IDEAS & INNOVATIONS

doi:10.2489/jswc.67.5.145A

Maps help landowners think beyond human scale

Jean Eells, Michael F. Dahlstrom, and Raeann Ritland

Soil and water conservation issues are landscape-level issues, yet the human mind is biased to focus on individual-level phenomenon. This mismatch of scale often hinders the adoption of behaviors necessary for effective soil and water protection.

The theory of grounded cognition claims that the human mind evolved to account for sensory input that directly led to bodily survival, and it is therefore optimized to comprehend ideas at this level (Kaschak and Maner 2009). Research suggests that as concepts deviate from this "human scale," comprehension becomes skewed. Referencing group sizes that are closer to cohesive units in human society, such as a value out of 125, permit easier assessment and are less influenced by message framing than when referencing larger group sizes beyond normal human relationships, such as a value out of 100,000 (Garcia-Retamero and Galesic 2011; Wang 1996). Similarly, people predict concepts psychologically near to them in concrete terms, but perceptions become more abstract and less contextualized as the concept moves more distant in time or space (Trope et al. 2007). Even the perceptions of numbers themselves are not linear; the difference between values commonly encountered in daily life, such as between 10 and 20, is given more importance than the same difference at a different scale, such as between 1,010 and 1,020 (Dehaene et al. 2008).

These biases become problematic when conservation professionals try to promote behaviors that are beneficial on the landscape scale. To evaluate the utility of such a landscape-level behavior, an individual needs to consider how his/her actions intersect with the actions of other individuals within a larger, cumulative system beyond human scale. However, what often happens is individuals evaluate such behaviors using criteria from within human scale that may conflict with the larger recommendations. To take a specific example, the concept of a watershed exists beyond human scale both in size, it involves multiple landowners across large areas of land, and in time, its status is cumulative and often not immediately observable. Conservation professionals often try to convince landowners to adopt practices beneficial to the watershed as a whole, such as septic system upgrades, wetland development, or riparian buffers, but often face questions based from within human scale: Is this a problem on my land? Will I see a difference if I adopt this behavior? Does my small contribution really matter?

What would be helpful is methods of communication that can help counter these inherent biases in human perception and help individuals better perceive concepts beyond human scale. Visual information is processed differently than logical discussion, and there is evidence that visual processing can improve the comprehension of risks, specifically by better revealing patterns, simplifying comparisons, and attracting and holding attention (Lipkus and Hollands 1999). Likewise, visuals are potentially powerful for linking specific verbatim knowledge to the larger gist of the message (Hawley et al. 2008).

A specific example of visual communication related to the landscape-level issues of soil and water conservation is a map. We hypothesized that including maps that were personalized for individual landowners within conservation meetings may leverage the benefits of visual communication to help landowners think beyond human scale and perceive the connections between their own property and the larger watershed. Perceiving this interconnectivity may then lead to greater perceived importance of water quality and greater acceptance of behaviors beneficial to the landscape scale. There is some research suggesting that, at least for middle-school students, the use of maps helps orient individuals within a watershed and gives them a better sense of scale (Santelmann et al. 2011). To explore if the use of personalized maps in conservation meetings increases the perceived importance of and adoption of behaviors toward soil and water conservation, we conducted a pilot study using women landowners in Iowa.

Jean Eells is vice chair of the State Soil Conservation Committee and Hamilton Soil and Water Conservation District Commissioner, Webster City, Iowa. **Michael F. Dahlstrom** is an assistant professor and **Raeann Ritland** is a graduate student in the Greenlee School of Journalism and Communication, Iowa State University, Ames, Iowa.

WATERSHED CONSERVATION MEETINGS

We worked with the Women Food and Agriculture Network to host five conservation meetings between September 2011 and April 2012 to discuss water quality issues with women landowners living in five different watersheds across the state of Iowa. We targeted this audience because there is evidence that women landowners already tend to perceive their land at more of a community than individual level (Bregendahl et al. 2007), which may provide larger effects for this pilot study. Likewise, women own or co-own half the land in the state of Iowa (Duffy et al. 2008), so impacting this audience carries significant weight in the conservation of the state's resources. Increasing communication with landowners in general is also important to supplement the existing campaigns that already target producers. Invitations were sent by mail to all women landowners in each watershed.

Across the five meetings, we attracted 51 attendants with an average age of 68 that owned an average of 115 ha (284 ac) each. Three of the meetings served as our experimental conditions and incorporated maps within the meeting. The other two meetings served as the control conditions and did not incorporate maps. The number of attendants across conditions was almost equal, with 26 seeing maps and 25 not.

