

AN ABSTRACT OF THE ESSAY OF

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Title: Theoretical and Quantitative Analysis of Chronological Changes of Wetland Mitigation Policy in the United States

Abstract approved:

Lori A. Cramer

The purpose of this research is to evaluate longitudinal changes of wetland mitigation policy in the United States theoretically and quantitatively. This study offers a deeper understanding of critical wetland conservation policy in the United States while providing a useful reference for policy makers and policy implementers of biodiversity offset policies in the world. I applied policy learning theory to understand the development process of the policy. I also conducted content analysis of public documents about wetland mitigation policy in the United States to evaluate the chronological shift of language use of the policy. As a consequence, two policy (conceptual) learnings were identified in the history of wetland mitigation policy: the introduction of the banking system and the concept of ecosystem services. The content analysis also revealed the increasing trend of language use about efficiency (market), and the decreasing trend of language use about equity (distributional equity), which were different from the initial expectation based on the review of literature. The results suggest that social learning which is improvement of communication among actors could be a next step to overcome the ongoing problems such as unfair redistribution of ecosystem services.

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**Theoretical and Quantitative Analysis of Chronological Changes of
Wetland Mitigation Policy in the United States**

by

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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1. Introduction

The wetland compensatory mitigation policy based on Section 404 of the Clean Water Act 1972 (CWA) is a critical policy tool to conserve wetlands in the United States (U.S.). By 2011, at least 450,000 acres of wetlands were permanently protected as a consequence of wetland mitigations based on this policy (Madsen, Carroll, Kandy, & Bennett, 2011). This policy which has a 43 year history is considered a pioneer of biodiversity offset policy which has recently gained attention in the world as a tool to balance environmental conservation and economic development. In 2011, at least 25 biodiversity offset programs were in various stages of development or investigation in the world (Madsen et al., 2011).

Although wetland mitigation policy in the United States has significant influence on wetland conservation and is considered as a reference case for new biodiversity offset policy in the world, how the policy has been developed has not been thoroughly examined. Research has been done about the effectiveness of the policy (such as research about success rates of wetland mitigations (Hill, Kulz, Munoz, & Dorney, 2013; Kentula, 2000; Reiss et al., 2009; Stein & Ambrose, 2000), but little literature has dealt with historical perspectives of policy development. In addition, the few existing works addressing the history of the policy are narrative (R. C. Gardner, 2011; Schenck, 2000; Williams & Connolly, 2005) and do not include theoretical or quantitative analysis.

The purpose of this research is to evaluate longitudinal changes of wetland mitigation policy in the United States theoretically and quantitatively and add new perspectives to existing knowledge about the development process of this pioneer biodiversity offset policy. This study provides deeper understanding of the critical wetland conservation policy in the United States. while providing a useful reference for policy makers and policy implementers of relatively new and up-coming biodiversity offset policy.

How can the longitudinal changes of policy foci and the development process of wetland mitigation policy in the United States be explained theoretically and quantitatively? In this research, I answered this question with the following steps. First, the history of wetland mitigation policy in the United States was reviewed based on literature explaining how policy foci have changed overtime. Second, these chronological shifts of policy foci were explained from the perspective of the theory of policy learning. Third, a hypothetical model which shows

chronological shifts of policy foci based on the theoretical analysis was developed with the policy evaluation indicators (effectiveness, efficiency, and equity). Finally, chronological shifts of language use (ratio of key words) reflecting the indicators in public documents about wetland mitigation policy were evaluated to quantitatively capture the trend of policy foci and test the hypothetical model.

There are many policy theories explaining policy changes. I chose the policy learning theory since the theory focuses on policy subsystems and the change of contents of policy (instruments and ideology) which are the focuses of this study. Effectiveness, efficiency and equity are well known indicators in policy evaluation and have been applied to analyze environmental or natural resource management policy and programs (Jost & Gentes, 2014; Kasterine & Vanzetti, 2010; Laycock, Moran, Smart, Raffaelli, & White, 2011; Payne, 1998). In fact, Payne (1998) used these indicators to evaluate wetland policy in Massachusetts. However, Payne's analysis did not include chronological perspectives. In addition, Payne's research focused on the local conservation commission and did not focus on wetland mitigation policy itself. In the next section, the history of the wetland mitigation policy is reviewed focusing on the changes of policy foci.

2. History of Wetland Mitigation Policy in the United States and Its Approaches

2.1 Emergence of wetland mitigation policy

At the beginning of the twentieth century, in the United States, wetlands were considered as useless nuisances that provided habitats for mosquitoes and mediators of epidemics.¹ Therefore, the U.S. government actively promoted the conversion of wetlands into farmlands, which governments thought more productive. However, as the scientific understanding of wetland functions was deepened, people began to realize the importance of wetlands and demand a new legal system for wetland conservation. In 1972, the Federal Water Pollution Control Act, known as the Clean Water Act (CWA) after 1977 amendments, experienced major changes including the introduction of wetland mitigation policy based on section 404. Section 404 of the CWA requires developers to mitigate (compensate) negative impacts on wetland functions when development activities involve the discharge of the dredged and fill material. In this study, wetland mitigation means a mitigation (compensation) work of wetlands based on this provision.

Section 404 of CWA is administered by the unique collaboration of two agencies: the U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA). Simply stated, the Corps has the authority to issue permits for the discharge of the dredged and fill material, yet the Corps has to follow the guideline developed by the EPA (which is in fact a formal regulation). The EPA also has to consult with the Corps when the guideline is administered. This awkward combination is related to the traditional jurisdiction of these agencies. Traditionally, the Corps has administered dredging and landfill activities based on the Rivers and Harbors Acts (RHA) of 1890 and 1899. When the draft of CWA was formed in 1972, the House of Representatives voted to give the authority to the Corps because of its long experience of the administration under RHA. However, the Senate insisted that the EPA should have authority since the Corps was considered to be completely lacking in environmental sensitivity. As a consequence, the collaborative structure of administration was formed.

¹ For a detailed history of wetland policy before the enactment of the Clean Water Act in the United States, see Gardner (2011).

Since the introduction of the wetland mitigation program based on Section 404 in 1972, the Corps and the EPA have gradually formed the structure of the program. The first 404 guideline was issued in 1975. In this guideline, the avoidance of negative impacts on wetlands was emphasized, meaning if there is no practicable alternative with smaller environmental impacts and the project would not cause unacceptable impact, the Corps can issue a permit (National Research Council, 2001). Although this guideline also required minimization of the adverse impact caused by permitted projects, there was no mention of compensation for negative impacts, such as restoration or creation of wetlands (National Research Council, 2001). In 1980, the EPA promulgated the updated guideline, which affirmed requirements of the avoidance and minimization. This guideline also referred to compensation as a subset of minimization. Although, the concept of avoidance, minimization, and compensation were stipulated, the current sequence structure among these three concepts was not clear at this point. In addition to the formal Section 404 guideline, the EPA and the Corps often publish less formal documents such as Memorandum of Agreements (MOAs) or regulatory guidance letters to interpret the guideline (R. Gardner, 1991). In 1990, the EPA and the Corps issued an MOA about the procedure of mitigation determinations. The MOA emphasized that mitigation has to be conducted in a sequential manner; an applicant first must consider the avoidance of adverse impacts on the wetland, then minimize the unavoidable impacts, and finally compensate the residual impacts (U.S. Army Corps of Engineers & Environmental Protection Agency, 1990). This sequence is one of the current principles of wetland mitigation and is also recognized as a world standard for biodiversity offsets (Business and Biodiversity Offsets Programme (BBOP), 2012).

The compensatory mitigation activities can be roughly categorized into three types: restoration, creation, and preservation. The MOA clearly stated that restoration is the first option because of its probability of success, and preservation of nearby wetlands can be accepted only in exceptional cases. The MOA also had the categorization and the priority order for locations and similarity of functions to secure the equivalent ecological functions (U.S. Army Corps of Engineers & Environmental Protection Agency, 1990). When mitigation of impact is required, on-site mitigation (mitigation in areas adjacent or continuous to the discharge site) is preferred to off-site mitigation, and in-kind mitigation (mitigation of the same type of function as that affected by the development) is preferred to out-of-kind mitigation. The sequential manner and

different levels of preference have formed the basis of wetland mitigation policy to date, although its effectiveness and efficiency have been argued over time.

The goal of wetland mitigation policy is the achievement of No-Net-Loss which was first propounded by the former President George H. W. Bush during his 1988 campaign (Sibbing, 2008). No-Net-Loss means the quality (functions) and quantity (area) of wetlands does not decrease after the development. Owing to the wetland mitigation policy based on Section 404 of the CWA and unfavorable agricultural economic conditions, acreage loss of wetlands dramatically fell from the 1970s to 1990s (National Research Council, 2001). Although wetland mitigation policy has had positive effects for restoration of wetlands at least on area-based criteria (National Research Council, 2001), many researchers pointed out the low quality of restored wetlands. For example, Turner, Redmond, & Zedler (2001) collected existing literatures, covering the success rate (compliance rate) of wetland mitigations, and tried to examine the holistic function-based success rate in the United States. According to their research, about half of existing literatures concluded that the compliance rate for wetland mitigation was less than 50%. The major causes of failure to achieve compliance include: the lack of knowledge about wetland function and values, the lack of a larger planning context (including ineffective site selection) (National Research Council, 1992; New Jersey Department of Environmental Protection, 2002; Zbiciak, 2000), inadequate size of restored wetlands (including edge effects) (Kevin L. Erwin, 1991; New Jersey Department of Environmental Protection, 2002), and lack of subsequent monitoring and compliance effort (Ladd & Minkin, 2003; New Jersey Department of Environmental Protection, 2002).

2.2 Introduction of the banking system

To deal with causes of failure of mitigation projects, in the early 1990s EPA and Corps started to consider the banking system (U.S. Army Corps of Engineers, Environmental Protection Agency, National Resource Conservation Service, Fish and Wildlife Service, & National Oceanic and Atmospheric Administration, 1995; U.S. Army Corps of Engineers & Environmental Protection Agency, 1990). Wetland mitigation banking system is the market-based system based on the trades and purchases of credits as is common with greenhouse gas emission trading schemes or tradable discharge permits (water emission trading). In this system, credits are established by

“preliminary” wetland mitigation activities. This system works as follows. First, a third party (banker) conducts mitigation activities, for example, restoration of wetlands. The agency certifies the credits based on the quality and quantity of mitigated wetlands. Then, bankers can sell those credits to developers, who can get approvals for developments by purchasing credits instead of mitigating impacts by themselves. Bankers can sell credits created from one mitigation activity to more than one developer (regarding details of structure, see e.g. McElfish & Nicholas, 1996).

The banking system has several advantages. First, a consolidated mitigation project led by the banking system can provide scientific expertise and financial resources which are not available to those performing small scale individual mitigation (U.S. Army Corps of Engineers et al., 1995). Second, the banking system can more likely secure the success of mitigation since the mitigation activities are preliminarily conducted and credits are certified based on the quality and quantity of wetlands (if mitigation fails, no credits will be certified) (R. C. Gardner, 2011; McElfish & Nicholas, 1996; U.S. Army Corps of Engineers et al., 1995). Third, because bankers can conduct one large scale mitigation activity in order to compensate for several development projects, the size of mitigated wetlands can be ecologically large enough (Schenck, 2000; Shabman, Scodari, & King, 1994; U.S. Army Corps of Engineers et al., 1995). Fourth, the banking system can reduce or eliminate time-lag between loss of wetland caused by development activities and gain of wetland by mitigation activities since mitigation activities are preliminarily conducted (National Research Council, 2001; U.S. Army Corps of Engineers et al., 1995). Fifth, this system requires fewer monitoring activities because the number of mitigation sites can be smaller (they do not need to visit many mitigation sites) (Albrecht & Wenzel, 1996; Shabman et al., 1994; U.S. Army Corps of Engineers et al., 1995). In addition, agencies and applicants can spend less time reviewing the proposal since credits created by banking have already been reviewed (U.S. Army Corps of Engineers et al., 1995).

