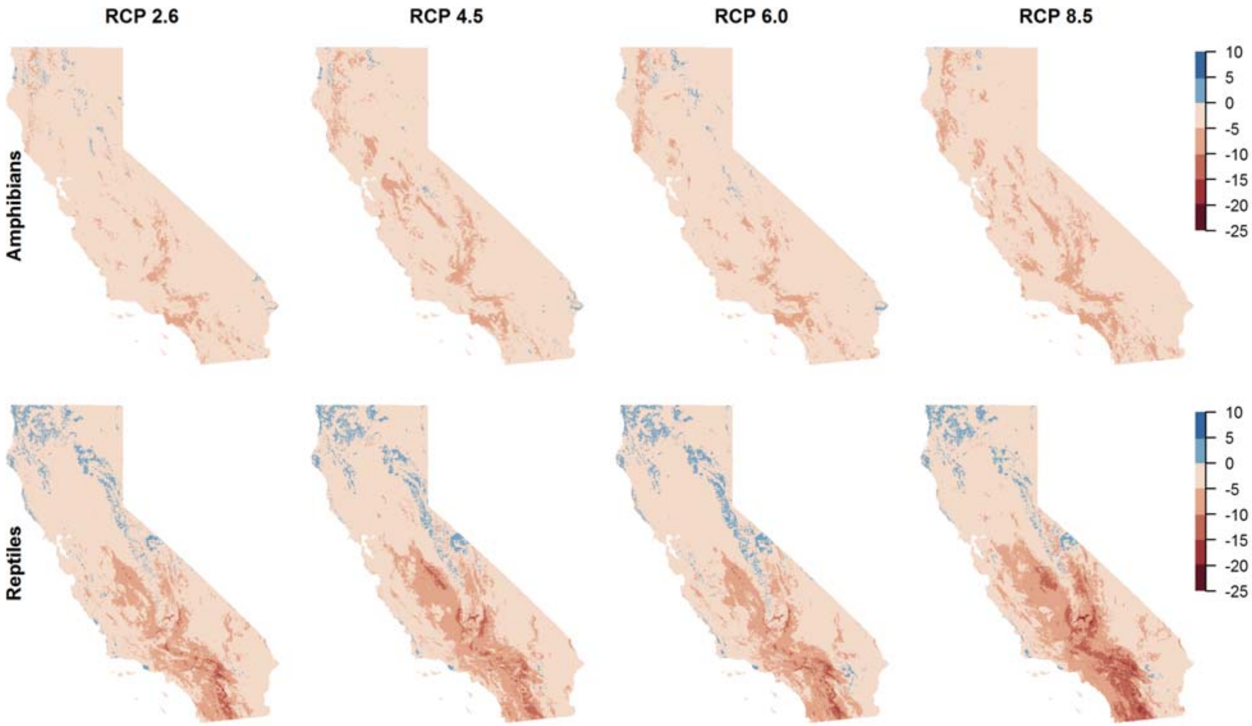
The predicted distribution of climatically suitable habitat in the future shows that while most species were not predicted to rank highly in risk individually, the combination of slight to moderate reductions across many species is apparent at the state level, particularly for reptiles (Figure 8). Amphibians were predicted to undergo slight reductions in habitat suitability state wide, with greater reductions scattered throughout much of California. Predicted increases in habitat suitability for amphibians were slight and occured in small patches, primarily in the Sierra Nevada and northern California. Reptiles were also predicted to undergo slight reductions in habitat suitability throughout much of the state, with the most severe reductions predicted in southern California in areas that currently support the highest reptile diversity. Conversely, conditions were predicted to increase in suitability for reptiles in northwestern California and the northern Sierra Nevada, areas of relatively low current reptile diversity. These projections are based on only considering areas of the state where all GCMs agree that habitat will remain suitable (100% consensus among GCMs); relaxing this criterion would result in less pessimistic maps.

Figure 7. Maps of predicted current suitable habitat



The legend represents the number of species predicted to have climatically suitable habitat in each 1x1 km cell. Note difference in scale between amphibians and reptiles. For each species, the lowest presence threshold was applied to the predicted suitability within a minimum convex polygon of currently occupied California localities (see Figure 2). These predictions were then stacked to produce the maps shown by summing the number of species with suitable habitat in each cell. Note that this figure represents the distribution of climatically suitable habitat, and not actual distributions of species occurrence.

Figure 8. Maps of predicted future changes in suitable habitat



The legend represents the change in the number of species predicted to have climatically suitable habitat in each 1x1 km cell between current and future conditions. Blue areas are gains: climate is becoming suitable for more species in the future. Red areas are losses: climate is suitable for fewer species in the future. These maps are 100% consensus maps, showing areas where all general circulation models (GCMs) for a given future greenhouse gas concentration (RCP) agree that cells will be suitable in the future. For each species and each RCP, the distribution of climatically suitable habitat was defined as all cells within the minimum convex polygon of currently occupied California localities that were predicted to remain suitable in the future by all eleven GCMs. This is the same as selecting all cells with value equal to eleven in Figure 3. The predictions for each species were stacked, and the current distribution map (Figure 6) was subtracted to create the map for each RCP.

Conclusions

The goal of this project was to broadly identify taxa predicted to have the greatest risk of losing climatically suitable habitat under future climate change. Overall, we found that most California reptiles and amphibians are at moderate to low risk of climate changing to the point that species are unlikely to tolerate future climate conditions. However, taken together, these slight to moderate losses in suitable habitat for many species resulted in predicted decreases in suitability at the state level, particularly in the Southern Coastal, Southern California Mountains and Valleys, and Great Valley ecoregions. Many of the highest risk taxa have small ranges in California. Given the uncertainties involved in modeling future climate, these results need to be interpreted with caution, and should be strengthened with the addition of species-specific biological data. Assessments which combine model outputs with expert opinion may provide the best strategy for conservation planning and management. Future studies may improve upon the current analysis by incorporating finer scale climate data where available, inclusion of additional localities (including presence-absence data where available), increasing precision of georeferenced localities, addition of other types of data (e.g. landcover), and exploration of a broader range of modeling approaches and risk metrics. In addition, our analyses evaluated the distribution of climatically suitable habitat in 2050. The representative concentration pathways show much greater differences in greenhouse gas concentrations between trajectories in 2100, so extending predictions farther into the future may result in more pessimistic predictions. Ecological niche models represent a basis for an initial assessment of climate driven risk. Climate change, however, interacts with the biology of species in ways that we have little capacity to predict, just as other drivers of change interact with climate to modify risk to species. Hence, an integrated approach to evaluating risk that incorporates distribution modeling is essential. The broad scope of this study evaluating all California reptiles and amphibians necessitated a very general approach. We hope that these results will provide an important overview that will lead to further integrated assessments focused on species and regions identified as being of particular concern.

Acknowledgements

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Acronyms

ARSSC Amphibian and Reptile Species of Special Concern
CMIP5 Coupled Model Intercomparison Project
CCVI NatureServe Climate Change Vulnerability Index
CWHR California Wildlife Habitat Relationships
GCM General Circulation Model
RCP Representative Concentration Pathway

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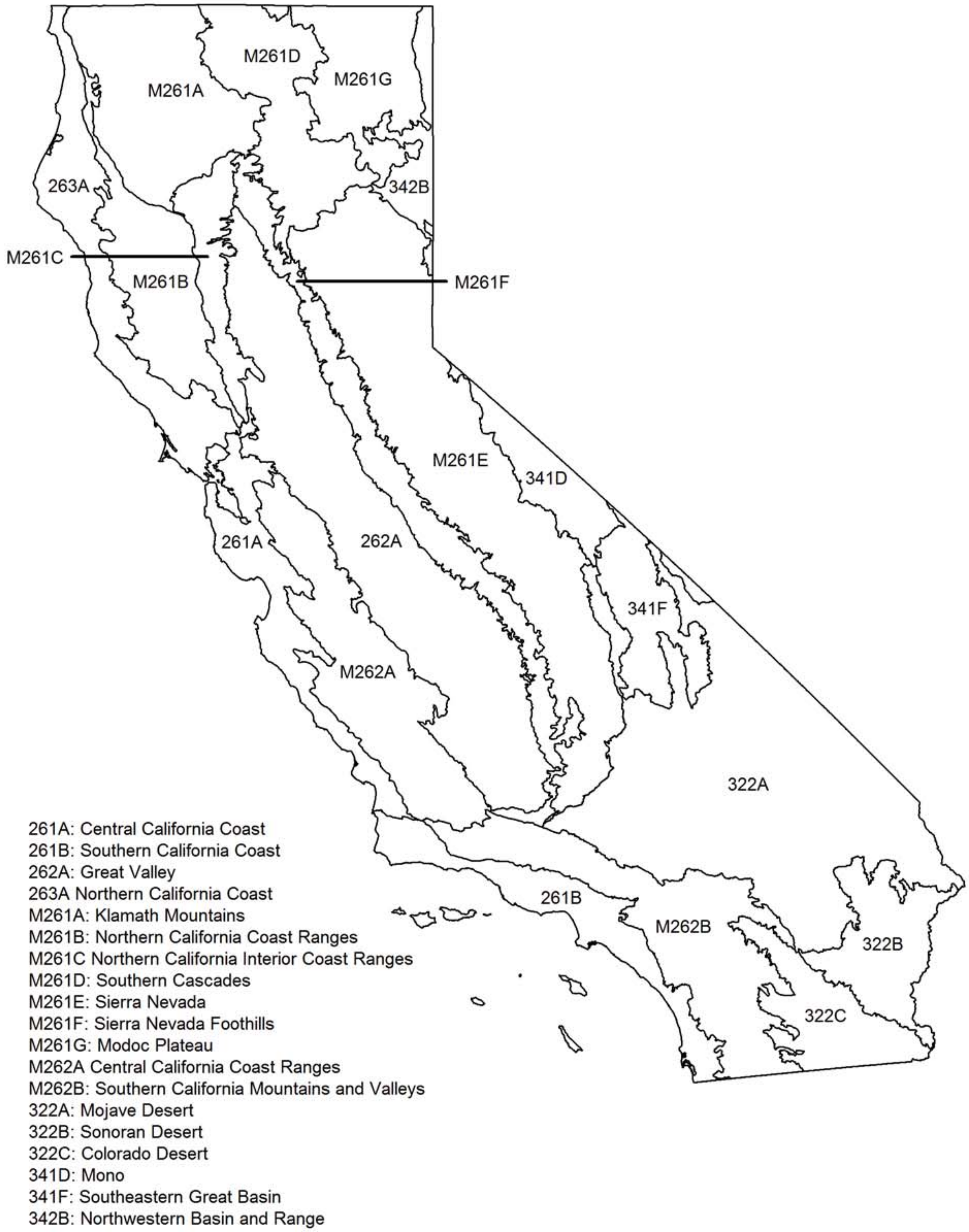
Appendix I. Ecoregions of California (USDA 1994). These are the same ecoregions used by the State Wildlife Plan 2015 update.



Appendix II. Comparison to ARSSC

Expert Climate Score is the Vulnerability to Climate Change metric from the ARSSC (2013). Modeled Climate Score is the expected score based on the model outputs. If the modeled score is different from the expert score, the adjusted ranking is calculated by using the modeled score instead of the expert score. Higher values of the ARSSC rankings indicate greater conservation risk. This table includes taxa that were designated as SSC and candidate taxa that were evaluated and deemed not to warrant SSC status (status = none). Note that Modeled climate scores were evaluated at the species level, while Expert climate scores were evaluated at the level of ARSSC taxon, which include species, subspecies, and populations.

ARSSC Taxon	Expert Climate Score	Modeled Climate Score	ARSSC Ranking	Adjusted Ranking	Status
Ambystoma macrodactylum sigillatum	10	3	0.66	0.60	SSC
Aneides ferreus	7	0	0.37	0.31	None
Aneides flavipunctatus niger	3	3	0.48	NA	SSC
Anniella pulchra	7	3	0.55	0.52	SSC
Arizona elegans occidentalis	3	3	0.67	0.67	SSC
Ascaphus truei	10	10	0.61	NA	SSC
Aspidoscelis hyperythra	3	3	0.47	NA	None
Aspidoscelis tigris stejnegeri	3	0	0.54	0.51	SSC
Batrachoseps campi	0	7	0.50	0.56	SSC
Batrachoseps gabrieli	7	3	0.36	0.33	None
Batrachoseps minor	10	10	0.71	0.71	SSC
Bogertophis rosaliae	3	7	0.38	0.45	SSC
Bufo alvarius	7	0	0.75	0.67	SSC
Bufo boreas halophilus	7	3	0.43	0.39	None
Bufo californicus	10	7	0.93	0.90	SSC
Bufo canorus	10	7	0.84	0.81	SSC
Chionactis occipitalis talpina	3	3	0.26	NA	None
Coleonyx variegatus abbotti	7	0	0.54	0.47	SSC
Crotalus ruber	3	3	0.44	NA	SSC
Crotaphytus vestigium	0	3	0.24	0.27	None
Diadophis punctatus regalis	7	3	0.68	0.58	SSC
Dicamptodon ensatus	3	3	0.66	NA	SSC
Elgaria panamintina	3	10	0.44	0.50	SSC
Emys marmorata marmorata	7	3	0.65	0.61	SSC
Emys marmorata pallida	7	3	0.75	0.71	SSC
Ensatina eschscholtzii xanthoptica	3	3	0.36	NA	None
Ensatina eschscholtzii croceator	3	3	0.42	NA	None
Ensatina eschscholtzii klauberi	7	3	0.38	0.35	None
Gambelia copeii	3	3	0.45	NA	SSC
Heloderma suspectum	10	0	0.60	0.40	SSC
Hydromantes platycephalus	10	7	0.30	0.27	None
Kinosternon sonoriense	3	0	0.66	0.62	SSC
Lampropeltis zonata Southern Clade	3	3	0.37	NA	None
Masticophis flagellum ruddocki	3	0	0.53	0.50	SSC
Masticophis fuliginosus	3	3	0.45	NA	SSC

ARSSC Taxon	Expert Climate Score	Modeled Climate Score	ARSSC Ranking	Adjusted Ranking	Status
Petrosaurus mearnsi	3	3	0.17	NA	None
Phrynosoma mcallii	3	3	0.49	NA	SSC
Phyllodactylus nocticolus	7	3	0.25	0.21	None
Phyrnosoma blainvilli	3	0	0.57	0.57	SSC
Pituophis catenifer pumilis	0	0	0.23	NA	None
Plestiodon gilberti	0	3	0.29	0.33	None
Plestiodon skiltonianus interparietalis	3	3	0.36	NA	None
Plethodon dunni	3	10	0.26	0.33	None
Plethodon elongatus	3	3	0.42	NA	None
Pseudacris cadaverina	7	3	0.46	0.43	None
Rana aurora	7	3	0.39	0.35	None
Rana boylii	10	3	0.83	0.76	SSC
Rana cascadae	7	7	0.65	0.65	SSC
Rana draytonii	7	3	0.76	0.73	SSC
Rana pipiens	10	3	0.73	0.66	SSC
Rana yavapaiensis	10	3	0.74	0.66	SSC
Rana_pretiosa	Data Deficient	0	0.82	0.75	SSC
Rhyacotriton variegatus	10	7	0.75	0.73	SSC
Salvadora hexalepis virgultea	10	3	0.54	0.46	SSC
Scaphiopus couchii	10	3	0.56	0.50	SSC
Sceloporus graciosus vandenburgianus	3	3	0.21	NA	None
Spea hammondii	7	3	0.69	0.73	SSC
Spea intermontana	7	3	0.29	0.25	None
Tantilla planiceps	3	3	0.35	0.35	None
Taricha rivularis	7	10	0.81	0.85	SSC
Taricha torosa So. Cal. only	7	3	0.66	0.63	SSC
Thamnophis hammondii	7	0	0.57	0.57	SSC
Thamnophis marcianus	0	0	0.24	NA	None
Thamnophis ordinoides	3	0	0.12	0.09	None
Thamnophis sirtalis sp.	3	3	0.72	NA	SSC
Uma notata	7	3	0.58	0.55	SSC
Uma scoparia	7	3	0.55	0.52	SSC
Urosaurus nigricaudus	3	7	0.24	0.27	None
Xantusia gracilis	7	0	0.38	0.45	SSC
Xantusia riversiana	3	10	0.47	0.54	SSC
Xantusia vigilis sierrae	10	3	0.47	0.41	SSC
Xantusia wigginsi	Data Deficient	3	0.43	0.40	None

Appendix III. Scientific names, common names, and sample sizes for locality data.

Species	Common Name	# Cells California	# Cells Range-wide	# Cells Background
Ambystoma californiense	California Tiger Salamander	1125	1125	9713
Ambystoma gracile	Northwestern Salamander	49	160	5346
Ambystoma macrodactylum	Long-toed salamander	482	710	9198
Aneides ferreus	Clouded Salamander	8	139	1731
Aneides flavipunctatus	Black Salamander	491	491	8490
Aneides lugubris	Arboreal Salamander	948	952	20699
Aneides vagrans	Wandering Salamander	205	205	3596
Anniella pulchra	California Legless Lizard	543	571	19192
Arizona elegans	Glossy Snake	694	1365	26605
Ascaphus truei	Coastal Tailed Frog	319	502	5513
Aspidoscelis hyperythra	Orange-throated Whiptail	428	662	8338
Aspidoscelis tigris	Western Whiptail	1214	2115	39533
Batrachoseps altasierrae	Greenhorn Mountains Slender Salamander	30	30	1107
Batrachoseps attenuatus	California Slender Salamander	1099	1116	10952
Batrachoseps bramei	Fairview Slender Salamander	20	20	824
Batrachoseps campi	Inyo Mountains Salamander	30	30	612
Batrachoseps diabolicus	Hell Hollow Slender Salamander	47	48	2193
Batrachoseps gabrieli	San Gabriel Mountains Slender Salamander	24	24	2141
Batrachoseps gavilanensis	Gabilan Mountains Slender Salamander	151	151	3539
Batrachoseps gregarius	Gregarious Slender Salamander	162	162	3298
Batrachoseps incognitus	San Simeon Slender Salamander	5	5	499
Batrachoseps kawia	Sequoia Slender Salamander	15	15	661
Batrachoseps luciae	Santa Lucia Mountains Slender Salamander	88	88	1331
Batrachoseps major	Garden Slender Salamander	523	554	8216
Batrachoseps minor	Lesser Slender Salamander	9	9	651
Batrachoseps nigriventris	Black-bellied Slender Salamander	456	459	7012
Batrachoseps pacificus	Channel Islands Slender Salamander	64	66	405
Batrachoseps regius	Kings River Slender Salamander	16	16	1169
Batrachoseps relictus	Relictual Slender Salamander	10	10	731
Batrachoseps robustus	Kern Plateau Salamander	34	34	1203
Batrachoseps simatus	Kern Canyon Slender Salamander	20	20	899
Batrachoseps stebbinsi	Tehachapi Slender Salamander	18	18	1255
Bogertophis rosaliae	Baja Rat Snake	1	15	1327
Bufo alvarius	Sonoran Desert Toad	17	181	4591
Bufo boreas	Western Toad	1758	2794	36722
Bufo californicus	Arroyo Toad	214	231	10947
Bufo canorus	Yosemite Toad	313	313	4155
Bufo cognatus	Great Plains Toad	61	669	11010
Bufo exsul	Black Toad	11	11	515
Bufo punctatus	Red-spotted Toad	135	763	18100
Bufo woodhousii	Woodhouse's Toad	72	1032	11143

Species	Common Name	# Cells California	# Cells Range-wide	# Cells Background
Callisaurus draconoides	Zebra-tailed Lizard	852	1806	20080
Charina bottae	Rubber Boa	260	401	21964
Chionactis occipitalis	Shovel-nosed Snake	637	792	11987
Coleonyx switaki	Barefoot Gecko	18	31	2688
Coleonyx variegatus	Western Banded Gecko	671	1100	18901
Coluber constrictor	Yellow-bellied Racer	496	1637	34097
Contia longicaudae	Forest Sharp-tailed Snake	31	35	5106
Contia tenuis	Common Sharp-tailed Snake	269	282	17486
Crotalus atrox	Western Diamond-backed Rattlesnake	65	822	11670
Crotalus cerastes	Sidewinder	812	1086	14417
Crotalus mitchellii	Speckled Rattlesnake	195	287	12021
Crotalus oreganus	Western Rattlesnake	1101	1525	35312
Crotalus ruber	Red Diamond Rattlesnake	373	576	8977
Crotalus scutulatus	Northern Mojave Rattlesnake	219	550	10787
Crotalus stephensi	Panamint Rattlesnake	101	137	4950
Crotaphytus bicinctores	Great Basin Collared Lizard	188	419	13619
Crotaphytus vestigium	Baja California Collared Lizard	12	48	3215
Diadophis punctatus	Ring-necked Snake	675	2465	37395
Dicamptodon ensatus	California Giant Salamander	213	216	5077
Dicamptodon tenebrosus	Pacific Giant Salamander	180	373	6449
Dipsosaurus dorsalis	Desert Iguana	515	864	13917
Elgaria coerulea	Northern Alligator Lizard	836	1025	19538
Elgaria multicarinata	Southern Alligator Lizard	1758	1864	31219
Elgaria panamintina	Panamint Alligator Lizard	29	29	1401
Emys marmorata	Western Pond Turtle	1424	1465	29277
Ensatina eschscholtzii	Ensatina	2225	2543	30304
Gambelia copeii	Cope's Leopard Lizard	7	50	2735
Gambelia sila	Blunt-nosed Leopard Lizard	409	410	4243
Gambelia wislizenii	Long-nosed Leopard Lizard	493	1119	22118
Gopherus agassizii	Desert Tortoise	124	169	7337
Heloderma suspectum	Gila Monster	11	90	4505
Hydromantes brunus	Limestone Salamander	29	29	1216
Hydromantes platycephalus	Mount Lyell Salamander	84	84	4912
Hydromantes shastae	Shasta Salamander	66	66	829
Hypsiglena chlorophaea	Desert Night Snake	109	256	15169
Hypsiglena ochrorhyncha	Coast Night Snake	244	351	24465
Kinosternon sonoriense	Sonoran Mud Turtle	6	52	2809
Lampropeltis californiae	California Kingsnake	896	1083	37013
Lampropeltis zonata	California Mountain Kingsnake	285	305	24591
Leptotyphlops humilis	Western Blind Snake	217	345	18100
Lichanura orcutti	California Rosy Boa	252	278	12947
Masticophis flagellum	Coachwhip	700	1692	30513

Species	Common Name	# Cells California	# Cells Range-wide	# Cells Background
Masticophis fuliginosus	Baja California Coachwhip	43	213	3706
Masticophis lateralis	California Whipsnake	589	614	27904
Masticophis taeniatus	Striped Whipsnake	47	437	12991
Petrosaurus mearnsi	Banded Rock Lizard	110	157	5274
Phrynosoma blainvillii	Coast Horned Lizard	1283	1315	22027
Phrynosoma douglasii	Pigmy Short-horned Lizard	4	32	711
Phrynosoma mcallii	Flat-tailed Horned Lizard	222	255	4602
Phrynosoma platyrhinos	Desert Horned Lizard	592	1217	17773
Phyllodactylus nocticolus	Leaf-toed Gecko	24	31	3934
Phyllorhynchus decurtatus	Spotted Leaf-nosed Snake	526	690	13696
Pituophis catenifer	Gopher Snake	2152	3816	47176
Plestiodon gilberti	Gilbert's Skink	665	682	25052
Plestiodon skiltonianus	Western Skink	795	897	29442
Plethodon asupak	Scott River Salamander	13	13	408
Plethodon dunni	Dunn's Salamander	7	148	1379
Plethodon elongatus	Del Norte Salamander	270	316	1812
Plethodon stormi	Siskiyou Mountains Salamander	99	116	498
Pseudacris cadaverina	California Treefrog	324	352	11403
Pseudacris regilla	Pacific Treefrog	3158	3818	36888
Rana aurora	Northern Red-legged Frog	145	390	4482
Rana boylii	Foothill Yellow-legged Frog	1774	1810	23489
Rana cascadae	Cascades Frog	295	412	3387
Rana draytonii	California Red-legged Frog	1597	1625	23862
Rana muscosa	Southern Mountain Yellow-legged Frog	350	350	8213
Rana pipiens	Northern Leopard Frog	51	3169	16999
Rana pretiosa	Oregon Spotted Frog	7	56	1763
Rana sierrae	Sierra Nevada Yellow-legged Frog	805	813	5953
Rana yavapaiensis	Lowland Leopard Frog	21	49	3602
Rhinocheilus lecontei	Long-nosed Snake	604	1316	30164
Rhyacotriton variegatus	Southern Torrent Salamander	248	359	3455
Salvadora hexalepis	Patch-nosed Snake	416	761	23671
Sauromalus ater	Chuckwalla	246	399	13336
Scaphiopus couchii	Couch's Spadefoot	30	468	8630
Sceloporus graciosus	Sagebrush Lizard	944	1446	32432
Sceloporus magister	Desert Spiny Lizard	499	1180	22154
Sceloporus occidentalis	Western Fence Lizard	3383	3862	36780
Sceloporus orcutti	Granite Spiny Lizard	276	375	8119
Sonora semiannulata	Western Ground Snake	63	413	13790
Spea hammondii	Western Spadefoot	714	727	19084
Spea intermontana	Great Basin Spadefoot	76	263	6260
Tantilla hobartsmithi	Southwestern Black-headed Snake	24	99	8036
Tantilla planiceps	California Black-headed Snake	132	157	15013

Species	Common Name	# Cells California	# Cells Range-wide	# Cells Background
Taricha granulosa	Rough-skinned Newt	425	774	12346
Taricha rivularis	Red-bellied Newt	127	127	3115
Taricha sierrae	Sierra Newt	206	206	6373
Taricha torosa	Coast Range Newt	732	732	17839
Thamnophis atratus	Aquatic Garter Snake	540	583	12884
Thamnophis couchii	Sierra Garter Snake	322	327	10267
Thamnophis elegans	Terrestrial Garter Snake	996	2177	31361
Thamnophis gigas	Giant Garter Snake	277	277	3809
Thamnophis hammondii	Two-striped Garter Snake	410	458	13672
Thamnophis marcianus	Checkered Garter Snake	14	357	6426
Thamnophis ordinoides	Northwestern Garter Snake	30	374	3198
Thamnophis sirtalis	Common Garter Snake	685	3002	36560
Trimorphodon lambda	Sonoran Lyre Snake	5	98	3992
Trimorphodon lyrophanes	Peninsular Lyre Snake	118	207	11169
Uma inornata	Coachella Valley Fringe-toed Lizard	217	217	2446
Uma notata	Colorado Desert Fringe-toed Lizard	110	118	2852
Uma scoparia	Mojave Fringe-toed Lizard	163	166	4467
Urosaurus graciosus	Long-tailed Brush Lizard	223	286	8897
Urosaurus nigricaudus	Baja California Brush Lizard	31	288	5282
Urosaurus ornatus	Ornate Tree Lizard	18	1022	8431
Uta stansburiana	Side-blotched Lizard	2211	4586	34302
Xantusia gracilis	Sandstone Night Lizard	4	4	1099
Xantusia henshawi	Henshaw's Night Lizard	208	226	6061
Xantusia riversiana	Island Night Lizard	32	32	75
Xantusia sp. San Jacinto	San Jacinto Night Lizard	60	60	3413
Xantusia vigilis	Desert Night Lizard	474	578	13660
Xantusia wigginsi	Baja Night Lizard	14	118	3570
Xantusia sp. Yucca Valley	Yucca Valley Night Lizard	91	91	2801

Appendix IV. Point and Area Rankings

Point rankings show the number of currently occupied cells predicted to remain suitable in the future and are as follows: 1 = 100% remaining, 2 = 80% to 100% remaining, 3 = 60% to 80% remaining, 4 = 20% to 60% remaining, 5 = Less than 20% remaining. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells and are as follows: 1 = + 50% or more, 2 = + 20% to + 50%, 3 = +20% to -20%, 4 = -20% to -50%, 5 = -50% to -100%, 6 = -100%. Both point and area ranks are averaged across GCMs (n = 11) ± 1 standard deviation for each RCP.

	Point Rankings				Area Rankings			
Species	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
Ambystoma californiense	2.45 ± 0.7	3.09 ± 1	2.82 ± 0.9	3.91 ± 1	3.73 ± 0.6	4.18 ± 0.4	3.55 ± 0.5	4.64 ± 0.5
Ambystoma gracile	1.27 ± 0.5	1.45 ± 0.5	1.55 ± 0.5	1.36 ± 0.5	3 ± 0	3.09 ± 0.3	3 ± 0	3 ± 0
Ambystoma macrodactylum	2 ± 0	2 ± 0	2 ± 0	2 ± 0	2.82 ± 0.4	2.64 ± 0.5	2.73 ± 0.6	2.36 ± 0.7
Aneides ferreus	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Aneides flavipunctatus	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	2.91 ± 0.3
Aneides lugubris	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3.09 ± 0.3	3.18 ± 0.4	3.09 ± 0.3	3.09 ± 0.3
Aneides vagrans	2 ± 0	1.91 ± 0.5	2 ± 0	2 ± 0	3.18 ± 0.4	3.45 ± 0.7	3.36 ± 0.5	3.27 ± 0.5
Anniella pulchra	1.82 ± 0.4	1.73 ± 0.5	1.91 ± 0.3	1.73 ± 0.5	3.09 ± 0.3	3.09 ± 0.3	3.18 ± 0.4	3.09 ± 0.3
Arizona elegans	1.73 ± 0.5	1.64 ± 0.5	1.64 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Ascaphus truei	3.18 ± 0.4	3.09 ± 0.8	3.36 ± 0.5	3.73 ± 0.6	3.73 ± 0.6	4 ± 0.6	4 ± 0.6	4.27 ± 0.5
Aspidoscelis hyperythra	1.91 ± 0.3	2 ± 0	2 ± 0	2.09 ± 0.7	3.09 ± 0.3	3 ± 0	3.09 ± 0.3	3.18 ± 0.6
Aspidoscelis tigris	1.09 ± 0.3	1.27 ± 0.5	1.27 ± 0.5	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Batrachoseps altasierrae	2.45 ± 1.5	2.82 ± 1.3	3 ± 1.2	2.91 ± 1.2	3.82 ± 0.9	3.82 ± 0.9	3.91 ± 0.8	4 ± 1.1
Batrachoseps attenuatus	1.36 ± 0.5	1.45 ± 0.5	1.45 ± 0.5	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Batrachoseps bramei	3.55 ± 1.6	3.55 ± 1.6	3.91 ± 1.5	3.27 ± 1.7	4.45 ± 1.1	4.45 ± 1.4	4.82 ± 1.3	4.45 ± 1.4
Batrachoseps campi	3 ± 1.3	3.09 ± 1.5	2.91 ± 1.1	3.36 ± 1.2	4 ± 1.1	4.09 ± 1.2	3.82 ± 0.9	4.18 ± 1.2
Batrachoseps diabolicus	1 ± 0	1 ± 0	1.09 ± 0.3	1 ± 0	2.18 ± 0.4	2 ± 0	2.09 ± 0.3	2.09 ± 0.3
Batrachoseps gabrieli	1.45 ± 0.9	1.82 ± 1.2	1.82 ± 1.2	2.27 ± 1.6	2.55 ± 0.9	2.82 ± 1.2	2.64 ± 0.9	2.82 ± 1.2
Batrachoseps gavilanensis	2.09 ± 0.5	2.18 ± 0.4	2.36 ± 0.7	2.64 ± 0.8	3.09 ± 0.3	3.09 ± 0.3	3.18 ± 0.4	3.27 ± 0.5
Batrachoseps gregarius	2 ± 0	1.91 ± 0.3	1.73 ± 0.5	1.91 ± 0.5	3.09 ± 0.3	3.09 ± 0.3	3.09 ± 0.3	3.18 ± 0.4
Batrachoseps incognitus	5 ± 0	5 ± 0	5 ± 0	5 ± 0	6 ± 0	6 ± 0	6 ± 0	6 ± 0
Batrachoseps kawia	1.45 ± 0.5	1.64 ± 0.5	1.73 ± 0.5	1.55 ± 0.7	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Batrachoseps luciae	4 ± 1.1	4.27 ± 1	4 ± 0.9	4.73 ± 0.6	4.64 ± 1	4.64 ± 1	4.64 ± 1	5.09 ± 0.9
Batrachoseps major	1.64 ± 0.5	1.36 ± 0.5	1.36 ± 0.5	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Batrachoseps minor	5 ± 0	5 ± 0	5 ± 0	5 ± 0	5.73 ± 0.5	5.82 ± 0.4	5.82 ± 0.4	5.91 ± 0.3
Batrachoseps nigriventris	1.91 ± 0.3	1.91 ± 0.3	2 ± 0	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Batrachoseps pacificus	1.45 ± 0.7	1.36 ± 0.5	1.45 ± 0.8	1.45 ± 0.7	3.09 ± 0.3	3.09 ± 0.3	3.27 ± 0.5	3.18 ± 0.4
Batrachoseps regius	1.27 ± 0.5	1.27 ± 0.5	1.09 ± 0.3	1.09 ± 0.3	3.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0
Batrachoseps relictus	1.27 ± 0.6	1.27 ± 0.9	1 ± 0	1.27 ± 0.6	3.27 ± 0.6	3.27 ± 0.6	3 ± 0	3.45 ± 0.8
Batrachoseps robustus	2.27 ± 1.2	2.45 ± 1.4	2.27 ± 1.5	2.64 ± 1.2	3.36 ± 0.8	3.64 ± 1	3.64 ± 1	3.36 ± 0.7
Batrachoseps simatus	3 ± 1.3	2.82 ± 1.1	3.18 ± 1.1	3.27 ± 0.9	4.09 ± 1.4	4 ± 1.1	4.27 ± 1.1	4.27 ± 0.9
Batrachoseps stebbinsi	3.64 ± 0.8	4 ± 1	4.09 ± 0.7	4.73 ± 0.6	4.18 ± 0.8	4.55 ± 0.7	4.55 ± 0.8	5.27 ± 0.8
Bogertophis rosaliae[1]	2.82 ± 2.1	2.45 ± 2	2.09 ± 1.9	2.45 ± 2				
Bufo alvarius	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Bufo boreas	1.82 ± 0.4	1.91 ± 0.3	1.73 ± 0.5	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Bufo californicus	2.45 ± 0.7	2.55 ± 0.7	2.36 ± 0.5	2.82 ± 0.9	3.36 ± 0.5	3.45 ± 0.5	3.64 ± 0.5	3.64 ± 0.5
Bufo canorus	2.27 ± 0.6	2.45 ± 0.7	2.45 ± 0.7	2.55 ± 0.8	3.36 ± 0.8	3.82 ± 0.9	3.64 ± 0.8	3.82 ± 0.9
Bufo cognatus	1.09 ± 0.3	1.09 ± 0.3	1.09 ± 0.3	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3.09 ± 0.3

Species	Point Rankings				Area Rankings			
	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
Bufo exsul	4.73 ± 0.9	5 ± 0	4.18 ± 1.4	4.91 ± 0.3	5.73 ± 0.6	5.55 ± 0.7	5 ± 1.2	5.73 ± 0.9
Bufo punctatus	1.64 ± 0.5	1.73 ± 0.5	1.82 ± 0.4	1.55 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Bufo woodhousii	1.64 ± 0.7	1.27 ± 0.5	2.09 ± 1.1	1.18 ± 0.4	3.09 ± 0.3	3 ± 0	3.36 ± 0.5	3 ± 0
Callisaurus draconoides	1.36 ± 0.5	1.45 ± 0.5	1.55 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Charina bottae	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3.18 ± 0.4
Chionactis occipitalis	1.64 ± 0.5	1.45 ± 0.5	1.36 ± 0.5	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Coleonyx switaki	1 ± 0	1.09 ± 0.3	1.09 ± 0.3	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3.09 ± 0.3
Coleonyx variegatus	1 ± 0	1.09 ± 0.3	1.09 ± 0.3	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Coluber constrictor	1 ± 0	1.18 ± 0.4	1 ± 0	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Contia longicaudae	2.73 ± 0.8	3.18 ± 1	2.82 ± 0.9	3.82 ± 0.8	4.36 ± 0.5	4.64 ± 0.5	4.45 ± 0.5	5 ± 0
Contia tenuis	1.18 ± 0.4	1.09 ± 0.3	1.27 ± 0.5	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotalus atrox	1.09 ± 0.3	1 ± 0	1.09 ± 0.3	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotalus cerastes	1.36 ± 0.5	1.18 ± 0.4	1.18 ± 0.4	1.36 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotalus mitchellii	1.55 ± 0.5	1.55 ± 0.5	1.55 ± 0.5	1.64 ± 0.7	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotalus oreganus	1.82 ± 0.4	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotalus ruber	1.82 ± 0.4	1.82 ± 0.4	2 ± 0	2 ± 0.8	3.09 ± 0.3	3 ± 0	3.09 ± 0.3	3.18 ± 0.6
Crotalus scutulatus	1.55 ± 0.5	1.64 ± 0.5	1.36 ± 0.5	1.55 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotalus stephensi	2 ± 0	1.91 ± 0.3	1.82 ± 0.4	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Crotaphytus bicinctores	1.73 ± 0.5	1.73 ± 0.5	1.73 ± 0.5	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3.09 ± 0.3
Crotaphytus vestigium	1.45 ± 0.5	1.27 ± 0.5	1.73 ± 0.6	1.55 ± 0.7	3.09 ± 0.3	3 ± 0	3.09 ± 0.3	3.09 ± 0.3
Diadophis punctatus	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Dicamptodon ensatus	1.91 ± 0.3	1.91 ± 0.3	1.82 ± 0.4	1.91 ± 0.3	3.09 ± 0.3	3.18 ± 0.4	3.09 ± 0.3	3.27 ± 0.5
Dicamptodon tenebrosus	1.73 ± 0.5	1.55 ± 0.5	1.91 ± 0.3	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Dipsosaurus dorsalis	1.91 ± 0.3	1.91 ± 0.3	1.91 ± 0.3	1.73 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Elgaria coerulea	1.73 ± 0.5	1.55 ± 0.5	1.45 ± 0.5	1.82 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Elgaria multicarinata	1.55 ± 0.5	1.45 ± 0.5	1.55 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Elgaria panamintina	4 ± 0.8	4.09 ± 0.8	3.91 ± 0.8	4.27 ± 1	4.82 ± 0.4	4.82 ± 0.6	4.45 ± 0.7	4.91 ± 0.9
Emys marmorata	1.27 ± 0.5	1.82 ± 0.4	1.55 ± 0.5	1.82 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Ensatina eschscholtzii	1.55 ± 0.5	2 ± 0	1.73 ± 0.5	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Gambelia copeii	1.64 ± 0.5	1.55 ± 0.5	1.64 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3.18 ± 0.6
Gambelia sila	1.82 ± 0.4	1.82 ± 0.4	1.73 ± 0.5	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Gambelia wislizenii	1.91 ± 0.3	2 ± 0	1.73 ± 0.5	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Gopherus agassizii	2.27 ± 0.5	2.18 ± 0.6	2.09 ± 0.3	2.27 ± 0.5	3.27 ± 0.5	3.27 ± 0.6	3.18 ± 0.4	3.36 ± 0.5
Heloderma suspectum	1.27 ± 0.5	1.45 ± 0.5	1.55 ± 0.5	1.27 ± 0.5	2.55 ± 0.5	2.73 ± 0.5	2.73 ± 0.5	2.45 ± 0.5
Hydromantes brunus	1.09 ± 0.3	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Hydromantes platycephalus	2.09 ± 0.3	2.64 ± 1.2	2.27 ± 0.5	2.55 ± 0.9	3.27 ± 0.5	3.73 ± 1.1	3.27 ± 0.5	3.45 ± 0.7
Hydromantes shastae	3.27 ± 1.3	3.45 ± 1.5	2.91 ± 1.1	3.82 ± 1.4	4.27 ± 1.1	4.27 ± 1.2	3.82 ± 0.9	4.45 ± 1.1
Hypsiglena chlorophaea	1.55 ± 0.5	1.55 ± 0.5	1.55 ± 0.5	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3.09 ± 0.3
Hypsiglena ochrorhyncha	1.91 ± 0.3	2 ± 0	2 ± 0	2.09 ± 0.3	3.09 ± 0.3	3.18 ± 0.4	3.09 ± 0.3	3.36 ± 0.5
Kinosternon sonoriense	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Lampropeltis californiae	1.18 ± 0.4	1.27 ± 0.5	1.18 ± 0.4	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Lampropeltis zonata	1.82 ± 0.4	1.73 ± 0.5	1.82 ± 0.4	1.73 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Leptotyphlops humilis	1.36 ± 0.5	1.27 ± 0.5	1.45 ± 0.5	1.27 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Lichanura orcutti	1.18 ± 0.4	1.27 ± 0.5	1.18 ± 0.4	1.27 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0

Species	Point Rankings RCP 2.6	Point Rankings RCP 4.5	Point Rankings RCP 6.0	Point Rankings RCP 8.5	Area Rankings RCP 2.6	Area Rankings RCP 4.5	Area Rankings RCP 6.0	Area Rankings RCP 8.5
Masticophis flagellum	1.36 ± 0.5	1.45 ± 0.5	1.27 ± 0.5	1.27 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Masticophis fuliginosus	1.45 ± 0.5	1.45 ± 0.5	1.55 ± 0.5	1.64 ± 0.9	3 ± 0	3 ± 0	3.09 ± 0.3	3.27 ± 0.6
Masticophis lateralis	1.82 ± 0.4	1.82 ± 0.4	1.73 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Masticophis taeniatus	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3.18 ± 0.4	3.09 ± 0.3	3.09 ± 0.3
Petrosaurus mearnsi	1.82 ± 0.4	2 ± 0	1.91 ± 0.3	2.09 ± 0.7	3.18 ± 0.4	3.09 ± 0.3	3.18 ± 0.4	3.27 ± 0.6
Phrynosoma blainvillii	1.82 ± 0.4	1.91 ± 0.3	2 ± 0	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Phrynosoma douglasii	2.82 ± 0.6	2.27 ± 1	2.82 ± 0.6	2.82 ± 0.6	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Phrynosoma mcallii	1.18 ± 0.4	1.09 ± 0.3	1.18 ± 0.4	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Phrynosoma platyrhinos	1.82 ± 0.4	1.82 ± 0.4	1.64 ± 0.5	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Phyllodactylus nocticolus	2.45 ± 0.9	2 ± 1.2	2.82 ± 1	1.91 ± 1.4	3.64 ± 0.7	3.45 ± 0.8	3.91 ± 1	3.55 ± 0.8
Phyllorhynchus decurtatus	1.55 ± 0.5	1.36 ± 0.5	1.18 ± 0.4	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Pituophis catenifer	1.27 ± 0.5	1.18 ± 0.4	1.45 ± 0.5	1.27 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Plestiodon gilberti	1.82 ± 0.4	2 ± 0.8	1.91 ± 0.3	2.09 ± 0.7	3 ± 0	3.36 ± 0.7	3 ± 0	3.18 ± 0.6
Plestiodon skiltonianus	1.55 ± 0.5	1.64 ± 0.5	1.55 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Plethodon asupak	2.27 ± 1.5	3.18 ± 1.5	2 ± 1.5	2.36 ± 1.7	3.64 ± 0.9	4.27 ± 1.1	3.55 ± 0.9	3.82 ± 1.2
Plethodon dunni	3 ± 2	2.73 ± 1.8	3.64 ± 1.9	4.18 ± 1.2	4.45 ± 1.5	4.27 ± 1.3	4.82 ± 1.5	5.27 ± 1
Plethodon elongatus	1.73 ± 0.5	1.73 ± 0.6	2.09 ± 0.7	2 ± 1.2	3 ± 0	3 ± 0	3 ± 0	3.18 ± 0.4
Plethodon stormi	2.18 ± 0.4	2.27 ± 0.5	2.09 ± 0.3	2.45 ± 0.5	3.18 ± 0.4	3.27 ± 0.5	3.09 ± 0.3	3.45 ± 0.5
Pseudacris cadaverina	2 ± 0	2 ± 0	2 ± 0	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Pseudacris regilla	1.64 ± 0.5	1.91 ± 0.3	1.82 ± 0.4	1.73 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rana aurora	1.73 ± 0.5	1.73 ± 0.5	2 ± 0	1.91 ± 0.3	3.18 ± 0.4	3.45 ± 0.5	3.36 ± 0.5	3.73 ± 0.5
Rana boylii	1.64 ± 0.5	1.82 ± 0.4	1.55 ± 0.5	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rana cascadae	2 ± 0	2.18 ± 0.4	2 ± 0	2.55 ± 0.5	4 ± 0.6	4.36 ± 0.7	4 ± 0.4	4.73 ± 0.5
Rana draytonii	1.64 ± 0.5	1.73 ± 0.5	1.73 ± 0.5	1.82 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rana muscosa	1.27 ± 0.5	1.36 ± 0.5	1.45 ± 0.5	1.27 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rana pipiens	2.36 ± 0.5	2.09 ± 0.3	2.18 ± 0.6	2.18 ± 0.4	3.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0
Rana pretiosa	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rana sierrae	1.91 ± 0.3	2 ± 0	2 ± 0	1.82 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rana yavapaiensis	2.18 ± 1	1.82 ± 1.2	2 ± 1	2.27 ± 1.2	2.73 ± 1	2.36 ± 1	2.36 ± 0.5	2.82 ± 1.3
Rhinocheilus lecontei	1.64 ± 0.5	1.45 ± 0.5	1.55 ± 0.5	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Rhyacotriton variegatus	3 ± 0.6	3 ± 0.8	3.36 ± 0.8	3.64 ± 0.8	3.91 ± 0.7	4 ± 0.8	4 ± 0.6	4.27 ± 0.6
Salvadora hexalepis	1.55 ± 0.5	1.55 ± 0.5	1.55 ± 0.5	1.64 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Sauromalus ater	1.36 ± 0.5	1.18 ± 0.4	1.18 ± 0.4	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Scaphiopus couchii	1.36 ± 0.7	1.18 ± 0.4	1.73 ± 1.3	1.45 ± 1.2	3.18 ± 0.4	3.09 ± 0.3	3.27 ± 0.6	3.18 ± 0.6
Sceloporus graciosus	1.45 ± 0.5	1.55 ± 0.5	1.45 ± 0.5	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Sceloporus magister	1.64 ± 0.5	1.18 ± 0.4	1.36 ± 0.5	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Sceloporus occidentalis	1.36 ± 0.5	1.55 ± 0.5	1.55 ± 0.5	1.55 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Sceloporus orcutti	2 ± 0	2 ± 0	2 ± 0	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Sonora semiannulata	1.27 ± 0.5	1.27 ± 0.5	1.27 ± 0.5	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Spea hammondii	2 ± 0	2.36 ± 0.7	2 ± 0	2.36 ± 0.7	3 ± 0	3.36 ± 0.7	3 ± 0	3.36 ± 0.7
Spea intermontana	1.64 ± 0.5	1.73 ± 0.5	1.73 ± 0.5	1.64 ± 0.5	3 ± 0	3.09 ± 0.3	3 ± 0	3.18 ± 0.4
Tantilla hobartsmithi	1.09 ± 0.3	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Tantilla planiceps	1.82 ± 0.4	1.91 ± 0.3	1.91 ± 0.3	1.82 ± 0.4	3.09 ± 0.3	3.09 ± 0.3	3.18 ± 0.4	3 ± 0.4
Taricha granulosa	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0

Species	Point Rankings				Area Rankings			
	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
Taricha rivularis	2.73 ± 1.1	3.45 ± 1.1	3.45 ± 1.2	3.91 ± 0.9	3.45 ± 0.7	3.91 ± 0.7	4 ± 0.6	4.36 ± 0.7
Taricha sierrae	1.27 ± 0.5	1.36 ± 0.5	1.36 ± 0.5	1.45 ± 0.5	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Taricha torosa	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3.09 ± 0.3	3.09 ± 0.3	3.09 ± 0.3	3.09 ± 0.3
Thamnophis atratus	1.73 ± 0.5	1.82 ± 0.4	1.82 ± 0.4	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Thamnophis couchii	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Thamnophis elegans	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Thamnophis gigas	1.09 ± 0.3	1.36 ± 0.7	1.36 ± 0.5	1.45 ± 0.5	3 ± 0	3.18 ± 0.4	3 ± 0	3.09 ± 0.3
Thamnophis hammondii	1.36 ± 0.5	1.27 ± 0.5	1.36 ± 0.5	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Thamnophis marcianus	1 ± 0	1.09 ± 0.3	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Thamnophis ordinoides	1 ± 0	1 ± 0	1 ± 0	1 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Thamnophis sirtalis	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Trimorphodon lambda	1.18 ± 0.4	1 ± 0	1.27 ± 0.5	1 ± 0	3.27 ± 0.5	3.18 ± 0.4	3.27 ± 0.5	3.09 ± 0.3
Trimorphodon lyrophanes	1.36 ± 0.5	1.18 ± 0.4	1.36 ± 0.5	1.27 ± 0.5	3 ± 0	3 ± 0	2.91 ± 0.3	2.91 ± 0.3
Uma inornata	1.45 ± 0.9	1.27 ± 0.5	1.55 ± 0.5	1.55 ± 0.5	3.18 ± 0.6	3 ± 0	3 ± 0	3 ± 0
Uma notata	1.82 ± 0.4	1.36 ± 0.5	1.64 ± 0.5	1.82 ± 0.6	3.09 ± 0.3	3 ± 0	3.18 ± 0.4	3.09 ± 0.3
Uma scoparia	1.73 ± 0.5	1.82 ± 0.4	1.64 ± 0.5	1.82 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Urosaurus graciosus	1.36 ± 0.5	1.36 ± 0.5	1.45 ± 0.5	1.18 ± 0.4	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Urosaurus nigricaudus	2.73 ± 0.8	3.09 ± 1	3 ± 1	2.82 ± 1	4.09 ± 0.9	4.09 ± 1	4.09 ± 1	4.09 ± 0.9
Urosaurus ornatus	1.27 ± 0.5	1.27 ± 0.5	1.91 ± 1	1.73 ± 1	2.45 ± 0.5	2.73 ± 0.6	3 ± 0.6	2.45 ± 0.5
Uta stansburiana	1.36 ± 0.5	1.27 ± 0.5	1.36 ± 0.5	1.09 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Xantusia gracilis[1]	1 ± 0	1 ± 0	1 ± 0	1 ± 0				
Xantusia henshawi	1.73 ± 0.5	1.91 ± 0.3	2 ± 0	1.91 ± 0.3	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Xantusia riversiana	4.64 ± 0.5	4.73 ± 0.5	4.73 ± 0.5	4.82 ± 0.4	5.36 ± 0.7	5.36 ± 0.7	5.27 ± 0.5	5.55 ± 0.5
Xantusia sp. San Jacinto	3.09 ± 0.8	3.73 ± 0.5	3.18 ± 0.9	3.36 ± 0.8	4.18 ± 0.4	4 ± 0	4 ± 0	4 ± 0.6
Xantusia vigilis	2 ± 0	2 ± 0	2 ± 0	2 ± 0	3 ± 0	3 ± 0	3 ± 0	3 ± 0
Xantusia wigginsi	2.36 ± 1.3	2.36 ± 1.5	2.36 ± 1.4	2.18 ± 1.5	3.55 ± 0.8	3.45 ± 0.8	3.45 ± 0.8	3.73 ± 1.1
Xantusia sp. Yucca Valley	2.09 ± 0.3	2.18 ± 0.6	2.18 ± 0.4	2.45 ± 0.9	3.45 ± 0.5	3.36 ± 0.5	3.45 ± 0.5	3.82 ± 0.9

[1]Too few localities to calculate a minimum convex polygon and compute an area ranking.

Appendix V: Climate Variables Used

See Methods for a description of how variables were selected. Description of variables can be found at http://www.worldclim.org/bioclim

Species	Bio 1: Mean Annual Temperature	Bio 2: Mean Diurnal Range	Bio 3: Isothermality	Bio 4: Temperature Seasonality	Bio 5: Max Temperature Warmest Month	Bio 6: Min Temperature Coldest Month	Bio 7: Temperature Annual Range	Bio 8: Mean Temperature Wettest Quarter	Bio 9: Mean Temperature Driest Quarter	Bio 10 : Mean Temperature Warmest Quarter	Bio 11: Mean Temperature Coldest Quarter	Bio 12: Annual Precipitation	Bio 13: Precipitation of the Wettest Month	Bio 14: Precipitation of the Driest Month	Bio 15: Precipitation Seasonality	Bio 16: Precipitation of the Wettest Quarter	Bio 17: Precipitation of the Driest Quarter	Bio 18: Precipitation of the Warmest Quarter	Bio 19: Precipitation of the Coldest Quarter
Ambystoma californiense	X		X			X	X						X		X		X		
Ambystoma gracile	X	X		X									X		X		X		
Ambystoma macrodactylum		X		X				X		X	X	X			X			X	
Aneides ferreus			X			X	X		X					X	X	X			
Aneides flavipunctatus	X	X	X										X					X	
Aneides lugubris		X	X	X						X	X		X	X	X				
Aneides vagrans		X	X							X					X			X	X
Anniella pulchra			X			X	X			X		X			X		X		
Arizona elegans		X	X	X	X			X	X					X	X			X	X
Ascaphus truei	X	X		X											X		X		X
Aspidoscelis hyperythra		X	X	X	X	X			X				X		X			X	X
Aspidoscelis tigris		X	X		X		X	X	X				X	X				X	
Batrachoseps altasierrae			X		X									X					X
Batrachoseps attenuatus			X	X				X		X		X			X				
Batrachoseps bramei			X				X							X		X			
Batrachoseps campi			X				X								X	X			
Batrachoseps diabolicus						X	X							X					X
Batrachoseps gabrieli				X		X								X	X	X			
Batrachoseps gavilanensis	X	X	X	X		X						X							
Batrachoseps gregarius			X												X	X	X		
Batrachoseps incognitus									X										
Batrachoseps kawia																	X		
Batrachoseps luciae	X		X		X										X		X		
Batrachoseps major		X	X	X		X			X			X		X	X			X	
Batrachoseps minor	X													X					
Batrachoseps nigriventris			X				X			X	X		X	X	X			X	
Batrachoseps pacificus		X				X							X				X	X	
Batrachoseps regius			X											X	X				
Batrachoseps relictus			X																
Batrachoseps robustus						X	X						X		X		X		
Batrachoseps simatus									X				X		X				
Batrachoseps stebbinsi						X								X					X

Species	Bio 1: Mean Annual Temperature	Bio 2: Mean Diurnal Range	Bio 3: Isothermality	Bio 4: Temperature Seasonality	Bio 5: Max Temperature Warmest Month	Bio 6: Min Temperature Coldest Month	Bio 7: Temperature Annual Range	Bio 8: Mean Temperature Wettest Quarter	Bio 9: Mean Temperature Driest Quarter	Bio 10 : Mean Temperature Warmest Quarter	Bio 11: Mean Temperature Coldest Quarter	Bio 12: Annual Precipitation	Bio 13: Precipitation of the Wettest Month	Bio 14: Precipitation of the Driest Month	Bio 15: Precipitation Seasonality	Bio 16: Precipitation of the Wettest Quarter	Bio 17: Precipitation of the Driest Quarter	Bio 18: Precipitation of the Warmest Quarter	Bio 19: Precipitation of the Coldest Quarter
Bogertophis rosaliae								X									X	X	
Bufo alvarius		X	X	X	X			X			X			X				X	
Bufo boreas		X	X	X				X		X					X	X		X	
Bufo californicus	X		X		X	X						X		X	X			X	
Bufo canorus			X		X								X	X	X				
Bufo cognatus		X				X	X	X							X		X	X	X
Bufo exsul			X					X	X				X		X				
Bufo punctatus	X	X		X				X	X						X		X	X	X
Bufo woodhousii		X					X	X	X	X				X	X			X	
Callisaurus draconoides		X	X	X	X						X			X				X	X
Charina bottae		X	X	X						X	X	X					X		
Chionactis occipitalis		X	X	X	X	X		X					X	X	X			X	
Coleonyx switaki										X				X	X			X	
Coleonyx variegatus		X		X				X		X	X				X	X	X	X	
Coluber constrictor		X	X			X	X		X	X		X			X			X	
Contia longicaudae		X	X			X				X									X
Contia tenuis			X				X			X					X			X	
Crotalus atrox		X			X	X	X	X						X	X			X	
Crotalus cerastes		X	X	X	X	X						X			X		X	X	
Crotalus mitchellii		X				X	X	X	X						X		X	X	X
Crotalus oreganus		X	X	X	X			X	X			X			X		X		
Crotalus ruber		X	X	X				X	X				X		X			X	X
Crotalus scutulatus		X	X		X	X	X	X					X	X	X				X
Crotalus stephensi		X	X	X		X									X	X		X	
Crotaphytus bicinctores		X	X	X				X	X		X			X	X	X			
Crotaphytus vestigium			X	X		X						X						X	
Diadophis punctatus		X				X	X	X		X				X	X	X		X	X
Dicamptodon ensatus			X			X				X		X		X					
Dicamptodon tenebrosus		X	X	X		X			X						X	X		X	
Dipsosaurus dorsalis	X	X	X				X						X				X		X
Elgaria coerulea			X			X	X			X		X						X	
Elgaria multicarinata			X			X	X			X				X	X	X			
Elgaria panamintina							X								X			X	
Emys marmorata		X	X	X		X				X			X		X		X		
Ensatina eschscholtzii	X	X	X	X											X				X

Species	Bio 1: Mean Annual Temperature	Bio 2: Mean Diurnal Range	Bio 3: Isothermality	Bio 4: Temperature Seasonality	Bio 5: Max Temperature Warmest Month	Bio 6: Min Temperature Coldest Month	Bio 7: Temperature Annual Range	Bio 8: Mean Temperature Wettest Quarter	Bio 9: Mean Temperature Driest Quarter	Bio 10 : Mean Temperature Warmest Quarter	Bio 11: Mean Temperature Coldest Quarter	Bio 12: Annual Precipitation	Bio 13: Precipitation of the Wettest Month	Bio 14: Precipitation of the Driest Month	Bio 15: Precipitation Seasonality	Bio 16: Precipitation of the Wettest Quarter	Bio 17: Precipitation of the Driest Quarter	Bio 18: Precipitation of the Warmest Quarter	Bio 19: Precipitation of the Coldest Quarter
Gambelia copeii		X	X			X			X					X			X	X	
Gambelia sila		X	X	X		X									X		X		X
Gambelia wislizenii		X	X				X	X	X		X			X		X		X	
Gopherus agassizii		X	X	X							X				X	X		X	
Heloderma suspectum		X									X			X		X			
Hydromantes brunus							X												
Hydromantes platycephalus			X	X				X					X	X	X				
Hydromantes shastae						X	X						X						
Hypsiglena chlorophaea		X			X		X	X	X					X	X			X	X
Hypsiglena ochrorhyncha		X		X	X			X							X	X	X	X	
Kinosternon sonoriense				X									X				X		
Lampropeltis californiae		X	X	X		X				X		X		X	X			X	
Lampropeltis zonata		X	X	X						X					X	X		X	
Leptotyphlops humilis		X	X	X				X	X	X	X			X				X	X
Lichanura orcutti	X	X	X	X				X				X		X	X				
Masticophis flagellum		X	X	X	X			X	X					X	X			X	X
Masticophis fuliginosus		X	X	X						X				X	X	X			X
Masticophis lateralis			X	X						X			X	X	X			X	
Masticophis taeniatus		X	X	X	X			X	X		X		X	X	X			X	X
Petrosaurus mearnsi		X	X	X				X	X				X		X			X	
Phrynosoma blainvillii			X				X	X		X			X	X	X			X	
Phrynosoma douglasii															X				
Phrynosoma mcallii		X	X	X				X			X			X	X			X	
Phrynosoma platyrhinos		X	X			X	X	X	X				X				X	X	
Phyllodactylus nocticolus		X	X	X									X					X	
Phyllorhynchus decurtatus		X		X		X		X		X		X		X	X			X	
Pituophis catenifer		X	X				X		X	X		X			X		X	X	
Plestiodon gilberti		X	X	X	X	X		X				X			X		X		
Plestiodon skiltonianus		X	X	X		X		X	X	X		X		X					
Plethodon asupak						X	X					X						X	
Plethodon dunni			X				X	X		X			X	X	X				
Plethodon elongatus							X		X		X			X	X			X	X
Plethodon stormi		X									X		X	X				X	
Pseudacris cadaverina		X	X	X		X		X	X			X			X		X	X	

Species	Bio 1: Mean Annual Temperature	Bio 2: Mean Diurnal Range	Bio 3: Isothermality	Bio 4: Temperature Seasonality	Bio 5: Max Temperature Warmest Month	Bio 6: Min Temperature Coldest Month	Bio 7: Temperature Annual Range	Bio 8: Mean Temperature Wettest Quarter	Bio 9: Mean Temperature Driest Quarter	Bio 10 : Mean Temperature Warmest Quarter	Bio 11: Mean Temperature Coldest Quarter	Bio 12: Annual Precipitation	Bio 13: Precipitation of the Wettest Month	Bio 14: Precipitation of the Driest Month	Bio 15: Precipitation Seasonality	Bio 16: Precipitation of the Wettest Quarter	Bio 17: Precipitation of the Driest Quarter	Bio 18: Precipitation of the Warmest Quarter	Bio 19: Precipitation of the Coldest Quarter
Pseudacris regilla	X	X		X								X		X	X				
Rana aurora		X		X				X		X					X			X	X
Rana boylii		X	X	X		X				X							X		X
Rana cascadae	X		X	X											X	X			
Rana draytonii	X	X	X	X								X			X		X		
Rana muscosa		X	X	X					X			X			X			X	
Rana pipiens			X	X						X				X	X			X	
Rana pretiosa			X					X				X			X				
Rana sierrae			X		X		X					X			X			X	
Rana yavapaiensis	X														X			X	
Rhinocheilus lecontei		X	X	X				X	X	X	X			X	X			X	X
Rhyacotriton variegatus			X	X		X			X			X		X	X				
Salvadora hexalepis		X				X	X	X		X				X	X			X	X
Sauromalus ater		X		X	X	X		X						X	X			X	X
Scaphiopus couchii		X		X	X	X		X					X	X	X				X
Sceloporus graciosus		X	X	X				X	X	X	X		X					X	
Sceloporus magister		X		X	X	X		X							X	X	X		X
Sceloporus occidentalis		X	X	X	X			X	X		X	X			X		X		
Sceloporus orcutti		X	X	X		X			X				X		X		X	X	
Sonora semiannulata		X		X	X	X		X	X					X	X			X	X
Spea hammondii	X	X	X	X									X	X	X			X	
Spea intermontana			X	X				X	X		X		X		X				
Tantilla hobartsmithi		X	X	X		X		X	X					X	X			X	X
Tantilla planiceps		X	X	X		X			X	X				X	X			X	X
Taricha granulosa		X		X		X						X							
Taricha rivularis			X				X				X			X	X				
Taricha sierrae			X	X							X			X		X			
Taricha torosa		X	X	X		X			X			X			X			X	
Thamnophis atratus		X	X	X				X		X						X	X		
Thamnophis couchii			X	X		X						X		X					
Thamnophis elegans		X	X	X		X		X		X		X			X		X	X	
Thamnophis gigas	X	X	X	X									X	X	X				
Thamnophis hammondii			X	X	X	X							X		X		X	X	
Thamnophis marcianus	X	X	X	X	X			X							X			X	X
Thamnophis ordinoides			X		X	X	X							X	X	X			

Species	Bio 1: Mean Annual Temperature	Bio 2: Mean Diurnal Range	Bio 3: Isothermality	Bio 4: Temperature Seasonality	Bio 5: Max Temperature Warmest Month	Bio 6: Min Temperature Coldest Month	Bio 7: Temperature Annual Range	Bio 8: Mean Temperature Wettest Quarter	Bio 9: Mean Temperature Driest Quarter	Bio 10 : Mean Temperature Warmest Quarter	Bio 11: Mean Temperature Coldest Quarter	Bio 12: Annual Precipitation	Bio 13: Precipitation of the Wettest Month	Bio 14: Precipitation of the Driest Month	Bio 15: Precipitation Seasonality	Bio 16: Precipitation of the Wettest Quarter	Bio 17: Precipitation of the Driest Quarter	Bio 18: Precipitation of the Warmest Quarter	Bio 19: Precipitation of the Coldest Quarter
Thamnophis sirtalis		X	X	X				X		X		X			X		X	X	
Trimorphodon lambda		X					X	X		X								X	X
Trimorphodon lyrophanes	X	X	X				X		X						X		X	X	X
Uma inornata		X		X				X			X				X			X	
Uma notata		X	X			X	X	X				X			X			X	
Uma scoparia		X	X	X				X	X					X				X	X
Urosaurus graciosus	X	X	X	X				X					X				X	X	
Urosaurus nigricaudus		X	X	X	X			X					X					X	X
Urosaurus ornatus		X		X						X				X	X			X	X
Uta stansburiana		X		X					X	X			X	X	X			X	X
Xantusia gracilis					X														
Xantusia henshawi			X	X		X			X						X		X	X	X
Xantusia riversiana									X									X	
Xantusia sp. San Jacinto		X	X	X		X							X						
Xantusia vigilis		X		X	X			X			X	X			X		X		
Xantusia wigginsi		X	X	X				X		X			X		X			X	
Xantusia sp. Yucca Valley	X	X													X		X		

Appendix VI Species Results

Species Results: *Ambystoma californiense* California Tiger Salamander

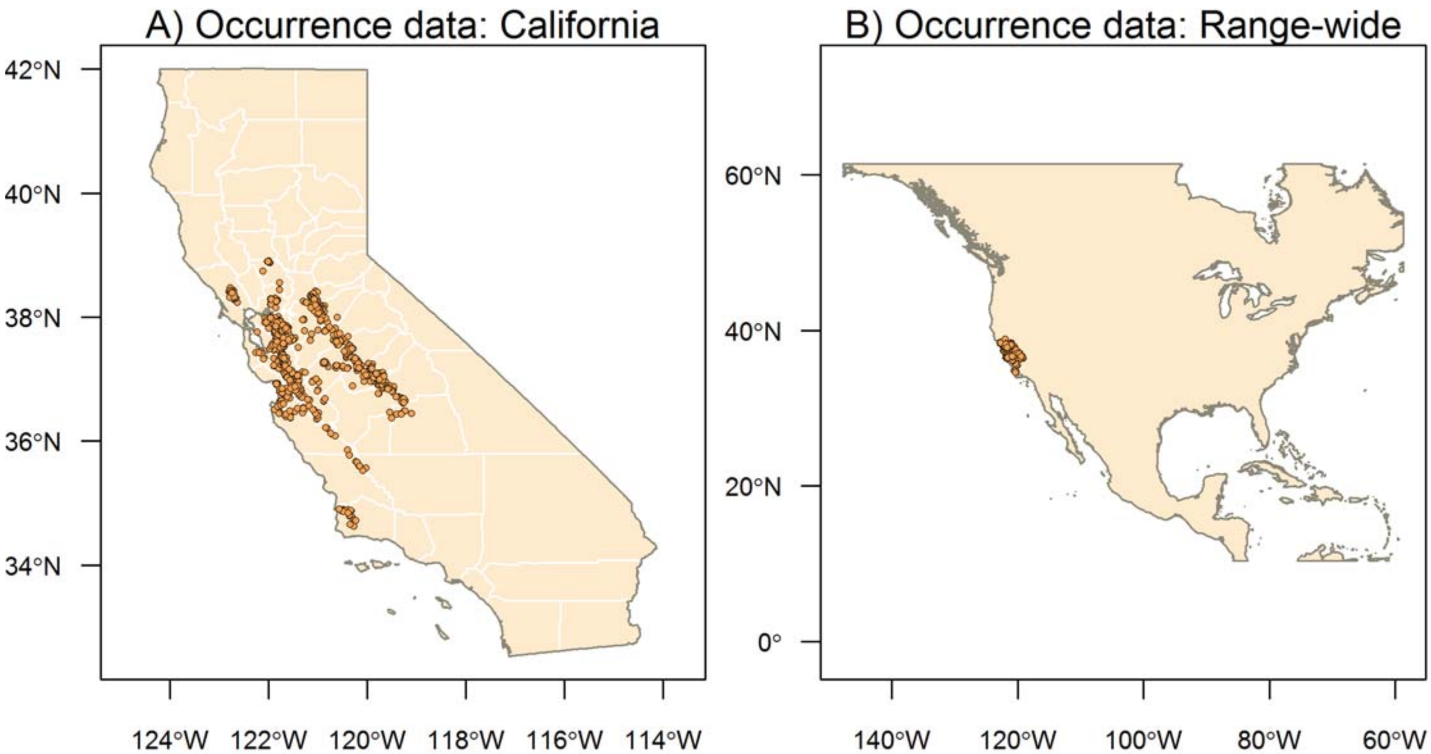


Figure 1. Occurrence data used to build Maxent models.

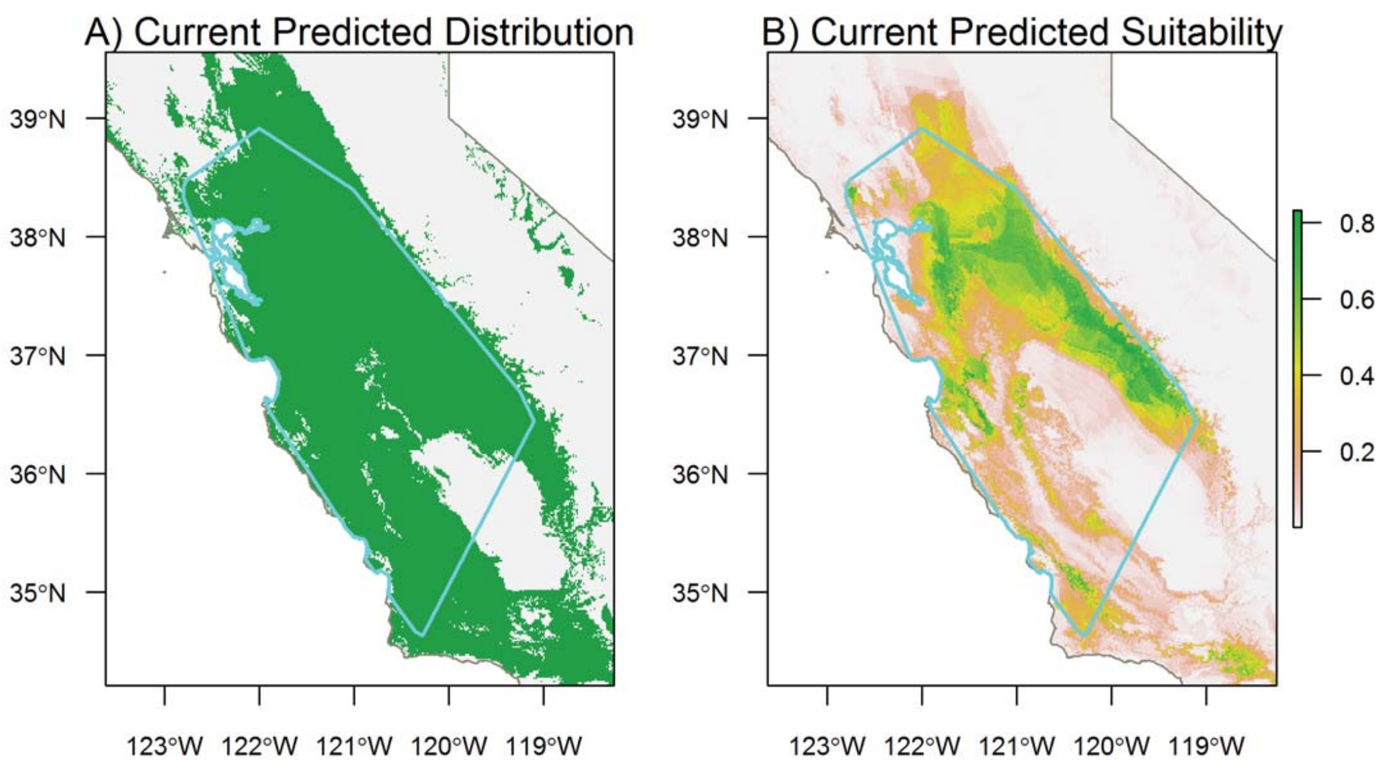


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Ambystoma californiense* California Tiger Salamander

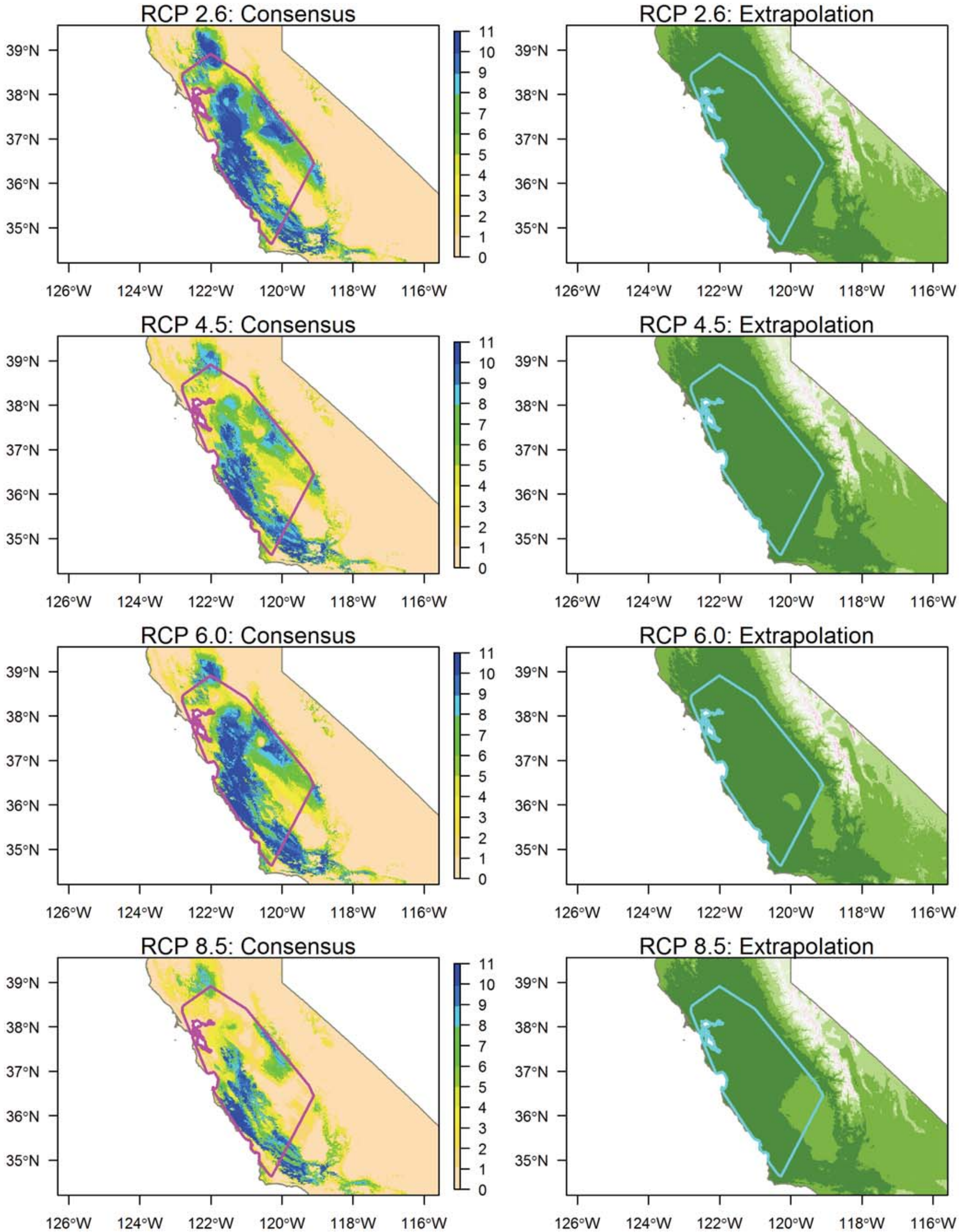


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

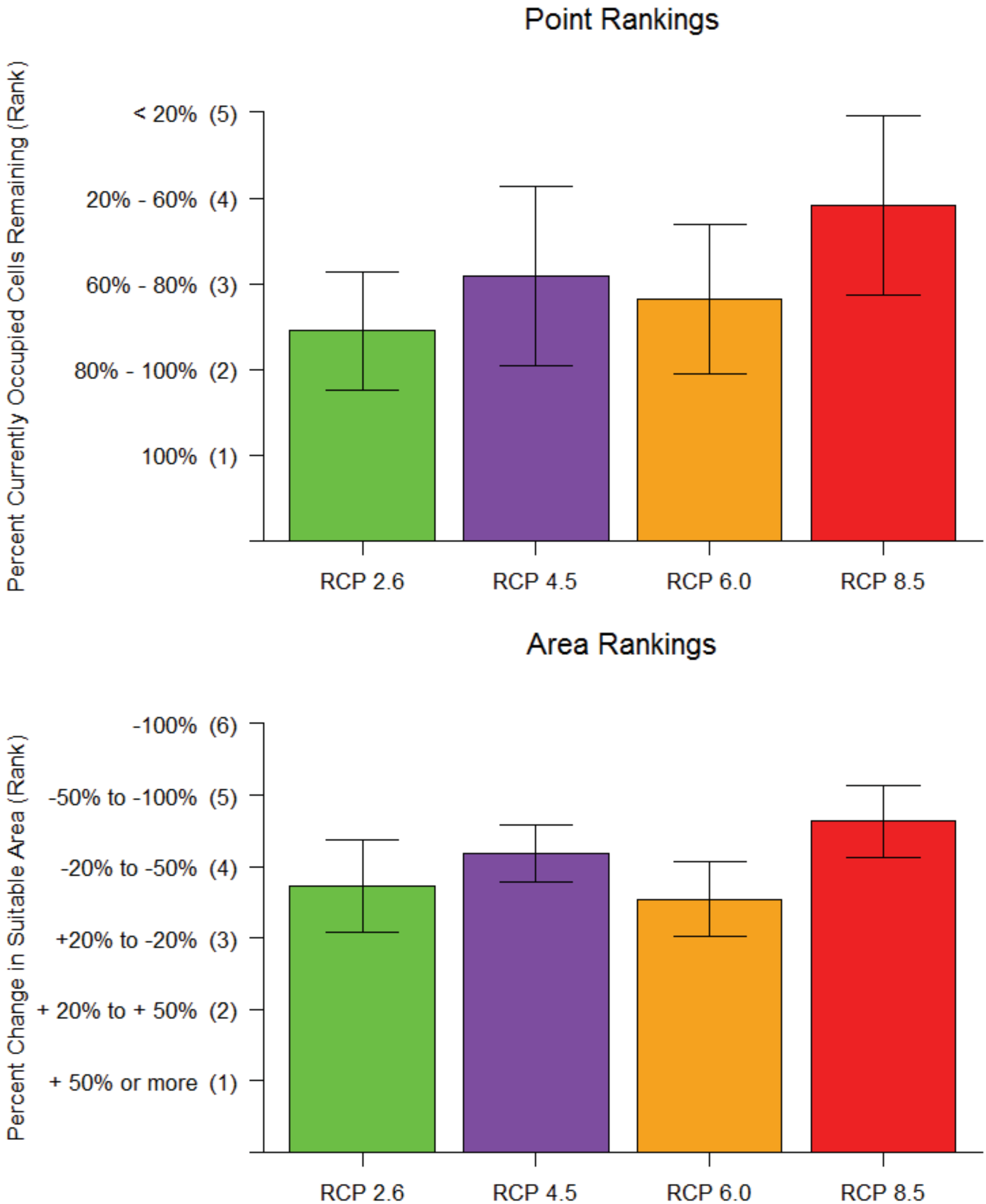


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Ambystoma gracile* Northwestern Salamander

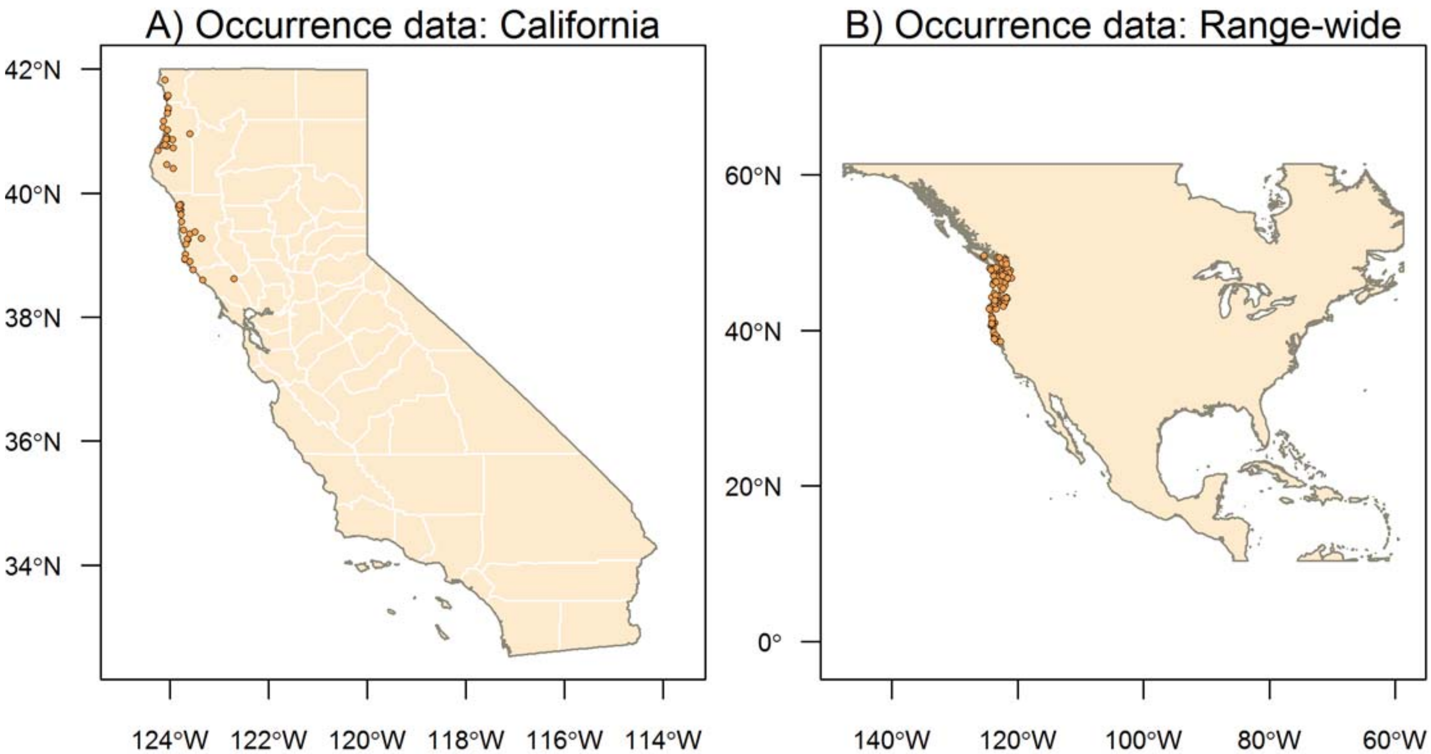


Figure 1. Occurrence data used to build Maxent models.

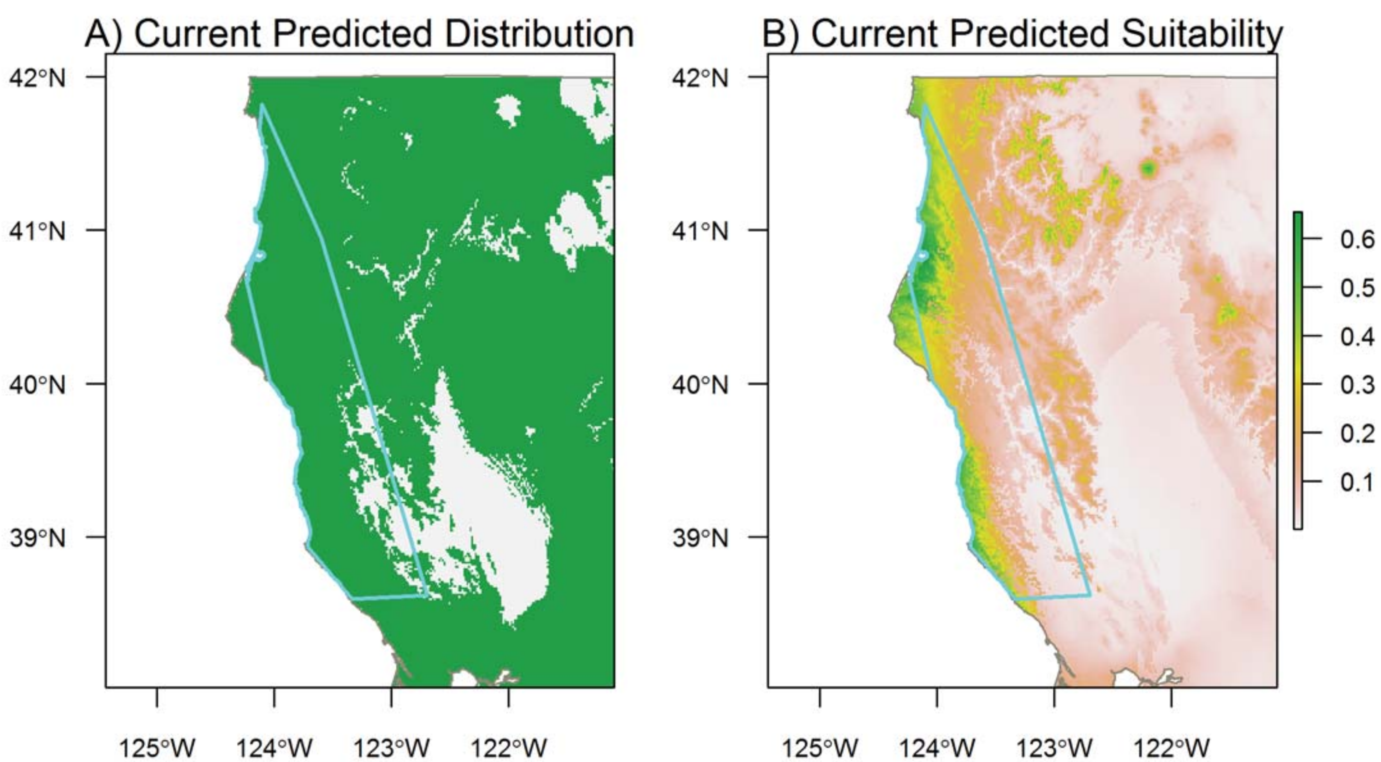


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Ambystoma gracile* Northwestern Salamander

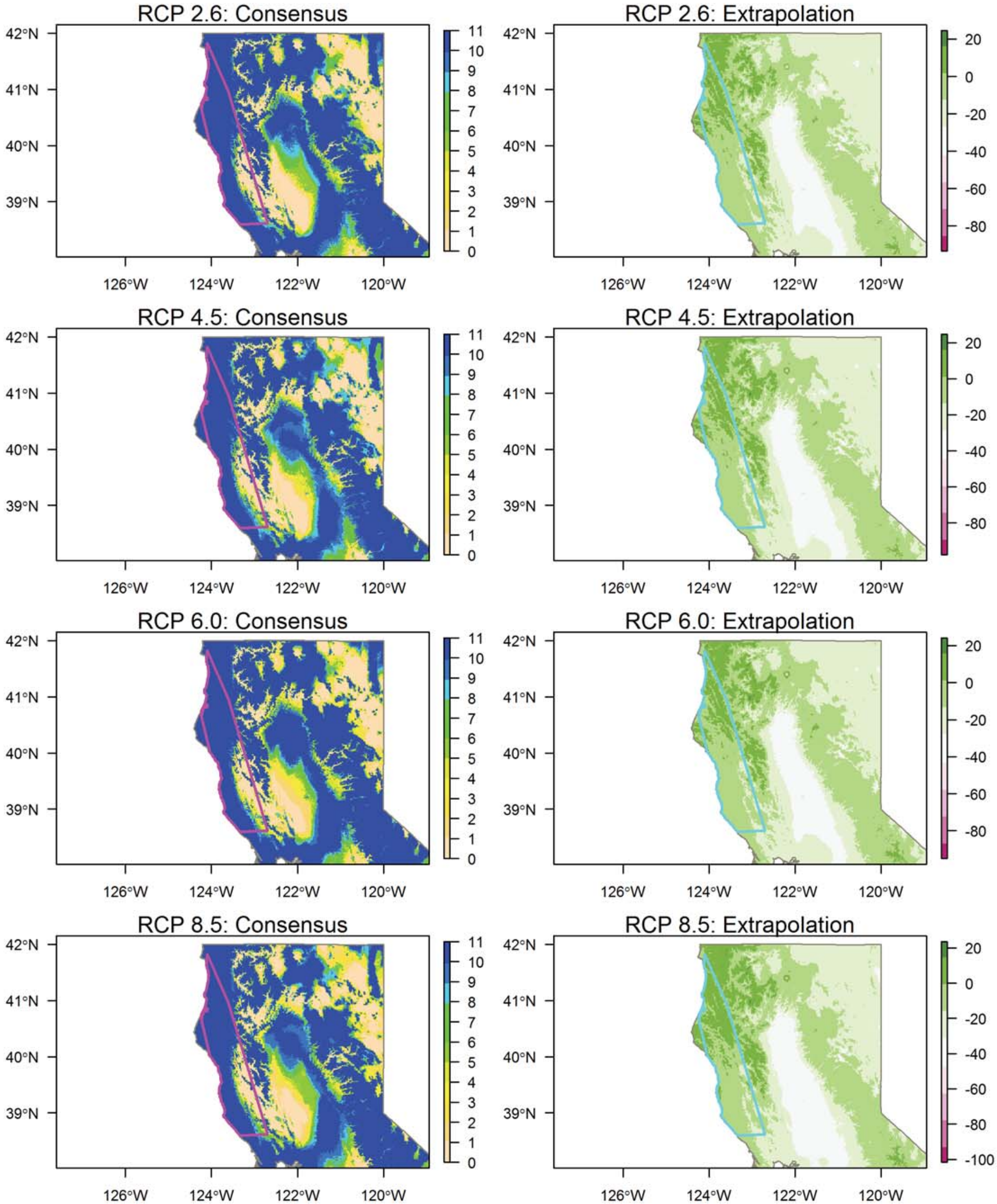
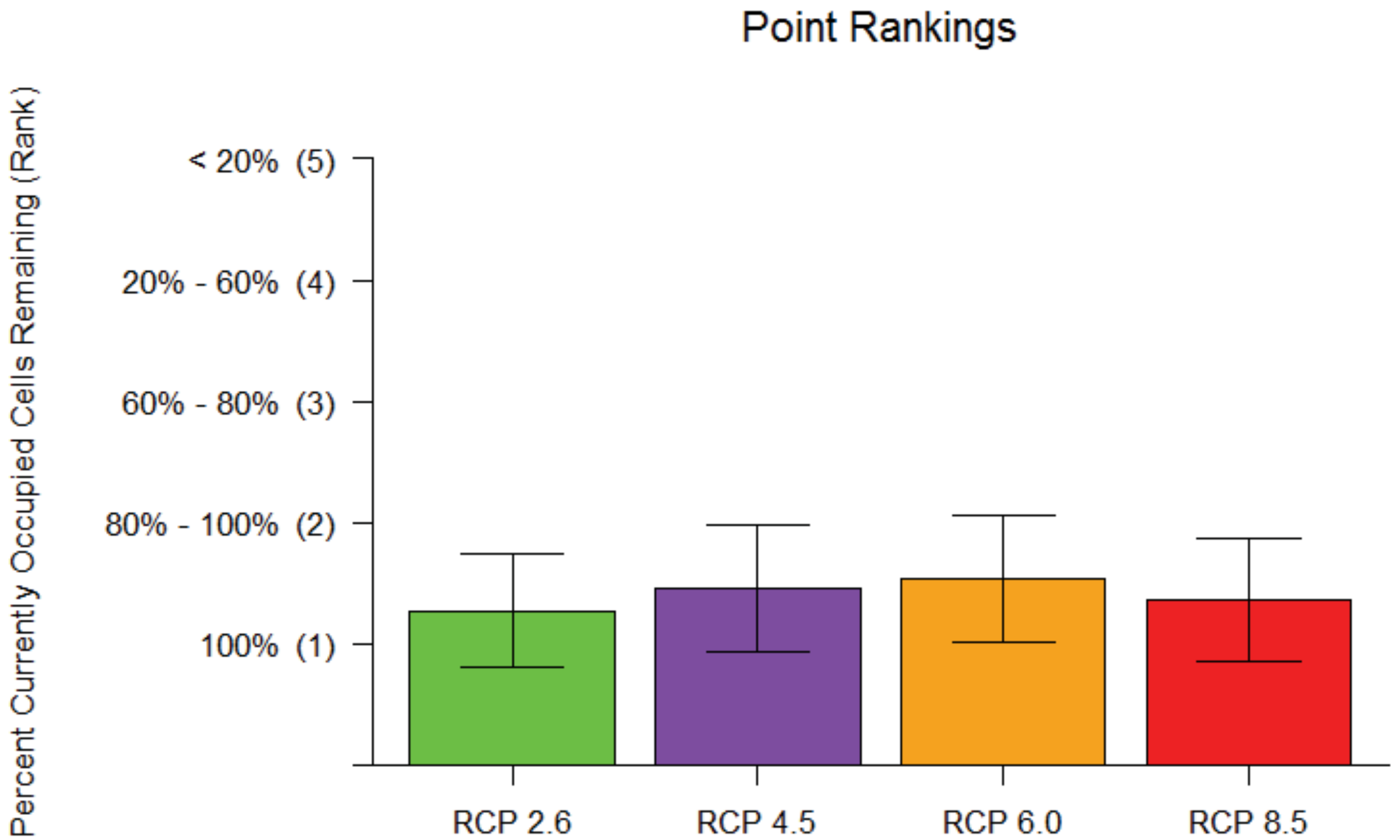


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Ambystoma gracile* Northwestern Salamander



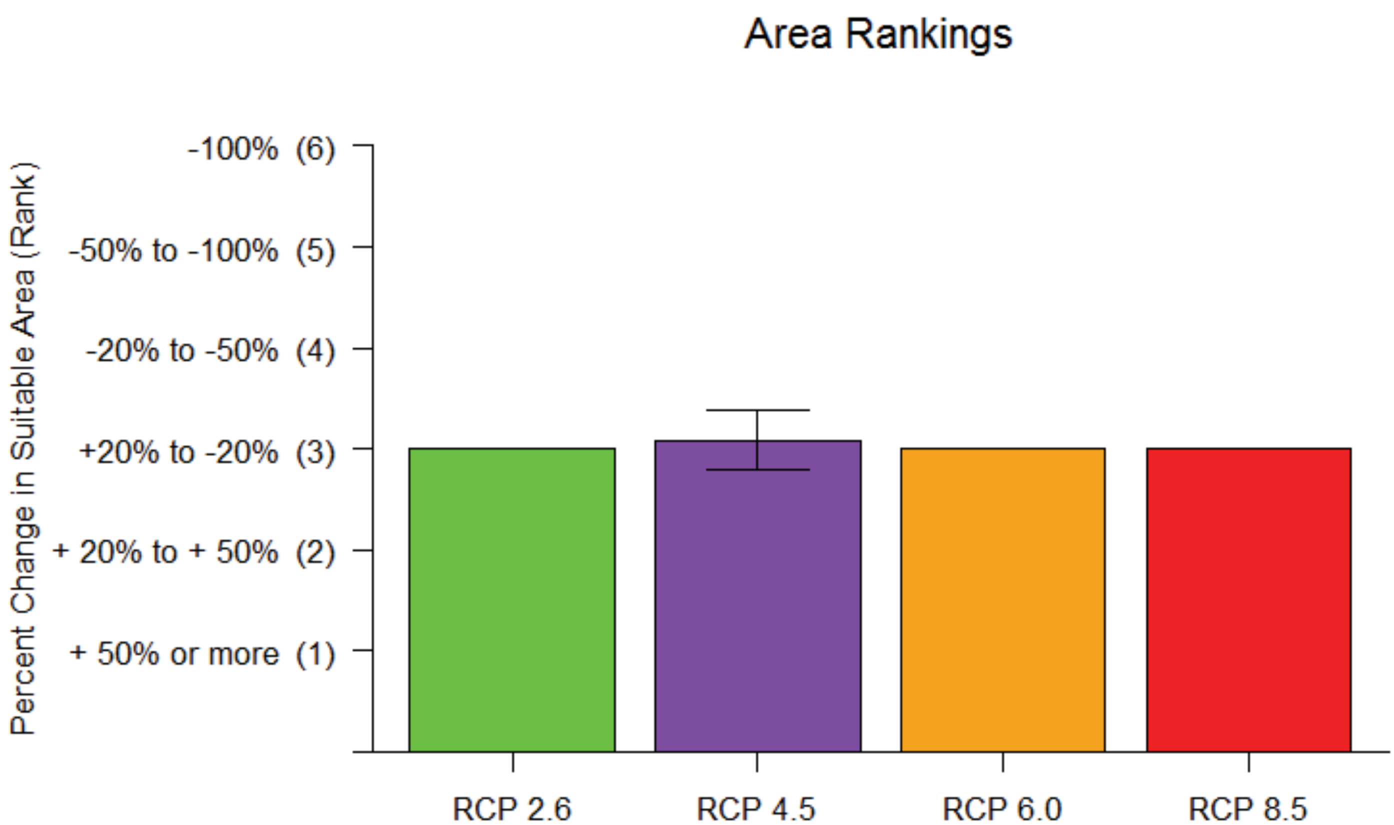


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Ambystoma macrodactylum* Long-toed Salamander

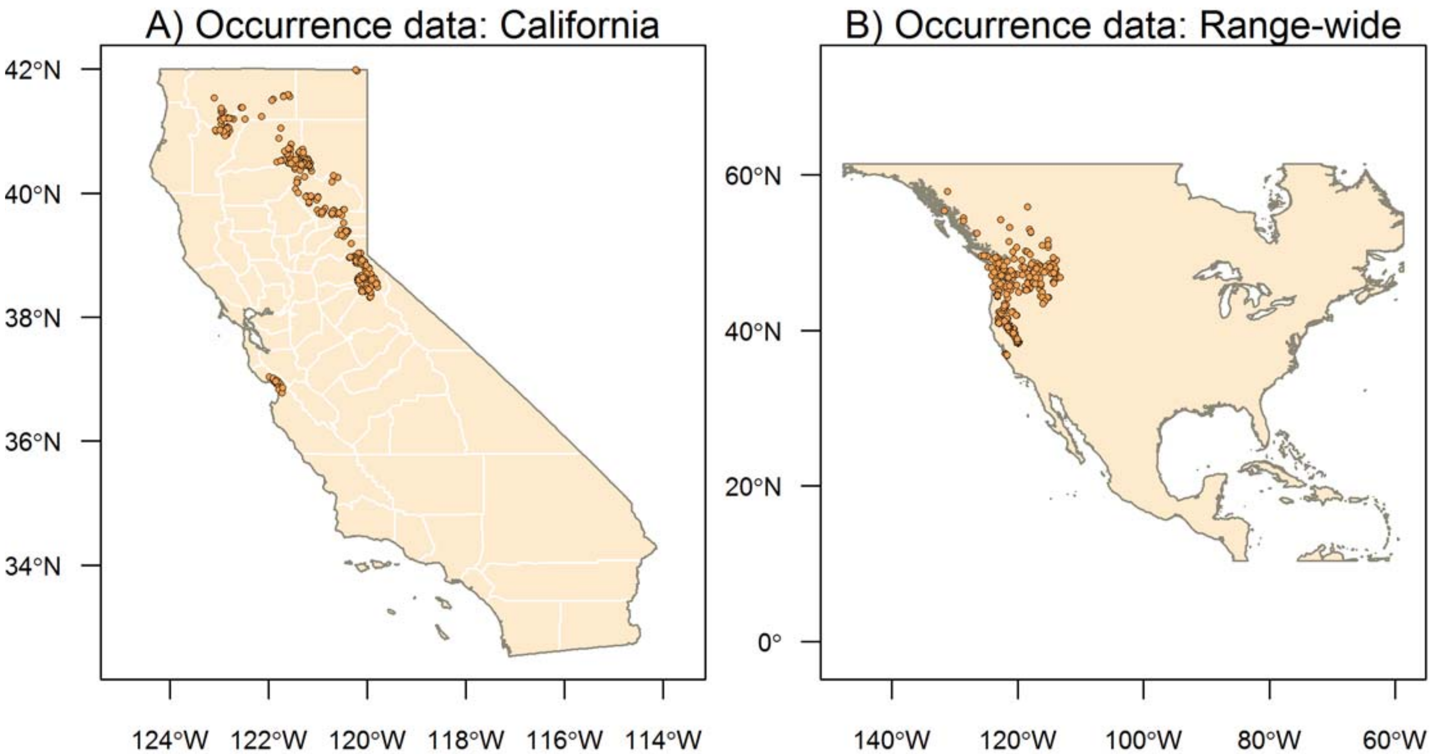
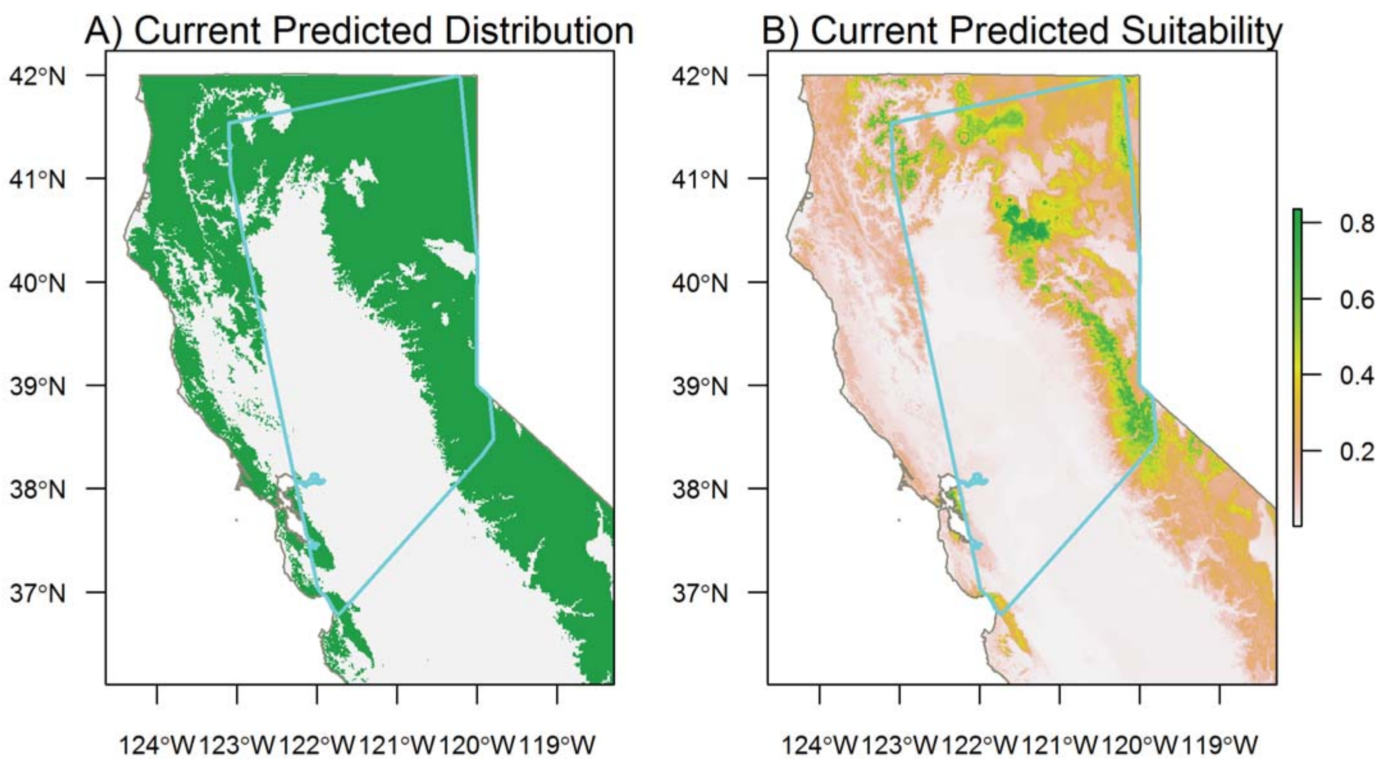


Figure 1. Occurrence data used to build Maxent models.



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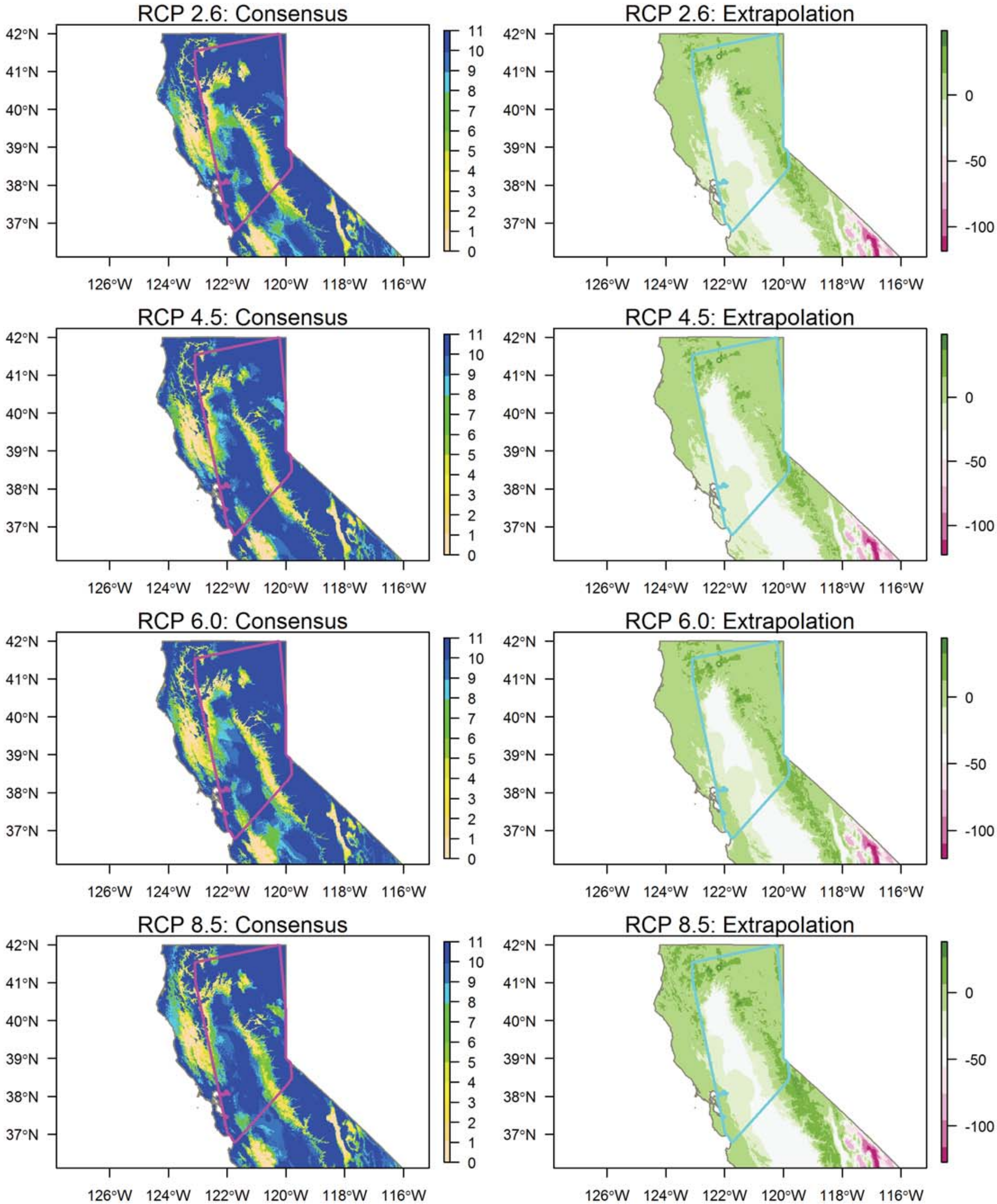
Species Results: *Ambystoma macrodactylum* Long-toed Salamander



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Species Results: *Ambystoma macrodactylum* Long-toed Salamander

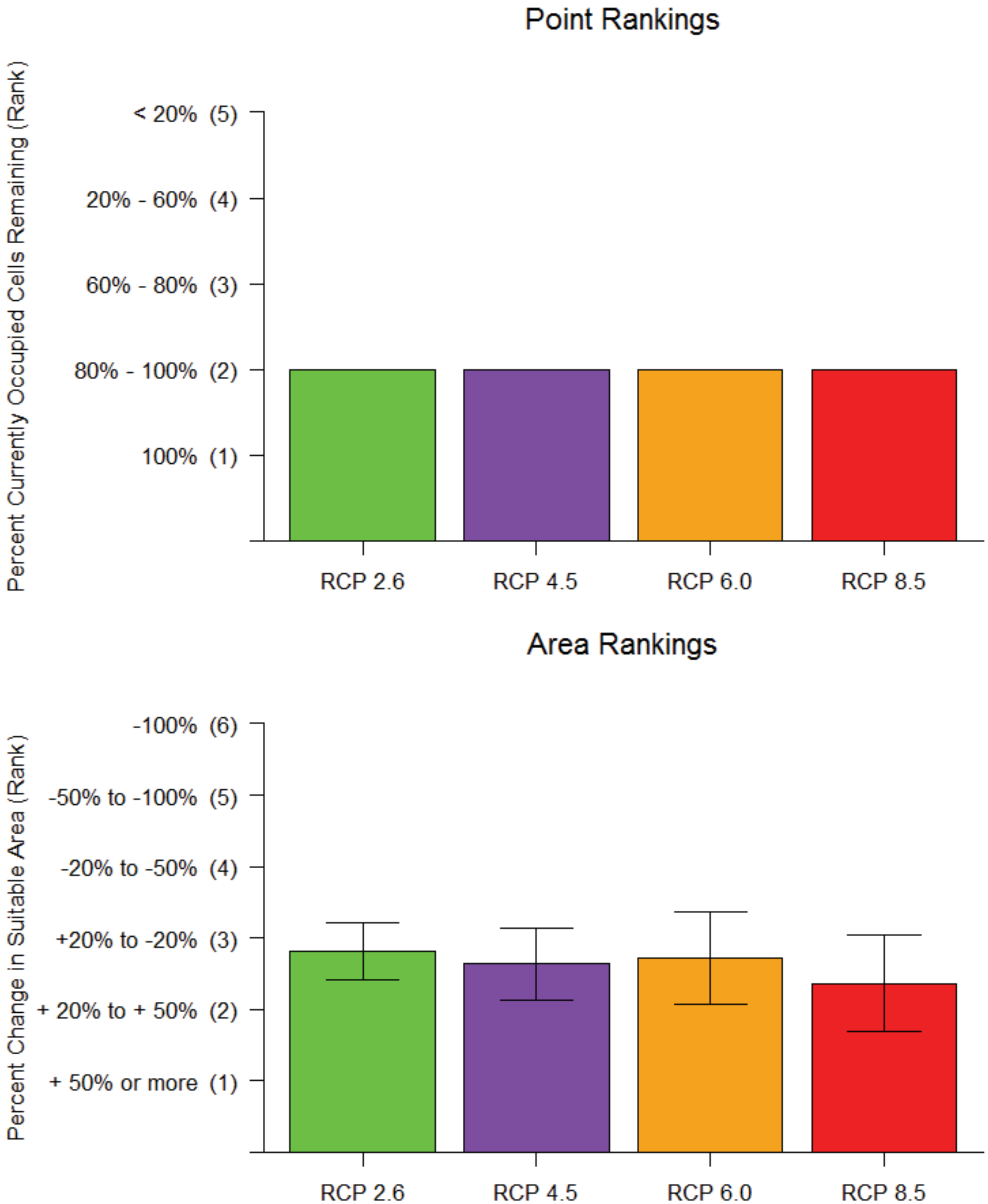


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Aneides ferreus* Clouded Salamander

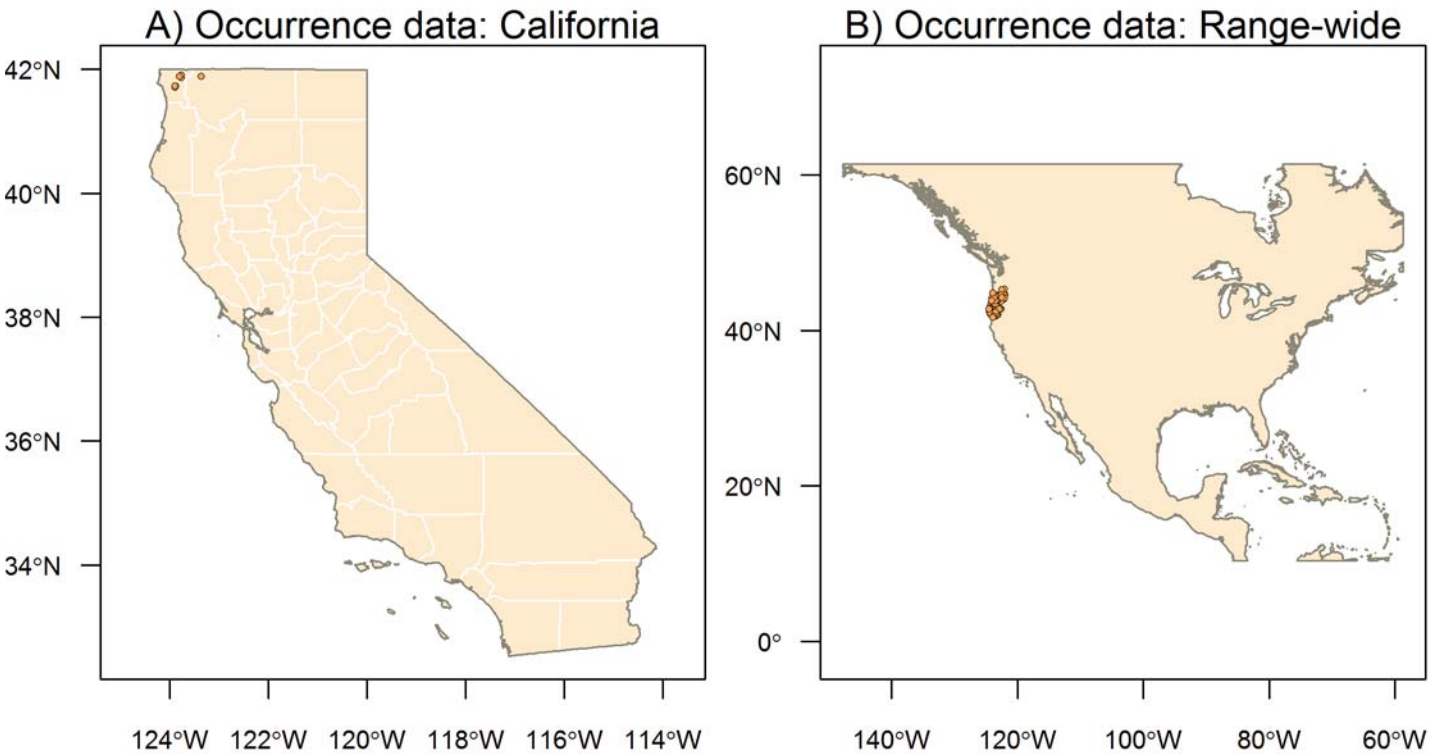
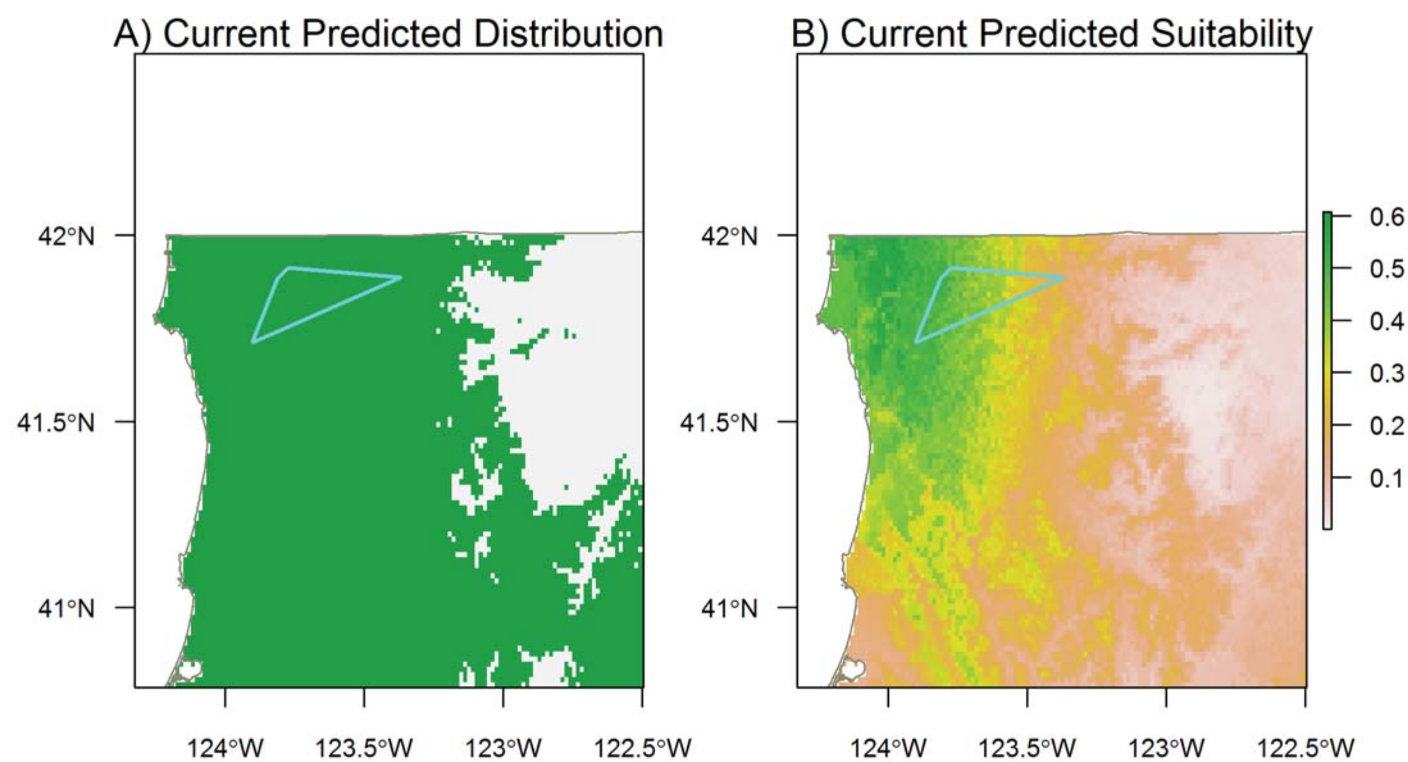


Figure 1. Occurrence data used to build Maxent models.



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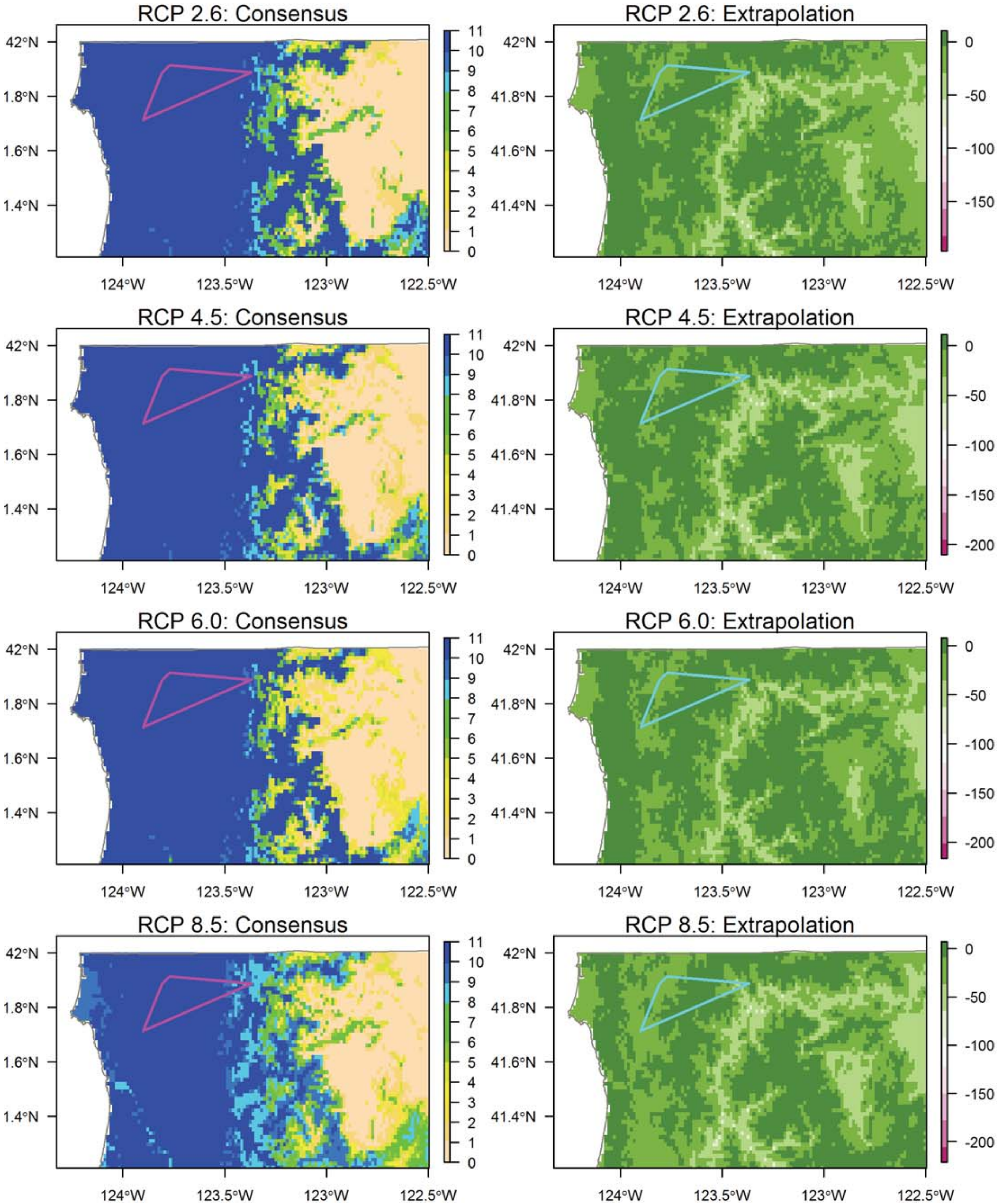
Species Results: *Aneides ferreus* Clouded Salamander



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Species Results: *Aneides ferreus* Clouded Salamander

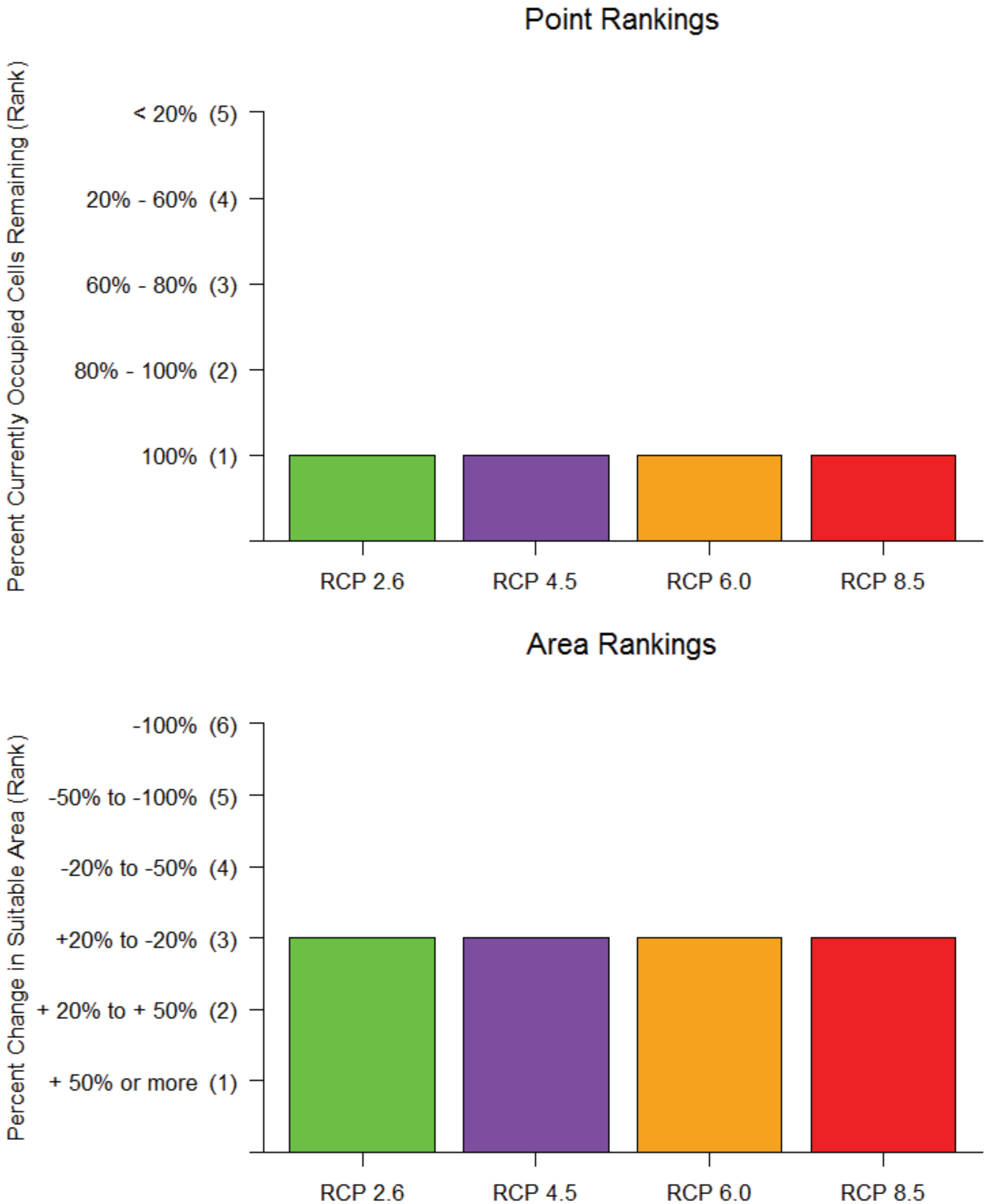


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Aneides flavipunctatus* Black Salamander

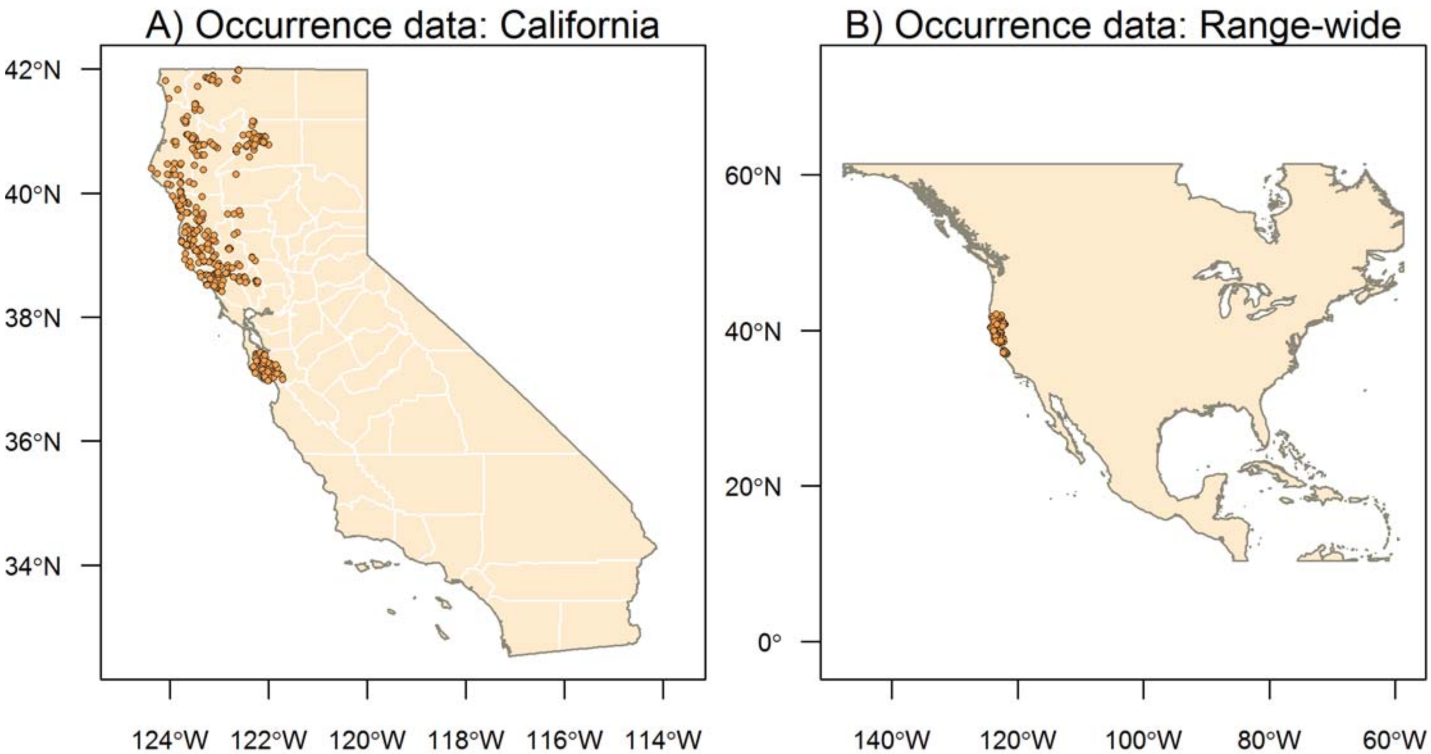
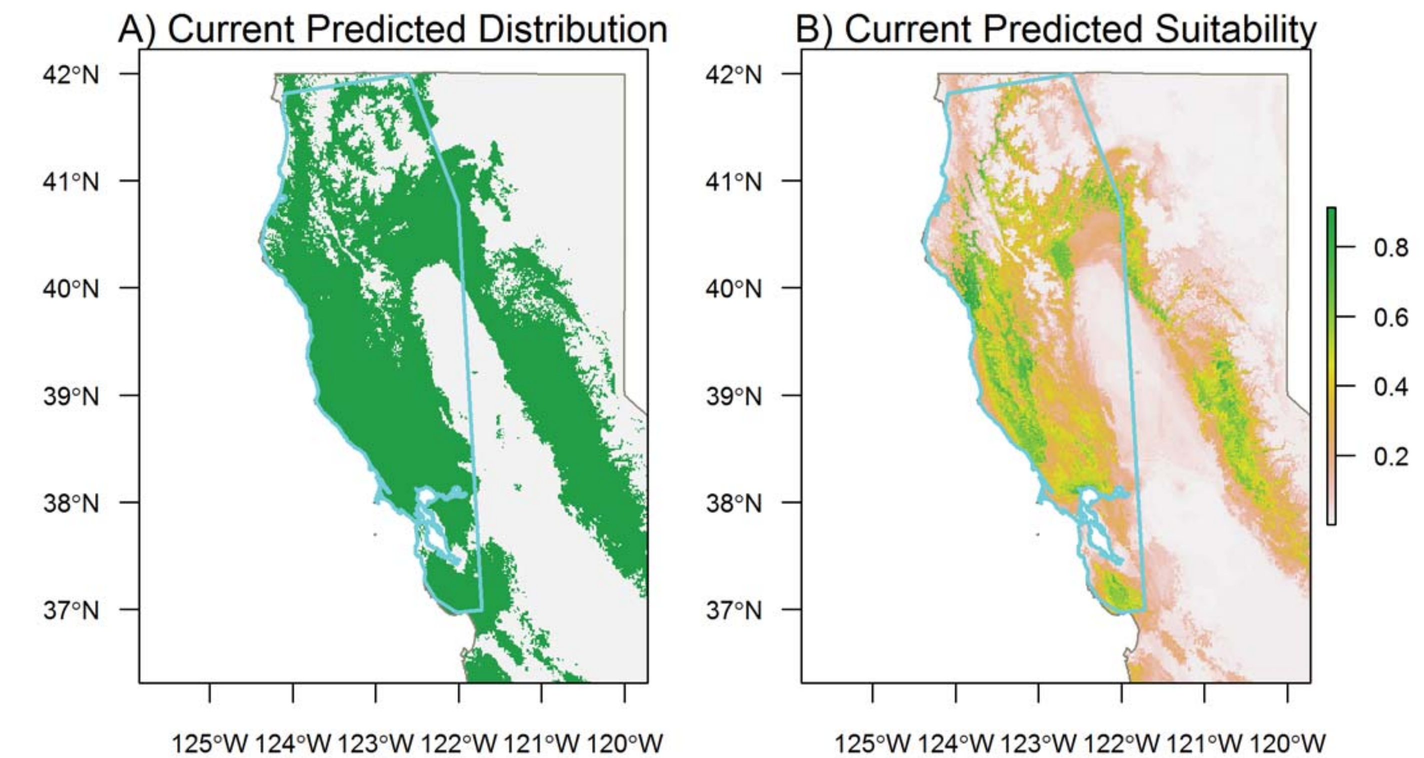


Figure 1. Occurrence data used to build Maxent models.



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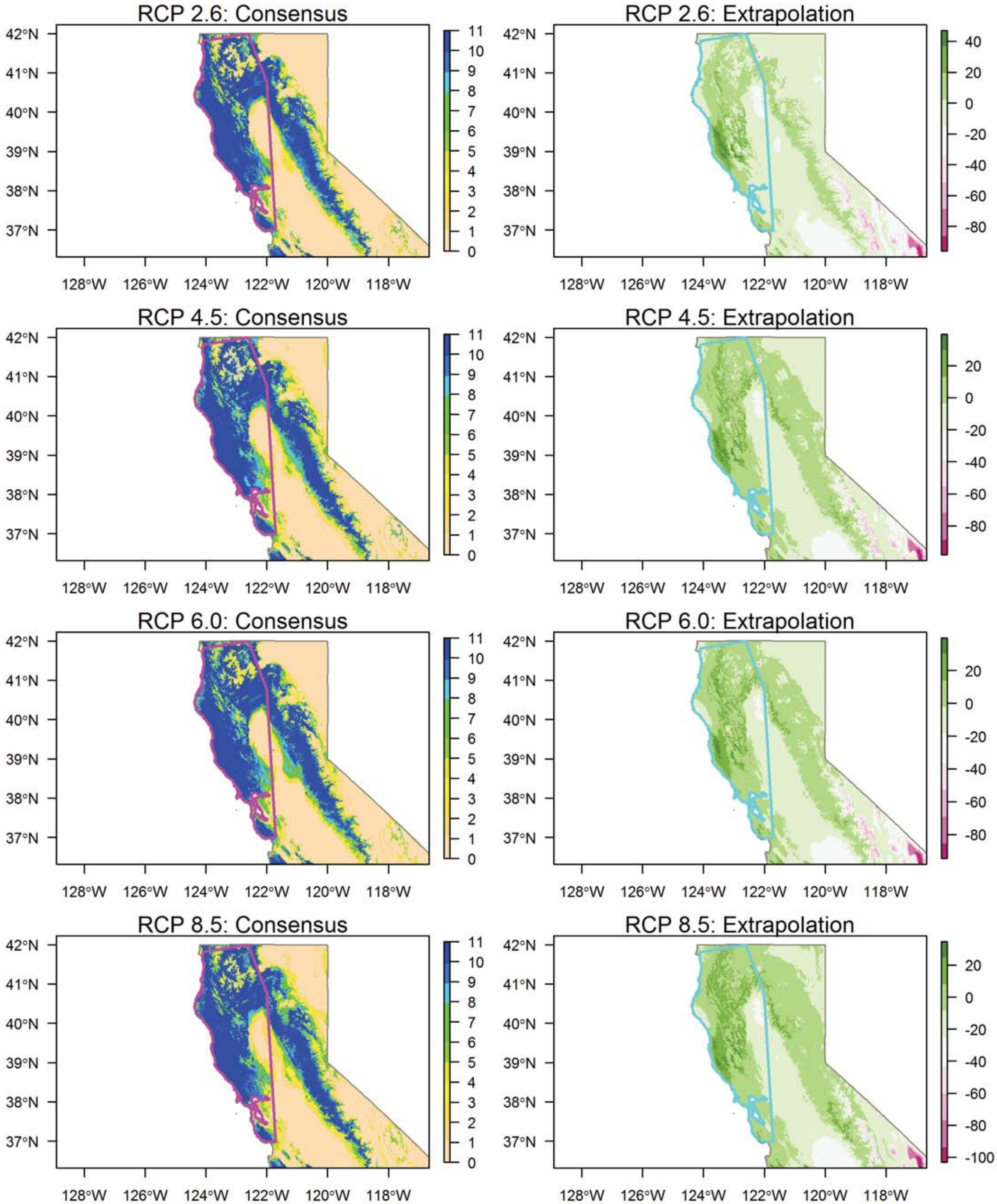
Species Results: *Aneides flavipunctatus* Black Salamander



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Species Results: *Aneides flavipunctatus* Black Salamander

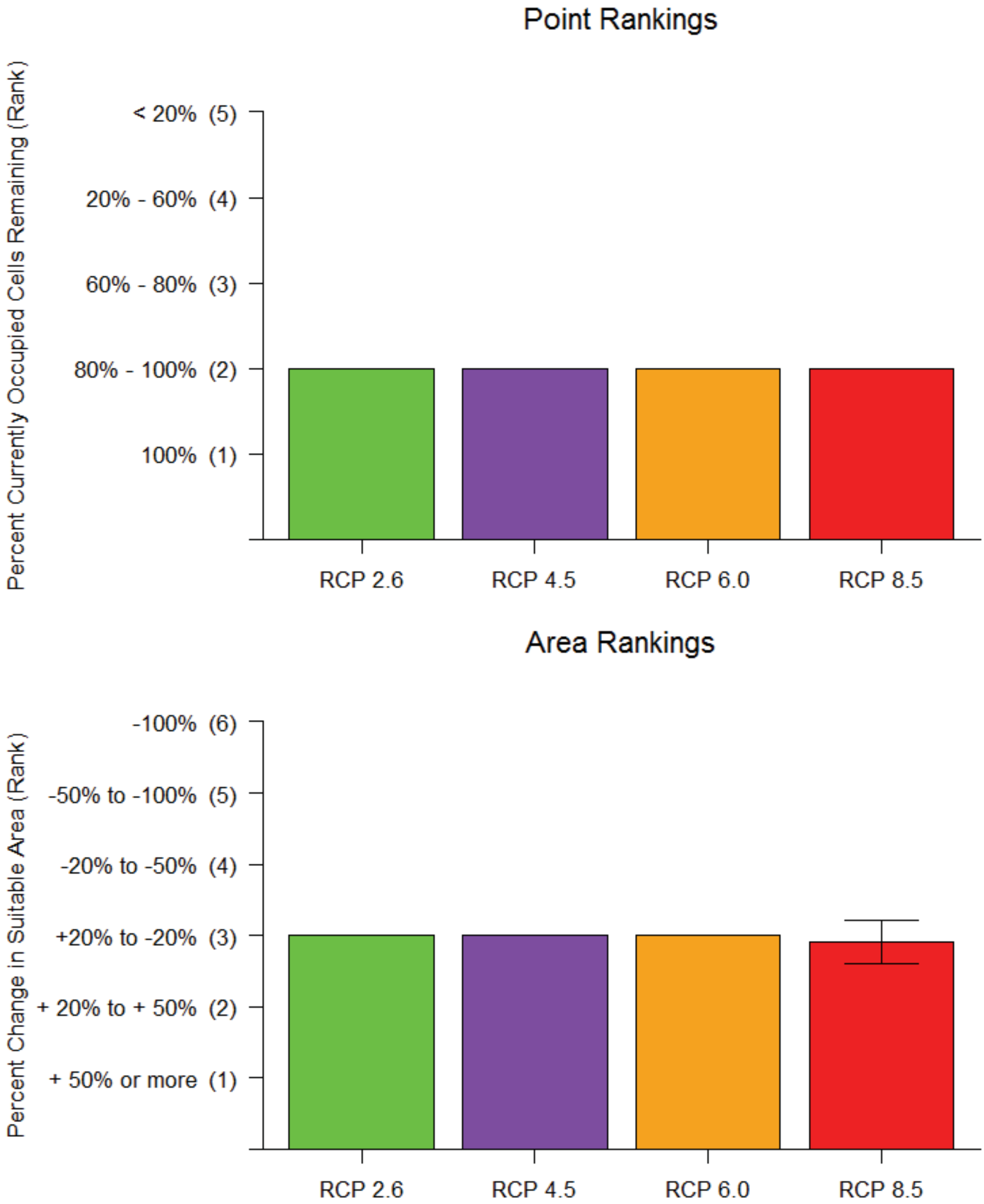


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Aneides lugubris* Arboreal Salamander

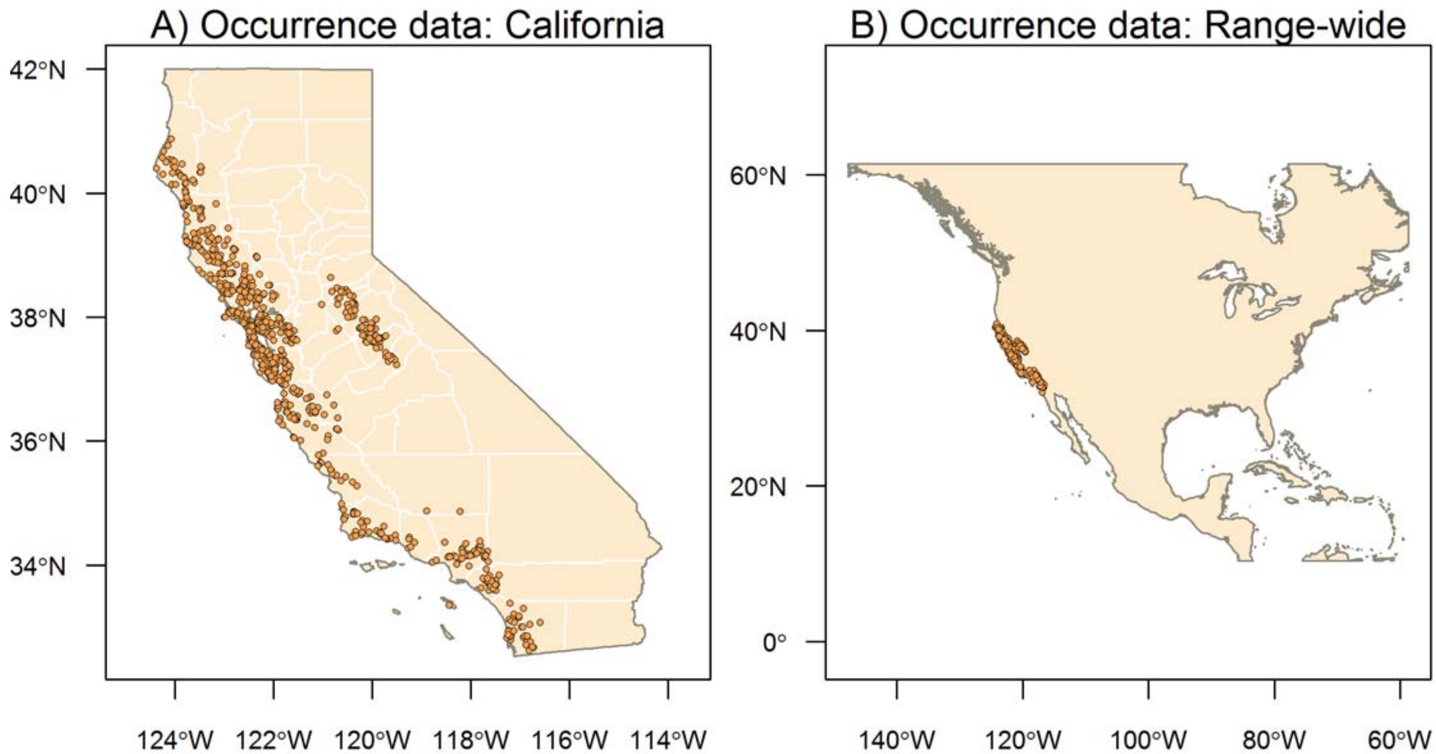
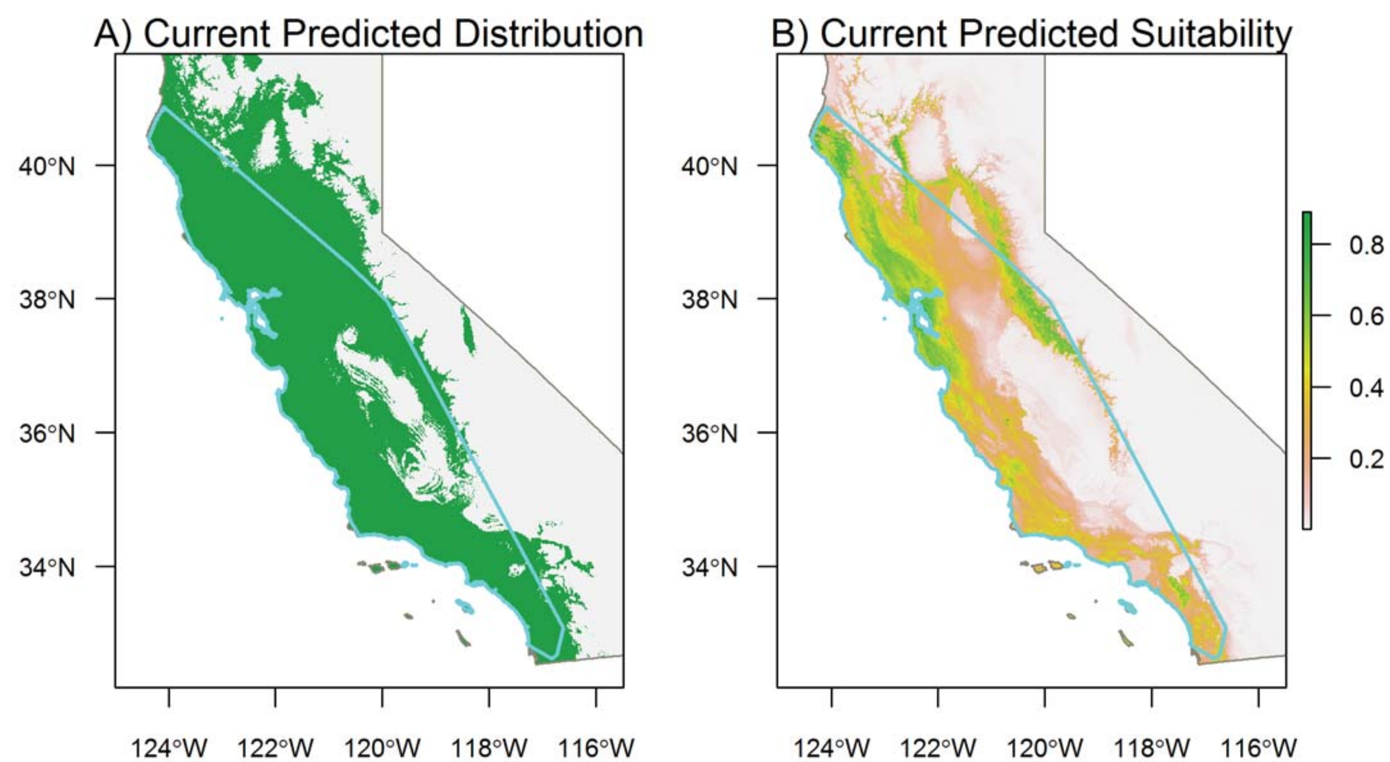


Figure 1. Occurrence data used to build Maxent models.



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Species Results: *Aneides lugubris* Arboreal Salamander

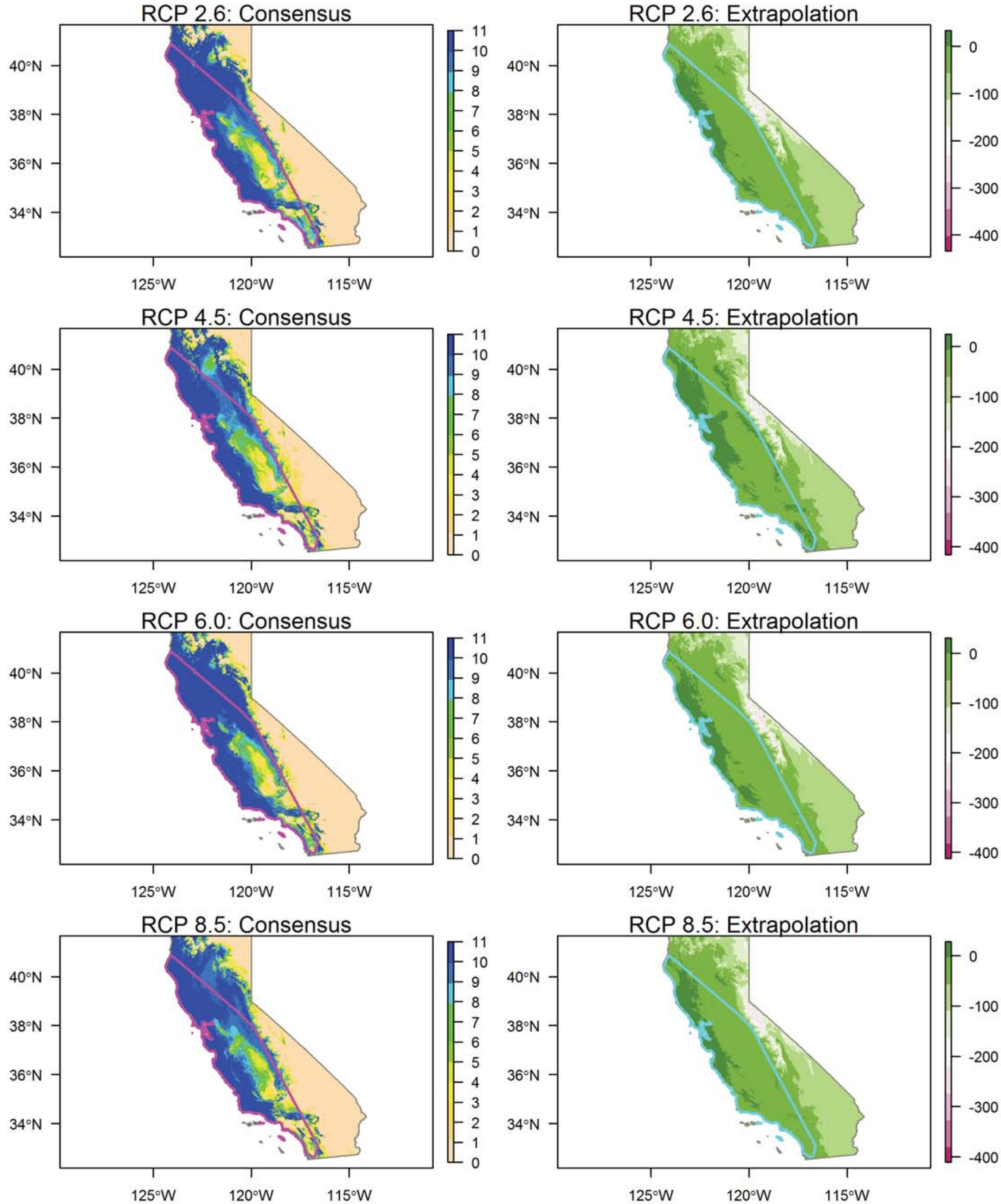


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Aneides lugubris* Arboreal Salamander

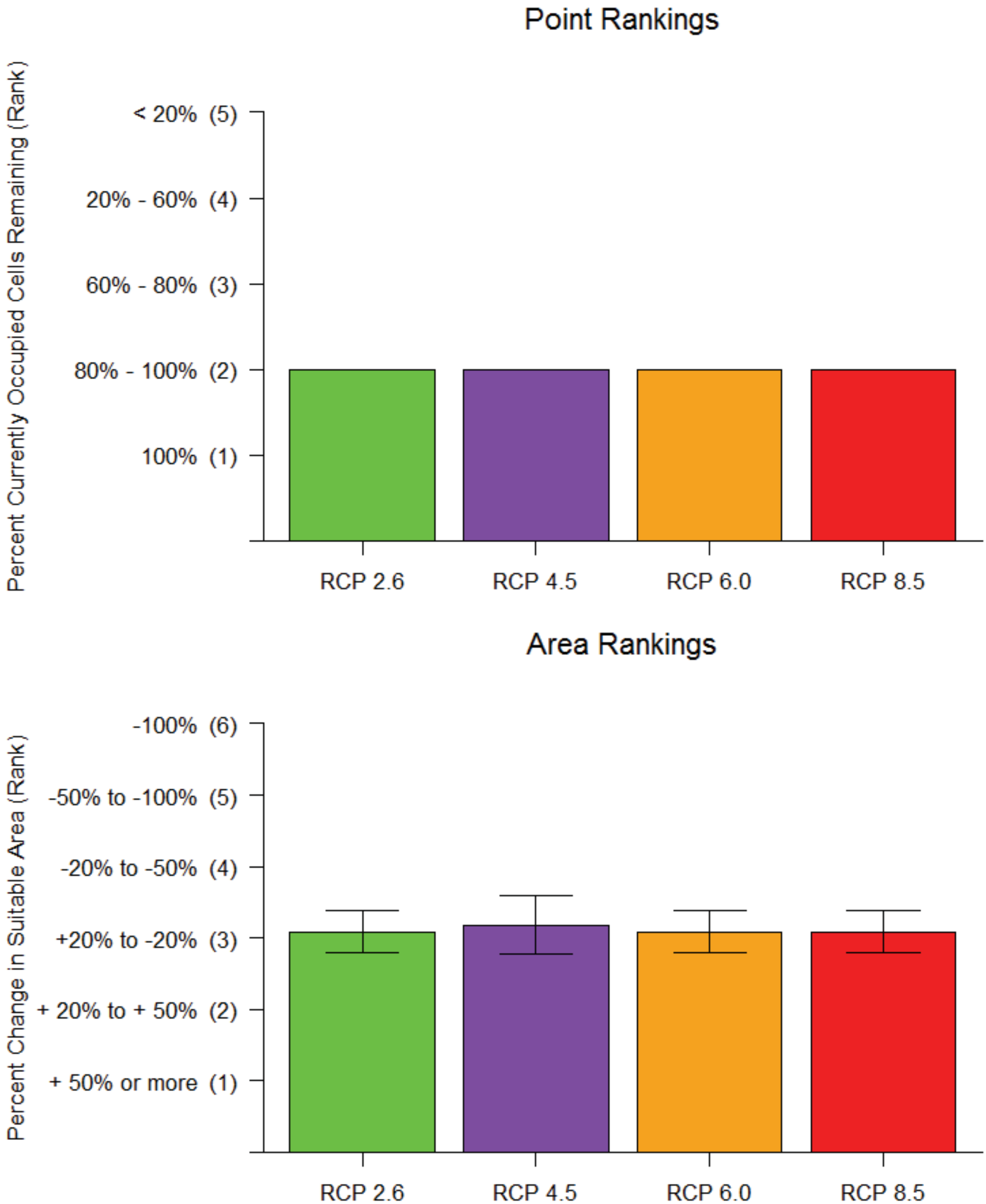


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Aneides vagrans* Wandering Salamander

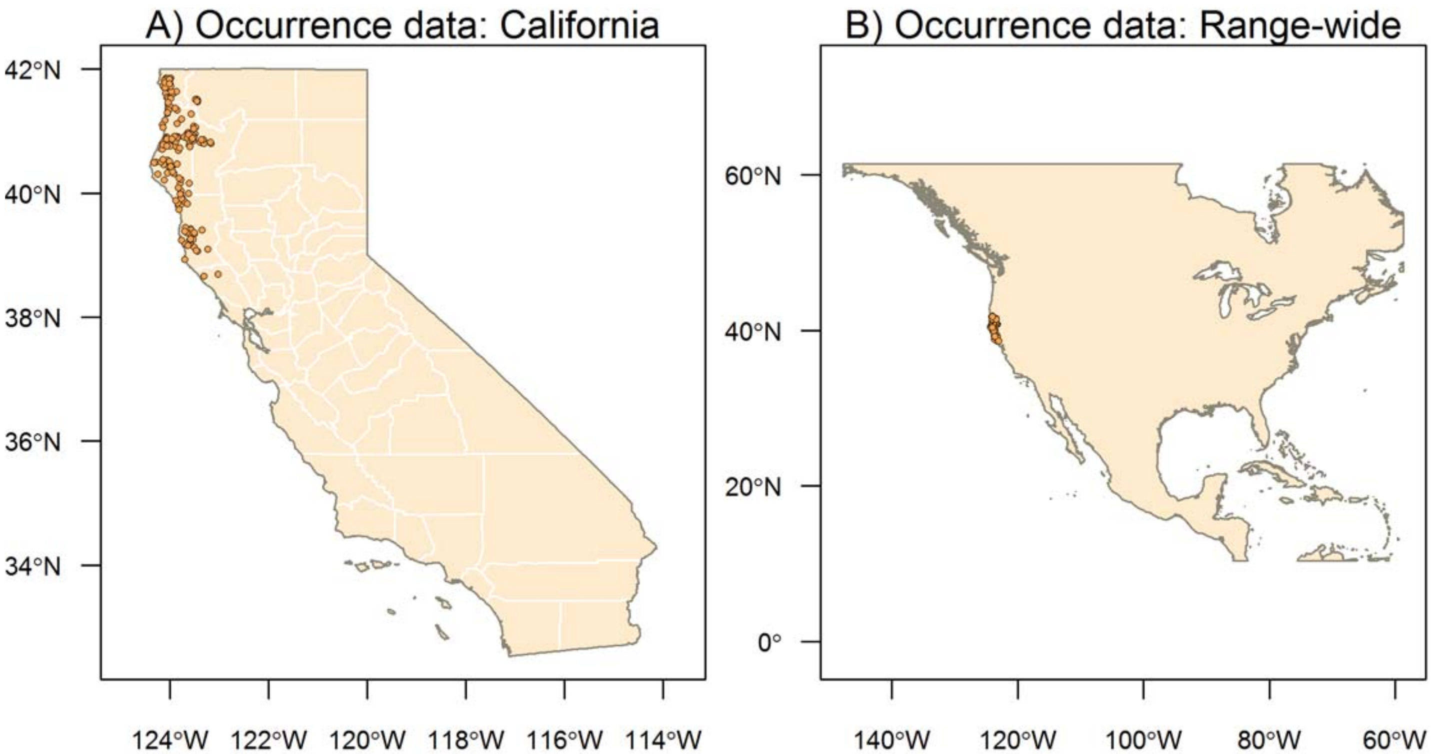
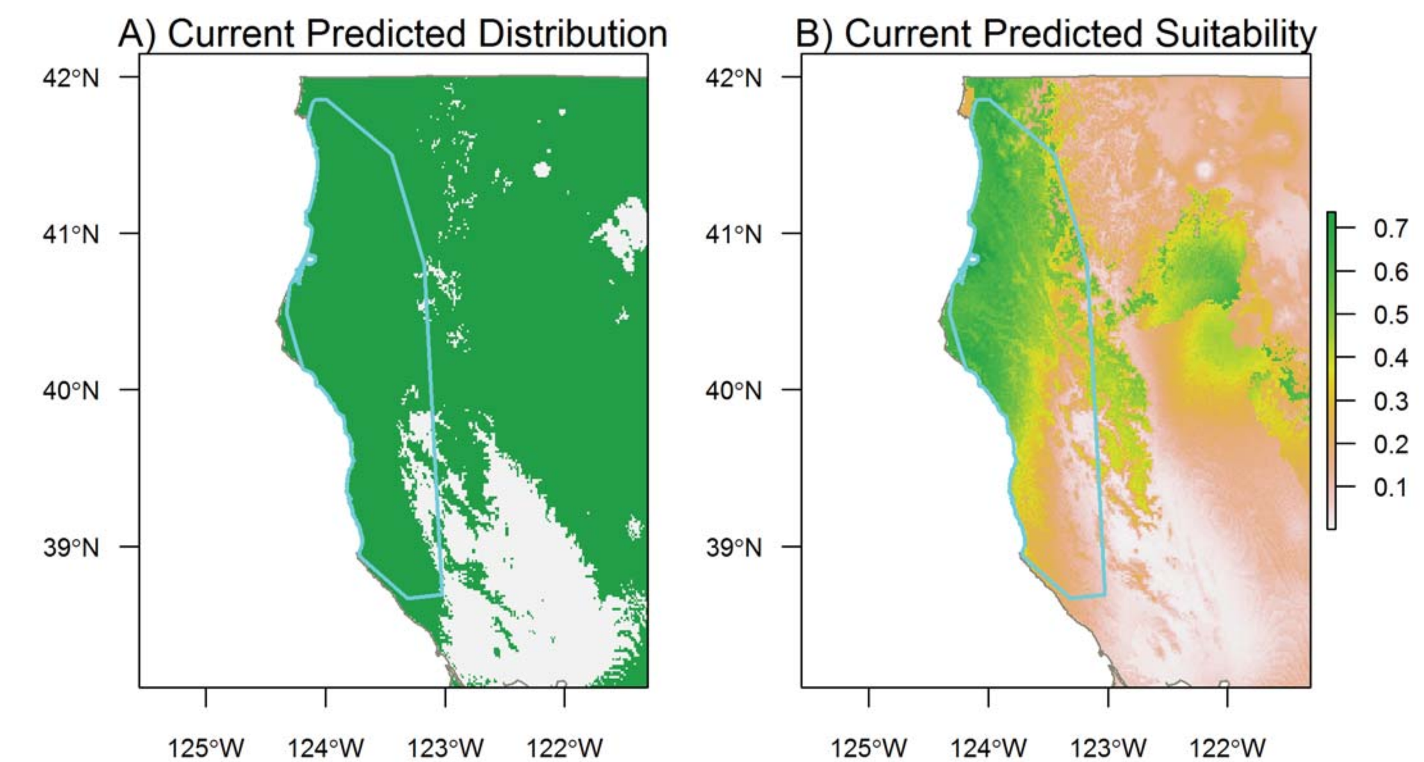


Figure 1. Occurrence data used to build Maxent models.



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Species Results: *Aneides vagrans* Wandering Salamander

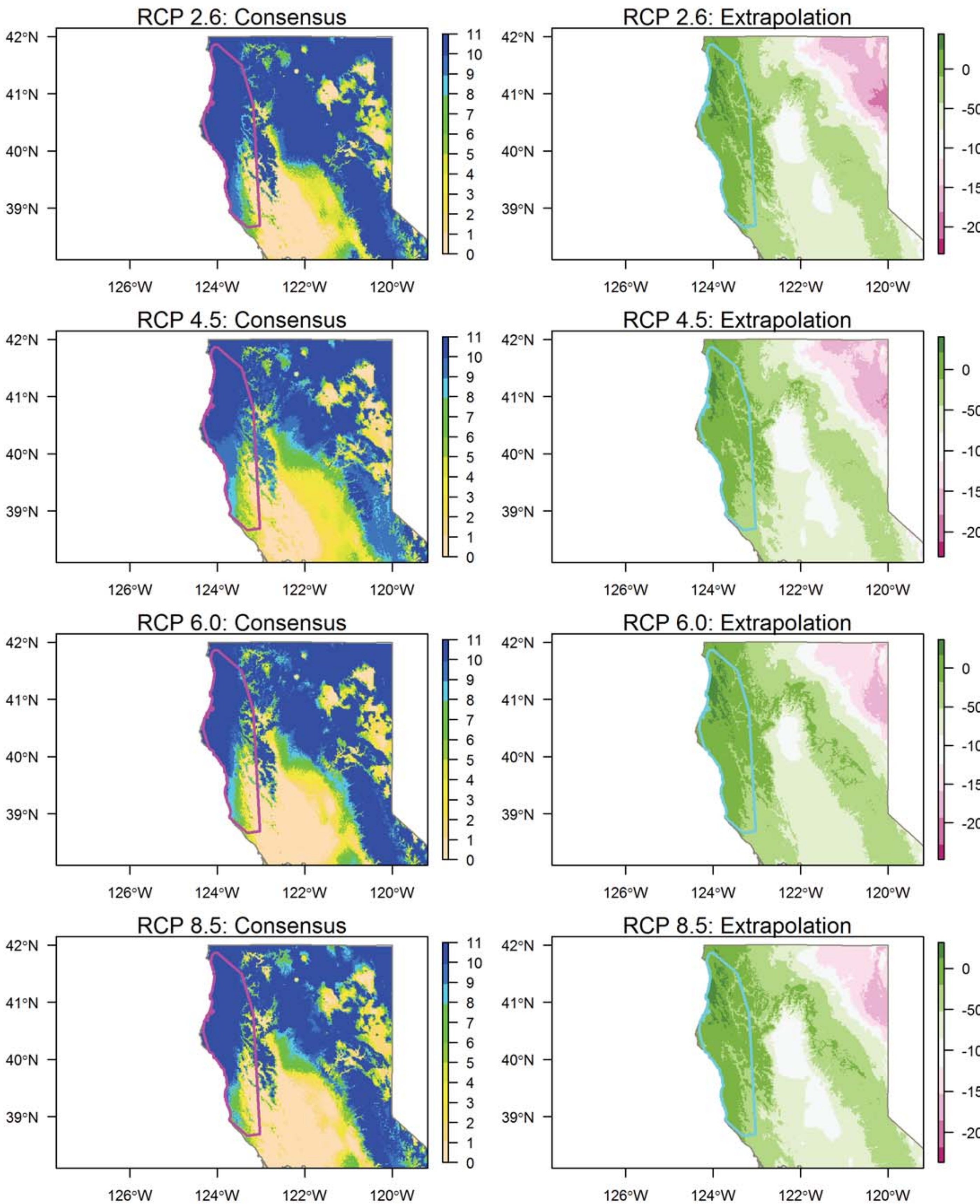

Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

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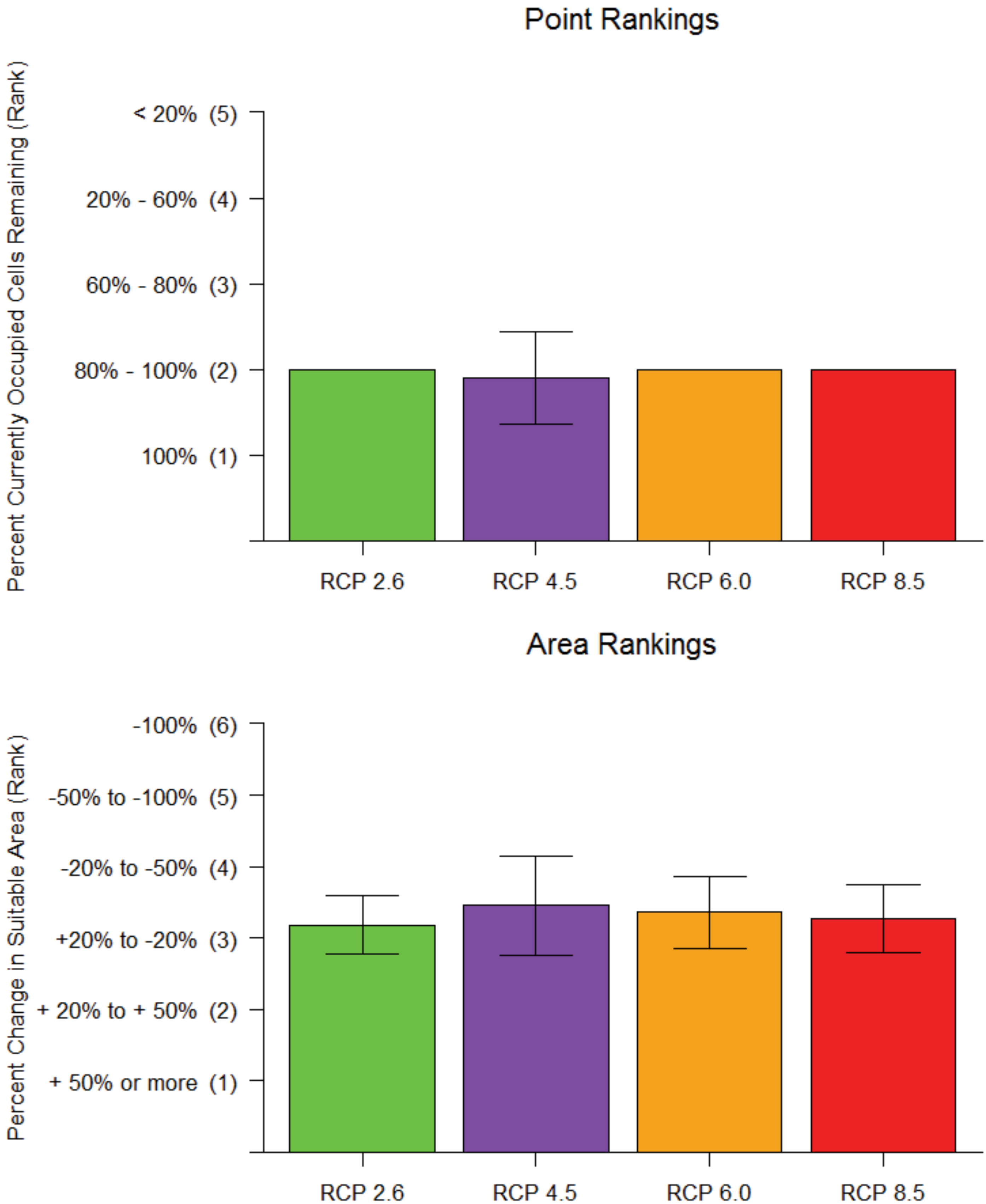


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Anniella pulchra* California Legless Lizard

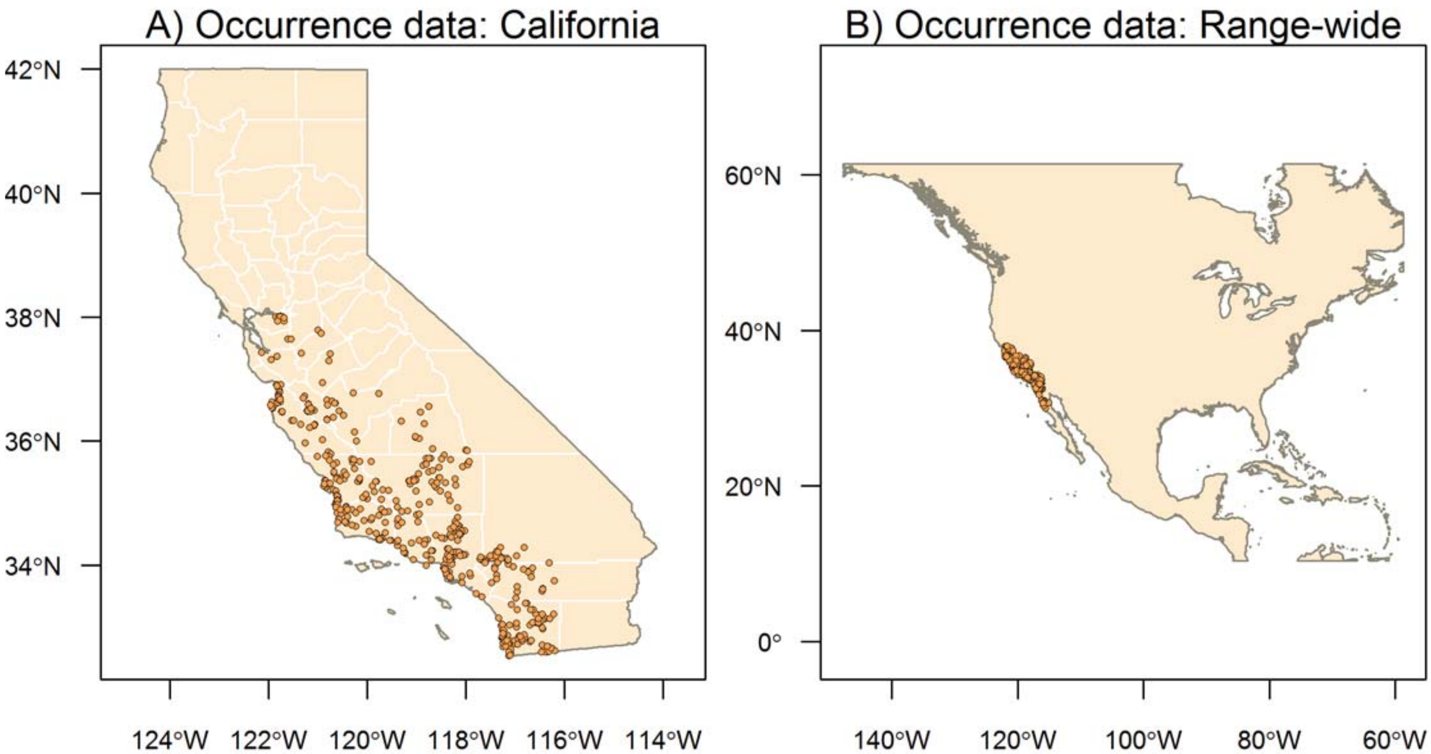
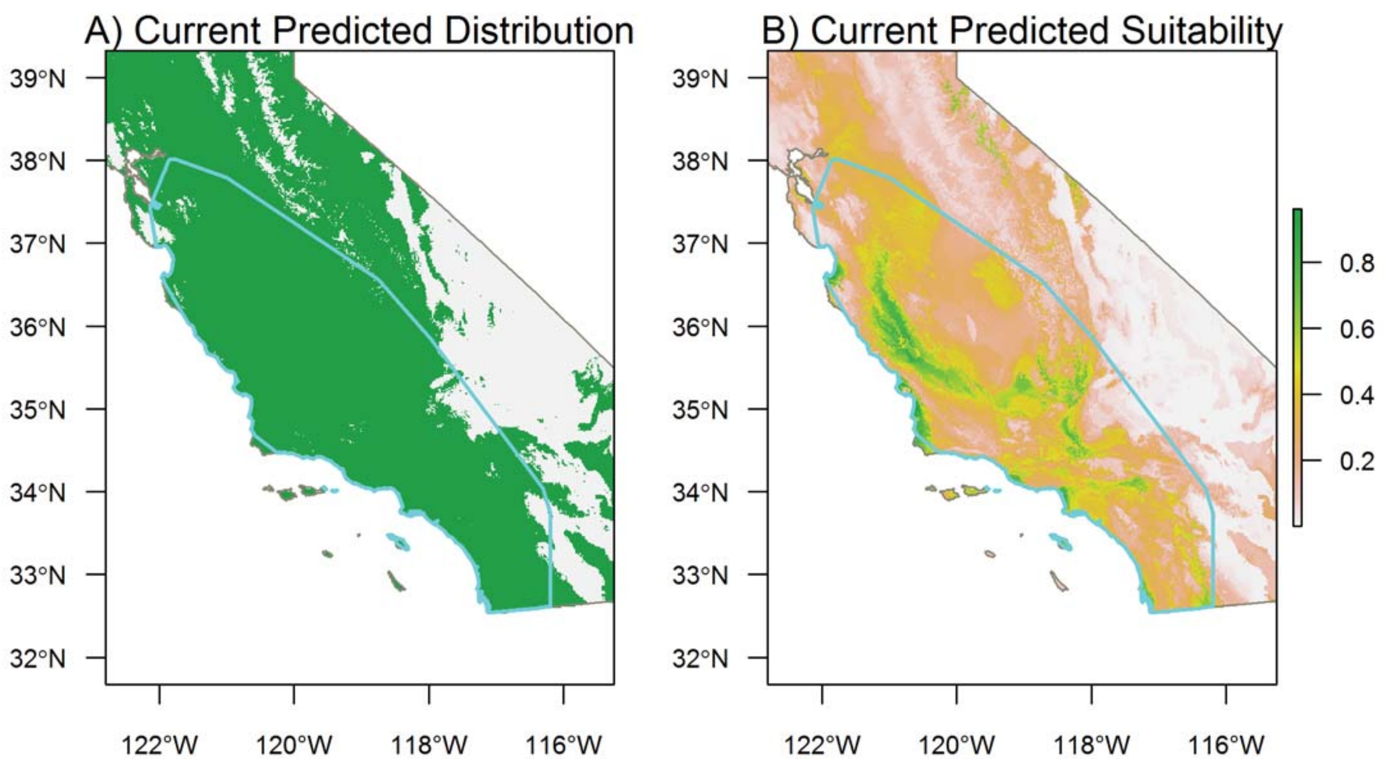


Figure 1. Occurrence data used to build Maxent models.



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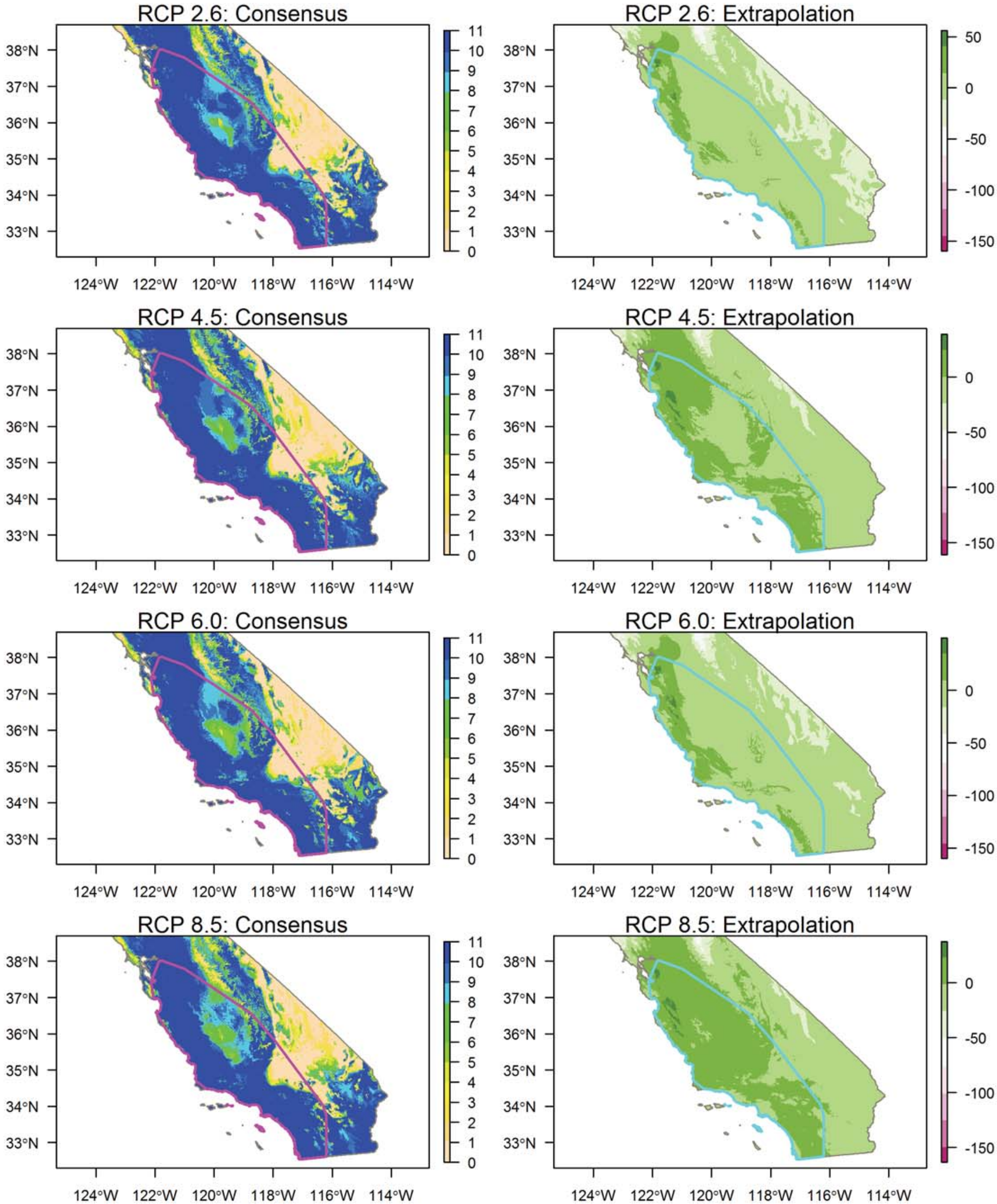

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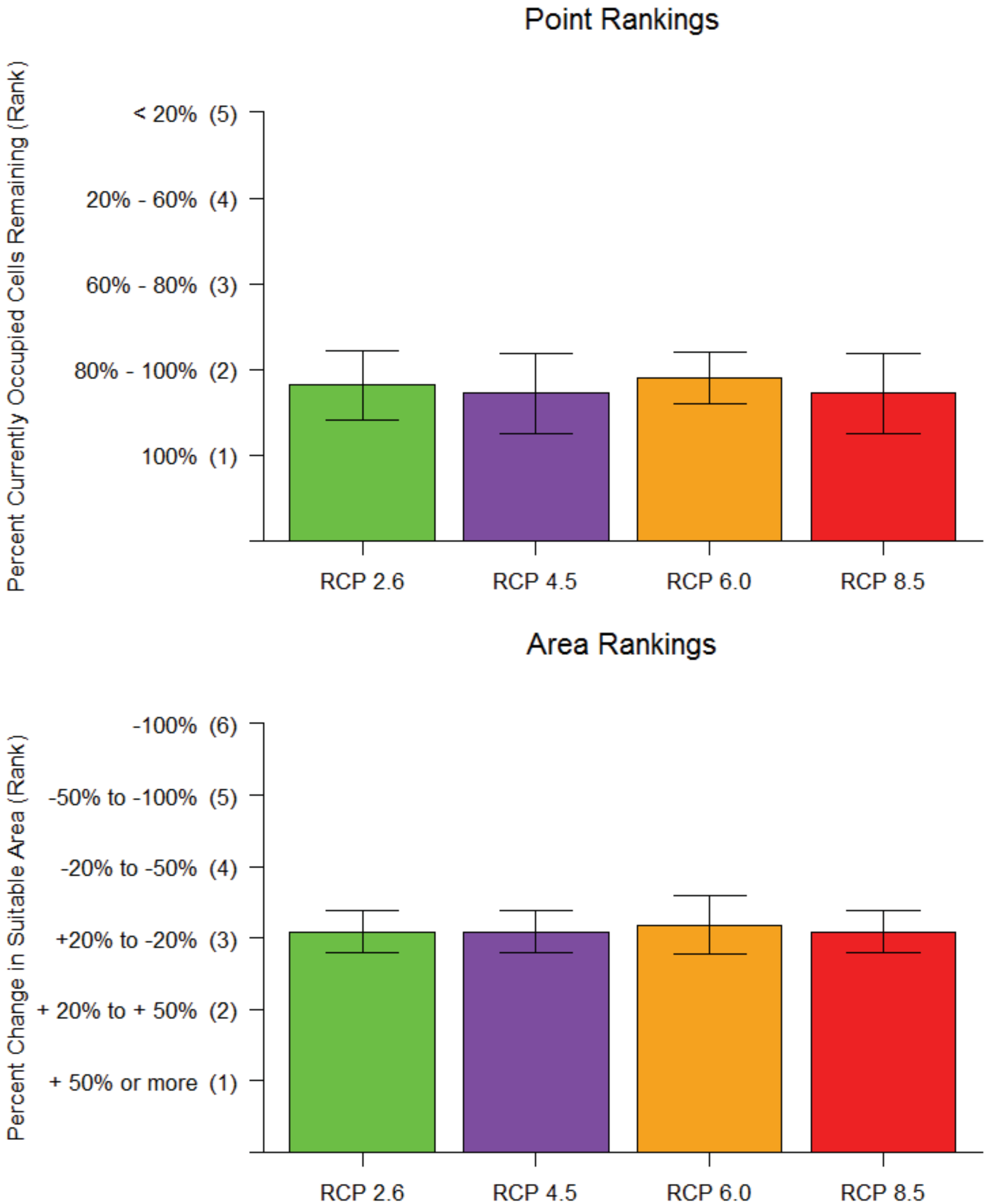

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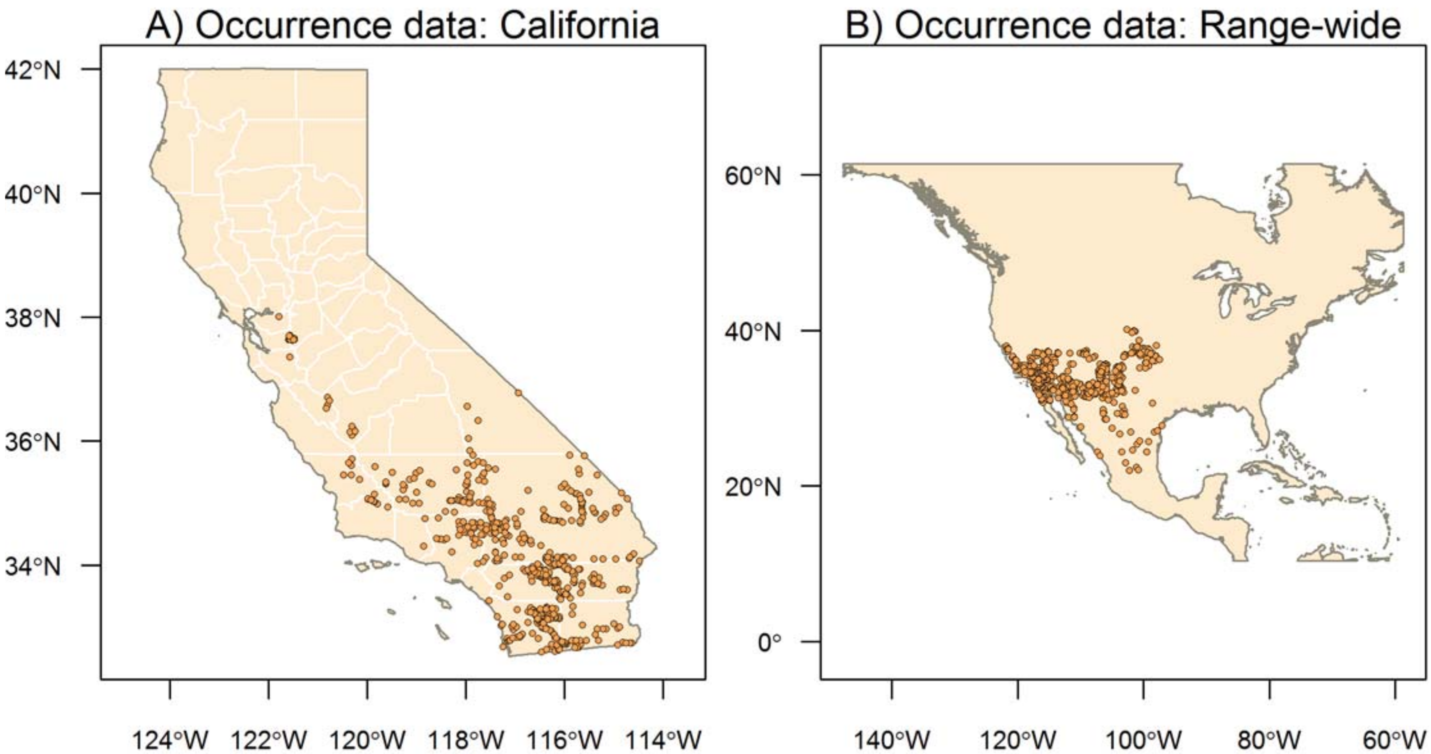
Species Results: *Arizona elegans* Glossy Snake



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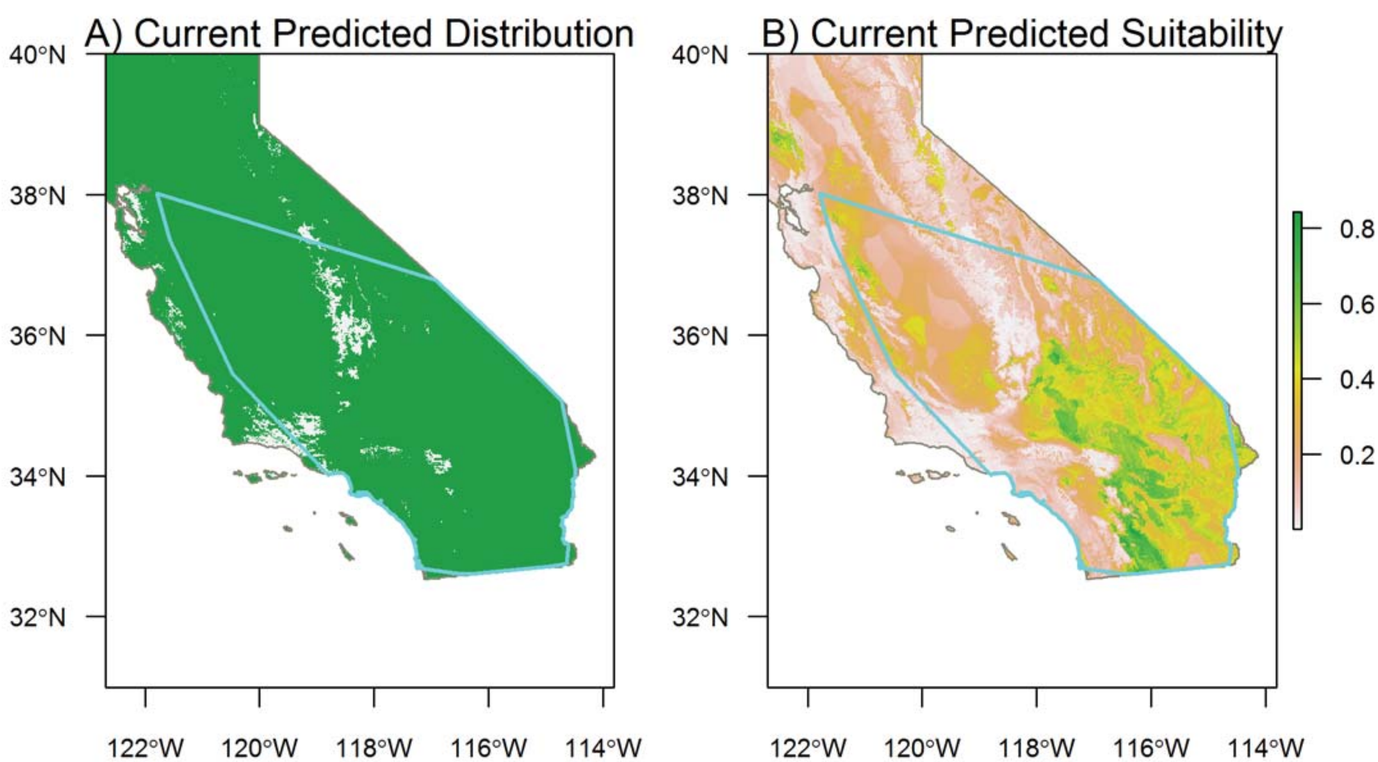

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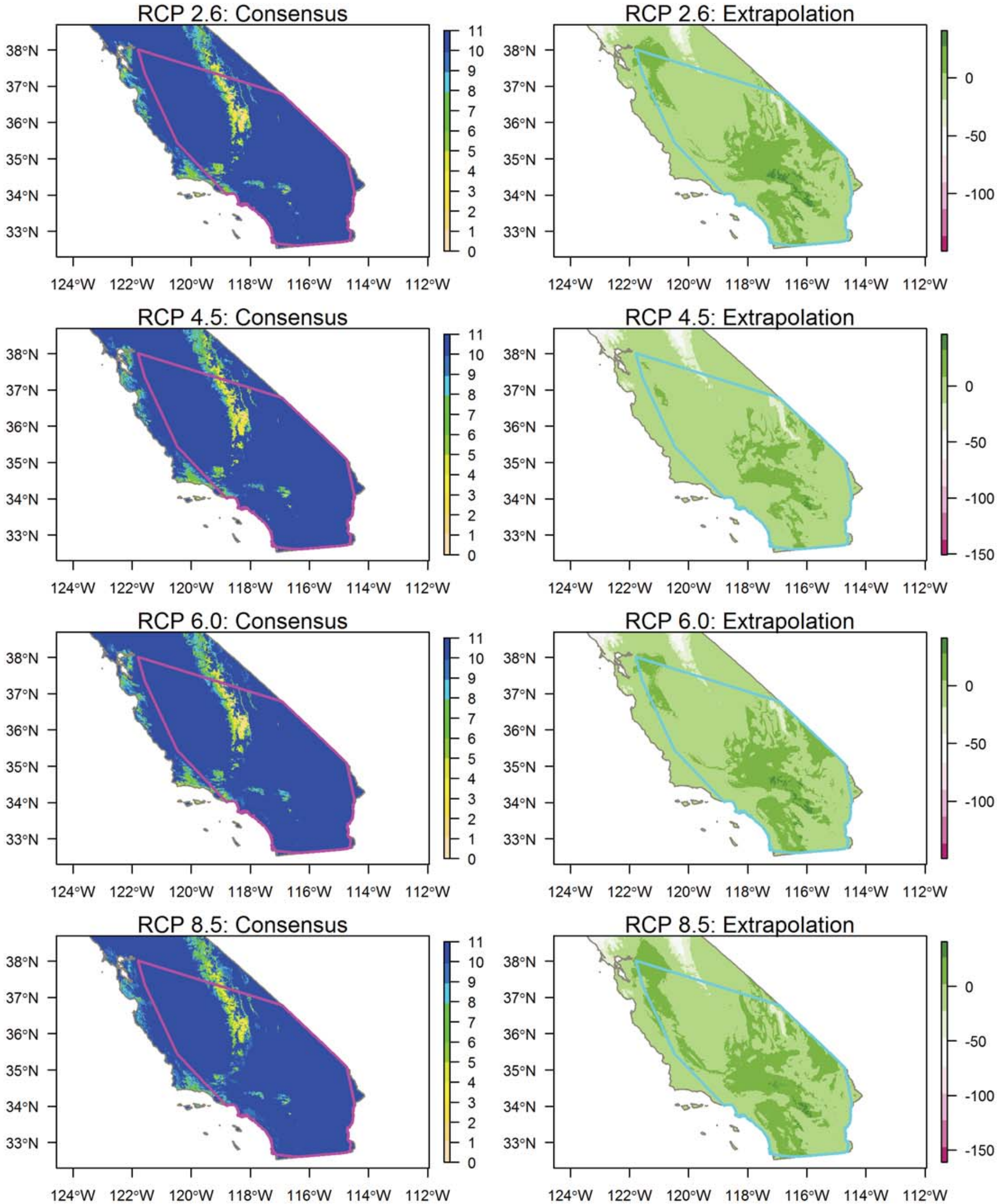

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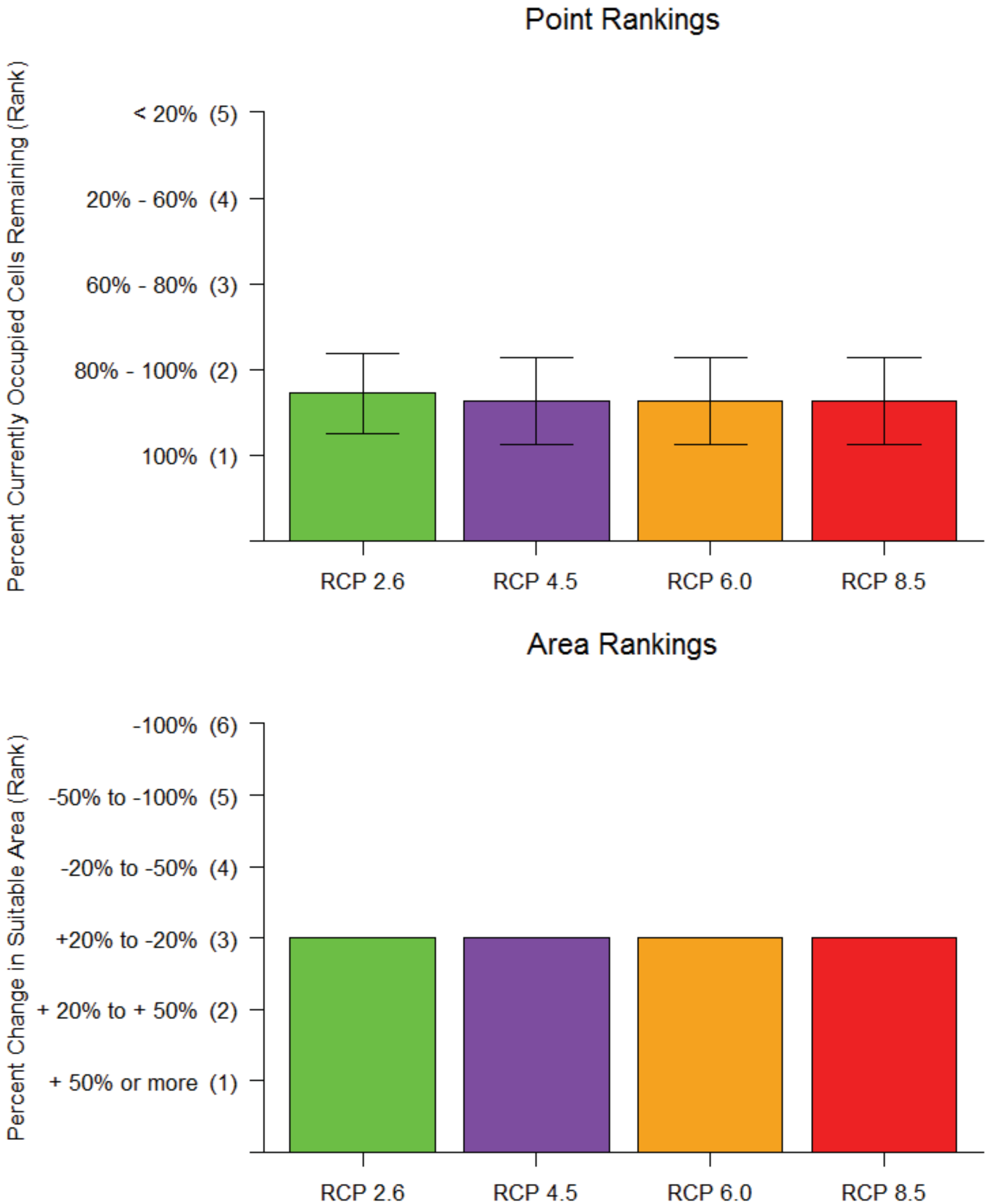
Species Results: *Arizona elegans* Glossy Snake



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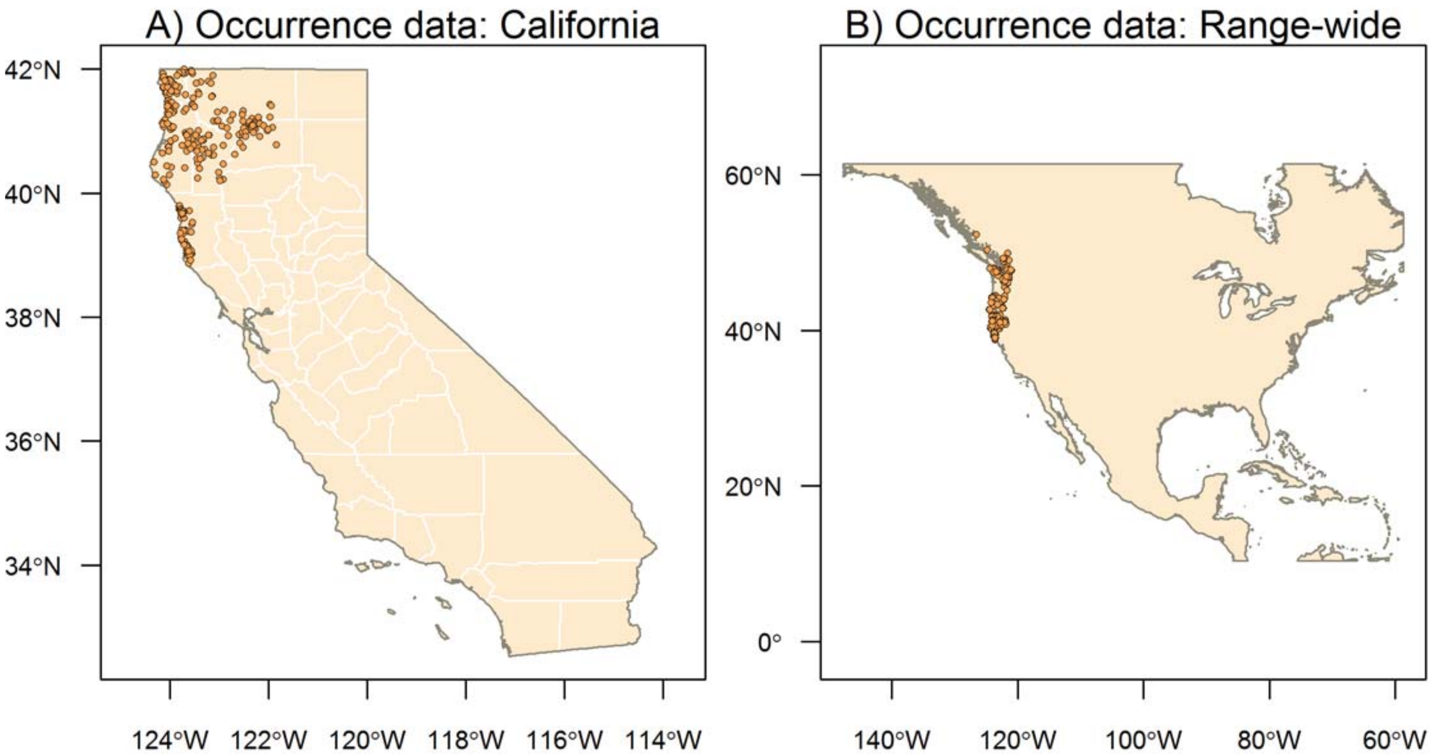
Species Results: *Ascaphus truei* Tailed Frog



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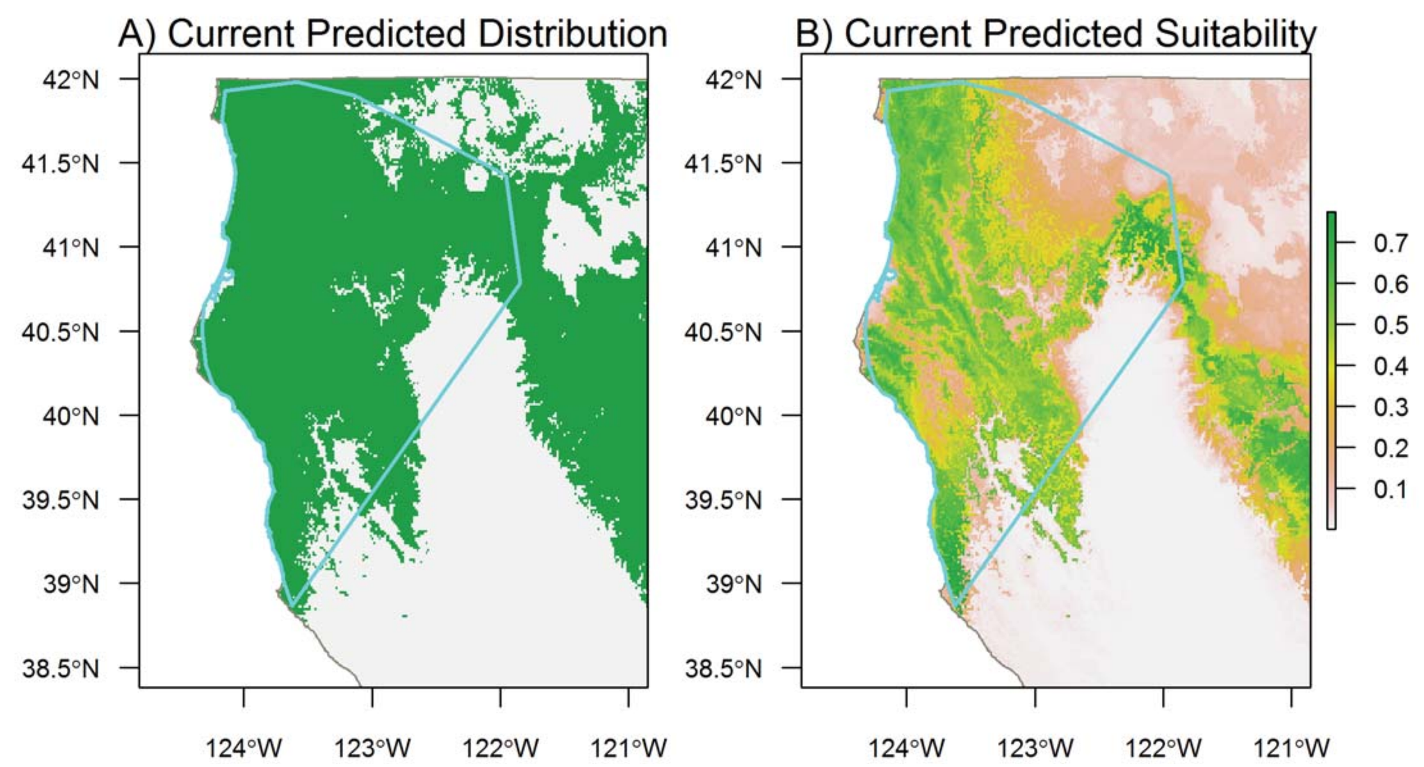

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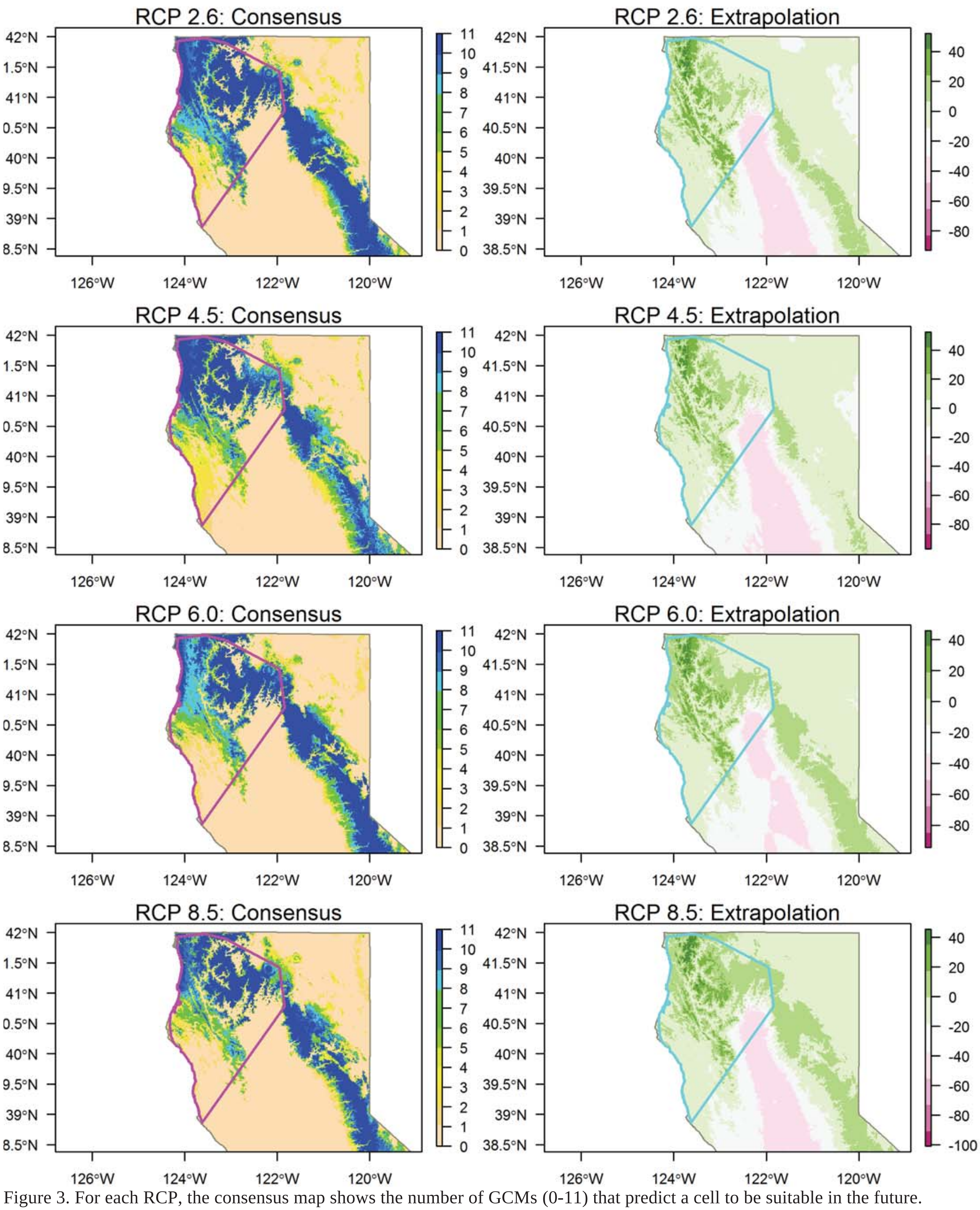

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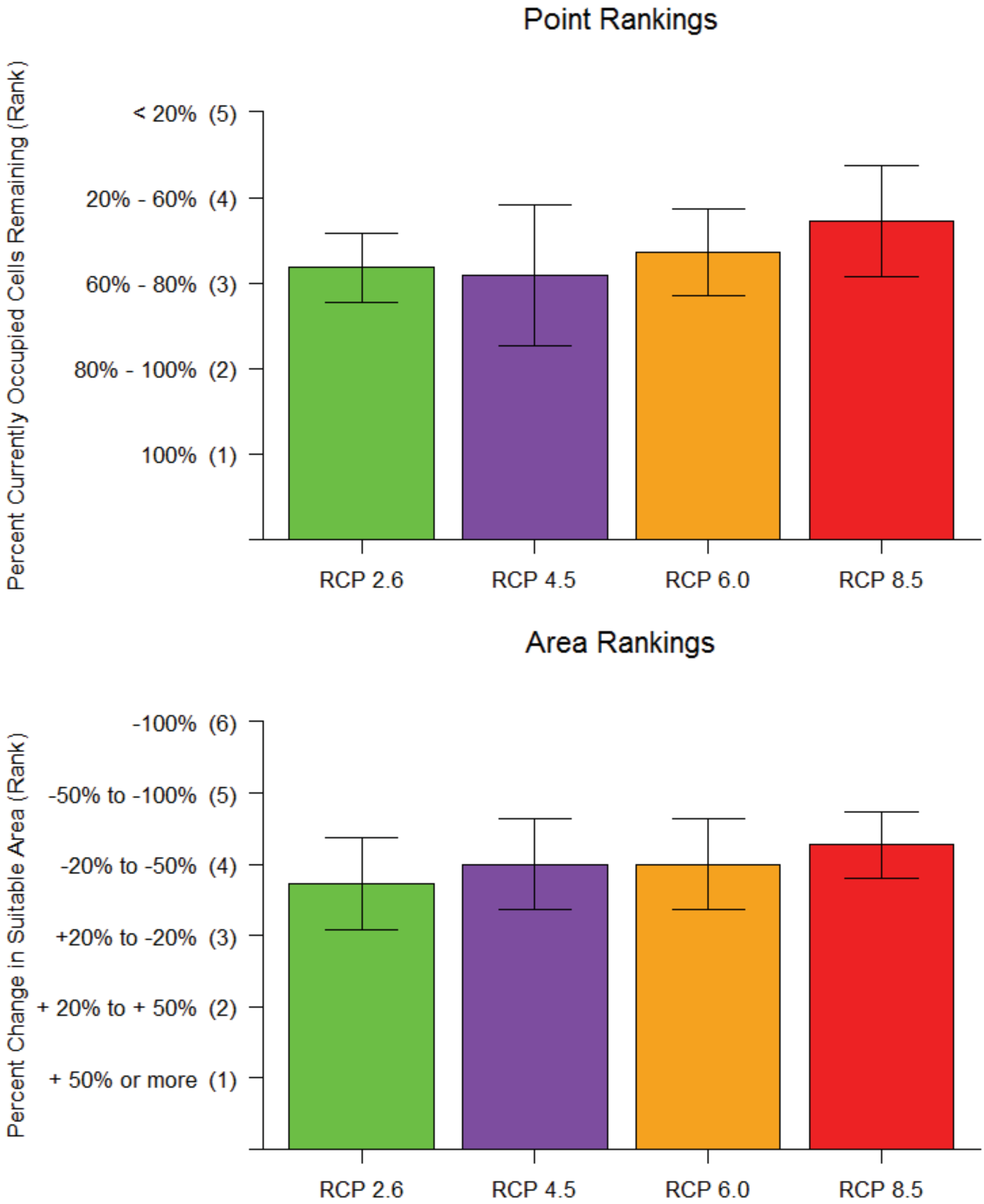

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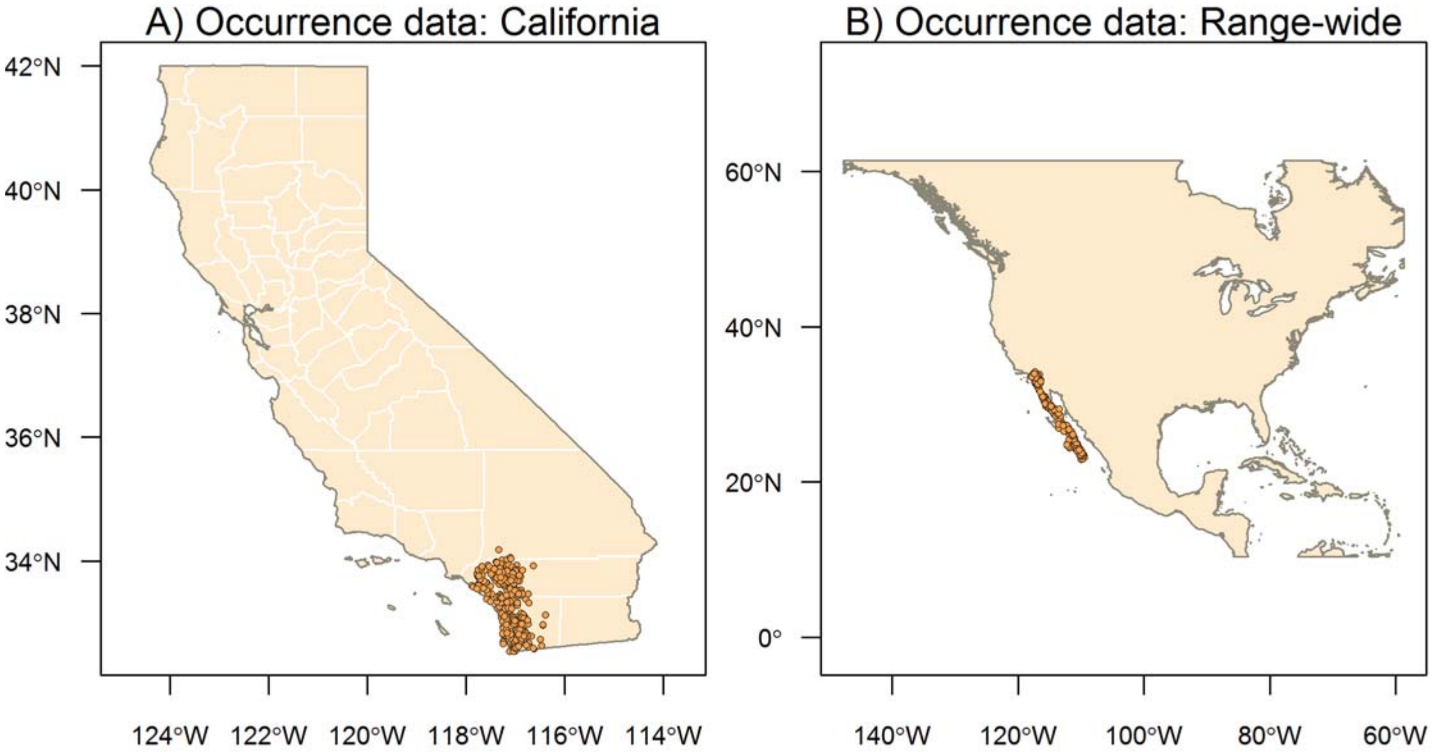
Species Results: *Aspidocelis hyperythra* Orange-throated Whiptail



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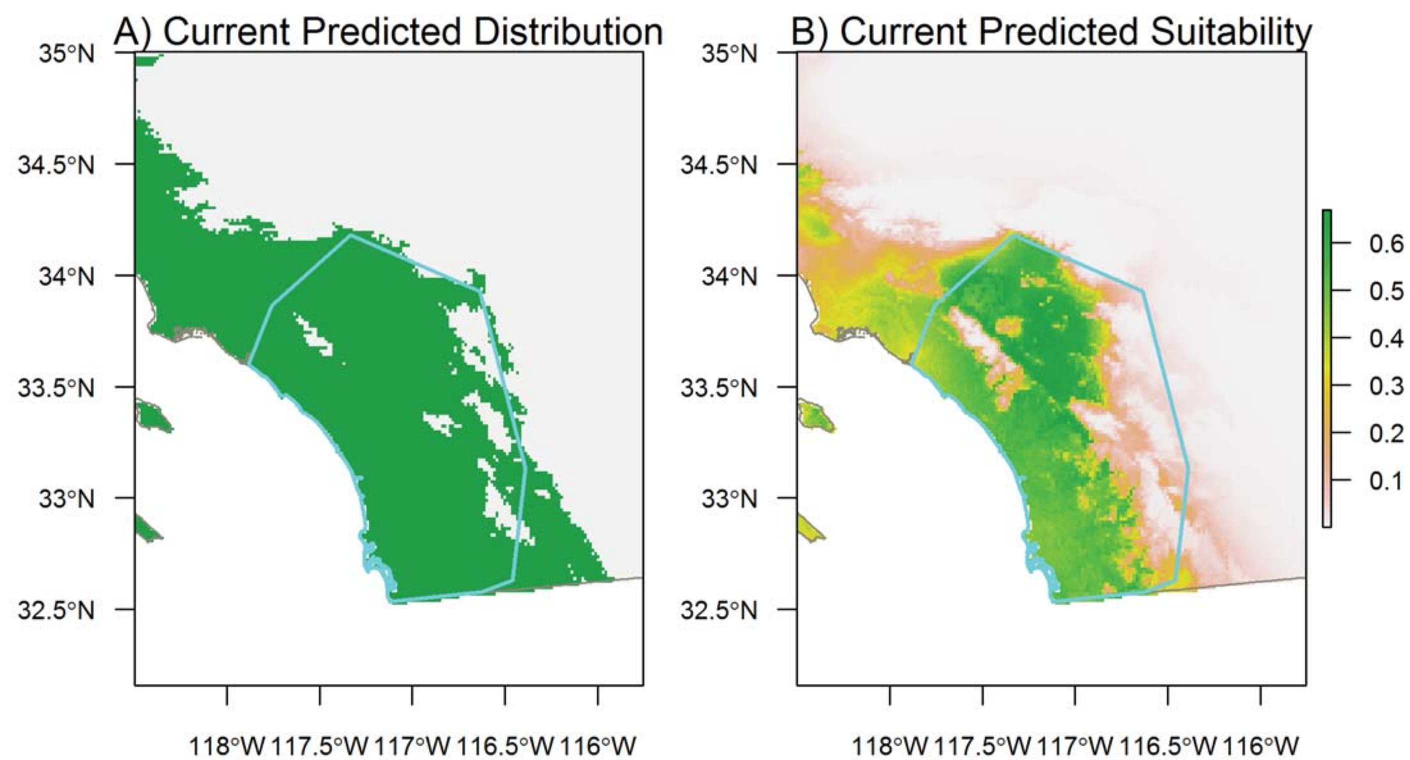

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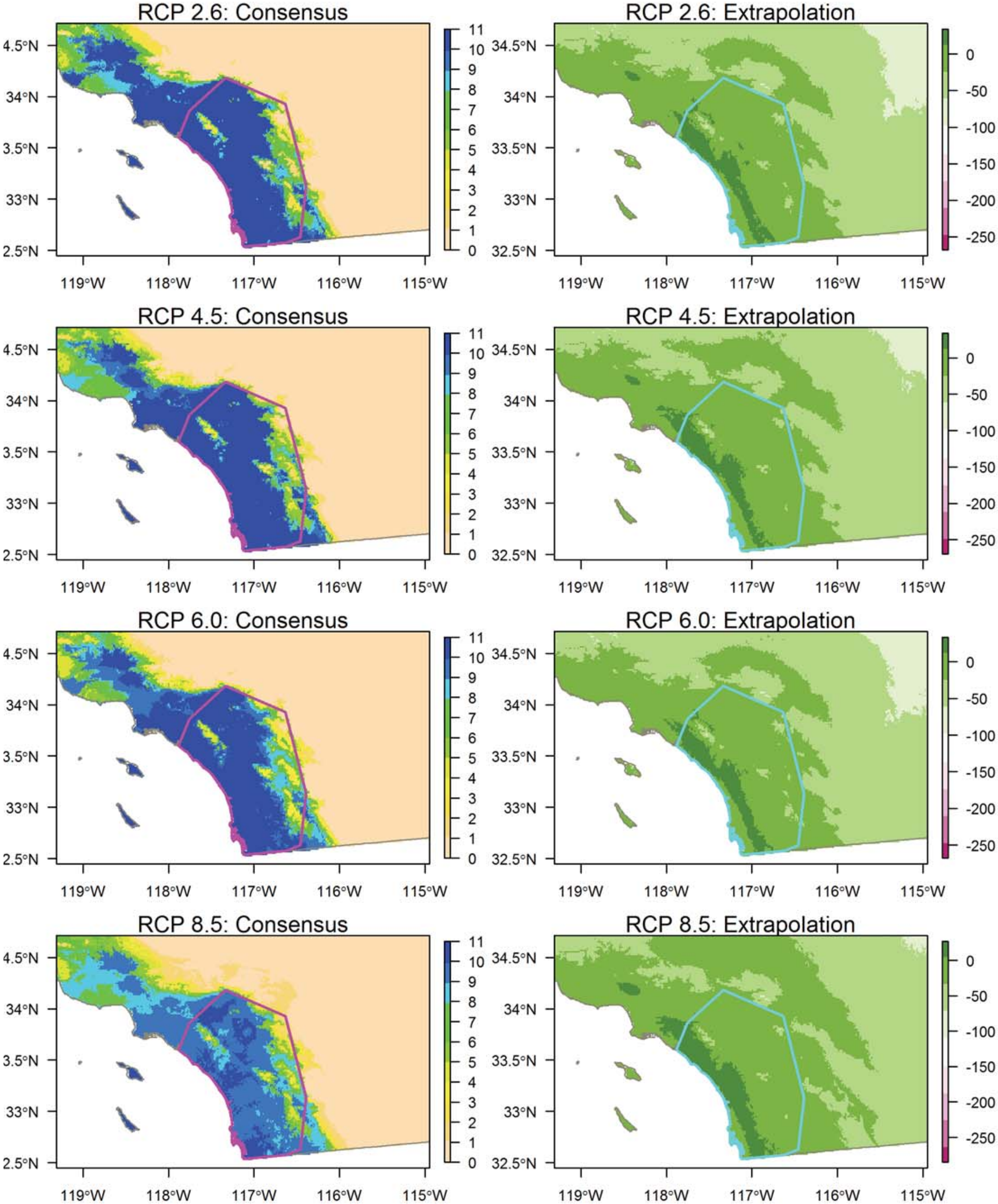

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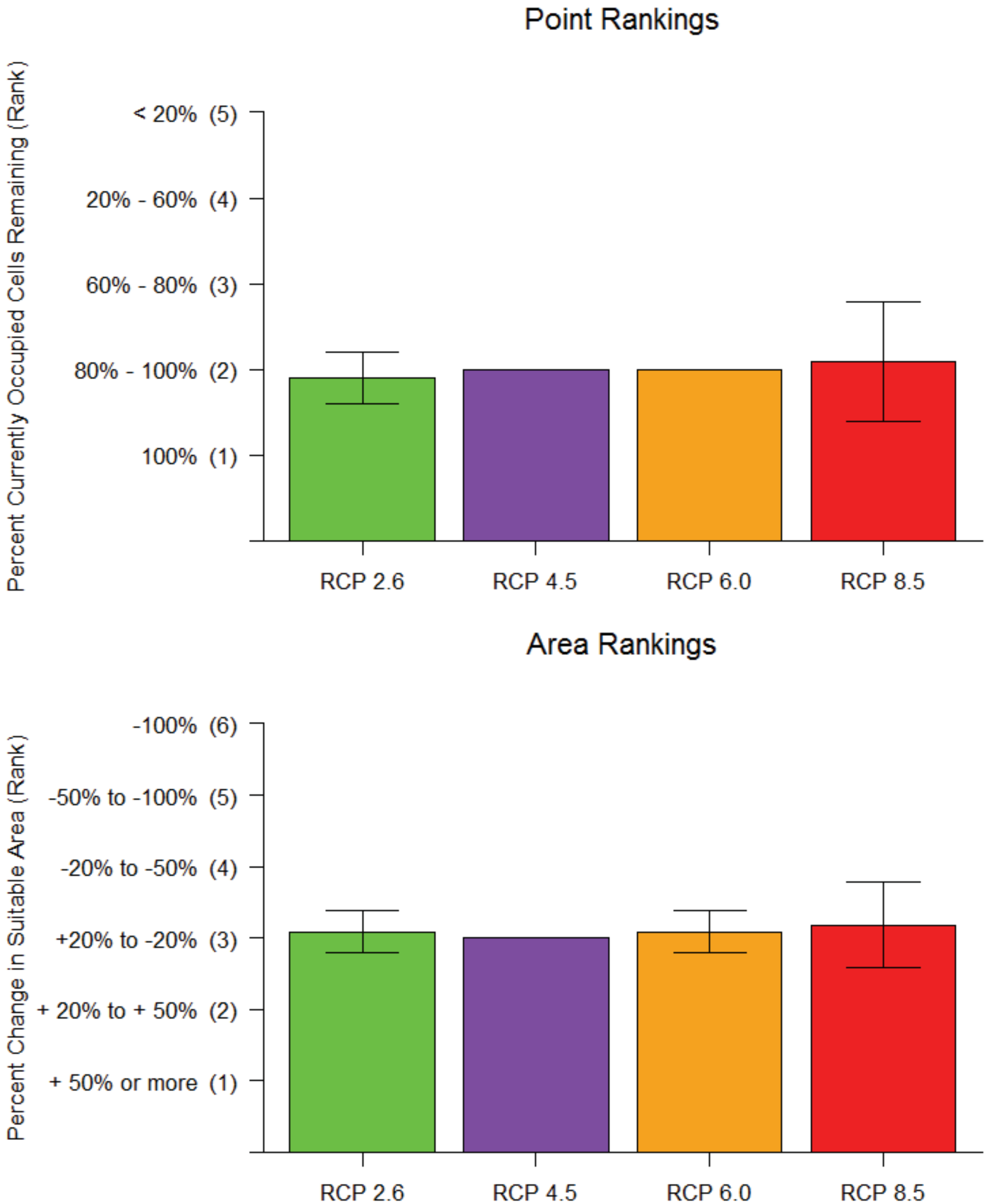

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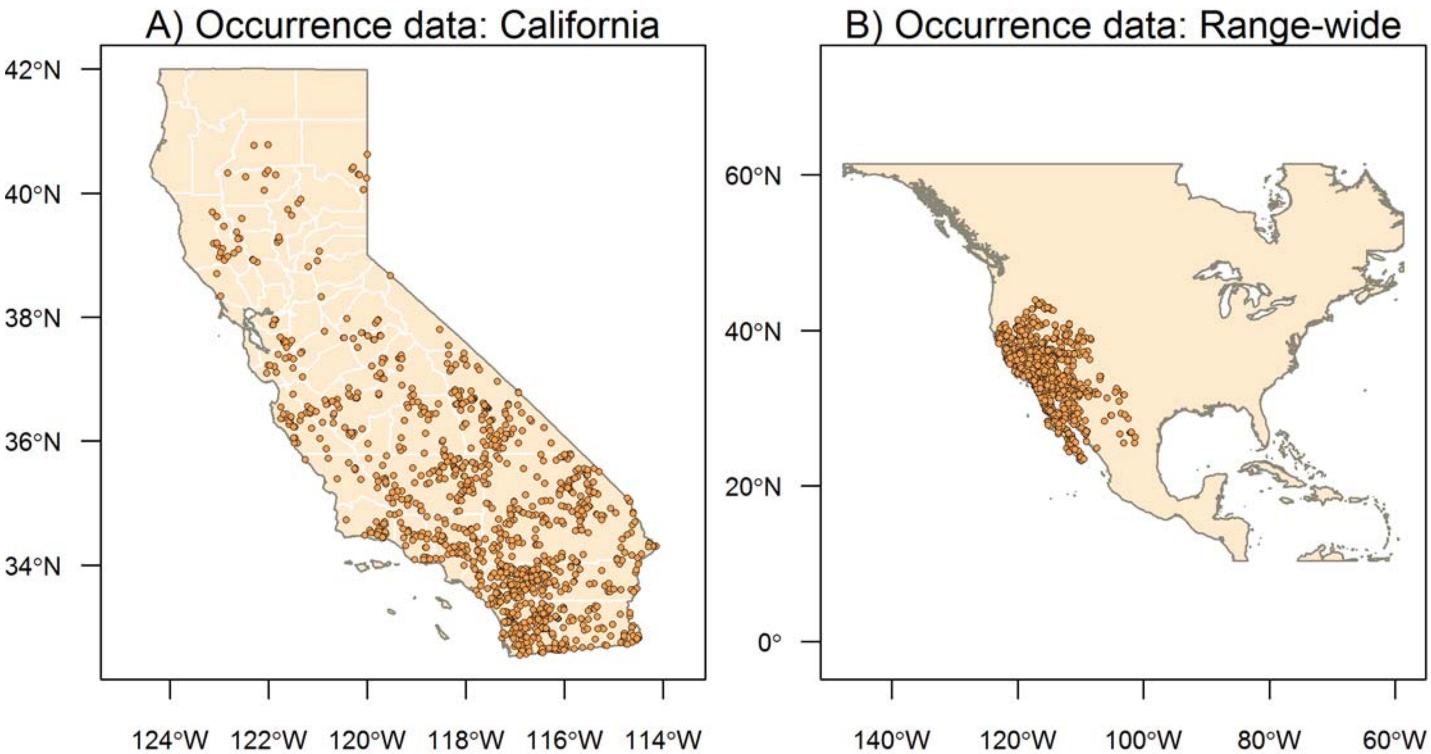
Species Results: *Aspidocelis tigris* Western Whiptail



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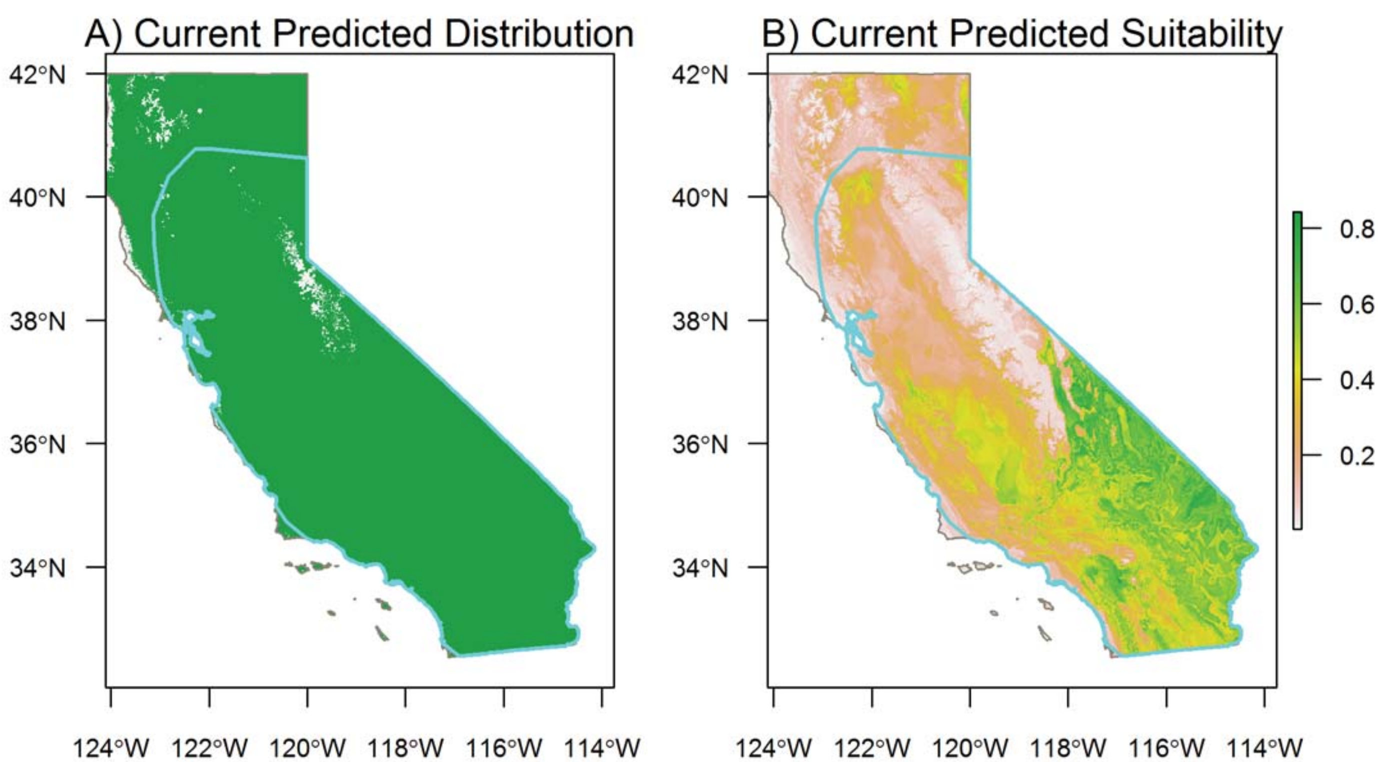

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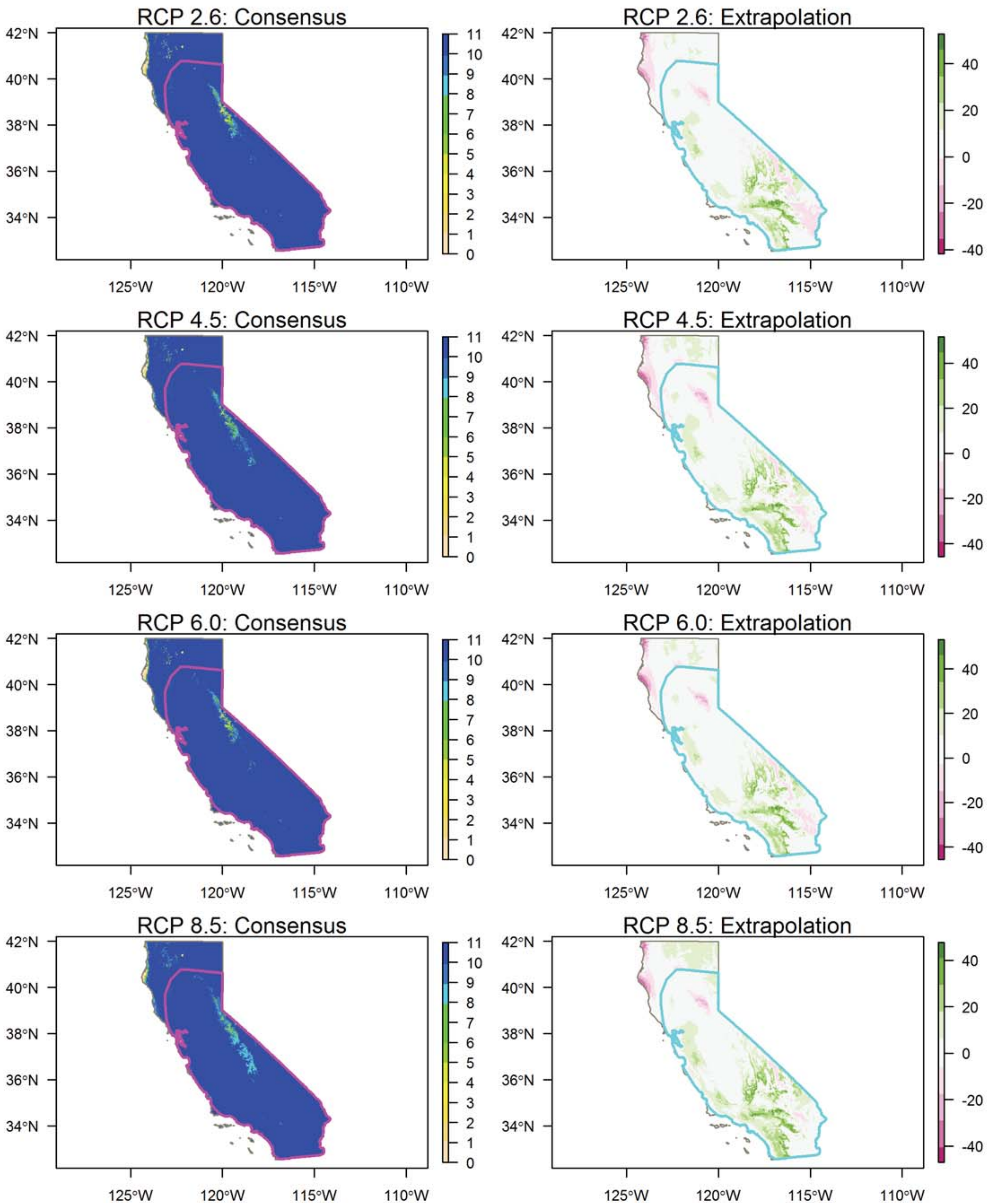
Species Results: *Aspidoscelis tigris* Western Whiptail



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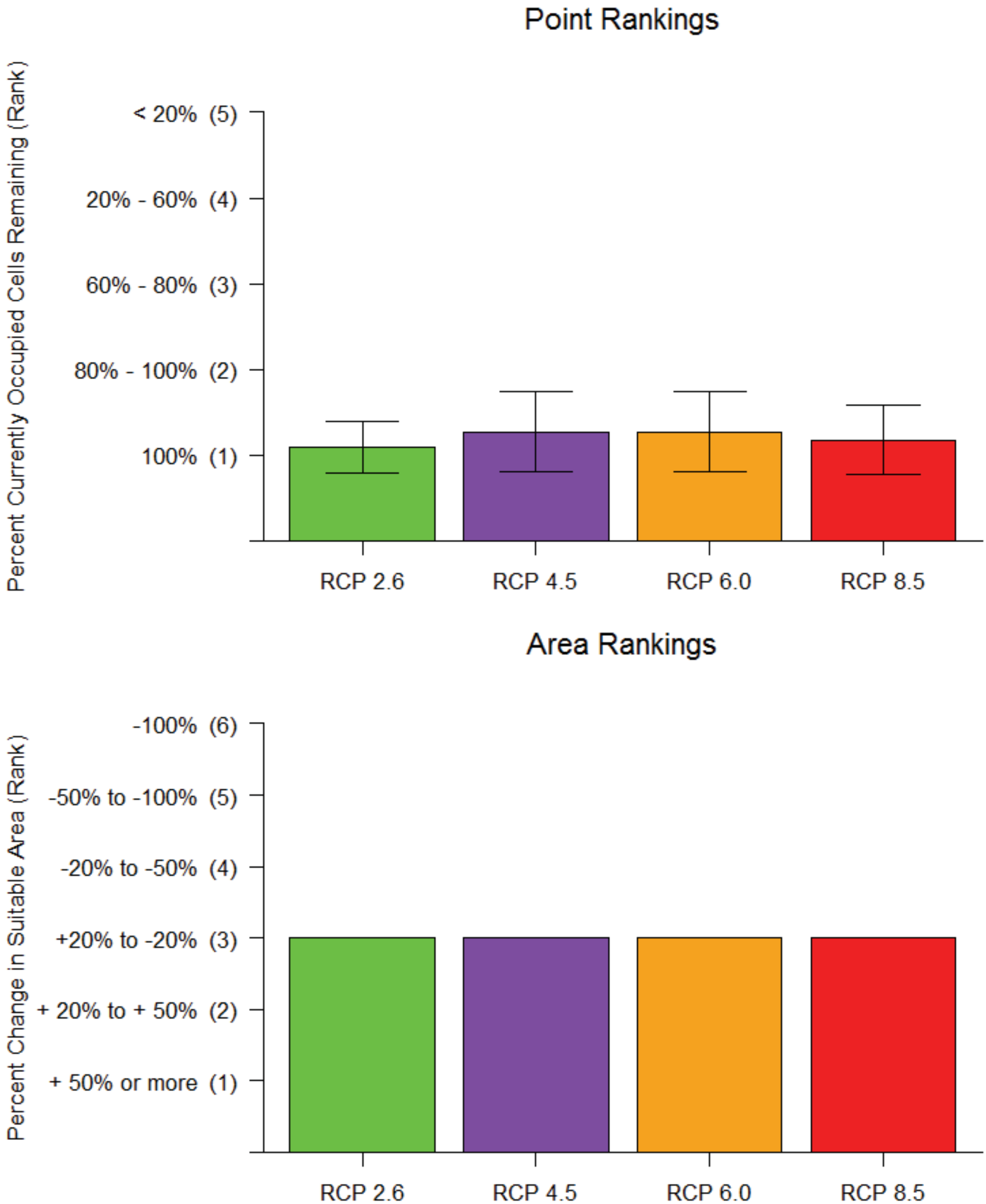

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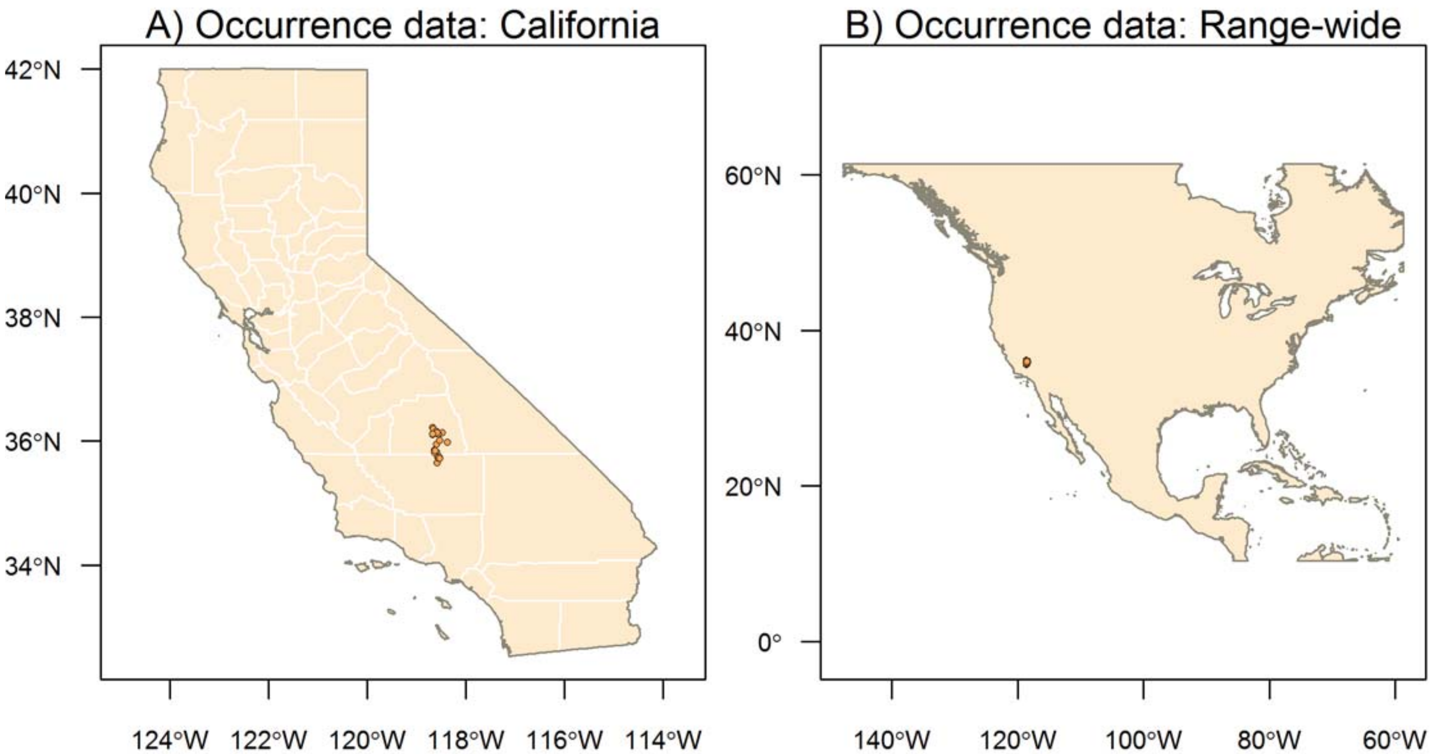
Species Results: *Batrachoseps altasierrae* Greenhorn Mountains Slender Salamander



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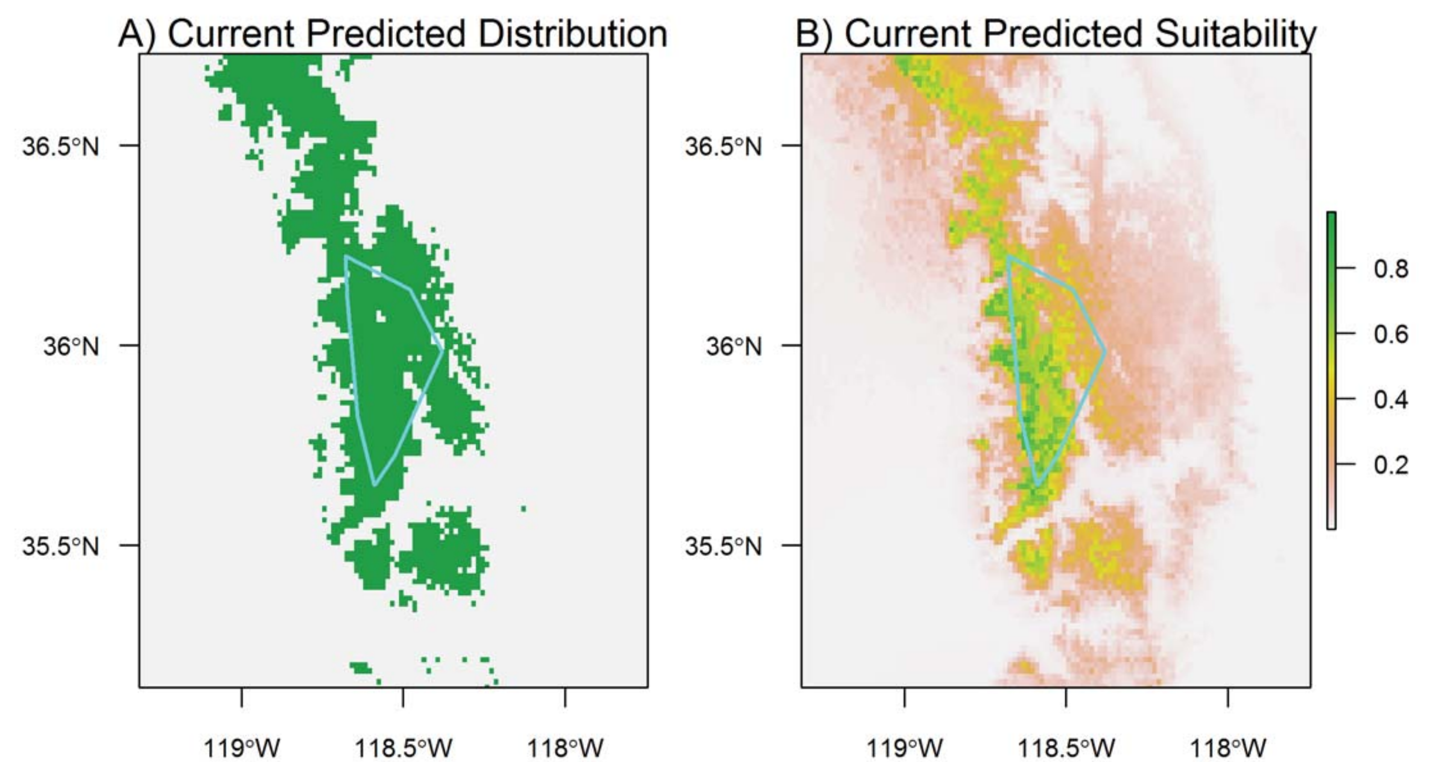

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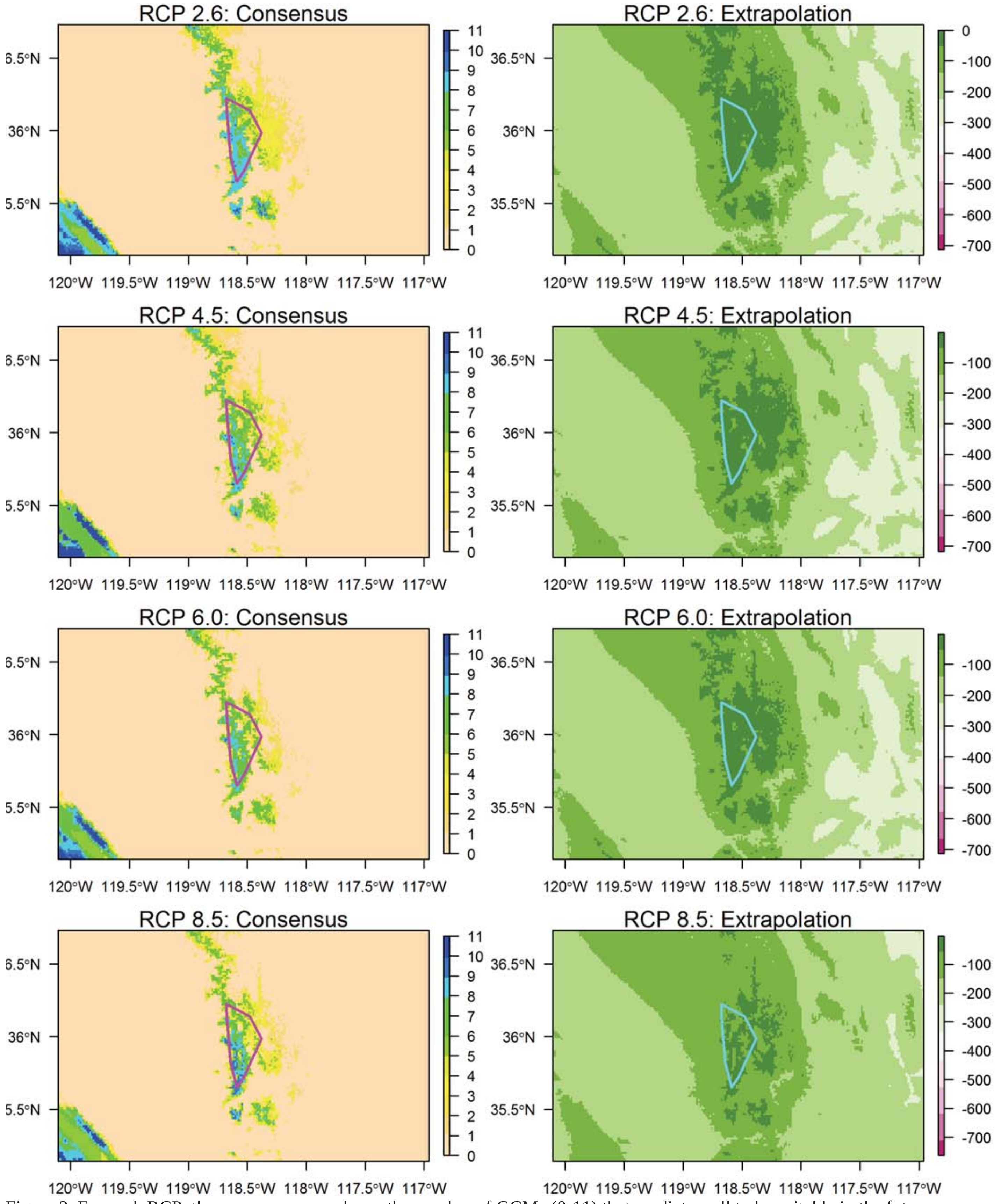
Species Results: *Batrachoseps altasierrae* Greenhorn Mountains Slender Salamander



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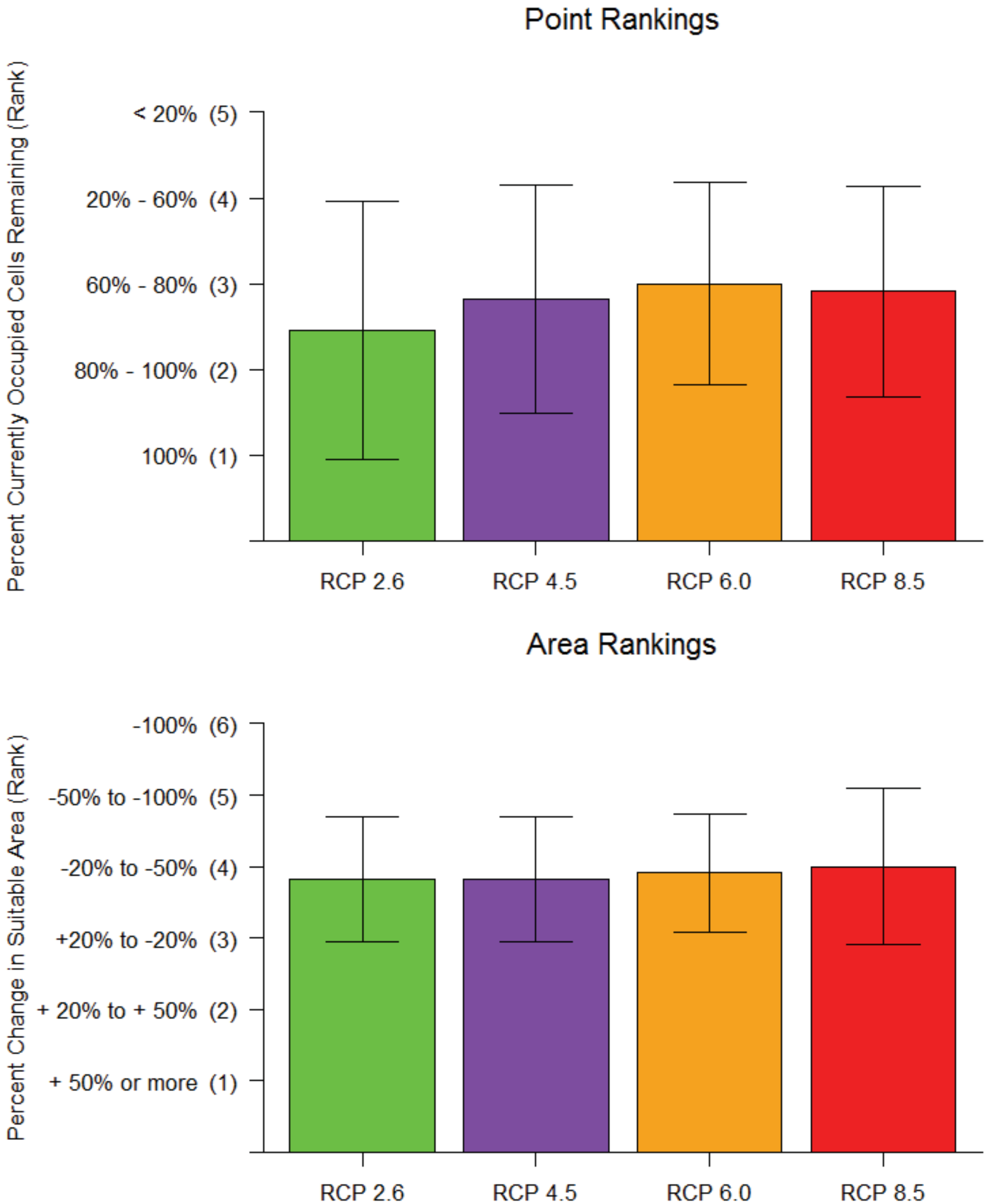
Species Results: *Batrachoseps altasierrae* Greenhorn Mountains Slender Salamander



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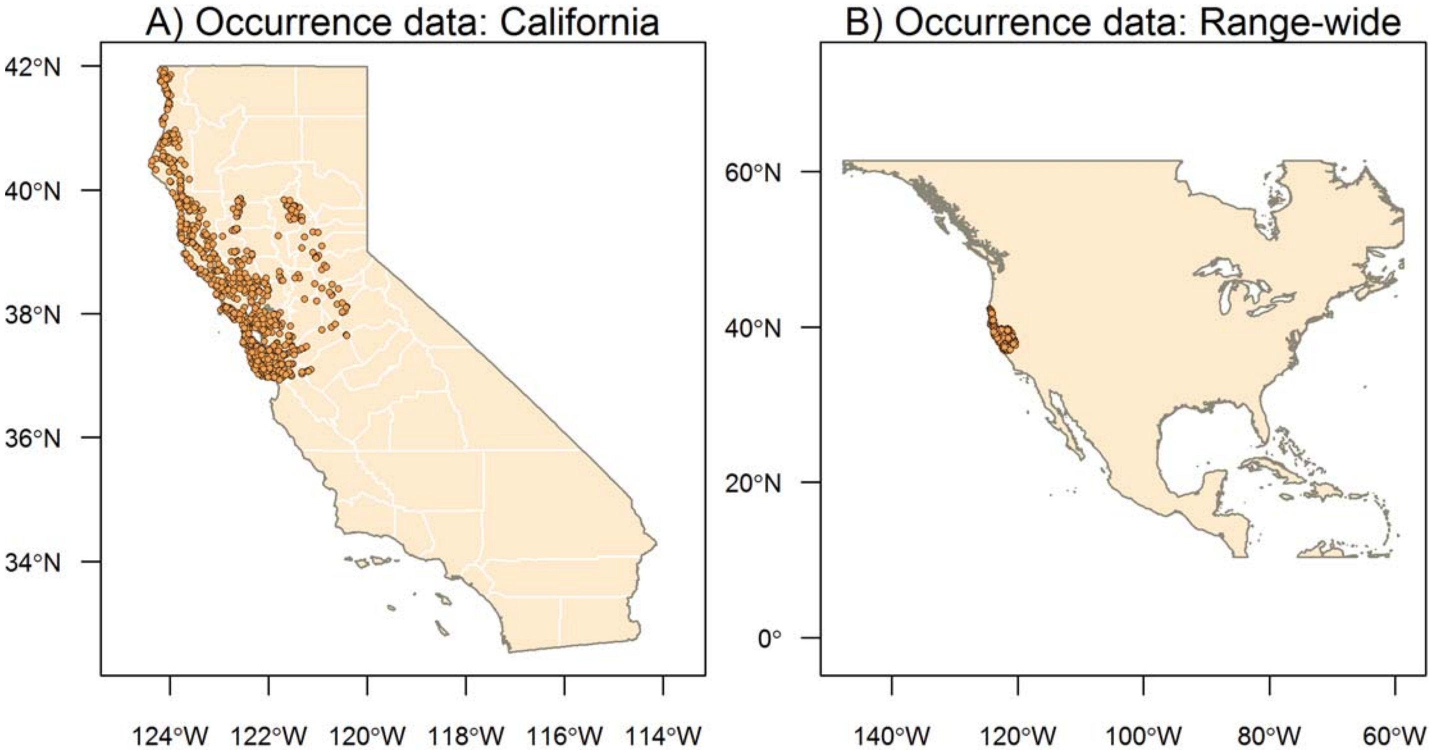
Species Results: *Batrachoseps attenuatus* California Slender Salamander



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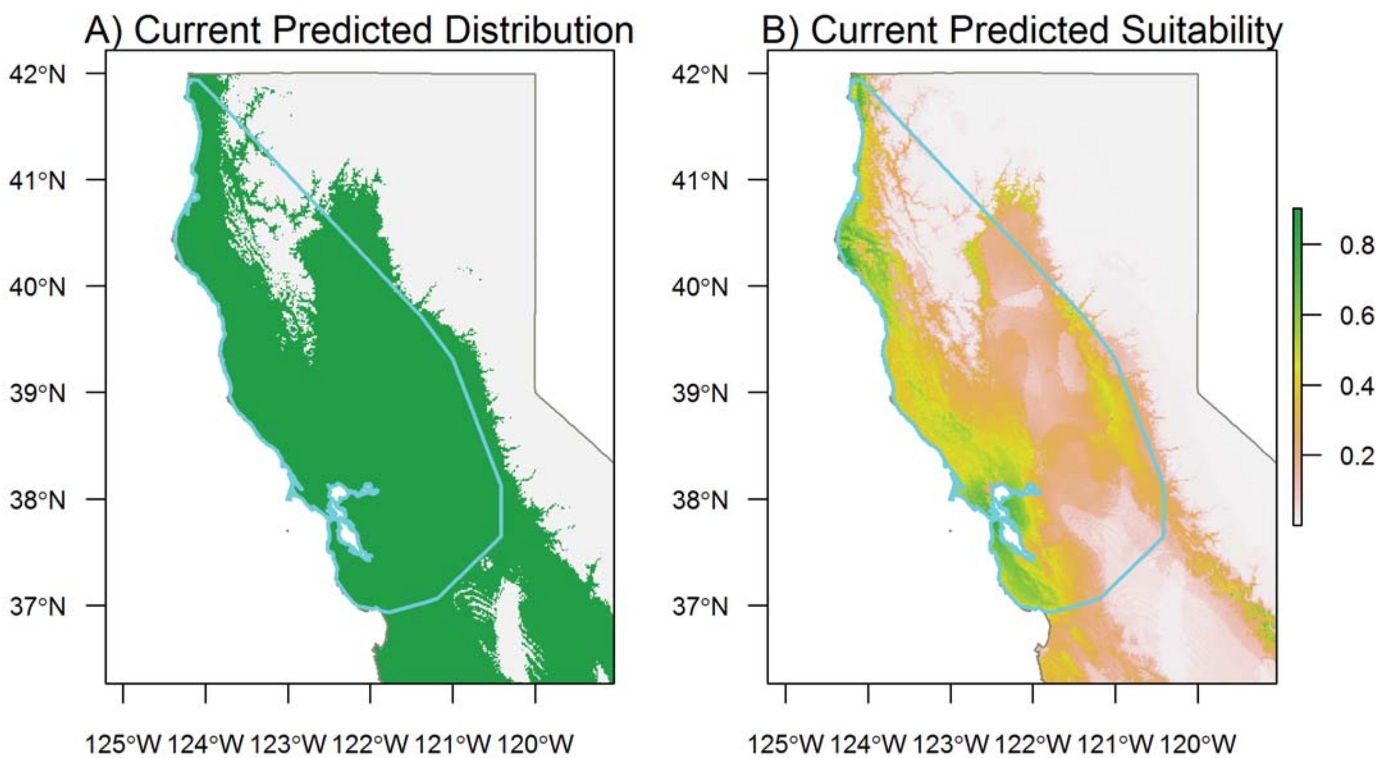

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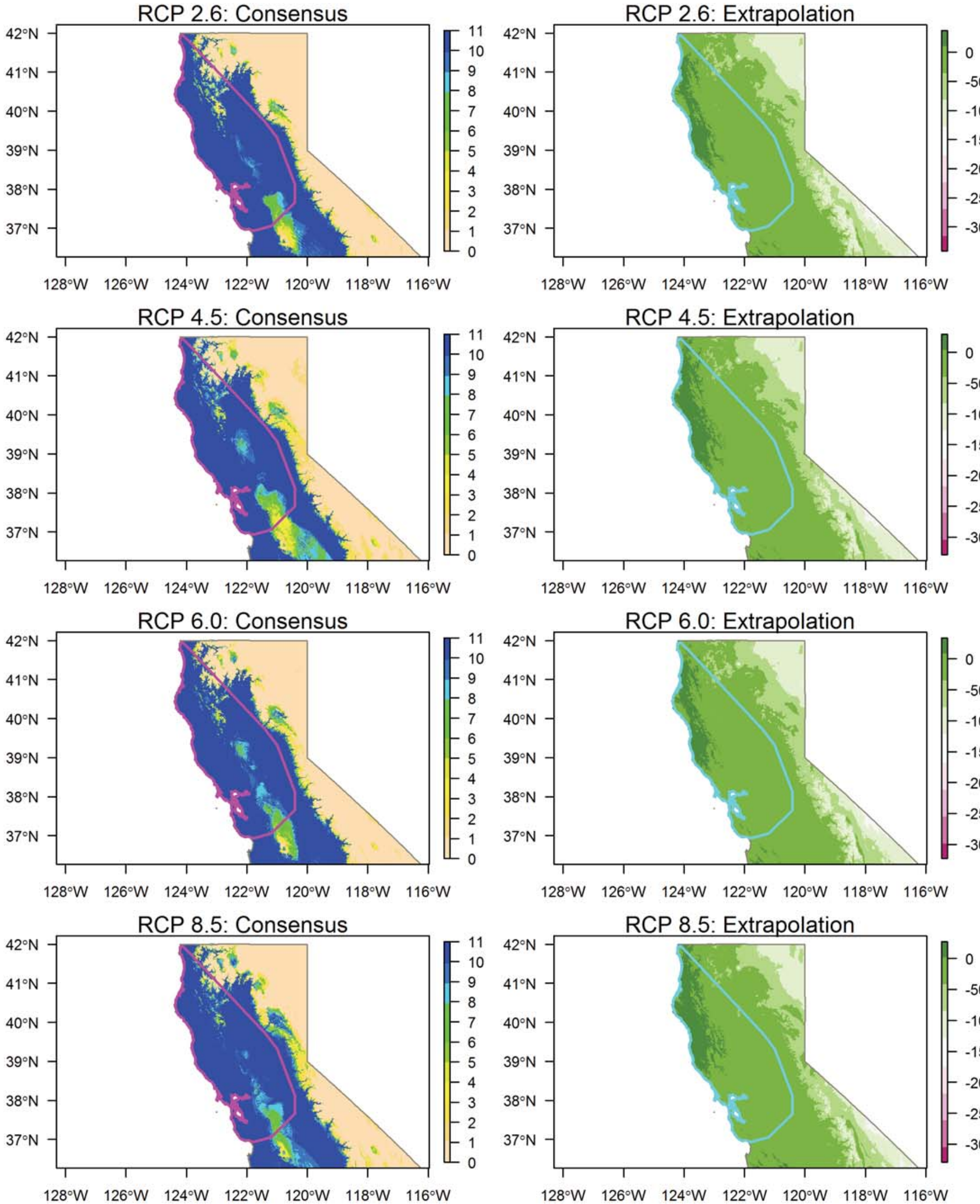
Species Results: *Batrachoseps attenuatus* California Slender Salamander



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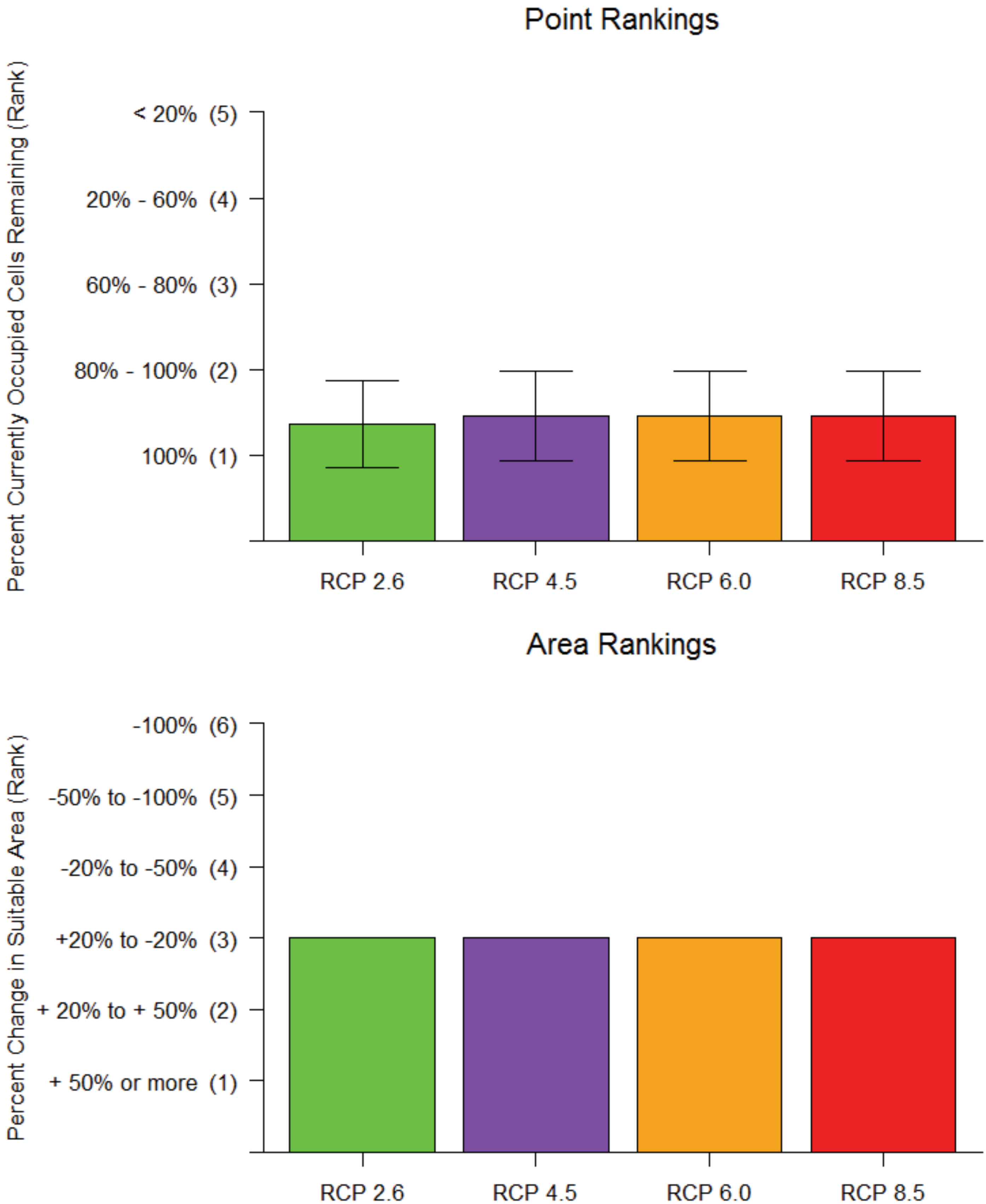
Species Results: *Batrachoseps attenuatus* California Slender Salamander



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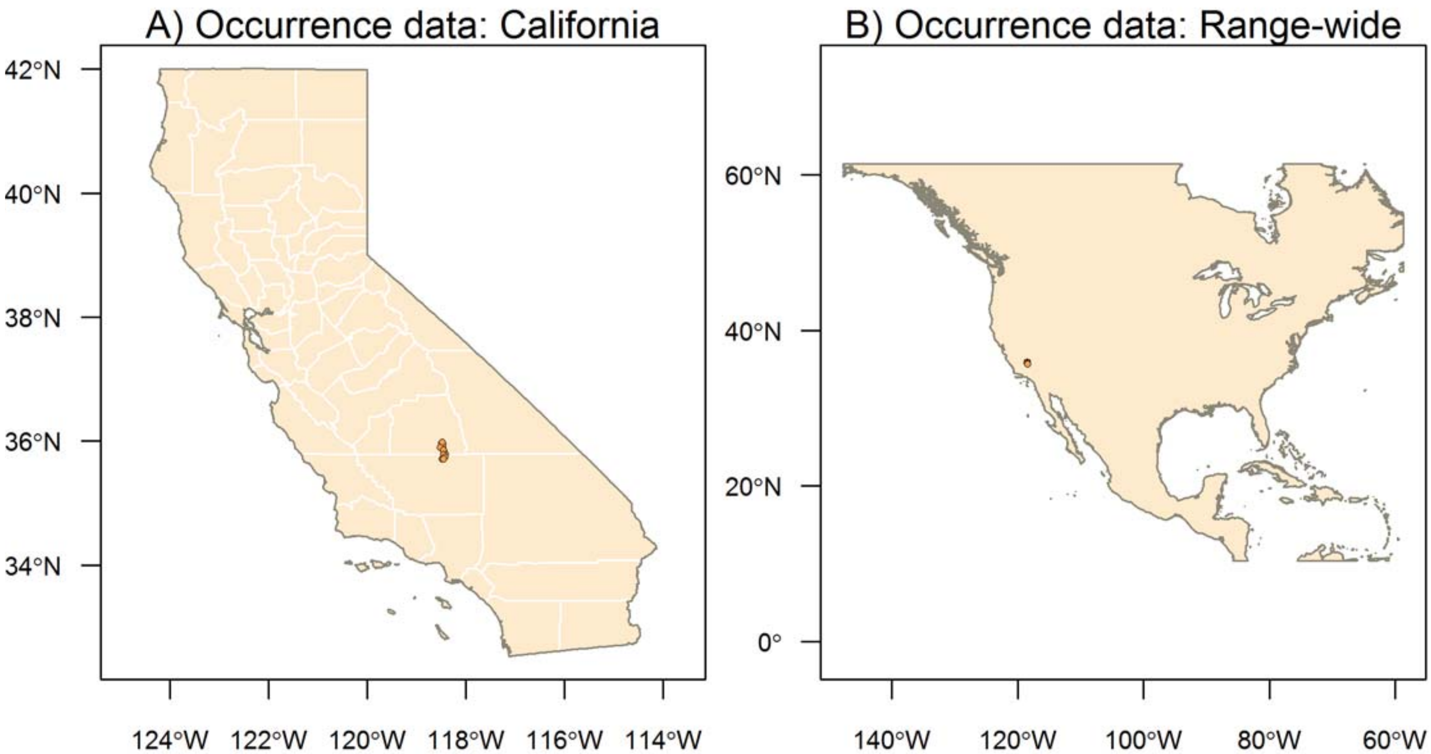
Species Results: *Batrachoseps bramei* Fairview Slender Salamander



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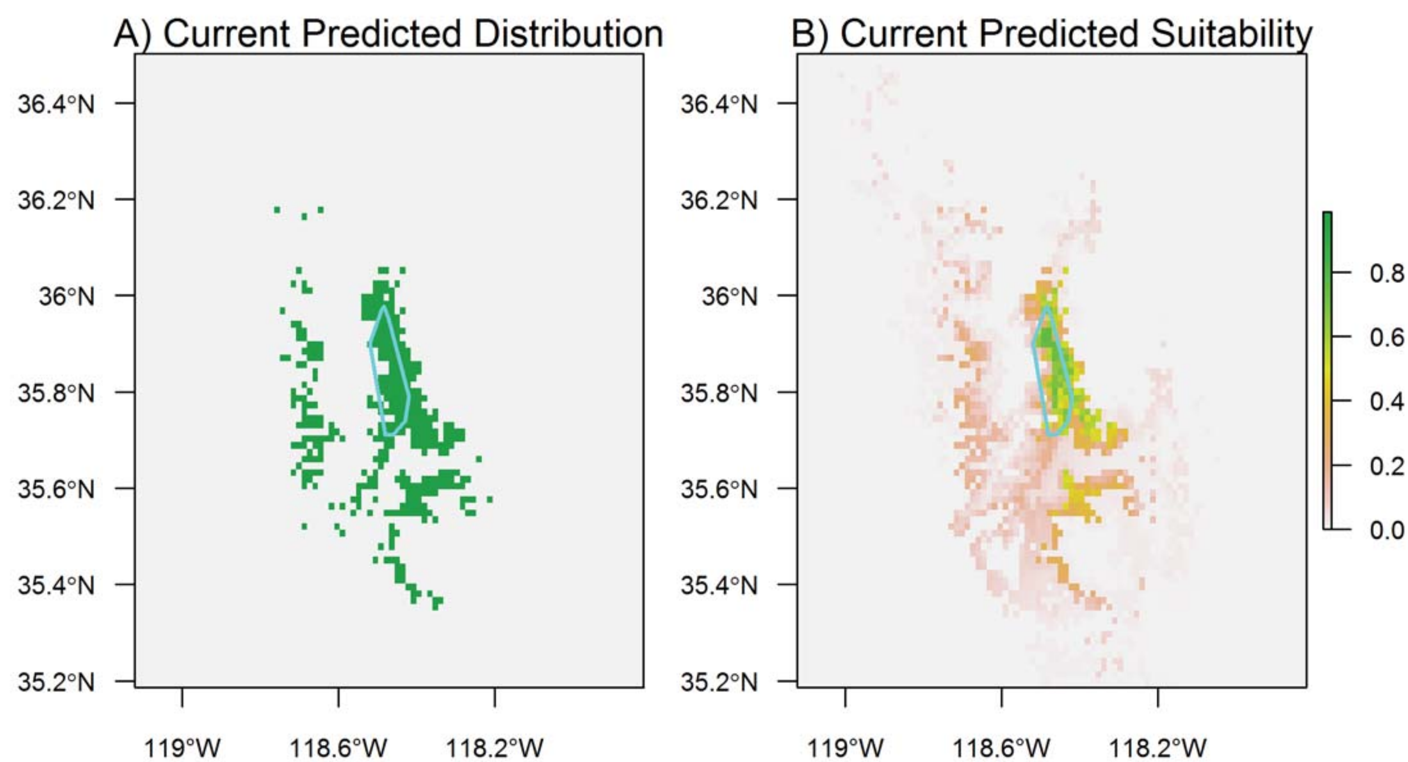

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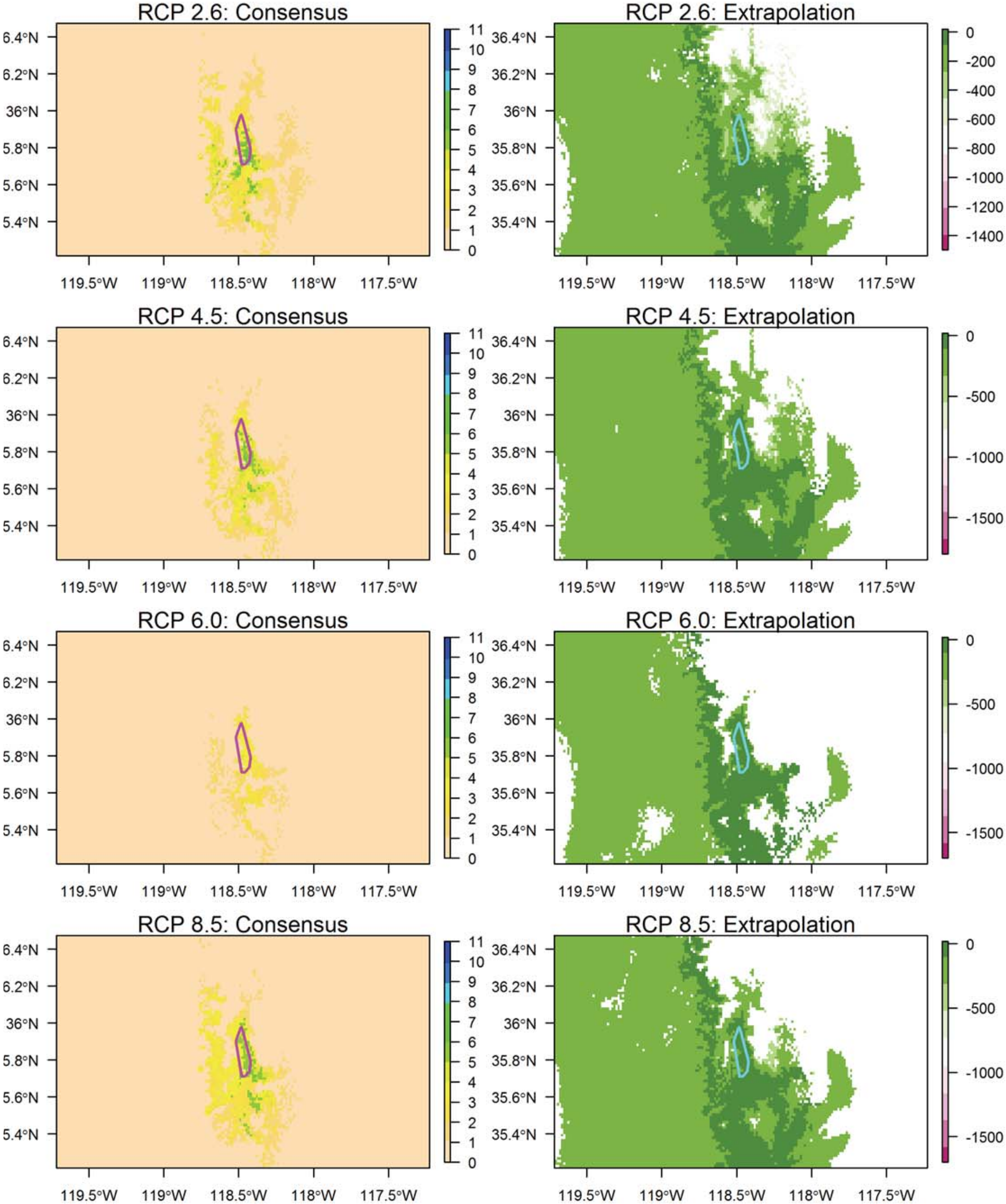
Species Results: *Batrachoseps bramei* Fairview Slender Salamander



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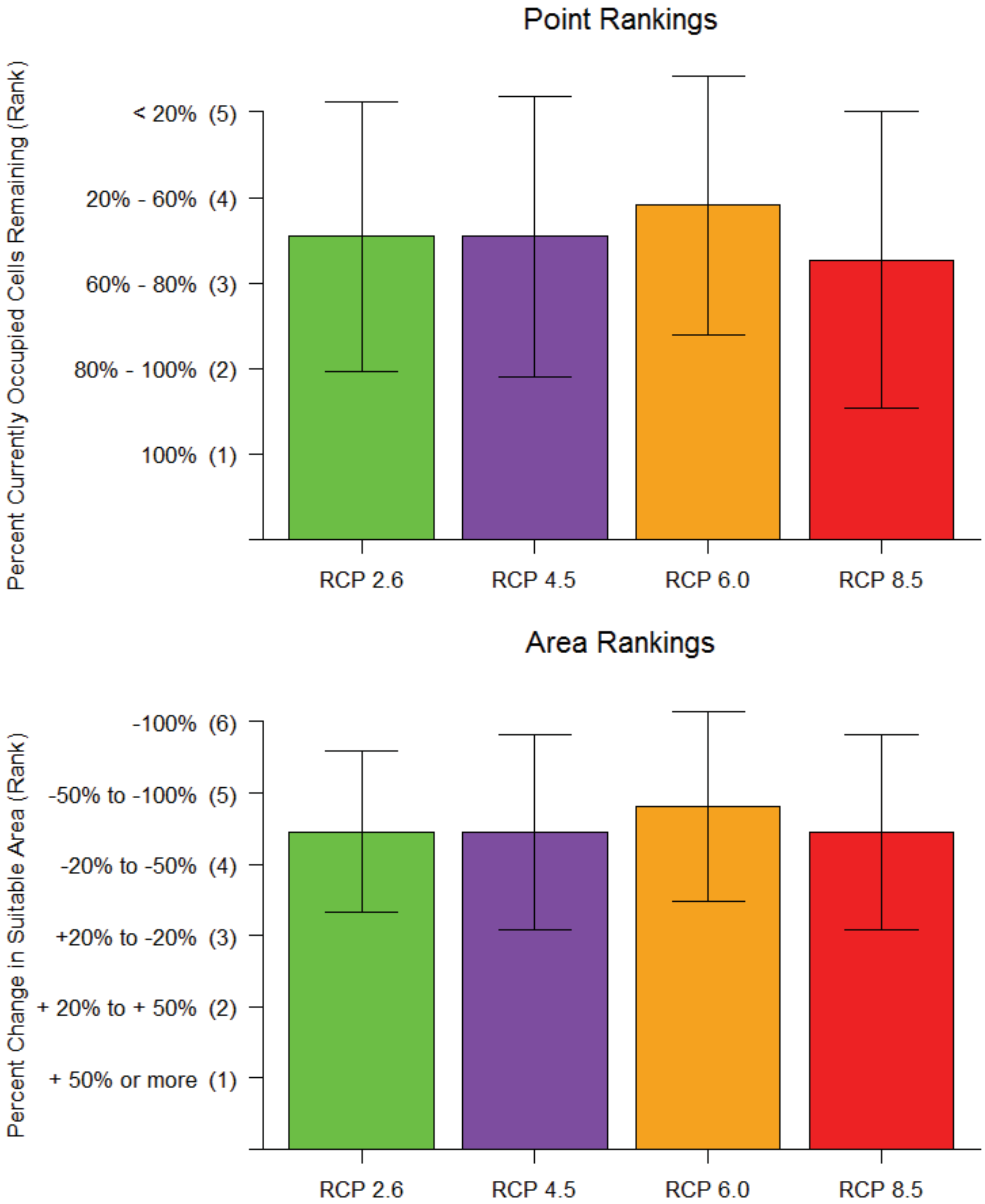

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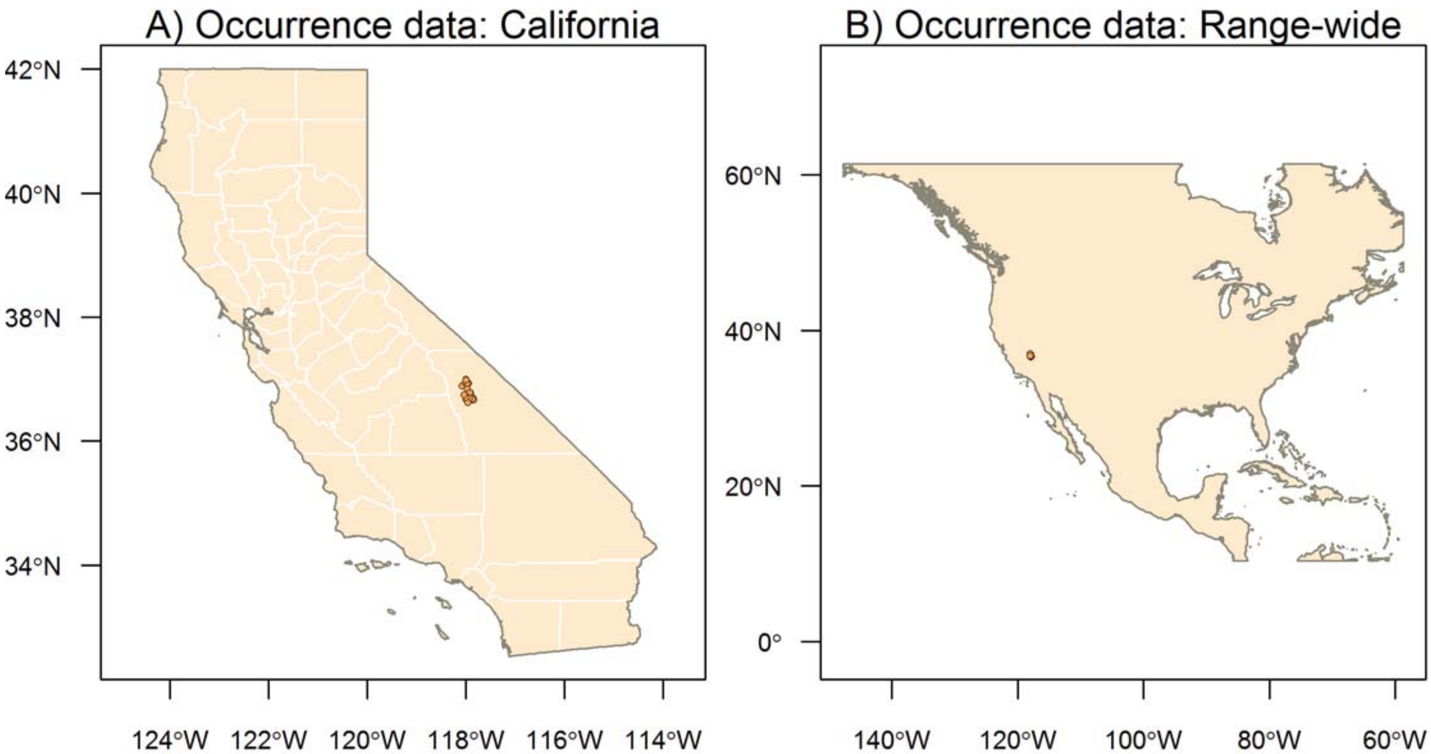
Species Results: *Batrachoseps campi* Inyo Mountains Slender Salamander



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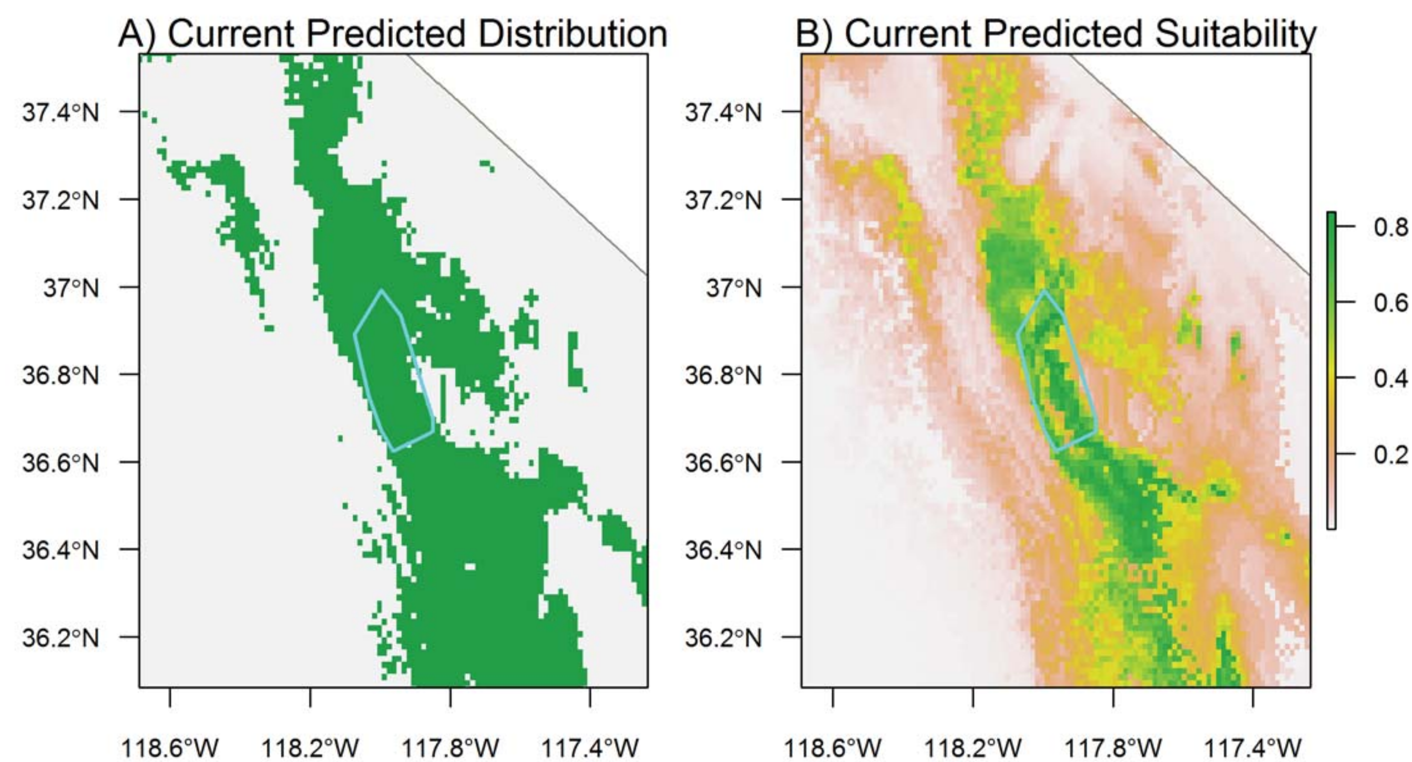

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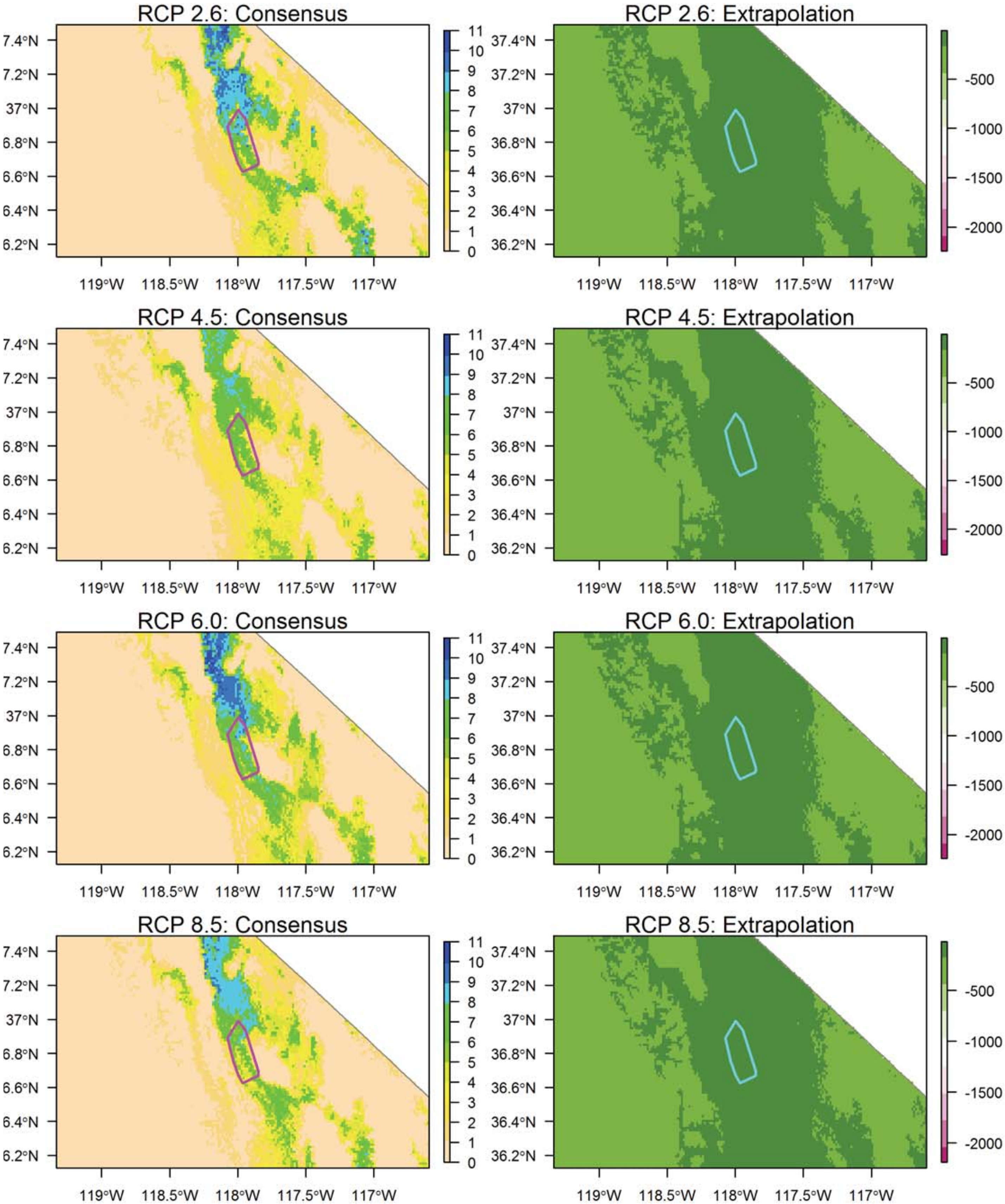
Species Results: *Batrachoseps campi* Inyo Mountains Slender Salamander



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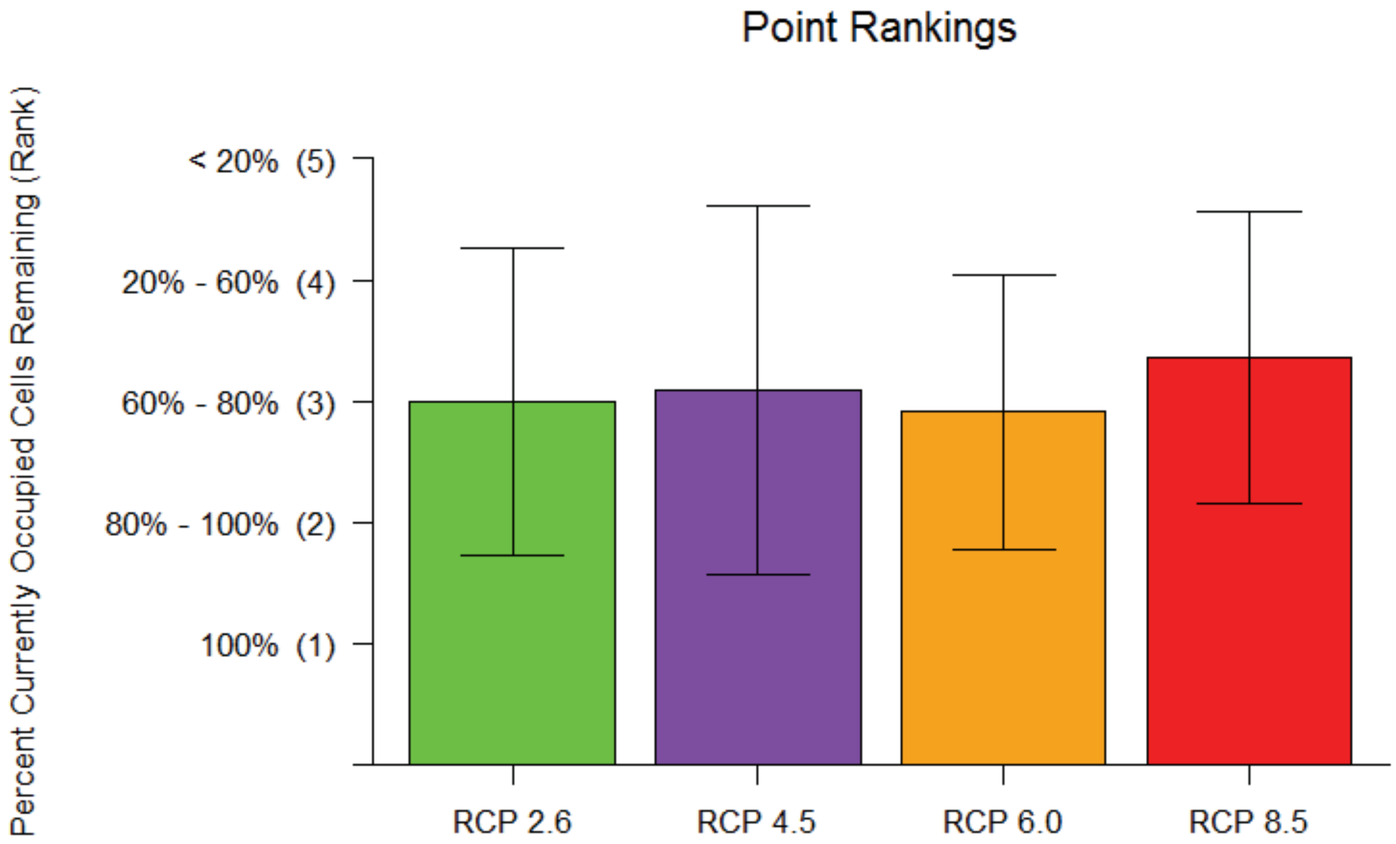
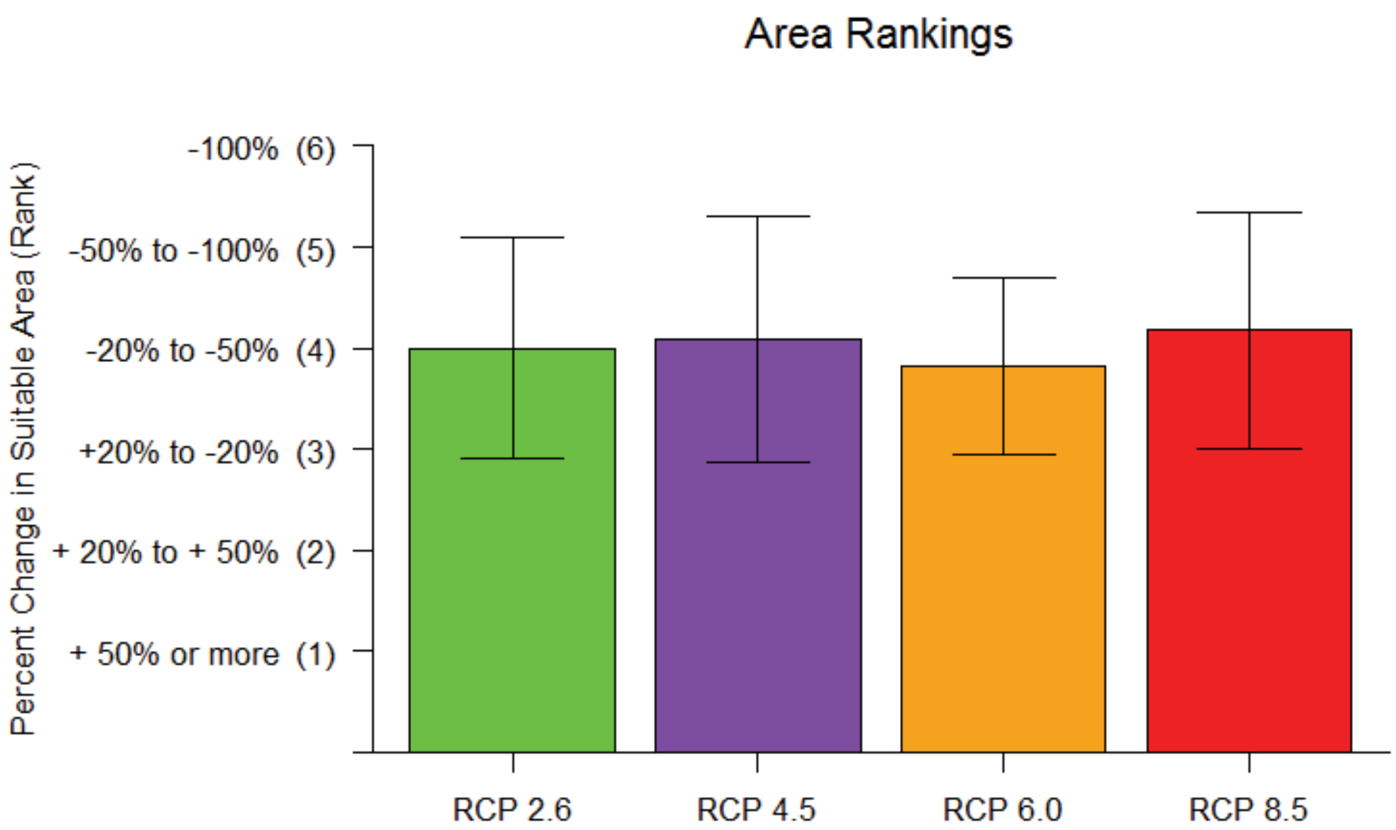
Species Results: *Batrachoseps campi* Inyo Mountains Slender Salamander





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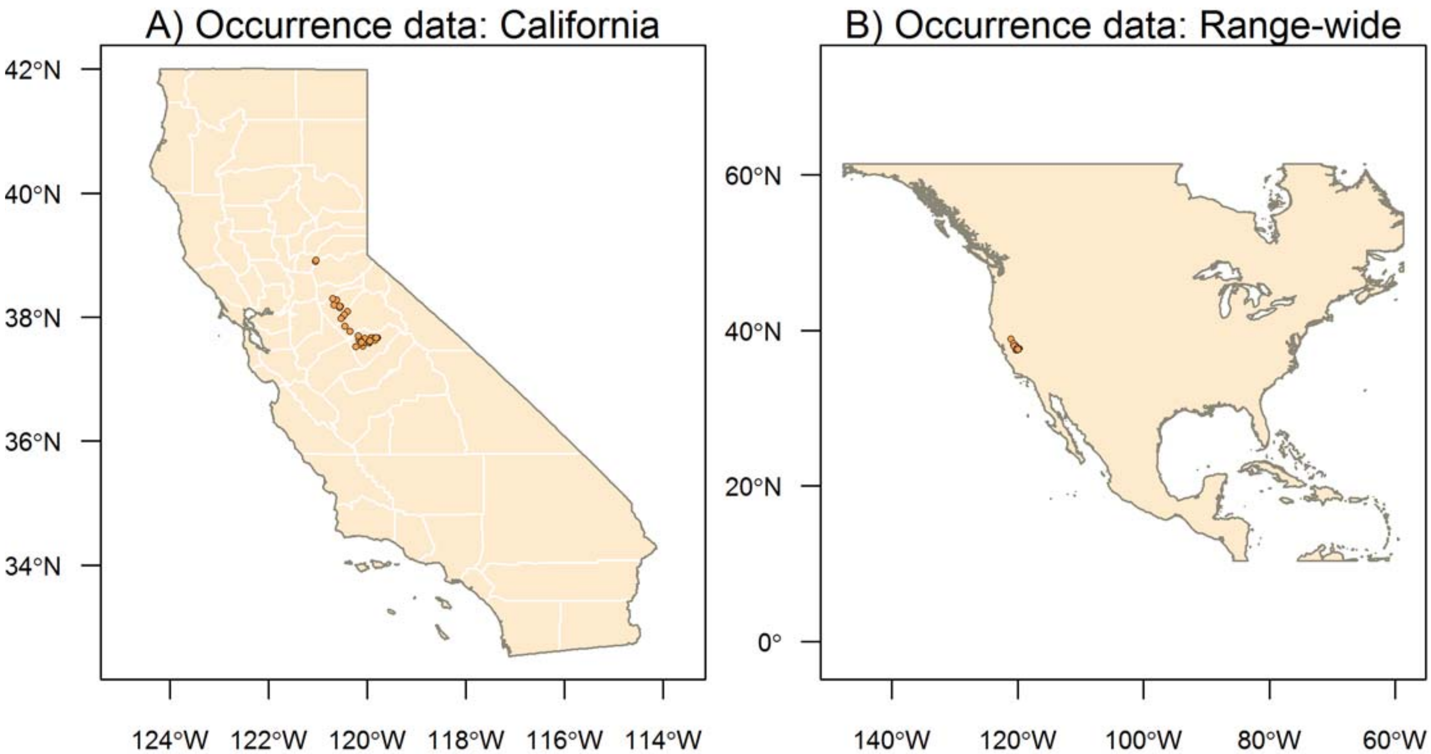
Species Results: *Batrachoseps diabolicus* Hell Hollow Slender Salamander



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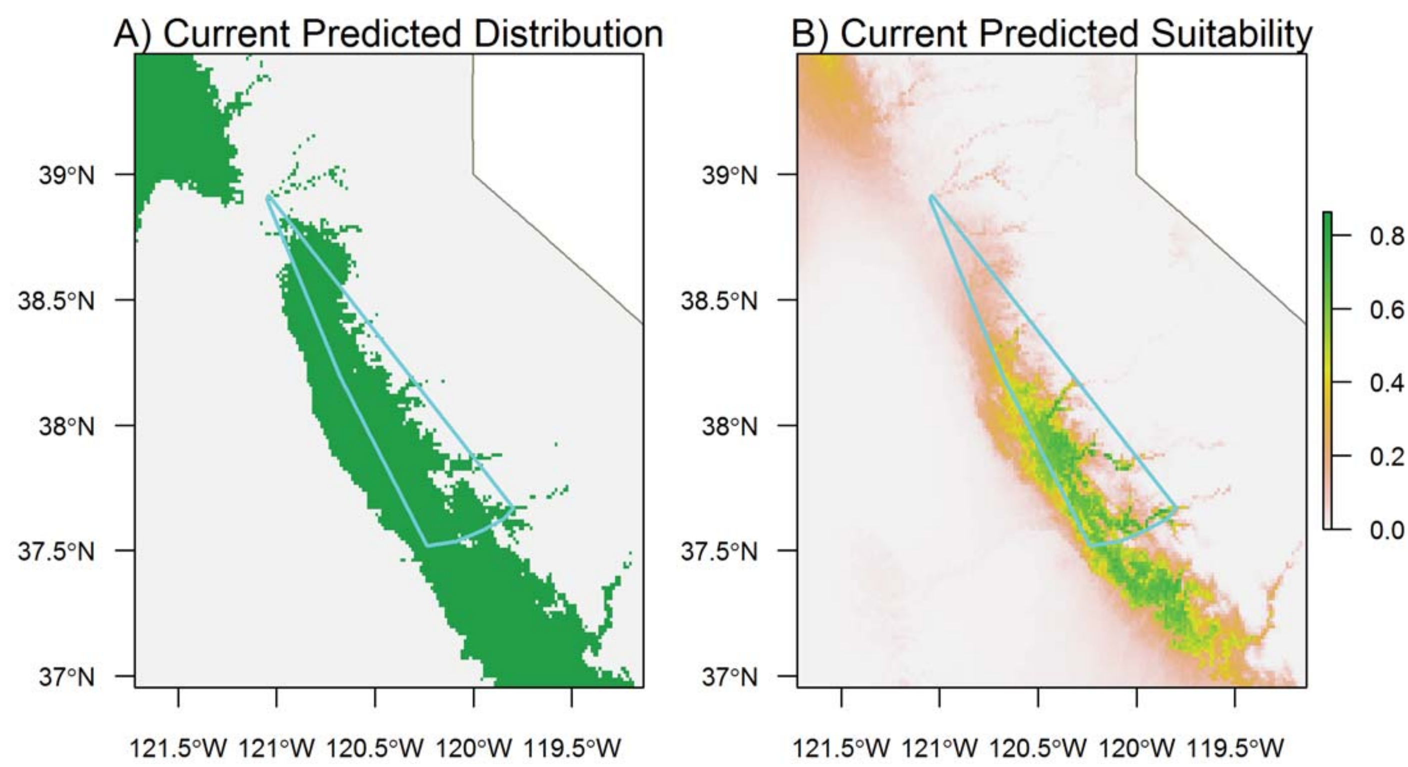

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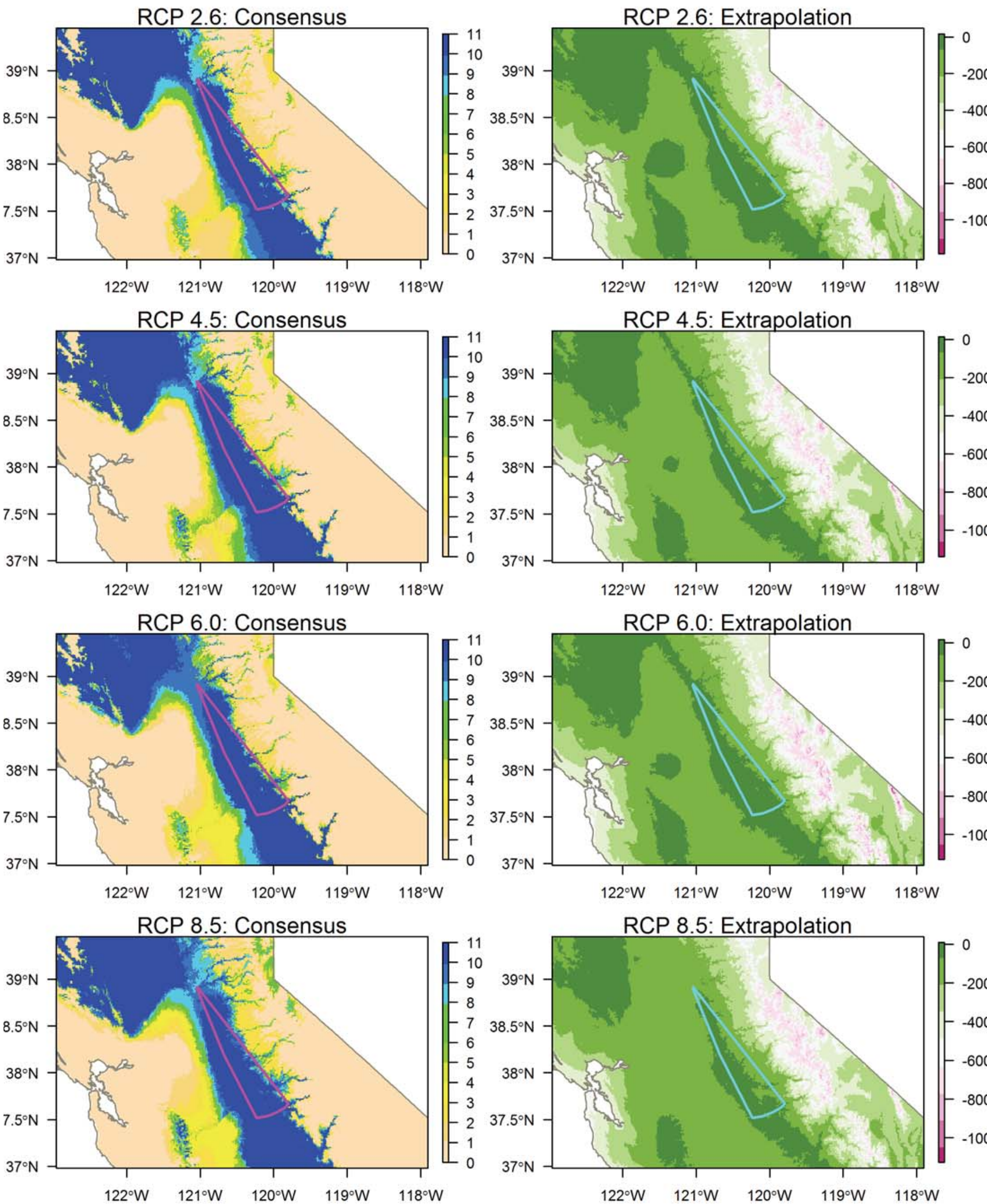
Species Results: *Batrachoseps diabolicus* Hell Hollow Slender Salamander



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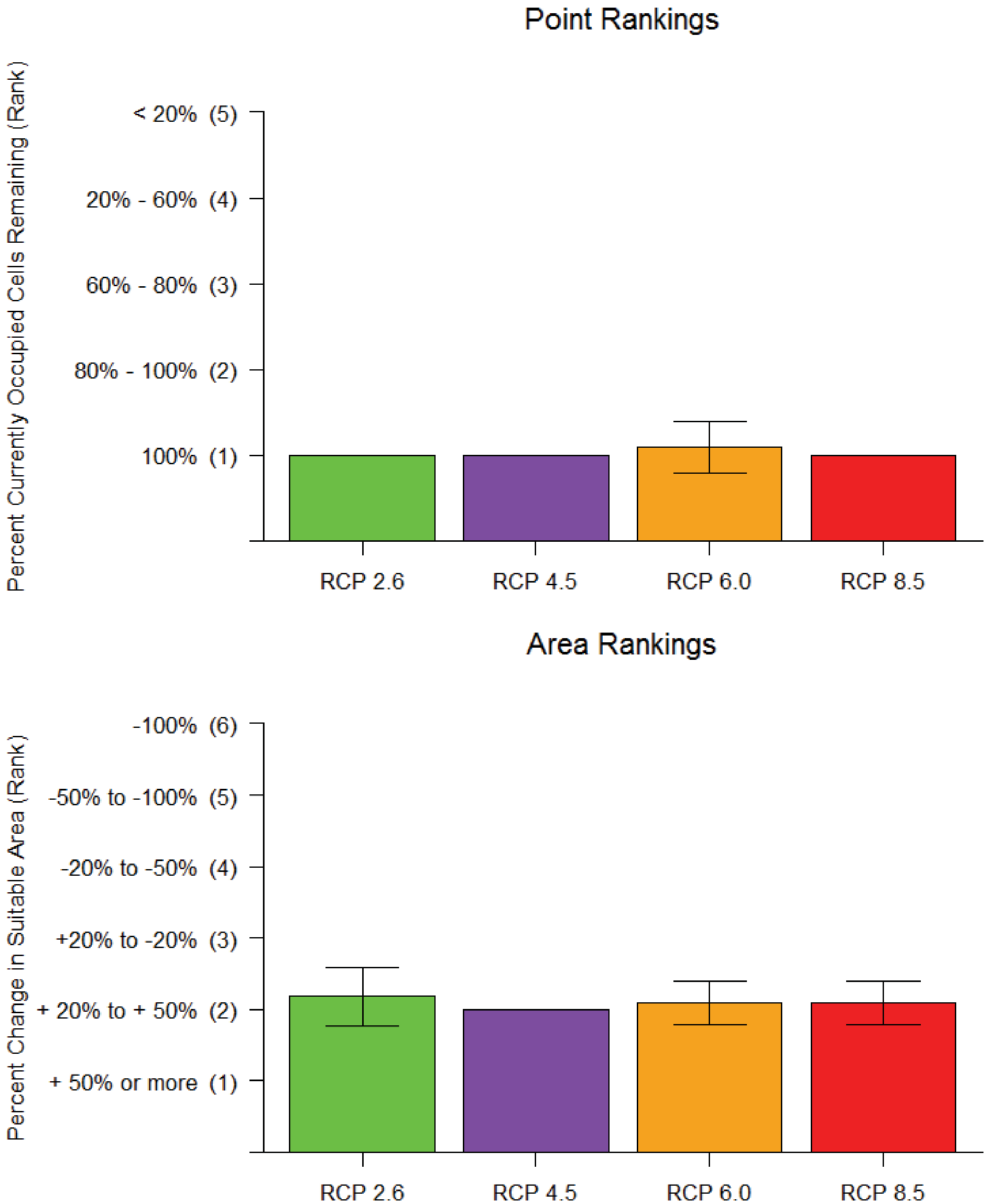


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps gabrieli* San Gabriel Mountains Slender Salamander

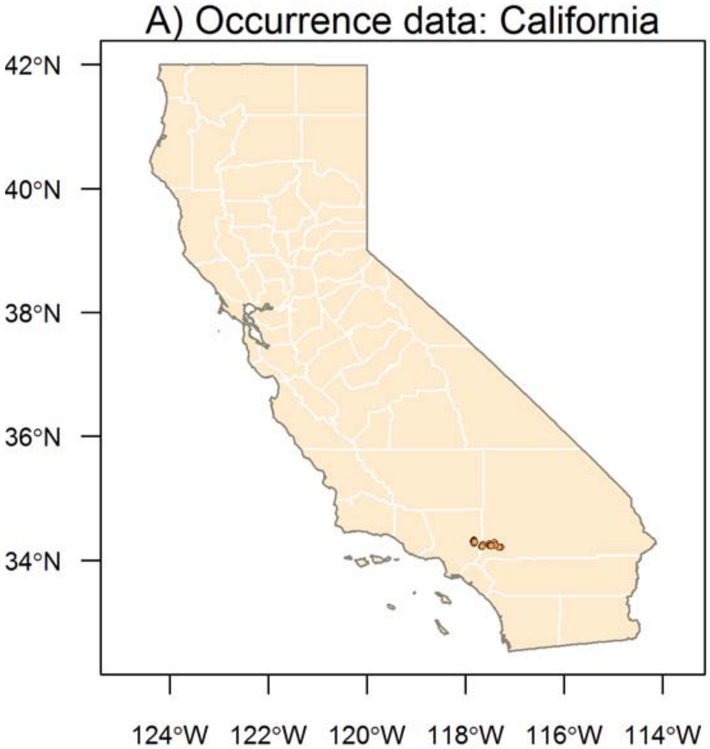


Figure 1. Occurrence data used to build Maxent models.

