

# Western Purple Martin (*Progne subis arboricola*) Occurrence on the Siuslaw National Forest, Summer 2019



Open-File Report 2020-1130

**Cover**, Landscape near Marys Peak survey site, Siuslaw National Forest, Oregon.  
(Photograph by Eric Branch, U.S. Geological Survey.)

Two purple martins (*Progne subis arboricola*) in a tree, Siuslaw National Forest,  
Oregon. (Photograph by Lorelle Sherman, U.S. Forest Service.)

# **Western Purple Martin (*Progne subis arboricola*) Occurrence on the Siuslaw National Forest, Summer 2019**

By Joan Hagar and Eric Branch

U.S. Geological Survey Open-File Report 2020-1130

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## Contents

Background .....	1
Methods .....	2
Survey Area and Sampling Design.....	2
Occurrence Surveys.....	5
Results.....	5
Discussion .....	8
Conclusions .....	11
References Cited .....	13
Appendix A .....	15

## Figures

<b>Figure 1.</b> Map showing location and status of Siuslaw National Forest sites surveyed for purple martin ( <i>Progne subis arboricola</i> ) breeding status, defined according to criteria in table 1 .....	3
<b>Figure 2.</b> Map showing probability of purple martin ( <i>Progne subis arboricola</i> ) occurrence assigned to individual sections of the Siuslaw National Forest by using a habitat-suitability model developed by Sherman (2019).....	4
<b>Figure 3.</b> Photograph showing a pair of purple martins ( <i>Progne subis arboricola</i> ) (after-second-year male [ASYM] and second-year female [SYF]) occupying a cavity in a natural snag located on Marys Peak in the Siuslaw National Forest, July 2019.....	7
<b>Figure 4.</b> Photograph showing general location of suspected purple martin ( <i>Progne subis arboricola</i> ) nest site (red dot) at Drift Creek Oxbow, Siuslaw National Forest, July 2019.....	7
<b>Figure 5.</b> Photograph showing small patch of early-seral habitat with retained snags located on Siuslaw National Forest land (T06S_R10W_S12), bordered on all sides by mature, closed-canopy forest.....	8
<b>Figure 6.</b> Photograph showing members of a large purple martin ( <i>Progne subis arboricola</i> ) colony perching on one of several snags used as nesting substrate on a section of private timberland. On several occasions, this colony was observed demonstrating mob behavior to displace turkey vultures and an unidentified bird of prey. ....	9
<b>Figure 7.</b> Photographs showing retained snags in post-disturbance patches of land located within two upland forest survey sites in Tillamook County on the Siuslaw National Forest. ....	10

## Tables

<b>Table 1.</b> Criteria used to assign purple martin status at survey sites (Cousens and Airola 2006, Hagar and Sherman 2018). ....	5
<b>Table 2.</b> Area (acres), number of surveyor visits, and status determined for 11 sites surveyed for western purple martins ( <i>Progne subis arboricola</i> ) on the Siuslaw National Forest, summer 2019 .....	6

## Abbreviations

BLM	Bureau of Land Management
USFS	U.S. Forest Service

# **Western Purple Martin (*Progne subis arboricola*) Occurrence on the Siuslaw National Forest, Summer 2019**

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## **Background**

The western subspecies of the purple martin (*Progne subis arboricola*) is currently listed as a “critically” sensitive species in four ecoregions of western Oregon: Coast Range, Klamath Mountains, West Cascades, and Willamette Valley (Oregon Department of Fish and Wildlife, 2019). Importantly distinct from the abundant and widespread eastern subspecies (*Progne subis subis*), the western subspecies is of particular concern to Federal forest managers. Whereas the eastern subspecies is almost entirely dependent on artificial human-provided housing, the western subspecies continues to rely on natural cavities for nesting habitat (Bettinger, 2003). Accurate estimates of the regional abundance of the western purple martin are difficult to obtain; the most recent statewide census for Oregon, conducted in 2005, estimated the population at 1,100 pairs (Western Purple Martin Working Group, 2010). Several factors, including a small population size, loss of breeding habitat, and reductions in the number of suitable nesting sites have put populations of the western purple martin at risk throughout much of the Pacific Northwest region (Rockwell, 2019).

As aerial insectivores and secondary-cavity nesters, western purple martins require open, post-disturbance (early-seral) habitat with high insect productivity and retained snags (dead trees), which provide suitable nesting substrate (Tarof and Brown, 2013). This unique combination of habitat features is typically present only after disturbances such as fire and logging activity (Rockwell, 2019). A decrease during recent decades in the amount of early seral forest available as suitable breeding habitat for purple martins may be at least partially a result of the curtailment of timber harvest on Federal lands under the Northwest Forest Plan (Kennedy and Spies, 2004; Swanson and others, 2011; Phalan and others, 2019). Declines in the amount of early-seral ecosystems are most evident in the Cascades and Coast Range ecoregions, including the Siuslaw National Forest (Phalan and others, 2019). Furthermore, fire suppression, post-fire salvage logging and management, and removal of snags during timber harvest have all contributed to decreased nesting-site availability (Airola and Williams, 2008; Cousens and Lee, 2012), which is commonly cited as the primary factor limiting the abundance of western purple martins (Williams, 1998).

