Net Losses or Net Gains? Analyzing Locations of and Impacts to Waters within the United States via Individual Permits

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Executive Summary: Many activities affecting waters of the US (WUS) must be authorized via permits issued by the US Army Corps of Engineers (USACE). Outputs of permits which authorize the greatest impacts to WUS (Individual Permits—IPs) were analyzed to determine the net change in WUS coverage within the US annually. 2,050 Individual Permit Applications (IPAs) released during 2012 were surveyed, 1,193 of which had been approved by the end of 2013 and granted as IPs, with only 26 denied. Both linear feet (LF) and acreage measures of non-wetland WUS experienced net losses (92,854 acres and 600,476 LF, respectively) while wetlands experienced net gains of roughly 5,574 acres. Differing outcomes among WUS metrics could be the result of recent policies aimed at bolstering wetlands (a historically neglected resource) over other WUS types. Furthermore, a "State Effect" hypothesis was developed, proposing that parts of the same district within different states will have significantly different impacts, while parts of the same state within different districts will not have significantly different impacts. To test this hypothesis, 23 "within district" Analysis of Variance (ANOVA) tests were performed on issued IP data, only two of which showed significant results. However, 12 "within-state" ANOVAs were also performed on the same data set, none of which showed significant results. While not definitive, these results do suggest support for the State Effect hypothesis. Across much of the data, a repeated pattern was observed, whereby districts containing data only from a single state showed more extreme results than districts containing data from multiple states, suggesting the presence of a unique implementation structure represented within these "single-state" districts. To make studies like this one easier in the future, the USACE database of approved IP decisions should include numeric information concerning impacts, and applicants should be required to submit information in a standardized format using area in their submitted IPAs.

I. Introduction

Those who wish to modify Waters of the United States (WUS) are required to first obtain a permit from the United States Army Corp of Engineers (USACE). Permits are required for negative (decreasing WUS coverage, function, or value) as well as positive impacts (increasing WUS coverage, function, or value). There are three permit types: Individual Permits (IPs), Letters of Permission, and General Permits. General Permits are further divided into Regional, Nationwide, and Programmatic General Permits (Darden, n.d.).

The USACE is a federal organization with a large regulatory jurisdiction, and so their regulatory processes for assessing IPAs have been divided into 38 districts, distinguished along the lines of US watersheds. Thus, districts often cut across state lines, so that a single district can regulate waters in up to nine states. Likewise, a single state can have between one and seven districts within its bounds. When a district contains more than one state, that

district's offices are subdivided by state. Similarly, when a single state contains multiple districts, IPAs from different parts of the state will be processed by their respective district offices.

The objective of the USACE permitting system is to allow the opportunity for diminishing proposed impacts to WUS, through outlining various alternatives and means of mitigation. In the special case of wetland-type WUS, the purpose of permitting procedure has also aimed to limit net impacts to wetlands and require their mitigation in order to meet the larger goal of no annual net loss of wetland acreage, value, and function (Memorandum of Agreement, 2012). In 1998, Clinton's administration was the first to set out a goal of achieving a net gain of national wetlands annually through his Clean Water Action Plan (United States Environmental Protection Agency, Clean Water Action Plan, 2012). The Plan set forth a goal of gaining 100,000 wetland acres per year by 2005 (Sibbing, National Wildlife Federation, 2004).

The USACE's permitting program is linked to the states due to Section 401 of the Clean Water Act (CWA), since all regulated actions within WUS also require a separate Section 401 certification issued from a state water quality agency (Taylor, 2013, 28). Though states do not have a specified role in regulating WUS beyond Section 401, they can establish extra regulation, and so many have developed additional wetland regulatory programs (Taylor, 2013, 1). Due to these conditions, proposals to USACE Districts for activities in WUS from (savvy) applicants in different states are likely tailored to meet both USACE- and state-specific regulatory standards (Taylor, 2013, 29), and so simultaneous inquiry into both state and national contributing factors seems warranted. This study was inspired by the work of Dr. Ryan Taylor as embodied in his book, Federalism of Wetlands, in which he explains that the physical overlap of national and state regulations necessitates a term describing each unique combination of state/district-level implementation structures "subjected to… potentially different intergovernmental relationships". He calls such structures "wetland regulatory units," or WRUs (Taylor, 2013, 59). To refer to those structures in this study, I will be borrowing the acronym "WRU" while making a slight alteration to its meaning; "WRU" should be read herein as "WUS regulatory unit."

In the 1970's and 1980's, multiple studies of net impacts to US wetlands were conducted within individual states and regions, focusing on net effects of all issued permits which required mitigation. Kentula and her colleagues, for instance, studied multiple states in the South and on the Pacific coast, and revealed that certain states consistently approved annual net losses of wetland acreage among issued permits of all types (Ambrose, 2000). One commonality among all studies performed during this period which examined wetland impacts is that they only gathered data on permits that required mitigation. This practice bestows a deficiency upon representative samples, since the numerous permits issued which did not require mitigation were not accounted for. Thus, in 1996, Mark Sudol expanded upon the scope of previous studies by assessing all USACE permits issued to impact waters in Orange County, California—regardless of mitigation requirements. He found that more mitigation than impacts were required among permits that required mitigation. Among permits which did not require mitigation, however, Orange County experienced a net loss of regulated waters (Ambrose, 2000). It wasn't until 1993 and 1994 that Congress began requiring that the USACE report the results of its permit program. The USACE based its reports on the total area of wetlands impacted and required to be mitigated in the United States, and stated that, in 1993 and 1994, the destruction of wetland acreage was less than wetland acreage mitigated, resulting in a net gain (Ambrose, 2000).[1]

Mandates which aim to control negative impacts to WUS (especially wetlands), are one example of a policy implementation challenge between the various levels of government in the US. 'Policy implementation' here refers to actions undertaken by individuals and groups in both public and private spheres (permit applicants and states), which affect the achievement of national goals (wetland-related objectives) stated in previous governmental policies

[1] In 1993, said the USACE, 11,600 acres of wetlands were negatively impacted under Section 404 permits, but mitigation requirements led to 15,200 acres of wetlands being positively impacted by mitigation. In 1994, the USACE reported, 17,200 acres of wetlands were permitted to be impacted, with 38,000 acres of wetland mitigation required to be performed. This data indicates that, by a measure of acres alone, the "no net loss" policy for wetlands in the U.S. seems to be working to protect wetlands, as intended (Ambrose, 2000).

(Van Horn and Van Meter, 1977). Patricia Crotty's 1988 paper applies Christopher Hood's theory of 'governmental tools' to the EPA's tasks of enforcing the Clean Air, Clean Water, Safe Drinking Water, and Insecticide Acts. Crotty's study examines how successful the EPA has been at convincing states to take up their federally-compelled responsibilities within ten EPA Regions, for a given timeframe. Since the EPA is a federal organization which faces political restrictions in addressing the needs of the states that it supervises (much like the USACE and its districts), Crotty's study interprets the EPA's success based on the degree to which different states utilized "tools" (such as grant money) made available to them by the EPA. Like the EPA, the USACE's policy implementation problem is that regulations are issued on a national level—but must also be implemented by individual WRUs, if national goals are to be achieved (Crotty, 1988).

In a vein related to the analyses of both Sudol and Crotty, an independent, quantitative assessment concerning the USACE's overall achievement of the no-net-loss goal is contained in this study. Roughly two decades have passed since Sudol and Crotty performed their analyses of no-net-loss, and so this study was designed to create an updated assessment of the USACE's permitted impacts to regulated waters. To examine all permitted impacts across the country required a sacrifice, however: time constraints rendered it impossible to include all types of permits issued, as others have done in smaller previous studies. To take the "macro" perspective required that the permits which authorize the majority of total impacts from USACE permits be used to measure overall effects on waters in the US. Other studies have noted that although non-IP actions make up over 95% of program outcome in terms of permit quantities, the IP activities in that study accounted for over 57% of the total wetland fill permitted by the USACE (Taylor, 2013, 94). No comprehensive third-party effort thus far, however, has compiled original data on the US's net annual losses and gains of waters using records of IPs.

