data tables

2025-07-18

helper summary of Table 2

| mean.mean.monthly.crossings | range.mean.monthly.crossings | tot.tot.crossing.steps | mean.tot.crossing.steps | range.tot.crossing.steps |
| --- | --- | --- | --- | --- |
| 11.8 | 3.5–30.2 | 4,377 | 364.75 | 38–1312 |

Table 2

| Mt lion | Sex | Start | End | # months tracked | # road crossing steps | mean road crossings/month |
| --- | --- | --- | --- | --- | --- | --- |
| P1 | F | Oct, 2016 | Dec, 2022 | 60 | 1,312 | 21.9 |
| P2 | F | Dec, 2016 | Oct, 2017 | 11 | 77 | 7.0 |
| P4 | F | Feb, 2017 | Dec, 2023 | 75 | 727 | 9.7 |
| P5 | M | Apr, 2017 | Feb, 2018 | 11 | 38 | 3.5 |
| P9 | F | Feb, 2018 | Jan, 2019 | 12 | 148 | 12.3 |
| P6 | F | Apr, 2018 | Jul, 2018 | 4 | 121 | 30.2 |
| P13 | M | Dec, 2018 | Dec, 2023 | 61 | 1,210 | 19.8 |
| P16 | F | Mar, 2019 | Oct, 2021 | 32 | 274 | 8.6 |
| P31 | M | Aug, 2021 | Jan, 2023 | 18 | 90 | 5.0 |
| P33 | F | Nov, 2021 | Dec, 2023 | 26 | 194 | 7.5 |
| P39 | F | Aug, 2022 | Dec, 2023 | 17 | 88 | 5.2 |
| P41 | F | Oct, 2022 | Jul, 2023 | 9 | 98 | 10.9 |