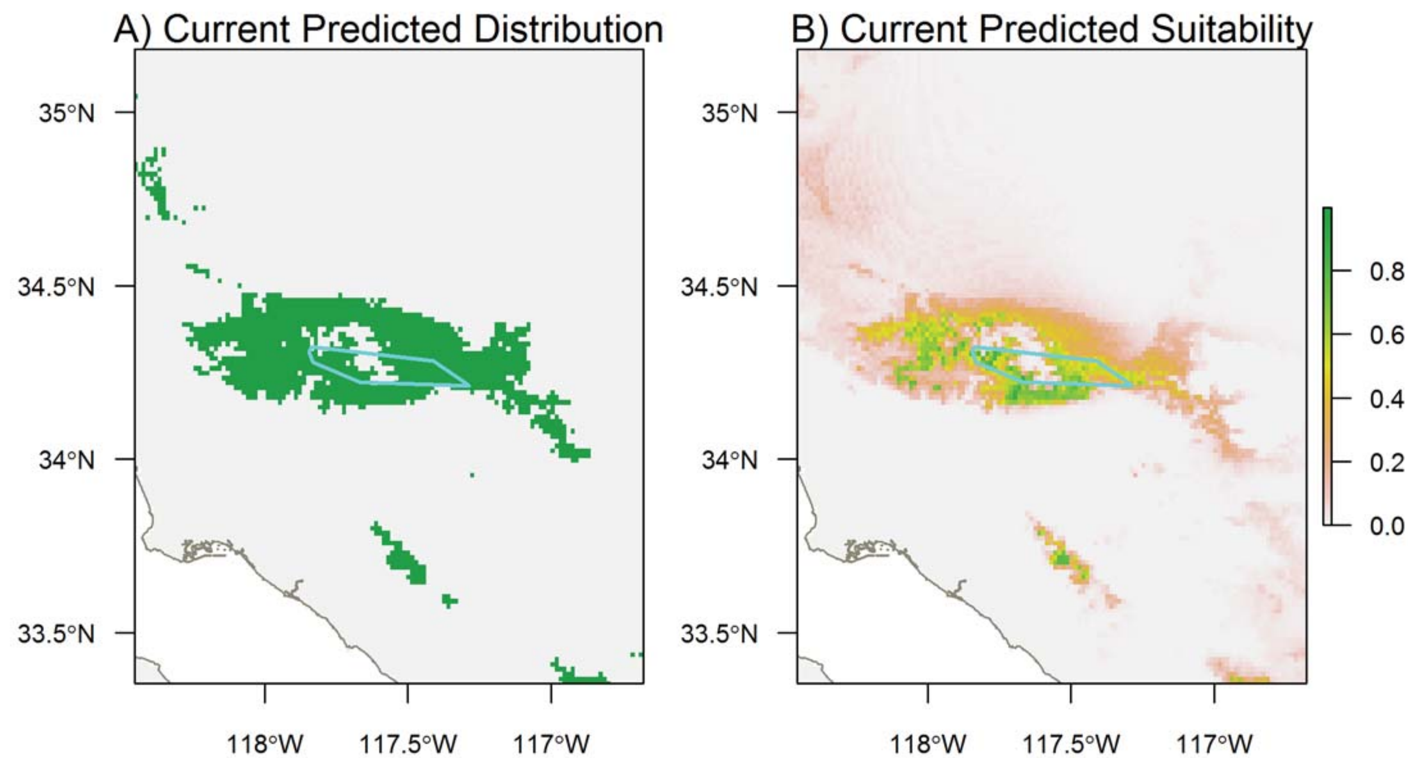


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Batrachoseps gabrieli* San Gabriel Mountains Slender Salamander

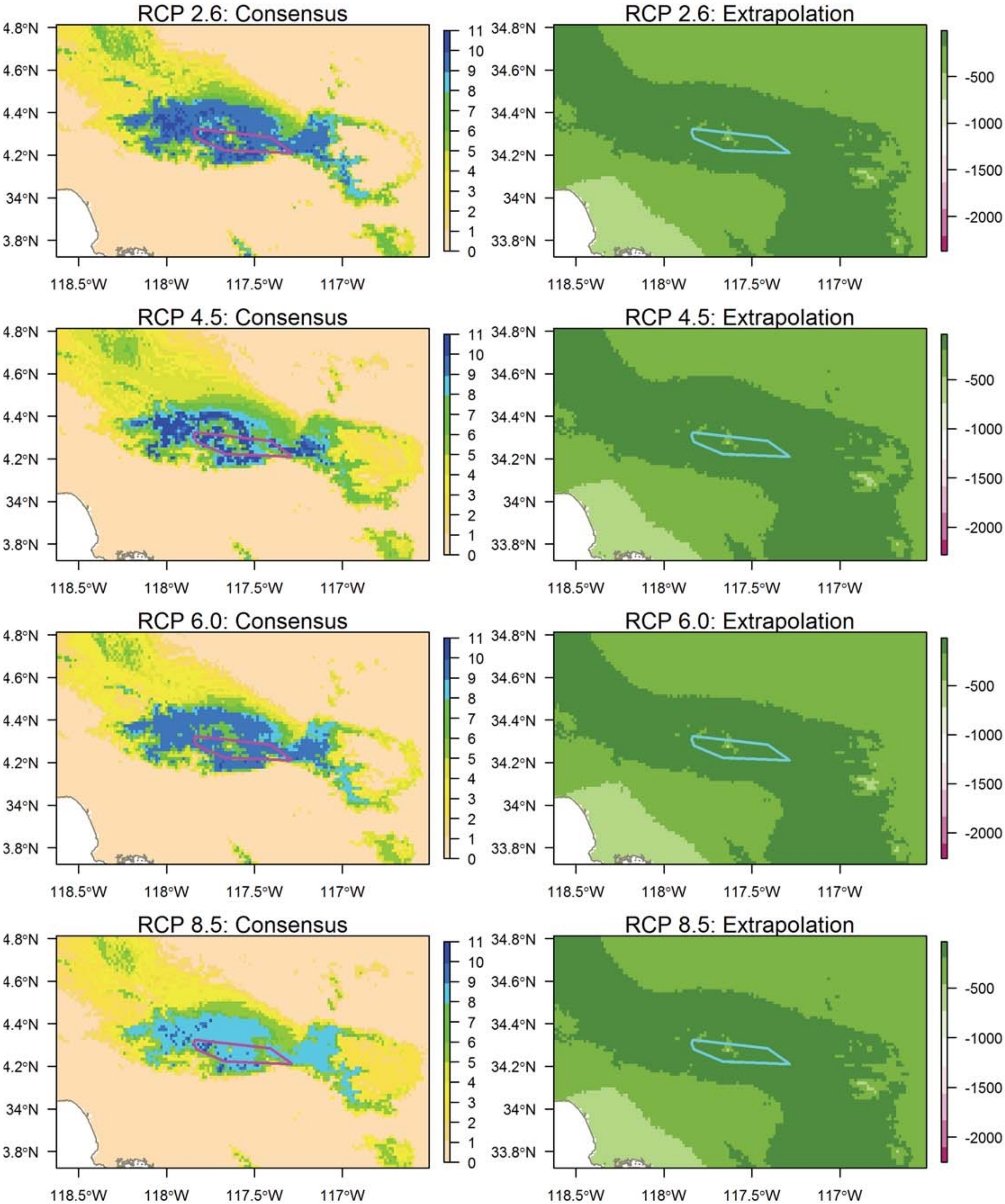
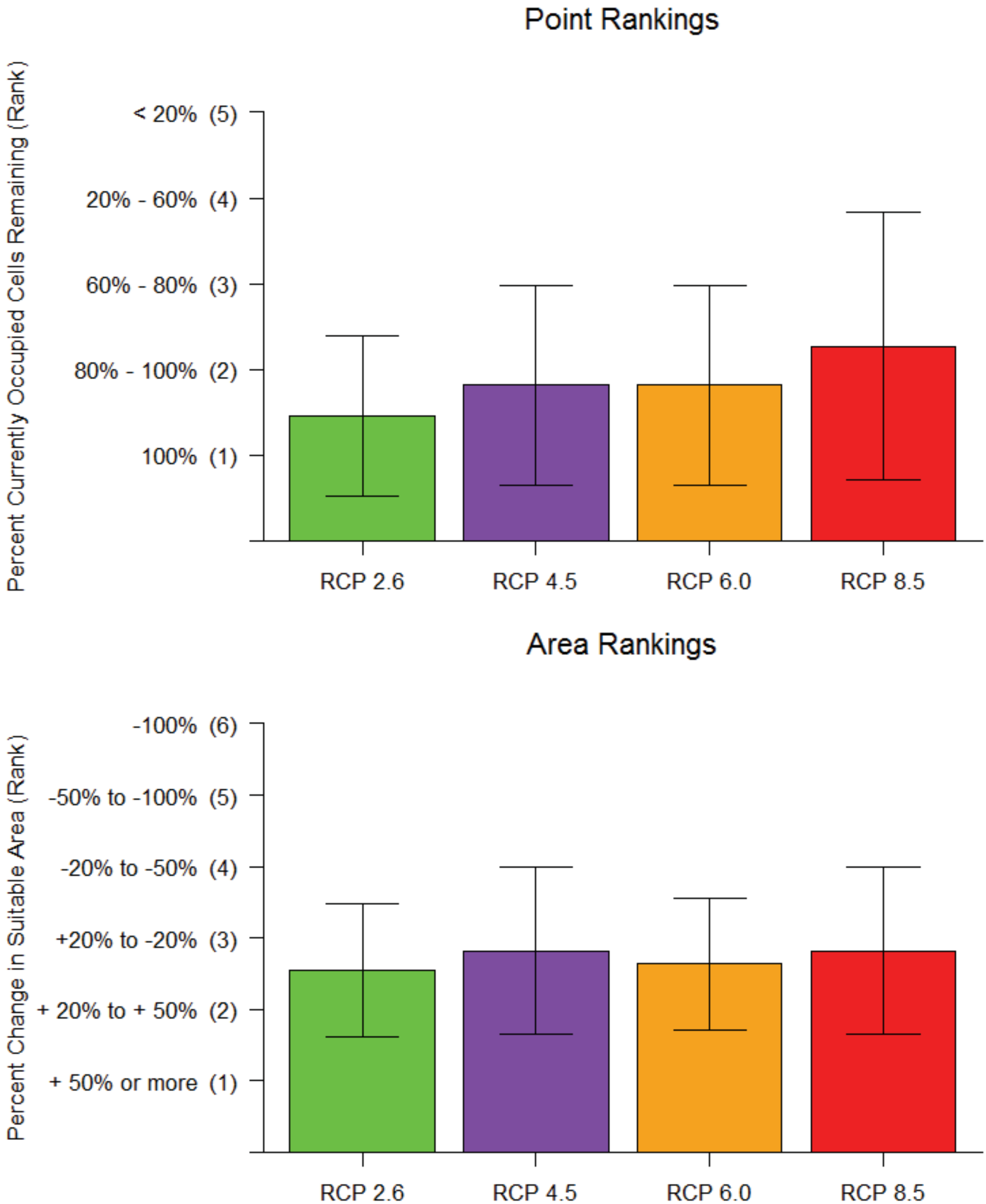


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Batrachoseps gabrieli* San Gabriel Mountains Slender Salamander



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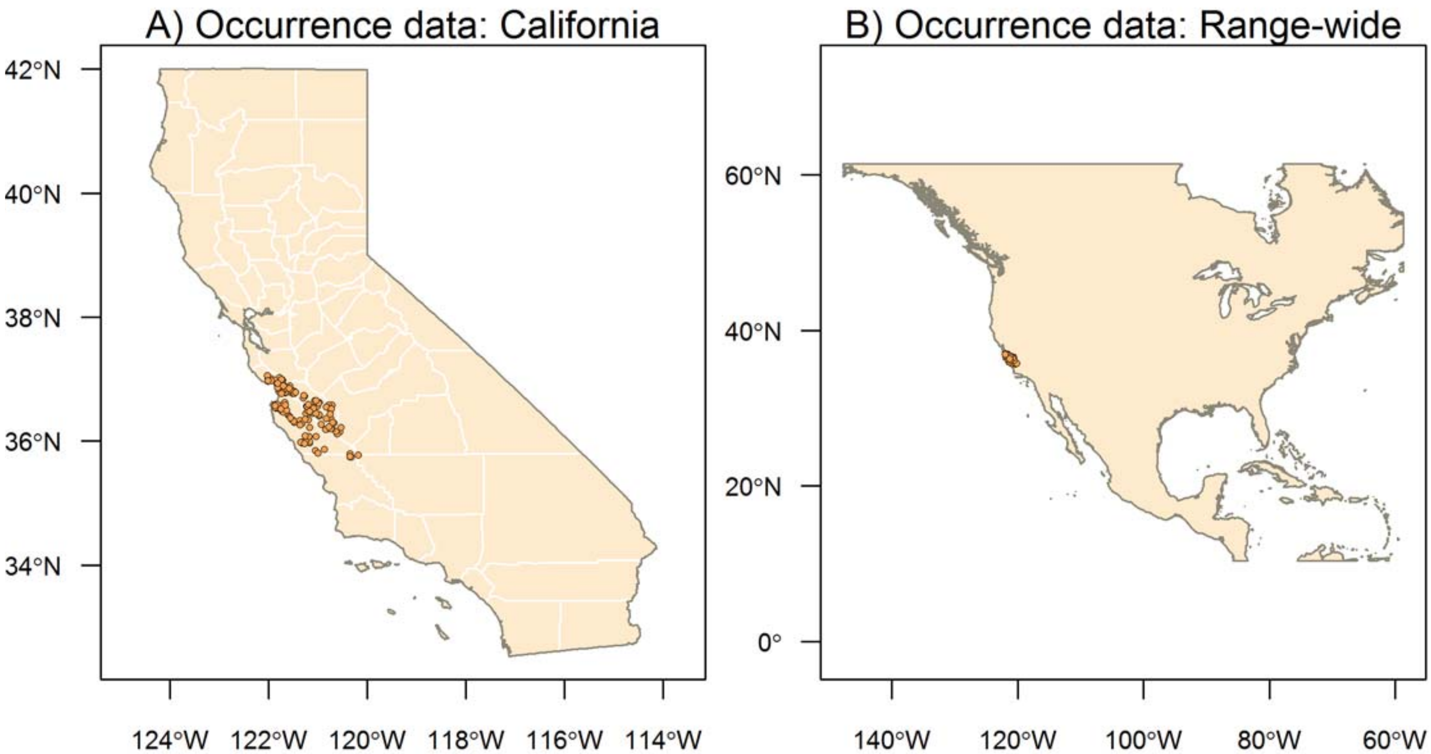
Species Results: *Batrachoseps gavilanensis* GabilanMountains Slender Salamander



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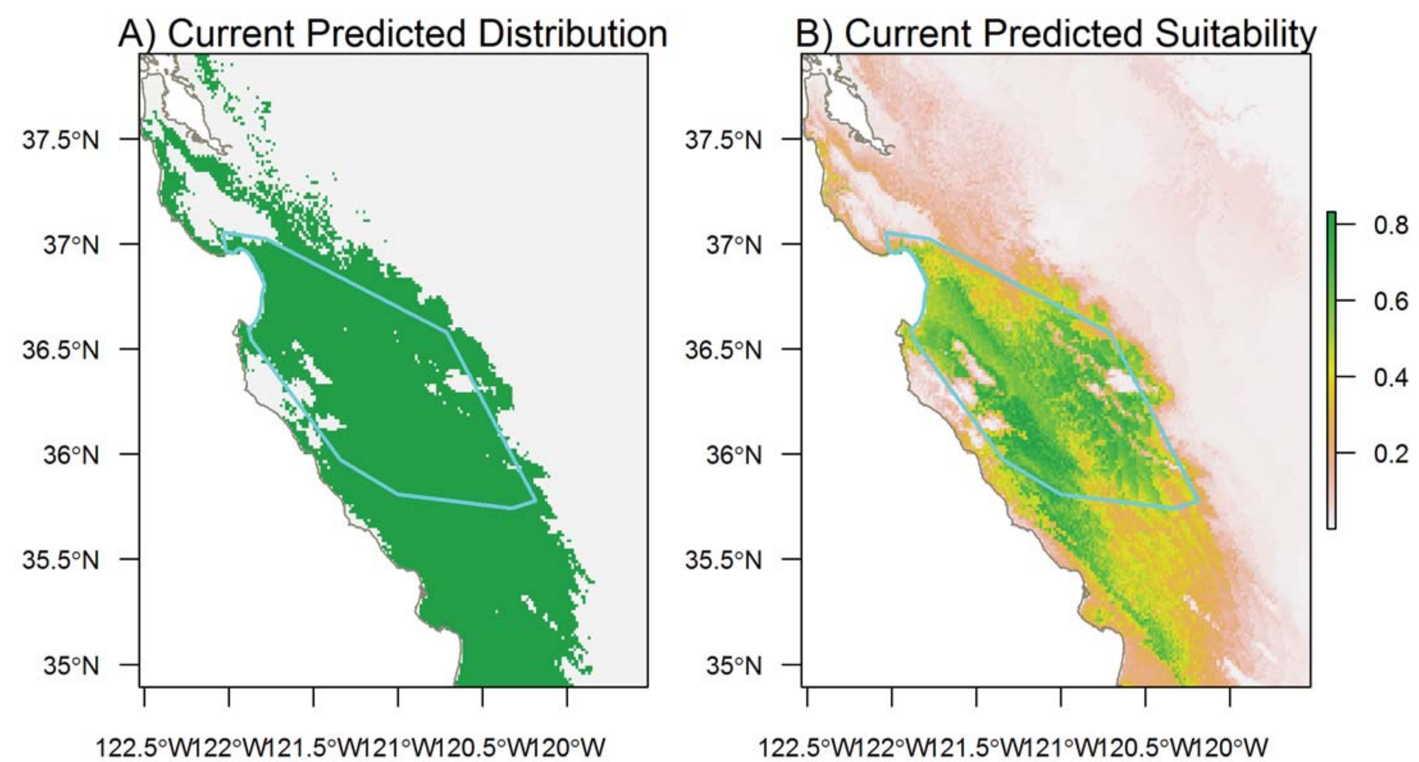

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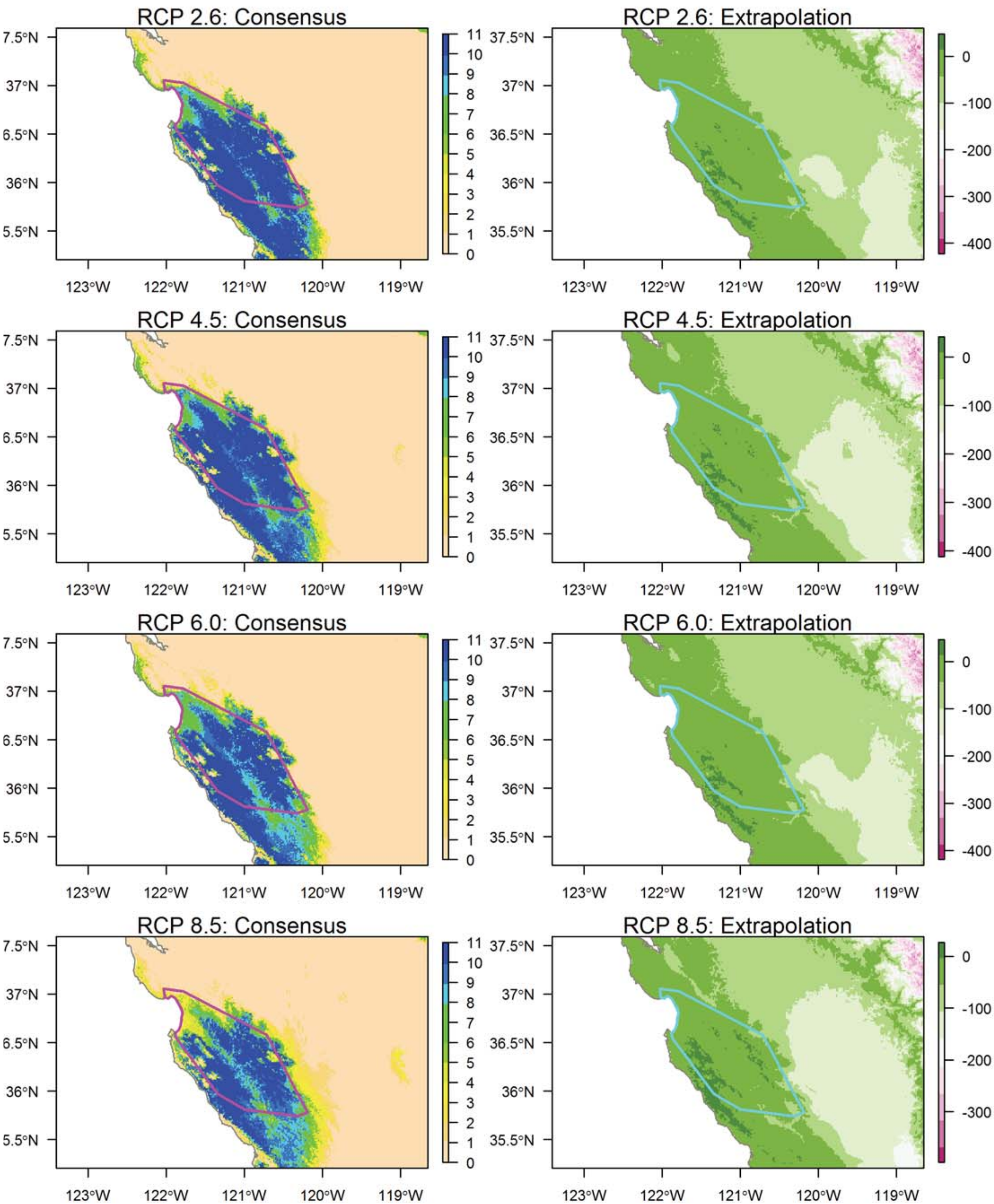
Species Results: *Batrachoseps gavilanensis* Gabilan Mountains Slender Salamander



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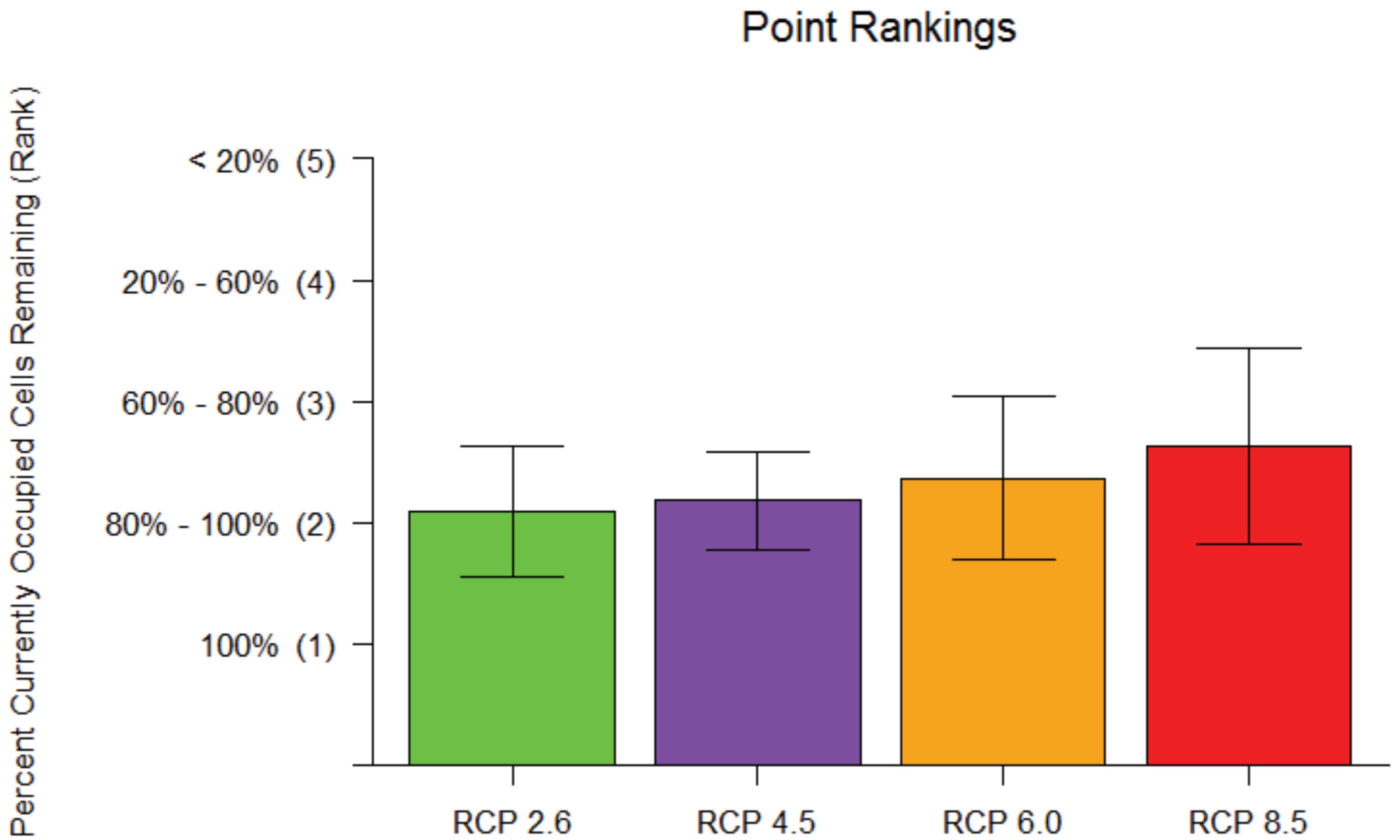
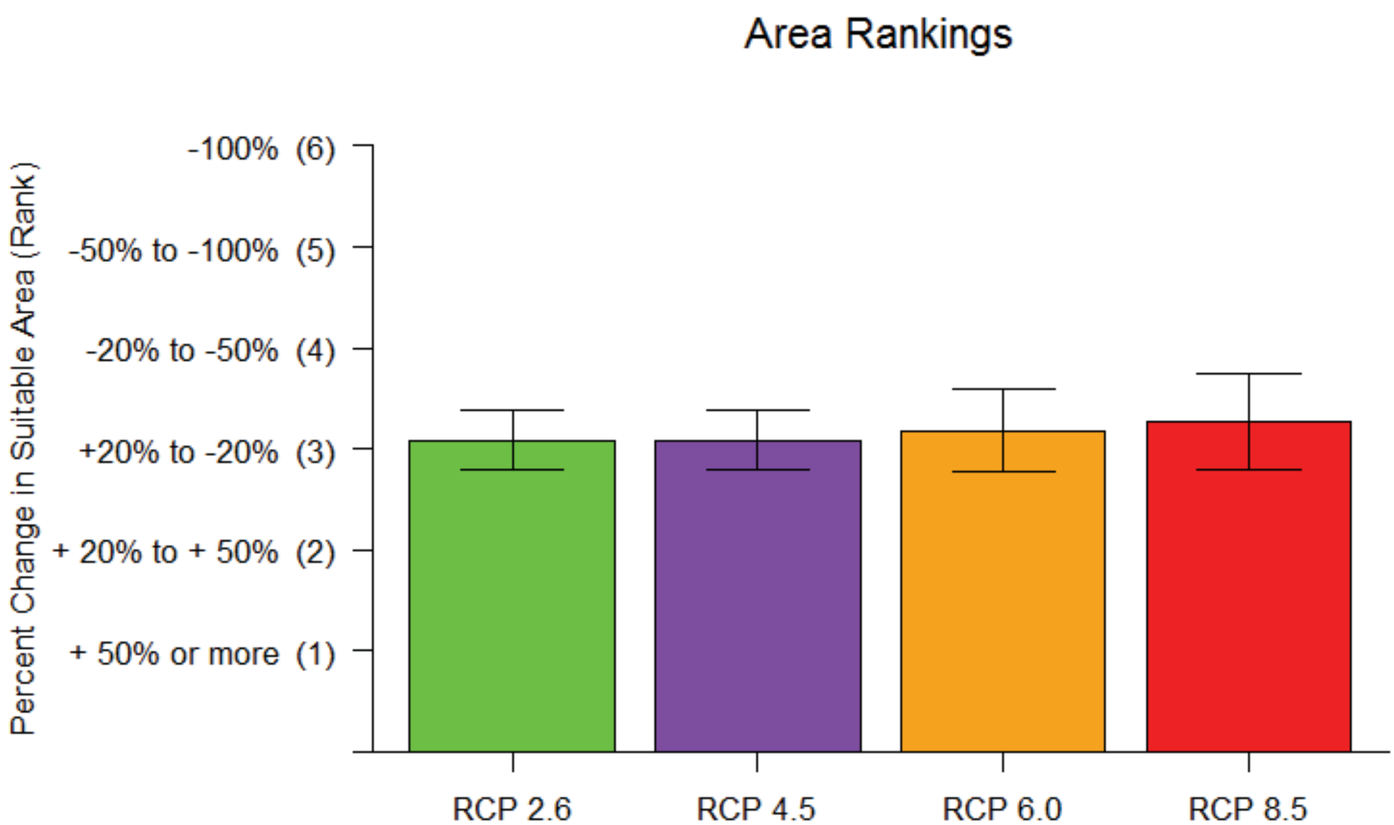
Species Results: *Batrachoseps gavilanensis* Gabilan Mountains Slender Salamander





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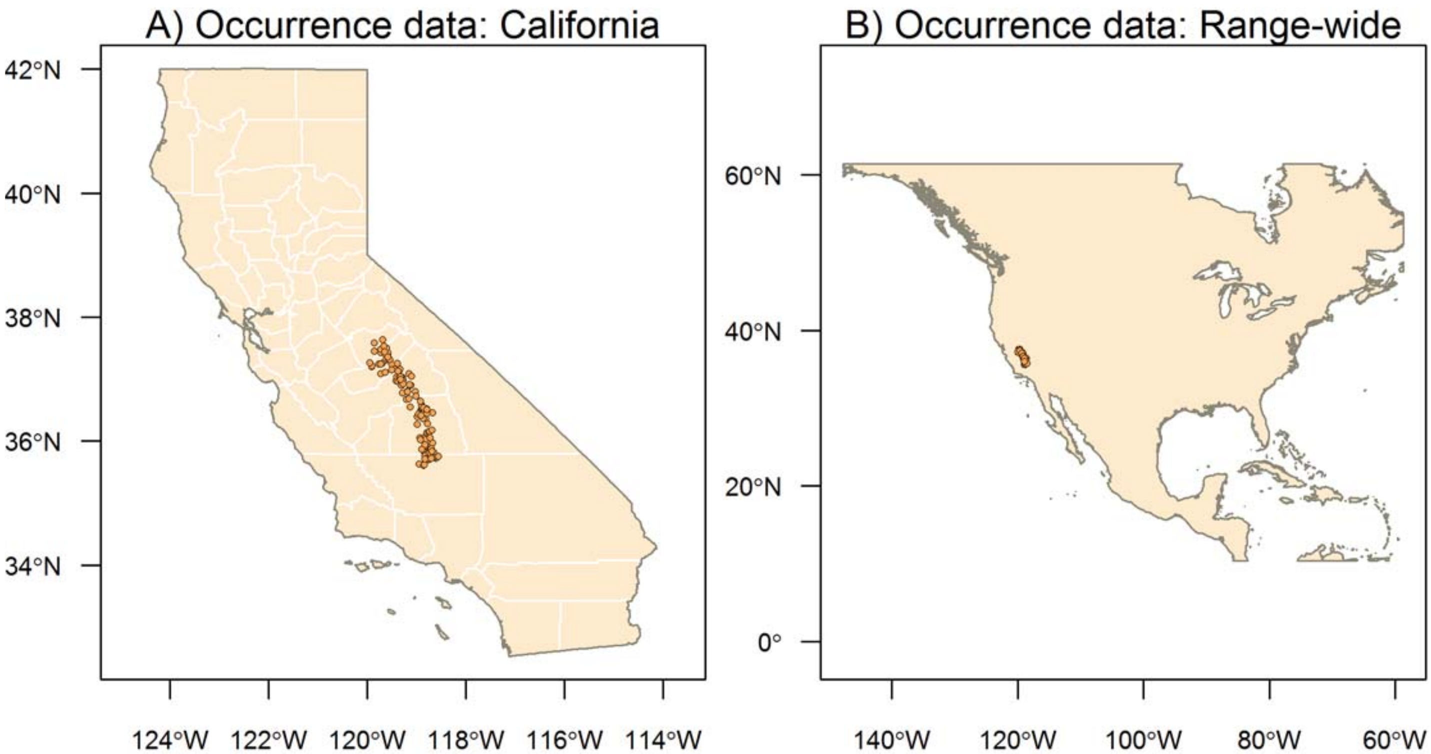
Species Results: *Batrachoseps gregarius* Gregarious Slender Salamander



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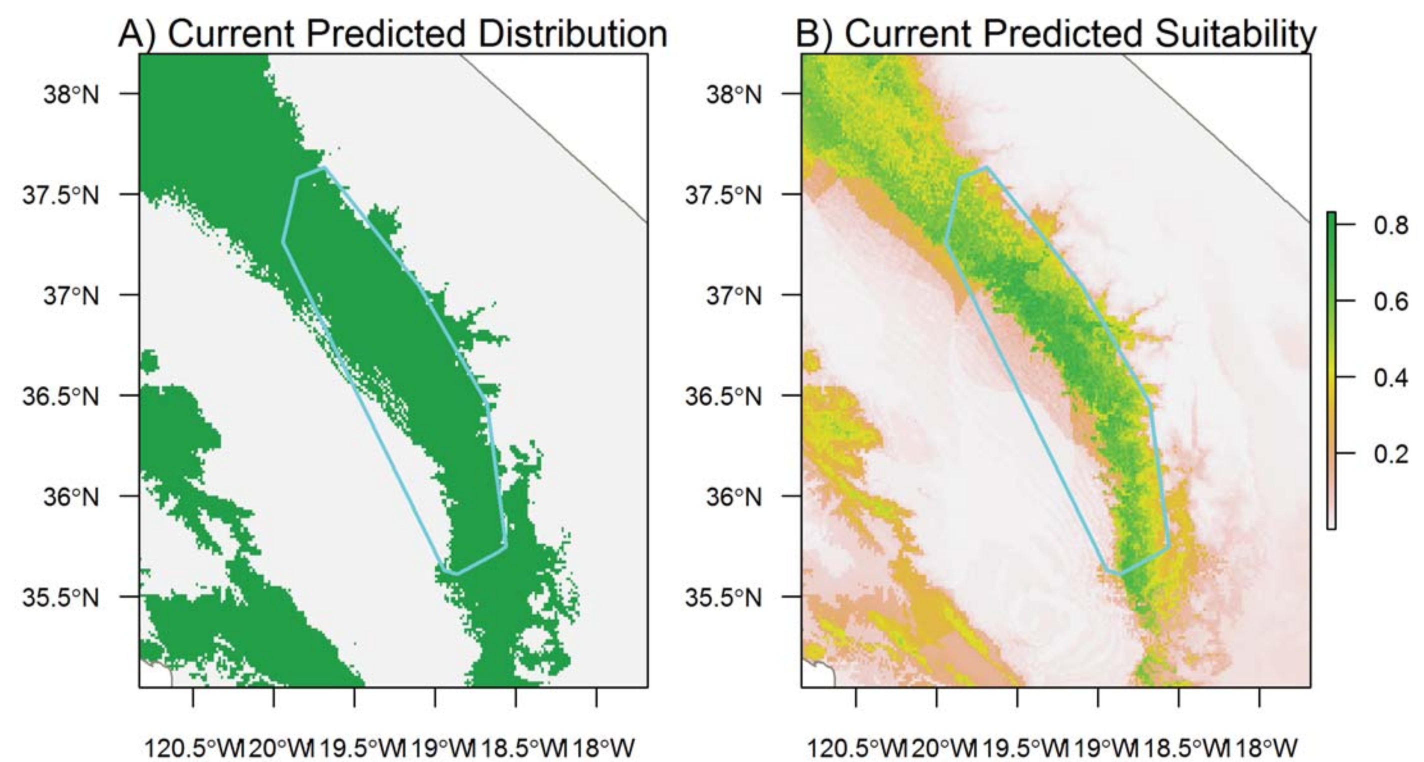

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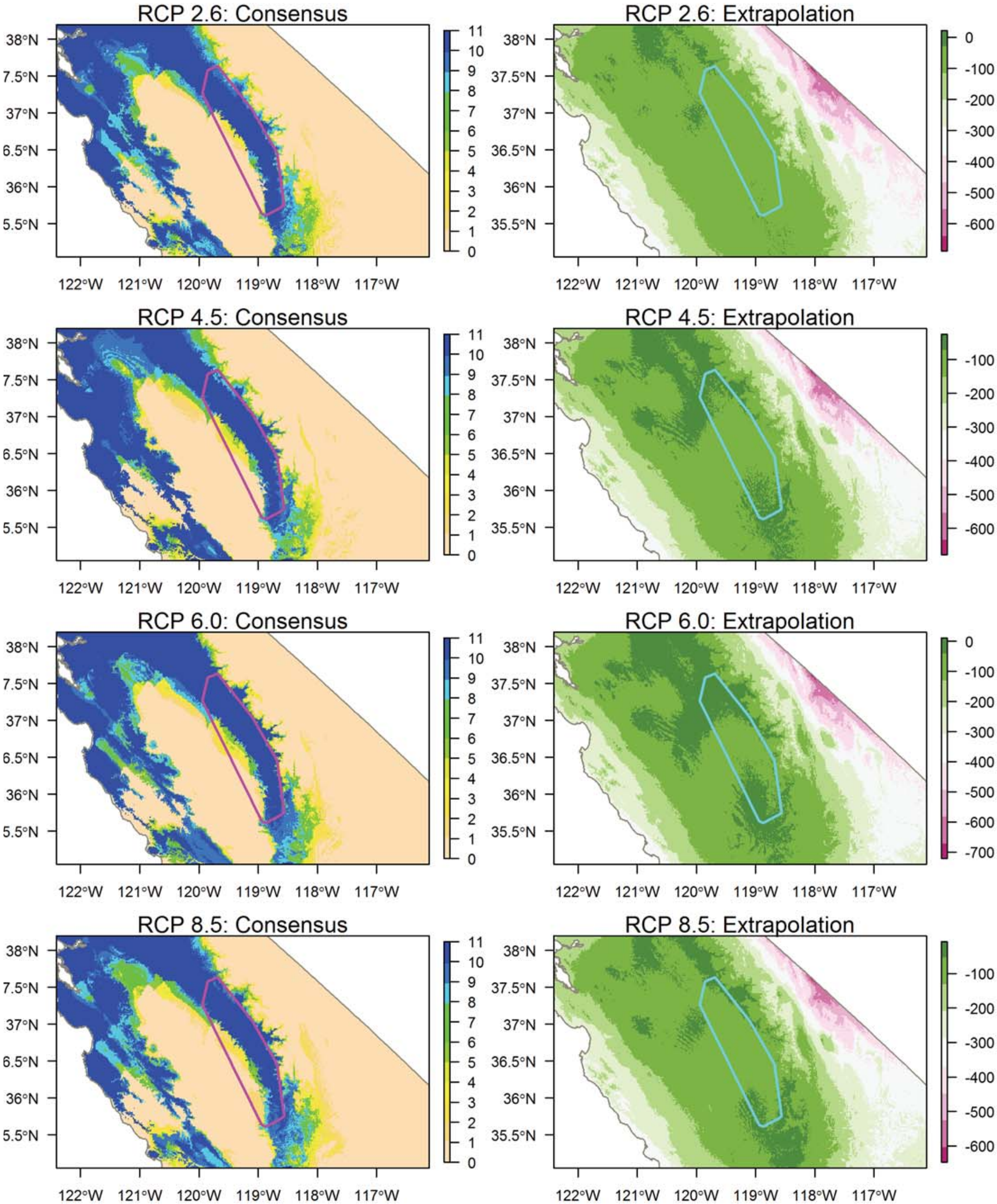
Species Results: *Batrachoseps gregarius* Gregarious Slender Salamander



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Species Results: *Batrachoseps gregarius* Gregarious Slender Salamander

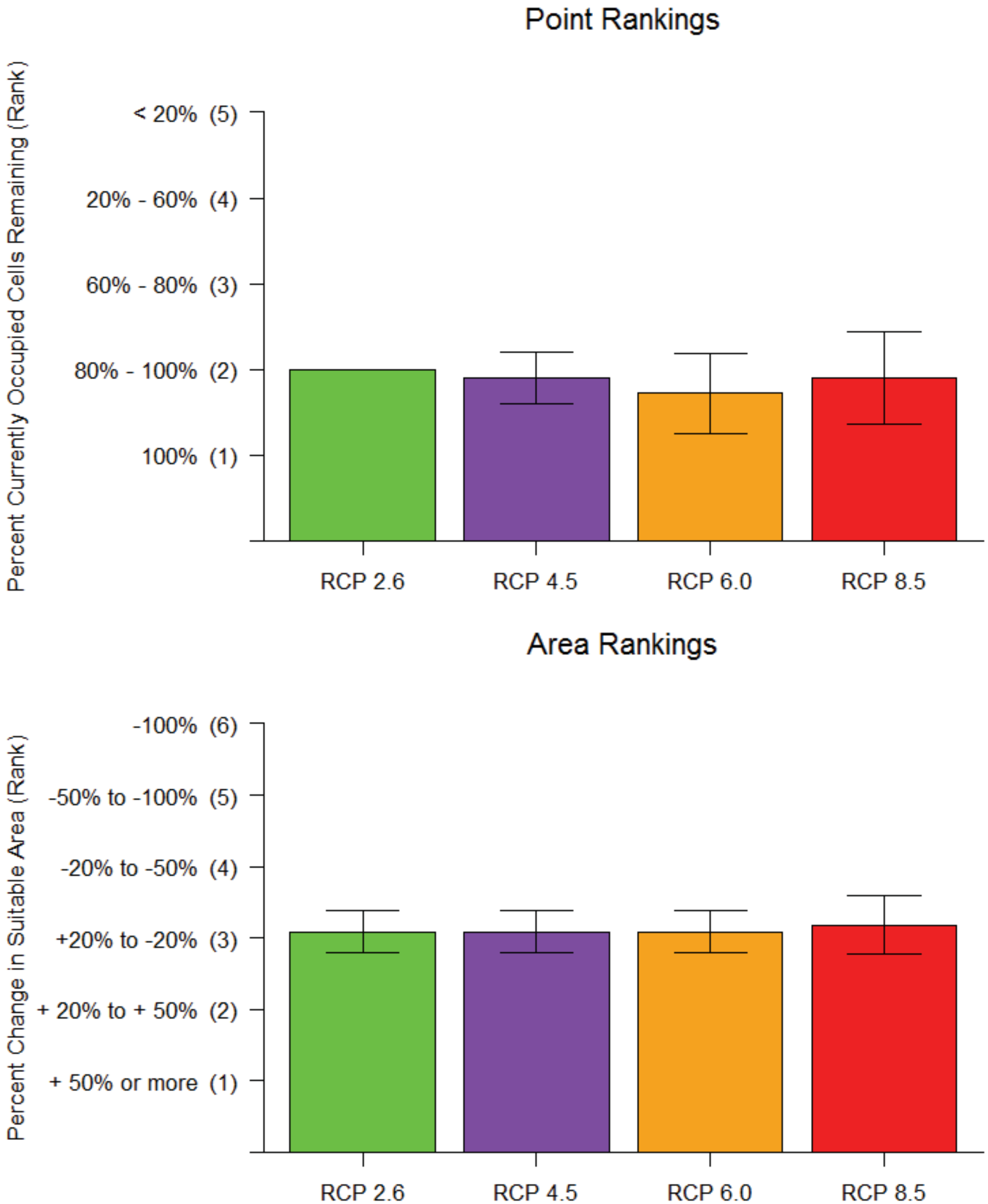


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps incognitus* San Simeon Slender Salamander

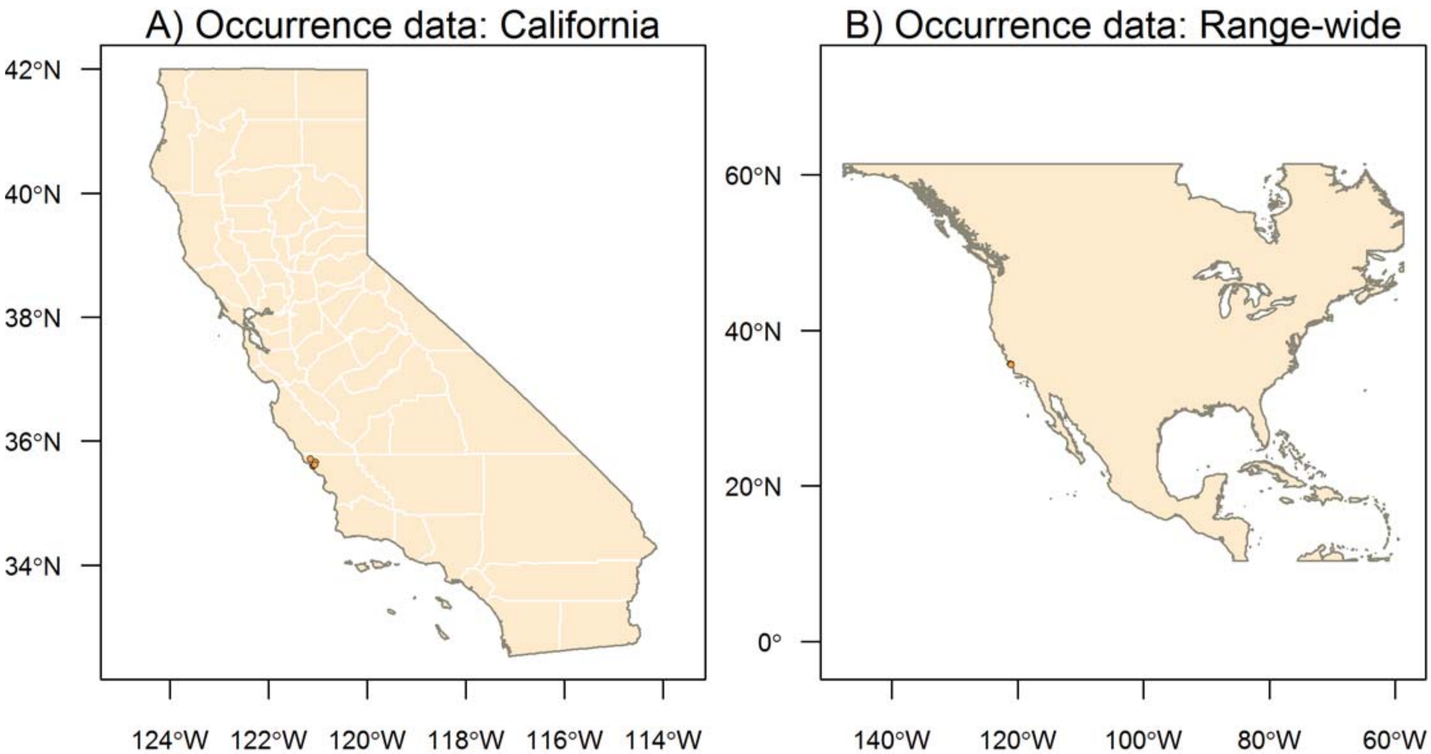
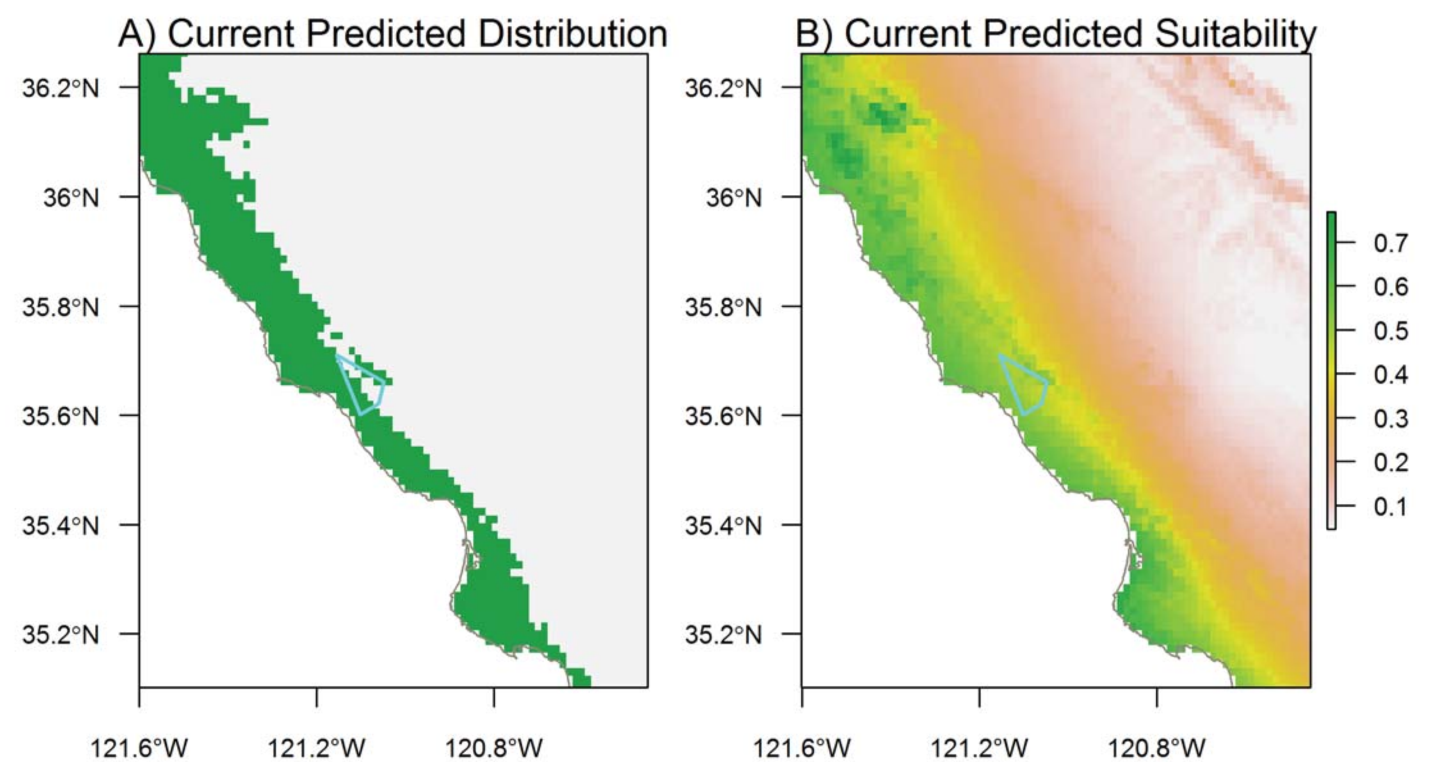


Figure 1. Occurrence data used to build Maxent models.



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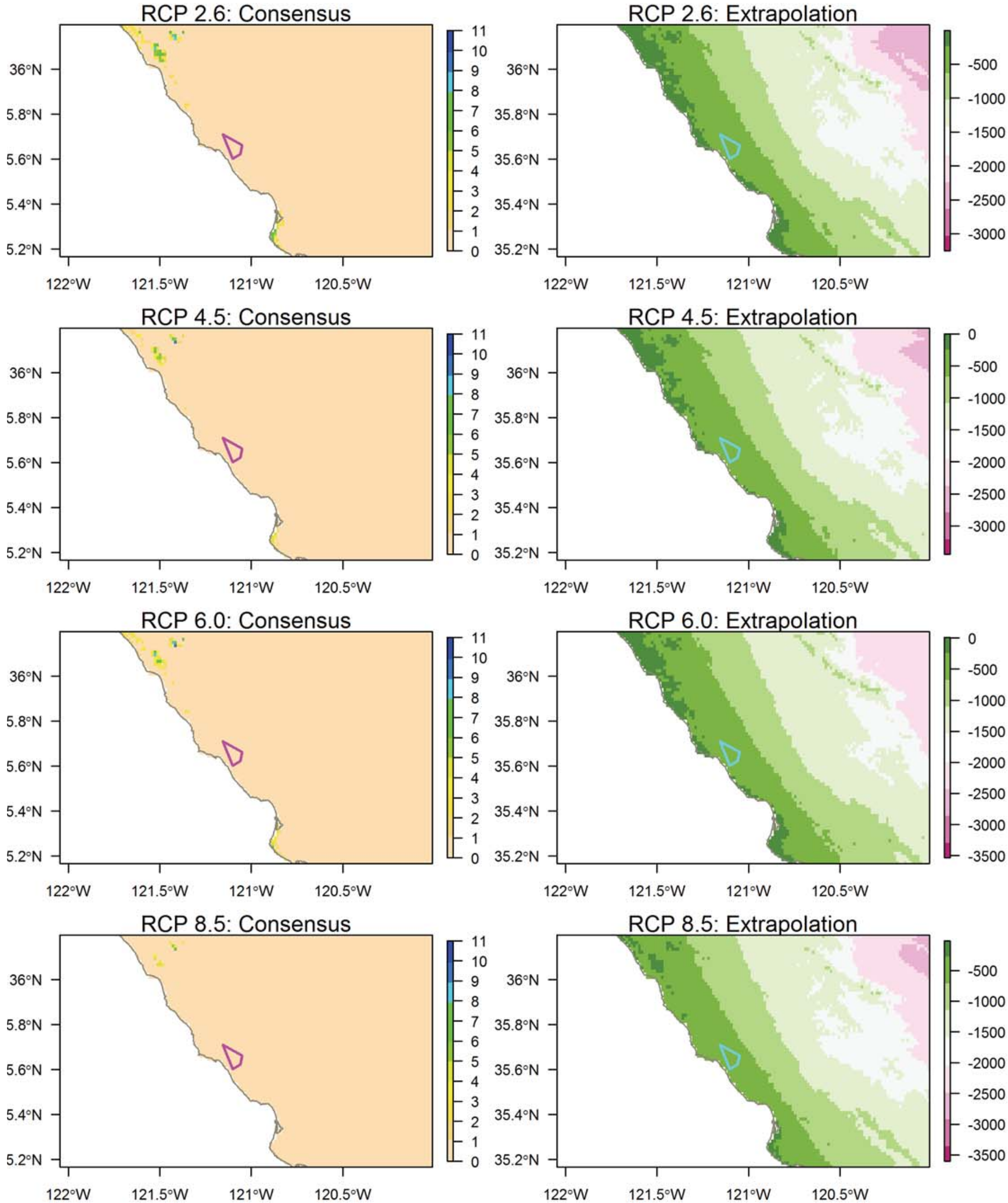
Species Results: *Batrachoseps incognitus* San Simeon Slender Salamander



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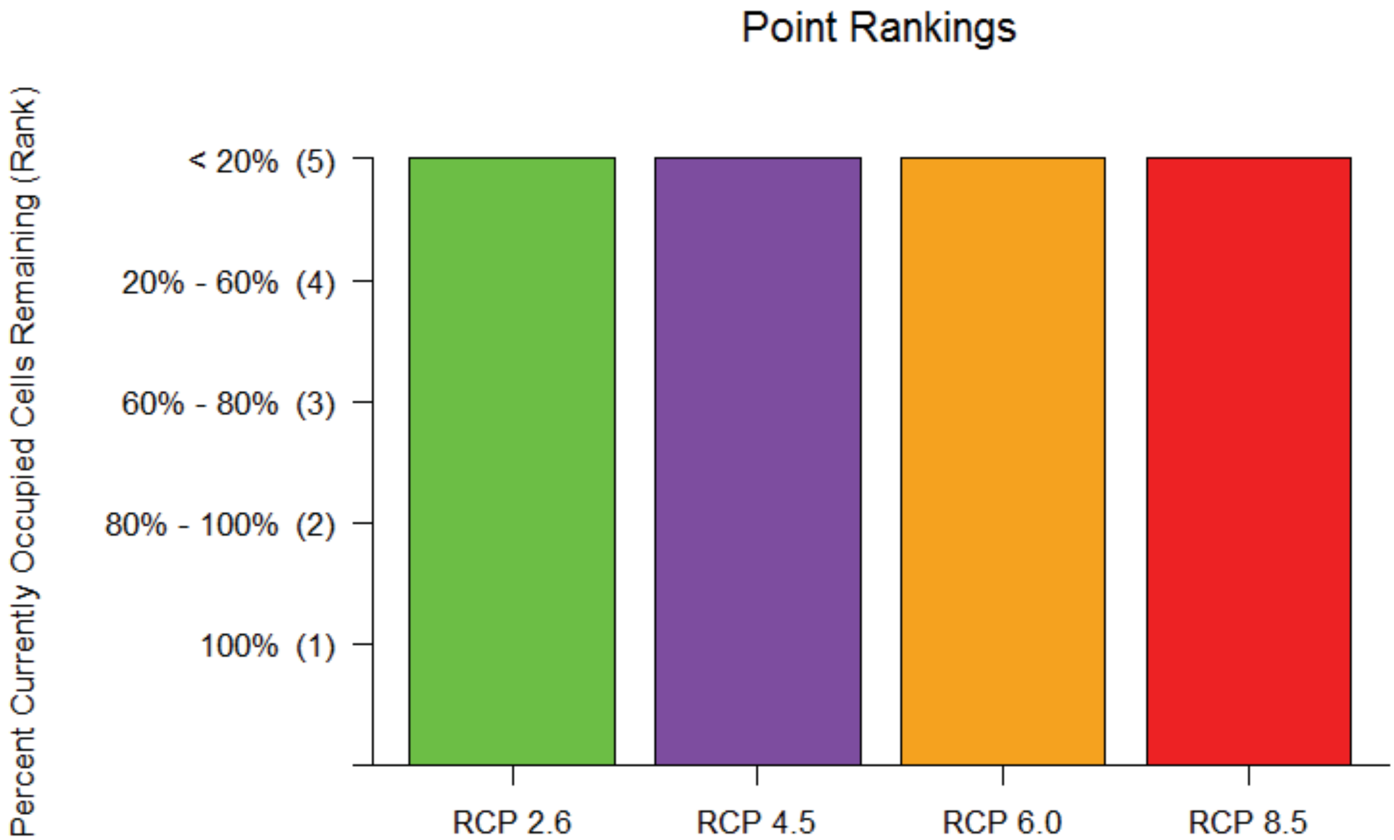
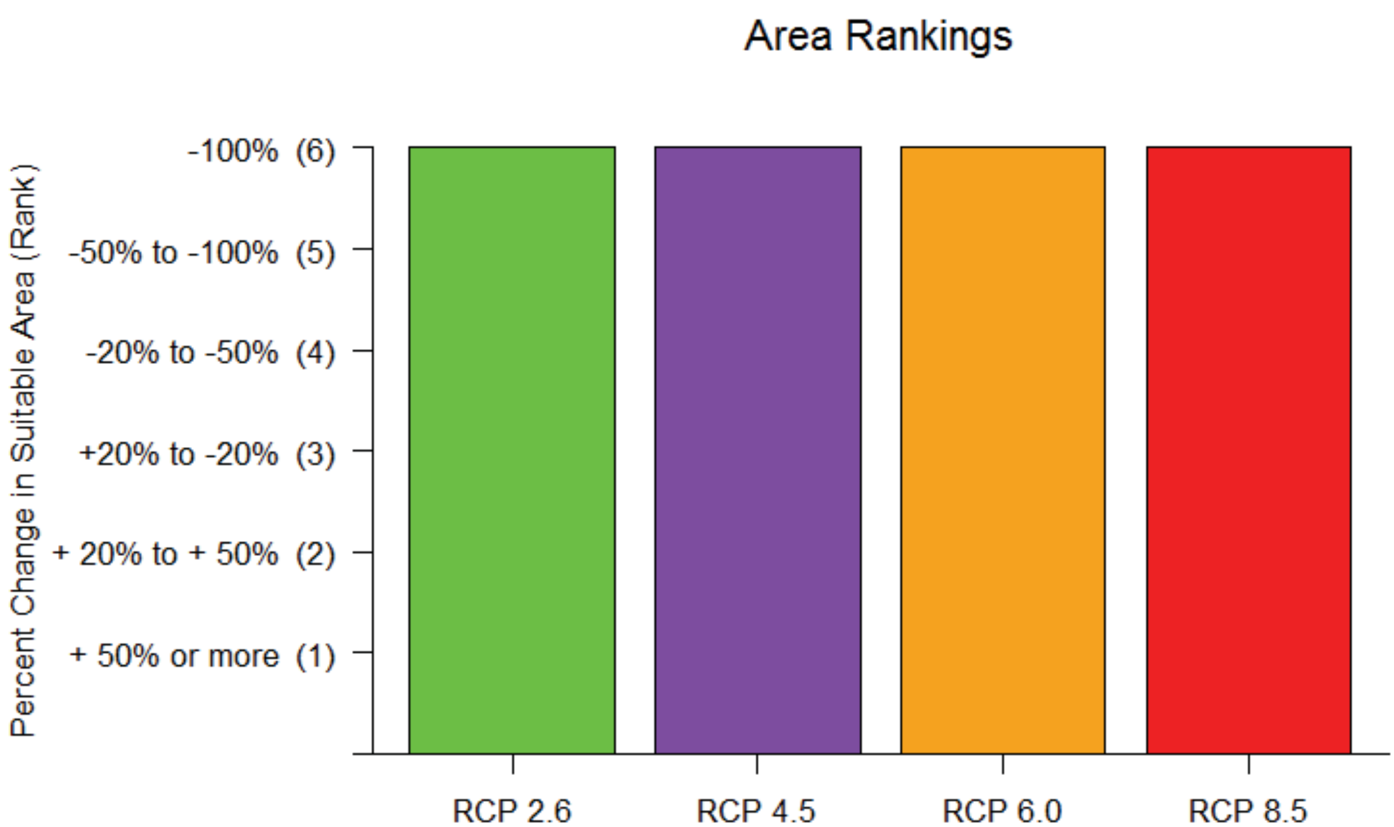
Species Results: *Batrachoseps incognitus* San Simeon Slender Salamander





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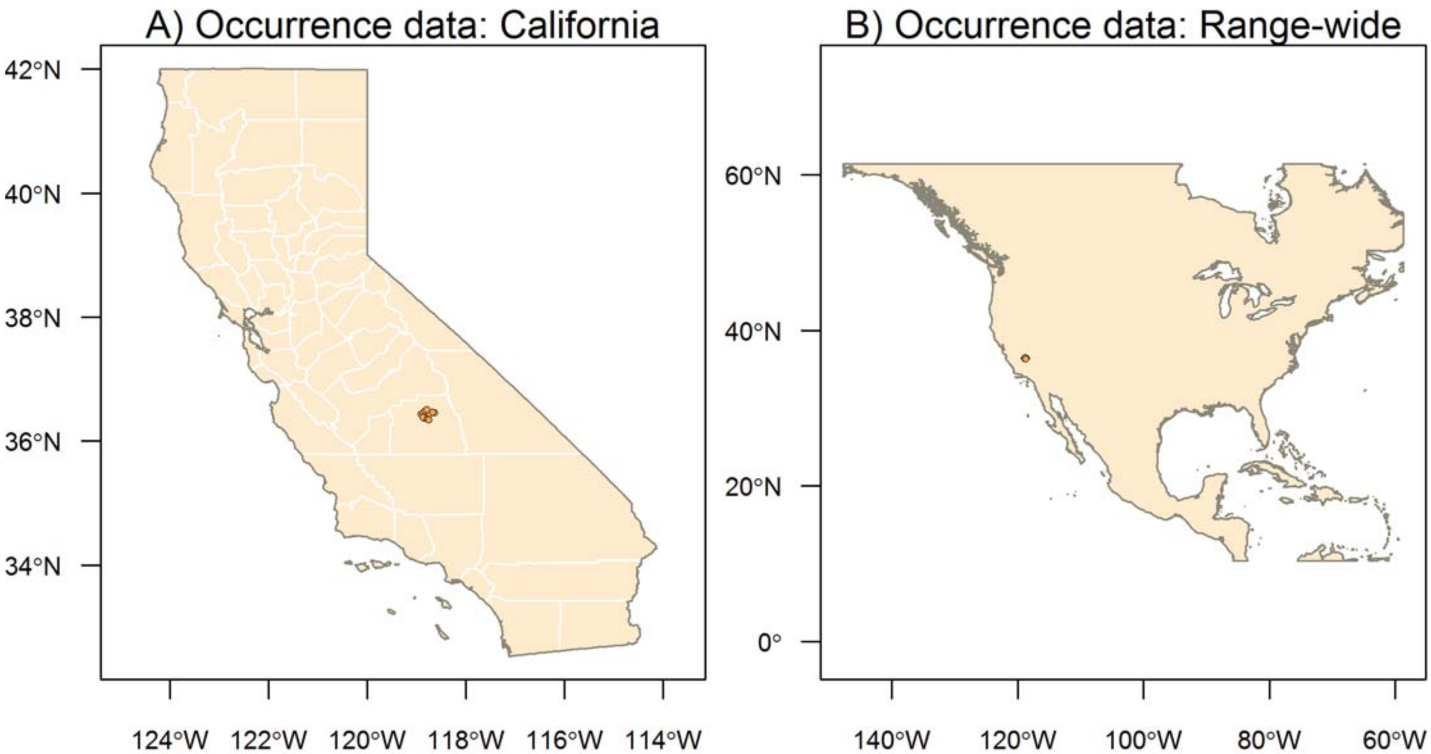
Species Results: *Batrachoseps kawia* Sequoia Slender Salamander



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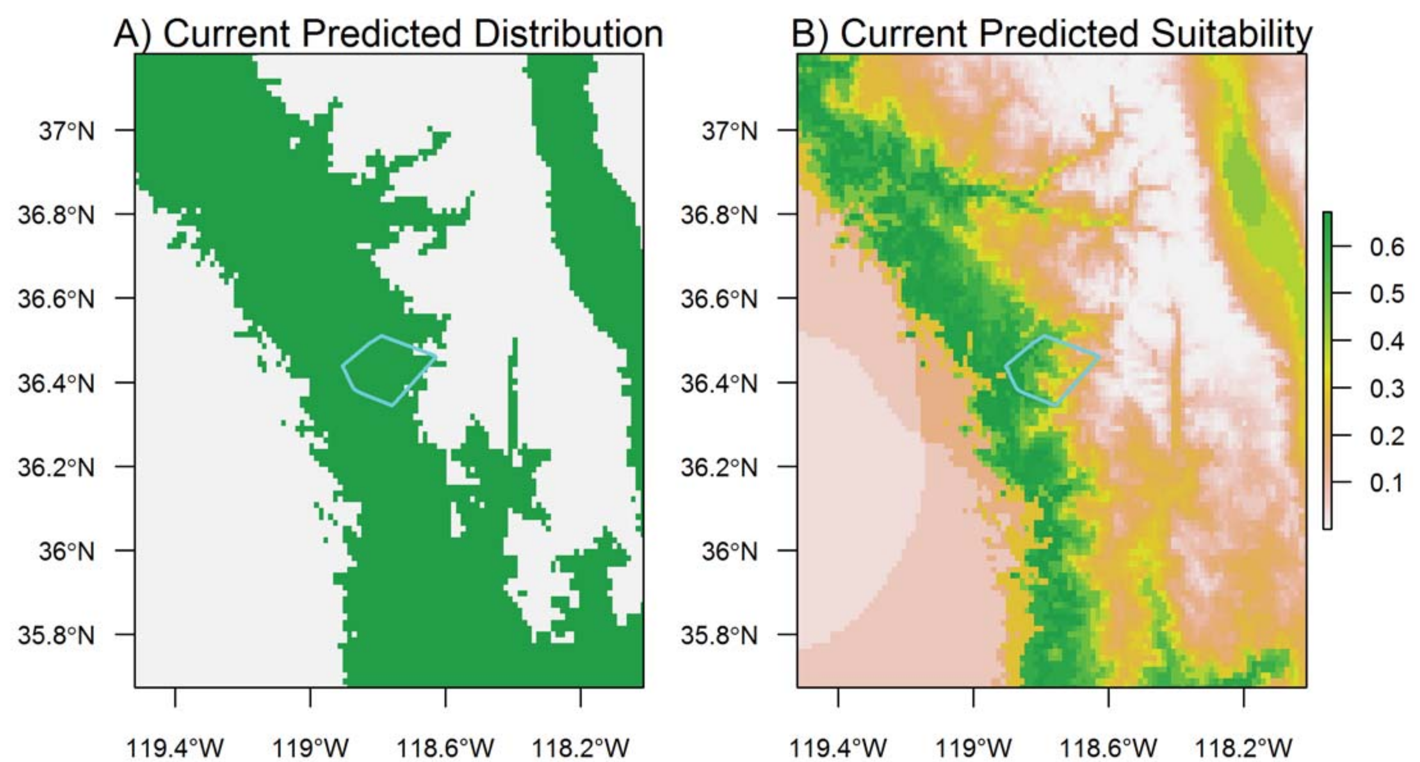

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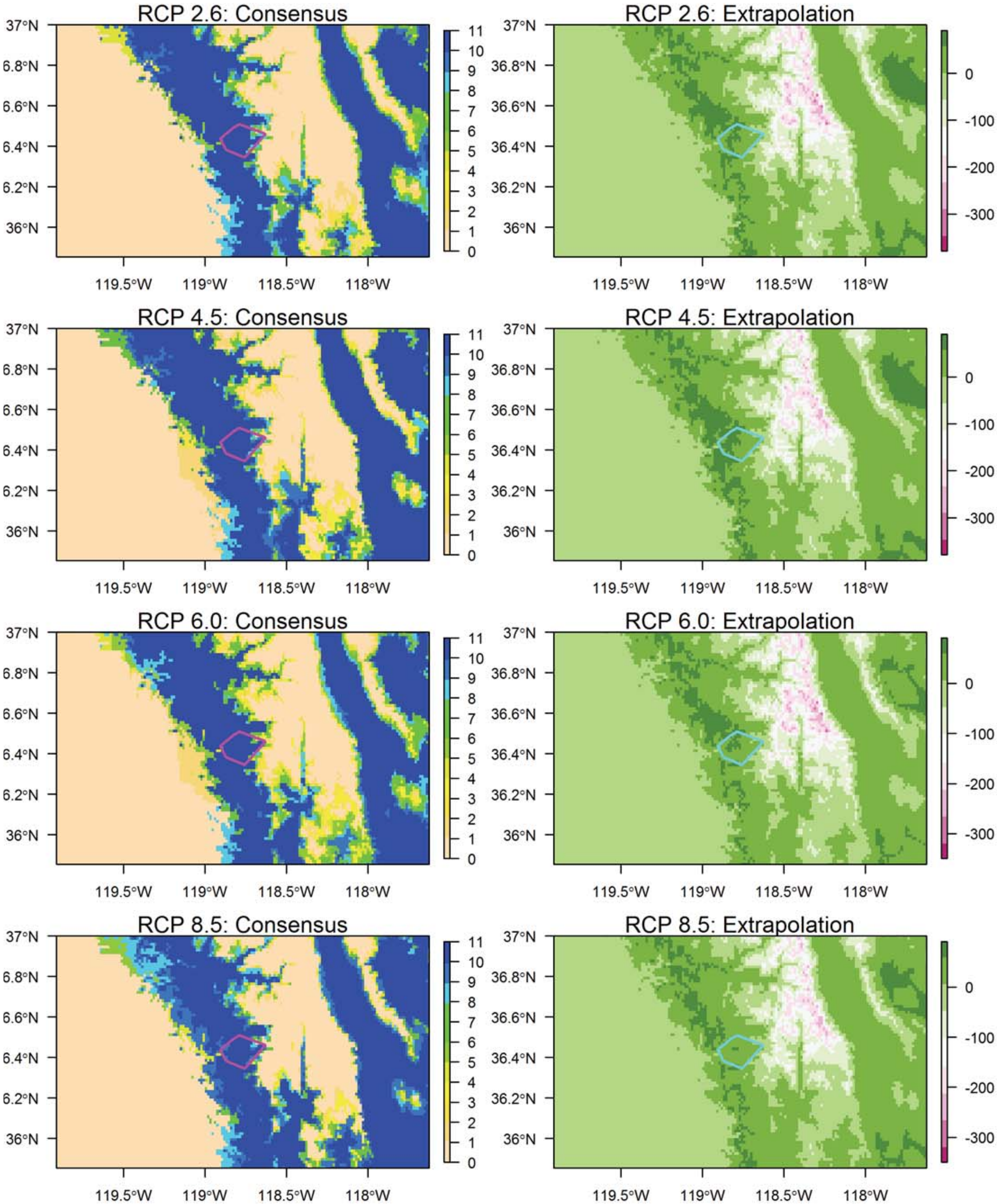
Species Results: *Batrachoseps kawia* Sequoia Slender Salamander



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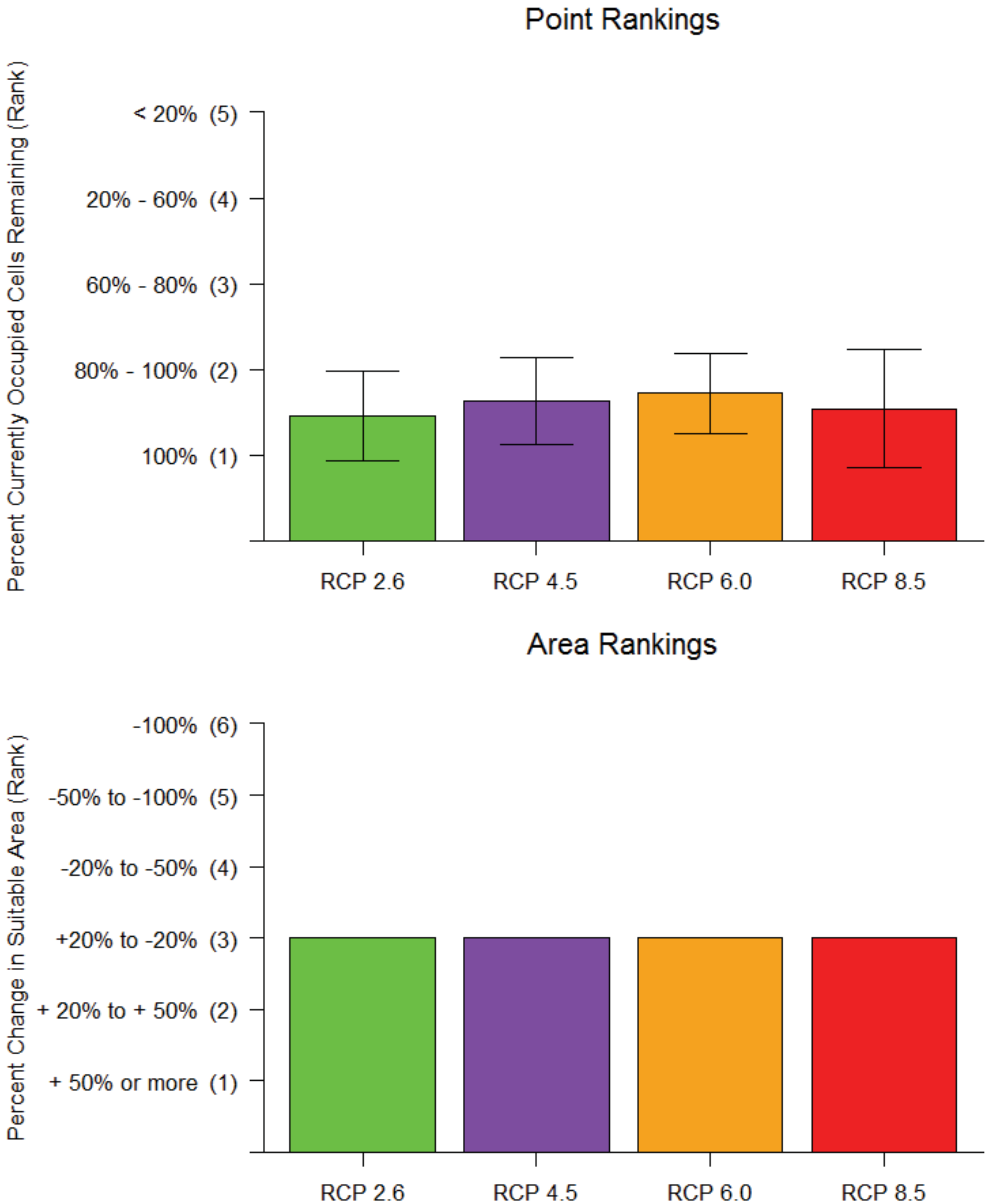

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Species Results: *Batrachoseps luciae* Santa Lucia Mountains Slender Salamander

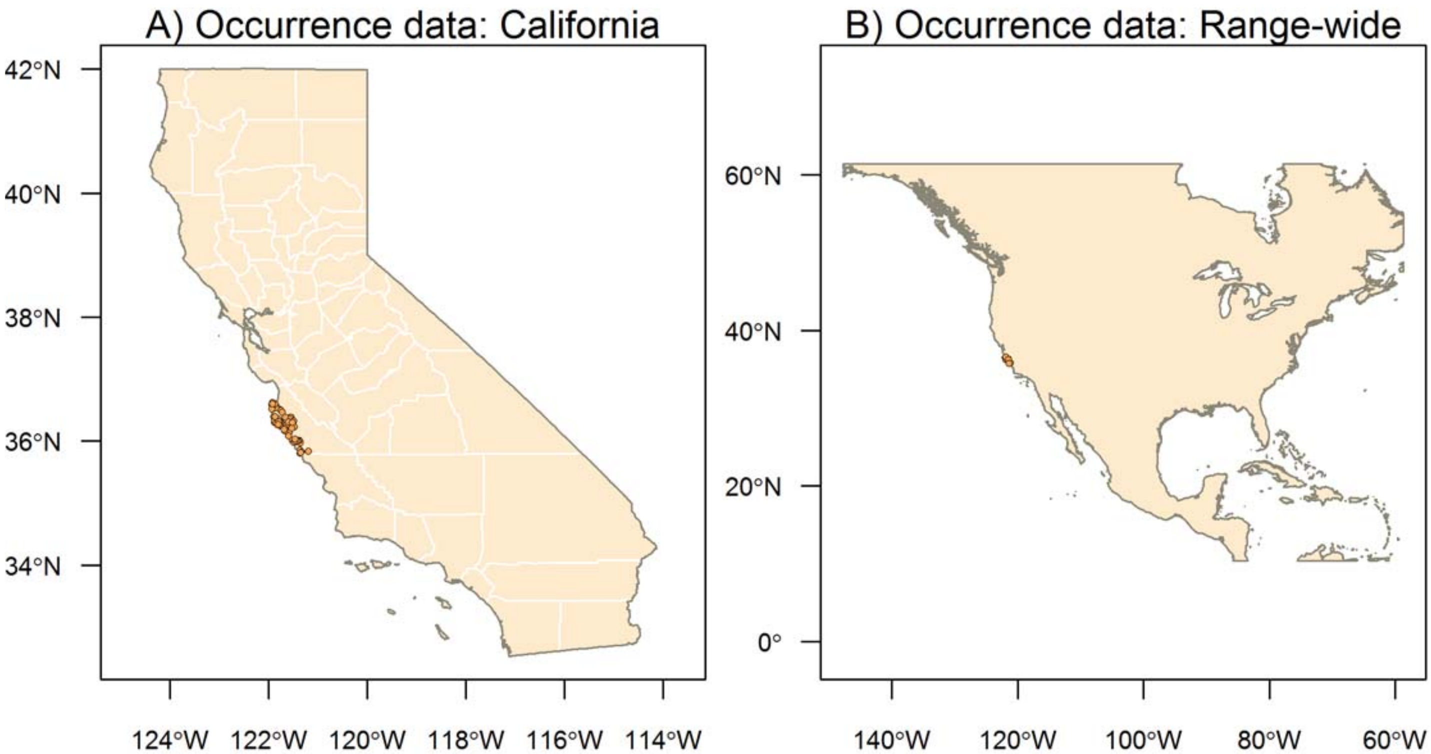
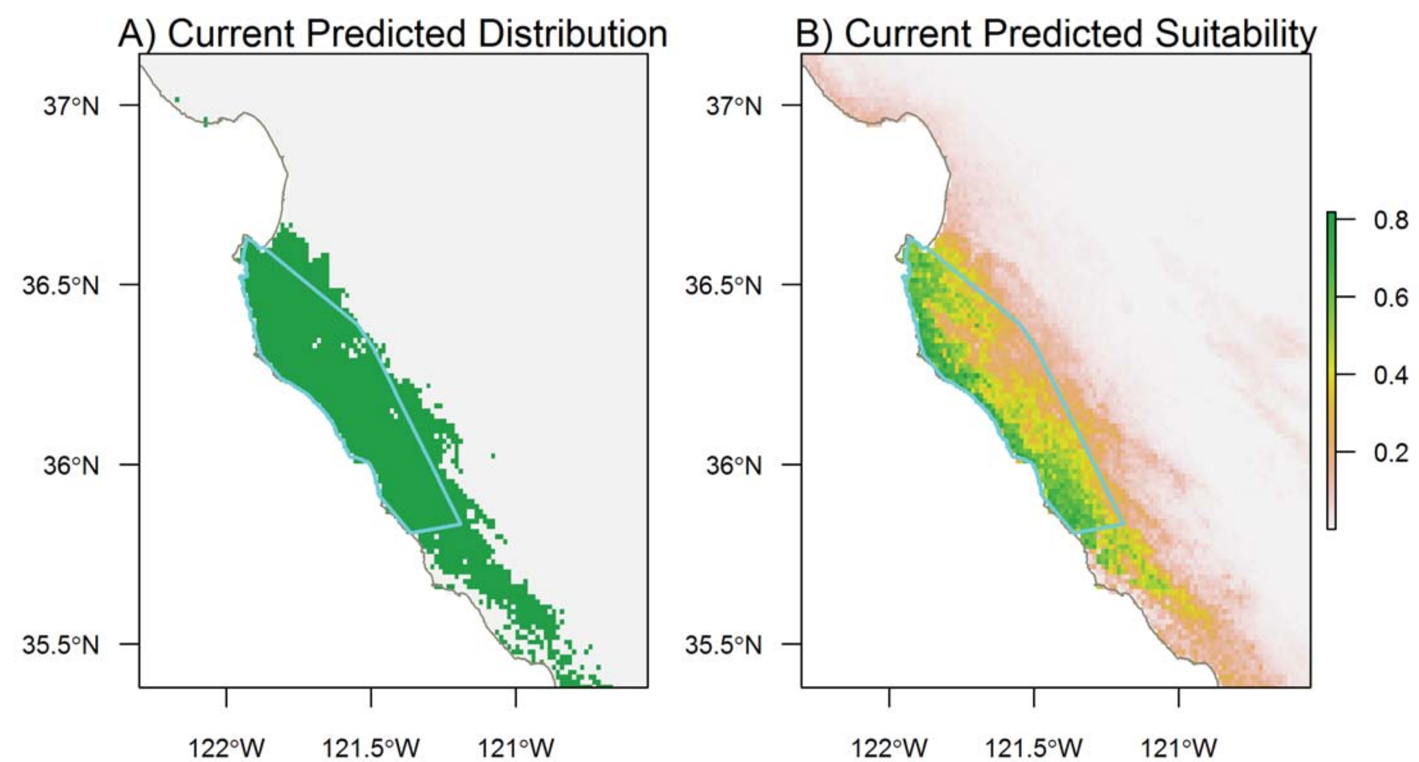


Figure 1. Occurrence data used to build Maxent models.



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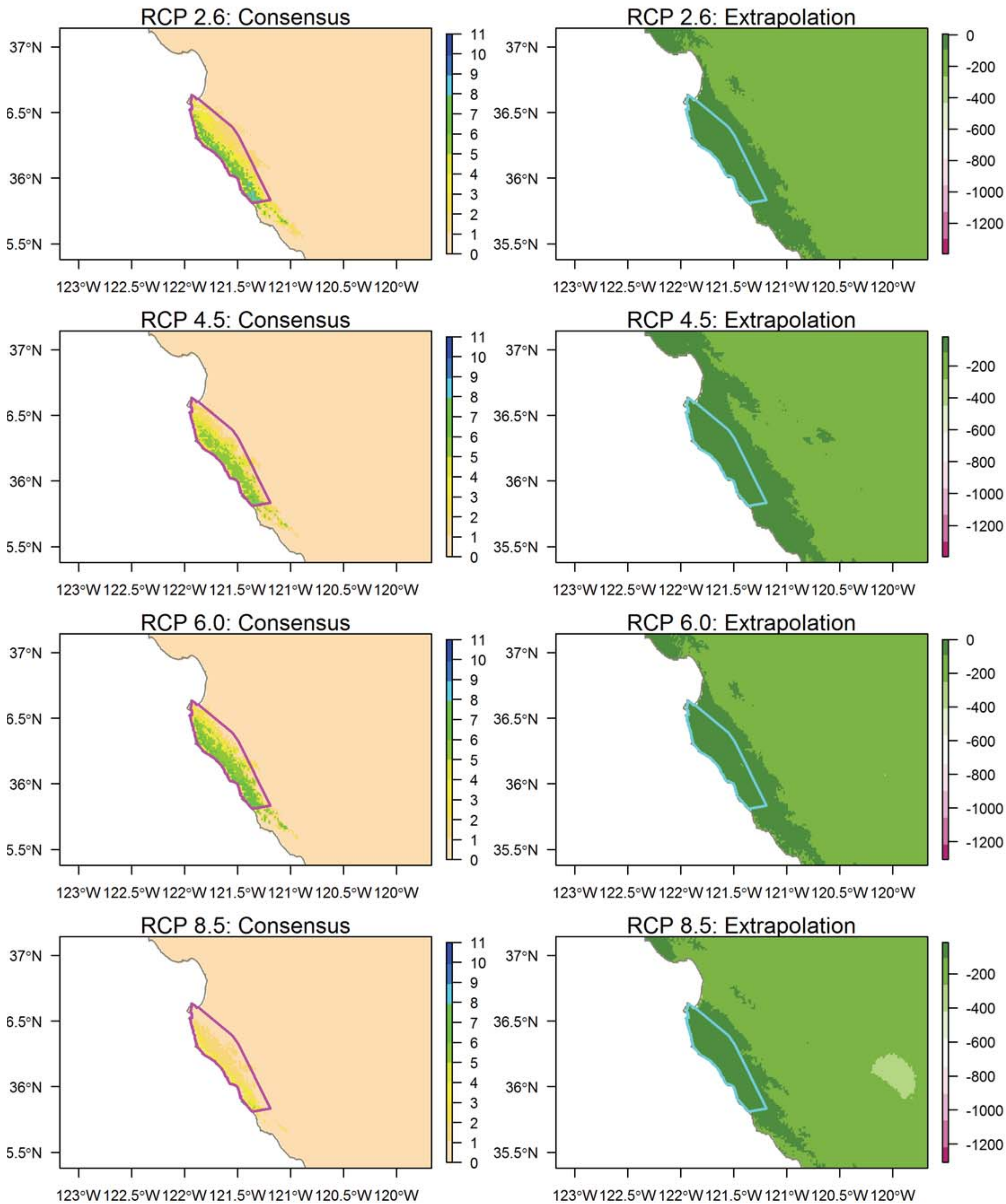
Species Results: *Batrachoseps luciae* Santa Lucia Mountains Slender Salamander



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Species Results: *Batrachoseps luciae* Santa Lucia Mountains Slender Salamander

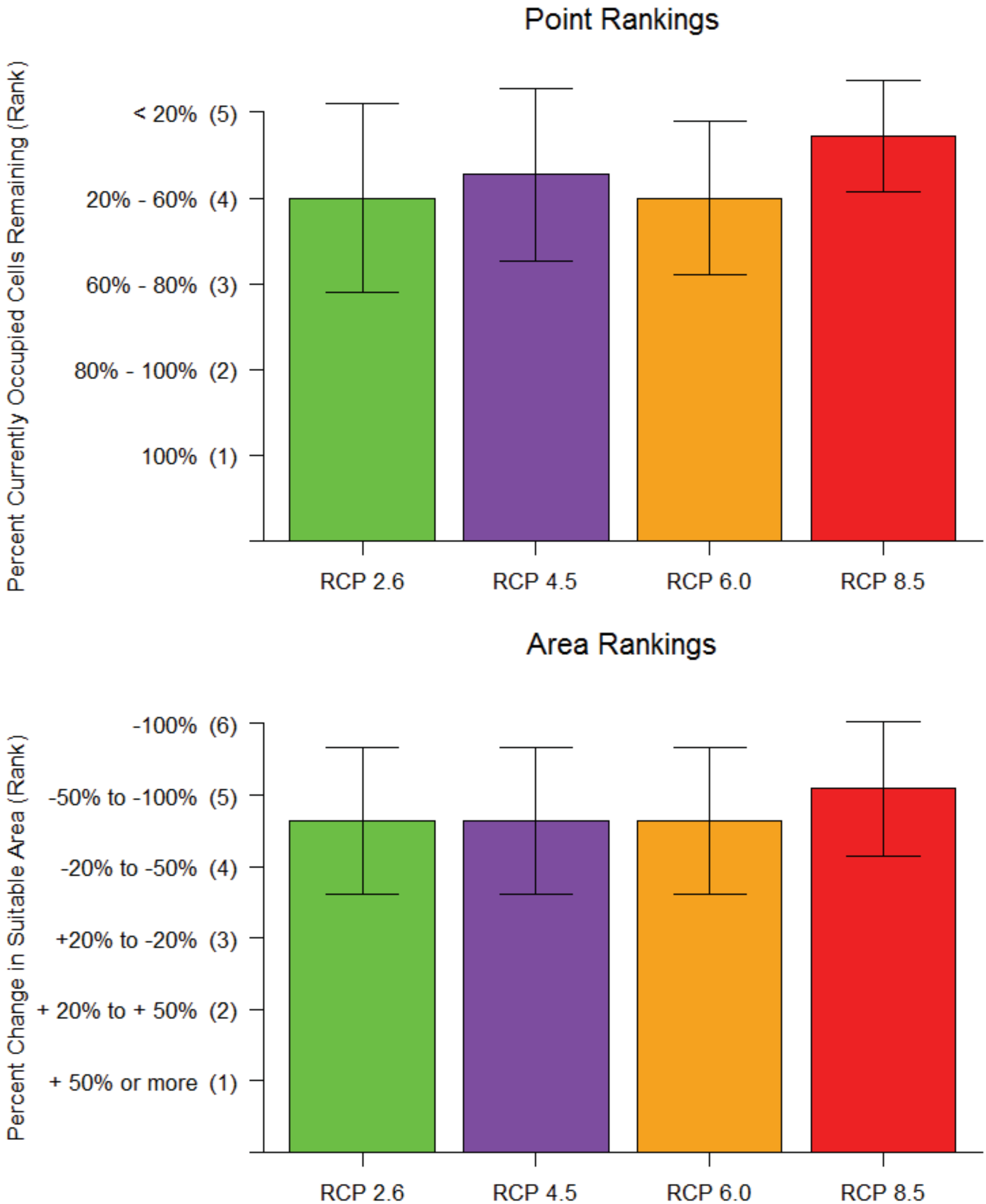
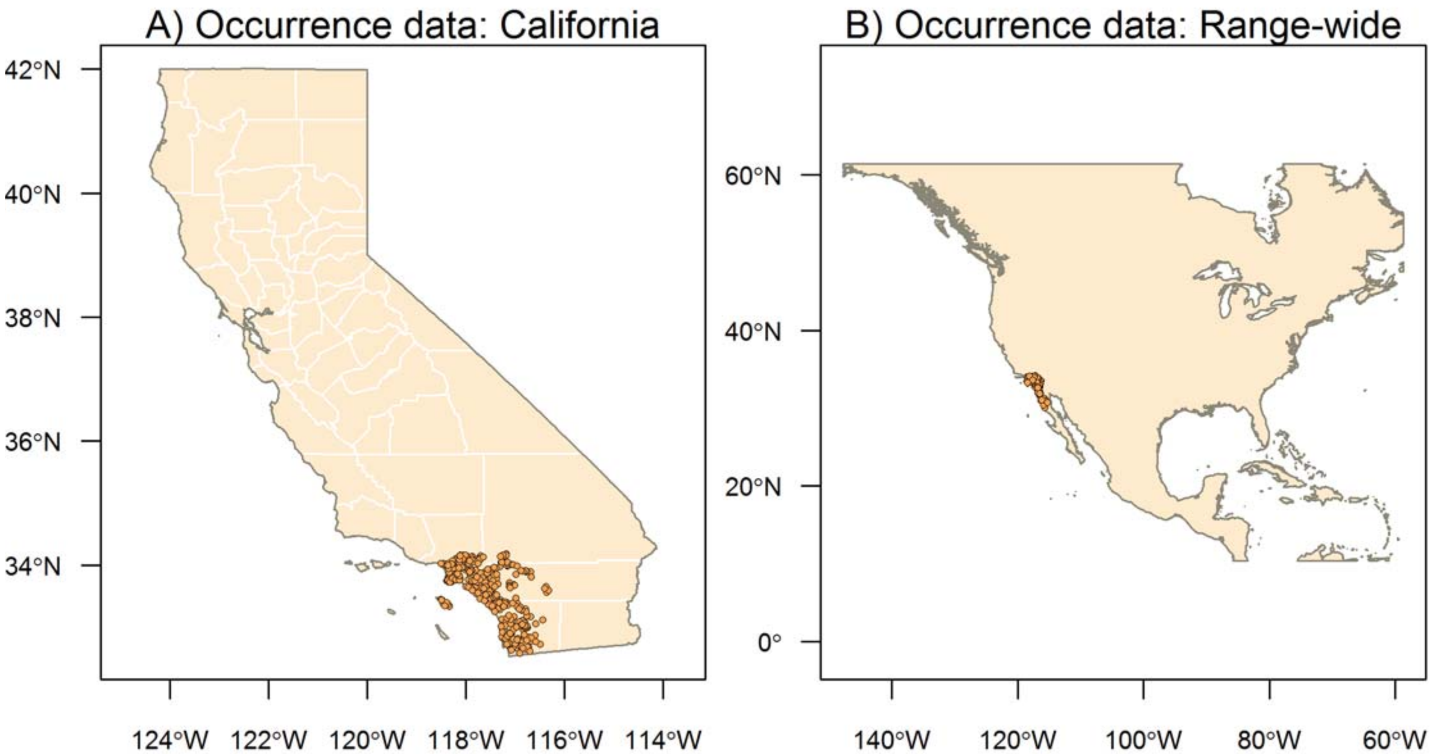


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps major* Garden Slender Salamander



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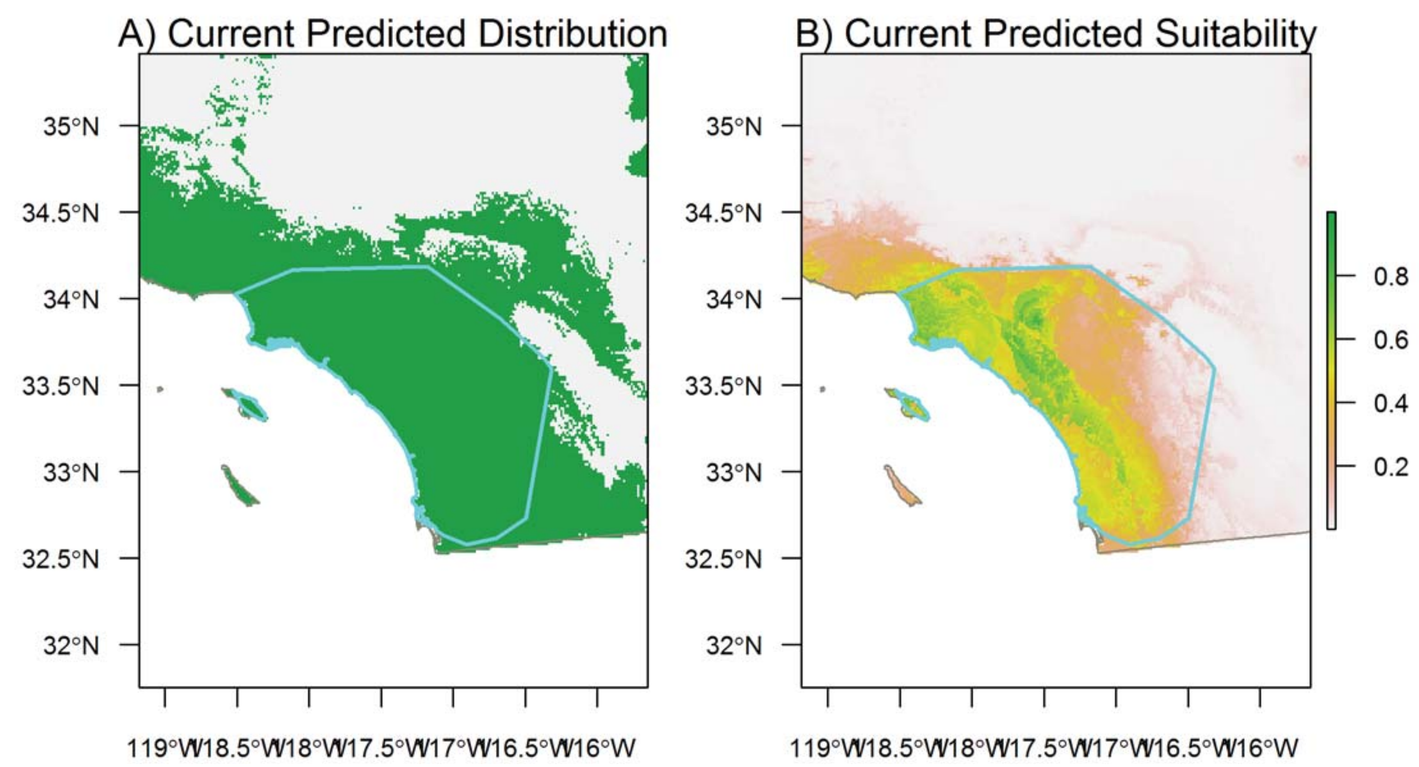

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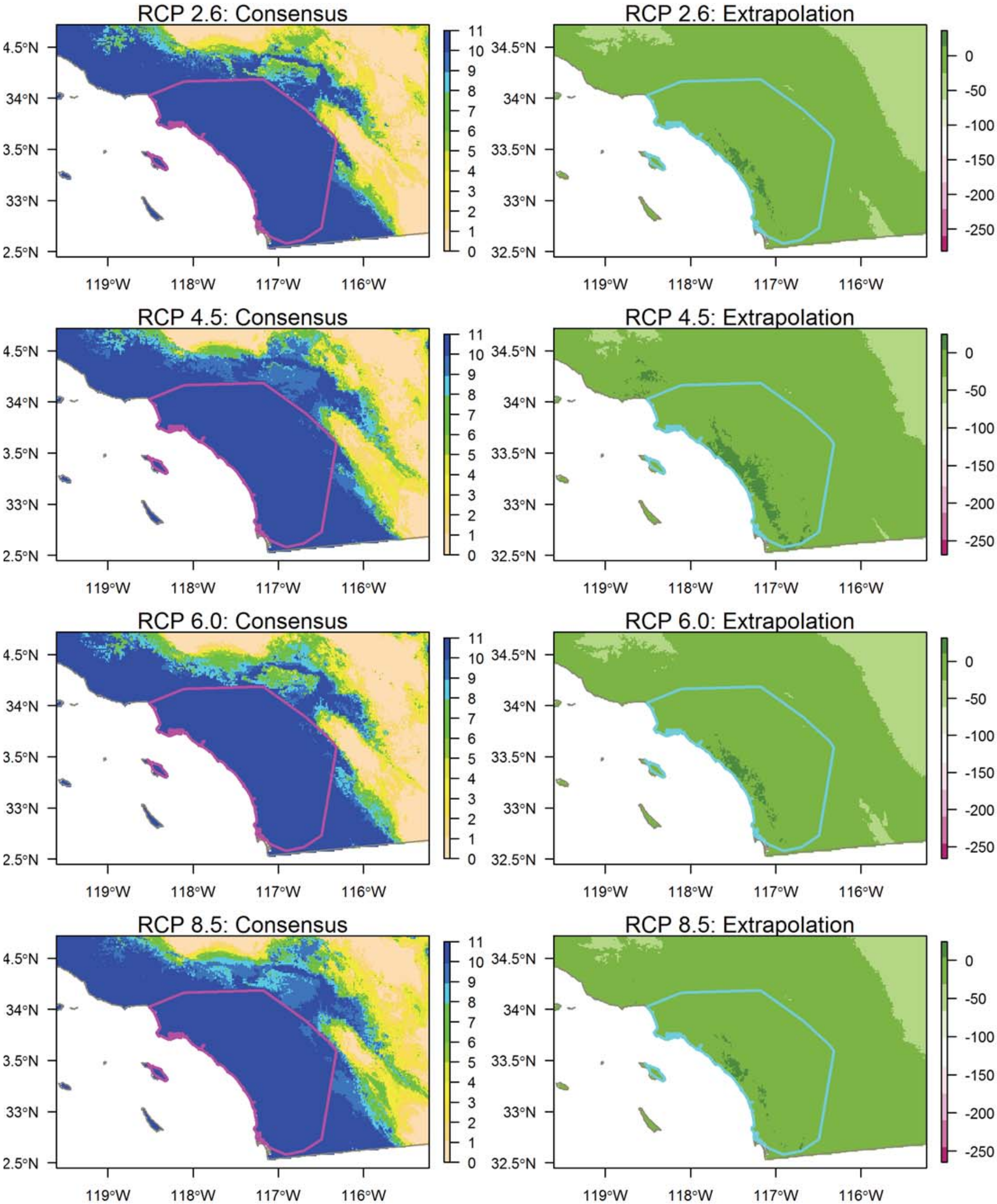
Species Results: *Batrachoseps major* Garden Slender Salamander



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Species Results: *Batrachoseps major* Garden Slender Salamander

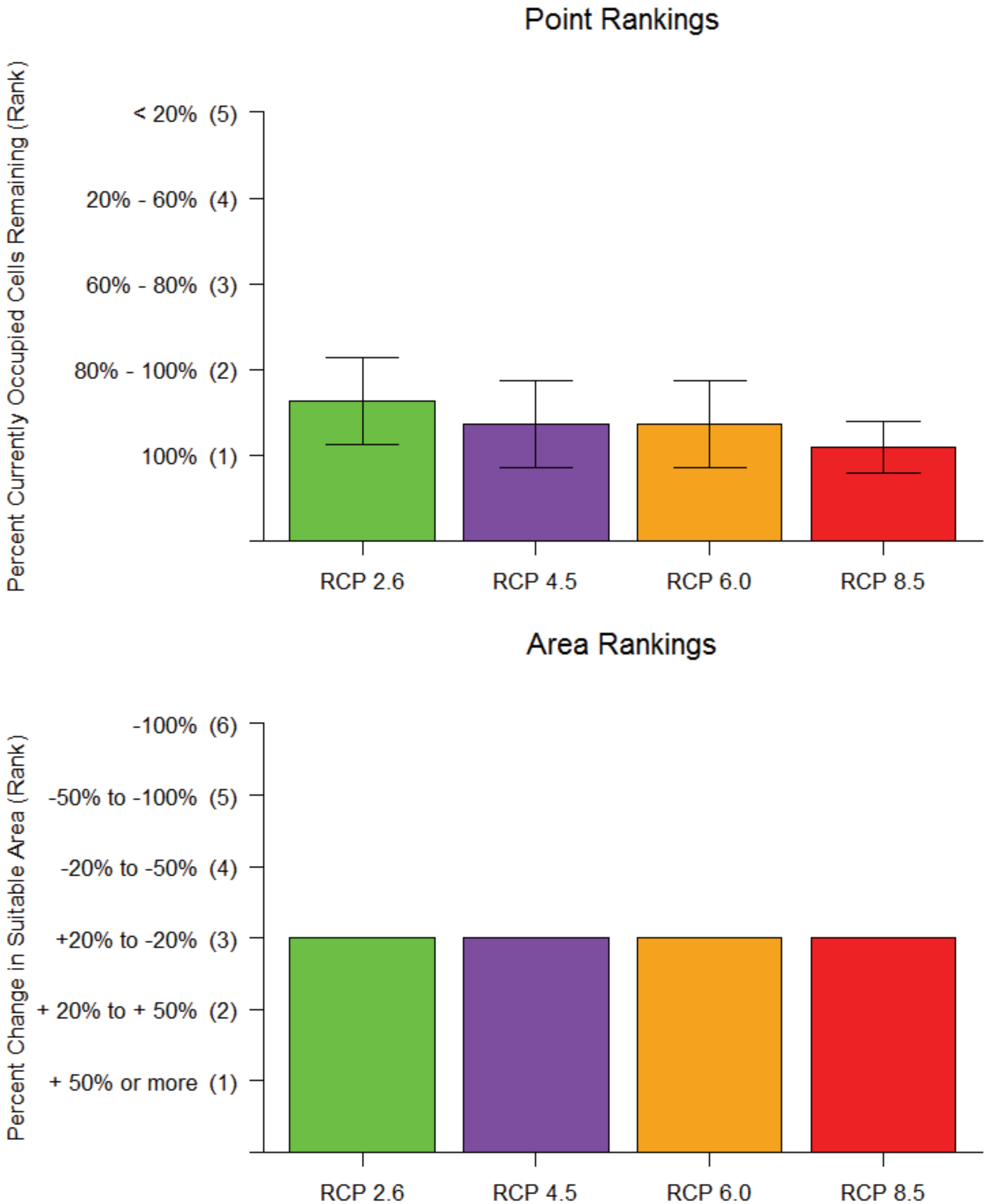
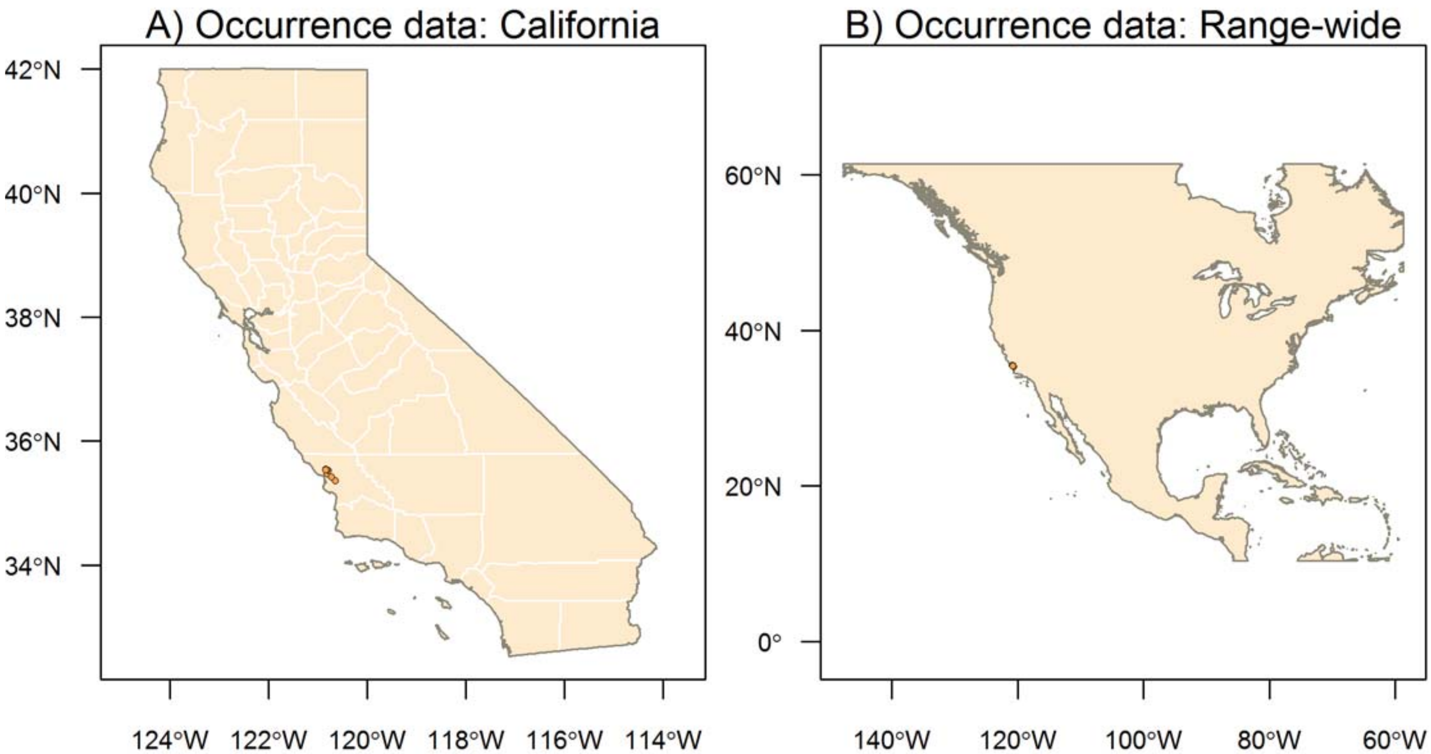


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps minor* Lesser Slender Salamander



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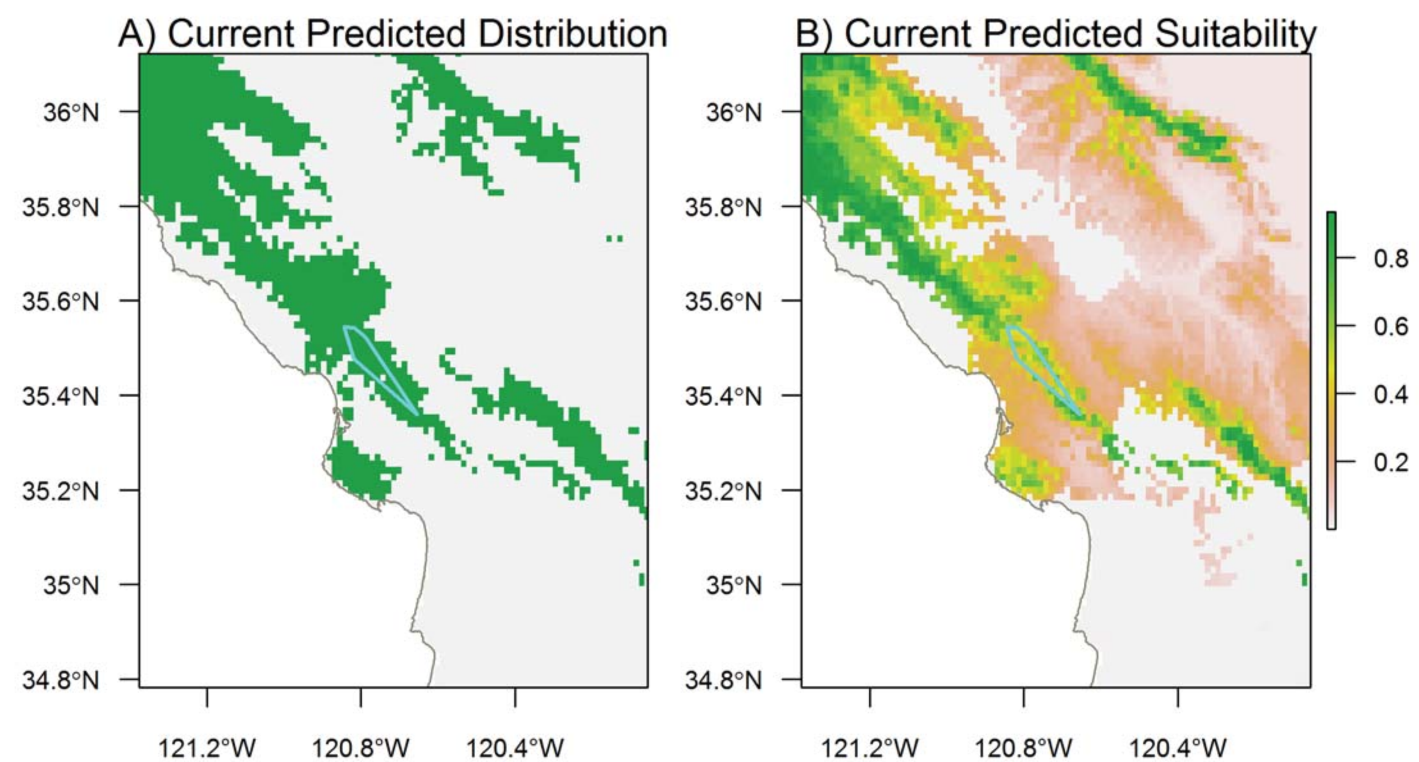

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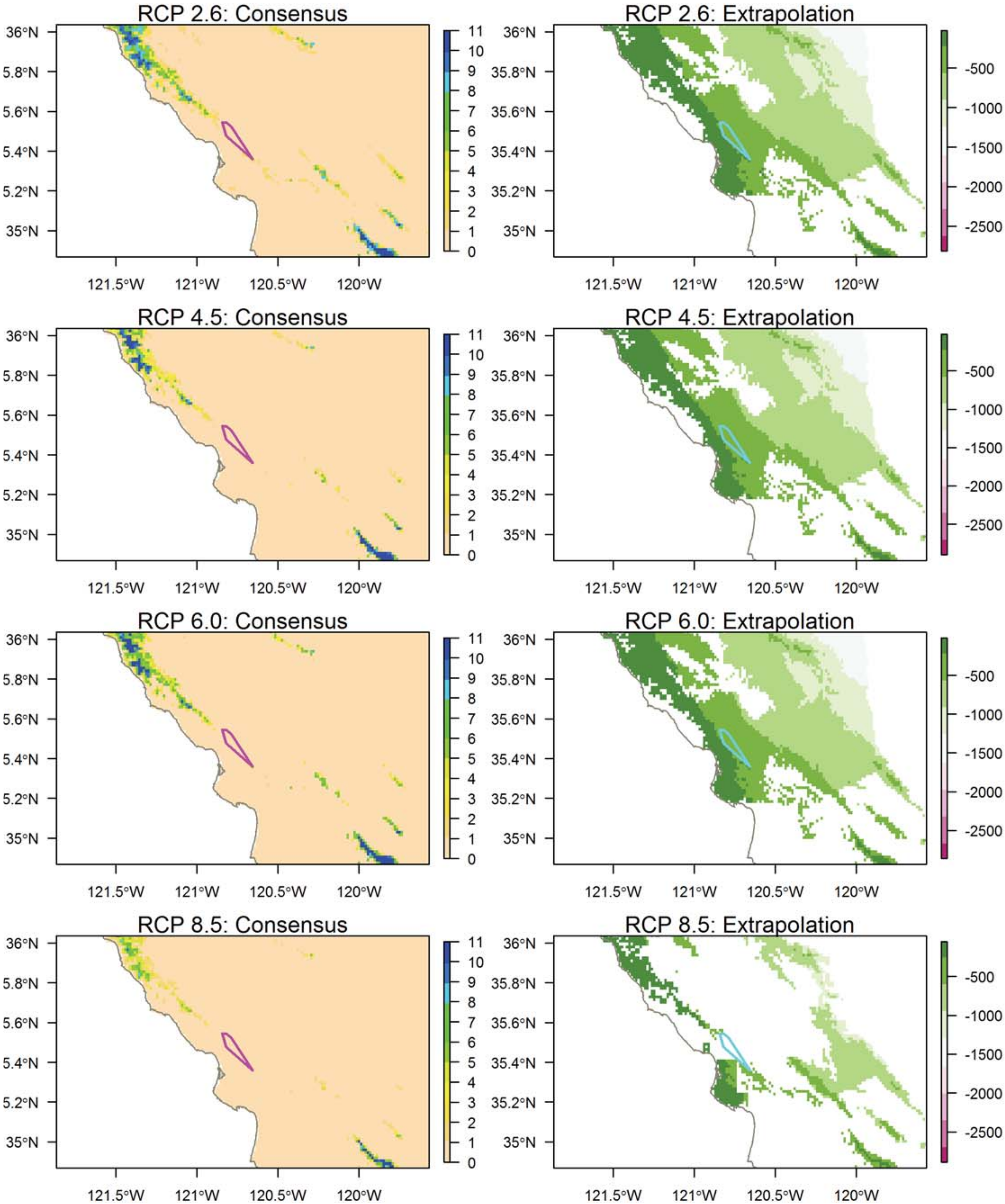
Species Results: *Batrachoseps minor* Lesser Slender Salamander



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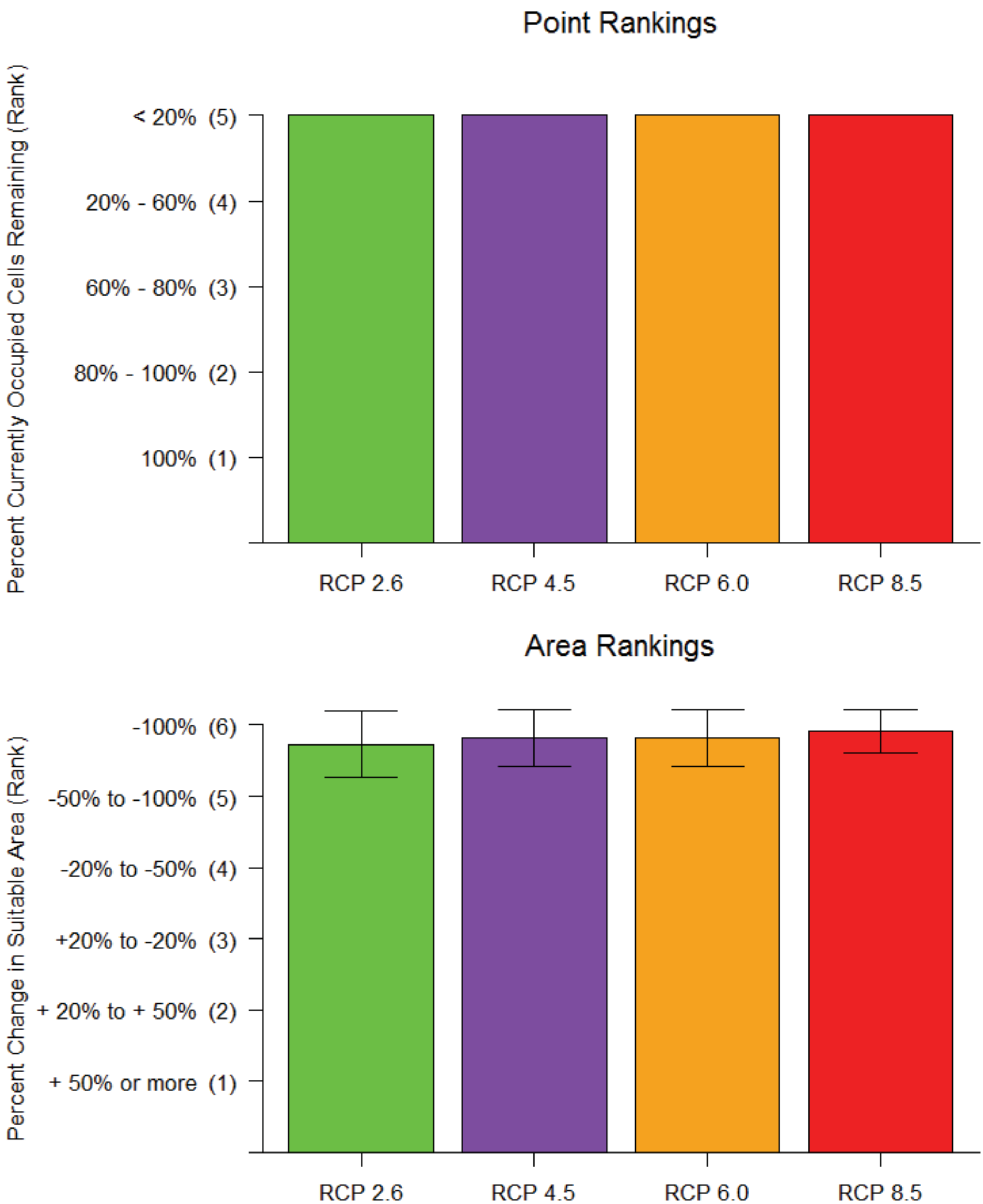
Species Results: *Batrachoseps minor* Lesser Slender Salamander



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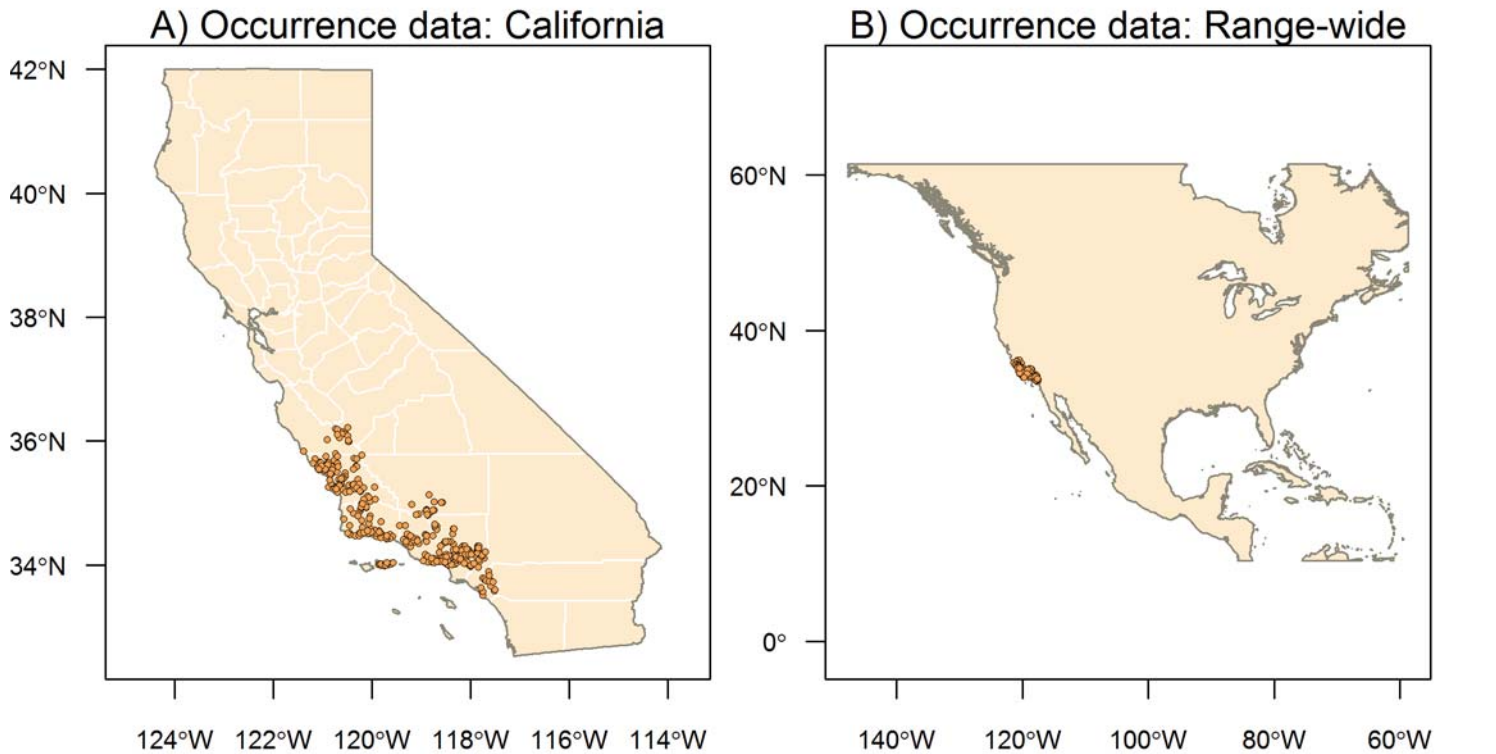
Species Results: *Batrachoseps nigriventris* Black-bellied Slender Salamander



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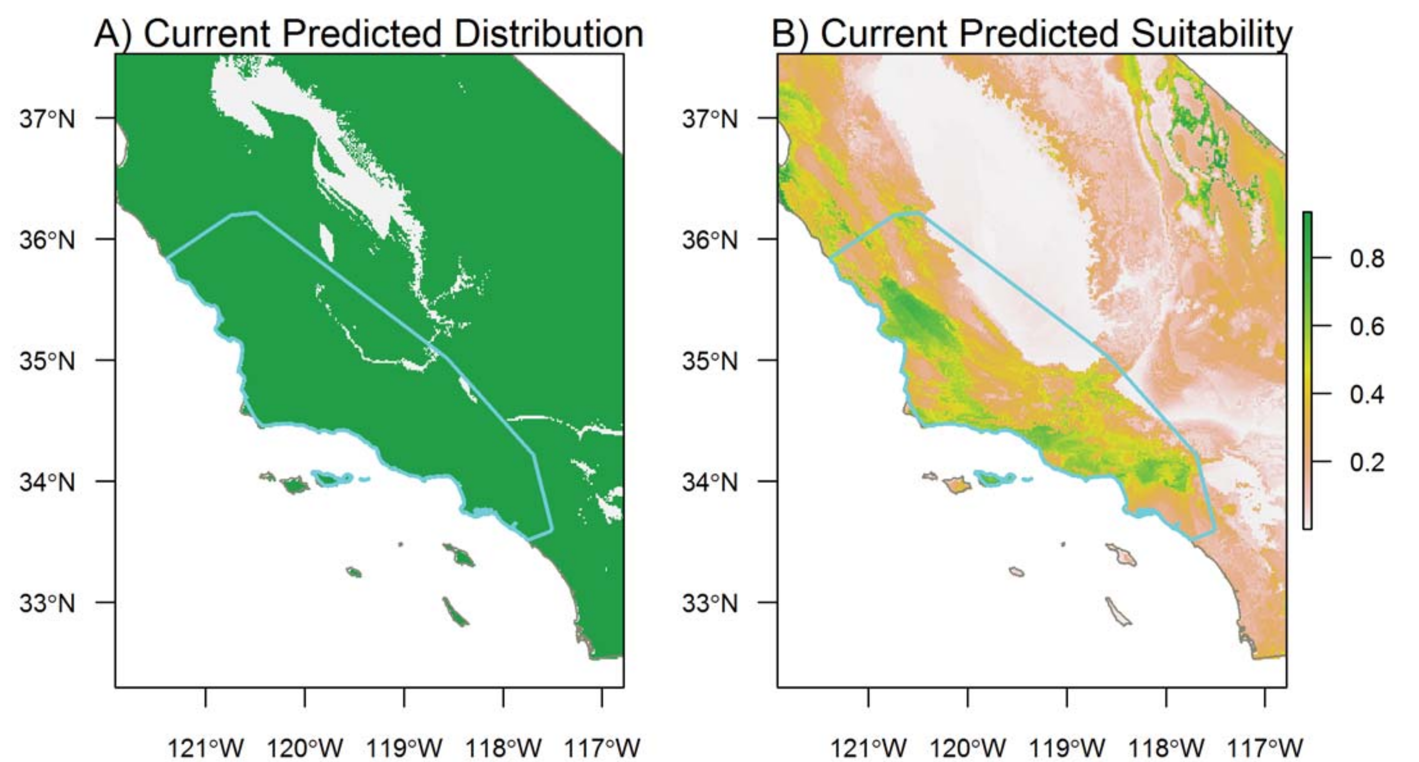

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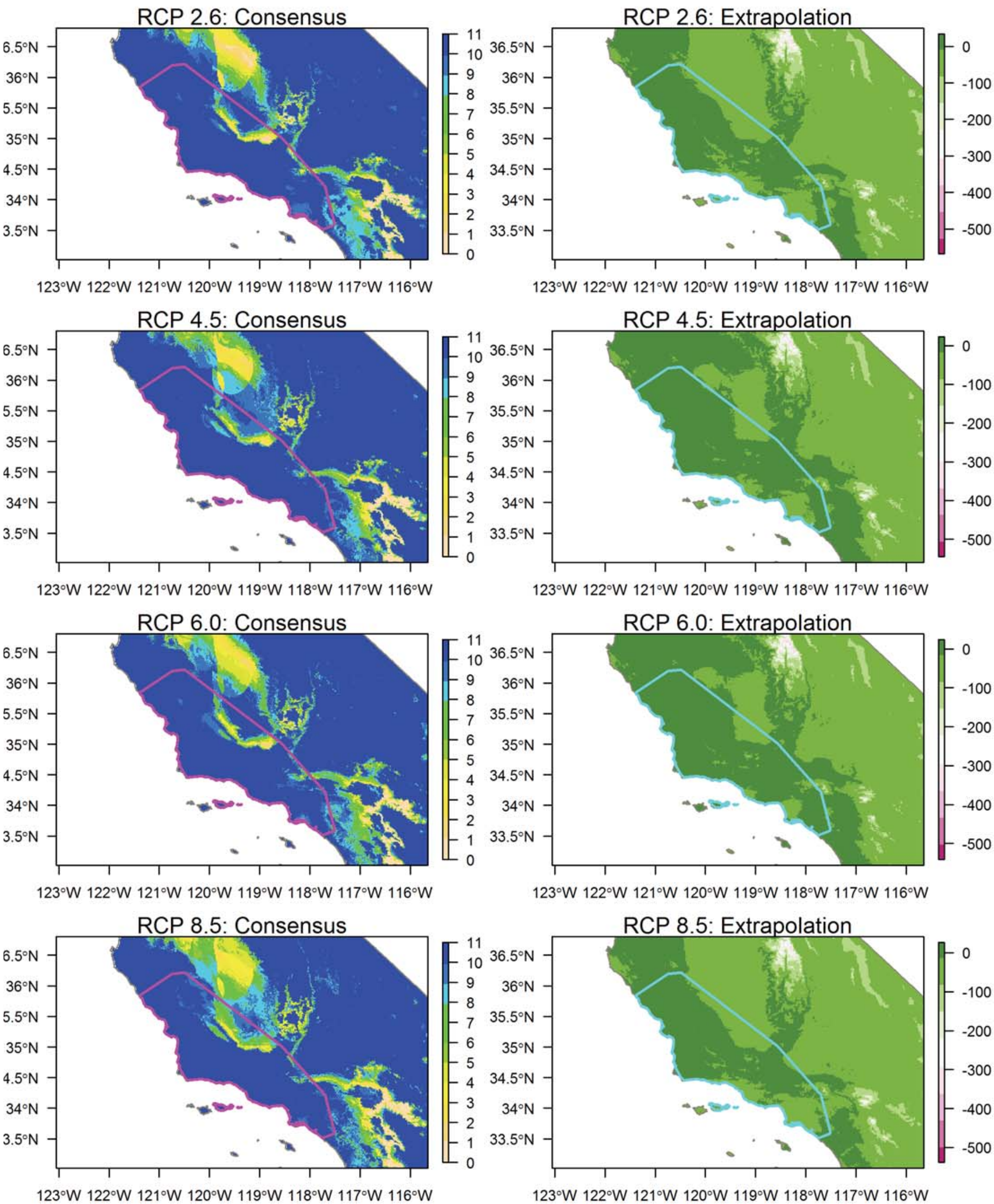
Species Results: *Batrachoseps nigriventris* Black-bellied Slender Salamander



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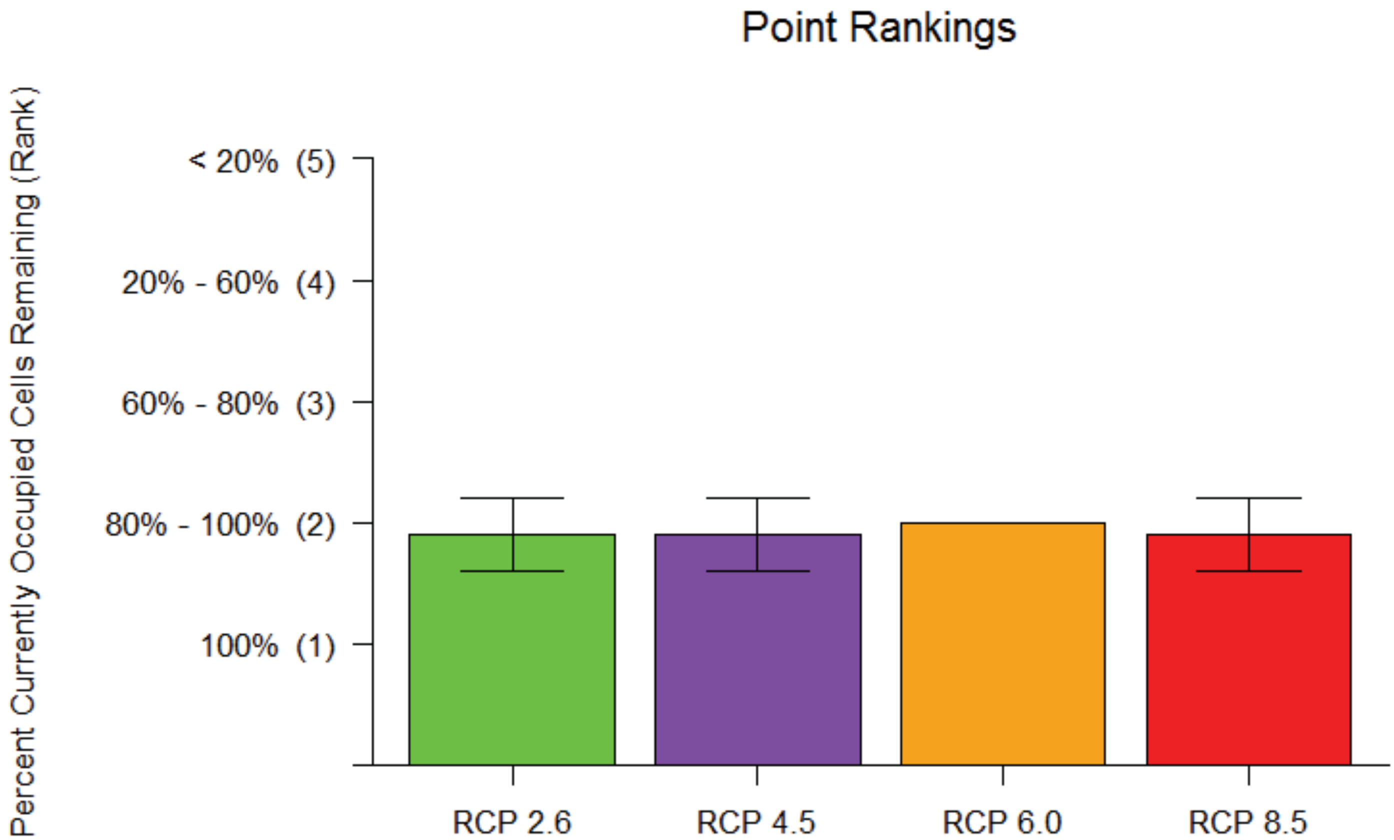
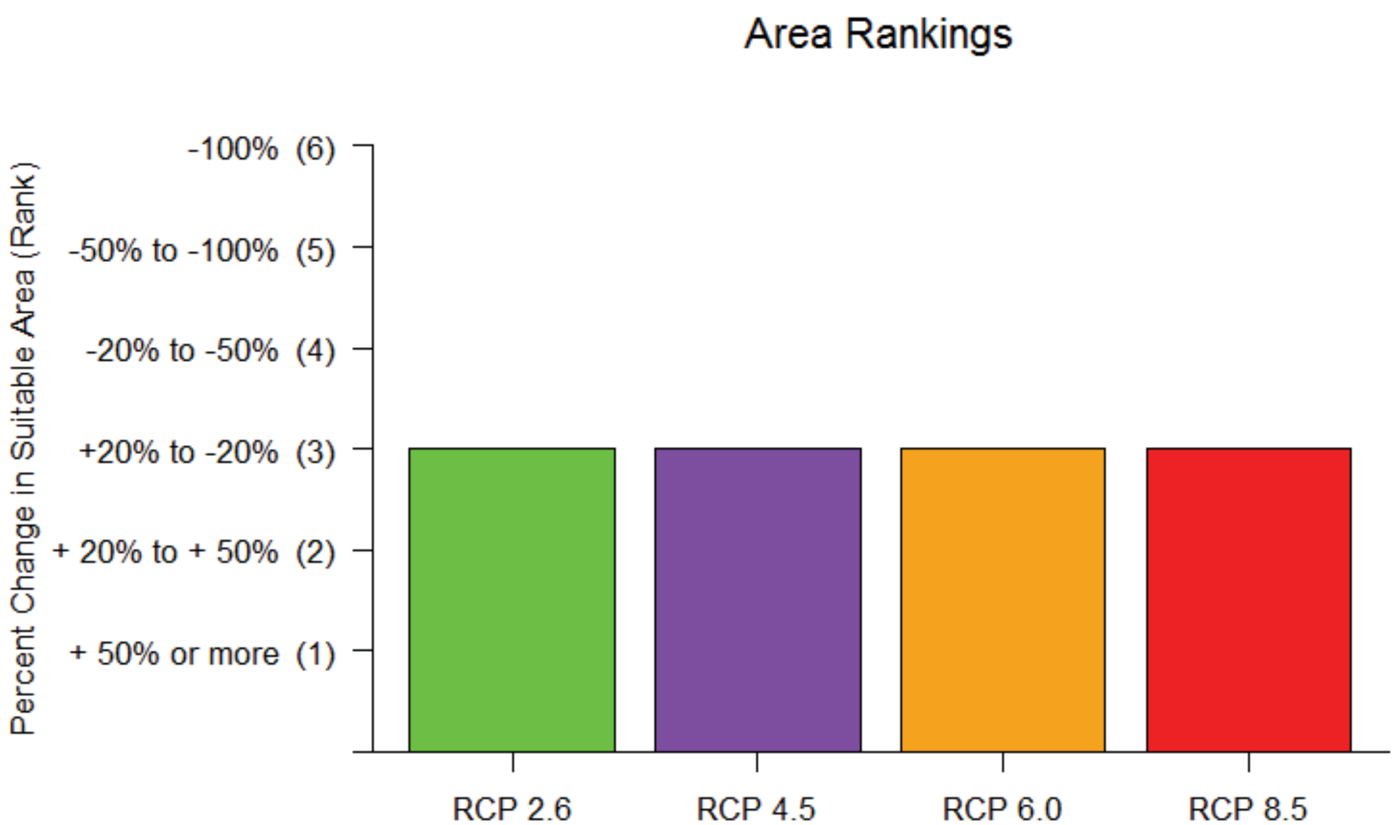
Species Results: *Batrachoseps nigriventris* Black-bellied Slender Salamander





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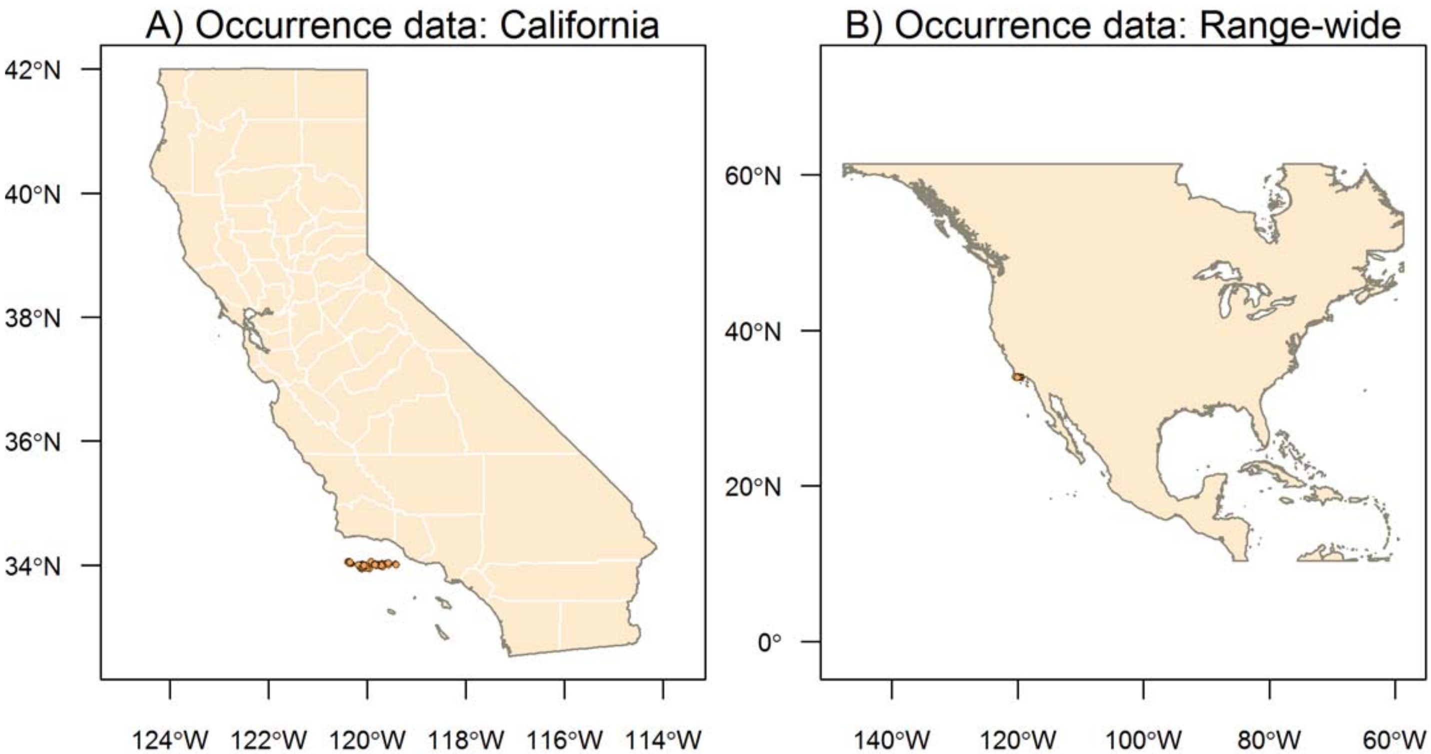
Species Results: *Batrachoseps pacificus* Channel Islands Slender Salamander



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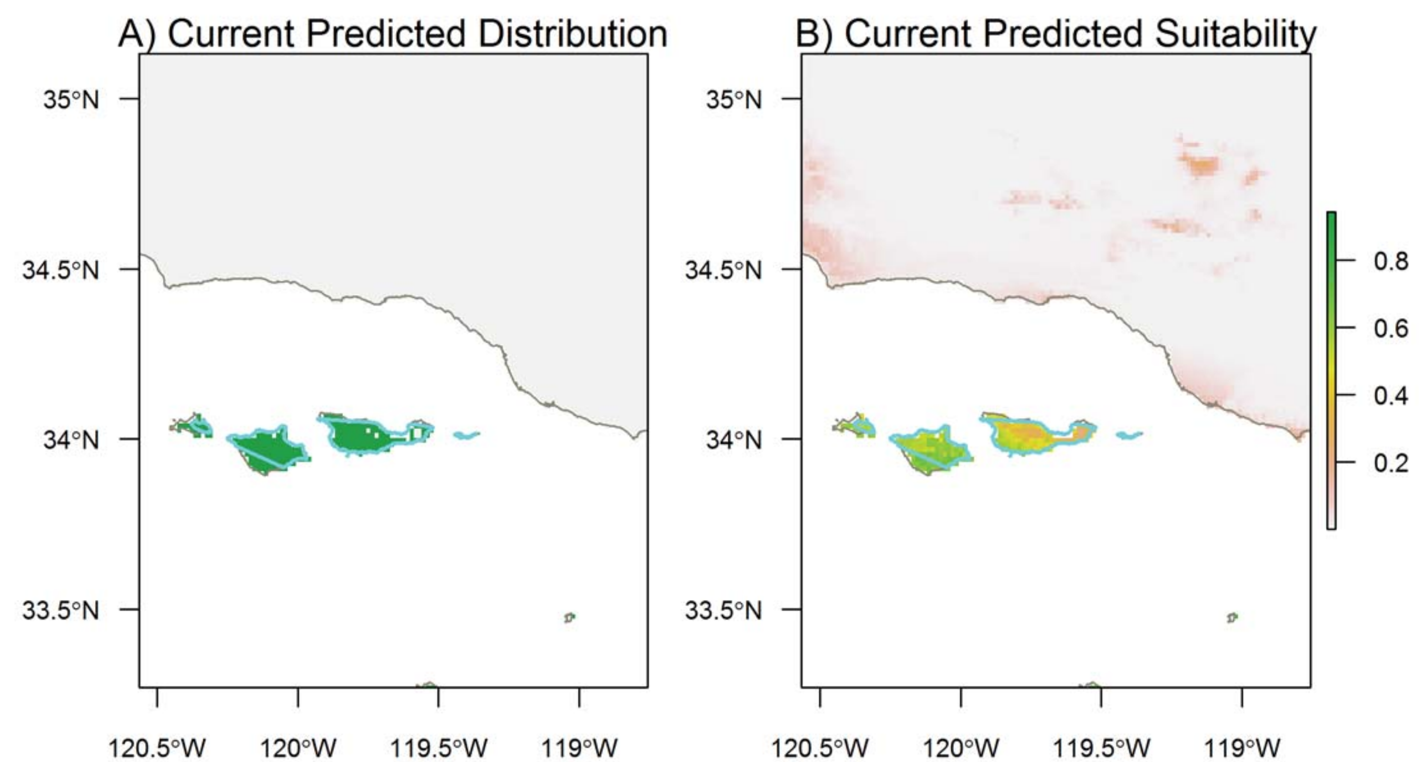

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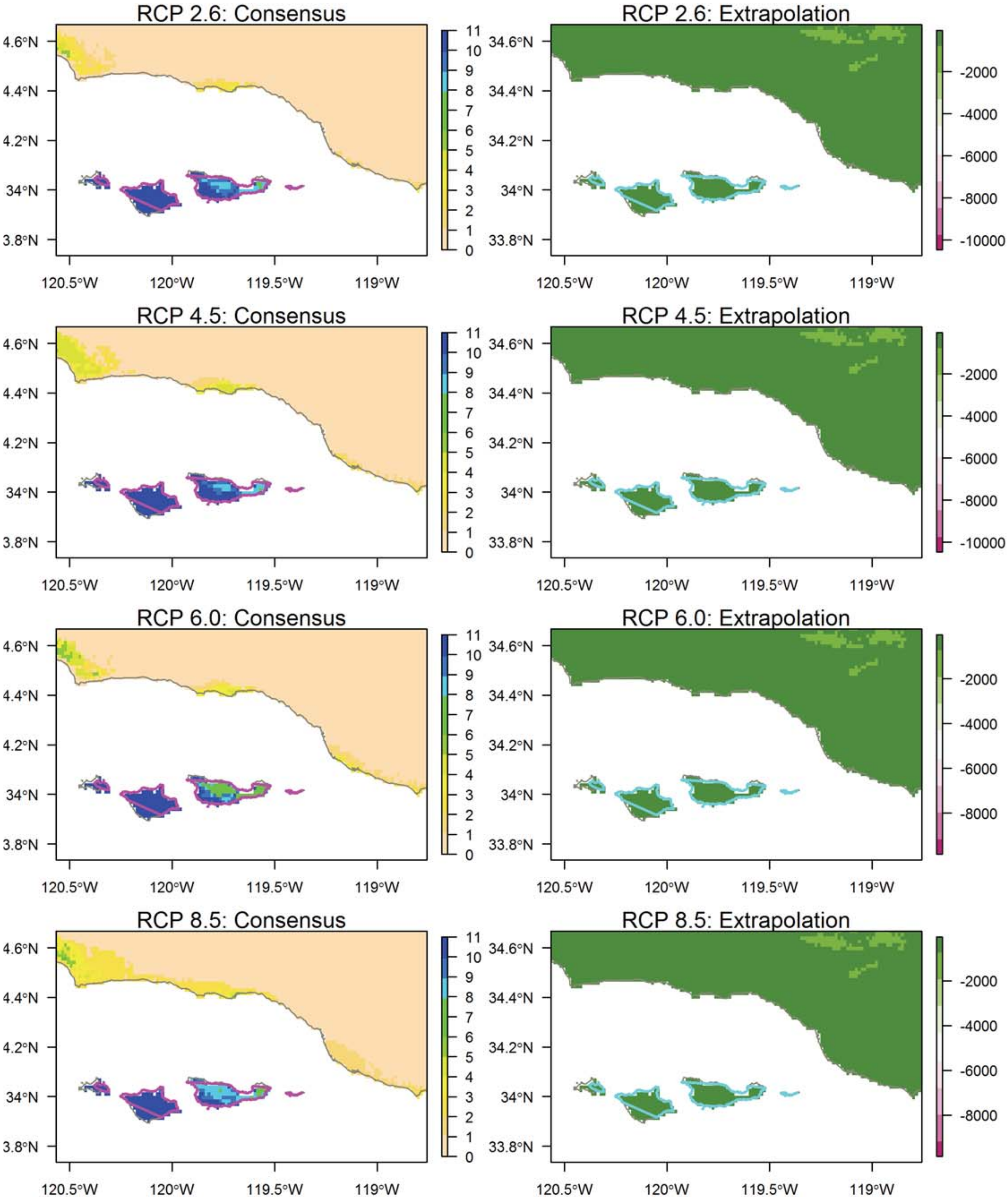
Species Results: *Batrachoseps pacificus* Channel Islands Slender Salamander



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Species Results: *Batrachoseps pacificus* Channel Islands Slender Salamander

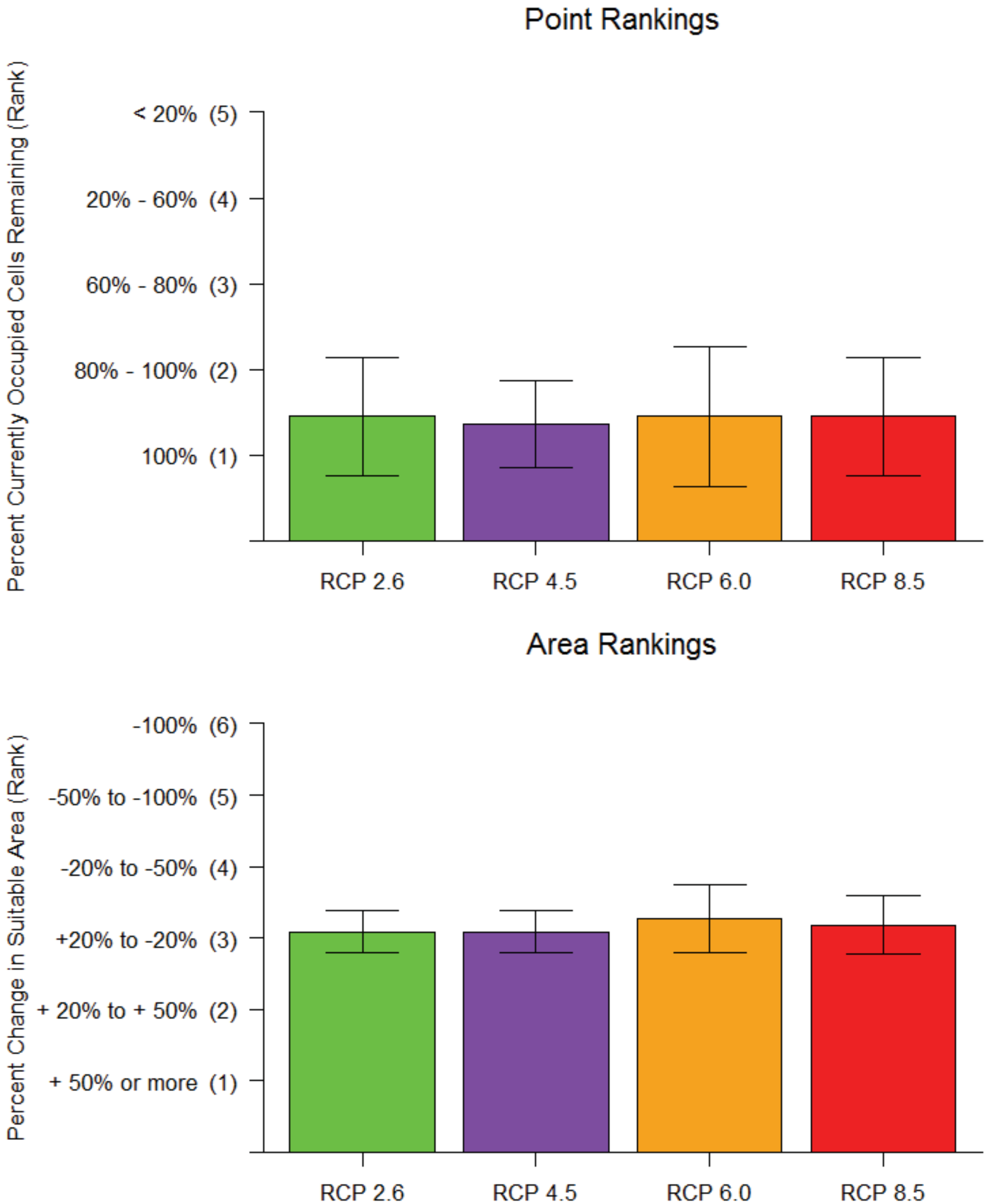


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps regius* Kings River Slender Salamander

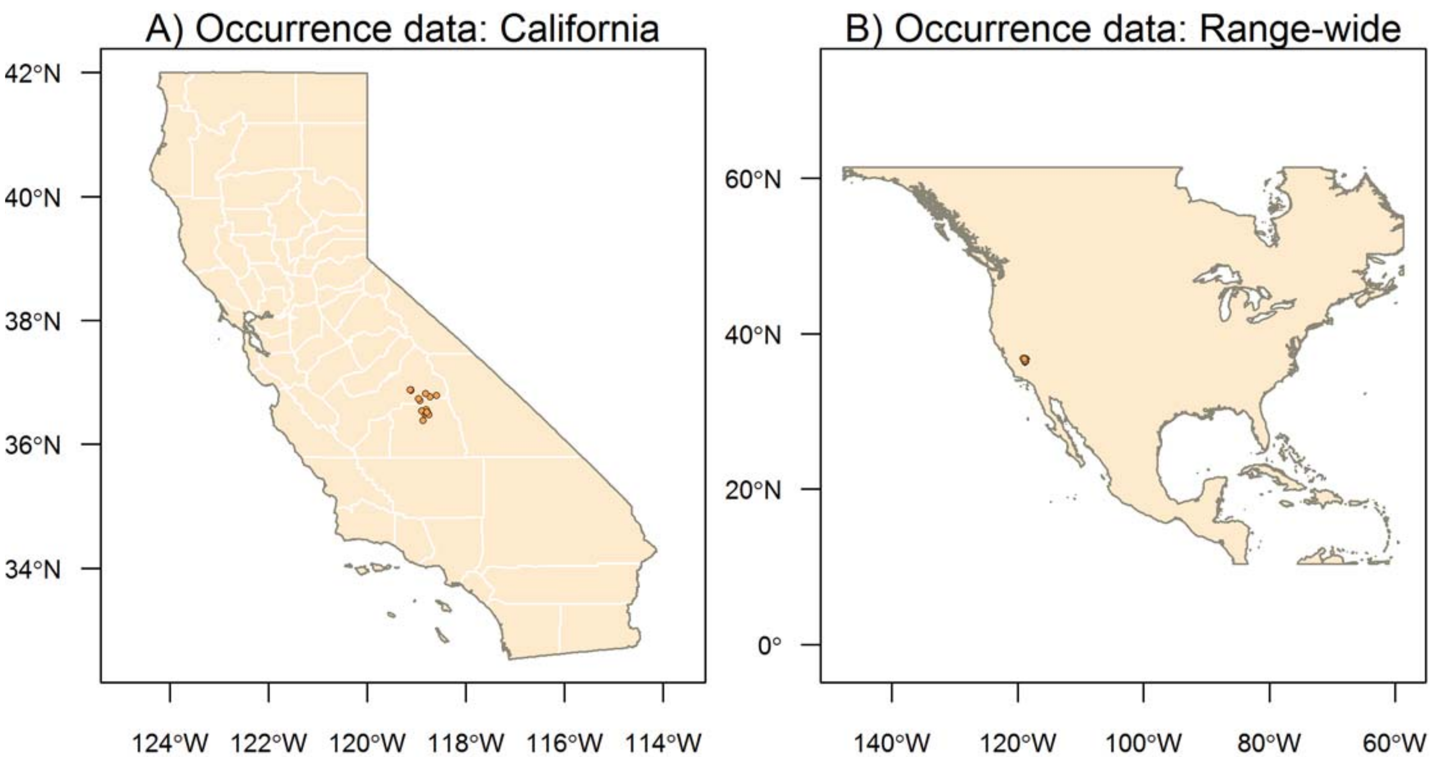


Figure 1. Occurrence data used to build Maxent models.

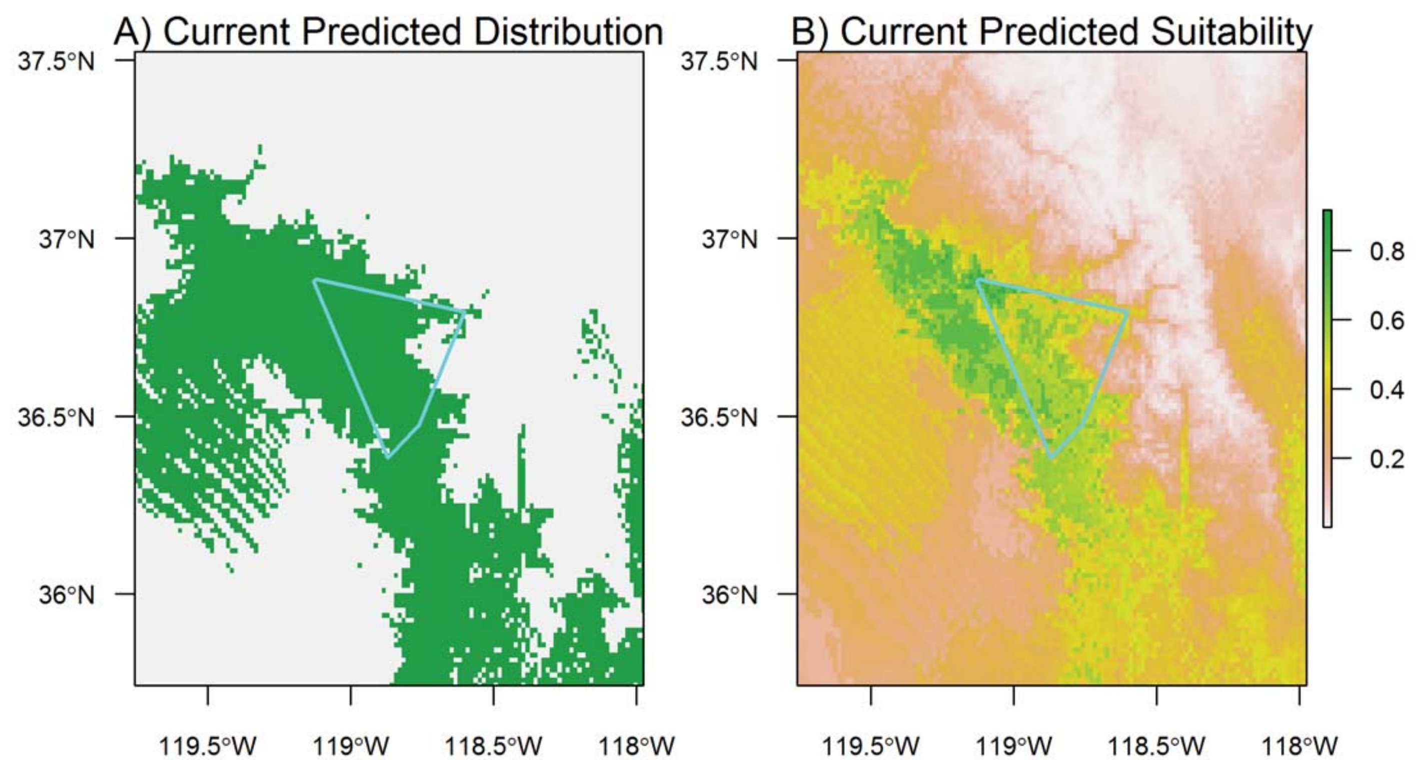


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Batrachoseps regius* Kings River Slender Salamander

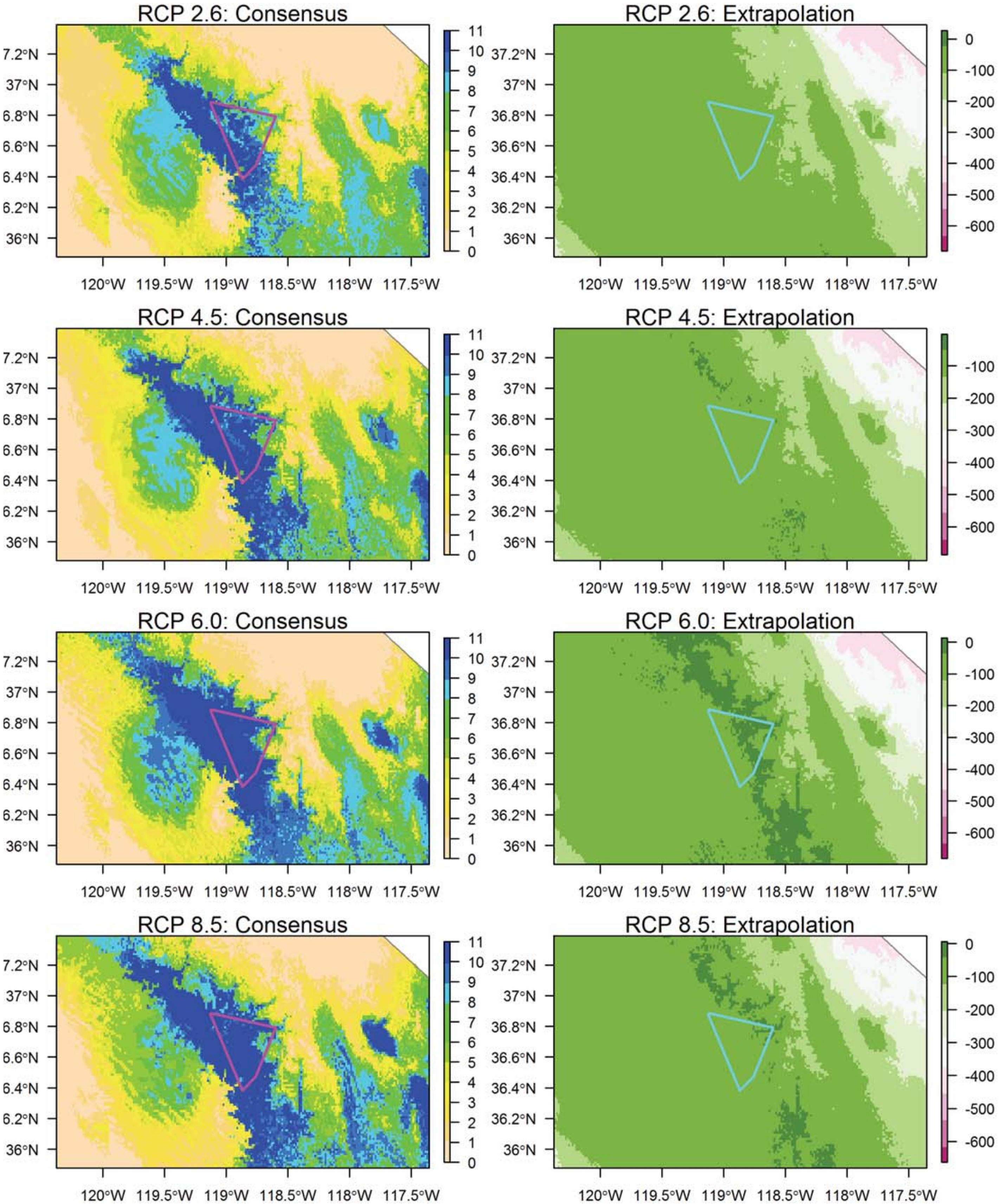


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Batrachoseps regius* Kings River Slender Salamander

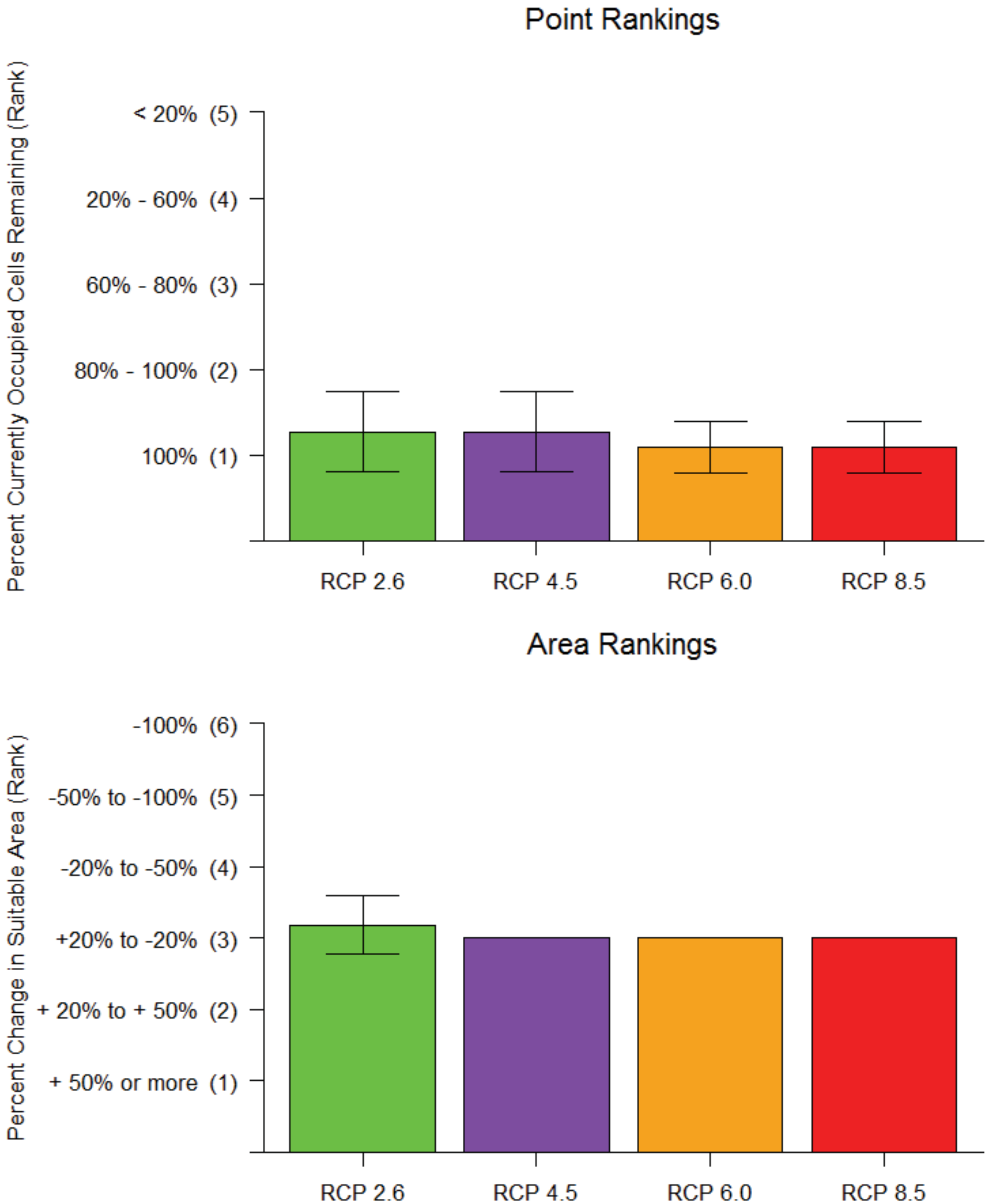


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps relictus* Relictual Slender Salamander

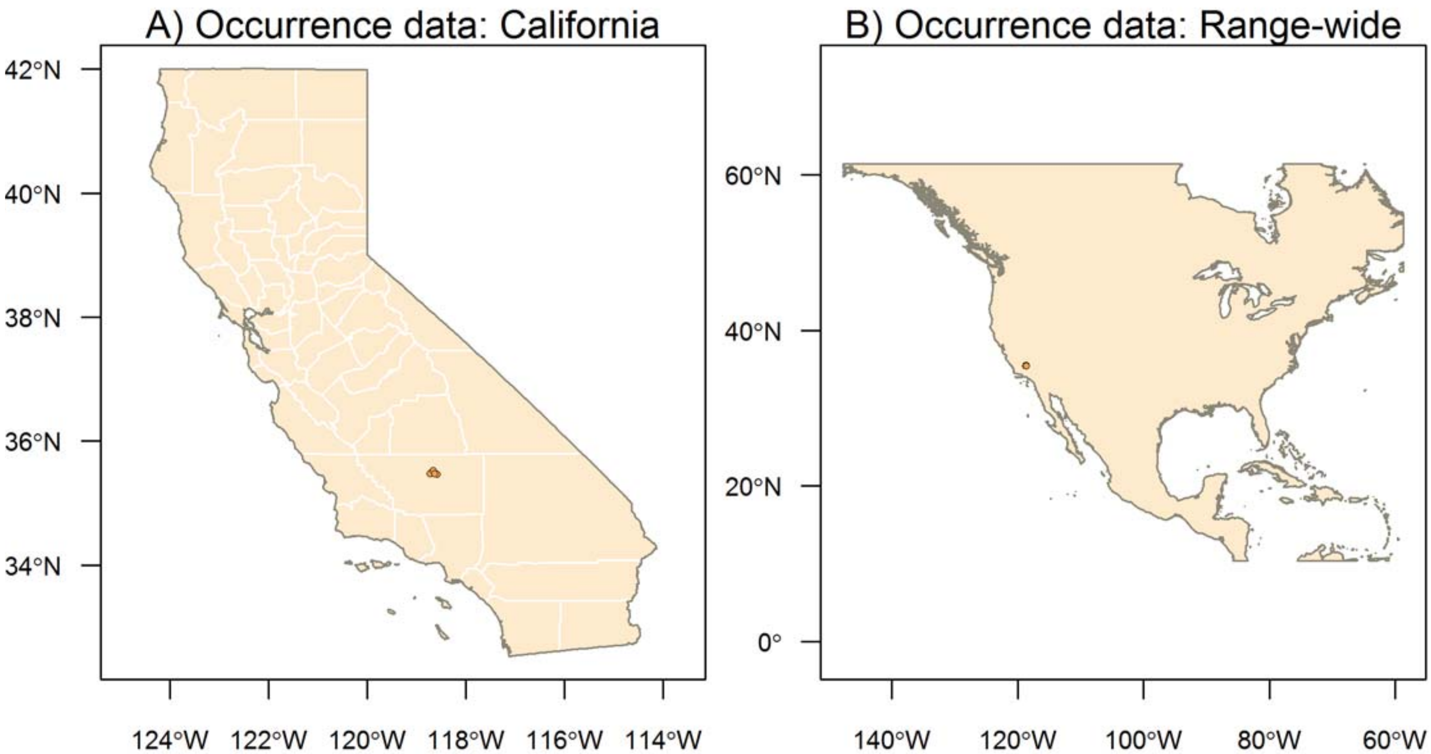


Figure 1. Occurrence data used to build Maxent models.

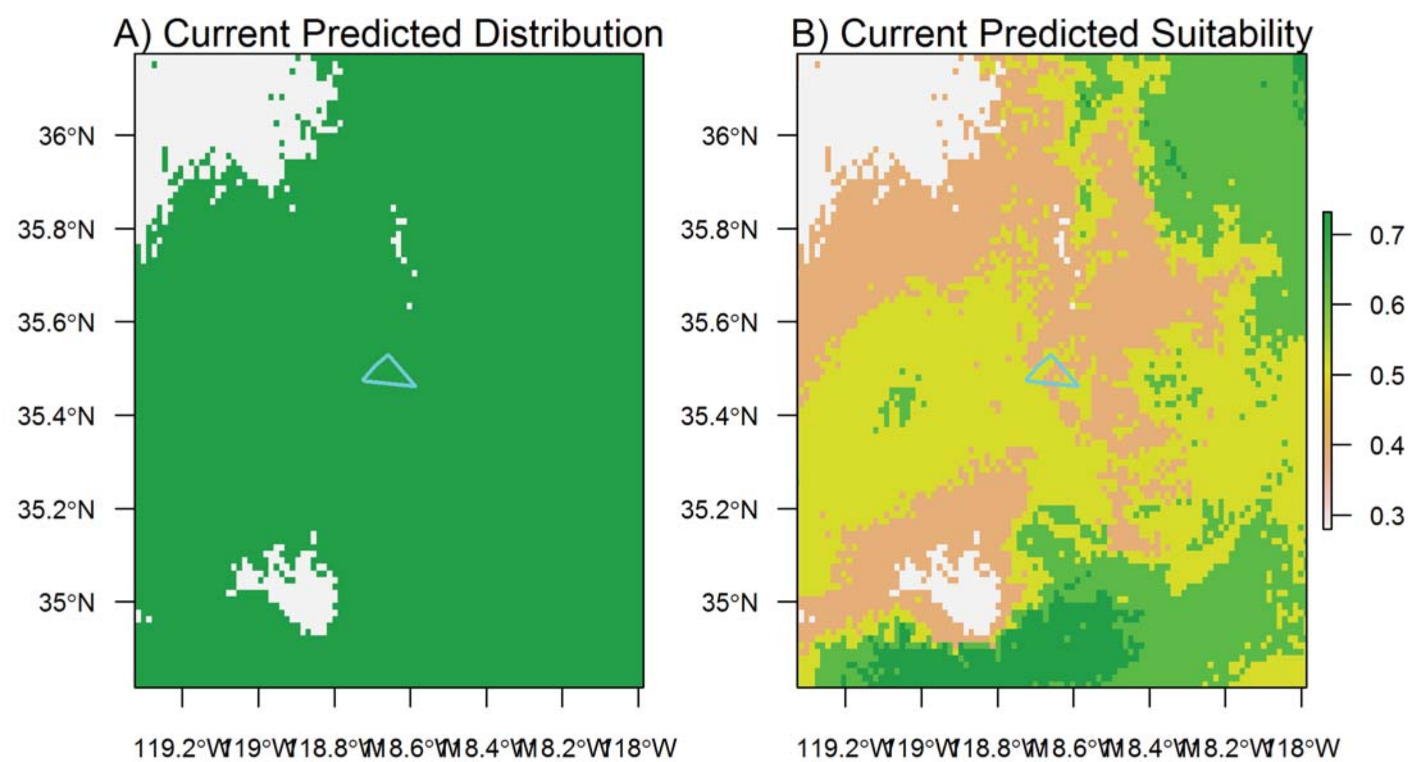


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Batrachoseps relictus* Relictual Slender Salamander

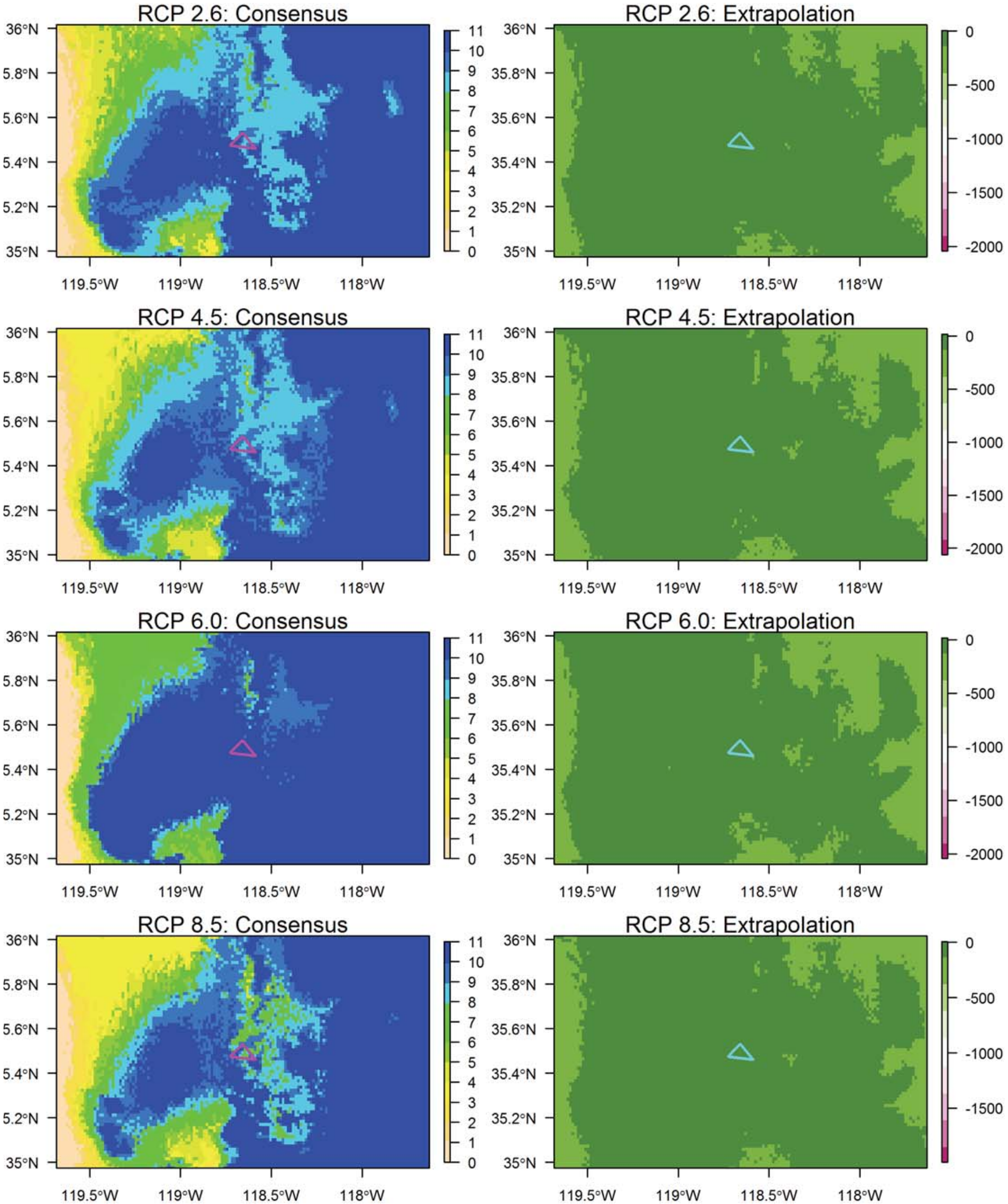


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

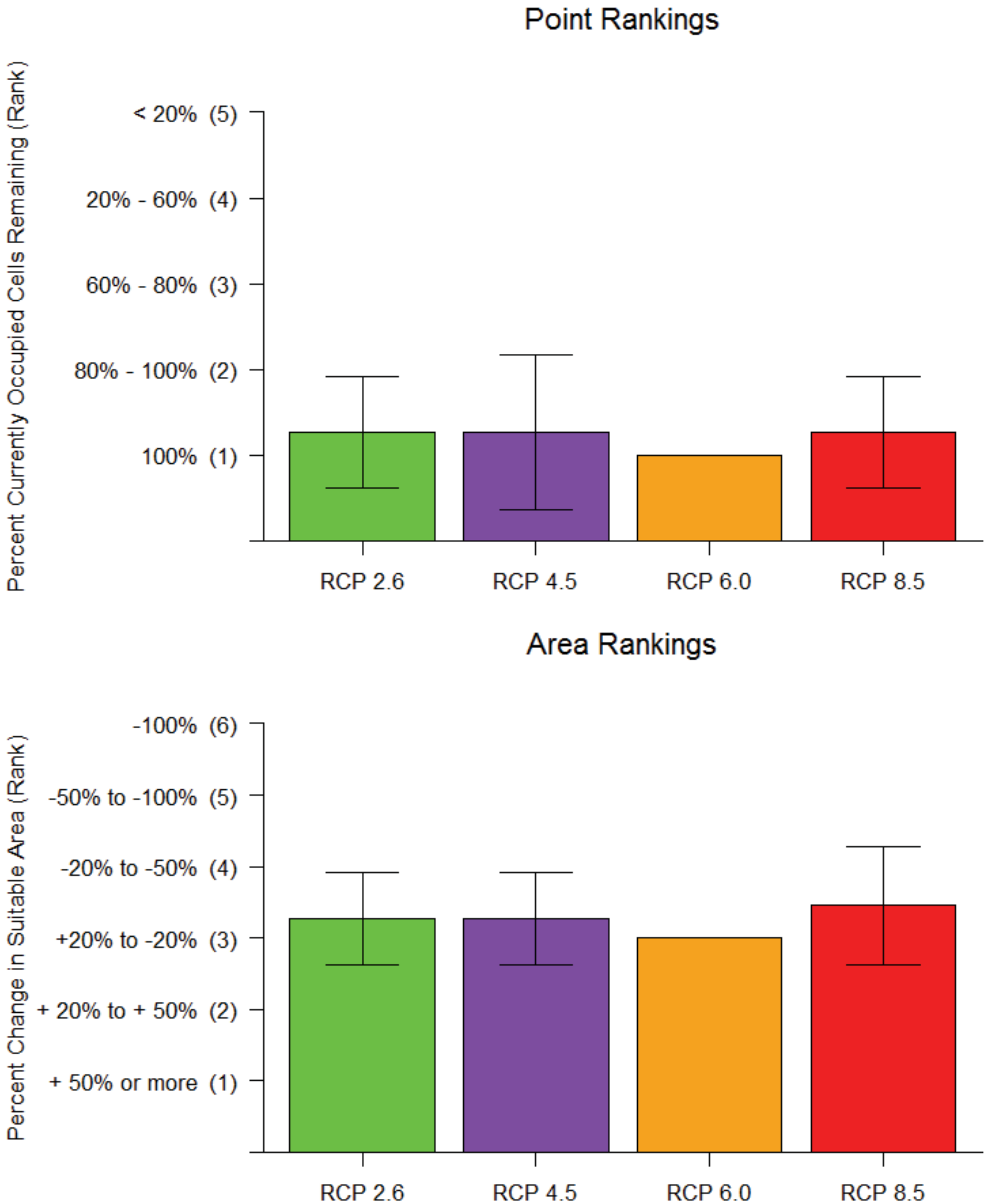


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps robustus* Kern Plateau Salamander

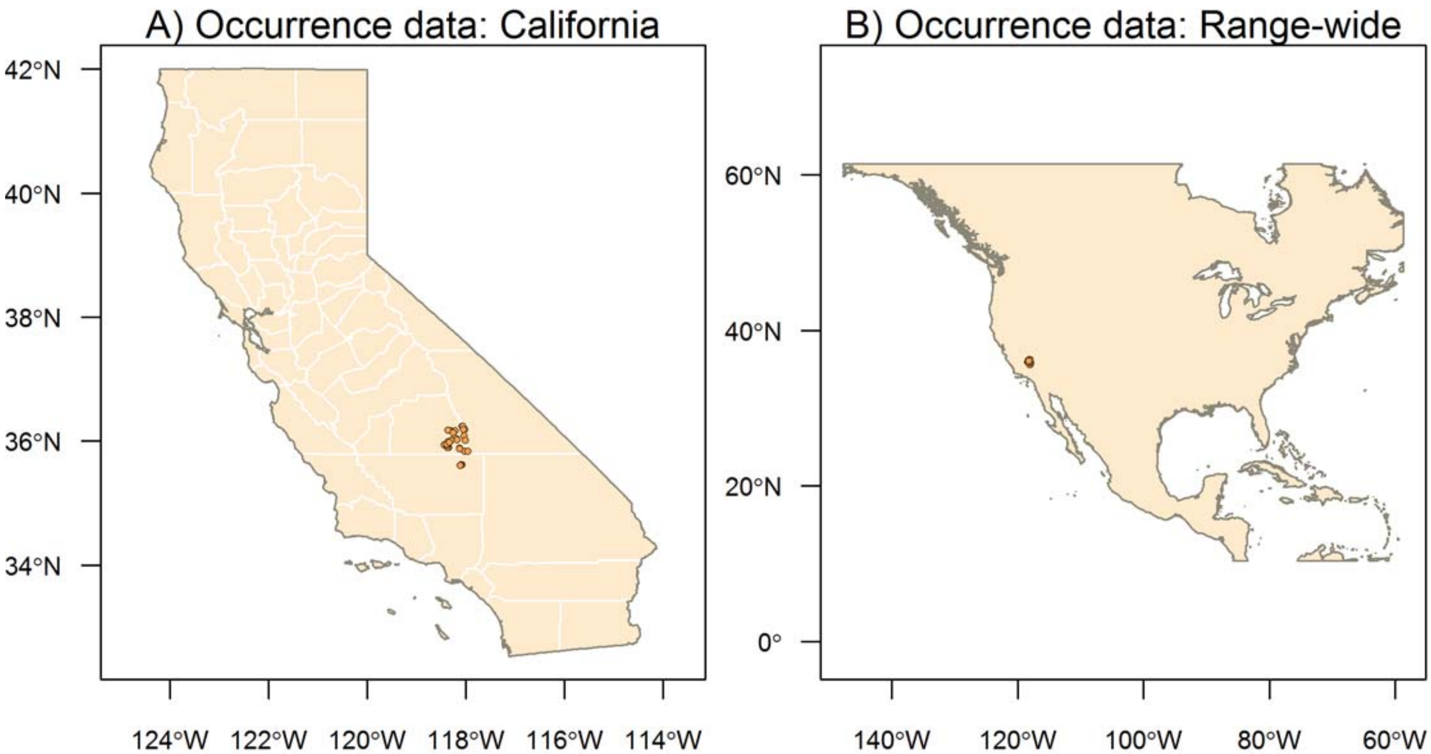
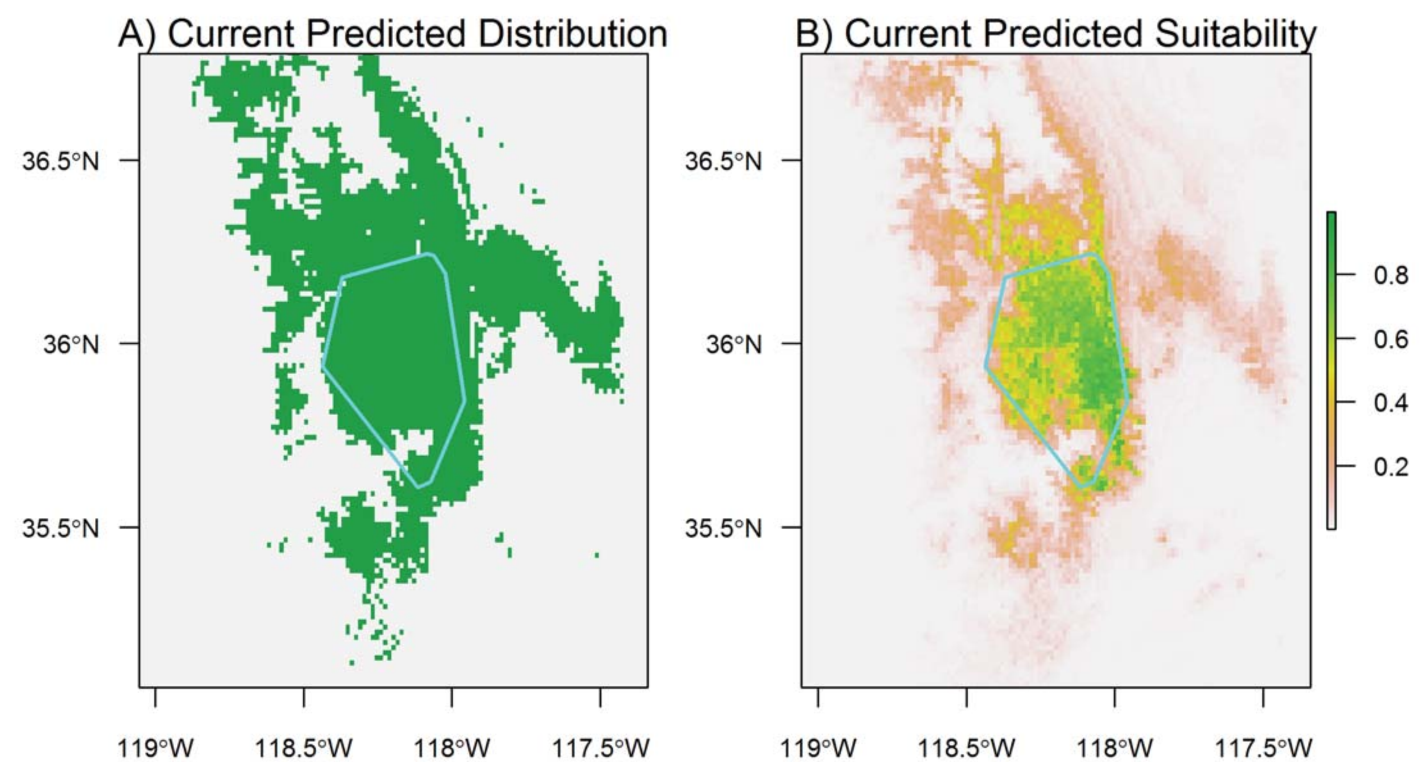


Figure 1. Occurrence data used to build Maxent models.



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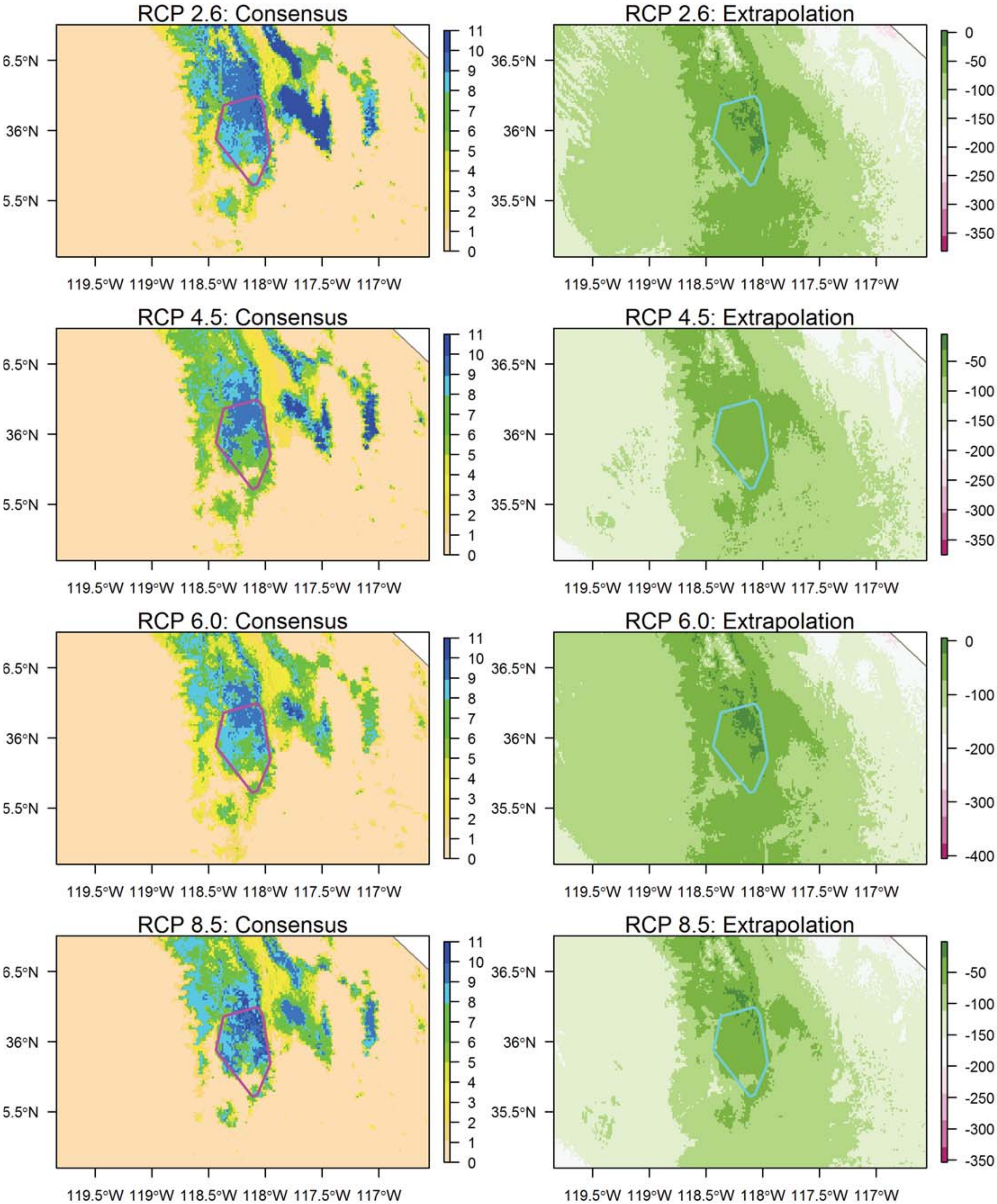


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Batrachoseps robustus* Kern Plateau Salamander

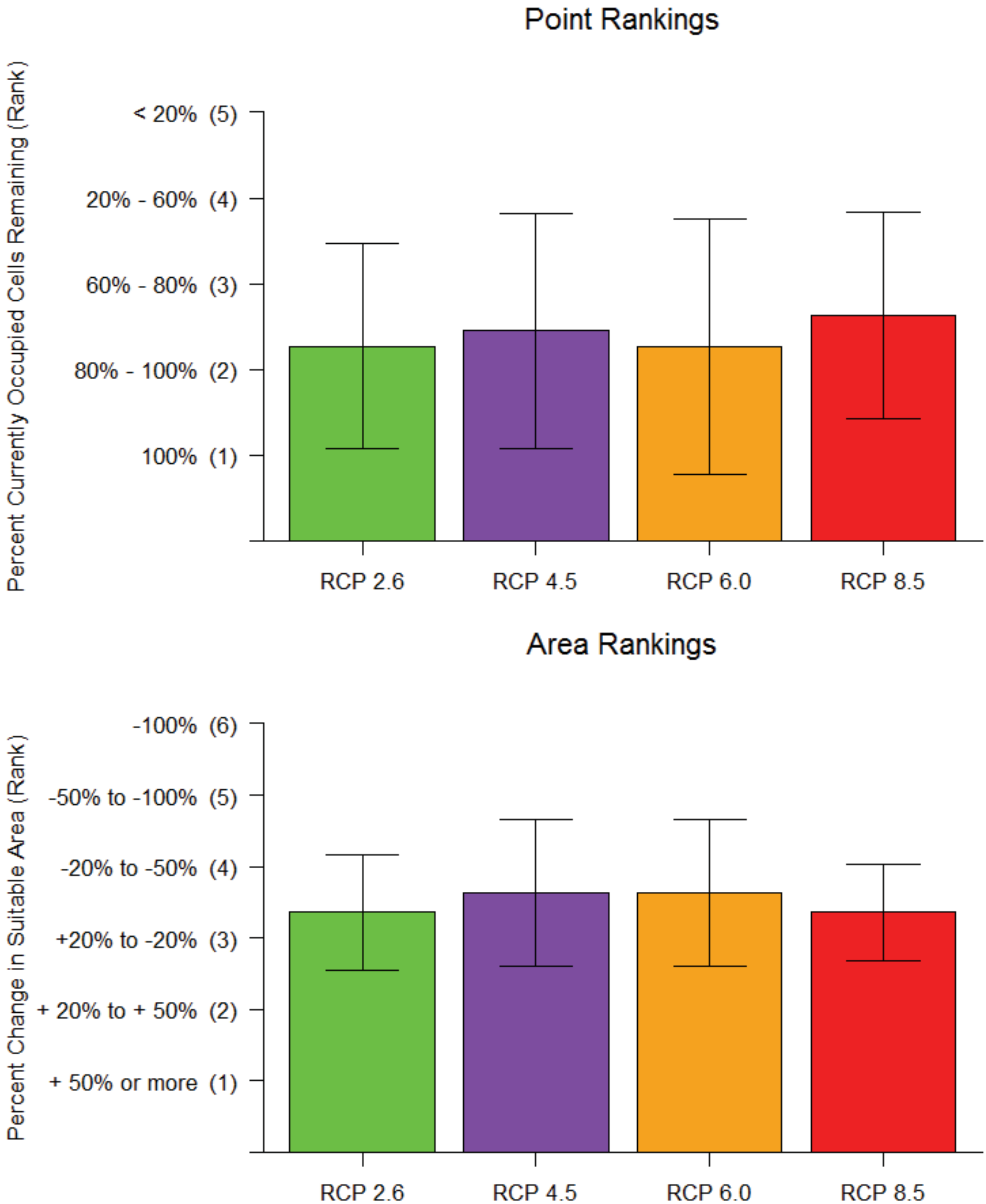


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Batrachoseps simatus* Kern Canyon Slender Salamander

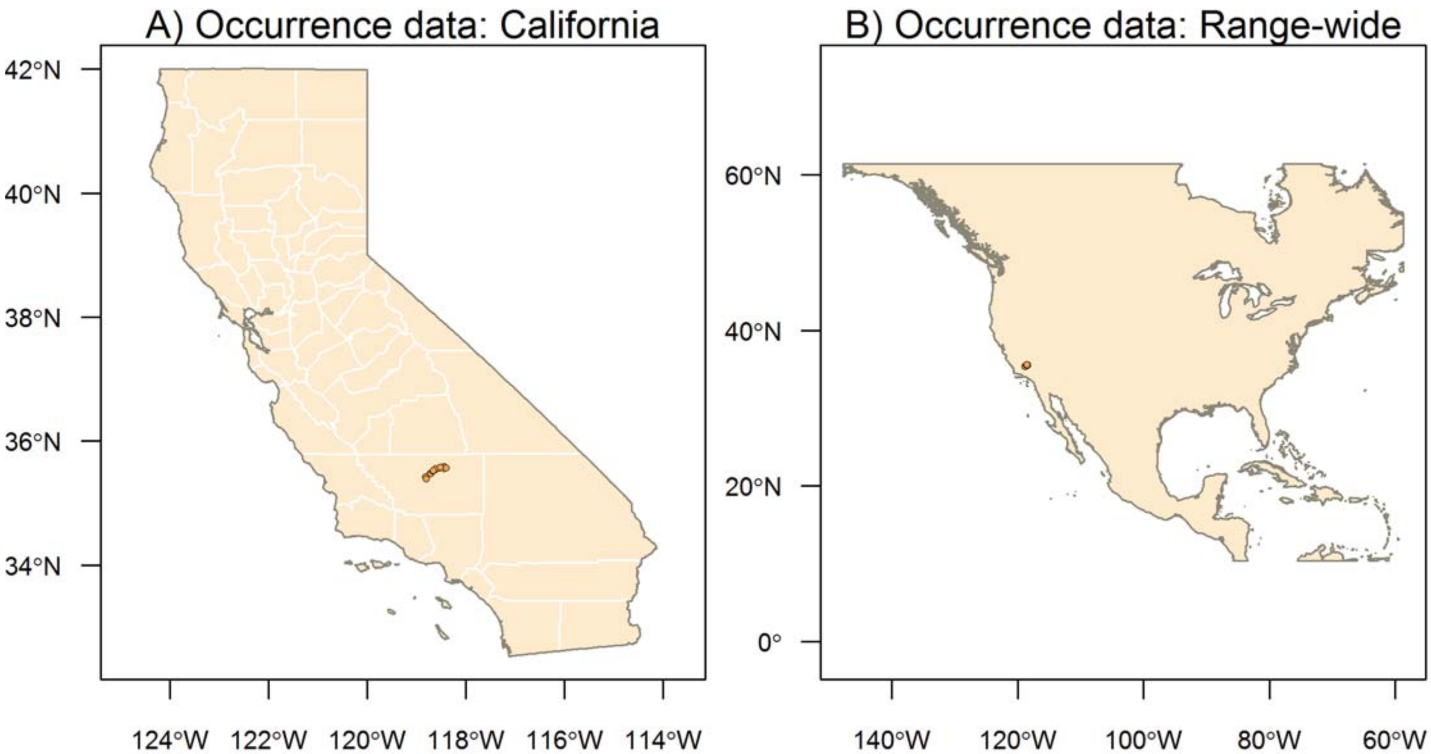


Figure 1. Occurrence data used to build Maxent models.

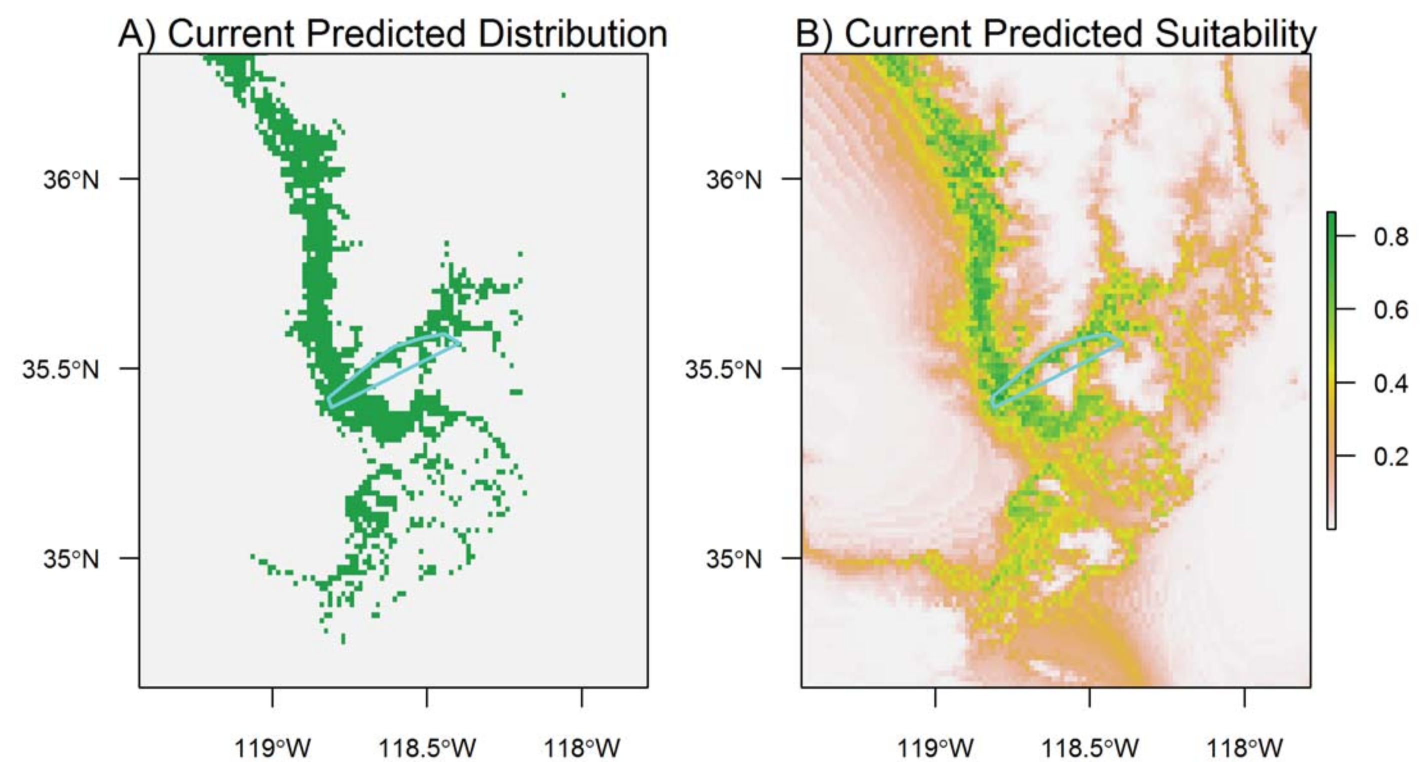


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Batrachoseps simatus* Kern Canyon Slender Salamander

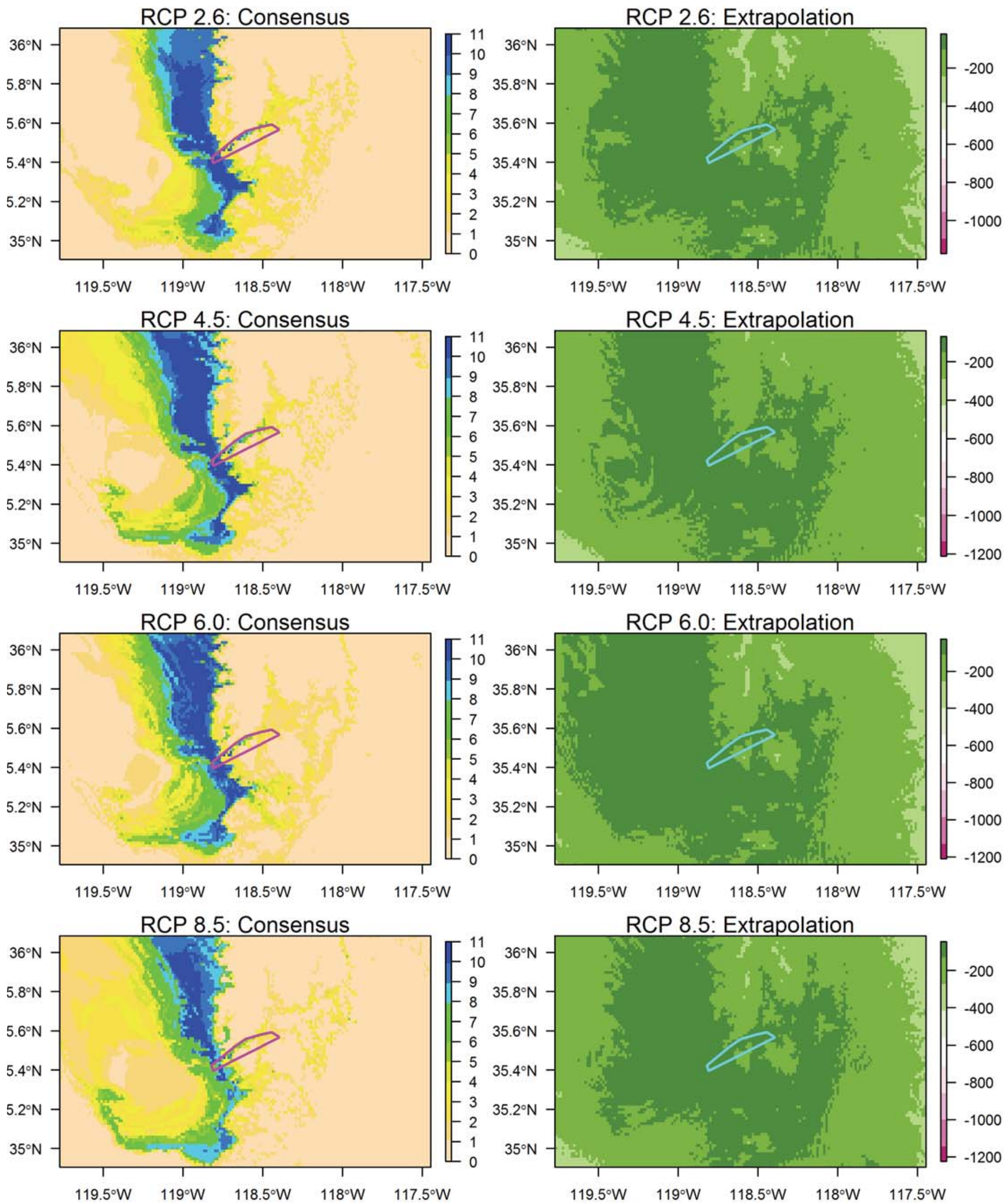


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

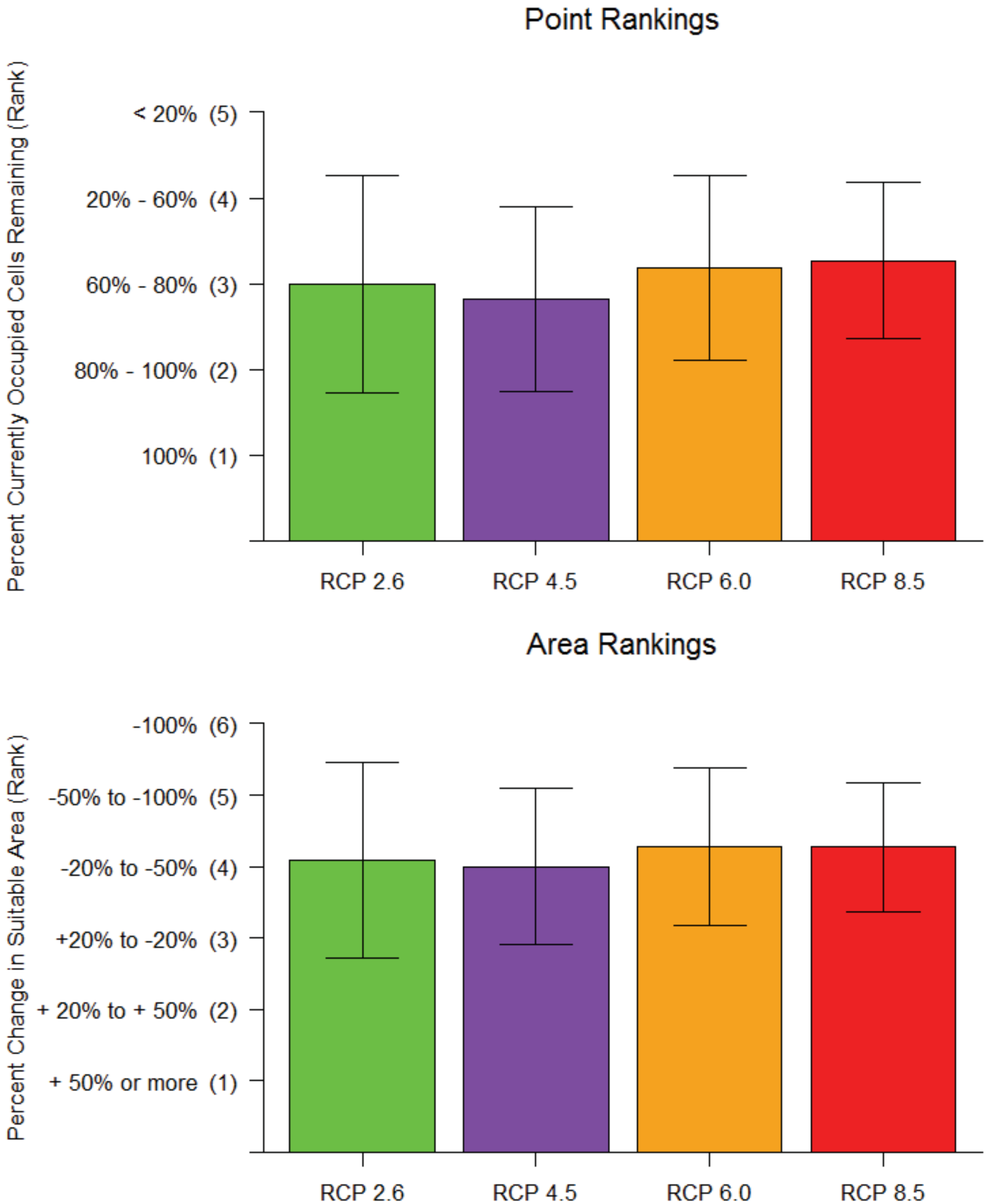


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

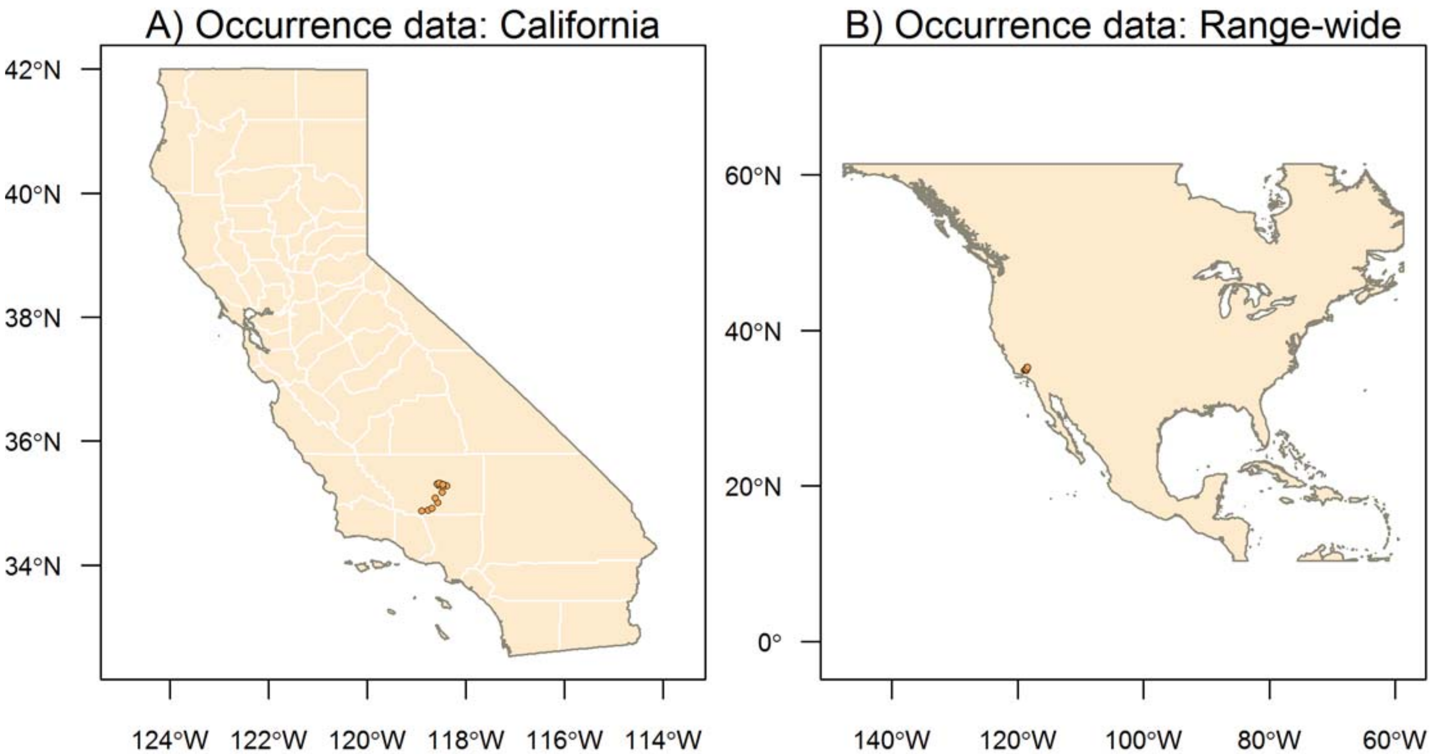
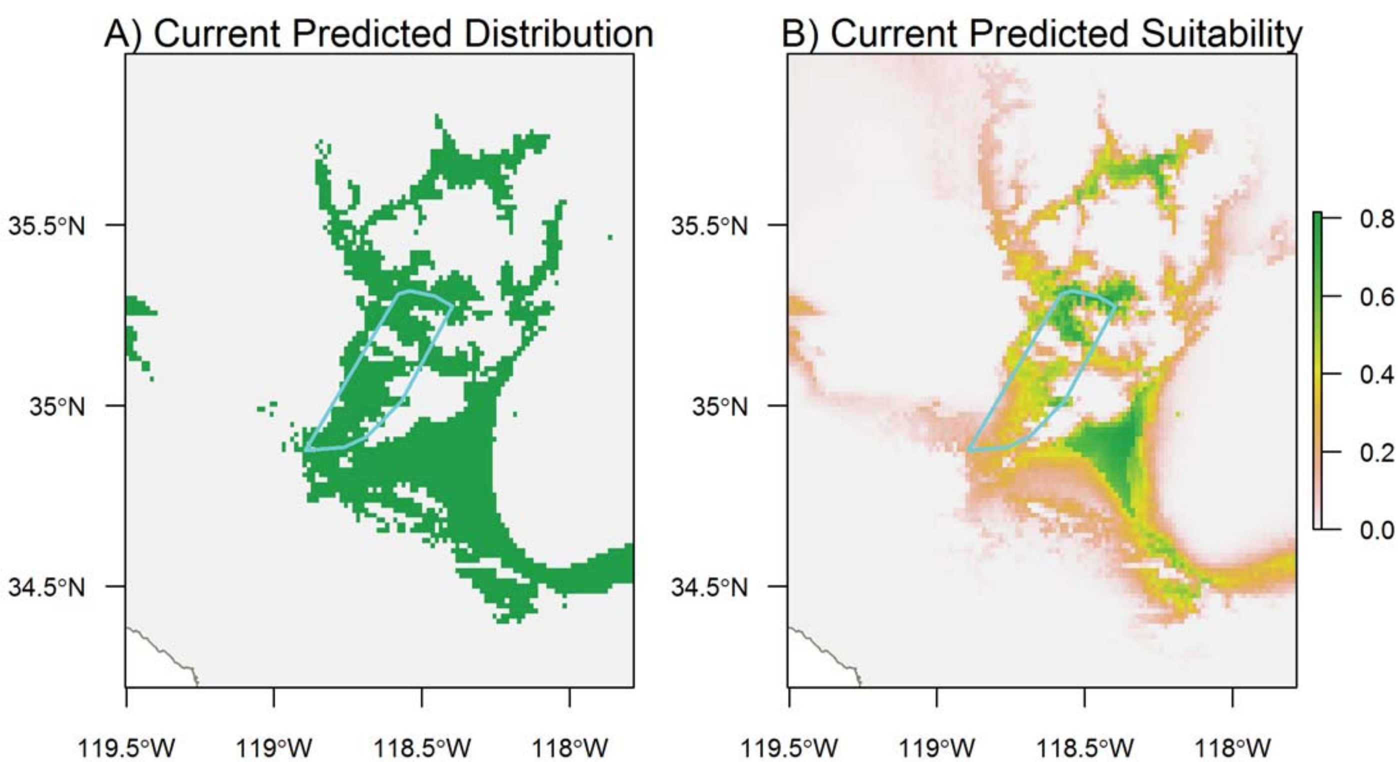


Figure 1. Occurrence data used to build Maxent models.



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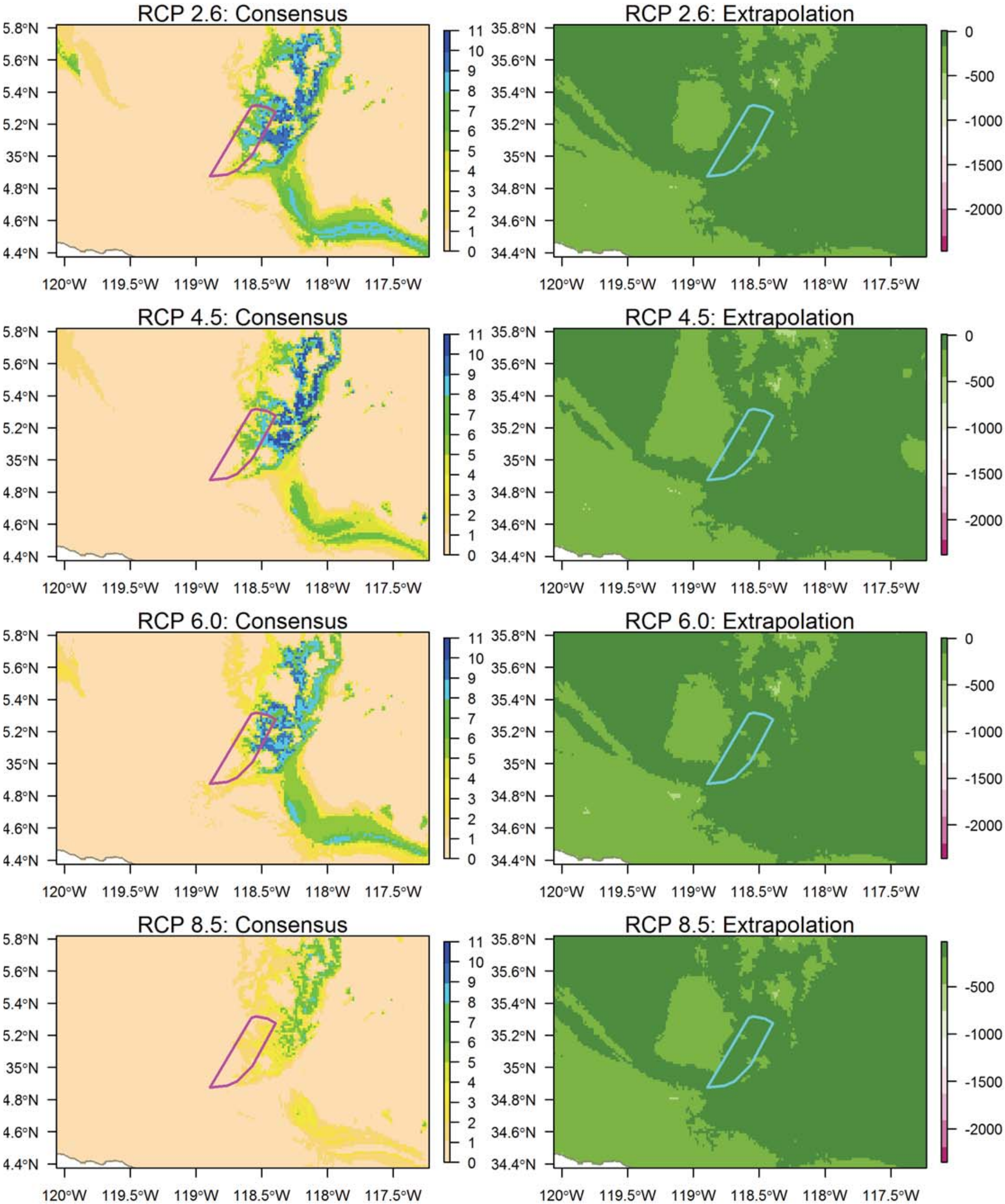


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

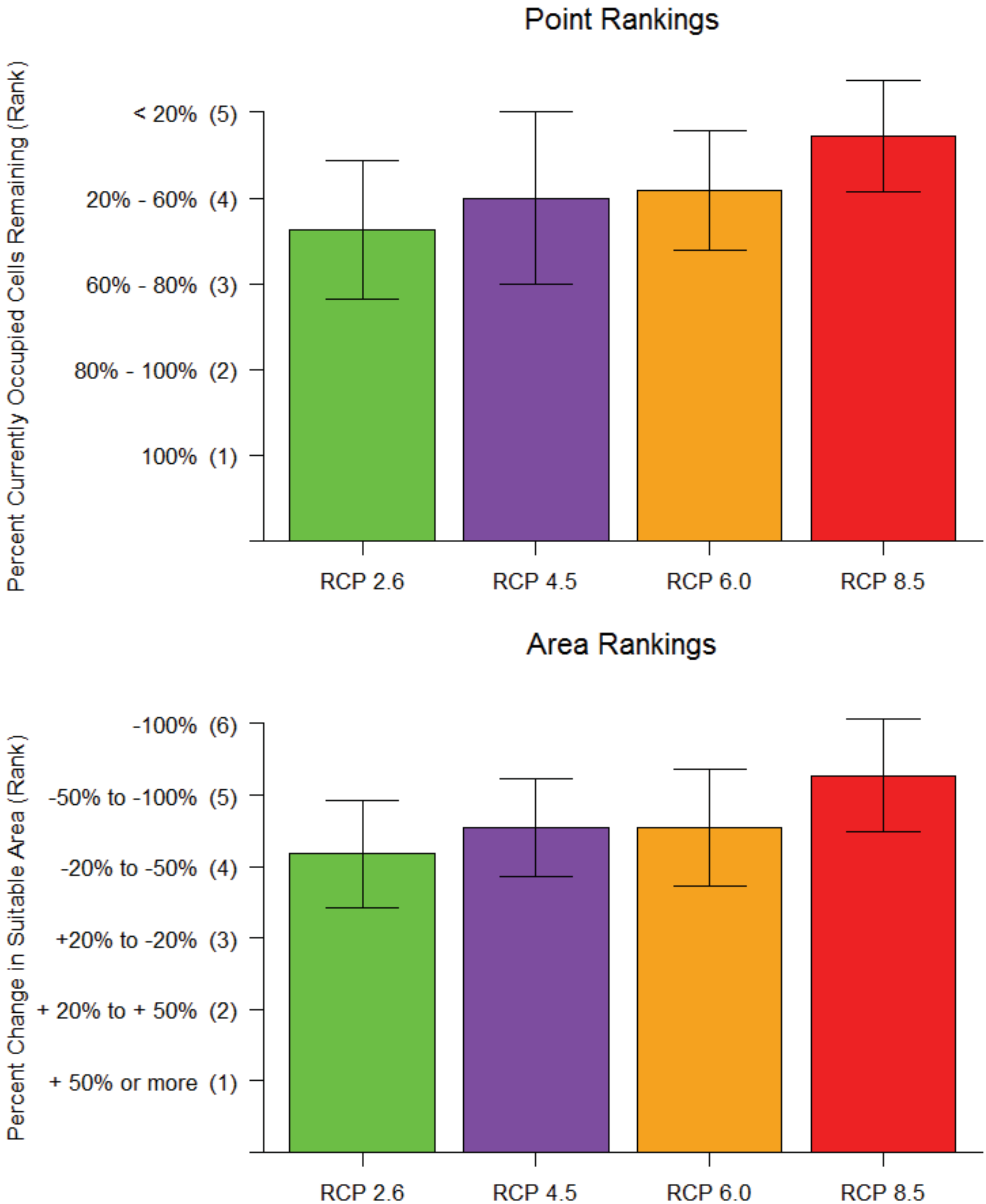


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bogertophis rosaliae* Baja Rat Snake

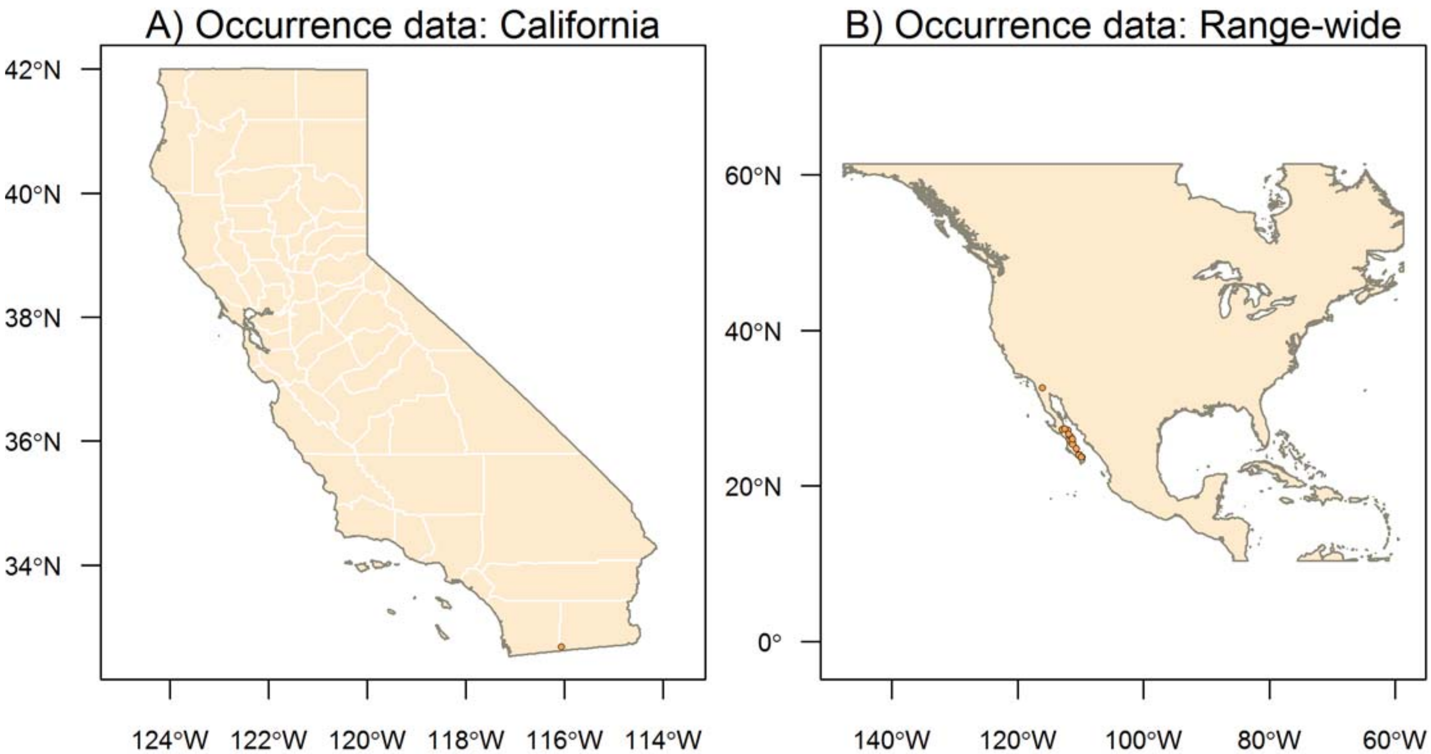


Figure 1. Occurrence data used to build Maxent models.

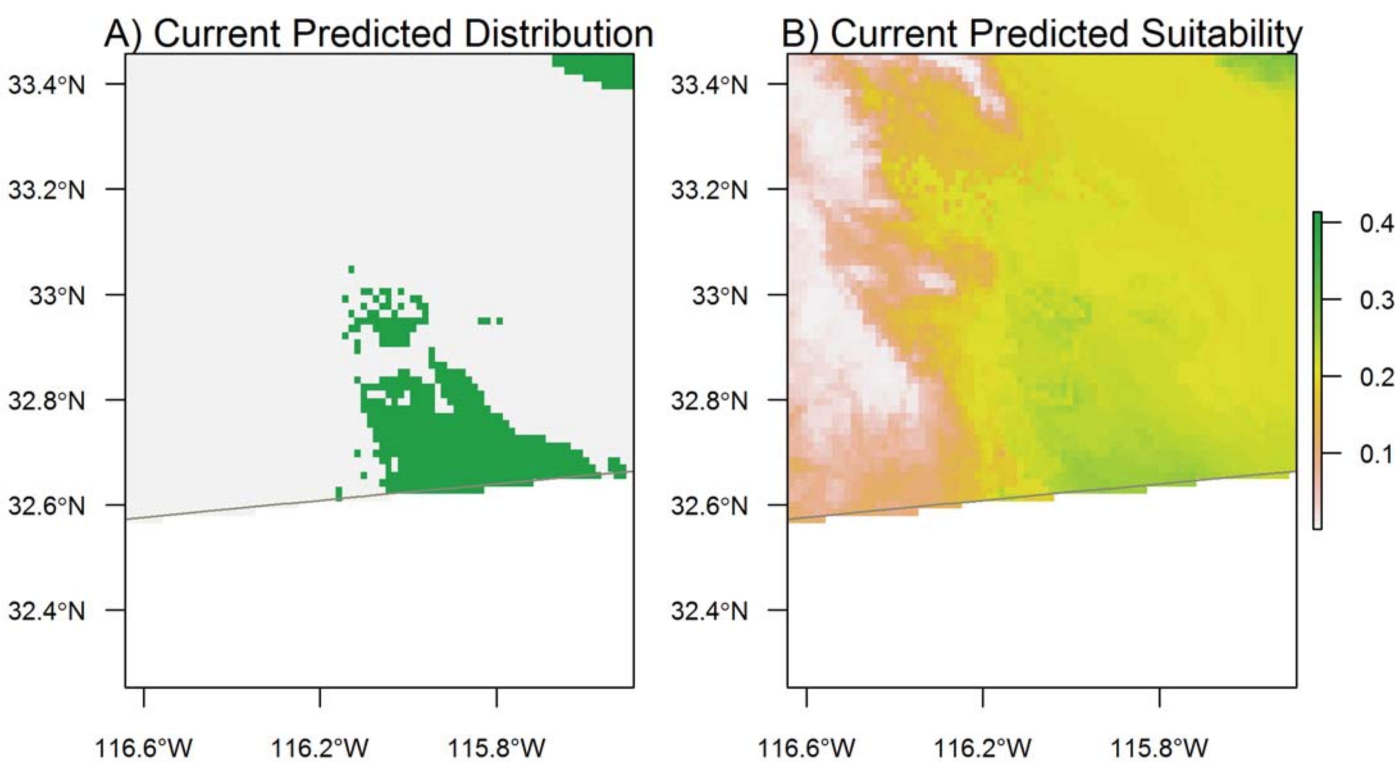


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Bogertophis rosaliae* Baja Rat Snake

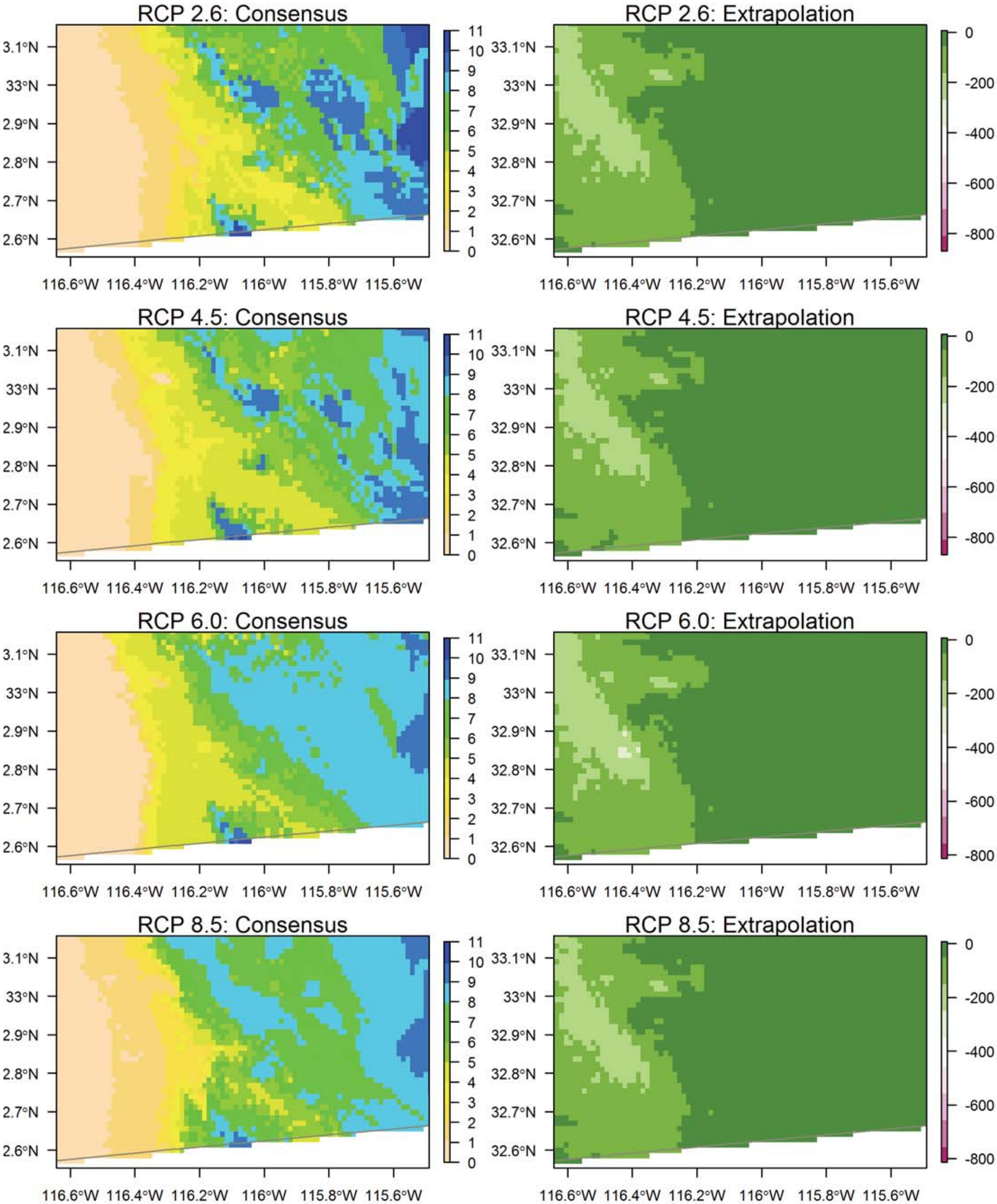


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set.

Species Results: *Bogertophis rosaliae* Baja Rat Snake

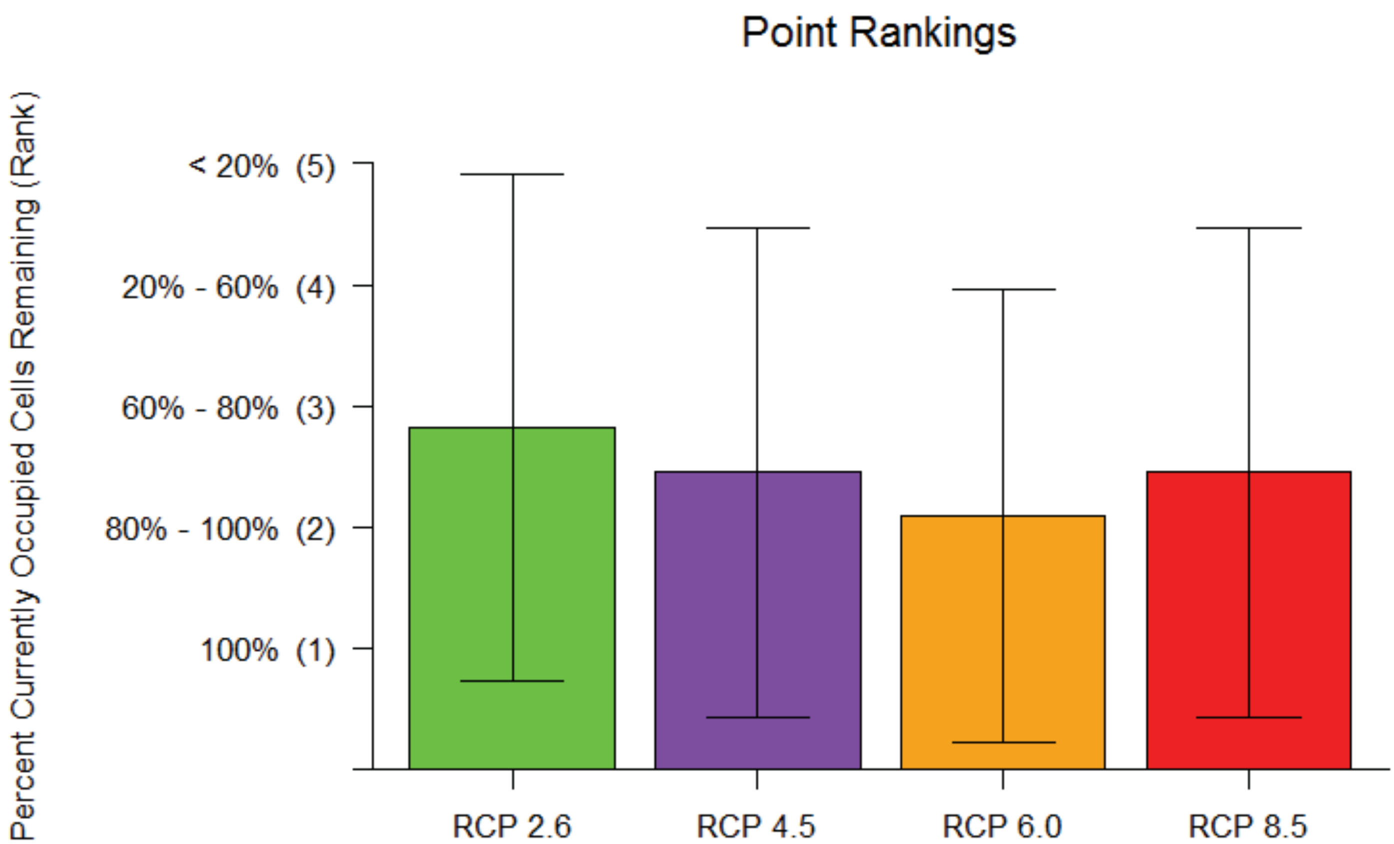


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings were not calculated for this species because it has too few occurrences in California to construct a minimum convex polygon. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo alvarius* Sonoran Desert Toad

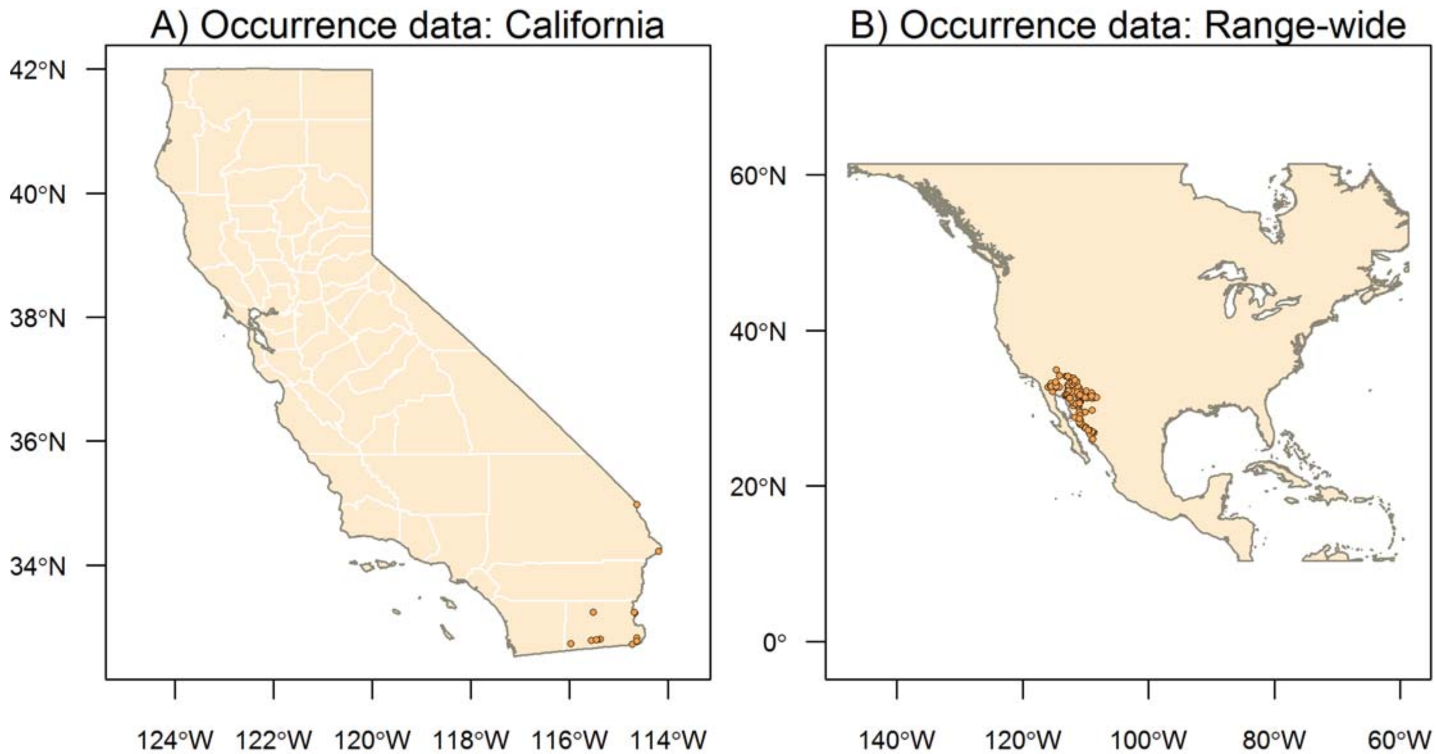


Figure 1. Occurrence data used to build Maxent models.

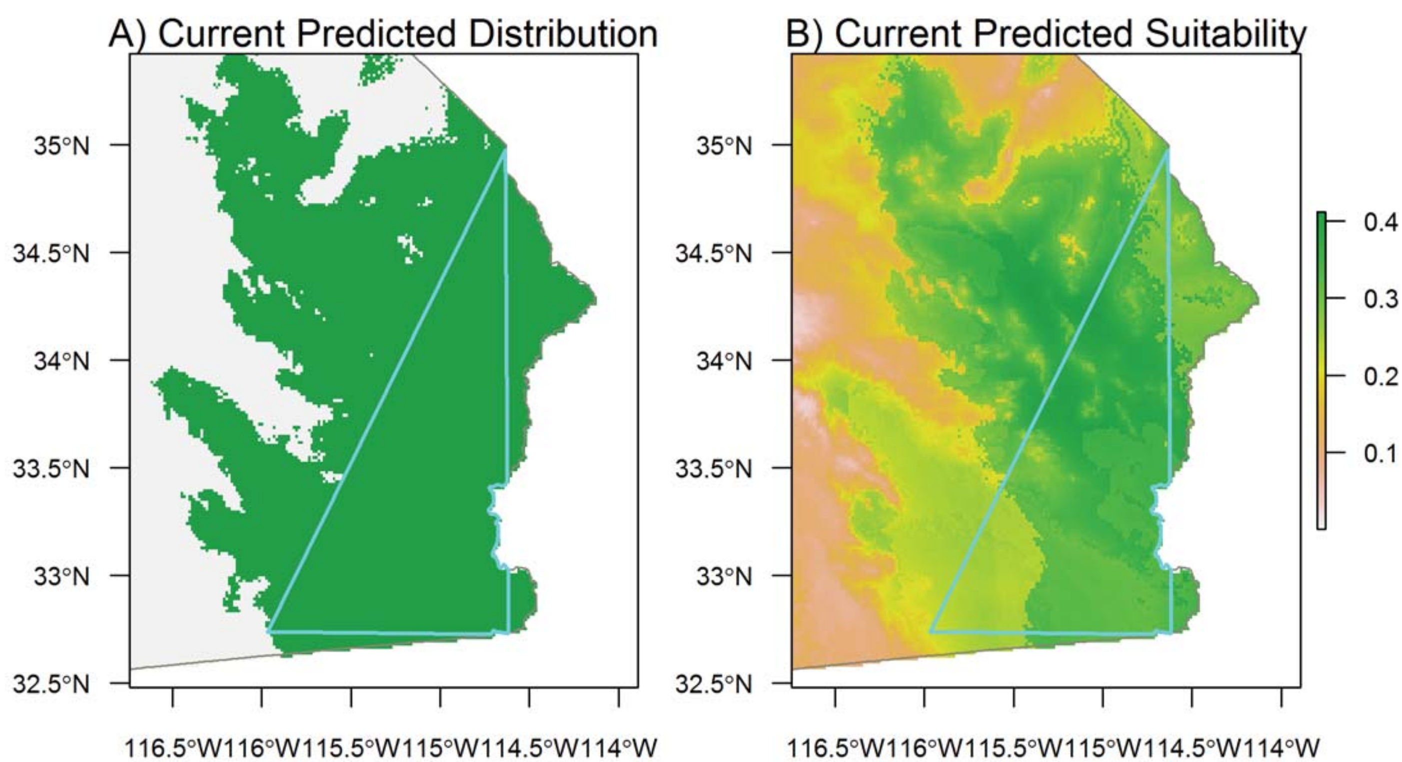


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

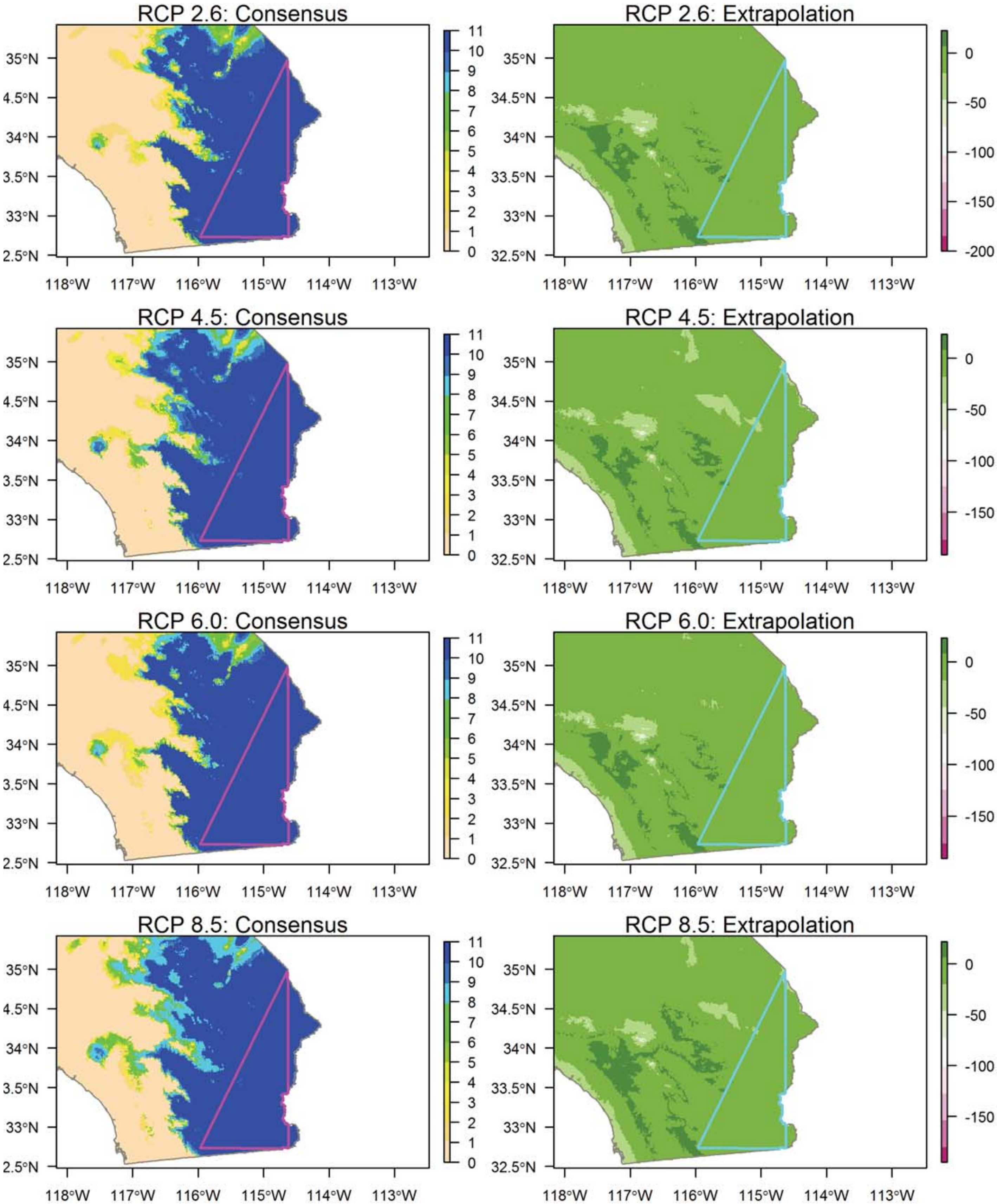
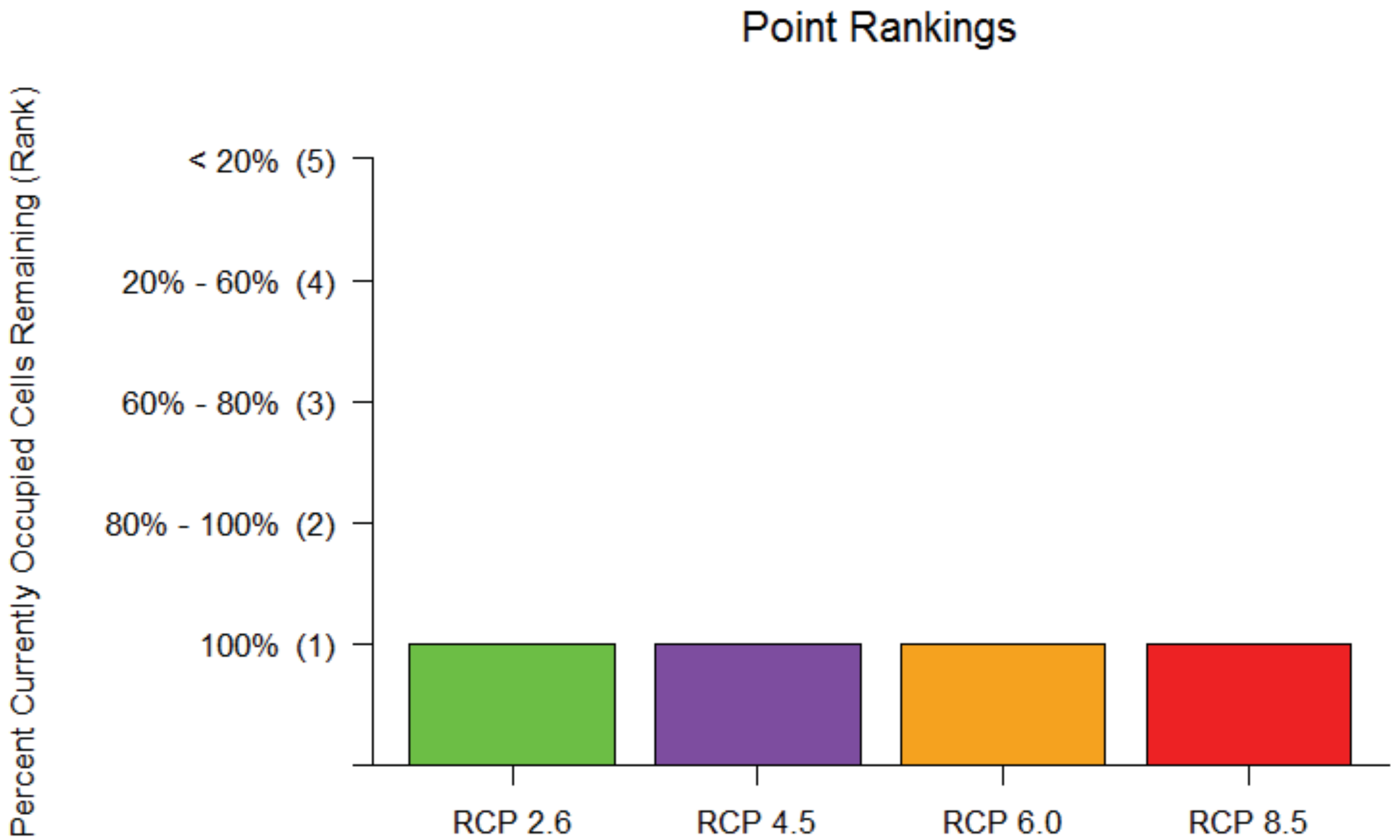


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.



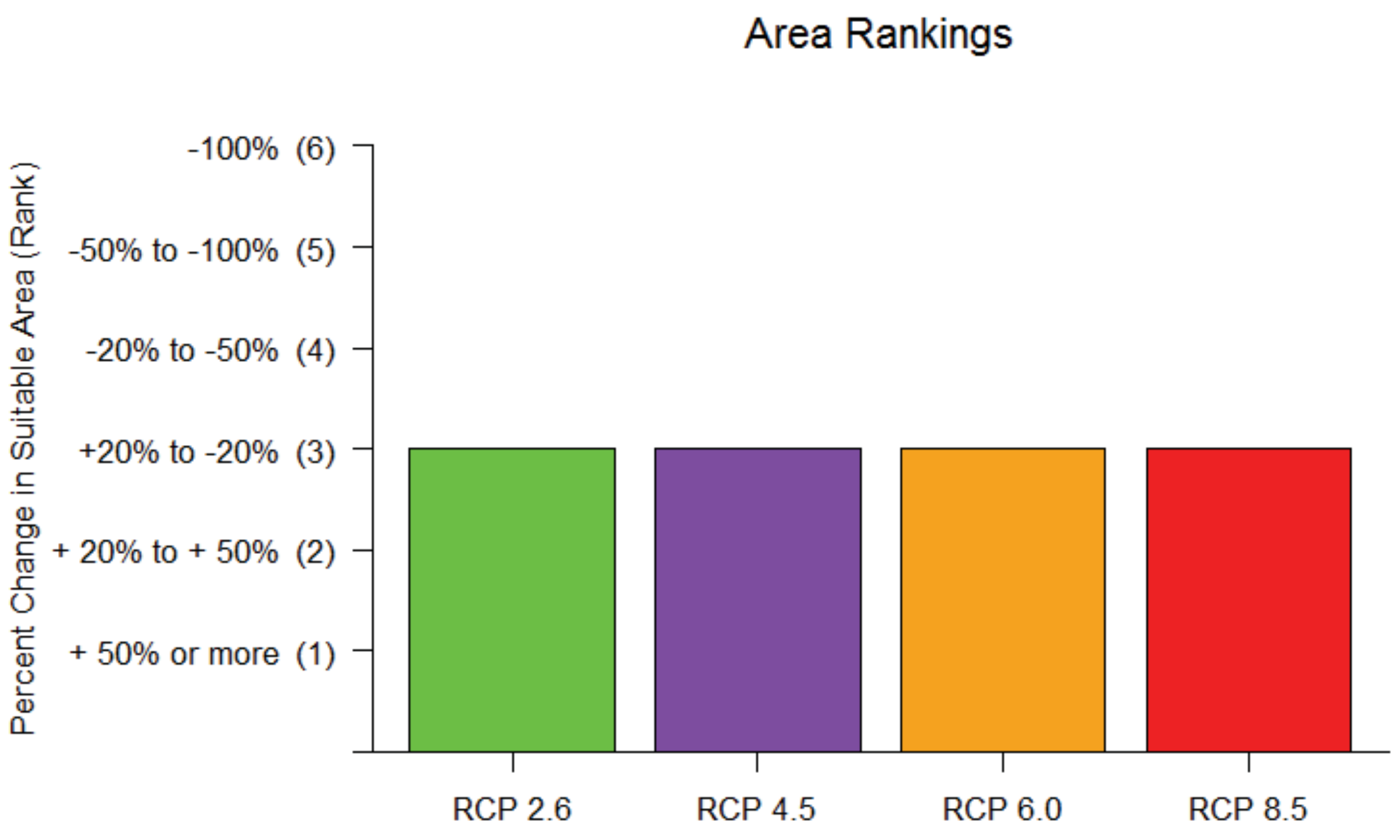


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo boreas* Western Toad

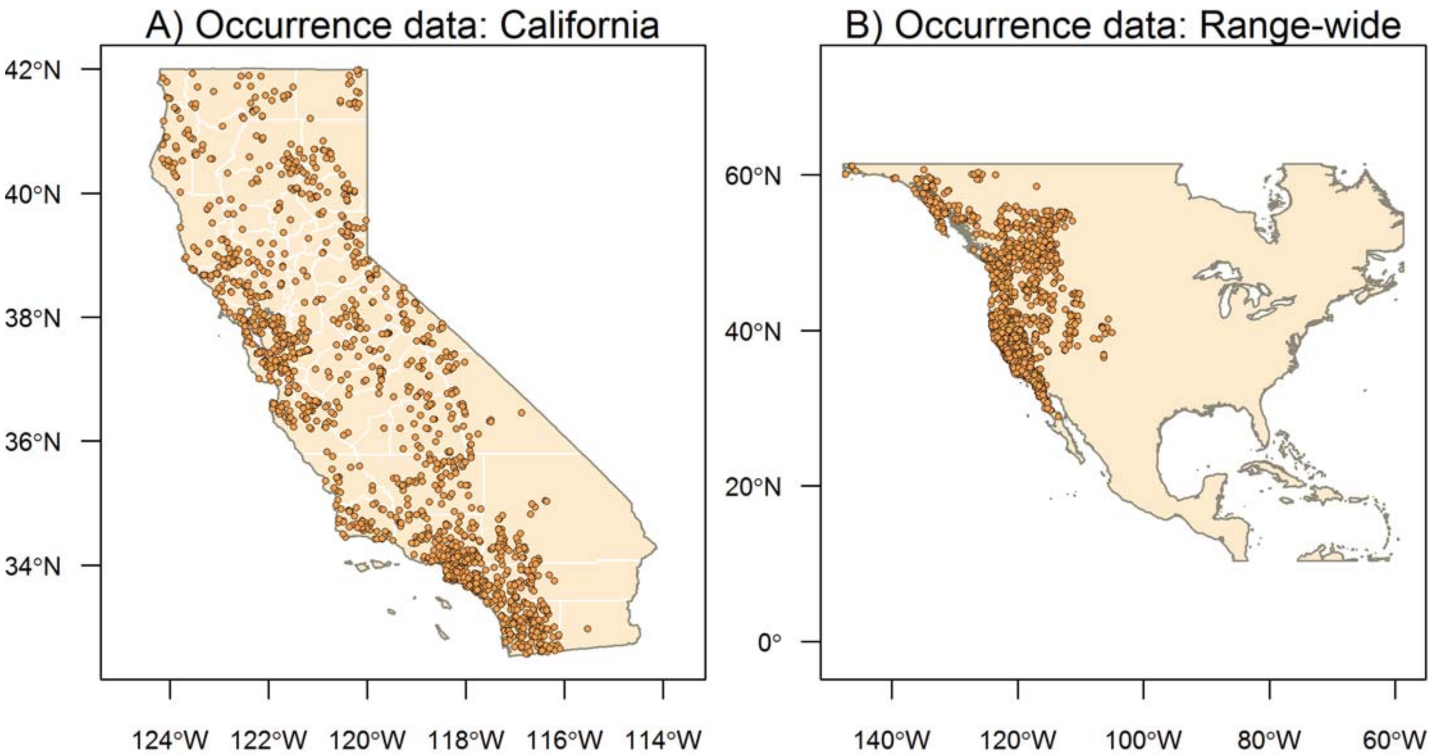
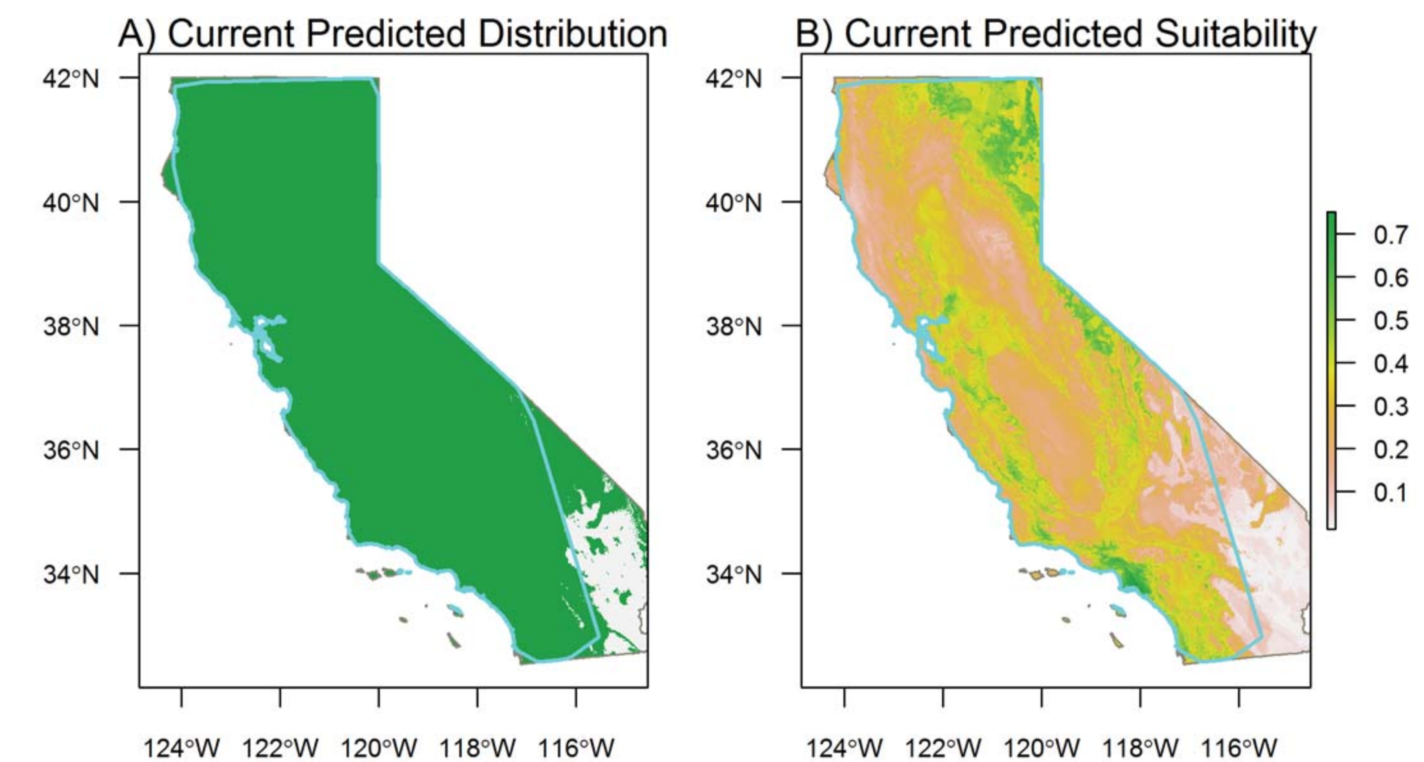


Figure 1. Occurrence data used to build Maxent models.



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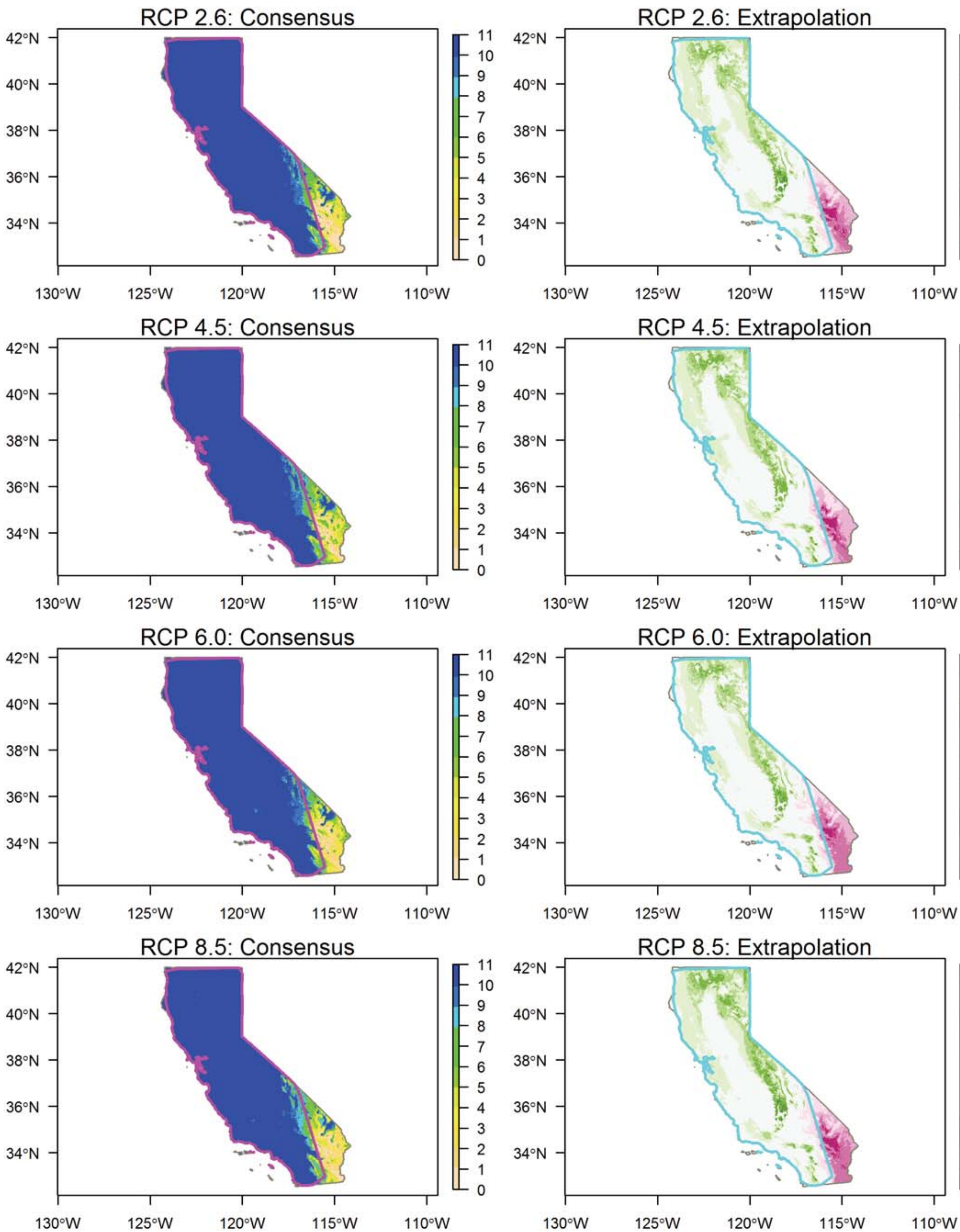
Species Results: *Bufo boreas* Western Toad



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Species Results: *Bufo boreas* Western Toad

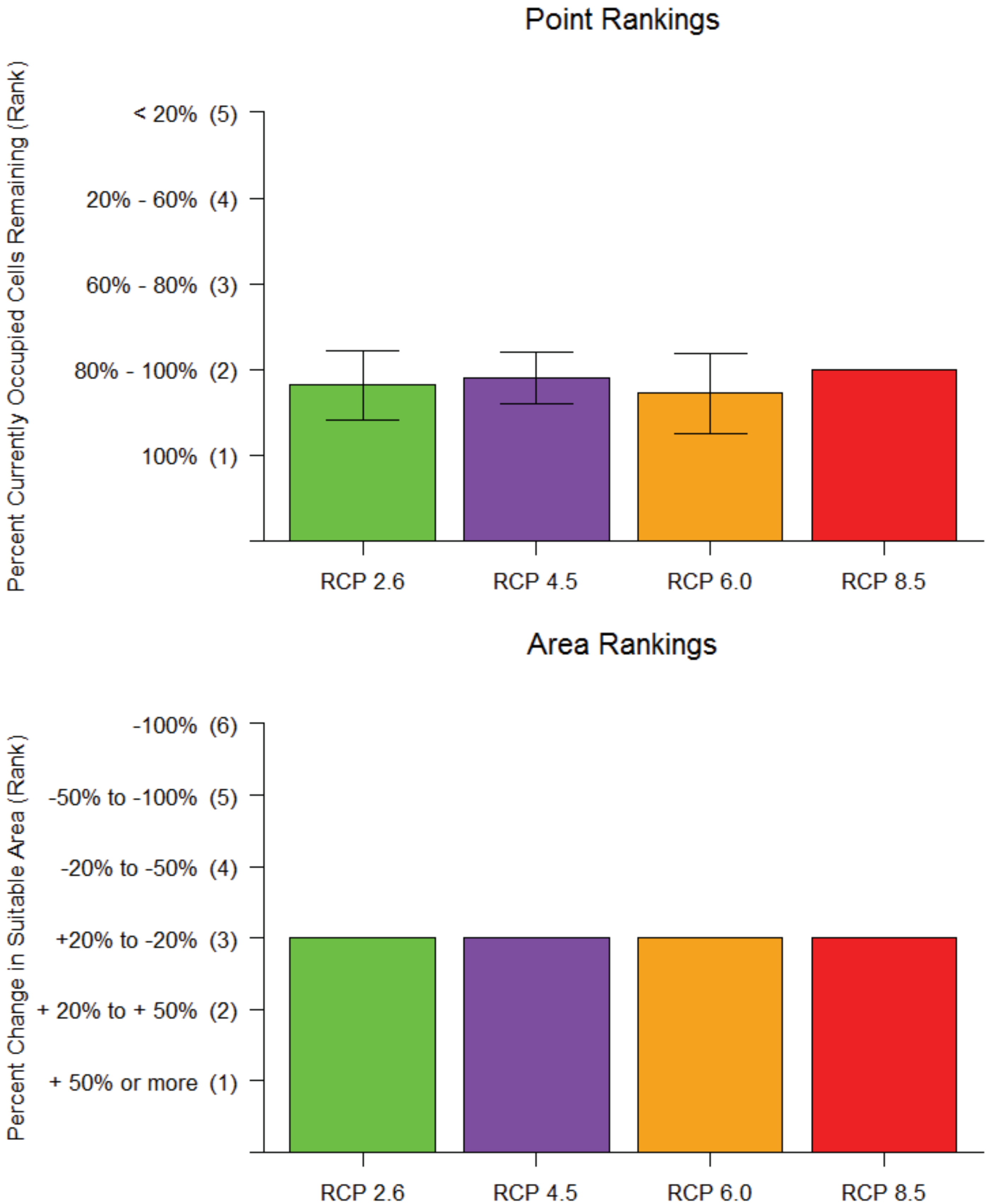


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo californicus* Arroyo Toad

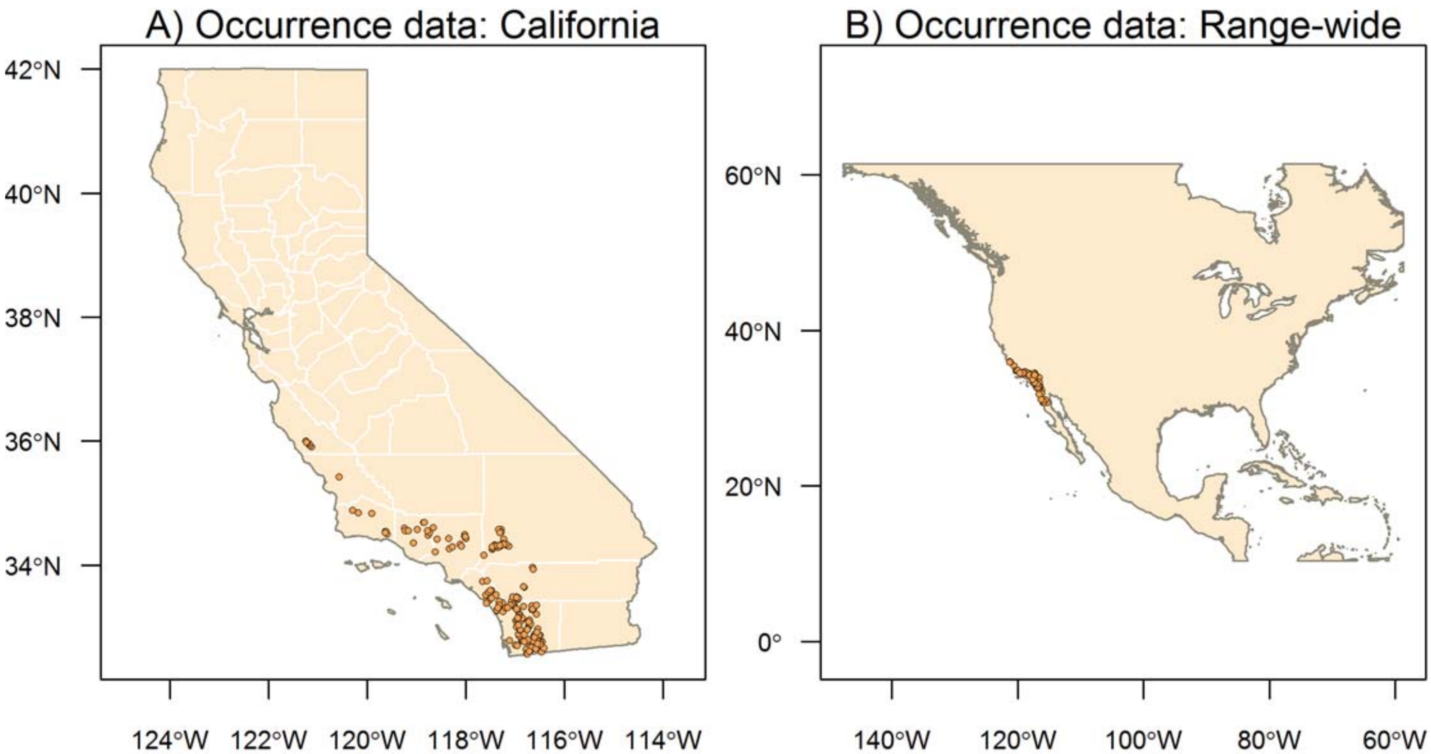
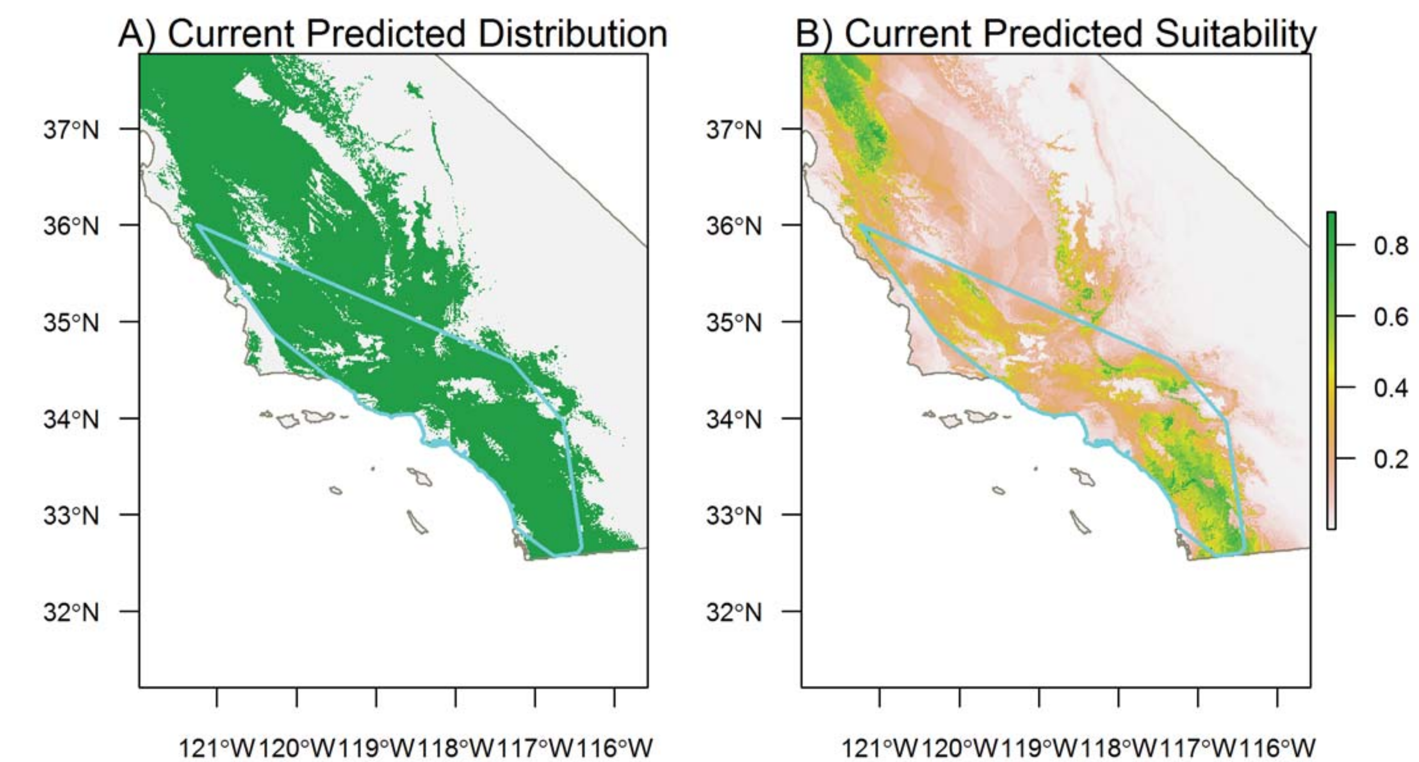


Figure 1. Occurrence data used to build Maxent models.