II. Materials and methods

Purposes of the study and methods of data collection

This study was designed to assess numerical differences between positive and negative impacts to US waters authorized by issued IPs within all USACE districts, and to ascertain whether there were net gains or net losses within each WUS metric. This study examined data on permitted rather than actual impacts, as the use of permitted impacts in place of actual ones has been used previously (Taylor, 2013, 83), and recording "ground level" impacts was not feasible. Information collected from IPAs was thus used to conduct an independent assessment of USACE's success with meeting the "no net loss" goal in regards to wetlands, and to discern whether the EPA and USACE met the Clinton administration's goal of gaining 100,000 acres of wetlands per year, for IPAs released during 2012 and issued as IPs during 2012 or 2013.

Another purpose of this study was to assess the impact implementation structures might have on outputs of the IP program, in the spirit of works which have opted to use these structures as units of evaluation for success (Hjern and Porter, 1982). Implementation structures are the final link in the chain of policy enactment, and consist of local officials who deal directly with those regulated by a given policy. The implementation structures in this study are WRUs, since each WRU represents a specific office inside a larger USACE district, and will directly influence IP outputs affecting WUS in that area via its specific local permitting regulations and practices.

This study will address the question of whether differences exist between districts, between different states located within a given district, and between different districts located within the same state. The first level of analysis has been established at the recommendation of Taylor's study, which suggests collecting program output data "directly from each district office" (Taylor, 2013, 74). The last two levels of analysis have been established to provide some insight into the intersection between federal and state agencies, as expressed in WRUs. This avenue was explored based on Taylor's claims that "...states have more power in federal relationships than many scholars typically describe" (Taylor, 2013, 3). To test for the strength of the states' impacts on IP outputs, a "State Effect" hypothesis was developed: parts of the same district within different states should have significantly different impacts, while parts of the same state within different districts should not have significantly different impacts.

This study began with materials publicly available online, since the scope was too broad to be filled through Freedom of Information Act (FOIA)

requests alone. Public notices of IPAs (which contain numerical information) had to be combined with public records of IP decisions (which lack numerical information) to compile data sets. Data collection began in early 2012.[2] Though the original hope was to record impacts to different WUS types together in a homogenous area metric, many IPAs did not contain enough information to do this, so the data ultimately had to be organized based on the different metrics of WUS impact given in the IPAs. Qualitative data was collected first, and was then "crunched" into quantitative data. From the impacts proposed in 2012, IPAs successfully matched with "issued" decisions (released during 2012 or 2013) were separately recorded, to form the data set of approved impacts to WUS.

Methods used to standardize data

Most IPA data (and therefore recorded numbers) were "approximate," and the information in many IPAs was also incomplete. Methods used to estimate activities where records were incomplete included using minimums, maximums, ratios, and averages of different possible outcomes/alternatives/mitigation ratios; equally splitting activities between listed categories (such as permanent/temporary, wetland/non-wetland, on/offsite, LF/area non-wetlands "containing" wetlands, types of wetlands to be mitigated, etc.); assuming the "worst case scenario" (for negative impacts) and "best case scenario" (for positive impacts); and adding impacts from both below and above/landward of the high tide line, spring high water, mean low water, mean high water, and ordinary high water.[3] LF along with "maximum riverward projection" or "extending X feet channelward" measurements was also used to calculate area.

Due to the non-standardized nature of information given in IPAs, many general judgement calls had to be made about how to categorize their contents. For example, when multiple metrics were given for the same proposed impact in a single IPA, area metrics were preferred (as these measurements are most ecologically relevant), followed by linear feet, and lastly measures of volume. Furthermore, all WUS impacts given in area were assumed to be non-wetland, unless stated otherwise or implied by the presence of wetlands in the mitigation section. When total positive or negative impacts for a given WUS metric were not given in an IPA, all impacts listed separately were assumed to represent discrete impacts, then added together and recorded. This principle was adopted because, in many cases, it was impossible to tell whether listed activities were occurring in the same place and/or at the same time. In addition, many mitigation proposals were only presented qualitatively, and thus were estimated based on the quantity of either area or LF negative impacts given in that IPA (since volume is not a logical way of measuring mitigation).[4]

[2] Data set assembly was complicated when it became apparent that all USACE districts were gradually switching their websites over to a new format during 2012, meaning that districts took down all IPA archives suddenly when their websites were updated, and so some data needed to be obtained from districts upon request. New Orleans was the only district which failed to provide the correct information in a timely manner, and thus IPAs released from 1/1/12 through 7/8/12 are missing from that district's data. Out of all IPAs examined, only six could not be accessed in their entirety due to technological issues: two in the Charleston District, and one per district in the Baltimore, Norfolk, Pittsburgh, and San Francisco Districts, respectively.

[3] Where two mitigation measures were proposed in a "primarily...remaining" way, but a specific numeric breakdown was not given, the "primary" method was assumed to compensate for impacts at a 1:1 ratio, and the "remaining" measure was not recorded. Where two or more mitigation activities were proposed in an "or" or an "and/or" scenario, with a numeric amount given for each activity, the total amounts of mitigation proposed by each means were divided by the total number of activities proposed, in order to record the appropriate mitigation total.

[4] When mitigation was proposed implicitly or explicitly (via "bank," "on-site," "offsite," or "Permittee-responsible" avenues for a given WUS metric, or by another conventionally recognized means including "preservation," "establishment," "creation," "expansion," "restoration," or "enhancement" of WUS), without a numeric value, a mitigation ratio, or a specification of impacts being mitigated for (within applications containing one or multiple types of impacts), mitigation was assumed to be compensatory, and therefore numerically equivalent to all permanent impacts to WUS (specified in an area or length metric) at a ratio of 1:1. Where mitigation was proposed without a quantified extent, and did not include/imply any of the abovementioned terms (which were taken as signals of quantifiable "landscape level" mitigation activities), this mitigation was not recorded, since it couldn't be quantified into a relevant environmental measure of positive impacts to WUS.

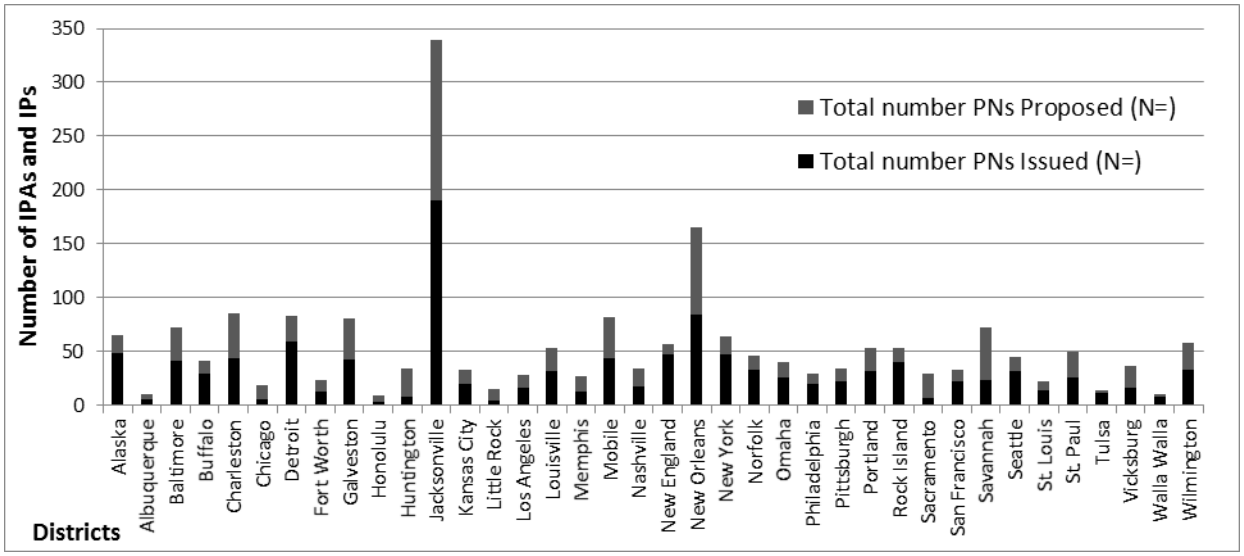

Figure 1: Number of IPs proposed in 2012 vs. number of IPs issued in 2012/2013, by district

The need for judgement calls did not stop there, however. All impact measures were assumed to be permanent and to affect WUS, and all conversion impacts were assumed to result in the loss of the WUS, unless stated otherwise. Jurisdictional/non-jurisdictional and on/off site impacts were counted together under the appropriate impact category, but certain types of listed impacts (those affecting buffers, uplands—except "upland ditches"—"riparian" areas, and non-wetland vegetation, plus those outside the US border) were deemed to be outside the scope of this study and were therefore excluded. Where "reclamation" was mentioned, the activity was assumed to be occurring in-place and was thus recorded as temporary impact. Permit revisions which represented a change in impacts were revised retroactively, and duplicate mitigation measures proposed by the same applicant in multiple IPAs were only counted once.

