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Nov 18, 2013

Re: SANDAG contract UCD 12-00606 – Mountain Lion Connectivity Study
Report prepared by T. Winston Vickers, DVM, MPVM
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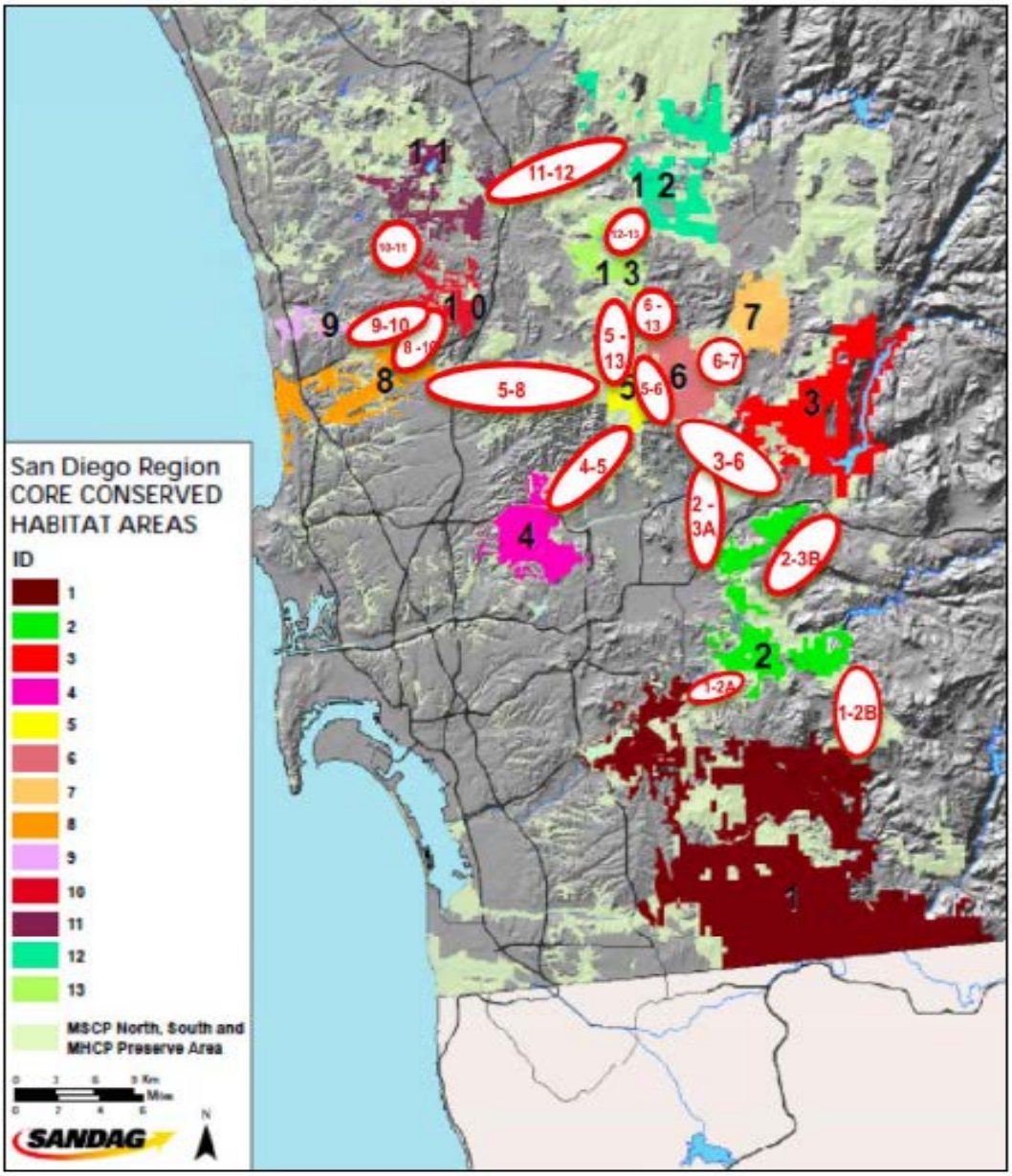
U.C. Davis Wildlife Health Center Southern California Mountain Lion Study

As prescribed in the above listed contract with the San Diego County Association of Governments (SANDAG), personnel from the UC Davis Wildlife Health Center (UCD-WHC) and Western Tracking Institute (WTI) (collectively UC Davis Team) have been conducting field activities relating to the study of connectivity of conserved lands in portions of San Diego County for mountain lions. The aforementioned contract was finalized in May, 2012 and field activities began almost immediately. Some pre-contract field scouting and trail camera placement and monitoring was conducted in the fall of 2011 and early 2012. The results from trail cameras placed originally during that time and subsequently incorporated in this field effort are also reported here.

