Deploying Technology for Small Watershed-Based Conservation

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Introduction

The Agricultural Conservation Planning Framework (ACPF) is a unique and valuable tool when planning for conservation implementation at the small watershed scale. The Framework has been used sporadically across the upper Midwest and the small watershed approach to conservation implementation has been piloted in many places. Ensuring statewide access to the ACPF and other tools is one piece of the puzzle for institutionalizing the small watershed approach across states and the region. This document explores the barriers and opportunities for expanding the incorporation of ACPF analyses into conservation and planning processes across upper Midwest states.

The Small Watershed Policy Forum on August 31, 2017 was hosted by the University of Minnesota Water Resources Center and the Harvard Environmental Policy Initiative. The 29 participants, from 10 states, were leaders in watershed management from state NRCS offices, soil and water conservation district organizations, watershed divisions of state EPA agencies, and state agriculture departments. The group was charged with examining the policy and institutional barriers and opportunities for planning for implementation at the small watershed scale. They identified challenges and learned how their counterparts in other states have supported small watershed implementation, despite federal and state policies often designed to support planning at larger scales or implementation at the scale of farms and stream reaches.

This article examines one piece of the discussion: how to develop and deploy the technological tools needed to implement small watershed work. Konopacky and Ristino (2017) provide a broader discussion of policy needs.

About the ACPF

The ACPF is an approach to water resource planning and an ArcGIS toolbox that facilitates conservation planning in small watersheds through landowner participation. The ArcGIS toolbox identifies practical options for siting conservation practices by applying topographic, hydrologic, soils, and land use criteria to customized high resolution databases. Learn more at http://acpf4watersheds.org/

The importance of small watersheds

Water resource management – the planning and implementation of land use and land management practices – is ultimately a process of adaptive management at the local scale. Effective water management requires understanding the interactions among physical practices, environmental conditions, and social attributes – components that come together uniquely at a place. Watersheds of 10,000 to 40,000 acres are the right size place for understanding and acting upon these components to change land use and management practices in support of water quality. The optimal scale for implementation depends in part on the population density and existing opportunities for organizing, collaborating, and funding.

At that scale – the size of HUC-12 watershed – one or a few staff can establish relationships with all the landowners and engage most of the stakeholders. The hydrologic processes can be described and used to prioritize practices and sites. Conservation activities can have measurable impacts on water and social characteristics.

Strategic planning and monitoring are valuable at larger scales to ensure statewide coverage, prioritize small watersheds, and inform small watershed planning. However, these larger scale plans typically lack the detail needed to get practices on the ground and to maintain local support.

Constraints on deploying technology for watershed-based conservation

Deploying the ACPF and other technology across a state requires three sets of conditions:

> **Appropriate planning frameworks** – The ACPF goes hand-in-hand with a small watershed approach. Effective use of the ACPF requires widespread understanding of and support for the small watershed approach.
>
> **Well-designed tools** – The tools must be appropriate for the full range of landscapes, practices, and problems faced in a state.
>
> **Technological capacity** – The right hardware and software must be accessible, along with trained staff, ongoing technical support, and adequate commitment of staff time.

In the upper Midwest, all three of these types of constraints exist: policies that don't allow for a small watershed approach, lack of the needed tools, and inadequate funding and support to deploy tools across the state. The rest of this article expands on each of these.

Appropriate planning framework

A framework for employing a statewide small watershed approach is described by Konopacky and Ristino (2017), and was examined at the 2017 forum. According to this framework, the following elements need to be in place to successfully implement watershed conservation across a state.

