

Needs Assessment: Watershed Science for Water Resources Directors

Abstract

We conducted a needs assessment to identify watershed science training needs for locally elected directors of Nebraska's 23 natural resources districts (NRDs). We interviewed NRD staff and surveyed NRD directors to determine training needs and identify relevant topics and preferred delivery formats. We found that training would be valuable; however, directors are busy, meaning that opportunities for training are limited. Additionally, we learned that directors rely on printed material and other NRD personnel for watershed science information. Therefore, web-based information may be most useful if designed for collaborative learning through hybrid delivery during regular NRD activities. Our findings are relevant to current and future regulatory systems reliant on locally elected boards.

Keywords: [watershed science](#), [water resources management](#), [continuing education](#), [needs assessment](#), [focus groups](#)

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Introduction

Local governments charged with watershed management are uniquely positioned to enhance environmental and socioeconomic conditions through policy decisions. Given the large-scale interconnectedness of water resources, local management decisions can have cascading effects on water, people, and ecosystems well beyond local jurisdictions. Extension programs in watershed science therefore have potential for widespread impacts generated through the provision of needed resources for better informed policy development. To be relevant and effective, educational programs should address learners' needs and priorities and should involve

preferred learning formats. A needs assessment is essential for identifying such needs and priorities (Gamon, 1992; Garst & McCawley, 2015; Robinson & Shepard, 2011). Our goal with the assessment reported here was to identify the watershed science needs of directors (board members) of Nebraska's natural resources districts (NRDs)—the local governing organizations for water and other natural resources.

Background

In 1972 the Nebraska state legislature enacted laws that eventually resulted in 23 NRDs (there were 24 originally), with boundaries that approximately align with river basin boundaries. Most basins were subdivided into two or more NRDs (Bleed & Hoffman Babbitt, 2015). The NRD system features strong local governance through locally elected boards of directors. Directors of an NRD work with a full-time manager and staff to develop policies, implement programs for the district, and coordinate transboundary issues.

NRDs are tasked with 12 statutory responsibilities, including groundwater and surface water management, erosion prevention, flood control, recreation area management, soil conservation, solid waste disposal, and wildlife habitat protection (Bleed & Hoffman Babbitt, 2015). Performing these responsibilities depends on watershed science, "the interdisciplinary study of the natural processes and human activities that affect fresh water resources" (Warner College of Natural Resources, n.d.).

NRD directors comprise a unique educational audience—dissimilar to the audience of watershed management practitioners (e.g., Wolfson et al., 2015). Directors have various educational and professional backgrounds and serve varying tenures on their boards. They receive minor compensation for meetings and related expenses, but many have full-time careers.

We assessed three factors: (a) the need for watershed science training for directors, (b) critical topics on which watershed science education is needed, and (c) preferred educational delivery formats for education on those critical topics. We used focus groups of NRD staff and managers initially and then conducted a web-based survey of NRD directors.

Methods

We used a mixed-methods design wherein we first collected qualitative interview data to assist in developing a quantitative web-based director survey. The interviews and director survey were administered by the Bureau of Sociological Research at the University of Nebraska–Lincoln. Semistructured interview questions and survey items were reviewed by the University of Nebraska–Lincoln Institutional Review Board.

Qualitative Interviews

In February and March 2017, we conducted qualitative interviews with NRD staff and managers through two focus group sessions with 12 people total and three individual phone interviews. The semistructured interviews focused on five questions, with probes. Questions were designed to evaluate the educational needs of the directors—including related to critical topics and preferred delivery methods—as perceived by NRD staff and managers who often provide technical information to directors.

Focus group and phone interviews lasted 30–90 min, were recorded and transcribed verbatim, and were then analyzed for common themes independently by two social scientists to validate the data through

triangulation. Thematic analysis grounded in the data transcripts (Braun & Clarke, 2006) allowed water topics and subtopics and relevant themes and salient meanings to emerge from the data. In developing the quantitative survey, we emphasized topics and themes that interviewees had become passionate about, that were repeated, and/or that were agreed on by multiple interviewees.

