Nesting Raptors of Griffith Park and Surrounding Area
2020

Final Report

Peregrine Falcon (Falco peregrinus) at nest cavity in Griffith Park
Photo courtesy of Courtney McCammon.

Peregrine Falcons attempted to breed in Griffith Park in 2020 for the first time in modern history during a months-long park closure, but was unsuccessful at fledging young, presumably due to disturbance at the nest by hikers or climbers when the park re-opened in May.

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EXECUTIVE SUMMARY

We expanded our study area and greatly increased the number of monitored nests for the fourth year of the Griffith Park Nesting Raptor Survey (2020), owing to extra observation time made possible by reduced traffic and altered schedules as a result of the COVID-19 pandemic. While investigators and volunteers monitored 60 active nests in 2019, in 2020 we confirmed and monitored *192* active nests, and an additional 38 presumed active breeding territories. Unlike in prior years, we were able to confirm as active many territories by the presence of recently-fledged young and recently-used nests, using clues learned this year while more closely observing known nests.

We expanded our coverage to include the Sepulveda Basin, Glendale/Burbank, and the Baldwin Hills. We attempted to expand further, to East Los Angeles/El Sereno, Encino and Pasadena; however, as in prior years, our coverage here remained light, so nests from these areas were dropped from the study to ensure that we were finding as many nests as possible within a clearly-defined study area.

In all, we detected 94 active Red-tailed Hawk nests/territories, 93 Cooper's Hawks, 21 Red-shouldered Hawks, 17 Great Horned Owls, two Western Screech-owls, and single nests/territories each of Barn Owl, American Kestrel, and Peregrine Falcon. These numbers (at least the diurnal species) probably more closely reflect actual numbers of active nests in the study than those in prior years' surveys. Nest success was very high in 2020; of 188 active nests where the outcome was known or strongly suspected, 175 fledged at least one young (93%); just 9 nests were believed to have failed, or were apparently abandoned, generally in the incubation stage.

With the expanded coverage areas, the 101-405 Freeway subregion (including the Santa Monica Mountains between Ventura Blvd. and Sunset Blvd.) had the most active nests/territories, with 69. This was followed by Griffith Park (34) and the San Fernando Valley floor (33).

As in 2019, 2020 again found pines (*Pinus* spp.) to be the most common nest tree used (68 nests), followed by gums (*Eucalyptus* spp.) and related species (42 nests), Shamel ash (*Fraxinus udhei*) with 21 nests, and sycamores (*Platanus* spp.) with 18 nests. Just six active nests were in native trees other than sycamores, including coast live oak (*Quercus agrifolia*) (3 nests), cottonwood (*Populus* spp.) (2 nests) and willow (*Salix* spp.) (1 nest).

Due to the great difference in our sample size of nests between 2019 and 2020 (and because so many nests in 2020 were newly discovered due to much higher effort levels and expanded coverage, particularly in the San Fernando Valley), it is difficult to compare nest re-use from 2019. However, trends remained similar, with high levels of nest and territory re-use documented for Red-tailed Hawks, and low re-use by Cooper's Hawks.

1.0 BACKGROUND

Our "Griffith Park Raptor Survey", launched in 2017 (Cooper et al. 2017), is an attempt to build our ecological understanding of the park and to encourage public stewardship of its resources. By documenting and tracking each raptor nest in the park and surrounding landscape, we hope to understand how ecological dynamics change from year to year in the park, and how human activity may be impacting wildlife here. While a handful of Los Angeles-area raptor nesting sites had been documented by prior work (e.g., Allen et al. 2017) and individual nests are generally afforded protection when found during utility line replacement and other agency activities, the data contained in our annual summary reports from the Griffith Park area represent the first comprehensive dataset of an entire raptor community in the urban core of Los Angeles.

Raptors are important apex predators in most of the earth's ecosystems, and coastal southern California supports (or once supported) around a dozen breeding species (Garrett and Dunn 1981). Of these, several are known to nest, or formerly nested, in Griffith Park, one of the largest urban parks in the U.S., if not the world. Cooper Ecological Monitoring, Inc. has been conducting surveys on the flora and fauna in Griffith Park since 2007, when the Griffith Park Wildlife Management Plan (Cooper and Mathewson 2009) first documented the park's flora and fauna and suggested best management practices for the future, including improved species monitoring.

Based on prior records (e.g., eBird: www.ebird.org), the Griffith Park area (eastern Santa Monica Mountains and surrounding lowlands) provides potentially suitable nesting habitat for nine resident raptors including Turkey Vulture (*Cathartes aura*), Red-shouldered Hawk (*Buteo lineatus*), Red-tailed Hawk (*Buteo jamaicensis*), Cooper's Hawk (*Accipiter cooperii*), Great Horned Owl (*Bubo virginianus*), Barn Owl (*Tyto alba*), Western Screech-Owl (*Megascops kennicottii*), Peregrine Falcon (*Falco peregrinus*) and American Kestrel (*Falco sparverius*). Former nesters include Golden Eagle (*Aquila chrysaetos*) and Long-eared Owl (*Asio otus*), but both are rare today at any season. Osprey (*Pandion haliaetus*) is frequently seen through the nesting season (mainly along the Los Angeles River) but does not regularly nest in the study area. A handful of species of raptors occur locally in migration and/or winter (e.g., White-tailed Kite (*Elanus leucurus*), but nesting has not been suspected as occurring in the study area in modern times. Life-history summaries of the more commonly encountered nesting raptors in the study area, including our own local observations, are provided in Appendix A.

2.0 STUDY AREA AND METHODS

2.1 Location

The "Study Area" in for 2020 centers on Griffith Park, but was expanded this year to include additional portions of the San Fernando Valley and coastal plain that were not covered in prior years (see Appendix A). For 2020, the Study Area extends to the 405 Freeway/Sepulveda Pass in the west, Vanowen Blvd. in the north, Interstate 10 in the south, and the Arroyo Seco/110 Freeway in the east. We also newly included the entire Sepulveda Basin and the Baldwin Hills for the 2020 study. This expanded area includes the entire eastern Santa Monica Mountains, as well as Elysian Park, the Los Angeles River, Silver Lake Reservoir, Echo Park, Debs Park, Eagle Rock, Glendale, Burbank, and surrounding neighborhoods. A handful of raptor nests just outside this area were monitored by volunteers (e.g., Encino), but we did not specifically search for nests in these areas.

The City of Los Angeles Department of Parks and Recreation manages Griffith Park, Elysian Park, Echo Park, Debs Park, and Balboa Park; the Los Angeles Department of Water and Power manages Silver Lake Reservoir; Los Angeles County and the State of California manage portions of the Baldwin Hills; and various other agencies operate in the remaining open space of the eastern Santa Monica Mountains (e.g., Mountains Recreation and Conservation Authority). Importantly, the study area – and many nesting sites – is dominated by private property within the City of Los Angeles, mainly occupied by single-family homes and yards, and many nests were located in street trees or backyard trees.

Griffith Park itself contains over 4,300-acres of rugged wilderness and is one of the largest municipal parks in the United States. It sits at the eastern-most end of the Santa Monica Mountain range and is surrounded by three major freeways on its western, northern and eastern borders, and by dense urban development (Hollywood) to the south. Still, the park boasts a large and vibrant wildlife population that includes both diurnal and nocturnal birds of prey. The climate is Mediterranean, with low or no summer precipitation and cool winters, and periods of drought. February receives the highest levels of precipitation with annual average rainfall of 14 inches. Fairly regular El Niño effects once or twice per decade can result in much higher annual rainfall amounts, and regular droughts can reduce rainfall to half the normal amount (or less in exceptional years). Of note, the year of the project launch (2017) followed an exceptional four-year drought in the Los Angeles area; however, the 2018 – 2019 rainy season saw a total of 18.82 inches in the downtown Los Angeles area, which is 4.09 inches (>20%) above the seasonal average for the area, and the 2019-2020 season saw a return to average, with 14.86 inches, though roughly half of it fell during March and April (2020), which is unusually late (and which coincided directly with our 2020 raptor nesting season)[1].

[1] http://www.laalmanac.com/weather/we13.php; http://www.laalmanac.com/weather/we08aa.php

Habitats within the Study Area vary considerably from manicured parks to dense urban neighborhoods, to rugged, deep canyons in isolated, "wilderness-like" areas. Urban habitats are highly variable, with large, estate-like lots in places like Toluca Lake and Beverly Hills, and multi-story high-rises in areas close to downtown and along the Wilshire Corridor. Griffith Park and other large open space areas feature semi-arid native in the interior, with irrigated landscaping, including very tall trees, at the perimeter.

As in prior years, we were denied access to the large protected habitat area around Stone Canyon Reservoir (Los Angeles Dept. of Water and Power), which has been closed to birders/researchers for many years, but we greatly increased observer coverage, including nest-searching for new nests and territories, in areas such as the San Fernando Valley and eastern Santa Monica Mountains.

2.2 Survey Methods

Cooper and McCammon conducted opportunistic surveys in the Study Area during late winter 2020 to document the status of existing and potential raptor nests, which continued through the spring and summer. In early March (2020), the citywide "Safer at Home" program lead to the shuttering of businesses and offices throughout Los Angeles, which greatly reduced traffic on the roadways throughout the study area, to the point that normal commuting hours looked like early Sunday morning. We (Cooper/McCammon) continued our fieldwork on other jobs during this period and visited the study area before and after these projects, ultimately spending several days per week searching for new nests, and re-visiting known territories trying to confirm breeding. Gerry Hans, and several enthusiastic volunteers (including Nurit Katz) also spent dozens of field hours between March and July searching for nests, which had not been done at this level in prior years.

Unlike in prior years, we also scanned online bird reporting platforms such as eBird and iNaturalist for reports of adults and juveniles (the latter particularly evident by June), and then visited the reported areas to track down nests (which yielded several dozen new territories/nests). We also posted several announcements and updates of the project to Facebook and local Nextdoor boards, requesting sightings of nests and juvenile raptors.

Our surveys were performed mostly by foot using 8-10x binoculars, 20x spotting scopes, and "super-zoom" cameras to determine nest activity and the presence or absence of raptors. Surveys were timed to avoid undue disturbance to nesting raptors and other birds during the most critical breeding periods later in spring.

We again held two training sessions, each attended by 40+ volunteer "community-scientists" in late winter (February 1st and 9th), and by the end of June, we had roughly 100 potential raptor nests/territories located, with 60 of them active at some point during the spring. As in prior years, we then assigned nests to one or more volunteers based on their location preferences

and birding ability. Volunteers were asked to visit their assigned nests twice per month (and no more than weekly) to identify nesting stages throughout the season, and were asked to send back completed data sheets at least monthly. Each active nest was confirmed (by photograph if possible) by Cooper, McCammon, or Gerry Hans to ensure data reliability. Completed data sheets were kept in a central location for easy access and may be provided upon request. GPS coordinates of nests were collected with Google Earth app in the field, or later using volunteers' written descriptions and Google Earth Pro. Coordinates were taken as close to the nest tree as possible, but the accuracy of nest coordinates may vary due to access issues, proximity of the edge of a tree to the nest, or the inability to obtain accurate readings under dense tree canopy.