Although the concept of the banking system itself was born in the 1970s, there was no mention about the banking system in legal documents for Section 404 program prepared by the EPA or Corps until the MOA in 1990. In the 1990 MOA, the EPA and Corps considered mitigation banking as “an acceptable form of compensatory mitigation under specific criteria” (U.S. Army Corps of Engineers & Environmental Protection Agency, 1990). In 1993, the EPA

and Corps issued the interim guidance on mitigation (Environmental Protection Agency & US Army Corps Engineers, 1993). This guidance emphasized mitigation banking cannot be an excuse to skip the avoidance and minimization requirements and the preferences for on-site and in-kind mitigation, while stating that these preferences do not preclude the use of mitigation banks.

In 1995, the EPA and the Corps, along with the Fish and Wildlife Services (FWS), National Marine Fisheries Service and the Natural Resource Conservation Service issued policy guidance which set forth a more detailed process and rules for establishment of mitigation banks (U.S. Army Corps of Engineers et al., 1995). The guidance also intended to ensure flexibility of program administration to allow the use of the banking system within a watershed planning context (Zinn, 2004). The guidance was not a binding regulation and did not require public input; agencies sought public comments in the process of the development of this guidance because of the controversial nature of the topic (R. C. Gardner, 2011). This guidance also clarified the overall goal of a mitigation bank:

“The overall goal of a mitigation bank is to provide economically efficient and flexible mitigation opportunities, while fully compensating for wetland and other aquatic resource losses in a manner that contributes to the long-term ecological functioning of the watershed within which the bank is to be located” (U.S. Army Corps of Engineers et al., 1995).

Backed by these public documents, the number of banks have significantly increased since the mid-1990s (Madsen, Carroll, & Moore Brands, 2010). For example, the number of permits requiring wetland mitigation that used a mitigation bank in the Corps’ Chicago District increased from 1 to 14 percent, and the number of active banks increased from 46 to 330 from 1992 to 2005 (Wilkinson & Thompson, 2006). The number of private commercial banks especially increased. Only one bank was a privately owned commercial bank out of 46 banks in 1992; more than 70 percent of active mitigation banks were private commercial banks in 2005 (Environmental Law Institute, 1994; Wilkinson & Thompson, 2006).

The introduction of the banking system was not only promoted by a need to fix internal flaws but also related to the broader context and the trend of the U.S. environmental policy. One of the influential trends is the increasing attention towards market-based approach from the Bush Administration through the Clinton Administration (Cavanagh, Hahn, & Stavins, 2001). The

cost of environmental regulations had increased from \$205 million in 1970 to over 4 billion in 1992 (Hahn, 1994), and thus the improvement of economic efficiency was the central goal of the regulatory reform in the Congress during the 1990s (Cavanagh et al., 2001). The other influential shift is the shift from the top down approach to the more collaborative based approach. Through the 1980s anti-environmental movement (anti-green backlash) after the golden era of environmental law in the 1960s and 1970s, both environment and anti-environmental parties were worn out by fragmented inefficient administration and conflicts including many legal battles. As a consequence, collaborative action and management among public agencies, as well as between the public and private sectors, became a major trend. In the wetland conservation context, the emergence of watershed-based planning reflects this trend. The watershed-based approach is the way to achieve the integration of sustainable economic prosperity and preservation of environmental quality (National Research Council, 1999). There are two ways watershed-based planning could promote the private commercial wetland mitigation banking (Roger, 1996). First, watershed-based planning could reduce the likelihood of mitigation failure by providing better design and site selection. Second, a watershed-based plan could add flexibility in regulatory requirements by identifying suitable sites for restoration works (potential bank sites). In fact, the Clinton administration emphasized the multiple-objective watershed planning as the framework for mitigation banks (Marsh, Porter, & Salvesen, 1996). These trends can be considered as external promoters for the introduction of the banking system.

Although the banking system has significant potential to contribute to effective and efficient wetland mitigation, the banking system also has some disadvantages. The most significant disadvantage is that the banked mitigation activities must be “off-site” mitigation, which is usually less preferable than “on-site” mitigation. The banking system promotes off-site mitigation because 1) often mitigation activities have been already conducted off-site when developers seek the credits, and 2) site selection for a mitigation bank is often driven by economic factors, such as land cost, rather than ecological factors (Environmental Law Institute, 2005). This feature leads to the migration of wetlands (which will be addressed in the next section). Critics also have contended that “in-kind” criteria will be loosened since regulators may neglect potential impacts and simply rely on available credits (Schenck, 2000). In addition,

some researchers have pointed out that the banking system may remove small wetlands which have many functions which large wetlands cannot replicate (Schenck, 2000).

2.3 Redistribution of ecosystem services and service criteria

Conventionally, permittees had only focused on “functions” of wetlands, which “means the physical, chemical, and biological processes that occur in ecosystems” (33 C.F.R. at §332.2) and do not actually relate to the human aspects. In the 2000’s, in addition to the function, much research has indicated the importance of ecosystem services from wetlands, such as provision of habitat for species, flood protection, water purification, amenities, and recreational opportunities (Ruhl & Gregg, 2001; Woodward & Wui, 2001). “Services” in wetland mitigation policy is defined as “the benefits that human populations receive from functions that occur in ecosystem” (33 C.F.R. at §332.2). Some services, such as carbon sequestration, are not local, but many services, such as amenities or recreational opportunities, are location dependent (D. M. King, Wainger, Bartoldus, & Wakeley, 2000). Thus, change of location of wetlands led by the banking system can be a problem. Some researchers (D. King & Herbert, 1997; Salzman & Ruhl, 2006) indicated that wetlands are “migrating” from urban areas to rural areas as a consequence of wetland mitigation since generally development permits are required in populated areas and mitigations are conducted in rural areas. Since the banking system leads to off-site mitigation, the banking system fosters the migration of wetlands (Brown & Lant, 1999; Ruhl & Salzman, 2006; Sando, Harnack, & Hugoson, 1998). This migration of wetlands leads to the issue of “distributional equity” (Salzman & Ruhl, 2006). In other words, some people lose services and some other people gain services from wetland mitigations (BenDor, Brozovic, & Pallathucheril, 2008; Ruhl & Salzman, 2006).

In 2008, the EPA and Corps announced the final regulation for wetland mitigations based on Section 404 of the CWA. The renewal of the regulation was mainly motivated by the need to establish one comprehensive regulation reflecting recent scientific knowledge, and this final regulation introduced ecosystem “services” as a consideration for wetland mitigations. Ruhl, Salzman, and Goodman (2009) reviewed how the final regulation integrates the concept of ecosystem “services” into the final rule, and explained the potential impact of the regulation

(Ruhl et al., 2009). They argued that this recent regulation may remedy the issue of distributional equity of ecosystem services accompanied with the wetland migration since the integration of the service factor “into the rule enables the EPA and the Corps to consider the issues arising from the migration of wetland services from urban to rural areas” (Ruhl et al., 2009, p. 264).

The EPA and the Corps in fact mentioned public comments regarding wetlands migration and benefits redistribution in the Federal Register as follows:

“A number of commenters expressed concern that an emphasis on off-site compensatory mitigation can lead to the transfer of wetland ecosystem services from urban to rural areas. Two commenters argued that unless the rule requires applications to include a description of service values and benefits at the impact site and the compensatory mitigation project site, rural areas will benefit and urban populations will incur the costs” (US Army Corps Engineers & Environmental Protection Agency, 2008, p. 91629).

The agencies eventually addressed the location of mitigation and services in the Code of Final Regulation (CFRs) as follow:

“Location factors (e.g., hydrology, surrounding land use) are important to the success of compensatory mitigation for impacted habitat functions and may lead to siting of such mitigation away from the project area. However, consideration should also be given to functions and services (e.g., water quality, flood control, shoreline protection) that will likely need to be addressed at or near the areas impacted by the permitted impacts” (Environmental Protection Agency, 2008, p. 283; US Army Corps Engineers, 2008, p. 505)

In the final regulation in 2008, the EPA and the Corps repeatedly used the phrase “functions and services.” Given the claims of existing literature and the language of the final regulation, it is reasonable to consider the agencies are more focused on the distributional equity issue and more broadly social impacts for people in the final regulation.

3 Policy Learning Theory and the Development of Wetland Mitigation Policy

The previous section offered a review of the history of the wetland mitigation policy focusing on how policy foci have shifted over time. In this section, the chronological changes of policy foci are explained by applying policy learning theory. In the policy science field, there are countless theories and frameworks to explain the policy process and development. However, not many theories and frameworks address micro level policy changes which occur within policy subsystems. For example, social construction theory does not focus on subsystems but broad society, and policy network theory addresses policy subsystems but focuses more on the configuration and interaction of actors and does not pay attention to the alteration or adoption of policy instruments and goals (Edella, 2007). Although punctuated equilibrium theory seems to be feasible to analyze the longitudinal trends of policy, the theory assumes punctuations are caused by interactions by macro level politics and does not describe changes within subsystems in detail (these changes are considered as mere equilibriums). The advocacy coalition framework (ACF) provides detailed explanation about the policy process within subsystems (Sabatier & Weible, 2007; Sabatier, 1988). In fact, Sabatier and Weible argue policy-oriented learning as one of the paths to major policy changes (Sabatier & Weible, 2007). ACF's focus is, yet, broad and includes diverse components from external socio-economic conditions to the individual belief system, and it is not necessary to mention all components in the framework to analyze changes of problems and approaches of the wetland mitigation policy. On the other hand, policy learning theory focuses on the nature of policy changes including instrumental and ideological changes often based on policy failure (problems) which were focuses of this study. For this project, thus, the policy learning theory was applied.

One of the most well-known definitions of policy learning (or policy-oriented learning) is provided by Sabatier (1988). He defined policy learning as “relatively enduring alterations of thought or behavioral intentions which results from experience and which are connected with the attainment (or revision) of policy” (Sabatier, 1988, p. 133). Hall (1993) also defined policy learning as “a deliberate attempt to adjust the goals or techniques of policy in response to past experience and new information” (P. Hall, 1993, p. 278). Although the definition by Sabatier is precise, this definition only mentions experience as a source of learning, and does not mention

new information, which is a critical source of policy learning. In this study, therefore, discussions were based on the definition by Hall.

Some researchers have categorized policy learning into several groups. For example, May (1992) divided policy learning into three types: instrumental policy learning, social policy learning, and political learning. Instrumental policy learning is defined as learning about “the viability of policy interventions or implementation designs” (May, 1992, p. 332), or simply, “learning about the effectiveness of policy tools and interventions” (Birkland, 2005, p. 193). This learning process involves assessments of the efficacy of existing policy instruments and requires improvement of understanding of policy instruments (Birkland, 2005; May, 1992). Social policy learning is learning about “social construction of policy problems, the scope of policy, or policy goals” (May, 1992, p. 332). May argued that social policy learning requires “changes in fundamental aspects of policy, including redefined objectives--, changes in target groups--, or altering rights associated with a policy” (May, 1992, p. 338). Political learning is defined as “learning about making more effective political advocacy” (Birkland, 2005, p. 196). Political learning is fundamentally different from instrumental policy learning and social policy learning. While two forms of policy learnings are concerned with lessons about policy content, political learning is concerned with manipulation of policy process (May, 1992). May called two forms of policy learning simply “policy learning” and distinguished political learning from policy learning.

Glasbergen (1996) also distinguished four types of policy learning: technical learning, conceptual learning, cognitive learning, and social learning. Fiorino adopted the classification of Glasbergen and reorganized the category into three types: technical learning, conceptual learning and social learning (Fiorino, 2001). Fiorino described these types of learning based on Glasbergen’s study as follows:

“Technical learning consists of a search for new policy instruments in the context of fixed policy objectives. Change occurs without fundamental discussion of objectives or basic strategies. Policy makers respond to demands for change with "more of the same" kinds of solutions that they adopted in first responding to environmental problems: more regulation, oversight, and enforcement” (Fiorino, 2001, p. 324).