Quantitative Director Survey

The director survey contained the following 34 items:

- seven multiple-choice knowledge items,
- 14 Likert-type items on potential topics for watershed science education (4-point scales of *not at all interested* to *very interested*),
- two categorical items asking where watershed information was obtained,
- three items asking about the amount of time spent on work for the NRD board, and
- eight demographic items (addressing gender, race, education, geographic region, number of terms on the NRD board, and occupation).

In November 2017, all 23 NRD managers were emailed a link to a web-based survey. Managers sent the link to 323 current directors. Reminders were sent 10 and 25 days after the original request, and data collection ended after 36 days. A total of 59 directors completed part or all of the survey, for a response rate of 18%. Simple statistics (means, frequencies, and percentages) were calculated in Excel (Office 2016 version). The average reported age of respondents was 58.5 years ($SD = 12.1$, 49 respondents); 96% were male, and 86% reported having had at least some college education (Table 1). The average age of and percentage of males among our respondents were similar to demographics of farm operators in Nebraska (55.7 years and 92%, respectively) (U.S. Department of Agriculture National Agricultural Statistics Service, n.d.), who regularly make up a large percentage of NRD directors.

Table 1.

Key Demographics of Natural Resources District (NRD) Director Survey Respondents

Category	Percentage of respondents ^a	Number of respondents
Gender		
Female	4%	2
Male	96%	47
Race		
White (Caucasian)	100%	49
Highest education level		
High school/GED	14%	7
Some college, no degree	22%	11

Technical/associate's degree/junior college	14%	7
Bachelor's degree	39%	19
Graduate or professional degree	10%	5
Location in Nebraska		
East	31%	15
North central	31%	15
South central	35%	17
West/panhandle	4%	2
Experience on NRD board (typical term = 4 years)		
<1 term	33%	16
1–2 terms	27%	13
3–4 terms	27%	13
>4 terms	14%	7
Occupation		
Farmer	43%	21
Rancher	12%	6
Trades/contractor	6%	3
Engineering/technical	2%	1
Other professional	20%	10
Retired	4%	2
Other, please specify	12%	6

^aPercentage calculated according to the number of respondents for the specified question.

Results and Discussion

Demonstrating a Need for Targeted Watershed Science Education

Interview and director survey responses indicated a need for watershed science training.

Most interview participants indicated that watershed science training would help NRD staff provide background to assist directors in making policy decisions. They further stated that the information should specifically target issues that are under NRD jurisdiction and should be easily accessible to directors. Several interview participants noted that workshops and courses on watershed science topics were sometimes available but that the time and travel required to attend were prohibitive to many (e.g., "If you're going to educate [directors], maybe you need to do it in chunks rather than trying to get everybody in a group some place"). Further, interviewees stated that although web searches provide a plethora of information choices, it is difficult to determine what information is most relevant and reliable (e.g., "There is no way to get a little bit of information"). These interview responses highlight a need to provide targeted and specific information, consistent with other studies, to effectively address watershed issues (e.g., Shepard, 1999).

In the director survey, we assessed training needs related to a subset of topics and hydrologic terms identified during the interviews (see Appendix A). The director survey contained two conceptual questions (i.e., "Under which of the following conditions is groundwater most likely to have high nitrate concentrations?" and "What is the primary benefit of wetlands?") and five definition questions (for the terms *aquifer*, *groundwater model*, *unsaturated zone*, *unconfined*, and *watershed*). Responses were more accurate regarding the contribution of environmental factors to elevated nitrate concentrations in groundwater (94% correct) and the primary benefits of wetlands (98% correct). Overall, 59% of definition questions were answered correctly. The definition of *watershed* was understood by most interviewees (78%), perhaps related to the knowledge that NRD boundaries generally coincide with watershed boundaries.

