Summary Report:
Recovery Potential Screening of Louisiana Watersheds
in Support of Nutrient Management

INTRODUCTION

The U.S. Environmental Protection Agency's (EPA's) Total Maximum Daily Load (TMDL) Program, in cooperation with state water quality programs, released a long-term *TMDL Vision* document in December 2013. One of the objectives of TMDL Vision is for states to systematically prioritize watersheds for restoration and protection efforts and better link TMDLs and other water quality improvement approaches to these priority watersheds. A 2011 Office of Water policy memorandum on nutrients also recommended a systematic watershed analysis, comparison and priority setting process to improve overall efforts towards nutrient reduction. EPA's TMDL program has provided watershed data, comparative assessment tools and state technical assistance for the past ten years through the Recovery Potential Screening (RPS) approach and tools (see Attachment 1). In support of state requests for assistance in nutrient-related prioritization, the TMDL program has partnered with several states, including Louisiana, to jointly carry out RPS assessments and use the results to help states consider their watershed nutrient management options systematically with consistent data. These RPS assessments were designed to address primarily nutrient-related issues identified by each state using state-specific indicators and data relevant for watershed comparison. This report summarizes the Louisiana project approach and findings, and identifies multiple additional products (e.g., RPS Tools and data files) that were developed along with this report.

Background

RPS is a systematic, comparative method to identify differences among watersheds that might influence their relative likelihood to be successfully restored or protected. The RPS approach involves identifying a specific purpose for comparison, identifying a group of watersheds to be compared, selecting appropriate indicators from three categories (ecological, stressor, social) that describe the primary mechanisms by which natural and man-made factors influence watershed health and recovery, calculating index values for the watersheds, and applying the results in support of strategic planning, prioritization and decision-making. EPA developed the RPS Tool to provide states and other restoration planners with a systematic approach for comparing watershed differences in terms of key environmental and social factors that can affect watershed protection and restoration success. RPS is an easy to use screening and comparison tool that is user-customizable for the geographic area of interest and a variety of specific comparison and prioritization purposes. The RPS Tool is a custom-coded Excel spreadsheet that performs all RPS calculations and generates RPS outputs (e.g., rank-ordered index tables, graphs and maps). It was developed several years ago to help users calculate Ecological, Stressor, Social, and Recovery Potential Integrated index scores for comparing up to thousands of watersheds in a desktop environment using widely available and familiar software. To encourage the use of the RPS Tool, EPA developed a standardized set of indicators and state-specific data for all of the lower 48 states.

Louisiana Department of Environmental Quality (LA DEQ) requested assistance from EPA in 2012 due to their interest in a more systematic, data-supported comparison of watersheds for restoration investments. An RPS assessment project was jointly undertaken by EPA's TMDL program, Tetra Tech, Inc. (EPA contractor), and LA DEQ. A total of 121 base, ecological, stressor, and social indicators were initially developed from state and federal data sources at the HUC12 scale, and compiled in a Louisiana statewide RPS Tool (Excel file). A RPS workshop at LA DEQ in 2013 hosted trainees from several LA DEQ water program units, such as the 303(d)/TMDL units, and the 319 Program. This workshop marked the completion and delivery of the state's first RPS Tool and enabled LA DEQ to begin its routine use. In 2013, LA DEQ requested follow-on assistance in RPS Tool enhancement and application as one of several state nutrient demonstration projects using RPS. EPA made new national-scale data available in 2014. These data, in addition to datasets from the state, enabled development of the current (2015) Louisiana statewide RPS Tool for this project. Today, the RPS Tool contains nearly 300 indicators with full statewide coverage at HUC12, HUC8, or both scales. The assessment findings and most of the figures in this document were generated by the Louisiana RPS Tool.

APPROACH

As a starting point, each RPS nutrient project was designed to apply recommendations from the 2011 EPA Office of Water nutrients policy memorandum, which reads in part:

> *Prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions*
>
> *A. Use best available information to estimate Nitrogen (N) & Phosphorus (P) loadings delivered to rivers, streams, lakes, reservoirs, etc. in all major watersheds across the state on a Hydrologic Unit Code (HUC) 8 watershed scale or smaller watershed (or a comparable basis.)*
>
> *B. Identify major watersheds that individually or collectively account for a substantial portion of loads (e .g. 80 percent) delivered from urban and/or agriculture sources to waters in a state or directly delivered to multi-jurisdictional waters.*
>
> *C. Within each major watershed that has been identified as accounting for the substantial portion of the load, identify targeted/priority sub-watersheds on a HUC 12 or similar scale to implement targeted N & P load reduction activities. Prioritization of sub-watersheds should reflect an evaluation of receiving water problems, public and private drinking water supply impacts, N & P loadings, opportunity to address high-risk N & P problems, or other related factors.*

The two-stage approach described above fits well with the RPS Tool, which easily supports comparing HUC8 watersheds in a first, targeting stage and then focuses on screening and comparing HUC12s in a second, implementation-oriented stage (Figure 1). All of the RPS nutrients projects utilized the same general two stage approach (HUC8 or similar larger-scale unit in Stage 1, HUC12 in Stage2), while encouraging state-specific customizing of the approach in identifying stage 1 scenarios, establishing state approaches for priority watershed identification, and selection and weighting of the most nutrients-relevant indicators for use in both stages. For this project LA DEQ, EPA, and its contractor collaborated to compile the data sources and indicators in the RPS Tool, select indicators, choose demonstration watersheds, and weight the indicators in the nutrients-related screening runs. Nevertheless, this technical project's findings and outputs are not meant to represent decisions or policies of LA DEQ, EPA, or any other entity.

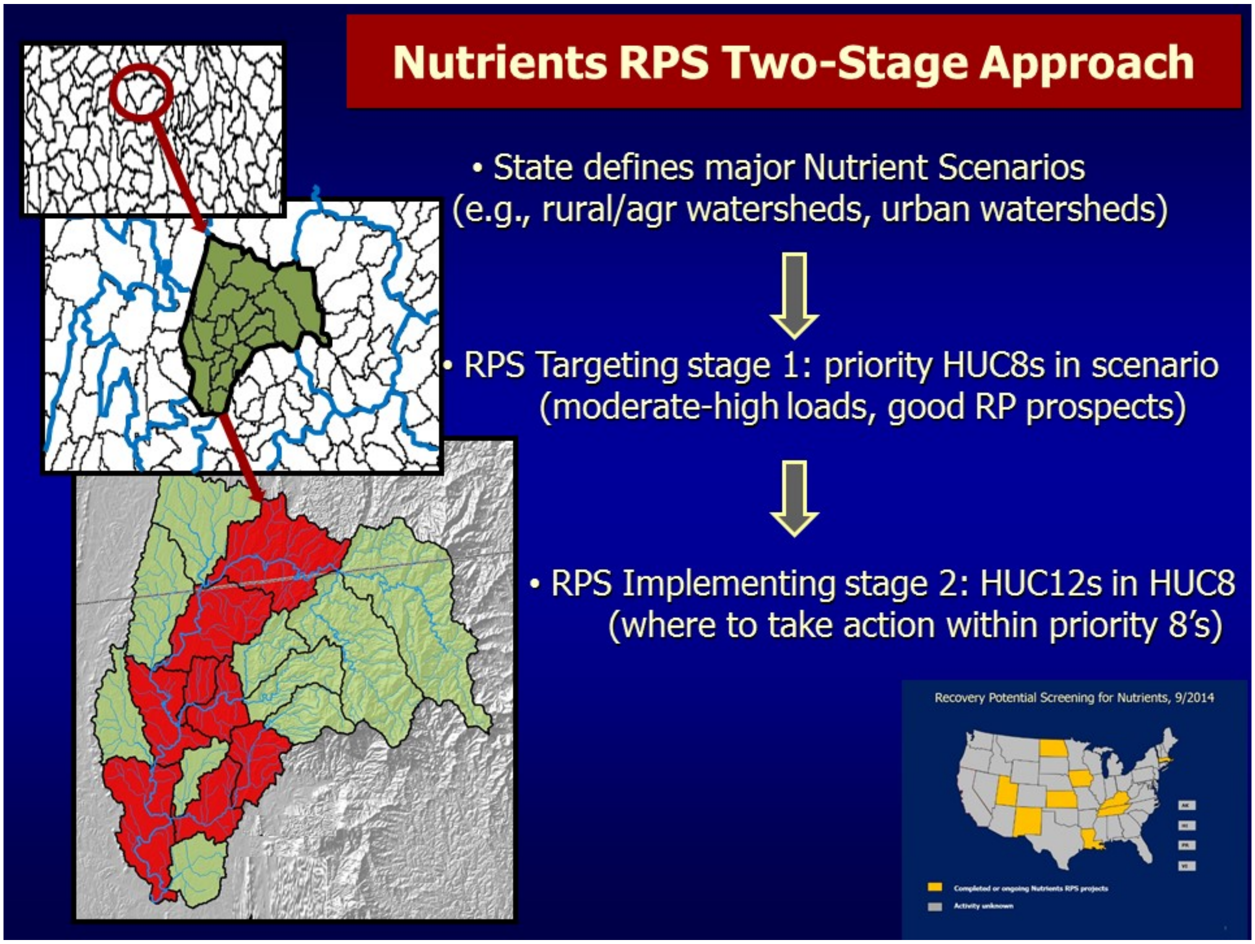


Figure 1. Two-stage conceptual approach generally utilized in RPS projects for supporting state nutrients management. Louisiana's modified two-stage approach focused on ecoregions as the larger Stage 1 unit and on HUC12s per ecoregion in Stage 2.

Stage 1

Identifying Nutrient Scenarios. The RPS Tool is most effective in comparing groups of watersheds that have something in common, such as generally similar landscapes, nutrient sources, impacts and possible management options; for this reason, Stage 1 begins by engaging the state in defining specific types or groups of watersheds with something in common regarding their primary nutrient management challenges. The term "scenario" is used here to describe the sets of shared characteristics that provide a basis for groups of similar watersheds to be compared and contrasted with one another effectively. Nutrient management challenges in any given state can be complex and involve multiple scenarios. Breaking down a large group of watersheds statewide into smaller, more similar groups and focusing on scenarios most relevant to each group enables a narrower focus on nutrient issues and possible solutions. For example, nutrient scenarios can differentiate between groups of watersheds with primarily agricultural/rural loading sources and groups of more urban-suburban watersheds with wastewater and urban runoff nutrient sources. Screening these scenarios separately enables selection of indicators that can be more specific to each scenario.