Recent surveys of Federal land and private timberlands throughout western Oregon in 2016 and 2017 demonstrate the importance of post-disturbance habitat: the probability of snag being used for nesting by purple martins was positively correlated with the surrounding area of early-seral habitat (Hagar and Sherman, 2018). Surveys of Bureau of Land Management (BLM) and U.S. Forest Service (USFS) lands throughout western Oregon in 2016 and 2017 confirmed

that the combination of early-seral forest with suitable nesting snags was relatively rare on Federal lands. Whereas private timberlands may presently offer suitable breeding habitat for purple martins, they are unlikely to be a sustainable source of breeding habitat in the future because of a focus on short harvest rotations that preclude the development of trees large enough to eventually become large snags. As a result, the large trees produced on Federal lands under the Northwest Forest Plan will likely become increasingly important sources of breeding habitat for western purple martins.

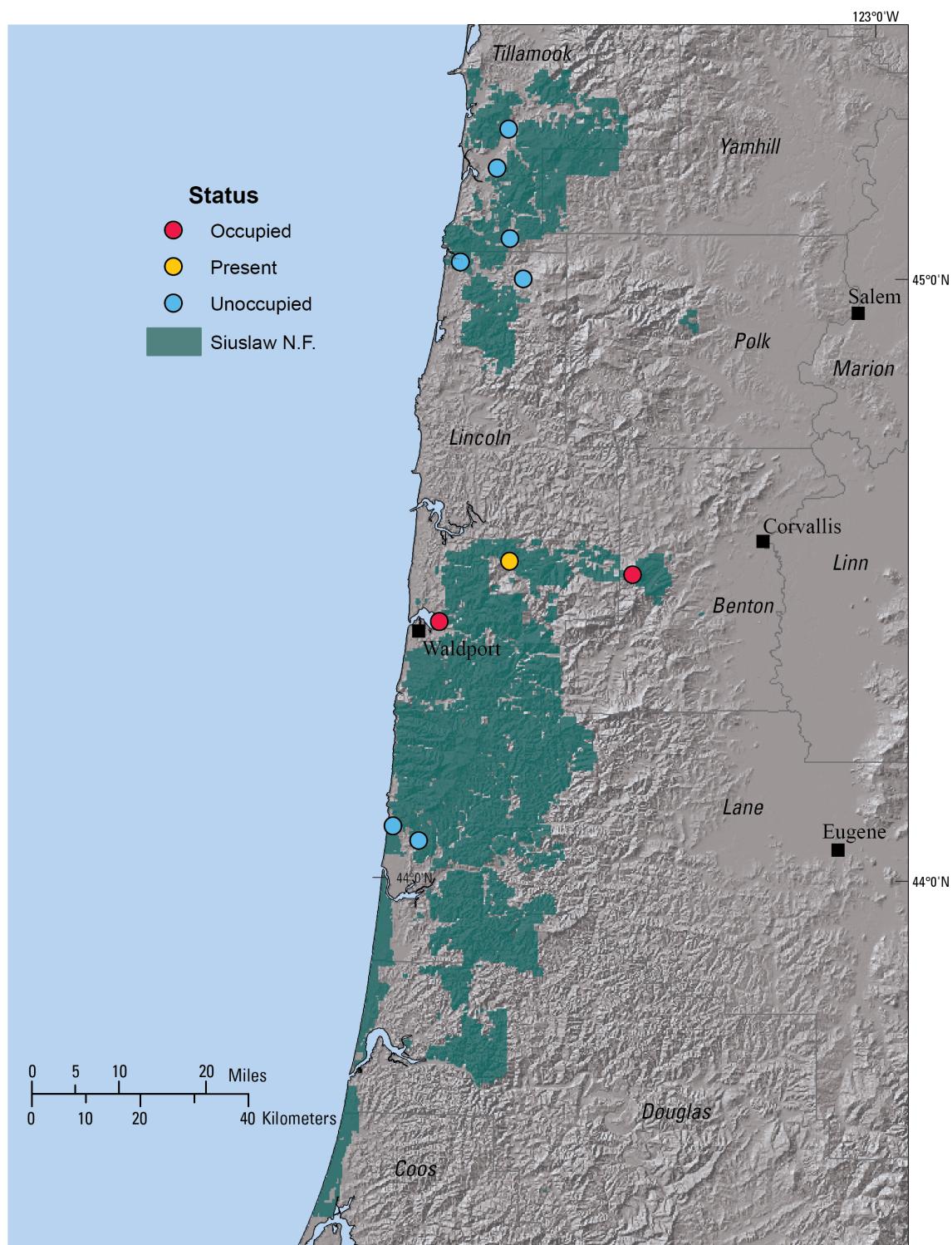
A critical first step to maintaining self-sustaining populations of western purple martins in the Pacific Northwest is to determine occurrence patterns on Federal lands. Currently, the available data regarding distribution and occurrence of purple martins on Siuslaw National Forest land in western Oregon is inadequate. A habitat model recently developed to identify nesting habitat for purple martins in upland forest (Sherman, 2019), was used to identify potentially suitable sites with a high probability of purple martin occurrence, and the results were used to guide surveys during the 2019 breeding season. The goal of the surveys was twofold: to test the efficacy of the habitat model, and to determine the status of potentially suitable breeding habitat for western purple martins in the Siuslaw National Forest.

