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Viewpoint

Using social criteria to select watersheds for non-point source agricultural pollution abatement projects

N. Babin^{a,*}, N.D. Mullendore^b, L.S. Prokopy^b

^a Department of Earth and Environmental Sciences, Taylor University, Upland, Indiana, USA

^b Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana, USA

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ABSTRACT

This article proposes social criteria for siting watershed-level agricultural non-point source (NPS) pollution abatement projects. A suite of indicators is introduced and a methodology is described for assessing the indicators and making a relative comparison between sites. Indicators discussed include funding availability, project interest, problem salience, and stakeholder collaboration and trust. The article concludes with a discussion of the challenges associated with measuring and comparing qualitative criteria.

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1. Introduction

Non-point source (NPS) agricultural runoff continues to cause downstream impacts despite decades of attempts to address the problem. In order to significantly reduce the size of the hypoxic zone located in the Gulf of Mexico, researchers have suggested that phosphorous and nitrogen loads in the Mississippi River need to be reduced by anywhere from 45% (Greene et al., 2009) to 70% (Liu et al., 2010). The process of identifying pollution sources and economically efficient treatment or mitigation strategies is confounded by the legacy effects of historical management decisions, difficulties in calibrating models, poorly designed monitoring plans, and other related challenges (Osmond et al., 2012). By definition, NPS is a distributed problem attributed to numerous actors within a watershed. In landscapes dominated by production agriculture, the majority of the land is privately owned and managed. As a result of these and other factors, most NPS reduction efforts are voluntary.

While NPS reduction initiatives vary tremendously in terms of scale and objectives, they share an inherent need for local coordination and support. Without the coercive force of regulation,

local efforts often fail because producers and other land managers choose not to participate, or because inadequate resources are made available to coordinate projects, provide technical expertise, compensate for economic losses for agricultural producers, and control for production risks. While the literature generally focuses on success stories, the cumulative effect of these failures has been widely documented in recent policy reviews (e.g., Murchison, 2005; Andreen, 2013; Williams, 2013).

In response to these failures, a number of agencies and organizations have initiated intensive, targeted outreach approaches at the watershed (HUC 10) and sub-watershed (HUC 12) levels (Tomer, 2010; Magner, 2011; Nowak, 2012; Legge et al., 2013; Tomer et al., 2013). These approaches incorporate emergent planning tools such as LIDAR imaging and novel management technologies such as tile drainage treatment wetlands, bioreactors and two-stage ditches. While these novel projects incorporate focused outreach and evaluation strategies, the procedures used for initial watershed selection lack formal guidelines. Analysts have pointed out that attention has usually been given on a “worst-first” basis, targeting limited funds and resources to the most polluted waterways (Nowak et al., 2006; Norton et al., 2009). While it is important to address these “worst” watersheds, recent modelling efforts demonstrate that there are an abundance of watersheds and sub-watersheds contributing significantly to NPS pollution in the Mississippi Basin (McLellan et al., 2014), indicating a wide field of suitable project sites from a strictly biophysical perspective.

* Corresponding author at: Department of Earth and Environmental Sciences, Taylor University, 236W. Reade Avenue, Upland, Indiana 46989-100, USA.
E-mail address: ncbabin@taylor.edu (N. Babin).

Table 1
Proposed framework of indicators for site selection.