For Louisiana, the Stage 1 screening followed a different path than many other states that have used the RPS Tool. Most states develop Stage 1 at the HUC8 scale, while Louisiana decided to use the ecoregion-scale. Louisiana ecoregions are larger than the HUC8 scale but each ecoregion represents a group of watersheds that have generally similar geographic, hydrologic and biologic characteristics and similar land uses. Because of these similarities across many of the watersheds within an ecoregion, focusing on each ecoregion in Stage 1 plays the same role as the development of nutrient scenarios among HUC8s in Stage 1. In each case, identifying a group of watersheds with similar properties provides a narrower and more specific focus on the type of nutrient issues present and their possible solutions. LA DEQ identified four ecoregions within the state that were of interest for nutrient issues. Rather than creating a scenario using a set of indicators, the state selected the four ecoregions based on *a priori* knowledge of the state and its nutrient issues. These four ecoregions served as the results of Stage 1 and were moved forward to Stage 2 for HUC12 scenarios.

Of the 15 ecoregions in Louisiana, LA DEQ selected the Upper Mississippi River Alluvial Plains (UMRAP), the Lower Mississippi River Alluvial Plains (LMRAP), the Southern Plains Terrace and Flatwoods (SPTF) and the Gulf Coastal Prairie (GCP) ecoregions for detailed Stage 2 RPS analysis. These ecoregions are shown in dark blue in Figure 2. The ecoregions were selected by LA DEQ because the majority of waterbody nutrient impairments are within these ecoregions. In addition, these ecoregions represent a range of land use conditions across the state, including row crops, pasture, rice cultivation, urban and forest. The UMRAP was selected as a nutrient-impaired, predominantly row crop-dominated agricultural ecoregion. The GCP was selected because it is a nutrient-impaired ecoregion with both high density urban areas and agricultural uses, mainly rice cultivation and pasture land. The LMRAP and SPTF are both more urban ecoregions, but the SPTF has more undeveloped forestland.

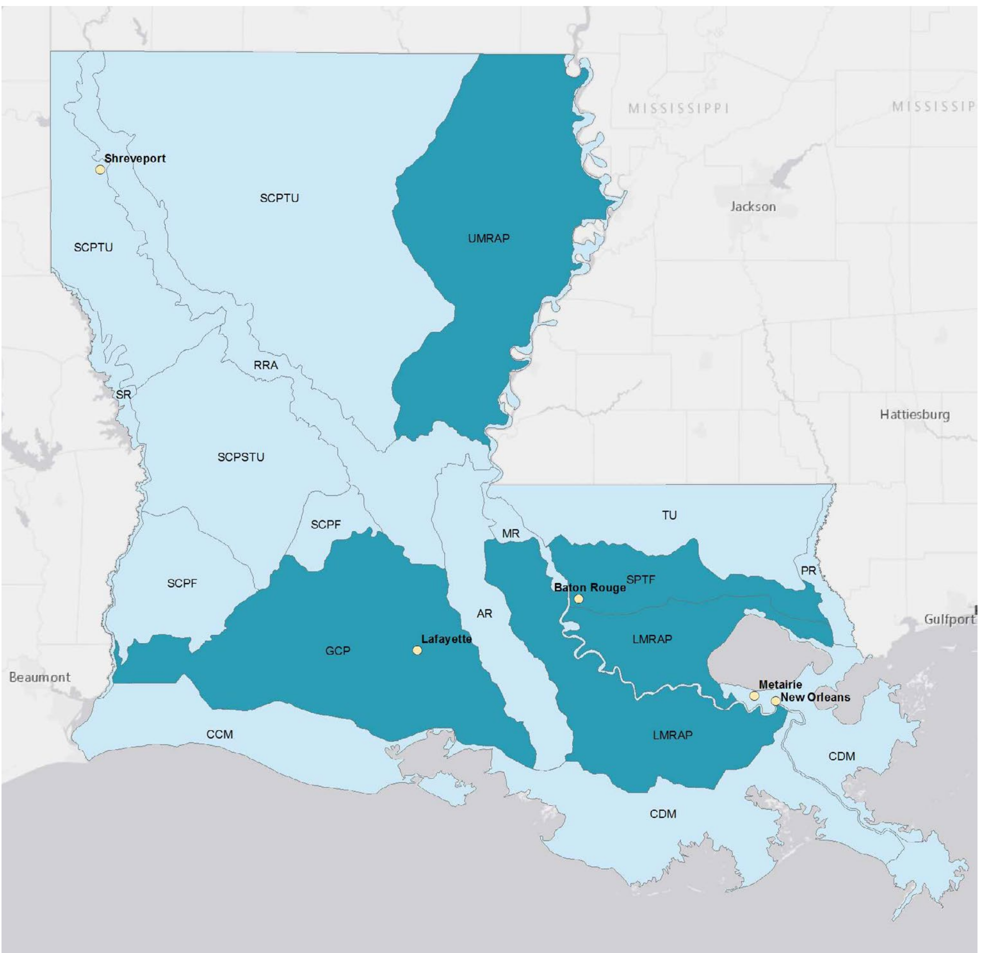


Figure 2. Ecoregions selected by Louisiana DEQ for use in Stage 2 Scenarios.

Stage 2

<u>*Selection of Stage 2 Indicators*</u>. Stage 2 assessment is intended to compare smaller watersheds (HUC12s) for a more specific planning purpose (i.e., considering where best to implement control efforts) than Stage 1. Stage 2 continues Stage 1's focus on scenarios, as different sets of Stage 2 indicators are selected for assessing the HUC12s within each ecoregion. The scenarios focused on the rural-agricultural characteristics of the UMRAP and GCP ecoregions, the mixed agricultural and developed land characteristics of the LMRAP and SPTF. Indicator

selection at this second, more detailed stage can draw from the varied set of indicators compiled statewide at the HUC12 scale, and thus is capable of being tailored to address more specific land use settings or control practices. Indicator selections and weights assigned by LA DEQ based on best professional judgement (see Table 1) were used for screening the HUC12s within each of the ecoregions.

Within-Ecoregion Comparison of HUC12s. Stage 2 compares watersheds (meaning HUC12s in this report) in the context of a geographic sub-state area, in this case the ecoregion, and not across the state's entire population of HUC12s. This means that Stage 2 screening identifies watersheds that might influence the health and future of the larger ecoregion, as well identifying opportunities for action within these watersheds individually. Comparison of all HUC12s statewide is appropriate for some purposes, but comparisons of HUC12s within a defined area such as an ecoregion or a single HUC8 are frequently more useful because they reveal relative differences among HUC12s within the context of a smaller, more homogeneous setting rather than a highly variable statewide setting.

Potential Stage 2 ranking watersheds. RPS Tool screening runs performed on each of the four ecoregions identify a range of conditions among the HUC12s within each ecoregion. Each screening run generates an ecological, stressor, social and integrated recovery potential integrated (RPI) score and rank for every HUC12. The RPI score and rank account for all three indicator categories in a single score or rank for each watershed, but the RPI represents just one of many options for comparing watersheds. The ecological, stressor and social indices and ranks, and even single indicators of interest, may also be used in comparing differences among the watersheds to inform strategies for where to invest nutrient management and watershed protection resources. This report is intended to demonstrate procedures and alternatives for identifying potential watershed priorities and how to use this information to adapt watershed planning. The Stage 2 results presented in this report are demonstrations of alternatives rather than final selections. Louisiana can build off the results of these scenarios and refine them to assist with future nutrient-related watershed prioritization, restoration, implementation and planning activities.

STAGE 2 RESULTS

As described in the Approach section, Stage 2 screening is performed on the selected ecoregions individually and compares the HUC12s within each ecoregion to each other. One Stage 2 scenario was developed for each of the four ecoregions, based on the predominant land use characteristics identified by Louisiana DEQ for each of the ecoregions. The broad set of indicators available at HUC12 scale enables specific targeting of indicators relevant to implementing nutrient management activities. These indicator selections and weights (see indicators in Table 1 and definitions in Attachment 2) were finalized by LA DEQ after a series of meetings with EPA and Tetra Tech and used in the Stage 2 scenario screenings carried out by Tetra Tech. The ecoregion scenarios are briefly summarized below, followed by the results for each ecoregion. A separate copy of the RPS Tool for each of the four ecoregions in the scenarios has been archived for delivery to LA DEQ with other products (see Attachment 4).

Scenario 1 – Mixed uses, but predominantly stormwater runoff nutrient issues – for LMRAP and SPTF Ecoregions.

Scenario 1 addresses those watersheds that are dominated by developed land uses (low to high densities) but also retain some degree of rural/agricultural characteristics. Key sources of nutrients in developed watersheds are diffuse stormwater and point source discharges. These watersheds are typically served by storm sewer networks and can be regulated MS4s. Stormwater in urban areas is a function of the impervious area. Runoff is routed quickly over impervious areas into storm sewers, which can be treated by BMPs or discharged to downstream waters. This runoff collects pollutants including nutrients, sediment, bacteria, and others common in developed areas and due to the volume of runoff being conveyed, pollutant loading is typically high. These watersheds also include population centers and typically have wastewater treatment facilities which may discharge to surface waters and also other point source discharges such as industrial process water. Since these watersheds do contain agricultural land uses, pasture and row crop sources of nutrients are also included in the scenario. Stage 2 screening for Scenario 1 was carried out separately for LMRAP and SPTF.

Scenario 2 – Rural row-crop dominated watersheds – for UMRAP Ecoregion.

Scenario 2 addresses those watersheds that are dominated by row crop agriculture. These watersheds can have widespread drainage ditches and are typically subject to intense tillage practices and fertilizer application. Drainage ditches may be used to collect and route surface runoff to nearby waters. Key sources of nutrients in these watersheds include runoff and erosion from fields and in nearby streams. These watersheds may include a few point sources and other significant non-point sources such as septic systems and feedlots.

Scenario 3 – Mixed uses, but predominantly rural non-row crop watersheds – for GCP Ecoregion.

Scenario 3 can be used to identify and prioritize watersheds that are mixed use, but primarily agricultural, non-row crop land uses. These watersheds are predominately pasture and hay and rice and often include animal agriculture activities. Pathways for pollutants can include watershed and stream channel erosion, feedlot runoff, and manure management activities. This scenario focuses on watersheds with high levels of non-row crop agriculture land uses (pasture, hay, rangeland, rice). Fertilizer application to rice and agricultural water use are key stressor sources.

