# Healthy Soils, Healthy Region:
# A summary of regional vision and priorities for soil health

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# Executive Summary: Priority Themes from the Healthy Soils, Healthy Region Workshop

The Healthy Soils, Healthy Region multi-state event, was held March 12-14, 2019 in Pendleton Oregon, engaging with 151 stakeholders representing agricultural professionals and others. A workshop summary provides additional detail of the workshop and agenda. Attendees collaboratively identified regional soil health priorities through facilitated break-out discussions, a large group discussion, and a farmer panel. Several overarching soil health themes were identified:

1. ***Metrics***
    a. Develop baseline and benchmarks for our region and cropping systems that are:
        i. Universally accepted, inexpensive, and easily utilized.
        ii. Easy to interpret and providing management-relevant guidance.
2. ***Research and Innovation***
    a. Continue work focused on soil health (strategies, specific barriers, challenges, etc.) in specific and diverse production systems relevant to our region.
    b. Continue and accelerate research for and with producers focusing on field trials, case studies, etc. with a focus on empowering early adopters.
    c. Emphasize economic analysis (return on investment), both on the field scale and in the community, relating to measurable ecosystem services.
    d. Advance scientific frontiers relating to soil health, including the soil microbiome, and the links between soil health, plant health, and human health.
3. ***Economics, Finance, and Policy***
    a. Develop scientifically defensible methods that measure short- and long-term economic impacts in ways that connect with agricultural producers, and the public, who all consume food and accrue the public benefits of soil health?
    b. Maintain and increase financial incentives for producers to experiment with new practices to reduce risk and encourage innovation.
    c. Generate data and methodologies for collecting data over time relevant to the impact of soil health strategies on risk reduction, to use for communication to insurance programs, bankers, and others.
4. ***Engagement, Networks, and Collaboration***
    a. Enhance communication across sectors and jurisdictional boundaries to keep stakeholders trained and informed (i.e., producers, technical advisors, industry, university personnel, etc.).
    b. Collect, utilize and share information and demonstrate progress (e.g., farmer success stories, existing projects/programs, events, successes, etc.) through listserves, networks, clearinghouse or other formats with a variety of stakeholders.
    c. Build a soil health toolbox that gives a matrix of options for issues, metrics, practices that fit individual needs.

d. Highlight various stakeholders working with producers to create marketing strategies and articulate a unifying message on soil health for consumers to generate marketplace valuation.

This document has additional detail on each of these themes.

## Facilitation Summary

*A vision of success, looking forward to the next 5 – 10 yrs. We will have succeeded when we have achieved:*

- ***Economic and Social Benefits***
    - Communication among farmers and stakeholders discussing soil health benefits and profitability. Discussions have progressed to new techniques instead of principles.
    - Adoption of known soil health practices is widespread and "automatic". Equipment for no-till is easily accessible/affordable.
    - Economic improvements are experienced by producers via soil health practices. Soil health is valued in the marketplace and supports thriving businesses and communities.
    - Healthy food is grown sustainably in a system rooted in soil health.
- ***Agricultural System Improvements Ecological Resilience***
    - Erosion reduced, in turn decreasing dust storms, road closures, and soil runoff.
    - Water quality improved through lowered nutrient and sediment loads.
    - Water filtration and storage increased, creating better drainage in winter and drought resistance in summer.
    - Soil organic matter increased.
    - Resiliency to climate stressors, leading to more stable crop yields.
    - Disease, pest, and invasive weed pressure reduced.
- ***Metrics/Measurements/Research*:**
    - Metrics and measurements have been developed that are cheap, universally accepted, relevant to specific cropping systems, and can be easily used to inform management decisions.
- ***Practice Changes*:**
    - Grazing/livestock practices improved through the integration of crops and livestock or crops and organic wastes.
    - Soil amendment knowledge and adoption increased and accepted within soil health initiatives (i.e. biosolids, compost, biochar, other organic materials).
    - Fertilizers and Pesticides are reduced with stable yields.
    - Cover Cropping systems relevant to PNW cropping systems are developed and adopted.
    - No-till/reduced tillage practices are widely adopted.
- ***Policy***
    - Policy approaches emphasize voluntary, incentive-based approaches (as opposed to regulatory), are consistent among agencies and reduce barriers to improvingsoil health.
- ***Public Understanding***
    - The general public understands soil health and its relationship to sustainable land management, ecosystem services, and healthy food.

