CORE INDICATORS AND SOCIAL MEASURES GUIDE

A GUIDE TO TRACK AND MONITOR HUMAN DIMENSIONS OF CONSERVATION ACTION

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The University of Minnesota Twin Cities is located on traditional, ancestral, and contemporary lands of Indigenous peoples. The University is in Dakota Oyate, the ancestral land of the Ocheti Sakowin and sacred land of the Dakota People. The Center for Changing Landscapes respects this land, acknowledges the harms and mistakes of the past, and is committed to moving forward in respectful partnerships with Indigenous peoples as we search for collective healing and true reconciliation and as we honor the land and water together.

Contents

Background and Purpose

This guide describes core social indicators and measures that can be used to assess human dimensions of conservation action. In this guide, we define core indicators as social and psychological conditions or mechanisms such as awareness, beliefs, norms, and attitudes, and conservation action. Conservation action or pro-environmental behaviors are defined as actions that contribute towards environmental preservation or conservation (Axelrod and Lehman, 1993; Stern, 2000), and includes private-sphere (e.g., conservation practice adoption) and public-sphere behaviors (e.g., civic engagement in water protection).

The indicators and measures reflect more than four decades of theory and research in sociology, psychology, and related disciplines. The core indicators and measures in this guide are intended to be used by environmental actors including natural resource managers and policy makers who aim to better understand and integrate human and social dimensions into conservation programs. This guide and the accompanying survey items sample sheet provide a social science-based framework and a tool to standardize and relate social data across time and space. The specific measures and items presented in this guide may be used in survey research questionnaires across geographic scales and as benchmarks in tracking change over time. The core indicators and measures described in this guide can be used to:

1. Inform conservation program development,
2. Assess and track over time social measures across human communities, and
3. Evaluate the social impacts of conservation outreach and engagement programs and policies.

At the Center for Changing Landscapes, researchers have collected social data associated with water management from more than 20 Minnesota watersheds. These studies provide important information about the drivers of and constraints to conservation action, including adoption of conservation practices among Minnesota's farmers and landowners. Understanding factors influencing conservation action is critical in achieving clean water outcomes, including meeting nutrient reduction goals of Minnesota's Nutrient Reduction Strategy (MPCA, 2014). Information collected from each study watershed has helped inform local watershed-specific programming. However, a systematic, standardized framework to monitor and assess social dimensions of water management is lacking. Based on a synthesis of existing data, this guide provides a framework to monitor social data. This guide was developed with funding from the U.S. Environmental Protection Agency and in collaboration with the Minnesota Pollution Control Agency (MPCA) and the University of Minnesota Water Resources Center.

This guide outlines core indicators and measures, and the survey items sample sheet includes a pool of example survey questions. Core social indicators along with associated measures are presented in Table 1. Sample survey items are presented in the accompanying survey measures sample sheet. The survey items listed in the survey measures sample sheet can be tailored to project objectives (e.g., baseline assessment of community perceptions vs. program evaluation), audience (e.g., farmers, landowners, renters, fishers), and scale of analysis (e.g., neighborhood, county, watershed, state).

This guide builds on the social measures monitoring system (SMMS) (Davenport, 2013) designed to assess and monitor community capacity to engage in water resource protection and restoration. Based on a multi-level community capacity model (Davenport & Seekamp, 2013), SMMS identifies and describes several project-specific indicators and measures.

The core indicators draw upon various social-psychological theories including the theory of planned behavior (Ajzen, 1991), norm-activation theory (Schwartz, 1977), value-belief-norm theory (Stern, 2000), and diffusion of innovation (Rogers, 2003). The core indicators and survey measures were selected based on extensive literature review of water and agricultural conservation social science research (e.g., Baumgart-Getz et al., 2012; Lu et al., 2022; Prokopy et al., 2019; Ranjan et al., 2019), and recent studies investigating indicators such as awareness, norms, ability, and conservation behavior in Minnesota (Davenport and Pradhananga, 2012; Davenport, Pradhananga and Olson, 2014; Fellows, Davenport and Pradhananga, 2019; Pradhananga and Davenport, 2022; Pradhananga et al., 2021; Pradhananga, 2021; Pradhananga, Davenport and Moeller, 2019; Pradhananga and Davenport, 2019; Pradhananga and Davenport, 2018; Pradhananga and Davenport, 2017a; Pradhananga and Davenport, 2017b; Pradhananga et al., 2017; Pradhananga and Davenport, 2015; Pradhananga, Davenport and Olson, 2015; Pradhananga, Perry and Davenport, 2014)

