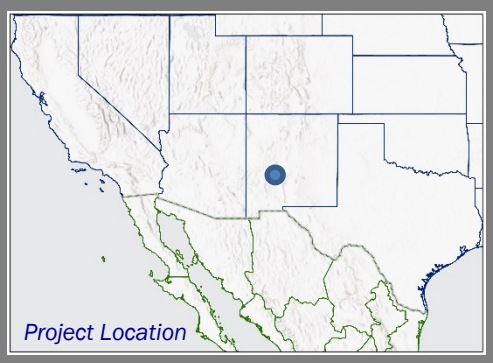
ACTIONABLE SCIENCE

Ecological Benefits of Compost for Rangeland Plant and Soil Health

Collecting a Soil Subsample in a Control Plot to Measure Soil Carbon

Climate change and resulting drought conditions are degrading rangelands across the United States. In arid and semi-arid rangelands, this degradation can decrease plant productivity and biodiversity. One restoration tool is the use of organic amendments, such as compost. Compost can support many aspects of rangeland ecosystem function, including increasing plant productivity and reducing soil erosion. One significant barrier to compost use is the monetary and labor cost to producers. This group of researchers focused on the foundational ecological benefits of compost which must be understood and quantified before assessments about economic viability can be made.



KEY ISSUES ADDRESSED

According to existing research, compost application can in many cases be beneficial to rangelands. Some optimization of compost placement according to local environmental conditions may be possible, potentially leading to more beneficial outcomes at a lower cost to producers. Many questions remain about the optimal methods for implementing compost across diverse landscapes and management systems. Because compost can be produced by many different methods, effects of applying each compost type can vary widely. However, little is known about these effects, such as the difference in ecological benefits from biosolid-based versus manure-based compost. As a result, many potential benefits of composting for ranchers remain untapped.

PROJECT GOALS

- Measure the ecological benefits of applying biosolid-based compared to manure-based compost to rangeland
- Offer information and advice to producers about how to apply compost and which type to choose

A DRY YEAR

The first year of this study had below average rainfall. Because microbes and plants typically respond to wet conditions, the dryness could partially explain the minimal changes in microbial community composition.

A Compost Plot During the Monsoon Season

PROJECT HIGHLIGHTS

Experiments in the Field: The research team studied nine 64 m^2 plots with loamy soils and a <5% slope on privately-owned rangeland in New Mexico.

Compost Type Affected Plant Performance: Six months after treatment, plots which received biosolid-based compost had grown the most, with a trend of over twice the plant biomass compared to plots with no compost. Plots which received manure-based compost showed intermediate plant growth compared to untreated plots.

Soil Characteristics Changed Over Time: Aggregate stability, an indicator of soil health and quality, initially decreased at six months. This may have been a result of increased livestock movement, trodding on the compost plots. After one year, aggregate stability in plots with manure-based compost recovered to native soil stability values, and increased intermediately in plots with biosolid-based compost as well.

Resilient Native Soils: Both compost types host diverse communities of fungi and bacteria. Researchers therefore expected large changes in microbial diversity in plots with compost additions. However, they found that six months and one year after treatment, microbial communities in native soils did not shift dramatically. This surprising result indicates that microbial ecosystems in native soils are well-established and not destabilized by new microbes from compost.

Collaborators

- Quivira Coalition's Carbon Ranch Initiative

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Photos courtesy of Eva Stricker/UNM
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LESSONS LEARNED

Despite varied results between compost types and at different time intervals, compost additions overall increased plant growth and improved some soil properties. At this stage in the research, one compost type has not proven to be dramatically more effective than the other. These mixed preliminary results indicate that compost shows some promise as a tool to increase rangeland productivity. Importantly, they also highlight the importance of continued research on the ecological effects of compost. By quantifying the potential ecological benefits of compost, researchers can help producers to make a more informed decision about investing time and money into this practice. This study demonstrates one way in which waste can be used productively on rangelands, contributing to a broader rangeland circular economy. The research team hopes in the long-term, their findings can help shift producers' perspective on waste towards increased strategic use. Here they show that, for example, composted excess manure from dairy cows could be beneficial for soil health. This mindset change is one important step towards regenerative management.

NEXT STEPS

- Continue project to investigate the effects of compost over a longer timescale
- Set up experiments to study how far microbes travel from the plots where compost is added: Understanding the microbes' dispersal capacity will help researchers make recommendations on optimizing compost placement
- Collaborate with economic experts to present the cost-benefit ratio of compost to producers

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Setting up a Livestock Exclosure on a New Compost Addition Plot