

LIBERTY COUNTY SOIL HEALTH TARGETED IMPLEMENTATION PLAN

CHESTER USDA-NRCS FIELD OFFICE

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TIP Summary

This TIP will target dryland crop producers in Liberty County who are pioneers of soil health. By defraying costs and short-term setbacks typical of any system change, this TIP will encourage producers to implement broad soil health changes and create a new norm for Liberty County crop production. By eliminating fallow, increasing crop diversity, and dramatically increasing the residue cover on fields after harvest, this TIP aims to increase soil aggregate stability and resiliency. The focus of this TIP will be on a maximum of 640 acres of each producer’s operation, but the impact of the TIP can safely be extrapolated to all acres they operate. While soil health is a combination of many resource concerns, this TIP will focus on soil *aggregate instability* as the primary resource concern, and *terrestrial habitat for wildlife* and *organic matter depletion* as secondary resource concerns. Applications for this TIP will be accepted across Liberty County for three years (FY2022-FY2024) and result in five-year contracts. **Total financial ask is \$6 million. \$915,982 was funded in 2022 (4 contracts), asking \$3,375,00 for 2023 (15 contracts), and \$2,700,000 for 2024 (12 contracts).**

Geographic Focus

The scope of this Targeted Implementation Plan (TIP) is geared more towards encompassing innovative producers who can lead a broader scale soil health movement than a particular geographic location. To do this we are proposing a county-wide boundary. County-wide TIPs can be perceived in some instances as being too generic, but as this TIP is focused on cloud seeding producer innovation rather than locality, we feel this is justifiable. Initially, the TIP focused on the geographic area encompassing the majority of interested producers, an area including and surrounding (with a 5-mile buffer) the Cottonwood Creek watershed. After discussion and reviews, we feel a county-wide TIP will best serve the resource concern need and better facilitate producer involvement. The chosen watershed covered much of the county anyway but only served to exclude rather than include potential involvement and limit the possibility of growth. The need for this TIP is large scale as is. We believe the small size of Liberty County should be taken into consideration, as well as the widespread distribution of interested producers across the county and their ability to influence their neighbors who might’ve been excluded if we chose a watershed area. Over the three years of the TIP proposal, it is projected that 22% of the dryland crop acres in Liberty County would be affected, the projected ripple effect county-wide will be even more widespread.