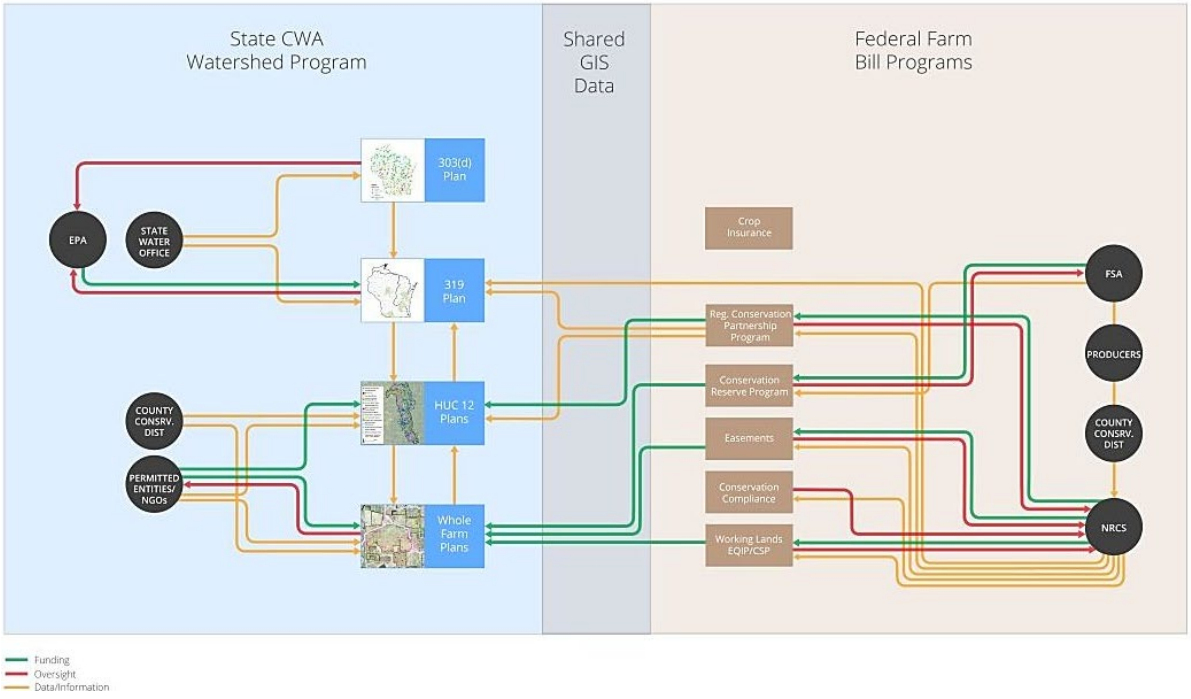
1. Establish statewide **numeric water quality standards** covering all waterbodies.
2. **Monitor P and N at the HUC 10 scale and identify/ prioritize** planning and implementation effort in the most impaired HUC 10s.
3. Complete **screening-level analyses of HUC 12s** in prioritized HUC 10s, establish tiers of priority HUC 12 watersheds and establish timeline for HUC 12 plan development and implementation.

4. **Connect high priority HUC 12 watersheds to Clean Water Act goals.** Reference prioritized HUC 12 watersheds on state impaired waters list and reference and track HUC 12 planning and implementation in state nonpoint management plan and nutrient reduction strategy.
5. Work with conservation districts (or similar local entity) to **complete HUC 12 plan development, implementation,** monitoring and adaptive management utilizing the ACPF and 9 key element planning framework.
6. Utilize monitoring from local HUC 12 watershed projects to track water quality improvements and support **adaptive management and impairment delisting** of waterbodies.

Cutting across these elements is the need for (1) data sharing and communication across stakeholders and across scales; (2) enough skilled and stable staffing who can build relationships with landowners; and (3) efficient and reliable funding for planning and implementation. All of these components influence whether conservationists are likely to take a scattershot approach or an integrated, proactive watershed approach. In Figure 1 below, Konopacky and Ristino (2017) illustrate the complexity of interactions between the federal programs driving water management and the state and local implementers.

