Integrating Ecosystem Services into Environmental Law: A Case Study of Wetlands Mitigation Banking

J. B. Ruhl* and R. Juge Gregg**

I. INTRODUCTION

The federal wetland mitigation banking experience, a habitat trading program that has been in existence for over a decade, presents an opportunity for examining how ecosystem service values could be integrated into existing environmental law frameworks. In wetlands mitigation banking, a "bank" of wetlands habitat is created, restored, or preserved and then made available

* Professor, The Florida State University College of Law. This article was prepared for Washington College of Law, American University, through funding provided by EPA/NSF Grant #R82612-01, James Salzman, Principal Investigator. Because this article has not been subjected to any EPA review and does not necessarily reflect the views of the Agency, no official endorsement should be inferred. Please direct comments or questions to jruhl@law.fsu.edu.

** Associate in the Portland, Oregon office of Perkins Coie LLP.

to developers of wetlands habitat who must "buy" habitat mitigation as a condition of federal government approval for development in wetland areas.[1] Wetlands provide extensive and important services to human populations, including flood control and water quality improvement. If environmental law protects ecosystem services, evidence to that effect should exist in the structure and performance of the wetlands banking program. In particular, a program allowing what essentially amounts to trading of wetlands—exchanging acres destroyed in one location for acres created or improved elsewhere—ought to take into account the service values of the wetlands being traded. This article tests that hypothesis, exploring both the legal authority and the actual practice that exists in wetlands mitigation banking with respect to accounting for ecosystem service values that wetlands provide.

The genesis of wetlands mitigation banking was the revelation of widespread evidence that various forms of mitigation for wetlands losses used in the 1980s were not adequately protecting environmental values. During the 1990s, government and industry moved toward the banking program as a cornerstone of wetlands mitigation. This movement presented an opportunity to introduce greater emphasis on service values in the goals of mitigation. Indeed, there are now several specific regulatory provisions within the wetlands regulation and mitigation program that are particularly suited to incorporating ecosystem service values into the regulatory decision making process. Yet, while the existing legal framework of wetlands banking clearly accommodates integration of ecosystem service values with little or no changes to regulatory text, nothing in the regulations explicitly requires or encourages that approach generally. In short, the authority to integrate ecosystem service concerns into the wetlands mitigation banking pro-

1. For comprehensive analyses of the wetlands mitigation banking concept and its history, see ENVTL. L. INST., WETLAND MITIGATION BANKING (1993) [hereinafter ELI-WETLAND]; Royal C. Gardner, *Banking on Entrepreneurs: Wetlands, Mitigation Banking, and Takings*, 81 IOWA L. REV. 527 (1996). The ELI report is available in slightly modified form as ROBERT BRUMBAUGH & RICHARD REPPERT, INSTITUTE FOR WATER RESOURCES, U.S ARMY CORPS OF ENGINEERS, NATIONAL WETLANDS MITIGATION BANKING STUDY: FIRST PHASE REPORT (1994) [hereinafter FIRST PHASE REPORT]. The Institute for Water Resources of the United States Army Corps of Engineers has published a number of studies of wetlands mitigation banking in connection with its National Wetlands Mitigation Banking Study, all of which are available at http://www.iwr.usace.army.mil/iwr/Services/PDCPNWetlandsM.htm. For a more extensive discussion of wetland mitigation banking as a market trading instrument, see James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. (forthcoming 2001), brief portions of which appear, as edited, in this Article.

gram is implicit, but implementation in any broad, deliberate policy form remains only a latent potential.

Although the legal authorities governing wetlands mitigation banking do not specifically require protection or restoration of ecosystem services, mitigation banks might, in practice, take advantage of the implicit authority to do so. In this article, we use a literature review and a limited survey of operating wetland mitigation banks, to consider this possibility. Our findings reveal that, notwithstanding the available framework and historical context of wetlands mitigation banking, attention to ecosystem service values only rarely occurs.

The current inattention to wetland ecosystem services may result in part from a lack of simple and yet accurate estimates of ecosystem function, which are necessary to value the services and trade them in an efficient market. Although functional value is supposed to be considered in mitigation banking, the current regulations allow use of relatively crude surrogates for functional values, such as acres and rough functional assessment scores. These simple indicia of wetland value are the predominant "currency" for wetland mitigation banking in practice—most likely because they are inexpensive for all parties involved to measure and monitor. Wetlands banking, to realize the efficiencies its market model purports to offer, requires fluid markets with low transactions costs, which simple currencies such as acres and quick functional assessment help provide.[2] However, while these techniques are less costly and time consuming, the concern persists that they are not sufficiently accurate to assure meaningful trades. Until a technique is developed to accurately calculate and compare wetland ecosystem service values without undue cost and delay, it is unlikely that wetlands mitigation banking law or practice will adopt ecosystem service values as part of the medium of exchange. Research into such methods, such as the project Wainger et al. describe in their article appearing in this issue, is thus a critical first step to integrating ecosystem services into wetlands mitigation policy and, most likely, other environmental policy programs designed to protect ecosystem functions.[3]

---

2. *See* Salzman & Ruhl, *supra* note 1.

3. Lisa A. Wainger et al., *Wetland Value Indicators for Scoring Mitigation Trades*, 20 STAN. ENVTL. L.J. 413 (2001); *see also* James Boyd, Dennis King, & Lisa Wainger, *Compensation for Lost Ecosystem Services: The Need for Benefit-Based Transfer Ratios and Restoration Criteria*, 20 STAN. ENVTL. L.J. 393 (2001).

In this article, Part II outlines the background of the federal law and policy of wetlands regulation and the practice of mitigation banking. Part III identifies specific regulatory provisions within the wetlands regulation and mitigation program that are particularly suited to incorporating ecosystem service values into the regulatory decision making process. Part IV examines the actual record of wetland mitigation banking to determine the degree to which it has in practice incorporated ecosystem service valuation techniques. Part V concludes that until a technique is developed to calculate and compare wetland ecosystem service values without undue cost and delay, it is unlikely that wetlands mitigation banking law or practice will adopt ecosystem service values as part of the medium of exchange.

II. LAW AND POLICY BACKGROUND

Section 311 of the Clean Water Act (CWA) prohibits "the discharge of any pollutant by any person,"[4] which, because of the way those terms are defined, also prohibits filling of wetlands. Nevertheless, section 404(a) of the statute authorizes the Secretary of the Army, through the Army Corps of Engineers (the Corps), to "issue permits for the discharge of dredged or fill material in the navigable waters of the United States at specified disposal sites."[5] Pursuant to section 404(b)(1) of the CWA, the Environmental Protection Agency (EPA) must promulgate substantive permitting standards, known as the "404(b)(1) Guidelines," which the Corps must follow in administering the permit program.[6] Thus, under the CWA, wetlands may be filled only if a permit is granted in accordance with the 404(b)(1) guidelines. These permits, known ubiquitously as "404 permits," "wetland permits," or "Corps permits," have become the cornerstone for federal protection of wetland resources.[7] The permitting program, however, admits of many

4. 33 U.S.C. § 1311(a) (1994).

5. *Id.* § 1344(a).

6. *Id.* § 1344(b)(1). EPA also has the power to veto Corps permits if it finds the discharge would have an unacceptably adverse effect on environmental resources. *Id.* § 1344(c). EPA has exercised this power infrequently, having completed only eleven veto actions for an estimated 150,000 permit applications received since the regulations went into effect in October, 1979. *See* U.S. EPA, EPA'S CLEAN WATER ACT SECTION 404(c) VETO AUTHORITY 1 (2000), *available at* http://www.epa.gov/OWOW/wetlands/facts/fact14.html.