Data reported is as of November 1, 2013 except where noted. This report is the third 6-month report required by this contract.

Study area:
The study area (SANDAG study area) is depicted in Figure 1 below. Broadly speaking, the study area extends from the Ramona area in the north to the U.S. – Mexico border in the south, east to the Cuyamaca Mountains region, and west to urban areas of the county. Due to the wide ranging nature of mountain lions the UC Davis team expects mountain lions to utilize multiple conserved cores and corridors that may include areas outside the primary study area. Thus, some field activities (camera monitoring and baiting for mountain lion capture) have also been conducted immediately north and east of Ramona where previous field camera monitoring by Megan Jennings of the US Forest Service had indicated periodic mountain lion movement. Due to their large ranges, mountain lions captured adjacent to the primary study area are expected to also inform connectivity in the study region.

Figure 1 – SANDAG study area with core conserved habitat areas and designated corridor areas.



From the scope of work / task list (in italics):

Task 1 - Determine the locations within the study area for baiting and potential trapping

To optimize the capture of mountain lions in potential linkages or adjacent core areas, UCD WHC will place trail cameras in 30+ locations along likely mountain lion travel paths. GPS locations of these camera / potential bait stations will be recorded. These stations will be utilized for attempted mountain lion captures in Task 2 if camera monitoring indicates regular mountain lion activity in the area. Monitoring of these stations will continue during Task 2 activities (mountain lion baiting and trapping) and those costs will be incorporated into the Task 2 budget.

A short summary report (1 hard copy and a PDF) on the selected locations, including a map with GPS coordinates of the camera/potential bait stations will be provided to SANDAG every 6 months beginning November 1, 2012 and will also be included in the final report of the project. No GIS analysis of the site characteristics is included in this task. The GPS location of the stations will be included in the appendix and provided in an Excel spreadsheet to SANDAG, along with the number of photos of each wildlife species that are captured by each camera station. Photos will be imprinted with date and time information, and photo archives will be made available to SANDAG-SDMMP for downloading if desired.

Activity to date:

During the period August 2011 – November 2011 (prior to initiation of this contract), the UC Davis Team conducted initial scouting of various locations in the study area where mountain lion activity had been reported historically or where GPS data from mountain lions captured outside the current study area suggested mountain lion movement might be occurring. Trail cameras were placed in some locations in order to get information about whether mountain lion movement was ongoing in those areas. Mountain lion activity was detected during that period at the south end and on the west side of El Capitan Reservoir.

During this same time frame one mountain lion was captured to the east of the current study area in Carrizo Gorge in the southeast corner of the county in a separate project evaluating mountain lion movement in the U.S.-Mexico border region. That mountain lion did not enter the SANDAG study area, and after approximately 4 months was found to have died of disease. Additionally, 1 mountain lion was captured at the far northern portion of the county on the Santa Margarita River Reserve, and 1 mountain lion that was captured originally in Orange County dispersed into northern San Diego County, also in the area of the Santa Margarita River drainage. However, neither of these mountain lions crossed I-15 or entered the SANDAG study area.

Once work under this contract was authorized in mid-May, 2012, an array of sites were identified where mountain lion activity might be expected based on historical and current evidence of tracks, sightings, road kills of mountain lions, etc. Camera placement and monitoring began almost immediately, and by early July the majority of trail cameras that have continued to be monitored by the UC Davis team were in place in locations scattered over the study area. Since that time, there has been some fluctuation in the number of cameras that were active at any point in time due to scattered loss of cameras to theft or mechanical failure, and cameras have been added in some areas west of the primary study area, and numbers of cameras supplemented south of I-8. Cameras have been checked on average once per month, and have been serviced by both paid staff and volunteers.

