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The Effects of Wetland Mitigation Banking on People

In the first comprehensive empirical study of the demographics of wetland mitigation banking, the authors find a systematic, pervasive downside to the practice. Banking facilitates the redistribution of wetland resources from urban to rural areas, reallocating the important environmental services wetlands provide to human communities.

BY J. B. RUHL AND JAMES SALZMAN

In the decade since the U.S. Army Corps of Engineers and Environmental Protection Agency officially blessed wetland mitigation banking for purposes of satisfying mitigation requirements under section 404 of the Clean Water Act,¹ there has been ongoing debate about the pros² and cons³ of the practice. The debate mainly has focused on the advantages and disadvantages of banking in terms of administrative efficiency and ecological impact, whereas little attention has been paid to the effects of wetland mitigation banking on people. This article presents the first comprehensive empirical study of the demographics of wetland mitigation banking, and reveals what has long been suspected: Banking facilitates the redistribution of wetland resources from urban to rural areas, reallocating the important ecosystem services wetlands provide to human communities.

Wetland Mitigation and Ecosystem Services

When a land development project involves filling of wetland areas regulated under the Clean Water Act or similar state laws, the permit authorizing the activity usually requires mitigation for the loss of wetland functions. Permittees can accomplish mitigation themselves by creating or enhancing wetlands at the development site or at an off-site location, or by paying a fee to fund wetland mitigation by a third-party entity.⁴ Wetland mitigation banking is a third-party variation of off-site mitigation. The practice allows a developer to compensate for resource losses

by purchasing “credits” from another landowner—the wetland banker—who has created or enhanced wetland resources elsewhere.

Several hundred entrepreneurial banks now operate in the nation, selling credits within defined “service area” boundaries.⁵ Mitigation banking today reportedly accounts for [X] percent of all regulatory mitigation carried out under section 404 nationwide.⁶ Moreover, as the shortcomings of on-site and off-site mitigation provided directly by permittees has become increasingly apparent,⁷ EPA and the Corps continue to praise wetland banking.⁸ Federal policy now encourages federal agencies to use mitigation banking as the preferred means of

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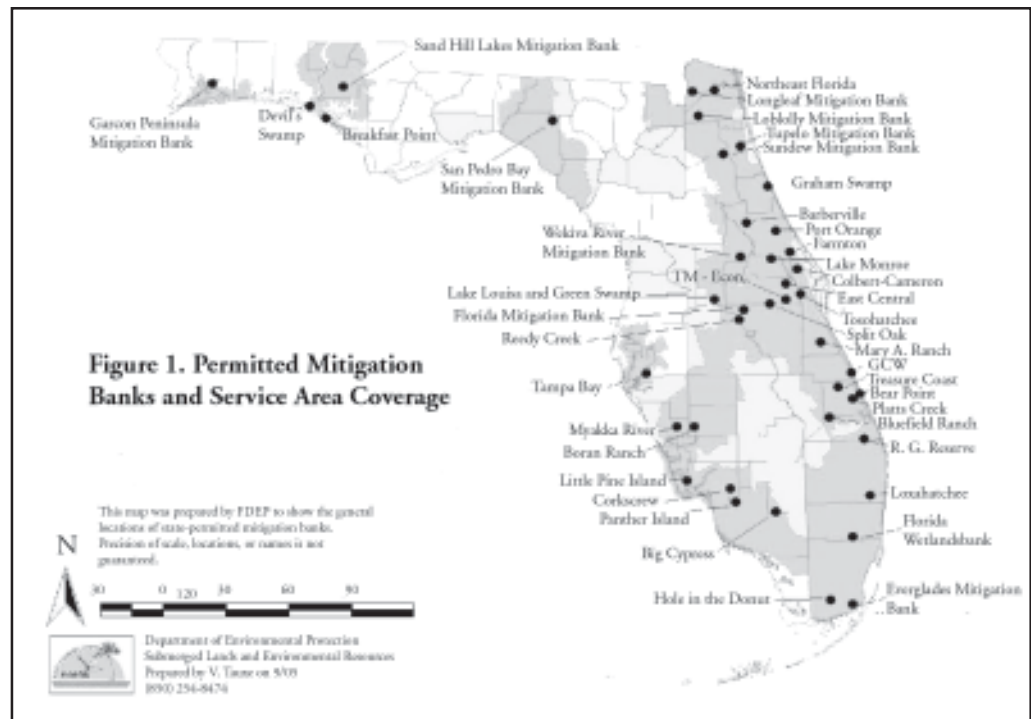
compensating for wetland losses their projects cause.⁹ In its 10 short years of official endorsement, wetland mitigation banking has gone from a novel concept to a government-promoted and routinely employed wetland mitigation option.