7. The agencies' regulations define a wetland as an area "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do[es] support, a prevalence of vegetation typically adapted for life in saturated soil conditions." 33 C.F.R. § 328.3(b) (2000); 40 C.F.R. § 230.3(t) (2000). Al-

exceptions and nuances making it less than straightforward to determine whether a permit is required for a particular fill activity, and how to get one.[8] Many routine land development activities do, however, require and receive a 404 permit. And along the way, permit applicants and the agencies often confront the issue of "mitigation" as one of the conditions the developer must satisfy in order to obtain the permit.

The Corps' guidelines for administering wetlands mitigation require it to review 404 permit applications using a preference "sequencing" approach.[9] The first preference is to require the applicant to avoid filling wetland resources; the second preference is to require minimization of adverse impacts that cannot reasonably be avoided; and the least desirable preference is to require the developer to provide compensatory mitigation for those unavoidable adverse impacts that remain after all minimization measures have been exercised.[10] The least desirable option, compensatory mitigation, is the basis for wetlands trading.

Both EPA and the Corps traditionally have preferred on-site to off-site locations for the compensatory mitigation activity,[11] and

---

though the Clean Water Act makes no reference to wetlands with respect to the Corps' jurisdiction under section 404, early in the program's history judicial interpretation required the Corps to extend its reach to tidal wetland areas. *See* Natural Resources Defense Counsel v. Callaway, 392 F. Supp. 685 (D.D.C. 1975). Since then the courts have upheld Corps efforts to extend its jurisdiction even further inland. *See, e.g.*, United States v. Riverside Bayview Homes, 474 U.S. 121 (1985) (upholding regulation of wetlands "adjacent to" navigable waters). The line where the Corps' jurisdiction ends, however, is hard to define. *See* Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, __ U.S. __; 121 S. Ct. 675 (2001) (finding that the Corps may not regulate isolated non-navigable waters such as ponds and mudflats).

8. For a concise description of the section 404 permitting process, particularly in the land development context, see S. Scott Burkhalter, *Oversimplification: Value and Function: Wetland Mitigation Banking*, 2 CHAPMAN L. REV. 261, 267-74 (1999); Margaret Strand, *Wetlands: Avoiding the Swamp Monster*, *in* ENVIRONMENTAL ASPECTS OF REAL ESTATE TRANSACTIONS 720, 729-38 (James B. Witkin ed., 2d ed. 1999).

9. *See* Memorandum of Agreement Between Department of the Army and the Environmental Protection Agency Concerning the Clean Water Act Section 404(b)(1) Guidelines, 55 Fed. Reg. 9,210, 9,211-12 (1990) [hereinafter Mitigation Guidance]. Section 404 does not mention a mitigation requirement for permit issuance. Rather, this provision of the statute directs EPA, in conjunction with the Corps, to develop guidelines that the Corps must apply in deciding whether to authorize the fill disposal at a wetlands site. 33 U.S.C. 1344(b).

10. Mitigation Guidance, *supra* note 9, at 9,211. For background on the agencies' sequencing requirement, see ELI-WETLAND, *supra* note 1, at 19-22; Gardner, *supra* note 1, at 535-39.

11. *See* Mitigation Guidance, *supra* note 9, at 9,211. For background on the agencies' preference for on-site mitigation, see ELI-WETLAND, *supra* note 1, at 30-32, 56-57.

have preferred in-kind mitigation to mitigation that uses a substantially different type of wetland.[12] Regardless of location, EPA and the Corps prefer measures that restore prior wetland areas as the highest form of mitigation, followed by enhancement of low-quality wetlands, then creation of new wetlands, and, least favored of all, preservation of existing wetlands.[13] To take an extreme example, if compensatory mitigation is deemed appropriate for a project involving fill of mangrove swamp wetlands in Florida, on-site restoration of an area of prior mangrove swamp wetlands would be a favored mitigation strategy, whereas off-site preservation of existing cranberry bog wetlands in Maine would be least favored.

Notwithstanding its official status as the least-favored alternative in the agencies' sequencing pecking order, compensatory mitigation has been used frequently in the 404 program. Compensatory mitigation frees up highly valued wetlands for more comprehensive and flexible development.[14] While attractive for these purpose, the project-by-project compensatory mitigation approach has been widely regarded as having failed miserably in terms of environmental protection.[15] Whether mitigation was accomplished onsite or

12. *See* Mitigation Guidance, *supra* note 9, at 9,211. For background on the agencies' preference for in-kind mitigation, see ELI-WETLAND, *supra* note 1, at 58-59. Wetland ecologists generally divide wetlands into seven major types; yet even for wetlands of a particular type, there is tremendous variation from region to region in terms of physical characteristics and functions. *See id.* at 25-29.

13. *See* Mitigation Guidance, *supra* note 9, at 9,211. For background on the agencies' mitigation type preferences, see ELI-WETLAND, *supra* note 1, at 53-55. Another variation of compensatory mitigation is to dispense with the identification of mitigation habitat, whether on-site or in off-site banks, and simply allow the developer to pay a fee that can be used later to finance habitat restoration, creation, enhancement, or preservation. The Corps and EPA recently developed guidance on the use of these so-called "in-lieu fee" methods, approving of them in certain broadly defined circumstances. *See* Federal Guidance on the Use of In-Lieu Fees Arrangements for Compensatory Mitigation Under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, 65 Fed. Reg. 66,914 (2000). For a thorough discussion of in-lieu fees, criticizing their use in wetland protection contexts, see Royal C. Gardner, *Money for Nothing? The Rise of Wetland Fee Mitigation*, 19 VA. ENVTL. L.J. 1 (2000).

14. As Dennis King describes,

> The market value of an acre of dry land can be as high as a few hundred thousand dollars per acre, even a few million dollars per acre in some prime coastal areas. If the land is a wetland but is "permitable," its market value might be slightly less because developing it would require draining and filling as well as some "compensatory mitigation." The same wetland, if it had no hope of being permitted for development, could have a market value as low as a few thousand dollars per acre.

Dennis King, *The Dollar Value of Wetlands: Trap Set, Bait Taken, Don't Swallow*, NAT'L WETLANDS NEWSL., July-Aug. 1998, at 7.

15. *See, e.g.*, Alyson Flournoy, *Restoration Rx: An Evaluation and Prescription*, 42 ARIZ. L.

near-site, the piecemeal approach complicated the Corps' ability to articulate mitigation performance standards, monitor success, and enforce conditions; not surprisingly, the success rate for this approach suffered as a result.[16]

In light of these problems, during the late 1980s the Corps and EPA started shifting compensatory activities increasingly from on-site to off-site mitigation, thus opening the door to the wetlands mitigation banking technique. This approach, its proponents argued, would prove advantageous both in terms of economic efficiency and ecological integrity, aggregating small wetlands threatened by development into larger restored wetlands in a different location.[17] It is defined generally as "a system in which the creation, enhancement, restoration, or preservation of wetlands is recognized by a regulatory agency as generating compensation credits allowing the future development of other wetland sites."[18] In its most basic form, wetlands mitigation banking allows a developer to protect wetlands at one site in advance of development and then draw down the resulting bank of mitigation "credits" as development is implemented and wetlands at another site are filled. Indeed, the concept has progressed beyond this personal bank

---

REV. 187, 208 (2000) (observing that by making mitigation the "quid pro quo" for the permit, permittees seek only enough mitigation success to obtain and retain the permit, thus placing a heavy monitoring burden on the permitting agency); Gardner, *supra* note 1, at 540 (declaring that "[t]he failure of compensatory mitigation is wetland regulation's dirty little secret."); Michael Rolland, *The Systemic Assumptions of Wetland Mitigation: A Look at Louisiana's Proposed Wetland Mitigation and Banking Regulations*, 7 TUL. ENVTL. L. J. 497, 510-11 (1994) (noting that on-site mitigation "puts the mitigation for wetlands loss in the hands of a sometimes hostile developer"); Virginia C. Veltman, *Banking on the Future of Wetlands Using Federal Law*, 89 NW. U.L. REV. 654, 670 (noting that "[t]he California State Coastal Conservancy sponsored a review of fifty-eight permits issued for creation and restoration projects in the San Francisco Bay Area between 1978 and 1983 . . . [and] found that only two of the fifty-eight projects could be deemed successful.").