Research on conservation practice adoption and pro-environmental behaviors in Minnesota and across the U.S. has established the validity and reliability of multiple psychometric scales and individual measures. The survey measures listed in the sample survey sheet have been successfully applied across multiple study communities across Minnesota to assess environmental behavior including the drivers of and constraints to farmer conservation action (Davenport and Pradhananga, 2012; Fellows, Davenport and Pradhananga, 2019; Pradhananga and Davenport, 2022; Pradhananga et al., 2021; Pradhananga, 2021; Pradhananga, Davenport and Moeller, 2019; Pradhananga and Davenport, 2019; Pradhananga and Davenport, 2018; Pradhananga and Davenport, 2017b; Pradhananga et al., 2017; Pradhananga, Perry and Davenport, 2014), landowner and resident perspectives on and uses of water (Davenport, Pradhananga and Olson, 2014; Davenport, Perry, Pradhananga and Shepard, 2016; Pradhananga and Davenport, 2013; Pradhananga, Davenport, and Green, 2019; Roth et al., 2021; Pradhananga and Davenport, 2017a ; Pradhananga and Davenport, 2017c; Pradhananga and Davenport, 2015; Pradhananga, Davenport and Olson, 2015), and natural resource professionals perceptions of their communities' capacities to engage in groundwater protection (Fellows et al., 2018; Pradhananga, Green and Davenport, 2017; Pradhananga, Davenport and Perry, 2015). This guide presents a framework and tool, but it is not a how-to guide on social science research or how to implement a survey study. Additional expertise or consulting will be required for essential social science data collection tasks including community partnership building or research agreements, participant recruitment strategies, survey design and sample selection, data collection, data management and analysis, or interpretation and reporting. Additionally, careful consideration is needed when conducting research with human participants including protocol for protecting participants (e.g., free, prior, and informed consent). Follow your organization's institutional review board or ethics committee policies.

Table 1. Core indicators of conservation action

Core Indicator 1: Awareness of water resource problems and its consequences
Measure 1: Perception of water quality and water protection
Measure 2: Awareness of consequences of water pollution
Measure 3: Awareness of pollutant types and sources of pollutants
Core Indicator 2: Concern about water resource problems
Measure 1: Concern about local water resource problems
Measure 2: Concern about the consequences of water pollution
Core Indicator 3: Responsibility to protect water resources
Measure 1: Personal responsibility to protect water
Measure 2: Collective responsibility to protect water
Core Indicator 4: Personal norms of conservation action
Measure 1: Personal obligation to protect water resources
Core Indicator 5: Social norms of conservation action
Measure 1: Social norms of conservation action
Core Indicator 6: Perceived ability and efficacy to take conservation action
Measure 1: Perceived ability to take conservation action
Measure 2: Perceived self-efficacy to protect water
Measure 3: Perceived collective efficacy to protect water
Core Indicator 7: Perceived benefits and risks of conservation practices
Measure 1: Perceived benefits of conservation practices
Measure 2: Perceived risks of conservation practices
Core Indicator 8: Conservation action
Measure 1: Current use of conservation practices
Measure 2: Intention to use conservation practices
Measure 3: Current engagement in conservation action
Measure 4: Intention to engage in conservation action
Measure 5: Support for conservation programming and policy

Core Indicator Description

Core Indicator 1: Awareness of water resource problems and its consequences

Awareness of consequences refers to the knowledge that a water resource problem exists and that it has consequences for the well-being of oneself and others (Stern 2000). Awareness of a problem (e.g., water pollution) and how it is tied to on-farm or community outcomes is an important factor influencing conservation action. Awareness of the impacts of water pollution affects actions such as the use of best management practices, and landowner/farmer engagement in conservation (e.g., Pradhananga and Davenport 2019, Pradhananga, Davenport and Perry 2017, Prokopy et al. 2019).