Spatial AIC table

| Fixed effect structure | # fixed effect parameters | marginal AIC | Δ marginal AIC | marginal AIC weight | logLik |
| --- | --- | --- | --- | --- | --- |
| Cohesion + RoadXwoody + % Woody + % Dev + # riparian + Class | 8 | 54,646.96 | 0.000 | 1 | -27,312.48 |
| Cohesion + RoadXwoody + % Woody + % Dev + Class | 7 | 54,778.25 | 131.293 | 0 | -27,379.13 |
| Cohesion + RoadXwoody + % Dev + # riparian + Class | 7 | 54,843.44 | 196.483 | 0 | -27,411.72 |
| Cohesion + RoadXwoody + % Dev + Class | 6 | 54,850.92 | 203.961 | 0 | -27,416.46 |
| Cohesion + RoadXwoody + % Dev + # riparian | 5 | 54,874.80 | 227.843 | 0 | -27,429.40 |
| Cohesion + RoadXwoody + % Woody + % Dev | 5 | 54,906.34 | 259.378 | 0 | -27,445.17 |
| Cohesion + % Woody + % Dev + # riparian + Class | 7 | 54,918.82 | 271.863 | 0 | -27,449.41 |
| Cohesion + RoadXwoody + % Dev | 4 | 54,967.17 | 320.208 | 0 | -27,476.58 |
| Cohesion + % Dev + # riparian + Class | 6 | 54,976.71 | 329.756 | 0 | -27,479.36 |
| Cohesion + % Dev + # riparian | 4 | 55,002.83 | 355.869 | 0 | -27,494.41 |
| Cohesion + % Dev + Class | 5 | 55,026.54 | 379.580 | 0 | -27,505.27 |
| Cohesion + % Woody + % Dev + Class | 6 | 55,064.39 | 417.434 | 0 | -27,523.20 |
| Cohesion + % Dev | 3 | 55,065.72 | 418.760 | 0 | -27,526.86 |
| Cohesion + % Woody + % Dev + # riparian | 5 | 55,106.48 | 459.526 | 0 | -27,545.24 |
| Cohesion + % Woody + % Dev | 4 | 55,143.94 | 496.980 | 0 | -27,564.97 |
| Cohesion + RoadXwoody + % Woody + % Dev + # riparian | 6 | 55,196.57 | 549.612 | 0 | -27,589.28 |
| RoadXwoody + % Dev + # riparian + Class | 6 | 55,196.91 | 549.951 | 0 | -27,589.45 |
| RoadXwoody + % Woody + % Dev + Class | 6 | 55,204.10 | 557.139 | 0 | -27,593.05 |
| RoadXwoody + % Dev | 3 | 55,235.34 | 588.385 | 0 | -27,611.67 |
| RoadXwoody + % Dev + Class | 5 | 55,250.35 | 603.391 | 0 | -27,617.17 |
| RoadXwoody + % Woody + % Dev + # riparian | 5 | 55,273.76 | 626.798 | 0 | -27,628.88 |
| RoadXwoody + % Woody + % Dev | 4 | 55,303.56 | 656.607 | 0 | -27,644.78 |
| RoadXwoody + % Dev + # riparian | 4 | 55,380.49 | 733.536 | 0 | -27,683.25 |
| RoadXwoody + % Woody + % Dev + # riparian + Class | 7 | 55,600.80 | 953.847 | 0 | -27,790.40 |
| % Dev + # riparian | 3 | 55,675.31 | 1,028.350 | 0 | -27,831.65 |
| % Woody + % Dev | 3 | 55,729.67 | 1,082.716 | 0 | -27,858.84 |
| % Dev | 2 | 55,779.10 | 1,132.146 | 0 | -27,884.55 |
| % Dev + # riparian + Class | 5 | 55,794.30 | 1,147.346 | 0 | -27,889.15 |
| % Woody + % Dev + Class | 5 | 55,797.96 | 1,151.000 | 0 | -27,890.98 |
| % Woody + % Dev + # riparian | 4 | 55,817.15 | 1,170.197 | 0 | -27,901.58 |
| % Dev + Class | 4 | 55,832.59 | 1,185.634 | 0 | -27,909.30 |
| Cohesion + RoadXwoody + % Woody + # riparian + Class | 7 | 55,885.41 | 1,238.448 | 0 | -27,932.70 |
| Cohesion + RoadXwoody + # riparian + Class | 6 | 55,914.05 | 1,267.096 | 0 | -27,948.03 |
| Cohesion + RoadXwoody + # riparian | 4 | 55,932.65 | 1,285.693 | 0 | -27,959.33 |
| Cohesion + RoadXwoody + Class | 5 | 55,934.54 | 1,287.583 | 0 | -27,959.27 |
| % Woody + % Dev + # riparian + Class | 6 | 56,008.43 | 1,361.474 | 0 | -27,995.22 |
| Cohesion + RoadXwoody | 3 | 56,073.01 | 1,426.054 | 0 | -28,030.51 |
| Cohesion + RoadXwoody + % Woody + # riparian | 5 | 56,094.58 | 1,447.625 | 0 | -28,039.29 |
| Cohesion + RoadXwoody + % Woody | 4 | 56,102.37 | 1,455.410 | 0 | -28,044.18 |
| Cohesion + % Woody + # riparian + Class | 6 | 56,119.92 | 1,472.964 | 0 | -28,050.96 |
| Cohesion + # riparian | 3 | 56,132.26 | 1,485.300 | 0 | -28,060.13 |
| Cohesion + % Woody + Class | 5 | 56,161.92 | 1,514.961 | 0 | -28,072.96 |
| Cohesion + Class | 4 | 56,182.89 | 1,535.935 | 0 | -28,084.45 |
| Cohesion + % Woody + # riparian | 4 | 56,252.38 | 1,605.419 | 0 | -28,119.19 |
| Cohesion + RoadXwoody + % Woody + Class | 6 | 56,282.40 | 1,635.447 | 0 | -28,132.20 |
| Cohesion | 2 | 56,318.82 | 1,671.863 | 0 | -28,154.41 |
| Cohesion + % Woody | 3 | 56,335.14 | 1,688.180 | 0 | -28,161.57 |
| RoadXwoody + % Woody + # riparian + Class | 6 | 56,354.83 | 1,707.876 | 0 | -28,168.42 |
| Cohesion + # riparian + Class | 5 | 56,500.06 | 1,853.098 | 0 | -28,242.03 |
| RoadXwoody + # riparian | 3 | 56,635.11 | 1,988.152 | 0 | -28,311.55 |
| RoadXwoody + # riparian + Class | 5 | 56,708.67 | 2,061.713 | 0 | -28,346.34 |
| RoadXwoody + Class | 4 | 56,753.02 | 2,106.066 | 0 | -28,369.51 |
| RoadXwoody + % Woody + Class | 5 | 56,794.26 | 2,147.305 | 0 | -28,389.13 |
| RoadXwoody | 2 | 56,880.68 | 2,233.719 | 0 | -28,435.34 |
| % Woody + # riparian + Class | 5 | 57,013.40 | 2,366.440 | 0 | -28,498.70 |
| RoadXwoody + % Woody | 3 | 57,068.50 | 2,421.544 | 0 | -28,528.25 |
| RoadXwoody + % Woody + # riparian | 4 | 57,170.43 | 2,523.470 | 0 | -28,578.21 |
| % Woody | 2 | 57,344.42 | 2,697.458 | 0 | -28,667.21 |
| % Woody + Class | 4 | 57,380.38 | 2,733.426 | 0 | -28,683.19 |
| Class | 3 | 57,673.86 | 3,026.900 | 0 | -28,830.93 |
| % Woody + # riparian | 3 | 57,721.32 | 3,074.363 | 0 | -28,854.66 |
| # riparian + Class | 4 | 57,790.35 | 3,143.392 | 0 | -28,888.17 |
| # riparian | 2 | 57,802.28 | 3,155.322 | 0 | -28,896.14 |
| 1 | 1 | 58,126.53 | 3,479.576 | 0 | -29,059.27 |