16. *See* Michael S. Rolband et al., *Wetlands Banking for Sound Mitigation? Yes, Virginia*, NAT'L WETLANDS NEWSL., May-June 1999, at 4 ("Off-site non-bank mitigation, authorized by individual project permits, is difficult to administer, monitor, and enforce"). As several commentators have observed, "the success record for isolated mitigation projects has been spotty, and few regulators believe that these projects will succeed." Lawrence R. Liebesman & David M. Plott, *The Emergence of Private Wetlands Mitigation Banking*, 13 NAT. RESOURCES & ENV'T 341 (1998) (discussing a Florida state agency study finding a twenty-seven percent success rate of such projects); Gardner, *supra* note 1, at 540-42 (discussing the Florida study). *See also* CHESAPEAKE BAY FOUNDATION, MARYLAND NONTIDAL WETLAND MITIGATION: A PROGRESS REPORT 28-35 (1997) (discussing independent study finding poor record of compensatory mitigation); ELI-WETLAND, *supra* note 1, at 31 (discussing the dismal record of piecemeal on-site mitigation projects).

17. *See* Veltman, *supra* note 15, at 673.

18. *See* ELI-WETLAND, *supra* note 1, at 3.

model. Today, large commercial and public wetlands banks, not tied to a particular development, sell mitigation piecemeal to third-party developers in need of compensatory mitigation.[19]

The Corps and EPA officially endorsed the mitigation banking approach in their 1995 *Federal Guidance for the Establishment, Use and Operation of Mitigation Banks,* setting out a standard review procedure for establishing and using wetlands banks in the 404 permit process.[20]

III. THE POTENTIAL ROLE FOR ECOSYSTEM SERVICE VALUATION

As the preceding discussion suggests, there are three legal instruments that directly address wetlands mitigation banking. First, under the Clean Water Act section 404(b)(1), Congress delegated to EPA the responsibility for issuing regulations governing the location of wetlands fill-sites to ensure adequate environmental protec-

19. *See* Gardner, *supra* note 1, at 581-87; Jonathan Silverstein, *Taking Wetlands to the Bank: The Role of Wetland Mitigation Banking in a Comprehensive Approach to Wetlands Mitigation Protection,* 22 B.C. ENVTL. AFF. L. REV. 129, 145 (1994). The Corps of Engineers Institute for Water Resources reports that as of January 2000 at least 230 wetlands mitigation banks are operating with Corps approval and that over half of those are commercial banks. *See* INSTITUTE OF WATER RESOURCES, U.S. ARMY CORPS OF ENGINEERS, EXISTING WETLAND MITIGATION BANKING INVENTORY (2000), *available at* http://www.wrsc.usace.army.mil/iwr/Regulatory/regulintro.htm. *See also* Liebesman & Plott, *supra* note 16, at 341 (noting that there are over seventy such commercial mitigation banks operating in the United States today). The growth in banks, particularly commercial banks, has been steady since the inception of mitigation banking as an acceptable approach under section 404. Robert Brumbaugh, manager of the Corps of Engineers' Institute for Water Research National Wetlands Mitigation Banking Study, reports that there were 5 banks of all varieties in operation in 1985, 40 in 1992, and more than 100 in 1995, with hundreds more in development at that time. *See* Robert W. Brumbaugh, *Wetland Mitigation Banking: Entering a New Era,* WETLANDS RESEARCH PROGRAM BULL., Oct-Dec. 1995, at 3 fig.1, *available at* http://www.wes.army.mil/el/wrtc/bulletins/v5n3/brum.html; *see also Wetland Mitigation Banking: Fingertip Facts,* NAT'L WETLANDS NEWSL., Jan.-Feb. 1998, at 3 (noting 200 banks in operation by 1997, 40 of which were commercial banks).

20. 60 Fed. Reg. 58,605 (Nov. 28, 1995) [hereinafter Banking Guidance]; *see generally* Gardner, *supra* note 1, at 563-69. A prospective bank sponsor must submit a prospectus to the Corps, based on which the relevant federal and state agencies, known as the Mitigation Bank Review Team, evaluate the merits of the bank pursuant to the sequencing approach and other preferences applicable to compensatory wetlands mitigation in general. The agencies and the bank sponsor then negotiate a banking instrument outlining all the details of bank objectives, ownership, operation, and enforcement. Finally, the proposed bank instrument is submitted for public notice and comment before a final bank instrument is implemented. A number of states have also provided statutory or regulatory frameworks for using commercial wetlands mitigation banks in satisfaction of state wetlands protection laws. *See* ELI-WETLAND, *supra* note 1, at 16-18; Gardner, *supra* note 1, at 569-77; Rolland, *supra* note 15, at 511-44.

tion.[21] These regulations are known as the "404(b)(1) Guidelines."[22] Second, in 1990, the United States Army Corps of Engineers (Corps) and the EPA signed a memorandum of agreement, known as the "Mitigation Guidance," clarifying the role each plays in wetlands mitigation under the 404(b)(1) Guidelines.[23] And finally, as promised in the Mitigation Guidance, several agencies issued a guidance document in 1995 detailing operation of a wetlands mitigation bank, known as the "Banking Guidance."[24]

This section discusses how these three instruments could be used to integrate consideration of ecosystem service values into wetland mitigation banking decision making with little or no change to regulatory text. For now, however, the authority to do so remains only implicit, leaving any more comprehensive and deliberate integration of ecosystem services in the wetlands mitigation banking program a latent potential.

A. *404(b)(1) Guidelines*

The 404(b)(1) Guidelines provide extensive descriptions of wetlands values that the Corps should consider in assessing potential mitigation requirements. These guidelines are the reference point for both the Mitigation Guidance and the Banking Guidance, and provide clear regulatory authority to consider ecosystem service values such as those derived from the water purification and recreational opportunities that wetlands provide.

Subparts D through F of the Guidelines focus on the negative effects of disrupting wetlands, identifying the functions and values that may be lost due to the discharge of dredged or fill materials.[25] Subpart F, entitled "Potential Effects on Human Use Characteristics," focuses exclusively on wetlands functions used for the benefit of humans; it thus deals most directly with values and functions that can be considered ecosystem services.[26] Subpart F identifies five general human uses that are potentially impacted by wetlands development: (1) municipal and private water supplies; (2) recreational and commercial fisheries; (3) water-related recreation; (4) aesthetics; and (5) parks. For each category, the Guidelines chroni-

21. *See* 33 U.S.C. § 1344(b)(1) (1994).
22. *See* 40 C.F.R. pt. 230 (2000).
23. Mitigation Guidance, *supra* note 9.
24. Banking Guidance, *supra* note 20.
25. 40 C.F.R. § 230.4, 230.30-.45.
26. 40 C.F.R.§ 230.50-.54.

cle specific impacts that such developments could have on wetlands values.

Subparts D through F thus acknowledge that certain human activities influence wetland functioning, and Subpart F explains how humans benefit from wetland functioning. The scope of Subpart F does not cover the full range of service values associated with wetlands; for example, it fails to address the value to humans of such functions as sedimentation control, nutrient cycling, flood control, and energy fixation. The tone and content of the section clearly indicates, though, that EPA's authority under section 404(b)(1) includes protection of wetland service values generally.