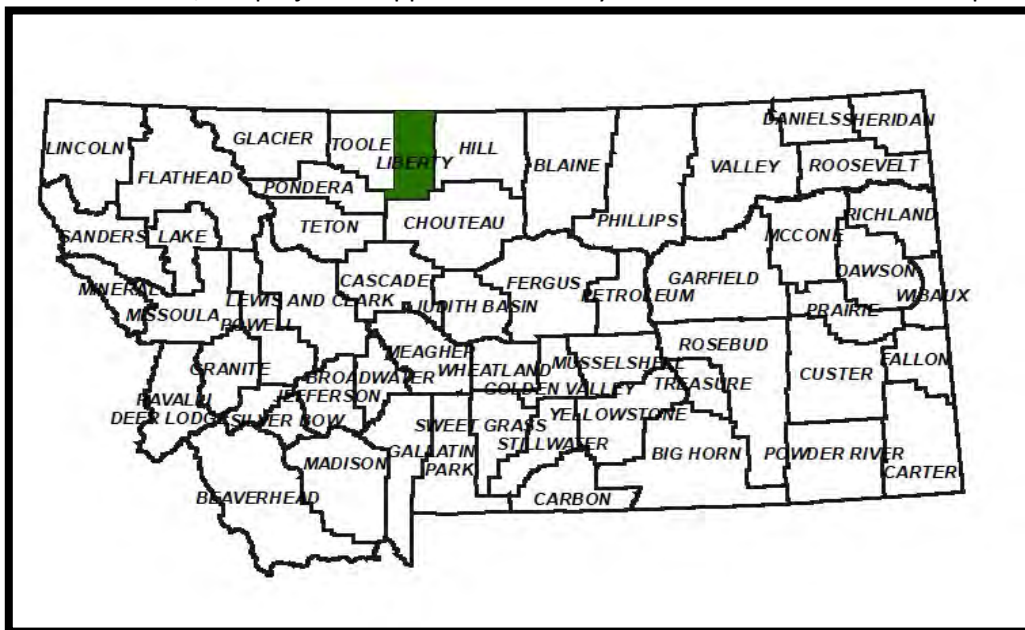
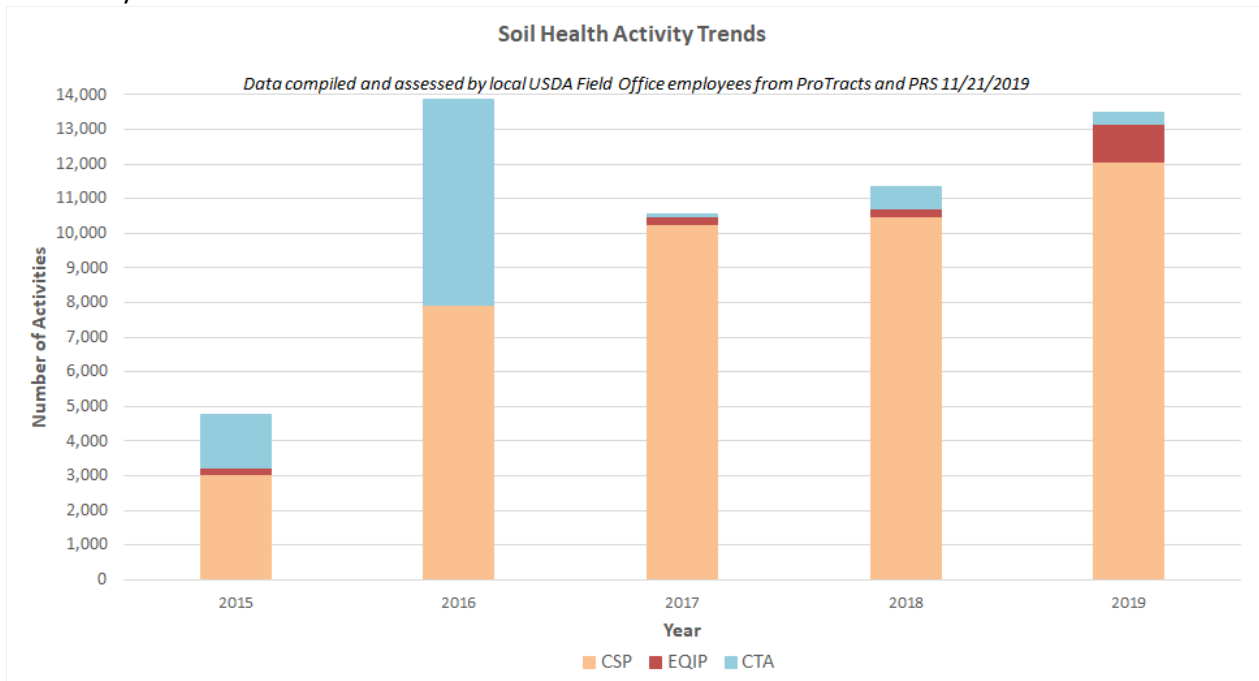


Figure 1 Liberty County within the state of Montana. Proposed TIP boundary is county-wide and includes 593,532 acres of non-irrigated cropland.

Goals and Objectives

Soil health was a main priority identified in the Liberty County Long Range Plan, with aggregate instability, organic matter depletion, and soil organism habitat loss being the top resource concerns identified by the local working group. Producers have shown innovation by attending workshops and embracing programs such as the Conservation Stewardship Program (CSP) and the Environmental Quality Incentive Program (EQIP), and through Conservation Technical Assistance (CTA) to capture this focus. The following graph shows this positive trend through the application of direct and indirect soil health activities such as: conservation crop and resource conserving crop rotations, no-till, cover crops, deep rooted crops, converting cropland to grass based agriculture, and through assessment and tracking of benefits via soil health nutrient tools. Application of soil health practices through EQIP has been increasing but shows room for improvement. Focusing effort and financial opportunities on soil health improvements now will build upon current momentum in the county.



