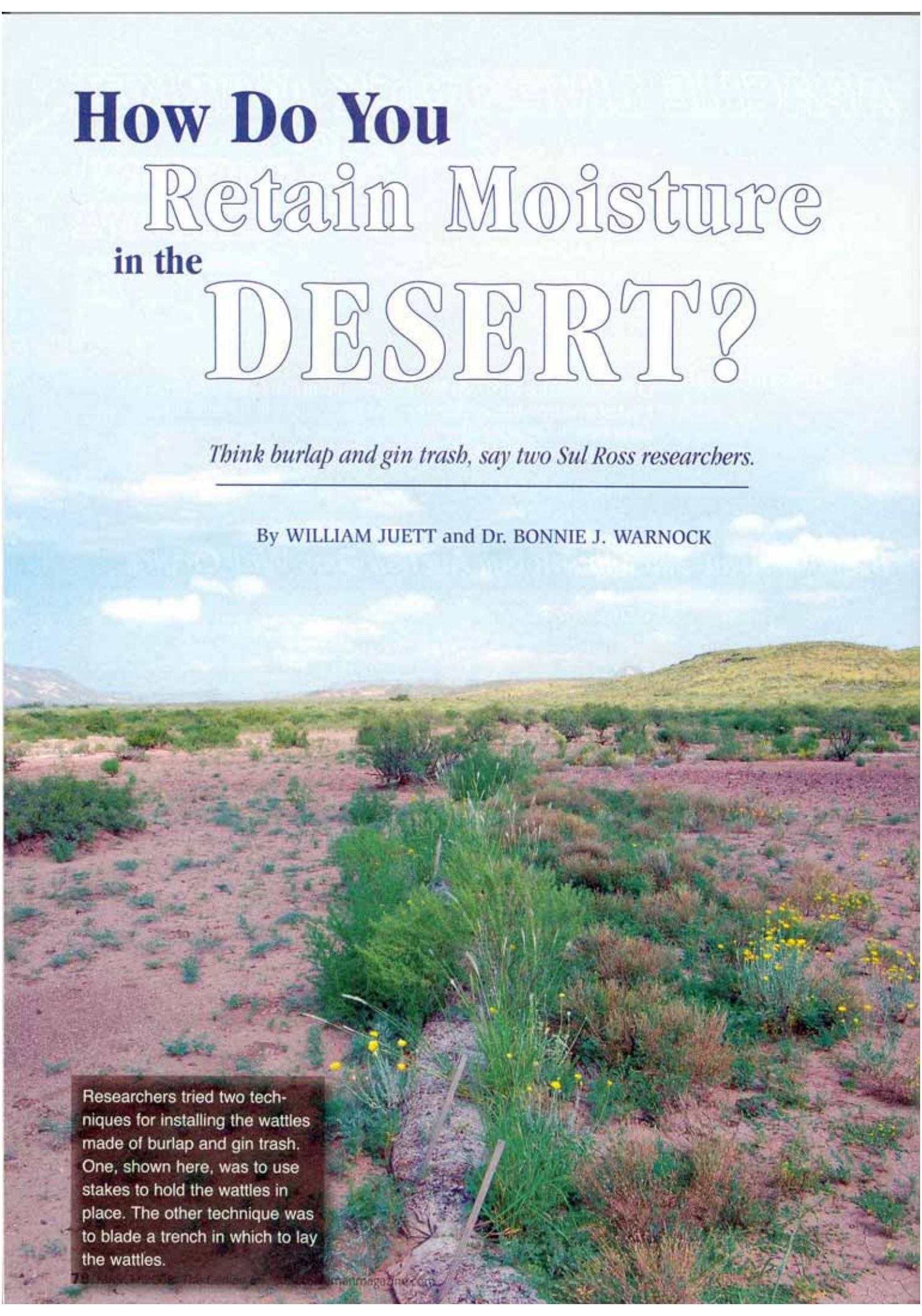
How Do You Retain Moisture in the DESERT?

Think burlap and gin trash, say two Sul Ross researchers.

By WILLIAM JUETT and Dr. BONNIE J. WARNOCK



Researchers tried two techniques for installing the wattles made of burlap and gin trash. One, shown here, was to use stakes to hold the wattles in place. The other technique was to blade a trench in which to lay the wattles.

Water is a critical component to range health and this is especially true in arid and semiarid regions such as the Chihuahuan Desert. Limited precipitation and high temperatures can make water a scarce commodity. One of the keys to a healthy rangeland is retaining moisture.

Keeping moisture on-site makes it available for vegetation growth as well as seep, spring, and creek flow, and ground water recharge.

When moisture leaves an area in the form of excessive runoff, it causes a decline in the health of the rangeland. Unfortunately, when rangeland health begins to decline it starts a downward trending cycle.

As a site becomes degraded, the ability to retain precipitation decreases. This leads to further degradation from effects like loss of plant cover, loss of organic matter, erosion, and increased susceptibility to desert termites.

