

Global Perspectives Grant Program, Final Project Report

Award Period – Spring 2014

Principle Investigator: Andrew Kniss, Department of Plant Sciences – akniss@uwyo.edu

Project Title: Development of an Online Course for Statistical Analysis in Weed Science

Amount Spent: \$4,000

Non-Technical Summary:

Statistical analysis is a critical aspect of research in the agricultural and biological sciences. Because biological experiments rely on data from complex, living systems, there is always an element of variability that can only be dealt with using proper statistical analysis. Essentially, statistics is a way to summarize the variability of data so that we may evaluate the confidence with which we should draw conclusions. It is critical that scientific training, particularly graduate programs in the biological sciences, provide a sound background in statistics. Statistical training allows young scientists to not only apply correct methodology to their own research, but also to critically evaluate others work. In the Summer of 2014, Dr. Jens Streibig was a visiting scientist in the University of Wyoming Department of Plant Sciences. While here, Dr. Streibig and Dr. Kniss developed a comprehensive educational website for graduate students in the agricultural sciences to learn the statistical program R (<http://rstats4ag.org/>). This website represents the beginning of a teaching collaboration between Dr. Streibig and Dr. Kniss.

Development of an Online Course for Statistical Analysis in Weed Science

Dr. Andrew R. Kniss
Associate Professor
Department of Plant Sciences
University of Wyoming

Dr. Jens Streibig
Professor
Faculty of Science
University of Copenhagen

Basis for the project & project benefits:

Statistical analysis is a critical aspect of research in the agricultural and biological sciences. Because biological experiments rely on empirical data, there is always an element of variability that can only be dealt with using proper statistical analysis. Essentially, statistics is a way to summarize the variability of data so that we may evaluate the confidence with which we should draw conclusions. Even with the well-recognized importance of statistical analysis to scientific progress, there is a great deal of concern that statistics are being used inappropriately. Many high-profile examples of poor statistical methodology have made headlines in recent years. It is critical that scientific training, particularly graduate programs in the biological sciences, provide a sound background in statistics. Statistical training allows young scientists to not only apply correct methodology to their own research, but also to critically evaluate others work.

There are relatively few resources that provide easily accessible “how-to” information on proper analysis of the experimental designs most often employed by weed scientists. Dr. Streibig and Dr. Kniss have observed an overwhelming interest from their weed science colleagues on using proper statistical methods, but many cite the lack of available resources to learn more. In response to this need, Dr. Streibig and Dr. Kniss have collaborated previously on a short-course taught at the Weed Science Society of America annual meeting in Vancouver, as well as a statistical methods paper submitted as a special issue in the journal *Weed Science*. They both also regularly teach statistical methods and are sought out by other weed scientists for advice and to give talks on the topic.

Project Objective:

The objective of this project is to increase the level of statistical knowledge of weed scientists, and thereby improve the quality of research conducted within the discipline.

Accomplishments:

While in Laramie, Dr. Streibig and Dr. Kniss developed materials and methods for a new website that provides code examples for many common experimental designs used in the agricultural sciences. During his stay, Dr. Streibig was housed in the Department of Plant Sciences. A comprehensive website was developed during Dr. Streibig's stay at the University of Wyoming (<http://rstats4ag.org/>). The website was advertised at the Weed Science Society of America meeting the following winter, and has been used regularly as part of Dr. Streibig's workshops conducted in developing countries around the world. In just the 6 months following launch in September, 2014, the website had already received

over 2,700 page views. This greatly exceeded expectations for such a targeted website. The website forms the basis of future teaching programs that will be administered individually and collaboratively by Dr. Streibig and Dr. Kniss.

In addition to course and website development, Dr. Streibig presented a seminar on the public resistance to pesticides and biotechnology in Denmark, which was well received by faculty and students alike. He attended several field days at the University of Wyoming Research and Extension Centers, and he has used much of the information from those experiences in his teaching back in Denmark.



The screenshot shows the homepage of the website "STATISTICAL ANALYSIS OF AGRICULTURAL EXPERIMENTS WITH R". The page has a blue header with the title and navigation links for "BLOG", "CONTRIBUTED DATA & ANALYSES", and "DISCUSSION FORUM (COMING SOON)". On the left, there is a sidebar with the "RSTATS4AG" logo, a search bar, and a list of topics including Introduction, Getting Data into R, Calculating Descriptive Statistics, Data Visualization & Plotting, Tests, Analysis of Variance (ANOVA), Linear Regression, Analysis of Covariance (ANCOVA), Mixed Models, ANOVA, Mixed Models: Regression, Dose Response, Logistic Regression, Selectivity, Germination, and Plant Competition. Below this is a section titled "On this page:" with links to "What is this site?", "Downloading and installing R", "R packages - CRAN", "RStudio", "Conventions", "Basics of using R", "How to get help?", "Help files", and "Online help". The main content area is titled "Introduction" and "What is this site?". It features a quote: "Statistics, like all other disciplines, is dynamic; it is not a fixed set of unchanging rules passed down from Fisher and company." - W. Stroup. Below the quote, there are two paragraphs of text explaining the website's purpose and scope.

The website developed by Dr. Kniss and Dr. Streibig with support of the Global Perspectives Grant Program.