

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

Overview

Predicted Impacts	
Habitat Change	
2030	59-79% Loss
2060	57-67 % Loss
2090	44-91% Loss
Adaptive capacity	Very Low
Fire Response	Negative

Status:

Cuckoo populations in New Mexico have declined precipitously since the 1960's as humans have altered riparian habitats (Howe 1986). Population size of The Western yellow-billed cuckoo may vary greatly from year-to-year even in undisturbed habitats, presumably due to changes in food supply. The Western yellow-billed cuckoo is considered species of high concern at risk from drought and wildfire in New Mexico by the Wildlife and Wildfire Work Group of the Governor's Task Force on Drought. Currently, the Western yellow-billed cuckoo is designated as threatened under the Endangered Species Act (FWS, 2014).

Range and Habitat:

The breeding range of the Western yellow-billed cuckoo formerly included most of eastern North America and parts of Northern Mexico (FWS 2014). The Western yellow-billed cuckoo is thought to dwell west of the continental divide at northern latitudes and west of the Pecos River at southern latitudes (Figure 1). This cuckoo species is associated with riparian habitats with willow and cottonwood (Hughes 1999). The Western yellow-billed cuckoo is restricted to riparian areas, which provide cooler and more humid environments, in hot regions.

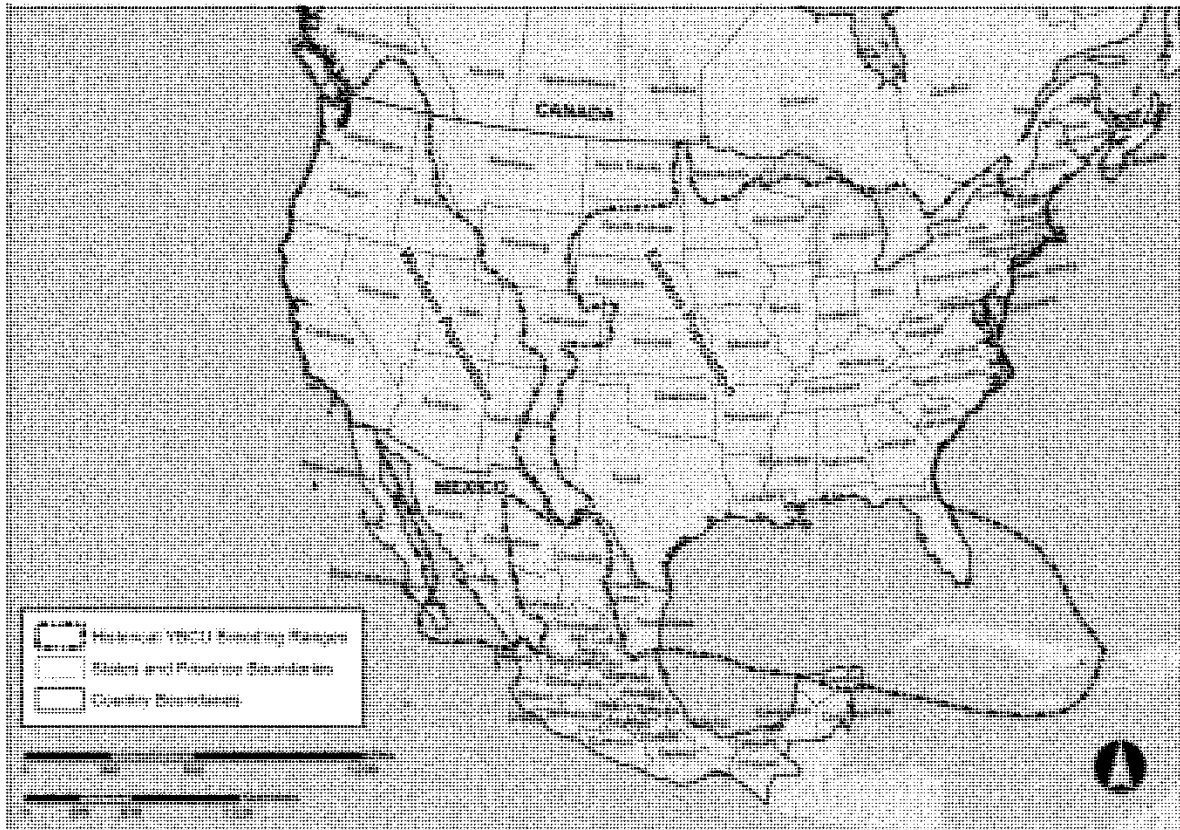


Figure 1. Historical Breeding range of the Eastern and Western yellow-billed cuckoos based on the American Ornithological Union's checklist (from FWS 2014)