Previous efforts by NRCS have focused on adoption of one or two soil health principles rather than a full system, which is necessary to realize long-term improvements to aggregate stability. The problem with only implementing a few principles is that producers don't see the benefits to the soil or their production system. If they don't see positive results quick enough, they tend to abandon everything and go back to what they know and have done. This TIP will provide the incentive Liberty County producers need to implement soil health practices. It will showcase producers at the forefront of improving soil health in the county and they will serve as a model for other producers beginning to adopt soil health principles. This system approach aims to improve soil health with the additional benefit of increasing wildlife cover and habitat.

Focusing on a maximum of 640 acres of each producer's farm accomplishes several factors: it provides cost share incentive for producers to change their system, allows for several rotation options, and is adequate acreage to monitor improvement in soil aggregate stability. Once a producer has committed to this system change, it is likely to be adopted on all their non-contracted acres as well. As mentioned above, this TIP is projected to impact 22% of the county's non-irrigated cropland with the interested producers, that number may be an underestimate depending on farm-

sizes enrolled. A goal to impact 25% of dryland crop acreage in the county is not far-fetched.

Overview/Background Information

Although NRCS has been actively promoting soil health principles for several years, few producers have adopted cropping systems that incorporate all five principles: minimize disturbance, keep a living root in the soil, diversify crops, cover the soil, and incorporate livestock where possible. The 5th principle, incorporating livestock, is not as vital as the other four but has been proven to move the soil health needle faster. Late season cover crops also provide excellent nutrition for livestock and wildlife. NRCS has provided incentives for no-till and cover crops for years, but we have never been able to offer program benefits that encourage producers to farm using a complete soil health system approach. Many producers in Montana have dabbled in soil health by trying one or two principles but these efforts have only provided mixed results. In some cases, the results have been negative and because of this, producers have abandoned the whole idea. It is only through adopting all four soil health principles and the fifth, where possible, that real results can be achieved. The overall purpose of this TIP is to target producers that are very interested and have received education regarding soil health methods of farming but have not yet applied all the principles on the land. The payment rates offered through EQIP will provide incentive for the producers to take the risk of changing their operation to a soil health focus. It is also important to do so now while there is abundant support and enthusiasm to adopt better soil health practices, and while we are witnessing large scale resource issues such as wind and water erosion, soil compaction, crop pests, disease, soil acidity, and chemical resistance by weeds, all of which relate back to the health of the soil.

Problem Statement

The specific resource concern that will be addressed by this TIP is soil aggregate instability. Management-induced degradation of water stable soil aggregates results in destabilized soil carbon; surface crusting; reduced water infiltration, water holding capacity, and aeration; depressed resilience to extreme weather; increased ponding, flooding, soil erosion, and plant stress; and reduced habitat and soil biological activity (National Resource Concern List and Planning Criteria). All over Central Montana we see these issues that all correspond to decreased aggregate stability. Currently, the main crop rotation in Liberty County is small grain/chemical fallow. With the land being left idle in fallow every other year, there is very limited soil cover, which increases soil erosion and reduces habitat and soil biological activity, decreasing aggregate stability. Soil biology create soil aggregates, but they need food and habitat to be able to complete this function. Without a diverse rotation that provides food for the biology, soil aggregation slows or ceases. Fallow acres have little to no soil cover and soil temperatures can increase so much that biology die, even when no-tilled. Along with fallow, hoe drills are commonly used. These drills create soil disturbance that degrades soil biological habitat and soil aggregate stability. The combination of fallow, lack of diverse rotation, and the use of hoe drills has led to decreased soil aggregation which in turn has led to large scale wind and water erosion that is visible each year.

