

# Implementing the New Ecosystem Services Mandate

## *A Catalyst for Advancing Science and Policy*

By J.B. RUHL, JAMES SALZMAN, AND IRIS GOODMAN

*The new rule provides an important opportunity for improving compensatory mitigation by integrating a needed ecosystem services component in the assessment process—the only problem—the science necessary to create the methods for assessment does not widely exist. Where do we go from here?*

**O**n April 10, 2008, the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (EPA) jointly published final regulations defining standards and procedures for authorizing compensatory mitigation of impacts to aquatic resources that the Corps permits under §404 of the Clean Water Act (CWA).<sup>1</sup> Prior to these final regulations, §404's compensatory mitigation program was administered under a mish-mash of guidances, inter-agency memoranda, and other policy documents issued over the span of 17 years.<sup>2</sup> Although motivated primarily by the need to bring the program under one comprehensive regulatory framework, the final regulations also introduce ecosystem services into the mitigation decisionmaking standards for the first time by requiring that "compensatory mitigation should be located . . . where it is most likely to successfully replace lost functions and services."<sup>3</sup> Easily overlooked in the lengthy *Federal Register* document, this is a potentially significant development, but it is unlikely to gain policy traction without substantial research into the development of efficient and reliable wetland ecosystem service assessment methods. To help orient such research efforts, this article provides an overview of how the final regulations integrate ecosystem service analysis into compensatory mitigation decisions and offers suggestions for a research agenda to support implementation of that feature of the rule.

### **Ecosystem Service Assessment Methods**

The new compensatory mitigation regulation represents a signifi-

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cant turning point in the program's integration of ecosystem services into mitigation decisionmaking. It is the first major federal agency legislative rule to explicitly integrate ecosystem services as one of the decisionmaking factors in a regulatory permitting program.

Initially, the rule adopts the term "services" to mean "the benefits that human populations receive from functions that occur in ecosystems."<sup>4</sup> The rule mandates that "[i]n general, the required compensatory mitigation should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions *and services* . . ."<sup>5</sup> Supporting that directive, the rule explains that "the success of compensatory mitigation for impacted habitat functions . . . may lead to siting of such mitigation away from the project area. However, consideration should also be given to functions and services (e.g., water quality, flood control, shoreline protection) that will likely need to be addressed at or near the areas impacted by the permitted impacts."<sup>6</sup>

Accordingly, Corps district engineers, when making mitigation determinations, "may require on-site, off-site, or a combination of on-site and off-site compensatory mitigation to replace permitted losses of aquatic resource functions *and services*."<sup>7</sup> EPA adopted an identical set of provisions in its part of the joint rule to implement the §404(b)(1) Guidelines.<sup>8</sup>

Although the impact to ecosystem services is just one of many factors the Corps must weigh in the compensatory mitigation decision under the new regulations,<sup>9</sup> the integration of that factor into the rule enables the EPA and the Corps to consider the issues arising from the migration of wetland services from urban to rural areas, as well as the question of how wetland ecosystem services generally should be factored into compensatory mitigation decisions. The Corps' permit rules and the EPA's §404(b)(1) Guidelines are summarized as follows:

- The Corps may require on-site, off-site, or a combination of on-site and off-site compensatory mitigation to replace permitted losses of aquatic resource services.
- Compensatory mitigation should be located within the same watershed as the impact site and should be located where it is

most likely to successfully replace lost ecosystem services.

- When off-site compensatory mitigation is used, specific consideration should be given to ecosystem services that will need to be addressed at or near the areas impacted by the permitted impacts.<sup>10</sup>

There is, however, no further detail in the rule to guide implementation of these requirements. In particular, the provision requiring permittees to develop mitigation plans does not require assessment of ecosystem services at the impact site as part of the “baseline information” that the permittee must compile.<sup>11</sup> On this point, the agencies explained in the rule’s preamble that “[a]lthough the services provided by aquatic resource functions are important to consider when determining the type and location of compensatory mitigation projects[,] there are few methods available for assessing services. Therefore, in most cases consideration of services will be conducted through best professional judgment.”<sup>12</sup> Yet the rule offers no additional guidance on what will inform this “best professional judgment” or how the Corps will exercise it.

The sparse level of detail in the rule, however, by no means defines the limits of detail for the program as a whole or for the development and use of ecosystem service assessments. Just as the overall compensatory mitigation program evolved over time prior to the rule through a series of inter-agency and Corps guidances and policy memoranda outlining standards and practices, so too can the ecosystem services component of the new rule be further defined and implemented.