Another addition to this years' survey was the collaboration with Cornell Lab of Ornithology through the use of NestWatch, a nation-wide nest monitoring program designed to track status and trends in the reproductive biology of birds. McCammon input the Griffith Park Raptor Survey nest data into NestWatch in order to contribute to a nation-wide data set increasing our understanding of differences and similarities among hawk species on a larger scale. While NestWatch is a citizen science tool used by the public in monitoring the fate of bird nests around the United States, the Griffith Park Raptor survey data has the location kept hidden due to the sensitive nature of the information. The data is mostly used to support other raptor monitoring programs and to provide comparative data to fellow researchers. The public cannot view the location of any nests tracked through the Griffith Park Raptor Survey.

Please refer to Appendix B for notes on focal species' natural history, including insights gained from the 2020 field season.

2.3 Classifying Nest Structures

We refined our definitions and classification of nests and territories in 2020, to account for new information learned through our more intensive monitoring and nest-searching this year. The following designations were used to classify nesting success for this survey, and refer to *nests* (rather than territories).

- Active – A physical nest in good condition with at least one individual of the appropriate species engaged in clear breeding behavior at the nest (e.g., nest-building, incubation, etc.);
- Inactive – A likely or known/historical raptor nest in which no current nesting activity is observed (e.g., no birds present, cobwebs covering the nest, no whitewash below the nest);
- Fledged – A known nest where one or more young successfully left the nest. Typically, this was confirmed by observations of large young in the nest, then an empty nest shortly thereafter, with copious whitewash and down feathers near the nest, and usually with at least one fledgling (dependent on adults and incapable of sustained/smooth flight) in the area. In some cases, a successful nest was identified based on whitewash/down even if no fledgling was observed nearby.
- Failed – An active nest that produced no young, but where nesting activity had been observed in the current year;
- Unknown – Ambiguous observations, such as one or both adults at the nest possibly incubating or tending young, but where no fledglings were detected later in the season; or where we did not have enough observations to make a determination of success due to scheduling/access issues.

For 2020, we increased our effort determining the breeding status of territories where nests had not been located, but where we found a pair of raptors exhibiting breeding behavior such as tandem flights, copulation, stick-carrying, etc.; in some cases, we identified a territory based on the presence of a single adult, such as an adult Cooper's Hawk delivering a territorial call. We also included as territories areas where we found fledglings that appeared to have been hatched very close by (see "Fledged", above), but where we could not locate a physical nest. Several of these "territories" were later confirmed as "nests" when a physical nest (appropriate to the species and clearly from the current year) was located. In all, territories without nests accounted for 16.5% of our total active breeding sites monitored (the remaining 83.5% were observed nests).

3.0 RESULTS

3.1 Nest Success and Phenology

Our 2020 survey evaluated 352[2] potential nests and territories of 8 raptor species: Red-tailed Hawk, Red-shouldered Hawk, Cooper's Hawk, Great Horned Owl, Western Screech-owl, Barn Owl, Peregrine Falcon and American Kestrel. We confirmed very few nests and territories of the latter four species in 2020 (<3 each), so these are not analyzed here. Thus, only our "focal species" are the three hawks and Great Horned Owl, which we analyzed here. Tables 1a and 1b provide a breakdown of species and outcomes for both 2019 and 2020:

Table 1a. Nests Monitored and Outcome, 2020[3].

Species	# Active nests	# Fledged[4]	# Failed/ Abandoned	# Unknown outcome
Red-tailed Hawk	80	77 (96.3%)	3	-
Red-shouldered Hawk	17	16 (94.1%)	1	-
Cooper's Hawk	76	67 (88.1%)	5	4
Great Horned Owl	15	15 (100%)	-	-
Total	188	175 (93.0%)	9	4

Table 1b. Nests Monitored and Outcome, 2019.

Species	# Active nests	# Fledged	# Failed	# Unknown outcome
Red-tailed Hawk	33	29 (88%)	1	3
Red-shouldered Hawk	4	4 (100%)	-	-
Cooper's Hawk	11	8 (73%)	1	2
Great Horned Owl	12	11 (92%)	-	1
Total	60	51 (87%)	2	6

The number of fledglings for all four focal species ranged to four chicks (Table 2). The highest number of fledglings on average was the Great Horned Owl (2.27) followed by Red-tailed Hawk (2.19), Cooper's Hawk (2.18), and Red-shouldered Hawk (1.92). In general, the data suggest that the average number of chicks across all species is somewhat similar, but that there is less

[2] We include nests from prior years (to 2017), as well as suspected raptor nests that were later confirmed.
[3] We include nests that were discovered post-fledging (i.e., with copious whitewash and down, indicating successful fledging). As this biases the results somewhat toward successful nests (it is essentially impossible to count all the nests that failed but which were never discovered), future effort should clarify actual success more accurately. We did not include territories where no physical nest was observed, even if we found juveniles there.
[4] Includes presumed-fledged nests, i.e., large young seen in nest on last visit, but no final visit made to confirm fledging.

variability in fledgling number among Red-shouldered Hawks and Great Horned Owls as compared to Cooper's Hawks and Red-tailed Hawks.

Phenology data were gathered mainly by volunteers, so this information is somewhat incomplete, owing to variation in data-gathering abilities and timing of visits. This is particularly apparent in the 2020 data due to the COVID pandemic causing many closures making access to nests difficult for many volunteers. Since we only asked volunteers to visit the nests every two weeks, certain gaps emerged with respect to start dates of the nesting phenomena. As in prior years, Red-shouldered Hawk nestlings have appeared a few weeks after those of the first Red-tailed Hawk chicks, and Cooper's Hawk nestlings appeared much later (c. 6 weeks after Red-tails; Table 2). We also noted that Cooper's Hawk chicks fledged from the nest in a relatively shorter amount of time as compared to Red-tailed or Red-shouldered Hawks, so all three hawk species saw their mean first fledging dates in the same month (June).

Table 2. Nesting success and phenology by species, 2020, showing mean date and range of *first* observation for each nest monitored (for each nest where we had data). Note: sample size indicates maximum sample size.

Species	# Fledglings[5] (mean, SD)	Incubation	Nestlings	Branching	Fledging
Red-tailed Hawk	2.19 ± 0.91	March 15 (2/11 to 4/12)	April 25 (3/20 to 6/14)	May 18 (4/22 to 7/5)	June 5 (5/3 to 7/9)
Red-sh. Hawk	1.92 ± 0.83	March 24 (3/15 to 4/4)	May 10 (4/16 to 5/24)	May 29 (5/24 to 6/10)	June 9 (5/23 to 6/20)
Cooper's Hawk	2.18 ± 1.06	April 23 (3/27 to 5/28)	June 3 (5/14 to 7/27)	June 16 (6/1 to 7/11)	June 29 (6/6 to 7/19)
Great Horned Owl	2.27 ± 0.88	March 10 (2/15 to 4/7)	March 31 (2/15 to 4/7)	April 14 (3/15 to 5/7)	April 28 (3/26 to 5/23)

3.2 Geographic and Habitat Patterns

We provide the geographic setting of our active nests and territories (even if outcome unknown) in Table 3a, and the nesting substrate (tree type) Table 3b. Because of the greatly increased effort put into searching out new nests in 2020, this breakdown is probably the most accurate we have had in any prior survey year. While our subareas vary in size and search effort, clear patterns have emerged. The eastern Santa Monica Mountains, which includes the extensive area of hills between Sepulveda Pass (405 Fwy.) and Cahuenga Pass (101 Fwy.), supported the largest number of active raptor nests/territories (70), followed by Griffith Park and the San Fernando Valley.

[5] COHA and RTHA nests had a range of 0-4 chicks produced in 2020, while GHOW and RSHA nests had a range of 1-4 chicks produced .

Species distribution within each subarea is very different, with Red-tailed Hawks most numerous in the Santa Monica Mountains and Griffith Park (and still a dominant species in Elysian Park and Northeast L.A.), yet with relative few nests on the floor of the San Fernando Valley and in the urban Los Angeles Basin between Westwood and Downtown Los Angeles.

Cooper's Hawks show essentially the opposite pattern, with the largest number of breeding pairs found in the (urban) San Fernando Valley and in Westwood-Downtown. In terms of representation, Cooper's Hawks were found to comprise roughly a quarter (23-26%) of the breeding raptor pairs in Griffith Park and the Santa Monica Mountains, yet comprised >80% of pairs found in the San Fernando Valley/Westwood-Downtown. Red-shouldered Hawks and Great Horned Owls occur in much lower numbers and are more evenly distributed, but appear to avoid these more urban areas favored by Cooper's Hawks.

Table 3a. Geographic distribution of active nests and territories, by species, 2020.

Species	Griffith Park[6]	Eastern SMM[7]	Silverlake/ Echo Park[8]	Glendale-Burbank	Northeast L.A.[9]	San Fernando Valley	Westwood-Downtown[10]	Baldwin Hills
Acres	8,780	20,285	6,382	9,361	11,348	19,795	29,098	9,572
Red-tailed Hawk	18	41	12	5	12	4	2	0
Red-shouldered Hawk	3	7	3	2	3	0	1	2
Cooper's Hawk	9	16	6	5	7	28	19	3
Great Horned Owl	4	5	3	0	3	1	1	0
TOTAL	**34**	**69**	**24**	**12**	**25**	**33**	**23**	**5**

As in 2019, 2020 again found pines (*Pinus* spp.) to be the most common nest tree used (67 nests), followed by gums (*Eucalyptus* spp.) and related species (53), Shamel ash (*Fraxinus udhei*) with 21 nests, and sycamores (*Platanus* spp.) with 18 nests (Table 3b). Just six active nests were in (other) native trees, including coat live oak (*Quercus agrifolia*) (3 nests), cottonwood (*Populus* spp.) (2 nests) and willows (*Salix* spp.) (1 nest). We also documented two nests in transmission towers (both Red-tailed Hawks, both in Glendale), three nests in rock ledges/caves (single pairs of Red-tailed Hawk, Great Horned Owl and Peregrine Falcon), and two nests on

[6] Includes all area of hills between 101 Fwy. and I-5

[7] Includes hills between 405 and 101 Fwy., south of Ventura Blvd. and north of Sunset Blvd. (i.e., all or portions of Sherman Oaks, Beverly Hills, Bel Air, Studio City, West Hollywood, Hollywood)

[8] Includes Elysian Park

[9] Includes Mt. Washington, Eagle Rock, and Debs Park area

[10] Includes entire "coastal plain" extending from vic. 405 Fwy. in Westwood east through Mid-City into Downtown L.A.

building ledges (Red-tailed Hawk and Great Horned Owl). More than 20 tree species were represented in the final tally of active raptor nest sites in 2020, including just four native trees (western sycamore *Platanus racemosa*, Fremont cottonwood *Populus fremontii*, coast live oak *Quercus agrifolia* and willow *Salix* sp.). While some pines are native to higher elevations in the mountains above Los Angeles, the species widely planted in the city are Old World taxa, including Canary Island pine (*Pinus canariensis*) and Aleppo pine (*P. haleppensis*).