Critical Topics

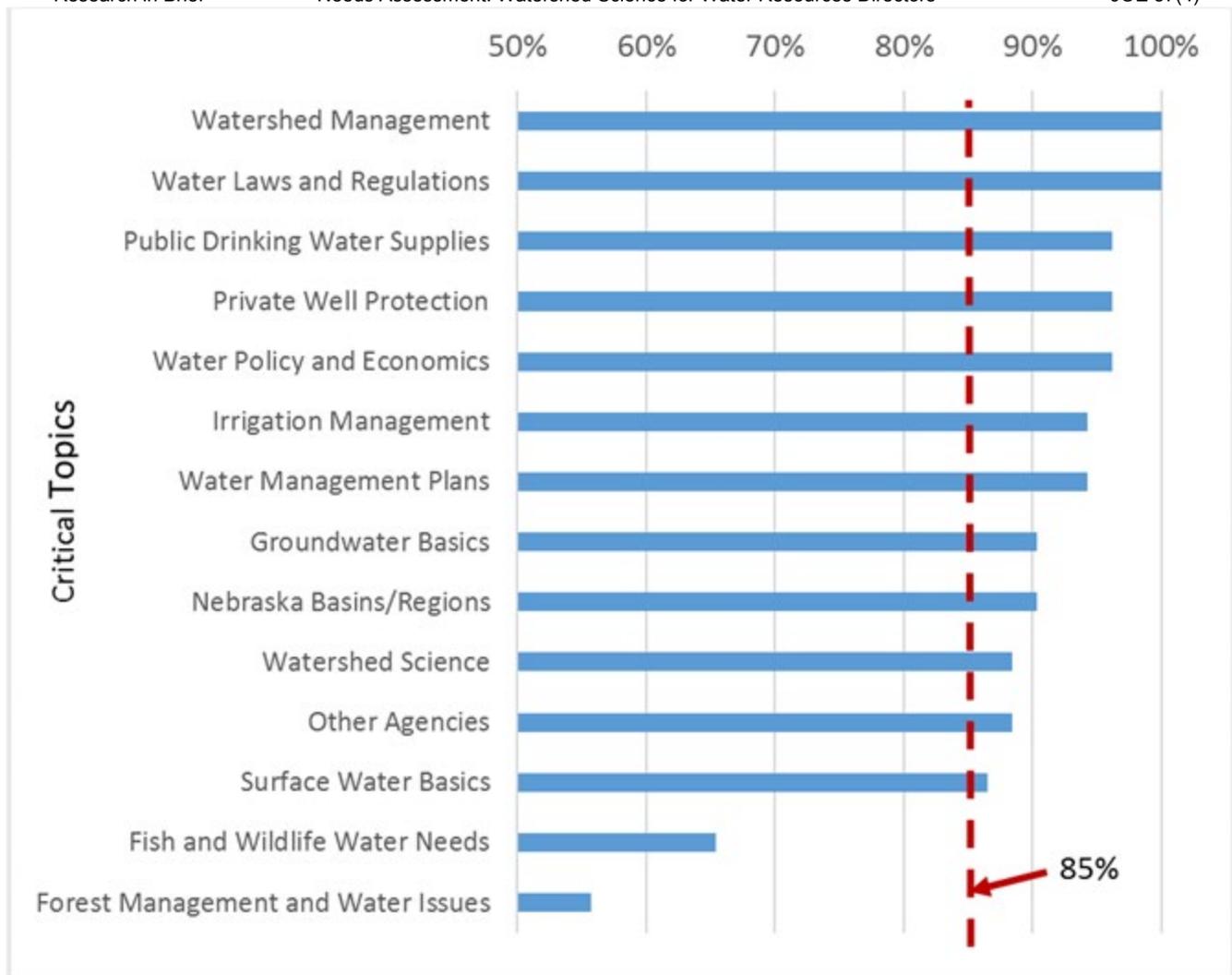
The critical educational topics identified by interview participants related to the categories of (a) basic watershed science, (b) regional issues, and (c) legal, regulatory, and agency issues (see Appendix A). The greatest emphasis was on the critical topics of water quantity and water quality and related subtopics (detailed in Appendix B). Interview participants strongly emphasized the need for basic terminology and concept education, but the scope of learning spanned from basic to complex watershed topics. For example, one participant cited the need for directors to understand "confined aquifers and unconfined aquifers and how does it all relate," and another interview participant noted that effective watershed management requires a recognition of interactions across "groundwater, water quantity, water quality, the storm water, the flooding, the conservation practices, right down to the recreation and protection of those resources."

