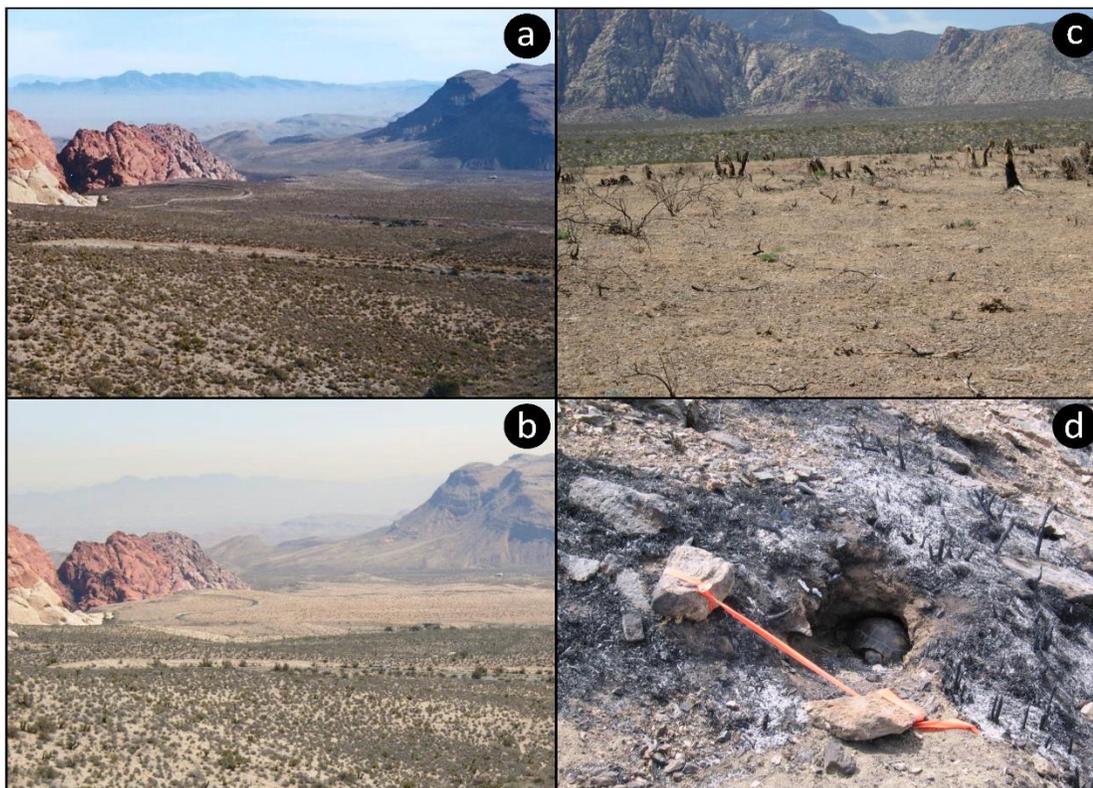


# Best Management Practices *Rehabilitating Severe Disturbance*

Reestablishment of mature perennial plant communities after severe disturbance, such as severe wildfire or land clearing, is slow in desert tortoise habitat. Perennial plant cover reestablishes within an average of about 40 years. But this cover is provided by different species than those of mature communities. An early colonizing community of generally small-statured perennial plants persists for decades to centuries. Complete recovery of mature perennial communities after severe disturbance is increasingly uncertain, given continued disturbance, pervasive invasion by non-native plants, and climate change. It is possible that perennial cover and availability of large-statured, mature perennial communities limit desert tortoise populations (Fig. 1). Shrubs are heavily used by desert tortoises for cover for temperature regulation and to construct burrows beneath.

Best-management practices for ameliorating habitat conditions after severe disturbance include:

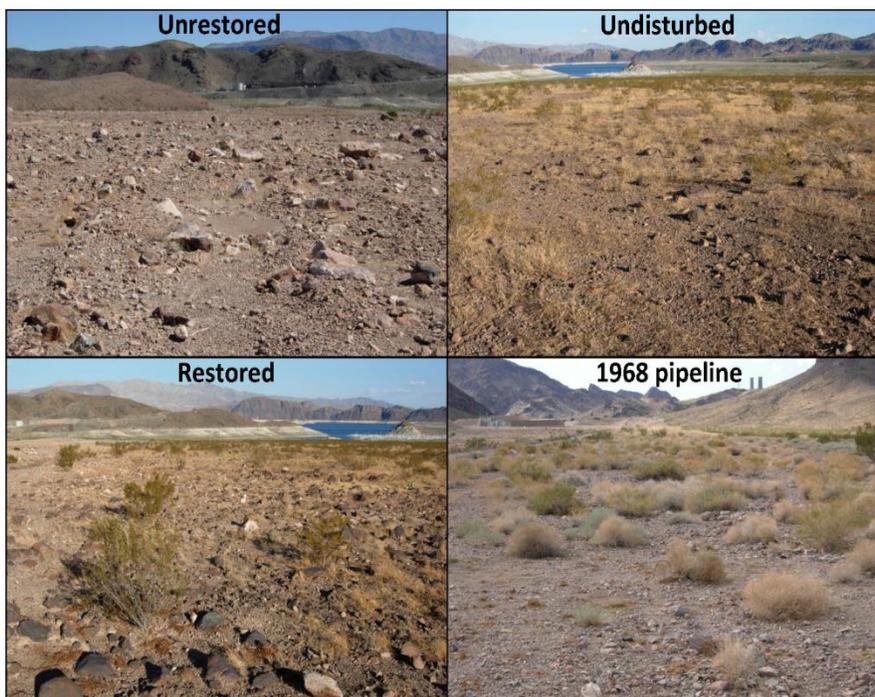
- **Implementing active restoration can accelerate development of mature perennial communities on disturbed sites.** For example, applying salvaged topsoil following severe, land-clearing disturbances is among the most ecologically beneficial techniques for accelerating soil and vegetation recovery. Specific practices for salvaging topsoil and reestablishing perennial plants are covered in separate fact sheets.



*Fig. 1. Drastically altered habitat before (1996, a) and after (2007, b, c) fire, Red Rock Canyon National Conservation Area, Nevada. Dead tortoise in burned burrow after fire in Joshua Tree National Park (d). Photo credits: a) R.J. Abella, b,c) S.R. Abella, and d) National Park Service.*

- **Understand variation in resprouting abilities of shrubs.** Resprout ability varies among species, disturbance severity (with no resprouting if root structures are destroyed), and post-disturbance weather. Some perennial species, such as creosote bush (*Larrea tridentata*), can have more than 50% of individuals resprouting. Others, like blackbrush (*Coleogyne ramosissima*), have minimal or no resprouting.

- **Protecting top-killed, resprouting perennials can enhance natural recovery.** Enclosing resprouting individuals in cages or shelters – to protect from herbivory or provide ameliorated microclimate – can potentially increase growth rates and stimulate seed production. Under optimal conditions, resprouting creosote bushes can achieve pre-disturbance sizes within five years.
- **Augment perennial plant establishment through active revegetation.** If insufficient resprouting individuals are available to meet revegetation goals, planting nursery grown plants using good quality stock and effective plant care can establish perennials. The “Restoring perennial plants” fact sheet provides further information.
- **De-compact and roughen severely compacted soil.** Severe disturbances, such as bulldozing and road construction, can leave soils largely unsuitable for water infiltration and plant establishment. Ripping, imprinting (creating indentations in soil), or applying salvaged topsoil are among several techniques with potential for enhancing water infiltration and seed retention.
- **Protect severely disturbed areas from additional disturbance.** Fire (including re-burning), off-road vehicles, and livestock (including feral animals) are some of the many disturbances that can limit recovery after an earlier disturbance. Limiting subsequent disturbances, such as through controlling non-native plants to reduce fuel and installing protecting fencing, can assist natural recovery.
- **Avoid severe disturbance in the first place whenever possible.** While restoration has great potential to ameliorate severe disturbances, it is expensive and has varying effectiveness on time scales of decades. In comparison to mature desert shrublands, the functions provided to desert tortoises by recovering early colonizing perennial communities or restoration ecosystems are poorly understood (Fig. 2). One study found that tortoise use of burned habitat initially colonized by short-lived perennials may depend on availability of forage on the burn and presence of shrubs as cover on nearby unburned areas (Drake et al. 2015). Severely disturbing desert tortoise habitat under the premise that restoration can rapidly recreate habitat is unrealistic ecologically and economically. Instead, restoration is an important part of an overall conservation strategy that includes conserving mature habitat.



*Fig. 2. Varying desert tortoise habitat condition as a function of disturbance, restoration, and length of recovery in Lake Mead National Recreation Area. Left side and top right photos show restoration of a bladed area through outplanting perennial plants, in comparison to undisturbed conditions. Bottom right shows a 40-year-old cleared pipeline with a persistent, early colonizing community of small-statured perennial plants. Photos by S.R. Abella.*

### **Example References and Further Reading**

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