A database file (excel format) that details the locations where monitoring cameras are located has been provided to SANDAG. A listing of monitoring sites where mountain lions have been detected to date, as well as other species that have been detected, is provided in Appendix A. Currently, 55 trail cameras are active in the study area (Figures 1 and 2, Appendix A). Some additional monitoring sites have been decommissioned due to camera theft or other reasons. For all camera sites combined (active and inactive) over 12,500 total camera trap nights of data have been accumulated as of 10/03/13. With the exception of mountain lion photos, data relating to other wildlife that were photographed in October 2013 are not yet included in Appendix A.

To date, mountain lions have been detected on the UC Davis Team's cameras 102 times at 19 of the 55 camera sites (Figures 1 and 2, and Appendix A). Those sites where mountain lions have been detected on camera to date are in 9 general areas, with the majority of mountain lion photos having been acquired north of I-8.

1. Boulder Oaks County Park
2. Canada de San Vicente property belonging to California Dept. of Fish and Wildlife
3. Cleveland National Forest near the San Diego Country Estates area west of El Capitan Reservoir
4. Chocolate Canyon at the south end of El Capitan Reservoir
5. Black Canyon and Sutherland Reservoir area north and northeast of Ramona
6. Hollenbeck Canyon east of Jamul
7. Sweetwater River south of I-8 bridge
8. Loveland Reservoir north end
9. Barrett Lake west side

Since the previous 6-month progress report, new camera sites were activated west of I-15 in Deer Canyon and Penasquitos Canyon west of I-15, and additional cameras were placed south of I-8. At the time of the previous report no mountain lions had been detected on camera south of I-8. During the current period (May 1 – Oct 31 2013), uncollared mountain lions have been detected on monitoring cameras south of I-8 a total of 10 times on 4 of 23 cameras, and 23 times over 5 nights at 1 site as a single mountain lion was feeding on its kill nearby. These camera findings suggest that mountain lion population density is likely lower on conserved lands south of I-8 than north of I-8.

Additional cameras are in use monitoring bait carcasses (road killed deer) that are currently present in the portion of the study area south of I-8.

Megan Jennings of USFS / UCSD / UC Davis, who has had camera stations operating in the northern portion of the study area previously, has communicated to our team the locations where her cameras have detected mountain lion presence. Mountain lions have been captured on camera 18 times at 5 sites that Megan Jennings was monitoring concurrent to the beginning of our study. Those cameras were in Pamo Valley north of Ramona, in Boden Canyon, in Boulder Oaks County Park, and in the San Vicente highlands (M. Jennings personal communication).

Task 2 - Place bait, trap, and GPS-collar captured mountain lions

The project will capture mountain lions in the study area using road-killed deer placed at selected camera/bait stations where mountain lion activity has been detected. Bait stations will be monitored daily once bait is placed, and if mountain lion feeding is noted, cage traps will be set at the site and monitored constantly via radio transmitters and/or cameras. Mountain lions captured will be anesthetized and fitted with GPS collars. GPS collars will be Lotek 4400S remotely-downloadable collars or Lotek satellite-communicating collars. Each collar will be equipped with 2 timed drop-off mechanisms. This redundancy will increase the likelihood that all data collected by the collars is retrieved, and reduce the likelihood that the animals will wear collars indefinitely if not recaptured. Programming of the time-till-dropoff will vary dependent on various factors such as expected collar battery life with a given program (frequency and timing of GPS acquisitions).

Activity to date:

Mountain lion baiting and capture activity was scheduled to commence November 1, 2012 but was delayed due to administrative delays at the California Department of Fish and Wildlife (CDFW) relating to issuing the project's permit. The UC Davis Team's permit for conducting mountain lion baiting and capture activities became active on January 25, 2013 and baiting efforts were instituted on January 29 at sites where camera monitoring had indicated mountain lion activity in the previous 9 months of camera monitoring. In the 3 1/2 month period from February 1 – May 15, 2013 the UC Davis team placed road killed deer carcasses as bait at 22 sites that were at or near camera locations where mountain lion activity had been recorded previously. These sites were active and checked daily or every other day for variable periods of time for a total of more than 375 bait nights.