These increases in runoff and erosion can also begin to have adverse effects on adjacent sites. This makes it important to maximize infiltration and keep as much moisture as possible on site.

A lesson from the ancients

With this as a goal, Sul Ross University set out to experiment with the ancient technique of harvesting moisture using wattles. Wattle is a generic term for a man-made water obstruction.

Using wattles to slow overland flow is a common practice in many construction projects in this country. They can often be seen on highway construction to stabilize de-vegetated slopes.

These wattles are commercially available and usually are constructed from coir or rice straw wrapped in polypropolene netting.

In many arid regions of the world, wattles are used for agricultural purposes. The Bedouins of Egypt originally constructed these strips out

... **vegetation** growth ... **seep**, spring, and creek **flow**, and ground water **recharge**.

Before the wattle installation, vegetation was sparse.

After the wattles had been in place for about a year, the effects of more water retention were shown in more vegetation, and even in frogs and mushrooms.

of stone and mortar. They were spaced across ephemeral channels. The adjacent upland provided the water catchment area. As water hit the strips it would pond and drop its sediment load. The water was given a chance to infiltrate and the addition of sediment provided a more fertile seedbed.

Wattles have not been used for rangeland restoration because of the high cost and limited availability. The rice and coir wattles have had mixed results when used to slow erosion in National Forests.

At Sul Ross State University, a Master of Science project was designed to determine if the problems with wattles could be overcome, so that they could be used successfully on rangelands.

The project had these objectives: Determine if biodegradable wattles could be efficiently constructed from local materials; determine if wattles combined with reseeding could be successfully implemented to revegetate a severely degraded rangeland; and determine if different wattle installation techniques yielded different results.

Use what's at hand

Commercial wattles are expensive. Their components are often imported and they have large freight costs since they are not constructed in the ag region. Another drawback is that they are usually produced with a photodegradable (breaks down in sunlight) material. This means that the underside is left on site indefinitely because it doesn't receive light.

Because they are tightly wound, they are very stiff like a log. A trench must be dug to place them in because water will erode the soil underneath creating channels and gullys. They must also then be staked to the ground to prevent them from washing away.

The Sul Ross project wanted to create a wattle that would be more practical to use as a range restoration tool.

The wattles were constructed from burlap tubes filled with cotton burs (gin trash). These are readily available in Texas from the wool/mohair and cotton industries. Because they are constructed locally from local sources, there are fewer freight costs.

These wattles are 100 percent biodegradable and the natural composting process of the cotton burs at the gin yard neutralized any weed seeds.

... to **maximize** infiltration ...

Another advantage of these wattles is the nature of the burlap and cotton burs holds the water until saturation and then allows excess to seep through as opposed to a less permeable material.

The burlap also allows the wattle to flatten, which helps stabilize them.

The wattles ended up costing a third of the price of the commercial ones. Freight was a fraction as well, because commercial wattles must be shipped in from the east or west coast, traditionally.

(Continued on page 82)

Retain Moisture ...
(Continued from page 80)

A tough experiment site

For the location of the study site, an area with a Straddlebug soil was selected.

This soil is a sodic soil and one of the most challenging to restore. Sodic (high sodium content) soils are common in West Texas. In Brewster County alone, these soils cover approximately 200,000 acres. They lack structure and are, therefore, weakly bonded. As a result, vegetation is often the only thing holding these soils together. When there is a good vegetative cover, that same loose structure allows very good rates of infiltration. This can be a highly productive soil as a result.

When there is no vegetative cover, however, there is nothing to slow the overland flow, so there is very little infiltration and very high rates of erosion.

Over time, these soils lose their production capacity. As the soil becomes shallower the sodium becomes concentrated and thereby restricts the type of plants that can survive there.

There are many proven techniques, such as ripping and pitting, to increase infiltration on rangelands. These techniques were not applicable on sodic soils, because disturbances can lead to gullying and increased erosion. Ripping on such a loose soil would be, in essence, like ripping sand.

Wattle ... man-made **water obstruction**.

The ideal location to carry out this project was on the 02 Ranch in Brewster County. The 02 Ranch is owned by Lykes Bros. Inc., a Florida corporation.

Lykes Bros. Inc. purchased the ranch in 1941, at this time the ranch had a long history of grazing use. Terlingua Creek flows through the ranch and the area has been used to pasture domestic livestock since the 1500s.

In 1998, a 30-year lease came to an end and Lykes Bros. assumed active control of the ranch again.

They have lowered stocking rates and set out to restore much of the ranch to native grassland. In cooperation with Sul Ross State University, United States Department of Agriculture, United States Fish and Wildlife Services, and Texas Parks and Wildlife Department, many projects have been initiated, including ripping, rootplowing, mesquite grubbing, prescribed burning, targeted aerial herbicide application, GIS mapping, installation of wildlife waterers, propagating and planting riparian trees (cottonwoods and willows from the ranch), and reseeding. Alternate forms of income such as ecotourism are being pursued.