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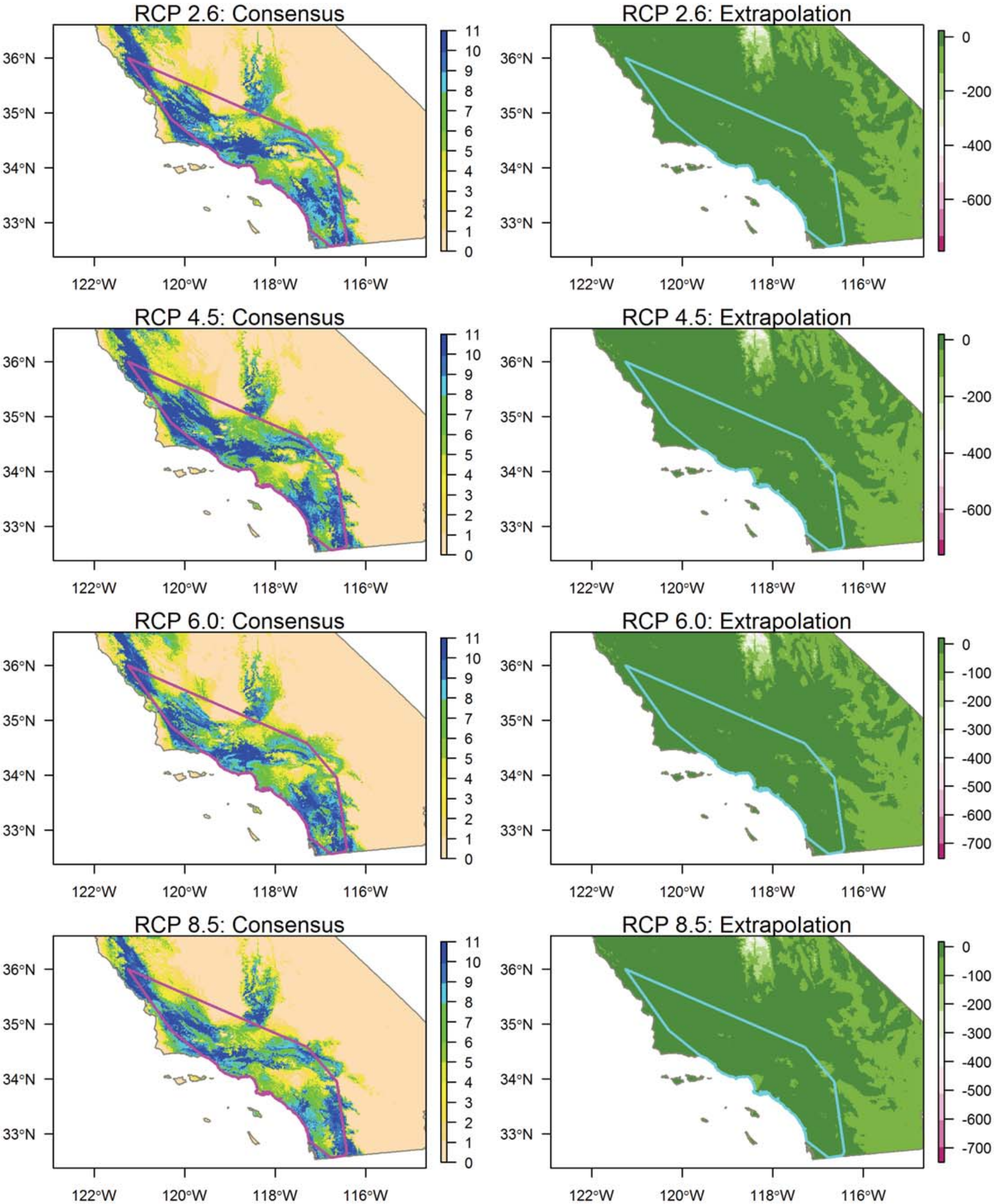
Species Results: *Bufo californicus* Arroyo Toad



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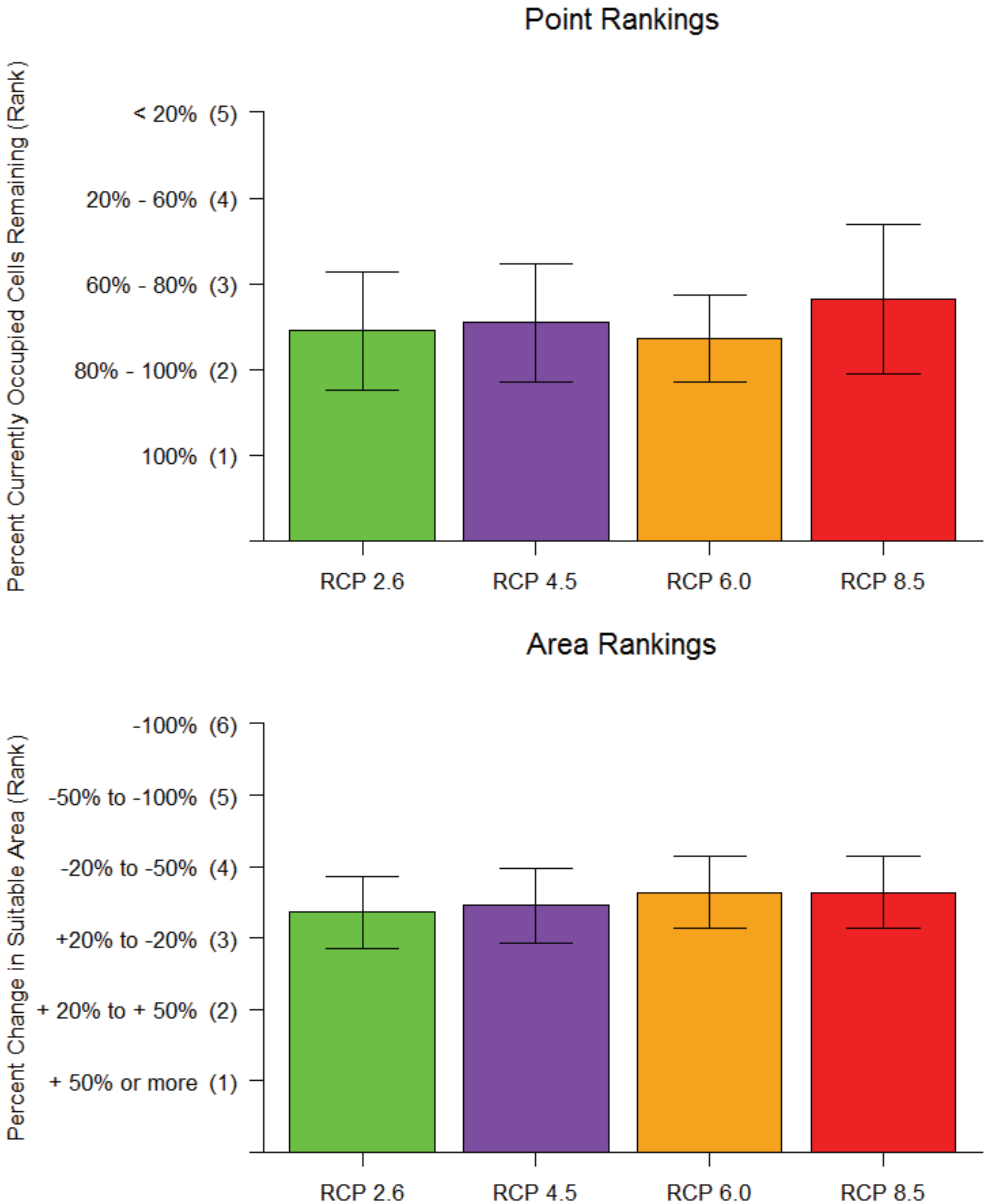


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo canorus* Yosemite Toad

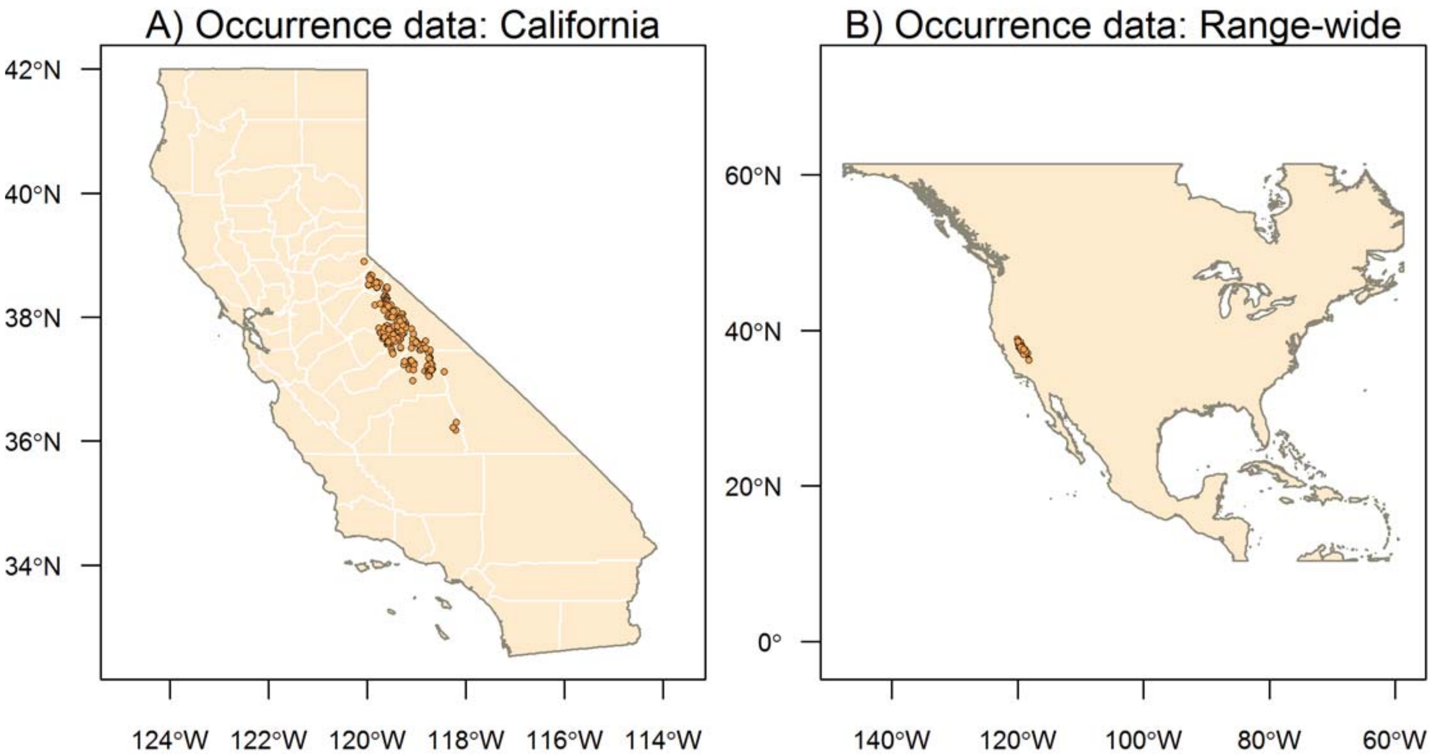
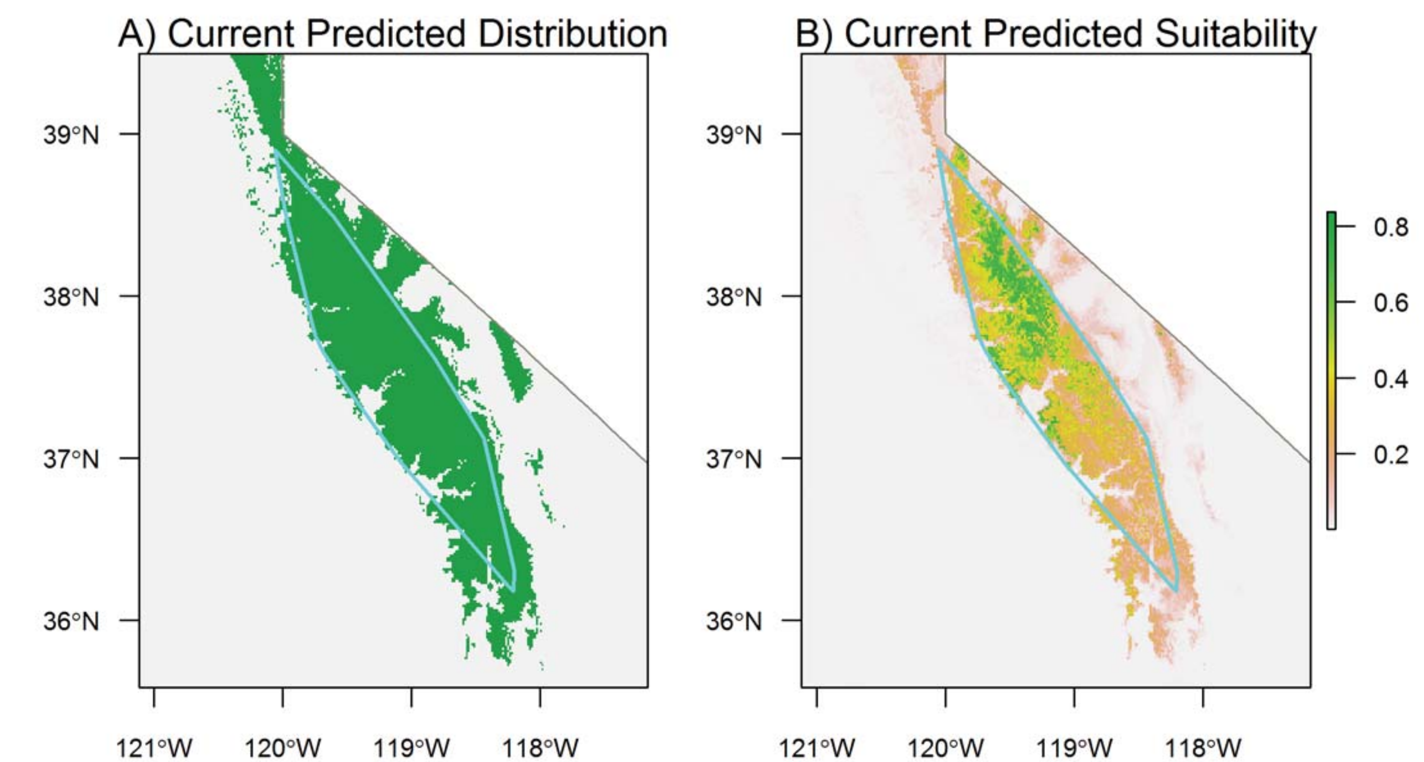


Figure 1. Occurrence data used to build Maxent models.



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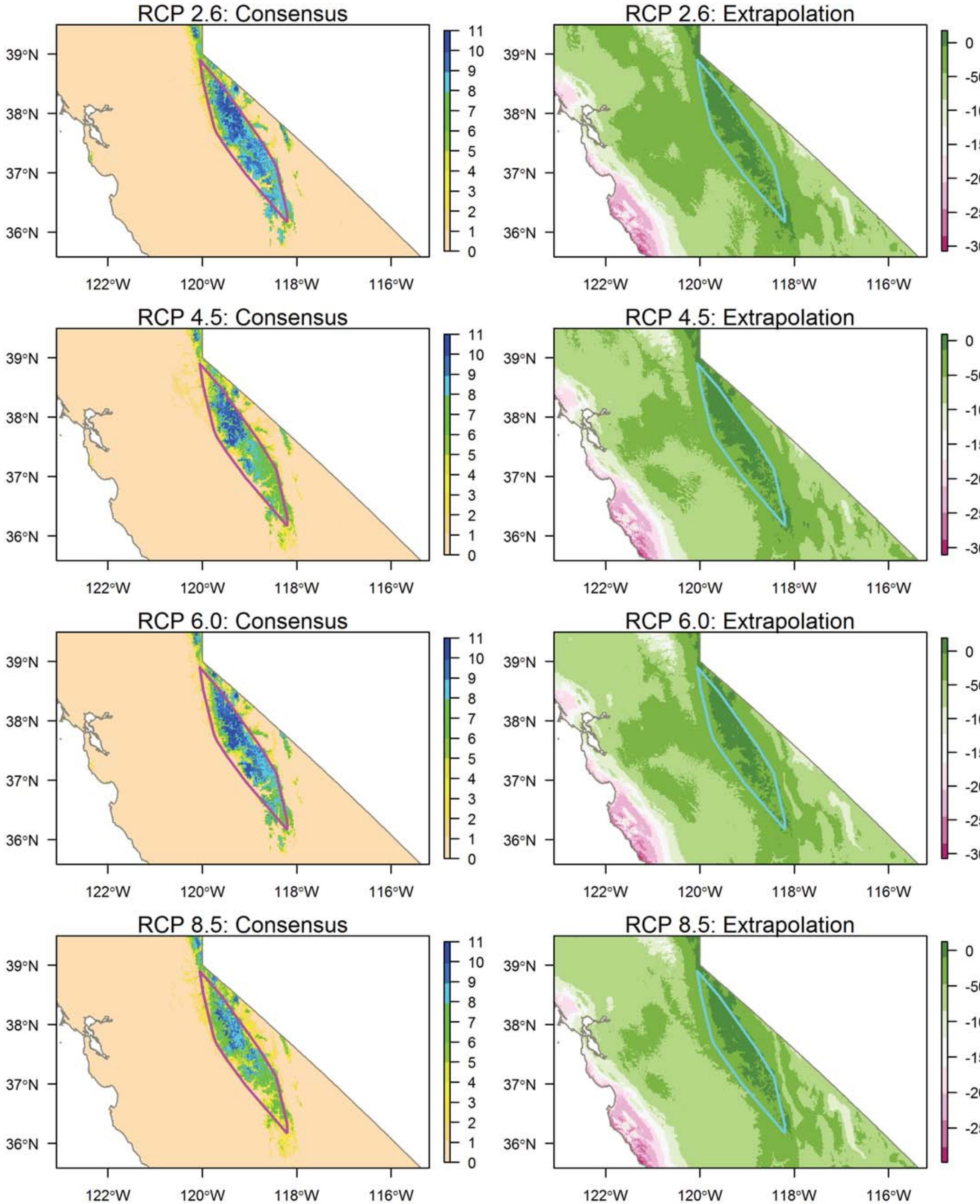
Species Results: *Bufo canorus* Yosemite Toad



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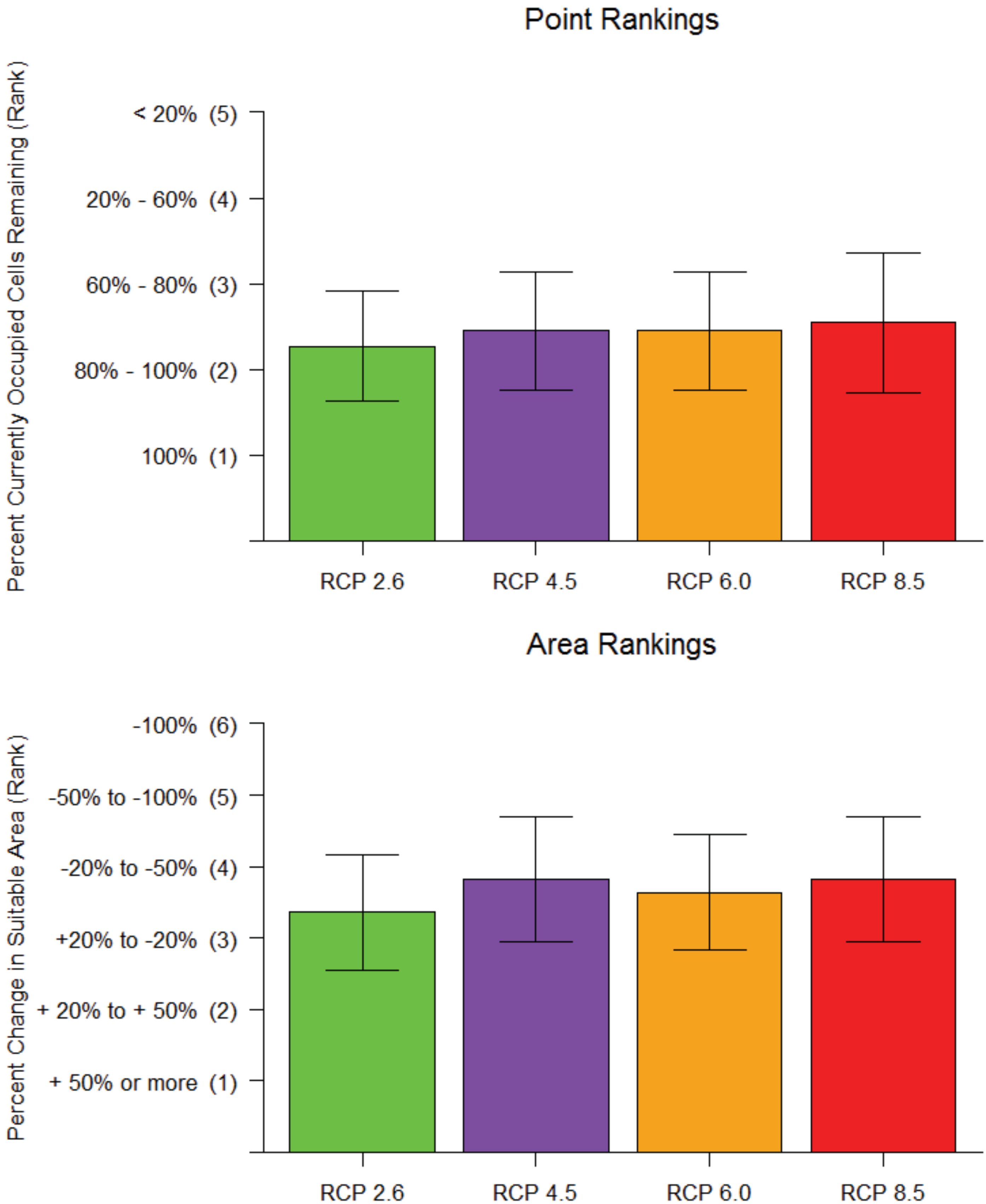
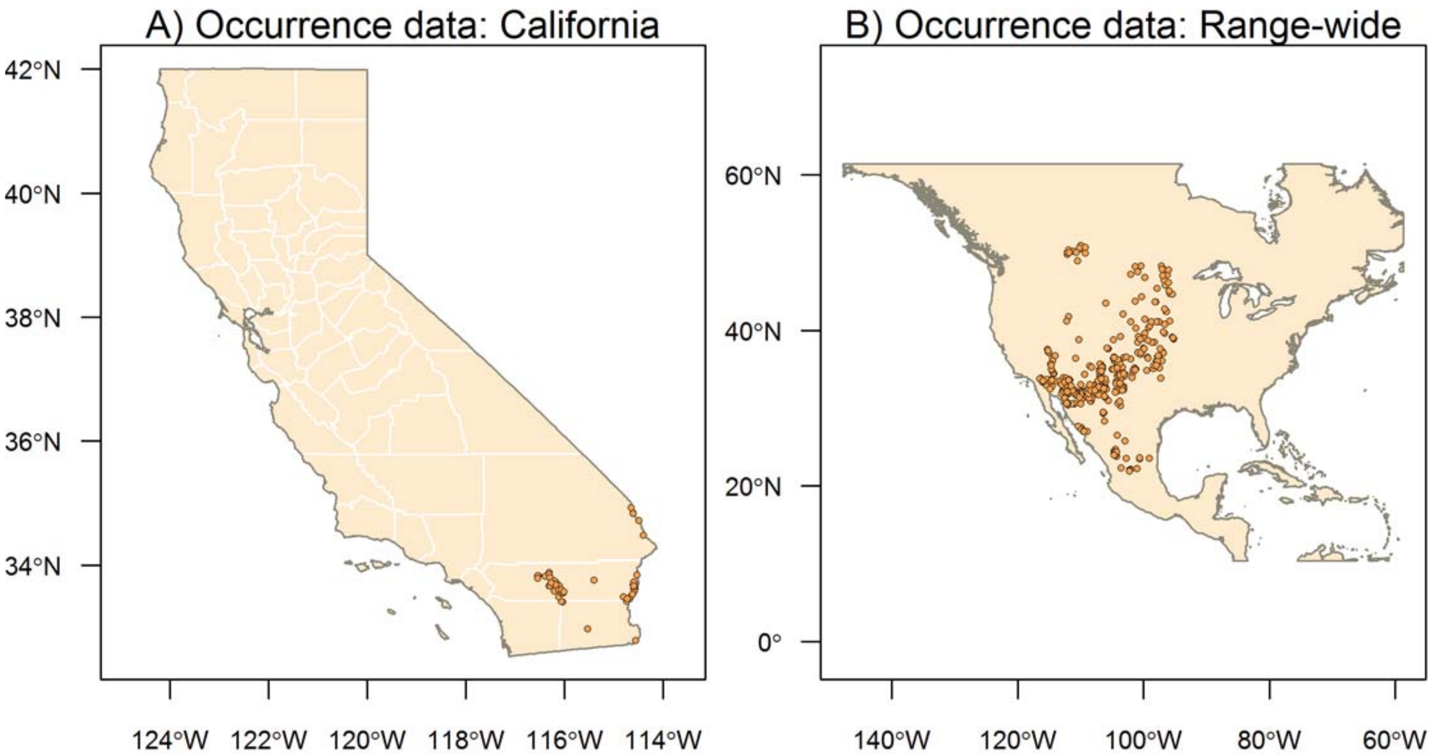


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo cognatus* Great Plains Toad



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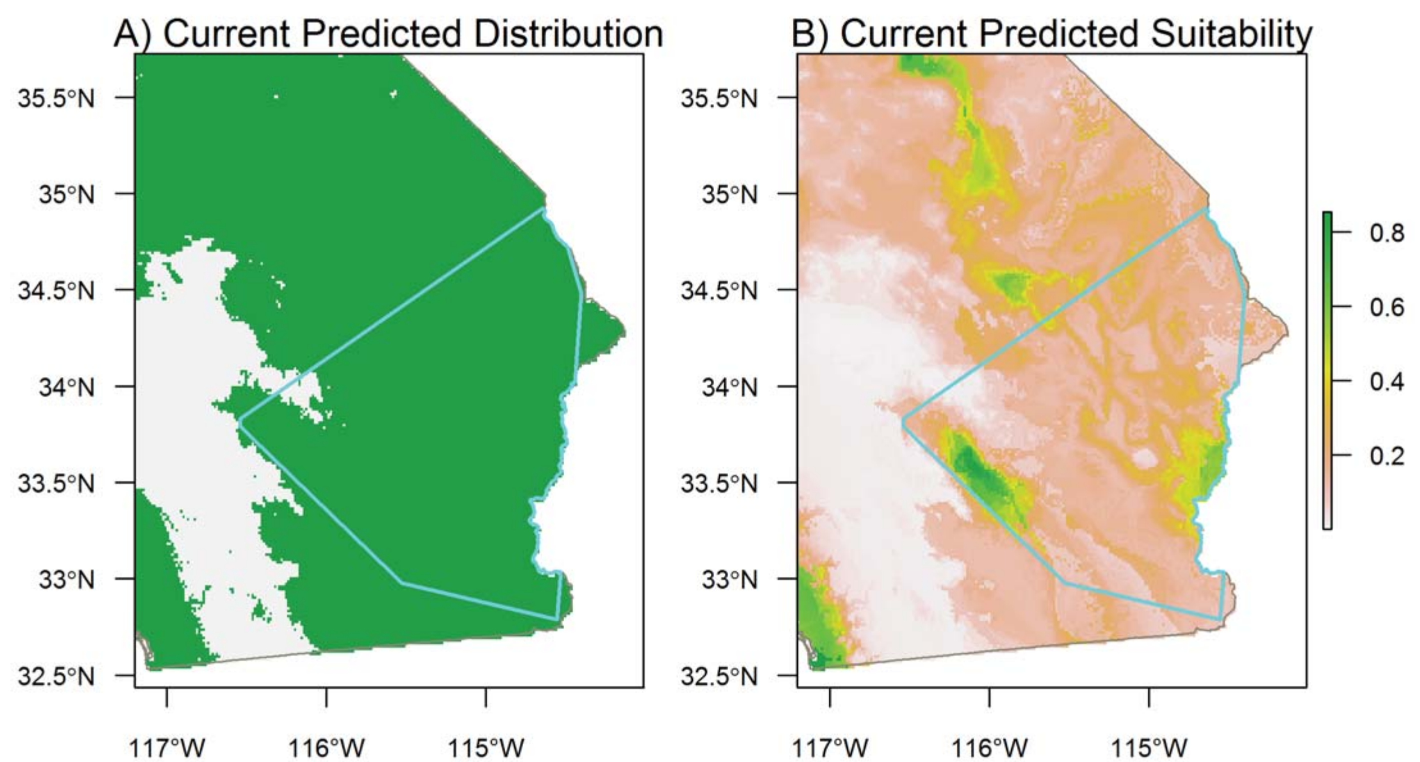

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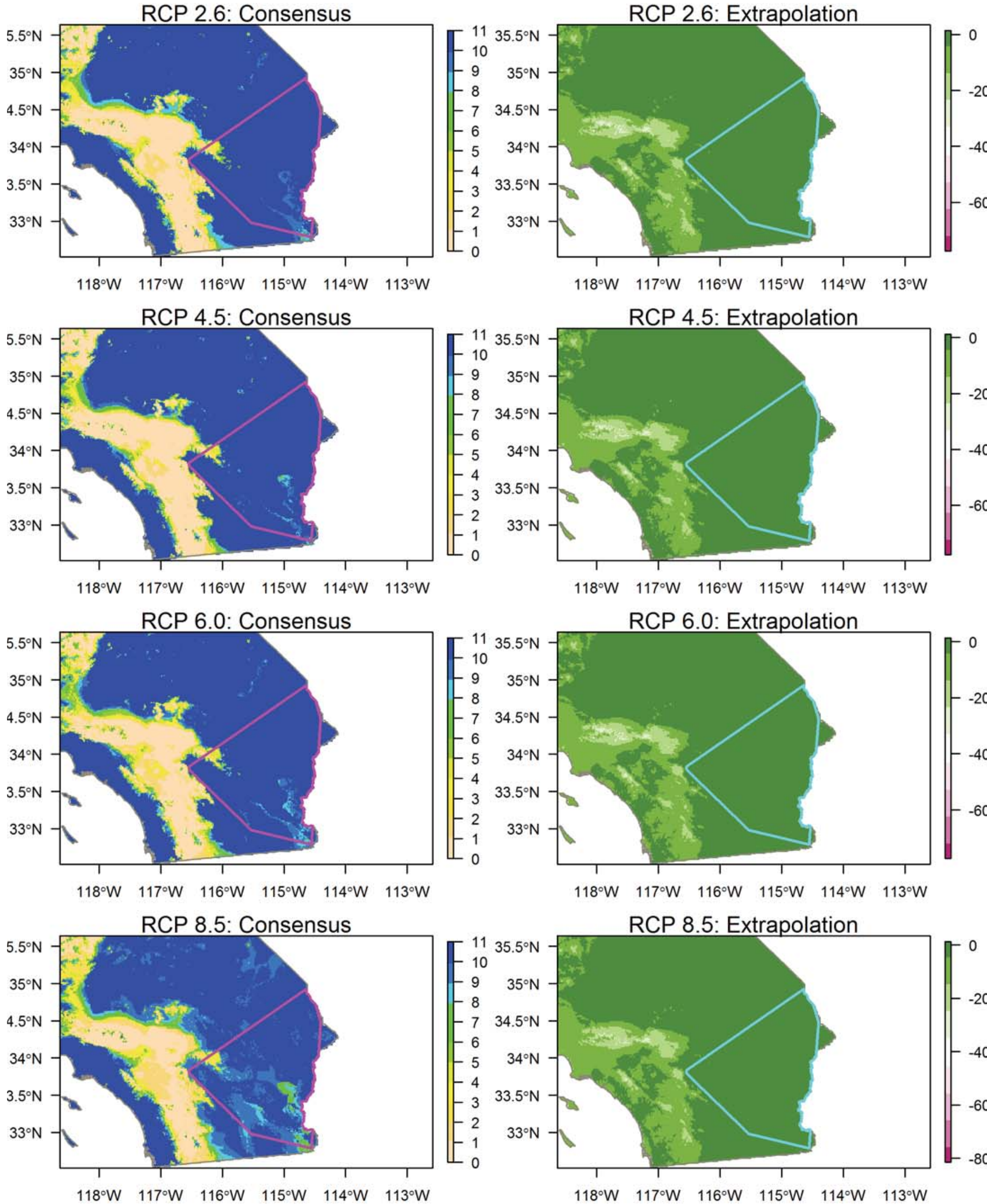
Species Results: *Bufo cognatus* Great Plains Toad



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Species Results: *Bufo cognatus* Great Plains Toad

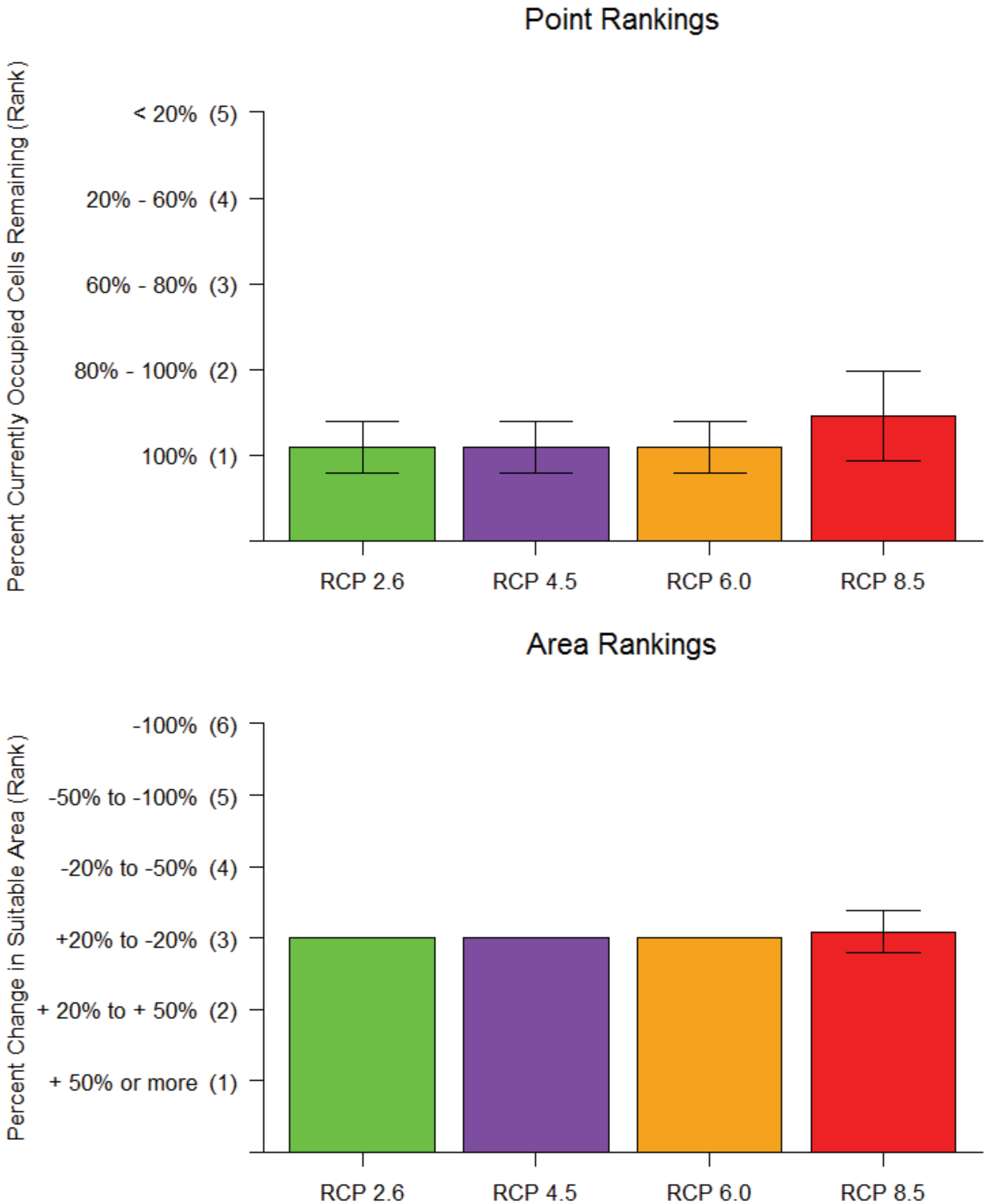

Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo exsul* Black Toad

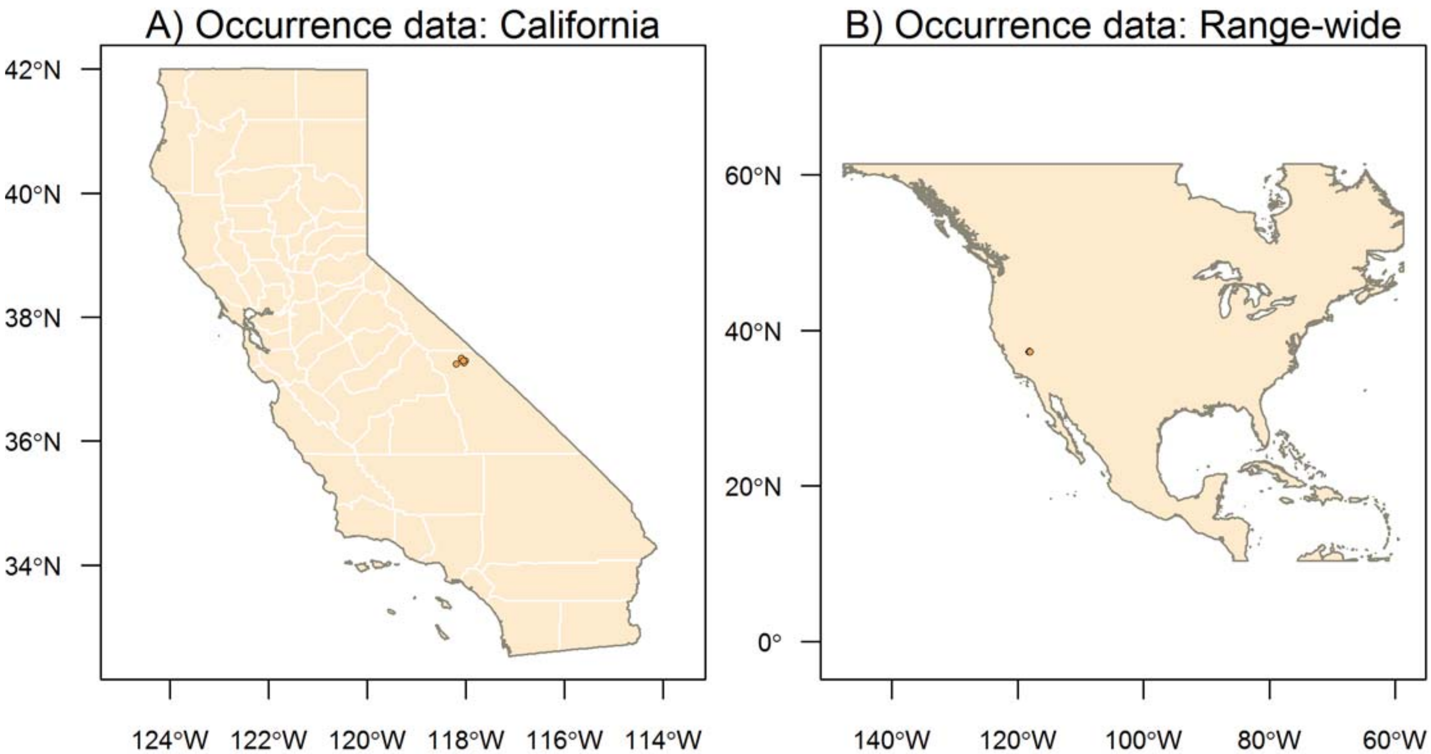

Figure 1. Occurrence data used to build Maxent models.

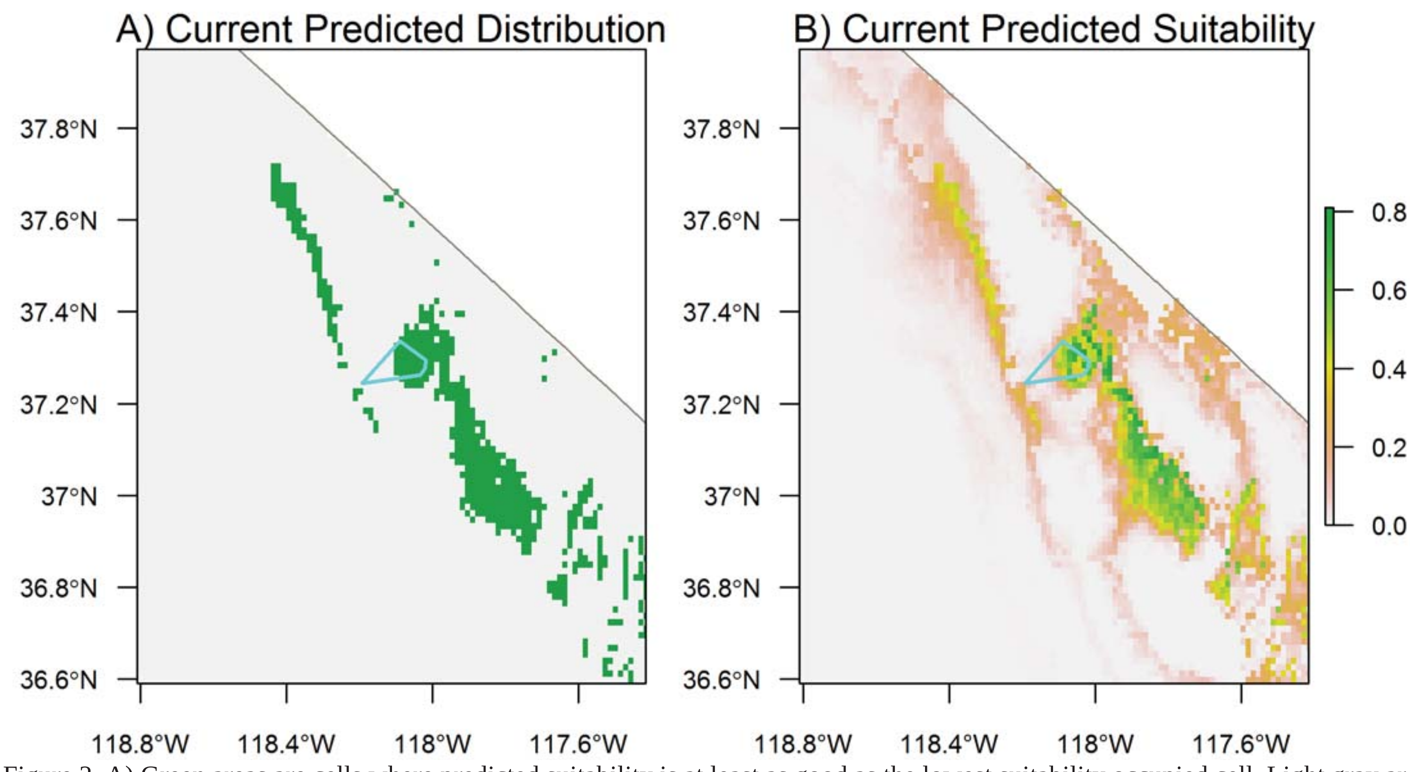

Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Bufo exsul* Black Toad

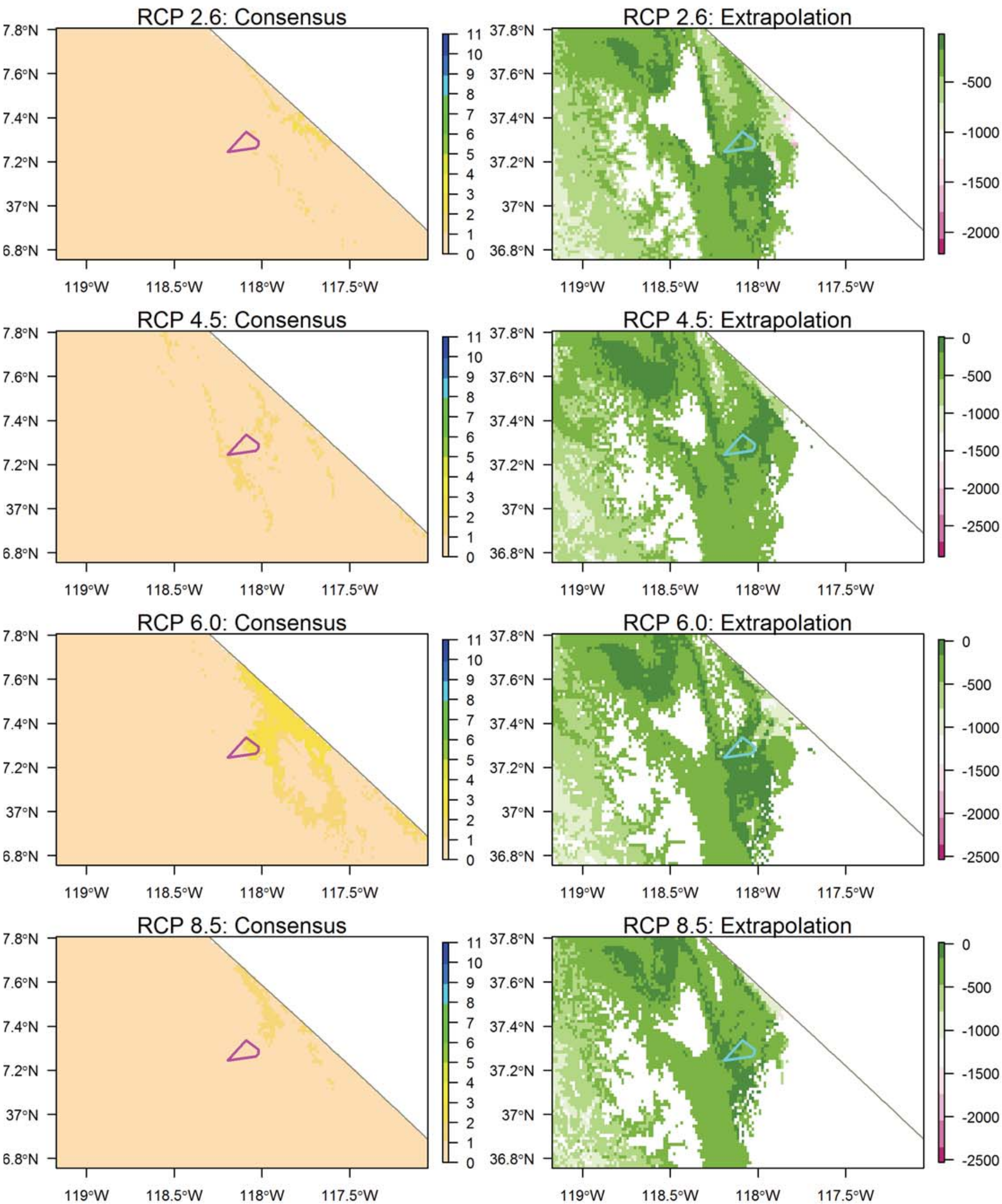

Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

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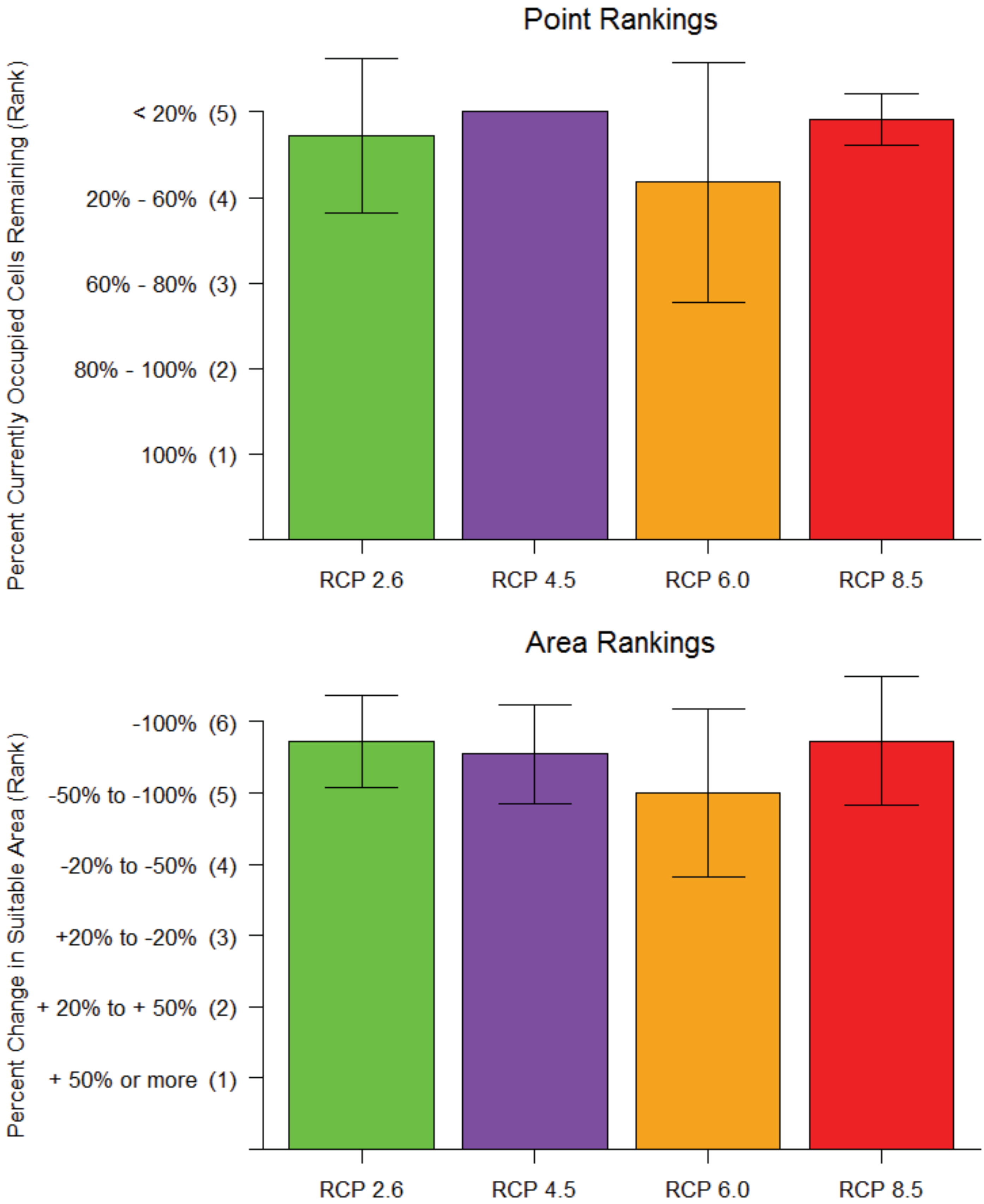

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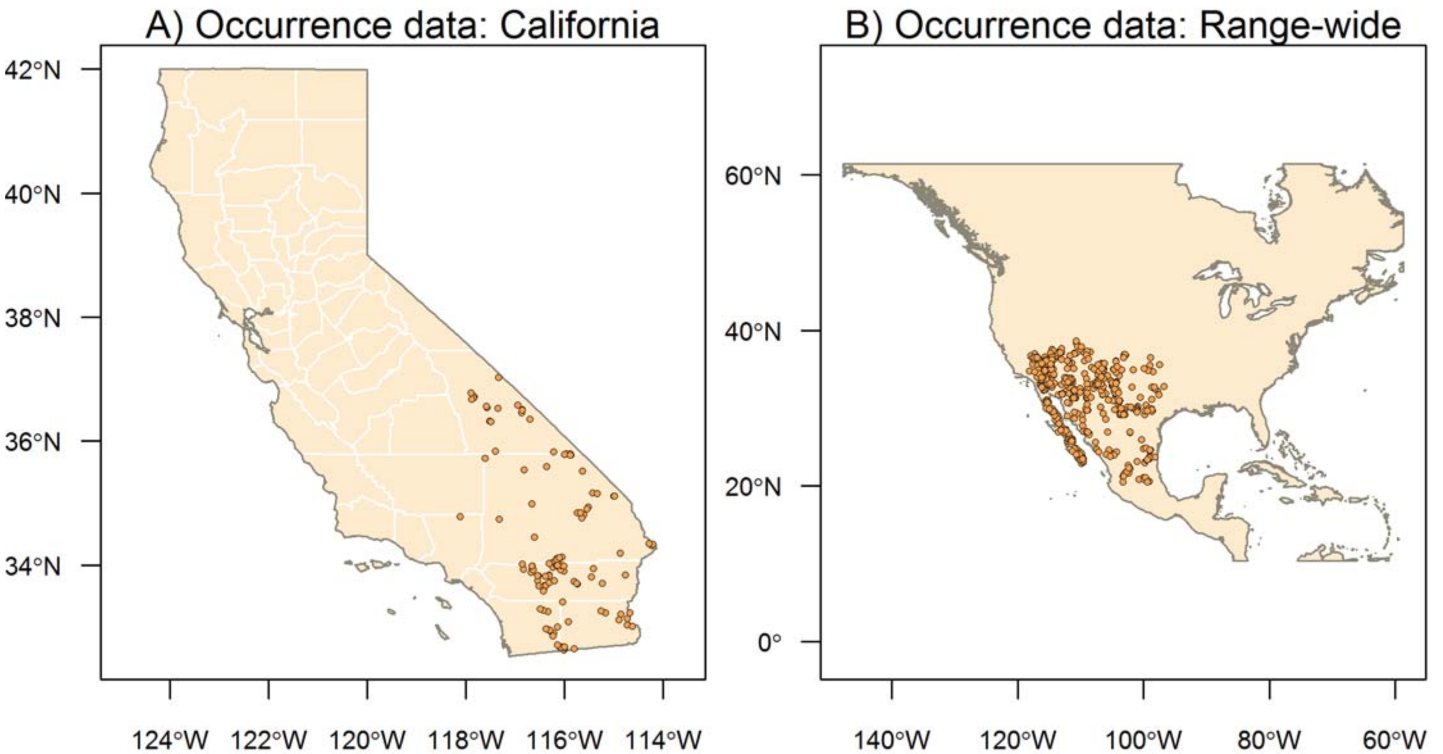
Species Results: *Bufo punctatus* Red-spotted Toad



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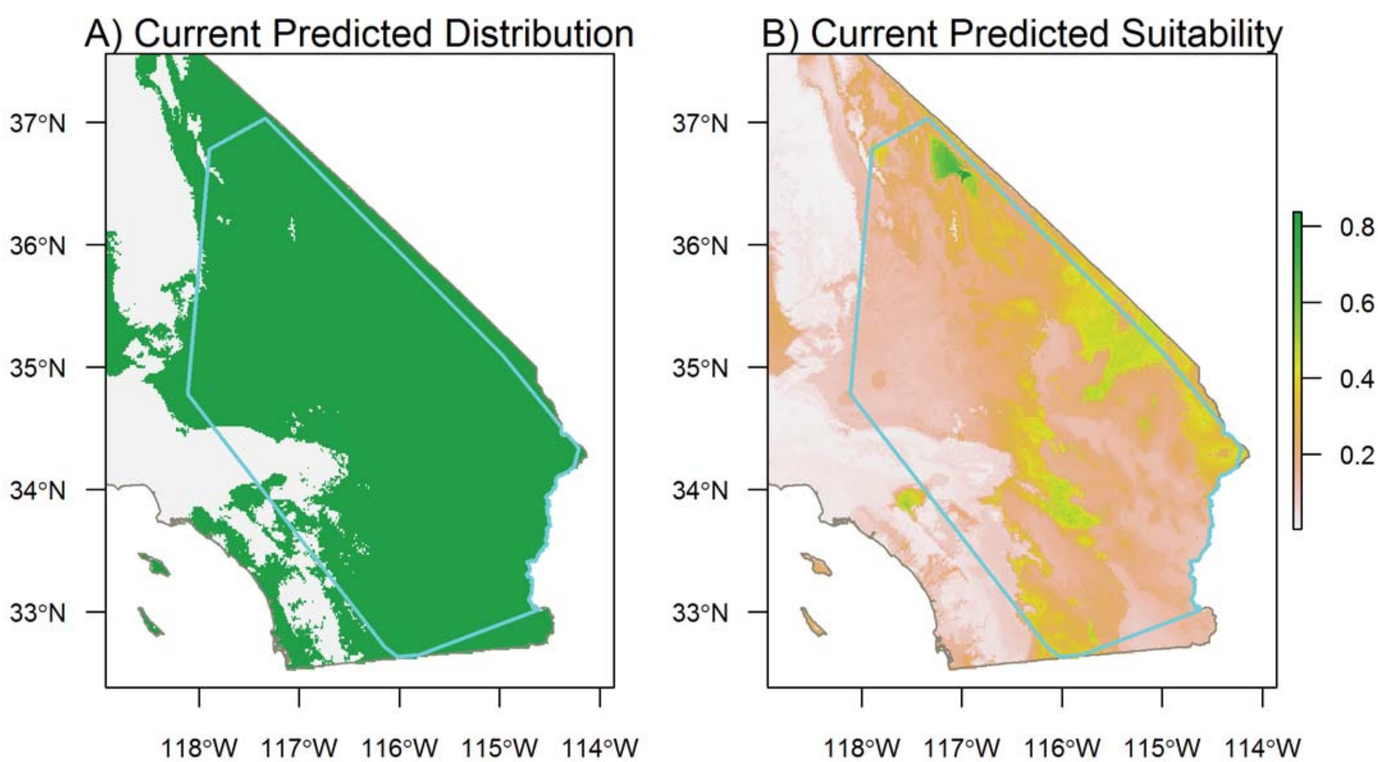

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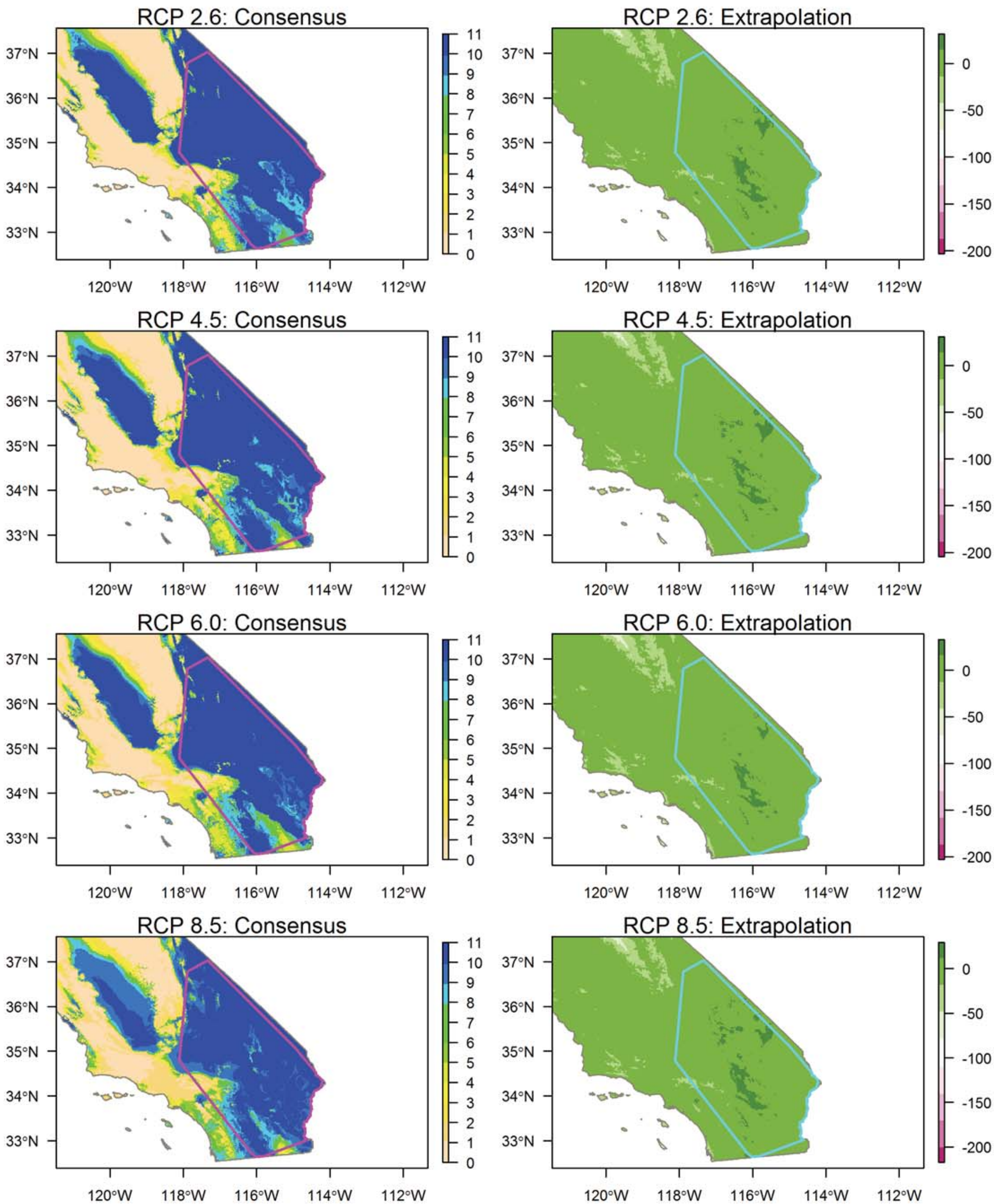
Species Results: *Bufo punctatus* Red-spotted Toad



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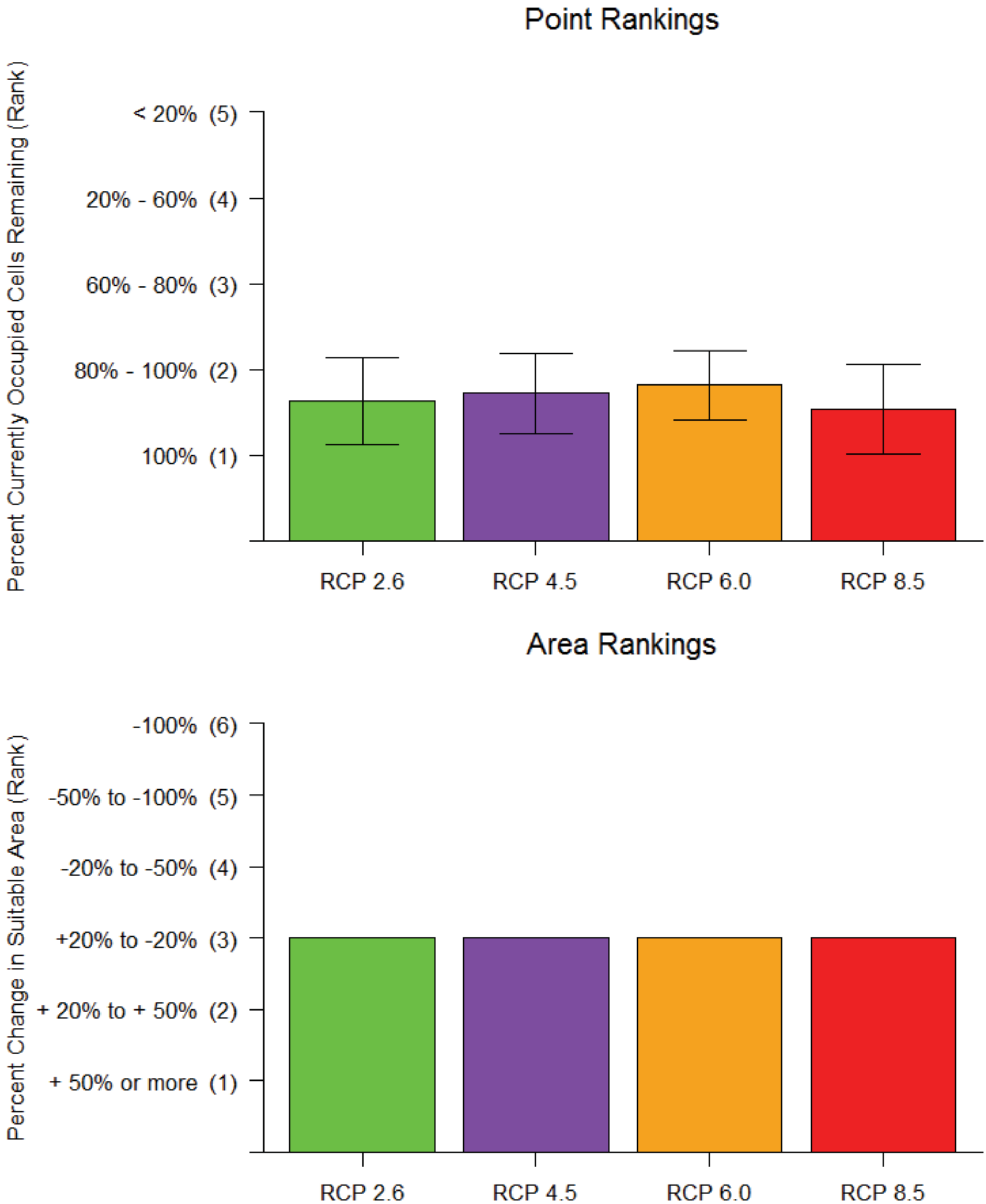
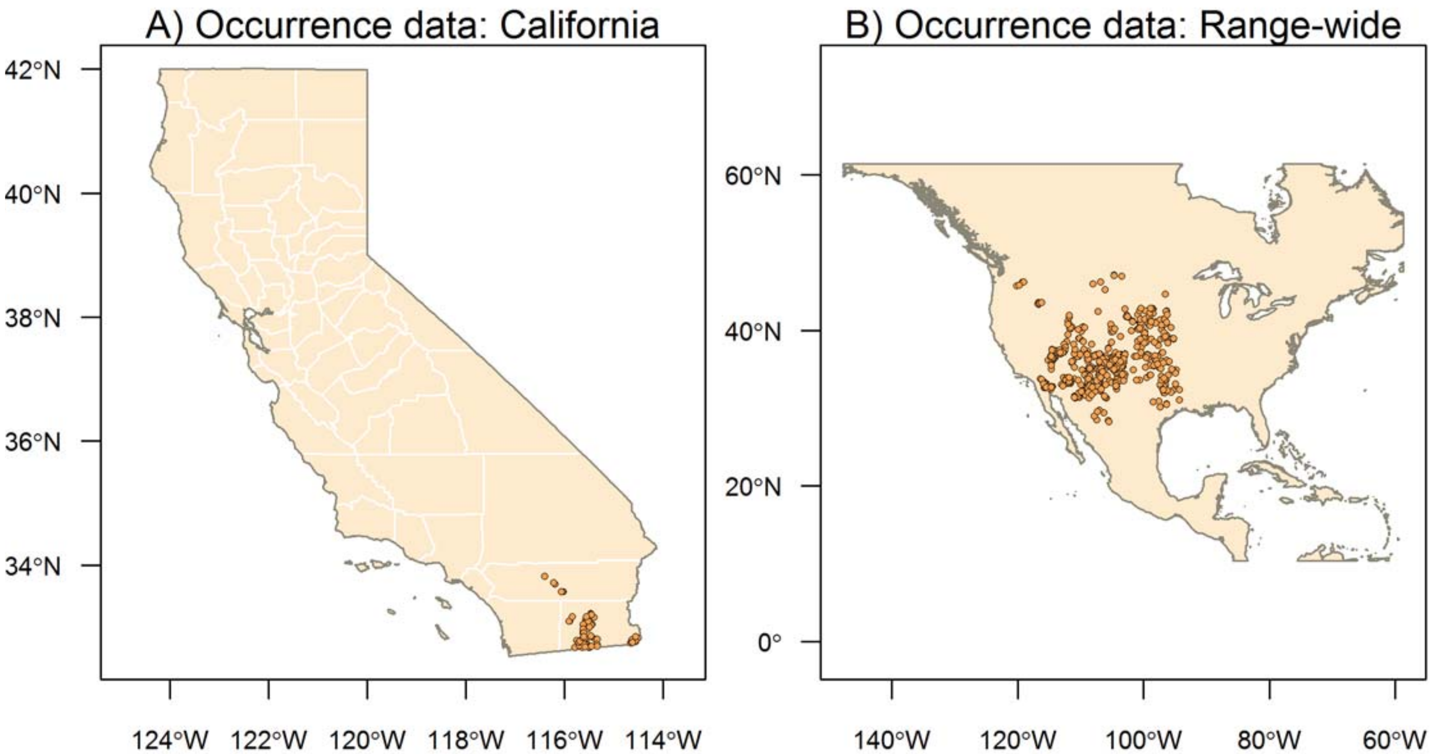


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Bufo woodhousii* Woodhouse's Toad



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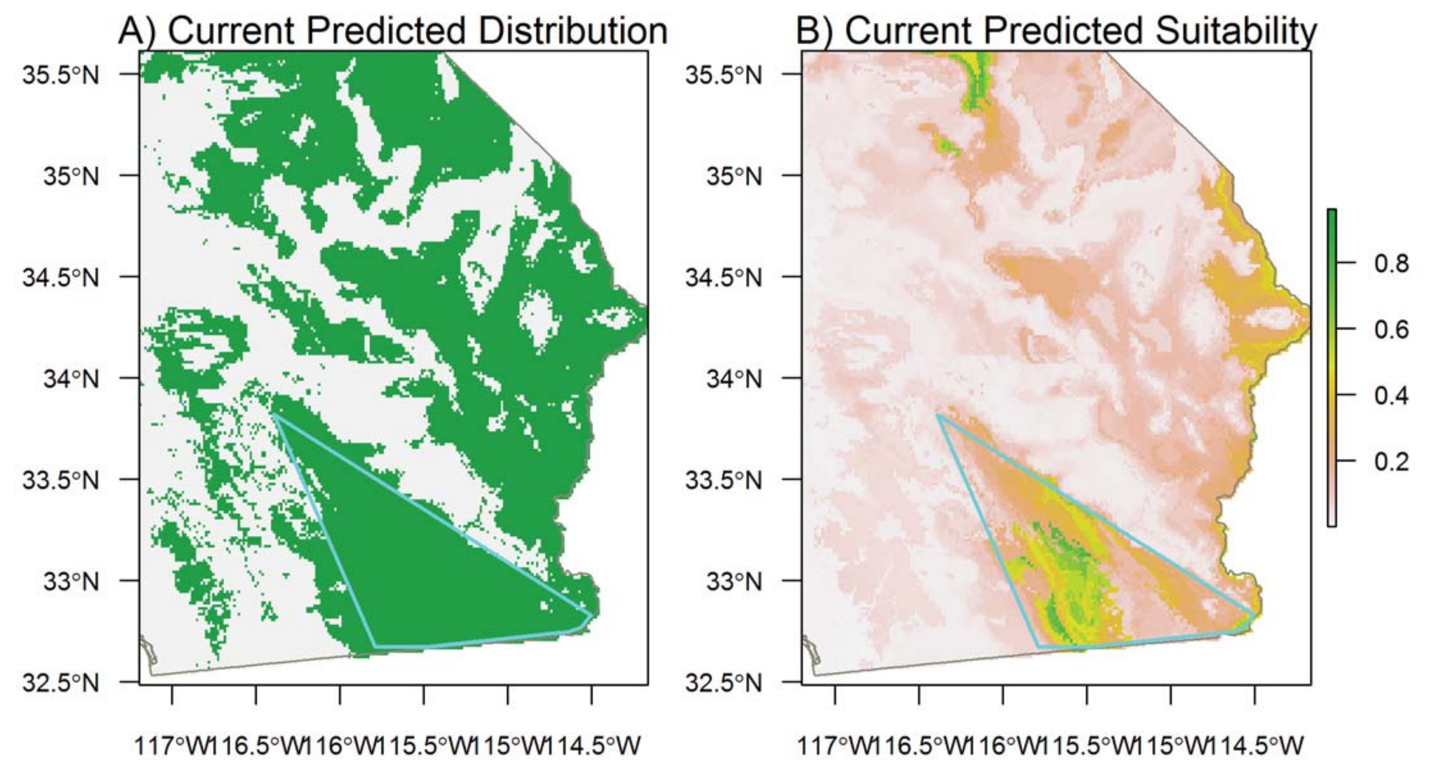

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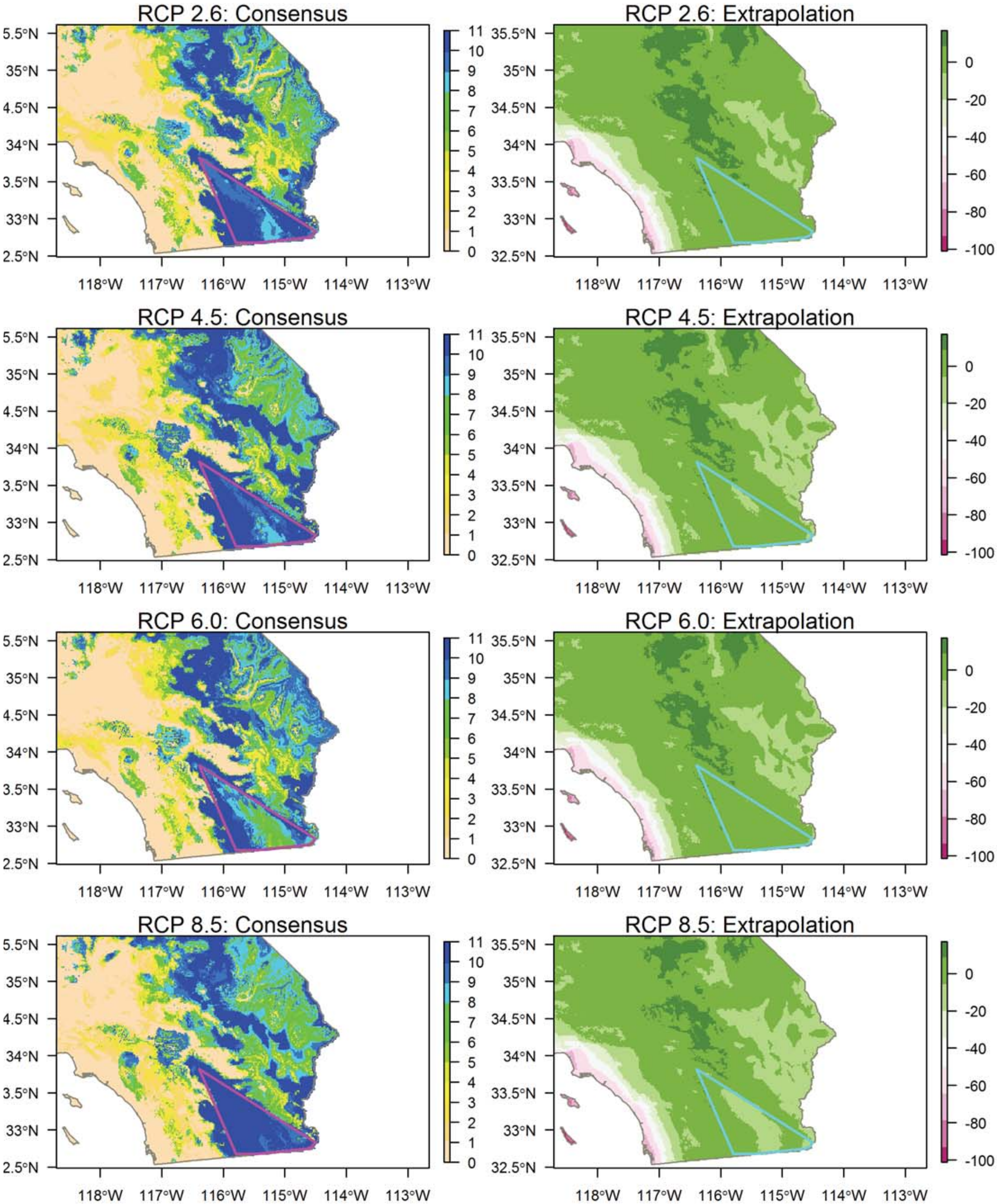
Species Results: *Bufo woodhousii* Woodhouse's Toad



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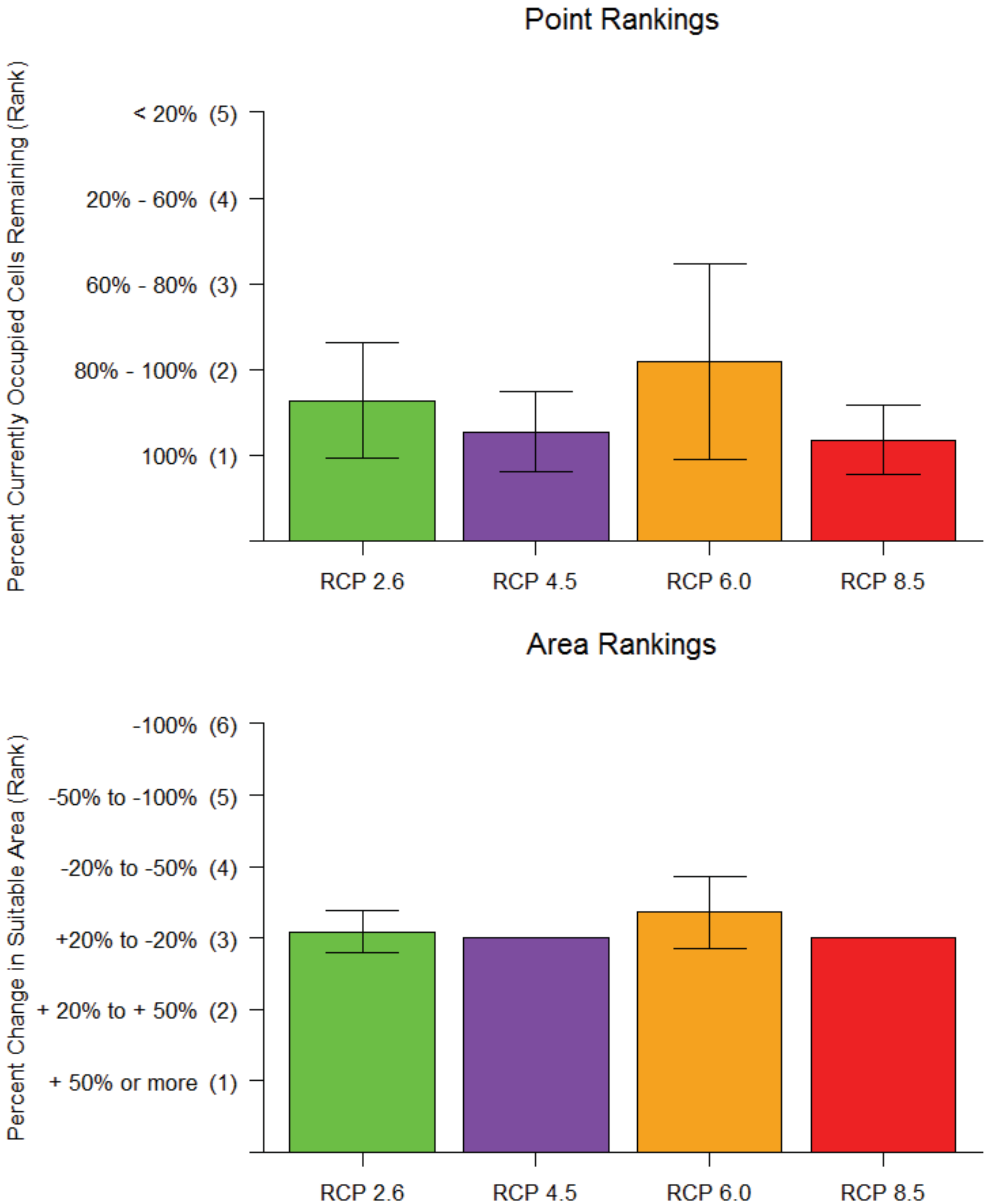


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Callisaurus draconoides* Zebra-tailed Lizard

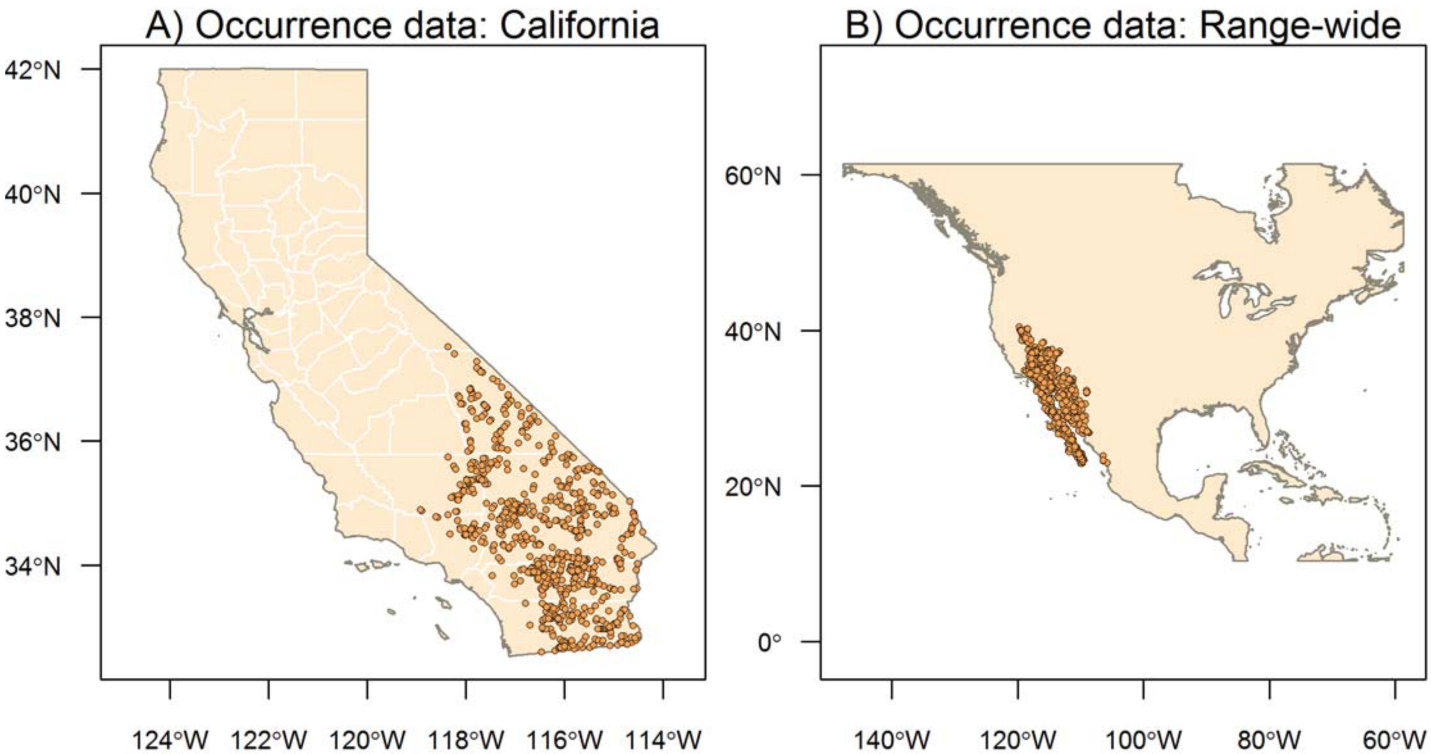
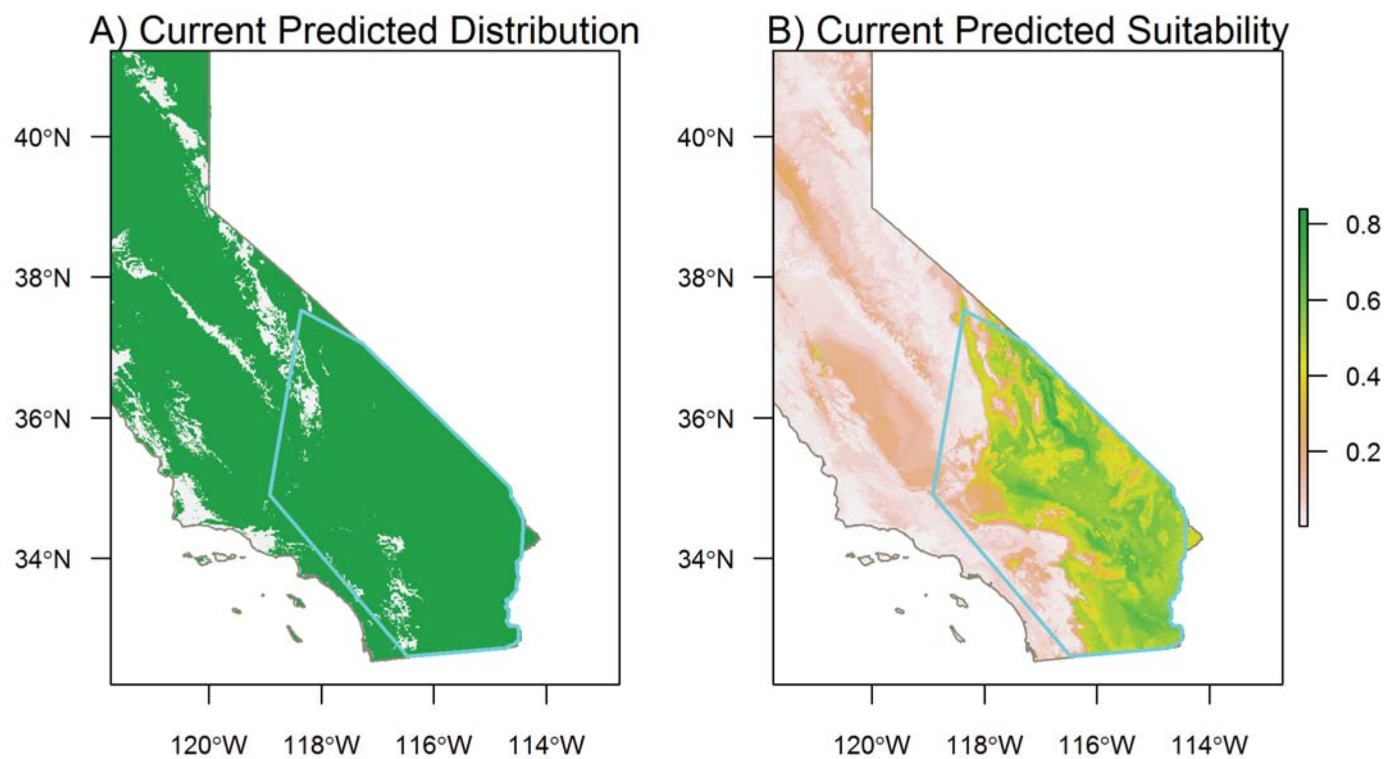


Figure 1. Occurrence data used to build Maxent models.



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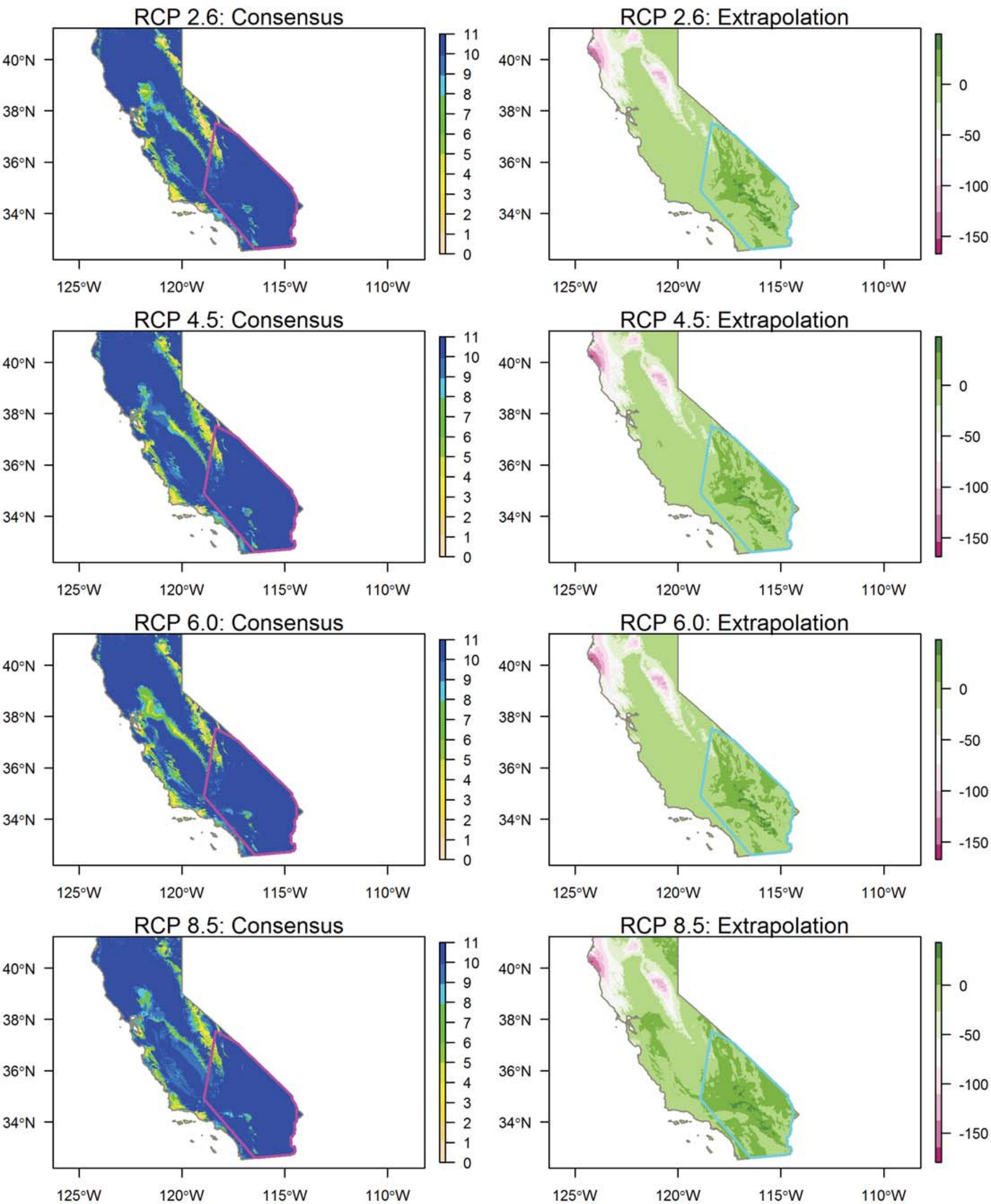
Species Results: *Callisaurus draconoides* Zebra-tailed Lizard



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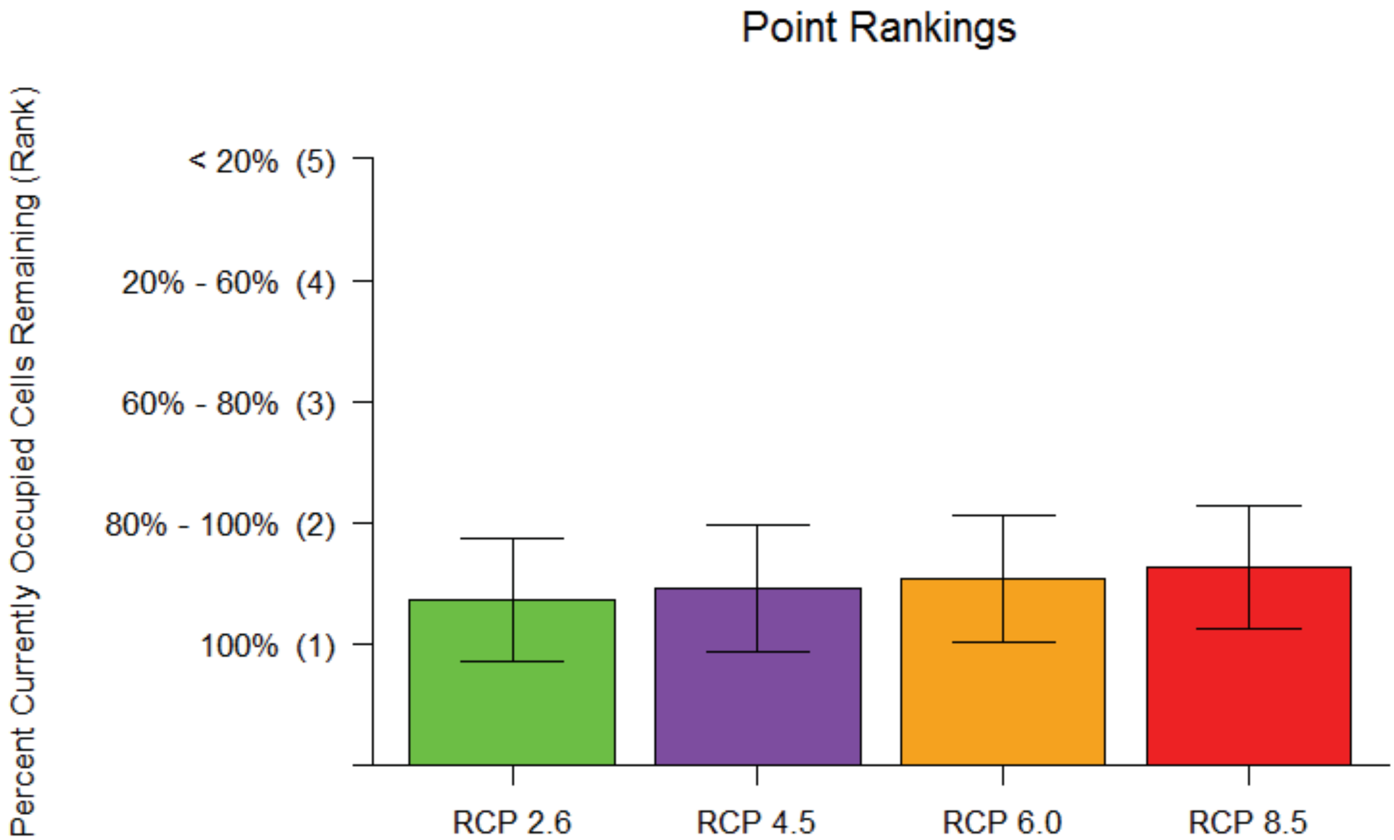

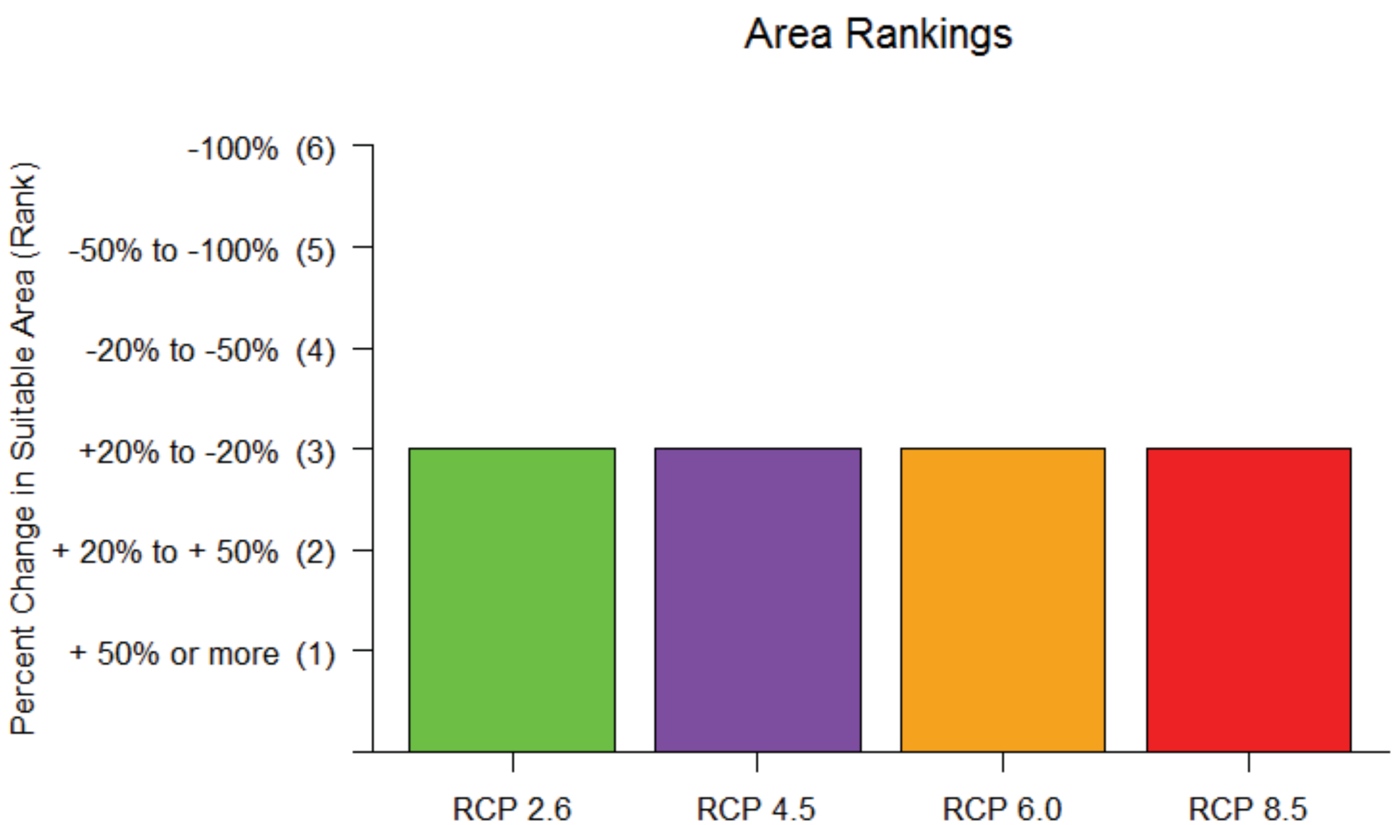

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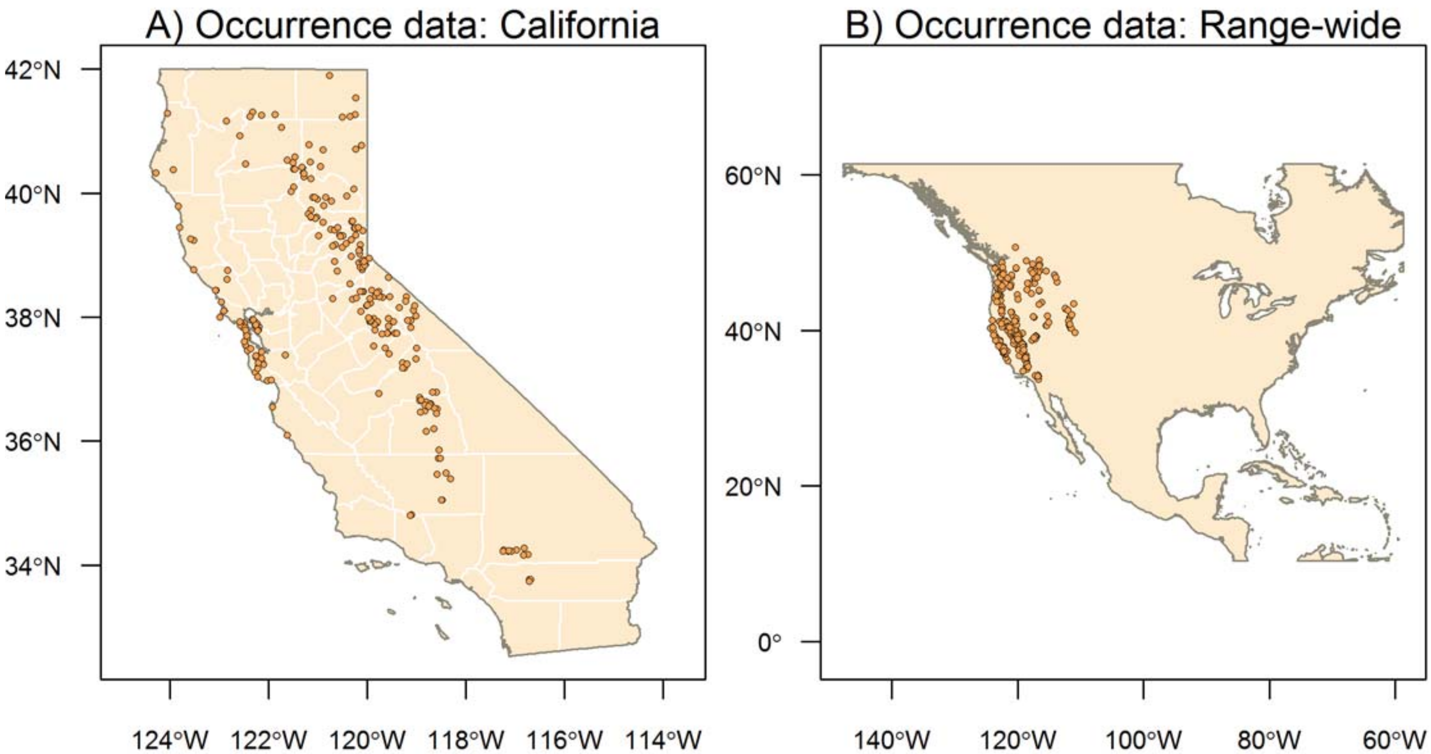
Species Results: *Charina bottae* Rubber Boa



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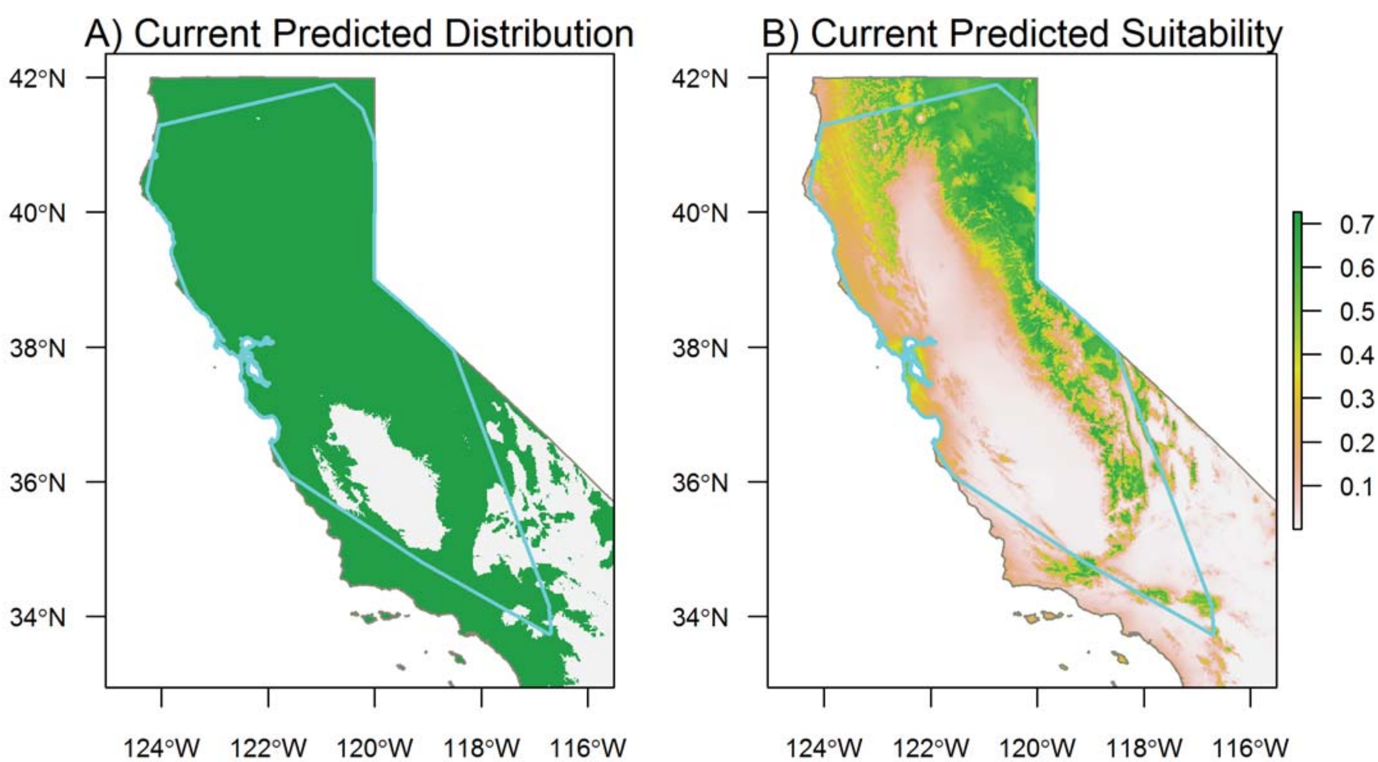

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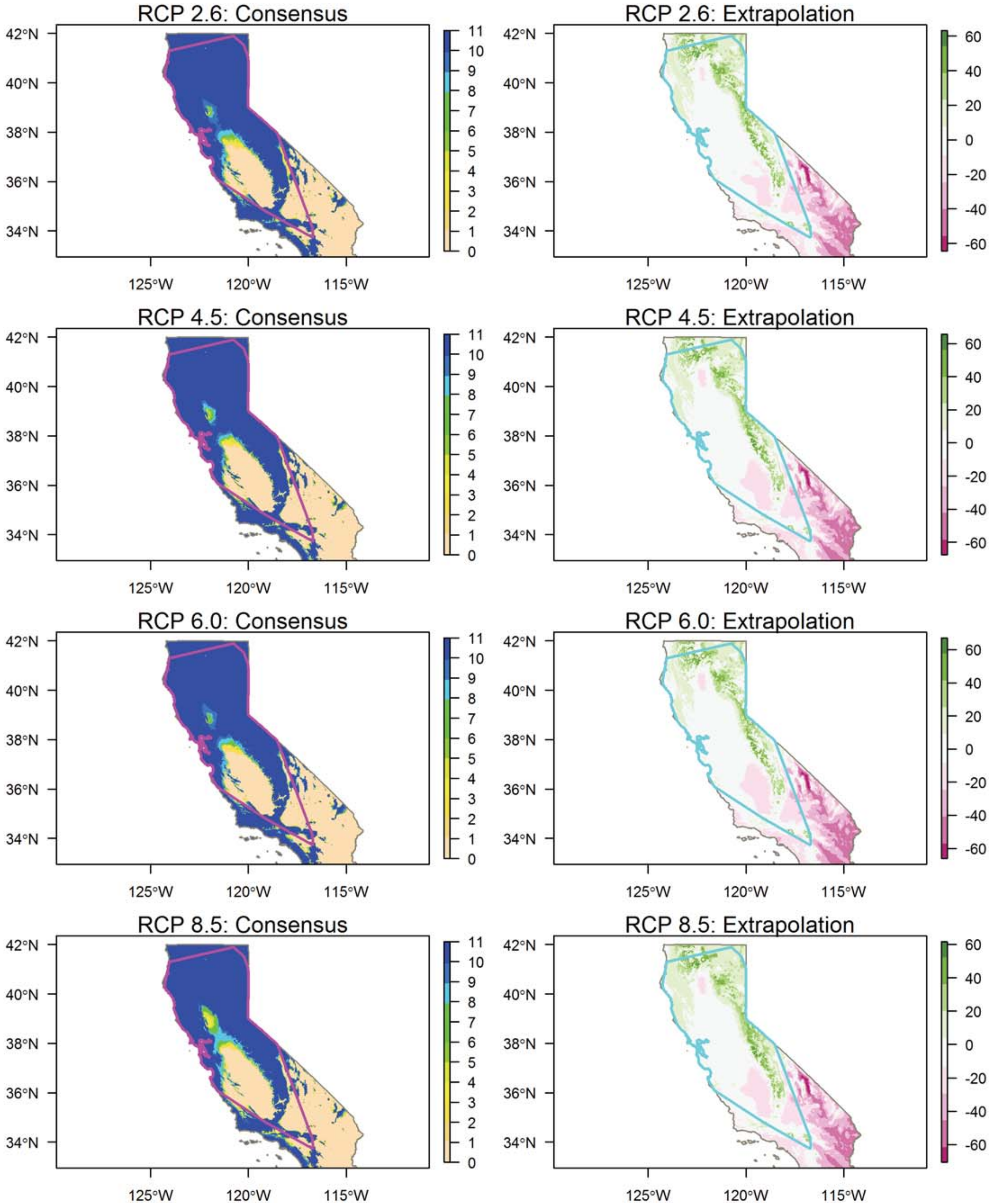
Species Results: *Charina bottae* Rubber Boa



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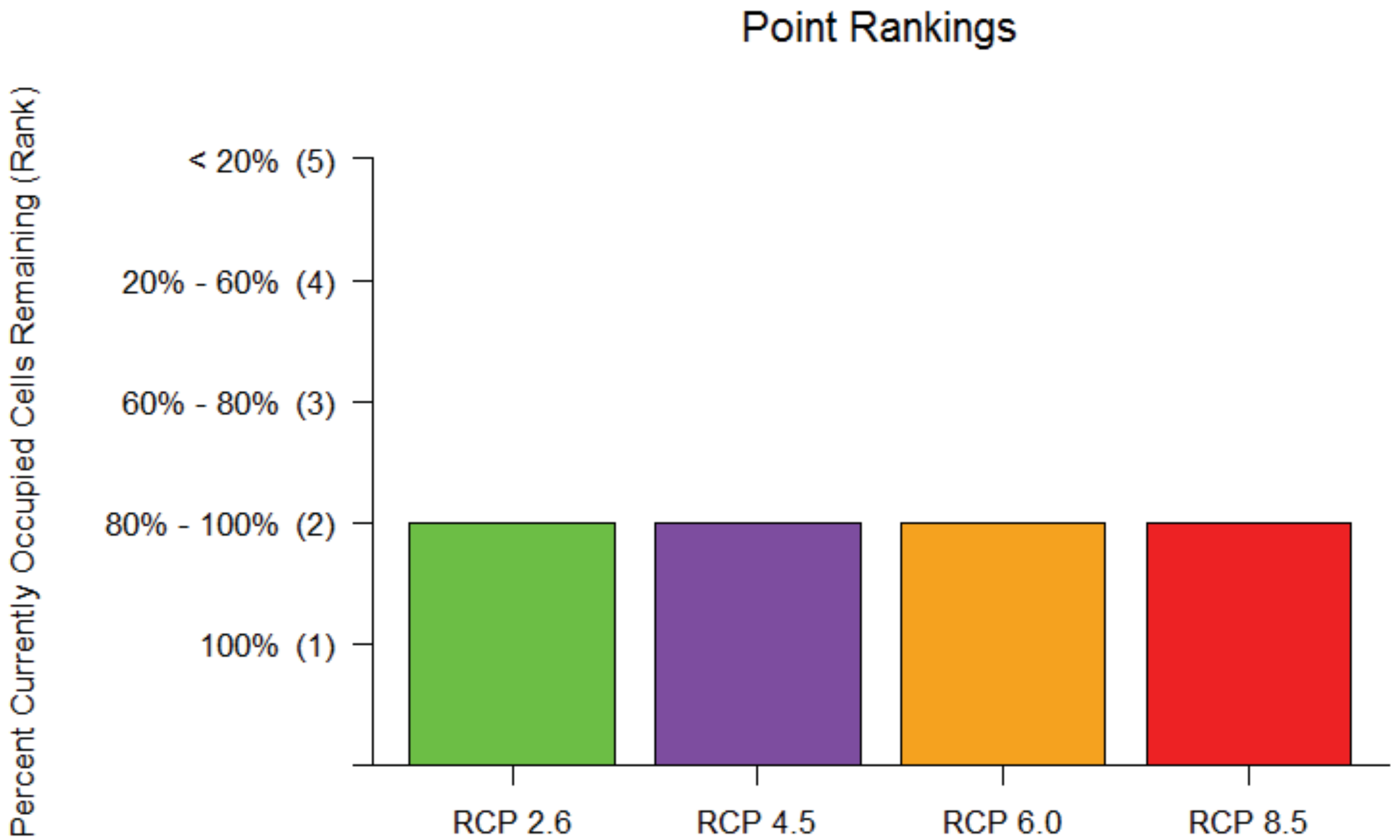

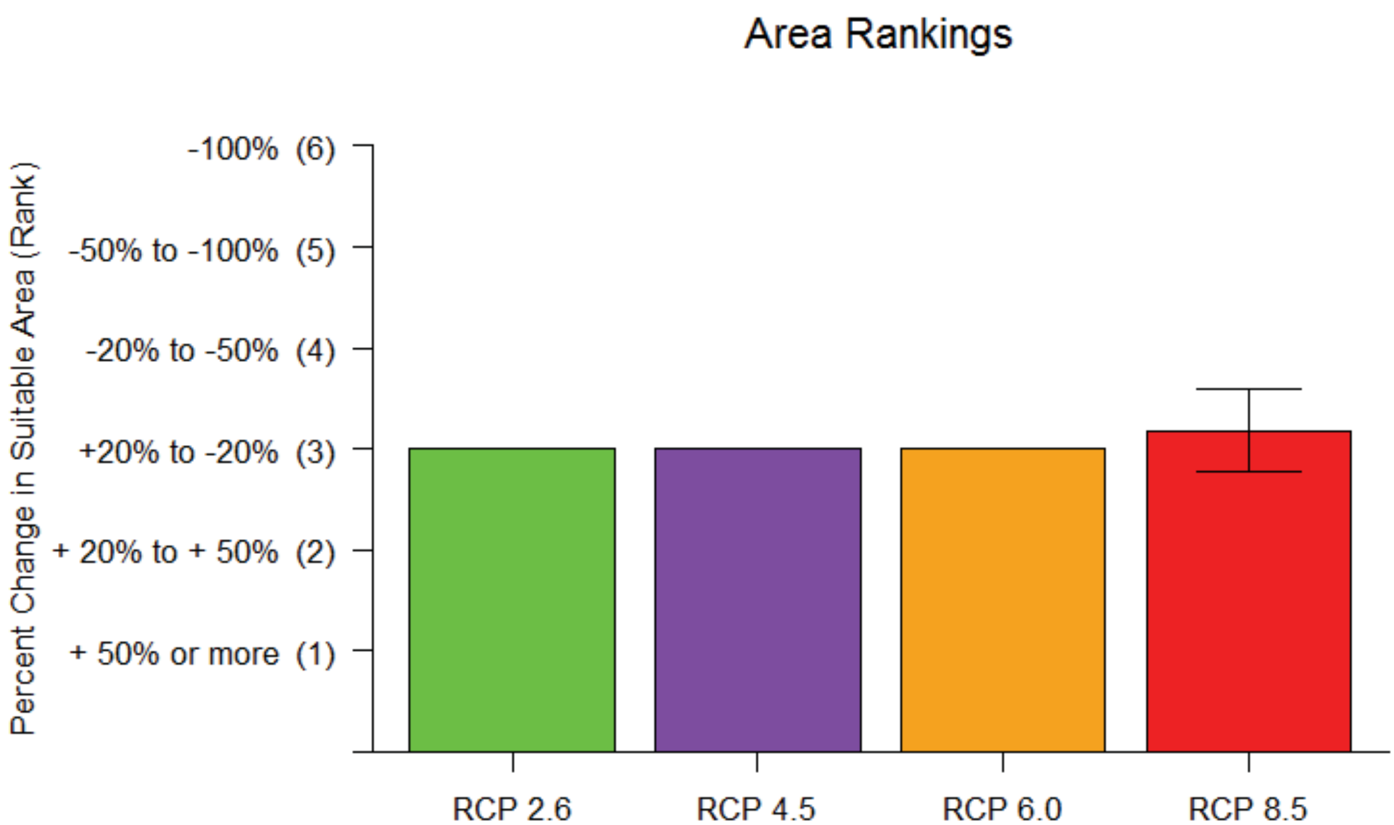

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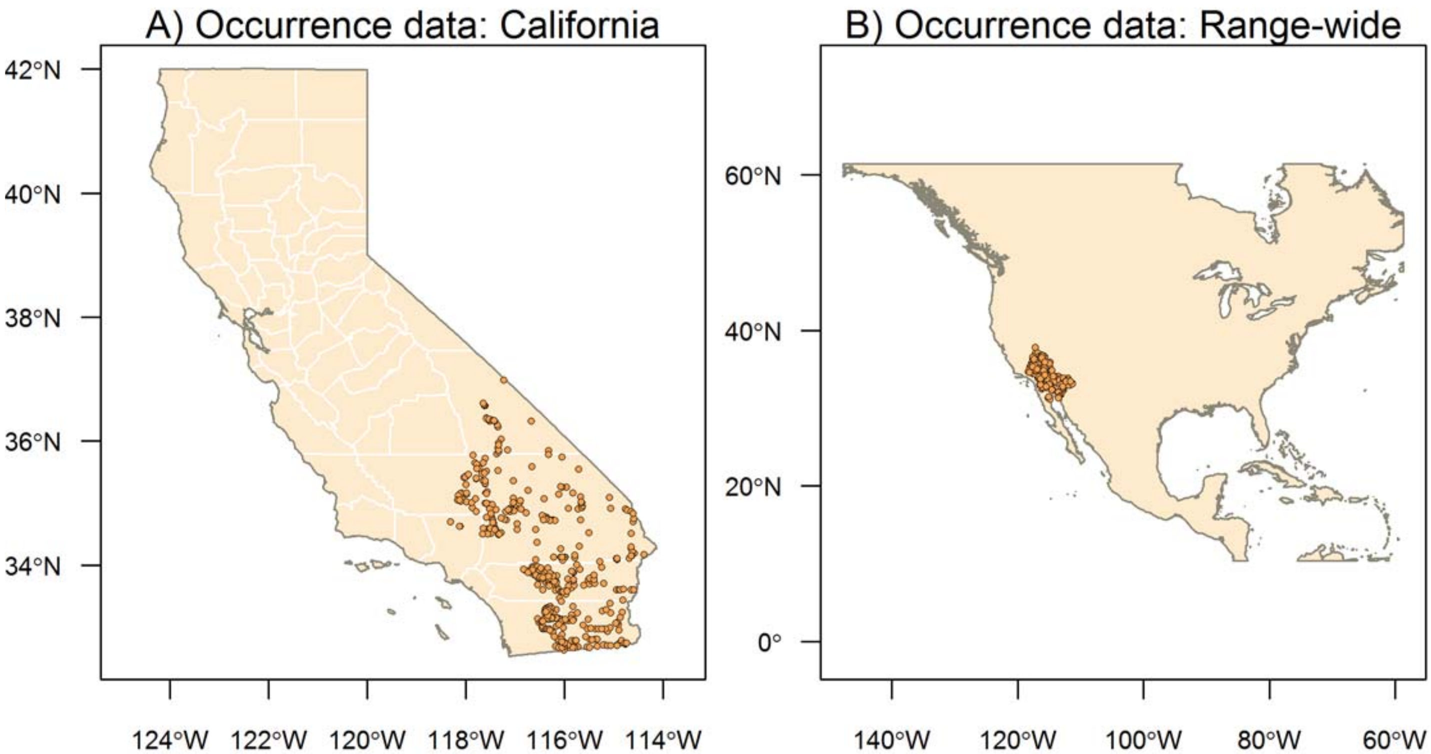
Species Results: *Chionactis occipitalis* Shovel-nosed Snake



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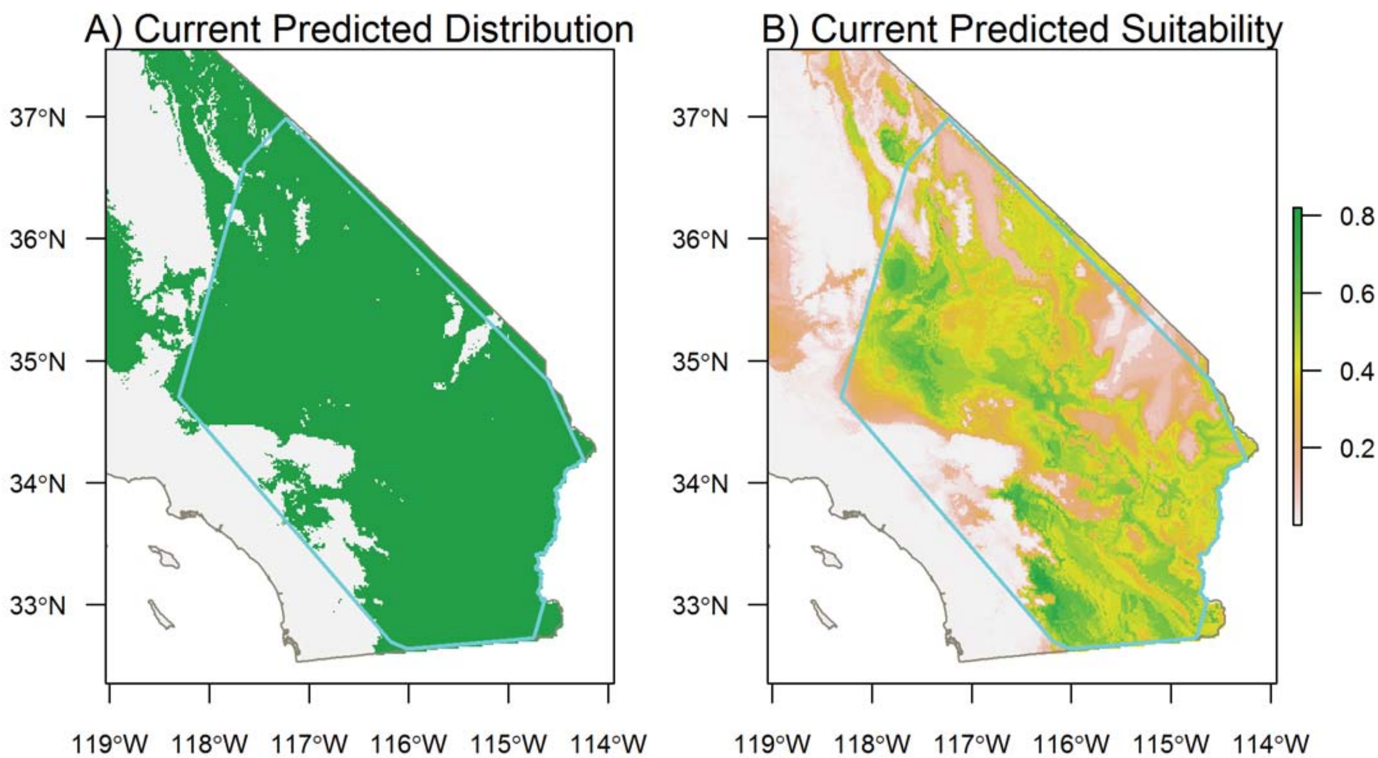

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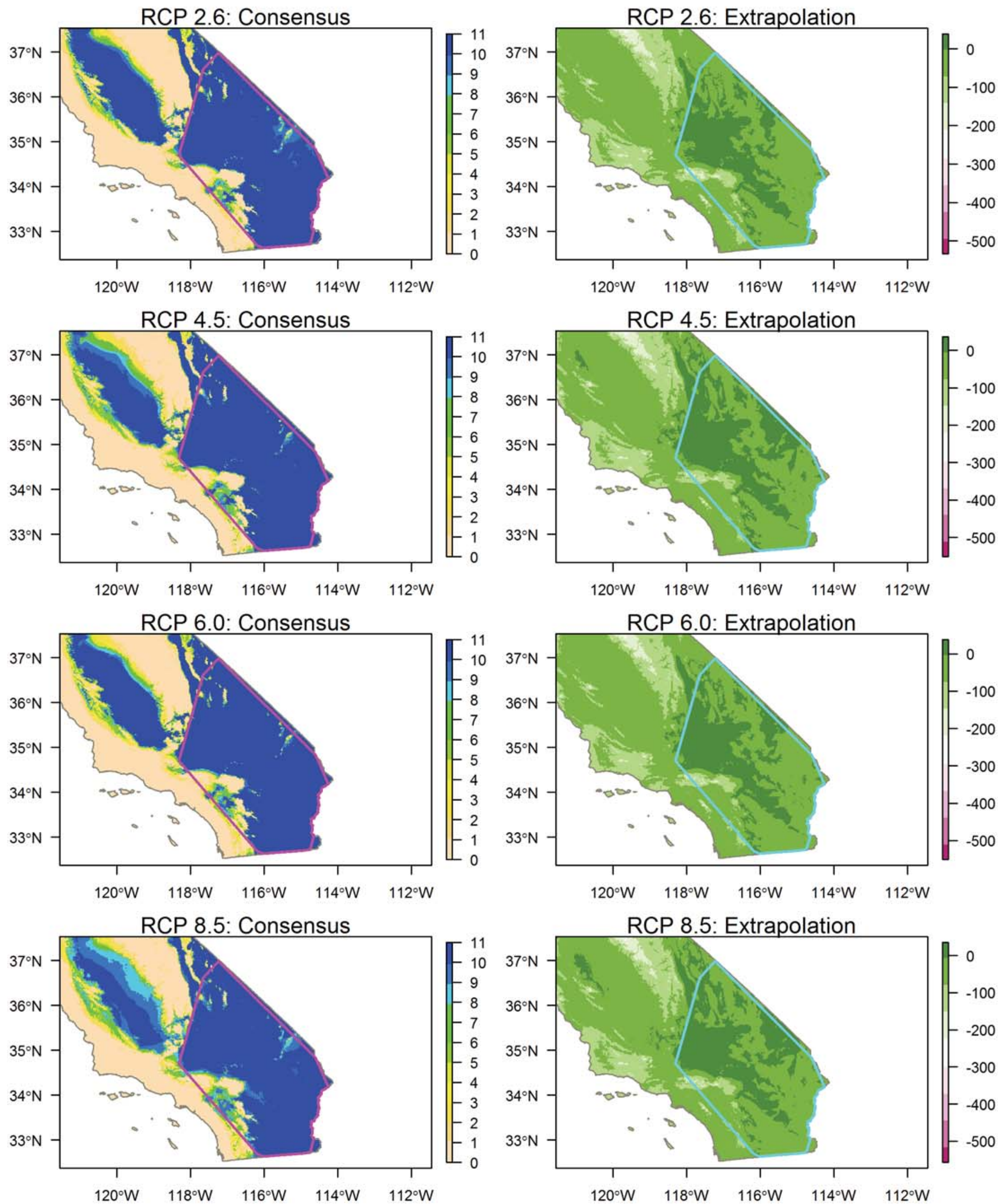
Species Results: *Chionactis occipitalis* Shovel-nosed Snake



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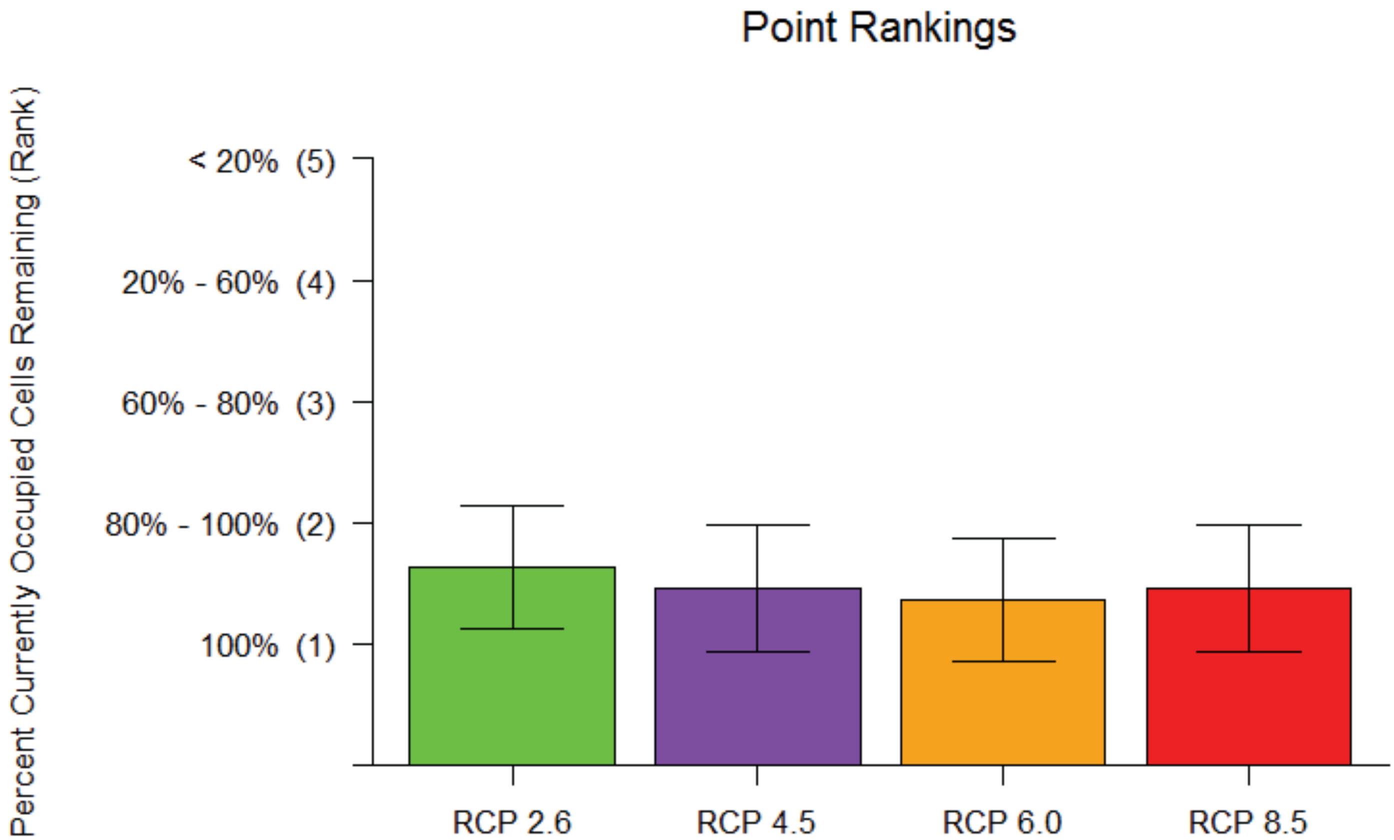
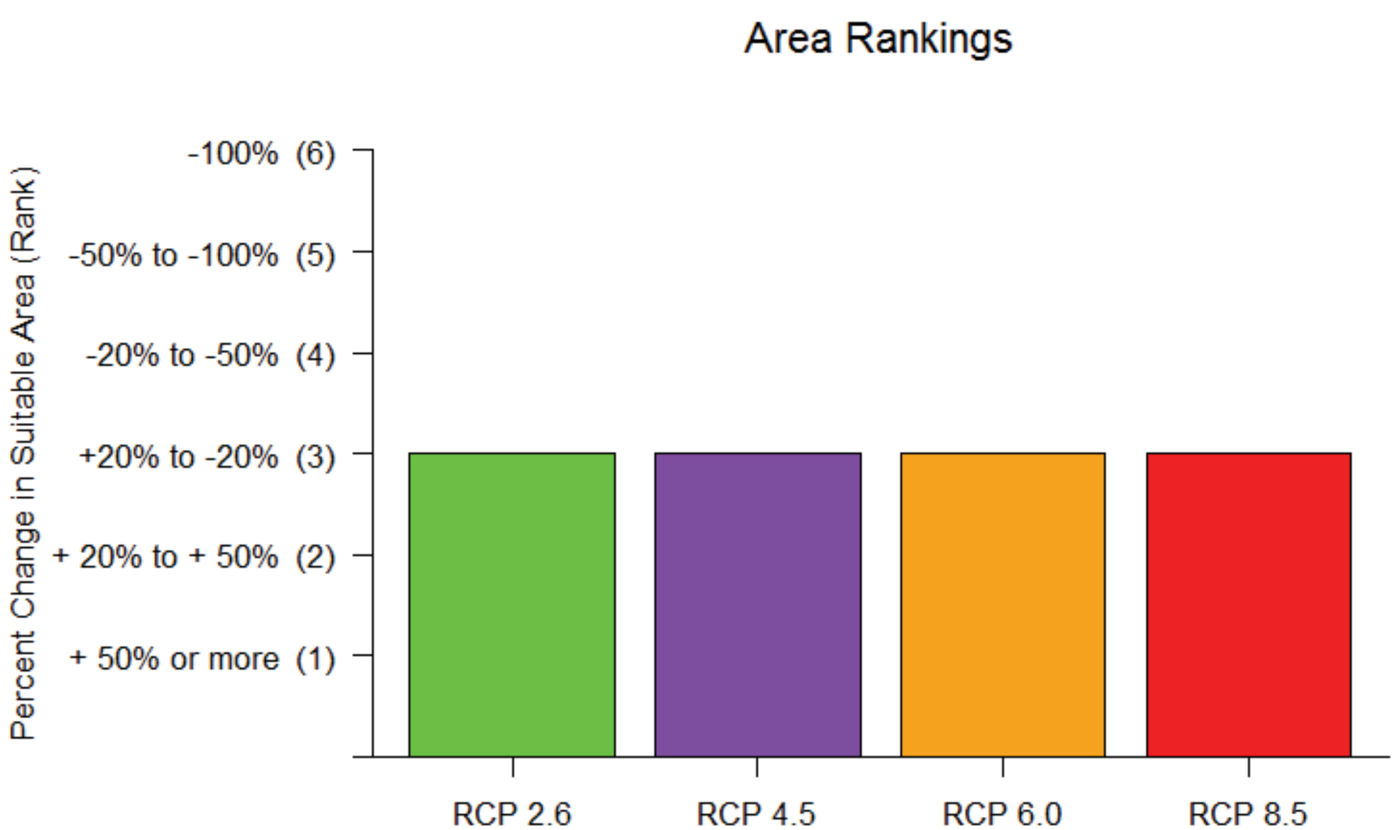
Species Results: *Chionactis occipitalis* Shovel-nosed Snake





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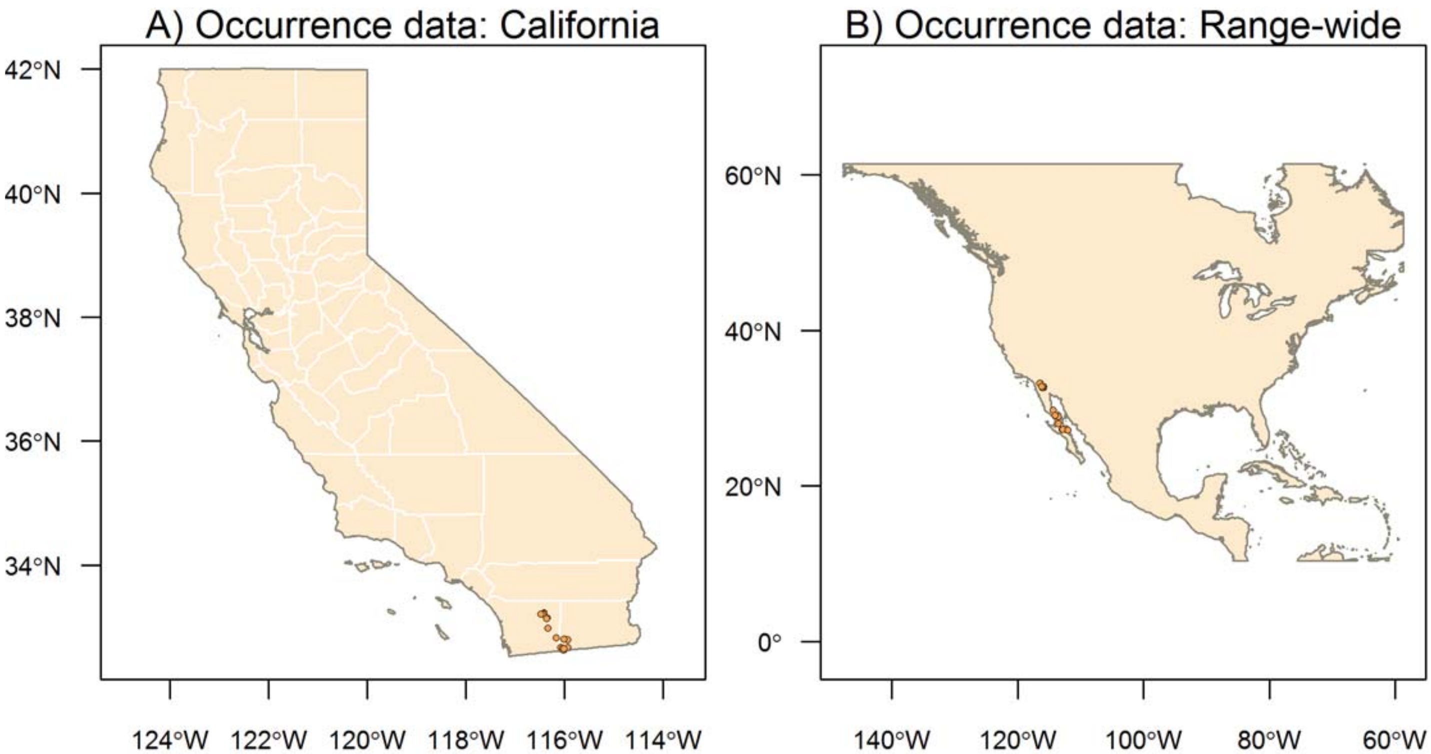
Species Results: *Coleonyx switaki* Barefoot Gecko



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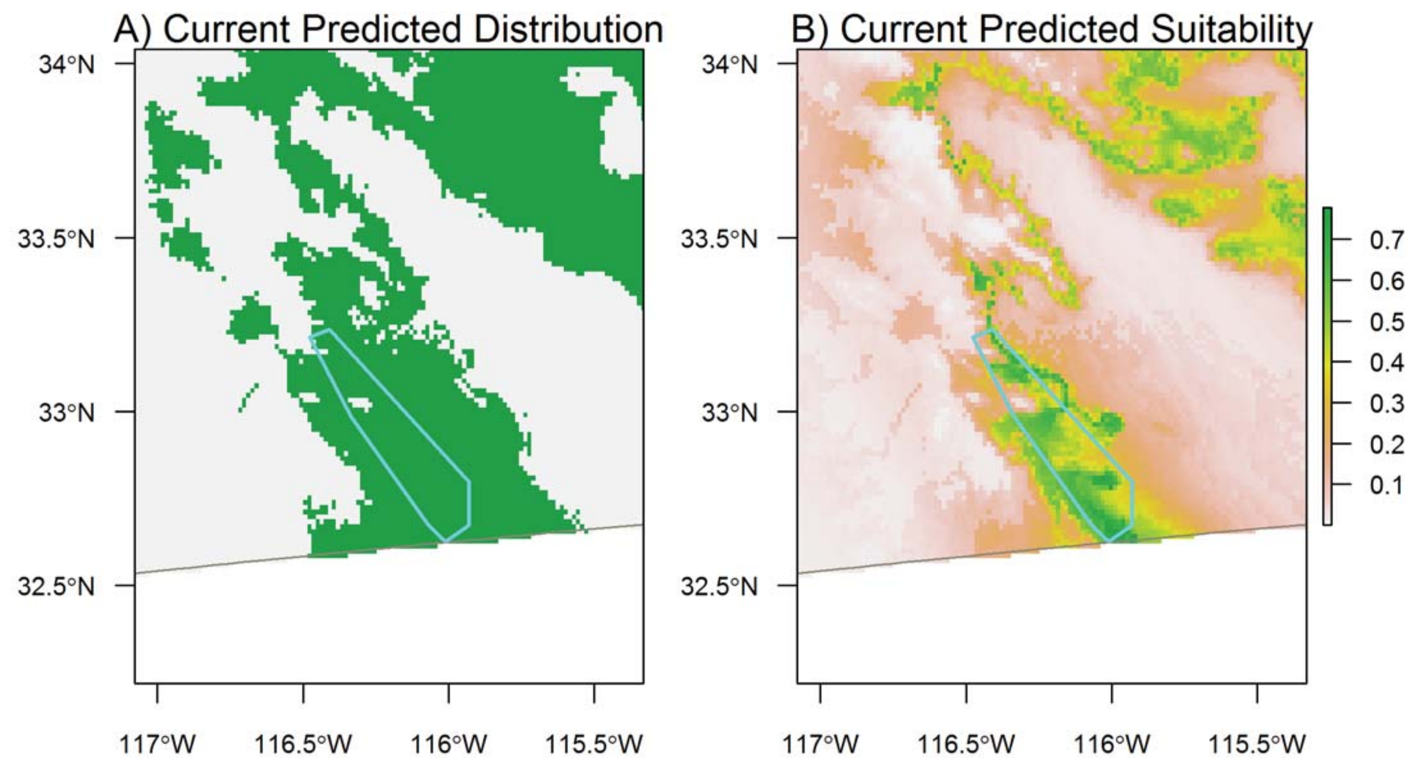

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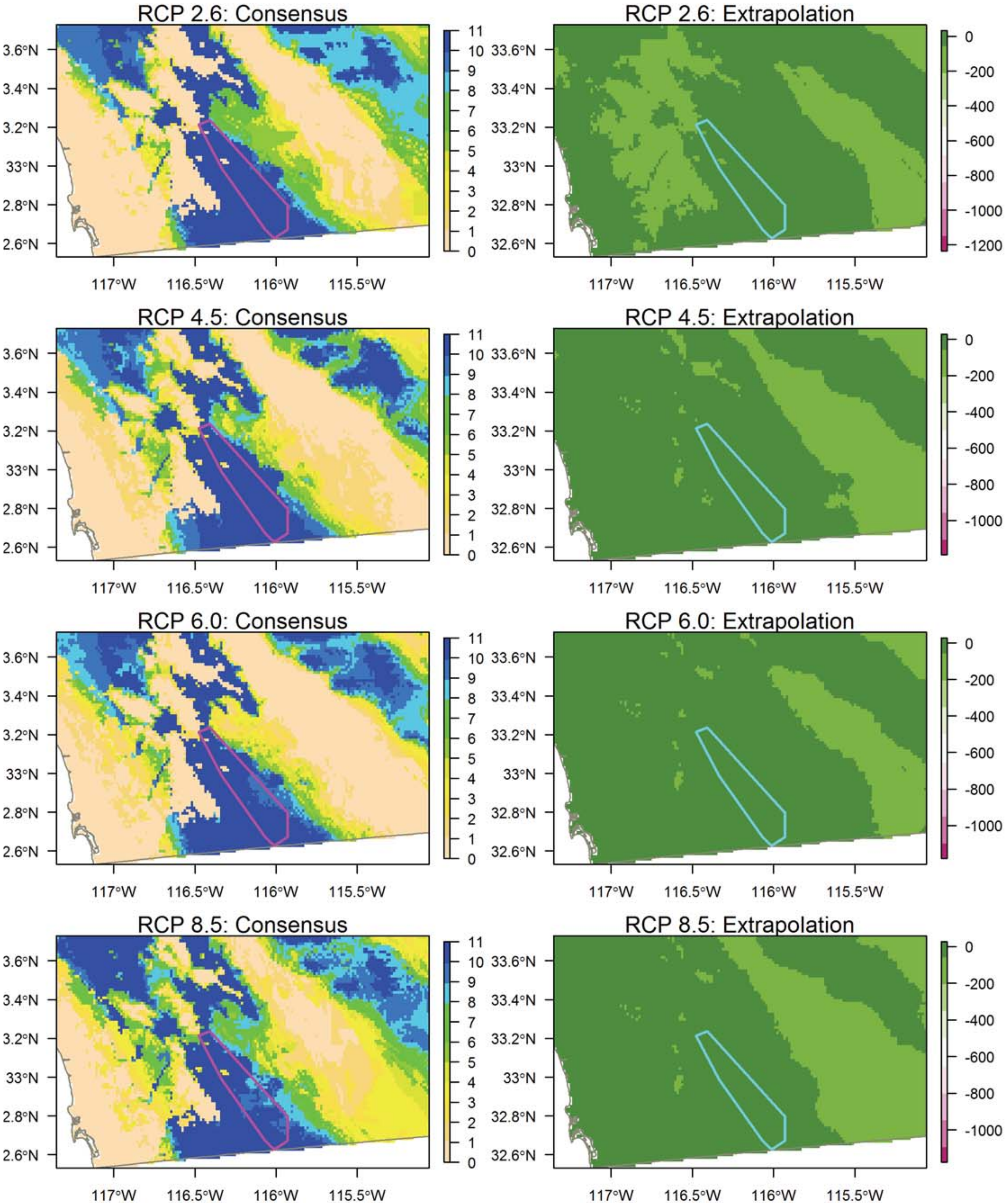
Species Results: *Coleonyx switaki* Barefoot Gecko



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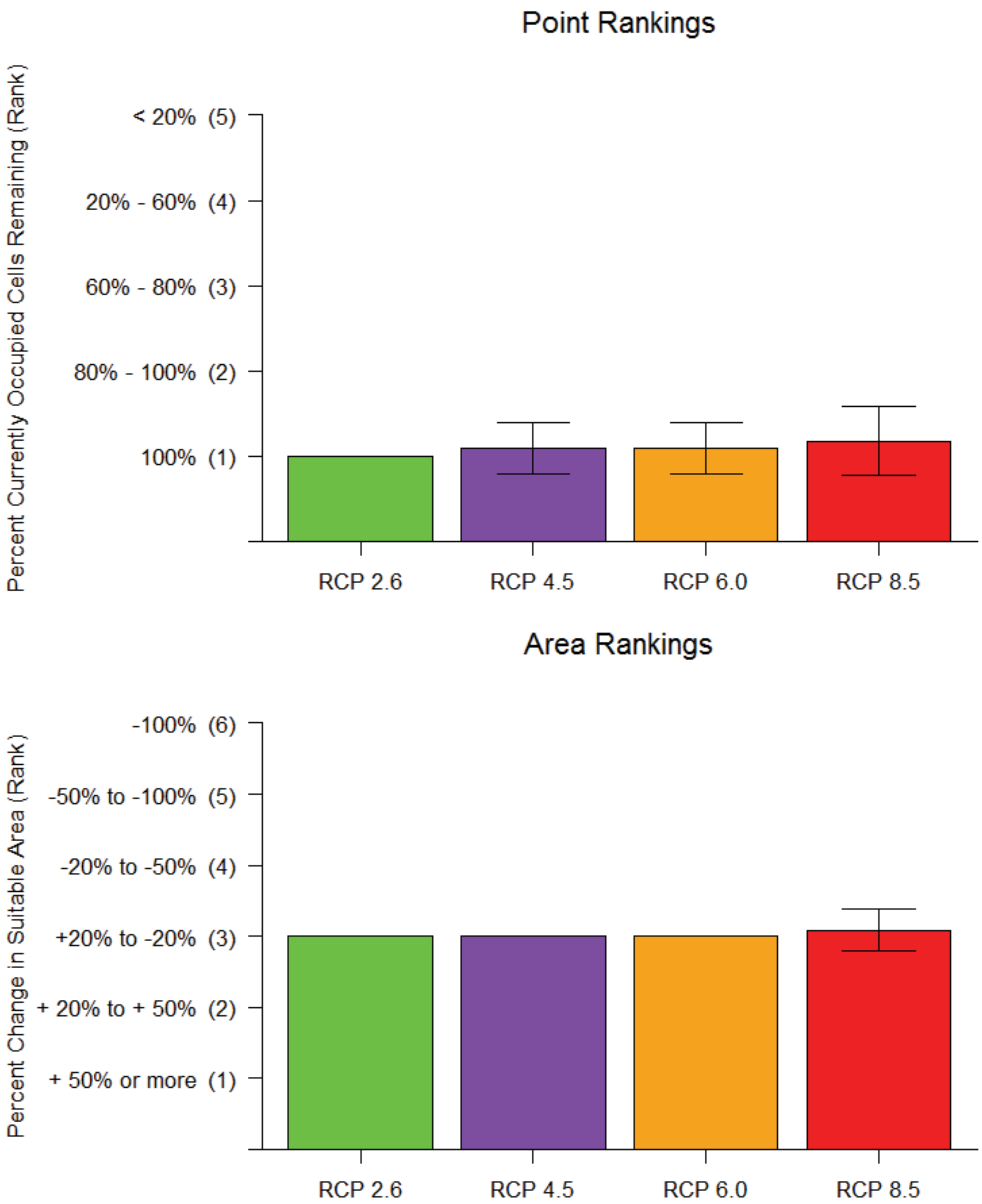

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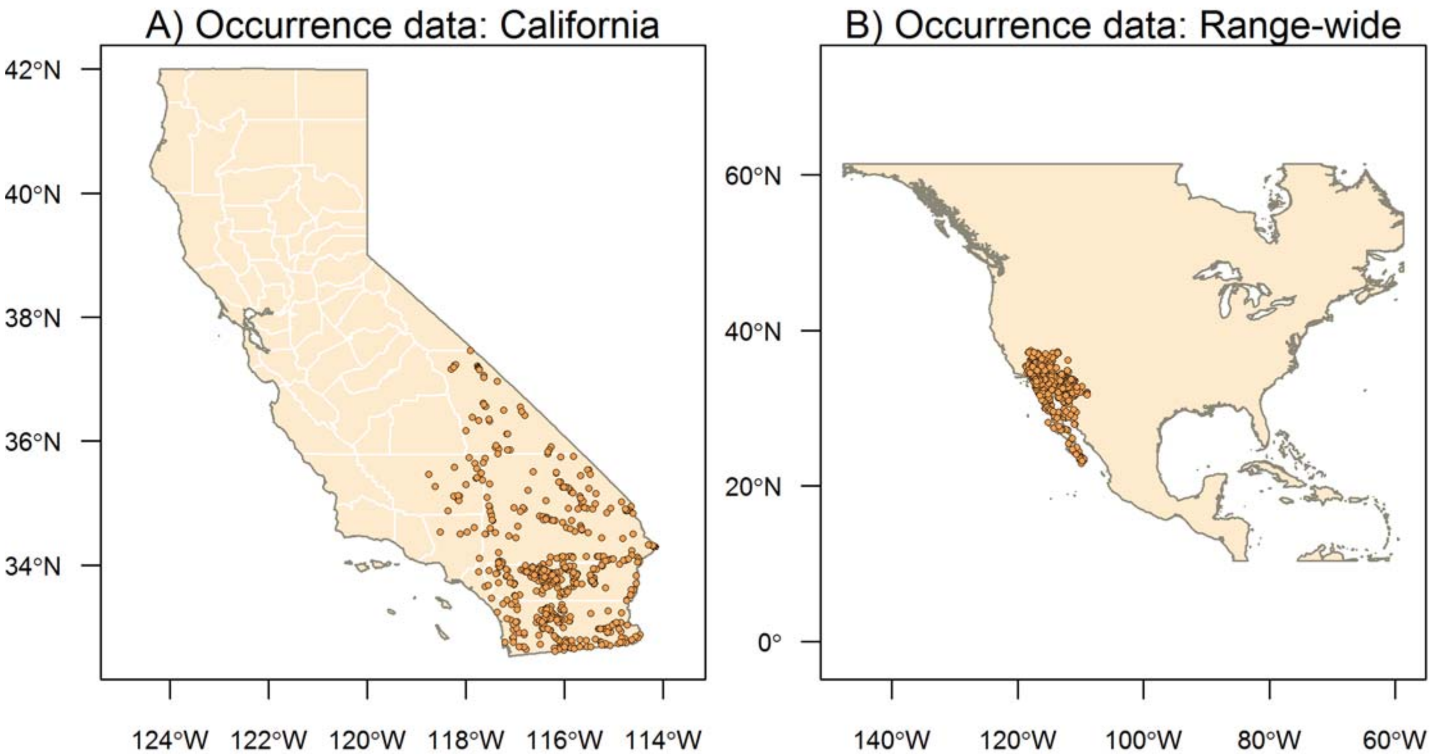
Species Results: *Coleonyx variegatus* Western Banded Gecko



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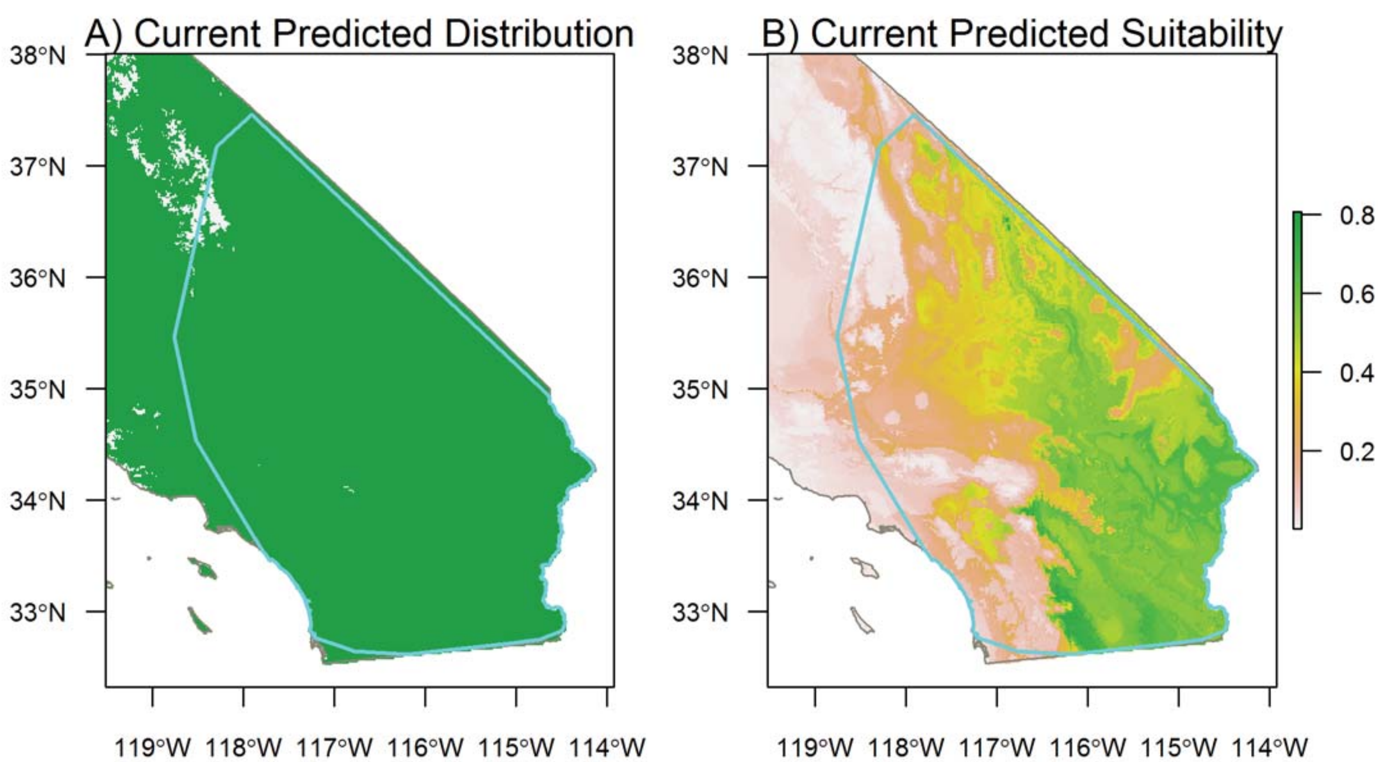

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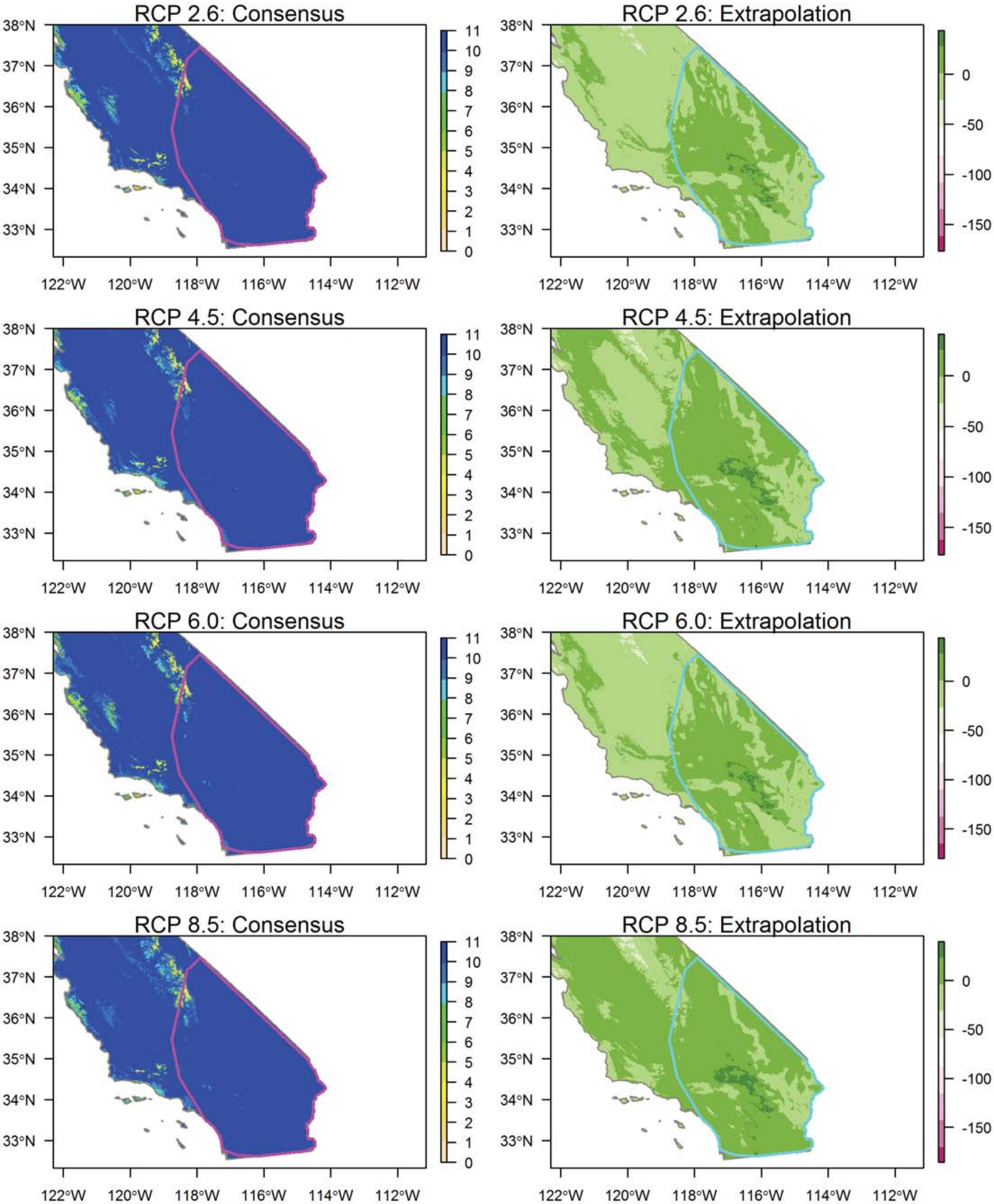
Species Results: *Coleonyx variegatus* Western Banded Gecko



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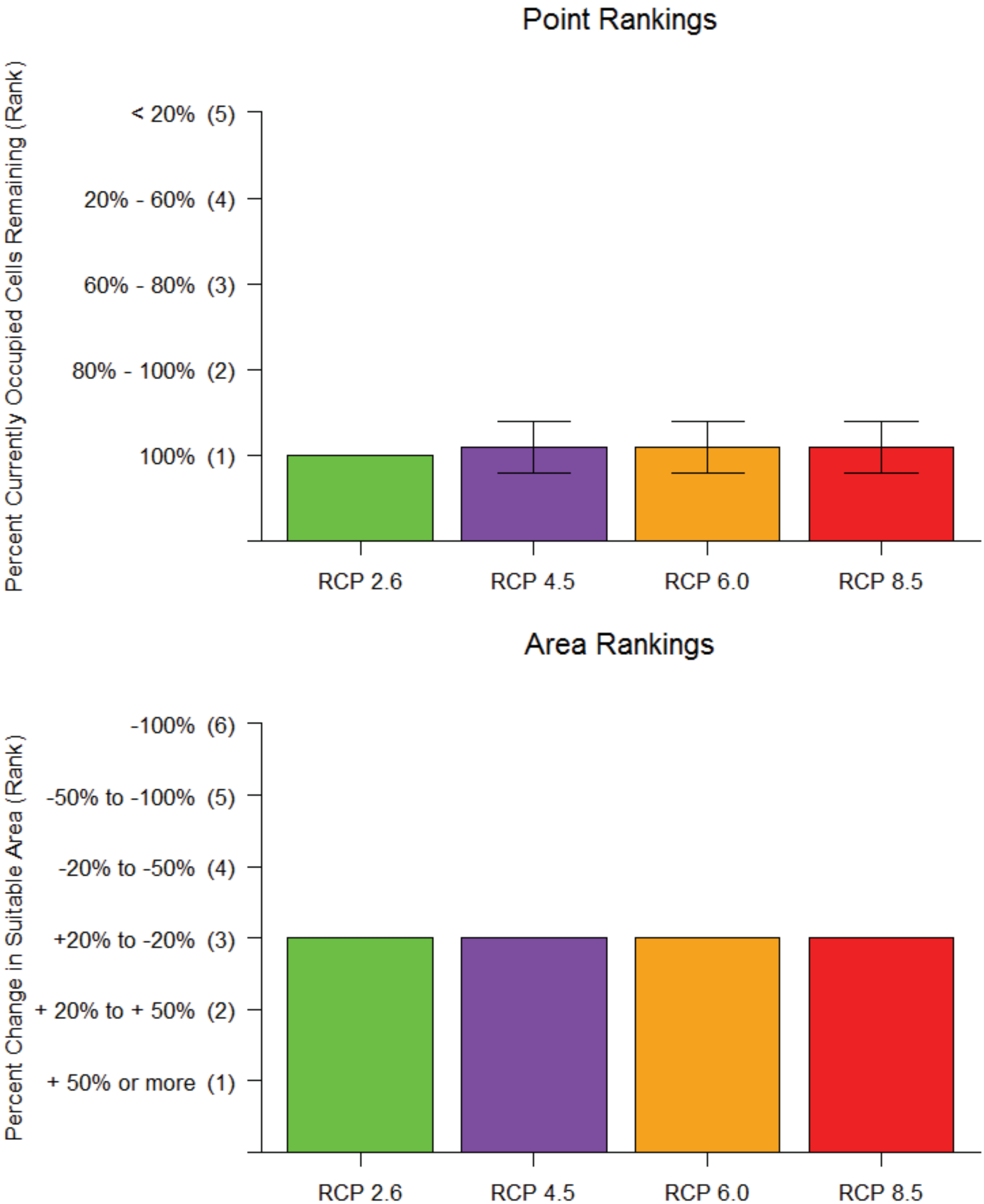
Species Results: *Coleonyx variegatus* Western Banded Gecko



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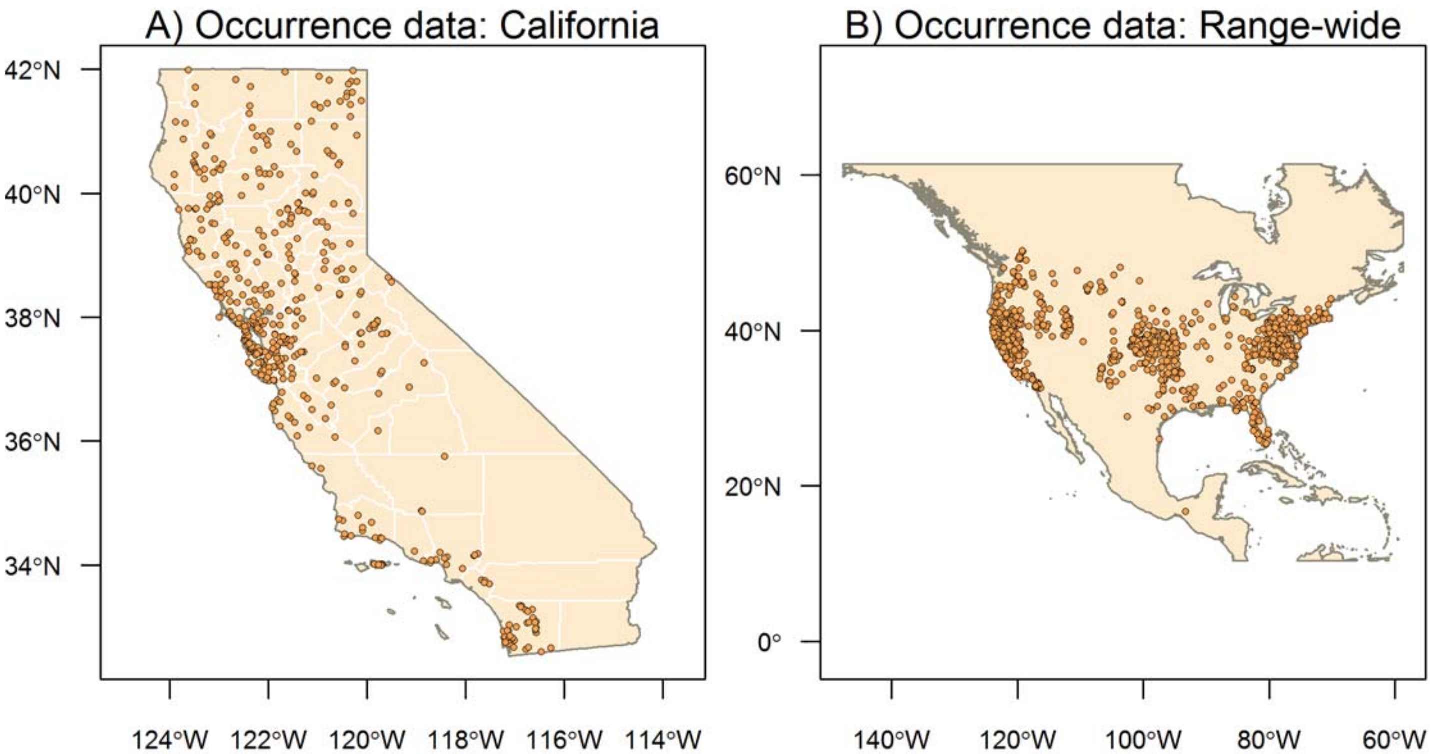
Species Results: *Coluber constrictor* Yellow-bellied Racer



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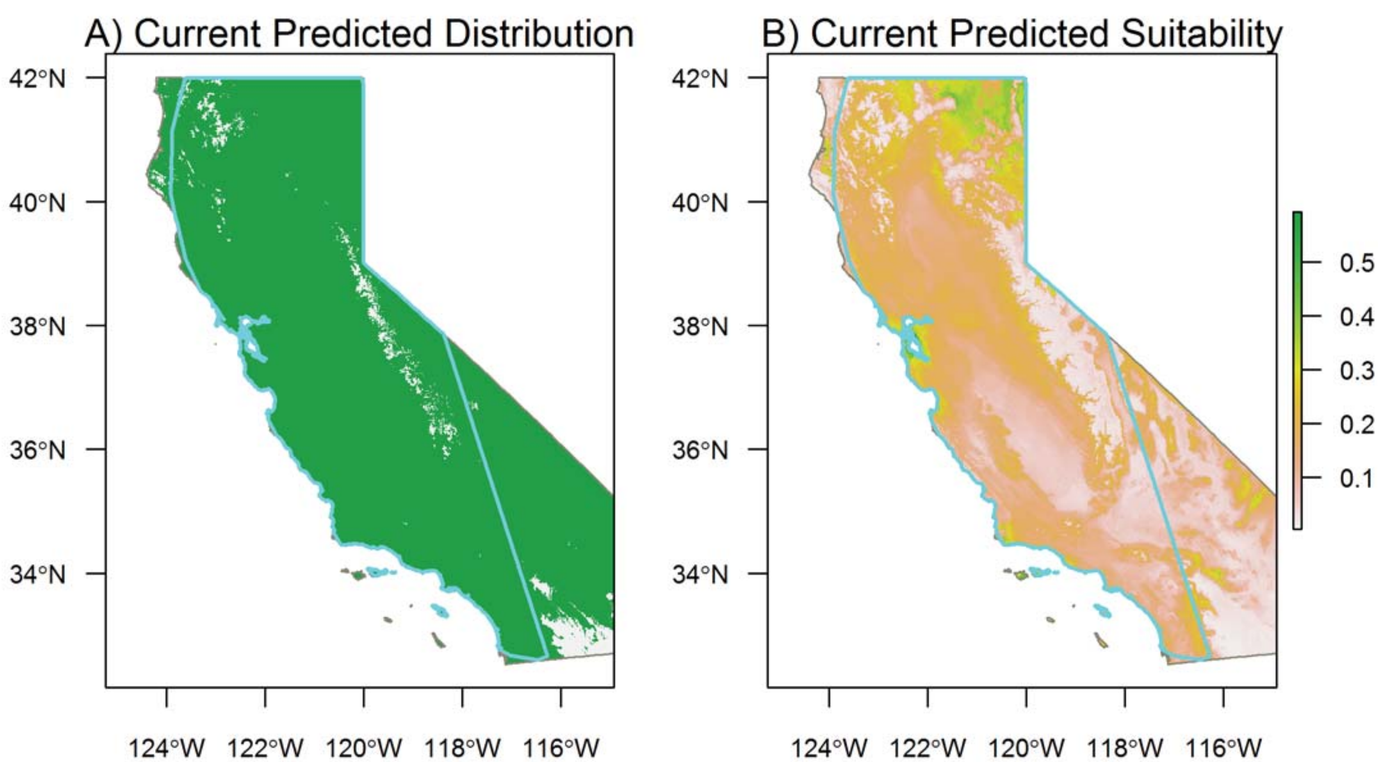

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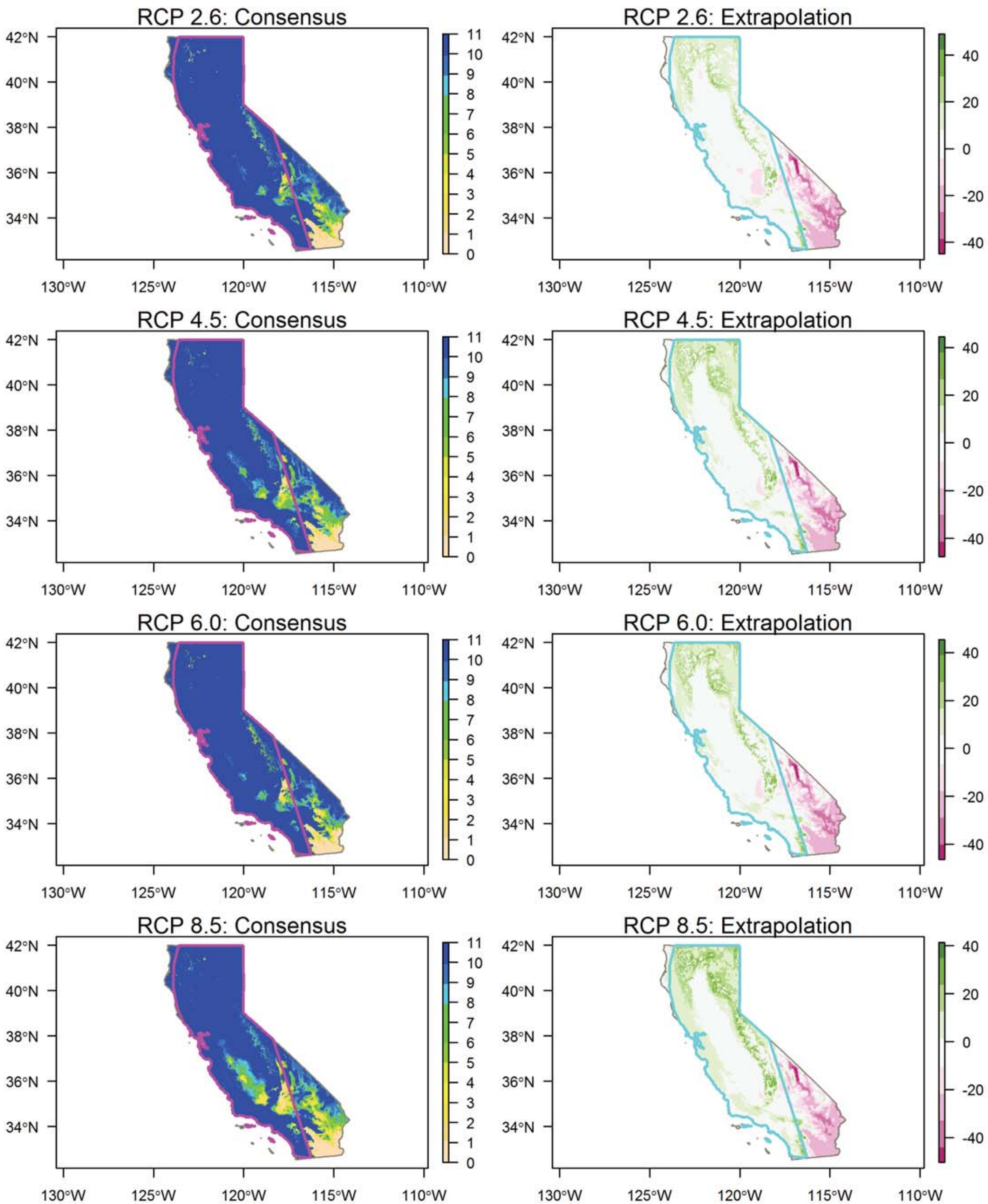
Species Results: *Coluber constrictor* Yellow-bellied Racer



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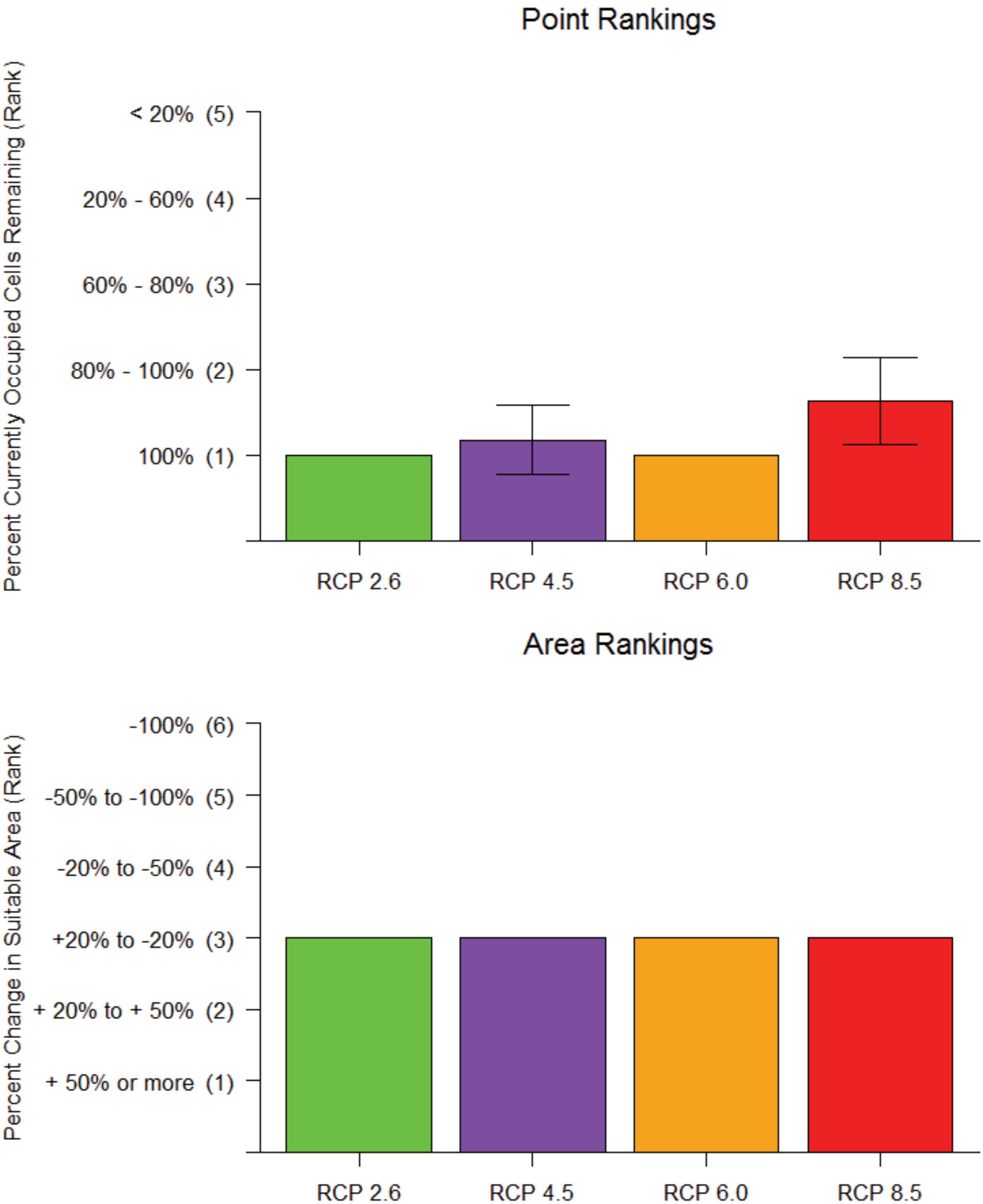
Species Results: *Coluber constrictor* Yellow-bellied Racer



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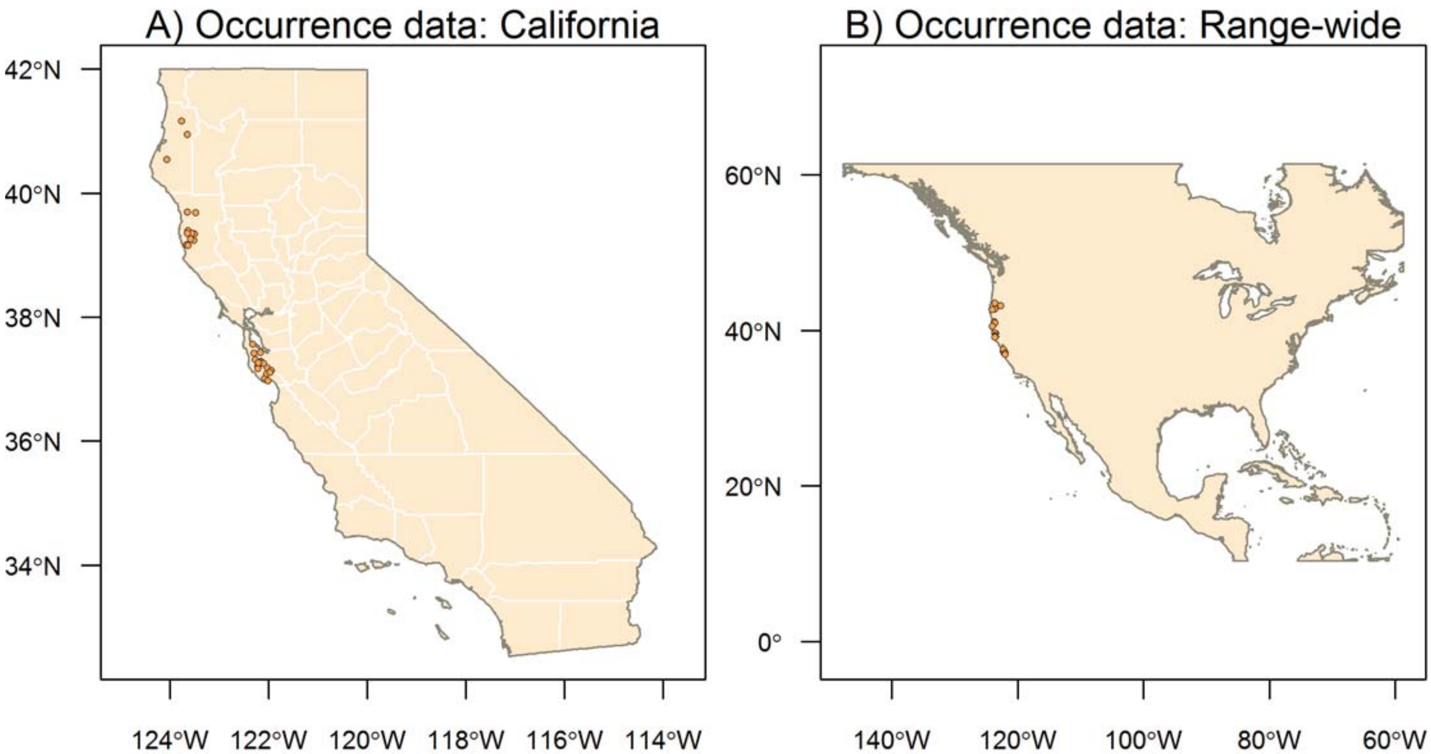
Species Results: *Contia longicaudae* Forest Sharp-tailed Snake



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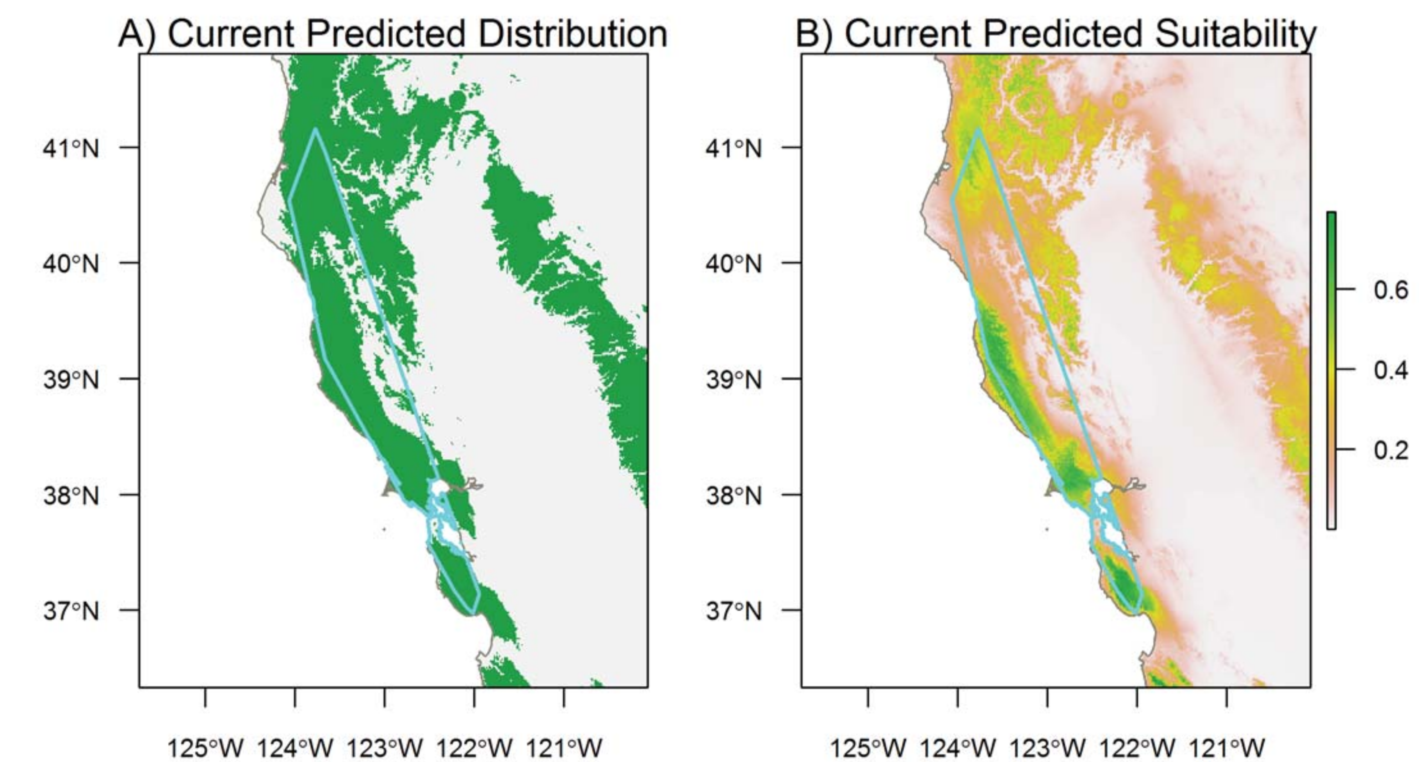

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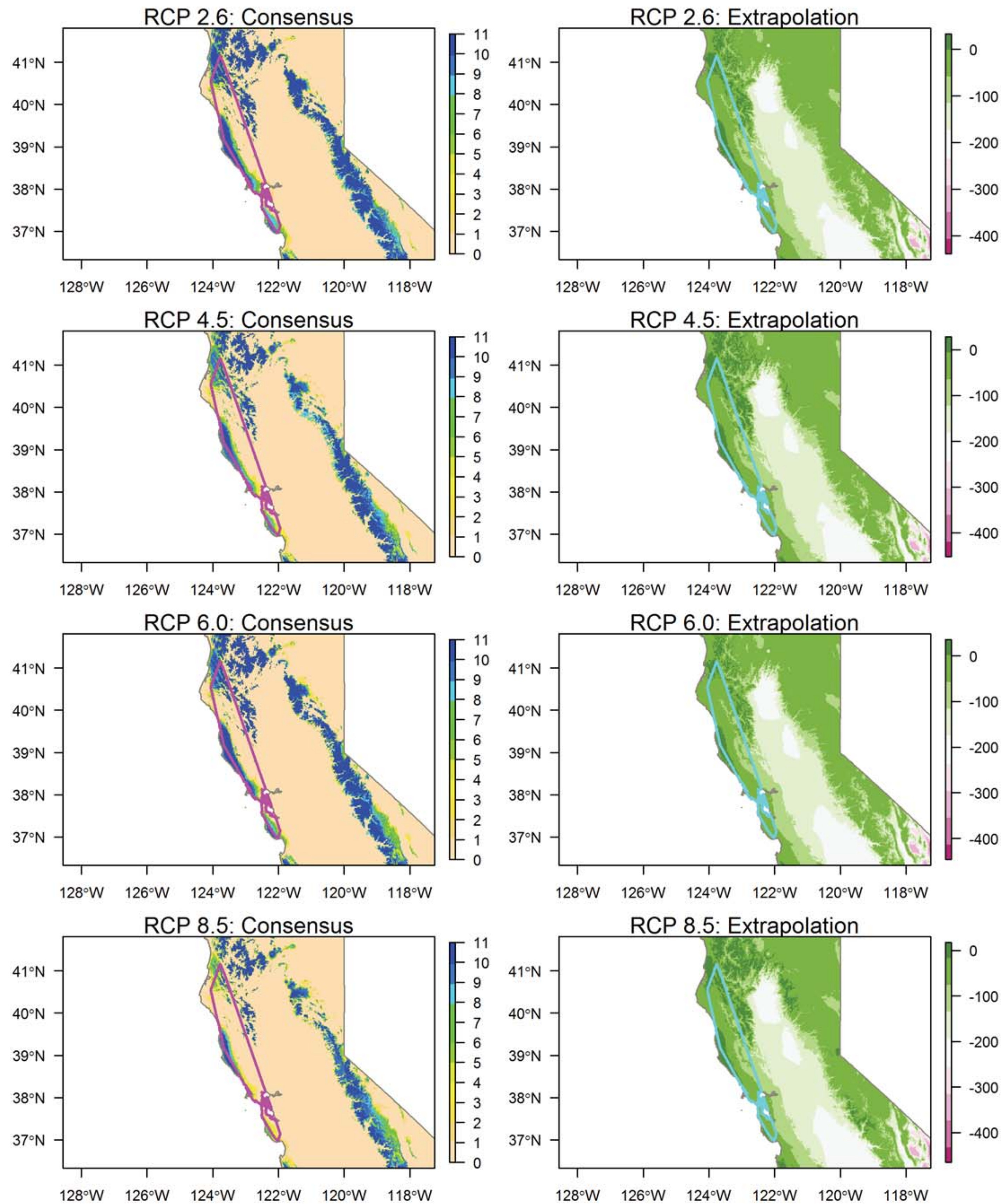
Species Results: *Contia longicaudae* Forest Sharp-tailed Snake



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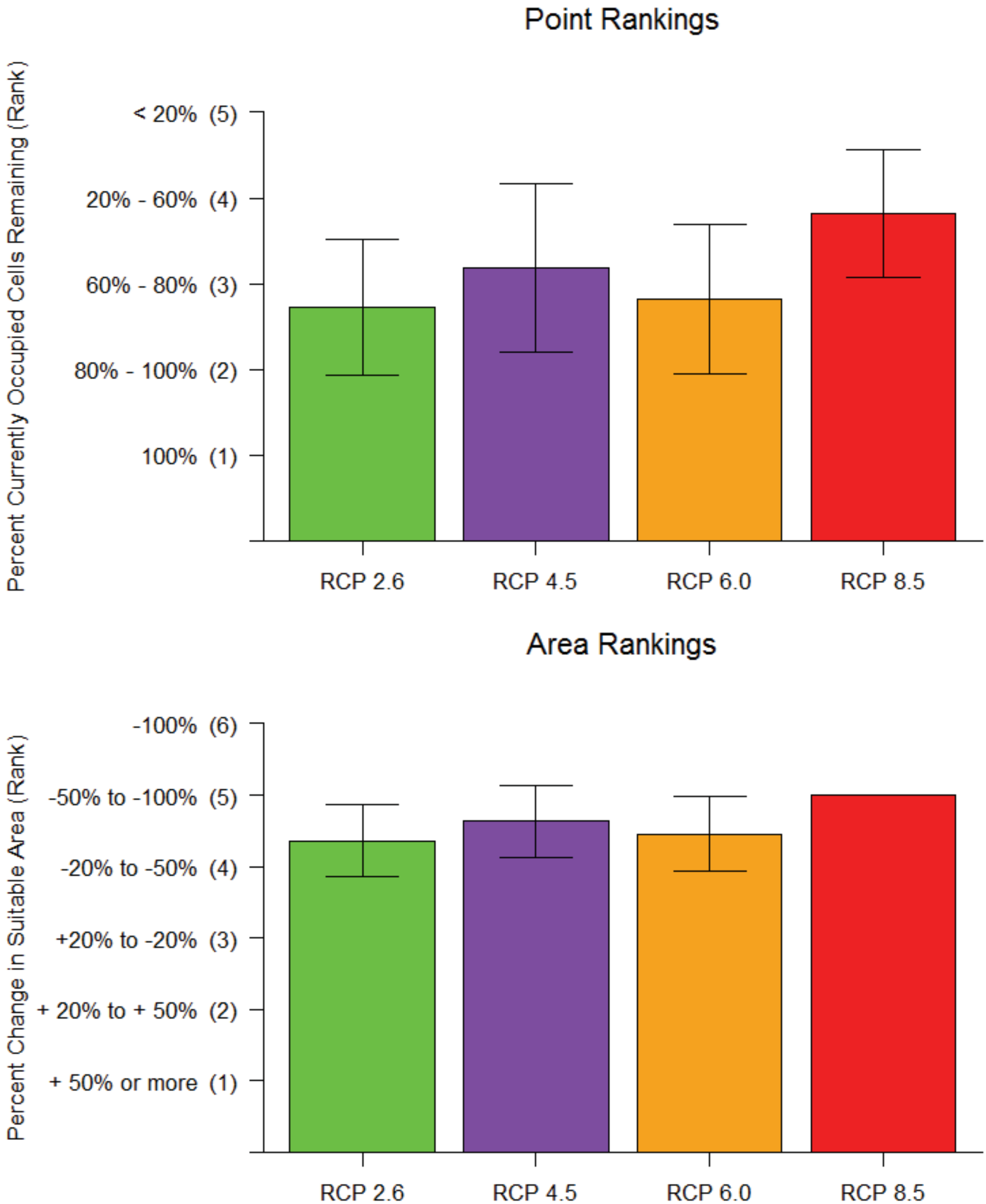
Species Results: *Contia longicaudae* Forest Sharp-tailed Snake



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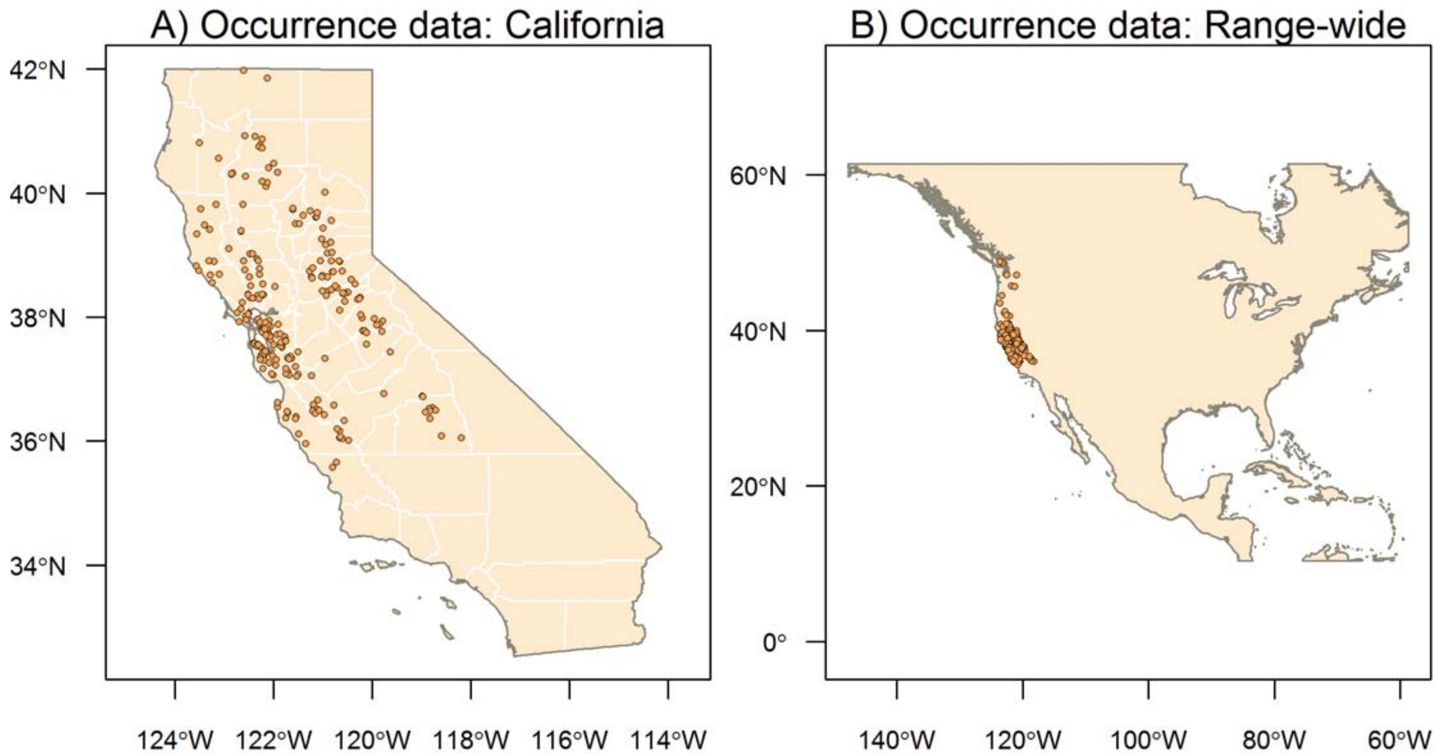
Species Results: *Contia tenuis* Common Sharp-tailed Snake



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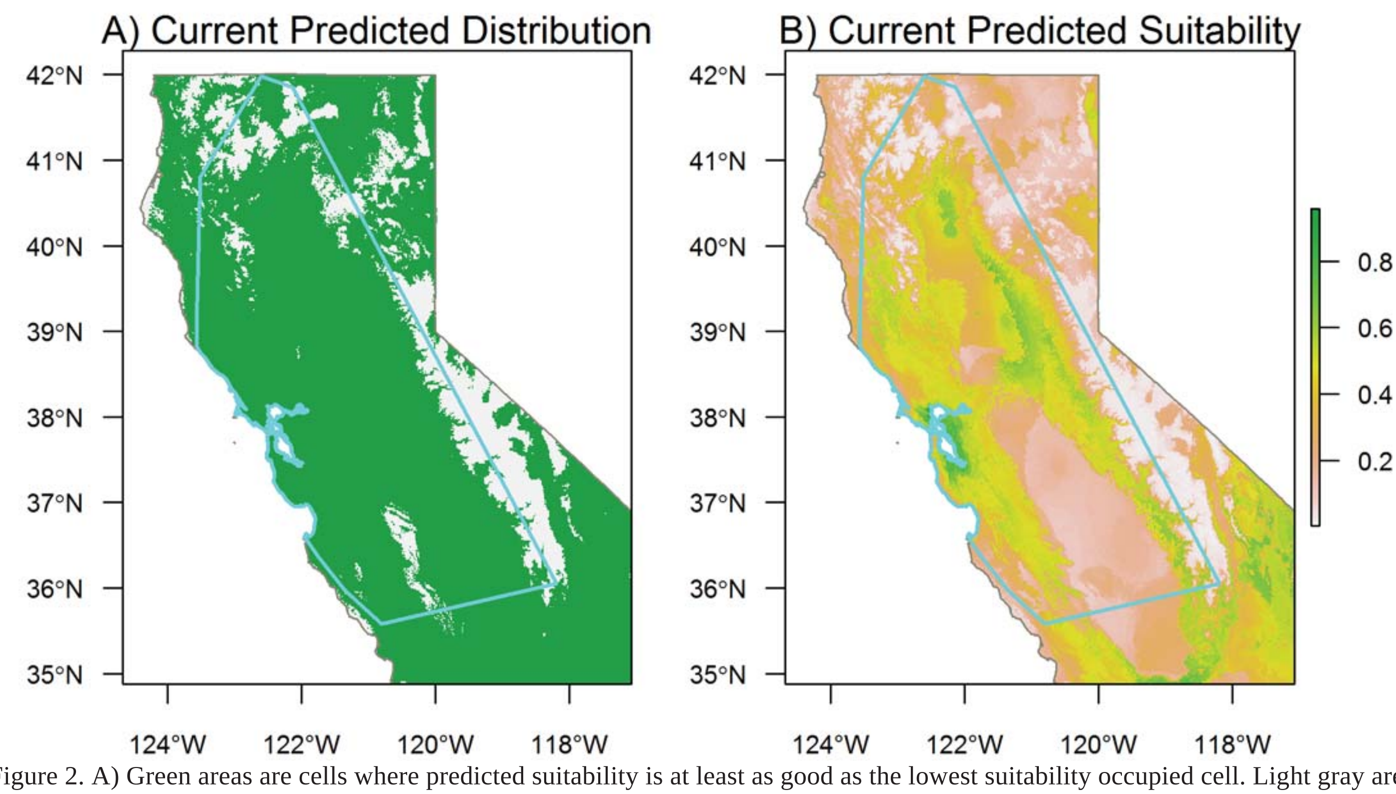

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Species Results: *Contia tenuis* Common Sharp-tailed Snake

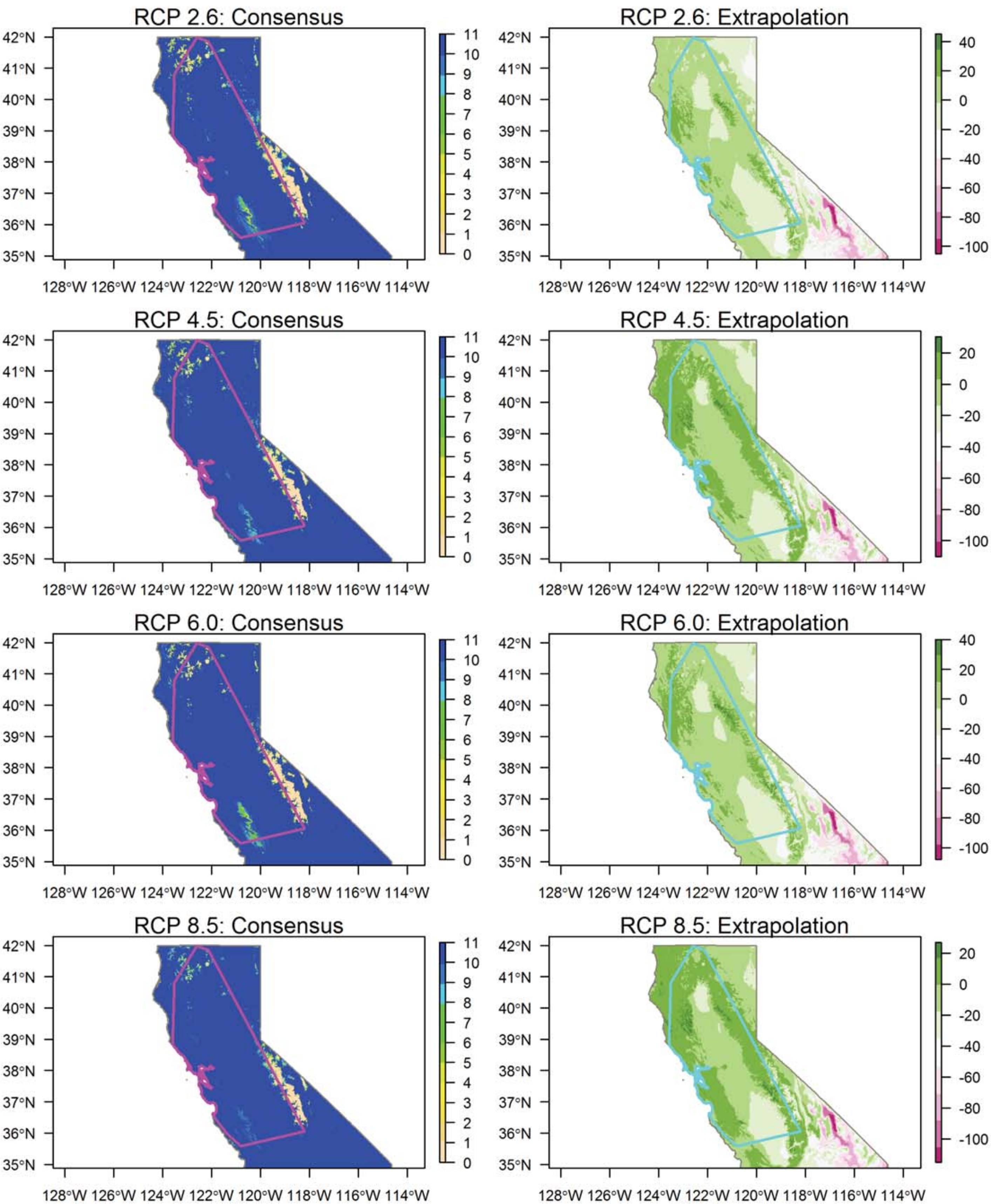


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Contia tenuis* Common Sharp-tailed Snake

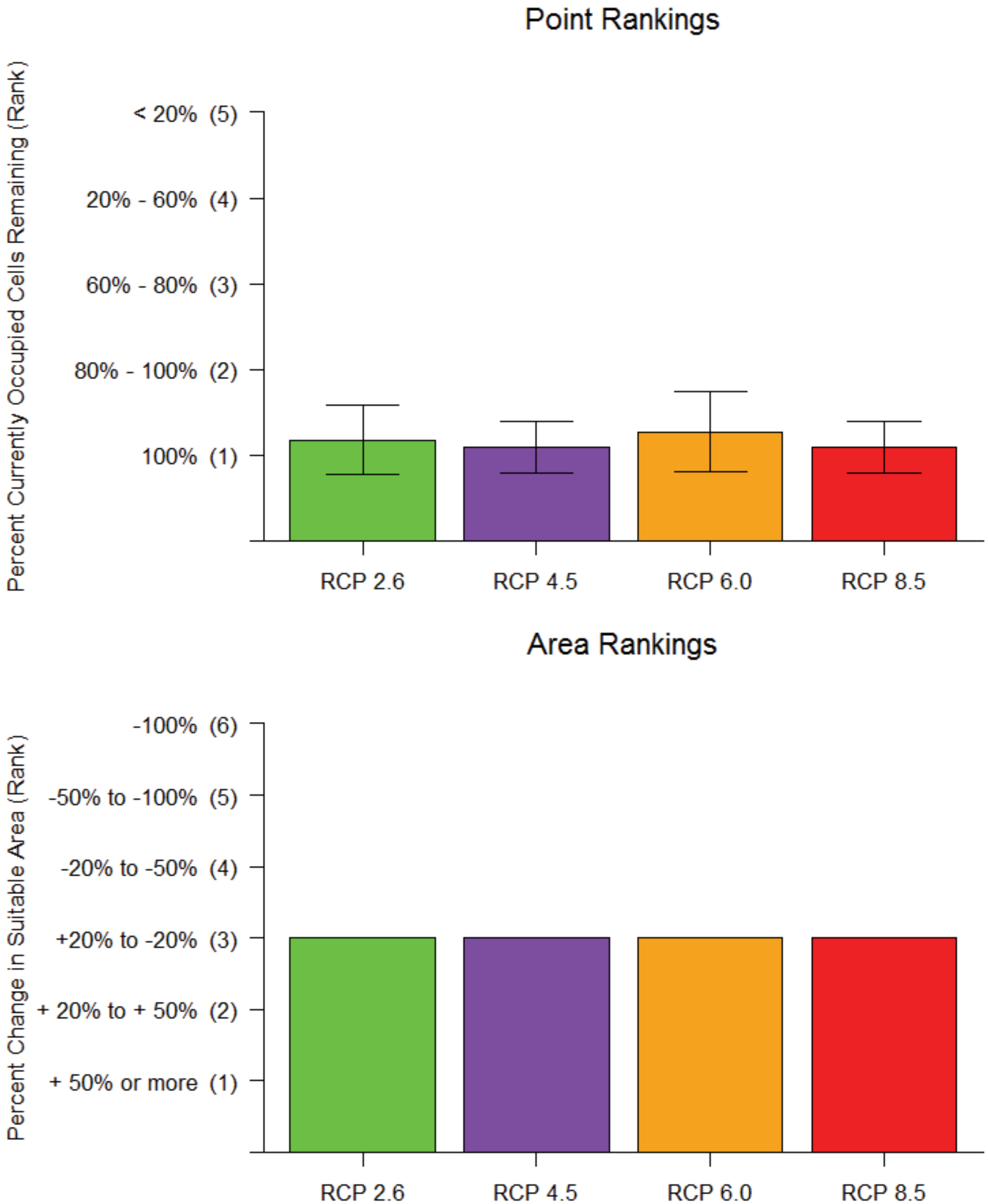


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus atrox* Western Diamond-backed Rattlesnake

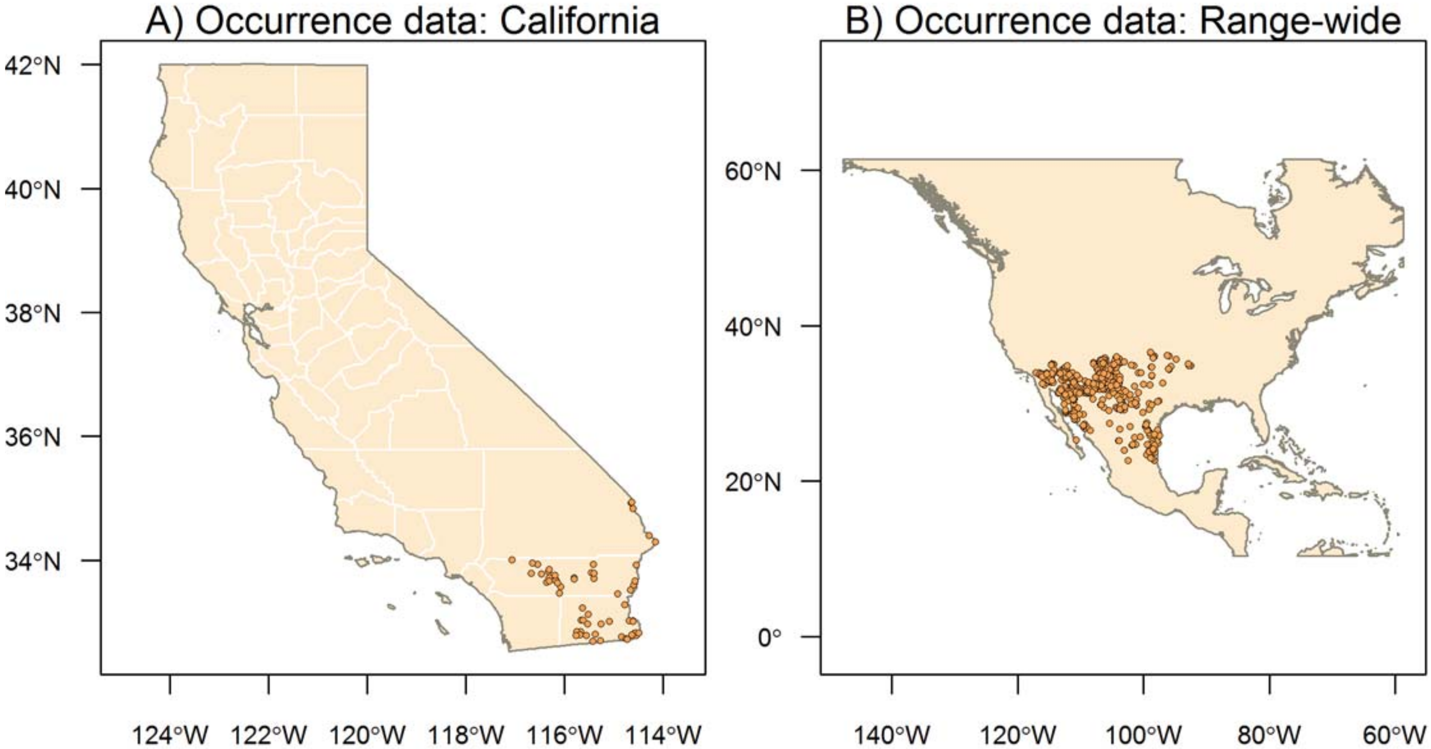
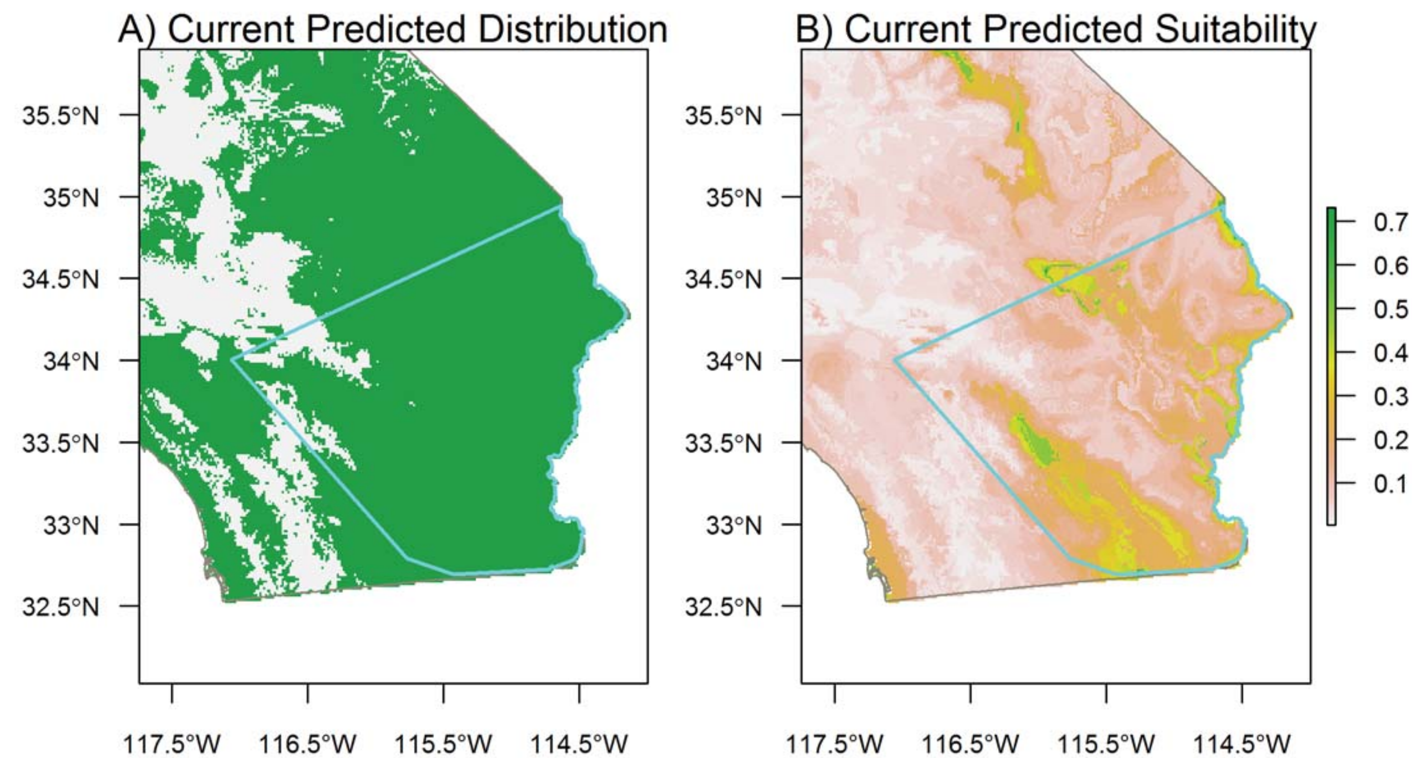


Figure 1. Occurrence data used to build Maxent models.



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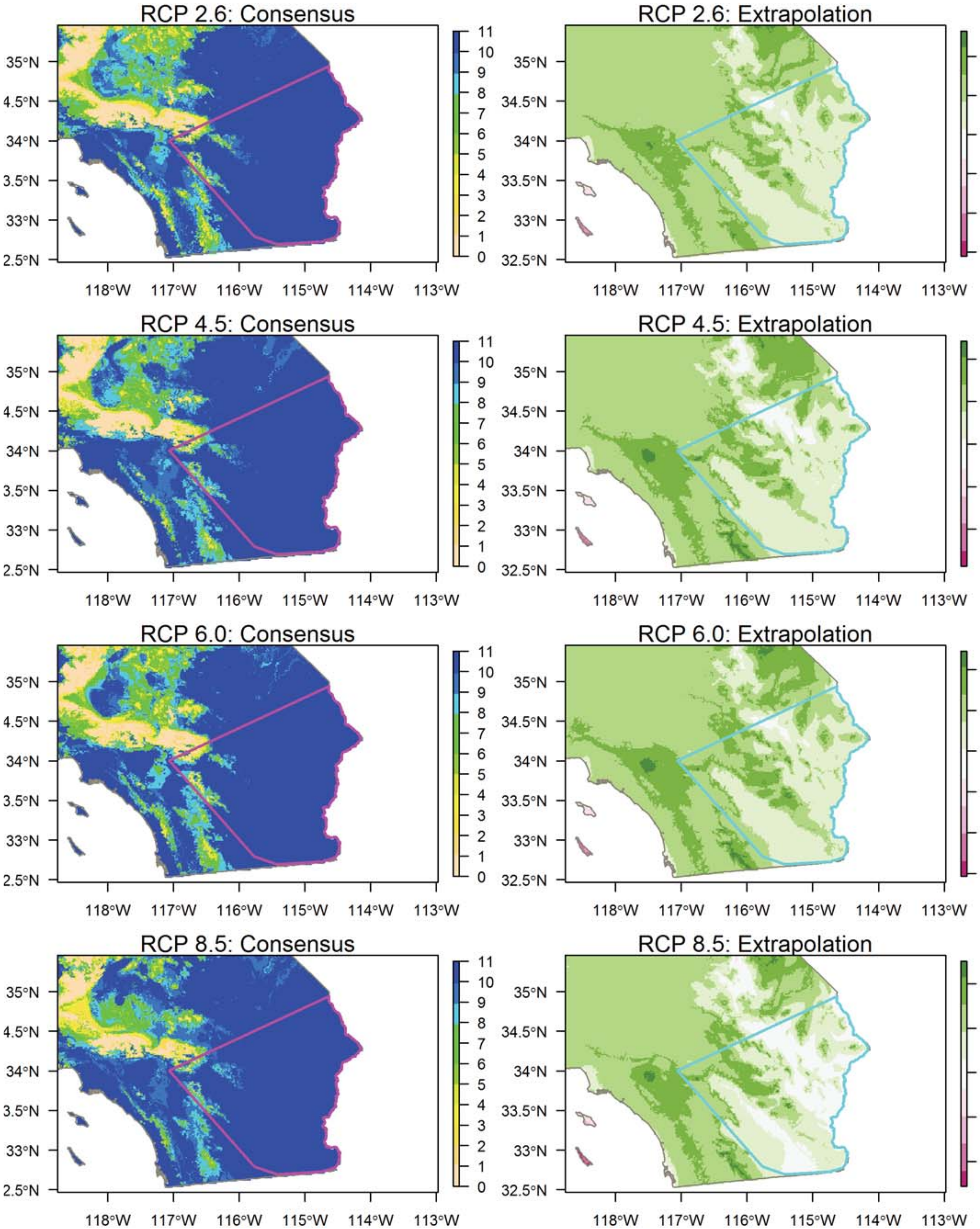
Species Results: *Crotalus atrox* Western Diamond-backed Rattlesnake



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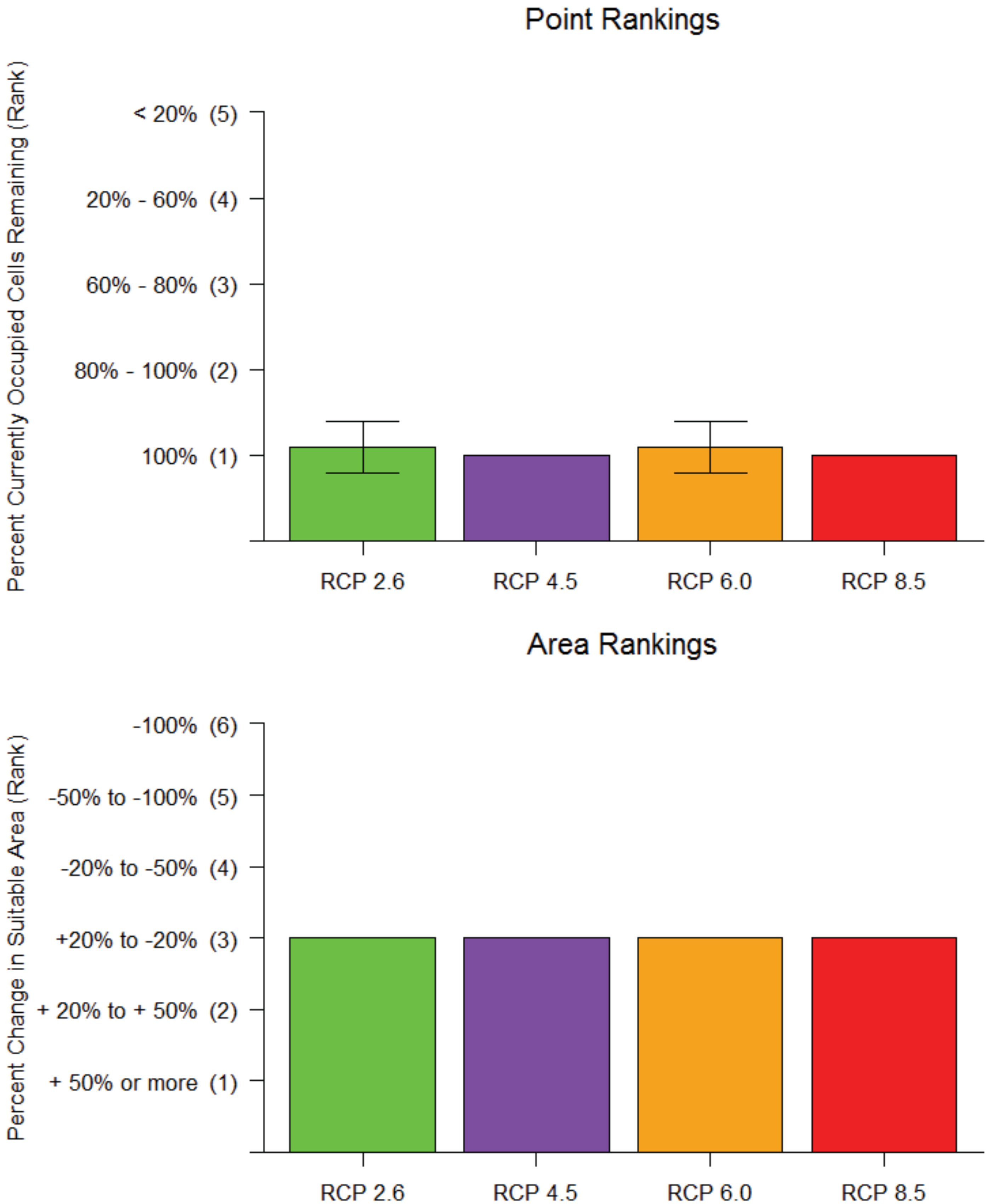


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus cerastes* Sidewinder

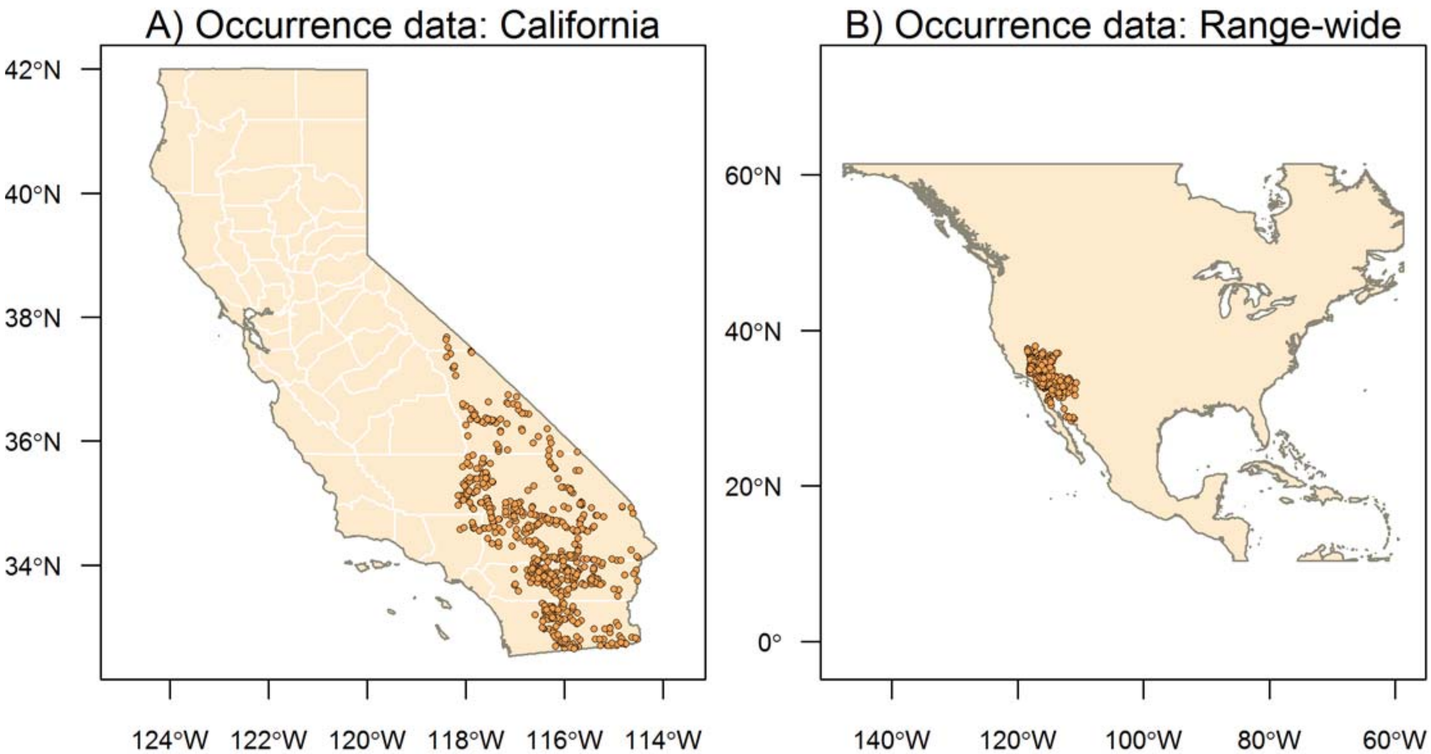
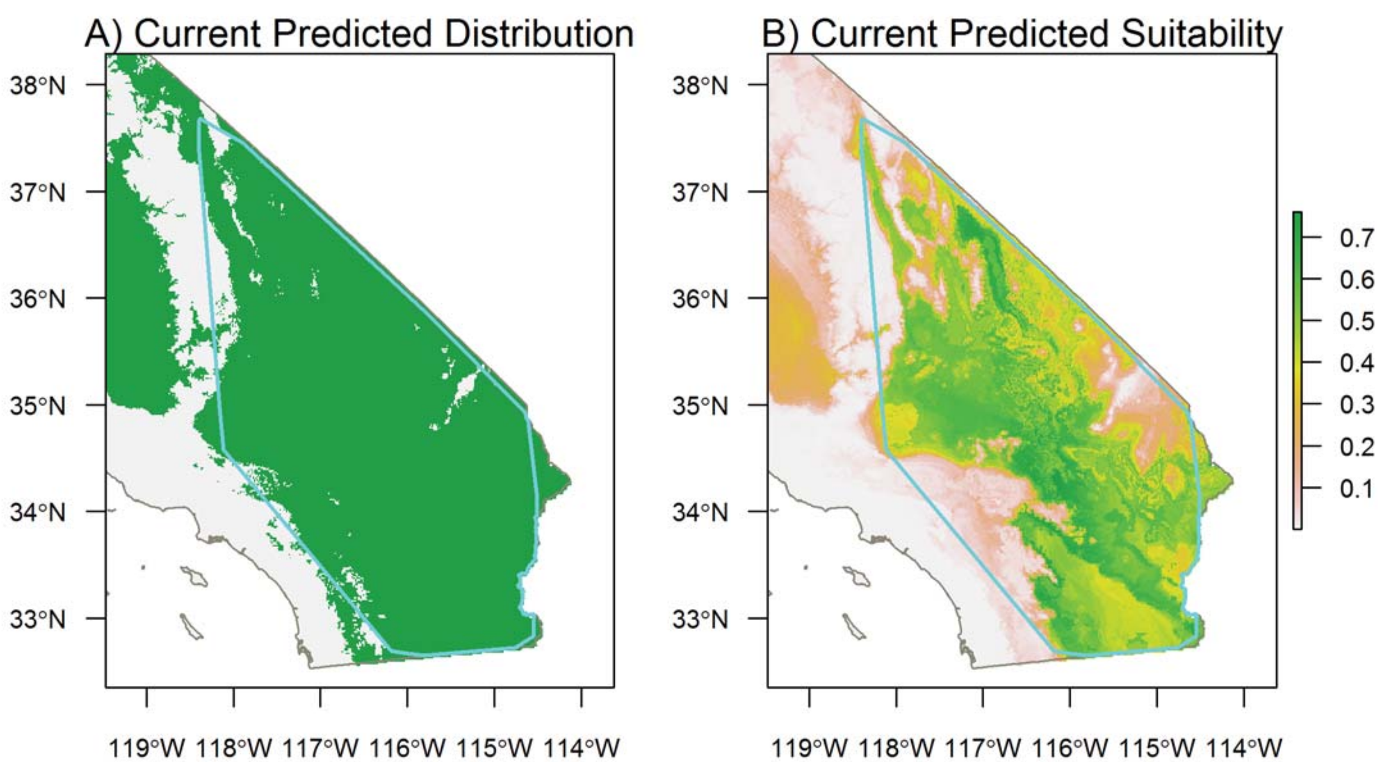


Figure 1. Occurrence data used to build Maxent models.



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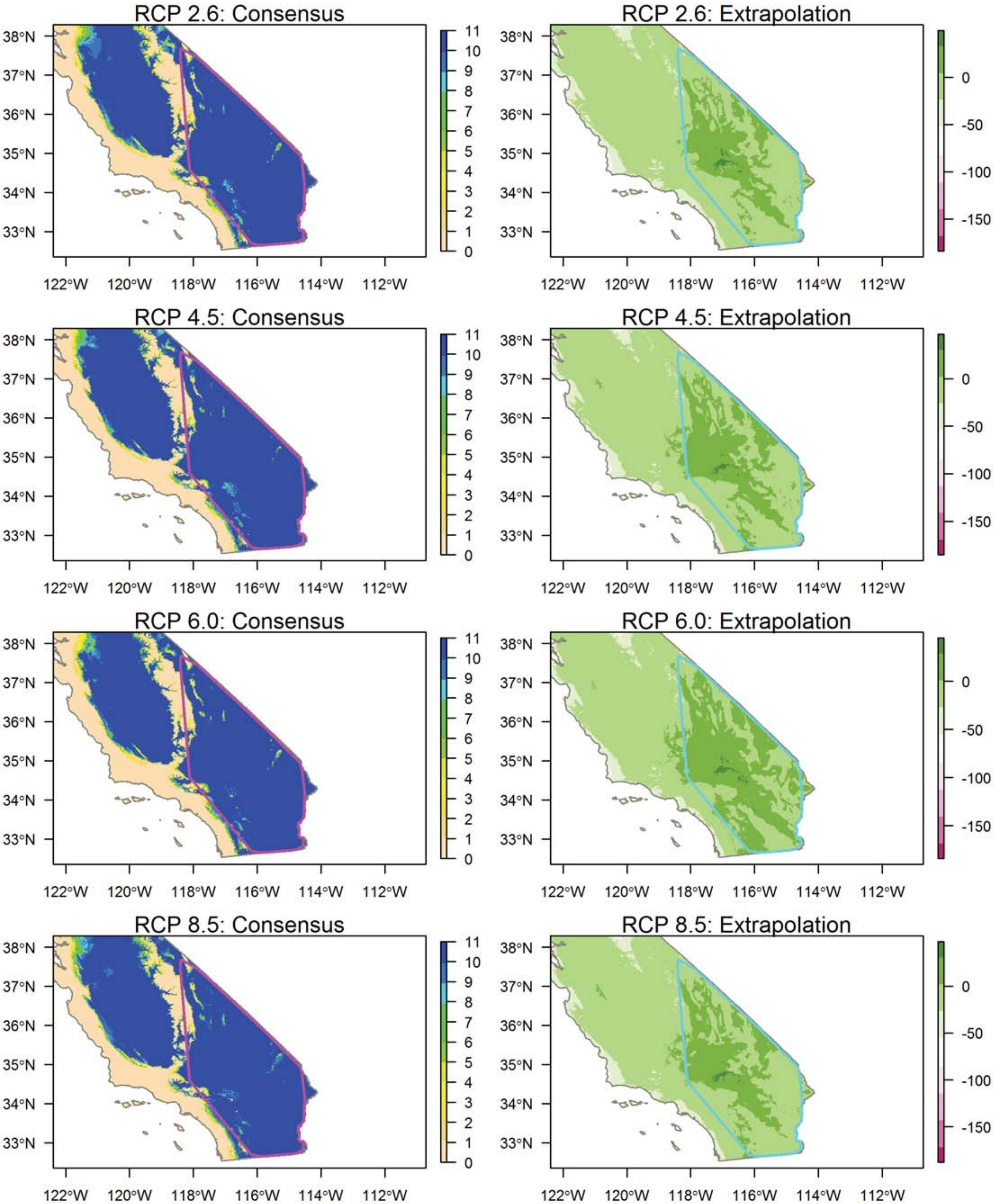
Species Results: *Crotalus cerastes* Sidewinder



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Species Results: *Crotalus cerastes* Sidewinder

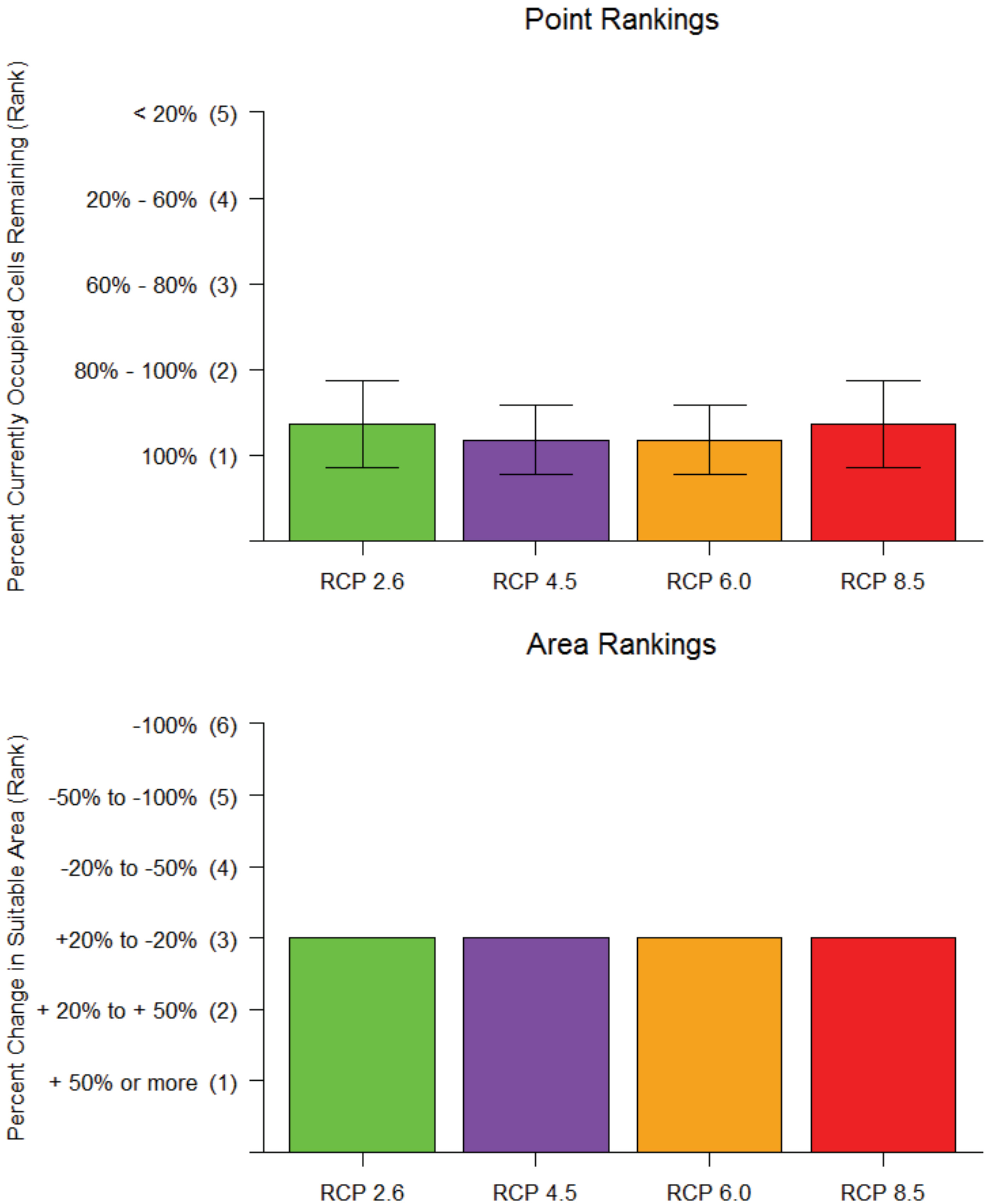


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus mitchellii* Speckled Rattlesnake

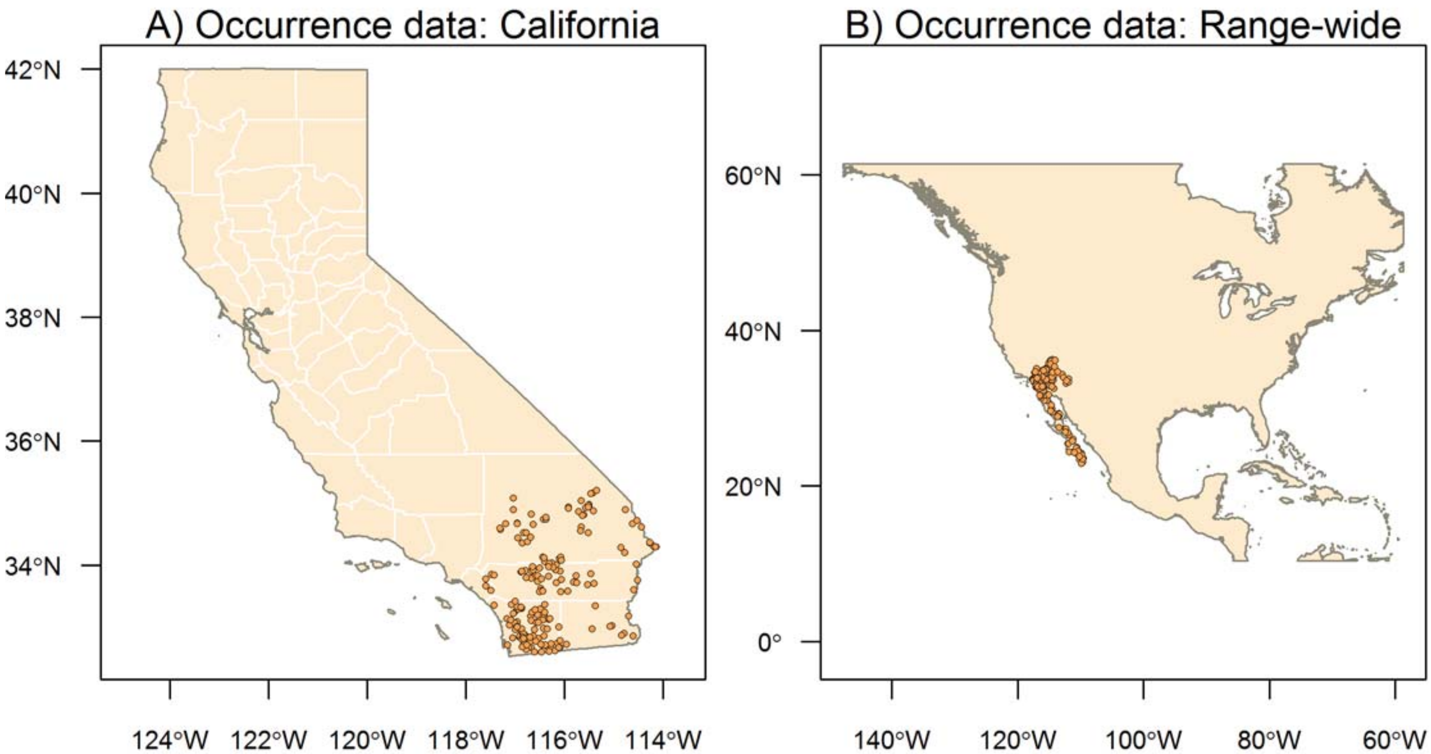


Figure 1. Occurrence data used to build Maxent models.

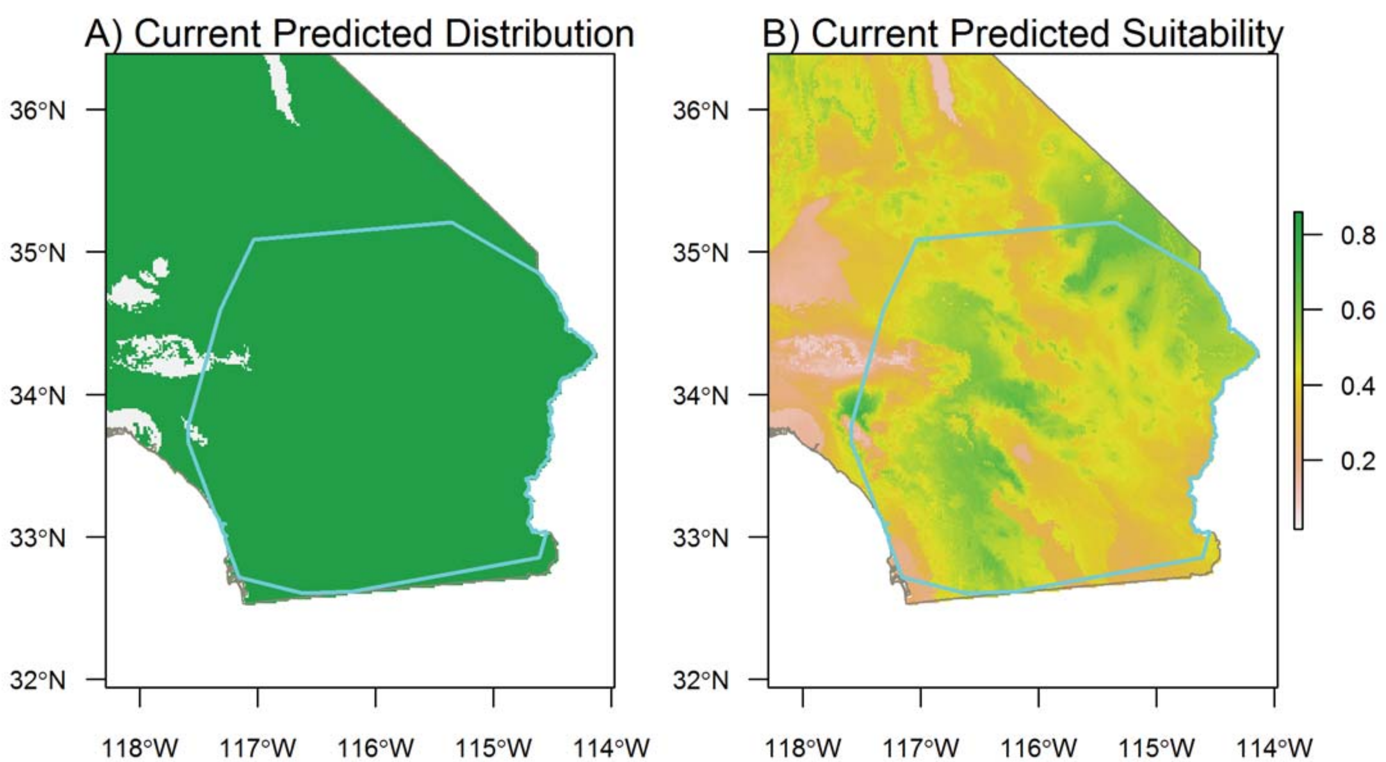


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Crotalus mitchellii* Speckled Rattlesnake

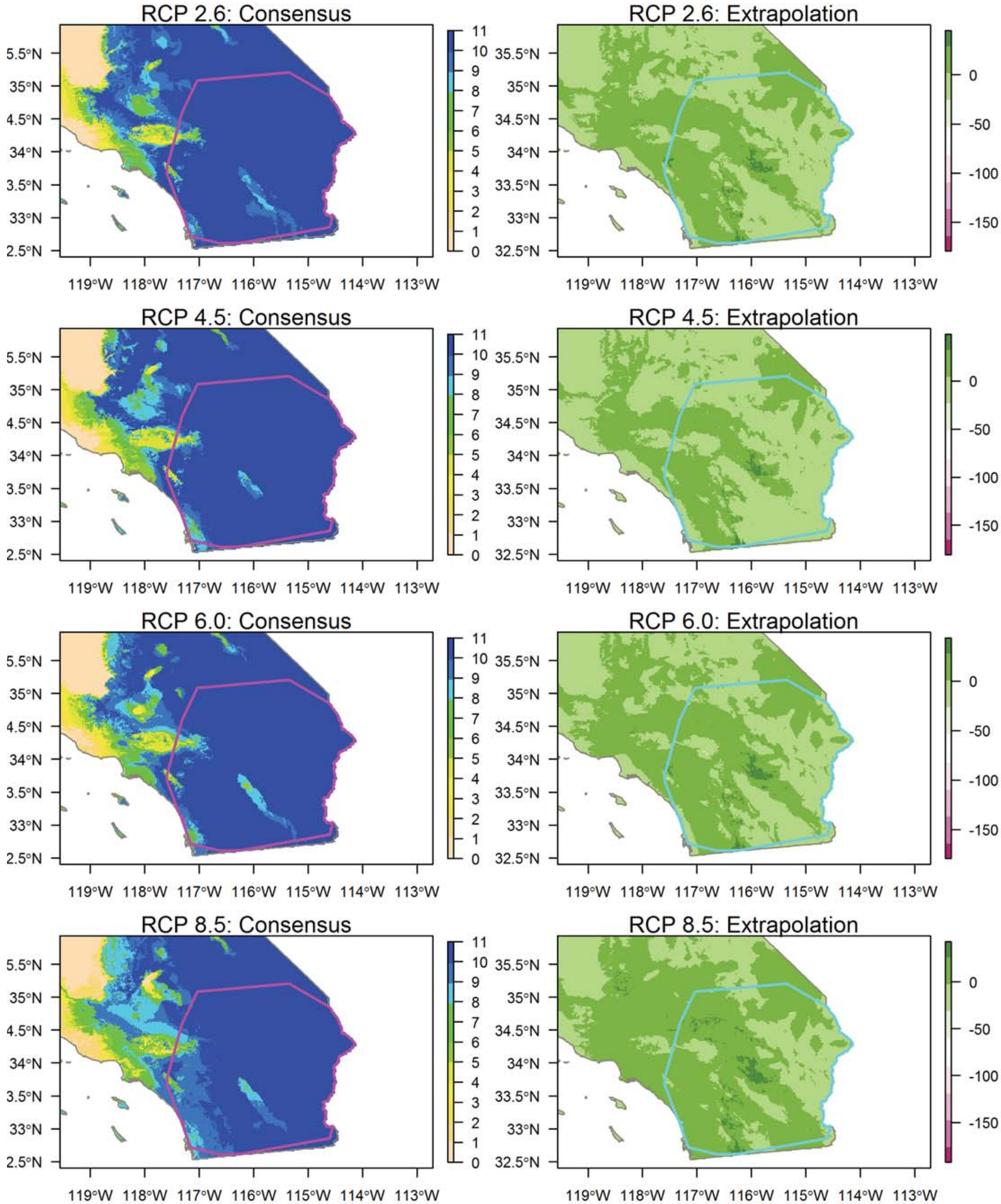


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

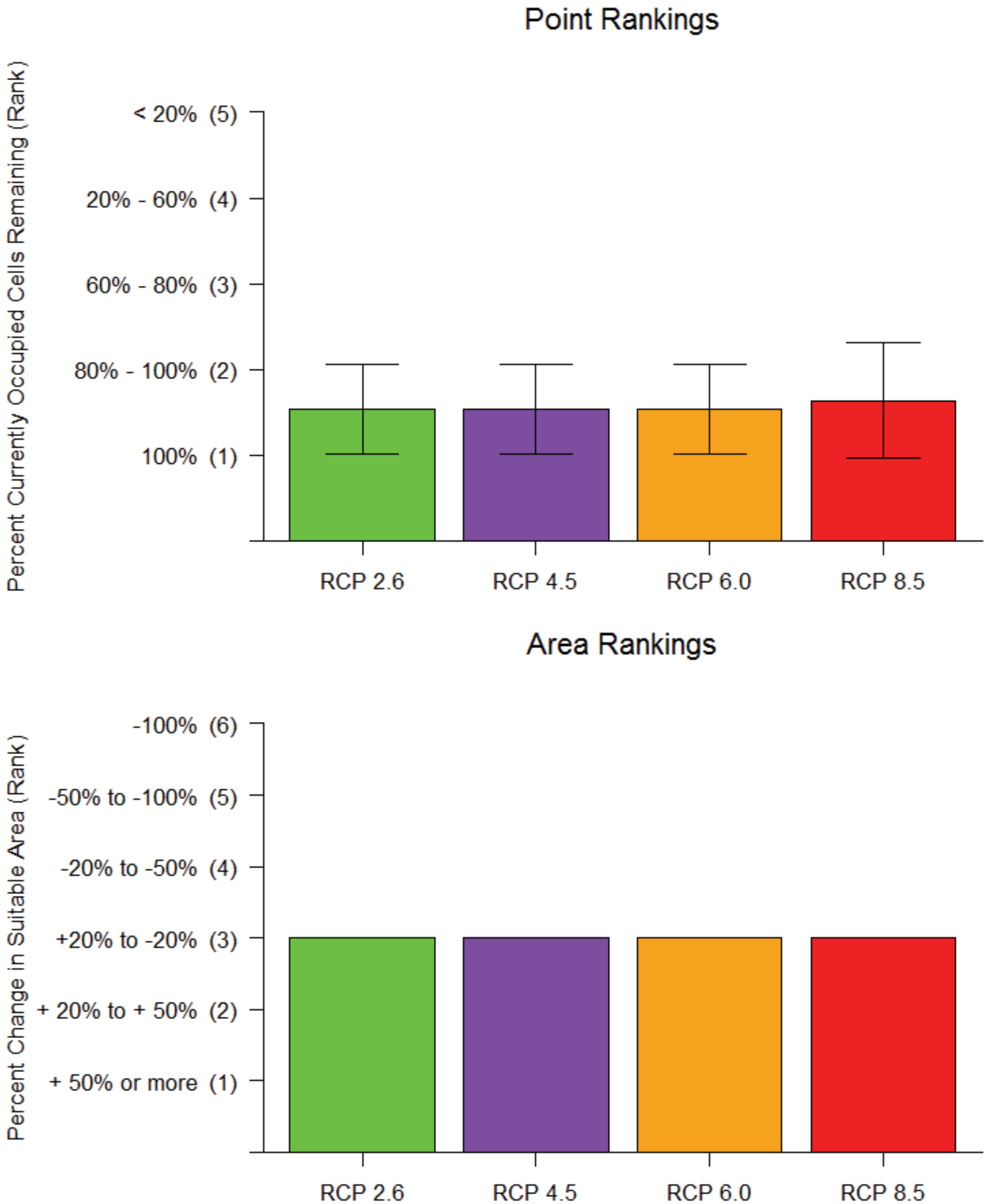


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus oreganus* Western Rattlesnake

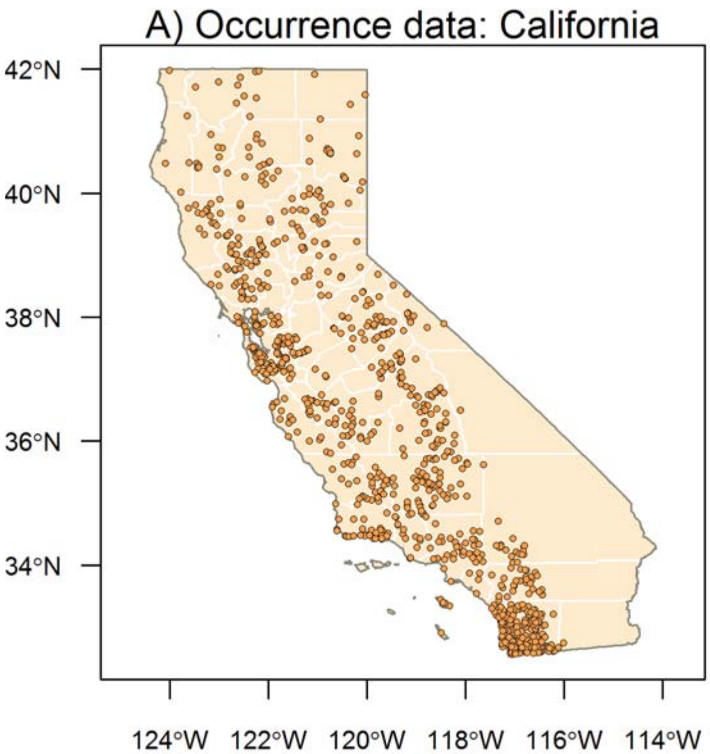
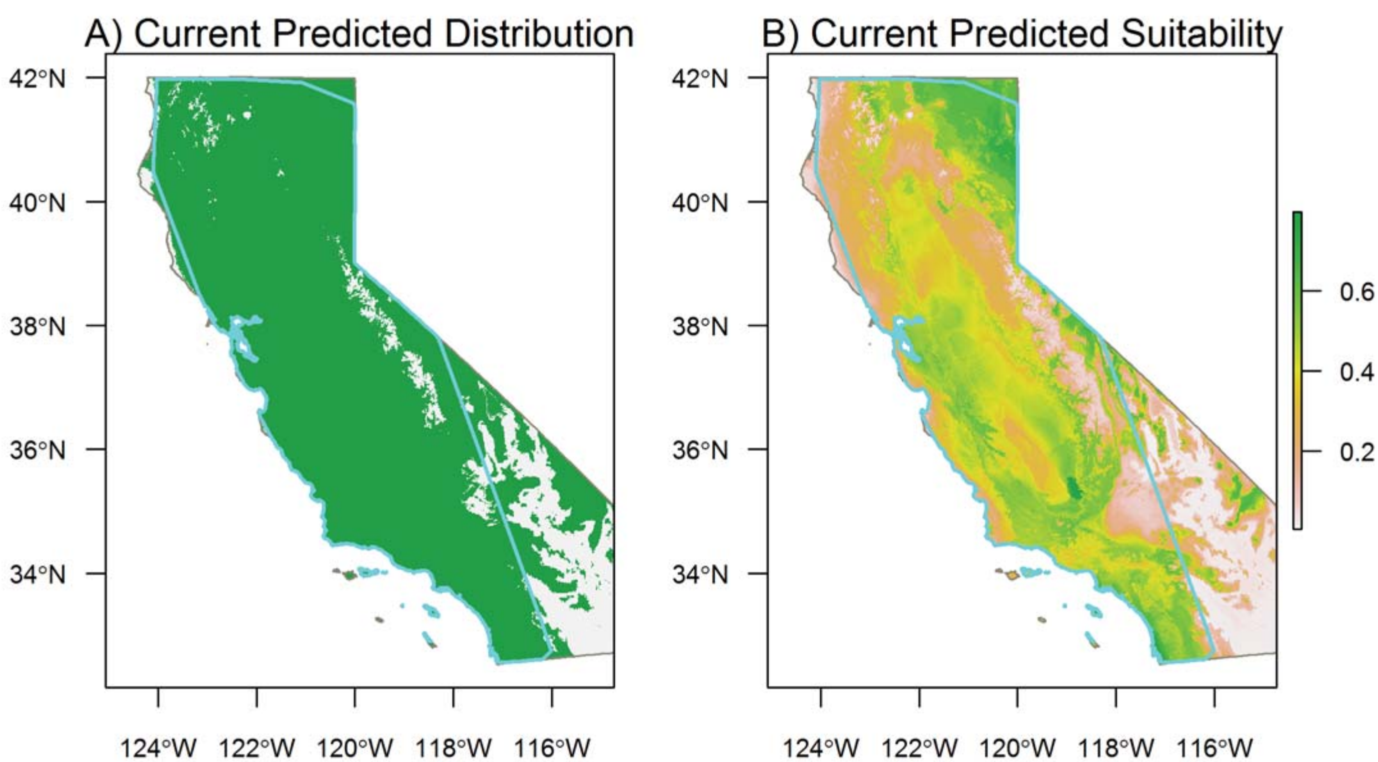


Figure 1. Occurrence data used to build Maxent models.



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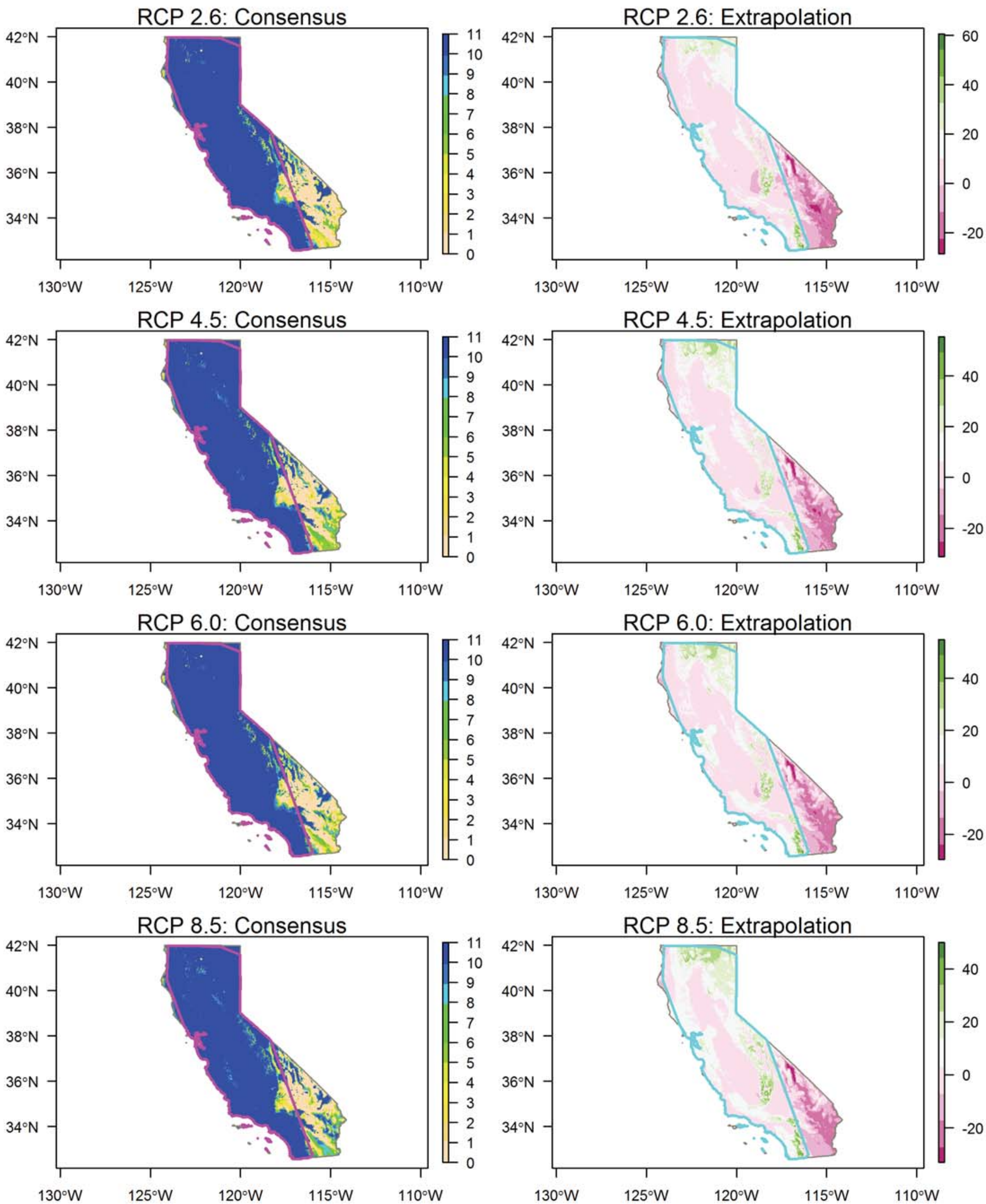
Species Results: *Crotalus oreganus* Western Rattlesnake



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Species Results: *Crotalus oreganus* Western Rattlesnake

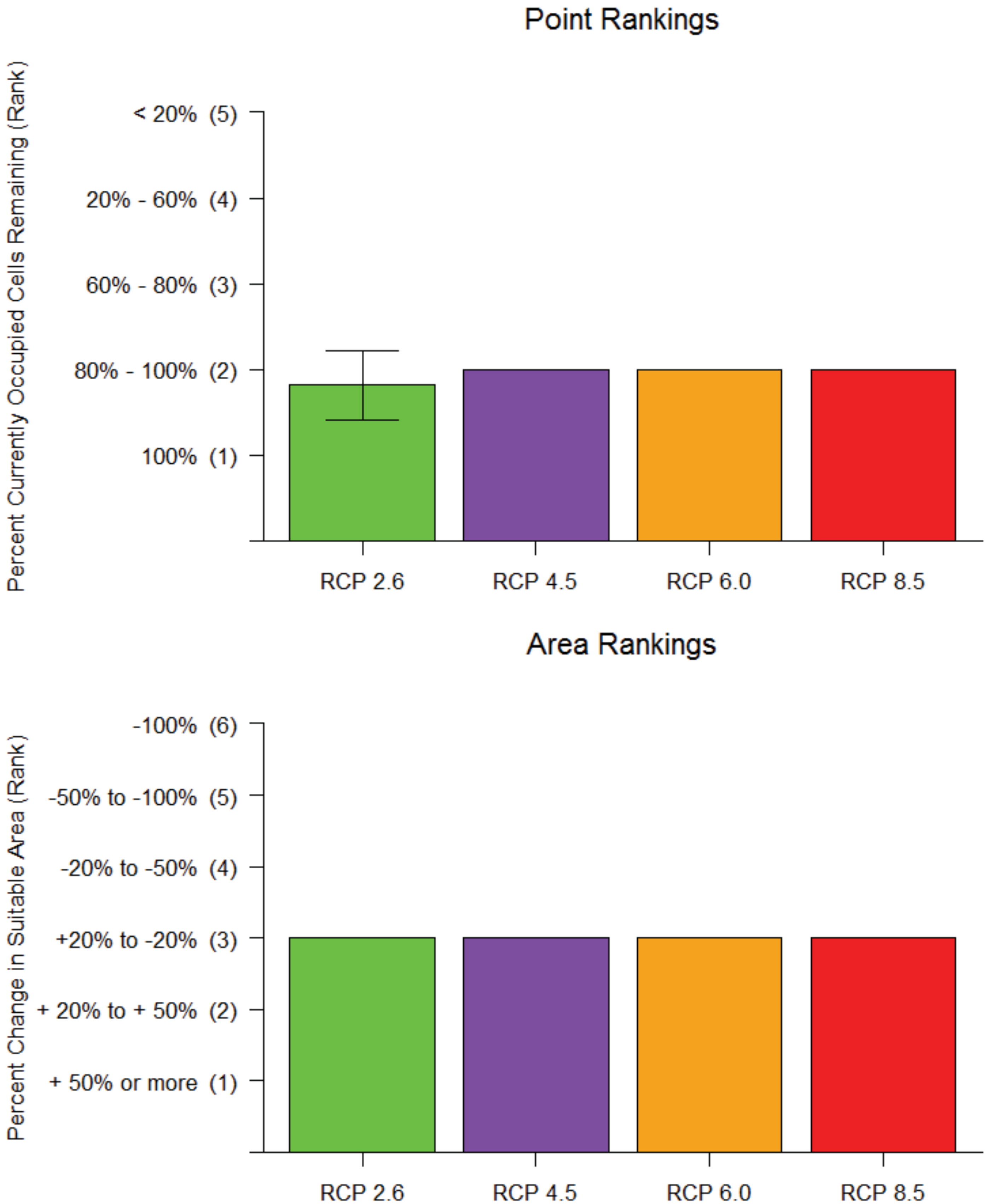


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus ruber* Red Diamond Rattlesnake

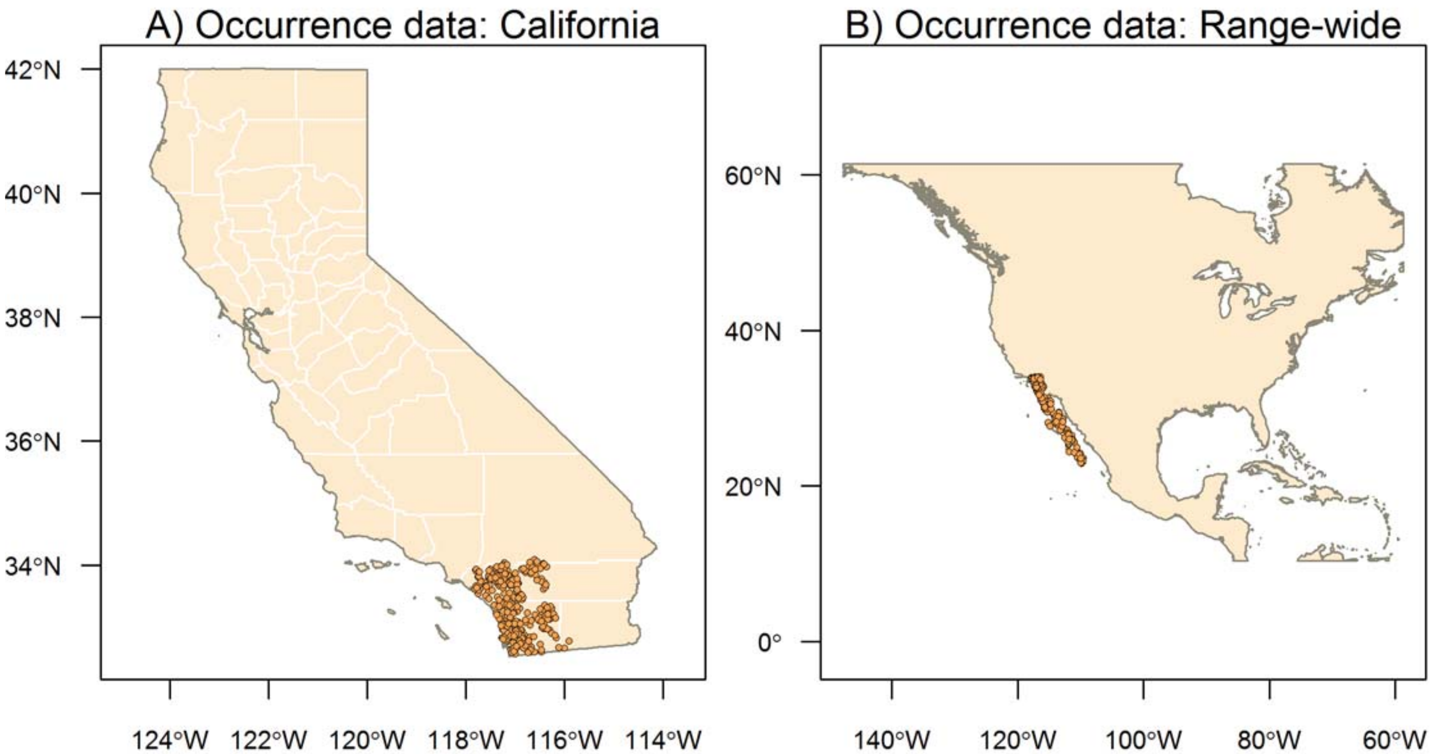
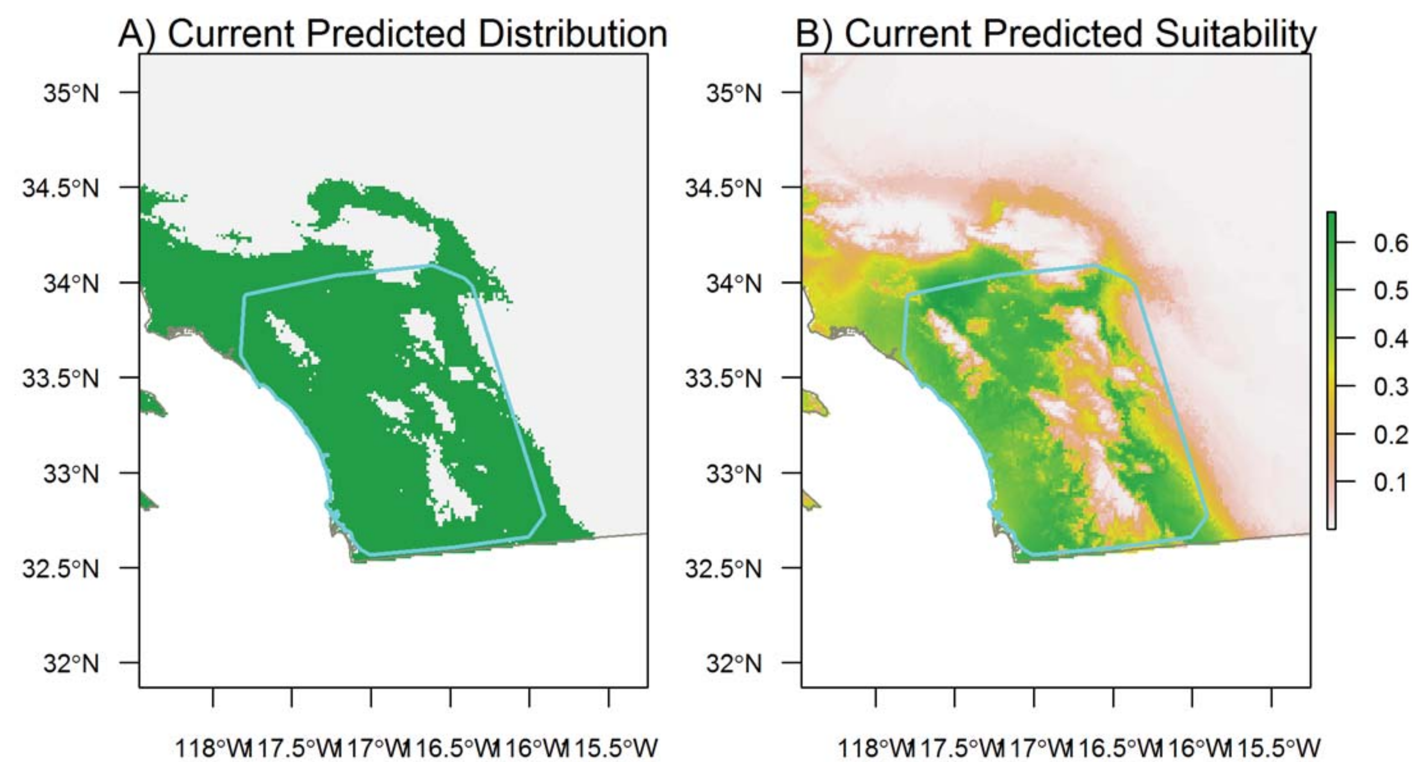


Figure 1. Occurrence data used to build Maxent models.



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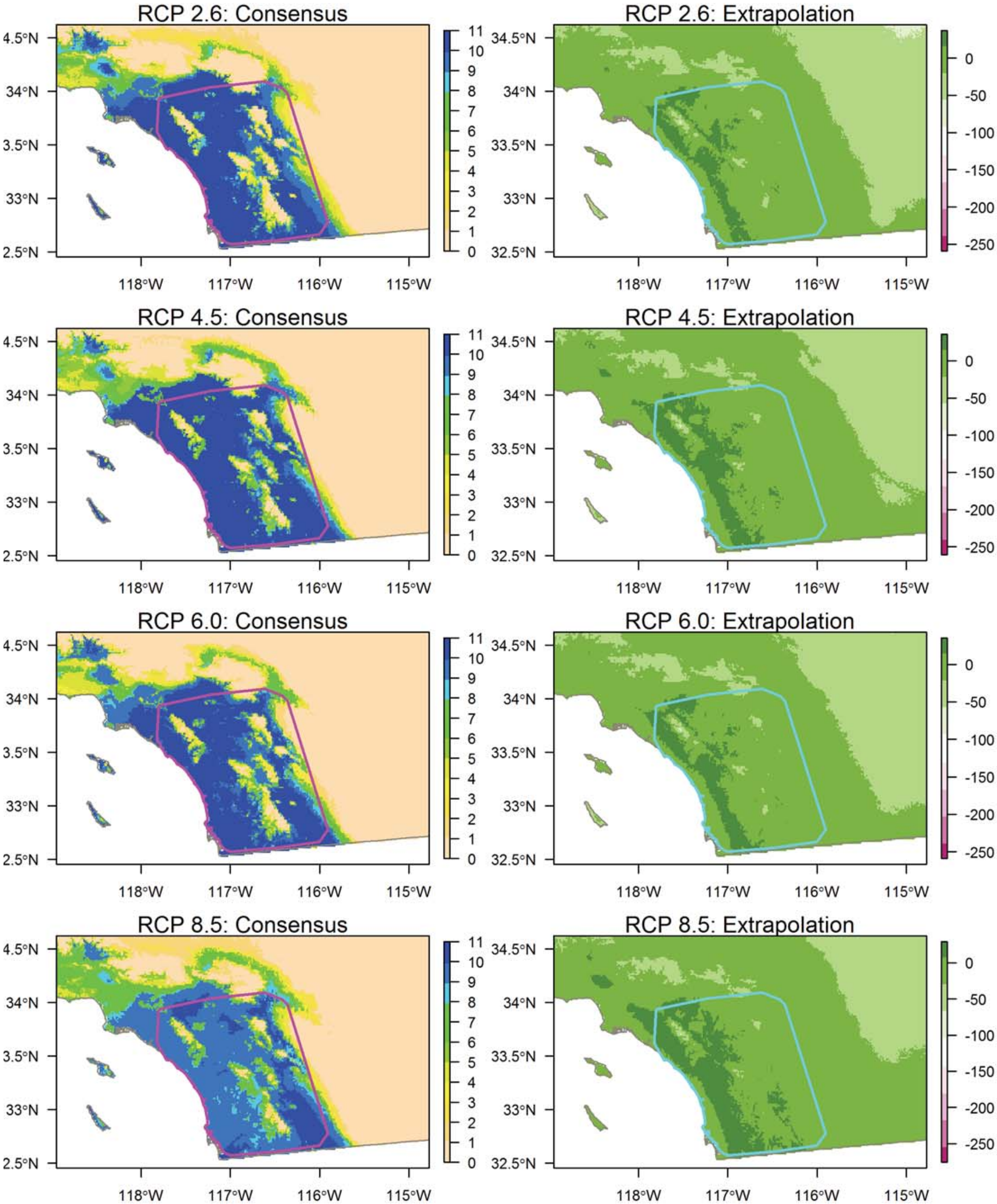

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Species Results: *Crotalus ruber* Red Diamond Rattlesnake

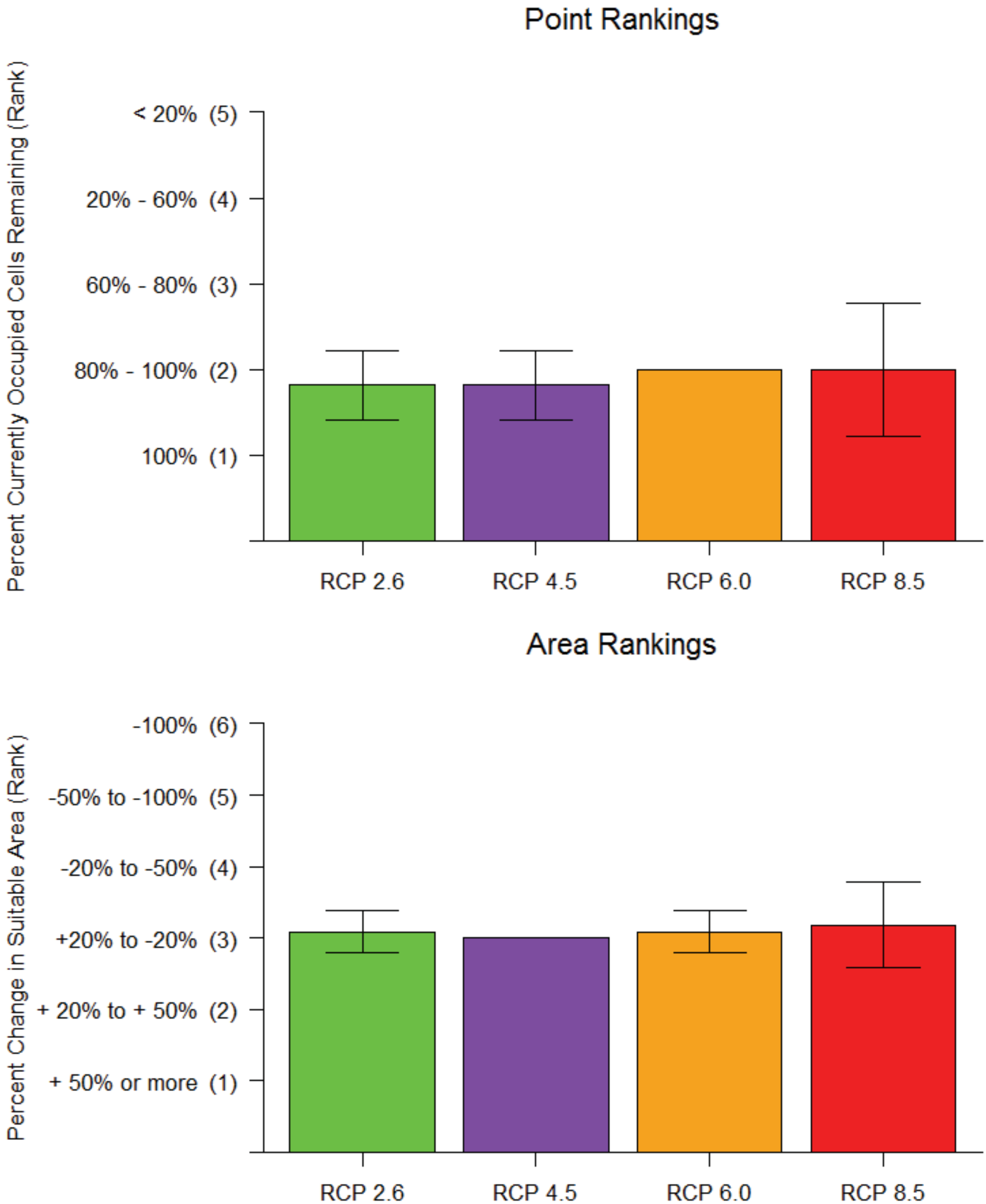


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus scutulatus* Northern Mojave Rattlesnake

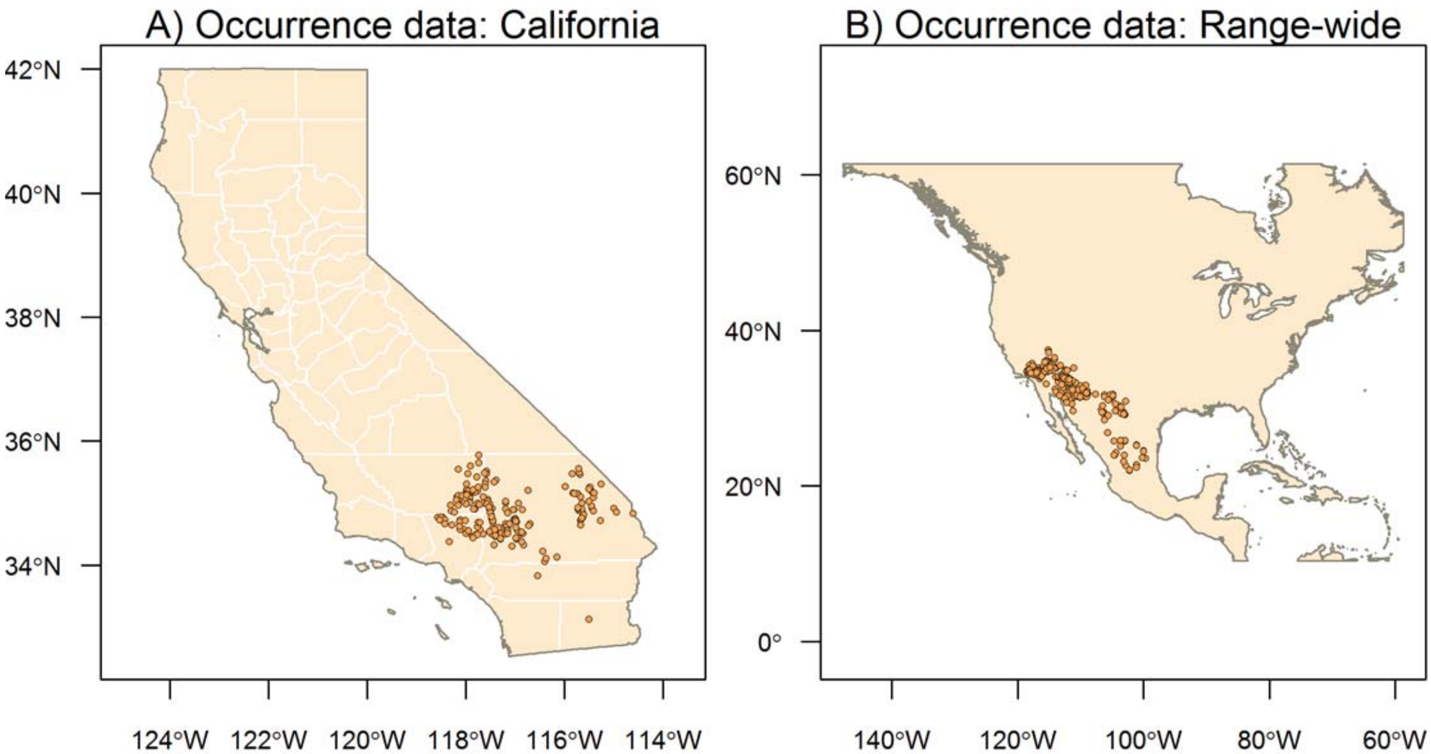
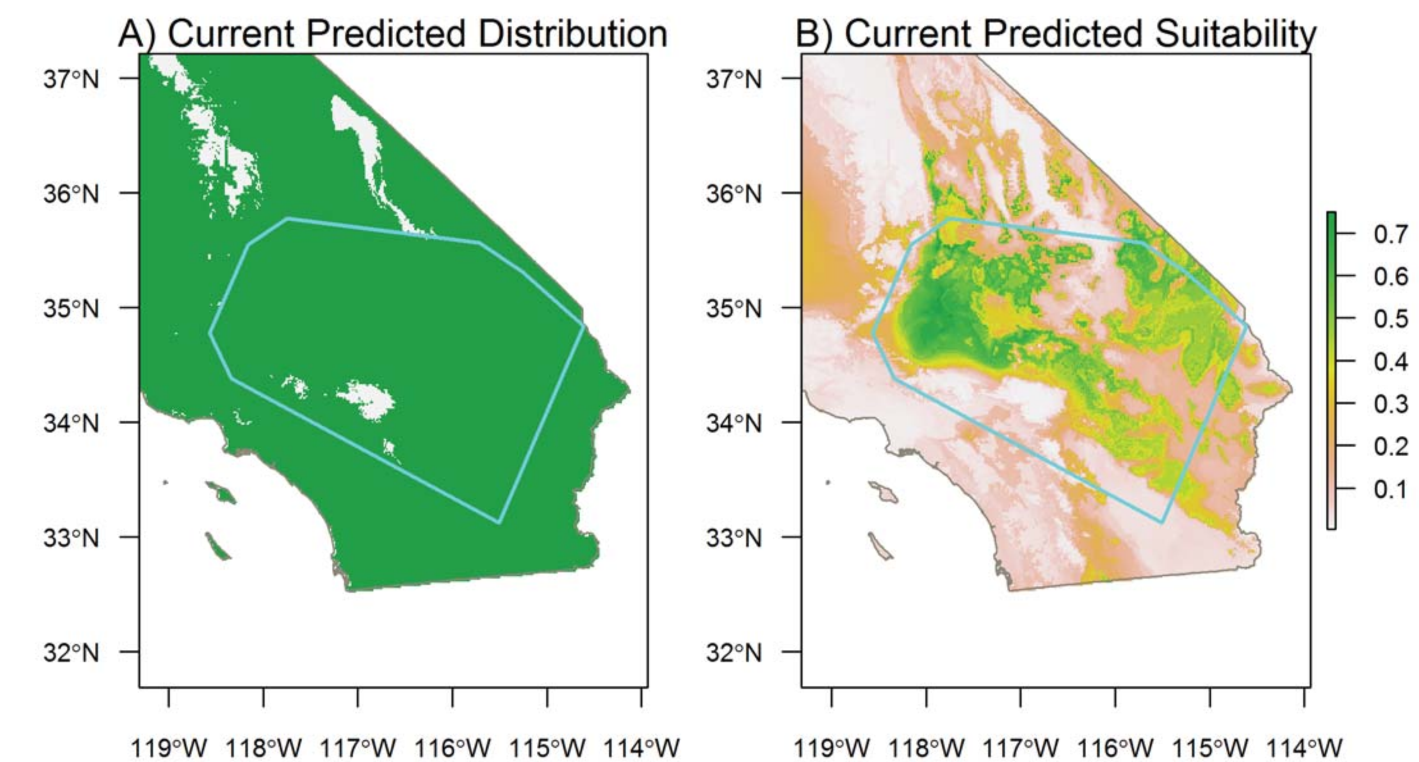


Figure 1. Occurrence data used to build Maxent models.



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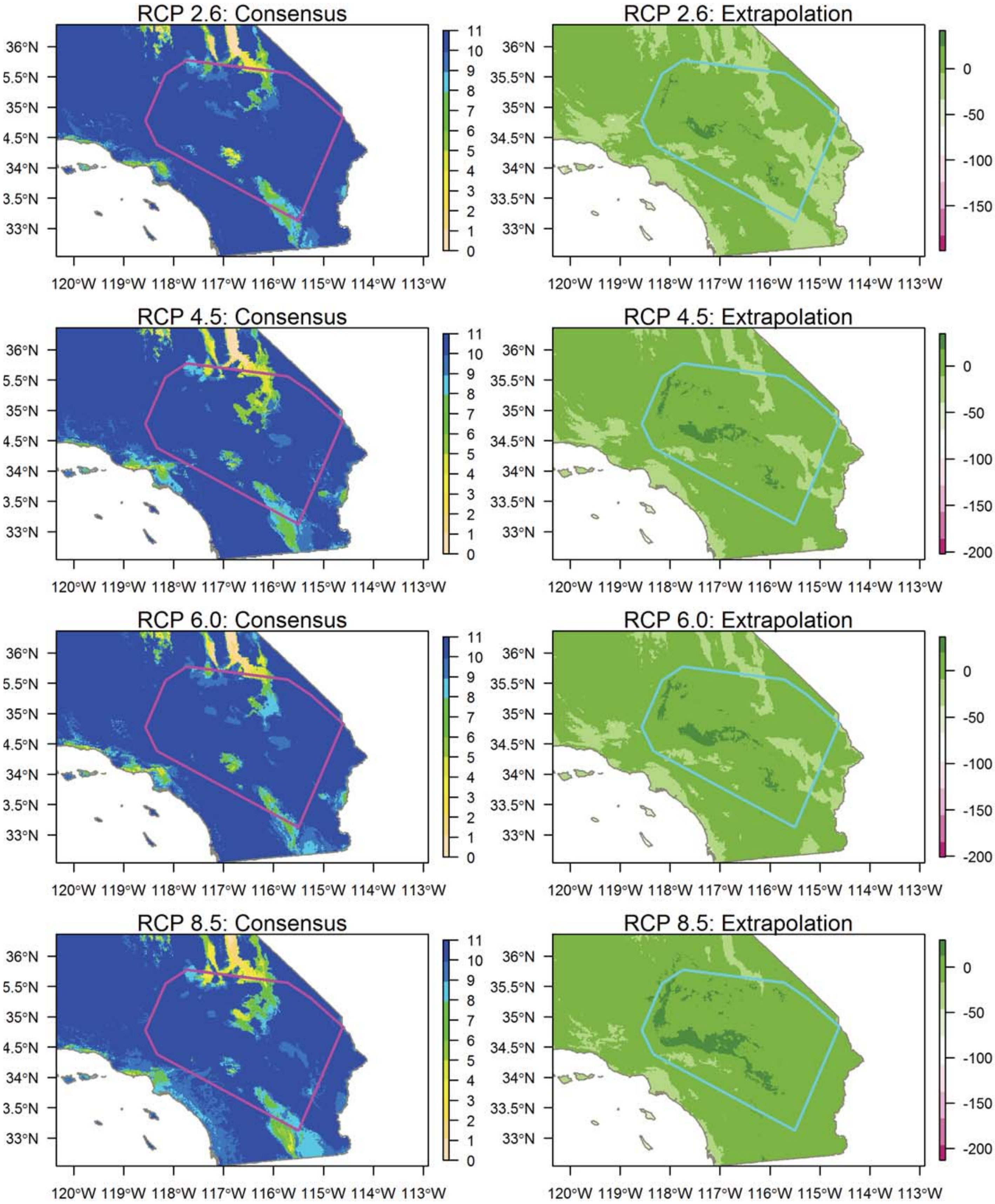
Species Results: *Crotalus scutulatus* Northern Mojave Rattlesnake



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Species Results: *Crotalus scutulatus* Northern Mojave Rattlesnake

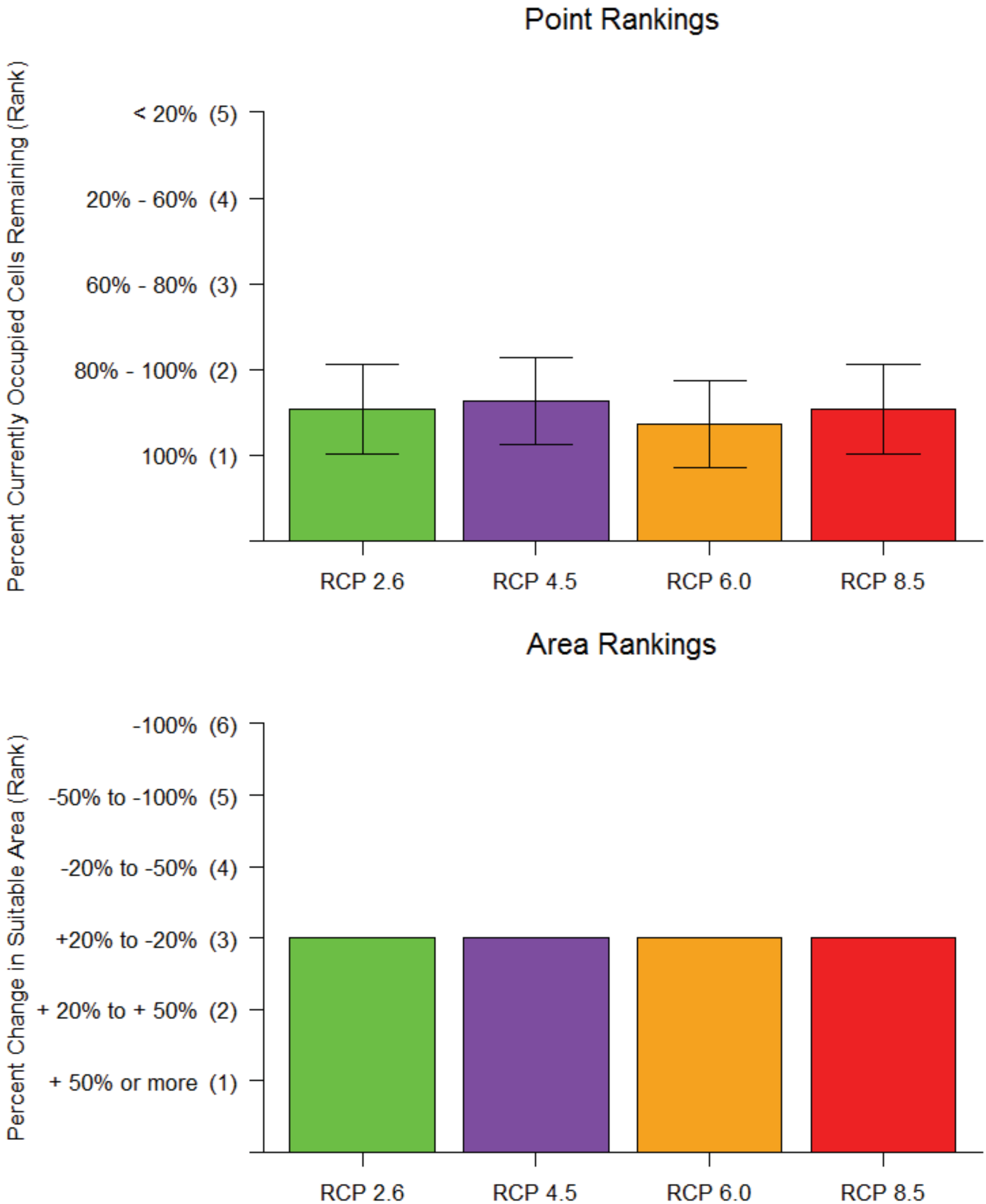


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotalus stephensi* Panamint Rattlesnake

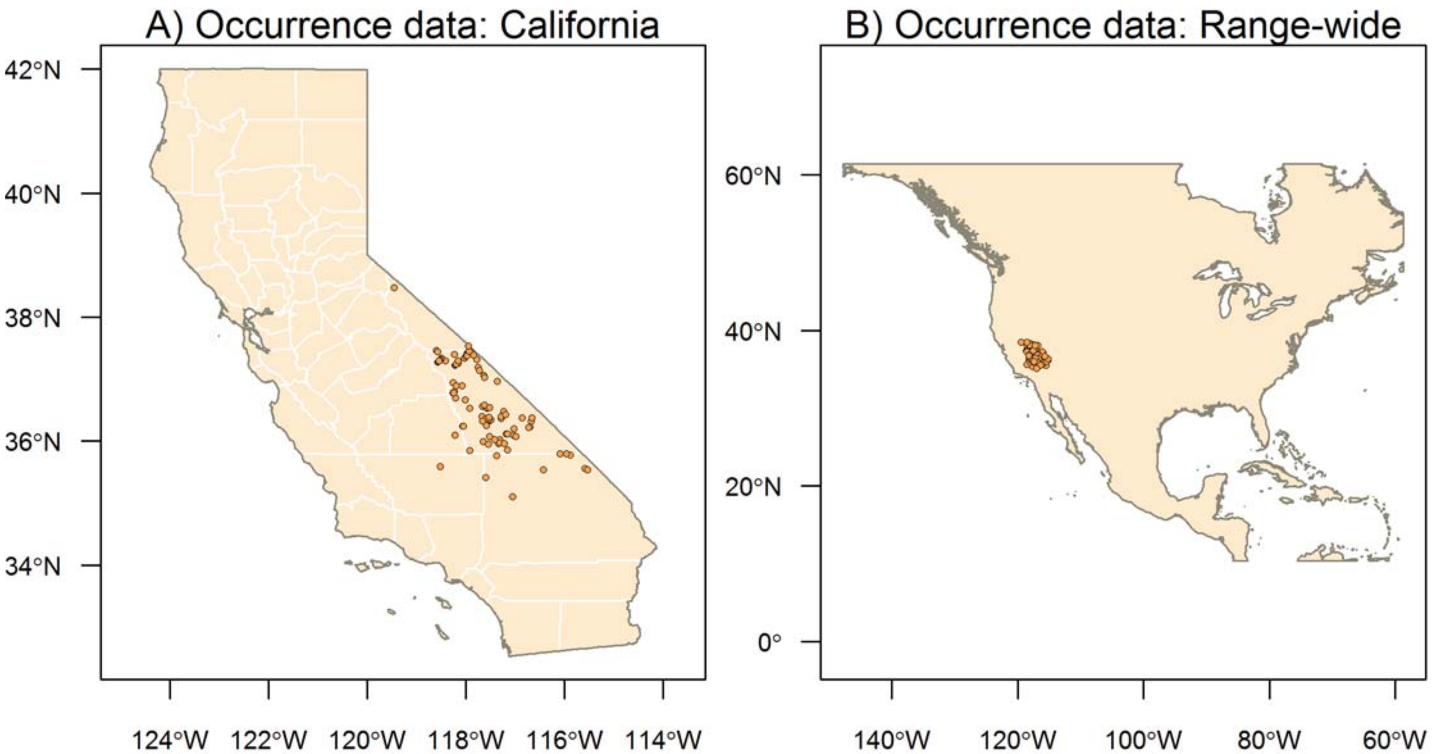
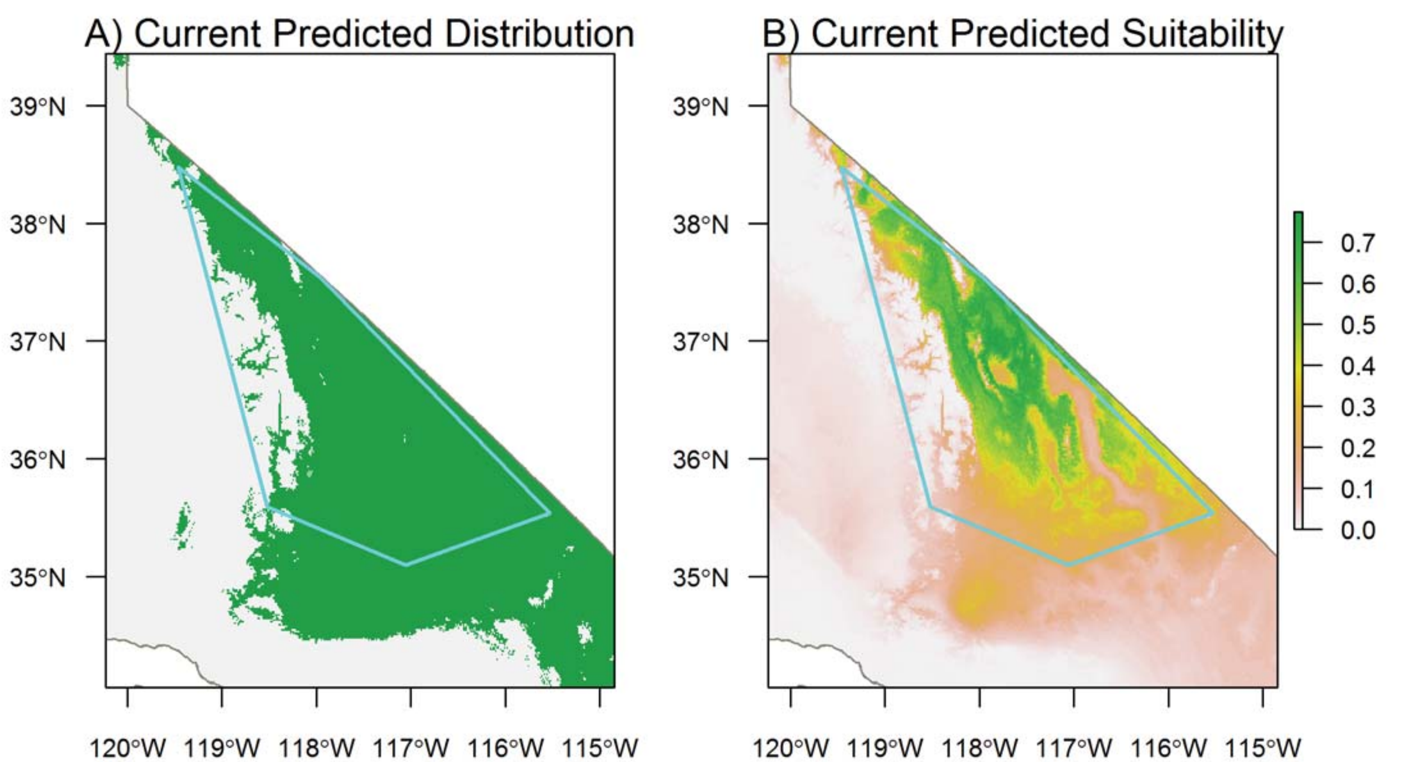


Figure 1. Occurrence data used to build Maxent models.



