

Planning for Resiliency: Evaluation of State Hazard Mitigation Plans under the Disaster Mitigation Act

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Abstract: State mitigation plans play a critical role in supporting disaster loss reduction and long-term resiliency of human communities. The Disaster Mitigation Act of 2000 requires all states to prepare mitigation plans. Based on six principles of plan quality, we content analyzed a sample of 30 coastal state plans to determine how well they support mitigation. Findings indicate that although plans scored moderate to low for all plan quality principles, plan quality has modestly improved over the past decade. In addition, some states scored low for one principle, which can undermine implementation of otherwise high-scoring plans for the remaining principles. Recommendations are offered on how plan quality evaluation can be used to guide and monitor state development of hazard mitigation plans. DOI: 10.1061/(ASCE)NH.1527-6996.0000063. © 2012 American Society of Civil Engineers.

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Introduction

The role of state planning for mitigation to achieve disaster resiliency has been a subject of interest and contention. The federal Disaster Mitigation Act (DMA) of 2000 requires states to prepare plans that are to guide state hazard mitigation activities. This role involves a variety of choices. States can choose to advance mitigation narrowly by preparing standalone mitigation plans or integrate mitigation plans with ongoing efforts in land use planning, ecosystem management, economic development, disaster recovery, and climate change adaptation. Further, the relationship between state mitigation plans and local mitigation activities, and the interrelationship among other state agency plans, is subject to controversy and debate (Godschalk et al. 1999). In all cases, state mitigation plans can serve a critical role in fostering intergovernmental coordination (Burby and May 1997), enhancing local plan compliance with broader state goals (Deyle and Smith 1998), and ultimately building resiliency of human communities to resist or absorb and rapidly recover from disaster impacts (Beatley 2009; Godschalk et al. 2009; Peacock et al. 2008).

If state plans are intended to guide state and local government behavior to support state and federal interests in hazard mitigation, then the quality of plans becomes a critical issue. The DMA strongly encourages all state and local governments to prepare hazard mitigation plans based on a participatory process and technical vulnerability analysis. DMA-based plans should identify and

prioritize a range of incentives (e.g., funding, technical assistance), regulatory powers, taxing and spending powers, and infrastructure investment strategies that state and local governments can apply to mitigation. Once DMA plans are in place, state (and local) governments become eligible for pre- and postdisaster federal mitigation funds. However, with the exception of the Godschalk et al. (1999) pre-DMA study, state mitigation plans have not received attention by planning and hazard mitigation researchers, and no national-level studies have assessed the quality of plans produced under the DMA.

This study examines the quality of state plans prepared under DMA. Plans are but one step in a broader process aimed at effectuating change (Berke and Smith 2010). However, without setting clear and practicable goals for the future and a coordinated strategy for achieving the goals, the prospects for real change are limited. Two research questions are examined here: (1) How well do state mitigation plans prepared under DMA achieve the principles of plan quality? (2) What are the comparative strengths and weaknesses of individual state plans by plan quality principle?

This paper is organized as follows. First, past efforts at plan quality conceptualization are reviewed, and a set of principles of plan quality is derived that provides criteria for evaluating state mitigation plans. Then key requirements for state mitigation plans as stipulated by DMA are reviewed. Next, the study methods are described, and findings from the evaluation of plans are provided. Finally, conclusions are summarized, recommendations for improving state mitigation plan quality are presented, and guidance for future research is offered.

Conceptual Foundations: Principles of Plan Quality

Given the potential benefits of mitigation, state plans should be evaluated to enable examination of the quality of plans, both to review the effectiveness of past processes and to guide future processes. The literature has begun to yield an agreed-upon set of principles for assessing the quality of plans. In one of the earliest empirical evaluations of comprehensive plans, Gruft and Gutstein (1972) developed a set of criteria based on a set of principles indicating that plans should be derived from a rational process

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in a scientific sense, and a democratic process that included representation of all stakeholders.

Various plan quality studies focused on hazard mitigation began to appear in the 1980s and 1990s. In the first empirical work on plans aimed at disaster reduction, sociologists Wenger et al. (1985) explored the links between disaster plans and public perceptions. Soon, planning scholars started to show steady interest in the topic. Deyle and Smith (1998) assessed local plan quality and plan compliance with Florida's coastal hazards planning mandate, and Tang et al. (2008) examined plan quality in response to the national tsunami mitigation program. Berke and French (1994), Burby and May (1997), and Dalton and Burby (1994) examined the direction-setting function (facts, goals, and policies) of hazard mitigation elements of plans in six states and addressed data reliability issues by double coding 139 comprehensive plans and computing inter-coder agreement scores. Hopkins (2001) suggested including the external validity of plans, addressing their relevance in meeting the needs of local situations. As noted, the Godschalk et al. (1999) empirical evaluation of plans represents the only study of state mitigation plan quality.

In an assessment of plan evaluation as embodied in the plan document, Baer (1997) extended plan quality thought and practice by developing the most robust set of plan quality principles completed at that time. He developed a composite list of 60 criteria arranged according to various basic principles including, for example, rational model considerations (problems, goals, policies); procedural validity (who was involved, why they were chosen); scope that connected to larger geographic scales; implementation; and communication linked to convincing presentation. More recently, Norton (2008) observed that a fundamental approach to deriving principles of plan quality comes from communicative action theory. Viewed as a communicative policy act, Norton argues that the plan can be thought of as originating from a rational process that embraces place-making and democratic discourse. He contends that the principles of plan quality should reflect certain conditions that support democratic discourse in that plans must be (1) comprehensible to all as they should be clearly understood, (2) legitimate in that they reflect the interests of stakeholders affected by the plan, (3) accurate in a scientific sense and in an emancipatory sense in that information has been subject to alternative interpretations and corrections by stakeholders, and (4) sincere in that they include implementation and monitoring procedures that hold organizations accountable for carrying out the plan (Forester 1989; Innes 1995; Innes and Booher 1999).

