

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Overview

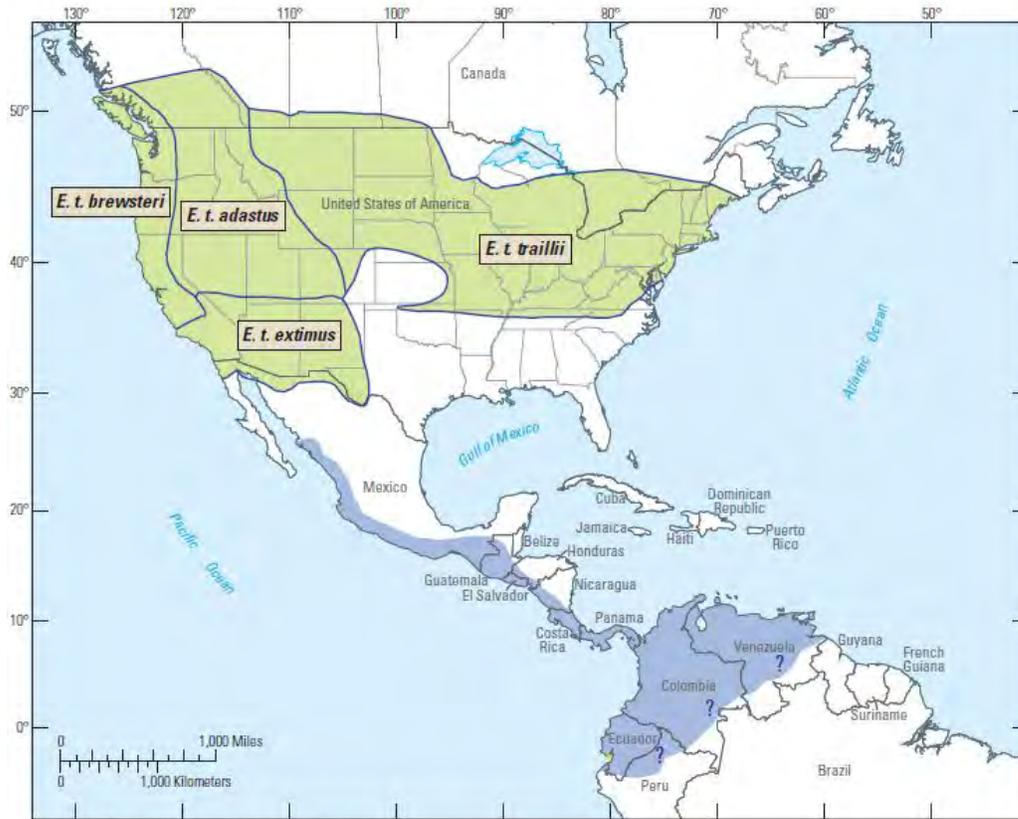
Predicted Impacts	
Habitat Change	
2030	48-50% Loss
2060	54-62% Loss
2090	62-71% Loss
Adaptive capacity	Very Low
Fire Response	Negative

Status:

The Southwestern willow flycatcher has been on the federal endangered species list since 1995.

Range and Habitat:

The Southwestern Willow flycatcher inhabits riparian areas in the southwestern U.S. (Figure 1). It winters in southern Mexico, Central America and northern South America (Sedgwick 2000). In the Middle Rio Grande, the Southwestern willow flycatcher migrates through willow, cottonwood and saltcedar stands (Hunter 1988; Cartron et al. 2008). It is common in New Mexico during migration in the spring and fall, but also breeds in a few areas along the Middle Rio Grande. This species is associated with dense shrubby and wet habitats and typically nests in flooded areas with willow dominated habitat (Sedgwick 2000). Generally, the Southwestern willow flycatcher does not occupy areas dominated by exotics (Skoggs and Marshall 2000), but can successfully nest in saltcedar-dominated habitats (Skoggs et al. 2006).



Basemap modified from U.S. Geological Survey and other agency digital data, various scales. Projection Mercator, World Geodetic System 1984 datum.

