

Communicating About Water in the Floridan Aquifer Region: Part 6—Stakeholders’ Mental Models of Regional Water Challenges¹

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If we could look into the minds of agricultural producers and environmentalists to see how they think about regional water challenges, we may be better able to help stakeholders understand each other’s perspectives and resolve perceived conflicts.

A 2017–2018 study provides visual maps of producers’ and environmentalists’ conceptions of the relationship between water and the regional economy. The maps reveal that the two groups think about the topic in fundamentally different ways. While surveyed producers possess an agricultural, operational-level view of the water-economic system, environmentalists possess a watershed-level view.

As reported in Part 5 of this series, EDIS publication #AEC788, “[Increasing Collaboration Between Producers and Environmentalists on Water Challenges](#),” there are tensions between producers and environmentalists that impede their collaboration toward shared water goals. Environmentalists tend to believe that producers do not share their land ethic, and producers often feel unfairly blamed by environmentalists for water quality issues. Through examination of the mental models of both stakeholder groups, the findings of this study indicate steps that water communicators can take to reduce these sources of conflict and improve communication between groups. This publication is intended for use by Extension agents and

other water communicators seeking to improve stakeholder communication and collaboration.

How Were Stakeholder Groups Defined?

In the study, 39 participants indicated their level of self-identification as producers and environmentalists. They were then assigned to the group with which they most strongly identified. In other words, a participant was classified as either an environmentalist ($n = 14$) or a producer ($n = 25$), not both.

How Were Stakeholders’ Mental Models Evaluated?

Stakeholders’ mental models were documented using a method called conceptual content cognitive mapping or 3CM (Kearney & Kaplan, 1997). The process began with participants receiving the following prompt: *Imagine someone you know recognizes your knowledge of local water issues (i.e., water quality and quantity) and has asked for your honest perspective on the relationships between water and the regional economy.* Participants took a moment to consider how they would respond to the inquiry and what things they would include in their response. Next, every

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participant received a deck of 57 cards, each printed with a term related to water or the regional economy (e.g., jobs, aquifer, agricultural best management practices, ecosystem health, water conservation, costs). They then completed the following process (adapted from Kearney, 2015).

1. *Create two stacks of cards.* Create one stack for those terms you would use in your response and another for those terms you would not use.
2. *Add missing terms.* Use the provided blank white cards to add additional terms that you would include in your response.
3. *Create clusters.* Divide the cards into clusters of terms you feel go together.
4. *Name each of the clusters.* Using the provided colored cards, assign a name to each cluster.

This process captured, with cards, the mental models of each individual participant.