Interviewees expressed a preference for topics locally or personally relevant to directors. For example, case studies for regions of the state might interest directors. Some inconsistency occurred during discussions on the generality of information. Several participants cited examples of existing information that is too site-specific, but others indicated that research or Extension products are sometimes overly generalized given the differences in geology, precipitation, and/or land use across Nebraska.

Directors were asked to indicate their levels of interest in 14 of the topics identified by interview participants. Eighty-five percent of the directors indicated that they were somewhat to very interested in learning more about all but two of the selected topics (Figure 1).

Figure 1.

Percentages of Natural Resources District Directors Somewhat to Very Interested in Watershed Topics Identified by Focus Group Participants



Preferred Delivery Methods for Meeting Educational Needs

Interview participants favored web-based materials due to geographical diversity across NRDs. However, inclusion of some personal interaction (i.e., hybrid delivery) was desired. They emphasized preference for learner–content interaction (e.g., Kuo & Belland, 2016), especially for topics for which visualization and engagement are difficult (e.g., water quality).

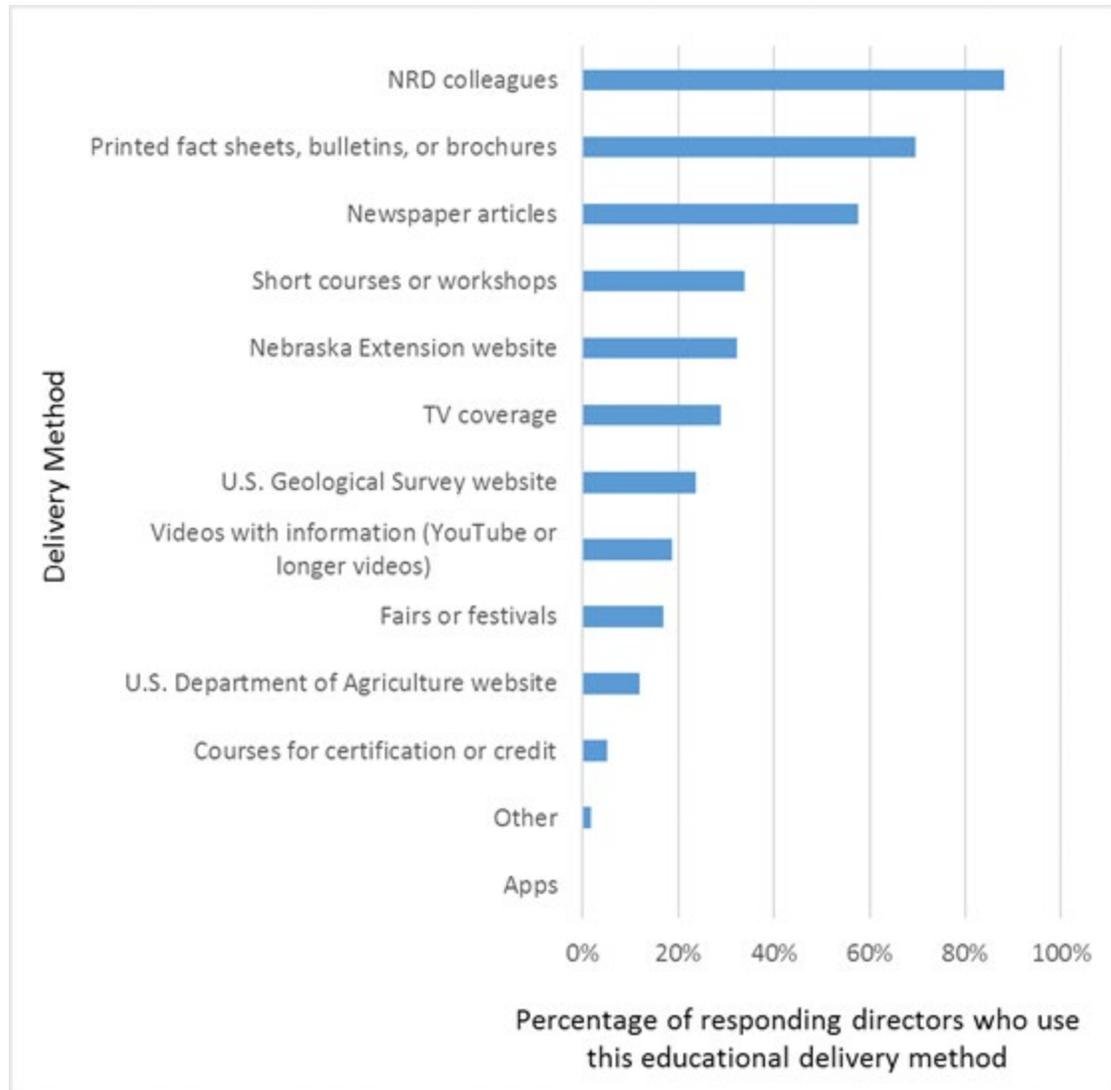
The director survey revealed that many of the directors relied on print media to obtain watershed information (Figure 2). Moreover, one director printed the web survey for manual completion, and another requested that future surveys be available in print. The directors' preference toward printed material suggests potential headwinds for delivering online-only content. However, the majority of directors learned about watershed issues from NRD colleagues (Figure 2). The relevance of this circumstance was underscored by a comment from one of the interview participants: "If we had a committee meeting and we could devote 20 or 30 minutes to a topic and then do our regular business, they [directors] would be willing to do that." Such an approach might facilitate collaborative learning through group discussions (e.g., Laal & Ghodsi, 2012).