Table 3b. Substrate (tree) usage, by species (active nests only), 2020.

Species	Pine	Eucalyptus	Shamel Ash	Sycamore[11]	Oak[12]	Other/Unk.
Red-tailed Hawk	47	19	0	4	0	10
Red-shouldered Hawk	1	8	2	6	0	0
Cooper's Hawk	10	12	18	8	3	25
Great Horned Owl	10	3	1	0	0	1
TOTAL	**68**	**42**	**21**	**18**	**3**	**36**

[11] Includes the native western sycamore (*Platanus racemosa*) as well as non-native/hybrid plane trees (*Platanus* sp.), which are planted as street trees.
[12] Coast live oak (*Quercus agrifolia*) unless noted.

3.3 Nest and Territory Re-use

Overall nest re-use trends remained similar to prior years, with higher rates of re-use between 2019 and 2020 documented for Red-tailed Hawks (60% of 2019 nests re-used in 2020), and lowest for Cooper's Hawks (9% re-used). For the territory analysis, we analyzed all four years of the survey, rather than for just the year immediately prior. This offers a more comprehensive view of how pairs of each species remain in nesting territories over time. We summarize these findings in Table 4.

Table 4. Nest and territory re-use, 2020.

Species	Nests active 2019	Nests re-occupied in 2020	Territories active 2017-2019	Territories re-occupied in 2020	New territories in 2020
Red-tailed Hawk	35	21 (60%)	54	39 (72%)	55
Red-sh. Hawk	5	2 (40%)	10	7 (70%)	14
Cooper's Hawk	11	1 (9%)	32	17 (53%)	75
Great Horned Owl	17	7 (41%)	21	8 (38%)	9

As in prior years, the full spreadsheet with location information will be provided to Friends of Griffith Park separately due to the sensitive nature of the data. FoGP shares nest locations with park managers to encourage them to avoid disturbances during nesting season, including filming and tree maintenance.

3.4 Rare Species

In addition to the four focal species, we documented two breeding territories of Western Screech-owl (one in a Peruvian pepper *Shinus molle*, one in a coast live oak); one of Peregrine Falcon (rock ledge in Griffith Park, which failed), and one of American Kestrel (vic. Rio de Los Angeles State Park near Glassell Park, where birds may have nested in a vent on a building).

4.0 DISCUSSION

4.1 Nest Success and Phenology

During the 2017, 2018 and 2019 field seasons, we were able to monitor c. 100 active raptor territories (including confirmed nests and suspected nesting areas). During 2020, the additional effort devoted to the project resulted in 230 nests and territories mapped and monitored, representing a more than doubling of that in prior years. In addition, in 2020 we visited and confirmed lack of breeding activity at 83 previously-active nest sites/territories, and deemed 30 nest sites/territories to be equivocal, with breeding activity possible but not confirmed. We found nesting success much higher than in prior years, but again, this was likely due to additional effort as much as (unknown) improved conditions for raptors.

Calculating fledging success rate is problematic for each species, since we discovered so many active nests post-fledging in 2020, and thus would not have caught nests that failed early (or pairs that simply did not nest this year). We expect the number of newly-discovered nests (or at least, new territories) in the study area to drop in future years (or at least, to make up a lower proportion of the overall total), provided effort remains roughly the same.

Phenological patterns changed somewhat in the 2020 season potentially due to several factors. The increased number of nests monitored this spring has appeared to have shifted the phenology results. A majority of the Cooper's Hawk nests were found late in the spring with already fledged young, resulting in very few nests with full phenology records. And while the phenology data is unevenly collected every year based on the volunteer visitation (generally on weekends), this year the data are more uncertain because of the "shelter in place" order, which resulted in data gaps or nesting stages being caught late. For example, a nest could have been recorded as having chicks on March 10^{th,} but the chicks were fairly large when observed, leading to a recorded "first date chicks seen" date as being on March 10th (when they likely were hatched weeks prior). In future years, we hope to better this data collection through increased education of the volunteers and additional data to be gathered throughout the spring.

As in past years, it may be instructive to review why the few failed nests did so. We summarize the 12 nests believed to have failed or that were apparently abandoned in Table 5. We continue to suspect rodenticide the deaths of several adult and fledgling raptors and tested.

Table 5. Fate of failed/abandoned nests (does not include territories where nesting was suspected but where no nest was found). Some of these, in particular the Cooper's Hawk nests, may have been early nest attempts by pairs that decided to nest elsewhere.

Species	Location	Tree type	Explanation
Red-tailed Hawk	Griffith Park: Live Steamers	Pine	No activity past incubation/blew down in April during windstorm
Red-tailed Hawk	Elysian Park: Elysian/5 freeway/110 freeway	Pine	No activity past incubation
Red-tailed Hawk	Sepulveda Pass: 405 freeway across from MWD plant	Sycamore	Nest apparently fell/blew down in May
Red-shouldered Hawk	Bel Air: Stone Canyon	Sycamore	No activity past incubation
Cooper's Hawk	Silverlake: Dillon Street	Silk oak	No activity past nest-building
Cooper's Hawk	Glendale: Carr Park	Sycamore	No activity past nest-building
Cooper's Hawk	Van Nuys: Buffalo Ave.	Shamel ash	No activity past nest-building
Cooper's Hawk	Silverlake: Silverlake and 101 Fwy	Acacia	No activity past incubation
Cooper's Hawk	Sepulveda Basin: Wildlife Reserve	Cottonwood	No activity past incubation
Cooper's Hawk	Sherman Oaks: Hesby and Noble	Shamel Ash	Mate (female) found dead near nest in May; 3 chicks died shortly thereafter.
Peregrine Falcon	Griffith Park	Rock cavity	2 chicks in early June, just as park re-opened; no chicks/adults seen at nest thereafter.

4.2 Geographic and Habitat Patterns

The saturation of the study area in 2020 likely yielded a much more accurate picture of actual proportions of nesting territories for each species, as well as their geographical location. Indeed, up until last year (2019) we figured that Cooper's Hawks were relatively scarce, particularly in places like the San Fernando Valley floor; yet, this was clearly simply an artifact of lack of survey effort there. However, they proved to be very common based on this year's effort. As we wrote in the 2019 report, "given that Cooper's Hawk nests are much more difficult to locate than Red-tailed Hawk nests, it is likely that there were more Cooper's Hawk nests in the study area that will simply need to be found (and monitored) to get an accurate tally of each". A similar urban study of Cooper's Hawks in the Berkeley/East Bay area (Pericoli and Fish 2004xx) found Cooper's Hawk nests spaced 0.8-1.1 km (0.33-0.50 mi.) apart, which is similar to our findings for the San Fernando Valley.

Some geographical bias is likely still present in our tally, as the nests of Cooper's Hawks seemed harder to detect in wildland areas (or easier to find in the city). Fledged Cooper's Hawk nests result in large sprays of whitewash below the nests which is particularly visible on black asphalt (as on a paved roadbed), and their nests tend to be buried in the crown of fairly large trees, often right along the central axis, which requires good visual access up into the canopy which

can be difficult to achieve in wildland areas where oaks and sycamores may be in rugged canyons far from trails. Future survey years should result in more of these more difficult-to-find territories being confirmed in places like Elysian Park and the eastern Santa Monica Mountains where they were likely undercounted (based on the presence of juveniles discovered after the survey's completion in July).

The same may be said for Great Horned Owl nests, as these are probably the most difficult to detect (our few owl nests were found opportunistically, and we conducted no specific nighttime surveys).

That said, we feel that we probably detected most of the Red-tailed Hawk nests, which are generally very large and visible (and we have improved our search image in terms of where to look). We also feel confident that we detected most of the active Red-shouldered Hawk territories (which maintain large, usually conspicuous nests and are highly vocal essentially year-round), if not their physical nests.

The finding of a complementary distribution of Red-tailed Hawks (hilly, wildland areas) vs. Cooper's Hawks (urban "flats") is somewhat unexpected, in that we were not sure whether the apparent ubiquitous-ness of each species across the Los Angeles Basin (e.g., Allen et al. 2017) was reflected in the even placement of their nests. Based on our findings, their nests are clearly not evenly distributed throughout the city, and in particular, large open space areas (such as Griffith Park and parkland within the eastern Santa Monica Mountains) appear to be very important for the persistence of Red-tailed Hawks. Even in (relatively) highly urbanized Northeast Los Angeles (e.g., Mount Washington, Eagle Rock, and Highland Park) and Silver lake/Echo Park, Red-tails are still finding enough resources to nest and raise young. Yet, this is clearly not the case across the floor of the San Fernando Valley nor the urban Los Angeles Basin (Westwood-Downtown subregion), where we located only a handful of Red-tailed Hawk nests, mainly associated with large open areas (e.g., Sepulveda Basin and Los Angeles Country Club).

Relatively less common than Red-tails or Cooper's hawks, both Red-shouldered Hawk and Great Horned Owl nests appear to be thinly distributed across the study area, and both are nearly absent from the floor of the San Fernando Valley as well as from the Westwood-Downtown subregion, indicating the importance of hilly open space areas like the Griffith Park area in keeping them around.

As in 2019, non-native pines and eucalyptus proved extremely important to nesting raptors, in particular for Red-tailed and Red-shouldered hawks and Great Horned Owls. Cooper's Hawks utilized these species (in particular, eucalyptus), but also made extensive use of non-native urban street trees, notably Shamel ash. As we had inadequately surveyed the floor of the San Fernando Valley and the Westwood-Downtown subregions in 2019, we had not appreciated the importance of species like this ash, sweet gum (*Liquidambar* sp.), *ficus* (Ficus sp.), and more than a dozen others in supporting nests of Cooper's Hawks.

Native trees were relatively little-used, but this also must correlate strongly with availability, as native trees are almost non-existent as street trees, and large specimens of native trees (typically coast live oak and western sycamore) are largely restricted to larger patches of open space as are found in the eastern Santa Monica Mountains, and more sparingly elsewhere. The only species we documented nesting in oaks, for example, were three Cooper's Hawk nests, two at Griffith Park and one in Franklin Canyon. Sycamores were more widely used, but many of these are likely non-native London Plane trees or hybrids and occur as street trees. Pericoli and Fish (2004) also report high usage of non-native trees as nest sites by Cooper's Hawks in the urban San Francisco Bay area, with American Elm (*Ulmus* sp.) the most-used tree in 2002 and 2003.

As we wrote in 2019, by virtue of their abundance across the urban and suburban landscape of the study area, pines and eucalyptus "accounted for a relatively large proportion of our local nests, highlighting the importance of the very large, non-native trees in and around the park, many of which have matured – and are now the tallest trees around – since they were planted decades ago. While non-native, they clearly provide excellent nesting opportunities to the local raptor community, and have essentially outpaced native substrates locally, perhaps enabling native raptors to continue using the habitats."

