The OutREACCH
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Director's Corner:
REACCH's Better Half

Sanford Eigenbrode, Project Director, UI

We are now roughly half way through the five-year term of our REACCH project. Is the glass half empty or half full? That depends on your point of view. Our glass might be half empty in the sense that the heady and exciting epoch of discovery and genesis at the beginning of REACCH is now behind us. Our teams are formed, our students are on board, projects are under way and integration is in full swing. Now our glass is half full because the most important and impactful period for the REACCH project is just beginning. In a sense we are transitioning from what might be considered our "Phase 1" (establishment) to our "Phase 2" (generating and communicating research results useful for our stakeholders). According to the Pareto principle, most project output results are from a relatively small amount of time expended, often towards the end of the project. So, I think our glass is more than half full. There is a lot more to come from REACCH!

This OutREACCH introduces Phase 2 of REACCH. It includes the first edition of the "*Extension on the Move*" blog, from our new REACCH Extension Specialist, Kristy Borrelli. Kristy will be helping us translate project research into reports, on-line resources, tools and other projects for use by our stakeholders, essential for realizing our project's desired impacts. One of Kristy's first activities was a one-half-day workshop on extending our REACCH on August 9. With her leadership we will be fast-tracking some Extension products early in Phase 2 of REACCH. An example of research activities with interest for stakeholders appears in an article in this by Kristy, Lauren Young, Bill Pan and Tai McClellan Maaz (*Measuring the Harvest – Considerations for Assessing Cropping Systems*). REACCH investigators include climate scientists who are communicating relevant climate science to stakeholders. A popular example is John Abatzoglou' s article in this issue of the OutREACCH (*Why Hasn't Spring Gotten Warmer?*). REACCH is also providing resources to high school teachers throughout the region, to help them incorporate climate into their classrooms. This summer, 18 teachers from around the region and all three of our partner states (Idaho, Washington and Oregon) spent the better part of a week in Moscow learning innovative lesson plans and sharing ideas (*Tools for Teaching Climate Related Secondary Science*, this issue). These teacher workshops will be part of REACCH for its duration. Finally, this issue includes a report on our successful summer internship program for undergraduate students. We were joined by 16 students from around the country who spent nine weeks embedded in our research teams and conducting their own projects on topics ranging from economics to entomology (*Summer Interns' Diverse Research Contributions*, this issue). As our REACCH products continue to proliferate, we will be adding more links to additional and primary sources to help our stakeholders explore our outputs in more depth.

2013 REACCH Summer Graduate Student Retreat Participants

Please enjoy this issue of the OutREACCH!

Sanford Eigenbrode, REACCH Project Director

Measuring the Harvest – Considerations for Assessing Cropping Systems

Kristy Borrelli, Lauren Young, Bill Pan and Tai McClellan Maaz

Its late summer in the IPNW and wheat harvest is here! Soon you will read reports about the performance of new crops, variations in yield and grain quality, and even articles on nitrogen (N) and carbon (C) balances. Have you ever wondered what researchers measure to make these important decisions? Here are a few things they are thinking about when harvesting wheat.

Harvest Index (HI) – Harvest Index is a quick indicator of crop yield. Simply, it is the ratio of harvested grain to total above ground crop biomass and is calculated using the following formula:

$$\boldsymbol{Harvest\ Index = lbs\ of\ grain/(lbs\ straw + lbs\ grain)}$$

To determine HI, researchers cut 3 meter rows of crop per plot, just before harvest. The three samples are collected randomly to ensure a representative sample. This entire sub-sample is then weighed, threshed (Figure 1), and the remaining grain is weighed a second time.

Figure 1. REACCH graduate students using a stationary thresher to separate grain from straw in Pullman, WA.

Harvest index can vary depending on cultivar, soil type and weather conditions, so it is mostly used as a reference point rather than as an absolute determination of yield. However, by comparing the calculated HI to estimated averages (typical HI values for small-grain cereals and legumes average around 40%) someone can gauge how efficiently their crop is producing grain. Harvest index is also a useful way for researchers to estimate where components like carbon (C) and nitrogen (N) are partitioned in the plant.

Crop Harvest – Depending on the size of the plots, conventional equipment or smaller research combines may be used. Grain yield is calculated based on area harvested. Grain quality aspects including test weight, moisture, dockage, carbohydrate and protein content are often determined in the lab, but more sophisticated, computerized combines can measure these traits directly in the field.

Crop C and N – Carbon and N are important components of carbohydrates and proteins that impact wheat quality and salability, but they also give plants structure and drive their metabolism. They transform easily and as a result, can be lost to the environment in various forms, many of which can become pollutants and greenhouse gasses. Researchers often create balances, similar to the one below, as a way to account for sources and sinks of C or N within a cropping system to help monitor management decisions.