Producers

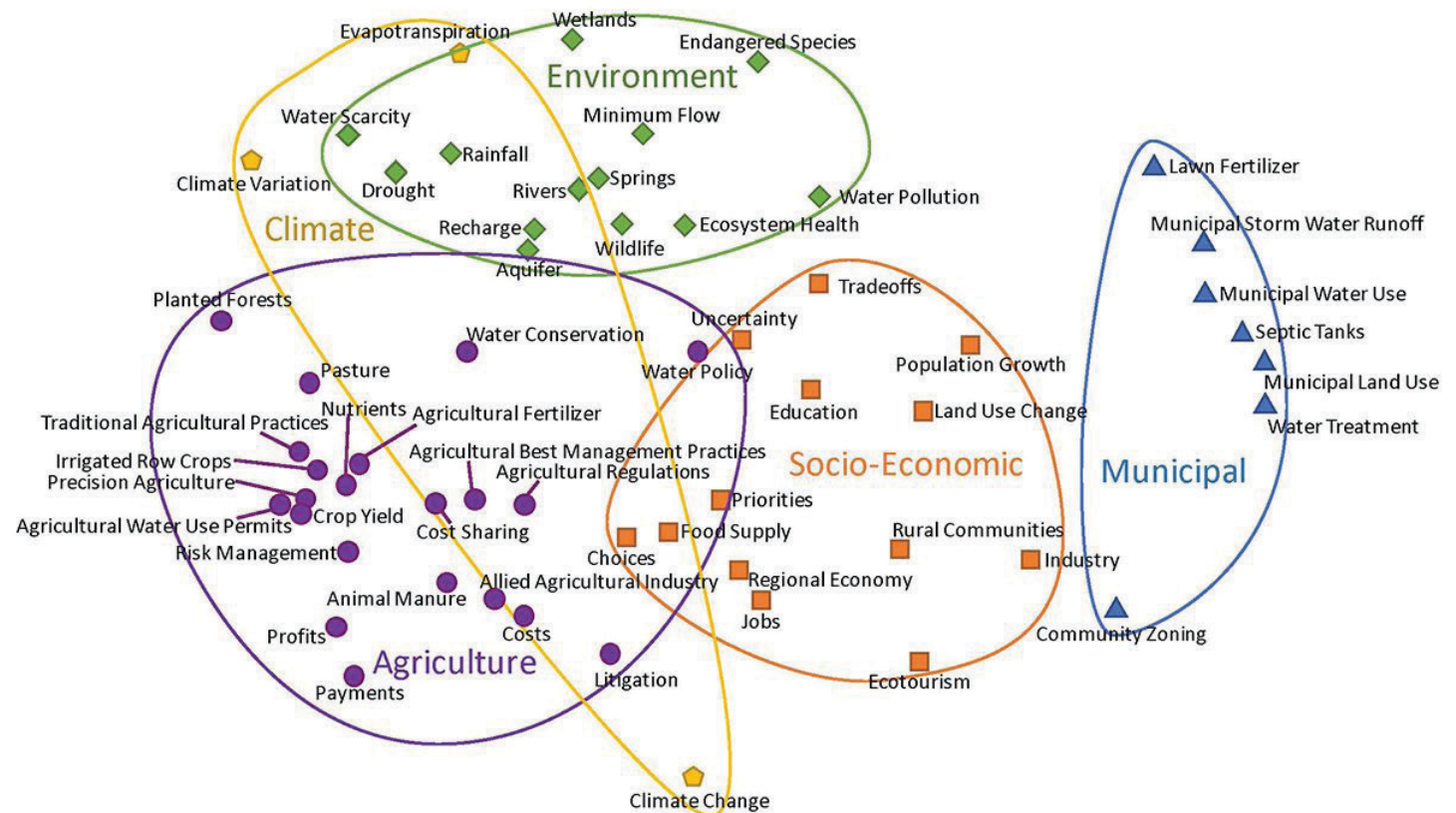


Figure 1. Composite map of participating agricultural producers' mental models.
Credits: Hundemer & Monroe (2020)

Interpreting the Composite Maps of Stakeholders' Mental Models

Using the application, ANTHROPAC, the mental models of individual participants were compiled into composite maps representing the mental models of producers as a whole and environmentalists as a whole (Borgatti, 1992; Borgatti et al., 2002). As illustrated in Figures 1 and 2, the maps depict how surveyed agricultural producers and surveyed environmentalists perceive the relationship between water and the regional economy. Each point on the maps represents a term (from a card) related to water or the economy. The distance between any two points indicates how often the terms were grouped together and their perceived relatedness. The clustered terms (circled within the maps) indicate dominant domains of thought on the topic.