## Methods

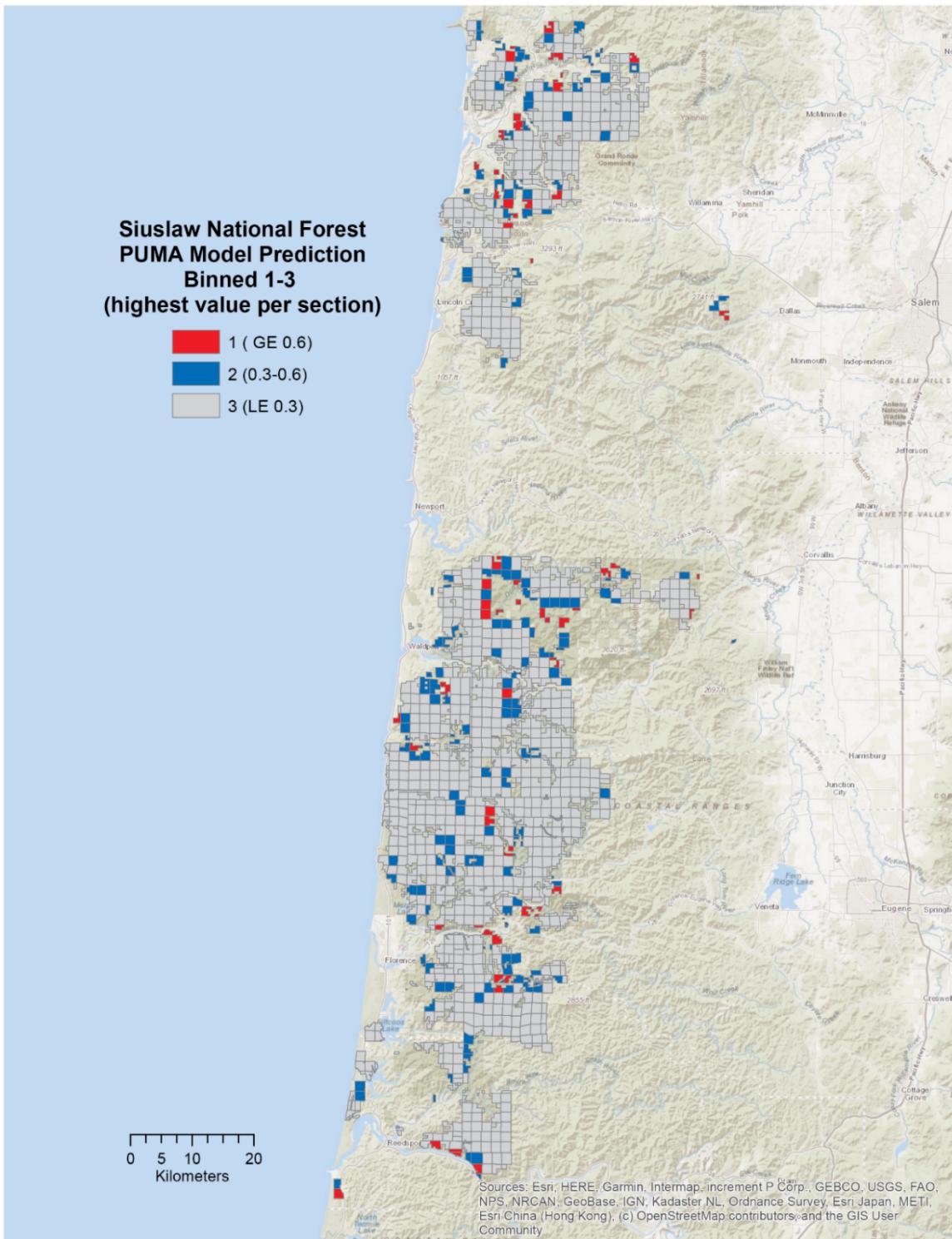
### Survey Area and Sampling Design

Survey sites were located within the Coast Range ecoregion and spanned four counties: Benton, Lane, Lincoln, and Tillamook. We surveyed 11 sites located on the Siuslaw National Forest in 2019 (fig. 1; see appendix for photos and descriptions of habitat characteristics for each site that was surveyed). Five of the sites surveyed were selected from a list produced by USFS biologist C. Hase (Bruner) based on their perceived suitability for purple martin nesting and foraging (for example, by the presence of snags or large, open areas adjacent to water source, or reported purple-martin detections from previous years). The remaining six survey sites were generated from a habitat model developed for purple martins nesting in upland forests in western Oregon (Sherman, 2019). Because model output is a continuous surface, Township Range sections were used to bin the model results in spatially discrete areas within the Siuslaw that could be ranked for field examinations. The habitat model was used to estimate the probability of nesting by at least one pair of purple martins for individual sections within the Siuslaw National Forest based on the maximum value per section (fig. 2). Sections with an estimated maximum probability of occurrence greater than 60 percent were assigned high priority for a survey, and six of these were randomly selected for surveys. Google Earth was used to identify potentially suitable habitat (early-seral or open canopy) on which we focused our survey efforts within each section.

The probability of occurrence for the five sites identified for survey by the Siuslaw biologist was not calculated because they were either above an elevation threshold or in non-forest vegetation type and therefore outside of the intended scope of the model.