4.3 Nest Re-usage Patterns

Due to the great difference in sample size of nests between 2019 and 2020 (so many were newly discovered in 2020 due to much greater effort and expanded coverage, particularly in the San Fernando Valley), it is difficult to interpret absolute levels of nest re-use in 2020 with the new nests/territories included. However, the rate of re-use involving *known* nests/territories from 2019 (and in prior years) to 2020 is likely to remain stable. When territory re-use (as opposed to that of nests) is compared over time, we find that at least Cooper's and Red-shouldered hawks are much more faithful to their *territories* than to their actual *nests*, with just over half the Cooper's Hawk pairs studied remaining in territories that had seen breeding activity in at least one year over the four years of surveys (assuming the same pairs are using the same territories). By contrast, only one of the 11 Cooper's Hawk nests from 2019 was re-used in 2020.

Pericoli and Fish (2004) found much higher nest/territory re-use rates for Cooper's Hawks in the urban San Francisco Bay area, though they used a much smaller sample size (n=12); four of 12 nests were re-used between the two years studied, and 10 of 12 territories were active from one year to the next. Interestingly, the average distance between nests in successive years (which we have not yet calculated) was found to be 250' (76 meters) and ranged from 72'-400' (22-121 m). Interestingly, the single territory not re-used between years in the Bay Area study was one in which the adult female had been found dead after the young fledged.

Red-tailed and Red-shouldered hawks showed the highest territory fidelity after four years (>70% in 2020), while Great Horned Owl showed the lowest (38%), more on par with nest site fidelity. This could reflect the difficulty in finding Great Horned Owl nests; they're either found

by the presence of adults in the nest (and thus determined to be active), or are simply missed if the old nest is not active.

Interestingly, while we speculated in 2019 that Red-shouldered Hawks were "flexible" in their nest location choice (compared to Red-tailed Hawks), it seems that this may indeed apply to nest sites but *not* to territories (though the very small sample size of 2019 Red-shoulders – 5 nests – is also problematic). Red-shouldered Hawk territories were re-used at a relatively high rate (similar to that of Red-tailed Hawks), and we did discover few truly new territories this year. Intuitively, it would make sense that Red-shouldered Hawk territories are stable, since they seem to require more specific and complex habitat features, such as tall, old trees near water/riparian habitat, than the other species studied. Given how uncommon Red-shouldered Hawks are across the study area, much remains unknown about the limiting factors of the species locally.

With roughly half the existing territories re-used in 2020, Cooper's Hawks may truly be moving around more – and presumably establishing new territories – than the other two hawk species, perhaps taking advantage of more rapidly changing urban conditions, or after depleting a locally abundant food resource.

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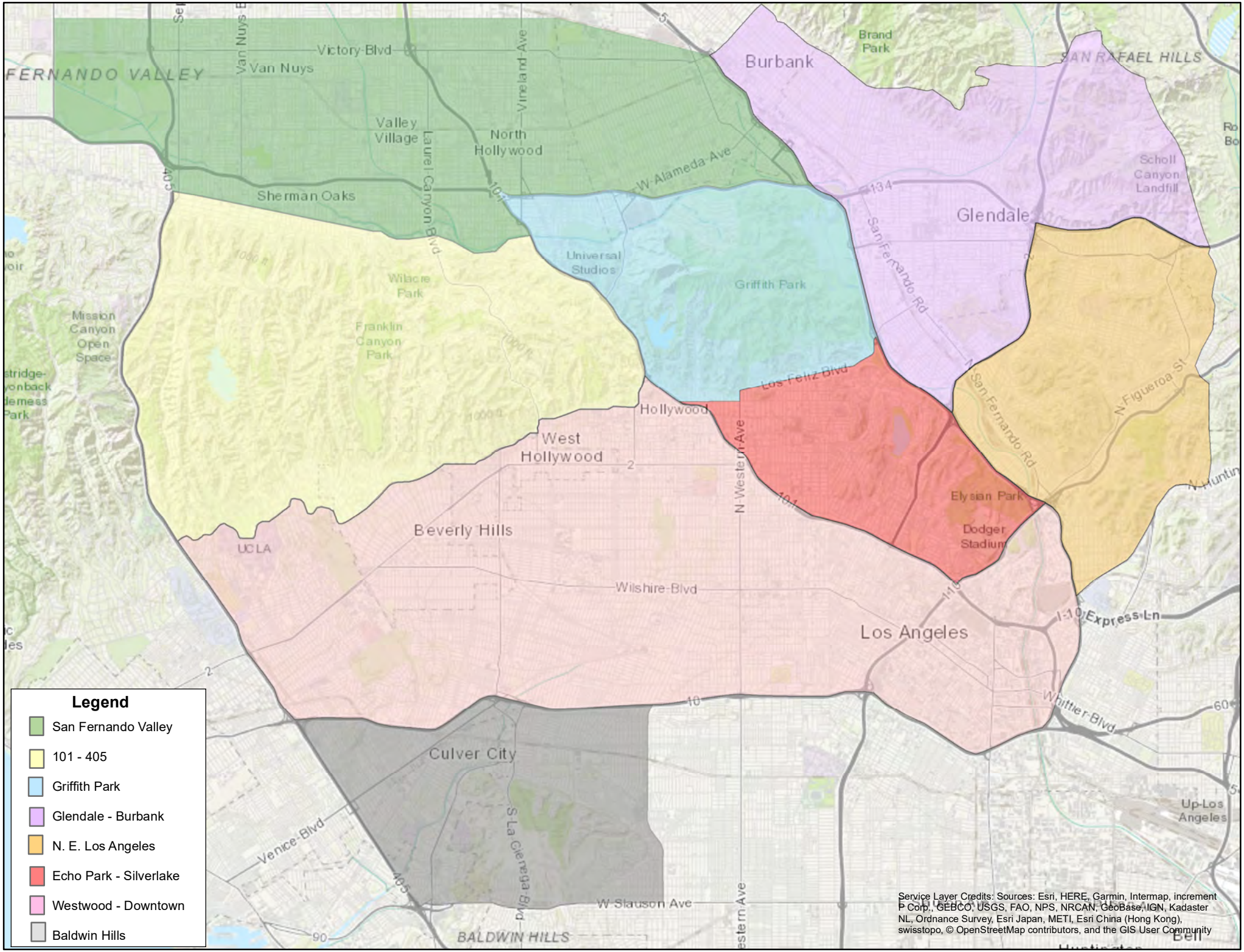
APPENDIX A. Study Area boundaries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San Fernando Valley
101 - 405
Griffith Park
Glendale - Burbank
N. E. Los Angeles
Echo Park - Silverlake
Westwood - Downtown
Baldwin Hills
FERNANDO VALLEY
Van Nuys
Victory-Blvd
Valley Village
North Hollywood
Sherman Oaks
Laurel Canyon Blvd
Vineland Ave
W-Alameda-Ave
Burbank
Brand Park
SAN RAFAEL HILLS
Scholl Canyon Landfill
Glendale
San Fernando Rd
Universal Studios
Griffith Park
Wilacre Park
Franklin Canyon Park
Mission Canyon Open Space
Los Feliz Blvd
Hollywood
West Hollywood
N Western Ave
Elysian Park
Dodger Stadium
N Figueroa St
Beverly Hills
UCLA
Wilshire-Blvd
Los Angeles
I-10 Express Ln
Whittier-Blvd
Culver City
Venice-Blvd
S La Cienega Blvd
W-Slauson Ave
BALDWIN HILLS
Up-Los Angeles
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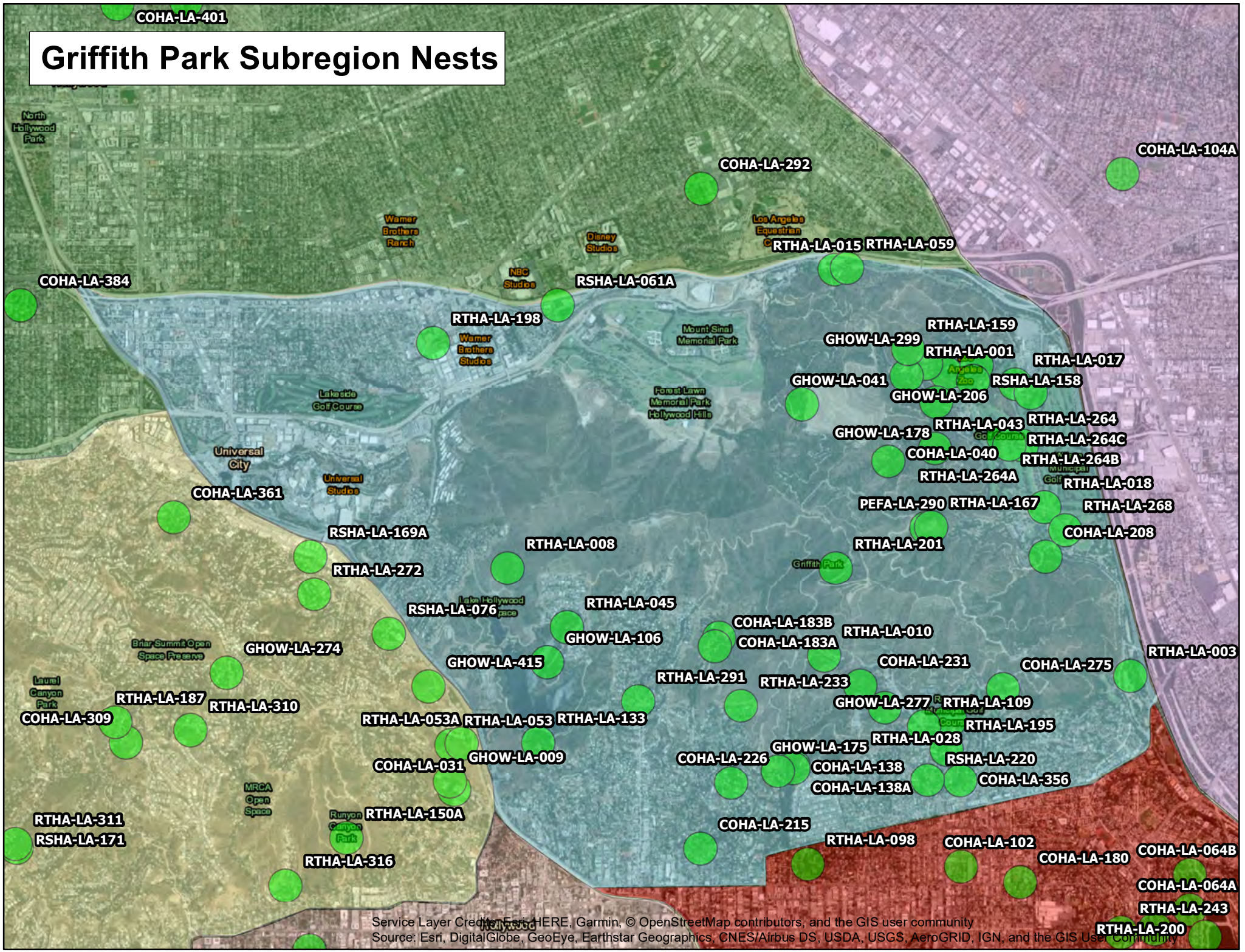
APPENDIX B. Maps of nest sites, by subregion.