Figure 1: Healthy Watershed Policy Matrix

Circles indicate the primary players for Clean Water Act (CWA) and Farm Bill programs. Rectangles indicate the major program mechanisms. Arrows indicate the recommended relationships to support small watershed plan development and implementation. (Figure 2 from Konopacky and Ristino 2017)



The ACPF is designed to support HUC-12 scale conservation planning and implementation. To make use of it, local agencies need the capacity to plan and prioritize activities proactively, with consideration of the hydrology and pollutant sources across the whole watershed. If staff are constrained to reactive and

untargeted conservation, the ACPF will be of much less value, though it can still inform one-on-one conversations with landowners.

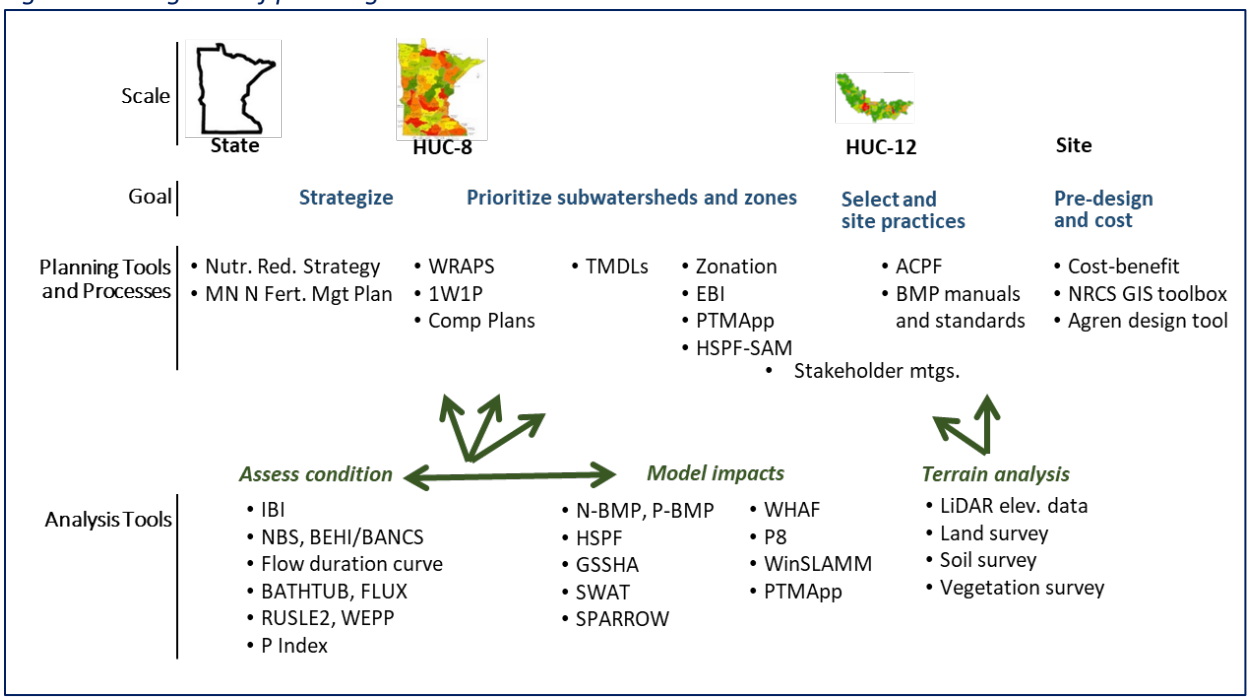
While many local and state leaders appreciate the need to plan for implementation at the small watershed scale, such plans are sporadic across the Midwest. The impaired waters list and Total Maximum Daily Load (TMDL) plans are still strong drivers for organizing conservation activities and these sometimes conflict with a small watershed approach.

Another institutional barrier to effective implementation is the disconnect between plans and planners on the one hand, and implementers on the other. Large scale plans – such as statewide nutrient reduction strategies or HUC-8 scale studies – need to connect to small watershed implementation and the associated 9-element planning required for Clean Water Act (CWA) Section 319-funded projects. Some of this disconnect arises when the people implementing local plans are not responsible for developing the plan. For example, the efficiencies of centralizing ACPF analyses While some state leaders have been tempted to centralize ACPF analyses, the process requires some engagement from local experts to optimize settings and correctly interpret results.

