

Using Causal Maps to Analyze Policy Complexity and Intergovernmental Coordination: An empirical study of floodplain management recommendations

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Abstract

This paper presents the findings of an empirical study on floodplain management recommendations identified in Sharing the Challenge (STC) and the Response to Senator Boxer Report. Causal relationships for each recommendation argument in STC were coded to produce 97 causal loop diagrams. The relationships in these causal loop diagrams were used as the unit of observation for an analysis on the relationship between outcomes and floodplain management issues, solutions, and government institutions. In addition, the causal maps were used to analyze the impact of intergovernmental relationships on recommendation outcomes. This paper presents a multi-method approach for the analysis of policy recommendations in complex systems. In terms of methodology, the paper presents a new approach for conducting content analysis that compliments existing qualitative methods. The findings in this study revealed several layers of complexity in this policy domain: (1) federal “top-down” approaches to floodplain management have not made progress; (2) recommendations to increase knowledge and research on flood problems have been successful; (3) floodplain recommendations with environmental implications have made no progress; and (4) intergovernmental coordination does not hinder successful solutions - sharing the challenge is challenging but not impossible.

Key words: qualitative system dynamics, content analysis, coordination, flood risk, multi-method

1. Introduction

The Midwest Flood of 1993, which resulted in 21 billion dollars of damage (NOAA <http://www.ncdc.noaa.gov/oa/reports/billionz.html>), created a potential focusing event for policy change. In January 1994, the Administration Floodplain Management Task Force asked the Interagency Floodplain Management Review Committee “to delineate the major causes and consequences of the 1993 Midwest flooding; to evaluate the performance of existing floodplain management and related watershed management programs.” The Review committee was also asked to make recommendations on changes in current policies, programs, and activities of the federal government to “achieve risk reduction, economic efficiency, and environmental enhancement in the floodplain and related watersheds.” The final report, Sharing the Challenge, was completed by the Floodplain Management Review Committee in June of 1994 (Sharing the Challenge, 1994). The report contained 97 recommendations discussed in eight themes that were designed to improve many aspects of floodplain management in the United States.

The Midwest Flood of 2008 was a potential focusing event with damages in excess of 15 billion dollars (NOAA <http://www.ncdc.noaa.gov/oa/reports/billionz.html>). This event showed that despite efforts to mitigate damages, the country is still vulnerable to flooding. Many areas affected in the 2008 flood had experienced flood damages in the Great Flood of 1993. The Midwest Floods of 2008

sparked Senator Boxer to ask the Army Corps of Engineers to analyze the status of those 97 recommendations in Sharing the Challenge. The Army Corps of Engineers’ Institute for Water Resources took the lead on this task and delivered a status report to Congress in April 2009.

The research presented here used a public administration and policy lens to answer an underlying question that was the impetus for Senator Boxer’s request. *Which characteristics of a recommendation make it more or less likely to be adopted?* This paper presents the empirical findings of research conducted to identify the association between stakeholder interests, issues and solutions and the adoption and implementation of floodplain management recommendations in Sharing the Challenge. The findings in this paper show levels of complexity and interconnectedness in decisions which impact floodplain management outcomes. In particular, this research highlights complexity with respect to the intergovernmental coordination needed to successfully implement flood plain and flood risk management recommendations.

2. Summary of Sharing the Challenge and the Response to Senator Boxer

The Response to Senator Boxer Report divided Sharing the Challenge’s 97 recommendations into three categories: no progress, partial progress, and substantial progress. While there were no exact criteria provided in the report, the category names have an intuitive meaning. 11 recommendations have made substantial progress. 65 recommendations have made partial progress. 20 recommendations have made no progress. One recommendation was identified as no longer relevant. As the recommendations are discussed in this report, there will be reference made to No Progress and Substantial Progress recommendations. Approximately 11% of the recommendations had made No Progress and 21% of the recommendations have made Substantial Progress.

Table 1: Sharing the Challenge / Response to Boxer Overview by Chapter

Chapter in Report to Senator Boxer	Sharing the Challenge								Total
	4	5	6	7	8	9	10	11	
N/A							1		1
No Progress		7		6	2		5		20
Partial Progress	2	12	12	3	12	10	4	10	65
Substantial Progress					3	2	1	5	11
Grand Total	2	19	12	9	17	12	11	15	97

The report flows from broad ranging and large scale floodplain management recommendations in the earlier chapters to more specific recommendations in the later chapters, with the later chapters having a little more success. In fact, none of the early chapters have made substantial progress. In contrast, several of the later chapters have made substantial progress. Depending on how one keeps score, certain chapters could be viewed as more successful than others. The least successful is chapters are chapter 7 Focusing on the Environment, chapter 5 Organizing floodplain management for success, and Ch 10 A New Approach for the Upper Miss. The most successful is Chapter 11 Using Science and Technology for Water Resource Information.

Table 2: Sharing the Challenge Summary of Chapters

Chapter	Recommendations with No Progress	Recommendations with Partial Progress	Recommendations with Substantial Progress
Ch 4: Vision for the floodplain	NONE	Replacing the 100-year flood with the “standard project flood” in the definition of vulnerability for cities and critical infrastructure	NONE
Ch 5: Organizing floodplain management for success	Federal level: enacting a national floodplain management act to define the roles; Water Resource Council; phase out federal leases in floodplain; OMB vulnerability study; coordination of cost sharing methods; coordination with other federal agencies	Federal level: executive order to reaffirm federal role, P&G update to reflect dual mission (reduce loss, environment), State and Local level: increasing state and local roles in floodplain management (includes a commitment to maintaining the cost-sharing) and making states and locals more accountable.	NONE
Ch 6: Avoiding Vulnerability Through Planning	NONE	Interagency watershed management; critical land acquisition; NFIP CRS system; flood mapping; education and outreach	NONE
Ch 7: Focusing on the Environment	Land acquisition; environmental protection; ecosystem management; procedural flexibility	Protecting local tax base; expanding fed, state, local cost sharing; spending on mitigation land same pace of projects	NONE
Ch 8: Minimizing Vulnerability of Existing Development	block grant mitigation grants	support for programs with mitigation incentives; levee safety issues	reaffirm pl 84-99; insurance for mitigation activities; repetitive loss program
Ch 9: Mitigating Flood Impacts Through Recovery and Insurance	NONE	changes to existing insurance program to make people more accountable for their pre-disaster decisions	waiting period for insurance; strategic planning on multi-agency recovery
Ch 10: A New Approach for the Upper Miss	Establish a basin commission; require USACE to coordinate all levee activities	reports on environment and ecological issues for upper miss; increase state accountability for land use and levee decisions	DOI ecological needs investigation for Upper Miss
Ch 11: Using Science and Technology for Water Resource Information	NONE	Multi-agency flood study; inter-gov flood study; interagency high energy study; review of disaster relief funding; review farm programs; bio tech engineering	USGS data clearinghouse; FEMA feasibility study for inventory of flood prone structures; flood forecasting; research on market penetration

Ch 4: Vision for the floodplain

The central focus of chapter four concerned the definition of a flood. The authors suggested replacing the 100-year flood with the standard project flood to analyses to reduce vulnerability of urban centers and critical infrastructure. These recommendations were determined to be a partial success in the Response to Boxer Report. Actions were taken in the spirit of the recommendation to protect critical infrastructure and cities – the standard project flood / 500 yr flood has been used but has not replaced the 100 yr flood.

Ch 5: Organizing floodplain management for success

Chapter 5 faced a few challenges. The chapter attempted to define federal, state and local floodplain management roles, but with limited success. In part, some of these recommendations were rather coercive, proposing new courses of action without reference to quantitative analyses of cost savings. None of these recommendations have made substantial progress. In fact, 36% of the recommendations have made no progress. The less effective recommendations dealt with federal issues. The partial progress recommendations dealt with state and local issues.

Ch 6: Avoiding Vulnerability Through Planning

All of the recommendations in chapter six have made partial progress. In part this chapter deals with intermediate steps. The chapter is filled with non-coercive policies that deal with mapping, educating, and programs that provide incentives and rewards, rather than sanctions for undesired behavior.

Ch 7: Focusing on the Environment

For the most part, recommendation arguments with any mention of the natural environment have made no progress. With that said, policies with partially progress focused on protecting local tax base, cost sharing, and spending on mitigation at the pace of projects. On the other hand, environmental protection, ecosystem management, land acquisition, and procedural flexibility have not made any progress.