Results indicate openness to Extension expertise among directors. Among web-based options on the director survey, Nebraska Extension websites were more likely to be used (32%) as compared to other sources. Fifty-nine percent of directors reported using Nebraska Extension information to make decisions about water

resources management. This response is similar to the percentage of directors who rely on newspapers or printed fact sheets, bulletins, or brochures (Figure 2).

Figure 2.

Current Learning Methods Used by Natural Resources District (NRD) Directors for Watershed Issues



Regardless of information source and delivery format, time limitations of directors were highlighted by interview participants, who suggested that training should be limited to 30-min sessions. Most directors (61%) reported spending less than 5 hr per month on NRD issues, whereas 39% reported spending more than 5 hr. Thus, one short training session per month would substantially increase the time most directors spend on NRD business—1 hr of training equates to an increase of about 20% of such time for most directors—unless the activity were to be completed during regular meetings.

Summary and Conclusions

The research reported here is the first step in a coproduction approach (Baumgart-Getz, Prokopy, & Floress, 2012) to influencing NRD directors' knowledge levels and decision-making approaches. We assessed need, topics of interest, and preferred delivery formats related to providing watershed science information to locally

elected directors. Focus group and individual interviews with NRD staff and managers and a web survey of directors indicated that additional watershed science training would be beneficial. Directors who responded to the survey were interested in learning about a wide range of watershed science topics. Directors performed well when asked about two applied concepts related to water quality. Their understanding of hydrologic terminology was less advanced and is therefore an intuitive starting point for any training program. Further analysis of the core technical competencies exhibited and/or identified by effective directors (e.g., after Koundinya et al., 2018) is warranted to prioritize topics identified in our study.

