2015 REEPORT sections exported to 2016 final report with notes under other sections for new input

**Accomplishments**

**Year 6: Reported Accomplishments**

**Other Accomplishments**

* Continued to populate legacy website <https://www.reacchpna.org> and made plans for maintenance 5 years into the future
* David Meyer’s mind map
* EWG info here
* Primer
* Evaluator will design and conduct summative evaluation including a review and analysis existing data, providing a synopsis management efforts over the course of the project. Summary report generated with key recommendations that are relevant to funders, transdisciplinary research practitioners, and project managers.
* Coordinate 15 regional experiment station field tours under a single REACCH theme to highlight all aspects of REACCH to our study are producers. An inaugural tri-state abstract book will be published for distribution to all field day participants.
* In lieu of an annual report, 2 special journal issues will be published with REACCH themes: one in Frontiers of Ecology containing overarching synthesis papers highlighting REACCH's trans-disciplinary scientific results and impacts and one in AGEEE, expanding on the international trans-disciplinary work on cereal systems in semiarid regions from our 2015 international conference.
* Continue to work on the NWREAP concept, a collaboration of 18+ partners working on climate and cereals in the Pacific Northwest. The Northwest Climate hub and the Cook Farm Long-term Agricultural Research site are especially noteworthy of work to be continued beyond REACCH.
* Identify and disseminate vetted REACCH policy information/papers to stakeholders and policy community.
* Complete REACCH handbook.

**Modeling Framework**

**Year 5**

* Generated future climate projections at a 25-km horizontal resolution.
* Calculated spatial patterns of seasonal changes in temperature and precipitation between 1986-2014, 2030-2059 over the
* PNW.
* Projected monthly changes variables (e.g. temperature, precipitation, evapotranspiration, soil moisture, and short and long-
* wave radiation).
* Analyzed changes in extreme precipitation events in NW US and their association w/hydrological impacts.
* Projected changes in cold hardiness zones and growing zones for cold sensitive agricultural crops across the coterminous
* US.
* Analyzed projected changes in wind erosion on agricultural lands in the Columbia plateau.

**Other Accomplishments**

* Add accomplishments from Claudio, John, John, Erin, Tina, Harsimran, Wenlong, Hongliang Intl work
* Climate tools
* Lauren’s work on cold hardiness zones

**Year 6: Reported Accomplishments**

* Complete development of web and mobile enabled climate tools that can enhance information and decision making for
* our stakeholders.
* Complete analyses and publications (special priority for grad student led work).
* The climate projections component will submit two papers on spatial variability in regional climate change projections
* from high-resolution climate modeling. The first paper will focus on temperature, and the second on precipitation, examining
* changes in both means and extremes and their underlying causes.
* Cropping systems investigated under alternative climate and policy scenarios

**Monitoring**

**Year 5**

* Water, sediment, and carbon transport measurements at field sites, 2 basin scale locations.
* Developed WEPP soil erosion model including regional predictions of effects of climate change on sediment transport by water for REACCH high precipitation zones.
* Atmospheric flux measurements of CO2 and H2O continue on automated basis at 5 flux towers, data processed and archived monthly. N2O flux measurements implemented and continuously operated using a combination of chamber and tower
* methods at the Cook (no-till) and Clark (till) sites.

**Other Accomplishments**

* Extra 6 months of flux tower time
* Erin finished sampling to complete crop rotation

**Year 6: Reported Accomplishments**

* Water erosion monitoring will continue through the growing season and the same will be true for the carbon/water and
* N2O flux tower operations.
* We anticipate that monitoring at a subset of tower sites will be continued as part of the new LTAR program centered at the Cook Agronomy Farm.
* Our major focus will be on developing journal manuscripts describing the final long term flux data sets. We are planning to develop a synthesis paper which highlights potential adaptations to climate change in dynamic AECs.