Baiting efforts during this winter-spring period resulted in 5 mountain lion capture attempts (4 successful) after feeding activity by mountain lions was detected at bait sites. An adult mature female was captured on Feb 4 (designated F105), and two mature adult male mountain lions were captured on Feb 21 (designated M107) and April 1 (designated (M109). All 3 individuals appeared to be healthy and were fitted with Lotek Globalstar S satellite-communicating GPS collars.

The fourth individual, a young (est 2 – 3 yr) male (designated M110) was captured on May 7, 2013. M110 was thinner than normal for the estimated age but otherwise had no obvious signs of ill health except for a healing foot wound. He was also fitted with a Globalstar S collar and released at the site. Subsequent analysis of blood samples taken at capture suggested that this male had been suffering from chronic infection of some type, but serology to detect antibodies to some of the more serious diseases known to affect mountain lions was negative.

All 4 GPS collars functioned normally after placement. With the exception of M107, GPS-collars were programmed to collect data points every hour throughout each 24 hour period. M107's collar was programmed to collect data every 2 hours. So as to preserve collar battery life, the collars were programmed to only send a subset of their total collected GPS data points to the Globalstar satellite system for regular retrieval. It is expected that remaining data in the GPS collars will be collected from the collars after they drop off the animals, or upon recapture or death. All GPS collars were equipped with timed drop-off units that are programmed to release the collars from the animal in 1 year. Two drop-off units are placed on each collar for redundancy.

On October 24th, M110's collar transmitted a mortality signal that was communicated via satellite link to the UC Davis Team. Upon ground investigation, M110 was located and visualized and was still alive and mobile. Investigation in the neighborhood where he was located south of Woods Valley Rd. found that he had been shot and wounded by a livestock owner after a depredation incident over a week previously. Ultimately, M110 was killed by a CDFW warden on October 26th due to public safety concerns secondary to his wounded status and location near homes (Appendix B). Upon examination and necropsy, it was determined that M110 also had recent fractures of both rear legs, likely caused by vehicle collision. Had he not been euthanized, he would doubtless have died from starvation due to these injuries. Necropsy results indicated no evidence of the previous episode of apparent chronic infection. The analysis for anticoagulant rodenticide residues detected 4 different compounds, but there was no evidence of active bleeding episodes prior to him being killed.

Data downloaded from M110's collar suggested that he had crossed busy highways (Hwy 67, Hwy 78, Wildcat Canyon / Barona Rd, and Valley Center Rd) a minimum of 20 times in the 5 ½ months since his initial capture (Table 1 and Appendix B).

Baiting for captures south of I-8 began October 29, 2013 at 3 sites where cameras have recorded mountain lion activity. No capture activities have occurred as of the time of this report, but baiting activities are expected to continue in this portion of the study area throughout the normal field capture season from late October 2013 to early May 2014.

Recapture of F105 may be attempted during this period in order to detect and potentially capture any kittens she has for DNA sampling and possible GPS collar placement.

Task 3 - Download data from GPS collars

Data will be downloaded during flights in fixed wing aircraft, via close approach to the animal on the ground, or via satellite on regular schedules. Data download frequency from either remote-downloadable or satellite-communicating collars will be based on balancing the need to extend battery life of the collar for as long as possible, with the timing of needs for the data. Budgeted costs are based on acquiring data from all Lotek 4400S collars every 2 months and more frequently from satellite collars.

Activity to date:

The UC Davis Team has regularly downloaded and mapped the subset of the GPS data that has been transmitted via the Globalstar satellite system. Access to this data on the Lotek website has been given to Ron Rempel and SANDAG so as to allow timely use of the data if desired.

All datapoints that are available up to November 1, 2013 from F105, M107, M109, and M110 are depicted on attached maps (Appendix B). On some maps datapoints generated by mountain lions previously GPS collared by the UC Davis Team are also depicted. Inclusion of previous data is intended to provide context to the current data and movement patterns, and to help illuminate previously established connectivity patterns for mountain lions within the current study area, as well as between the current study area and larger habitat blocks to the east. Maps are also included that depict current and previous mountain lion data overlaid on conserved lands whose use by mountain lions are the subject of the current study, as well as maps depicting road crossing areas in more detail.

