



LA's Urban Carnivores: Mountain Lions

Sample Lesson Plan

Supplies

- Worksheet
- Pencil
- Internet Access
- White board
- White board markers
- Projector

Standards

NGSS Appendix F

Practice 2: Using Models

Practice 3: Planning and Carrying out Investigations

Practice 4: Analyzing and Interpreting Data

Practice 6: Constructing Explanations and Designing Solutions

Practice 7: Engaging in Argument from Evidence

Practice 8: Obtaining, Evaluating, and Communicating Information

Vocabulary

Urban

Carnivore

Radiocollar

Habitat

Range

Inbreeding

Anti-coagulant poison



Concepts

- Analysis of real-world data can give us insight into the survival of mountain lions in the Los Angeles area.
- Data can help us understand how urbanization and human impact on the land affect the species that share our home.
- Data analysis is an important component of designing solutions to real-world problems.

Objectives

- Students will access real data on mountain lions using online tools.
- Students will transpose verbal and written data onto a map to outline mountain lion ranges.
- Students will analyze both mountain lion range data and maps of mountain lion fatalities to determine the biggest threats to mountain lion survival.
- Students will use data and map analysis to propose a solution to mountain lion habitat threats.

Outline

1. Students will access mountain lion habitat data on www.urbancarnivores.com.
2. Students will work in groups and use data to plot mountain lion ranges on a map.
3. Compare results with other groups, adding their ranges to a large map projected on a white board
4. Compare range overlap to sites of mountain lion fatalities
5. Identify the major threats to mountain lion survival based on the data collected and mapped.
6. Design a solution that will alleviate mountain lion habitat stresses in the Los Angeles area.

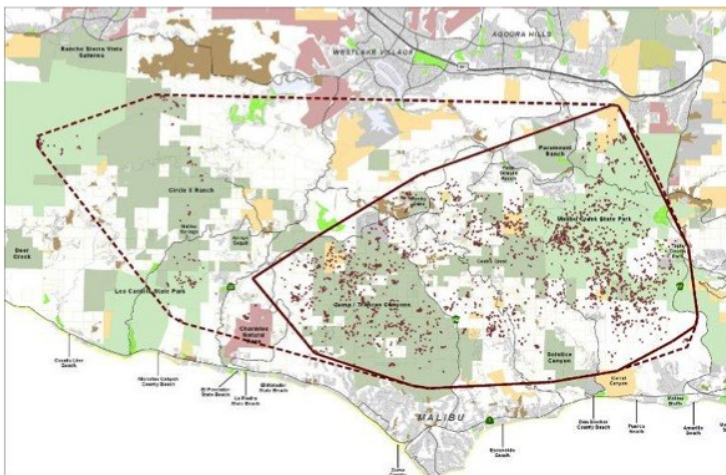
Mountain Lions P01 - P04

P01

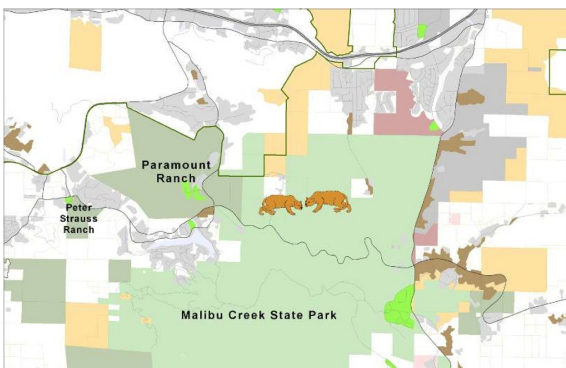
Was the first mountain lion caught in the Santa Monica Mountains! He was caught 5 times between 2002 and 2006. He was one impressive animal! He used almost the entirety of the Santa Monica Mountains south of the 101 Freeway and between Topanga State Park and Camarillo as his home range (see map below). This size of home range area is not unusual for an adult male mountain lion. He was known to mate and have kittens with at least 2 females, P02 and P06. If you read about P06, you will notice that she is the daughter of P01. In an area like the Santa Monica Mountains with the 101 Freeway creating a formidable barrier to movement for animals, it is not unusual that inbreeding would occur for such large carnivores with low population densities. The last time P01 was captured was in July, 2006 in Trancas Canyon area. His radiocollar prematurely failed shortly after that capture.

P02

Was the second mountain that was captured in the Santa Monica Mountains. Like P01, she was captured south of the 101-freeway. She mated with P01 at least once, and had at least one litter with him. The kittens born of her litter with P01 were numbered P05-P08. When P02's kittens were approximately 1-year old, P01 killed P02. This type of aggression between mountain lions is not uncommon in our region and happens to be the number one source of mortality for mountain lions in Santa Monica Mountains National Recreation Area.