“Conceptual learning is a process of redefining policy goals and adjusting problem definitions and strategies. Policy objectives are debated, perspectives on issues change, strategies are reformulated. New concepts (pollution prevention, ecological modernization, sustainability) enter the lexicon” (Fiorino, 2001, p. 324)

“Social learning focuses on interactions and communications among actors. It builds on the cognitive capacities of technical learning and the rethinking of objectives and strategies that occurs in conceptual learning, but it emphasizes relations among actors and the quality of the dialogue” (Fiorino, 2001, p. 324).

Glasbergen and Fiorino’s categorization is similar to May’s categorization to some extent (See Table 1). Technical learning in the Glasbergen and Fiorino’s categorization seems to be almost corresponding to instrumental learning in May’s categorization. Both social policy learning in the Glasbergen and Fiorino’s categorization and conceptual learning in May’s categorization include a redefinition (reaffirmation) of policy problems and goals. Although political learning in May’s categorization focuses on the effectiveness of the advocacy while social learning in Glasbergen and Fiorino’s categorization focuses on broadly interactions among actors, both learnings are about communication and not about contents of policy itself. In fact, Hall reviewed the categorizations of policy learning in existing literature and summarized into three types of learning: instrumental or technical learning, conceptual or social learning, and political learning (C. M. Hall, 2011). One difference between the categorization of Glasbergen and Fiorino and the categorization of May is that the categorization by Glasbergen and Fiorino are developmental; conceptual learning is based on technical learning, and social learning is based on both technical learning and conceptual learning. Although both categorization could work for this study, I applied the Glasbergen and Fiorino’s categorization because (1) it was developed in the context of environmental policy (Glasbergen, 1996) and applied to U.S. environmental policy in the existing literature (Fiorino, 2001), and (2) its developmental feature is suitable for the analysis of chronological changes of the policy.

Author	Instrumental/Technical Learning	Social/Conceptual Learning	Political/Social Learning	Evolving
May (1992)	Instrumental Policy Learning: "Instrumental policy learning entails new understandings about the viability of policy interventions or implementation designs. The foci are policy instruments that form the basic building blocks of policy and implementation designs" (p. 335)	Social Policy Learning: "Social policy learning entails a new reaffirmed social construction of a policy by the policy elites of a given domain. The foci are the policy problem itself, the scope of policy, or policy goals" (p.337)	Political Learning: "Political learning entails policy advocates learning about strategies for advocating policy ideas or drawing attention to policy problems. The foci are judgements about the political feasibility of policy proposals and understandings of the policy process within a given policy domain" (p. 339)	No
	Technical Learning: "Technical learning consists of a search for new policy instruments in the context of fixed policy objectives. Change occurs without fundamental discussion of objectives or basic strategies. Policy makers respond to demands for change with "more of the same" kinds of solutions that they adopted in first responding to environmental problems: more regulation, oversight, and enforcement" (p. 324)	Conceptual Learning: "Conceptual learning is a process of redefining policy goals and adjusting problem definitions and strategies. Policy objectives are debated, perspectives on issues change, strategies are reformulated. New concepts (pollution prevention, ecological modernization, sustainability) enter the lexicon" (p. 324)	Social Learning: "Social learning focuses on interactions and communications among actors. It builds on the cognitive capacities of technical learning and the rethinking of objectives and strategies that occurs in conceptual learning, but it emphasizes relations among actors and the quality of the dialogue" (p. 324)	Yes

Table 1 Comparison of the categorization of policy learning

In the previous section, I explained two changes of wetland mitigation policy: the introduction of the banking system and the adoption of the concept of (ecosystem) services. How can these two changes be explained from the perspectives of policy learning? Which type of learning can explain the policy changes? The banking system is a market-based instrument which aims at the win-win relationship between environmental conservation and economic development. The banking system introduced the new perspective (monetary evaluation of wetlands) into the wetland mitigation policy. Technical learning is learning with incremental changes in solutions ("more of the same" kinds of solutions) without major changes of policy objectives and strategies. In the wetland mitigation context, alteration of the mitigation ratio can be an example. The introduction of the banking system includes the major shift of the strategy

(from the top-down command and control approach to the market-based approach), it cannot be considered as a “more of the same” kind of solution. In addition, according to Fiorino, “part of technical learning is the assumption that economic and environmental goals conflict” (Fiorino, 2001, p. 325). This characteristic contradicts the concept of the “win-win” relationship promoted by the market-based approach.

Conceptual learning consists of the redefinition of policy goals and problems and the introduction of new perspectives and concepts. In the process of conceptual learning, policy makers become more interested in alternatives to direct regulation (command and control) (Fiorino, 2001). The banking system was introduced with the new concept “market-based approach” to address the problem of “inefficient administration” in addition to the ecological difficulty. In fact, Fiorino raised the introduction of “market instruments” as a good example of conceptual learning (Fiorino, 2001). Although the banking system requires more communication and organization due to its structure, the system does not necessarily emphasize the communication among stakeholders. Therefore, conceptual learning is the most suitable type of learning to explain the introduction of the banking system.

The introduction of the concept of services into wetland mitigation policy potentially addresses the “unequal redistribution” of ecosystem services provided by wetlands. Although the introduction of the concept of services has not changed the basic structure of the policy instrument, inclusion of the concept of services itself can be considered as an alteration of policy goals (from restoration and protection of the functions of wetlands to restoration and protection of the functions and “services”). In addition to the alteration of the policy goal, the “unequal redistribution” of services altered the problem perspectives, which now includes social impacts in addition to ecological impacts. These alterations of the policy goals and perspectives on policy problems can be considered indicators of conceptual learning. Although the concept of services also introduced new stakeholders (residents living in the vicinity of wetlands and development sites), it has not changed the communication structure within the wetland mitigation policy. Thus, introduction of the concept of (ecosystem) services cannot be considered social learning, and conceptual learning is also the most suitable to explain this change.

In this section, I reviewed the policy learning framework of Fiorino to explain the two changes of wetland mitigation policy and examined which type of policy learning could explain these policy changes. The prima facie evidences suggested that both policy changes can be considered as consequences of conceptual learning. However, this evidence is only suggestive and not direct proof. To alledge that two conceptual learnings have happened, evaluation with some indicators is required. By evaluating with the indicators, it is also possible to depict these longitudinal, conceptual, and perspective shifts of the policy. In the next section, I introduce the concepts of effectiveness, efficiency, and equity as indicators of changes of policy goals, problems, and strategies and develop a hypothetical model to explain the longitudinal changes of the policy foci of wetland mitigation policy in the United States.

4 Effectiveness, Efficiency, and Equity and a Hypothetical Model

Effectiveness and efficiency are traditional indicators for policy evaluation. Nagel (1986) defined effectiveness as “the extent to which the policies are achieving the benefits they are supposed to achieve plus any unanticipated side benefits,” efficiency as “the extent to which they are keeping costs down, especially monetary costs, as indicated by either total costs or a ratio that involves both benefits and costs” (Nagel, 1986, p. 99). Equity is a relatively new criteria compared to effectiveness and efficiency. The Standing Panel on Social Equity in Governance defined (Social) equity as follows:

“the fair, just and equitable management of all institutions serving the public directly or by contract; the fair, just and equitable distribution of public services and implementation of public policy; and the commitment to promote fairness, justice, and equity in the formation of public policy” (The Standing Panel on Social Equity in Governance, n.d.).

Given these definitions, policy approaches to wetland mitigation so far can be classified as follows.

The purpose of Clean Water Act 1972 is “restoration and maintenance of the chemical, physical and biological integrity of Nation’s water” (Section 101 (a) of the CWA), and the goal of wetland mitigation is No-Net-Loss of wetland acreage and function. Since the mitigation hierarchy (avoidance, minimization, and mitigation) and categorization and prioritization of location (on-site, off-site) and similarity of functions (in-kind, out-of-kind) were set to achieve these goals, these can be considered approaches to improve “effectiveness” by addressing ecological issues (such as uncertainty). The banking system has addressed ecological issues by securing adequate area, improving expertise, and ensuring the fund and reducing time lag. In addition, the banking system has addressed administrative and economic issues by reducing the cost of monitoring, taking advantage of the economy of scale, and reducing the time required to get a permit. Thus, the banking system can be considered an approach to improve “efficiency” and at the same time as “effectiveness.” At this point, it seems as though conceptual learning brought “efficiency” into policy perspectives. Banking, yet, has some disadvantages relating to securing on-site wetland functions and services, which led to “unequal” redistribution of ecosystem services. Finally, the introduction of the concept of services into the final regulation can be considered a policy approach to improve social “equity” by addressing unequal redistribution of services, which was also brought by conceptual learning.

Given the longitudinal order and mutual effects of these approaches and issues, the changes of the policy foci (including changes of policy goals, problem definitions, and strategies) led by the conceptual learning can be summarized in Figure 1. First, policy focused on ecological effectiveness, and then the policy began to recognize administrative and economic inefficiency. Then, the banking system (market-based concept) was introduced to address these administrative and economic inefficiencies in addition to ecological issues. At the same time, however, the banking system fosters the unequal distribution of services. Finally, the concept of services was introduced by the final regulation in 2008 to address the human benefits including social equity. In short, as a consequence of two conceptual learnings, the policy foci of wetland mitigation policy seem to be changed from ecological effectiveness to administrative/market efficiency, and efficiency to social equity. Since the figure is expressed in a relative scale, downward trends do not necessarily mean decreasing in an absolute scale. For example, a downward trend of ecological effectiveness before 1995 does not mean people cared less about ecological effectiveness. The trend explains that the attention to ecological effectiveness became smaller “relative to” market efficiency due to increasing attention to market/administrative efficiency. Also, changes of foci start a little before the formal introduction of new concepts since people discussed issues in informal and less critical ways before the critical changes finally occurred in public documents.

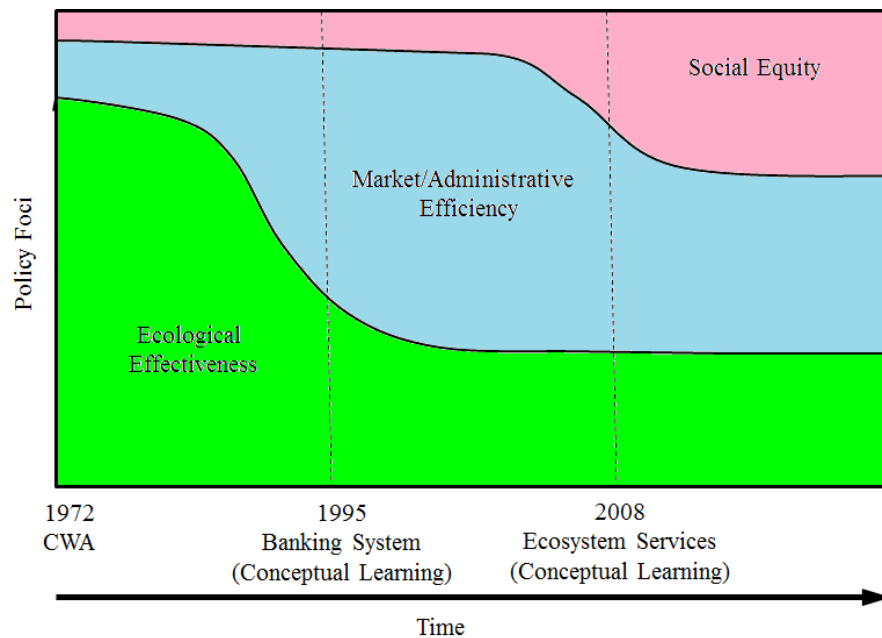


Figure 1 Chronological shift of policy approaches and issues in wetland mitigation policy

This framework is based on two hypotheses;

H₁: Policy foci (perspectives) have shifted from ecological effectiveness to market/administrative efficiency, and from market/administrative efficiency to social equity.