The cumulative effect of these projects can already be seen. One of the springs on the ranch had been reduced to a few hundred feet of standing water for decades. Today, there are two and a half miles of running water year-round, with a healthy riparian community surrounding the flowing water.

The wattle restoration project

was located at the confluence of Paradise and Hackberry draws, the head waters of Terlingua Creek. This small area has a major impact on Terlingua Creek and the amount of sediment and erosion occurring in the creek channel. Restoration of this small area has the potential to have a beneficial impact on several hundred more acres.

... constructed from **burlap** tubes ... **cotton burs** ...

Installation processes

Wattles were installed along contour lines beginning every 110 feet. Two installation techniques were used. The first technique was to drive three to four pine stakes on the downslope side of each 20-foot wattle.

The second technique was to dig an eight-inch trench using the side of a D2 dozer blade and lay the wattle directly in the trench.

Sul Ross grad students monitored a control area adjacent to these treatments to ensure that our results were not from natural causes.

Surprising seed settlement

It is important to plan for restoration treatments to have long-term effects. While the wattles may slow overland flow and decrease erosion by themselves, they will eventually break down and no longer be beneficial to the site.

Vegetation, especially the fibrous roots of perennial grasses, can have the same effect on runoff. The goal is for the wattles to stay intact long enough to allow a strip of vegetation to establish; then the site begins to restore itself.

They seeded and harrowed a mixture of native grasses in an eight-foot strip on the upslope side of the wattle lines.

Studies have shown that reseeding can be a difficult process and this project confirmed that.

None of the seeds germinated in the strip where they were seeded. This showed that seeding alone is a waste of time and money on this type of site.

... like **ripping** sand.

The seeds did, however, wash down and germinate along the wattle itself. Not only did the wattle hold the soil long enough to allow the seed to germinate, but the cotton burs acted as moisture-retaining mulch and created an excellent microclimate conducive to vegetation establishment.

More moisture, regulated temperatures, and shade could be found underneath and adjacent to the wattles.

The soil moisture was substantially higher in the treated areas than in the untreated control area. The dozed area had an average soil moisture of 10.1 percent during the course of the study. The staked area's average soil moisture was 9.5

percent, and the control had the lowest average soil moisture of 7.8 percent.

All of the seeded species (blue grama, green sprangletop, alkali sacaton, sideoats grama, fourwing saltbush, and cane bluestem) became established in the treated areas and there were also many desirable species that became established from the seed bank (tobosa, bush muhly, deer muhly, and plains bristlegrass).

... 100 percent **biodegradable** ...

There was no establishment of any perennial grasses of any kind in the control. Vegetative cover was estimated at 84 percent (28 percent of which was perennial grasses) along the dozed wattles; 67 percent (22 percent of which was perennial grasses) along the staked wattles; and 30 percent (3 percent of which was annual grasses) in the control transects.

The control looked much the same as it did at the beginning of the study. There was absolutely no perennial grass and some germination of very small forbs and annual grass. The majority (76.6 percent) of the forbs in the control were small Russian thistle. The only grass was the small annual sixweeks grama.

... **pasture** domestic livestock since the **1500s**.

How the techniques compared

Comparison of the two installation techniques showed the dozed treatment had a significantly higher soil moisture and higher vegetative cover than the staked treatment.

The dozed area retained much more moisture around the wattles. This created a much wider zone of germination.

The dozed treatment visually held more moisture, indicated by

the presence of mushrooms and frogs along the wattles. While dozing a trench in this type of soil would be a risk for increasing erosion; the wattle supported and protected the berm, allowing the highest moisture retention.

... wash down and **germinate** along the **wattle** ...

The wattles were successful in the establishment of vegetation within a one year period. The area will continue to be monitored to determine how long it takes the wattles to totally degrade and the vegetation bands to become self-sustaining.

Although much cheaper than using traditional wattles, the cost of the treatment with the burlap and gin trash wattles is more than $100 per acre (most of this in labor).

At this point, this is not a tool for large pastures, but it is a tool to restore small target areas that may be difficult to restore with any other method. This can also be used in sensitive areas, where a low impact technique is needed for revegetation.

... **mushrooms** and **frogs** along the **wattles**.

Streamlining the construction and transportation process would greatly increase cost-effectiveness. This would make wattles a more competitive option for larger areas.

Construction materials could also be further studied. Different burlap weaves and chemical treatments to resist decay (coppernapthalate) could be studied to increase longevity.

The study of wattles on different soil types could be very useful in determining their extent of applications. ■

Editor's Note: Will Juett is beginning his doctorate at Texas Tech, under Dr. David Wester, and in cooperation with Sul Ross State University, Dr. Bonnie Warnock, and Lykes Bros. Inc. hopes to further the study of these range wattles.