### Research Agenda

The agencies unquestionably are correct that there are few methods available for assessing services;<sup>13</sup> thus it would have been imprudent for the agencies to demand more detailed and substantive wetland ecosystem service impact assessments before the science is available to do so. On the other hand, the science on ecosystem services left the agencies little choice but to acknowledge in the rule that compensatory mitigation does have an impact on the distribution and delivery of ecosystem services to discrete human populations.<sup>14</sup> The potential for co-evolution of policy and science defines an important step for implementing the wetlands compensatory mitigation rule—i.e., to develop a more robust base of research and knowledge from which to develop such methods for assessing services. The following sequence of three questions is a useful way of designing such a research agenda: (1) What questions must the Corps and the EPA address under the new ecosystem services provisions? (2) What information and methods will the Corps and EPA need to competently answer those questions? and (3) What research is needed to begin to compile the necessary information and develop the necessary methods?

### Questions

First, consider the questions the Corps and EPA must answer under the new set of provisions:

- What combination of on-site and/or off-site compensatory mitigation will best replace permitted losses of

ecological resource services?

- At what locations will compensatory mitigation be most likely to successfully replace lost services?
- If off-site compensatory mitigation is used, what services at or near the areas impacted by the permitted impacts need to be addressed?<sup>15</sup>

### Information Needs

Next, consider what information the Corps and the EPA should have at their disposal and what information must be generated, either by the agencies or by the permittee, to effectively answer these questions in site-specific decisions. Ideally, the following would be available:

- Qualitative information about the kinds of services associated with the particular wetland type in the particular region.
- Demographic information about human populations in the impact area and at mitigation sites.
- Geospatial models of the watershed area showing the transport pathways of services from the impact and mitigation sites to the relevant human populations.
- Quantitative assessments of the stocks and associated flows of such services within the watershed.
- Economic valuations of the flows of services.
- Models for assessing the effects that cumulative losses and gains of wetland resources within watersheds have on the supply and pathways of ecosystem services.
- Projections of demographic and environmental change in the relevant areas of the watershed.

### Research Design

With these information needs identified, research should be designed around the following:

- Classify types of wetlands and qualitatively describe the services associated with each under different environmental, biophysical, and regional conditions, as well as possible trade-offs in services from different management approaches.
- Develop geospatial databases and models that can readily display ecological and demographic attributes of the relevant impact and mitigation site areas, as well as cumulative impacts on aquatic resources and their associated services over time within watersheds.
- Establish an understanding of nonlinear temporal and spatial scale effects on ecosystem services flows, particularly as a consequence of cumulative losses or gains in aquatic resources within watersheds.
- Conduct pilot studies of wetland types in different regions, particularly in urban settings, to develop cost- and time-efficient methods for identifying service flow pathways, quantities, and beneficiaries.
- Develop economic models for valuing wetland services in local settings given information about the type of service, service flow pathways and quantities, and human population receiving the service.

In an example of research that anticipated emerging management issues related to ecosystem services, the EPA's Office of Research and Development in 2007 began planning such studies on wetlands as a major component of its Ecosystem Services Research Program (ESRP).<sup>16</sup> Initiated independently of the 2008 rule-making, this research provides a foundation to enable the assessment of an array of core ecosystem services provided by freshwater and coastal wetlands.<sup>17</sup> The core wetland ecosystem services under study include biological integrity and wildlife habitat provided by wetlands, which have long been valued in their own right by society.<sup>18</sup> In addition, ESRP research is developing methods to quantitatively assess other wetland services, including flood control and storm surge protection; maintenance of water quality, including nutrient cycling; maintenance of water quantity, including recharge and baseflow; carbon storage and sequestration; support of fisheries; and other contributions to human well-being, such as recreational and cultural values associated with wetlands.<sup>19</sup> This research extends ESRP's previous work to develop ecological stressor-response models. In particular, ESRP's new wetlands research is designed to develop methods to assess the effects of pollution, infrastructure development, hydrologic modification, resource extraction, invasive species, climate change, and changing patterns of land cover and use on these core ecosystem services.<sup>20</sup>

ESRP will conduct studies at wetland sites across the contiguous U.S., including tidal and freshwater wetlands in portions of the Pacific Northwest, the coastal wetlands of the Great Lakes, the coastal wetlands of North and South Carolina, isolated wetlands in the Midwest, and urban wetlands in and near Tampa Bay, Florida.<sup>21</sup> These studies will be conducted in collaboration with local communities, state resource agencies, the EPA's Regional Offices, other federal agencies, and ESRP research partners in academia and the private sector.<sup>22</sup>