**Figure 1.** Map showing location and status of Siuslaw National Forest sites surveyed for purple martin (*Progne subis arboricola*) breeding status, defined according to criteria in table 1. Blue represents unoccupied sites where no purple martins were observed; yellow represents one site classified as present, where purple martins were observed but not associated with a nest structure; and red represents sites classified as occupied, where evidence of nesting was observed.



**Figure 2.** Map showing probability of purple martin (*Progne subis arboricola*) occurrence assigned to individual sections of the Siuslaw National Forest by using a habitat-suitability model developed by Sherman (2019). Sections in red, “Priority 1” sites, which represent the highest probability of occurrence, were used to generate a list of high-priority sites for survey. GE, greater than or equal to; LE, less than or equal to; PUMA, purple martin.

## Occurrence Surveys

The 11 sites were visited initially in early June to determine whether or not these sites were potentially suitable nesting habitat. Criteria for this habitat category were (1) open canopy, early-seral conditions that is, fewer than 10 years after the disturbance), and (2) the presence of at least one snag. One observer (E. Branch) surveyed all sites meeting these criteria three times throughout the nest-establishment and fledgling production stages from June 10 through August 7, 2019. We did not make additional visits to survey sites that were not in an open-canopy condition or where no snags were available for nesting.

The first survey at each potentially suitable site was conducted between 1 hour before and 2 hours after sunrise to coincide with a period of greatest detectability at nest sites during the early phase of nesting (Cousens and Airola, 2006). A minimum of 30 minutes was spent searching and listening for purple martins within each 50-acre area of potentially suitable habitat. Purple martins are territorial and respond vocally to other martins entering their territory; if no purple martins were detected during the survey, recordings of purple martin dawn songs were broadcast from a speaker within each 50-acre unit of the site to increase detection probability (Grinde and others, 2018). Second and third surveys were conducted during the nestling provisioning stage and could therefore be done later in the day because continuously high levels of feeding activity would ensure high probability of detection at nest sites. We followed a standardized protocol (Cousens and Airola, 2006; table 1) to determine the breeding status for each site. At occupied sites, the age and sex of each purple martin observed were recorded.

**Table 1.** Criteria used to assign purple martin status at survey sites (Cousens and Airola 2006, Hagar and Sherman 2018).

[<, less than; >, greater than]

Colony/site status codes	Description of colony/site status code
<b>U (unoccupied)</b>	No PUMA observed nearby throughout observation period during usual time of peak activity. Monitor <2 hr after sunrise or <2 hr before sunset. Monitoring observations should coincide with the nestling-feeding periods in the area to be conclusive (nesting timing can be highly variable over relatively short distances due to local-climate variables).
<b>P (present)</b>	Bird(s) observed feeding and otherwise active near or high above potential nest site, but NOT using nesting structures.
<b>OC (occupied)</b>	Pair(s) of birds perched near or entering cavities or flying about potential nesting structures. Bird(s) seen entering, defending or guarding cavity, or adding nest material.
<b>AC (active cavity confirmed)</b>	Egg(s) or nestling(s) in nest cavity; evidence includes: young observed at entrance, dead nestlings, nestling begging calls heard from within nest cavity/structure, adults observed delivering food, adults carrying fecal sacks out of cavity.

## Results

A total of 51.25 hours was spent surveying for purple martins on the Siuslaw National Forest. Of the 11 sites surveyed, two (Marys Peak and Drift Creek Oxbow) were occupied by nesting purple martins (table 2; fig. 1). On the initial visit to Marys Peak, a second-year female (SYF) and an after-second-year male (ASYM) were seen repeatedly entering a natural cavity in a snag (fig. 3). However, neither bird was present on the second or third visit, indicating that the nest was ultimately unsuccessful. At the Drift Creek Oxbow site, no nest or nests were located because water surrounding the general vicinity prevented access by the surveyor (fig. 4). Evidence of use of at least one natural cavity at this site, however included (1) Multiple ASYMs

present in the area during multiple visits, (2) multiple ASYMs present near suspected nesting site at different periods of the day, including early afternoon, (3) repeated observations of ASYMs foraging over open meadow and returning to the suspected nesting area, and (4) aggressive/territorial response by two ASYMs to playback of a purple martin call and a dawn song when these recordings were broadcasted near the suspected nesting site.

**Table 2.** Area (acres), number of surveyor visits, and status determined for 11 sites surveyed for western purple martins (*Progne subis arboricola*) on the Siuslaw National Forest, summer 2019.

[**Source of survey site:** Indicates whether the site was selected for survey based on recommendations from USFS (U.S. Forest Service) wildlife biologists or on the probability of occurrence as determined by a habitat model (Sherman, 2019). <, less than. See table 1 for definitions of site status.]

