Meta-analysis of Natural Resource Conservation Plan Evaluations

Michaela Foster, *North Carolina State University, Department of Forestry and Environmental Resources, Raleigh, NC 27695*

M. Nils Peterson, *North Carolina State University, Department of Forestry and Environmental Resources, Raleigh, NC 27695*

Frederick Cubbage, *North Carolina State University, Department of Forestry and Environmental Resources, Raleigh, NC 27695*

Gerard McMahon, *Department of Interior, Southeast Climate Science Center, Raleigh, NC 27695*

Abstract: The number of studies evaluating the quality and content of many types of plans have grown in recent decades. Natural resource conservation plans have been included in some of these plan evaluation studies; however, no meta-analysis of natural resource planning literature has been conducted. This focus is needed because natural resource conservation planning differs from other types (e.g., hazards mitigation, urban planning), in that planners often come from natural resource backgrounds, must plan in compliance with federal and state planning mandates, and typically operate under the assumption that natural resources have a use value and are shared resources. We selected 10 natural resource conservation plan evaluation studies in peer reviewed literature, identified the plan components being evaluated and the methods used in each study, and compared our findings to two other plan evaluation meta-analyses in the literature. We found that natural resource conservation plan evaluation studies followed many of the same practices as the general body of evaluation studies but tended to focus more on goals, policies, implementation, and coordination. Compliance and stakeholder engagement were key gaps in natural resource conservation plan evaluation studies, and these findings highlight a need for more emphasis on these components among natural resource planners. We also found that natural resource conservation plan evaluation studies largely incorporated best practices for plan evaluation methodology. However, few studies provided the evaluation tool used, indicated whether or not the evaluation tool had been pretested, or reported intercoder reliability scores. These protocols should be incorporated and reported in future natural resource plan evaluation research. Future work could link planning efforts, planning laws and mandates, and plan quality to planning outcomes.

Key words: conservation, meta-analysis, natural resources, planning, plan evaluation, plan quality

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Natural resource conservation plans play an important role in shaping natural resource use and allocation under complex institutional, economic, and informational constraints (Lachapelle et al. 2003). Adopted conservation plans have power to shape the protection of the landscape and many other factors including biodiversity conservation, climate resilience, and public access and participation in future planning processes (Bassett and Shandas 2010, Lachapelle and McCool 2005, Steelman and Hess 2009). Plans provide a vision for what decision makers hope the future landscape will look like and are valuable tools guiding management (Berke et al. 2006). Natural resource conservation plans establish links between scientific information and problem definitions, objectives, and actions, and they reflect stakeholder values and concerns, which are often fragmented (Lachapelle and McCool 2005, Salwassar 2004). Legal mandates, such as the National Forest Management Act (NFMA) mandating National Forest plans, have made natural resource conservation plans even more important over recent decades. Considerable amounts of time, staff, and resources are poured into developing natural resource conservation plans, so it is important that plans are utilized and effective at achieving desired outcomes (Allen and Gould 1986, Berke et al. 2006). Berke and Godschalk (2009) found that high quality plans, in general, are more likely to be used and may be associated with successfully achieving objectives, so producing high quality plans should be a priority for natural resource management agencies (Berke and Godschalk 2009).

Because natural resource conservation plans are widely used to make decisions across millions of hectares of landscapes around the world, routine evaluation of plan quality is essential (Berke 1994). Plan evaluation studies use content analysis methodology, a systematic process of measuring plan characteristics using a set of criteria that is selected by the researcher, based in planning theory, and adapted to the purpose of the study and type of plans being evaluated (Baer 1997, Berke and Godschalk 2009). Plan evaluation studies highlight strengths and weaknesses in plans, identify key plan components, explore how factors such as stakeholder participation and planning jurisdiction affect plan quality, and contribute to learning about changes to planning theory and practice (Berke 1994, Berke and Godschalk 2009, Brody 2003a, Bunnell and Jepson 2011, Lyles and Stevens 2014). For example,