The right tools

From the perspective of local conservationists, planning and decision-support tools can seem endless in number, confusing, and inaccessible. State level support is important to evaluate and recommend appropriate tools. No single tool accomplishes all planning needs. The "best" tool for a purpose depends on scale, goals, and accessibility. Here are examples of tools used in Minnesota.

Figure 2: Categories of planning tools in Minnesota



The ACPF software is unique in that it identifies specific potential sites for conservation practices and it is reasonably accessible to local offices. It aligns well with small watershed work because outputs are organized around field boundaries – which is the relevant unit for working with individual landowners to

get practices on the ground. Tool parameters have enough flexibility to adapt the tools to local conditions, but they are not so flexible that they become difficult to use or provide excessive detail. The ACPF addresses the major conservation practices used on agricultural landscapes. Except for elevation data, all the other inputs for running the ACPF are easily downloadable and ready-to-use.

The ACPF does not model the water quality impacts of existing or proposed practices. For this, it needs to be coupled with other models. Some discussions have begun to connect ACPF results to SWAT and PTMApp analyses. While these will be valuable, there is a need to develop guidelines for simpler impact estimates that are more accessible in the context of local planning.

Technological tools require a significant investment to develop and ongoing commitments to maintain and support. Thus, partnerships across agencies and between states are essential. Cross-state collaborations are important for more efficient development and support, and because it creates a larger pool of comparable data to inform decisions.

Technological capacity

Statewide technological capacity to use the ACPF or other tools has several components:

1. The right people. The people assigned to run the ACPF require moderate, but not necessarily expert GIS skills, a level common in county and district offices. Moderate ArcGIS proficiency means more than mapping skills. Users should be comfortable with geodatabase naming and storage, editing procedures, geoprocessing tools, and multiple data formats. User should have enough experience to do troubleshooting.
   These GIS technicians should have access to field people who are knowledgeable of the local landscape and land use practices
2. Technical training. The GIS technicians need regular opportunities for technical training. The field people working with them need enough knowledge of the tool to be able work alongside the GIS technician, guiding their choices of parameters and understanding how to interpret output.
3. Watershed approach training. Local conservationists vary in their skills in watershed planning and implementation, engaging landowners, building collaborations, and communicating by using outputs from ACPF and other models. Training in these skills should be linked to the technical training so staff can effectively integrate them. Forum participants emphasized the need for trained field staff capable of connecting modeling tools/outputs to on-the-ground implementation.
4. Technical support. Beyond training, users need regular support from advanced users. An even greater concern to forum participants was the need for long-term support for software maintenance. Users need assurance that some entity has a long-term commitment to the software before they can justify investing time and resources in the tool.
5. Time. For a single HUC-12 watershed (e.g. 30 sq. mi. or 20,000 ac), a well-trained GIS technician needs one-to-several days to hydrocondition the DEM, and then a half-day to run the ACPF tools. With a few dozen watersheds in a county, this would require a significant amount of time. Ideally, state agencies would provide centralized dedicated staff who could efficiently do some of the work. For example, Iowa has funded state level GIS expertise dedicated to ACPF work. But as noted, close local collaboration during the process is essential. Even after the initial analysis, some local GIS expertise is needed to tweak analyses and format maps for specific purposes.