Recording mitigation presented its own set of needs for making general judgement calls. Proposals to purchase an "appropriate amount" of credits were assumed to equate to permanent impacts in the IPA. All permittee-responsible mitigation was assumed to occur onsite unless stated otherwise. Where mitigation was proposed only in credits, credits were equated with an appropriate measure of mitigated area (LF, acres), but physical measures were the preferred form of recording mitigation. Where mitigation for impacts was only given as a larger total of an offsite parcel, or as a grand total completed for multiple projects, mitigation was recorded only in the amount of new impacts. Activities proposed to establish mitigation banks were recorded as "onsite" mitigation, since activities would be occurring on the site of the proposed bank. Mitigation in the form of "mixed forest cover," breakwaters, and storm water management structures proposed to be created was not considered WUS and was therefore not counted.

In addition to the many general judgement calls that needed to be made, many more case-specific decisions had to be made regarding how to record data, such as where specified or unspecified amount of data of one metric was only said to be "included" within, or was given only in a combined total with, an amount of data in another metric. Deciding whether to categorize positive and negative impacts as affecting wetlands when they were given in unusual terms such as "vernal pools" or "vernal pool complexes" necessitated more specific judgement calls, as did dealing with the spatial aspect of much of the data, such as when relocation activities came into play. In addition, recording mitigation required its own set of case-specific judgement calls, such as when it was indicated that credits were intended for purchase, but the amount and/or type of credits was not given. Those interested in repeating this study are invited to contact this researcher directly at mollyrgoch@gmail.com for a complete list of all methods used to standardize data for recording.

Methods of State Effect testing

To test for the presence of a "State Effect" on net impacts to WUS, ANOVA tests were used. Use of ANOVA was deemed appropriate by a statistics professional, since all data measurements were taken independently of one another. IPA and IP outputs were assumed to have homogenous variances within WRUs, and also to be normally distributed. This assumption of normal distribution seemed to hold across results for all districts, save for Jacksonville, an obvious outlier. Since the Jacksonville District only contains one state (Florida) and that state is not functionally contained within any other district, however, the results from the Jacksonville Florida WRU are irrelevant to "State Effect" hypothesis testing in any case. To set up data for ANOVA testing, first districts which functionally[5] contained (at least one full IPA's worth of[6]) data from more than one state were selected.[7] Four data points was chosen as the minimum sample size for any WRU being used in the tests.[8] Data from each WRU was broken down into four WUS metrics—acres non-wetlands, acres wetlands, linear feet (LF or riverine) and cubic yards (CY) of impact. For the first three metrics, positive and negative effects were first summed within each IPA, to produce a single data point for each metric within IPAs. For the fourth metric (CY), all numbers represented negative impacts. This was because activities which only gave negative impacts in CY and called for an unspecified amount of mitigation could not see those impacts logically equated with the same volume of mitigation. While the volume of impacts to WUS may seem like a meaningful metric to developers, volume is not a traditional means of measuring either impacts or mitigation, because it is not environmentally meaningful. That is, the negative impacts of dredging 10,000 CY of material from a river might be less severe if the material were dredged 100 yards deep from a 10x10 yard area than if it were dredged 1 yard deep from a 100x100 yard area. Therefore, summing the positive and negative impacts together to find net impacts was not sensible for the CY metric. Next, two types of zeroes were discerned within the IPA data: "null zeros" and "true zeros".[9] IPAs not approved within the given timeframe were eliminated, and ANOVA tests were then performed on issued IPs.

III. Results

Data from 2,050 IPAs was collected. Out of those matched with a decision within 2012 and 2013 (1,219), only 26 were denied. The rest (1,193) were issued, as shown in Figure 1

To answer the first question of this study, results were analyzed for both IPA and granted IP data sets. Roughly 25% of proposed negative impacts and about 15% of proposed positive impacts to wetlands were matched with an approved decision. These results contrast outcomes for acres non-wetland WUS, for which about 79% of proposed negative and roughly 44% of proposed positive impacts were match with an approved decision. Similarly to acres non-wetland WUS, results for LF WUS showed that approximately 54% of negative and 36% of positive impacts were matched with an approved decision.

[5] The qualifier "functionally" should always be taken as implied, whenever it is stated herein that any state/district is "contained" within any other. Clarification is necessary because, as has been noted in a study similar to this one, the formal USACE and state boundaries create 152 unique WRUs (Taylor, 2013, 63), and it would be easy for one to mistakenly interpret this as an indication that 152 WRUs are represented in this study. In this study, the phrase "functionally contained" should thus be taken as implied in all claims of containment, to make clear that these claims have not been made by looking at a USACE civil boundaries map alone.

[6] Clarification was necessary because some IPAs were proposed within more than one state, resulting in each state representing data from only part of a full IPA.

[7] The few IPAs which were proposed within more than one state were excluded from the sets. This action was taken because, in most cases, impacts were not broken down by state. Thus, impacts had to be assumed to be split between states—an assumption which could have skewed the results of what was being tested.

[8] This minimum was set because four is the maximum number of WUS metrics that could be included in a single IPA/IP.

[9] "Null zeroes" are zero values which exist because no effects at all were proposed for that WUS metric within a particular IPA, whereas "true zeros" were the result of negative impacts in an IPA that were exactly equal to positive impacts of that IPA. The percentage of null zeroes within each sampling unit's four WUS metrics was recorded, and subtracting the percentage of null zeroes from 100 for each sampling unit yielded the percentage (probability) of IPs which had some effect on that particular WUS metric. It was this percentage ("percent affected") which was tested for each sampling unit in the ANOVAs, after all null zero entries were deleted.