Table 1. Stage 2 RPS Indicator selections and weights for screening and comparing HUC12 watersheds within the Louisiana Ecoregions from the Developed Land (wastewater and runoff) scenario, the rural row crop scenario and the rural mixed agricultural land use scenario. See Attachment 2 for indicator definitions.

Indicator	LMRAP/SPTF		UMRAP		GCP	
	Developed land runoff	Weighting	Rural row crop	Weighting	Rural non-row crop	Weighting
Ecological Indicators						
% natural cover, N-index 2 (2011) in watershed	x	2	x	1	x	2
% natural cover, N-index 2 (2011) in riparian zone	x	2	x	2	x	2
% wetlands (2011) in HCZ	x	1	x	2	x	2
% NEF2001, National Ecological Framework, WS	x	2	x	1	x	1
Watershed Mean Soil Stability	x	1	x	2		
Slope, Mean Values of Watershed	x	2				
Slope, Standard Deviation of Values in Watershed	x	1				
Stressor Indicators						
% pasture/hay (2011) in watershed					x	1
% pasture/hay (2011) in riparian zone	x	2	x	2		
% cultivated crops (2011) in watershed	x	1	x	1	x	2
% cultivated crops (2011) in riparian zone	x	2	x	2		
% Contiguous Agriculture (2006) in Watershed	x	1	x	1		

Indicator	LMRAP/SPTF		UMRAP		GCP	
	Developed land runoff	Weighting	Rural row crop	Weighting	Rural non-row crop	Weighting
% urban (2011) in watershed	x	1	x	1	x	1
% urban (2011) in riparian zone	x	2				
% Developed, High intensity (2011) Riparian Zone	x	2				
% Developed, Medium intensity (2011) Riparian Zone	x	2				
% urban change 2001-06 in watershed	x	2				
% urban change 2001-06 in HCZ	x	2				
Impervious cover (2006) IC ≥ 15%, % of watershed	x	2				
Agricultural water use in watershed	x	1	x	1	x	1
Watershed mean soil erodibility			x	1	x	2
HCZ mean soil erodibility	x	2	x	2		
Total nitrogen deposition in watershed					x	1
Synthetic nitrogen fertilizer application (kg N/ha/yr) in watershed	x	2	x	2		
Rice- Nitrogen Fertilizer Application Rate (lb/km/yr)					x	2
Rice- Phosporus Fertilizer Application Rate (lb/km/yr)					x	2
Row Crop (no wheat) - Nitrogen Fertilizer App Rate (lb/km/yr)	x	2			x	2
Row Crop (with wheat) - Nitrogen Fertilizer App Rate (lb/km/yr)			x	2		
Row Crop (no wheat) - Phosphorus Fertilizer App Rate (lb/km/yr)	x	2			x	2
Row Crop (with wheat) - Phosphorus Fertilizer App Rate (lb/km/yr)			x	2		
% watershed stream length 303d-listed nutrients	x	2	x	2	x	2
% watershed waterbody area 303d-listed nutrients	x	2	x	2	x	2
Incr Load from LA (SPARROW)	x	2	x	2	x	2
Area Weighted Count of Nutrient-Related Non-compliant Watershed Inspections (#/sq mi)	x	2	x	2	x	2

Indicator	LMRAP/SPTF		UMRAP		GCP	
	Developed land runoff	Weighting	Rural row crop	Weighting	Rural non-row crop	Weighting
Social Indicators						
% watershed that is protected lands (IUNC status, GAP status 1,2, 3)	x	2	x	2	x	2
Percent potentially restorable wetlands in watershed	x	1	x	1	x	1
% of HUC12 Instate (LA)			x	2		
% drinking water source protection area in watershed	x	2	x	2	x	2
Watershed Group WS	x	2	x	2	x	2
Area Weighted Count of Watershed Inspections (#/sq mi)	x	1	x	1	x	1
Area Weighted Count of Nutrient-Related Watershed Inspections (#/sq mi)	x	1	x	1	x	1

Interpreting the Results

Several products are produced through the screening runs for each scenarios. Each watershed in a scenario screening run receives an ecological, stressor, and social index and rank. There is also an aggregate RPI score and rank for each watershed. Ecological, stressor, and social index values have a range from 0 to 100. They are each calculated by summing weight-adjusted, normalized indicator values, dividing by the total weight, and multiplying by 100. RPI Scores are calculated as: [Ecological Index + Social Index + (100 - Stressor Index)] / 3. Single indicator values are also available for all the watersheds in a scenario and are sometimes used for comparison based on a single factor of interest.

Among the index values, a higher score implies higher relative recovery potential in the case of the ecological and social indices, and the overall RPI index. A higher stressor index score implies lower relative recovery potential. Conversely, in the case of rank order, all four indices (ecological, stressor, social and overall) are rank ordered so that a smaller number implies higher relative recovery potential (i.e., #1 is the highest and best rank in all cases).

Maps illustrating the watersheds in the screening run are generated. These can be customized to display values for each of the watersheds based on a number of factors. The RPI rank is a commonly used parameter to illustrate the spatial relationship among the watersheds and their overall ranking in the screening run.

Bubble plots are also produced for each screening run. These provide a visual tool for comparing the distribution of ecological, stressor and social indices across all watersheds in the screening run and individual watersheds can be color coded for investigation.

The position of any watershed along the value gradients of watersheds in a screening run provides relative information for supporting the discussion on recovery potential. It is not an absolute deterministic decision tool. While there is no absolute rule dictating what the actual recovery potential or protection value of a watershed is based on these plots, some at least theoretical considerations can be made about the relative position of sites within these plots that may help guide discussion.

The bubble plots position watersheds (each symbolized by a circle, or bubble) relative to the median stressor and ecological scores for every screening run. These axes split the plots into four quadrants. Sites most commonly lie along a diagonal axis of distribution from the upper left to lower right quadrant, but not always. Watersheds in the upper left quadrant have high ecological scores and low stressor scores. The size of the bubble indicates the social score. A watershed here (with low stressor and high ecological scores) might be considered a good candidate for protection, if the social scores indicate broad community support and if the watershed is not impaired. If it is impaired and, again, has high social scores, such watersheds might be good recovery potential candidates given their relatively low stress and high ecological value. In contrast, the lower right quadrant contains watersheds with high stressor scores and low ecological scores. These watersheds have a high hill to climb, but clearly a lot might be achievable in such watersheds if social index scores indicate a large social interest.

Watersheds in the upper right have high ecological scores, but also high stressor scores. If the symbols sizes are large, again indicating high social index scores, and the stressor metrics are manageable entities, then these might also be excellent candidates for stressor reduction, preventing potential ecological decline. Conversely, watersheds in the lower left quadrant have low stress, but low ecological scores. Such watersheds might have missing stressor information related to ecological condition or might have overemphasized the ecological condition. Restoring ecological condition scores without a link to known stressors constraining them can be more difficult, but approaches exist for helping explore such stressors (e.g., EPA CADDIS).

It is worth reiterating that the above discussion is just theoretical. Additional investigation and more local experience is equally valuable and the recovery potential scores and map information is meant to support such discussions.

The bubbles can also be customized to show differences in individual indicator values across watersheds. This feature is used extensively in this report to provide further analysis of the results of the RPS screening runs.

<u>Scenario 1 Results: Developed Ecoregions Scenario Screening (runoff focus) – LMRAP and SPTF Ecoregions</u>

The complete set of scores and ranks for all of the HUC12s within the LMRAP and SPTF are included in Attachment 3. Figure 3 shows the RPI ranks for each of the HUC12s in the SPTF ecoregion. The watershed ranking is designed so the highest overall watershed score has the best rank (#1) (meaning a high recovery potential). It is evident that there is a strong clustering of the lowest ranking (poorer quality) watersheds in the western portion of the ecoregion, in the vicinity of Baton Rouge, the most heavily developed portion of the watershed. The bubble plot in Figure 4 illustrates the distribution of the ecological, stressor and social indices for the watersheds in the SPTF ecoregion. The five highest ranking watersheds are colored and labeled. These are West Pearl River-Pearl River, Hammer Creek-Thompson Creek, Skulls Creek-Tangiphoa River, English Branch, and Talisheek Creek. The West Pearl River-Pearl River watershed ranks the highest due to its low stressor indicator score and very high social indicator score, even though its ecological indicator score is somewhat below the median value in the ecoregion. Skulls Creek-Tangipahoa River also ranked high due to a very favorable social index score combined with median ecological and stressor scores. The remaining top ranked watersheds were ranked high because of ecological scores well above the median and stressor indicators near or below the median for the ecoregion.

