



# Preliminary Investigations into Agricultural Teachers' Views of Sustainable Practices

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# Problem and Purpose of Study

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- **Problem**: as a whole, rural populations are more likely to be dismissive of efforts to adopt more sustainable practices than other populations.
- **Purpose of Study**: determining the extent to which the instructional model of agriscience education may be useful for increasing the adoption of sustainable knowledge and practice among rural students.
  - This is a precursor to a larger design-based research project for developing a national sustainability agriscience curriculum.



Photo Credit: C. Kohn

# Personal Background

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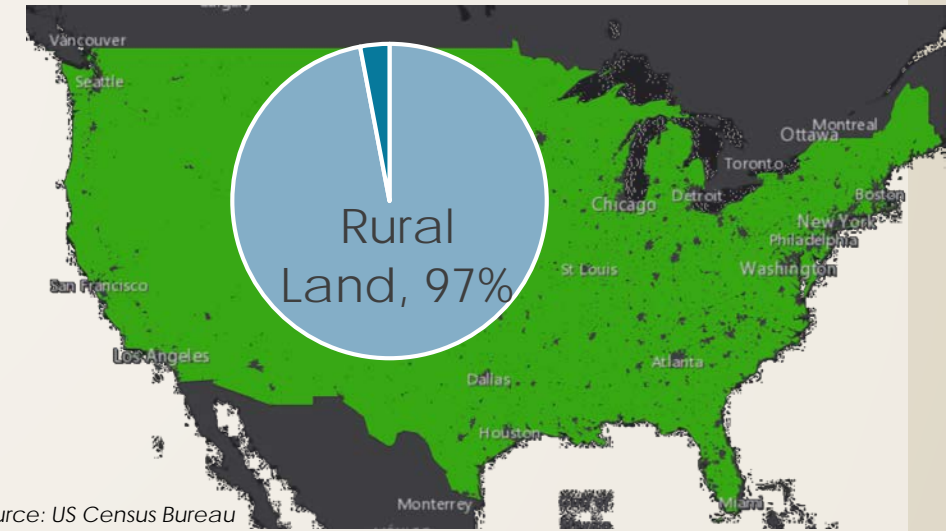
- Agricultural Experience
- Teaching Experience
- National Agricultural Education Policy Experience
  - National AFNR Academic Standards
  - SAE Renewal National Taskforce
- NSF Graduate Research Fellow



# Sustainability & Rural Populations

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- Rural Americans comprise less than 20% of the total US population.
  - However, they manage 97% of the land area in the United States (US Census Bureau, 2016)\*.
  - Rural Americans tend to be less supportive of efforts to improve sustainability compared to the national average.
- This is particularly true among farmers and other agriculturalists
  - The ag industry has vigorously supported environmental deregulation (Copeland, 2017).
  - Only 10% of farmers believe that climate change is both occurring and due to human activity (Prokopy, 2014; Arbuckle, et al., 2015).



Source: US Census Bureau

\*The US Census Bureau defines a rural area as population or region outside of an urban area (a population center of 50,000+).



Photo Credit: C. Kohn

# Sustainability & Rural Populations

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- ▶ **Many modern agricultural practices are currently unsustainable.**
  - ▶ Excess soil tillage degrades soil structural integrity and unnecessarily depletes soil nutrients (UNL, 2015).
  - ▶ Current agricultural practices are the leading cause of impairment to rivers and streams (CDC, 2016)
  - ▶ Rates of soil erosion are ten times greater on average than the rate of soil replenishment (Trautmann, Porter, & Wagenet, 2012).
  - ▶ Full utilization of the EPA's Best Management Practices among American farms has been sparse (Mulla, Birr, Kitchen, & David, 2008).



# Sustainability & Rural Populations

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Photo Credit: C. Kohn

- **American agriculturalists tend to believe that they know what is best for the stewardship of their own land and that their actions are in accordance with these needs.**
  - Farmers and ranchers are particularly regulation-adverse and believe that government regulations are largely a form of overreach (Waskom & Cooper, 2017).
- **Farmers are also prone to dismissing scientific conclusions in regards to ag-based concerns about sustainability.**
  - Many agriculturalists feel that they have a privileged personal connection to their land and ecosystem services and are dismissive of outside opinions.
  - Many view scientific recommendations for more sustainable practices as “just opinions” (Doll, 2017).