Ch 8: Minimizing Vulnerability of Existing Development

By the time of the Sharing the Challenge study, the 1990s were becoming the “decade of disasters”, as the United Nations General Assembly had coined the phrase. Attempts to impact vulnerability of existing development were met with limited success. Block grants for mitigation have made no progress. There has been partial progress on support for programs with mitigation incentives; and levee safety issues. Substantial progress was made in several areas: reaffirming pl 84-99; providing insurance for mitigation activities; and a repetitive loss program (which took several years to implement)

Ch 9: Mitigating Flood Impacts Through Recovery and Insurance

The modern era of floodplain management has focused heavily on the National Flood Insurance Program. Insurance programs have been described by policy scholars as a non-coercive policy tool (Salamon et al 2002). Partial progress has been made on changes to the insurance program to makes individuals more accountable. Substantial progress has been made to increase the waiting period for insurance and improving strategic plans for multi-agency recovery.

Ch 10: A New Approach for the Upper Miss

Specific recommendations to correct problems in the Upper Mississippi River Basin appear in chapter ten, but 50% of those have made no progress. Federal oversight where states have power were relatively unsuccessful and the Upper Miss was not ready for the return of a federal water resources commission. No progress has been made to establish a basin commission or require USACE to coordinate all levee activities. Partial progress has been made on reports on

environment and ecological issues for upper miss and increasing state accountability for land use and levee decisions. Substantial progress was made on an ecological needs investigation for Upper Miss.

Ch 11: Using Science and Technology for Water Resource Information

Many of the recommendations in the final chapter of Sharing the Challenge have reached successful outcomes. Partial progress was made on several research and data improvement issues, such as: a multi-agency flood study; an interagency high energy study; a review of disaster relief funding; review farm programs; bio tech engineering. Data inventories were very successful, such as a USGS data clearinghouse, a FEMA feasibility study for and inventory of flood prone structures, and research on market penetration.

3. Method for Analyzing Recommendations with Causal Models

The codebook developed to identify causal loop diagrams for each of the 97 recommendations in Sharing the Challenge was presented by the author at the 2009 System Dynamics Conference in Albuquerque, NM. This paper shows a three part analysis, where those causal maps were used to: (1) identify important feedback themes in the causal arguments; (2) measure the association between issues in the arguments and levels of progress (i.e., outcomes); and (3) establish the context for a second layer of analysis between feedback themes, recommendation issues, and policy outcomes. The following steps were used to develop and analyze feedback loops from qualitative data (i.e., recommendation arguments) in the government report.

Part 1: Identify casual feedback themes

Step 1: Code the recommendations for causal arguments

Step 2: Name the feedback loops

Step 3: Organize feedback loops on emerging themes

Part 2: Analyze arguments for floodplain management issues

Step 4: Use casual links as the unit of observation to identify Issues, Solutions, and Government Interests

Step 5: Analyze the association between issues, solutions, and interests against levels of progress

Part 3: Analyzing outcomes in the context of Feedback Themes

Step 6: Measure the association between outcomes and issues, solutions, and interests (from part 2) within the context of important feedback themes (identified in part 1).

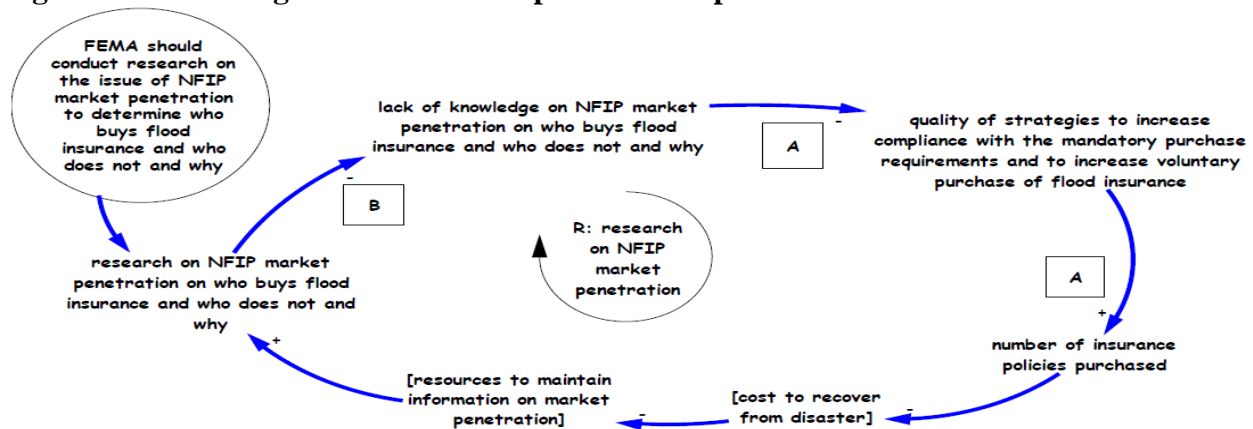
In the first part of the study, causal loop diagrams were identified from arguments made in Sharing the Challenge (**step 1**). On average, each argument contained approximately four causal relationships. The coding identified 396 causal relationships in arguments supporting 97 recommendations. It was assumed that task force recommendation arguments with more details and supporting evidence would also include the important issues and solutions. That is, a task force with limited resources would spend more of its time and effort explaining arguments to support important recommendations. However, it would not be wise to merely count the number words or paragraphs used in the argument. Quite often, recommendations begin with a discussion of background information that is unrelated or insignificant to the main argument. The important statements in an argument are the causal relationships. In essence, these statements are either assumptions about how the world should work or carefully constructed facts or “issue frames” as discussed in the public policy literature. Thus, to measure these essential components

of the argument (i.e., the causal statements) qualitative methods in system dynamics were explored for guidance (e.g., Luna and Andersen 2003; Kopainsky and Luna 2008; Kim 2008). In this study, causal loop diagrams were developed from supporting evidence in the recommendations as the primary data source (Deegan 2009). After the causal loop diagrams were defined, each feedback loop was identified (**step 2**) and feedback loops were organized on emerging themes (**step 3**). Figures 1 and 3 provide examples of the approach used in steps 2 and 3 respectively.

In the second part of the study, floodplain management issues, interests, and solutions were analyzed. Key words were established from the floodplain management literature for some of the more frequently cited issues, interests, and solutions in this policy domain. Issues, solutions, and interests were identified in the supporting argument for each causal link (**step 4**). Then, a chi-squared test was performed to identify areas where issues, solutions, and interests were more likely to have made “substantial progress” or “no progress” (**step 5**). Appendix A provides a table with a complete set of statistically significant variables in the study. The section which follows shows causal maps developed for some of the more interesting findings in the study.

In the third part of the study, the impacts of intergovernmental relationships on policy outcomes were analyzed against issues, solutions and interests identified in part two (**step 6**). An intergovernmental relationship was defined in a two step process. First, data were coded for the level(s) of government (local, state, federal) needed to implement the causal relationship identified in the argument. Second, an intergovernmental relationship existed if two or more levels of government were identified in the causal link. Finally, a threshold value was set to determine if enough of the argument contained intergovernmental relationships to be considered an intergovernmental recommendation. A threshold value to define an “intergovernmental relationship” was difficult to define in Sharing the Challenge. STC is a unique task force report where most (nearly all) of the recommendations include some mention of at least one intergovernmental relationships. For a document with broad appeal, it would seem reasonable to set the threshold at 50% of the causal links. A second threshold was set at 75% to address the larger recommendations in the study. Finding #4 reports the impact of intergovernmental relationships on policy implementation for each of the issues, interests, and solutions identified in the second part of study. This section continues with examples that further explain the coding process.

Figure 1: Naming Feedback Loops - Example for NFIP Market Penetration



Causal maps were constructed using text from supporting arguments in flood risk management recommendations. A process was developed to name the feedback loops in a way that makes it possible to organize feedback themes. An example of this process will be discussed using the causal loop diagram in figure 1 for reference.