Site name/location	Source of survey site	Area (acres)	Number of visits	Site status
Enchanted Valley	USFS biologists	80	1	Unoccupied
Lily Lake	USFS biologists	127	3	Unoccupied
Salmon River Estuary	USFS biologists	175	1	Unoccupied
Marys Peak	USFS biologists	<50	3	Occupied
Drift Creek Oxbow	USFS biologists	101	3	Occupied
T04S_R10W_S01	Habitat suitability model score = 0.40	<50	3	Unoccupied
T04S_R10W_S34	Habitat suitability model score = 0.26	120	3	Unoccupied
T06S_R10W_S12	Habitat suitability model score = 0.46	152	3	Unoccupied
T07S_R09W_S05	Habitat suitability model score = 0.27	71	1	Unoccupied
T12S_R10W_S13	Habitat suitability model score = 0.25	206	3	Present
T13S_R09W_S04	Habitat suitability model score = 0.30	157	1	Unoccupied

On several occasions, purple martins were observed on adjacent private land bordering the target survey sites in the Siuslaw National Forest. In Lincoln County (T12S\_R10W\_S13), when playback was broadcast on the border of National Forest and private timberland, an ASYM flew over from the surrounding private land, circled over the observer (E. Branch) for the duration of the playback, and then returned to the private land once the playback ceased. Similarly, a survey site in Tillamook County (T06S\_R10W\_S12) was unoccupied, yet two purple martins were seen foraging over private timberland approximately 0.5 km away from the National Forest border during the survey of this site.



**Figure 3.** Photograph showing a pair of purple martins (*Progne subis arboricola*) (after-second-year male [ASYM] and second-year female [SYF]) occupying a cavity in a natural snag located on Marys Peak in the Siuslaw National Forest, July 2019.



**Figure 4.** Photograph showing general location of suspected purple martin (*Progne subis arboricola*) nest site (red dot) at Drift Creek Oxbow, Siuslaw National Forest, July 2019.

## Discussion

Our observations indicate that breeding western purple martins were relatively rare on the Siuslaw National Forest (occurrence rate for potentially suitable habitat = 18 percent). We found evidence of purple martins nesting in both Lincoln and Benton counties (fig. 1), and observed purple martins foraging over adjacent private land in Tillamook County. Although, the habitat model was helpful in identifying areas in early post-disturbance condition in the Coast Range, most of this post-disturbance habitat was located on private industrial forest land directly bordering the Siuslaw National Forest boundary. We found that areas of early-seral habitat of sufficient size to constitute suitable breeding habitat (more than 25 acres; Sherman, 2019) were rare in the Siuslaw National Forest itself. Even where large snags were present, most sites surveyed comprised small (less than 25 acres) patchy areas of early-seral habitat separated by mature, closed-canopy forest (fig. 5).



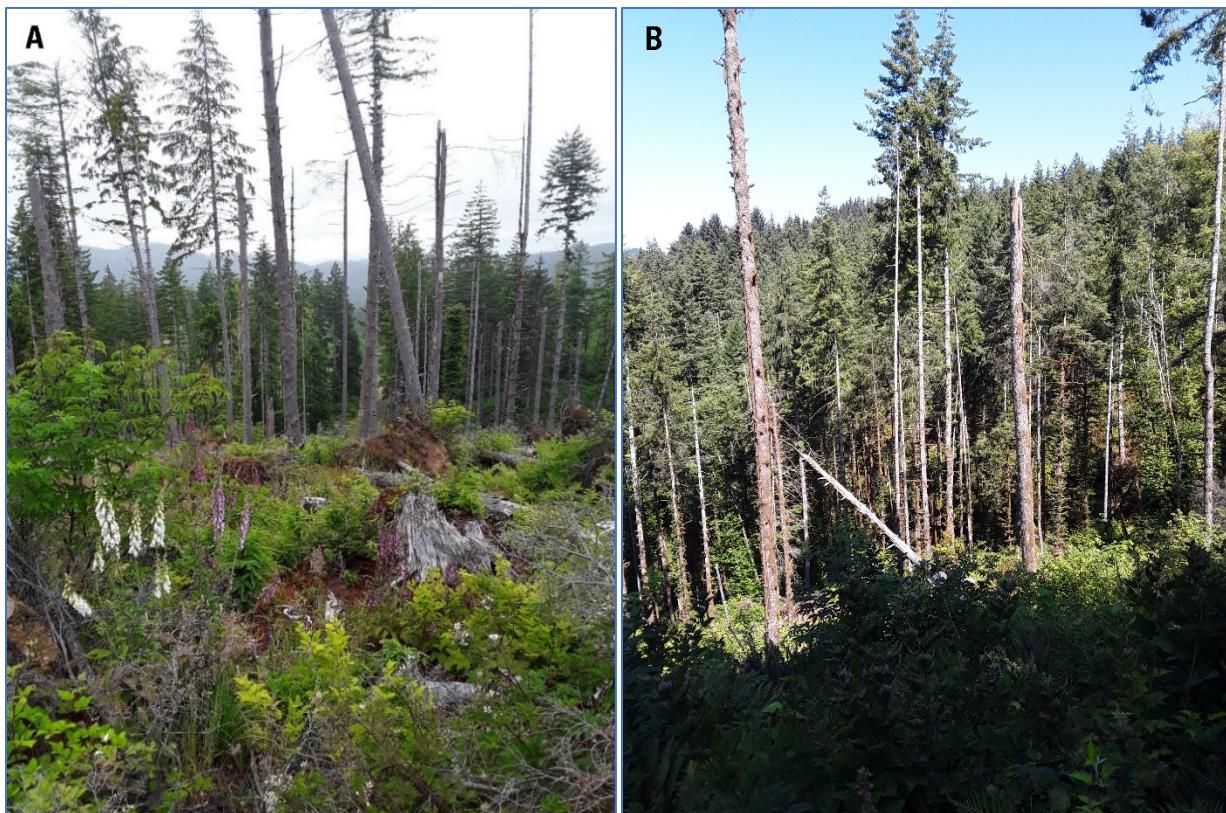
**Figure 5.** Photograph showing small patch of early-seral habitat with retained snags located on Siuslaw National Forest land (T06S\_R10W\_S12), bordered on all sides by mature, closed-canopy forest. Although these smaller patches of early-seral forest were encountered at several survey sites, the absence of active nests indicates that they may have been of insufficient size to represent suitable breeding habitat for purple martins (*Progne subis arboricola*).