Several secondary resource concerns are occurring in Liberty County because of decreased aggregate stability. The crop/fallow rotation has decreased soil organic matter and has required an increase of fertilizer to realize the same production they are accustomed to. During the fallow year excessive amounts of chemicals are also being used to treat weeds and are causing an influx of chemical resistant weeds. Operators, not understanding soil aggregation, have opted for the quick fix and have returned to tillage during the fallow year on large blocks of land. If this continues, we will see wind and water erosion that could match that of the Dust Bowl. Not to mention huge issues with program compliance that would have a negative impact on field office workload. We are already witnessing whistleblower complaints and more field visits on FSA flights. Recently, highways in the area have even been closed due to soil blowing. Also impacted by tillage and lack of soil cover are the wildlife species that depend on cover for protection. Because the current rotation lacks crop diversity, landowners in our area also have a myriad of pest and disease issues. This has resulted in an increased amount of fungicide and pesticide use. These chemicals wipe out the ecology in the soil and pollinators which drastically affects the stability of soil aggregates.

Proper soil aggregation forms the foundation for all ecological processes and can only be realized on cropland when all soil health principles are adopted. When we improve the health of the soil, aggregate stability along with the other issues improve over time. This has been proven around the country. Producers that try one or two soil health practices without fully implementing a soil health centric farming system are often disappointed with the results (e.g. reduced initial yields, no visible soil improvement). If NRCS does not encourage and offer financial incentives to producers to adopt a complete system, they are less likely to take the risk. With negative results, producers are reverting to what they have always done. The reality is that dabbling in soil health does not provide positive results and the real problem is that many producers don't have a complete understanding of the system. Producers also struggle economically when adopting these changes and there is always risk involved with making large scale management shifts.

Decreased soil aggregate stability is present nation-wide and Central Montana and Liberty County are no exception. This TIP is difficult to define geographically because the solution requires a paradigm shift in the way producers think about crop production and long-term sustainability of agricultural land. Consequently, the focus of this TIP must be on the producers that are willing to adopt a complete soil health centric system of cropping because they understand the function of soil. The Great Falls area has hosted Soil Health Workshops for the past nine years and Liberty County has held soil health field tours as well. We have a growing contingency of producers throughout the area that attend soil health workshops every year. The producers that we will focus on in this TIP have a good basic soil health knowledge; many of them are ready, willing, and able to move to the next step by implementing the Full Soil Health Meal Deal. These innovative producers in Liberty County will then serve to "inoculate" their neighbors and colleagues by demonstrating the advantages of farming with a soil health-oriented system. Liberty County will demonstrate the success of this TIP by having local field tours prior to the third year of this TIP. The Central Montana Area will have enough monitoring data by year three to provide good education for other producers in the area.

Goals and Objectives (Desired Future Conditions)

The main measurable outcome we will monitor is the increase of soil cover. With all the practices we are installing we can expect a 10-20% increase in soil cover. Practices that keep soil covered physically protect it from erosive forces that disrupt aggregation, while also building organic matter. Any practice that increases soil organic matter, and consequently biological activity, also improves aggregate stability. With increased aggregate stability we can also expect an increase in soil water infiltration. Increased residue from stripper header stubble will provide improved wildlife cover by leaving over 18 inches of grain stubble height through the winter. It provides animals with breeding, nesting, hiding, loafing, sleeping, feeding, and traveling cover. One or more types of cover such as grain stubble along with cover crop residue in the same area greatly enhances the survival and reproduction rate of animals. The desired future condition would be an increase of the soil biology, and we would hope that producers could start to realize a decrease of inputs which would make their operations more sustainable long-term.