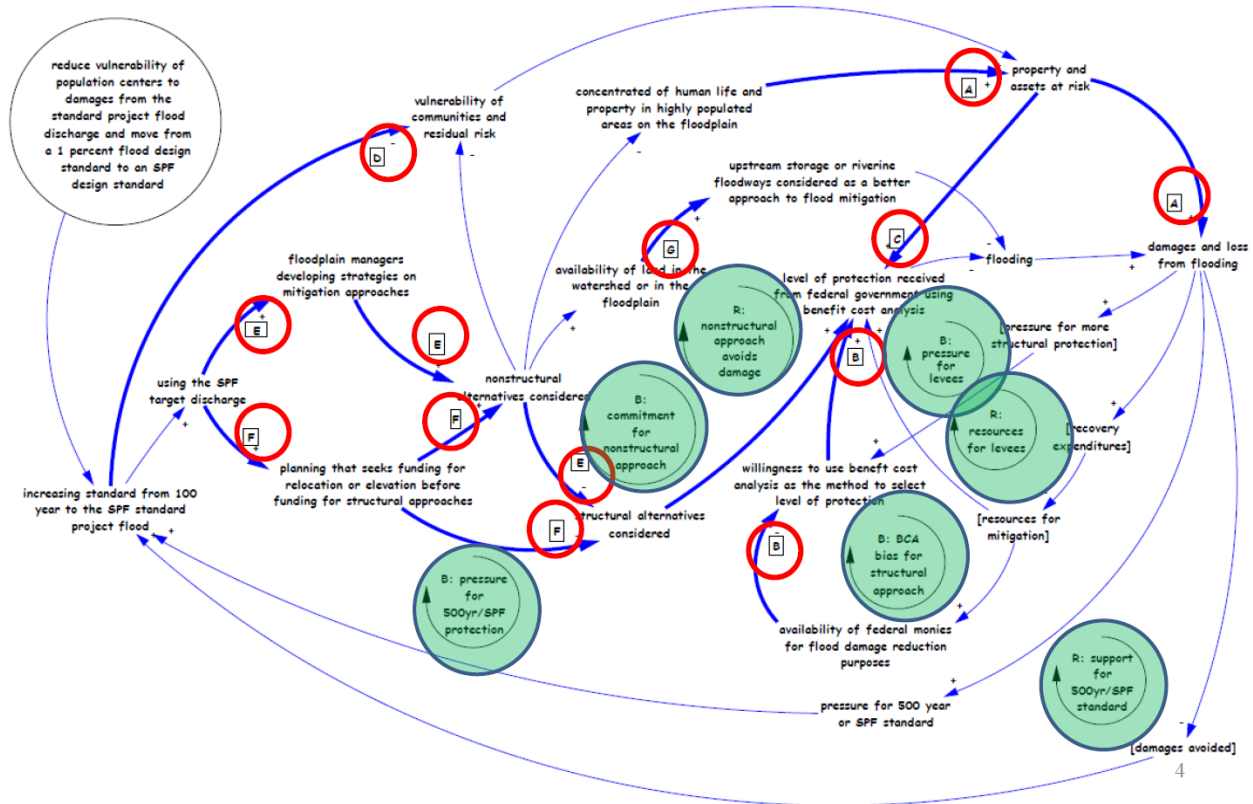
In terms of naming the feedback loop, there were a few basic rules to follow. If possible, each feedback loop was named with an “action” on a “variable” (preferably a stock). Figure 1 shows an example of the process used and the database snapshot in figure 3 illustrates how the names were organized. The loop name should imply some type of behavior on the variable and reflect what the loop would do when it is active. To provide a more intuitive meaning on the loop name it is also important to indicate whether the loop is reinforcing or balancing loop. In the figure 1 example, by showing this a reinforcing loop it implies when the loop is active as a virtuous cycle, research on NFIP market penetration will increase over time. Of course, if the loop were to become active as a vicious cycle, the knowledge gap would widen and create additional costs over time.

Whenever possible, direct quotes from the text were used as variables in the causal map. This guideline explains why many of the variable names in the map contain several words. While this may appear confusing on the surface, the additional text eliminates confusion, when the modeler is asked to justify support for the variable name. Minor changes were made to variable names to guarantee a quantity was clearly represented (with potential for reference mode behavior). The variables with circles around them are the specific recommendation statements. These were considered potential policy parameters – exogenous to the feedback loop.

In many cases, arguments did not discuss behavior over time nor did they explicitly close the feedback loop. In these cases, the modeler referred to the main objectives in the study, which were to reduce flood damages and lower costs associated with floodplain management. As the argument drew to a close, it was assumed some part of the argument would ultimately lead back to these main objectives. In addition, the modeler teased out assumptions in the document to show what would be needed for this policy to sustain the objective over time.

In the example above, the argument focuses on research for NFIP market penetration which will ultimately close the knowledge gap, improve the quality of strategies and increase the number of insurance policies purchased. The polarity for each of these statements has the letter “A” or “B” next to them to indicate direct quotes in the document for support. However, a judgment was then made to ask, “so what, why do we care?” In cases where the loop is not closed by the argument, the modeler refers back to the objectives in the report. It was then assumed that increased insurance market penetration would reduce costs associated with future disasters, which would free up resources for additional research on market penetration in the future. That is, the modeler uses the logic established in the document to close the feedback loop. In this case, the logic of the main objectives suggested, “if you implement these recommendations there will be fewer damages and lower costs associated with floodplain management.” These assumptions were used when arguments stopped short of a complete feedback description.

Figure 2: Complexity in Causal Arguments



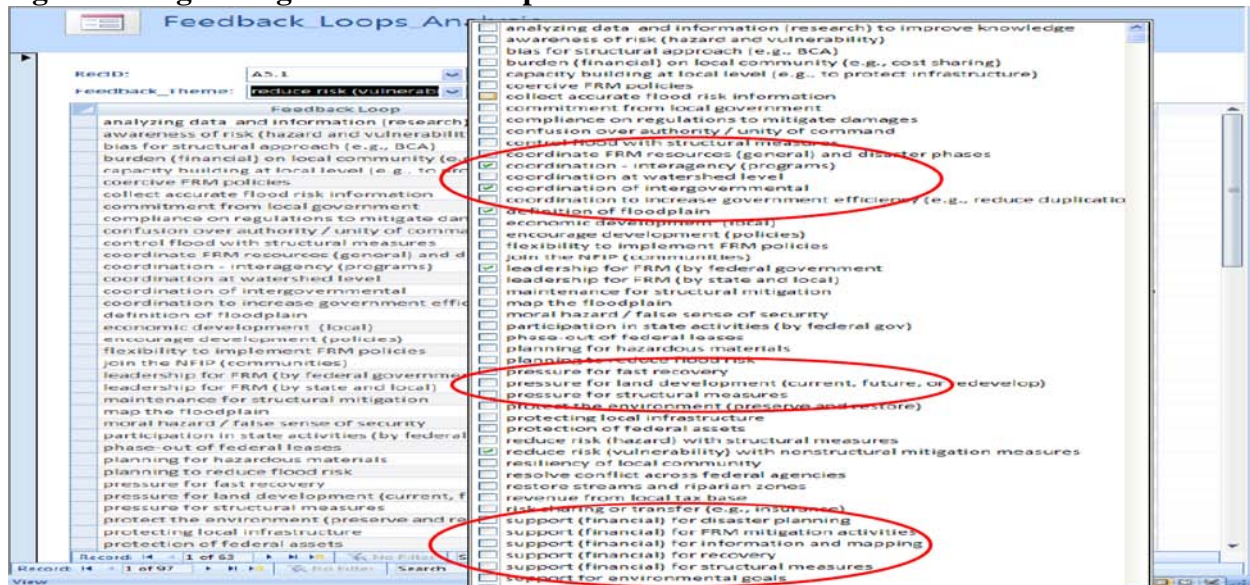
In this process, the modeler never introduces his/her own logic on the problem. The purpose is to model the argument of the source, taking the position that goals and objectives would be achieved if the recommendations are implemented. This becomes an important coding rule for modelers with knowledge of the subject area, since it can be difficult to refrain from inserting missing pieces to the argument that would derail the proposed outcome. With that said, variables should be added to close feedback loops only if they reveal assumptions about the argument. For example, this report assumed on several occasions that successful outcomes would provide future support for the policy. This sort of “success to the successful” thinking could be true, but reveals a challenge when the feedback loop is not active or working in the opposite direction. In either case, variables were added to the causal map to characterize this assumption via a closed feedback loop. One might argue this coding rule introduces some subjectivity in the coding, but it would be most inefficient (and perhaps ridiculous) for the source to repeat such statements in every supporting paragraph. The modeler must ask the following question. Over time, what assumptions must be made to sustain the outcome discussed in the recommendation? It will be up to the client and the system dynamics community to judge whether or not this question was addressed with the least amount of modeler subjectivity.

Figure 2 highlights a common challenge when arguments follow a complex set of logic. In *Sharing the Challenge*, some arguments contained a number of causal links. In fact, a few arguments stretched over several pages and were difficult to follow. In these cases, the challenge was discovering how (and where) pieces of the argument intersected. The recommendation

argument in figure 2 will not be discussed in great detail here. The purpose of the diagram is to provide the reader with visual for the level of complexity, in which the modeler must carefully decipher. As you can see by the letters circled in red, the causal logic did not build perfectly from statement to statement. The process was iterative. Causal loop diagrams were developed and redeveloped until the fewest number of variables were used while still maintaining the language of the text.

