

Soil Health & Sustainability Training for Field Employees- Training Checklist

Course Goal: Completing this training regime will allow employees to identify resource concerns related to degraded soil function, utilize soil health principles and apply them to conservation management systems that enhance soil ecosystem functions on agricultural lands.

State Specific Trainings: will be measured on how closely they match the components and objectives outlined below. Components are those topics and subtopics that are covered in a particular module. Objectives are those key learning points and skills, from each module, that participants need to enable Soil Health integration into the conservation planning process. Time is given as an indicator to the depth in which the components and objective will be covered. Modules will be available online for comparison to and integration in state-designed materials.

Key Soil Health Component	Session Objectives	Time
<p>Module 1: Soil Health Basics</p> <ul style="list-style-type: none"> ■ Historical context of soil health ■ Soil Health Demonstrations (using local sources if possible and same soil type for all demo management comparisons) <ol style="list-style-type: none"> 1. Slake 2. Infiltration 3. Tabletop Rainfall Simulator (N strips) optional 4. Soil Water Holding Capacity Demo (optional) 5. Aggregate Stability (colander and spray bottle) optional ■ Define soil health and how soil functions and its impact on resource management <ol style="list-style-type: none"> 1. Soil health definition 2. Soil functions 3. Soil health principles 4. Link soil health to resource management 	<ol style="list-style-type: none"> 1. Define and demonstrate the importance (why) of soil health in agricultural systems. 2. Define soil health and list primary ecosystem functions 3. Understand the linkage between degraded soil function, management and resource concerns 4. Understand the forms of soil disturbance, e.g. physical, biological and chemical, and their impact on soil function 5. Introduce the soil health principles 	<p style="text-align: center;">90 min</p>

