## **CALIFORNIA GROUND SQUIRREL-livestock conflicts on the Central Coast**

## Summarized for the CCRC/MROSD review of livestock-wildlife conflicts Sheri Spiegal, spiegal@berkeley.edu, 510-643-1367

In this context, a "conflict" is a scenario in which California ground squirrels negatively affect livestock or ranching practices, or vice versa.

	↓Rancher, manager, consultant interviews; popular press↓		<b>♦</b> Peer-reviewed articles, UC Cooperative Extension, etc. <b>♦</b>	
Area of conflict	Conflict experienced on the ground	Conflict mitigation implemented on the ground	Scientific literature on the conflict	Scientific literature on the mitigation
Habitat	Some people consider ground squirrels to be keystone species, but they are treated as pests. "I can understand that they make soil and provide habitat for other species, but lots of people don't like them" (-Rancher).	0	(Barry et al. 2006), (Davidson et al. 2012), (Fitch 1948), (Lenihan 2007), (Schiffman 2007)	0
	Squirrel burrowing can create hazards for livestock and damage water systems.	Killing of ground squirrels	(Marsh 1998), (Vertebrate Pest Control Research Advisory Committee 2013)	(Howard 1953), (Marsh 1994), (Salmon 2013), (Salmon et al. 2007), (Salmon and Schmidt
Forage	There is concern about forage consumption by ground squirrels.	Destruction of burrows	(Fitch 1948), (Howard et al. 1959), (Lidicker Jr. 1988), (Schitoskey and Woodmansee 1978)	1984), (Vertebrate Pest Control Research Advisory Committee 2013), (Whisson and Salmon 2009)
Predation/ Depredation	Poisoning squirrels can kill golden eagles and other predators that prey on the poisoned carcasses.  Gassing or explosions can kill other burrow residents, such as California tiger salamander and California red-legged frog.	Movement to ban Compound 1080  Avoidance of gassing or exploding burrows in known ranges of California tiger salamander or California red- legged frog	(Hegdal et al. 1986)	(Ford et al. 2013)
Disease	0	0	(Atwill et al. 2001)	0

<sup>&</sup>quot;0" means there was no mention of the topic in interviews, popular press, or scientific literature as of October 2013.

- Atwill, E. R., S. M. Camargo, R. Phillips, L. H. Alonso, K. W. Tate, W. A. Jensen, J. Bennet, S. Little, and T. P. Salmon. 2001. Quantitative shedding of two genotypes of Cryptosporidium parvum in California ground squirrels (Spermophilus beecheyi). Applied and environmental microbiology 67:2840–2843.
- Baldwin, R. A., T. P. Salmon, R. H. Schmidt, and R. M. Timm. 2013. Wildlife pests of California agriculture: Regional variability and subsequent impacts on management. Crop Protection 46:29–37.
- Barry, S. J., R. E. Larsen, G. A. Nader, M. Doran, K. Guenther, and G. Hayes. 2006. Understanding livestock grazing impacts: strategies for the California annual grassland and oak woodland vegetation series. University of California Agriculture & Natural Resources Publication 21626. University of California Division of Agriculture and Natural Resources, Oakland, California.
- Bartolome, J. W. 1997. The influence of cattle grazing on California ground squirrels in a blue oak savanna. Pages 327–330 *in* Pillsbury, Norman H., Tietje, William D., and Verner, Jared, editors. Proceedings of a Symposium on Oak Woodlands: Ecology, Management, and Urban Interface. San Luis Obispo, CA.
- Davidson, A. D., J. K. Detling, and J. H. Brown. 2012. Ecological roles and conservation challenges of social, burrowing, herbivorous mammals in the world's grasslands. Frontiers in Ecology and the Environment 10:477–486.
- Fehmi, J. S., S. E. Russo, and J. W. Bartolome. 2005. The effects of livestock on California ground squirrels (Spermophilus beecheyii). Rangeland Ecology & Management 58:352–359.
- Fitch, H. S. 1948. Ecology of the California ground squirrel on grazing lands. American Midland Naturalist 39:513–596.
- Ford, L. D., P. A. Van Hoorn, D. R. Rao, N. J. Scott, P. C. Trenham, and J. W. Bartolome. 2013. Managing rangelands to benefit California red-legged frogs and California tiger salamanders. Alameda County Resource Conservation District, Livermore, California.
- Hegdal, P. L., K. A. Fagerstone, T. A. Gatz, J. F. Glahn, and G. H. Matschke. 1986. Hazards to wildlife associated with 1080 baiting for California ground squirrels. Wildlife Society Bulletin 14:11–21.
- Howard, W. E., K. A. Wagnon, and J. R. Bentley. 1959. Competition between ground squirrels and cattle for range forage. Journal of Range Management 12:110–115.
- Howard, W. E. 1953. Rodent control on California ranges. Journal of Range Management 6:423-434.
- Lenihan, C. M. 2007. The ecological role of the California ground squirrel (Spermophilus beecheyi). Ph.D. dissertation, University of California, Davis.
- Lidicker Jr., W. Z. 1988. Impacts of non-domesticated vertebrates on California grasslands. Pages 135–150 *in* L.F. Huenneke and H.A. Mooney, editors. Grassland Structure and Function: California Annual Grassland. Springer.
- Marsh, R. E. 1994. Current (1994) ground squirrel control practices in California. Pages 61–65 *in* W. S. Halverson and A. C. Crabb, editors. Proceedings of the 16th Vertebrate Pest Conference. Santa Clara, California.
- Marsh, R. E. 1998. Historical review of ground squirrel crop damage in California. International Biodeterioration & Biodegradation 42:93–99.
- Salmon, T. P., and R. H. Schmidt. 1984. An introductory overview to California ground squirrel control. Pages 32–37 *in* D. O. Clark, R. E. Marsh, and D. E. Beadle, editors. Proceedings of the 11th Vertebrate Pest Conference. Sacramento, California.
- Salmon, T. P., D. A. Whisson, A. R. Berentsen, and W. P. Gorenzel. 2007. Comparison of 0.005% and 0.01% diphacinone and chlorophacinone baits for controlling California ground squirrels (Spermophilus beecheyi). Wildlife Research 34:14.
- Salmon, T. P. 2013. Ground squirrel best management practices. Agriculture and Natural Resources, University of California. <a href="http://ucanr.edu/sites/Ground">http://ucanr.edu/sites/Ground</a> Squirrel BMP>. Accessed 26 Aug 2013.
- Schiffman, P. M. 2007. Ecology of native animals in California grasslands. Pages 180–190 *in* M. R. Stromberg, J. D. Corbin, and C. M. D'Antonio, editors. California Grasslands: Ecology and Management. University of California Press, Berkeley, California.
- Schitoskey, F., and S. R. Woodmansee. 1978. Energy requirements and diet of the California ground squirrel. The Journal of Wildlife Management 42:373–382.
- Vertebrate Pest Control Research Advisory Committee. 2013. Ground Squirrels. The Vertebrate Pest Control Handbook online. <a href="http://www.vpcrac.org/about/handbook.php">http://www.vpcrac.org/about/handbook.php</a>. Accessed 23 Aug 2013.
- Whisson, D. A., and T. P. Salmon. 2009. Assessing the effectiveness of bait stations for controlling California ground squirrels (Spermophilus beecheyi). Crop Protection 28:690–695.