Because it simplifies off-site wetland mitigation, and thus arguably simplifies development in wetland areas, banking has attracted both praise and criticism of its purported administrative advantages over first-party mitigation and its overall ecological effects. Remarkably, what has been missing from this debate is any attention to the economic effects of wetland mitigation banking. Wetlands provide important ecosystem services to human populations, such as flood mitigation, groundwater recharge, water filtration, and sediment capture. These benefits, while unquestionably of economic value if measured in terms of the adverse impacts that would occur were they removed or the cost to replace them with technological substitutes, usually are not valued in the marketplace.¹⁰ Recent natural disasters such as Hurricane Katrina make clear that this omission is a case of market failure in which structural barriers exist to rational economic behavior. In particular, landowners cannot easily charge for the off-site flood or pollutant mitigation benefits flowing from wetlands they own, making the services of those wetlands a positive externality that appears free to other landowners.¹¹ Consequently, a landowner's decision about whether to convert wetlands to other uses is unlikely to account for their value to others.

On-site wetland mitigation is in principle neutral with respect to ecosystem services in the sense that it keeps wetland resources in generally the same location. In contrast, wetland mitigation banking facilitates moving wetland resources from one location, the development project, to a potentially distant location, the bank site.¹² Even with the generous assumption that this movement provides a net ecological advantage, it cannot be the case that the same human population benefits from the ecosystem services once associated with the damaged wetlands. If the wetlands move, their ecosystem services go with them.¹³ Some people will inevitably lose and others will gain the economic benefit of wetland ecosystem services.

Structural Biases in Wetland Mitigation Banking

Wetland mitigation banking employs some safeguards designed to sustain the delivery of ecosystem services to a particular hu-



man population. Banking policy generally requires that the “swap” be for wetlands of similar kind and within a “service area” usually defined by watershed boundaries. Some ecosystem services thus may be provided on the same basis to the human population within the service area regardless of where a development project depletes the wetlands and a bank enhances them. But the benefits of some wetland ecosystem services are primarily local. For example, research from Florida shows that wetlands help regulate local moisture and temperature.¹⁴ Even small wetlands in urban areas provide important pollution control services to the local population,¹⁵ and clusters of small isolated wetlands provide important functions as an ecological complex.¹⁶ Hence, moving wetland resources, even within a bank's defined service area, is likely to alter the allocation of benefits.

Indeed, there is good reason to believe that wetland mitigation banking will systematically move wetland resources from urban areas to rural areas within a bank's service area. Entrepreneurial bankers are interested in profit, and thus are likely to seek the least costly land that will produce credits. Land developers are likely to seek the least costly land in the development market. It is highly unlikely, however, that bankers and developers will compete for land. Bankers need large tracts capable of sustaining wetlands, which, if they exist in a development market area, are likely to be too pricy for the banker. The whole point of wetland mitigation banking—what makes its economic incentives work—is that developers get to wipe out wetland patches in the higher-priced land markets and bankers get to establish wetland banks in the less-pricy land markets. It is not surprising, then, that development projects using wetland mitigation banking often are located in urban

areas and the banks they use often are located in rural areas.¹⁷ Banking also is likely to redistribute local wetland services asymmetrically between those two areas.

