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Four years in the Eagle Ford:

Findings and recommendations from our oil field and pipeline restoration research

By Tony Falk, Forrest Smith, and Keith Pawelek

That the Eagle Ford Shale is having a huge impact on wildlife habitat in South Texas is without doubt. Reestablishing native vegetation following oil and gas activities is a major desire for many landowners in South Texas. Unfortunately, the task of reestablishing native plants after oil field activity is not as easy as just throwing out some native seed and walking way. But, through ongoing research projects conducted by *South Texas Natives,* we are learning a great deal about how to reestablish native plants in typical Eagle Ford Shale scenarios. Much of this research will also apply to other emerging oil and gas plays in Texas.

We urge landowners to continue to pay close attention to surface use agreements (SUA). The first item in any oil and gas project, from the landowner's standpoint, is that all decisions about reestablishing vegetation need to be discussed, decided on, and included in the SUA before any equipment enters the property. It is at this stage that conflicts are worked out, and solutions agreed upon - not later after the bull dozers are fired up. Make sure to be as specific as possible, and list every detail from how to manage soil, which specific seed varieties will be planted, and when, where, and how seeding and revegetation actions will be conducted. By getting all of the details agreed to in writing before the project begins, you will avoid any surprises that might arise as the project progresses. With ours and many others input, the **Texas Parks and Wildlife Department** recently released a publication titled ***"Voluntary Conservation Practices - Balancing Wildlife Conservation and Oil and Gas Development in the Eagle Ford Shale Region of South Texas"***. We would urge you to request a copy from TPWD or follow the link to the left. Follow the guidance provided as you develop your SUA.

When oil and gas activities commence on your ranch, there are several big-picture concepts to be aware of.

First, many non-native grass problems associated with oil and gas exploration start with and along road construction.

Non-native grasses are widespread along existing roads throughout South Texas. Their seeds are very effectively collected by and transported from one site to another by truck the grill or undercarriage. Take a look at your radiator if you doubt this. Many ranches are requiring all equipment and vehicles entering their properties to be

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washed or cleaned in some way to minimize introduction of non-native grass seeds. If your ranch does not have non-native grasses at present this would be a wise requirement.

Another important piece of the restoration puzzle often over looked in early stages of oil and gas exploration is soil handling.

Soils have a complex web of structure, biology, and chemistry, and where native habitats are concerned, soils are not easily replaced or remediated if lost, mixed with subsoil, or otherwise damaged. Great care needs to be taken in order to maintain top soil. Results from research conducted near Cotulla showed that in areas where soil layers (e.g. topsoil and subsoil) were mixed, resulting soil pH and salinity were well above tolerable levels for native plants to establish and grow. In other areas we have found clear evidence of soil layer mixing, often resulting in a large proportion of subsoil occurring near the surface. These are not viable seedbeds because of their poor soil structure and chemistry, making these areas very difficult, if not impossible to revegetate with native plants. Soil testing before and after oil and gas activity to clearly identify soil changes as a result of oil and gas activity is prudent to protect your interests from a ranching and habitat standpoint. Whenever possible, remove the topsoil from exploration or construction sites, and store it in a safe location until oil field work is complete. This is the best way to mitigate soil damage.

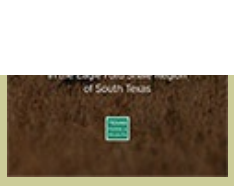
Planting Methods

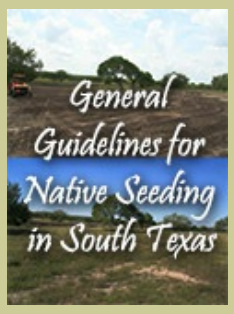
When it comes time to reseed native plants there are generally 3 planting techniques to consider. These are drill seeding, hydroseeding, and broadcast seeding.

Broadcast seeding is the cheapest application method, ranging $25-50 per acre not including seed costs. Unless you specify otherwise, this planting technique is what is used about 90% of the time by oil field operators. A common misconception regarding broadcast seeding is that it is a simpler planting method than drilling or hydroseeding. In reality, correct calibration of a broadcaster is more difficult, and can result in seeding rates that are less precise than with a drill or hydro seeder. Another shortfall of broadcast seeding is that a portion of the seed is wasted. In our experience, seed planted by broadcast methods commonly ends up planted too deeply in powdery soils or too shallow in hard-packed soils. If broadcast seeding is conducted, more effort is needed to insure a proper seedbed. For small planting sites, seed is often wasted by being thrown outside of the disturbed area that needs seeding. Another downfall of this application method is that it generally requires two passes over the site with a tractor, one to plant and another to pack or drag the seedbed to cover the seed. Time is money in the oil field, and this may be a good discussion point.