# Community-based Learning in Ag Ed

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Source: YouTube



Source: Four Paws and Whiskers



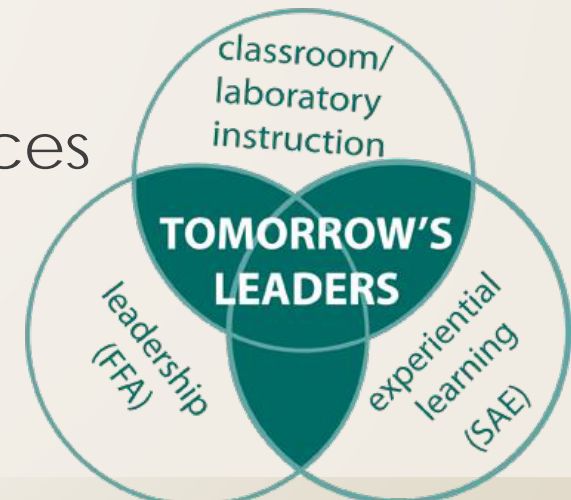
Source: Amazon

- Identity is likely a current key barrier for increased adoption of more sustainable agricultural knowledge and practice.
  - Agriculturalists tend to perceive that calls for more sustainable practices come from uninformed non-rural populations that lack sufficient expertise to make accurate judgments about ag practices.
  - As such, they tend to dismiss these suggestions as misinformed and misguided.
- **Curriculum that privileges rural identities may be crucial for changing this dichotomy.**
  - Instructional methods that utilize a student's sense of identity as a part of various communities can result in more informed action and decision making as a citizen (Birmingham and Calabrese Barton, 2014).

# Overview of Agricultural Education in the US

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- Agricultural education may be a valuable opportunity to reach rural populations who are resistant to adopting more sustainable practices.
  - Agricultural education in the US currently enrolls nearly a million secondary students per year primarily from rural areas (Jackman & Schescke, 2014).
- As the framework of secondary agricultural education, the Three Circle Model may be potentially valuable for the purposes of rural sustainability instruction.
  - This model stipulates that students need authentic career-based learning experiences as part of their ag education experiences.
  - This closely resembles situated learning theories such as Communities of Practice (Lave & Wenger, 1991).



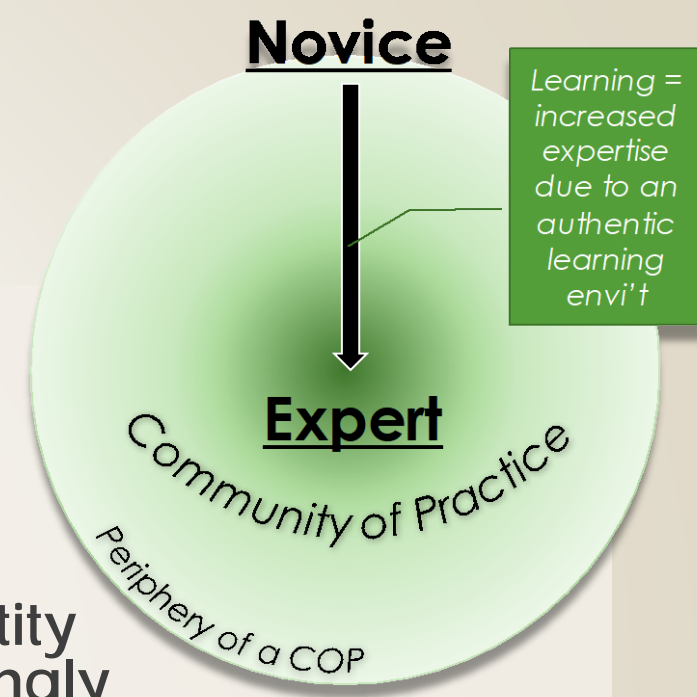
*Three Circle Model of Ag Education. (Source: NAAE)*



# Communities of Practice

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- Lave and Wenger (1991) suggested that learning happens mostly in authentic informal interactions.
  - These interactions serve as a means for the improvement of specific practices.
- Lave & Wenger define learning as a change in identity as a student moves from being a novice to increasingly acquiring expertise in a specific community of practice.
  - When student identity is privileged during instruction, students are likely have “constructive, persistent, focused interactions” (Nasir & Hand, 2008) resulting in more robust learning outcomes.
- The situated career learning opportunities inherent in agricultural education may prove to be a valuable means for increasing the adoption of sustainable knowledge and practice among rural students.
  - Little data exists in regards to the use of this model for this purpose (Barrick, 2015).