To increase aggregate stability the following conservation practices will be installed on up to 640 acres: (328) Conservation Crop Rotation, (329) Residue and Tillage Management – No till, (340) Cover Crops, (809) Conservation Harvest Management, and (590) Nutrient Management. Producers will initiate a cropping rotation that will eliminate fallow and include at least three of the four crop types. Crop types include warm and cool season grasses, and warm and cool season broadleaves. As part of their rotation, they will be encouraged to incorporate a cover crop that will include a minimum of eight species and will be required to grow for the entire growing season. Grazing the cover crop will not be required but will be encouraged. Some producers in the TIP Area have no access to cattle or do not have fence in place, so we will not be requiring full implementation of the fifth principle, however it will be encouraged where possible. Producers will be required to seed crops every year with no-till disc drills that have a STIR value rating less than 10. For the years that small grains are part of their rotation, we will use Conservation Harvest Management to

provide incentive to leave stubble heights at harvest greater than 18 inches. To determine benchmark soil conditions prior to installation of the practices and to monitor outcomes throughout the contract we will apply Nutrient Management. Nutrient Management will include soil testing each year to include a standard soil test, Haney test, wet aggregate stability test, and phospholipid fatty acid (PLFA) test. These tests will be completed each summer at the same time each year. These goals will be achievable in five years and the expected outcomes are as follows:

Primary Goals:

- Increase in soil aggregate stability via 10-20% soil cover increase – measured with a 100 ft transect every spring
- Increase in wildlife cover from 8 inches to 18 inches – height measurement of grain stubble
- Increase in soil organic matter – Haney test showing positive trend in Organic Matter, %LOI

Secondary Goals:

- Increase in soil biology – PLFA test showing increase in Total Living Microbial Biomass
- Increase in biological diversity – PLFA test showing increase in Functional Group Diversity Index
- Increase in soil carbon – Haney test showing increase in Total Organic Carbon
- Faster soil water infiltration rates – measured with infiltration rings in the first and last years

Proposed Alternatives and Actions

Proposed Action Alternative:

1. Including a cover crop, utilizing a diverse crop rotation, use of a no-till drill, and leaving as much residue on the field as possible.

No Action Alternatives:

1. Installing a cover crop as part of a chemical fallow-wheat rotation but not changing the rest of the rotation. This does not increase soil biological habitat over the long haul, so aggregate stability does not change.
2. Installing a diverse rotation but still using implements that disturb the soil. Disturbing the soil destroys microbial habitat and aggregate stability.
3. Using a no-till drill but not changing the crop rotation. The crop rotation is crucial for the habitat of the biology which directly relates to the aggregate stability.

The No Action alternatives are just a few of the systems that have been tried in Liberty County by producers dabbling in one or two soil health principles over the last five years. They have not achieved the goals listed above which include increased aggregate stability, soil cover, organic matter, soil biology, biological diversity, soil carbon, wildlife cover, and soil water infiltration. The preferred alternative is the one proposed by this TIP that will address at least four of the soil health principles.

Partnerships

- Liberty County Conservation District- Will support this TIP with education and outreach via newsletters and summer field tours.
- Ducks Unlimited- Can provide producers with additional 50% cost share for cover crops if they fall within priority areas of the county.
- Natural Resources Defense Council- May fund soil health sampling on rangelands (via SWCS) to provide soil test results to compare and strive to achieve on cropland.
- Prairie Pothole Joint Venture- Will help to synthesize soil test data for public outreach.

Conservation Practices Needed

- **328, Conservation Crop Rotation**: This practice will be used to increase diversity in cash crops as well as eliminating fallow years to keep living roots in the soil and improve soil microbial habitat. When soil biological habitat increases so does soil aggregate stability. At least three of the four crop types will be required in the crop rotation. A diverse warm season cover crop mix can often be used to achieve the required crop types.
- **329, Residue and Tillage Management**: This practice will be implemented to reduce soil disturbance. Less disturbance keeps biological habitat intact and allows for the creation of aggregates. This practice will incentivize the use of equipment that has a STIR rating less than 10.
- **340, Cover Crop**: This practice will be used as appropriate in some rotations to increase diversity and maintain living roots in the soil. It will be recommended that these cover crops are grazed by livestock, but it won't be required as not all producers have access to cattle. A minimum of an 8 species full season cover crop mix will be required. Cover crops won't be sprayed out early in the growing season to maximize the potential to improve microorganism habitat.
- **809, Conservation Harvest Management**: This practice will be applicable on small grains that are harvested using innovative techniques that leave 18 or more inches of stubble standing after harvest. Stubble will not be allowed to be grazed to maximize soil cover as well as wildlife winter cover. Subsequent crops will be seeded directly into this standing stubble.
- **590, Nutrient Management**: This practice will be used to test soils and gather data to determine benchmark conditions and measure soil outcomes throughout the life of the contract. Soil testing will include the Haney and PLFA tests, standard N-P-K soil test, aggregate stability, and infiltration rings.