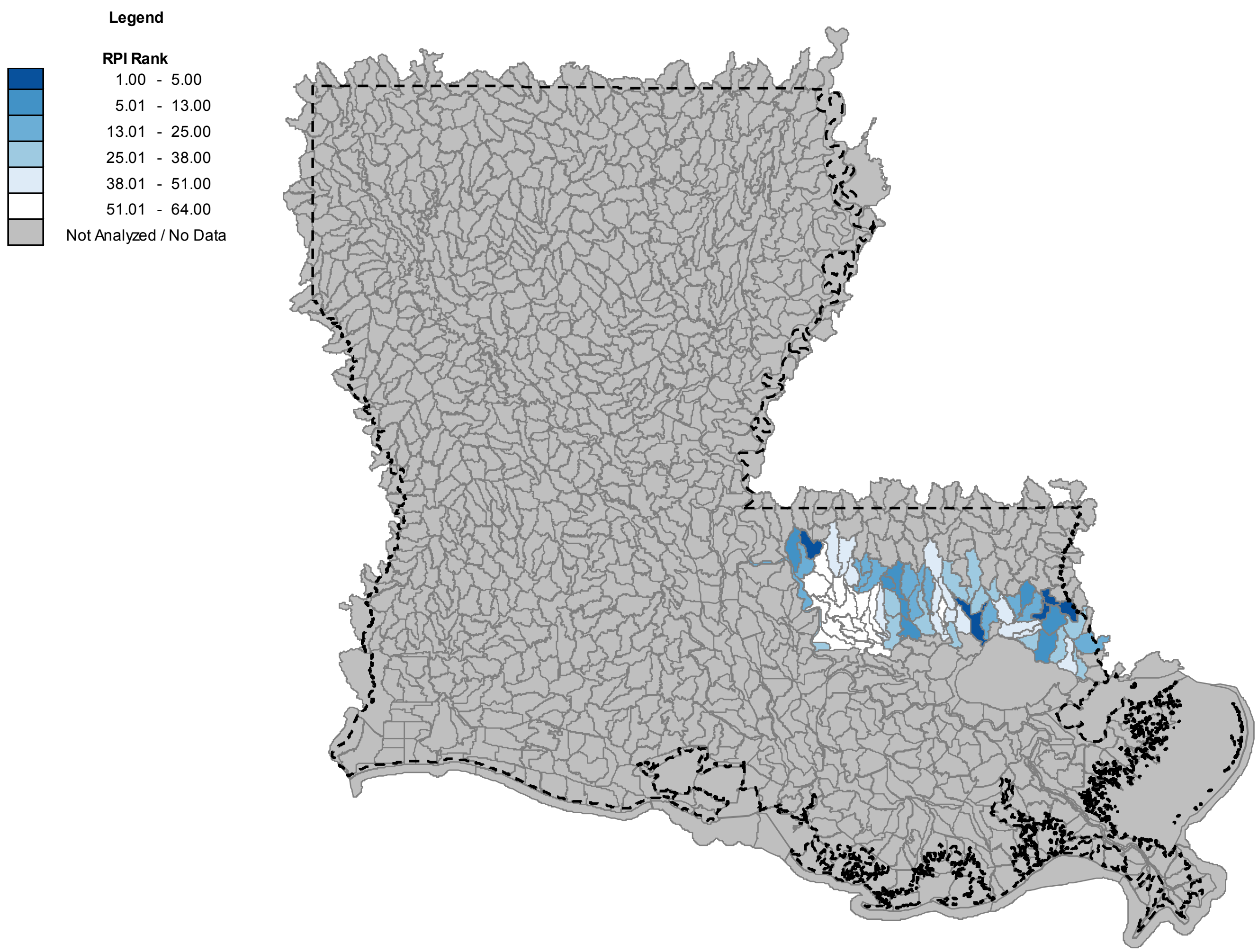


Figure 3. SPTF Scenario results map showing the RPI rank for each HUC12 in the ecoregion.

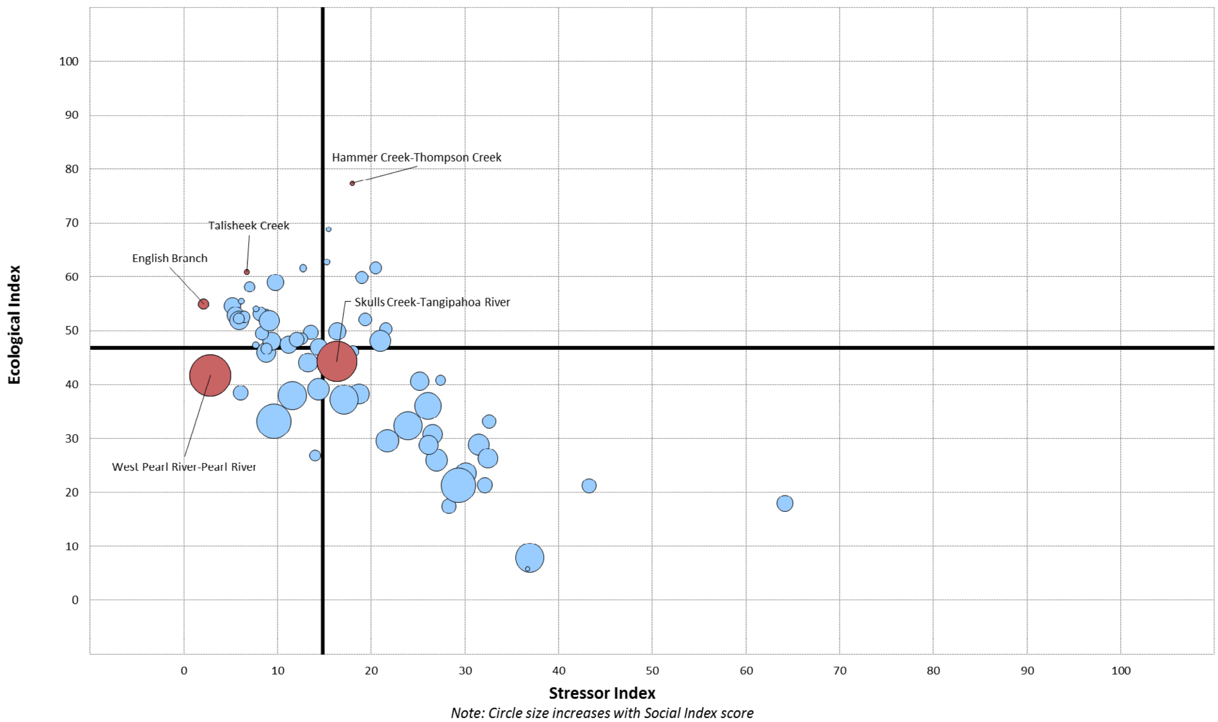


Figure 4. Bubble plot showing ecological, stressor and social index scores for SPTF watersheds with labels and highlighting for the five highest RPI ranked watersheds in the SPTF ecoregion.

Figure 5 shows the RPI ranks for each of the HUC12s in the LMRAP ecoregion. It should be noted that since ecoregions are not divided by watershed boundaries, there is substantial overlap between the watersheds appearing in the SPTF and the LMRAP ecoregion screenings. However, since for each ecoregion, the total universe of watersheds is different, the watersheds that appear in both screenings will have different ranks in each screening run because their relative rank position changes in comparison to the other watersheds in the screening.

Lower ranked watersheds in the LMRAP are clustered around the Mississippi River. In general terms, the further a watershed is from the Mississippi River, the higher the rank, especially in the northern part of the ecoregion. The bubble plot in Figure 6 illustrates the distribution of the ecological, stressor and social indices for the watersheds in the LMRAP ecoregion. The five highest ranking watersheds are colored and labeled. These are Simoneaux Ponds-Frontal Lake Salvador, Petit Lac Des Allemands-Bayou Des Allemands, Bayou Bardeaux-Frontal Lake Salvador, Bayou Vacherie-Frontal Lake Salvador, and North Pass-Manchac Pass. With the exception of Bayou Vacherie-Frontal Lake Salvador all of the watersheds ranked high due to very favorable ecological, stressor and social scores. Bayou Vacherie-Frontal Lake Salvador still ranked high, despite having one of the lowest social index scores because it had the highest ecological score in the ecoregion.

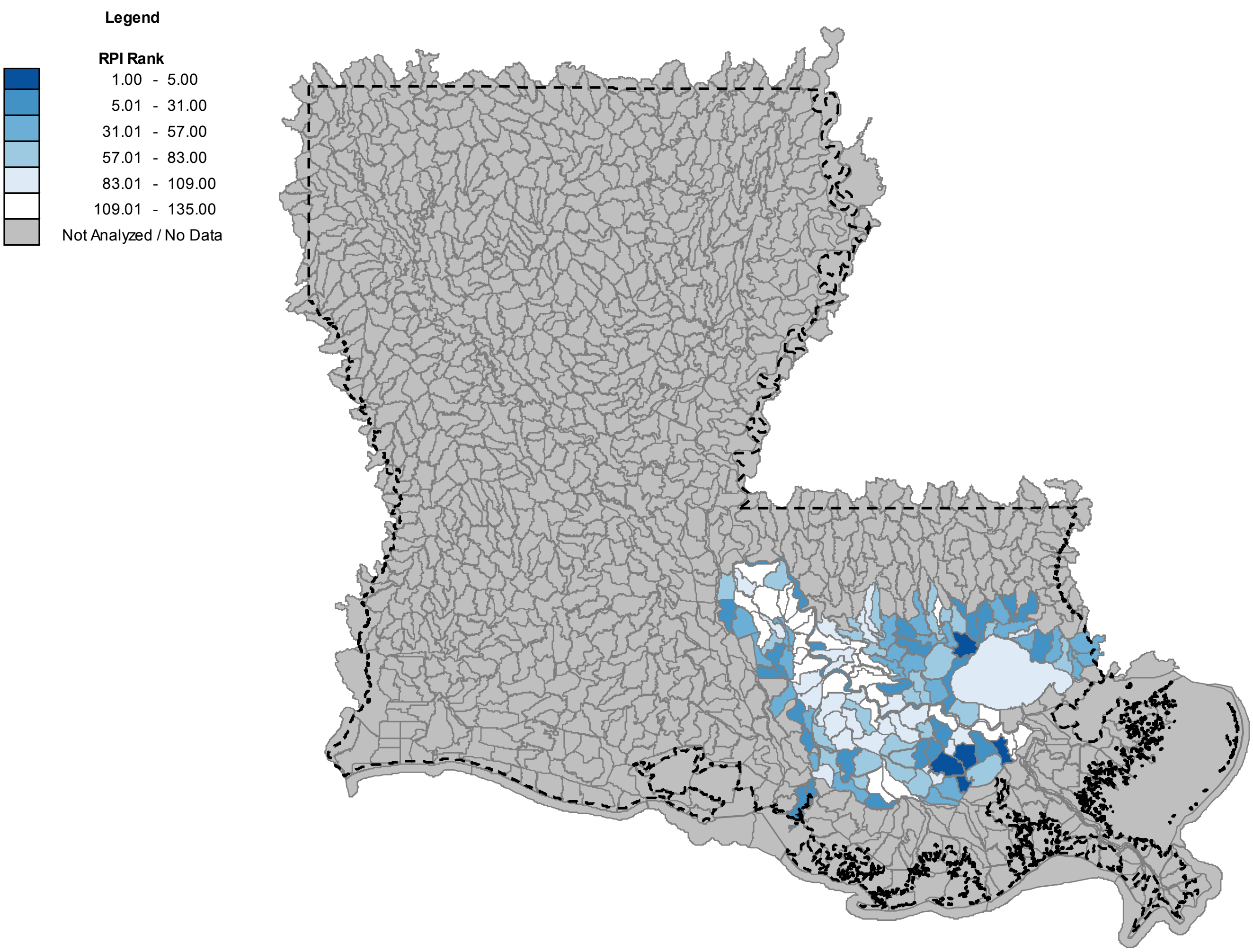


Figure 5. LMRAP Scenario results map showing the RPI rank for each HUC12 in the ecoregion.