# Research Questions

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- For agricultural education to be effective for increasing the adoption of sustainable knowledge and practice, ag instructors would need to be...
  - Informed and supportive of the adoption of more sustainable agricultural practices.
  - Able to effectively utilize their existing community-based instructional methods for sustainability instruction.
- **Research Questions:**
  - 1) Do agricultural educators have a positive, evidence-based understanding of sustainability? (*esp. ecological sustainability*)
  - 2) Do agricultural educators have an increased capacity for effectively utilizing a community-based instructional model due to the unique conditions that occur in ag education?



# Methods

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- **Semi-structured interviews of 16 instructors of agriscience content from four states.**
- **Interviews consisted of nine questions.**
  - Four questions focused on agricultural sustainability.
  - Five questions focused on use of situated learning and community-based instruction.
- **Of the participants:**
  - Eleven were fully licensed teachers.
  - Five were undergraduate student-teachers in their final two years of teacher education.
  - Ages ranged from early 20s to late 50s.
  - Ideological affiliation was evenly distributed across the political spectrum.



Source: WikiClipArt

# Data Analysis & Triangulation

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- **The interviews were transcribed and coded using Dedoose computer coding software.**
  - Initially the transcripts were analyzed using descriptive codes based on parameters and guidelines established by AERA (2006) and Miles, et al. (2014).
- **These codes were assessed for inter-rater reliability.**
  - Codes were revised and discrepancies were discussed until complete consensus was achieved.
- **Interviews were triangulated with both a follow-up surveys of interview participants to confirm findings as well as a separate non-scientific survey of the attitudes of 59 agriscience teachers in Wisconsin.**
  - Results were consistent across all measures.

# Findings – *Participant Archetypes*

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- Two archetypes became prevalent among the responses during the coding process.



- Farmer Promoters are most identified by their defense of farmers and current farming practices.

- Praised work ethic of farmers.
- One-sided arguments ("Of course GMOs are safe!").
- Exclusive worldviews ("if other people saw what we saw, they'd think differently")



- Sustainable Reformers are most identifiable by their willingness to critique current farming practices.

- More nuanced positions ("GMOs can be safe...")
- Used quantitative numerical data in their arguments.

# Findings - *Sustainability*

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- The frequency at which participant responses were coded as 'Sustainable Reformer' suggests that ag instructors are both well-informed and supportive of ecological sustainability.
  - These instructors often adopt stances that put them at odds with the general worldviews of farmers and other rural residents (even though they all had direct connections to farming).
- **In particular, agricultural educators were concerned about...**
  - The long-term impacts of existing agricultural practices on soil health and water quality.
  - The impact of climate change on food production.
  - Levels of meat consumption in industrialized countries.
  - Rates of food waste.