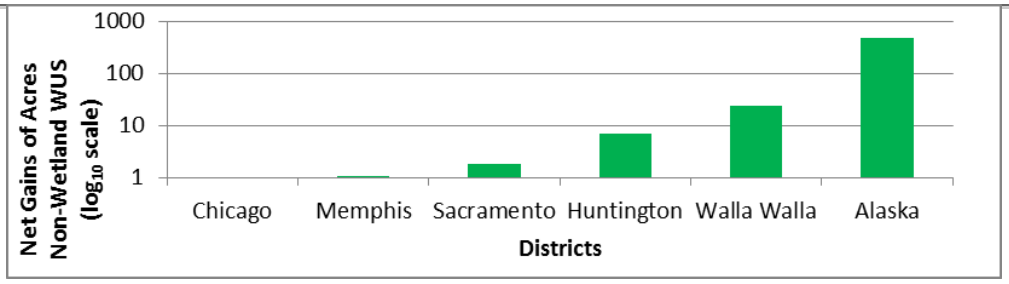

Figure 2: Net Gains or Net Null Effects to Acres Non-Wetland WUS, by District

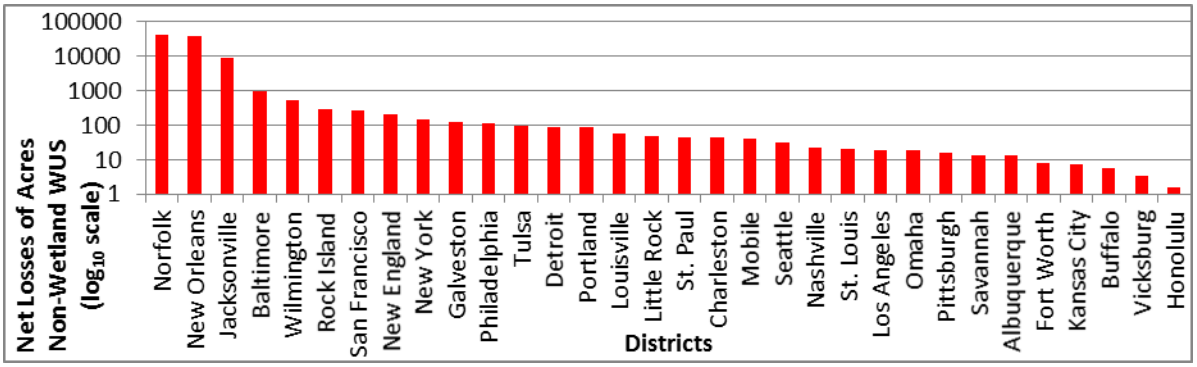

Figure 3: Net Losses of Acres Non-Wetland WUS, by District

When positive and negative impacts were summed within each WUS metric, the resultant sums were the net impacts. There were net losses of about 115,537 acres non-wetland WUS and roughly 309,691 LF WUS proposed, with approved net losses of about 92,854 acres non-wetland WUS and 600,476 LF WUS. By contrast, a net gain of approximately 51,325 acres wetland WUS was proposed. A net gain of about 5,574 acres wetland WUS was approved in 2012/2013.

The only district with net gains across wetland, non-wetland, and LF metrics was Huntington. Similarly, the Sacramento District approved net gains of acres wetland and non-wetland WUS, but no IPs which affected LF WUS were issued. Conversely, both Wilmington and Kansas City Districts approved net losses across all three metrics. In addition, the Little Rock and Vicksburg Districts did not approve any net gains across the three metrics. The Little Rock District approved net losses of acres non-wetland WUS and LF WUS, while no IPs impacting wetlands were issued. In the Vicksburg District, net losses of both acres wetland and non-wetland WUS were approved, while no IPs were granted which had any effect on LF WUS.

The Chicago District featured neither net gains nor net losses of acres non-wetland WUS, as seen in Figure 2. The district with the greatest net gains of acres non-wetland WUS was Alaska, the only district for which these net gains numbered in the hundreds of acres. The granted net impacts to acres non-wetland WUS were negative for most districts.

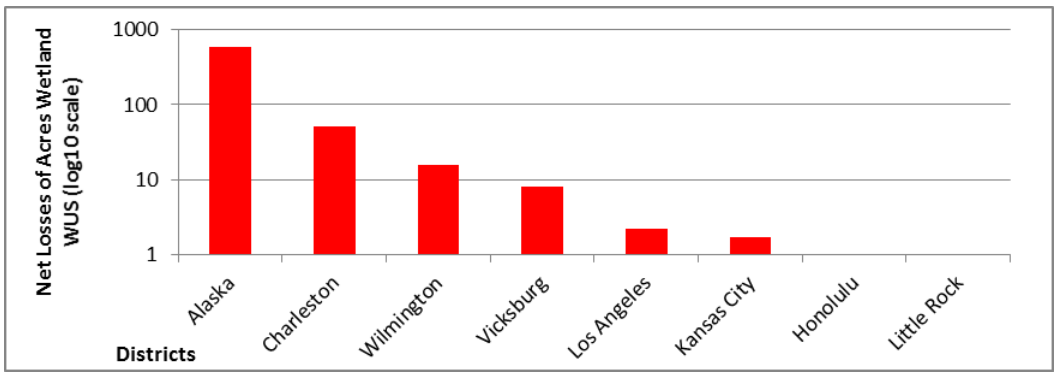

Figure 4: Net Losses or Net Null Effects to Acres Wetland WUS, by District

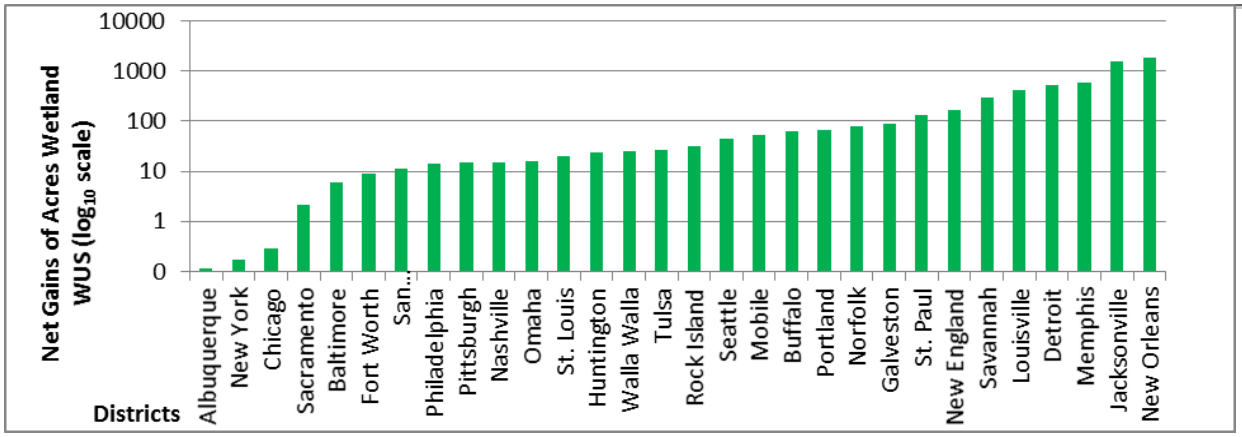

Figure 6: Net Gains of Acres Wetland WUS, by District

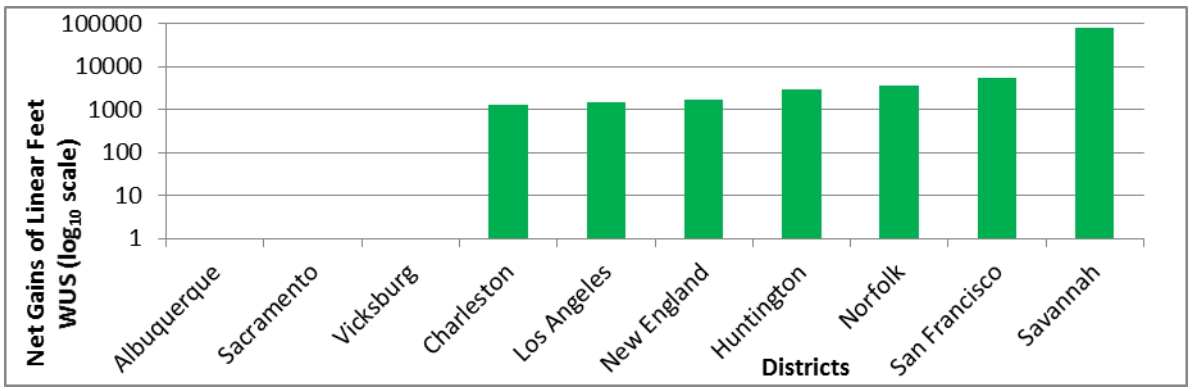

Figure 5: Net Gains and Net Null Effects of Linear Feet WUS, by District

Figure 3 shows that districts with the greatest net losses by far were Norfolk, New Orleans, and Jacksonville. The district with the least net gains of acres non-wetland WUS was Memphis.

There were more districts which featured net gains of wetlands than districts which featured net losses of wetlands, as pictured in Figure 4. Both Little Rock and Honolulu featured neither net gains nor net losses of wetlands. The district with the least net losses of acres wetland WUS was Kansas City. The district with the greatest net losses of acres wetlands by far was Alaska, the only district for which these impacts were in the hundreds of acres.