H₂: Policy (conceptual) learnings (based on Fiorino's theory) reflected the shifts in H₁.

To test this hypothesis, I conducted a content analysis with governmental documents about the wetland mitigation policy in the United States and evaluated how language in the documents changed overtime using effectiveness, efficiency, and equity as indicators. In addition, the content analysis provided additional explanation about “how much” and “how fast” policy foci have been changed.

5 Methods

5.1 Content analysis

Content analysis is a research method used to evaluate and summarize the contents of messages and documents by counting various dimensions. Neuendorf defined content analysis as follows:

“Content analysis is a summarizing, quantitative analysis of messages that relies on the scientific method (including attention to objectivity-intersubjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented” (Neuendorf, 2001, p. 10).

Content analysis can be applied to any document and message in society, and is therefore found in many fields of social science such as journalism, communication, sociology, psychology, business, as well as applied to environmental fields. In environmental fields, content analysis is frequently used for the analysis of information disclosures including reporting of environmental companies (Buhr & Freedman, 2001; Clarkson, Li, Richardson, & Vasvari, 2008; Guthrie & Abeysekera, 2006; Milne & Adler, 1999). Other types of environmental research with content analysis include, media analysis about environmental issues, and evaluation of topics or concepts in environmental journals (Antrop, 2001; Bengston, Fan, & Celarier, 1999).

Several researchers have identified and classified types of content analysis. For example, Janis classified content analysis into three categories: (1) Pragmatical content analysis, (2) Semantical content analysis, and (3) Sign-vehicle analysis (Janis, 1965). As elaborated by Krippendorff (1980), pragmatical content analysis classifies signs according to their probable causes or effects; semantical content analysis classifies signs according to their meanings. Krippendorff (1980) classified semantical content analysis further into three subcategories: (a) designations analysis, (b) attribution analysis, and (c) assertions analysis. Designations analysis “provides the frequency with which certain objects (persons, things, groups or concepts) are referred to, that is, roughly-speaking subject-matter analysis” (Krippendorff, 1980, p. 33). Attribution analysis “provides the frequency with which certain objects characterizations are referred to” (Krippendorff, 1980, p. 33). Assertions analysis “provides the frequency with which certain characterized in a particular way, that is, roughly speaking, thematic analysis” (Krippendorff, 1980, p. 33).

Content analysis has some advantages compared to other research methods in social science. Robson (2011) pointed out three advantages. First, content analysis is “unobtrusive.” Thus, a researcher does not affect the data. Second, the data are in permanent form and thus can be re-analyzed (reliability checks and replication studies are possible). Third, content analysis can provide a low-cost form of longitudinal analysis. In addition to Robson’s points, the summarizing (simplifying) feature can be considered an advantage. For example, although many historians attempt to report all details across a variety of units based on available data, researchers using content analysis summarize information for only a chosen unit of data and try to detect trends of data (Neuendorf, 2001). In short, content analysis is an appropriate method to summarize, detect, and evaluate trends in documents in a relatively objective manner, especially for a longitudinal analysis with a large amount of data. In this study a content analysis was used to evaluate longitudinal trends of language use in governmental documents related to wetland mitigation policy and to test the hypothetical framework developed in the previous section.

5.2 Dataset

The dataset for this analysis is public documents related to wetland mitigation policy based on the Clean Water Act of 1972. There are several selection criteria for the documents. First, since this study only addresses federal level policy changes, documents selected must be prepared by federal agencies (such as the EPA or the Corps) including Presidential Orders. Second, although federal agencies have published many documents related to wetland mitigation policy, only formal documents (such as Federal Registers, Memorandums of Agreement, or Regulatory Guidance Letters) are selected, and other miscellaneous documents (such as fact sheets or brochures) are excluded. The Code of Federal Regulations (CFR) was excluded because the federal government publishes Federal Registers which include revised and established parts of the CFR; therefore, it would risk being redundant. Third, the dataset includes documents only published from 1972 (the year Section 404 of CWA was established) to 2014. Finally, to exclude the documents which are not related to wetland mitigation, only documents that include the words “mitigate” (including “mitigate,” “mitigated,” “mitigating,” and “mitigation”) or “compensate” (including “compensate,” “compensated,” “compensating,” and “compensation”) are selected. The documents were also reviewed to exclude the documents which incidentally

include the word “mitigate” or “compensate” for reasons that are not related to wetland mitigation policy. For example, the documents which include the word “compensation” only in “the Comprehensive Environmental Response, Compensation and Liability Act” (so called Superfund), are excluded. The majority of documents are collected through websites of the EPA, the Corps, US Government Printing Office, and LexisNexis. For the list of the selected documents, see Appendix 1.

5.3 Process of the content analysis

The purpose of this analysis is to test the hypothetical framework developed in the previous section. This framework examines two hypotheses:

H₁: Policy foci (perspectives) have shifted from ecological effectiveness to market/administrative efficiency, and from market/administrative efficiency to social equity.

H₂: Policy (conceptual) learnings (based on Fiorino’s theory) reflected the shifts in H₁.

To test hypothesis 1, the words which represent ecological effectiveness, market/administrative efficiency, and social equity in the public documents were counted and the ratio of the words in documents were assessed for possible changes over time. For this analysis, the units of analysis are words, and the variables are ratio of words that represent ecological effectiveness, market/administrative efficiency, and social equity in the public documents, and time (year).

There are two phases to this project: Phase 1 is to use six core policy documents to develop a key word coding schema to assess the hypotheses; Phase 2 will be the application of the coding schema to wetland mitigation policy documents (N=58).

Phase 1 (Development of the coding schema). The most difficult task for this analysis was the selection of words to count which represent ecological effectiveness, market/administrative efficiency, and social equity. The first step in this process was to select six documents which are critical for wetland mitigation and cover the entire time period. The six documents include: two federal registers about section 404(b)(1) guidelines (in 1975, 1980) which are the most important public documents for wetland mitigation; two memorandums which provide detailed directions for policy implementation (in 1990 and 1995); one Regulatory Guidance Letter which provides

guidelines for considerations about wetland mitigation in the procedure of permits from the Corps; and Subpart (J) of 40 CFR 230 added by a Federal Register in 2008 which is about Section 404(b)(1) guidelines. See Table 2 for the detailed description of selected documents and reasons for selection. These six documents will serve as the baseline documents within which key words will ultimately be identified and used to assess the remainder of the government documents.

The second step in the process of determining key words for the content analysis was to identify the parameters to measure ecological effectiveness, market/administrative efficiency, and social equity. In the context of wetland mitigation policy in the United States, effectiveness refers to how far a policy has protected or restored wetland acreage and function. Thus, the parameters to measure the ecological effectiveness are ecological functions and acreage of wetlands. Market and administrative efficiency refer to how much cost (including time consumption) a policy requires to protect or restore wetland functions and acreage. Although ecological functions and acreage are also parameters of efficiency, the unique parameter for efficiency is financial cost. Social equity refers to the fair distribution of ecosystem services from wetlands functions which provide benefits for human population (society), such as flood control, recreational opportunities, educational opportunities, and scenic values. Thus, the parameters of social equity are (ecosystem) services (benefits for human population) and fairness of distribution of benefits.

Once the parameters of the concepts were identified, the six government documents listed in Table 2 were examined to elicit keys words that reflect the parameters. Table 3 illustrates this preliminary review process. In column one, the three categories are identified; in column two, the operationalization of the categories (in the form of parameters) are listed; and finally, in column three are the selected words (variables) that were identified in the six government documents to be used in subsequent analyses.

To improve the reliability of the words selected as variables for the content analysis, one other researcher was asked to conduct the same word selection process and results were compared. The selection of words was discussed and refined with the other researcher until there was full agreement.

Phase 2 (Application of the coding schema). Once the key words were determined in Phase 1, the number of each word in every document of the dataset (N=58, described above) was counted using the word search function of Microsoft Word and Adobe Reader. To confirm that the key words were used in the appropriate context, for some words which have broader meaning, the context of the word use was reviewed for the first 10 uses of the word, and subsequently every 10th time the word is found (see Table 3). The word in the inappropriate context was excluded from the count, and before and after 10 uses of the word were reviewed in case the word in the inappropriate context was found. The number of words were summed with respect to each category (ecological effectiveness, market/administrative efficiency, and social equity were determined) to calculate the total number of words for each category in a document. Then, the total number of words for each category was summed by year to calculate the total number of words for each category for each year. The yearly total number of words for each category was divided by the total number of whole words of documents in each year to calculate the ratio of the words which represent each category for each year. The longitudinal shift of policy foci was analyzed based on the change of the calculated yearly ratio of words used. Every seven years ratio of words used was also calculated to moderate the annual fluctuation caused by smallness of the sample size in each year and see generalized trends. In addition, the longitudinal shifts of the ratio of parameters for each category were compared with the category to see what parameters affect the changes of the category.

To test hypothesis 2, the introduction of new concepts into the lexicon of wetland mitigation policy and its influence on the ration of words representing efficiency and equity were evaluated to see whether policy learning happened or not. Recall from the literature review, that policy learning refers to the conceptual learning which is a process of redefining policy goals and adjusting problem definitions and strategies. According to Fiorino (2001), new concepts enter the lexicon when conceptual learning occurs. Although there are additional indicators to indicate conceptual learning (such as adjustment of problem definition or changes of perspectives on issues), the introduction of new concepts into the lexicon was evaluated since it is practical and easy to evaluate with content analysis. The banking system and ecosystem services can be considered as new concepts which entered into the lexicon of wetland mitigation policy in its history. Thus, the ratio of the words “bank” (including banks and banking), or “services” in the

public documents were chosen from the same dataset and evaluated overtime. Since “bank” and “services” are relatively general words, the context which these words are used were checked in the same way as before. Then, the ratio of the words “bank” and the words representing efficiency, and the ratio of “services” and the words representing equity were compared.

Table 2 Public documents for the word selection

Year	Documents	Descriptions	Reason for selection
1975	40 FR 41292	A federal register which published the first EPA 404(b)(1) Guidelines	The EPA 404(b)(1) Guidelines is official regulation speculated in CWA and the most influential documents regarding wetland mitigation under CWA.
1980	45 FR 85336	A federal register which provided the significant revision of EPA 404(b)(1) Guidelines	CWA was significantly amended in 1977 and this revision reflected the amendment of CWA.
1990	MOA The determination of mitigation under CWA section 404(b)(1) Guidelines	The detailed explication of the procedure and the determination of wetland mitigation under the 404(b)(1) Guidelines	This memorandum is the first public document clearly shows the mitigation hierarchy and the preference on on-site, in-kind mitigation.
1995	Memorandum to the field (banking guidance)	Policy guidance for the establishment, use and operation of mitigation banks	This memorandum provided the official guideline for the operation of mitigation banks.
2002	RGL Guidance on compensation mitigation under section 404 of CWA and section 10 of RHA	Regulatory Guidance Letter from Corps to provide the direction for the permit procedure concerning about wetland mitigation.	This guidance letter provides the guideline for considerations about wetland mitigation based on the influential report from National Research Council (2001)
2008	40 CFR 230 Subpart J (a part of 73 FR 19687)	The Subpart of 40 CFR 230 which addresses standards and criteria for the use of variety types of wetland mitigation added by a Federal Register in 2008 (73 FR 19687)	This subpart was added to improve clarity of the use of variety tyoes of wetland mitigation and introduced the concept of ecosystem services.