In this example, the recommendation calls for a redefinition of the floodplain from the 100 year flood to the standard project flood (which is approximately the 500 year flood). The argument suggested nonstructural mitigation techniques would be considered as often (if not more) under the new definition. There were seven major feedback loops identified in this causal map. It is important to note that one could probably identify several other feedback loops as they trace their way through the diagram. For the purpose of this study, counting feedback loops did not provide a metric for the analysis. The purpose here was to qualitatively identify feedback themes. Thus, the following rule was created for coding feedback loops. Loops were identified on titles with an intuitive meaning. You will notice the feedback loops here use words like commitment, pressure, and support. All of these words reflect the tone of the supporting statements in the argument for this recommendation.

Figure 3: Organizing the feedback loops



Recording feedback themes in the database involved another iterative process. The process begins by reviewing the first causal map. Each feedback loop is entered (and rewritten if necessary) to reflect the coding rules established in step 2. That is, each feedback loop contains an action followed by a variable (preferably a stock). This process continues for each subsequent causal map. Instead of entering a unique name for each feedback loop, the modeler observes the existing records (alphabetically sorted in the database) to use an existing feedback theme in the database, where applicable. If no feedback theme properly applies, a new theme is created. This process continued until feedback loops for all 97 causal maps were entered into the database. Keeping in mind that each causal map contained at least 1 feedback loop, this task took effort and patience.

The decision to organize by action first (and not variable/stock) was a practical one. Knowing that part two of the study would focus on specific issues and solutions, it made logical sense to focus on broad themes first and organize feedback themes based on general processes. In future versions of the database, the action and variable/stock will be two separate fields for easier sorting.

In this study, a few broad themes emerged from the data. After reorganizing the list, three broad areas became candidates for further investigation: different types of support, pressures and coordination process resonated through the document (see figure 3). Since this study was performed for U.S. Army Corps of Engineers, it seemed wise to confirm whether or not the preliminary themes from the first part of the study would be good candidates for follow-up in part three of study. That is, should coordination be a theme to compare issues/solutions/interests with outcomes?

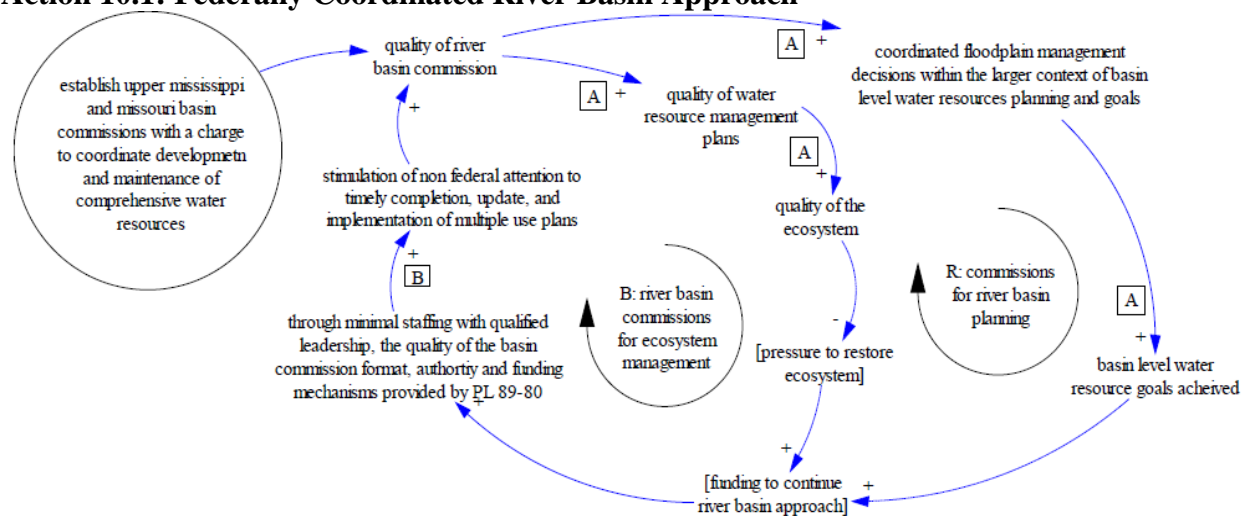
Upon further review, it appeared the coordination feedback theme was indeed a good choice. In the Response to Boxer report, 9 of the 30 Corps recommendations have made no progress. Over half of these recommendations (5 of 9) included a coordination theme. Knowing there are many types of coordination, the final part of this study focuses on intergovernmental coordination: coordination between federal, state and local governments. It is also worth noting that the coordination feedback theme did not appear alone in these recommendations (see figure 3). This study identified major themes separately, but future studies will explore feedback themes that appear in combination.

4. Findings and Results

Finding #1 Challenges for USACE: No Progress in recommendations with federal “top-down” approaches to floodplain management in the Upper Miss.

At first glance, the Corps’ success rate in the Response to Senator Boxer Report is very low. Nine of the 30 recommendations that mention USACE involvement have made no progress. Only three of those 30 recommendations have made substantial progress since 1994. Upon further inspection, a large percentage of recommendations with Corps involvement concern changes to floodplain management in the Upper Mississippi River Basin. Several of these recommendations placed the Corps in the role of coordinator for a federal basin commission to manage the Upper Miss. When chapter 10 is removed from the study, USACE performs much better. With this change, total recommendations reduce from 30 to 20, a 33% change. More importantly, the Corps is involved in only four no progress recommendations (instead of nine) when chapter 10 is removed from the analysis.

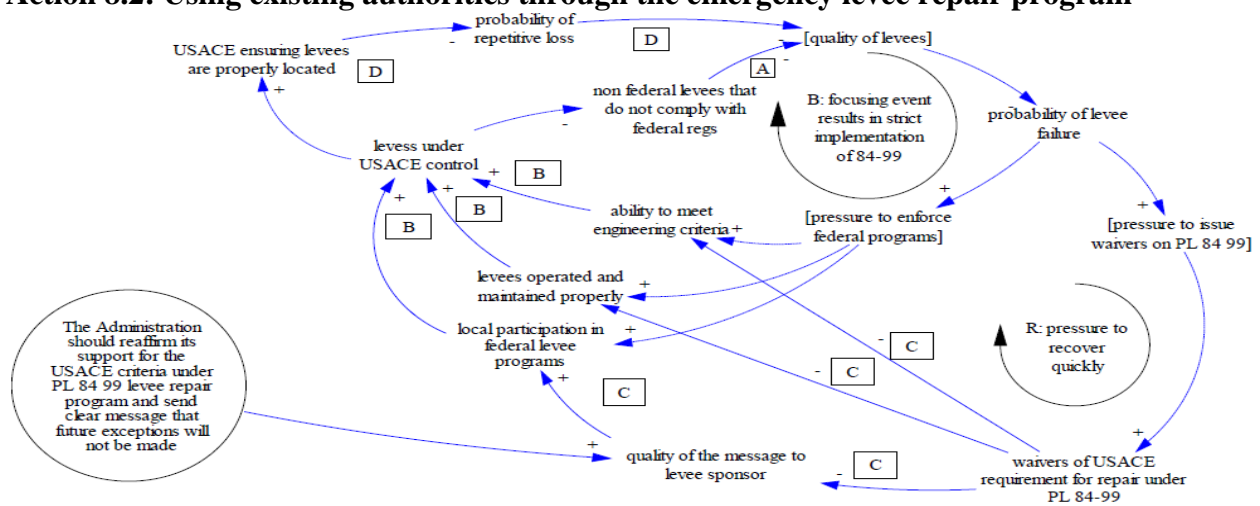
Action 10.1: Federally Coordinated River Basin Approach



Action 10.1 and 10.3 provide good examples of the nature of complexity in recommendations where Corps involvement struggles to produce outcomes. Action 10.1 in STC deals with establishing a federal river basin commission. “Establish upper Mississippi and Missouri basin commissions for comprehensive water resources management plans to include, among other purposes, ecosystem management, flood damage reduction, and navigation.” The Corps explains the lack of progress on this recommendation in the response to Boxer report, “the termination of the UMRBC and five other basin commissions by EO 12319 in 1981 complicated implementation of the [1978 Comprehensive Master Plan for Management of the Upper Mississippi River system (UMR&T)], which represented a successfully integrated federal-state-local planning effort with substantial public input. No subsequent commissions have been established (USACE, Jan 09).” Action 10.3 calls for the Corps to lead an Upper Miss systems plan. “Assign responsibility for development of an UMR&T system plan and for a major maintenance and rehabilitation program for federally related levees to an expanded Mississippi River Commission, operating under the USACE.” The Corps’ explanation why no progress has been made indicates while no system plan for floodplain management has been authorized, a plan for an assessment of the upper Miss River Basin has been submitted to the ASA and HQUSACE.