One of the occupied sites we identified on the Siuslaw National Forest most likely was unsuccessful. Although a pair of purple martins occupied a natural cavity on Marys Peak in early July (fig. 3), all evidence indicates that the nest was unsuccessful. Follow-up visits by the surveyor during the nestling-provisioning stage indicated that the nest site was no longer active. Marys Peak is at a higher elevation than is generally believed to be suitable for western purple martins at this latitude, a factor which may have negatively influenced prey availability and microclimate of the nest cavity. In addition, this was the only snag in the area, and it contained a single cavity suitable for nesting. Nest success for colonial species such as purple martins may be positively related to colony size because the effectiveness of deterring predators likely increases with mob size (Brown and others, 1990). Therefore, the number of suitable snags and cavities within a given area may influence reproductive success and could potentially be an important factor for maintaining self-sustaining populations. Furthermore, anecdotal evidence collected throughout our survey period supports this notion; a large colony of purple martins nesting on private land in multiple snags (fig. 6) was routinely observed successfully displacing turkey vultures and other birds of prey. Studies on eastern purple martins, however, found no correlation between reproductive success and colony size (Davis and Brown, 1999); this result indicates that more research is needed to quantify the effect of colony size on nest success for western purple martins.



**Figure 6.** Photograph showing members of a large purple martin (*Progne subis arboricola*) colony perching on one of several snags used as nesting substrate on a section of private timberland. On several occasions, this colony was observed demonstrating mob behavior to displace turkey vultures and an unidentified bird of prey.

Given that the goal of the Northwest Forest Plan for the Siuslaw National Forest was to restore mature forest for late-seral wildlife species, the scarcity of nesting purple martins that we observed was not necessarily surprising. The lack of large, open areas of early-seral habitat explains, at least in part, the relatively low occurrence rate of purple martins on Siuslaw land: surveys conducted in Oregon in previous years confirmed a strong positive relationship between snag use and the area of early-seral habitat at stand and landscape spatial scales (Sherman, 2019). Furthermore, while snags were relatively common on recently disturbed survey sites, they rarely were sufficiently decayed to provide suitable nesting substrates for secondary-cavity nesters such as purple martins (fig. 7). At several survey sites, snags were present in post-disturbance habitat, yet processes such as decay and woodpecker activity had yet to create nesting cavities. In addition, at some of these sites, advanced tree regeneration at the time of the survey demonstrated the brevity of the window of time during which conditions are suitable for nesting, between cavity formation in snags created by disturbance and canopy closure with stand regrowth.



**Figure 7.** Photographs showing retained snags in post-disturbance patches of land located within two upland forest survey sites in Tillamook County on the Siuslaw National Forest. Pictured snags have not yet decayed sufficiently to provide suitable nest cavities for purple martins (*Progne subis arboricola*). (A) T06S\_R10W\_S12; (B) T04S\_R10W\_S34.

The configuration and distribution of snags in early-seral patches may also influence their use by purple martins and explain a lack of occurrence at some of the sites identified by our habitat model or by expert opinion as being potentially suitable. At these sites, snags were packed in high-density patches rather than being widely distributed throughout the disturbed

area. The unoccupied Lily Lake site, for example, contained an expansive open meadow similar to the meadow in the occupied Drift Creek Oxbow site. The unoccupied snags present at Lily Lake, however, were densely packed and highly concentrated in a single area. In contrast, the occupied snags on Marys Peak and on private timberland were isolated in open areas. The preference of purple martins for open-air space around nest sites has been frequently reported (Hagar and Sherman, 2018; Rockwell, 2019) but not well quantified. Quantitative information on the influence of snag density on purple martin nest-site selection would be helpful in developing guidelines for snag retention and creation in post-disturbance management units.

## Conclusions

Snags with suitable nesting cavities in sufficiently large open areas were rarely encountered at survey sites located on the Siuslaw National Forest. Whereas the habitat model was useful in identifying early-seral forest of an area large enough to accommodate purple martins, critical information on the presence, quality, and distribution of snags could be obtained only through ground surveys. Furthermore, most of the early-seral habitat identified by the model was located on private timberlands directly bordering National Forest land. This observation corroborates findings from previous surveys in the Coast Range, where snag-nesting purple martins were found to be more abundant on private timberlands than on Federal lands (Hagar and Sherman, 2018).