B. *The Mitigation Guidance*

Initially, the Corps and EPA "clashed over the proper role of mitigation in the . . . permitting process."[27] However, the Mitigation Guidance that the two agencies adopted in 1990 clarified the role of wetlands mitigation under the 404(b)(1) Guidelines.[28] The Mitigation Guidance divides mitigation into three phases—avoidance, minimization, and compensatory mitigation—and required that those phases be conducted sequentially.[29] Thus, the Corps "[1] makes a determination that potential impacts have been avoided to the maximum extent practicable . . . ;" if there are any "remaining unavoidable impacts," the Corps is to mitigate them "to the extent appropriate and practicable by requiring steps to [2] minimize impacts, and . . . [3] compensate for aquatic resource values."[30] Mitigation banking is an option only if the third phase, compensatory mitigation, is reached.[31] The Mitigation Guidance explicitly endorses mitigation banking as a form of compensatory

27. *See* Veltman, *supra* note 15, at 664.

28. Mitigation Guidance, *supra* note 9.

29. *Id.* at 9,211-12; *see also* discussion *supra* Part II.

30. *Id.*

31. The Mitigation Guidance states:

> Mitigation banking may be an acceptable form of compensatory mitigation under specific criteria designed to ensure an environmentally successful bank. Where a mitigation bank has been approved by EPA and the Corps for purposes of providing compensatory mitigation for specific identified projects, use of that mitigation bank for those particular projects is considered as meeting the objectives of Section II.C.3 of this MOA, regardless of the practicability of other forms of compensatory mitigation. Additional guidance on mitigation banking will be provided. Simple purchase or "preservation" of existing wetlands resources may in only exceptional circumstances be accepted as compensatory mitigation.

Id. at 9,212.

mitigation and promised additional guidance on the subject.[32] With respect to compensatory mitigation generally, the Mitigation Guidance requires that it be used "for unavoidable adverse impacts which remain after all appropriate and practicable minimization has been required;"[33] expresses preferences for on-site mitigation and for wetlands restoration (as opposed to wetlands creation);[34] and requires that "functional values" be examined.[35] Thus, the Mitigation Guidance simply requires that functional value be examined and compensation provided—preferably onsite—for unavoidable adverse impacts.

The declaration of purpose is strong but the tactics to achieve it are not well-defined. Under the Mitigation Guidance, the Corps "*will strive* to achieve a goal of no overall net loss of values and functions."[36] The methodologies used to determine whether this goal is being met are, however, only broadly described. The Mitigation Guidance simply advocates that "qualified professionals" tailor generally recognized assessment techniques to each site, constrained only by the requirement that they "consider" the ecological functions listed in the 401(b)(1) Guidelines. Thus, to determine whether there has been a new loss of values and functions, the Corps is to rely on measures

> . . . identified only through resource assessments *tailored to the site* performed *by qualified professionals* because ecological characteristics of each aquatic site are unique. [And f]unctional values should be assessed by applying aquatic site *assessment techniques generally recognized by experts* in the field and/or the best professional judgment of Federal and State agency representatives, *provided such assessments fully consider ecological functions included in the [Section 404(b)(1)] Guidelines* (emphasis added).[37]

The methodologies used to determine whether compensation is adequate are similarly broadly described, providing what some observers describe as "virtually unfettered discretion in determining whether a just compensation for destroyed wetlands has been

32. *Id.* ("EPA and Army will develop specific guidance for preservation in the context of compensatory mitigation at a later date.").

33. *Id.*

34. *Id.* (stating that on-site mitigation is mitigation "in areas adjacent or contiguous to the discharge site.").

35. *Id.* at 9,212 ("In determining compensatory mitigation, the *functional values* lost by the resource to be impacted must be considered.") (emphasis added).

36. *Id.* at 9,211.

37. *Id.* at 9,212.

achieved."[38] According to the Mitigation Guidance, "mitigation should provide, at a minimum, one for one functional replacement (i.e., no net loss of values), with an adequate margin of safety."[39] Nevertheless, because determining functional replacement may be difficult, "in the absence of more definitive information on the functions and values of specific wetlands sites, a minimum of one-to-one acreage replacement may be used as a reasonable surrogate for no net loss of functions and values." Thus, the Mitigation Guidance purports to require a margin a safety that ensures a one-to-one functional replacement, but if information is uncertain—as it usually will be—the Mitigation Guidance only requires a more easily quantified and non-functional one-to-one acreage replacement.

The Mitigation Guidance pays homage to the idea of "functions and values" in numerous instances. It commits the agencies to "strive to achieve a goal of no overall net loss of [wetlands] values and function" and purports to base "[t]he determination of what level of mitigation constitutes "appropriate" mitigation . . . solely on the values and functions of the aquatic resource that will be impacted."[40] The Mitigation Guidance's attempts at quantitative valuation repeatedly focus on wetlands values and function, but it never defines these essential terms.

Because the agreement fails to offer substantive guidance on methodologies, a number of different means of quantitative valuation have been used under these guidelines. As discussed in Part III, these include the Fish and Wildlife Service's Habitat Evaluation Procedures (HEP), the Wetland Evaluation Technique (WET), best professional judgement, and ratios based purely on acreage.

C. *The Banking Guidance*

In 1995, five United States agencies[41] published the Banking Guidance, as promised in the Mitigation Guidance, in order to de-

38. Veltman, *supra* note 15, at 673-74.

39. Mitigation Guidance, *supra* note 9, at 9,212-13.

40. Mitigation Guidance, *supra* note 9, at 9211. And, as noted previously, the Guidance says that "[f]unctional values should be assessed by applying aquatic site assessment techniques generally recognized by experts in the field and/or the best professional judgment of Federal and State agency representatives, provided such assessments *fully consider ecological functions* included in the [Section 404(b)(1)] Guidelines" *Id.* at 9212, and that "mitigation should provide, at a minimum, one for one *functional replacement* (i.e., no net loss of values), with an adequate margin of safety." *Id.* at 9212-13 (emphasis added).

41. The Army Corps of Engineers, the Environmental Protection Agency, the National Resources Conservation Service, the Fish and Wildlife Service, and National Marine Fisheries Service.

tail the use and operation of mitigation banks.[42] The document's introduction declares that the "objective of a mitigation bank is to provide for *the replacement of the chemical, physical, and biological functions of wetlands and other aquatic resources which are lost* as a result of authorized impacts."[43] This perspective is later broadened to acknowledge that "[t]he 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."[44] The Banking Guidance thus qualifies the goal of replacing ecological functioning by acknowledging economic realities.

The Banking Guidance describes the intricacies of creating a wetlands mitigation bank, but, like the Mitigation Guidance, is vague on what exactly is being "banked." Also like the Mitigation Guidance, the document relies heavily on the term "function."[45] For example, site selection requires agencies to "give careful consideration to the ecological suitability of a site for achieving the goal and objectives of a bank, i.e., that it possess the physical, chemical and biological characteristics to support establishment of the desired aquatic resources and functions."[46] Similarly, credit for wetland preservation is contingent upon the "functions" provided or augmented by the preserved land,[47] and "credit may be given for the inclusion of upland areas occurring within a bank only to the degree that such features increase the overall ecological functioning of the bank."[48]

Because the crediting and debiting procedure forms the heart of a wetlands mitigation bank, the determination of what will be counted as "currency" is crucial. The Banking Guidance focuses initially on the use of "aquatic functions" as its banking currency—a currency that is easily "exchanged" or translated into service values. But the Banking Guidance then follows the lead of the Mitiga-

42. Banking Guidance, *supra* note 20; *see also supra* note 32 and accompanying text. Specific authority for mitigation banking does not exist at any regulatory or statutory level higher than "policy guidance." Gardner, *supra* note 1, at 564. For a discussion of the structures and procedures laid out by the Banking Guidance, see Liebesman & Plott, *supra* note 16, at 342-44.

43. Banking Guidance, *supra* note 20, at 58,606.

44. *Id.* at 58,608.