Figure 5 shows that the majority of districts in the approved set featured net gains of wetland WUS. The districts with the least net gains of wetland WUS were Albuquerque and New York, both of which were the only districts that had net gains of less than 0.2 acres wetlands. The districts with the greatest net gains of wetlands were New Orleans and Jacksonville, both of which were the only districts that had net gains of wetlands in the amounts of thousands of acres.

Figure 6 demonstrates that Vicksburg, Sacramento, and Albuquerque Districts featured neither net gains nor net losses of LF (riverine) WUS. The district with the greatest net gains of LF WUS by far was Savannah, the only district for which these net gains were in the tens of thousands of LF. The district with the least net gains of LF WUS was Charleston.

Many districts featured net negative impacts in terms of LF WUS, as shown in Figure 7. The districts with the greatest net negative impacts to LF WUS were Louisville and Fort Worth, the only districts for which these net negative impacts were in hundreds of thousands of LF. The district with the least net negative impacts to LF WUS was Alaska, the only district for which these net negative impacts were in hundreds of LF.

Figure 8 shows districts which approved CY impacts to WUS. Among these districts, Philadelphia was the only one with CY impacts in the hundreds, and therefore this district approved the least amount of CY impacts. As in the proposed set, Galveston approved the greatest amount of CY impacts by far, being the only district for which these impacts numbered in the tens of millions.

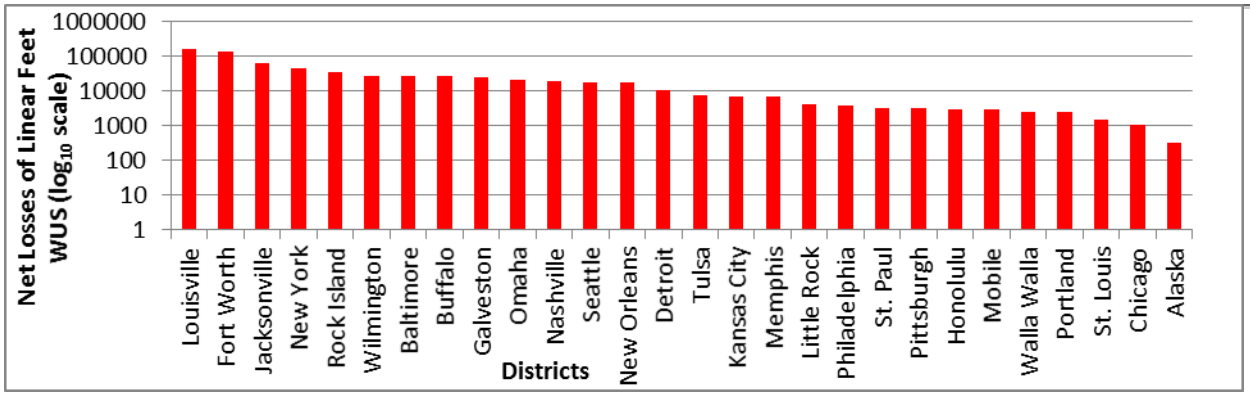

Figure 7: Net Losses of Linear Feet WUS, by District

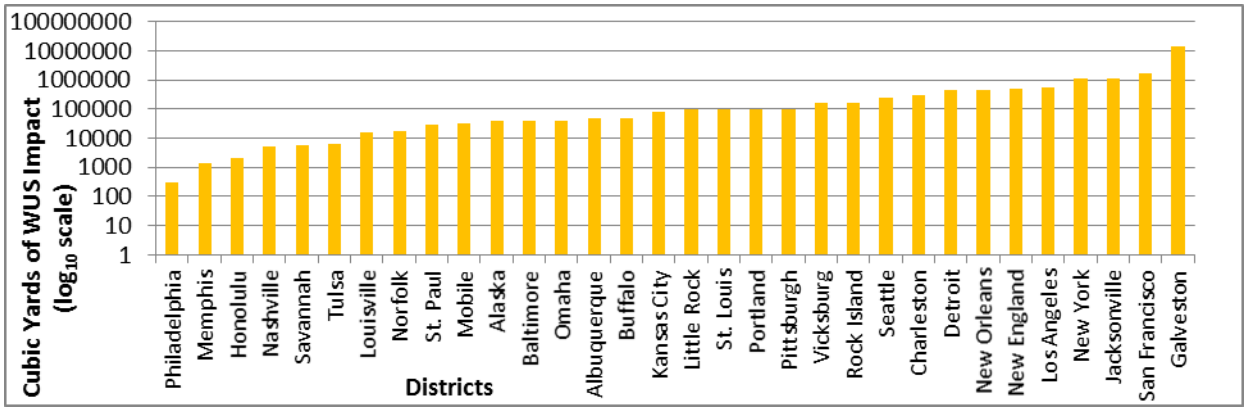

Figure 8: Districts with approved impacts to WUS given in volume (Cubic Yards)

About 6,036 acres of wetlands were negatively impacted—while around 11,610 acres were positively impacted—via IPs in the US in 2012.

As in the proposed set, the most popular form of positive wetland impacts by acreage was onsite mitigation, representing roughly 7,973 acres (69%) of the total, as is shown in Figure 9. Results for wetland mitigation onsite were abnormally distributed across districts. In addition to districts which had no IPAs containing this type of mitigation (Honolulu and Tulsa), the Little Rock, San Francisco, and Savannah Districts also granted no IPAs with onsite wetland mitigation. The Jacksonville and New Orleans Districts emerged as outliers in the granted onsite wetland mitigation results, since they were the only two districts which granted acres of onsite wetland mitigation that numbered in the thousands.

Unlike the proposed set, the second most popular form of positive impacts to wetlands approved was mitigation via bank, as shown in Figure 9. Mitigation credits purchased made up about 2,714 acres (23%) of total wetland mitigation. In addition to districts which contained no IPAs with wetland mitigation via bank (Albuquerque, Honolulu, Memphis, Detroit, and New England), Little Rock, Los Angeles Philadelphia, and St. Louis issued no IPs containing wetland mitigation via bank. The distribution of approved mitigation banking activities among districts was more normal than the distribution of approved onsite wetland mitigation, with no outliers and more districts clustered near the middle. Jacksonville and Sacramento had the greatest amounts of approved wetland mitigation banking, with just over 450 acres each.

Offsite activities were the least popular form of positive impact to wetlands, by acreage. About 923 acres of offsite activities were approved, about 8% of the total positive impacts to wetlands. Like the results for mitigation via bank, the distribution of offsite mitigation activities among districts was also more normal than the distribution for onsite activities, as shown in Figure 9. Among districts which did approve offsite wetland mitigation, the Alaska, Charleston, and Wilmington Districts approved the least (all under 2 acres), while the Louisville and Jacksonville Districts approved the most (over 150 acres each).