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Climate Change Impact and Adaptive Capacity

Adaptive Capacity Score= -2.5 (Very low)

Western yellow-billed cuckoos exhibit a number of vulnerabilities to potential climate impacts (Table 1). Its habitat requirements includes fairly large trees and dense vegetation (Hughes 1999), which were considered likely to decline in previous climate change assessments (Friggens et al., 2013). The Western yellow-billed cuckoo is a long distance migrant that relies on sites throughout Mexico and Central America. In addition, for 2-3 weeks before breeding, they may occupy upland vegetation including pinyon, oak, juniper, and manzanita (Hughes 1999). Reliance on multiple, spatially distinct sites is associated with an increased risk of negative impacts as migrating animals are exposed to a greater range of conditions and likelihood of habitat change. Conversely, migrant species are able to disperse to new habitats, an important trait for coping with potential climate changes.

Physiology:

The Western yellow-billed cuckoo does not appear to have physiological adaptations for dealing with additional temperature increases, increased storms, and drought (Table 1). In particular, the cuckoo appears to be sensitive to hot dry conditions. Incubating adults and nestlings have been observed panting on hot days (Hughes 1999). Western yellow-billed cuckoo eggs may be prone to drying, which reduces hatchability (Laymon and Halterman 1987). Drought is considered a limiting condition in terms of food availability for the Western yellow-billed cuckoo (Hughes 1999). Cuckoos may also experience increased mortality with increased exposure to hurricanes, but exposure is probably not high for western populations (Hughes 1999).

This species does not torpor nor does it exhibit other traits that are employed to deal with more variable resource availability. The Western yellow-billed cuckoo does engage in both inter- and intra-specific brood parasitism. This behavior allows females to lay larger clutches by putting extra eggs in nests of other individuals. This behavior is thought to increase breeding opportunities and populations during high resource years, but no effect of this behavior on populations has been documented during low resource years. Rates of brood parasitism are also not well known, but currently there are few records of occurrence, which may indicate this behavior is too rare to affect populations. Some pairs nesting in California have one or more helpers that assist in raising nestlings (Nolan and Thompson 1975), which may also be a strategy for increasing reproduction, but again effect on populations and frequency of this behavior are unknown. This species is not thought to live more than 5 years and therefore is unlikely to outlive limiting conditions (Friggens et al., 2013).

Phenology:

Western yellow-billed cuckoos exhibit mostly vulnerabilities to potential climate impacts (Table 1). Moisture may be related to breeding timing, at least in some populations (see below), but not known as cue. The Western yellow-billed cuckoo is thought to initiate breeding to time with abundance of local food or periods of greatest precipitation. This species is a long distance migrant and therefore at risk of mismatch in conditions between breeding and wintering grounds.

Populations of the cuckoo in the western U.S. are believed to raise only one brood per season during a relatively short breeding season (Hughes 1999). Recent information found evidence that yellow-billed cuckoos may breed a second time in western Mexico after migrating from the north (Rohwer et al., 2009), which may allow this species take advantage of seasonal resources in multiple locations. However, it is unknown cuckoos within habitats along the Rio Grande exhibit this behavior.

Biotic Interactions:

Western yellow-billed cuckoos feed primarily on large insects such as caterpillars, grasshoppers, crickets, katydids, cicadas. They also feed on small lizards, frogs, eggs, fruits, seeds, and nestlings. Cuckoo populations fluctuate greatly with food availability and increase dramatically in years of highest insect abundance such as tent caterpillar infestations and cicada cycles (Heath and Wilkin 1970). Cicadas are resilient to high temperatures (Heath and Wilkin 1970) and populations of at least one species (Apache cicadas) increased due to habitat changes associated with declining water tables (Glinski and Ohmart 1984) and increased Tamarix. Thus, cuckoo food sources could increase in the future. The risk that these food resources will appear outside of the cuckoos nesting season is considered within the phenology scores.