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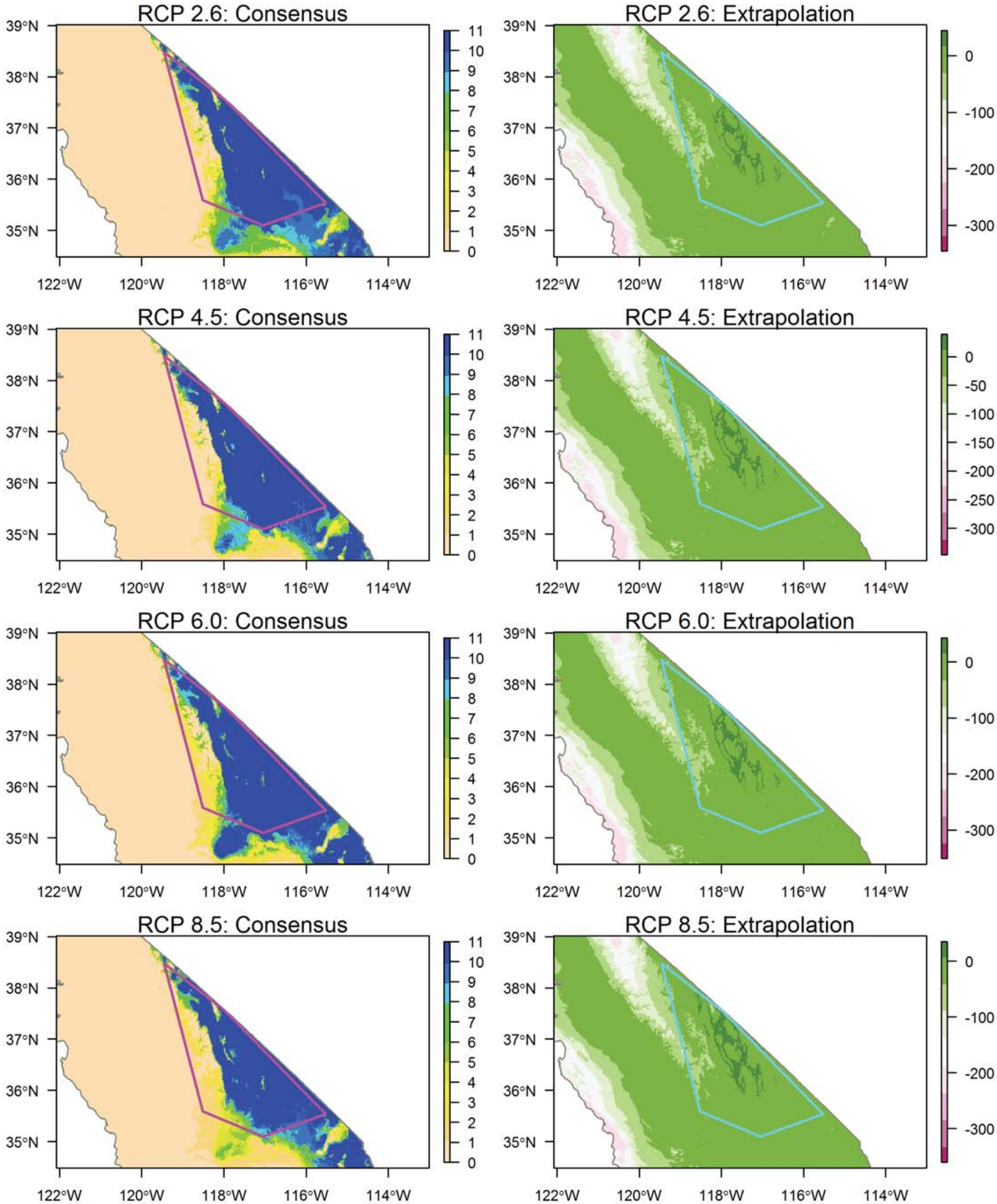
Species Results: *Crotalus stephensi* Panamint Rattlesnake



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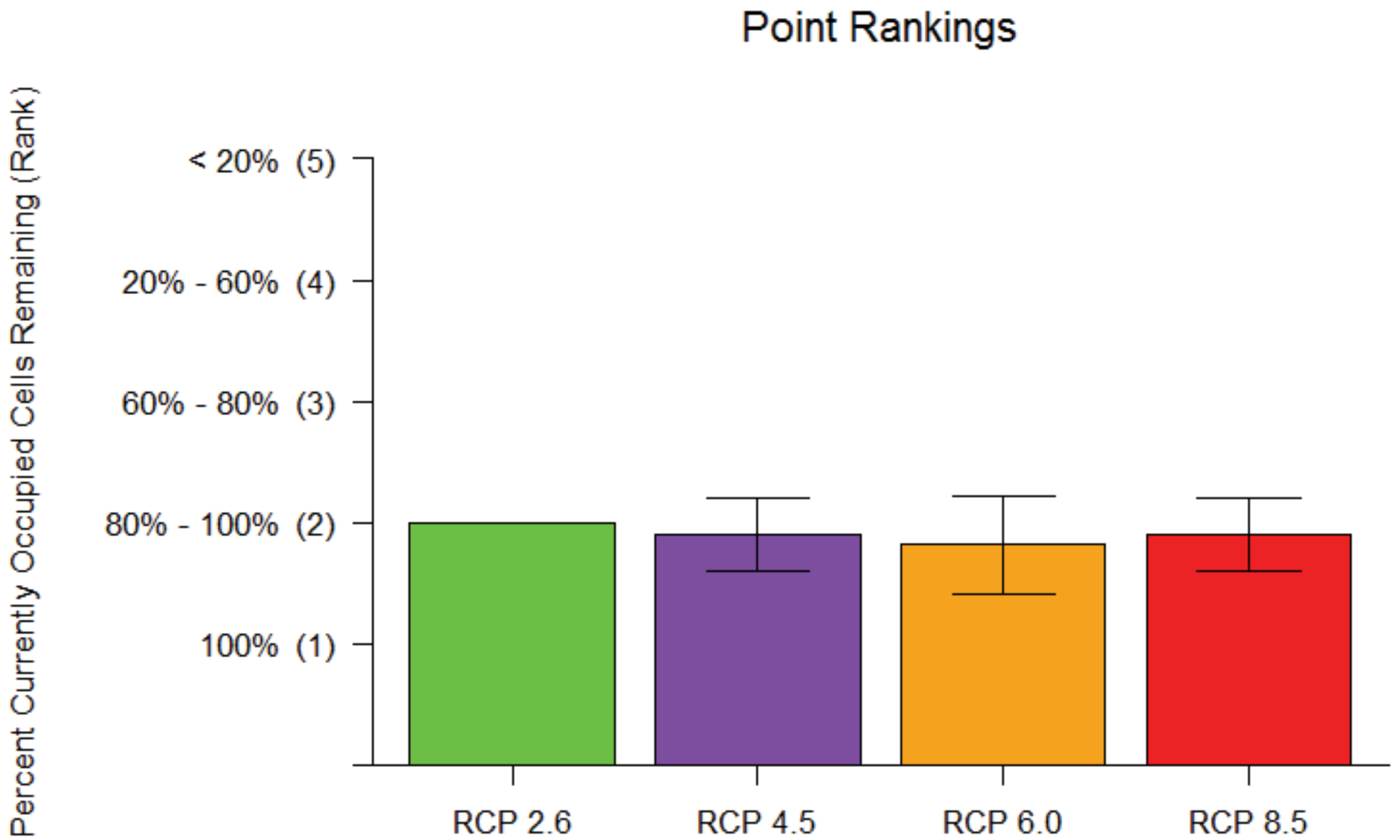
Species Results: *Crotalus stephensi* Panamint Rattlesnake



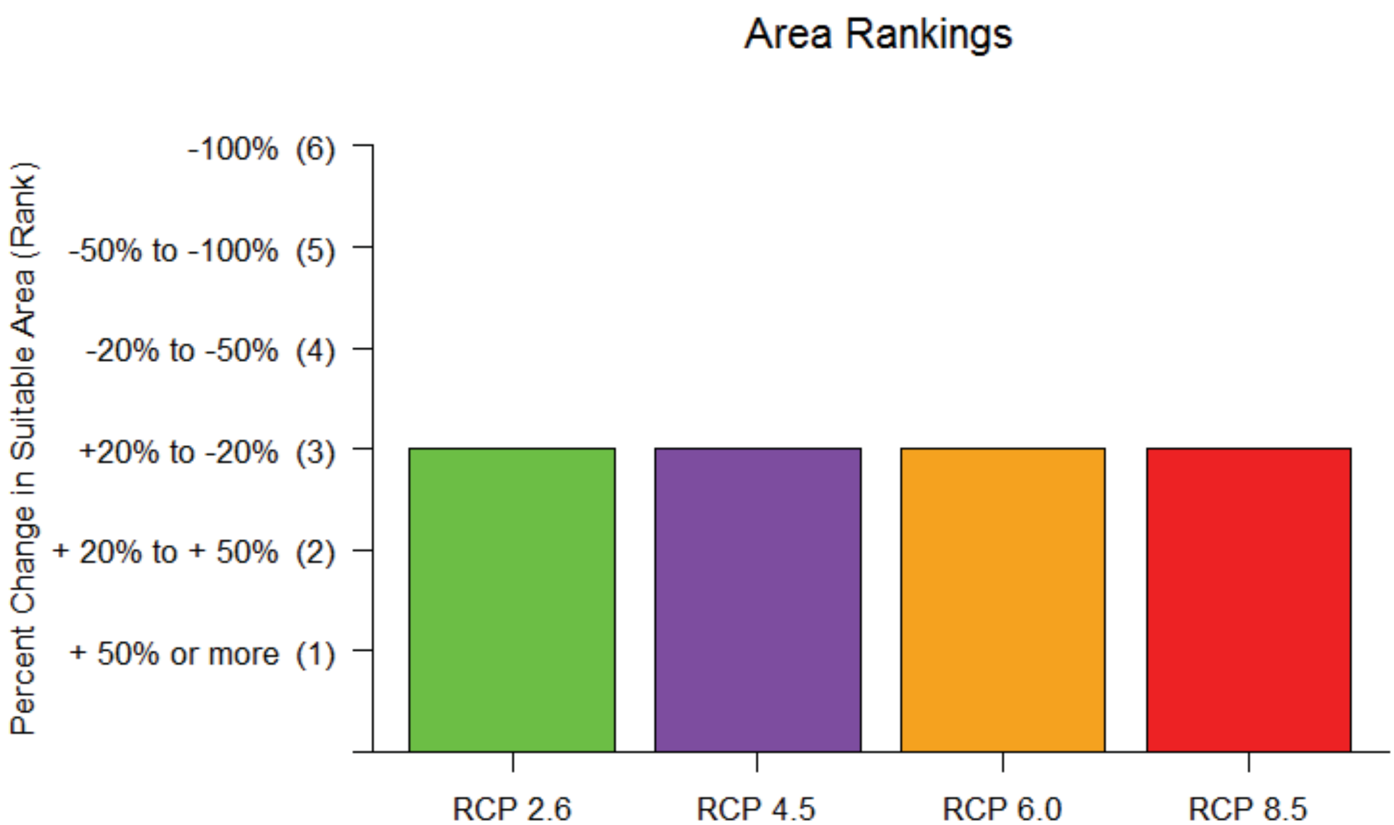
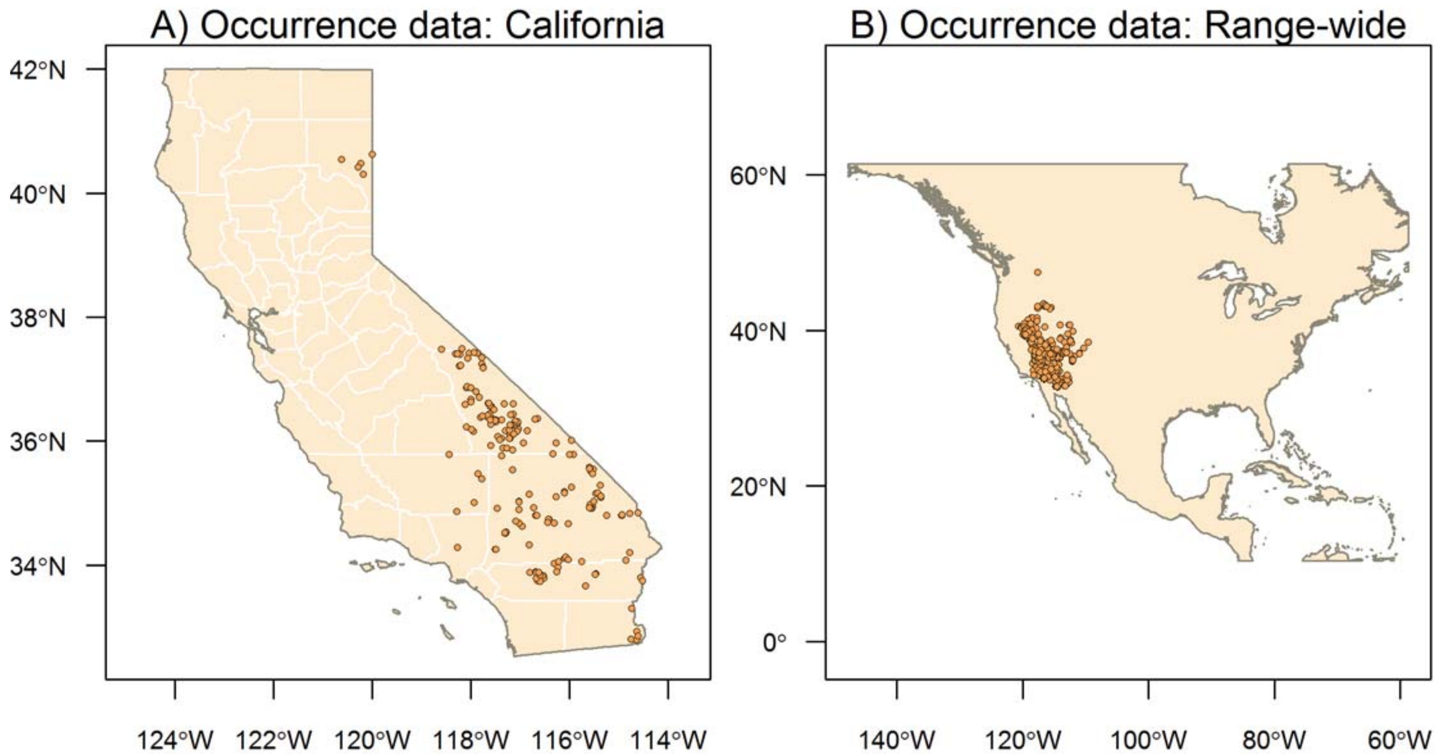


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotaphytus bicintores* Great Basin Collared Lizard



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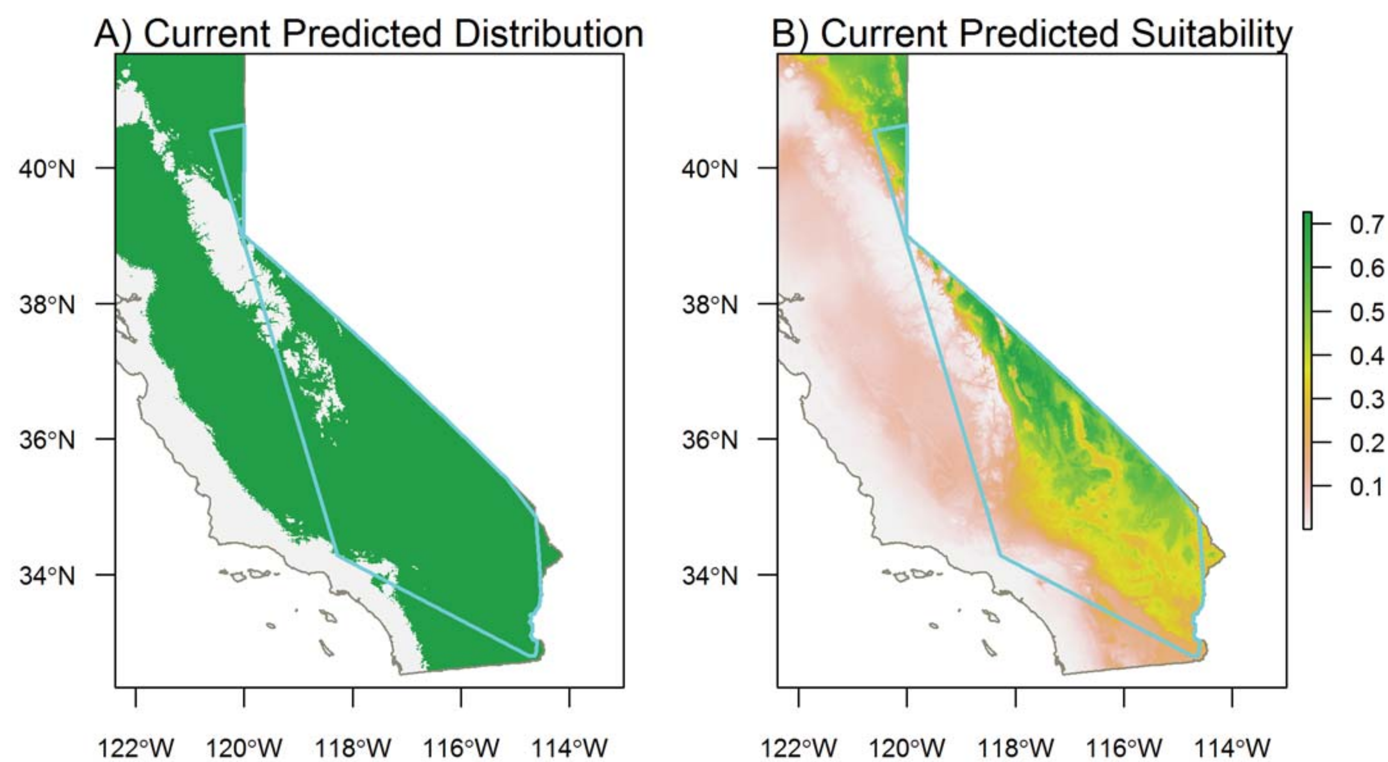

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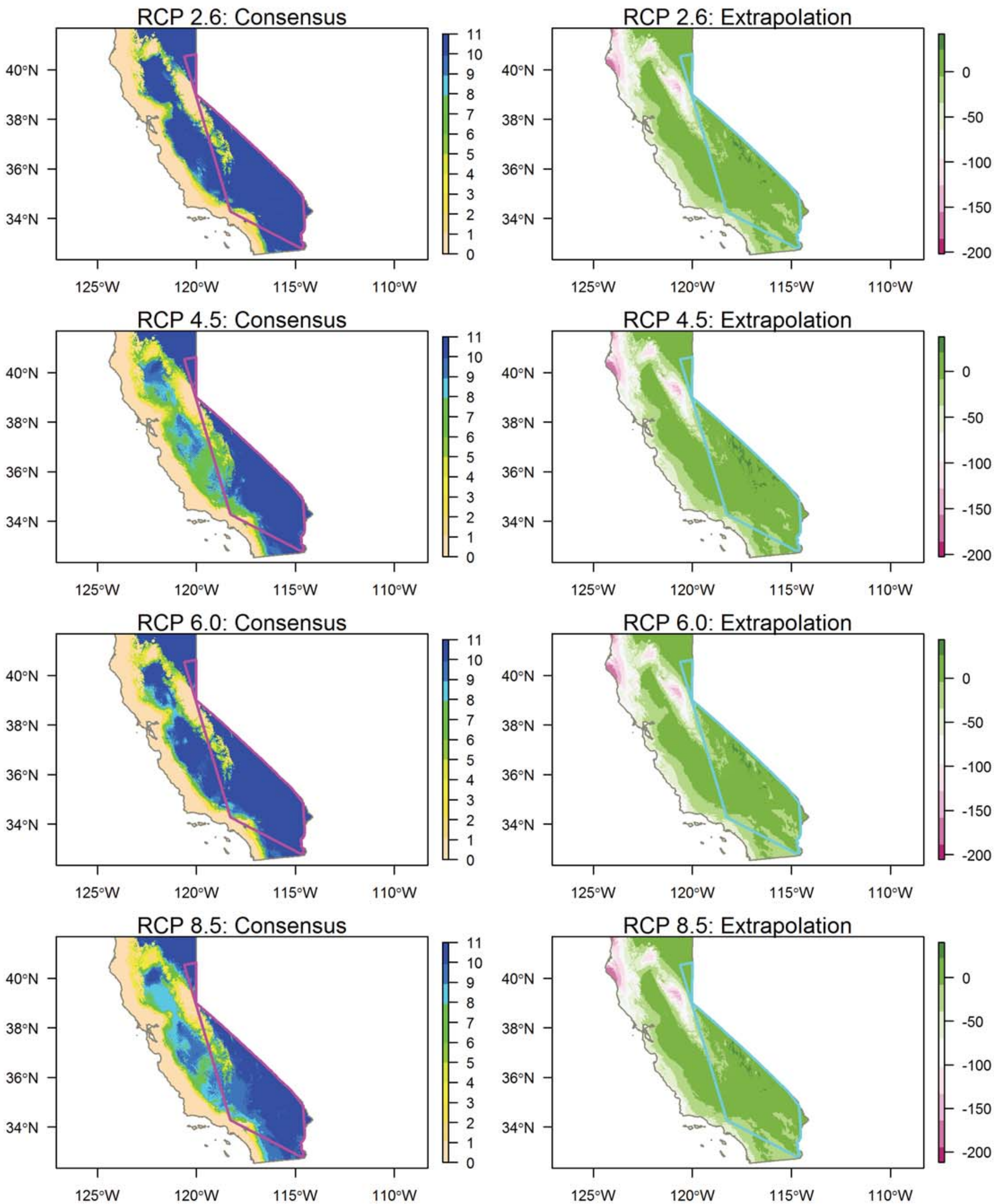
Species Results: *Crotaphytus bicintores* Great Basin Collared Lizard



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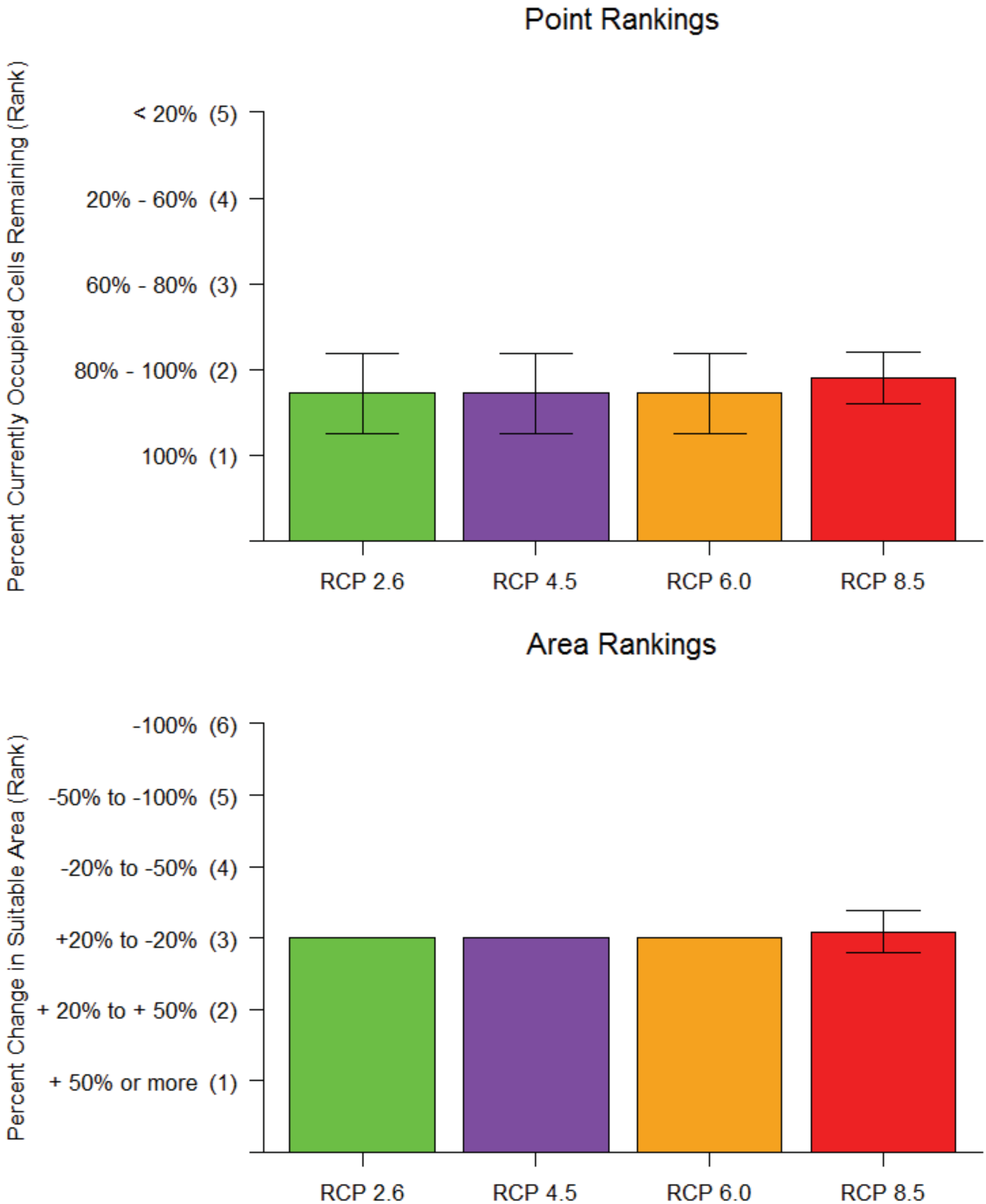


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Crotaphytus vestigium* Baja California Collared Lizard

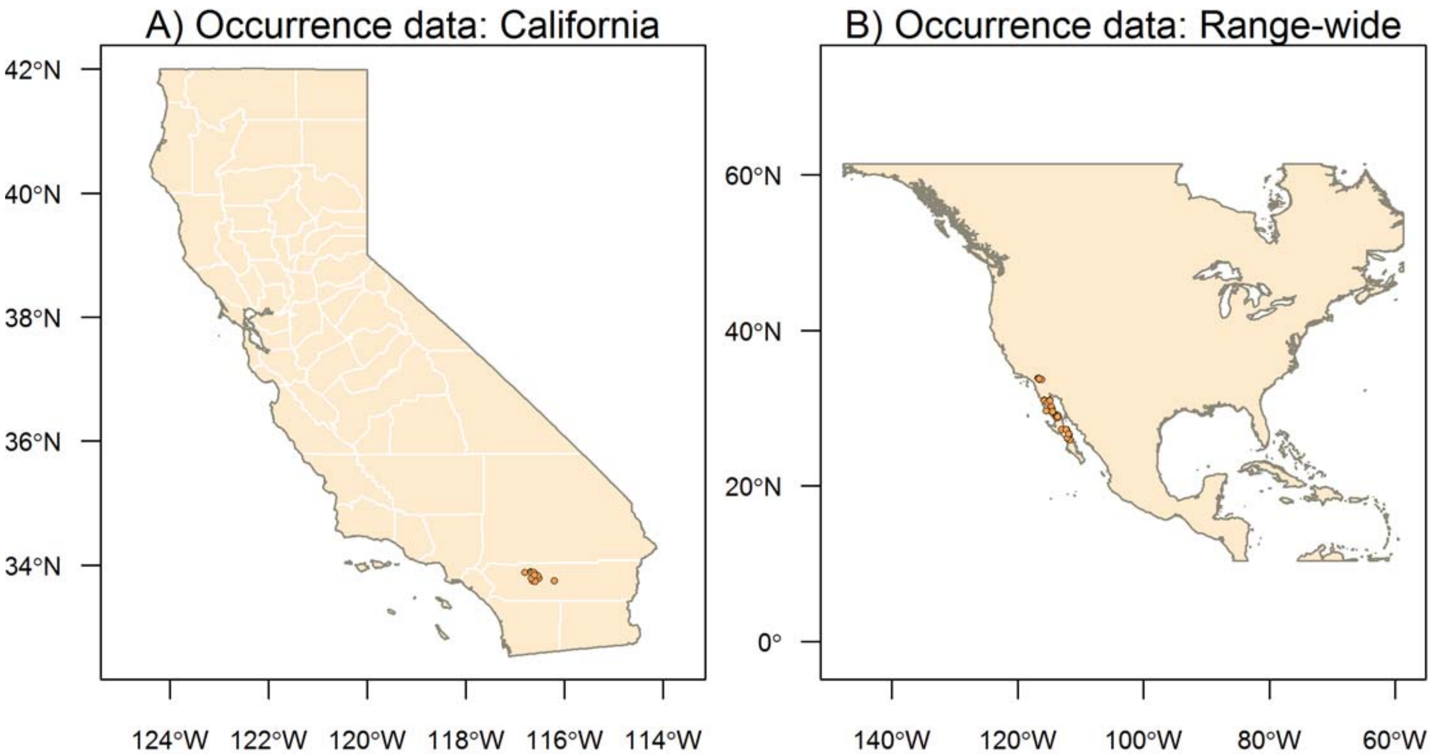
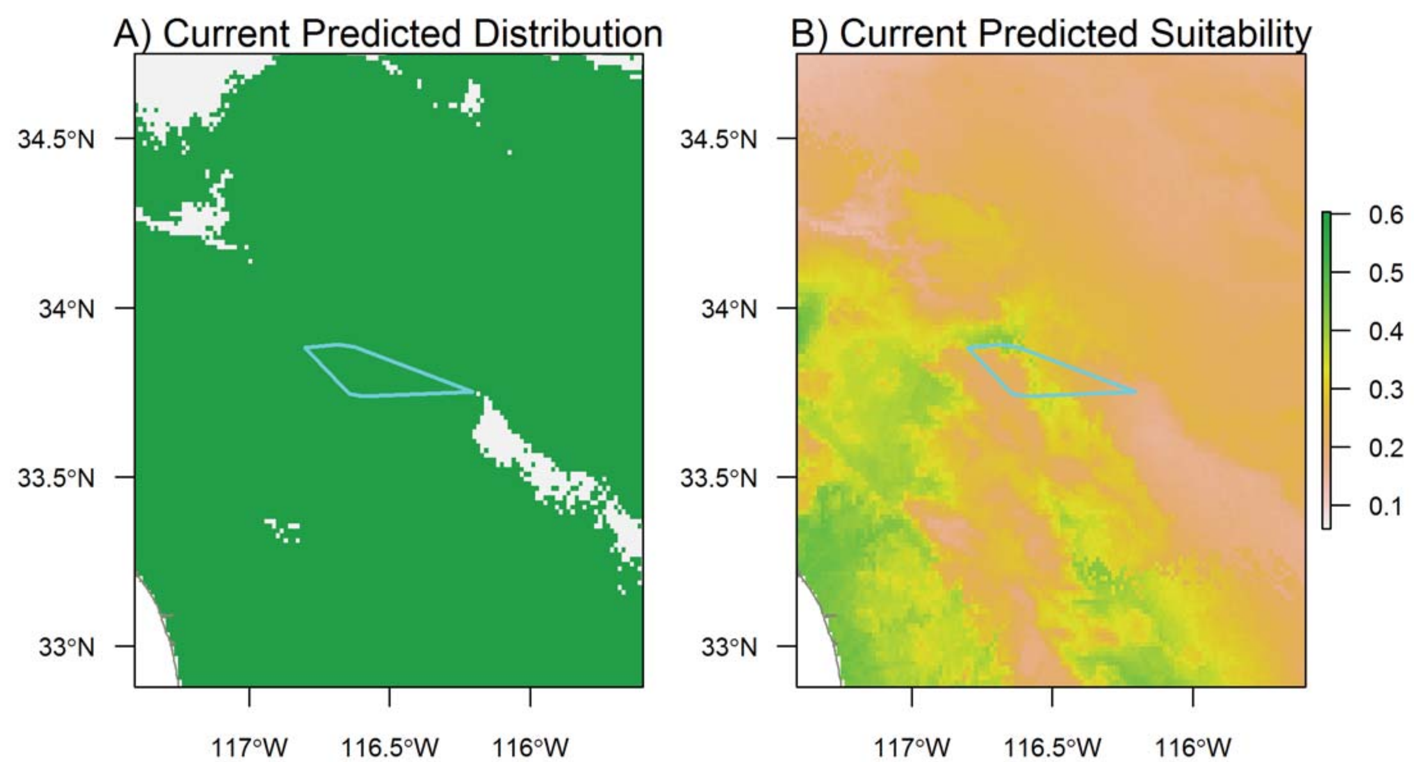


Figure 1. Occurrence data used to build Maxent models.



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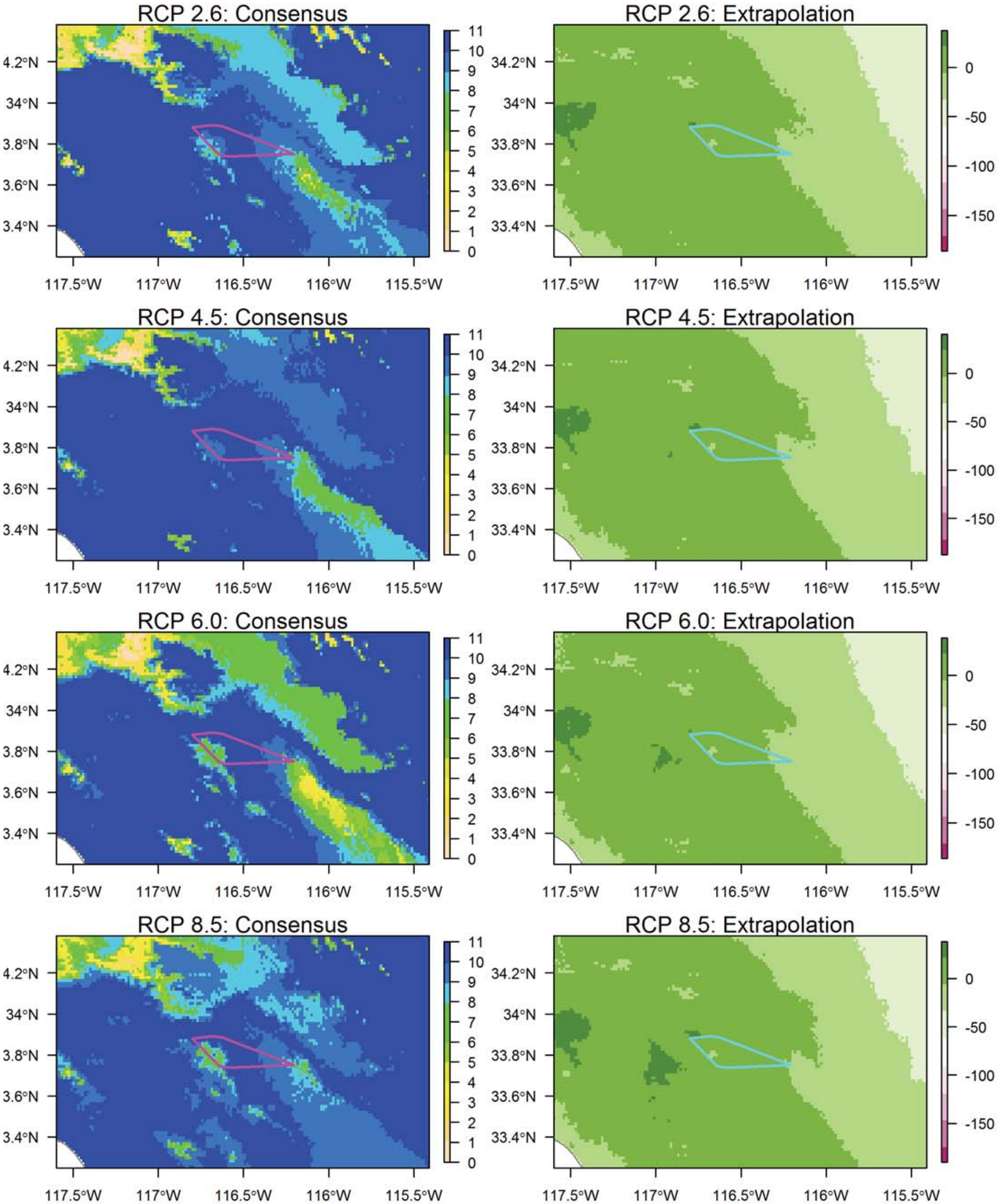
Species Results: *Crotaphytus vestigium* Baja California Collared Lizard



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Species Results: *Crotaphytus vestigium* Baja California Collared Lizard

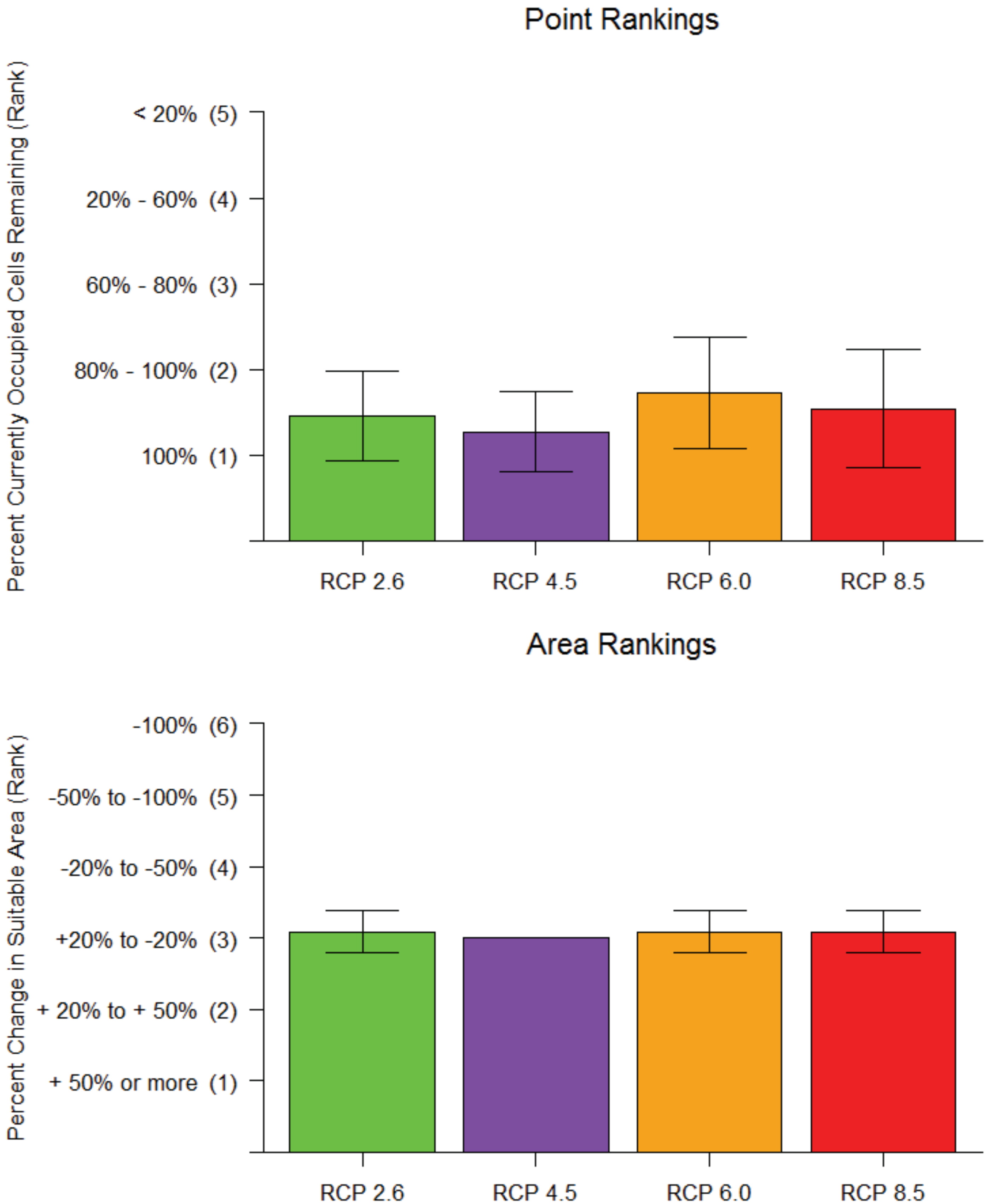


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Diadophis punctatus* Ring-necked Snake

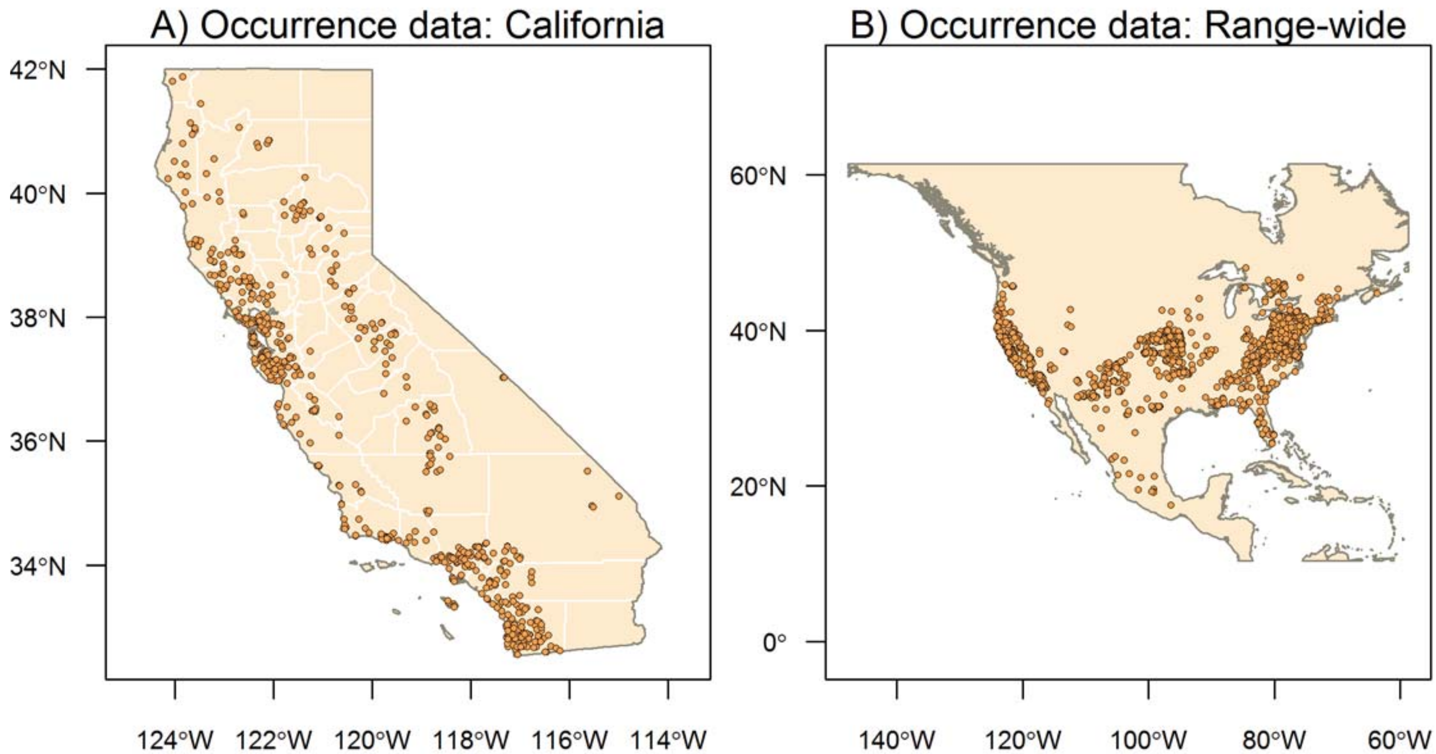
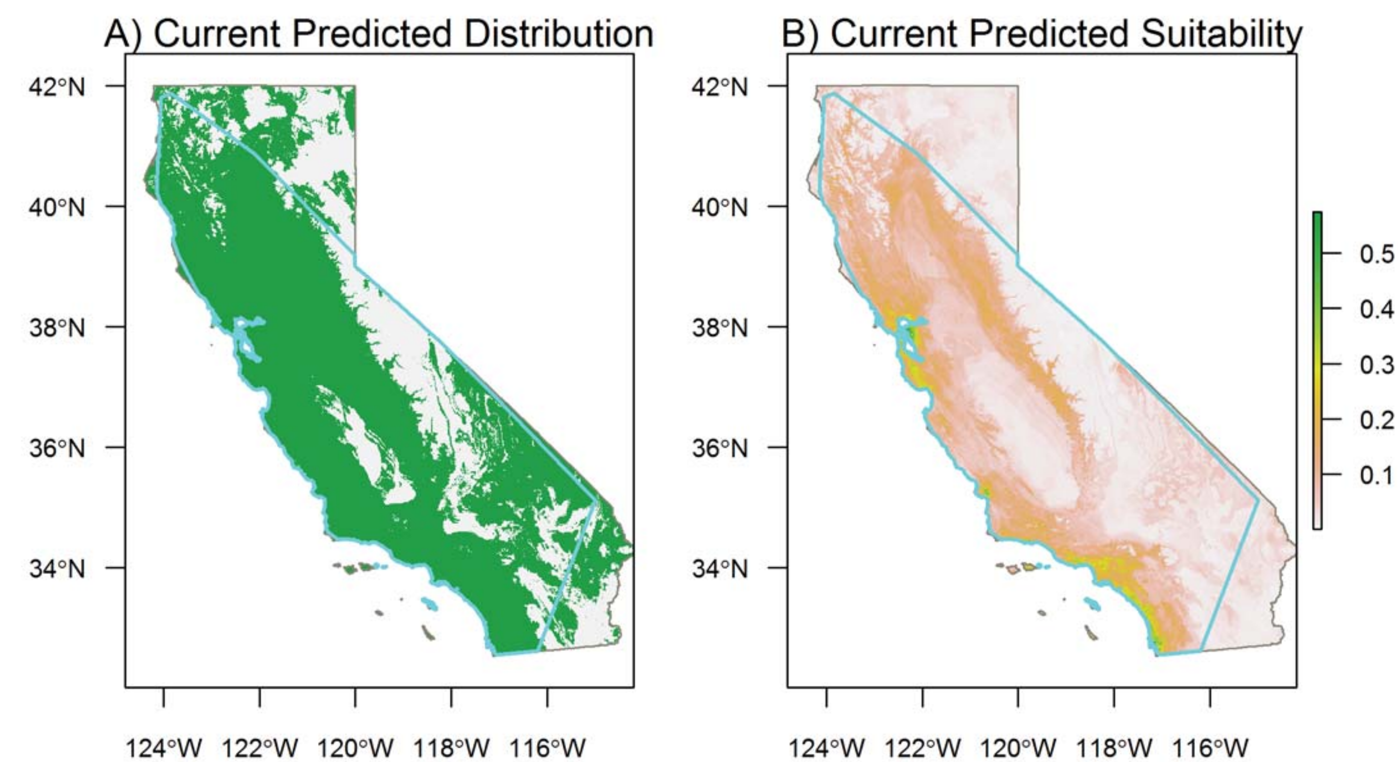


Figure 1. Occurrence data used to build Maxent models.



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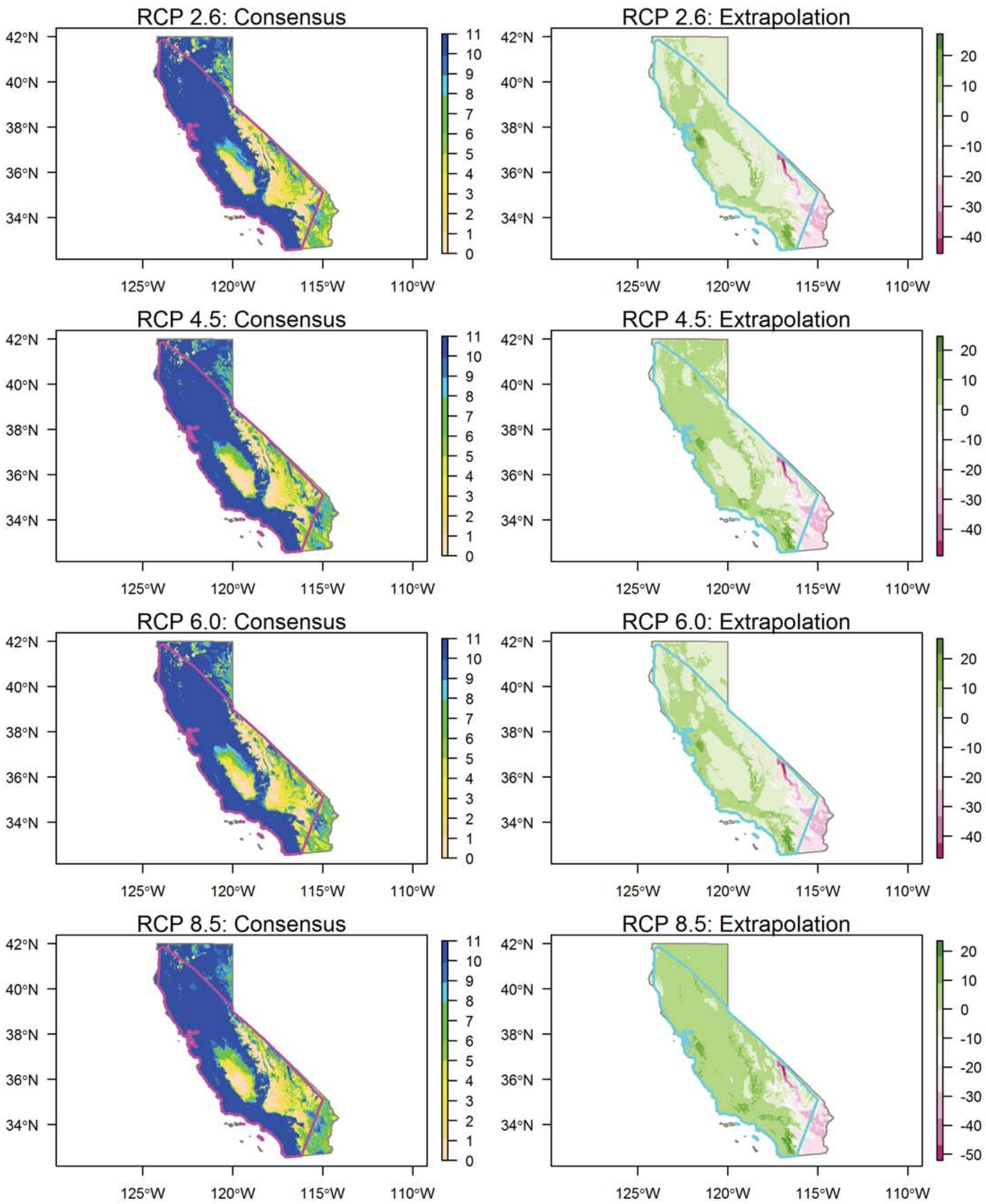

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Species Results: *Diadophis punctatus* Ring-necked Snake

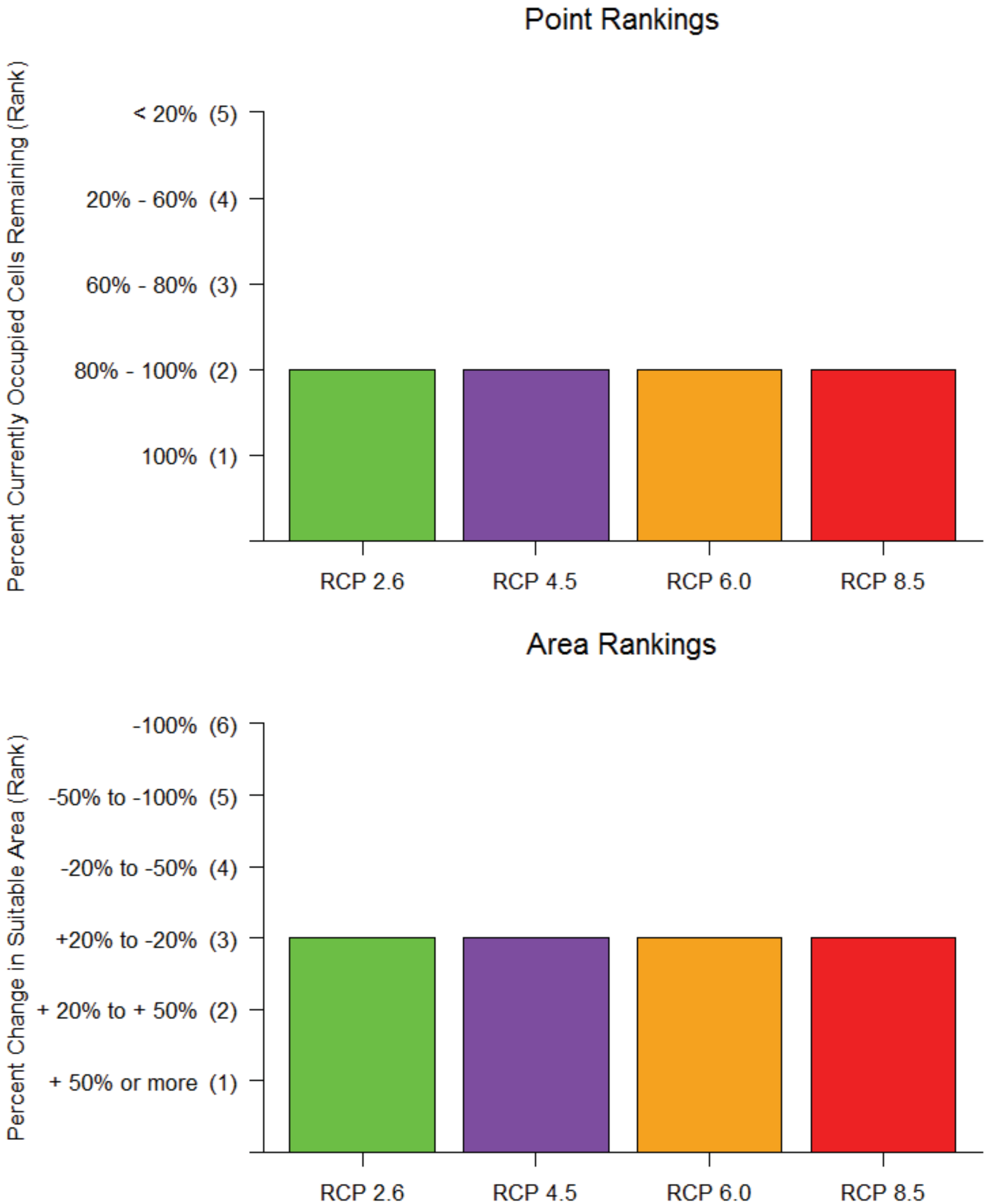


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Dicamptodon ensatus* California Giant Salamander

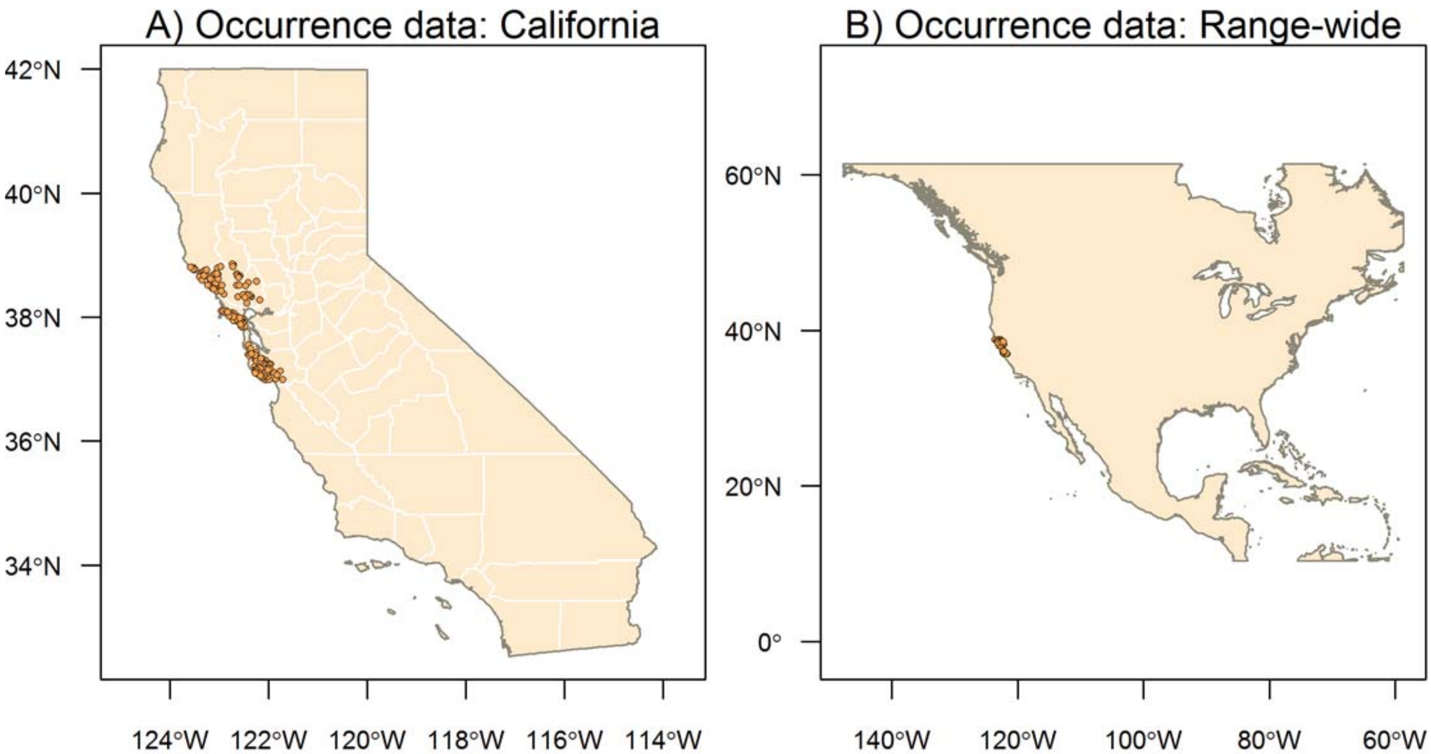
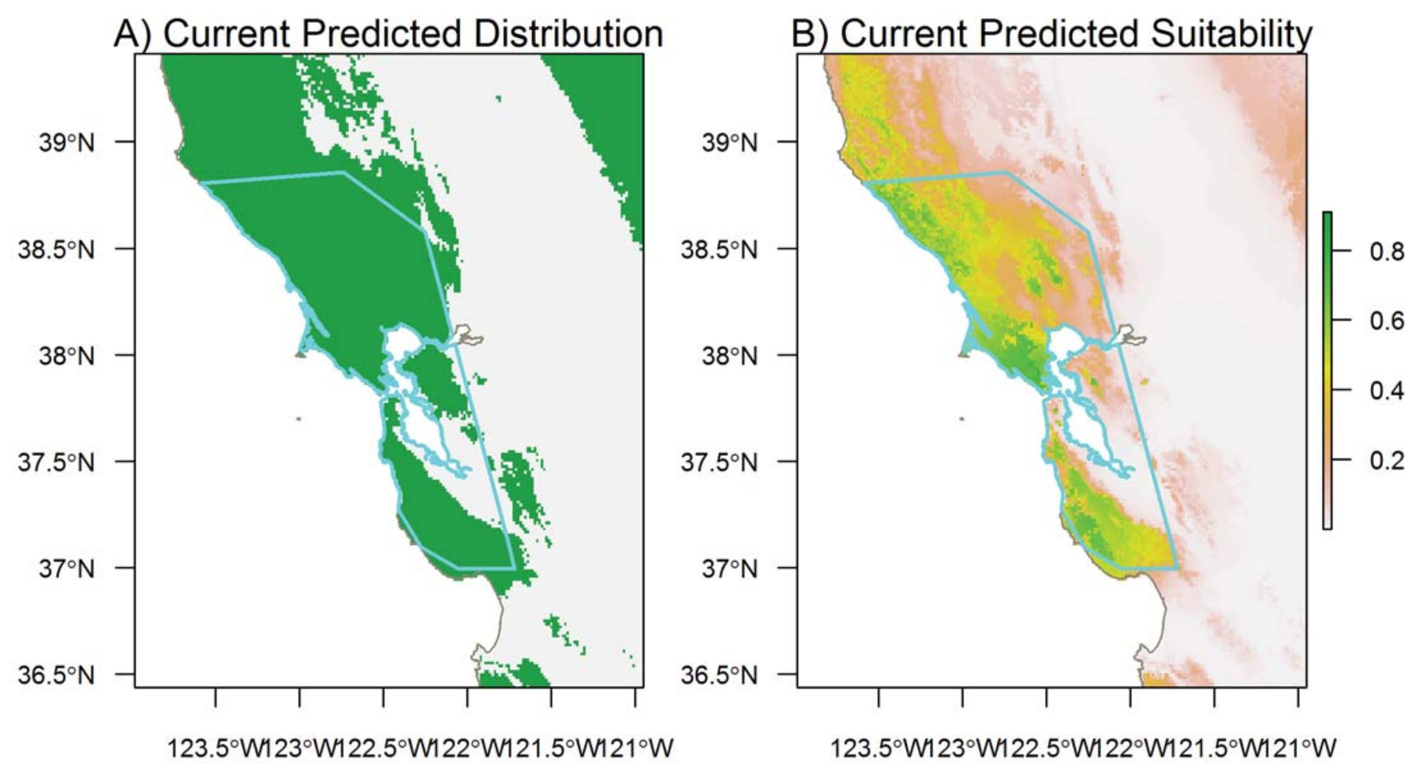


Figure 1. Occurrence data used to build Maxent models.



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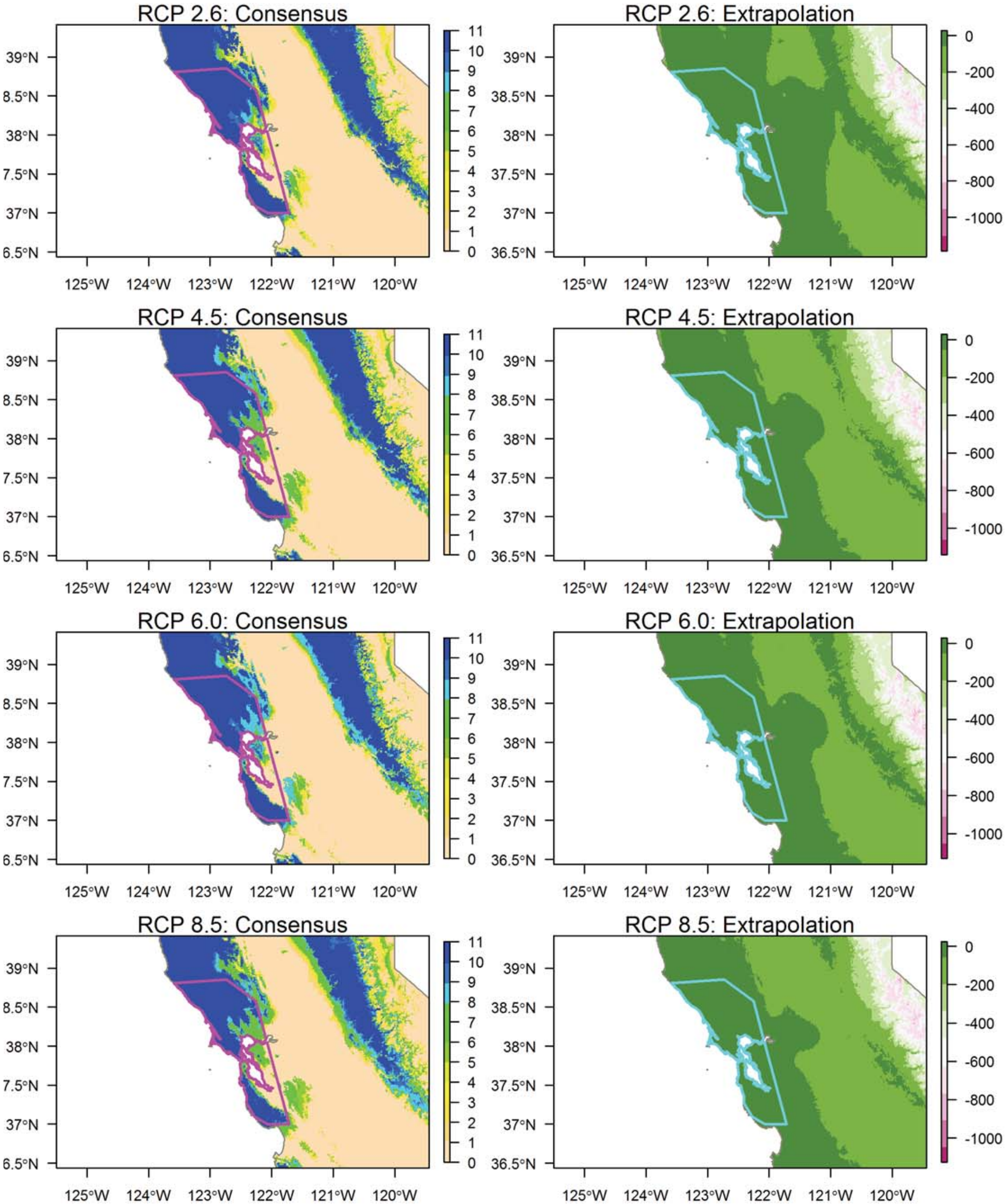

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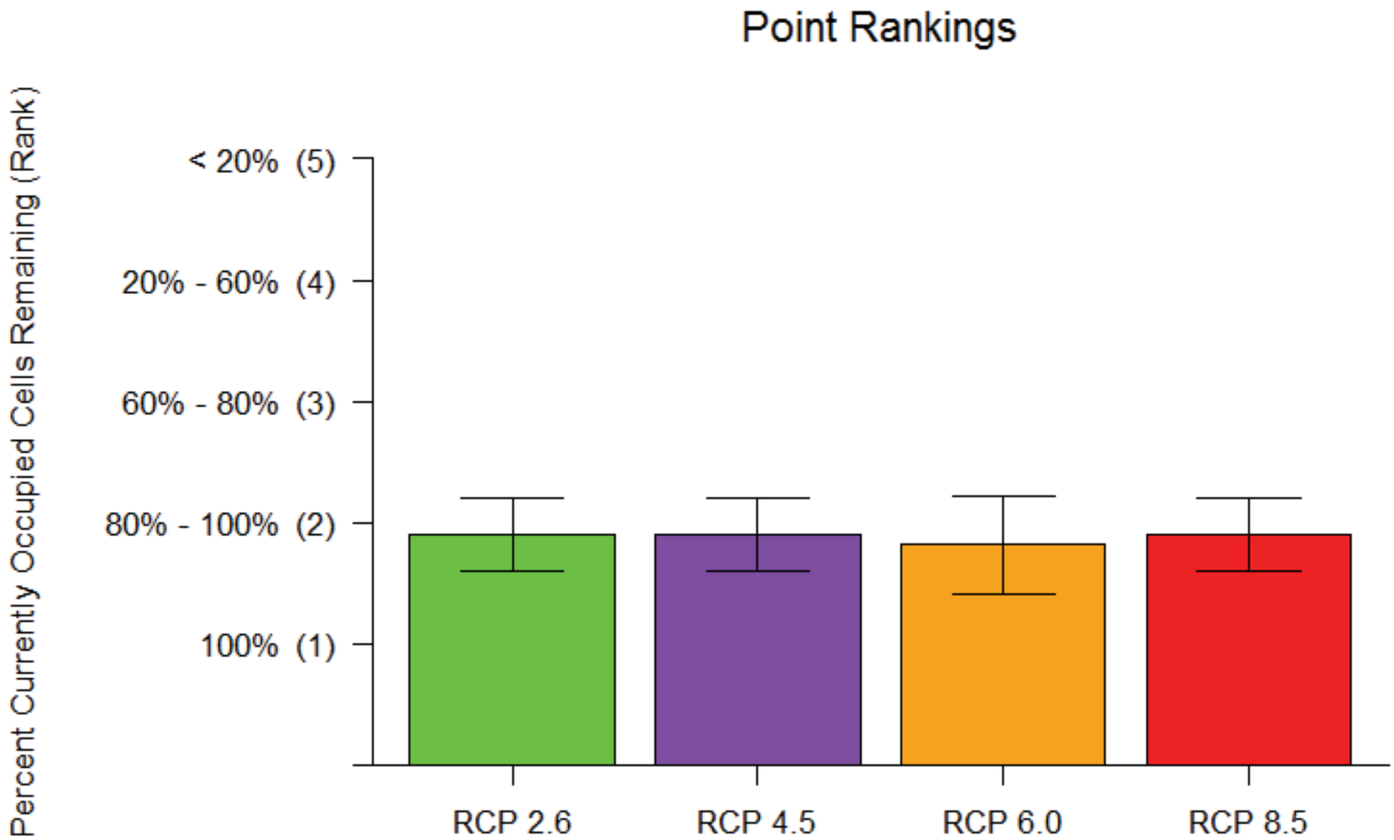

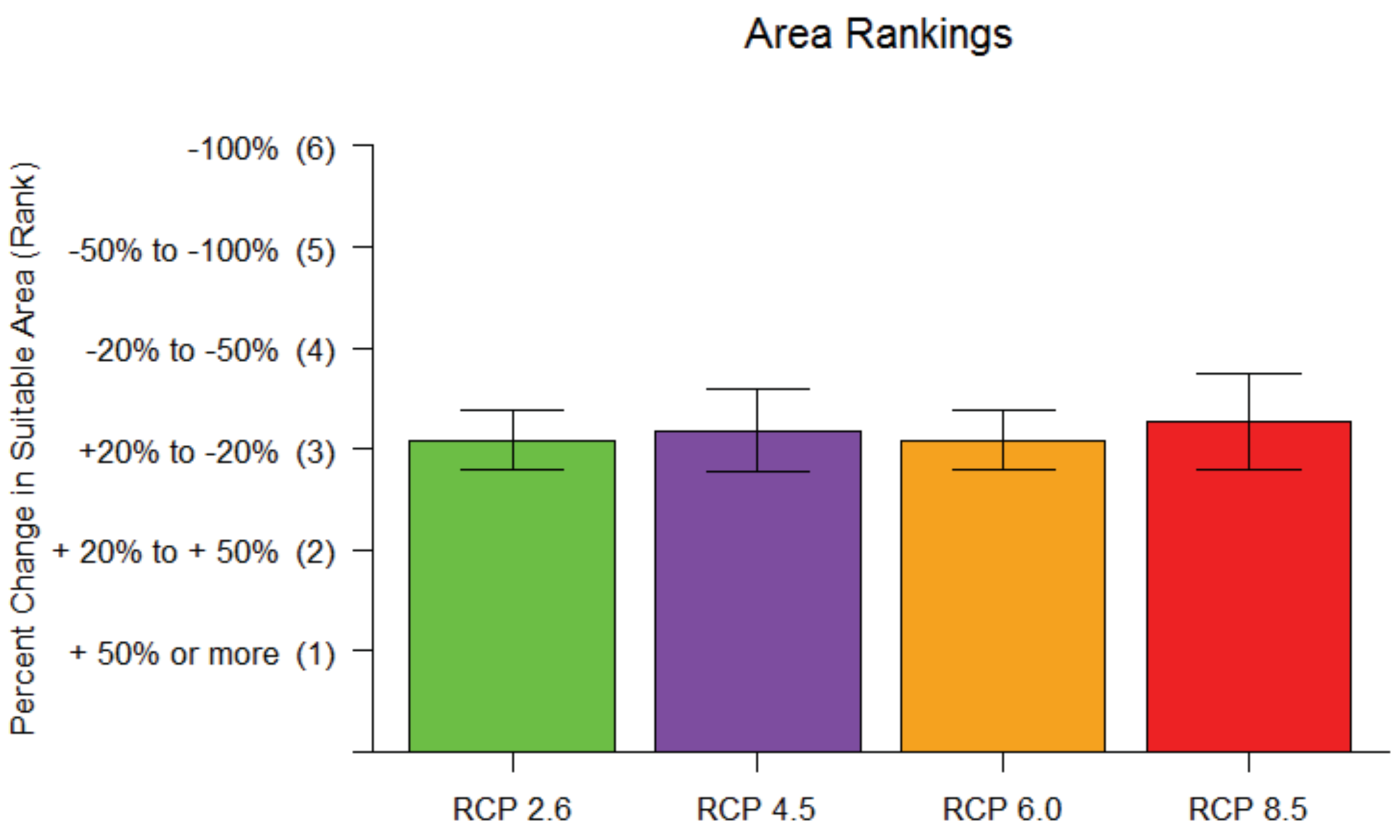

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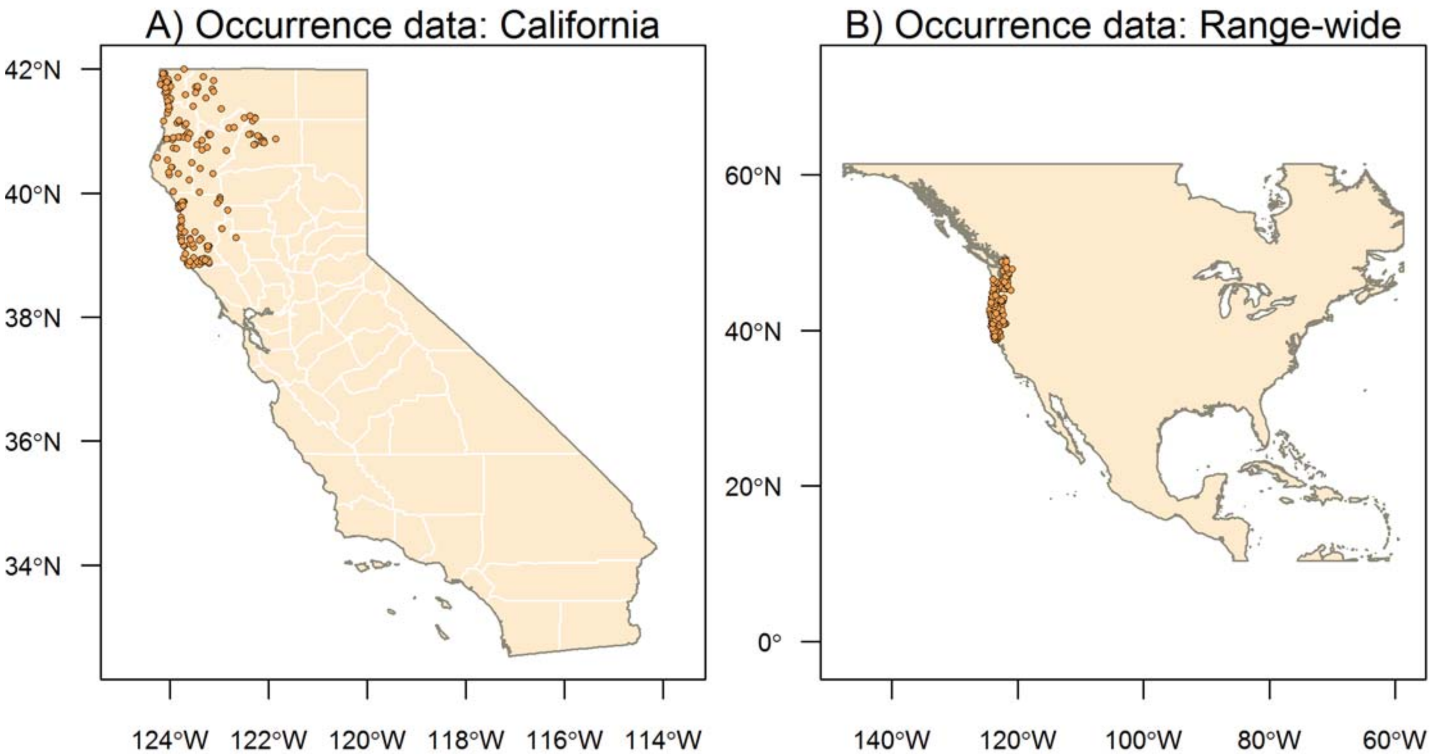
Species Results: *Dicamptodon tenebrosus* Pacific Giant Salamander



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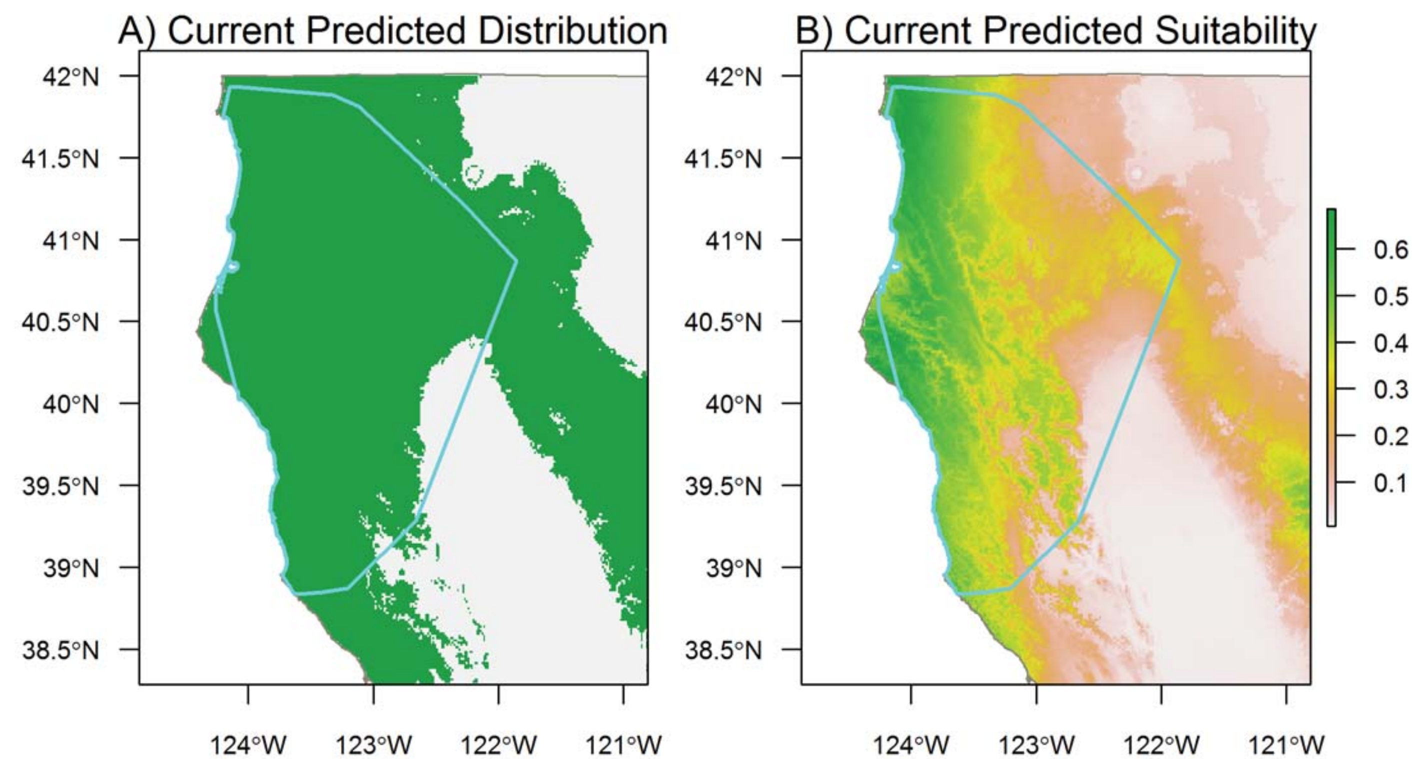

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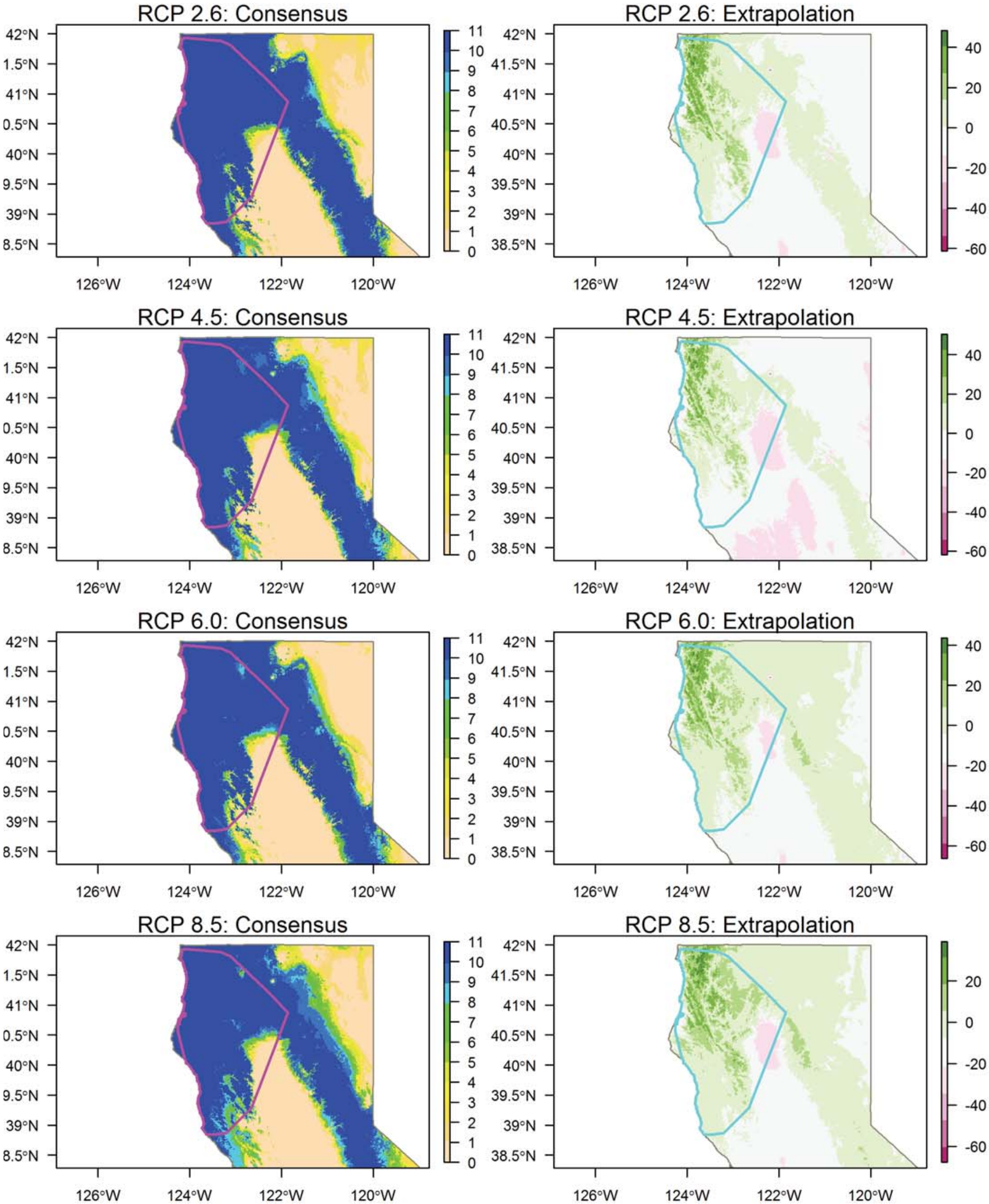
Species Results: *Dicamptodon tenebrosus* Pacific Giant Salamander



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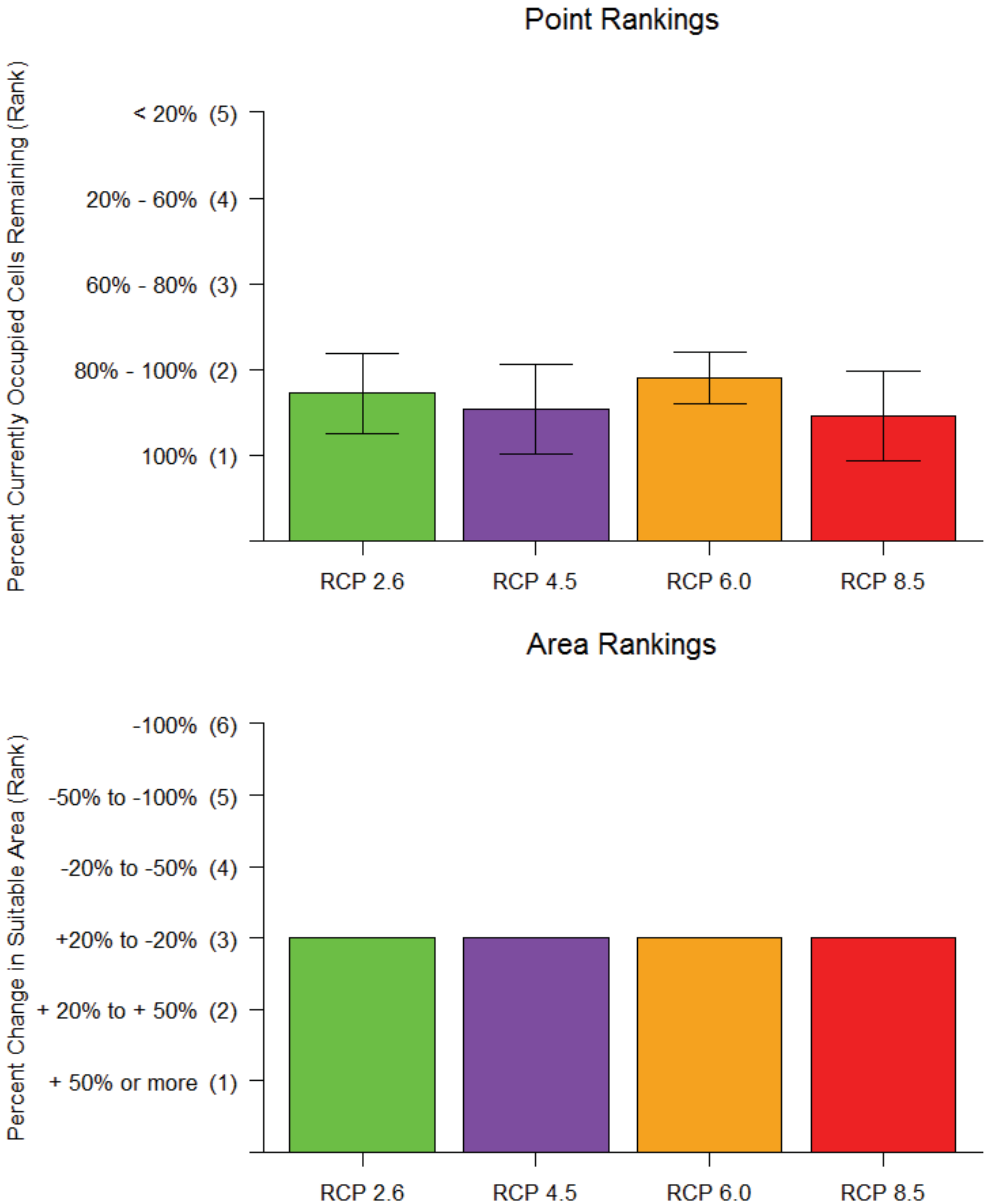

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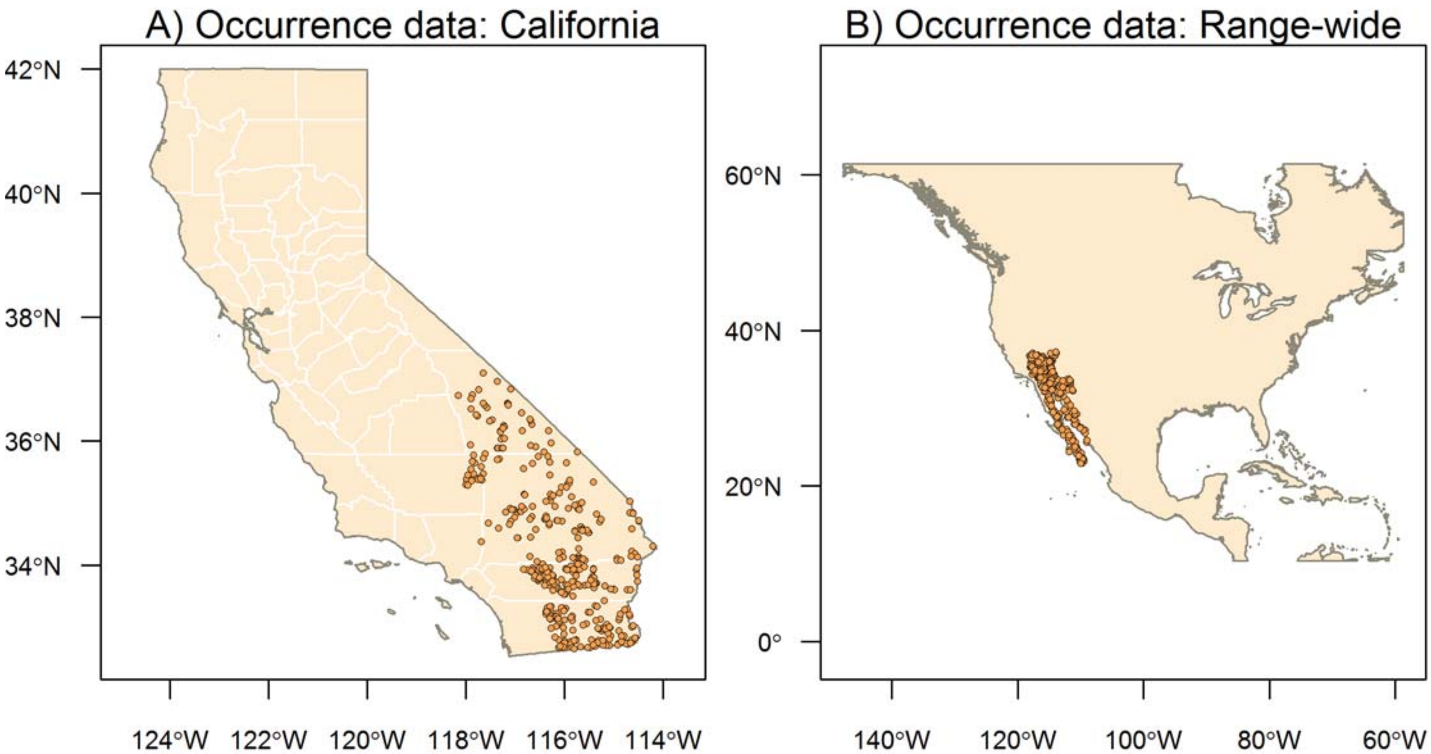

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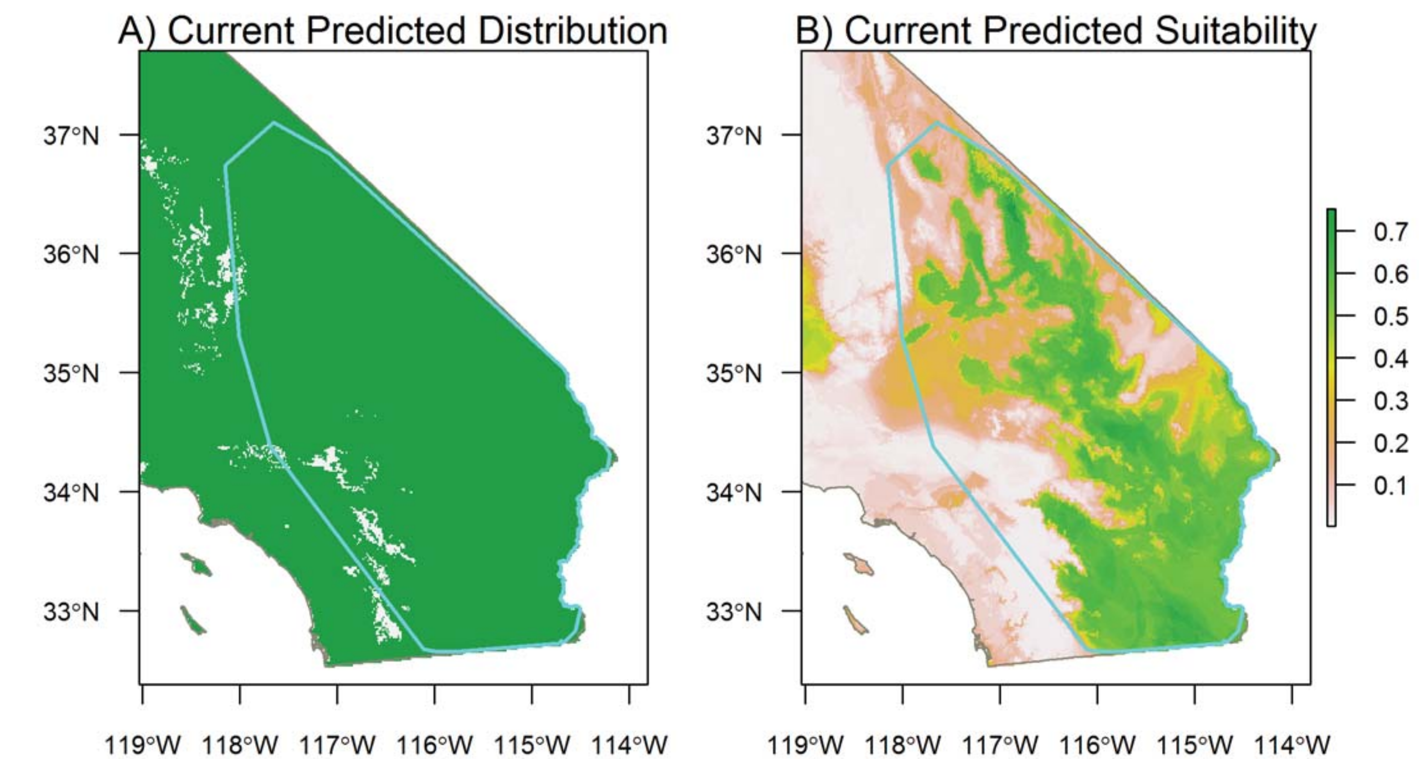

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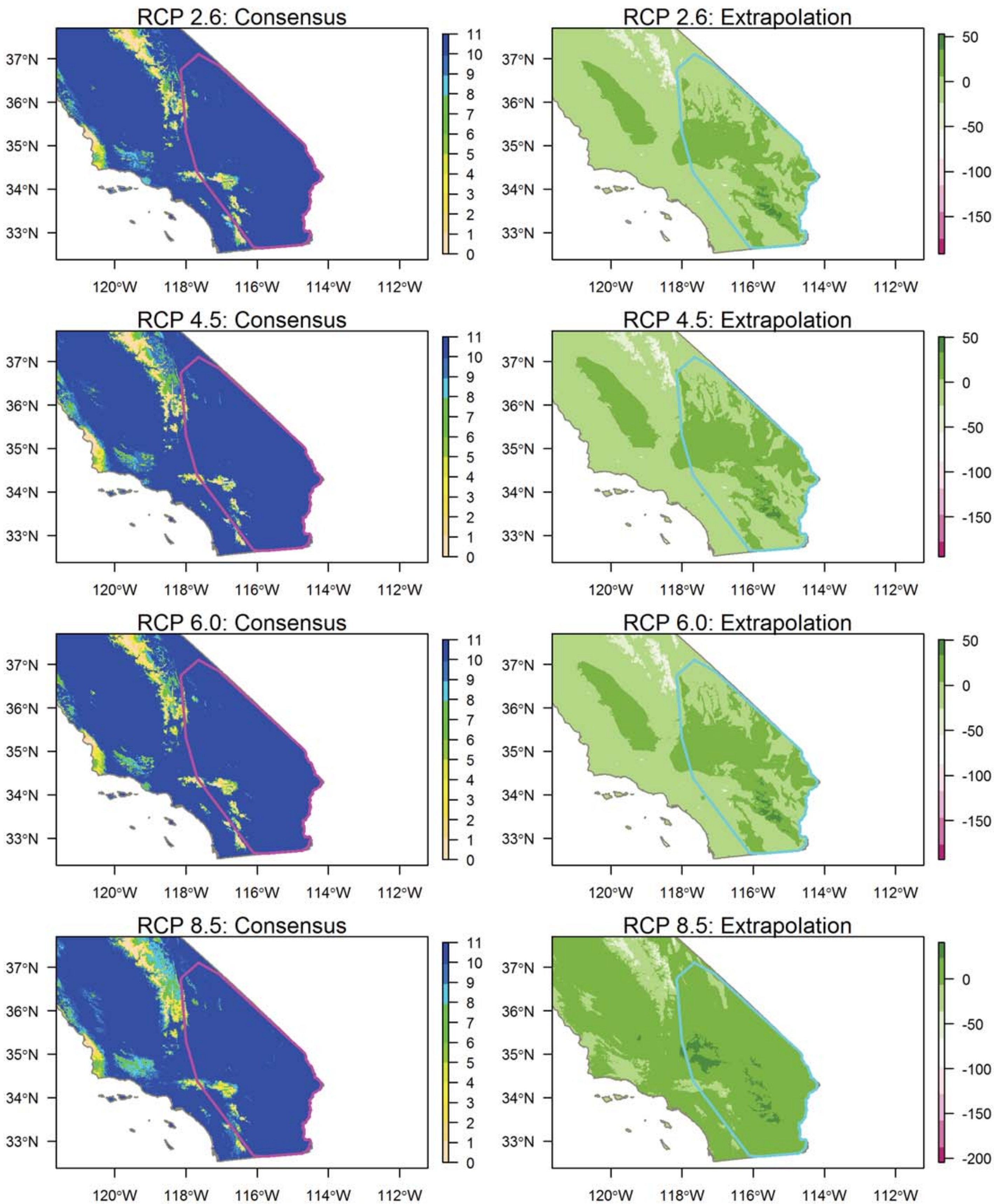
Species Results: *Dipsosaurus dorsalis* Desert Iguana



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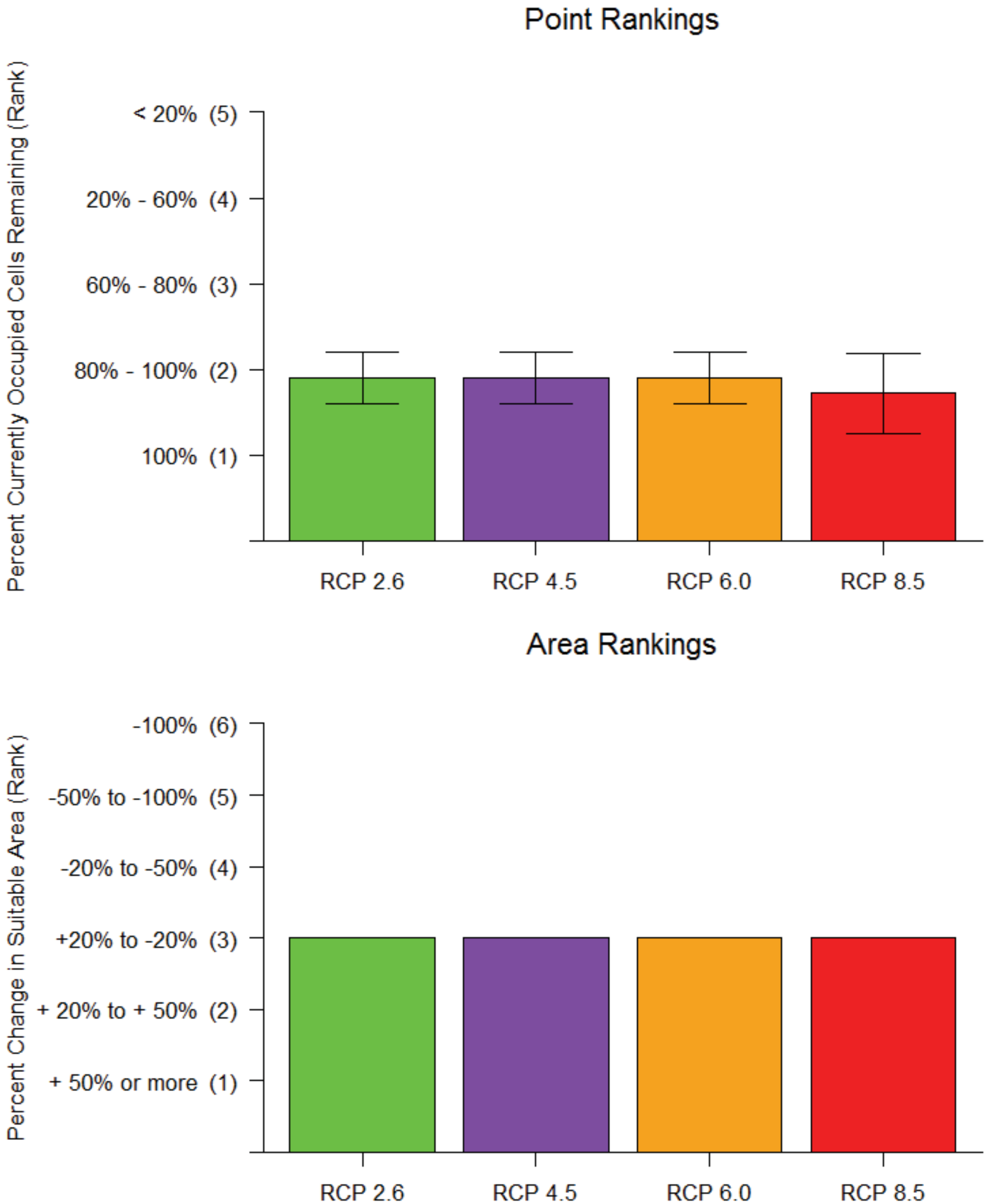

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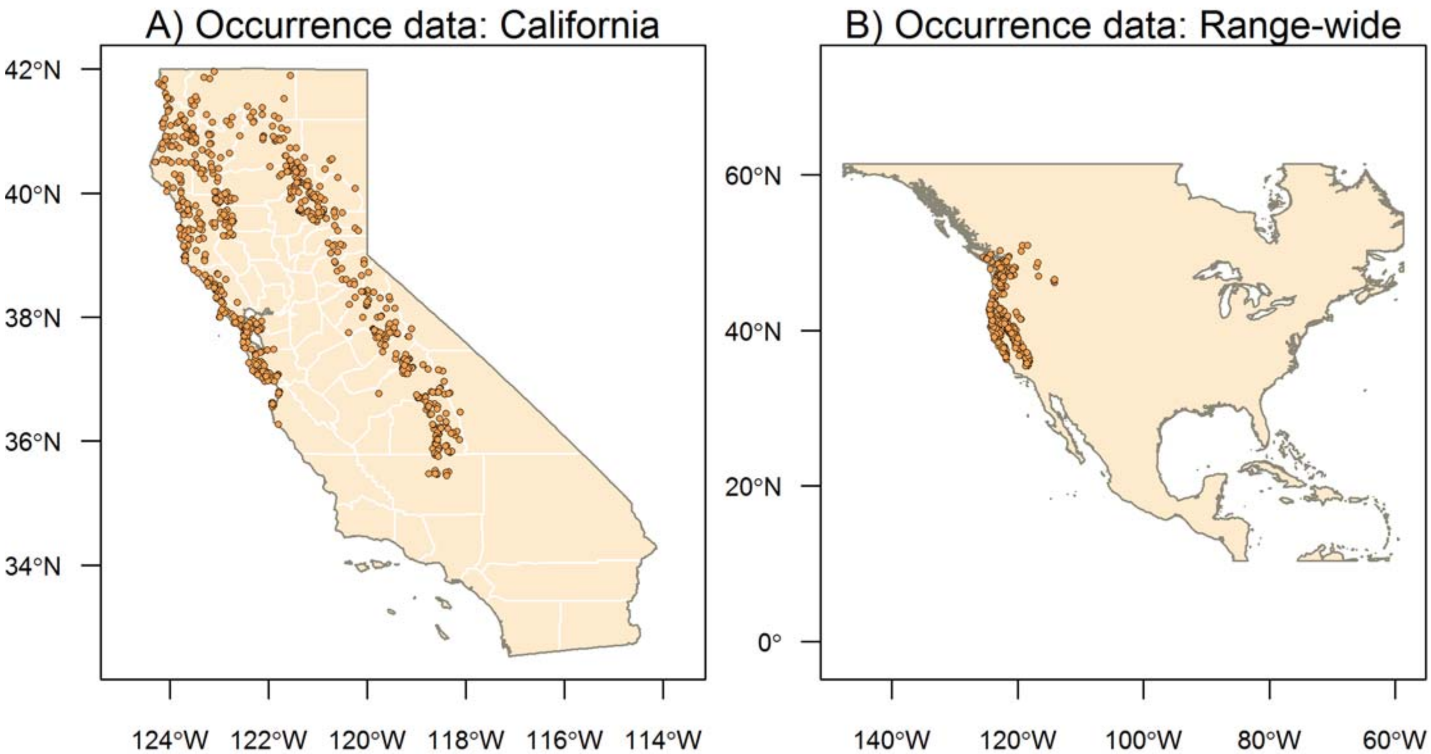
Species Results: *Elgaria coerulea* Northern Alligator Lizard



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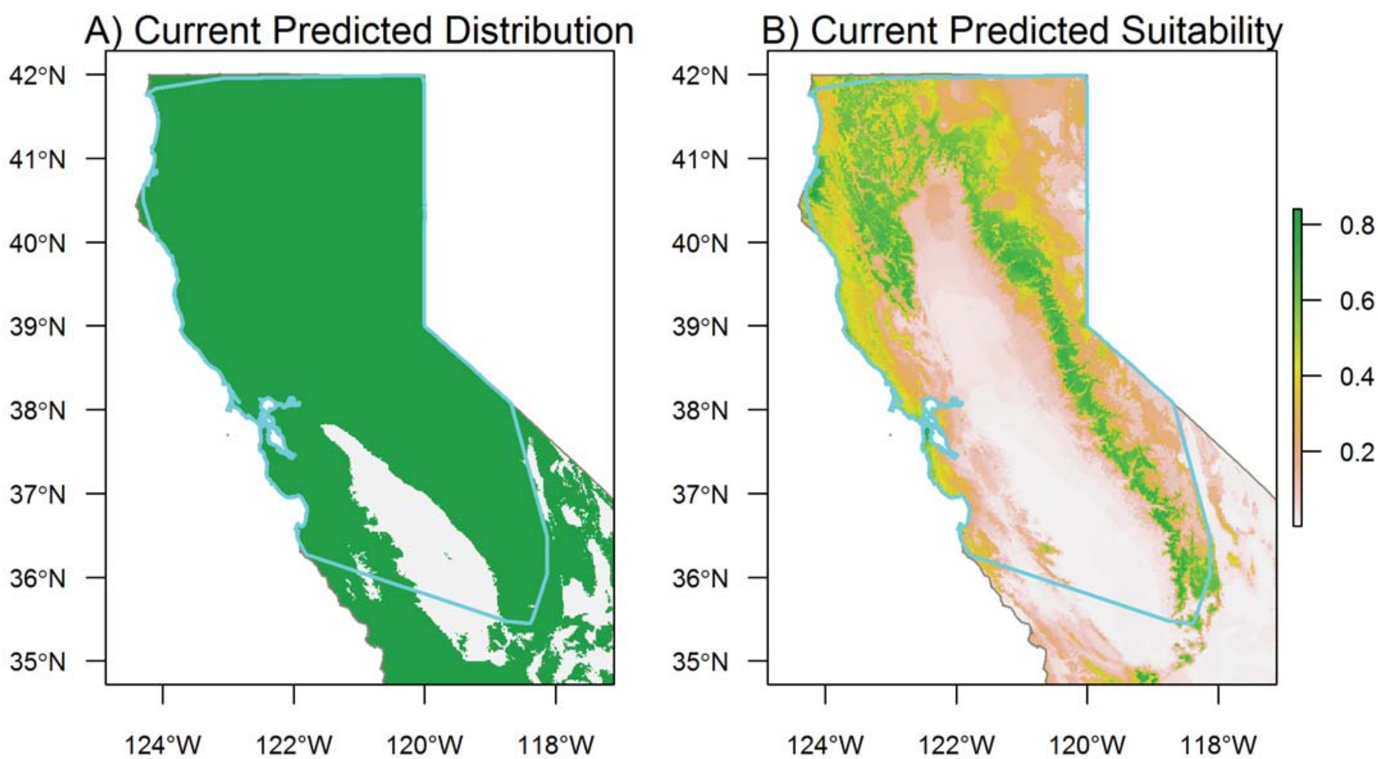

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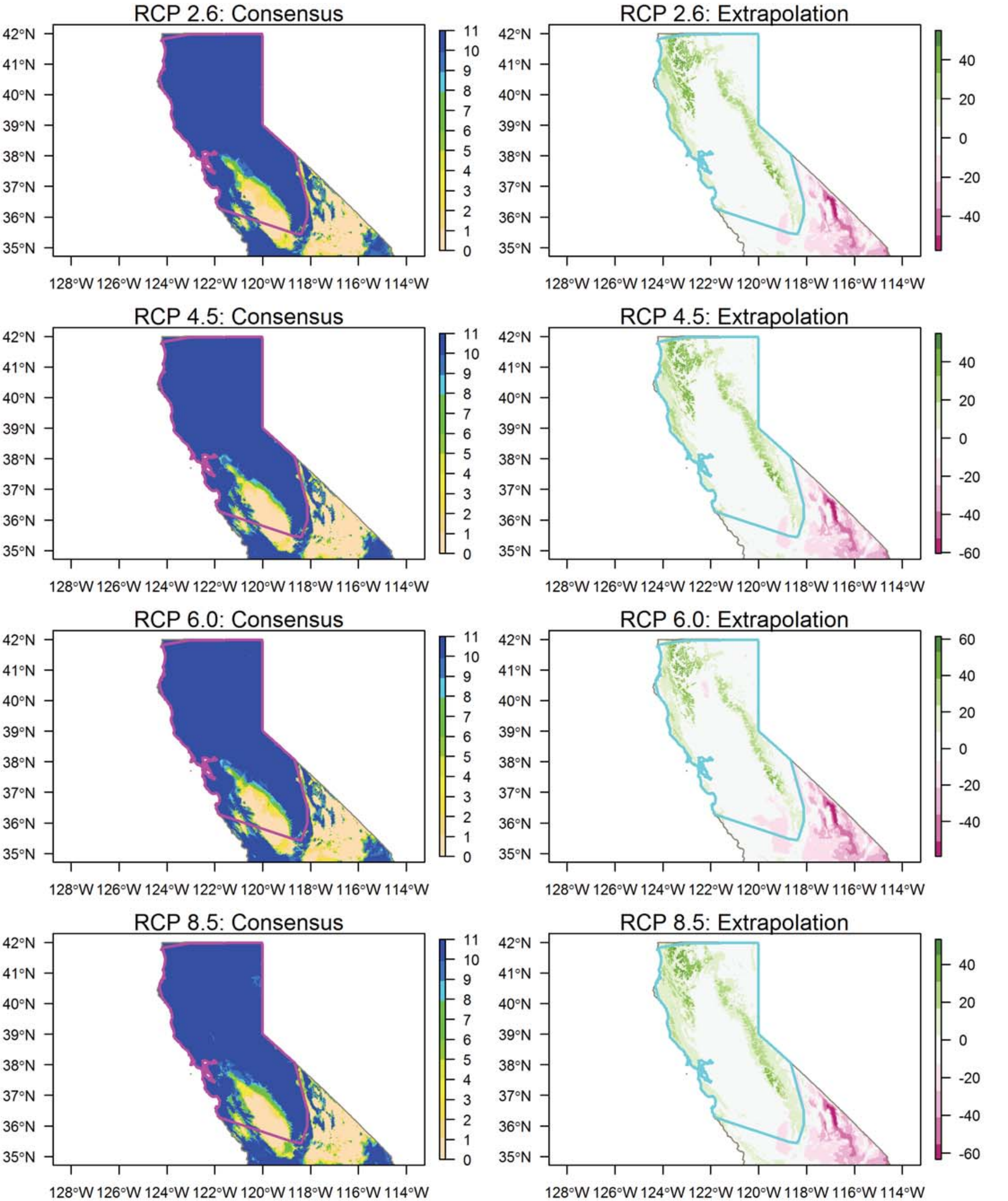

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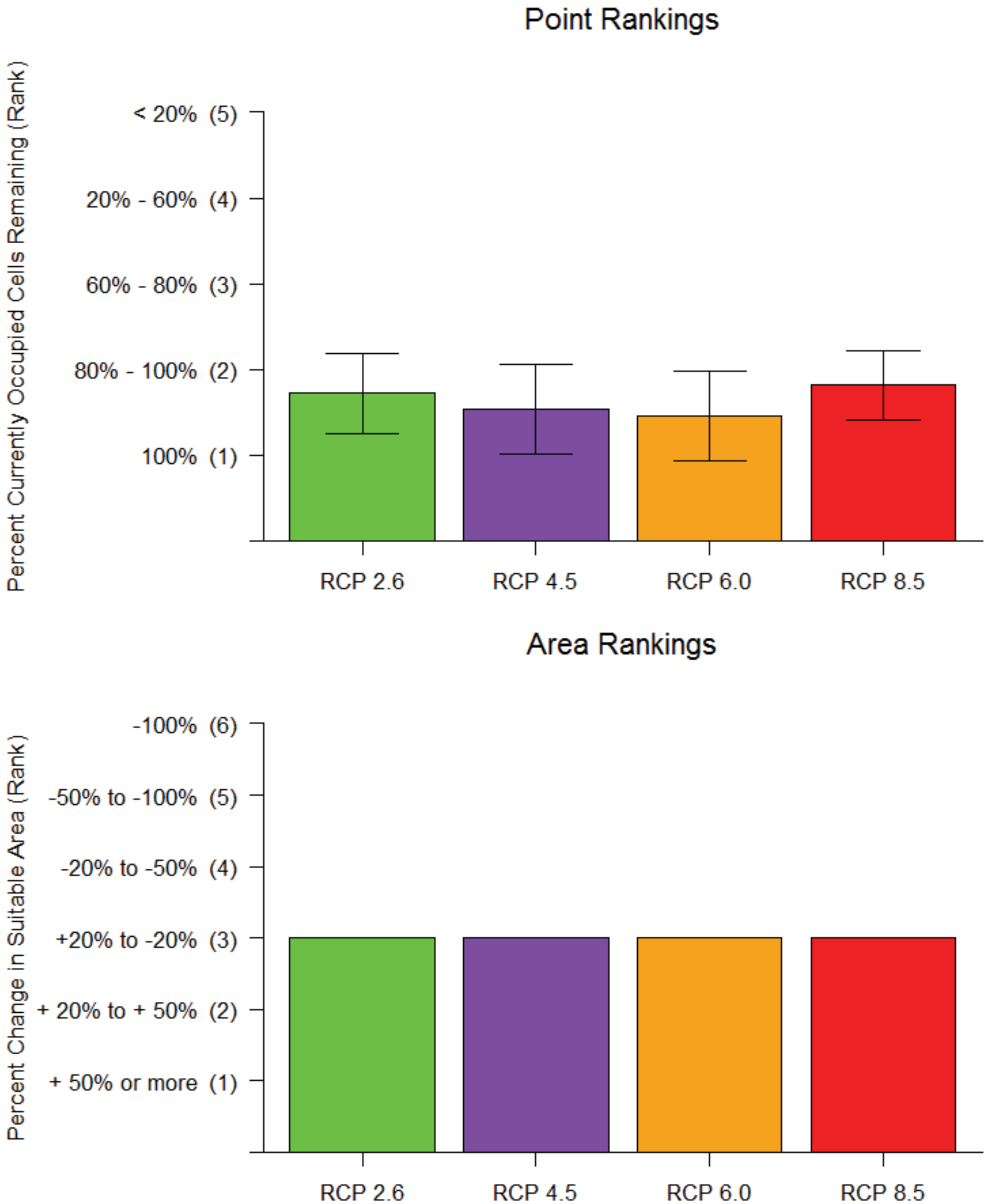

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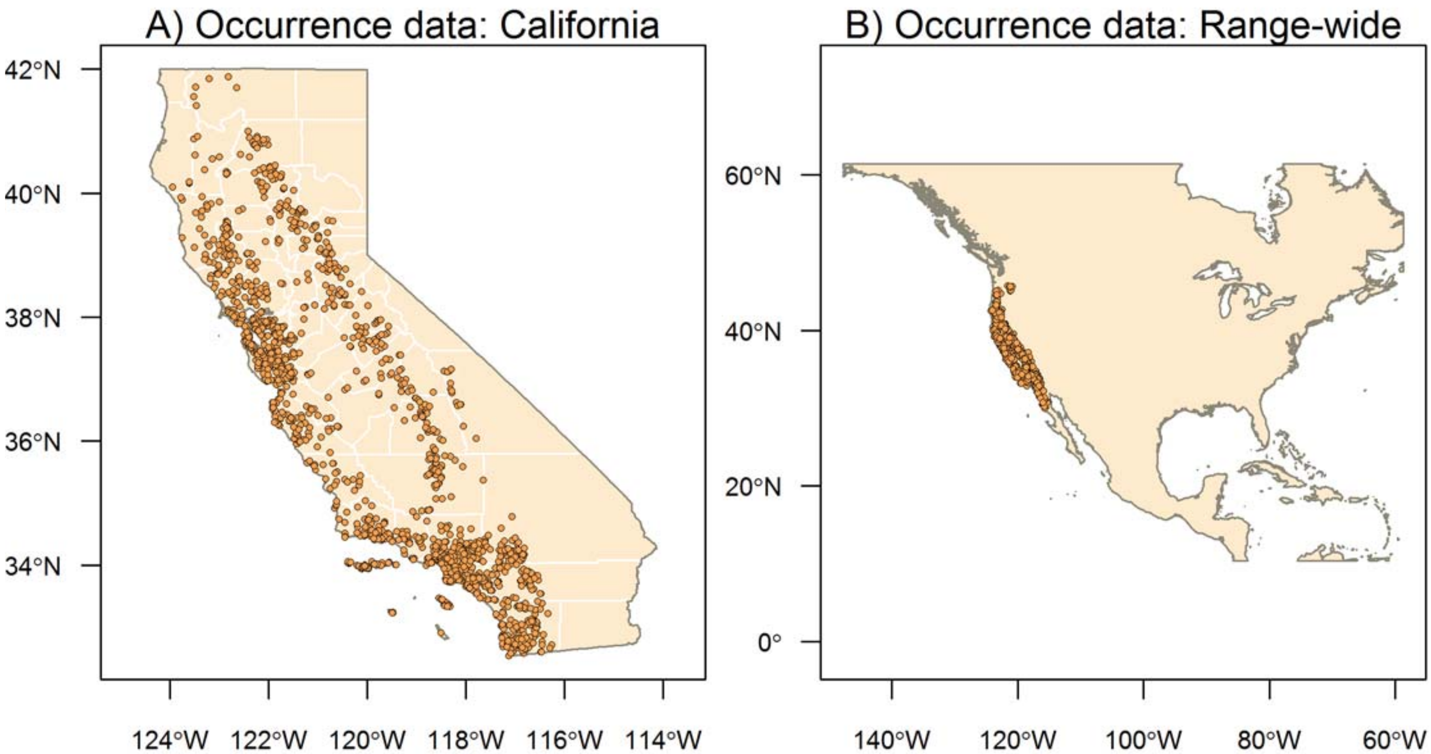
Species Results: *Elgaria multicarinata* Southern Alligator Lizard



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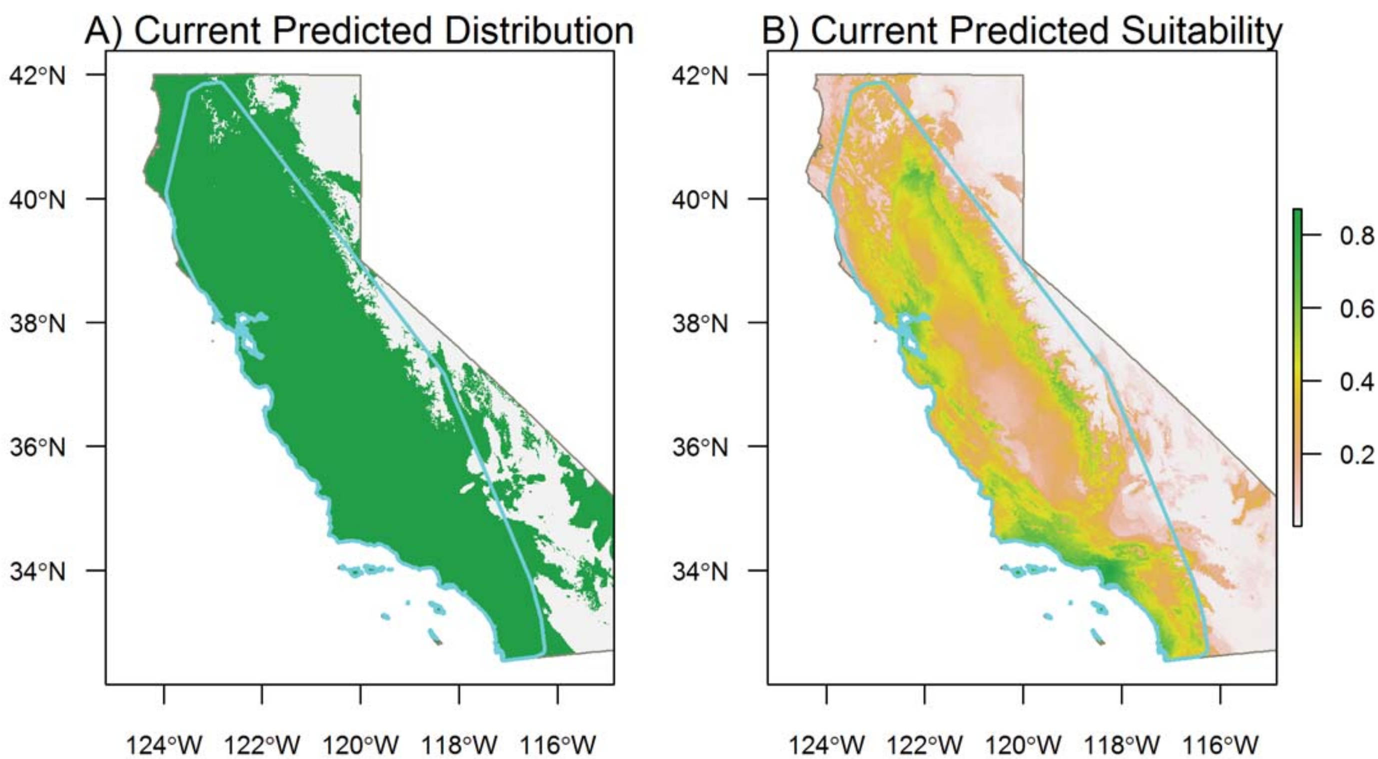

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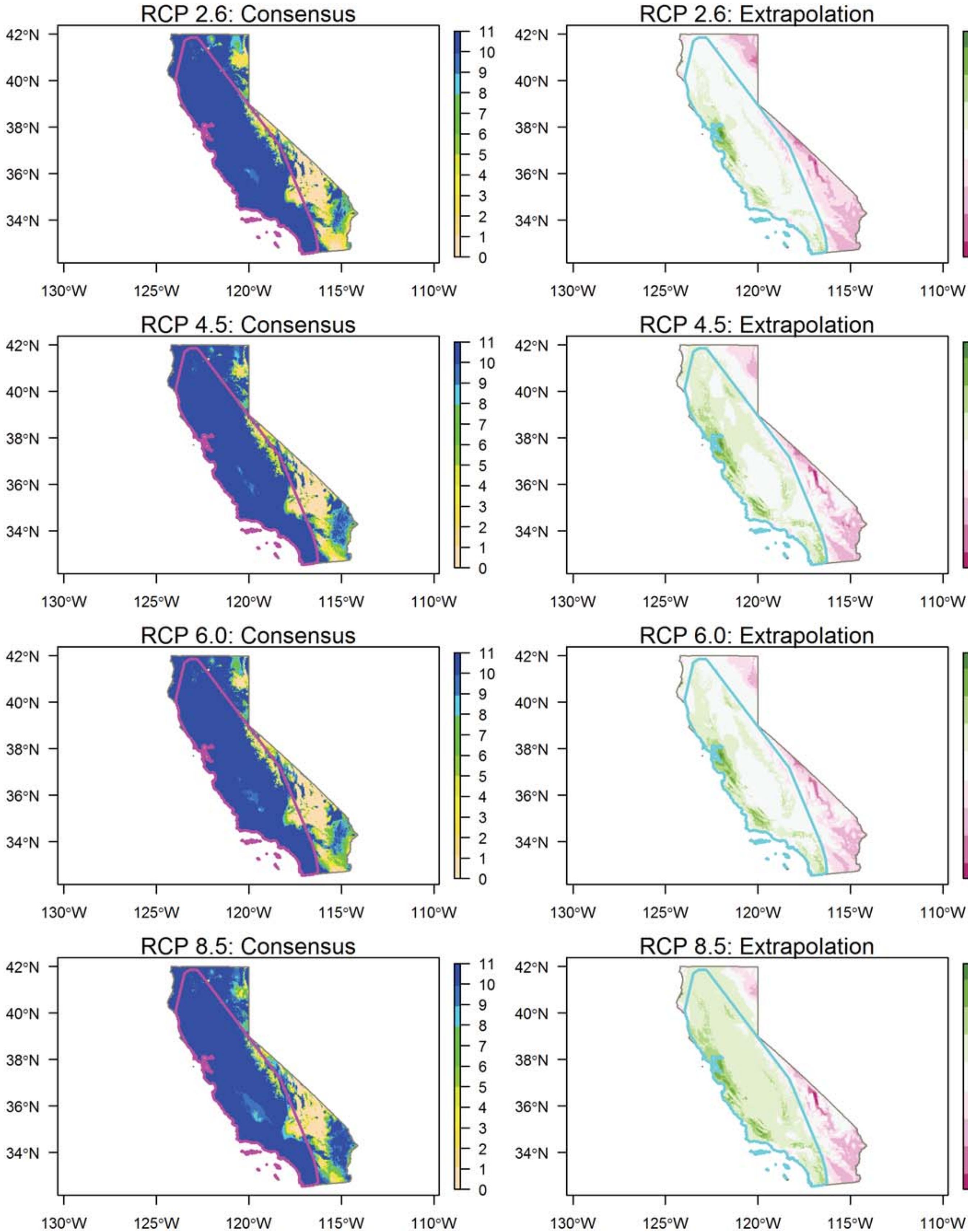
Species Results: *Elgaria multicarinata* Southern Alligator Lizard



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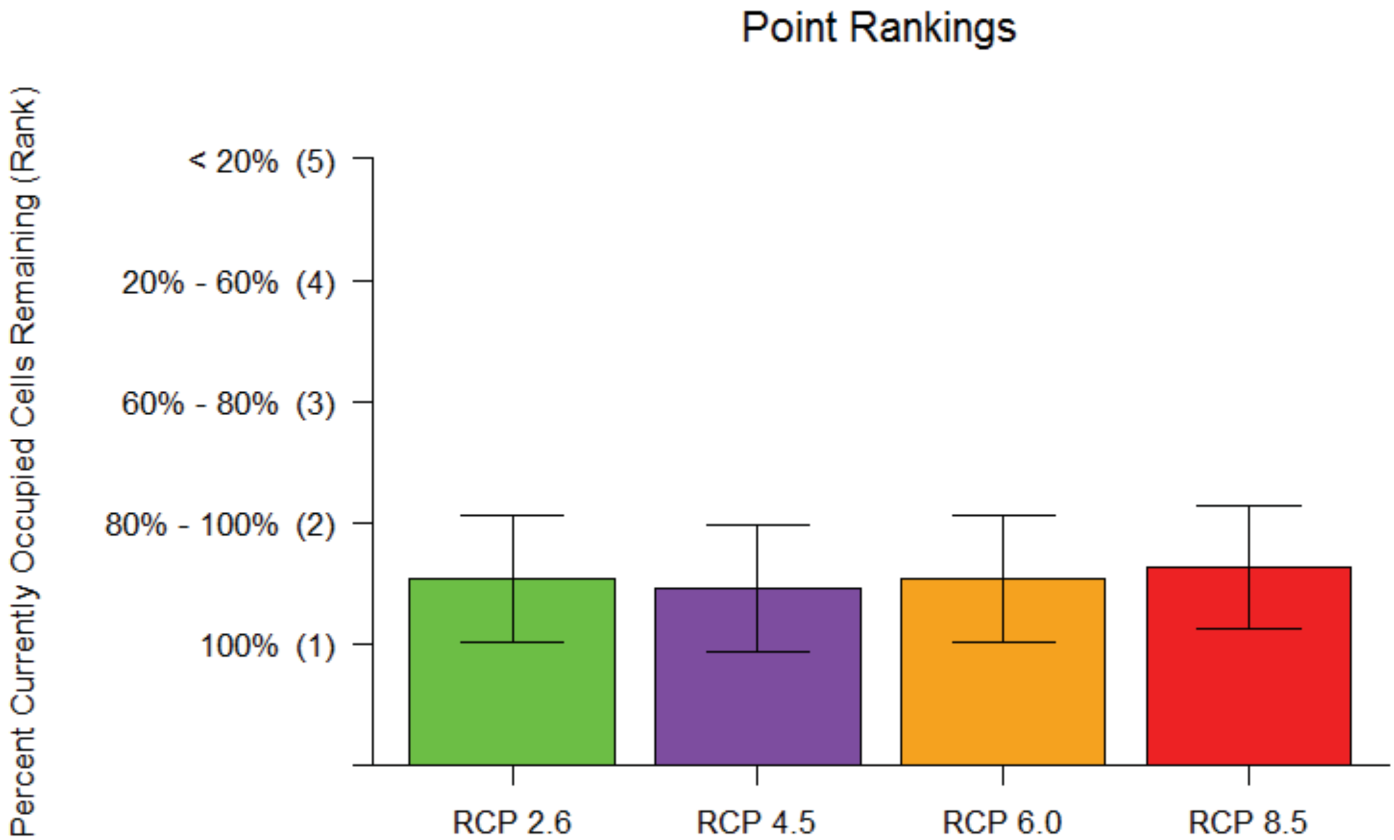

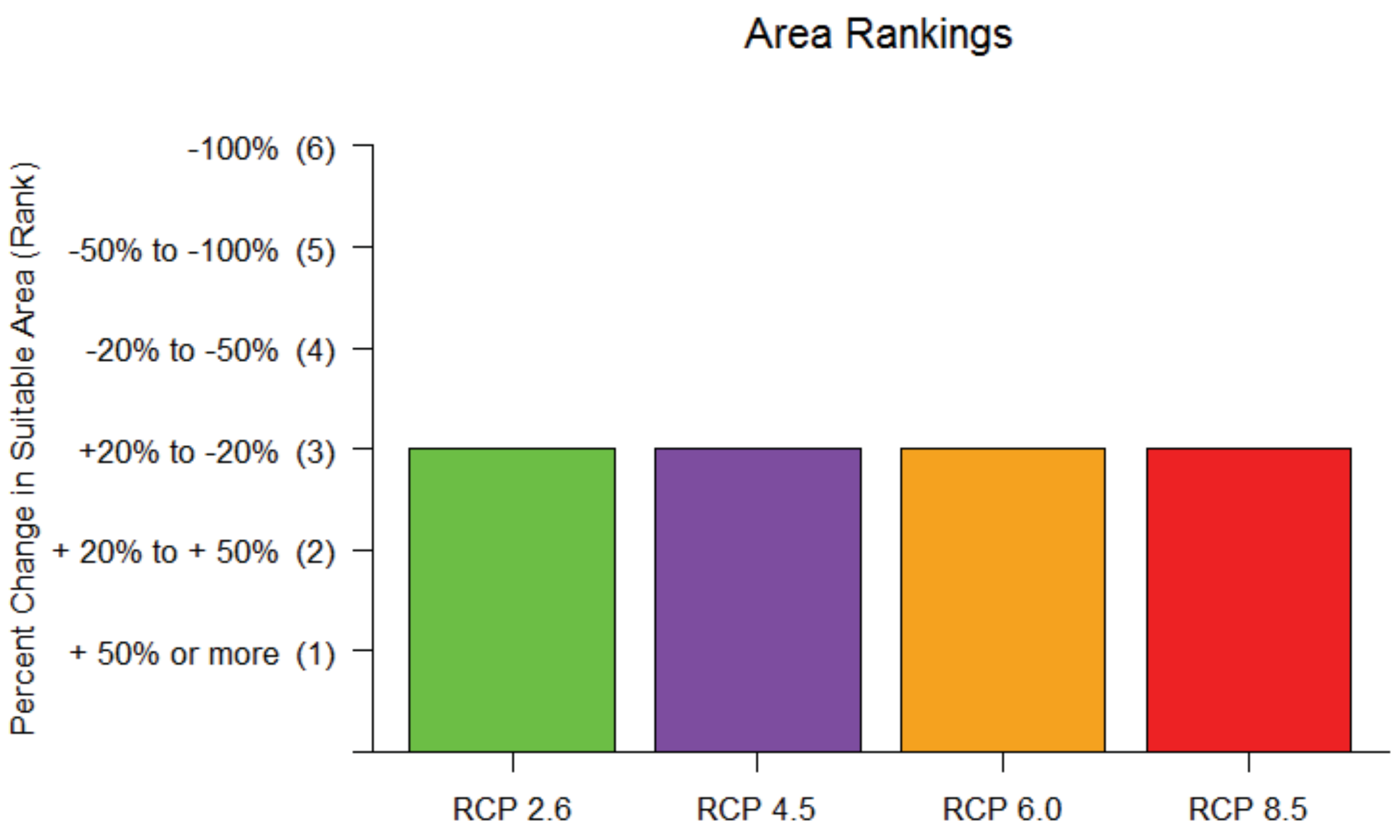

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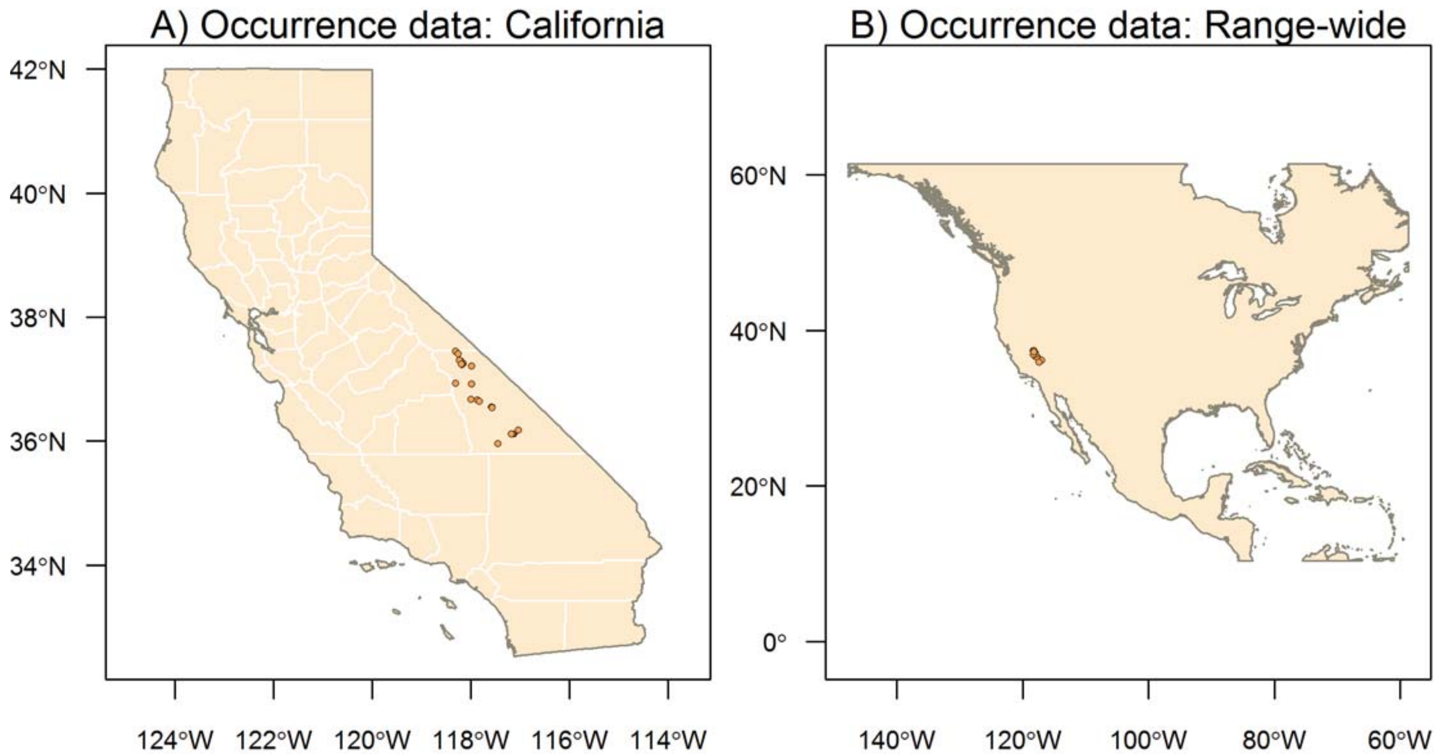
Species Results: *Elgaria panamintina* Panamint Alligator LIzard



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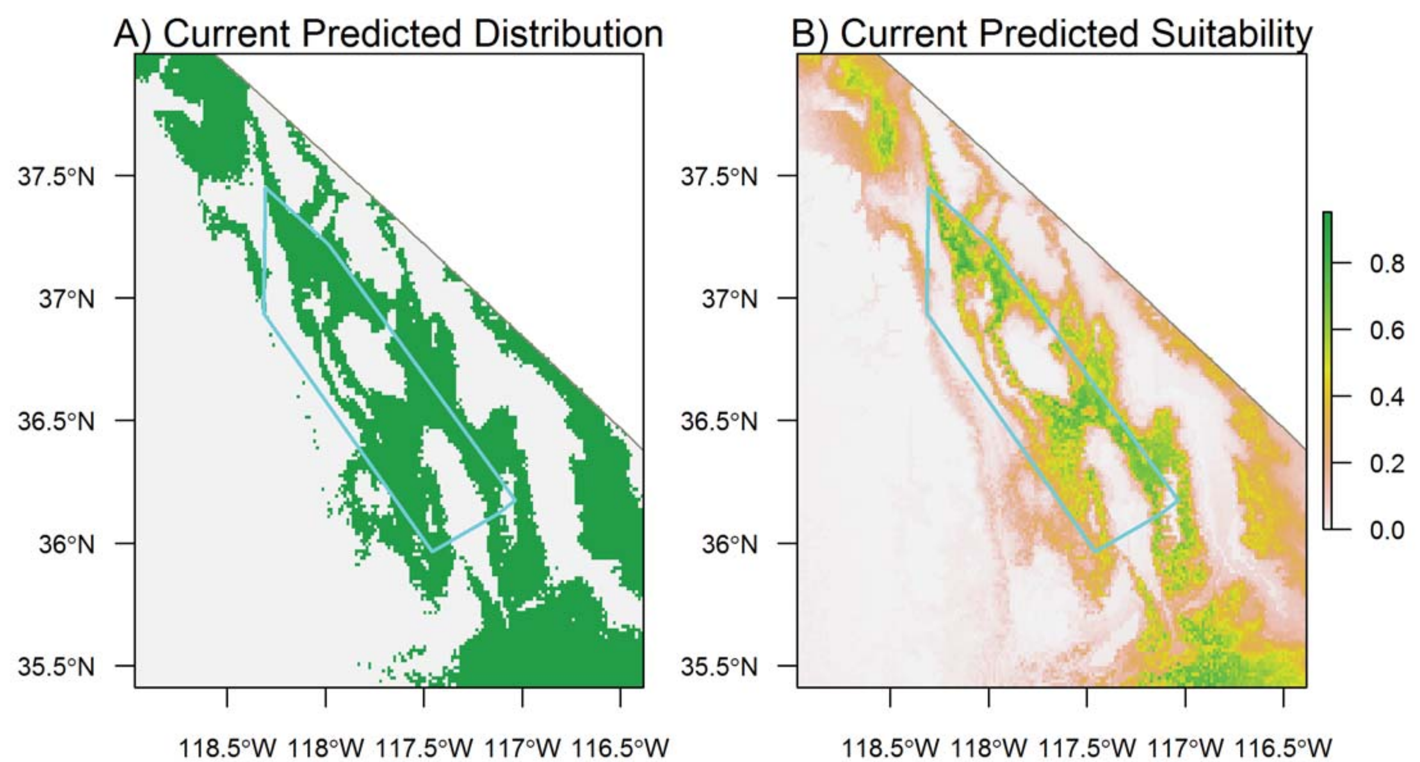

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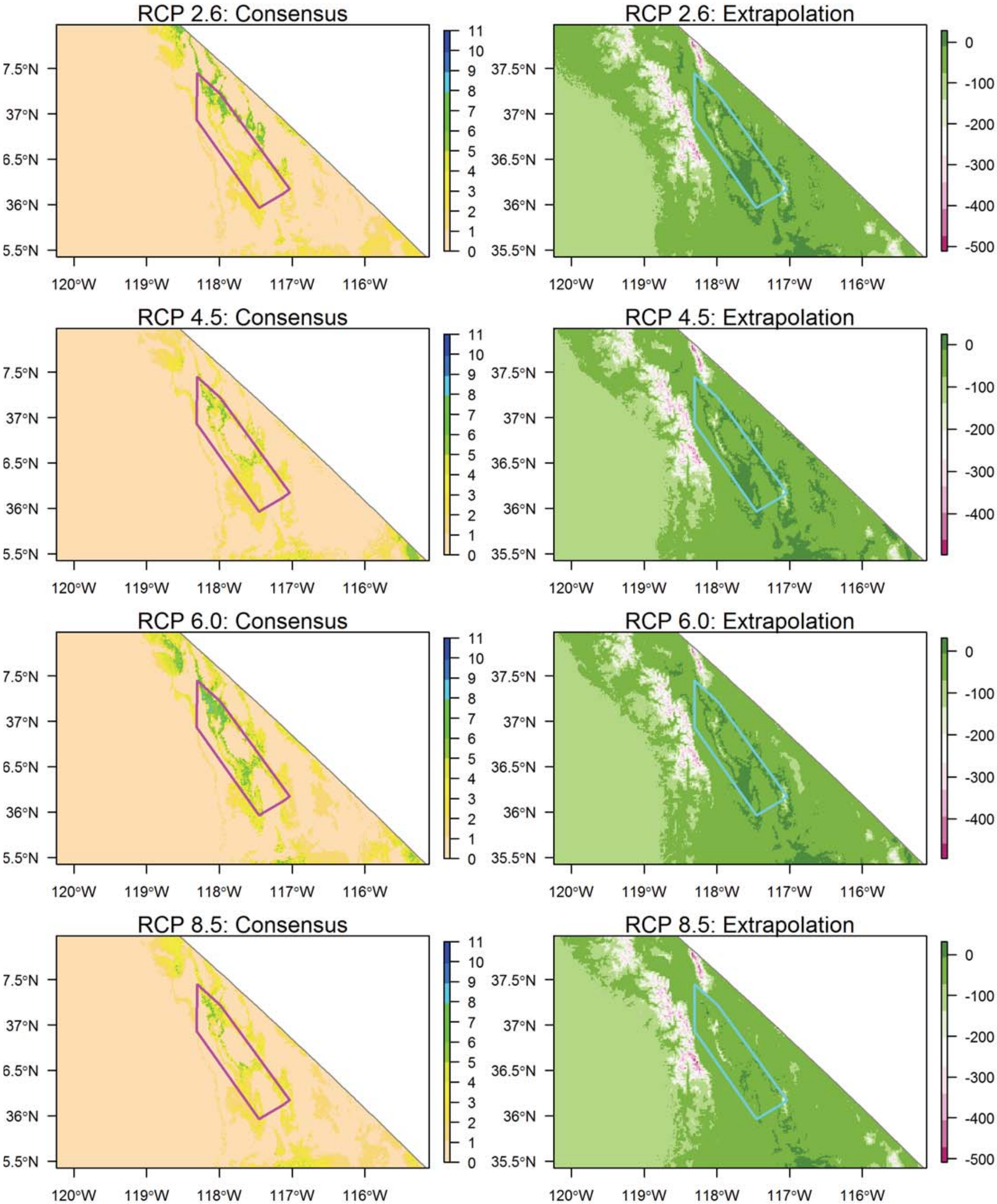

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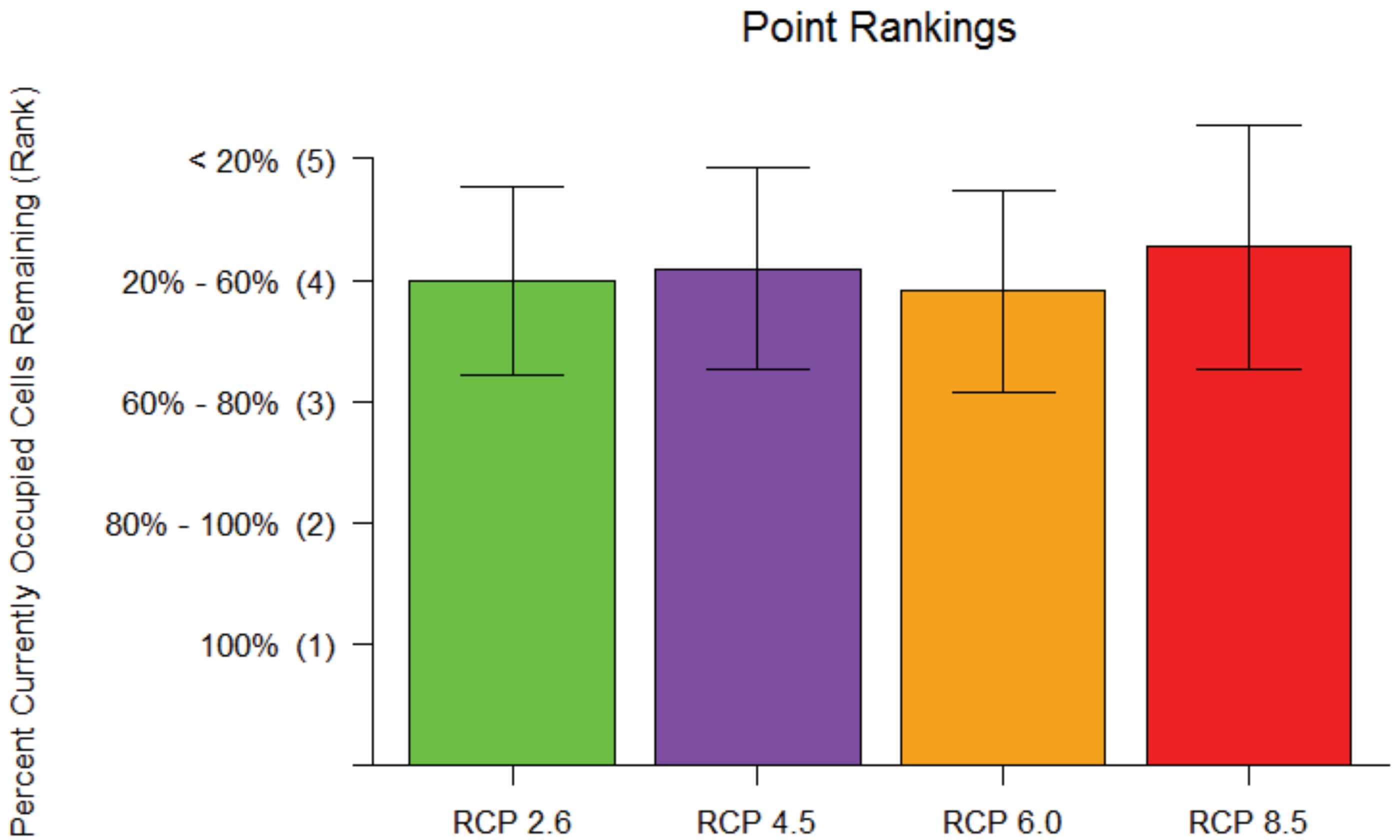

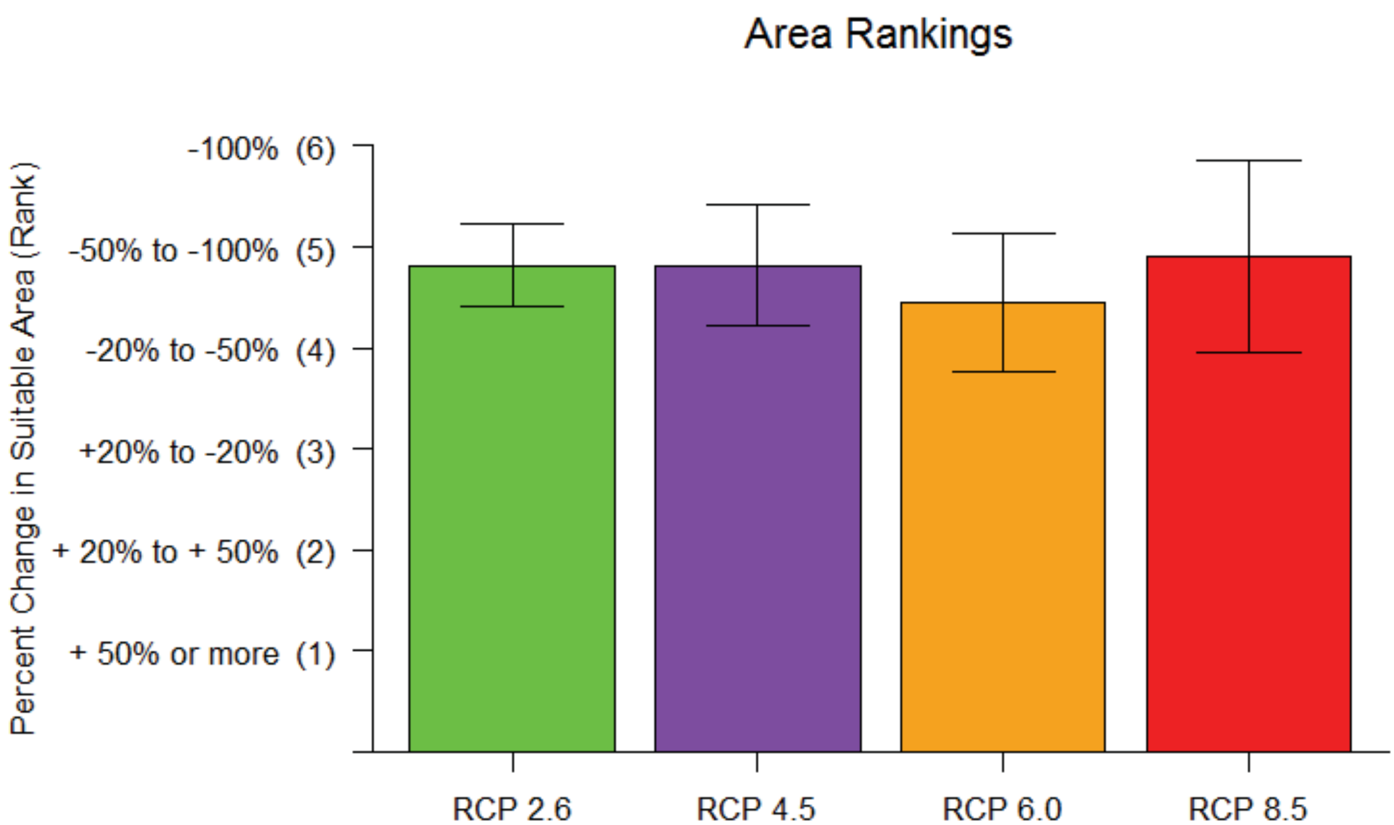

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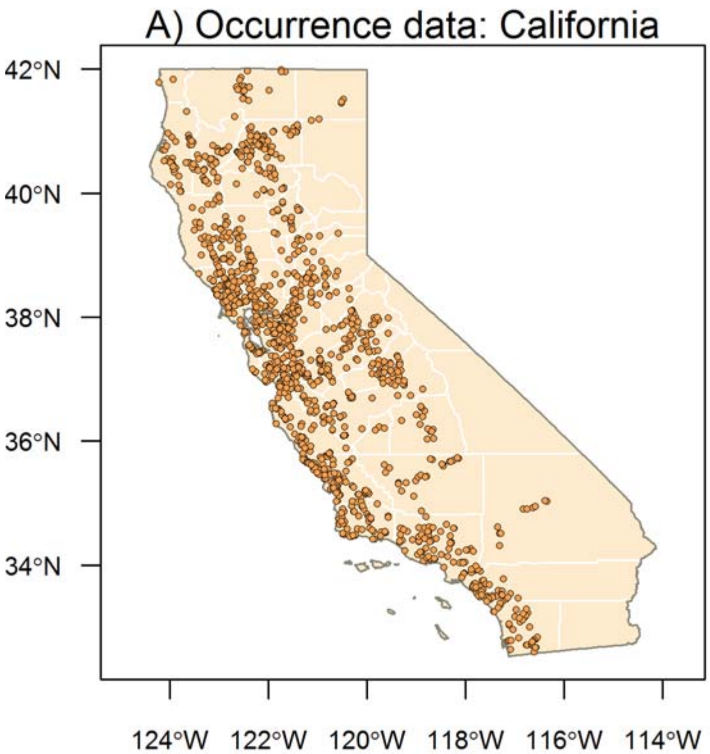
Species Results: *Emys marmorata* Western Pond Turtle



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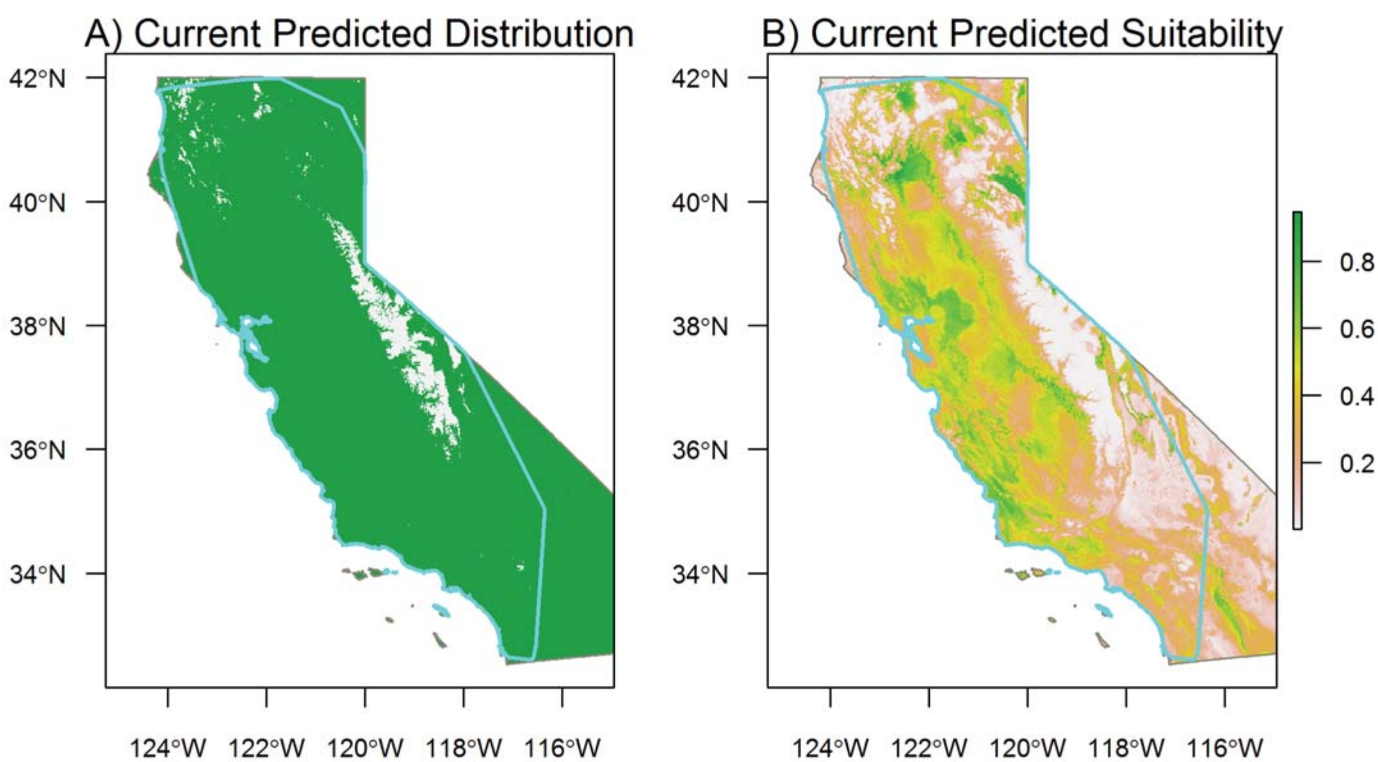

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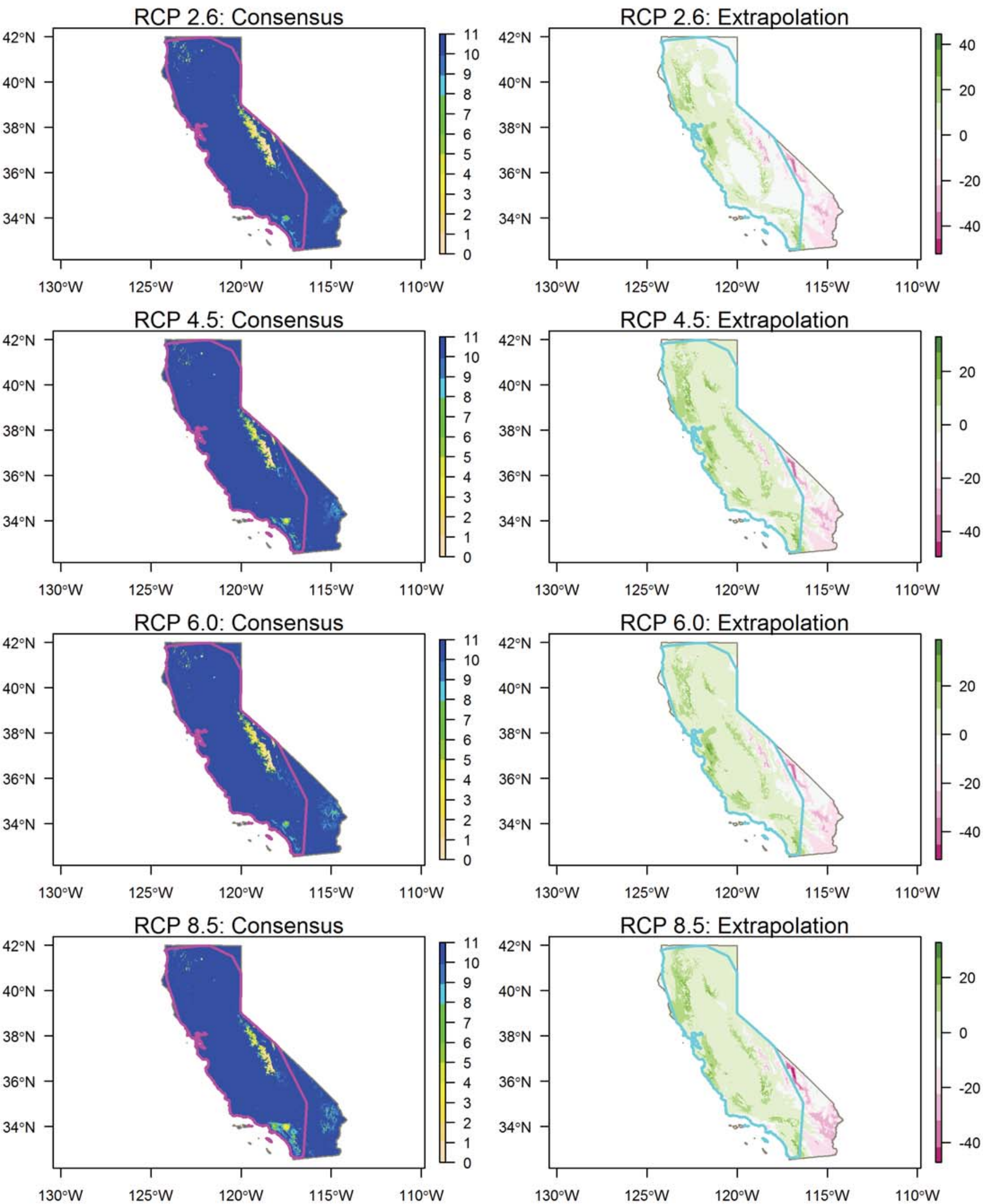

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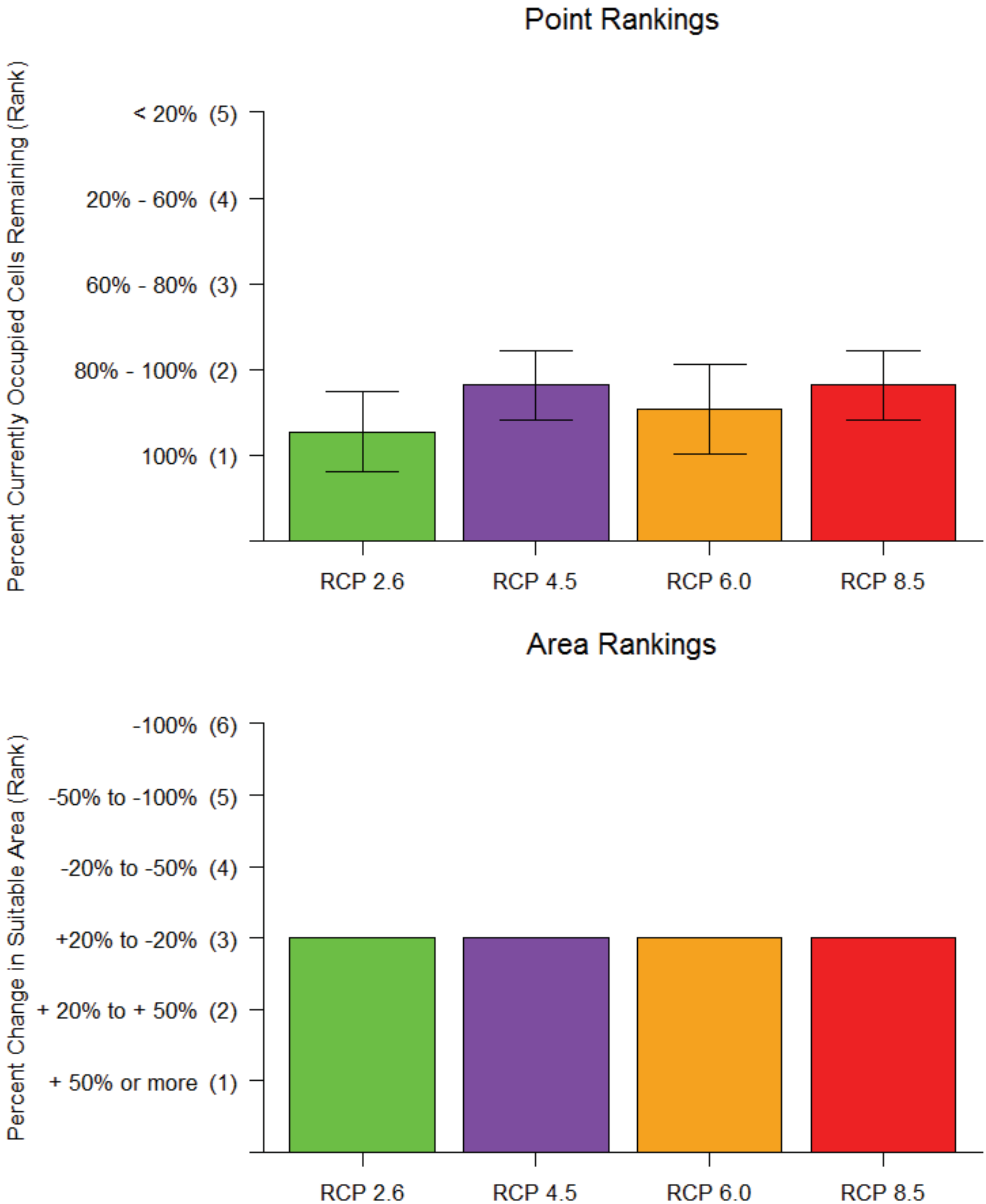

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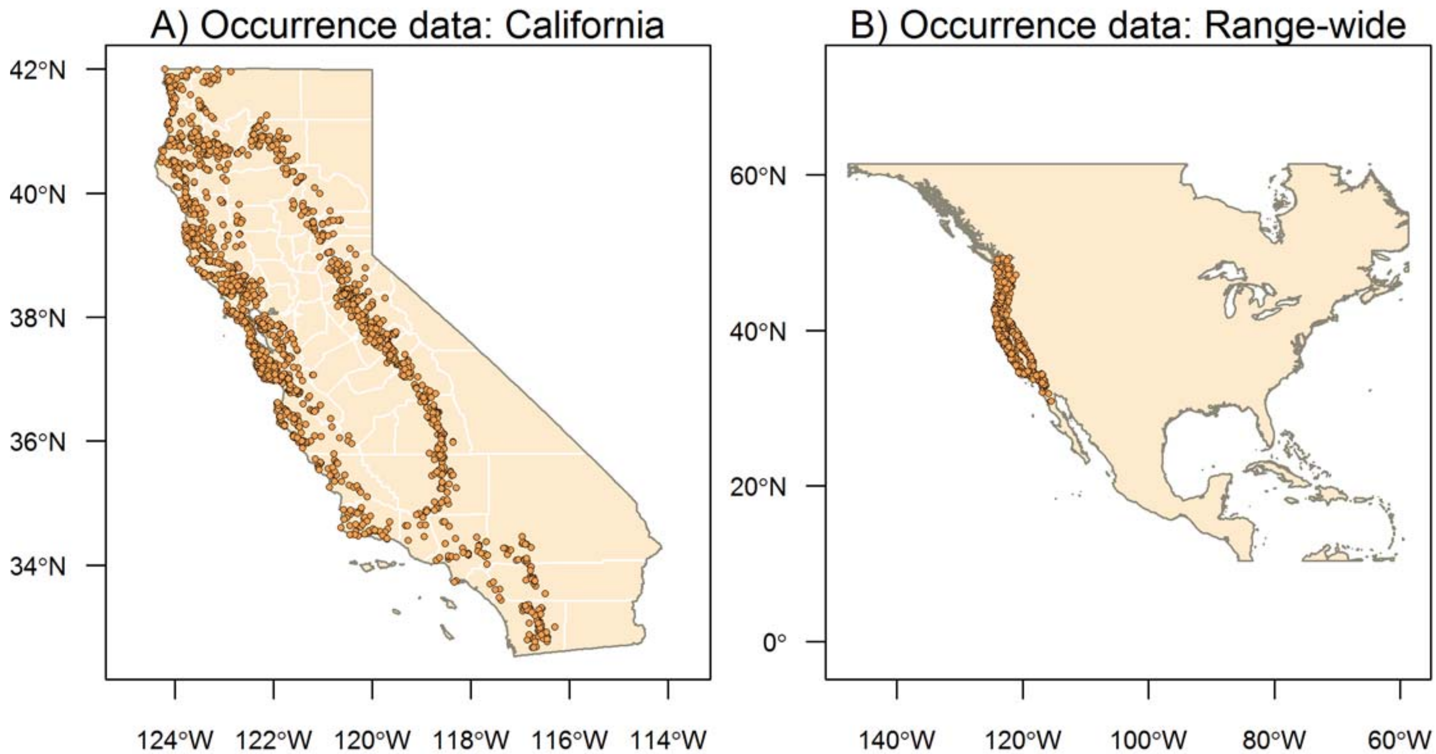
Species Results: *Ensatina eschscholtzii* Ensatina



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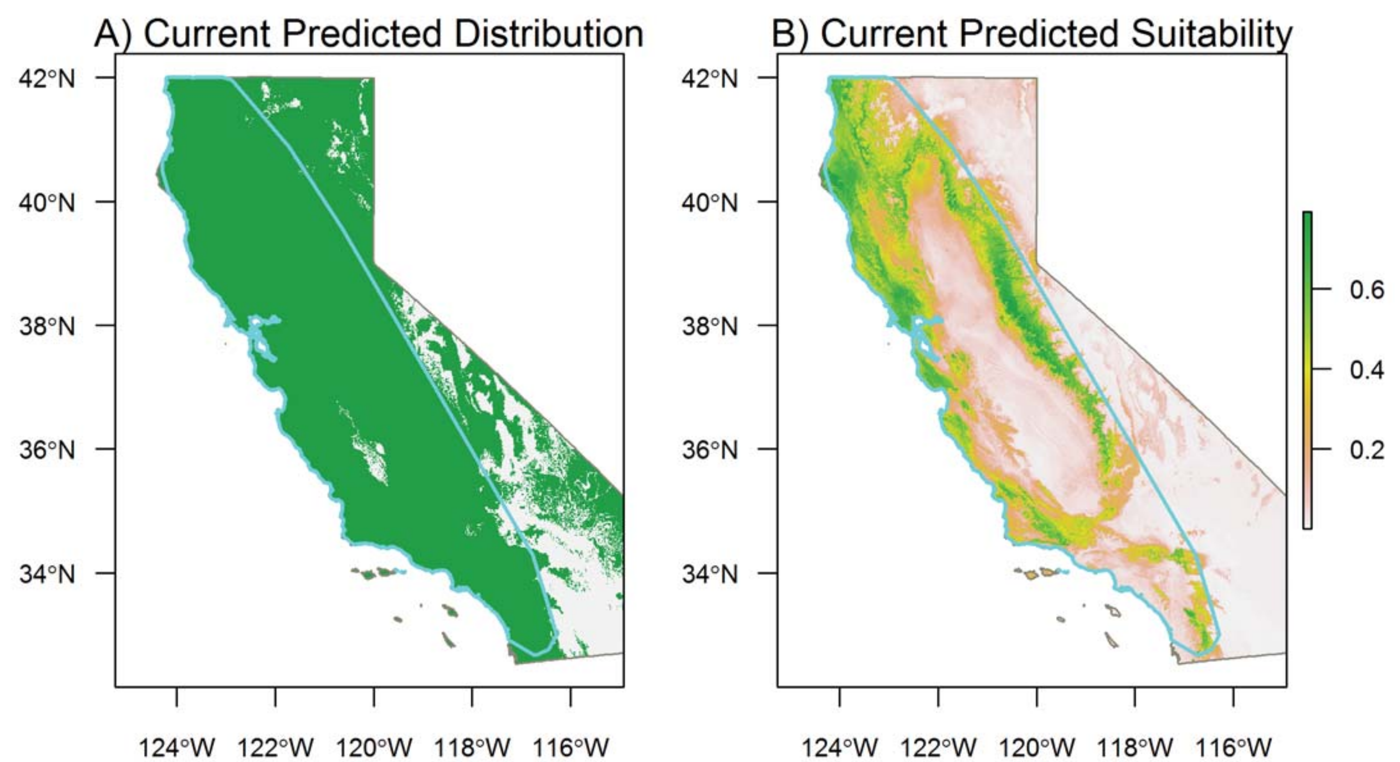

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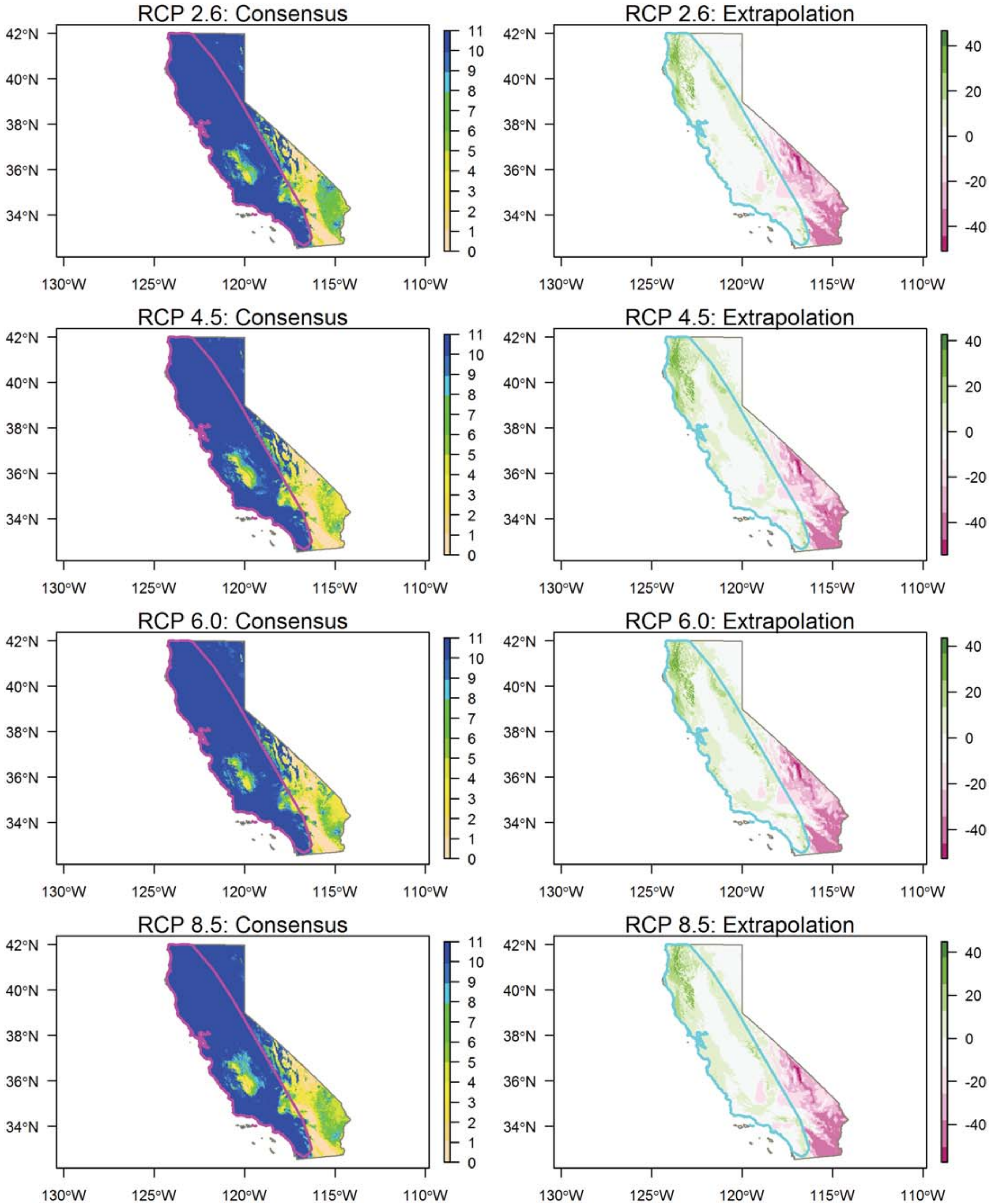

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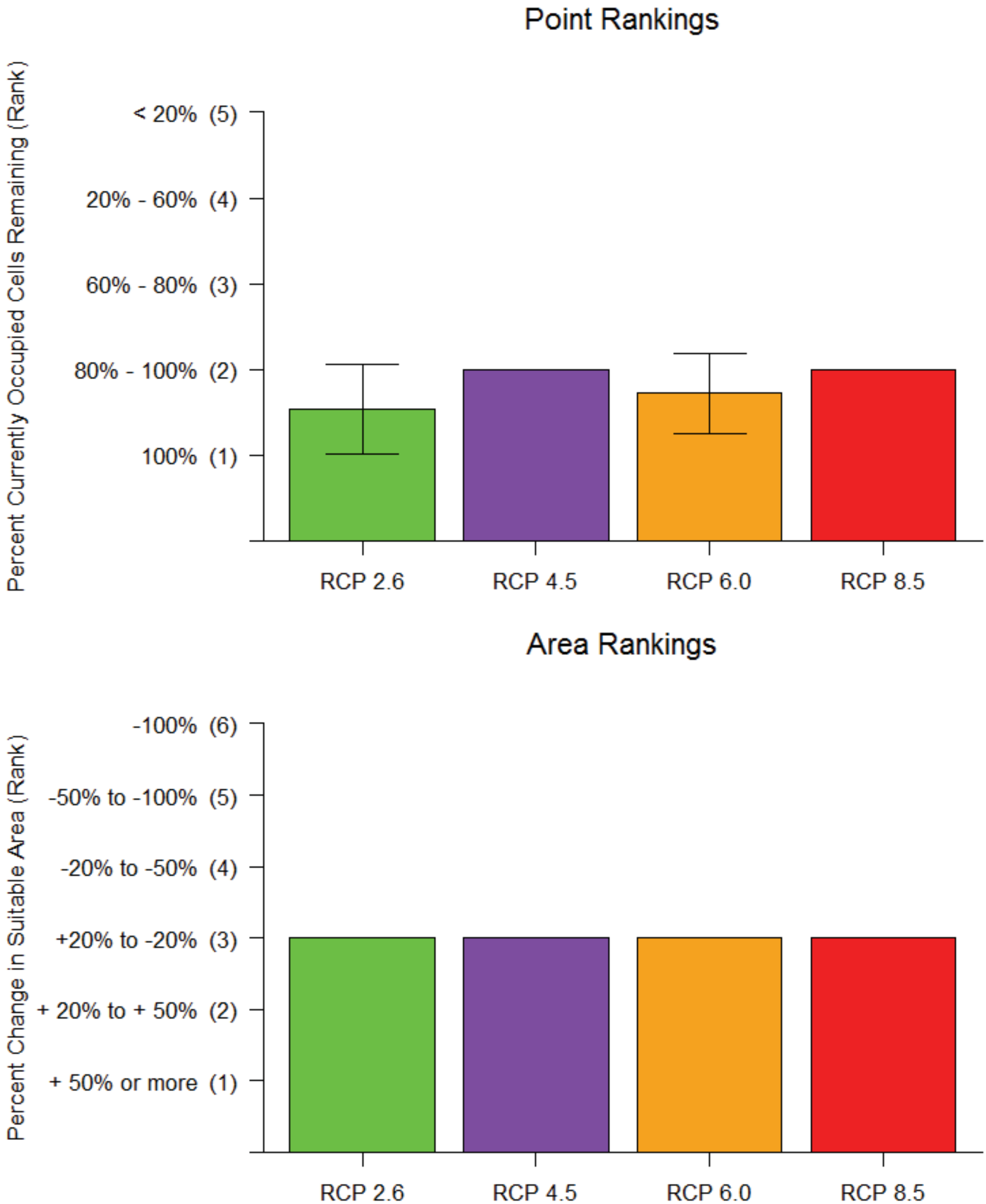

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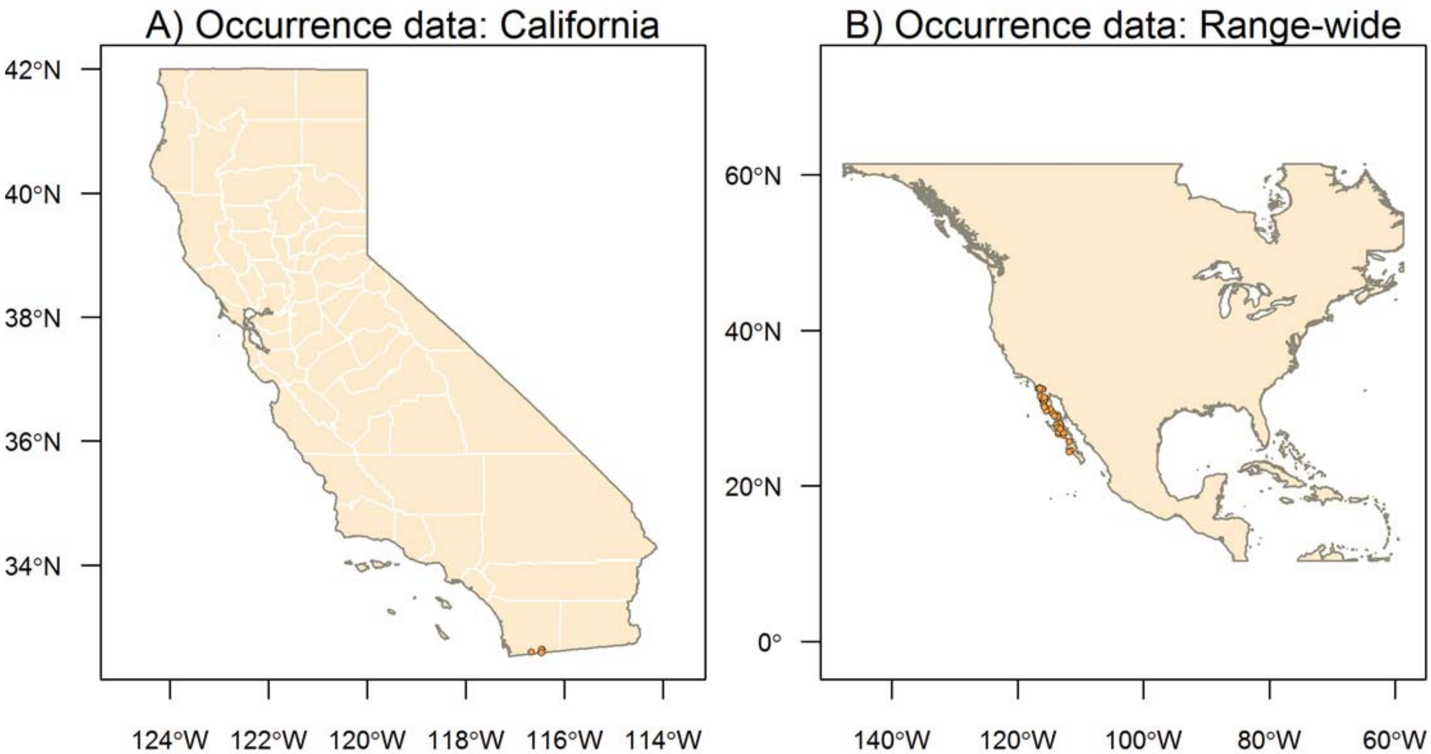
Species Results: *Gambelia copeii* Cope's Leopard Lizard



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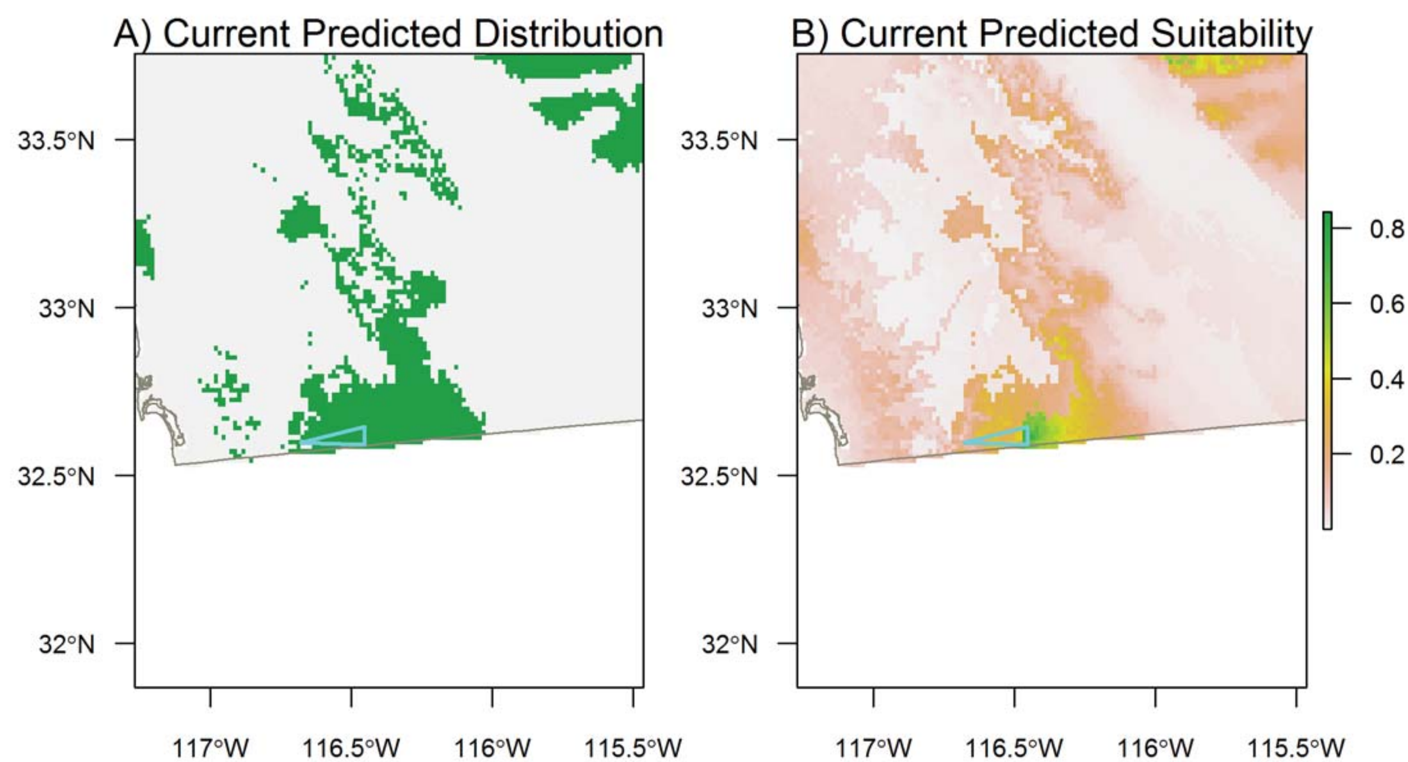

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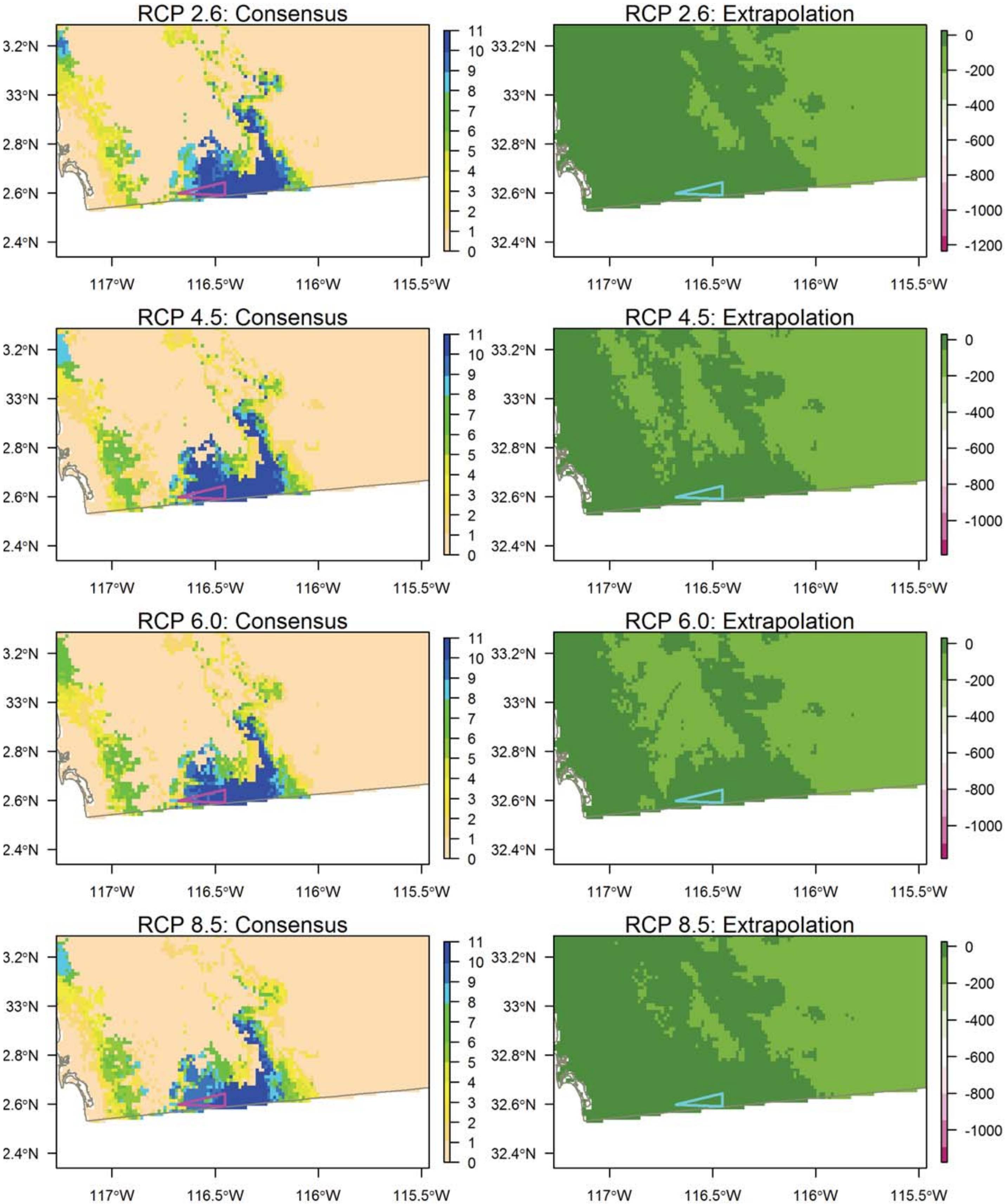

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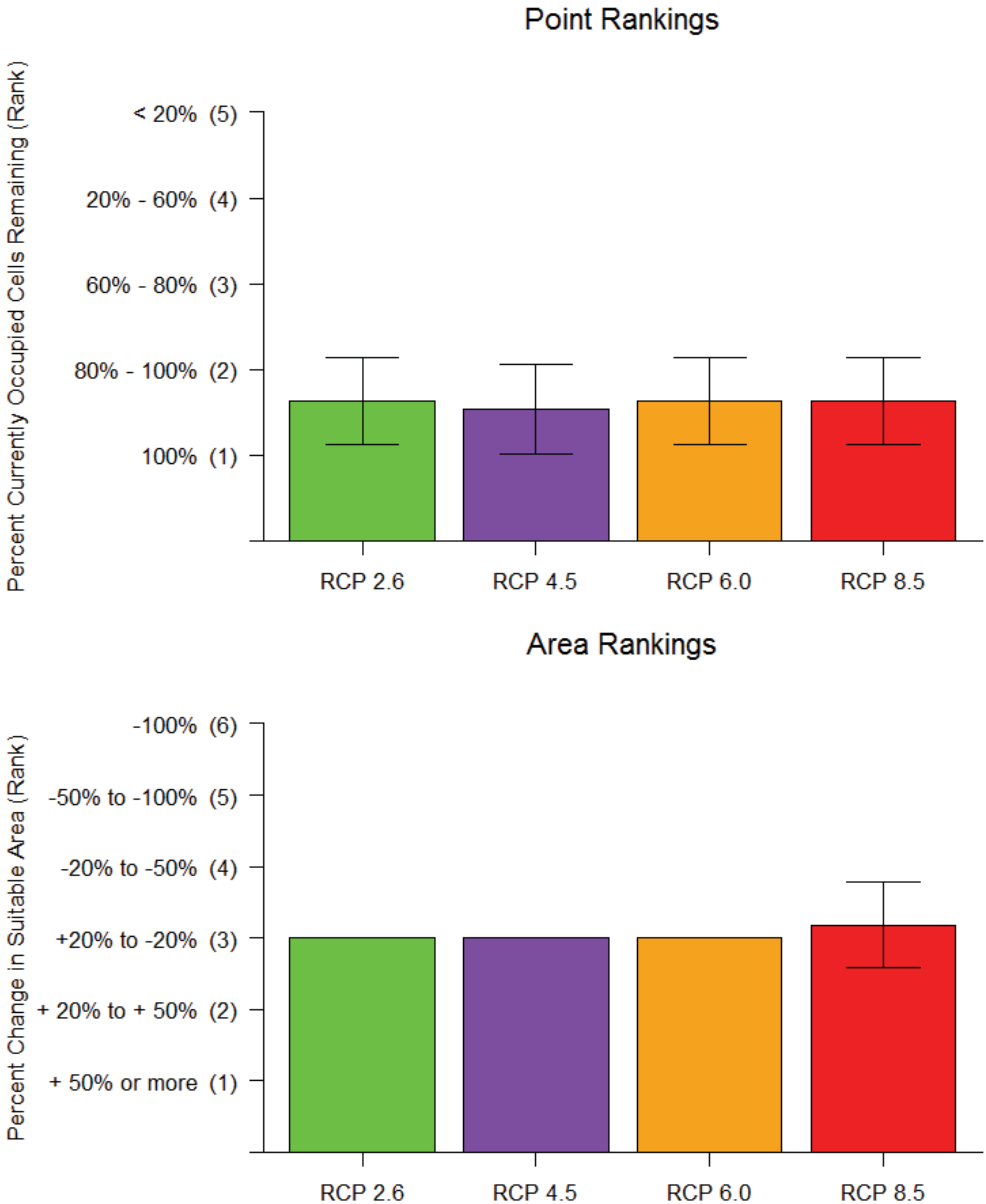

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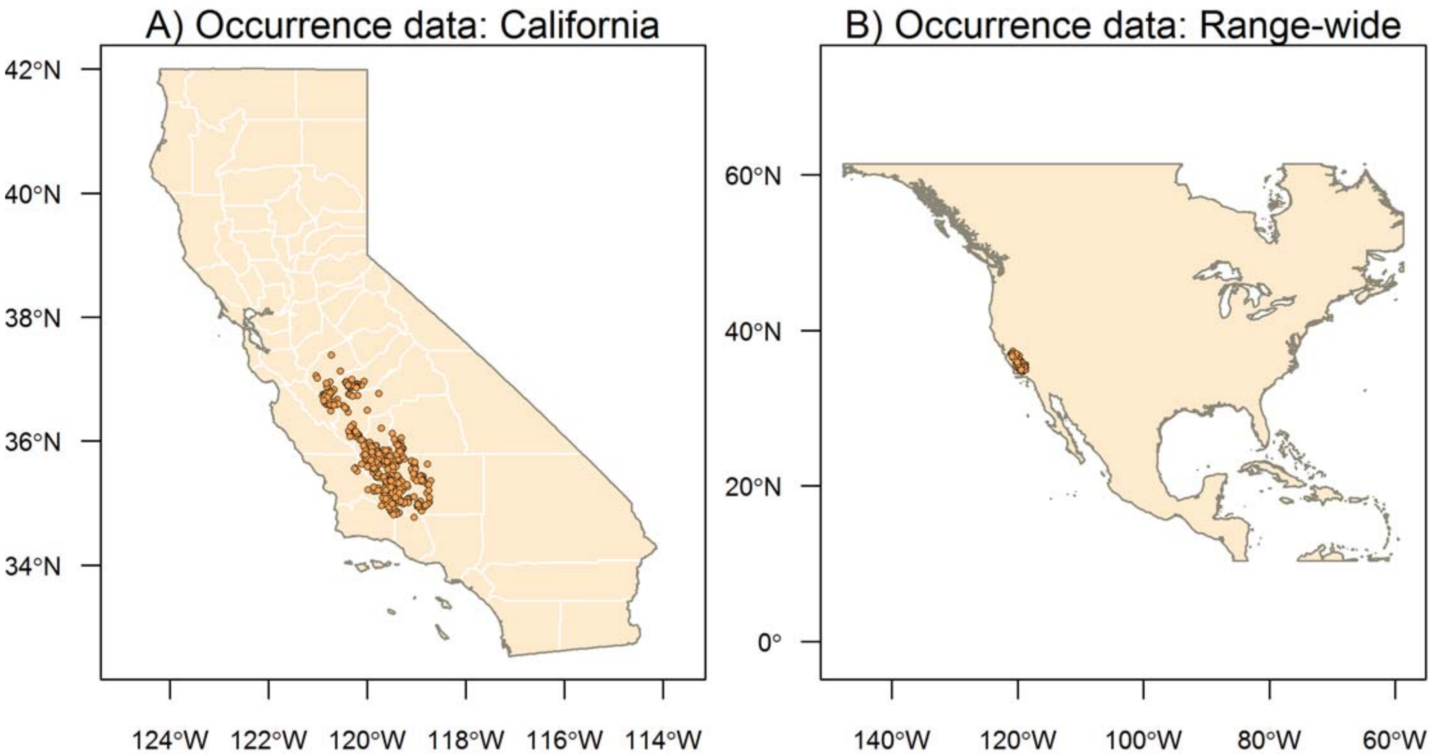
Species Results: *Gambelia sila* Blunt-nosed Leopard Lizard



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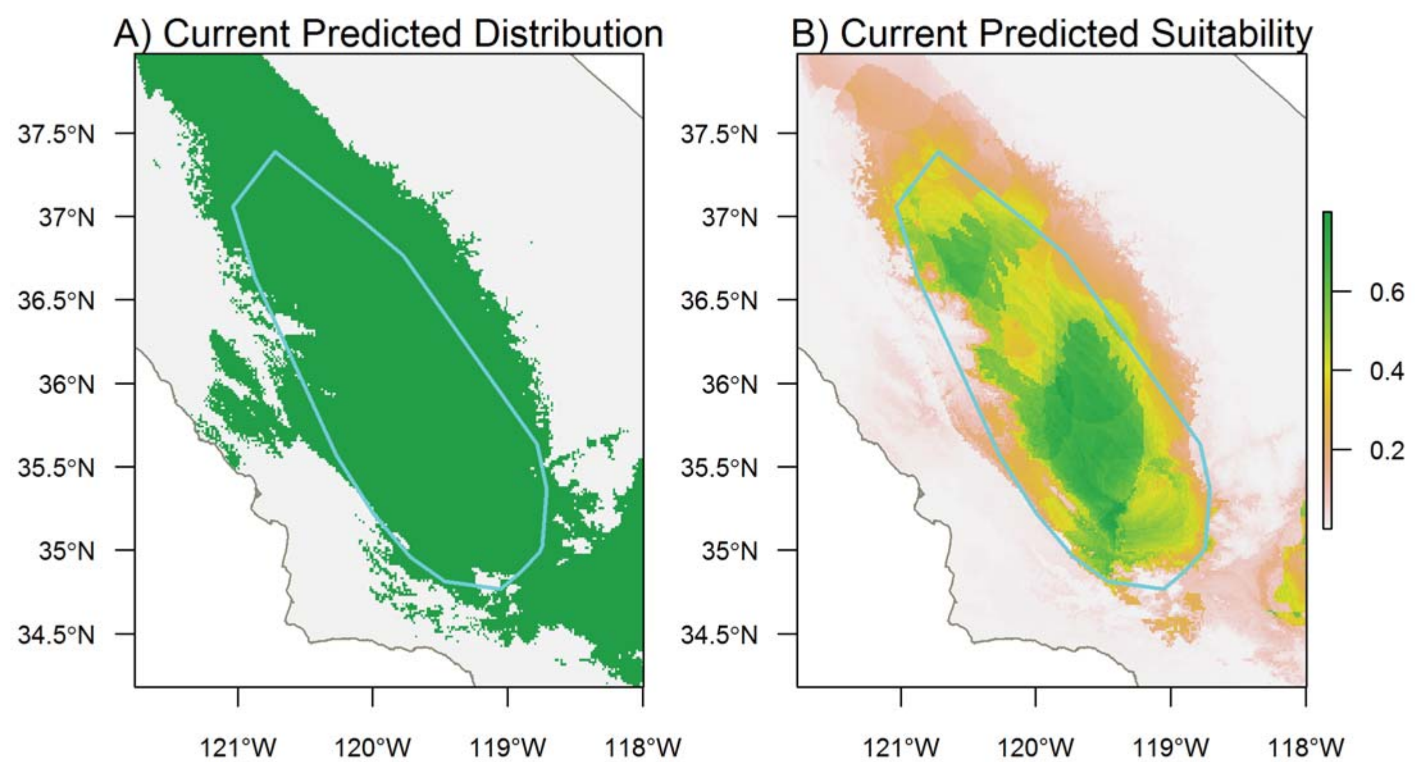

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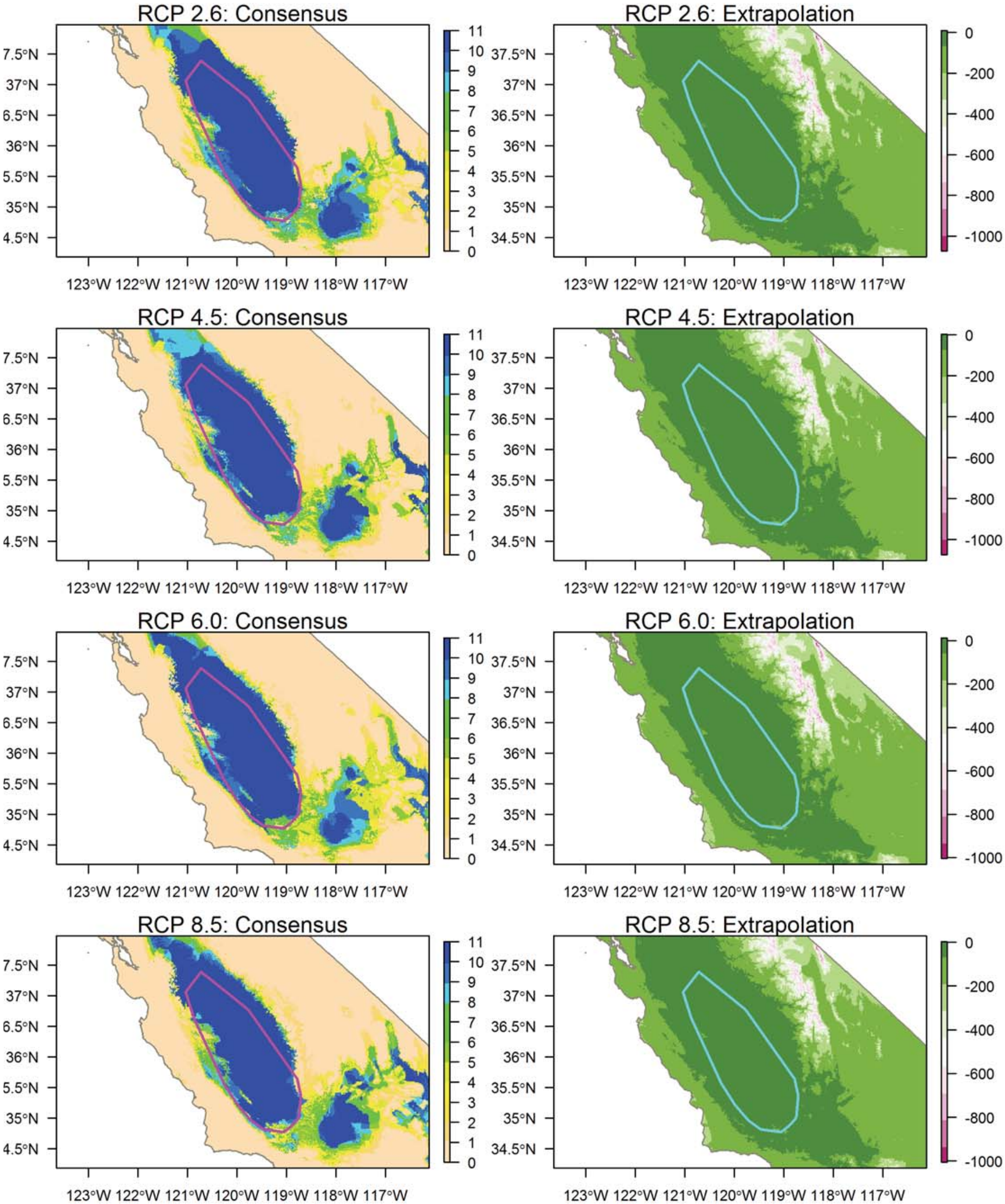

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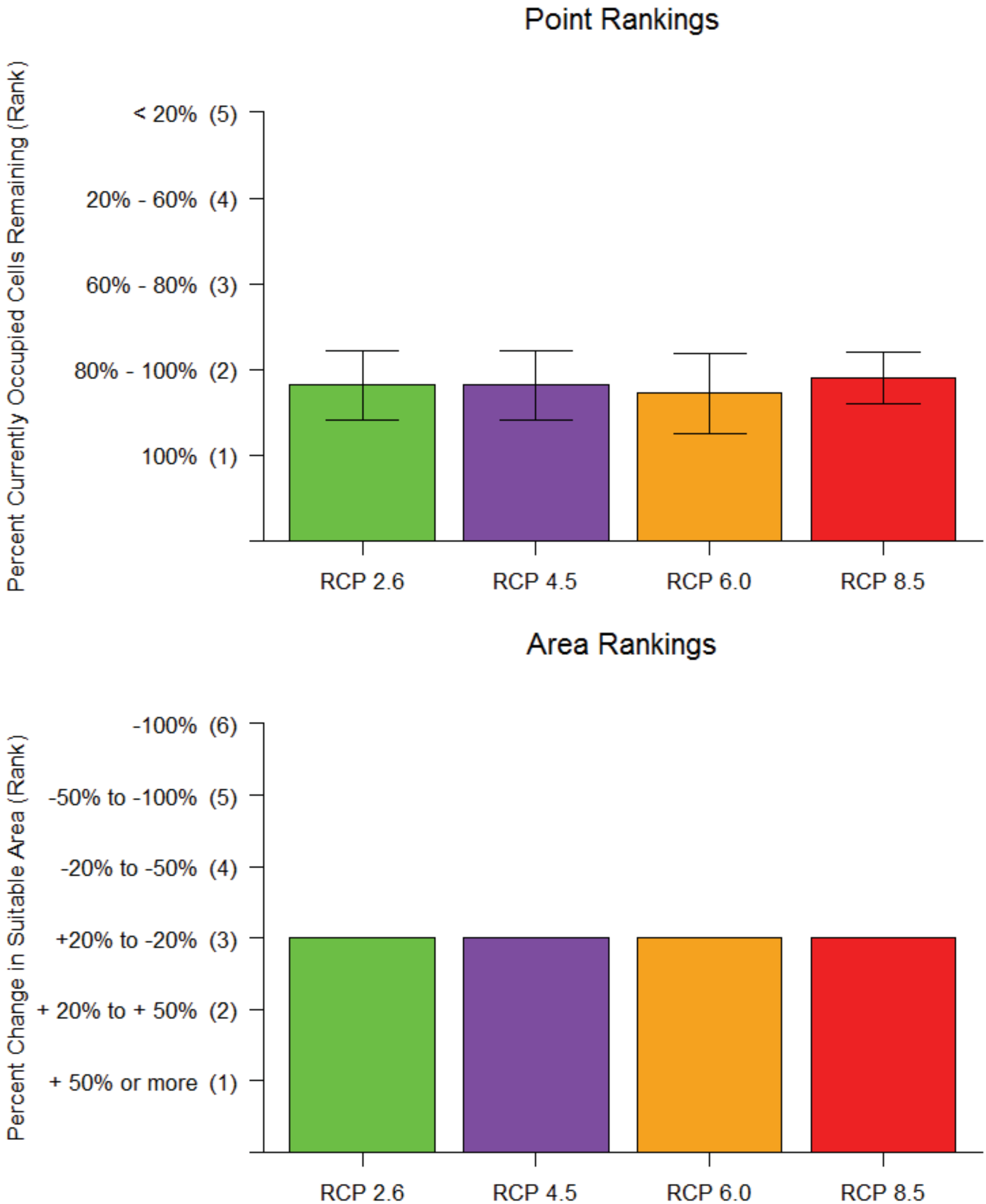

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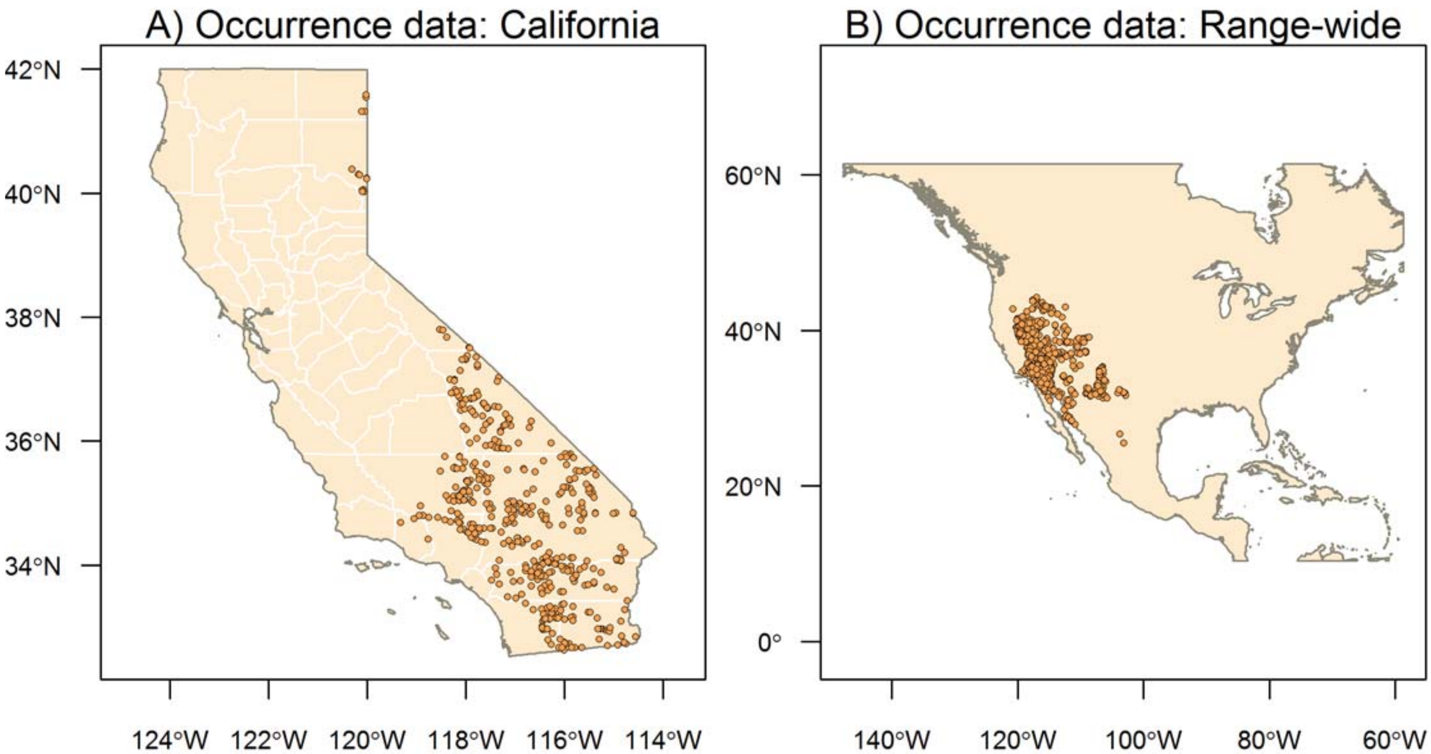
Species Results: *Gambelia wislizenii* Long-nosed Leopard Lizard



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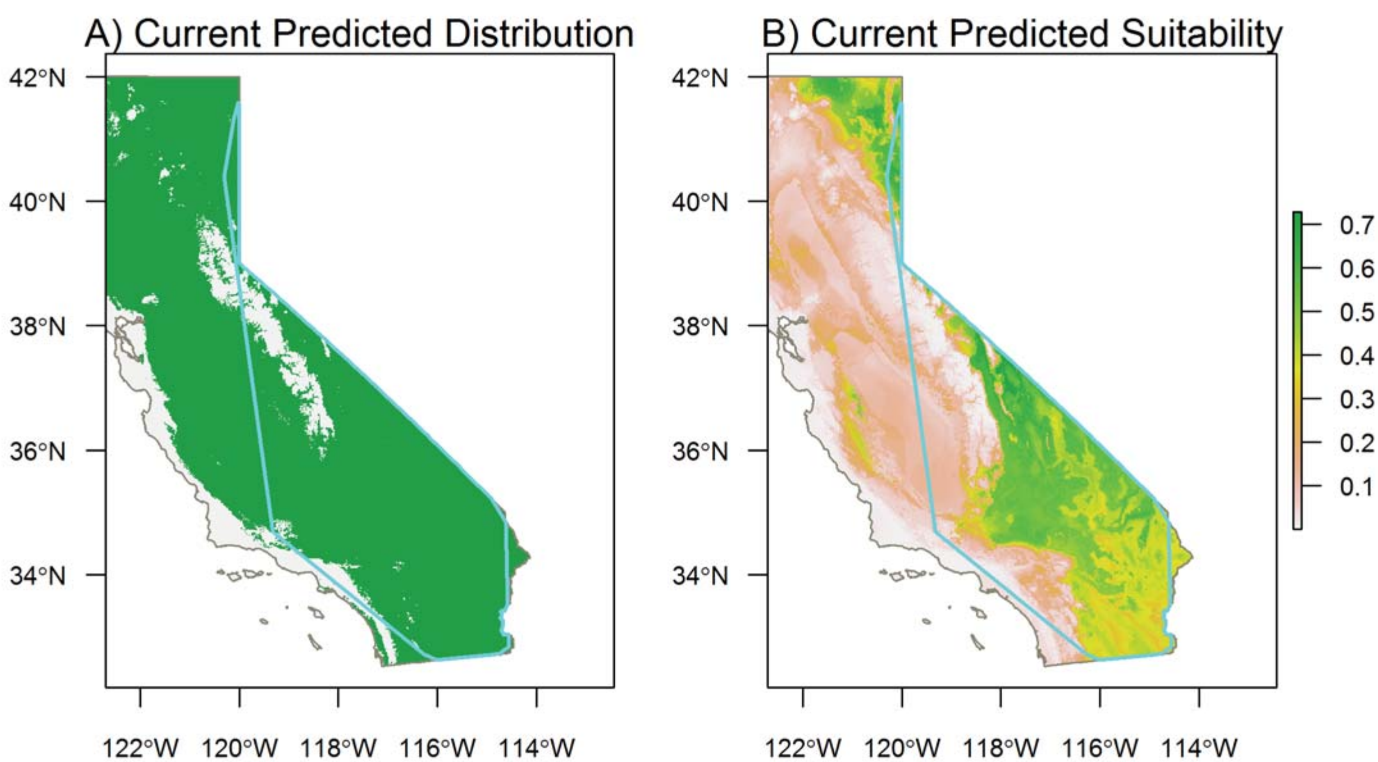

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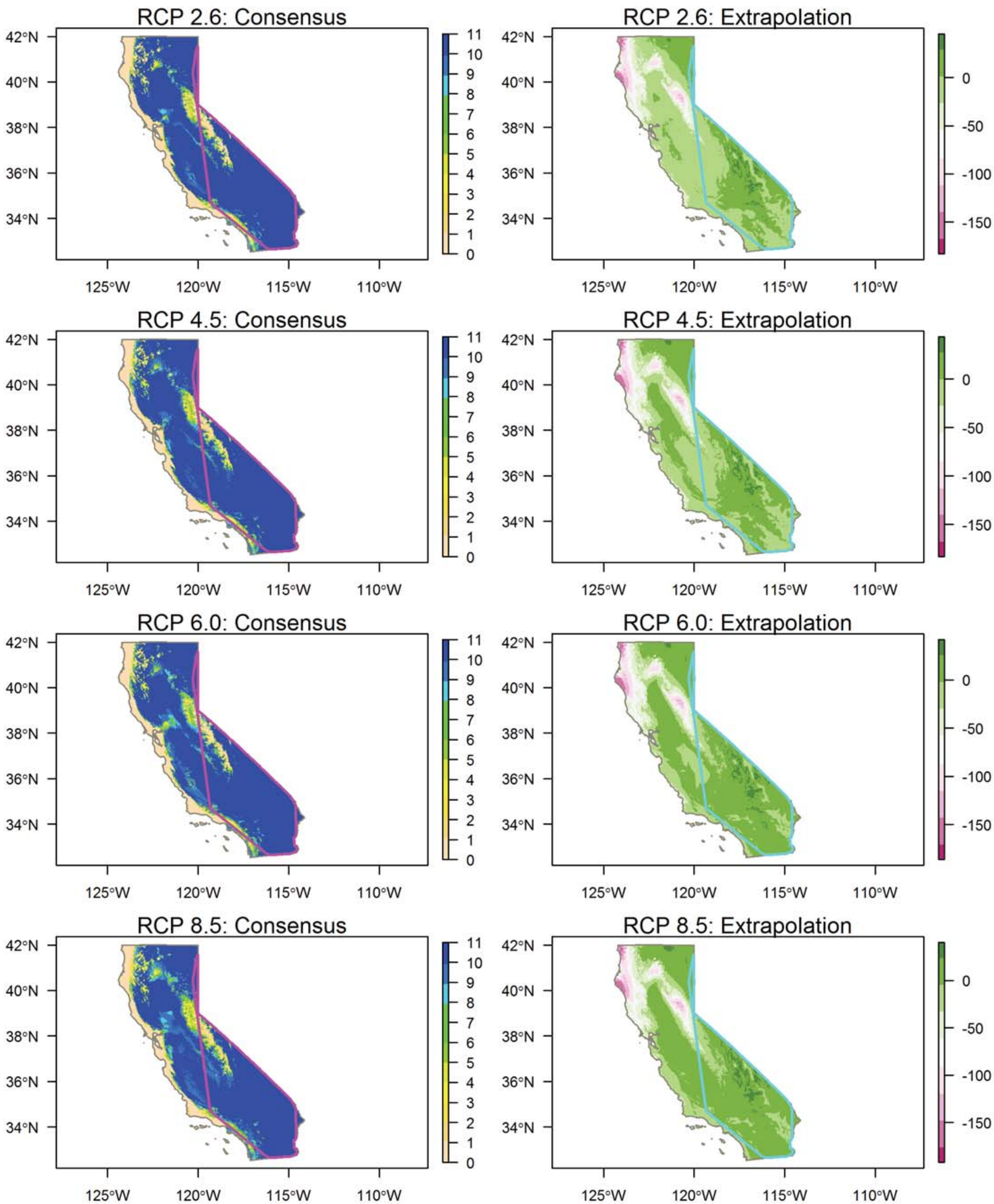
Species Results: *Gambelia wislizenii* Long-nosed Leopard Lizard



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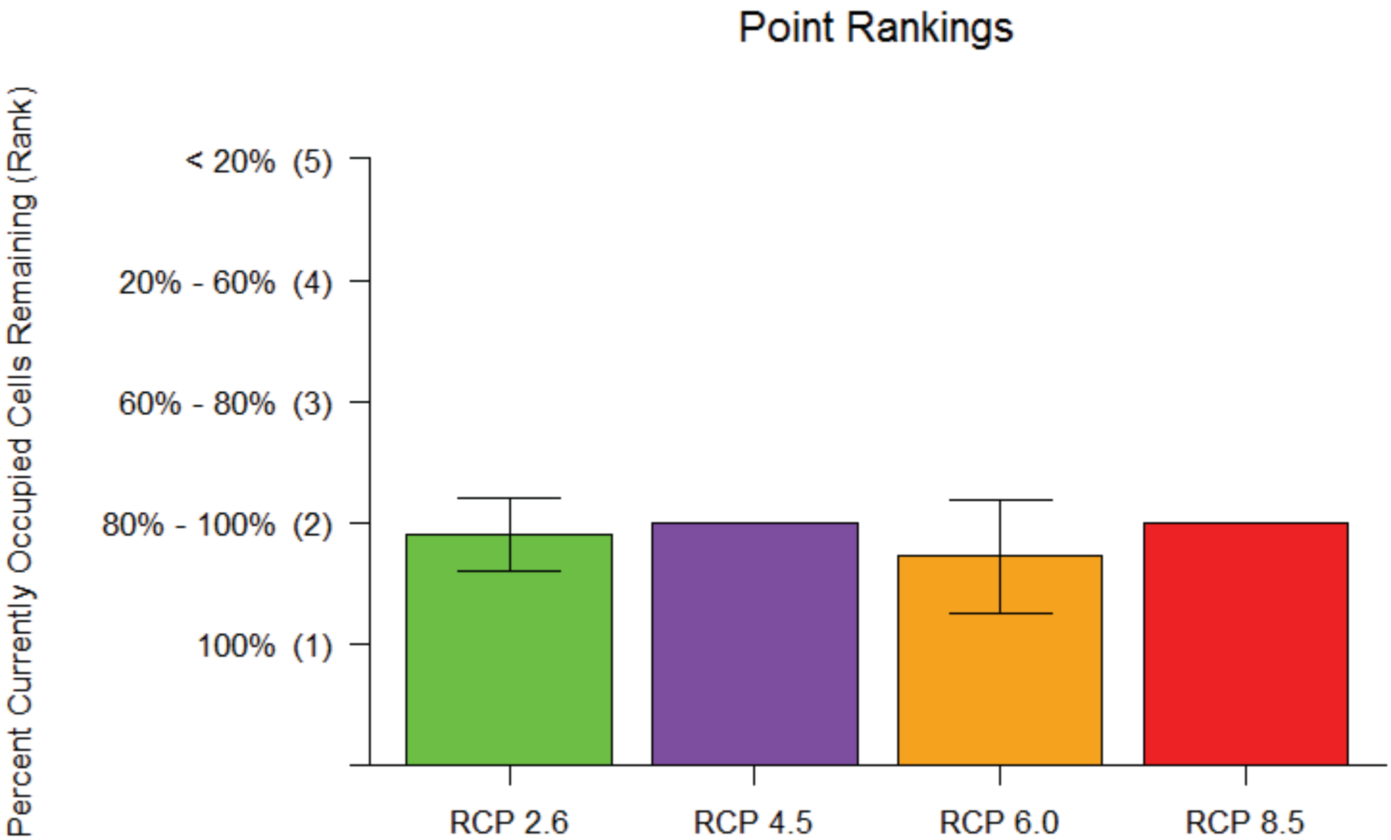

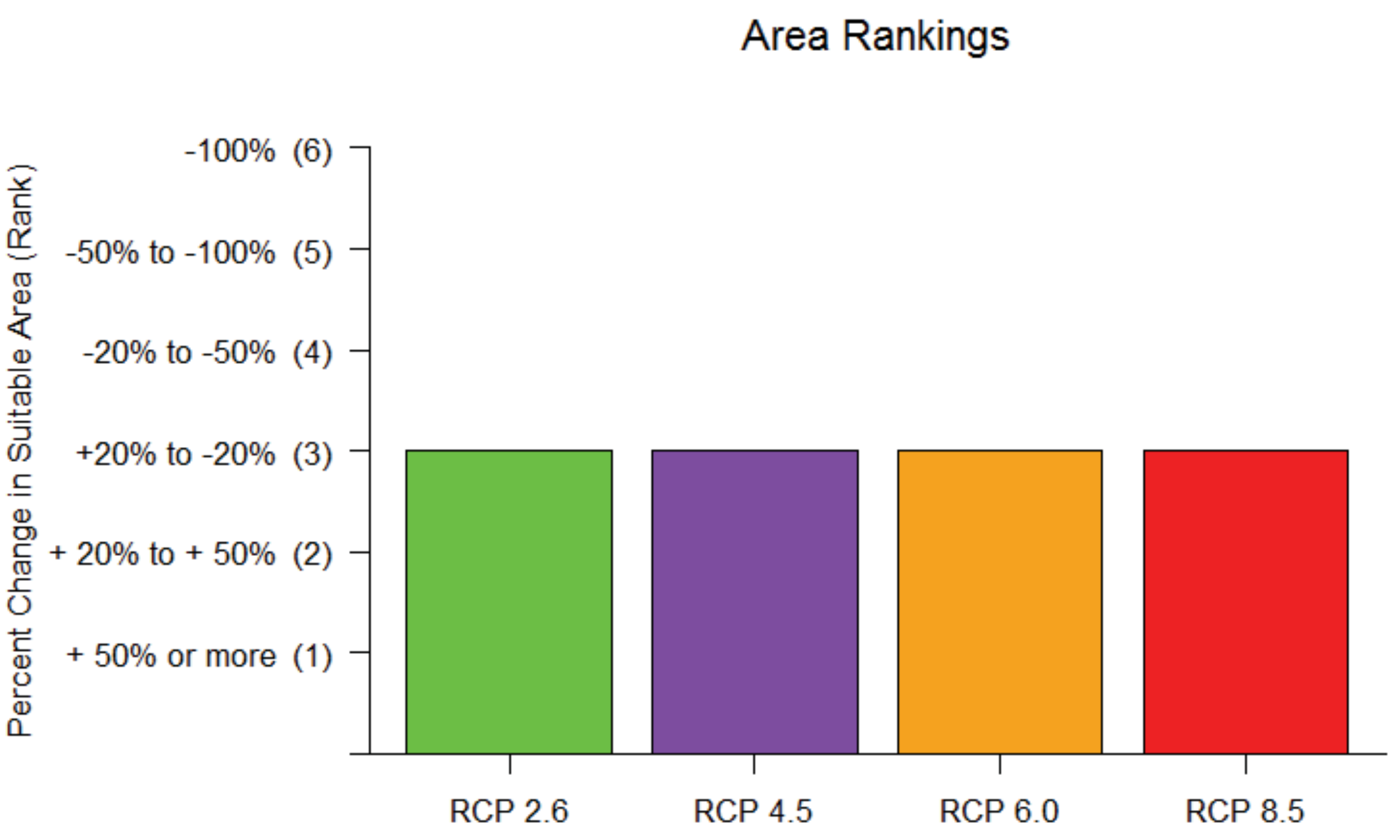

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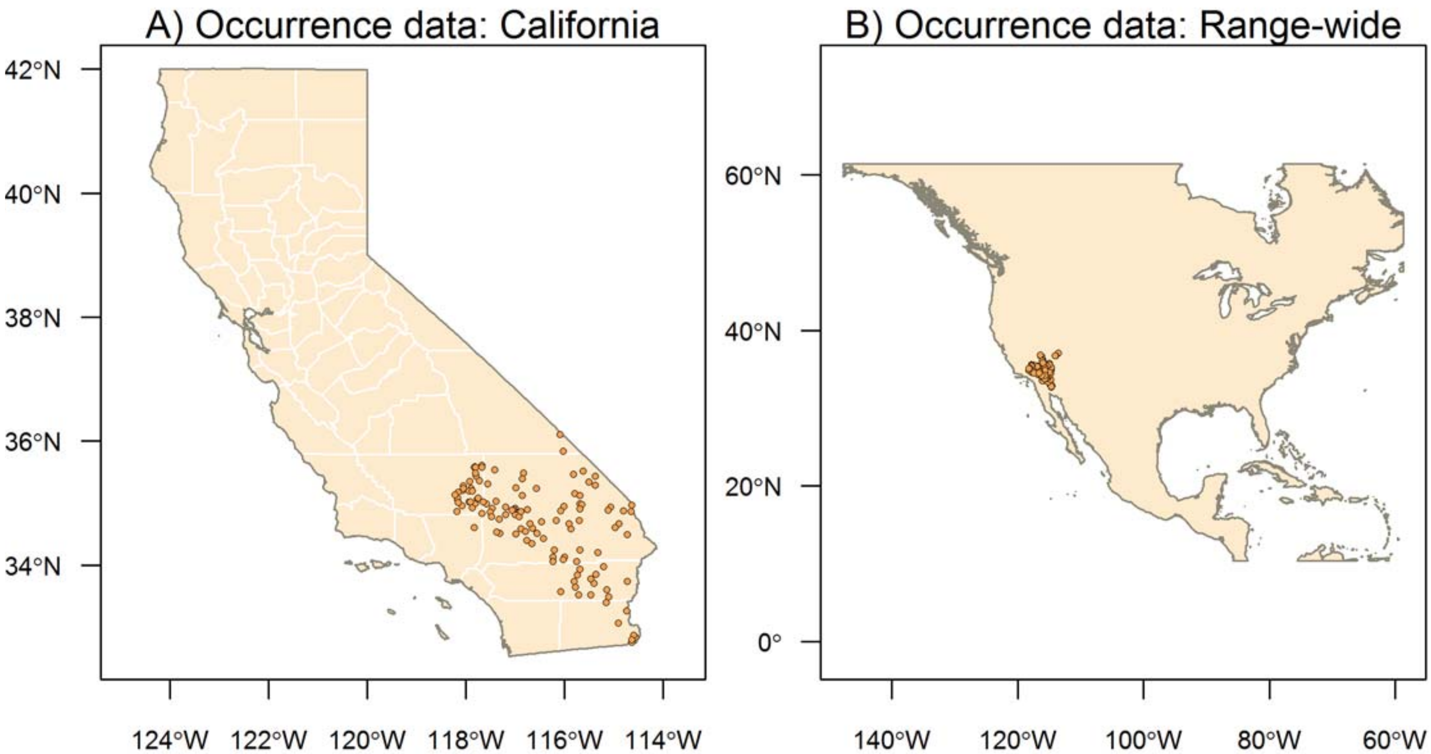
Species Results: *Gopherus agassizii* Desert Tortoise



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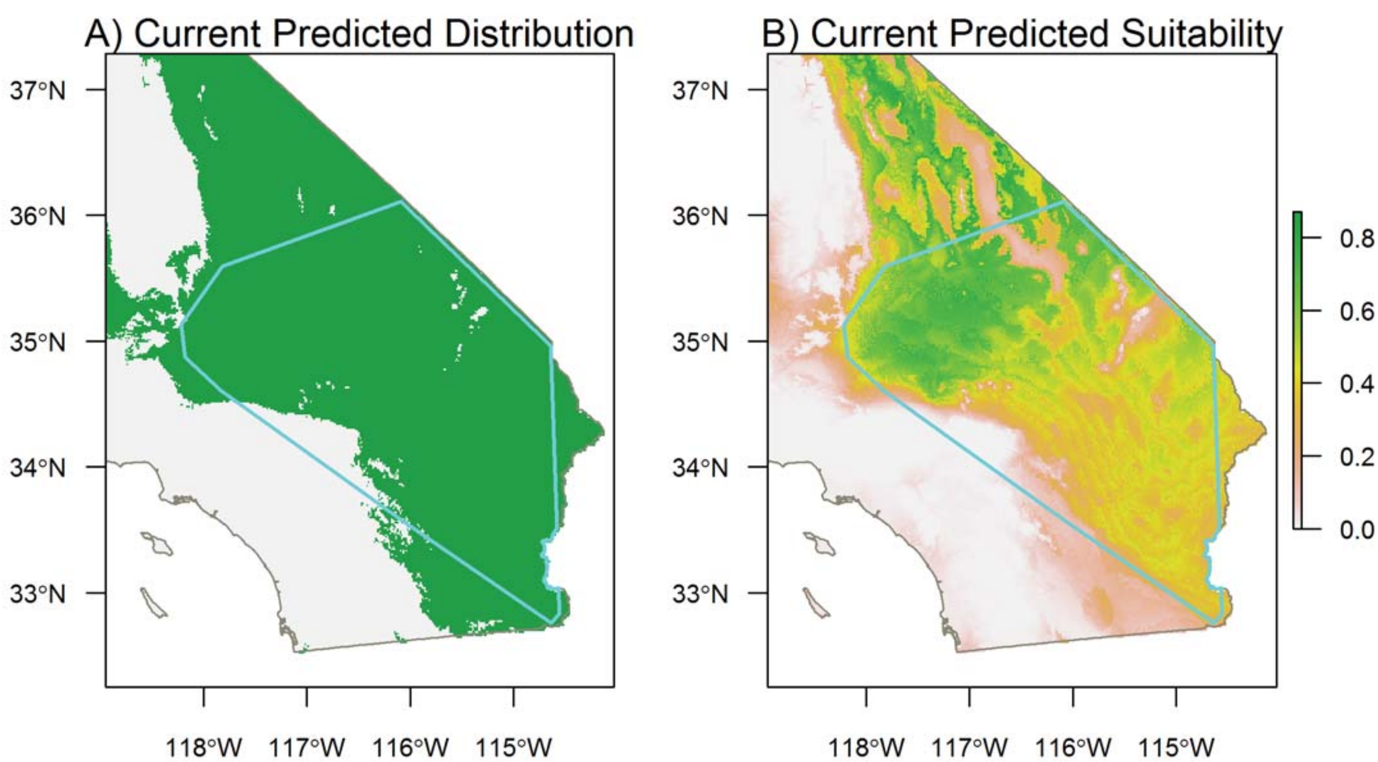

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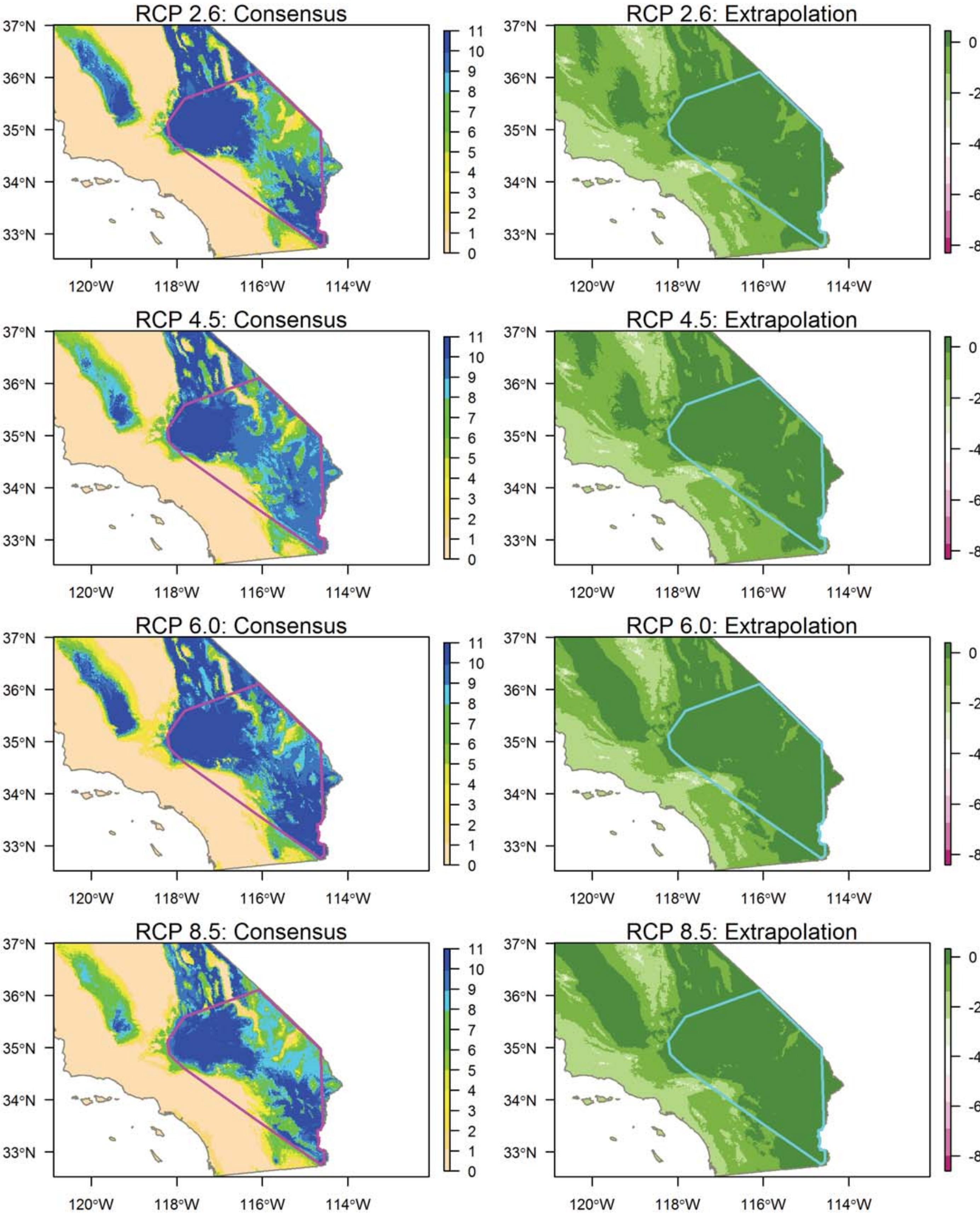

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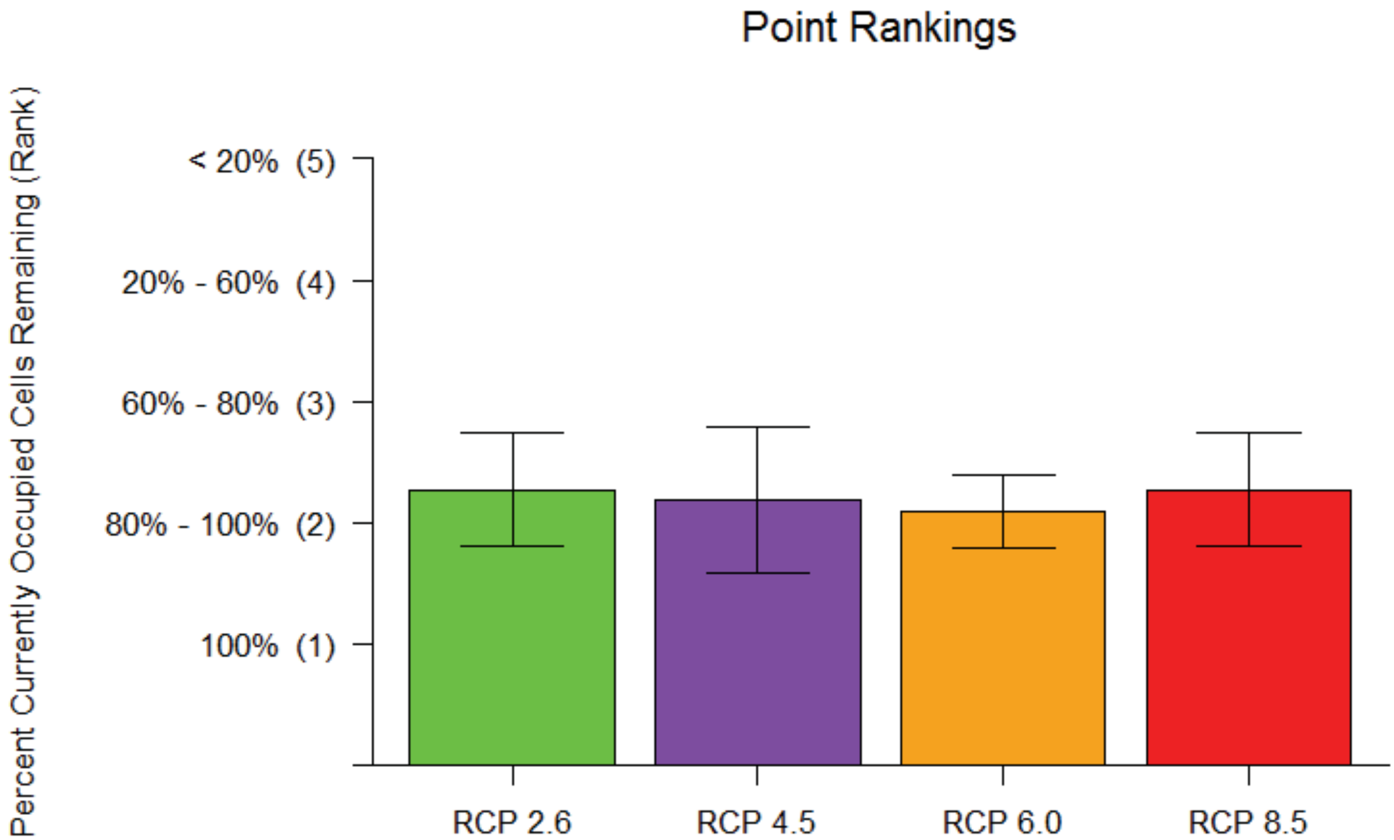

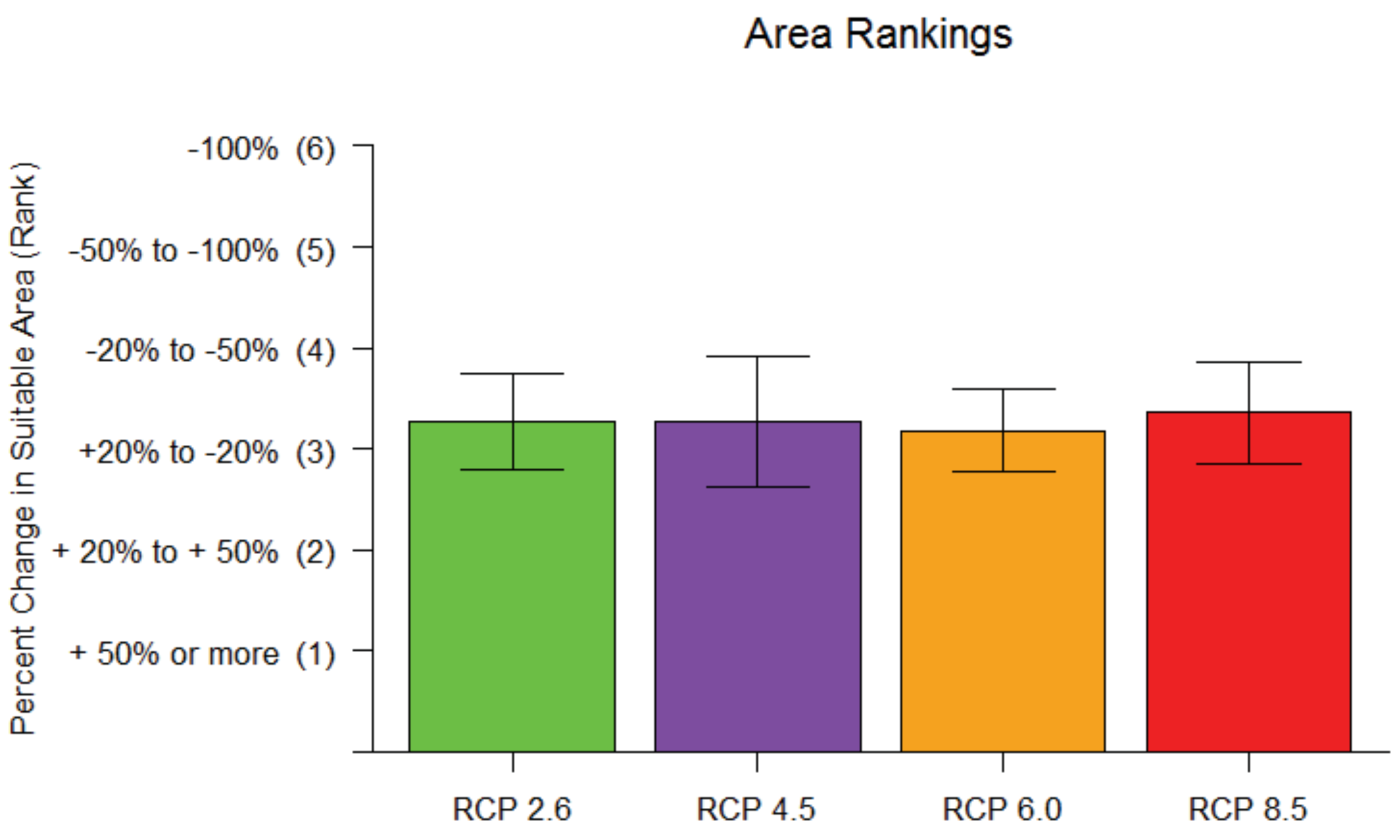

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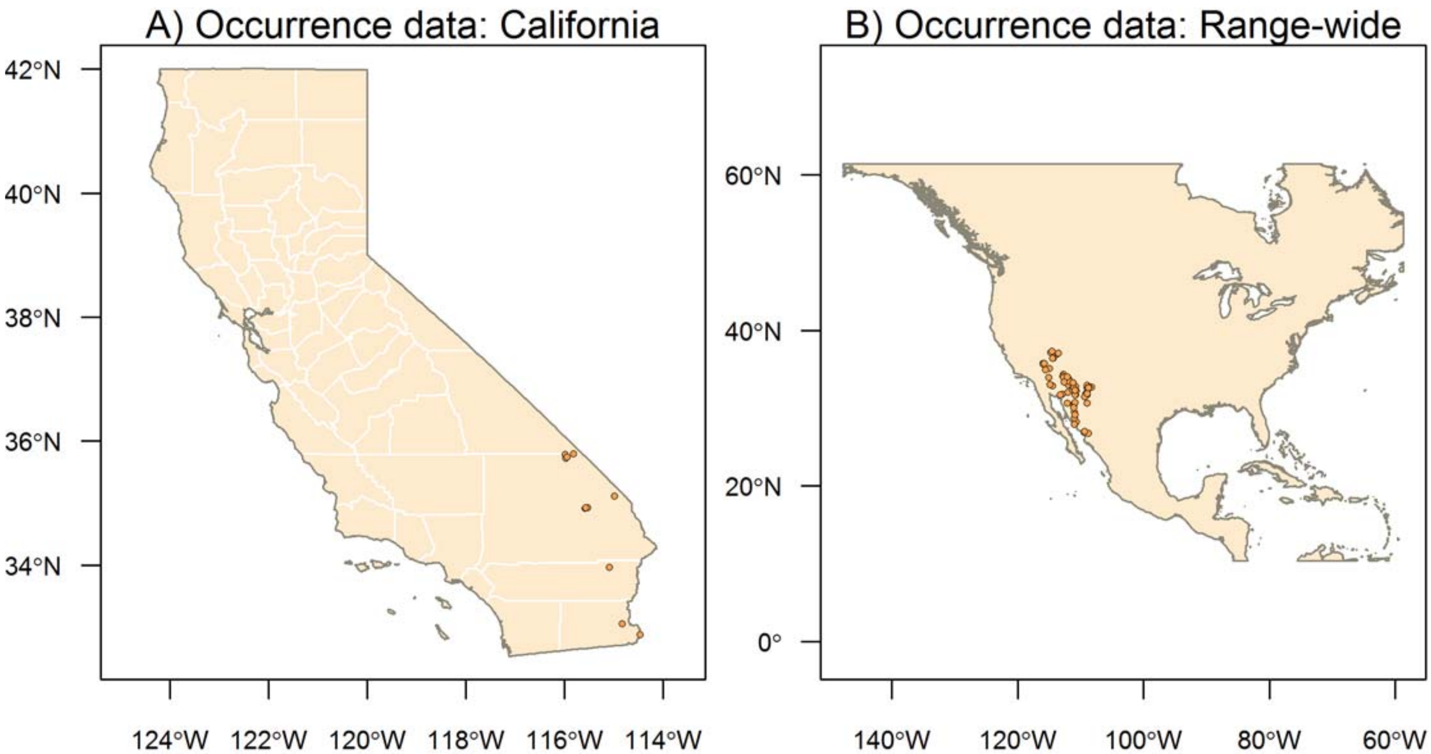
Species Results: *Heloderma suspectum* Gila Monster



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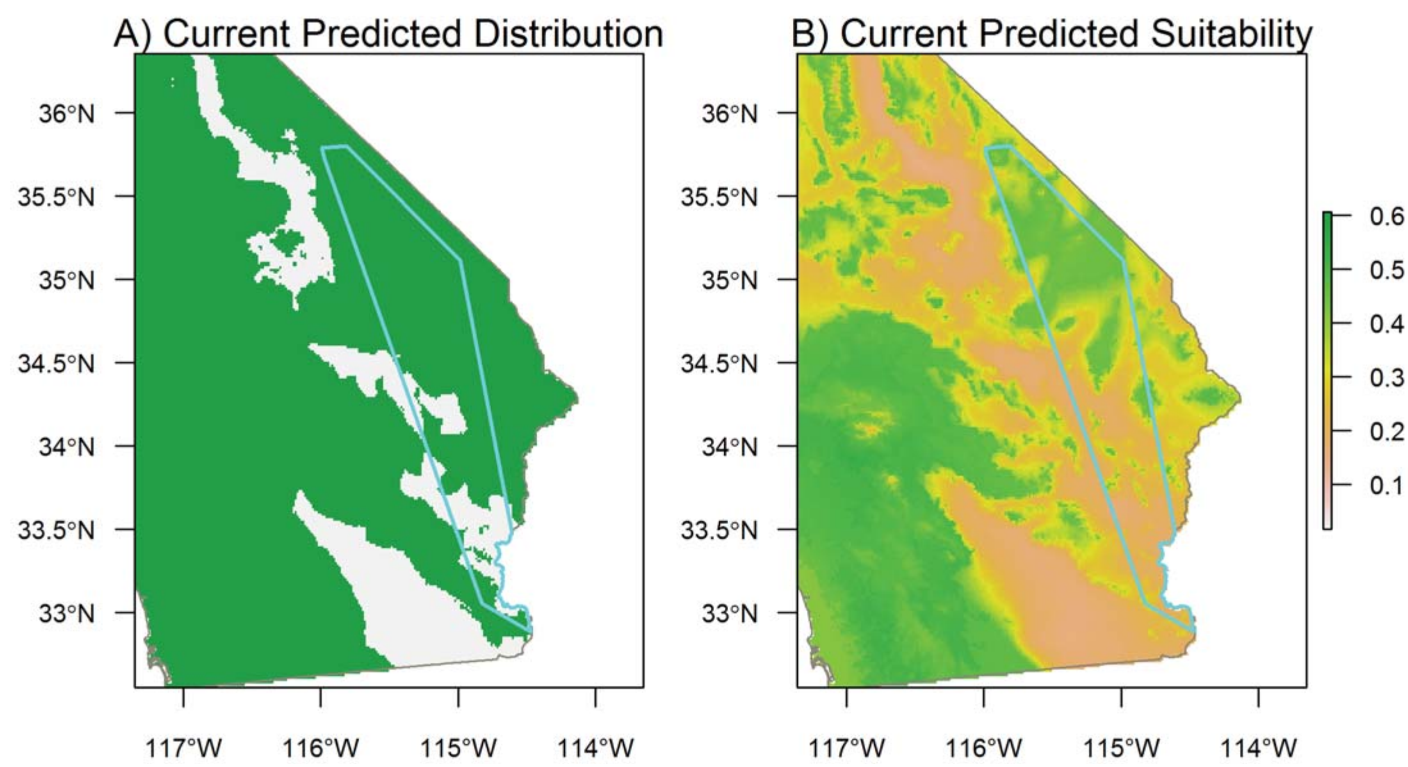

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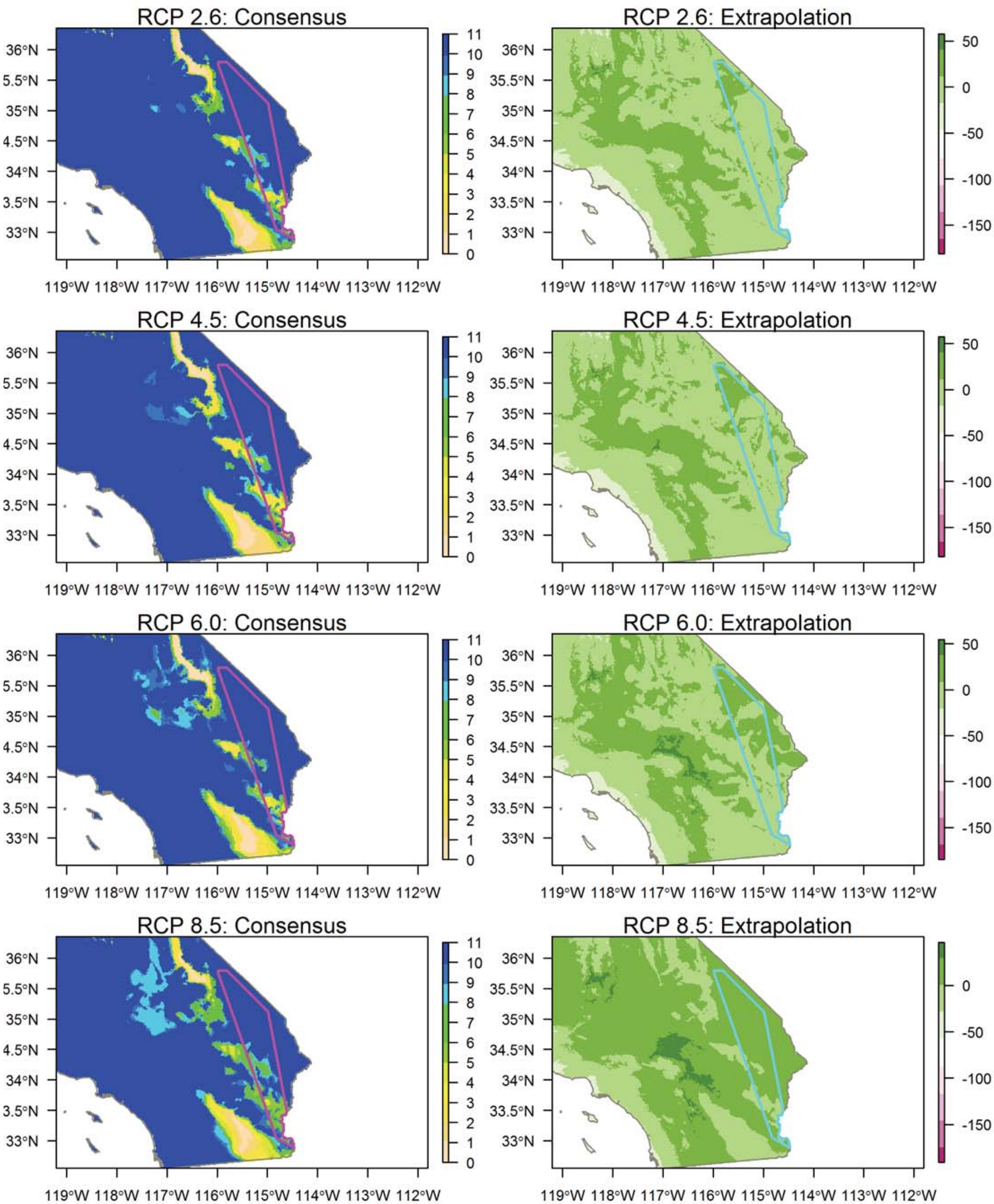

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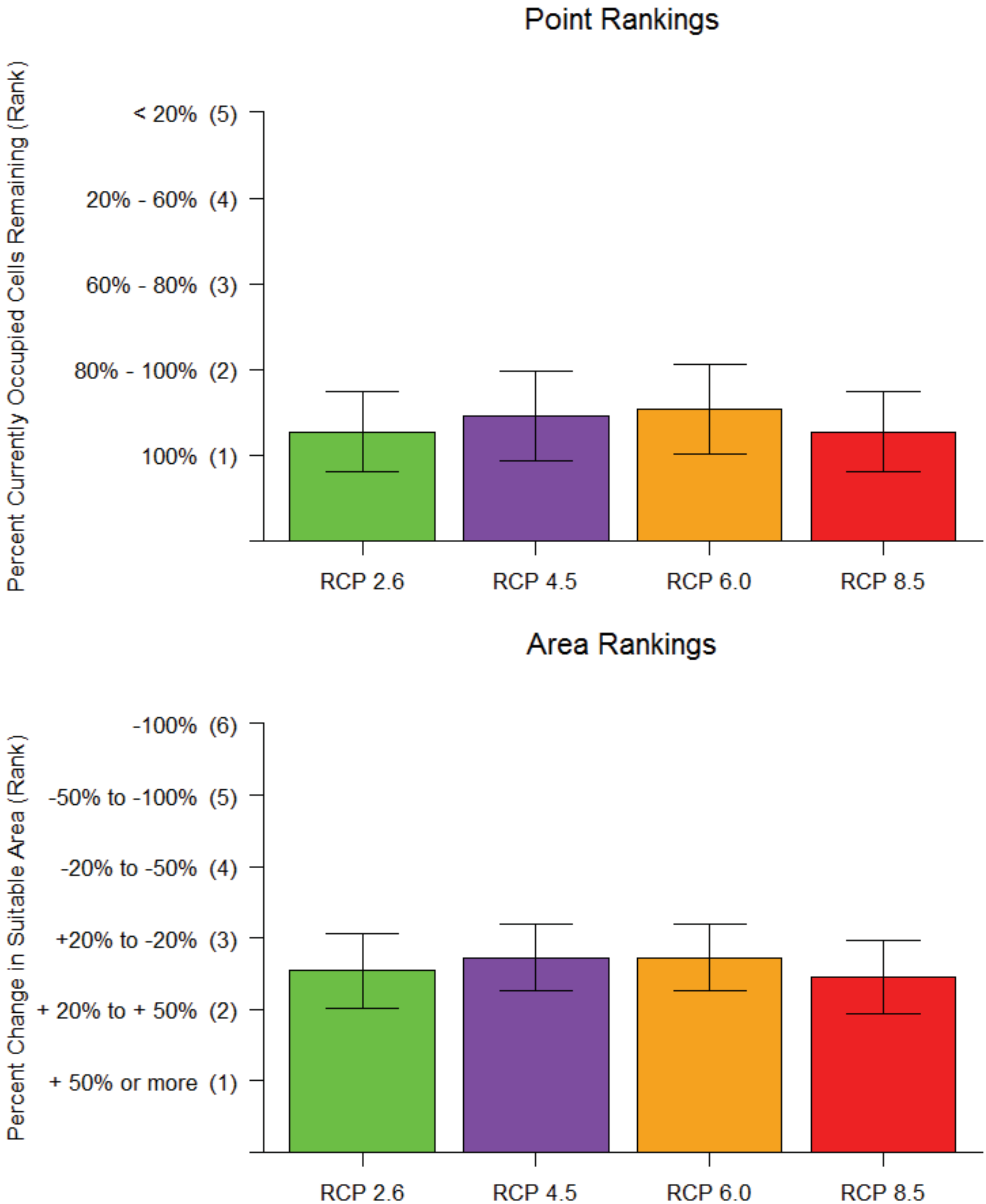

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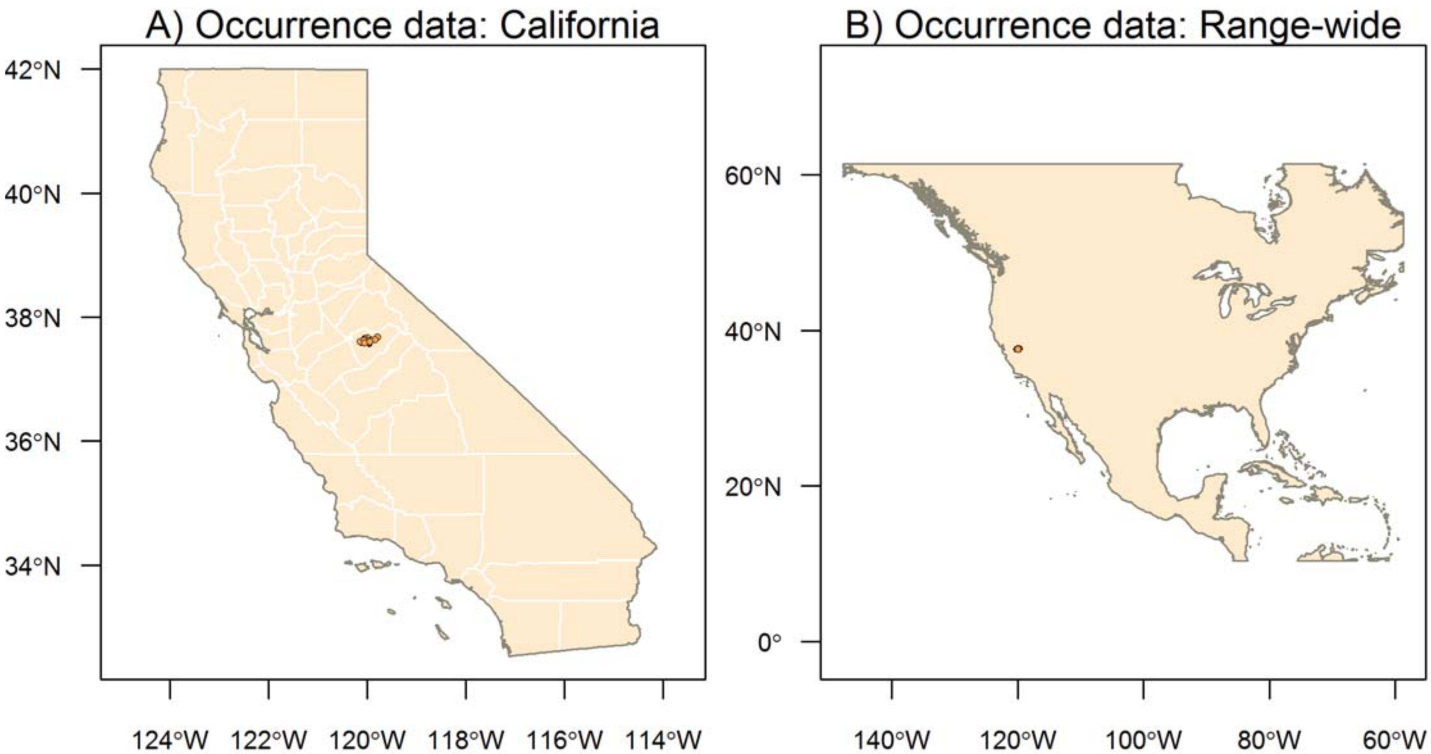
Species Results: *Hydromantes brunus* Limestone Salamander



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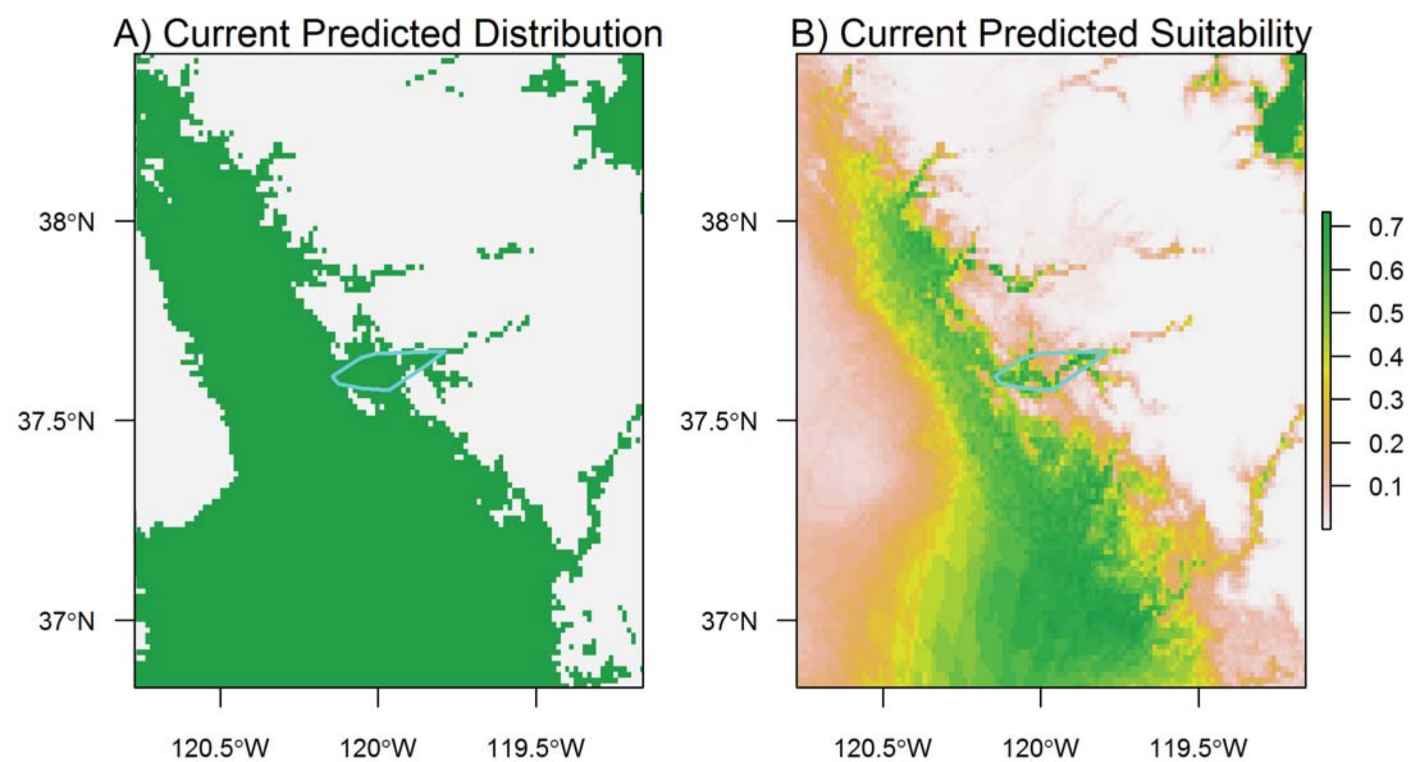

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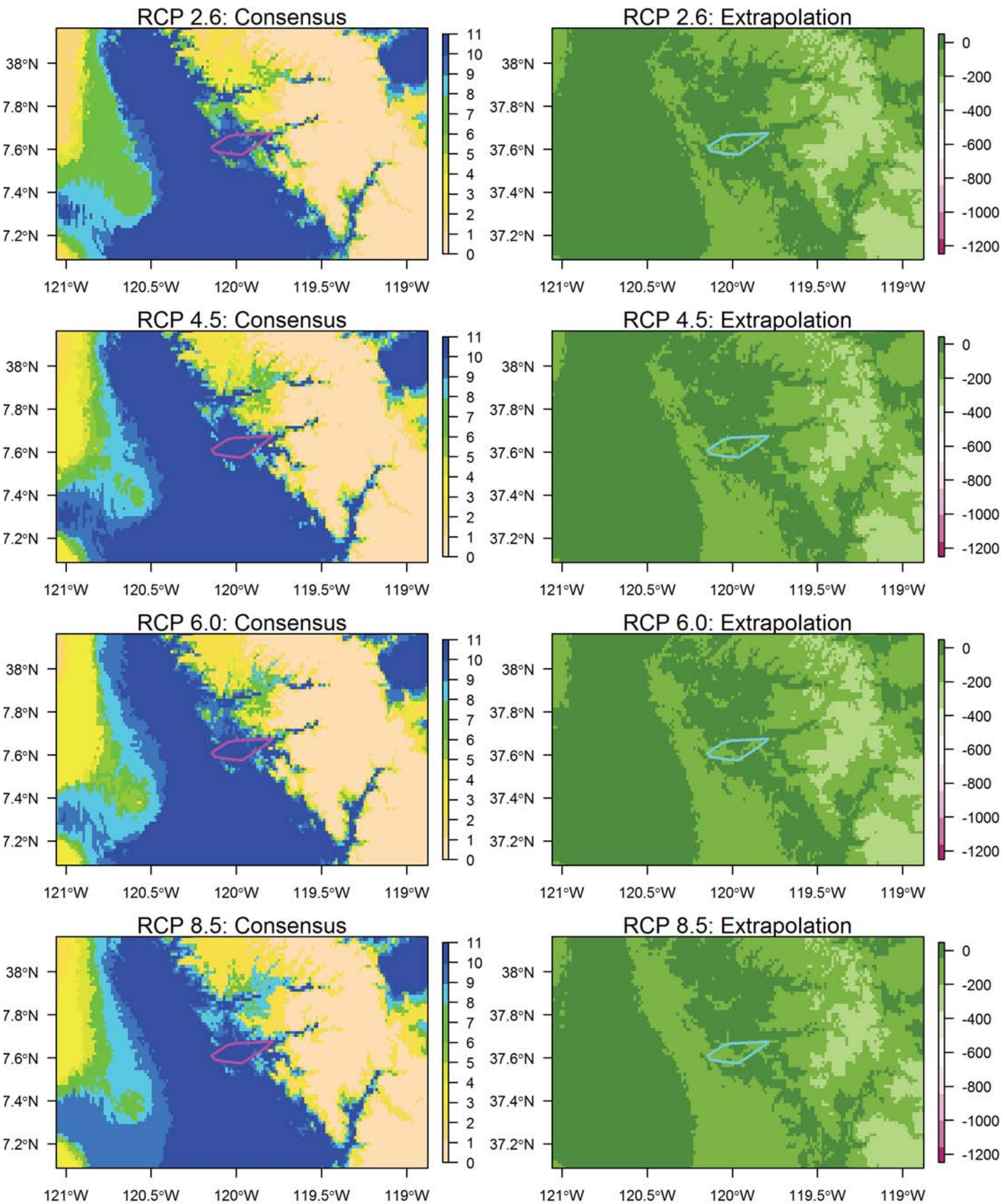

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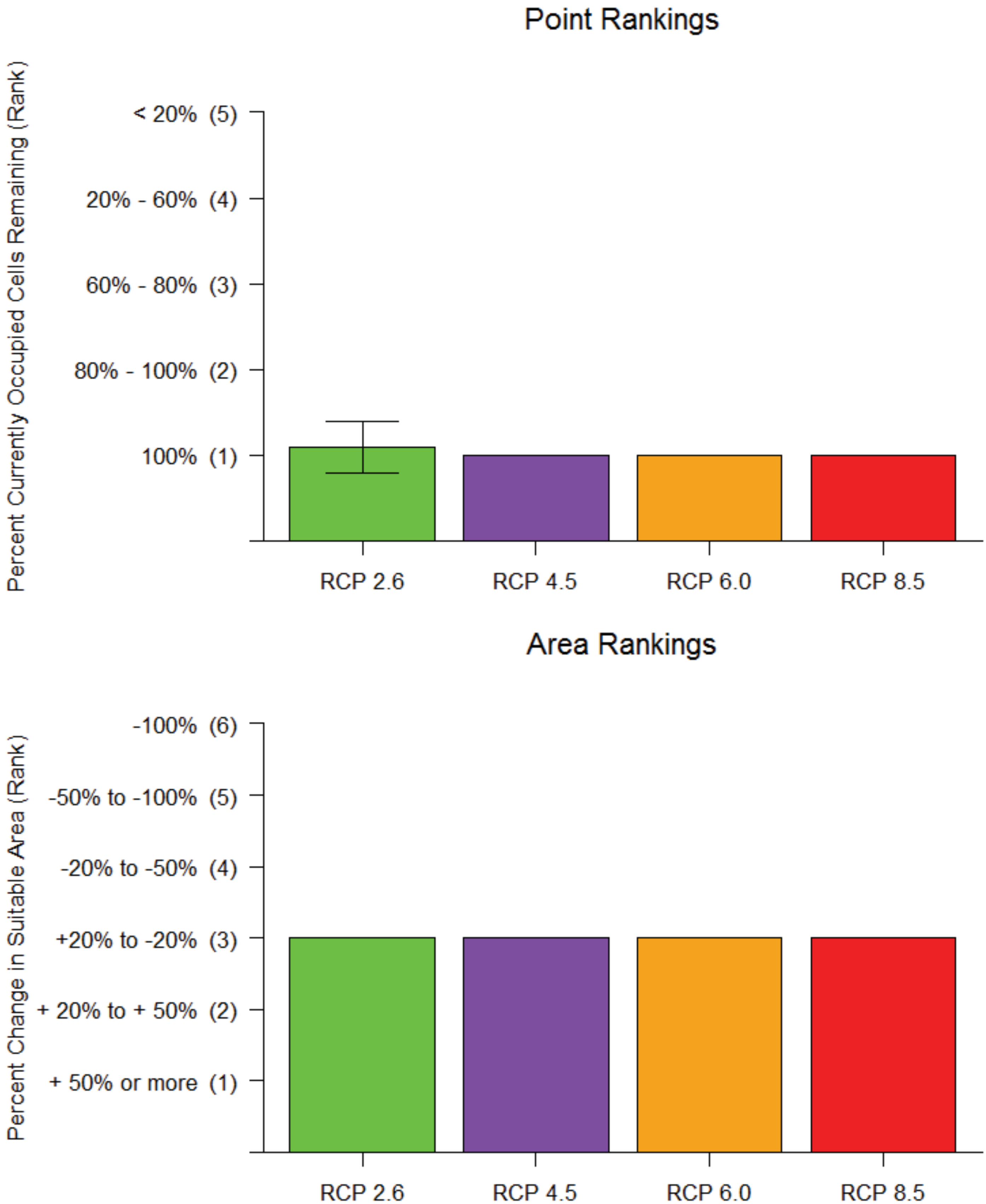

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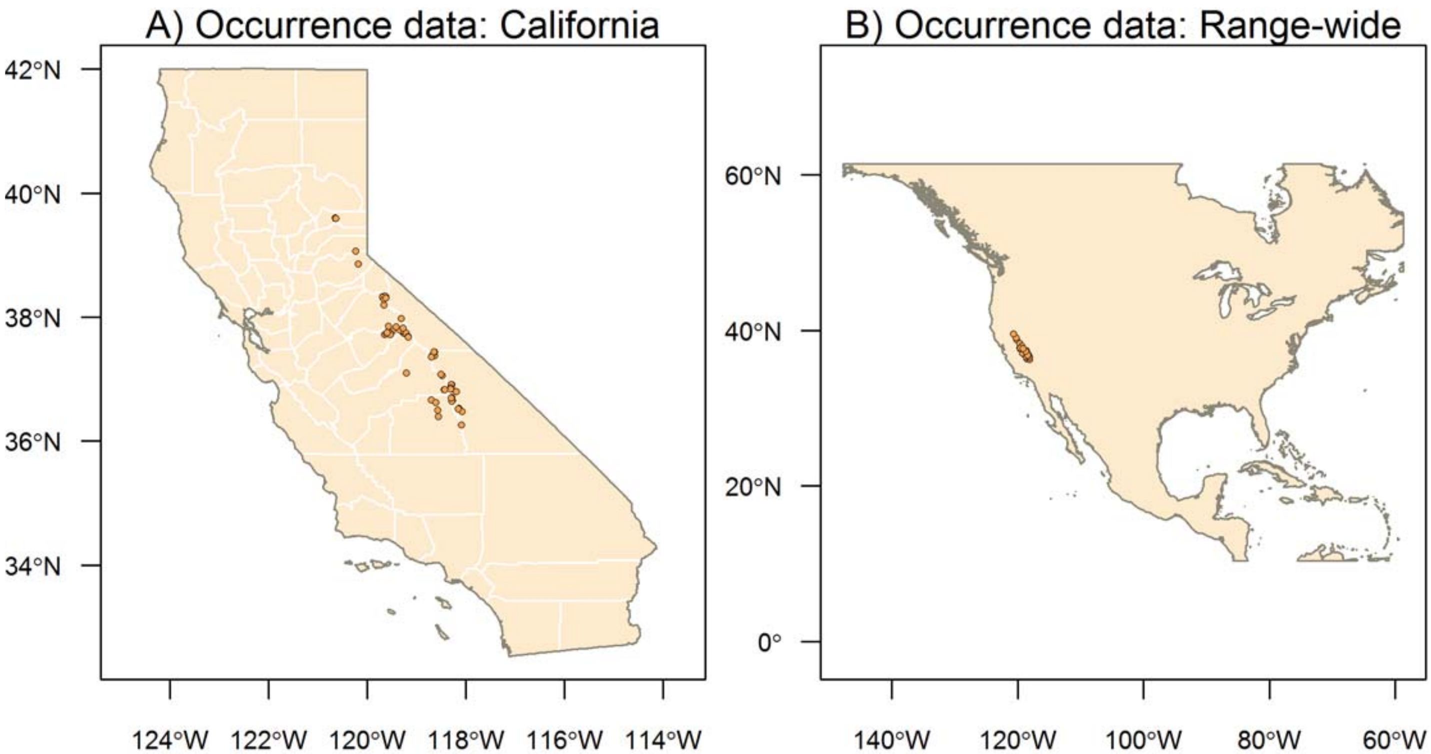
Species Results: *Hydromantes platycephalus* Mount Lyell Salamander



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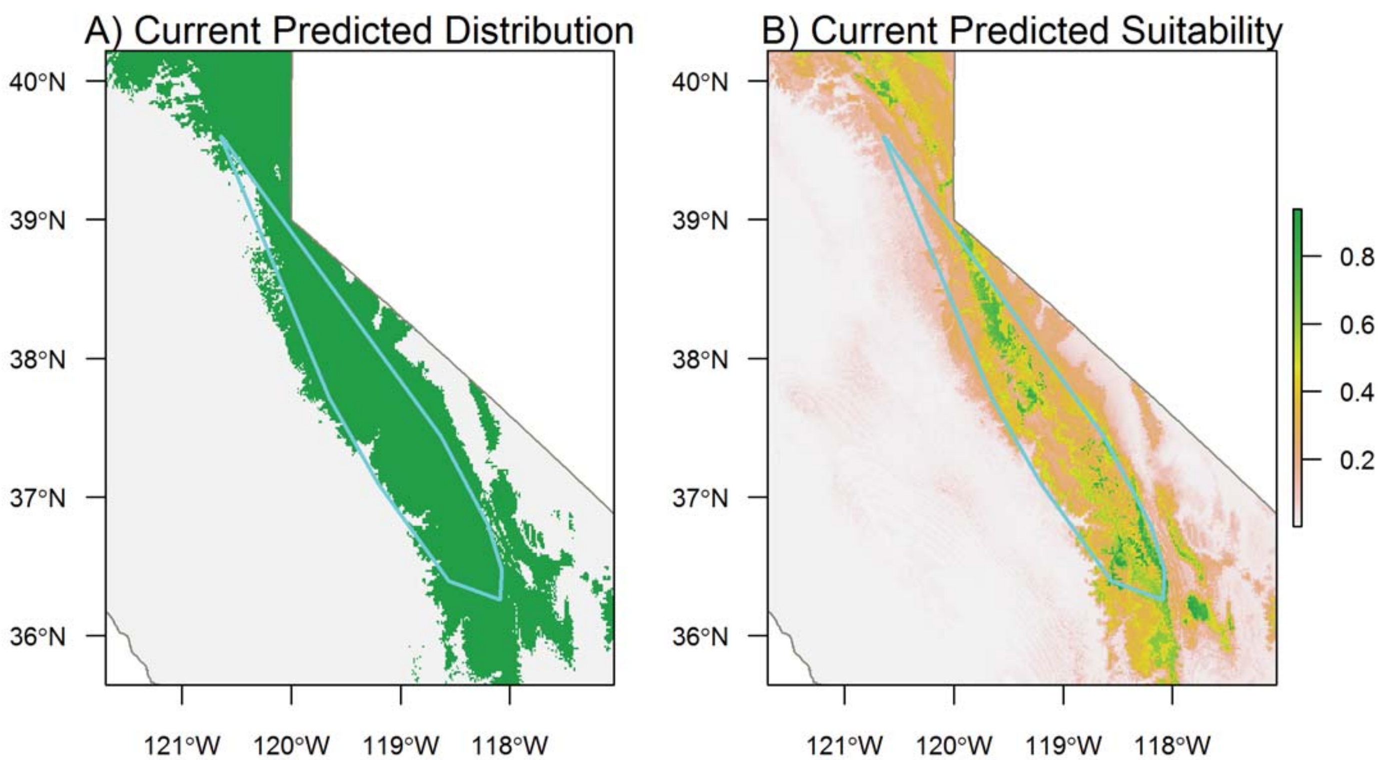

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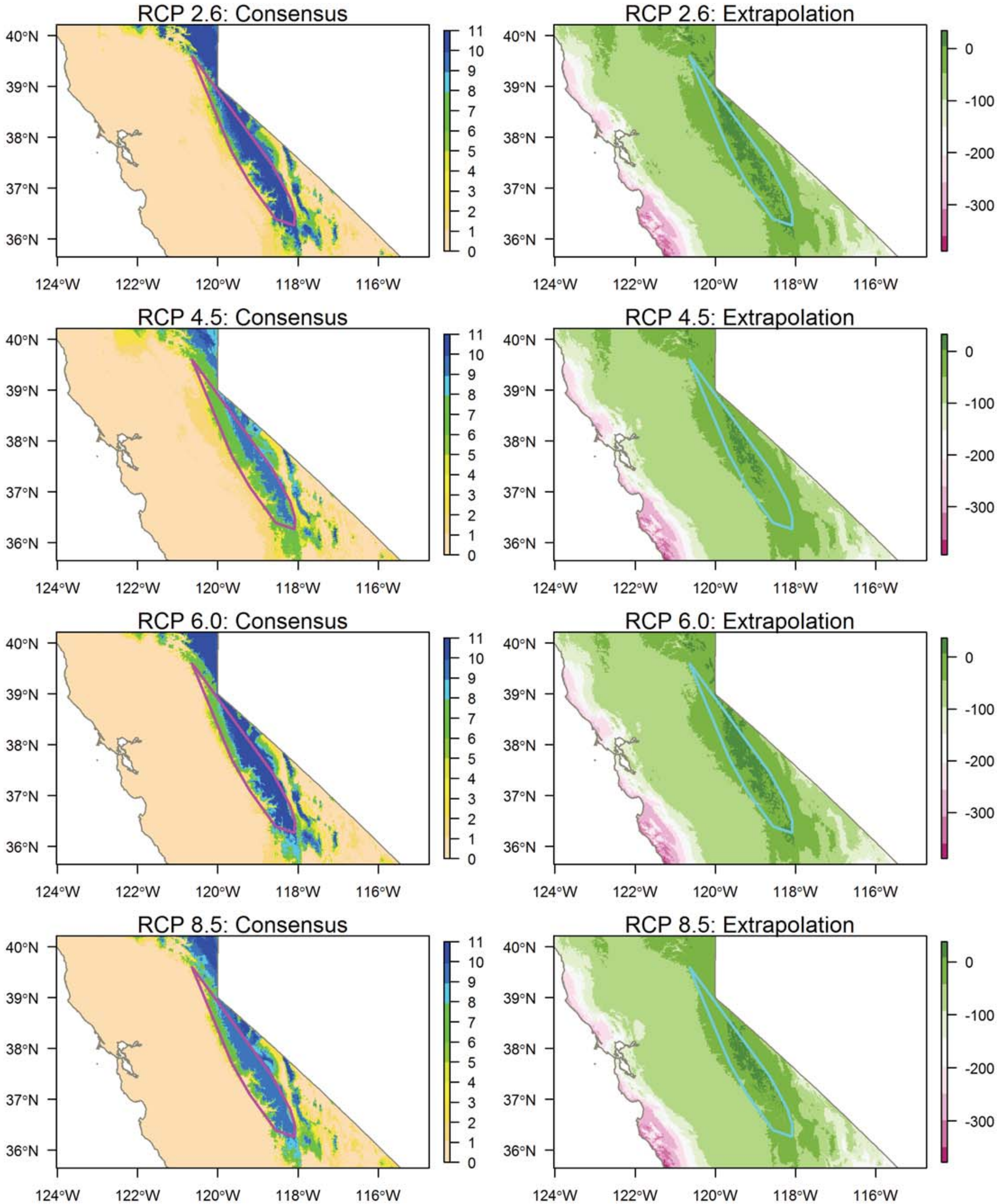

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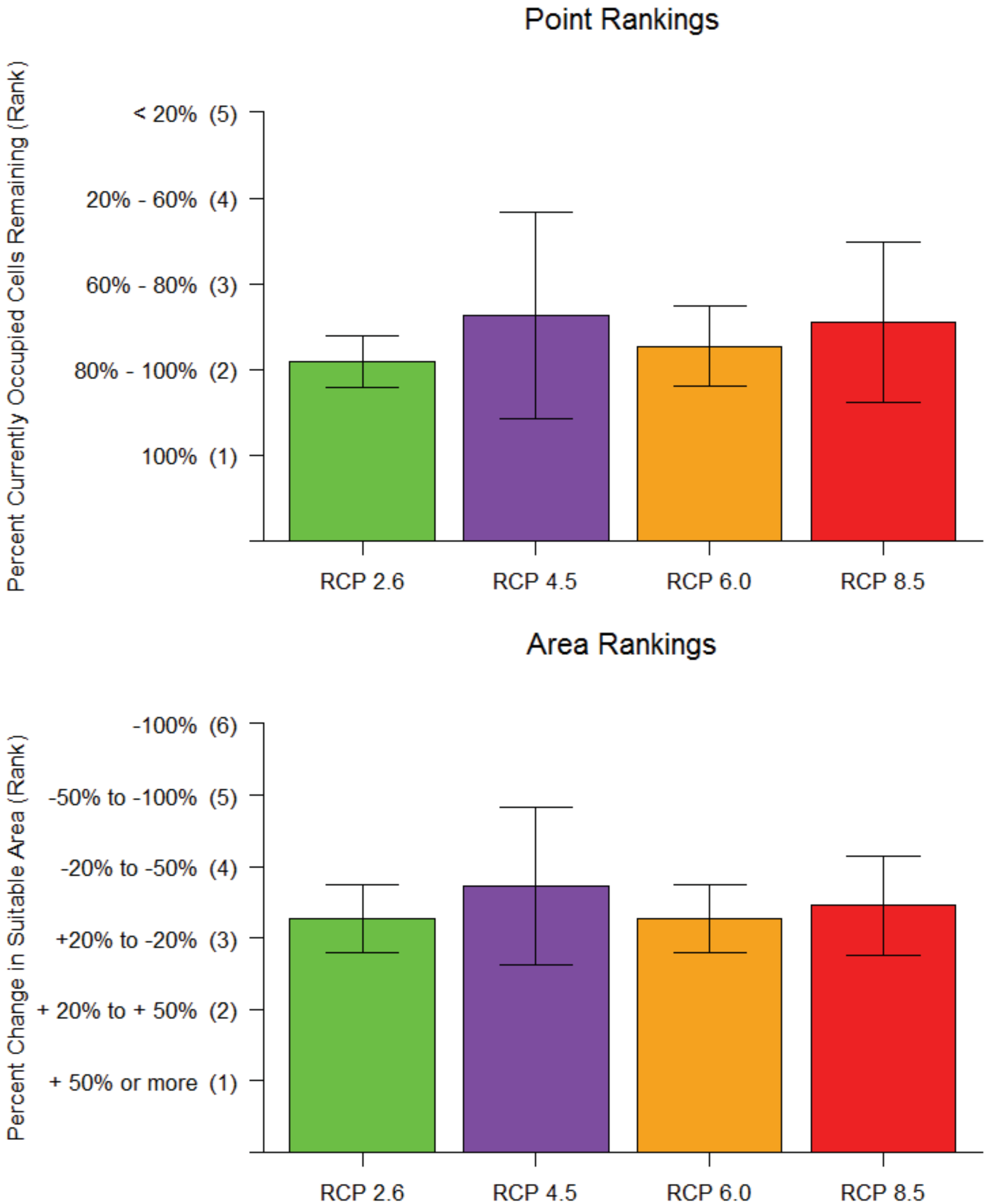

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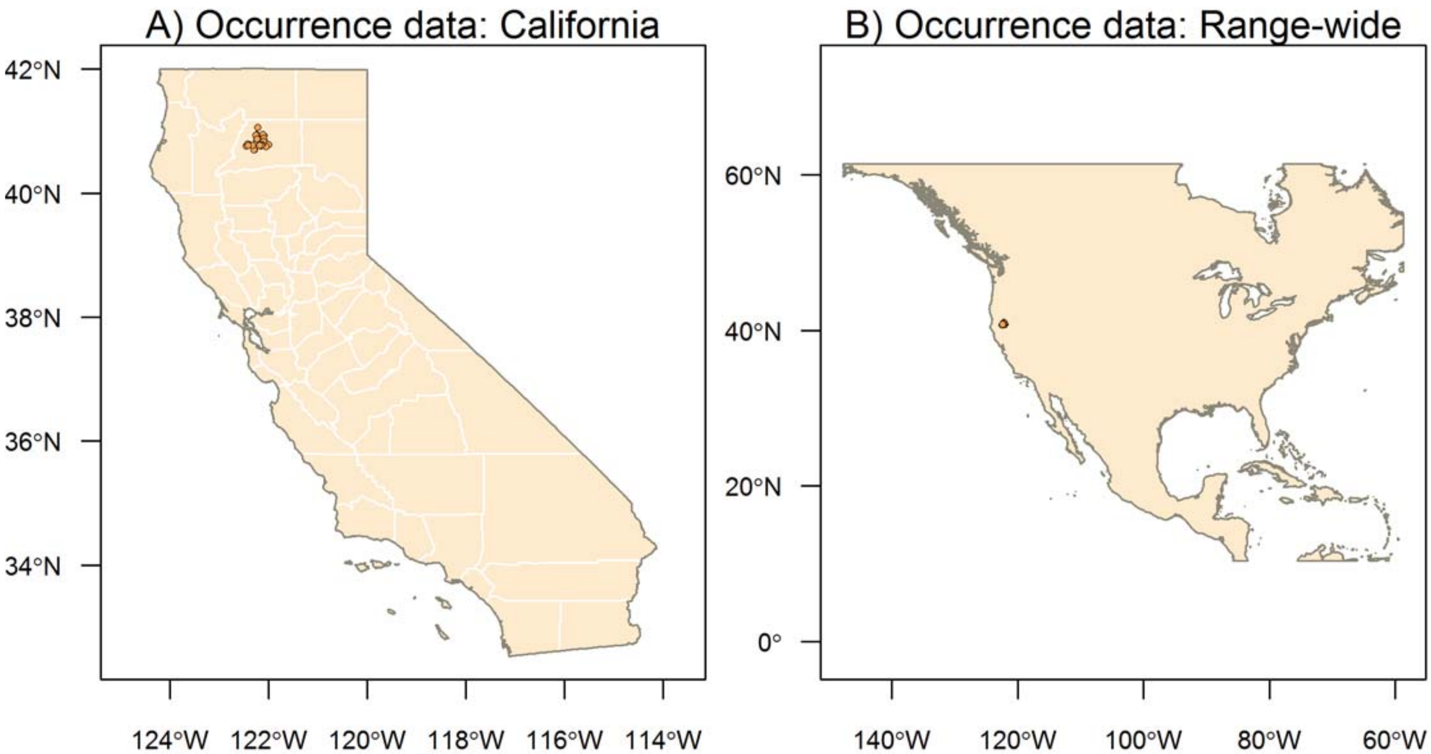
Species Results: *Hydromantes shastae* Shasta Salamander



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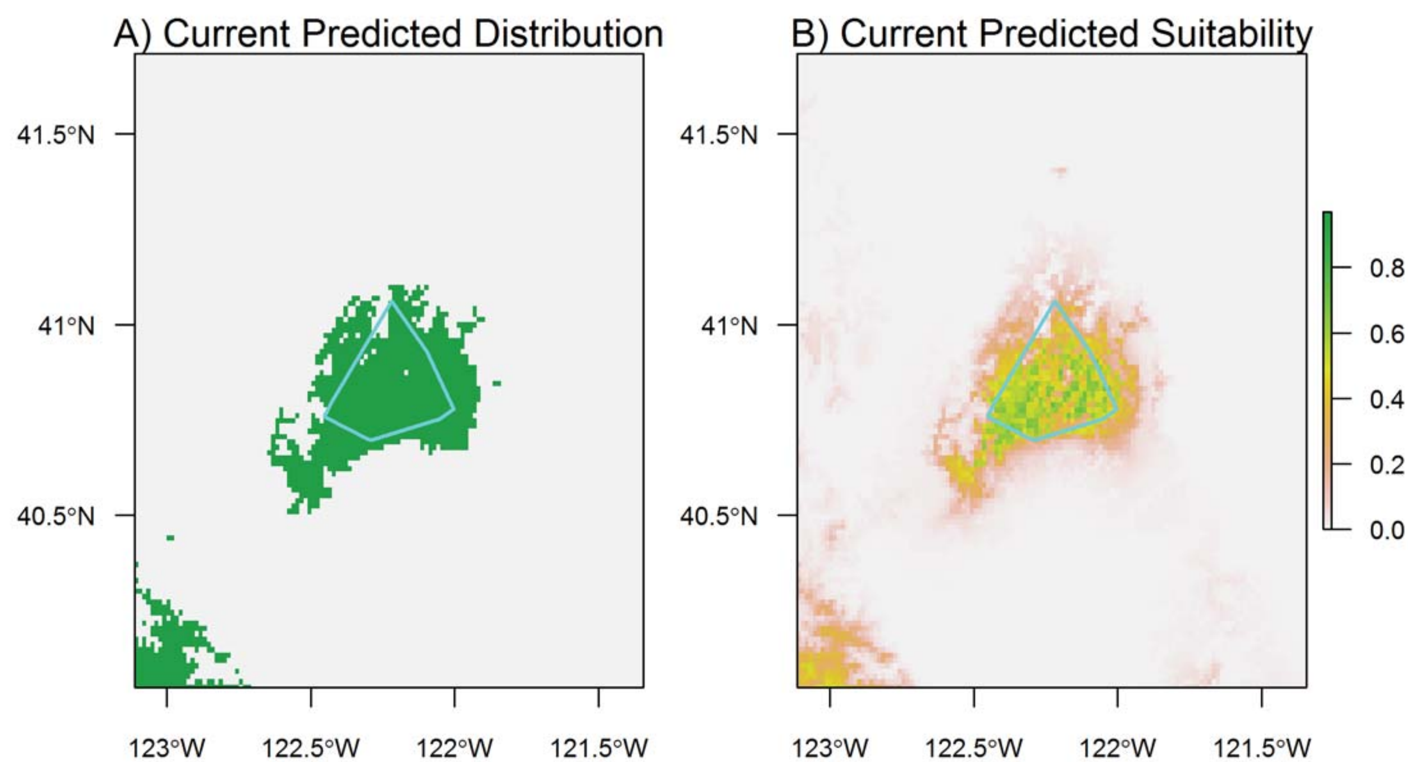

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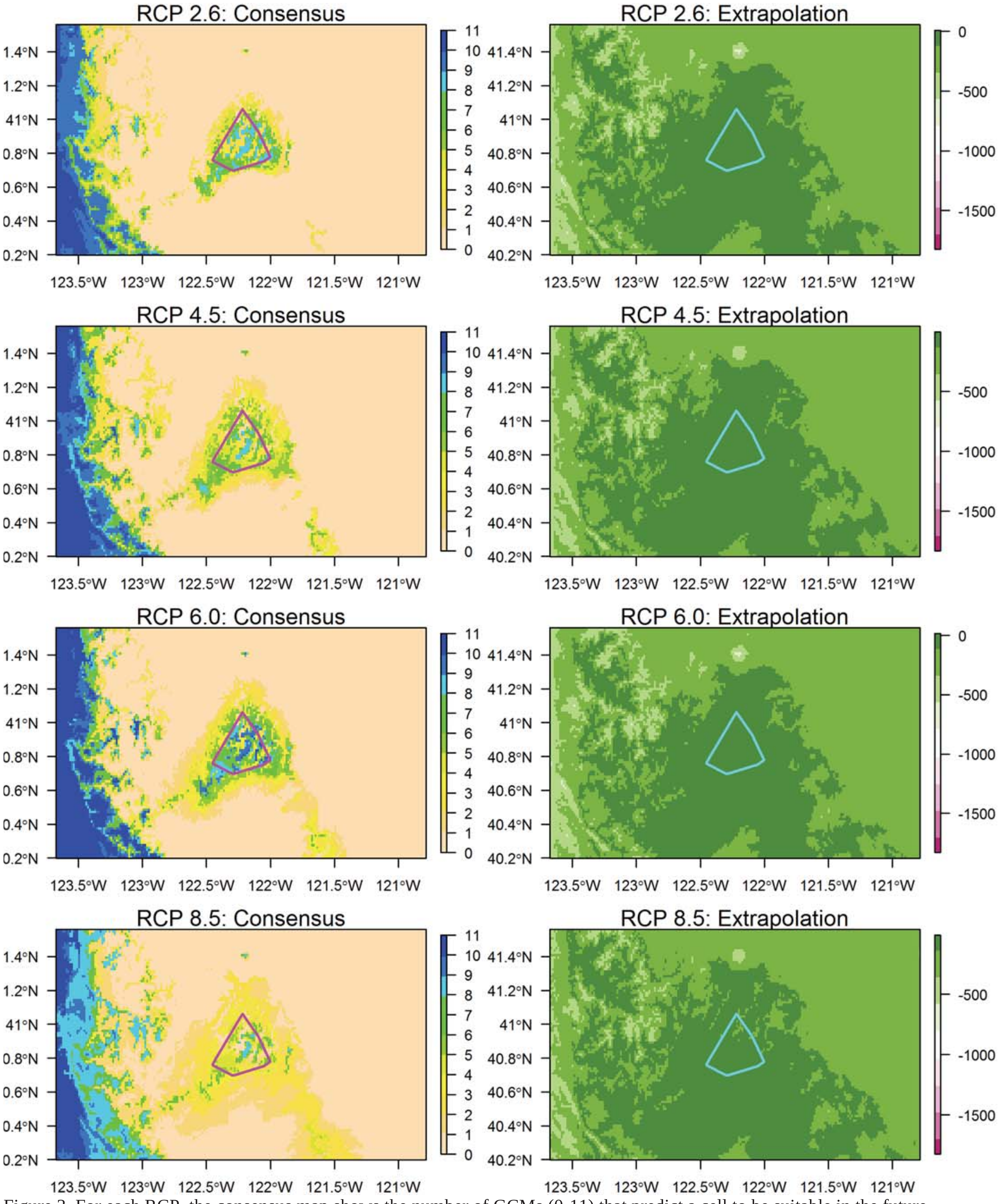