Net N Balance = Net N input – Net N output
Net N input = Fertilizer N, Straw N (crops, weeds, cover crops), and residual soil N at planting
Net N output = N Volatilization, N leaching, and N removal in grain

Now that researchers are compiling their third year of data for many of the cropping systems being evaluated in REACCH, C and N balances for many of these systems will begin to take shape. This data will be influential in recommending crops and management approaches to growers in the REACCH region.

Summer Interns' Diverse Research Contributions

Donna Mills, Interim Education Coordinator

On my summer vacation …I studied earthworm activity and density in relationship to agricultural zones in the PNW region; I researched carbon pools with repeated bio-solid application in wheat fields; I reviewed hydrologic modeling for agricultural erosion; I assessed genetic variation in Mayweed Chamomile and predicted the likelihood of Mayweed's range shifting with the changing rates of precipitation (Mayweed has very specific water requirements) as a result of climate change. Other summer work included the research of government policy and economics of climate change, the biological, socioeconomic, and cultural complexities of weed management in wheat agriculture. REACCH hosted 16 summer interns from across the country. The program provides valuable training for a new generation of scientists, adds to the body of our knowledge, sometimes with publishable and/or implementable results. The student research spanned a wide variety of projects. Projects can be found at https://www.reacchpna.org/mission/education/undergraduate/summer-research-internships/

Why Hasn't Spring Gotten Warmer?

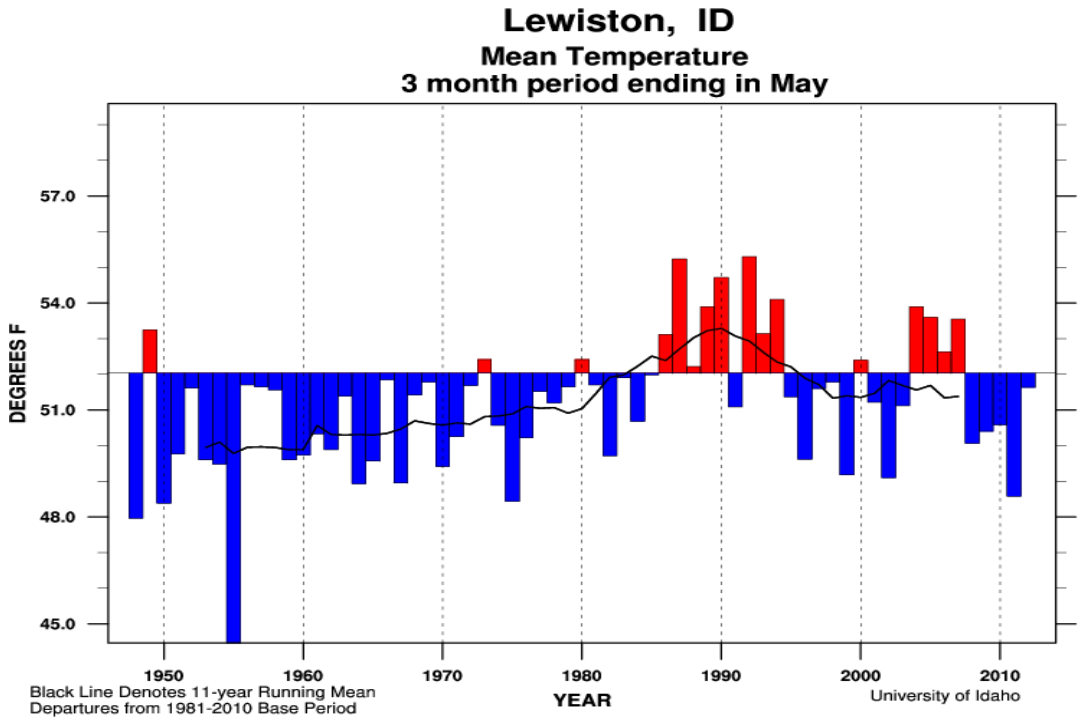
John Abatzoglou

Agriculture is a seasonal endeavor. And so the weather during each season can profoundly impact farmers and the crops they produce. Now, researchers at University of Idaho and Oregon State University are providing some new insights on how the seasonal climate has changed over the last century in the PNW, and how it might change over the next 50 years.

John Abatzoglou and his collaborators at Oregon State have analyzed the climate data for the Pacific Northwest by season over the last century. For the most part, their results are likely not a surprise. Annual temperatures warmed, as did summer, fall, and winter, and the rate of warming increased over time. But they also found one major exception, in spring. Temperatures in spring have cooled slightly over the past three decades, most notably since the early 1990s. Cooler springs during the last few decades affect cropping decisions, timing of field operations like planting or spraying, and pest cycles.