Raptors may be an important predator during migration and upon arrival on wintering grounds. Snakes, mammals, and birds are known nest predators (Hughes 1999). A wide variety of predators and climate influences led to no predictions in predation rate.

Yellow-billed cuckoos may use other bird's nests for eggs, but this is a facultative trait that may only rarely occur in the Western yellow-billed cuckoo (Hughes 1999). Numerous diseases and parasites have been documented for The Western yellow-billed cuckoo, but no information indicating significant negative effects on populations. Seldom subject to brood parasitism by brown-headed cowbird (*Molothrus ater*) as nesting duration is short (Hughes 1999). There is some evidence of competition with black-billed cuckoos in the eastern U.S (Hughes 1999), but black-billed cuckoos are not found in its range in New Mexico.

Table 1. Score sheet for *Coccyzus a. occidentalis*. “v” indicates a vulnerability or sensitivity, “r” indicates a resiliency or increased adaptive capacity, “n” indicates neutral response.

Question	Score	Notes
1. Changes to nonmodeled habitat components	v	Large trees, snags
2. Change in habitat quality	n	Not Predicted
3. Dispersal ability (Site fidelity or other limitations)	r	Good
4. Reliance on migratory or transitional habitats	v	Yes
5. Increase or decrease in physiological range limitation	v	Potential temperature threshold
6. Response to predicted extreme weather events/disturbances	v	Potential mortalities from storms
7. Changes to daily activity period	n	Not known
8. Variable life history traits or coping strategies	v	No
9. Ability to outlive limiting conditions	v	No
10. Sex Ratios determined by temperature or food changes	n	No
11. Migrates/hibernates in response to weather cues	n	Uses daylight as cue
12. Reliance on weather mediated resource (e.g. insect emergence)	v	Yes
13. Spatial or temporal separation between critical resources and life history stages	v	Yes
14. Can adjust timing of critical activities	v	Single clutch per year
15. Likelihood for decreased food resource	r	Increases possible for cicadas
16. Likelihood of increase predation	n	Not predicted
17. Loss of important symbiotic species	n	None determined
18. Increase in high mortality/morbidity disease	n	Not predicted
19. Increased competitive pressures	n	Not predicted

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Niche Model Analysis

Model AUC values were 0.95, 0.94, and 0.94 for CGCM3.1, GFDL_CM2.1, and Had_CM3, respectively. Habitat declines under all three models though the degree of habitat loss varies under the different scenarios (Table 2, Figures 2 and 3).

Table 2. Percent of original predicted habitat under three climate models.

Time	CGCM3.1	GFDL CM2.1	Had_CM3	Average
current	1	1	1	1
2030	0.37	0.21	0.41	0.33
2060	0.33	0.43	0.38	0.38
2090	0.09	0.36	0.11	0.19

For the yellow-billed cuckoo, distance to water and elevation were very important and potential annual evapotranspiration, slope and diurnal temperature range somewhat important predictors of suitable habitat (Table 3). Overall, cuckoo habitat suitability declined with increasing distance from water and elevation. Under GFDL_CM2.1, and in contrast to the other two models, August precipitation was more important than slope and max temperature during JJA. Habitat suitability was strongly and negatively associated with maximum summer (JJA) temperature under the GFDL_CM2.1, slightly negative under Had_CM3 and negatively related in only 1 of the 15 runs under CGCM3.1. A number of interactions were found for the cuckoo: a negative association with ai*bio3, bio18*bio5 and bio18*petnatveg, bio2*slope and bio 5*distance to water. Generally, suitability declined with increasing values of potential evapotranspiration of natural vegetation at low values but increases with increasing values after a minimum threshold is reached. The yellow-billed cuckoo was positively associated with riparian habitats within the Chihuahuan desert scrub Biome and negatively associated with riparian habitats within the Semidesert Grassland Biomes.

Table 3. Variables in order of importance for species habitat models. Relationship between variable and predicted suitability is listed as positive (+) negative (-) for linear and exponential curves or quadratic for parabola-like curves.

