POLICY REPORT

Why You Should Pay Attention to Stream Mitigation Banking

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Stream mitigation banking is rapidly becoming a major driver of the stream restoration industry, particularly in the Southeast. Like other types of mitigation banking regulated by the Clean Water Act Section 404 program, stream mitigation banking (SMB) gives developers the option to offset construction impacts by purchasing "credits." These credits are generated by for-profit companies that restore damaged streams on a speculative basis and are approved by federal regulatory agencies. In states such as North Carolina, SMB has now eclipsed wetlands banking in terms of number of credits bought and sold. SMB is becoming a major private-sector source of stream restoration funding, perhaps presaging a major shift in what has been until now a predominantly publicly funded market. In addition to its growing economic importance, the emerging practice of SMB is worth attention because many of the tensions and debates that have been settled in the more established practice of wetlands mitigation banking are still unresolved, and thus potentially open to input from practitioners and scientists. The most important of these are the proper amount and location of compensation, and how stream credits should be certified and measured.

Mitigation banking began in the early 1990s, when private developers frustrated with the slow pace of Section 404 permitting and the high cost of creating new on-site wetlands proposed the creation of large consolidated areas of constructed wetlands as advance compensation to the Chicago, Savannah, and Jacksonville Districts of the U.S. Army Corps of Engineers (Corps). Working together, developers and local Corps and Environmental Protection Agency (EPA) staff developed the regulatory rules necessary to define, create, and maintain a market in a new commodity: wetlands credits (Robertson 2006). As will by now be familiar to most *Ecological Restoration* readers, this framework allows mitigation banks to restore wetlands, which, once certified, can be sold as credits to developers who do not wish to do the restoration work themselves.

SMB is a more recent regulatory arrangement that adapts the wetland mitigation banking model to riparian systems. SMB was first developed by the St. Louis District of the Corps, which approved the Fox County Stream Mitigation Bank in 2000 (Litteken 2003). Over the last eight years the practice has become increasingly common. An informal survey of EPA regional regulatory staff suggests that in many regions 50 percent or more of the individual permits issued by the Corps every year are for impacts to streams. Thus, while Section 404 is often known as "a wetland program," streams are already an important part of its scope, and they are likely to become even more important. The new federal rule for compensatory mitigation requires in-kind compensation for streams: instead of past practices, which considered streams either impractical to compensate for or adequately compensated for using wetlands credits, the new rule requires compensation through the restoration or enhancement of similar streams, which will likely accelerate the already growing demand for SMB.

Federal rules, however, do not specify the requirements for establishing a stream mitigation credit market in a given region or district. Instead, the specifics are usually laid out in regional guidance adopted collaboratively by local Corps Districts, EPA branches, and state environmental agencies, often with input from private firms that hope to establish mitigation banks. Once the rules are in place, for-profit mitigation bankers work on a speculative basis to restore or enhance an area of stream habitat. This generates a "bank" of credits, which developers may buy to fulfill the conditions of their federal or state permit once the restoration projects have been certified for sale as stream credits by the Corps or by a Mitigation Bank Review Team (MBRT) generally made up of federal, state and/or local regulatory and resource agency representatives.

North Carolina is a good example of how the process of setting up stream credit markets works as it has one of the most developed SMB programs in the United States. During the mid-1990s, the North Carolina Department of Transportation (NCDOT) experienced project delays because of the lack of available compensation credits. In response, North Carolina developed the Ecosystem Enhancement Program (EEP), a state-administered program to create wetland and stream mitigation credits. The EEP uses projected NCDOT construction activities as a plan from which to proactively develop compensation credits in the geographic areas where impacts are scheduled

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to occur. EEP-generated compensation credits can also be used by private developers if they choose not to purchase credits from private mitigation banks. Thus, within North Carolina the market for stream mitigation credits is made up of trades between private developers and private banks, private developers and the EEP, and the NCDOT and EEP. For a sense of scale, in FY 2005–2006, the EEP restored > 95 km of stream and generated approximately $71 million of stream credits (EEP 2006).

Of what did these credits consist? In any market, determining the method for measuring the commodity for sale is a fundamental issue (Ruhl and Salzman 2006). In stream mitigation banking, the commodity is quantified as the "stream mitigation unit," or SMU. Defining what constitutes an SMU can be complicated, as it necessitates establishing both the quantity and the quality of the commodity to be traded. North Carolina addresses *quantity* simply by measuring credits in linear feet of stream, much as wetlands credits are measured in acres. Defining *quality* has proved controversial. In contrast to wetlands restoration, where there is national consensus around evaluation in terms of periodic saturation, soil types, and vegetation communities, in North Carolina and many other states stream restoration evaluation has been reduced to simple geomorphic classifications based on the maintenance of "form, pattern, and profile" (cross-section, planform, and longitudinal gradient) without substantial erosion or deposition over 5 years (USACE 2003, NC DENR 2001). Biological indicators of success "may be required in some circumstances," but preliminary interviews with mitigation bankers revealed that no projects have required aquatic ecological assessment to date.