45. Indeed, the term "wetlands value" is not used anywhere in the document.

46. Banking Guidance, *supra* note 20, at 58,608.

47. *Id.* at 58,608-09.

48. *Id.* at 58,609.

tion Guidance and allows acreage to be a surrogate measure if functional assessment is impractical.[49] The Banking Guidance then takes one more step back from its vision and allows any "appropriate functional assessment methodology . . . acceptable to all signatories"[50] to be used to quantify credits. Once again, therefore, the official guidance provides an opportunity, but not a requirement, to rely on ecosystem indicators as the assessment methodology.

D. *Conclusion: Implicit Authority but No Explicit Requirement*

Each of the three cornerstone policies supporting wetlands mitigation banking supports integrating greater use of ecosystem services in the wetlands mitigation banking decision making process. Certainly nothing in the 404(b)(1) Guidelines, the Mitigation Guidance, or the Banking Guidance precludes the use of ecosystem service factors. The emphasis in each of the sources of authority on wetlands functions opens the door to more focused attention to the service values of those functions. Nevertheless, the functions emphasis falls short of explicit adoption of ecosystem services as a central or even relevant factor in wetlands mitigation banking decisions. At best, therefore, the current legal framework of wetlands mitigation banking establishes the implicit authority, but no explicit requirement, for the consideration of ecosystem services.

IV. The Current State of Wetlands Mitigation Banking

As demonstrated in the previous section, the basic policies supporting wetlands mitigation banking—and the existing regulatory framework implementing those policies—offer potential for the use of ecosystem service values in the decision-making stages of wetlands mitigation banking programs. Having established that potential, this section uses a review of current literature and a survey of wetlands mitigation banking entities to assess the degree to which current wetlands mitigation banking incorporates the valuation of ecosystem services.

Ecosystem service valuation must be incorporated into wetlands mitigation banking decision making at two critical junctures: the wetlands assessment stage and the wetlands trading stage. The Environmental Law Institute's (ELI) groundbreaking 1993 study of wetlands mitigation banking describes these stages as raising the

49. *Id.* at 58,612.
50. *Id.*

"credits defined and valued" issues, and recognizes that they are the most complex issues in mitigation banking.[51] To fully capture ecosystem service values, the assessment method must consistently define the services and incorporate measurements of their value both for the wetlands to be lost and for those wetlands used for mitigation. Moreover, the trading ratio between wetlands lost and mitigated should reflect any differences in service population, service delivery type, and efficiency. It should also account for margins of error that may justify deviating from a fixed exchange rate.[52] When function values and service populations are reliably measured and appropriately compared among sites, using a reasonable margin of error, ecosystem service valuation methods can be integrated into the assessment and trading stages of wetland mitigation banking.

In our survey of mitigation banks, however, we found no explicit use of this kind of ecosystem service valuation at either the assessment or trading stages. Wetlands mitigation banking entities seem focused on using the most simple and expedient assessment method the relevant regulatory bodies would approve. Moreover, the regulatory bodies did not appear widely to require or even encourage a more sophisticated approach. These less refined valuation methods may work in situations involving an exchange of wetlands of basically similar attributes in the same watershed, because one can assume that similar wetlands provide similar functions to similar ecosystems. These basic valuation methods also suffice for trades based on gross comparisons between classes of wetlands—e.g., two acres of Type A are worth three acres of Type B. Trades based on wetland classes and fixed ratios thus dominate the wetlands mitigation banking practice.

Several of the assessment methods used by banks and discussed in the literature focus on wetland functions and appear to be amenable to expansion into more direct measurement of ecosystem service values. However, despite discussions in the assessment method literature that place increasingly greater emphasis on wetland function, there is an incentives problem: So long as the regulatory framework accommodates the current practices, there is little reason for those in need of wetlands mitigation banking units to integrate the more complicated, costly, and time-consuming tasks that ecosystem service valuation would entail without evi-

51. ELI-WETLAND, *supra* note 1, at 77.

52. These conditions are explored more fully in King, *supra* note 14, at 8-9.

dence that it will improve their net trading position. The effects of this disincentive are evidenced in the actual assessment and trading practices of wetlands mitigation banks.

A. *Assessment Methods*

ELI described the challenge of using wetland assessment methodology in mitigation banking as developing a "currency available for a variety of transactions."[53] Assessment methods "attempt to establish, in either a qualitative or quantitative fashion, the nature and extent of different services that a wetland may provide. Once those services are known, they may be translated into a 'currency' that can serve as a medium of trade for a wetland mitigation bank."[54]

As mitigation banking expands to encompass trades involving different types of wetlands, wetlands in different watersheds, and wetlands lost and restored in different time frames, the variety of transactions broadens and thus the need for such a currency becomes more acute. Defining a single, universal currency makes it possible to assess and compare various ecosystem services offered by various ecosystems. However, if the currency does not accurately capture the value of a service in a particular ecosystem at a particular time, confidence in the procedural and substantive adequacy of the trades will erode. Developing and using a wetland assessment methodology that measures ecosystem service values or some reliable indicia thereof is thus the critical first step in developing a framework for wetland mitigation banking. It is the step that will allow trades based on actual service value.

In his recent book, *Measuring the Benefits of Federal Wetland Programs*, Paul Scodari summarizes the literature addressing the theoretical use of wetland assessment methodologies to generate economic values, including ecosystem service values, that are capable of being used as the "currency" for wetlands.[55] He concludes that the theory is lacking at both ends of the banking process—i.e., it fails to offer viable methods for assessing wetland functions and services for purposes of developing the currency, and it fails to provide a valuation method for purposes of trades. He also finds that, in practice "wetland functional assessments produce measures of

53. ELI-WETLAND, *supra* note 1, at 77.

54. *Id.*

55. *See* PAUL F. SCODARI, MEASURING THE BENEFITS OF FEDERAL WETLAND PROGRAMS 49-73 (1997).

functional indices that are only suggestive of the capacity of wetlands to provide certain important outputs" and thus "limit[ ] our ability to develop estimates of wetland protection benefits."[56] In the absence of more informative and reliable assessment methods, valuation theories and estimates have necessarily been "based on flawed procedures that calculate measures that are, to varying degrees, inconsistent with the economic concept of value."[57]

Our examination of current wetland assessment methodology theory and practice supports Scodari's conclusions. There have been several comprehensive reviews of wetland assessment methodology theory and practice conducted since 1985, which marks the beginning of the use of mitigation banks.[58] The four most comprehensive studies, which we review here, are: (1) ELI's 1993 *Wetland Mitigation Banking* publication;[59] (2) The Corps of Engineers, Institute for Water Resources, National Wetland Mitigation Study's 1994 *First Phase Report* and its accompanying reports;[60] (3) the Florida Legislature's Office of Program Policy Analysis and Governmental Accountability (OPPAGA) March 2000 policy review, *Wetland Mitigation*;[61] and (4) Candy Bartoldus's 1999 publication, *A Comprehensive Review of Wetland Assessment Procedures.*[62]

These reports and our supplemental informal survey suggest two trends. First, counting acres has been and continues to be the predominant method of assessing wetlands for purposes of mitigation bank valuation and permit mitigation requirements. Second, simple functional assessment methods have gained some ground in the past ten years as an assessment method for banks, leading to an increasing focus on description of wetland function as a core output of the assessment. Overall, however, these trends mean that explicit and accurate measures of ecosystem service values remain beyond the reach of virtually all assessment methods in use in mitigation banking today and for the foreseeable future.

---

56. *Id.* at 54.

57. *Id.* at 58.

58. *See supra* note 19 and sources cited therein.

59. ELI-WETLAND, *supra* note 1.

60. FIRST PHASE REPORT, *supra* note 1.

61. OFFICE OF PROGRAM POLICY ANALYSIS AND GOVERNMENTAL ACCOUNTABILITY, WETLAND MITIGATION (Dep't Envt'l. Protection & the Water Management Dists. Report No. 99-40, 2000) [hereinafter OPPAGA].