Variables	CGCM3.1	GFDL CM2.1	Had_CM3	Relationship
Distance to Water	56.90	59.57	56.74	-
Elevation	20.18	18.88	19.71	Associated with lower elevations
Mean Diurnal Temp Range (bio2)	5.27	4.74	4.33	+
Pot Evap Natural Veg	4.57	4.56	5.77	Quadratic
Slope	3.43	2.77	3.76	-
Max Temp JJA (bio5)	2.32	2.64	2.23	+
Precip August (bio13)	2.05	2.89	0.49	Peaks at lower values
Precip JJA (bio18)	1.57	1.47	2.21	Peaks at lower values
Biome	1.56	1.84	0.92	
Aridity Index	1.50	0.29	3.30	- after 13
Isothermality (bio3)	0.44	0.33	0.22	-
Annual Precip	0.22	0.01	0.31	Peaks at lower values

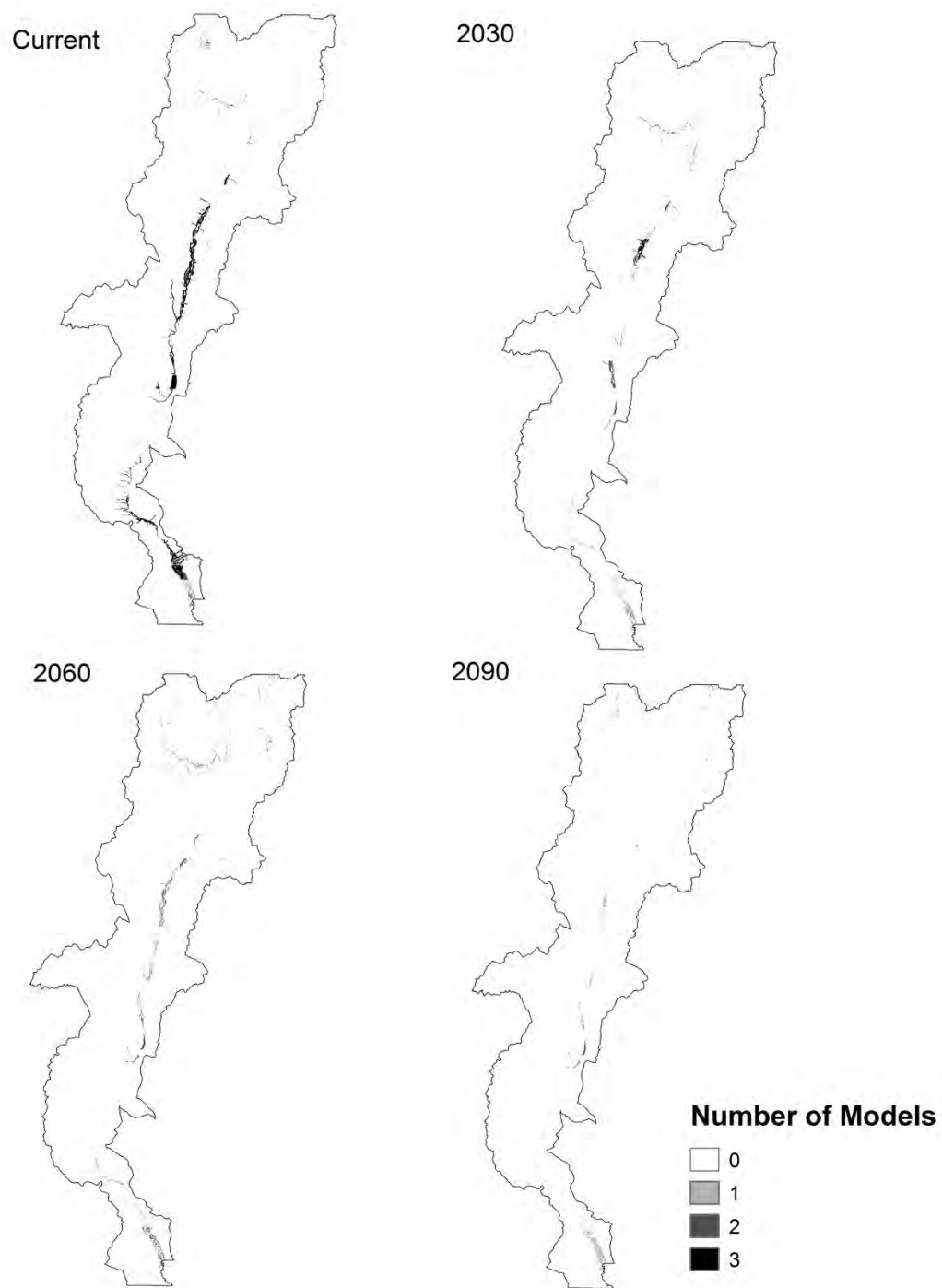


Figure 2. Distribution of suitable habitat for *Coccyzus a. occidentalis* for three future time periods. Future habitat predictions are based on three climate models: Had_CM3, CGCM3.1, and GFDL_CM2.1. Shading indicates the number of models that predict suitable habitat for a given area.