The solid and dashed lines represent P02's range both before and after she began traveling with her kittens.



A deadly encounter between P01 and P02.

Mountain Lions P01 - P04

P03

Was the first of 4 mountain lions have been captured north of the 101-freeway for the ongoing National Park Service mountain lion research. This mountain lion routinely used the Simi Valley and parts of the Santa Susanas for his home range, regularly crossing the 118 and 23 freeways. Unfortunately, this lion died directly of anticoagulant rat poison toxicity, not surprising given how much urban development exists in the Simi Valley area. Biologists are unsure of how mountain lions are being exposed to anticoagulant rat poisons since they are unlikely to consume large numbers of small mammals like our other smaller carnivores (bobcats and coyotes, for example). However, it is possible that this mountain lion was poisoned from eating a coyote that was secondarily poisoned, or that deer, the mountain lion's primary food source in the Santa Monica's, are directly eating poison baits and then poisoning the mountain lions.

P04

Was another mountain lion captured north of the 101 that used the Simi Valley and Santa Susana Mountains. P04 was a female that routinely used the Santa Susanas. And like P03, this mountain lion was one of two mountain lions that died directly of anticoagulant rat poison toxicity.

Mountain Lions P05 - P08

P05-P08

These were kittens born to P02 after mating with P01. Female mountain lions will care for their young until after the young are 1-year old. Typically, between 1-2 years old, the young will separate from the mother and seek their own territory. For males, it can take more than a year for them to establish what will be their 'home range.' When these kittens were nearly 1-year old, P01 killed P02. All four kittens managed to survive P02's death and disperse into different regions of the Santa Monica Mountains, establishing their own home ranges. See below for more information on each kitten's fate after P02 was killed.

P05

Was initially sampled and outfitted with a radio-transmitter as a month-old kitten. P05 was one of two males in a litter of kittens, parented by P01 (father) and P02 (mother). After P02 was killed by P01 (see above for more information), P05 dispersed to the western end of the Santa Monica Mountains around Point Mugu State Park. P05 was later recaptured and placed with a radiocollar. He was eventually killed by P01.

P06

Was initially sampled and outfitted with a radio-transmitter as a month-old kitten. P06 was one of two females in a litter of kittens, parented by P01 (father) and P02 (mother). P06 dispersed to the western end of the Santa Monica Mountains after P02 was killed. She was later recaptured and fitted with a radiocollar. Unfortunately, the radiocollar stopped working prematurely and biologists were unable to recapture her to fit her with a new radiocollar. NPS biologists are unsure whether she still roams the Santa Monica Mountains.

P07

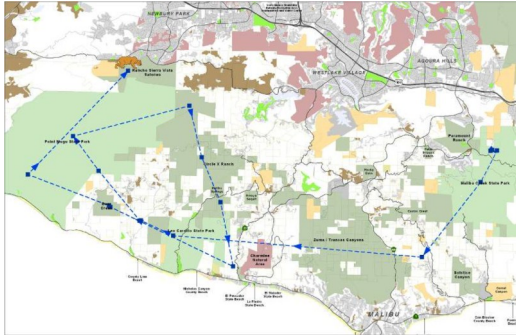
Spent time in the western end of the Santa Monica Mountains between Point Mugu State Park and Malibu Creek State Park. P07 was initially sampled and outfitted with a radio-transmitter as a month-old kitten. P07 was one of two females in a litter of kittens, parented by P01 (father) and P02 (mother). P07 used the western end of the Santa Monica Mountains, including Malibu Creek State Park. She was eventually killed by P01 near the Planet of the Apes rock wall in Malibu Creek State Park, a fight witnessed by local rock climbers! NPS biologists are unsure what instigated the aggressive encounter between P01 and P07, but they possibly fought over a kill (a deer that P07 killed to eat), or potentially because P01 was interested in mating with her.

P08

Was initially sampled and outfitted with a radio-transmitter as a month-old kitten. P08 was one of two males in a litter of kittens, parented by P01 (father) and P02 (mother). P08 preferred the eastern end of the Santa Monica Mountains and was frequently located in Topanga State Park and around Tuna Canyon. P08 took after his father- he was the largest of the litter and seemed to be the toughest individual. Biologists thought he would survive to adulthood. However, P08 was eventually killed by what was then an unknown, uncollared mountain lion. It was from P08's death, in fact, that we learned that another strong male mountain lion was in the eastern end of the Santa Monica Mountains! NPS biologists then set traps and caught P09, P08's killer.