Non-spatial AIC table  
This is the full candidate model set, fitted with glm() with no spatial autocorrelation structure.

| Modnames | K | AICc | Δ marginal AIC | AICcWt | LL | Cum.Wt |
| --- | --- | --- | --- | --- | --- | --- |
| Cohesion + RoadXwoody + % Woody + % Dev + # riparian + Class | 8 | 77,772.82 | 0.000 | 1 | -38,878.40 | 1 |
| Cohesion + RoadXwoody + % Woody + % Dev + # riparian | 6 | 78,357.51 | 584.686 | 0 | -39,172.75 | 1 |
| RoadXwoody + % Woody + % Dev + # riparian + Class | 7 | 78,627.56 | 854.741 | 0 | -39,306.77 | 1 |
| Cohesion + % Woody + % Dev + # riparian + Class | 7 | 78,749.91 | 977.086 | 0 | -39,367.94 | 1 |
| RoadXwoody + % Woody + % Dev + # riparian | 5 | 79,061.03 | 1,288.211 | 0 | -39,525.51 | 1 |
| Cohesion + RoadXwoody + % Woody + % Dev + Class | 7 | 79,439.44 | 1,666.616 | 0 | -39,712.71 | 1 |
| Cohesion + % Woody + % Dev + # riparian | 5 | 79,457.77 | 1,684.947 | 0 | -39,723.88 | 1 |
| Cohesion + RoadXwoody + % Woody + % Dev | 5 | 79,927.87 | 2,155.050 | 0 | -39,958.93 | 1 |
| RoadXwoody + % Woody + % Dev + Class | 6 | 80,191.06 | 2,418.238 | 0 | -40,089.52 | 1 |
| Cohesion + RoadXwoody + % Dev + # riparian + Class | 7 | 80,425.25 | 2,652.428 | 0 | -40,205.61 | 1 |
| RoadXwoody + % Woody + % Dev | 4 | 80,530.33 | 2,757.505 | 0 | -40,261.16 | 1 |
| RoadXwoody + % Dev + # riparian + Class | 6 | 80,534.67 | 2,761.849 | 0 | -40,261.33 | 1 |
| Cohesion + % Woody + % Dev + Class | 6 | 80,723.87 | 2,951.048 | 0 | -40,355.93 | 1 |
| Cohesion + % Dev + # riparian + Class | 6 | 80,886.98 | 3,114.163 | 0 | -40,437.48 | 1 |
| % Woody + % Dev + # riparian + Class | 6 | 80,909.20 | 3,136.382 | 0 | -40,448.59 | 1 |
| Cohesion + RoadXwoody + % Dev + # riparian | 5 | 81,130.77 | 3,357.951 | 0 | -40,560.38 | 1 |
| RoadXwoody + % Dev + # riparian | 4 | 81,174.49 | 3,401.665 | 0 | -40,583.24 | 1 |
| Cohesion + % Woody + % Dev | 4 | 81,349.32 | 3,576.500 | 0 | -40,670.66 | 1 |
| % Woody + % Dev + # riparian | 4 | 81,395.68 | 3,622.860 | 0 | -40,693.84 | 1 |
| % Dev + # riparian + Class | 5 | 81,590.57 | 3,817.748 | 0 | -40,790.28 | 1 |
| Cohesion + % Dev + # riparian | 4 | 81,672.60 | 3,899.774 | 0 | -40,832.29 | 1 |
| % Dev + # riparian | 3 | 82,202.65 | 4,429.829 | 0 | -41,098.32 | 1 |
| Cohesion + RoadXwoody + % Woody + # riparian + Class | 7 | 82,241.49 | 4,468.666 | 0 | -41,113.73 | 1 |
| Cohesion + RoadXwoody + % Dev + Class | 6 | 82,482.05 | 4,709.231 | 0 | -41,235.02 | 1 |
| RoadXwoody + % Dev + Class | 5 | 82,524.81 | 4,751.985 | 0 | -41,257.40 | 1 |
| Cohesion + RoadXwoody + % Woody + # riparian | 5 | 82,821.41 | 5,048.586 | 0 | -41,405.70 | 1 |
| % Woody + % Dev + Class | 5 | 82,883.43 | 5,110.604 | 0 | -41,436.71 | 1 |
| Cohesion + RoadXwoody + % Dev | 4 | 83,083.34 | 5,310.517 | 0 | -41,537.67 | 1 |