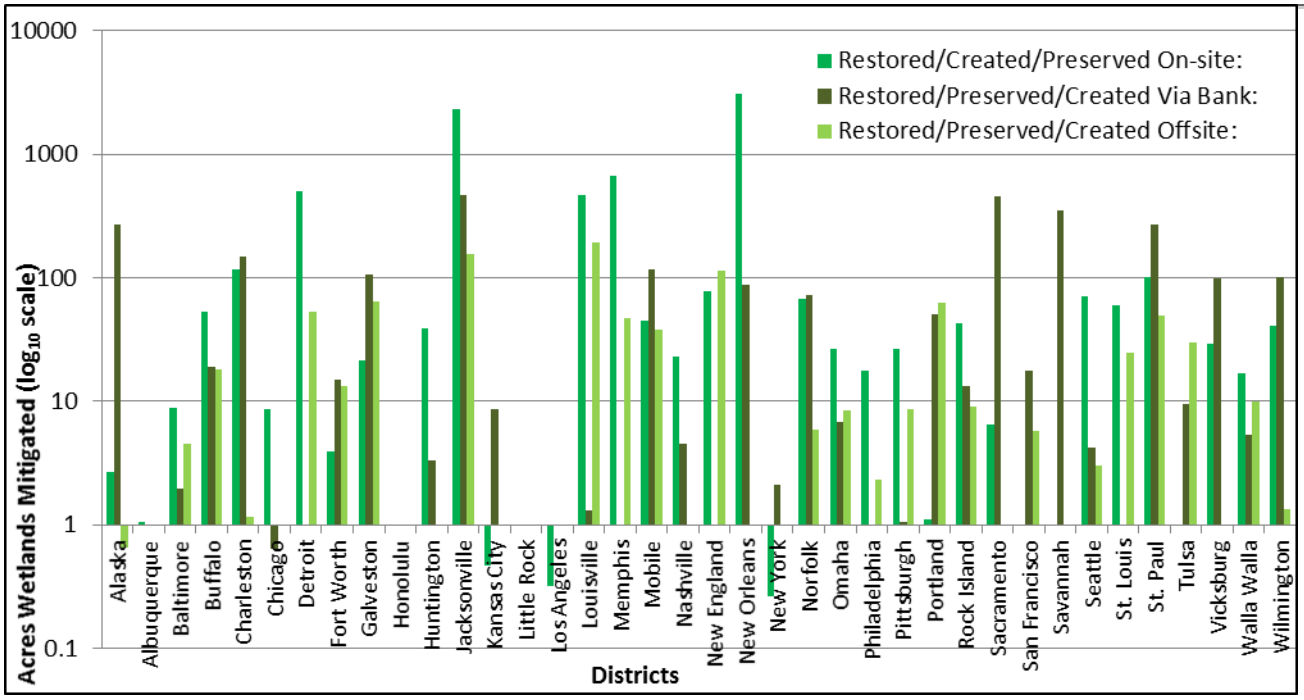

Figure 7: Positive Impacts to Acres Wetlands Onsite, via Bank, and Offsite, by District

To answer the second question of this study concerning how important implementation structures are to the outcomes of WUS regulatory programs, ANOVA tests were performed between different WRUs within a given district or state, using area of wetland and non-wetland WUS and LF WUS as dependent variables for each ANOVA. The purpose was to test the "State Effect" hypothesis, which posits that there will be significant differences between parts of different states within the same district, but not between parts of different districts within the same state.

Table 1 shows the results of 23 "within-district" ANOVAs performed on issued IP data, including number of states tested per metric/district combination. Significantly different results are highlighted. One WUS metric (LF) differed significantly between states within two districts; there were significant differences in LF WUS impacts between Alabama and Mississippi (parts of the Mobile District), as well as Montana and South Dakota (parts of the Omaha District).

District	No. States Tested	WUS Type Tested	Significance (P=)
Buffalo	2	Acres Non-Wetland	0.284
Buffalo	2	Acres Wetland	0.816
Buffalo	2	LF Waters	0.154
Kansas City	2	LF Waters	0.971
Los Angeles	2	Acres Non-Wetland	0.608
Louisville	2	Acres Non-Wetland	0.897
Louisville	2	Acres Wetland	0.216
Louisville	2	LF Waters	0.101
Mobile	2	Acres Non-Wetland	0.794
Mobile	2	Acres Wetland	0.958
Mobile	**2**	**LF Waters**	**0.049**
New England	4	Acres Non-Wetland	0.556
New England	3	Acres Wetland	0.383
New England	2	LF Waters	0.418
New York	2	Acres Non-Wetland	0.645
New York	2	LF Waters	0.756
New York	2	CY Waters	0.908
Omaha	**2**	**LF Waters**	**0.039**
Philadelphia	2	Acres Non-Wetland	0.179
Pittsburgh	2	LF Waters	0.720
Rock Island	2	Acres Non-Wetland	0.169
St. Paul	2	Acres Wetland	0.398
Vicksburg	2	Acres Wetland	0.373

Table 1: P-values of within-district ANOVAs for issued IPs, with significant entries highlighted

Table 2 shows the results of 12 "within-state" ANOVAs performed on the granted set of IP data. The number of districts tested for each metric is also shown. There were no statistically significant differences for any WUS impacts between different WRUs within any states tested.

State	No. Districts Tested	WUS Type Tested	Significance (P=)
New York	2	Acres Non-Wetland	0.476
New York	2	LF Waters	0.278
New York	2	CY Waters	0.289
California	2	Acres Non-Wetland	0.348
California	2	Acres Wetland	0.272
Mississippi	2	Acres Wetland	0.379
New Jersey	2	Acres Non-Wetland	0.208
Texas	2	Acres Non-Wetland	0.372
Texas	2	Acres Wetland	0.525
Louisiana	2	Acres Non-Wetland	0.699
Louisiana	2	Acres Wetland	0.484
Ohio	3	Acres Wetland	0.417

Table 2: P-values of within-state ANOVAs for issued IPs (no significantly different results)

IV. Discussion

Overall results for impacts and mitigation

Acres of wetland WUS affected decreased dramatically between IPA and granted IP data sets: less than 11% of the net wetland gain proposed was matched with approved decisions within the given timeframe. When the net gain was separated into positive and negative components, 25% of proposed negative and 15% of proposed positive impact acreage was approved for acres wetland WUS within the given timeframe, which is probably related to the fact that most IPAs for the establishment of mitigation banks were not approved during 2012/2013. Interestingly, though a greater percentage of negative impacts to wetlands were approved than positive impacts (as was the case for all WUS metrics studied), wetlands were the only metric to experience net gains in both proposed and granted sets. While acres non-wetland WUS still experienced a net loss in the set of IPs issued overall, this net loss did decrease between the proposed and approved sets, and thus might be perceived as an attempt to protect waters of this metric. The granted set only represented about 59% of proposed IPs, however, and so all things being equal, we would expect the approved impacts (both positive and negative) to be about 59% of those in the proposed set. In fact, about 80% of the net losses of acres non-wetland WUS among all IPAs were approved. When broken down into positive and negative components, roughly 79% of all proposed negative impacts, and about 44% of all proposed positive impacts were approved within this metric. Although only 54% of negative impacts and 36% of positive impacts were matched with an approved decision for the LF metric, almost 194% of the proposed net loss was approved for LF WUS, the only WUS metric for which the net loss proposed was less than the net loss approved. This could indicate greater applicant interest in, and/or greater regulator willingness to approve activities which negatively impact waters traditionally measured in LF, such as rivers and coastlines. Since a greater percentage of proposed negative impacts than positive ones were approved across all three WUS metrics, it seems this was likely caused, at least in part, by the fact that almost all IPAs for the establishment of mitigation banks were not approved during the given timeframe. This suggests some sort of hurdle standing in the way of the CWA meeting its goal of protecting our national water resources, especially as this goal is related to the establishment of mitigation banks.

With respect to acres non-wetland WUS impact approved, the Chicago District truly conformed to the null hypothesis: there was no difference between approved positive and negative impacts to acres non-wetland WUS, resulting in neither a net gain nor a net loss. Other districts which offered some support for the null were Honolulu, Vicksburg and Buffalo (on the negative side) and Memphis (on the positive side). Out of these five districts, all but the Honolulu district contained data from multiple states. The districts with the greatest net negative impacts to acres non-wetland WUS were Norfolk, New Orleans, and Jacksonville, which all contained data from a single state. In addition, the districts with the greatest positive impacts to non-wetland WUS were Alaska and Walla Walla, both of which are also "single-state" districts. This might suggest that greater net positive and net negative impacts to non-wetland WUS are likely to be approved in "single state," districts.

Honolulu conformed to the null hypothesis for acres wetland WUS impact approved, but only because no IPAs with any wetland impacts were submitted there, so none could be approved. Similarly, the Little Rock District featured no difference between positive and negative approved impacts to wetlands, but did not truly conform to the

null hypothesis, since no IPs affecting wetlands in any way were approved there. Districts which offered some true support for the null were Kansas City and Los Angeles on the negative side; and Albuquerque, New York, and Chicago on the positive side. All of these districts functionally contain more than one state. This suggests that districts which contain multiple states tend to have less extreme net approved impacts on wetlands in general. Furthermore, the district with the greatest approved net losses of wetlands by far, Alaska, functionally contains only one state, as do the other districts with the greatest differences between approved positive and negative impacts to wetlands (New Orleans and Jacksonville on the positive side, and Charleston and Wilmington on the negative side). This could suggest that "single state" districts tend to have greater differences between approved negative and positive effects on wetland type WUS.