*Existing opportunities, resources, assets, or programs that will help achieve this level of success:*

- ***Organizational research and engagement resources***
    - A wide array of resources that range from research on sustainable and organic agriculture through extension and outreach by agencies, universities and other organizations.
    - Technical support and funding available from diverse private and public sources.
- ***Collaboration***
    - An existing network of public and private entities working on soil health issues.
- ***Financial and Policy***
    - Improving soil health has additional costs and investment needs, and there are several public and private funding sources already exist that can help producers (for more detail see the *Economics, Finance, and Policy* appendix).
- ***Educational Outreach***
    - Existing  communication and technical expertise are many and diverse.
    - Technology provide opportunities to bring people together around specific needs and challenges both in-person and virtually. Both are important.
- ***Consumer Demand/Supply Chain***
    - Increasing consumer interest in sustainability provides an opportunity to reward/drive changes in practices.
    - Broadening the network of stakeholders could provide multiple benefits.

*Challenges, barriers, gaps in achieving the vision:*

- ***Research***
    - Scientific data (including financial information on benefits and risks) to support the adoption of specific soil health practices in specific cropping systems (current info is too general)
    - Challenges with understanding and interpreting soil health measures in our ag systems
    - Equipment options are limited, or technologies are still developing
    - It can be difficult to translate existing plot-level research to recommendations relevant to commercial scale.
    - Information needed now, waiting to address issues will delay progress.
- ***Communication and Collaboration***
    - Inconsistent or ineffective communication is an ongoing challenge.
    - Wealth of information available but no clearinghouse.
    - Communication challenges inhibit proper information transfer between farmers, researchers, government/policy makers, industry, and consumers.
    - Within research, communication and collaboration among various research/academic disciplines is also important.

- ***Economics and Policy***
    - Financial and other risks and up-front costs limit adoption.
    - The current economic system does not value full ecosystem benefits or capture "true costs" of production practice that degrade soil resources
    - Markets for diverse and alternative crops are in short-supply, which limits grower options.
    - Corporate demands do not generally incentivize good soil health practices
    - Crop insurance does not address the financial risk related to the adoption of new practices and is currently not supportive/reflective of the benefits of soil health
    - The inflexibility of programs and funding sources limit opportunities for small producers.
    - Policies dependent on funding cycles are slow and/or disappear year to year.
    - Landscape level changes needed to achieve public benefits.
- ***Lack of General Public Understanding***
    - Disconnect in public awareness regarding where food comes from as well as an urban-rural disconnect.
    - Need to understand the public benefits of soil health and how they benefit society.

*Priority needs and opportunities:*

- ***Research and Metrics*** (for more detail, see the *Research Priorities* appendix).
    - Need for inexpensive, regionally defined, and calibrated metrics useful in our diverse cropping systems, that have clearly defined interpretation and management implications.
    - Research trials are needed (getting baseline information, tracking progress including longer-term impacts, getting regionally and cropping-system specific information, using metrics to quantify progress). Producers should inform research and be engaged in research projects.
    - Information about economic and non-economic barriers to adoption, and financial costs and benefits of implementation of specific practices is needed.
    - Soil biology, cover cropping, amendments, reduced- and no-till, impacts of soil health strategies on pests, and interactions with climate change/resilience were all noted as areas that could use greater research attention.
    - There is also a need for soil health information relevant to rangelands, forestlands, and native ecosystems.
    - Research that might help connect soil health with consumer desires would include a better understanding of the **soil health – plant health – human health connections**.
- ***Economics, Finance, and Policy***: (for more detail see the *Economics, Finance, and Policy* appendix)
    - Current **financial and non-financial resources to reduce the risks or costs of adopting new soil health practices** should be maintained, or when possible, expanded. Successful strategies include cost share, equipment sharing, technical support, etc.