This simplification is based on the idea that streams are most fundamentally characterized by the transport of water and sediment, and that channel design should thus be dominated by considerations of sustaining that balance of transportation. Relying on geomorphic stability, however, does not address the state and federal requirement that compensation should replace lost *functions*. In North Carolina, the geomorphically defined SMU is intended to bypass the difficulty of enumerating and capturing all of the ecological functions lost at the destroyed sites and restored at the compensation site by *bundling* together the perceived benefits of stream restoration to aquatic habitat, nutrient retention, and flood abatement into a unified measure. However, the tacit assumption that a quantity of linear stream feet assessed solely for morphology can provide a consistent quantity of stream function is deeply problematic. For instance, ongoing research by David Penrose of North Carolina State University and Emily Bernhardt of Duke University (pers. comm.) at EEP restoration sites indicates that ecological factors ranging from benthic macroinvertebrates to nutrient retention show a lack of response to restoration. Despite the fact that the North Carolina MBRT considered these stream compensation sites adequate, critical ecological functions had not recovered within the monitoring timeframe.

Stream mitigation banking as practiced in North Carolina and other states thus raises three critical issues for the restoration community. Perhaps the most important issue (raised by wetlands mitigation banking as well) is a much larger question for restoration ecologists and scientists to resolve: does aquatic ecosystem restoration actually work? Given that SMB effectively enables the destruction of existing riparian systems under the assumption that new systems can be created functionally equivalent, this is a critical question and one that has received relatively little documentation given the scale of the stream restoration industry (Bernhardt et al. 2005). Arguably, successful stream restoration projects exist, but can they be reliably produced in a mitigation banking context?

Second, as SMB is currently structured in North Carolina and many other states, the trading ratios encourage restoration at the expense of enhancement and preservation of existing off-site resources (Table 1). There is no financial incentive for *preserving* riparian systems that remain in reasonable condition despite the fact that ecologists typically think preservation is preferable to the construction of new systems, particularly given the uncertainties about restoration outcomes just mentioned. Is it reasonable to discourage preservation as a strategy for compensating for the destruction of an existing riparian system because it leads to a net loss of aquatic resources, or should state and federal guidance on this be changed?

Finally, the bundled measures that are currently used to define both stream and wetlands mitigation credits raise the question of why we do not use the measurement of actual functions to set success criteria. To date, it has been Clean Water Act policy that restored streams compensate for the entire bundle of functions present at an impact site. A few characteristics are selected as proxies for the entire range of ecosystem functions, and thus the adequacy of a compensation site, despite the fact that the "form equals function" assumption is not well supported by current science. Recently, some mitigation bankers, economists, and scientists have begun to argue that wetland and stream banking policy should evolve toward a more explicitly function-based measure in which specific functions lost at a site would be precisely mitigated by the same functions purchased at a bank site. Bankers could then sell as many types of credits as there exist ecological functions: flood abatement credits could be measured and sold separately from denitrification and turtle habitat credits. Unbundling credits promises more accurate assessment of projects' actual impacts, but raises the troubling question of the segregability of individual functions; is it ecologically accurate to treat water quality and endangered species habitat as entirely separate issues? While for the moment bundled credits remain the norm, restoration practitioners and scientists have an important role to play in debates

Table 1: Ratios of compensation in North Carolina. The mitigation ratio depends on the quality of the impacted stream, and describes the linear feet of stream that must be restored for every linear foot of stream destroyed. Under NC stream mitigation guidance, "dimension" refers to cross-section, "pattern" to planform (sinuosity), and "profile" to slope. Thus, "Enhancement Level I" requires that channel cross-section and slope be manipulated at the project site, whereas "Restoration" requires the additional manipulation of planform.

Activity	Definition	Mitigation site	Impact site	
			"excellent"	"fair to poor"
		Specific Actions	Mitigation Ratio	
Restoration	Converting unstable, altered, or degraded stream to natural stable condition	Restoration of dimension, pattern, and profile based on reference reach information	3:1	1:1
Enhancement Level I	Rehabilitation to improve water quality or ecological function; may include in-stream or stream-bank activities but in total falls short of restoring one or more geomorphic variables	Improvement of dimension and profile based on reference reach information	2 to 4.5	1 to 1.5
Enhancement Level II	Rehabilitation that augments channel stability, water quality and stream ecology but falls short of restoring both dimension and profile	Bank stabilization, livestock exclusion, or reconnecting channel to floodplain	4.5 to 7.5	1.5 to 2.5
Preservation	Protection of ecologically important streams including upland buffers and both sides of channel	Purchase of land or establishment of easement	7.5 to 15	2.5 to 5

on this question, and thus the future of the mitigation banking industry.

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