Since the mid-1990s the empirical base of plan quality evaluation has expanded dramatically. This allowed Berke and Godschalk (2009) to conduct a meta-analysis that quantitatively compared plan quality scores. The 16 published studies included in the meta-analysis covered a range of topics, research designs, domestic and international settings, and samples. Natural hazard mitigation was the most frequent topic (seven studies), followed by smart growth, sustainable development, watershed protection, housing affordability, landscape ecosystems, coastal resources, and human rights of indigenous peoples. From the plan quality studies, Berke and Godschalk proposed a refined approach to plan quality evaluation that recognizes the core purpose of a high-quality plan, which is to "provide a clear and convincing picture of the future, which strengthens the plan's influence in the land planning arena" (2009, p. 229). They maintain that two dimensions of principles should be included in plan quality evaluation: the internal plan quality dimension includes principles that guide the content and format of the key components of a plan, and the external plan quality dimension offers principles related to how well the plan fits its local situation to maximize its usefulness and

influence. As will be discussed subsequently, six principles are important since they are closely aligned with DMA requirements for preparing state mitigation plans, with principles 1–4 representing the internal dimension and principles 5–6 representing the external dimension:

1. Goals are future desired conditions that reflect the breadth of values affected by the plan.
2. The fact base provides the empirical foundation to ensure that key hazard problems are identified and prioritized and mitigation policy making is well informed.
3. Policies (or actions) serve as a general guide to decisions about development and assure that plan goals are achieved.
4. Implementation and monitoring involves the assignment of organizational responsibilities, timelines, and funds to implement plan. It also involves tracking the extent to which policies are carried out.
5. Interorganizational coordination entails recognition of the interdependent actions of state and local organizations that need coordination for plan implementation.
6. Participation involves recognition of formal and informal actors engaged in preparing the plan, including other governmental bodies, private-sector institutions, nonprofits, and individual citizens.

Confidence in the validity of the plan quality principles has grown as there is an expanding literature that examines the effect of plan quality principles on the degree of success in plan implementation. While some principles have a greater effect than others (Brody et al. 2006; Deyle et al. 2008), there is an emerging trend showing that plan quality is influential across the range of principles. At the local level, studies have found that plan quality is a powerful driver on local government adoption of land use and building code regulations that reduce damage from an earthquake (Nelson and French 2002), integration of stormwater mitigation techniques in development permits (Berke et al. 2006), adoption of mitigation tools through increased commitment of local planners (Dalton and Burby 1994), and the strength of landscape protection provisions of zoning ordinances (Norton 2008). Less attention is directed at state plan quality effects on local plans and implementation, but the limited research on state planning indicates that state plan goals, policies, and implementation efforts have a significant influence on local plan quality and actions (Burby and May 1997; Deyle and Smith 1998).

Disaster Mitigation Act and the Role of States

Congress passed the DMA in 2000 in response to rising disaster losses in the United States, a desire to more effectively and efficiently distribute federal mitigation funds, a growing network of hazard scholars emphasizing the importance of improved risk-reduction measures, and questions regarding the efficacy of existing hazard mitigation programs (Mileti 1999; Godschalk et al. 1999, 2009; Burby et al. 1999; Birkland 2006; Smith 2008). The DMA represents a more proactive approach than the federal legislation predating the DMA, known as the Stafford Act. The primary difference in the two pieces of federal legislation is the increased emphasis on the importance of preevent planning at the state and local levels. While the Stafford Act required state "409 hazard mitigation plans," such plans were not evaluated on a regular basis by the Federal Emergency Management Agency (FEMA) plan quality was not tied to the receipt of postdisaster federal mitigation funds (Godschalk et al. 1999).

The DMA can be characterized as a reflexive law that emphasizes collaborative solutions and devolution of power from the

federal government to state and local governments (Mazmanian and Kraft 1999; Nolon 2009). The intent is to build lower level capacity (funding, training, technical assistance, databases) to develop and achieve performance-based solutions. Reflexive laws establish intergovernmental partnerships that encourage the engagement of stakeholders affected by the outcomes of proposed solutions, ensure connectivity and communication, and enhance the resiliency of networks capable of adapting to change. In contrast, formal regulatory mandates require higher-level governments to create and impose standards on lower-level governments.

Using the reflexive-law approach, the DMA provides a framework for federal, state, and local cooperation that is a model for a more comprehensive and integrated approach to hazard mitigation (Nolon 2009). State and local governments are encouraged to undertake a collaborative process to develop hazard mitigation plans, and once plans are approved by FEMA—the lead federal agency charged with implementation of DMA—they become eligible for pre- and postdisaster funding for mitigation, such as appropriations under the Pre-Disaster Mitigation program and the Hazard Mitigation Grant Program (FEMA 2004). States are to coordinate activities related to risk assessment, identification and implementation of mitigation strategies, and monitoring and evaluation of mitigation performance by supporting the development of local mitigation plans and providing technical assistance to local governments.

Thus, state plans are the linchpin for successful mitigation and long-term disaster resiliency under DMA. Their function is to establish comprehensive regimes for building cooperation among state agencies and between state and local government planning and regulation. Evaluation of the quality of state mitigation plans reveals whether they offer a strong foundation for proactive policy guidance to prevent or lessen loss and build resiliency.

Data and Methods

Sample Selection and Data Collection

The sampling unit of the present study is the state hazard mitigation plan. The sample is based on the 30 coastal states, including the Great Lakes states. The focus is on coastal states because they represent diverse geographic locations and have wide variation in population growth and development rates. Moreover, mitigation may be an especially important planning issue for coastal states because coastal areas are especially prone to hazards and tend to experience higher growth rates than the rest of the country [Beatley et al. 2002; National Oceanic and Atmospheric Administration (NOAA) 2004].

