REACCH
Regional Approaches to Climate Change – PACIFIC NORTHWEST AGRICULTURE

Meeting 2013
Speed Science Presentations

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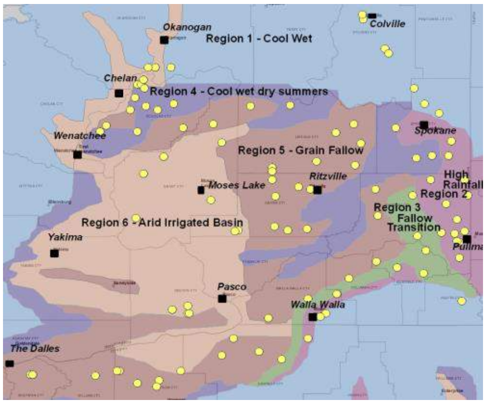
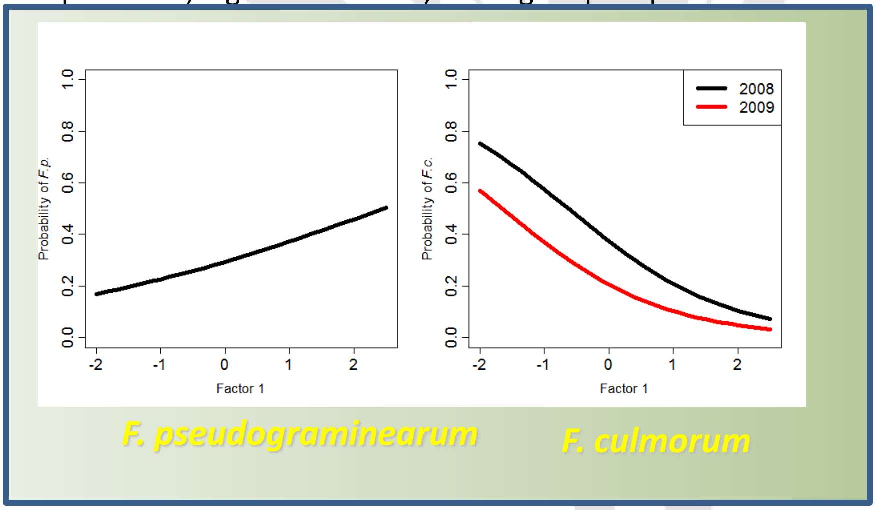
Distribution of Fusarium Crown Rot in the PNW-Relationship with Climate Factors

Tim Paulitz and Grant Poole, USDA-ARS and WSU

Fusarium crown rot is a yield limiting disease in wheat across the dryland PNW. It can cause up to 35% yield loss, and is caused by a complex of two species, *Fusarium pseudograminearum* and *F. culmorum.* The disease ins triggered by drought stress in the plant and excess N fertliization. Thus, it has a strong interaction with precipitation and temperature. Extensive surveys were conducted in 2008 and 2009, with over 500 samples from 100 locations each year. Disease (crown rot and node scores) and incidence of each species was measured at each location. Climatic date was obtained for each GPS location, based on 30 year average data sets. Generalized linear mixed models and factor analysis was used to analyze the data. Two factors, based on temperature and precipitation explained a large amount of the variability. *F. pseudograminearum* is associated with drier, high temperature locations, whereas *F. culmorum* was associated with cooler temperatures, higher elevations, and higher precipitation.





1) Symptoms of Fusarium crown rot.
2. Survey sample sites
3. Relationship of Fusarium spp. with factor 1, heavily loaded by mean annual temp, temps in coldest and warmest month

This presentation was given at REACCH 2013 Annual Meeting. This handout and supplemental video are available at reacchpna.org. Funded through Award # 2011-68002-30191 from the USDA National Institute for Food and Agriculture.