Berke (1994) found that New Zealand natural hazards plans scored low for fact base[1], goals, and policies, and local plans tended to score lower than regional plans. This evaluation highlighted the need for better data, more effort articulating goals, and more support for local planning, and similar insights are critical for natural resource conservation planning. Plan evaluation studies have assessed plans addressing several topics most notably ecosystem management (Brody 2003b), natural hazards (Berke 1994, Brody 2003a), climate change (Wheeler 2008), and sustainability (Berke and Manta-Conroy 2000), and most studies involved an analysis of similar types of plans from multiple jurisdictions (e.g., local comprehensive plans from a state) (Stevens et al. 2014).

Meta-analysis of plan evaluation studies, as opposed to analyzing just the plans themselves, is needed as the plan evaluation literature continues to grow. Meta-analysis of plan evaluation studies enables comparisons of planning efforts across fields or topics by providing a snapshot summary of plan quality through the pooling of plan evaluation results. Meta-analysis of plan evaluation studies provides additional information about the plan evaluation practice by highlighting differences in studies, the criteria they assess, and the methods they use while also providing a broader understanding of the quality of a particular sets of plans. Results from a meta-analysis may be compared to plan evaluation studies to highlight best (or worst) plan components and to assess what about plans matter most in a particular field. Meta-analysis of plan evaluation studies may be used to indicate the validity of the studies. While most evaluation studies generally follow widely accepted content analysis methodology, the evaluation instrument and methods used vary by study (Berke and Godschalk 2009, Lyles and Stevens 2014, Stevens et al. 2014). Pretesting the protocol and assessing reliability, along with providing a description of the coding process, are indicators of whether rigorous methodology was applied to generate reliable and replicable data during the plan evaluation study. Pretesting ensures that the protocol measures what researchers intend to measure, while reliability testing ensures that these measures can be done repeatedly over time with different samples of plans. The coding process refers to the protocol guiding how the plans were evaluated including how many individuals (called coders) evaluated each plan and if they did so independently or as a team.

Two important meta-analyses have assessed the growing body of plan evaluation studies (Berke and Godschalk 2009, Lyles and Stevens 2014), but none have focused specifically on natural resource conservation plan evaluation studies or compared results across other planning focus areas (e.g., hazards, transportation, urban planning). This represents an important gap in plan evaluation, since natural resources differ in critical ways from other popular planning areas. Notably, natural resources are often common pool resources (goods for which it is costly or impossible to exclude beneficiaries from using, such as fisheries or timber) requiring novel approaches to planning and management (Ostrom 1990), but many other types of plans fundamentally focus on private resources. Similarly, natural resource management often assumes use and existence values for resources, whereas other planning areas may not include that assumption. For example, hazards management centers on avoidance value such as the value of reducing damages from hurricanes. In addition, whereas natural resource conservation planners often work for government agencies (e.g., wildlife and forest management agencies) and develop plans for management of publicly owned land, those planning for hazards management often come from city planning backgrounds and develop plans that manage both public and private land. Further, natural resource management revolves around science based decision making, and long term data is often readily available, suggesting that the fact base in natural resource conservation plans may be stronger than in hazards mitigation or urban planning domains. A meta-analysis can identify a baseline of plan quality for researchers and practitioners to compare individual evaluation studies and plans to (1) provide insights into the planning context, strengths, and challenges within the field (2) and highlight how they differ from other planning areas.

In this paper, we conduct a meta-analysis of natural resource conservation plan evaluation studies. Our meta-analysis was informed by planning theory and literature, and we used plan evaluation frameworks (Baer 1997, Berke and Godschalk 2009, Lyles and Stevens 2014, Stevens et al. 2014) to determine what plan components might be evaluated and what methods could be used. We present findings from a meta-analysis of ten natural resource conservation plan evaluation studies, detailing the criteria evaluated in the studies and methods used. We conclude with discussion about our findings and suggestions for future work.