Griffith Park Subregion Nests
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COHA-LA-292
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RTHA-LA-059
COHA-LA-384
RSHA-LA-061A
RTHA-LA-198
RTHA-LA-159
GHOW-LA-299
RTHA-LA-001
RTHA-LA-017
GHOW-LA-041
RSHA-LA-158
GHOW-LA-206
RTHA-LA-043
RTHA-LA-264
GHOW-LA-178
RTHA-LA-264C
COHA-LA-040
RTHA-LA-264B
RTHA-LA-264A
RTHA-LA-018
COHA-LA-361
PEFA-LA-290
RTHA-LA-167
RTHA-LA-268
RSHA-LA-169A
RTHA-LA-008
RTHA-LA-201
COHA-LA-208
RTHA-LA-272
RSHA-LA-076
RTHA-LA-045
COHA-LA-183B
RTHA-LA-010
GHOW-LA-106
COHA-LA-183A
GHOW-LA-274
GHOW-LA-415
COHA-LA-231
COHA-LA-275
RTHA-LA-003
RTHA-LA-291
RTHA-LA-233
RTHA-LA-187
RTHA-LA-310
GHOW-LA-277
RTHA-LA-109
COHA-LA-309
RTHA-LA-053A
RTHA-LA-053
RTHA-LA-133
RTHA-LA-195
RTHA-LA-028
GHOW-LA-175
COHA-LA-031
GHOW-LA-009
COHA-LA-226
RSHA-LA-220
COHA-LA-138
COHA-LA-356
COHA-LA-138A
RTHA-LA-311
RTHA-LA-150A
COHA-LA-215
RSHA-LA-171
RTHA-LA-098
COHA-LA-102
COHA-LA-180
COHA-LA-064B
COHA-LA-064A
RTHA-LA-316
RTHA-LA-243
RTHA-LA-200
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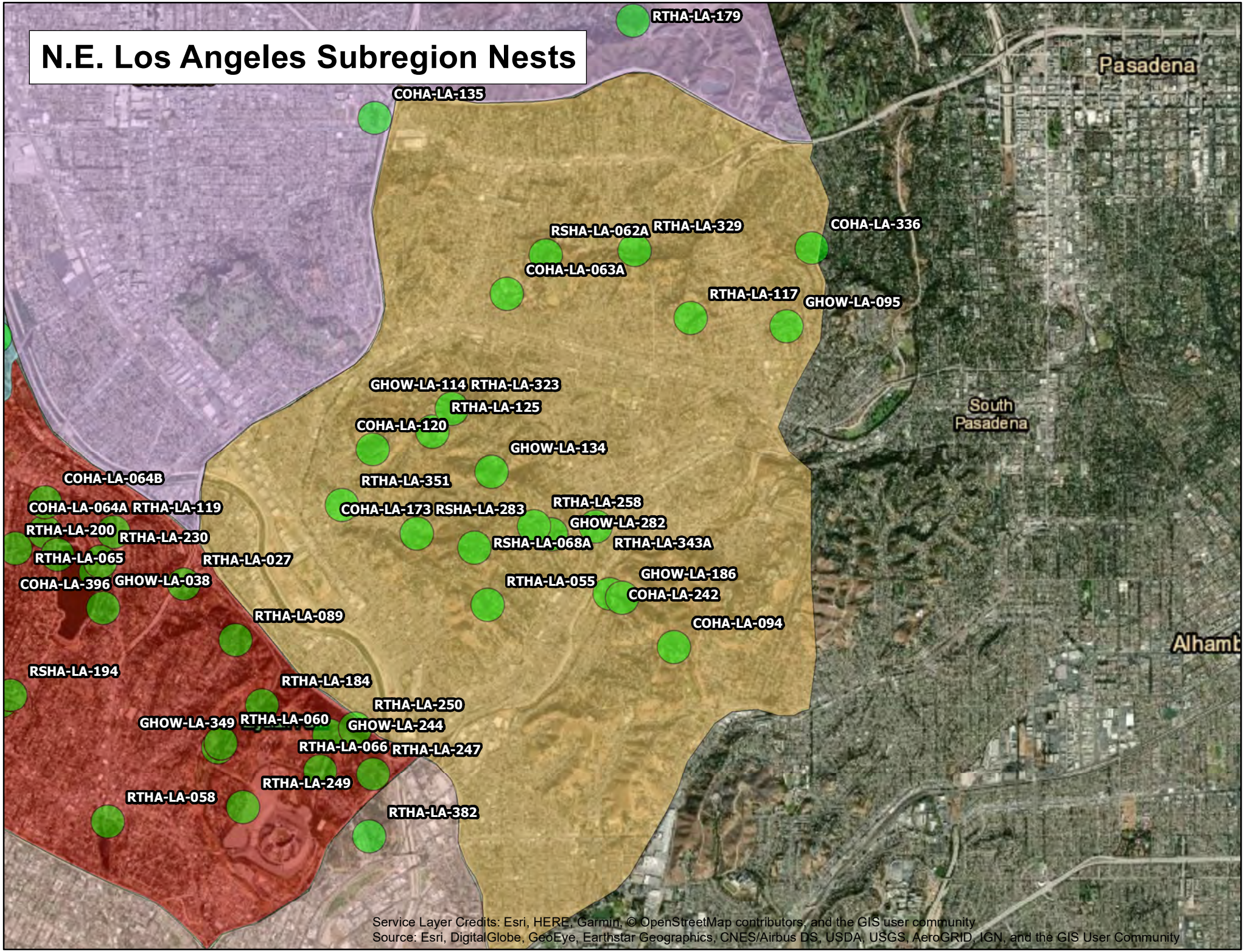
N.E. Los Angeles Subregion Nests
RTHA-LA-179
COHA-LA-135
Pasadena
RSHA-LA-062A
RTHA-LA-329
COHA-LA-336
COHA-LA-063A
RTHA-LA-117
GHOW-LA-095
GHOW-LA-114
RTHA-LA-323
RTHA-LA-125
South Pasadena
COHA-LA-120
GHOW-LA-134
COHA-LA-064B
RTHA-LA-351
COHA-LA-064A
RTHA-LA-119
COHA-LA-173
RSHA-LA-283
RTHA-LA-258
GHOW-LA-282
RTHA-LA-200
RTHA-LA-230
RSHA-LA-068A
RTHA-LA-343A
RTHA-LA-065
RTHA-LA-027
COHA-LA-396
GHOW-LA-038
RTHA-LA-055
GHOW-LA-186
COHA-LA-242
RTHA-LA-089
COHA-LA-094
Alhamb
RSHA-LA-194
RTHA-LA-184
RTHA-LA-250
GHOW-LA-349
RTHA-LA-060
GHOW-LA-244
RTHA-LA-066
RTHA-LA-247
RTHA-LA-249
RTHA-LA-058
RTHA-LA-382
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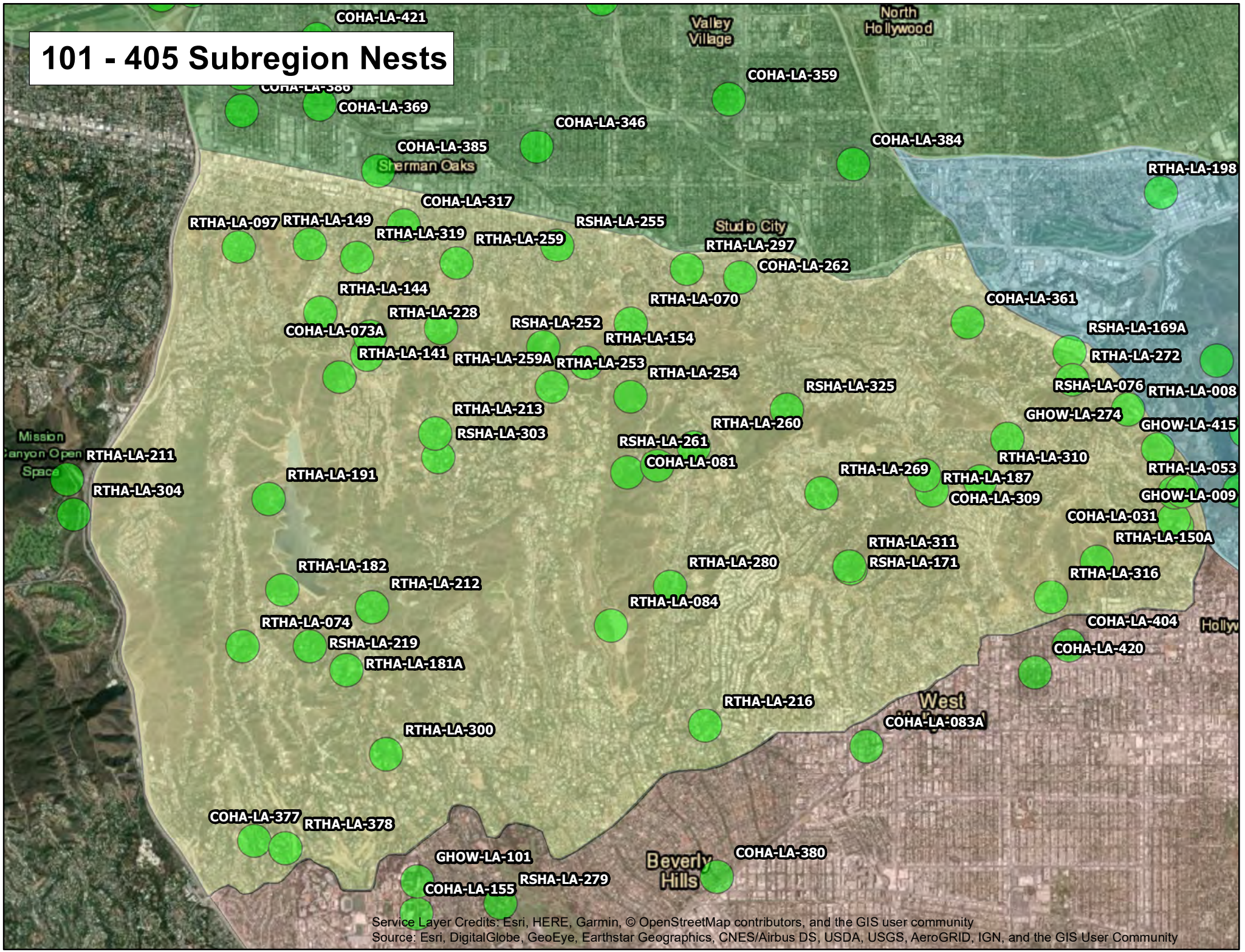
101 - 405 Subregion Nests
COHA-LA-421
Valley Village
North Hollywood
COHA-LA-359
COHA-LA-369
COHA-LA-346
COHA-LA-385
Sherman Oaks
COHA-LA-384
RTHA-LA-198
COHA-LA-317
RTHA-LA-097
RTHA-LA-149
RTHA-LA-319
RTHA-LA-259
RSHA-LA-255
Studio City
RTHA-LA-297
COHA-LA-262
RTHA-LA-144
RTHA-LA-070
COHA-LA-361
RTHA-LA-228
COHA-LA-073A
RSHA-LA-252
RTHA-LA-154
RSHA-LA-169A
RTHA-LA-141
RTHA-LA-259A
RTHA-LA-253
RTHA-LA-254
RTHA-LA-272
RSHA-LA-325
RSHA-LA-076
RTHA-LA-008
RTHA-LA-213
RTHA-LA-260
GHOW-LA-274
RSHA-LA-303
GHOW-LA-415
Mission Canyon Open Space
RTHA-LA-211
RSHA-LA-261
RTHA-LA-310
COHA-LA-081