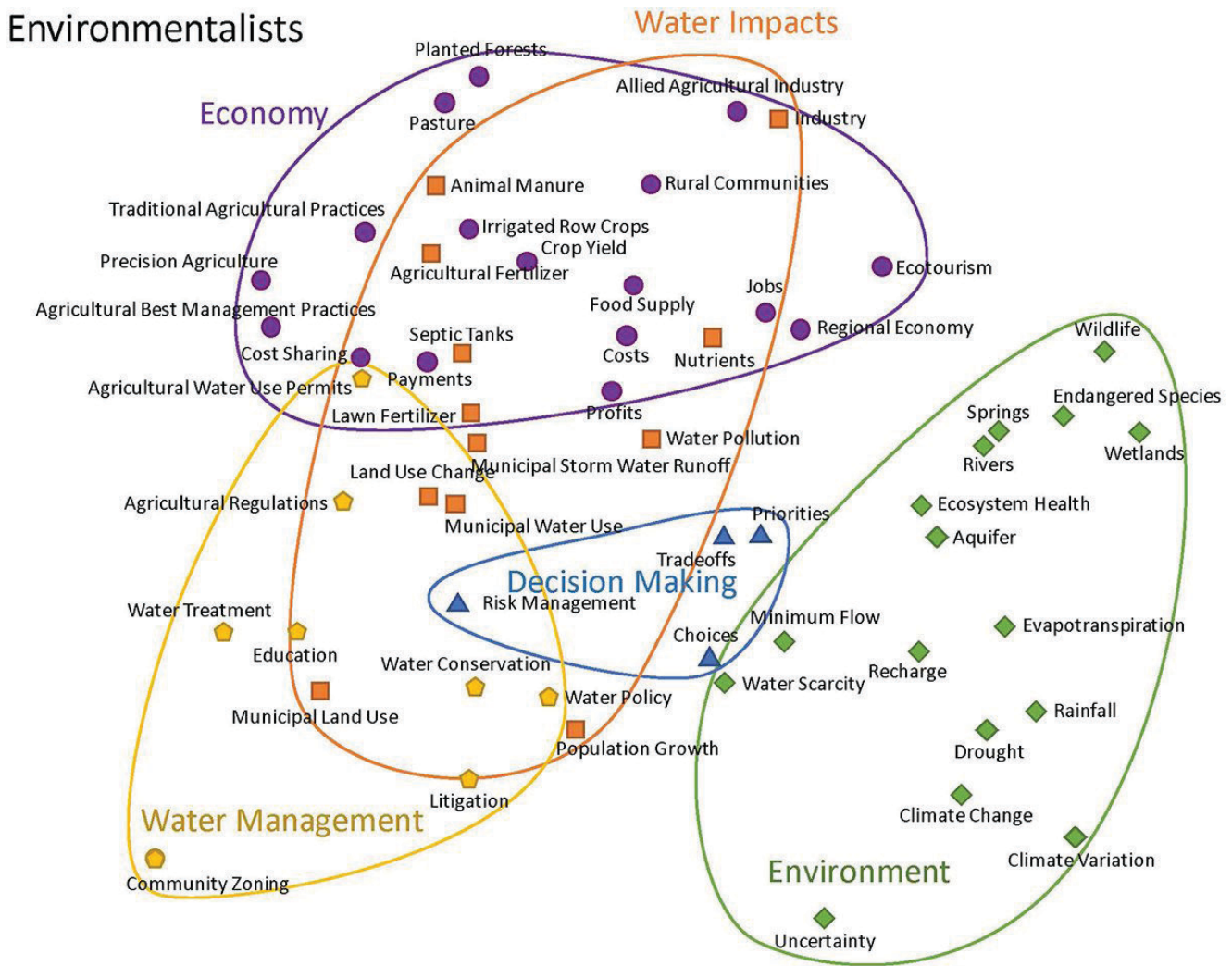


Figure 2. Composite map of participating environmentalists' mental models. Credits: Hundemer & Monroe (2020)

Producers' Mental Models

The map of surveyed producers' mental models (Figure 1) indicates five core domains of thought on the relationship between water and the regional economy—*agriculture*, *environment*, *socio-economic*, *climate*, and *municipal*. In other words, these were the five big topical areas that producers considered. With the exception of *climate*, the clusters overlap very little. The large number of terms in the *agriculture* cluster suggests that *agriculture* has a substantial impact on how producers think about the water-economic system. The *municipal* cluster is the most distant from other clusters, suggesting that it is cognitively distant from other parts of the water-economic system. In contrast, the *socio-economic* cluster is centrally located on the map, connecting *municipal* concepts with the domains of *agriculture* and *environment* in producers' minds.

Environmentalists' Mental Models

The map of surveyed environmentalists' mental models also indicates five dominant domains of thought—in this case, *water impacts*, *water management*, *economy*, *decision-making*, and *environment*. Many of these domains of thought overlap. At the center, the *water impacts* domain contains various causes of water challenges including agricultural and municipal activity. The *water management* domain includes a range of management concepts regardless of the social sector to which they apply. Overall, the map indicates that surveyed environmentalists think about the water-economic system primarily in terms of challenges and interventions, rather than distinct operational components.