Mountain Lions P05 - P08

P05



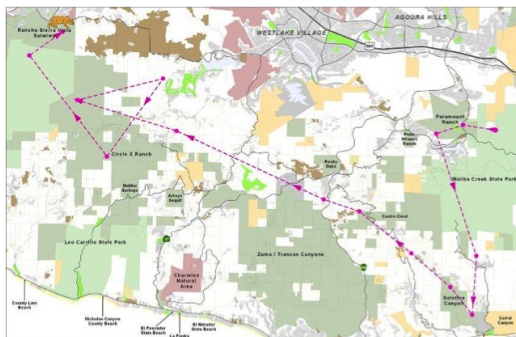
P05's dispersal before his encounter with P01.

P06



P06's dispersal before the loss of her radiocollar.

P07



P07's dispersal before her encounter with P01.

P08



P08's dispersal before his encounter with P09.

Mountain Lions P09, P10, P12, P15

P09

Was a male mountain lion that lived in the eastern end of the Santa Monica Mountains around Topanga State Park and Tuna Canyon. His presence was discovered when he killed P08. Genetic testing from wounds found on P08 confirmed that P08 was killed by an uncollared, male mountain lion. He was captured in Topanga State Park near Eagle Rock outlook. He was radiocollared and tracked for a very short time. He was hit and killed by a car on Las Virgenes during morning rush hour traffic.

P10

Was a young male when he was caught in February, 2010, in the western end of the Santa Monica Mountains near the north entrance to Point Mugu State Park. His primary homerange area consisted of the central and western end of the Santa Monica Mountains around Malibu Creek and Point Mugu State Parks. P10 was captured more than once as part of this study, once under remarkable circumstances in Pacific Palisades in the front yard of a residence. He was found lying in a bush in front of a residence early one morning by a National Park Service biologist who was tracking P10 that morning. He was likely exploring the residential area during the evening hours when he would be unseen by humans, and perhaps was stuck there when the sun rose. He hid in a bush in the front yard of a residence as he was making his way back to open space, and was too frightened to move from the bush during the daylight hours.

He died in July 2010, and two months prior to his death, fought with another male, P15. NPS biologists were able to document this encounter between the mountain lions because their radiocollars recorded GPS data that showed that P10 and P15 were in the same location at the same time. Both males survived the fight.

P12

Is a male mountain lion caught in Palo Comado Canyon (in the Simi Valley north of the 101-Freeway). Biologists originally started following P12, with GPS-telemetry in the Simi Hills on the north side of the 101-freeway in December 2008. In early 2009, P12 crossed the 101-freeway in the Liberty Canyon area and has remained in the Santa Monica Mountains since. He is the only radiocollared lion NPS biologists have followed in their 10 year study that has successfully crossed either of the major freeways (101-freeway or I-405) surrounding the Santa Monica Mountains.* When he crossed the freeway from north to south, he brought with him unique genetic variation into the Santa Monica Mountains mountain lion population- a population that has very low genetic variation due to its small size and because the 101-Freeway is a significant barrier to gene flow for the population. After crossing the 101-Freeway, he has remained in the Santa Monica Mountains. He primarily uses Malibu Creek State Park and Trancas Canyon areas. He is known to have mated with P13, fathering two litters of kittens (P17-P19; P25-P26) with her. He has also mated with his daughter, P19, to produce kittens P23 and P24. This is the second instance of first-order inbreeding that has been observed in Santa Monica Mountains mountain lions.

P15

Was a male mountain lion first captured in February, 2010. P15's home range was around the western region of the Santa Monica Mountains, such as Point Mugu State Park. P15 is known to have had a fight with P10, though neither suffered severe injuries as a result of the encounter.

**We also know that P22 (The Griffith Park mountain lion) has crossed both the 101 and 405 freeways.*

Mountain Lions P16, P20, P22, P23

P16

Was a subadult male when he was captured in May 2010. Mountain lions are considered 'subadult' when they are approximately 1.5-3 years old, and haven't yet mated with another mountain lion. P16's home range is the far southeastern region of the Santa Susana Mountains in Lake Piru area in Los Padres National Forest. He is the third mountain lion the National Park Service has captured north of the 101 Freeway. Although he is far outside of the Santa Monica Mountains, he is included in this study as a "reference" for mountain lion behavior in a more remote, less fragmented landscape. Without data on his (and other mountain lions in that area) movement patterns and home range size, biologists would be unable to draw robust conclusions about how urbanization and habitat fragmentation are affecting mountain lions in the Santa Monica Mountains, heavily impacted by urban development.

P20

Was a young male mountain lion captured in Malibu Creek State Park in October, 2010. He was an unexpected capture, and in fact, biologists were hoping instead to recapture P12! P20 was tracked for only a very short period of time before he was killed by an uncollared male in the eastern end of the Santa Monica Mountains (near Topanga). The uncollared male mountain lion that killed P20 also killed P14.