RTHA-LA-053
RTHA-LA-191
RTHA-LA-269
RTHA-LA-187
RTHA-LA-304
COHA-LA-309
GHOW-LA-009
COHA-LA-031
RTHA-LA-311
RTHA-LA-150A
RTHA-LA-182
RTHA-LA-280
RSHA-LA-171
RTHA-LA-212
RTHA-LA-316
RTHA-LA-084
RTHA-LA-074
COHA-LA-404
RSHA-LA-219
COHA-LA-420
RTHA-LA-181A
RTHA-LA-216
West
COHA-LA-083A
RTHA-LA-300
COHA-LA-377
RTHA-LA-378
GHOW-LA-101
COHA-LA-380
Beverly Hills
RSHA-LA-279
COHA-LA-155
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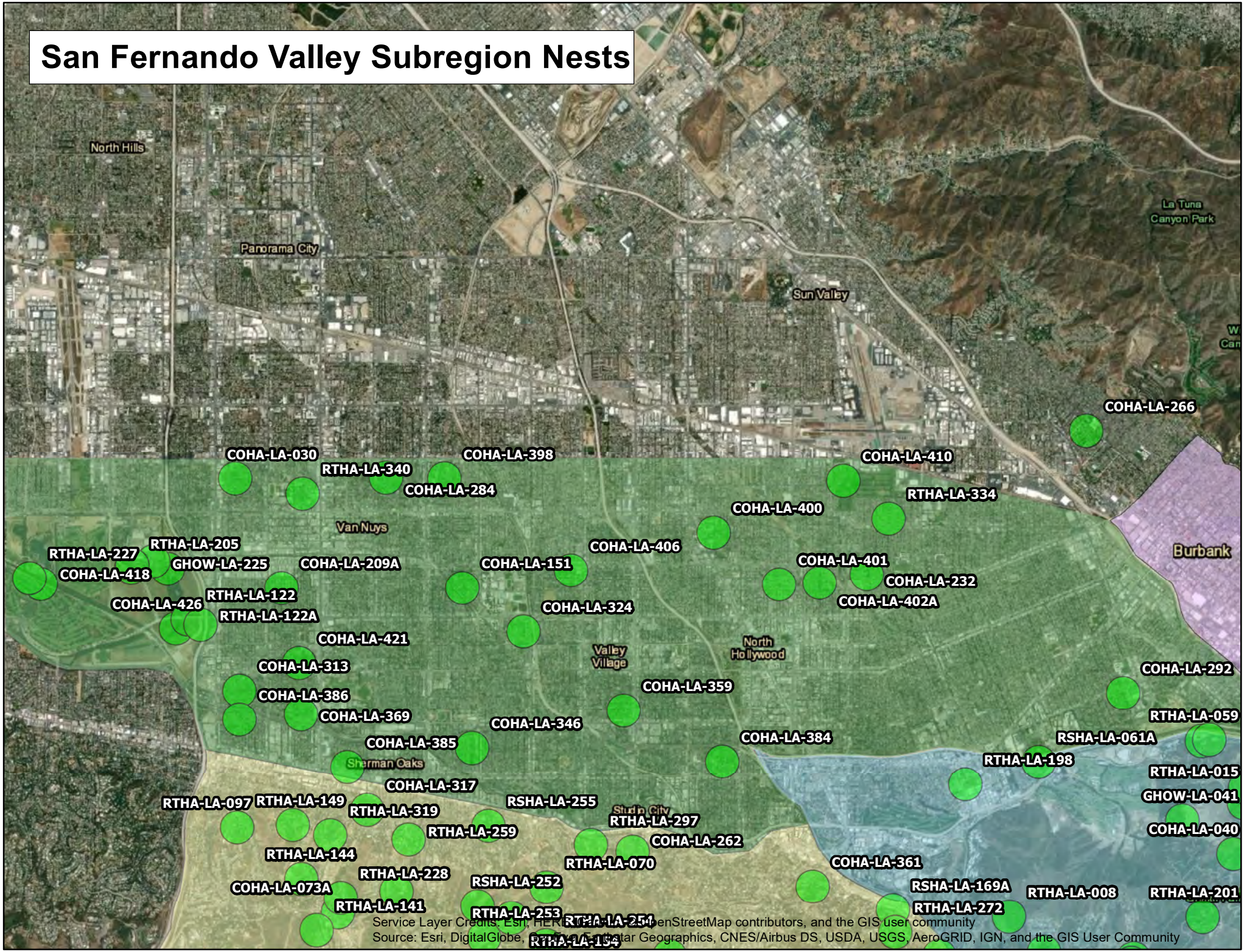
San Fernando Valley Subregion Nests
North Hills
Panorama City
Sun Valley
La Tuna Canyon Park
Van Nuys
Burbank
Valley Village
North Hollywood
Sherman Oaks
Studio City
COHA-LA-266
COHA-LA-030
RTHA-LA-340
COHA-LA-398
COHA-LA-284
COHA-LA-410
RTHA-LA-334
COHA-LA-400
RTHA-LA-205
RTHA-LA-227
GHOW-LA-225
COHA-LA-209A
COHA-LA-151
COHA-LA-406
COHA-LA-401
COHA-LA-418
COHA-LA-232
RTHA-LA-122
COHA-LA-426
COHA-LA-402A
RTHA-LA-122A
COHA-LA-324
COHA-LA-421
COHA-LA-313
COHA-LA-292
COHA-LA-386
COHA-LA-359
COHA-LA-369
RTHA-LA-059
COHA-LA-346
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RTHA-LA-198
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RTHA-LA-259
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COHA-LA-262
RTHA-LA-144
RTHA-LA-070
COHA-LA-361
RTHA-LA-228
RSHA-LA-252
COHA-LA-073A
RSHA-LA-169A
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RTHA-LA-201
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RTHA-LA-272
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RTHA-LA-154
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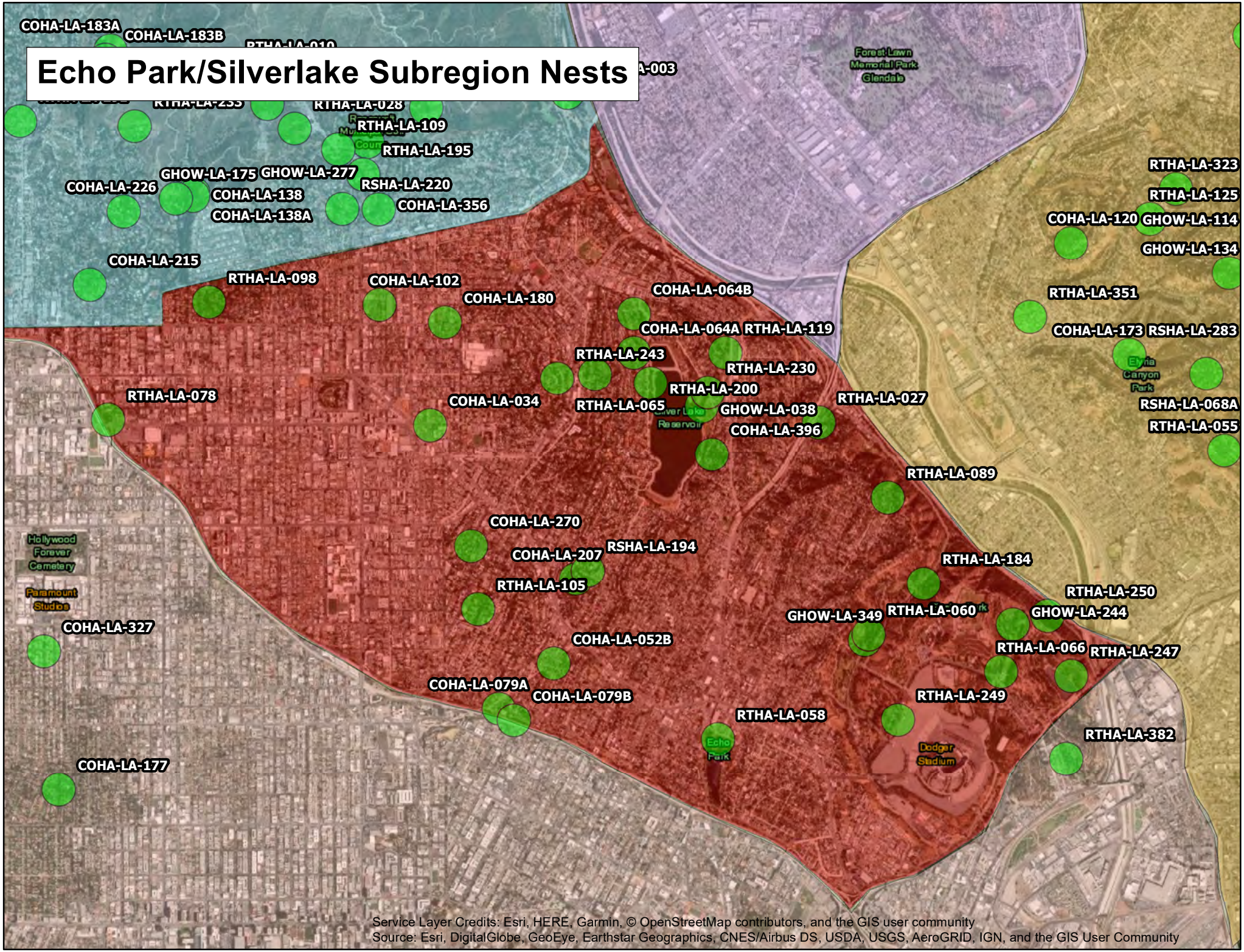
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COHA-LA-183B
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RTHA-LA-003
Forest Lawn Memorial Park Glendale
RTHA-LA-233
RTHA-LA-028
RTHA-LA-109
RTHA-LA-195
GHOW-LA-175
GHOW-LA-277
COHA-LA-226
RSHA-LA-220
COHA-LA-138
COHA-LA-356
COHA-LA-138A
RTHA-LA-323
RTHA-LA-125
COHA-LA-120
GHOW-LA-114
GHOW-LA-134
COHA-LA-215
RTHA-LA-098
COHA-LA-102
COHA-LA-180
COHA-LA-064B
RTHA-LA-351
COHA-LA-064A
RTHA-LA-119
COHA-LA-173
RSHA-LA-283
RTHA-LA-243
RTHA-LA-230
Elysian Canyon Park
RTHA-LA-078
COHA-LA-034
RTHA-LA-065
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RTHA-LA-027
GHOW-LA-038
RSHA-LA-068A
COHA-LA-396
RTHA-LA-055
RTHA-LA-089
COHA-LA-270
Hollywood Forever Cemetery
RSHA-LA-194
COHA-LA-207
RTHA-LA-184
RTHA-LA-105
RTHA-LA-250
Paramount Studios
GHOW-LA-349
RTHA-LA-060
