An examination of the spatial relationship between approved impacts and compensatory wetland, stream and riparian buffer mitigation in North Carolina, USA

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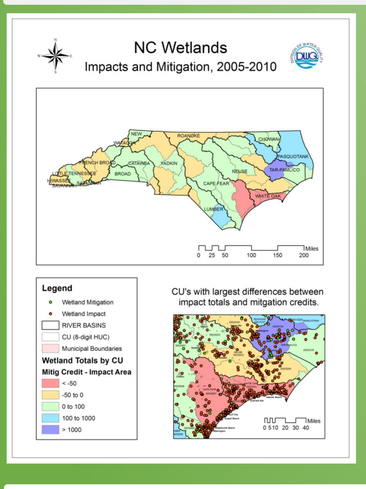
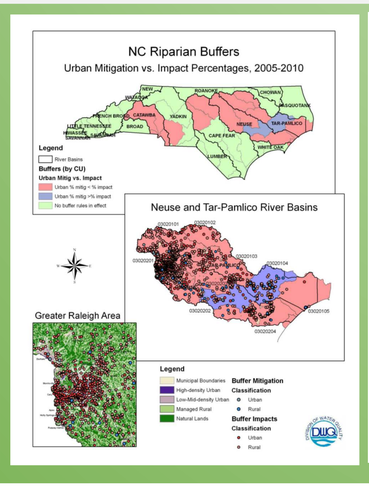
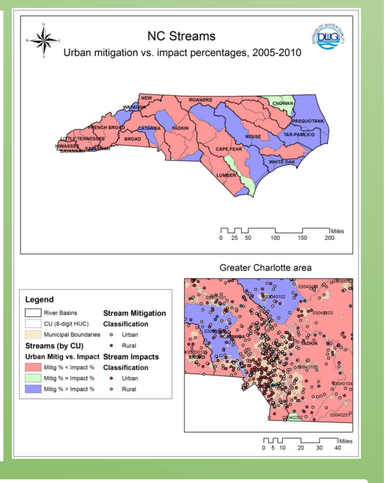
Introduction. Regulatory requirements for the location of compensatory wetland and stream mitigation have changed as scientific understanding of the ecological benefits of these projects has developed and as practitioners and regulators have learned from their experiences. Before 1990, there was a preference for mitigation sites located as close to the impact as possible, in order to offset negative effects on local water quality that resulted from the impact.

- The 2008 rule published by the US Army Corps of Engineers (USACE) and the US Environmental Protection Agency (EPA) emphasized a watershed context to strategic site selection for compensatory mitigation projects. Eight-digit hydrologic unit codes (8-digit HUC's, also known as subbasins) describe watersheds of approximately 600 to 2900 square miles (for those within and overlapping NC state boundaries), based on a drainage organizational system established by the US Geological Survey.
- The 8-digit HUC continues to be the primary service area in NC and many surrounding states, and two-thirds of compensatory mitigation for approved wetland and stream impacts is provided on an in-subbasin basis through mitigation banks or the state's in-lieu fee program, NCEEP (now DMS). This approach to compensatory mitigation generally facilitates larger mitigation projects than permit-specific on-site mitigation, and as noted earlier, is thought to provide greater ecological uplift than several smaller mitigation projects scattered across the landscape. In theory, this system allows mitigation to be placed where it will have the greatest benefit to the targeted local watershed.







Research Objectives.

- The objective of this project was to add a spatial dimension to the impact and mitigation tracking databases maintained by NCDWR in order to explore the landscape-scale relocation of stream, wetland and riparian buffer resources that may have occurred as a result of the state's 401 Certification and riparian buffer protection programs.
- Since aquatic resource impacts and their associated mitigation are largely disaggregated in NC, the analysis could not be completed for impact locations and the exact location(s) of required mitigation offsetting each impact.
- This analysis was conducted on a dataset including all approved impacts and mitigation projects during the same five-year timeframe. The project was conducted in three parts:
  1. identification and filling of data gaps, and evaluation of the dataset through a quality assurance procedure,
  2. quantification of impacts and mitigation by subbasin, which allowed an evaluation of statewide net loss for each resource type, and
  3. classification and quantification by subbasin of impacts and mitigation based on the land use type (urban or rural) at which each point occurred.

Data and Methods. Two datasets were considered in this study. Both datasets contained information for the five-year period from July 1, 2005 through June 30, 2010.