- Quantify economic risks and benefits of soil health strategies (in the presence and absence of incentives).
- Tracking the return on investment and aggregating data in a way that is useful to show measurable financial impacts.
- New technology may also help overcome barriers in some cases.
- Are there opportunities to reduce crop insurance rates for producers who apply soil health principles.
- Harnessing the power of the marketplace could be supported by a "true cost accounting" of the value of soil health strategies, and a communication/valuation strategy for the marketplace.

- ***Engagement, Networks, and Collaboration*** (for list of engagement priorities see *Engagement and Learning Priorities* appendix)
  - Improved coordination and communication amongst diverse stakeholders for soil health was a noted cross-cutting need. Specific needs included ongoing communication and agreement on / work related to priority needs and management practices.
  - Suggestions to foster improved coordination included work relating to specific cropping systems through existing regional channels, a toolbox or clearinghouse, and/or a soil health western association with annual state/regional meetings and group meetings every 3-5 years.
  - Supporting and cultivating farmer to farmer communication and learning is critical, including field trials utilizing early adopters, producer networks, mentor programs, producer awards, and other strategies.
  - Specific needs that farmers have from researchers include information about plant pathology, interpretation of soil health results, efficacy of new/emerging products on the marketplace.
  - Agricultural professionals of all types (including crop advisors, conservation district, extension, and other) need ongoing up-to-date training on soil health.
  - Non-farmer landowners and land trusts are important and influential stakeholders with an interest in soil health.
  - Engagement with the public (food consumers) and legislators is critical to enhance understanding of the public benefits of soil health and to harness the potential power of markets to support soil health. Diverse stakeholders should work together to develop a unifying and consistent message and build on growing enthusiasm related to regional food systems. Youth in both grade schools and universities should be engaged in soil health via a current emphasis on STEM education.

# Appendix I: Research Priorities

***Metrics/Indicators/Assessments***

- Improved understanding and ability to interpret indicators (e.g. enzymes, PCFA, POXC) and how they relate to overall productivity, resilience and management.
- A dependable soil health test; Meshing the research, science & measurements of soil health to settle upon the desirable metric(s) of measurement scale (universal, but regionally adapted).
- More regional surveys (by cropping system) with many datapoints would be helpful to try to link soil health metrics to yield data over time, and to generate additional data about what management strategies are working well.
- Long-term soil health data for the same sites (research and on farm), and performance evaluation for innovative practices and cropping systems.
- Soil health scale- Supplemental scientific analysis of positive soil attributes.

***Experimental/Demonstration Sites***

- Regional network of experimental sites spanning cropping systems; regional trials to promote soil health practices are needed even if they exist in other regions.
- Conduct on-farm research and demonstrations with growers incorporating soil health practices compared to conventional alternative, track costs (cost & return) and any associated effects on yield, soil water, erosion etc.
- Local proof that particular practices work within the diverse and specific cropping systems of the PNW.
- Research on methods and practices for improving soil health at the regional/sub-regional scale to determine the best specific recommendations for a given landscape.
- Improve understanding of management tools and practices best suited to improve particular indicators.
- Ongoing need for non-biased trials/ efficacy information relating to emerging alternative products (e.g. biological products).

***Economics***

- Information about costs and returns from actual installations of new practices would be helpful.
- Better understanding of barriers to adoption is needed (technical, economic, social, other).
- Cover crops as part of dryland winter wheat crop rotation needs economic analysis and demonstration projects.
- Technical and economic information relating to stubble management without burning need to be further developed.
- Work to develop markets for alternative dryland crops.
- Could soil health be added to enterprise budgets (e.g. cover cropping)
- Facilitate discussions between crop and livestock producers relating to the economics of transport of organic amendments to crop fields to identify and overcome barriers.

***Soil Biology***

- How can we build optimal biological communities in soil? (plants, microbes, insects etc.)
- Soil biological testing/research - we do not know over 90% of the living organisms in soil.
- Better understanding of specific enzymes and compounds relating to soil health.
- Understanding more mechanisms of how soil biological communities drive/contribute to soil health, and the best ways to measure that.
- Soil biology: how does management (e.g. enhancing diversity, types of organic matter) affect soil biology and nutrient cycling, and more importantly how do those effects translate to observable impacts on farm profitability and sustainability?
- Understanding the mycorrhizal communication network.
- There is a need to help farmers understand what to do in response to data on soil microbial communities found in their soils.