Vicksburg, Sacramento, and Albuquerque Districts featured neither net gains nor net losses of LF WUS, thereby technically conforming to the null hypothesis. Because no activities that would have affected LF WUS in any way were proposed in Albuquerque, however, none could be granted, and so Albuquerque did not "truly" conform to the null hypothesis. Similarly, in Vicksburg, although proposals to affect LF WUS were present, no IPs affecting LF WUS were granted there, so it doesn't "truly" support the null. The only district which "truly" conformed to the null hypothesis for LF WUS was Sacramento, for which there was no difference between the amounts of positive and negative impacts approved. The district with the greatest net approved positive effects on LF WUS by far was Savannah, while the districts with the greatest negative net effects on LF WUS by far were Louisville and Fort Worth.

Clearly, a pattern which extended throughout much of the data was that single-state districts (those containing data from just one state) seemed to continually display more extreme results than districts with data from multiple states. The reason for this could be connected with the State Effect hypothesis. Unlike districts with permit activities from multiple states, single-state districts likely allow for the district- and state-level offices within that region to operate in constant contact with one another, without any possible interference from other implementation structures (WRUs). Because of these conditions, the district- and state-level regulators in single-state districts could have unconsciously developed very similar assumptions and viewpoints regarding their roles as regulators, which in turn could have created a positive feedback loop between state and district regulatory agents in single-state districts, thereby leading these districts to experience more extreme net gains/losses than multi-state districts.

One peculiarity among the overall mitigation data was that while only 8% of the total proposed wetland mitigation was slated to take place via mitigation banking, 23% of the total approved wetland mitigation took place via banking. Furthermore, results for wetland mitigation via bank were unique, in that this was the only means of wetland mitigation which rose between the proposed and approved sets. Explaining these results is fairly straightforward. The US EPA and the USACE released updated regulations concerning compensatory mitigation in 2008. In response to criticisms that these organizations had been treating the three major forms of mitigation (applicant-responsible, in-lieu fee, and mitigation via bank) as if they were not discrete vehicles of activity, the new regulations specified that—where credits are available—mitigation via bank is the preferred activity, since it represents the most reliable form of compensation (United States Environmental Protection Agency, Mitigation Banking Factsheet, 2014). Thus, it is easy to understand why mitigation via bank represented such a large proportion of approved mitigation activities.

Explaining the low proportion of proposals to mitigate via bank in IPA data, however, is more complicated. The USACE can display its "preference" for bank mitigation by either issuing permits with bank mitigation more swiftly, or requiring a lesser amount of mitigation when applicants compensate for impacts via bank. Given the release of the new regulations, applicants should know about the USACE's preference, and hence one would expect bank mitigation to be more robustly represented among IPAs. These results are likely related to the fact that many mitigation bank establishment proposals (which themselves represented positive impacts to wetlands occurring "onsite") were not approved, and thus this "space" was filled in part within the approved set by IPAs with mitigation banking. The low rate of mitigation banking proposals among IPA data could also be explained, however, by observing these results through an

economic lens. A rational applicant might be tempted to try and reduce the costs of a project by performing applicant-responsible mitigation (on or off site), rather than hiring a professional (buying credits from a bank). These hypothetical assumptions about the relative costs of mitigation are likely valid, since the cost of the all-inclusive professional service (mitigation bank credits) is likely to be stabilized by the local market. Because the standards placed on applicant-responsible mitigation projects through Section 404 are far less stringent than regulatory standards imposed on mitigation banks, there is much more variability in the potential costs of applicant-responsible mitigation projects. This condition was evident across much of the IPA data. Some applicants seemed to feel their "mitigation" plans need not have any ground-level effects,[10] and where mitigation did have a ground-level component, it was often evident that the applicants were trying to cut costs of mitigation to the bare minimum—for example, by offering as "mitigation" the "preservation" of areas which were most likely just not suitable for commercial use—instead of improving existing WUS or creating more WUS coverage.[11] Thus, the greater potential variability in the cost of applicant-responsible mitigation could lead many applicants to try and cut costs by avoiding the proposal of wetland mitigation via bank, and instead proposing applicant-responsible mitigation by the cheapest means available. One must also consider the possibility, however, that credits were simply not available. The service areas of mitigation banks do not cover the entire country, so mitigation via bank may not have been an option for many applicants. Even if a project is within the service area of a bank, the bank must also have credits available. This could be problematic—especially considering the low issuance of IPs to establish mitigation banks discovered by this study.

In sum, results indicate that districts may be more likely to see greater positive impacts to wetlands via both onsite and bank mitigation than via offsite mitigation, and single-state districts may be more likely to see overall net gains of wetlands than multi-state districts. The results may also indicate a greater preference for wetland mitigation via bank on the part of the USACE, or a greater preference for applicant-responsible mitigation on the part of IP applicants.

State effect testing

It has been said since the 1890's that American federalism is unique because it features two regulatory spheres (federal/state) operating independently of one another within overlapping physical space (Taylor, 2013, xvi). Some modern opinions, however, go as far as to say that federal jurisdiction overpowers states in regard to Section 404 (Taylor, 2013, xvi). If the latter assertion were true, the State Effect Hypothesis would be rejected. The State Effect hypothesis was partially supported by the results, however. Over 6% of the total "within-district" ANOVA tests—and 100% of the total "within-state" ANOVAs—supported the State Effect hypothesis. The State Effect hypothesis predicted that parts of the same district within different states would have significantly different impacts proposed and/or granted, while parts of the same state within different districts would not have significantly different impacts proposed and/or granted. Out of 23 "within-district" ANOVAs performed for approved impacts of the various WUS metrics, two districts (or nearly 9% of these ANOVA tests) differed significantly in LF impacts between their respective states: Alabama/Mississippi in the Mobile District, and Montana/South Dakota in the Omaha District. This indicated that LF WUS was the only WUS metric for which impacts were likely to differ significantly between states within the same district. Although 12 "within-state" ANOVAs were performed on the approved data, none showed significant differences between parts of the same state that fell within different districts for any WUS metric, thus offering 100% support for the State Effect hypothesis. The support found for the State Effect hypothesis could be explained by the fact that

[10] For example, in the Jacksonville District, one IPA from the Portofino Resort, which sought after-the-fact authorization for impacting wetlands, provided the following applicant-responsible mitigation proposal: "Educational signage and tri-fold brochures will be provided and posted in the project vicinity to inform client and guests as to the importance of coastal and estuarine habitats such as seagrasses and coastal marshes."

[11] For example, in the Huntington District, an IPA for construction of a natural gas processing facility, which included wetland impacts, was received from Utica East Ohio Midstream LLC. They proposed as mitigation the preservation of an onsite stream and its associated riparian area, rather than the creation or improvement of wetlands.

while states do have a nationally-standardized role in USACE permitting via section 401 of the CWA, states are also free to establish additional regulation of their waters beyond section 401. Many states have chosen to take up the opportunity to establish additional regulation of their waters, and these state-based differences in extra regulation of waters could account for a "State Effect" on IP outputs.

Challenges, issues, and recommendations for the future

As noted by Taylor, the USACE does release a yearly report called the Annual Summary of Wetland Impacts, which formed the core of Federalism of Wetlands. Indeed, Federalism of Wetlands explains that the Annual Summaries, which focus on the amount of wetland fill approved, and the number of permits issued, are "Designed primarily for in-house use" (Taylor, 2013, 75). "Stripped almost entirely of any other detail or nuance," Taylor says of the Summaries, "readers must reconstruct their own autopsy of the program from scant details recorded concerning the amount of wetland fill requested in the permits and the amount of mitigation required as a result. Additional markers also describe...if the permits are issued through the 'general' or 'standard' permit processes" (Taylor, 2013, 75). Hence, the Annual Summaries of Wetland Impacts were not considered robust enough to support the kind of broad analysis which was called for in this study. Conducting this study would have been considerably easier if the public database of decisions associated with IPAs (released by the USACE) included numerical information on impacts/mitigation. Had this been the case, the approved IP data set in this study would not have needed to be contingent on information contained in IPAs.