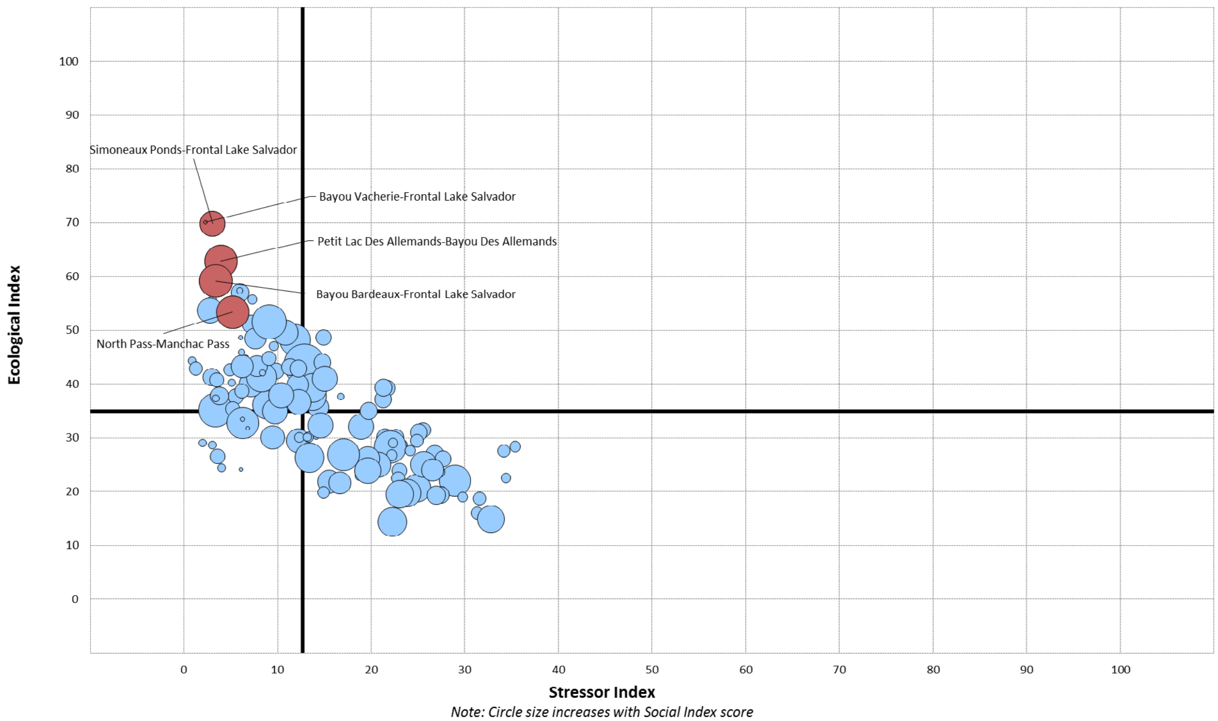


Figure 6. Bubble plot showing ecological, stressor and social index scores for LMRAP watersheds with labels and highlighting for the five highest RPI ranked watersheds in the LMRAP ecoregion.

Scenario 2 Results: Rural row-crop dominated watersheds – UMRAP Ecoregion

During the initial run of this screening, the RPS Tool provided a warning that the values for one of the indicators were the same for all watersheds and some watersheds also had missing values. Upon further investigation of this indicator, (area weighted count of non-compliant, nutrient-related watershed inspection), all watersheds but one were blank/no data, so this indicator was removed from the screening.

The complete set of scores and ranks for all of the watersheds within the UMRAP are included in Attachment 3. Figure 7 shows the RPI ranks for each of the HUC12s in the UMRAP ecoregion. There appears to be a cluster of higher ranking watersheds at the southern end of the ecoregion and a clustering of lower ranked in the northern and central portion of the ecoregion. The bubble plot in Figure 8 illustrates the distribution of the ecological, stressor and social indices for the watersheds in the UMRAP ecoregion. The five highest ranking watersheds are colored and labeled. These are French Fork-Little River, Bayou Natchitoches-Red River, Fool River-Tensas River, Rawson Creek, and Bayou Milligan-Red River. The French Fork-Little River, Fool River-Tensas River and Bayou Milligan-Red River watersheds rank the high, due to their relatively high ecological scores, low stressor scores, and very high social scores. Bayou Natchitoches-Red River ranked high because it has the second highest ecological score, second lowest stressor score and a reasonable high social score. Rawson Creek ranked high despite having one of the lowest social scores in the ecoregion because it has the highest ecological score and lowest stressor score.

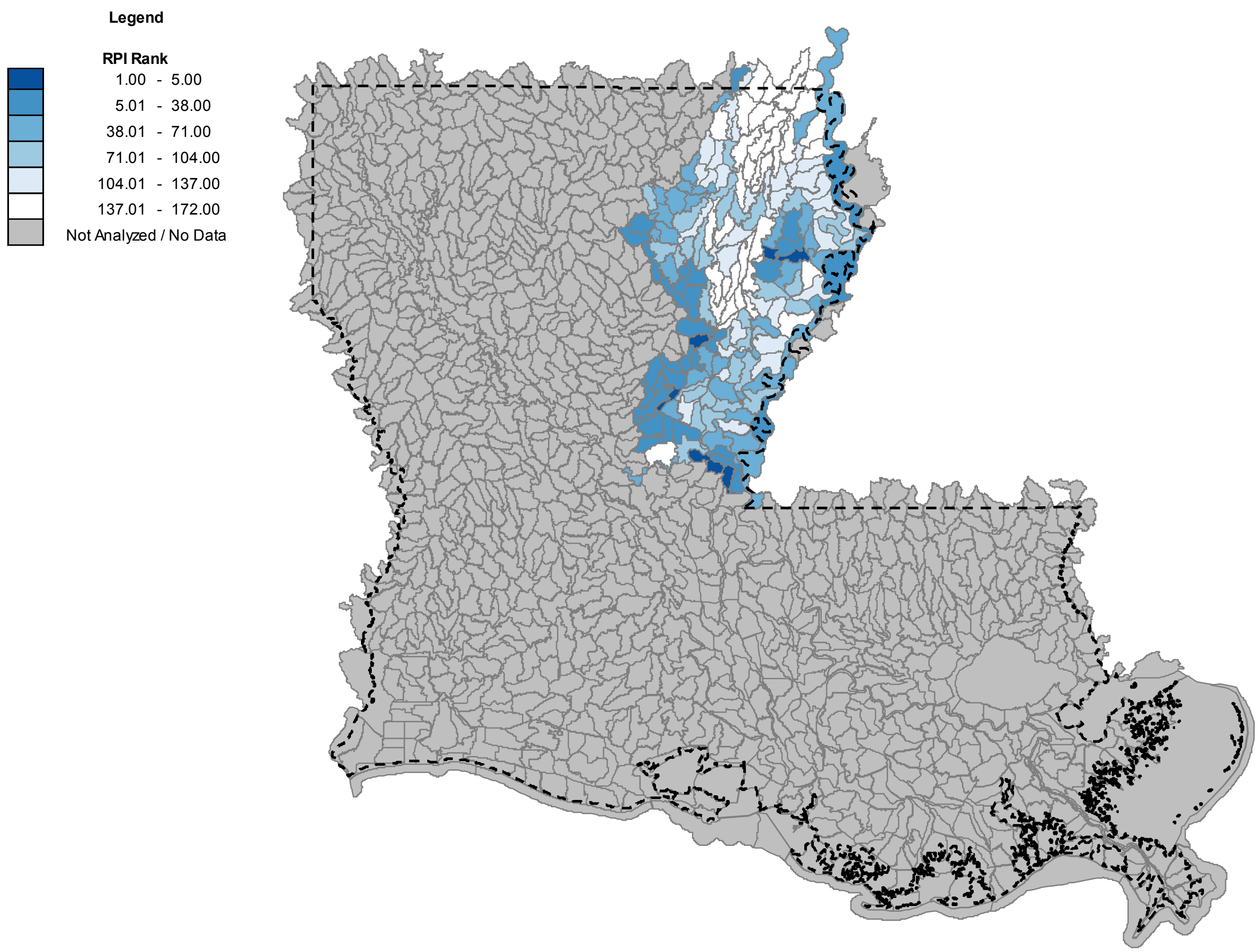


Figure 7. UMRAP Scenario results map showing the RPI rank for each HUC12 in the ecoregion.

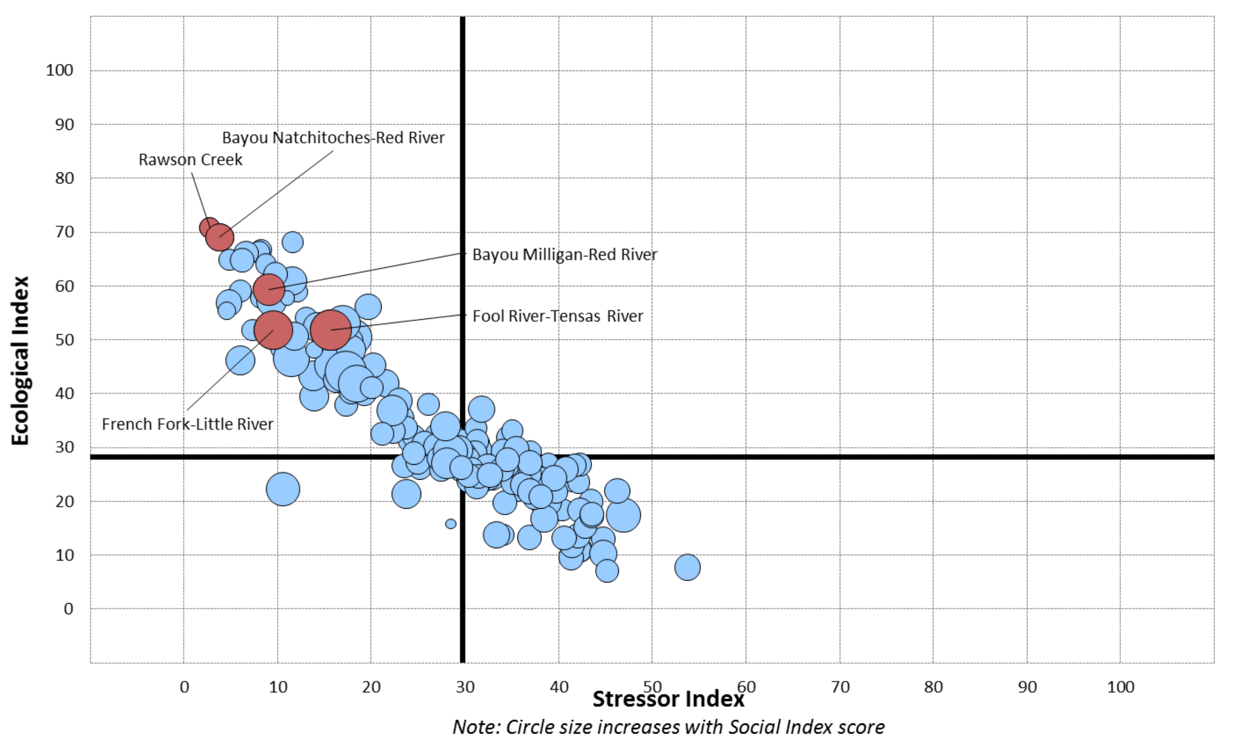


Figure 8. Bubble plot showing ecological, stressor and social index scores for UMRAP watersheds with labels and highlighting for the five highest RPI ranked watersheds in the UMRAP ecoregion.