The format of the meetings followed the Women Caring for the Land℠ peer-to-peer learning environments (Eells and Adcock 2012), which prior research

suggests are a preferred format for this audience (Bregendahl et al. 2007). This format represents a facilitated conversation rather than a lecture by experts. Content experts, such as watershed coordinators, were present. However, they sat among the participants and introduced information in response to the developed conversations. A facilitator introduced the meeting format and invited everyone present, including the conservation experts, to introduce themselves to the group, share information about their land, and comment about the convening topic. The facilitator listened to the women's introductions, connected issues in common, and directed the conversation towards the conservation professional who then responded in some detail. Details often included contextual information to illuminate causes of problems mentioned by the women or inform them of connections within the watershed that lead to water quality and quantity problems. The flow of the conversation was guided to connect content interesting to the women to the resource concern.

The meetings in the experimental conditions addressed watershed impairments and used a collection of satellite maps based on the data available for each watershed. Prior to the meetings, the attendees provided us with the legal description for their land, and the watershed coordinator printed aerial maps focused on their property that were placed inside a folder and given to the women when they arrived at the meeting. Additional maps of the watersheds showing impaired areas, such as stream bank erosion and nitrate losses, were also included. An example of the maps used is shown in figure 1.

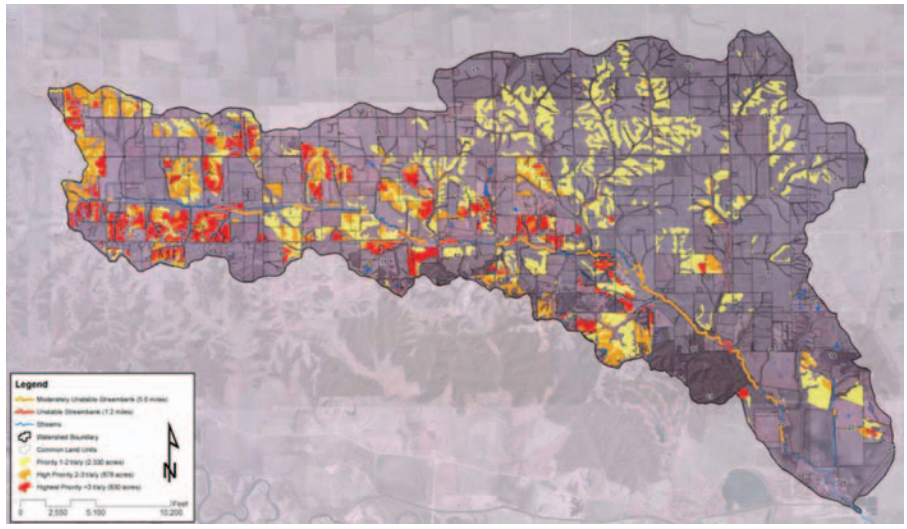
Maps were presented to explain the watershed concept, a term not common to the attendees. Connections to the hypoxic zone in the Gulf of Mexico were made using a map showing the entire Mississippi watershed in the United States, followed by maps highlighting smaller watershed units, in essence "zooming in" to the local level. The facilitator discussed the local watershed as being another type of community and used "watershed neighbors" and "watershed community" in reference to the maps. Participants looked at their own land in relation to the boundaries and main channels of the watershed. Following this orientation and explanations of water flow within a watershed, maps highlighting local areas of concern were discussed. Participants were shown photos of practices that are recommended and available through the USDA Service Centers and other organizations ad that were applicable to the specific watershed issues.

Meetings in the control condition followed the same peer-to-peer format, and the convening topic of soil and water conservation followed a normal conversation path. Watershed coordinators were present and they addressed the same watershed concepts, but maps were not provided.

After each meeting, the attendees were asked to fill out a questionnaire, asking how serious a problem did they consider water quality (1) before and (2) after the meeting, (3) how much they think actions taken on their land impacts their neighbors, (4) how much they think the actions of their neighbors impacts them, (5) their overall responsibility toward protecting the watershed, and (6) how likely they were to ask their tenant to take a new action to protect the watershed. The first 5 questions were rated on a 1 to 7 scale and the last question was rated on a 1 to 3 scale. The second question was subtracted from the first to calculate the change in the attendee's perception.

Figure 1

Example of the maps provided to women landowners during the conservation meetings in the experimental condition. The meetings in the control condition did not utilize maps.