Implementation

Applications for this TIP will be accepted across Liberty County for three years (FY2022-FY2024) and result in five-year contracts. A typical contract will be cost-shared at \$225,000. The first year four producers were funded. Based on producer interest NRCS estimates fifteen producers will participate in the second year, and twelve producers the third year of the TIP. This projects a financial obligation for the TIP of \$915,982 year one, \$3,375,00 year two, and \$2,700,000 year three. A sample crop rotation might look like this: **Spring Wheat- Pulse- Winter Wheat - Cover Crop- Brassica**. Residue Management (329) stipulates low soil disturbance i.e. seeding the crop with a disk drill. This will be done each year but EQIP only allows the payment for the same practice a maximum of three times on the same acres (three years). The 328 Conservation Crop Rotation practice, similarly, may only receive payment for three years on the same acres. It will obligate producers to a diverse cropping rotation sequence and requires no fallow years in the rotation. The Interim Practice code 809 ties a contract holder to harvesting the small grain crops (not required for pulse, oilseed, or other crop types) to be harvested at a minimum height of 18 inches, hence the use of a stripper header is necessary for harvest. The rotation sequence will dictate when this practice will be implemented and paid, and could be up to three years. The cover crop, practice code 340, will be paid the years a cover crop is grown and can only be paid once per acre. Nutrient management (Practice code 590) will be scheduled three years but completed annually to track changes to the soil and demonstrate a trend in the soil health over the course of the contract.

Liberty County Soil Health TIP		Producer: Jane Doe			Acres: 640 maximum	
Cost Estimate (based on FY2023 EQIP Cost Share Rates)						
* Management practices cannot be cost shared more than 3 times per acre per contract						
Practice Code	Practice	Pay Rate	Extent	Unit	NOTES	
*329	Residue and Tillage Management	\$16.57	640	ac	*Must use drill for seeding of all crops.	
*328	Conservation Crop Rotation	\$10.51	640	ac	*Crop rotation requiring 3 of 4 crop types.	
*809	Conservation Harvest Management	\$59.67	640	ac	*Use of stripper header required on small grains.	
340	Cover Crop	\$76.67	640	ac	Optional, used to achieve warm season crop type. Can be grazed. Cannot be hayed.	
*590	Nutrient Management	\$6.92	640	ac	*Soil sampling completed every year.	
Practice Code	Contract Year					Total Payment/Practice
	1 (FY2024)	2 (FY2025)	3 (FY2026)	4 (FY2027)	5 (FY2028)	
329	\$0	\$10,605	\$10,605	\$10,605	\$0	\$31,814
328	\$6,726	\$0	\$6,726	\$0	\$6,726	\$20,179
809	\$38,189	\$0	\$38,189	\$0	\$38,189	\$114,566
340	\$0	\$0	\$0	\$49,069	\$0	\$49,069
590	\$0	\$4,429	\$4,429	\$4,429	\$0	\$13,286
Annual Payment	\$44,915	\$15,034	\$59,949	\$64,102	\$44,915	\$228,915

The technical assistance and staff time needed from NRCS to complete this plan is included below.

1. Meet with small producer groups in the office: 2 days
2. Inventory and Planning: 2 days per producer
3. Plan and contract development: 3 days per producer
4. Soil sampling, analyze soil test results, clip for AUM's: 3 days per producer
5. Follow-up with producers: 2 days per producer per year

The individual plan implementation will be managed by the Chester/Shelby Work Unit with assistance from the State Soil Health Specialist, Great Falls Area Resource Conservationist – Technology, and the Great Falls Area Agronomist. NRCS staff will convene each year to evaluate the progress of this TIP and the soil and wildlife goals.