What We Don't Know About Wetland Mitigation Banking

We have no solid empirical foundation for assessing the impact of banking on the distribution of wetland ecosystem services because banking policy has not integrated this factor into decisionmaking or monitoring. The permitted banks in Florida, for example, include 3 that have sold all their credits, 30 banks actively selling credits, and 10 banks approved for operation but not yet selling credits.¹⁸ More than 1,000 land development projects have purchased credits from banks in Florida, buying more than 4,800 total credits. Though credit prices are not publicly available, they are reported to vary widely but average well into the tens of thousands of dollars per credit. One sold-out bank in Florida commanded \$45,000 per credit in the late 1990s.¹⁹ The permitted banks cover more than 117,000 acres and have the potential to offer more than 36,000 credits for sale. Figure 1 shows the locations of the permitted banks and their combined service areas, which cover roughly half the land mass of Florida.

Although Florida has recently adopted a uniform method of estimating wetland losses and credits that focuses on functions rather than merely counts acres, the method does not consider ecosystem service impacts when approving banks, estimating wetland losses, assigning bank credits, or tracking bank transactions.²⁰ Moreover, the above description sums up what is known about wetland mitigation banking in the state. The Corps, the Florida Department of Environmental Protection, and regional water management districts do not maintain a database of wetland mitigation banking transactions that would allow anyone to identify the location of projects using banks for mitigation or evaluate the economic, ecological, and demographic impacts of those transactions. After an exhaustive survey, we found that the Corps, EPA, and states administering wetland mitigation banking programs do not perform any better than Florida in this respect, though reportedly the Corps and EPA currently are testing data systems that would be a significant step forward.

This data vacuum is truly ironic. Wetland mitigation banking often is glowingly portrayed as one of the innovative "second-generation" environmental policy instruments that relies on information enrichment and market incentives rather

than on regulatory proscriptions.²¹ Some of these programs, such as the Toxic Release Inventory, do collect and disseminate information quite effectively, significantly altering polluter behavior without direct regulation.²² But federal and state wetland mitigation banking programs do not assemble data about the land values of development project and bank sites or the price of credit sales, and they do not collect and manage ecological, economic, or demographic data associated with the projects and the banks.

Survey of Wetland Mitigation Banking Demographics in Florida

We collected information concerning all of Florida's active and sold-out wetland banks and all of the land development projects that purchased credits from them to satisfy their regulatory mitigation requirements. The 24 banks for which adequate data were available²³ represent more than 900 development projects and more than

Chart 1. Project Area Population Densities

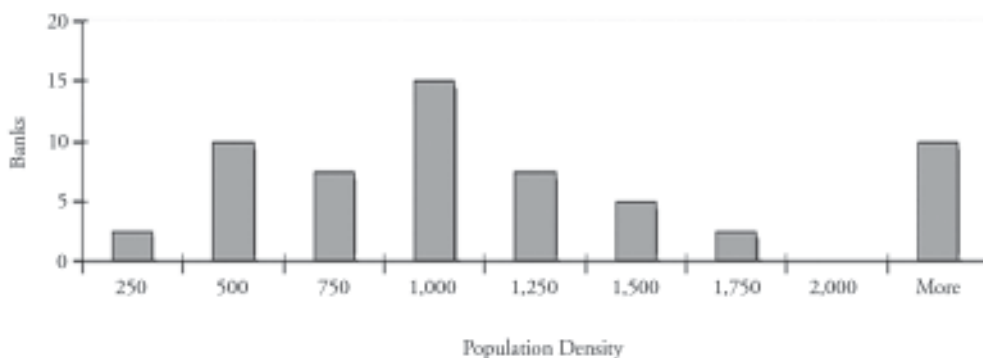
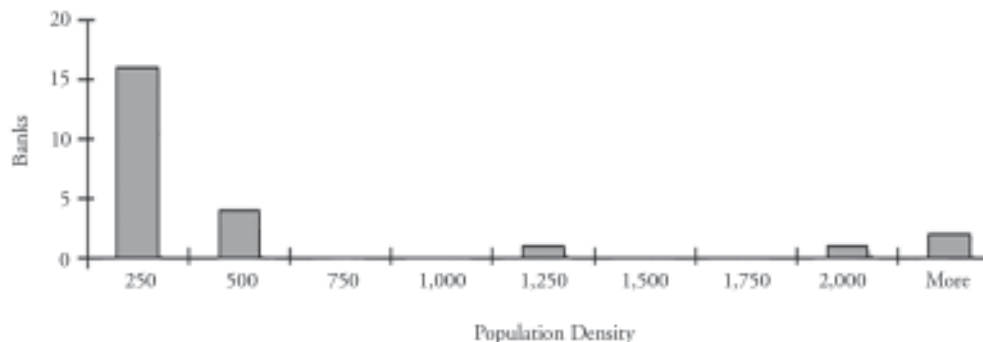