State hazard mitigation plans were collected primarily by downloading them from official state websites, typically the emergency management agency or planning department website. However, a number of states did not make their plans available online or had out-of-date plans posted online. These plans were obtained by submitting e-mail, phone, and mail requests to the state hazard mitigation officer or other mitigation planning staff. All 30 state hazard mitigation plans were obtained (Table 1). Each of the plans was an updated State Hazard Mitigation Plan and compliant with the DMA 2000. Two of the plans were adopted in 2006, 17 in 2007, and 11 in 2008.

Coding Instrument

A coding instrument was developed based on a derivation of coding items to serve as the recording unit for the study's data. The items were selected to assess how well each of the six plan quality principles was accounted for in a plan. The principles,

corollary indexes, and items are illustrated in the appendix, and the coding protocol is available online [Institute for the Environment (2011)]. Multiple rounds of testing the coding instrument were conducted following standard code development procedures (Krippendorff 2004). Each item was measured on one of two scales, a 0 to 1 binary scale or a 0 to 2 ordinal scale. For the binary items, 0 denoted that the item in question was not included and 1 denoted that the item was present. For the ordinal items, 0 denoted that the item was not included, 1 denoted that there was a general, brief description related to the item, and 2 denoted a clear and detailed narrative description, with lists, table, figures, and maps where applicable. The items were developed to measure the principles of plan quality and adapted to correspond with the FEMA plan development guidelines that assist states in development of state mitigation plans (FEMA 2004). Table 2 indicates how the sections in the FEMA planning guidelines correspond to the plan quality principles used in this study.

There are differences in the literature on the use of scales in plan coding. For example, this study uses a binary scale for goals that is consistent with the use of this scale by almost all previous studies that examined plans based on this principle (Berke and Godschalk 2009) with the exception of the Tang et al. (2008) study, which coded goals (and all other items for all principles) using an ordinal scale. The fundamental rationale for assignment of scales in the present study is based on coder interpretations of plan documents. Some analysts desire scale equivalency for all items because it eases comparison across items and does not require weighting of scales, which requires an assumption that weighting achieves equivalence. The present authors contend that scale equivalence could lead to a forced requirement for either binary or ordinal scales for all items that may not meaningfully capture the data. On the one hand, use of only binary scales is not necessarily meaningful if coders are able to make fine-grained distinctions through the use of an ordinal scale. This would significantly reduce the amount of information in the data when there are items that could be reliably coded based on ordinal scales. On the other hand, the present authors' counterargument against the use of only an ordinal scale is that for some items coders may be more prone to guess which category an item should be placed in because the distinctions among the categories are not always clear.

Content Analysis Procedures

To increase reliability in evaluation scores, each of the 30 state hazard mitigation plans was content analyzed by two of four coders on the coding team who independently coded each plan. Rules were developed by the coding team to ensure that all coders interpreted the items as consistently as possible. Coder pairings were systematically varied to ensure that each coder double-coded with each of the other three coders on multiple plans. This tactic minimized the potential for intercoder dynamics, which could have reduced reliability. An example of coder dynamics is the deference of one coder to another during the reconciliation process whereby the coders reviewed each difference in measurement and rechecked the plan document to determine which code was accurate. Overall percentage agreement scores reported in the plan quality literature ranged between 70 and 97% (Berke and Godschalk 2008). The present study's overall score of 73%, calculated from the double-coded data before the reconciliation process, falls within this range of acceptable scores.

Computation of Plan Quality Scores

Index scores for each of the four internal principles and two external principles were computed for each plan (see appendix). Consistent with previous plan quality evaluation studies, an index

Table 1. State Mitigation Plans Included in This Study

State	Plan title	Date
Alabama	State hazard mitigation plan update	September 2007
Alaska	Alaska: all-hazard risk mitigation plan	October 2007
California	State of California multi-hazard mitigation plan	2007
Connecticut	Natural hazards mitigation plan: for 2007–2010	December 2007
Delaware	State of Delaware hazard mitigation plan	June 2007
Florida	State of Florida hazard mitigation plan	August 2007
Georgia	2008 Georgia hazard mitigation strategy	March 2008
Hawaii	State of Hawai'i multi-hazard mitigation plan: update 2007	2007
Illinois	2007 Illinois natural hazard mitigation plan	October 2007
Indiana	State of Indiana standard hazard mitigation plan	April 2008
Louisiana	State of Louisiana hazard mitigation plan Update	April 2008
Maine	State of Maine hazard mitigation plan	October 2007
Maryland	State of Maryland	August 2008
Massachusetts	Commonwealth of Massachusetts state hazard mitigation plan	2007
Michigan	Michigan hazard mitigation plan	March 2008
Minnesota	Minnesota state all-hazard mitigation plan	2008
Mississippi	State of Mississippi standard mitigation plan	August 2007
New Hampshire	State of New Hampshire natural hazard mitigation plan 2007	2007
New Jersey	State of New Jersey 2007 state hazard mitigation plan	2007
New York	New York state multi-hazard mitigation plan	2008
North Carolina	State of North Carolina natural hazard mitigation plan	October 2007
Ohio	State of Ohio hazard mitigation plan	May 2008
Oregon	Oregon's enhanced state natural hazard mitigation plan	2006
Pennsylvania	Commonwealth of Pennsylvania enhanced all-hazard mitigation plan	October 2007
Rhode Island	Rhode Island state hazard mitigation plan	March 2008
South Carolina	South Carolina hazard mitigation plan	October 2007
Texas	State of Texas mitigation plan	October 2007
Virginia	Standard and enhanced hazard mitigation plan	November 2006
Washington	Washington State Enhanced hazard mitigation plan	November 2007
Wisconsin	State of Wisconsin hazard mitigation plan	December 2008