The prospects for future habitat for snag-nesting purple martins in the Oregon Coast Range becomes increasingly uncertain as the probability of the occurrence of large snags in early-seral conditions decreases with divergent management goals on public and private lands. On the one hand, clear-cut harvests on private industrial forests are a source of the requisite open habitats, but snag availability is likely to decline under the intensive management and short timber-harvest rotations practiced on these lands (Rose and others, 2001). The large snags on private industrial forest lands that are currently an important source of nesting habitat for purple martins are primarily remnants from the original old-growth forest and unlikely to be replaced once they fall (Mike Rochelle, Weyerhaeuser Co., personal communication). On the other hand, while current management goals to restore late seral forest on the Siuslaw National Forest are intended to produce large trees and snags, early-seral habitat is likely to remain scarce in the absence of harvest or other large disturbances. Stand-replacing fires are historically rare in the moist forests of the Coast Range (Long and Whitlock, 2002), but projected increases in wildfire frequencies may provide opportunities to offset the loss of early-seral habitat that has resulted from implementation of the Northwest Forest Plan (Airola and Williams, 2008; Phalan and others, 2019). The longevity (Swanson and others, 2011; Phalan and others, 2019) and utility of post-disturbance habitats for use by purple martins can be maximized by avoiding activities such as salvage logging, tree planting, and herbicide application (Airola and Williams, 2008). Ensuring that suitable nesting snags are present in areas of early-seral habitat created through natural disturbance may be the best way to passively increase the amount of suitable breeding habitat available to purple martins on National Forest land.

Although our results are based on just one year of monitoring, we are confident that the use of song playbacks ensured a high probability of detection, and that the occurrence rate of purple martins we reported is accurate for the sites we surveyed. The number of sites we surveyed is relatively small, however, and given the dynamic nature of disturbances in Pacific Northwest forests, the availability and distribution of early-seral conditions is likely to be constantly changing. Therefore, multiple years of monitoring at a larger number of sites is

recommended to better determine trends in purple martin populations on the Siuslaw National Forest and throughout the region.

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## Appendix A

A brief description of the habitat characteristics and the photo documentation of each site surveyed for purple martin occurrence on the Siuslaw National Forest in 2019.



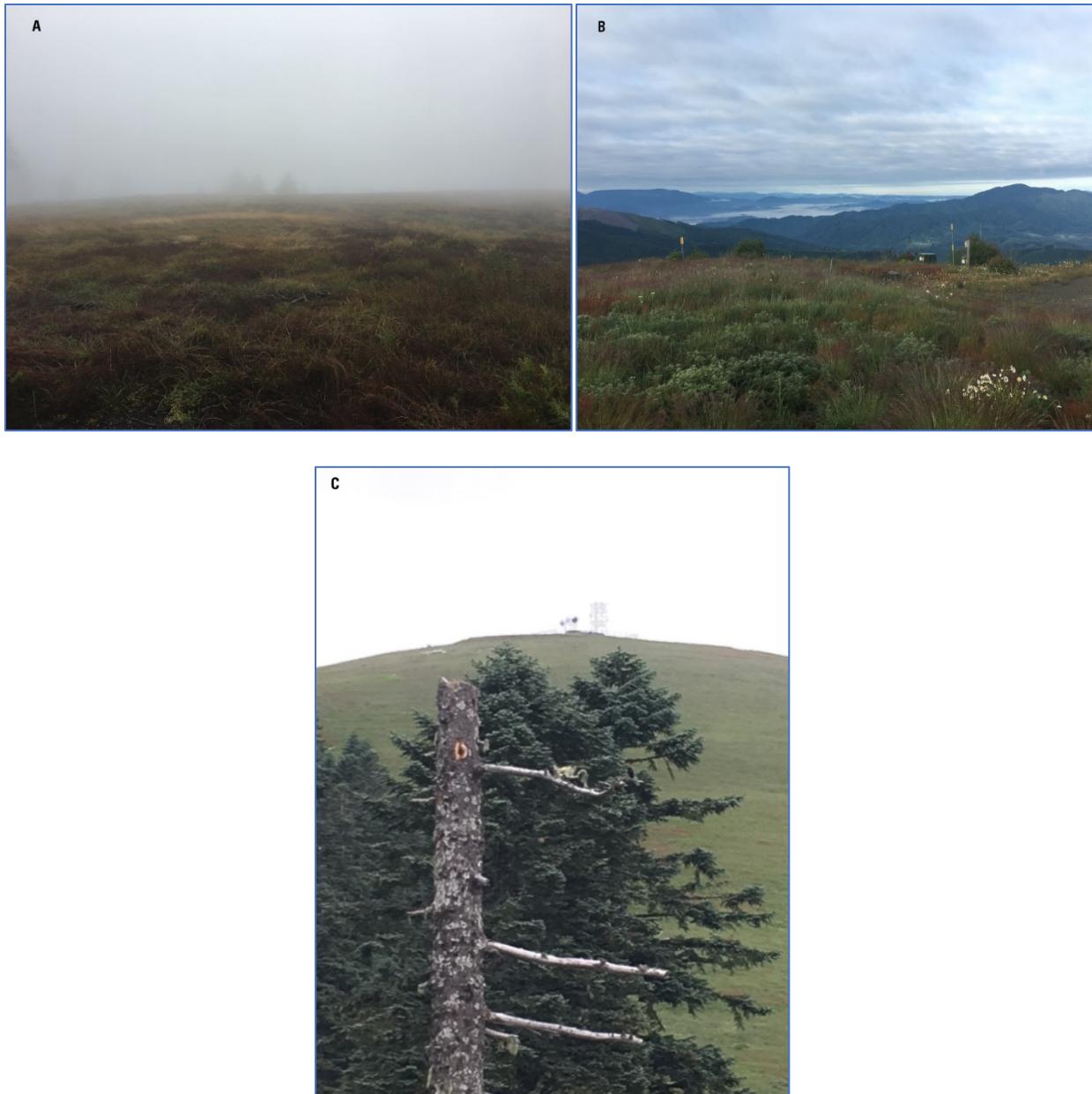
**Figure A1.** Enchanted Valley survey site: long, narrow meadow with Bailey Creek cutting through the middle. Bordered by mature forest, this site contained a single suitable nesting substrate (in the form of an old telephone pole), which contained two or three natural cavities and was located close to the mature-forest edge. At the time of survey, a tree swallow was occupying the largest and most suitable of the natural cavities. (A), The southern section of the site, and (B), the northern section of the site.