Chart 2. Bank Area Population Densities



4,000 credits sold. We cross-referenced the permit numbers with other databases to identify the county parcel identification numbers of each development project. We then generated the GIS location, represented as mapped polygon boundaries, for each project and bank, and gathered demographic data for the locations to allow comparison of human populations.²⁴ Our findings, summarized in Table 1, confirm the hypothesized migration of wetland resources to less densely populated areas. That shift was apparent for 19 of the 24 banks. This is not surprising, given that the average distance between a bank and its associated project areas was often considerable—more than 10 miles for all but 3 of the 24 banks studied.

The population density distributions in Charts 1 and 2 illustrate the sharp urban skew of project area population densities and the rural nature of the bank area population densities. For the banks whose transactions produced this urban to rural shift, the population density around a given project averaged 934 more people per square mile than around the associated bank. The pattern for median income and minority population was less clear, however. Project area median incomes were higher than bank area incomes for 11 banks, lower for 11, and equal for 2. Percentages of minority population were higher in project areas for 15 banks, lower for 7, and within a percentage point for 2. Nevertheless, although the directions were mixed, overall there were significant differences in median income and minority populations for project areas and banks. The average difference in median income was \$11,750, and the proportion of minorities in the population varied by an average of 13 percentage points.²⁵

The clear shift of wetlands from urban to rural areas, the significant differences between bank areas and project areas in terms of population density, median income, and percentage of minorities, and the considerable distance between banks and their associated projects all suggest that completely different populations are winners and losers in terms of locally delivered wetland ecosystem services. Moreover, in many cases we examined, the projects responsible for filling urban wetlands were tightly clustered, perhaps eliminating any synergistic effects of urban wetland complexes (see Figure 2).

Bringing Wetland Mitigation Banking Back Down to Earth

The question is whether this redistribution should matter for

policy. It is difficult to approach this question intelligently, since no actor in the banking process takes steps that would allow us to test the policy implications of the phenomenon—i.e., tracks the redistribution of wetlands, estimates the effects thereof on ecosystem service values, notifies the affected public, and provides opportunity for public input. The losers in wetland mitigation banking—the people in communities losing wetlands to the banking areas—do not even know that they are losing anything of economic value, much less what and by how much. It only seems appropriate, therefore, to identify the scope and magnitude of this phenomenon before deciding its relevance to policy.

But our study suggests more than just a reason to conduct more research. It calls into question two central foundations of wetland conservation policy. First, it suggests that the much-heralded national “no net loss” policy,²⁶ introduced by President George H. Bush and retained by every administration since, is not a sufficient response to economic pressures pushing development in wetlands. Even assuming the policy achieves no net loss of ecological function, when the geographic distribution of wetlands changes, one cannot reasonably assert that there has been no net change in the wetland universe. The redistribution of wetlands inherent in the banking approach has resulted in significant losses of ecosystem service values for some human populations and gains for others.