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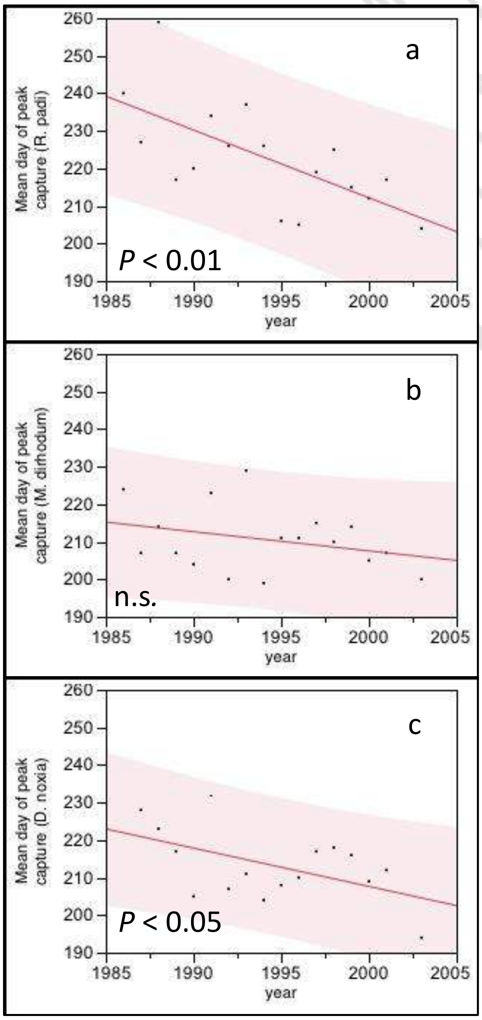
Long term patterns of herbivore abundance in cereal grain agrosystems of the Pacific Northwestern USA

Thomas “Seth” Davis, University of Idaho



Graphs indicate the mean day of peak flight for the aphid species (A) *R. padi*; (B) *M. dirhodum*; and (C) *D. noxia*, over a seventeen-year period. Shaded regions indicate the 95% CI of each fit.

We compiled a seventeen year record of cereal aphid abundance from a landscape-scale suction trap network located in the northwestern USA, and coupled abundance data with retrospective climatic projections using down scaled climate models. We asked four questions about the biogeography and phenology of cereal aphids:(1) Are aphid populations biogeographically structured by interannual variation in abundance?; (2) Is there evidence that peak flight periods changed over the trapping period?; (3) Which climatic and biotic factors are correlated with aphid abundances?; and (4) Does thermal sum or cumulative precipitation predict aphid phenology? Single-linkage clustering algorithms generated geographically supported groupings based on interannual abundance and trap catch phenology. We determined that by the end of the trapping period, peak flight periods occurred earlier on average for two of the three species, which correlated with an overall rise in temperature projections. Estimations of mean temperature, thermals sums, and interspecific aphid abundances were moderately correlated with aphid captures for each species and across all clusters. Thermal sums were a good predictor of cumulative aphid captures when variance due to site and year effects were omitted from analysis, and a random-draw simulation experiment demonstrated a strong linear effect of thermal sum on simulated mean aphid captures. This information will provide growers with accurate information regarding the timing and magnitude of cereal aphid flights, and the models we develop can be used to forecast aphid abundances using temperature estimates. Future challenges will include developing, refining, and comparing predictive models of aphid abundance across the region, and further investigating the influence of geographic features on these trends. There are significant possibilities to integrate this work within the broader framework of ecological and climate modeling, population ecology, and geospatial analysis.

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Annual Meeting 2013 *Speed* Science Presentations

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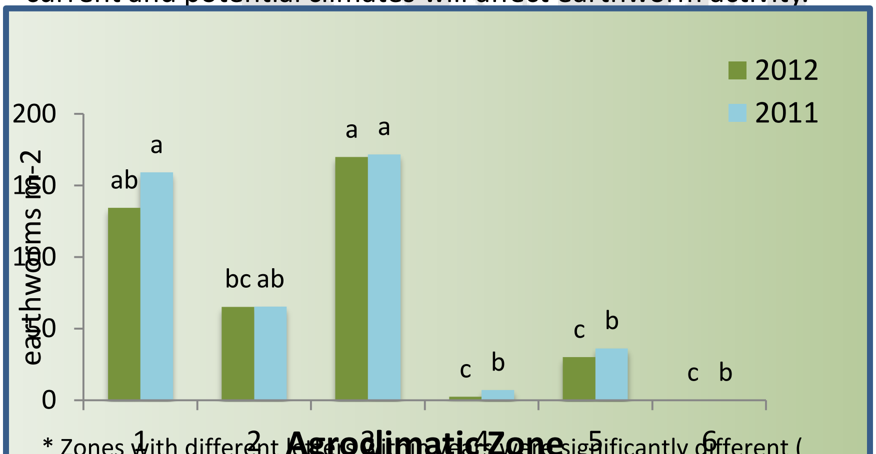
Earthworms Densities in the AEZ