Data collected to date suggests that F105 and M107 are likely the resident adult female and male in the region of the study area that is bounded by Interstate 8, Hwy 67, the city of Ramona, and the El Capitan Reservoir area including its major watersheds to the north (Appendix B). M109 appears to have a territory that stretches west past Lake Sutherland as far as Pamo Valley, but primarily incorporates lands south of Hwy 78, north and east of El Capitan Reservoir and east to the Julian area (Appendix B). Prior to his death, M110 circulated primarily from the Valley Center area south along the eastern edge of Escondido, and around San Vicente Reservoir. M110 made one foray further southeast past El Capitan Reservoir nearly to Descanso (Appendix B).

All 4 individuals use conserved lands within their areas of circulation and to regularly travel between conserved areas, however a substantial portion of their data points collected to date are on lands that are currently unconserved.

To date, all 4 individuals have crossed busy highways (Hwys 67, 78, Valley Center Rd (S6), and Widlcat Canyon / Barona Rd) multiple times (Table 1 and Appendix B). As noted previously, M110 was likely struck by a car and survived for a period with 2 fractured rear legs but would have succumbed to these injuries had he not been killed due to public safety concerns. An additional note is that immediately after one of F105's crossings of Wildcat Canyon / Barona Rd her rate of travel decreased dramatically for an extended period, and since that time she has not crossed that highway again – even though her crossings previous to that averaged 2 times per month. It may be that she was struck by a car but survived with injuries that eventually healed, though this is speculation at this time.

Table 1 – Number of highway crossings by GPS-collared mountain lions

	Hwy 67	Hwy 78	Valley Center Rd. (Sx)	Wildcat Canyon / Barona Rd.
F105	0	0	0	6
M107	0	0	0	15
M109	0	11	0	0
M110	6	6	6	2

It is notable that all crossings of Hwy 67 appear to have occurred in a relatively short stretch of highway north of S4 and west of Ramona, of Hwy 78 in an approximately 3 mile stretch between eastern Ramona and Santa Ysabel and in two specific short sections in San Pasqual Valley, of Valley Center Rd in a short section just south of Valley Center proper, and of Barona Rd. in a short section just north of the casino (Appendix B).

Also notable is the lack of crossing of Hwy 67 between the San Vicente Reservoir area and the Sycamore Cyn Reserve, the lack of crossing of I-8 south of El Capitan Reservoir, and the lack of crossing of I-15 despite close approaches to all 3 highways by multiple collared mountain lions (Appendix B). It is also interesting that M110 did not cross Cougar Pass Rd west of Turner Lake even though M56, a puma collared in the Santa Ana Mts, had crossed that road going southeast after dispersing from Orange County (Appendix B).

Mortalities from vehicle strikes are the number one cause of death in the UC Davis southern California cougar study to date, so this number of crossings of busy roads by these individuals during this period is a concern.

It is apparent that in order for mountain lions to occupy normally sized territories in this landscape, regular highway crossings are required, and this fact should be taken into account in highway / development and conservation planning. In order for highway crossings by mountain lions to safely occur consistently, adequately sized crossing structures as well as fencing that is adequate to funnel animals to safe crossings is often required. It appears that certain sections of the named highways and other roads in the study area likely pose a hazard for mountain lions, and / or are barriers to connectivity between blocks of conserved habitat in some instances.

The UC Davis Team is working with California Dept. of Fish and Wildlife regional biologist Randy Botta and SANDAG to utilize historic mountain lion road mortality data to better define sections of regional highways that pose high vehicle strike risk for mountain lions, and the results of that analysis will be forwarded to SANDAG for use in highway planning as appropriate.

Task 4 - Data Entry and Quality Control

The raw GPS data will be entered into an Excel database containing all information collected by the GPS collars. Data from the ongoing UCD WHC mountain lion study is currently curated by Brian Cohen of the San Diego office of The Nature Conservancy (TNC). The UCD WHC team will work with TNC to assure quality control of the data. For each collared animal, all attributes associated with that animal (e.g. age, sex, other samples collected, etc.) will be included in a separate Excel sheet that will also be included in reports in Task 5.