Comparing Stakeholders' Mental Models

Cluster Analysis

Overall, producers' view of the relationship between water and the regional economy is heavily influenced by *agriculture*. Producers interact with water, often on a daily basis, through farming or ranching. As a result, they think about the water-economic system in an operational manner. Their composite map has relatively distinct components and an agricultural emphasis. In contrast, environmentalists' mental models are influenced by their dominant water activities, which include assessing and advocating for environmental protection. This perspective creates overarching domains focused on problem identification and intervention. Effectively, surveyed producers possess an agricultural, operational-level view of the water-economic system, whereas surveyed environmentalists possess a watershed-level view. Both are logical and useful, but they are distinct.

As detailed in Part 5 of this series, EDIS publication #AEC788, “[Increasing Collaboration Between Producers and Environmentalists on Water Challenges](#),” producers and environmentalists often perceive themselves to be in conflict with one another. Despite common interests and water priorities, some environmentalists question producers' land ethics, and some producers feel unfairly blamed for water issues. Examining their mental models may help explain why this perceived conflict persists. With an operational-level view, producers may be oriented to focus on the steps that they and other producers take to protect water resources. With a watershed-level view, environmentalists are not focused on protective action by individuals but, instead, on the collective negative impacts of industry as a whole. As a result of this difference in perception and experience, environmentalists may not fully appreciate the actions farmers take to protect water, and farmers may not fully appreciate the implications that the agricultural industry has on the environment. These perspectives can cause producers and environmentalists to think their water priorities and concerns are less similar than they actually are.

Terms by Cluster

Another way to examine the composite maps is by term location—in what cluster does a term appear? See table 1 for a sample of terms and their associated clusters. The cluster names suggest the category of topics a stakeholder likely associates with each given term (Chong & Druckman, 2007; Fiske & Taylor, 2017). For example, the terms

“agricultural fertilizer,” “animal manure,” and “nutrients” may call to mind *agriculture* for producers but *water impacts* for environmentalists. This difference creates a potential challenge for cross-group communication.

Table 1. Cluster placement of selected terms.

Term	Producers	Environmentalists
Agricultural fertilizer	Agriculture	Water impacts
Animal manure	Agriculture	Water impacts
Education	Socio-economic	Water management
Industry	Socio-economic	Water impacts
Nutrients	Agriculture	Water impacts
Payments	Agriculture	Economy
Risk management	Agriculture	Decision-making
Uncertainty	Socio-economic	Environment

Term-Inclusion Percentages

A final way to compare the mental models of producers and environmentalists is through the terms (cards) included or excluded in their individual mental models. Table 2 indicates the percentage of participants who included a specific term as well as the inclusion difference between groups. Large differences between groups suggest that a concept perceived as important to one group may be off the radar for the other group.

The term with the greatest difference was “risk management,” included by only 38 percent of environmentalists but 71 percent of surveyed producers (who associated the term with *agriculture*). This suggests an opportunity to increase environmentalists' considerations of the economic risks incurred by producers related to water. Similarly, “ecosystem health” was less prominent in producers' mental models but could provide an entry point for expanding producers' appreciation for environmentalists' perspectives. On terms related to agricultural policy, producers more often included “cost sharing” and “payments,” whereas environmentalists more often included “agricultural water-use permits.”

How to Use This Information

Work toward shared understandings. Maps of stakeholder mental models illustrate their different foci and reveal the considerations that may be absent in each of their perspectives. This information provides communicators with specific entry points for helping stakeholders see others' points of view. For example, there may be a need to regularly connect operational-level considerations with watershed-level implications. As another example, the comparatively low inclusion of “precision agriculture” in

environmentalists' mental models suggests an opportunity to increase awareness of the methods producers use to minimize resource use, which may promote effective cross-group discourse on water strategy.

Consider how messages may be received. The findings also suggest how stakeholders will likely receive and process information (Kearney & Kaplan, 1997). For example, the clusters suggest how using particular terms and discussion topics may activate different cognitive domains. Therefore, topics can potentially activate different cognitive domains for different groups, impeding cross-group communication (Brønn & Brønn, 2003). As described above, the terms “agricultural fertilizer,” “animal manure,” and “nutrients” may call to mind *agriculture* for producers but *water impacts* for environmentalists. Consider the miscommunication or opposition that could arise if producers are primed to think about their businesses at the same time that environmentalists are primed to think about pollution.