62. *See* CANDY BARTOLDUS, A COMPREHENSIVE REVIEW OF WETLAND ASSESSMENT PROCEDURES (1999).

1. *Existing Studies.*

In this section, we summarize each of the major wetlands assessment method studies. Each of the four major studies examines the role of assessments in banking decisions, but the reports differ in level of detail and focus. For each study, we review any discussion of assessment methods, and then summarize the incidence of use for the discussed methods. Our supplemental survey was intended then to determine whether the common theme that emerges from the reports regarding assessment methods is consistent with the observed current practice in wetlands mitigation banking.

ELI Study. ELI's report provides a comprehensive overview of wetlands mitigation banking and covers assessment methods in a chapter devoted to the topic of "credits defined and valued." ELI puts assessment methods into three major categories:

> *Simple indices* derive from quickly and easily observed characteristics of a wetland, and usually serve as surrogate "indicators" of one or more ecological functions.
>
> *Narrowly tailored systems* attempt to measure directly a limited range of wetland services, such as wildlife habitat, through a detailed procedure focusing on that particular wetland service.
>
> *Broadly tailored systems* examine a range of wetland functions covering a number of observable characteristics.[63]

The ELI report discusses examples of each method-category in some detail, and provides comparative evaluations of the three categories in terms relevant to the discussion of ecosystem service valuation. For example, ELI concludes that simple index methods, such as counting acres, make mitigation banking easier and less costly, but are "least sensitive to wetlands values and functions. Also, most simple indices do not take into account scale effects."[64] The report suggests that it would be difficult to integrate an ecosystem service valuation step into wetlands mitigation banking programs relying on simple index methods.

Similarly, narrowly tailored methods, such as those attempting to evaluate habitat values, are generally focused on specific habitat types or species, and thus can result in "mitigating to the test"—i.e., driving the banking process toward the favored habitat type or species. Also, "comparing cumulative [habitat units] for different sets of species involves risks inherent in comparing apples and or-

63. ELI-WETLAND, *supra* note 1, at 78.
64. *Id.* at 89.

anges."[65] In other words, the narrowly tailored methods fail to produce a "currency" that can be reliably used across nonfungible features of assessment. Thus, these methods are unlikely to successfully integrate ecosystem service valuation measurements.

Given the shortcomings of the simple index methods and the narrowly tailored methods, ELI concludes that "[f]or wetland managers concerned about the spectrum of functions provided by a wetland, there is no substitute for a carefully considered, broadly tailored analysis."[66] Unlike simple indices, broadly tailored methods take into account values and function and, unlike narrowly tailored methods, they produce a "currency" that can used to integrate ecosystem service valuation measurements into exchanges. In practice, however, these methods tend to be expensive and to produce reams of qualitative results which, for ease of comparison, wetlands managers tend to reduce to quantitative value scores that often mask the ecological rationales behind them.[67]

The ELI report surveys the forty-six existing wetlands mitigation banks in operation at the time, and includes a brief entry for "currency/evaluation method." Based on ELI's summary chart,[68] four banks used the Wetland Evaluation Technique (WET), a broadly tailored method, and the rest were split between using acre counts, a simple index, and the Habitat Evaluation Procedure (HEP), a narrowly tailored method. Thus, simple indices and narrowly tailored methods clearly predominated in this survey.

ELI counts *economic valuation* among three "other approaches" that could be used in wetlands assessment. Economic valuation is distinctly different than the three other methods, which focus on ecological function. None of the mitigation banks operating at the time of the ELI study included methods devoted to assigning value indicators to ecosystem services that the assessed wetlands provide.

IWR Study. IWR's First Phase Report,[69] a major component of IWR's ongoing National Wetlands Mitigation Banking Study, takes much of the theoretical discussion of ELI's report and applies it to the forty-four existing banks and forty-five proposed banks included in IWR's 1992 survey inventory.[70] Unlike ELI, IWR

65. *Id.* at 90.
66. *Id.*
67. *Id.* at 91.
68. *Id.* at app. B.
69. FIRST PHASE REPORT, *supra* note 1.
70. *See id.* at tbls.B-1, B-2.

divides assessments into four methods: "inventory, subjective scoring, production/diversity indices and measures, and function evaluation methods." Under this framework, inventory methods provide only area as an output, whereas the other three approaches can use area or function units such as Habitat Units (HUs).[71]

IWR's framework does not differ substantially from ELI's in describing a basic dichotomy between acre-based methods and functional assessment methods. The IWR's inventory category corresponds to ELI's simple indices type, and the other three IWR categories include methods that correspond to the ELI narrowly tailored indices and broadly tailored indices categories.

Consistent with the ELI study, IWR found that "among existing banks, debiting and crediting transactions are based on two basic currencies—acreage and functional replacement."[72] Thus, in the IWR study of existing (in 1992) banks, twelve banks used an inventory method (acres) exclusively, and eight used a function evaluation method (usually habitat units) exclusively, and the other banks used other methods and combinations of methods.[73] IWR counted none using what ELI would call a broadly tailored index method such as WET.[74]

Florida OPPAGA Study. In March 2000, in response to a legislative request, the Florida Legislature's Office of Program Policy Analysis and Government Accountability (OPPAGA) compiled a comprehensive policy review of wetlands mitigation under state law, including the state's approach to wetlands mitigation banking.[75] OPPAGA identified a critical structural problem in the state's

71. *Id.* at 31.

72. *Id.* at 18.

73. *See id.* at 32.

74. *See id.*

75. *See* OPPAGA, *supra* note 61. OPPAGA explained the use of mitigation banking in Florida in state environmental permitting programs, and the relationship between the state and federal programs, as follows:

> Mitigation banks are an additional offsite mitigation option. Mitigation banks are entities that restore, create, enhance, or in some cases preserve wetlands and/or other aquatic resources. To establish a mitigation bank, an applicant must obtain a Mitigation Bank Permit from the appropriate state agency and a Mitigation Banking Instrument from the federal agencies. Mitigation bank applicants are encouraged to meet with an interagency Mitigation Bank Review Team before submitting a permit application. This process is intended to streamline and ensure consistency between the state and federal reviews. Once the state application is deemed complete, differing regulatory requirements may not allow for a con-

method of valuing wetlands and accounting for trades in mitigation banking: whereas mitigation bank credits are awarded based on wetland function values, wetland permit mitigation requirements are quoted in terms of acres.[76] Consequently, when permittees use function-based mitigation bank credits to fulfill their acre-based mitigation needs, regulators are "unable to ensure that permitted mitigation fully offsets the loss of wetland functions."[77]

To harmonize the banking method (functions) with the permit mitigation method (acres), OPPAGA recommended that the state adopt a statewide mitigation assessment methodology that would include a "functional assessment of wetlands and include factors for time, lag, risk, location of mitigation, and contain provisions for regional differences in ecosystem type."[78] Acting on OPPAGA's recommendation, Florida adopted potentially groundbreaking legislation requiring the Florida Department of Environmental Protection to devise and adopt, for use by all state and local agencies engaged in wetland mitigation decisions, a uniform wetland mitigation assessment method that "must determine the value of functions provided by wetlands and other surface waters considering the current conditions of these areas, utilization by fish and wildlife, location, uniqueness, and hydrologic connection."[79] The

---

current review. Thus, the Mitigation Bank Permit and Mitigation Banking Instrument may be issued at different time.

Id. at 7.

76. *Id.* at 7-8.