| RoadXwoody + % Dev | 3 | 83,088.57 | 5,315.750 | 0 | -41,541.28 | 1 |
| Cohesion + % Dev + Class | 5 | 83,152.88 | 5,380.062 | 0 | -41,571.44 | 1 |
| % Woody + % Dev | 3 | 83,267.29 | 5,494.470 | 0 | -41,630.64 | 1 |
| Cohesion + % Woody + # riparian + Class | 6 | 83,562.19 | 5,789.373 | 0 | -41,775.09 | 1 |
| % Dev + Class | 4 | 83,757.33 | 5,984.513 | 0 | -41,874.66 | 1 |
| Cohesion + % Dev | 3 | 83,848.49 | 6,075.670 | 0 | -41,921.24 | 1 |
| Cohesion + RoadXwoody + # riparian + Class | 6 | 83,928.43 | 6,155.613 | 0 | -41,958.21 | 1 |
| % Dev | 2 | 84,282.28 | 6,509.459 | 0 | -42,139.14 | 1 |
| Cohesion + % Woody + # riparian | 4 | 84,292.81 | 6,519.986 | 0 | -42,142.40 | 1 |
| RoadXwoody + % Woody + # riparian + Class | 6 | 84,326.40 | 6,553.575 | 0 | -42,157.19 | 1 |
| Cohesion + RoadXwoody + # riparian | 4 | 84,597.35 | 6,824.531 | 0 | -42,294.67 | 1 |
| RoadXwoody + % Woody + # riparian | 4 | 84,678.92 | 6,906.103 | 0 | -42,335.46 | 1 |
| Cohesion + # riparian + Class | 5 | 84,710.66 | 6,937.841 | 0 | -42,350.33 | 1 |
| RoadXwoody + # riparian + Class | 5 | 84,877.20 | 7,104.379 | 0 | -42,433.59 | 1 |
| RoadXwoody + # riparian | 3 | 85,335.70 | 7,562.879 | 0 | -42,664.85 | 1 |
| Cohesion + # riparian | 3 | 85,487.29 | 7,714.468 | 0 | -42,740.64 | 1 |
| Cohesion + RoadXwoody + % Woody + Class | 6 | 85,867.93 | 8,095.106 | 0 | -42,927.96 | 1 |
| Cohesion + RoadXwoody + % Woody | 4 | 86,412.24 | 8,639.418 | 0 | -43,202.12 | 1 |
| Cohesion + RoadXwoody + Class | 5 | 87,800.25 | 10,027.426 | 0 | -43,895.12 | 1 |
| Cohesion + % Woody + Class | 5 | 87,837.30 | 10,064.478 | 0 | -43,913.64 | 1 |
| RoadXwoody + % Woody + Class | 5 | 88,094.85 | 10,322.025 | 0 | -44,042.42 | 1 |
| % Woody + # riparian + Class | 5 | 88,182.40 | 10,409.574 | 0 | -44,086.19 | 1 |
| # riparian + Class | 4 | 88,244.75 | 10,471.929 | 0 | -44,118.37 | 1 |
| RoadXwoody + % Woody | 3 | 88,404.97 | 10,632.150 | 0 | -44,199.48 | 1 |
| Cohesion + RoadXwoody | 3 | 88,436.44 | 10,663.620 | 0 | -44,215.22 | 1 |
| Cohesion + % Woody | 3 | 88,588.12 | 10,815.296 | 0 | -44,291.06 | 1 |
| % Woody + # riparian | 3 | 88,611.22 | 10,838.394 | 0 | -44,302.61 | 1 |
| # riparian | 2 | 88,644.58 | 10,871.757 | 0 | -44,320.29 | 1 |
| RoadXwoody + Class | 4 | 88,760.29 | 10,987.470 | 0 | -44,376.14 | 1 |
| Cohesion + Class | 4 | 89,082.67 | 11,309.844 | 0 | -44,537.33 | 1 |
| RoadXwoody | 2 | 89,184.53 | 11,411.712 | 0 | -44,590.27 | 1 |
| Cohesion | 2 | 89,875.11 | 12,102.291 | 0 | -44,935.56 | 1 |
| % Woody + Class | 4 | 93,280.04 | 15,507.216 | 0 | -46,636.02 | 1 |
| Class | 3 | 93,399.60 | 15,626.775 | 0 | -46,696.80 | 1 |
| % Woody | 2 | 93,710.12 | 15,937.295 | 0 | -46,853.06 | 1 |
| intercept | 1 | 93,790.67 | 16,017.848 | 0 | -46,894.33 | 1 |