Measures and Survey Items:

The measures and sample survey items associated with this indicator are used to assess community perceptions about water quality and water management, perceptions about the impacts or consequences of water pollution, and awareness of pollutant types and potential sources of pollutants. The sample survey items include Likert-type scale items (e.g., on a scale from strongly disagree to strongly agree). The survey items that measure awareness of pollutant types and sources of pollutants are not comprehensive and can be tailored to project needs and area concerns.

Table 2. Measures and survey items associated with core indicator 1: Awareness of water resource problems and its consequences

Measures and Survey Items	Response Scale
Measure 1: Perception of water quality and water protection	
Water resources in Minnesota need better protection	*Strongly disagree* to *Strongly agree*
Water resources in [watershed/county/city] are adequately protected	
Measure 2: Awareness of consequences of water pollution	
Water pollution affects human health	*Strongly disagree* to *Strongly agree*
Water pollution can affect my lifestyle	
Excessive water runoff causes soil and nutrient loss	
Water pollution poses serious threats to the quality of life in my community	
Measure 3: Awareness of pollutant types and sources of pollutants	
In your opinion, how much of a problem are the following water pollutants/issues in your [watershed/county/city]? [list of relevant water pollutants/issues]	
Nitrogen in surface water	*Not a problem* to *Severe problem*
Nitrogen in drinking water	
Flooding	
Algae	
In your opinion, how much of a problem are the following potential sources of water pollutants/issues in your [watershed/county/city]? [list of sources of water pollutants]	
Industrial discharge to streams, rivers, and lakes	*Not a problem* to *Severe problem*
Tile drainage	
Urban/suburban water runoff	
Soil erosion from farmland	

Core Indicator 2: Concern about water resource problems

This indicator measures an individual's concern about water pollution and its consequences for themselves, others, and the natural world (e.g., aquatic life). Concern is influenced by environmental values, or deeply held beliefs about the human-environment relationship. People may be concerned about the impacts of water pollution for oneself (i.e., egoistic concern) (e.g., consequences of water pollution for "my or my family's health"), for others (i.e., altruistic concern) (e.g., consequences of water pollution for "people downstream"), and for the environment (i.e., biospheric) (e.g., wildlife) (Schultz, 2001).

Measures and Survey Items:

The measures and sample survey items associated with this indicator are used to assess general level of concern about water problems and about the consequences of water pollution. The water problems listed under measure 1 may include specific problems such as "flooding in my neighborhood" and "stormwater runoff," and can be tailored based on project needs and area concerns. Items in measure 2 assess concern about the impacts of water pollution for oneself (e.g., my or my family's health), others (e.g., people downstream), and for the environment (e.g., aquatic life).

Table 3. Measures and survey items associated with core indicator 2: Concern about water resource problems

Measures and Survey Items	Response Scale
Measure 1: Concern about local water resource problems	
How concerned are you about the following in your [watershed/county/city]? [list of relevant water problems]	
Flooding in my neighborhood	*Not at all* to *Extremely*
Water that is not safe for drinking	
Lake water levels dropping	
Stormwater runoff	
Measure 2: Concern about the consequences of water pollution	
To what extent do you agree or disagree with the following statements?	
I am concerned about the consequences of water pollution for…	*Strongly disagree* to *Strongly agree*
My or my family's health	
My farm's profitability	
People living downstream	
Future generations	
Aquatic life	
Wildlife	

Core Indicator 3: Responsibility to protect water resources

Responsibility refers to the sense of connection to the problem (e.g., water pollution), its consequences, and a realization that one's actions can help address the problem (Schwartz, 1977; Stern, 2000). People may assign responsibility to address problems to themselves (i.e., personal responsibility) or to other relevant actors or a group (e.g., landowners) (i.e., collective responsibility). The extent to which one feels personal or collective responsibility for water protection affects their conservation norms and actions (e.g., Pradhananga et al., 2017; Pradhananga and Davenport, 2019). Denial of responsibility to

address water problems can be a barrier to pro-environmental actions and norms (Schwartz, 1977; Stern, 2000).