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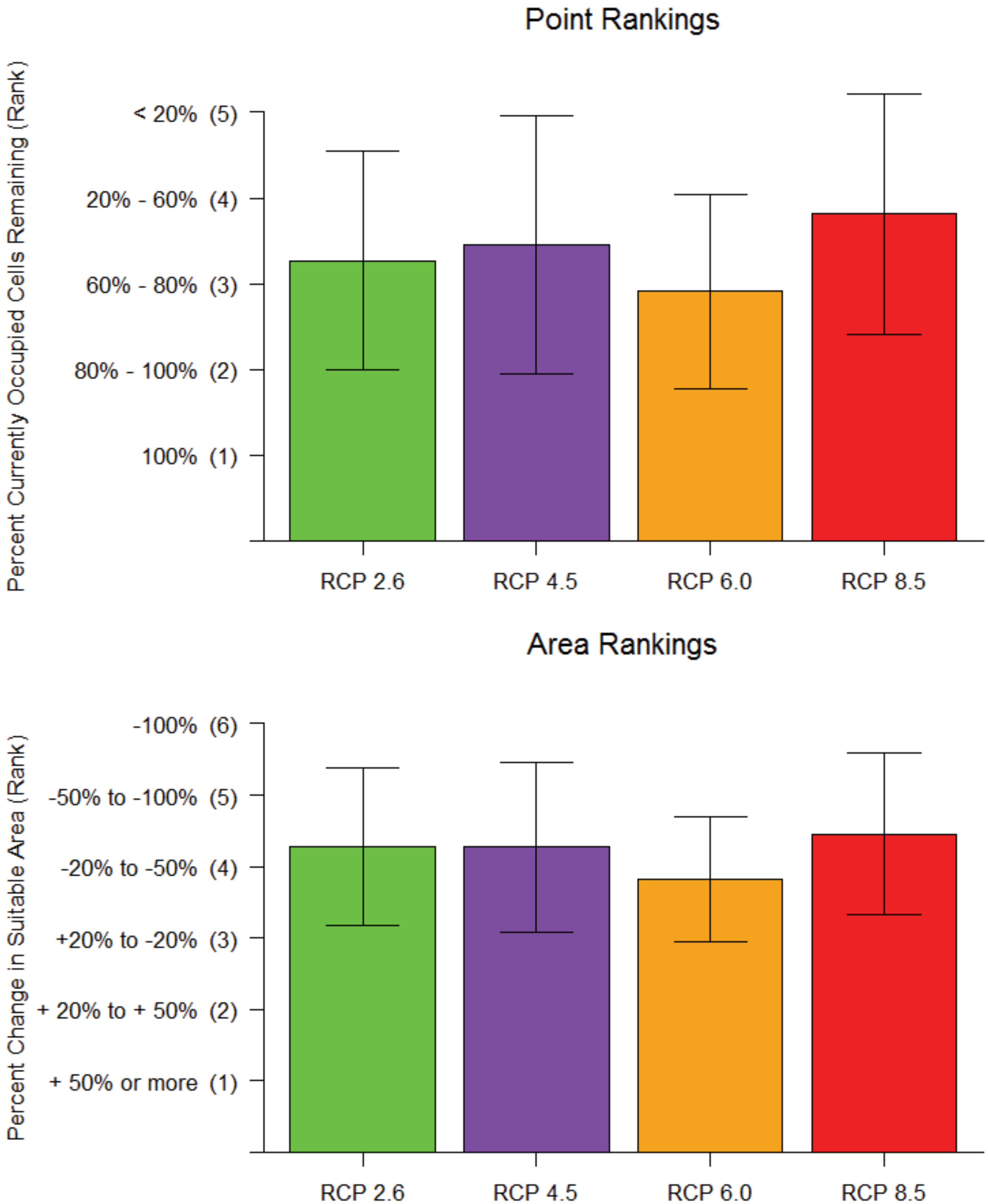

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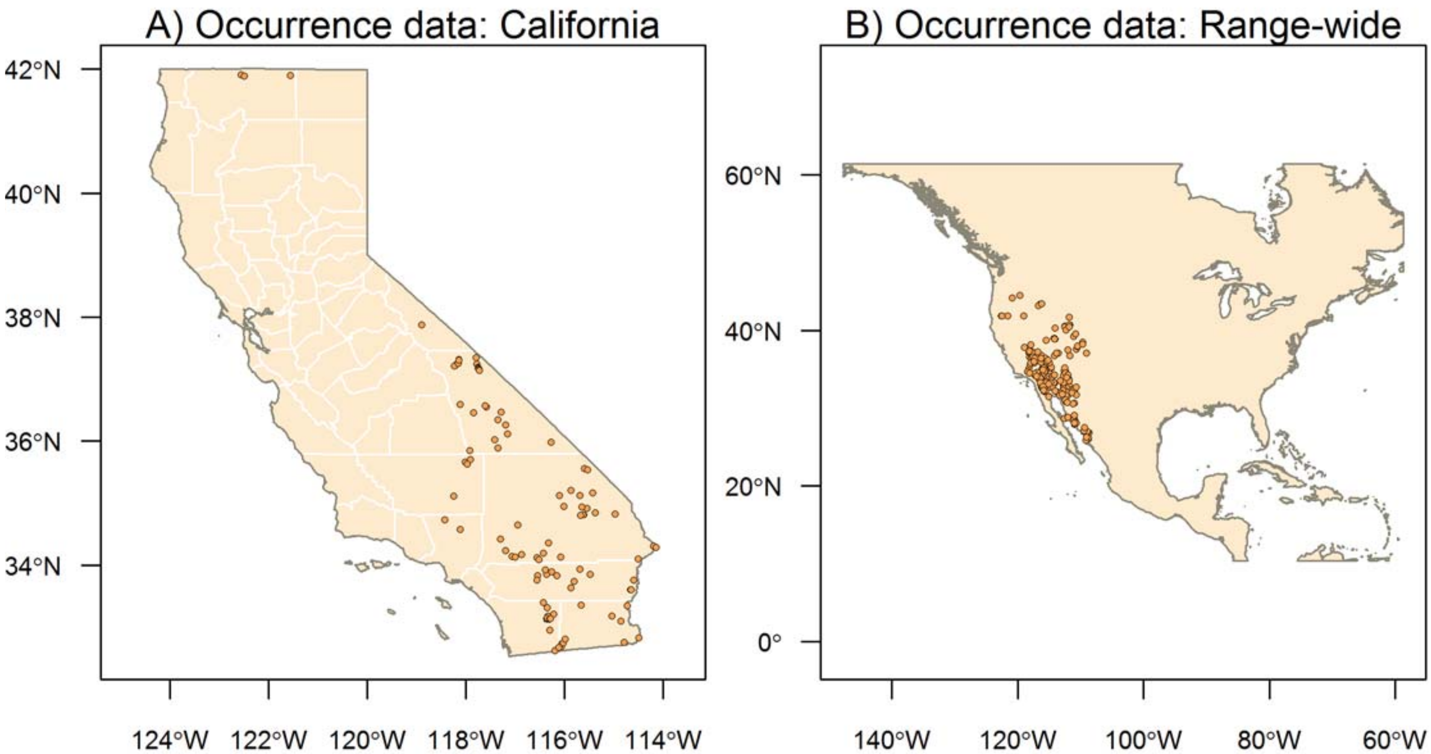
Species Results: *Hypsiglena chlorophaea* Desert Night Snake



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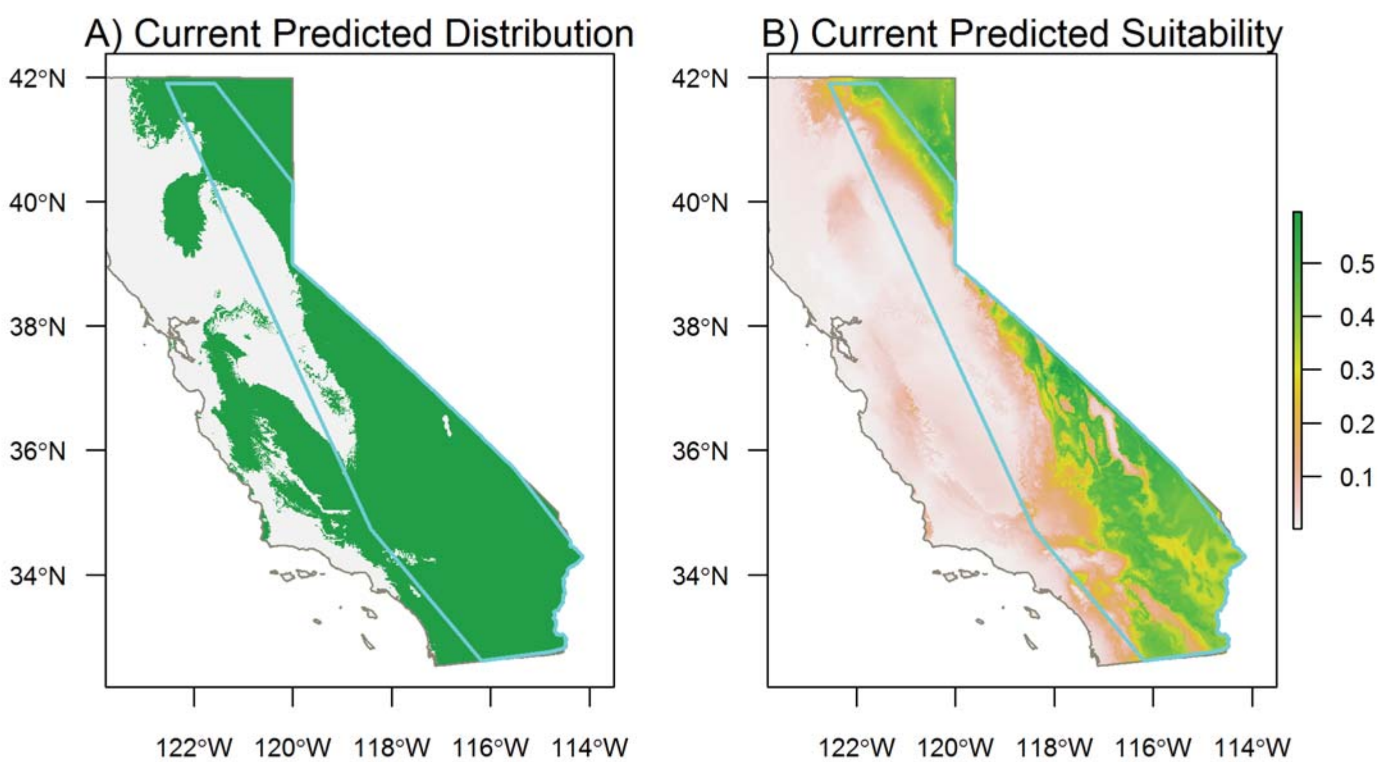

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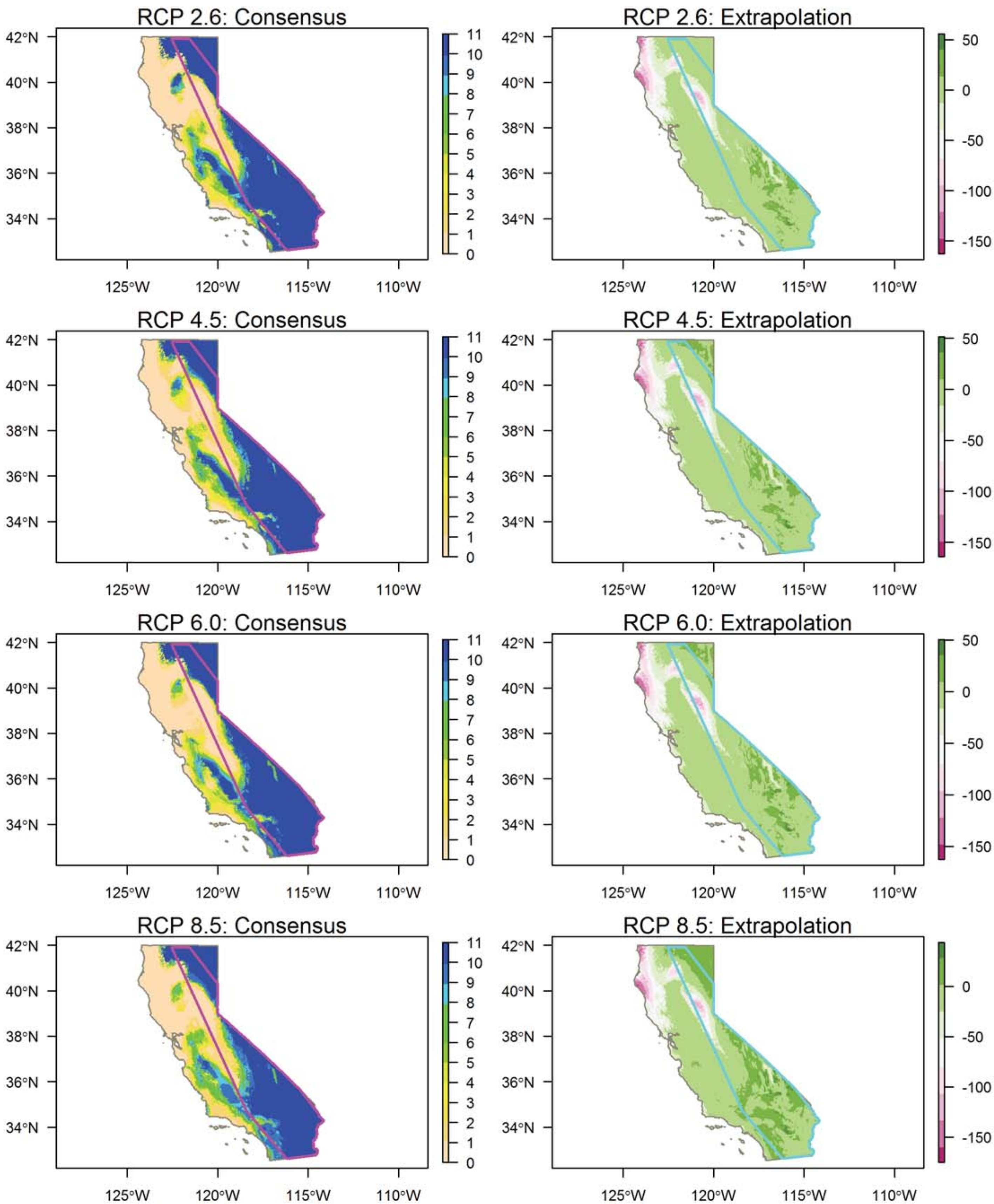

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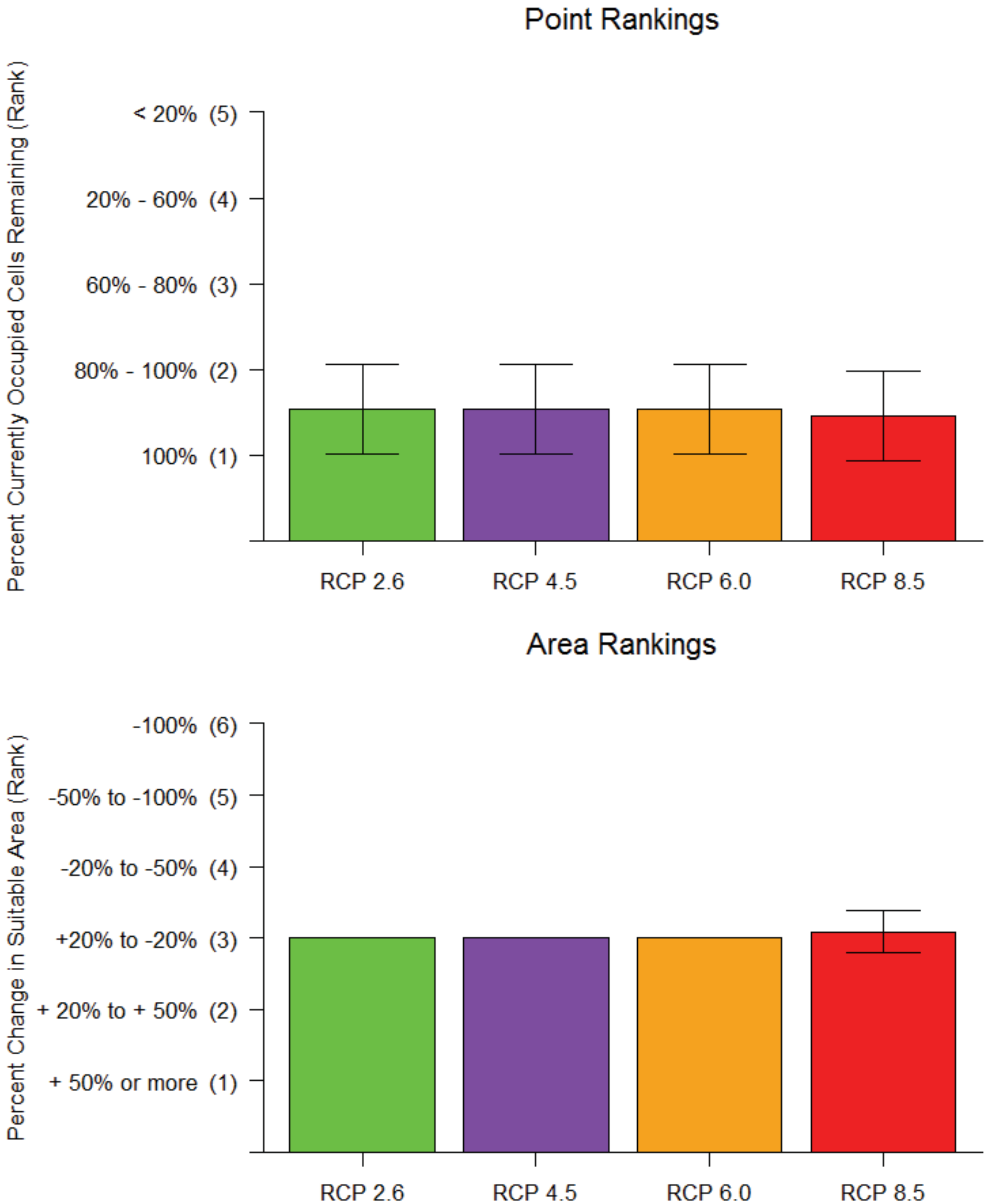

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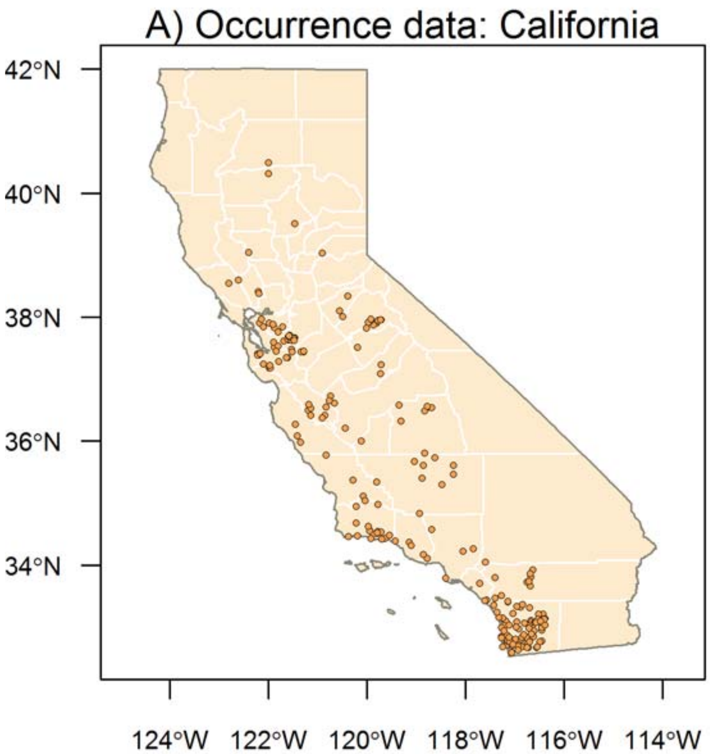
Species Results: *Hypsiglena ochorhyncha* Coast Night Snake



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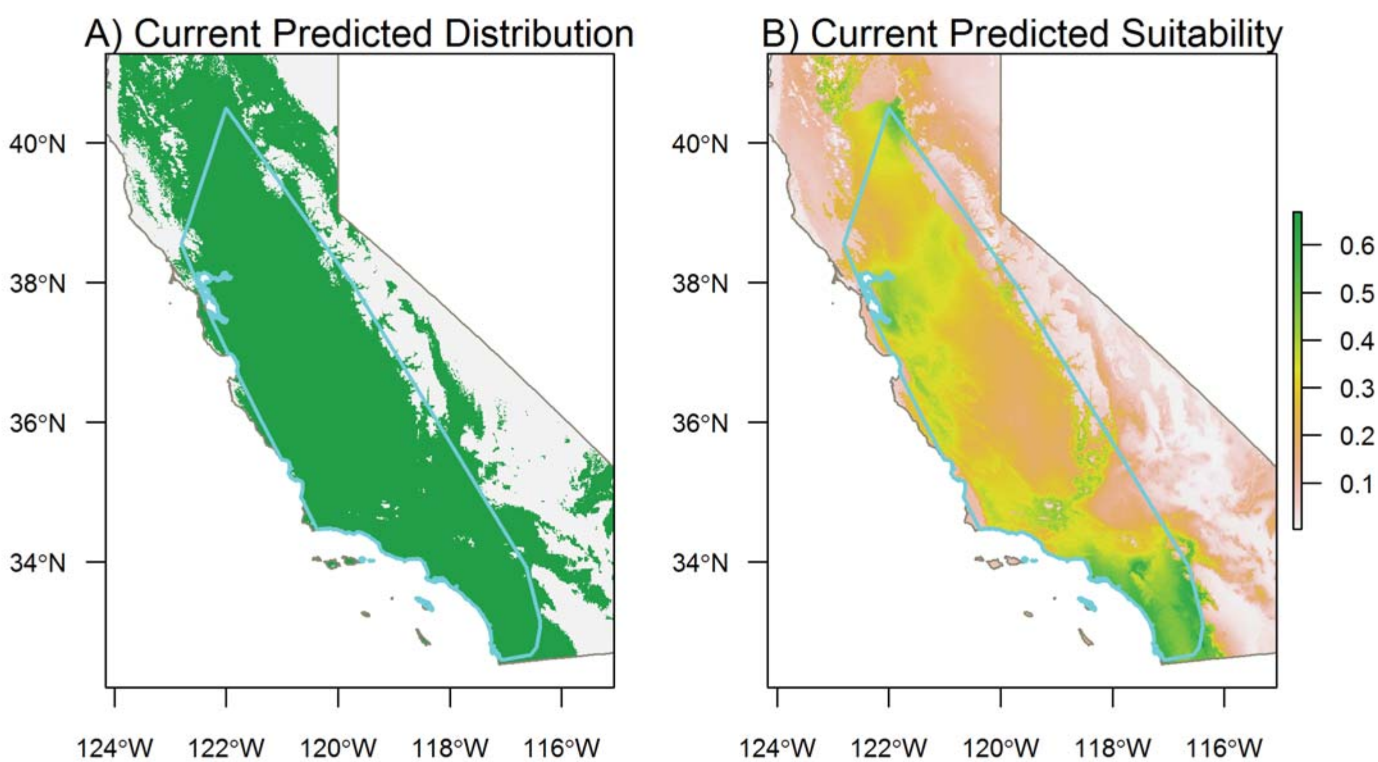

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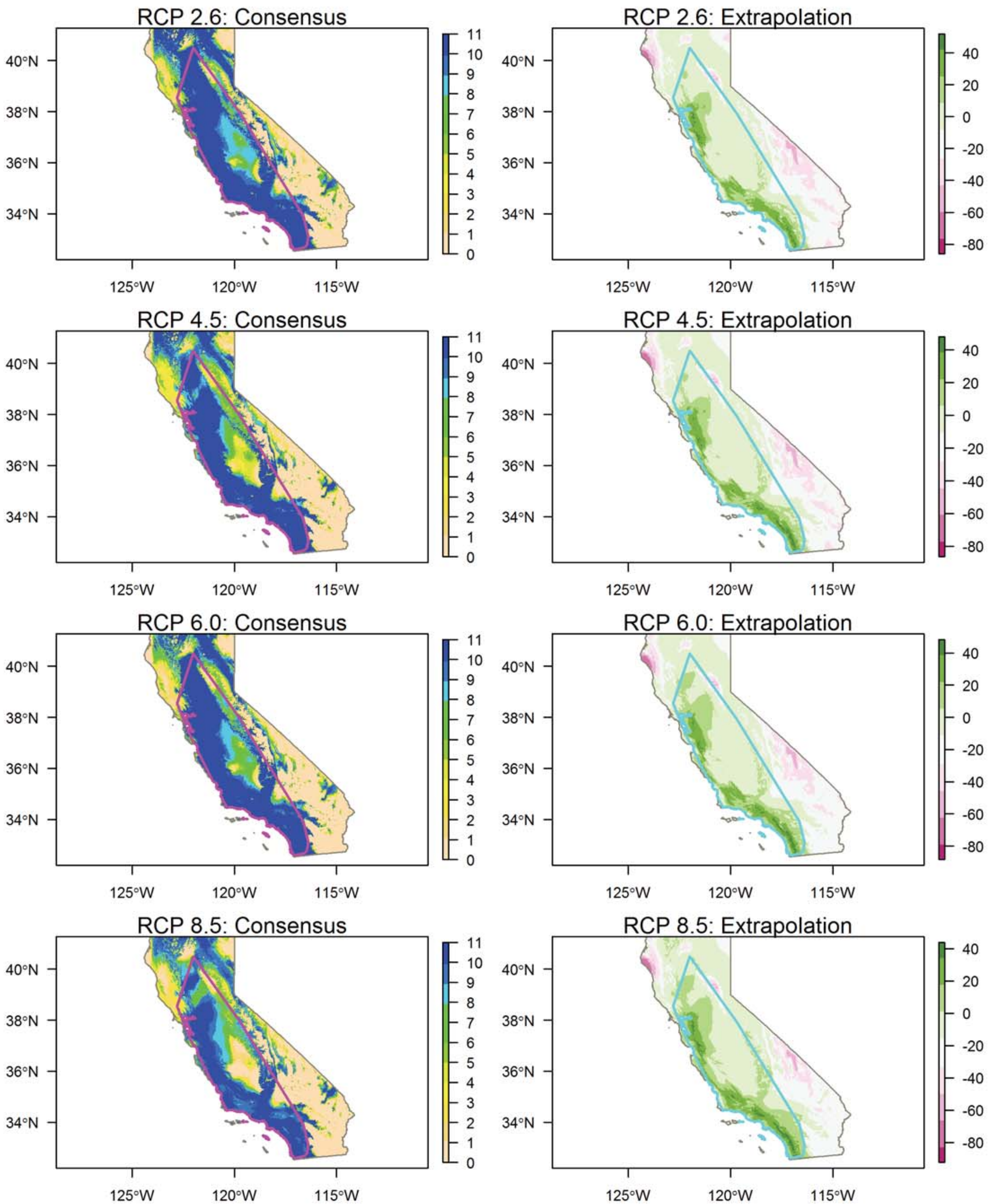

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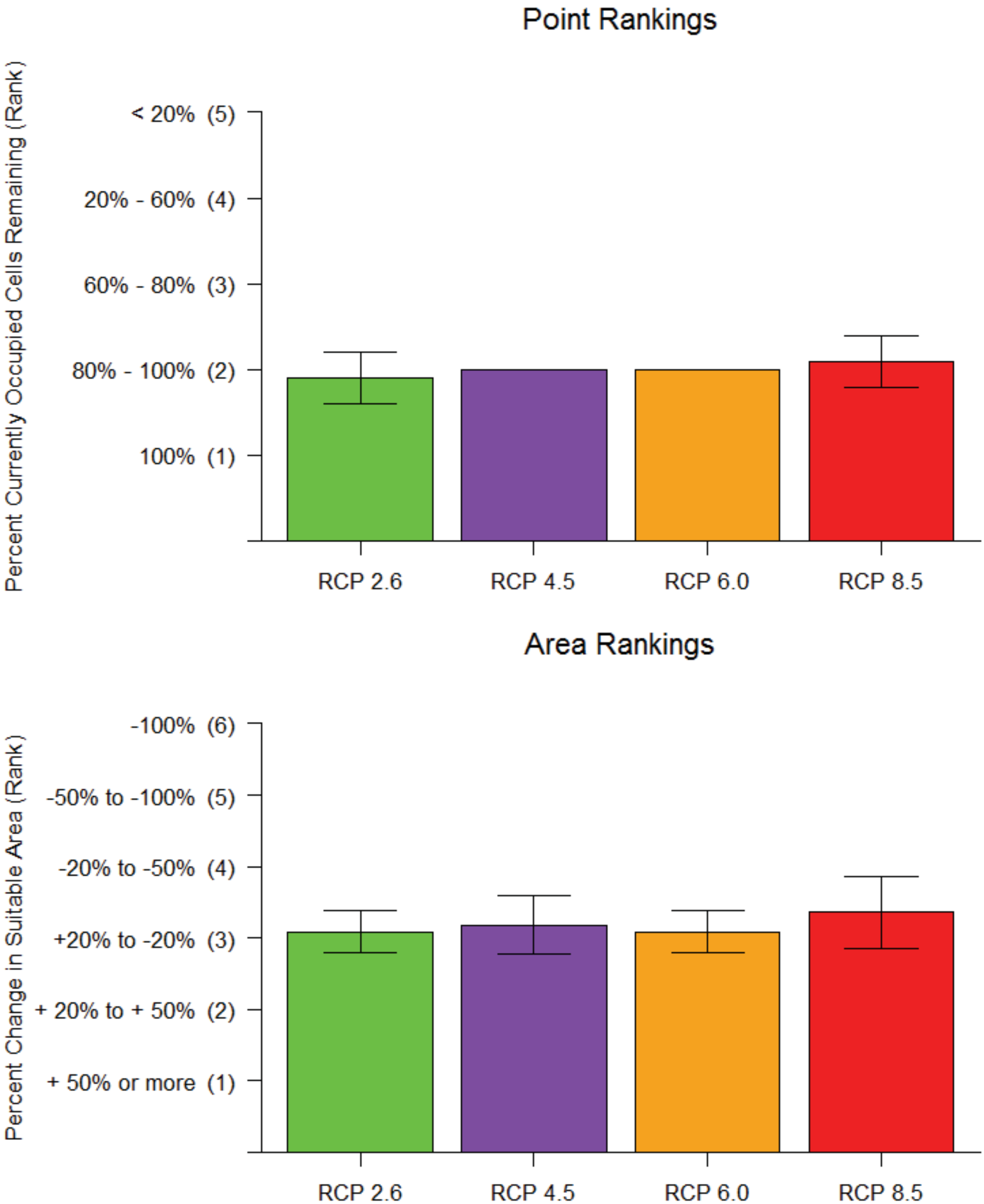

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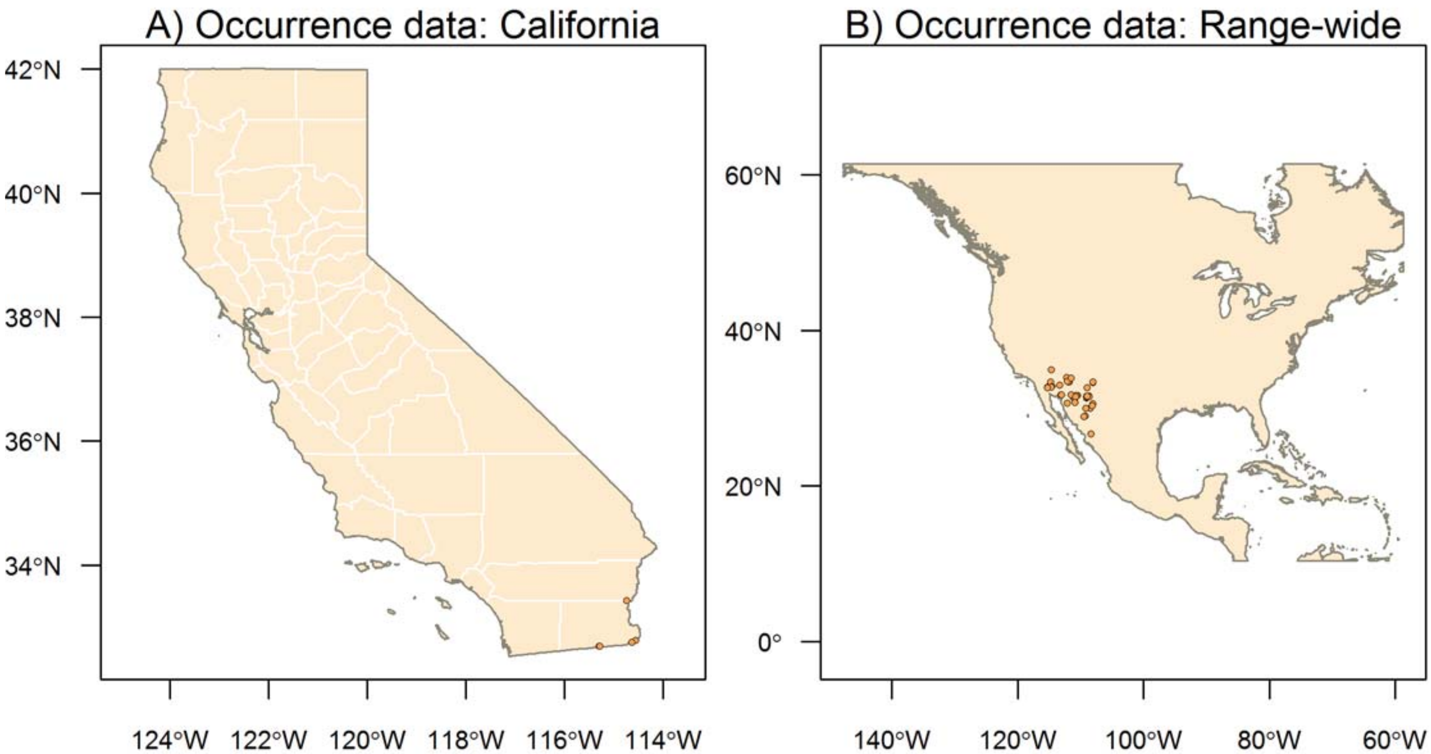
Species Results: *Kinosternon sonoriense* Sonoran Mud Turtle



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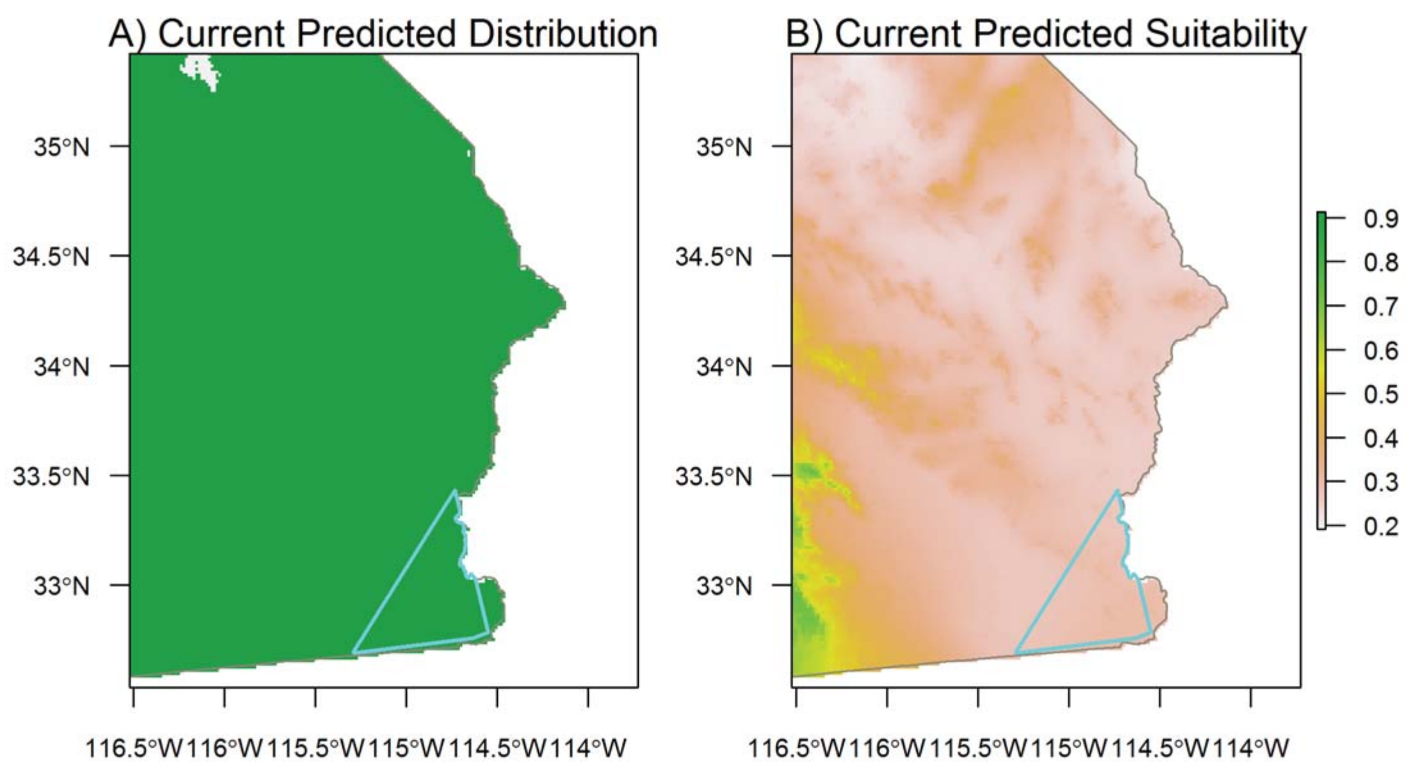

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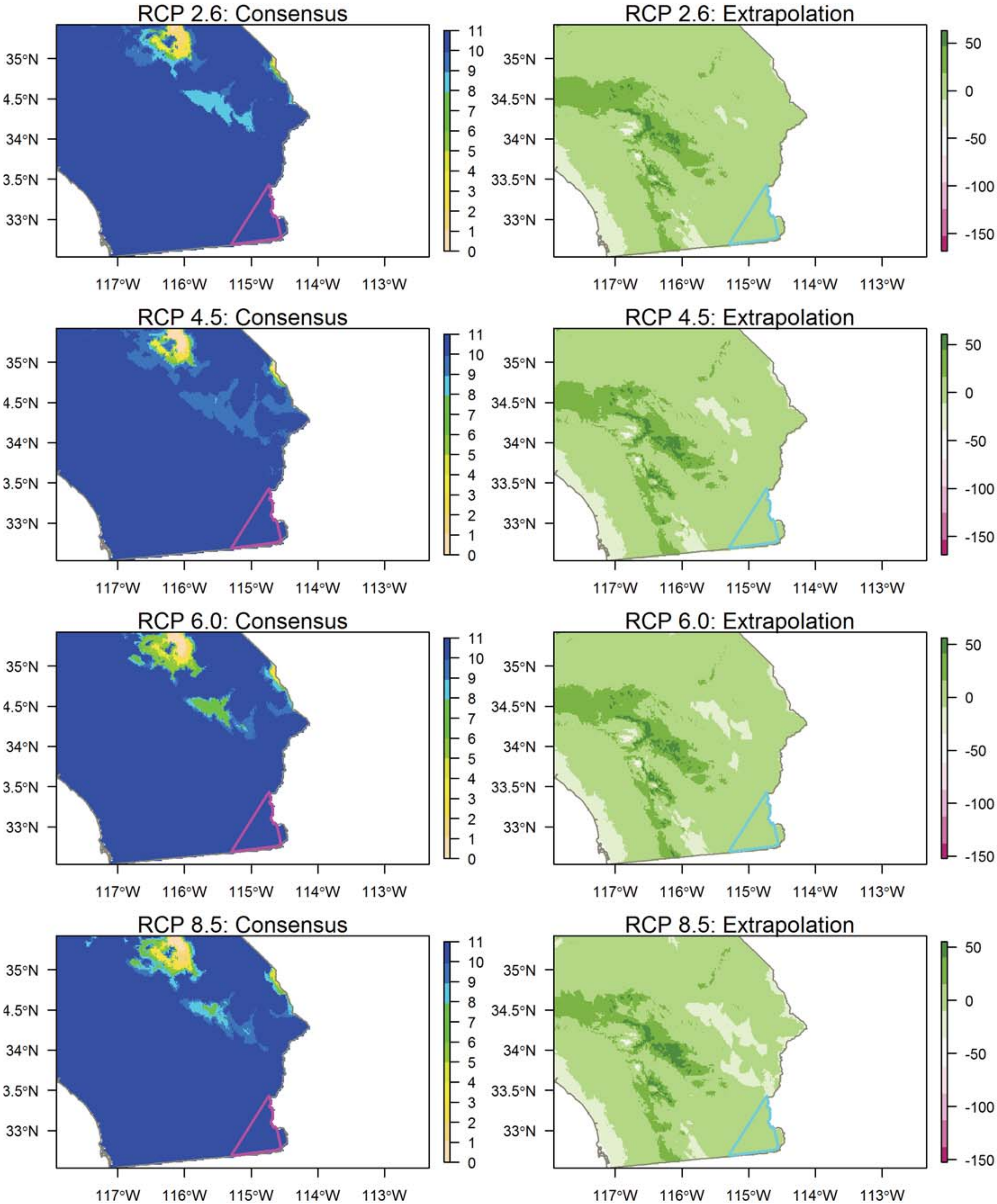

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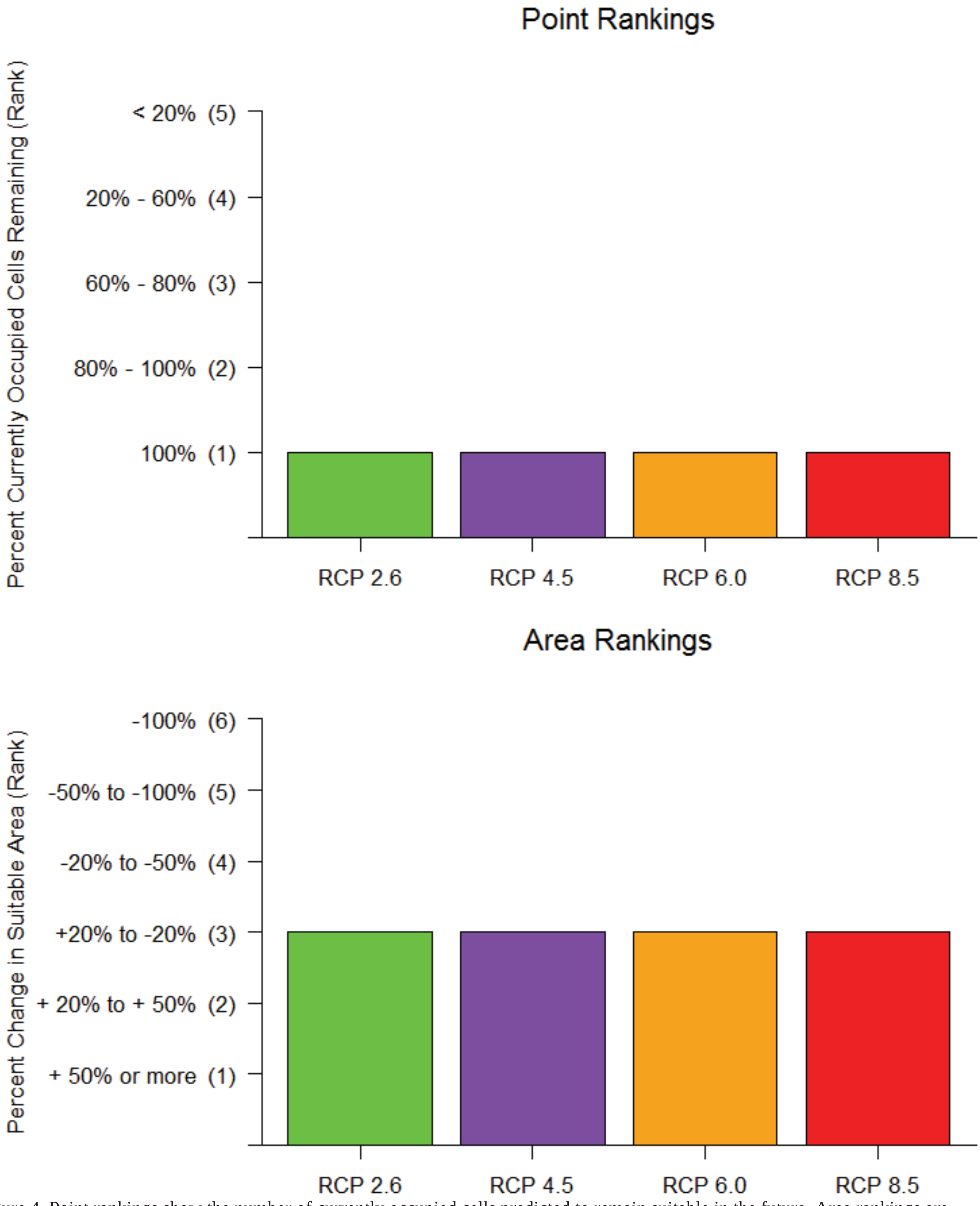

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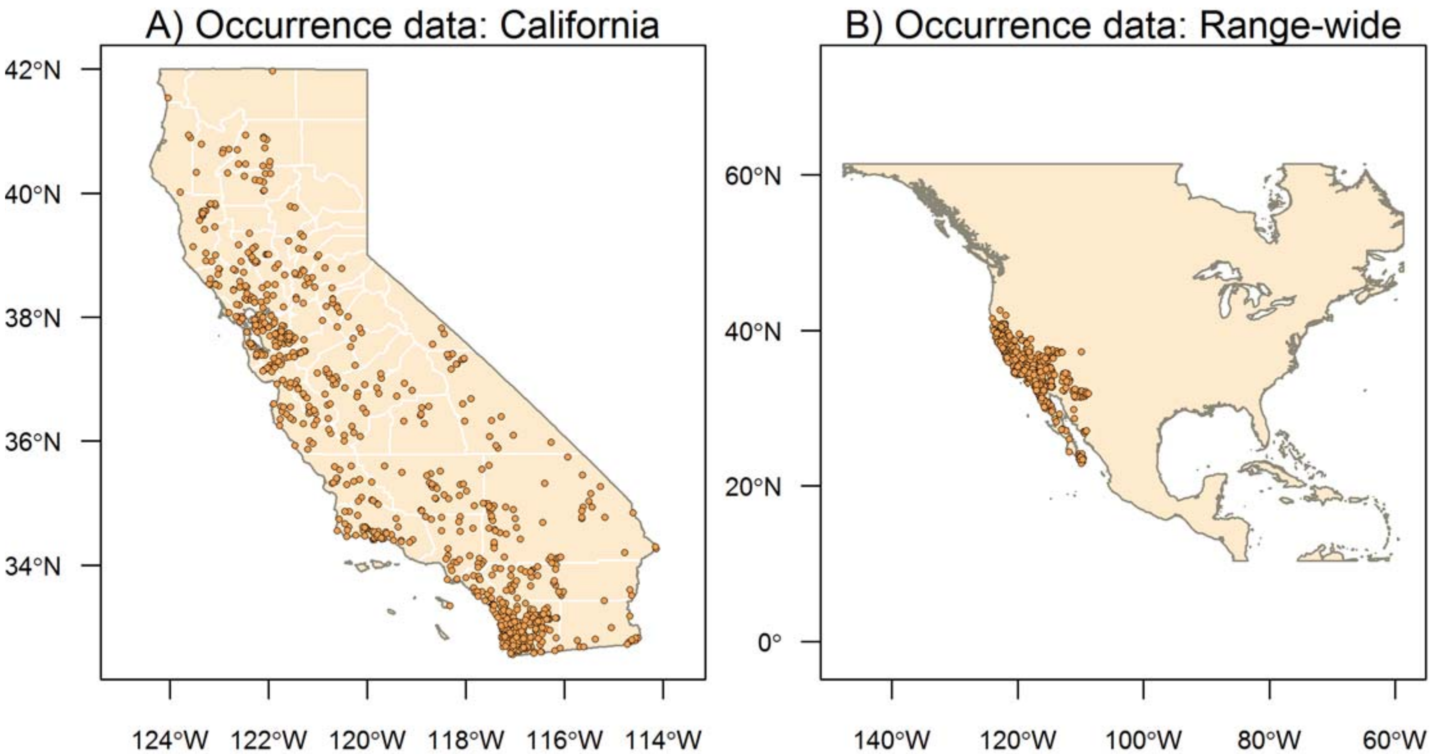
Species Results: *Lampropeltis californiae* California Kingsnake



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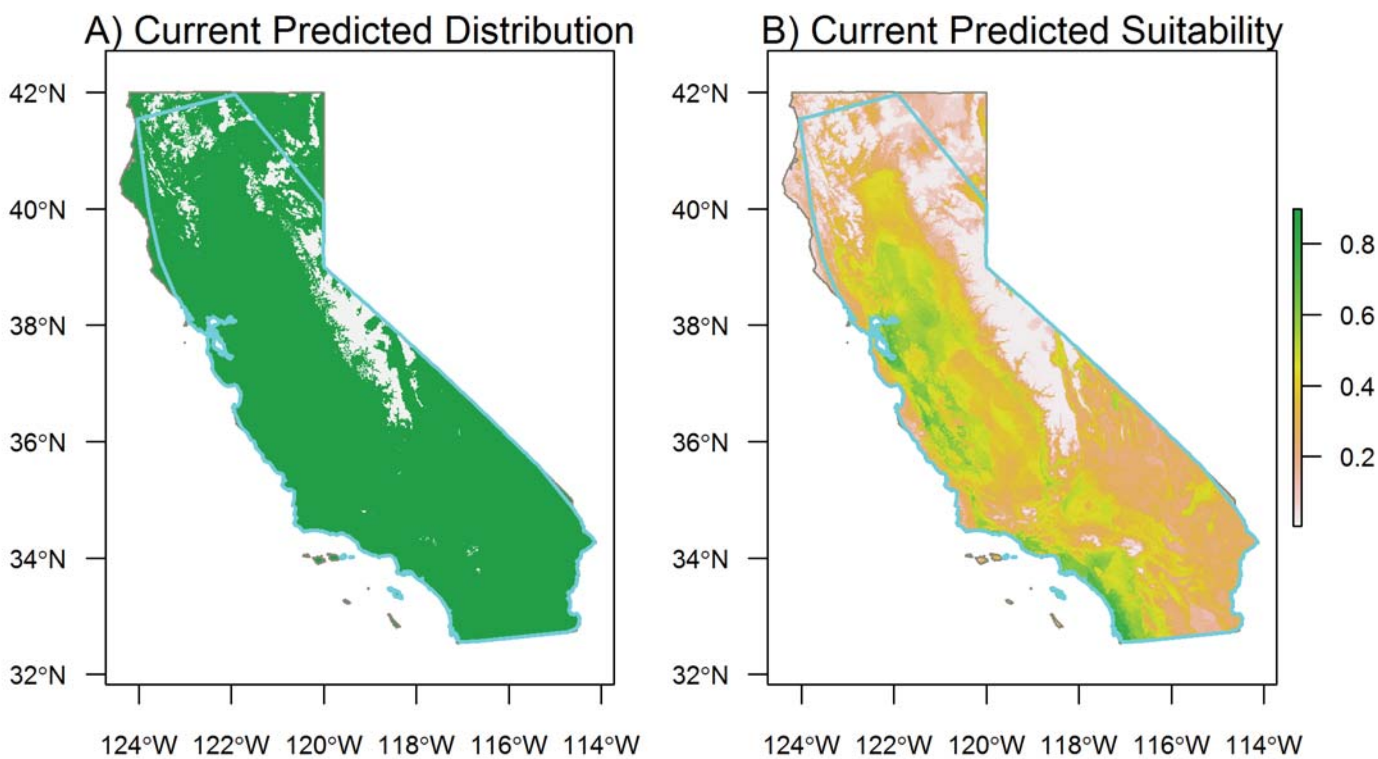

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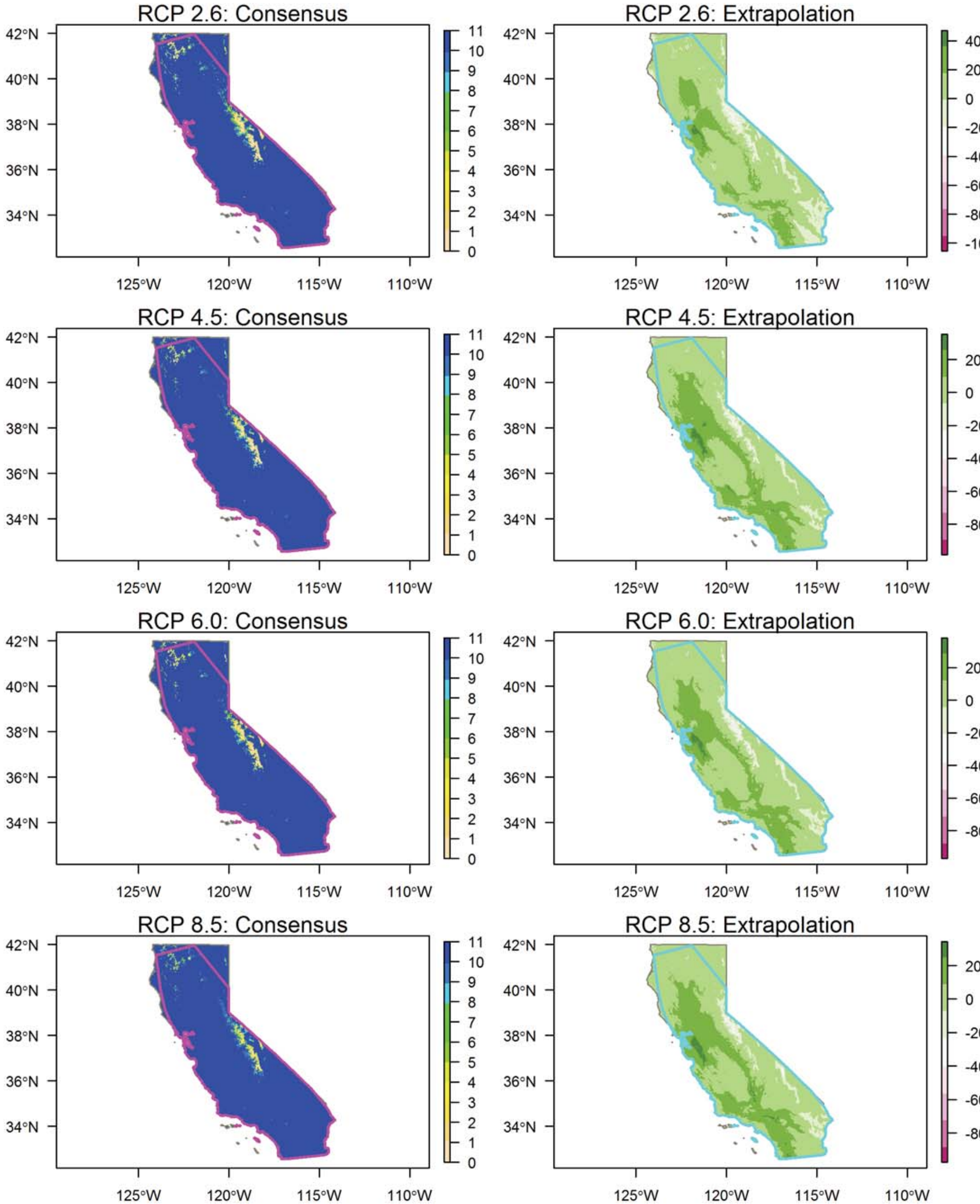

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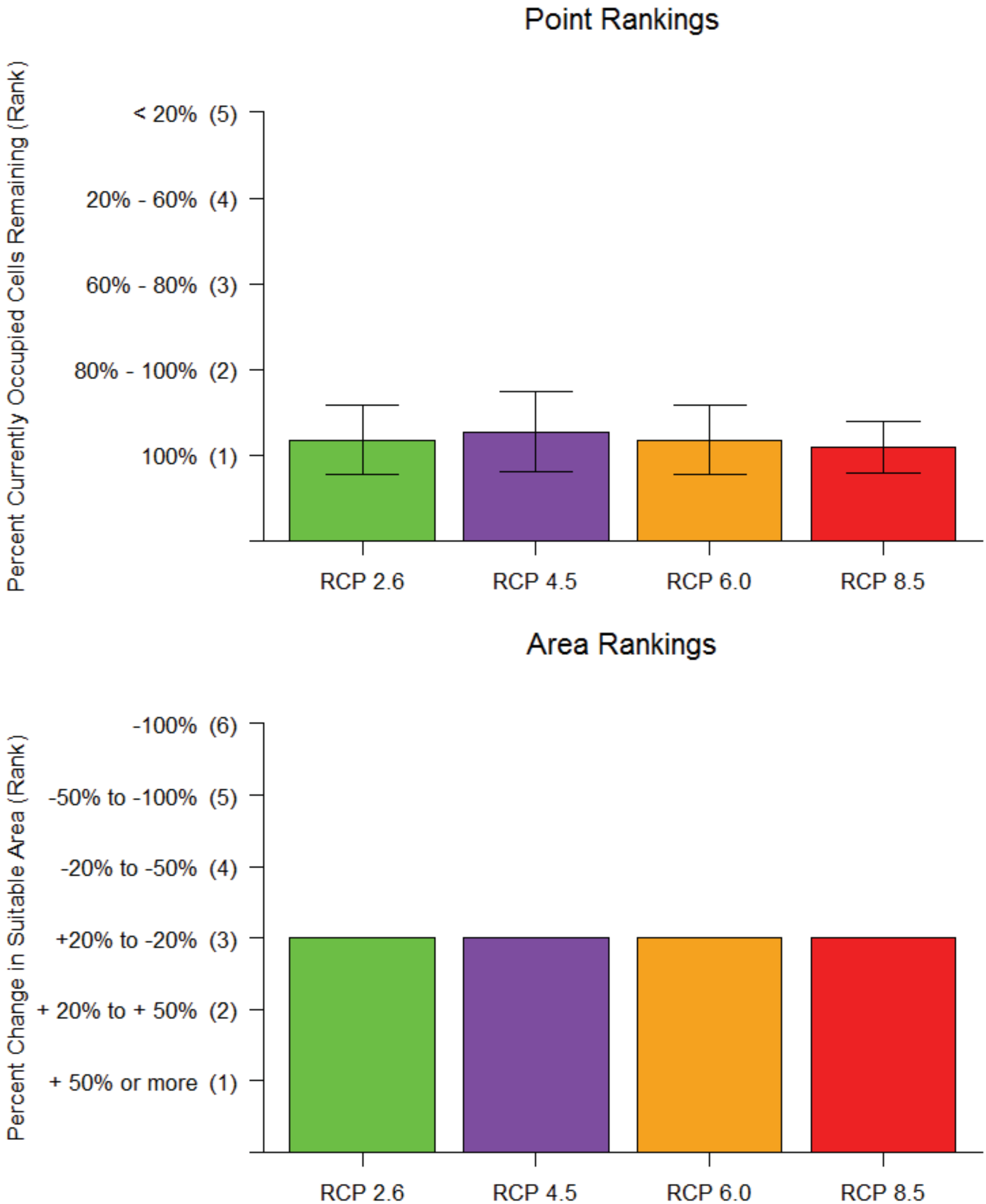

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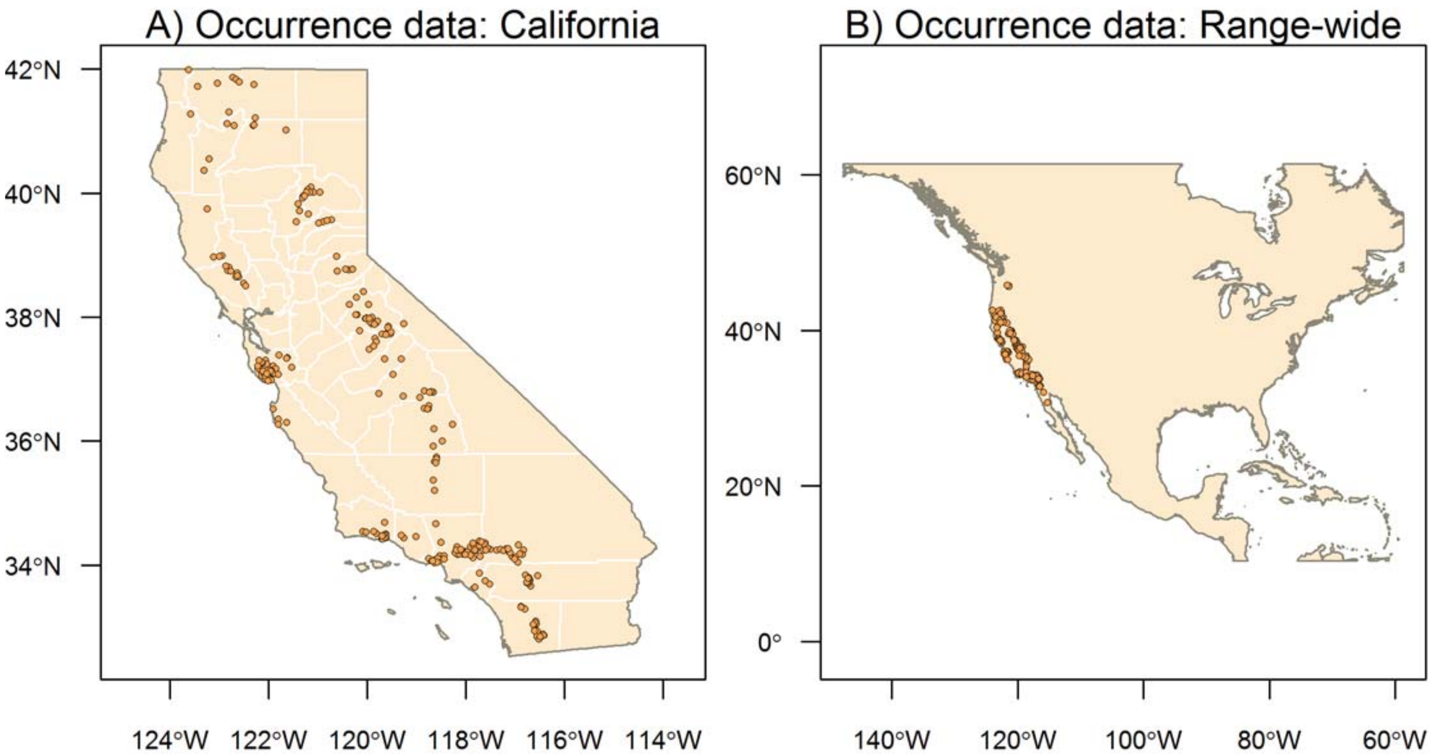
Species Results: *Lampropeltis zonata* California Mountain Kingsnake



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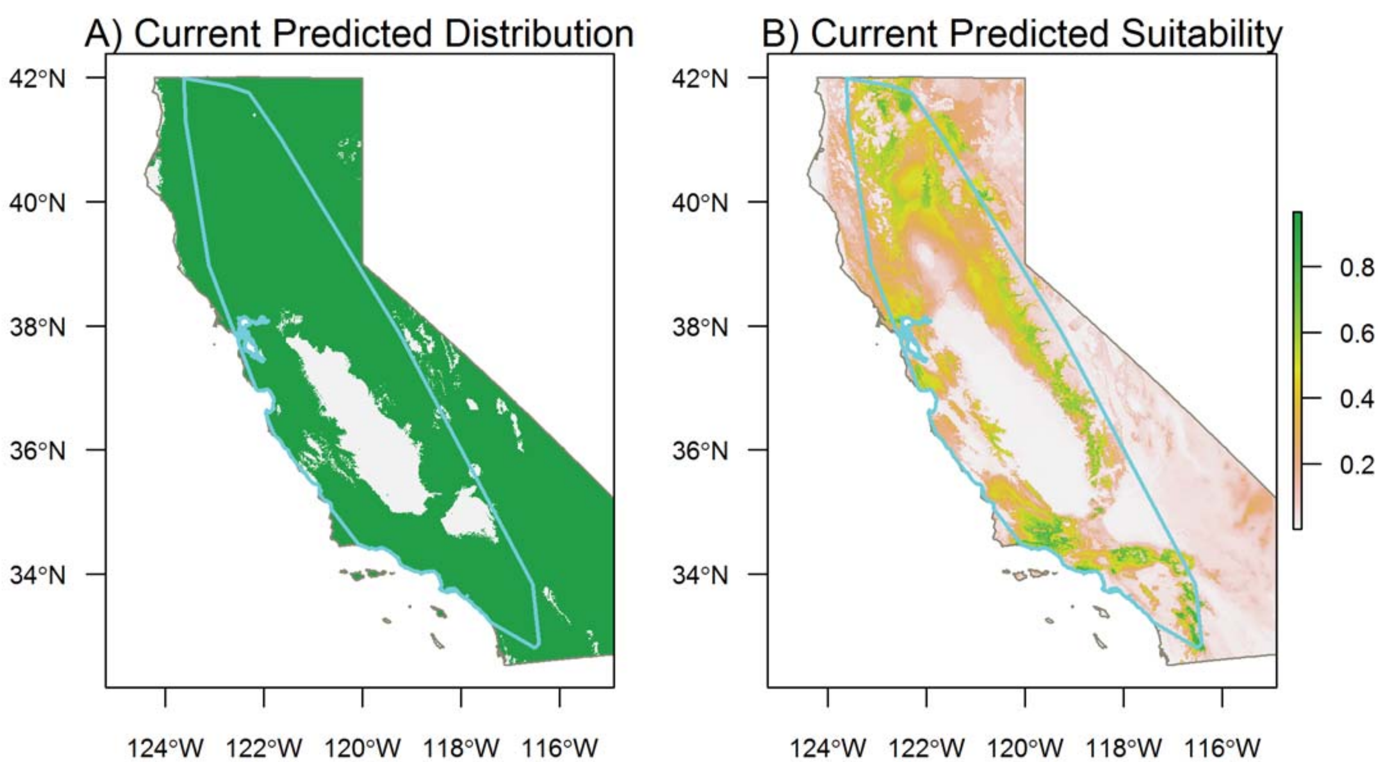

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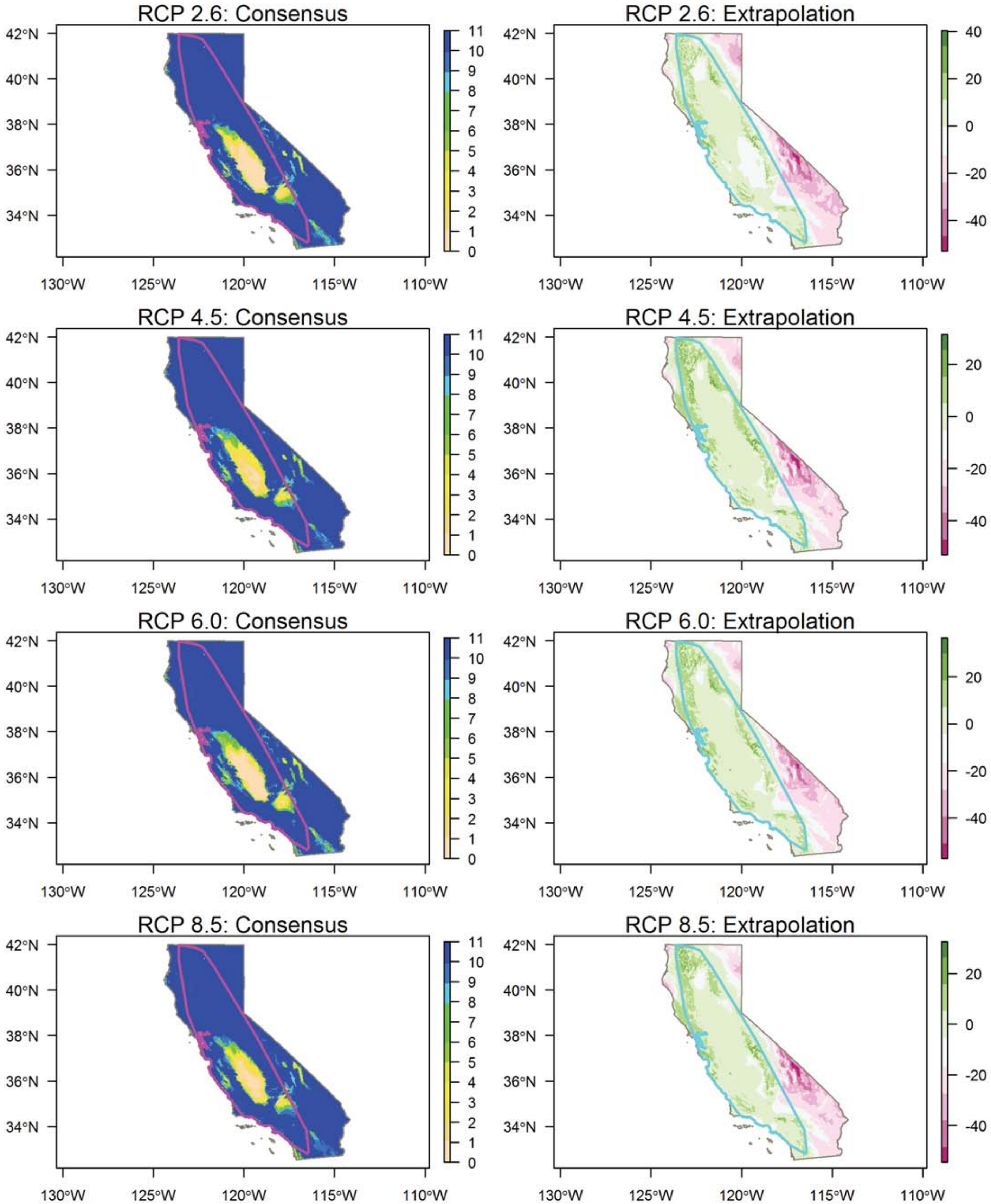
Species Results: *Lampropeltis zonata* California Mountain Kingsnake



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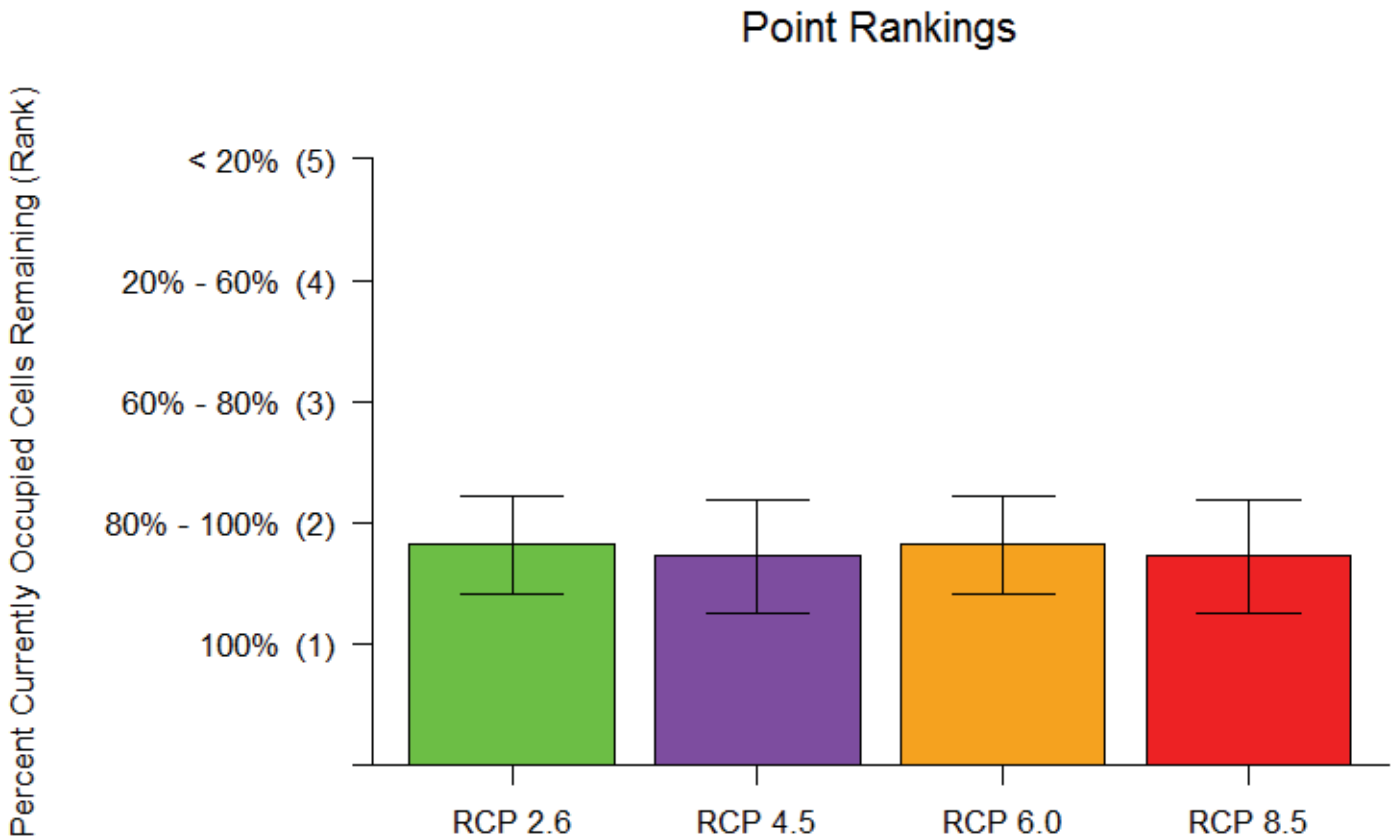
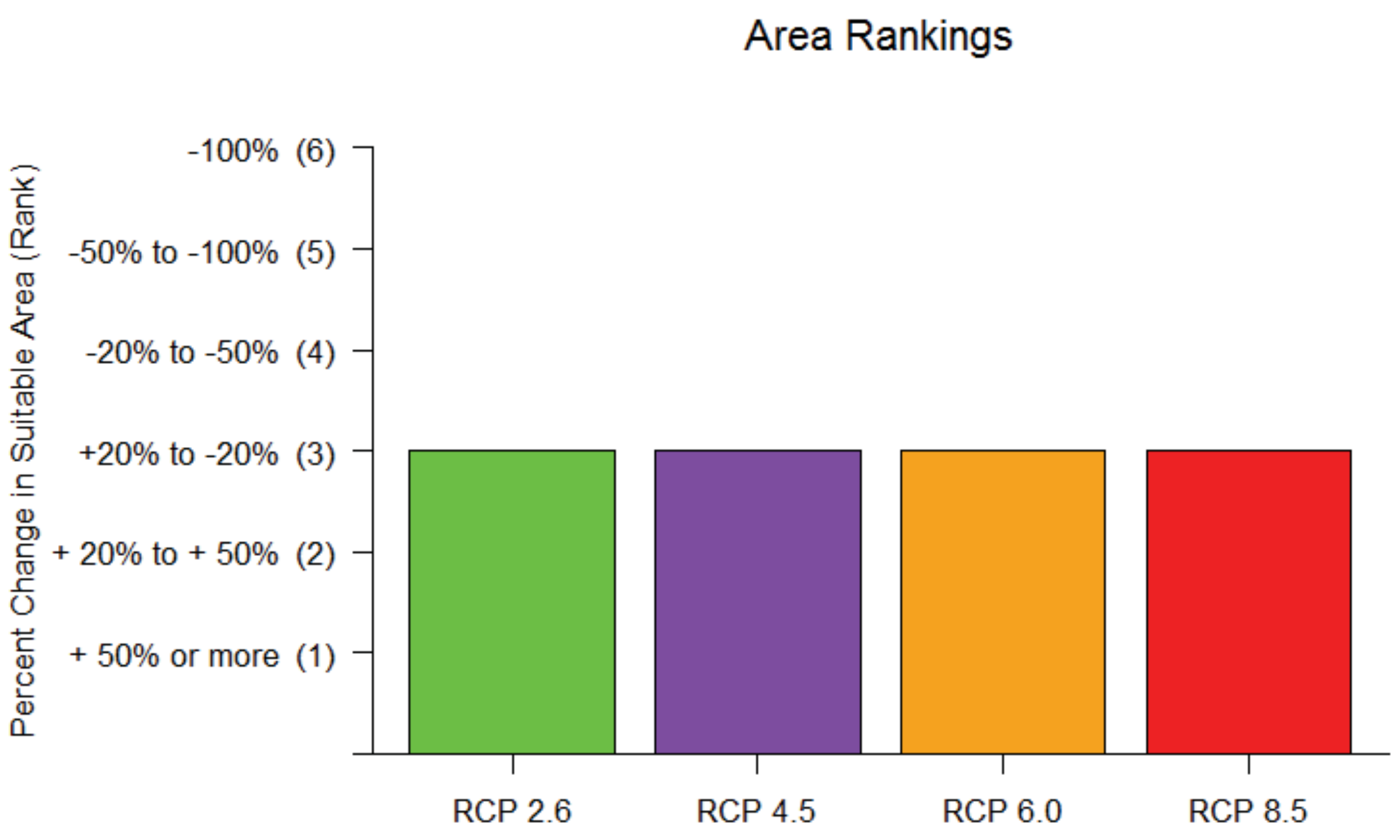
Species Results: *Lampropeltis zonata* California Mountain Kingsnake





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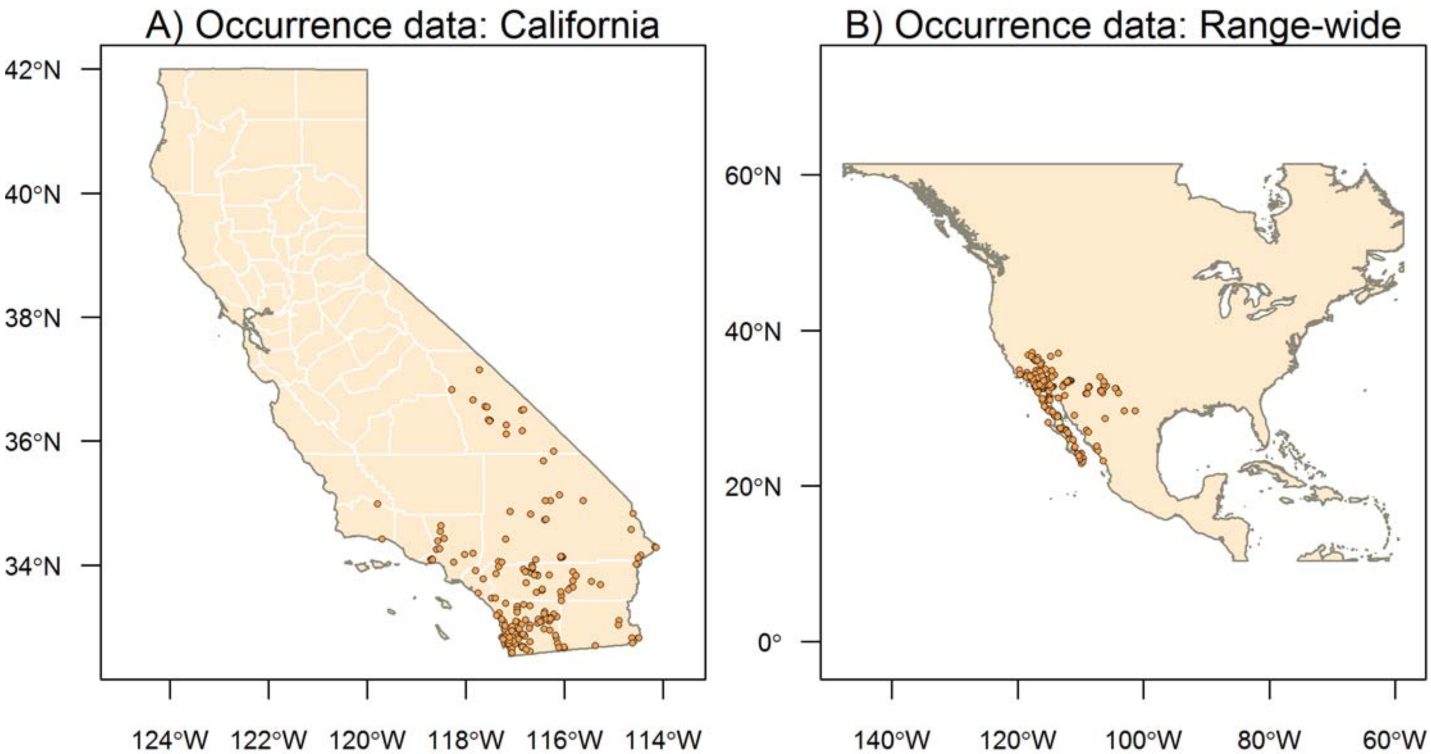
Species Results: *Leptotyphlops humilis* Western Blind Snake



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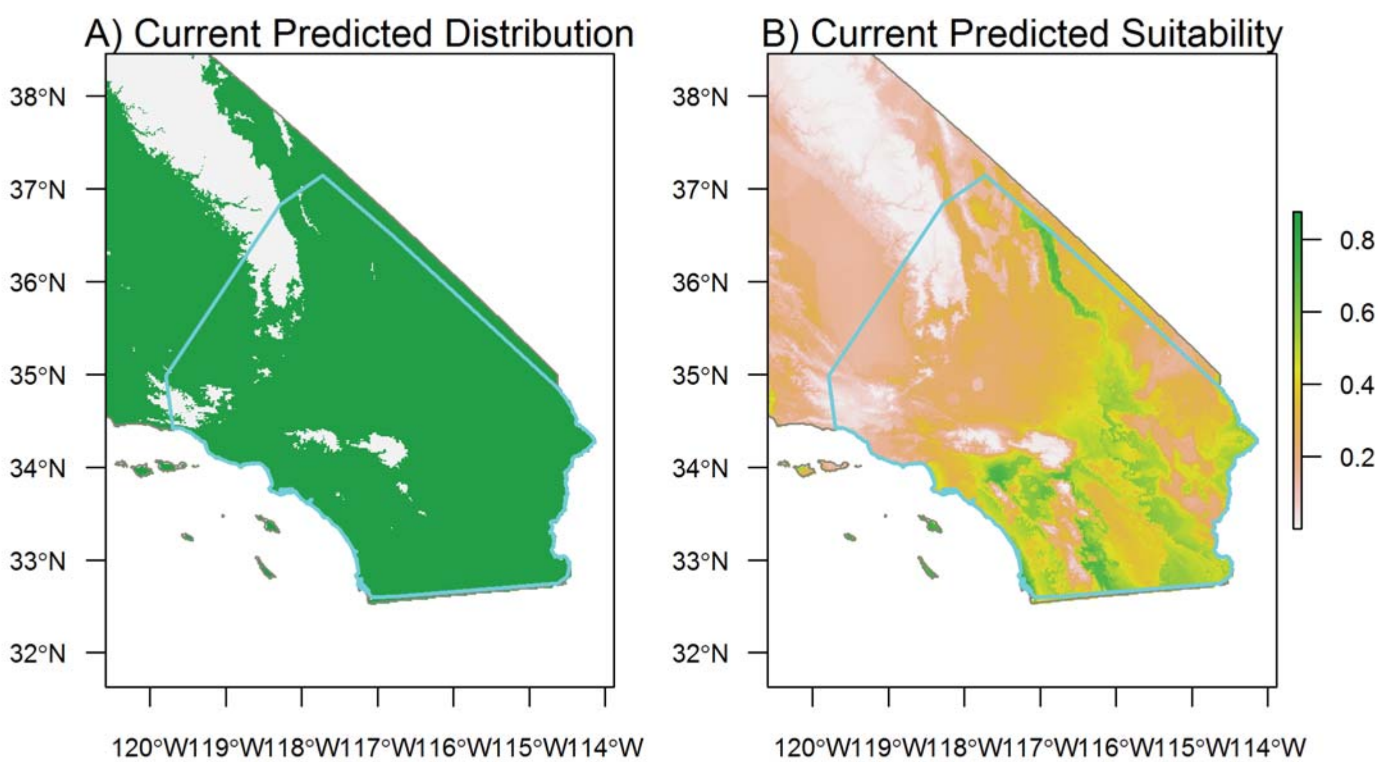
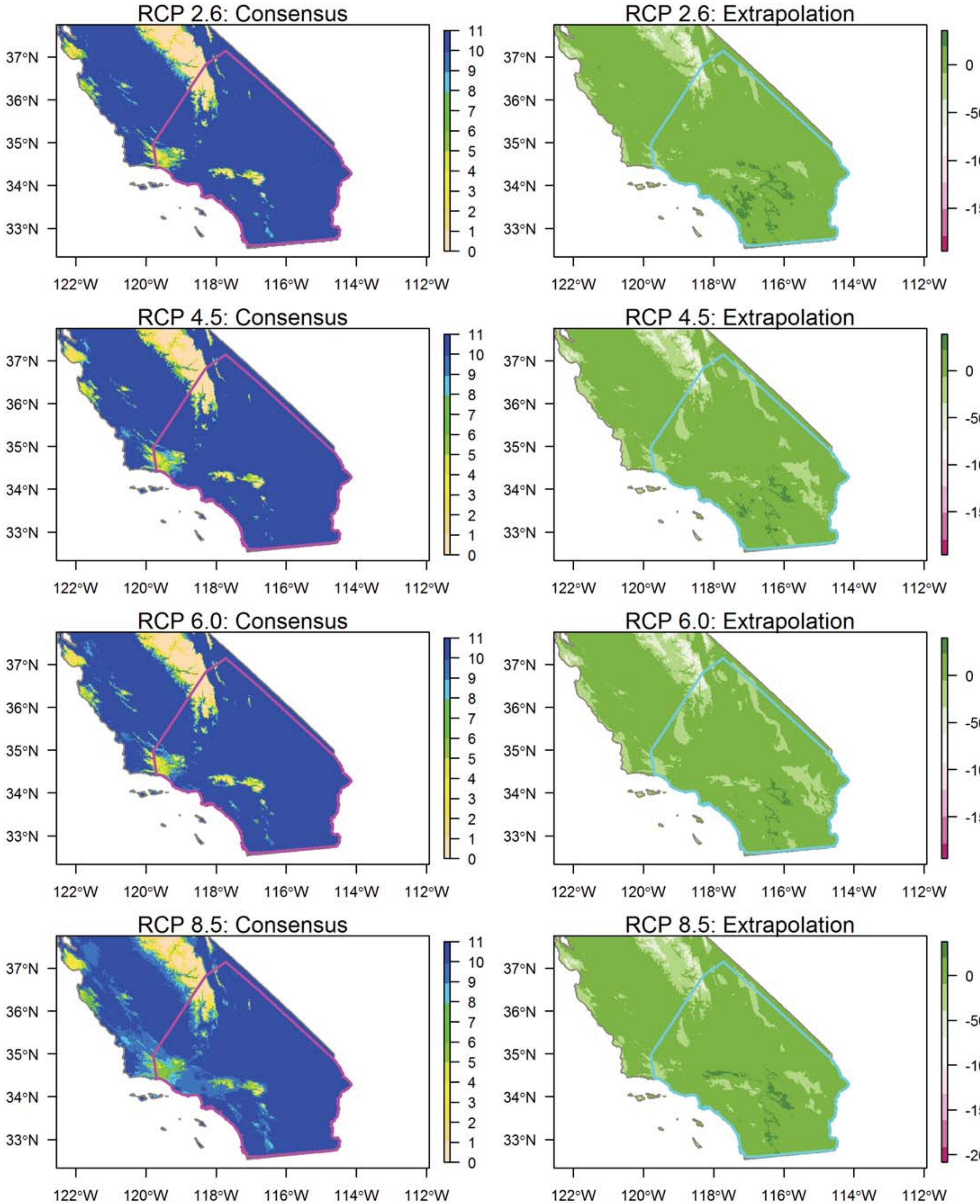


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Leptotyphlops humilis* Western Blind Snake



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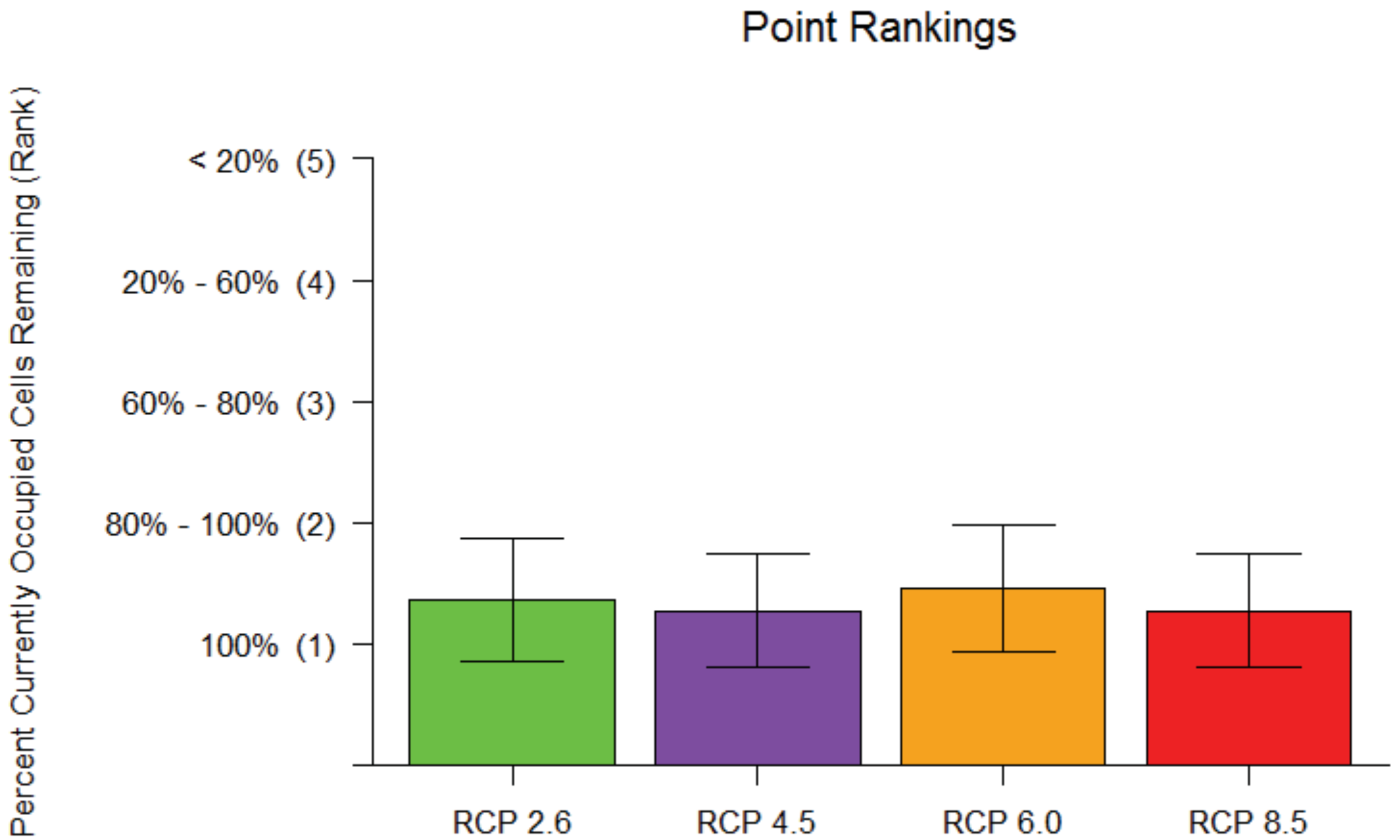
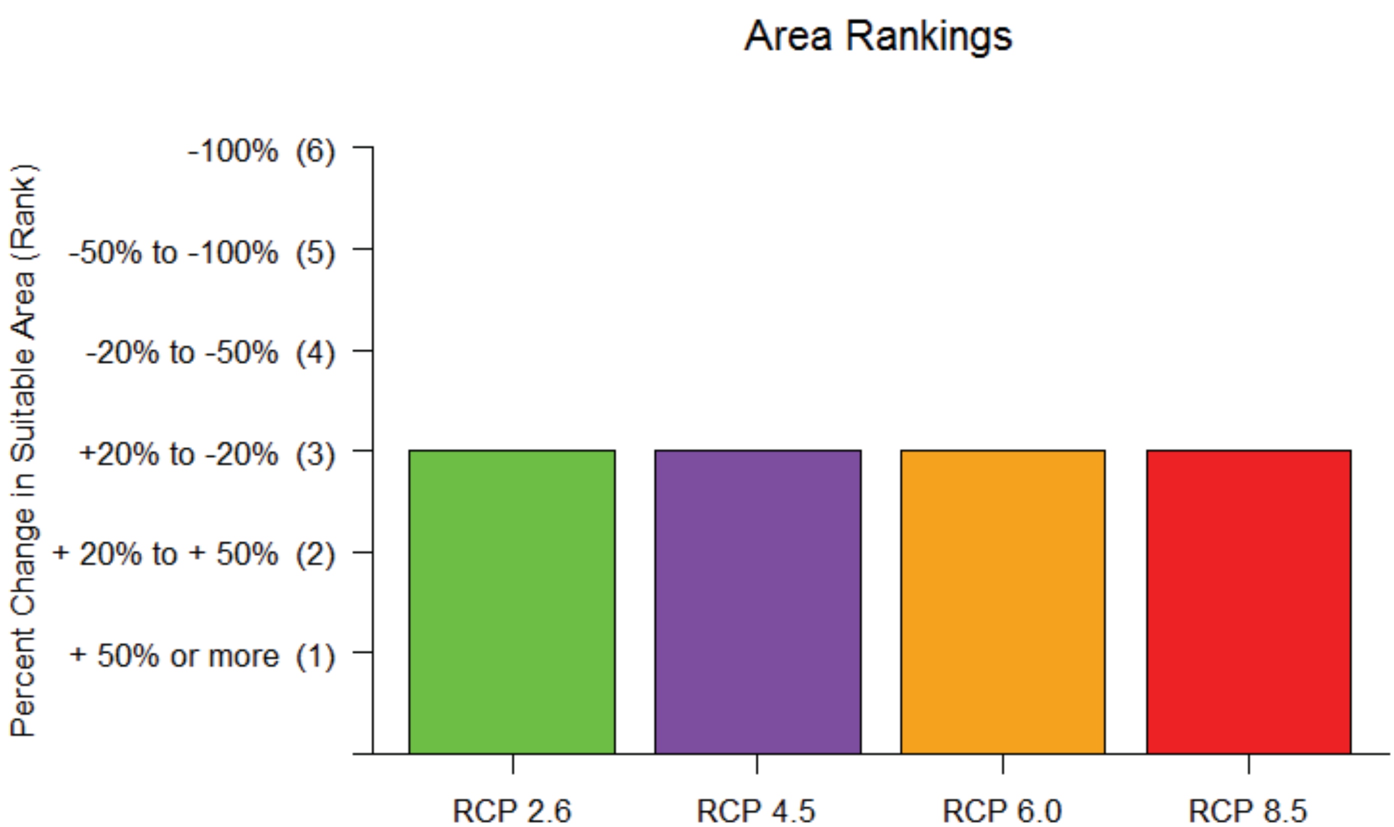
Species Results: *Leptotyphlops humilis* Western Blind Snake





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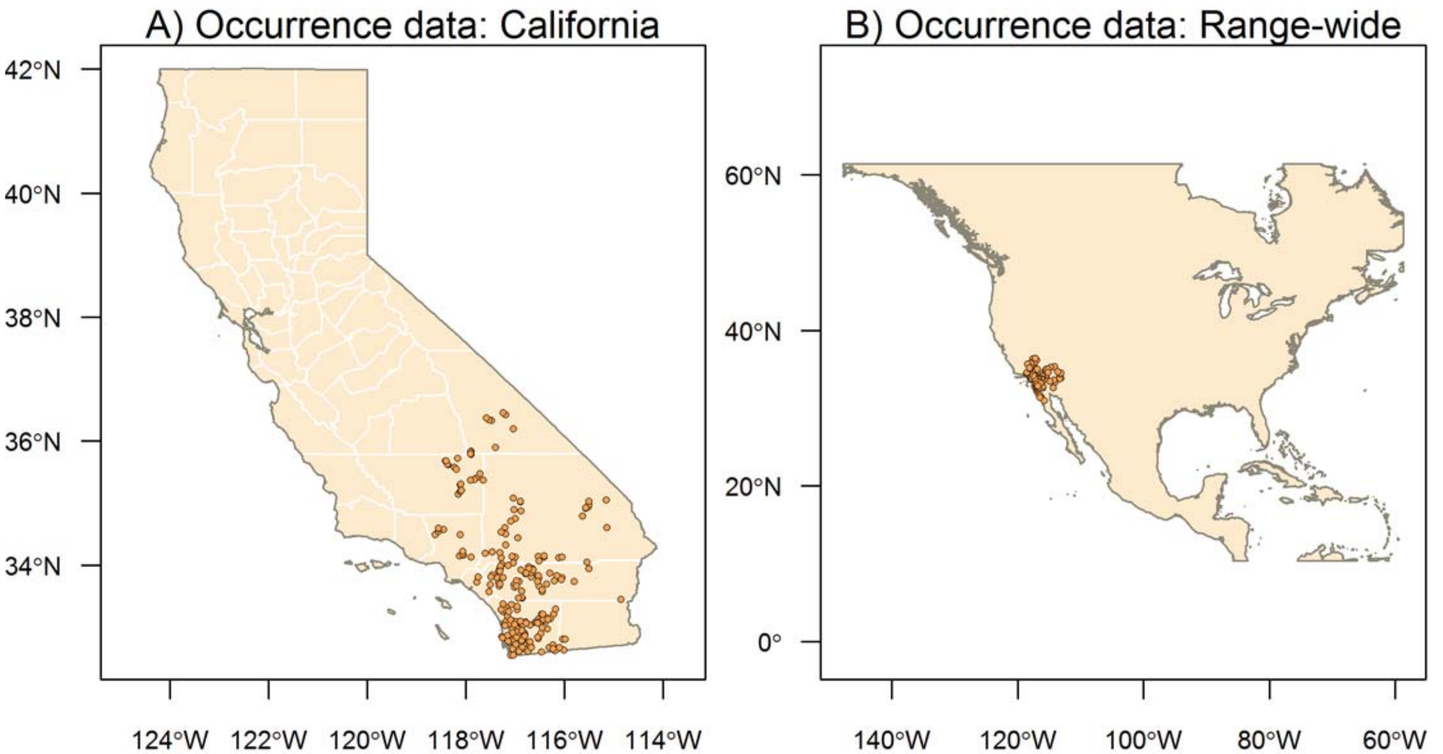
Species Results: *Lichanura orcutti* California Rosy Boa



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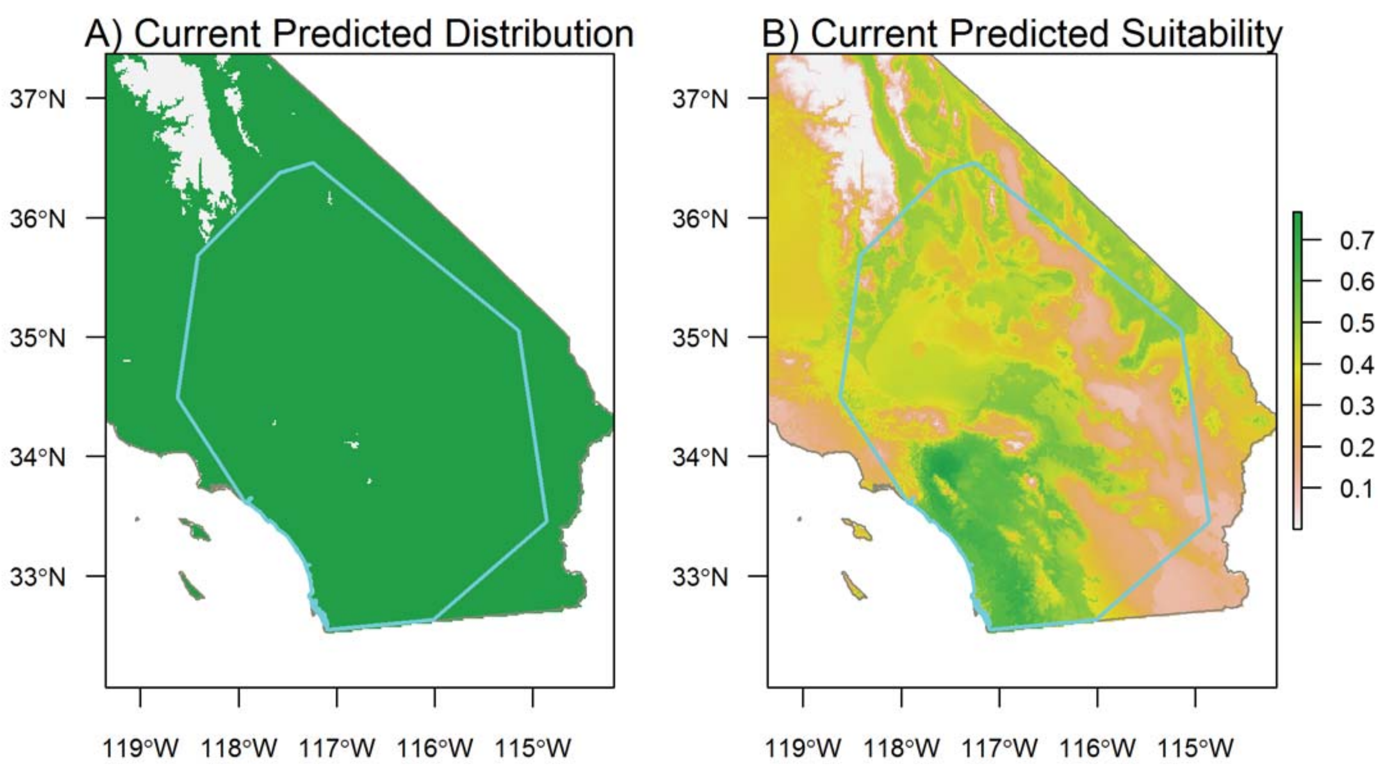

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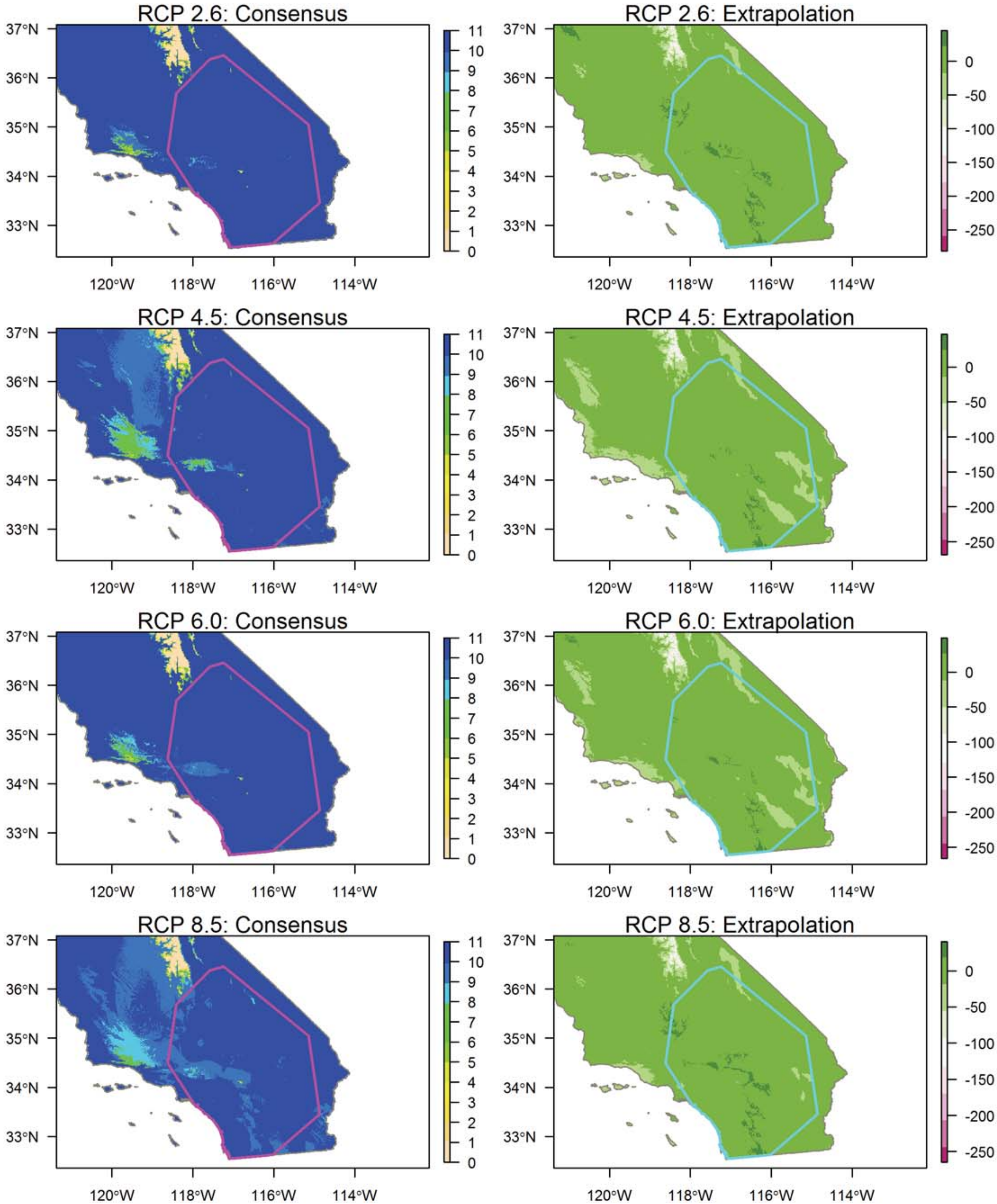

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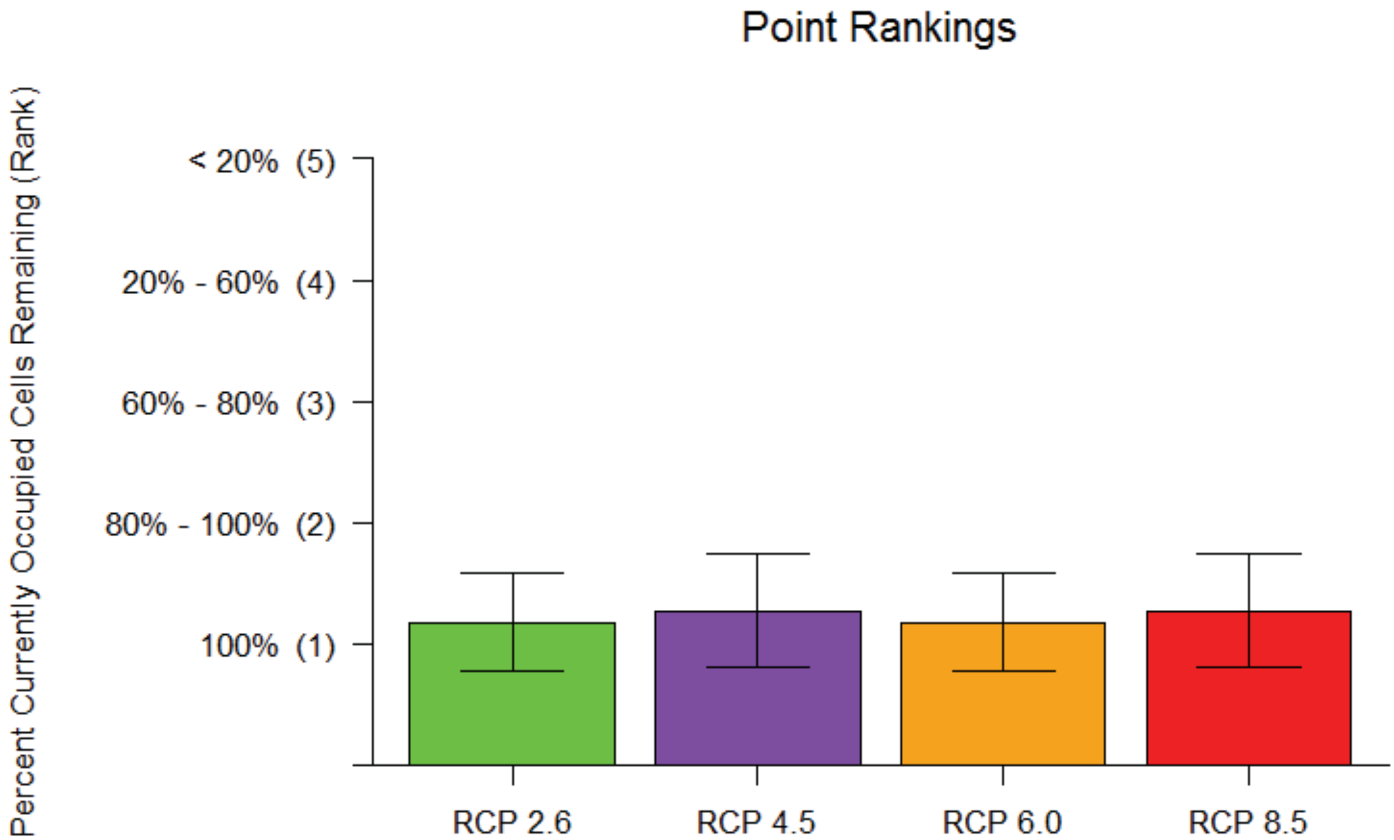

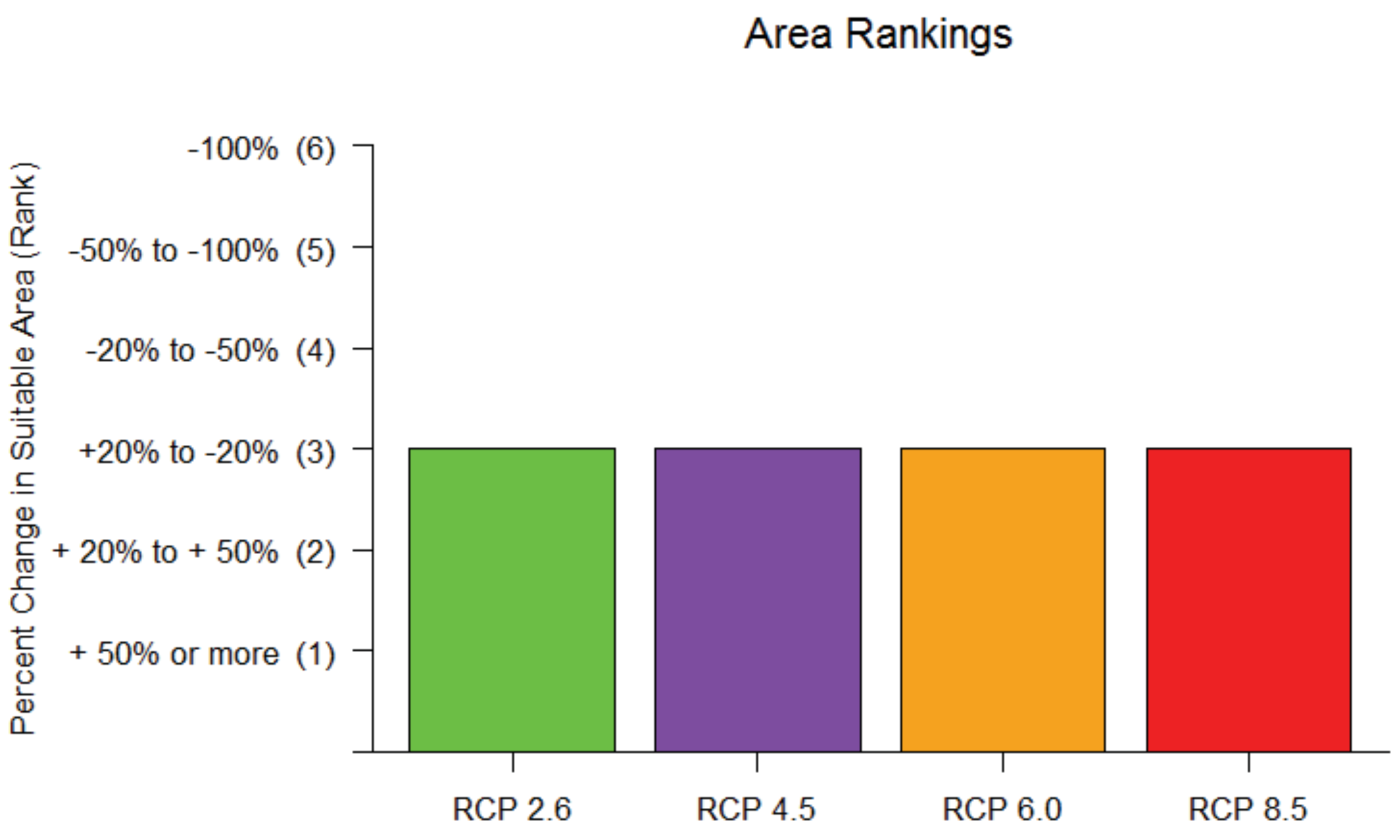

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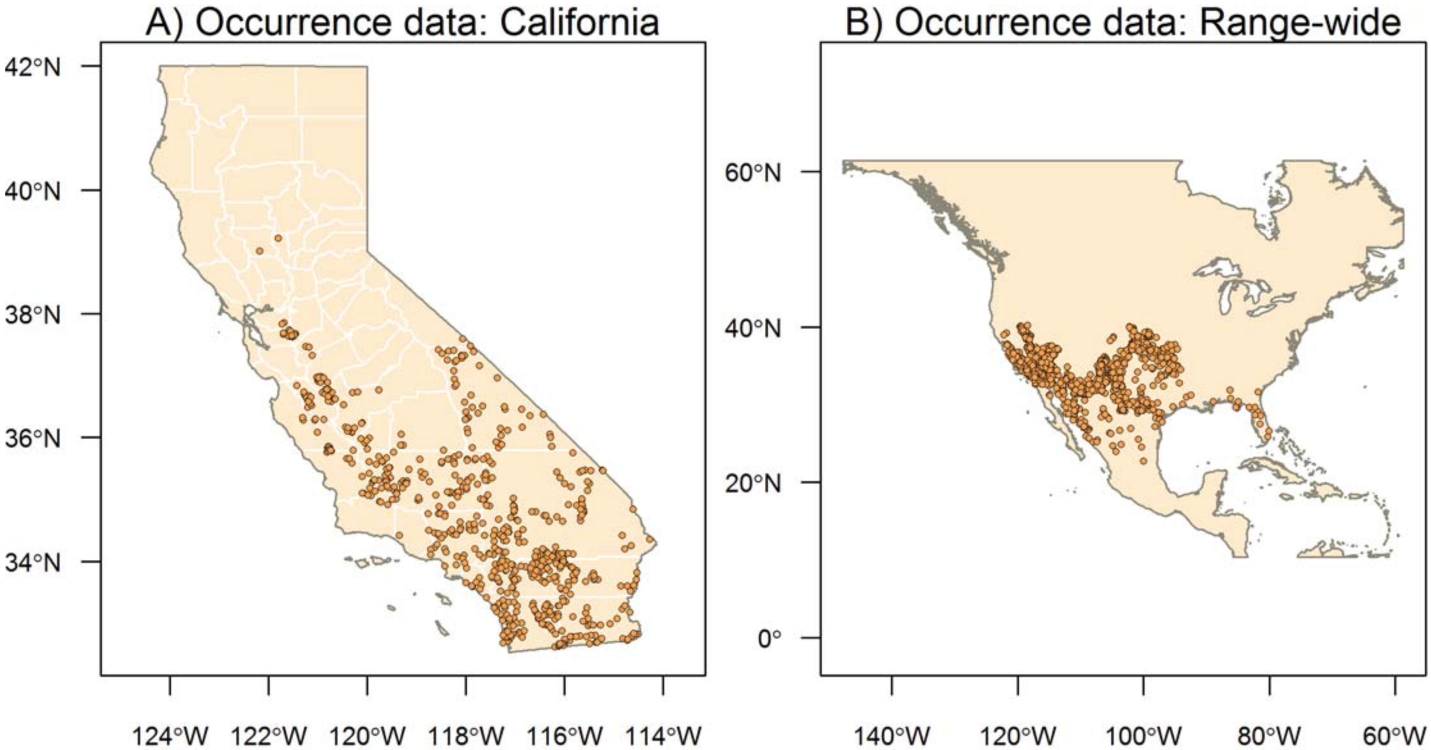
Species Results: *Masticophis flagellum* Coachwhip



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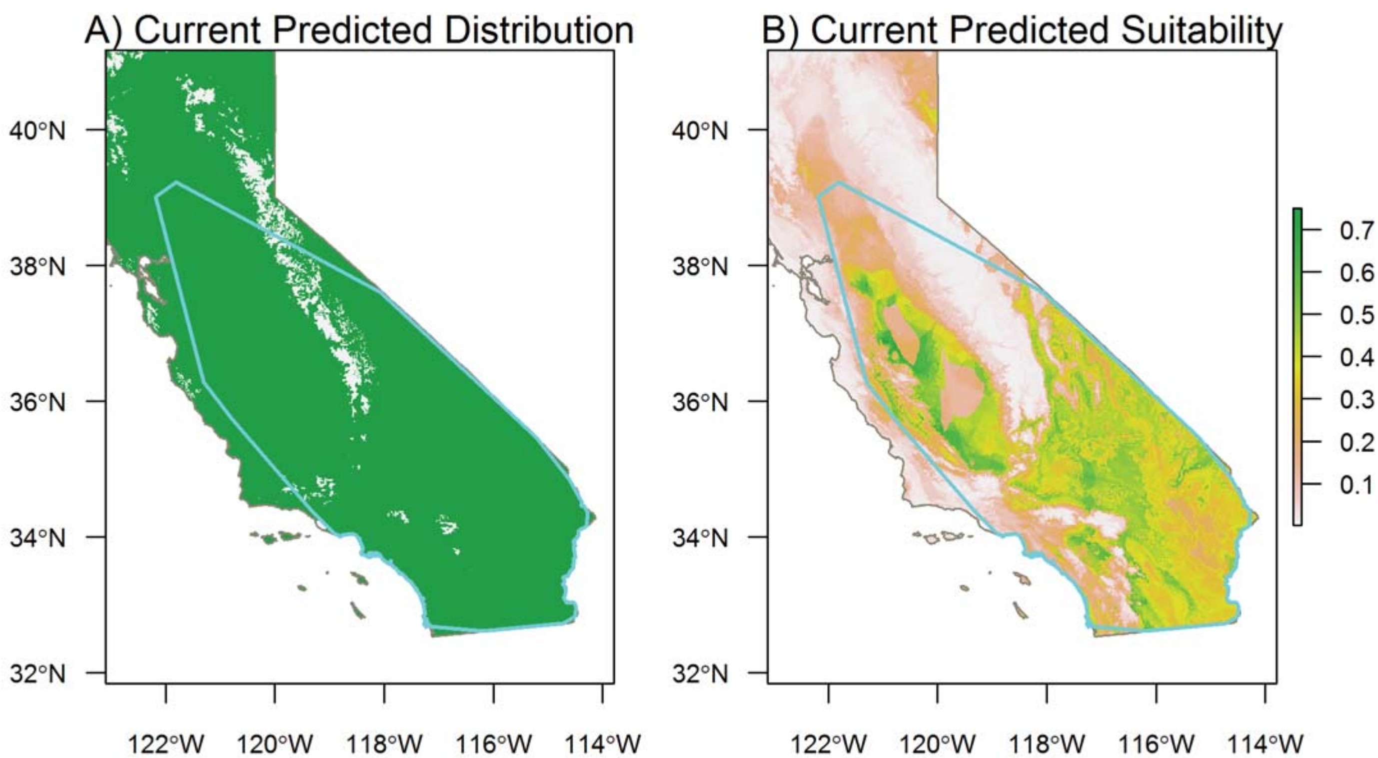

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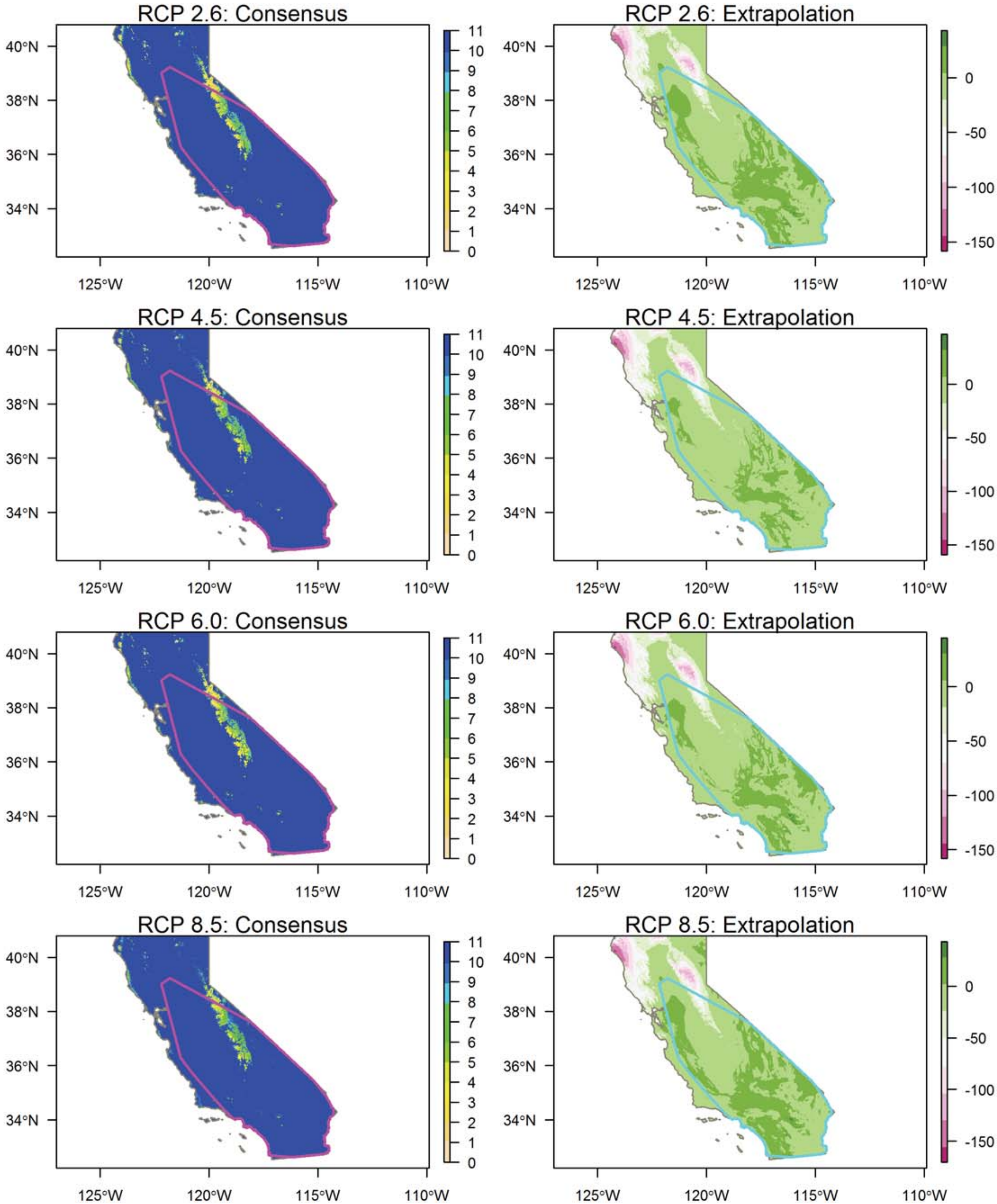
Species Results: *Masticophis flagellum* Coachwhip



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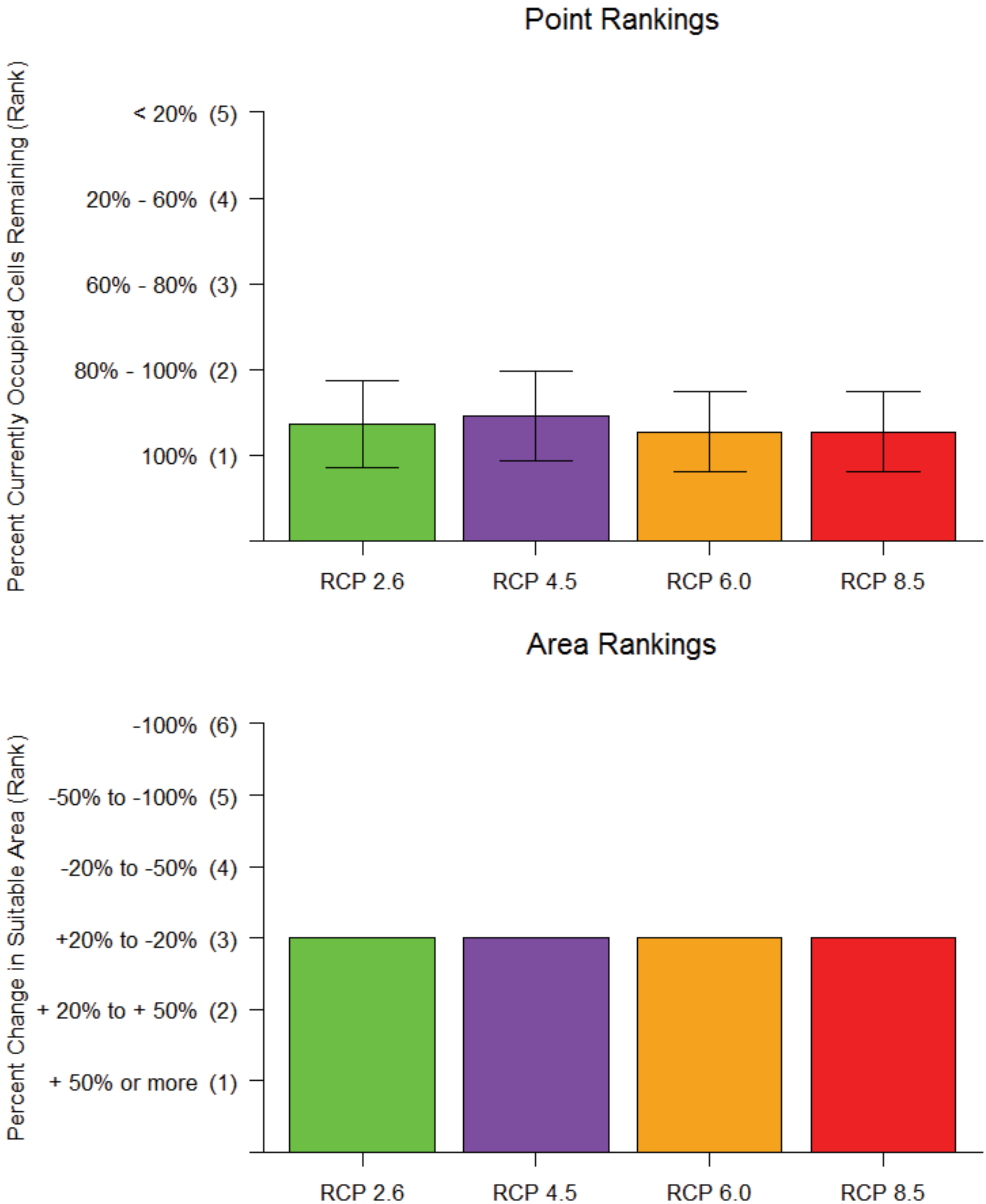
Species Results: *Masticophis flagellum* Coachwhip



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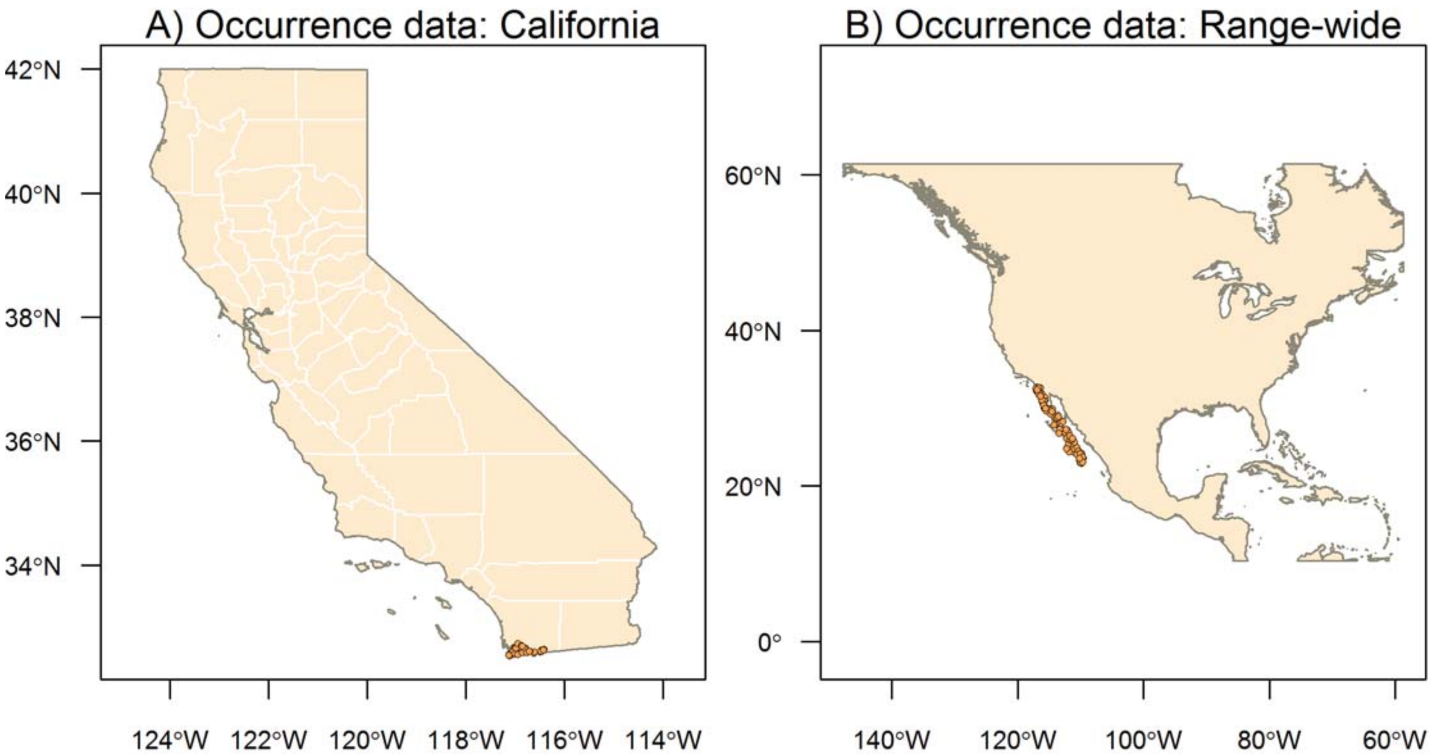
Species Results: *Maticophis fuliginosus* Baja California Coachwhip



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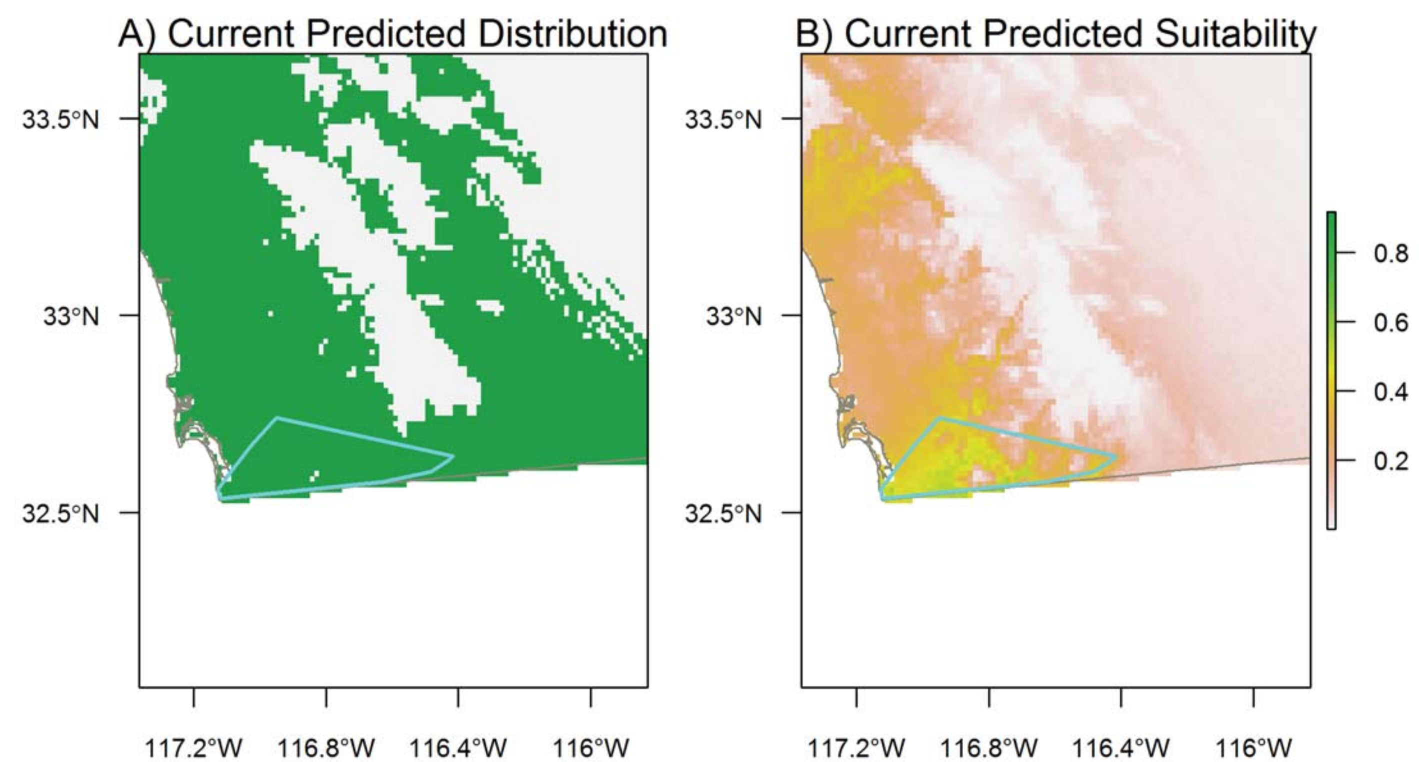

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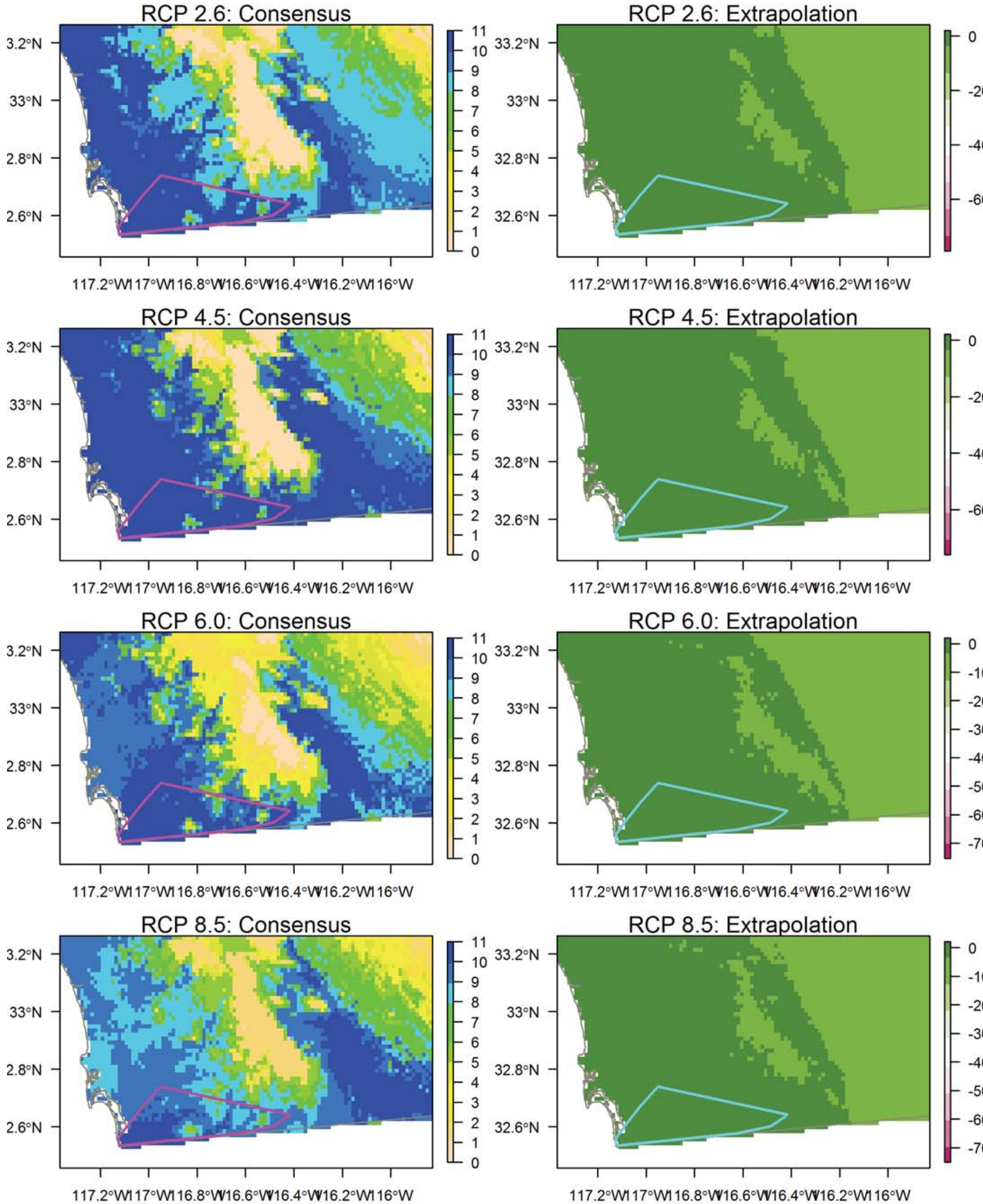

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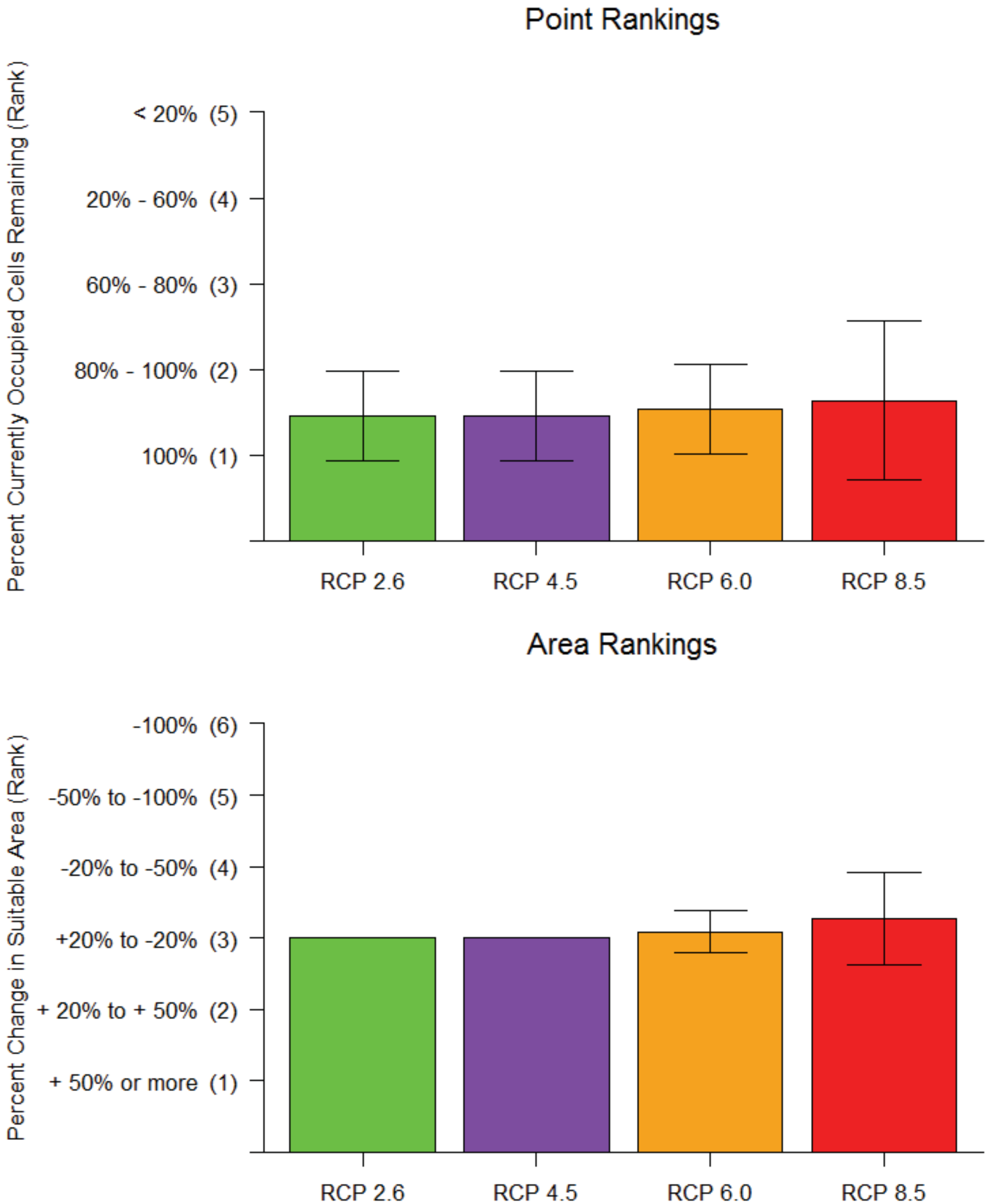

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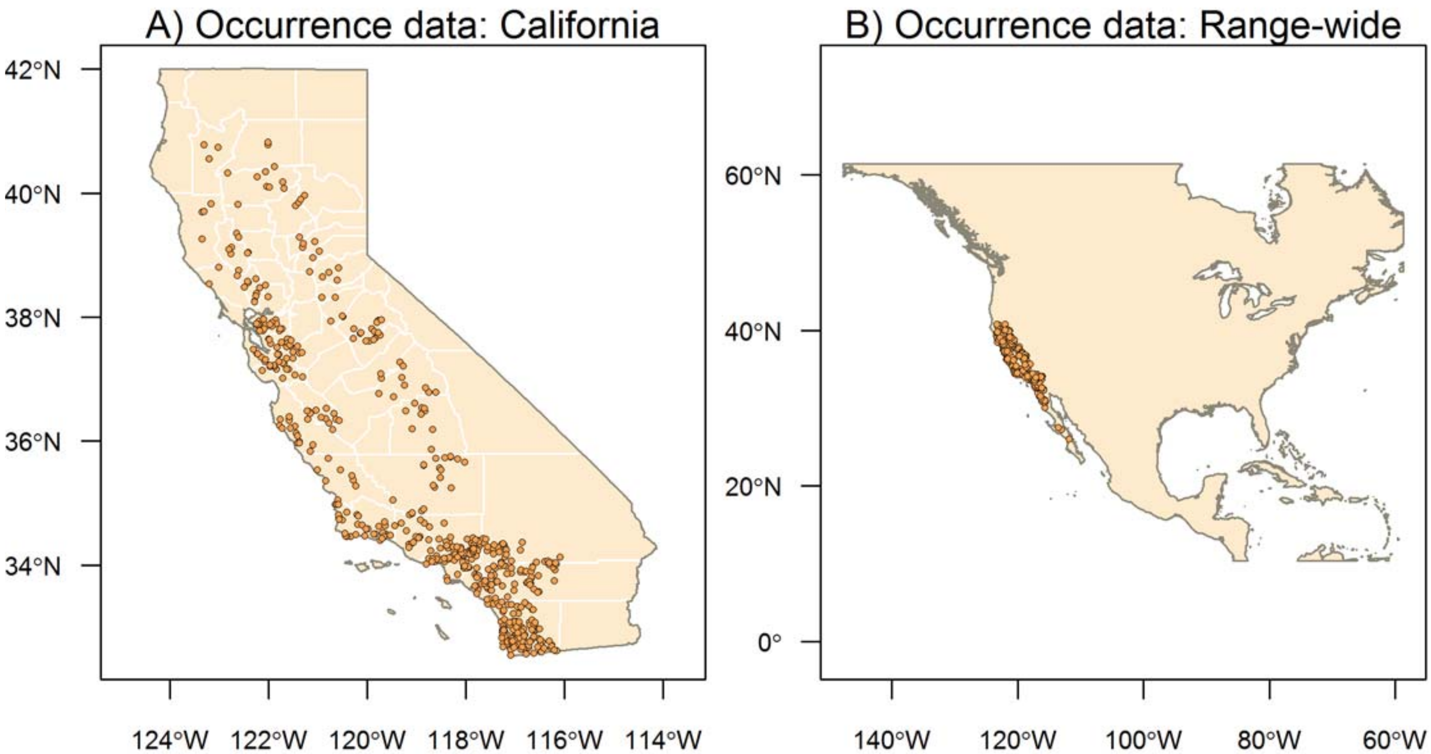
Species Results: *Masticophis lateralis* California Whipsnake



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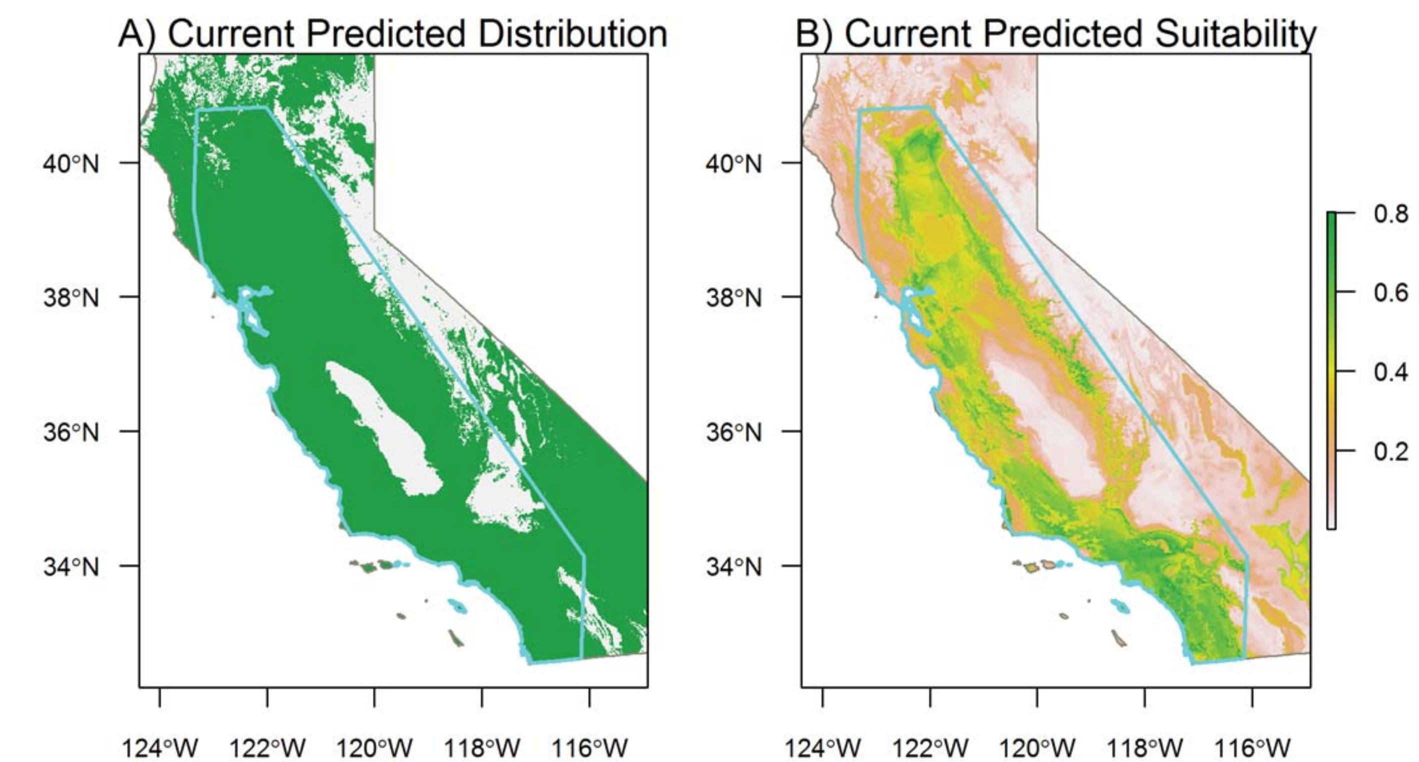

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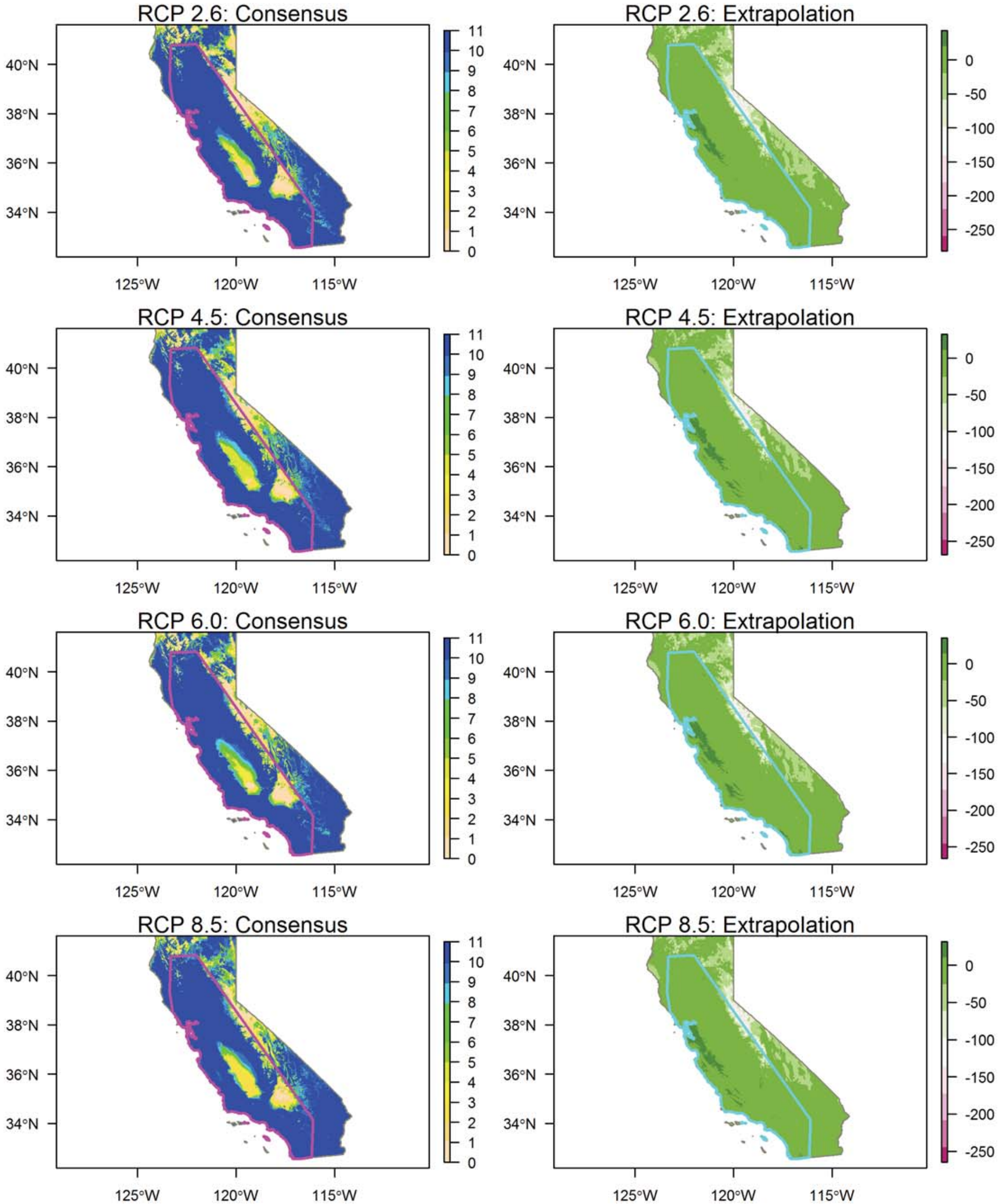

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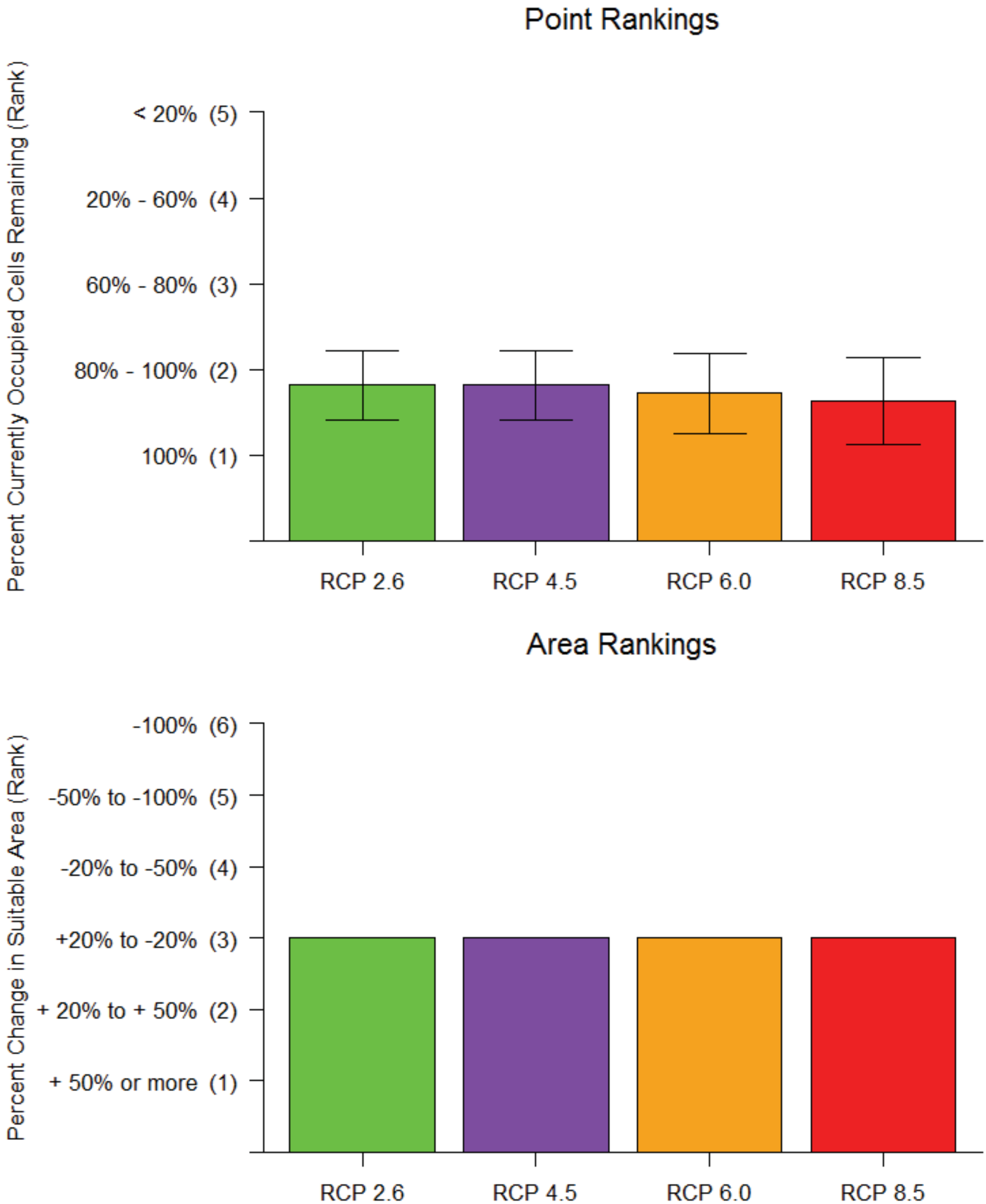
Species Results: *Masticophis lateralis* California Whipsnake



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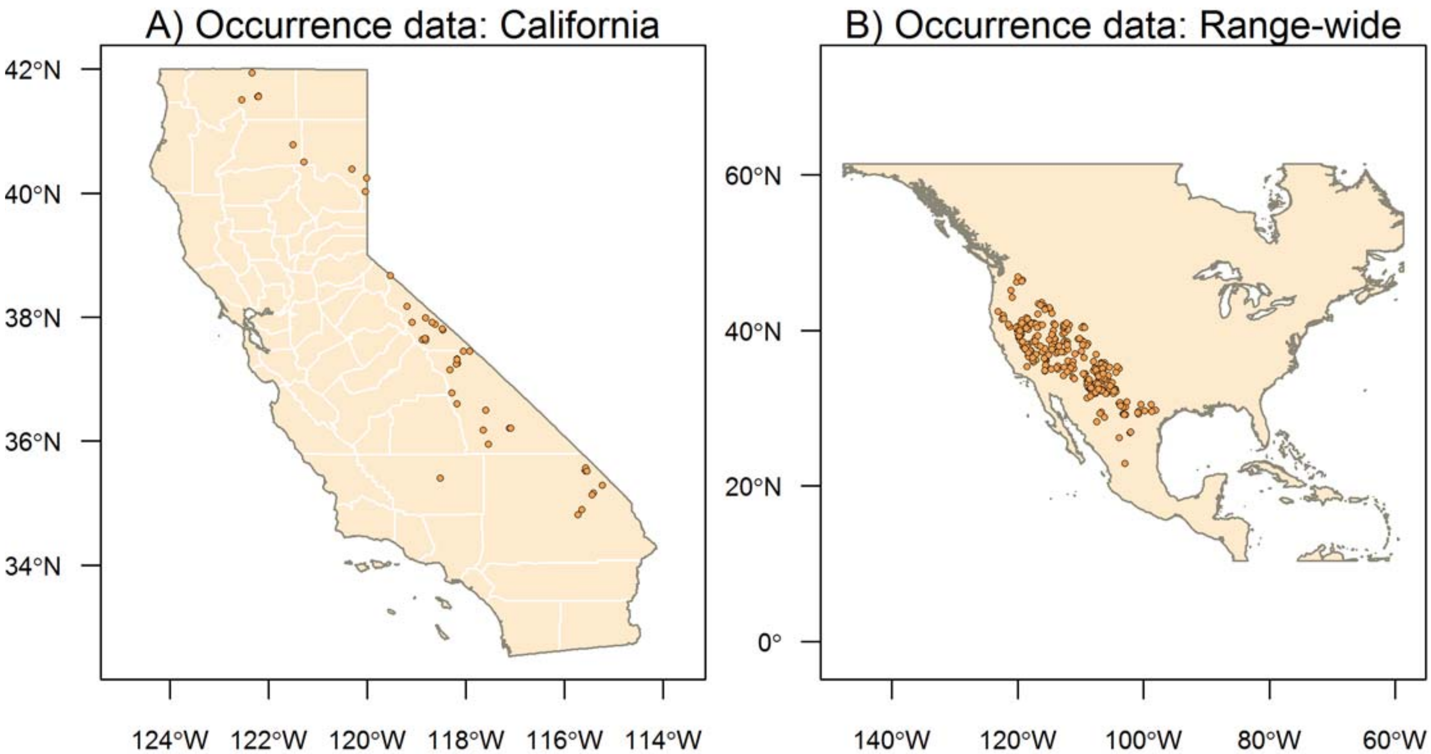
Species Results: *Masticophis taeniatus* Striped Whipsnake



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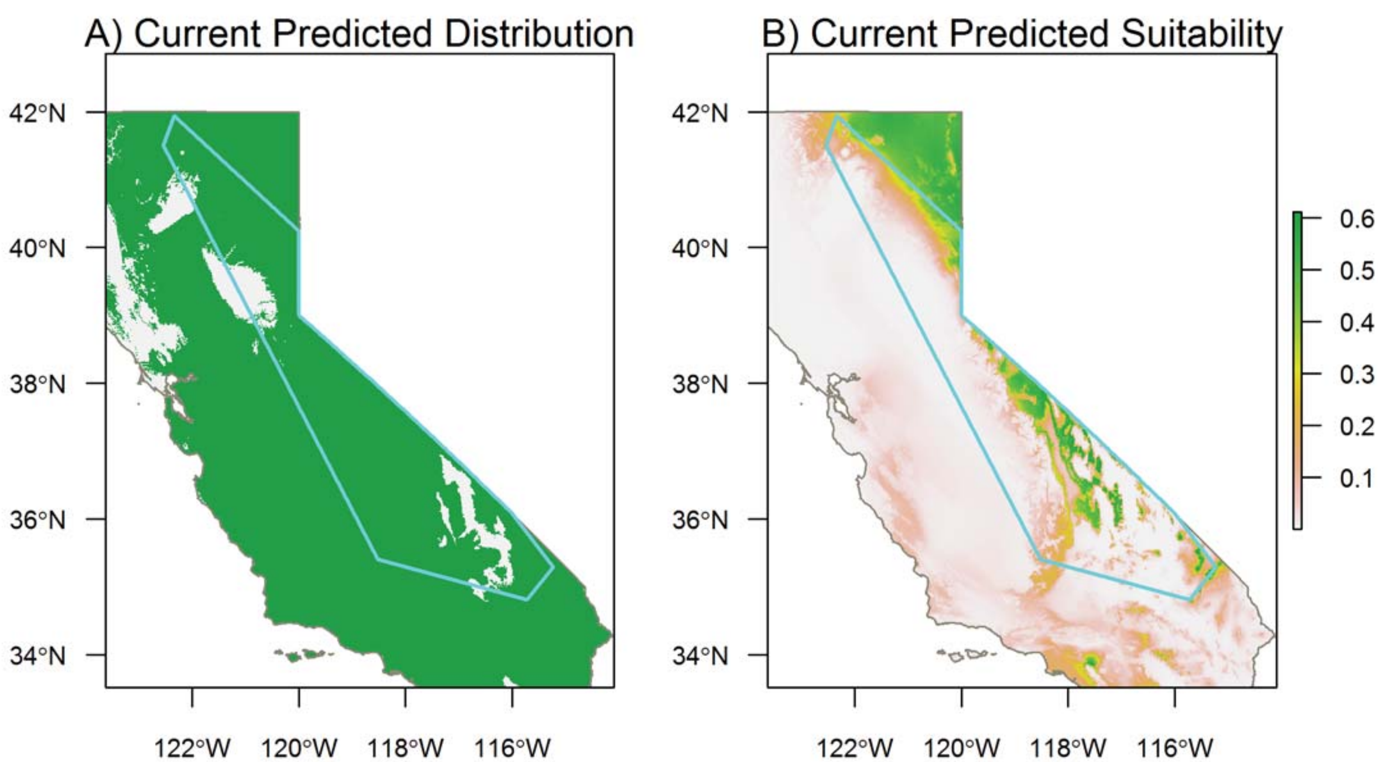

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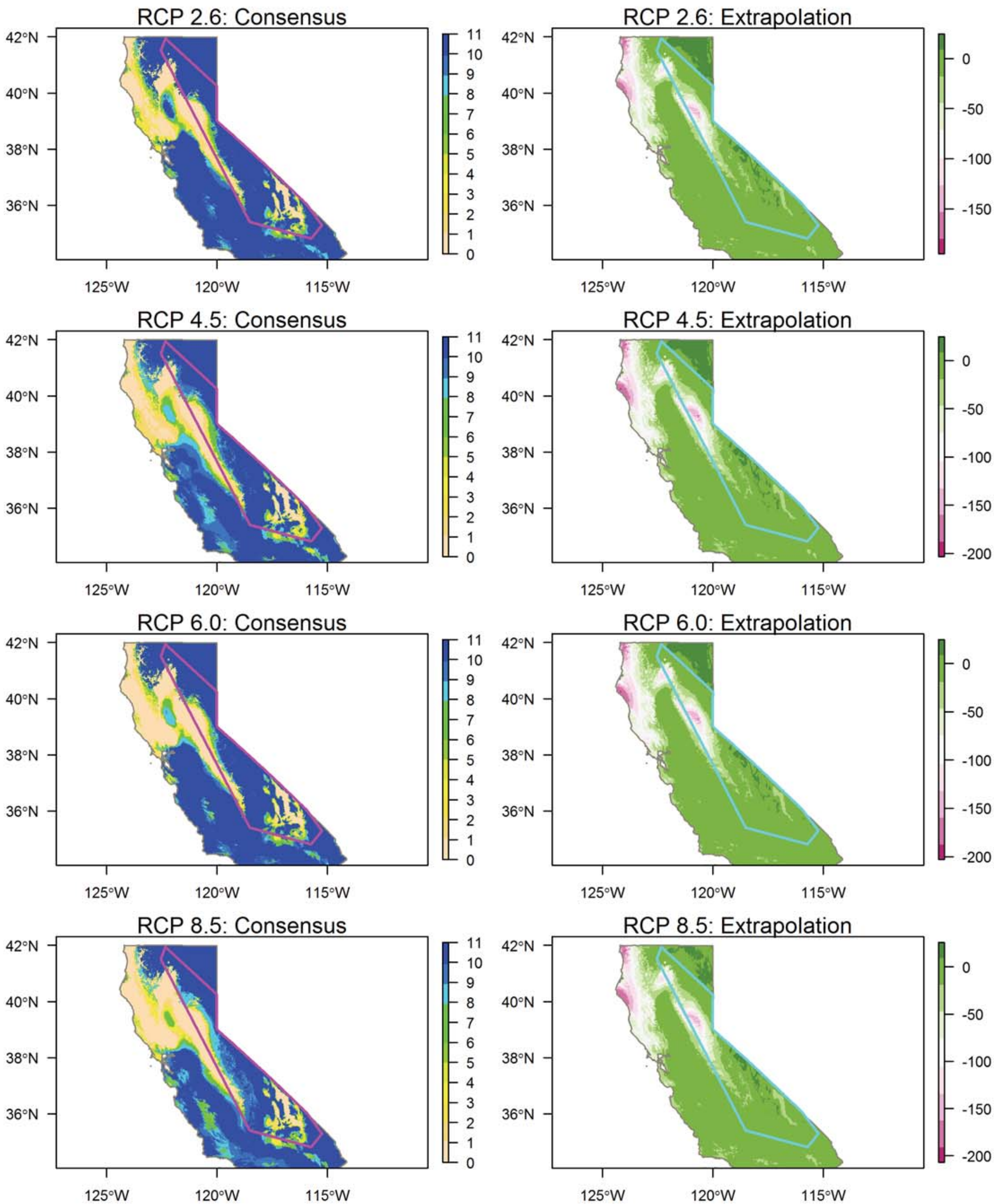
Species Results: *Masticophis taeniatus* Striped Whipsnake



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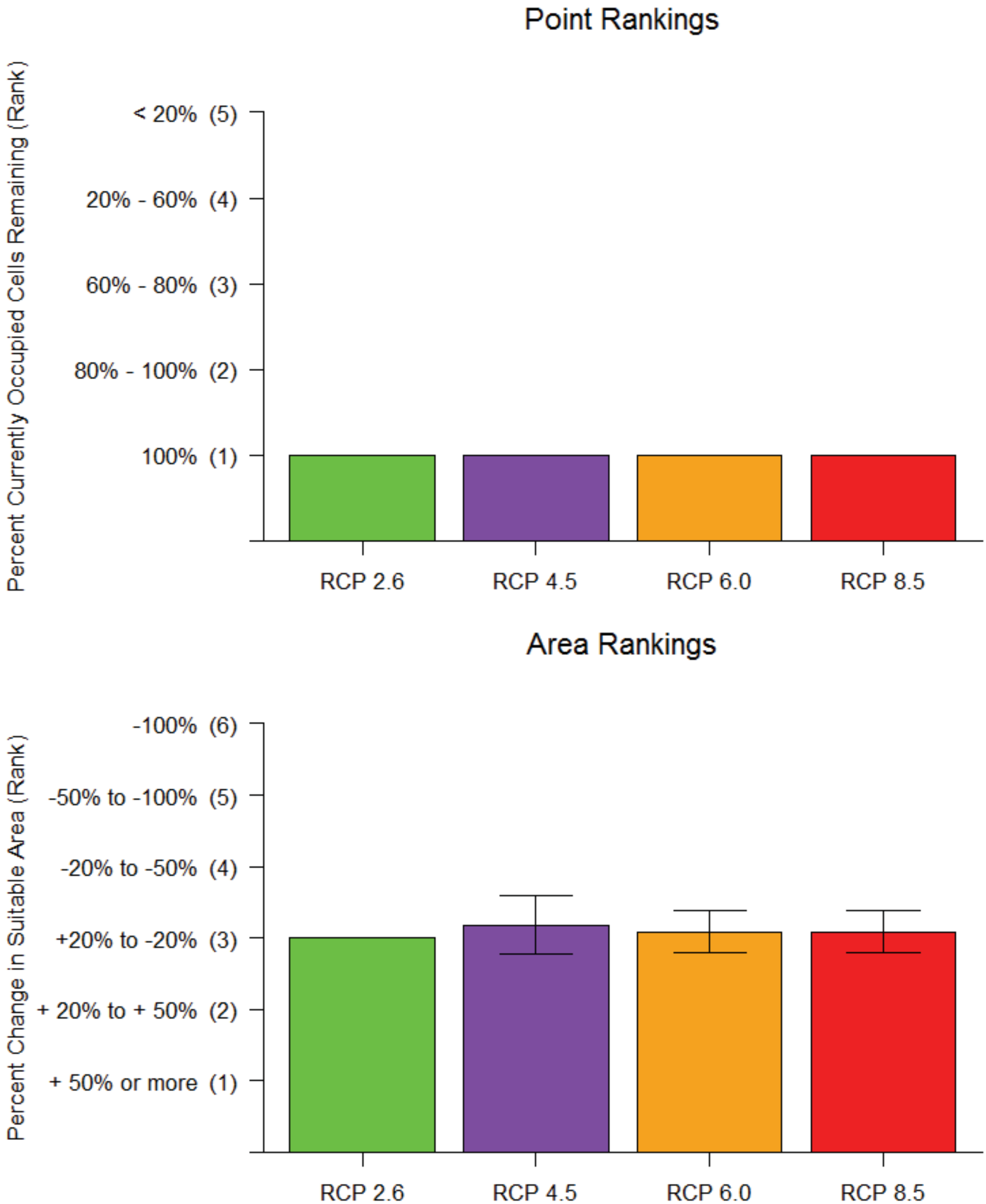
Species Results: *Masticophis taeniatus* Striped Whipsnake



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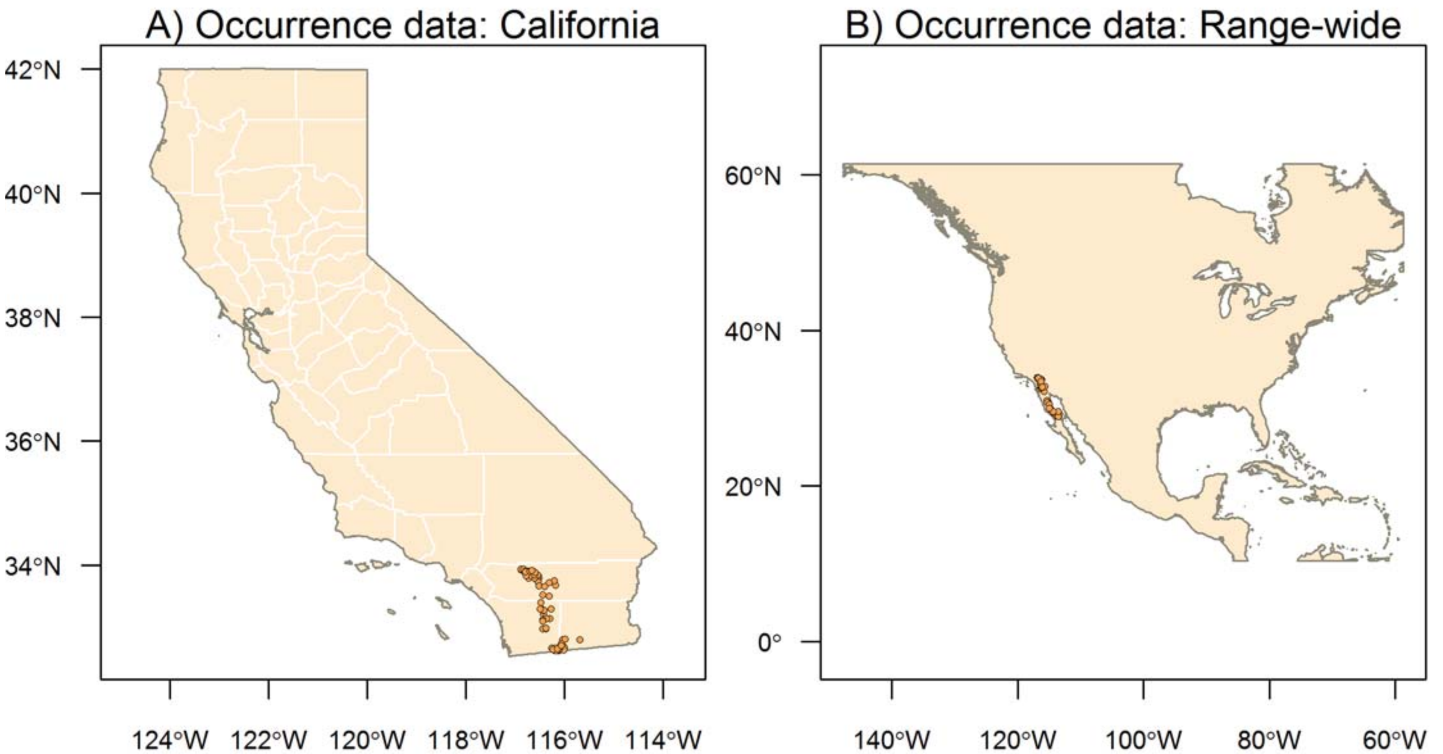
Species Results: *Petrosaurus mearnsi* Banded Rock Lizard



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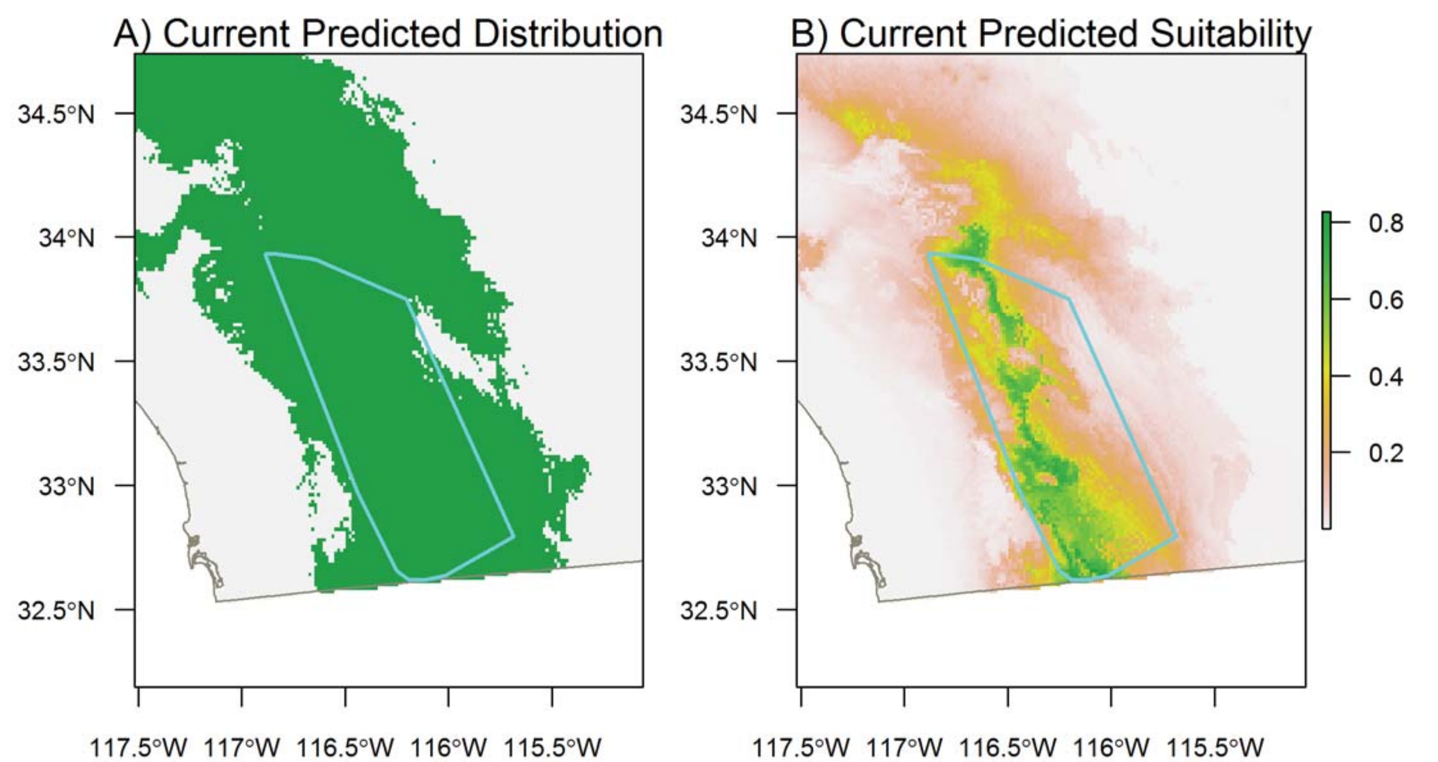

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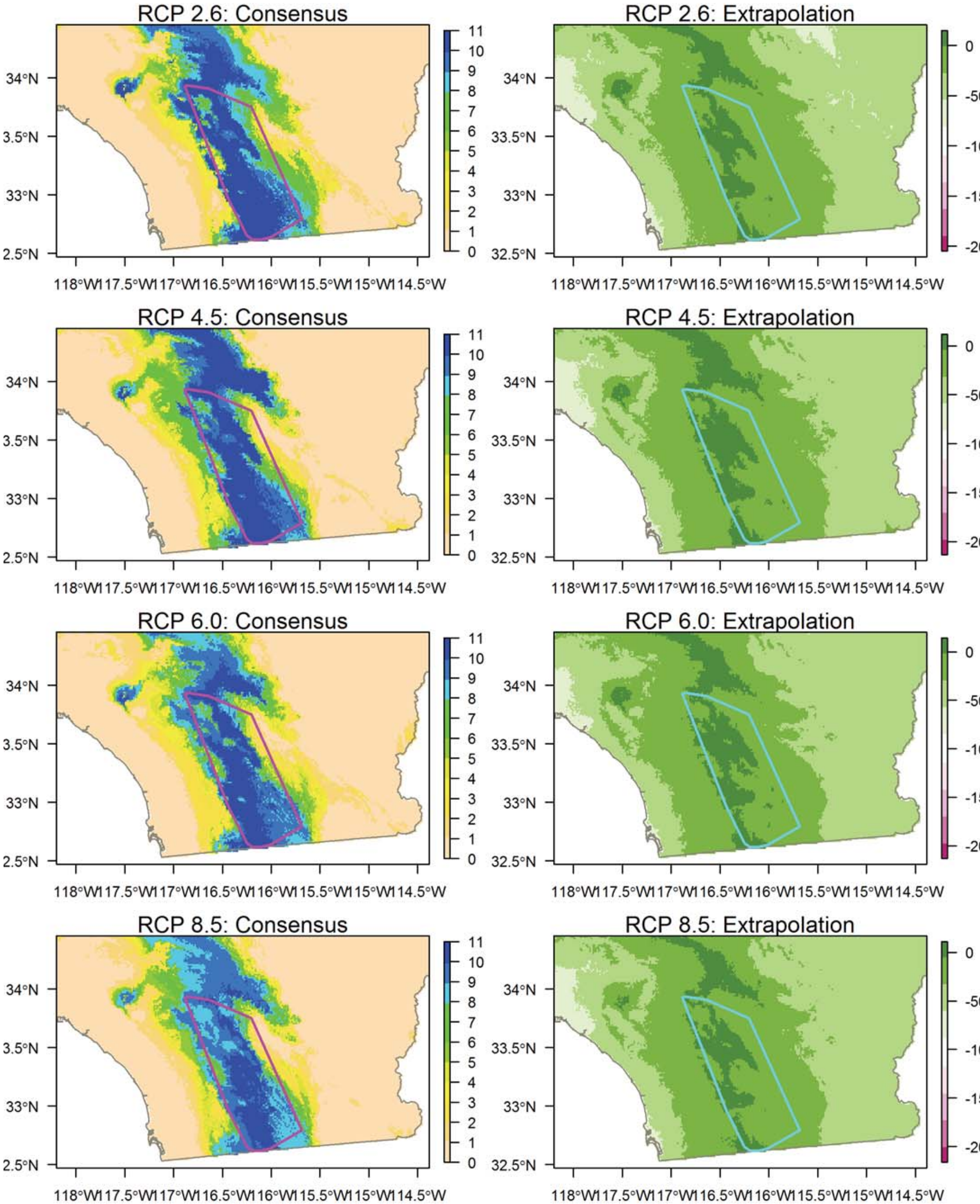
Species Results: *Petrosaurus mearnsi* Banded Rock Lizard



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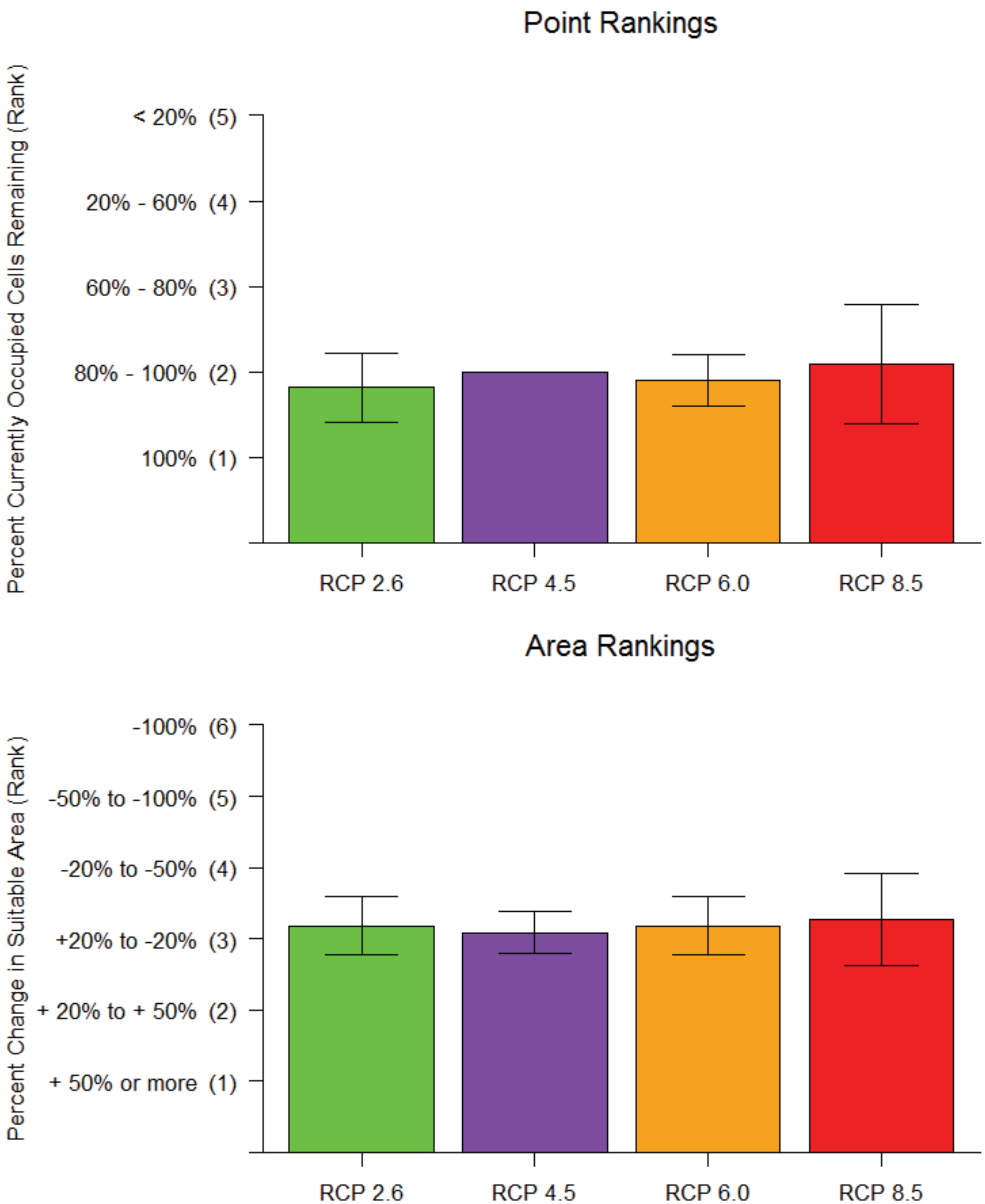
Species Results: *Petrosaurus mearnsi* Banded Rock Lizard



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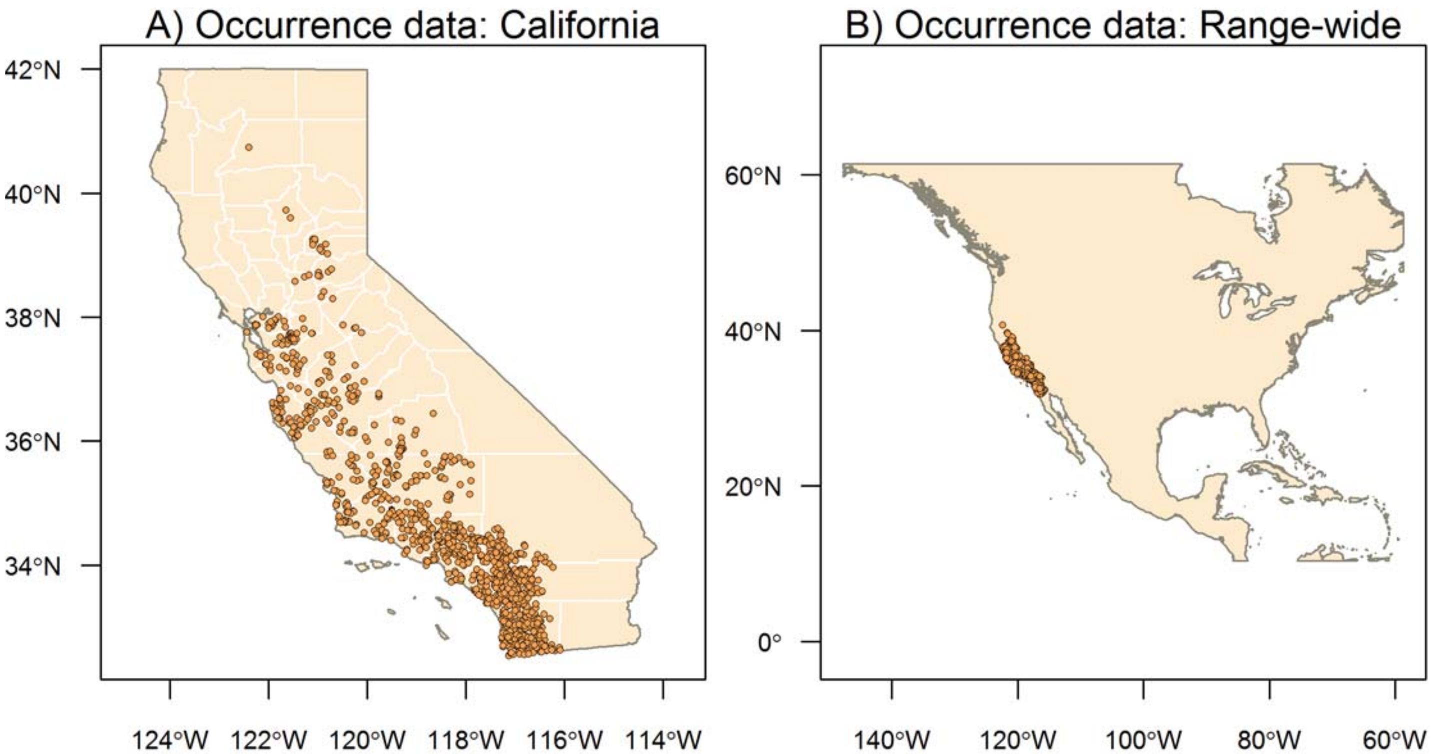
Species Results: *Phrynosoma blainvillii* Coast Horned Lizard



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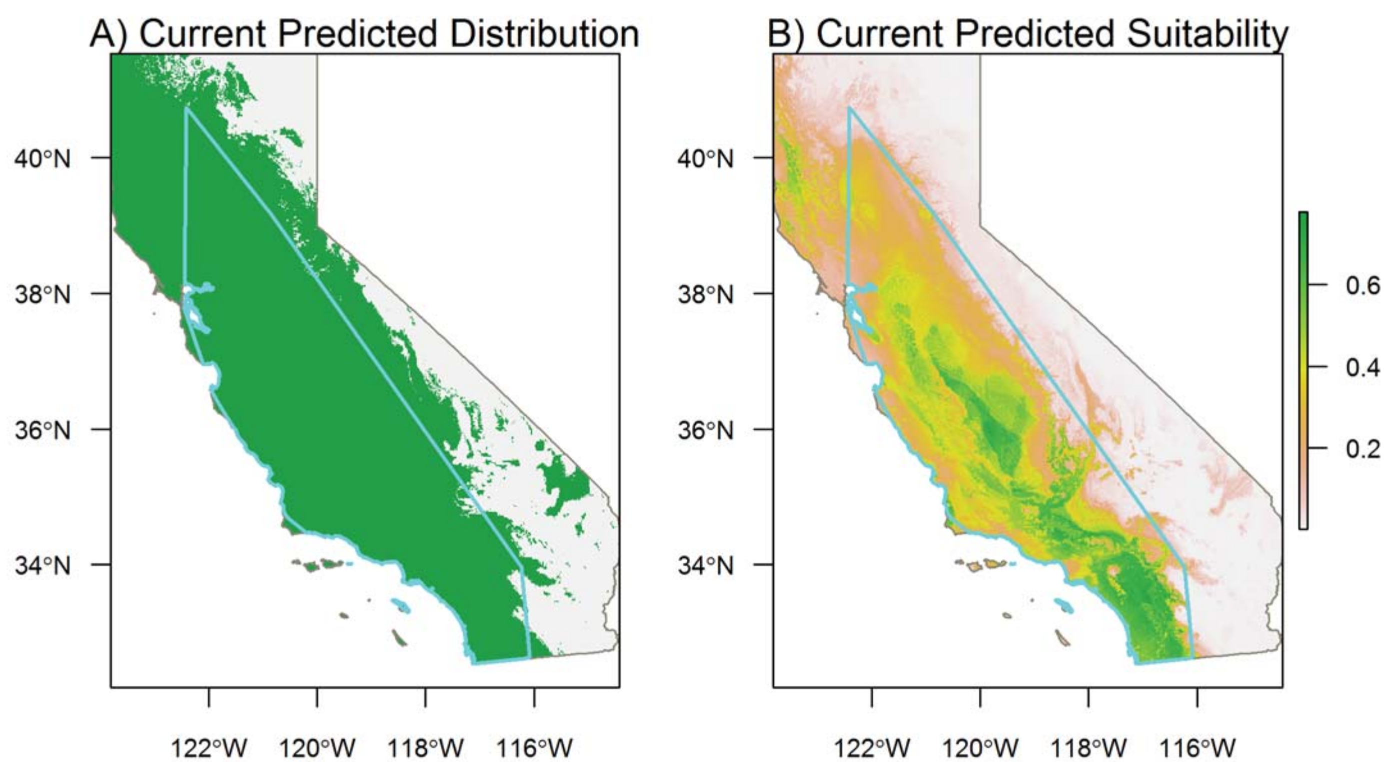

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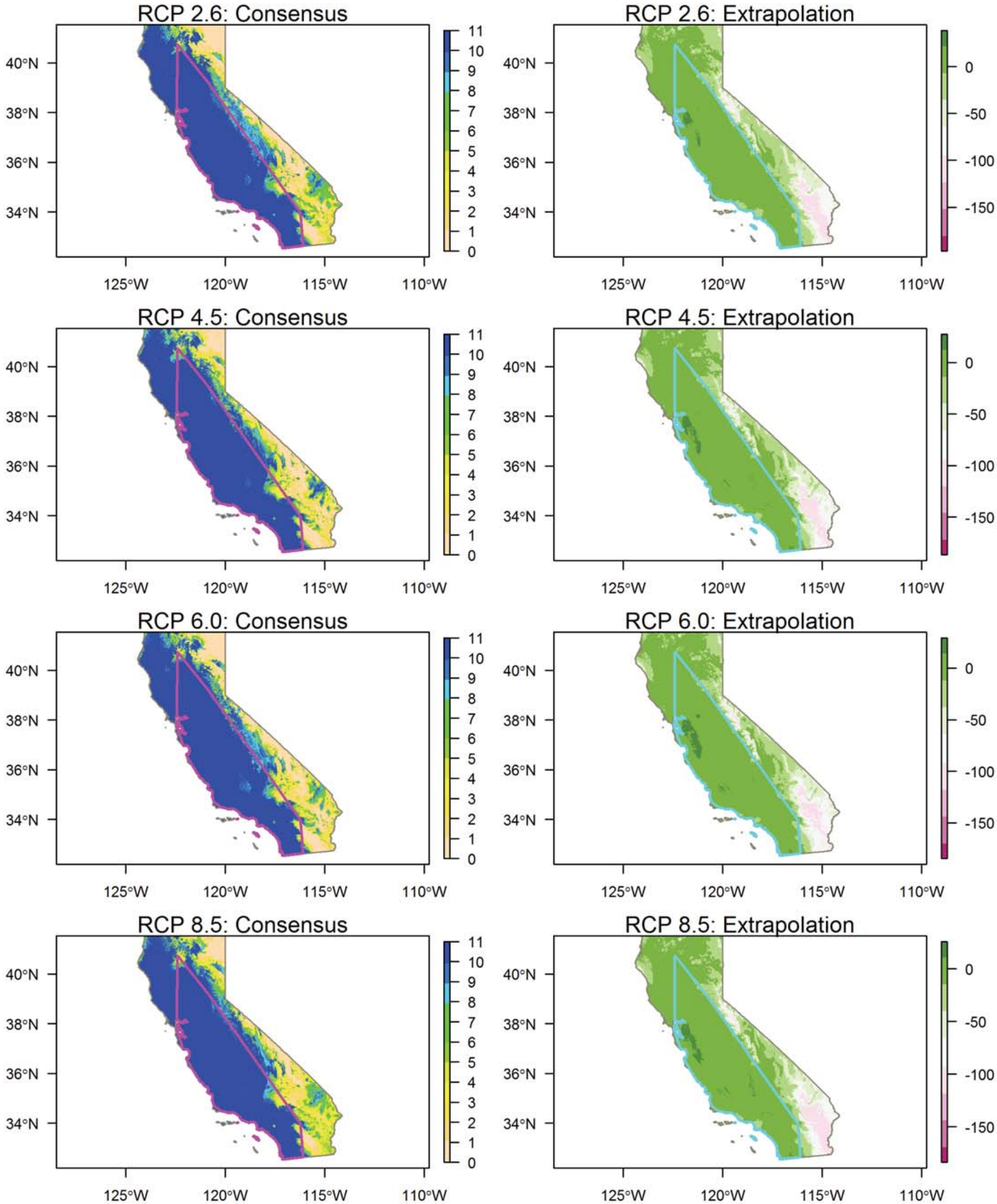
Species Results: *Phrynosoma blainvillii* Coast Horned Lizard



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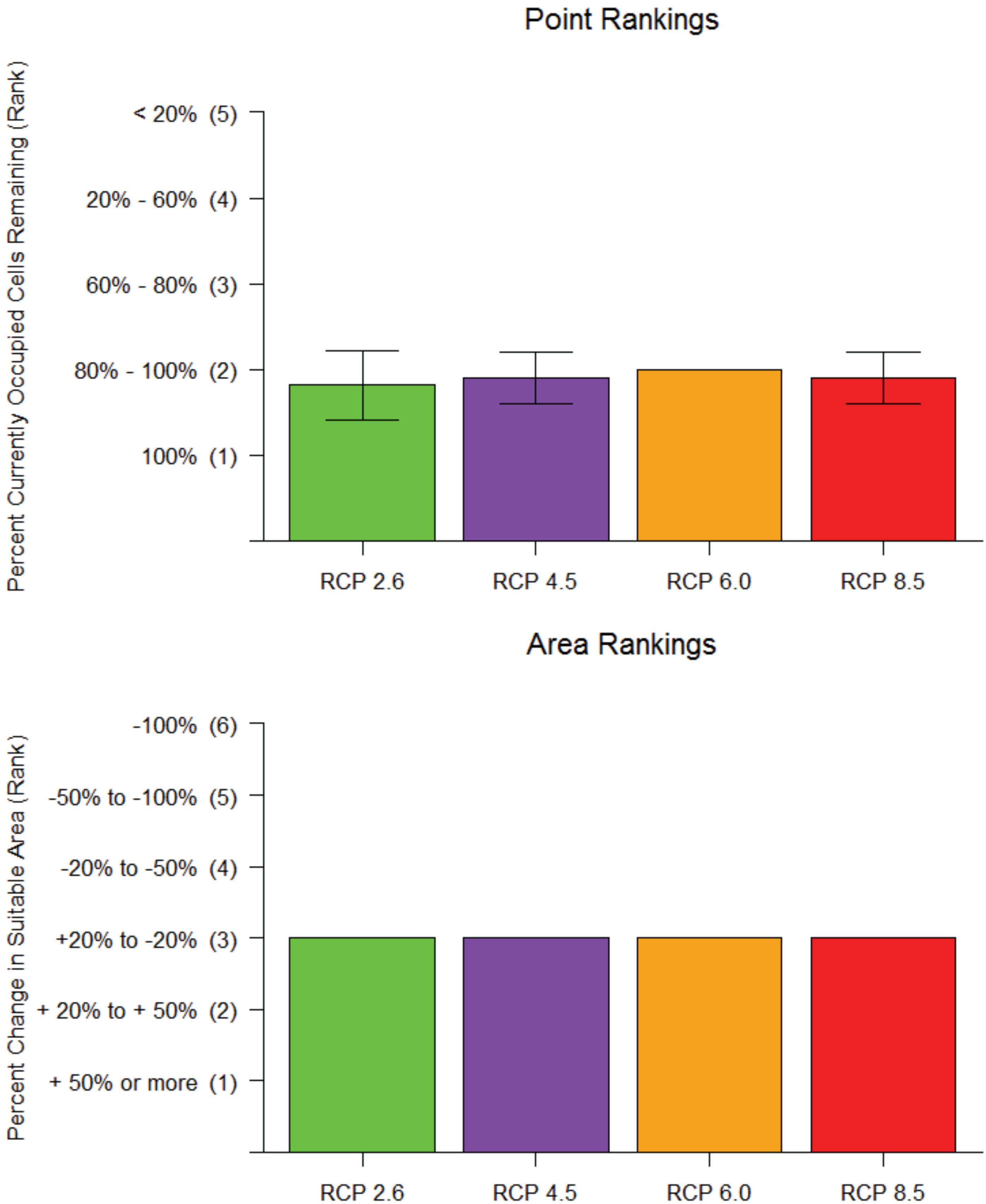
Species Results: *Phrynosoma blainvillii* Coast Horned Lizard



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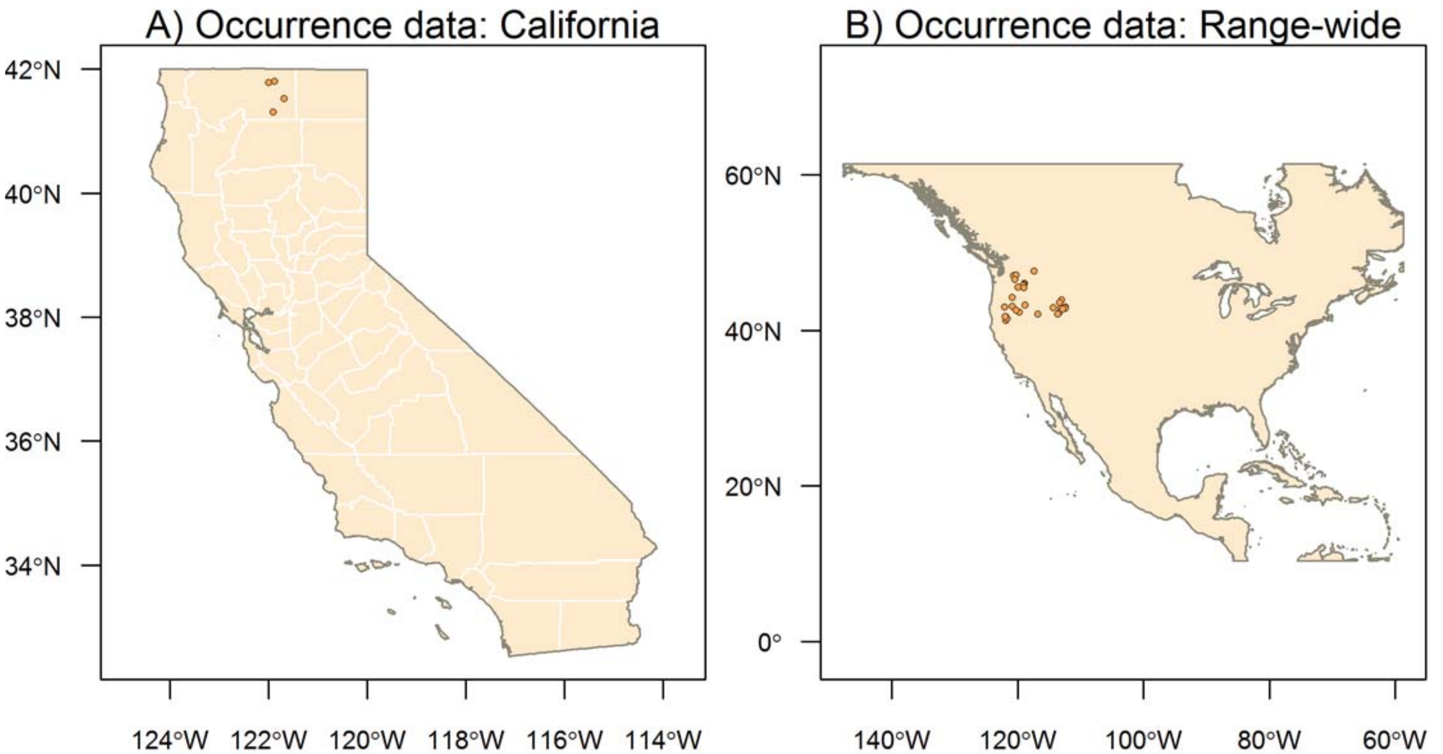
Species Results: *Phrynosoma douglasii* Pygmy Horned Lizard



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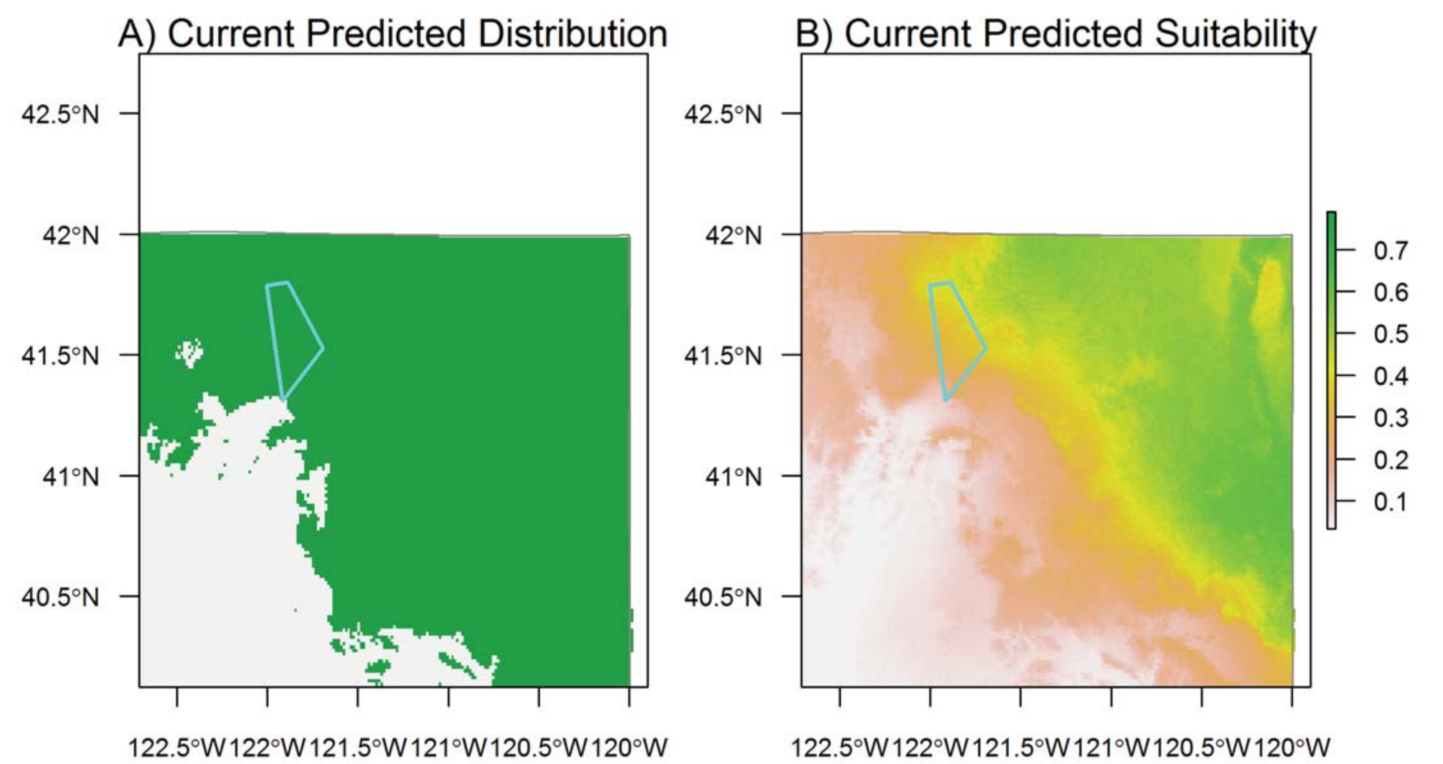

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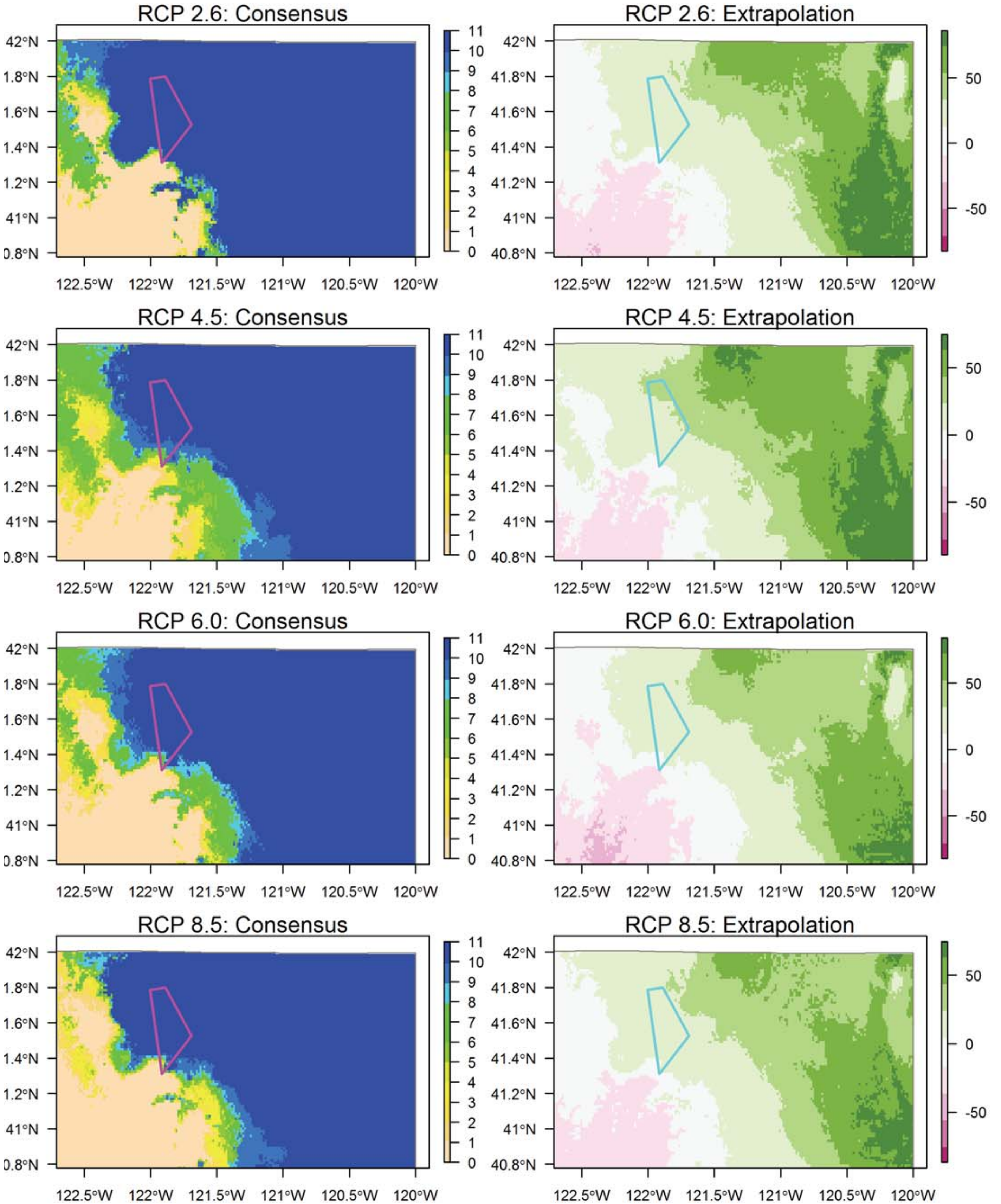

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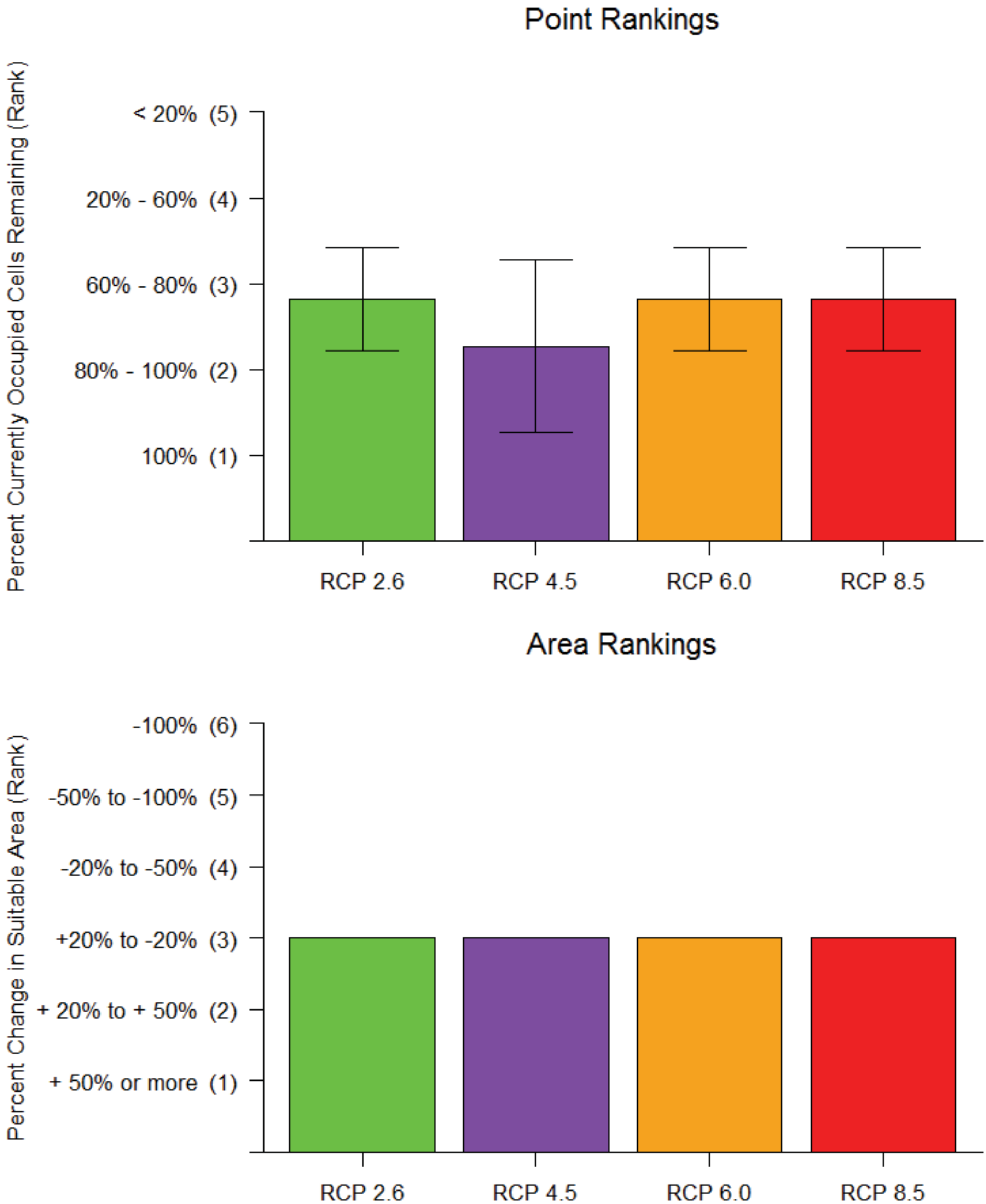
Species Results: *Phrynosoma douglasii* Pygmy Horned Lizard



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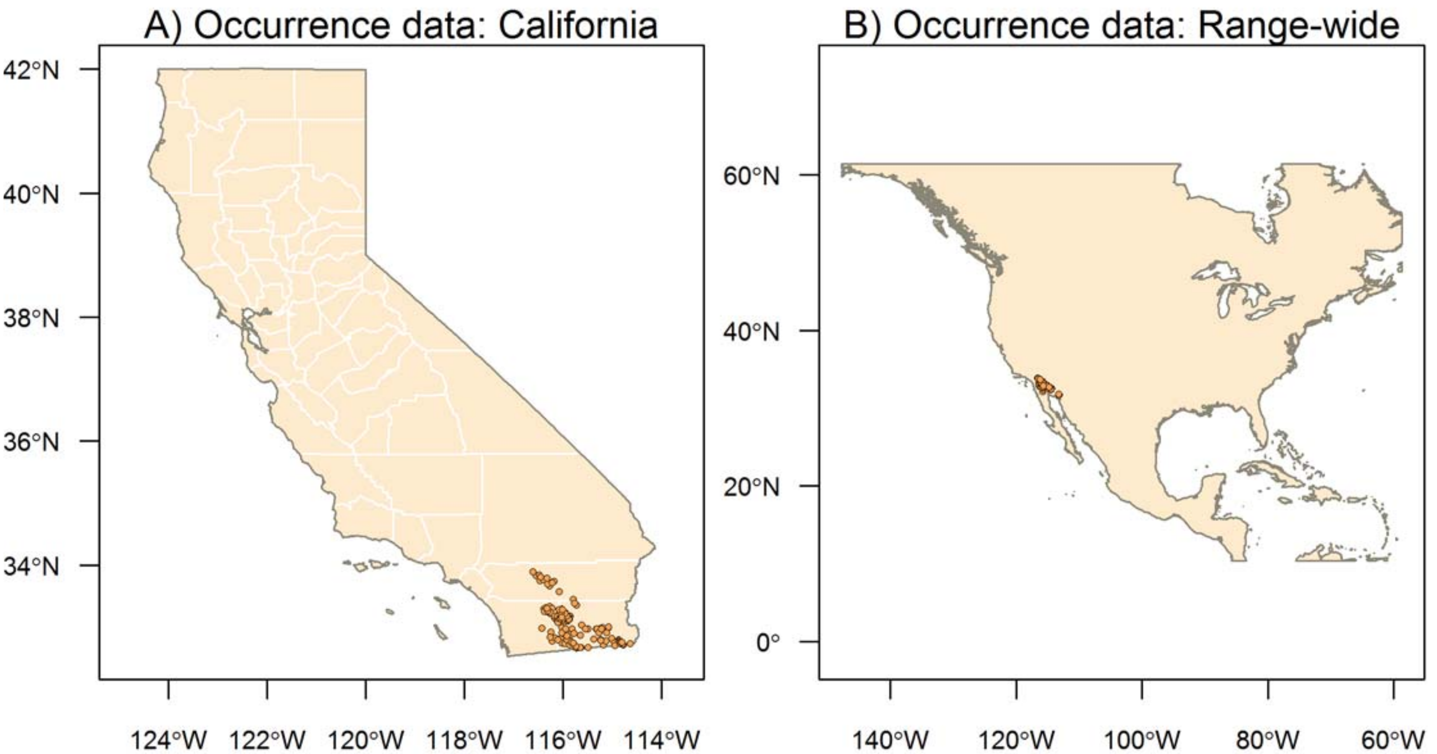
Species Results: *Phyrnosoma mcallii* Flat-tailed Horned Lizard



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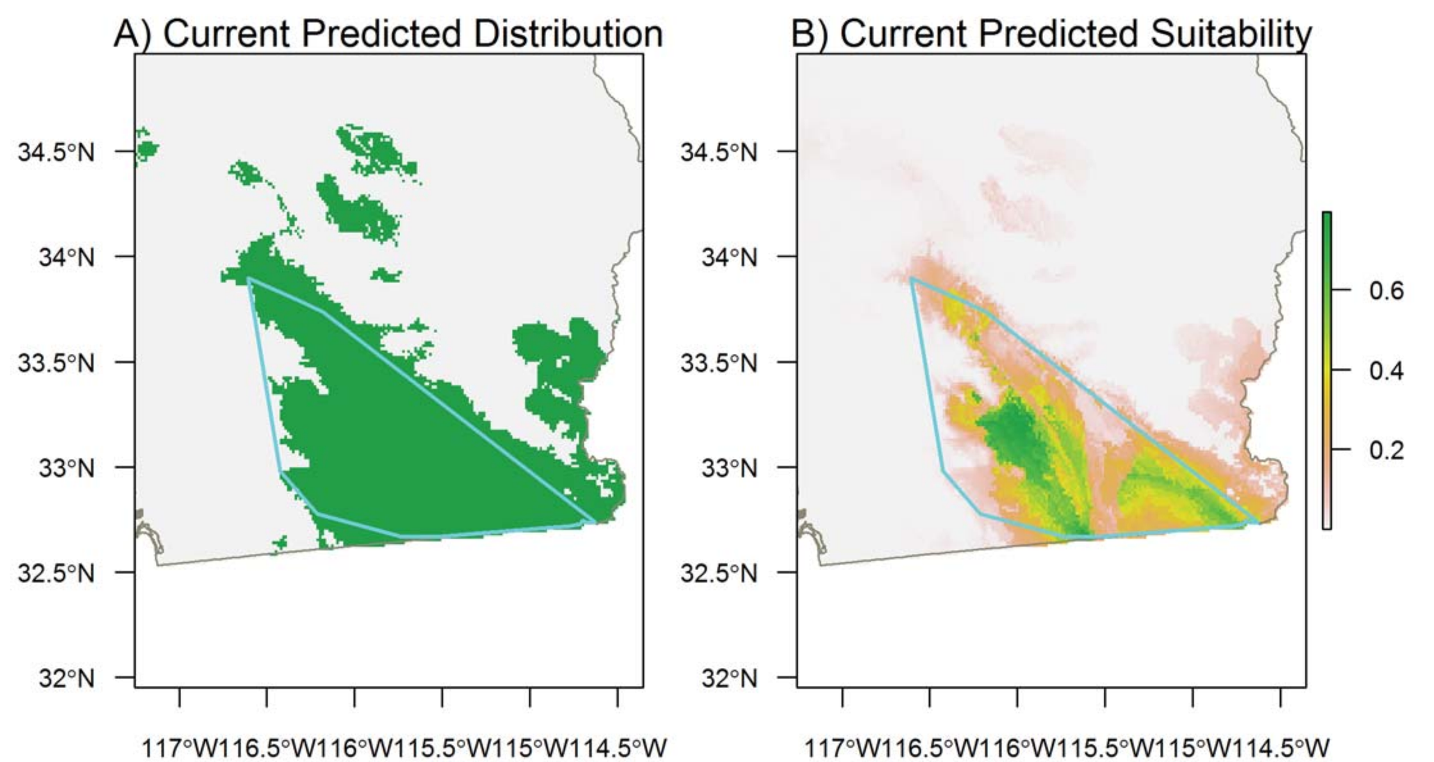

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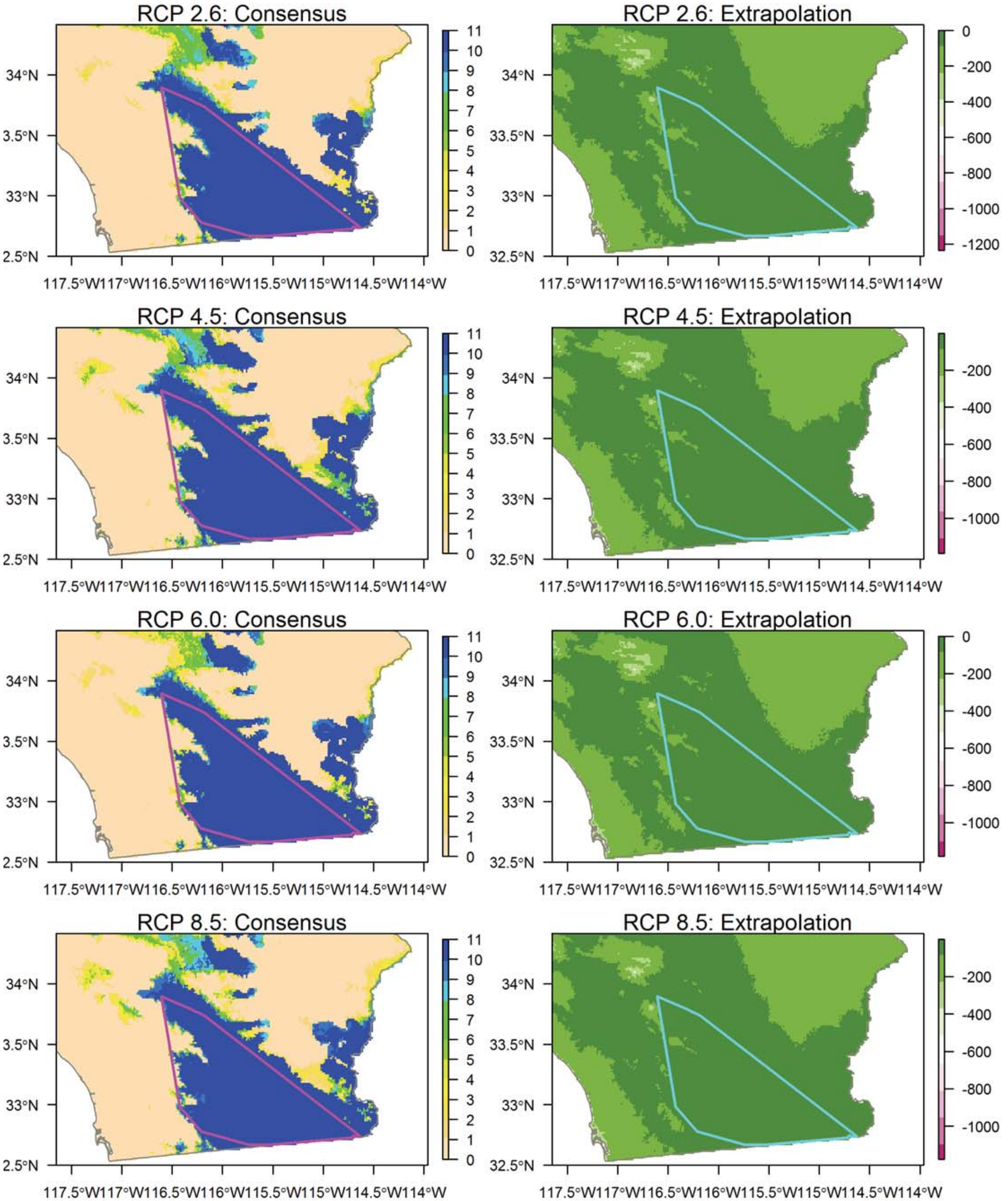
Species Results: *Phyrnosoma mcallii* Flat-tailed Horned Lizard



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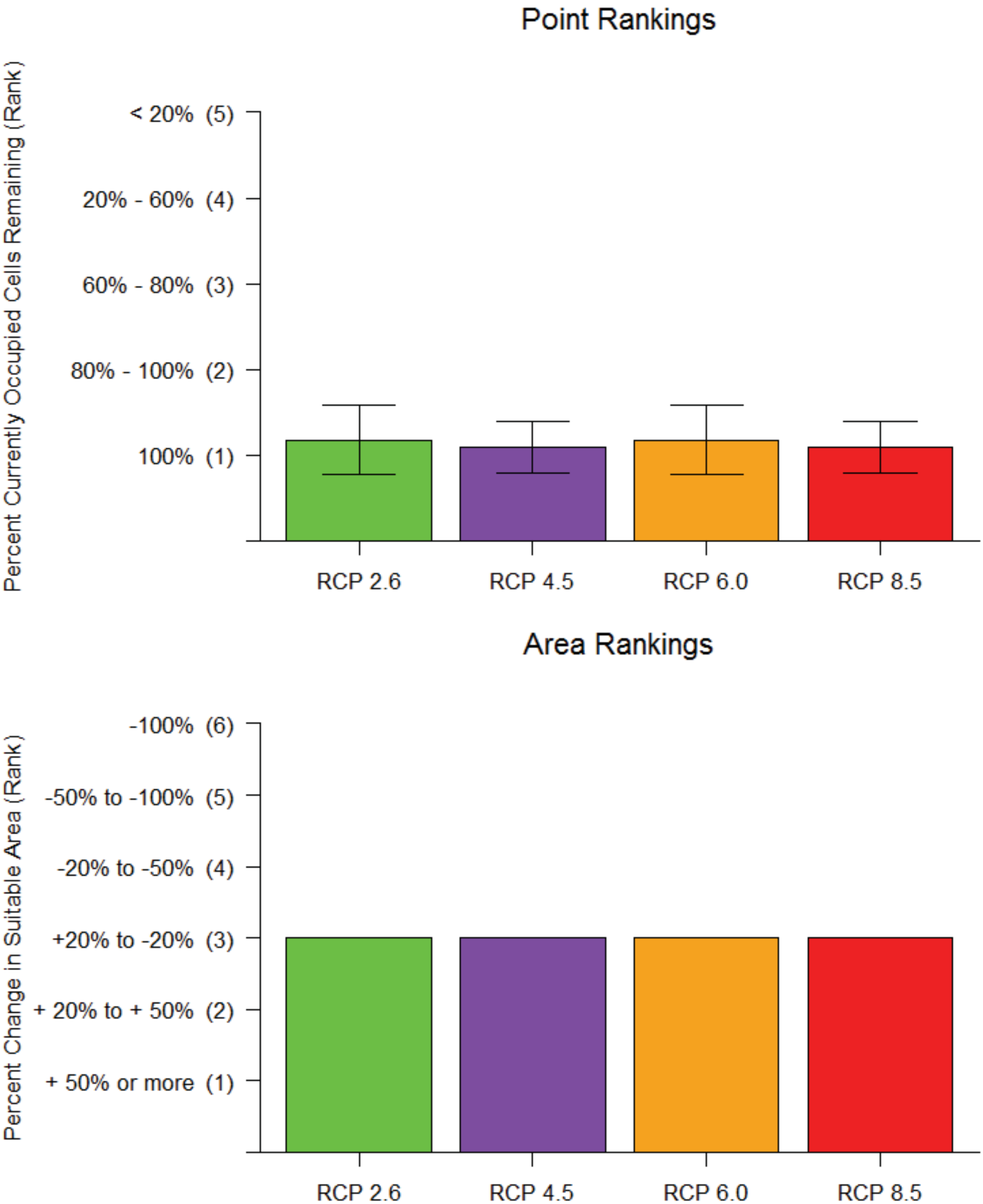

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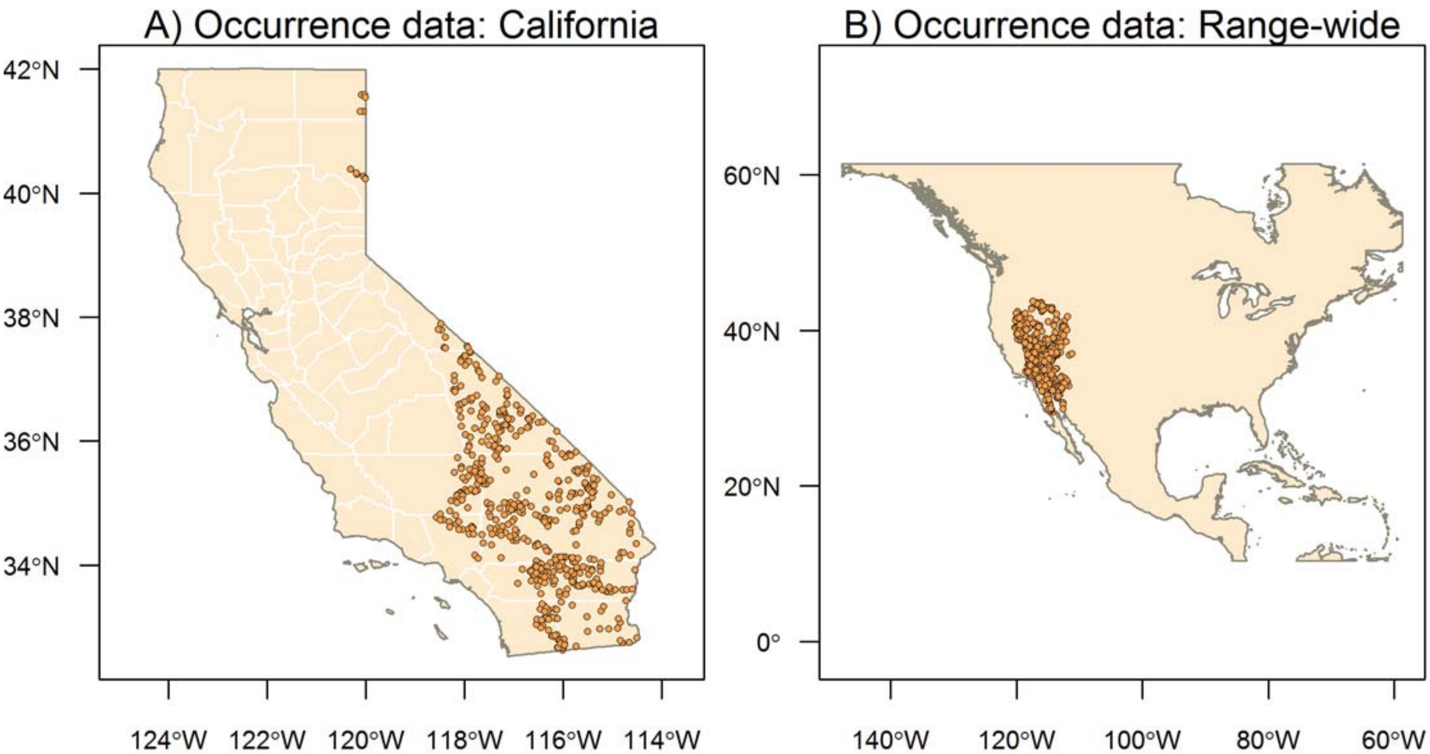
Species Results: *Phrynosoma platyrhinos* Desert Horned Lizard



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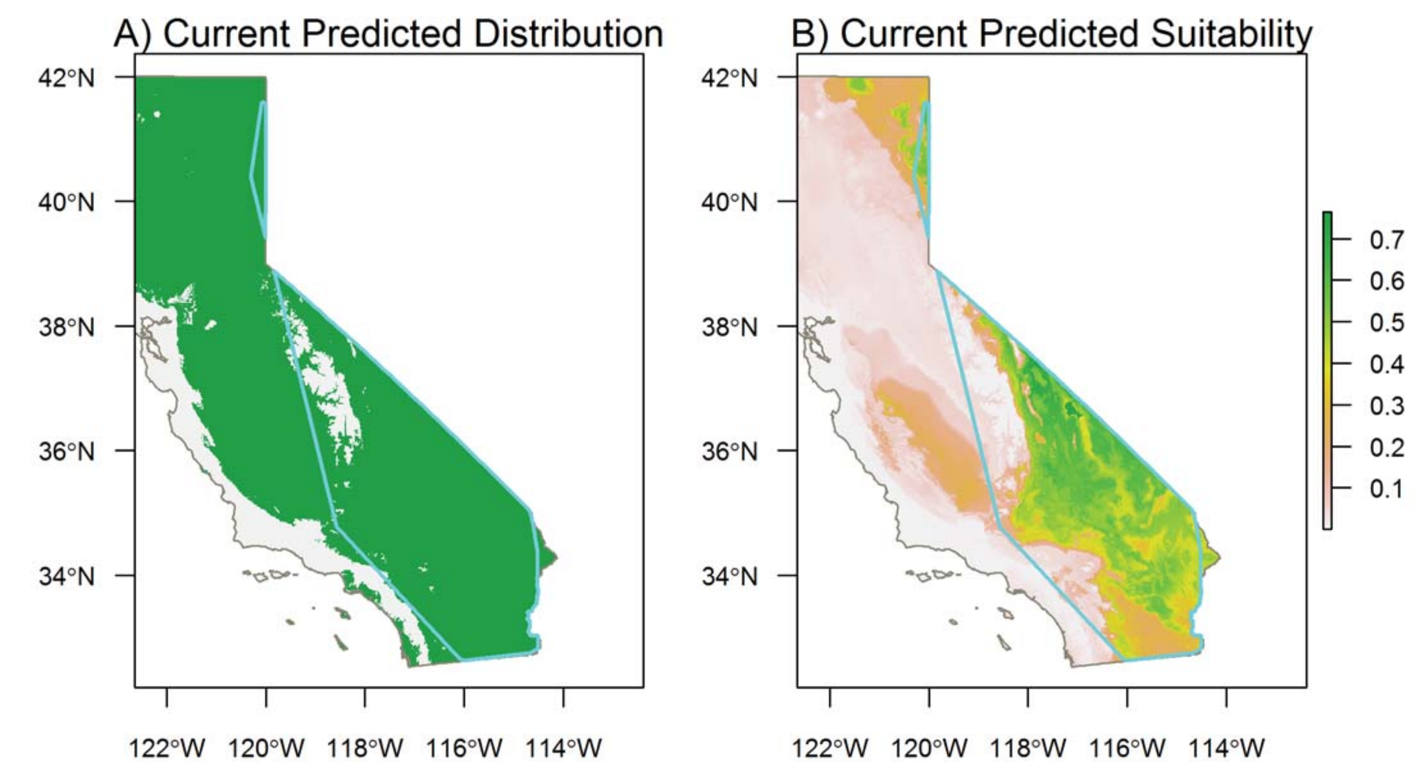

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Species Results: *Phrynosoma platyrhinos* Desert Horned Lizard

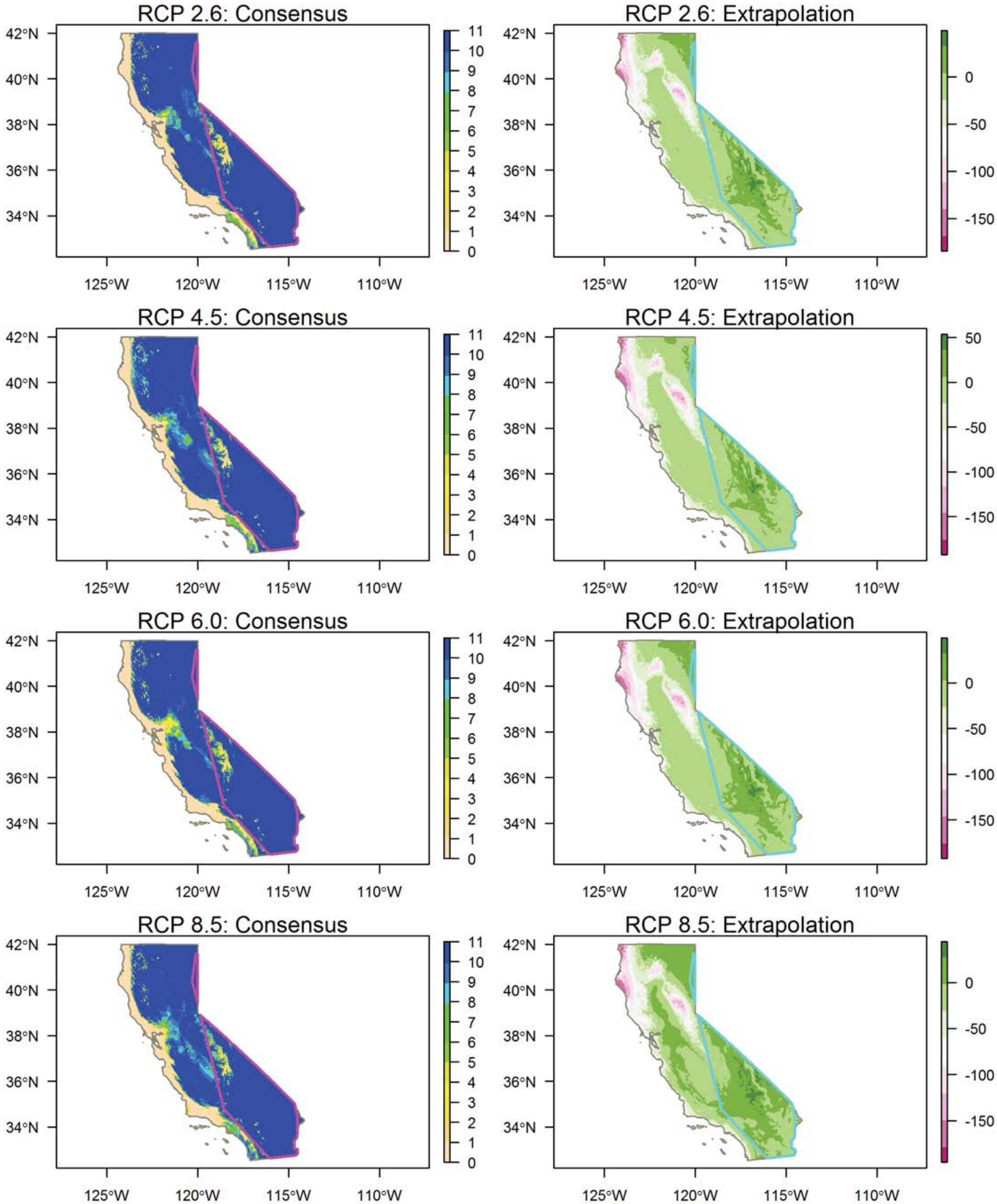

Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

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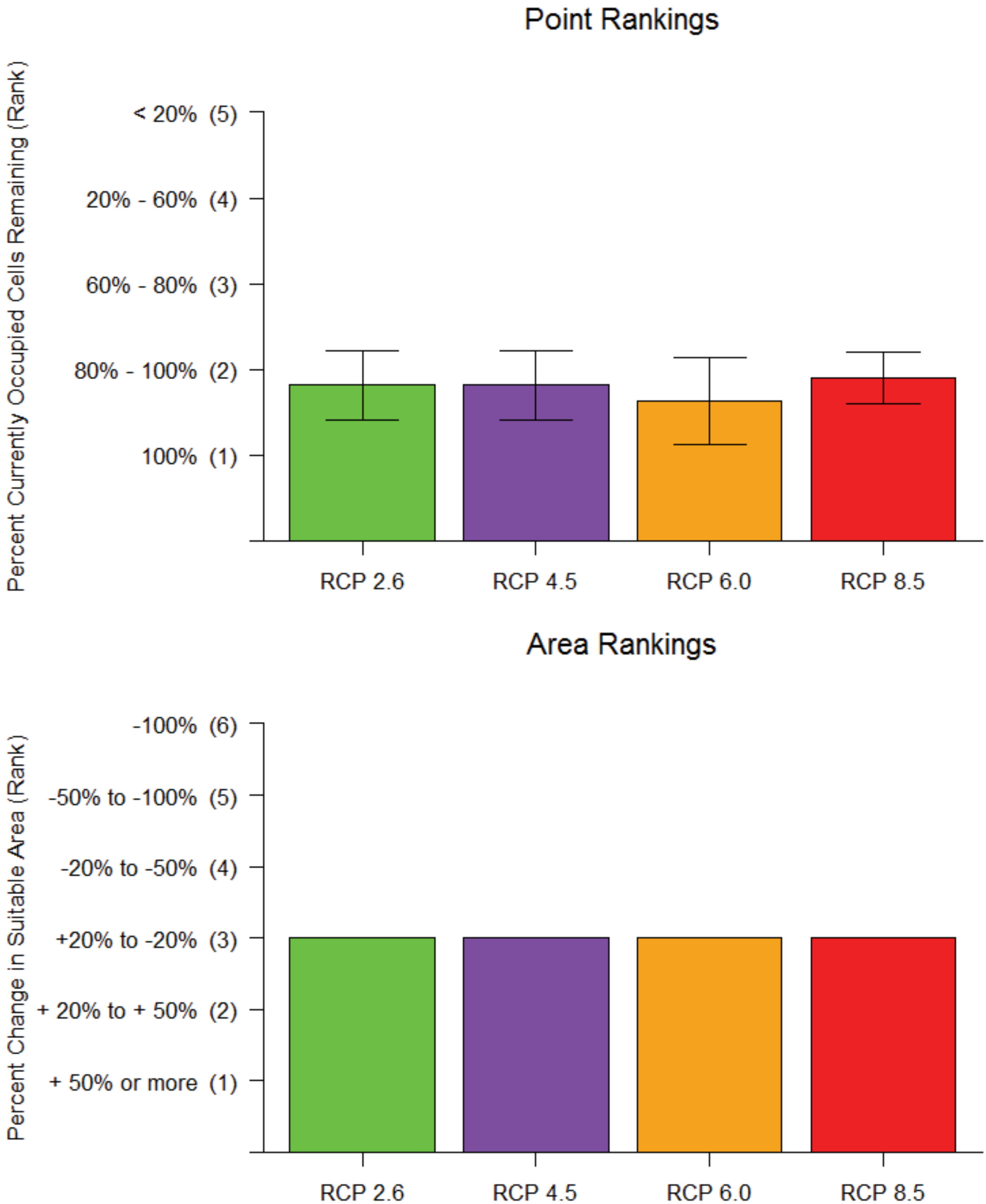


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Phyllodactylus nocticolus* Leaf-toed Gecko

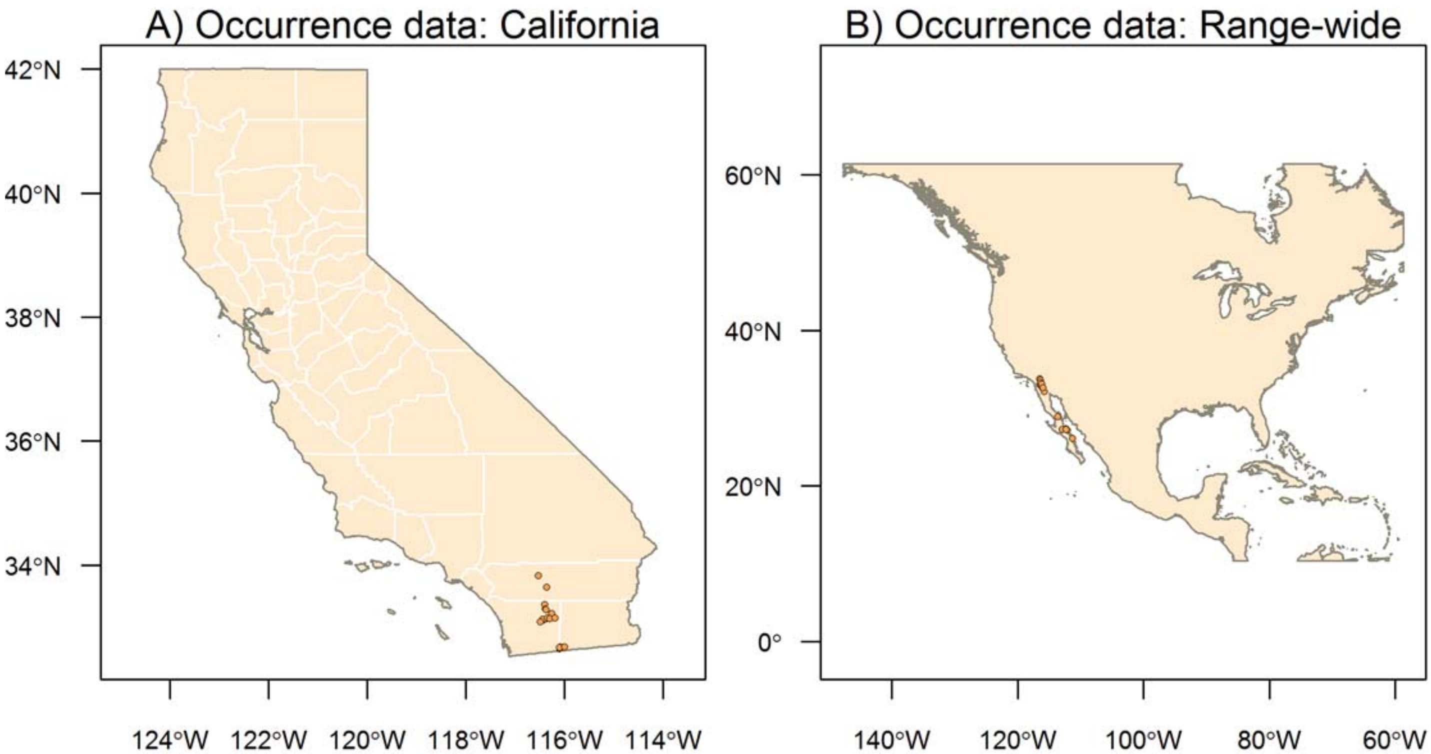
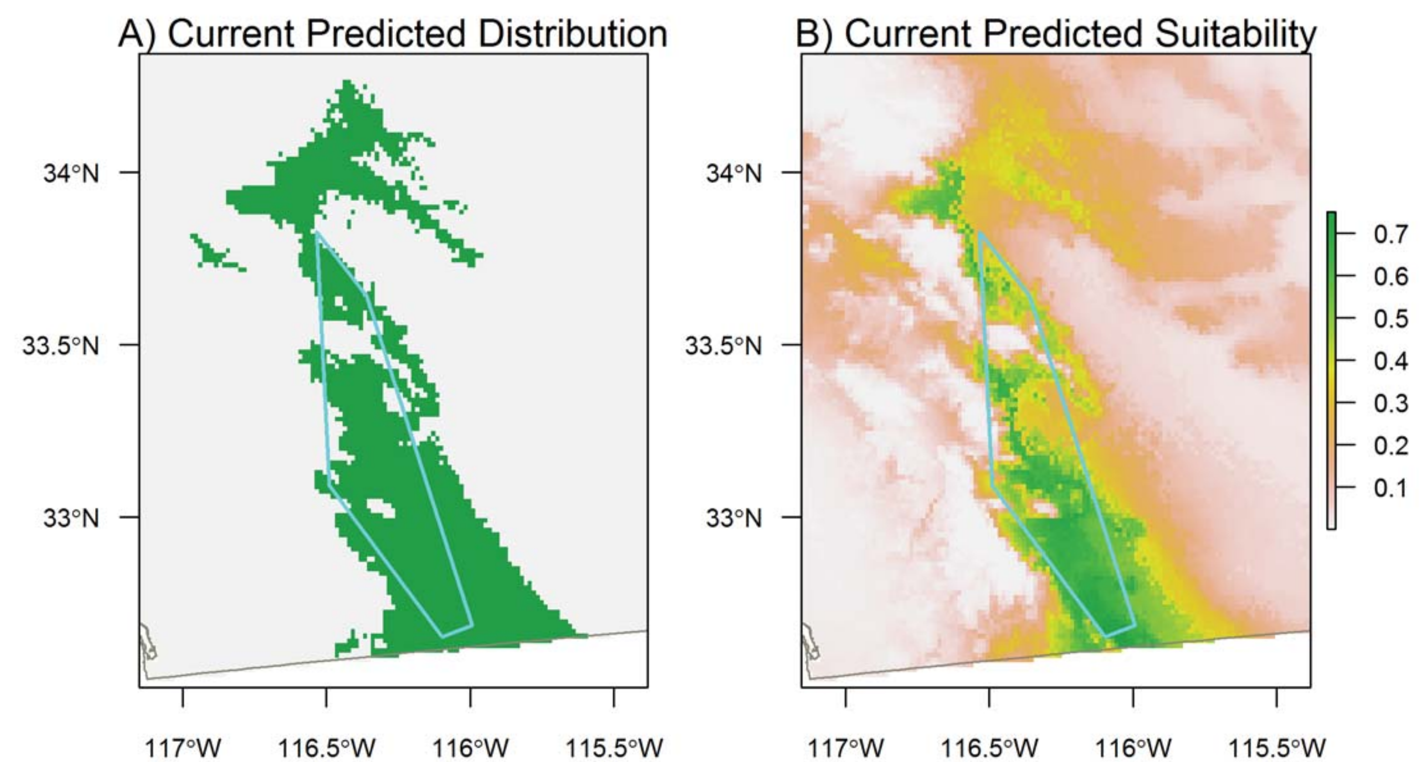


Figure 1. Occurrence data used to build Maxent models.



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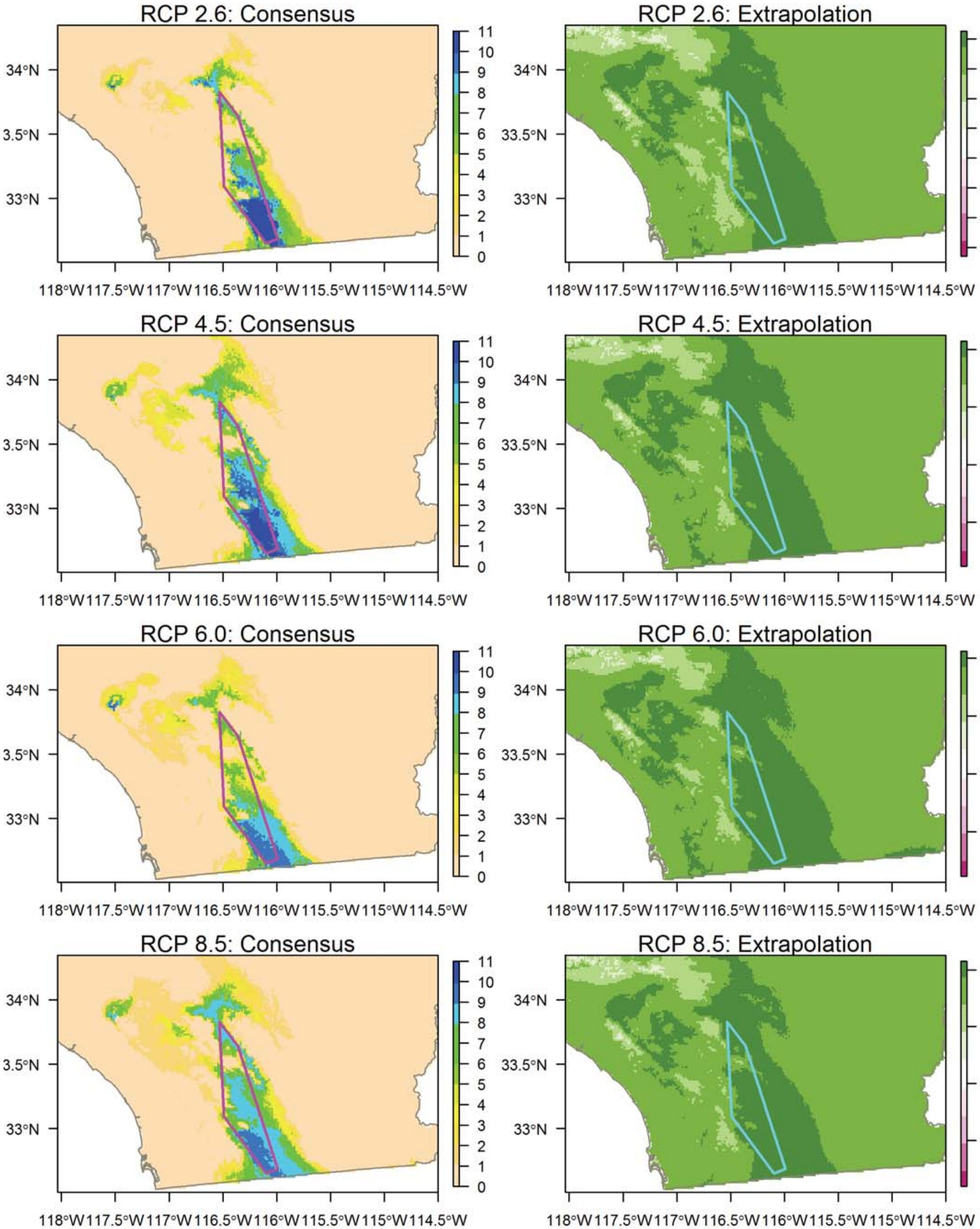
Species Results: *Phyllodactylus nocticolus* Leaf-toed Gecko



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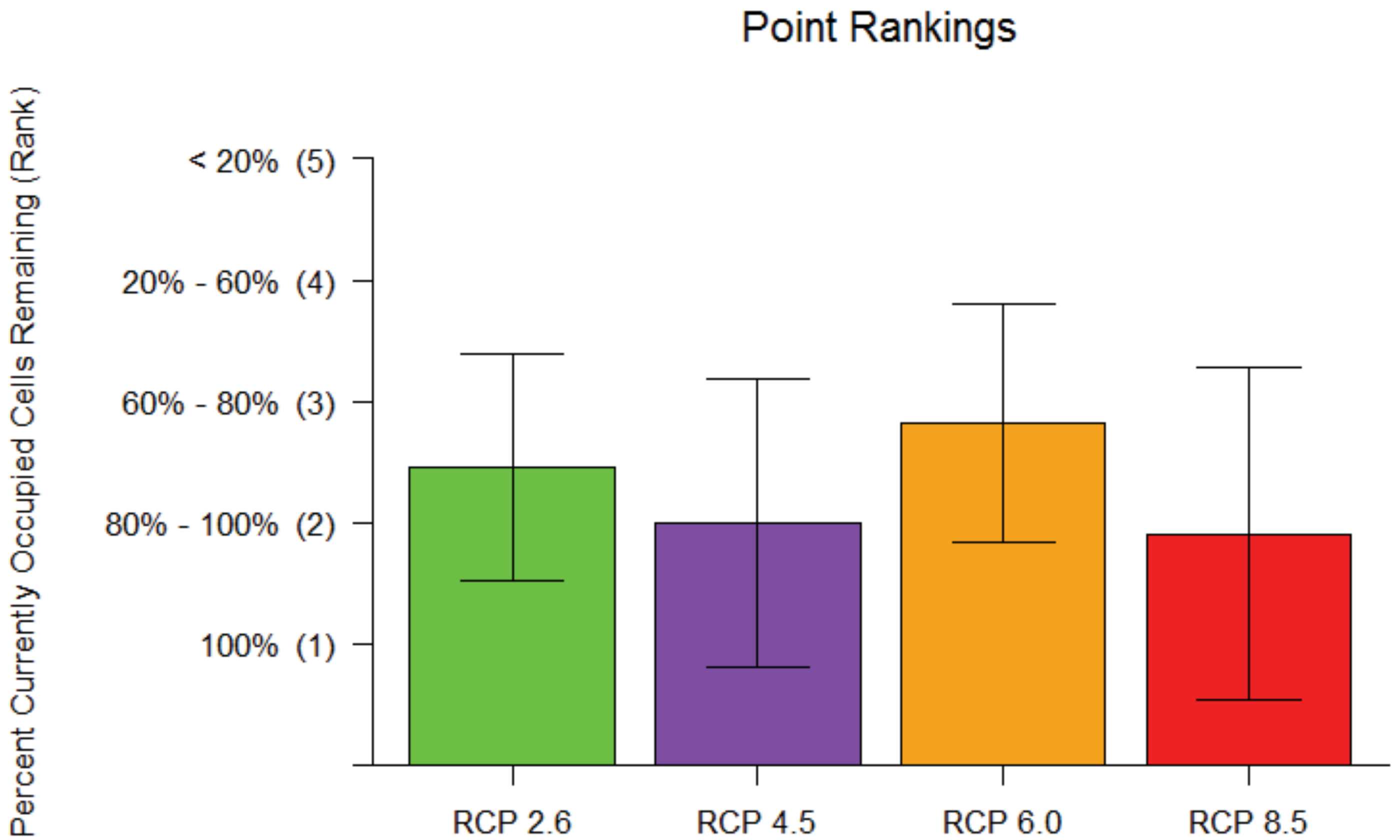

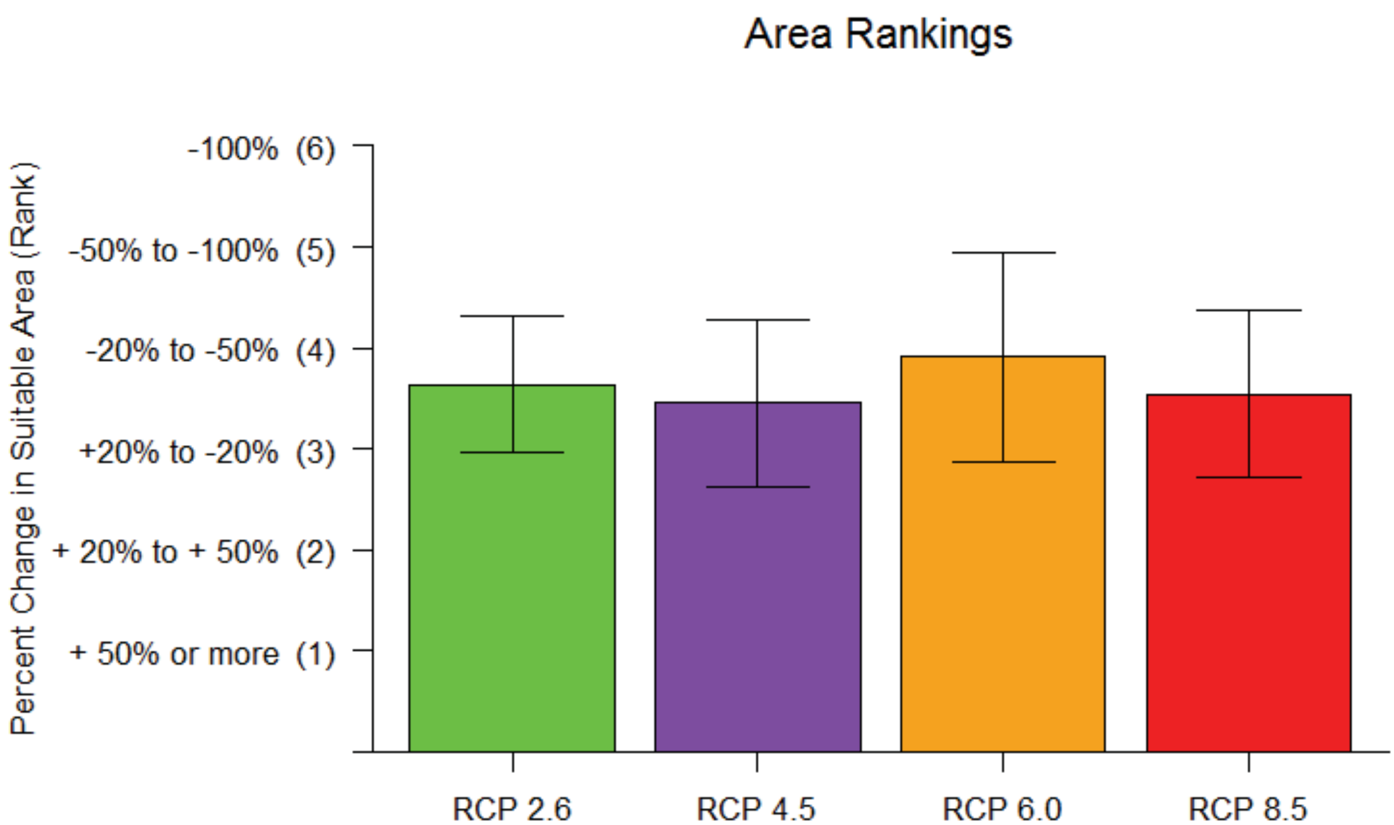

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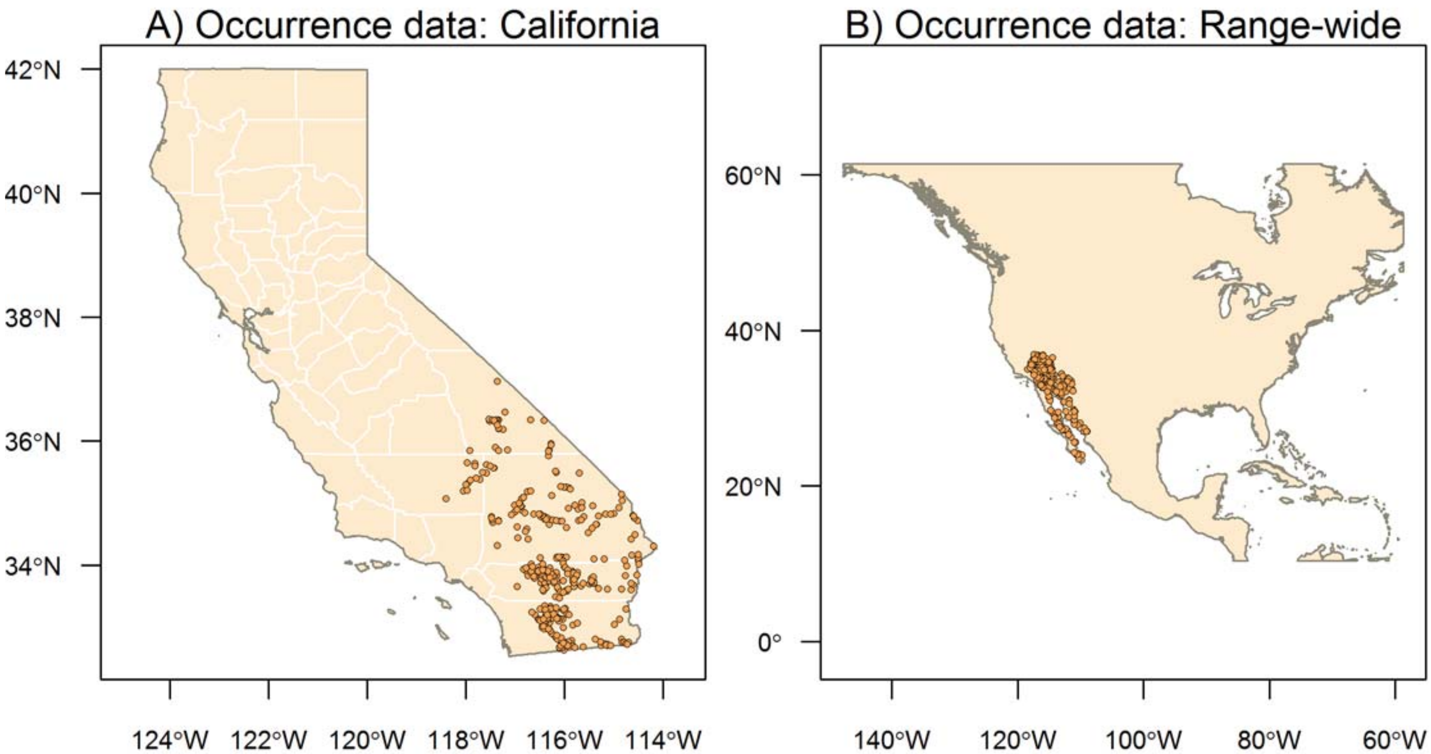
Species Results: *Phyllorynchus decurtatus* Spotted Leaf-nosed Snake



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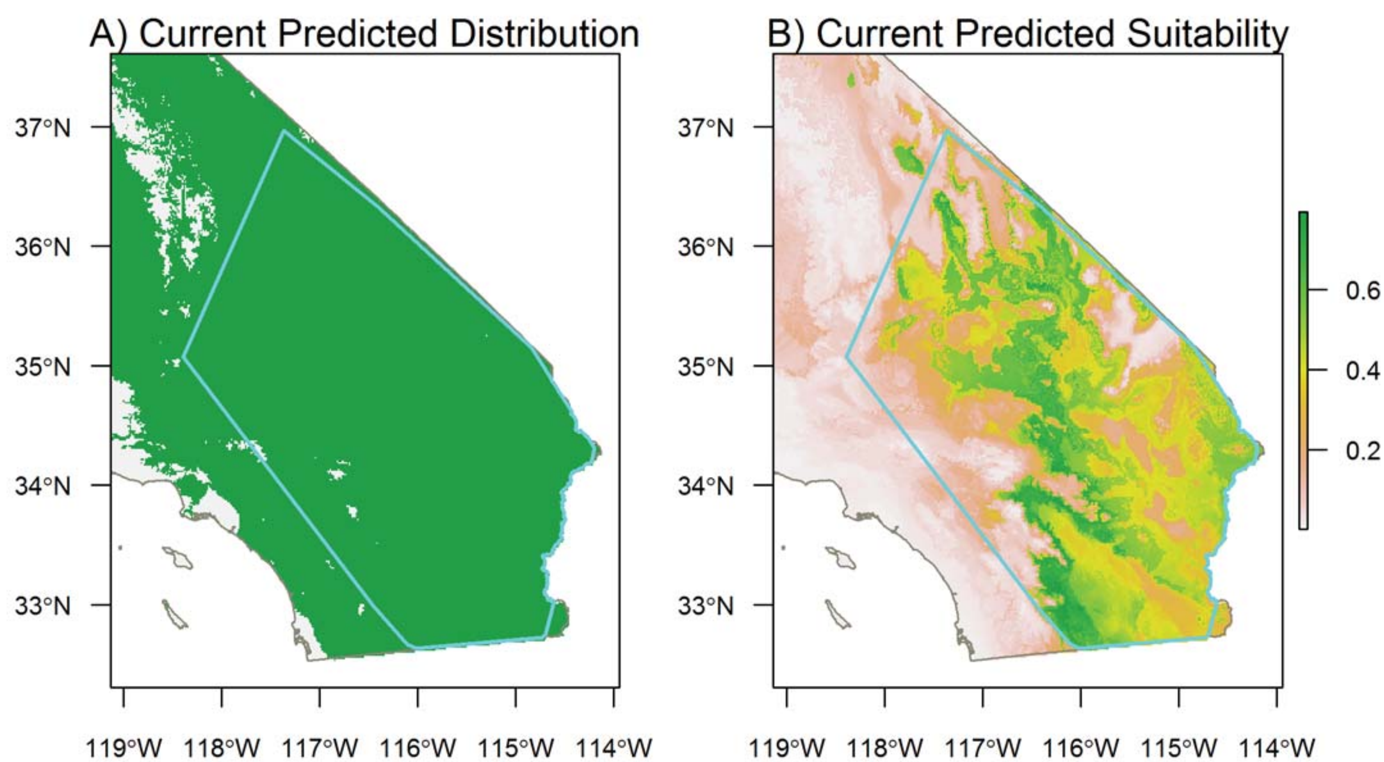

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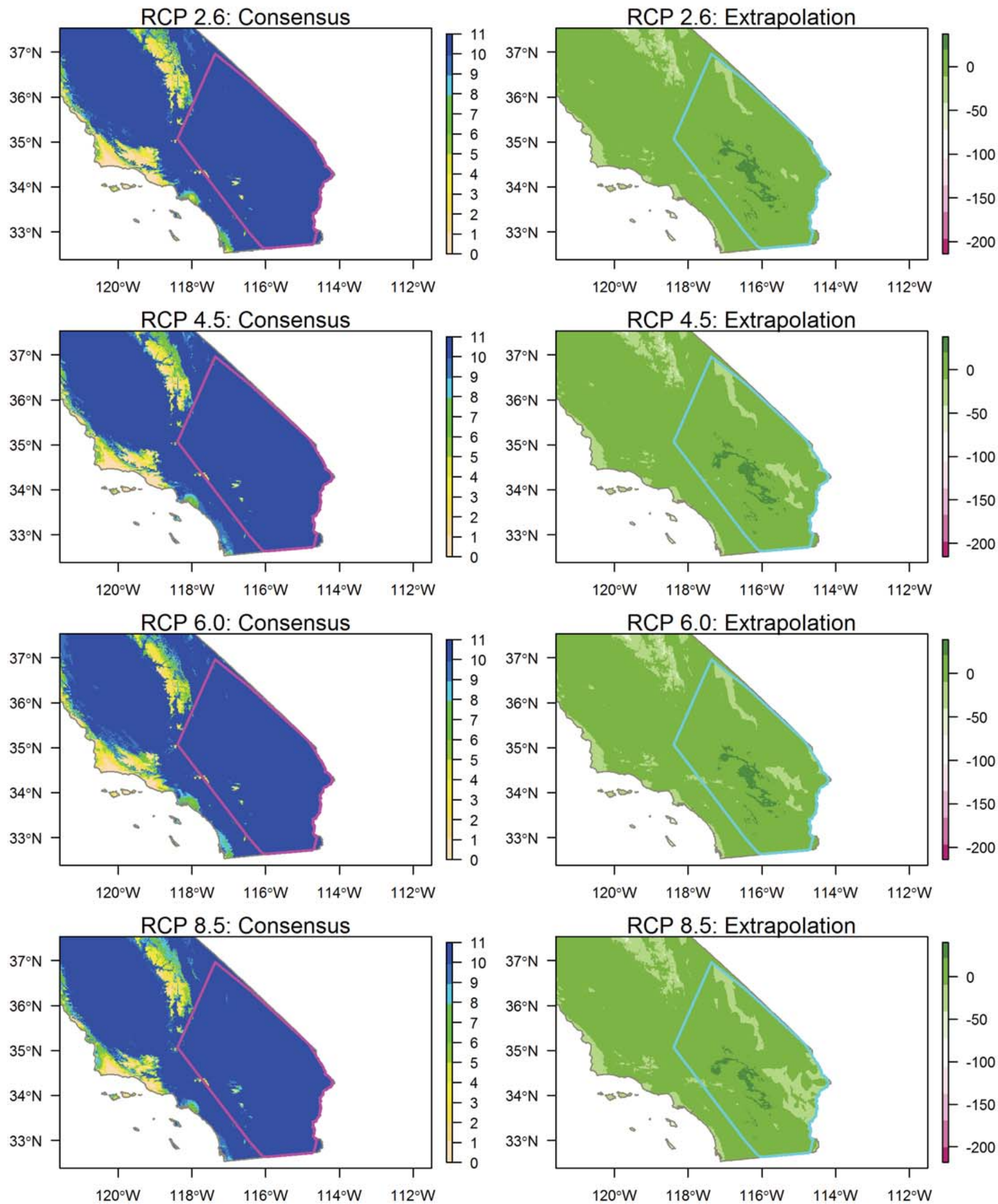

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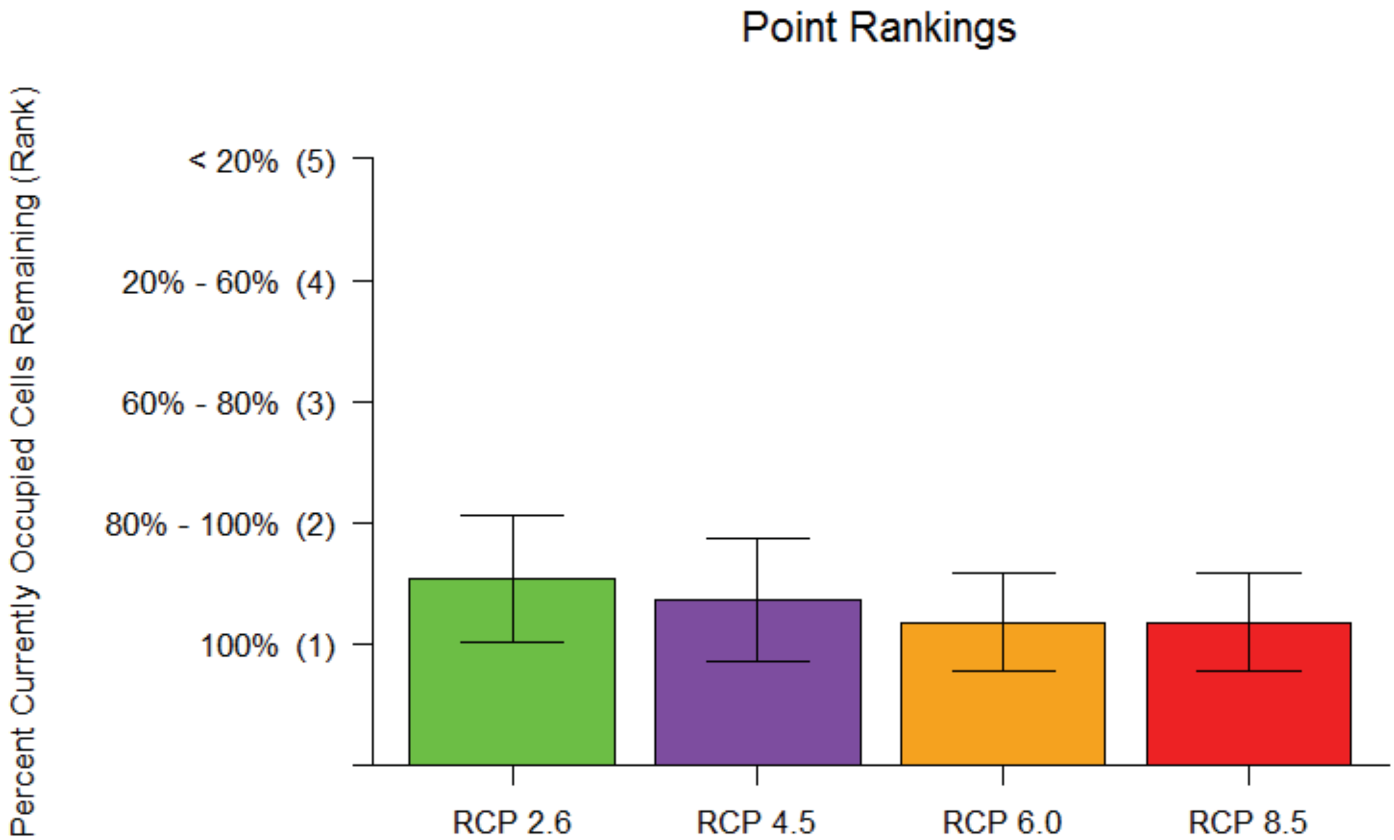

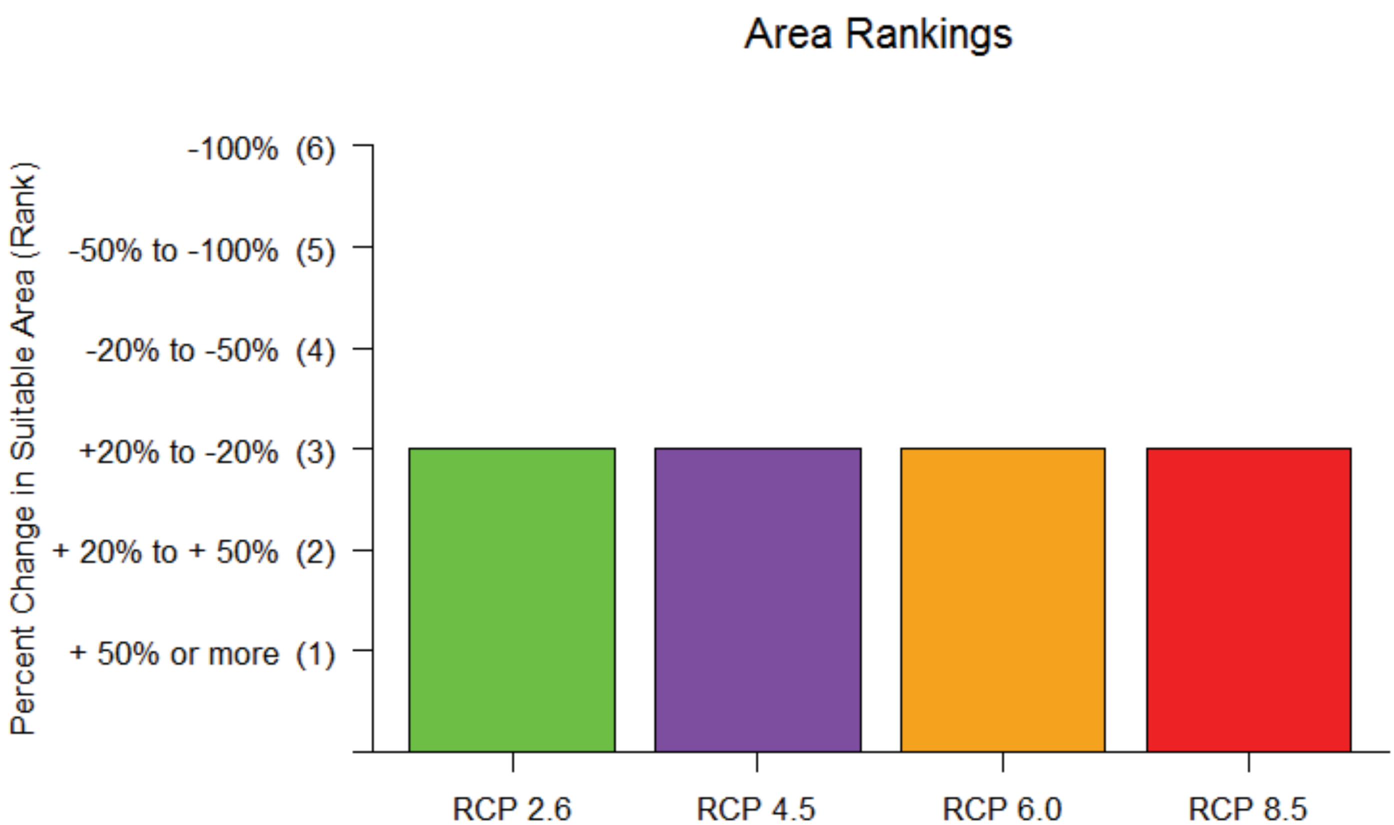

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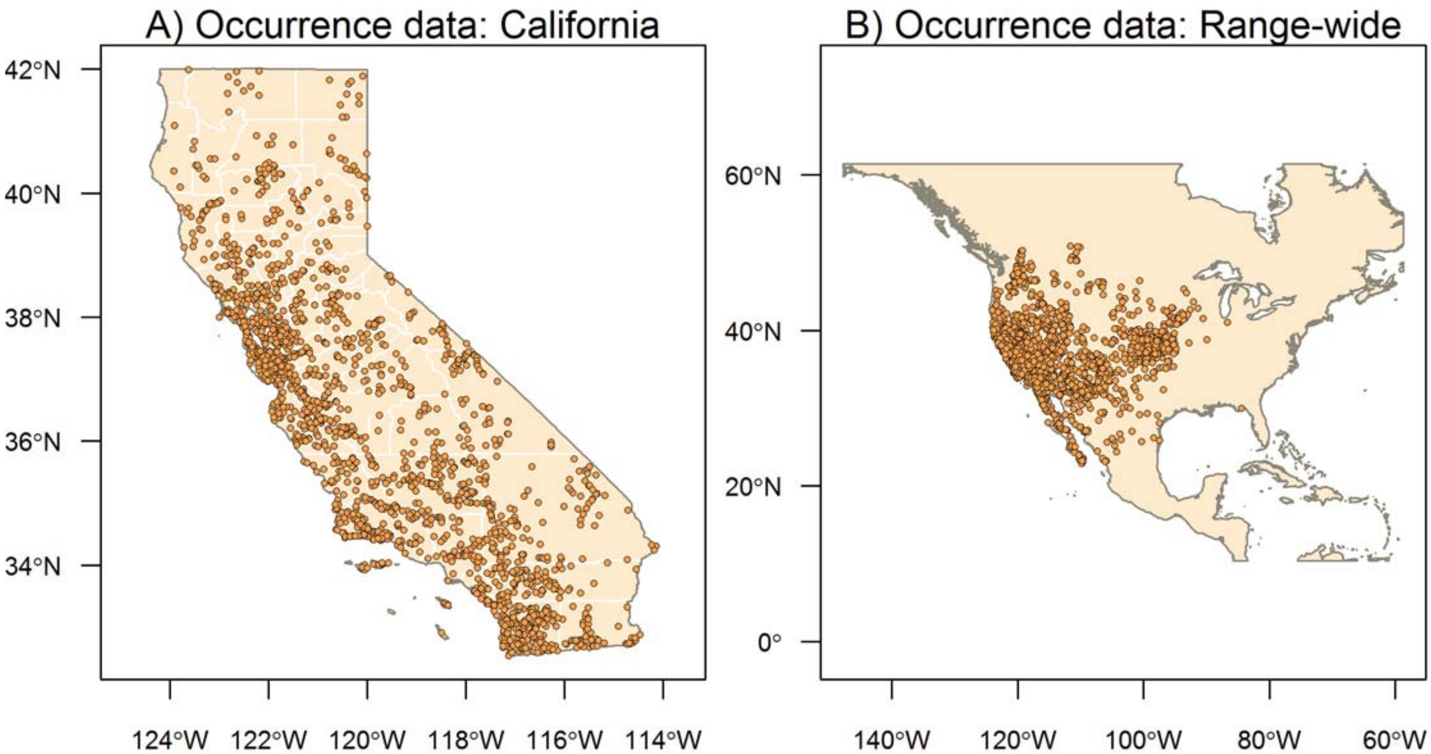
Species Results: *Pituiphis catenifer* Gopher Snake



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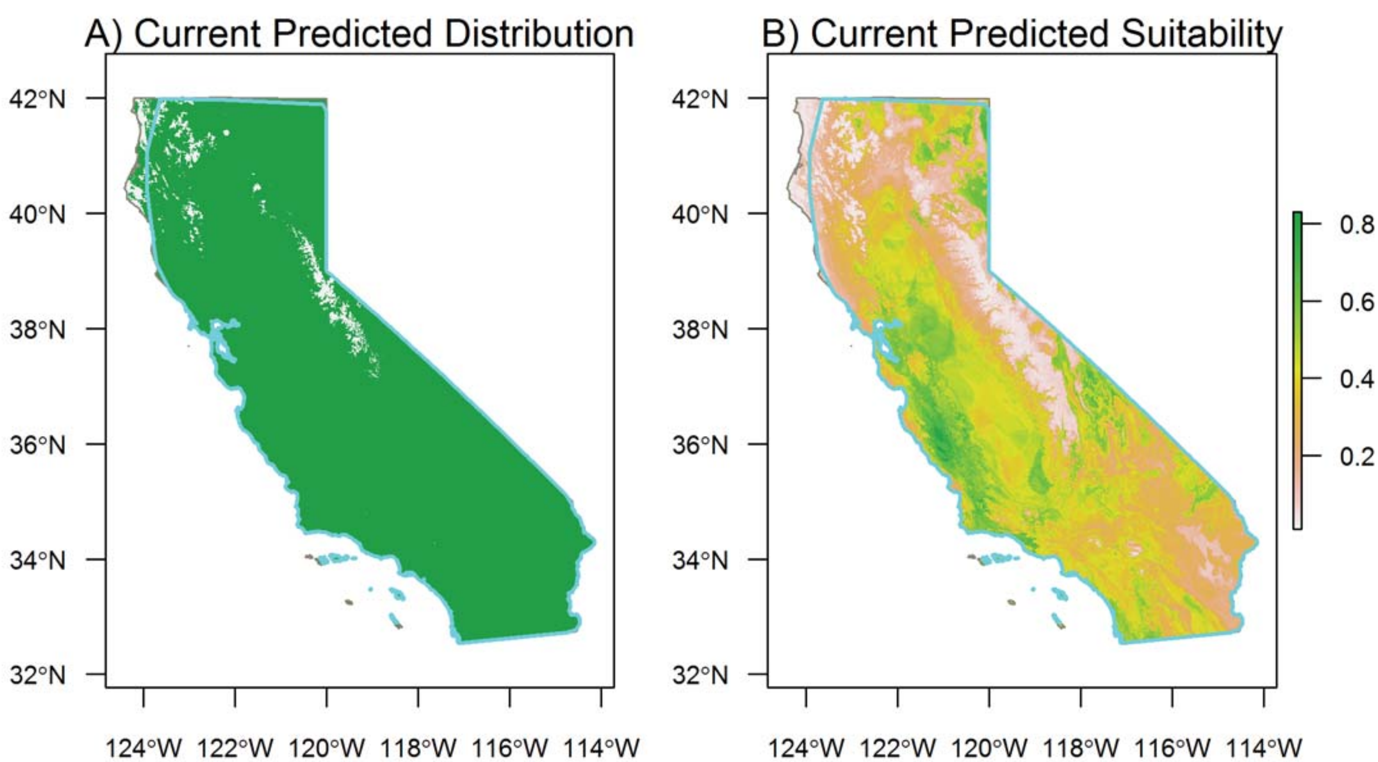

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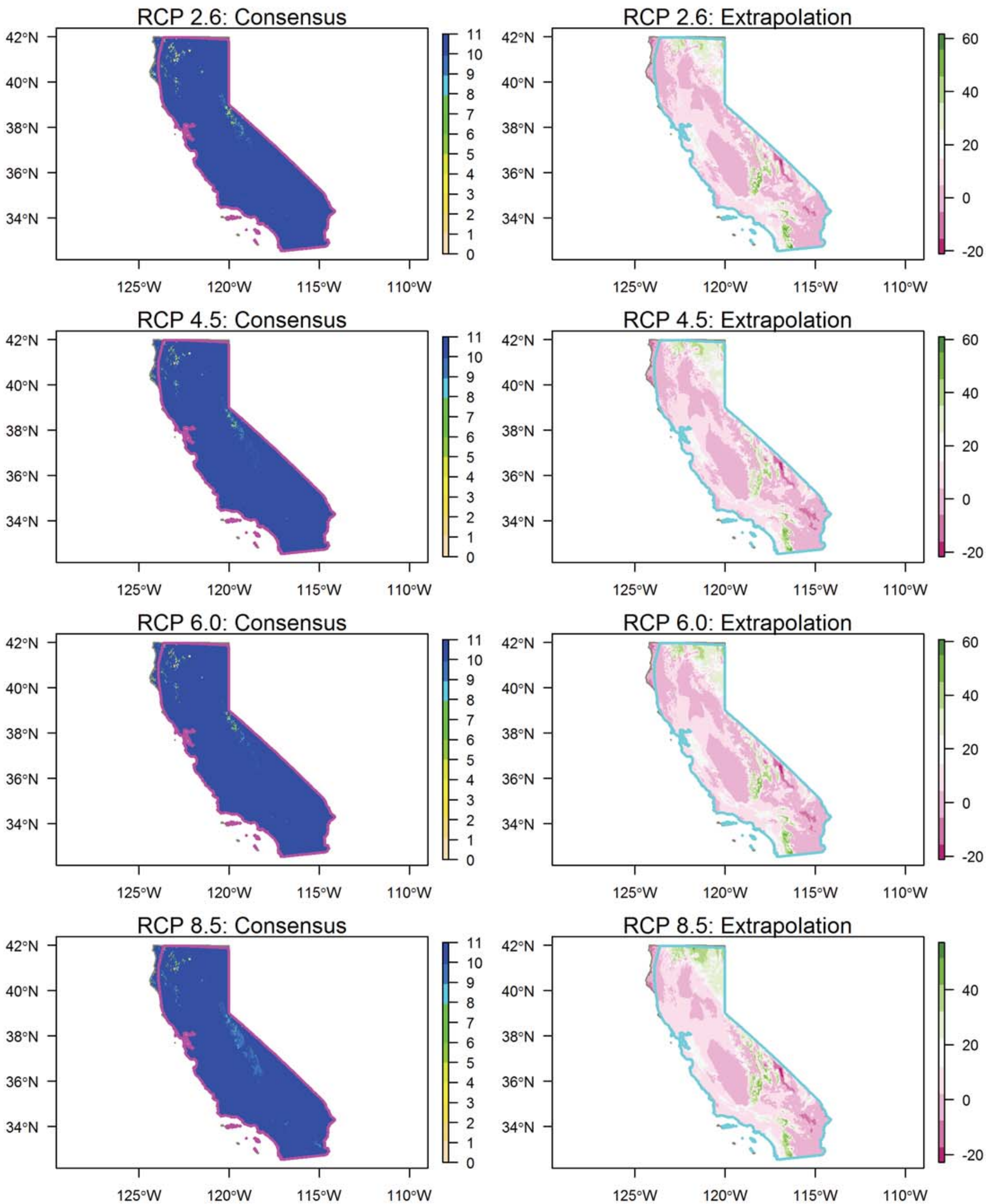

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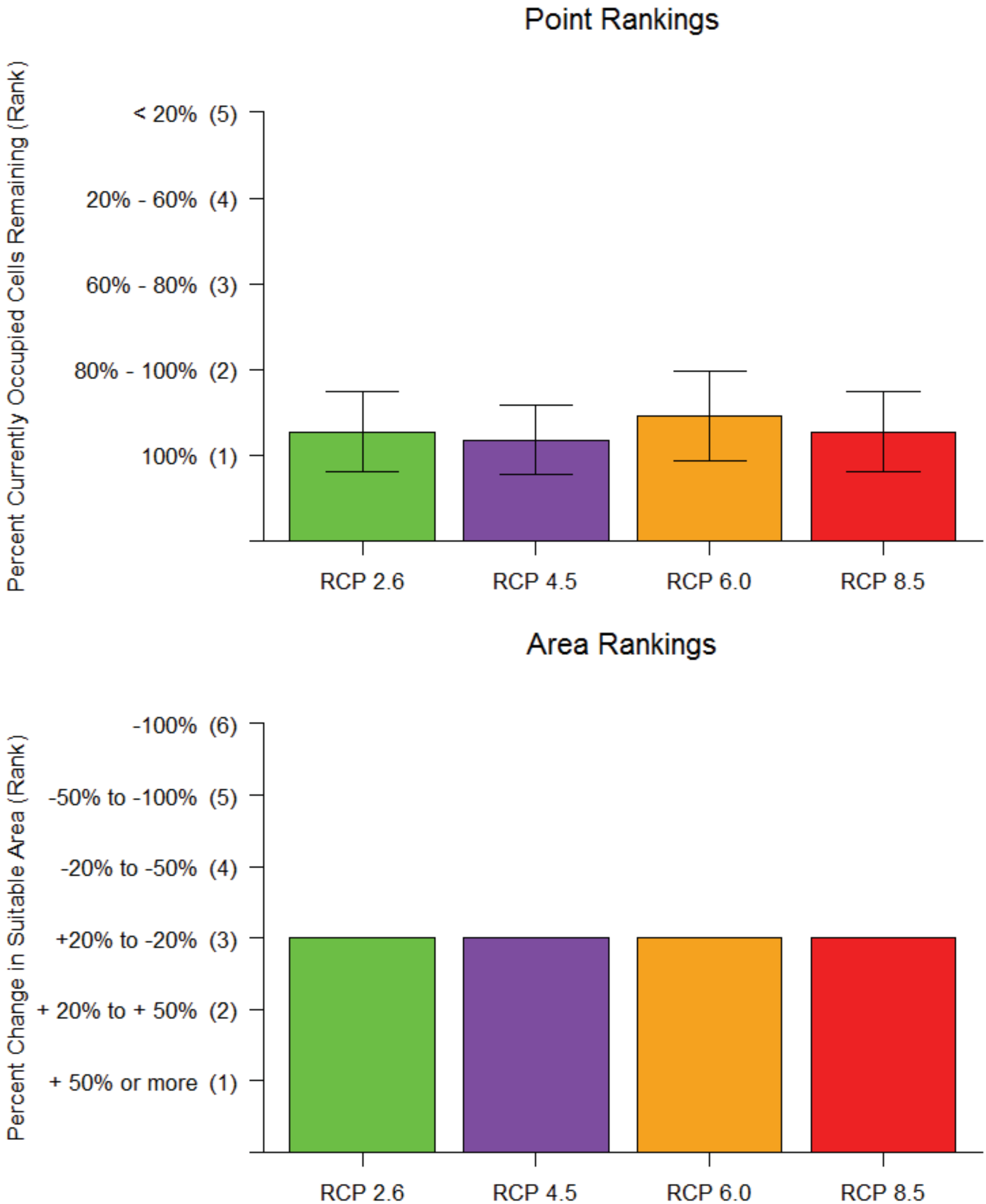

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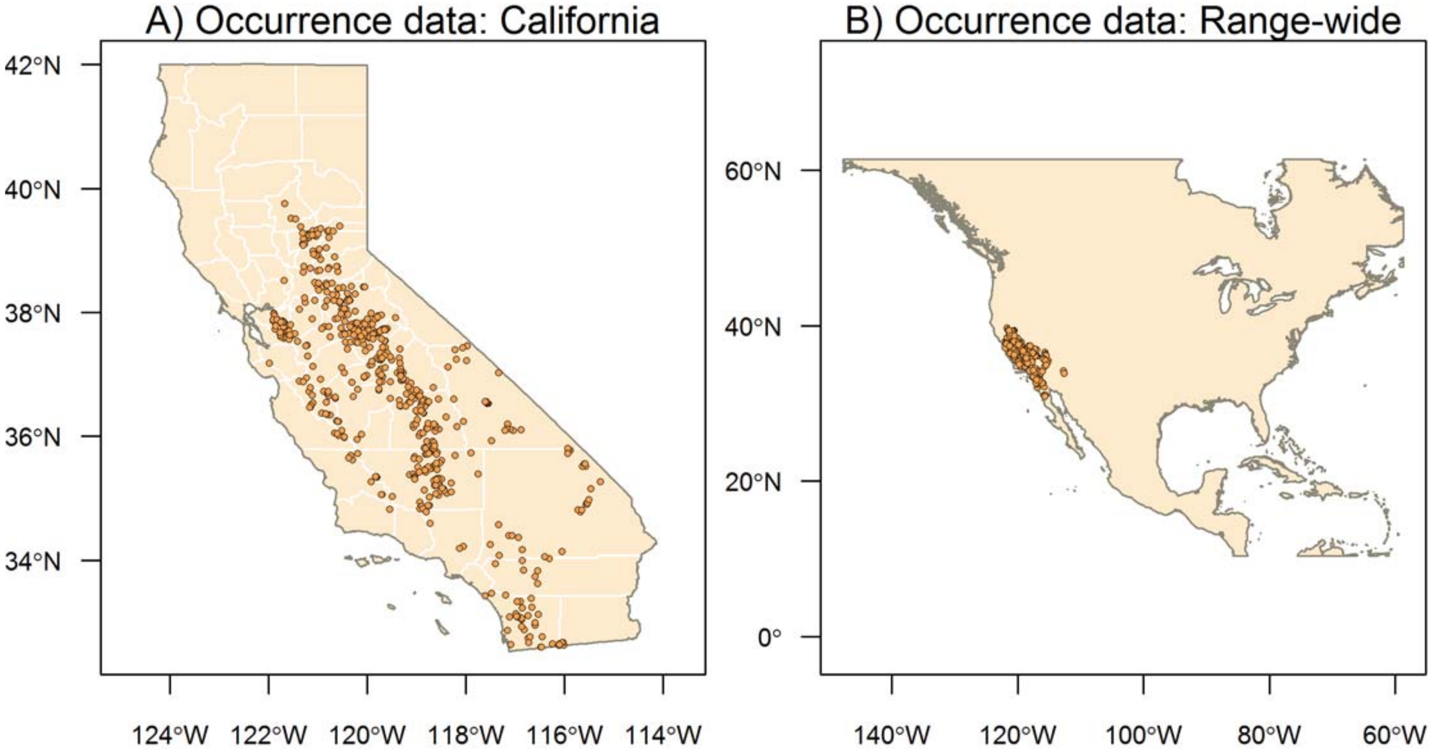

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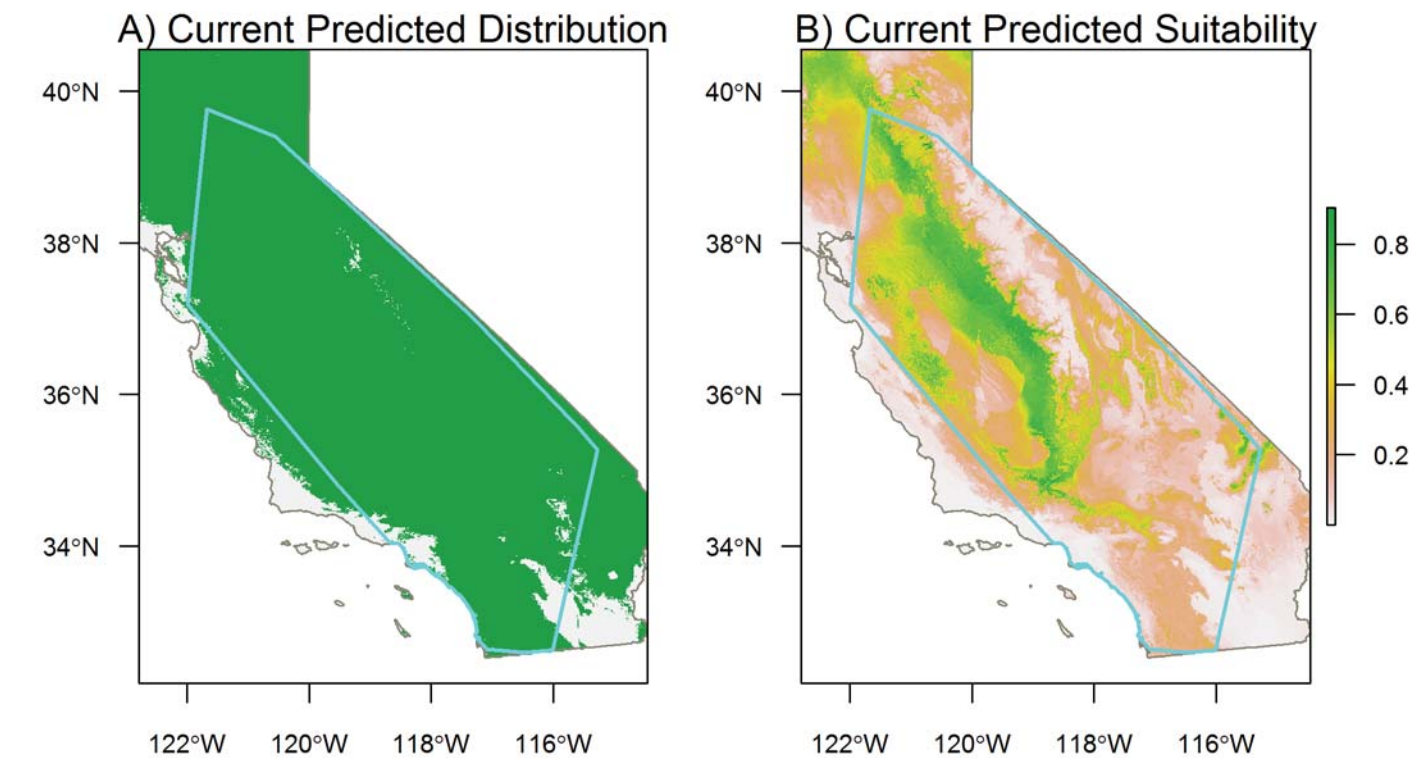