spatial AIC table, 1km spatial aggregation  
This is the full candidate model set, fitted with spAMM::fitme() with spatial autocorrelation structure, and with coordinates aggregated to a 1km grid.

| model\_name | k\_fixed | marginal AIC | deltaAIC | AIC\_weight | logLik |
| --- | --- | --- | --- | --- | --- |
| Cohesion + Road intersects woody cover + % Development cover + # riparian crossings + Road Class | 7 | 50,821.61 | 0.000 | 1 | -25,400.80 |
| Cohesion + Road intersects woody cover + % Woody cover + % Development cover + Road Class | 7 | 50,903.46 | 81.858 | 0 | -25,441.73 |
| Cohesion + Road intersects woody cover + % Development cover + # riparian crossings | 5 | 51,220.61 | 399.003 | 0 | -25,602.31 |
| Cohesion + Road intersects woody cover + % Development cover + Road Class | 6 | 51,302.02 | 480.412 | 0 | -25,642.01 |
| Cohesion + Road intersects woody cover + % Woody cover + % Development cover + # riparian crossings + Road Class | 8 | 51,365.35 | 543.740 | 0 | -25,671.67 |

Table 3. Sensitivity of fixed effect coefficient estimates to different levels of aggregation of coordinates for estimating spatial random effects for 12 mountain lions GPS tracked in Sonoma and Napa counties, California, 2016-2023.

| Variable | Mean (min, max) | St. Dev. | Coef. of Variation |
| --- | --- | --- | --- |
| Cohesion | 0.012 (0.011, 0.014) | 0.001 | 0.100 |
| Road intersects woody | 0.465 (0.392, 0.512) | 0.047 | 0.101 |
| # riparian crossings | 0.184 (0.131, 0.23) | 0.035 | 0.191 |
| % Development | -0.034 (-0.048, -0.029) | 0.008 | 0.238 |
| (Intercept) | -4.054 (-5.262, -2.288) | 1.145 | 0.282 |
| Road Class-Major | 0.491 (0.344, 0.666) | 0.161 | 0.329 |
| Road Class-Local | 0.212 (0.103, 0.335) | 0.112 | 0.526 |
| % Woody | -0.006 (-0.014, 0) | 0.006 | 0.942 |

Summary of crossing and non-crossing steps for all lions.

| animal.id | is.crossing.step | num.steps | mean.step.hour |
| --- | --- | --- | --- |
| P1 | FALSE | 12,285 | 11.382011 |
| P1 | TRUE | 2,255 | 11.226608 |
| P13 | FALSE | 13,289 | 11.313944 |
| P13 | TRUE | 2,353 | 11.824479 |
| P16 | FALSE | 7,701 | 11.600831 |
| P16 | TRUE | 377 | 10.485411 |
| P2 | FALSE | 1,229 | 11.683483 |
| P2 | TRUE | 205 | 10.985366 |
| P31 | FALSE | 990 | 11.362626 |
| P31 | TRUE | 207 | 12.004831 |
| P33 | FALSE | 5,401 | 11.518423 |
| P33 | TRUE | 296 | 8.976351 |
| P39 | FALSE | 2,227 | 11.901661 |
| P39 | TRUE | 181 | 10.767956 |
| P4 | FALSE | 17,746 | 11.301758 |
| P4 | TRUE | 1,022 | 12.856164 |
| P41 | FALSE | 990 | 11.396970 |
| P41 | TRUE | 163 | 10.766871 |
| P5 | FALSE | 812 | 11.732759 |
| P5 | TRUE | 146 | 12.178082 |
| P6 | FALSE | 1,141 | 10.988606 |
| P6 | TRUE | 172 | 11.011628 |
| P9 | FALSE | 2,296 | 11.080575 |
| P9 | TRUE | 244 | 7.979508 |