Establishing the Corps, or any federal entity, as an intergovernmental coordinator presents a few challenges. First, executive order 12319 clearly changed the direction of floodplain management in the country by eliminating seven federally coordinated river basin commissions under the authority of section 203(a) of the Water Resources Planning Act. The resulting shift in power from federal to state and local entities has made it difficult for federal agencies to promote a role as coordinator in floodplain management. In addition, the federal coordination of resources is complex and requires both horizontal and vertical collaboration between levels of government and agencies and organizations with floodplain management missions.

Action 8.2: Using existing authorities through the emergency levee repair program

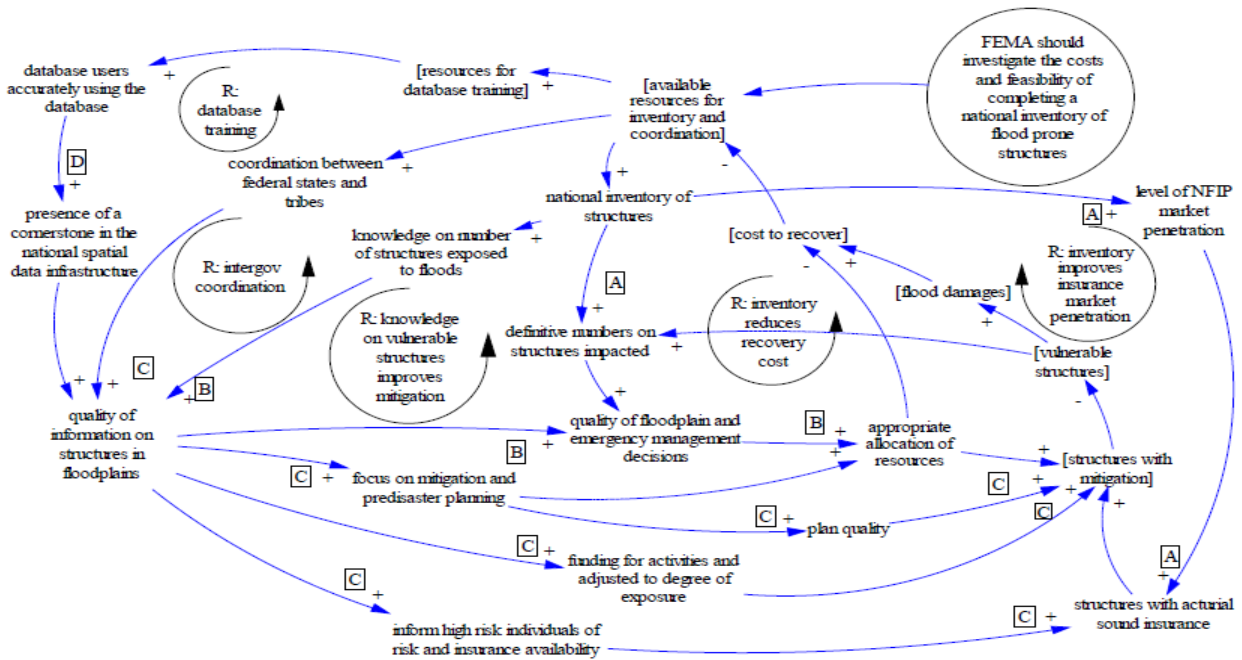


An example of a Corps success is found in Action 8.2, which focuses on the levee repair and rehabilitation program. “The Administration should reaffirm its support for the USACE criteria under the PL 84-99 levee repair program and send a clear message that future exceptions will not be made.” This recommendation places responsibility on non-federal groups to be accountable for their actions in the floodplain. The recommendation argument continues by suggesting federal funds only support those levees that are properly located. This action is probably success because it is less complex than other recommendations involving USACE involvement. The action builds on an existing authorities (i.e., levee repair authority under PL 84-99), instead of calling for new authorities or activities beyond the scope of the agencies’ current objectives. In addition, this action is a coordination role where the Corps’ has been asked to strengthen its existing relationships, instead of creating new relationships with non-federal partners. The lower level of complexity in this action is indicative of the types of recommendations that work in Sharing the Challenge.

Finding #2 Data/Research: Recommendations to learn about problems are successful

The most successful category of recommendations in Sharing the Challenge are those which call for a study or research to gather information or data to improve knowledge on an existing or emerging problem. Chapter 11 effectively uses this type of recommendation to support its objective for “using science and technology” to improve floodplain management. In terms of success rate, 31% of the recommendations that mention data issues, whether calling for research or closing knowledge gaps, were identified as having made substantial progress. Forty percent of the recommendations to develop or improve *models* have made substantial progress, while 0% were categorized as having made no progress.

Action 11.2: National inventory of flood prone structures



Three examples from chapter 11 illustrate the success of data issues in floodplain management recommendations. Action 11.2 states, “FEMA should investigate the costs and feasibility of completing a national inventory of flood prone structures.” Action 11.4 suggests, “The Hydrology Subcommittee of the Federal Interagency Advisory Committee on Water Data should review the current standards for computing discharge-frequency relationships in light of observations from the 1993 flood and other recent large floods in the upper Miss.

Recommendation 11.7 proposes, “FEMA should conduct research on the issue of NFIP market penetration to determine who buys flood insurance and who does not and why.”

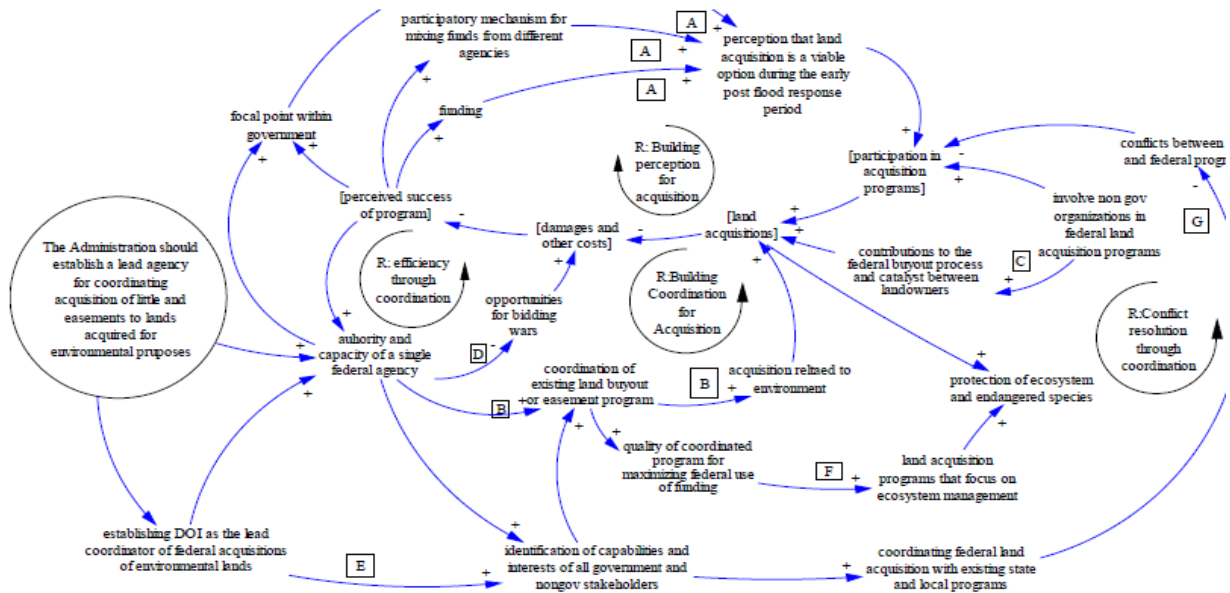
Research to build knowledge, data and information gathering activities, and model development are not complex activities. These objectives can be obtained without making changes to existing policy, and in most cases, existing resources can be temporarily reallocated to implement the activity. One could go as far to say recommendations to address these sorts of data issues are “cherry picking” recommendations for government entities. As long as the deliverable is qualitative and not performance based, data issue recommendations require very little effort to implement successfully. In terms of accountability, government agencies would be more likely to pursue research and model building activities, since these are intermediary steps in the policy making process. Research and model building activities provide evidence and support for policies, but they do not require final decisions, actions or policy changes which might be considered coercive or politically controversial.

Finding #3 Recommendations with attention to the environment have made no progress

The primary objective of floodplain management in the 1960s and 1970s focused on reducing flood losses. Over time, this focused was amended to include an objective to protect the country’s natural environment. The Floodplain Management Task Force produced three

floodplain management assessment reports between 1979 and 1992 to reflect this change. With that said, environmental issues were more likely to appear in recommendations that have made No Progress than any other theme in *Sharing the Challenge* (NP=35%)¹. Ecological issues also have very little success (NP=43%). In addition, natural resource issues in general have low success (NP=38%).