Table 3 Word selection for each concept

Category	Parameters	Selected words* ¹
Ecological Effectiveness	Wetland functions (and its indicators)	chemical, biological, ecological, hydr* ² , function* ³ , habitat, biodiversity, spawn, breed
	Wetland area	acre
Market/Administrative Efficiency	Market cost	econom, cost, market, price, purchase, financ, invest* ⁴ , fund* ⁵ , sponsor, credit, debit, expense, fee* ⁶ , bank* ³
	Administrative cost	compliance, evaluation, monitor, practicable
Distributional/Social Equity	Services (benefits for human population)	aesthetic, education, health* ³ , welfare, water use* ⁷ , recreation, human, fishing, hunting, water right, services, flood, storm
	Fairness of distribution	distribution* ³ , public* ⁸ , hearing

*1 Each word includes its variation and plural forms.

*2 "hydropower" was omitted.

*3 Contexts of words were checked.

*4 "investigat" was omitted.

*5 "fundamental" was omitted.

*6 "feet," "feel" and "feed" were omitted.

*7 Two words (such as water use) were counted as one word.

*8 "publication" was omitted.

6 Results

In terms of hypothesis 1, the words representing efficiency appear frequently from the mid-1990s to 2000s as the hypothesis suggested, although the ratio of the words representing equity did not illustrate the change as hypothesized (see Figure 1 and 2). Figure 3, 4, 5, 6, 7 and 8 show the longitudinal changes of the ratio of the words about parameters for effectiveness, efficiency, and equity. To illustrate the detailed fluctuation and more general trend, the result were evaluated annually and also every seven years which is long enough to moderate the annual fluctuation. The last term includes eight years (07-14) since data contains 43 years and it cannot be divided by seven. No public documents about wetland mitigation policy were found in 1973, 1974, 1976, 1978, 1979, 1981, 1982, 1983, 1985, 1987, 1988, 1997, 2010, and 2011. Therefore values for these years were simply omitted.

Figure 4, 5, 6, 7, 8 and 9 compared the trends of the ratio of words for indicators (effectiveness, efficiency, and equity) and their parameters to see which parameters contribute to the trends. In terms of effectiveness, the longitudinal trend of the ratio of words for effectiveness clearly reflects the trend of the ratio of words for functions (Figure 4 and 5). Regarding efficiency, the trend of efficiency reflects the trend of the ratio of the words about market, and the ratio of the words about the administrative efficiency was stable (Figure 6 and 7). The parameters for equity show an unexpected trend (Figure 8). Until mid-1990s, the trend of the ratio of words representing equity reflects the trend of the ratio of words representing distribution. However, since the mid-1990s, the trend of equity reflects the trend of the ratio of words representing services. In fact, the ratio of the words representing services shows the increasing trend, although the overall ratio of words representing equity has not been increasing. On the other hand, the ratio of the words representing distribution shows the decreasing trend overtime.

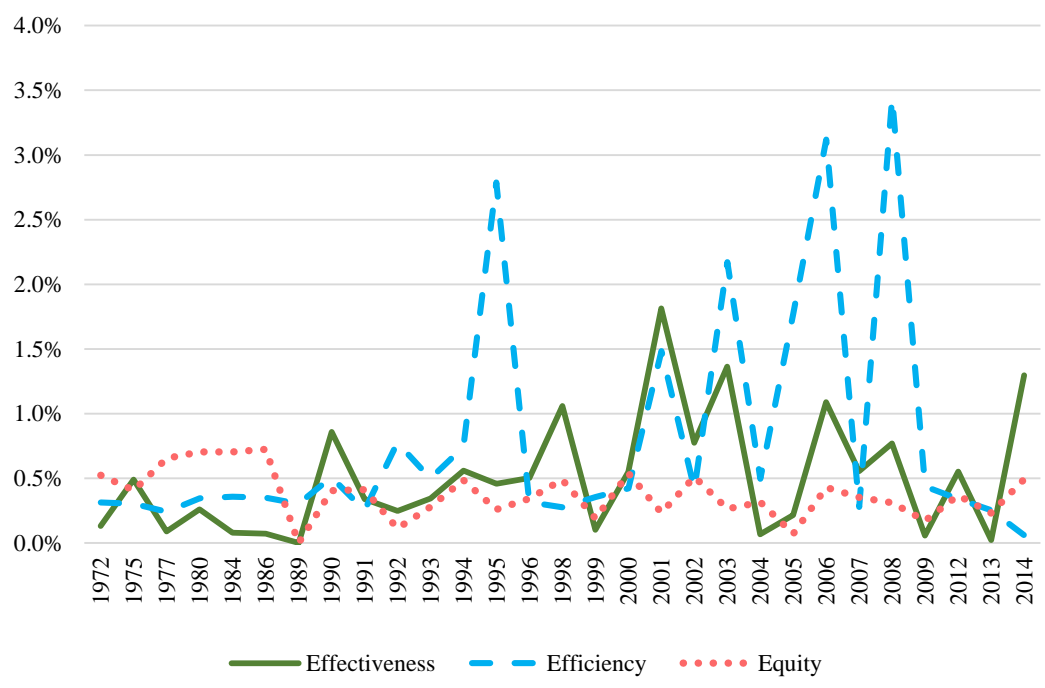


Figure 2 Longitudinal shifts of the ratio of words representing effectiveness, efficiency, and equity in the public documents about wetland mitigation (annual)

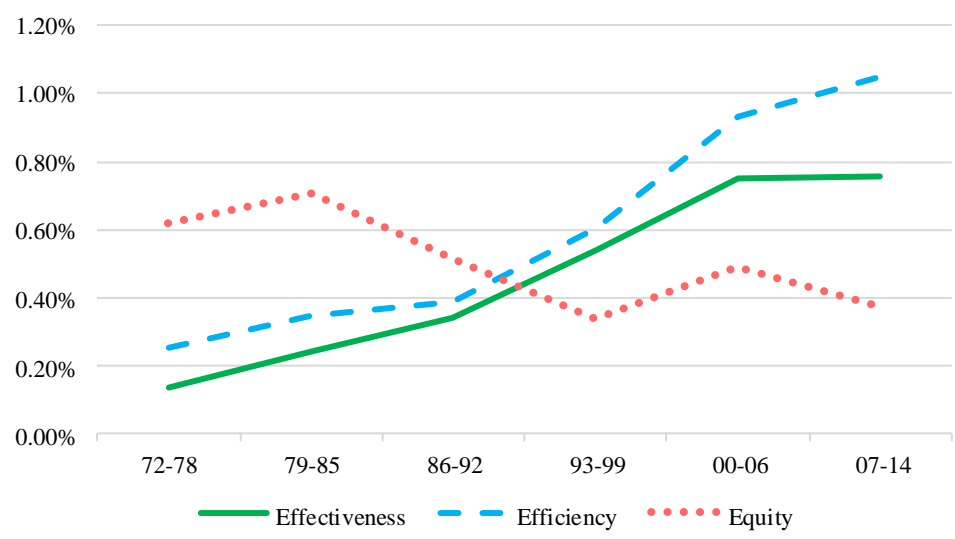


Figure 3 Longitudinal shifts of the ratio of words representing effectiveness, efficiency, and equity in the public documents about wetland mitigation (every seven years)

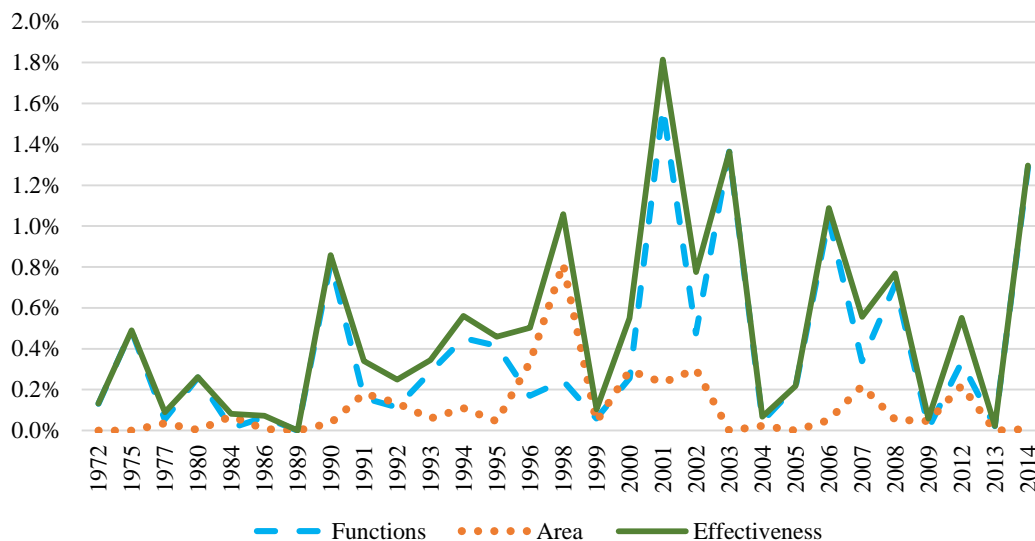


Figure 4 Longitudinal shifts of the ratio of words representing wetland functions, wetland area, and effectiveness in the public documents about wetland mitigation (annual)

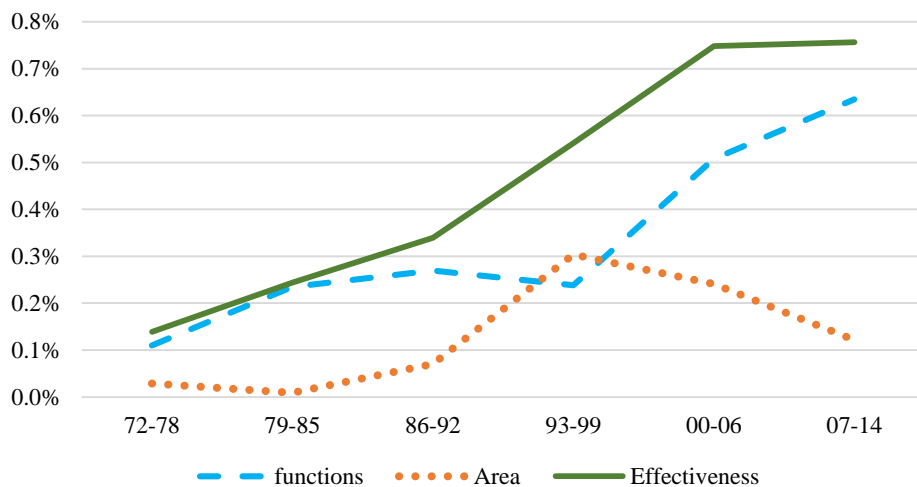


Figure 5 Longitudinal shifts of the ratio of words representing wetland functions, wetland area, and effectiveness in the public documents about wetland mitigation (every seven years)

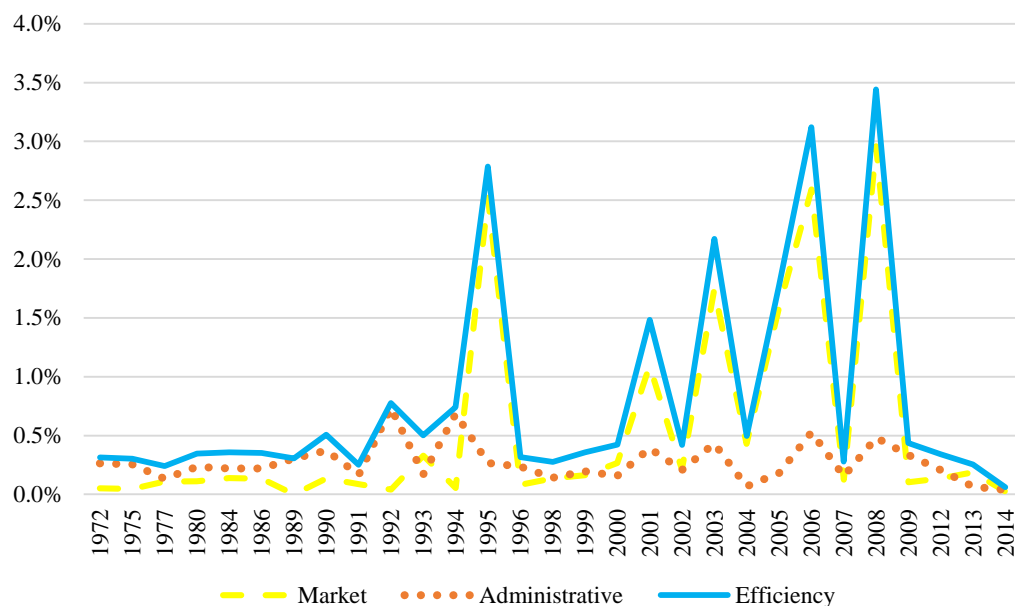


Figure 6 Longitudinal shifts of the ratio of words representing market, administrative efficiency, and overall efficiency in the public documents about wetland mitigation (annual)

