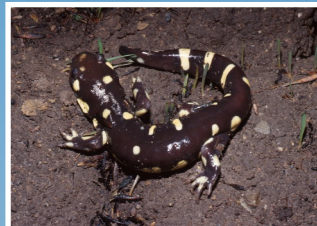


Managing California Grasslands for California Tiger Salamander and California Red-Legged Frog: Considerations When Applying Compost

Introduction:

Applying compost on rangelands as a climate change mitigation strategy has shown promise to increase soil carbon stocks through direct addition of carbon-rich compost and via the additional CO₂ drawdown from improved vegetation productivity. Compost may be used to improve soil structure, increase water-holding capacity, and restore degraded rangeland soils. One unknown is the impact of rangeland compost application on sensitive amphibian species, in particular California tiger salamander (CTS) and California red-legged frog (CRLF). This fact sheet informs rangeland managers and partners of the current understanding for species management in areas with compost application and identifies areas where additional research is needed.



Habitat

Both species rely on a mix of aquatic and upland habitats. Migration from upland to aquatic habitats corresponds with the amphibians' breeding patterns during the rainy season when surface water is recharged. Connectivity of breeding and dry-season habitat is critical for CRLF to create a network of suitable breeding sites and other core habitat requirements.



Habitat Requirements for CTS and CRLF			
Habitat	Season	California Tiger Salamander	California Red-Legged Frog
Breeding	Wet	Ponds or vernal pools, and potentially quarries, lakes, and reservoirs. Preferably turbid water and inundated through May at a minimum. Possible habitation in areas with moderate emergent vegetation. Little to no predator pressure preferred.	Ponds or pools in slow-moving creeks. Inundation preferably through September but at least July. Mix of open and vegetated areas, deep and shallow sections. Little to no predator pressure preferred.
Winter-Spring			
Non-Breeding	Dry	Upland habitat with ground squirrel or pocket gopher burrows. Can cohabitate with gophers and/or ground squirrels in burrows.	Moist habitat (springs, riparian zones, perennial ponds, burrows) protected from predators. Preferably near breeding habitat.
Summer-Fall			

Compost: The main considerations for compost application on grasslands with regard to California tiger salamander and California red-legged frog are application location and timing, operation of spreading equipment, and potential habitat changes resulting from compost application. Studies on compost effects on CTS and CRLF as a result of direct contact do not currently exist; however, studies showing the effects of compost on grassland composition and quality exist, which may affect both CTS and CRLF.

Benefits & Impact of Compost Application on Grassland Quality:

- Addition of nutrients to rangeland systems, primarily C and N
- Increased water holding capacity of soils
- Increased soil C cycling from direct addition of compost
- Increased primary productivity of grassland ecosystems—yielding greater forage production and greater soil carbon sequestration
- Stabilization of deteriorated grasslands prone to erosion that may lead to sediment accumulation in ponds and waterways



Potential Impact	Concerns	Recommendations
Disturbance of Upland Habitat	Heavy equipment operation, compost stockpiles, and spreading compost may damage, obstruct, or fill burrow structures used by CTS and other wildlife. Equipment operation may result in incidental take (kill) of wildlife species during movement.	Avoid operating equipment at night or near breeding habitat, operating equipment during or immediately after rain events, and storing or staging equipment near riparian zones or near ground squirrel colonies. In areas of potential CTS and CRLF habitation, assume presence as a preventative measure. Avoid ground squirrel and gopher burrows when applying compost to prevent cave-ins of burrow complexes and to avoid obstruction or blocking of burrows used for CTS habitation from the spread compost, to the maximum extent feasible.
Vegetation Community and Growth Changes	Compost application may increase grassland productivity, resulting in greater forage density and height. Thatch may accumulate and impede migration, movement, and genetic distribution of CTS and CRLF individuals. Compost may stimulate productivity of non-native grassland species, leading to population shift away from natives, particularly in sensitive habitats.	Do not apply compost to grasslands with intact and abundant or diverse populations of native grasses and forbs. Continue grazing grassland areas where compost is applied. Resting fields may result in an undesired abundance of grassland productivity.
Direct Contact	Currently there are no known negative impacts of compost application. Both species are sensitive to some herbicides and pesticides, indicating potential sensitivity to other compounds. Compost is not one of the known harmful compounds.	Obtain compost data sheet records from the compost vendor to show compliance with established standards and maximum allowance for compost contamination by harmful chemicals (e.g., glyphosate, 2,4-D, diquat bromide, diazinon, PFAs). Avoid use of equipment contaminated with chemical compounds with known or suspected toxicity to CTS and CRLF. Avoid compost from sources that may contain higher amounts of microplastics and other inert contamination (glass, metals, plastics). Use compost that has matured completely and is neither acidic nor alkaline (pH ~6-8); mature compost should smell like a forest floor. Use compost that reached the temperature threshold and required amount of time to kill potentially harmful pathogens or parasites (131+ degrees F for 3-15 days).

For information on compost quality standards and regulations, contact CalRecycle (California Department of Resources Recycling and Recovery), the US Composting Council, and the Alameda County Waste Management Authority (StopWaste). For information and guidance on species, contact resource agencies such as the California Department of Fish and Wildlife. In Alameda County, the Alameda County Conservation Partnership (Alameda County Resource Conservation District & USDA Natural Resources Conservation Service)

provides technical expertise and local guidance on management and regulatory conditions concerning CTS and CRLF. Contact information can be found at <https://acrcd.org/>. This fact sheet was developed with funding support from the California Department of Food and Agriculture (grant no. 190670000SO).