EXPLANATION

Approximate range distribution of the Willow Flycatcher (*Empidonax traillii*)—Adapted from Unitt (1987), Browning (1993), and Paxton (2008)

- Breeding range, including boundaries of the Willow Flycatcher subspecies
- Wintering range—Question marks reflect uncertainty of the location of the eastern boundary of the winter range

Figure 1. Distribution of *Empidonax traillii* subspecies. From Sogge et al. 2010, USGS.

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Climate Impacts and Adaptive Capacity

Adaptive capacity score = 2.5 (very low)

There are a number of indications for potential negative impacts for the flycatcher under changing climate (Table 1). The Southwestern willow flycatcher uses shrubs and small trees for nesting substrates. Increased shrub cover is associated with reproductive success of the Southwestern willow flycatcher (Bombay et al. 2003). Additionally, willow flycatchers will not nest if water is not flowing (Johnson et al. 1999). Flooding may be associated with reduced predation by mammalian predators (Cain et al. 2003). Flooding due to precipitation changes may increase with warmer winter temperatures, but lower overall water output and advancement of flood pulse may shift pulse too early to benefit nesting.

Low fecundity and starvation in Southwestern willow flycatcher nestlings has been associated with low snowpack and drying of marshes in Oregon (Sedgwick 2000). Saltcedar, while used for nesting, may be limiting for nesting in hotter climates, because it does not provide needed shade (Hunter 1988; Cartron et al. 2008). Decreased streamflow will likely drop water tables and favor saltcedar over willow which might decrease habitat quality for the flycatcher. This may decrease flycatcher reproductive success because of microclimate disadvantage in saltcedar, which will be more critical as temperatures increase.

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. The Southwestern willow flycatcher is highly mobile and has a good capacity to shift with changes in habitats. This species exhibits fairly high site fidelity to breeding grounds (Sedgwick 2000), but is known to recolonize habitats.

Physiology:

There are several indications that the southwestern willow flycatcher is sensitive to increased temperatures (Table 1). Decline of willow flycatcher populations are associated with spread of tamarisk, which may not have the thermal protection of broadleaf shrubs (Hunter 1988; Cartron et al. 2008), though flycatchers nest successfully in tamarisk in many areas (Skoggs et al. 2006). Its association with moist and shady microclimates may relate to its relatively late season nesting and accompanying hot temperatures (Skoggs and Marshall 2000). The Southwestern Willow flycatcher is not expected to be exposed to greater storms because it uses interior migration (Bagne et al. 2011). No mortalities have been noted due to extreme weather with the exception of nestlings. However, these flycatchers are drought sensitive due to effects on food resources and drying of habitat. This species does not possess an ability to reduce metabolic energy or water requirements and does not have alternative life history strategies to cope with variable resources or climate conditions. The Southwestern Willow flycatcher can live up to 11 years, but mean life span is around one year (Sedgwick and Iko 1997).

Phenology:

Photoperiod is likely important for timing migration and no change in cue is expected. However, the Southwestern willow flycatcher has a short nesting season that is thought to be limited by resource availability (Sedgwick 2000). Insects may emerge earlier or become more variable with more variable rainfall. There is also a potential difference in migrant arrival and insect emergence because this species is a long distant migrant. One advantage for this species is that it is a late season breeder that can raise multiple broods minimizing reproductive losses due to spring storms or other sources of nest loss.

Biotic Interactions:

Willow flycatchers are primarily insectivorous (Sedgwick 2000). Willow flycatchers are dependent upon localized food sources during nesting and tend to specialize on insects that are associated with water. Years of low rainfall are known to reduced food supplies and lower reproductive success in the flycatcher. Future dry periods with increase rainfall variability may exacerbate losses due to resource changes. Flycatchers are preyed upon by various species though overall changes in predation rates are not expected (Sedgwick 2000). Southwestern willow flycatcher nests are parasitized by brown-headed cowbirds, which are considered a threat under climate change. Currently, willow flycatcher reproduction occurs relatively late, which does not allow them to escape cowbird brood parasitism (Robinson et al. 1995). The shorter migration distance in cowbirds will likely allow cowbirds to keep pace with any advancement in breeding by willow flycatchers. In addition, cowbirds possess a number of resilience traits to climate change (Friggens et al. 2013).