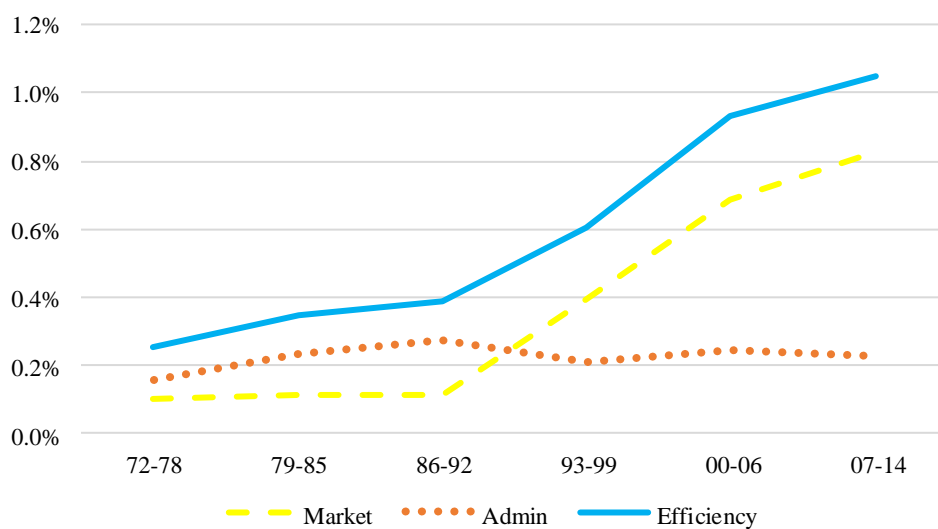


Figure 7 Longitudinal shifts of the ratio of words representing market, administrative efficiency, and efficiency in the public documents about wetland mitigation (every seven years)

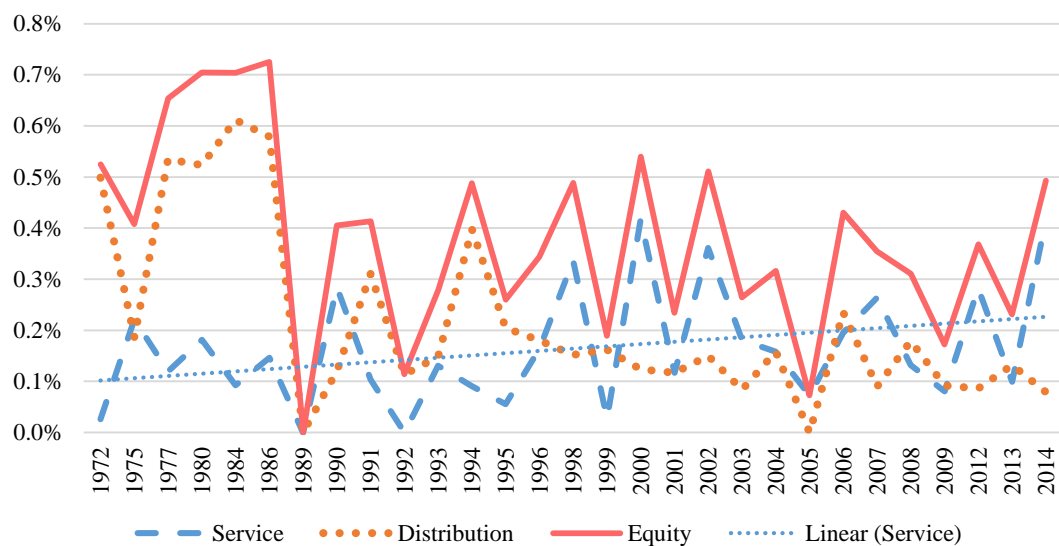


Figure 8 Longitudinal shifts of the ratio of words representing ecosystem services for people, fair distribution, and equity in the public documents about wetland mitigation (annual)

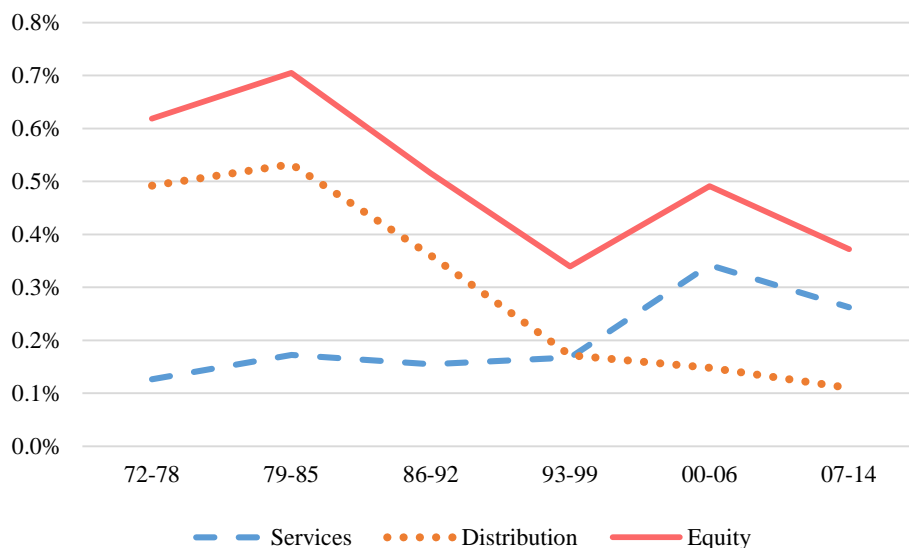


Figure 9 Longitudinal shifts of the ratio of words representing ecosystem services for people, fair distribution, and equity in the public documents about wetland mitigation (every seven years)

To compare the results to the hypothetical framework (Figure 1), the results are expressed as 100% stacked area charts, which show the percentage each concept contributes to the total across time. Figure 10 shows annual changes of the ratio of words representing effectiveness,

efficiency, and equity. Although it is possible to see the trends that the ratio of words representing effectiveness and efficiency has been increasing, it is difficult to tell the general trend due to the volatility of the annual values. Figure 11 shows the hypothetical framework and the changes of the ratio of words representing effectiveness, efficiency, and equity every seven years except 2007 to 2014 which is eight years. According to Figure 11, the ratio of words representing effectiveness and efficiency seems to have increasing trends and the ratio of words representing equity seems to have the decreasing trend. These trends are different from the trends in the hypothesis. These trends are also represented in Figure 12 which is a stacked area chart (not 100%). As general trends, the ratio of words representing effectiveness shows the constant increase and the ratio of words representing efficiency has increased since 1990s. The ratio of words representing equity had decreased until 1990s and then became static. In summary, the evaluation did not show the shifts of policy foci from effectiveness to efficiency and efficiency to equity and failed to support hypothesis 1, although the policy has focused on efficiency more as the hypothesis expected.

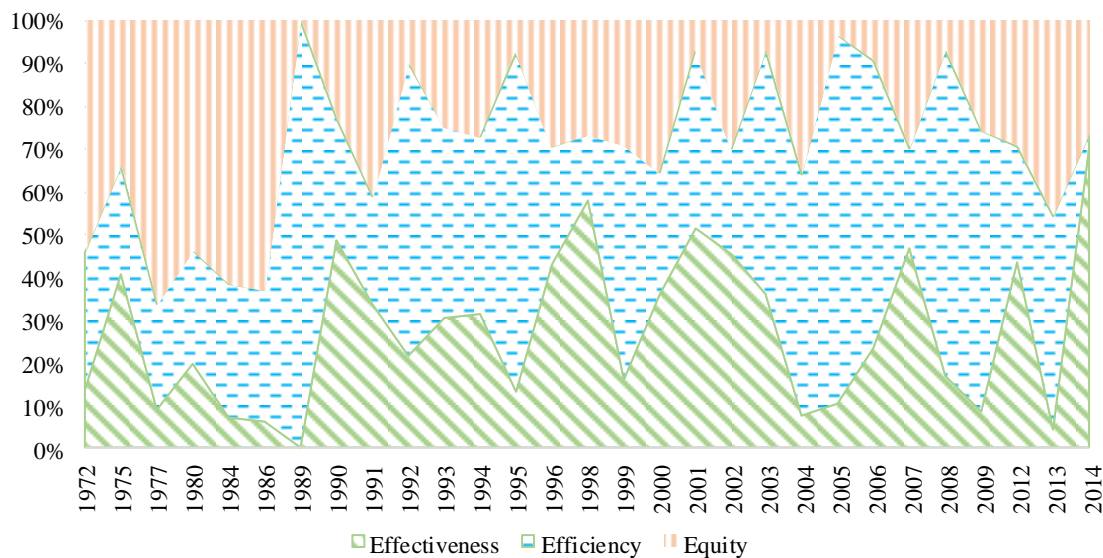


Figure 10 Longitudinal shifts of the ratio of words representing effectiveness, efficiency, and equity in the public documents about wetland mitigation (100% stacked area chart)

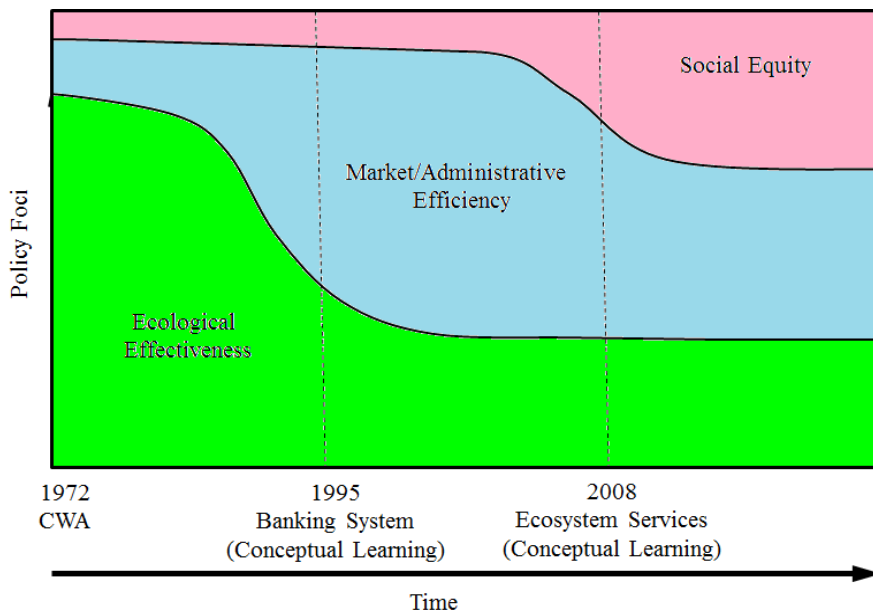
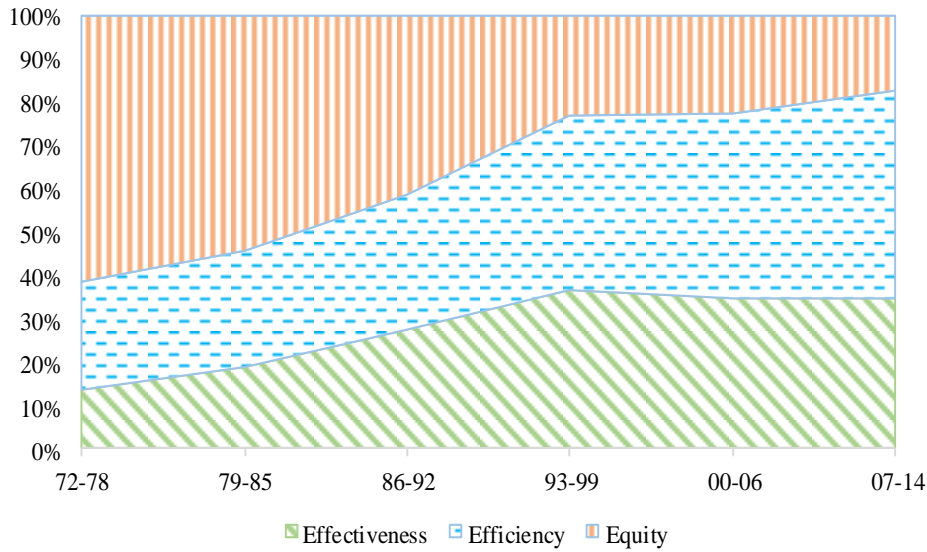