Table 2. FEMA Hazard Mitigation Plan Sections and Conceptual Plan Quality Principles

FEMA sections and requirements (FEMA 2004)	Corresponding plan quality principles
1. Planning Process	Principle 6 (Participation)
Documents planning process, coordination among agencies, and program integration	
2. Risk Assessment	Principle 2 (Fact Base)
Identifies and profiles hazards, assesses vulnerability, and estimates potential losses	
3. Mitigation strategy	Principle 1 (Goals)
Identifies goals; state and local policies, programs, and capabilities; mitigation actions; and funding sources	Principle 2 (Fact Base)
	Principle 3 (Policies)
	Principle 4 (Implementation and Monitoring)
4. Coordination of Local Mitigation Planning	Principle 5 (Interorganizational Coordination)
Identifies local funding, technical assistance, and plan integration and prioritizes local assistance	
5. Plan Maintenance Process	Principle 4 (Implementation and Monitoring)
Monitoring, evaluating, and updating the plan and monitoring the progress of mitigation actions	

score was computed by summing the scores for each of the items and then dividing the sum by the total number of items combined (Berke and Godschalk 2009). Each of the items measured on a 0–1 scale was doubled to a 0–2 scale before adding the item scores into component scores. This process resulted in equal weighting of binary and ordinal items rather than a double weighting for

the ordinal items. Next, index scores were standardized so that those with a larger number of items did not automatically generate higher values. The standardization divides the sum of scores for all items by the number of items in the index. This procedure puts each index on a scale of 0 to 2, which allows for comparison of indices containing different numbers of items.

Findings on the Quality of State Hazard Mitigation Plans

First, overall mean scores of plan quality are presented as an indicator of states' commitment to hazard mitigation. Then mean scores, standard deviations, and the range from lowest to highest scores are presented for each of the internal and external principles of plan quality. Next, the spatial distribution of the plan quality scores is presented on maps to permit comparison of state plans, followed by an assessment of how well plans account for hazards linked to climate change.

Overall Plan Quality Scores

Plans offer limited direction to guide short-term decisions to achieve long-term mitigation. For each of the four internal plan quality principles the overall mean score ranged from only 0.97 for goals to 0.60 for policies out of a maximum score of 2 (Table 3), indicating that none of the internal principles received more than half the maximum. Plans will also likely have limited influence on hazard mitigation outcomes. For the two external plan quality principles the overall mean score was only 0.87 for interorganizational coordination and 0.65 for participation out of a maximum score of 2 (Table 4), which indicates that none of the external principles received more than half the maximum. The findings showed that, overall states do not have well-organized, technically sound, and thoroughly prepared plans that reflect a strong commitment to mitigation.

Internal Principles of Plan Quality Scores

As noted, the goals principle had the highest overall mean score among internal principles, but there was considerable variation in the extent to which plans included various types of goals (Table 3). Three indexes are reported under the goals principle. Plans most strongly focused on goals addressed the reduction of hazard loss, including, for example, protecting life and property, minimizing economic impacts, and reducing inequities of impacts on socially vulnerable population groups (mean = 1.21 on a 0–2 scale). Plans only moderately focused on interorganizational coordination (mean = 1.10) scored very low on advancing a broader vision tied to resiliency and sustainability (mean = 0.23). These findings indicate that goals of state plans concentrate most on interorganizational coordination to understand, seek, and implement mitigation solutions aimed at reducing various types of losses. Under a broader view, mitigation is not just about reducing loss but also about achieving gains such as enhancing the resiliency of human communities to resist, absorb, and bounce back from impacts of natural hazards (Peacock et al. 2008). This would require promoting economic development, protecting the life support functions of natural systems upon which human communities depend, and reducing poverty.

The fact base principle scored moderately low (overall mean = 0.90). Among the five indexes included in the fact base, the quality of hazard assessment (e.g., location, magnitude, likelihood of occurrence of each hazard) received the highest score (mean = 1.44), followed by moderate scores for vulnerability assessments that identify the number of exposed people and property

Table 3. Internal Plan Quality Principles and Indexes

Principles	Indexes	Mean	Standard deviation	Range	Number of items
Goals	Hazards loss	1.21	0.66	0–2.00	5
	State and local coordination	1.10	0.84	0–2.00	2
	Overarching vision	0.23	0.50	0–2.00	2
	Overall mean	0.97	0.33	0.44–1.56	9
Fact base	Quality of hazard assessment	1.44	0.36	0.80–2.00	5
	Hazards addressed and their prioritization	0.73	0.64	0–1.75	8
	Vulnerability assessment	1.17	0.38	0.56–2.00	9
	Risk assessment	1.05	0.63	0–2.00	2
	Capability assessment	0.79	0.30	0.36–1.58	36
	Overall mean	0.90	0.28	0.50–1.70	60
Mitigation policies	Promotion of awareness/knowledge	1.04	0.41	0.38–2.00	8
	Development regulations	0.60	0.54	0–1.60	5
	Development incentives	0.22	0.39	0–1.00	2
	Acquisition	1.17	0.87	0–2.00	1
	Structural controls	0.46	0.57	0–2.00	3
	Protection of infrastructure	0.58	0.50	0–1.50	4
	Recovery measures	0.11	0.20	0–0.80	5
	Financial assistance	0.52	0.40	0–1.20	5
	Overall mean	0.60	0.31	0.15–0.133	33
Implementation and monitoring	Evaluation and update	0.80	0.34	0.33–1.50	6
	Monitoring implementation	0.85	0.35	0.25–1.75	8
	Implementation support	0.90	0.36	0.40–1.60	5
	Overall mean	0.85	0.29	0.32–1.53	19