In order to enhance their comparability and extend their usefulness to resource managers, these studies will share common methods and products.<sup>23</sup> These include developing ecosystem service indicators for wetlands, predictive landscape models that incorporate landscape profiles and wetland functional surfaces, atlases that depict the spatial distribution of wetland services, and tools to assess trade-offs among wetland ecosystem services, as affected by various stressors to these systems.<sup>24</sup> A major objective of ESRP's wetlands research is to provide quantitative information on baseline services provided by wetlands, as well as methods for prospective scenarios of how these services may change in the future—at site, landscape, and sub-regional scales.<sup>25</sup> ESRP's goal is to provide information about wetland ecosystem services that will support innovation in resource management and private-sector investments in wetland stewardship and conservation.<sup>26</sup>

It will be important, of course, to build from the results of such research to develop wetland service assessment methods that the Corps can apply in permitting decisions efficiently and reliably, without undue time and expense. As these methods emerge and are refined over time, Corps district engineers exercising best professional judgment about impacts to services can move from basing decisions on generalized qualitative assessments to more site-specific quantitative, biophysically-based assessments. This

shift will make their decisions more transparent and justifiable from site to landscape to sub-regional scales. Moreover, the Corps and EPA can begin to integrate information collected on ecosystem services into aggregate geospatial databases on wetland mitigation, allowing regional assessments of wetland ecosystem service distributions. Ultimately, manuals and other forms of guidance can be published to provide more uniform practice across the program. The same co-evolution of science and policy implementation occurred for wetland delineation methods and functional assessment methods<sup>27</sup>—there is no reason to believe it cannot also happen for wetland service assessment methods.

## Conclusion

Prior to the rise of mitigation banking, the principal method for a land development project to satisfy regulatory wetland mitigation requirements was to compensate for resource losses through on-site creation, enhancement, or preservation of wetlands. The result of this practice, compounded over tens of thousands of land development projects, was an administrative nightmare for federal and state regulatory agencies administering wetland protection programs. Numerous retrospective studies show that individual project compensatory mitigation was poorly designed, inadequately implemented, and infrequently monitored. In mitigation banking, by contrast, the banker is more easily subjected to permitting standards and close monitoring and has an economic incentive to produce and sustain the wetland values needed to generate credits to sell. Yet, far from discounting these advantages or suggesting that mitigation banking is inherently inferior to on-site mitigation, it is precisely these features of mitigation banking that suggest ecosystem service values could appropriately be integrated into compensatory mitigation. The good should, and can, be made better, and the new rule is a significant move in that direction. From here, much will depend on follow through in research and, ultimately, in the Corps' commitment to implement a mandate that should have long been a part of the §404 program. ■

## ENDNOTES

1. 33 C.F.R. §§325, 332 (2008); 40 C.F.R. §230 (2008); *see also* 73 Fed. Reg. 19594 (Apr. 10, 2008) (providing supplementary information).
2. Palmer Hough & Morgan Robertson, *Mitigation under Section 404 of the Clean Water Act: Where It Comes from, What It Means*, 17 WETLANDS ECOLOGY & MGMT. \_\_\_\_ (forthcoming 2009) (copy available at <http://www.springerlink.com/content/ag615v755494325v/>) (describing this collection of policies).
3. 33 C.F.R. §332.3(b)(1).
4. *Id.* §332.2.
5. *Id.* §332.3(b)(1) (emphasis added). For marine resources, the rule uses the term "marine ecological system" in place of watershed. *See, e.g., id.* (discussing compensating for impacts to marine resources).
6. *Id.* §332.3(c)(2)(ii).
7. *Id.* §332.3(d)(2) (emphasis added).
8. 40 C.F.R. §230.92 (defining terms used in the regulations); *id.* § 230.93(b)(1) (replacing lost services); *id.* §230.93(c)(2)(ii) (addressing services at impact site); *id.* at § 230.93(d)(2) (replacing lost services). The focus in this Article is on the Corps' regulations for permitting wetland impacts under §404 of the CWA, as that is the stage at which wetland services assessments will most frequently take place. As the EPA §404(b)(1) rules are the same regarding services, the research agenda outlined herein would apply equally to EPA's implementation of the §404(b)(1) Guidelines.
9. *See* 33 C.F.R. §332.3(b)(1) (stating that the Corps must also consider factors such as