Why is this? There are lots of influences on the climate, including volcanoes, solar output (the total radiation coming from the sun, which can vary based on sunspots and solar flares), known large-scale climate cycles (such as El Niño and the lesser known Pacific North American pattern), and human caused greenhouse forcing (the factor most prominently associated with global climate change).

Their analysis found on www.reacchpna.org (see a factsheet here and presentation summarizing the results here) suggests that the cooling is largely the result of natural large-scale climate cycles. In the absence of these cycles, spring warming would have likely occurred, at about the same rate as predicted by climate change models that consider greenhouse gas emissions. You can see these cycles in spring temperature clearly in the graphic below, showing mean spring temperatures in Lewiston, Idaho. The mean springtime temperature for the entire time period was 52°, and you can see departures from that mean for each year (red bars for years when the mean temperature exceeded 52°, blue bars for years when it was below 52°). The black line denotes the 11 year running mean and makes the cycles evident, with periods during which there are cooler-than-average spring temperatures followed by periods when there are warmer-than-average temperatures. (Similar data for other locations in the Northwest is available at http://www.wrcc.dri.edu/research/jtwrcc/idaho-mon/index.html).



Extension on the Move: Upcoming Projects and Opportunities

Kristy Borrelli

The Extension team is in full swing and ready for Phase 2 (see Director's Corner this issue) of REACCH. Dr. Stephen Machado (OSU Pendleton) also recently joined our team. I am really excited about the many great projects and buzz of activity happening in Extension.

This year we awarded three mini grants projects that will fund the development of grower case study videos, a climate change communication tool, and a grower-directed publication on ammonia volatilization in cereal production. Requests for proposals for 2014 mini-grants will come out this fall, so be sure to look for those soon.

Our REACCH graduate students have busily engaged in collaboration (see related article on-line https://www.reacchpna.org/whatsnew/press/reacch-summer-2013-graduate-student-retreat-big-success/) that will culminate in outstanding education and extension projects including demonstration videos, short courses, dynamic activities and informative publications, for a summary of these projects see https://www.reacchpna.org/mission/education/graduate/graduate-student-projects Keep your eyes open in 2014 for all their great work!

Last week we hosted an internal workshop for REACCH colleagues and focused on Extension product development. Our goal was to communicate how we can best integrate research results into applicable products. Although interaction with our researchers is important, similar communication with our stakeholders is imperative to best meet your needs, please share your ideas.

I look forward to meeting and working with you all!

UPCOMING CONFERENCES

Pacific Northwest Climate Science Conference: September 5-6 Portland, OR. The conference emphasizes oral presentations that are comprehensible to a wide audience and on topics of broad interest. http://pnwclimateconference.org

Hold the date!! REACCH 3rd annual conference: March 5-7, 2014 at the Red Lion Hotel in Richland, WA. Ask for our group rate. The meeting will emphasize interaction with our stakeholders and our Extension activities.

Tools for Teaching Climate Related Secondary Science

Troy White

REACCH held it second annual teacher workshop on the University of Idaho campus in July. We hosted 18 teachers from across the region hailing from Jewel High School on the Oregon coast to Salmon High School in central Idaho. The teachers represented grade levels from elementary through high school. The teacher's expertise was split between science, agricultural science and technology courses. The diversity brought new challenges and provided the education objective team an opportunity to identify areas for improvement that we may not have recognized without this great group.

Last year we focused on climate change and related issues. This year we focused on giving the teachers tools relating to soils, water, erosion, and ecological cycles. New Common Core State Standards have been implemented across the three state regions, and Oregon and Washington have also adopted the new Next Generation Science Standards. These two new sets of standards have brought to the science and agriculture classrooms a renewed focus on hands on activities and technical reading. We provided Vernier carbon dioxide sensors, digital thermometers, and two-gallon chambers for conducting experiments to enable our teachers to meet these standards. This coming fall we are creating and modifying lab activities with the help of these great teachers. The labs and related learning aids will be incorporated into the REACCH high school curriculum that is currently in development.

Teachers participated in a range of activities including creating soil monoliths, taking soil samples from multiple horizons at road cuts, conducting erosion experiments, and using the large growth chambers for experiments with photosynthesis, respiration, and a small model of the effects of water vapor and carbon dioxide in atmospheric heat retention. Activities will be piloted with students this fall and recommendations from the teachers will lead to improved activities that will be available freely at reacchpna.org beginning next summer. Our pilot tests will lead to next generation integrated science curricula that will benefit students in the region for decades.

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