Table 1. Vulnerability scores for *Empidonax traillii extimus*. “v” indicates a vulnerability or sensitivity, “r” indicates a resiliency or increased adaptive capacity, “n” indicates neutral response.

Question	Score	Notes
1. Changes to non-modeled habitat components	v	Flooded habitats
2. Change in habitat quality	v	Declines under dryer conditions
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	May be sensitive to extreme heat
6. Response to predicted extreme weather events/disturbances	n	Drought sensitive
7. Changes to daily activity period	n	Not expected
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

Question	Score	Notes
11. Migrates/hibernates in response to weather cues	n	No, daylight likely cue
12. Reliance on weather mediated resource (e.g. insect emergence)	v	Yes, breeding timed to insects
13. Spatial or temporal separation between critical resources and life history stages	v	Yes, long distance migrant
14. Can adjust timing of critical activities	r	Yes, 2 or more clutches per year
15. Likelihood for decreased food resource	v	Specialist on aquatic insects
16. Likelihood of increase predation	n	Not expected
17. Loss of important symbiotic species	n	None known
18. Increase in high mortality/morbidity disease	v	Cow bird parasitism may increase
19. Increased competitive pressures	n	Not expected

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Niche Model Analysis

Model AUC values were 0.83, 0.85 and 0.86 for CGCM3, GFDLCM2, and HadCM3, respectively. Models predictions were similar under all three climate scenarios with declines in suitable habitat by approximately 2/3^{rds} (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	0.58	0.50	0.55	0.54
2060	0.49	0.38	0.47	0.44
2090	0.38	0.29	0.34	0.33

Distance to water, slope, diurnal range of temperature, and biome were the most important variables for predicting suitable habitat for the Southwestern willow flycatcher (Table 3). Habitat suitability decreased with increasing distance from water. Slope contributed to the model both as a linear and hinge function with higher quality habitat associated more strongly with areas with low slope. Suitability was greatest for areas with intermediate values of potential evapotranspiration of natural vegetation. Mean diurnal range of temperatures that fell within values of 17 and 19 °C were most strongly associated with suitable habitat whereas areas with ranges less than 17 °C were less suitable. This species is positively associated with riparian habitats in Semidesert Grassland biomes and negatively associated with riparian habitats in Great Basin Conifer Woodland and Plains 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	41.59	43.50	41.82	-
Slope	14.77	13.43	15.14	-
Mean Diurnal Temp Range (bio2)	10.03	10.45	9.64	+ at low values
Biome	9.78	9.69	11.14	+SemDesGssd, -GB ConWdld, PlnsGssd
Pot Evap Natural Veg	5.61	5.09	5.52	Quadratic
Precip August (bio13)	4.59	4.23	4.58	-
Precip JJA (bio18)	4.23	3.22	4.04	-
Max Temp JJA (bio5)	3.96	3.58	3.14	+

Variables	CGCM3.1	GFDL CM2.1	Had_CM3	Relationship
Annual Precip	3.03	4.75	2.85	-
Elevation	2.22	1.99	2.01	Peaks at low values
Aridity Index	0.21	0.07	0.10	Peaks at low values
Isothermality (bio3)	0.00	0.01	0.01	Peaks at low and high values