Measures and Survey Items:

The measures and survey items for this core indicator measure perceived sense of *personal* as well as *collective* responsibility for water resource protection. Using these items, resource managers can assess community members' perceptions about who should be responsible for water resource protection, and the extent to which they feel personal responsibility for water resource protection.

Table 4. Measures and survey items associated with core indicator 3: Responsibility to protect water resources

Measures and Survey Items	Response Scale
Measure 1: Personal responsibility to protect water	
To what extent do you agree or disagree with the following statements?	
It is my personal responsibility to help protect water	*Strongly disagree* to *Strongly agree*
It is my personal responsibility to make sure that what I do on the land doesn't contribute to water resource problems	
Measure 2: Collective responsibility to protect water	
To what extent do you agree or disagree with the following statements?	
Landowners upstream should be responsible for protecting water downstream	*Strongly disagree* to *Strongly agree*
Farmers in [watershed/county/city] should be responsible for protecting water	
Local government should be responsible for protecting water	
Urban residents in [watershed/county/city] should be responsible for protecting water	
Landowner's/property owners in my community should be responsible for protecting water quality	

Core Indicator 4: Personal norms of conservation action

Personal norms are feelings of moral obligation to take actions to address a problem such as water pollution. Personal norms are self-expectations or internal self-evaluations that compel people to act in ways that are consistent with their deeply held values (Schwartz, 1977). Personal norms drive pro-social and pro-environmental behaviors such as conservation practice use that may not have direct benefits to self but may affect the well-being of others (Pradhananga and Davenport, 2019; Schwartz, 1977; Stern, 2000).

Measures and Survey Items:

The measures and survey items associated with this indicator assess community members' feelings of personal obligation, or personal norms for conservation action. The survey items include general measures of personal obligation for water protection and use of conservation practices, as well as personal obligation to use specific practices (e.g., cover crops). The practices can be tailored depending on project-specific assessment needs.

Table 5. Measures and survey items associated with core indicator 4: Personal norms of conservation action

Measures and Survey Items	Response Scale
Measure 1: Personal obligation to take conservation action	
To what extent do you agree or disagree with the following statements?	
I feel a personal obligation to…	
Do whatever I can to prevent water pollution	*Strongly disagree* to *Strongly agree*
Maintain my land/farm in a way that does not contribute to water resource problems	
Use conservation practices on my land/property	
Take actions to stop the loss of wildlife habitat	
Plant cover crops on my farm	

Core Indicator 5: Social norms of conservation action

Social norms are "rules and standards that are understood by members of a group and that guide and/or constrain social behavior without the force of laws" (Cialdini & Trost, 1998, p.152). Social norms are perceived as social pressure or expectations to take (or not take) certain actions (Ajzen, 1991). Social norms or expectations may come from society, social groups or individuals or groups that are important to oneself. People are influenced by what others think one should do (i.e., injunctive norms), and what others do (i.e., descriptive norms) (Cialdini, 2003). Social pressures and expectations can drive individuals to take more pro-environmental actions and can also activate feelings of personal obligation, or personal norms (Schwartz, 1977). In the context of water management, for example, social norms around engagement in conservation among landowners influenced their feelings of obligation to act, and their level of engagement in water protection (Pradhananga, Davenport, and Olson, 2015).

Measures and Survey Items:

The survey items associated with this core indicator measure social norms, or the extent to which community members feel social pressure to take conservation action. These items measure the extent to which community members are influenced by what others *think* they should do (e.g., expect them to use conservation practices on their land), as well as the extent to which they are influenced by what others *do* (e.g., use conservation practices on their land).