| Indicator | Metric (s) | Potential method of assessment | Proposed scale of assessment |
|---|---|--|------------------------------|
| Biophysical impairment | Presence–absence | Review records and lists | State-level |
| Federal/state/local funding programs | Presence–absence | Review records and lists/state-level informant | State-level |
| Historical projects | Multiple and current projects | Internet search/regional-level informant | Regional-level |
| Funded watershed group with current paid staff | Amount and length of funding/number and job description of staff | Internet search/regional-level informant | Regional-level |
| Existing watershed plan or assessment | Presence–absence and whether up-to-date/comprehensiveness and quality | Internet search | Regional-level |
| Adoption and re-enrollment rates of BMPs | % of area in each practice over time | Interviews with local conservation staff | Site-level |
| Problem salience | Level of knowledge and awareness/perceptions and attitudes | Interviews with local conservation staff and producers | Site-level |
| Collaboration and trust | Material support/past or current conflict | Interviews with local conservation staff and producers | Site-level |
| Stakeholder commitment/project interest | Level of interest, commitment, and motivation | Interviews with local conservation staff and producers | Site-level |
| Farmers as conservation leaders | Presence–absence | Interviews with local conservation staff and producers | Site-level |
| Supportive farm, sportsmen and wildlife organizations | Presence–absence/type of project influence | Interviews with local conservation staff and producers | Site-level |

Research findings and experiential evidence indicate that when selecting among several watersheds with comparable levels of biophysical impairment to participate in targeted watershed conservation projects that feature innovative planning techniques and novel management practices, using social criteria can greatly improve the selection of appropriate study sites. Prokopy et al. (2014b) examine the role of catalysts such as increased grant funding in leading to change within a watershed. They find that the effectiveness of a catalyst is dependent upon baseline social conditions. This article builds off of Prokopy et al. (2014b) by identifying specific baseline social conditions that can influence the success of NPS reduction projects. A focus on social criteria takes seriously Chess & Gibson's observation that "all watershed are not created equal (socially); some watersheds may benefit little from watershed management efforts" (2001: 775). While there is increasing interest in utilizing social criteria in the watershed selection processes for targeted NPS reduction projects, there has been little effort towards identifying potential indicators and outlining strategies for their measurement. Thus, many watershed managers and policymakers lack guidance in properly conducting comparative watershed assessments that take into account both biophysical and social dimensions. A notable exception is that of Norton et al.'s (2009) important work at first developing social criteria indicators of a watershed's recoverability potential. These criteria, alongside more traditional ecological indicators, were employed by the Illinois Environmental Protection Agency (IEPA) to prioritize work in the state's 723 impaired waterways (US EPA, 2011). Norton et al. focused on the ability to quantitatively screen and rank the recoverability potential of large numbers of impaired watersheds simultaneously within a given area. While meeting the needs of the EPA, the macro-level scale of the screening approach, based on only quantitative indicators, results in the unavoidable loss of crucially important qualitatively assessed and locally-produced indicators of a watershed's capacity to recover. It is these mostly qualitative indicators that can be crucially important when deciding where to

test out new solutions to water quality problems, especially those incorporating emergent planning and management technologies. There is a risky tradeoff in efficiency for accuracy within frameworks, such as that of Norton et al. (2009), which are committed to macro-scale screening procedures and only quantitative indicators. They eliminate from consideration social context indicators that may be most relevant to determining a watershed's likelihood of supporting novel targeted NPS reduction initiatives as these are most often qualitative in nature.

This article suggests both quantitative and qualitative social criteria that should be considered when prioritizing sites for novel NPS reduction projects. A suite of indicators is proposed that represent common social factors driving successful watershed-based conservation projects. A process and some methodologies for collecting these indicators and using them to comparatively select sites for NPS abatement projects is also proposed. The focus is not on identifying the factors inherent to the projects themselves that lead to success or not (although see Wondollock and Yaffee, 2000; Sabatier et al., 2005; Margerum, 2008, 2011 for detailed treatments). Instead, the emphasis is placed on beginning to identify the key social preconditions within a locale that indicate a higher potential for success in completing a watershed-based NPS reduction project. The preliminary framework presented here is intended to stimulate discussion and lead to further refinement of metrics and methodologies for selecting sites in United States agricultural landscapes with the best chances for success when undertaking novel NPS reduction projects.

1.1. Proposed indicators

First, each of the proposed indicators are described (Table 1). Then an assessment methodology is proposed for selecting watersheds (HUC 10) and sub-watersheds (HUC 12) for siting novel NPS pollution abatement projects. The indicators were gathered from government program administrators, university researchers,

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