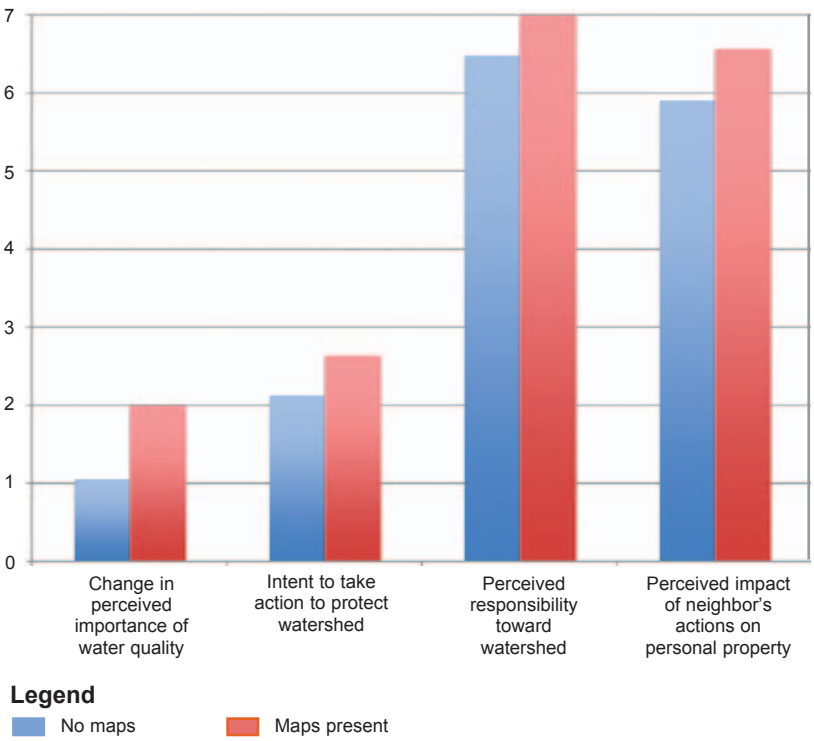


EFFECTS OF THE MAPS

All analyses were conducted using analysis of variance (ANOVA) and, because of the small sample size, we selected $p < 0.10$ for our cutoff of significance. As seen in figure 2, attendees in the experimental conditions exhibited almost twice an increase in perceived severity of water quality problems, $F(1, 44) = 2.79$, $p = .10$, $\eta_p^2 = 0.06$, and were more likely to ask their tenant to try a new action to protect the watershed than the attendees in the control meetings, $F(1, 33) = 7.34$, $p = .01$, $\eta_p^2 = 0.18$. Attendees seeing the maps also felt a greater responsibility toward the health of the watershed and were more concerned about how their neighbor's actions would impact their land, although these two relationships were not statistically significant. Attendees in the experimental conditions were encouraged to expand on what they would take away from using the maps, and the responses supported our hypotheses. Many women noted that the maps helped them understand how their land fit within the larger system. Another theme that emerged was that the maps were useful not just for comprehension, but also for sharing what they had learned with others who have some stake in the land. This last theme is intriguing as maps may not only help landowners mentally situate their

Figure 2

Women landowners who saw maps in conservation meetings perceived water quality as a more important topic and had an increased likelihood of asking their tenant to try a recommended behavior than women who did not see the maps. The difference between feeling a responsibility toward the health of the watershed and being concerned about how a neighbor's actions may impact personal property were also in the predicted direction but were not statistically significant.



land within the larger landscape, but also offer an easily sharable "unit" of information that may multiply the beneficial effect within a social group.

It is important to emphasize that these results are based on a small sample of a targeted group using a particular format of meeting and the generalizability of these effects is unknown. That being said, the results are encouraging. The use of maps in a conservation setting is a relatively simple practice that can be incorporated into existing programs with little cost or modification. Our sample of women landowners across the state of Iowa showed significant increases in both perceived importance of water quality and likelihood of adopting related behaviors as a consequence of seeing maps of their watershed and how their property fits within it. Even if these effects are larger than what we may expect from a more generalized audience, any communication technique that may help counter the inherent biases of perceiving the world through "human scale" warrants further examination for the protection of larger, landscape-level phenomenon.

ACKNOWLEDGEMENTS

Authors thank the following organizations for the in-kind and financial support: Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation, Iowa Department of Natural Resources, Women Food and Agriculture Network, the Greenlee School of Journalism and Communication at Iowa State University, and USDA Natural Resources Conservation Service.

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