Action 7.1: Coordination on acquisitions for environmental purposes



Chapter seven provides examples of these unsuccessful themes. For example, action 7.1 recommends, “the Administration should establish a lead agency for coordinating acquisition of title and easements to lands acquired for environmental purposes.” Action 7.6² asks the federal government to, “require agencies to co-fund ecosystem management using Operation and Maintenance funds.” While action 7.5 is more specific, “the DOI should focus land acquisition efforts on river reaches and areas with significant habitat values or resource impacts.” All of these recommendations have made no progress since their publication in 1994.

There are a several possible explanations for the overwhelming unsatisfactory performance in recommendations that mention the natural environment. First, the environment is a tangential issue to floodplain management. While the tone of floodplain management recommendations changed in the 1980s, as reflected in the 1986 assessment report, the primary focus of floodplain management historically has been damage reduction. Second, progress measures are not tangible. To this day, many federal agencies, including the Corps, still wrestle with understanding how “benefits” of the natural environment can and should be quantified. Third, flooding and the environment are complex and not necessarily complimentary issues. The organizations and interests needed to implement flood and environmental policies both are not the same.

¹ The notation NP= and S= refer the % of recommendations in the Response to Boxer Report with No Progress and Substantial Progress respectively.

² Due to file size constraints on the proceeding website, some of the causal maps in the findings do appear in this document. See supplemental file for a comprehensive list of causal maps in this study.

Finding #4 Coordination between levels federal state and local government: Sharing the challenge is challenging but not impossible³

A recommendation with an intergovernmental relationship, as defined for this study, is one where at least one level of government would need to make a decision during implementation. Intergovernmental relationships help explain why certain recommendations have made no progress. However, intergovernmental relationships were not as much of a barrier to floodplain management recommendations that have made substantial progress. That is, a strong recommendation would most likely not be held back because of coordination needed for implementation between federal, state, and/or local government interests. Yet, recommendations with intergovernmental relationships would be more likely to have made no progress.

Thirty of the issues, solutions, and institutions identified in this study appear in a relatively high percentage of No Progress recommendations. That is, where the Response to Boxer Report identified 21% of the recommendations in Sharing the Challenge to have made No Progress, there were thirty themes that appeared in No Progress recommendations at least 31% of the time they were mentioned. Nineteen of these thirty themes were more likely to have an intergovernmental relationship mentioned most of the argument (IG75=63% of HIGH NP).

Nineteen of the issues, solutions and institutions identified in the study appear in a relatively high percentage of Successful recommendations. That is, where the Response to Boxer Report identified 11% of the recommendations in Sharing the Challenge to have made No Progress, there were nineteen themes that appeared in Substantial Progress recommendations at least 21% of the time they were mentioned. Only one of these nineteen themes was less likely to have an intergovernmental relationship mentioned in most of the argument (IG75=95% of HIGH S).

The tables which follow provide a summary of issues, solutions and government institutions identified in the study. The findings from the first layer of analysis re-examined with the following question, are recommendations with a high level of intergovernmental coordination less likely to be implemented and those with low levels of intergovernmental coordination? Column four of the table shows the percent a theme category appeared as either No Progress (NP) or Substantial Progress (S) in the Response to Boxer Report. Column five of the table shows the percent difference between theme categories that appear in recommendations with high levels of intergovernmental relationships and those that do not have high levels of intergovernmental relationships.

Table: Issues and Intergovernmental Relationships

Theme	NP / S	Variable	% in Boxer	% point diff w/ Intergovernmental
Administrative Issues	50NP:	Data	6%	-33%
	75NP:	Data	6%	-25%
	50S:	Data	31%	-3% p=.024
	75S:	Data issues, overtop, tech-capacity	all high	all + difference

³ IG 50: more than one level of government is mentioned in 50 percent of the causal links in the argument.
IG 75: more than one level of government is mentioned in 75 percent of the causal links in the argument

Theme	NP / S	Variable	% in Boxer	% point diff w/ Intergovernmental
			substantial	
Economic and Financial	50NP:	All Econ n=35	8%	+11% (p=.067)
	75NP:	All Econ n=35	8%	+4% (p=.08)
	50S:	Market Pen	40%	+50% (p=.045)
		Rep Loss	67%	+67% (p=.002)
	75S:	Market Pen	40%	+67% (p=.009)
		Re Loss	67%	+100% (p=.001)
Environmental	50NP:	All Nat Resources, water quality, water resources	High No Progress	- difference
		Ecological, endangered, environment, fish and wildlife, natural resources, wetlands	High No Progress	+ difference
	75NP:	natural resources, water resources;	High No Progress	- difference
		All Nat resources, Ecological, endangered, environment, fish and wildlife, water quality, wetlands	High No Progress	+ difference
	50S:	None		
	75S:	endangered species	25%	+25%
Risk	50NP:	Facilities	50%	-24%
		Infrastructure	67%	+67%
	75NP:	Facilities	50%	-24%
		Infrastructure	67%	+67%
	50S:	N/A		
	75S:	N/A		
Social	50NP:	N/A		
	75NP:	N/A		
	50S:	N/A		
	75S:	N/A		

Issues

Recommendations with administrative issues were more likely to be amplified with an intergovernmental relationship mentioned in the argument. That is, some administrative issues were more likely to have made no progress when implementation required more than one level of government: navigation (50NP +60%, p=.077), technical capacity (75NP +33%) levee overtop or fail (75NP +14%). Data issues rarely appeared in no progress recommendations, and were even less likely to do so in an intergovernmental setting (Boxer NP 6%, 50NP -33%). On the other hand, some administrative issues were more likely to have made substantial progress when decisions require more than one level of government: navigation (50S +20%), overtop (50S +25%), technical capacity (50S +33%), all administrative issues (50S +5%, n=42). With respect to data issues, intergovernmental relationships held back substantial progress just slightly (Boxer S=31%, 50S -3%, p=.024).

Like the impact on administrative issues, intergovernmental relationships in arguments supporting recommendations with economic issues amplified the impact as defined in the

Response to Boxer. While all of the economic issues taken together had a low level of no progress (Boxer NP=8%), they were more likely to do so in an intergovernmental relationship (50NP +11%, n=35, p=.067). Land development issues were more likely to have made no progress in recommendations with intergovernmental relationships (50NP +19%, n=19). In cases where substantial progress was made, intergovernmental relationships supported this success: market penetration (Boxer 40%, 75S +26%, p= .042, n=35), repetitive loss (Boxer 67%, 75S +100%, p=.001). Other economic issues that had not made more than average substantial progress were more likely to be substantial in an intergovernmental setting: external impacts (75S +33%), land development (75S +22%), market penetration (75S +67%, p=.009).

Nearly all of the natural environment issues mentioned in Sharing the Challenge have made no progress. Intergovernmental relationships only make matters more complex. Many of the natural environmental issues were more likely to appear in no progress recommendations when intergovernmental relationships were identified in the supporting argument: ecosystems (Boxer NP 43%, 75NP +27%, p=.02), endangered species (Boxer NP 50%, 75NP +50%), environmental (Boxer NP 35%, 75NP +11%, p=.07), fish and wild (Boxer NP 43%, 75NP +13%, p=.08), water quality (Boxer NP 43%, 75NP +42%), wetlands (Boxer NP 30%, 75NP +50%).

Risk and vulnerability themes with prominent appearances in the Response to Boxer were generally unaffected by intergovernmental relationships, with the exception of facilities (Boxer NP 50%, 50NP -24%) and infrastructure (Boxer 67%, 50NP +67%). Other risk themes were adversely impacted by intergovernmental relationships, such as hazardous materials (50NP +67%, p= .047); residual risk (50NP +25%), all risk themes together (75S -20%), damages not declared (75S -100%, p=.02), facilities (75S -33%). In addition, some social themes were amplified when set in an intergovernmental argument. Where some issues were more likely to have no progress, such as health safety (50NP +25%), and poverty (50NP +20%), there were others that were more successful, such as social benefits and costs (75S +25%).