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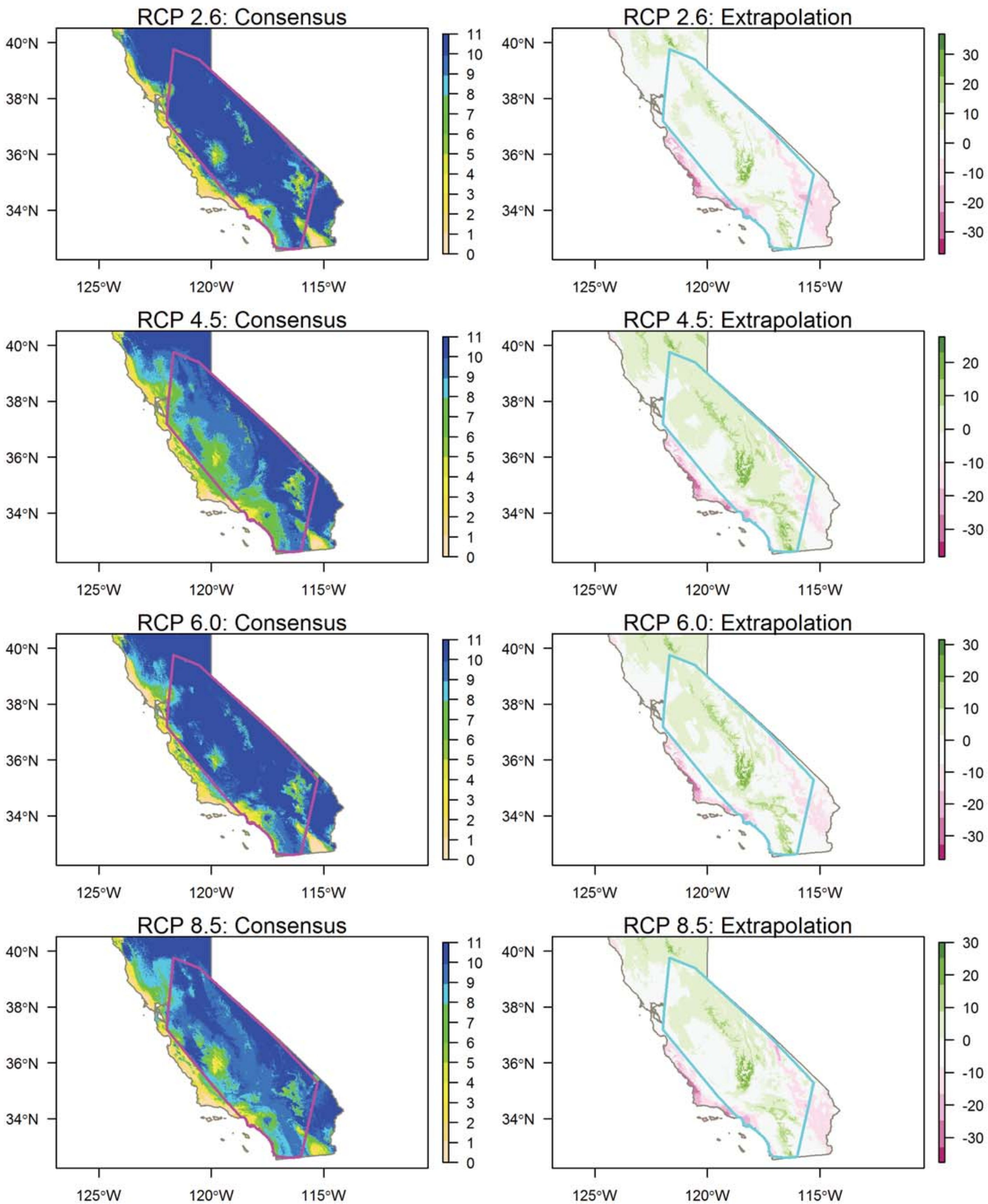
Species Results: *Plestiodon gilberti* Gilbert's Skink



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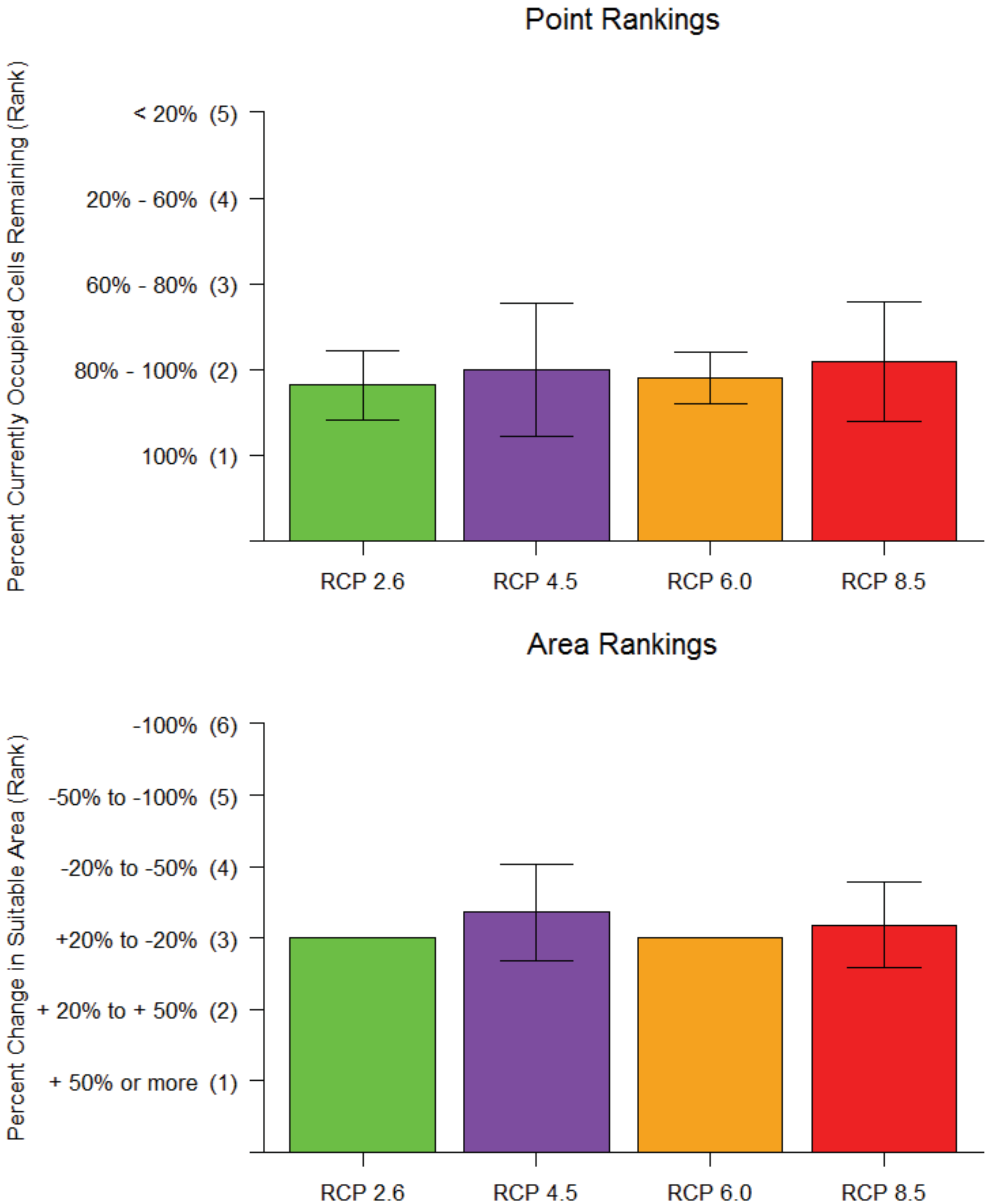

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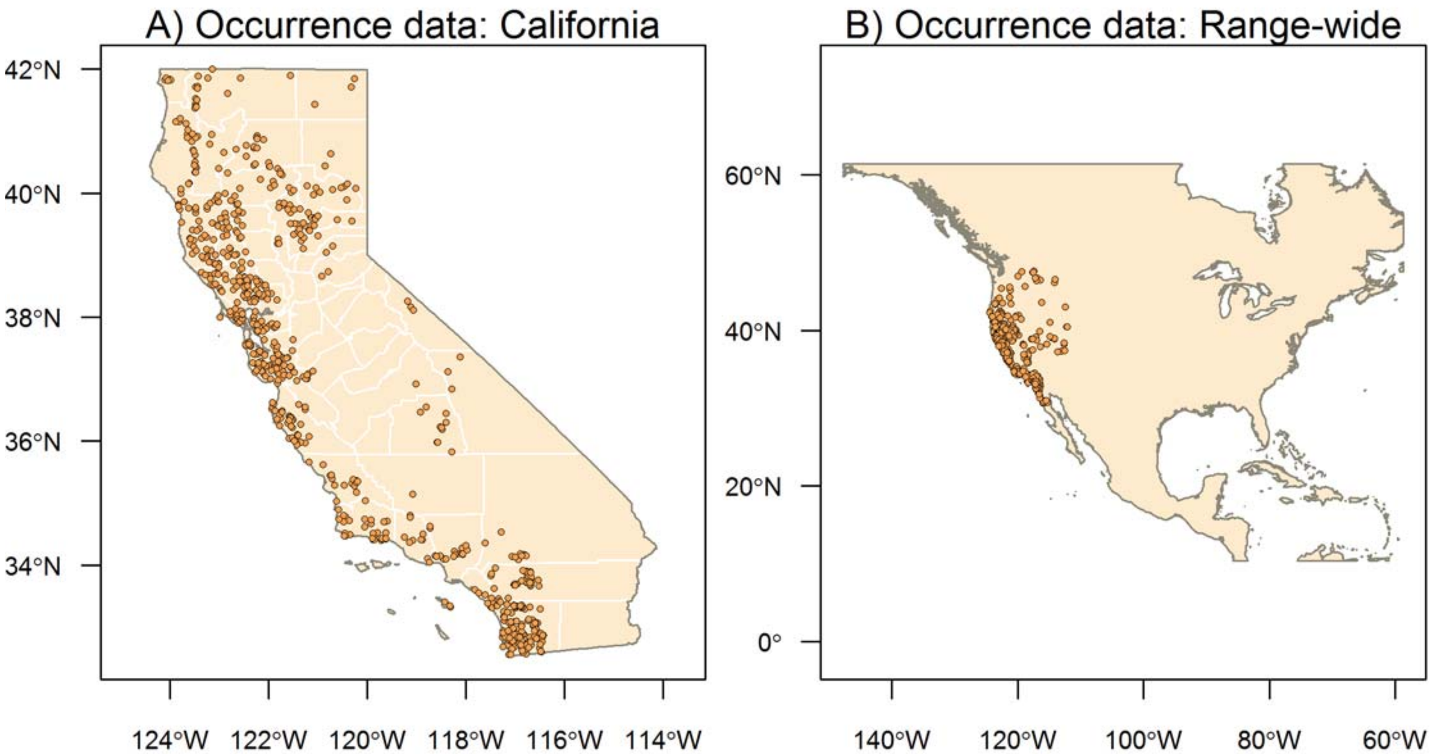
Species Results: *Plestiodon skiltonianus* Western Skink



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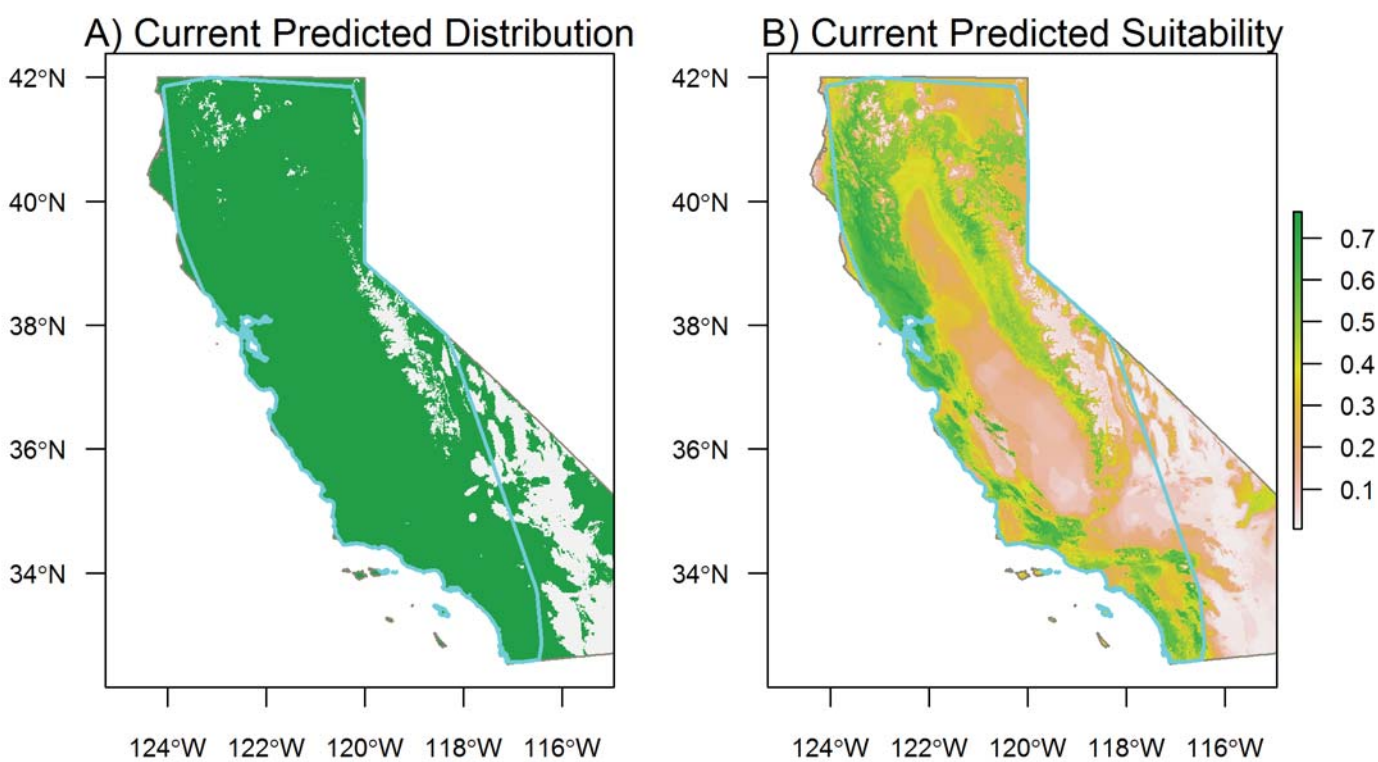

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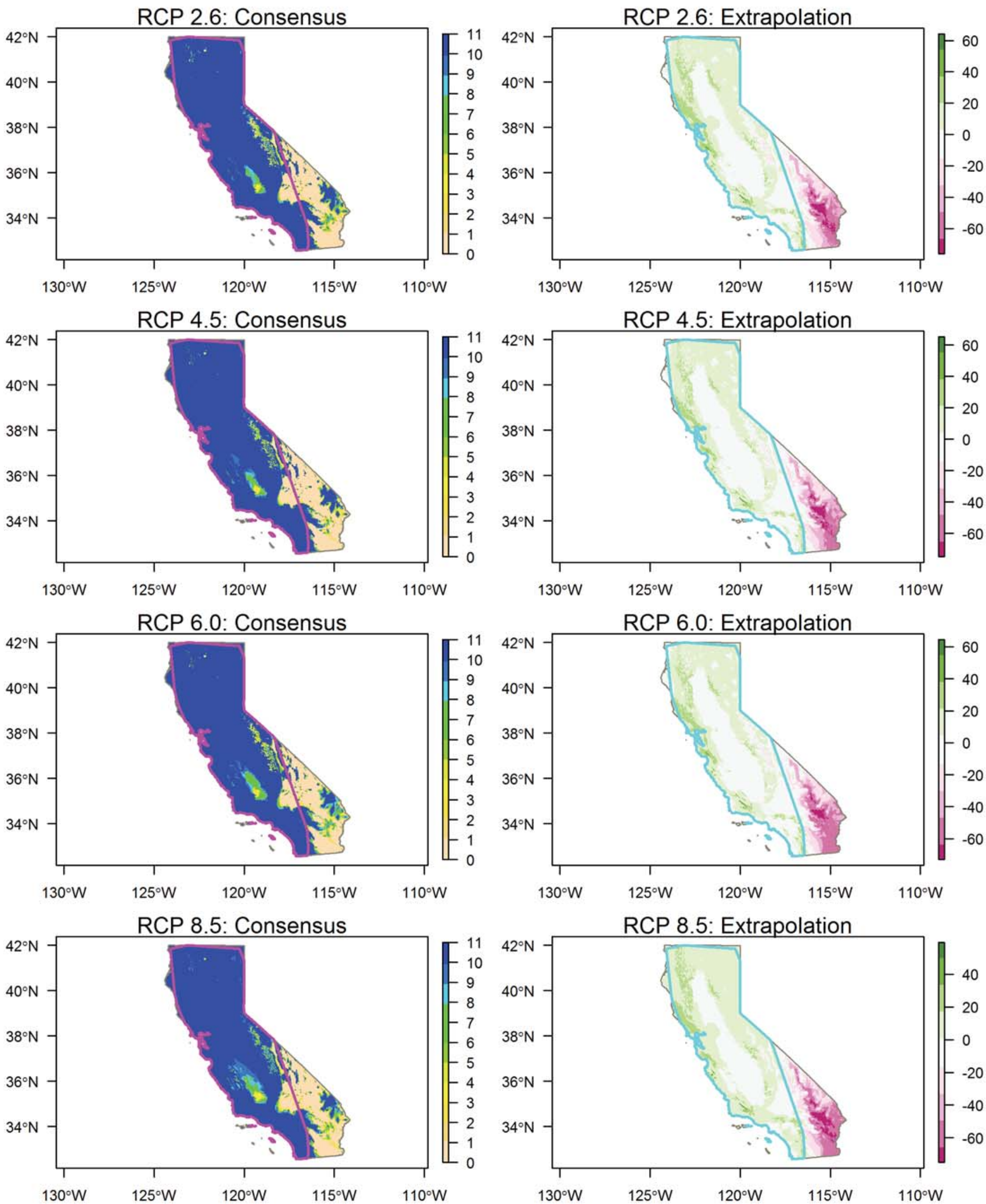

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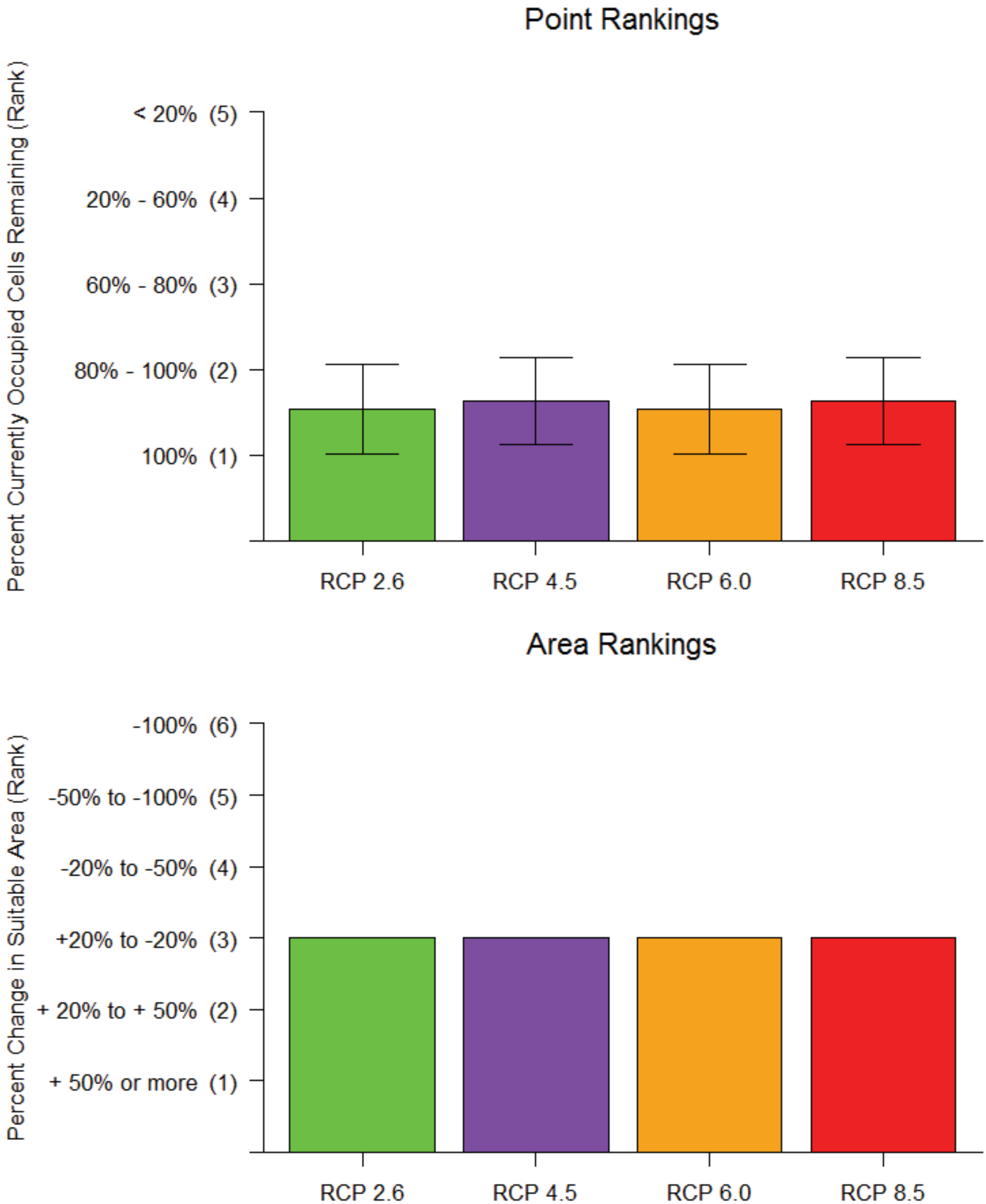

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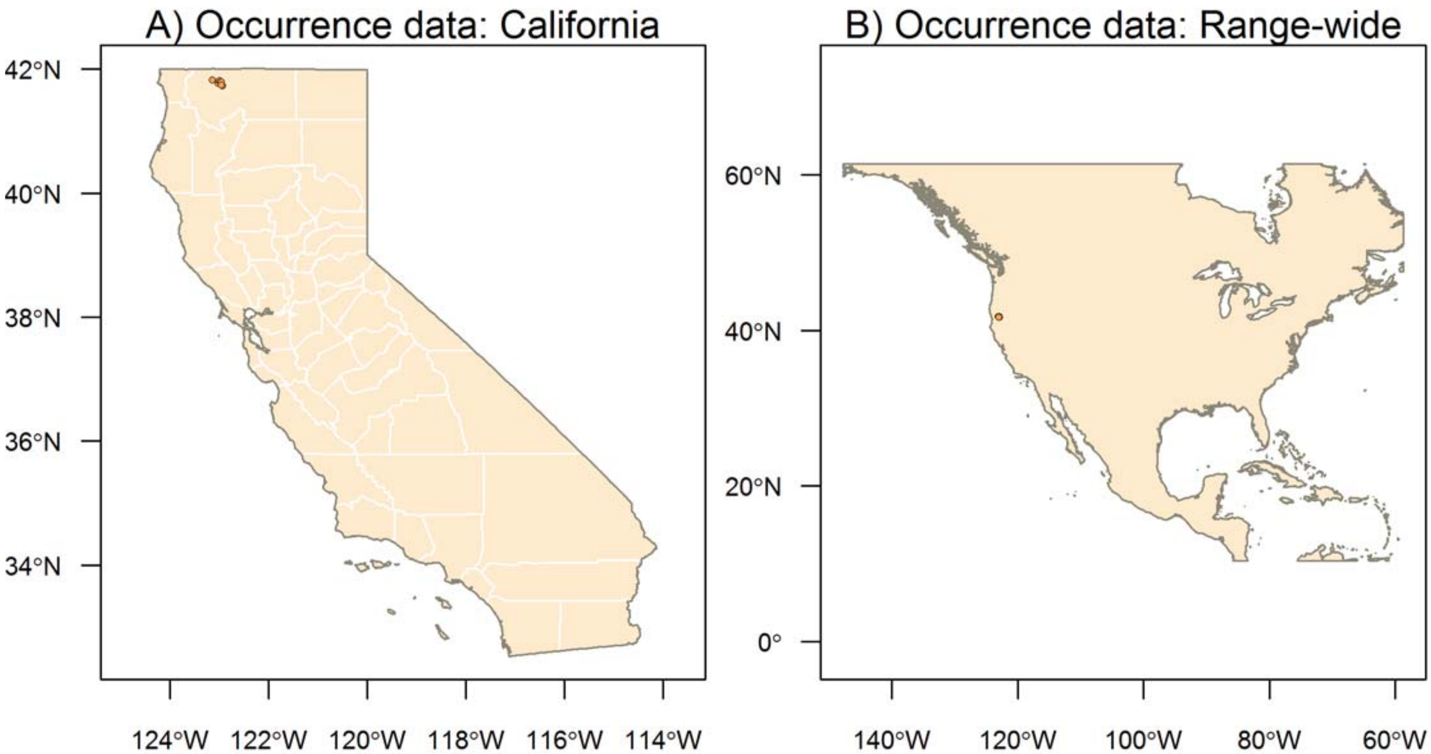

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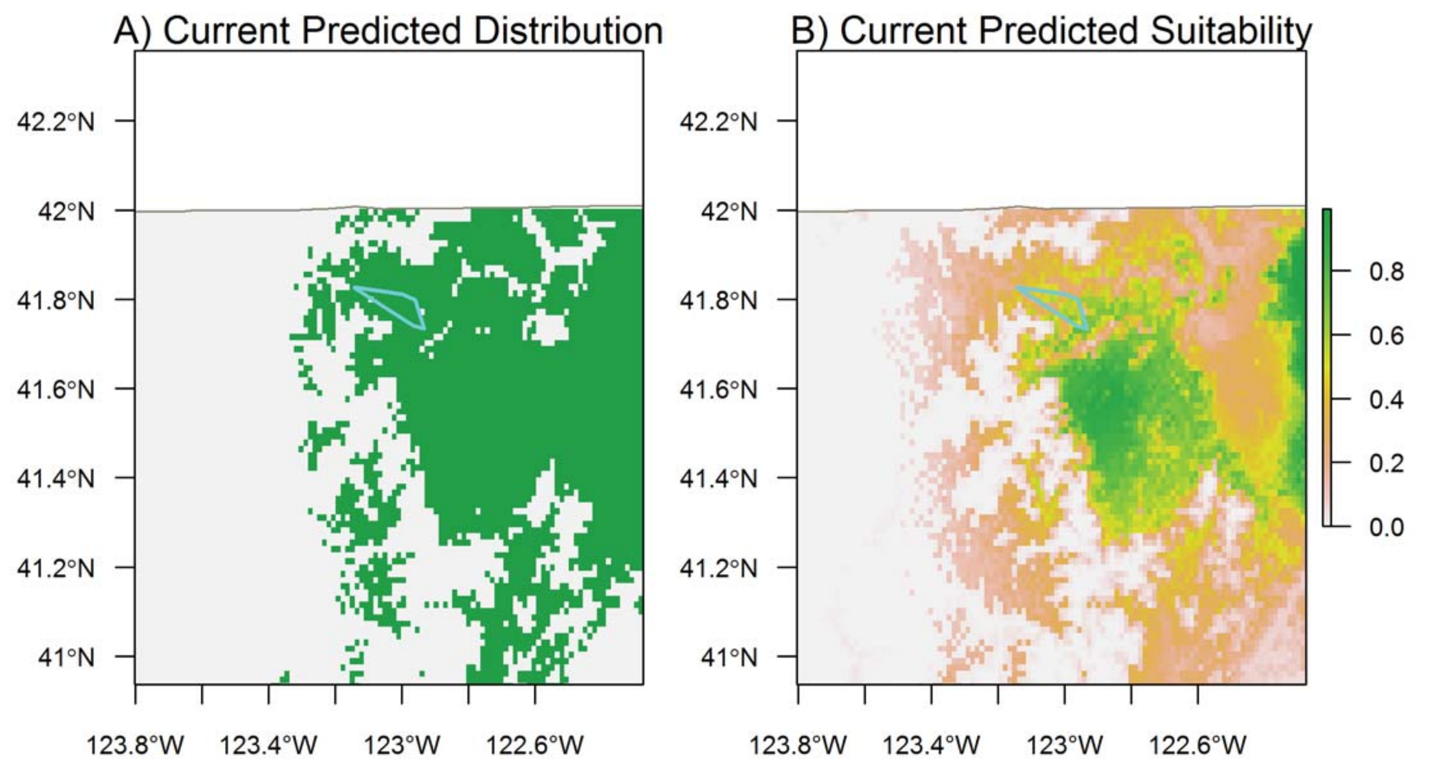

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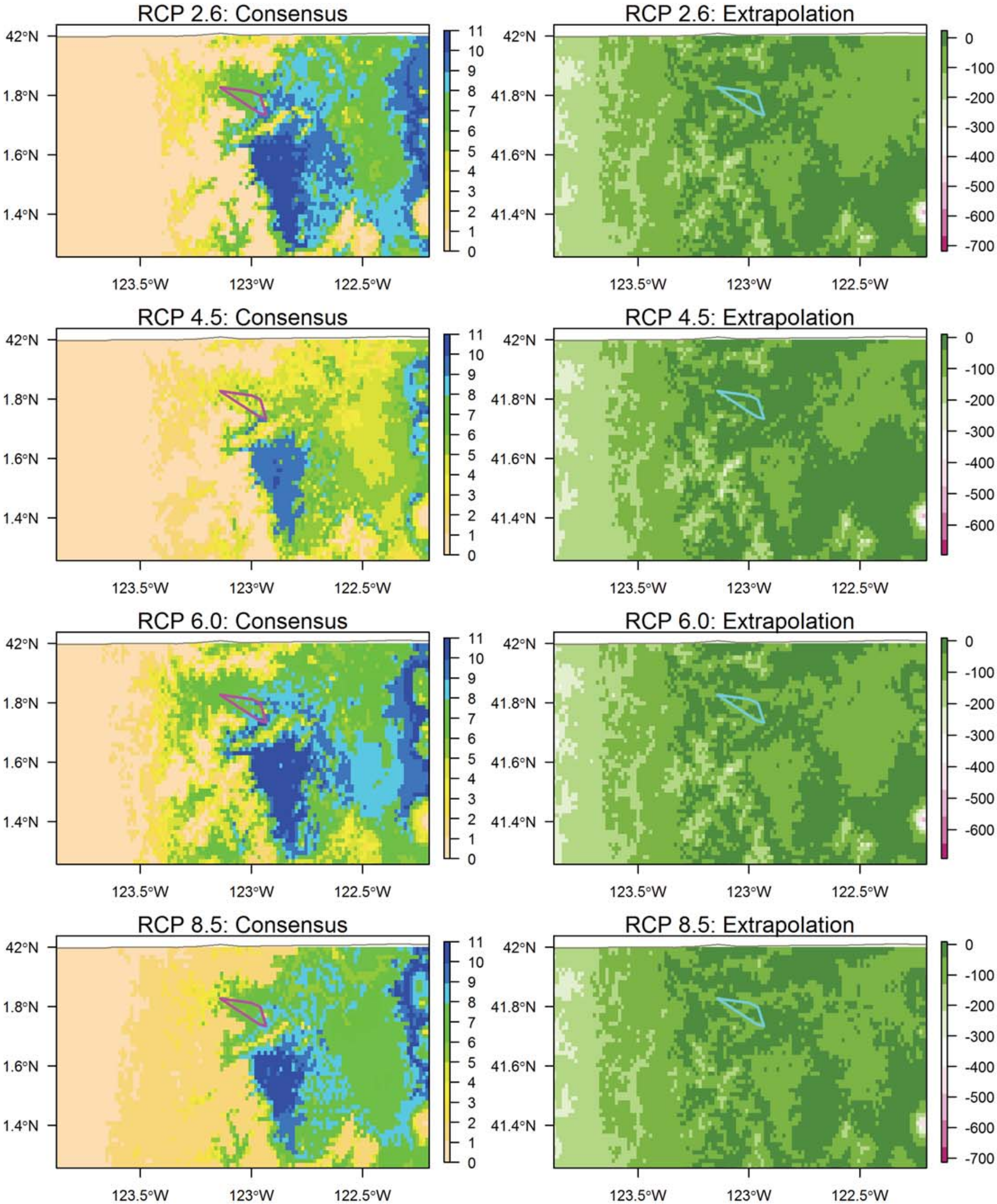
Species Results: *Plethodon asupak* Scott River Salamander



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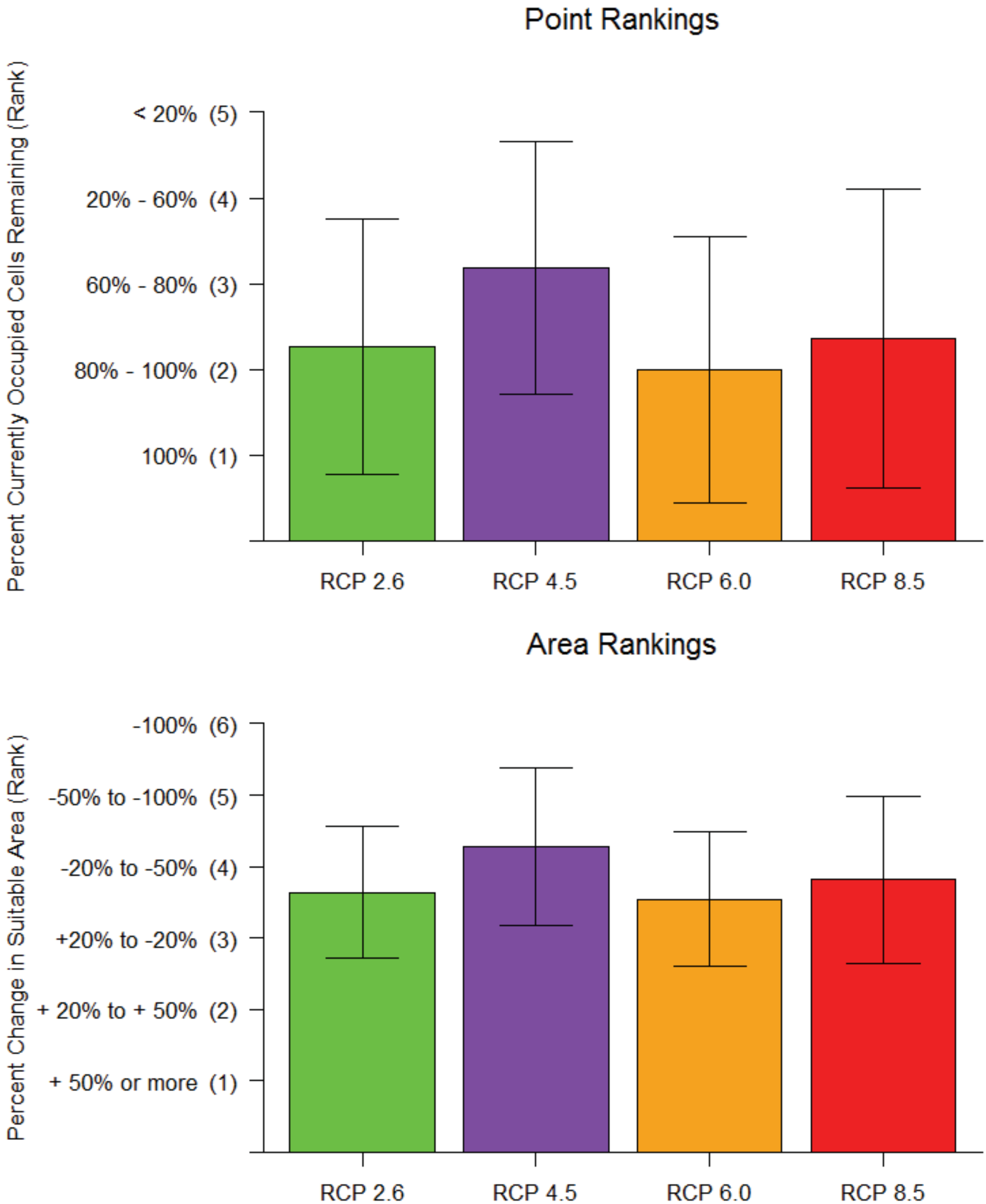

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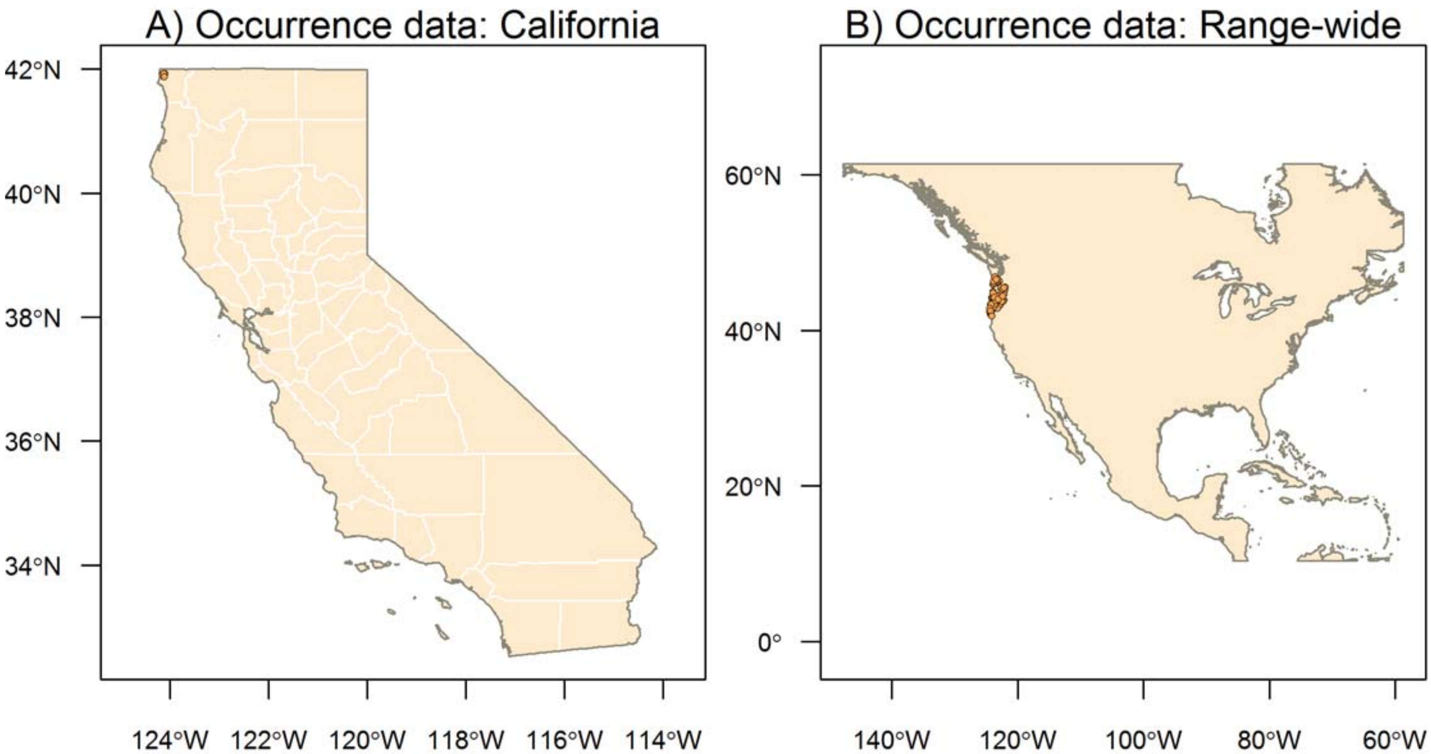
Species Results: *Plethodon dunni* Dunn's Salamander



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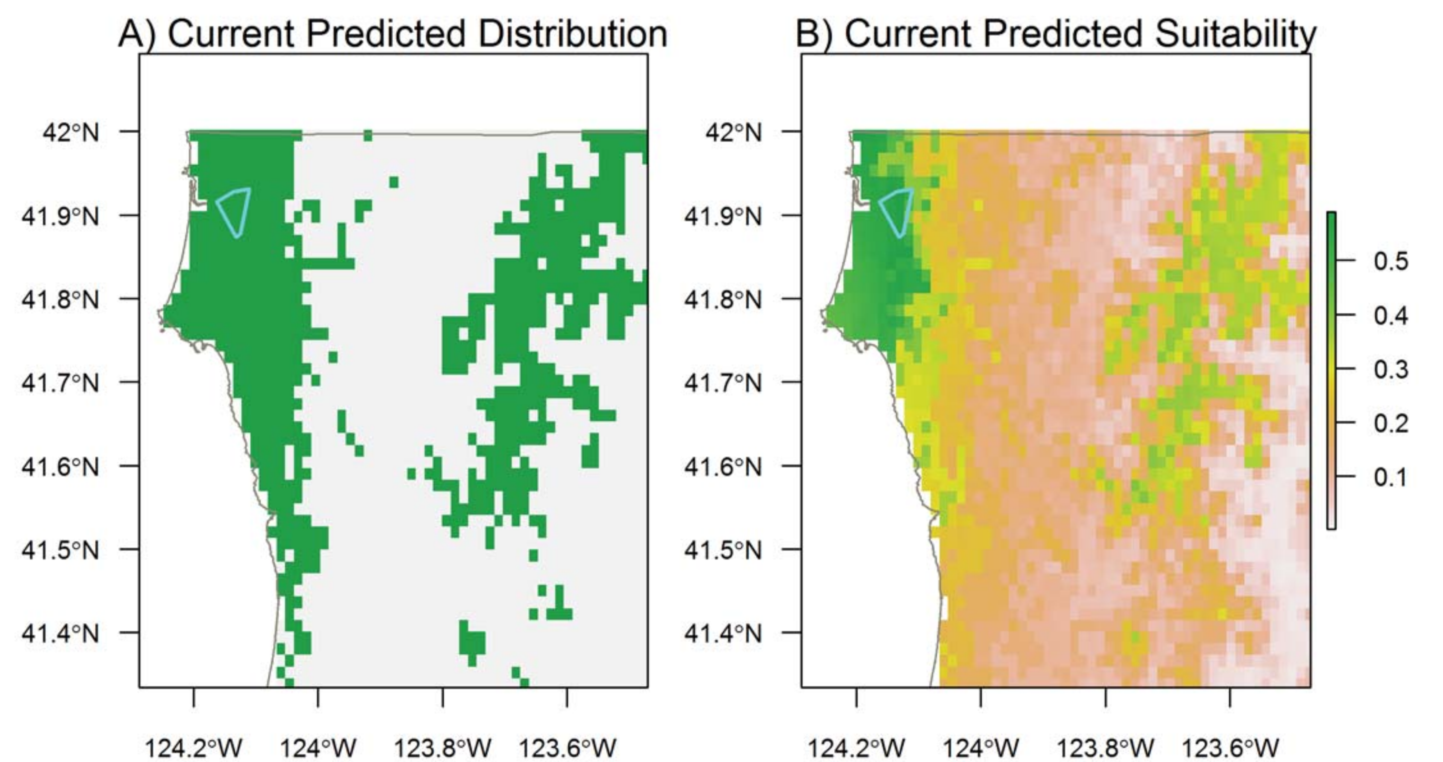

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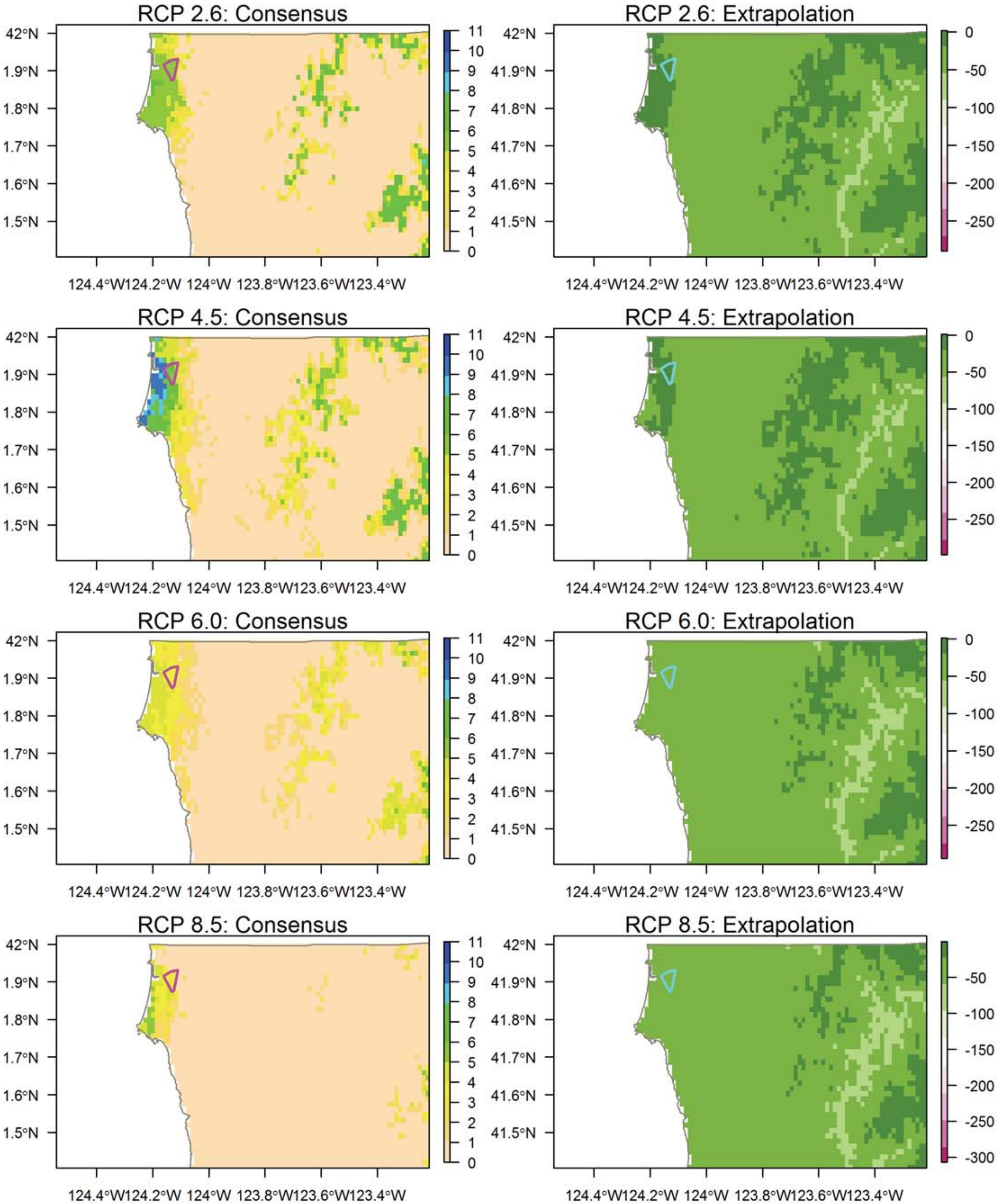

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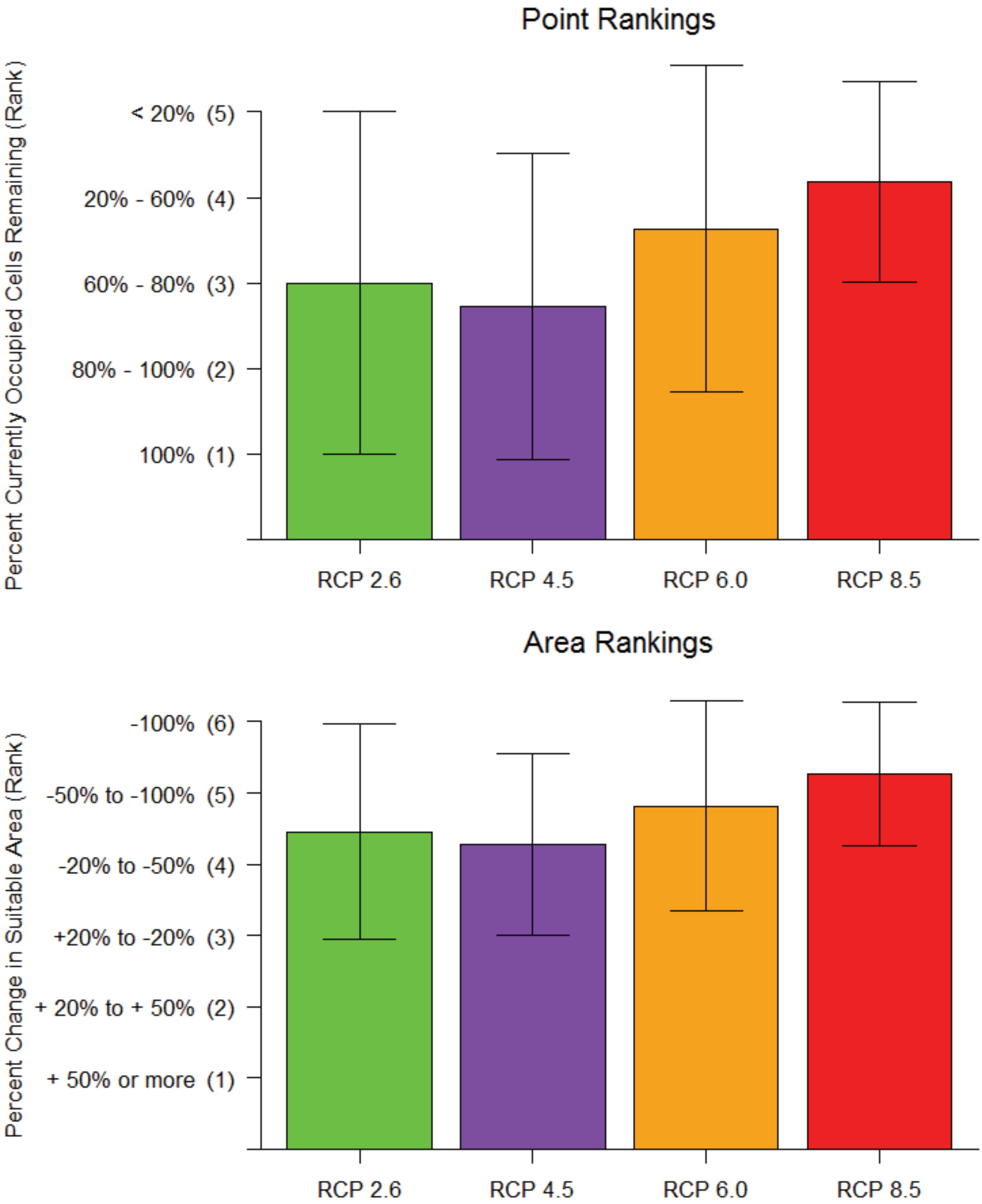

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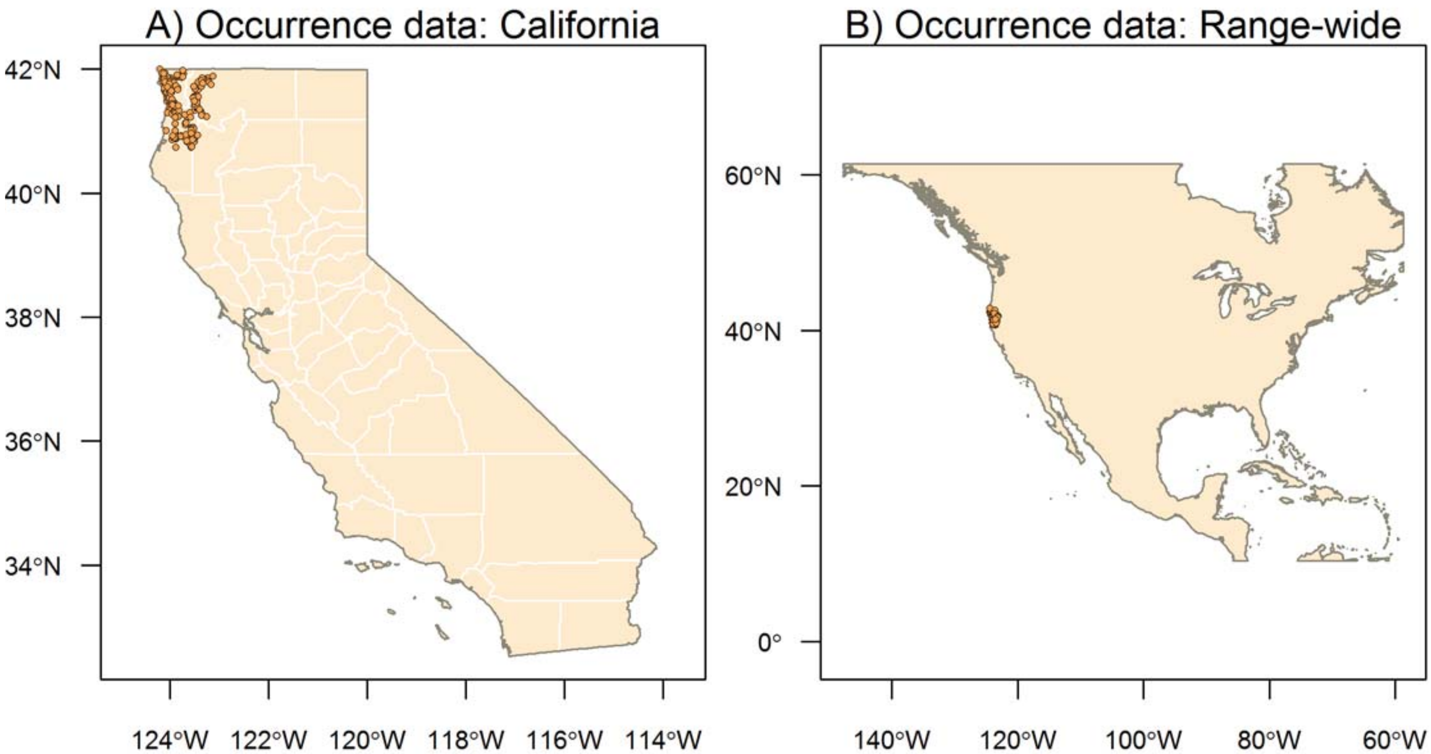
Species Results: *Plethodon elongatus* Del Norte Salamander



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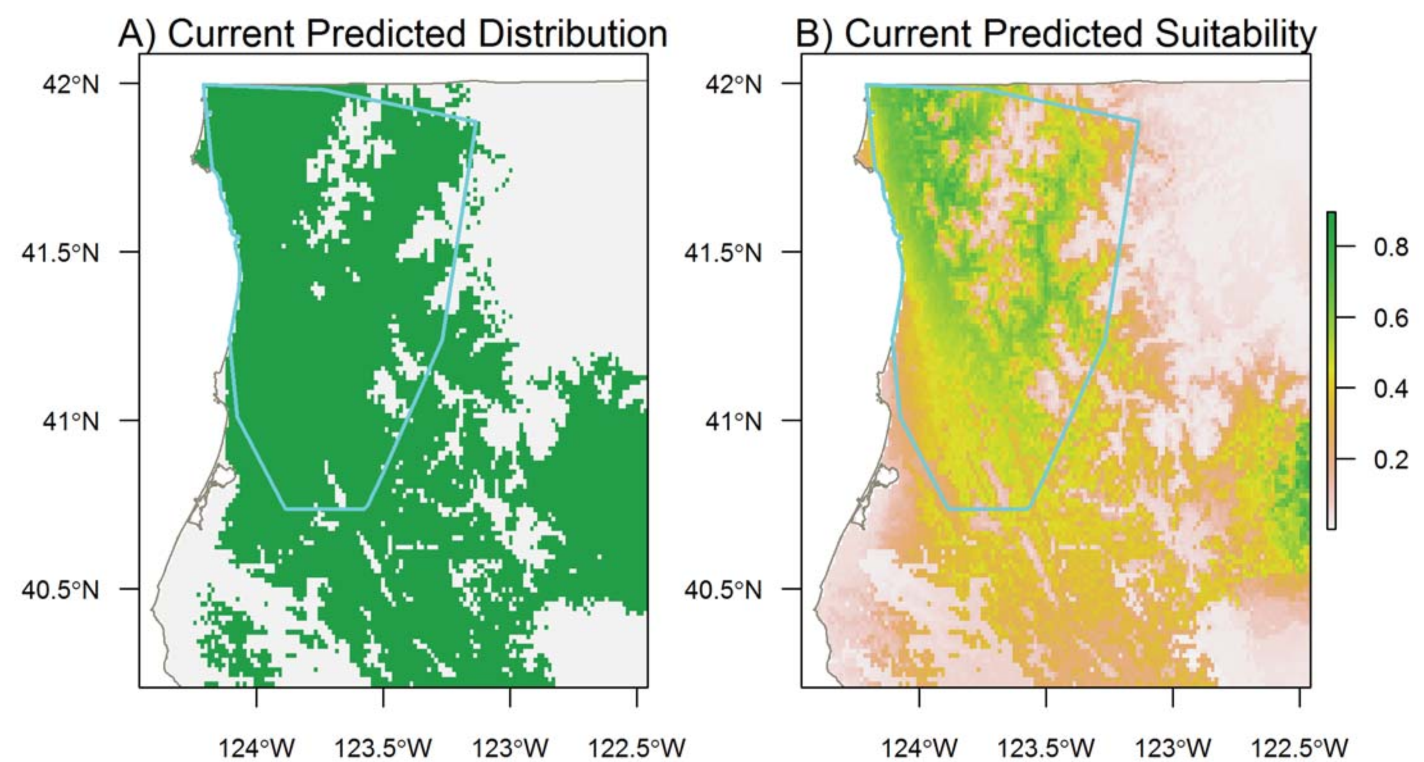

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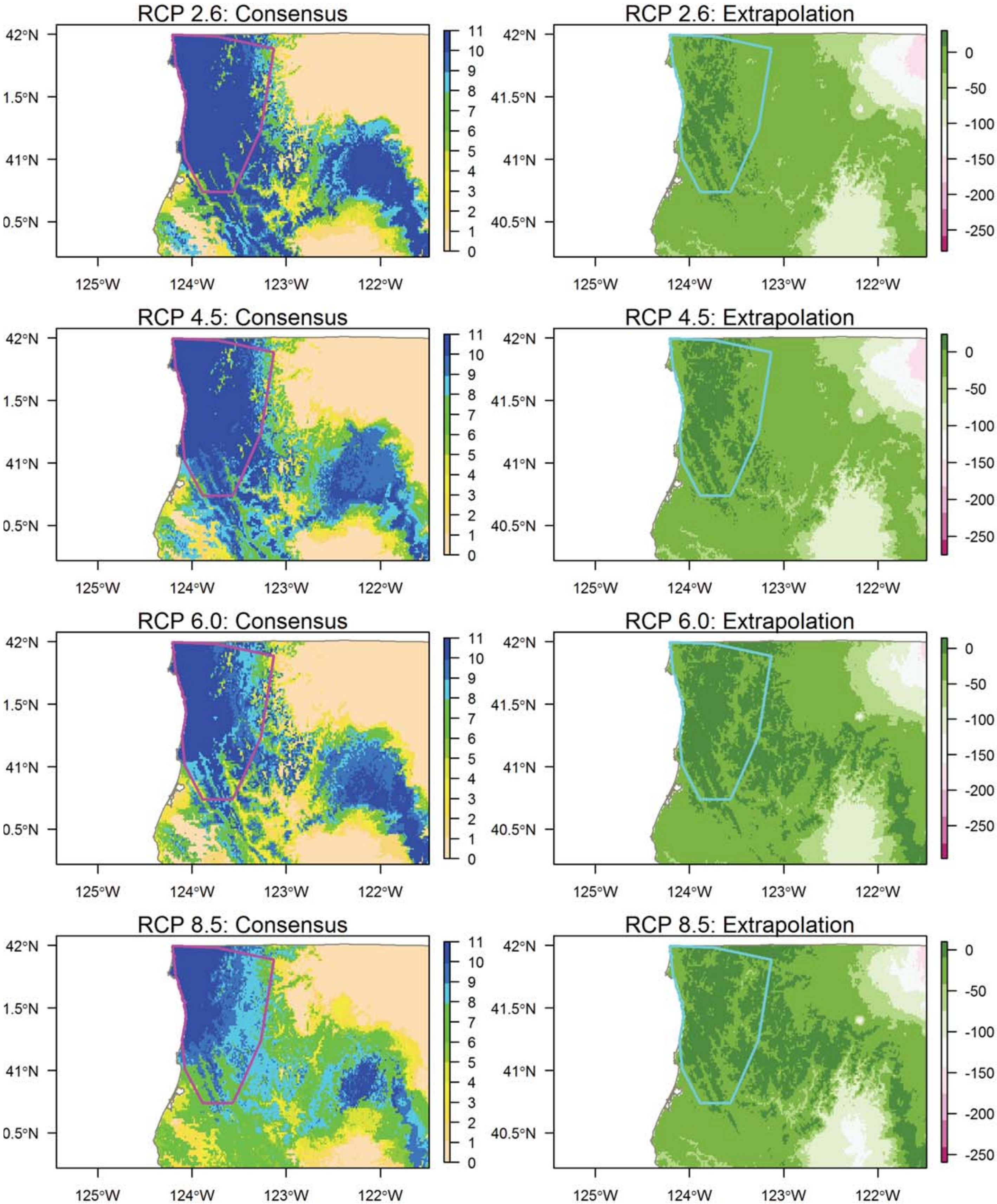

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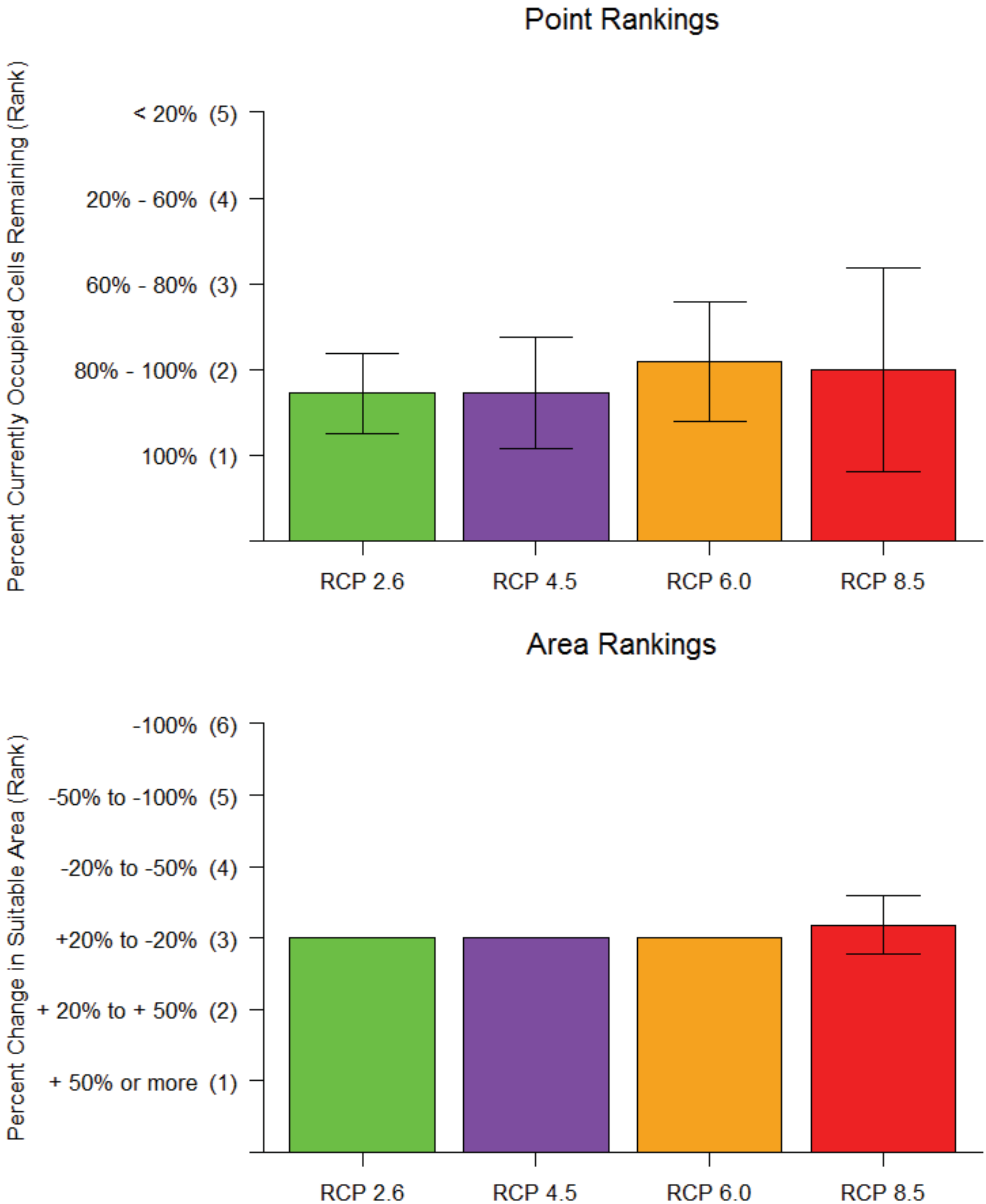

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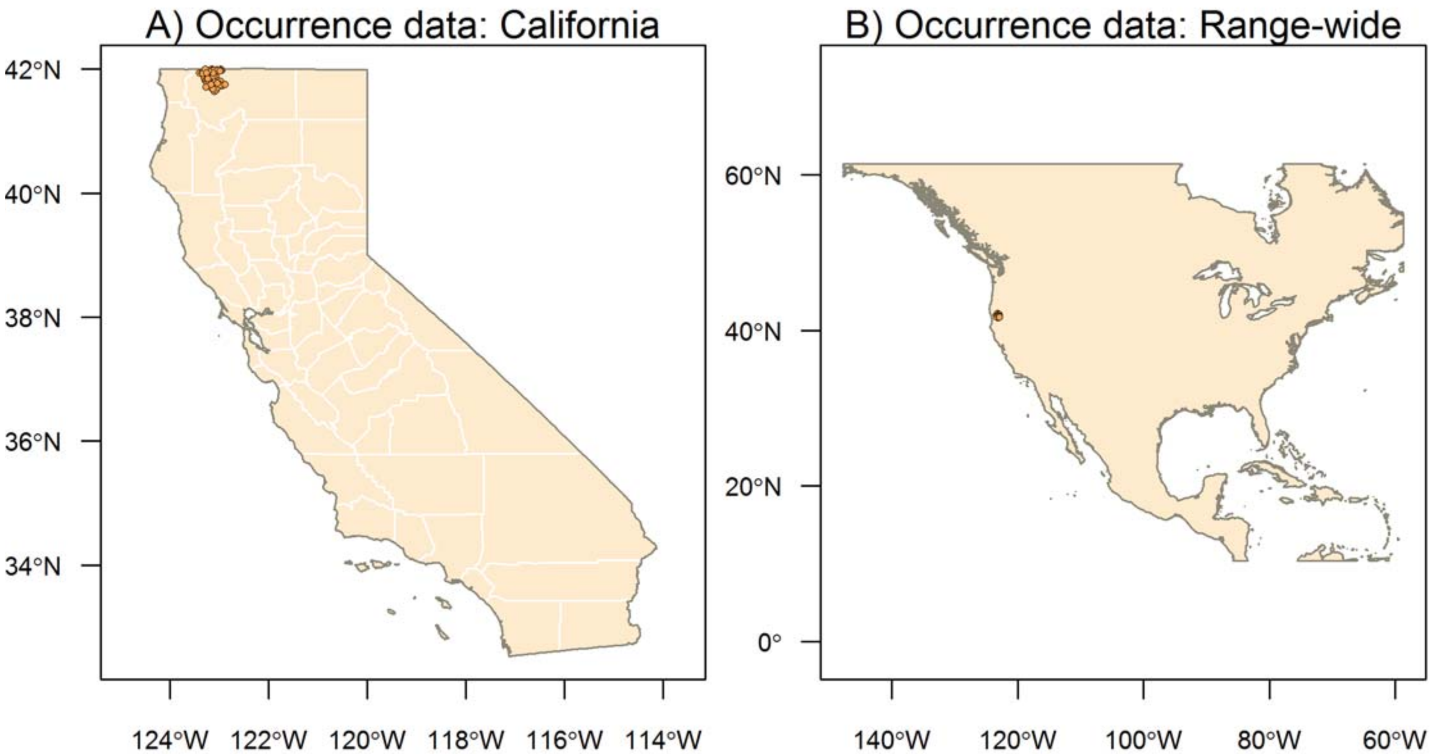

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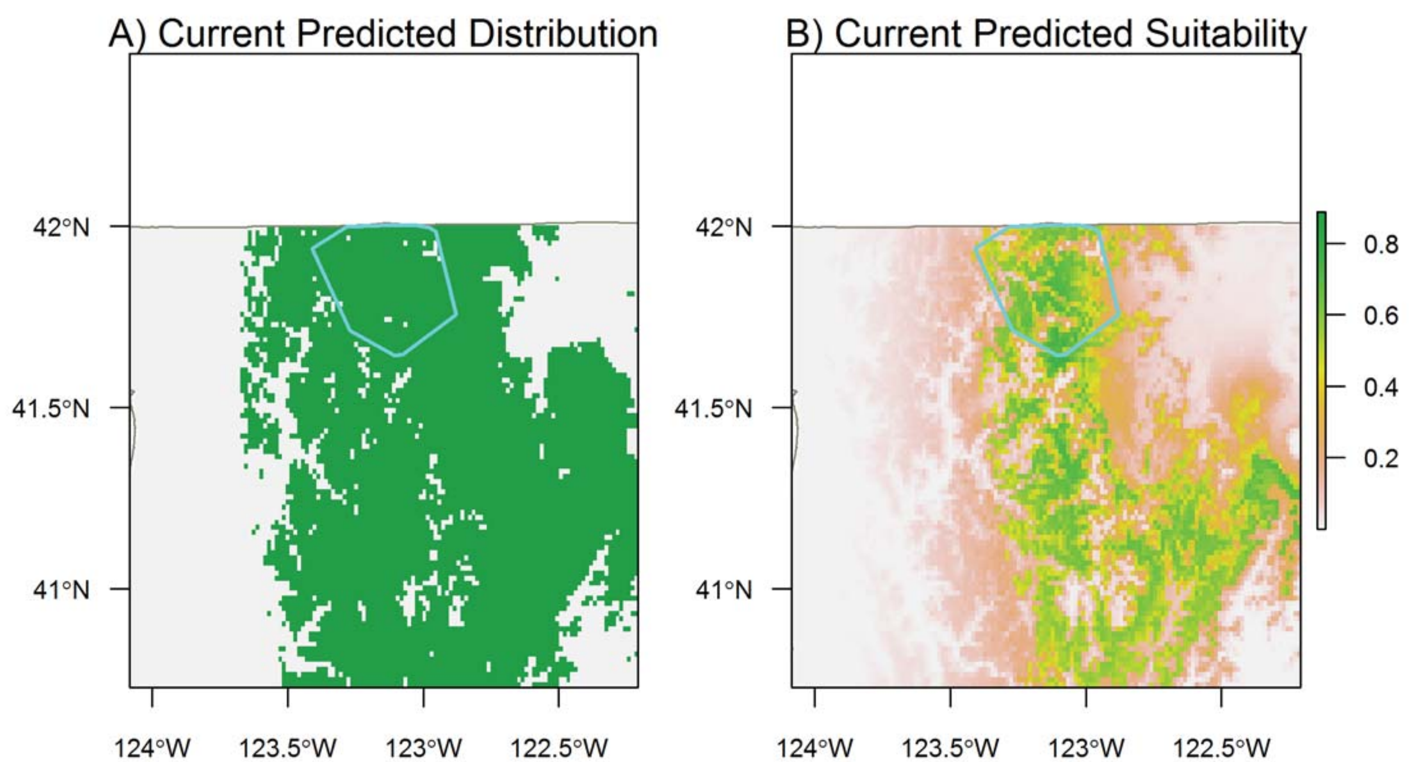

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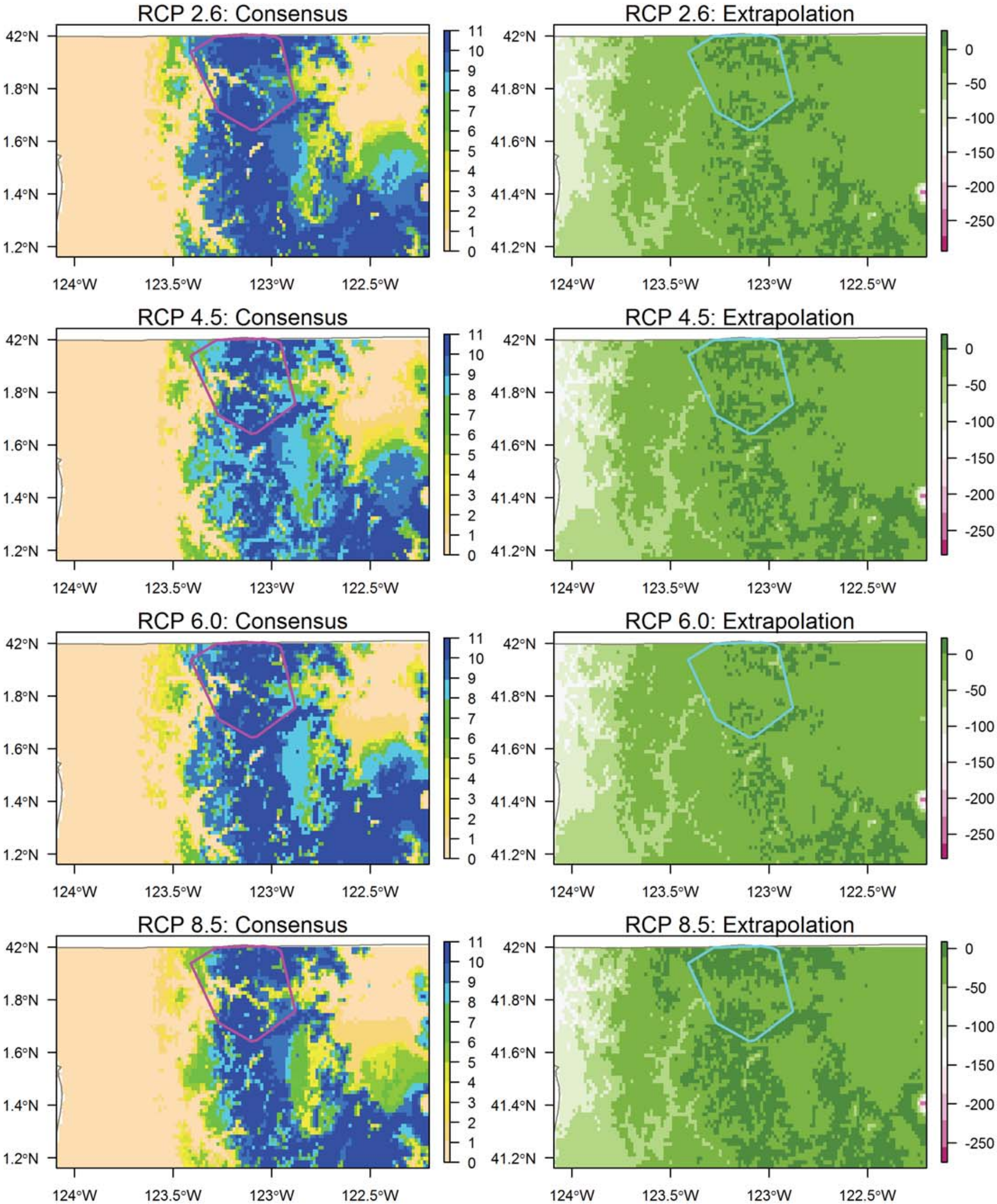
Species Results: *Plethodon stormi* Siskiyou Mountains Salamander



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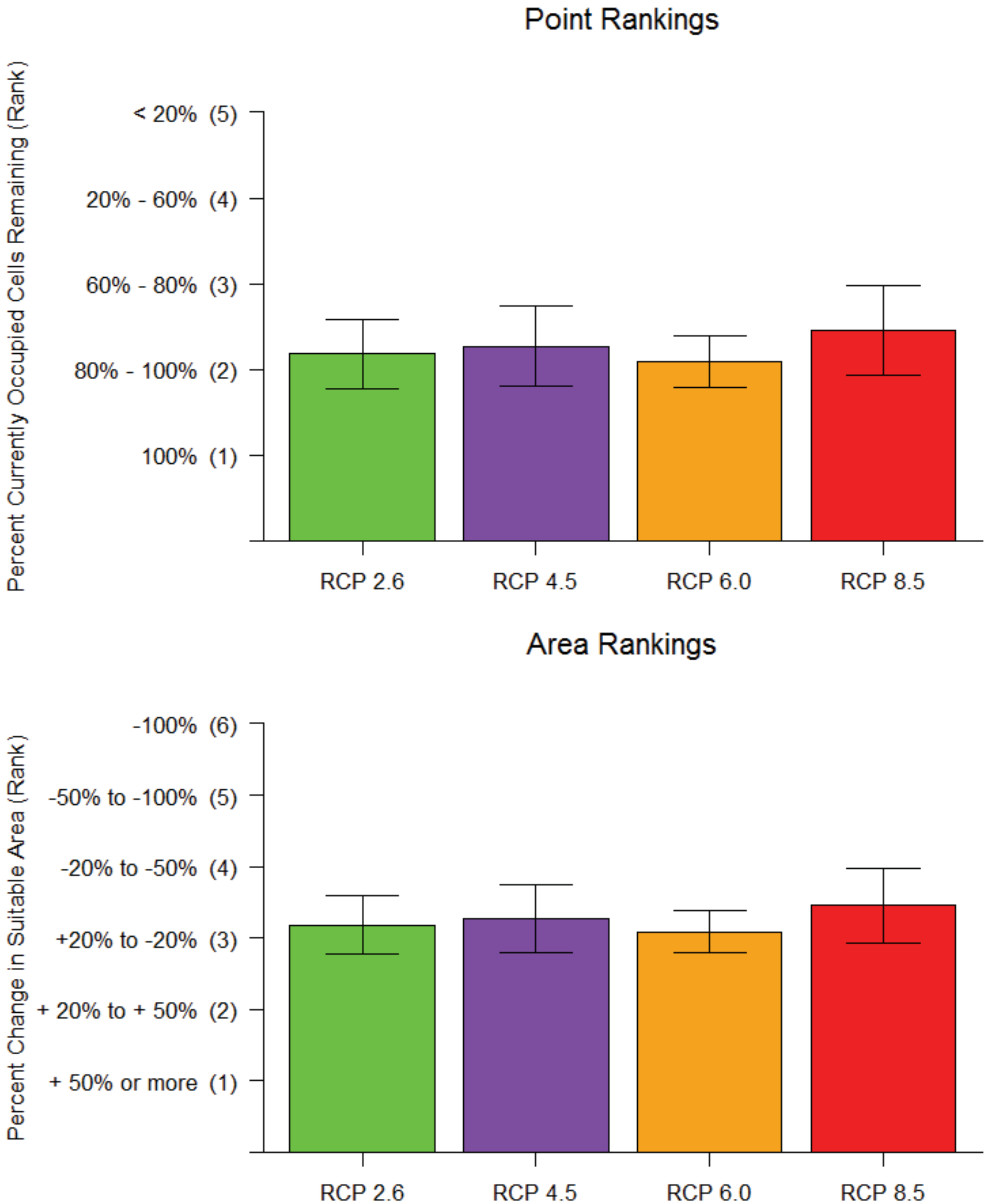

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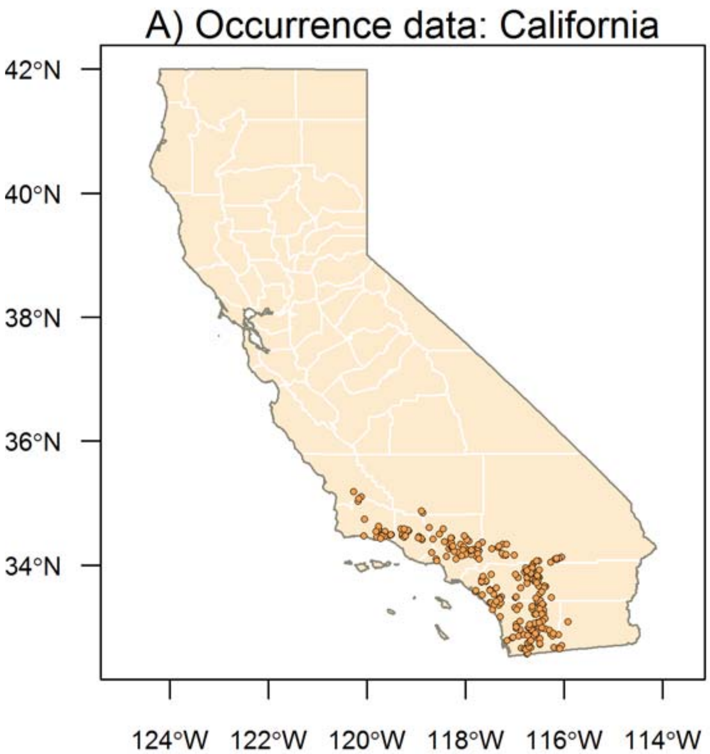
Species Results: *Pseudacris cadaverina* California Treefrog



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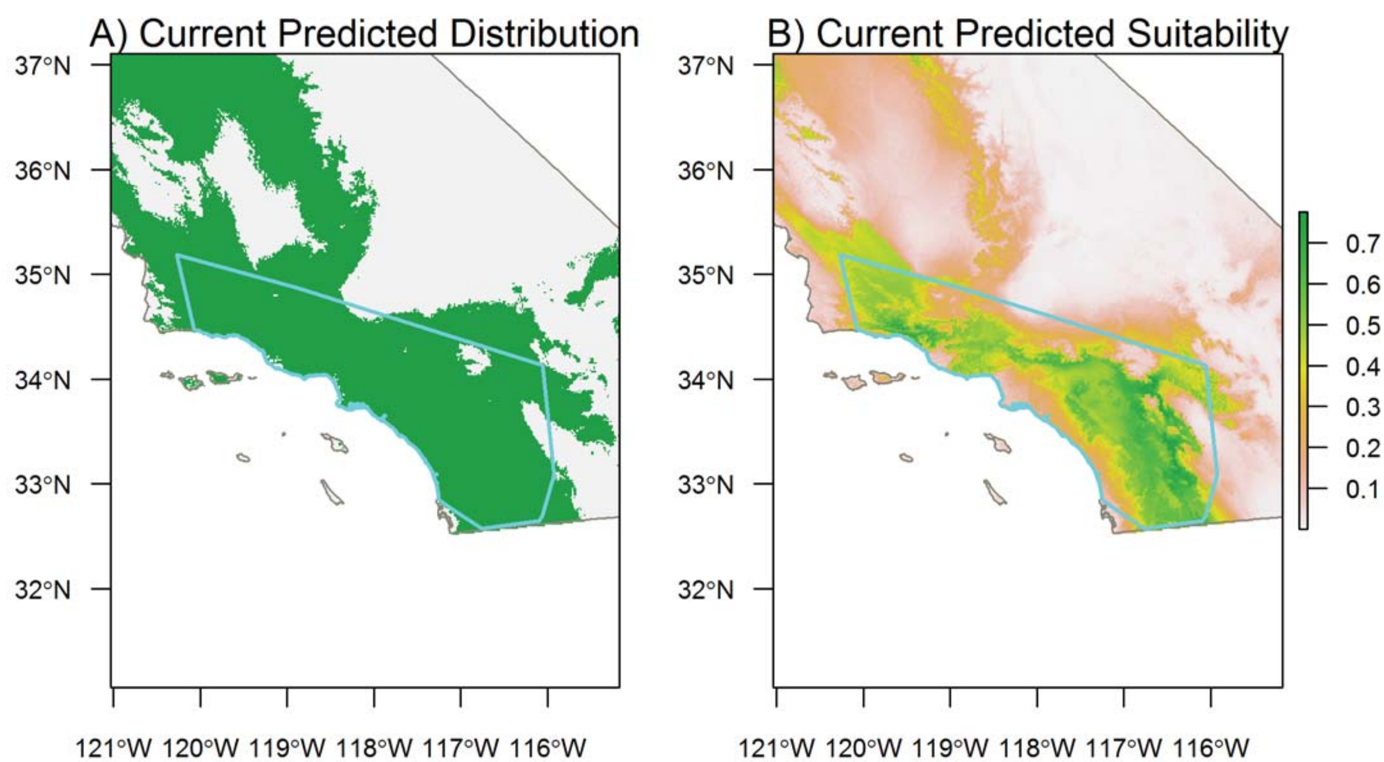

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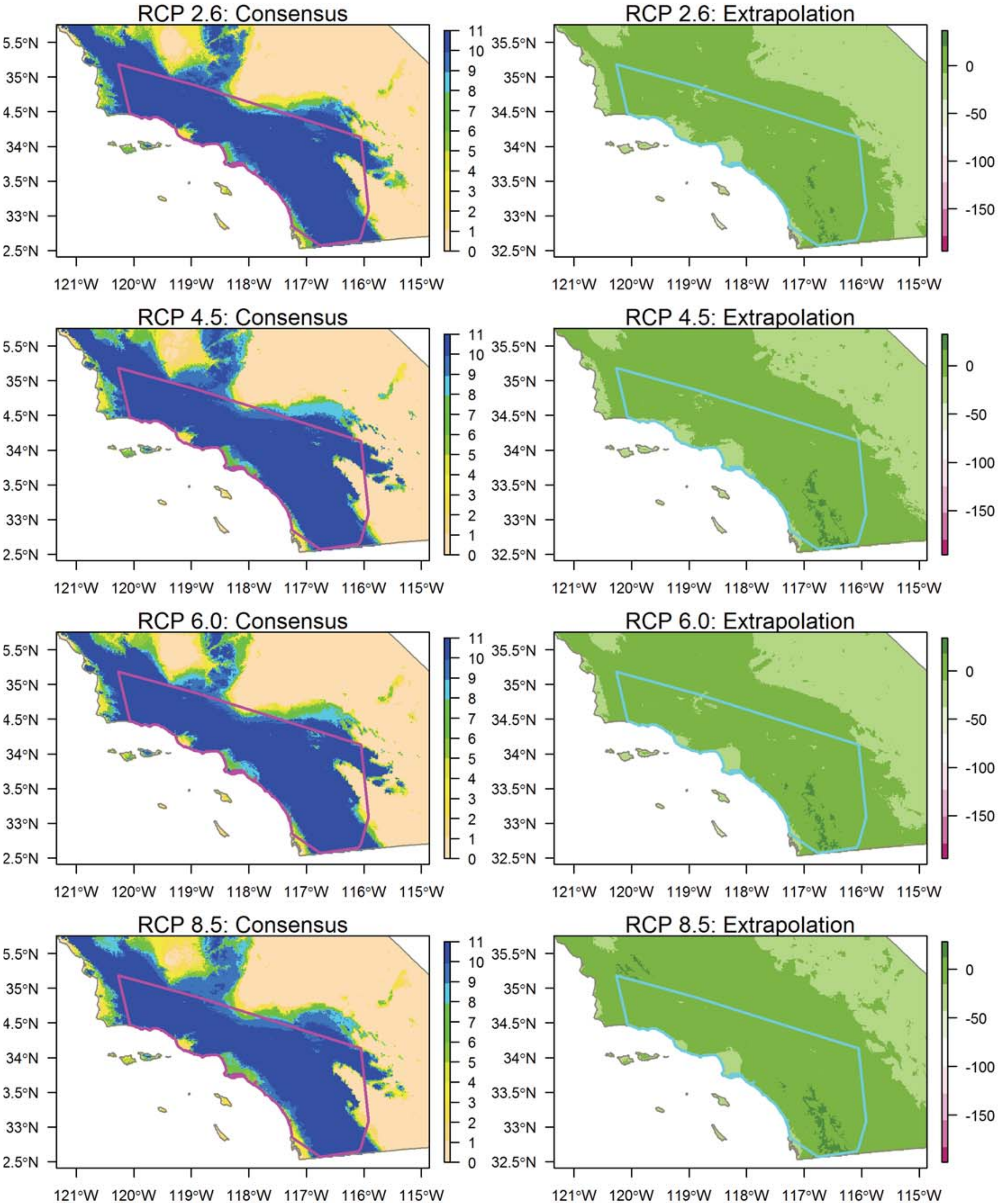

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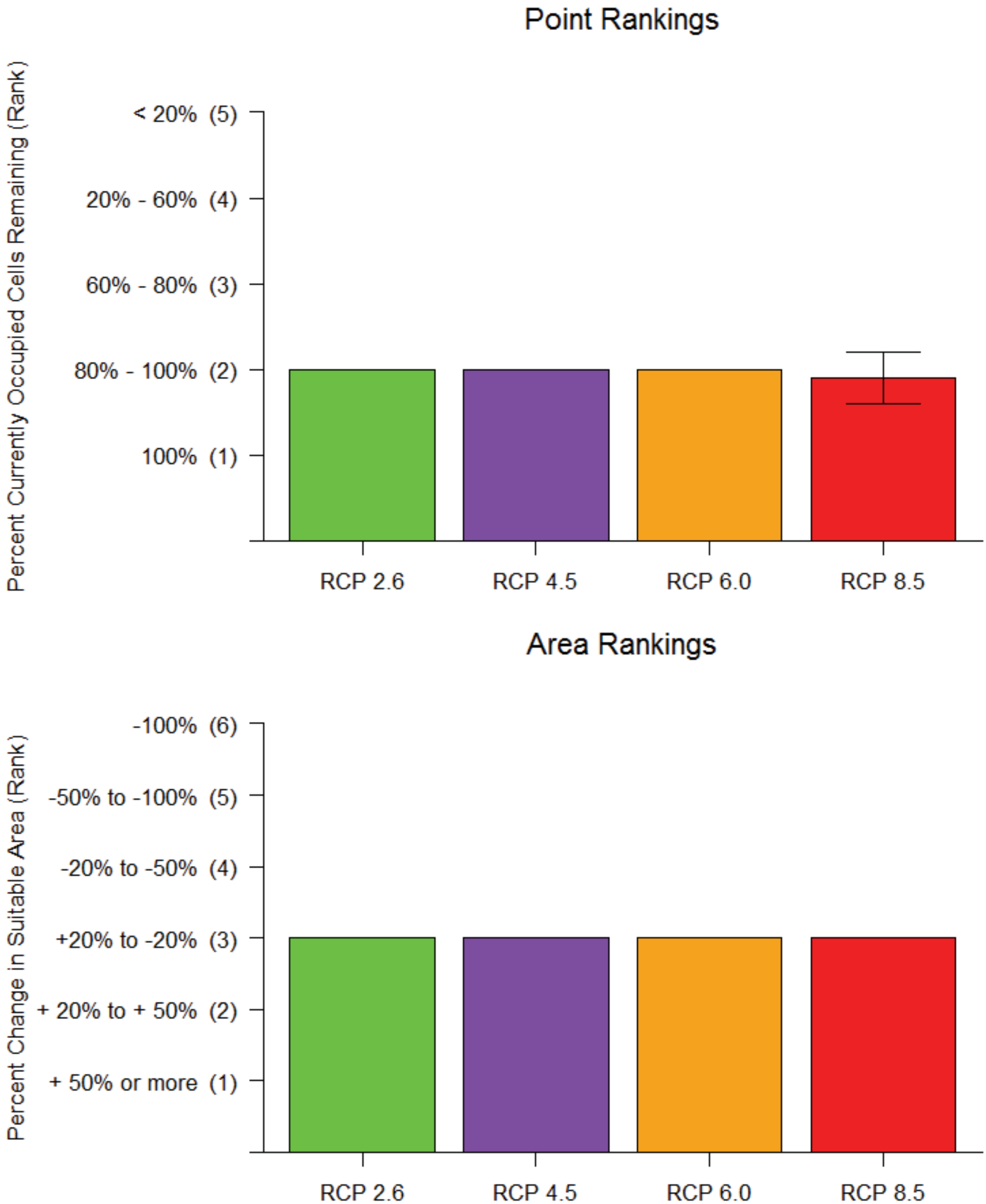

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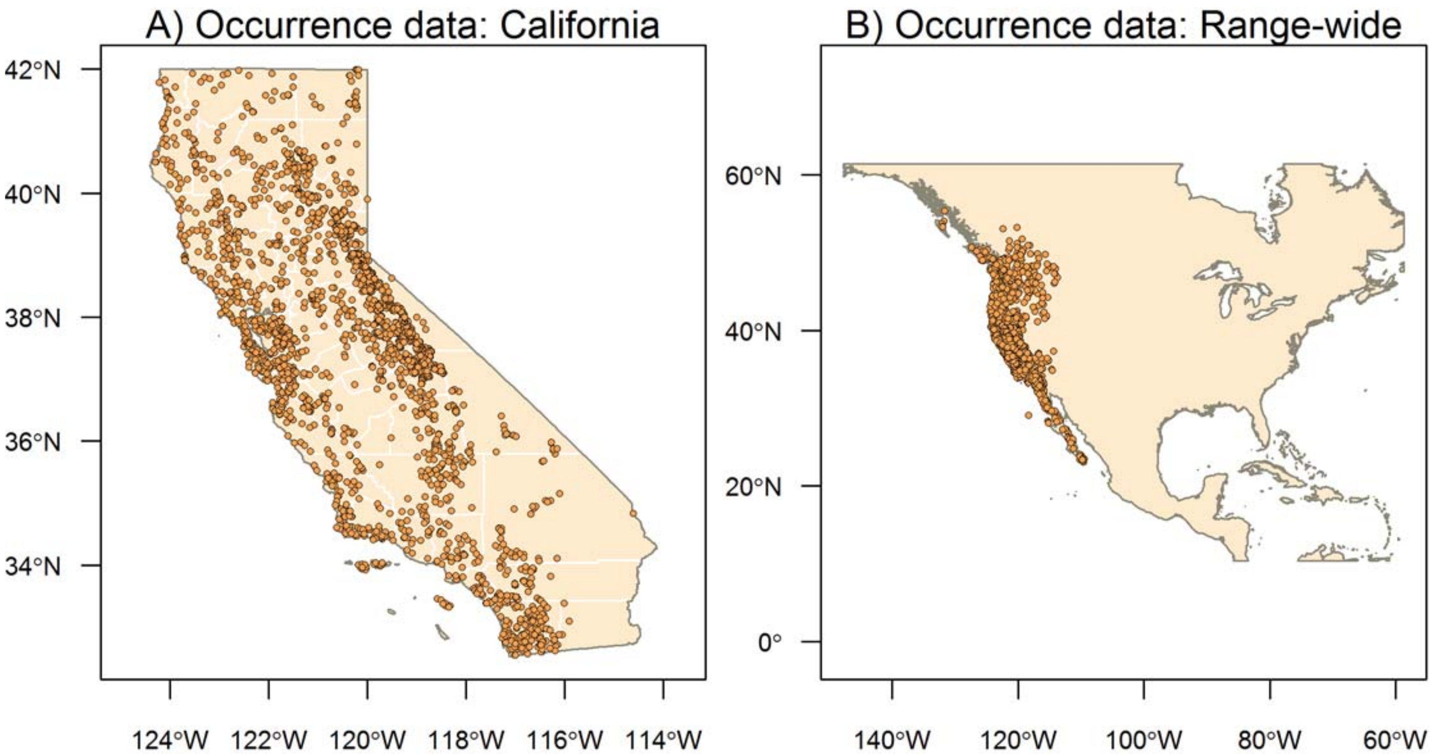

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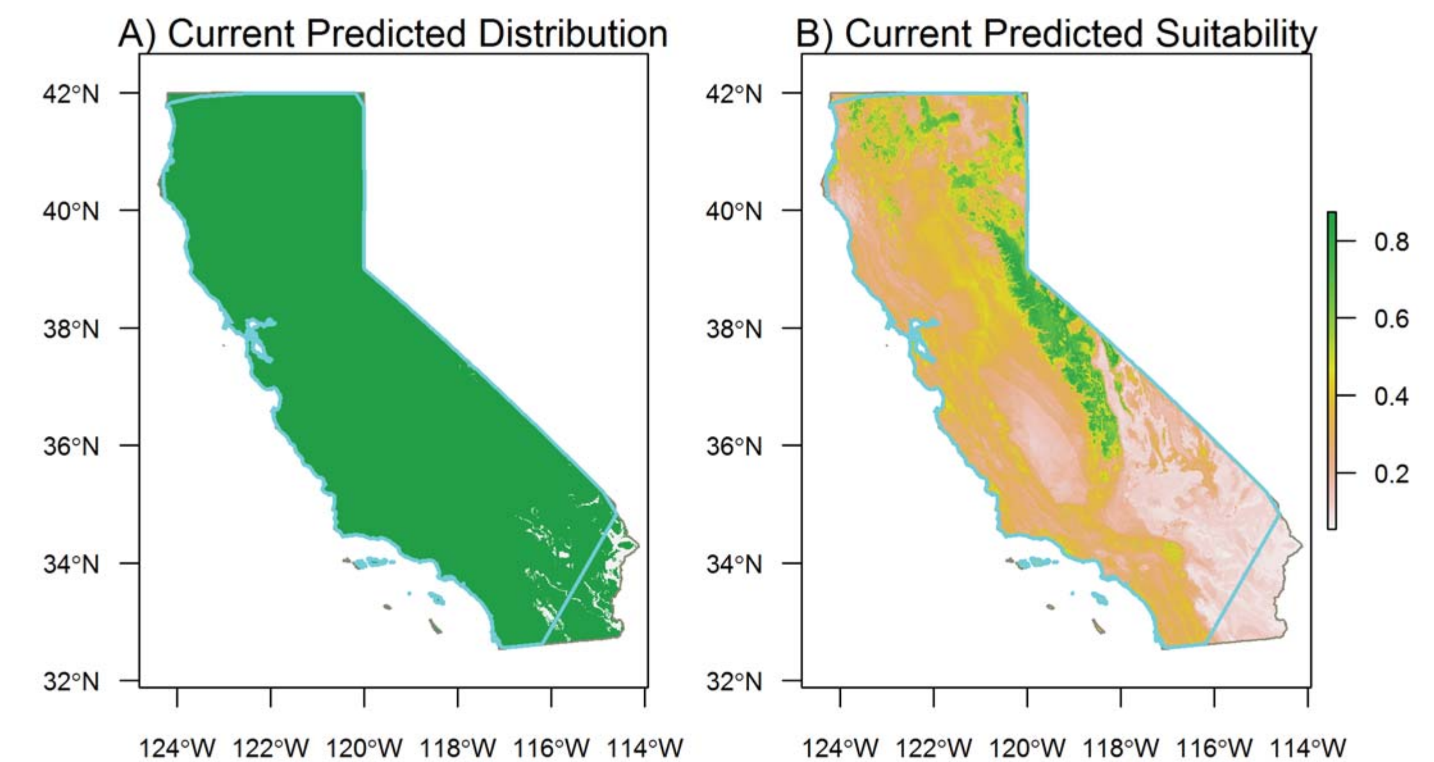

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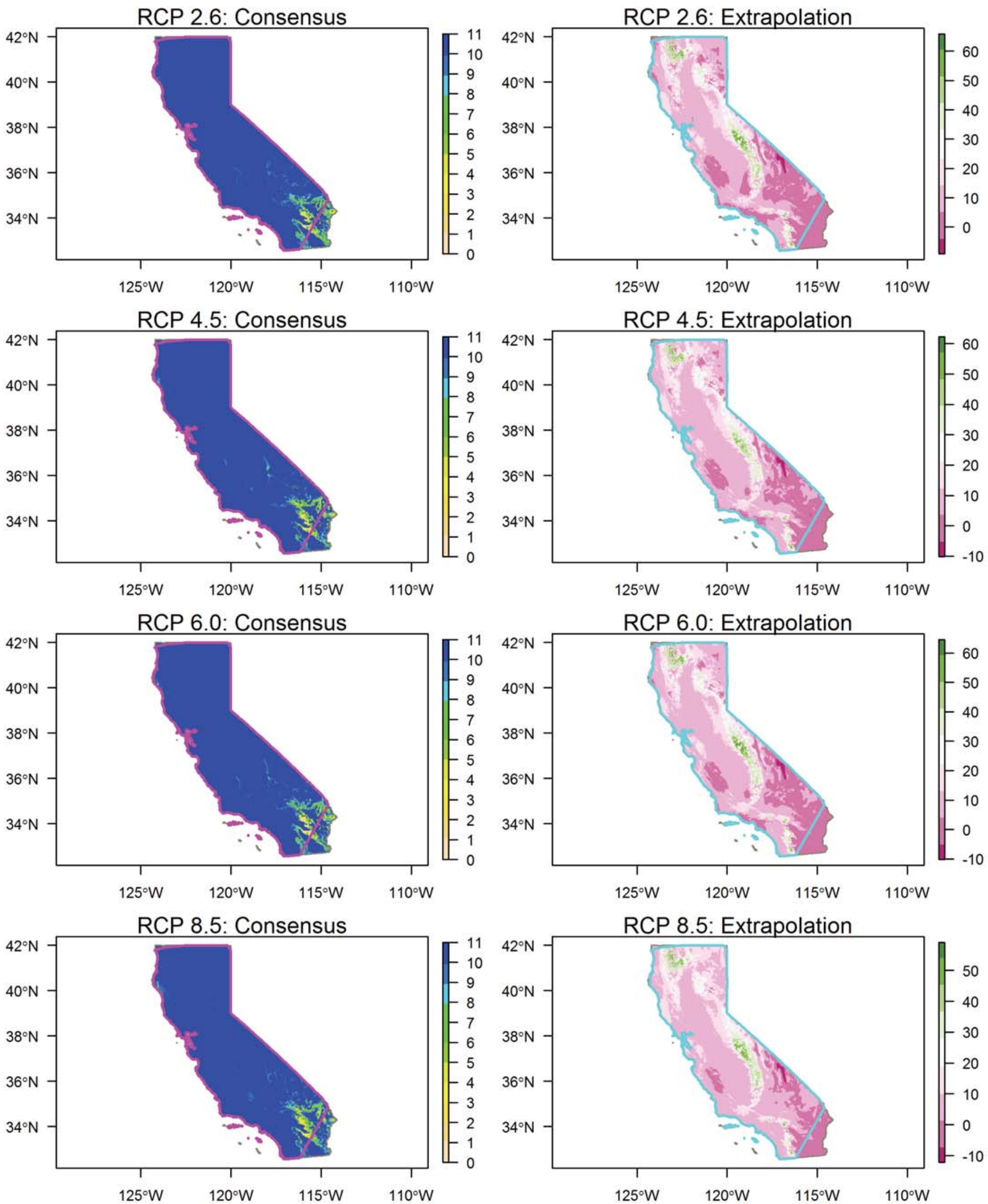

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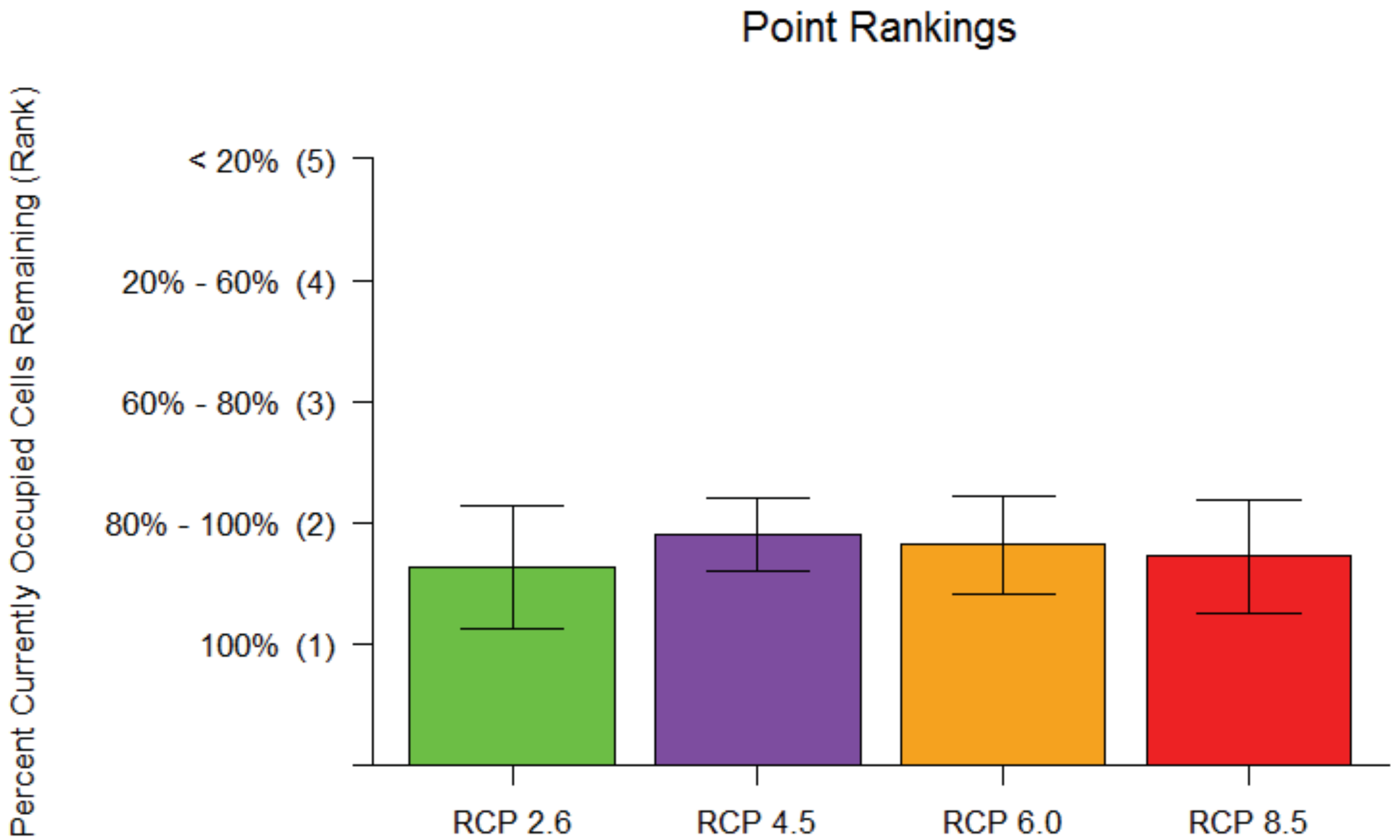
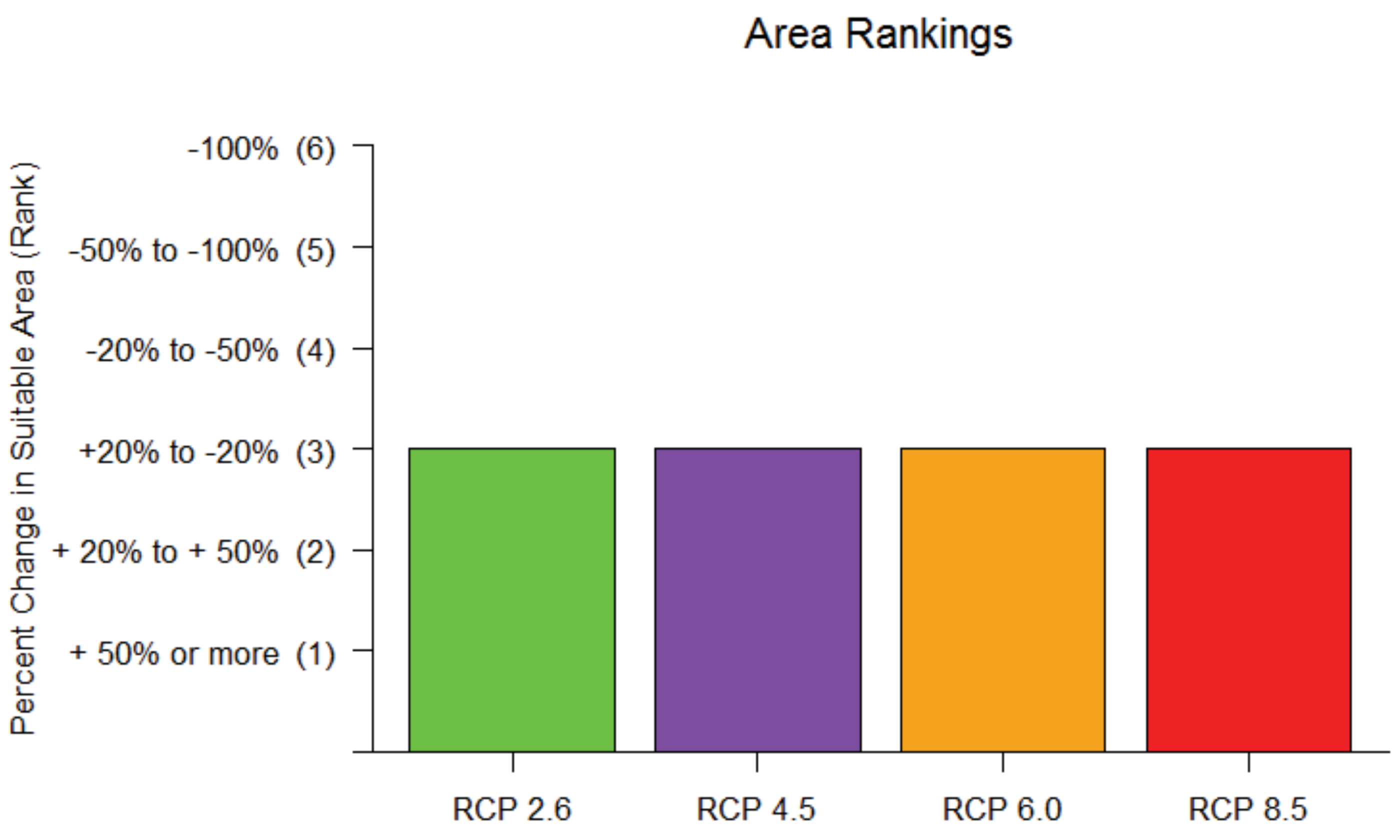
Species Results: *Pseudacris regilla* Pacific Treefrog





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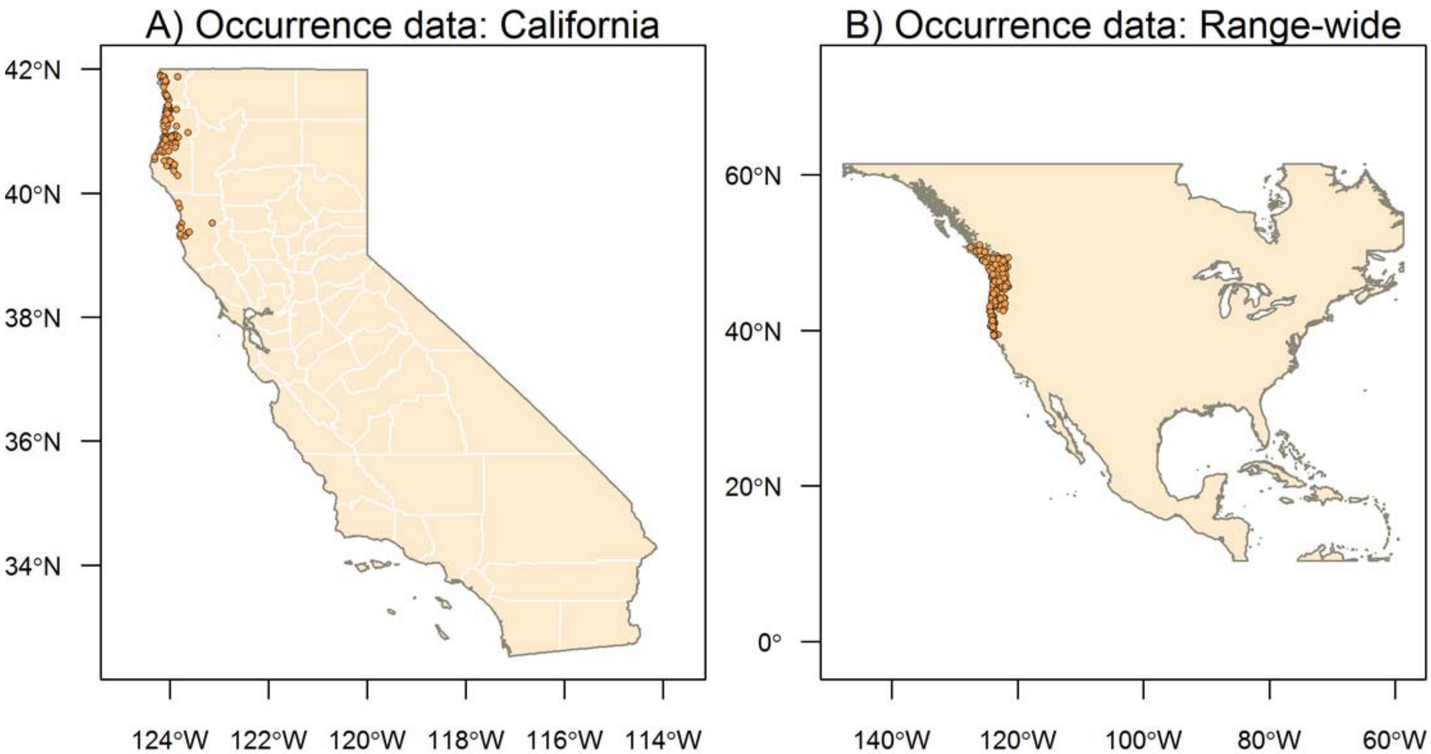
Species Results: *Rana aurora* Northern Red-legged Frog



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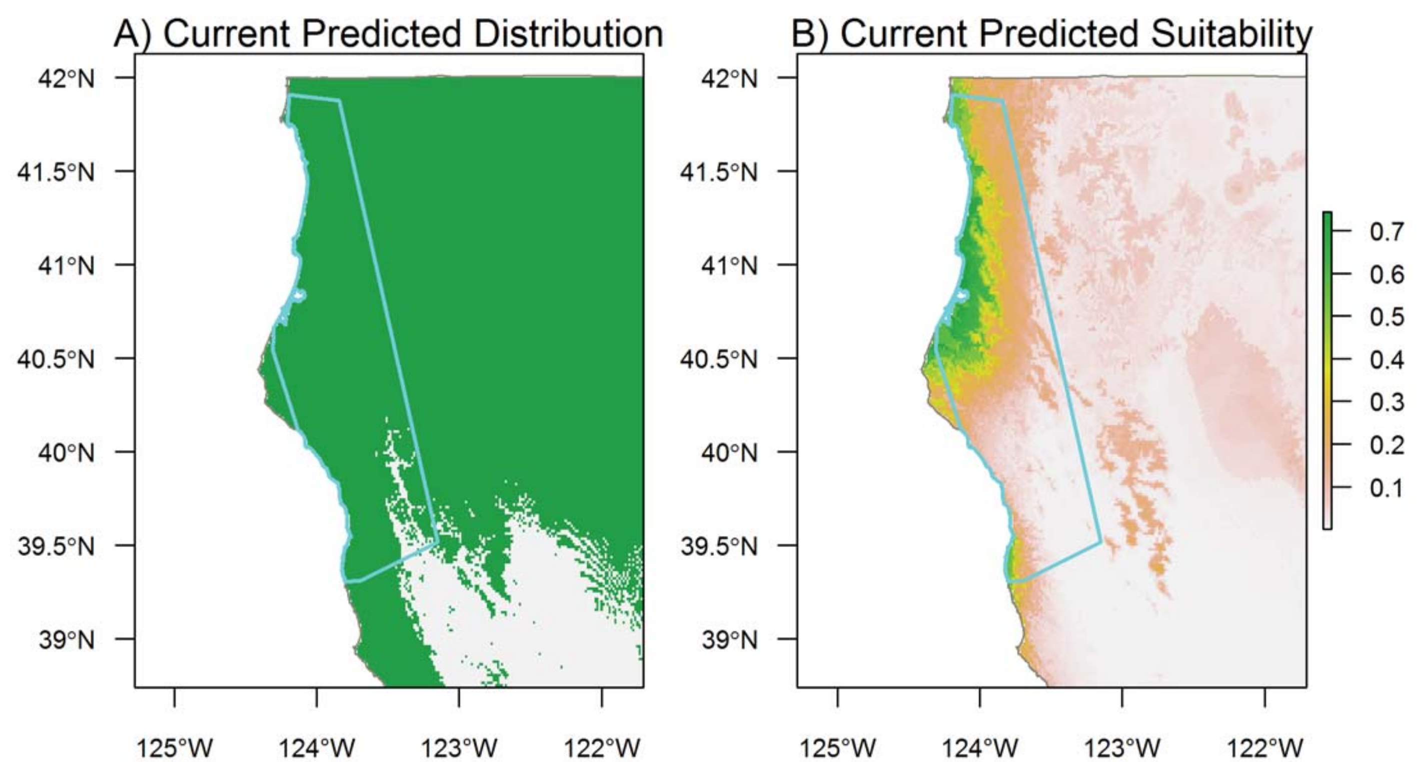

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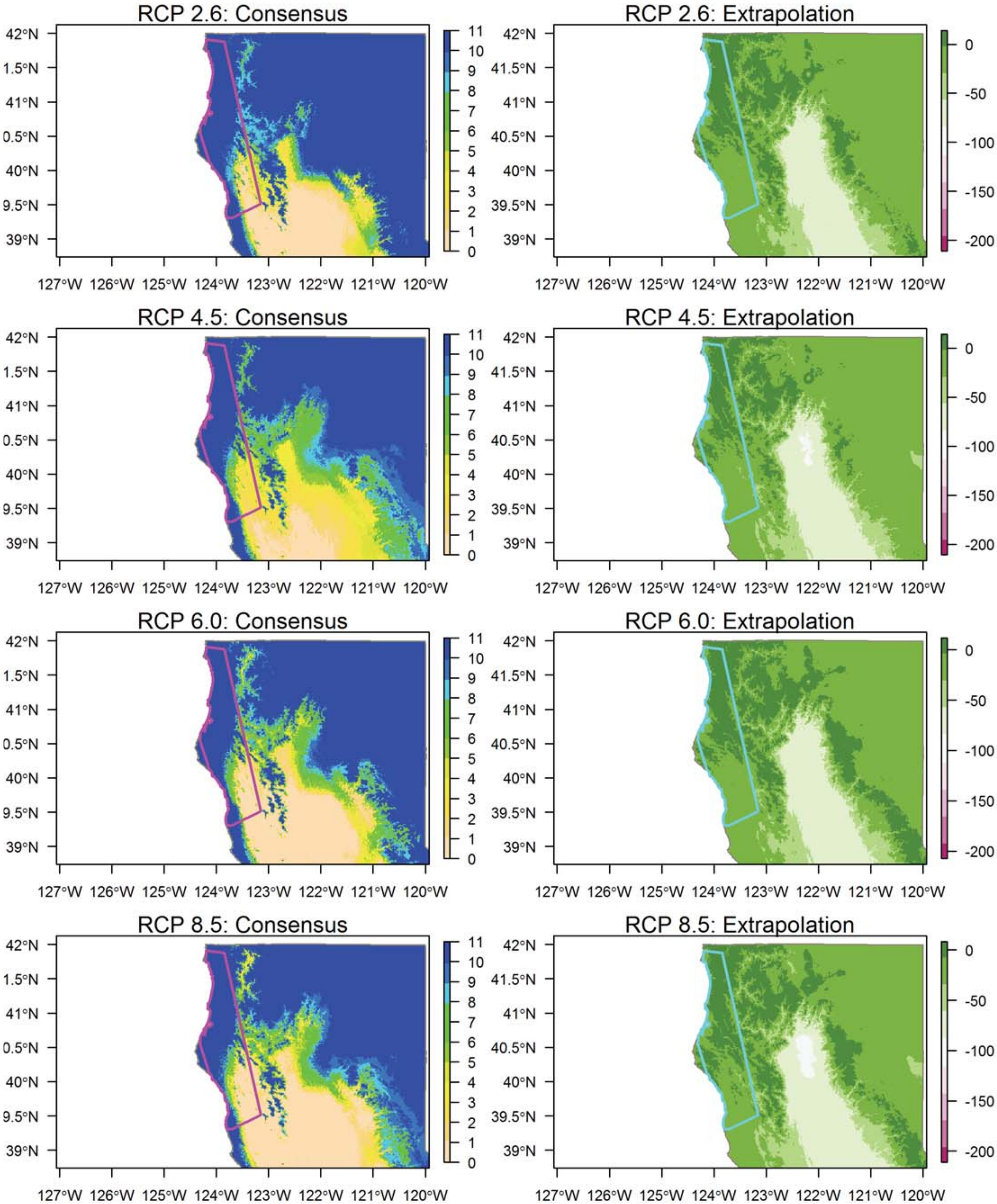
Species Results: *Rana aurora* Northern Red-legged Frog



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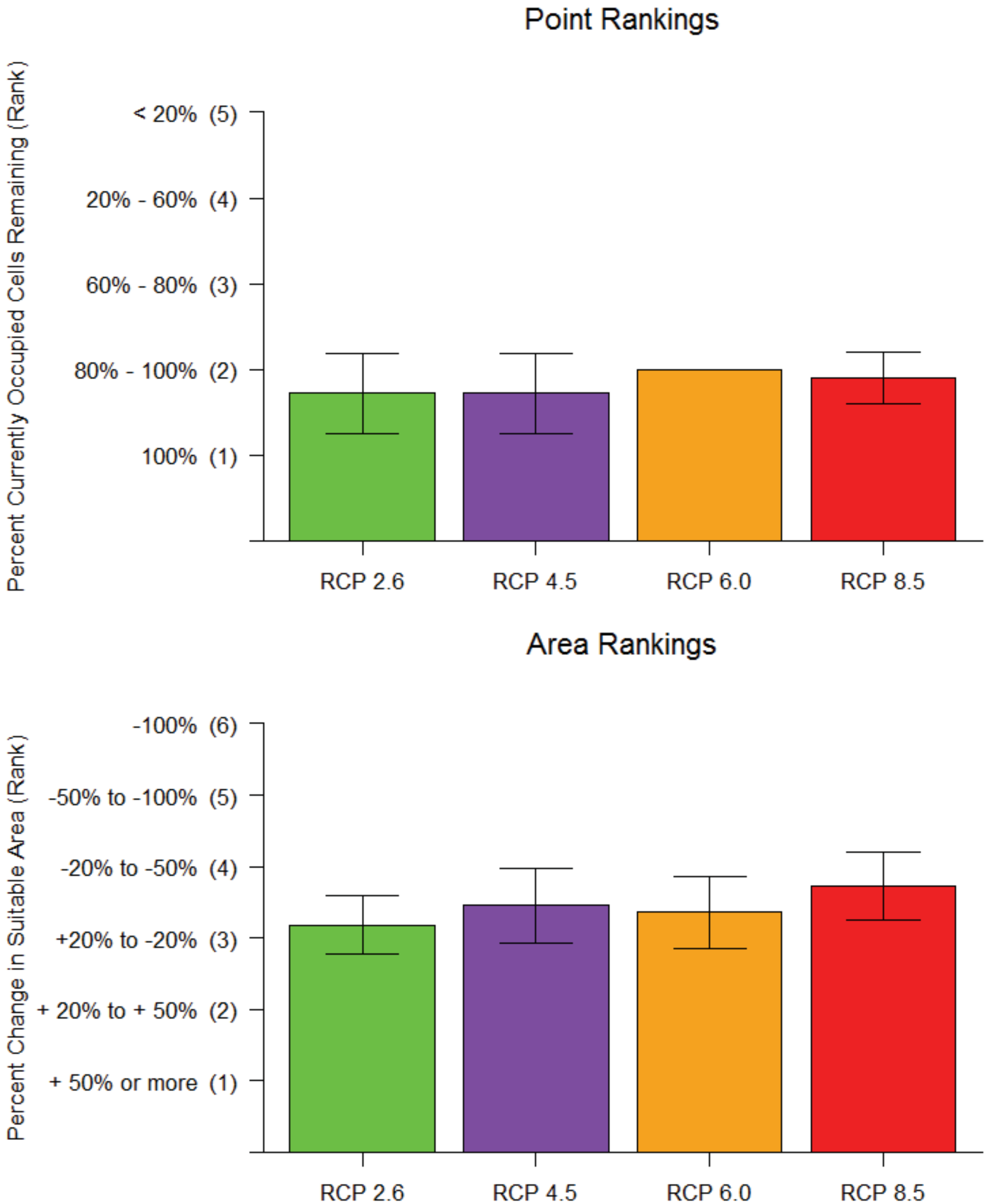

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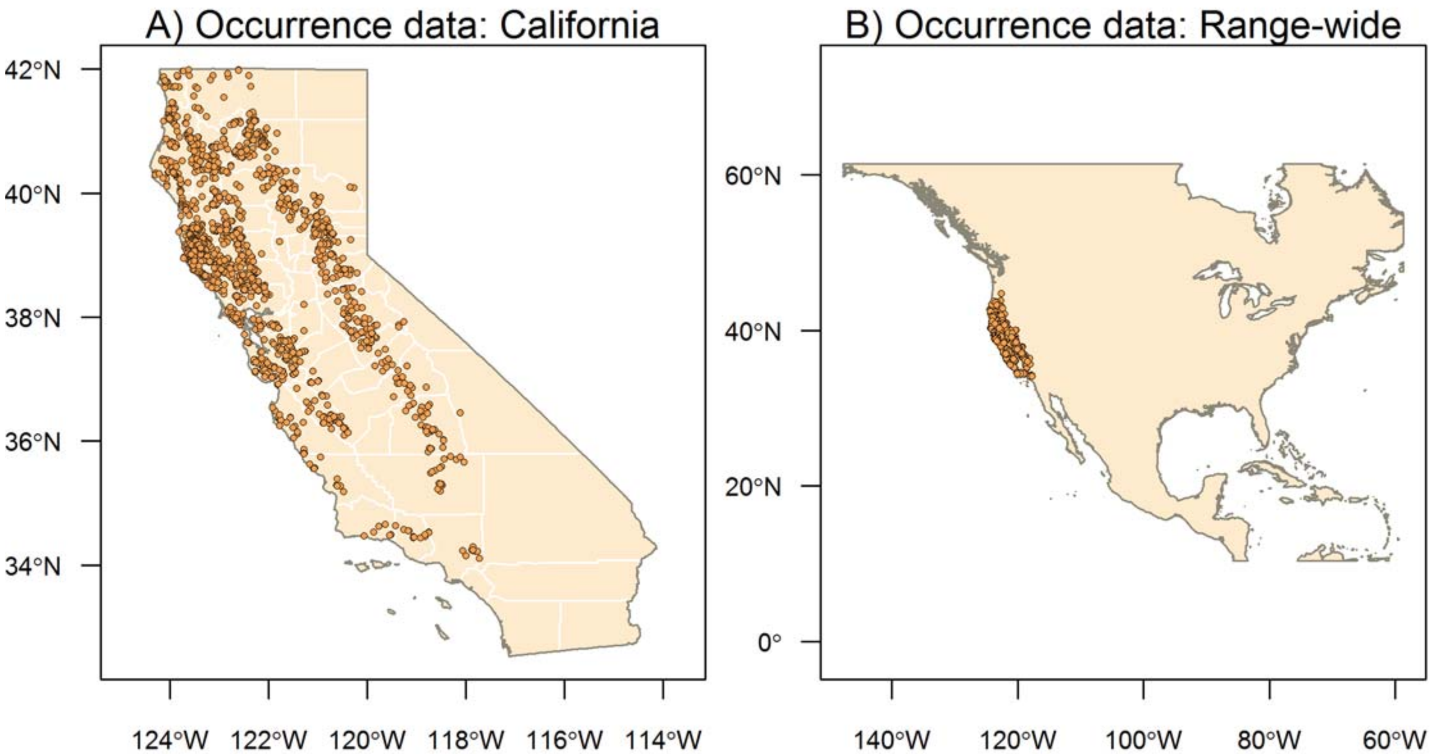
Species Results: *Rana boylii* Foothill Yellow-legged Frog



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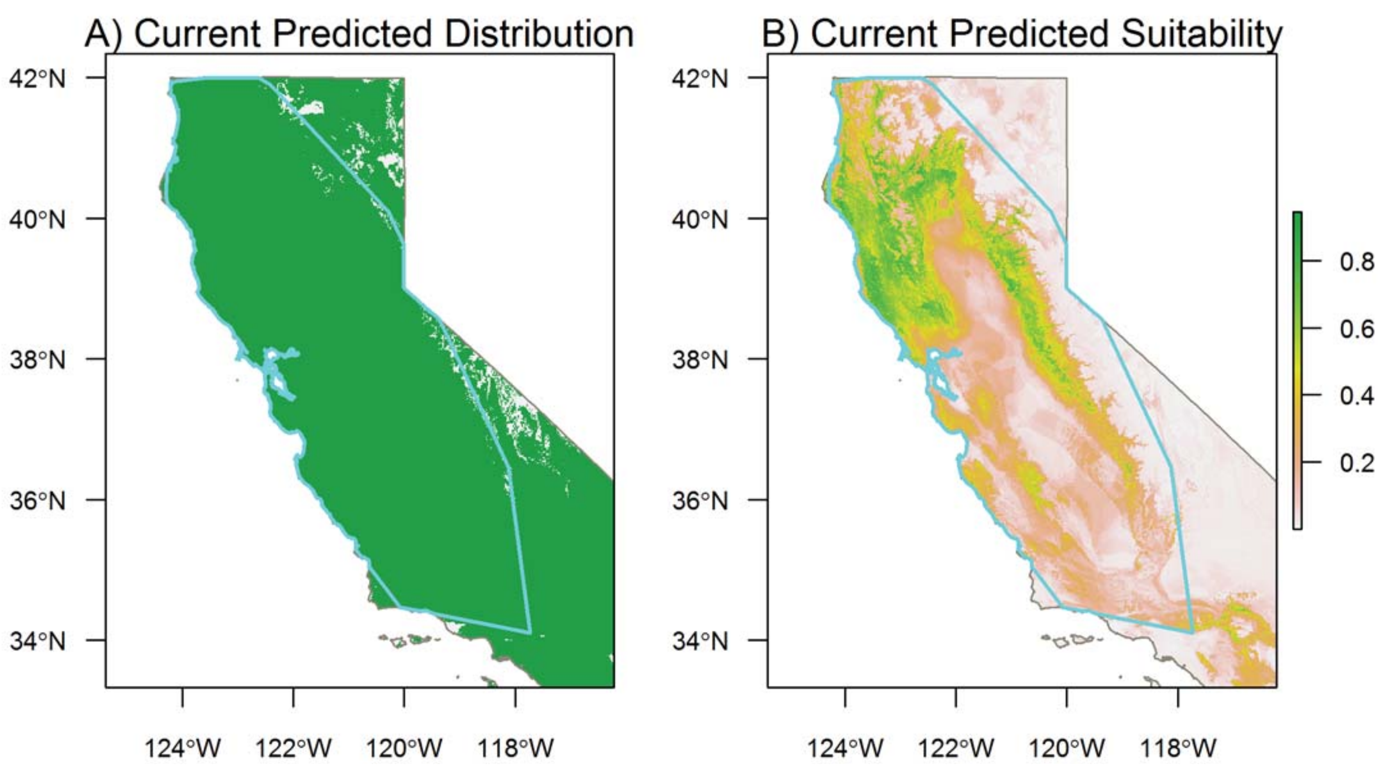

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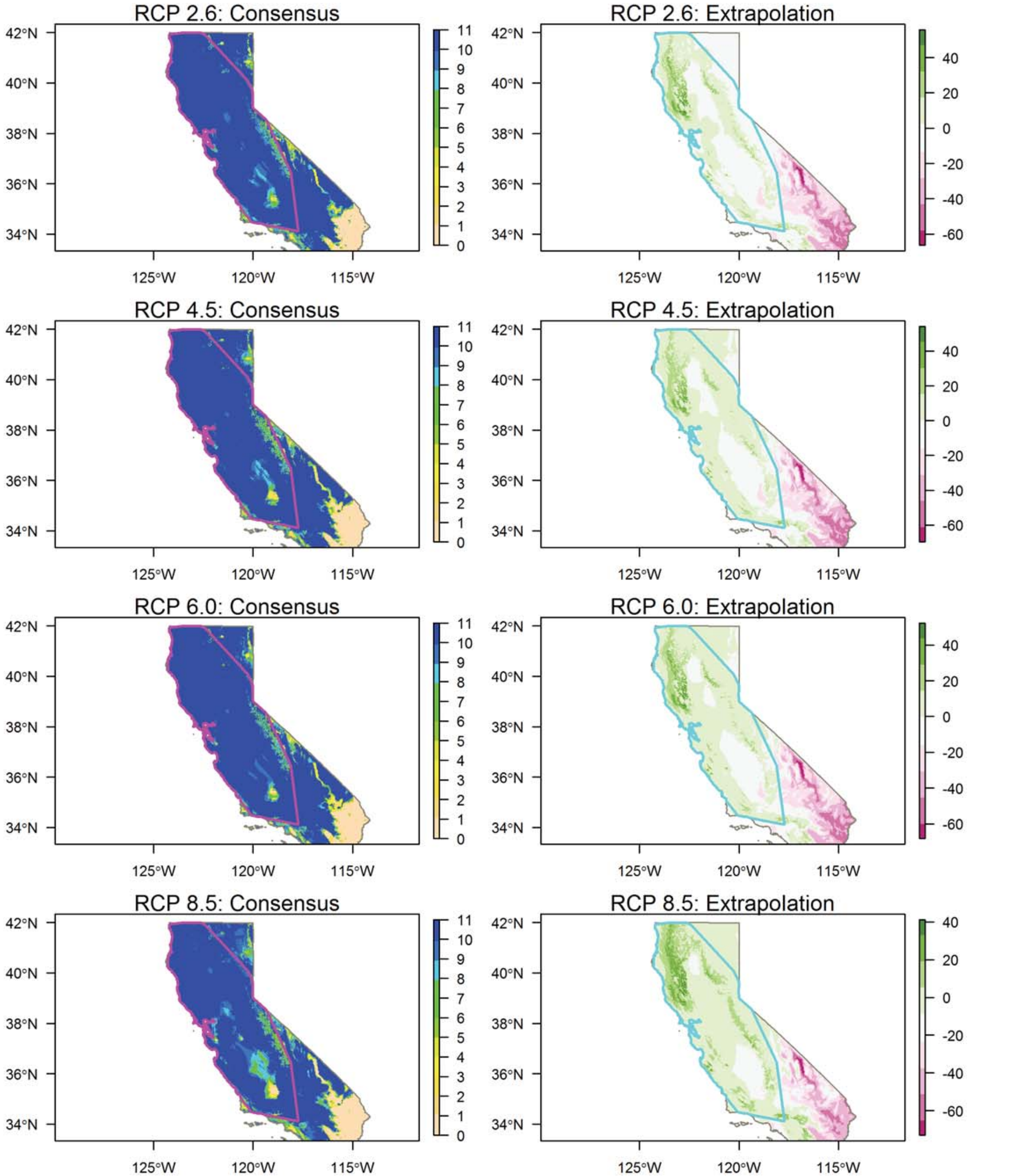
Species Results: *Rana boylii* Foothill Yellow-legged Frog



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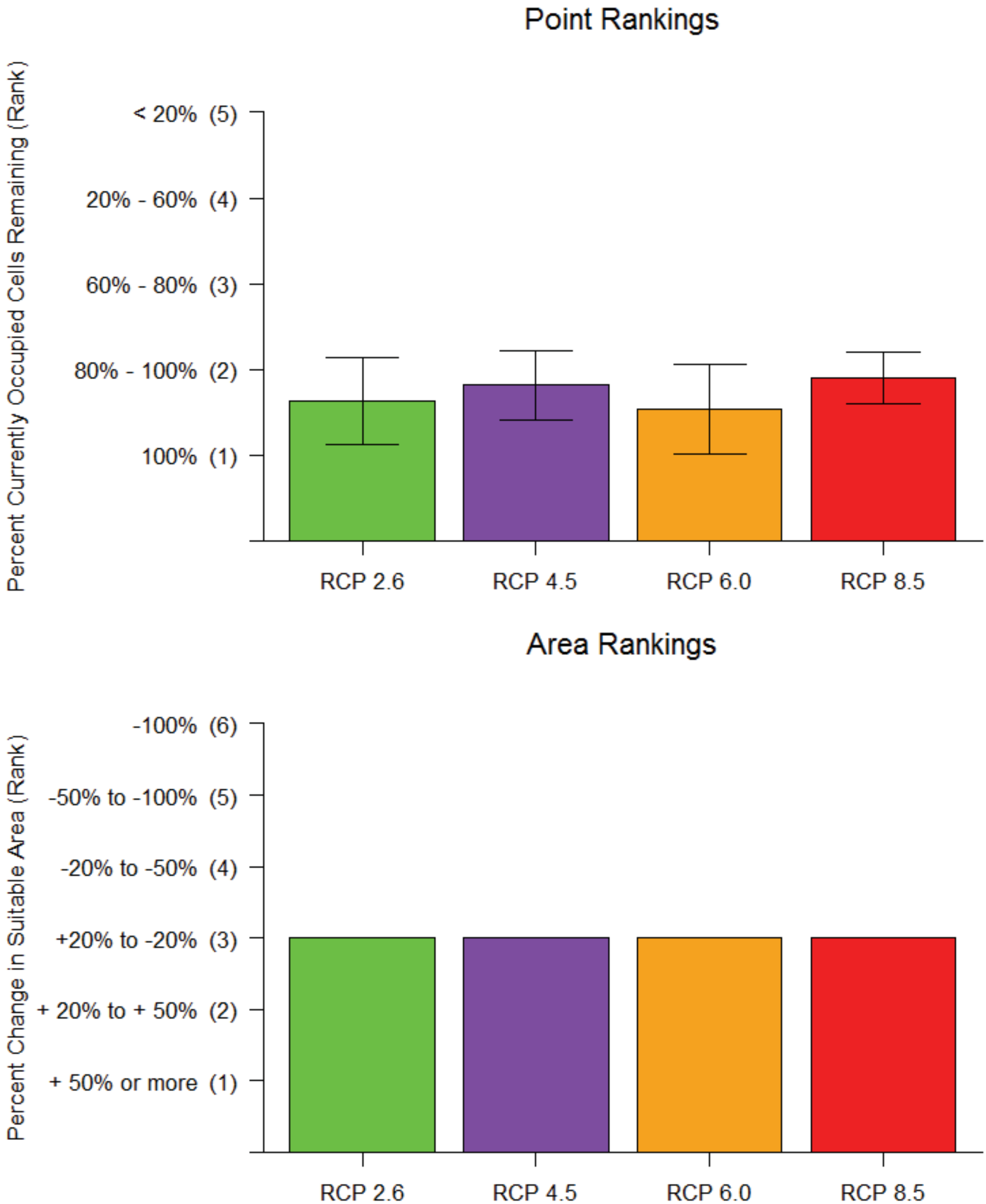

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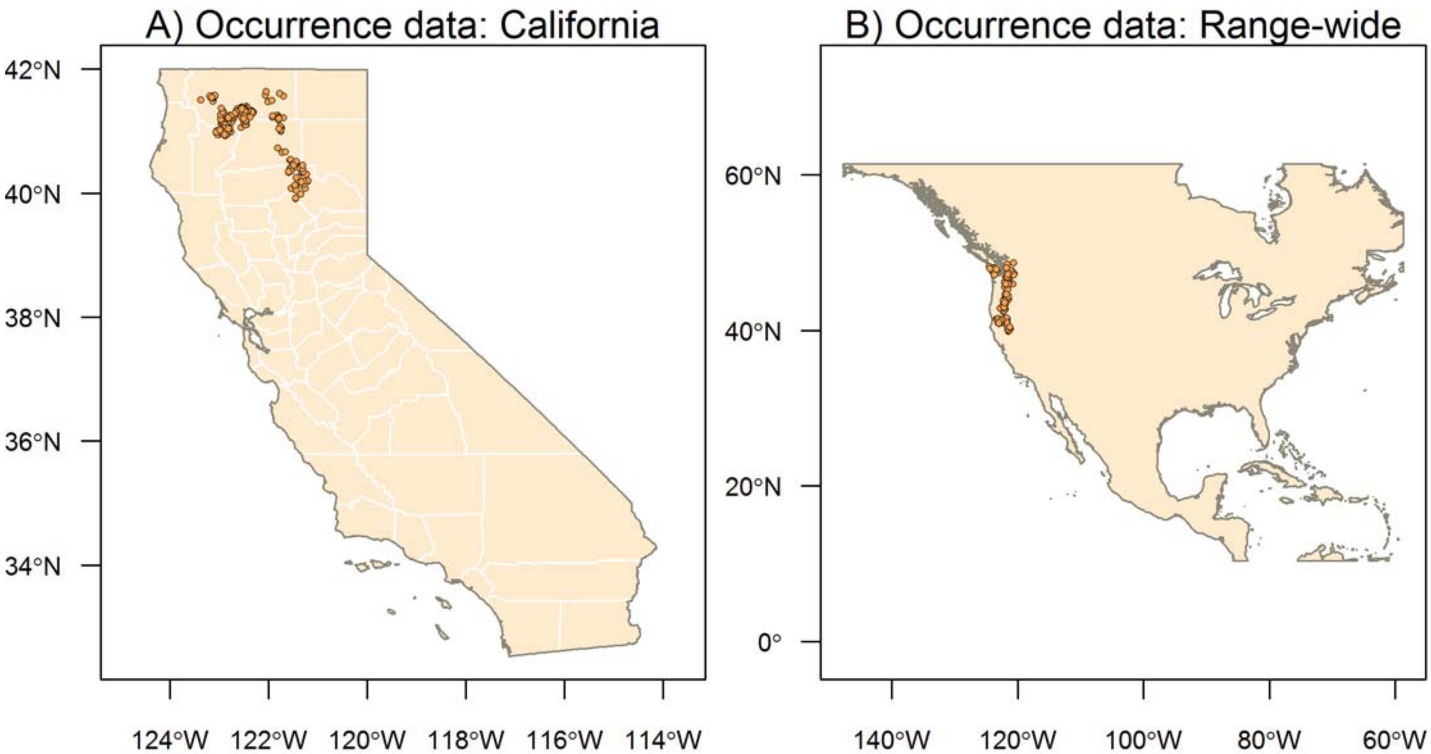
Species Results: *Rana cascadae* Cascade's Frog



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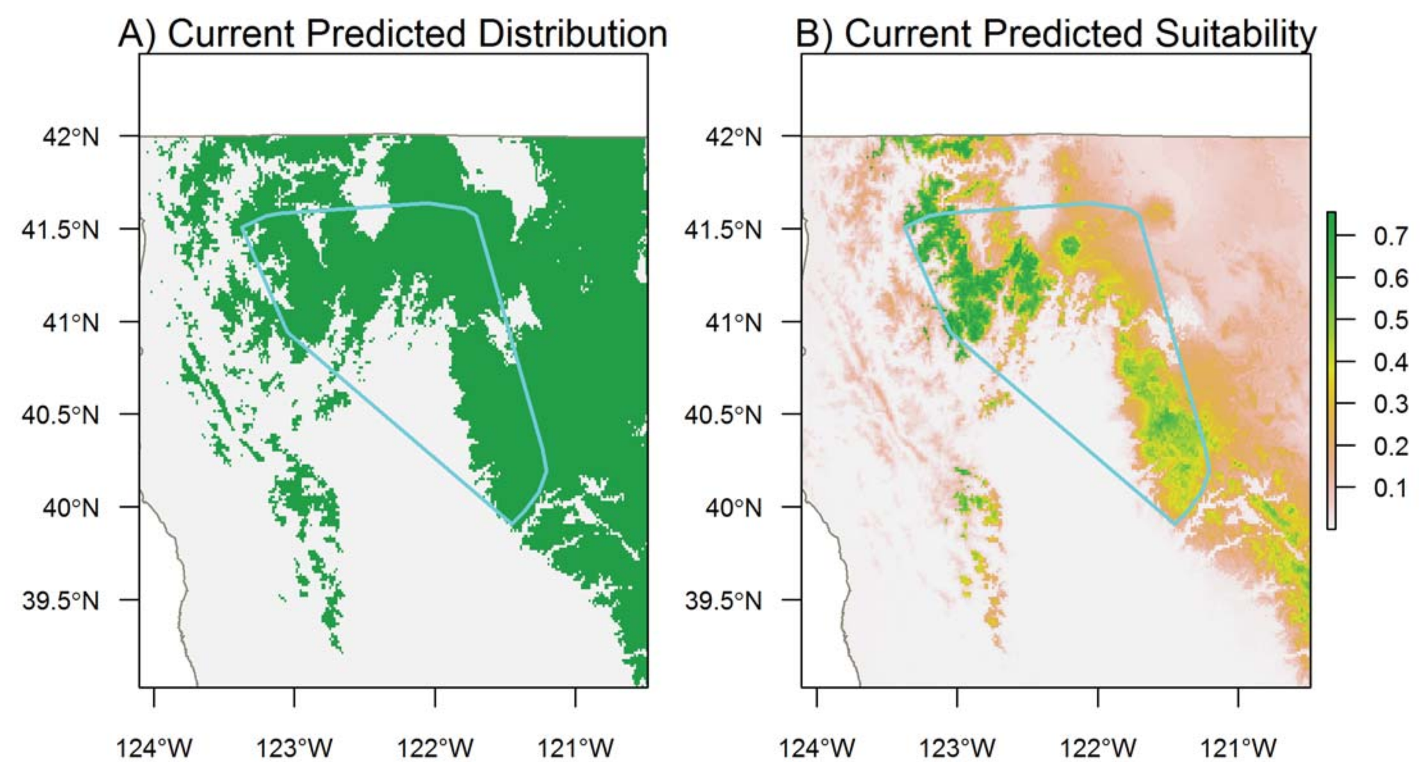

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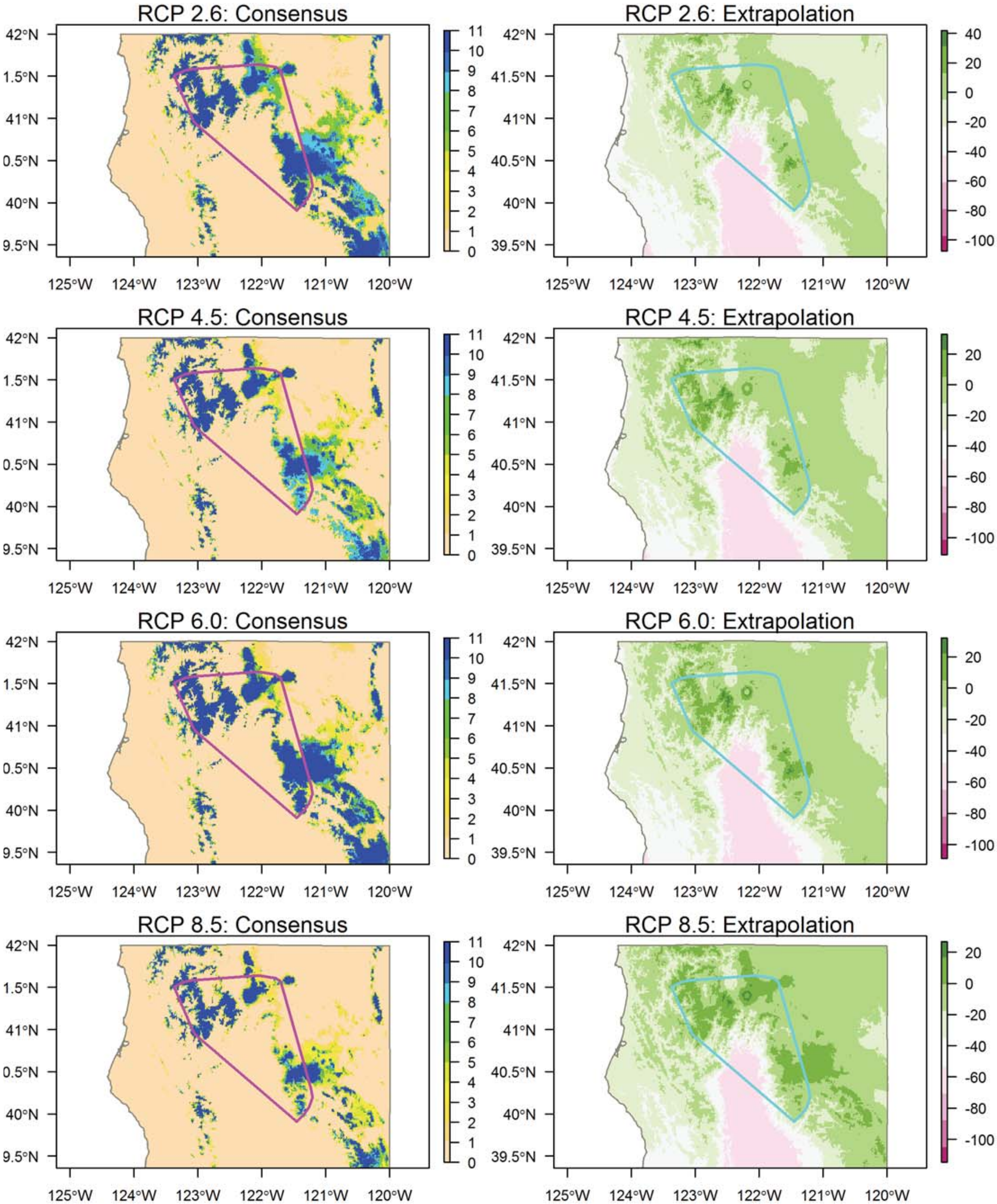

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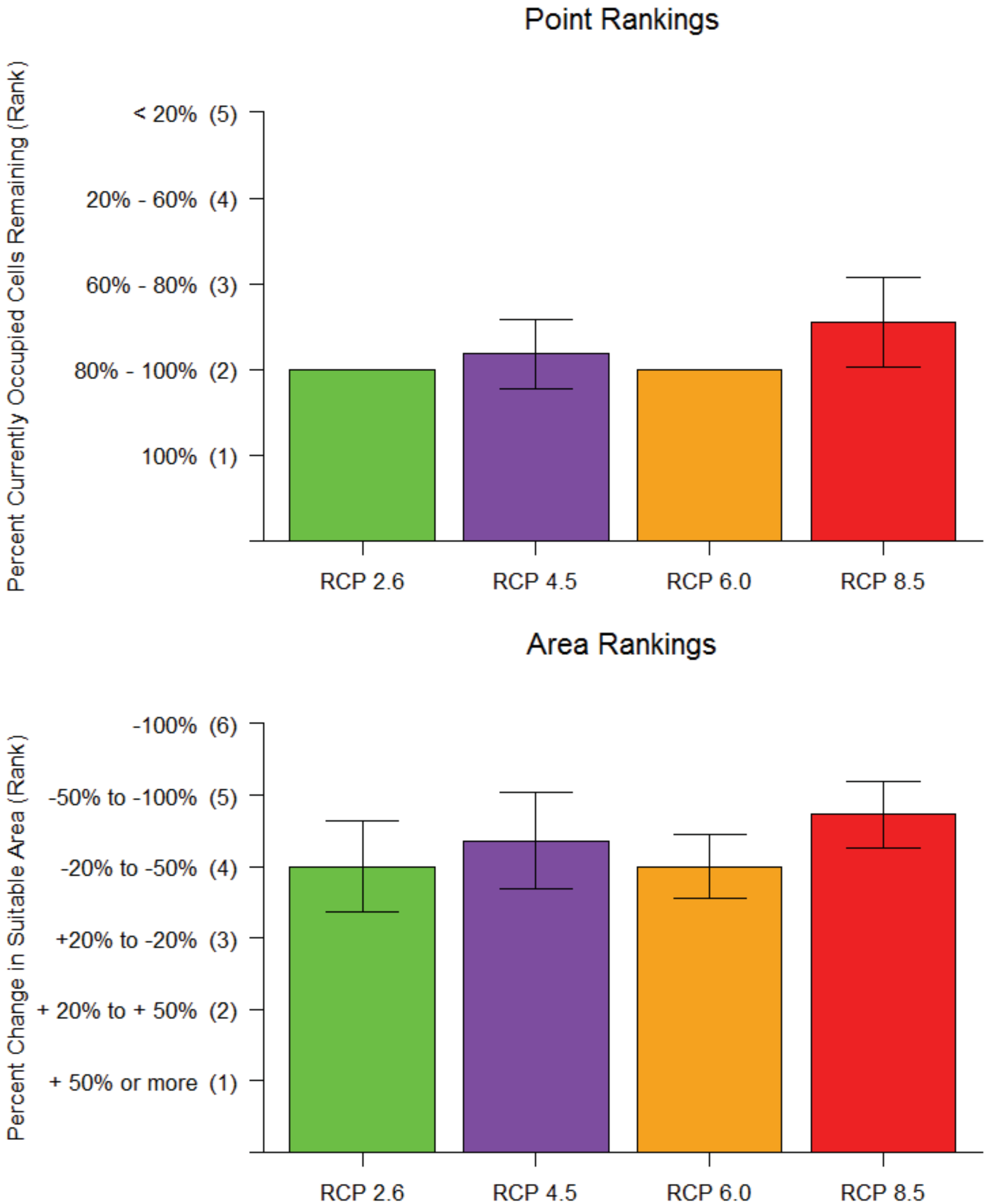

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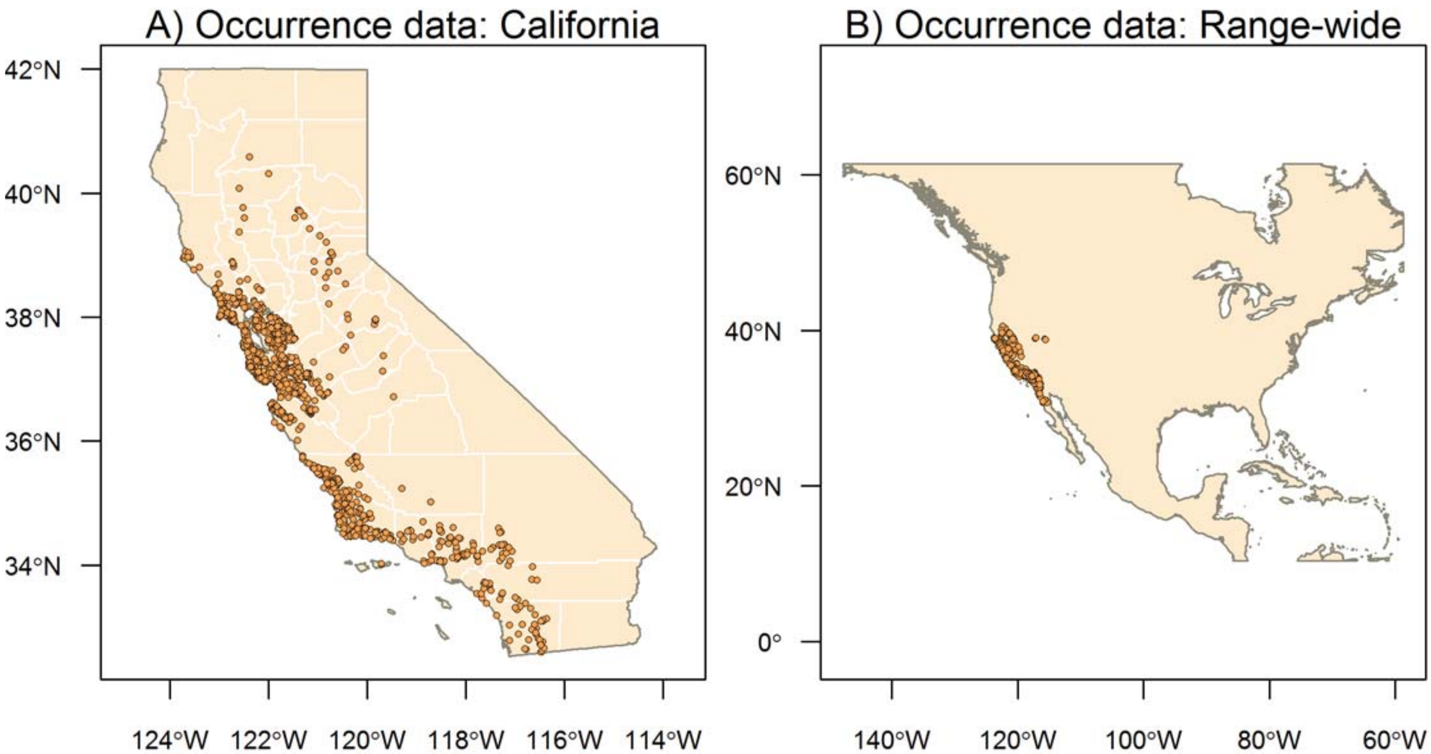
Species Results: *Rana draytonii* California Red-legged Frog



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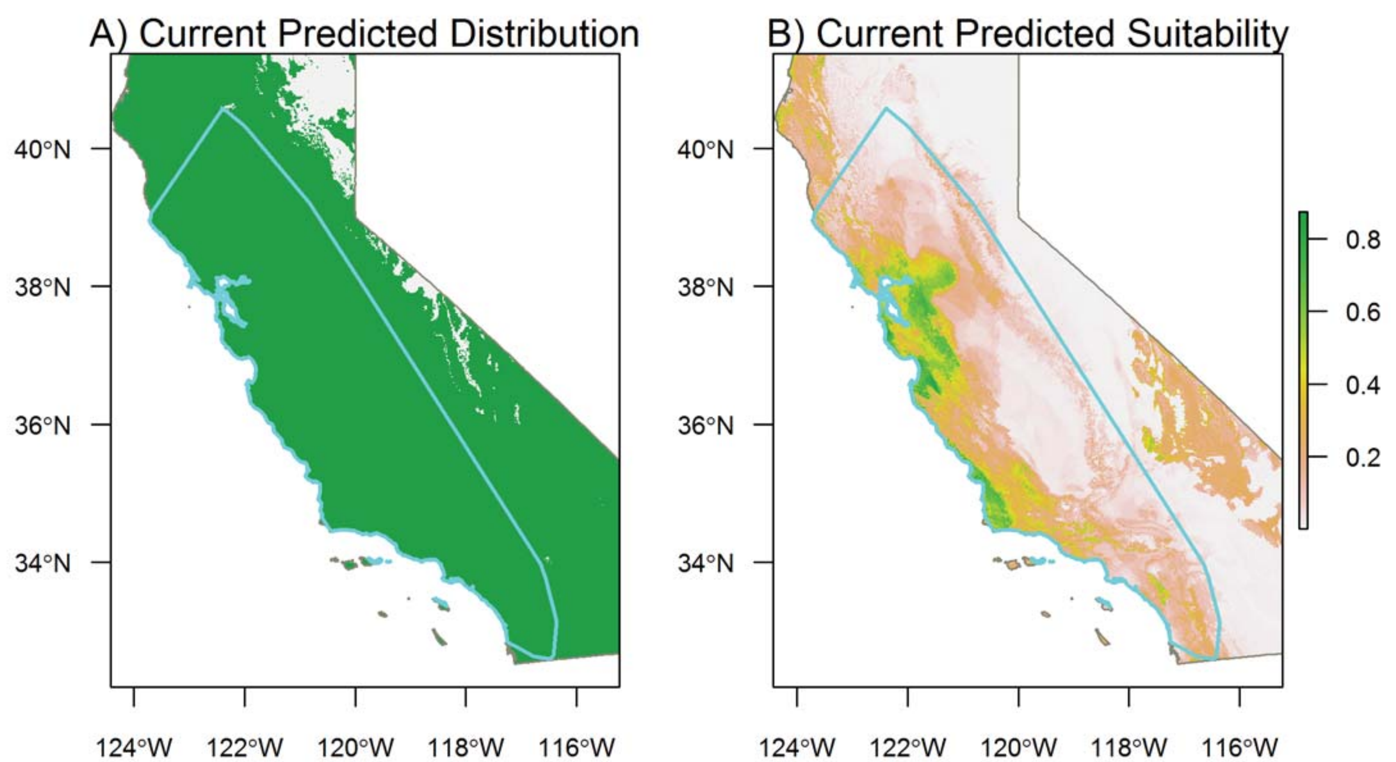

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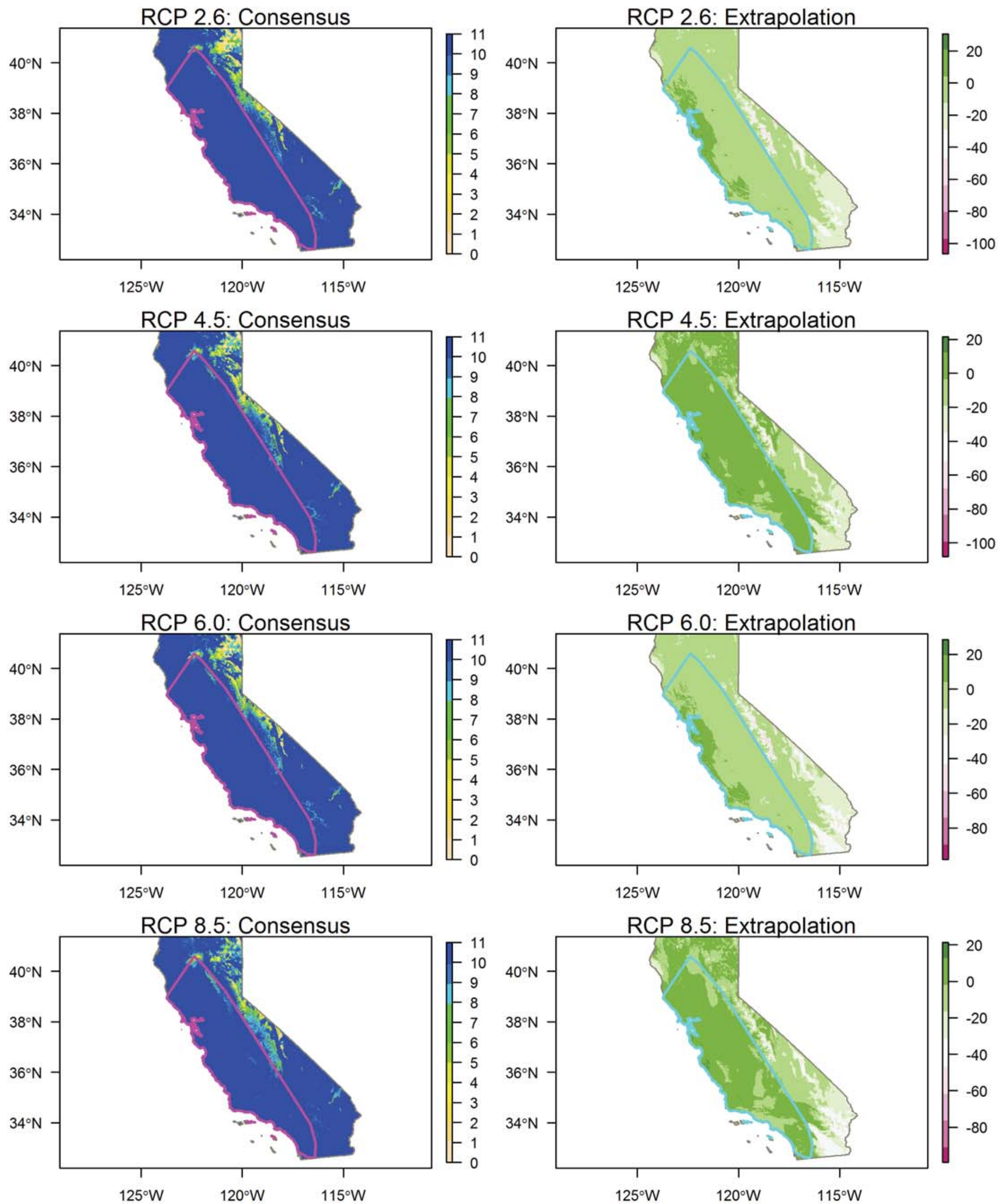
Species Results: *Rana draytonii* California Red-legged Frog



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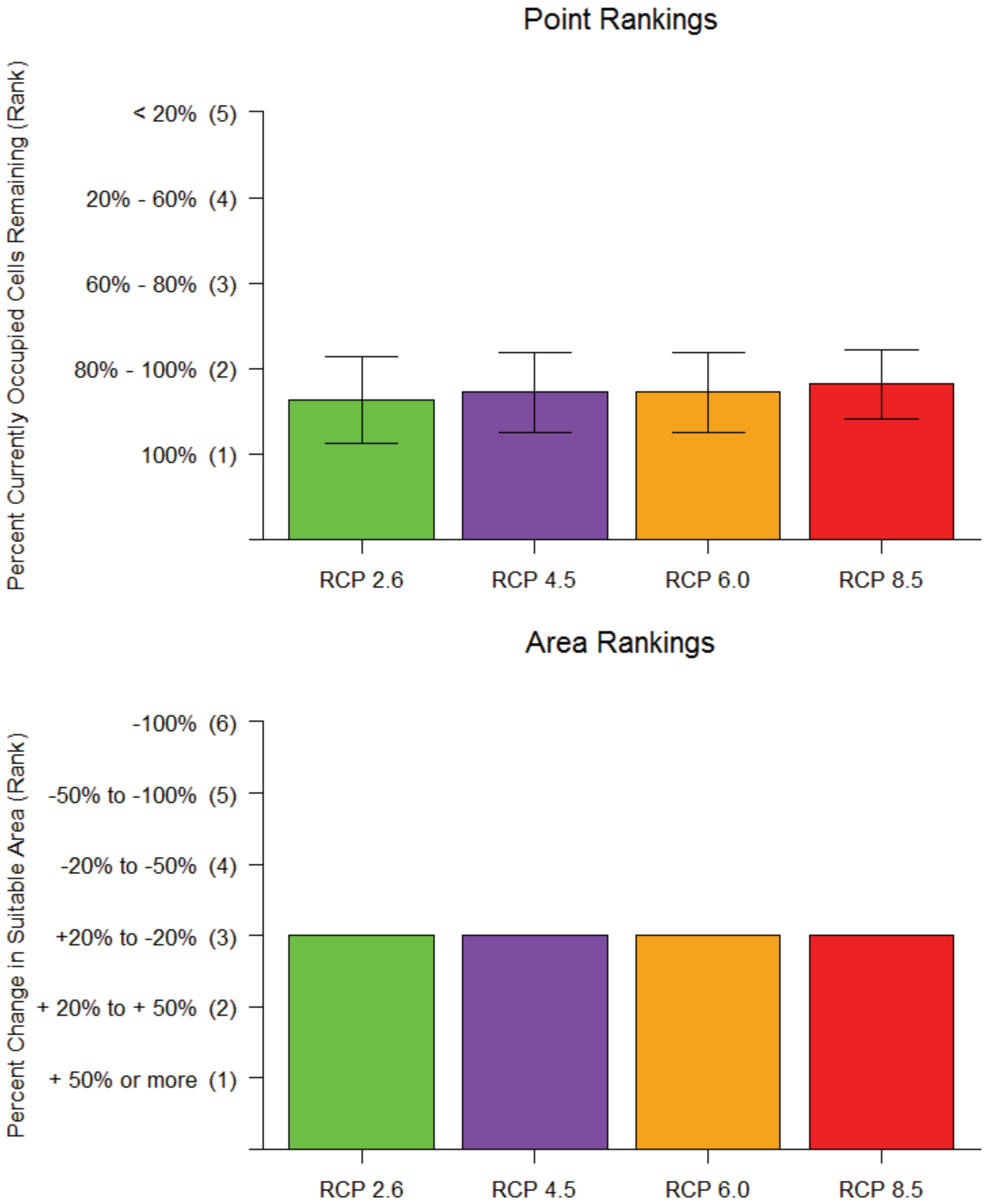

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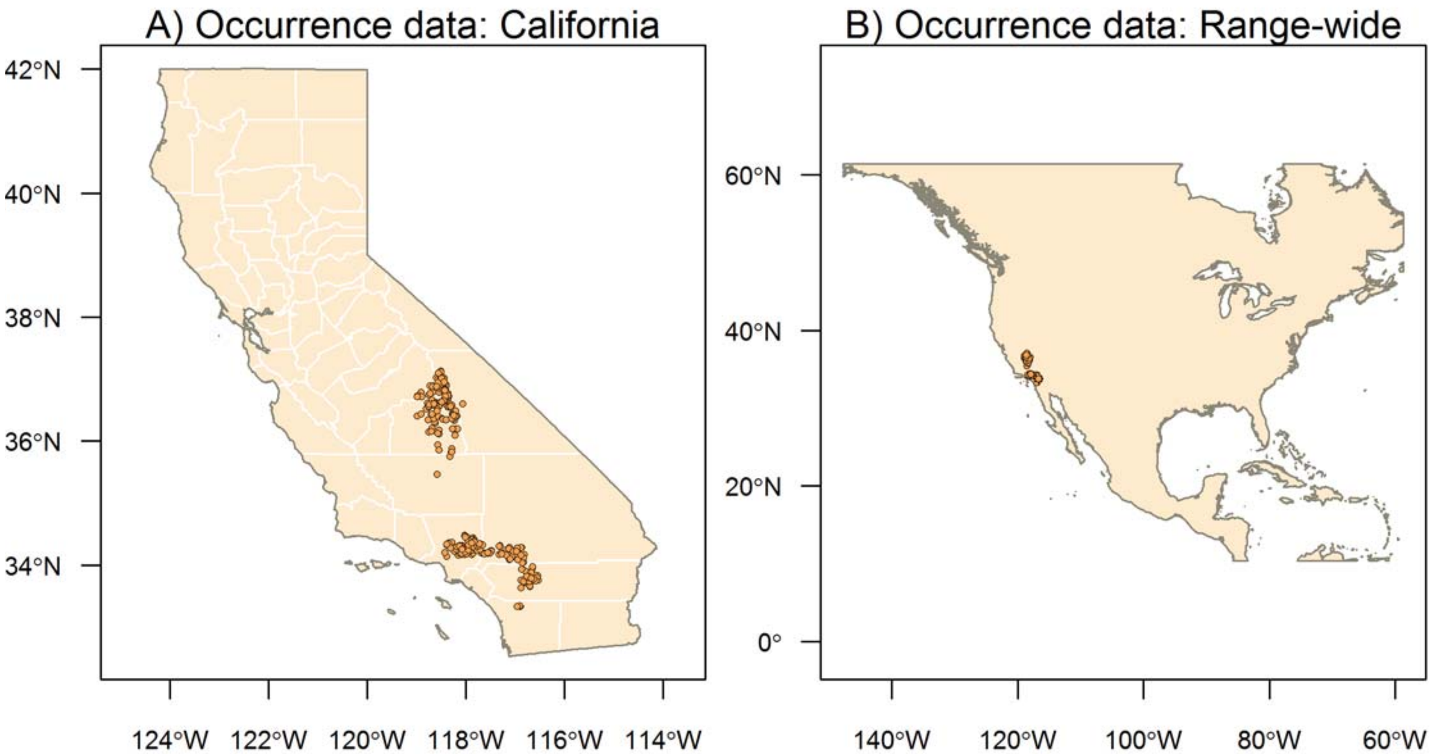

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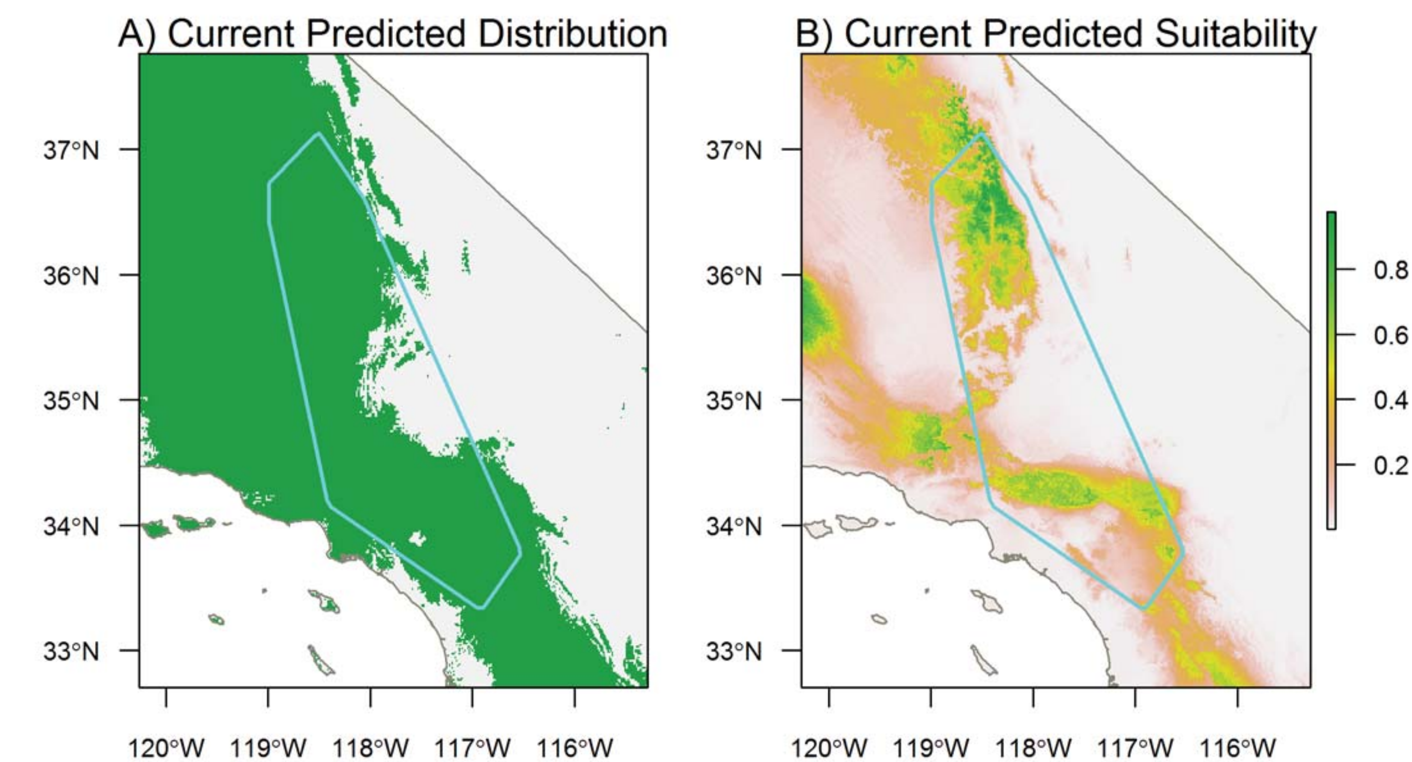

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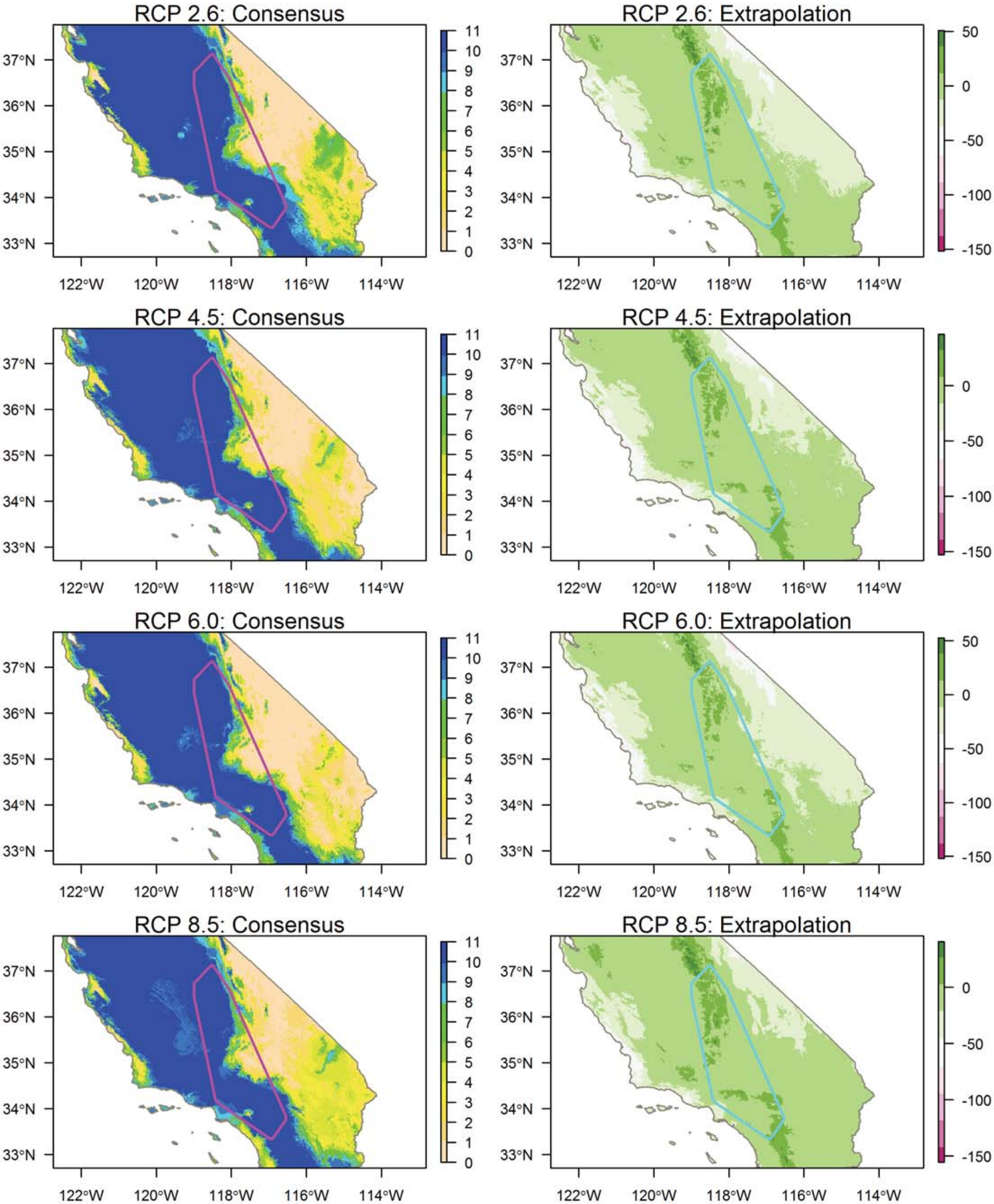

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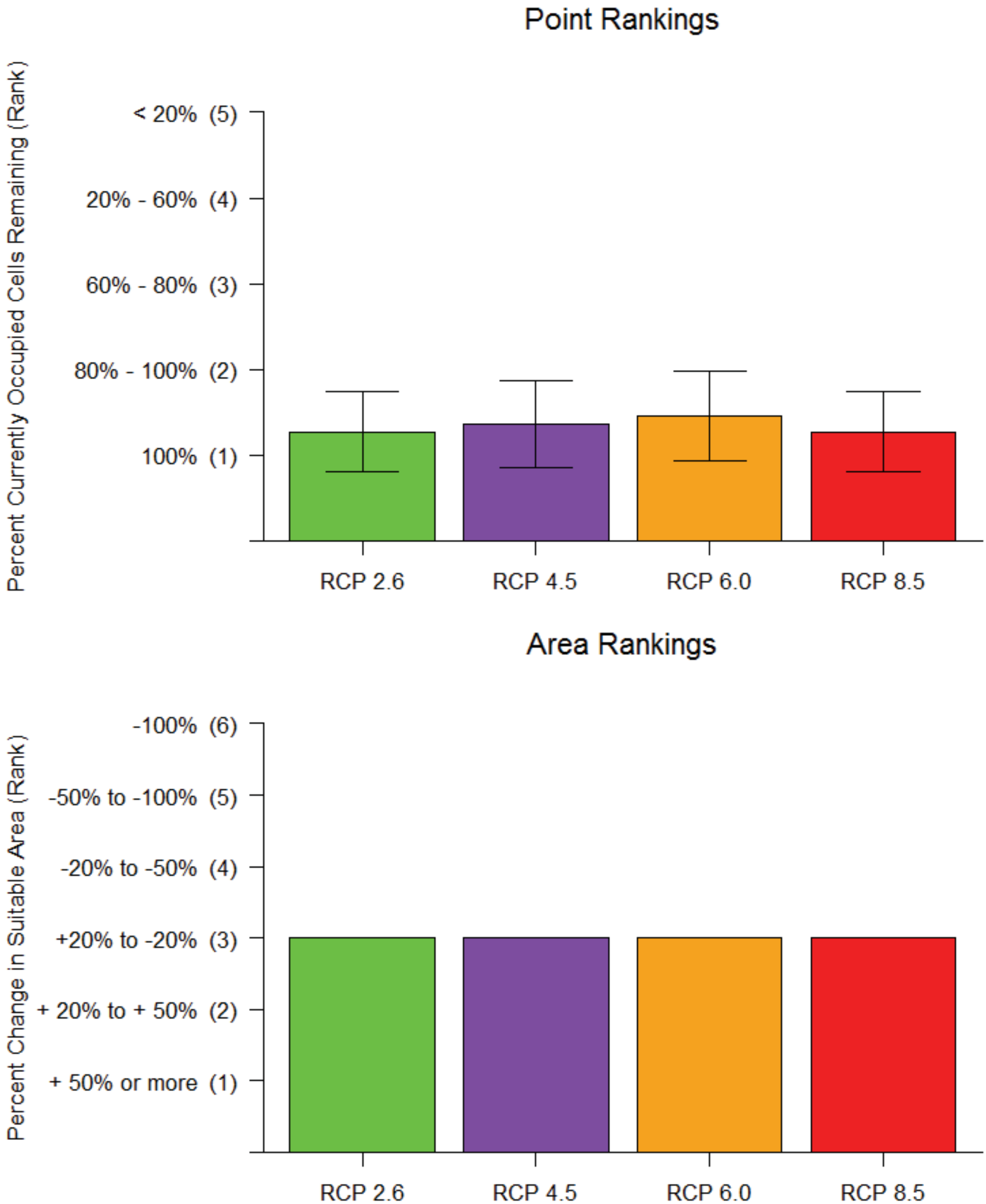
Species Results: *Rana muscosa* Southern Mountain Yellow-legged Frog



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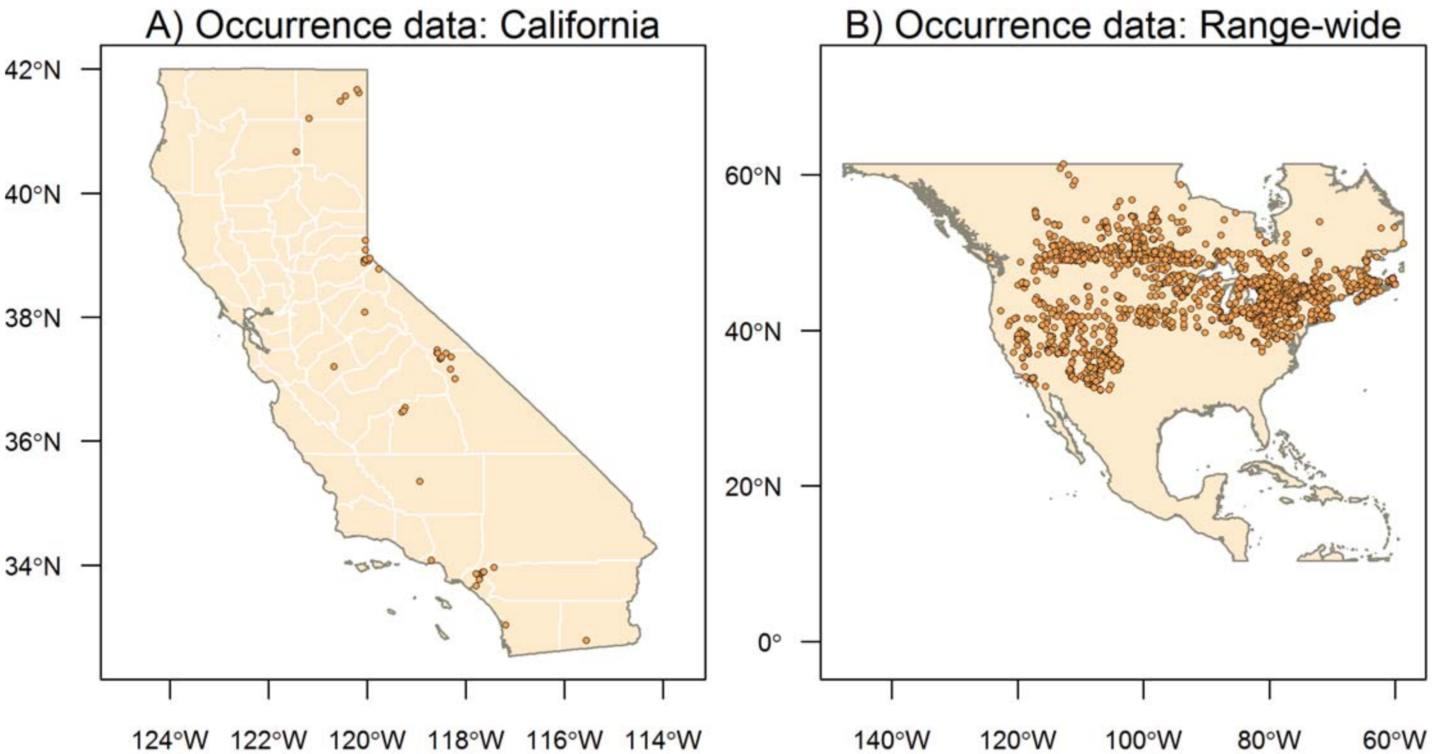
Species Results: *Rana pipiens* Northern Leopard Frog



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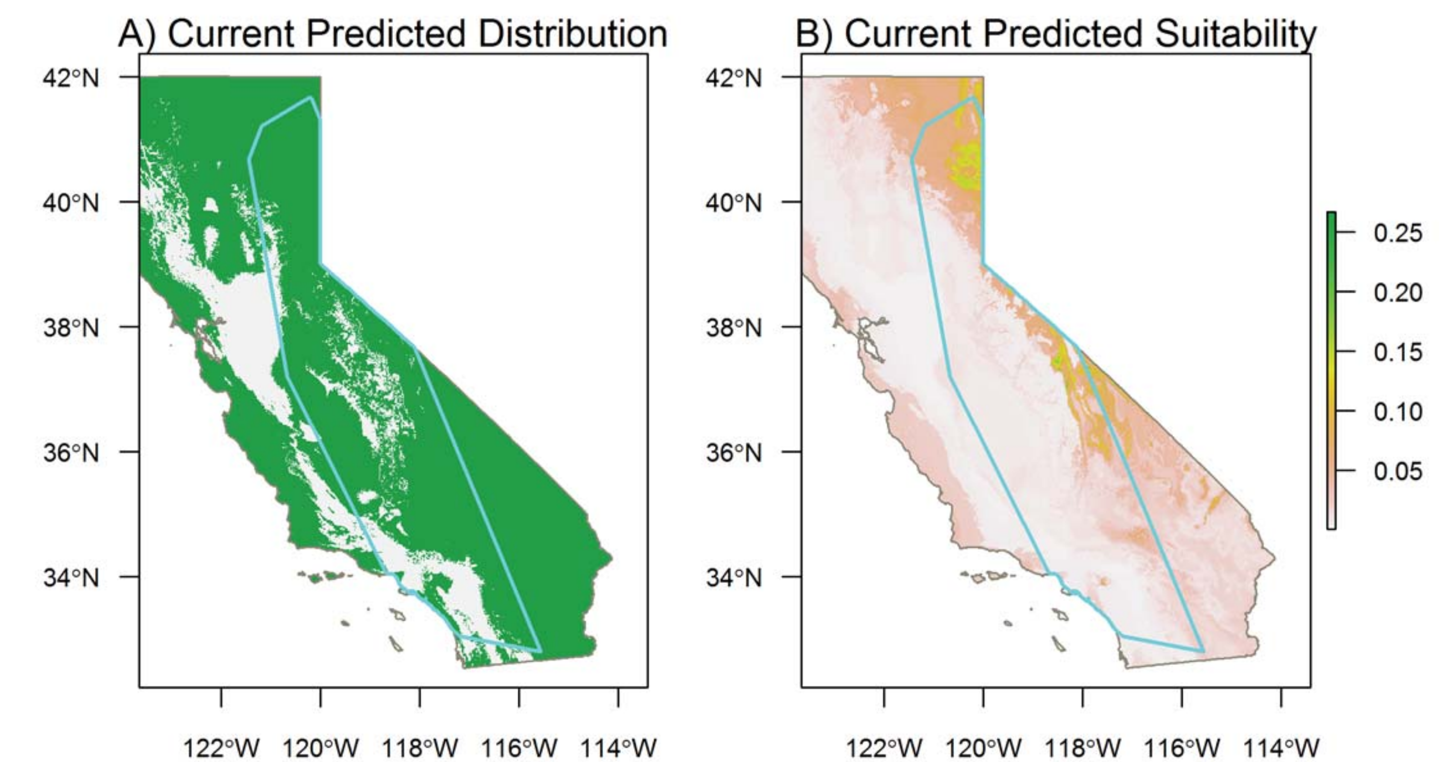

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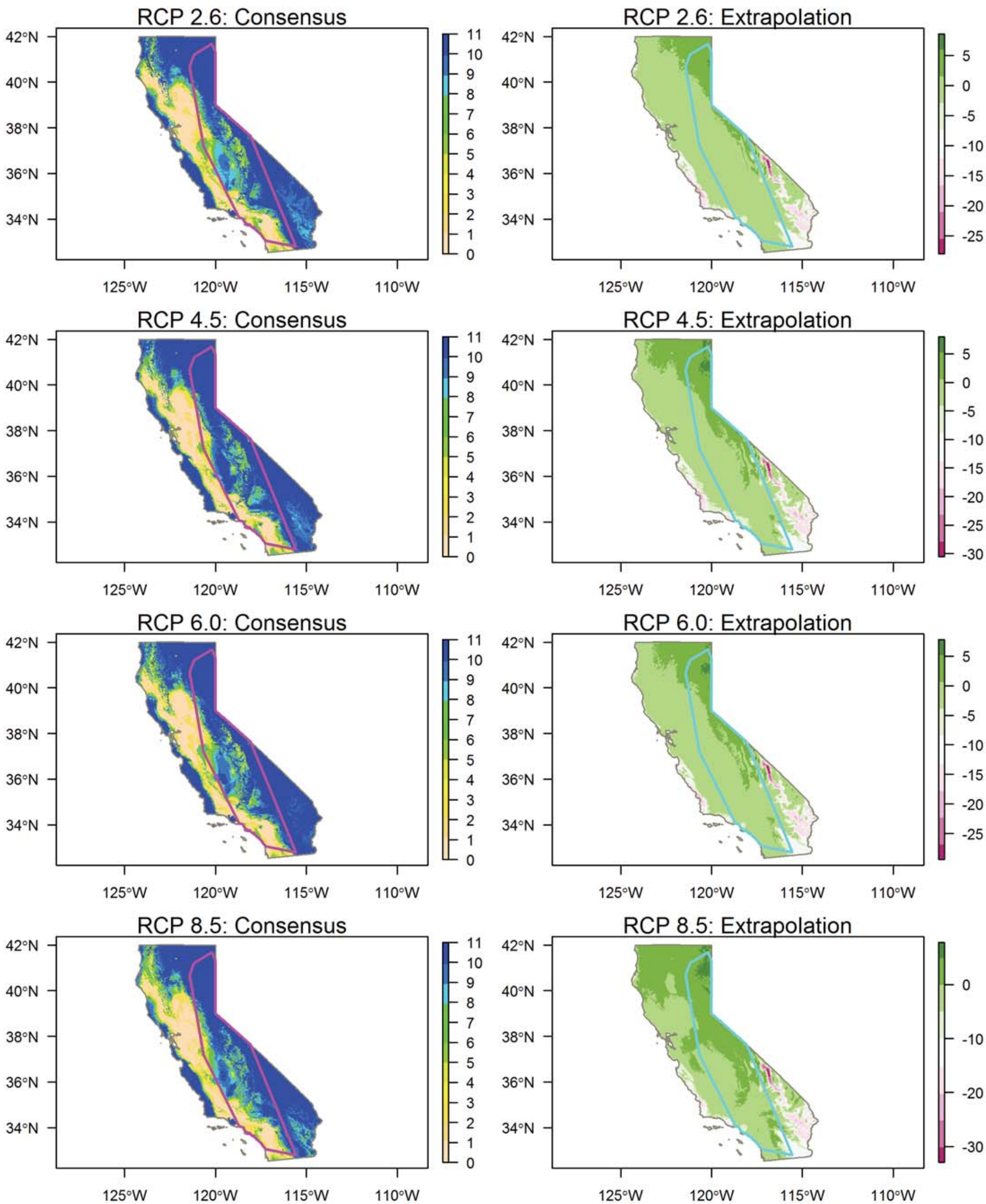

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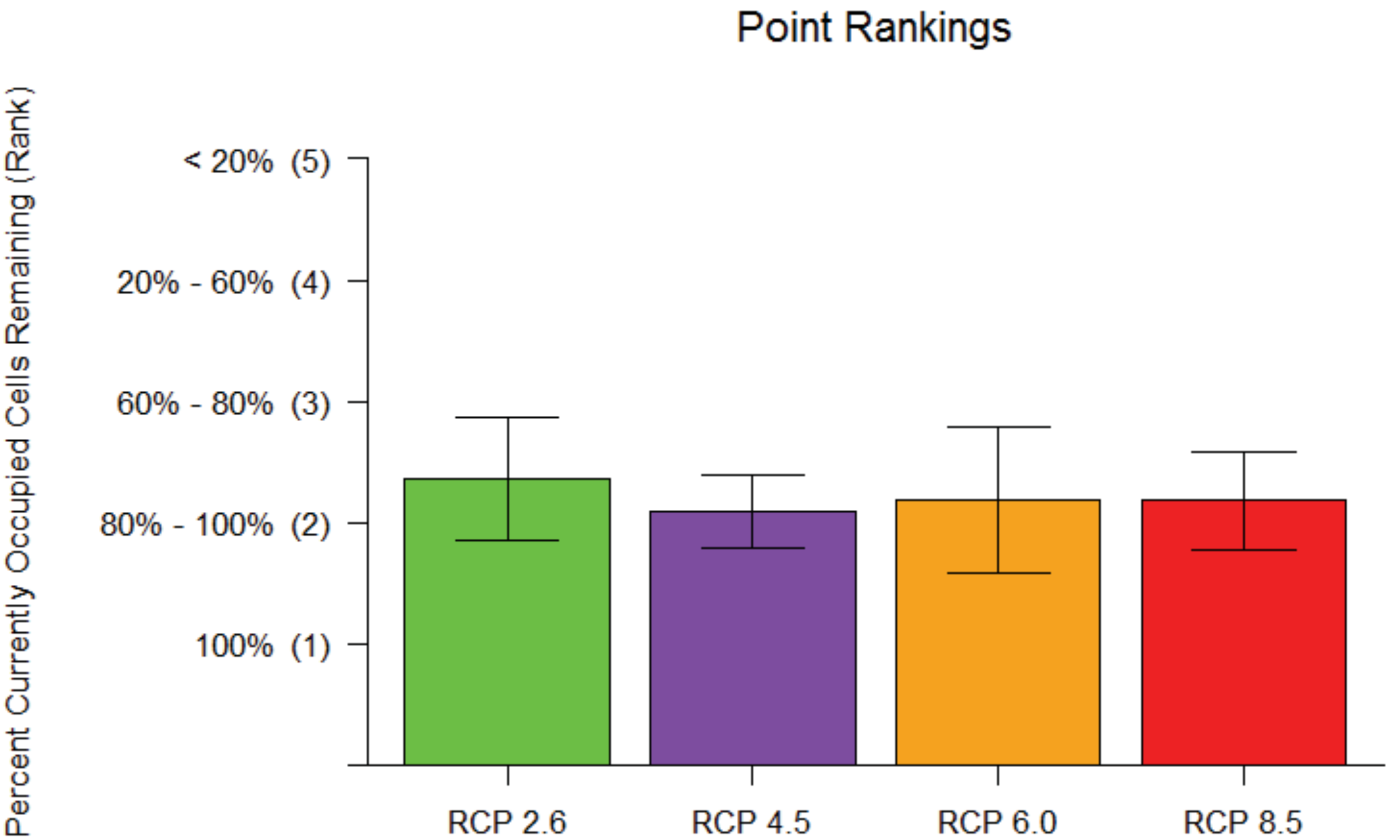
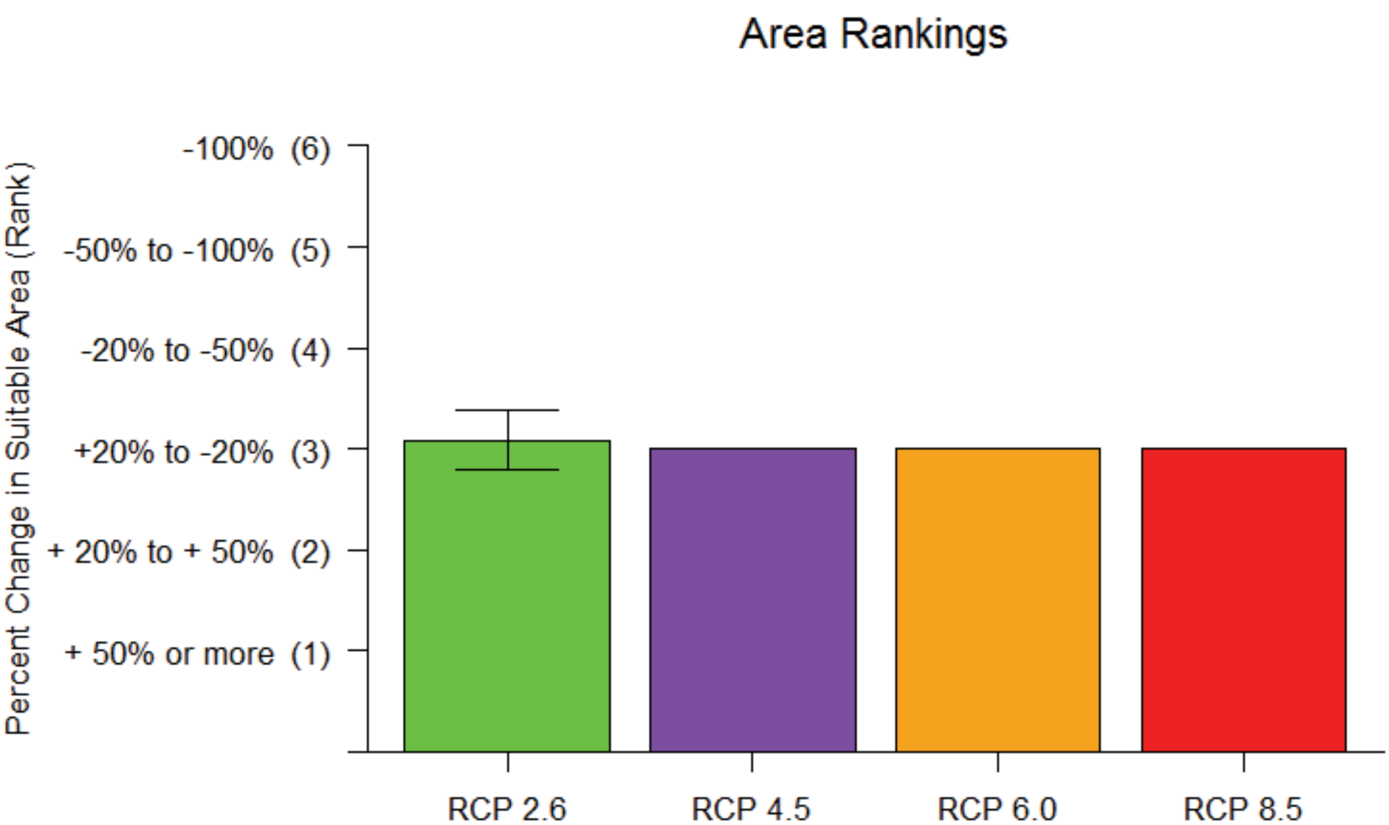
Species Results: *Rana pipiens* Northern Leopard Frog





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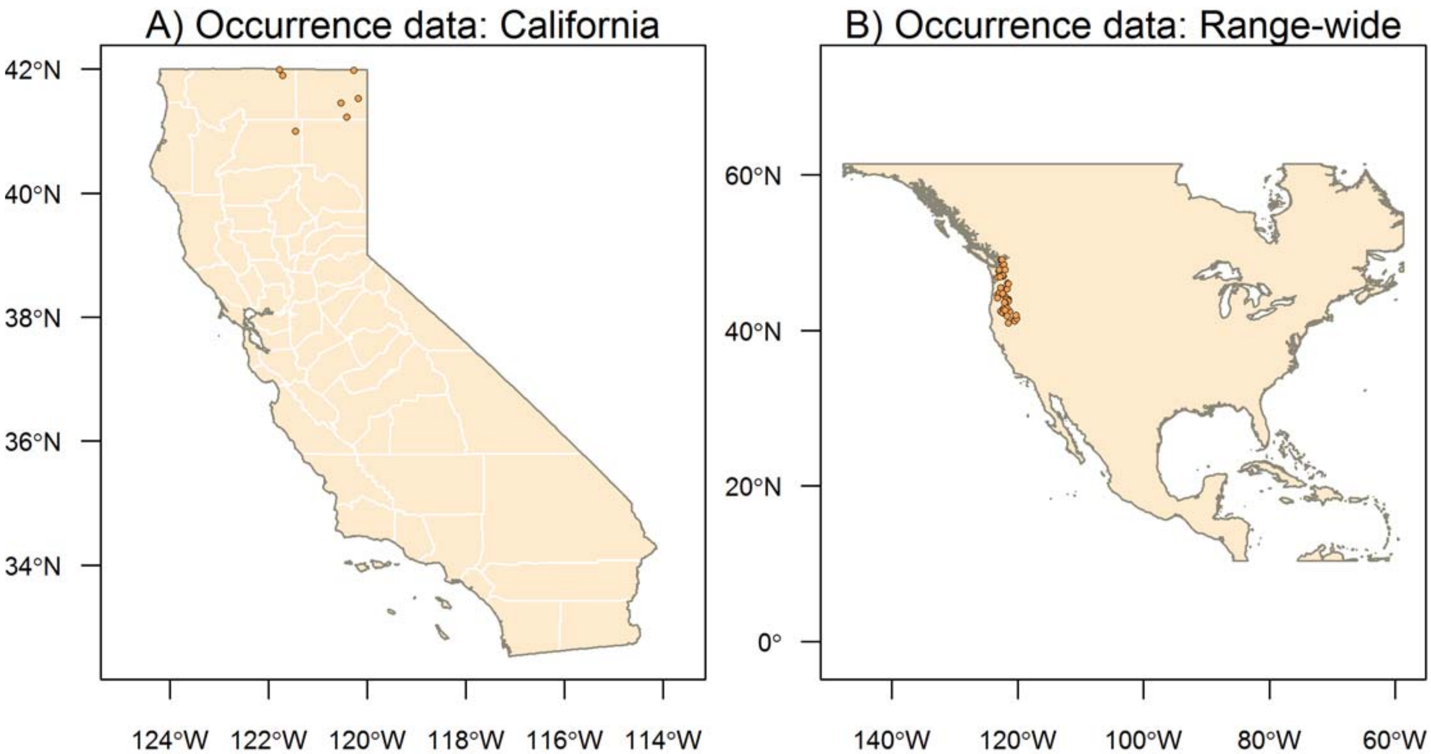
Species Results: *Rana pretiosa* Oregon Spotted Frog



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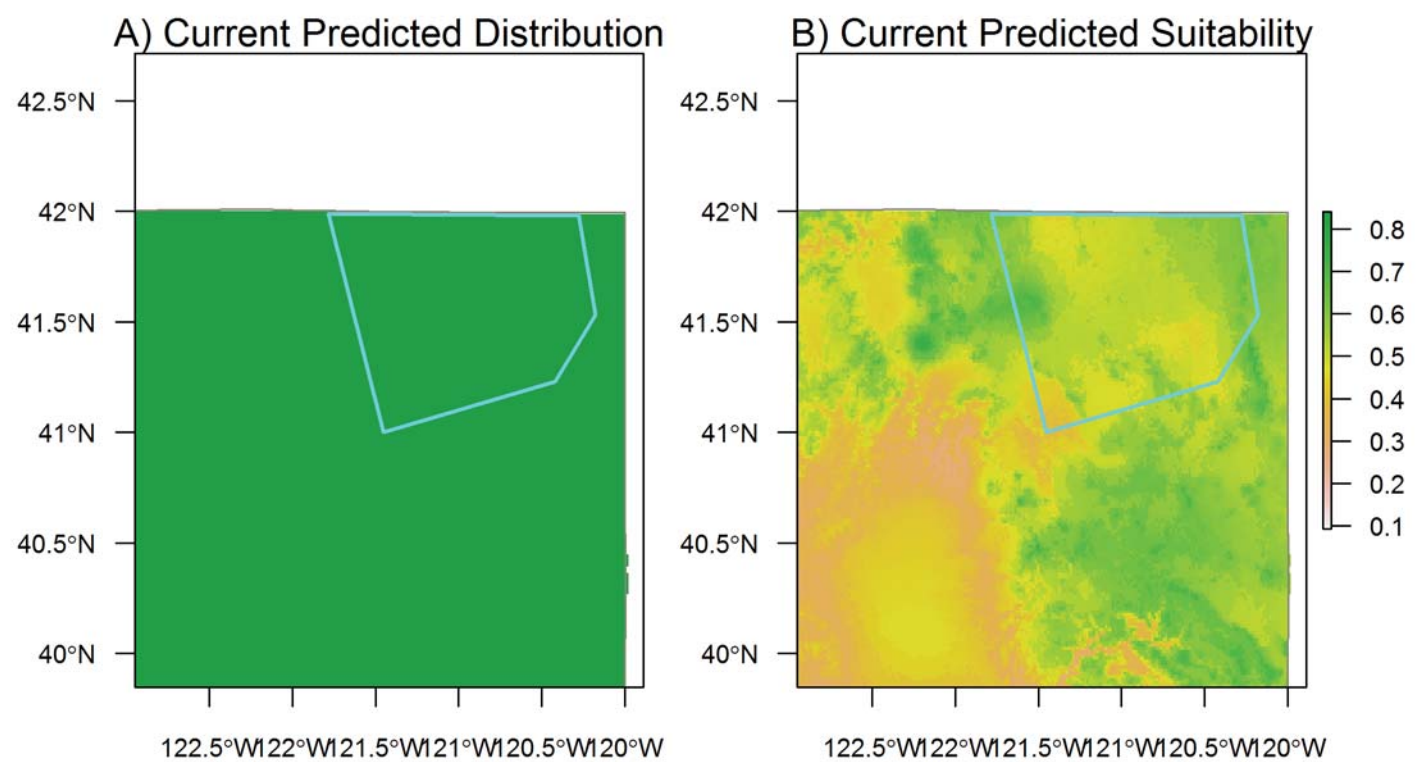

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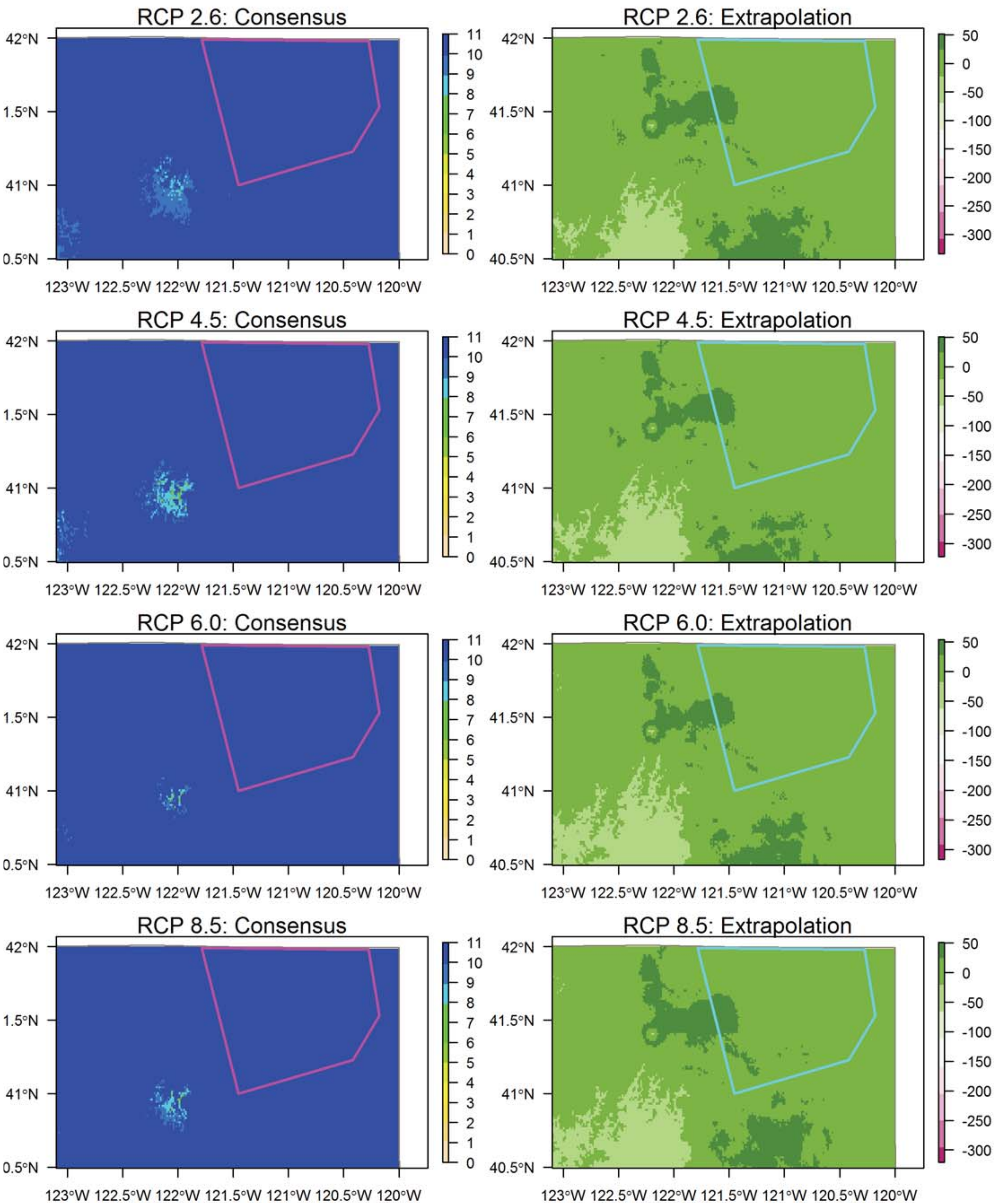

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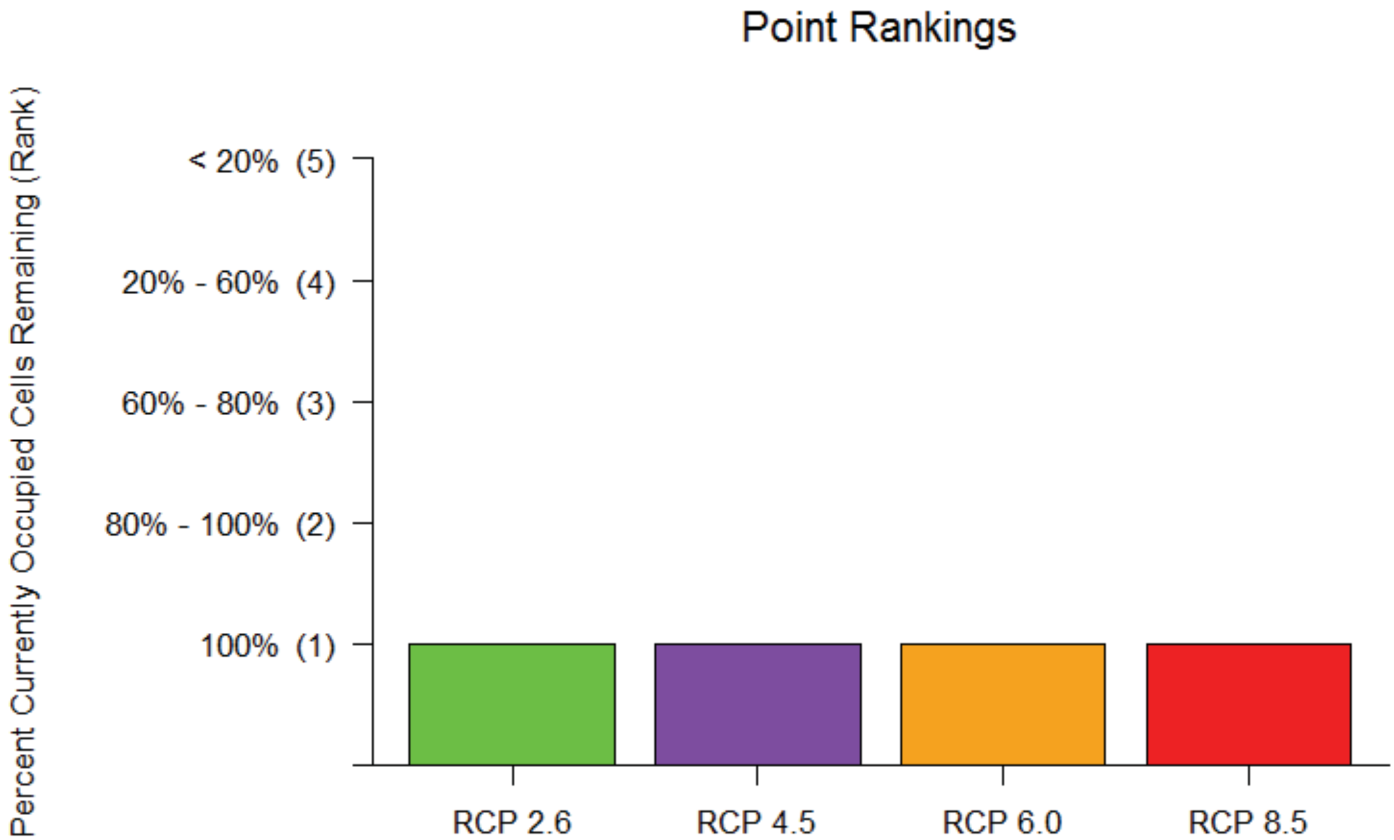

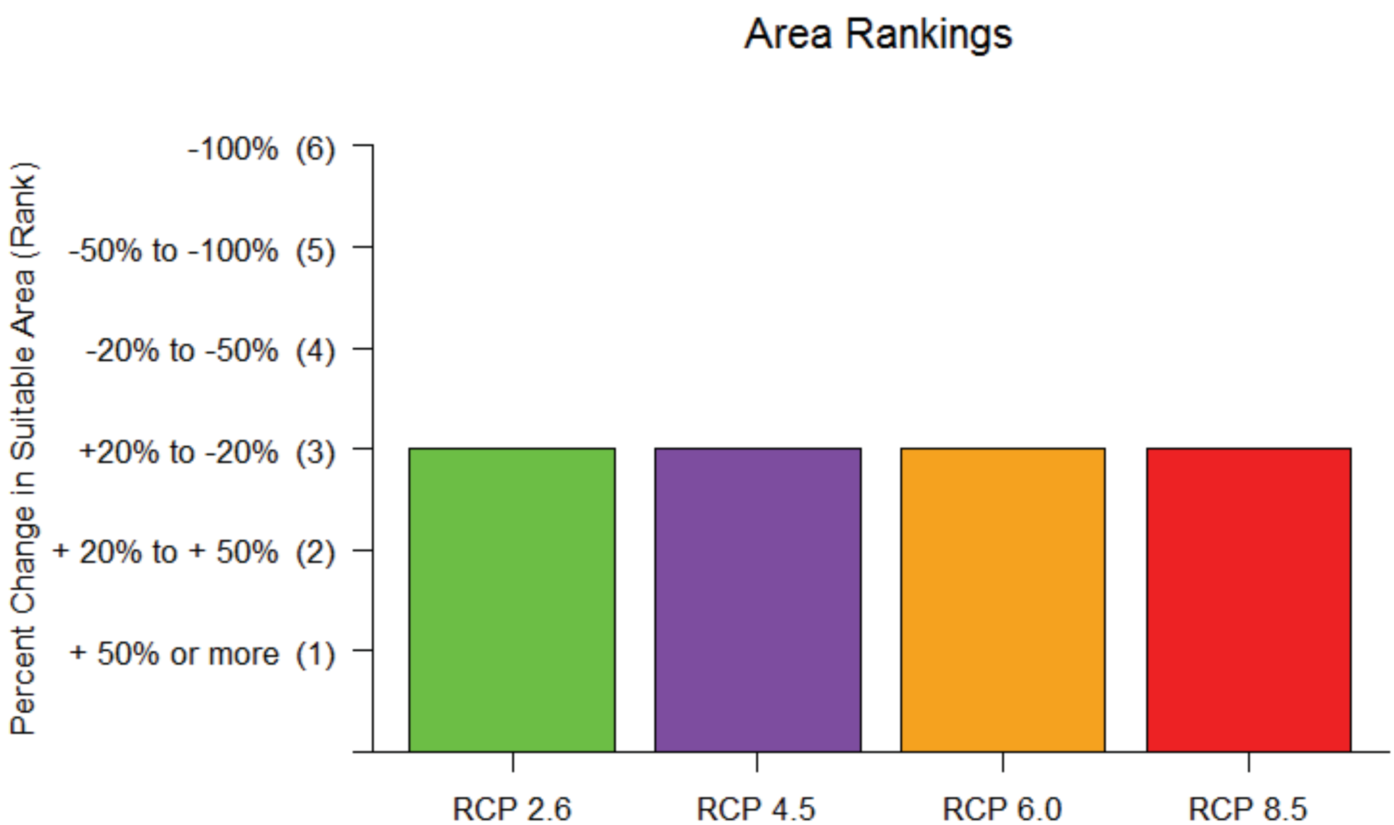

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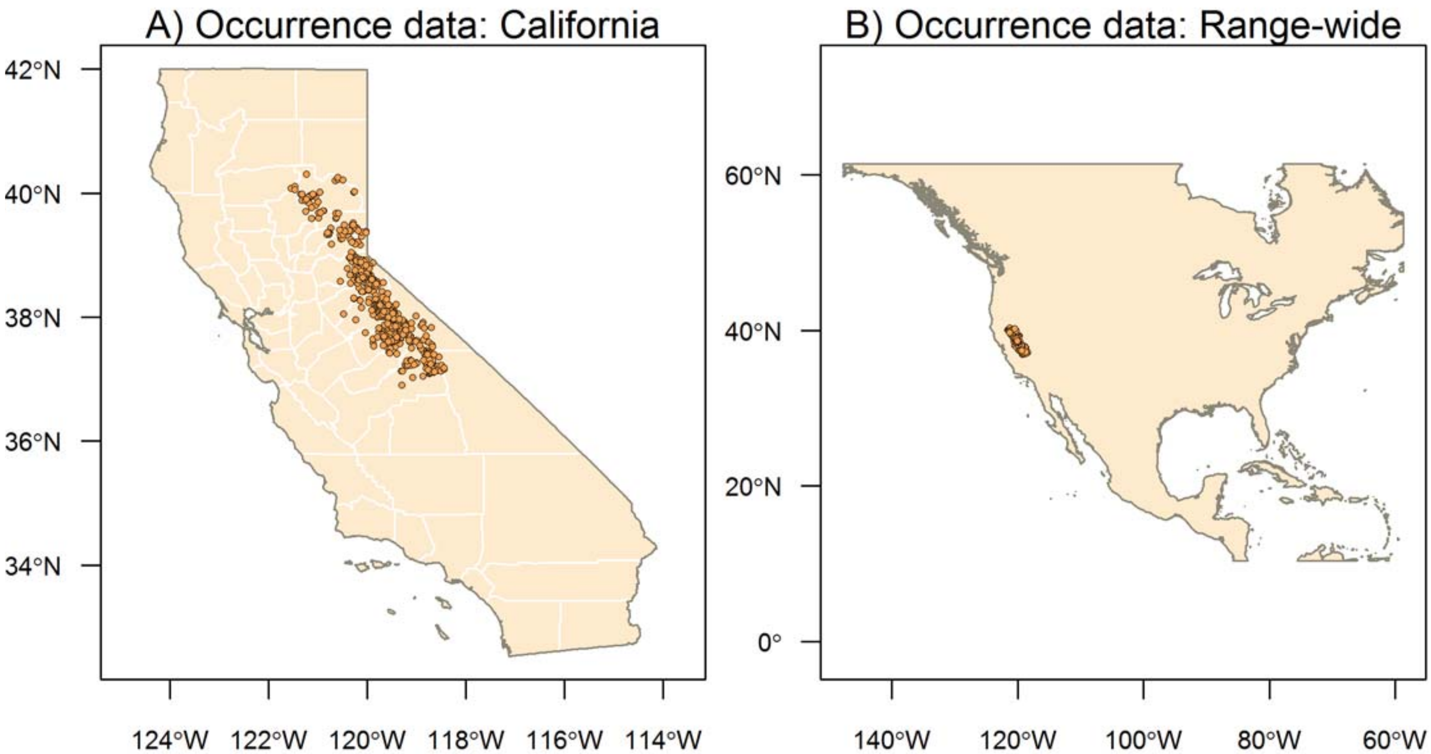
Species Results: *Rana sierrae* Sierra Nevada Yellow-legged Frog



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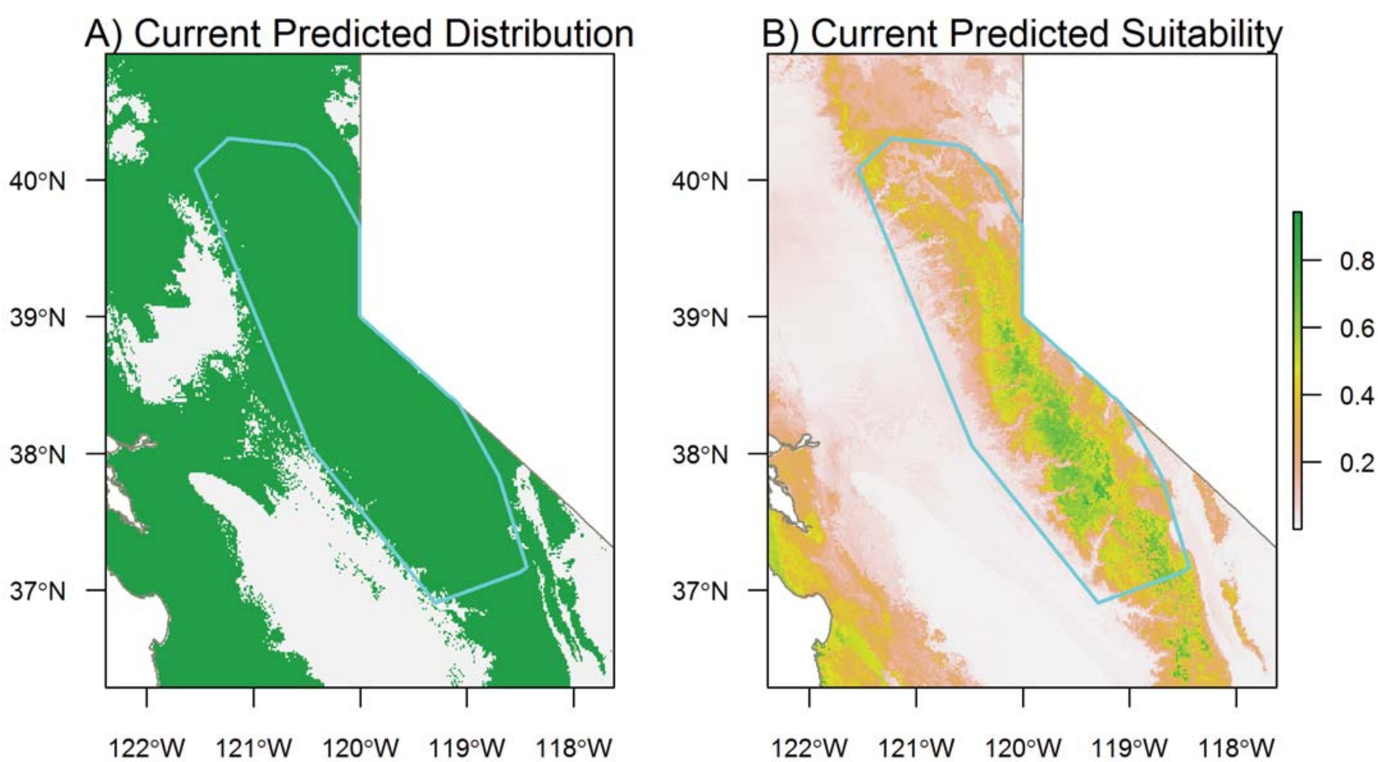

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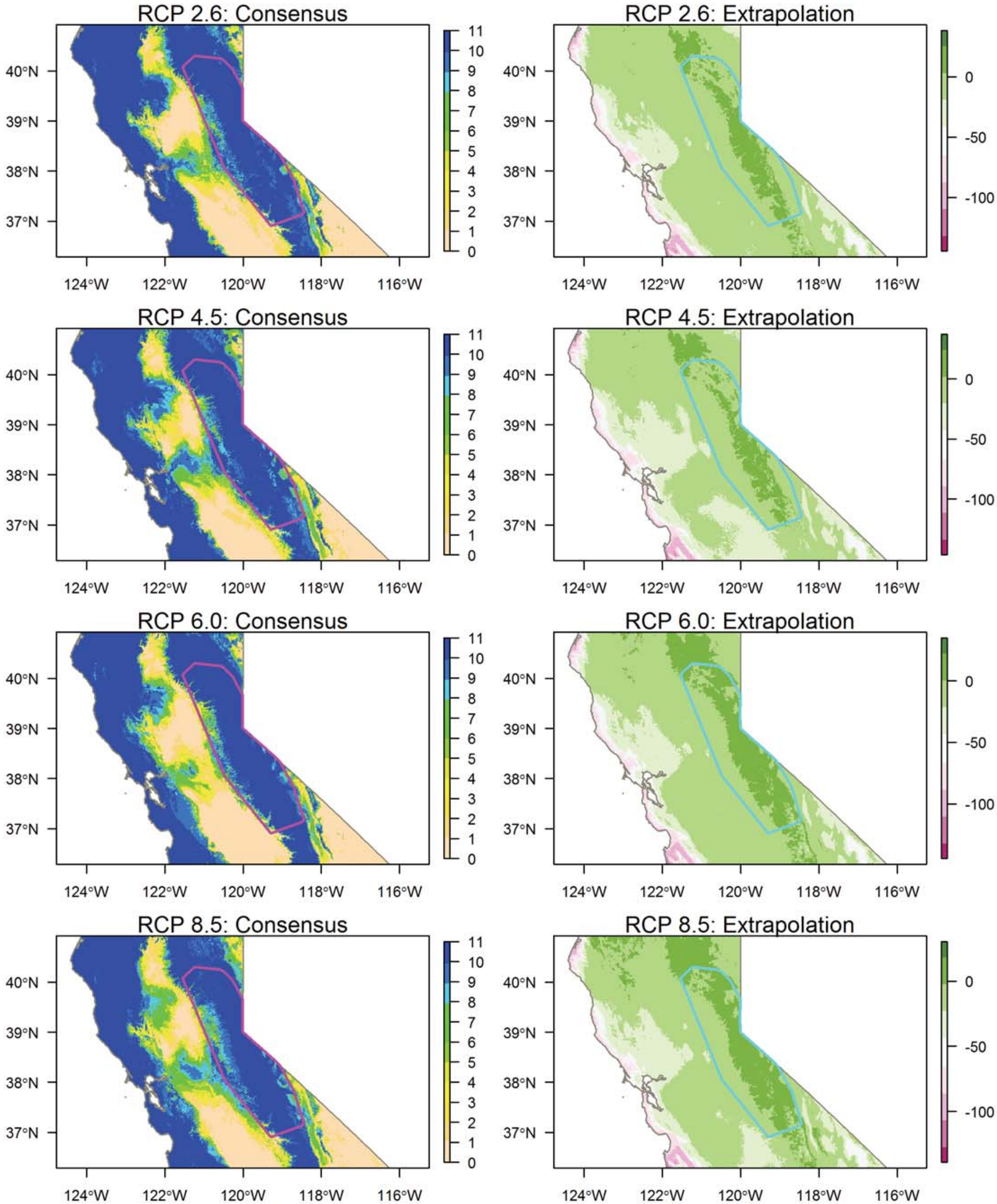

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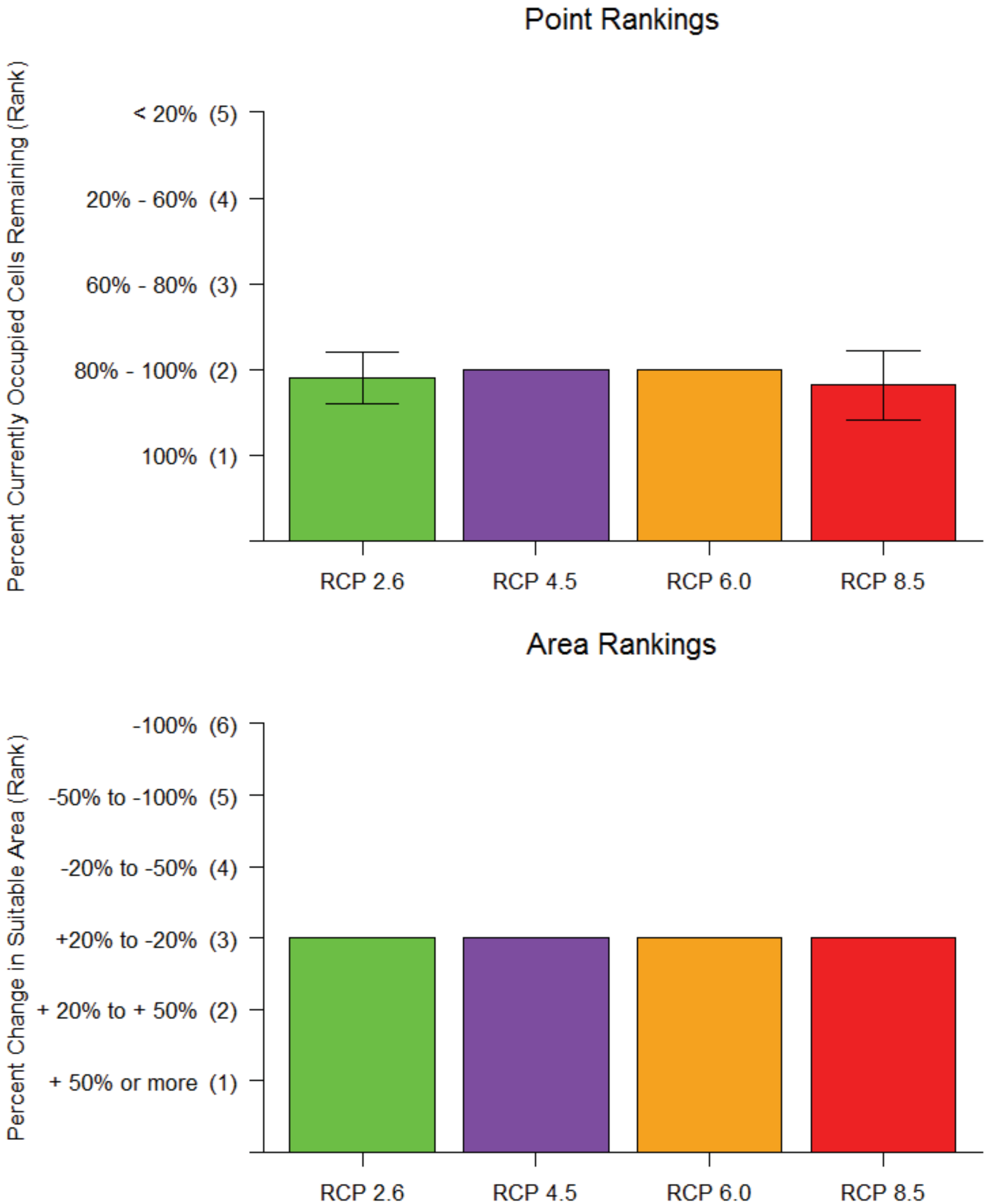

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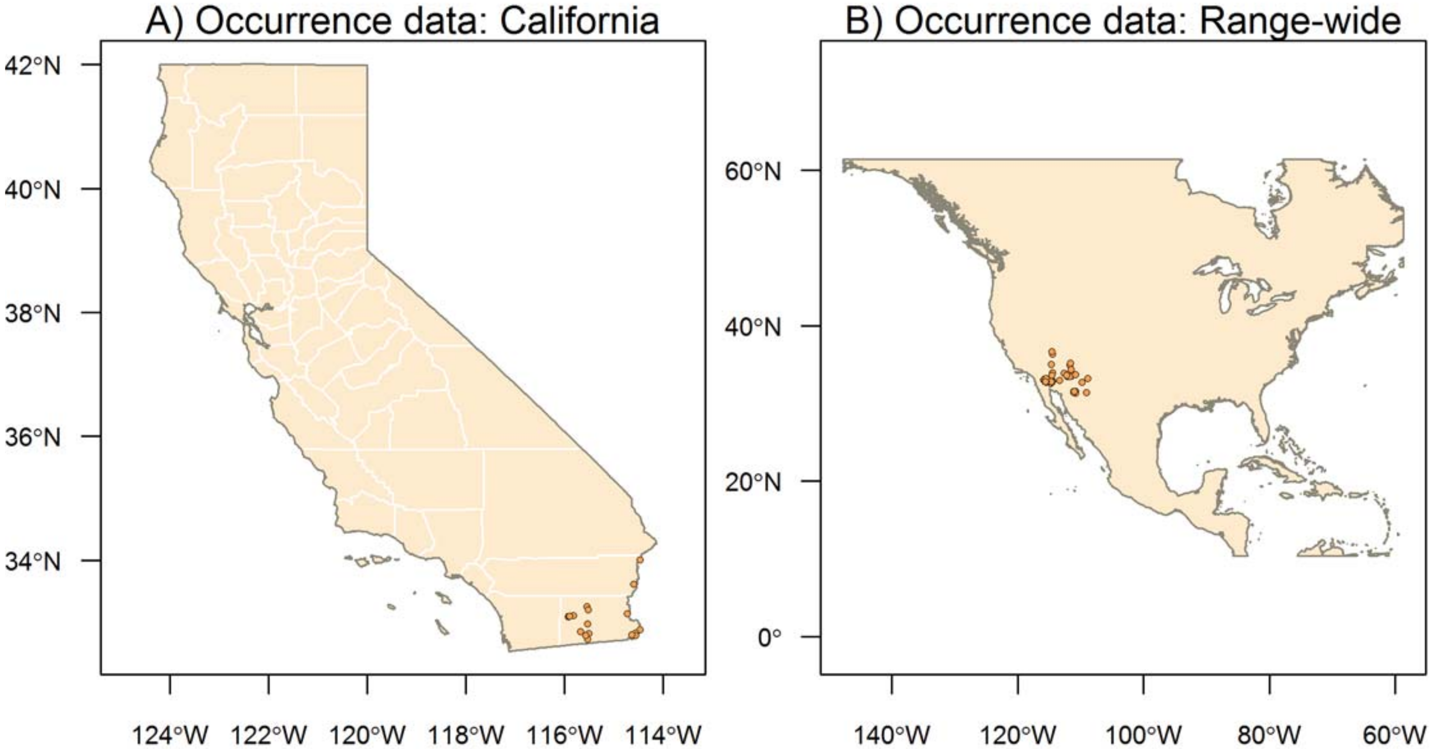

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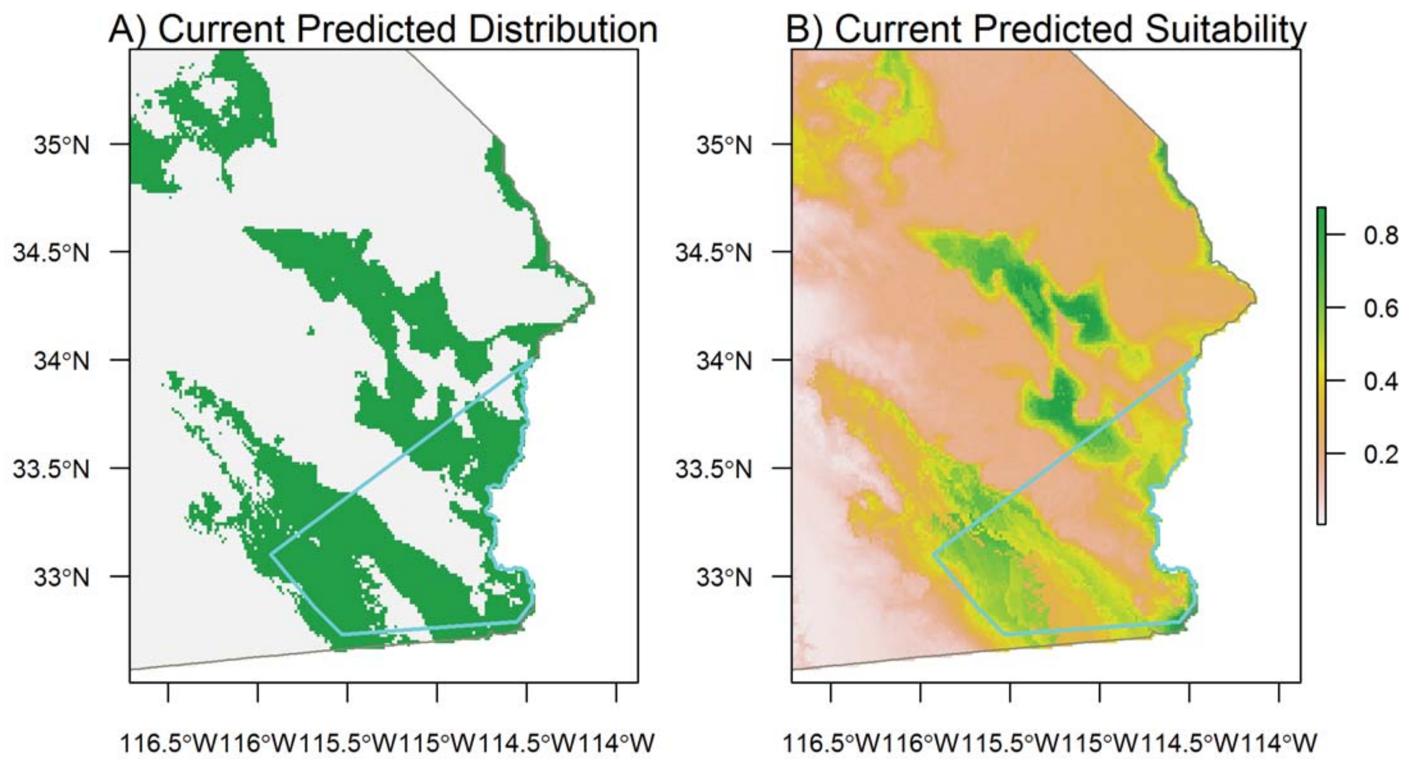

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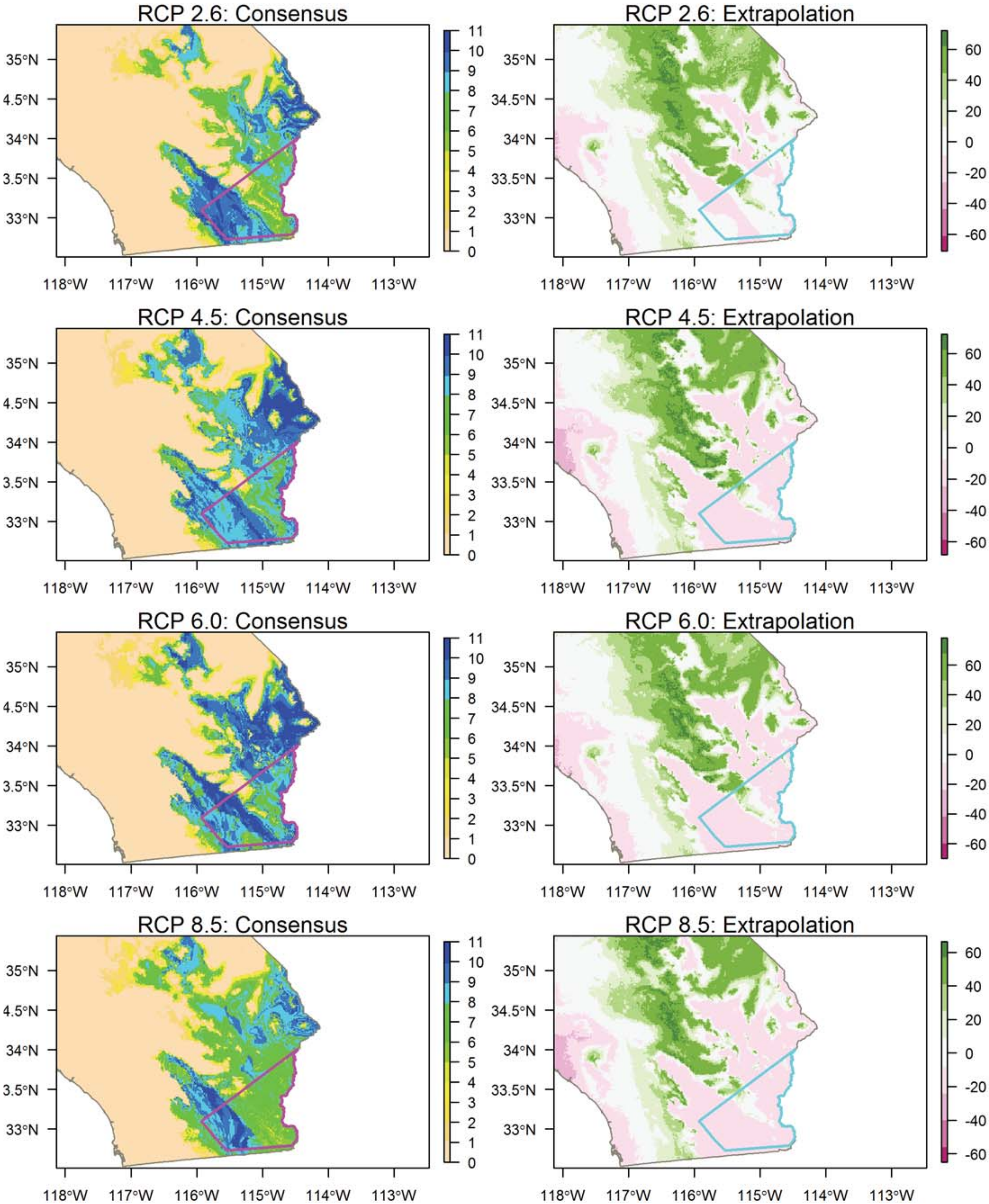

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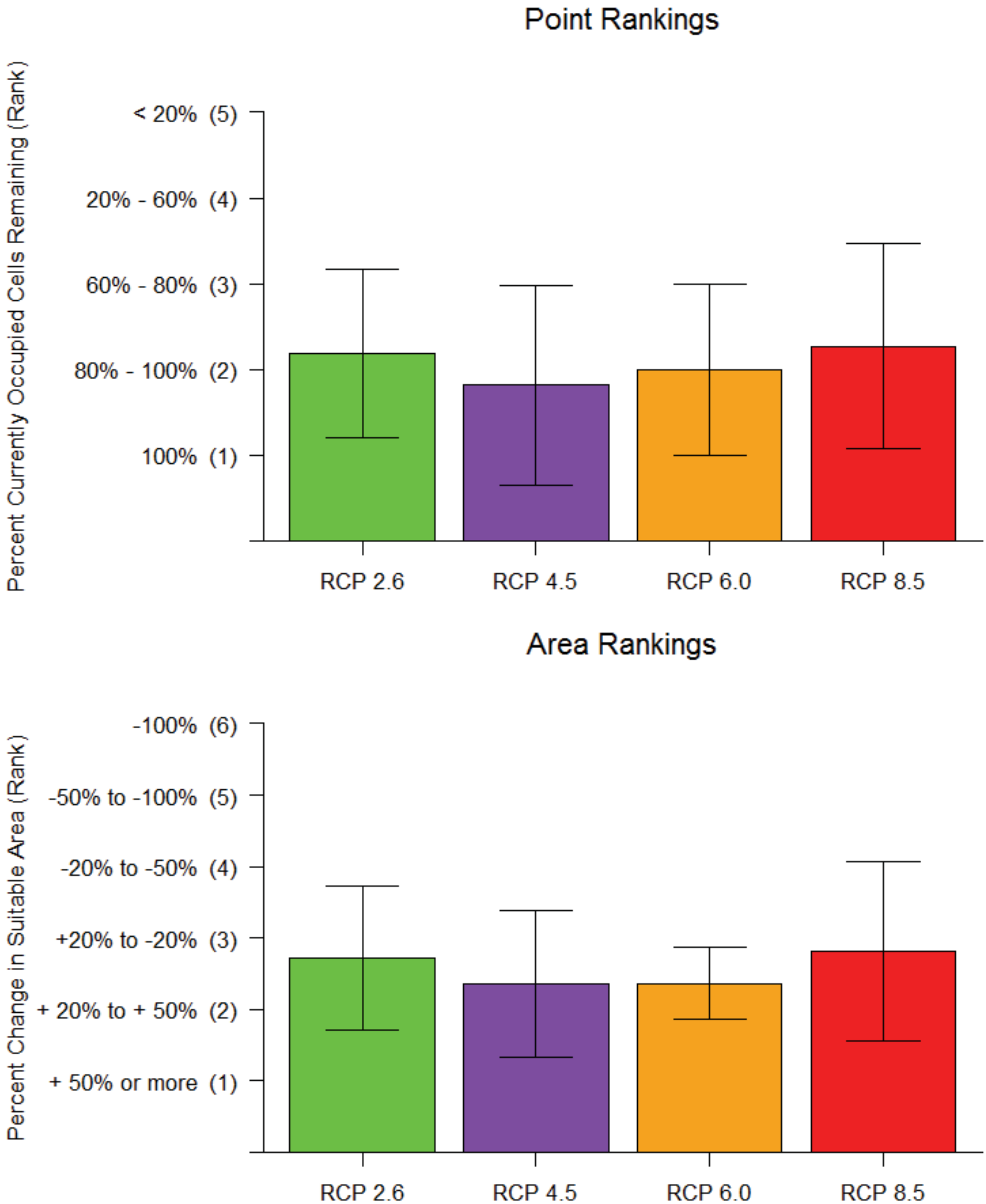

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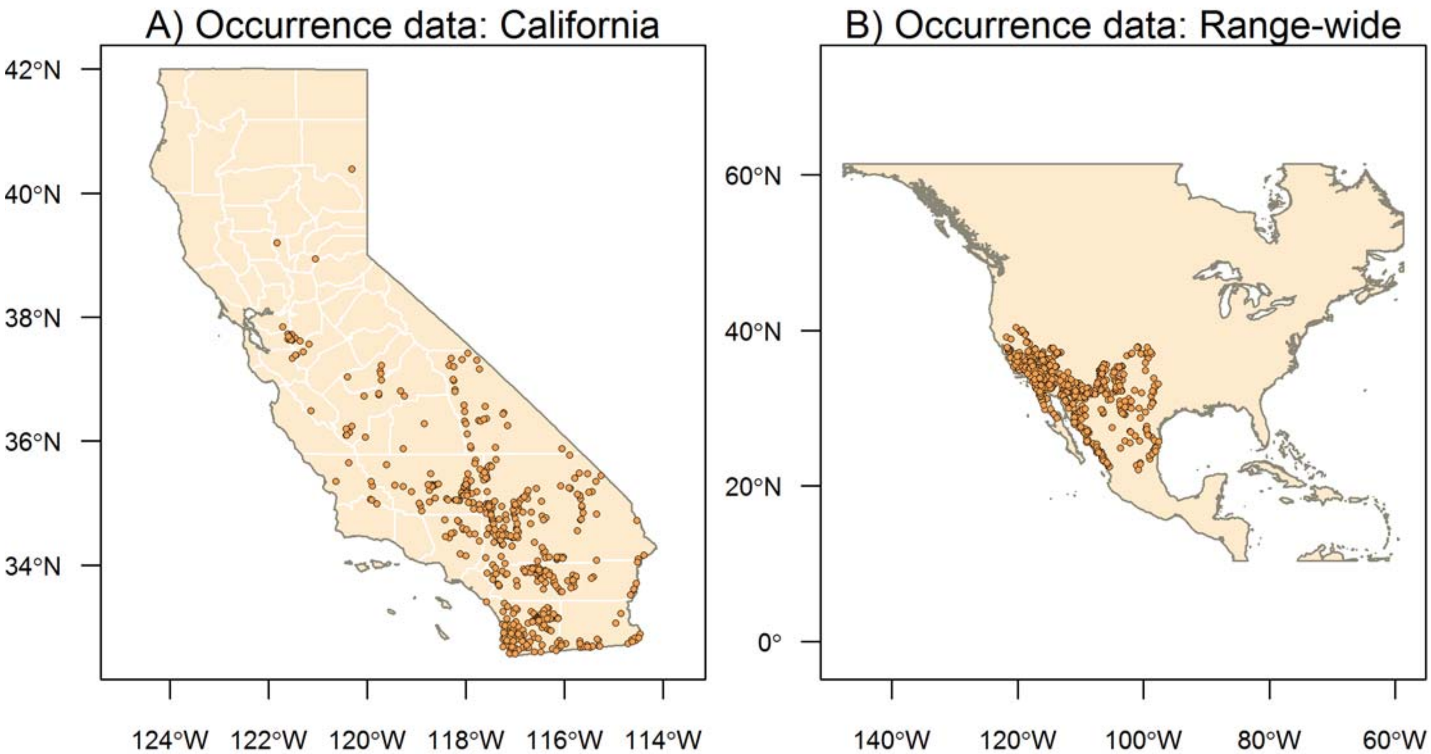
Species Results: *Rhinoceilus lecontei* Long-nosed Snake



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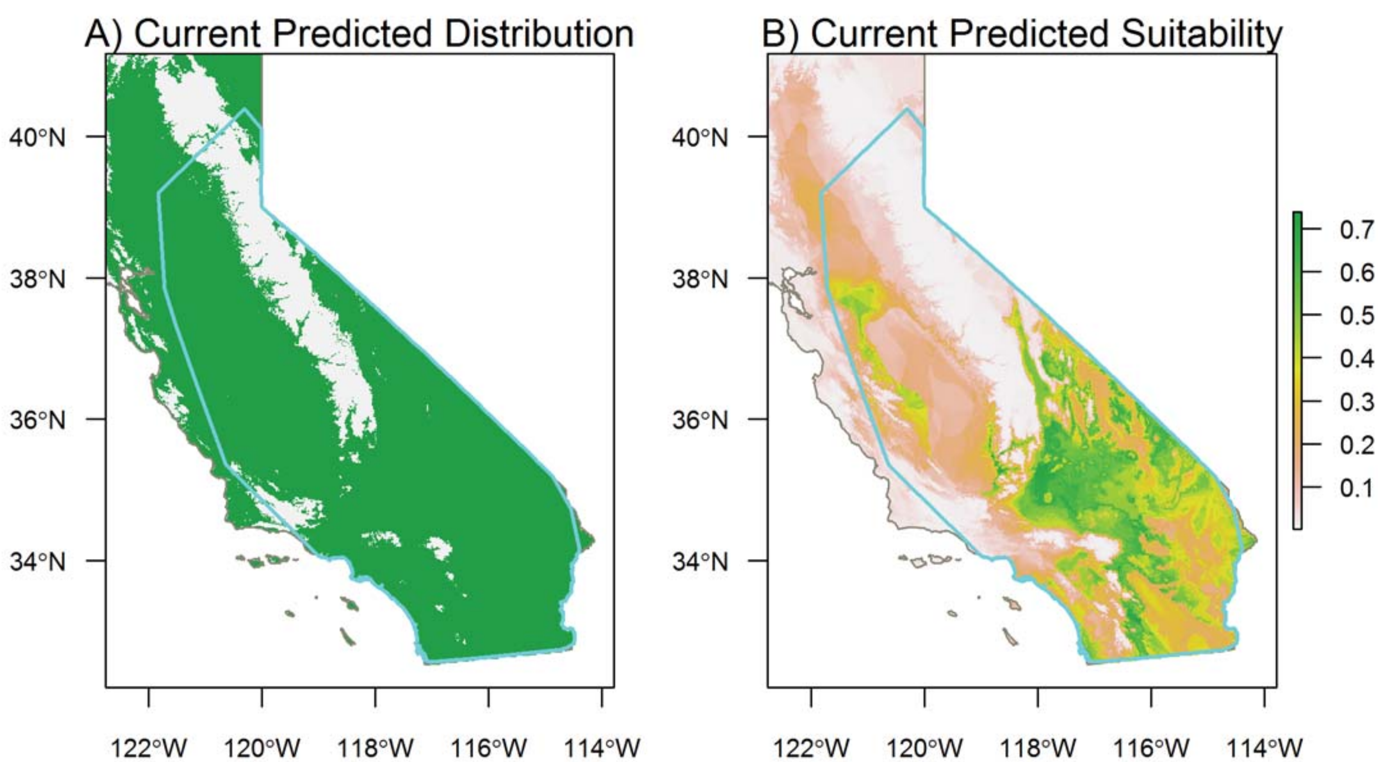

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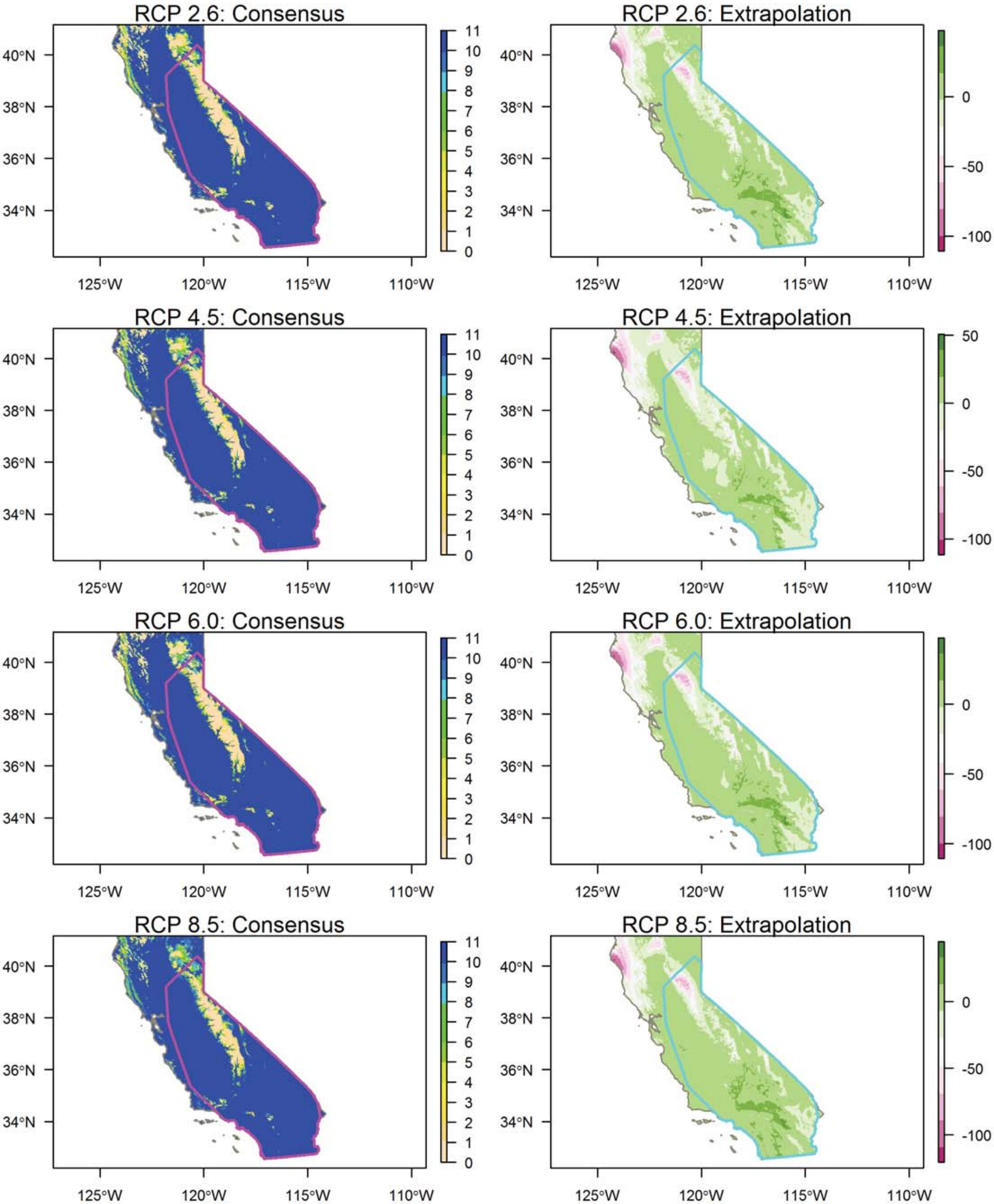

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Species Results: *Rhinoceilus lecontei* Long-nosed Snake

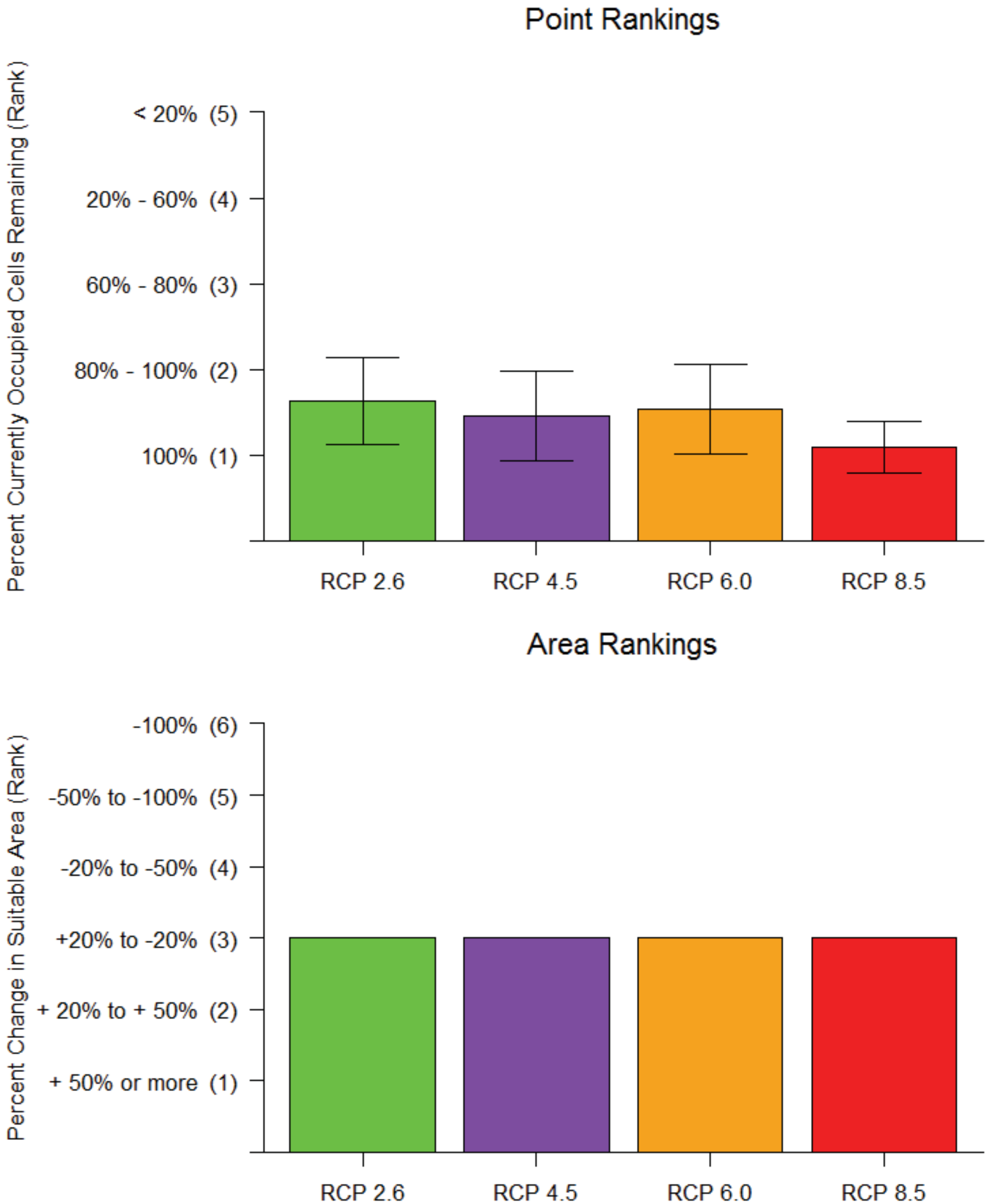


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Rhyacotriton variegatus* Southern Torrent Salamander

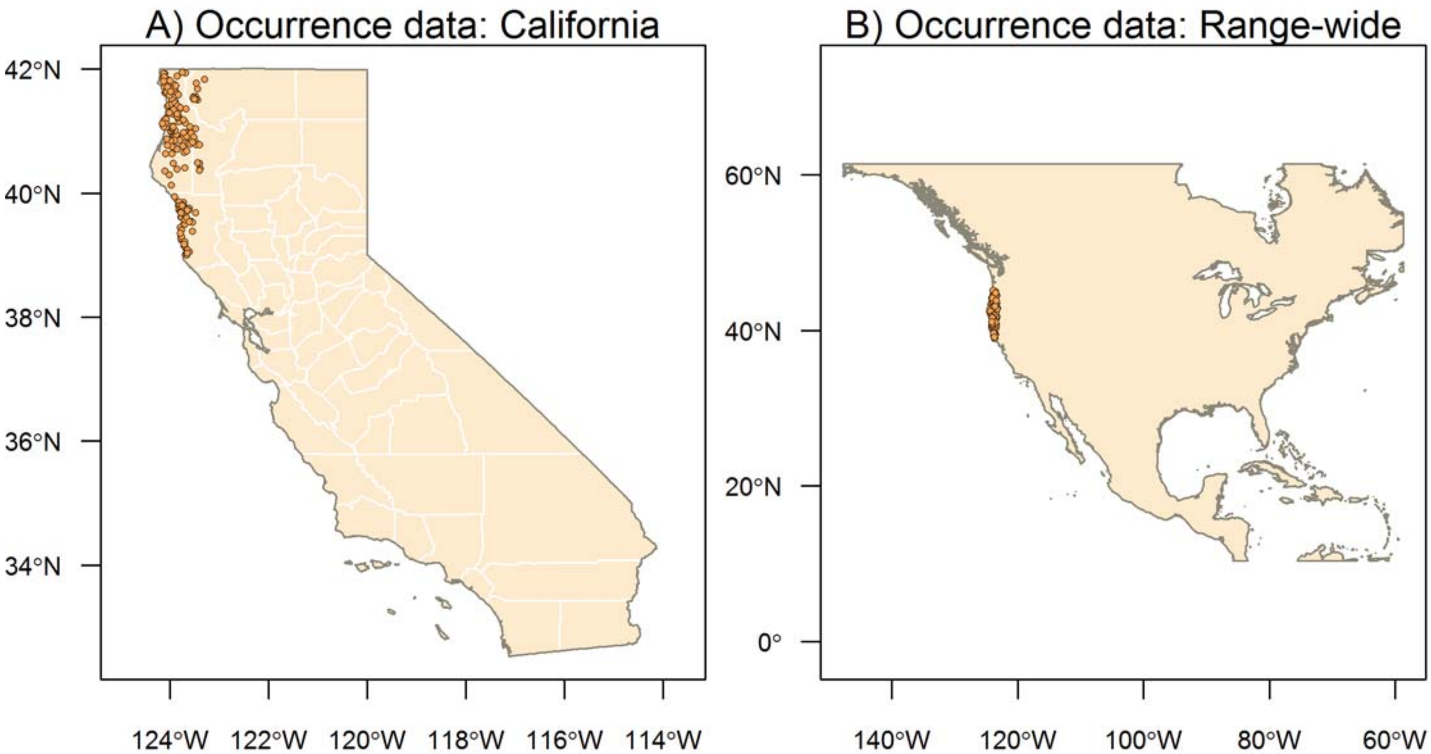


Figure 1. Occurrence data used to build Maxent models.

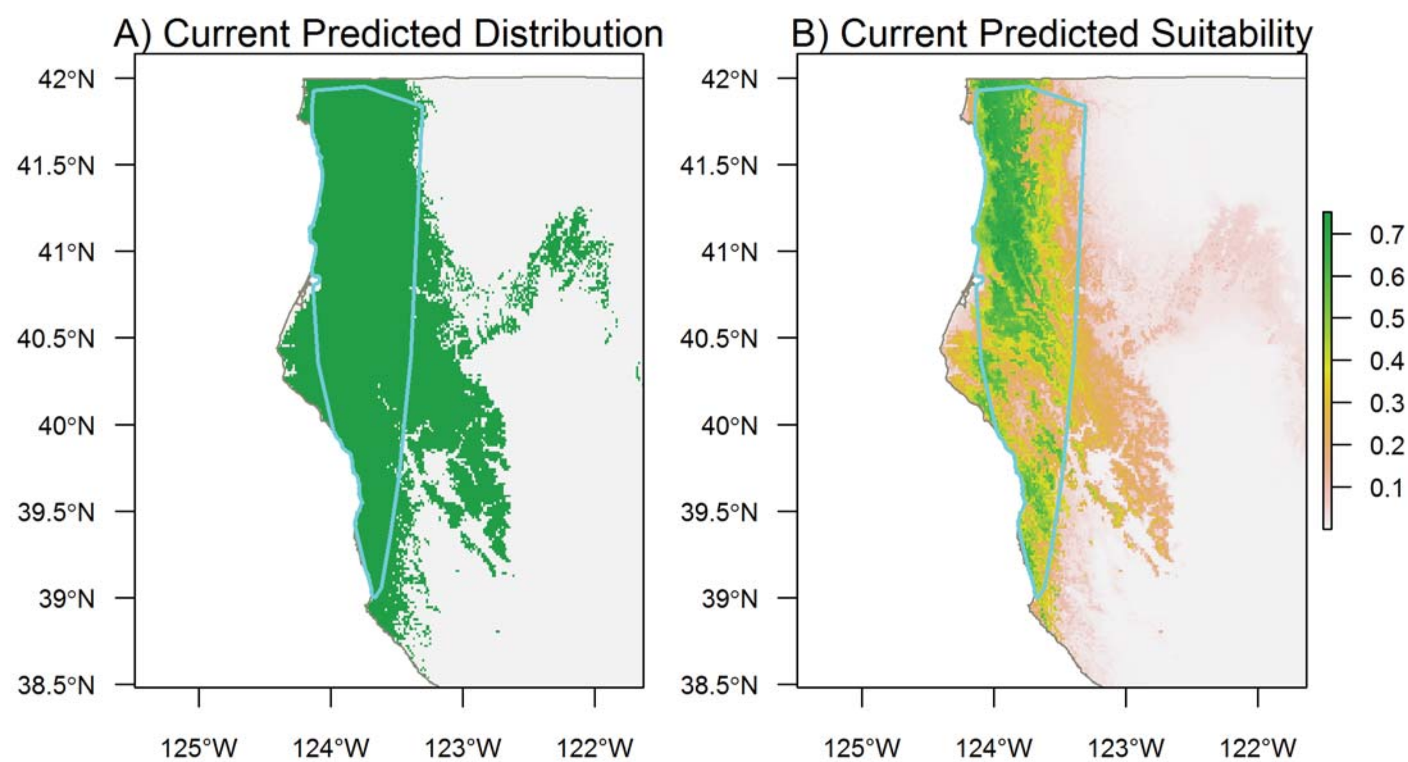


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Rhyacotriton variegatus* Southern Torrent Salamander

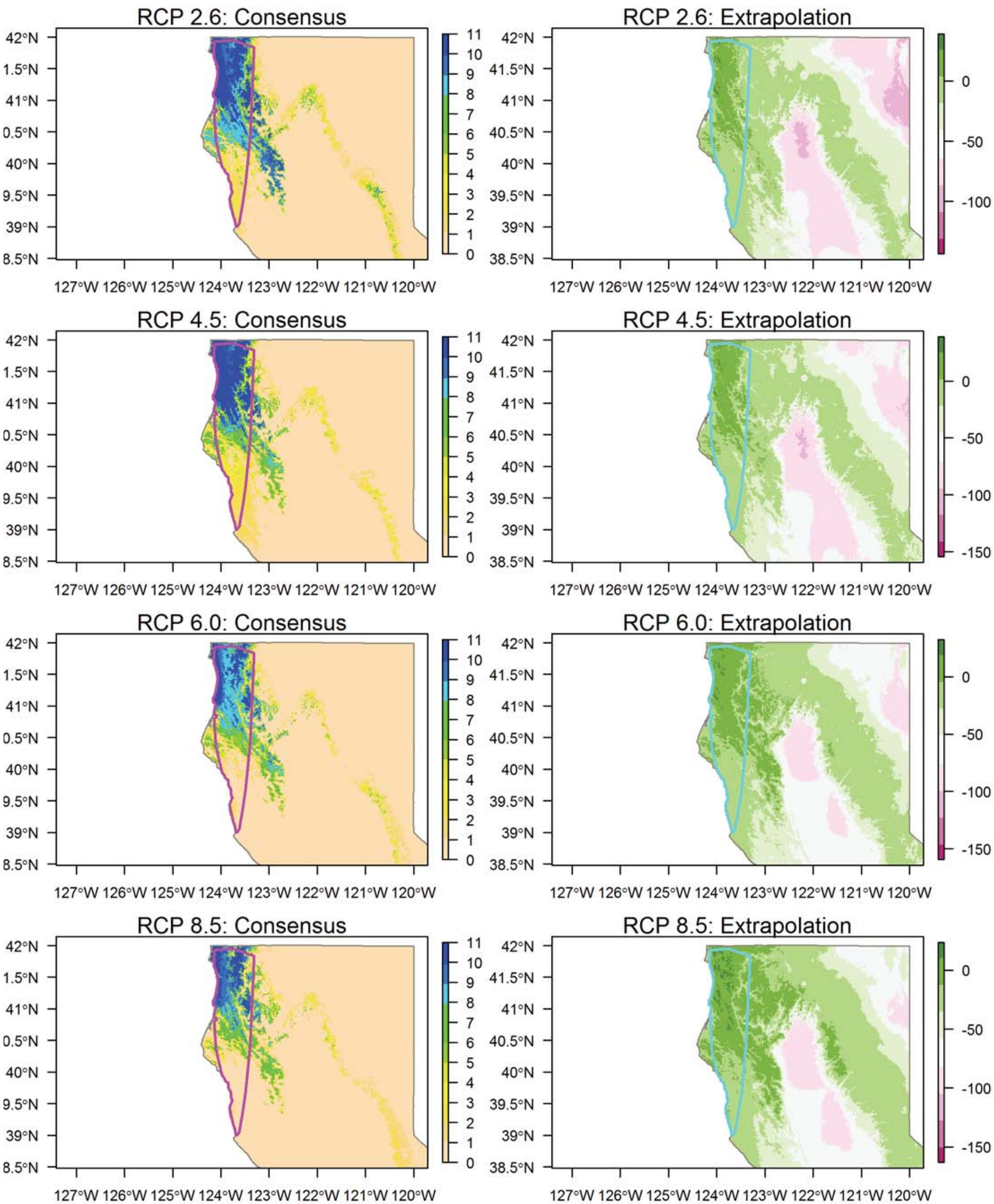
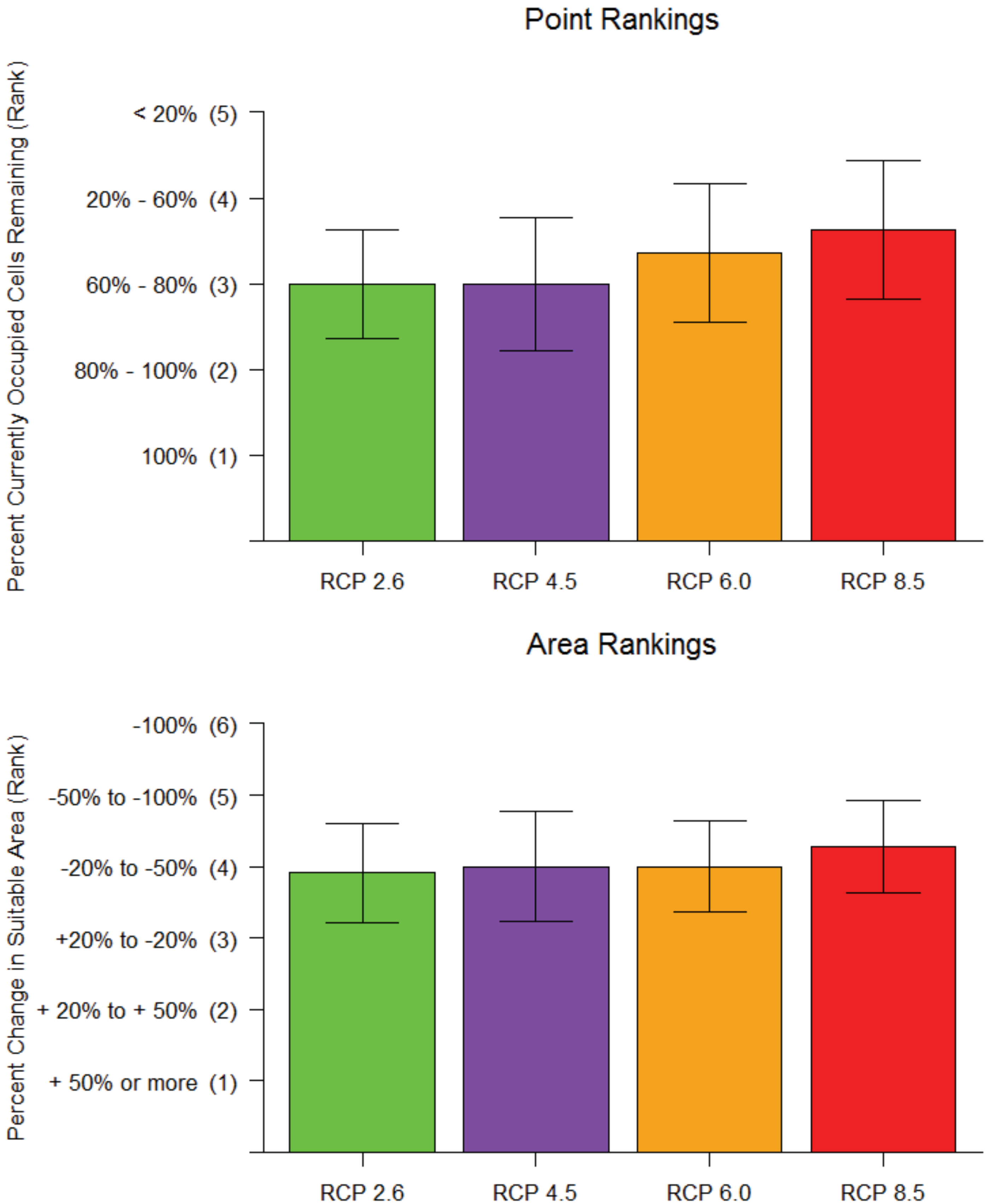


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.



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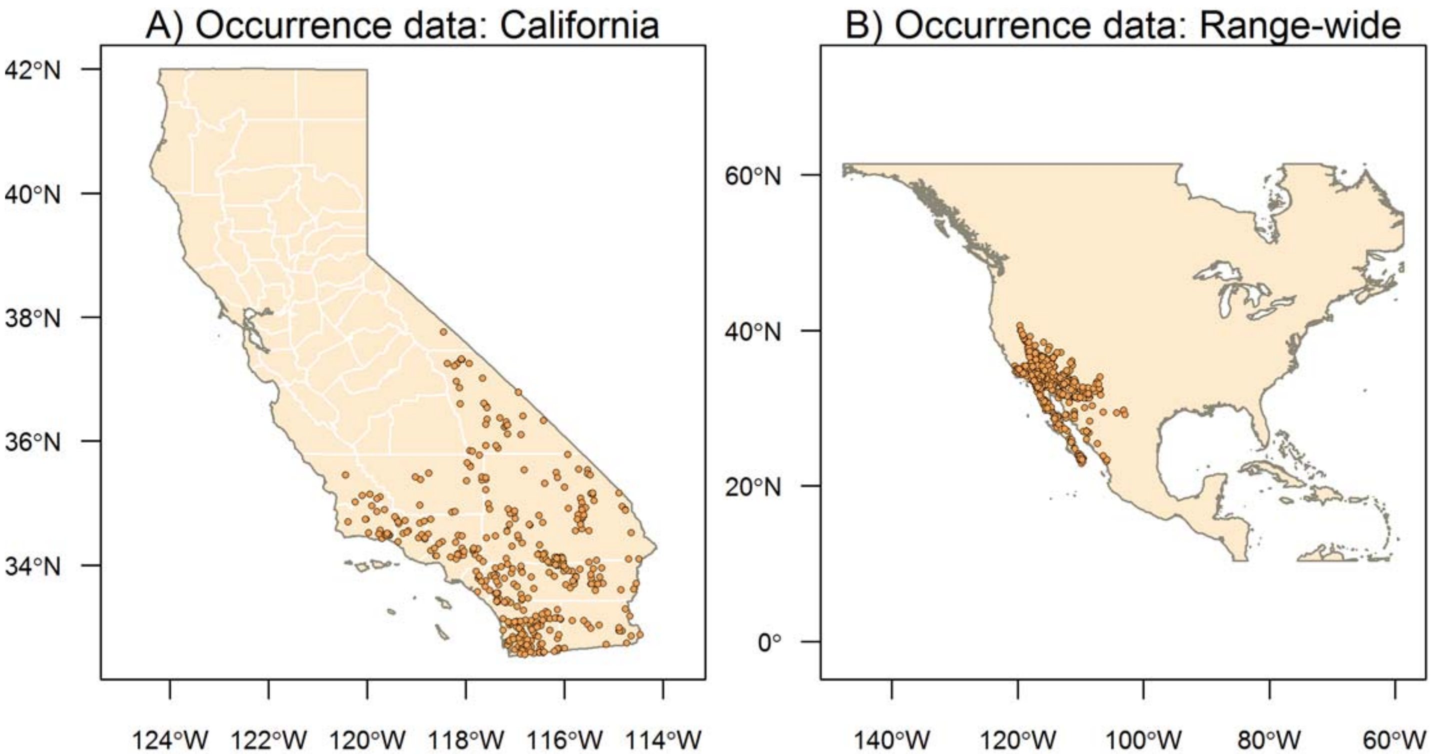
Species Results: *Salvadora hexalepis* Patch-nosed Snake



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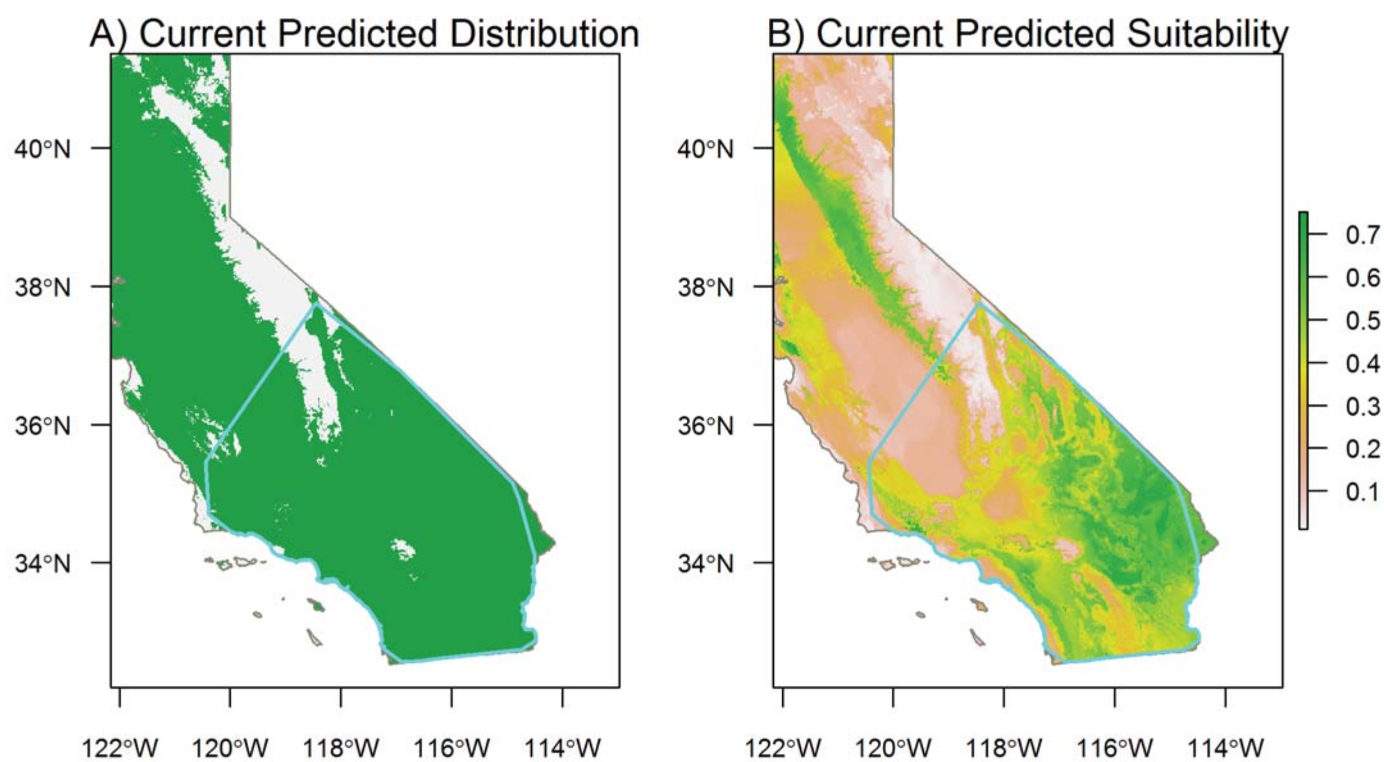

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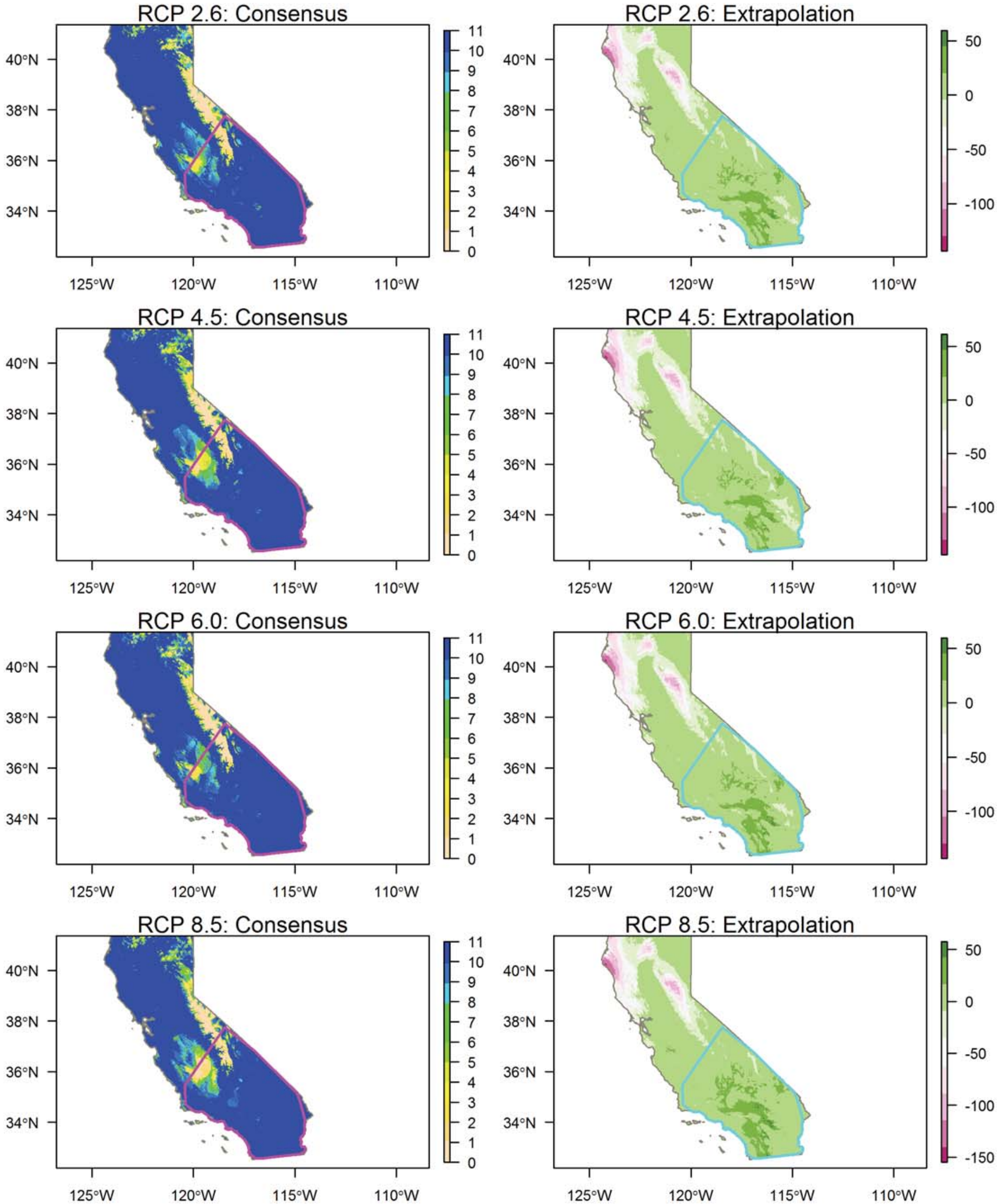
Species Results: *Salvadora hexalepis* Patch-nosed Snake



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Species Results: *Salvadora hexalepis* Patch-nosed Snake

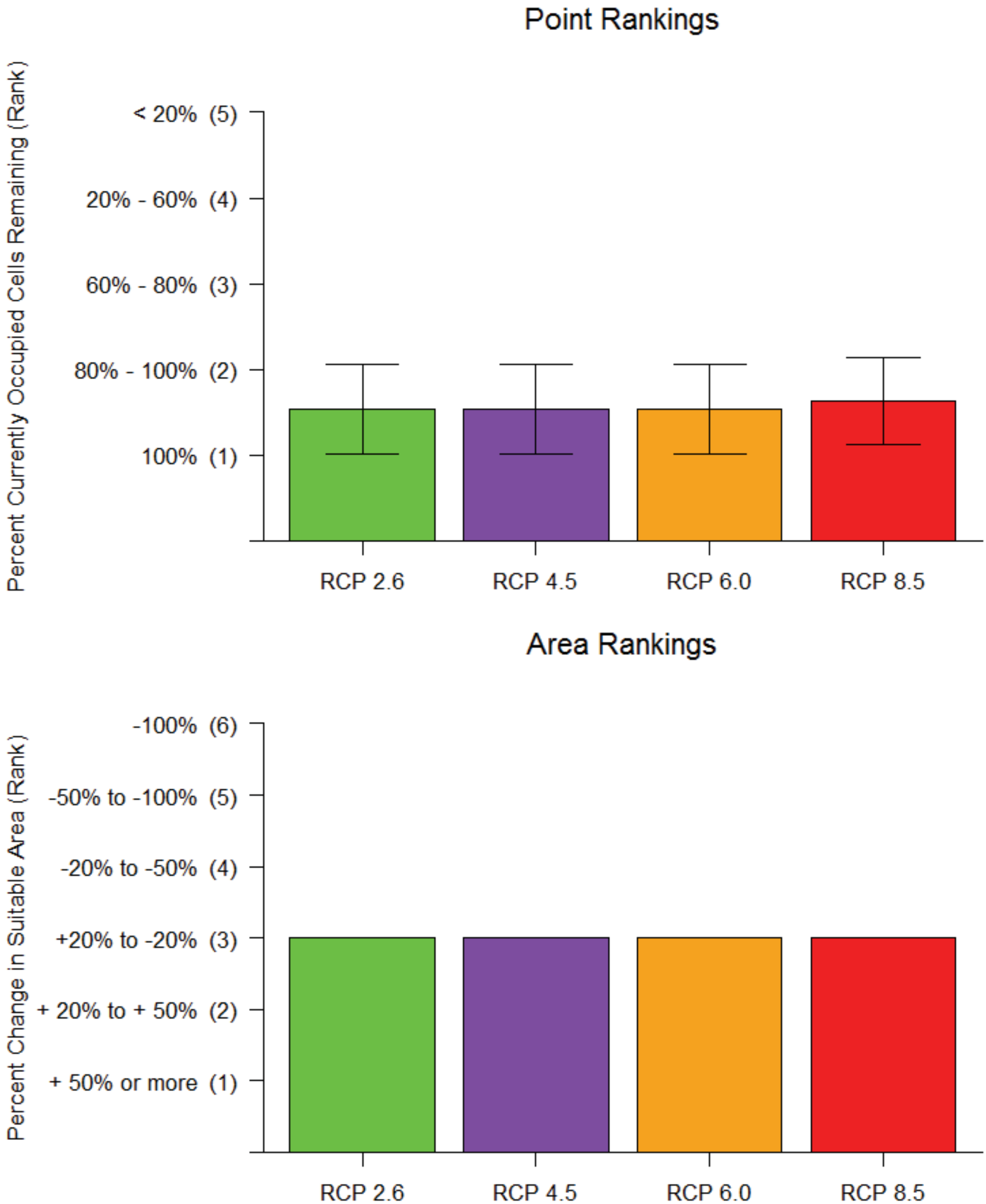


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Sauromalus ater* Chuckwalla

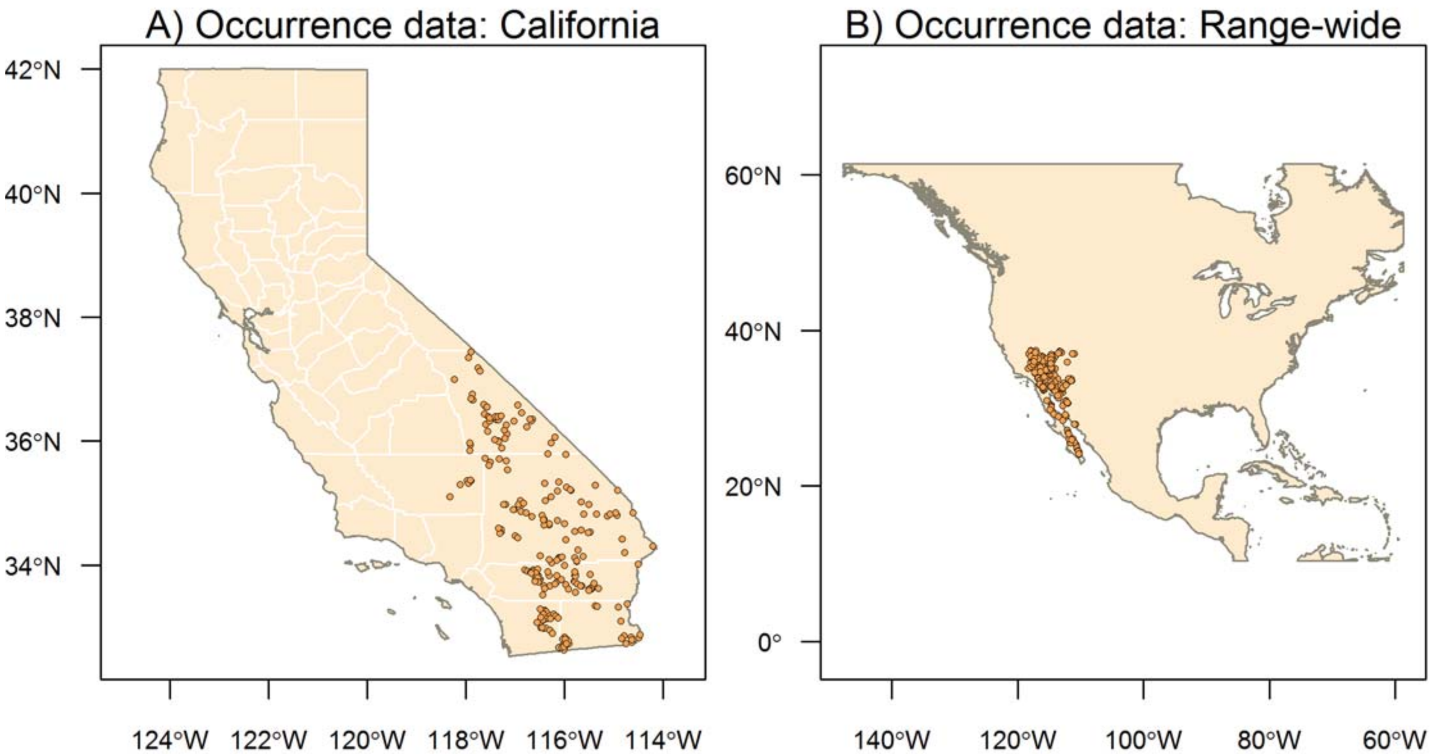
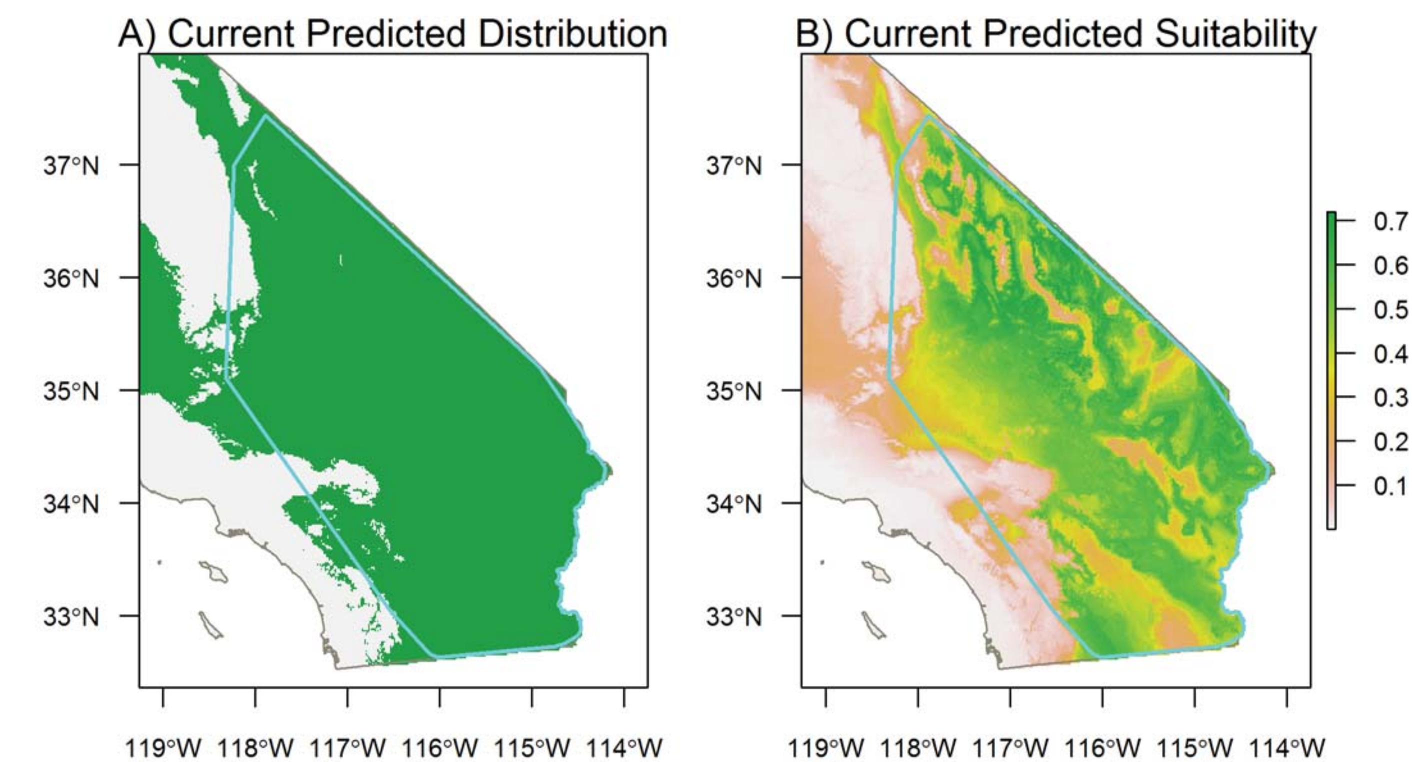


Figure 1. Occurrence data used to build Maxent models.