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ENDNOTES

1. NRC, COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT (Nat'l. Acad. Press 2001).
2. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19594, 19595 (Apr. 10, 2008) (codified at 33 C.F.R. pt. 325 & 332 and 40 C.F.R. pt. 230).
3. NRC, *supra* note 1, at 59.
4. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. at 19619.
5. 33 C.F.R. §332.3(c)(1) (2008); 40 C.F.R. §230.93(c)(1) (2008).
6. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. at 19610.
7. *Id.* at 19,620.
8. NRC, *supra* note 1, at 144.
9. *Id.* at 272. The SOP further divides the segments into "above-the-line" activities and "below-the-line" activities. The former are regulatory priorities, while the latter are not. Indeed, the NRC report noted "that 'below-the-line' activities should be accomplished only after the 'above-the-line' activities are fully executed." *Id.* at 102. At that time, "below-the-line" activities included "compliance inspections for all mitigation" and "multiple visits to a mitigation site." Accordingly, the NRC report found that "careful evaluation of mitigation projects" was not a Corps priority. *Id.* 10. *Id.* at 272.
11. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. at 19644. The revision of the SOP presents another opportunity for the Corps to establish an institutional commitment to carefully evaluate mitigation projects.
12. NRC, *supra* note 1, at 144.
13. 33 C.F.R. §332.1(c)(2); 40 C.F.R. §230.91(c)(2).
14. 33 C.F.R. §332.3(e)(3); 40 C.F.R. §230.93(e)(3).
15. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. at 19608.
16. NRC, *supra* note 1, at 123–128.
17. Operational guidelines 1, 2, 3, 4, 5, 9 and 10.
18. Operational guidelines 6, 7 and 8.
19. 33 C.F.R. §332.5 (emphasis added); 40 C.F.R. §230.95 (emphasis added).
20. NRC, *supra* note 1, chs. 6 & 7.
21. U.S. ARMY CORPS OF ENGRS, WETLANDS RESEARCH PROGRAM, EXAMPLES OF PERFORMANCE STANDARDS FOR WETLAND CREATION AND RESTORATION IN SECTION 404 PERMITS AND AN APPROACH TO DEVELOPING PERFORMANCE STANDARDS, (WG-RS-3.3, 1999) (*available at* <http://el.erc.usace.army.mil/wrtc/wrp/tnotes/wgrs3-3.pdf>).
22. *See* 33 C.F.R. §332.5(b); 40 C.F.R. §230.95(b).
23. The EPA Office of Water and Wetlands, Monitoring and Assessment web page

- is an example of this type of web-based information sharing. *See* <http://www.epa.gov/owow/wetlands/monitor/>.
24. The requirement that performance standards must be based on the best available science may become an avenue for environmentalists to challenge the issuance of permits. *See* *Defenders of Wildlife v. Hall*, 565 F. Supp. 2d 1160 (D. Mont. 2008) (granting plaintiffs' motion for a preliminary injunction against the Endangered Species Act delisting of the northern Rocky Mountain gray wolf in part because the U.S. Fish and Wildlife Service ignored the best available science).
  25. "Adaptive management" means [t]he development of a management strategy that anticipates likely challenges associated with compensatory mitigation projects and provides for the implementation of actions to address those challenges, as well as unforeseen changes to those projects. It requires consideration of the risk, uncertainty, and dynamic nature of compensatory mitigation projects and guides modification of those projects to optimize performance. It includes the selection of appropriate measures that will ensure that the aquatic resource functions are provided and involves analysis of monitoring results to identify potential problems of a compensatory mitigation project and the identification and implementation of measures to rectify those problems.
  - 33 C.F.R. §332.2; 40 C.F.R. §230.92.
  26. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. at 19609.
  27. *Id.*
  28. *Id.*
  29. *Id.*
  30. A small, but perhaps telling, example: As of February 2009, the Corps website had not updated its regulatory statistics since Fiscal Year 2003. *See* US Army Corps of Engineers, Regulatory Statistics, [http://www.usace.army.mil/CECW/Pages/reg\\_stats.aspx](http://www.usace.army.mil/CECW/Pages/reg_stats.aspx) (last visited Feb. 18, 2009).
  31. NRC, *supra* note 1, at 160–164.
  32. 33 C.F.R. §332.3(b); 40 C.F.R. §230.93(b).
  33. 33 C.F.R. §332.8(b); 40 C.F.R. §230.98(b).
  34. NRC, *supra* note 1, at 157.
  35. *Id.* at 152.
  36. *Id.* at 153–154.
  37. 33 C.F.R. §332.7; 40 C.F.R. §230.97.
  38. 33 C.F.R. §332.7(a)(1); 40 C.F.R. §230.97(a)(1) (emphasis added).
  39. 33 C.F.R. §332.7(d)(1); 40 C.F.R. §230.97(d)(1).
  40. 33 C.F.R. §332.7(b); 40 C.F.R. §230.97(b) (emphasis added).