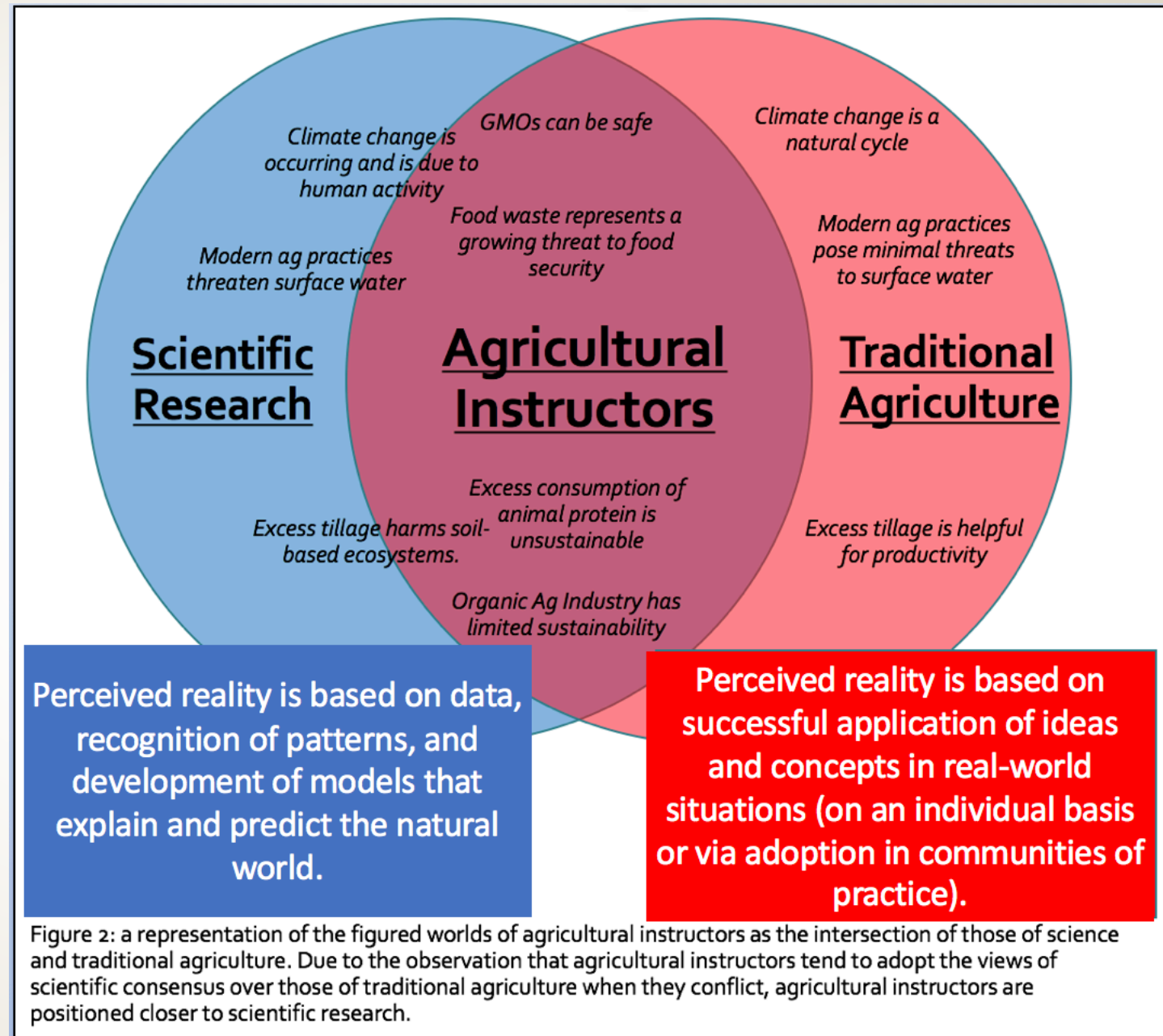


Photo Credit: C. Kohn

# Findings

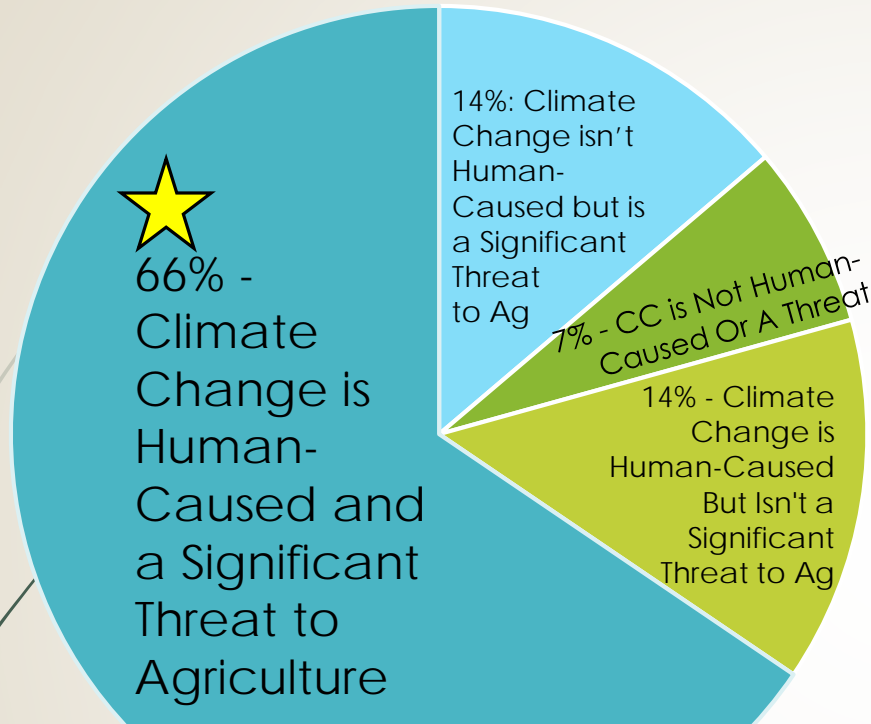
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- ➔ The stances on sustainability of agricultural instructors align more with the consensuses of scientific research than with the worldviews most commonly seen among rural populations.



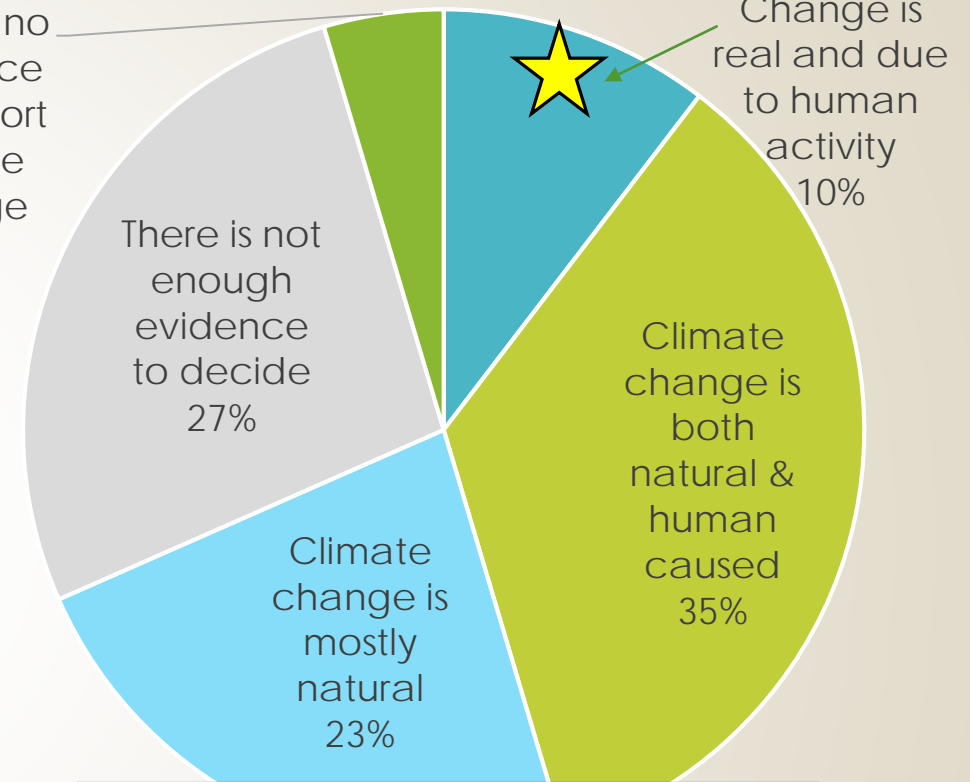
# Central Tension of Rural Sustainability

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2017 Wisc. Agricultural Instructors  
"Future of the Ag Industry" Survey

There is no evidence to support climate change 5%



2011 Iowa Farm & Rural Life Survey\*

- While 66% of instructors in this survey believed that climate change was caused by human activity and was a threat to agriculture, only about 10% of farmers accept that climate change is both real and caused by humans.