Table 6. Measures and survey items associated with core indicator 5: Social norms of conservation action

Measures and Survey Items	Response Scale
Measure 1: Social norms of conservation action	
To what extent do you agree or disagree with the following statements?	
People who are important to me…	
expect me to use conservation practices on my land.	*Strongly disagree* to *Strongly agree*
expect me to maintain my land in a way that does not contribute to water resource problems.	
expect me to do whatever I can to prevent water pollution.	
maintain their land/farm in a way that doesn't contribute to water resource problems.	
use conservation practices on their land/farm	

Core Indicator 6: Perceived ability and efficacy to take conservation action

Perceived ability refers to perceptions about the availability of resources (e.g., knowledge, financial resources, equipment) needed to take action (e.g., plant cover crops) (Schwartz, 1977). Higher levels of perceived ability has a positive influence on pro-environmental behaviors (e.g., Pradhananga et al., 2015, Pradhananga et al., 2019). It is also important to note that perceived ability is different from *actual* ability. The adoption of conservation practices may depend on *actual* availability of resources in a community. However, perceived ability represents community members' *perceptions* of their own ability or perceptions of the availability of those resources (Ajzen, 1991). Efficacy refers to the belief that one is capable of taking actions to address a problem or relieve a need (Bandura, 2001). Confidence in one's ability to take action (e.g., use conservation practices) to address water pollution affects norms and behaviors (e.g., Pradhananga and Davenport, 2022; Perry and Davenport, 2020).

Measures and Survey Items:

The measures and sample survey items are used to assess perceptions about individual and collective ability, and self-efficacy to engage in conservation. The survey items measure the extent to which individuals believe they have the knowledge, skills, time, financial resources, and equipment needed to use conservation practices. Another subset of items measures perceived collective ability, or the extent to which individuals believe that their community has the resources and capacity to address water resource issues. Finally, survey items that measure self-efficacy are used to assess the extent to which individuals believe they are capable of changing land use practices and using and maintaining conservation practices.

Table 7. Measures and survey items associated with core indicator 6: Perceived ability and efficacy to take conservation action

Measures and Survey Items	Response Scale
Measure 1: Perceived ability to take conservation action	
To what extent do you agree or disagree with the following statements?	
I have the knowledge and skills I need to use conservation practices on the land	*Strongly disagree* to *Strongly agree*
I have the financial resources I need to use conservation practices on the land	
I have the equipment I need to adopt a new conservation practice	
I do not have the time to use conservation practices	
Measure 2: Perceived self-efficacy to protect water	
To what extent do you believe you are capable of the following?	
Using a new conservation practice on the land/farm	*Not at all capable to Very capable*
Maintaining conservation practices on the land/farm	
Changing land use practices to reduce impacts on water resources	
Influencing decision making about water resources in your community	
Measure 3: Collective ability to protect water	
To what extent do you agree or disagree with the following statements?	
Farmers in my community have the ability to work together to change land use practices	*Strongly disagree* to *Strongly agree*
My community has the financial resources it needs to protect water resources	
My community has the leadership it needs to protect water resources	

Core Indicator 7: Perceived benefits and risks of conservation practices

Perceptions about the characteristics of conservation practices are an important factor in farmer and landowner decision making. Perceptions about the benefits of conservation practices have a positive effect on adoption decisions, while perceived risks of practices have a negative influence (e.g., (Arbuckle & Roesch-McNally, 2015; Bergtold et al., 2012). For example, the benefits of cover crops (including improved soil productivity and reduced soil erosion), and potential risks of cover crop adoption (including impacts to yield and costs of cover crops) are important considerations in farmers' adoption of cover crop (Arbuckle & Roesch-McNally, 2015). Thus, understanding the benefits and risks associated with conservation practices can help resource managers develop effective programs that communicate the benefits, and help address risks.

Measures and Survey Items:

The measure and survey items associated with this core indicator assess general beliefs about the outcomes of conservation practices, and perceptions about practice-specific benefits and risks. The sample survey items examine risks and benefits of cover crops. The items can be tailored to project needs and the benefits and risks associated with practice(s) of interest.