Making an adjustment to the amount of information released to the public could translate into a much greater ease of study for other environmental scientists interested in this topic. Indeed, according to Taylor, "...because each district office's Regulatory Branch Chief is accountable to their respective division commander, most district offices use some form of an automated database to keep track of their regulatory workload...This means, nationwide, at the district office level of organization all USACE 404 permit data is accounted for" (Taylor, 2013, 75). This study isn't the first to propose the idea of a publicly available database, either. One study by the National Academy of Sciences Research Council made this same suggestion, recommending that the USACE establish a national wetland gains and losses database, which would include not only information on mitigation required and executed, but also information on functional success of mitigation sites (relative to the function of the original impacted wetlands). That study argues that such a database is essential for accurate assessment of policy implementation (Brandywine Conservancy Environmental Management Center, 2002).

Given that this study did have to rely on information contained in IPAs, however, the most time-consuming and arduous part of this study was the conversion of qualitative data into quantitative data. It was very difficult to get an accurate picture of overall impacts from IPAs with no standardized format for reporting those impacts.[12] Often, the type of WUS being impacted wasn't even noted. One way to increase the ease with which outside studies in this field could be performed, (and the transparency of the permitting process) would be for the USACE to recommend or require a standardized format to applicants in describing impacts within IPAs.

The practice of reporting impacts to WUS in the form of LF or CY within IPAs made it impossible to produce a single area of total impacts and mitigation, respectively. Impacts proposed in the form of CY—a measure of volume—were an especially serious problem, since no inferences could be made regarding the ground-level boundaries of these impacts. Thus, impacts proposed only in CY struck this researcher as being the least transparent way an applicant can propose impacts to WUS, especially since applicants within some districts saw little or no need to propose impacts in this way. In addition, where mitigation was proposed for a given amount of volume impact but the amount of mitigation was unspecified, inferences were not made about the amount of mitigation based on impacts, the way these inferences were made for other WUS metrics. Recommendations or rules on how to report impacts to WUS (i.e., in a measure of area, rather than in LF or CY) might have at least partially ameliorated

[12] For example, construction of ten docking structures in a lake might be proposed in the form of total acreage impact for all ten structures, dimensions for each structure's impacts in square feet, or as accounts of separate dredge, fill, and construction events associated with the establishment of each docking structure. Sometimes, it wasn't even clear which of these levels of specificity applicants were attempting to conform to.

these issues, and would be useful to those wishing to conduct a study like this one in the future, should they also have to rely on data from IPAs. It is the hope of this researcher that the USACE districts will try to rectify these issues in their records of applicant requests to affect WUS via IPs—especially those districts which currently contain many impacts proposed linearly or in volume. Again, assuming that those who might wish to study this subject in the future would also have to rely on data from IPAs, it is also important to note that their job would be made much easier if it were standard practice for all USACE districts to file an archive of all IPAs they release, dating back at least several years, regardless of any website updates.

The study revealed that although there is a desire in many districts to establish mitigation banks, these requests are not being approved with much efficiency. Perhaps this is simply an inherent characteristic of proposals to establish mitigation banks. There is also a possibility, however, that these results arose because of a regulatory "lag" between the 2008 decision on the part of the EPA and USACE to prefer mitigation banks, and the ability of the USACE's bureaucratic system to accommodate the proposals for mitigation bank establishment arising due to that decision. This researcher hopes that, if the latter instance is indeed the case, this study will provoke reexamination of the processes necessary to approve the establishment of mitigation banks with the greatest possible efficiency. In addition, this study reveals that while the actions taken to protect US wetlands have had some success, the condition of US wetlands is still probably not improving as quickly as it could be if more large-scale wetland improvement projects (like mitigation banks) were granted more efficiently. Though wetlands experienced the smallest proportion of proposed negative impacts approved in the given timeframe out of the three metrics measured, a smaller percentage of improvements to wetlands were approved within the timeframe compared to the percentage of negative impacts that were approved. Indeed, this study found that a greater proportion of negative impacts than positive impacts were approved across all WUS metrics, which is almost certainly correlated with the finding of low efficiency in the approval of mitigation bank establishment proposals.

In addition, the recent focus on protecting wetlands in the US seems like it could be coming at the expense of protecting other kinds of WUS. According to the US Census Bureau, there are 699,284 square kilometers or about 172,727 acres of perennial waters within the US (United States Census Bureau, 2010), meaning that the net loss of 92,854 acres non-wetland WUS found by this study represented more than half of the area of all perennial waters in the entire country. Furthermore, the protection of wetlands coming largely at the expense of destroying other WUS types was probably not the intention of those who initially set out to protect wetlands. As is evident by comparing the results of this study with previous analyses of states such as Arkansas, Texas, and Oregon, the net wetland losses discovered in those states in the past have reversed themselves in this study's results. This outcome could have been influenced by the attention previous studies, such as those by Kentula et al., brought to the prior net losses occurring in those states. Similarly, it is the hope of this researcher that this study will be used by policy-makers to improve the environmental performance of the USACE'S individual permitting process as a whole.

References

Ambrose, Richard F. "Wetland Mitigation in the United States: Assessing the Success of Mitigation Policies." Wetlands (Australia) 19 (2000): 1-27. Accessed April 12, 2014. http://water.epa.gov/lawsregs/guidance/wetlands/upload/2004_10_28_wetlands_ambrose_wetlandmitigationinus.pdf.

Brandywine Conservancy, Environmental Management Center. "Wetland "No Net Loss" Mandate Failing: Conservation Easements More Important Than Ever in Protecting Wetland Resources." Stewardship Perspectives Winter (2002). Accessed April 19, 2014. http://www.brandywineconservancy.org/perspectives3_02wetlands.html.

Crotty, Patricia McGee. "Assessing the Role of Federal Administrative Regions: An Exploratory Analysis." Public Administration Review 48, no. 2 (1988): 642-648.

Darden, Richard L. "What You Need To Know About Section 404 Permits." Regulatory Division, Charleston District, U.S. Army Corps of Engineers. Accessed March 12, 2014.

http://www.dnr.sc.gov/marine/NERR/present/regulations/Darden_USACEprocess.pdf.

Hjern, Benny and David O Porter. "Implementation Structures: A New Unit of Administrative Analysis." Organization Studies 2, no. 3 (1982): 211-227.

Sibbing Julie M. "Nowhere Near No Net Loss." National Wildlife Federation (2004). Accessed March 4, 2014. http://www.nwf.org/pdf/Wildlife/Nowhere_Near_No-Net-Loss.pdf.

Taylor, Ryan W. Federalism of Wetlands. New York: Routledge Explorations in Environmental Studies, 2013.

United States Census Bureau. "State Area Measurements and Internal Point Coordinates – Geography – U.S. Census Bureau." U.S. Census Bureau, unpublished data from the Master Address File/Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) database (2010). Accessed May 11, 2014. http://www.census.gov/geo/reference/state-area.html.

United States Environmental Protection Agency (US EPA). "Clean Water Action Plan | Restoration | US EPA." USEPA (2012). Accessed March 11, 2014. http://water.epa.gov/type/wetlands/restore/cwap.cfm.

United States Environmental Protection Agency (US EPA). "MEMORANDUM OF AGREEMENT | Wetlands | US EPA." USEPA (2012). Accessed March 4, 2014. http://water.epa.gov/lawsregs/guidance/wetlands/mitigate.cfm.

United States Environmental Protection Agency (US EPA). "Mitigation Banking Factsheet." USEPA (2014). Accessed May 11, 2014. http://water.epa.gov/lawsregs/guidance/wetlands/mitbanking.cfm.

Van Horn, Carl E and Donald S Van Meter. "The Implementation of Intergovernmental Policy." Policy Studies Review Annual (1977). Sage Publications: Beverly Hills, California.

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