Table 4. External Plan Quality Principles and Indexes

Principles	Indexes	Mean	Standard deviation	Range	Number of items
Interorganizational coordination	State review of local plans	0.47	0.43	0–1.33	3
	State priorities for assisting local governments	1.73	0.45	1.00–2.00	1
	State provision of support for local governments	0.93	0.52	0.20–2.00	5
	Overall mean	0.87	0.38	0.33–1.67	9
Participation	Process of developing and updating plan	1.33	0.96	0–2.00	1
	Organizational involvement	0.64	0.37	0.20–1.40	5
	Public engagement	0.53	0.58	0–2.00	5
	Overall mean	0.65	0.34	0.09–1.18	11

(mean = 1.17) and risk estimates that integrate the probabilities of occurrences of hazard events with vulnerabilities to approximate loss (mean = 1.05). However, systematic prioritization of hazards based on the level of risk from each hazard only received a moderately low score (mean = 0.73). Insufficient data on hazard priorities reduce the capability to shape mitigation policy and use funding to maximize reduction of risk. Finally, the assessment of states' capability to manage mitigation efforts based on policies, laws, and funding received a moderately low score (mean = 0.79). Thus, knowledge about existing management strengths and areas in which the state needs to strengthen its capabilities is generally incomplete in state plans.

For mitigation policies it was reasoned that since mitigation of the multiple impacts of natural hazards is a complex problem, no single policy tool effectively mitigates the multiple impacts. Rather, the greater the number of tools and the clearer the explanation of how they apply to mitigation, the more complete and effective the mitigation policy. The overall score for mitigation policies was low (overall mean = 0.60). This finding is troublesome since a weak set of policies means that a state is less likely to exert control over its planning agenda and ensure that long-range statewide interests supersede short-range local interests, and that plans will not provide a clear, relevant basis for implementing and monitoring a state plan.

While the policies of plans scored low, there is considerable variation across policy types. Acquisition of structures and land in hazardous locations received the highest score (mean = 1.17) largely due to financial support provided by federal programs for floodplain buyouts. The two primary programs that offer federal funds for buyouts of structures in flood-prone areas are the Pre-Disaster Mitigation program and Hazard Mitigation Grant Program (FEMA 2004). The next highest scoring policy is promotion of awareness and knowledge (mean = 1.04), which is low cost and requires little political commitment. A low scoring group of policies involves more significant commitment and intervention, including land development regulations aimed at controlling the type, design, and arrangement of land uses in hazardous areas (mean = 0.60), adjusting the location and design of public infrastructure (mean = 0.58), financial assistance for mitigation projects (mean = 0.52), and structural controls (e.g., levees and seawalls) to lessen the effects of hazardous forces (mean = 0.46). Market incentives (e.g., tax abatements, reduced impact fees, density bonuses) aimed at encouraging private investment away from hazardous locations received a very low score (mean = 0.22). Researchers emphasize the importance of integrating mitigation with disaster recovery (Smith 2010), but this policy received the lowest score among all policies (mean = 0.11).

The overall mean score for the implementation and monitoring principle is moderately low (overall mean = 0.85). If plans score

high on policies, for example, but low on implementation and monitoring, then plans may become paper documents that are not carried out and lack regular evaluation and updating to improve their performance. There is limited variation in mean scores across the three index scores that include evaluating and updating the plan (mean = 0.80), monitoring implementation (mean = 0.85), and implementation support involving identification of sources of funds, staffing, and mediation expertise to enable implementation (mean = 0.90).

External Principles of Plan Quality Scores

Table 4 indicates that under the external plan quality principles the interorganization coordination principle received a subpar score (overall mean = 0.87). Variation among the three types of activities under interorganization coordination is considerable. Descriptions of criteria for prioritizing assistance to communities for project grants were clear and detailed as reflected by the high score (mean = 1.73). A second set of coordination activities involving provisions of support for local plan development received a moderately low score (mean = 0.93). While descriptions of the types of local support were included in most plans, the level of detail varied by type of assistance. Technical assistance and grants associated with federal funds were described in detail, but plans only included vague explanations about guidance, best practices, and training programs to help local governments conduct analyses, select strategies, and design public engagement programs. Thus state plans often missed the opportunity to serve as a single-stop reference for local officials who often desire identification of types, sources, and steps toward obtaining plan-making assistance. Finally, state review of local plans received a low score (mean = 0.47). Plans generally did not provide a clear and detailed description of review criteria wherein results of a systematic assessment of local plans could be used to improve local plan quality. Instead, the review process described in the plans typically consisted of verbal statements indicating that a basic precheck of local plans would be conducted to avoid rejection by FEMA.

As noted, the overall score for the documentation of the participation process was somewhat low (mean = 0.65). Among the three indexes under the participation principle, the explanation of how each component of the plan was analyzed during the updating process scored highest (mean = 1.33). Plans that clearly identified how fact base, policies, and monitoring and implementation were updated demonstrated how mitigation planners were learning over time and adapting their plans. The second index, which aims to explain organizational involvement, received a low score (mean = 0.64). Plans often did not identify new organizations that became involved in the most recent update process or why organizations that were involved in prior planning were not

involved in the update. This finding raises concern that plan authors have not given a clear rationale for any changes in the organizations involved and their coordination with others. Finally, the range of techniques described in plans to engage the public received a low score (mean = 0.53). Typically, plans indicated that only one public participation technique was used or none at all. The most common techniques used were the posting of a draft copy of the plan to a website and soliciting comments and public notice of official meetings. Neither technique is proactive in reaching out to stakeholders, especially those disadvantaged groups (e.g., low-wealth, racial and ethnic minorities) often underrepresented in government decision-making processes.

In sum, our analysis of state mitigation plans reveals that their overall quality is moderate to low. While unsatisfactory, these findings suggest that plans show modest gains in improvement over the last decade. A study of 50 state mitigation plans revealed that entire sections that cover goals, fact base, policies, implementation, monitoring, and organizational coordination were absent in many plans (Godschalk et al. 1999, ch. 9). The present analysis indicates that all 30 coastal state plans covered each of these sections.