***Communication/Research Partnerships***

- Communication between producer and consumer is needed to support soil health.
- Applied research- partnerships between research institutions and farmers/growers/landowners is needed to "sell" new practices to growers.
- Synthesize available literature into field-usable guidelines and widely share.
- Tighter linkage between incentives and research/demonstration questions might aid adoption.

***Cover Cropping***

- Many specific applied questions need to be answered relating to cover crops: e.g. minimum length of time for cover crop, best cover crop mix for specific situations, cover crops for short-growing seasons and cold climates. Right now this is all being explored through trial and error on an individual basis
- Western Cover Crop Council is an opportunity to share/build knowledge relating to these practices.
- Cover cropping in dryland systems presents unique challenges that need to be addressed.
    - Are there viable systems that can be developed that will work in dryland wheat without using too much water and reducing yields for the following crop?
- Need more information on each species in a cover crop mix – when to use it and warnings of species to avoid, so that producers can select the best species for each situation.

***Amendments***

- Soil amendments (compost, biochar, biosolids, digestate, co-compost, biorefinery) designed for specific production systems, soils, crops that yield better soil health and better animal and human health.
- Biochar production and use – more public involvement relating to funding/standards and certification.
- Development of more integrated crop-livestock systems is needed to help with live root decay in subsoil and better distribution of manure for building soil.

***Reduced Tillage***

- No-till needs ongoing research, including on long term effects.
- What does 'conservation agriculture' look like for crops that require soil disturbance? (e.g. potatoes)
- We need more knowledge relating to how to make no-till/reduced-till work in western OR and WA, given slugs, heavy soils, and the related compaction issues.

***Soil Health Practices - Other***

- Correlation of management practices to outcomes in perennial fruit crops is a particular challenge.
- Ongoing work on strategies for diversifying dryland systems should continue. Winter pea, chickpea and canola production are opportunities for farmers to diversify and potentially stretch those rotations.
- Within winter wheat-fallow systems, a critical need is to understand how a variety of soil health strategies, especially cover crops, impact the amount of water stored in the soil.
- More knowledge about how to manage slug populations in the Willamette Valley is needed, as they currently are a barrier to high residue and cover crops practices. OSU is sponsoring slug research, but it could be coupled with soil health trials.
- We need to understand how much exactly can fertilizer usage be reduced after implementing specific soil health practices. When? At what point can pesticides be reduced?

***Pests***

- Correlation of soil health management practices to disease suppression, plant health/disease.
- We need to better understand how pests/pathogens of the main cash crop interact with cover crops. (Another way to put this: why is green bridging not a concern anymore?)

***Other Land Uses***

- Need metrics for evaluating soil health on rangelands and forestlands.
- Need metrics for understanding and evaluating soil health in native habitats and in managed native ecosystems.

***Climate Change/Resilience***

- Better understanding of how fast things will shift with climate change.
- Effects of climate change and how soils and soil health will adapt to climate change.
- Continue effort to study and understand system resilience. Can we develop more concrete ways to talk about the connection between soil health & 'climate resilience'?

***Other***

- We need to be careful of unintended consequences.
- We need to understand the linkages between soil health, plant health, and **human health**.
- Can you stay in furrow irrigation and get credit for improving soil quality?

# Appendix II: Economics, Finance, and Policy

***Financial and Policy Opportunities / Priorities***

- Funding for applied research to speed up the development of results
- Market development /market pressures
- Important to tie soil health to blockchain technologies
- Crop insurance (USDA/FSA) – could these programs recognize reductions in risk relating to improved soil health?
- Existing financial returns to technology can be powerful but are not always clear/understood. Ongoing work on this is needed. New technology may also help overcome barriers in some cases.
- Tracking the return on investment and aggregating data in a way that is useful to show measurable and financial impacts.
- Cost-share could be offered for biological soil testing to encourage adoption.
- NRCS economist OR/CA/WA
- Cover crop seed production is a regional economic opportunity
- Programs that offered direct payment for building soil organic matter (e.g. per acre incentives) would help this effort.
- Harnessing the power of the marketplace could be supported by a "true cost accounting" of the value of soil health strategies, and a communication/valuation strategy for the marketplace.
- More flexibility in the implementation of NRCS programs to meet the needs of individual producers and to facilitate adaptive management.