**Cropping Systems**

**Year 5**

* Formed a crop-animal integration team, interviewing crop and livestock producers exploring knowledge gaps for future research/extension projects. Provided leadership to broaden the Direct Seed Conference to an all-encompassing regional Cropping Systems Conference.
* Nitrogen and water requirements defined for canola integrated into wheat rotations. Component analysis of N use efficiency conducted in concert.
* Experiments revealed: WW-SF cropping system depletes SOC and negatively impacts climate change; NT, cropping intensification, addition of biochar and cover crops have the potential to mitigate climate change by sequestering CO2
* Introduced a way to value SOC and associated ecosystems as an alternative way to incentivize producers to sequester carbon and mitigate climate change; demonstrated winter pea, canola and triticale are viable crops for diversifying winter
* Wheat-fallow; Stripper header grain harvesting reduces hot soil temperatures, surface wind speeds and soil moisture losses.

**Other Accomplishments**

* Coordinated field days
* Tri-state abstract book
* Winter pea work
* Update on long term experiments
* Coordination with LTAR
* Field day adaptation survey

**Year 6: Reported Accomplishments**

* Complete all publications.
* Contribute to completion and dissemination of mobile-enabled decision support tools for producers.
* Complete all contributions to the REACCH handbook.
* Alternative cropping systems assessed, linked to biophysical and socio-economic modeling.
* Cropping alternatives and associated C, N, water measurements completed.
* Analyses of NUE, WUE, C, energy and delivery of initial inputs for modeling.

**Socioeconomics**

**Year 5**

* Web-based decision support tool (AgBiz Logic) assesses the impacts of climate change and associated adaptive and mitigation practices; incorporated AgClimate into existing suite of software programs (AgProfit, AgLease, and AgFinance), providing web-based modules to understand financial and environmental trade-offs of alternative management decisions.
* Completed preliminary analyses on tillage practices, precision agriculture, and climate change risk perceptions, furthering efforts to understand producers' perceptions/behaviors on climate change adaptation/mitigation. Baseline indicates most producers acknowledge weather variability and rise in temperature, but don't credit the change to human activities.
* Mailed 1284 follow up producer surveys to study current farm production and changes to on-farm practices. Results will be used to improve outreach, education, research, and policy.
* Initiated a Citizen Science project to document wheat yields across time and space.

**Year 6: Reported Accomplishments**

**Other Accomplishments**

* Policy chapter in handbook
* Stat atlas for Ap1
* Maybe Ap1/Ap2 cross over
* Sierra and Adrianna work
* AgBiz Climate
* Focus group session- Clark and JD
* Complete the follow-up agricultural producer survey and analyses. This is a unique effort to develop cross-sectional and representative population data from a large region of farmers about topics concerning risk and climate change.
* • REACCH researchers at OSU in cooperation with the Oregon Climate Research Institute and the Climate Hub will continue to work on the development of a unique web-based decision support tool (AgBiz Logic™) for assessing the impacts
* of climate change and associated adaptive and mitigative management practices. When completed, AgBiz Logic will incorporate AgClimate™ into the existing suite of software programs (AgProfit™, AgLease™, and AgFinance™), providing
* web-based modules, and information to farmers, ranchers, and land use managers so that they can better understand the financial and environmental trade-offs associated with alternative management decisions. AgBizLogic will also allow users to look at a range of changes (exposure to risk) to their net returns and to understand connections to both onsite and offsite environmental changes.
* Complete the Climate Change Awareness learning modules.
* Complete the Policy Chapter for the Extension Climate Change Handbook.
* Conduct a survey of scientists who participated in the Questions from REACCH Scientists portion of longitudinal survey.
* Complete a journal article and an Extension Bulletin documenting the economic results of the REACCH Longitudinal
* Survey, which collected production data from 47 wheat producers across the REACCH study region from 2011-2015.
* Spatial representation of adoption likelihood incorporating socioeconomic variability.
* Socio-geographic functions for N, water, energy use shifts due to crop, policy, climate, completed.
* Longitudinal and key informant interviews following AEZ strata.
* Project impact evaluation (formerly in Obj. 7)
* Decision support tools for economic analysis.
* Conduct producer workshops on climate perceptions and changing human behavior