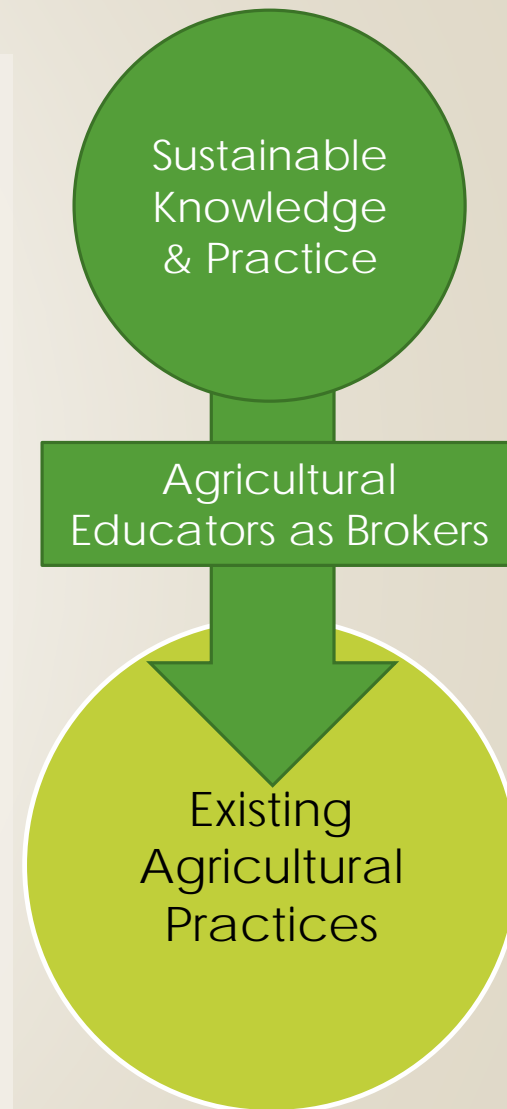
\*J. Gordon Arbuckle, J., Morton, L. W., & Hobbs, J. (2015). Understanding Farmer Perspectives on Climate Change Adaptation and Mitigation: The Roles of Trust in Sources of Climate Information, Climate Change Beliefs, and Perceived Risk. *Environment and Behavior*, 47(2), 205-234. <https://doi.org/10.1177/0013916513503832>



# Ag Instructors as Brokers of Knowledge

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- Wenger (2000) suggests that a community of practice can evolve to adopt new knowledge and practice due to the involvement of individuals who are skillful in creating connections between different communities.
  - Wenger uses the term “*brokers*” to describe these individuals.
- Agricultural educators may be potential brokers of sustainable knowledge and practice in rural communities of practice.
  - They have direct connections with community members, agricultural professionals, and secondary school students.



# Findings – *Community-based Instruction*

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Photo Credit: C. Kohn



- **Use of community-based instructional practices was widespread among all interviewed participants.**
  - This suggests that a community-based approach to sustainability instruction would be well-received among this audience.
- **Career-based community-based learning in off-site locations resulted in reports of...**
  - More impactful learning for students w/ longer-lasting effects.
  - Stronger student engagement in classroom content.
  - Greater trust in the instructor and the content they taught.
- **Participants frequently mentioned their struggles to create more opportunities for community-based learning.**
  - They actively sought assistance to increase these options, suggesting that curriculum for this purpose would be valuable.

# Conclusion

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- **These are potentially promising results.**
  - Ag instructors are much more positive and informed about ecological sustainability than initially expected.
  - The use of community-based instruction appears to be common and enables improvements to classroom trust & engagement.
- **Additional data collection and analysis is still needed.**
  - Why isn't existing ag instruction more impactful?
  - Can an emphasis on scientific literacy enable more transformative worldviews among students?
- **These findings will be used to guide the development of an open-access community-based sustainability curriculum that will be made available to agricultural instructors for use in their programs.**



Photo Credit: C. Kohn

## ➤ Thank you to...

- Advisor: Charles "Andy" Anderson
- Collaborator: May Lee
- Wisc. Association of Ag Educators
- All Teacher Participants