Methods

We searched online databases for published, peer-reviewed plan evaluation studies. We conducted keyword searches of online databases and Google Scholar using search terms 'assess,' 'evaluation,' 'plan,' and 'quality,' and we reviewed the citations of plan evaluation studies to identify other studies. The studies covered a range of plan topics, methodology, and samples. We narrowed

1. Fact base refers to data used in planning and included in the plans. In Berke (1994), the evaluation of fact base included the presence of hazard maps, emergency shelter capacity, and estimates of infrastructure at risk. In natural resource conservation plans, fact base evaluation could include, for example, data from species or ecosystem assessments.

Table 1. Component scores from natural resource plan evaluation studies between 1999 and 2011. The scores listed are standardized scores. We standardized the scores to a range of 0 to 1 by dividing the score listed in the study by the total possible score for each category in the particular study. For those studies that reported standardized scores, we include the scores directly. An X indicates plan components that were evaluated in studies but which a score was not reported in the study.

Study authors	Issues	Fact base	Goals	Policies	Implementation	Monitoring and evaluation	Coordination	Stakeholder engagement	Organization	Compliance	Clarity of purpose
Berke et al. 1999	0.54	0.09				0.30	0.45		0.43	0.36	0.69
Brody 2003b		0.23	0.36	0.44	0.58[a]		0.51				
Brody et al. 2004		0.25	0.38	0.44	0.31		0.43				
Davis 2004			X	X	X	X					
Evans-Cowley and Gough 2009		0.25	0.24	0.19			0.42				
Norton 2005		X[b]	X	X	X	X					
Tang 2008		0.53	0.62	0.44	0.32	X	X		X		X
Tang et al. 2011		0.47	0.63	0.39	0.36		0.46				
Steelman and Hess 2009	X		X		X		0.43	X			
Termorshuizen et al. 2007[c]		X	X	X			X				

a. Assessment of monitoring was included in implementation category
b. Data analysis section corresponds to fact base
c. Study assessed awareness and key indicators which corresponded to some of the categories

down the group of studies to examine by selecting only those studies that evaluated plans that provided guidance for natural resource conservation. Those plan evaluation studies included plans which discussed open space protection, management of watersheds and coastal zones, and local and regional environmental and resource management. We selected one publication, the most comprehensive, from any set of publications based on the same plan quality data set.

We analyzed the evaluation content and methodology used in the studies. To assess the content of the studies, we first identified the plan components used in each study to evaluate plans. Then, we compiled the scores for each component from every study that included them. It was not possible to use some of those scores directly because of differences in how the components were measured and how scores were computed in the studies (e.g., number of indicators in each category and scales varied), so we standardized those scores to a range from 0 to 1 by dividing the score by the total possible score for each category. For those studies that reported standardized scores, we included the scores directly. We reported the standardized scores for each component for the studies that included them in Table 1, and we indicated plan components that were evaluated in studies but did not have a reported score with an (X).

We used a set of 11 indicators to assess methodology; we then identified whether the indicators were included in the each plan evaluation, and responses were scored either yes or no. The questions used to identify indicators were:

Does the study contain a justification for which plan components were evaluated?
Is the evaluation tool included?
Is the sampling process explained?
Was the evaluation tool pretested?
Was a reliability test conducted?
Was a reliability score reported?
Is a discussion of coders included?
Were multiple coders used for the evaluations?
Did coders work independently?
Is there an explanation of scoring procedures?
Are evaluation scores standardized?

Since there was a very small population of studies to draw from, we conducted a complete census, gathering all studies; thus, no statistics are needed to interpret results. Our evaluation protocol aligns with previous plan evaluation meta-analysis research by Berke and Godschalk (2009) and Lyles and Stevens (2014). Some of the studies analyzed in this paper were also analyzed in those papers. We will compare our results to the findings presented in those papers to provide a broader view of how natural resource conservation plan evaluation studies relate to the larger plan evaluation literature.

