Welcome to REACCH: Project overview

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Farmers are the world's original integrators. Successful modern farming requires a good understanding of the components and processes of entire production systems and how they interact. The tremendous importance of cereal-based agriculture greatly affects local economies and influences regional culture and communities. Some of the most productive wheat land in the world can be found in the inland Pacific Northwest (PNW) region, which includes northern ID, north-central OR, and eastern WA. The REACCH project is designed to enhance the sustainability of cereal production systems in the inland PNW under ongoing and projected climate change, while contributing to climate change mitigation by reducing emissions of greenhouse gases. REACCH is a comprehensive response to the implications of climate change for the already challenging task of managing cereal production systems for long-term profitability. Scientists from many disciplines, including engineering, climate science, agronomy, sociology, and economics, are working together to ensure greater relevance of the information provided to regional cereal farmers and their associates. Our aim is to conduct the best agricultural science relevant to regional climate projections and the needs for adaptation and mitigation, and to extend this science to our diverse group of stakeholders.

Our fourth annual report for REACCH provides a compendium of 63 short reports representative of activity underway within the REACCH project. The report has four objectives: (1) to showcase the breadth of our work pertaining to climate and cereal production systems of the region, (2) to set the stage for realizing the benefits of this work to producers and other stakeholders beyond the term of our grant from the National Institute of Food and Agriculture (NIFA), (3) to highlight important current collaborators and future partners that will help us to maximize these benefits, (4) to provide information useful to our diverse stakeholders, including farmers, other agricultural industry personnel, teachers, policymakers, and general citizens of the region. This report is a part of our ongoing conversations among all of these groups. We continue to be proud of what REACCH is accomplishing and remain deeply committed to producing results that will be useful to Pacific Northwest agriculture.

REACCH team members convene yearly with collaborators, producers, our Stakeholder Advisory Committee, and our Scientific Advisory Panel. In year 3, we gathered in Richland, WA. Join us in Moscow, ID, March 4 to 6, 2015, for our next meeting. Photo by Brad Stokes.

REACCH audiences

Because climate change and agriculture affect everyone, REACCH recognizes the importance of considering how our research, education, and outreach efforts influence multiple audiences. In most cases, these efforts apply to multiple public and private sectors, which will be indicated throughout this report by the following icons. These icons are a guide highlighting key interest areas. Many of our readers will have multiple interests throughout the report.

Grower/Agricultural Industry

Scientists

Educators

Policy Makers

General Public

Partners and collaborators

- 4 institutions
- 3 states
- 25 project investigators
- 58 graduate students and postdocs
- 12 academic departments at three land-grant universities, and the U.S. Department of Agriculture Agricultural Research Service.

Scientific Advisory Panel members: Karen Garrett, University of Florida; Matt Baker, Texas Tech University; Phil Robertson, Michigan State University; Richard Howitt, UC Davis; Rich Jones, Pacific Northwest Direct Seed Company; Senthold Asseng, University of Florida.

Stakeholder Advisory Committee members: A diverse group of local producers and people involved in climate and sustainable agriculture nongovernmental organizations, grower support industries and associations, supply companies and cooperatives, state agencies, tribal associations, federal agencies, and K-12 teachers.

REACCH Research Areas: Modeling Framework, Greenhouse Gas Monitoring, Cropping Systems, Economic and Social Factors, Biotic Factors, Education (K-12, undergraduate, graduate), Extension, Cyberinfrastructure, Data Management and Technology, Agroecozone Modeling, and Life Cycle Analyses.

Cook Farm student harvest crew celebrates after a long day's work. Photo by Dave Huggins.

Win-win scenarios for farm and climate

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Efforts to achieve climate adaptation and mitigation in regional cropping systems are coupled and can present potential short- and long-term, "win-win" scenarios for both agriculture and the environment.

Management Strategies	Short-Term Benefits (1-10 years)	Long-term Benefits (40+ years)
Reduced tillage/Direct seeding	• Decreased soil erosion and nutrient runoff • Increased SOM and improved soil quality • Increased nutrient cycling and storage	• Reduced CO_2 emissions by storing soil C
Crop Intensification – Reduce fallow	• Increased food, fuel feed production • Increased farm productivity and income	• Fixed CO_2 removes it from atmosphere by increasing PS • Increased straw biomass and soil C sequestration
Crop Diversification – Legumes	• Improved control of pests and grass weeds using a broadleaf crop in rotation • Reduced N fertilizer costs using BNF	• Reduced GHG emissions and natural gas use during N fertilizer production • Reduced reactive soil N that leads to N_2O emissions
Crop Diversification – Oilseeds	• Improved control of pests and grass weeds using a broadleaf crop in rotation • Improved soil structure and water infiltration with canola's strong taproot • Glyphosate resistant canola is only RR crop that can be grown in PNW rotations	• Increased net productivity, PS and C fixation • Reduced atmospheric CO_2 through increased soil C sequestration • Reduced N_2O emissions and improved N cycling • Avoid summer heat and drought stress with a short season crop
Customize wheat class and variety to AEZ	• Potential to improve protein premiums • Improved overall regional wheat quality and market reputation • Match heat and drought tolerance to AEZ • Potential to adapt to pest variability	• Improved resource efficiency and lower loss, as crops are better suited to environment • Tolerant varieties are more adaptable to climate change and associated concerns
Prescription N management	• Reduced N fertilizer costs • Reduced N over-fertilization that can reduce yields • Reduced N runoff and loss	• Reduced GHG emissions and natural gas use during N fertilizer production • Reduced reactive soil N that leads to N_2O emissions
Recycled organic byproducts	• Increased SOM and improved soil quality • Reduced N fertilizer costs • Recycled valuable nutrients • Reduced landfilling biological wastes	• Tightened global nutrient cycles reduces N_2O and CO_2 emissions • Reduced GHG emissions and natural gas use during N fertilizer production

Abbreviations: SOM = soil organic matter; C = carbon; CO_2 = carbon dioxide; PS = photosynthesis; N = nitrogen; BNF = biological nitrogen fixation; N_2O = nitrous oxide; AEZ = agroecological zones; GHG = greenhouse gases; RR = Roundup™ ready.

Metric conversion table	
From	**To**
1 hectare	2.47 acres
1 acre	0.41 hectare
1 pound	454 gram
1 pound	0.45 kilogram
1 kilogram	2.2 pounds
1 foot	0.31 meter
1 meter	3.3 foot
1 inch	2.54 centimeters

Climate Trend	Observed Change (1985-2014) vs. (1895-1984)	Projected Change (2040-2069) vs. (1971-2000)	Impacts
Warmer Winters	+1.3F	+5.2F	Reduced snowpack, increased winter runoff, reduced overwinter mortality
Warmer Springs	+1.3F	+5F	Earlier greenup and plant maturation, longer freeze free season
Warmer Summers	+1.2F	+6F	Increased heat stress and evapotranspiration
Wetter Springs	+12%	+5%	Offset increased water use by plants, increased potential for water logged soils
Drier Summers	-3%	-9%	Increased drought stress

Obs change is from NCDC data using an average of WA/OR/ID
Projected change are from MACA RCP8.5 data and represent the multi-model mean change for the NW US covering WA/OR/ID and western MT.