Table 8. Measures and survey items associated with core indicator 7: Perceived benefits and risks of conservation practices

Measures and Survey Items	Response Scale
Measure 1: Perceived benefits of conservation practices	
To what extent do you agree or disagree with the following statements?	
Conservation practices protect aquatic life	*Strongly disagree* to *Strongly agree*
Conservation practices contribute to quality of life in my community	
Conservation drainage management reduces water runoff from farmland	
Streamside buffers help to improve water quality for people living downstream	
Cover crops can reduce soil erosion	
Cover crops can improve water quality	
Cover crops can improve soil productivity	
Cover crops can reduce nutrient losses	
Measure 2: Perceived risks of conservation practices	
To what extent do you agree or disagree with the following statements?	
Conservation tillage decreases crop yield	*Strongly disagree* to *Strongly agree*
Streamside buffers reduce the value of land	
There is rarely enough time between harvest and winter to justify the use of cover crops	
Cover crops' water use can pose a risk to yields in dry years	
I am not convinced cover crops are right for my farm	
The expenses of cover crops outweigh the potential benefits	

Core Indicator 8: Conservation action

Conservation actions include private-sphere actions (e.g., use and maintenance of conservation practices) and public-sphere actions or civic engagement (e.g., participating in a water resource protection initiative, attending a meeting about water resources) (Stern, 2000). Intention to engage in conservation is a measure of how likely individuals are to engage in conservation and how much effort they are willing to put into taking actions (Ajzen, 1991). People with higher level of intention to act are generally more likely to take action.

Measures and Survey Items:

The measures and survey items associated with this indicator assess current levels of conservation practice use (e.g., cover crop adoption, use of nutrient management practices) among community members, current level of civic engagement (e.g., attending a meeting or public hearing about water), future intentions to use conservation practices and engage in civic actions, and support for conservation programming and policy. These measures provide resource managers with important baseline information about current levels of practice use, and future likelihood of practice adoption and civic engagement that can be used to develop programs to promote conservation. When monitored over time, these measures can also serve as an important indicator of program success. The list of conservation practices provided in table 9 is not comprehensive and can be tailored to practices of interest to resource managers.

Table 9. Measures and survey items associated with core indicator 8: Conservation action

Measures and Survey Items	Response Scale
Measure 1: Current use of conservation practices	
Do you use the following practices on your land?	
Protect wetlands on the land/property	*Yes/No*
Cover crops	
Follow a nutrient management plan on the farm	
Conservation tillage practices (e.g., no till, minimum till)	
Drainage water management planning	
Land in conservation cover (e.g., Conservation Reserve Program)	
Measure 2: Intention to use conservation practices	
How likely are you to use the following practices on your farm in the next 12 months?	
Protect wetlands on the land/property	*Very unlikely to very likely*
Cover crops	
Follow a nutrient management plan on the farm	
Conservation tillage practices (e.g., no till, minimum till)	
Drainage water management planning	
Land in conservation cover (e.g., Conservation Reserve Program)	
Measure 3: Civic engagement in conservation	
How often have you engaged in the following actions in the past 12 months?	
Heard about a water resource protection initiative	*Never to weekly or more*
Participated in a water resource protection initiative	
Worked with other community members to protect water	
Talked to others about conservation practices	
Attended a meeting or public hearing about water	
Measure 4: Intention to engage in conservation action	
How likely or unlikely is it that you would engage in the following actions in the future?	
Learn more about water resource issues in my [watershed/county/city]	Very unlikely to very likely
Work with other community members to protect water	
Talk to others about conservation practices	
Attend a meeting or public hearing about water	
Take a leadership role around water resource conservation in the community	
Measure 5: Support for conservation programming and policy	
To what extent do you support or oppose the following potential water resource management actions in Minnesota?	
Increasing regulations on businesses, corporations, and industries to protect water resources.	Strongly oppose to strongly support
Increasing regulations on private property owners to protect water resources.	
Streamlining existing programs that offer financial incentives to property owners/farmers for conservation practices.	
Increasing land use laws and regulations	

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