LAND CONSERVATION

Restoring Rangelands in Northern New Mexico with Keyline Design

In northern New Mexico, drought-hardened coarse-loamy soils lower infiltration of the region's summer monsoonal rains and increase soil erosion in rangeland ecosystems. Lowered infiltration and subsequent erosion have resulted in the loss of native vegetation and soil organic matter, including the carbon important for water storage and plant growth. In response, the owners of C-B Ranch and Esquibel Ranch are implementing keyline design, a land management practice that uses the natural ridges and contours of a property's topography to slow, spread, and sink rainwater to restore vegetation and soil organic matter. The ranches are sharing the equipment and knowledge necessary to implement keyline design, including specialized plows to dig swales (trenches) to manipulate the flow of water throughout their ranches.

Aerial view of 10 acre pasture in C B Ranch

KEY ISSUES ADDRESSED

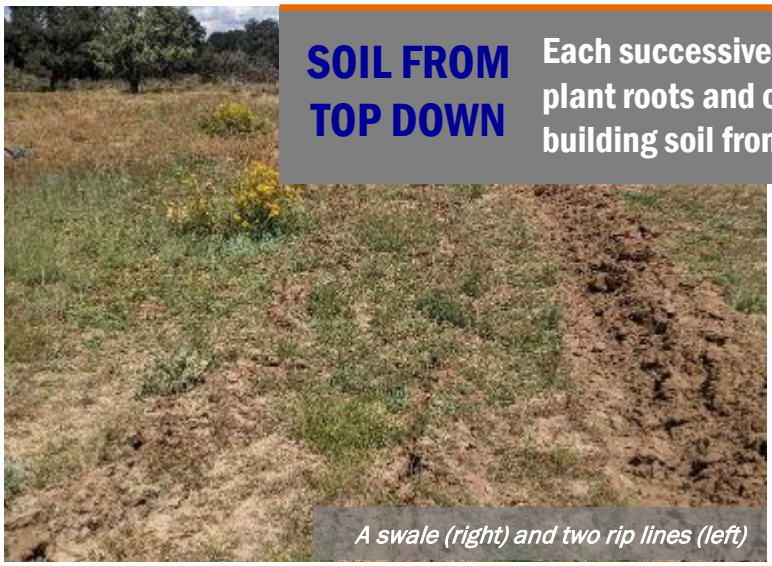
The soils present in both ranches include sandy, clay, and loamy soils. The sandy soils have become hydrophobic from dry conditions, the clay soils have become compacted from livestock trampling, and the loamy soils contain fine sands that are easily transported by heavy rainfall. Due to these soil conditions, 80% of the rain that lands on C-B Ranch runs down the 3% slope of the pasture instead of soaking into the soil, causing soil erosion. While keyline design has been implemented in different landscapes, there is a need for more understanding on how it works on grasslands and with various soil types. Further, ranch managers may be unaware of the specialized tools and technologies required to create finer detailed maps or where and how to plow swales and rip lines.

PROJECT GOALS

- Map contour lines to identify potential locations for swales and rip lines
- Use plows to create swales and rip lines, to increase infiltration, and encourage growth of native and seeded vegetation
- Host workshops to share knowledge of keyline design principles and on the technologies required in keyline design

SOIL FROM TOP DOWN

Each successive year of plowing swales and rip lines stimulates plant roots and organic matter to spread deeper into the soil, building soil from the top down over time.



A swale (right) and two rip lines (left)

PROJECT HIGHLIGHTS

Visualizing the Landscape: Managers used a consumer drone to take hundreds of photos of the project areas, then used GIS software to combine the images into an elevation map. Managers placed swales and rip lines 100 feet apart to leave room for plows and future swales and rip lines.

Implementing the Design: Managers rented a high-capacity laser level to delineate the contour lines along the ground. Managers passed over the contour lines twice with a single moldboard plow to turn soil and create swales. Then, managers installed two, 15-inch-deep rip lines with a specialized, two-shank, Yeoman's plow fitted with equipment to evenly disperse compost and cover crop seed mix.

Tools Specialized for Soil: Managers installed swales using a single moldboard plow, which features a curved plate to turn soil upside down. Managers created rip lines using the Yeoman's plow. At the bottom of each shank is a wide boot, which fractures and aerates subsoil, as opposed to the moldboard plow that aerates surface soil.

Knowledge Sharing: Together, the two ranches hosted a workshop to share a process overview of mapping contour lines and plowing swales and rip lines. Over 20 participants gained a better understanding of why and how to implement keyline design principles.

Collaborators

- C-B Ranch and Esquibel Ranch
- NM Healthy Soil Working Group

LESSONS LEARNED

Swales and rip lines are designed to nudge ecosystems in the direction of restoration; however, they will not produce changes in vegetation overnight, especially in arid landscapes. The ranchers are patient and monitor swales and rip lines to see when maintenance needs to be performed (e.g., replowing rip lines if the subsurface water infiltration pathways become compacted).

The efficiency of plowing swales and rip lines largely depends on how much precipitation the soil has received. Plowing in conditions between hardened soils and muddy soils provides the best results.

While timing is important for the efficiency and effectiveness of plowing, the equipment used is critical for the success of the swales and rip lines. For example, soil clods can prevent contact between seeds and the soil in rip lines. A plow attachment, such as a roller or cultipacker, can be attached to the Yeoman's plow to break up clods prior to seed dispersal.

While the equipment can be expensive, ranchers can reach out to local organizations that can connect them to equipment or funding sources. A consumer drone and laser level can be rented by the day for more affordable access. Ranchers can also work with their neighbors to share equipment.

NEXT STEPS

- Reseed areas with perennial native vegetation
- Observe project area to determine required maintenance of swales and rip lines and to see if water is flowing and soaking as needed
- Hold more workshops to share keyline design techniques and restoration possibilities

For more information on this project, contact Craig Conley: landhealth1@gmail.com

Single mold board plow

CART Author: Jackelyn Alessi, Drought Learning Network (DLN), February 2024.
Photos courtesy of Craig Conley/C-B Ranch.
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