6. Software and hardware. Running all the tools in the ACPF toolbox requires a standard ArcGIS license. This is the most expensive license and not available in many local offices. This constraint is another reason for states to support dedicated centralized staff to help run the tools.
7. Data. States are rapidly improving access to the high-resolution digital elevation models (DEMs) required to run the ACPF and other hydrologic models. Additional supplementary data are valuable to combine with model outputs. States and local offices vary widely in how available these are. Data availability is also a training issue in that users need to understand the nature of the underlying datasets to make sure they are appropriate for the intended application.
   Efficient data management depends on strong collaboration among partners within a state, and across state boundaries. The Indiana Conservation Partnership is an example of the power of within-state coordination. Multiple agencies track conservation activities associated with their individual programs. By consolidating data generated by all of the agencies they can track the conservation workload and model the water resource impacts watershed-by-watershed.
   The Midwest would benefit from cross-state sharing of data, as well. Some lessons learned are relevant across state boundaries, and stronger conclusions can be generated from research data combined from multiple studies.
   A significant concern of sharing and combining data is securing the data and protecting privacy.

Checklist for state decision-makers

The following set of questions and criteria can be used to examine how state policies and infrastructure impact deployment of the ACPF and other conservation technology, and to identify strategies for expanding use of the ACPF.

1) A Supportive Policy Framework
   a) **Examine the major planning and implementation processes** in the state. For each plan type: What is the scale? Who creates the plan and who implements it? How effectively does it connect to plans and implementation at other scales?
   b) What are the requirements of each **source of conservation funding**? Are they consistent with a watershed approach?
   c) Examine the formal **mechanisms for sharing data** among agencies and other stakeholders. What are the strengths and opportunities for better collaboration?
   d) Examine the state's status in terms of each of the **six elements of the policy framework** described above.
2) The Right Tools for the Job
   a) Do local conservationists have access to a **summary and recommendations of existing tools** that support conservation planning and implementation in your state?
   b) **Evaluate existing technology tools** including the ACPF for how well they support local decision-making. Here are some suggested criteria:
      i) Do the ACPF and other tools address the conservation practices important in your landscapes?
      ii) Do the tools address the specific water quality issues of concern in your state?
      iii) Do the tool outputs serve reporting requirements and planning templates?
      iv) Are the tools appropriate for local use in terms of the time, data, and expertise required to run them?

v) Are key tools interconnected so they "play well" with each other? For example, is the ACPF output connected to a protocol or hydrologic models for assessing the impact of proposed practices on water resources?

c) What are the gaps between the identified technology needs and existing tools?

d) What tools are in use or development in neighboring states that could help your state? What are the opportunities for **multi-state collaboration on tool development and data sharing**.

3) Capacity to use the Tools

a) For each tool, which entity has made a long-term commitment to support and maintain it?

b) Who has the **time, skills, and hardware/software** to run the ACPF and other models? Is this enough people? Are they located in the right offices? Where are the gaps?
See the Technological Capacity section for specific requirements for ACPF.

c) Is the **training** structure adequate? How many people need training? How often?
For the ACPF, users need two full days of training, whether in a workshop or on their own, to gain enough background to start applying the tool. Collaborating field staff also need a day of training.

d) Where can local staff go for **technical support**?
For the ACPF, a discussion forum is available for help with troubleshooting. (See northcentralwater.org/acpf).

e) Are the **data** inputs easily accessible? What data resources would most enhance effectiveness?

f) Can users access the needed **hardware and software**? Consider bulk licenses for software and funding for equipment.

Resources

Konopacky, Jamie and Laurie Ristino. 2017. The healthy watershed framework: A blueprint for restoring nutrient-impaired waterbodies through integrated Clean Water Act and Farm Bill conservation planning and implementation at the subwatershed level. Environmental Law. Vol 47:647. http://elawreview.org/articles/healthy-watershed-framework-blueprint-restoring-nutrient-impaired-waterbodies-integrated-clean-water-act-farm-bill-conservation-planning-implementation-subwatershed-l/

Lewandowski, Ann. 2016. The Agricultural Conservation Planning Framework: Experience from Minnesota ACPF Users. University of Minnesota Water Resources Center. http://hdl.handle.net/11299/199795
This report describes requirements for local use of the ACPF.