Scenario 3 Results: Mixed Use, but predominately rural non-row crop watersheds – GCP Ecoregion

The complete set of scores and ranks for all of the watersheds within the GCP are included in Attachment 3. Figure 9 shows the RPI ranks for each of the HUC12s in the GCP ecoregion. Generally, the higher ranked watershed appears to be along the boundaries of the ecoregion, with lower ranked watersheds in the central portion. The bubble plot in Figure 10 illustrates the distribution of the ecological, stressor and social indices for the watersheds in the GCP ecoregion. The five highest ranking watersheds are colored and labeled. These are North Canal-Bell City Drainage Canal, Bayou Misere-Frontal Grand Lake, Intercoastal Waterway-Frontal Calcasieu Lake, Bayou Carlin-Frontal Cote Blanche Bay, and the Billy Bayou-Frontal Intercoastal Waterway. All of these watersheds rank high due to their high ecological index scores and low stressor index scores. Except for Bayou Carlin-Frontal Cote Blanche Bay, all of the watersheds had very high social index scores as well. Bayou Carlin-Frontal Cote Blanche Bay had a social score of 0, but is buoyed by an ecological index of nearly 100 and a stressor index of nearly 0.

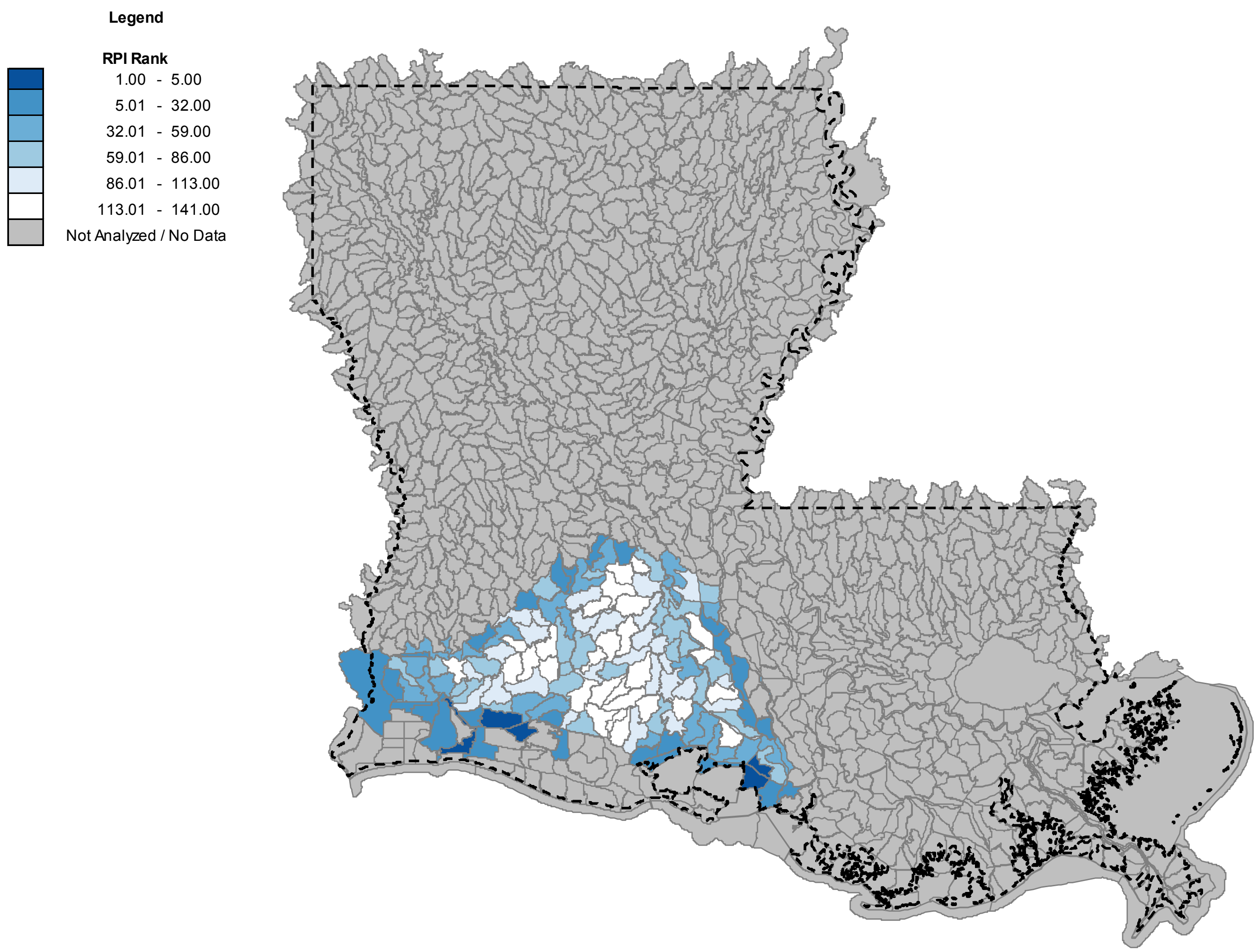


Figure 9. GCP Scenario results map showing the RPI rank for each HUC12 in the ecoregion.

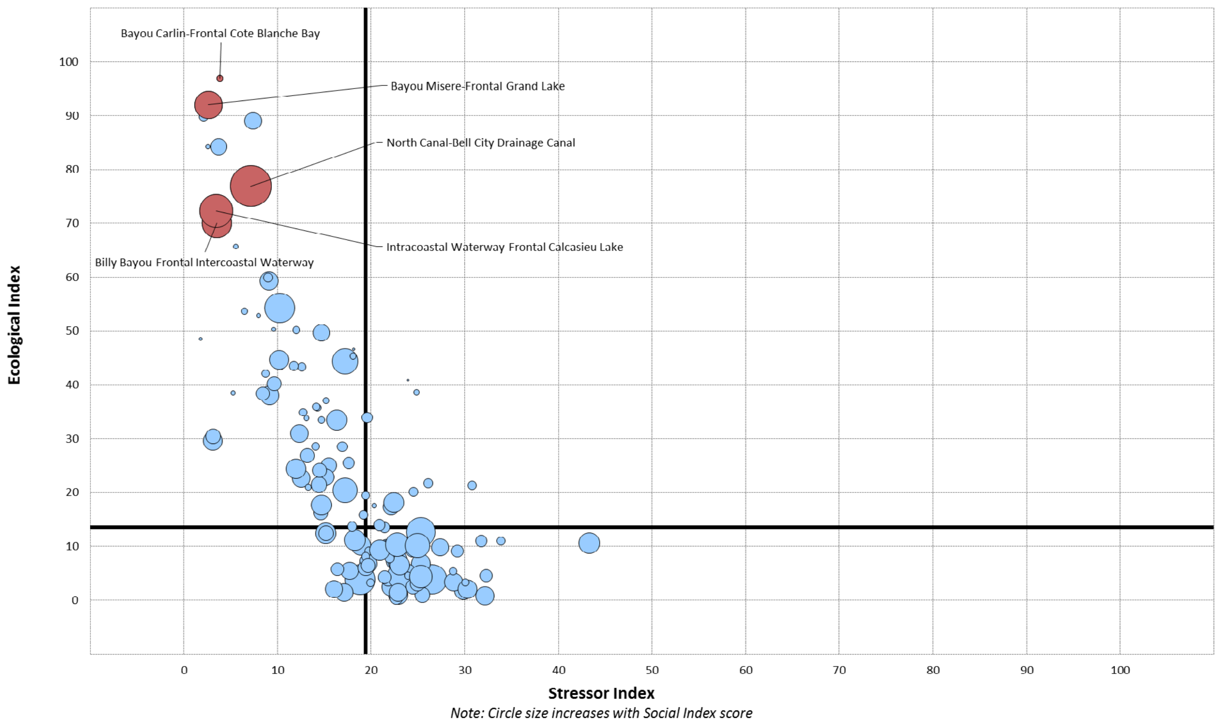


Figure 10. Bubble plot showing ecological, stressor and social index scores for GCP watersheds with labels and highlighting for the five highest RPI ranked watersheds in the GCP ecoregion.

STAGE 2 RESULTS ANALYSIS

Regardless of which indicators are used in a screening, the RPS Tool can color-assign a value gradient for any indicator in the data table and use this to gain insights into the bubble plot or map results. In this section, the results of the screenings are analyzed using this feature. A series of questions are posed to further explore the individual watershed results for each of the screenings.

Where are the impairments relative to how the HUCs scored?

In Figure 11 through Figure 14, the bubble plot results from the screenings are further explored by displaying the relative percent of stream length listed as nutrient-impaired.

In the SPTF ecoregion, twenty-three of the 64 HUC12s have >10% listed for nutrients. Although these are scattered throughout the bubble plot, the majority are clearly located in the lower half of the plot – below the median ecological index value. However, it is noteworthy that many of the watersheds with higher impairment levels also have stronger social indices than many of the watersheds with fewer impairments. These HUC12s might be good choices for implementing nutrient management programs, since they have strong social scores and yet large needs for ecological improvement and in many cases stressor reduction.