Results

Ten plan evaluation studies focusing on natural resource conservation plans were published between 1999 and 2011. All but one study evaluated plans from the United States. The studies evaluated between nine and 53 plans, and eight of the studies evaluated 20 or more plans. Many of the studies evaluated similar plan components. Twenty percent of studies evaluated a plan's management issues component (Table 1). Eight out of ten studies evaluated the plan's fact base. Nearly all (90%) of the studies included an assessment of goals, and 80% of studies addressed policies. Seven out

Table 2. Evaluation methodology used in natural resource plan evaluation studies between 1999 and 2011. Note: An X indicates evaluation methodology was used in the study. We list the number of plans evaluated in each study. We list what reliability test was conducted and the scores if they were described in the study.

Study Authors	*N* of plans	Criteria selection discussion	Tool provided	Sampling process	Pretest	Reliability test	Reliability score	Coder Discussion	# of Coders	Independent Coding	Scoring Justification	Standardized Score
Berke et al. 1999	50	X	X	X	X	% Agreement	0.8	X	2		X	X
Brody 2003b	30	X		X							X	X
Brody et al. 2004	45	X		X		% Agreement	0.97	X	2	X	X	X
Davis 2004	15	X		X							X	X
Evans-Cowley and Gough 2009	9	X		X	X	% Agreement	0.88	X	2		X	X
Norton 2005a	40	X		X							X	
Steelman and Hess 2009	20	X	X	X				X	2		X	
Tang 2008	46	X		X							X	
Tang et al. 2011	53	X		X	X	% Agreement, Cronbach's alpha	0.84 %, 0.95 alpha	X	2	X	X	X
Termorshuizen et al. 2007	38	X		X								

of 10 studies evaluated implementation and coordination components, and an assessment of monitoring and evaluation protocols was included in 40% of studies. Two studies assessed the organization of plans. Several studies evaluated components that were not evaluated in other studies. Notably, stakeholder engagement and compliance were only included in evaluations in one study each. This is surprising given the importance of these components to natural resource management and planning.

While only two studies included the evaluation tool, all studies provided an explanation of protocols used and an explanation of which components were selected for evaluation (Table 2). All 10 studies described how the plans included in the evaluation were selected, and all studies listed how many plans were evaluated. Half of the studies provided information about the coding process, and those five studies utilized multiple coders. Only two studies noted that coders worked independently. All but one study provided some description of how the plans were coded, and most commonly indicators were scored on an ordinal scale where 2 = identified, complete; 1 = identified, incomplete or unclear; and 0 = not identified or other slight variations. Just over half of the studies (60%) provided standardized scores. Only 30% of the studies noted pretesting the evaluation tool.

To pretest, Berke et al. (1999) and Evans-Cowley and Gough (2009) evaluated multiple plans, each time comparing results, resolving interpretation and scoring differences, and refining the protocol. Both continued the pretesting process until plans evaluated consistently. However, the specific number of plans that were part of the pretesting was not listed, and the Berke et al. (1999) study did not indicate if pretesting was done on plans in the sample or outside of the sample. Four studies noted conducting reliability tests between two coders and reported scores. Brody et al. (2004) and Evans-Cowley and Gough (2009) noted scores were calculated from all plans in the sample, Berke et al. (1999) from four plans, and Tang et al. 2011 from 11 randomly-selected plans. The four studies used percentage agreement, and percentage agreement scores ranged between 80% and 97%. One of these studies also used Cronbach's alpha test.

Discussion

Our analysis of natural resource conservation plan evaluation studies highlights several key similarities with other plan evaluation studies for components being assessed and the methods used in the evaluations. These similarities may emerge for two reasons: (1) many of the studies were conducted by a common set of researchers, and (2) content analysis best practices have been established and many were used in evaluation studies. Three researchers, along with their teams, conducted half of the natural resource conservation plan evaluation studies we analyzed and have authored other evaluation studies (Berke and Godschalk 2009, Lyles and Stevens 2014). Many of the plan evaluation studies based their evaluation protocol from Berke and others which identified several plan components to consider including issues, fact base, goals, policies, and implementation. Similarly, these authors outlined what methodology should be used. Developing their protocol largely from Berke and others may be problematic if researchers fail to identify and evaluate key components that are specifically relevant to the natural resource conservation planning field.