As far as price is concerned, **drill seeding** is the middle of the road planting technique, averaging $40-100 an acre, not including seed cost. An advantage of drill seeding is that it requires just one trip over the site with a tractor. Good drills (those designed for use with native seeds) ensure almost all the seed is placed at the correct depth in the soil and is placed directly on the disturbed area. That assures the best chance of germination and growing when conditions are right. The downfall of this method is that not just any seed drill will work with native seed mixes. Drills designed to plant fluffy native seeds are needed-brands include Truax, Great Plains, and Tye. Proper calibration for the specific mix of seeds being used on your site is imperative.

Hydroseeding is a very expensive planting method, costing upwards of $500 per acre not including seed costs. A benefit of hydroseeding is that it is a one pass seed and





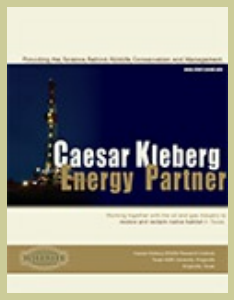
Recommended General Seed Mixes for the Eagle Ford Shale

Mix of Erosion Control of Roadsides and Fracks Pits

Mix for Lowland Sites

Mix for Upland Sites

Support our Eagle Ford Shale Research



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erosion control application. Hydroseeding applies a mixture of seed, water, and mulch material to the planting site. It is especially useful for areas where use of a tractor is not feasible, such as steep slopes, ramaderos, or frac-tank dams. There are several companies that have hydroseeders for rent, or that do custom work throughout the Eagle Ford. The limitations of hydroseeding obviously include cost, as well as the need for large quantities of water, mulch material, and labor. All of these can create logistical problems if the planting area is not accessed by roads or if water is not readily accessible.

The real question is, what works best? In short, we have found that all three methods described above can produce comparable results if done correctly. In experiments conducted by STN and near Three Rivers and Kingsville, we compared all three planting methods in combination with typical native seed mixes for the Eagle Ford region. In these experiments, there was no statistical difference in native- seeded vegetation establishment between the three planting techniques. At the Three Rivers study we were able to establish an average of 3 native grass plants per square foot and in Kingsville we were able to establish 1.2 plants per square foot across planting techniques. These plant densities easily meet accepted revegetation success standards in South Texas.

We present these recent results with a caveat regarding broadcast seeding. Many past research projects and published guidance regarding revegetation methods indicate broadcast seeding often falls short of drill or hydroseeding unless excellent seed bed preparation is done prior to seeding. In our recent projects, we had excellent seedbeds to plant into. However, all seedbeds were representative of most oil and gas-related revegeation sites. In poorer seedbeds, results could differ.

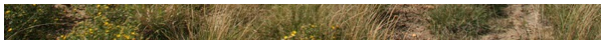
Drill seeding results were excellent, as expected. Over the course of many rangeland seeding projects in South Texas, we have consistently documented that using a specialized native seed drill in combination with STN released seeds is the best restoration seeding method.

Surprisingly to some, these projects clearly demonstrated that hydroseeding is also very good method for reestablishing native vegetation in oil and gas fields in South Texas. Obviously because of cost, hydroseeding is limited to use in areas that are highly erodible, environmentally sensitive, or not easily planted using drill or broadcast methods. On sites with severely altered soil chemistry or soil mixing, hydroseeding may be the best option. In another experiment conducted near Cotulla, we evaluated native seed mix establishment between drill seeding and hydroseeding on mixed-soil pipeline right of ways. In these mixed soils scenarios, hydroseeded plots had 2-3x better establishment than drilled plots in the first few months after planting. Another example of where hydroseeding has been tested and works well in combination with native seeds is on the steep slopes of frac tank dams and visual obstruction berms on pipeline right of ways.

Seed Selection

Last but not least, and according to our research, more important than the seeding method used, is the selection of native plant species included in the restoration planting mix.

It is imperative in all revegetation projects to select the correct species of native plant for each planting site. In our past seeding research, we found a strong correlation between quick cover



of native plants and long term restoration success. This is particularly true in areas where exotic grasses are problematic. In our recent planting projects, we identified a number of standout seed releases for rapid vegetative cover on Eagle Ford sites. The top 3 seed varieties in our planting trials have been **Dilley Germplasm slender grama**, **Kinney Germplasm false rhodesgrass**, and **South Texas Germplasm sideoats grama**. Other species that have worked well in our Eagle Ford experiments include **Van Horn green sprangletop**, **Oso Germplasm Halls panicum**, **Maverick Germplasm pink pappusgrass**, and **Webb Germplasm whiplash pappusgrass**. The STN website has extensive guidance on seed mix selection for the Eagle Ford projects, and we are always glad to provide specific seed mix recommendations upon request. A planting date and GPS coordinate for the site in question are all we need to provide this information to you.

The Eagle Ford Shale and other emerging oil and gas plays are impacting many thousands of acres of wildlife habitat in South Texas. If you share our concern for learning how to restore native plants to these sites, consider supporting STN's Eagle Ford Shale research. There is no doubt we have much left to learn, and there are many acres of restoration to come.

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