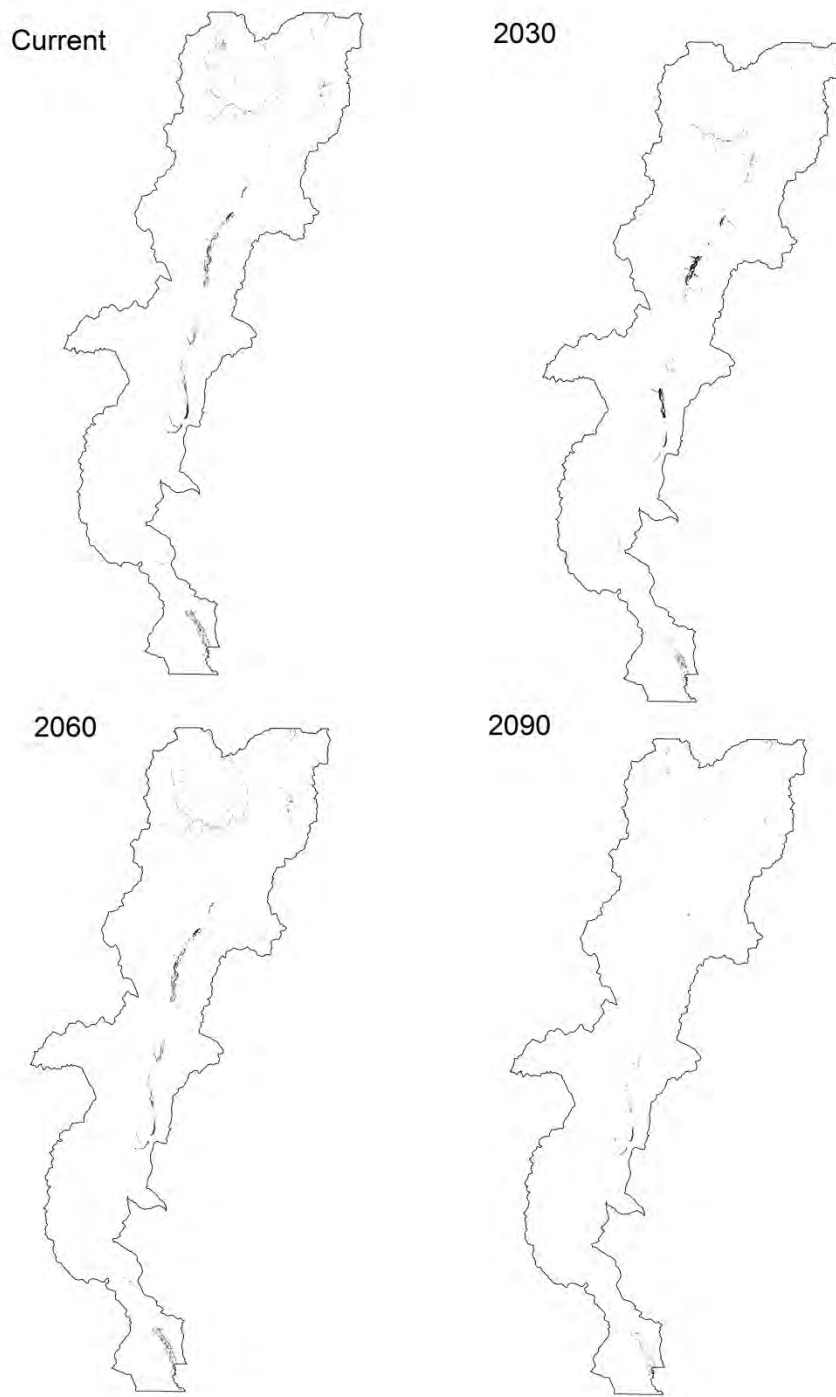


Figure 3. Two-thirds consensus models for suitable habitat for *Coccozyus a. occidentalis* for three future time periods. Future habitat is predicted where at least two of three climate models, Had_CM3, CGCM3.1, and GFDL_CM2.1, identify suitable habitat.

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Fire Analysis

Fire can alter bird habitat by changing vegetation composition and structure which influences nest site availability, foraging substrates, and nest predation rates. Prescribed or wildfire during breeding season is likely to reduce habitat for shrub and ground dwelling species (Finch et al., 1997). Loss of snags due to fire will harm cavity nesters (Finch et al., 1997 but see Smith et al., 2005) though such losses can increase beetle food in the short term. There is some concern that fire can encourage the spread the exotic Tamarisk species especially during drought years (Smith et al., 2005). Cicadas emerged earlier on burned versus unburned plots along the Rio Grande increasing potential mismatches between