Second, our findings expose the soft underside of “market-based” environmental management instruments. Defenders of wetland mitigation banking might argue that the redistribution of ecosystem services associated with wetland banking is not a concern because, as a market-based instrument, banking

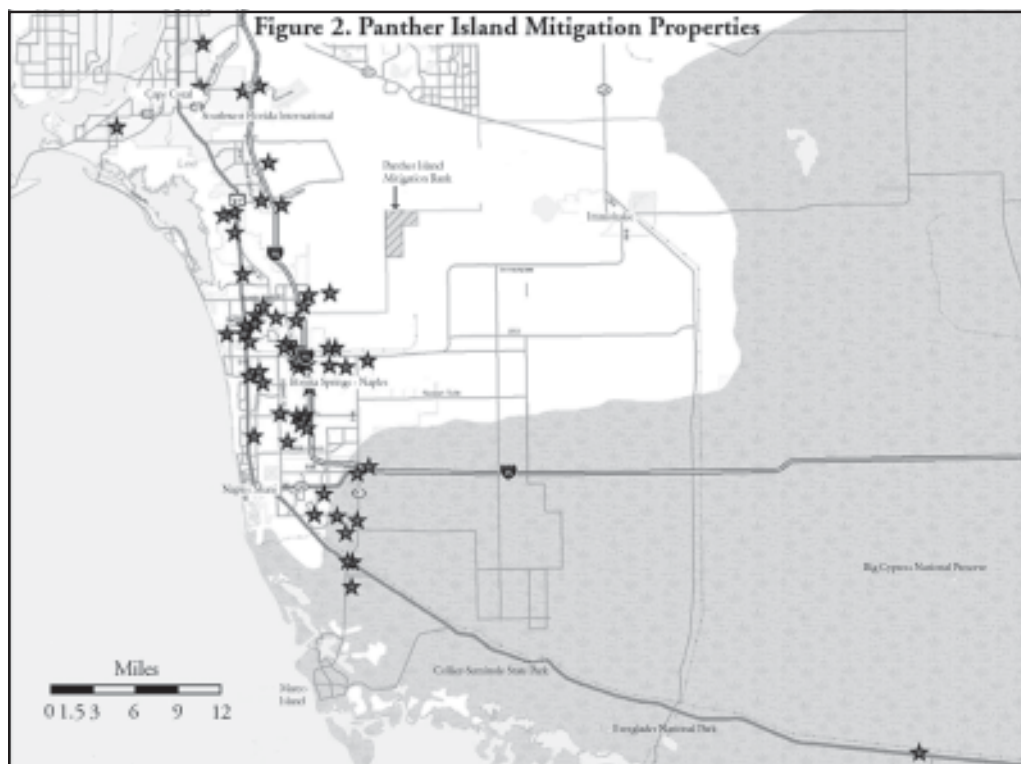


Table 1. Florida Wetland Banks: Demographic Statistics

Bank	Projects	Credits	Population Density (square miles)	
			Projects	Bank
Barberville	15	30	779	34
Big Cypress	20	126	553	4
Bluefield Ranch	24	85	748	66
Boran Ranch	44	74	413	35
CGW	14	40	425	1,975
East Central	46	144	2,349	39
Everglades	40	182	2,448	11
Farmton	136	404	789	486
Florida MB	93	588	1,024	1,246
Florida Wetlands	63	367	3365	2,254
Lake Louisa	25	172	511	116
Lake Monroe	10	233	1,713	352
Little Pine	94	97	941	401
Loblolly	20	115	786	211
Loxahatchee	43	157	1,376	2,469
Mary A. Ranch	18	86	1,297	6
Northeast Florida	108	377	987	115
Panther Island	74	935	798	61
Reedy Creak	16	84	460	465
Split Oak	19	88	1,112	88
Sundew	13	67	348	31
TM-Econ	21	66	2,285	12
Tosohatchee	11	153	60	12
Tupelo	8	128	1,179	86

produces the most efficient allocation of resources and therefore the redistribution is not only appropriate but desirable. The problem with this argument is that wetland mitigation banking is not a market, at least not one that can satisfy the principles of efficient allocation.