77. *Id.* at 13-15. OPPAGA elaborated on the problem:

> Differences in methodologies potentially affect the amount of mitigation required. Establishing a comparable functional exchange requires a quantitative assessment of wetland functions on the impact site and the mitigation site. However, this approach is not taken when the permit applicant uses a mitigation bank to offset the impacts. Mitigation bank credits are determined using a functional assessment methodology and are equivalent to one acre of successful wetland creation. . . . The actual amount of mitigation may be lost in the translation between mitigation credits and mitigation ratios. As a result, the amount of mitigation required may be overstated or understated since both the impact and mitigation sites were not assessed using a functional assessment methodology. This may result in the permit applicant being required to purchase more or fewer bank credits than are possibly needed, which affects the cost of mitigation.

Id. at 15.

78. *Id.*

79. H.R. 2365, 102nd Leg., 2nd. Sess., 2000 Fla. Sess. Law Serv. 00-133 (West) (amending FLA. STAT. ch. 373.414(18)). The assessment method must also (1) "account for different ecological communities in different areas of the state"; (2) "determine the value of functions provided by wetlands . . . considering . . . location"; and (3) "account for the expected time-lag associated with offsetting impacts." *Id.*

seeds of an ecosystem services approach to wetlands banking methodology may lie in the agency's efforts to fulfill this mandate.

Bartoldus Study. The Bartoldus study provides a detailed description of forty different wetlands assessment methods,[80] but does not suggest which method holds the most promise in terms of wetlands mitigation banking. The study does provide significant detail about the type of habitats in which each method of assessment is used, the basic targets of assessment, and the functional and social values encompassed in the assessment. The report also summarizes the basic data input demands and data output form and scope.

Appendix 1 to this Article summarizes Bartoldus' findings regarding the general scope of the assessment method (assessment coverage), the type of habitats in which each method of assessment is used (habitat coverage), the functional values encompassed in the assessment (function coverage), and basic data input demands for each of the forty methods. Over half of the described methods go beyond assessment of habitat suitability to encompass some assessment of wetland function, suggesting that wetland assessment methods are moving beyond the approaches that focus simply on acres. Consistent with ELI's findings, however, Bartoldus shows that many of these function-based methods are bounded by limitations on type of habitat for which the method can be used (e.g., coastal wetlands only) and limited in terms of the functions assessed (e.g., limited to avian species functions). Bartoldus also explains that few of the methods include assessment of social values,[81] and few are actually in use for wetlands mitigation banks.[82]

2. *Supplemental Survey.*

Our supplemental survey was designed to determine whether banks established *after* the ELI and IWR studies are adopting methods that fit within the trends ELI and IWR found—i.e., heavy reliance on acre counting and simple functional assessment methods—or whether wetlands banks have progressed to more advanced functional assessment methods that may capture some ecosystem service values. We contacted as many banks as possible

80. BARTOLDUS, *supra* note 62.
81. *See id.* at 182-84 tbls.6,7.
82. *See id.* at 179-81 tbl.5; *see also infra* app.1.

by telephone or e-mail within the time and budget constraints of the study. In this report, we include only those banks for which we were able to either (1) assemble information from subsequent IWR studies,[83] or, in the absence of subsequently compiled information from IWR, (2) communicate substantively with bank or Corps personnel about the assessment method and the role, if any, that ecosystem service valuation plays in the bank's assessment method. Given the difficulty of identifying and communicating with bank and Corps personnel, the survey is not a comprehensive study of all or even most banks; however, it does provide a meaningful sample of recently established banks distributed around the nation.

Subject to the above-stated criteria, we were able to describe forty-one banks established after the IWR *First Phase Report*. The names of the banks, the state where each is located, and the methods that each used to assess value, are presented in Appendix 2. Twenty-one of these banks use an acreage-based index; eleven use some function-based method, four use a habitat-valuation method, and five use a "best professional judgment" approach. This split between acre-based and function-based methods is consistent with ELI's and IWR's earlier findings. For the most part, then, wetlands assessment methods in use in recently established wetlands mitigation banks have changed very little from those in use since the beginning of the banking program.

B. *Trading Practices*

ELI's *Wetland Mitigation Banking* report explains that the central reason to develop a "currency" for wetland mitigation banking is to facilitate the trades that mitigation banks make among wetlands of different types and locations, at different times. Crude currencies, such as simple index measures of acres, result in crude trading schemes, such as acre "ratios" that attempt to capture and account for these differences. By contrast, a sophisticated assessment method that fully captures ecosystem service values would, in theory, allow trades to be made regardless of differences in type, location, and time. The full representation of service value would make

83. IWR does not maintain complete or reliable information regarding the assessment methods used at the 230 banks currently included in its list of existing banks. *See* E-mail from Robert Brumbaugh, Manager, IWR National Wetlands Mitigation Banking Study (Jan. 11, 2001 16:44:06). IWR has published one report subsequent to its *First Phase Report* that contains information we found useful to our study of assessment methods. *See* IWR, U.S. ARMY CORPS OF ENGINEERS, NATIONAL WETLAND MITIGATION BANKING STUDY B, COMMERCIAL WETLAND MITIGATION CREDIT VENTURES: 1995 NATIONAL SURVEY (1996).

differences in type irrelevant, would allow comparison of impacts to different service populations, and would allow discounting to account for timing differentials.

Although the policy rationales offered in support of wetland mitigation banking focus on these advantages of market-based trading, our research suggests that the development of such sophisticated trading schemes is severely hampered by financial and time constraints at the wetland assessment stage of mitigation banking, which in turn limit the sophistication of assessment methods used. As ELI concluded, "it is apparent that in order for any banking program to function, the selected credit definition cannot be too complex."[84] In other words, practical constraints on implementation of more sophisticated assessment methods designed to produce a monetized service-value-based currency for trades—i.e. a currency based on their costs, time demands, and complexity—have prevented mitigation banking from taking full advantage of all the benefits a market-based trading framework can offer. Assessment methodology has thus become the proverbial tail wagging the dog. As the ELI report aptly concludes:

> in order for a wetland mitigation bank currency to work, it must be (1) simple to determine and to monitor, and (2) able to represent a sufficient range of values and functions. None of the existing systems do both of these things well. The multivariate systems are quite useful for onsite [sic], or project specific, mitigation, but they lack the simplicity for use in banking. The simple systems overlook critical functions. The selection of a currency should reasonably be tied to the purpose of the banking system, regional wetland goals, and the ease of determination.[85]

Given these practical realities, it is no surprise that ecosystem service value approaches to wetlands mitigation banking have been slow to emerge. Instead of developing and refining service valuation approaches for assessment and trades, wetlands mitigation banking assessment methods have stagnated in the acre-based and narrow function-based approaches, resulting in relatively crude "currencies" for trading purposes. Trading practices have compensated by restricting the market for trades in ways that reduce the risks posed by the crude currencies employed (e.g., allowing only trades of like-kind wetlands or closely situated wetlands). It would be premature under these circumstances for the Corps to decree, before reliable assessment methods are developed, that ecosystem

84. ELI-WETLAND, *supra* note 1, at 157.
85. *Id.* at 91.

services must be fully accounted for in wetlands mitigation banking.

V. CONCLUSION

Given the current state of affairs, there is little promise for the integration of ecosystem service valuation methods into wetlands mitigation banking until methods of wetland assessment are significantly improved. In the absence of widely available, readily applied methods for calculating and comparing ecosystem service values of the wetlands being traded, the Corps will likely put constraints on trading markets to compensate for ecosystem function losses not recognized by acre-based methods. These constraints significantly undercut the market and information advantages ecosystem service valuation would impart to wetlands mitigation banking in general, thus further reducing any incentive to apply such methods.