GHOW-LA-244
COHA-LA-327
COHA-LA-052B
RTHA-LA-066
RTHA-LA-247
COHA-LA-079A
COHA-LA-079B
RTHA-LA-249
RTHA-LA-058
Echo Park
Dodger Stadium
RTHA-LA-382
COHA-LA-177
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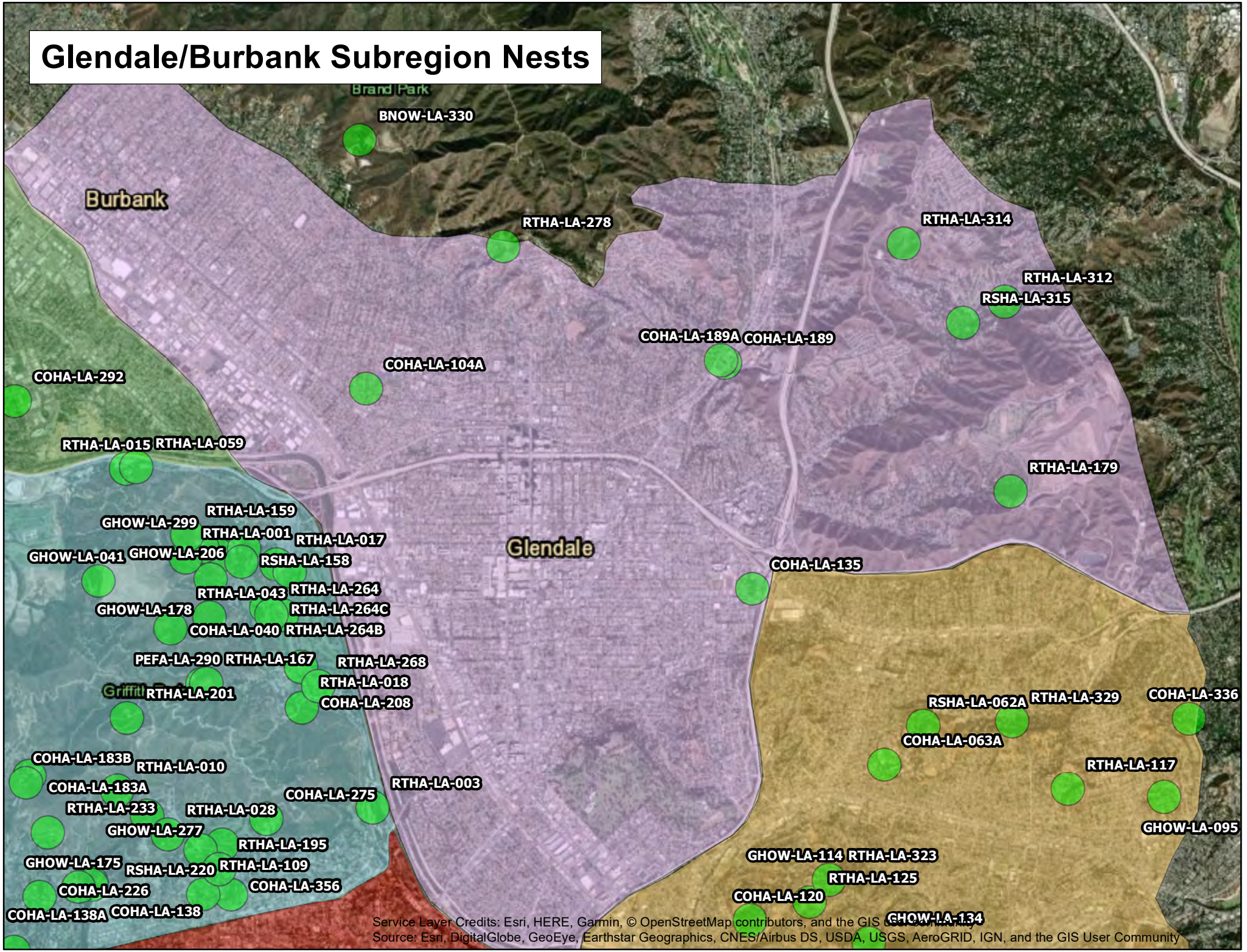
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Glendale/Burbank Subregion Nests
Brand Park
BNOW-LA-330
Burbank
RTHA-LA-278
RTHA-LA-314
RTHA-LA-312
RSHA-LA-315
COHA-LA-189A
COHA-LA-189
COHA-LA-104A
COHA-LA-292
RTHA-LA-015
RTHA-LA-059
RTHA-LA-179
RTHA-LA-159
GHOW-LA-299
RTHA-LA-001
RTHA-LA-017
Glendale
GHOW-LA-041
GHOW-LA-206
RSHA-LA-158
COHA-LA-135
RTHA-LA-043
RTHA-LA-264
GHOW-LA-178
RTHA-LA-264C
COHA-LA-040
RTHA-LA-264B
PEFA-LA-290
RTHA-LA-167
RTHA-LA-268
RTHA-LA-018
Griffith
RTHA-LA-201
COHA-LA-208
RSHA-LA-062A
RTHA-LA-329
COHA-LA-336
COHA-LA-063A
COHA-LA-183B
RTHA-LA-010
RTHA-LA-117
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RTHA-LA-003
COHA-LA-275
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RTHA-LA-028
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GHOW-LA-175
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RTHA-LA-125
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COHA-LA-120
COHA-LA-138A
COHA-LA-138
GHOW-LA-134
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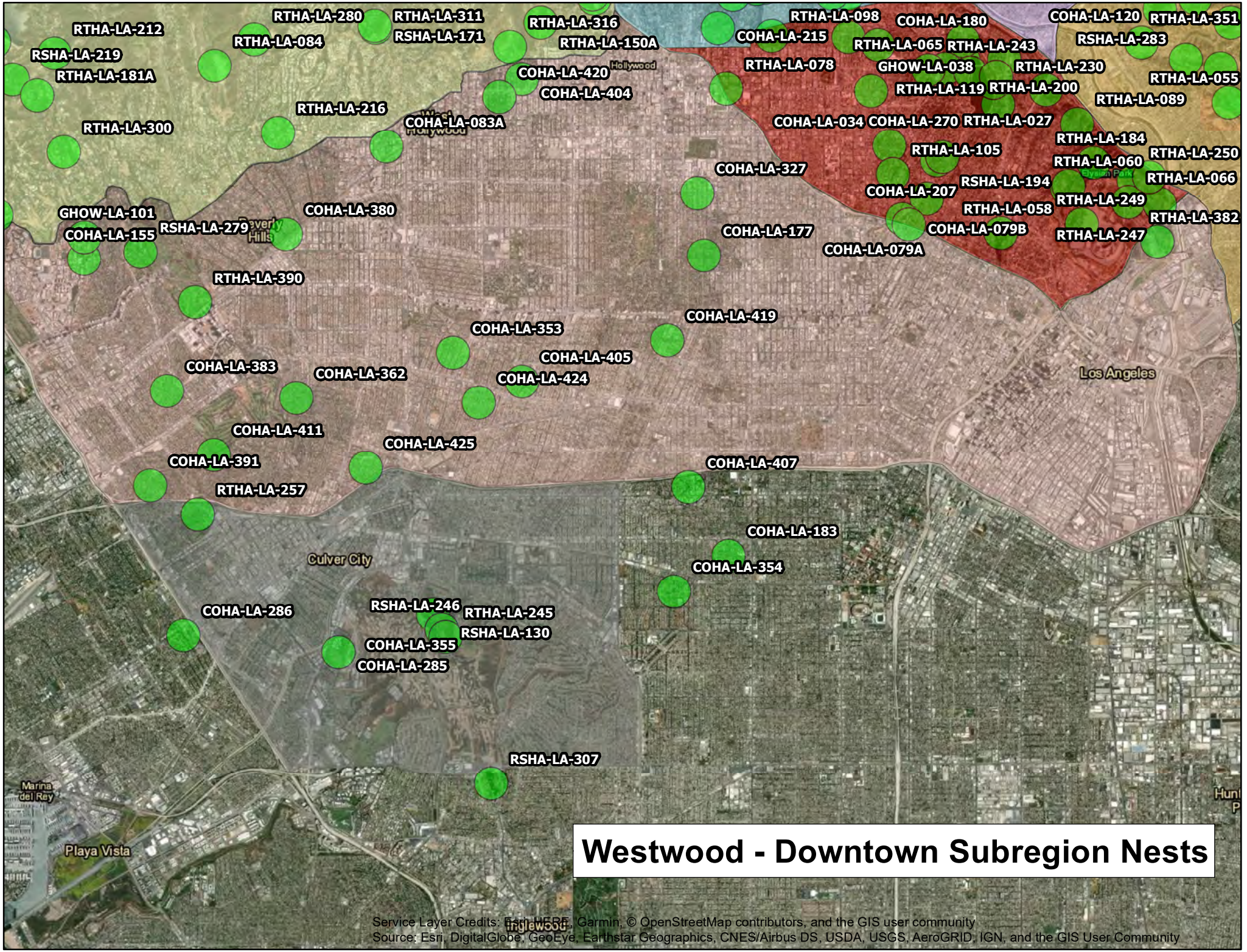
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COHA-LA-420
Hollywood
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GHOW-LA-038
RTHA-LA-230
RTHA-LA-055
COHA-LA-404
RTHA-LA-119
RTHA-LA-200
RTHA-LA-089
RTHA-LA-216
COHA-LA-083A
RTHA-LA-300
COHA-LA-034
COHA-LA-270
RTHA-LA-027
RTHA-LA-184
RTHA-LA-105
RTHA-LA-250
RTHA-LA-060
COHA-LA-327
RSHA-LA-194
RTHA-LA-066
COHA-LA-207
RTHA-LA-249
GHOW-LA-101
COHA-LA-380
RTHA-LA-058
RTHA-LA-382
COHA-LA-155
RSHA-LA-279
Beverly Hills
COHA-LA-177
COHA-LA-079B
RTHA-LA-247
COHA-LA-079A
RTHA-LA-390
COHA-LA-419
COHA-LA-353
COHA-LA-405
COHA-LA-383
COHA-LA-362
COHA-LA-424
Los Angeles
COHA-LA-411
COHA-LA-425
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COHA-LA-407
RTHA-LA-257
COHA-LA-183
Culver City
COHA-LA-354
COHA-LA-286
RSHA-LA-246
RTHA-LA-245
RSHA-LA-130
COHA-LA-355
COHA-LA-285
RSHA-LA-307
Marina del Rey
Playa Vista
Inglewood
Westwood - Downtown Subregion Nests
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APPENDIX C. Life history information on locally-nesting raptors, including new information learned in 2020.