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- Allred, B. W., Twidwell, D., & Fuhlerndorf, S. D. (2014). The interaction of climate change, land cover, and political representation in the USA. *Ecosphere*, 5(12), art159. <https://doi.org/10.1890/ES14-00220.1>
- American Educational Research Association. (2006). Standards for Reporting on Empirical Social Science Research in AERA Publications: American Educational Research Association. *Educational Researcher*, 35(6), 33–40. <https://doi.org/10.3102/0013189X035006033>
- Arbuckle, J., Morton, L. W., & Hobbs, J. (2015). Understanding Farmer Perspectives on Climate Change Adaptation and Mitigation: The Roles of Trust in Sources of Climate Information, Climate Change Beliefs, and Perceived Risk. *Environment and Behavior*, 47(2), 205–234. <https://doi.org/10.1177/0013916513503832>
- Birmingham, D., & Calabrese Barton, A. (2014). Putting on a green carnival: Youth taking educated action on socioscientific issues. *Journal of Research in Science Teaching*, 51(3), 286–314.
- Copeland, C. (2015, June 29). EPA and the Army Corps' Rule to Define "Waters of the United States" [Report]. Retrieved February 16, 2018, from <https://digital.library.unt.edu/ark:/67531/metadc795373/>
- Centers for Disease Control. (2016, October 11). Water Contamination | Other Uses of Water | Healthy Water | CDC. Retrieved February 16, 2018, from <https://www.cdc.gov/healthywater/other/agricultural/contamination.html>
- Doll, J. E., Petersen, B., & Bode, C. (2017). Skeptical but Adapting: What Midwestern Farmers Say about Climate Change. *Weather, Climate, and Society*, 9(4), 739–751. <https://doi.org/10.1175/WCAS-D-16-0110.1>
- Jackman, W.J. & Schescke, K.. (2014, February). Discover the Possibilities of Agricultural Education. National Association of Agricultural Educators. Retrieved from [https://www.naae.org/whatisaged/AgriculturalEducationAdvocacyHandout\\_22713Print.pdf](https://www.naae.org/whatisaged/AgriculturalEducationAdvocacyHandout_22713Print.pdf)
- Kibblewhite, M. ., Ritz, K., & Swift, M. . (2008). Soil health in agricultural systems. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1492), 685–701. <https://doi.org/10.1098/rstb.2007.2178>
- Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge Univ. Press.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: a methods sourcebook (Third edition)*. Thousand Oaks, California: SAGE Publications, Inc.
- Prokopy, L. S., Morton, L. W., Arbuckle, J. G., Mase, A. S., & Wilke, A. K. (2014). Agricultural Stakeholder Views on Climate Change: Implications for Conducting Research and Outreach. *Bulletin of the American Meteorological Society*, 96(2), 181–190. <https://doi.org/10.1175/BAMS-D-13-00172.1>
- Remler, D. K., & Van Ryzin, G. G. (2011). *Research methods in practice: strategies for description and causation*. Thousand Oaks, Calif: SAGE Publications.
- Trautmann, Porter, & Wagenet, (2012). PSEP Fact sheets: Modern Agriculture: Its Effects on the Environment. Cornell University. Retrieved February 16, 2018, from <http://psep.cce.cornell.edu/facts-slides-self/facts/mod-ag-grw85.aspx>
- U. of N.-L. | W. D. (2015, September 17). Soil & Water Management: Soil Structure. Retrieved February 27, 2018, from <https://cropwatch.unl.edu/tillage/structure>
- US Census Bureau. (2016). New Census Data Show Differences Between Urban and Rural Populations. <https://www.census.gov/newsroom/press-releases/2016/cb16-210.html>
- Waskom, R. and Cooper, D. (2017, March 4). Why farmers and ranchers think the EPA Clean Water Rule goes too far. PBS News Hour. Retrieved February 16, 2018, from <https://www.pbs.org/newshour/nation/farmers-ranchers-think-epa-clean-water-rule-goes-far>
- Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization*, 7(2), 225–246. <https://doi.org/10.1177/135050840072002>
- Wenger, E. (2011). Communities of practice: A brief introduction. Retrieved from <http://scholarsbank.uoregon.edu/xmlui/handle/1794/11736>