Hence, unless some way is developed to capture the ecosystem service value of wetlands without costly, time-consuming, and complicated valuation methods—e.g., by measurement of readily determinable indicators of ecosystem service value—wetlands mitigation banking is likely to rely most heavily on acre-based and narrow function-based methods and highly regulated "markets" for trades. Nevertheless, if such assessment methods can be developed, through measures such as the legislation Florida recently adopted[86] and through research such as that which Wainger et al. are undertaking,[87] the authority to require their use is implicit in the existing legal framework of the section 404 program. By using these new assessment methods, the wetlands mitigation banking program would surely come closer to meeting its environmental protection objectives.

86. *See supra* text accompanying note 79.
87. *See* Wainger et al., *supra* note 3.

APPENDIX 1: ESSENTIAL CHARACTERISTICS OF WETLANDS ASSESSMENT PROCEDURES.[88] Procedures are the names officially or commonly used for each assessment method. Assessment coverage is the overall assessment focus of the method. Habitat coverage is the type of habitat to which the method is limited for use (NT = tidal wetlands, NT = nontidal wetlands, up = uplands, up rip = upland riparian). Function Coverage is the wetlands functions included in the assessment, if any (hyd = hydrology, wq = water quality, hab = habitat). Input Demand is level of cost and difficulty of obtaining the assessment data required by the method (L = low, M = moderate, H = high).

Procedure Assessment Coverage	Habitat Coverage	Function Coverage	Input Demand
Avian Richness Evaluation Method (AREM)			
avian richness and habitat suitability	NT	hab	M
Coastal Method			
function	T	hyd, wq, hab	L to M
Connecticut Method			
functional value	NT	hyd, wq, hab	M
Wetland Functions and Values: A Descriptive Approach			
functions and values	NT, W	hyd, wq, hab	L
Evaluation for Planned Wetlands (EPW)			
functions	NT, T	hyd, wq, hab	M
Habitat Assessment Technique (HAT)			
habitat quality	NT, T	hab	M to H
Habitat Evaluation Procedure (HEP)			
habitat suitability	NT, T, up	hab	M to H
Hydrogeomorphic Approach (HGM)			
functions	NT, T	hyd, wq, hab	M to H
Method for Assessing the Function of Wetlands			
functions	NT	hyd, wq, hab	M
Index of Biological Integrity (IBI)			
biological conditions	NT, T, up	none	H
Interim HGM			
functions	NT, T	hyd, wq, hab	L to H
Indicator Value Assessment (IVA)			
functions and values	NT, T	hyd, wq, hab	L to M
Models for Assessment of Freshwater Wetlands (Larson Method)			
resource factors (functions)	NT	hyd, hab	L to M
Method for the Assessment of Wetland Function (MDE Method)			
functions	NT	hyd, wq, hab	M
Maine Citizens Tidal Marsh Guide (ME Tidal)			
ecological integrity, functions, and values	T	hab	L to M
Minnesota Routine Assessment Method (MNRAM)			
functions	NT	hyd, wq, hab	L to M
Montana Wetland Field Evaluation Form (MT Form)			
functions and values	NT	hyd, wq, hab	L to M
Narragansett Bay Method (NBM)			
ecological health	T	hyd, wq, hab	L to M

88. BARTOLDUS, *supra* note 62 (the information presented in Table 1 is derived from summaries of selected fields from tables 1-7).

North Carolina Coastal Regional Evaluation of Wetland Significance (NC-CREWS)			
functions and ecological significance	NT, T	hyd, wq, hab	M
Guidance for Rating the Values of Wetlands in North Carolina (NC Guidance)			
functions and values	NT	hyd, wq, hab	M
New England Freshwater Wetlands Invertebrate Biomonitoring Protocol (NEFWIBP)			
biological integrity	NT	hab	H
New Hampshire Method (NH Method)			
functional value	NT	hyd, wq, hab	M
Watershed-Based Wetland Assessment Method for the New Jersey Pinelands (NJ Method)			
ecological integrity	NT	hyd, wq, hab	H
Oregon Freshwater Wetland Assessment Methodology (OFWAM)			
functions	NT	hyd, wq, hab	M
Pennsylvania Modified 1980 Habitat Evaluation Procedure (PAM HEP)			
habitat suitability	NT, T, up	M to H	
Process for Assessing Proper Functioning Condition (PFC)			
functional condition	NT, T, up	hyd, wq, hab	L to M
Wetland Assessment: A Regulatory Assessment Method (RA)			
functions and values	NT, T	hyd, wq, hab	L to H
Rapid Assessment Procedure for Assessing Wetland Functional Capacity			
functions	NT	hyd, wq, hab	M to H
Synoptic Approach for Wetlands Cumulative Effects Analysis			
functions/losses, values, replacement potential	NT, T, up	hyd, wq, hab	H
Technique for Functional Assessment of Virginia Coastal Plain Nontidal Wetlands (VIMS Method)			
functions	NT	hyd, wq, hab	M
Washington State Wetland Function Assessment Method (WAFAM)			
functions	NT, T	hyd, wq, hab	M
Wildlife Community Habitat Evaluation (WCHE)			
suitability and richness	NT	hab	M
Wetland Evaluation Technique (WET)			
functions and values	NT, T	hyd, wq, hab	L to M
WEThings			
habitat potential	NT, T	hab	M
Wildlife Habitat Assessment and Management System (WHAMS)			
habitat suitability	NT, T, up	hab	M to H
Wildlife Habitat Appraisal Procedure (WHAP)			
habitat quality	NT, T, up	hab	L to M
Wisconsin Rapid Assessment Methodology (WI RAM)			
functional value	NT	hyd, wq, hab	L
Wetland Quality Index (WQI)			
wetland quality	NT	hyd, wq, hab	L to M
Wetland Rapid Assessment Procedure (WRAP)			
functions	NT,T*	hyd, wq, hab	L to M
Wetland Value Assessment Methodology (WVA)			
habitat suitability	NT, T	hab	L to M

APPENDIX 2: WETLAND MITIGATION BANK CREDIT EVALUATION METHOD–SURVEYED BANKS. The wetlands mitigation banks listed in this appendix were approved or commenced operation after the Environmental Law Institute and Corps' Institute of Water Resources wetland banking studies were completed. Only banks for which we could confirm assessment method by direct contact or through Corps documentation are included. Banks are identified by state and name. Method refers to the overall assessment method focus used by the bank (acres = acre-based method; functions = some narrow or broad functional assessment method; professional judgment = the bank leaves each trade open to discretion of the parties and agency approving the permit).

State	Bank	Method
AK	City and Borough of Juneau	functions
CA	Aliso Creek	functions
CA	Canada Gobernadora	acres
CA	Cottonwood Creek	acres
CA	Mystic Lake	acres
CA	Wikiup	habitat
CA	Wildlands, Inc.	habitat
FL	Florida Wetlands Bank	functions
FL	Panther Island	functions
GA	Old Thorn Pond	professional judgment
IL	DuPage County	functions
IL	St. Charles	acres
LA	Pine Flatwoods	habitat
ND	North Dakota State WMB	acres
NJ	Hackensack Meadowlands	functions
OH	Big Island	acres
OH	Hebron	acres
OH	Ohio Edison	functions
OH	Sandy Ridge	functions
OH	Slate Run	acres
OH	Three Eagles	acres
OR	Henderson Marsh	habitat
OR	West Eugene	functions
SC	Friends Neck	acres
SC	Vandross Bay	acres
TX	Anderson Tract	professional judgment
TX	Byrd Tract	professional judgment
TX	Hawkins	professional judgment
TX	KAty-Cypress	functions
TX	KLAMM	professional judgment
VA	City of Virginia Beach Creeds Bank	acres
VA	Davis Wetland Bank, LLC	acres
VA	Great Dismal Swamp	acres
VA	James River	acres
VA	Julie J. Metz	acres
VA	Neabsco	acres
VA	North Fork	acres
VA	ODEC-Virginia Power	acres
VA	White Cedar	acres
VA	White Cedar LLC	acres
WA	Mill Creek Special Area Management Plan	functions