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Useful to Usable: Developing usable climate science for agriculture

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ABSTRACT

The Useful to Usable (U2U) project was a six-year research and extension project funded by the United States Department of Agriculture to provide both useful and usable climate information for the agricultural (corn) sector in the Midwestern United States. The project adopted an extensive co-production of knowledge and decision-making approach that involved intense iteration with potential end-users, including farmers and a variety of professional agricultural advisors, through focus groups and surveys, feedback at outreach events, and frequent informal interactions to develop both decision support tools and delivery mechanisms that met stakeholder needs. This overview paper for this special issue illustrates some key ways that the co-production process informed the overall project. Subsequent papers in the special issue span the different objectives of the U2U project, including social, climate, and agronomic sciences. A brief overview of these papers is presented here.

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1. Introduction

Useful to Usable (U2U) was a multi-year research and extension project funded by the U.S. Department of Agriculture's National Institute for Food and Agriculture (USDA-NIFA) to enhance the usability and up-take of climate information in the Midwestern United States (see [Fig. 1](#)) with the long-term goals of supporting more profitable agricultural systems and greater resilience to a variable and changing climate. The U2U team comprised more than 50 faculty, staff, and students from nine Midwestern universities, two NOAA Regional Climate Centers, and the National Drought Mitigation Center. This highly interdisciplinary team included experts in climatology, agronomy, crop modeling, economics, information technology, decision science and knowledge usability, sociology, environmental planning, Extension, evaluation, communication, and marketing. Together, this diverse team addressed the following objectives:

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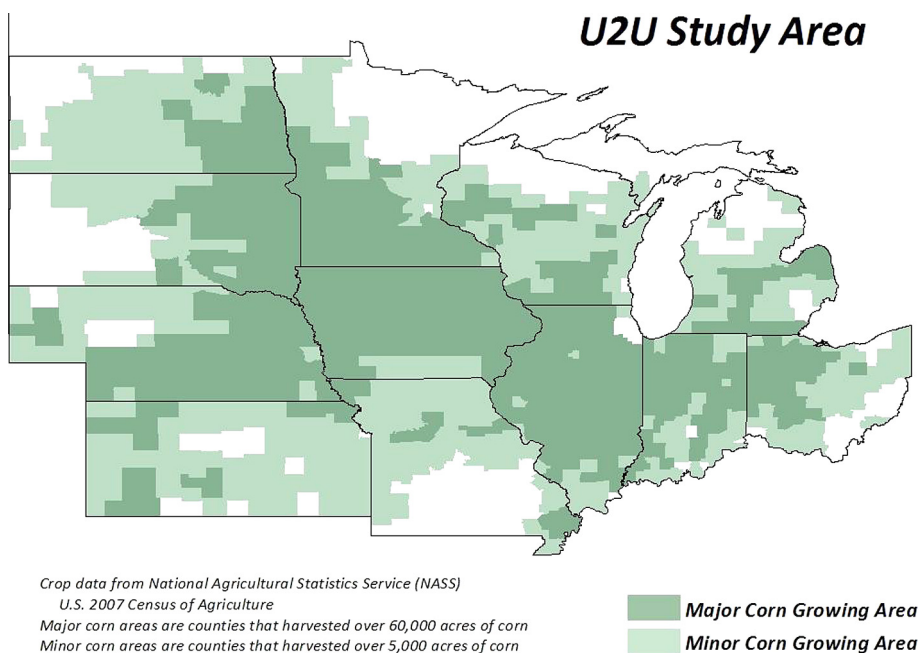


Fig. 1. Useful to Usable (U2U) project study area (map originally published in Prokopy et al., 2015b).

Objective 1: Use existing data and models to better understand the contributions of anomalous weather to crop variability and implications for future management options

Objective 2: Understand the use and value of climate information for agricultural decision making, and determine effective methods for disseminating usable climate knowledge

Objective 3: Integrate climate modeling results with needs of target audiences to develop tools, training materials, and implementation approaches that lead to more effective decision making and the adoption of climate-resilient farm practices

Objective 4: Evaluate the effectiveness of decision support tools and materials, refining resources as needed based on stakeholder feedback

Objective 5: Broadly disseminate validated decision support resources and extension programs across the Corn Belt.

Over the course of this six-year project, the U2U team developed five climate-based decision support tools, published over 70 journal and Extension publications, connected with the agricultural community at more than 140 outreach events, and received national and local recognition for successful integration of research, extension, and education efforts.

The hallmark of U2U was a co-production approach that enabled the team to provide useful and usable products to the potential end-users. This overview paper for this special issue highlights the processes through which co-production was carried out—especially how the results of surveys and focus groups drove the tool development and outreach approaches. In the next sections we offer a brief review of the co-production literature, describe the U2U co-production process in detail, and provide a brief description of the additional papers in this special issue.

2. Co-producing knowledge and decision-making

For the past few decades the concept of co-production of science and society has gained prominence in two main ways. First, from a constructivist perspective that seeks to reveal the ontological underpinnings of public policy, scholars have argued for the inseparability of the development of knowledge and society (knowledge is an element of society and society constitute knowledge) (Jasanoff, 2004; Latour and Woolgar, 2013) and the implications of its application to issues of power and equity (Löfbrand, 2011; Swart et al., 2014). Second, from a more utilitarian perspective that defines co-production as a practical mechanism to increase the usability of knowledge in decision-making (Lemos et al., 2012; Lemos and Morehouse, 2005), scholars have argued that mechanisms can be purposefully designed and implemented to facilitate it (Dilling and Lemos, 2011). While the former highlights the role of science in shaping society and vice versa, the latter seeks to understand the means to narrow the gap between knowledge production and use. Lemos and Morehouse (2005) define co-production as a two-way iteration between scientists and stakeholders that depends on three conditions: 1. Interaction with stakeholders in all phases of research; 2. Interdisciplinarity, which in turn depends on scientists' willingness and low institutional barriers; 3. The creation of usable science, defined as that which "directly reflect expressed constituent needs, should be

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