The “market” for wetland bank credits is purely a construct of federal and state regulatory programs that restrict development in wetlands and mandate compensation in exchange for authorization. Developers and bankers account only for the factors, such as habitat value, that are relevant to the regulation-constructed trading arrangement. So long as federal and state wetland regulation programs do not acknowledge the geographic distribution of ecosystem services as a criterion for regulation and a factor in wetland mitigation policy, the “market” for credits will not do so either.

Next Steps and Pathways of Reform

Our research reveals a conundrum. On-site compensatory mitigation keeps wetland resources within the local community, and if it worked, would avoid the redistribution problem. But on-site compensation has proven administratively complex and inherently unfavorable to developers. Wetland mitigation banking presents just the reverse set of conditions—administrative

efficiency and private incentives to produce and sustain mitigation, but an inevitable redistribution of wetlands and their ecosystem services. The question is how to solve the distribution problem of banking without undermining the practice’s administrative and incentive advantages. Several approaches being tested in other resource management regimes seem promising:

Enrich the Information Base

The Toxic Release Inventory produced emission reductions in part because it provided citizens in the area around each source readily accessible data about the quantity and quality of emissions to which they were being exposed. Were the public given ready access to the kind of information our research has assembled concerning wetland mitigation banking, agencies, communities, land developers, and prospective mitigation bankers might alter their perceptions of the pros and cons of banking arrangements.

Restructure Banking Incentives

To change how wetland mitigation banking influences ecosystem service distribution, we could change the incentive structure. For example, an incentive premium, such as an enhanced credit allotment, could be awarded to banks that locate closer to the

Median Income (\$)		Percentage Minority		Average Distance to
Projects	Bank	Projects	Bank	Project (miles)
5,3750	32,250	24	24	21
50,500	31,250	17	70	35
35,000	29,000	17	40	17
31,250	37,500	18	10	28
42,000	35,250	20	29	4
43,500	37,750	31	12	16
53,000	35,500	38	42	40
48,250	53,750	21	11	20
41,750	64,250	37	39	9
57,750	77,500	48	41	8
50,000	50,000	28	30	19
62,250	41,750	26	18	12
44,750	37,250	18	11	15
53,500	36,250	28	15	11
61,250	75,750	22	15	13
39,000	66,750	28	14	21
43,000	44,250	24	21	15
55,250	35,750	12	28	12
40,500	39,500	39	40	12
41,000	65,250	42	10	15
32,500	36,500	24	2	18
57,000	65,250	39	10	12
65,250	65,250	13	10	11
41,250	35,750	28	13	17

urban areas losing wetland resources. Bankers would have an increased expected revenue stream to offset higher land costs, and the urban population would benefit from wetlands in closer proximity.

Use Adaptive Regulation

Although structural features prompt an inherent asymmetry between bank and development project locations, it may be difficult to predict where development projects will locate, at what rates, and in what clustered concentrations. The changing distribution of ecosystem services will be at least as dynamic. Thus, a decision to approve a wetland bank location and service area could be based on only a rough prediction of future wetland ecosystem service distributions; information enrichment and market restructuring are unlikely to ameliorate all instances of undue redistribution. Direct regulatory intervention, such as closing certain areas to trades, may be justified in such instances.

Of course, just as with information-based and market-based policies, effective regulation of a dynamic program requires a reliable and continuous stream of monitoring data and room for an agency to respond adaptively. Rather than define a wetland bank location and service area and never look back, adaptive management involves a process of goal setting (e.g., seeking to

avoid unduly disproportionate redistribution of wetland ecosystem services), continuous monitoring (e.g., tracking development locations associated with banks in real time), and decision adjustment (e.g., adjusting credit allotments, emphasizing on-site mitigation in certain areas, and more closely examining of future bank locations).

Conclusion

Our research has revealed a potential downside of wetland mitigation banking that had been posited in the literature but never empirically demonstrated to be as systematic and pervasive as our findings suggest. However, the response should not be a rush to abandon wetland mitigation banking or to overhaul its structure radically. Rather, we suggest further research to identify with more precision the magnitude of ecosystem service redistribution and other socioeconomic effects associated with bank transactions. Then, regulatory authorities, who should be equipped to conduct adequate monitoring and make adaptive responses as bank transactions progress, must make measured and careful corrections.