<p>Module 2: Linking Soil Biology to Soil Health</p> <ol style="list-style-type: none"> 1) Soil functions performed by soil organisms 2) Defining biodiversity <ol style="list-style-type: none"> i) Richness ii) Evenness 3) Categorizing soil organisms using three broad ecological groups. For each group describe: <ol style="list-style-type: none"> (a) Who they are (b) Where they live in soil (c) Their abundance/diversity <ol style="list-style-type: none"> i) Chemical engineers ii) Biological regulators ii) Soil ecosystem engineers 4) Biological Pathways for nutrient release <ol style="list-style-type: none"> i) Grazing, predation and mineralization ii) Brief overview of biological role in nitrogen cycle iii) Brief overview of biological role in phosphorus cycle 5) Biological role in aggregate formation and stabilization 6) Biological role of plant protection and enhancement <ol style="list-style-type: none"> i) Example of plant microbe communication and plant protection ii) Examples of symbiosis <ol style="list-style-type: none"> (a) nitrogen fixation (b) mycorrhiza 7) How to build a Tullgren/Berlese Funnel and collect soil fauna 8) Soil health principles and relation to soil biology <ol style="list-style-type: none"> i) Protect biological habitat (aggregates and organic matter) <ol style="list-style-type: none"> (a) Minimize disturbance (b) Maximize cover ii) Feed soil organisms <ol style="list-style-type: none"> (a) Maximize biodiversity (b) Maximize presence of living root 	<ol style="list-style-type: none"> 1. List soil functions performed by soil microbes 2. List the three biological functional groups used to categorize soil organisms and briefly describe the functional roles for each group. 3. For each group, list key organisms 4. Understand linkage between plants and soil biology 5. Describe how soil health principles influence soil biology and soil function 6. Define: biodiversity, evenness, richness, mycorrhizae, rhizobia, rhizosphere, Berlese funnel 	<p>60 min.</p>
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<p>Module 3A: Soil Health Planning Principles</p> <ul style="list-style-type: none"> ■ Minimize disturbance <ul style="list-style-type: none"> ○ Protects habitat ○ Maintains soil aggregates ○ Controls erosion ○ Types of disturbance ○ Identify practices & activities ■ Maximize biodiversity <ul style="list-style-type: none"> ○ Builds resilience ○ Manages pests ○ Balances soil microbial communities ○ Increases and diversifies food sources ○ Opportunity to enhance other principles ○ Including livestock as part of diversity ○ Plant diversity and why it's important ○ Compare and contrast rotations ○ Identify practices & activities ■ Maximize Presence of Living Roots <ul style="list-style-type: none"> ○ Increases rhizosphere activity ○ Protects and provides food sources ○ Scavenges nutrients ○ Provides carbon to build organic matter ○ Tap roots and fibrous roots contribute to soil structure ○ Root exudates ○ Root biomass ○ Identify practices & activities ■ Maximize Soil Covered <ul style="list-style-type: none"> ○ Prevents erosion ○ Moderates soil temperatures ○ Reduces evaporation ○ Reduces compaction from machines and livestock ○ Provides food for microbes ○ Fuels the nutrient cycle ○ Provides carbon to build organic matter ○ Identify practices & activities 	<ol style="list-style-type: none"> 1. Define and describe Soil Health (SH) principles impact on soil ecosystem functions 2. Review the SH Definition- understand key words <ul style="list-style-type: none"> ○ Continued capacity ○ Soil Functions ○ Living Ecosystem ○ Health vs. quality ○ Describe in detail each of the SH principles and how they interact to create a synergistic effect that improves soil health 3. Identify conservation practices and activities that address each planning principle for the typical agriculture enterprises across the nation. 4. Describe improvements in several Indicators of soil health that can be obtained as the soil health principles are applied. 5. Describe and demonstrate the fragile nature of gains in soil health and identify practices that can lead to rapid loss of these gains. 	<p>60 min.</p>
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<p>Module 3B: Regenerating Soil Health and Planning for a Soil Health Management System</p> <ul style="list-style-type: none"> ■ Key Soil Health Indicators <ul style="list-style-type: none"> ○ Organic matter ○ Aggregate stability ○ Water infiltration ○ Aeration ○ Available water holding capacity ○ Nutrient cycling ○ Soil biology ○ Erosion ■ Regenerative systems for soil health <ul style="list-style-type: none"> ○ Improve soil function by adopting systems of soil health management practices and activities ○ Quality of how practices/activities are implemented affects benefits obtained 	<ol style="list-style-type: none"> 1. Describe what soil health indicators are and which ones are used to evaluate soil health in the field and/or laboratory. 2. Describe how soil health indicators provide information about a range of critical soil processes, and build upon each other for an understanding of soil health status 3. Describe how key soil health indicators are linked to the soil health principles. 4. Discuss soil organic matter, the various SOM pools and their role in soil health. 5. Discuss aggregate stability, its role in soil function and how it can be affected by management. 6. Discuss how nutrient cycling is affected by degraded soil function 7. Describe the “Regenerative Systems” for healthy soils 	<p>60 min.</p>
<p>Module 4: Rethinking the Management Paradigm</p> <ul style="list-style-type: none"> ■ An Ecological Framework for Management ■ Soil Ecological Engineering ■ SHMS Enhance Ecosystem Processes ■ Soil is a Complex Living Factory ■ Areas of Influence Resulting from Biological Activities Through Ecological Succession ■ Spheres of Influence on Soil Function 	<ol style="list-style-type: none"> 1. List the differences between modern agricultural systems and ecological systems. 2. Describe the 4 ecosystem processes necessary for food and fiber production 3. Define ecological succession – plant succession and biological succession 4. Describe areas of influence in a soil profile that affect soil function. 5. Briefly explain key nutrient cycle processes in healthy soils, e.g. mineralization & immobilization, carbon cycle, nitrogen cycle 6. Introduce the role that healthy soil play in pest management 	<p>60 min.</p>
<p>Module 5: Soil Health Farm Visit</p> <ul style="list-style-type: none"> ■ Soil Health Management Practices and Activities <ul style="list-style-type: none"> ○ Conservation Crop Rotation (328) ○ Cover Crops (340) ○ No-Till (329) ○ Nutrient Mgt. (590) ○ Pest Mgt. (595) ○ Prescribed Grazing (528) ○ Others as locally applicable ■ Soil Health Assessments (In-Field) <ul style="list-style-type: none"> ○ Surface condition & residue 	<ol style="list-style-type: none"> 1. Observe healthy soils in the field under various agricultural systems 2. Discuss how farm manager are incorporating soil health principles into their operations, e.g. no-till, cover crop, intensive grazing, etc. 3. Discuss what constitutes high quality soil health management practices, activities, and systems 4. Complete an in-field soil health assessment to identify resource concerns 5. Develop some management alternatives based on SH assessment 	<p>480 min.</p>