**Biotics**

**Year 5**

* Completed analysis of aphid populations across project domain; studies of the invasive aphid species M. festucae cerealium, its host range, response to drought, competition w/other aphids, vector competence; studies on interactions of drought and virus stress on wheat.
* Advanced work on cereal leaf beetle under climate projections based on published models and data and on herbivory module for CropSyst. Engaged new collaborator E. Evans, Utah State U.
* Preparing synthesis on the wheat agroecosystem and potential responses to climatic change.
* Participated in a U. of Kansas workshop on analysis of long term data sets in response to changing climate and the mathematical detection of synchrony in regional sampling datasets.
* Working on paper assessing effects of changing climates on pests of forests and agricultural systems.
* Analyzed downy brome populations and modeled phenology across Inland PNW.
* Characterized vernalization requirements and expression of BDVRN1 in downy brome.
* Projected downy brome development in PNW small grain production region using downscaled climate modeling.
* Investigated how temperature and water potentially affect the lifecycles of Rhizoctonia and Fusarium, pathogens causing root and crown rot of wheat. Completed in-vitro work, and moving to soil microcosms.
* Completed studies of bacterial communities as affected by long-term no-till.
* Completed sequencing studies of fungal communities as affected by long-term no-till over 2 yrs. and 3 locations.
* Completed final year of earthworm density and activity in the Palouse

**Year 6: Reported Accomplishments**

**Other Accomplishments**

* Biotic decision support tools
* Summarize Nate thesis
* Ian has “total package” on Downy Brome
* Update in Iqbal/Paulitz work
* Byju work
* Assessment of climate adaptation and mitigation on selected pests and beneficials.
* Recommendations for climate-related changes in biota to producers and scientists.
* Incorporate responses of a key pest into process based simulation models of wheat growth in the region.

**Education**

**Other Accomplishments**

* Conducted XX student exit surveys
* XX graduate students graduated.
* Completed high school and 5th grade curriculums
* Secured USDA summer intern grant for next 4 years. Hosted 10 summer interns in 2016.

**Year 6: Reported Accomplishments**

* Finalize high school and elementary curricula and make it available to a wide group of teachers.
* • Assist all REACCH graduate students in completing their programs.

**Extension**

**Year 5**

* Progress made on literature review and drafting of REACCH Conservation Agriculture Handbook. Completed 5 chapters.
* 10 presentations or displays at producer field days.
* Sponsored 2 workshops: Precision Ag Field Tour and Extension Curriculum Grant Program.
* Gave $160,264 $$ for 14 mini-grants. On planning committees for Climate Hub, Far West Agribusiness and Direct seed
* Association meetings.

**Other Accomplishments**

* Handbook update
* Cast study update
* Agclimate.net
* March Kennewick meeting/white paper
* Mini grant update- results
* REACCH presence at tristate growers meeting
* Upcoming Direct seed conference

**Year 6: Reported Accomplishments**

* Complete REACCH Conservation Handbook.
* • Finalize decision support tools under development in the project.
* • Finalize content for interactive website.
* • Develop and train a virtual community of stakeholder educators.
* • Funding to Extension network for product development and demonstrations.

**Cyberinfrastructure**

**Year 5**

* Mobile application tools created: tool visualizing real time growing degree day models for several species spatially and temporally; calculator tool for estimating the cost/benefit of spraying barley for Russian wheat aphids; tool for identifying wireworms.
* Migrated data management systems to an environment sustainable into the future.
* Contributed to a USDA Data Harmonization workshop, organized by tAgMIP. Leaders in agriculture, data and climate
* discussed ways in which data can be integrated for enhanced research efforts.

**Other Accomplishments**

* Reported tools elsewhere as team 8 not lead
* update on # of datasets AnhPhu uploaded
* Migration to NKN
* Ed Flathers work in publications

**Year 6: Reported Accomplishments**

* Create a website (http://climate.nkn.uidaho.edu/REACCH/) that includes separate pages for tools/information relating to wheat, peas, barley and pest/weeds/pathogens that affect them (i.e. aphids, wireworms, russian wheat aphid, wheatmidge, cereal leaf beetle, cheatgrass, etc.)
* Connect with farmers and farmer consultants to get feedback on the utility of tools in order to make improvements.
* Finalize CI Assessment, legacy data migration, and data transition plan.