It is likely that the administrative and incentive advantages wetland mitigation banking will become less pronounced once

ecosystem service distribution is taken into account. Right now we know that at least part of the advantage wetland mitigation banking enjoys over on-site mitigation is a function of the former practice's blindness to the distribution of ecosystem services. We do not know how much this blindness advantages wetland mitigation banking, and we do not know this because, quite simply, the Corps, EPA, and state wetland agencies have not been asking the right questions. We suggest it is time they begin doing so. ■

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NOTES

- ¹ See Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks, 60 Fed. Reg. 58605 (Nov. 28, 1995).
- ² For recent advocacy of the merits of wetland mitigation banking, see Royal C. Gardner & Theresa J. Pulley Radwan, *What Happens When a Wetland Mitigation Bank Goes Bankrupt?*, 35 *Env'tl. L. Rep.* (Env'tl. L. Inst.) 10590, 10591–92 (Sept. 2005).
- ³ For a comprehensive discussion of concerns expressed about wetland mitigation banking, see James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 *STAN. L. REV.* 607, 657–68 (2000).
- ⁴ For a comprehensive explanation of wetland mitigation approaches, see ENVIRONMENTAL LAW INSTITUTE, *BANKS AND FEES: THE STATUS OF OFF-SITE MITIGATION IN THE UNITED STATES* (2002) [hereinafter *BANKS AND FEES*].
- ⁵ OFFICE OF WETLANDS, U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA), *A WATERSHED DECADE 19* (2001), available at <http://www.epa.gov/owow/home/accomplishments/wetlands.pdf> (last visited Oct. 28, 2005).
- ⁶ See [forthcoming Corps report]. A much lower figure of 10 percent for the mitigation banking share had previously been reported by the National Mitigation Banking Association. See Craig Denisoff, *Banking and Transportation Projects: Merging Ecological Protection and Economic Growth*, NAT'L WETLANDS NEWSL., Sept./Oct. 2005, at 9, 10.
- ⁷ Mitigation provided directly by permittees has been described as resulting in numerous "postage stamp" mitigation sites, making it difficult for the Corps and EPA to monitor the permittees' performance. See NATIONAL RESEARCH COUNCIL, *COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT* (2001). See also R. Eugene Turner et al., *Count It by Acre or Function—Mitigation Adds Up to Net Losses of Wetlands*, NAT'L WETLANDS NEWSL., Nov./Dec. 2001, at 5; Joy Zedler & Leonard Shabman, *Compensatory Mitigation Needs Improvement, Panel Says*, NAT'L WETLANDS NEWSL., July/Aug. 2001, at 1.
- ⁸ See, e.g., Office of Wetlands, U.S. EPA, *Wetlands Mitigation Banking*, at <http://www.epa.gov/owow/wetlands/facts/facts16.html>.
- ⁹ See 10 U.S.C. § 2694b (authorizing military agencies to use mitigation banks); Pub. L. No. 108-136, div. A, tit. III, § 314(b), 117 Stat. 1431 (2003) (requiring the Corps to promulgate standards facilitating mitigation banking).
- ¹⁰ See GEOFF HEAL, *NATURE AND THE MARKETPLACE: CAPTURING THE VALUE OF ECOSYSTEM SERVICES* (2000).
- ¹¹ See James Salzman et al., *Protecting Ecosystem Services: Science, Economics, and Law*, 20 *STAN. ENVTL. L.J.* 309, 311–12 (2001).
- ¹² The propensity for wetland mitigation banks to be located at significant distances from the development projects to which they sell credits was identified early in the history of banking. See MINNESOTA DEP'T OF NATURAL RESOURCES ET AL., *MINNESOTA WETLAND MITIGATION BANKING STUDY* 10–11 (1998). These early studies did not compile demographic information about the different human populations in the respective locations.