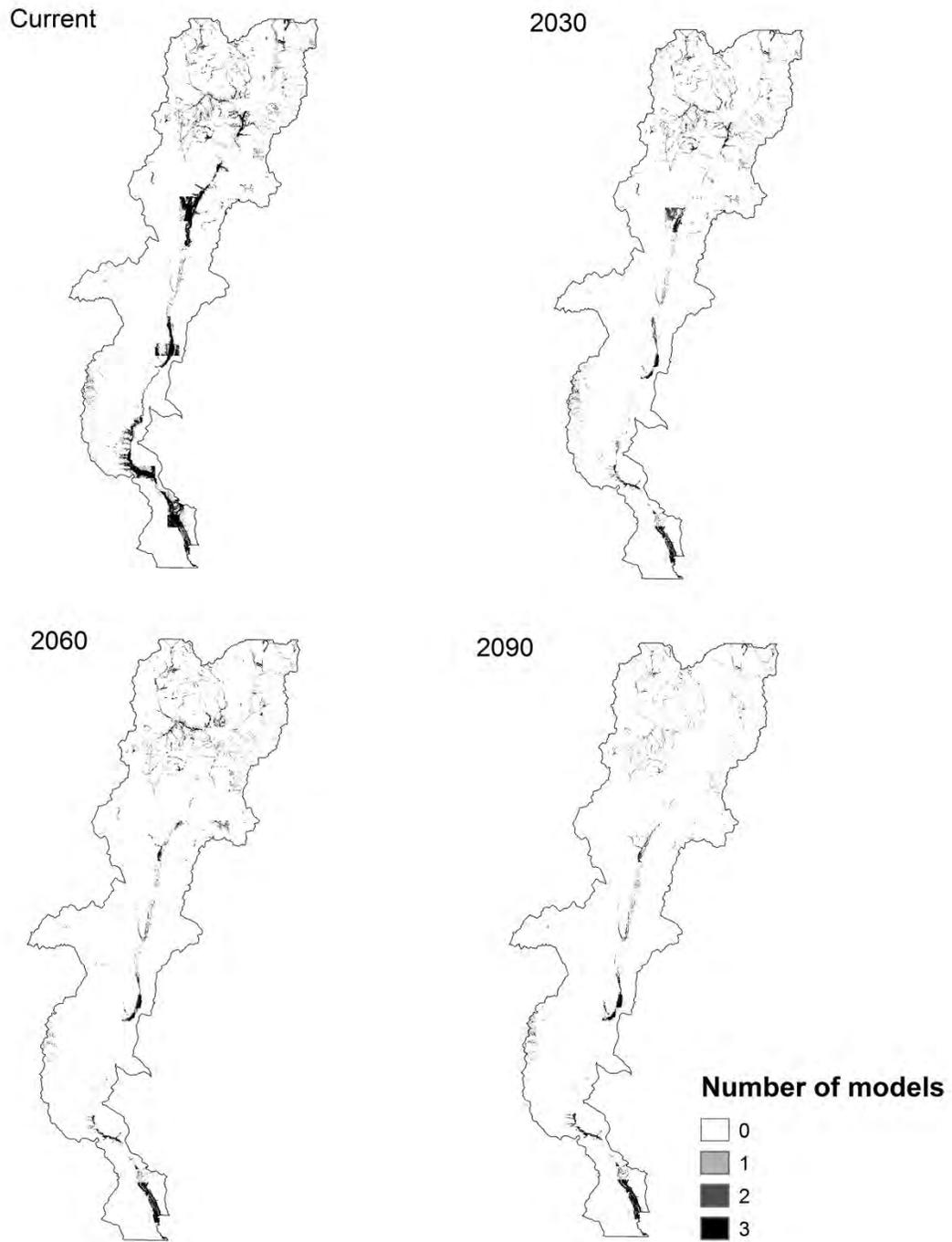


Figure 2. Distribution of suitable habitat for *Empidonax t. extimus* for three future time periods. Future habitat predictions are based on three climate models: Had_CM3, CGCM3.1, and GFDL_CM2.1. Shading indicates the number of models that predict suitable habitat for a given area.