In the LMRAP, two-thirds of the watersheds have no stream segments listed for nutrient impairments. Another 10 percent have less than 10 percent of watershed stream length listed for nutrient impairments. The remaining watersheds with 10 percent of more of the stream lengths listed for nutrient impairments are scattered across the bubble plot, with no strong pattern of dominance in any quadrant. This lack of pattern may be due to a low level of water quality-assessment in this ecoregion, or it may indicate that impaired waters are not closely tied to the overall conditions of watersheds in this ecoregion – other factors may be more important.

In the UMRAP ecoregion, most of the watersheds do not appear to have any nutrient listings. This may be a true lack of impairment or it may be that many of the watersheds in this ecoregion have not been assessed for impairment. Of the watersheds with impairments on significant portions of the stream lengths, these do seem to be primarily located in the lower right quadrant. Notably however, the Little River-Catahoula Lake watershed has over 25 percent of its streams listed as impaired for nutrients yet it seems to have a high ecological score and low stressor score. This suggests there may be other factors at play in this watershed that are not adequately captured in the existing screening run.

In the GCP some watersheds with high proportions of stream length impairment still scored relatively high on the ecological index and relatively low on the stressor index, being located in the upper left quadrant of the bubble plot (Lower Lake Long Pass-Grand Lake and Atchafalaya Basin Main Channel-Wax Lake Outlet). Conversely, several watersheds without any identified impairments were in the lower right quadrant on the bubble plot, scoring relatively low on the ecological index and relatively high on the stressor index. It is possible that many of the watersheds in this ecoregion have not been assessed for impairment. It is also possible that the screening run is not capturing the factors that are causing nutrient impairments in some of the watersheds.

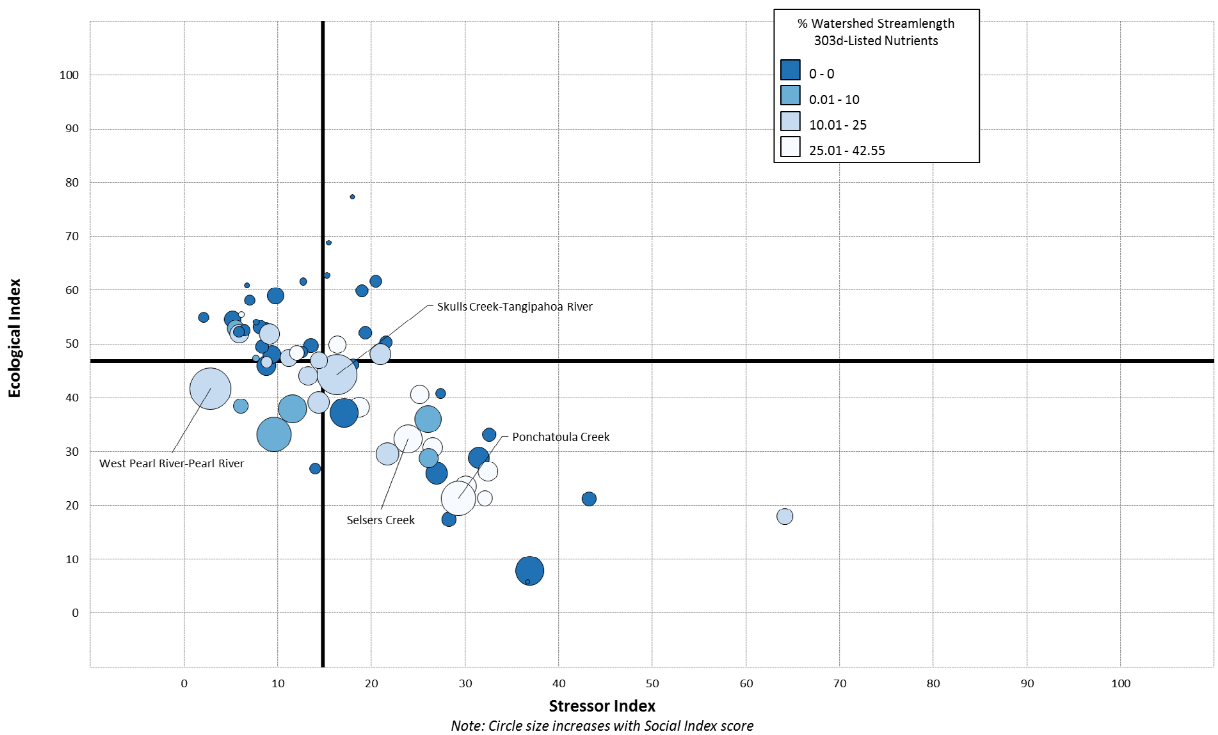


Figure 11. SPTF Ecoregion HUC12 watersheds color-coded by percent of watershed stream length 303d-listed for nutrients.

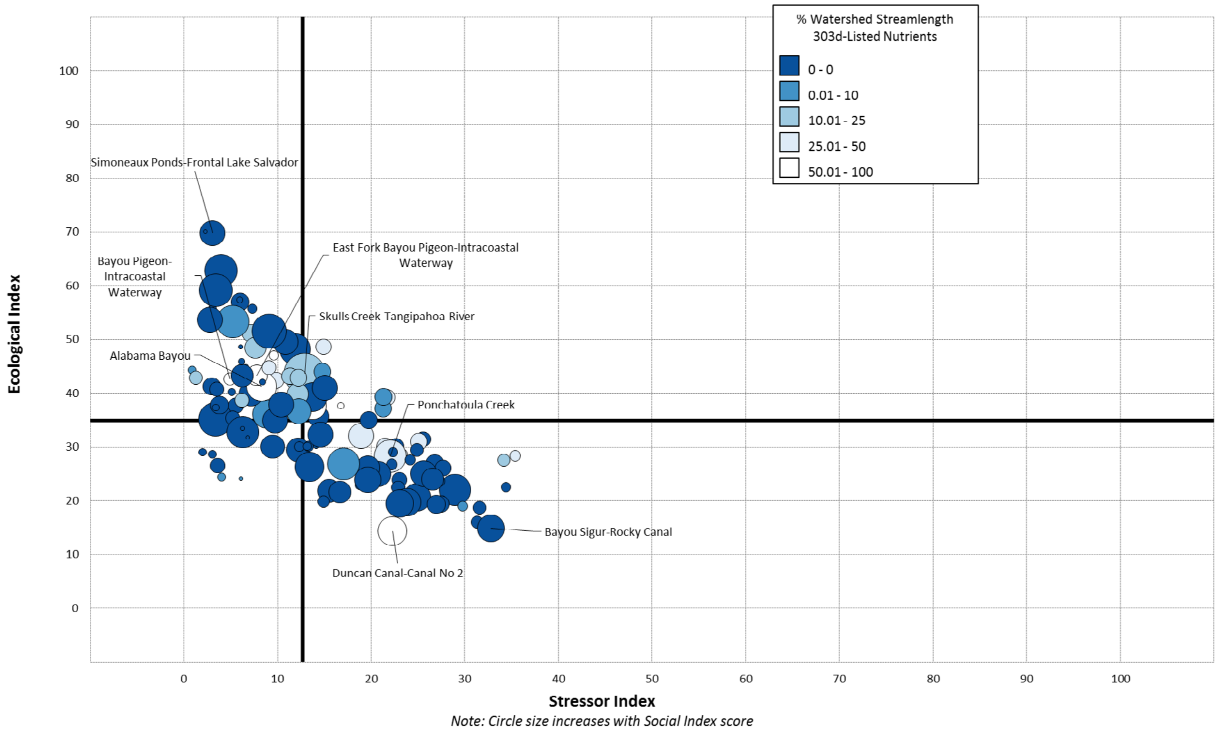


Figure 12. LMRAP Ecoregion HUC12 watersheds color-coded by percent of watershed stream length 303d-listed for nutrients.

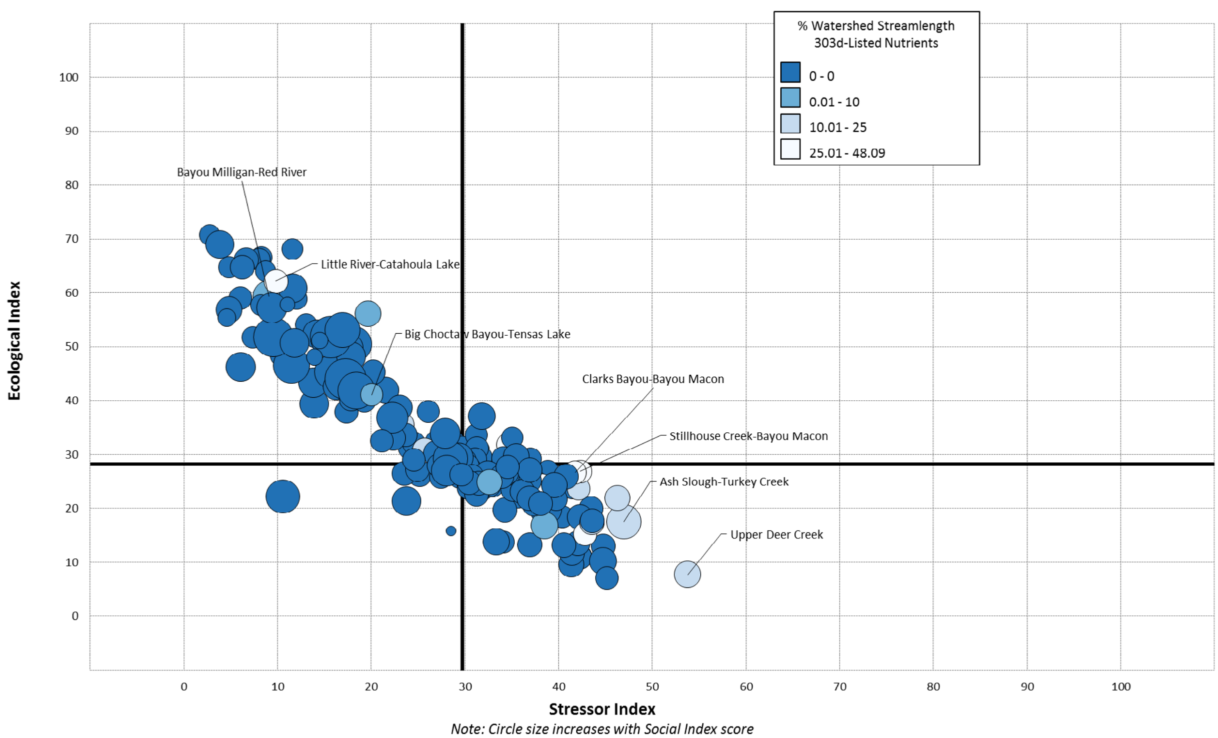


Figure 13. UMRAP Ecoregion HUC12 watersheds color-coded by percent of watershed stream length 303d-listed for nutrients.