- ¹³ This concern was first raised in Salzman & Ruhl, *supra* note 3, at 666–67, and later covered in J.B. Ruhl & R. Juge Gregg, *Integrating Ecosystem Services Into Environmental Law: A Case Study of Wetlands Mitigation Banking*, 20 *STAN. ENVTL. L.J.* 365 (2001); James Salzman & J.B. Ruhl, "No Net Loss" and Instrument Choice in Wetland Protection, NAT'L WETLANDS NEWSL., Jan./Feb. 2004, at 3, 18, and LEONARD SHABMAN & PAUL SCODARI, *PAST, PRESENT, AND FUTURE OF WETLAND CREDIT SALES* 21–23 (Resources for the Future 2004).
- ¹⁴ See C.H. Marshall et al., *Crop Freezes and Land Use Change in Florida*, 426 *NATURE* 29 (2003).
- ¹⁵ See U.S. EPA, *NATIONAL MANAGEMENT MEASURES TO PROTECT AND RESTORE WETLANDS AND RIPARIAN AREAS FOR THE ABATEMENT OF NONPOINT SOURCE POLLUTION* 11–14 (2005); Brant Keller, *What We Always Knew: Wetlands Win Hands Down at Pollution Mitigation*, NAT'L WETLANDS NEWSL., Sept./Oct. 2005, at 12.
- ¹⁶ See Raymond D. Semlitsch, *Size Does Matter: The Value of Small Isolated Wetlands*, NAT'L WETLANDS NEWSL., Jan./Feb. 2000, at 5.
- ¹⁷ A few early empirical studies suggested this urban-to-rural shift effect. See Dennis M. King & Luke W. Herbert, *The Fungibility of Wetlands*, NAT'L WETLANDS NEWSL., Sept./Oct. 1997, at 10, 11 (single watershed in Florida); Ann Jennings et al., *Down Sides to Virginia Mitigation Banking*, NAT'L WETLANDS NEWSL., Jan./Feb. 1999, at 9, 10.
- ¹⁸ See Florida Dep't of Environmental Protection (FDEP), *FDEP: Mitigation and Mitigation Banking: Questions and Answers*, at <http://www.dep.state.fl.us/water/wetlands/mitigation/banking.htm> (last visited Oct. 28, 2005).
- ¹⁹ See *BANKS & FEES, supra* note 4.
- ²⁰ See FLA. STAT. ANN. § 373.414(18)(b) (West 2006); FLA. ADMIN. CODE ANN. r. 62-345 (2004), and FDEP, *Mitigation Banking: Development of the State-Wide Uniform Wetland Mitigation Assessment Method*, at <http://www.dep.state.fl.us/water/wetlands/mitigation/uwmam.htm> (last visited Oct. 28, 2005).
- ²¹ See ENGINEER RESEARCH & DEVELOPMENT CENTER, U.S. ARMY CORPS OF ENGINEERS, *RIBITS FACT SHEET* (2005).
- ²² See Gardner & Radwan, *supra* note 2, at 10592 (wetland mitigation banking is a "market-based trading system" that creates "economic incentives for mitigation providers to do their jobs well").
- ²³ See U.S. EPA, *Toxic Release Inventory (TRI) Program*, at <http://www.epa.gov/tri> (last visited October 28, 2005).
- ²⁴ Our study includes 24 of the 33 banks actively selling or sold out of credits. We eliminated banks that had sold credits to five or fewer development projects on the basis that no demographic pattern has emerged for those banks. We were unable to obtain adequate data from agencies to compile a sufficiently complete data set for several of the banks.
- ²⁵ Because our focus is on the relocation of ecosystem services wetlands provide locally, we drew demographic data from a relatively close radius around the locations. For the development projects, we used the demographic data for the census tract in which the centroid of the project was located and computed an average for all projects associated with a bank. For the banks, we used an average of the demographic data for any block group touching within three miles of the bank.
- ²⁶ See Memorandum of Agreement Between the Environmental Protection Agency and Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines, 55 Fed. Reg. 9210, 9211 (Mar. 12, 1990).