Our findings suggest compliance and stakeholder engagement may be key gaps in natural resource conservation plan evaluation studies. In comparison to five studies that evaluated compliance in the Berke and Godschalk (2009) meta-analysis study, only one natural resource conservation plan evaluation study evaluated compliance. This is surprising as legal mandates requiring these management plans and the inclusion of particular elements is

common in the natural resource management field (e.g., NFMA requiring National Forest plans, inclusion of eight elements in all state wildlife action plans). Compliance may not be assessed as often in natural resource conservation plan evaluation studies for a few reasons: 1) mandates may vary by jurisdiction and thus are only relevant to individual or a subset of plans within a particular jurisdiction, 2) researchers may assume that all plans already comply with mandates, or 3) plans put minimal focus on compliance, which does not trigger researchers to examine this component. Failing to evaluate compliance may result in missed opportunities to reveal mismatches in plan proposals and resources needed to implement planned actions (e.g., an unfunded mandate to protect species) or to assess how plan quality differs under various mandates and planning contexts (Berke et al. 1999).

Stakeholder engagement was assessed in only one natural resource conservation plan evaluation study; however, it is none-theless an important plan component and thus warrants evaluation. Stakeholders have a vested interest in natural resources as they receive the benefits of high quality natural resources but may incur costs if quantity decreases (e.g., decrease in recreation opportunities or negative health effects), so stakeholder values should be incorporated in the planning process and reflected in goals and policies (Fontaine 2011, Lachapelle et al. 2003). The importance of stakeholder values and inclusion during the planning process has been recognized by agencies and advocated for by the public, and federal agencies and state agencies are often required by law to engage with stakeholders. Plans may lack discussion about stakeholder engagement because many agencies must comply with mandated public involvement procedures and may deem assessing those efforts in plans as redundant. This approach, however, can be problematic because poorly planned public engagement processes are notorious for stoking, rather than ameliorating, conflicts between management agencies and their constituents (Cox 2012, Daniels and Walker 2001). Stakeholder engagement also may be omitted because it is hard to measure. Information about whether comments are received, acknowledged, synthesized, and responded to, and whether forums or other types of meetings are held and adhere to best practices is rarely collected, and thus cannot be evaluated. Government agencies have criticized stakeholder engagement processes as inefficient since it is difficult to engage the entire population and to incorporate their values in plans (Tang 2008), and this sentiment may have permeated to natural resource conservation plan evaluation researchers, who may believe stakeholder engagement is not a significant enough process in planning worth evaluating. However, in a study by Steelman and Hess (2009) stakeholder engagement was a positive predictor of plan quality, and failing to assess stakeholder engagement in plan evaluation studies may lead to an inadequate measure of plan quality.

Natural resource conservation plan evaluation studies tended to analyze goals, policies, and implementation more often than was common in other planning meta-analyses, and this divergence from the larger body of research may be a reflection of researchers tailoring evaluation protocol to specific plans or topics (Lyles and Stevens 2014). As Bunnell and Jepson (2011) discuss, the complexity and variety of planning contexts make it impossible to identify a singular best plan or planning process, and consequently, these differences should be incorporated into what evaluation criteria is used. Customizing plan evaluation studies allows researchers to capitalize on the knowledge of planners in a specific field by utilizing their expertise to develop protocols, while ensuring that the findings are relevant to that planning field (Lyles and Stevens 2014). Unique attributes of natural resources and natural resource planning (e.g., planners from natural resource departments using science based decision making, common pool resources with assumed use values) may explain differences between natural resource conservation plan evaluation studies and the general body of studies. Some natural resource agencies have strong cultures of science based decision making, which puts explicit focus on goal setting and linking goals to implementation, and this may explain why natural resource plan evaluation studies more often included goals, policies, and implementation evaluation elements (Peterson et al. 2007).