Figure 11 The hypothetical framework and longitudinal shifts of the ratio of words representing effectiveness, efficiency, and equity in the public documents about wetland mitigation every seven years (except 07-14) (100% stacked area chart)

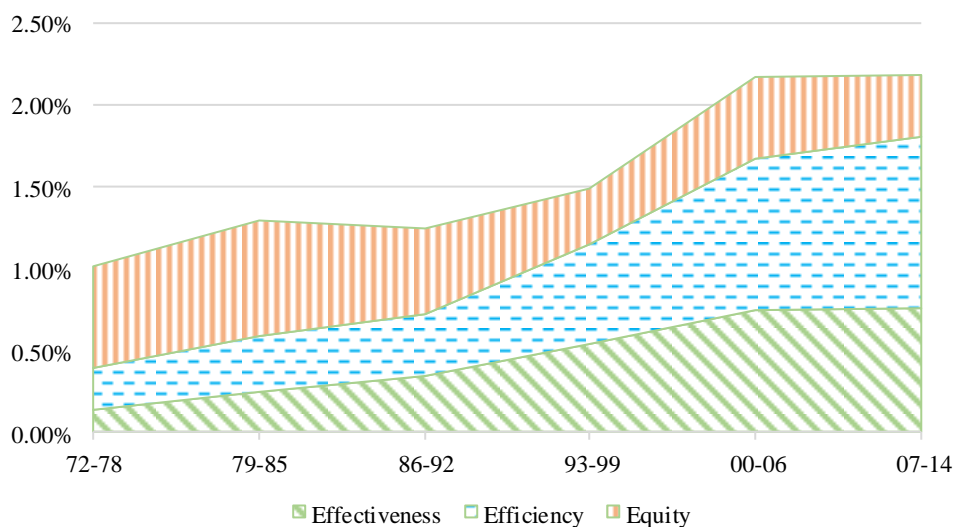


Figure 12 Longitudinal shifts of the ratio of words representing effectiveness, efficiency, and equity in the public documents about wetland mitigation every seven years (except 07-14) (stacked area chart)

In terms of hypothesis 2, the entrance of words “bank” and “services” into the lexicon and its relation with the shifts of policy foci were evaluated. Figure 13 shows the longitudinal changes of the ratio of words “bank” and “services.” The mitigation “bank” and ecosystem “services” respectively entered into the lexicon in 1995 and 2006. Figure 14 shows that longitudinal shift of the ratio of the word “bank” and words representing efficiency. Although there is a gap between the increasing trend of the ratio of the words representing efficiency and the introduction of the word “bank”, the ratio of the words representing efficiency is clearly higher after the introduction of the banking system (1995) compared to the ratio before the introduction. Figure 15 shows that the longitudinal shift of the ratio of the word “services” and words representing equity. There is no clear difference between before the introduction of the concept of ecosystem services (2006) and after the introduction, although it may be too soon to conclude since the introduction of the concept of ecosystem services is relatively recent and it generally takes time to integrate the concept in the regulation (Fiorino, 2001). In summary, the result of the content analysis supported the presumption that the introduction of the banking system led to the shift of policy focus toward efficiency, but it did not support the presumption that the introduction of the concept of ecosystem services led to the shift of policy focus toward equity.

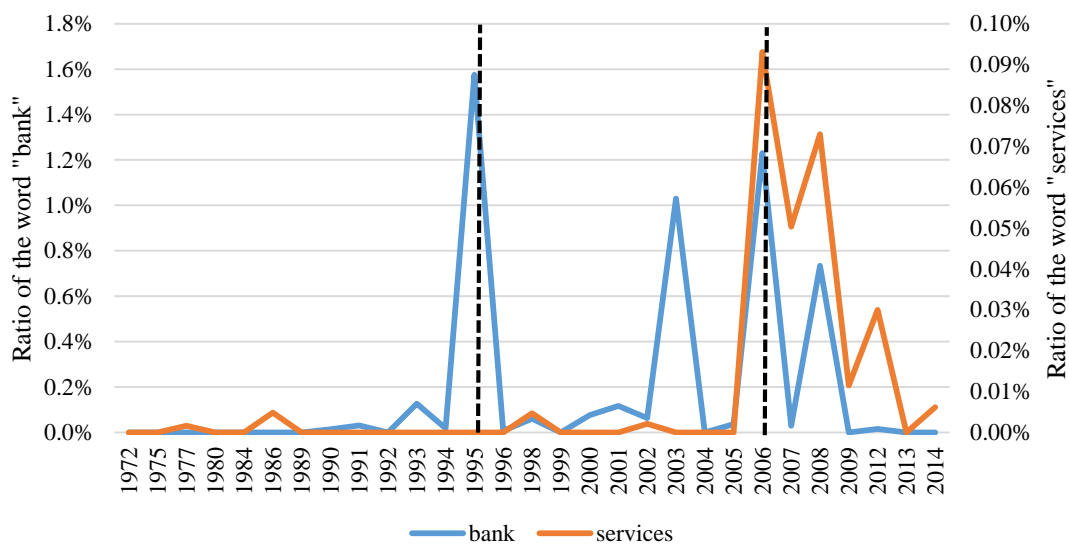


Figure 13 Longitudinal shifts of the ratio of words “bank” and “services” in the public documents about wetland mitigation

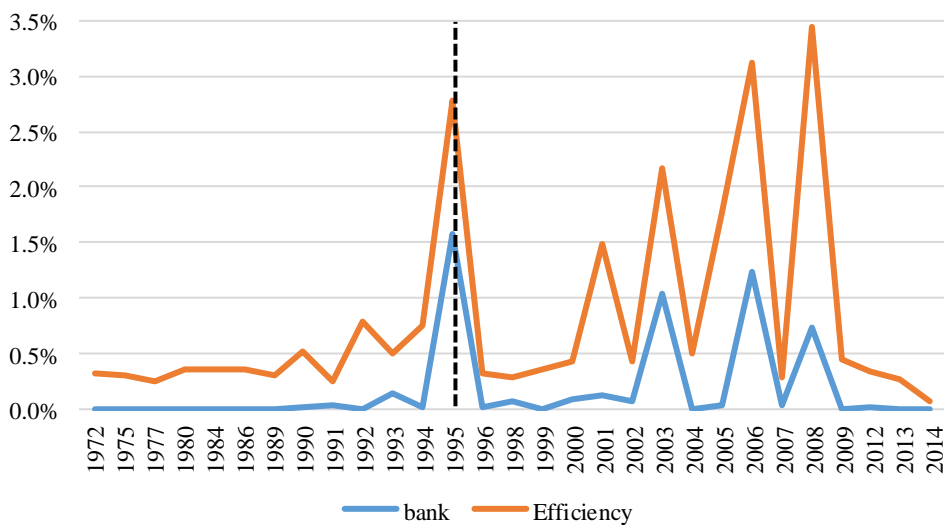


Figure 14 Longitudinal shifts of the ratio of words “bank” and words representing efficiency in the public documents about wetland mitigation

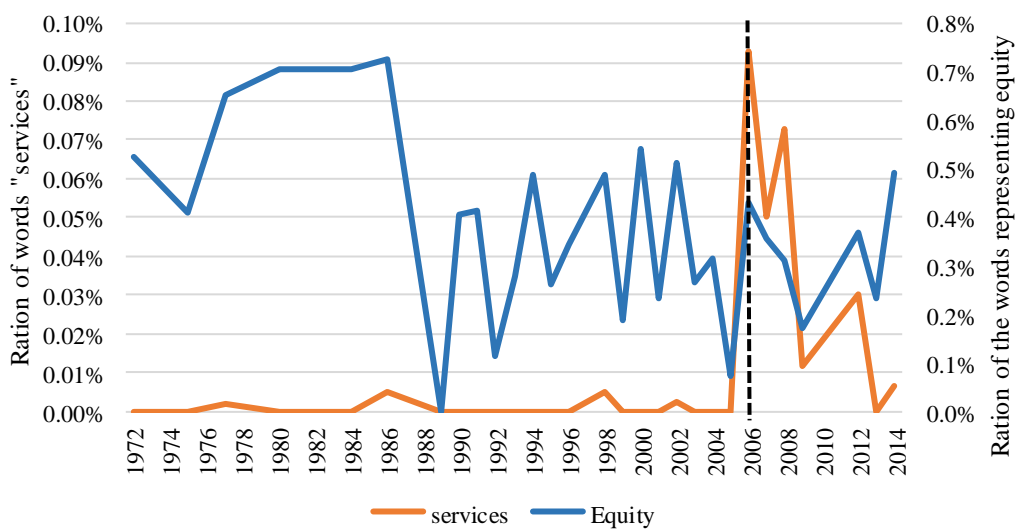


Figure 15 Longitudinal shifts of the ratio of words “services” and words representing equity in the public documents about wetland mitigation

7 Discussion

According to the results of the content analysis, the shift of the policy foci from effectiveness to efficiency and efficiency to equity was not seen. The introduction of the banking system can be considered conceptual learning which brought the shift of policy foci toward efficiency. In terms of the introduction of ecosystem services, it could also be considered conceptual learning since the new word apparently entered into the lexicon. However, the introduction of ecosystem services may not have led the shift of policy foci, at least not in the way the existing literature argues (from efficiency to equity). Given the fact the ratio of the words representing distribution decreased, the introduction of the concept of ecosystem services was not considered the key concept to deal with the unfair redistribution of the wetland services. In fact, the word “distribution” was appeared only a few times with the concept of ‘fair’ in the documents.

This also implies another possibility. This study applied content analysis and evaluated the ratio of the words which represent certain concepts. Some concepts, yet, can be elusive in this method. For example, the unfair redistribution of wetland services is sometimes mentioned with “the migration of wetlands.” Although this represents equity, “migration” is quite often used in different contexts (such as migration of birds) and thus was difficult to count. One way to make the method more robust would be to include “sentences” as a target of content analysis in addition to words to capture the contexts. Still, if the concept was the main topic of the documents, certain words or phrases should have been repeated enough to be chosen as words to count. Therefore, addressing this problem may not change the results significantly.

Another possibility is that the “ratio” may not be an appropriate criterion to evaluate the shift of policy foci. It is possible that the some words are used in a substantively critical manner, but only occur a few times; that is, the ratio does not reflect *how* the words are used. Since major changes of policy generally require a certain amount of discussion, it is possible to avoid this issue as far as appropriate words are selected. Although the ratio of words representing ecosystem services is gradually increasing, policy implementers may have paid more attention to people even though it reflected in the language of fairness since the ratio of words representing fairness of distribution was decreasing. It may also be the case that since it takes time to

integrate new concepts into policy, there is still a possibility that the policy foci will shift toward equity in the near future.