<ul style="list-style-type: none"> ○ Compaction ○ Water infiltration ○ Aggregate stability ○ Earthworm count ○ Soil temperature ○ Root & shoot evaluation ○ Color (SOM) ○ Smell 		
<p>Module 6: Implementing a Soil Health Management System</p> <ul style="list-style-type: none"> ■ Key components of practices and activities to develop a quality soil health management system (SHMS) ■ Practices that complement other practices in a system ■ Overcoming barriers to implementing SHMS ■ Case studies : Developing SHMS recommendation to overcome identified limitations <ul style="list-style-type: none"> ○ Implementing specifics of practices and activities 	<ol style="list-style-type: none"> 1. Describe the interaction, dependency, and synergy among practices within a cropping or grazing system 2. Recognizing barriers to implementing practices and activities that are components of a soil health management system 3. Describe entry phase strategies to develop practical SHMS for cropping/grazing systems for various regions 	90 min.
<p>Module 7: Cover Crop Management</p> <ul style="list-style-type: none"> ■ Cover crop benefits and impact on soil function ■ Consideration for successful cover crop planning <ul style="list-style-type: none"> ○ Goal/purpose/benefit to be achieved ○ Timeframe ○ Site prep/ early weed control ○ Impact of residual herbicides ○ Seeding and termination methods ○ Nutrient cycling (C:N ratio) ■ Designing multi-species cover crop mixes to achieve specific benefits <ul style="list-style-type: none"> ○ NRCS planting standards for rate and variety ○ Seeding rates (based on plant species and biomass objectives) ○ Cover crop calculator(s) ○ Tips for success ○ CC species/families 	<ol style="list-style-type: none"> 1. Identify management strategies to integrate cover crops into soil health management systems 2. Discuss the impact that cover crops on soil functions, e.g. water infiltration & availability, nutrient cycling 3. Identify benefits of cover crops in agricultural systems. 4. Understand key concepts for successful cover crop management, including planting, termination and species selection. 5. Design a cover crop (mono and multi-species) strategy to address identified resource concerns 6. Discuss key concepts to trouble shoot problem cover crop plantings 7. Discuss differences in cover crop planning and management across various geographic regions. 	90 min.

<ul style="list-style-type: none"> ■ Trouble shooting cover crop problems <ul style="list-style-type: none"> ○ Herbicide carry over ○ Crop Insurance termination guidelines ○ Selecting CC to address resource concerns ■ Examples of CC in various cropping systems <ul style="list-style-type: none"> ○ CC in various moisture regimes ○ CC in different cropping systems ○ Gaging success of CC planting 		
<p>Module 8: Grazing management to improve soil health</p> <ul style="list-style-type: none"> ■ Incorporating soil health principles into a grazing systems <ul style="list-style-type: none"> ○ Minimizing grazing disturbance ○ Diversity is critical ○ Managing to keep a living root growing ○ Keeping the soil covered ■ Grazing principles that can improve soil health <ul style="list-style-type: none"> ○ Rest periods ○ High density stocking ○ Grazing cover crops ■ Understanding the impact of manure ■ Grazing impact on nutrient cycling <ul style="list-style-type: none"> ○ Fast vs. Slow cycling ○ Effects on plant growth 	<ol style="list-style-type: none"> 1. Identifying management strategies to integrate grazing into soil health management systems 2. Link soil health principles to pasture or range land health principles 3. Discuss the impact of grazing on soil health and function, e.g. herd impact, manure distribution 4. Gain an understanding of stocking density and its importance to improve soil health. 	75 min.
<p>Module 9: Economics of Change</p> <ul style="list-style-type: none"> ■ Economics information for the farmer vs. for policy – the erosion example ■ Value of improving soil health, reducing risk and building resilient soils <ul style="list-style-type: none"> ○ Increase infiltration and water holding capacity ○ Improve nutrient cycling ○ Increase soil organic matter ○ Build resilience and reduce risk ■ Costs and benefits of soil health improving practices <ul style="list-style-type: none"> ○ Cover Crops ○ No-till 	<ol style="list-style-type: none"> 1. Discuss the economic benefits of improving soil health, reducing risk and maintaining production efficiencies 2. Identify soil health indicators that show reduced risk, leading to more resilient soils. 3. Gain an understanding of the cost of poor soil function, e.g. low water holding capacity, poor nutrient cycling, high risk 4. Discuss the value of increasing soil organic matter and its role in improving soil function. 	60 min.

<ul style="list-style-type: none"> ○ Nutrient Management ○ Pest Management ○ Prescribed Grazing 		
<p>Module 10: Overcoming Barriers to Implement Change</p> <ul style="list-style-type: none"> ■ Soil Health Demos <ul style="list-style-type: none"> ○ Using them to change paradigms ○ Key points to emphasize ■ Adoption-Diffusion Model <ul style="list-style-type: none"> ○ Stage of adoption ○ Adopter categories for community ■ Let's Strategize for Change <ul style="list-style-type: none"> ○ Involving innovative producers in peer-to-peer learning ○ Involving partners ○ Learning from and leveraging others' successes 	<ol style="list-style-type: none"> 1. Effectively communicate key soil health messaging 2. Understand how change take place 3. Organize a local soil health community in your work area 4. Formulate a plan to build a support network 5. Leverage local resources 	<p>90 min.</p>