Table: Solutions and Intergovernmental Relationships

Theme	NP / S	Variable	% in Boxer	% point diff w/ Intergovernmental
Mitigation	50NP:	Buyout	31%	+38%
		damage reduction	30%	+6%
		Easement	67%	+67%
		maintenance	50%	-29% (p=.006)
	75NP:	Buyout	31%	+3%
		Damage reduction	30%	+14%
		Easement	67%	+100% (p=.02)
		Maintenance	50%	-26% (p=.01)
	50S:	Flood fight	25%	+29%
		Insurance	21%	-51%
		Preparedness	50%	+50%
	75S:	Flood fight	25%	+29%
Insurance		21%	+2%	
Preparedness		50%	+67%	

Management Process	50NP:	Active states	37%	+44%
		Coordination	35%	+27% (p=.015)
		Cost sharing	33%	-75%
		Innovation	29%	-15%
		Info awareness	11%	-100% (p=.05)
		research	11%	-13%
	75NP:	Active states	37%	+43% (p=.085)
		Coordination	35%	+8% (p=.04)
		Cost sharing	33%	-21%
		innovation	29%	-28%
		Info awareness	11%	-33%
		research	11%	-9%
	50S:	Models	40%	-13% (p=.01)
		Research	31%	+16%
		Research analyst	25%	+29% (p=.004)
75S:	Models	40%	-13% (p=.01)	
	Research	31%	+22% (p=.003)	
	Research analyst	25%	+42% (p=.002)	
Rules and Programs	50NP:	Exec order (n=6)	50%	-60% (p=.078)
	75NP:	Exec order (n=6)	50%	+33%
	50S:	NA		
	75S:	NA		
Recovery	50NP:	Gov assistance (n=28)	11%***	-29% (p=.09)
	75NP:	Gov assistance (n=28)	11%***	-25% (p=.08)
	50S:	After disaster	21%	+6%
		rebuild	***	-26% (p=.10)
	75S:	After disaster	21%	+7%
rebuild		***	+2%	
Response	50NP:	During disaster (n=19)	31%	-12%
	75NP:	During disaster	31%	-16%
	50S:	During disaster	19%	-12%
	75S:	During disaster	19%	+6%

Solutions

Mitigation activities to reduce vulnerability and flood hazards have made varying degrees of progress. The most interesting finding with respect to mitigation solutions is the impact of intergovernmental relationships on recommendations that mention insurance. While insurance solutions made substantial progress in the Response to Boxer (S=21%), these solutions were less likely to appear in recommendations with substantial progress that contained intergovernmental relationships (50S -51%). Other solutions, however, that made substantial progress were more likely to make progress with their argument set in an intergovernmental relationship: flood fighting (S=25%, 50S +29%), preparedness (S=50%, 50S +50%), reducing damage prior to an event (S=18%, 50S +38%). While other solutions that did not have as large an impact in the Boxer Report were somewhat less likely to make substantial progress with intergovernmental relationships defined: elevation and flood proofing (50S -33%), mapping (50S -25%). With respect to mitigation solutions that made no progress in the Response to Boxer, many of these solutions except for maintenance of structural projects were more likely to have made no progress when set in an intergovernmental relationship: buyouts (NP=31%, 50NP +38%),

damage reduction solutions (NP=30%, 50NP +6%), easements NP=67%, 50NP +67%), maintenance (NP=50%, 50NP -29%, p=.006). However, other mitigation solutions that were not necessarily more likely to have made no progress were in fact less hindered by intergovernmental relationships: levee (50NP -23%, n=27), structural (50NP -22%).

Management solutions to control the process by which floodplain management decisions are made were generally unsuccessful in the Response to Boxer Report. However, one area with substantial progress concerned modeling and research to improve information and knowledge on floodplain management issues. It is interesting to note that recommendations that mentioned models, while having made substantial progress (S=40%) were less likely to appear in substantial progress recommendations when framed in the context of an intergovernmental relationship (75S -13%, p=.01). On the other hand, management and process solutions with substantial progress that identified research needs held up rather well when framed in an intergovernmental setting: research (S=31%, 75S +22%, p=.003), research analyst (S=25%, 75S +42%, p=.002). Some of the management and process solutions that made no progress in the Response to Boxer report were more likely to make no progress in the context of intergovernmental relationships: active state involvement in floodplain management (NP= 37%, 50NP +44%), and coordination (NP=35%, 50NP +27%, p=.015). While other management solutions which have made no progress were less likely to have made no progress in an intergovernmental context: cost sharing (NP=33%, NP50 -75%, p=.137), and solutions to increase innovation (NP=29%, 50NP -15%). Still other management solutions that were less likely to appear in no progress recommendations in the Response to Boxer (i.e., make at least some progress) were even less likely to have made no progress when placed in an intergovernmental context: information awareness (NP=11%, 50NP -100%, p=.051), and research (NP=11%, 50NP -13%).

Sharing the Challenge mentions a few solutions to implement new floodplain management rules, as well solutions to manage the recovery and response phases of disaster. Recommendations that included mention of an Executive Order in the supporting argument have made no progress in the Response to Boxer Report (NP=50%), but were less likely to have made no progress in an intergovernmental setting (50NP -60%, p=.078). Recommendations that identified public assistance opportunities had made some progress (NP=11%) and were less likely to appear in no progress recommendations when set in intergovernmental relationships (50NP -29%, p=.09). Arguments that identified activities during the response (NP=19%) phase of disaster have made substantial progress, but were less likely to do so when framed in an intergovernmental relationship (50NP -12%). While discussions of rebuilding after disaster were not necessarily more successful than other recommendations, these solutions were less likely to be substantially implemented as intergovernmental relationship were identified in the supporting argument (50S -26%, p=.10).

Accountable Entities / Government Institutions

Theme	NP / S	Variable	% in Boxer	% point diff w/ Intergovernmental
Accountable Entities / Government Institutions	50NP:	DOI	60%	+67% (p=.002)
		DOT (n=2)	50%	+50%
		EPA (n=16)	38%	+55% (p=.009)
		FWS (n=7)	57%	-50% (p=.026)

Theme	NP / S	Variable	% in Boxer	% point diff w/ Intergovernmental
		USDA	31%	+40%
		FEMA	12%	-14%
	75NP:	DOI (n=10)	60%	+17% (p=.01)
		DOT (n=2)	50%	+50%
		EPA (n=16)	38%	+50% (p=.01)
		FWS (n=7)	57%	-17% (p=.04)
		USACE (n=30)	30%	-6%
		USDA	31%	+18%
		FEMA	12%	+7%
	50S:	NWS (n=3)	33%	+50%
		USGS (n=5)	40% **	+40% (p=.04)
	75S:	NWS	33%	+50%
		USGS	40% **	+40% (p=.04)

Government Agencies

There are several types of government agencies needed to implement floodplain management recommendations. For purpose of discussion, agencies have been grouped in four categories: floodplain management focus, environmental focus, economic development focus and scientific/technical focus. For the most part, recommendations that have made no progress are more likely to make no progress when the arguments include intergovernmental relationships. For example, agencies with an environmental focus were identified in recommendations that have made no progress in the Response to Boxer Report. Conditions for these agencies were even worse when framed in an intergovernmental context: EPA (NP=38%, 50NP +55% n=16 p=.009), and FWS (NP=+57%, -50% n=7 p=.026). Agencies more focused on economic development were also more likely to make no progress when framed in an intergovernmental relationship: DOI (NP=60%, 50NP +67%, p=.002, n=10), DOT (NP=50% 50NP +50%, n=2), and USDA (NP=31%, 50NP +40%).

The floodplain management agencies experienced mixed results in recommendations with intergovernmental relationships: FEMA (NP=12%, 50NP -14%, 75NP +7%), and USACE (NP=30%, 75NP -6%). The scientific and technical agencies made substantial progress in the Response to Boxer Report and managed to hold up rather well when accounting for intergovernmental relationships: NWS (S=33%**, 75S +50% n=3), and USGS (S=40%, 75S +40%, p=.04 n=5). Other agencies that had not made substantial progress were slightly better off in intergovernmental recommendations: FEMA (50S +12%), USACE (50S +17%), FWS (50S +25%), and USDA (50S +13%).

5. Conclusions

This paper presented a multi-method approach for analyzing policy complexity and intergovernmental relationships using a qualitative system dynamics methodology. The empirical study has both policy and methodological contributions. From a policy perspective, there were four important flood risk management findings. First, the data showed that a federal “top-down” approach to floodplain and flood risk management has not been successful. In particular, the

Corps was included in recommendations that included a federal approach which were far less likely to make progress. Second, recommendations to increase knowledge and research on flood problems have been successful. Politically, these recommendations are less controversial and promote an important first step for both federal and state interests. Third, floodplain recommendations with environmental implications have yet to make substantial progress. While the tone of floodplain management recommendations (not just Sharing the Challenge) have shifted towards more focus on the environment, implementation of these recommendations have proved to be difficult. This finding should come of no surprise, considering the number of stakeholders needed to sustain support for the implementation of such recommendations. Finally, there was statistically significant evidence to show that intergovernmental coordination does not necessarily prevent successful solutions. If anything, it appears that intergovernmental relationships amplify the outcomes. That is, for issues, solutions, and interests that would normally appear in substantial progress recommendations, this outcome is even more likely in the context of an intergovernmental relationship. Sharing the challenge is challenging but not impossible. The findings in this study support the demand for a new program at the US Army Corps of Engineers called Silver Jackets. This program has progressed quite rapidly over the last few years and its main goal is to coordinate horizontally with other federal flood risk management programs and vertically with the states on their flood risk management planning.