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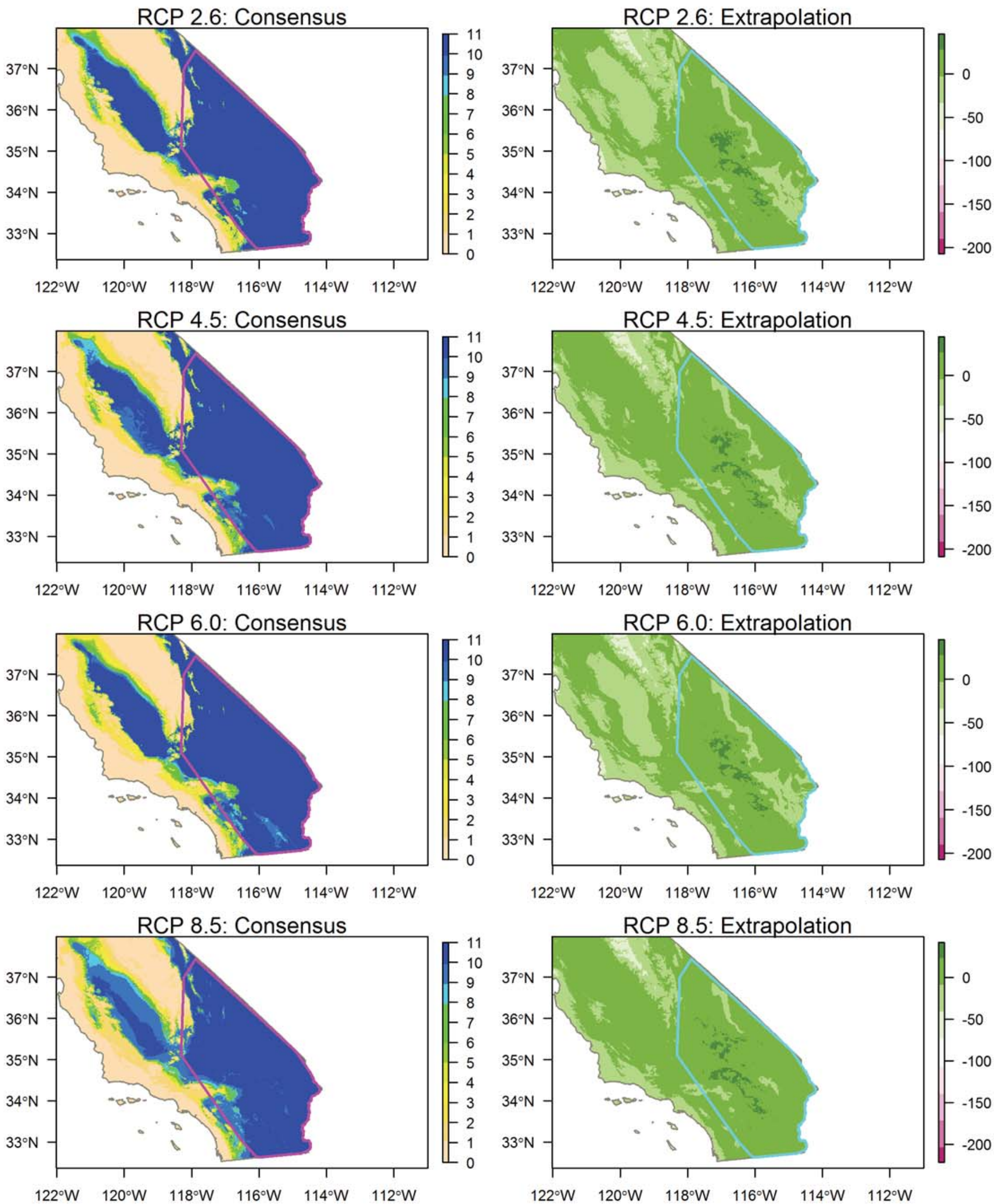

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Species Results: *Sauromalus ater* Chuckwalla

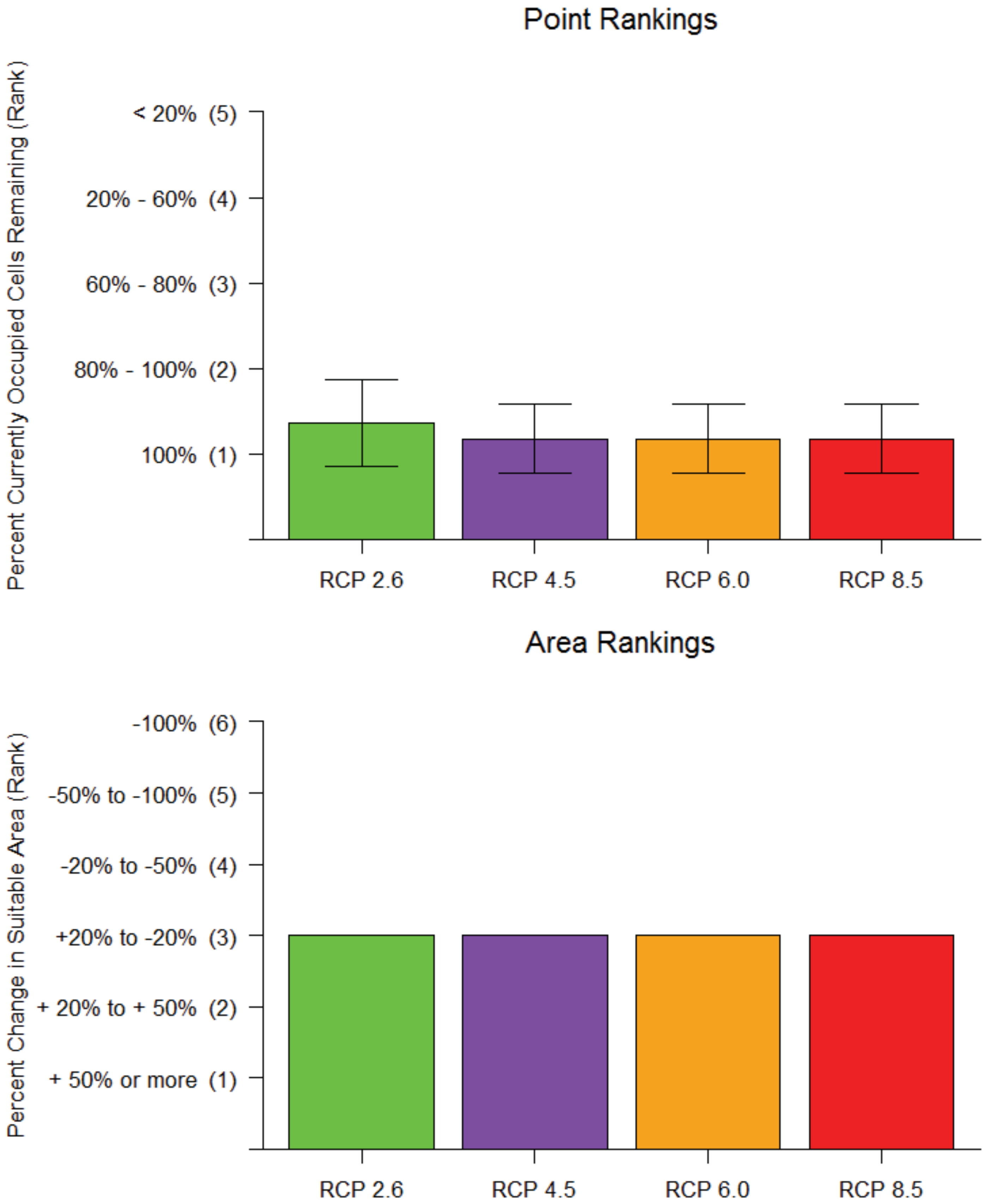
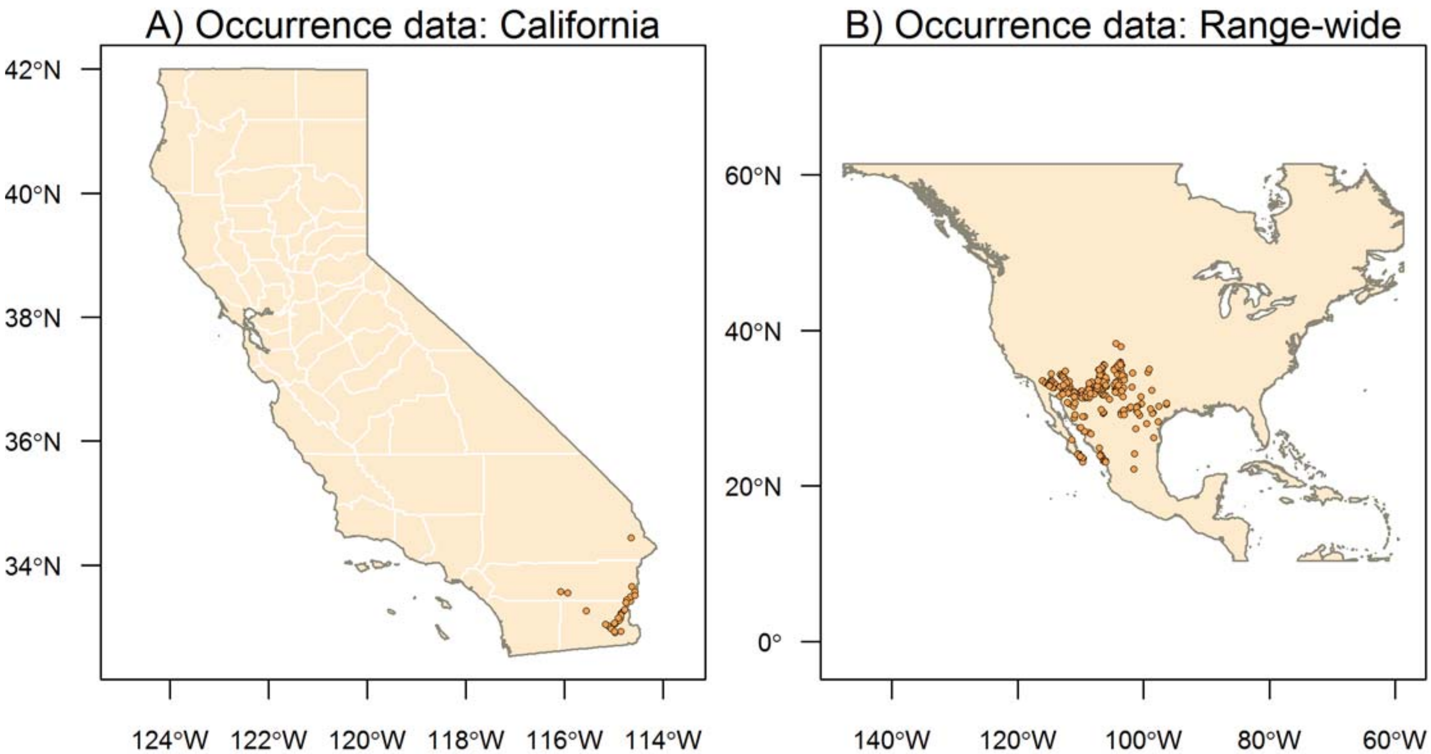


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Scaphiopus couchii* Couch's Spadefoot



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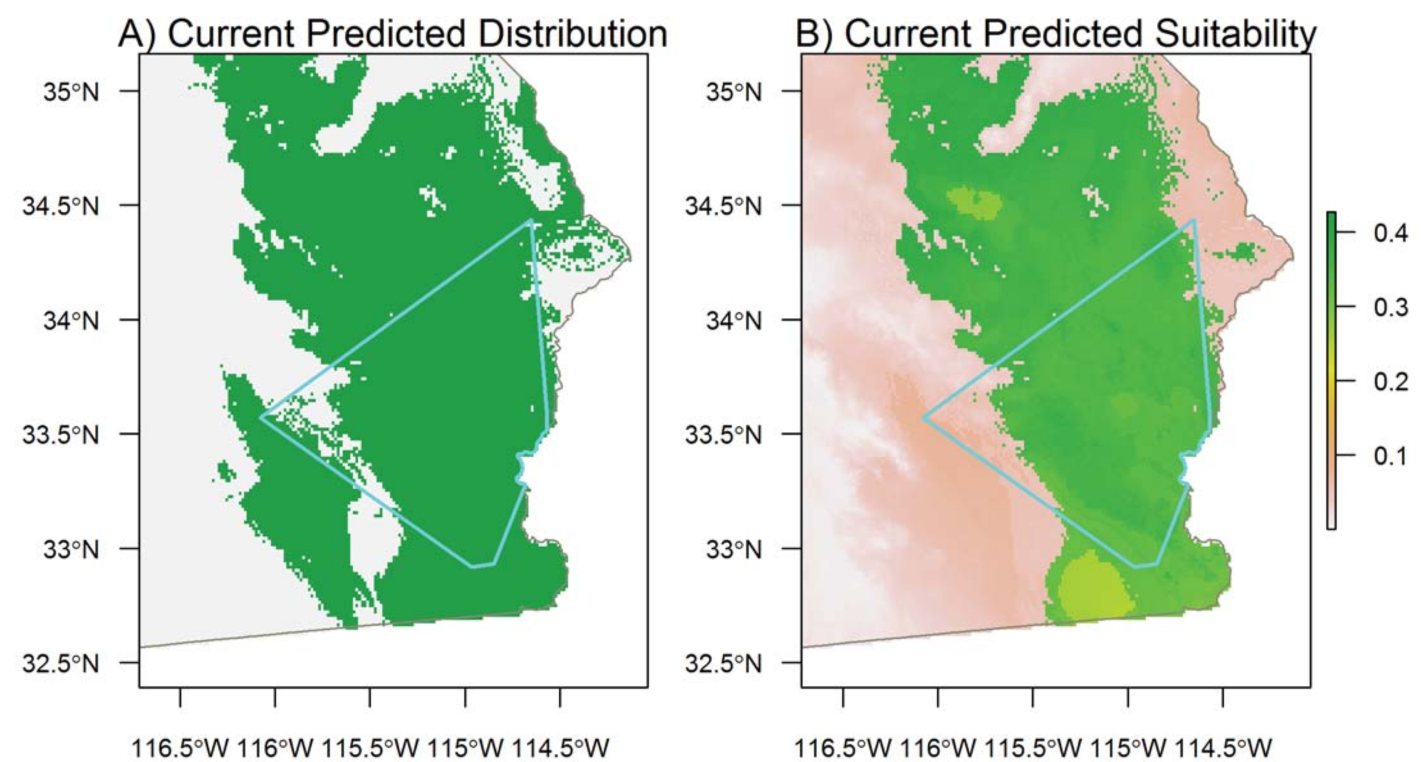

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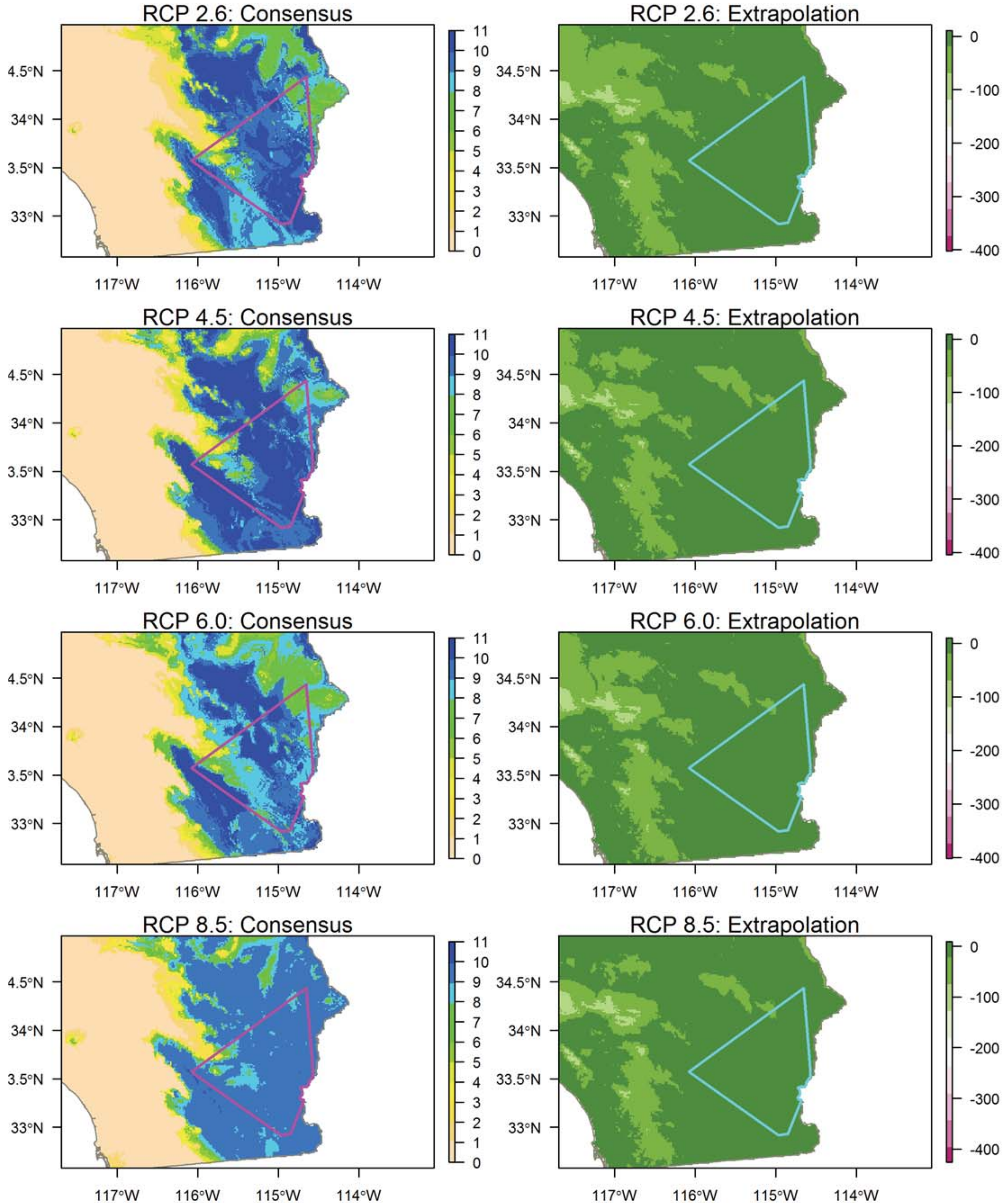
Species Results: *Scaphiopus couchii* Couch's Spadefoot



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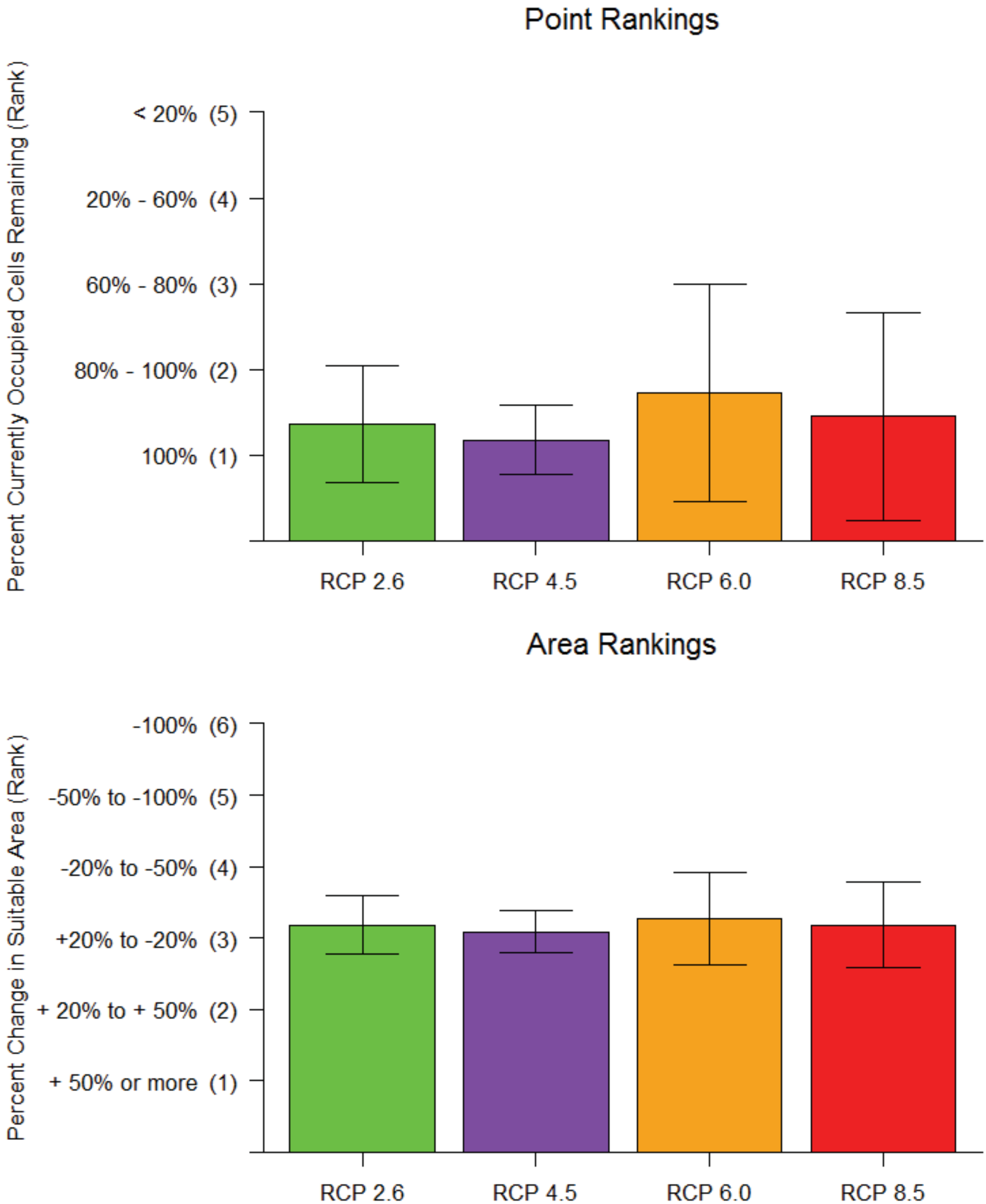

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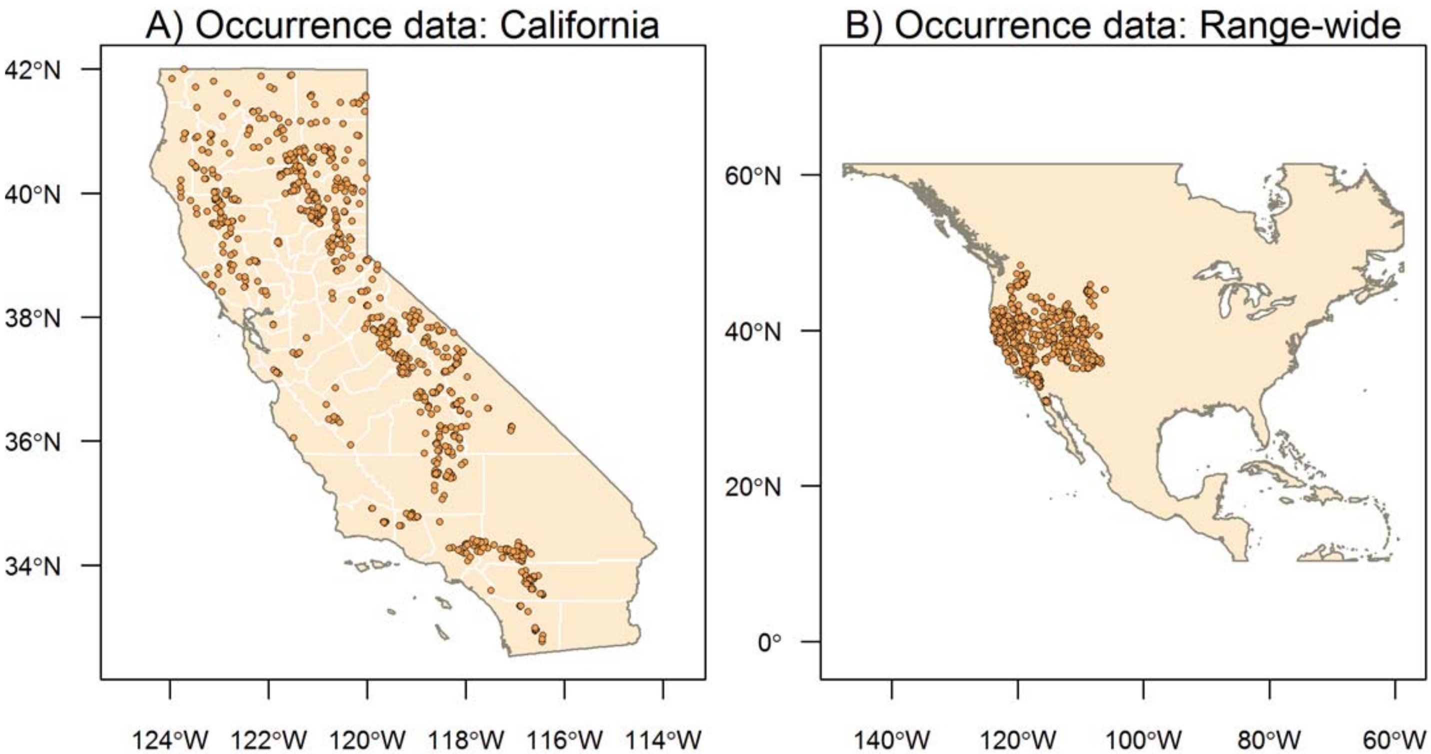

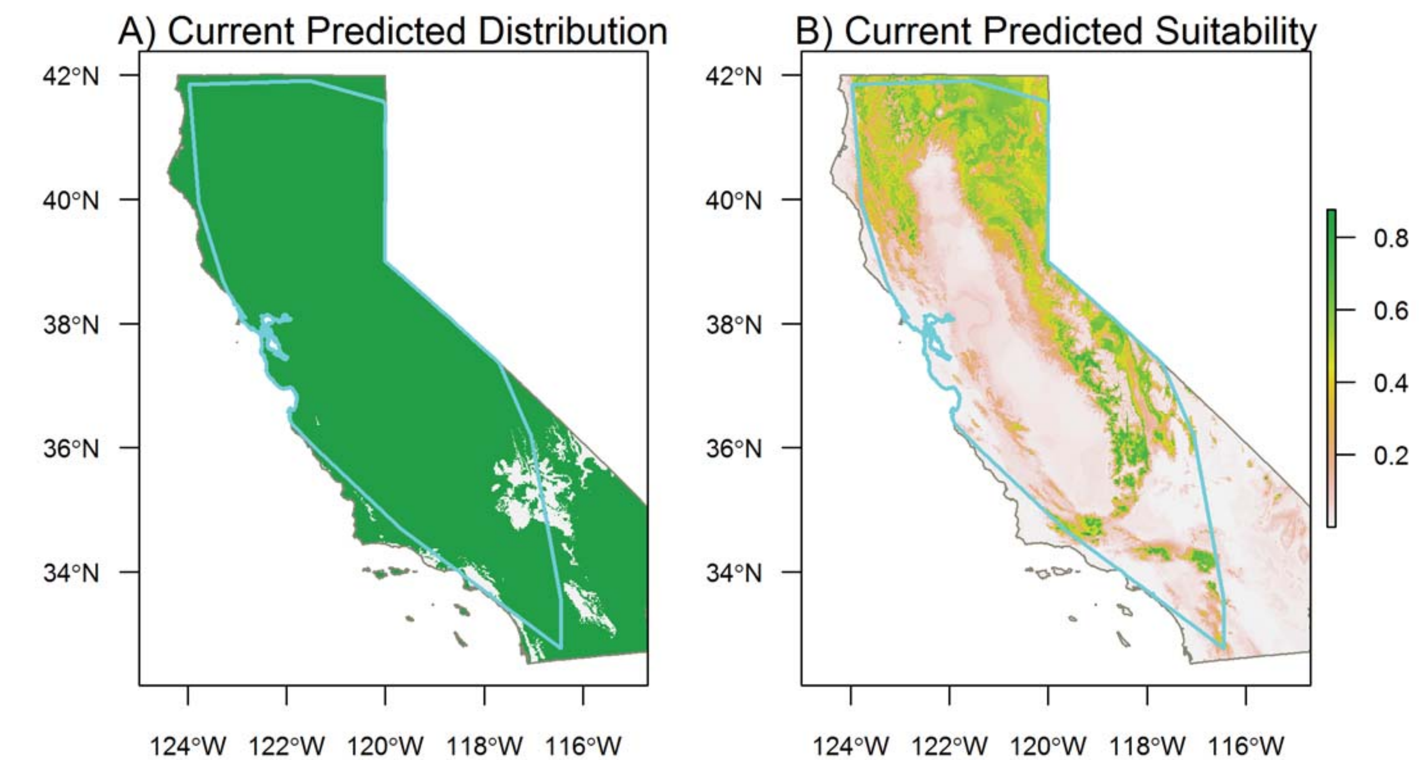

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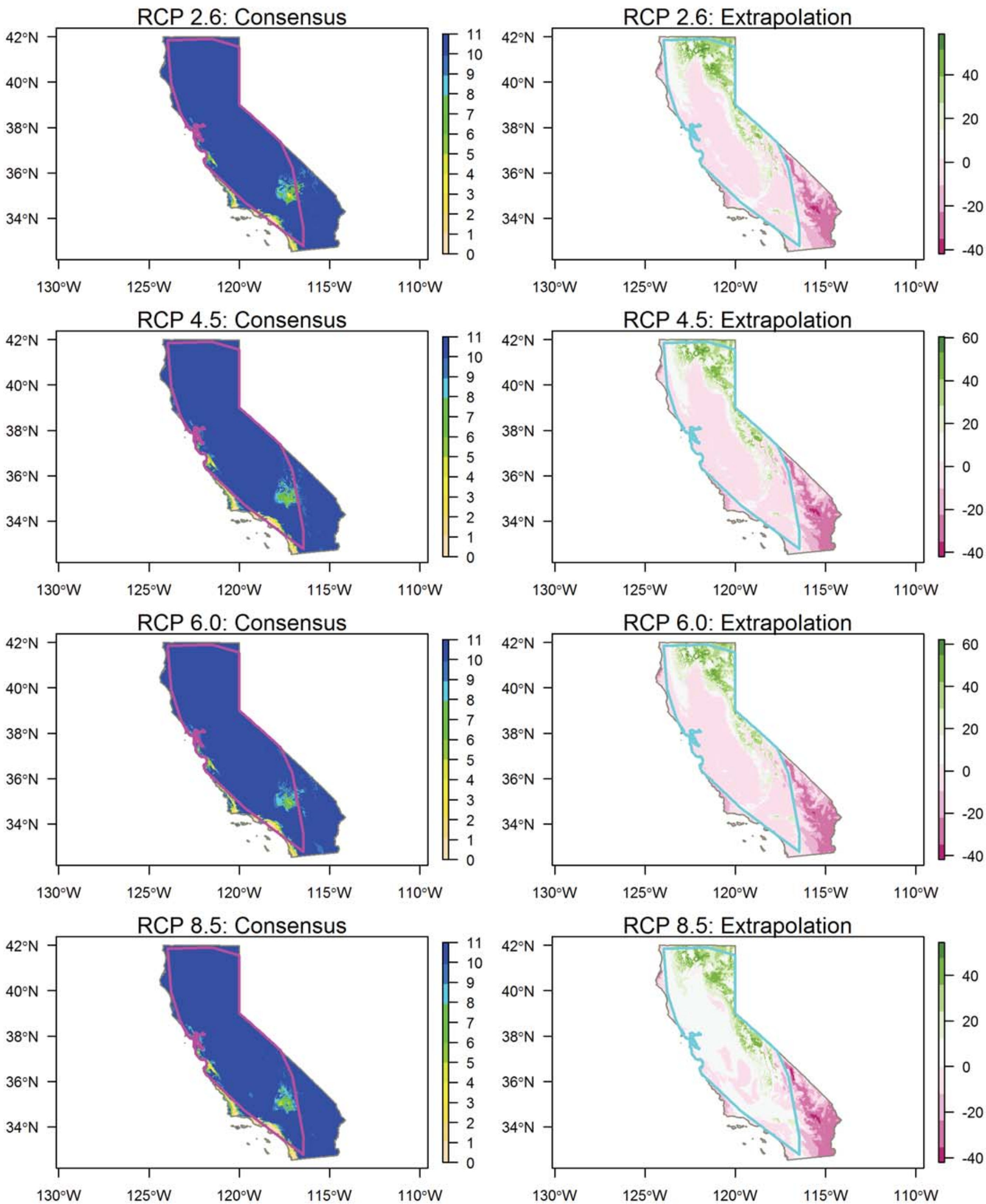
Species Results: *Sceloporus graciosus* Sagebrush Lizard



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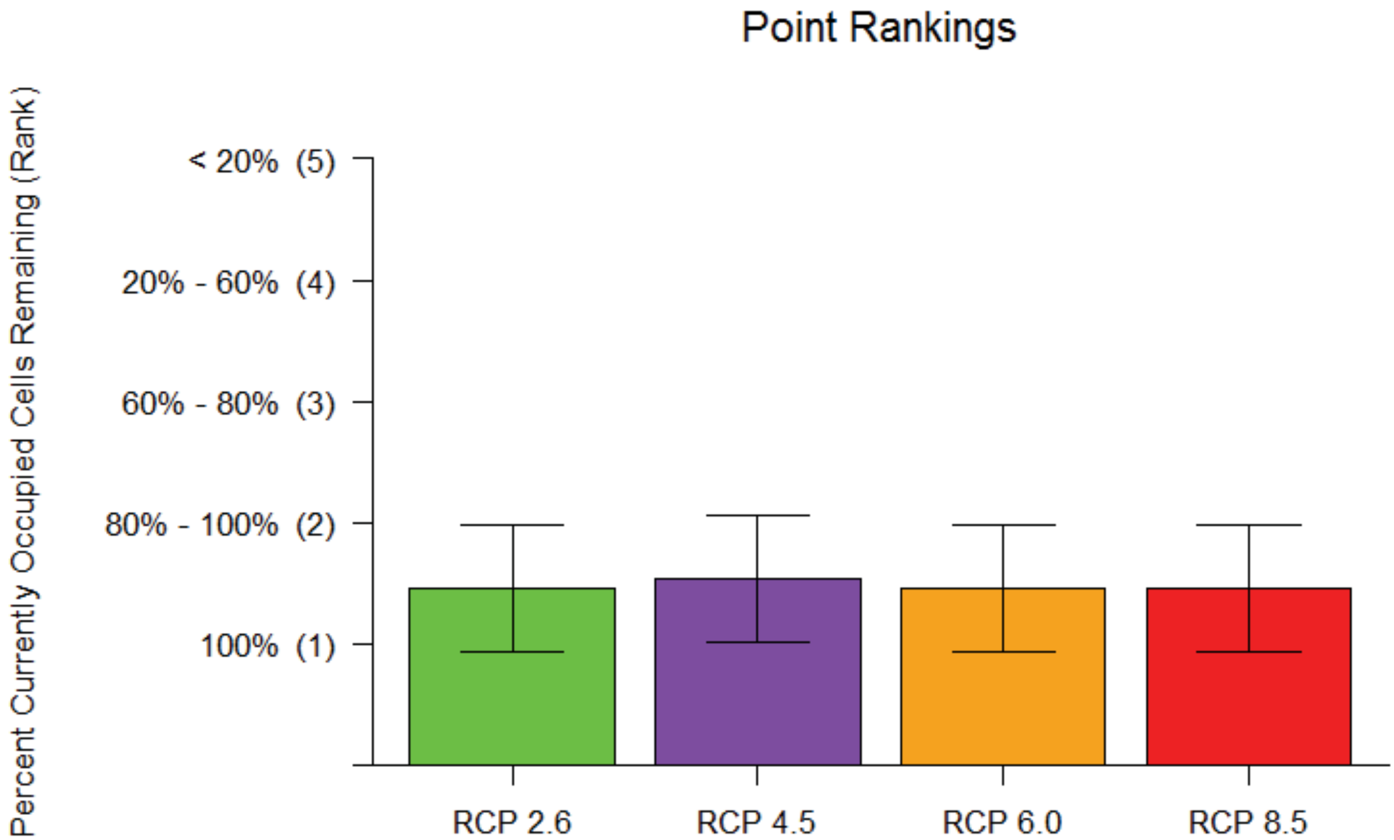

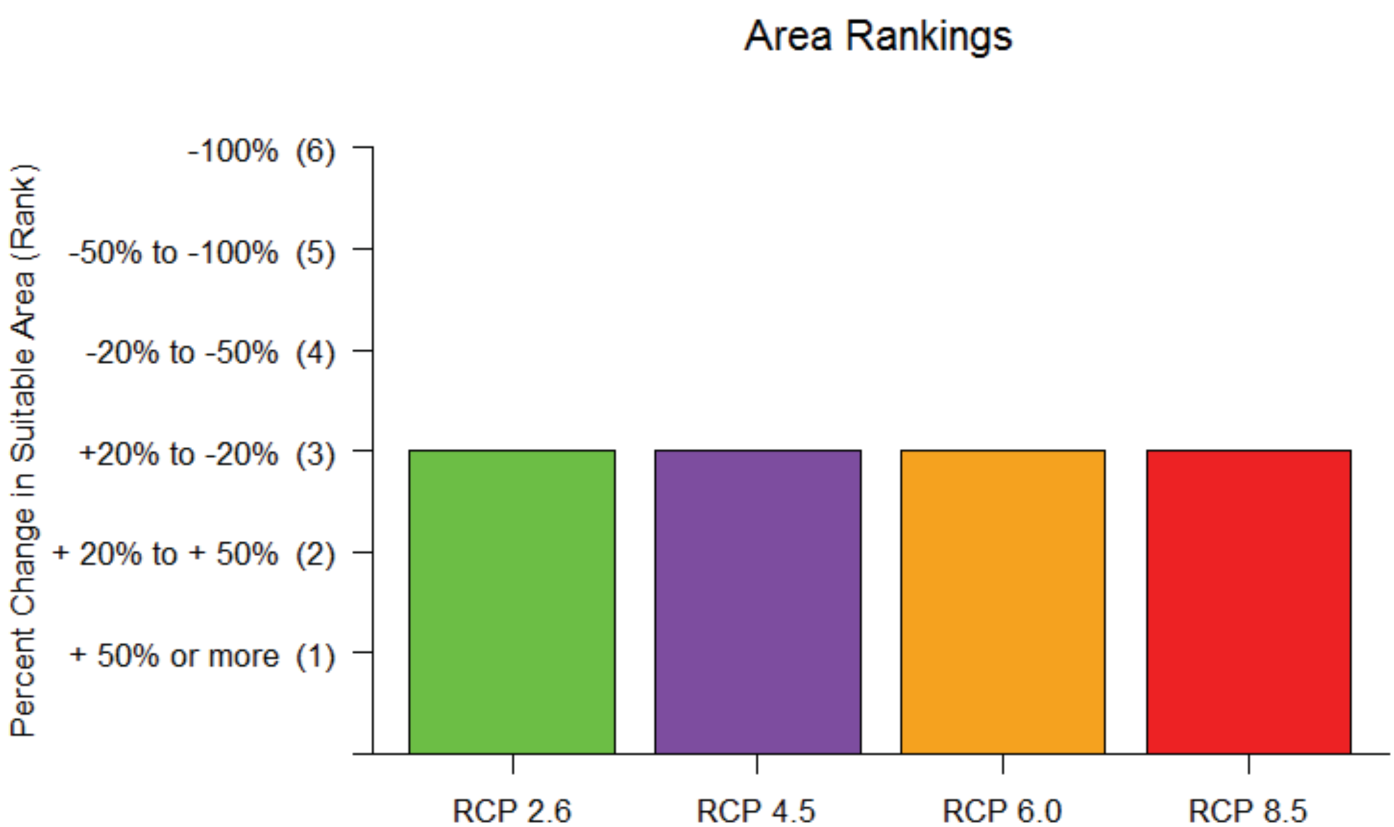

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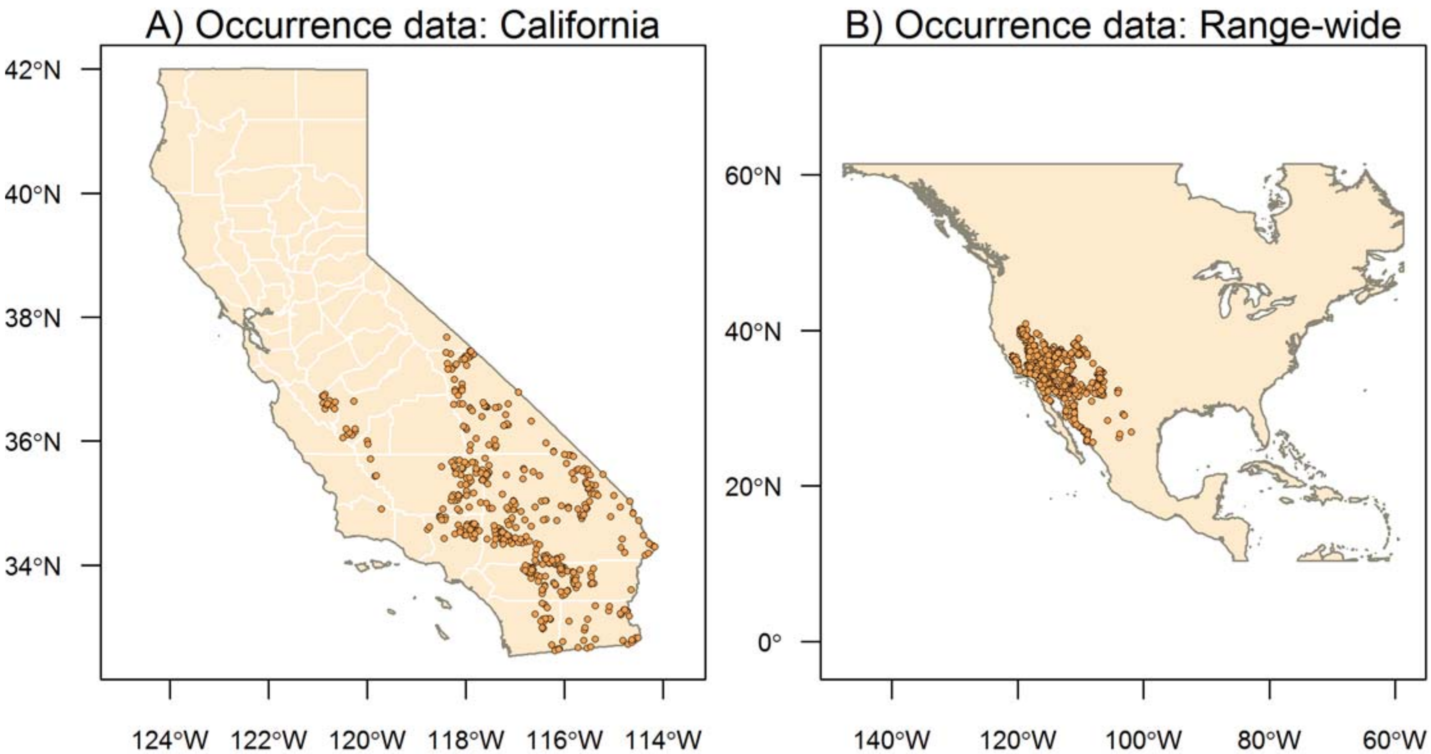
Species Results: *Sceloporus magister* Desert Spiny Lizard



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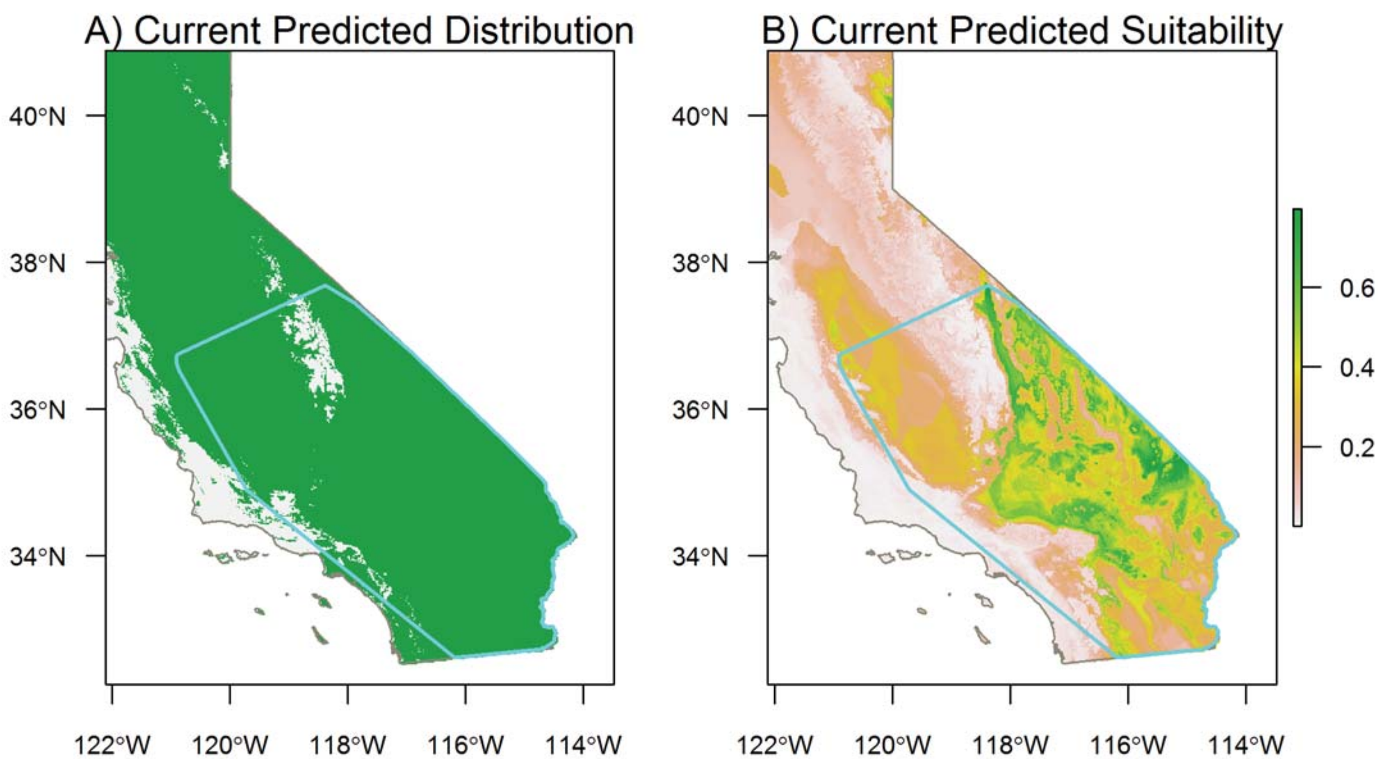

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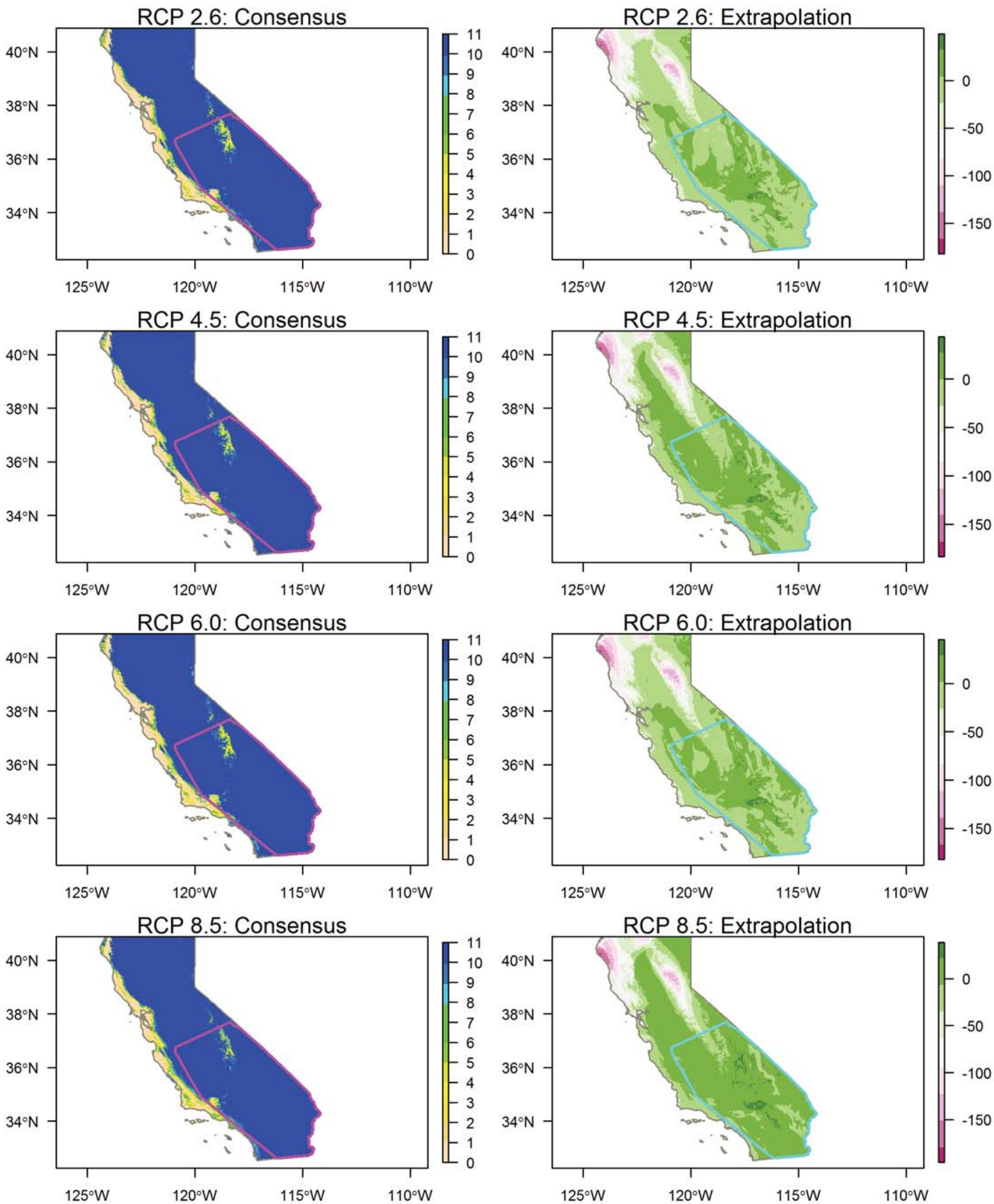
Species Results: *Sceloporus magister* Desert Spiny Lizard



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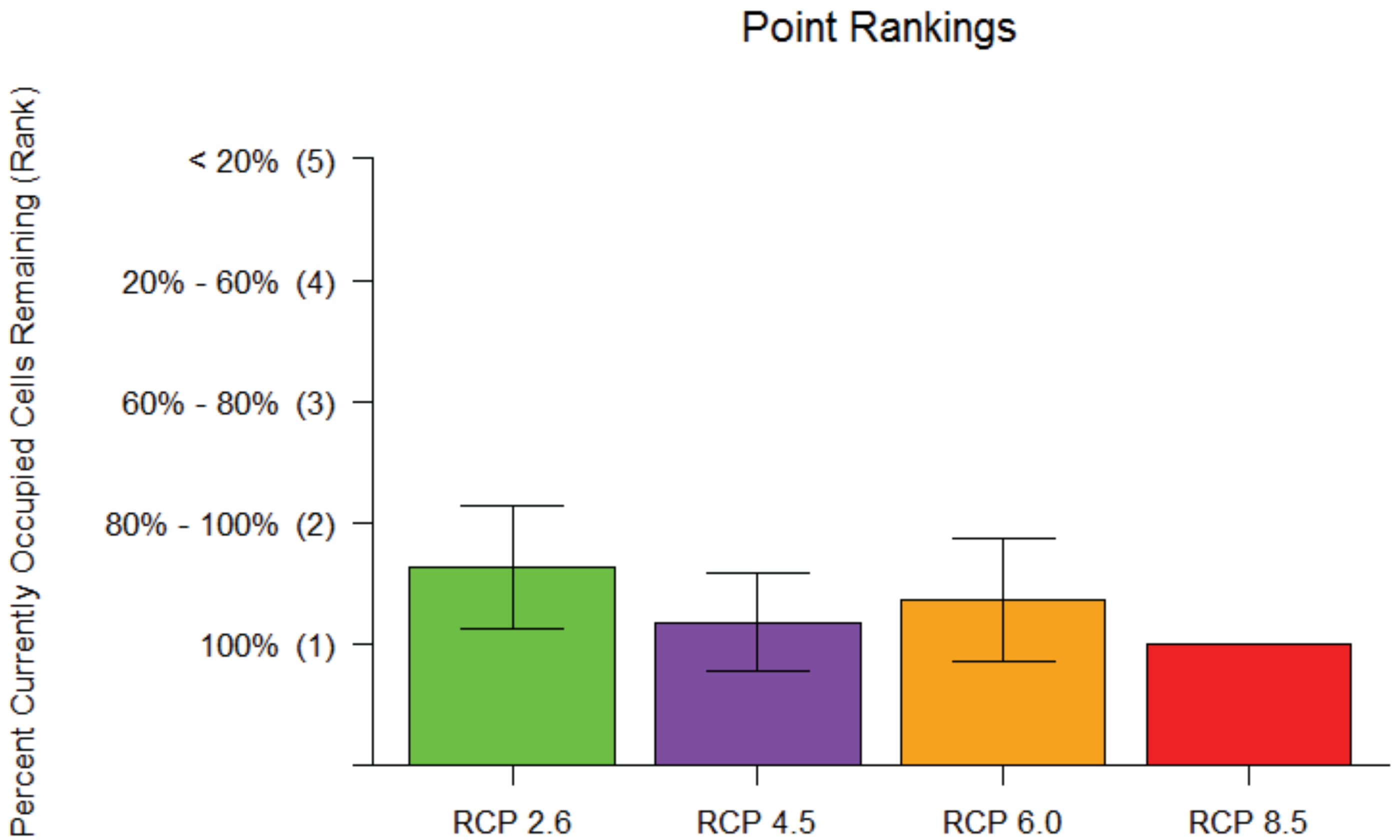
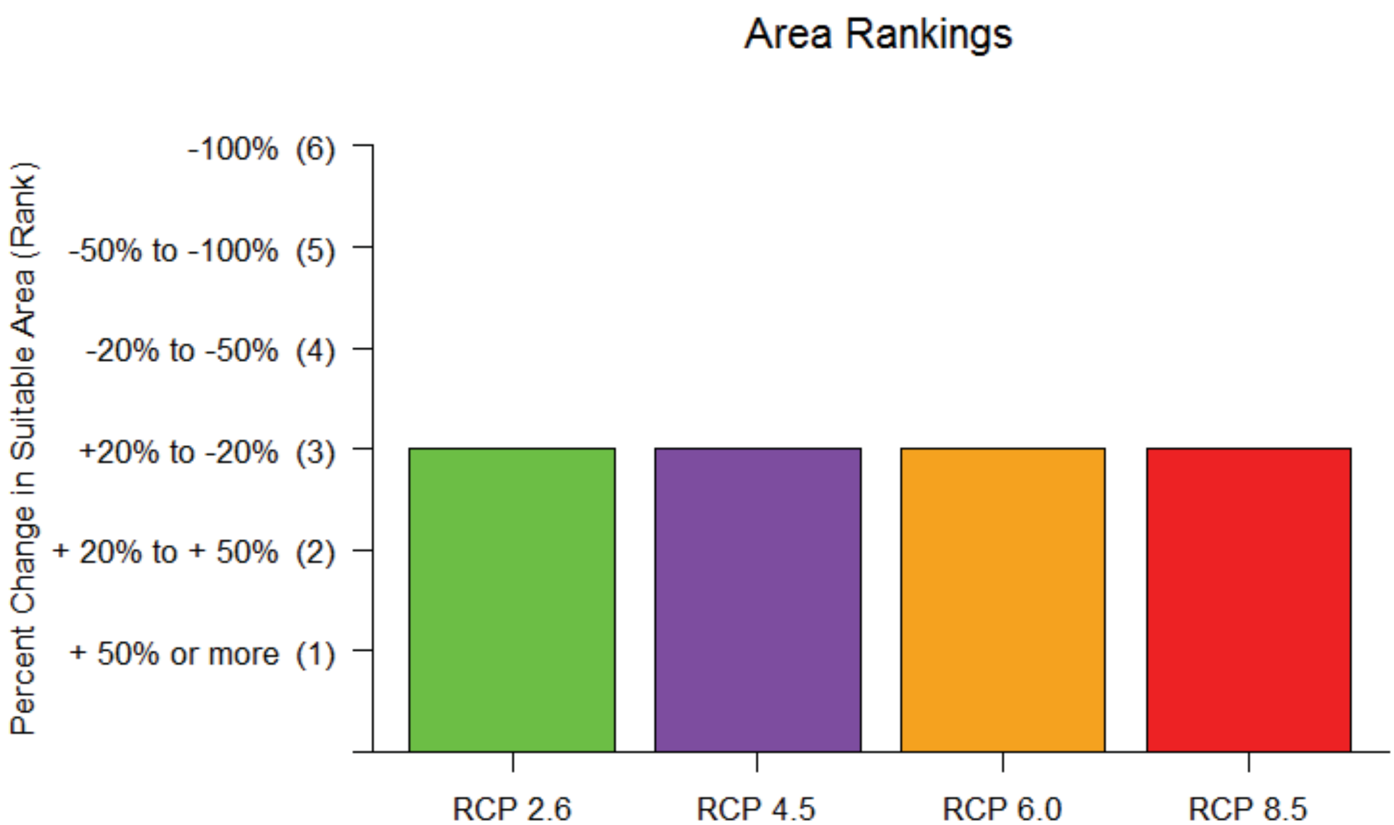
Species Results: *Sceloporus magister* Desert Spiny Lizard





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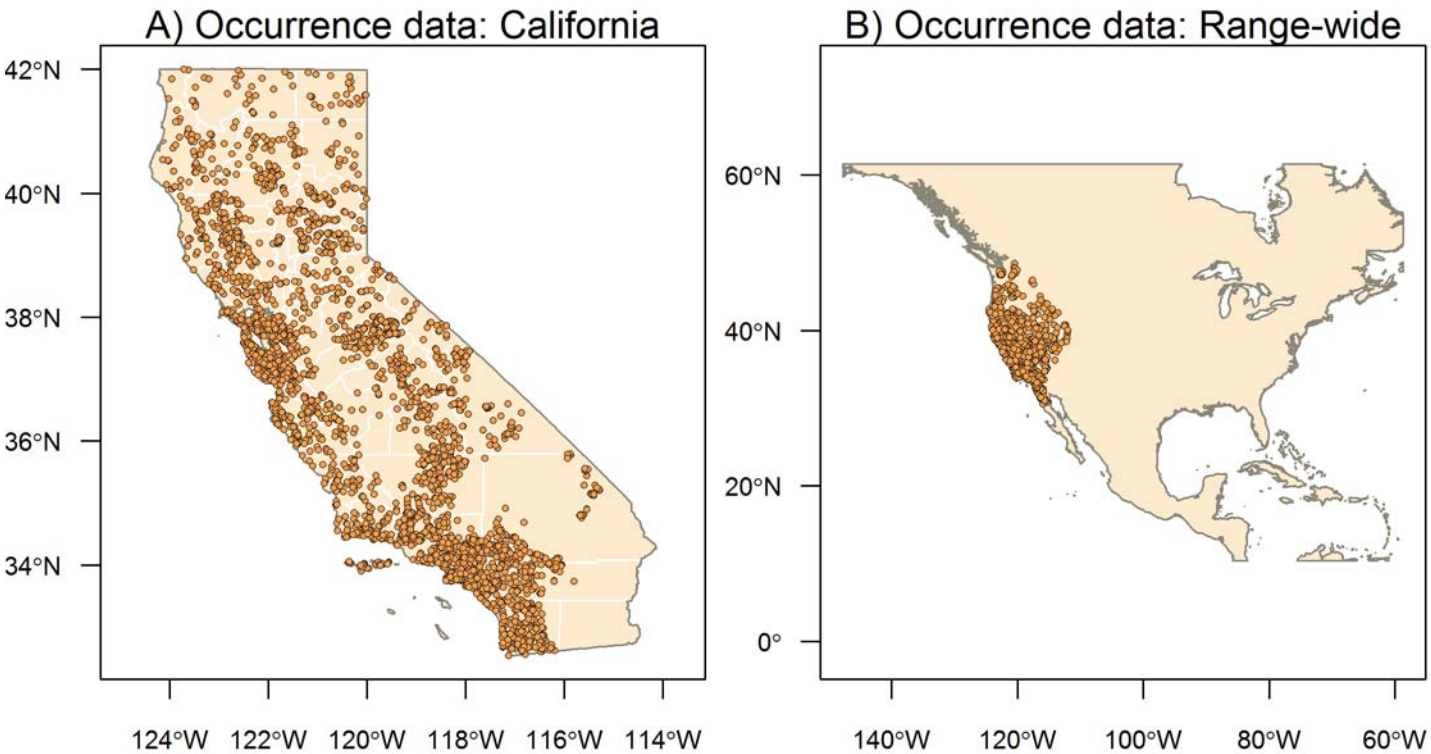
Species Results: *Sceloporus occidentalis* Western Fence Lizard



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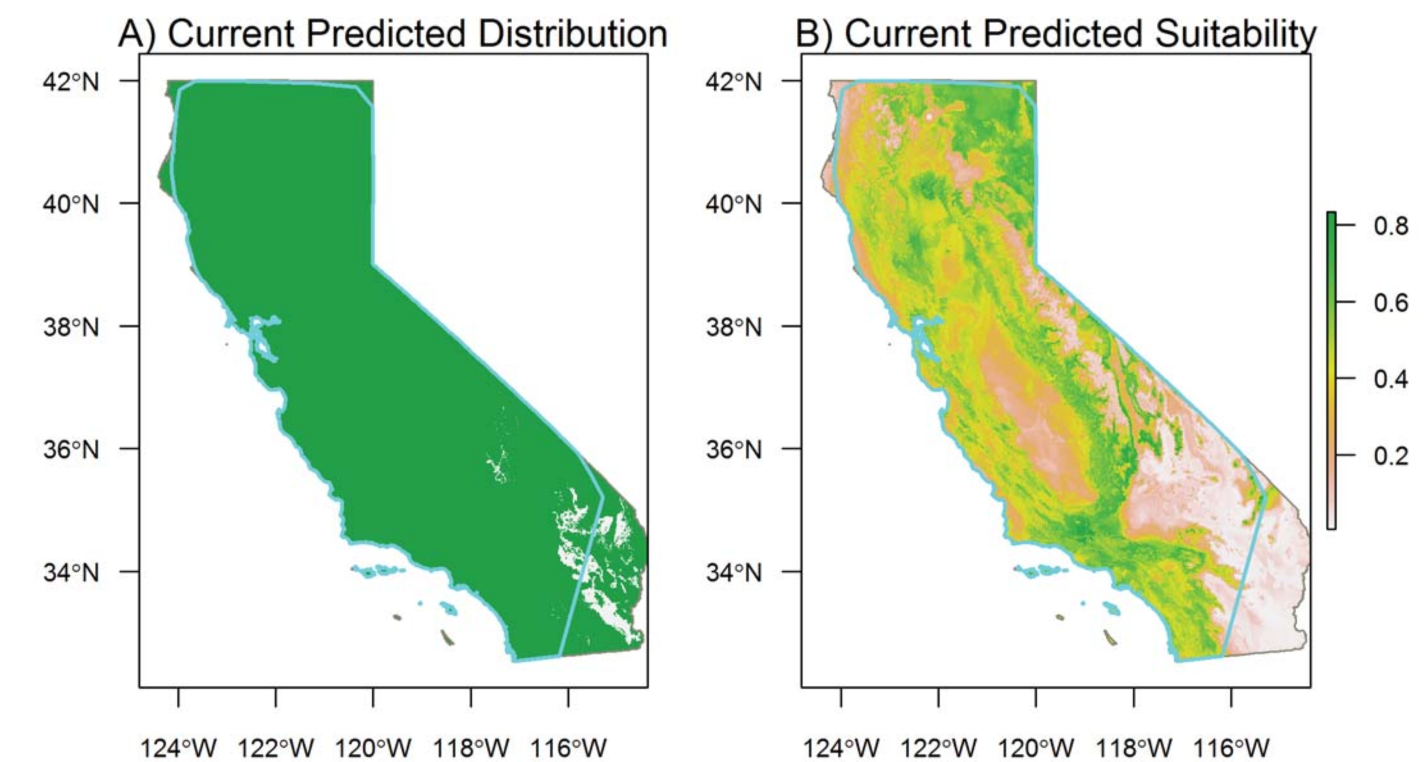

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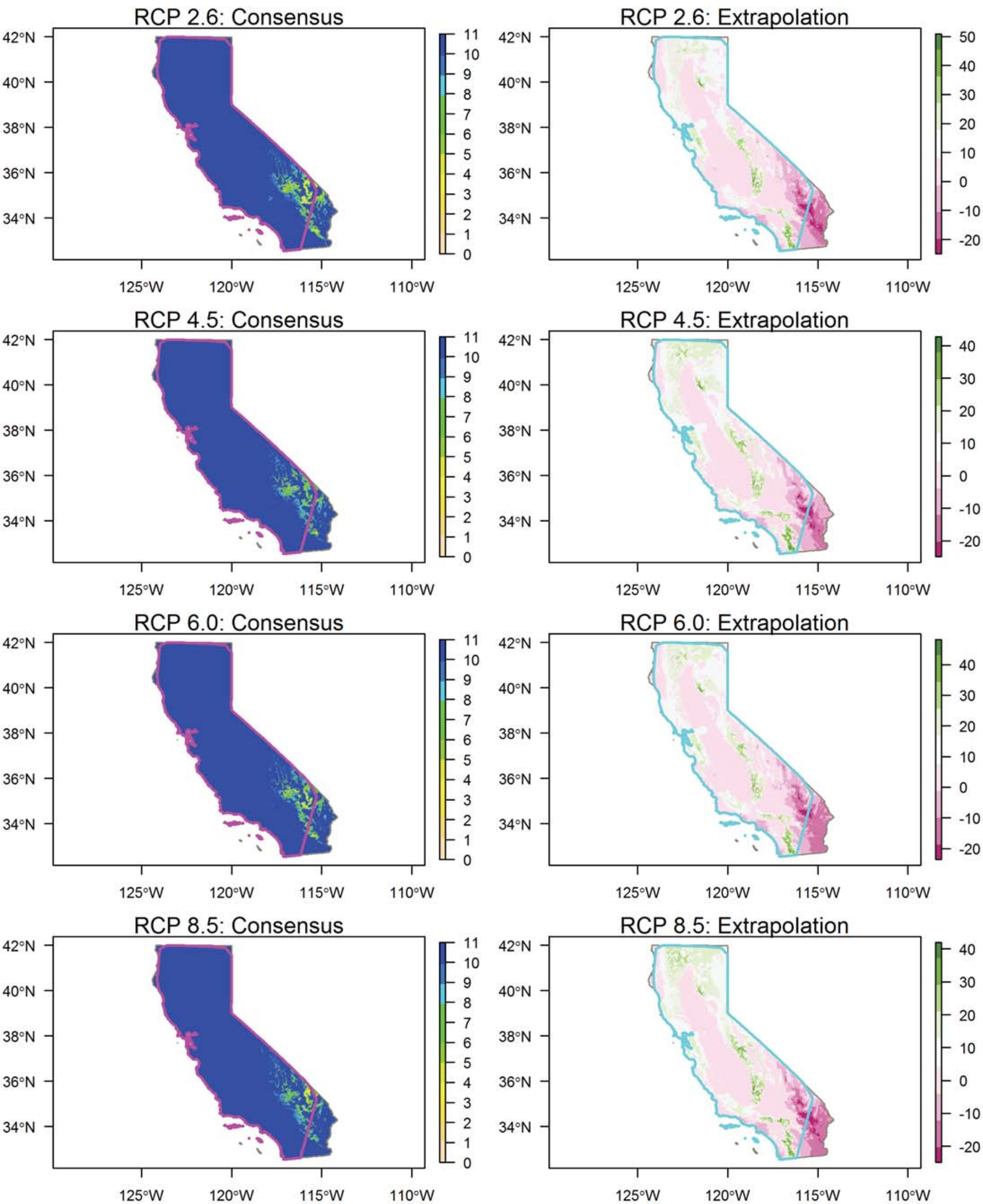

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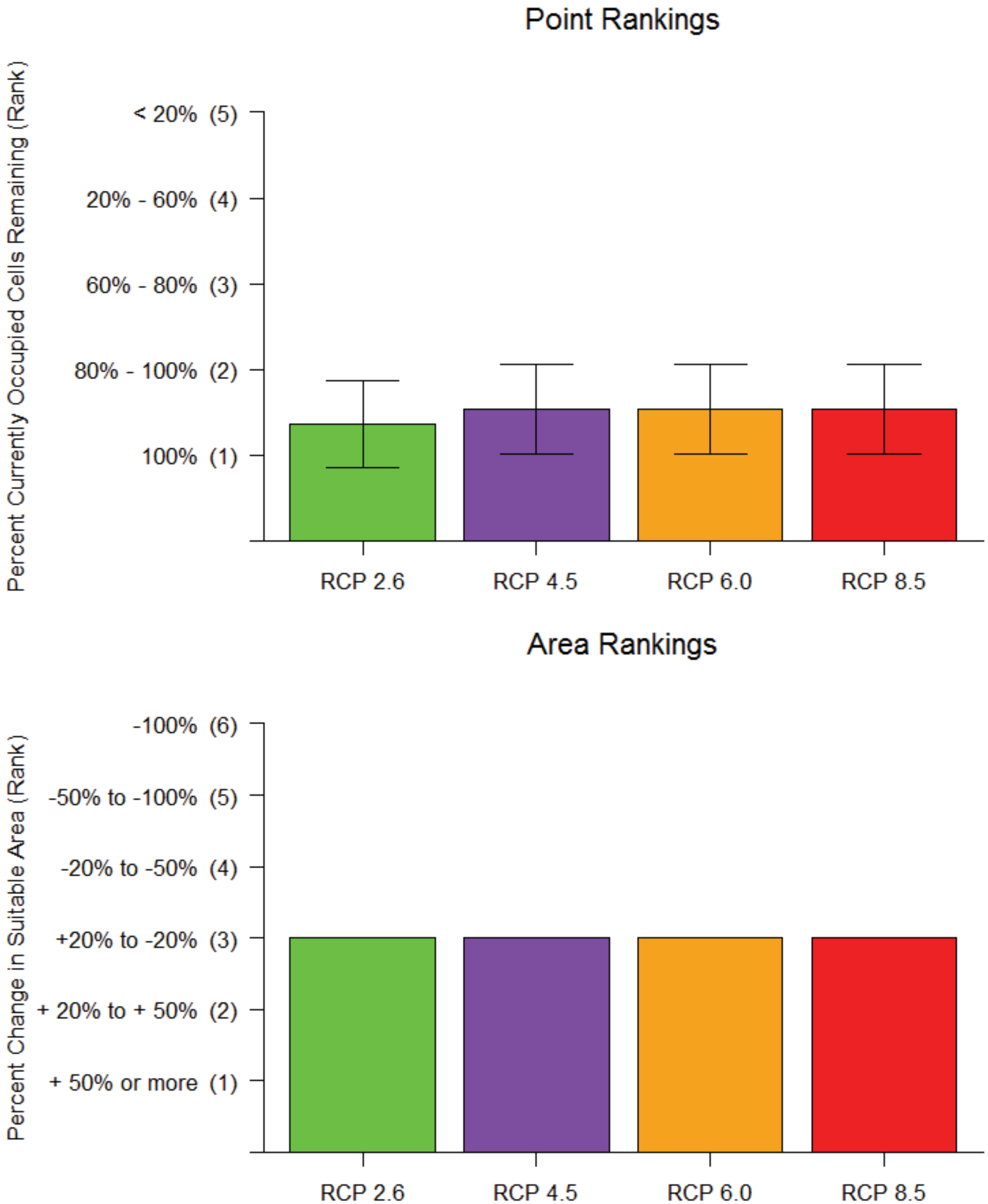
Species Results: *Sceloporus occidentalis* Western Fence Lizard



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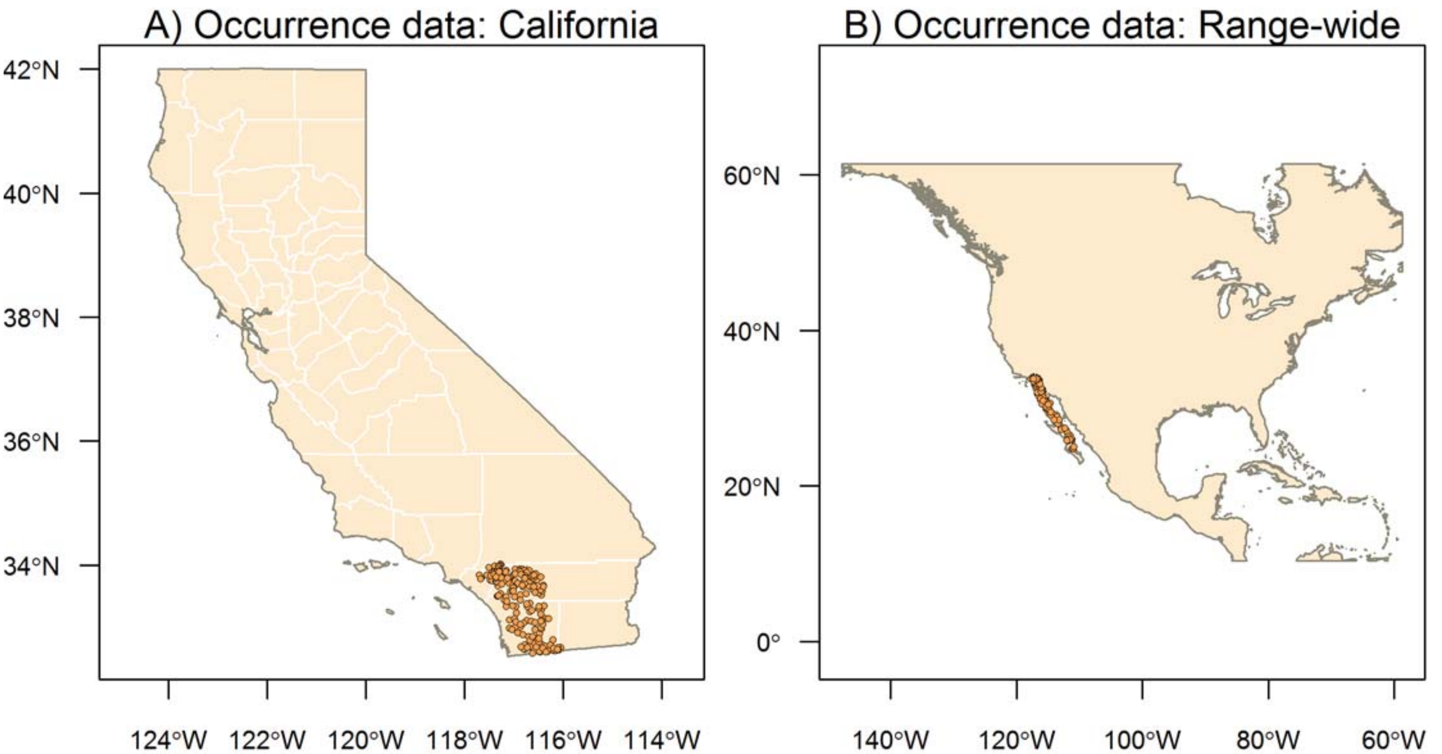
Species Results: *Sceloporus orcutti* Granite Spiny Lizard



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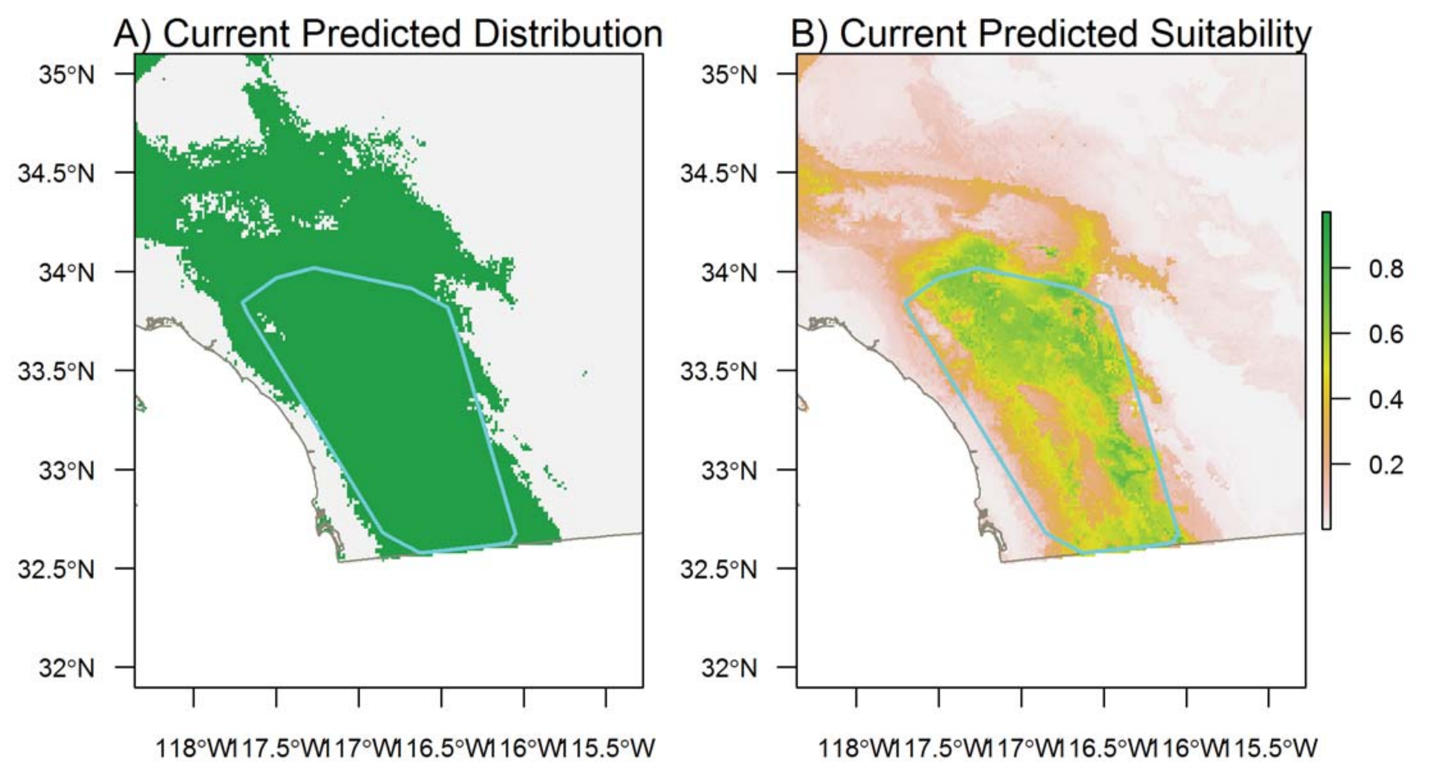

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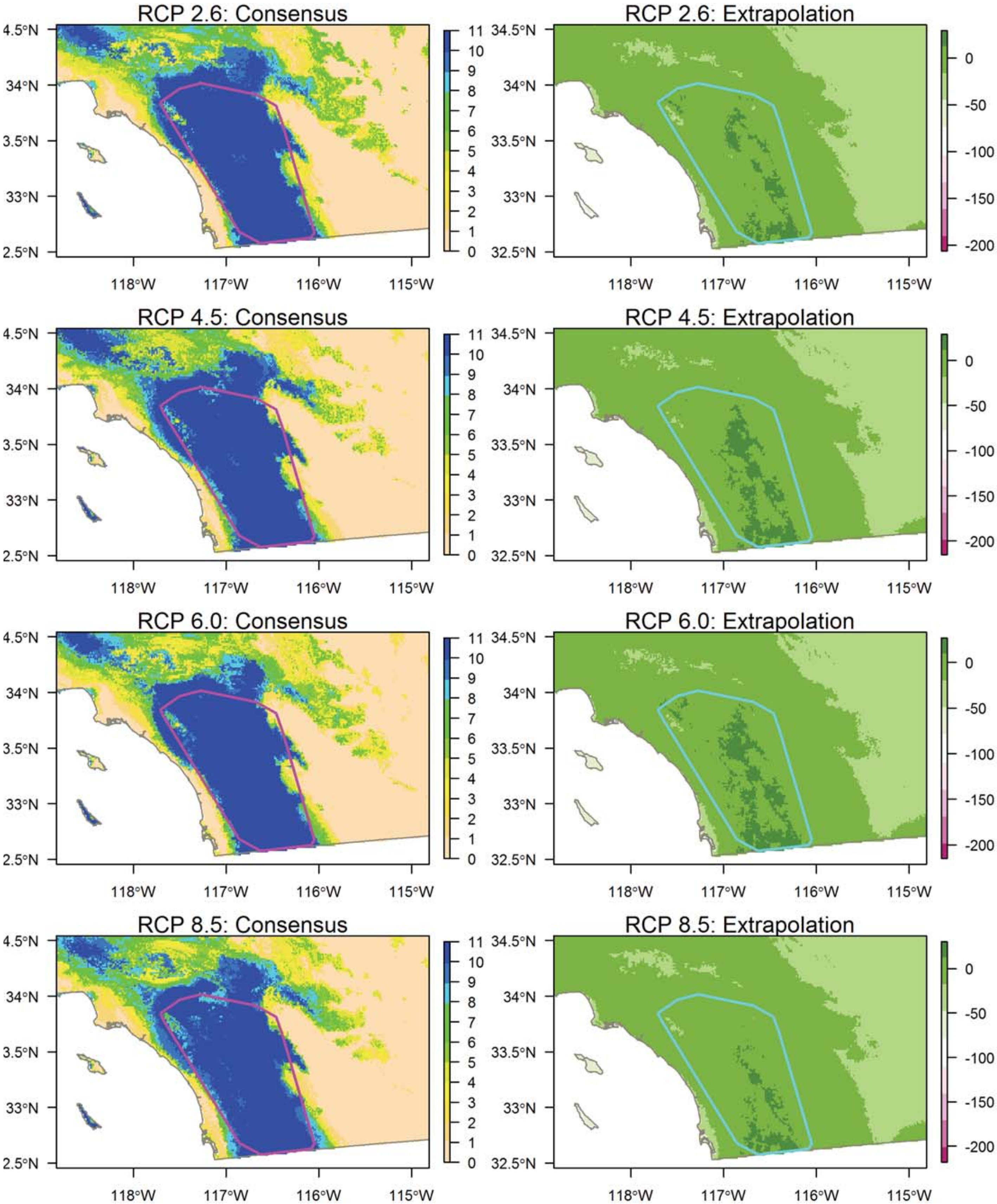

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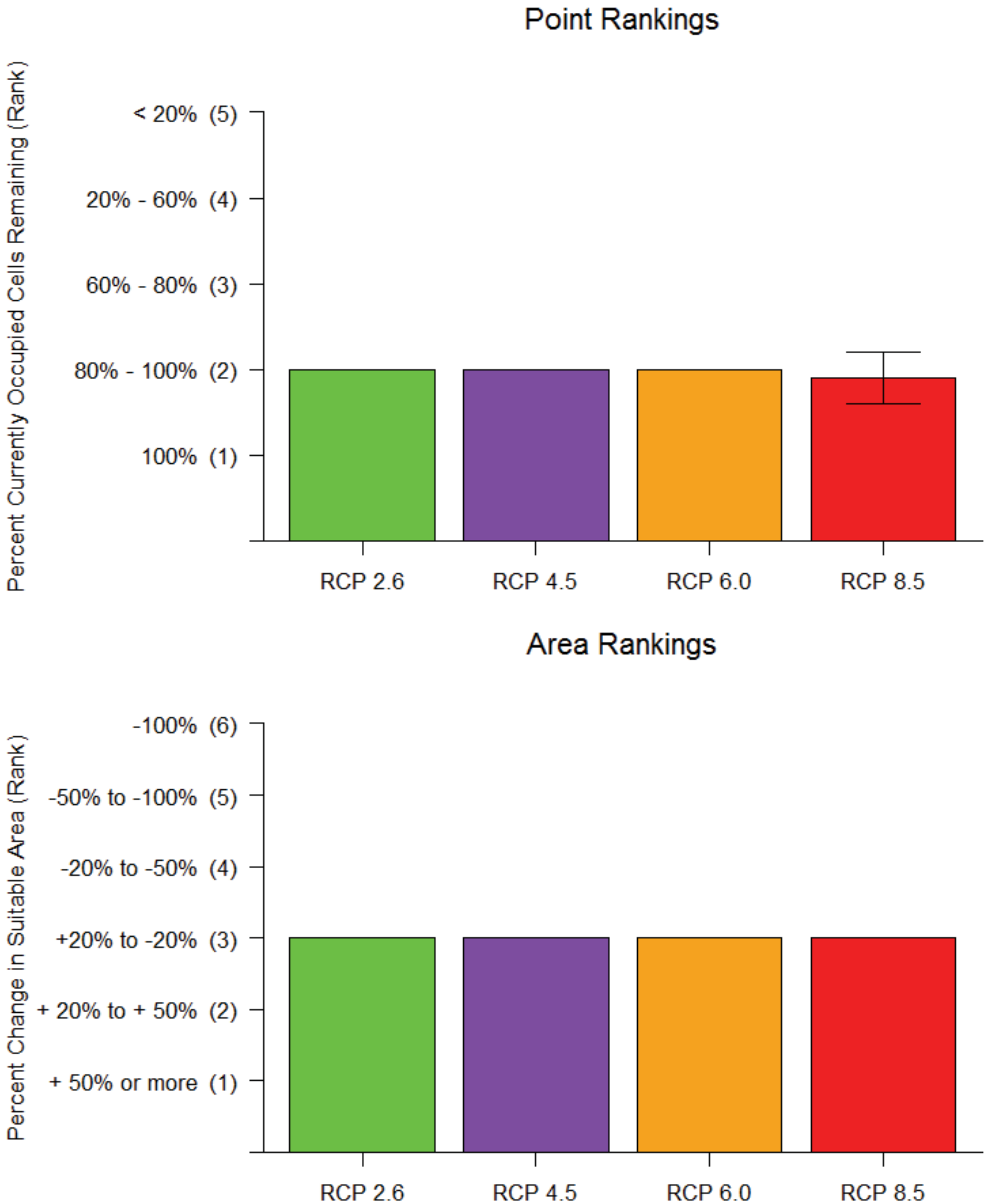
Species Results: *Sceloporus orcutti* Granite Spiny Lizard



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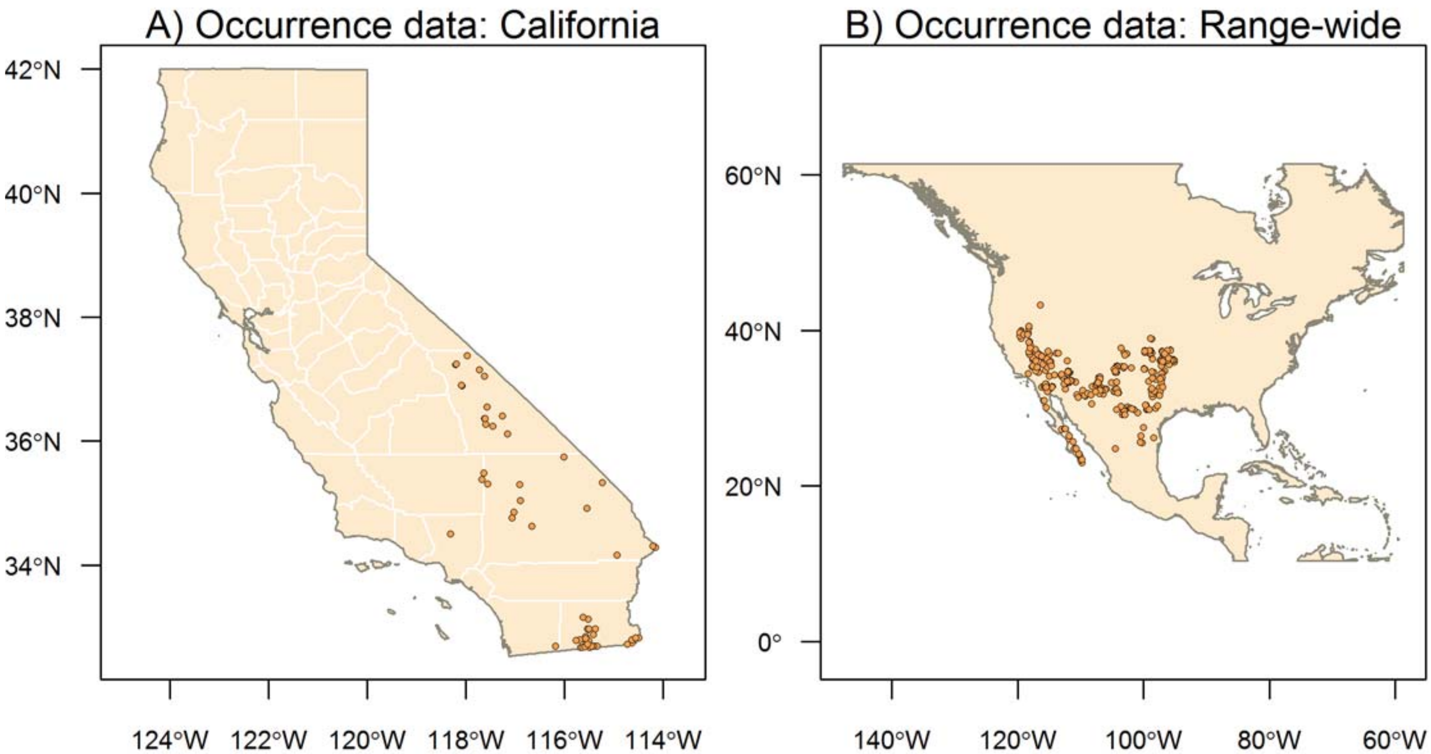
Species Results: *Sonora semiannulata* Western Ground Snake



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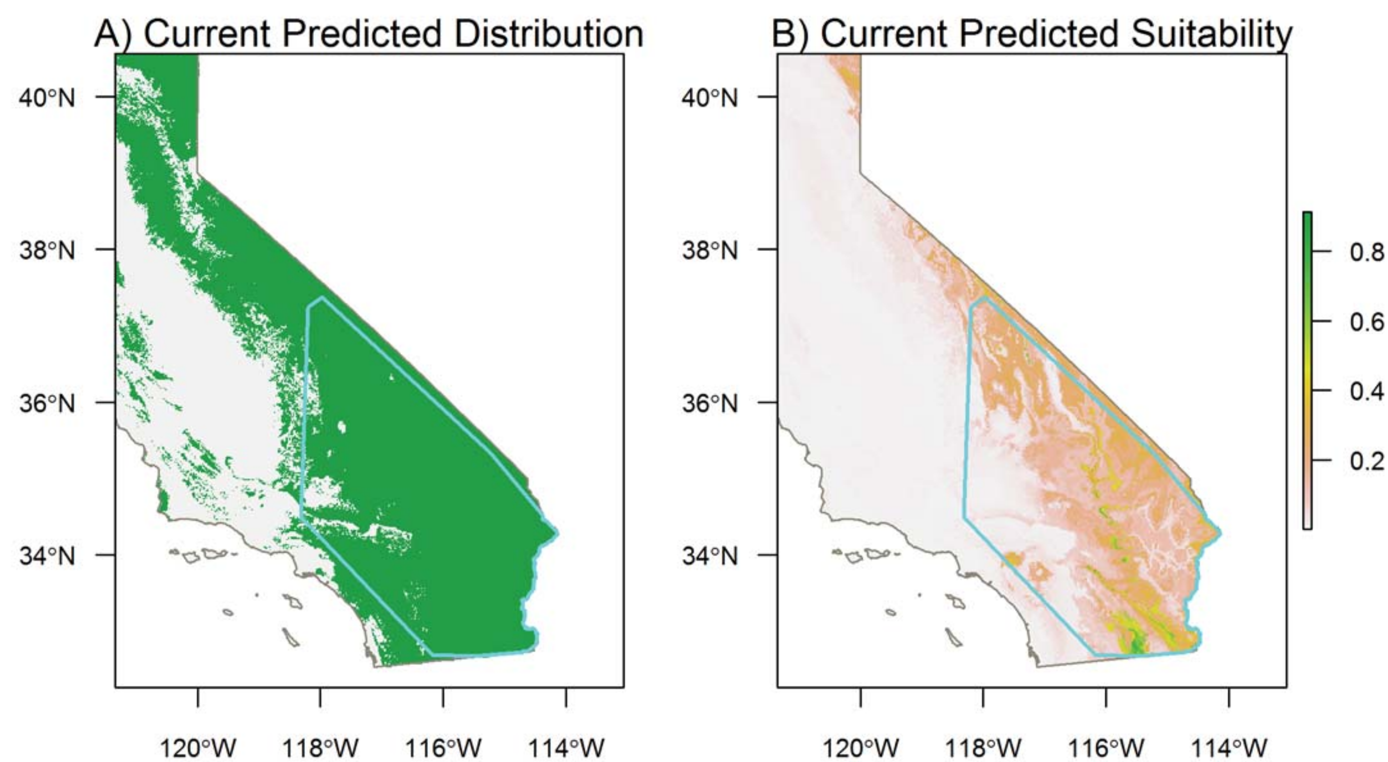

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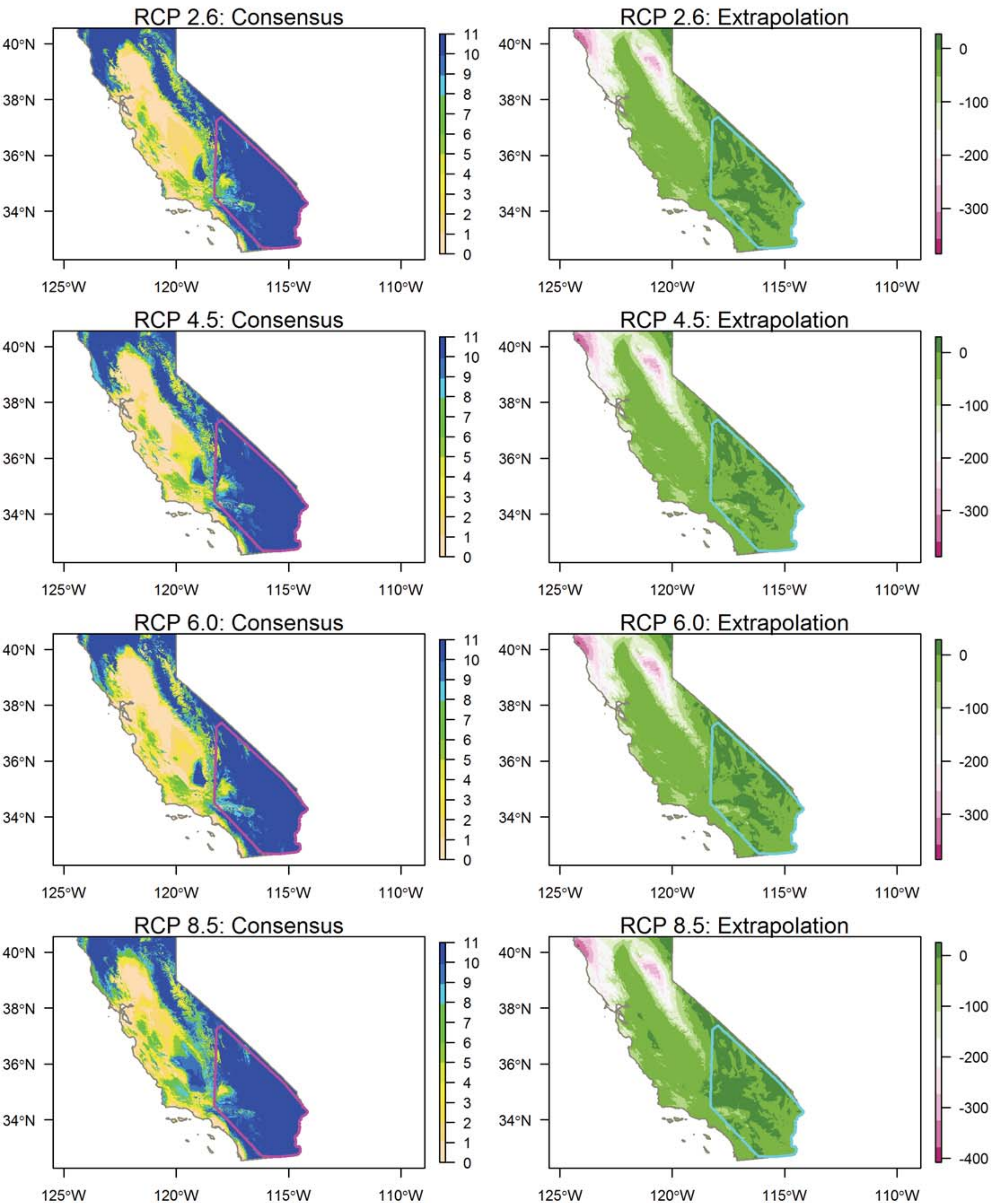
Species Results: *Sonora semiannulata* Western Ground Snake



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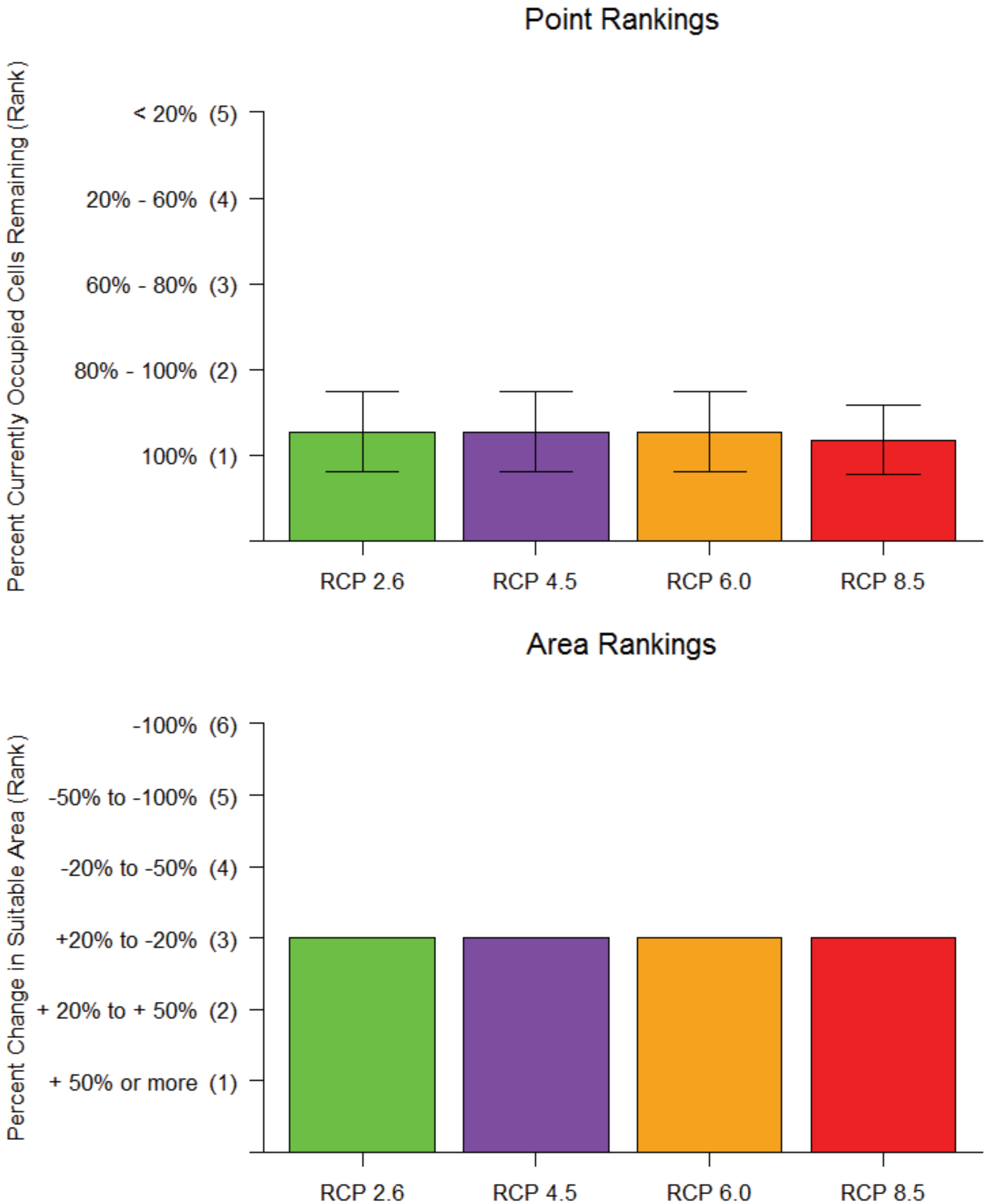

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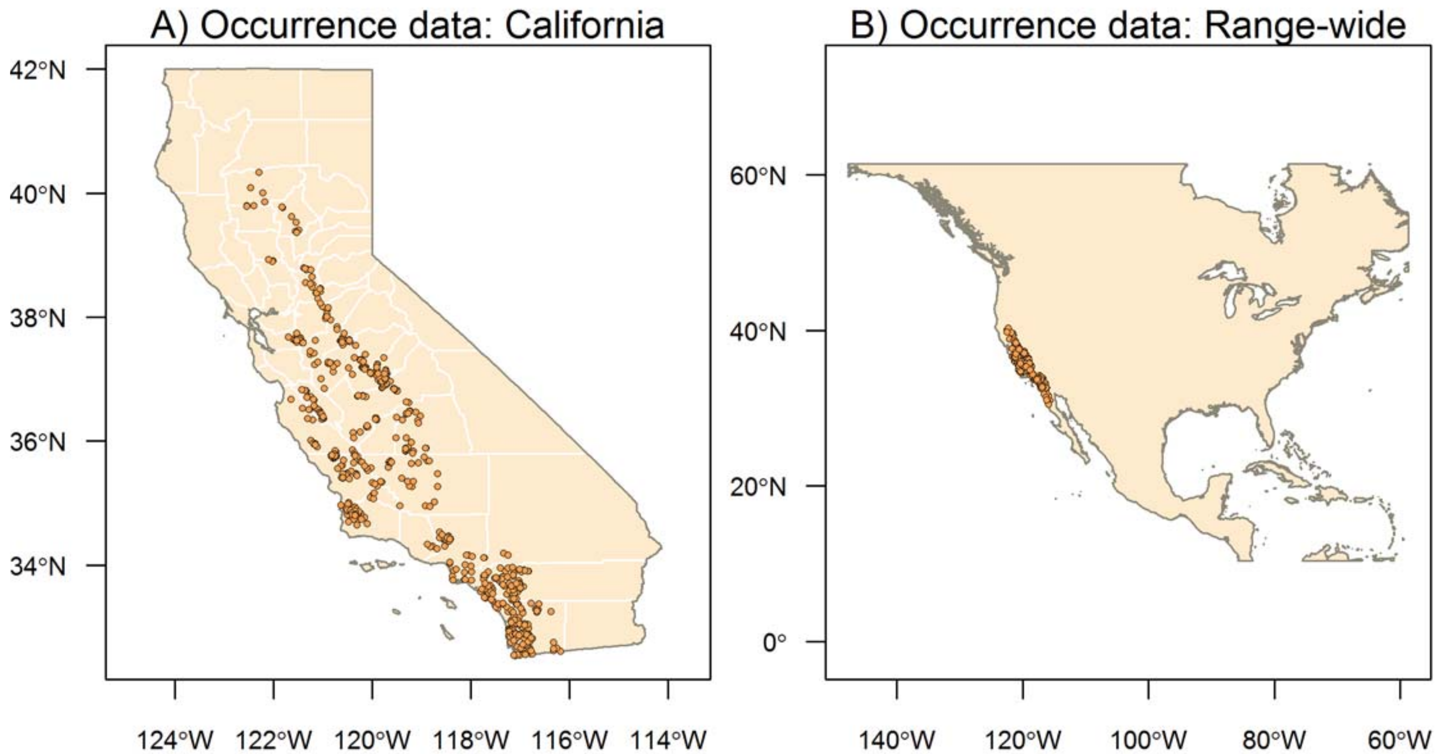
Species Results: *Spea hammondii* Western Spadefoot



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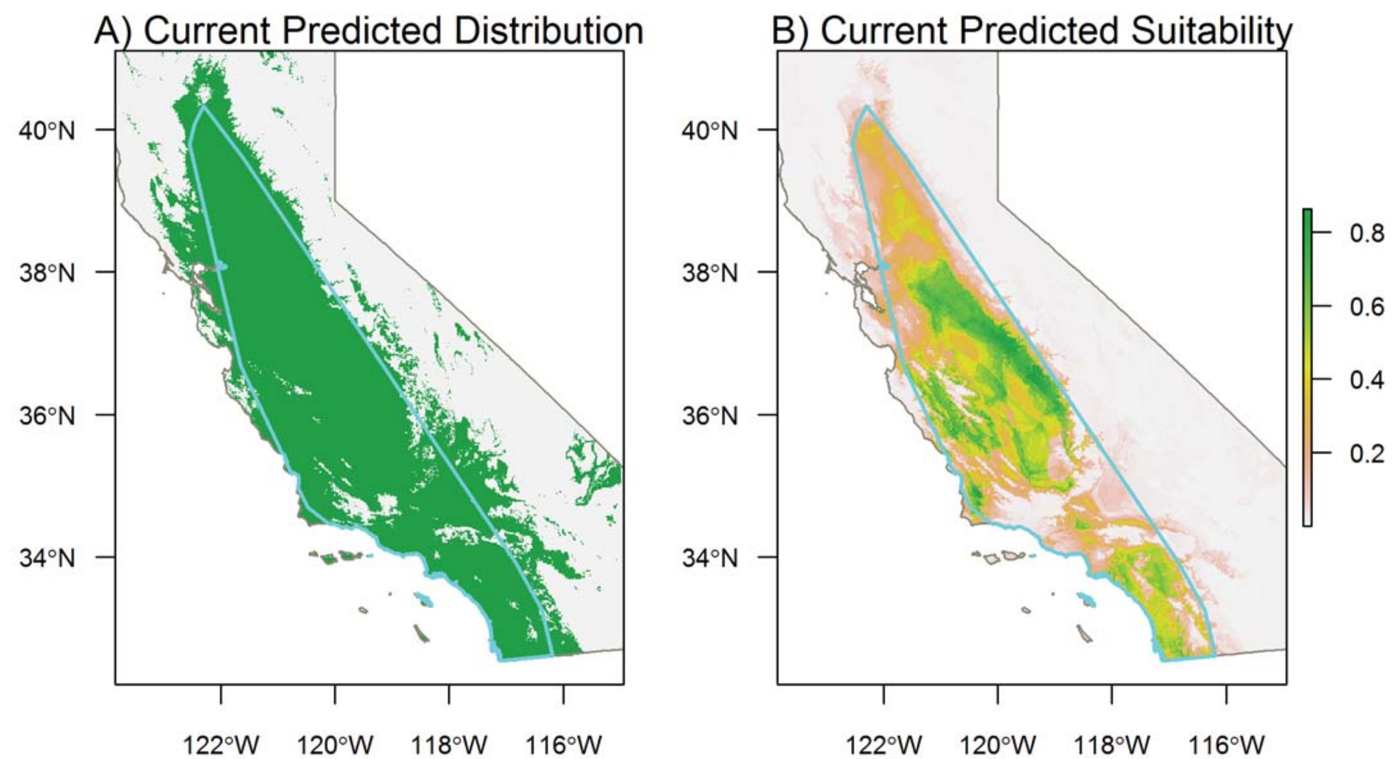

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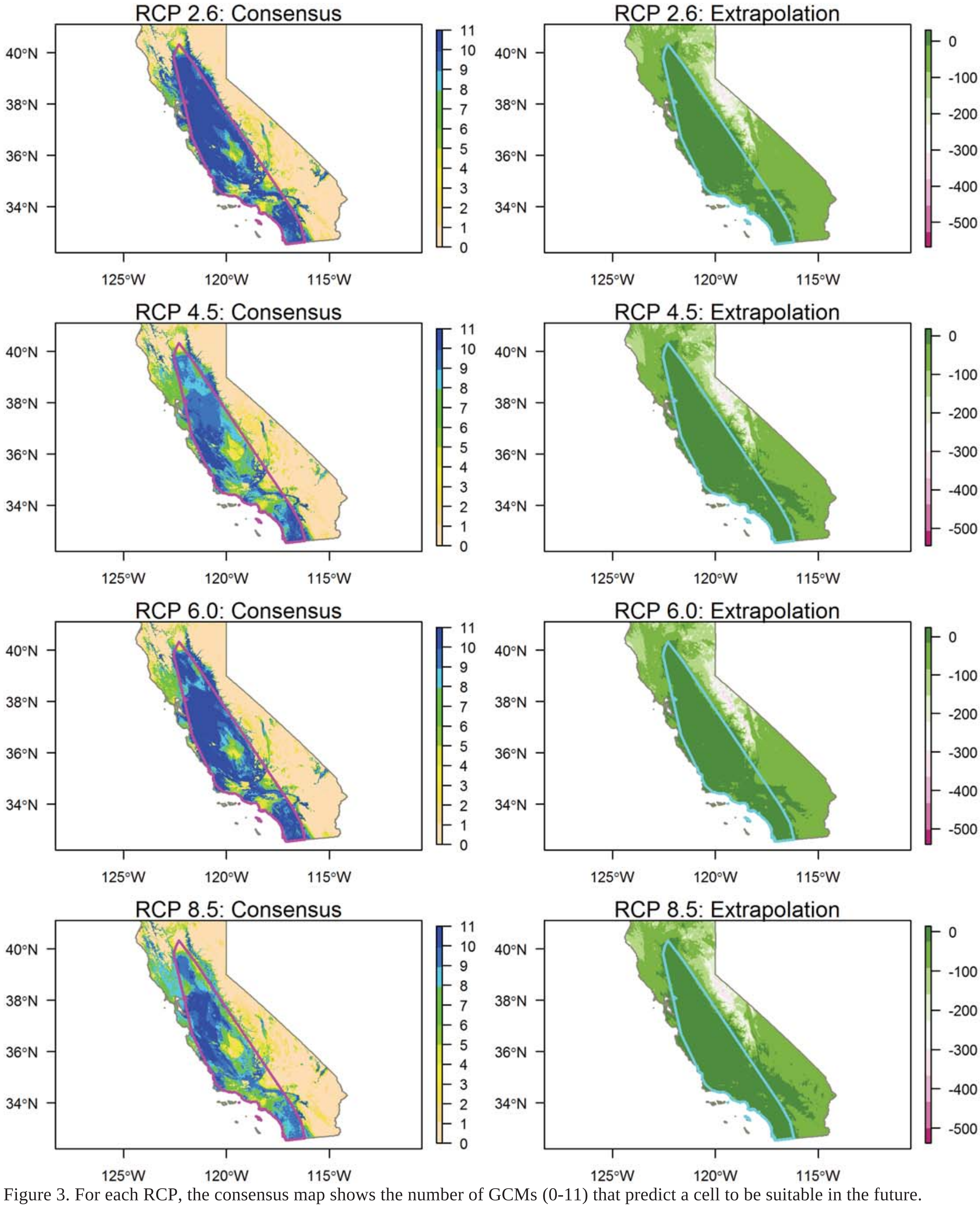
Species Results: *Spea hammondii* Western Spadefoot



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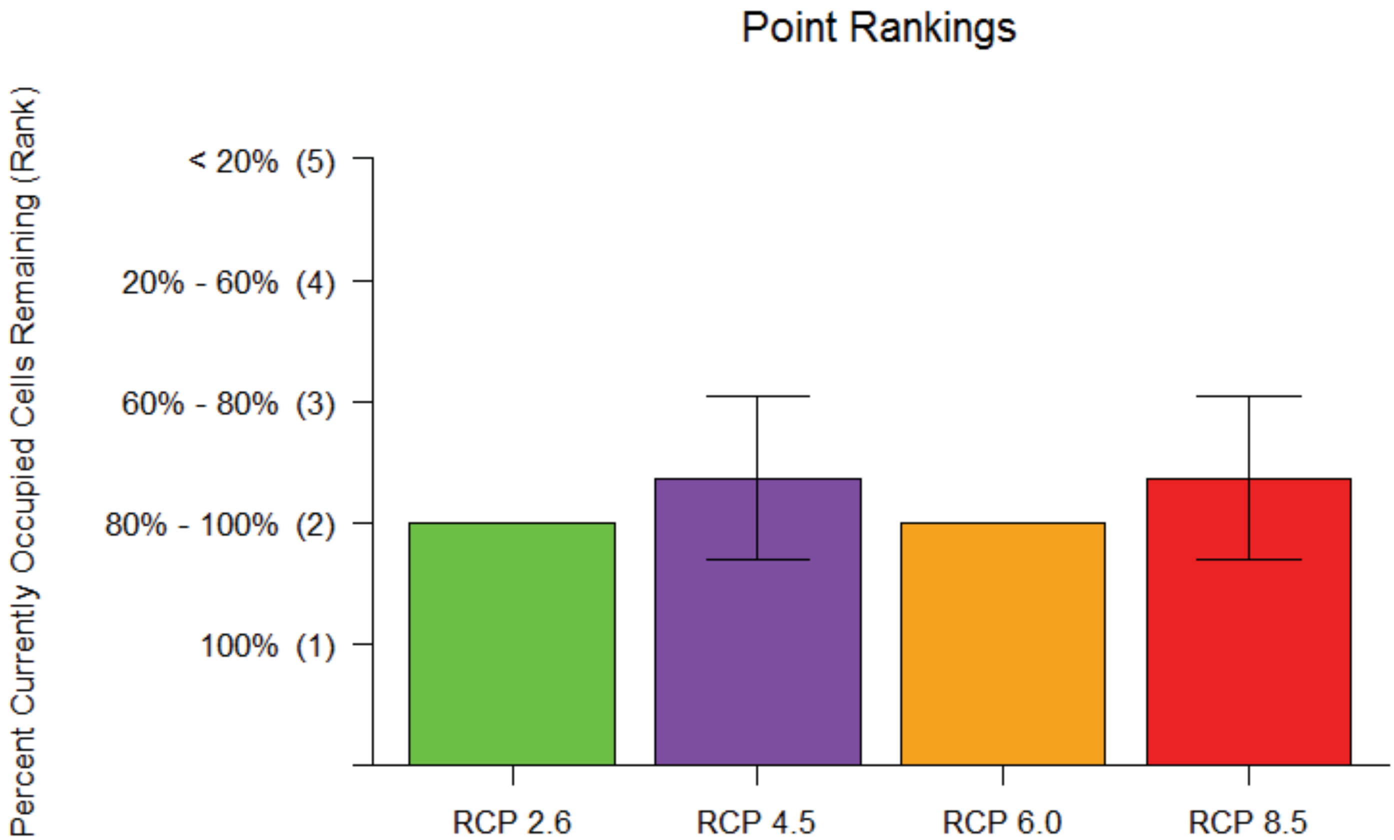

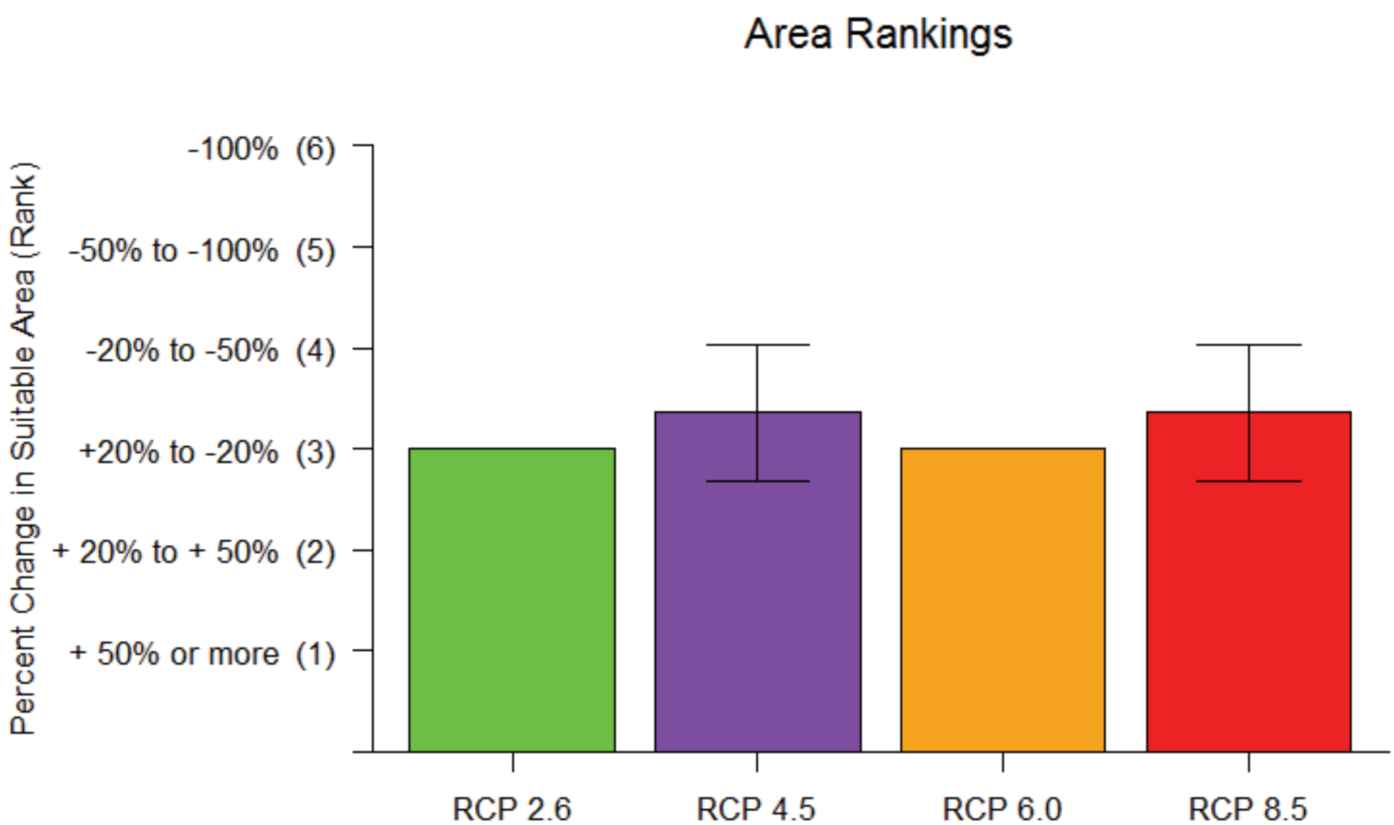

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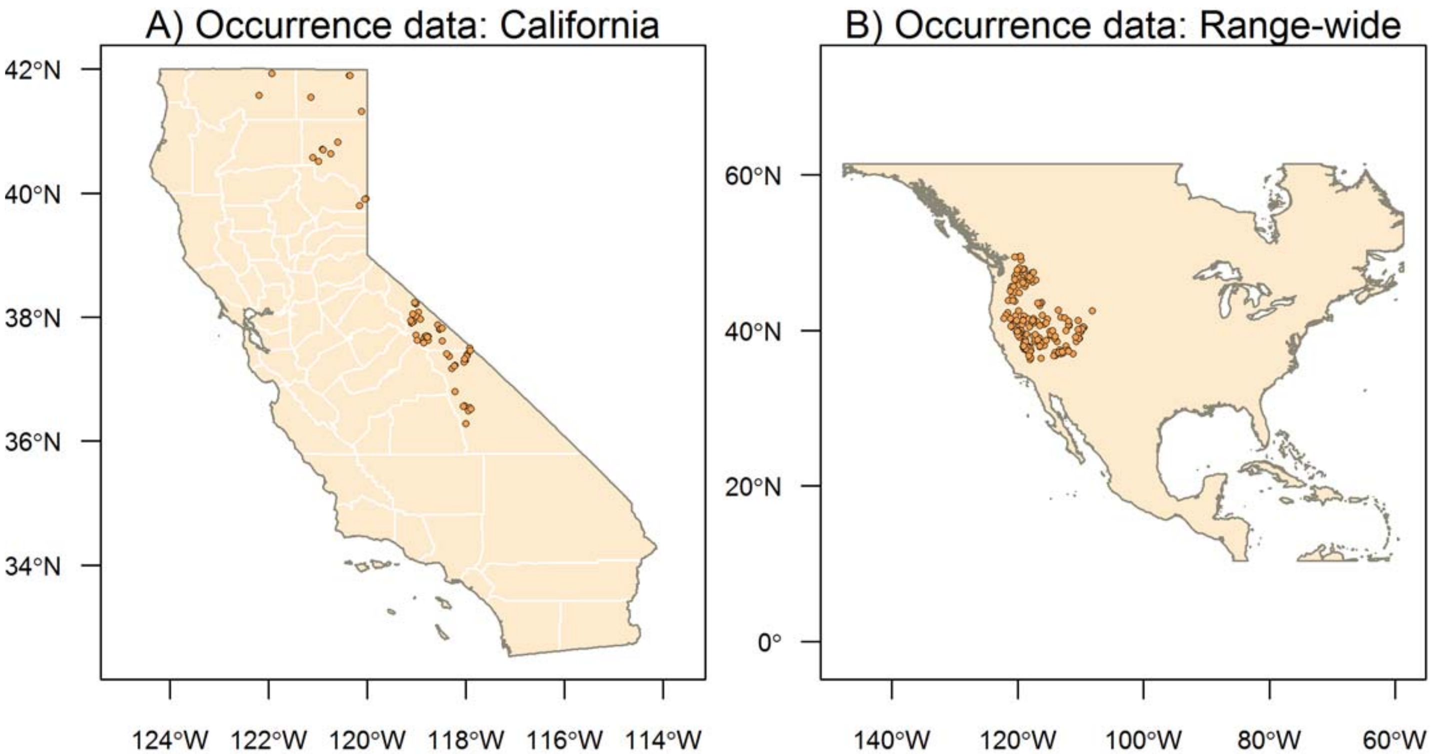
Species Results: *Spea intermontana* Great Basin Spadefoot



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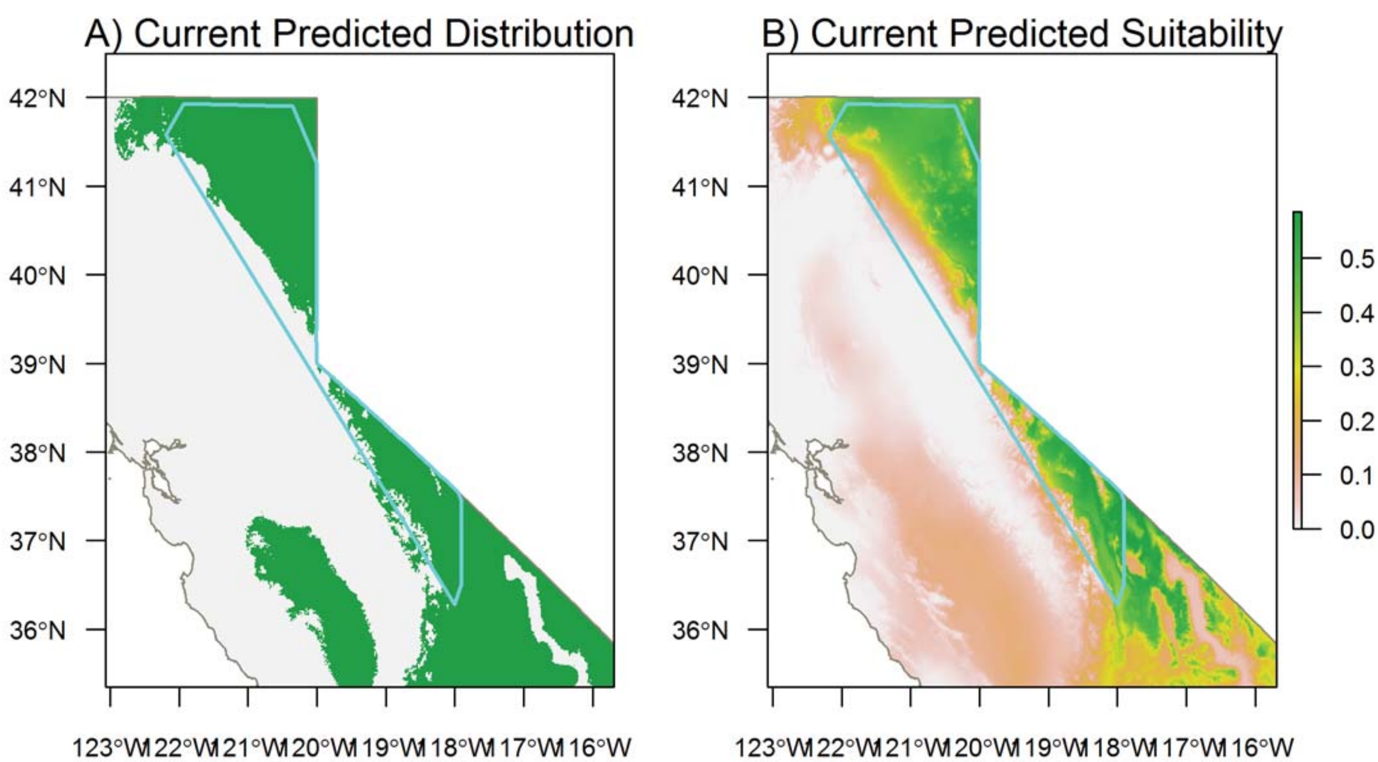

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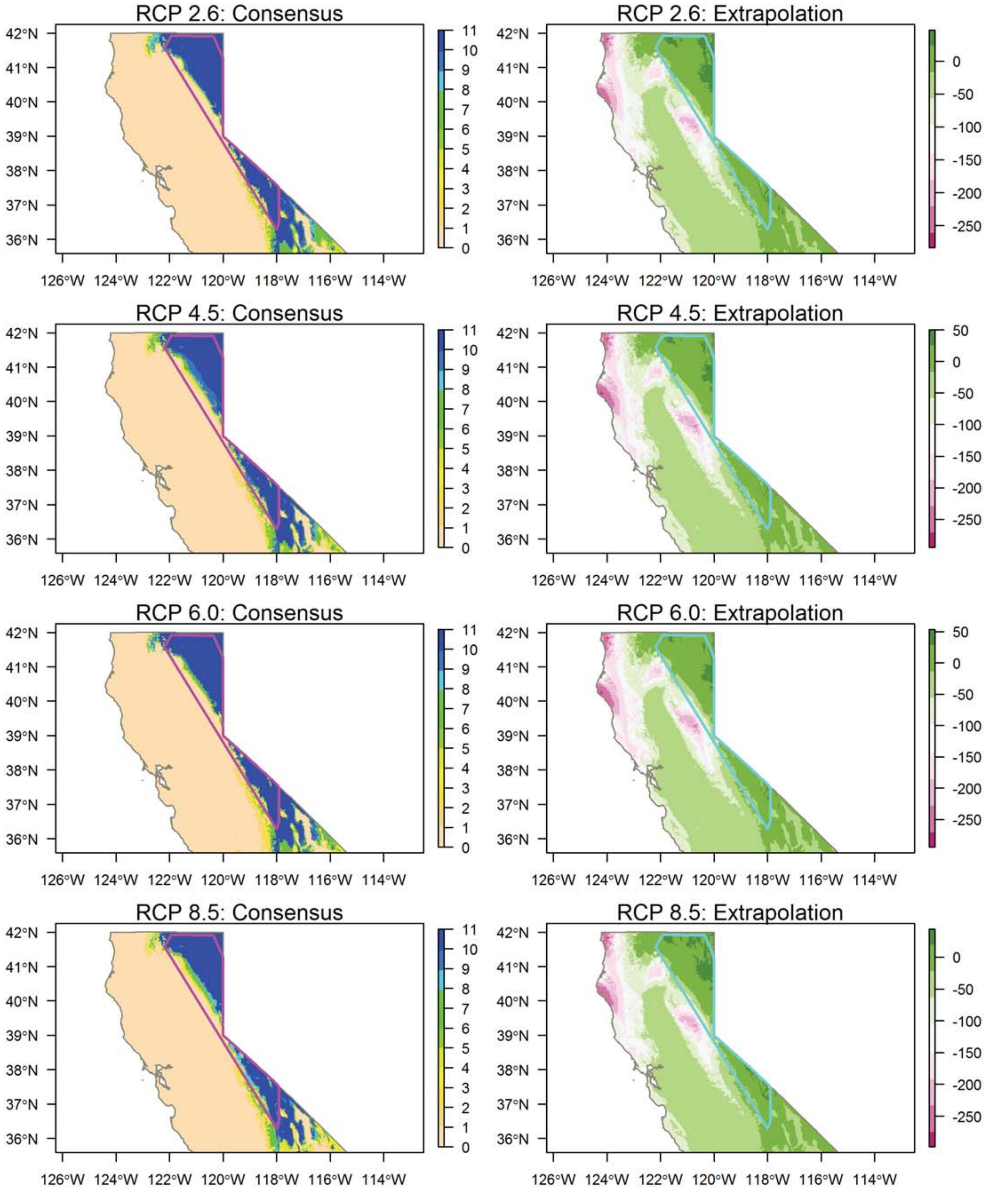
Species Results: *Spea intermontana* Great Basin Spadefoot



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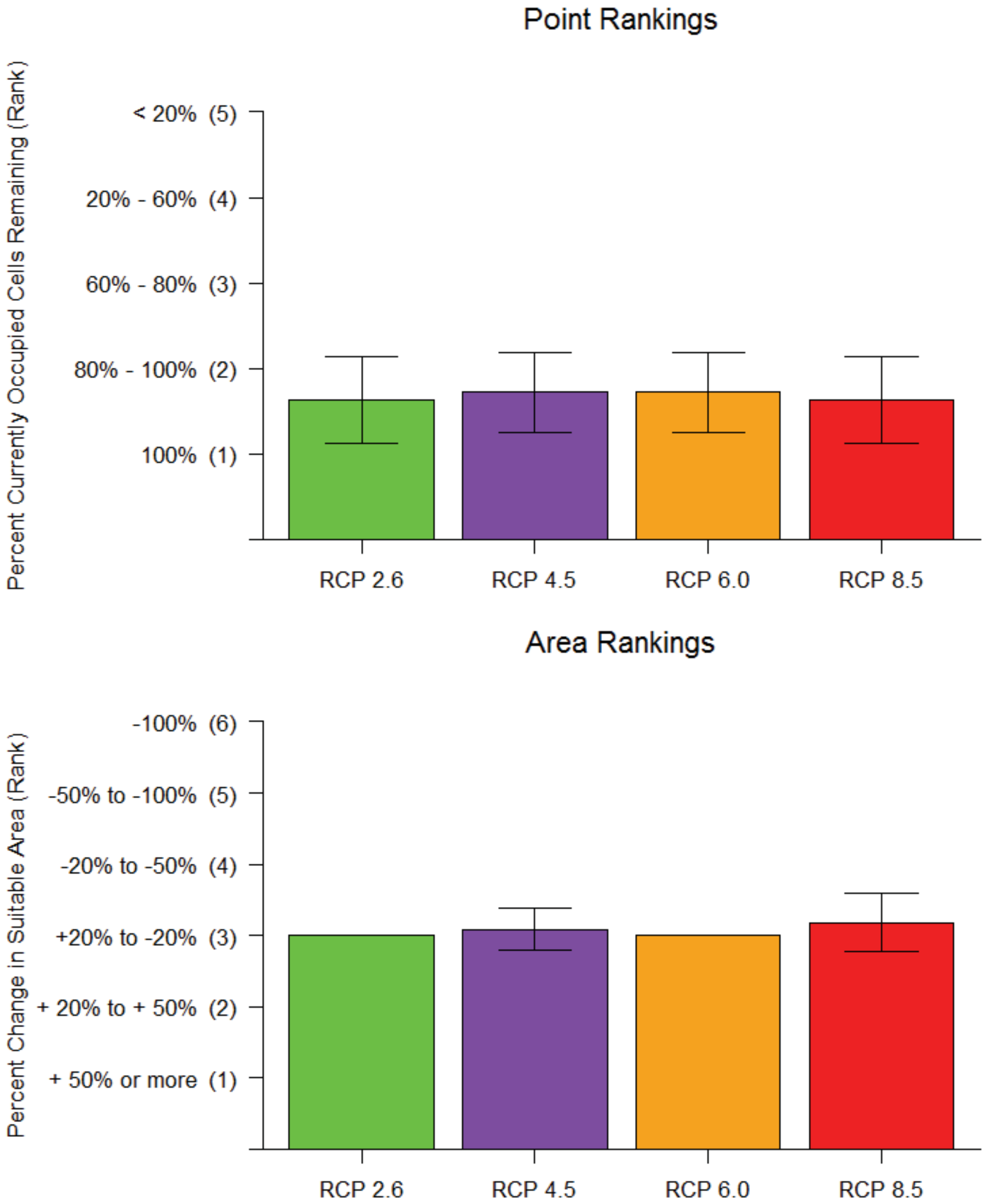
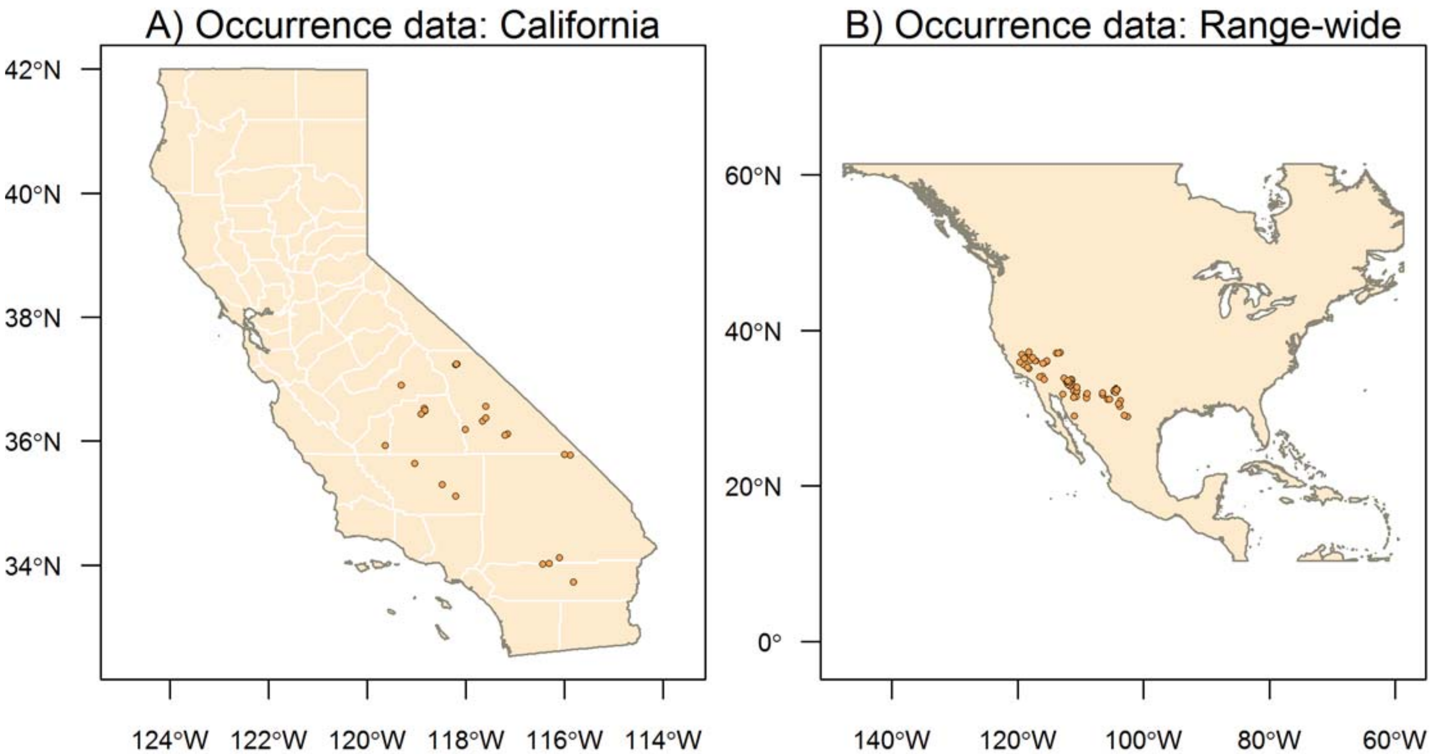


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Tantilla hobartsmithi* Southwestern Black-headed Snake



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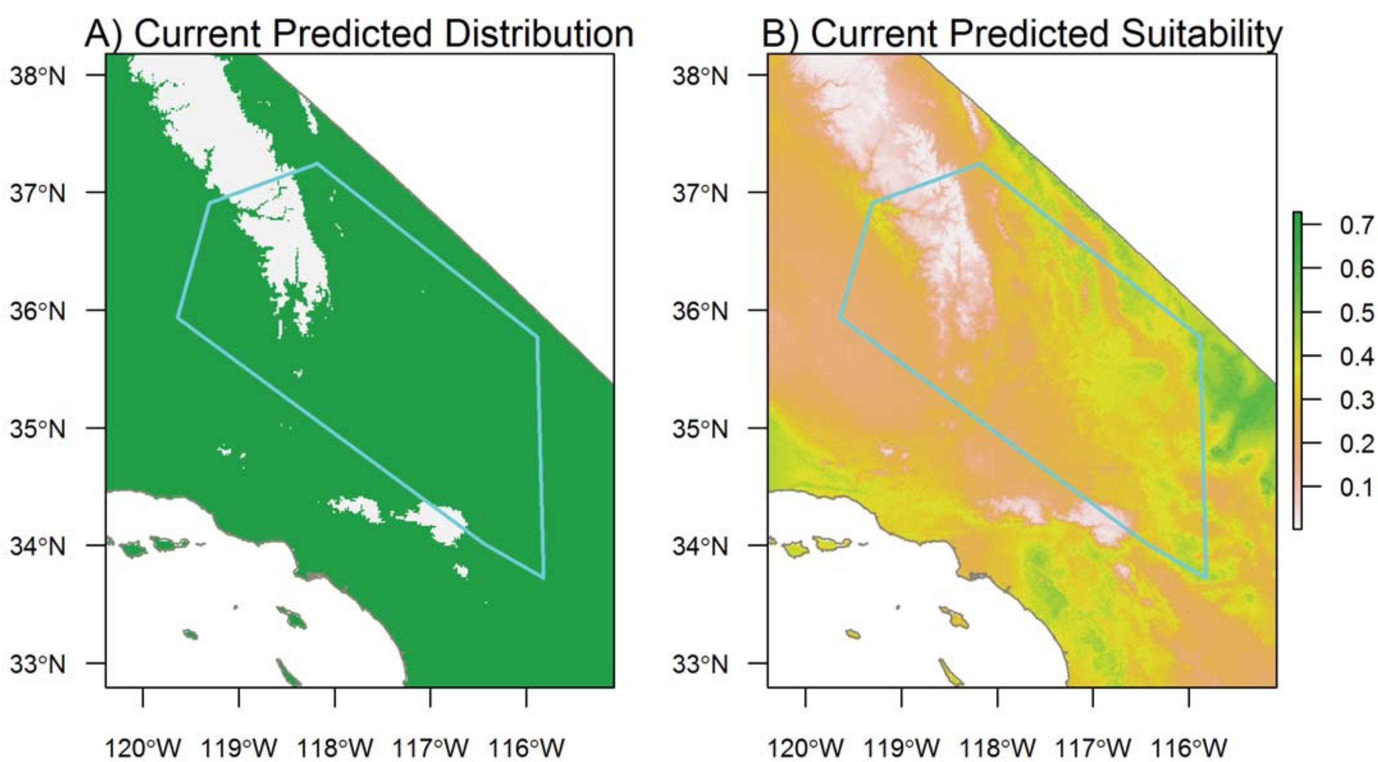

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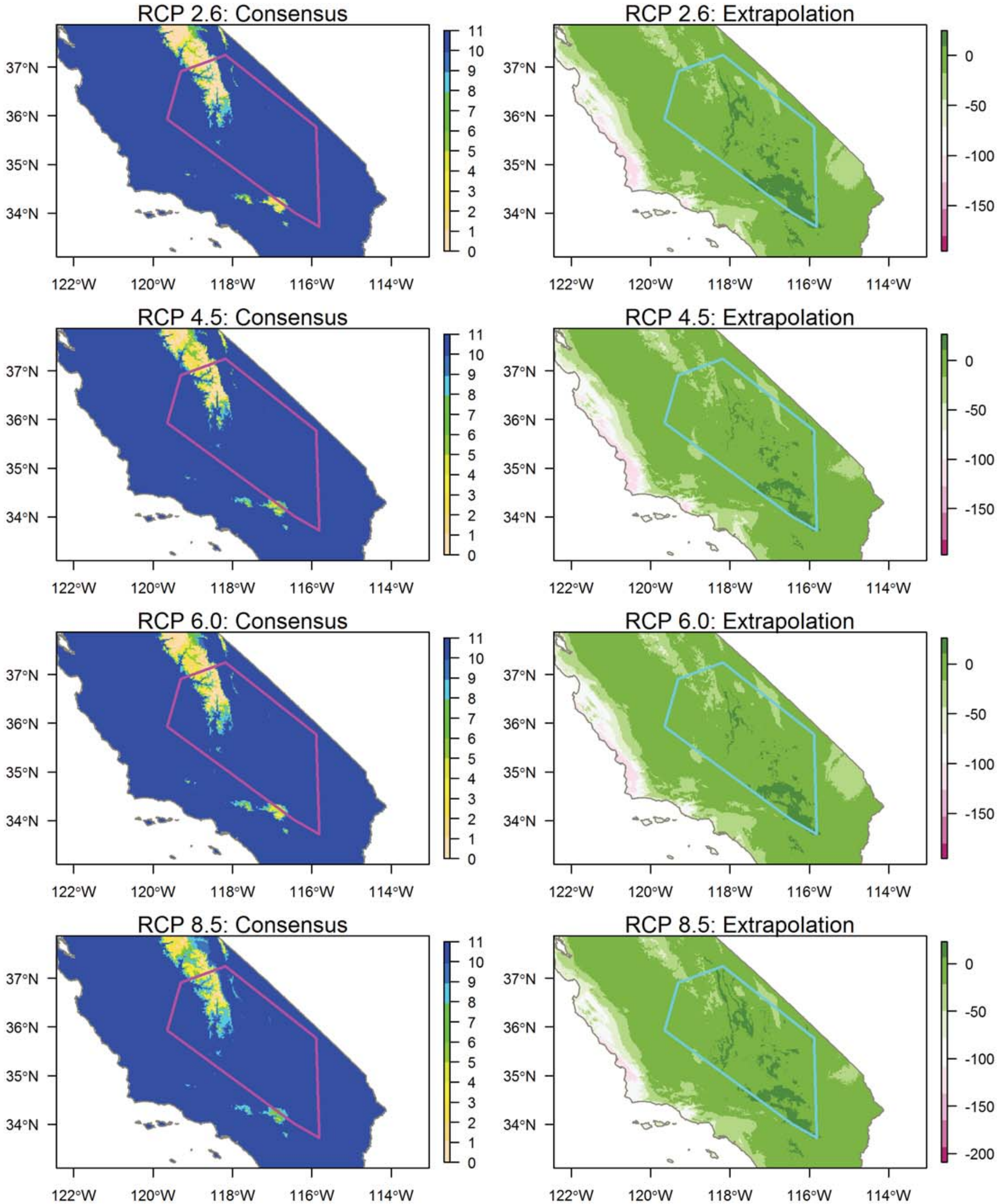
Species Results: *Tantilla hobartsmithi* Southwestern Black-headed Snake



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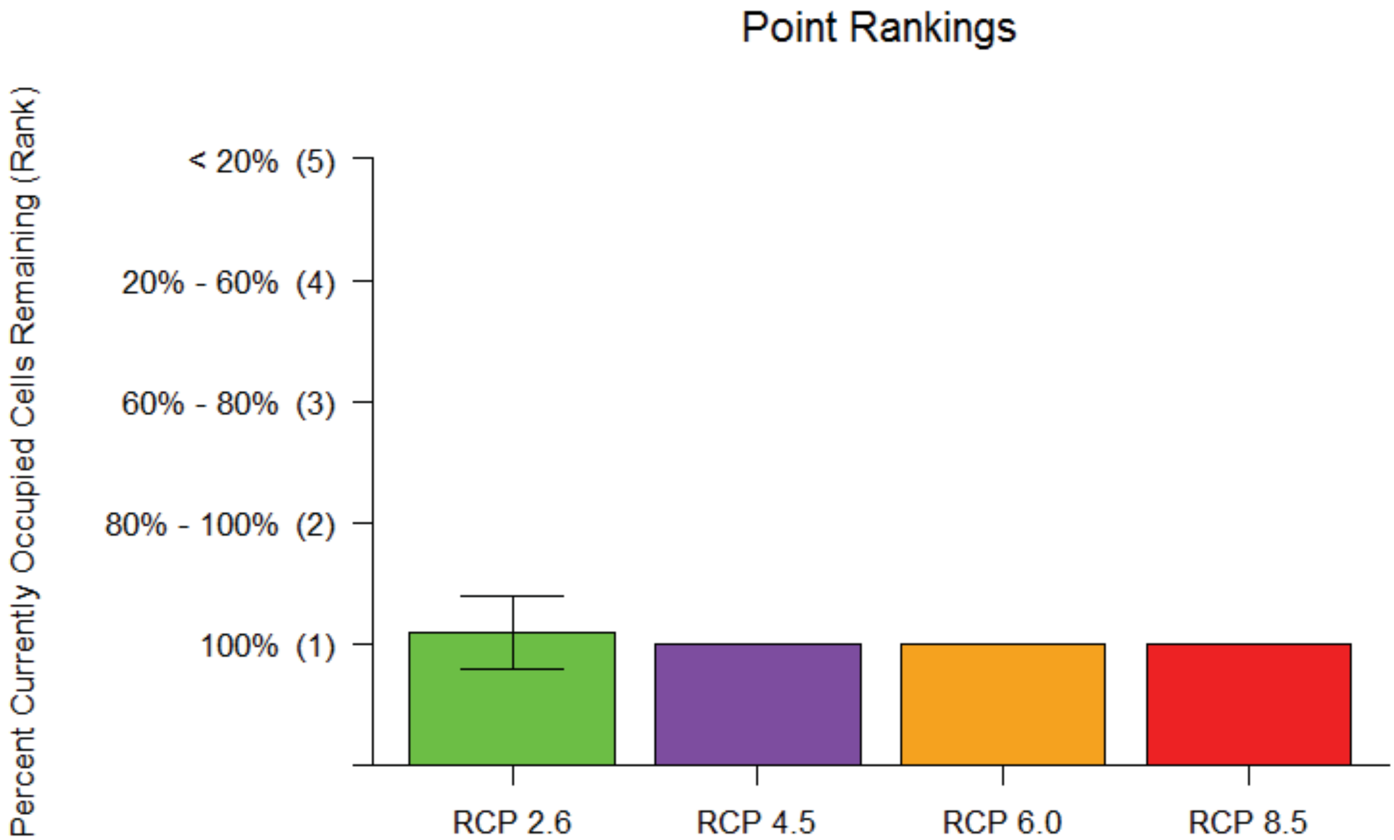
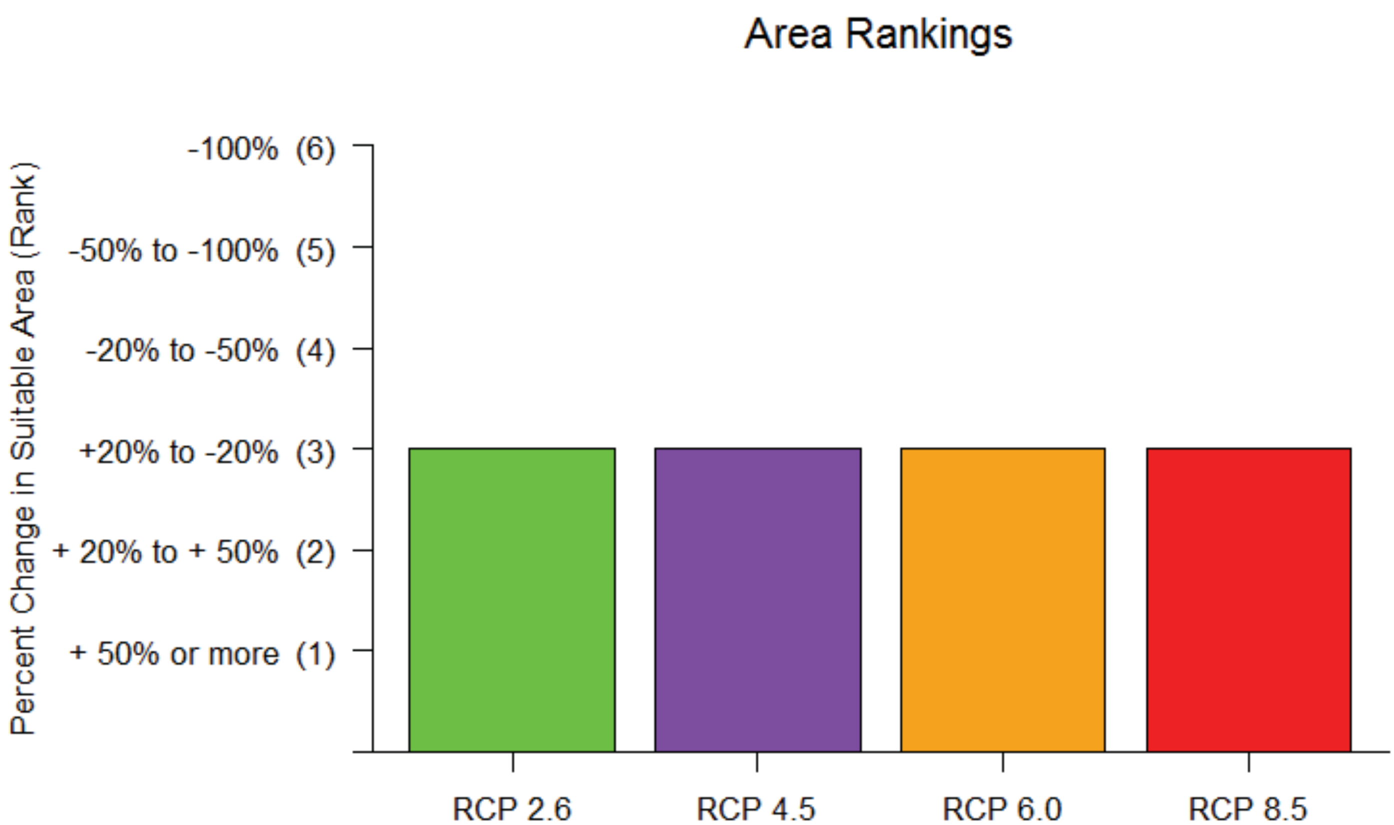
Species Results: *Tantilla hobartsmithi* Southwestern Black-headed Snake





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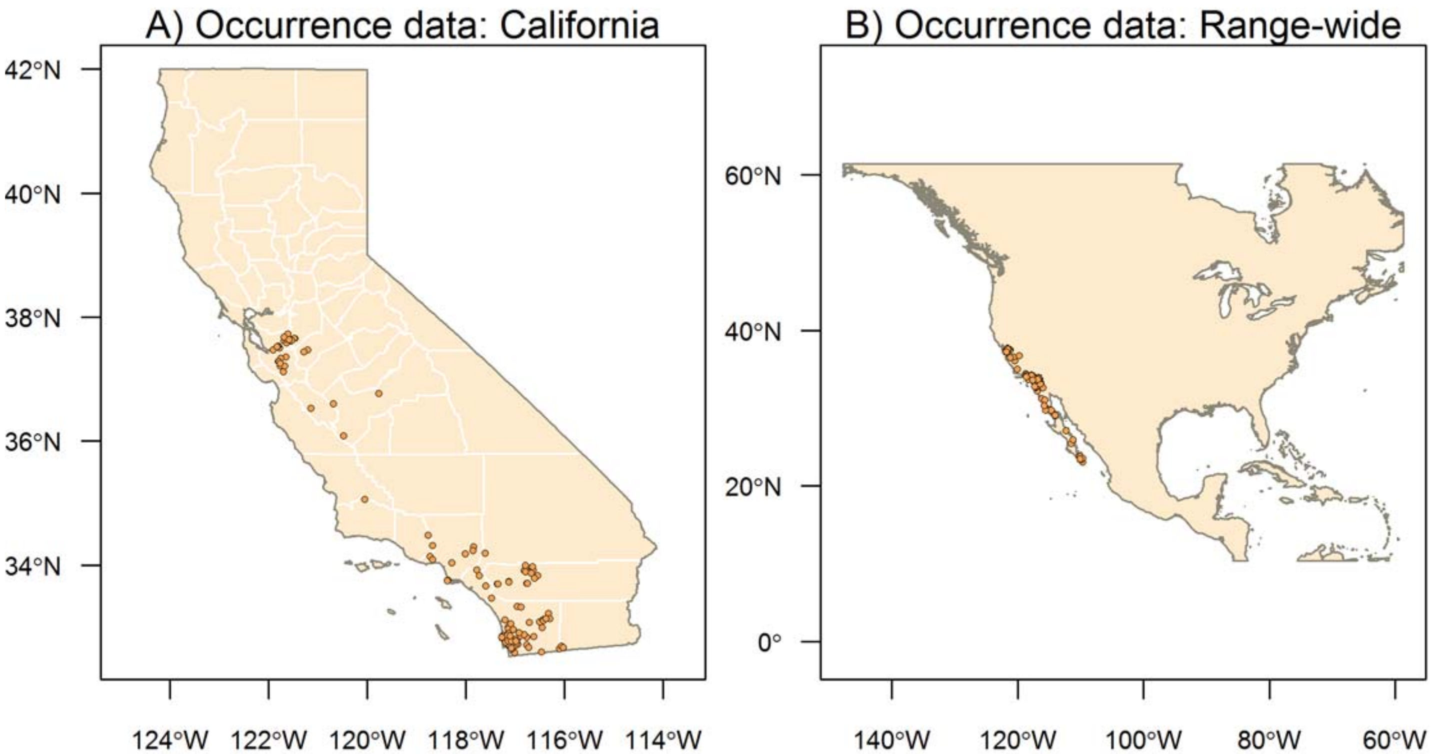
Species Results: *Tantilla planiceps* California Black-headed Snake



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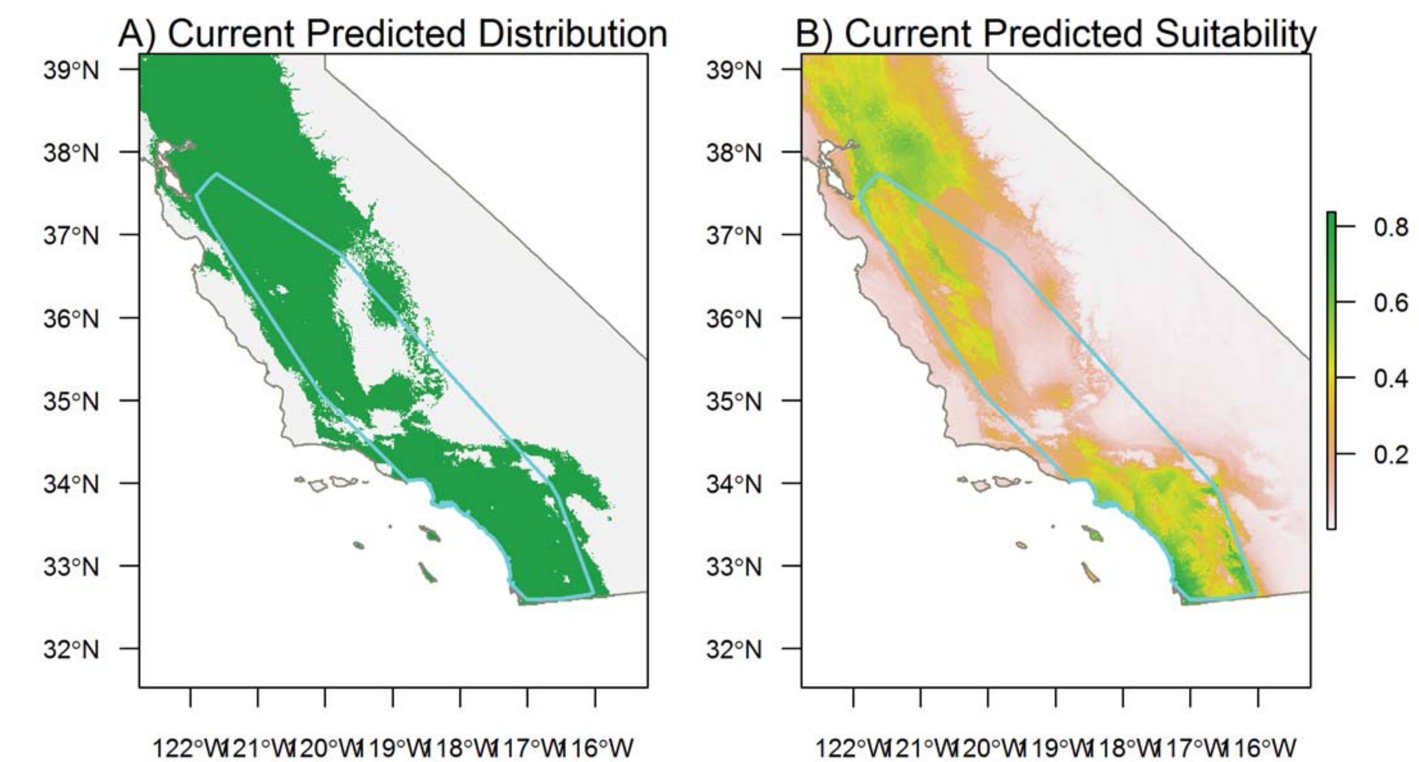

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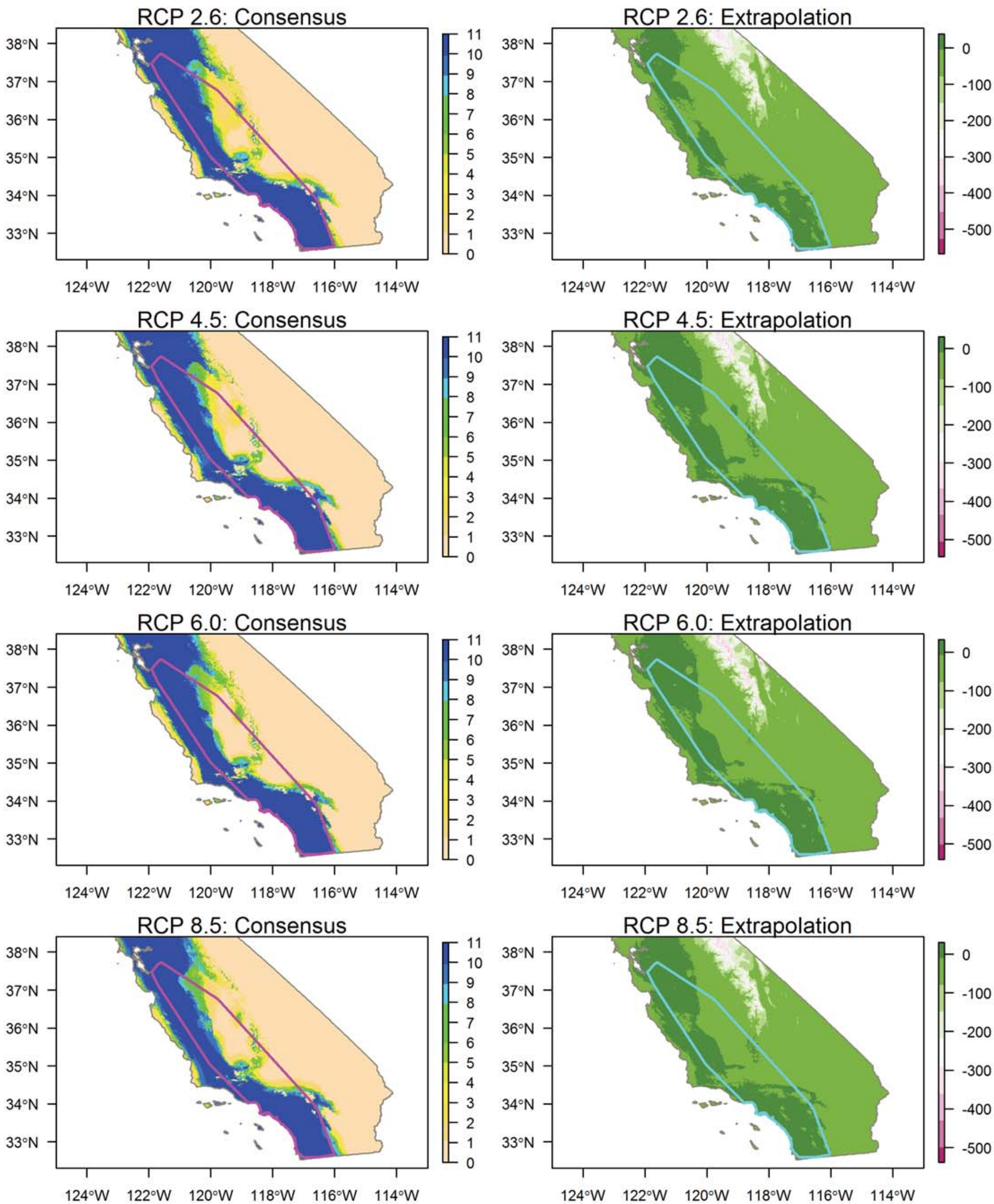
Species Results: *Tantilla planiceps* California Black-headed Snake



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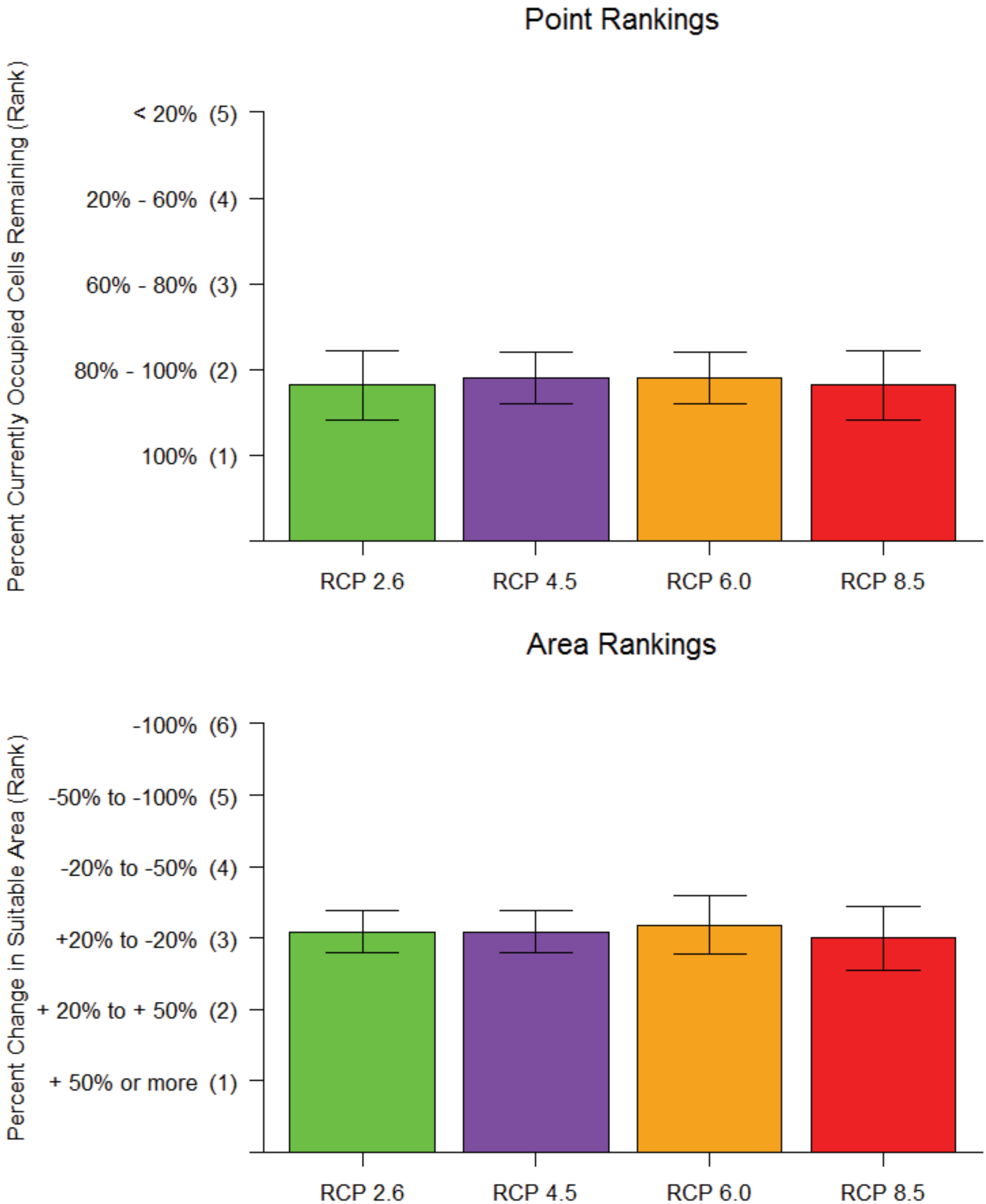
Species Results: *Tantilla planiceps* California Black-headed Snake



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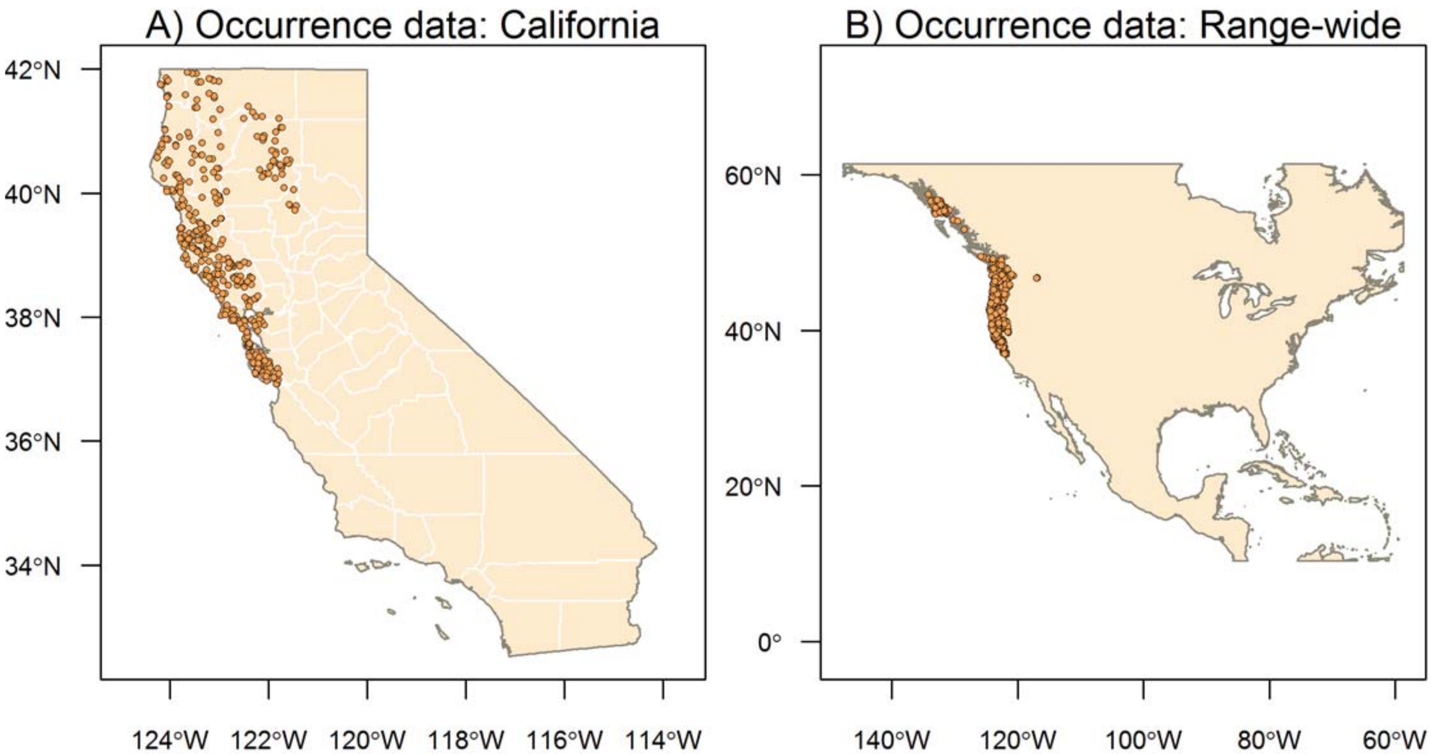
Species Results: *Taricha granulosa* Rough-skinned Newt



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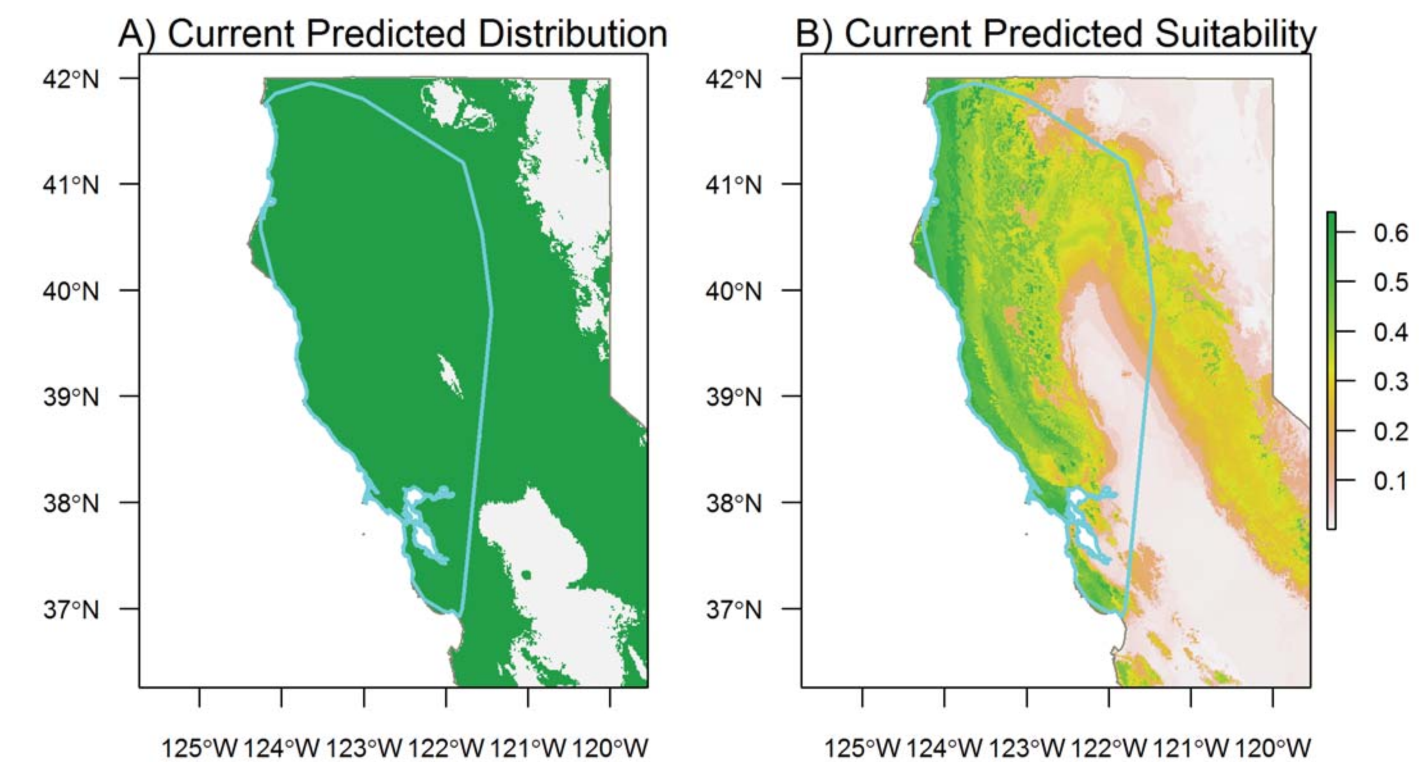

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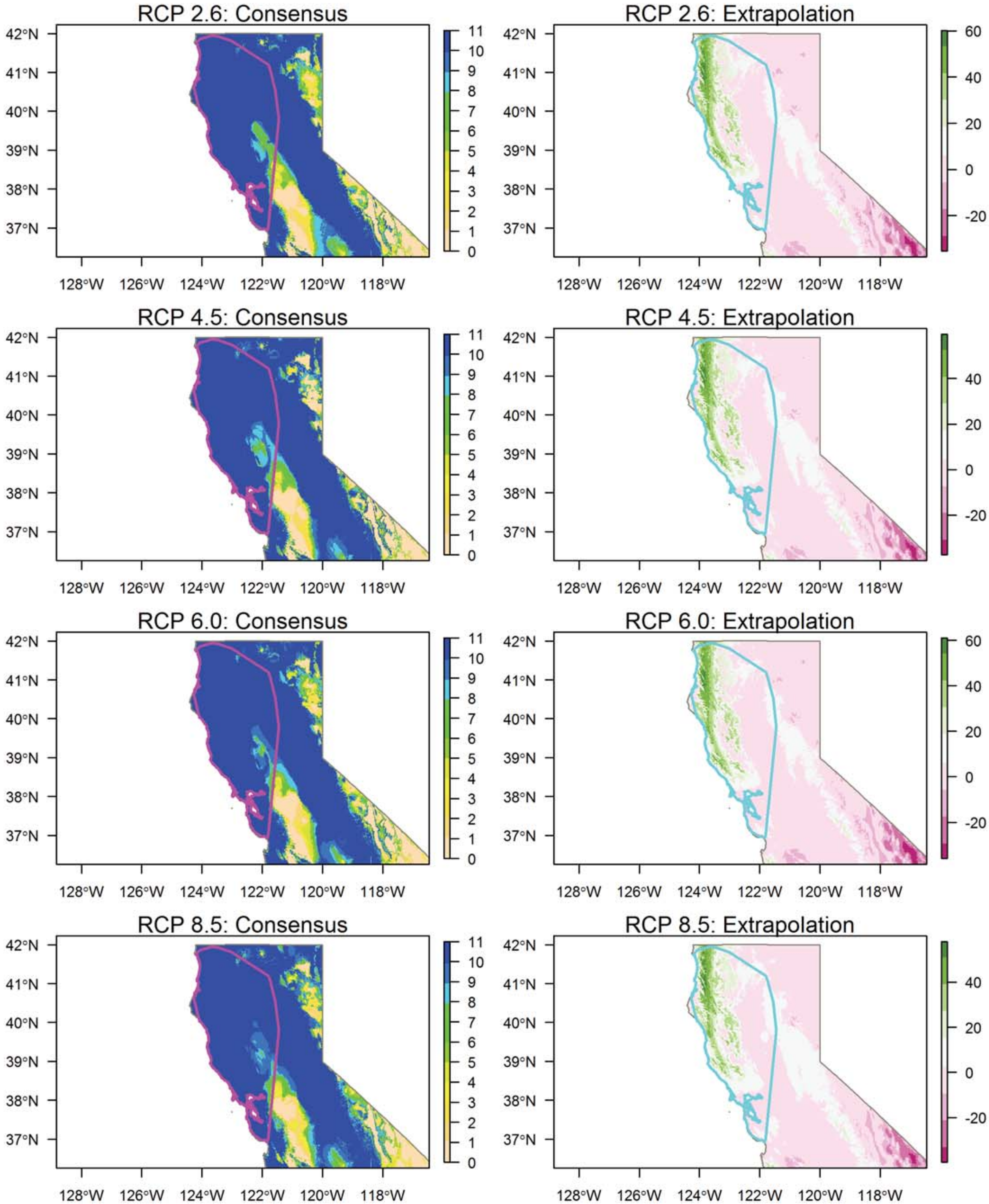

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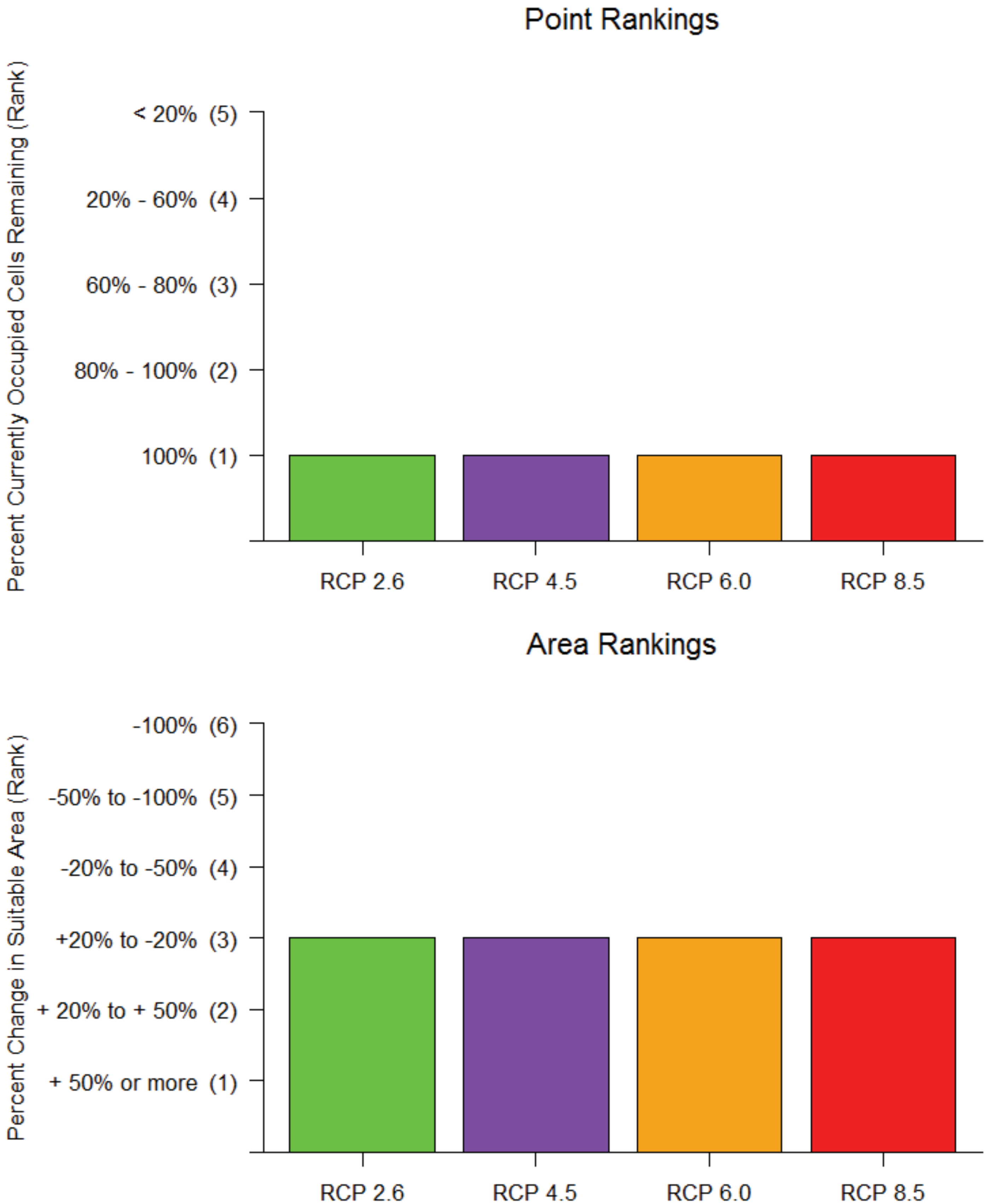
Species Results: *Taricha granulosa* Rough-skinned Newt



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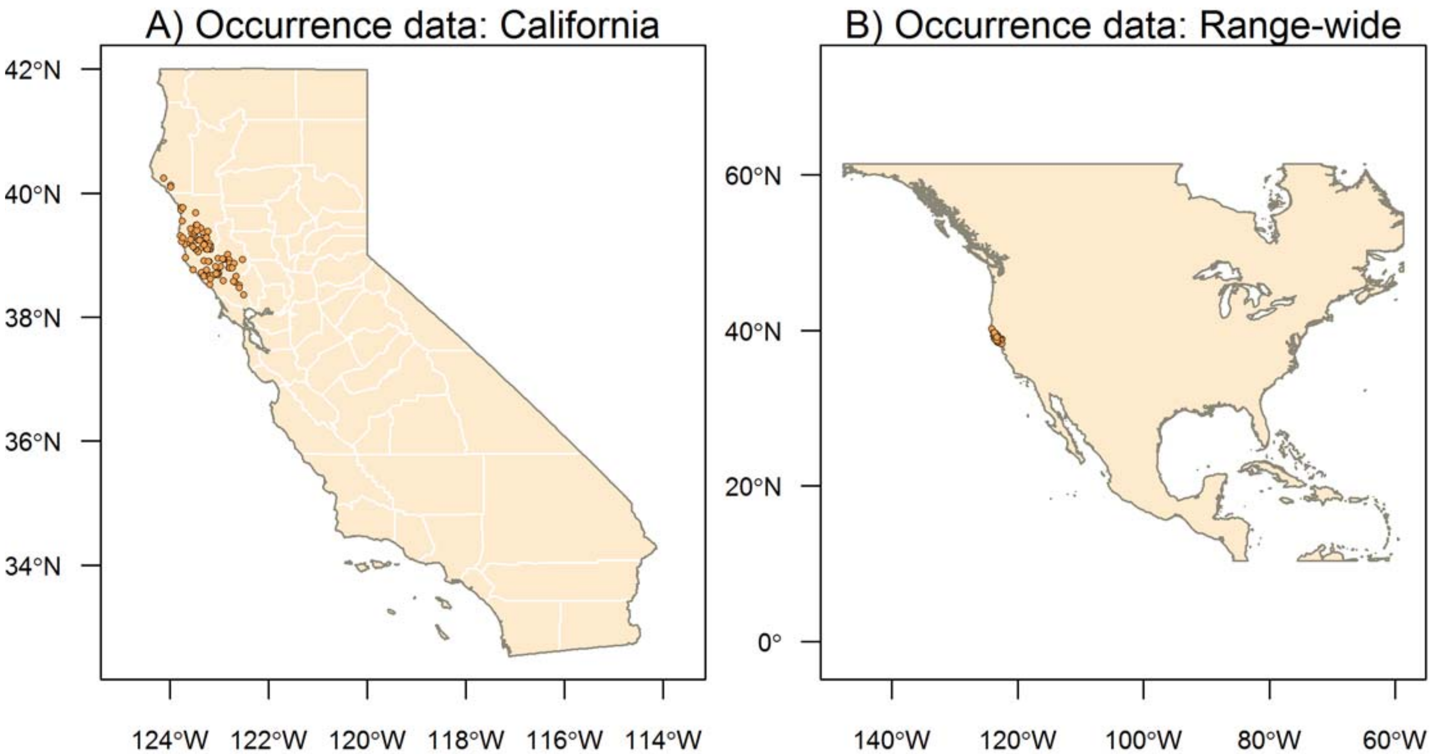
Species Results: *Taricha rivularis* Red-bellied Newt



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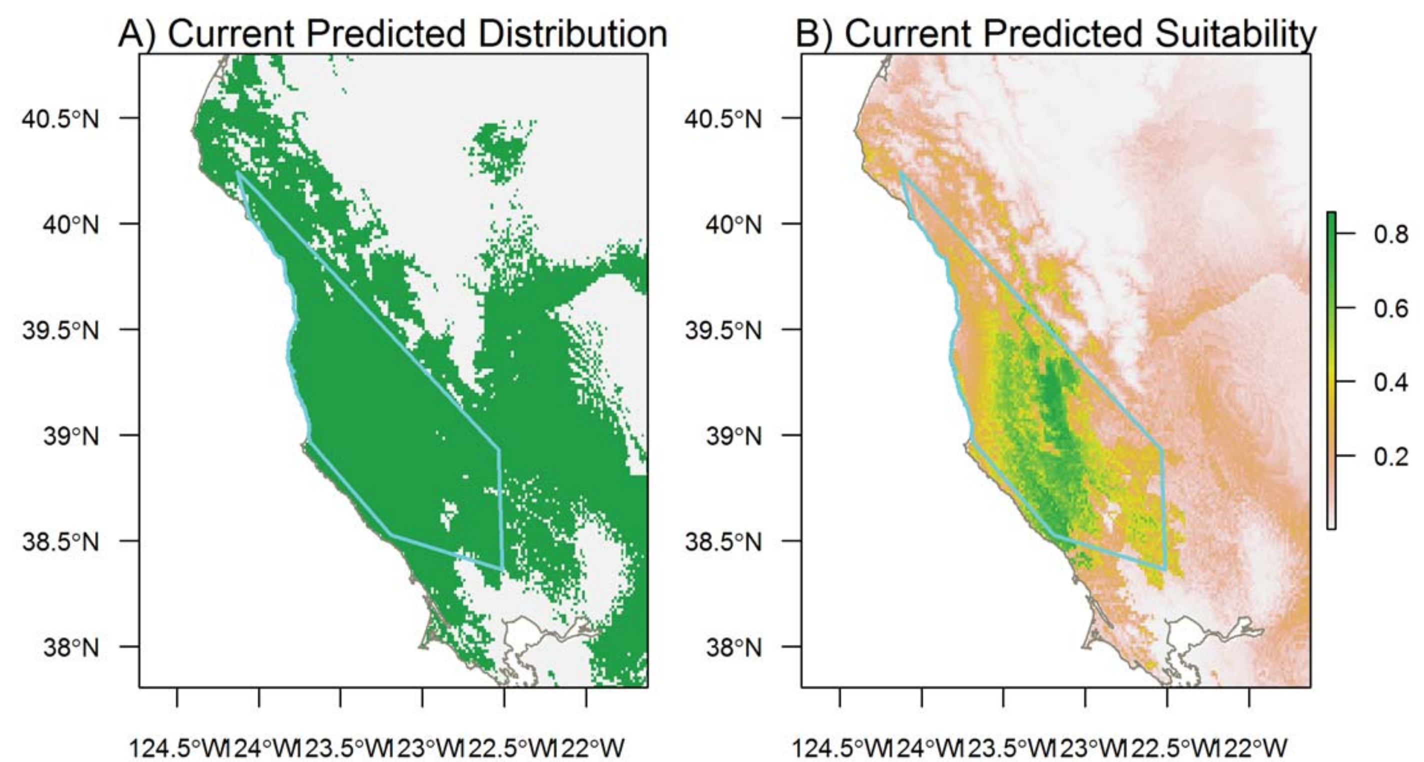

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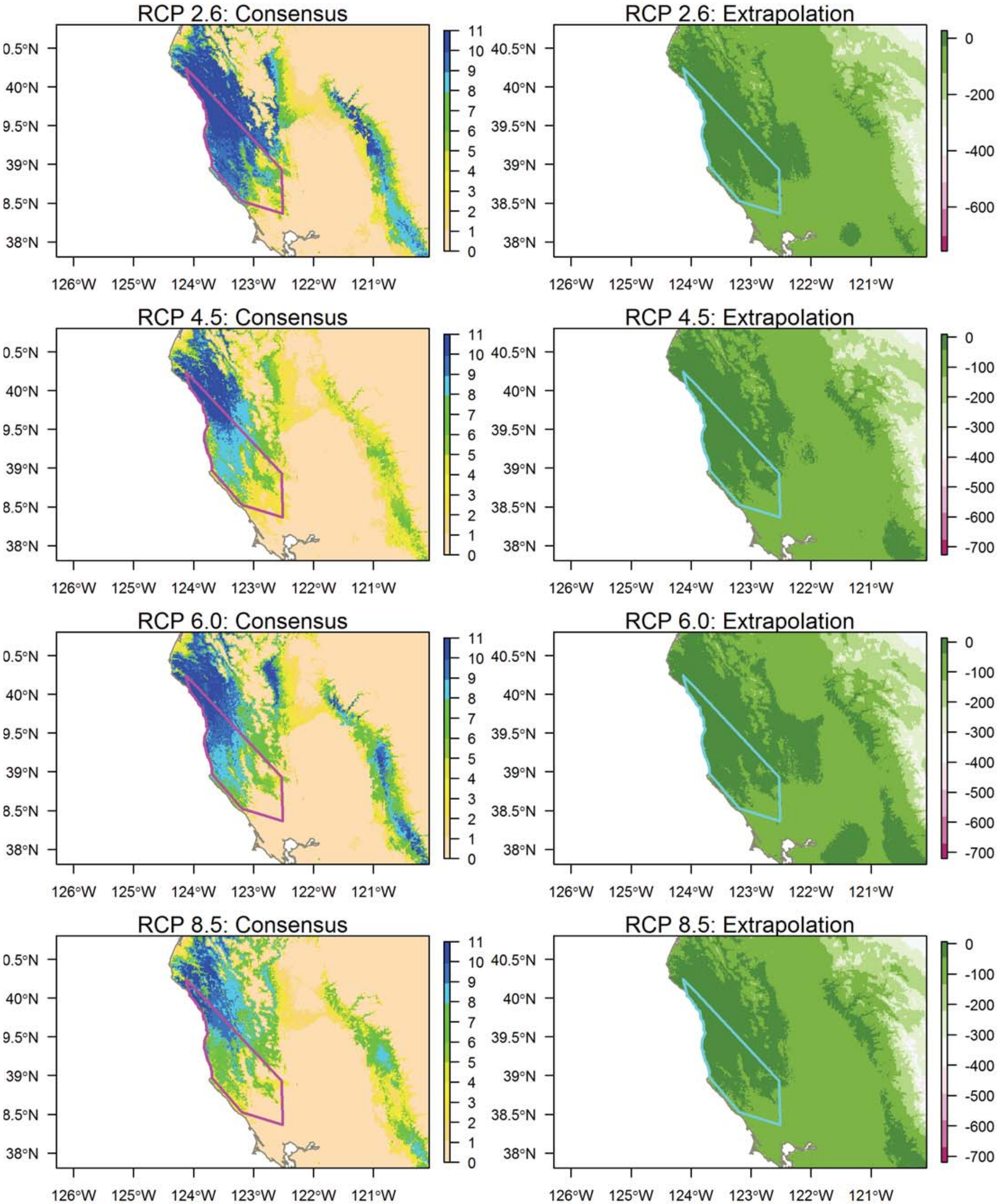
Species Results: *Taricha rivularis* Red-bellied Newt



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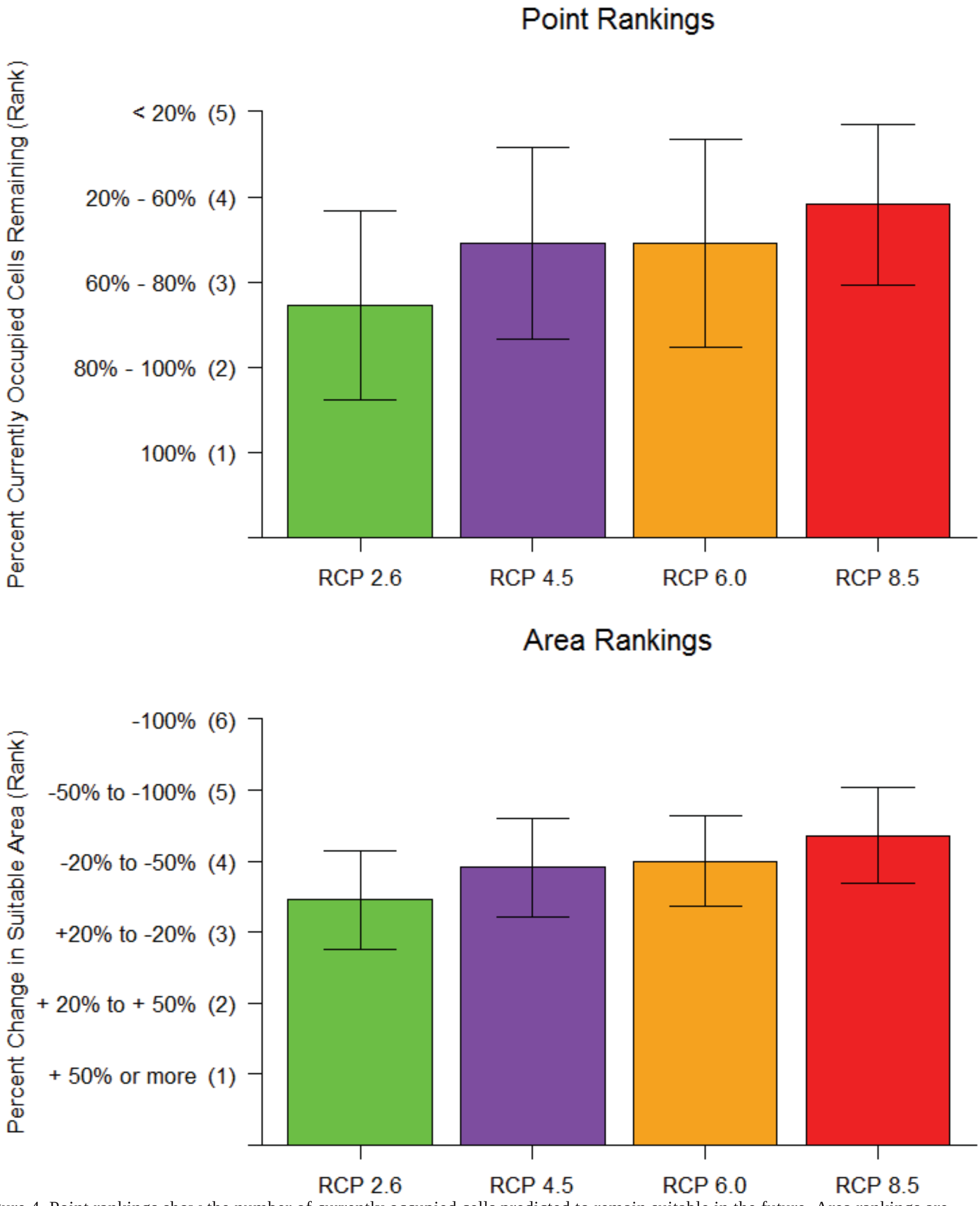

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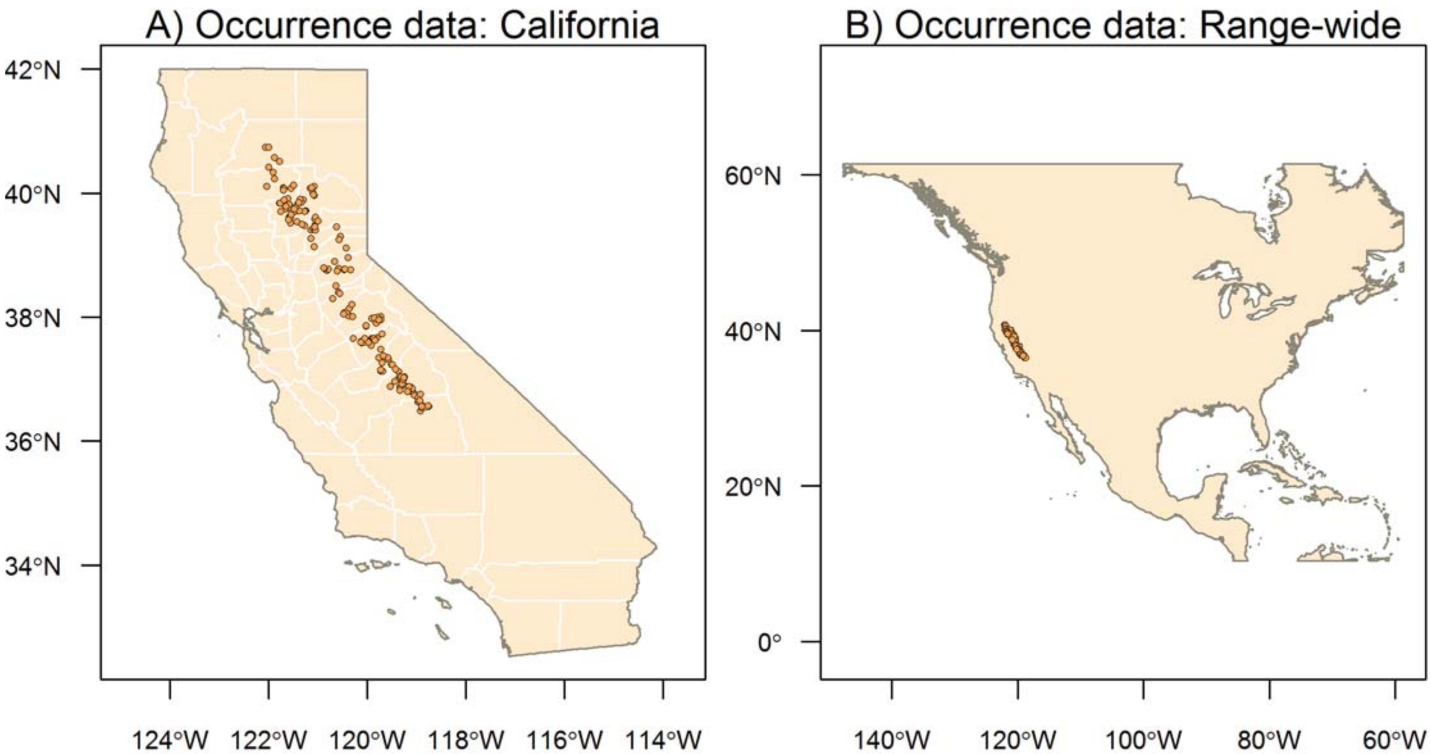
Species Results: *Taricha sierrae* Sierra Newt



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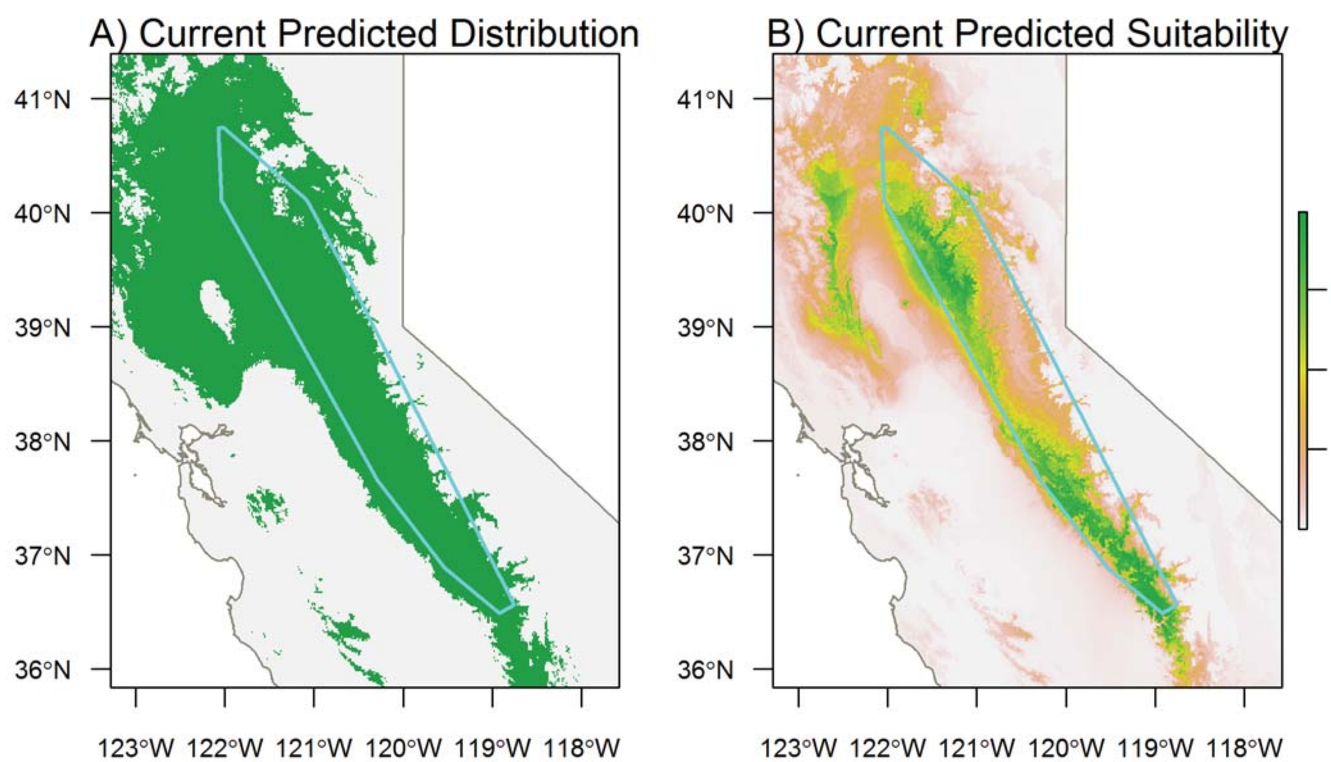

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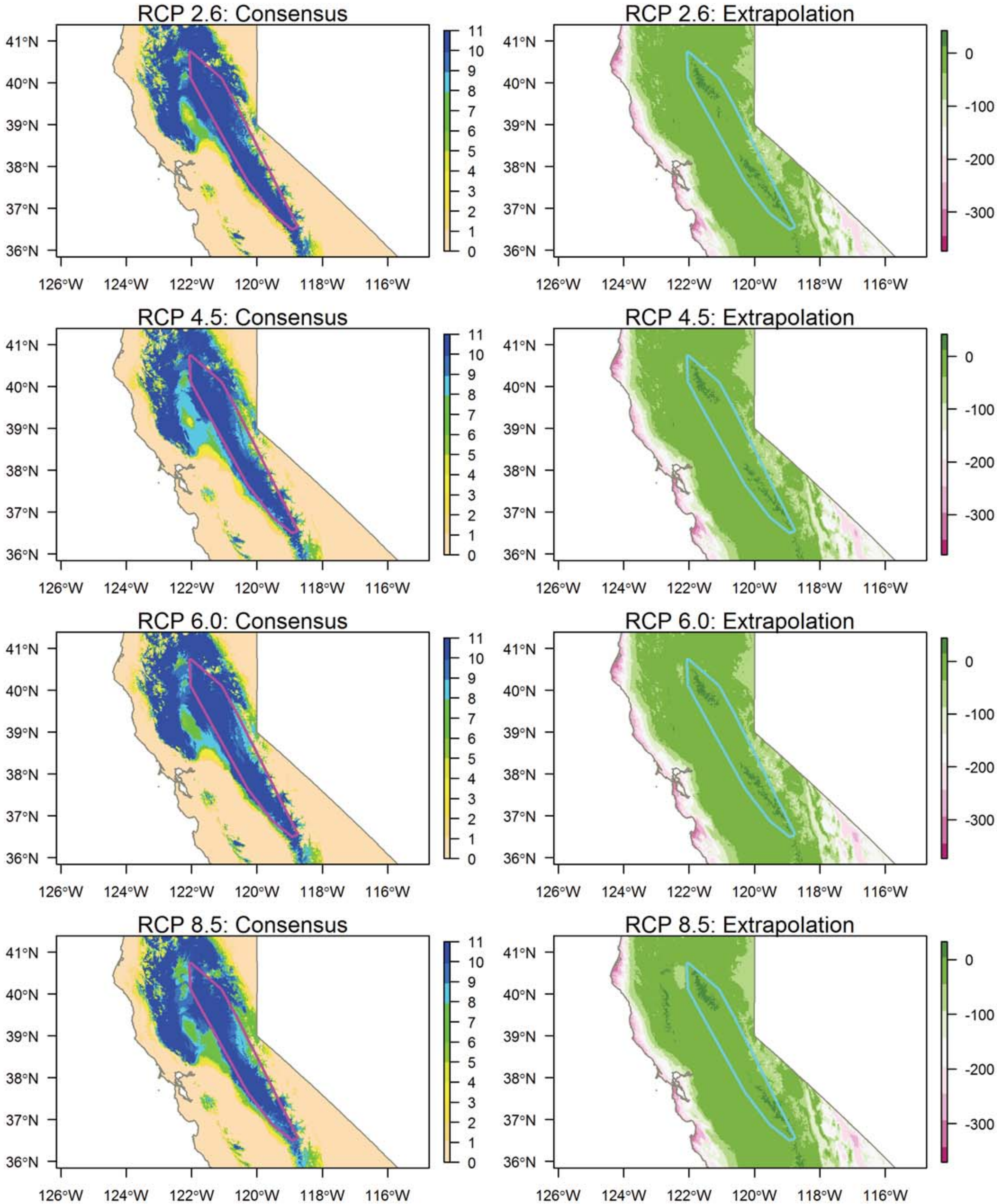
Species Results: *Taricha sierrae* Sierra Newt



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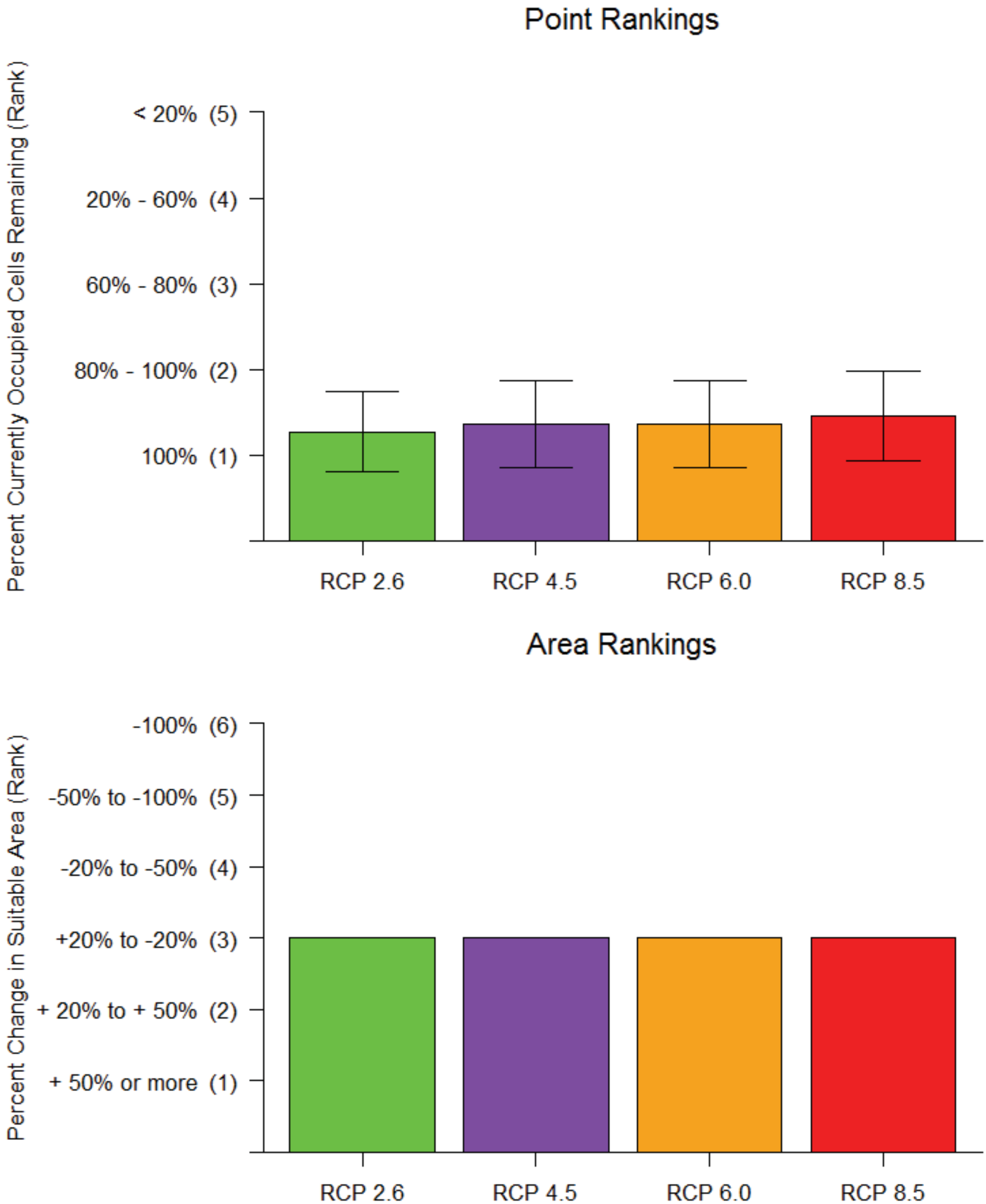

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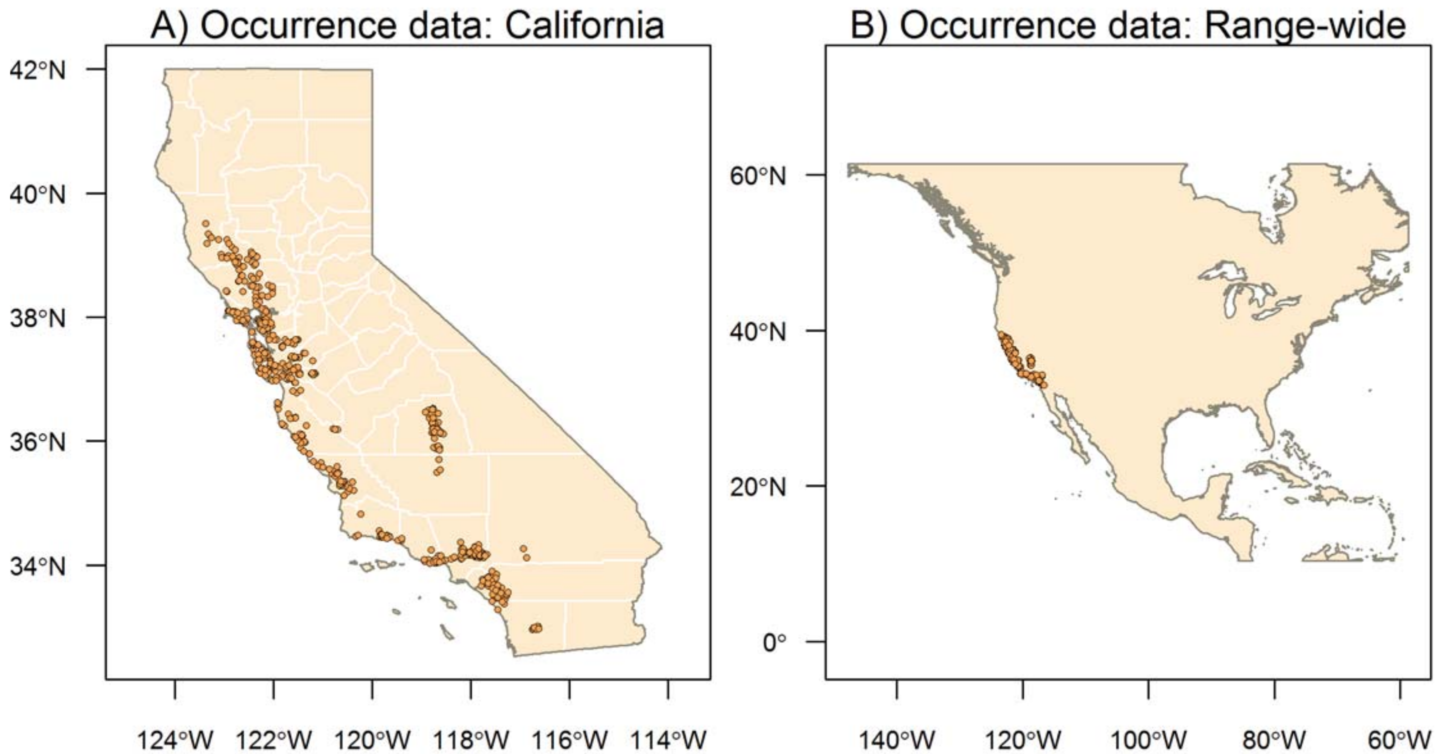
Species Results: *Taricha torosa* Coast Range Newt



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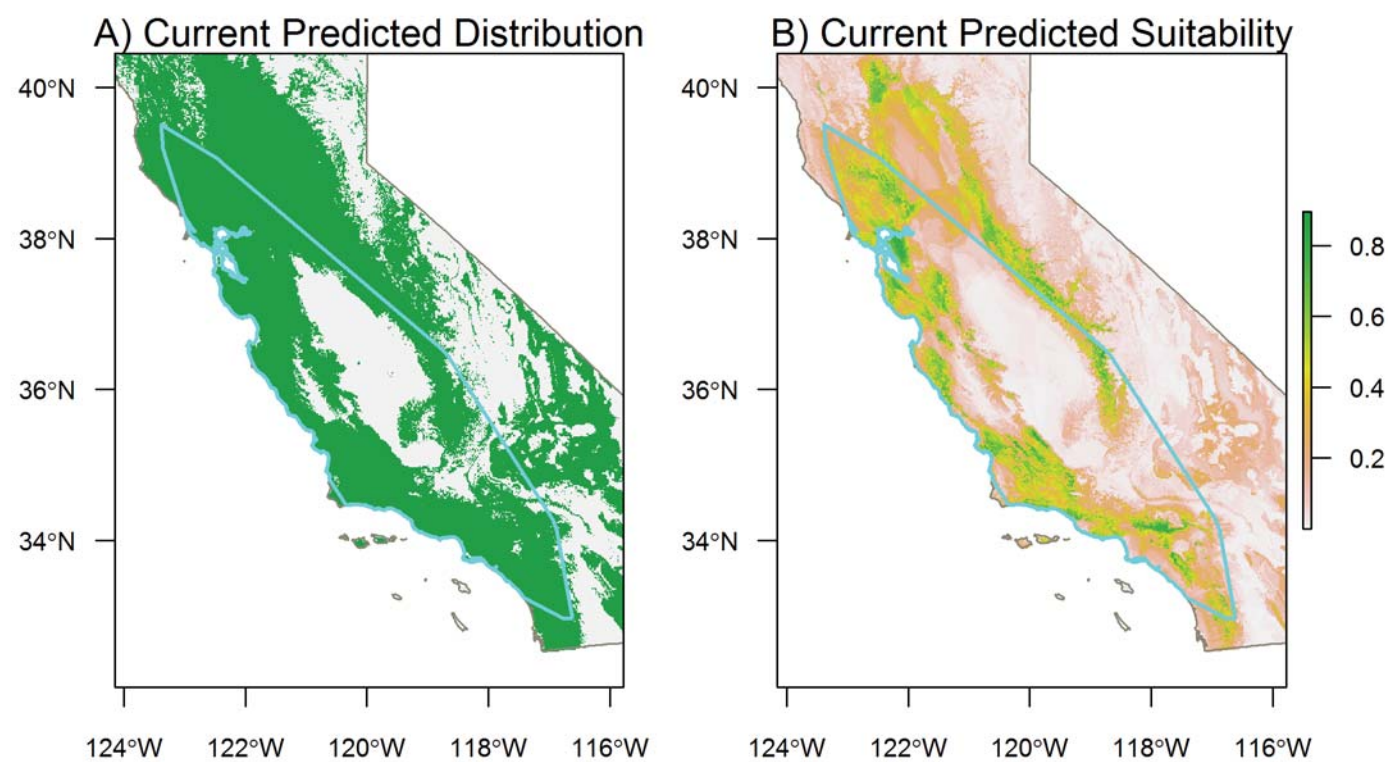

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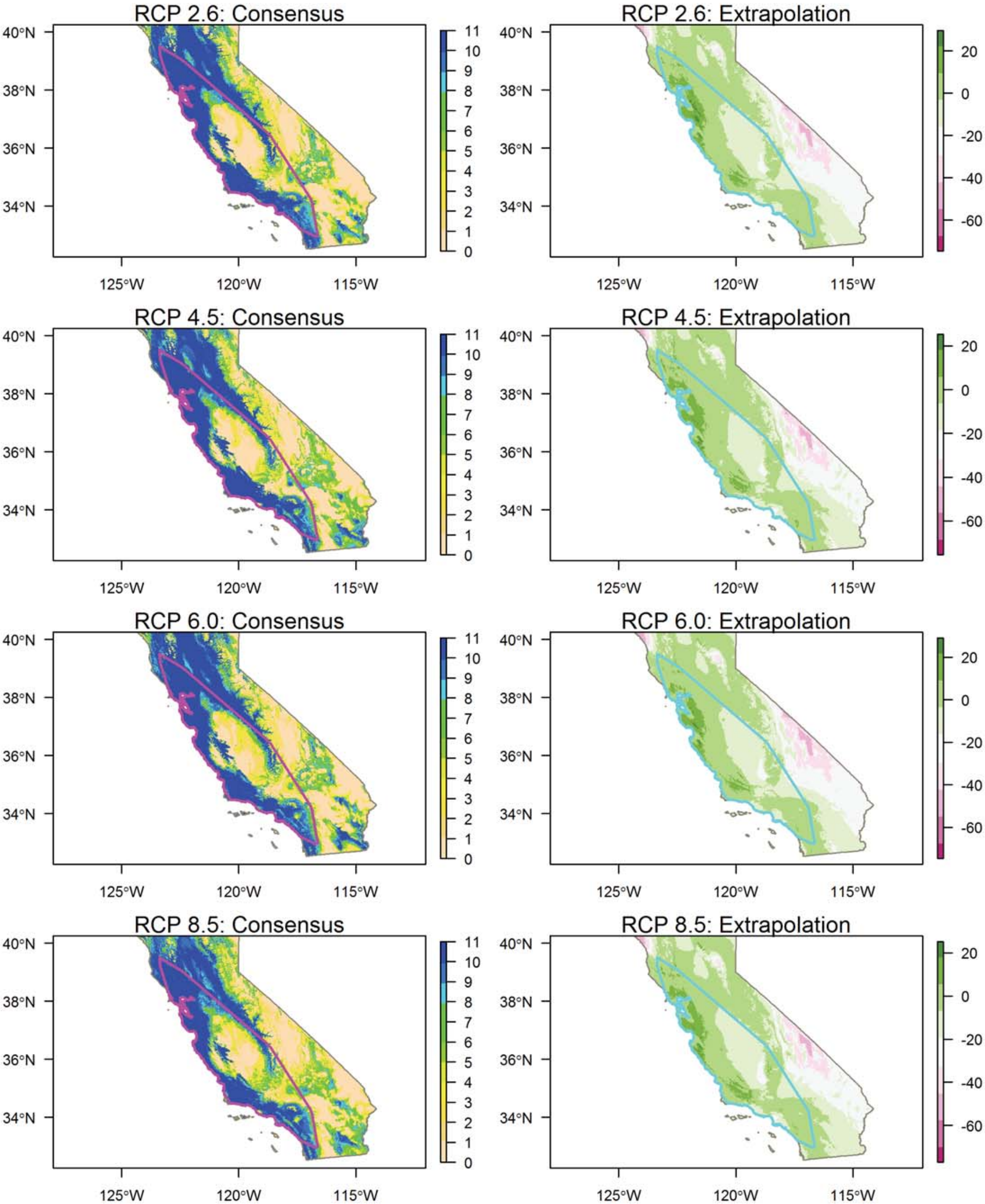
Species Results: *Taricha torosa* Coast Range Newt



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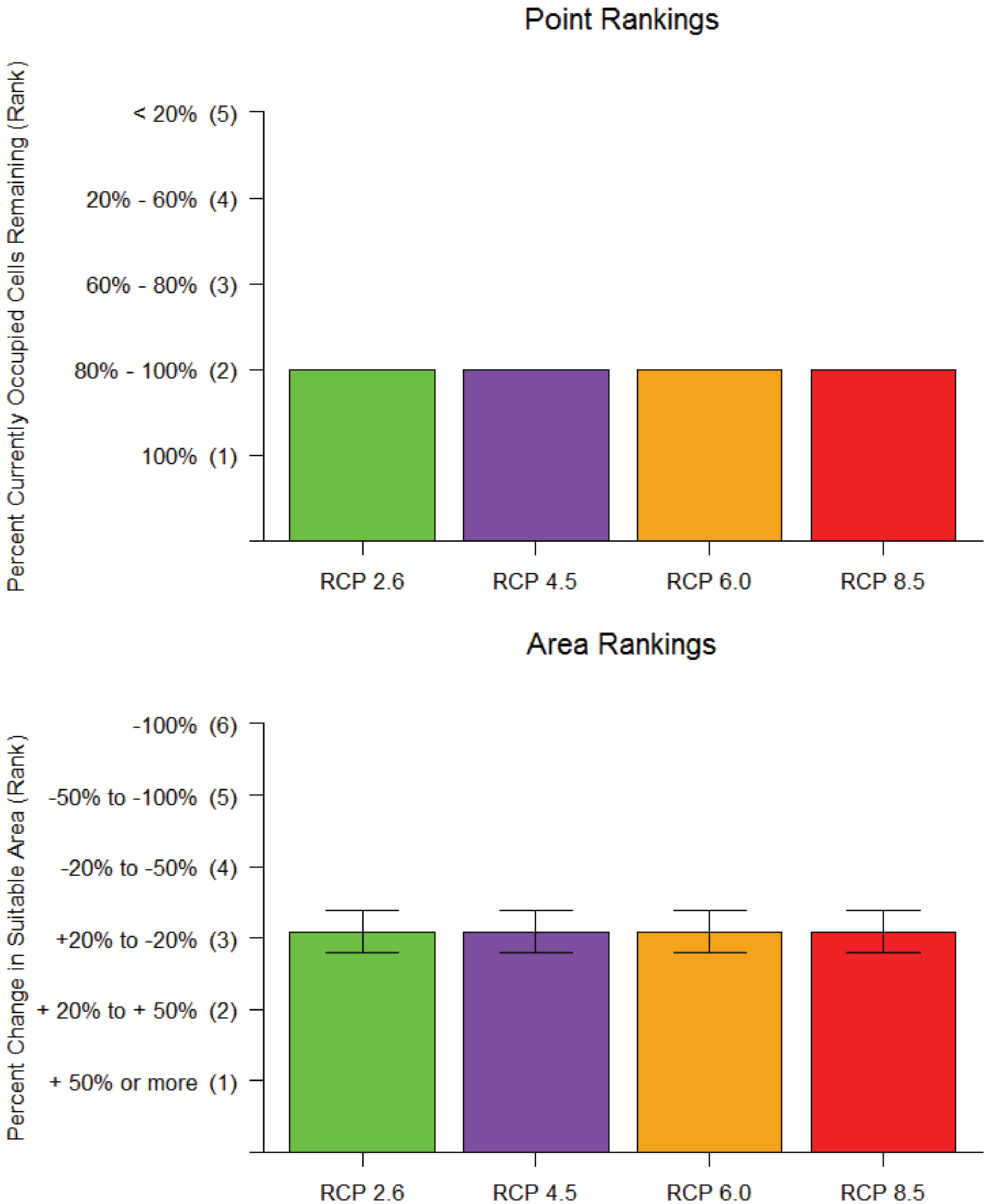

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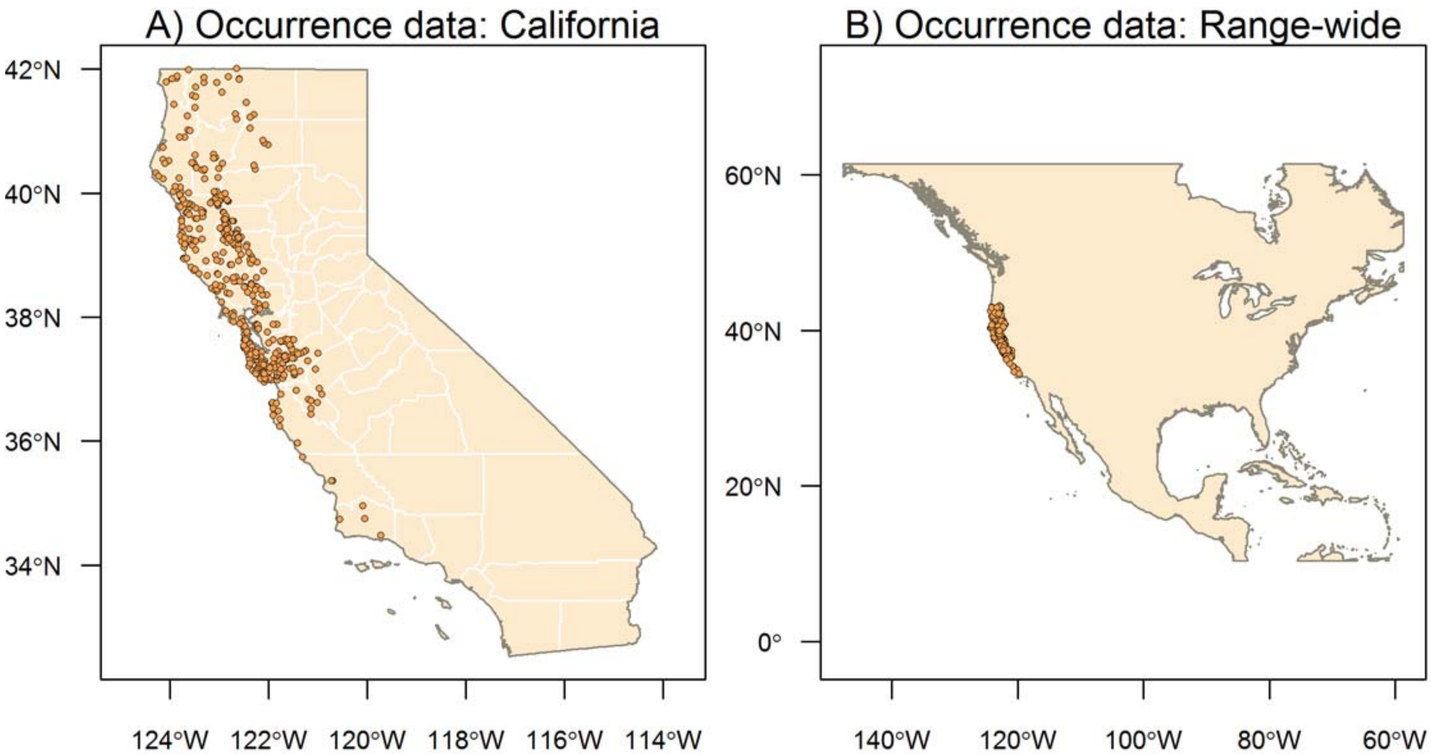
Species Results: *Thamnophis atratus* Aquatic Garter Snake



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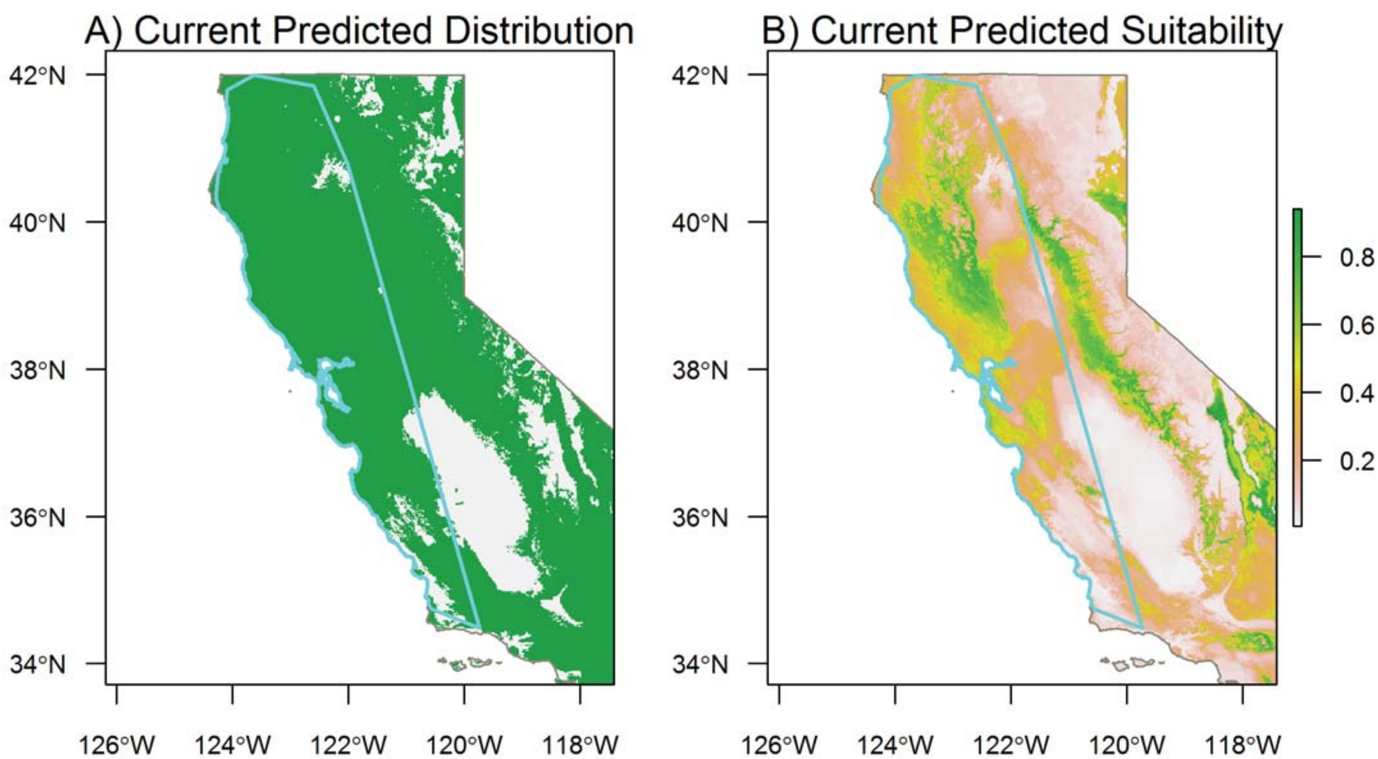

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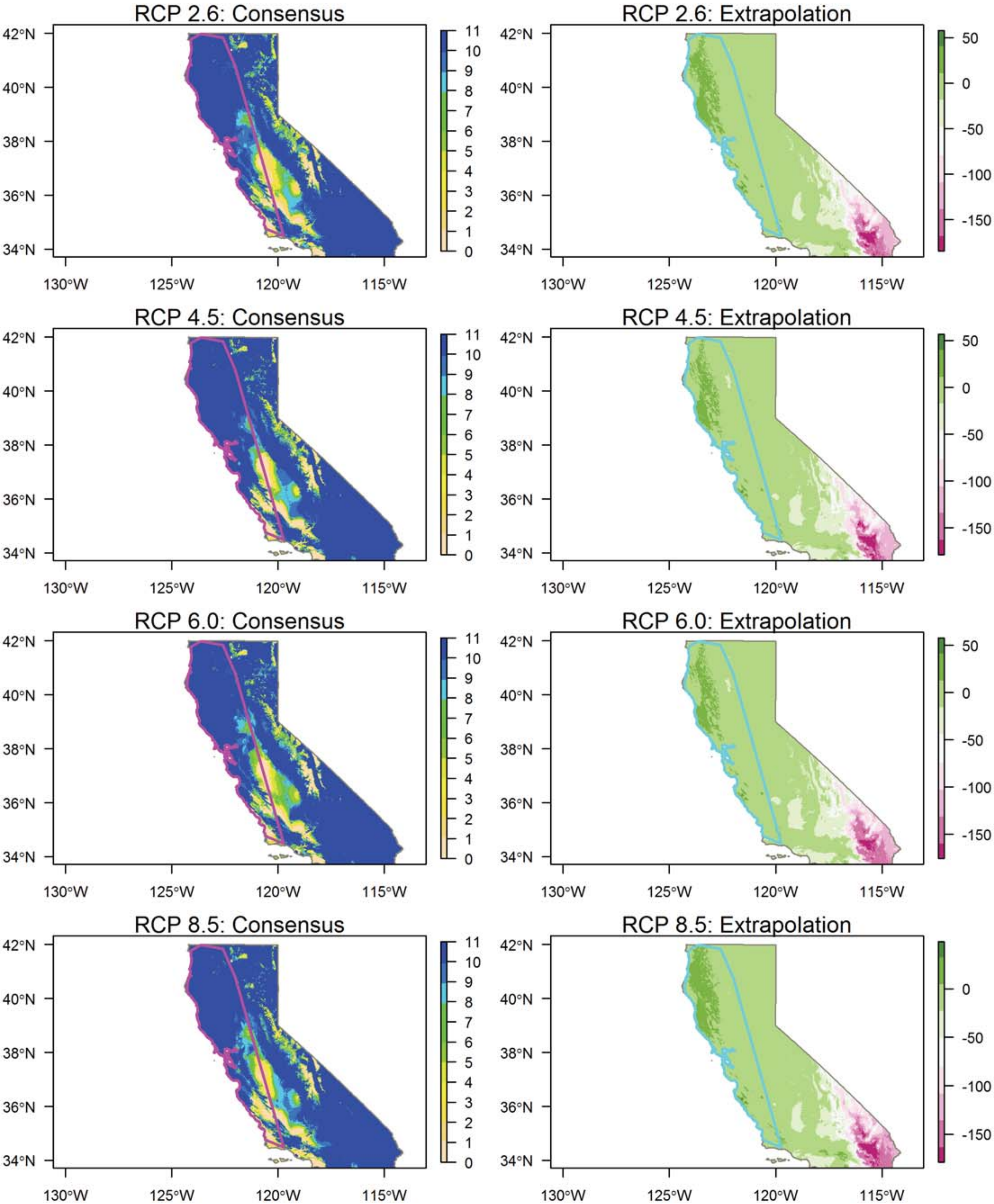

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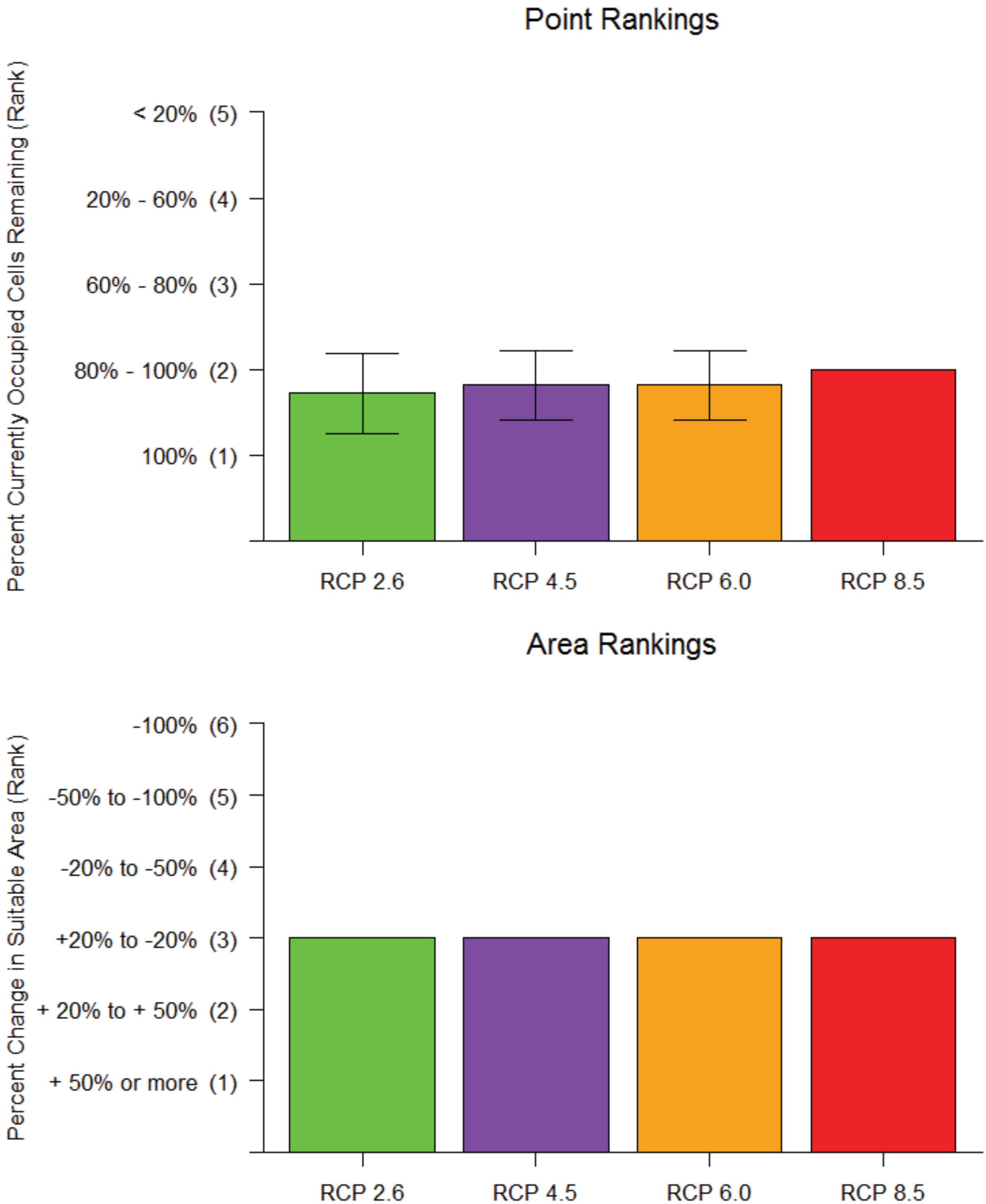

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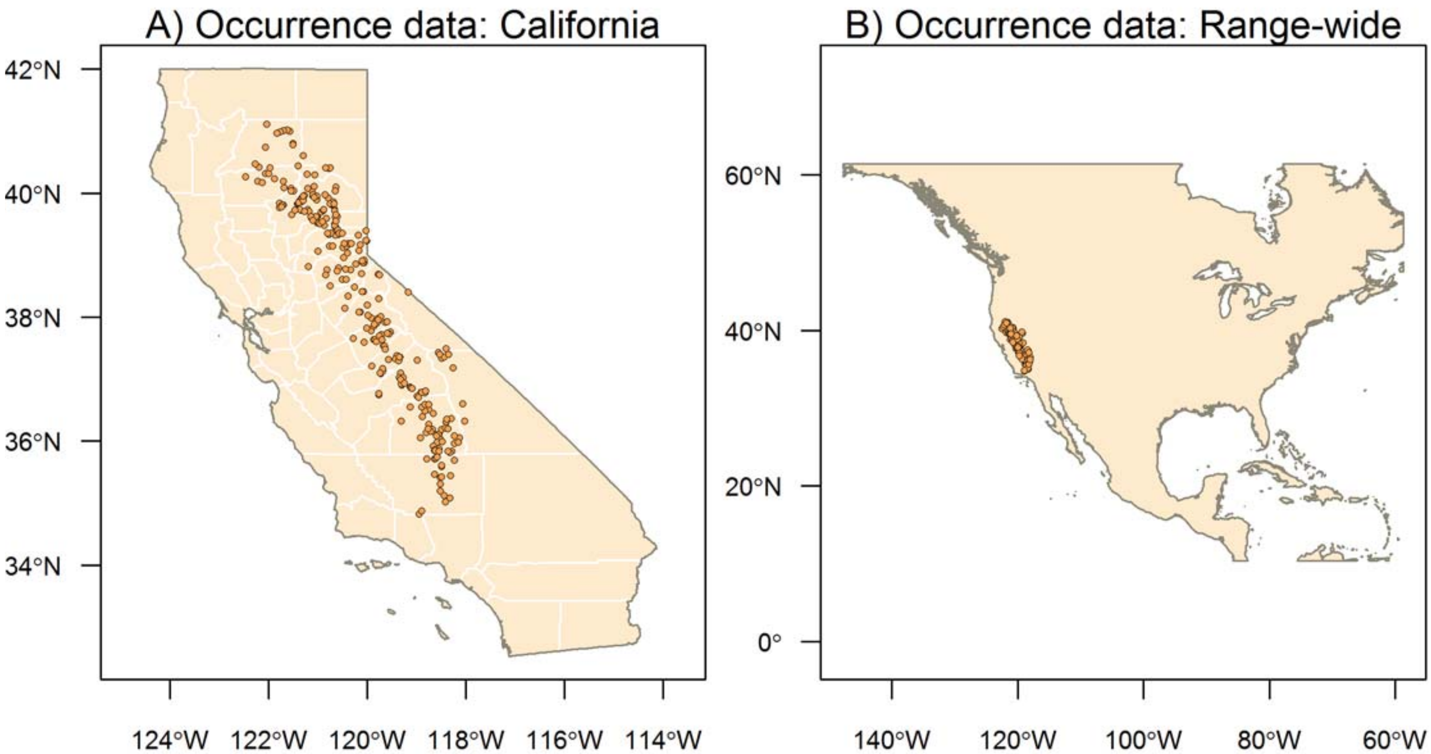
Species Results: *Thamnophis couchii* Sierra Garter Snake



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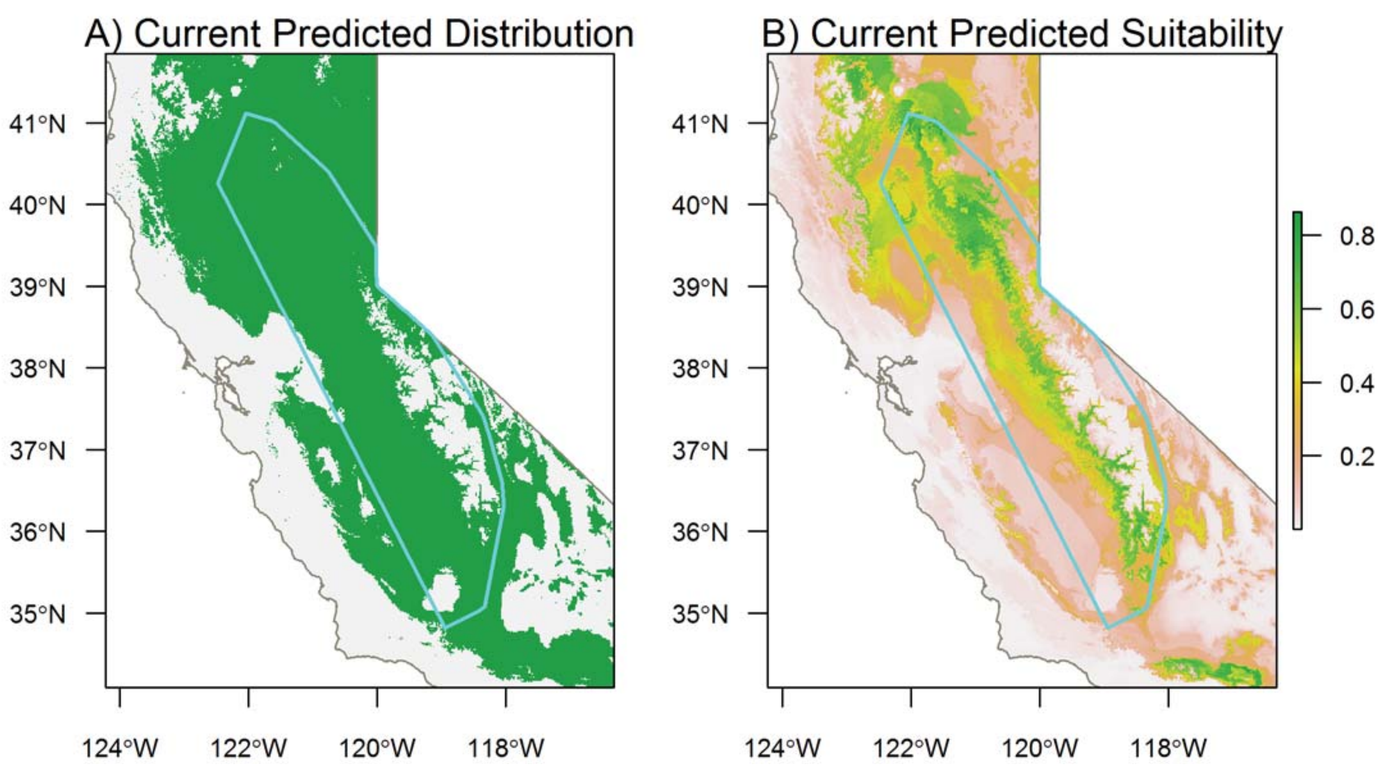

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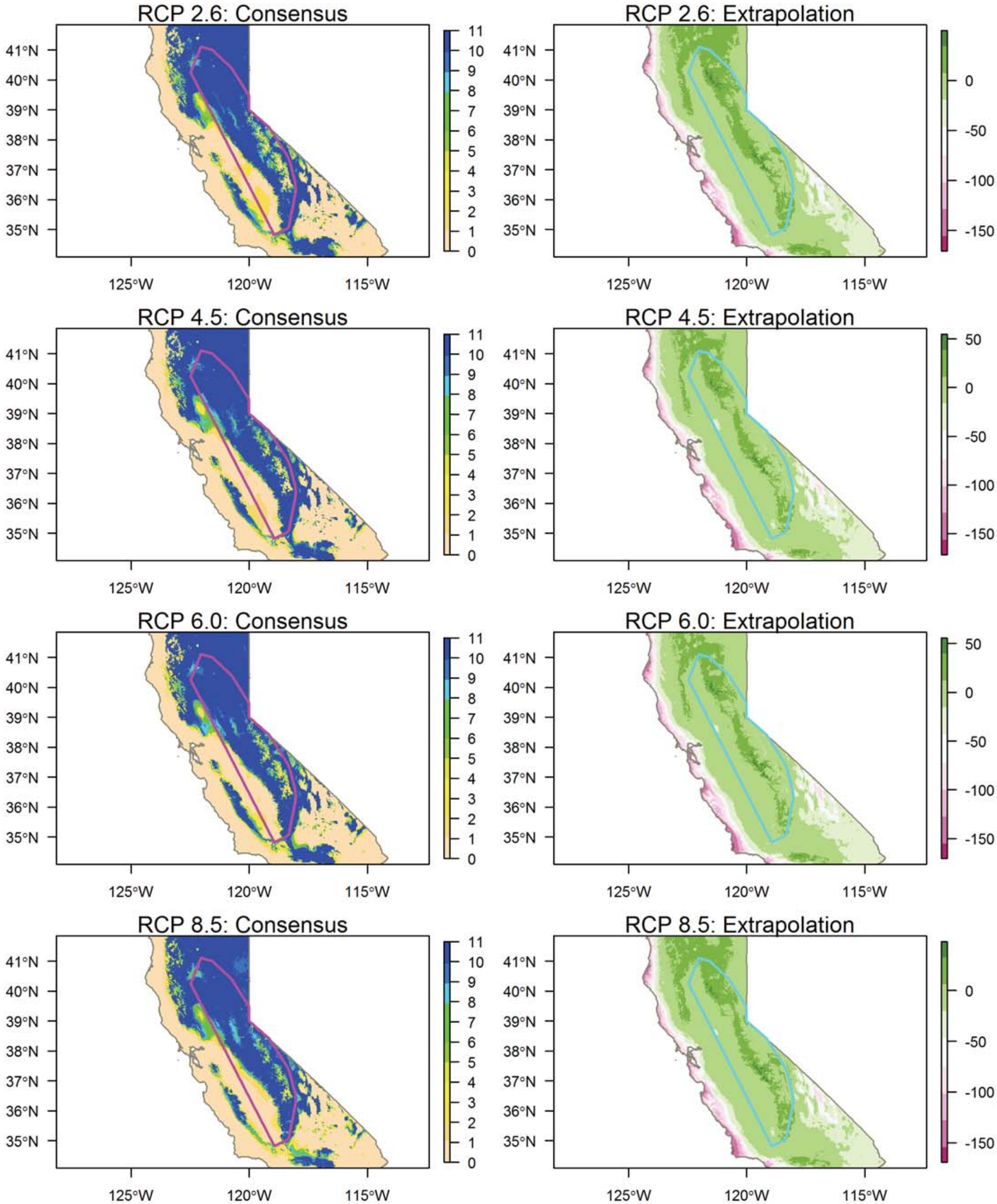

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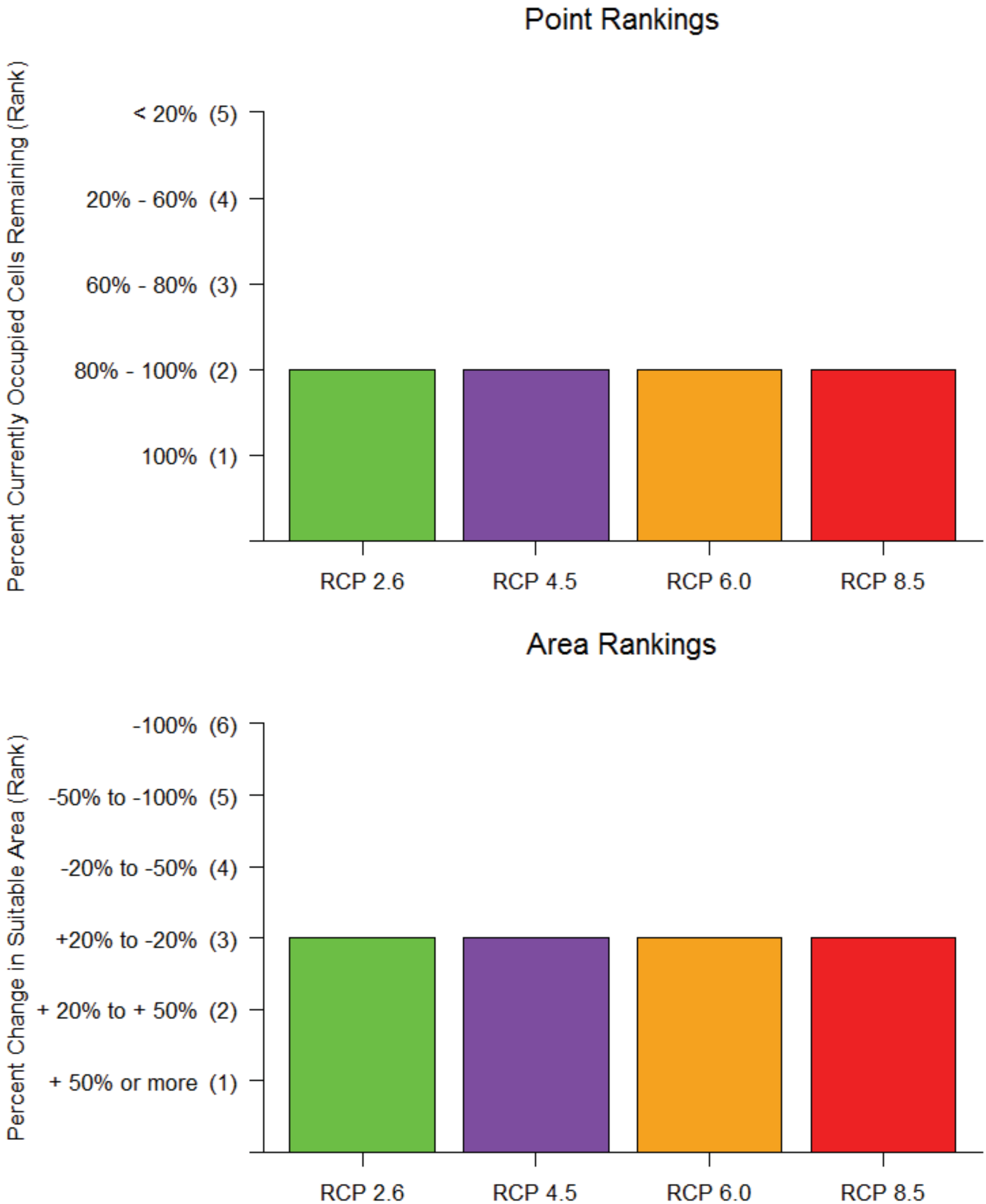
Species Results: *Thamnophis couchii* Sierra Garter Snake



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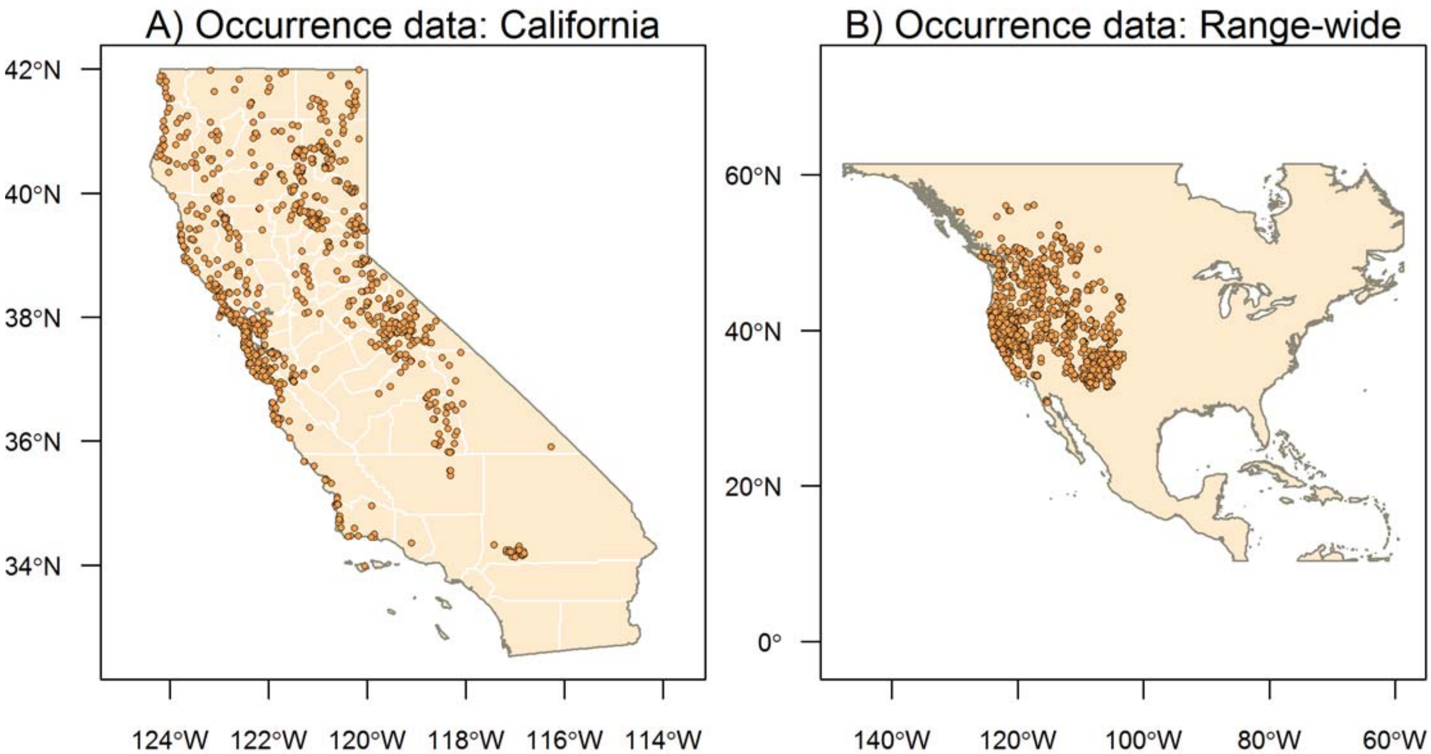
Species Results: *Thamnophis elegans* Terrestrial Garter Snake



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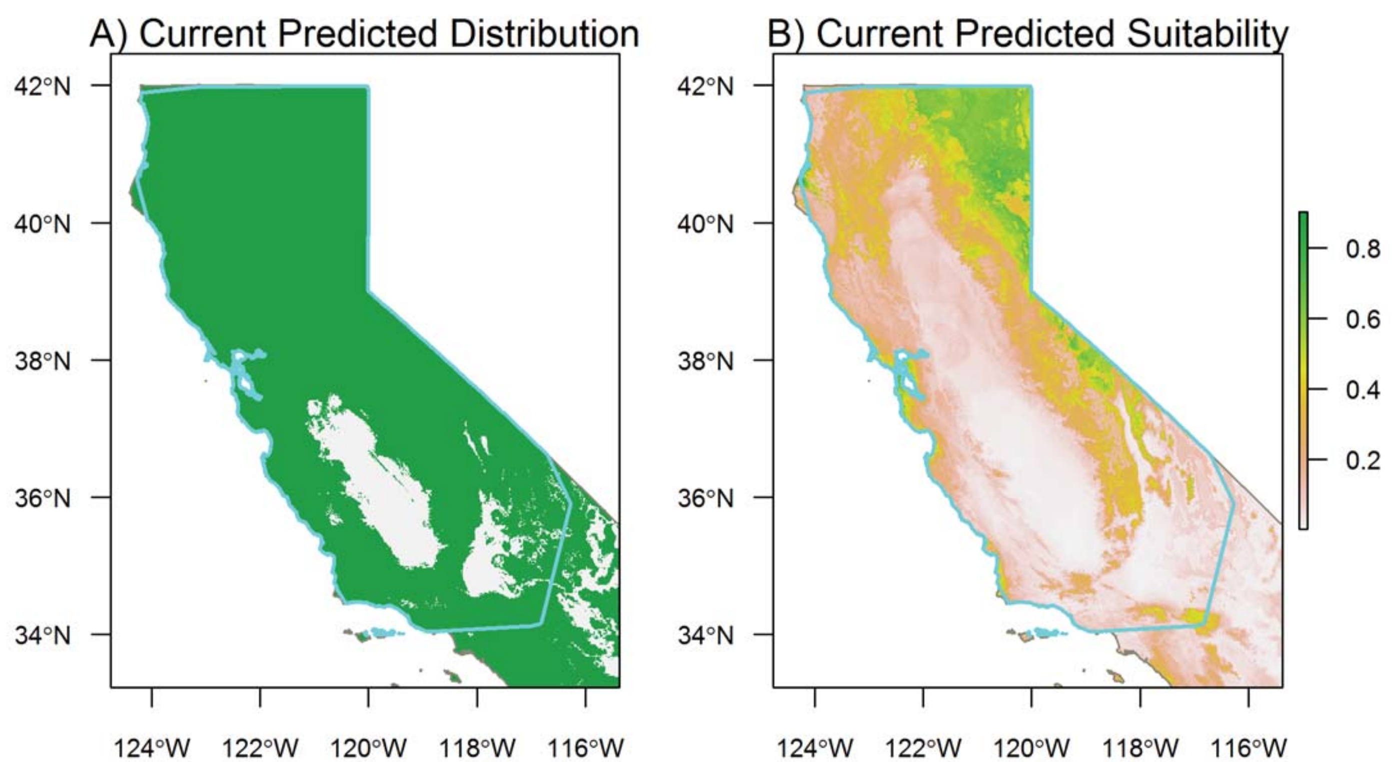

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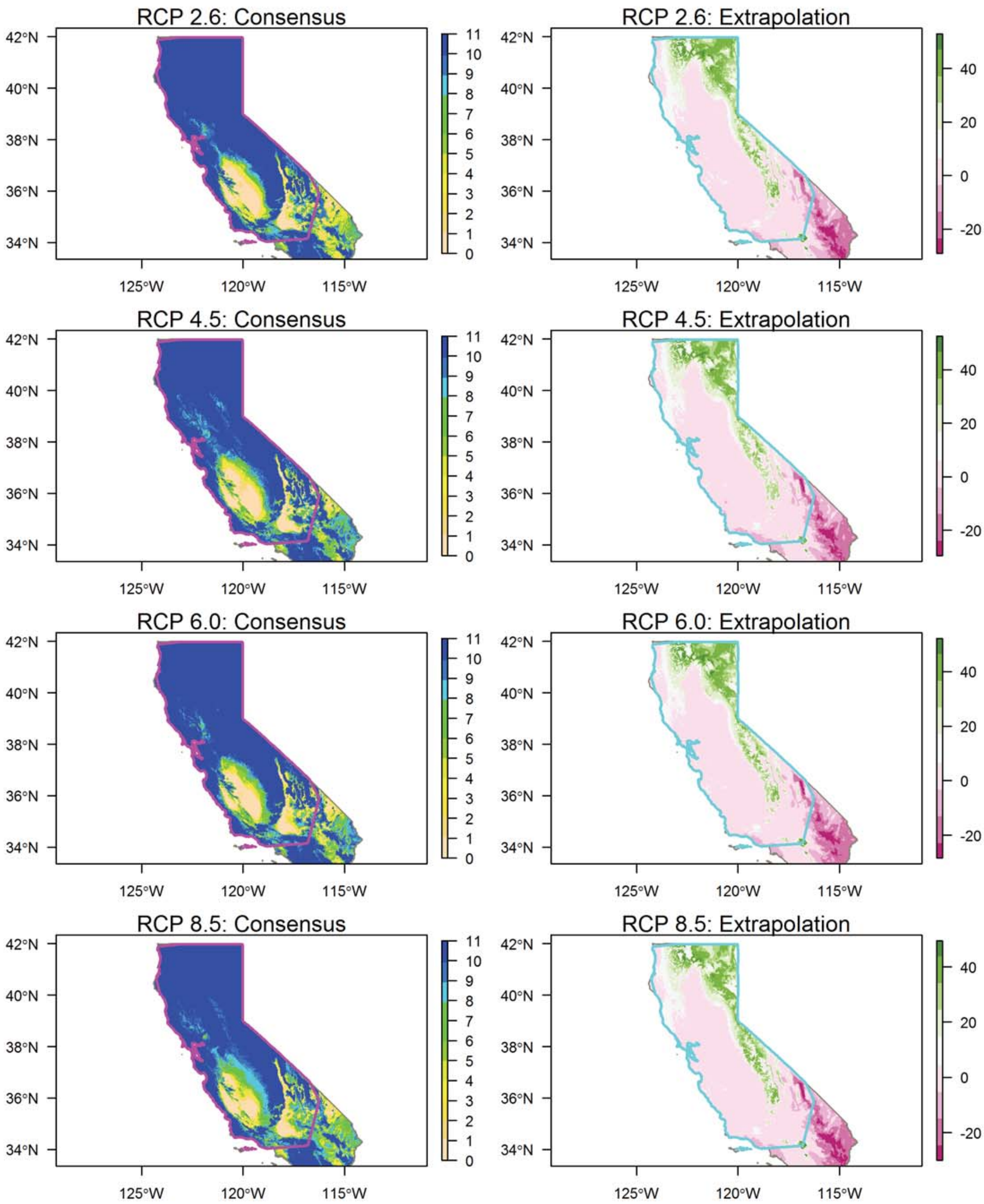
Species Results: *Thamnophis elegans* Terrestrial Garter Snake



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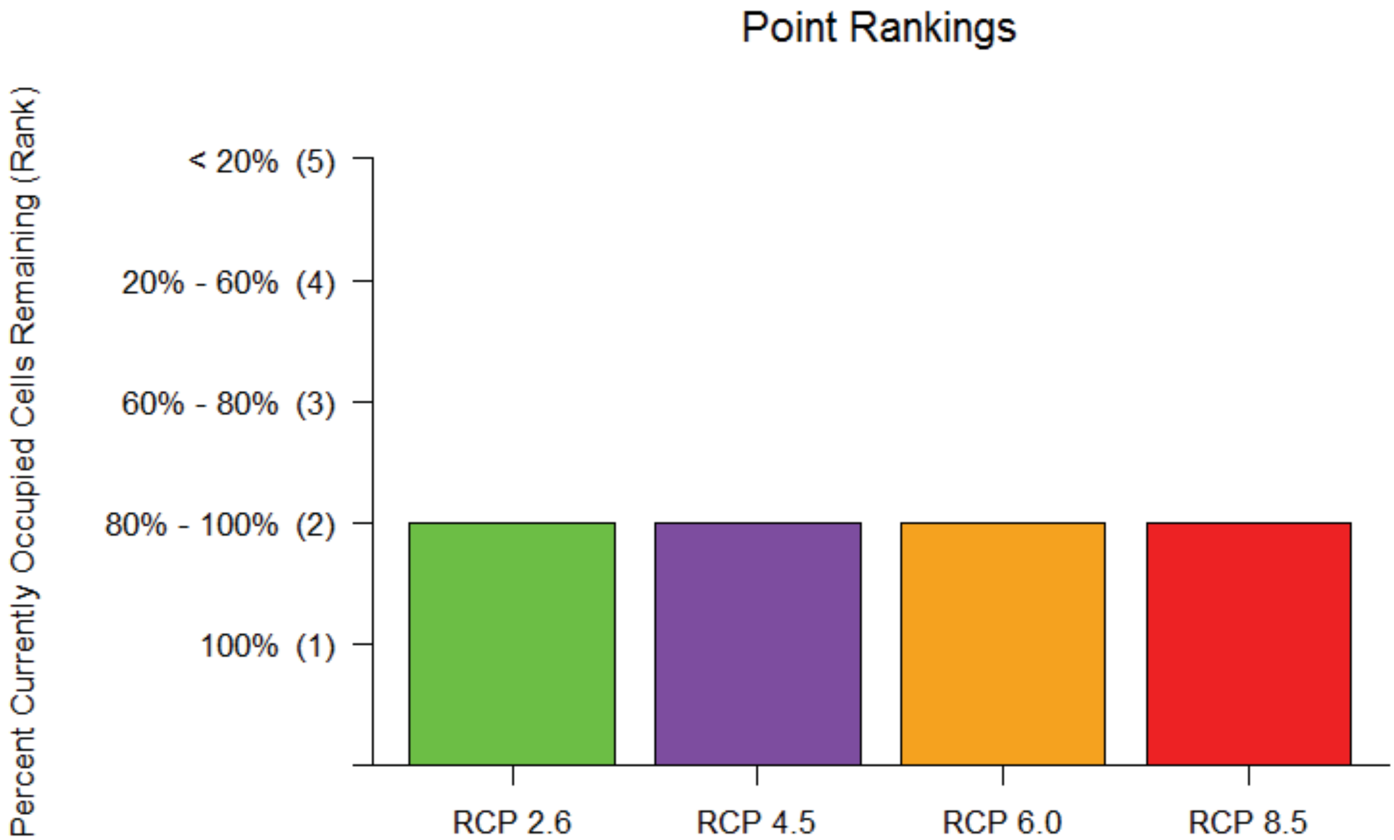

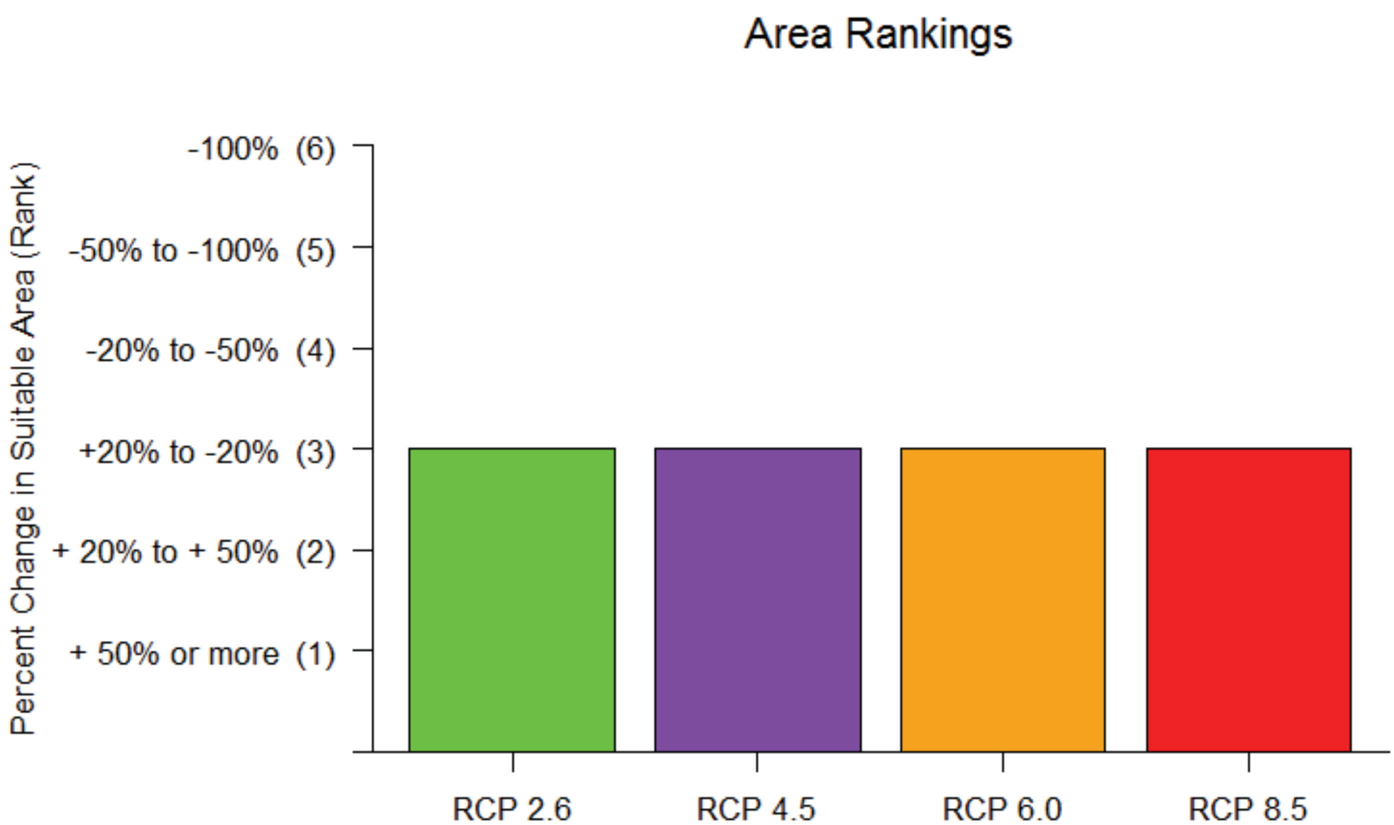

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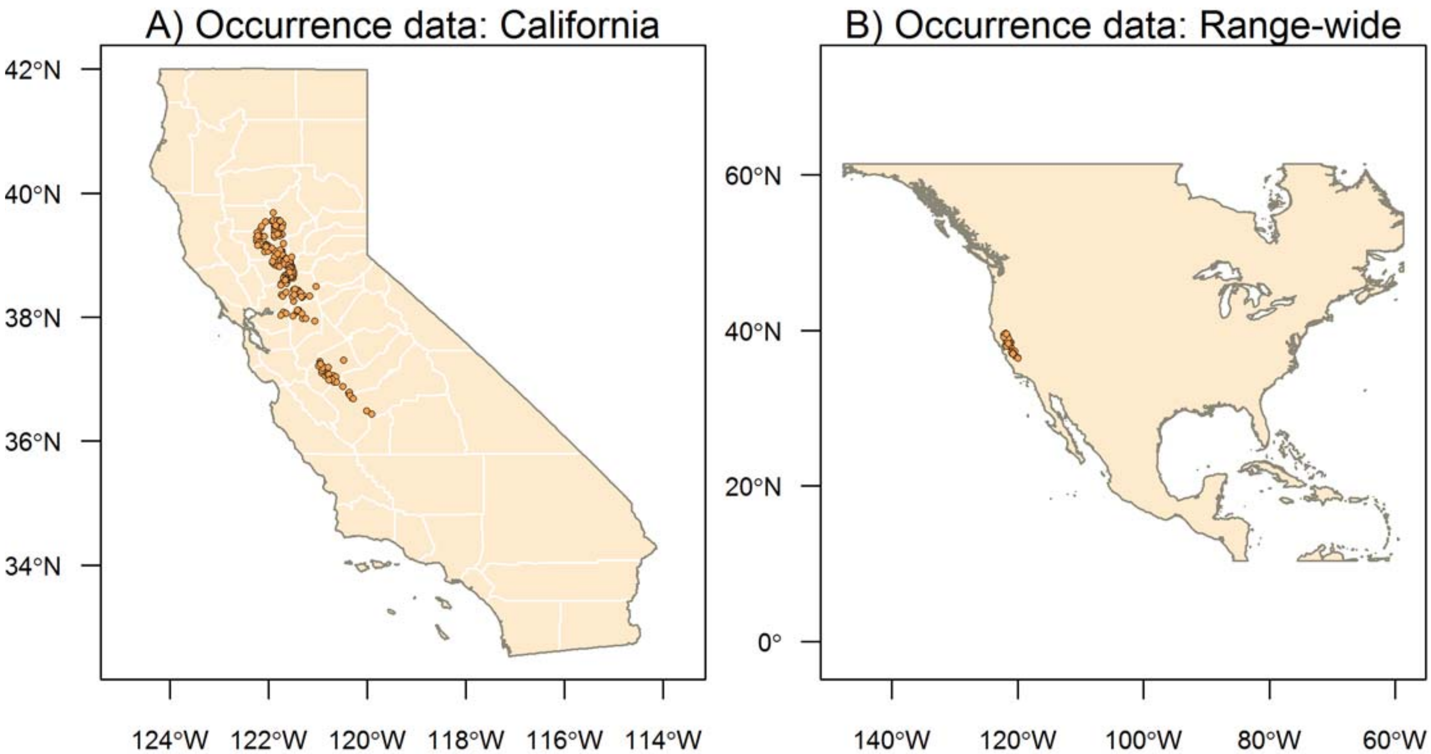
Species Results: *Thamnophis gigas* Giant Garter Snake



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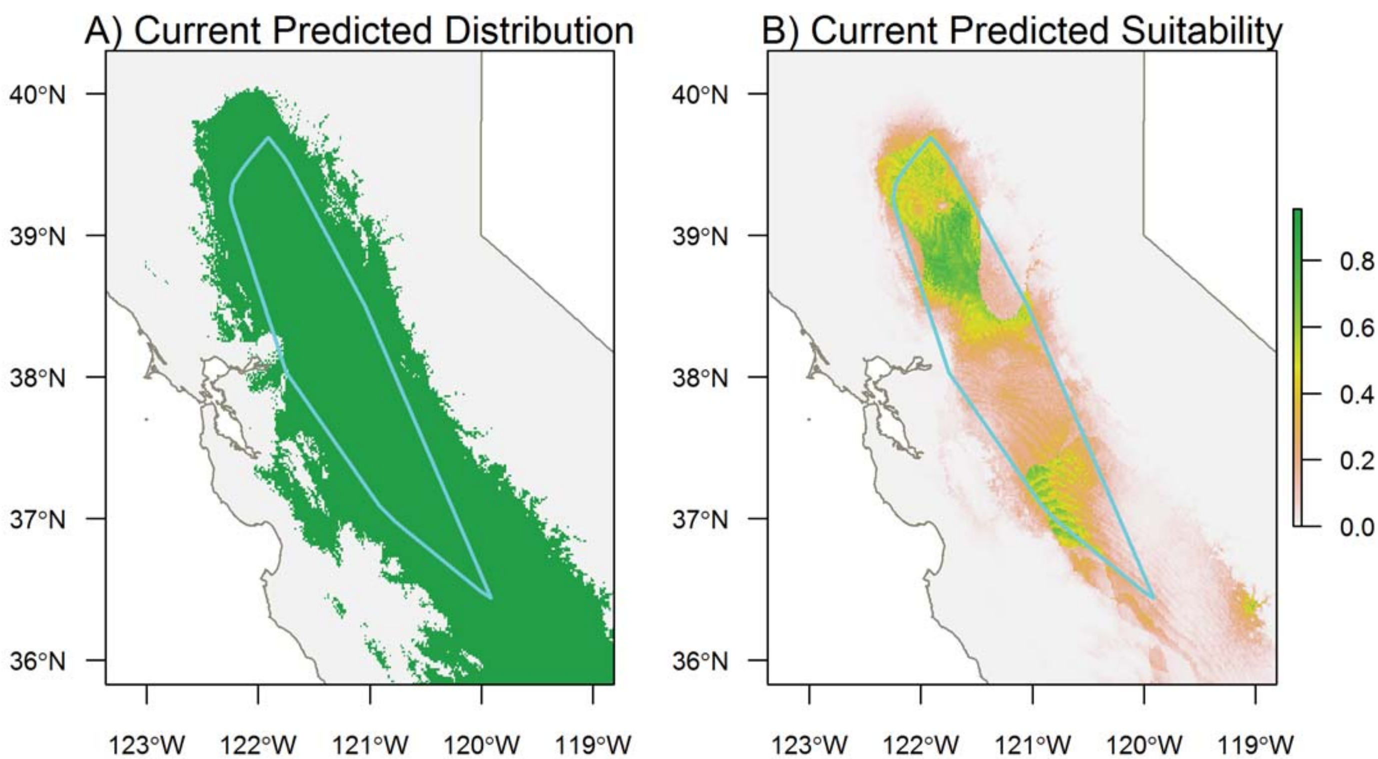

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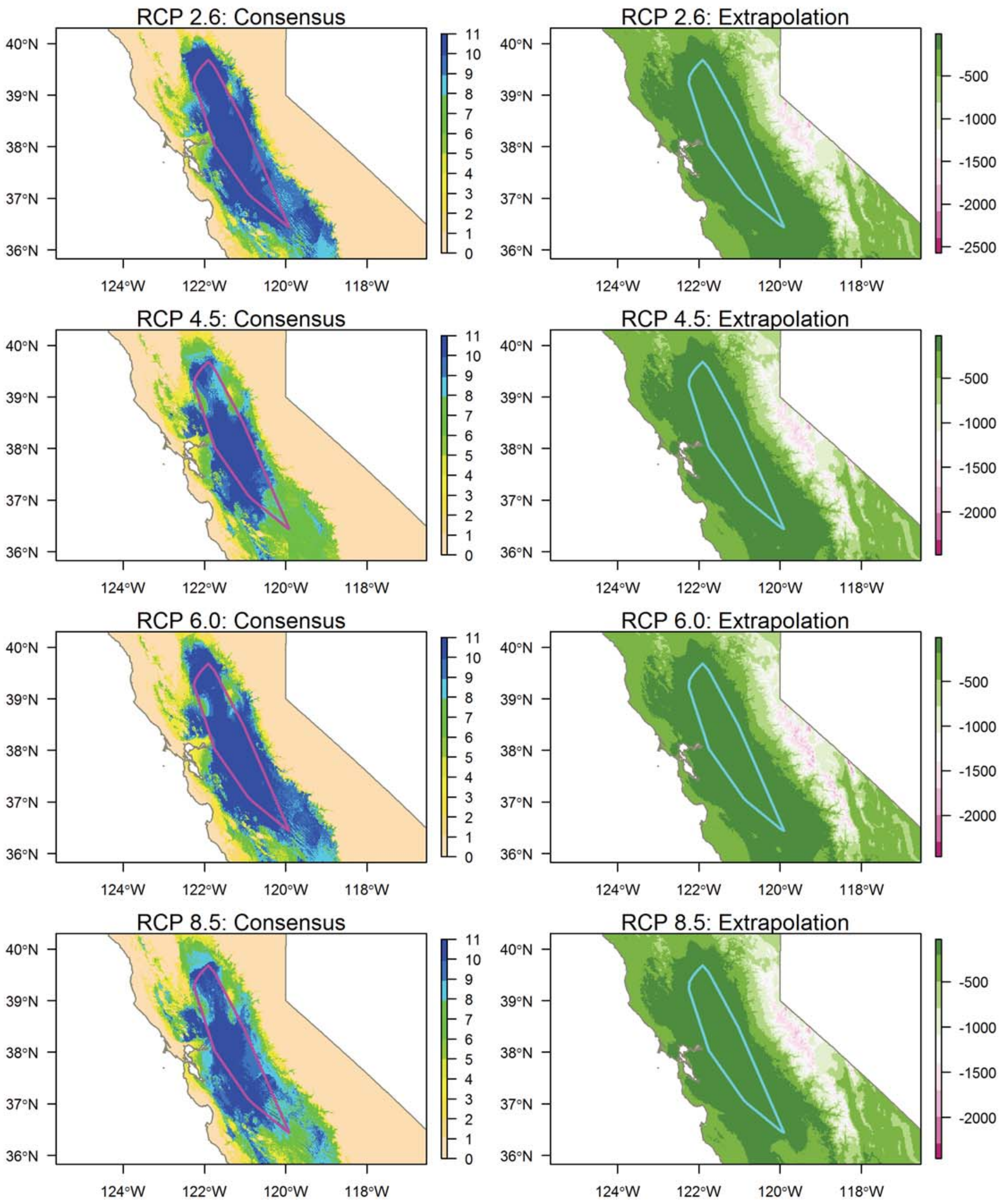
Species Results: *Thamnophis gigas* Giant Garter Snake



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Species Results: *Thamnophis gigas* Giant Garter Snake

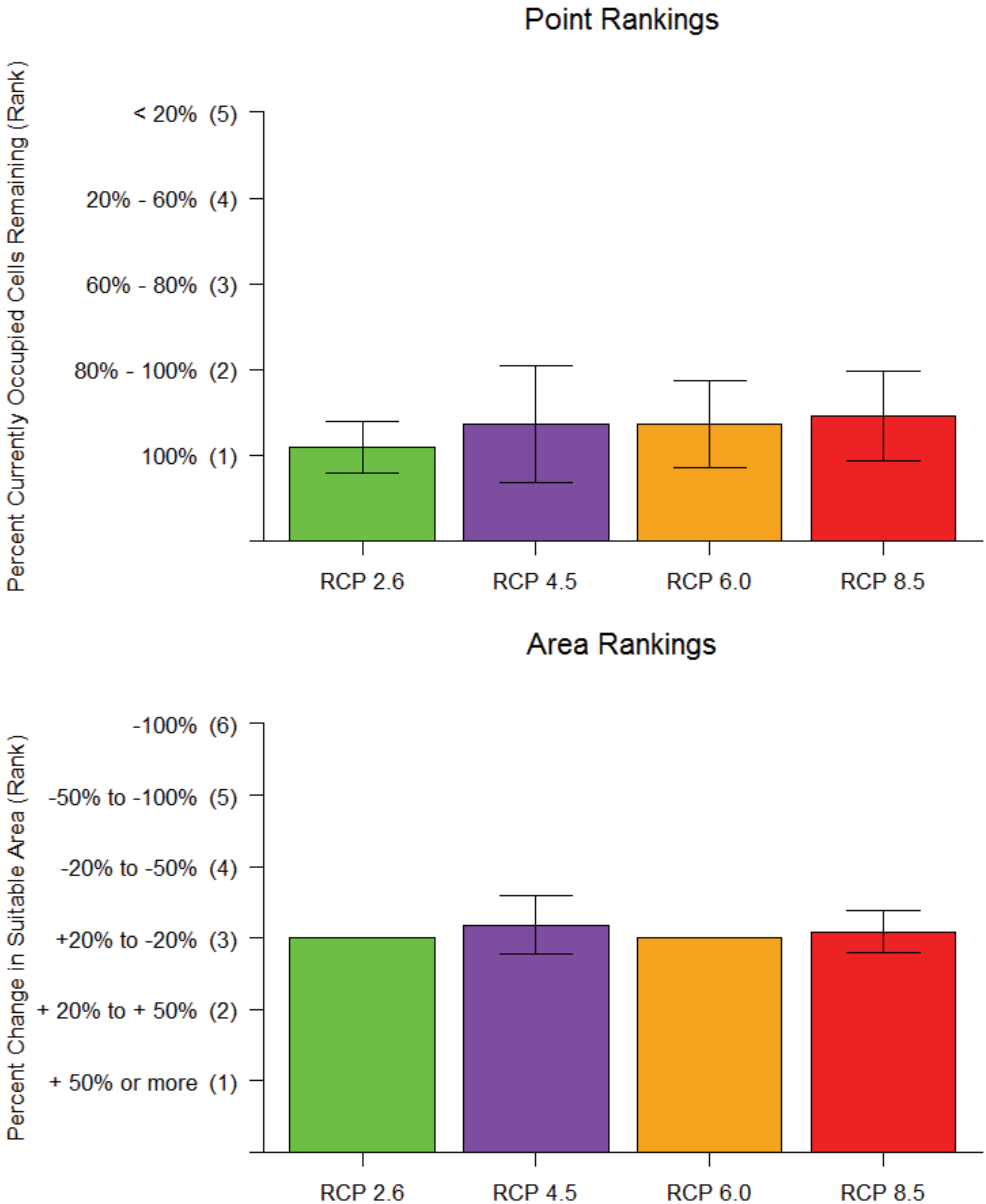


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Thamnophis hammondii* Two-striped Garter Snake

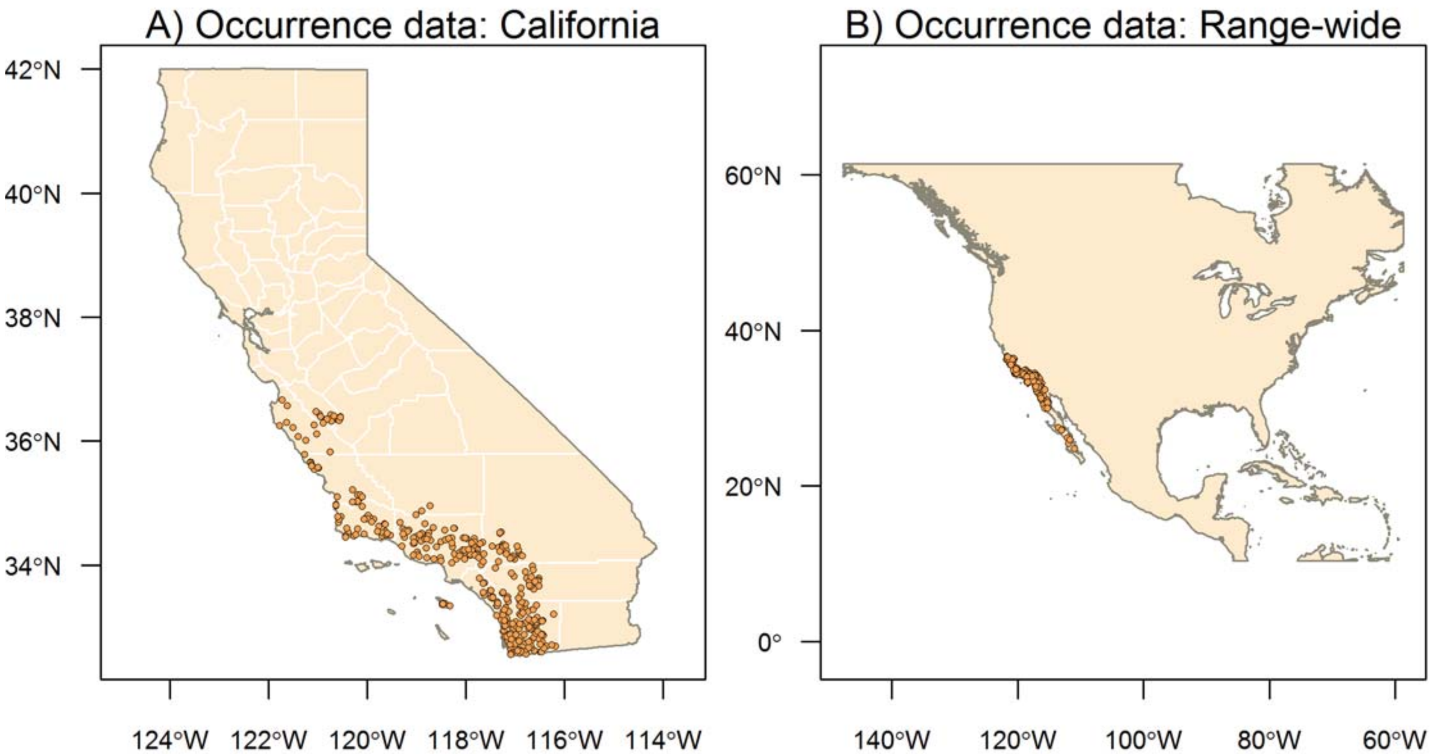


Figure 1. Occurrence data used to build Maxent models.