Progress Evaluation

The **Montana Soil Health Card** will be used to inventory benchmark conditions of the 640 acres. The Montana Soil Health Card is a tool used by NRCS employees to evaluate soil condition based on several different parameters scored in the field. Results are shared with producers to increase their knowledge of the evaluation process. The main outcome of increasing soil cover will be measured with a 100 ft transect in the spring. Trends in county wide acreage in cover as compared to fallow can also be tracked. Infiltration benchmarks and progress will be assessed with infiltration rings, taking the average of 5 infiltration rings per site. Producers will be assisted with taking the Haney, aggregate stability, and PLFA soil tests to monitor and evaluate the increase of soil microbiology every spring.

There are three parts to the **Haney Soil Test**. The first part is a **Soil Respiration** test or CO₂ 24-hour burst test which is an indicator of soil microbial activity. The more microbial life present the more CO₂ produced. The second part is **Water Extract** where total organic carbon (TOC) and total nitrogen (TN) are measured. The third part is H3A Organic Acid Extract. The organic acid extract mimics plant root exudates, a good measure of nutrient supply. Nitrogen fertilizer recommendations are lower for the Haney test because we can measure mineralizable organic N and ammonium that we normally do not analyze in a standard soil test. The **Haney Test** lets us know how active our soil is and then help improve our Nitrogen fertilizer application. **Soil Aggregate Stability** is a measure of the ability of soil aggregates

to resist degradation when exposed to external forces such as water, wind, shrinking and swelling processes, and tillage. It is a measure of soil structure and can be impacted by soil management. The Soil Aggregate Stability test allows us to monitor changes in our soils as aggregate stability serves as an early indicator of soil recovery or degradation.

The **PLFA** test gives a representation of living soil microbial biomass and allows us to identify the presence or absence of various functional groups. PLFA is a snapshot of soil community structure and abundance at the time of sampling. Bacteria, fungi, protozoa, nematodes, earthworms, etc. are all present in the soil. These organisms provide the breakdown of crop residues, store plant nutrients, create stable organic matter, and help build soil structure, leading to reduced compaction and erosion, increasing water holding capacity and allowing for deeper root structures. The relationship between different microorganisms and plants is dynamic. The ability of the soil microbial community to change provides producers with a tool to compare agricultural management techniques with respect to overall better microbial health and sustainable agriculture practices.

Outcomes

From a producer and public standpoint several long-term benefits will be realized:

- Stripper header stubble will reduce soil erosion rates, increase wildlife habitat cover, maximize snow catch and lower evaporation rates. For the public, this translates to safer roadways with reduced blowing soils, as well as more wildlife hunting and viewing opportunities with improved cover.
- No-tilling with a disc drill will result in less weed and pest pressure and helps maintain standing residue and soil aggregation. For the public, this leads to better air and water quality and for producers, reduced weed pressure means fewer chemical inputs and expenses.
- Increase in crop diversity provides potential of less disease and weed pressure while decreasing herbicide resistance, improving resiliency to drought, and creating pollinator habitat. Both the public and producer benefit as this will result in less chemicals applied, improved pollination and yields, and better air quality.
- Overall, this regenerative approach supports the production of climate-smart commodities and will provide all of us with more resilient soils and food sources, better air and water quality, and more wildlife to enjoy.

Ranking/Prioritization

Ranking Questions:

1. Does the application include a multi-species cover crop?
2. Will the applicant facilitate grazing of a multi-species cover crop?
3. How many crop types will the rotation include (not counting a cover crop)?
 - a. 4 of 4 crop types
 - b. 3 of 4 crop types
 - c. 2 of 4 crop types
 - d. 1 of 4 crop types
4. Will the applicant be implementing inter-cropping as part of their conservation crop rotation on at least half of the proposed acreage?
5. Will the applicant complete soil testing for biological analyses?
6. Is conservation harvest management (809) newly adopted in the application?
7. Will changes to the residue management result in a planned STIR rating of <10?