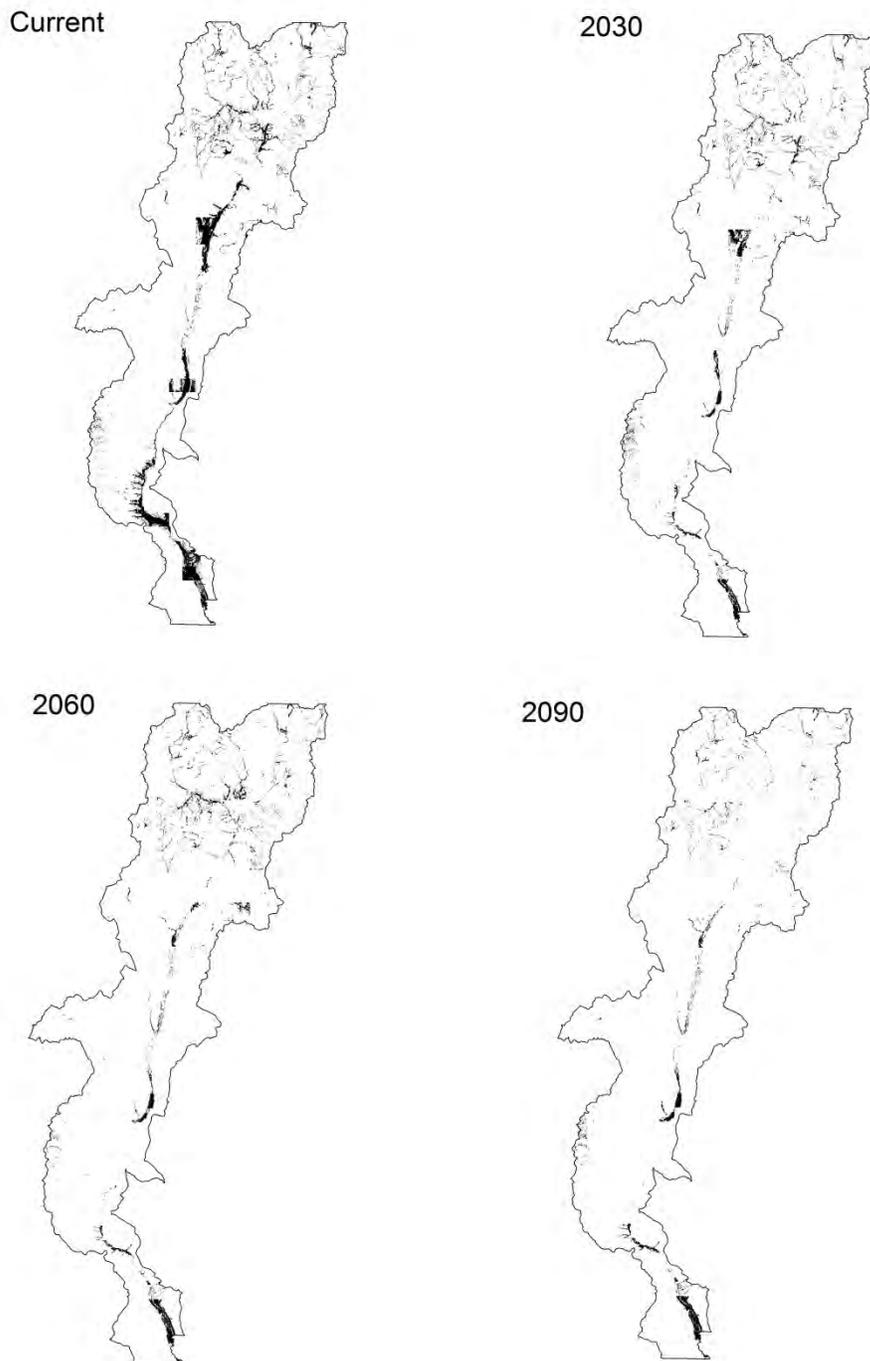


Figure 3. Two-thirds consensus models for suitable habitat for *Empidonax t. extimus* for three future time periods. Future habitat is predicted where at least two of three climate models, Had_CM3, CGCM3.1, and GFDL_CM2.1, identify suitable habitat.

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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). There is some concern that fire can encourage the spread the exotic *Tamarix* 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). Though willow flycatchers are not likely to feed on cicadas, similar patterns may be seen for other prey insects. 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>). Fire may increase shrubby habitats, though Paxton et al. (1996) noted that fire destroyed habitat.

We considered the southwestern willow flycatcher at risk of habitat declines due to wildfire. Flycatchers were considered at high risk of negative impacts for torching fires in shrub and forest habitats and at moderate risk for habitat loss with non-torching fire (Figures 4 and 5).