The data selection restrictions used in this analysis may have unduly limited the text available for analysis. In this study, only federal-level formal regulatory documents were examined. The results could have been different if the analysis had included other types of government documents such as state-level documents, or relatively less formal documents (such as minutes of meetings or hearings).

Even after taking into consideration these limitations, the wetland mitigation policy does not appear to exhibit an unfair redistribution of ecosystem services, as the literature suggests, at least it is not evident by the use of “fair distribution” language in the formal documents. An additional consideration for the lack of distributional equity found in this study could be a lack of public knowledge or awareness regarding potential inequities in the distribution of ecosystem services. Therefore, as suggested by policy learning theorists, the next step beyond conceptual learning (the focus of this study) would be to address aspects of social learning, which involves communication among actors. It may be important to make general public acknowledge the issue to make major change of the policy. The process of improving cognition and motivating general public to change policy may be examined and explained with social learning which is about the improvement of communication among actors and the next step of conceptual learning.

There were some trends which the hypothetical model did not predict. One trend was the increasing ratio of words representing ecological functions. One possible explanation of this trend is that the introduction of the mitigation banking system brought more words about effectiveness in addition to the words about efficiency since the banking system also improves effectiveness (at least theoretically). In addition, ecosystem services are significantly related to ecosystem functions which are providers of services and the concept of monetary evaluation of ecosystems. Thus, the introduction of services may have also increased the ratio of words representing ecological effectiveness and market efficiency. In this sense, “services” may not have been a good parameter to measure equity.

Another unexpected trend was the high ratio of the words representing equity in the 1970s and 1980s. This high ratio was the reflection of the high ratio of words representing the

distribution. Since “distribution” was used in the documents only a few times, this high ratio was the reflection of the high ratio of the use of words “public” and “hearing.” Since public hearing or public comments, public review are the fundamental functions of the legislation, these words could be used at the early phase of the policy development. In addition, the United States was amidst the environmental movement in the 1970s and 1980s, and the public had a high level of consciousness about the environment. The 1970s and 1980s were also a developmental phase of environmental justice, and it is easy to imagine that the governmental agencies had to pay attention to public awareness and growing participation in the decision making process.

Although the results did not support the hypothesis based on claims of existing literature, it does not necessarily mean that this research approach was ineffective. Instead, this research demonstrated unseen perspectives of the history of the policy by applying the unique approach: combination of policy learning theory and content analysis. The content analysis allowed the chronological changes of policy to be visualized, and policy learning theory also showed the current stage of the policy in the developmental policy learning process. In this study, I used effectiveness, efficiency, and equity as indicators of policy changes, but other indicators may show different results. In this sense, this approach could have enough flexibility to apply to different policies with different research questions.

8 Conclusions

In this study, I tried to describe the chronological change of wetland mitigation policy theoretically and quantitatively by applying policy learning theory and the content analysis technique. According to Glasbergen and Fiorino's policy learning theory and the results of content analysis, two policy (conceptual) learnings happened in the history of wetland mitigation policy: the introduction of the banking system and the concept of ecosystem services, although the introduction of ecosystem services did not have influences on how the policy addresses distributional equity as I expected. The content analysis also revealed the chronological changes of policy foci including the increasing trend of language use about efficiency (market), and the decreasing trend of language use about equity, which were different from the initial expectation based on the literature review.

This study revealed the lack of the attention to the fair distribution of ecosystem services in wetland mitigation policy, although the concept of ecosystem services was indeed introduced and may remedy the issue of unfair redistribution of ecosystem services in the future. The policy learning theory provides a suggestion for the future direction of the wetland mitigation policy in the United States to deal with the problems which are stubborn even after the conceptual learning. According to Glasbergen (1996) and Fiorino (2001), if problems are stubborn even after the conceptual learning, the next step is social learning which is the learning process through improvements in collaboration and interaction among stakeholders based on improved acknowledgement and understanding of the problems. Thus, it may be a good idea to consider how to improve acknowledgement and understanding of the problems by the general public and improve communication as a strategy to overcome the potential problem of unfair redistribution of services. In fact, the move toward more discussion and collaboration-based approaches, such as the introduction of the watershed approach could be seen as one of the signs of this trend. Although I did not focus on the introduction of the watershed approach in this study, it would be beneficial for future research to consider the introduction of the watershed approach as one of the significant policy changes and evaluate it as social learning.

This study describes a successful wetland mitigation policy development process that can serve as an example to other biodiversity offset policies being developed throughout the world.

It is difficult to offer universal recommendations to other places since policies are highly dependent on local goals and resource limitations; however, experiences from this study offer recommendations for future policy analysis. First, it would be beneficial to extend the study of wetland mitigation policy to include social learning. According to Glasbergen (1996) and Fiorino (2001), following conceptual learning is social learning. The primary focus of the current study was conceptual learning as measured through content analysis of formal documents, thus the social learning process in wetland mitigation policy was not addressed. To analyze social learning using content analysis, data could be drawn from interview research or minutes of committee meetings, in addition to formal documents since social learning is about communication among actors.

A second recommendation for future policy analysis would be to include control variables, such as the Environmental Policy Administration budget, ruling party, or other precipitating external events. Additionally, statistical analyses, including correlational analyses of policy learning would be useful to examine trends for statistical significance to complement the substantive analyses conducted in this project. Finally, the chronological shifts of the other biodiversity offset policies occurring around the world can be evaluated to assess which policy learning stage they are in, what they are (are not) focusing on, and how these focuses have changed. Such comparisons may be particularly important to advocates of ecological and social equity.

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Appendix 1. Dataset for the content analysis

No	Name	Year	Number of words	Category	Agency
1	Section 404 of Clean Water Act	1972	3811	Law	EPA
2	40 CFR 230 40 FR 41292 Sep 5	1975	8578	FR	EPA
3	33 CFR 320 42 FR 37122 Jul 19	1977	60391	FR	Corps
4	40 CFR 230 45 FR 85336 Dec 24	1980	23474	FR	EPA
5	33 CFR 320 325 330 45 FR 62732 Sep 19	1980	55991	FR	Corps
6	33 CFR 320 325 330 49 FR 39478 Oct 5	1984	8079	FR	Corps
7	Permitting Activities Associated with Corps Planning and O&M Projects	1984	584	RGL	Corps
8	33 CFR 320 325 330 51 FR 41206 Nov 13	1986	61638	FR	Corps
9	40 CFR 233 53 FR 20764 Jun 6	1988	25689	FR	EPA
10	33 CFR 325 53 FR 3120 Feb 3	1988	20965	FR	Corps
11	Federal Enforcement for Section 404 program of the CWA	1989	1970	MOA	EPA/Corps
12	33 CFR 325 55 FR 27000 Jun 29	1990	8692	FR	Corps
13	Water Quality Standard	1990	16567	Guidance	EPA
14	Wetlands & Non-point Source Guidance	1990	6989	Guidance	EPA
15	The Determination of Mitigation under the Clean Water Act Section 404(b)(1) Guidelines	1990	2573	MOA	EPA/Corps
16	33 CFR 330 56 FR 14617 Apr 10	1991	388	FR	Corps
17	33 CFR 330 56 FR 59110 Nov 22	1991	41192	FR	Corps
18	40 CFR 230 57 FR 52716 Nov 4	1992	3150	FR	EPA
19	Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army	1992	3326	MOA	EPA/Corps
20	Federal Agencies Roles and Responsibilities	1992	1801	RGL	Corps

21	Water Dependency and Cranberry Production	1992	1381	RGL	Corps
22	40 CFR 230 58 FR 45008 Aug 25	1993	35687	FR	EPA
23	Protecting America's Wetlands: A Fair Flexible, and Effective Approach	1993	11198	Presidential Policy	White House
24	Appropriate Level of Analysis Required for Evaluating Compliance with the Section 404(b)(1) Guidelines Alternatives Requirements	1993	2096	Memo	EPA/Corps
25	Guidance on Flexibility of the 404(b)(1) Guidelines and Mitigation Banking	1993	3778	RGL	Corps
26	40 CFR 230 59 FR 26162 May 19	1994	5536	FR	EPA
27	33 CFR 320 325 60 FR 13654 Mar 14	1995	8091	FR	Corps
28	Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (expired) FR Nov 28 1995 vol 60 No 228 58605-58614	1995	9048	Guidance	EPA etc.
29	Individual Permit Flexibility for Small Landowners	1995	944	Memo	EPA/Corps
30	NWP 1996 61 FR 65874 Dec 13	1996	56119	Regulation	Corps
31	NWP 1998 63 FR 36040 Jul 1	1998	42801	Regulation	Corps
32	33 CFR 320 64 FR 11708 Mar 9	1999	13072	FR	Corps
33	Coral Reef Protection under the Clean Water Act, Marine Protection, Research, and Sanctuaries Act, Rivers and Harbors Act, and Federal Project	1999	2122	Memo	EPA/Corps
34	Effective Coordination in the Evaluation of Surface Coal Mining Operations Resulting in Placement of Excess Spoil Fills in the Waters of the United States	1999	3312	Memo	EPA etc.
35	33 CFR 320 65 FR 16486 Mar 28	2000	15017	FR	Corps
36	NWP 2000 65 FR 12818 Mar 9	2000	94887	Regulation	Corps
37	Use of In-Lieu-Fee Arrangements for Compensatory Mitigation under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act (expired)	2000	3415	Guidance	EPA etc.
38	Establishment and Maintenance of Compensatory Mitigation Projects Under the Corps Regulatory Program Pursuant to Section 404(a) of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899	2001	5124	RGL	Corps
39	NWP 2002 67 FR 2020 Jan 15	2002	88083	Regulation	Corps
40	Compensatory Mitigation Projects for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899	2002	3281	RGL	Corps

41	National Wetlands Mitigation Action Plan	2002	4141	Action Plan	EPA etc.
42	Federal Guidance on the Use of the TEA-21 Preference for Mitigation Banking to fulfill Mitigation Requirements under Section 404 of the Clean Water Act	2003	2666	Guidance	EPA etc.
43	Incorporating the National Research Council's Mitigation Guidelines Into the Clean Water Act Section 404 Program	2003	4519	Memo	Corps
44	33 CFR 330 69 FR 69563 Nov 30	2004	4425	FR	Corps
45	Guidance on the Use of Financial Assurances, and Suggested Language for Special Conditions for Department of the Army Permits Requiring Performance Bonds	2005	2762	RGL	Corps
46	40 CFR 230 33 CFR 325 332 71 FR 15520 Mar 28	2006	39099	FR	EPA/Corps
47	40 CFR 230 33 CFR 325 332 71 FR 29604 May 23	2006	621	FR	EPA/Corps
48	U.S. Environmental Protection Agency (EPA) coordination between Regional offices and Headquarters on Clean Water Act (CWA) Section 404(q) actions	2006	1109	Memo	EPA
49	Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Creation, Restoration, and/or Enhancement of Aquatic Resource	2006	2160	RGL	Corps
50	NWP 2007 72 FR 11092 Mar 12	2007	121116	Nationwide Permits	Corps
51	40 CFR 230 33 CFR 325 332 73 FR 19594 Apr 10	2008	121398	FR	EPA/Corps
52	Jurisdictional Determinations	2008	3994	RGL	Corps
53	Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources	2008	2102	RGL	Corps
54	EPA Needs a Better Strategy to Identify Violations of Section 404 of the Clean Water Act	2009	8703	IG Report	EPA
55	NWP 2012 77 FR 10184 Feb 21	2012	123251	Nationwide Permits	Corps
56	33 CFR 330 78 FR 5726 Jan 28	2013	9083	FR	Corps
57	40 CFR 230 79 FR 22188 Apr 21	2014	110039	FR	EPA
58	EPA Needs to Clarify Its Claim of "No Net Loss" of Wetlands	2014	2412	IG Report	EPA

*1 FR: Federal Register

*2 RGL: Regulatory Guidance Letter

*3 MOA: Memorandum of Agreement

*4 IG Report: Inspector General Report