Coordination with other plans and agencies was assessed in eight out of the ten natural resource conservation plan evaluation studies, compared to in just six out of sixteen evaluation studies in Berke and Godschalk (2009), suggesting that such coordination is a key component in natural resource conservation plans. As noted, natural resources are often common pool resources, and as such, may need collective action to be managed effectively. Managing natural resources often involves dealing with problems that extend beyond the jurisdictional boundaries outlined in the plan and a lack of clearly defined boundaries for actions and consequences of those actions. Thus how, and if, agencies engage with stakeholders and coordinate with other conservation agencies are important considerations for accomplishing goals and objectives, and assessing how well plans recognize and are integrated with other plans and agencies is, therefore, an essential component for plan evaluations (Adams et al. 2003, Armsworth et al. 2015, Tang 2008).

We found that natural resource conservation plan evaluation studies followed many of methods presented in other plan evaluation studies, and findings were fairly consistent with those from the Lyles and Stevens (2014) meta-analysis: multiple coders were often used, coders worked independently, and coders used ordinal scoring scales. These methods fall under best practices described

by Berke (1994), Baer (1997), and Lyles and Stevens (2014). Following best practices ensures rigorous and reliable methods are used to generate data and increases confidence in the study. However, our findings indicate that improvements may be needed in the use and the reporting of methodology. Key weaknesses of the natural resource conservation plan evaluation studies were failures to provide the evaluation tool, a description of pretesting, and an assessment of reliability. In this analysis, we were not able to determine if methodology weaknesses were due to failures to apply best practices in the studies or to fully document methodology. The evaluation tool was included in just two of the studies, and exclusion of the tool decreases transparency and hinders replication, and in turn, prevents possible future refinement of the evaluation practice or expansion on research in future studies. Pretesting and reliability testing were incorporated sparingly in our set of studies. These findings indicate there is a lack of accepted and consistently used methodology in plan evaluation literature; however, Tang et al. (2011) provides a noted example for describing the reliability assessment with percent agreement and Cronbach's α, including detailing how raters were trained, why score disagreements occurred, how those disagreements were addressed, explaining what tests were used, and reporting reliability scores compared to published standards.

Our meta-analysis explored both the evaluation content and methodology of ten published natural resource conservation plan evaluation studies. The results indicate that these studies follow many of the same practices as the general body of evaluation studies but tended to analyze goals, policies, implementation, and coordination plan components more often than the larger body of plan evaluation studies. These findings may be attributed by the unique attributes of natural resource management and planning as well as to the relatively thorough plans that are required by law, which in turn, lead to thorough evaluations corresponding with required elements.

Although our findings highlight several important insights about natural resource conservation plan evaluation studies, future research is needed to further uncover how plans and plan evaluation studies differ within and across planning areas, how they contribute to both plan development and plan evaluation in practice, and how plans and plan quality are linked to outcomes. First, meta-analysis of plan evaluation studies should explore differences in other planning topics and settings (e.g., hazard mitigation, zoning, community development) to reveal patterns of plan and plan evaluation strengths and to refine best practices for plan evaluation. While plan evaluation studies provide useful information about plans and the planning process and can reveal new ways for understanding how to prepare better plans, it is unclear if federal, state, and other agencies are incorporating this information into revising and creating new plans or into conducting their own plan evaluations (Lyles and Stevens 2014). Few studies link planning laws and mandates, plan quality, and planning outcomes, and future research exploring whether goals outlined in plans are achieved could contribute to the debate about the value of plans (i.e., do plans matter?) (Berke and Manta-Conroy 2000). This is an important contribution for the future of plan evaluation research, as plan evaluations may not be necessary if plans are not used or if there is no relationship between better plans and achievement of desired outcomes (Lyles and Stevens 2014). Last, few studies have explored what factors drive changes in plans and why or how those factors influence plans and plan quality, and longitudinal studies are needed to determine how planners are learning over time (Brody 2003a). Future research could examine which plan components most strongly influence plan quality to help agencies identify specific areas to improve in future planning efforts.

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