Activity to date:

GPS data from the 3 GPS collars active at this date, as well as the data from M110's collar, is being accumulated in an excel database after examination for quality control and removal of any datapoints that are not reliable. This database will be provided in its entirety after full downloads of all GPS collars, but all of M110's data has already been provided to SANDAG, along with the more limited uncorrected data from F105, M107, and M109 that is directly accessible from the Lotek website.

Figure 1 – Currently active camera locations (dark blue camera symbols) in northern half of study area.

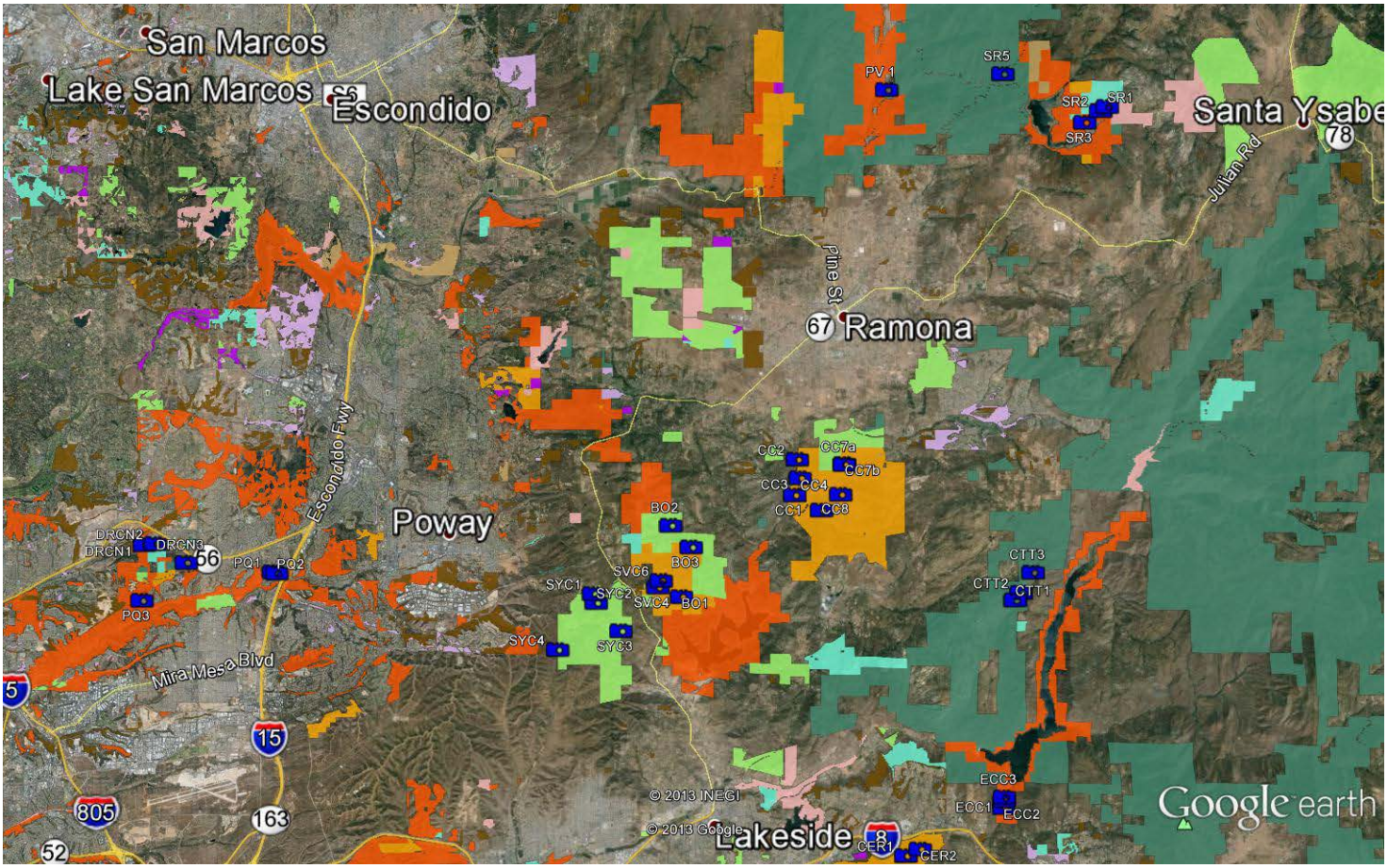
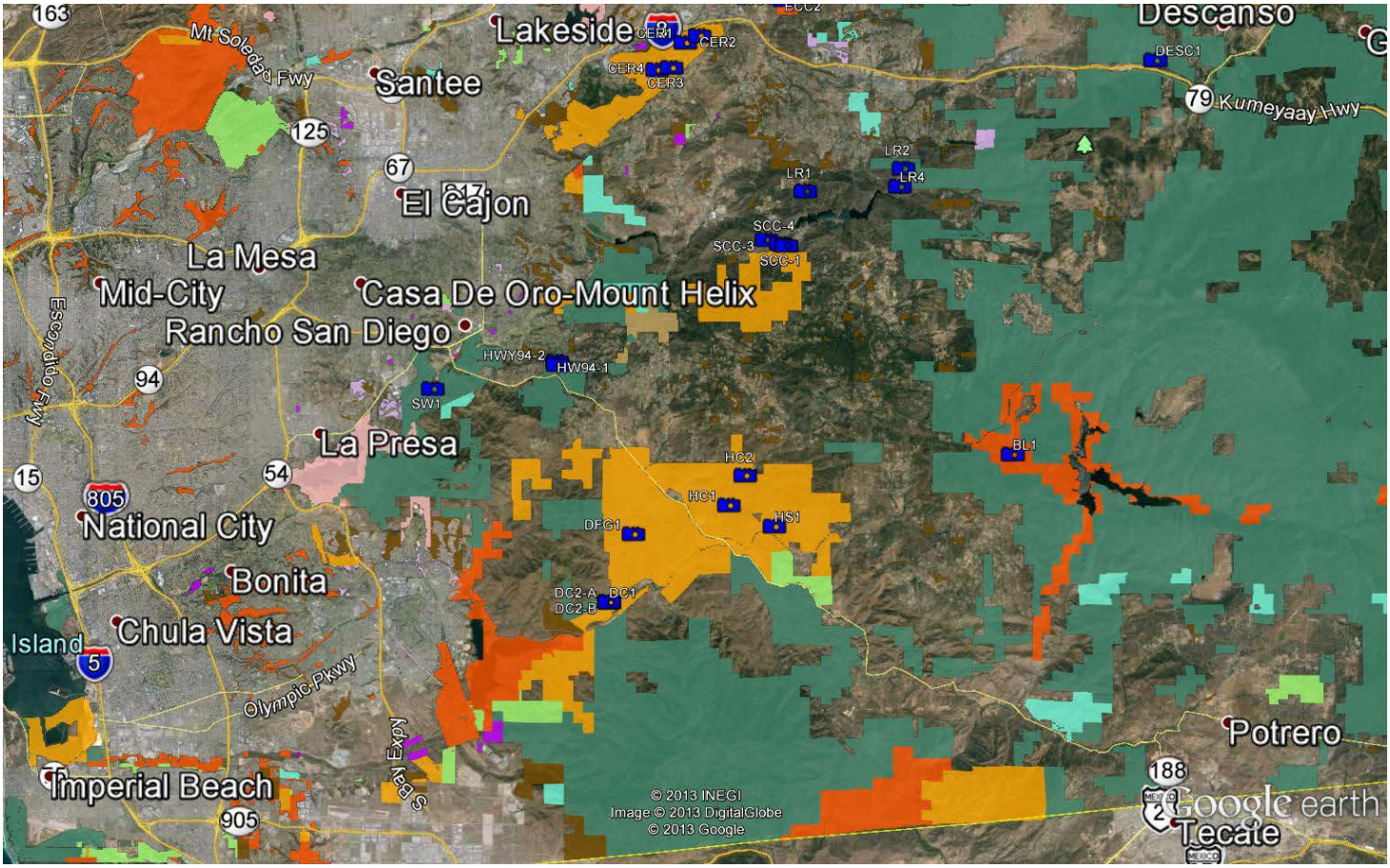


Figure 2 – Currently active camera locations (dark blue camera symbols) in southern half of the study area.



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