**Life Cycle Analysis**

**Year 5**

* Worked w/lobal modeling community (AgMIP, MODEXTREME and BioMA) to improve CropSyst tomodel inter comparison under climate change scenarios and making global model improvements. Completed CropSyst
* MicroBasin, a spatially-distributed model that includes 3-D hydrology and chemical transport, carbon/nitrogen cycling, and crop biomass/yield production modules. Model runs on: analysis of potential shifts of cropping systems zones in the US PNW; evaluation of historical and projected weather to determine risk associated w/ changes in wheat phenology and exposure to heat stress during reproductive stage; plug-in developed to incorporate pest and disease models into CropSyst; modeling of N2O-N emissions was improved, and model outputs compared w/ field emissions; conducted multi-model comparison of projections in selected PNW sites including CropSyst and four other important cropping systems models available.

**Year 6: Reported Accomplishments**

* We will continue to improve modeling capabilities and to evaluate the impact and adaptation of cropping systems to climate change in the Pacific Northwest, and we will apply models to account for biotic stresses as impacted by climate change.
* Continue collaboration within AgMIP and other international cooperation (BioMA project of the European Community).
* Complete projection of disease damage as a function of future climate for selected sites.
* Compare gridded-based vs. ground based weather & crop simulations.
* Formulate and apply a process based weed model.

**What opportunities for training and professional development has the project provided?**

* Need to get year 6 list of students/post docs from teams. Include those cost shred and where we secured funding from LTAR.
* Identify new students- Machado others
* 10 summer interns
* Identify number of dissertations and theses completed
* Summary of placements- ask advisors for this
* Summarize Jodi’s career building workshop
* MOSS
* Laurie’s outreach to schools
* Count Renee as teacher trained
* Count number of student employees
* Focus groups educating crop advisors producers, also field days
* Hits on webinars- Gellar #s
* Flipped seminars
* Get hits on reacchpna webinars, case studies, etc.

**How have the results been disseminated to communities of interest?**

**Year 5**

* In year 5, REACCH team members produced 66 refereed publications or published abstract. Outputs include 84 presentations for farmers, teachers, agri-business, crop advisors and other stakeholders, 92 presentations at professional meetings, 8 workshops or field days, 50 extension fact sheets, bulletins, extension blogs and popular article publications or web delivered products for producers.
* Additionally, the project maintains or contributes to 4 websites (reacchpna.org. agclimate.net, aridcereals.org and http://css.wsu.edu/biofuels. We create blogposts, posts videos from conference presentation, research seminars, etc. Our updated legacy reacchpna.org website received 33,890 page views in year 5. In year 5 we added 30 new videos to our YouTube catalog.
* We have over 17,000 datasets on our web portal http://reacchapp2.nkn.uidaho.edu:8080/geoportal3/catalog/main/home.page.
* Included in this are: Total datasets in Geoportal: 87
* Publication - Conference Presentation : 485
* Publication - Webinar : 37
* Publication - Journal Article : 213
* Publication - Conference Poster : 3
* Publication- Presentation : 15
* Publication- Website : 25
* Total GRIDMET data files: 378
* Total MACAV1 data files: 5157
* Total MACAV2 data files: 16601
* We developed a website (http://climate.nkn.uidaho.edu/REACCH/) that includes separate pages for tools/information relating to wheat, peas, barley and pest/weeds/pathogens that affect them (i.e. aphids, wireworms, russian wheat aphid, wheatmidge, cereal leaf beetle, cheatgrass, etc. )
* The number of views of information targeted to our producers on agvliamte.net and reacchpna.org:
* New views of webinars in 2015: 177 (2447 cumulative live and asynchronous viewers since completed)
* New views of case study videos in 2015: 1019 (1461 cumulative since posted)
* Views of Allen et al. Factsheet - 10 views
* Views of agclimate.net (website): In 2014, we had 2481 views total. 2015, 2945 total. (9.5 average views over both years).
* Views of blog posts (CSANR blog): 752
* Views of blog posts authored by our team (agclimate.net - captured in the agclimate.net numbers): 619
* The Washington Oilseed Cropping Systems Project (WOCS) website (http://css.wsu.edu/biofuels/) user access increased
* again in 2015, with 9,715 page views and 2,467 users from 53 countries (up 15%), 45 states and 71 cities in Washington (up
* 9%). Thirty-three percent of Washington visitors accessed the website for the first time. Users from 17 cities in Oregon and
* 17 cities in Idaho also visited the website.
* ARID CEREALS
* Analytics for Feb15, 2015 through Feb 11, 2016:
* # of Sessions: 3908
* # of Users: 2617
* # of Pageviews: 9270