Chelsea Walsh, University of Idaho

Top two pictures:
Summer intern and Ian Leslie digging earthworm samples
Bottom picture:
Ying Wu and intern sifting for cocoons and earthworms

Earthworms can play an important role in agroecosystems, effecting nutrient cycling, soil physical properties and, sometimes, crop yields. Earthworms also interact with other organisms with largely unmeasured ecosystem impacts. Earthworm activity is sensitive to both soil moisture and temperature and is expected to vary between climatic zones. Earthworms were collected from 40 sites during the springs of 2011 and 2012. Densities varied between and within zones, sites and years. Earthworms were not found in the lowest rainfall zone sampled (less than 310 mm per year), even where irrigation was utilized. Average earthworm densities in 2011 and 2012 were 333 and 113 earthworms m^{-2}, respectively. Earthworm populations were dominated by the invasive species, *Aporrectodea trapezoides,* which represented 85% of all adults collected. Directions for continuing research include a better understanding of the factors effecting density/activity, interactions with above and below ground biota and how current and potential climates will affect earthworm activity.



* Zones with different letters within years were significantly different (p<0.05). Lack of vertical bars indicate values of zero.

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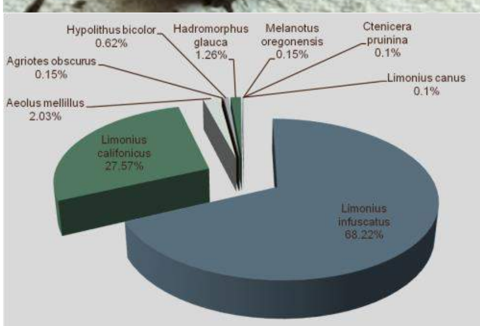
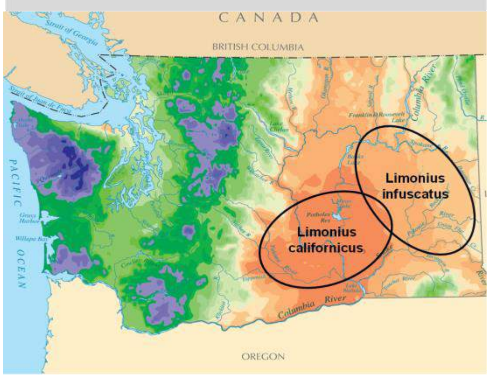
Climatic Effects on Wireworm Species Distributions

Dave Crowder, Washington State University





Pictures shown, from top to bottom, are:

1) Wireworm larvae
2) Relative abundance of wireworms in Washington
3) Distribution of two most common wireworm species

Wireworms, the subterranean larval stages of click beetles (Fig. 1), are pests of cereal crops in North America and globally. Wireworms have proven difficult to manage because in-season sampling is difficult, and damage can be done to crop fields before management strategies are implemented. **Thus, wireworms represent an emerging threat to the continued productivity of cereal crops in the PNW.**

Here, we report results of the first comprehensive survey to look at the wireworm species present in Washington and effects of climatic factors on wireworm distributions. We found a diverse mixture of wireworms, with nine species collected (Fig. 2). Two species, *Limonius infuscatus* and *L. californicus,* represented approximately 96% of wireworms collected (Fig. 2). *L. californicus* was the dominant species in the dryland region of Washington, while *L. infuscatus* was the dominant species in the irrigated region (Fig. 3). Future work will explore how these factors contribute to management of these pests.

Outputs of our project will be disseminated to growers, extension agents, and researchers through the development of an extension bulletin, talks at field days, and research publications. Our results should impact growers interested in wireworm management, as well as researchers interested in the biology and ecology of these species and their interactions with other organisms in cereal systems.

Future challenges include developing a better understanding of the role of climatic factors across landscapes, and micro-climates in farms, on wireworm distributions. In addition, we will explore how farming systems affect wireworms. Therefore, integration with other groups modeling climate change and cropping systems could occur in the future.

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