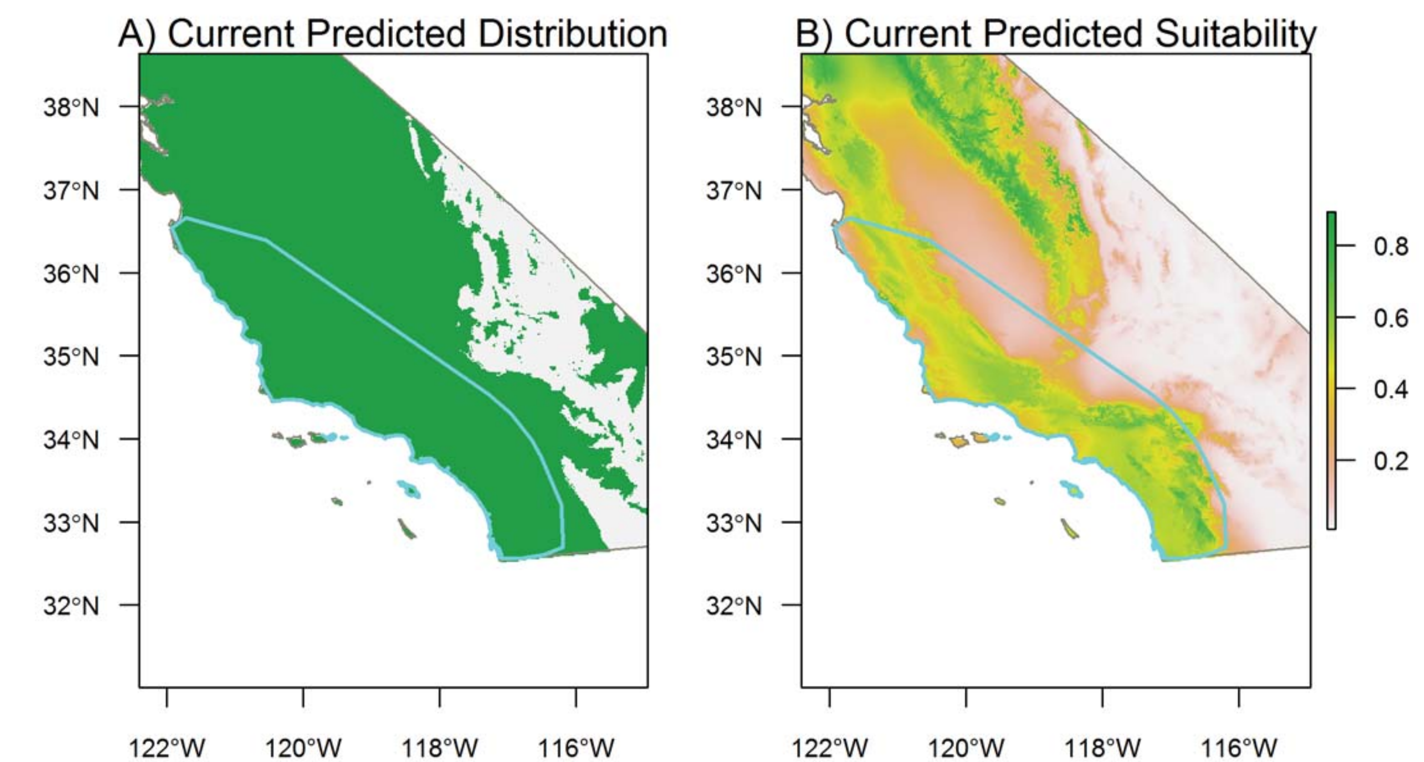
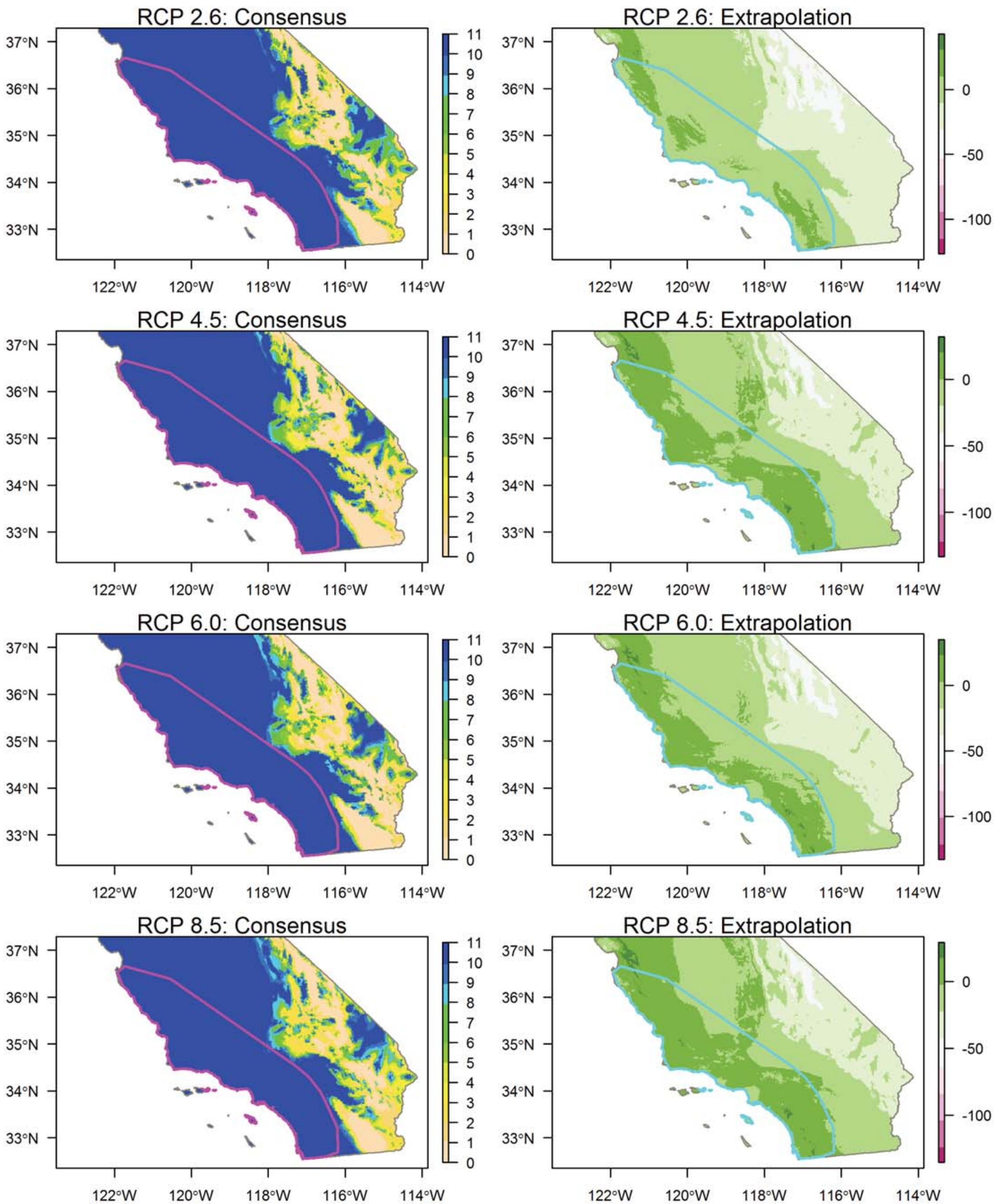


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Thamnophis hammondii* Two-striped Garter Snake



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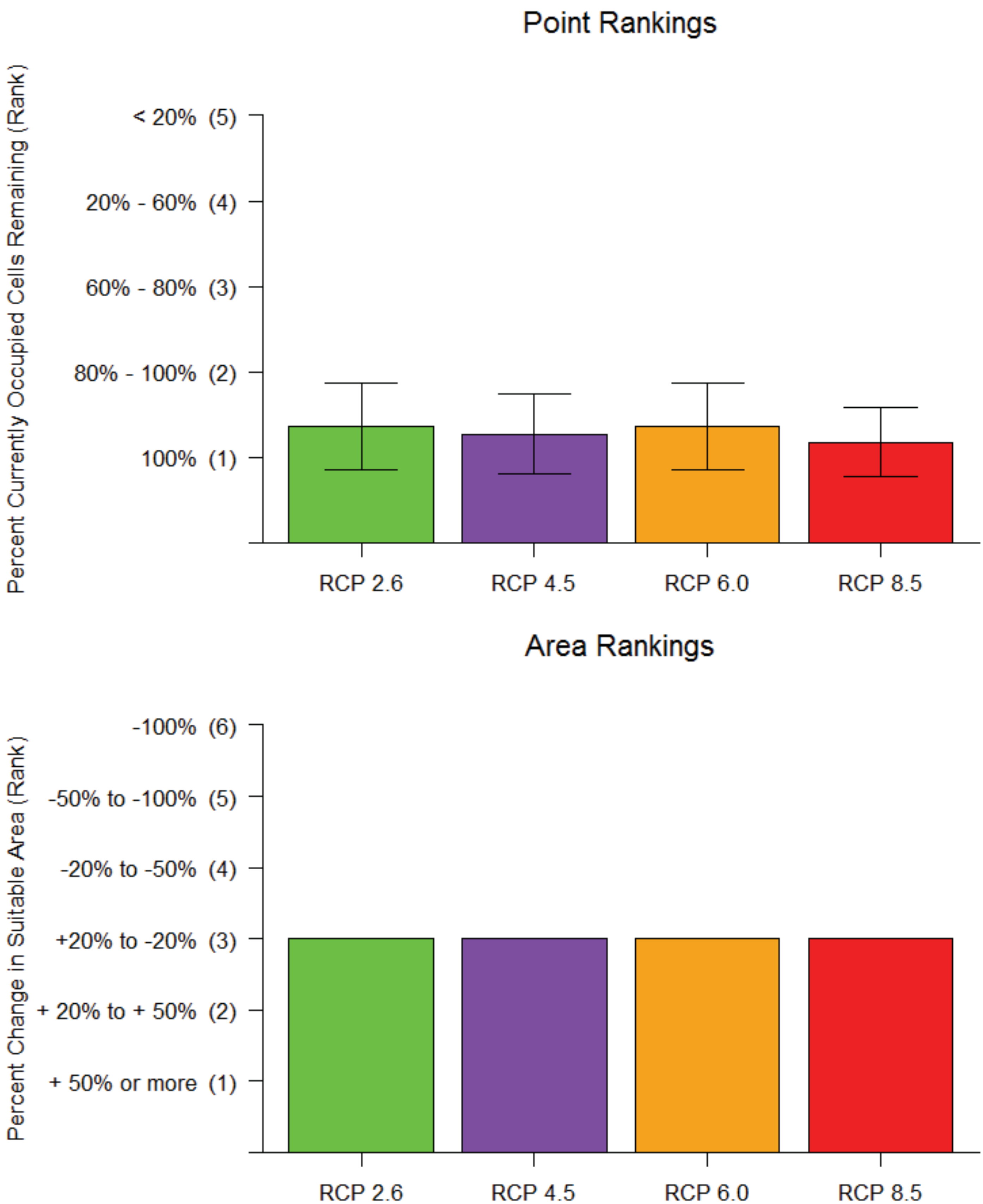
Species Results: *Thamnophis hammondii* Two-striped Garter Snake



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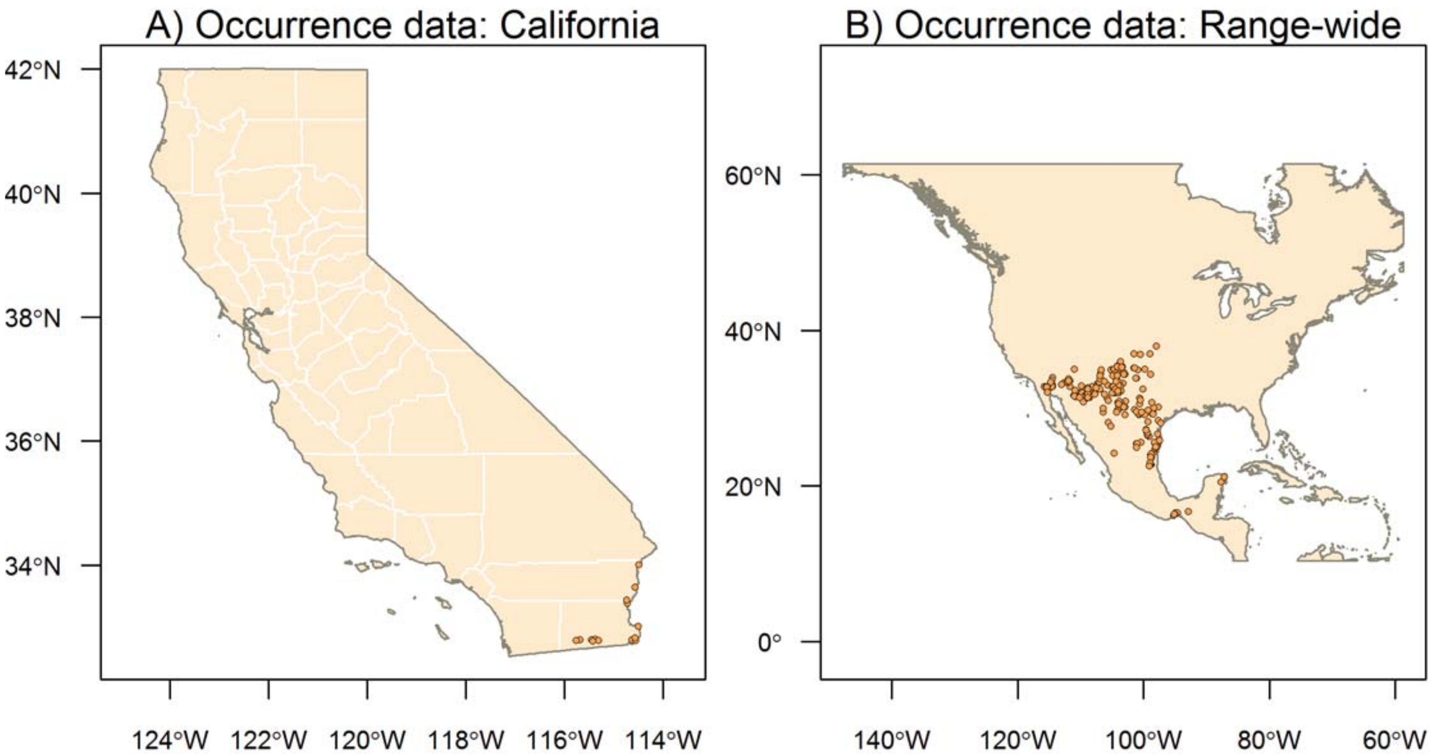
Species Results: *Thamnophis marcianus* Checkered Garter Snake



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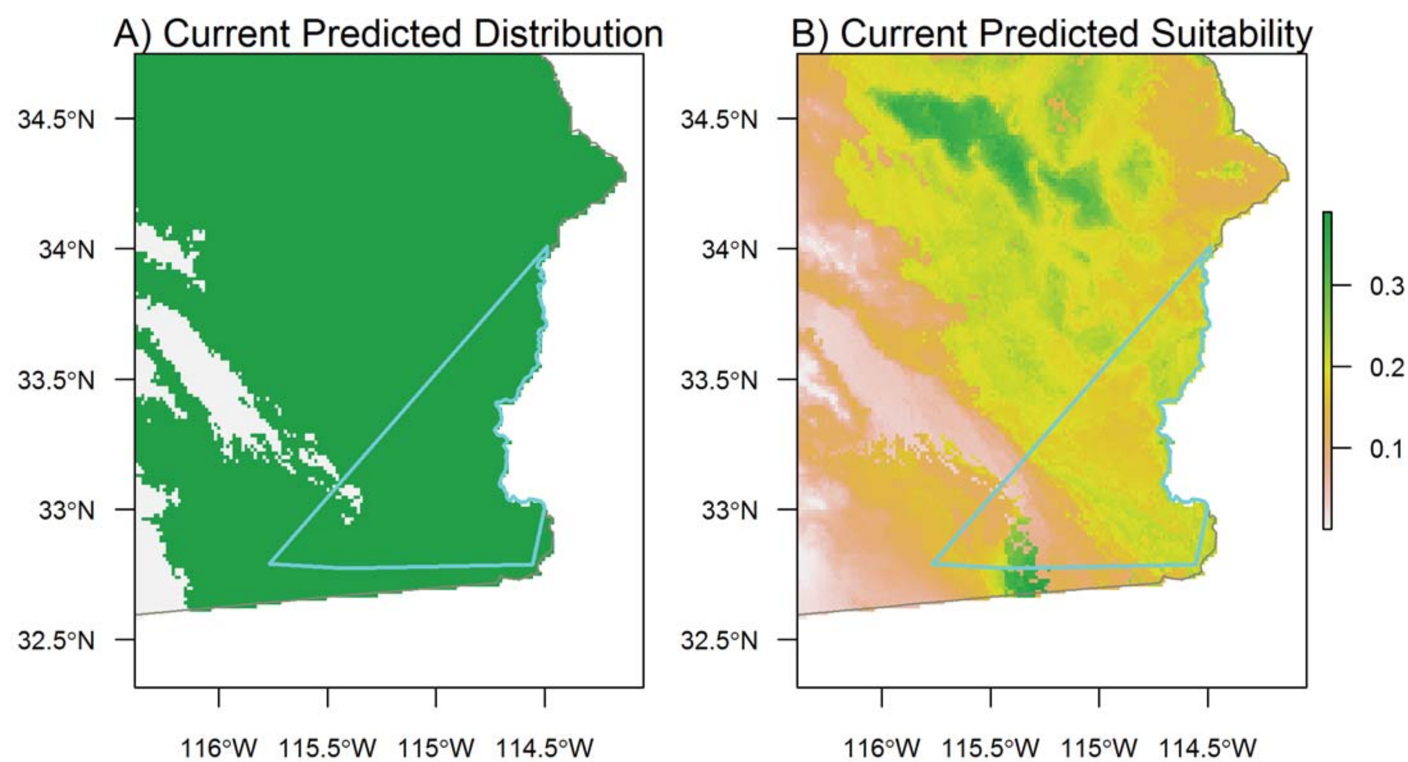

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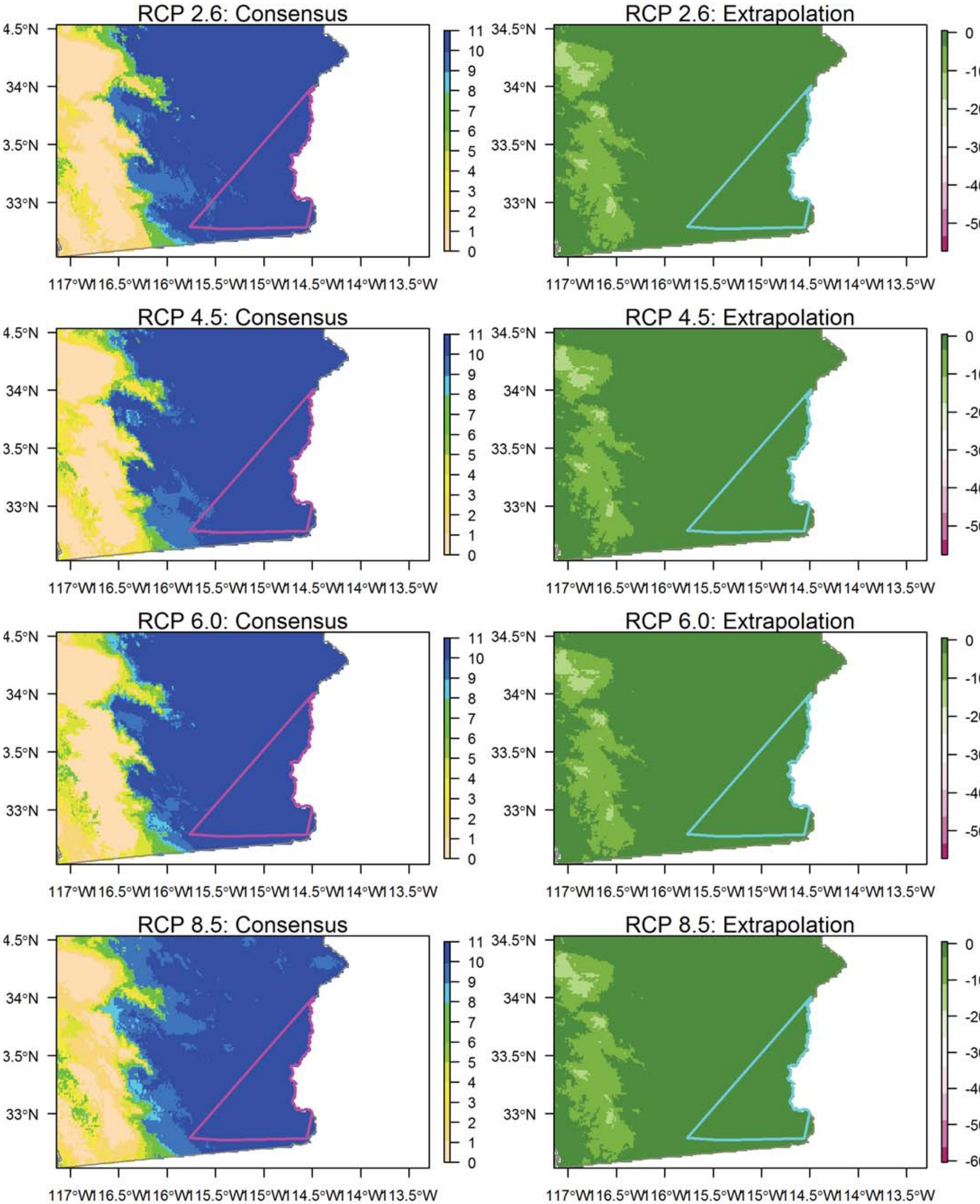
Species Results: *Thamnophis marcianus* Checkered Garter Snake



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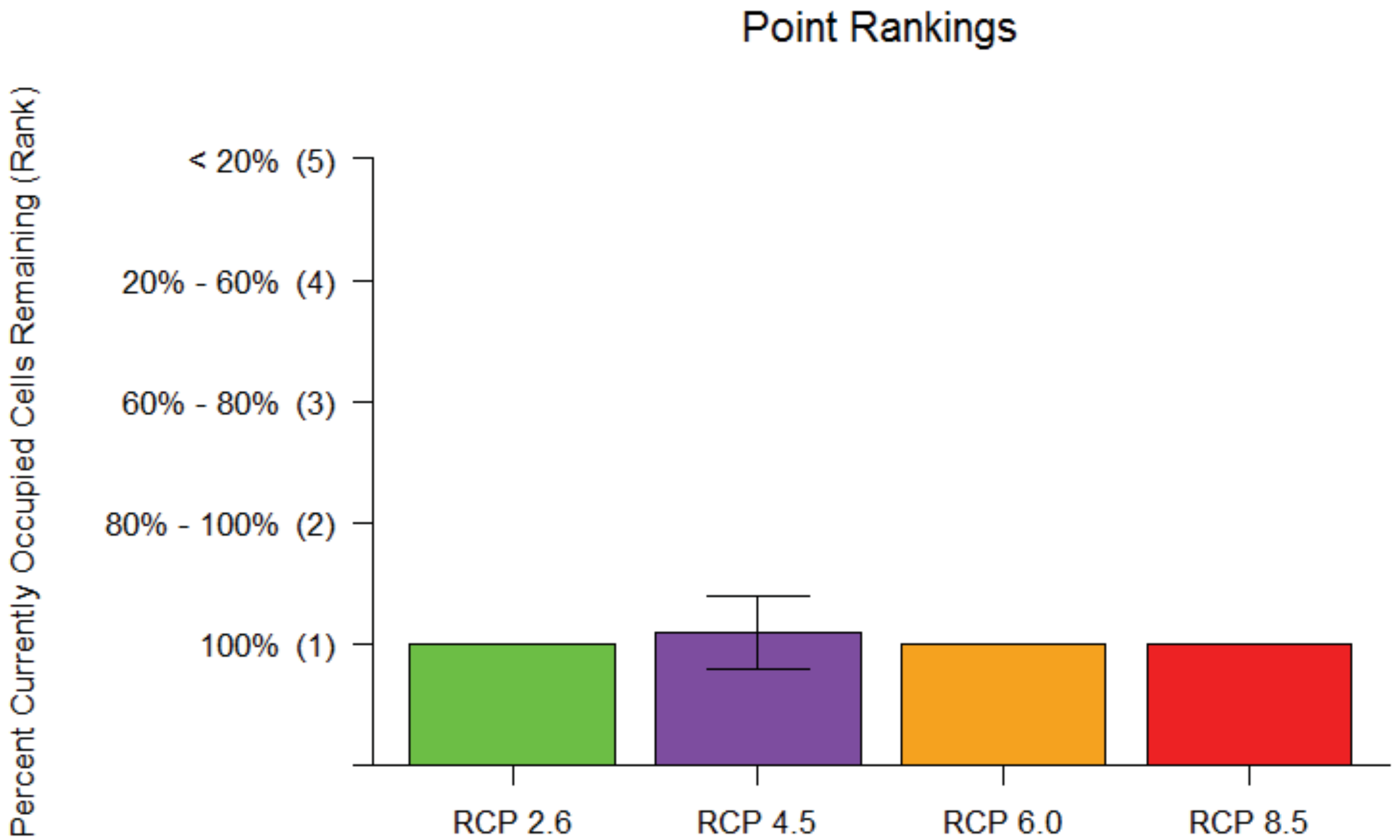
Species Results: *Thamnophis marcianus* Checkered Garter Snake



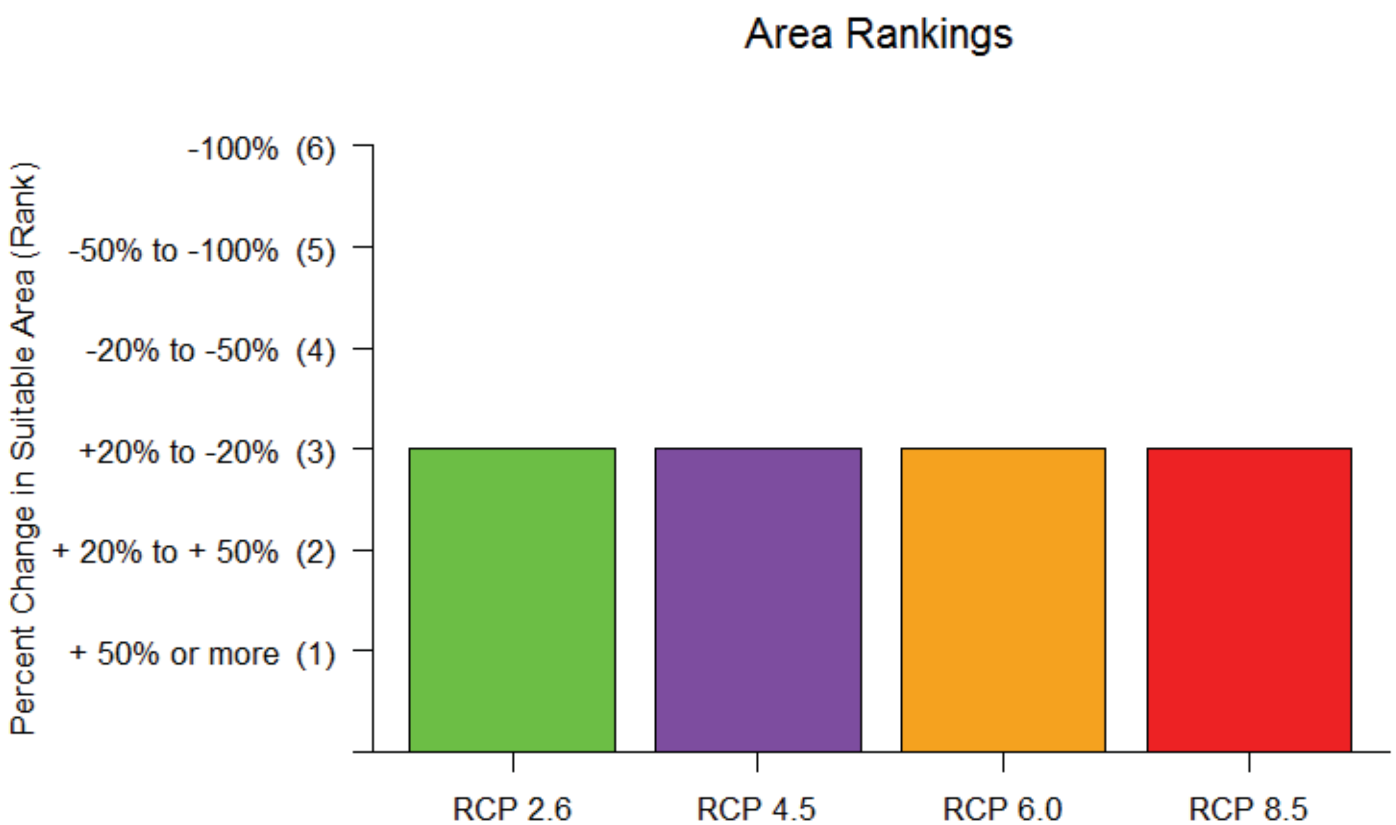
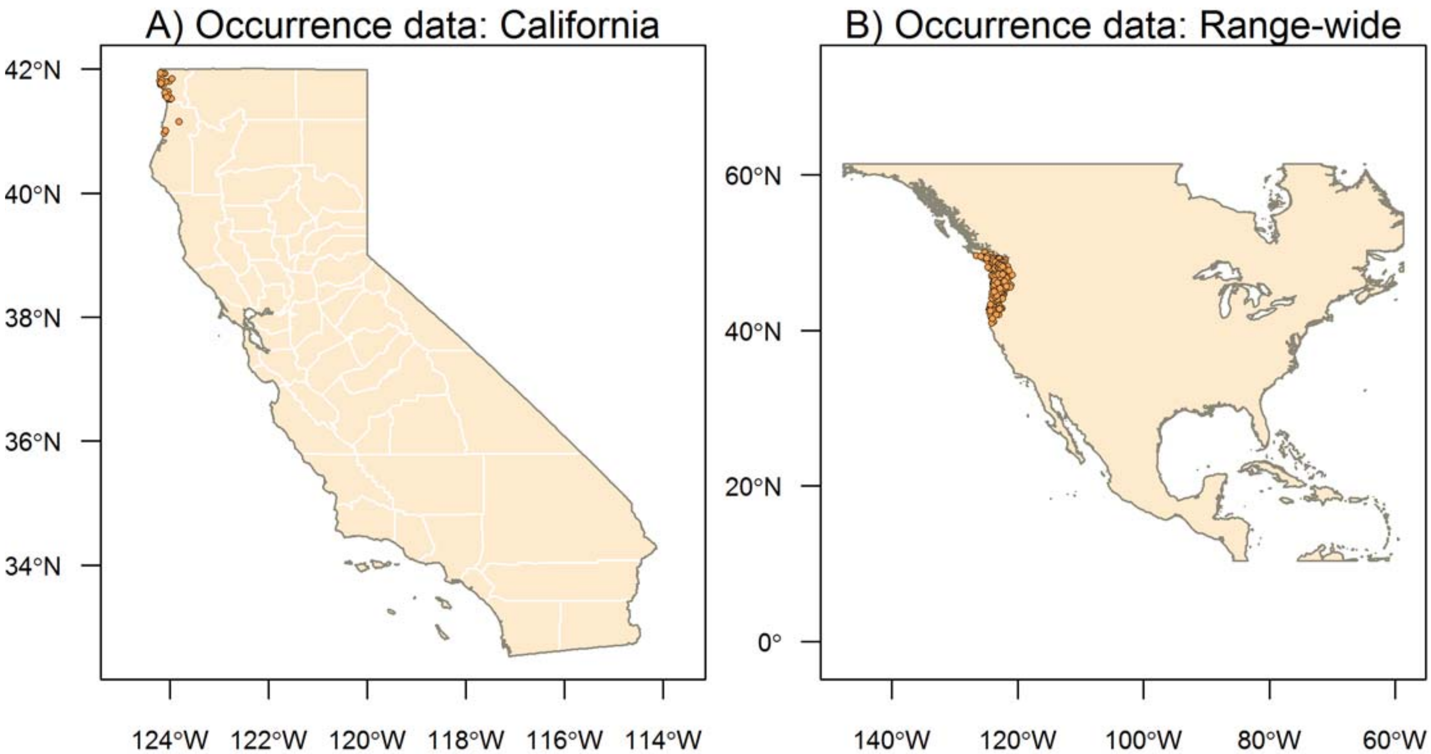


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Thamnophis ordinoides* Northwestern Garter Snake



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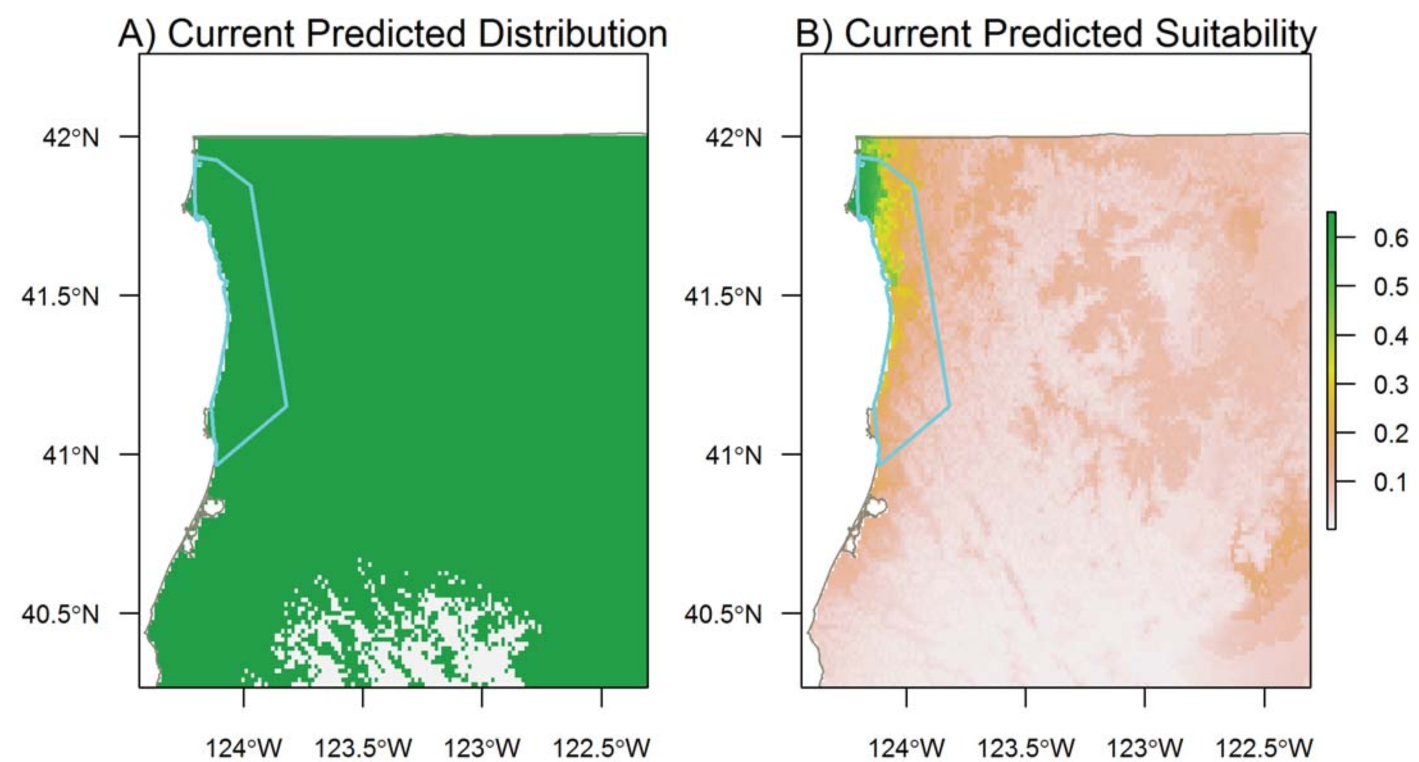

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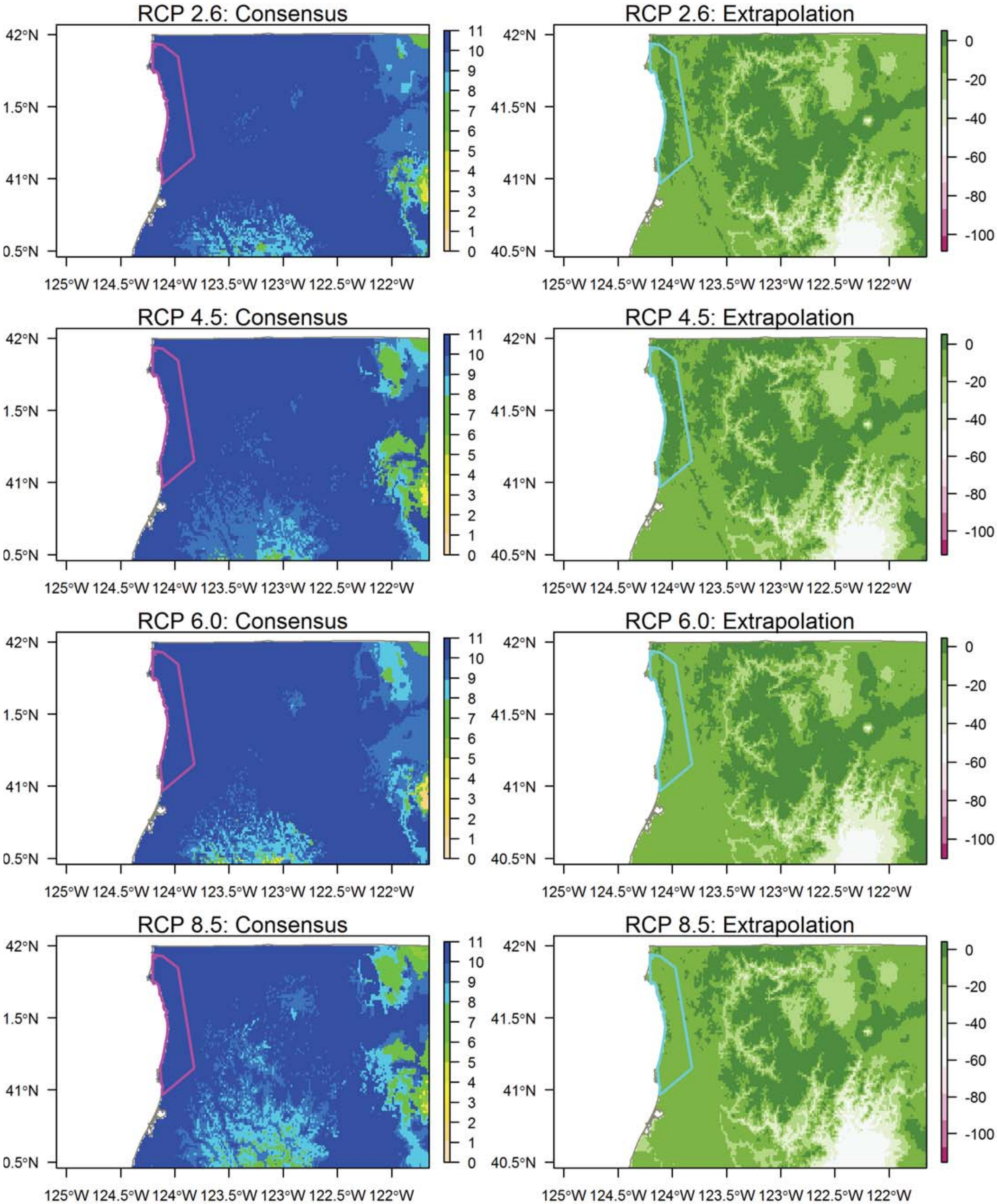

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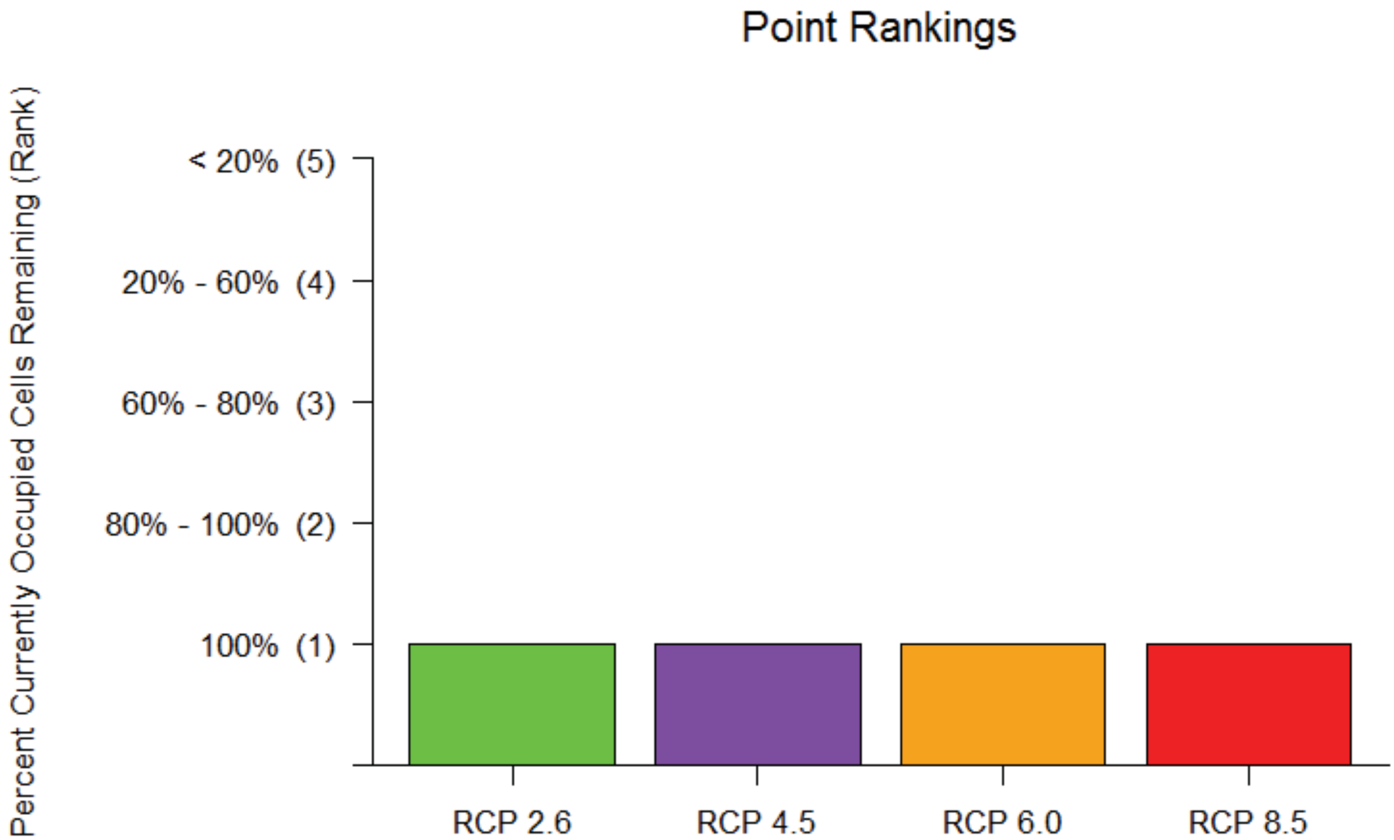
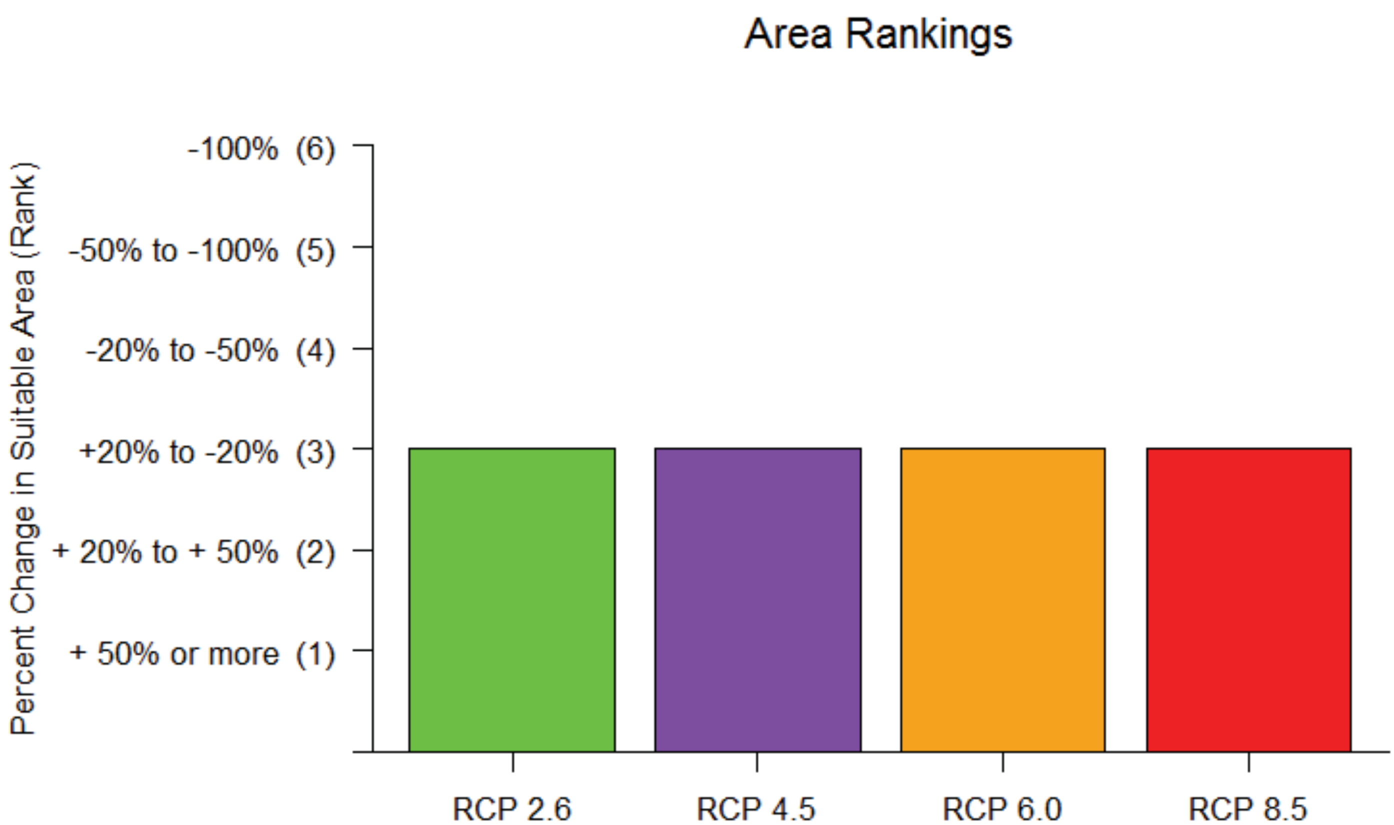
Species Results: *Thamnophis ordinoides* Northwestern Garter Snake





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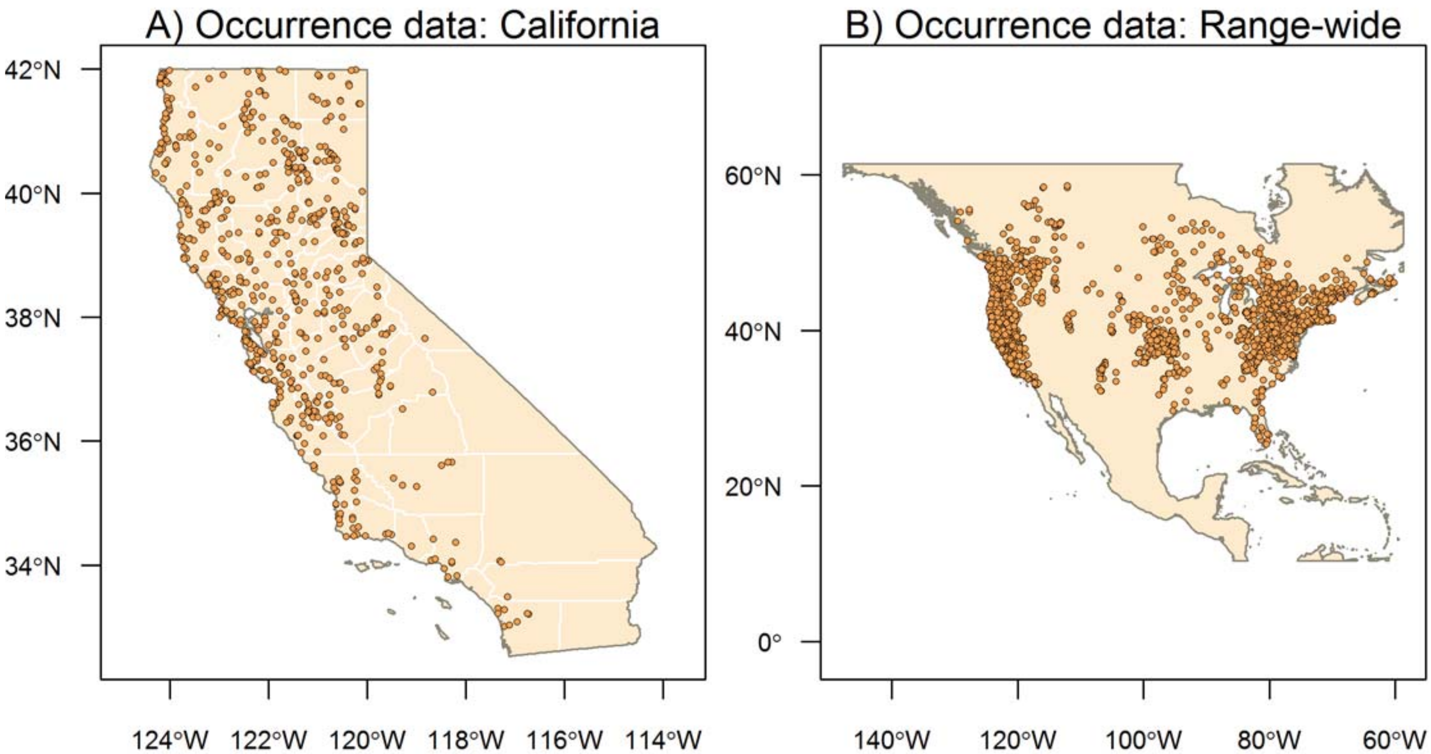
Species Results: *Thamnophis sirtalis* Common Garter Snake



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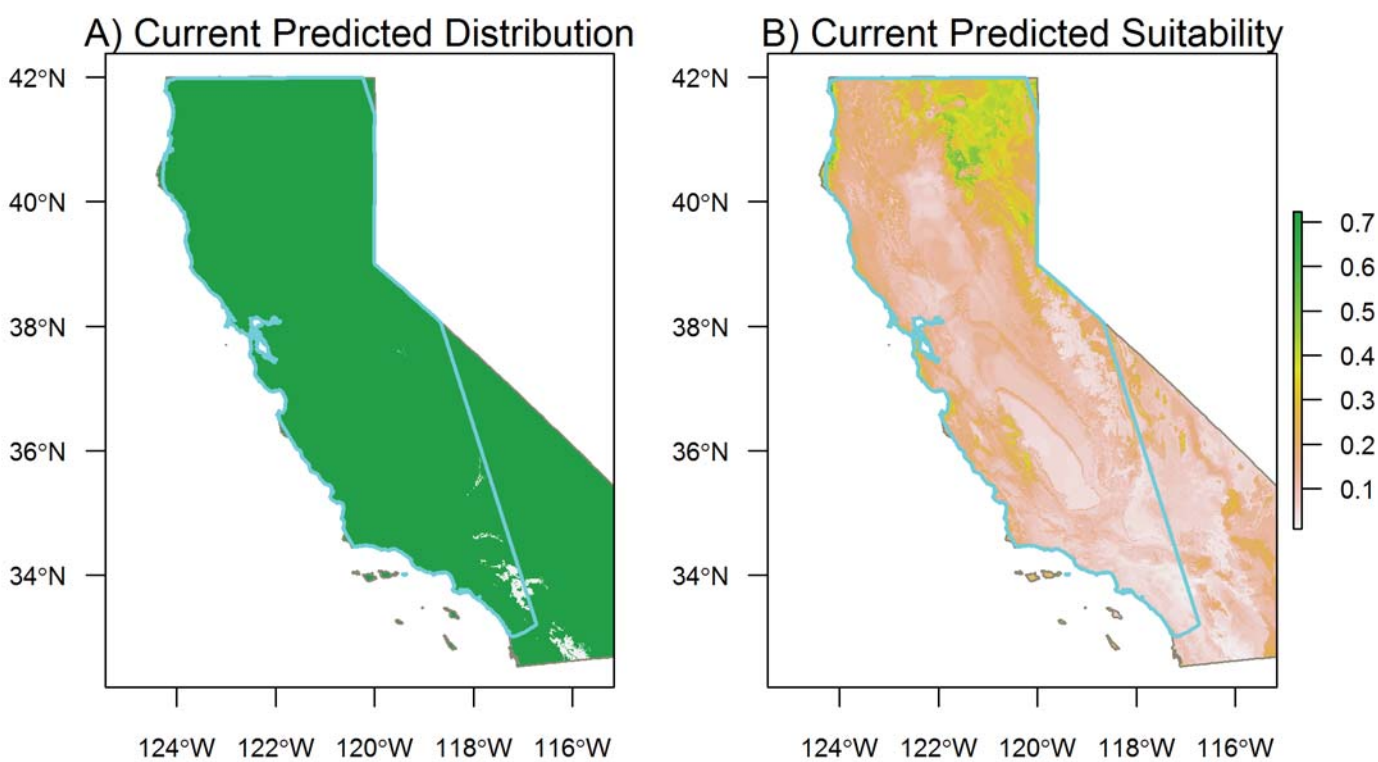

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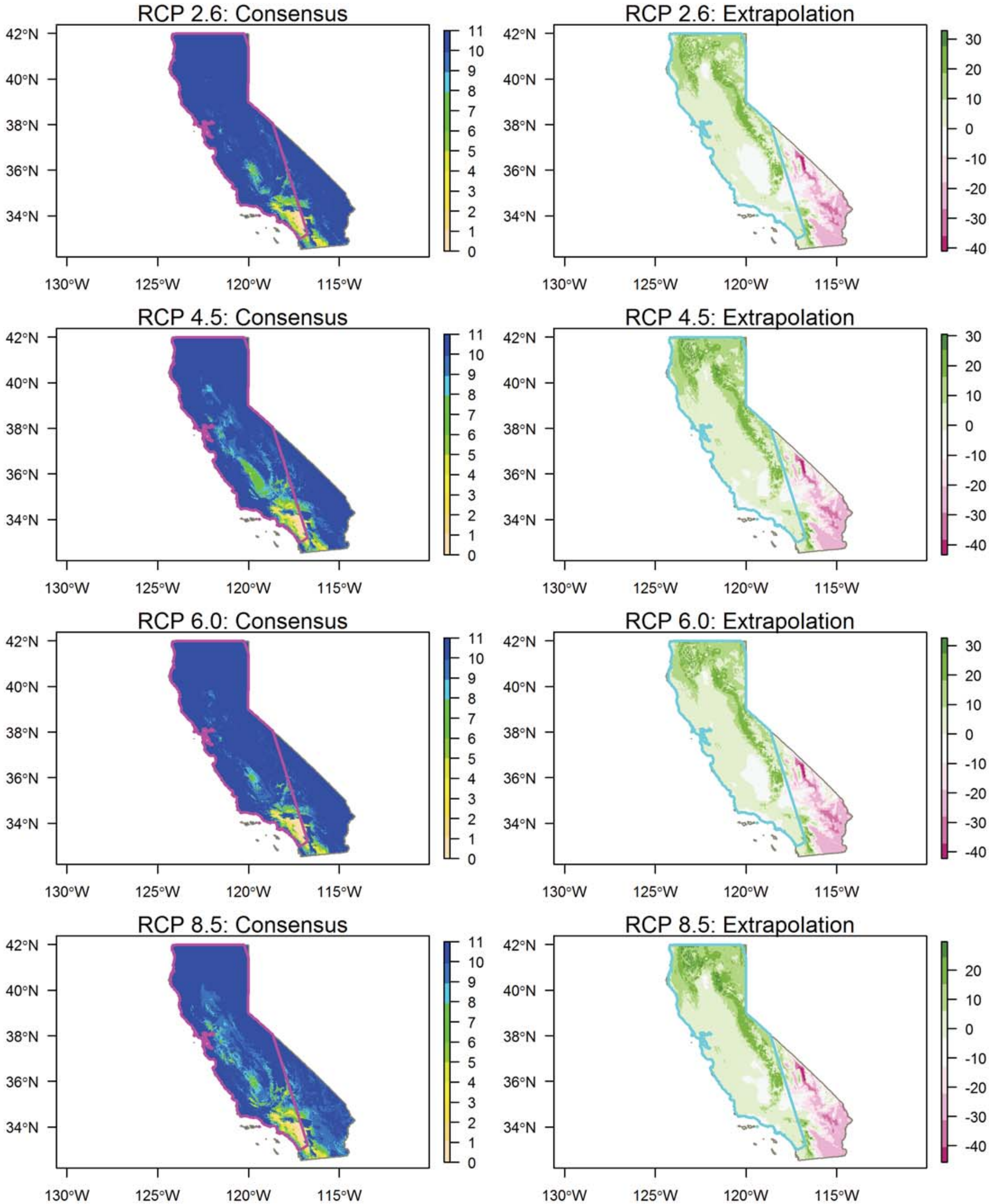
Species Results: *Thamnophis sirtalis* Common Garter Snake



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Species Results: *Thamnophis sirtalis* Common Garter Snake

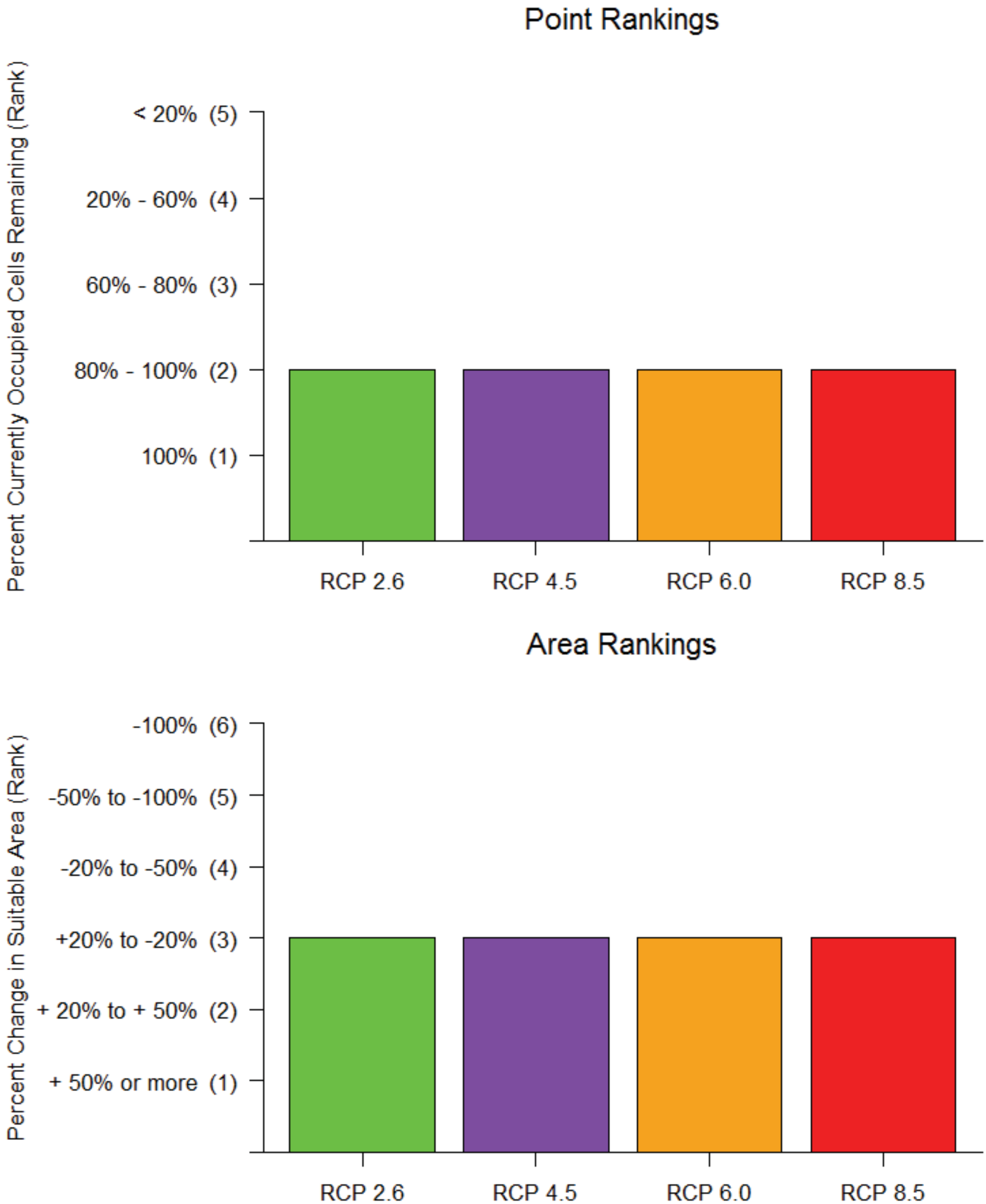
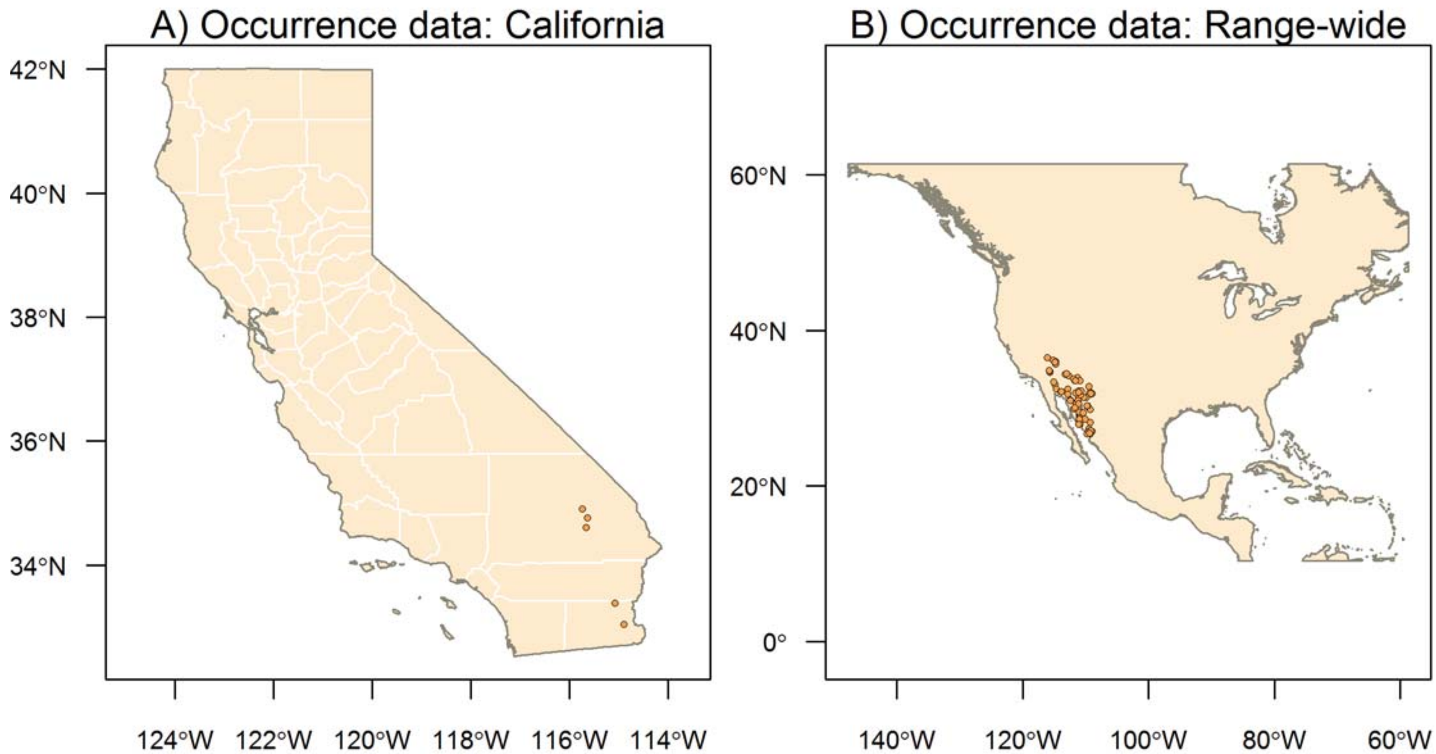


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Trimorphodon lambda* Sonoran Lyre Snake



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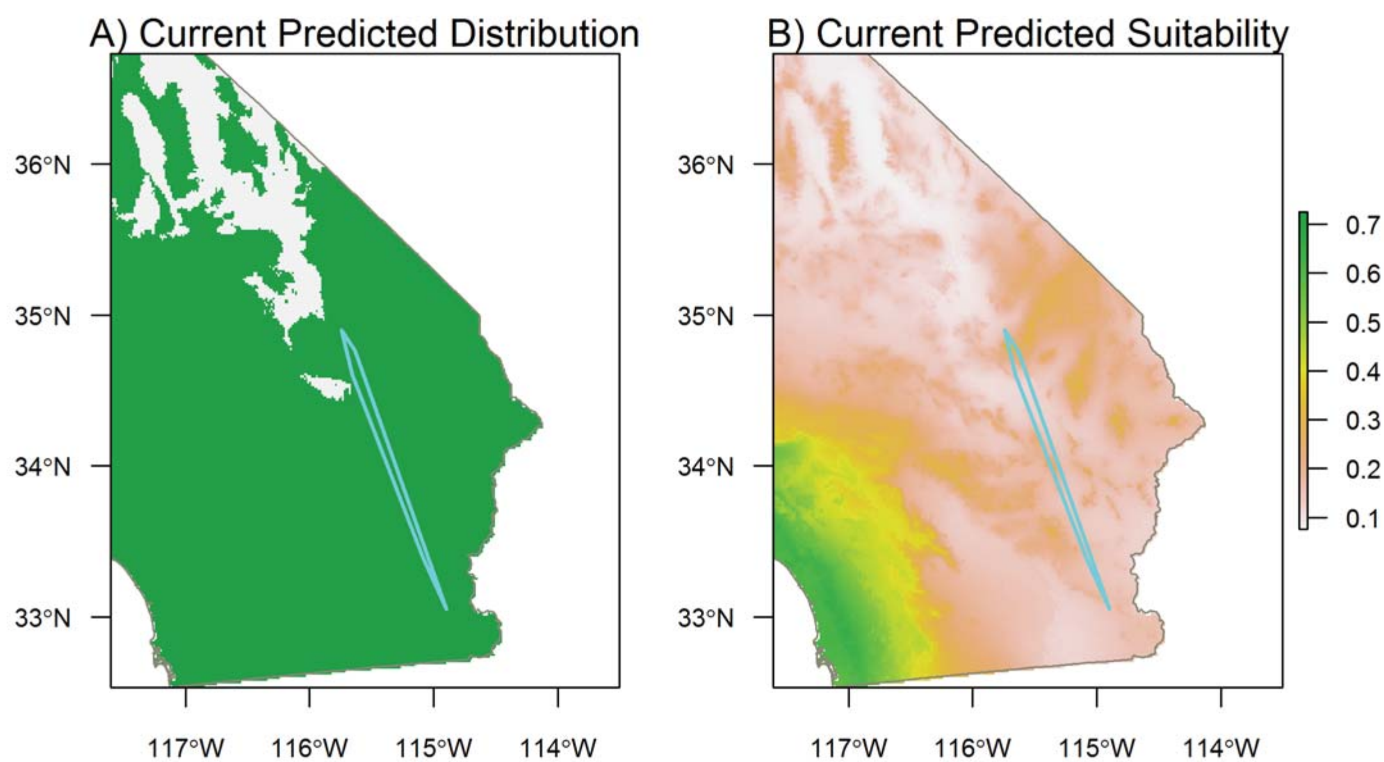

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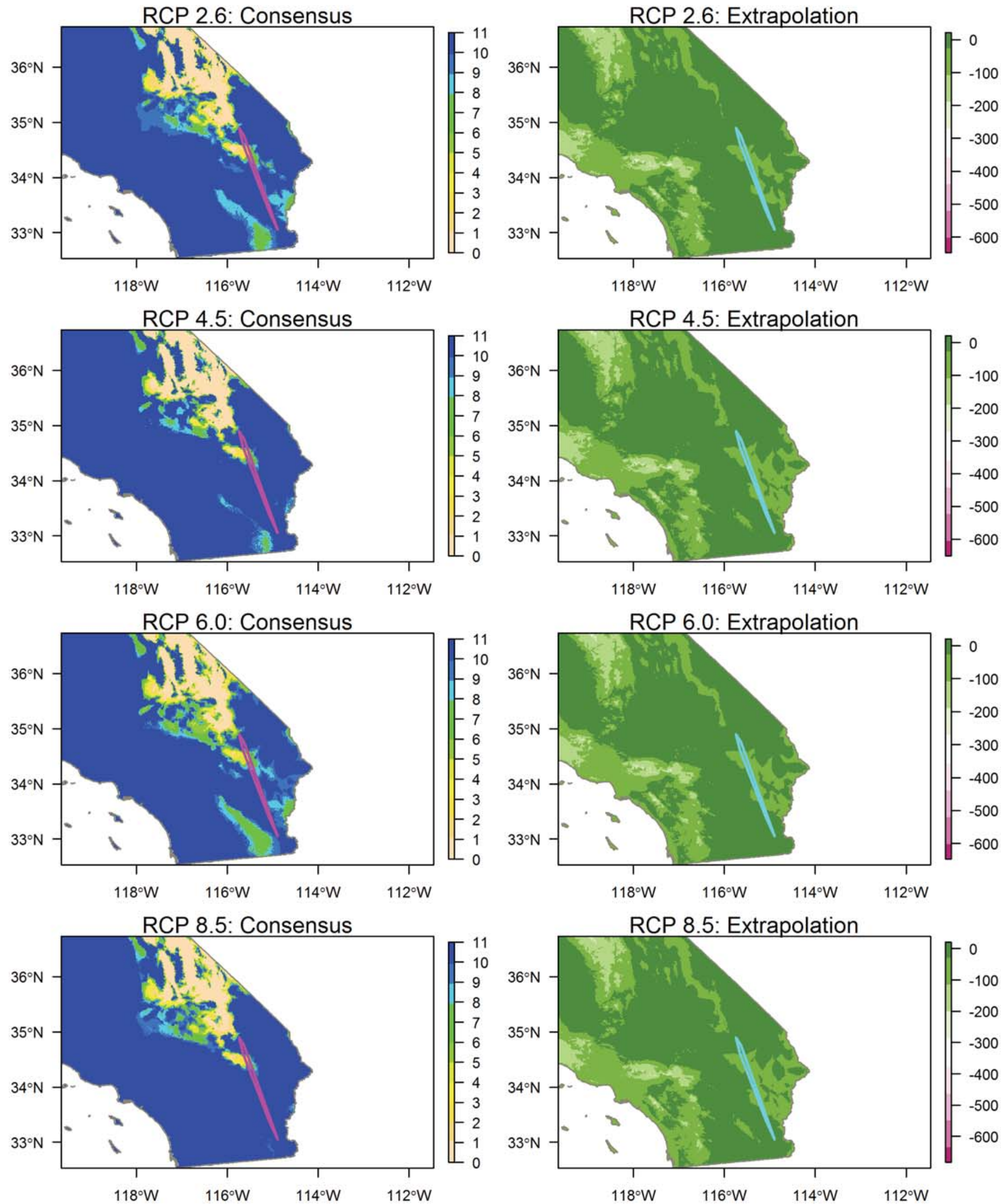
Species Results: *Trimorphodon lambda* Sonoran Lyre Snake



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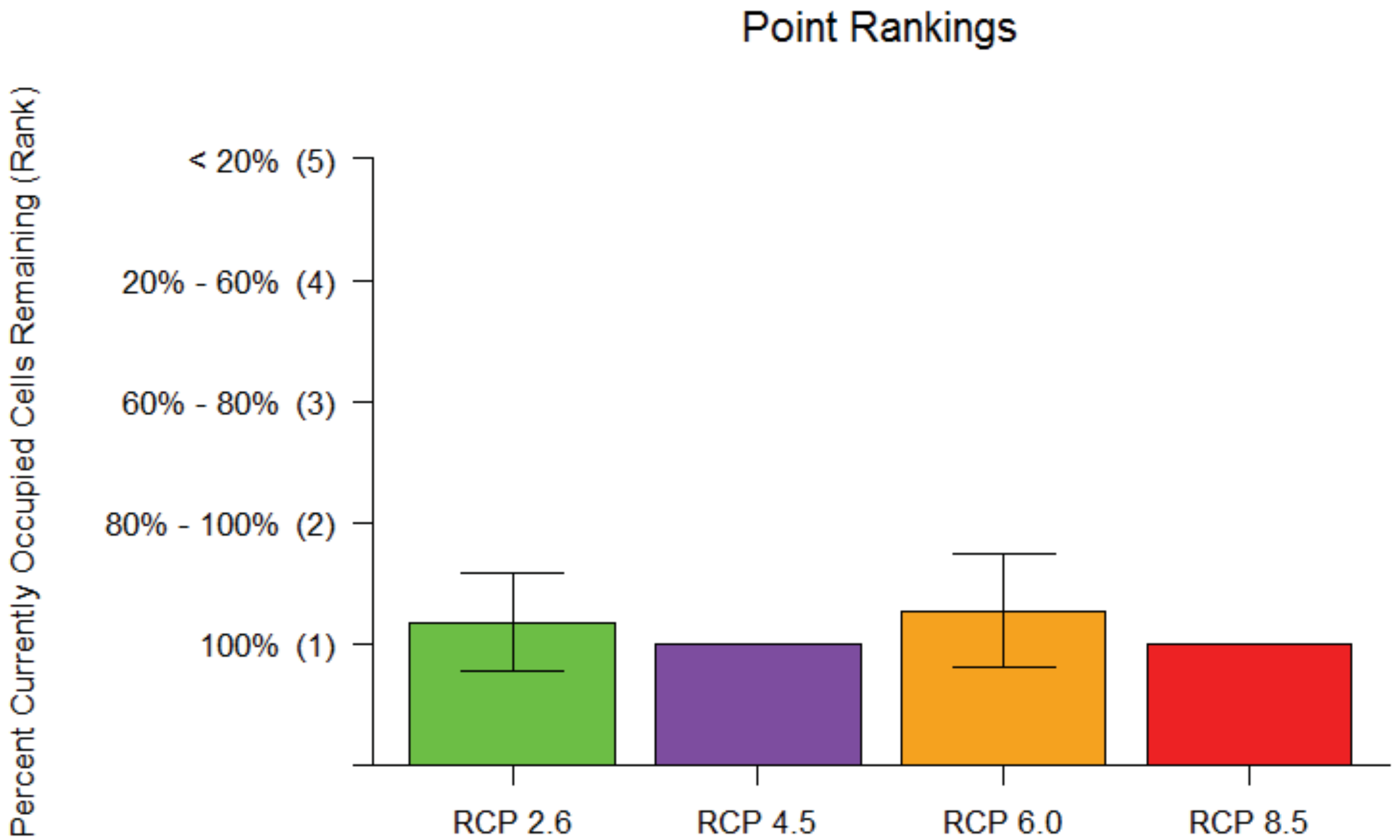

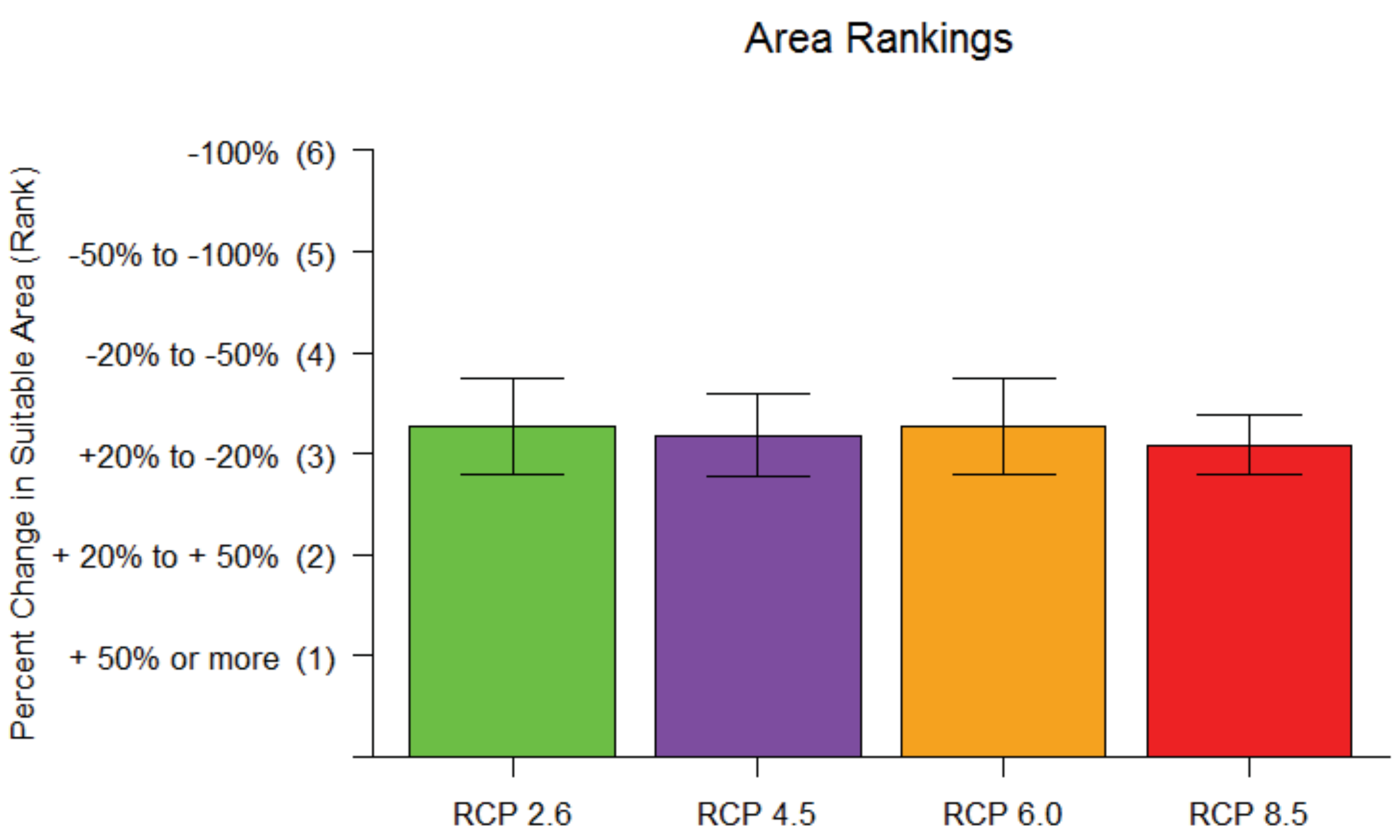

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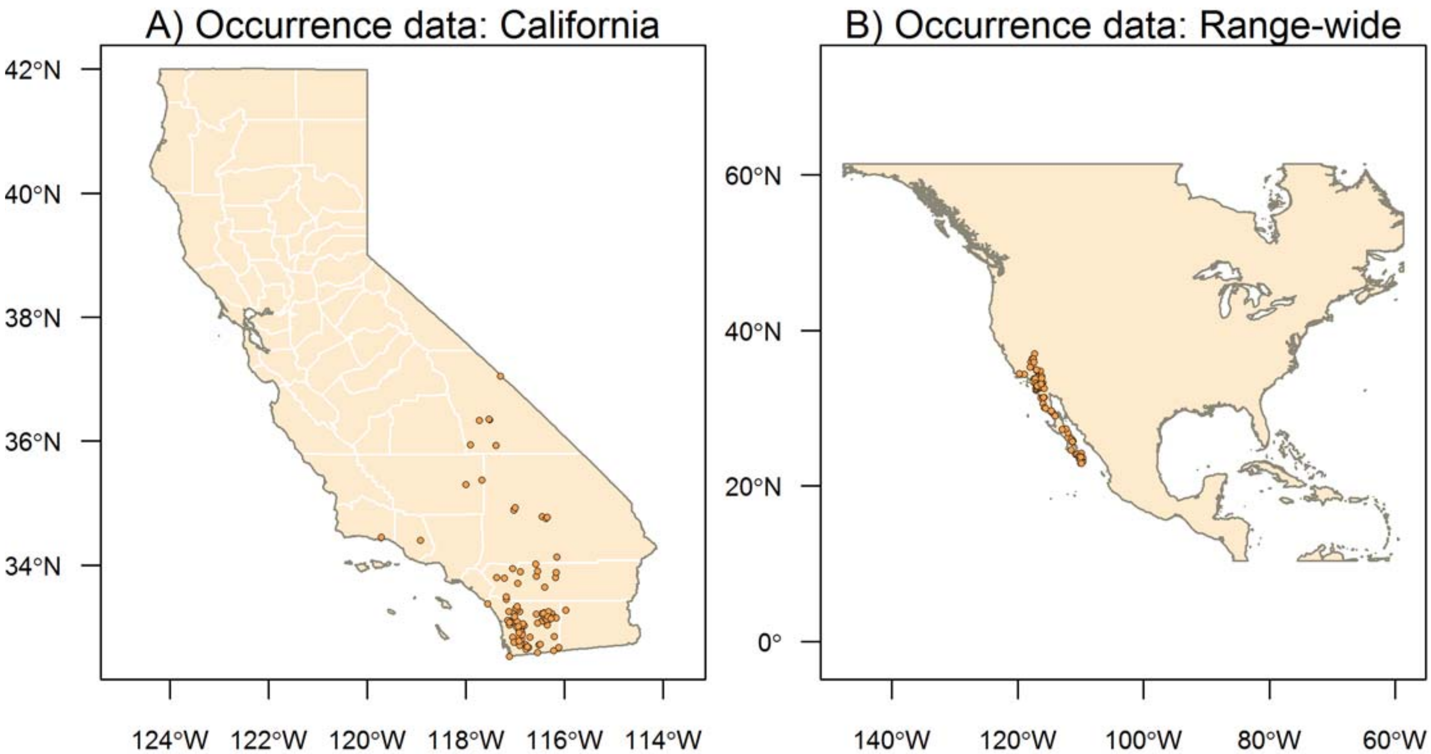
Species Results: *Trimorphodon lyrophanes* Peninsular Lyre Snake



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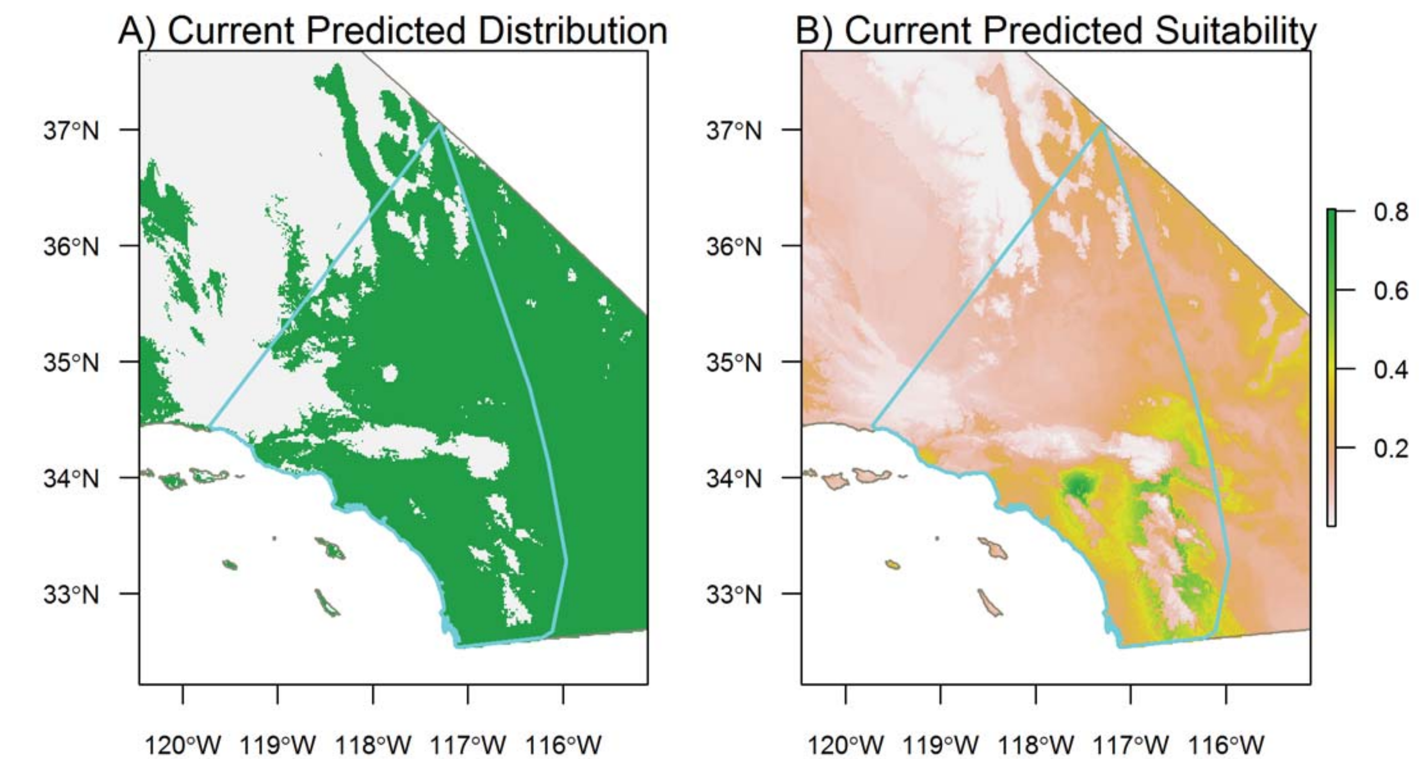

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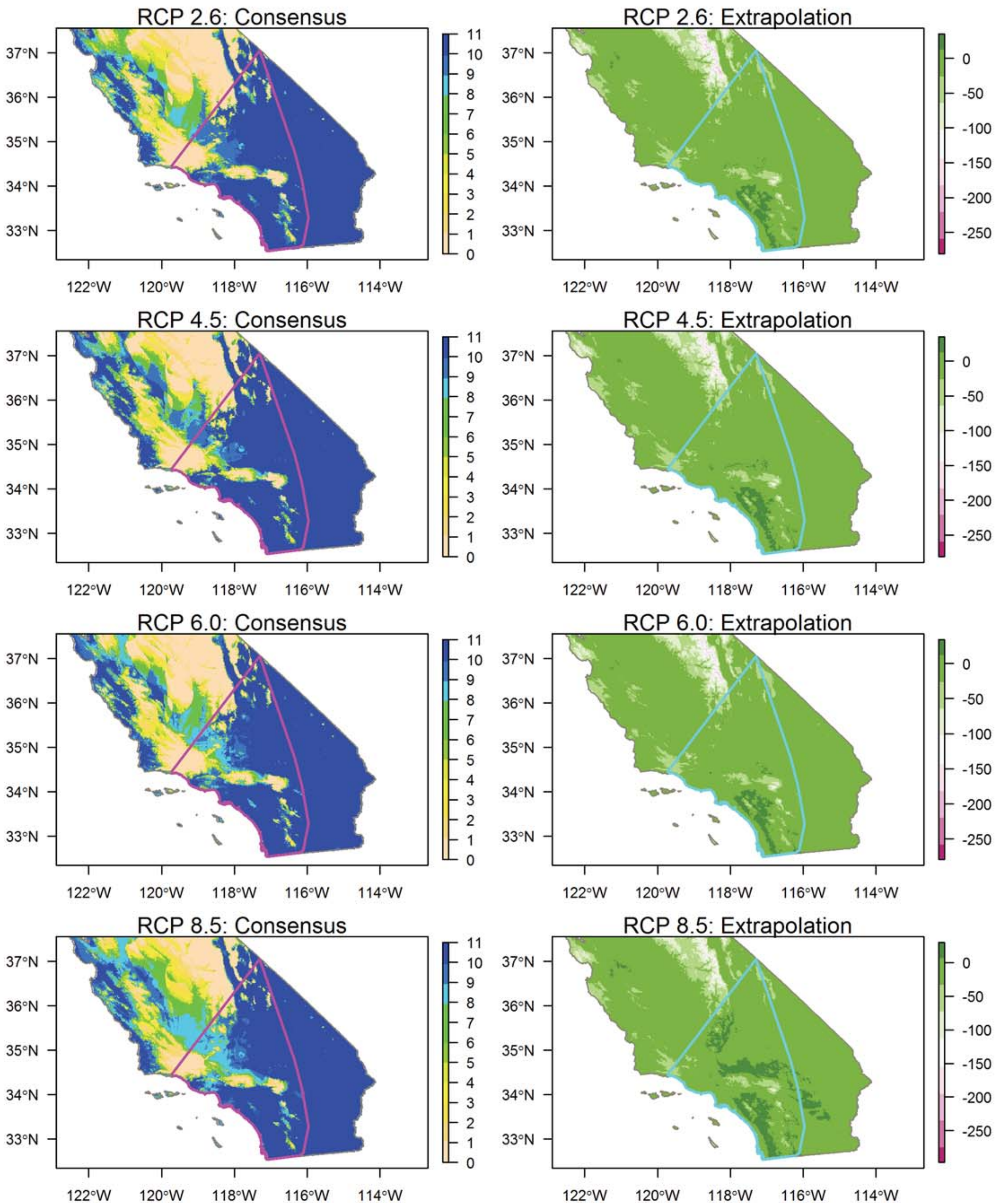
Species Results: *Trimorphodon lyrophanes* Peninsular Lyre Snake



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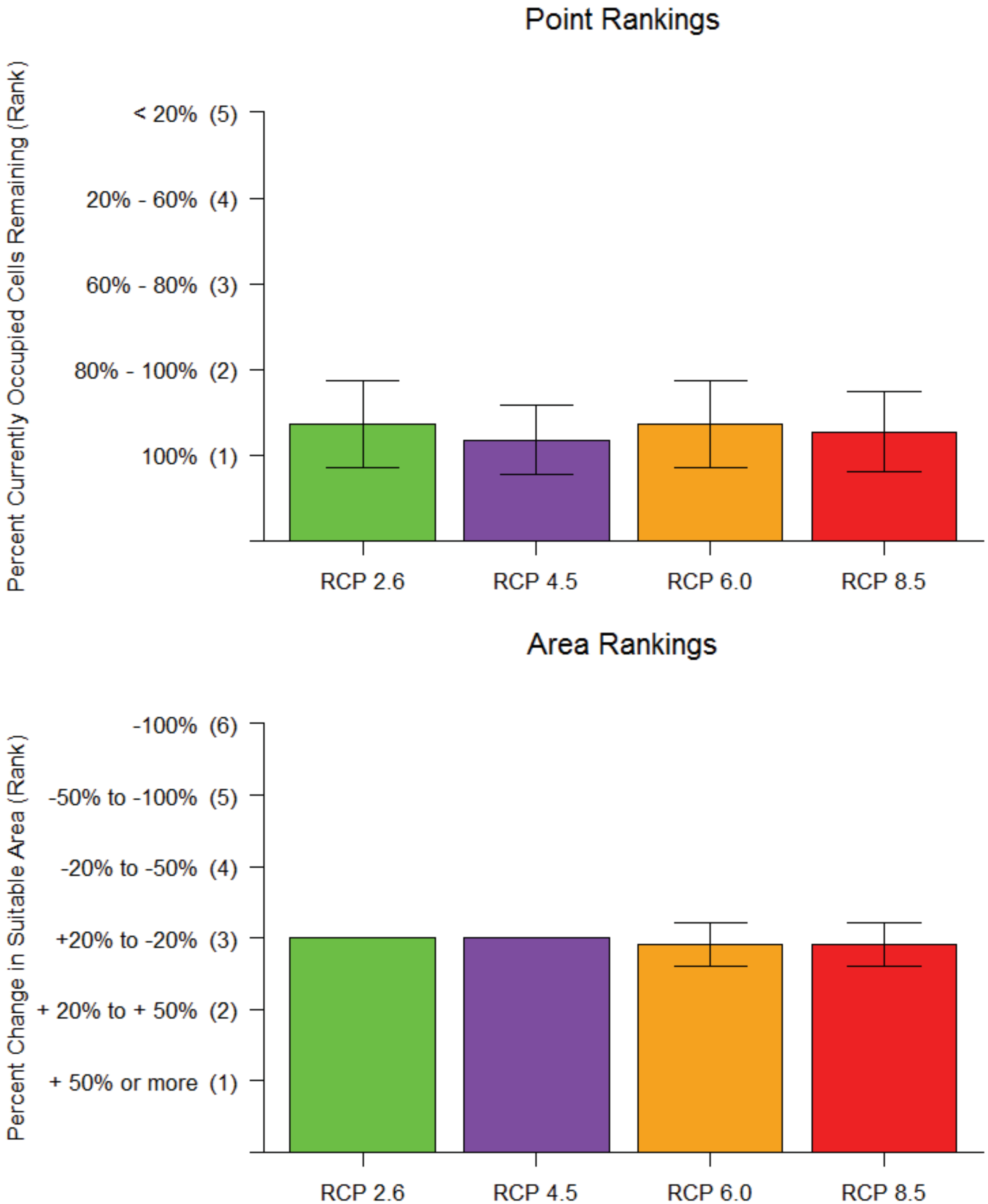

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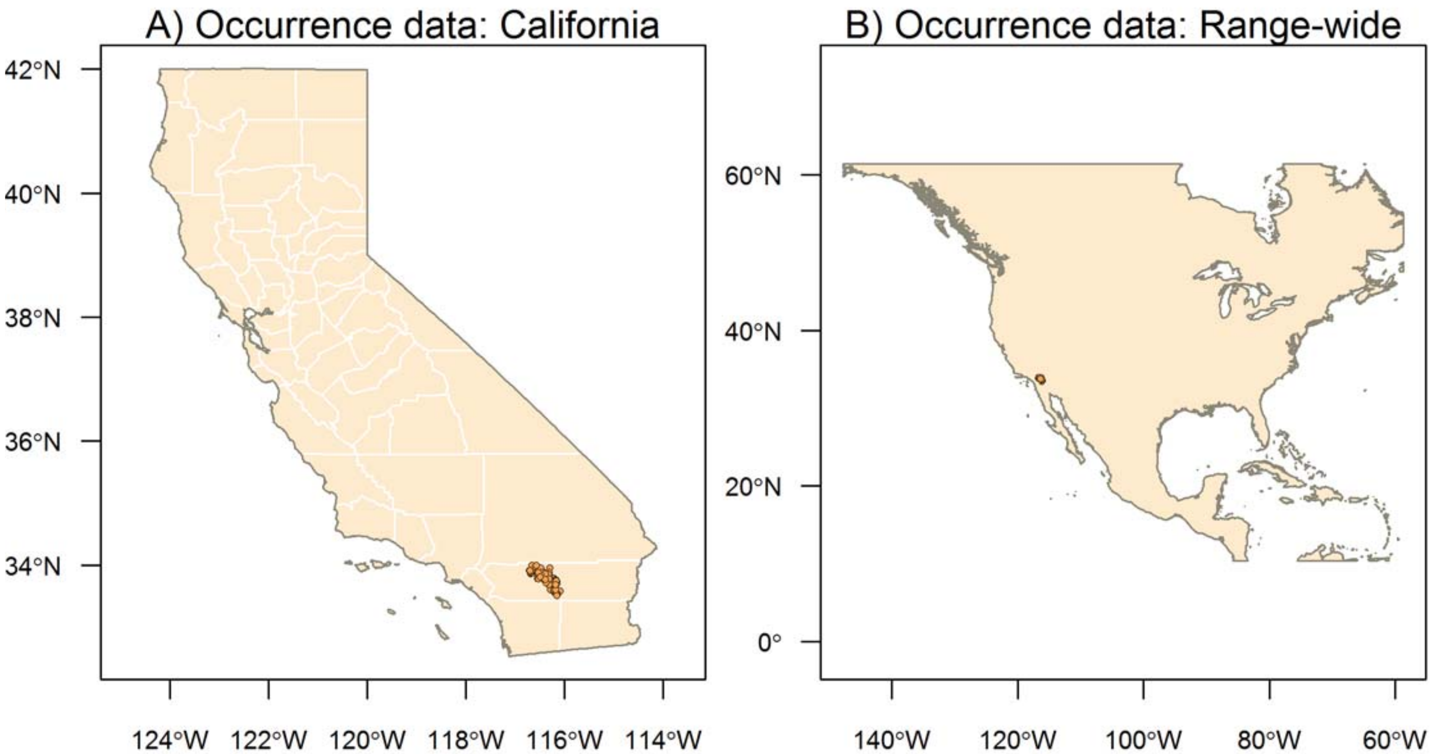
Species Results: *Uma inornata* Coachella Valley Fringe-toed Lizard



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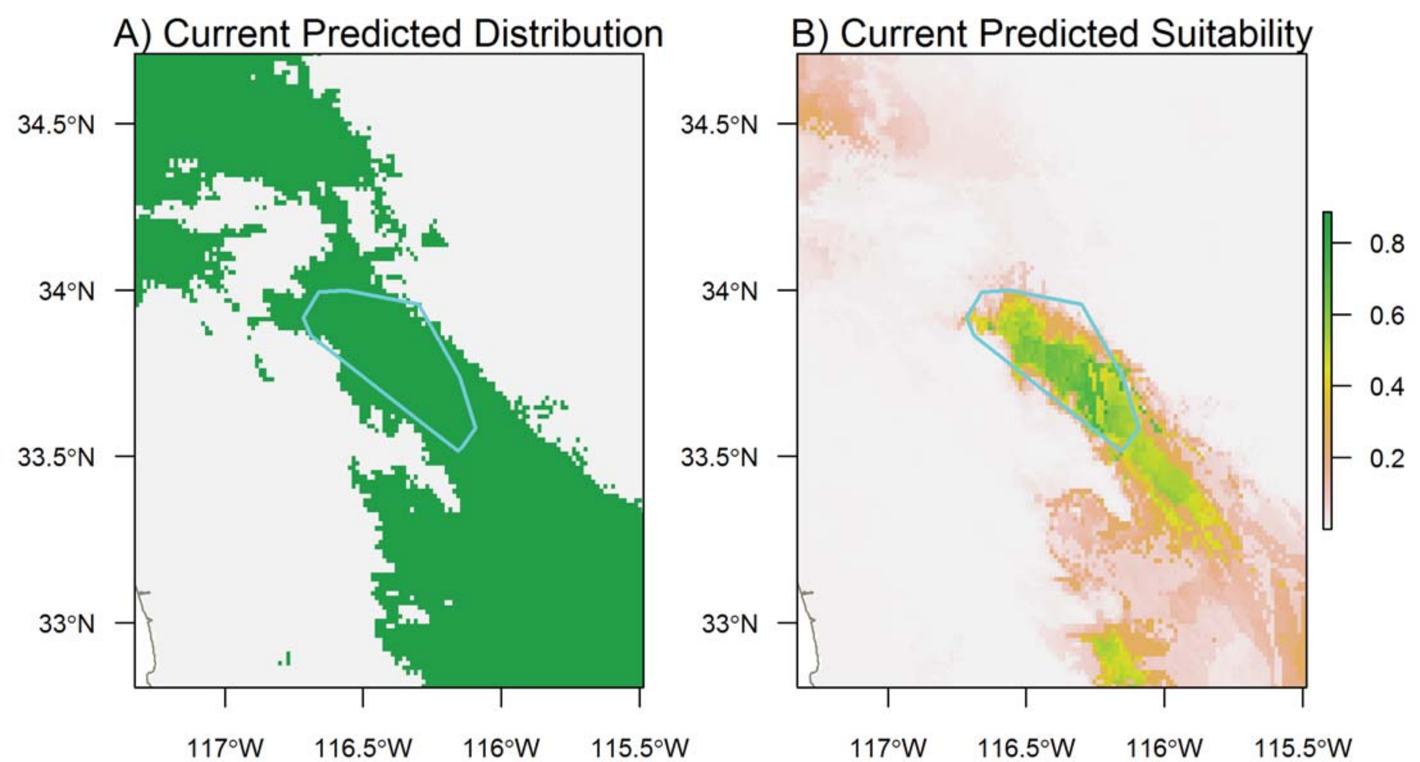

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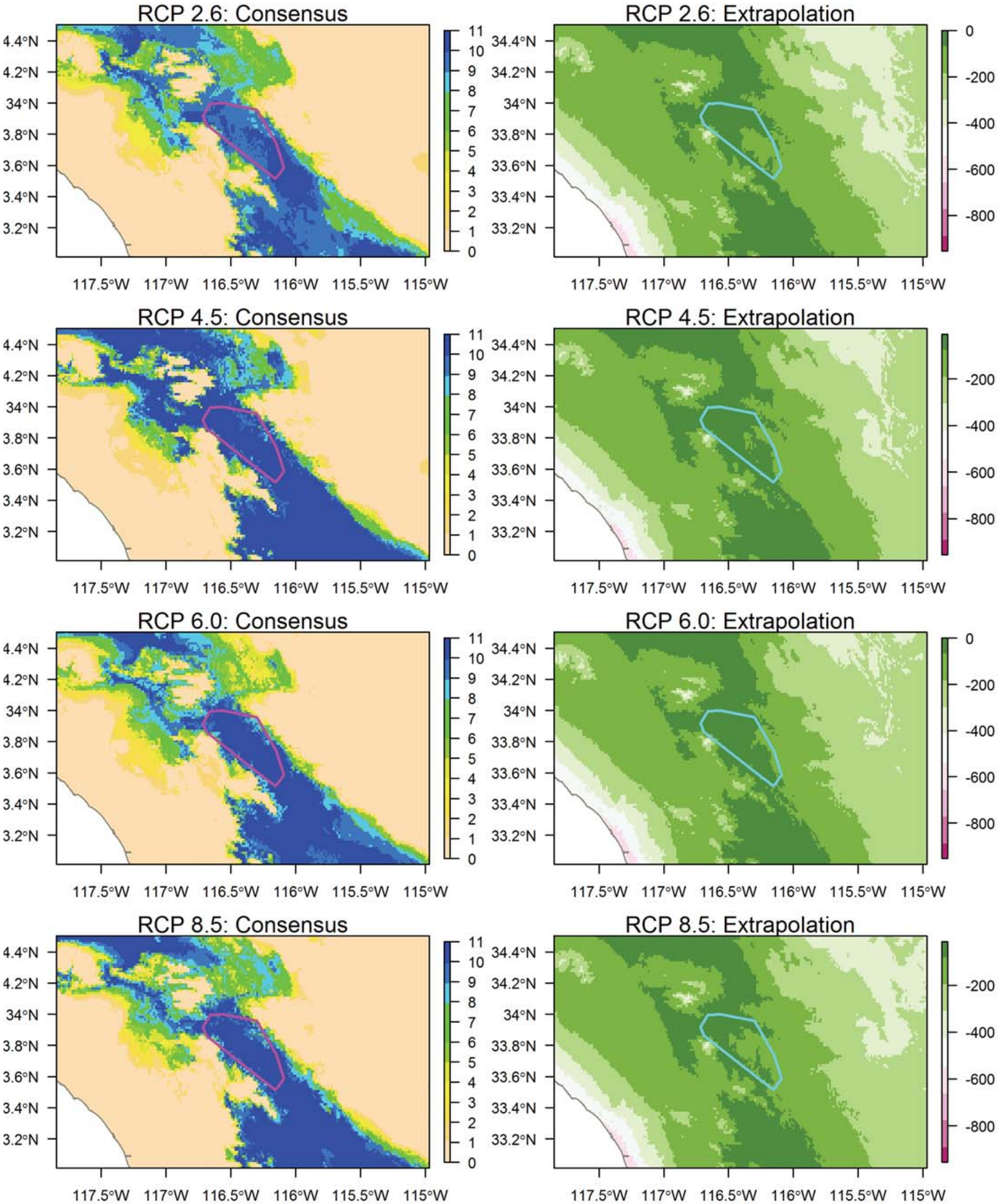

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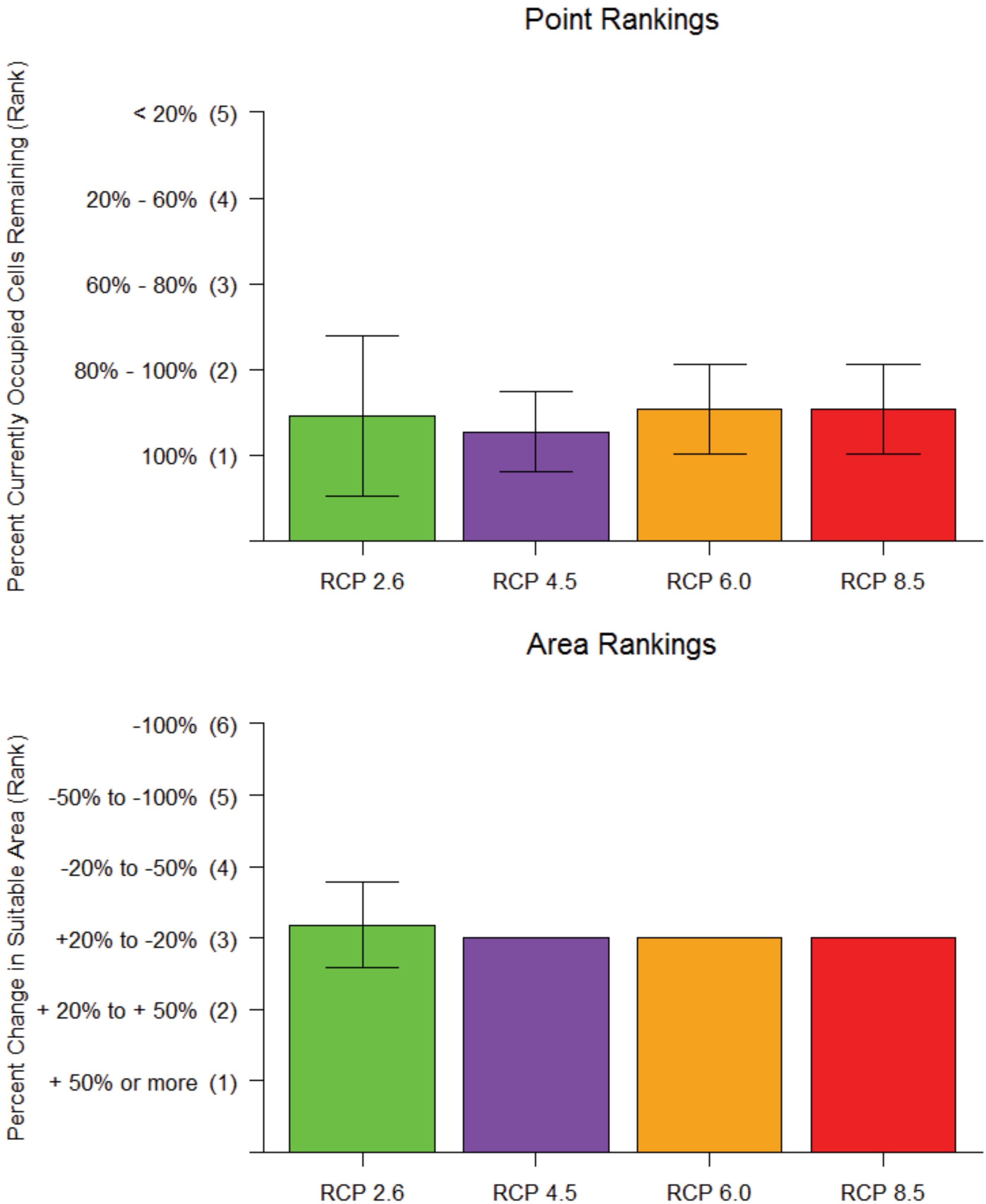

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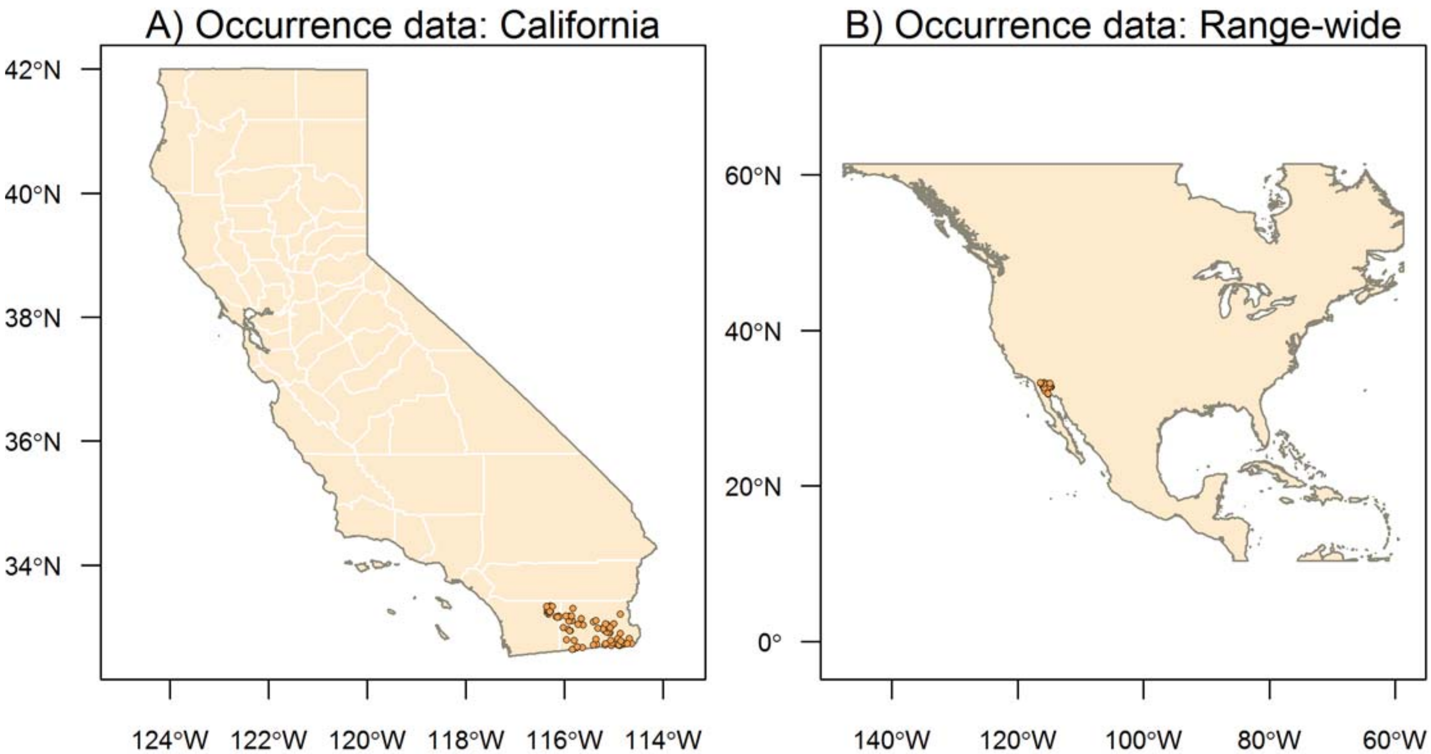
Species Results: *Uma notata* Colorado Desert Fringe-toed Lizard



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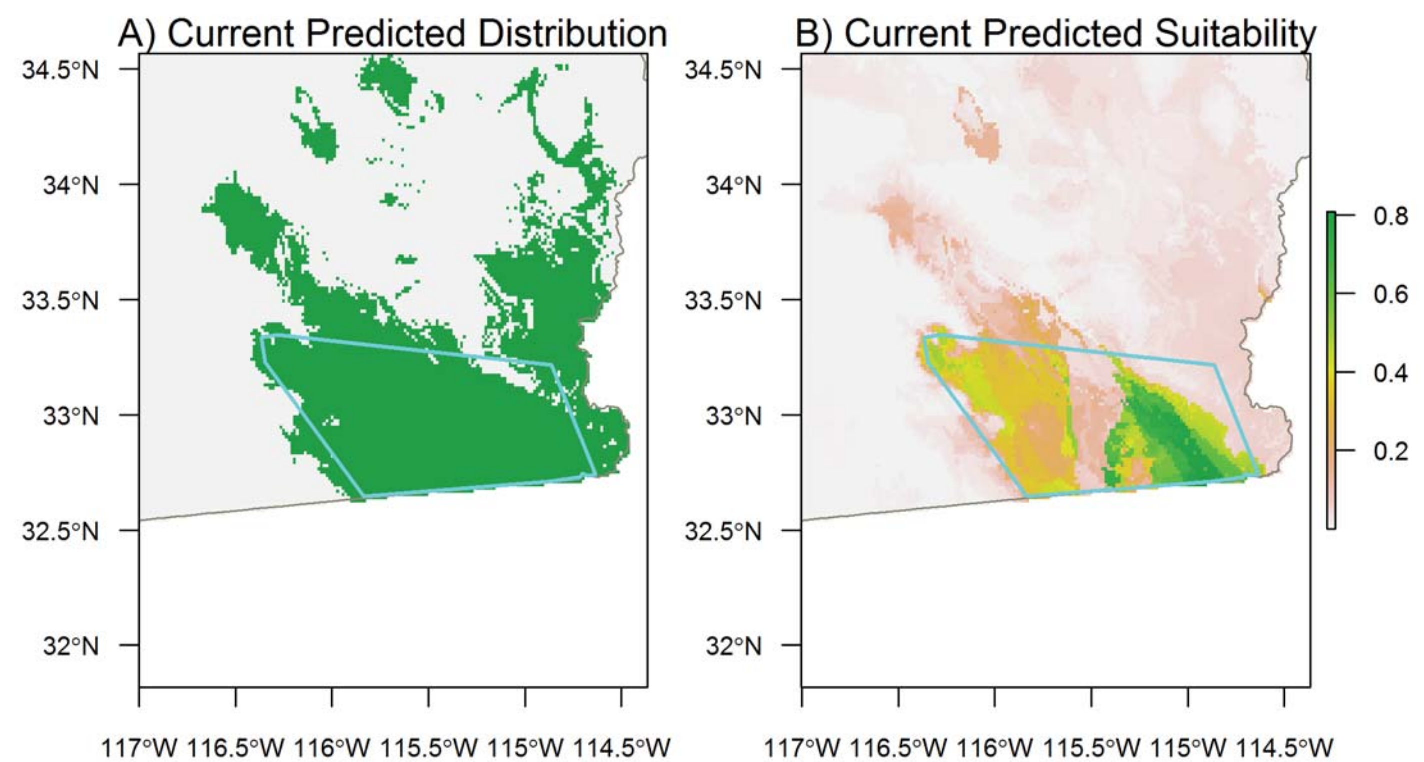

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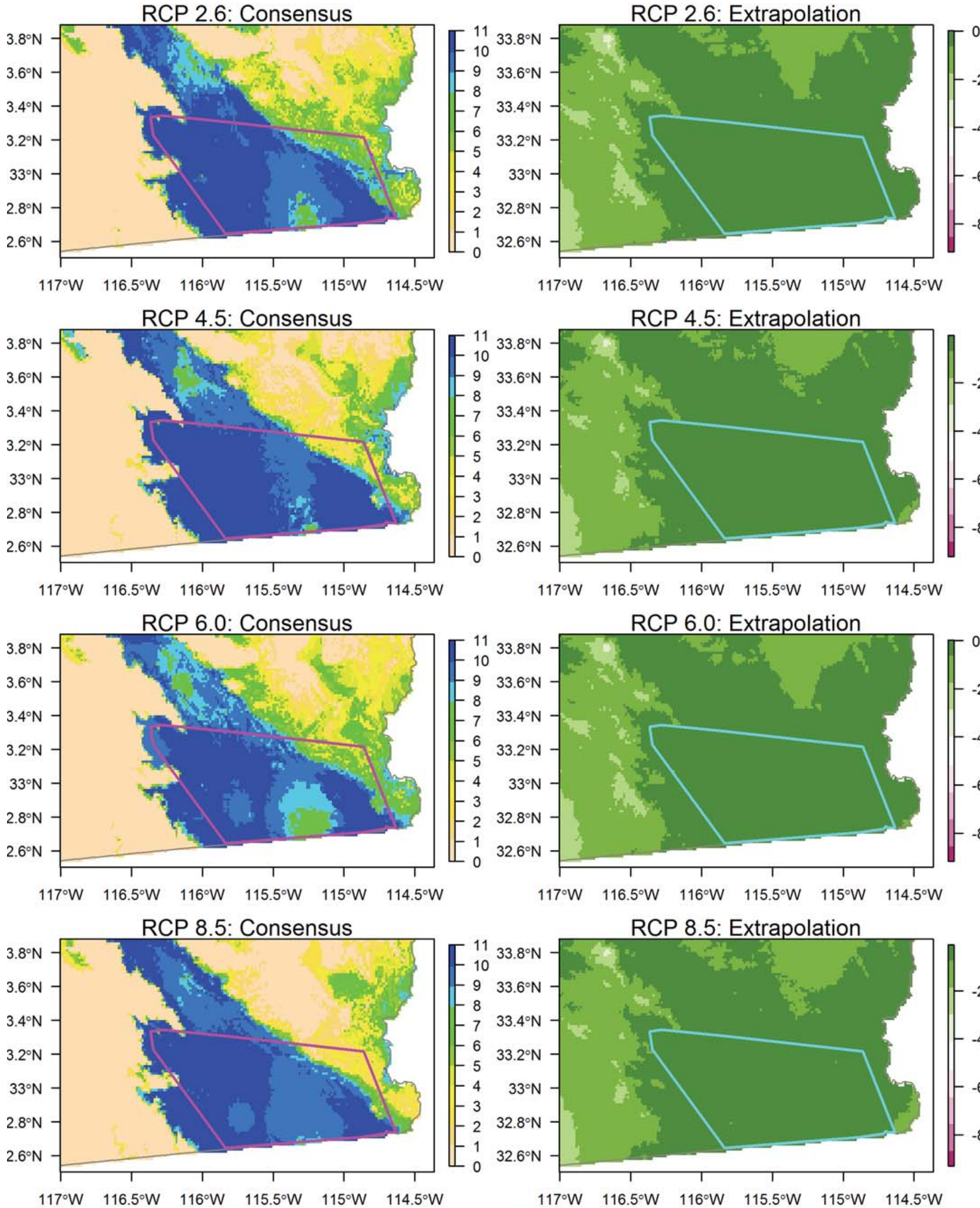
Species Results: *Uma notata* Colorado Desert Fringe-toed Lizard



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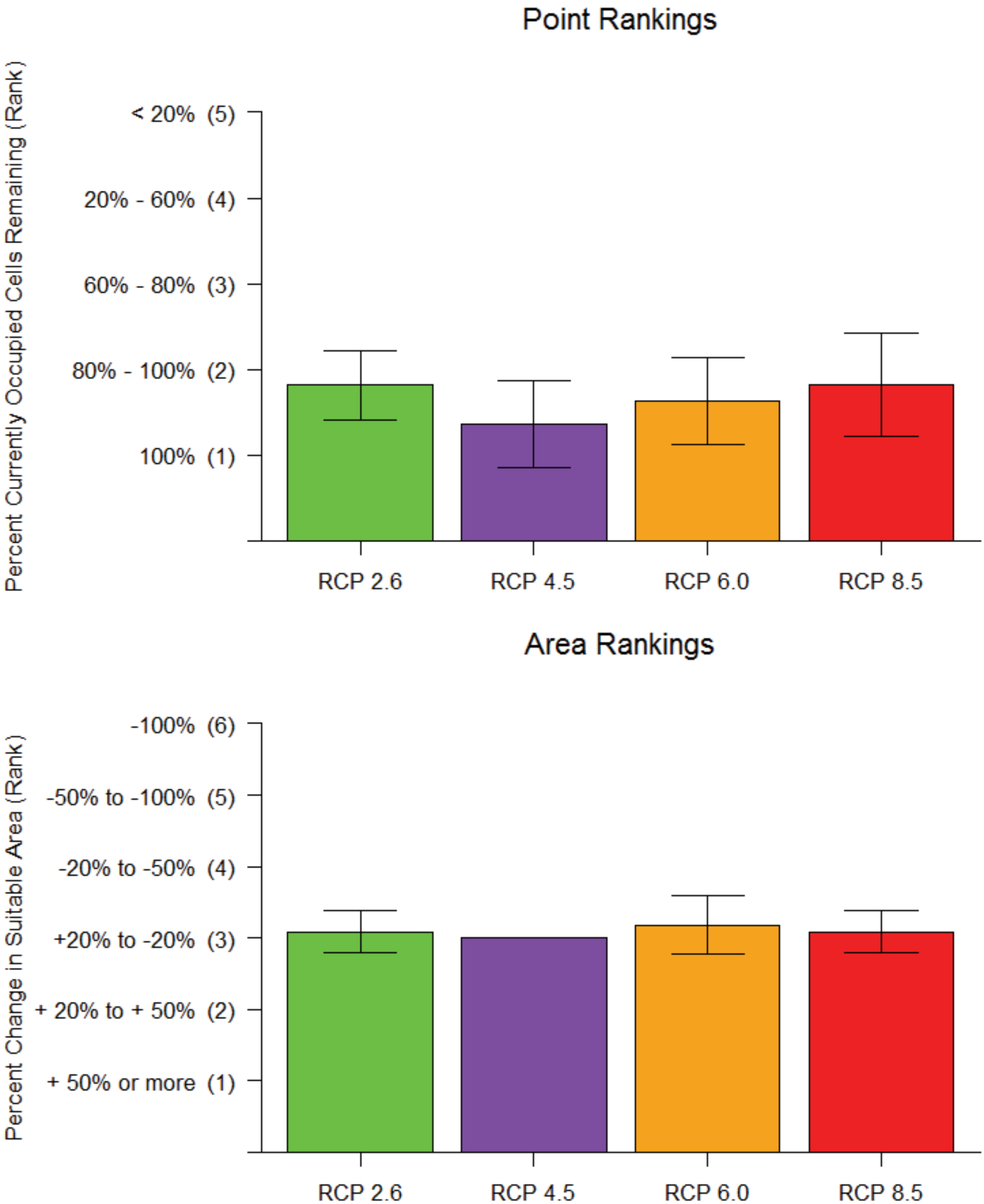

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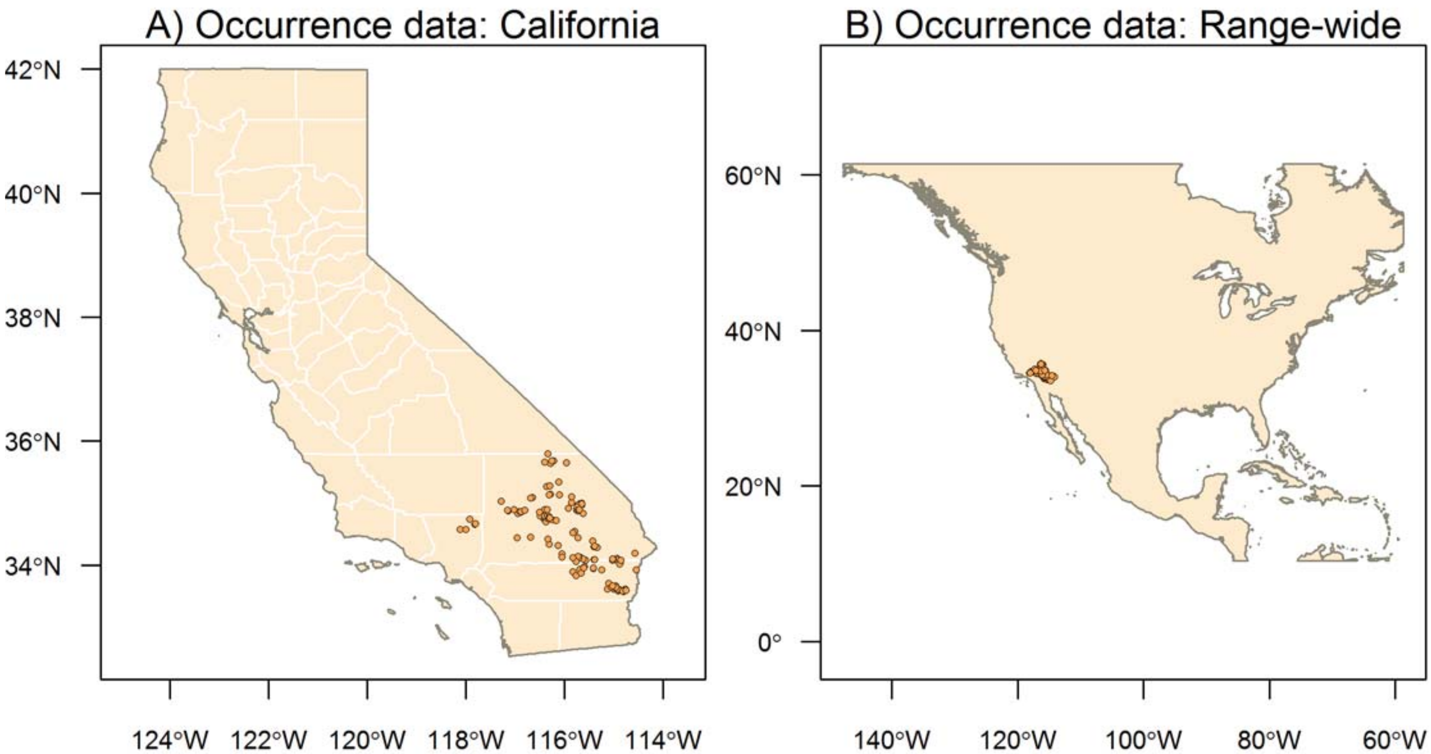
Species Results: *Uma scoparia* Mojave Fringe-toed Lizard



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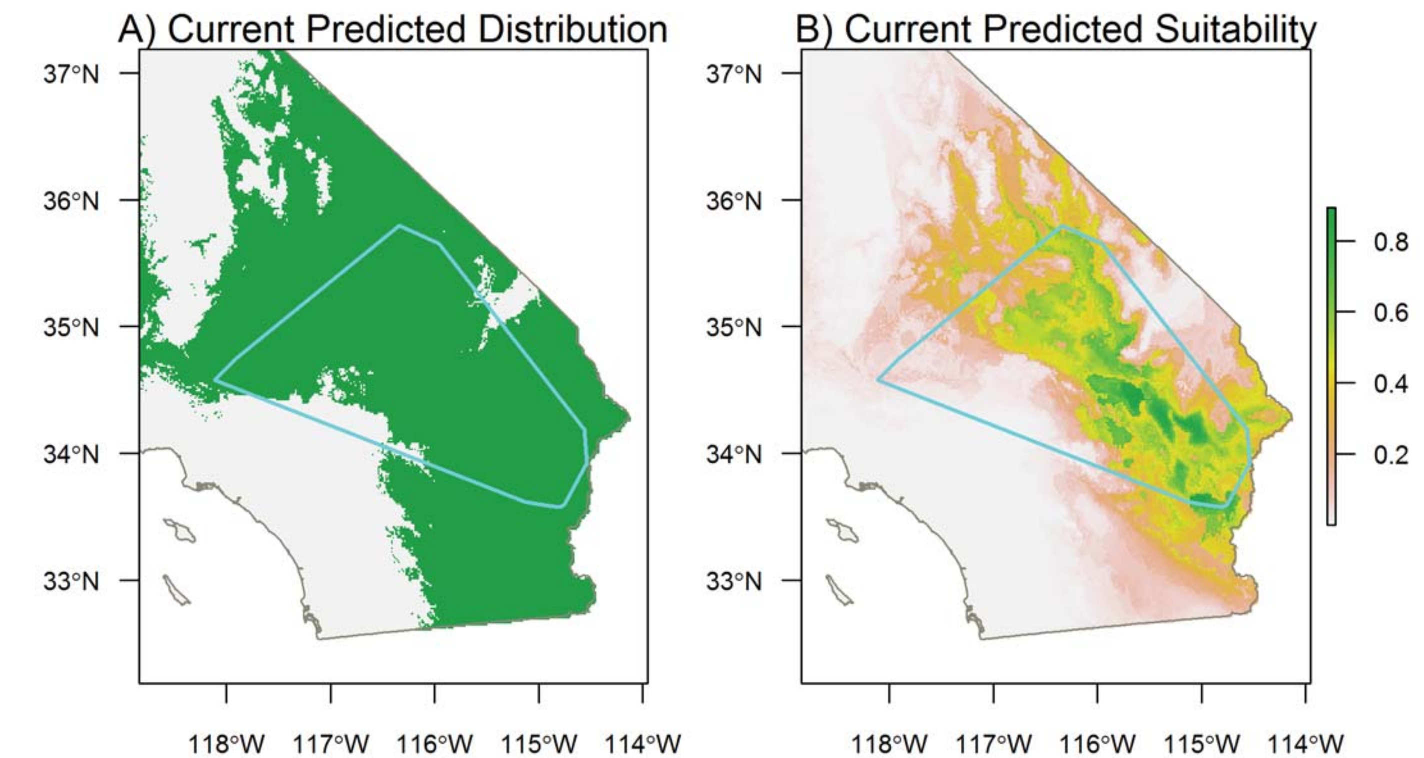

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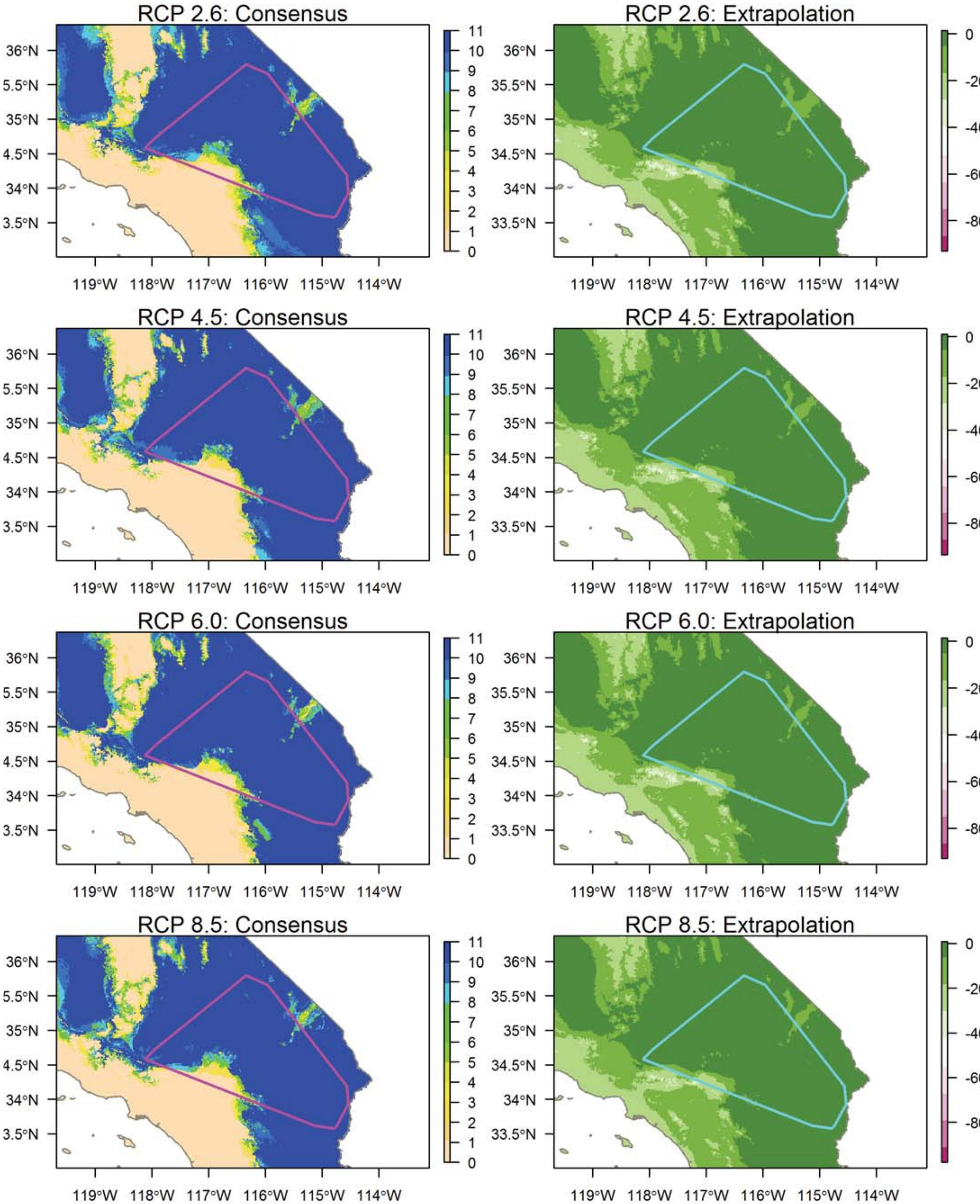
Species Results: *Uma scoparia* Mojave Fringe-toed Lizard



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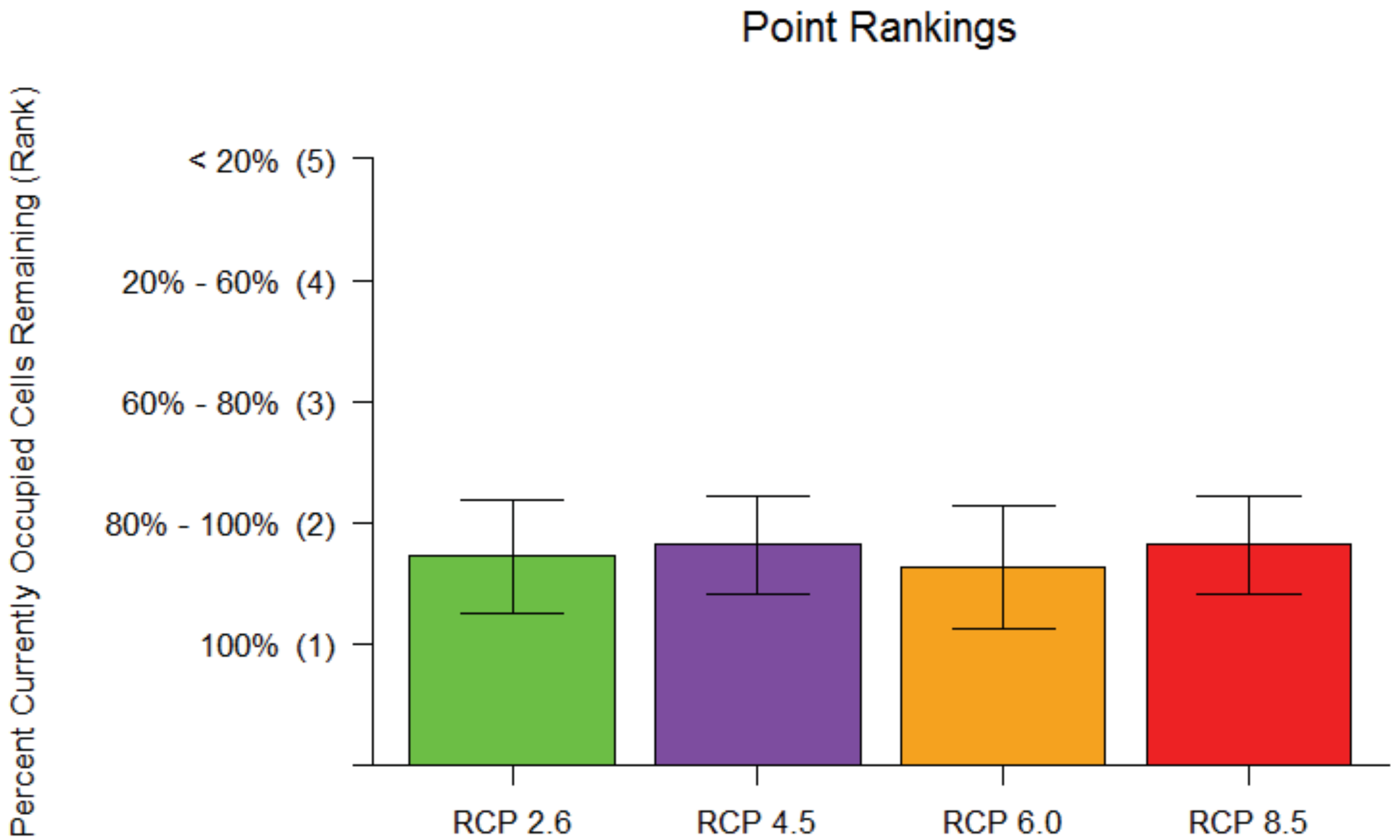
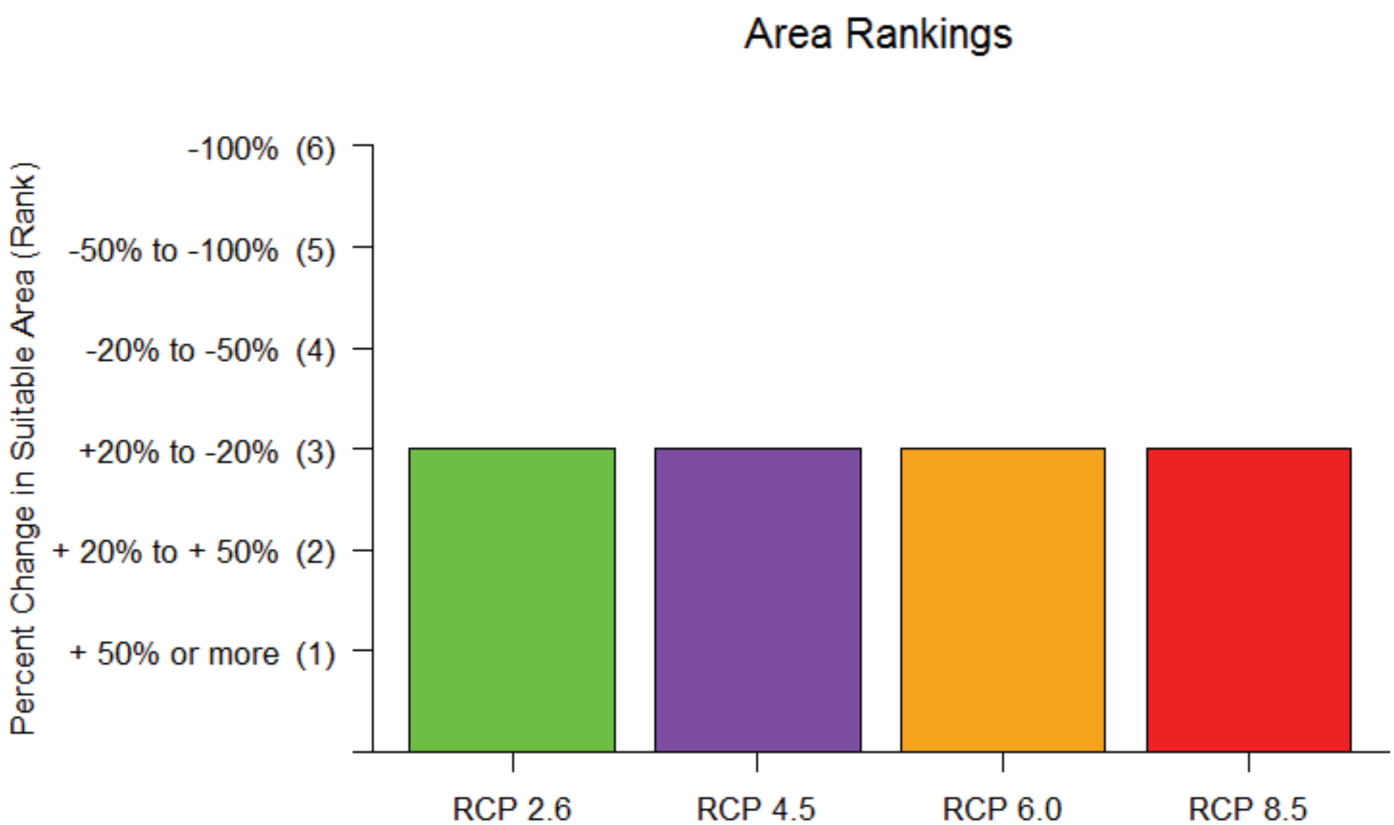
Species Results: *Uma scoparia* Mojave Fringe-toed Lizard





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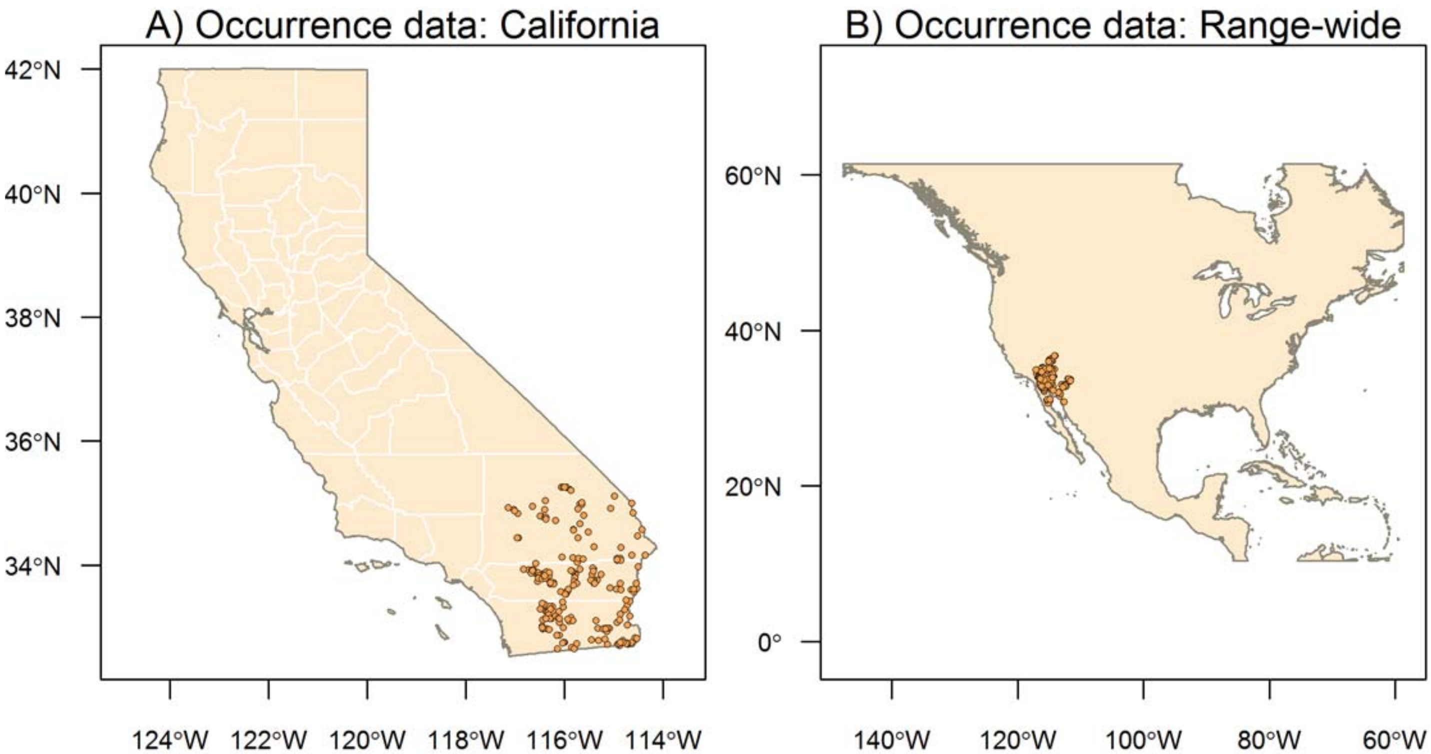
Species Results: *Urosaurus graciosus* Long-tailed Brush Lizard



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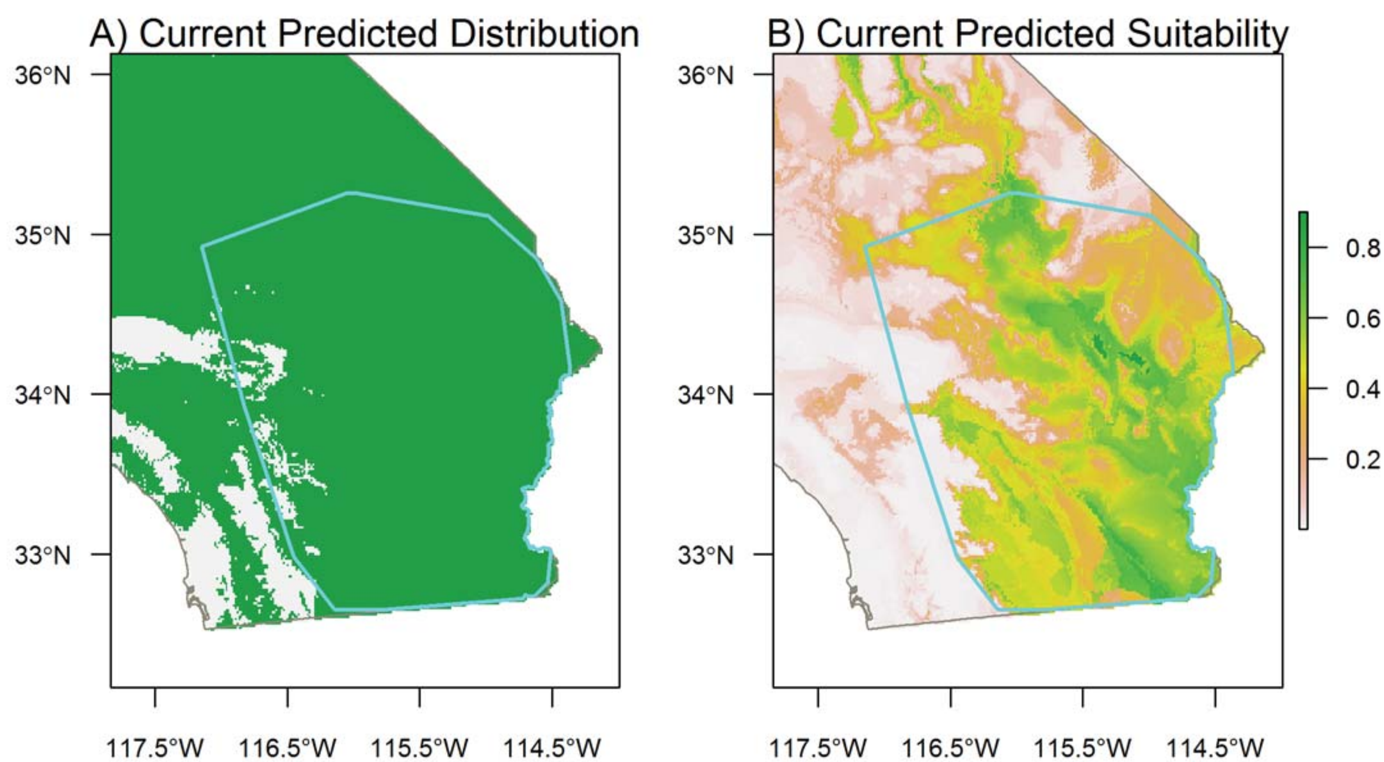

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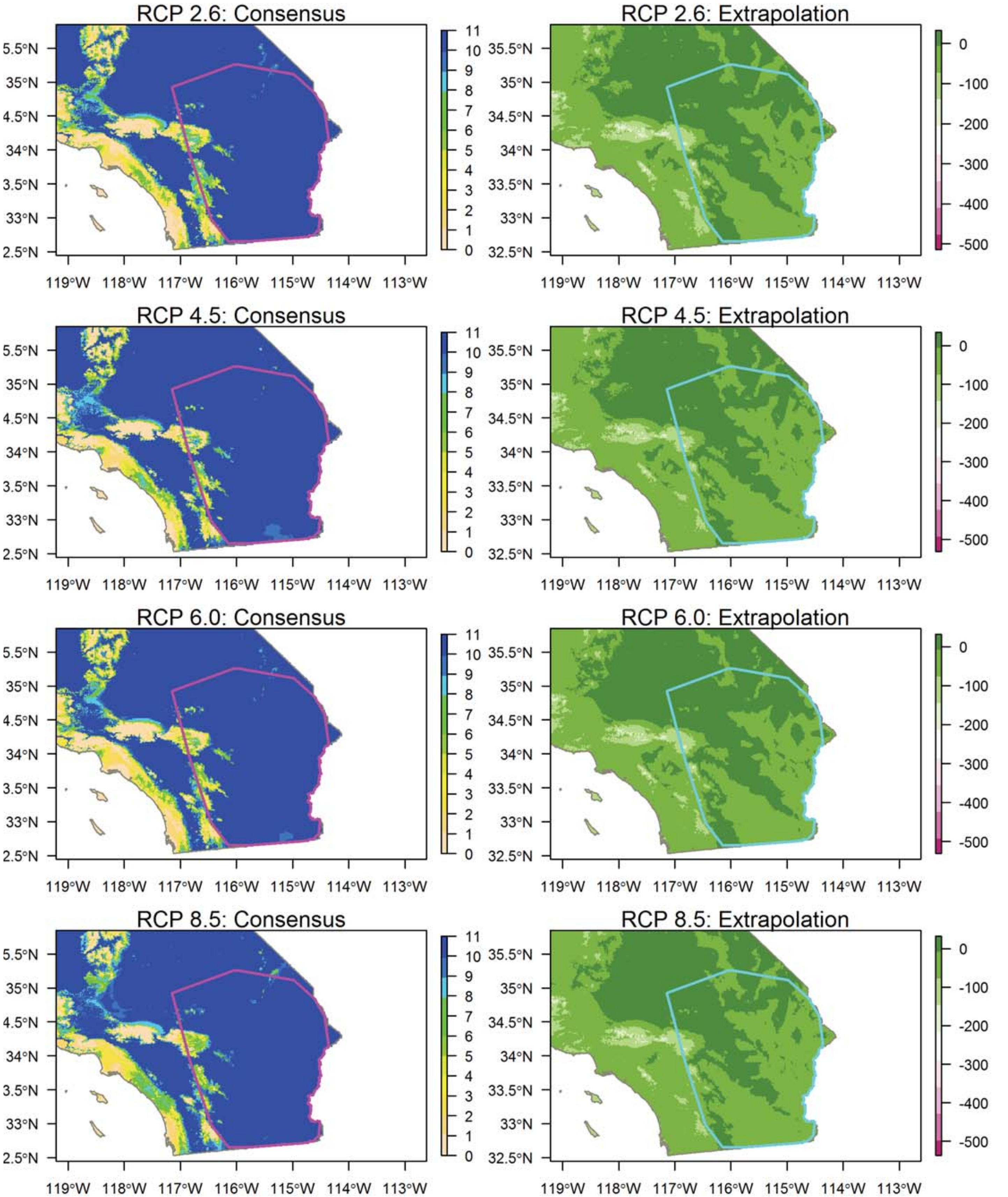

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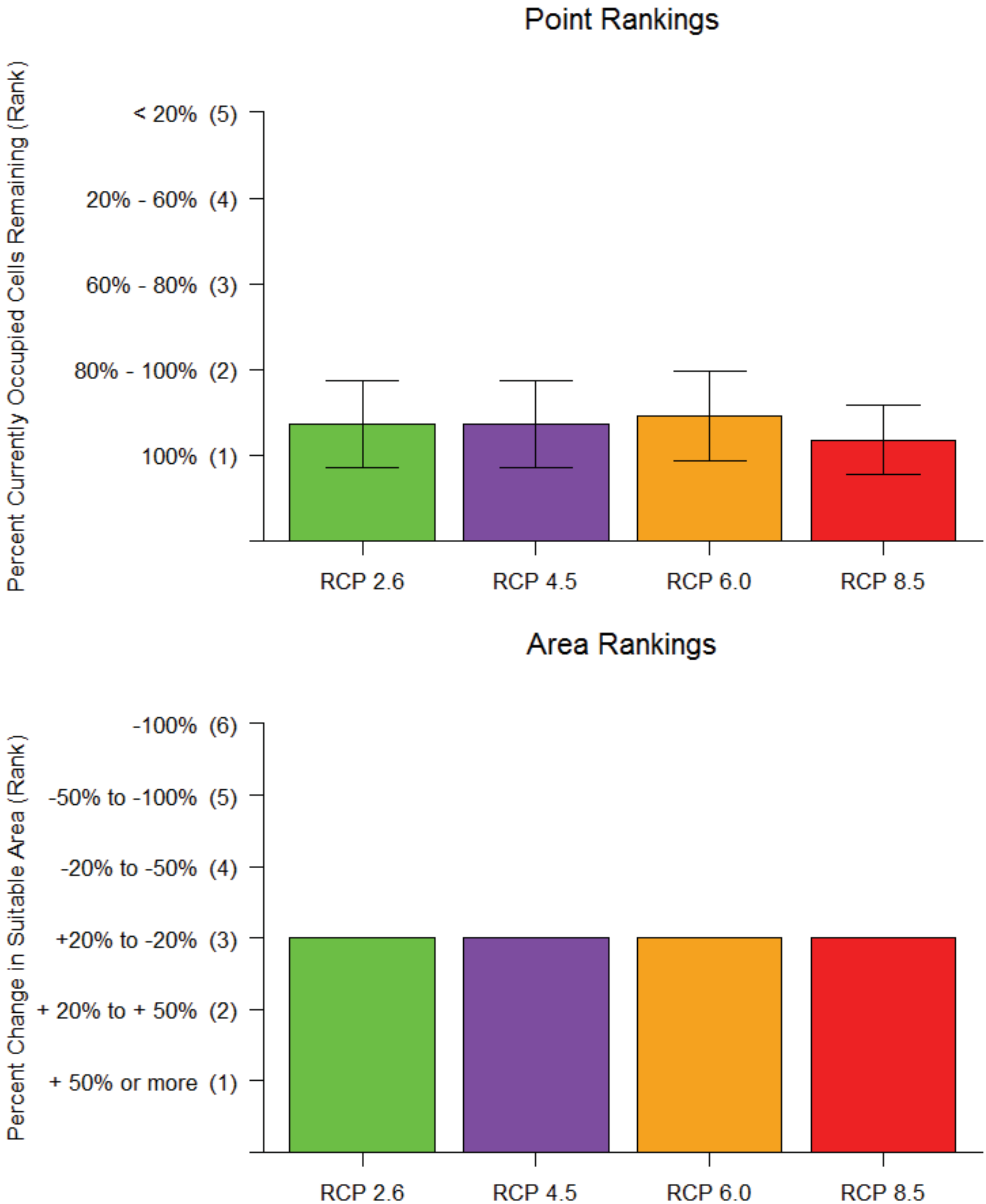


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Urosaurus nigricaudus* Baja California Brush Lizard

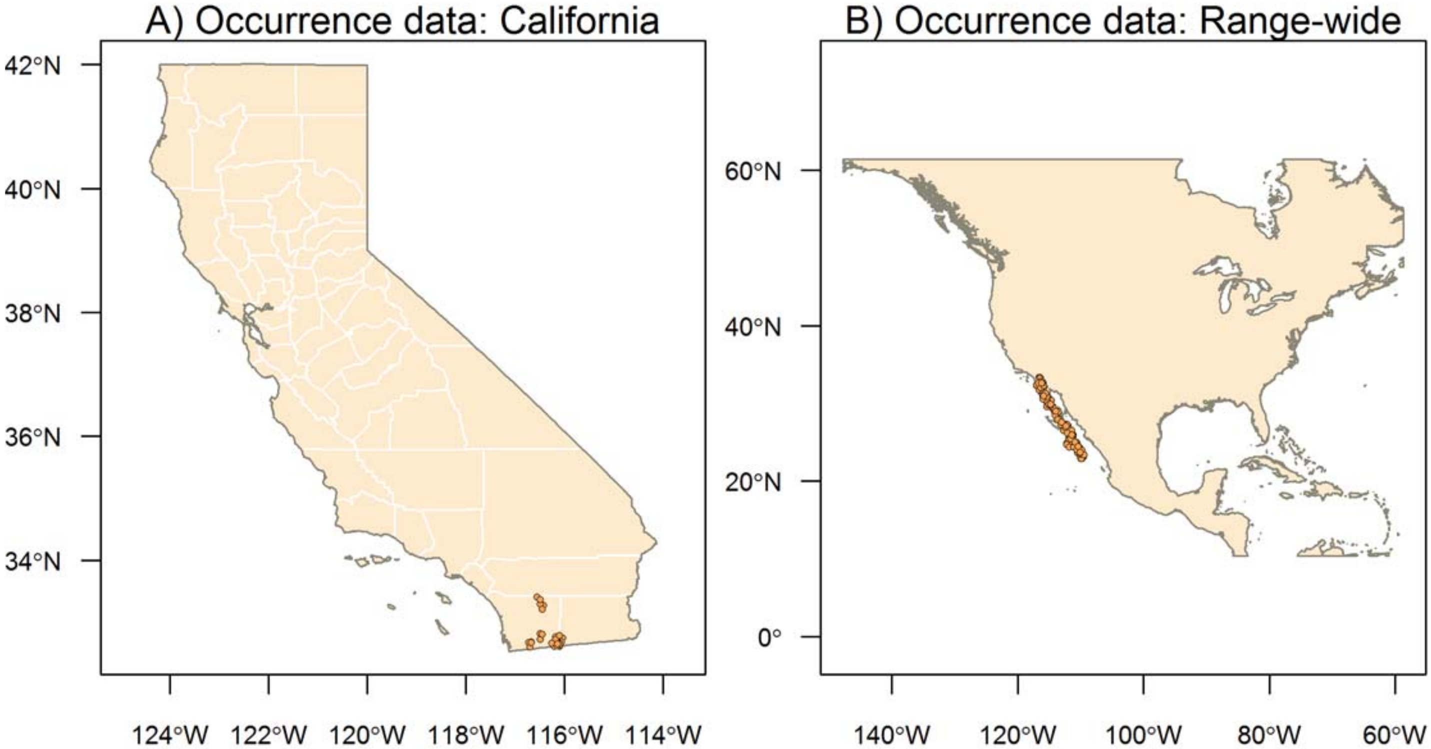


Figure 1. Occurrence data used to build Maxent models.

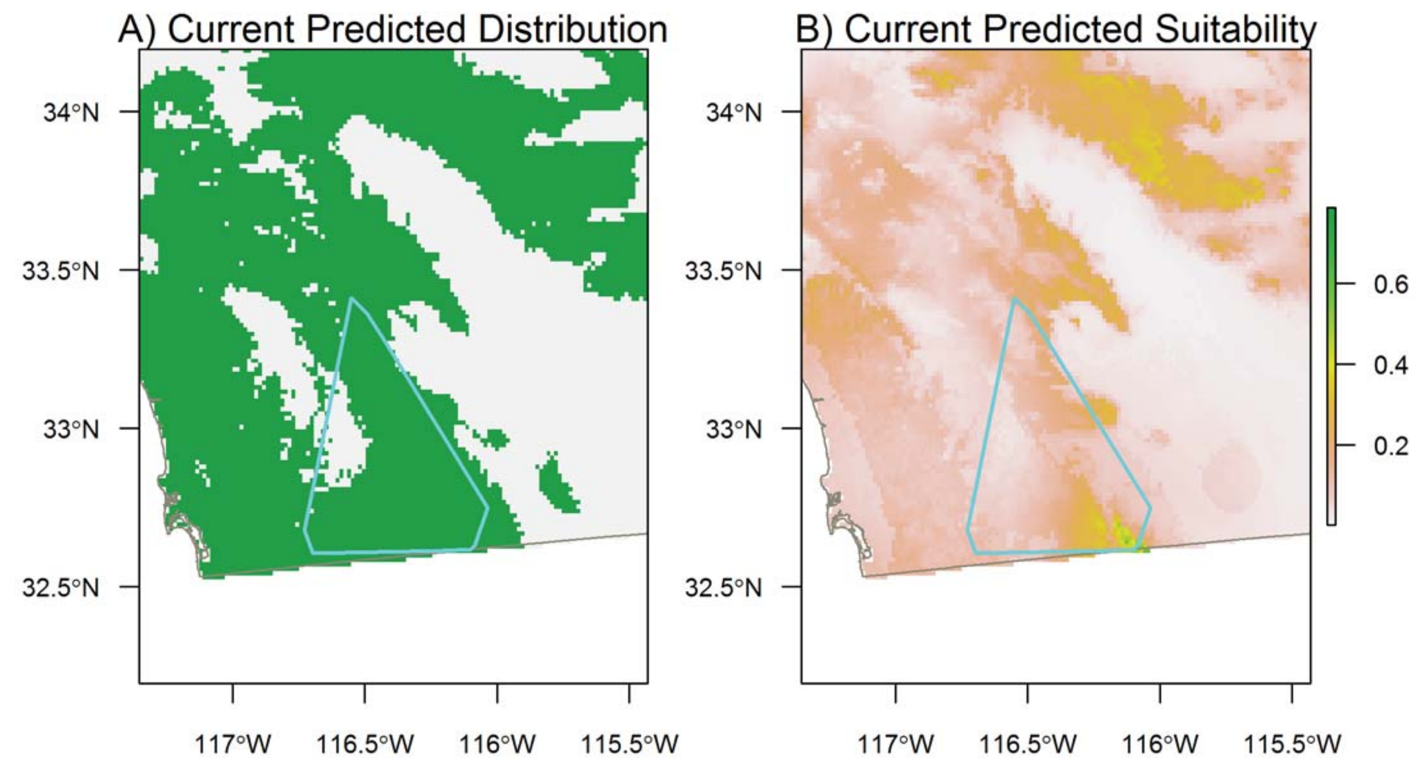


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

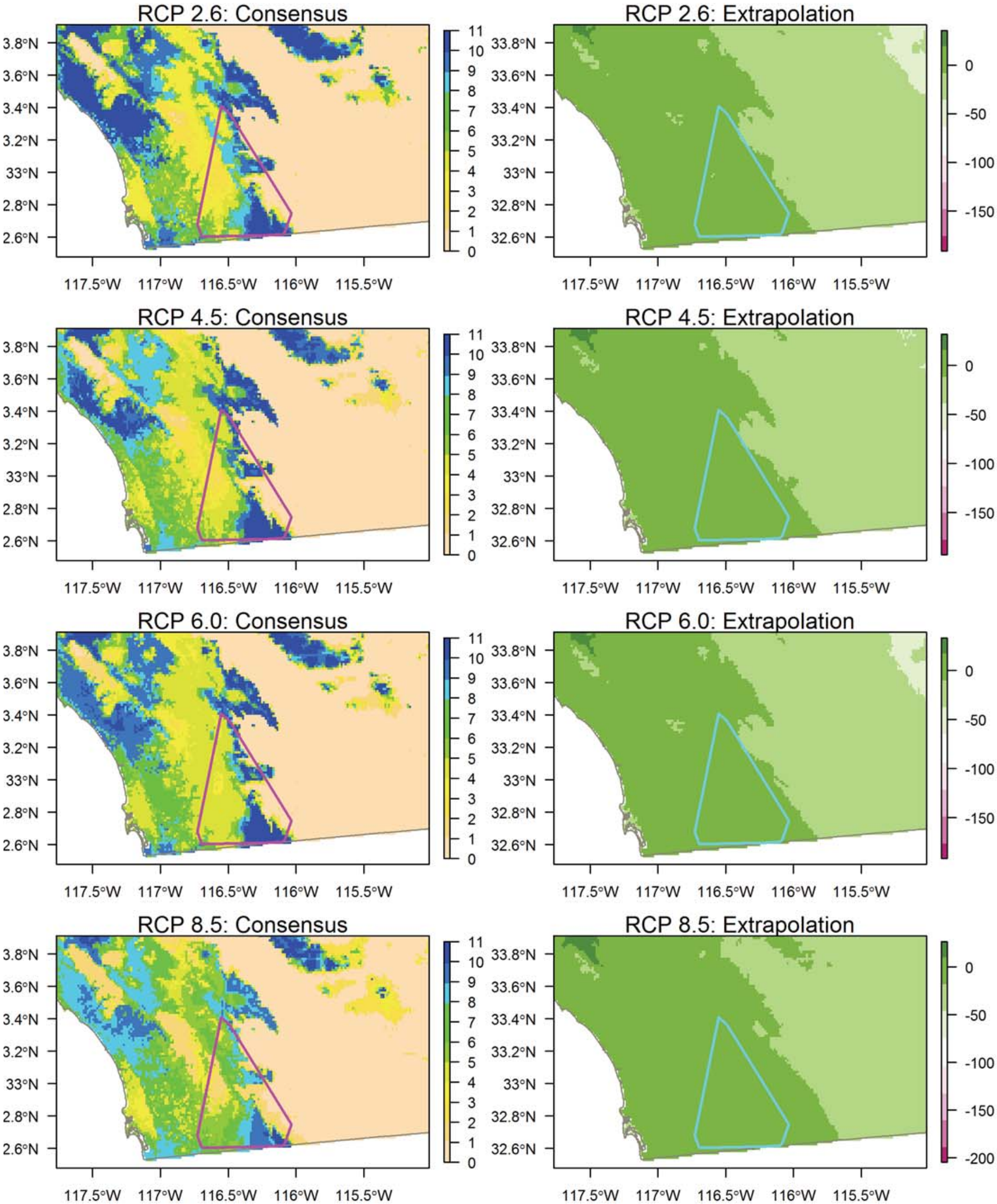


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Urosaurus nigricaudus* Baja California Brush Lizard

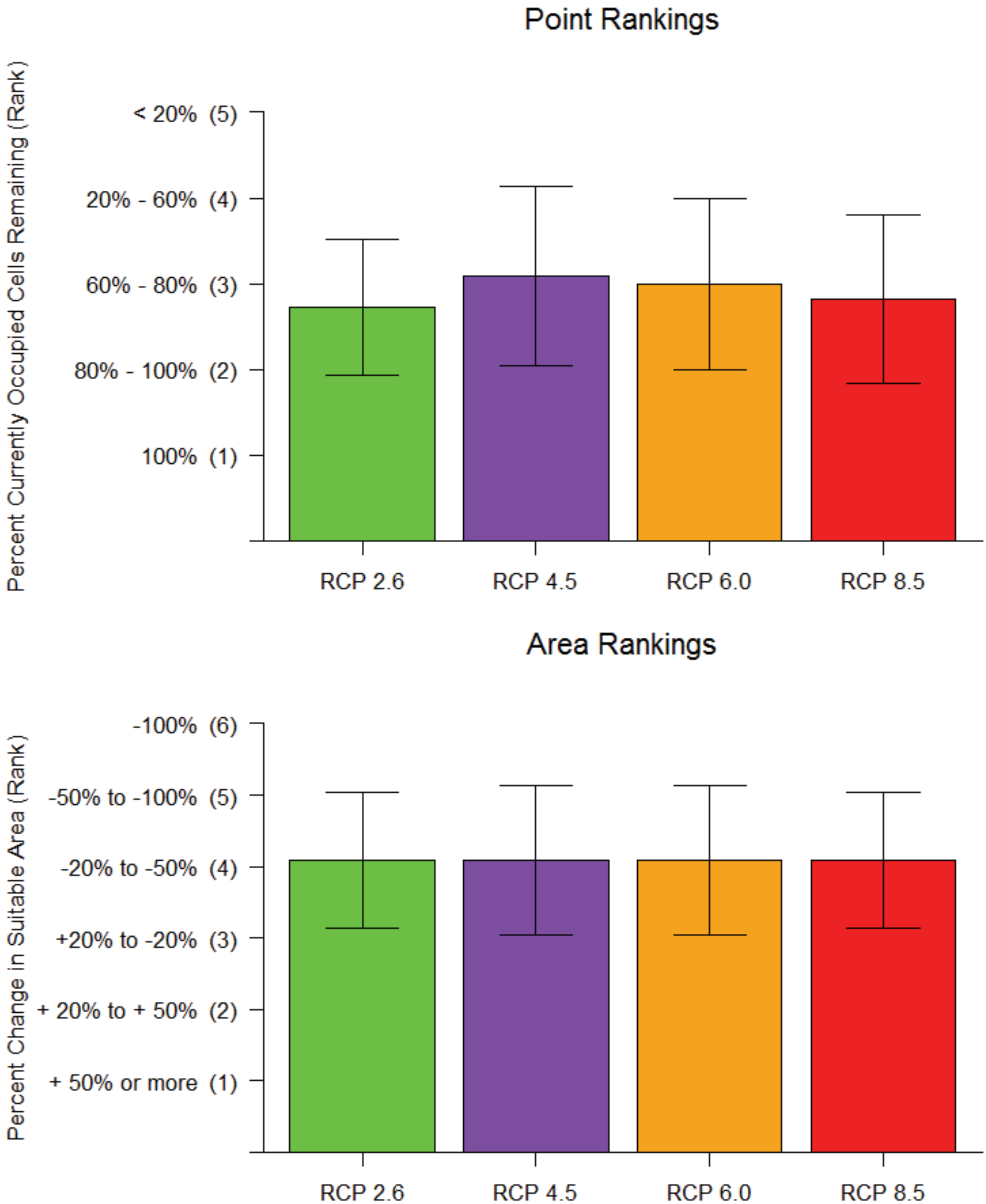


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Urosaurus ornatus* Ornate Tree Lizard

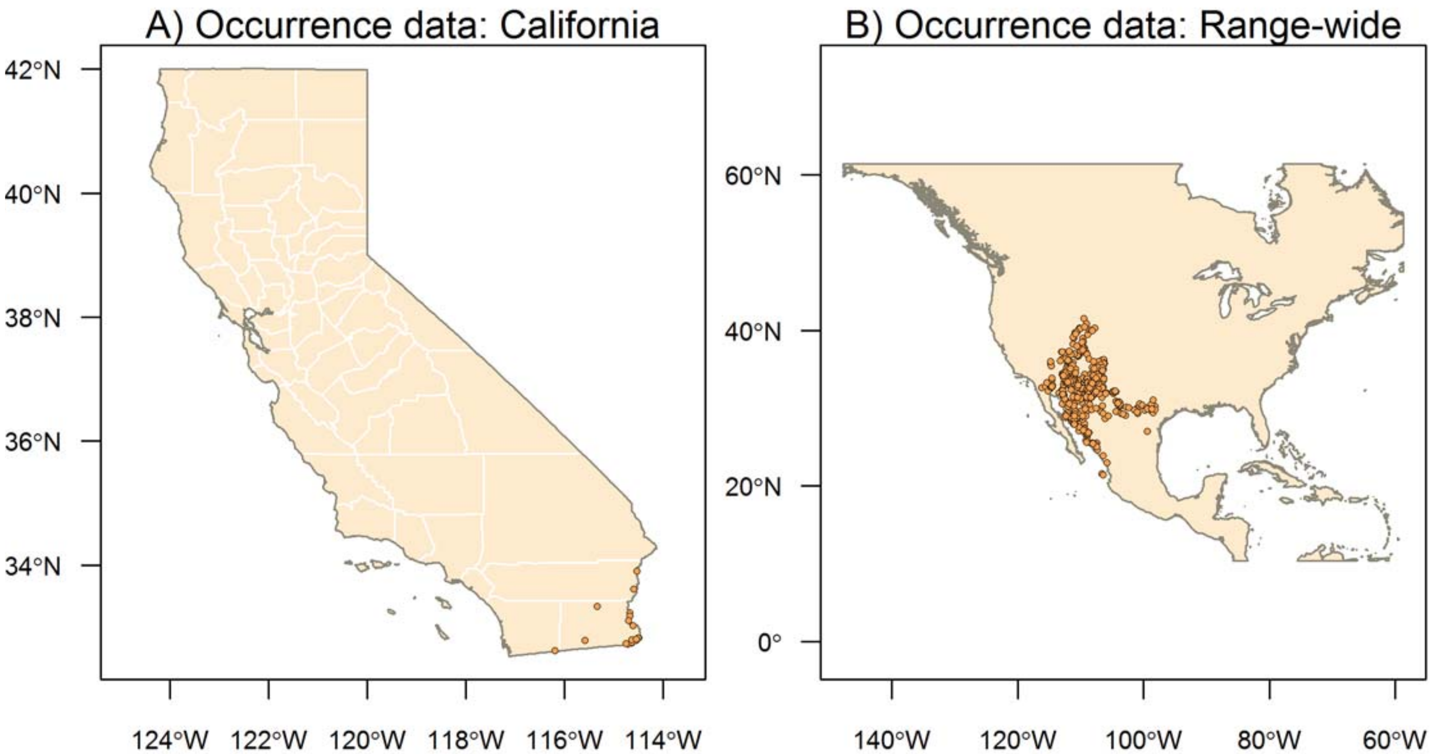


Figure 1. Occurrence data used to build Maxent models.

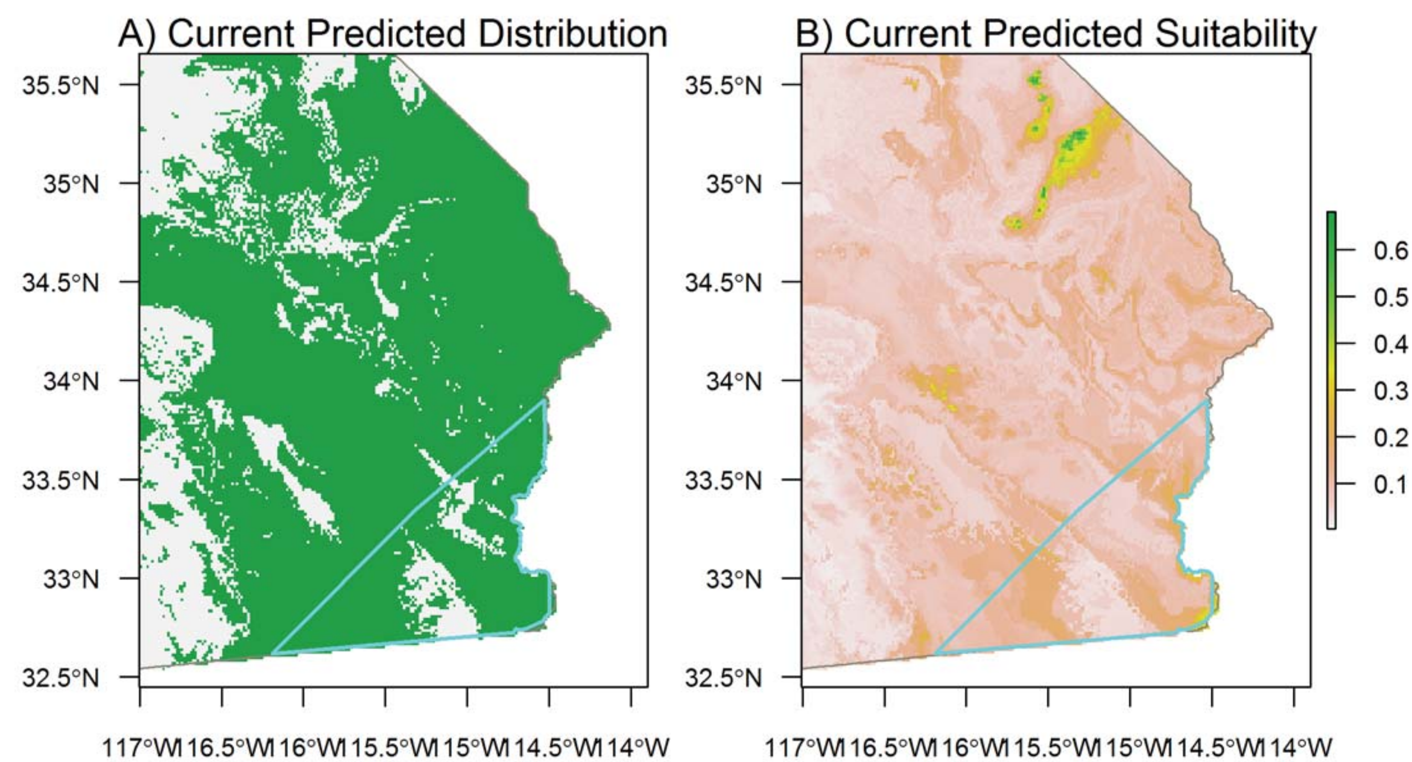


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

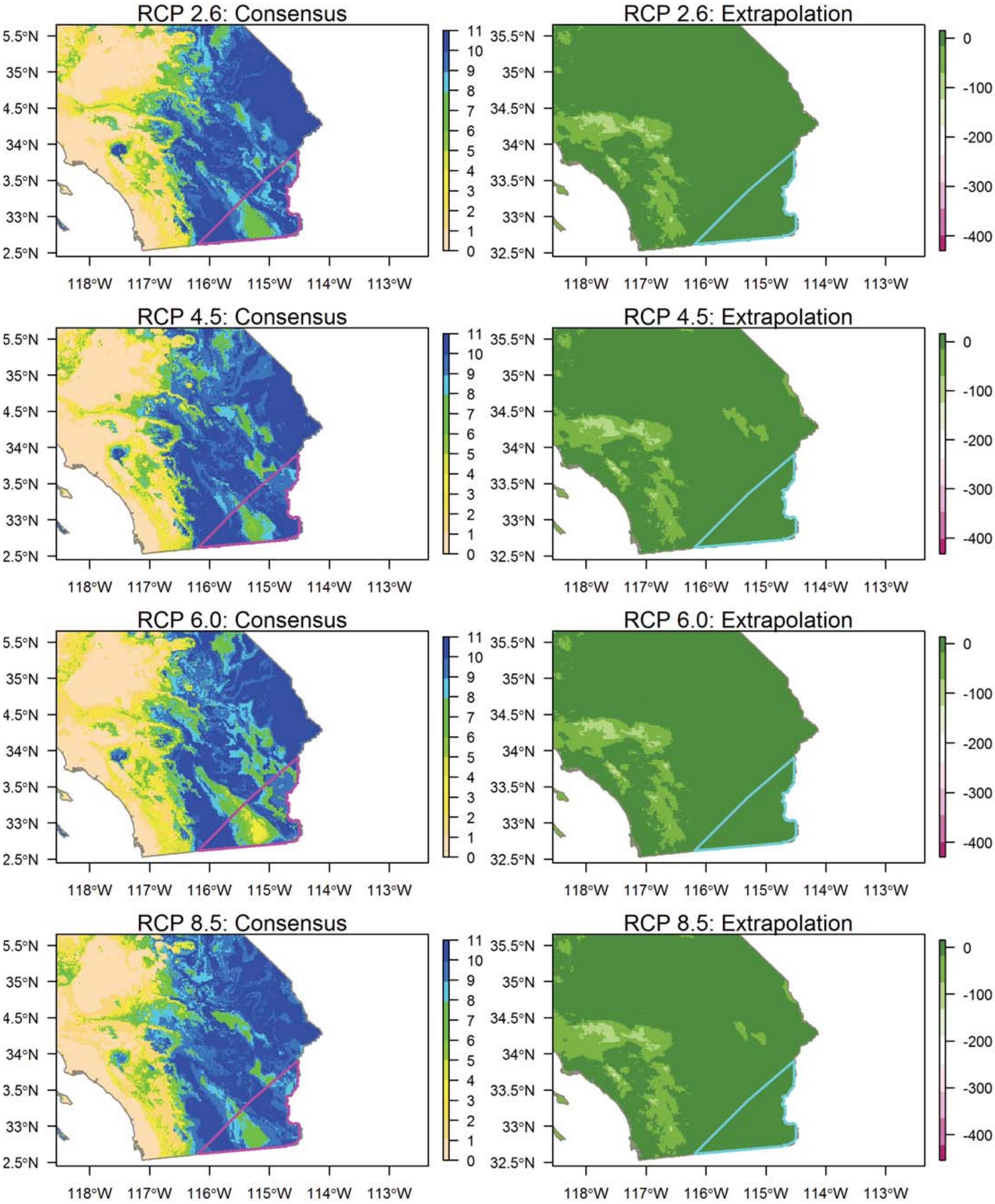


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

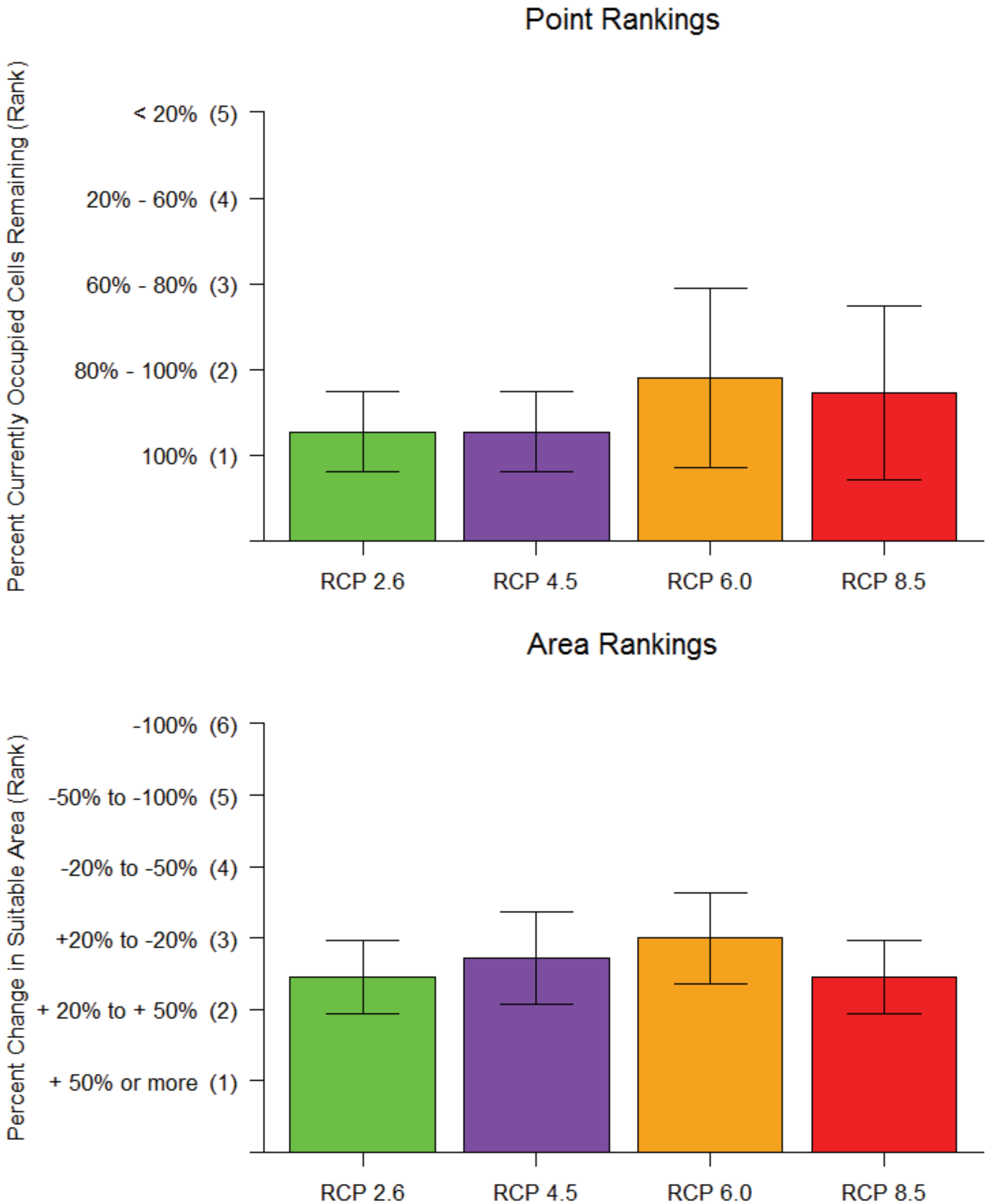


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Uta stansburiana* Side-blotched Lizard

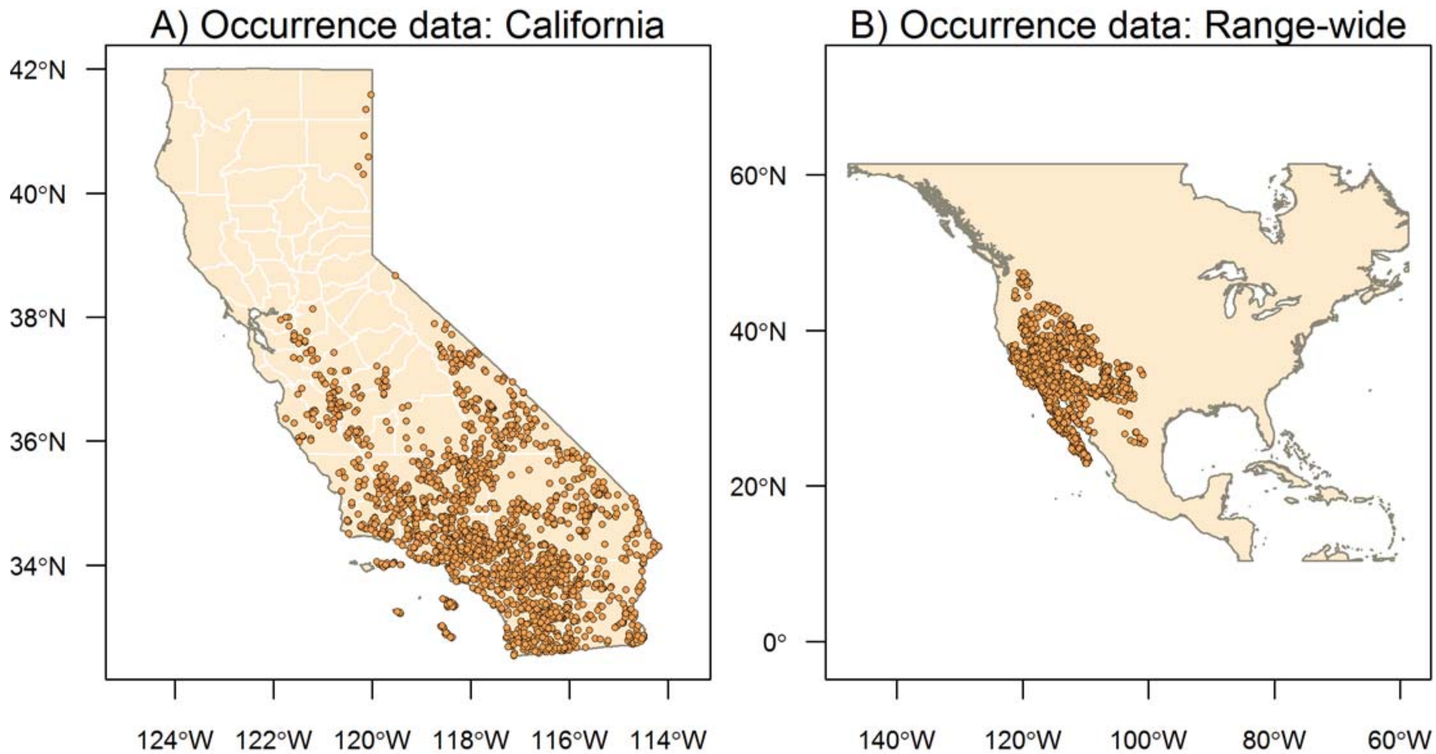


Figure 1. Occurrence data used to build Maxent models.

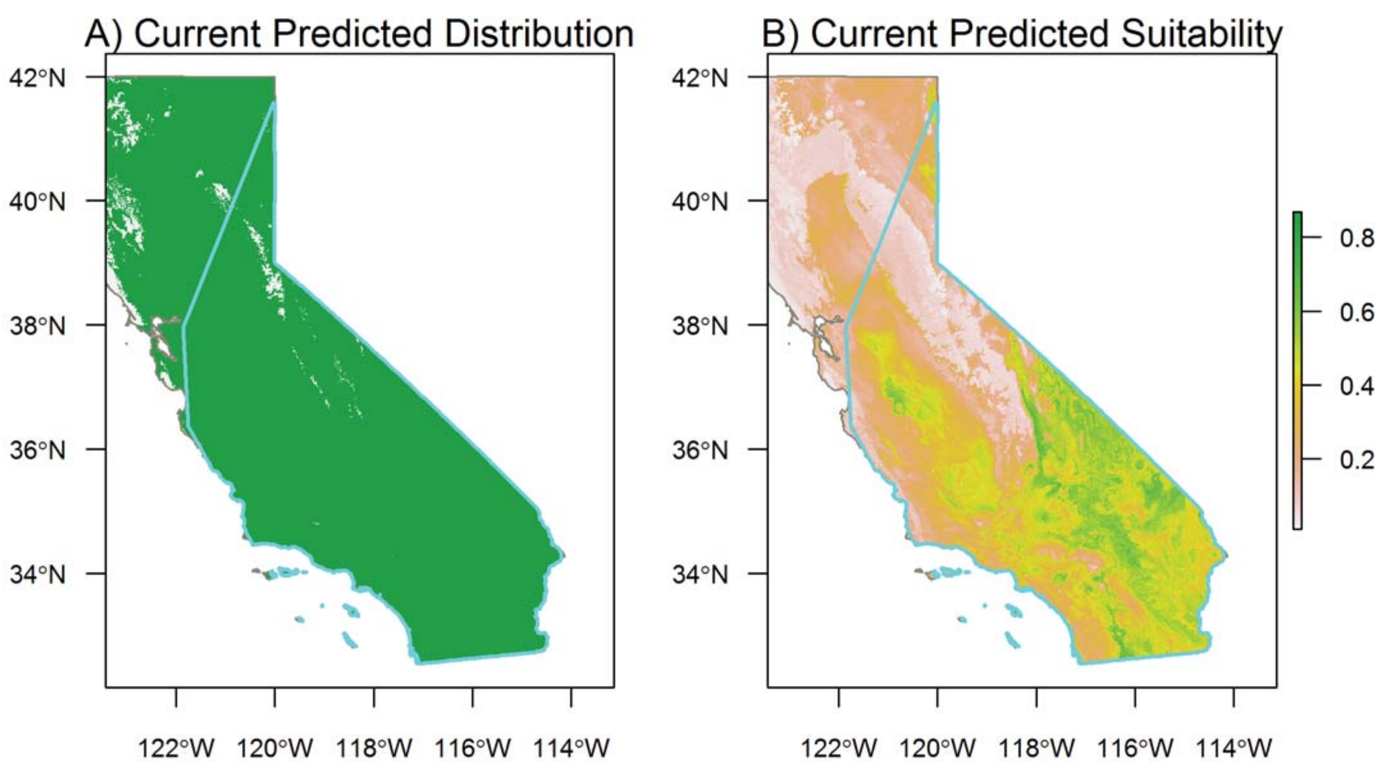


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Uta stansburiana* Side-blotched Lizard

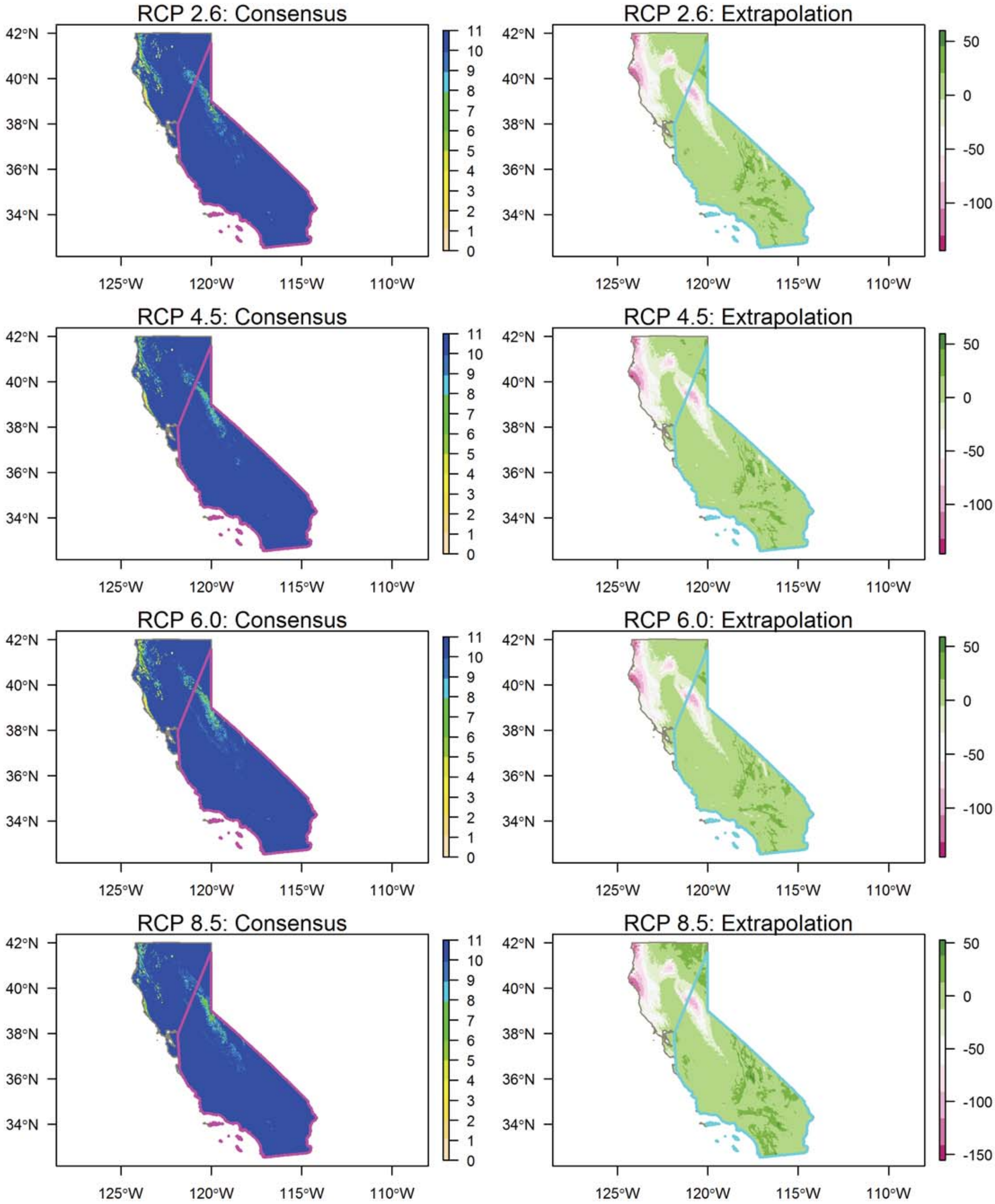
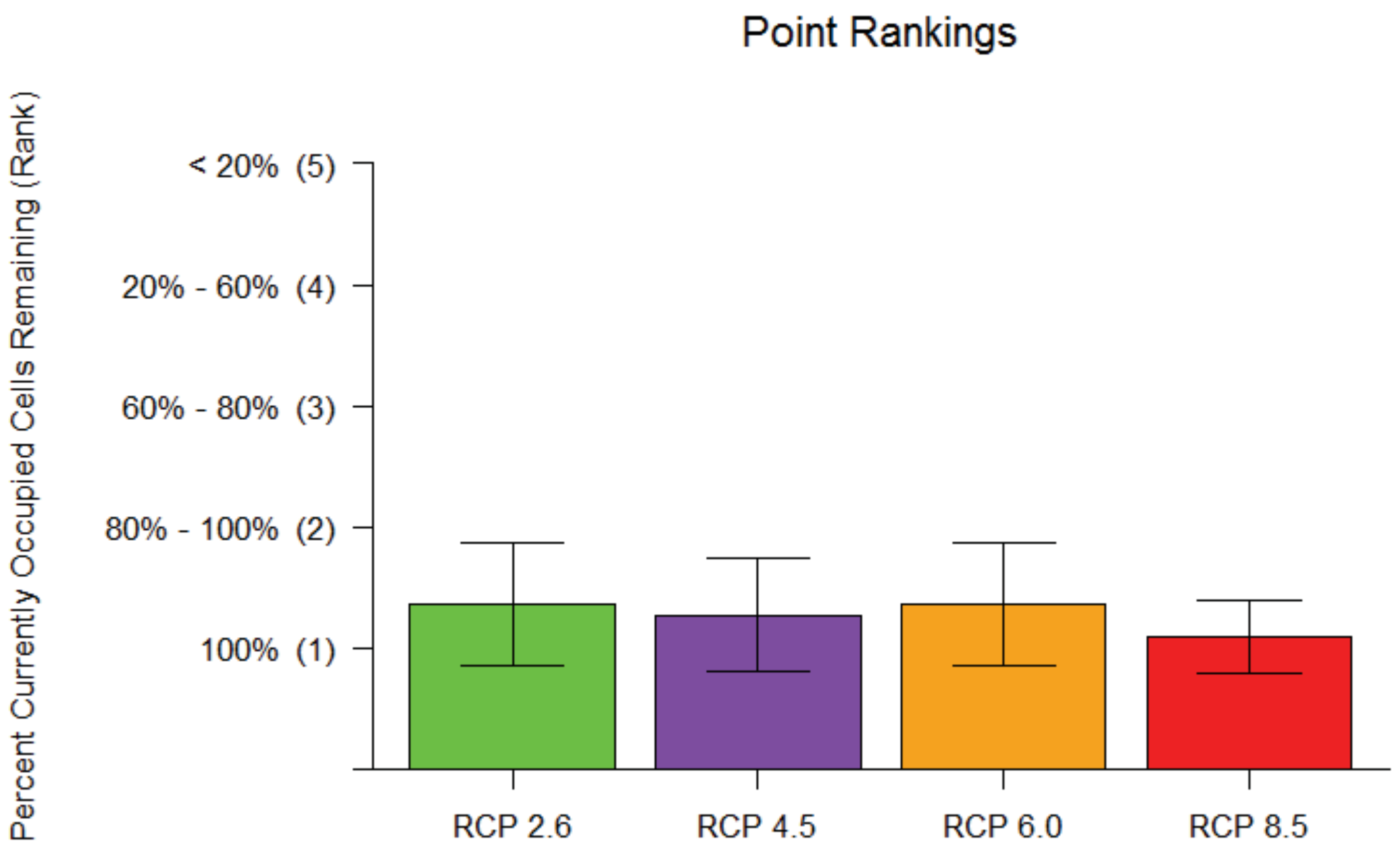


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Uta stansburiana* Side-blotched Lizard



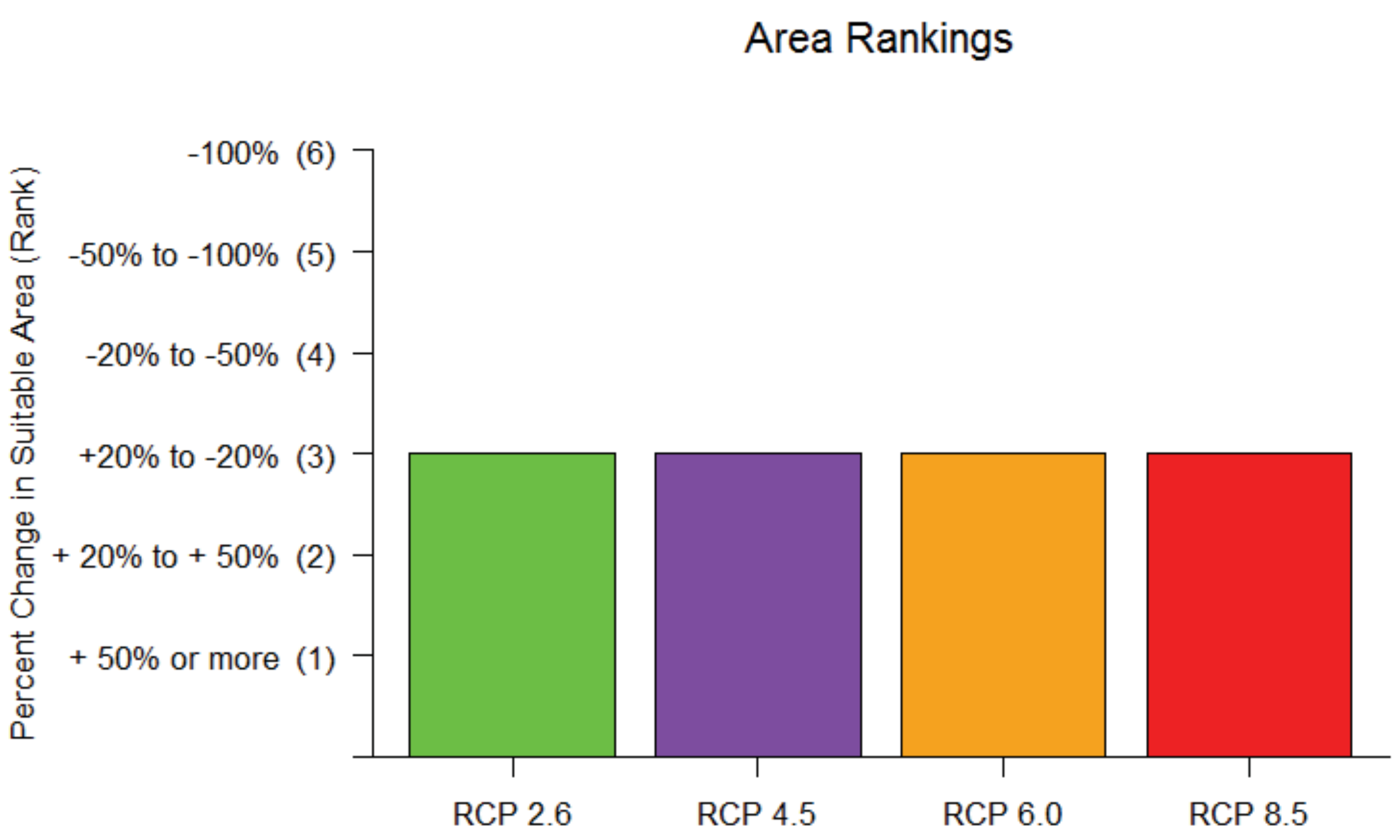


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia gracilis* Sandstone Night Lizard

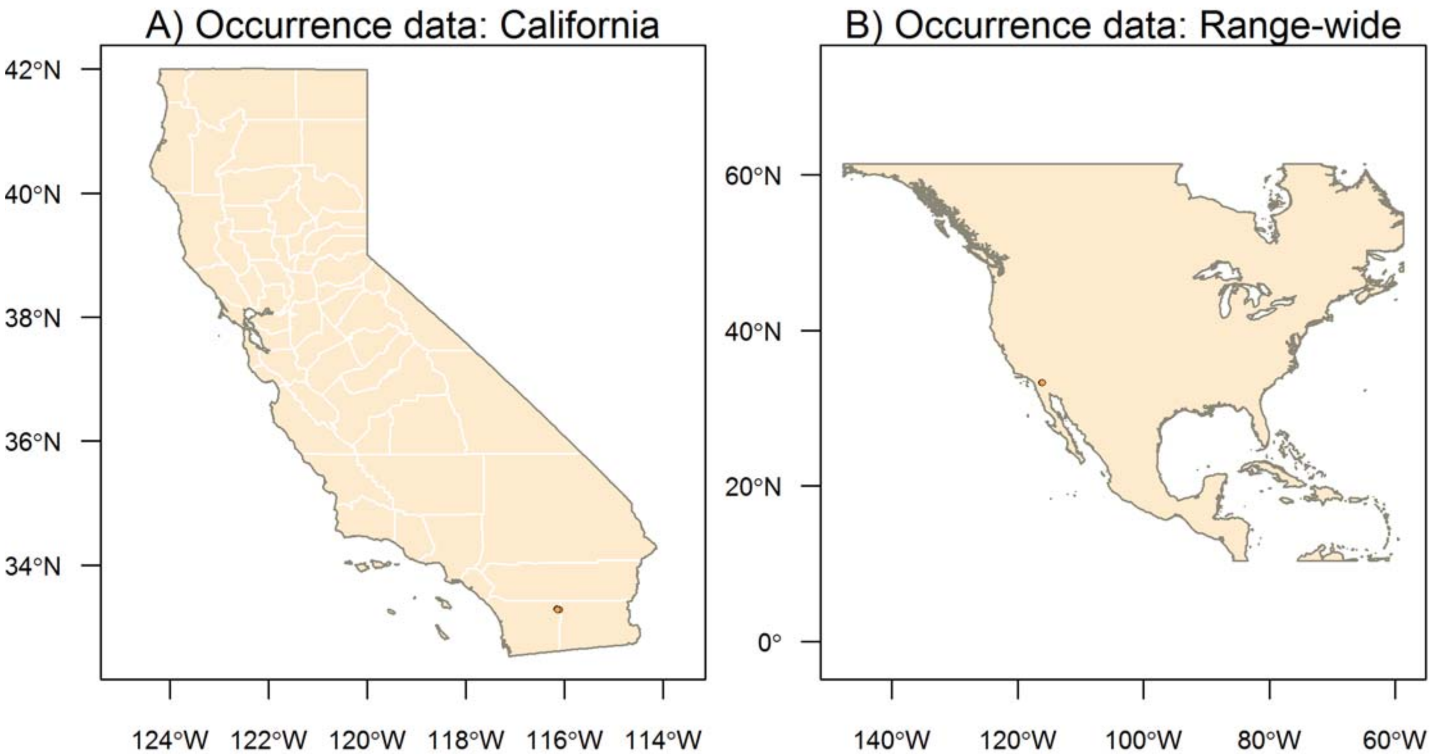


Figure 1. Occurrence data used to build Maxent models.

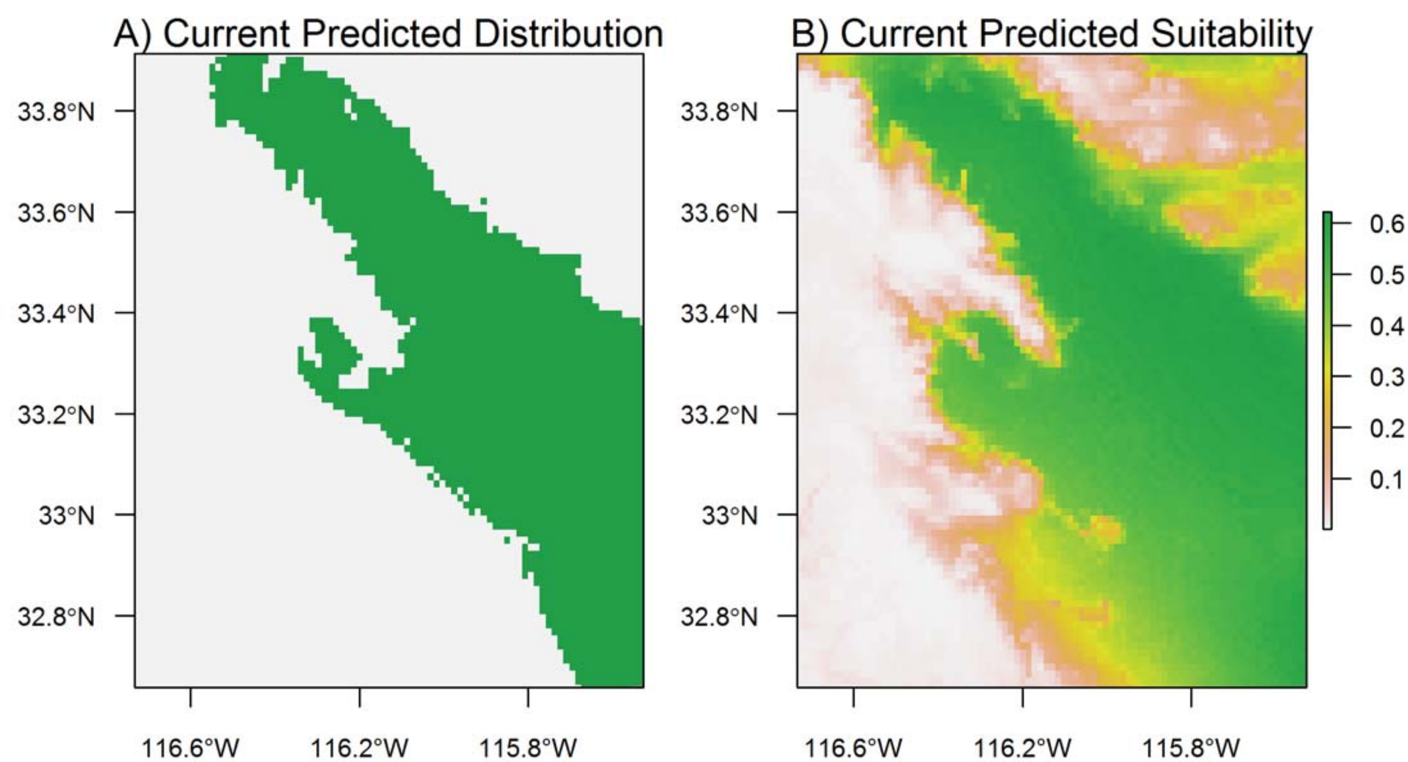


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Xantusia gracilis* Sandstone Night Lizard

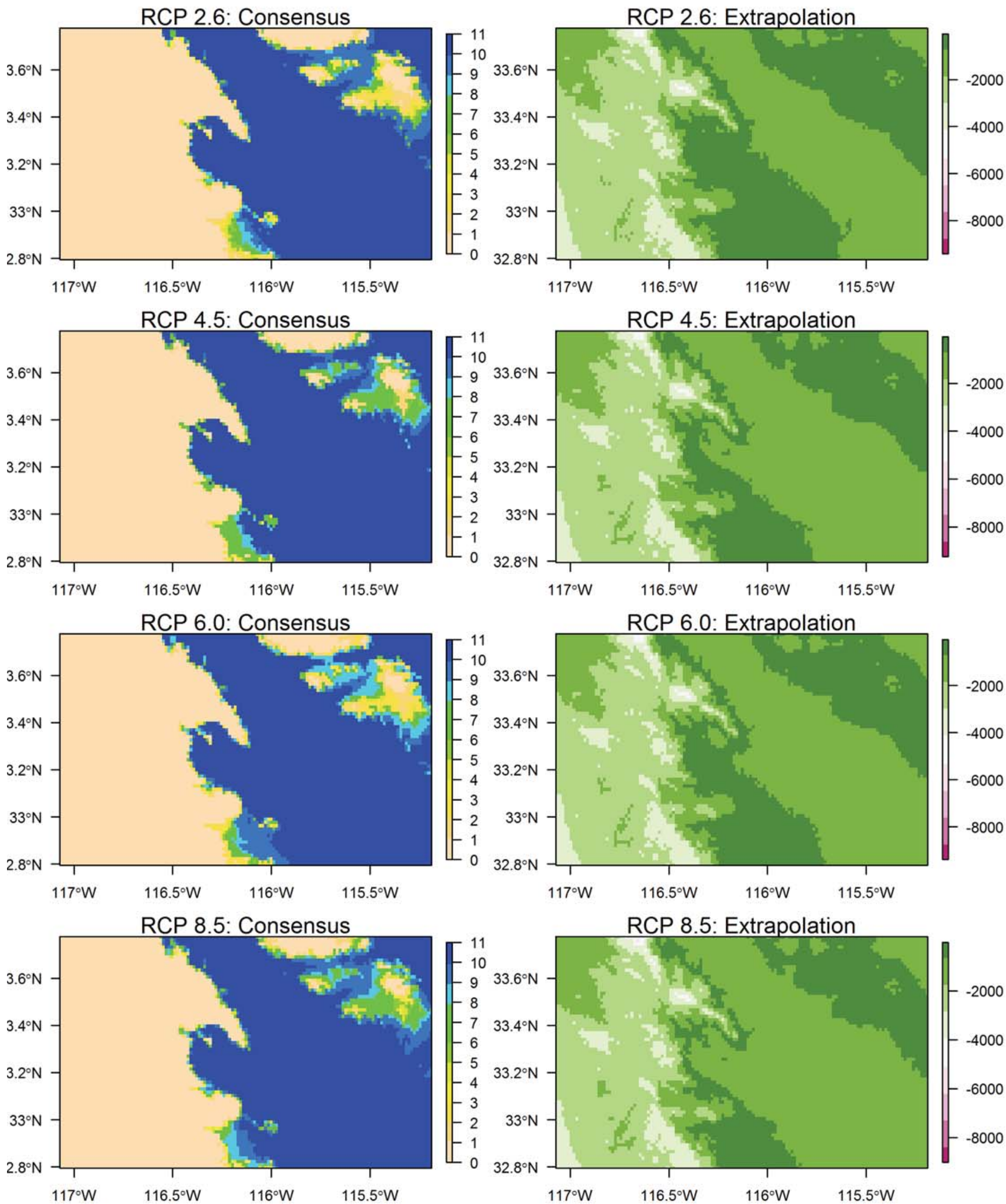


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set.

Species Results: *Xantusia gracilis* Sandstone Night Lizard

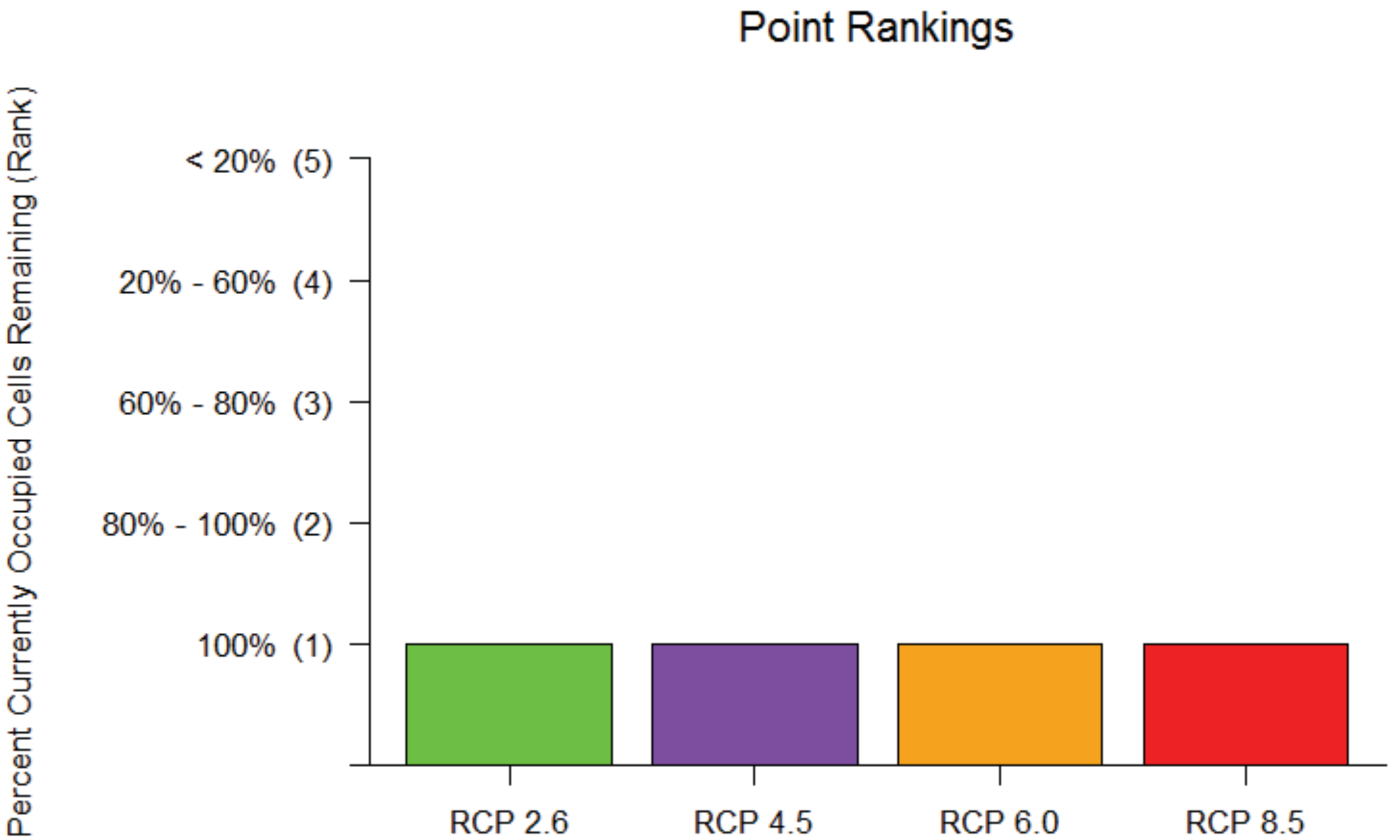


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings were not calculated for this species because it has too few occurrences in California to construct a minimum convex polygon. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia henshawi* Henshaw's Night Lizard

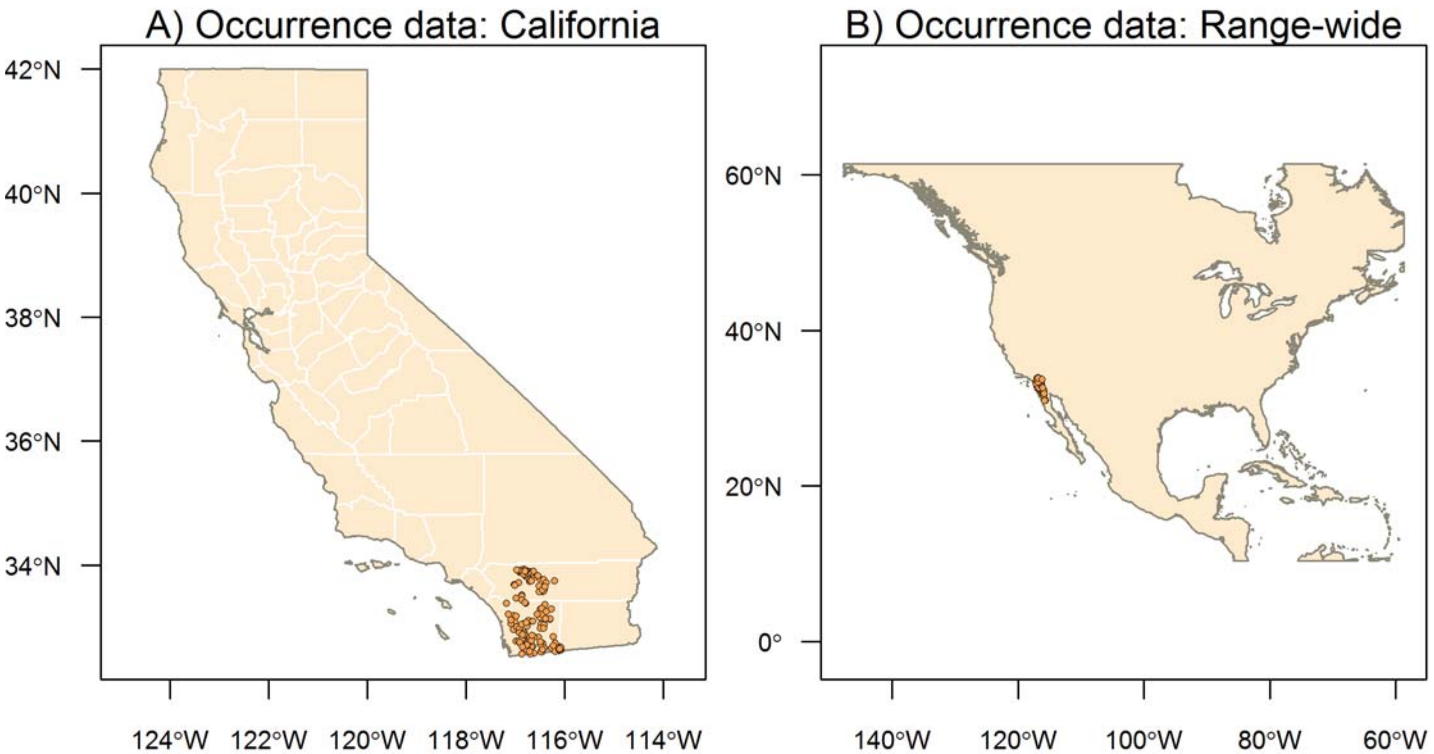


Figure 1. Occurrence data used to build Maxent models.

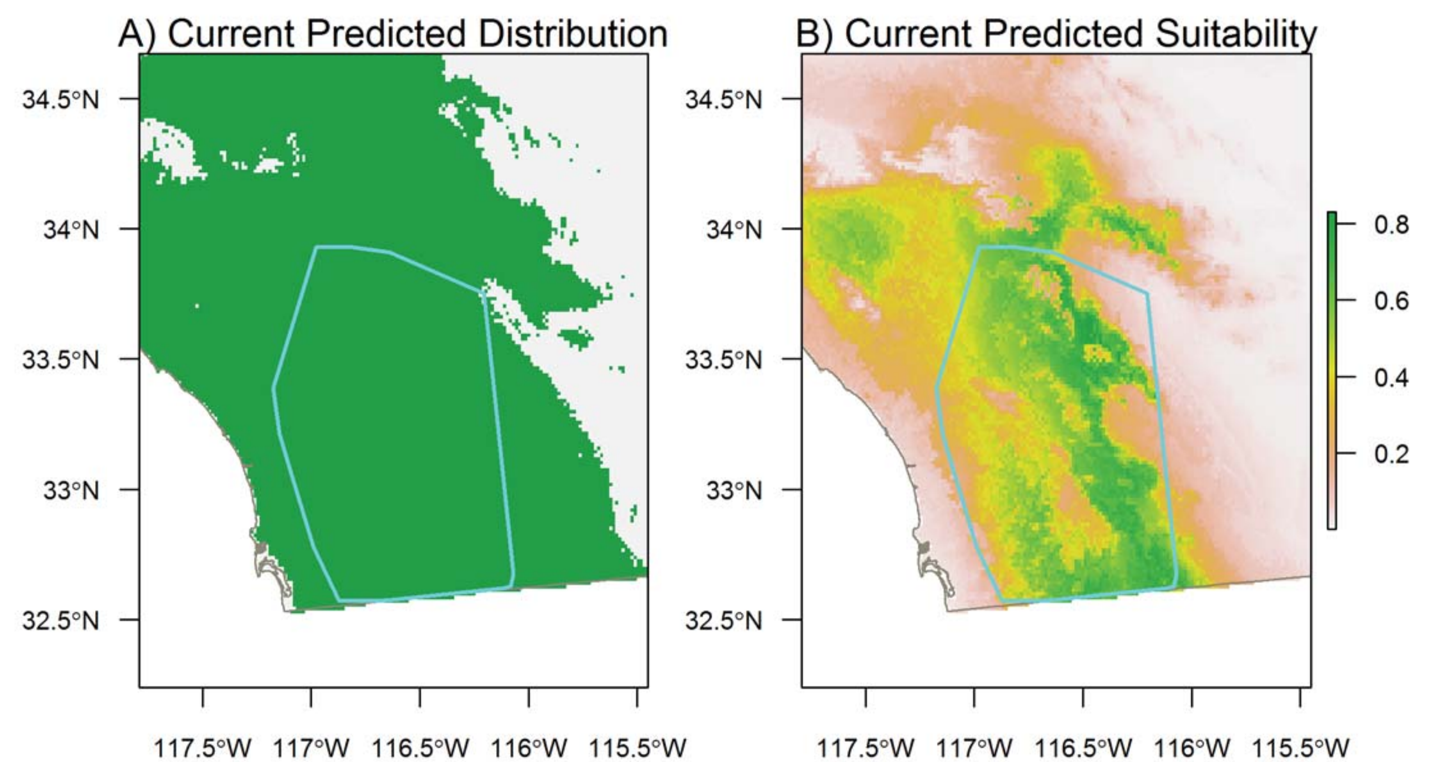


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Xantusia henshawi* Henshaw's Night Lizard

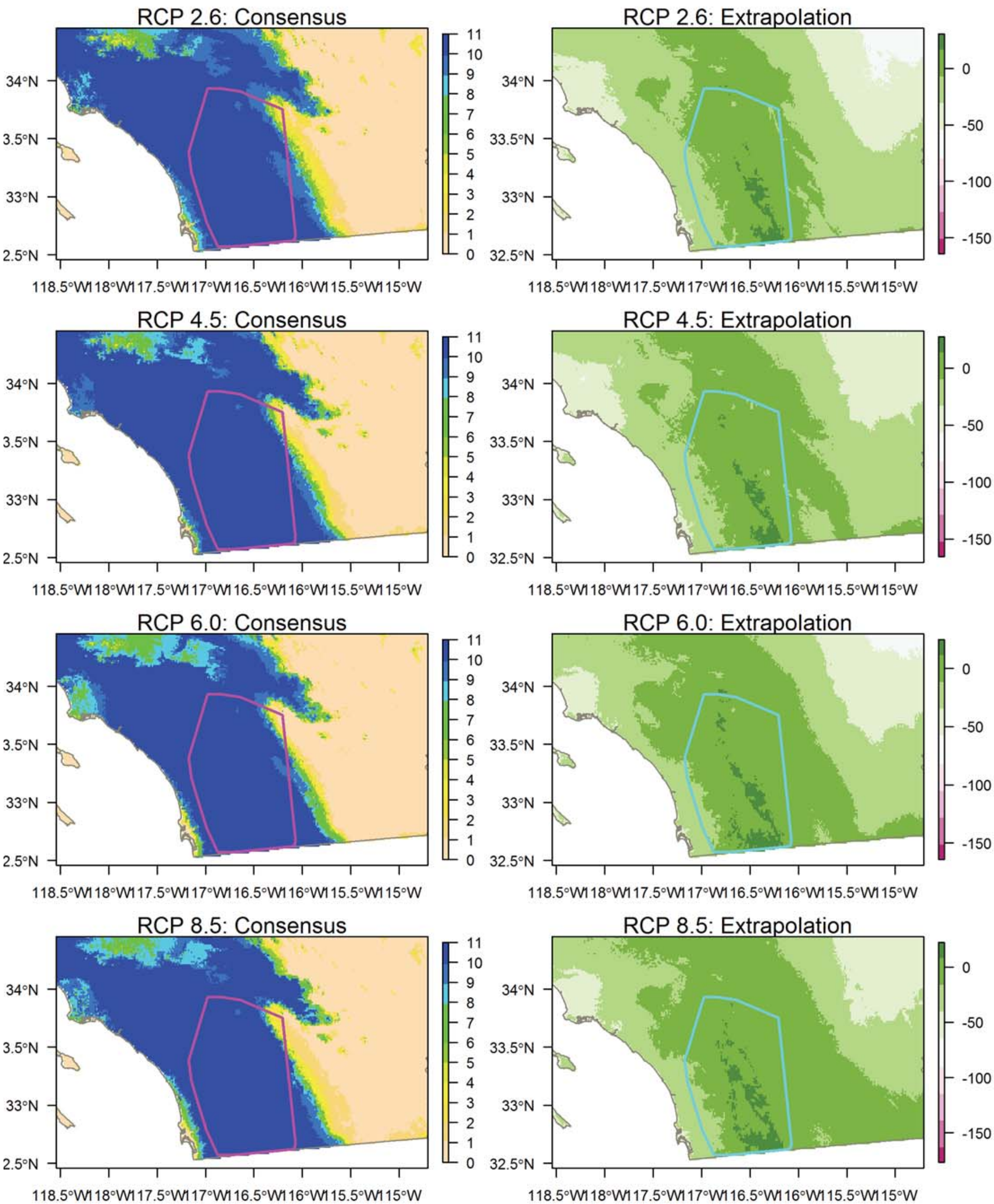


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Xantusia henshawi* Henshaw's Night Lizard

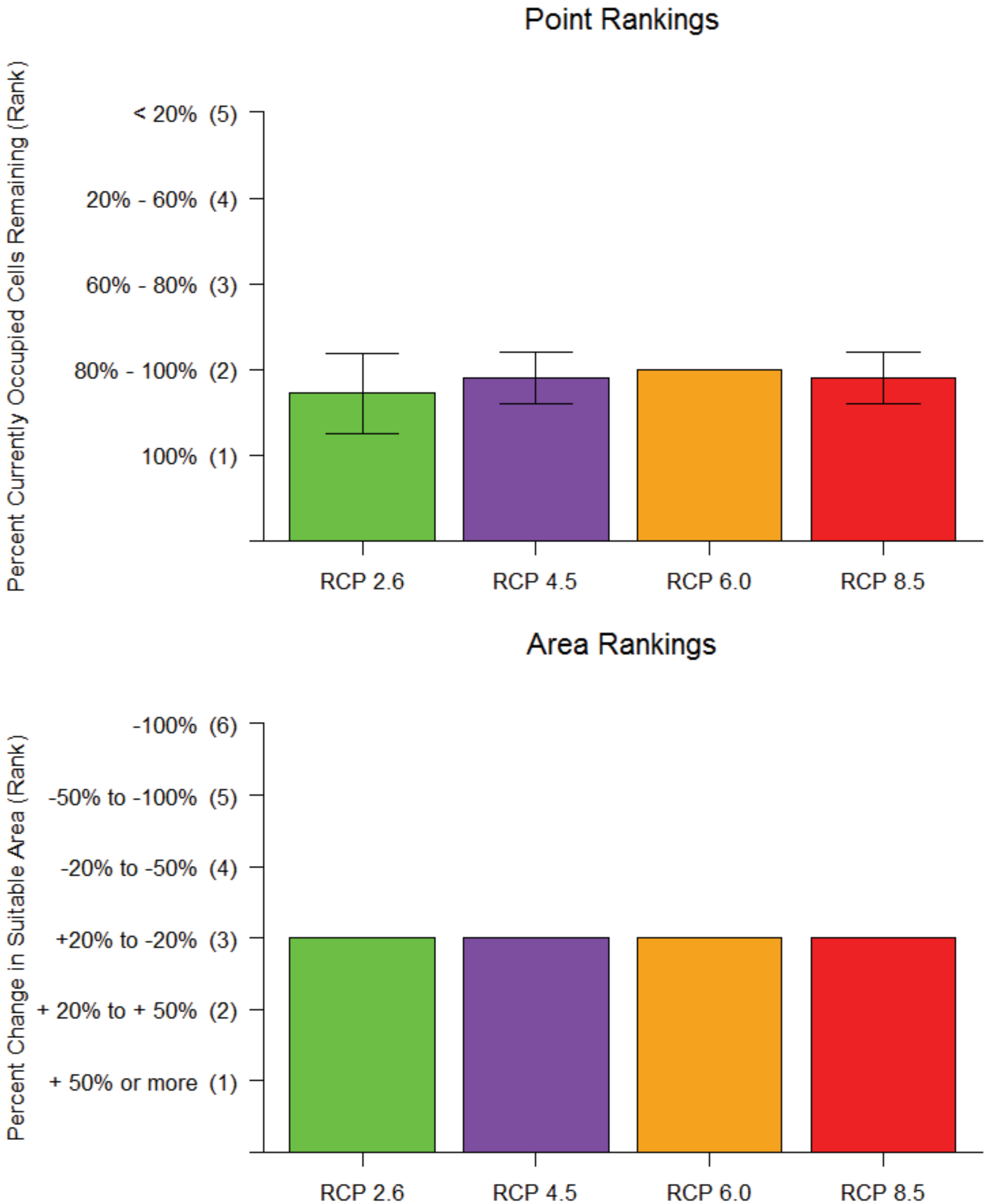


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia riversianna* Island Night Lizard

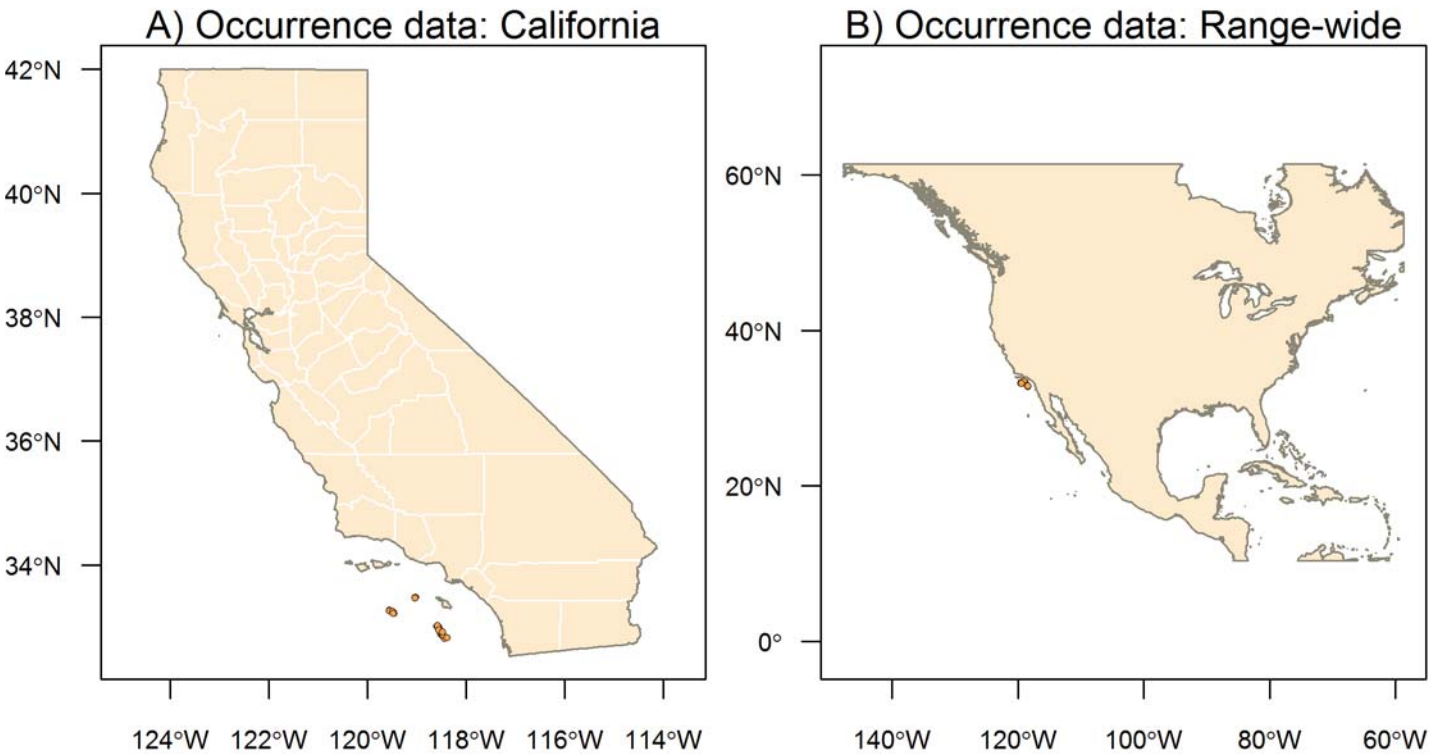


Figure 1. Occurrence data used to build Maxent models.

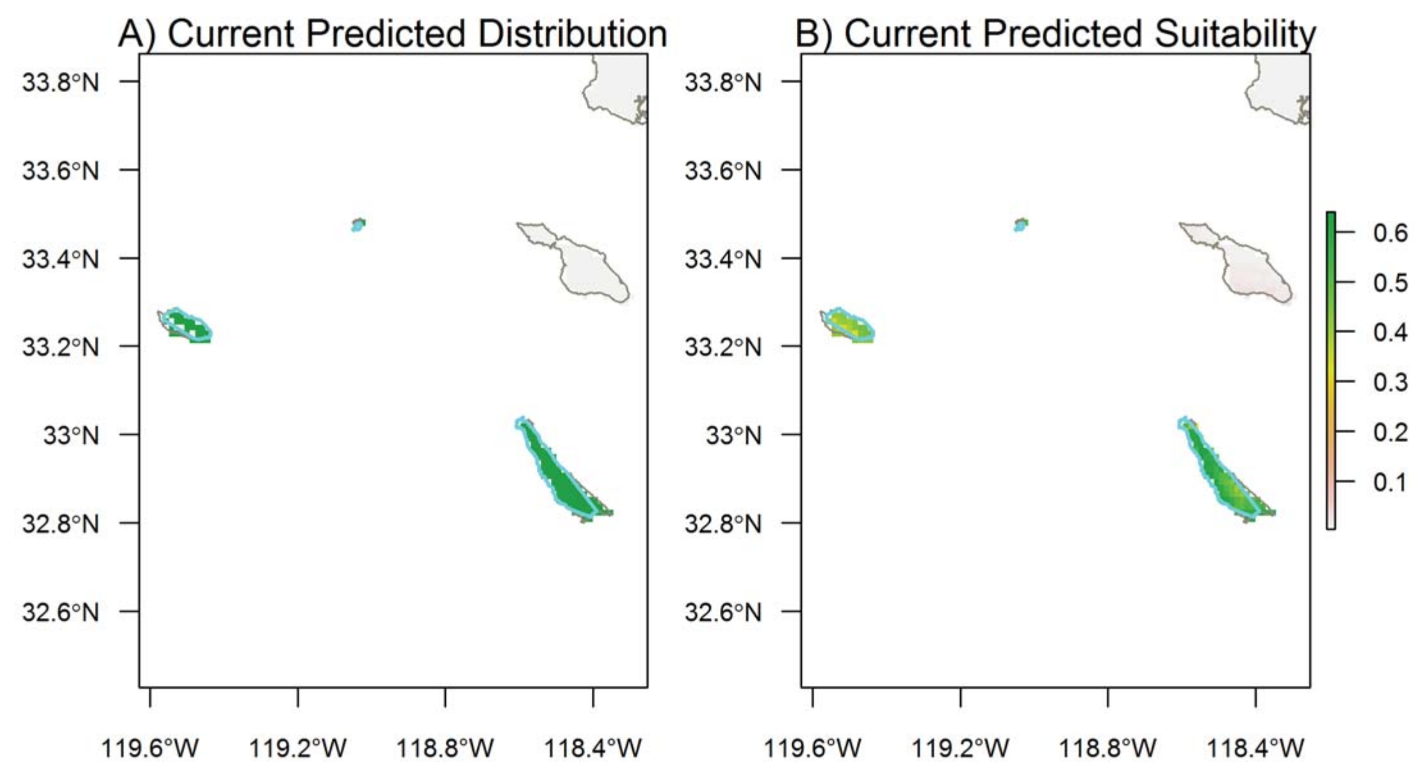


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

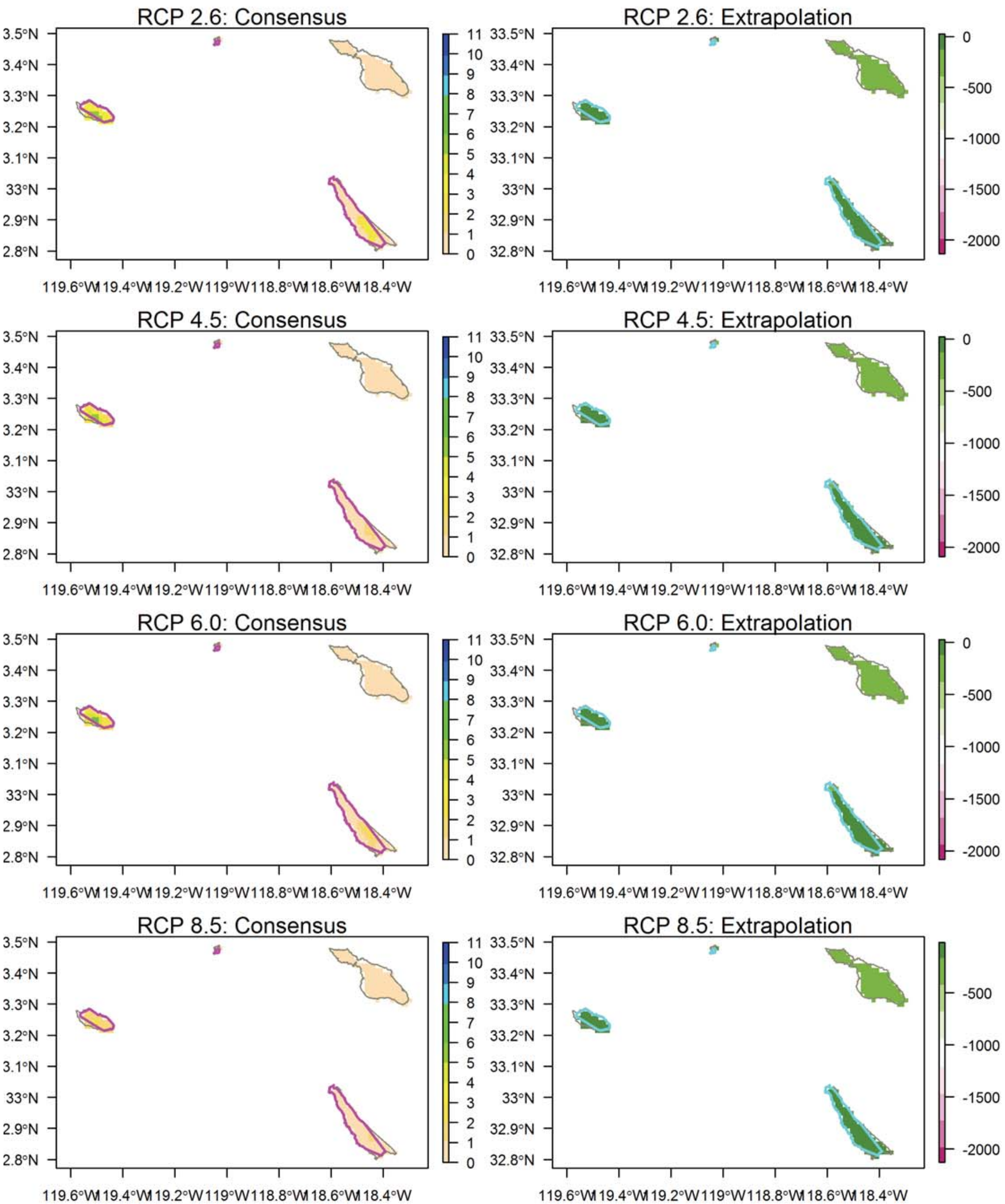


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Xantusia riversianna* Island Night Lizard

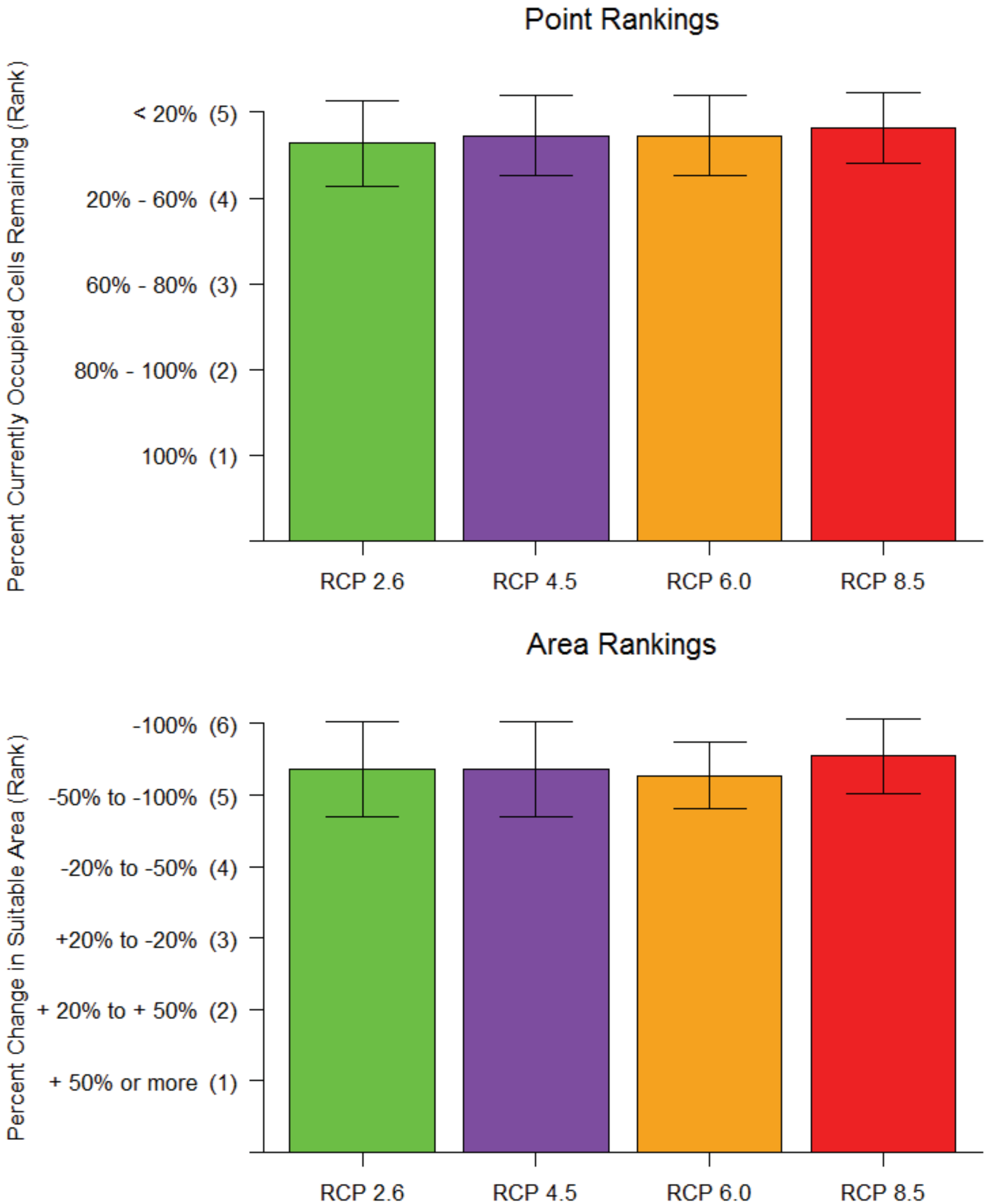


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia sp.* San Jacinto

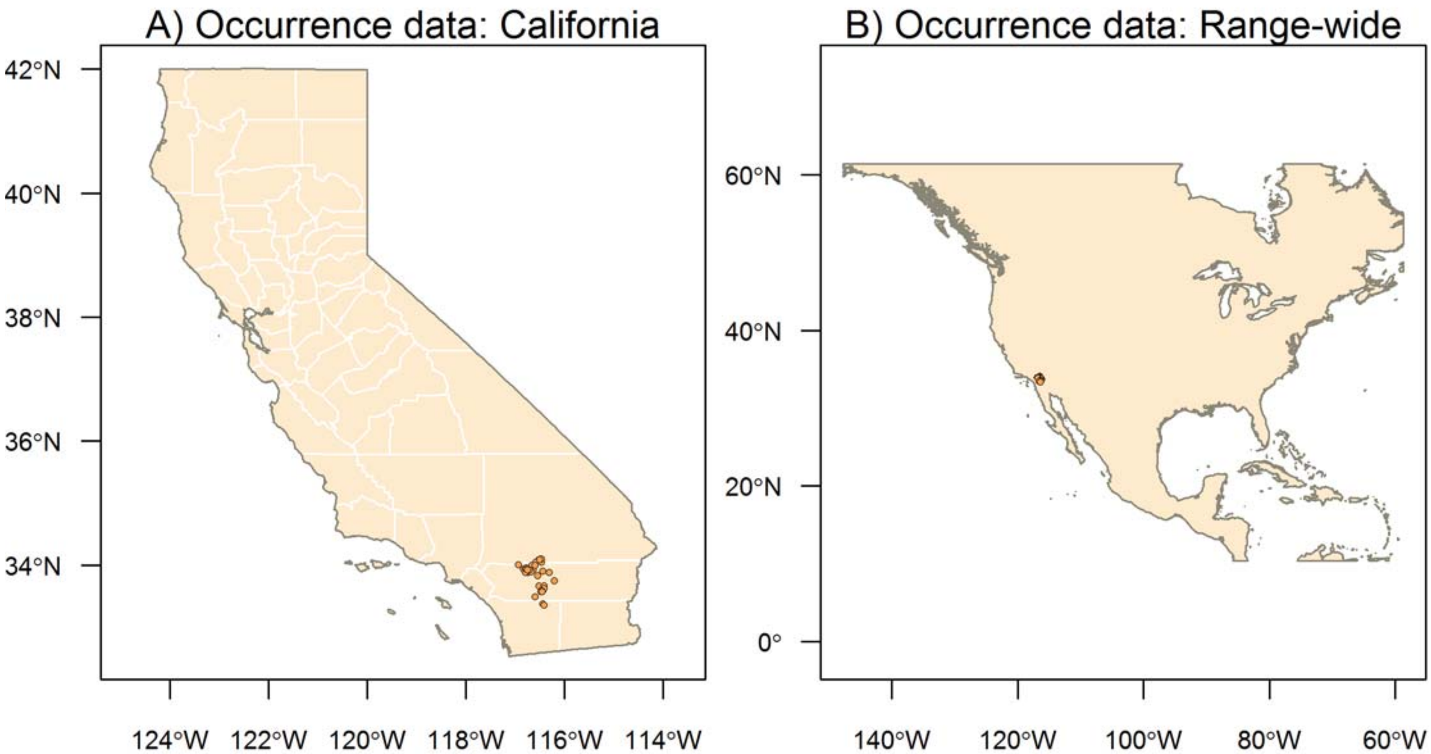


Figure 1. Occurrence data used to build Maxent models.

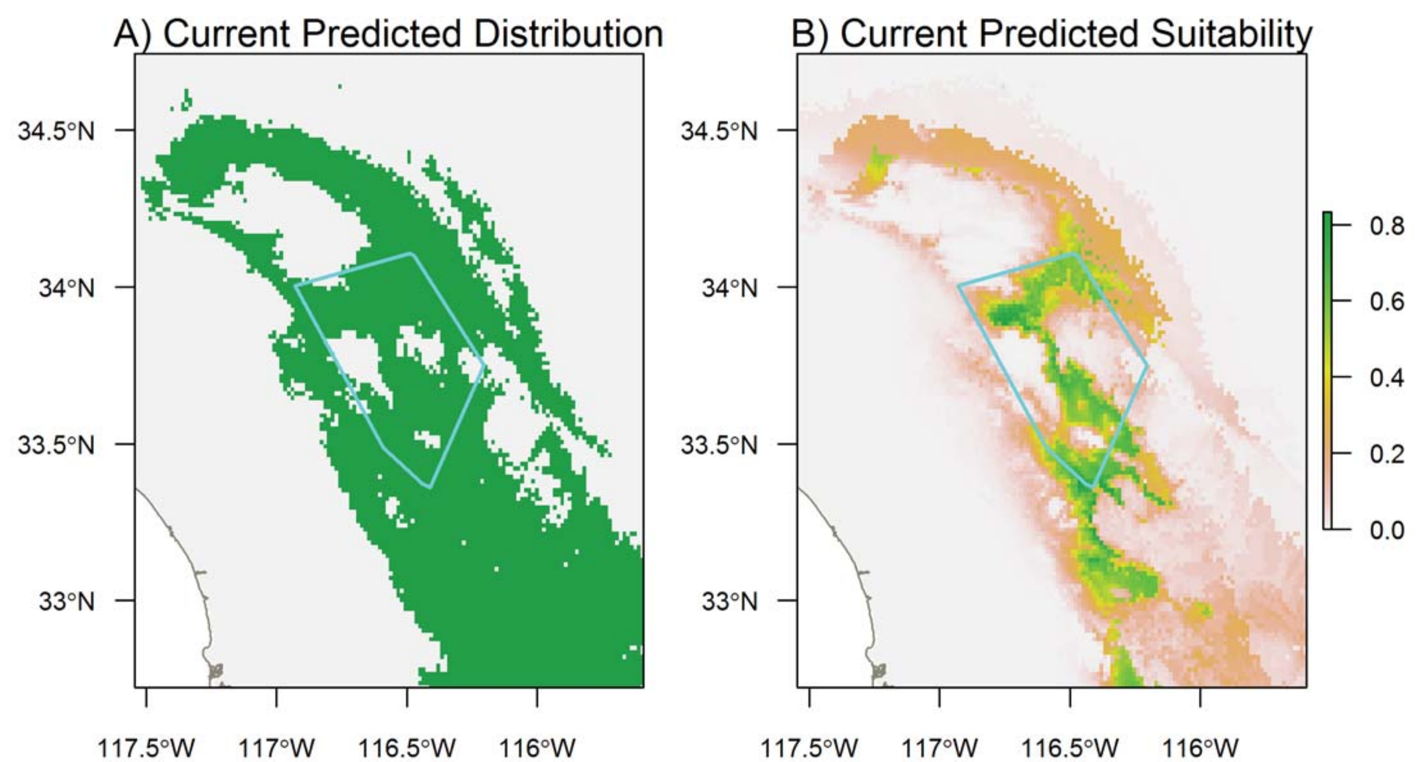


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Xantusia sp.* San Jacinto

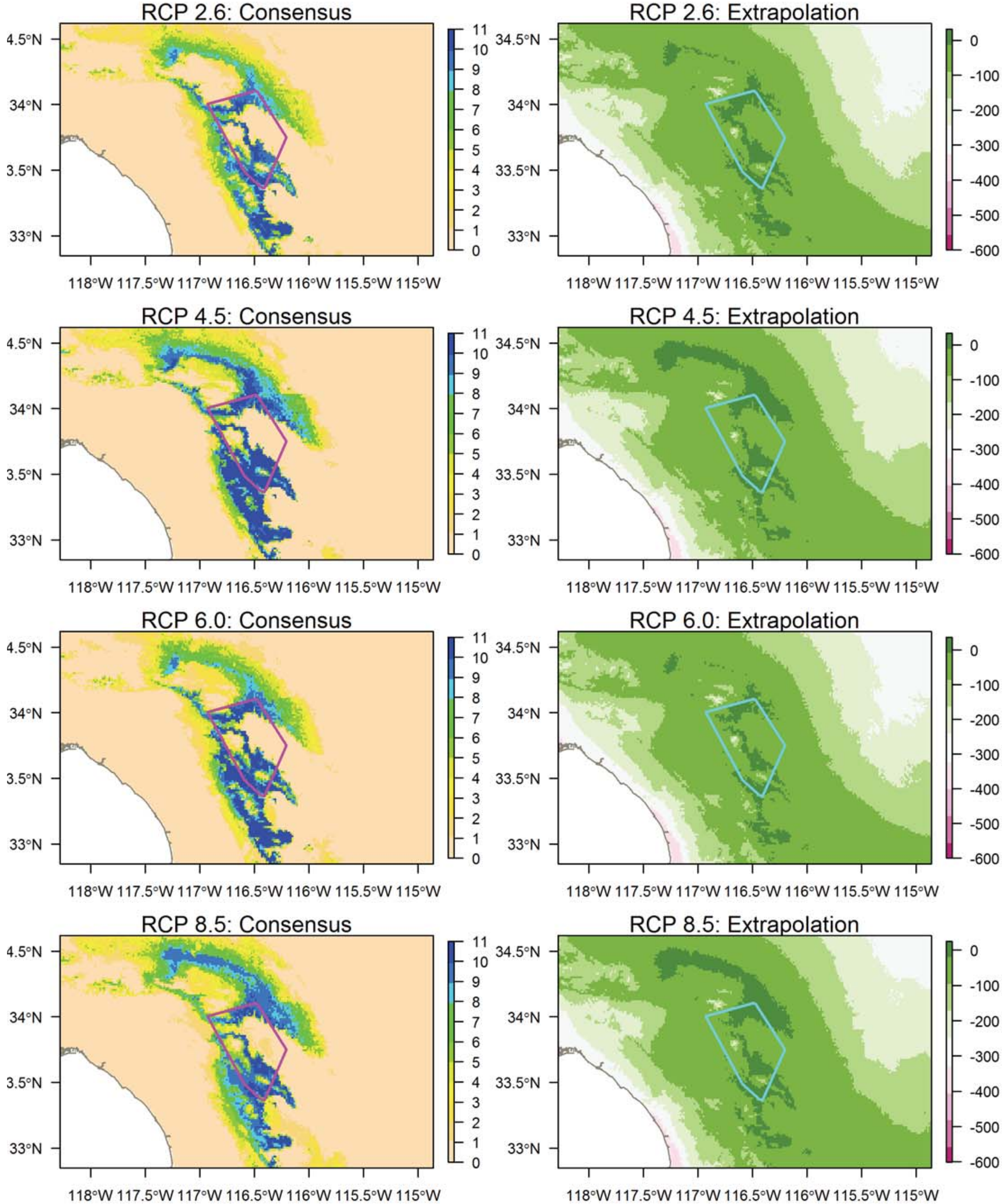
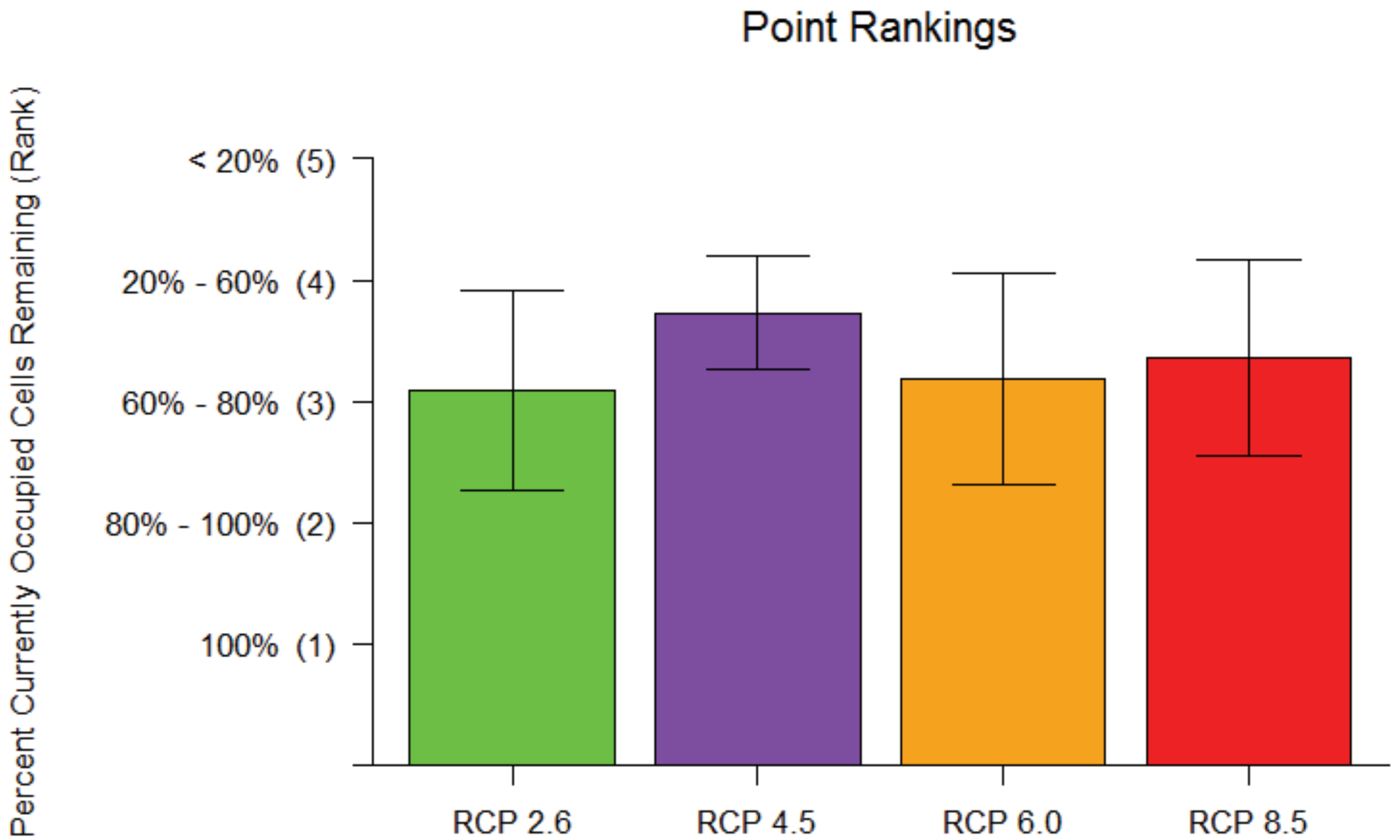


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Xantusia sp.* San Jacinto



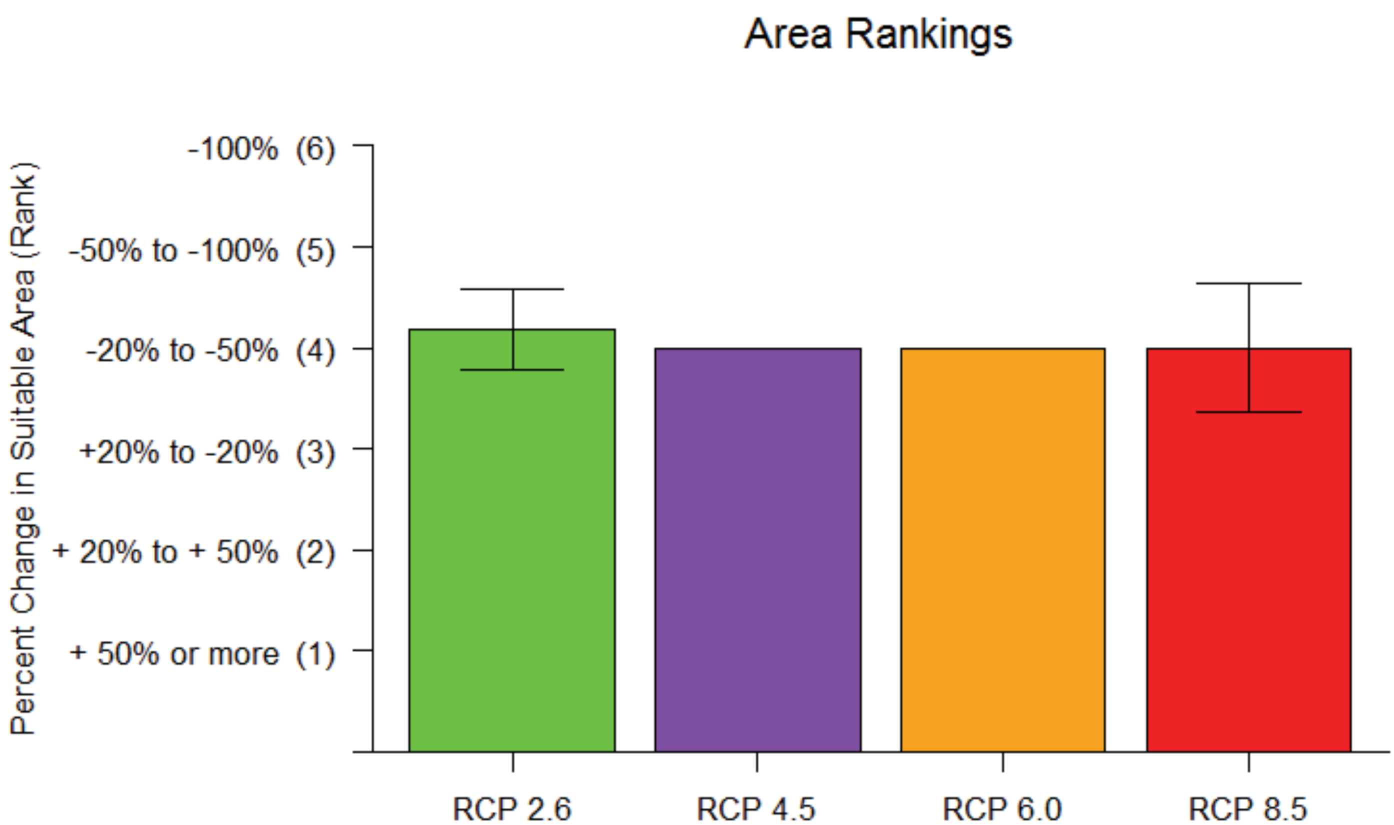


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia vigilis* Desert Night Lizard

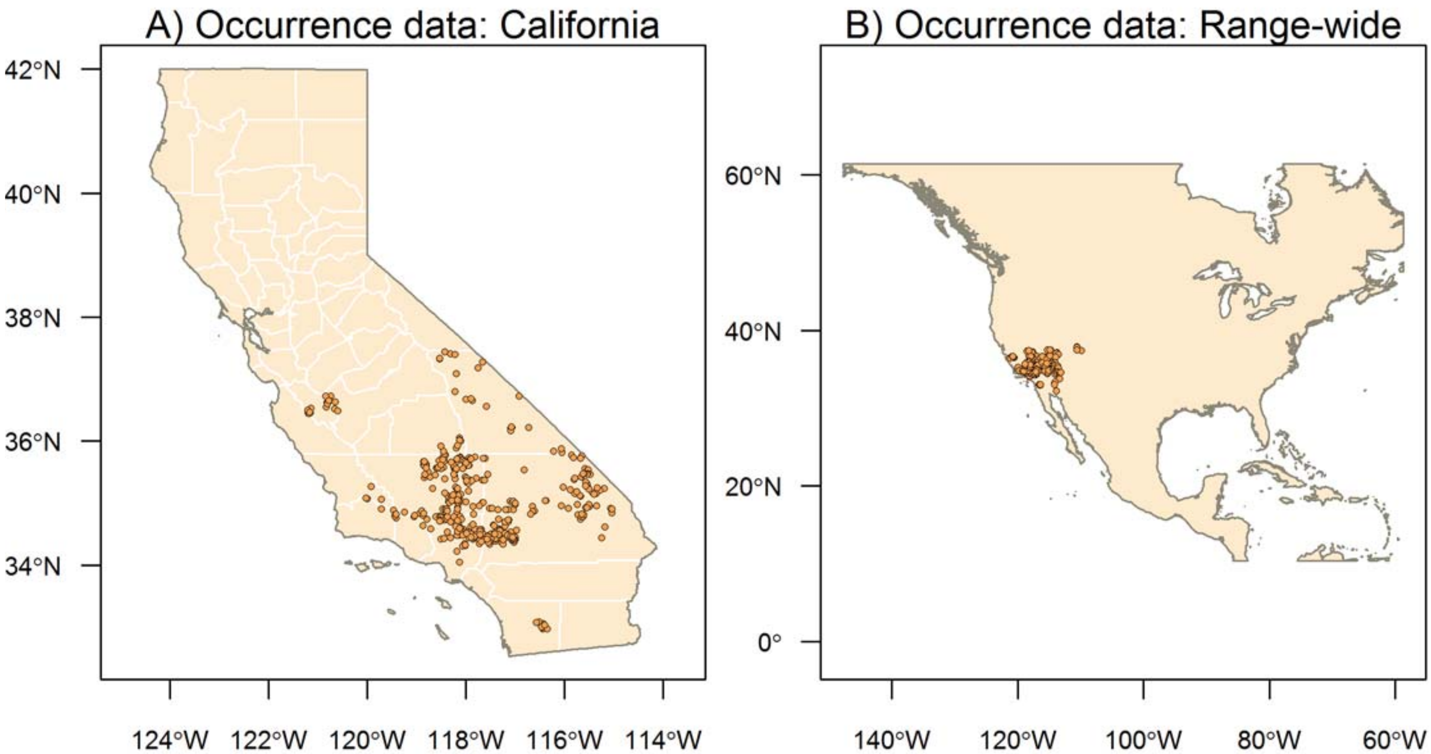


Figure 1. Occurrence data used to build Maxent models.

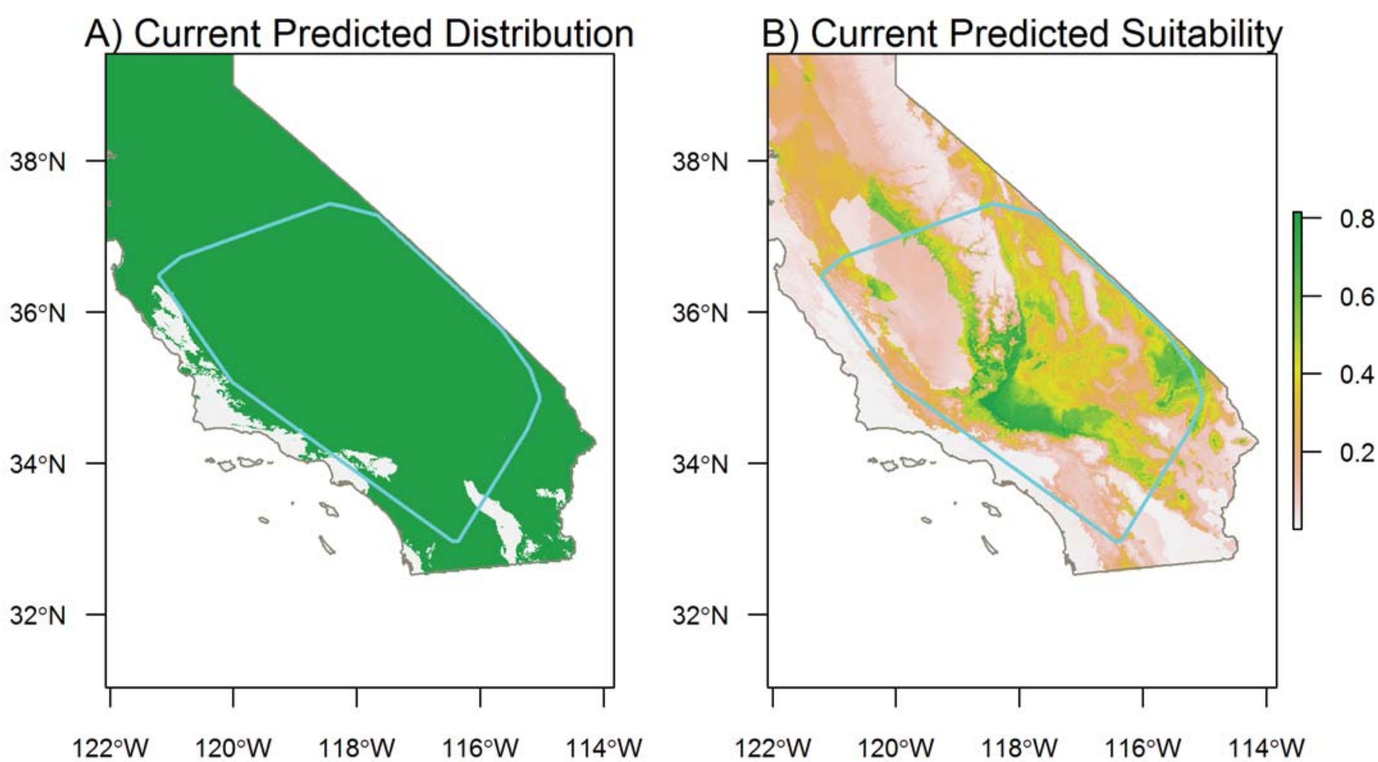


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Xantusia vigilis* Desert Night Lizard

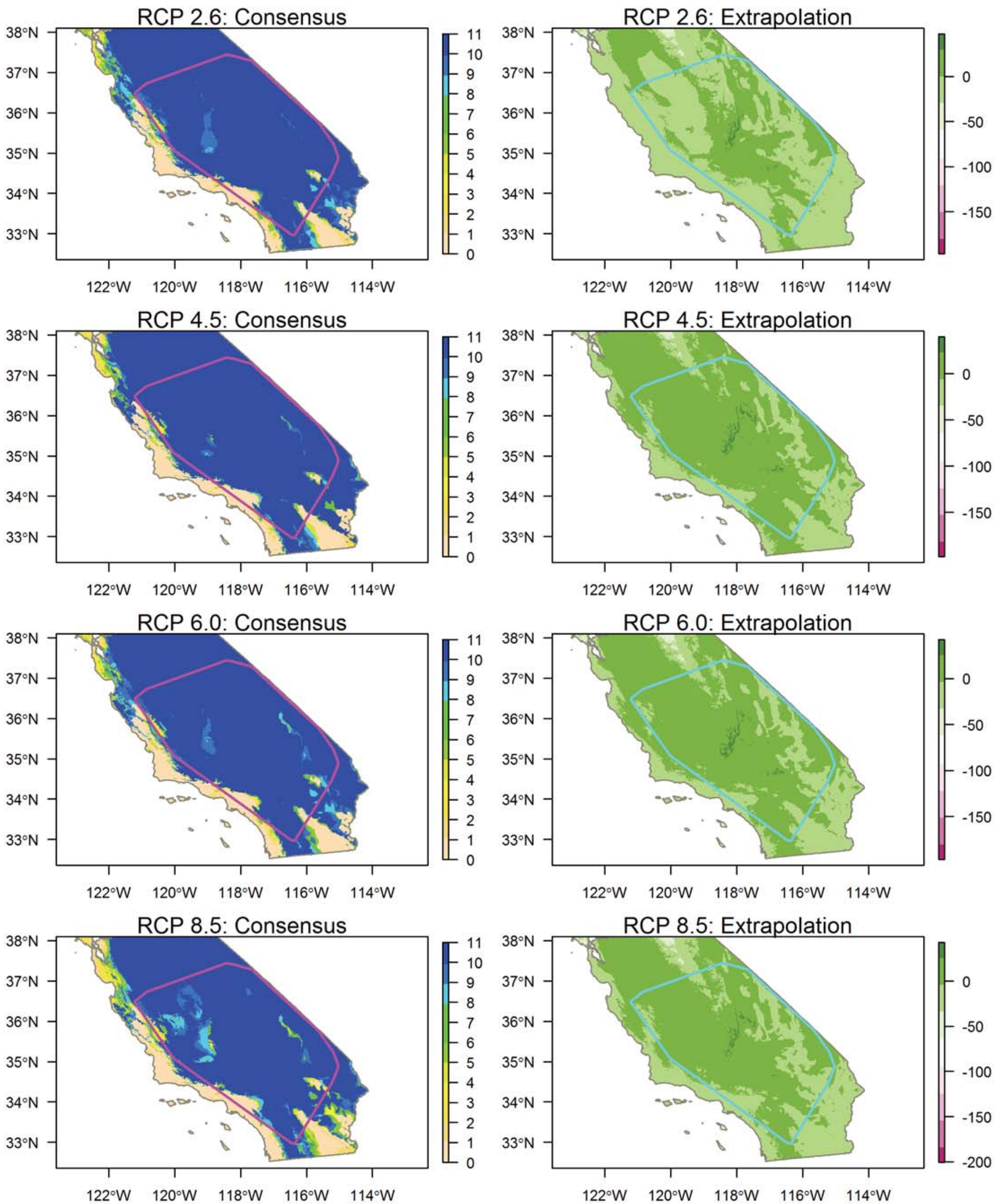
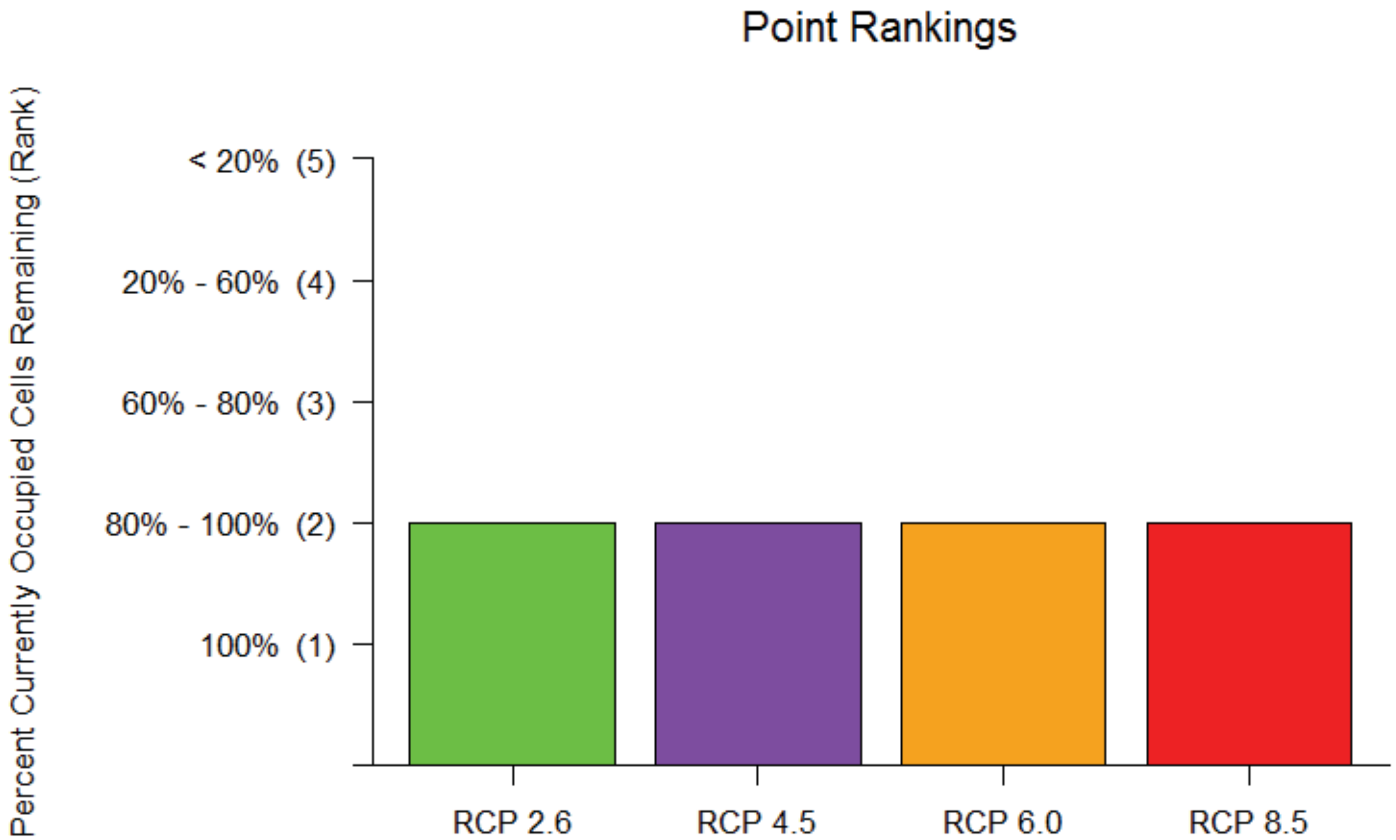


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Xantusia vigilis* Desert Night Lizard



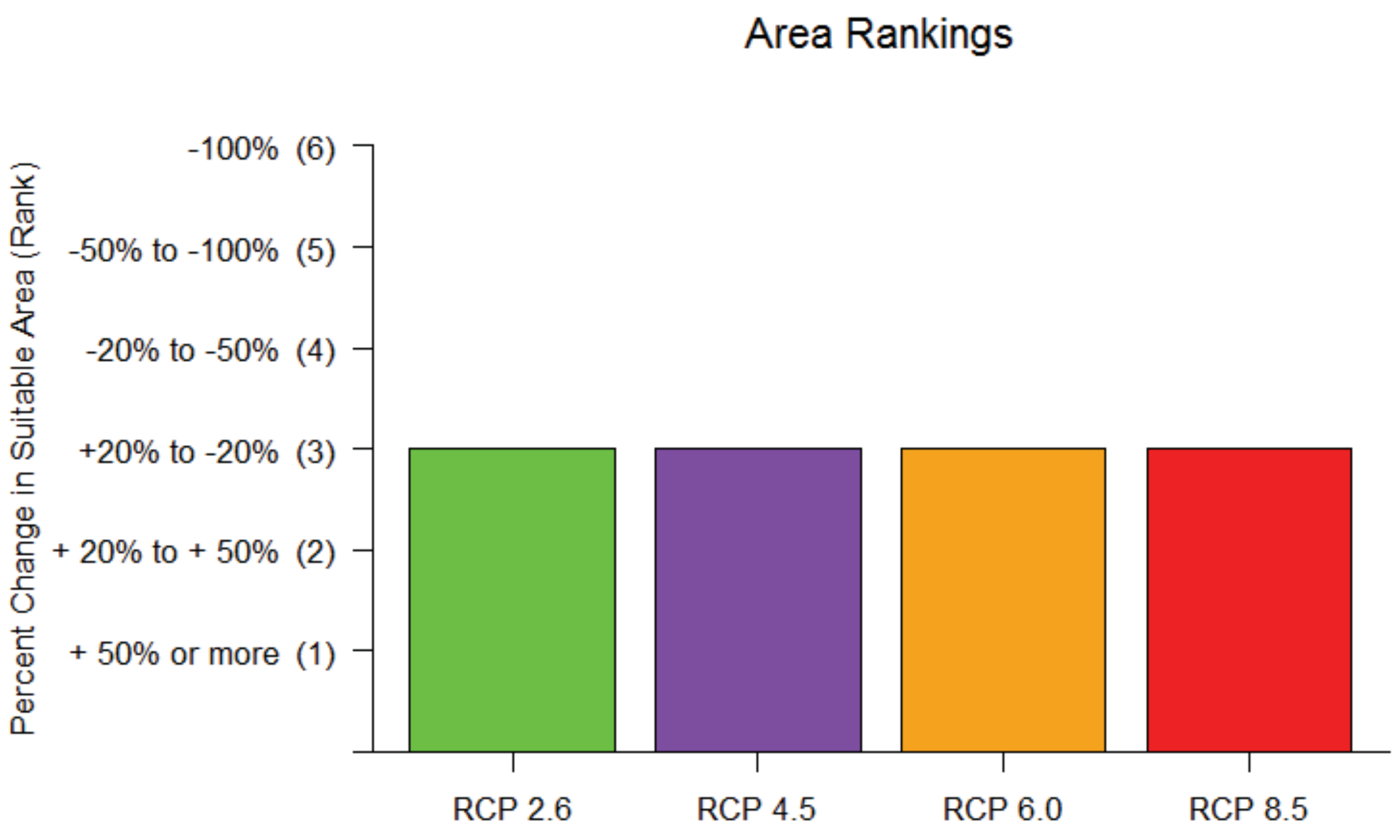


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia wigginsi* Baja Night Lizard

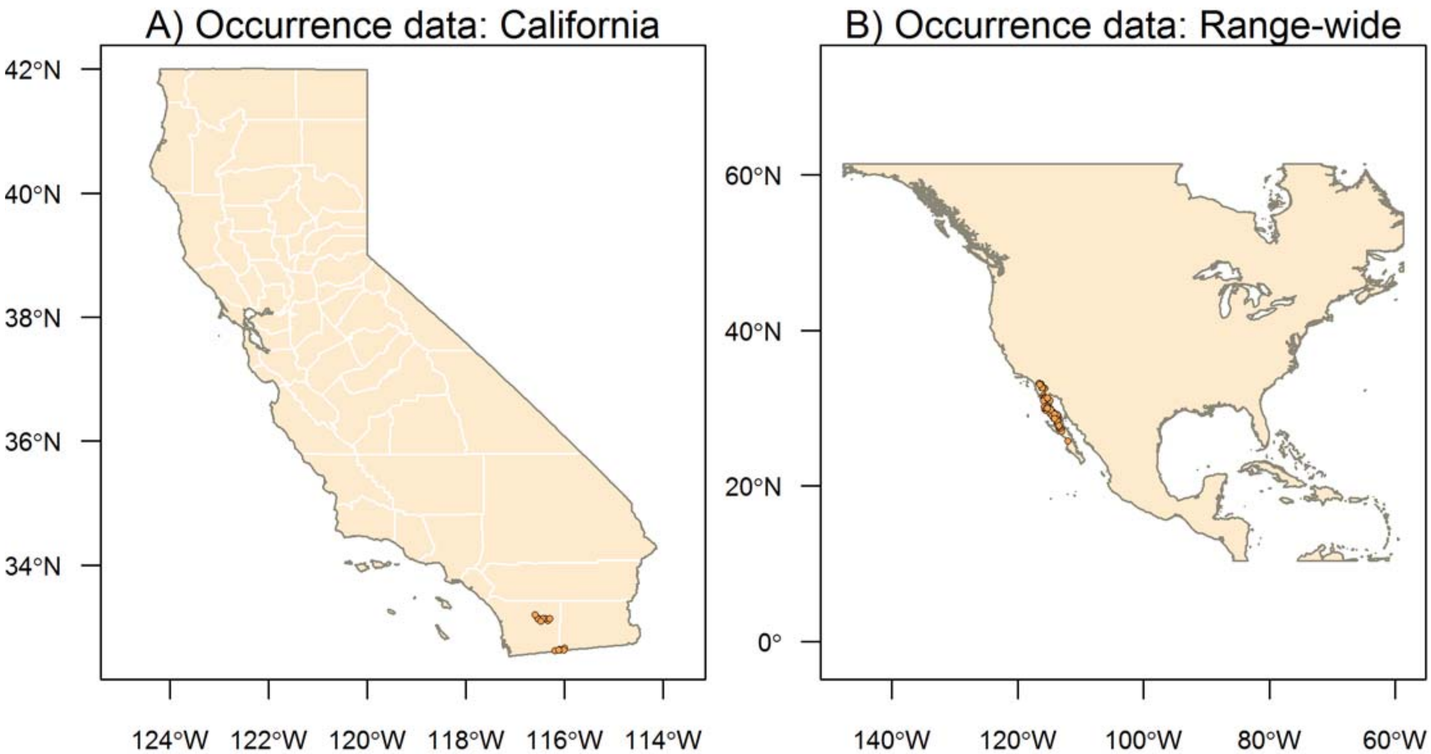


Figure 1. Occurrence data used to build Maxent models.

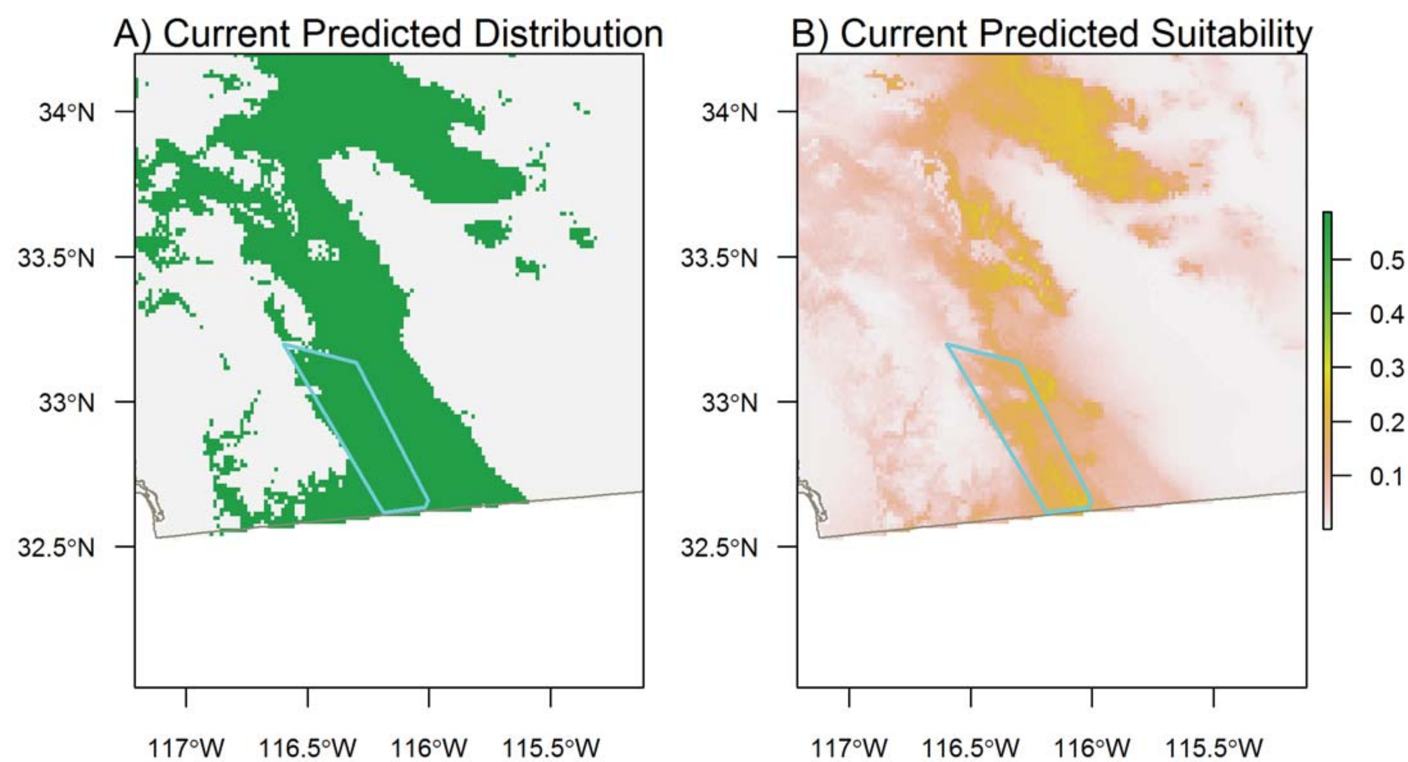


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Xantusia wigginsi* Baja Night Lizard

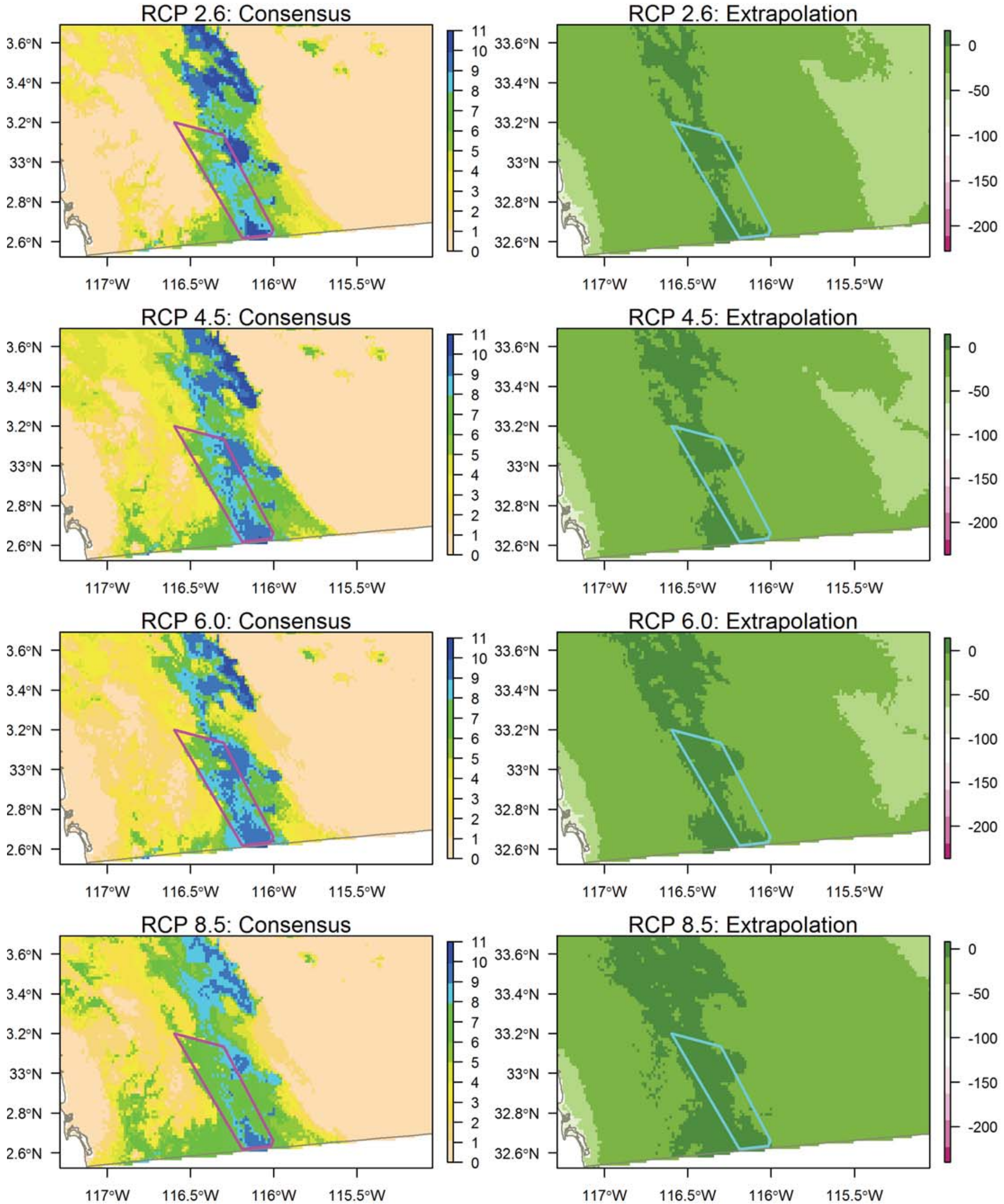


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

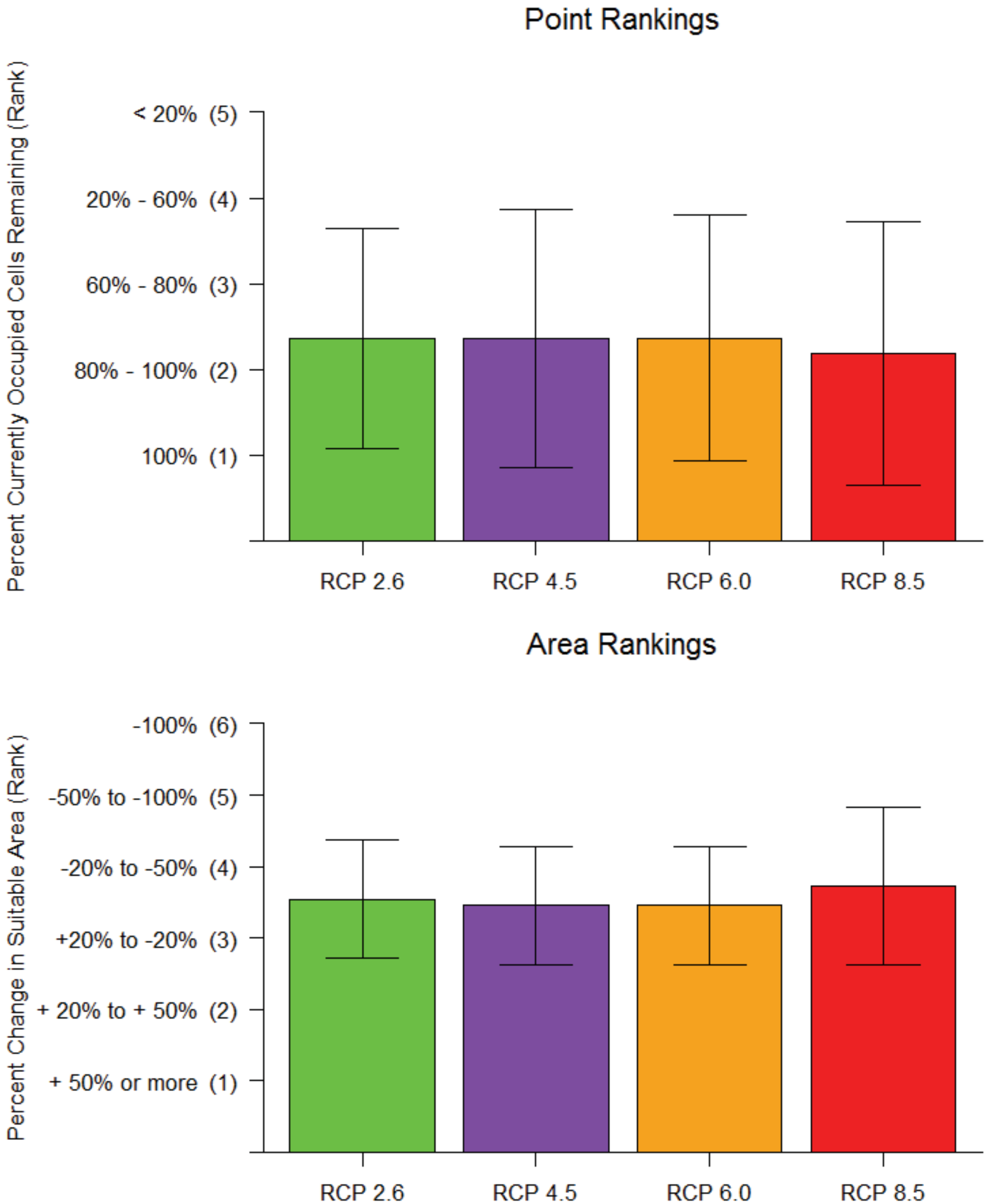


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations

Species Results: *Xantusia sp.* Yucca Valley

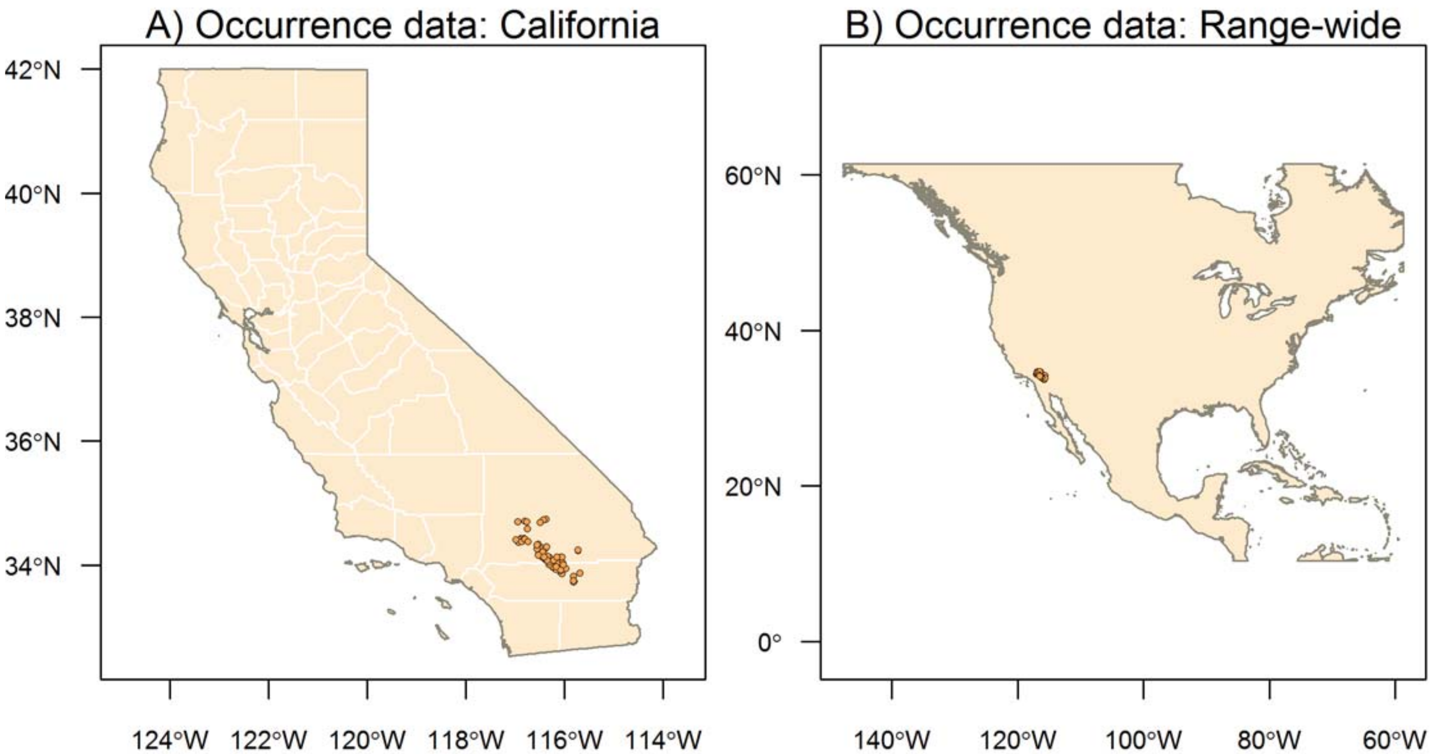


Figure 1. Occurrence data used to build Maxent models.

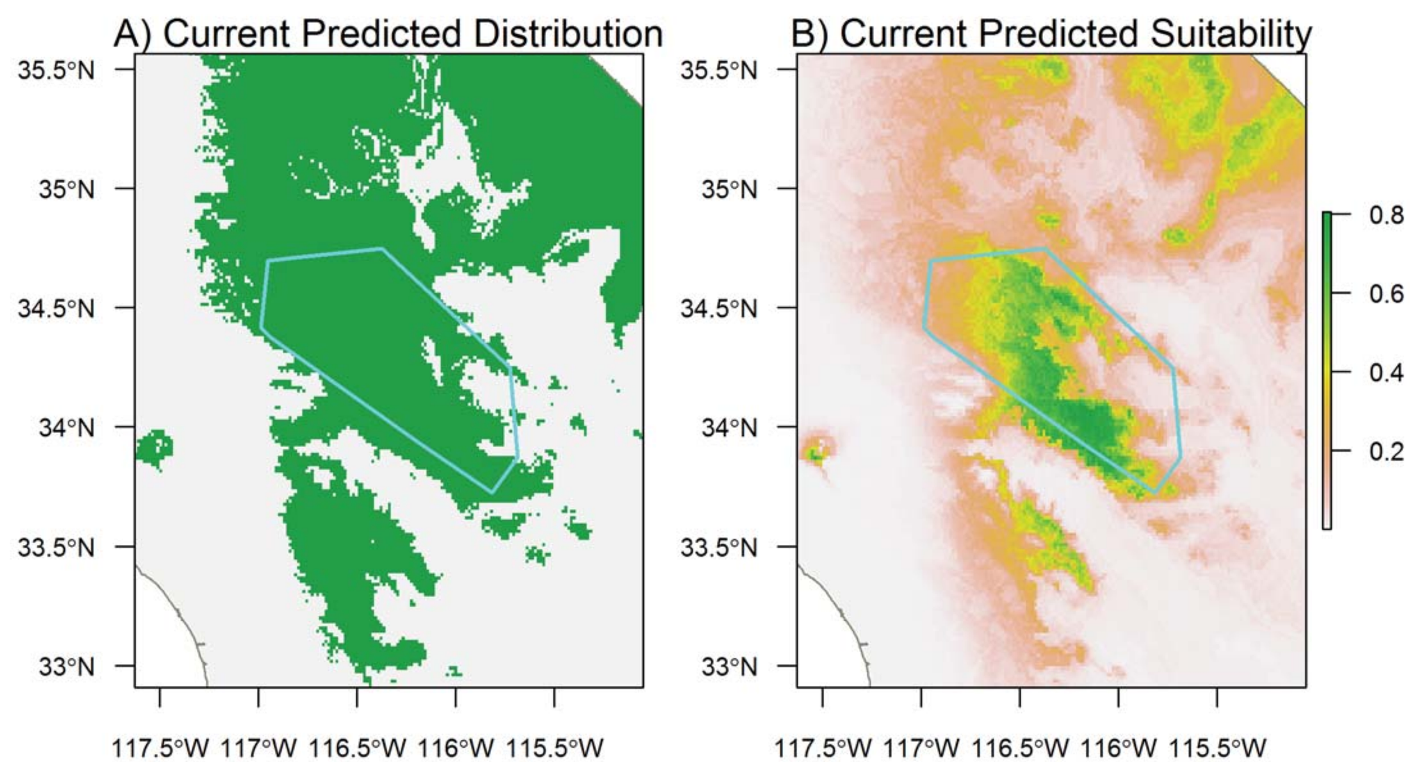


Figure 2. A) Green areas are cells where predicted suitability is at least as good as the lowest suitability occupied cell. Light gray areas are cells where predicted suitability is worse than the lowest suitability occupied cell. B) Maxent logistic output of predicted suitability. Higher values represent more suitable habitat. The polygons outlined in turquoise are minimum convex polygons containing currently occupied cells in California.

Species Results: *Xantusia sp.* Yucca Valley

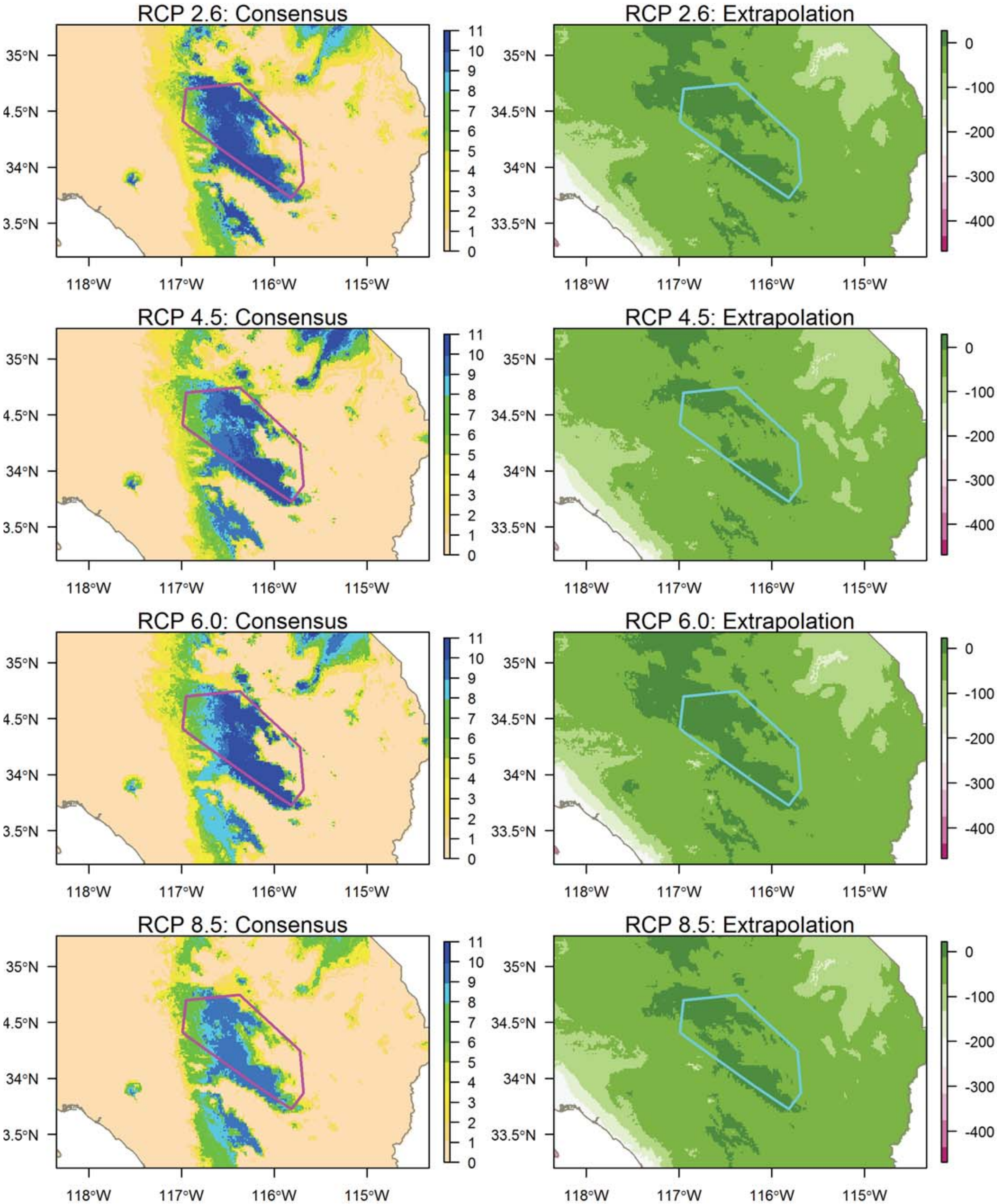


Figure 3. For each RCP, the consensus map shows the number of GCMs (0-11) that predict a cell to be suitable in the future. Extrapolation maps (Multivariate Environmental Similarity Surface maps) show areas where model predictions should be interpreted with caution because some extrapolation is occurring. Negative values are sites where at least one climate variable in the future has a value that is outside of the range of values in the current climate data set. The polygons outlined in magenta and turquoise show the minimum convex polygon containing currently occupied cells.

Species Results: *Xantusia sp.* Yucca Valley

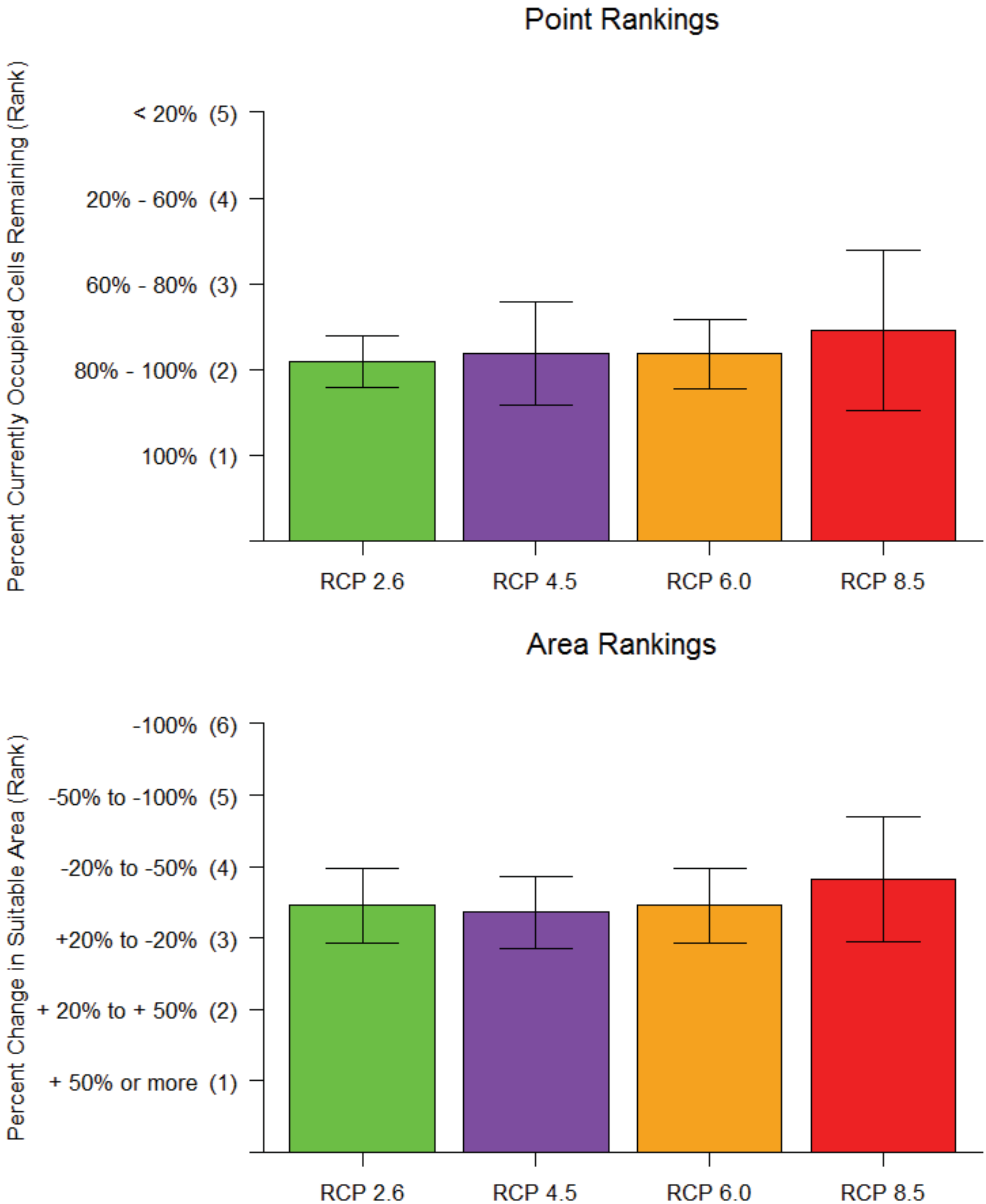


Figure 4. Point rankings show the number of currently occupied cells predicted to remain suitable in the future. Area rankings are calculated as the percent change in predicted suitable habitat within the minimum convex polygon containing currently occupied cells. Ranks are averaged across GCMs (n = 11). Error bars are standard deviations