**Participants**

* Actual FTE’s for this Reporting Period
* Student Count by Classification of Instructional Programs (CIP) Code
* NOTE: Dianne will request this from institutions in early January to be due Jan. 15

 **Target Audience**

Target audiences for this project are scientists, regional producers of cereal crops, agri-business personnel and leadership, commodity organizations, policy makers, extension personnel, regional conservation districts, primary and secondary school teachers, graduate and undergraduate students, modelers, non-profit NGOs, allied industries, government agencies, members of affiliated professional and other stakeholders. The primary targets are these demographics in the inland Pacific Northwest, but many of our outputs have national and global audiences. Scientists, students, and NGO staff from 15 countries attended our international conference, Transitioning to Cereal Systems to Adapt to Climate Change,www.aridcereals.org. A special issue of AGEEE and a listserv resulting from this conference as well as a new expert working group with the International Wheat Initiative will further increase our G20 and international audiences. The REACCH Cyber-infrastructure team has been very active in the national big data arena with national agency and academic data policy makers. Efforts designed to produce changes in knowledge for these audiences during this reporting year include 80 presentations for farmers, teachers, or other stakeholders, 91 talks and posters at professional meetings, 5 workshops or field-days, 61 extension fact sheets, bulletins, extension blogs and popular articles publications or web-delivered products for producers. Our project website and regional blog agclimate.net communicate information about climate change and agriculture to area producers. Extension educators increased capacity through train-the-trainer webinars. A workshop for high school science teachers increased climate scientific approaches to disseminate knowledge on climate change and its potential and realistic impacts and the need for sustainable agricultural systems. A summer internship program for undergraduate students increased knowledge of scientific research, preparation for graduate school and issues of food production under a changing climate. Monthly communication with PINEMAP, Sustainable Corn and other AGFRI CAPs has increased knowledge on large complex project management. REACCH was featured in 5 articles in the weekly agricultural newspaper Capital Press, with a readership of over 29,000. We produced an annual report targeted to stakeholders with 61 articles for growers, agricultural industry, scientists, educators, policy makers and the general public, <https://www.reacchpna.org/sites/default/files/REACCHreportYr4.pdf>

**Changes/Problems**

**Year 5**

* REACCH is losing personnel, graduate students and postdocs which has shifted more milestone completion to fewer people.
* See attached Milestone Appendix for milestones that have changed or been dropped over the past 5 years, and the explanations for these changes, all approved by NIFA in our continuation requests.
* Policies changed within the National Agricultural Statistics Service (NASS) such that we had to modify the partnership protocol REACCH had on the original agricultural producer survey to comply. We identified a new sampling frame and had to move forward with the project in order to field it and collect data, even though this change was not ideal for the comparative aspects of the results.

**Integration, Management and Assessment**

**Year 5**

* Held 4th annual meeting. https://www.reacchpna.org/sites/default/files/archive/2015\_Annual\_Meeting\_Agenda.pdf
* Transitioned to legacy website https://www.reacchpna.org
* Hosted The Art and Science of Climate Change. Original music score composed for REACCH integration. https://www.reacchpna.org/arts
* Completed assessment w/measures for trust, collaborating quality and productivity impacts and a qualitative survey on project management.
* Hosted Transitioning Cereal Systems to Adapt to Climate Change, w/scientists from 15 countries, established global network on cereal systems in semiarid regions. www.aridcereals.org. International Wheat Initiative Expert Working group formed as an outcome.