From a methodological perspective, this study contributes to the literature on qualitative approaches to content analysis using system dynamics. As a way to analyze arguments, it became apparent that qualitative system dynamics and systems thinking concepts would support a detailed content analysis in a way that may not be possible using other methods. Causal structure and casual loops identified in arguments reveal assumptions about how the messenger (in this case the task force in Sharing the Challenge) perceives the world. If these assumptions were to hold true, the recommendations would lead to improved outcomes. Causal loop diagrams help answer important questions about how these policies would be sustained over time. That is, will the outcomes yield support for the policies? Will program outcomes yield savings to guarantee funding in the future? The causal structure also reveals the interaction between balancing and reinforcing feedback loops.

As we know in the system dynamics literature, policies are often implemented to control reinforcing loops that create undesirable behavior or stimulate reinforcing loops that help attain a most desirable outcome. In addition, policies may be implemented to activate balancing loops that help control a vicious cycle in the system. In this study, causal loop diagrams were used to identify those interactions between policies and outcomes through major feedback themes. In this particular system, it appeared many of the policies were attempting to control dangerous reinforcing loops in the system, while recognizing difficult tradeoffs among competing issues. For example, the data showed arguments where environmental problems were reinforcing loops, with potential for a vicious cycle when activated by unintended consequences of increased land development. In terms of balancing loops, the assumptions in the arguments revealed that it might be difficult to sustain these policies over a long period of time. For example, nonstructural measures that lower damages in the community yield a desired outcome. However, when this balancing loop reaches equilibrium (or desired state), it would no longer be active, and other issues in the community (such as pressures to maintain tax base) would become active. A systems thinking perspective makes it possible to observe several types of policy complexity in arguments. I found four general types of feedback themes in this study: (1) interconnected issues

in feedback loops that create complexity; (2) unintended consequences that activate harmful feedback processes; (3) limits to growth on balancing loops that dampen the impact of a policy; and (4) assumptions about support for policies that control reinforcing loops in vicious cycles.

There were several advantages in using causal maps in a policy research project. First, causal maps provide the analyst with a way to deconstruct arguments into individual components (i.e., causal links) and use the components to identify the size and scope of a recommendation. By doing so, I argue this approach allows us to define complexity in the policy recommendation. It also provides a way to analyze variables and concepts in specific sections of the argument and discount for concepts that are only briefly mentioned. From a statistical analysis and research design perspective, this approach provides for more observations in the data collection. With only 97 observations (vs. 396 using causal links), several of the variables in Appendix A would not have been identified as statistically significant if all recommendations were deemed to have equal strength. In addition, by using causal links to define arguments, this method provides a way to discount concepts that are repeated frequently in supporting evidence for one argument. A content analysis that merely searched for key terms might overstate the importance of a concept that does not appear in arguments supporting other causal relationships.

In conclusion, I believe this approach contributes to the literature on qualitative system dynamics and provides an improved method for conducting a content analysis. This empirical approach provides a way to explicitly measure complexity and feedback themes using qualitative data in recommendation arguments. Of course, more work needs to be done. Future research will include case studies that will improve the codebook developed in the 2009 conference paper and test the findings in the content analysis presented in this paper.

References

- Deegan, M. (2009). "Developing Causal Map Codebooks to Analyze Policy Recommendations: A preliminary content analysis of floodplain management recommendations following the 1993 Midwest Floods." Paper presented at the 27th International System Dynamics Conference, Albuquerque, <http://www.systemdynamics.org/conferences/2009/proceed/papers/P1354.pdf>.
- Kim, H. (2008). "Qualitative mapping for understanding the collective judgment building process: A study of the Federal Open Market Committee." Albany NY, University at Albany, State University of New York. PhD Dissertation, 229 p.
- Kopainsky B. and L. Luna-Reyes (2008). "Closing the loop: Promoting synergies with other theory building approaches to improve system dynamics practice." *Systems Research and Behavioral Science* 25(4): 471-486.
- Luna-Reyes, L. and D. Andersen (2003). "Collecting and analyzing qualitative data for system dynamics: methods and models." *System Dynamics Review* 19(4): 271-296.

Appendix A

Chi Square results for Issues, Solutions, and Government Interests

Interests, Issues, and Solutions					Recommendations with No Progress						Recommendations with Substantial Progress					
Theme	Stakeholder Group	Stakeholder Name	N	df	Yates	p	Sig	obs	exp	diff	Yates	p	Sig	Obs	Exp	diff
Interests	Institution	DOI	396	1	12.441	0.000	***	9	3.1	5.90						-
Interests	Institution	FEMA	396	1	5.222^	0.022	**	4	10	(6.00)						
Interests	Institution	FWS	396	1	8.058	0.005	***	6.00	2.00	4.00						-
Interests	Institution	Local	396	1	7.251	0.007	***	13.00	23.30	(10.30)						-
Interests	Institution	NWS / NOAA	396	1							4.50	0.034	**	2.00	0.30	1.70
Interests	Institution	USGS	396	1							16.20	0.000	***	4	0.6	3.40
Interests	Institution	WRC	396	1	35.107	0.000	***	11.00	2.40	8.60						-
Issue	Admin	Data Issue	396	1	4.252^	0.039	**	2.00	6.40	(4.40)	40.19	0.000	***	12.00	2.40	9.60
Issue	Admin	Depreciation	396	1	3.793	0.051	**	3.00	0.90	2.10						
Issue	Admin	Measure / monetize	396	1	4.819^	0.028	**	1	5.3	(4.30)						
Issue	Admin	Navigation	396	1	8.058	0.005	***	6.00	2.00	4.00						-
Issue	Econ	Market Penetration	396	1	2.626	0.105	*	0.00	2.90	(2.90)		0.148				
Issue	Econ	Repetitive Loss	396	1							15.52	0.000	***	3.00	0.30	2.70
Issue	Environment	Ecological	396	1	5.076^	0.024	**	11.00	6.20	4.80		0.193		0.00	2.30	(2.30)
Issue	Environment	Environmental	396	1	3.520^	0.061	*	16.00	10.90	5.10						
Issue	Environment	Fish and Wildlife	396	1	4.275	0.039	**	9	4.7	4.30						
Issue	Environment	Natural Resources	396	1	9.213	0.002	***	9	3.6	5.40						-
Issue	Environment	Water Resources	396	1	23.980^	0.000	***	15.00	5.30	9.70						-
Issue	Risk	Damages	396	1	4.992^	0.025	**	3.00	8.40	(5.40)	2.08	0.150		6.00	3.20	2.80
Issue	Risk	Hazardous Materials	396	1	5.470	0.019	**	5	1.8	3.20						
Solution	Management	Active States	396	1	3.267	0.071	*	7	3.6	3.40						
Solution	Management	Coordination	396	1	4.284^	0.038	**	20	13.8	6.20						
Solution	Management	Models	396	1	4.432	0.035	**	0	4.2	(4.20)	11.10	0.001	***	6	1.6	4.40
Solution	Management	Research	396	1	7.672^	0.006	***	1	7.3	(6.30)	25.99	0.000	***	11	2.8	8.20
Solution	Management	Research Analyst	396	1							4.56	0.033	**	7	3.1	3.90
Solution	Mitigation	Acquisition / Buyout	396	1	10.585^	0.001	***	17.00	8.90	8.10						-
Solution	Mitigation	Easement Acquisition	396	1	9.818	0.002	***	5.00	1.30	3.70						-
Solution	Mitigation	Insurance	396	1	26.871	0.000	***	0	16.9	(16.90)	29.01^	0.000	***	18	6.3	11.70
Solution	Mitigation	Maintenance	396	1	5.935^	0.015	**	12.00	6.70	5.30						
Solution	Mitigation	Maps	396	1	5.437^	0.020	**	1.00	5.80	(4.80)						
Solution	Mitigation	Preparedness	396	1							19.94	0.000	***	4	0.5	3.50
Solution	Mitigation	Upland Storage	396	1	2.626	0.105	*	0	2.9	(2.90)						
Solution	NonGov_Recovery	Rebuild	396	1							6.54	0.011	**	7.00	2.70	4.30
Solution	Recovery	Government Assistance	396	1	6.487^	0.011	***	3	9.6	(6.60)						-
Solution	Response	Disaster, during	396	1							3.26	0.071	*	5	2.1	2.90
Solution	Rules	Rules	396	1	7.650^	0.006	***	7.00	15.80	(8.80)						-

p<.1, **p<.05, ***p<.01
^Expected count in all cells>5, Pearson Chi Squared applied instead of Yates Correction