- The first dataset, - impact data - referred to wetland, stream and riparian buffer impacts approved through the state's 401 Certification , Isolated Wetland Permitting, and riparian buffer protection programs.
- The second dataset - mitigation data - was comprised of compensatory mitigation projects initiated through the state's 401 Certifications, Isolated Wetland Permits, and Buffer Authorizations.
- Data sources included NCDWR's Basinwide Information Management System (BIMS) database, an Access database developed to track compensatory mitigation projects as part of an EPA Wetland Program Development Grant (WL 9643505-01) and NCEEP's online Interactive Map and mitigation credit database.

- **Impact Data.** The initial data consisting of 14,752 individual impact records was summarized by resource category (i.e. wetland, stream, riparian buffer) yielding 7,720 consolidated wetland, stream or buffer impacts within 5,227 unique Project IDs. ESRI Analysis Tools were used to locate impact points within the corresponding subbasins and summarized by resource type per subbasin.

- **Mitigation Data.** Mitigation projects in the dataset were initiated from July 1, 2005 to June 30, 2010, and included approved private, mitigation bank, NC EEP and NC DOT mitigation sites. Resource amounts were converted to credits using mitigation credit ratios commonly utilized in North Carolina based upon the type(s) of mitigation activity conducted at the site.

- **Data Limitations.** In accordance with 15A NCAC 2H .0506(h) and 15A NCAC 2H .1305(g), NCDWR generally required mitigation for approved impacts exceeding one acre of wetlands or 150 linear feet of stream (only perennial streams during most of the study timeframe). It was expected that all impacts approved and mitigation required in a 401 Certification were included in BIMS; however, impacts and associated mitigation below those thresholds may or may not have been entered especially for some Nationwide Permits with smaller impacts.

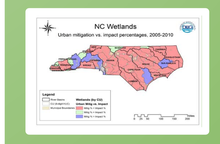
- **Data Quality Assurance.** A quality assurance (QA) procedure was utilized to evaluate the accuracy of the geographic coordinates and approved resource area and length values in the impact and mitigation datasets. A probability stratified sampling design was used to select the quality assurance sample. The sample size was determined using optimal allocation.

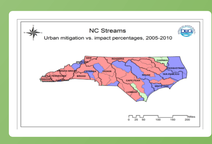
- **Land Use Classification.** The national USGS Gap Analysis Program has produced land cover data for ecological planning and management purposes. The North Carolina Gap Analysis Project was a state affiliate of the national program. NC-GAP land cover data were based on 1991-1992 Landsat TM satellite imagery, classified into general land cover types based on the 1992 National Land Cover Dataset. For the current project, land cover classifications developed by NC-GAP were reclassified to consolidate impact and mitigation locations into generalized urban versus rural categories in the project datasets.

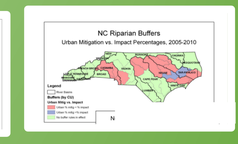
Results- Statewide.

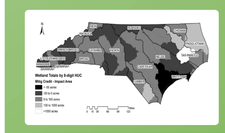
Mitigation success - A study done in 2011 determined regulatory mitigation success rates in NC of 74% for wetlands and 75% for streams (riparian buffers were not evaluated) in North Carolina.

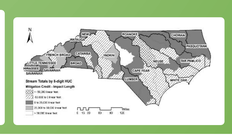
- There were 2198 permitted **wetland** impacts totaling 1977 acres, and 274 wetland mitigation project components totaling 9905 acres or 4728 credits (over 3000 of which were generated via wetland restoration); thus still yielding a gain of wetland acres with or without weighting by mitigation success.
- **Streams** showed a net loss when preservation mitigation was excluded from the calculation. If these values were applied to the stream mitigation totals, including preservation, during 2005-2010, a net loss of streams statewide would be indicated. If preservation mitigation credits were excluded, the net loss would have been even greater.
- Although ten of the 15 buffer subbasins showed losses for the individual basins, the composite amount for all 15 subbasins showed a total increase in **buffers** due to buffer mitigation.

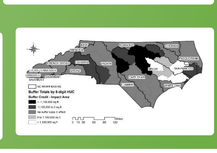












Results-Urban vs Rural

- Based on the current study results, it appears that North Carolina's system of impact permitting and mitigation approval has relocated aquatic resources from urban areas into more rural settings.
- The higher percentage of rural stream mitigation in the Charlotte area was surprising due to the presence of a large municipal mitigation bank that had conducted many urban stream restoration projects. However, an explanation was found in comparing the amounts of urban impacts (over 79,000 linear feet) and rural impacts (nearly 9,000 linear feet). While urban and rural mitigation amounts were similar, there was likely not enough opportunity for urban stream mitigation to offset the magnitude of approved urban impacts in and around the City of Charlotte.
- The far western areas of NC such as Asheville faced different limitations in achieving urban mitigation: the area of urbanized lands was very small compared to the amount of rural land.

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