Attend to perceived conflicts. This research suggests that perceived conflict between producers and environmentalists may stem in part from the manner in which the groups interact with and think about water. While producers are oriented to think about what precautions they take to protect water, environmentalists are oriented to think about the environmental implications of the agricultural industry as a whole. These very different views can place agricultural production in either a positive or negative light. It can also cause producers to be associated with problems of agricultural scale, regardless of their individual conservation efforts. As a result, feelings of blame can impede cross-group collaboration. Water communicators can bridge mental models by taking care to distinguish between individual producer actions and broader industry impacts.

Create opportunities for stakeholders to reflect on their perspectives and the perspectives of others. Cognitive maps are tools for stakeholders to better understand why others think the way they do. Moreover, it can help stakeholders reflect on the factors that shape their own perspectives. With this information, stakeholders can independently overcome some communication barriers. They may identify gaps in their own perspectives and also find ways to communicate their points of view more effectively to those with alternative mental models.

Check your own biases. A look inside the thought process of stakeholders also provides an opportunity for communicators to examine their own perspectives with a critical eye. Communicator bias can shape stakeholder conversations, potentially impeding cross-group collaboration.

Make use of stakeholder knowledge. Mental model analysis exposes the different ways that stakeholders interact with the water-economic system. Their unique experiences and perspectives can help scientists and policy makers design more effective water management strategies.

For more information on this study, see “A Co-orientation Analysis of Producers’ and Environmentalists’ Mental Models of Water Issues: Opportunities for Improved Communication and Collaboration” at <https://doi.org/10.1080/17524032.2020.1828128> (Hundemer and Monroe, 2020).

Table 2. Selected term inclusion percentages.

Term	Producers	Environmentalists	Difference
Selected more frequently by producers			
Risk management	71%	38%	34%
Pasture	79%	46%	33%
Allied agricultural industry	64%	33%	31%
Precision agriculture	93%	67%	26%
Choices	79%	54%	24%
Education	79%	54%	24%
Cost sharing	86%	63%	23%
Crop yield	93%	71%	22%
Jobs	93%	71%	22%
Payments	71%	50%	21%
Selected more frequently by environmentalists			
Climate change	36%	63%	27%
Septic tanks	57%	79%	22%
Regional economy	64%	83%	19%
Agricultural water use permits	79%	96%	17%
Ecotourism	50%	67%	17%
Ecosystem health	71%	88%	16%
Land-use change	71%	88%	16%
Lawn fertilizer	57%	71%	14%
Climate variation	50%	63%	13%
Endangered species	50%	63%	13%
Water treatment	50%	63%	13%

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References

- Borgatti, S. P. (1992). *Anthropac (4.0)*. Analytic Technologies. <http://www.analytictech.com/anthropac/anthropac.htm>
- Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *UCINET (Version 6)*. Analytic Technologies. <https://sites.google.com/site/ucinetsoftware/home>
- Brønn, P. S., & Brønn, C. (2003). A reflective stakeholder approach: Co-orientation as a basis for communication and learning. *Journal of Communication Management*, 7(4), 291–303. <https://doi.org/10.1108/13632540310807430>
- Chong, D., & Druckman, J. N. (2007). Framing theory. *Annual Review of Political Science*, 10(1), 103–126. <https://doi.org/10.1146/annurev.polisci.10.072805.103054>
- Fiske, S. T., & Taylor, S. E. (2017). *Social cognition: From brains to culture (3rd Edition)*. Sage Publications, Inc.
- Hundemer, S., & Monroe, M. C. (2020). A co-orientation analysis of producers' and environmentalists' mental models of water issues: Opportunities for improved communication and collaboration. *Environmental Communication*, 15(3), 320–338. <https://doi.org/10.1080/17524032.2020.1828128>
- Kearney, A. R. (2015). 3CM: A tool for knowing “where they’re at.” In R. Kaplan & A. Basu (Eds.), *Fostering reasonableness: Supportive environments for bringing out our best* (pp. 273–294). Michigan Publishing.
- Kearney, A. R., & Kaplan, S. (1997). Toward a methodology for the measurement of knowledge structures of ordinary people: The conceptual content cognitive map (3CM). *Environment and Behavior*, 29(5), 579–617. <https://doi.org/10.1177/0013916597295001>