A web-based, interactive delivery format was suggested by NRD staff, but directors favored print media. Many directors indicated that they learned a great deal from NRD colleagues, although some did acquire information from web sources, including Extension websites. Directors may be more receptive to web-based learning modules if associated collaborative learning is available (e.g., Laal & Ghodsi, 2012) and/or hybrid delivery is executed (e.g., Friedl, Ober, Stein, & Andreu, 2015). For example, NRD staff are well positioned to facilitate completion of online training in a group setting, perhaps supplemented by print-based exercises. Continued collaboration between Extension personnel and NRD staff and integration of NRD directors' feedback are essential for developing the most effective curriculum and delivery method (e.g., Prokopy et al., 2017).

Our work focused on training needs for directors in Nebraska, but water resources management leaders in other states (Minnesota, South Dakota) and countries (Argentina, Brazil) are currently studying the NRD approach. Groups that adopt components of the NRD model may encounter similar training needs. Therefore, our results and subsequent training materials could appeal to broader audiences.

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Appendix A

Critical Watershed Science Topics Identified as Educational Needs by Interview Participants (Natural Resources District [NRD] Staff)

- Water cycle/sources
 - *Watershed* definition^b
 - Spatial scales of watersheds
 - Aquifer and subsurface hydrology terminology^{a,b}
 - Aquifer types^b
 - Groundwater–surface water interaction
 - Groundwater and surface water^a quality basics, protection^b
 - Groundwater and surface water^a quantity basics, water budgets
 - Water modeling basics^b
 - Water quality
 - Water quantity
- Nebraska river basins^a
 - Nebraska geology
 - Connections across water, geology, soils, and habitat in different NRDs
 - Interactions and feedback across watersheds, aquifers, and management actions
 - Shared experience: What are other NRDs doing?
- Water laws and regulations^a
 - NRD responsibilities
 - NRD director responsibilities
 - NRD interactions with state agencies
 - NRD budget, costs, funding, taxes (policy and economics)^a
 - Water management plans (quality and quantity)^a
 - Federal/state/NRD roles, missions, interactions^a

^aIn the director survey, respondents were asked whether they were interested in learning more about these topics. ^bThese concepts or definitions were used to assess directors' baseline knowledge of watershed science.

Appendix B

Water Quantity and Quality Subtopics Emphasized by Interview Participants (Natural Resources District [NRD] Staff)

Water quantity

- Water resources monitoring
- Water resources planning
- Gaining versus losing streams

Water quality

- Understanding regulations
- Contaminant sources and remediation: Manure, nitrate, pesticides, metals, etc. and subsequent biogeochemical interactions

- Drought mitigation
- Flood control
- Irrigation management^a
- Modeling: Appropriateness of different water models for planning and predicting water resources needs
- Stream flows
- Land management issues
 - Dams: Types, impact of age, maintenance
 - Habitat conservation^a
 - Recreation areas
 - Urban versus rural impacts
- Relationships between environmental factors and groundwater quality^b (including drinking water supply^a)
- Impacts of drought and climate on water quality, including short-term variability in chemical concentrations
- Recreation and surface water management
 - Storm water runoff
 - Bacteria, health alerts
 - Algal blooms, eutrophication
 - Treatment options
- Soil conservation and mechanics of erosion (e.g., causes and impacts)
- Land management issues
 - Impacts of land-use change
 - Effects of buffers and filter strips
 - Protected area management
 - Urban versus rural impacts

^aIn the director survey, respondents were asked whether they were interested in learning more about these topics. ^bThese concepts or definitions were used to assess directors' baseline knowledge of watershed science.

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