***Current Financial Resources (enhancing these could accelerate adoption)***

- Existing research funding for sustainable ag and soil health research, especially applied research.
- Financial Support- numerous grant and cost-share programs can reduce financial risk and reduce upfront costs for many practices/technologies to advance soil improvement, including EQIP, CSP, OWEB, SARE, CD, CIG, Special Initiatives, NPS water quality funding (state), WA Dept Ecology WQ grants, EPA 3/9 funding (federal), other funding (national, state, commission, industry), potential from private sources (may not always be realized)
- Shared Equipment - Low cost/shared roller crimpers & drills funding for equipment purchase or lease or rental program smaller farms
- Non-regulatory, voluntary, incentive-based, programs and technical assistance, from conservation districts is critical and welcome (as opposed to a regulatory approach).
- Conservation farmer of the year (innovation, promoting conservation)
- Non-monetary benefits are also powerful – e.g. recognition by peers and other opportunities to recognize/reward innovators in tangible ways (e.g. sign, award).

## Appendix III: Engagement, Networks, and Collaboration

Engagement and learning needs identified are organized by target audience.

***Farmers***

- Soil health general topics
- Case studies of early adopters; farmers trialing practices; demonstrate "how" and success within the context of a particular (and nearby/relevant) cropping system.
- Understanding farmer knowledge base and the potential power of farmer-to-farmer learning sessions (perhaps coordinated regionally?). Facilitating interactions between growers is some of the most important work that can be done by extension/agricultural professionals, as growers are often ahead of the research in some ways.
- Funding assistance for producers to attend conferences/workshops would be useful.
- Pulling together and summarizing existing information related to specific cropping systems would be useful.
- Cultivating relationships and improving coordination – with other innovative growers, agencies, extension, and university researchers – is likely key as this is important for growers who are at the forefront of soil health
- Specific information needs include information about plant pathology, interpretation of soil health test results, the efficacy of biological products or other emerging/alternative products on the market, and weeds associated with compacted soils.
- Supporting an experimental mindset that views failure as a pathway rather than a negative is also important.
- A toolbox or clearinghouse and a soil health western association with annual state/regional meetings and group meetings every 3-5 years.

***Landowners***

- Non-operator landowners are a unique / potentially influential group who may need to have soil health information.
- Land trusts are another important stakeholder audience who is beginning to have an interest in this topic.

***General Public***

- The value of soil and soil health (both core benefits, and co-benefits such as cleaner water, carbon sequestration, etc.).
- Examples - case studies of producer stewardship.
- Understanding the role of recycling organics for soil health.
- Understanding of sustainable food production to drive support for particular farming practices.
- One challenge with the general public is that the depth of understanding is limited – e.g. they may conflate organic with soil health
- Legislators are a unique subset of the "public" who need to understand the value of soil health.

***Agricultural professionals***

- Need for Extension agent in every County who is familiar with soil health
- Crop consultants, agricultural input suppliers, are important target audiences with high levels of influence.
- CDs & NRCS offices are important for connecting with producers in a local area.
- There would be value in regional "hubs" to connect people doing similar work (i.e. list-serves) – though this is challenging in some cases to resource and maintain over time.

***Formal Education – Youth & University***

- In elementary school, basic agriculture and food education are needed.
- Cultivate interest at elementary-high school levels.
- Opportunity to coordinate with current emphasis on STEM.

***Outreach Methodology***

- Factsheets, making YouTube videos, need media explosions (TV, blogs, Facebook, Twitter), workshops, field trials, field days, tours, meetings, face to face experiences.
- Connective, humanized storytelling is powerful.
- Conversion of "science" to BMPs and dissemination/outreach of BMP's is needed.
- Build soil health toolbox.
- Diverse stakeholders should work together to develop a unifying and consistent message and build on growing enthusiasm related to regional food systems.
- Opportunity to better communicate climate resiliency and soil health to find shared goals among agencies.