Comparison of State Plan Quality Scores

To permit comparison of plan quality scores for individual states, scores using standard deviations from the mean were classified and mapped. Because this study's primary focus is on the degree of the distribution, high and low plan qualities (*PQ*) are defined as those states with *PQ* scores greater than one standard deviation from the mean (high *PQ* = +1 SD; low *PQ* = -1SD).

The geographic patterns of scores are illustrated for internal plan quality principles in Figs. 1(a)–1(d) and external principles in Figs. 1(d) and 1(e). The distribution of scores across states is displayed for each principle. For example, for the fact base principle [Fig. 1(b)], three states (California, Florida, and North Carolina) have high scores, but four states (Indiana, Massachusetts, Pennsylvania, and Texas) have low scores. In another example, under interorganizational coordination with local planning [Fig. 1(f)], four states (Florida, North Carolina, Texas, and Wisconsin) scored high, whereas eight states (Alabama, Connecticut, Georgia, Hawaii, Maine, Massachusetts, New Jersey, and Pennsylvania) had low scores.

Although it is instructive to see the national pattern for each principle of plan quality, mapped scores provide insight about the strengths and weaknesses of individual plans. California has the strongest mitigation plan, with above average scores on all principles, while another three states (Delaware, Florida, and Wisconsin) have above average scores on all but one principle. Meanwhile three states (Connecticut, Georgia, and Maine) have below average scores on all principles. In some instances, states prepared strong plans for all principles but scored below average for one principle, which could prevent an otherwise strong plan from being implemented. For example, scores for Wisconsin are above average for all plan quality principles, except for a below average score for participation. Wisconsin's plan includes a sound set goals, fact base, mitigation strategy, implementation and monitoring program, and interorganizational coordination, but all this effort may not be fully realized given the low score for participation. Since engagement with the public, interest groups, and other state-level organizations with a stake in mitigation is critical to successful plan implementation, it could be that Wisconsin's otherwise strong plan may not be fully carried out.

Conclusions: Quality and State Hazard Mitigation Plans

The results of this study address two research questions. First, how well do state mitigation plans prepared under DMA achieve the principles of plan quality? The results indicate that states have moderate- to low-quality plans for all internal and external principles. Second, what are the comparative strengths and weaknesses of state plans across the plan quality principles? Only one state (California) had above average scores for each of the six plan quality principles, three states (Connecticut, Georgia, and Maine) had uniformly below average scores on all principles, and some states prepared strong plans but scored below average for one principle, which could jeopardize successful implementation.

This study's results are partially consistent with the only previous study on state hazard mitigation plan quality (Godschalk et al. 1999). In that study, pre-DMA state mitigation plan quality was shown to be generally low in the 1990s. Weaknesses were found in the fact base, goals, policies, and provisions for monitoring and implementation. The plan quality indexes were slightly different in this study, which precludes determination of differences in scores for each plan quality principle. However, as noted, entire sections for goals, fact base, policies, implementation and monitoring, and interorganizational coordination were often absent in the pre-DMA plans (Godschalk et al. 1999, but the present study's results indicate that all contemporary DMA plans addressed each of these plan quality principles.

There are several possible reasons for the range of plan quality scores across states. The disaster experiences of states vary widely. In some cases, states experience a number of smaller events, whereas in other states major disasters are more common. The degree to which these experiences lead to policy learning is instructive. Although many states scored low on policy principles, there were exceptions. For instance, several high-risk states learned from past events and modified their policies accordingly; Florida, North Carolina, and California established state-level planning initiatives prior to the passage of the DMA. In other situations, states may question the value of engaging in a lengthy preevent hazard mitigation planning exercise, particularly if clear benefits are not readily available, hence a possible reason for low public participation and interorganizational coordination scores.

Another reason for the range of plan quality scores across states is that state agencies responsible for emergency management (which is typically where the state hazard mitigation plan is housed) view the importance of hazard mitigation differently. In some cases, hazard mitigation is not seen as a primary mission of the agency, nor as important as a strong response capability. Not only can this lead to a weak state mitigation plan, but it may not be supported by the necessary state-level policies that span other agencies and departmental responsibilities, including economic development, coastal management, and environmental protection. Viewed from a broader external perspective, the legitimacy of state mitigation planning may suffer as other state agencies tend to view the work of emergency management agencies narrowly, failing to recognize the complementary nature of hazard mitigation activities, environmental preservation, water quality, sustainability, and, more recently, resiliency and climate change adaptation. This observation is also reflected in low fact base scores associated with the identification of a state's ability to manage hazard mitigation efforts using existing laws, programs, plans, and financial resources that go well beyond those administered by state emergency management agencies. Conversely, a hazard mitigation plan benefits from a strong, broad-based risk-reduction-policy milieu that includes the emergency management agency and the larger network of

state agencies, private-sector organizations, nonprofits, and others. California is emblematic of a state with a strong hazard mitigation policy framework, derived in part from a number of major earthquakes that triggered improvements in mitigation policy over time (Birkland 2006).

Variation in the strength of state plans may also stem from the presence of a hazard mitigation advocate or a network of actors that provide collective advocacy. Mitigation advocates provide technical, political, and collaborative leadership or a combination thereof.

Technical leadership may involve the development of a strong fact base that serves to undergird good policy. Political leadership may involve taking a strong position on the role of land use and hazards that may face strong opposition from those that stand to benefit from weak risk-reduction policies and development standards. Collaborative leadership involves the ability to garner support and build multi-faceted coalitions that support strong mitigation policies.

We maintain that FEMA standards for approving state mitigation plans may partially explain the low state plan quality scores.