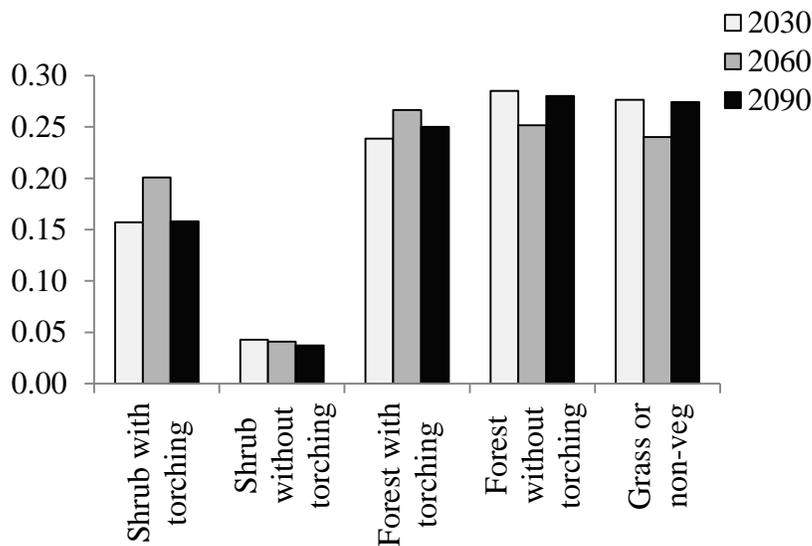
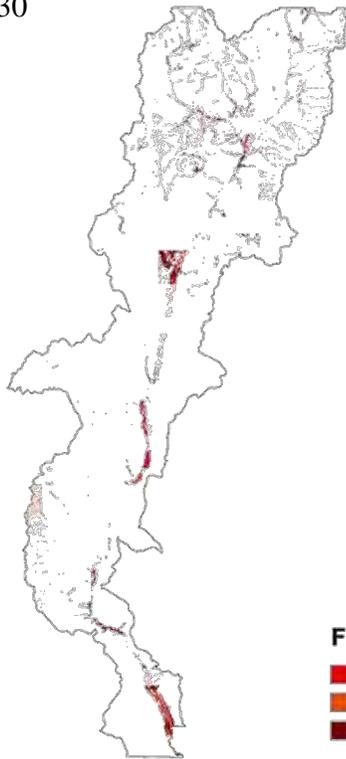
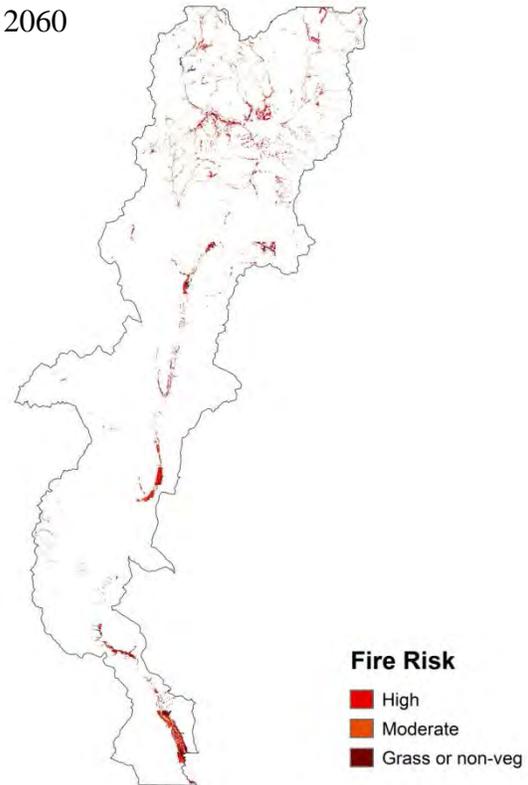


Figure 4. Percent of habitat falling within each fire type category.

2030



2060



2090



Figure 5. Fire impacts for *Empidonax traillii extimus* 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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