this important food source and breeding events (Smith et al., 2006). The biggest risk from wildfire for bird species along the Rio Grande is the further degradation and isolation of limited habitat (FWS, 2014). Fire is considered a major threat to remaining habitat for the southwestern willow flycatcher (FWS Species Report <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B094>) and is listed as a concern for determination of threatened status for the Western yellow-billed cuckoo. The Western yellow-billed cuckoo is considered species of high concern at risk from drought and wildfire in New Mexico by the Wildlife and Wildfire Work Group of the Governor's Task Force on Drought

We considered the Western yellow-billed cuckoo at risk of habitat declines due to wildfire. Cuckoos were considered at high risk of negative impacts for all fires occurring in shrub habitat and fires in forests with torching and at moderate risk for forest fires without torching.

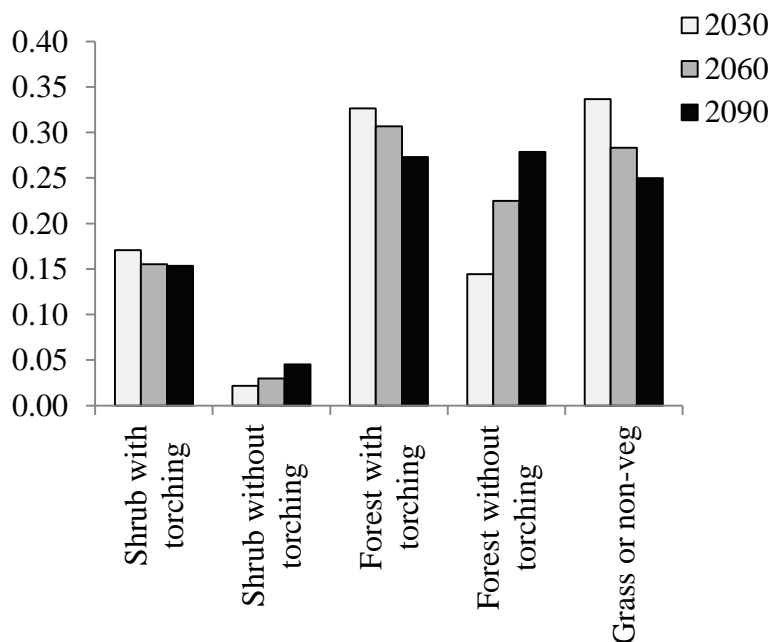


Figure 4. Percent of habitat falling within each fire type category.