1.1.1 Red-tailed Hawk

General notes (published): One of the most common large raptor species in North America, Red-tailed Hawks are abundant nesters in Los Angeles. They can nest in almost any habitat and on a variety of structures including buildings, cliffs and rock outcrops, native and non-native trees, and power line towers, but prefer very high sites, often somewhat protected from the elements (e.g., along a canyon bottom or toe of a slope, but with a broad/unobstructed view of the surrounding landscape. Breeding populations in Southern California are comprised primarily of resident birds that migrate only during their first few years (Bloom and Catino 2016). Mating for life, pairs typically visit two or more nests from previous years before rebuilding one for the current season. Nest building can begin as early as December in some cases, and the female begins incubation once the first egg is laid. Usually a clutch of 2-3 eggs but Red-tailed Hawks can sometimes have a clutch of 4. Incubation lasts about 30 days with young fledging at 7 weeks of age. Young hawks may disperse up to 1,000 miles from their nest site, however studies indicate most return to breed within 50 miles of where they fledge (Bloom 1985; this distance may be much smaller in urban populations). They primarily feed of small mammals, but they have also been known to forage on small birds and snakes. They seem particularly affected by rodenticide, with poisoned, “tame” individuals appearing around golf courses and parks.

General notes (this study): Red-tailed Hawk nests were predictably placed in the tallest trees in an area, often near, but not at, the head of the drainage or the crest of a ridge. In canyons where more than one pair was active, there would typically be an “upper” nest toward the head of the canyon, and a “lower” one farther down toward the valley/basin floor. Within the trees (usually pines or eucalyptus), Red-tail nests were placed roughly 3/4 –way up the tree, though occasional nests were placed in the crown of the tree (in the case of deodars and some pines), but other times would be located lower down, in the heavy boughs roughly 2/3-way up the tree – provided a clear “flight path” in and out of the tree was present. Red-tail nests were virtually never located in the dense center of any tree (vs. Cooper’s Hawks, which virtually always were). They were sometimes very visible, but often were only visible from one specific location (usually not from an obvious spot), suggesting that the adult birds strategically locate nests in such a way that people are not staring at them constantly (even though they may be located in a rather high-traffic area, such as along a major road). There were several exceptions, but these may be nests that have persisted for decades such that the nest tree, and the immediate surroundings, have changed somewhat. We only observed adult Red-tails (i.e., with red tails and dark eyes) breeding; several one-year-old birds were around during the spring, but these were always unpaired, and often in places where breeding pairs were not present (they’d be mercilessly harassed by adults when they entered active territories).

Nesting behavior (early): We rarely observed local Red-tailed Hawk pairs nest-building, though when seen carrying sticks/grass, they almost always flew directly to the nest (provided we weren't standing too close or looking directly at them, in which case they'd circle for a while and almost invariably drop the material). Stealth is key; hiding behind bushes/houses is usually important for watching Red-tails approach the nest. Local Red-tails are quite vocal before, during and following nesting, and nearly all pairs observed were actively nesting. Vocalizations include the "classic" descending "keeeeeeer" call, but also more emphatic, almost panting calls ("eeeh, eeeh, eeeh"), that sound like juvenile vocalizations were given by breeding birds throughout the season, often from the nest (or while perched very close by). During the nesting season, adults were frequently seen perched either in the nest tree (usually above the nest) or in an adjacent tree; this was so reliable that any observation of a perched Red-tailed Hawk during March – May usually resulted in the discovery of a nest. During the breeding season, adults tended to soar/circle very high overhead, but often directly over the nest. However, certain pairs would forage fairly far from the nest, occasionally in an adjacent canyon/open space, which was confusing since one could search for days near a foraging Red-tailed Hawk, but still miss the nest. Adult Red-tails were extremely good at slipping away, seeming to wait until the observer would look in the other direction before gliding to/from a nest tree. Flights to the nest tree were fairly distinctive, usually a long, gliding swoop fairly low over the territory with a brief lift at the end as the bird alighted on the nest. This flight was so characteristic, that a glimpse of a bird doing it during March – May usually indicated an active nest at the end point of the flight. During the egg stage, adults frequently do not incubate, especially on warm days, and may be seen perched around the territory – but always within "eyeshot" of the nest.

Nesting behavior (late): As chicks hatch and are fed, adults appeared to take turns foraging, and were often not present together. During April and May, as chicks get larger, their loud cries will help locate a nest (these are often louder as the adults approach, but some nests/broods were extremely quiet, and we virtually never heard them call). As with birds carrying nesting material, any Red-tail seen carrying prey in spring almost invariably flew directly to the nest structure to feed young. As young Red-tails fledged, they seemed to disperse fairly quickly out of the natal territory, appearing in the nest canyon over, with the young sometimes far apart (out of ear/eye-shot). Fledglings remained fairly vocal out of the nest (though not as vocal as most Cooper's Hawks).

1.1.2 Red-shouldered Hawk

General notes (published): In California, the Red-shouldered Hawk is strongly associated with riparian and forested habitat (Dixon 1928, Bloom et al. 1993). While they continue to nest locally in lush residential areas with large, old trees, increased development has likely affected its distribution. The Red-shouldered Hawk has been shown to have one of the smallest average home ranges of any diurnal raptor in North America, 0.25 square miles or less (Bloom et al. 1993); however, our Red-shouldered Hawk territories appear to be very large, with wide gaps in between pairs.

General notes (observed): As one of our rarer raptors, we made relatively few observations of Red-shouldered Hawks. They seemed especially partial to dense groves of large trees, especially big, old eucalyptus groves with ample shedding bark, leaf litter, and shady canopy. Nesting territories were usually associated with a creek or spring, or a former one. Red-shoulder territories were very widely spaced, several miles apart (unlike Red-tails, which we found nesting within a quarter mile of each other if a ridge separated two canyons). While Red-shoulders are typically loud hawks, several of our pairs were very quiet, rarely flying together or delivering the usually gull-like vocalizations (which may be an urban adaptation?).

Nesting behavior: We observed most Red-shoulder nests fairly low in trees, usually on substantial limbs (like right at the first division of the trunk). However, some nests (including those just outside the study area) were small structures in the uppermost branches of trees – almost unbelievably flimsy structures that didn't seem like they could support a nesting hawk. Indeed, some of the nests are large limbs had relatively little nesting material visible other than a few stray sticks or bark sticking out. Red-shoulders were typically very hard to actually see when incubating – we often could see just a tip of a bill or tail (unlike Red-tails, where much more of the bird – and the nest – is usually visible). In 2020, most nests produced just a single chick (unlike Red-tails, which produced 2-3, or Cooper's which produced 3-4).

1.1.3 Cooper's Hawk

General notes (published): Over past decades, Cooper's Hawk populations have increased in urban and suburban habitats such as Los Angeles. Because of the apparent "boom" in urban populations, researchers have found their home ranges to be smaller than that of non-urban habitat. These species could also be benefitting greatly from their urban nesting pattern because there are fewer natural nest predators. The presence of domestic dogs and the lack of natural predators, such as the raccoon (*Procyon lotor*) and bobcat (*Lynx rufus*), might have enabled Cooper's Hawks to have high nesting success (Chiang et al., 2012), but certainly the decline in shooting hawks and taking their young for falconry (prevalent into the 1980s) has resulted in local increases as well. Cooper's Hawks use a combination of prey-capture methods that include brief perch-and-scan episodes to locate prey, followed by a sudden burst of speed in addition to hunting from higher flight (Beebe 1974, Clark 1977, Fischer 1986). They primarily prey on smaller bird species but it is not uncommon for them to forage on small mammals and reptiles.

Nesting behavior (early): Cooper's Hawk nests were almost impossible to find during the early/incubation season. Adults might call occasionally, but due to the dense foliage in which they prefer to place their nest, we could rarely find nests early away from known territories. As they tend to shift nest sites each year, we caution against assuming a territory (or a nest) is inactive just because a bird isn't observed after multiple visits early in the season (i.e., before May). Incubating adults tend to sit very low in nests, with only a tail tip sticking up and visible (and they sit stone-still, unlike Red-tails, which often shift around a bit, and fly in and out of nests during the egg stage. As young hatch, adult/pair behavior becomes more conspicuous. Males seem to spend increasing time away from the nest, presumably foraging, with females

"standing sentry" in a nest tree, usually a tall deodar/pine, or utility pole, usually with a few hundred feet of the nest (and almost always staring directly at the nest). These perches develop a distinctive splatter of whitewash below them, as the adults often consume a portion of their prey before flying a short distance to the nest. The whitewash drops below these nests are roughly the size of a quarter, and are fairly widely-spaced. By contrast, droppings from corvids, which share the same types of perches, are more "goopy", and often have blackish and gray tones, presumably due to a more varied diet.

Nesting behavior (late): As the young fledge, they become extremely vocal, and tend to spend weeks within c. 100' of the nest. During this post-fledging period, their behavior can be extremely conspicuous and even "goofy", as they might jump down off a perch to "attack" a bird they have dropped. They often perch on low fences, patio furniture, and cars – and so are often photographed by the public and posted to iNaturalist, NextDoor, etc. Nests with fledglings/large nestlings tend to become festooned with white down cover the entire rim of the nest and often the sides of the nest and nearby leaves/twigs. A large "spray" of chalk-white whitewash develops below the nest, which is easily seen if the nest is over black asphalt of a roadbed or a house roof, but can be easily missed if over lawn or vegetation (or if within a natural habitat such as an oak grove).

1.1.4 Great Horned Owl

General notes (published): A large owl species, Great Horned Owls are habitat generalists allowing them to have the most flexibility in nesting sites of any American owl (Houston et al., 2013). They often nest in abandoned hawk or raven nests, as well as cliff ledges and manmade structures. Great Horned Owl nesting season begins earlier than other diurnal or nocturnal raptors, laying 2-4 eggs per clutch, often initiating nesting in fall. The Great Horned Owl diet consists primarily (90%) of small mammals, but can include rabbits, gophers, squirrels, and other bird species. Their home ranges in California can range from 135 ha (0.6 square miles) to as high as 1198 ha (4.5 square miles) depending on the sex of the bird and the surrounding habitat (Bennett and Bloom 2005).

Nesting behavior: Great Horned Owl nests sites were usually in dense foliage and difficult to find – most sites were reported to us by locals (often homeowners with owls in their backyard/front yard trees). Fledgling owls tend to stay on the natal territory for weeks after leaving the nest, sometimes flying around awkwardly, as adults bring them food. Thus, the later nesting season can be a productive time to find owl nesting locations as the young can be more conspicuous than the adults.