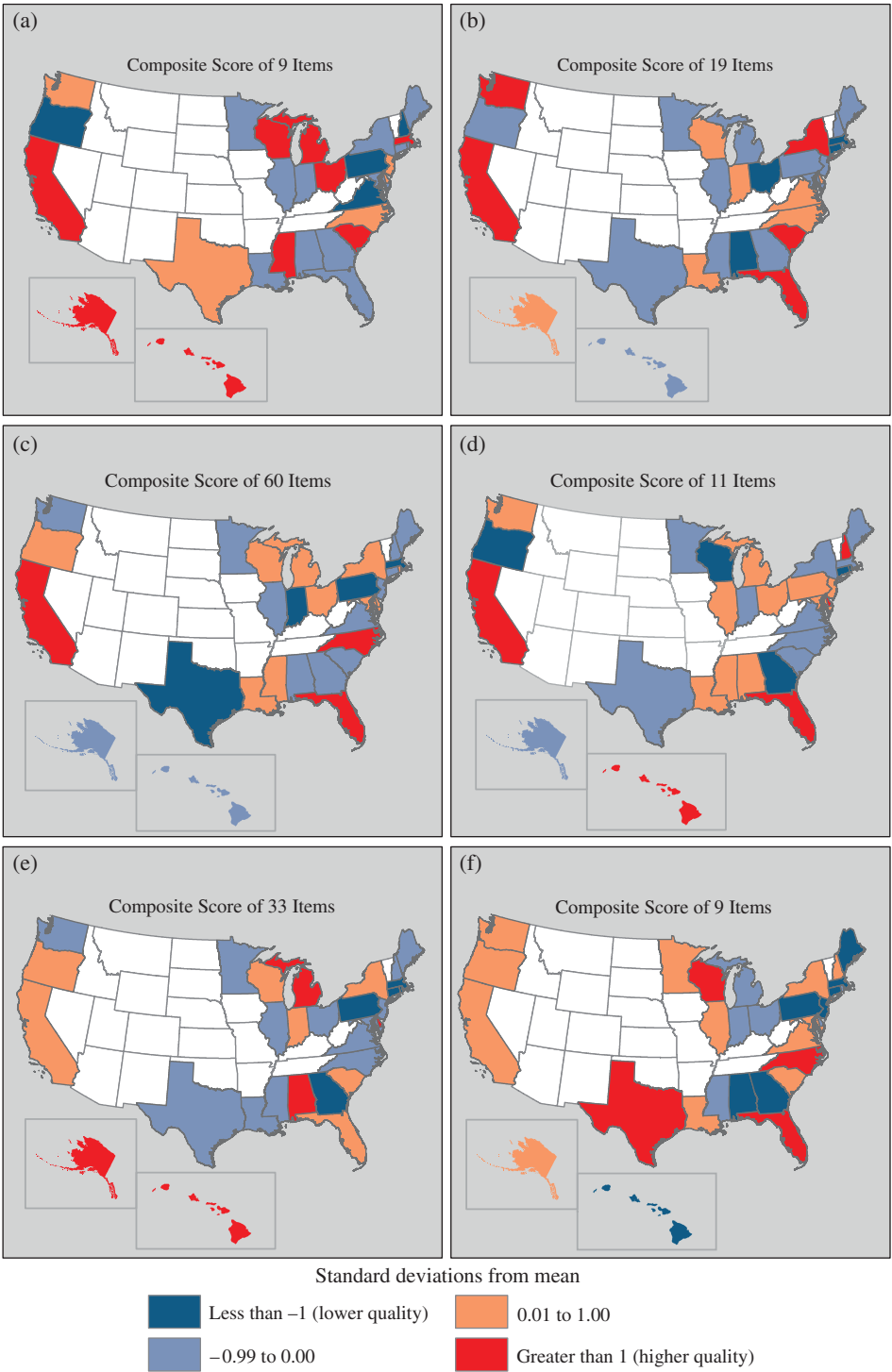


Fig. 1. (Color) Plan quality principle scores for states: (a) goals; (b) fact base; (c) mitigation policies; (d) implementation and monitoring; (e) participation; (f) interorganizational coordination

Current standards for plan quality are minimal. Under these standards, state (and local) governments gain approval of plans and become eligible for pre- and postdisaster mitigation funds. For example, eligibility to receive appropriations from the largest source of postdisaster federal assistance, the Public Assistance Program (used to fund debris removal and the repair of damaged infrastructure, often to those states vulnerable preevent conditions), requires an approved plan based on the minimal standards.

Implications for Policy and Future Research

This study provides a comprehensive set of plan quality principles (see appendix) that the authors recommend states use to guide the development of hazard mitigation plans. Application of the principles allows for empirical documentation of patterns of gaps in current plans, identification of specific weak points that could undermine the effectiveness of individual plans, and insights on how these plans can be improved. By understanding the areas in which these plans are deficient, states can be more effective in the establishment of a cooperative and proactive policy framework aimed at achieving disaster resiliency.

By following these principles, state hazard mitigation plans can be more effectively reviewed as part of FEMA's 3-year plan update cycle for state mitigation plans and following disasters. Applying the principles also allows for comparative analysis across states during the higher-level external review conducted by FEMA. The findings can provide FEMA with tangible measures to make targeted improvements in enabling administrative rules that guide plan making and federal legislation.

As with all research, there are questions left unanswered by this study. The prominent issue of whether plan quality scores help lead to successful implementation and better outcomes should be examined. Researchers and practitioners have long questioned the value of plans when the issues raised by plans are not acted on. Three basic questions will guide future research on state mitigation plan implementation: (1) How successfully are the hazard issues raised by state plans integrated into local jurisdiction mitigation plans? (2) Does the quality of state plans affect state agencies' commitment to hazard mitigation? (3) How influential are the local building practices used by state agencies, and what is the effect of these practices on bringing about local plans and actions focused on these issues?