**Figure A2.** Lily Lake survey site: dunes/beach/lake habitat with a dry meadow and a small section of densely packed snags concentrated near Baker Beach Road. Whereas this site appeared to contain all necessary characteristics of suitable purple-martin habitat, the densely packed nature of the snags may have deterred martins from nesting in them; Sherman (2019) documented a strong positive association between snags located in open spaces and snag use. (A), The dry meadow and lake part of the survey site, and (B) the dunes and beach part of the survey site.



**Figure A3.** Salmon River Estuary survey site: a large, expansive meadow with Salmon River running through parts of the site. Whereas the site represents suitable foraging habitat, no snags were present in the surveyed area, making it unsuitable for nesting.



**Figure A4.** Marys Peak survey site: Located within the Marys Peak Botanical Special Interest Area near Marys Peak Campground, this high-elevation upland site contains a wide-open meadow with a single suitable nesting snag, which was located in an open area away from the forest edge. (A) The meadow surrounding the occupied snag, (B) a view of the meadow and the surrounding habitat on a clear day, and (C) the single suitable nesting snag occupied by a pair of purple martins (*Progne subis arboricola*; not shown).



**Figure A5.** Drift Creek Oxbow survey site: Located in the Oxbow of Drift Creek (a tributary of the Alsea River), this site features an expansive wet/dry meadow with a section of densely packed snags. As is true for the area near Lily Lake, the densely packed section of snags was not occupied by purple martins (*Progne subis arboricola*), which we attribute to their documented preference for snags located in open areas. As discussed in the report, evidence suggests that purple martins were nesting in an area on the opposite side of Drift Creek, but the particular nesting substrate(s) used were not observed due to lack of access/visibility. (A) The expansive wet/dry meadow within the survey site, and (B) Drift Creek, which runs along the outside edge of the site and prevented access to the opposite side, where purple martins were nesting.



**Figure A6.** T04S\_R10W\_S01 survey site: The survey site includes a steep slope with mature forest on top of and west of the ridgeline. A section of early-seral habitat is present east of the ridgeline, but this area lacks retained snags, rendering it unsuitable for purple-martin nesting. (A) The view from the top of the ridgeline, showing the section of early-seral habitat and the mature forest (in background) that covers most of the site, and (B) the section of early-seral habitat, which lacks retained snags suitable for use as nesting substrate.



**Figure A7.** T04S\_R10W\_S34 survey site: The northern part of the site was predominantly closed-canopy climax forest lacking any snags. The southern part of the site was thinned forest and included small patches of early-seral habitat. Although snags were present in these patches, they were recently formed and lacked natural cavities for nesting. The surrounding private land featured large areas of early-seral habitat, but no snags were retained. (A) The dense, mature forest part of the site, and (B) a small section of early-seral habitat, including snags that lacked nesting cavities.



**Figure A8.** T06S\_R10W\_S12 survey site: The site was bordered by mature, closed-canopy forest, but did contain multiple patches of early-seral habitat. Recently formed snags were occasionally encountered in these patches, but only one snag was identified as containing suitable nesting cavities. The combination of limited availability of nesting substrate and the small sizes of the areas of early-seral patches likely explains the lack of use by purple martins (*Progne subis arboricola*). (A) One of several sections of early-seral forest including a high number of recently formed snags that lacked nesting cavities, and (B) the single snag with potential nesting cavities (center of photo) identified within early-seral areas of the site.



**Figure A9.** T07S\_R09W\_S05 survey site: 80 percent of the survey site was composed of mature, closed-canopy forest. The remaining 20 percent of the site was early-seral habitat lacking retained snags. (A) Mature forest that composed approximately 80 percent of the survey site, and (B) a part of the small section of early-seral habitat that did not include any retained snags.



**Figure A10.** T12S\_R10W\_S13 survey site: This site predominantly included closed-canopy forest interspersed with patches of open-canopy areas that primarily consisted of relatively young, dense stands of planted conifers. The surrounding privately owned timberland included expansive areas of early-seral forest. Suitable nesting snags were identified on private land, but snag availability appeared to be limiting. A broadcast of a recording of purple martin (*Progne subis arboricola*) song on the border of private land and the National Forest did elicit a response from an adult male, indicating that purple martins were likely occupying the surrounding private land, where large areas of early-seral habitat and retained snags were present. (A) Mature forest that covered most of the survey site, and (B) open-canopy area of site containing a young conifer stand.



**Figure A11.** T13S\_R09W\_S04 survey site: The entire survey site was mature, closed-canopy forest. Private timberland bordering the site contained expansive areas of recently harvested, early-seral habitat, but lacked snags. (A) The actual survey site, characterized by closed-canopy, mature forest, and (B) private timberland that surrounded the National Forest survey site.



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