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Issues Facing Tortoise Translocation in an Urbanizing Area

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Copper Mountain College (CMC) established an 85-acre tortoise preserve in 2008 to serve as a translocation area (TA) for tortoises displaced from the adjacent 55 acres by campus expansion. Sixty monthly surveys along TA fencelines, and five annual 100% coverage surveys from 2009-2013, documented management concerns and generally bimodal (spring and fall) variance in tortoise activity. There was no statistically significant difference in tortoise abundance (*1-way ANOVA, $p = 0.26$*) or mortality ($p = 0.50$) after five years, suggesting successful translocation thus far. There was significant seasonal variance ($p < 0.05$) in tortoise activity between months and years, along fencelines, and near roads. Tortoise activity was strongly correlated with environmental temperature and prior winter precipitation (*Spearman's $r = 0.80$*). Subadult tortoises, scat and burrows were significantly less detectable than adults ($p < 0.01$). Subadult tortoises experienced significantly higher mortality than adults, primarily due to predation ($p = 0.04$). During the study period tortoise activity increased significantly along fences, except along the southern fence bordering Highway 62, indicating that road proximity affected tortoise behavior ($p = 0.0008$). Management successes included no mortality of adult translocated tortoises, good compliance by construction personnel and vehicles, removal of invasive mustard species, educational efforts, and opportunities for citizen science. Persisting management issues included predation by ravens and canids, presence of *Mycoplasma*, ectoparasitic tick vectors, shell disease, recurrent litter, and storm or vehicle damage to fences. More effective population monitoring could be implemented using radiotelemetry, serological or genetic testing, and durable identification markers. This translocation scenario is likely to be repeated when tortoises are displaced from other urban areas.