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- aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land use).
10. *See* 40 C.F.R. §230.93(e)(1)–(2) (2008) (allowing the district engineer authority to determine whether off-site compensatory mitigation will serve the aquatic resource needs of the watershed).
  11. *See* 33 C.F.R. §332.4(c)(5) (discussing the baseline information the permittee must compile, such as descriptions of historic and existing plant communities, hydrology, soil conditions, a map of the locations of impact, and other site characteristics appropriate).
  12. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19594, 19659 (Apr. 10, 2008).
  13. James Boyd, Dennis King & Lisa A Wainger, *Compensation for Lost Ecosystem Services: The Need for Benefit-Based Transfer Ratios and Restoration Criteria*, 20 STAN. ENVTL. L.J. 393, 397–98 (2001) (stating that the valuation of benefits is often an ignored component of environmental trading and compensation schemes); Lisa Wainger et al., *Wetland Value Indicators for Scoring Mitigation Trades*, 20 STAN. ENVTL. L.J. 413, 415 (2001) (indicating that there is not yet a way to determine with reasonable certainty whether trading existing wetlands for restored wetlands promotes social welfare).
  14. *See* 40 C.F.R. §230.93(c)(2)(ii) (discussing the role that locational factors play in the success of compensatory mitigation).
  15. 40 C.F.R. § 230.93(b)(6) (stating that the district engineer must determine the likelihood of offsetting the permitted impacts).
  16. *See* U.S. EPA, *Research to Value Ecosystem Services Identifying, Quantifying, and Assessing Nature's Benefits*, <http://www.epa.gov/ord/npd/pdfs/erp-overview-fact-sheet-final.pdf> (July 2007) (discussing the importance of ecosystem services in researching wetlands).
  17. *See id.* (stating that this new wetland research will determine how the position of wetlands on the landscape alters the provision of ecosystem services).
  18. *See* U.S. EPA, *Ecosystem Services Research Focuses on Wetlands*, at [http://www.epa.gov/ORD/npd/pdfs/erp-place-based-research\\_wetlands-factsheet.pdf](http://www.epa.gov/ORD/npd/pdfs/erp-place-based-research_wetlands-factsheet.pdf)

- (Oct. 2007) [hereinafter *Research Focuses on Wetlands*] (discussing the range of benefits gained from wetland ecosystems that contribute to human well-being).
19. *See id.* (stating that ecosystem services include safe water supply, fish and fiber, wildlife habitat, flood regulation and recreation among others); U.S. Environmental Protection Agency, *Basic Information: Foundation for Research*, <http://www.epa.gov/ord/erp/basic-foundation.htm> (last updated May 1, 2008) (discussing the future research of the ESRP is designed to measure and assess these ecosystem services).
  20. *See id.* (stating that this new wetland research will determine how the position of wetlands on the landscape alters the provision of ecosystem services).
  21. *See* *Research Focuses on Wetlands*, *supra* n. 18 (discussing the range of benefits gained from wetland ecosystems that contribute to human well-being).
  22. *See id.* (indicating that these four studies will be a collaborative effort).
  23. *Id.*
  24. *See* U.S. EPA, *Research Tests New Approach to Assessing Wetlands*, at <http://www.epa.gov/ord/npd/pdfs/wetlands-assessment-tool-fact-sheet-final.pdf> (Oct. 2007) (discussing the research tests developed to assess wetland functions).
  25. *See* *Research Focuses on Wetlands*, *supra* n. 18 (discussing the application and impact of the research to predict the effects of local and landscape manipulations on the provision of wetland ecosystem services).
  26. *See* U.S. EPA, *Ecosystem Services Research in Communities: Developing Tools to Support Sustainability and Good Stewardship*, at [http://www.epa.gov/ord/esrp/pdfs/ESRP-place-based-research\\_overview-factsheet.pdf](http://www.epa.gov/ord/esrp/pdfs/ESRP-place-based-research_overview-factsheet.pdf) (Dec. 2007) (stating that the research will be used to enable decision-makers to consider the value of the ecosystem services and to improve stewardship of the land and its services).
  27. *See, e.g.* Leah Stetson, *Wetland Assessment: Measuring the Quality of the Nation's Wetlands*, 18 WETLAND NEWS 3 (Feb. 2008), *available at* [http://www.aswm.org/propub/news/wetland\\_assessment\\_0208.pdf](http://www.aswm.org/propub/news/wetland_assessment_0208.pdf) (discussing the evolution of wetland functions).