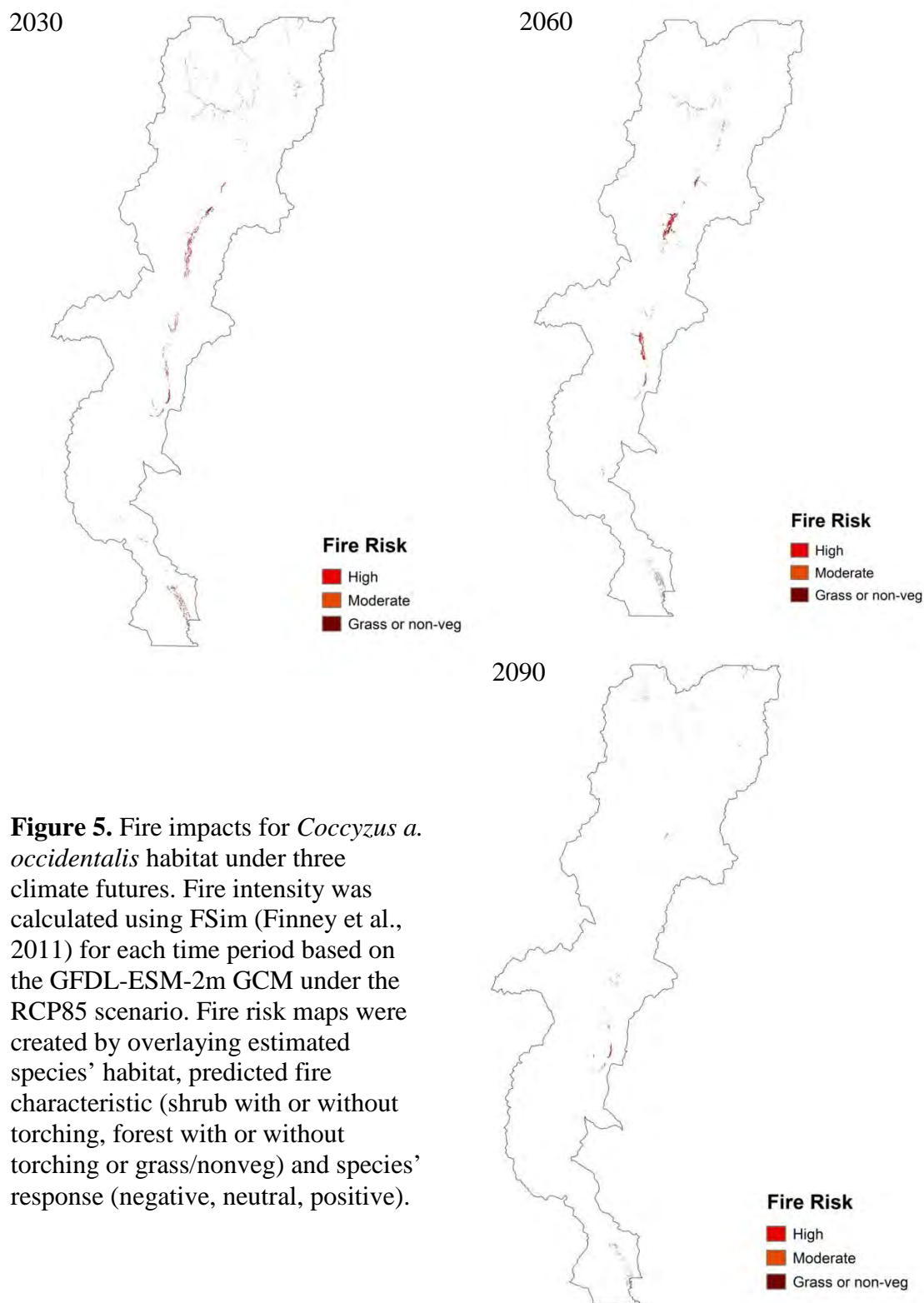


Figure 5. Fire impacts for *Coccozyus a. occidentalis* habitat under three climate futures. Fire intensity was calculated using FSim (Finney et al., 2011) for each time period based on the GFDL-ESM-2m GCM under the RCP85 scenario. Fire risk maps were created by overlaying estimated species' habitat, predicted fire characteristic (shrub with or without torching, forest with or without torching or grass/nonveg) and species' response (negative, neutral, positive).

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