In sum, the authors maintain that plan quality evaluation is emerging as a valuable tool for systematic analysis of plans. The concepts and methods presented in this paper offer an objective and straightforward approach to studying plan quality and guiding plan preparation. While implementation of plans is a critical next step for exploration, the issue of plan quality should come first. Without good plans, implementation could merely become an act of carrying out empty policy promises.

Appendix. List of Principles, Indexes, and Items for Plan Coding

1. Goals

a. Hazard Loss

- (1) Reduce damage to property*
- (2) Protect safety of population*
- (3) Reduce economic loss*
- (4) Reduce degradation of environment*
- (5) Reduce social inequities*

b. State and Local Coordination

- (1) Increase state and local coordination*
- (2) Increase availability of mitigation information*

c. Overarching Vision

- (1) Increase resilience*
- (2) Promote sustainable development*

2. Fact Base

a. Quality of Hazard Assessments

- (1) Location and boundaries of hazardous areas
- (2) Magnitude of potential hazard (e.g., intensity and duration)
- (3) Information on previous occurrences (hazard history)
- (4) Likelihood of occurrence of hazard event (e.g., annual probability)
- (5) Description/analysis of separate characteristics of the hazard

b. Hazards Addressed and Their Prioritization

- (1) Hazards are prioritized
- (2) Factors used in priorities are identified*
- (3) Factors used in prioritization (6 factors were evaluated) *

c. Vulnerability Assessment

- (1) Number of people exposed to hazard
- (2) Disadvantaged populations exposed to hazard
- (3) Property value exposed to hazards
- (4) Number of critical facilities exposed to hazards
- (5) Number of state facilities exposed to hazards
- (6) Number of severe repetitive loss properties
- (7) Danger from secondary hazards, such as dam breaking after an earthquake
- (8) Danger of hazardous facilities or hazardous materials in hazard areas
- (9) Environmental impacts of a disaster

d. Risk Assessment

- (1) Systematic risk assessment, combining probabilities of hazardous events with the likely expected losses from those events
- (2) Estimates expected losses across different hazard scenarios

e. Capability Assessment

- (1) Federal Capabilities (18 Programs, Policies, or Laws)
- (2) State Capabilities (8 Programs, Policies, or Laws)
- (3) Local Capabilities (8 Programs, Policies, or Laws)
- (4) Identifies policies and programs that increase hazard vulnerability
- (5) Identifies changes needed in policies and programs that increase hazard vulnerability *

3. Mitigation Policies

- a. Promotion of Awareness/Knowledge (8 policies)
- b. Development Regulations (5 policies)
- c. Development Incentives (2 policies)
- d. Acquisition (1 policy)
- e. Structural Controls (3 policies)
- f. Protection of Public Facilities and Infrastructure (4 policies)

- g. Recovery Measures (5 policies)
 - h. Financial Assistance (5 policies)
4. Implementation and Monitoring
- a. Evaluation and Update
 - (1) Identifies parties responsible for monitoring and evaluation
 - (2) Citizen participation in the monitoring, evaluating and update process
 - (3) Provision for monitoring of hazards
 - (4) Provision for updating baseline Hazard Identification/Risk Assessment data
 - (5) Schedule for updating Hazard Identification/Risk Assessment data
 - (6) Development of an ongoing information system, organization, and process for monitoring and evaluation
 - b. Monitoring Implementation
 - (1) Provision for monitoring of implementation progress
 - (2) Provision for evaluation of success/failure of measures
 - (3) Schedule for monitoring of hazards and implementation and evaluation of measures
 - (4) Implementing agencies specified
 - (5) Implementation costs of actions identified
 - (6) Assesses losses avoided following disasters
 - (7) Timetable identified for implementation
 - (8) Assessment of obstacles/problems in implementation of measures
 - c. Implementation Support
 - (1) Identifies current sources of funding
 - (2) Identifies current staffing sources
 - (3) Identifies current sources of technical assistance
 - (4) Mediation to resolve conflicts that arise during implementation
 - (5) State financial assistance beyond federal programs to agencies/governments responsible for implementation *
5. Inter-Organizational Coordination
- a. State Review of Local Plans
 - (1) Results of a systematic assessment of local hazard mitigation plans summarized in plan
 - (2) Identifies rewards, such as funding beyond receiving HMGP, PDM or FMA funding, for local governments based on plan review*
 - (3) Identifies consequences for local governments based on plan review*
 - b. State Priorities for Assisting Local Governments
 - (1) Provides a description of the criteria for prioritizing those communities and local jurisdictions that would receive planning and project grants under available mitigation funding programs
 - c. State Provision of Support for Local Governments
 - (1) Identifies current sources of technical assistance
 - (2) Identifies current sources of guides
 - (3) Identifies current sources of data and analysis
 - (4) Identifies current sources of training sessions
 - (5) Identifies current sources of grants or funding above and beyond HMGP, PDM and FMA

- 6. Participation
 - a. Process of Developing and Updating Plan
 - (1) Makes clear which sections were or were not revised as part of update*
 - b. Organizational Involvement
 - (1) Explains why the organizations and individuals identified in plan were involved
 - (2) Identifies organizations/individuals involved in plan update process not involved in plan development process
 - (3) Indicates how coordination has changed between original plan approval to updated plan development
 - (4) Identifies which agencies and organizations provide data incorporated in plan
 - (5) Identifies which agencies and organizations provide technical assistance in plan preparation
 - c. Public Engagement
 - (1) Process included public notice*
 - (2) Process included public meetings or workshops*
 - (3) Process included focus groups, surveys or questionnaires*
 - (4) Process included website*
 - (5) Process included newsletter and brochures*

Items marked with an asterisk are coded using a 0-1 binary scale. All other items are coded using a 0-2 ordinal scale. The plan quality protocol is available from <http://www.ie.unc.edu/cscd/projects/dma.cfm>.

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