P22

Is possibly Los Angeles' most famous mountain lion. He was humanely caught in Griffith Park on March 28, 2012 and radiocollared by the National Park Service. The first evidence of this mountain lion was recorded on remote cameras as part of the Griffith Park Connectivity study being performed by USGS and Cooper Ecological biologists. Once photographic evidence was found of this male mountain lion, the National Park Service set traps near Lake Hollywood and captured him. He weighed approximately 120 pounds and is estimated to be 3 years old. Genetic testing performed in the Robert Wayne Lab at UCLA shows that he is originally from the Santa Monica Mountains! Griffith Park, a patch of habitat near downtown Los Angeles, is too small to support a resident mountain lion population. P22 would have had to cross two freeways (the 405 and 101) to get to Griffith Park. He is radiocollared and the National Park Service is tracking his movements to see where he heads next! As of January 2014, he is still in Griffith Park.

P23

A young female mountain lion (born June 2012), has earned some fame for being spotted with a deer that she'd killed...on Mulholland Hwy! She was spotted by some weekend cyclists having tackled the deer and attempting to drag it into some dense brush where she could safely feed on it. She was just over 1-year old when she killed this adult male deer, showing that she was on her way to becoming a successful and masterful hunter. The cyclists, lucky enough to have a rare glimpse into mountain lion biology, were patient and respectful- they stayed a safe distance from P23 and did not disturb her while she dragged the deer off into the brush just off the road where she would feed on it. And P23 did not disturb the cyclists. She concentrated on quickly dragging the deer into thick brush where she could feed on the deer in safety and cover. She is fitted with a radiocollar and is being tracked by National Park Service biologists. She uses the western end of the Santa Monica Mountains around Pt. Mugu State Park.

Mountain Lions P24, P26, P27, P14

P24

Is being followed by National Park Service biologists with a radio-transmitter that was implanted when he was approximately 1-month old by a veterinarian. The transmitter will soon run out of batteries, and so biologists are working exceedingly hard to try to capture P24 before the transmitter dies. He dispersed from his mom (P19) and primarily uses the eastern end of the Santa Monica Mountains (Topanga State Park area).

P26

Dispersed from his mom (P13) around January 8, 2013. Biologists were tracking him using the expandable radiocollar that was placed on him in August 2012. A few months after his dispersal, he would've been large enough to be fitted with a non-expandable (and therefore sturdier) radiocollar, and so biologists hoped to capture him to fit him with a new radiocollar. However, on March 13, 2013, he fought with female mountain lion P19, and his expandable radiocollar fell off of P26 during the fight. At the time of the fight, P19 had a litter of kittens, and so P19 was likely defending the area where she was denning with her kittens (and therefore protecting her kittens from potential threats). Without radiocollars, biologists are unable to track the local mountain lions, and so P26's whereabouts are unknown. At the time of his dispersal, he was primarily using the western end of the Santa Monica Mountains (Malibu Creek to Point Mugu), and so he may still be in that area of the mountains.

P27

Is male mountain lion caught in April 2013 in Topanga State Park. At the time of his capture, he was estimated to be around 6-years old. He is thought to be the offspring of P01 and P06 (another example of first-order inbreeding). As of January 2014, biologists continue to track his movements and his behaviors are exemplary of the average male mountain lion. His homerange encompasses the areas between Malibu Creek State Park east to the I-405 (Topanga State Park area). He shares the mountains with another male approximately the same age- P12. It appears that they attempt to avoid each other, and so P12's homerange is primarily in the western end of the Santa Monica Mountains while P27 uses areas east of P12's homerange. And he's been feeding on deer, the primary prey of mountain lions in the Santa Monica Mountains, and other parts of Southern California.

P14

Was a young male captured initially in 2009. His home range was primarily the eastern end of the Santa Monica Mountains around Topanga State Park and Tuna Canyon. He was captured twice, first in August, 2009 and a second time in February, 2011. He was killed in April, 2011 by an unknown mountain lion that lives in the eastern end of the Santa Monica Mountains. National Park Service biologists recovered liver tissue from his body and had it tested for anticoagulant rat poisons. Results of these tests indicate exposure to multiple anticoagulant rat poison compounds including brodifacoum, bromadiolone, difethialone, and diphacinone. Given that he was exposed to four different compounds suggests that P14 was exposed to these poisons multiple times.

 **LA's Urban Carnivores****Analyze...**

Based on our research, what is the biggest threat to mountain lion survival in the Los Angeles area and why?

Engineer...

Work as a group to design one possible solution that might alleviate this threat. How would it work?