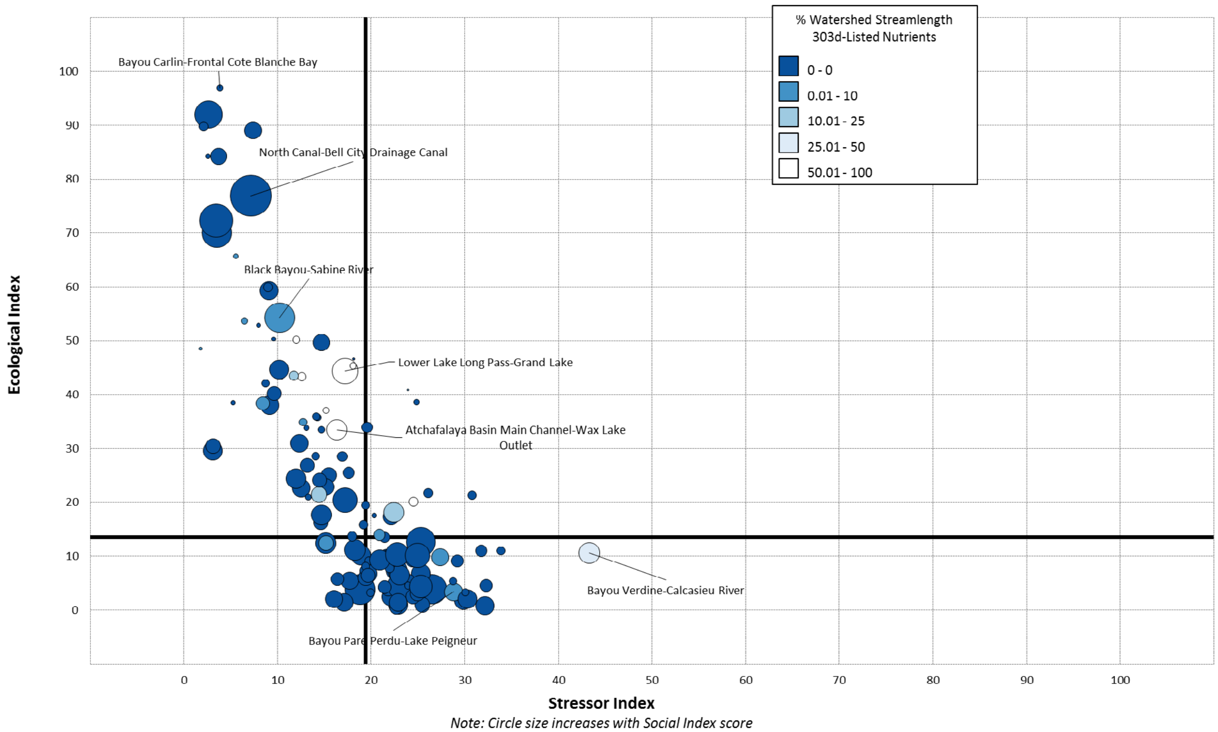


Figure 14. GCP Ecoregion HUC12 watersheds color-coded by percent of watershed stream length 303d-listed for nutrients.

Where are we better prepared for action and where are there specific community motivators?

The existence of watershed groups can indicate a willingness within the community to take action. Figure 15 through Figure 18 show the ecoregion bubble plot outputs with color assignment based on the number of watershed groups within a watershed. The majority of the watersheds do not have any watershed groups. Noticeably, the only three watersheds with two watershed groups span both the SPTF and LMRAP watersheds. Most of the watershed groups are located in watersheds that are on the lower half of the bubble plot across all four ecoregions. This could indicate that the groups were formed in response to a noticeable lack of ecological integrity within the local community.

Further investigation is needed to verify whether TMDLs are in place in watersheds with watershed groups or whether activities (e.g., Nonpoint Source control projects) exist in these area that might add to their readiness for carrying out implementation actions.

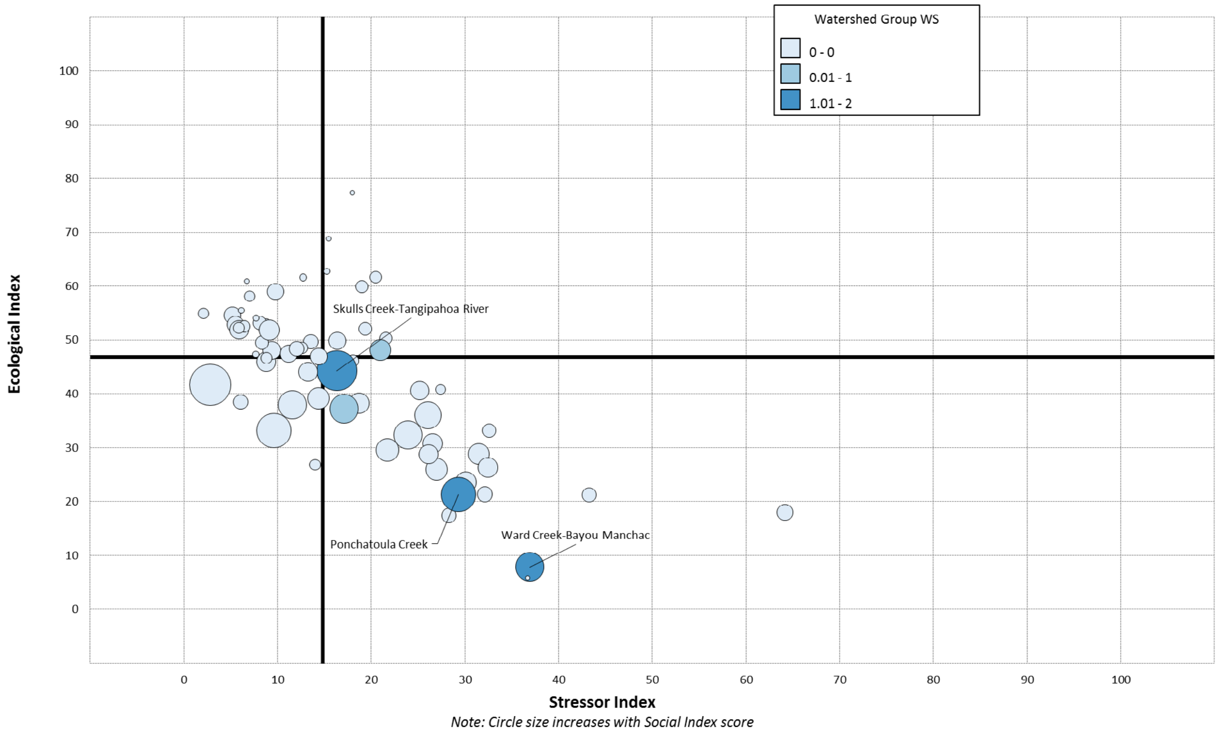


Figure 15. Bubble plot output showing the HUC12s with highest number of watershed groups in the SPTF.

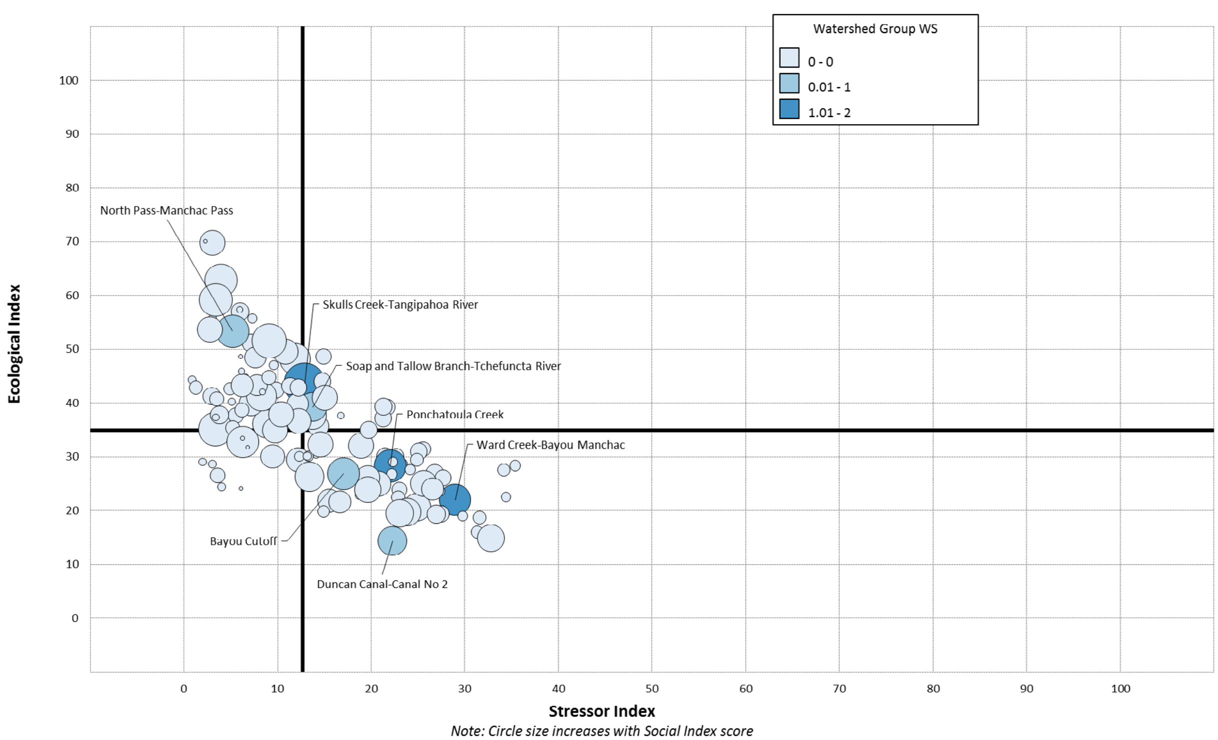


Figure 16. Bubble plot output showing the HUC12s with highest number of watershed groups in the LMRAP.

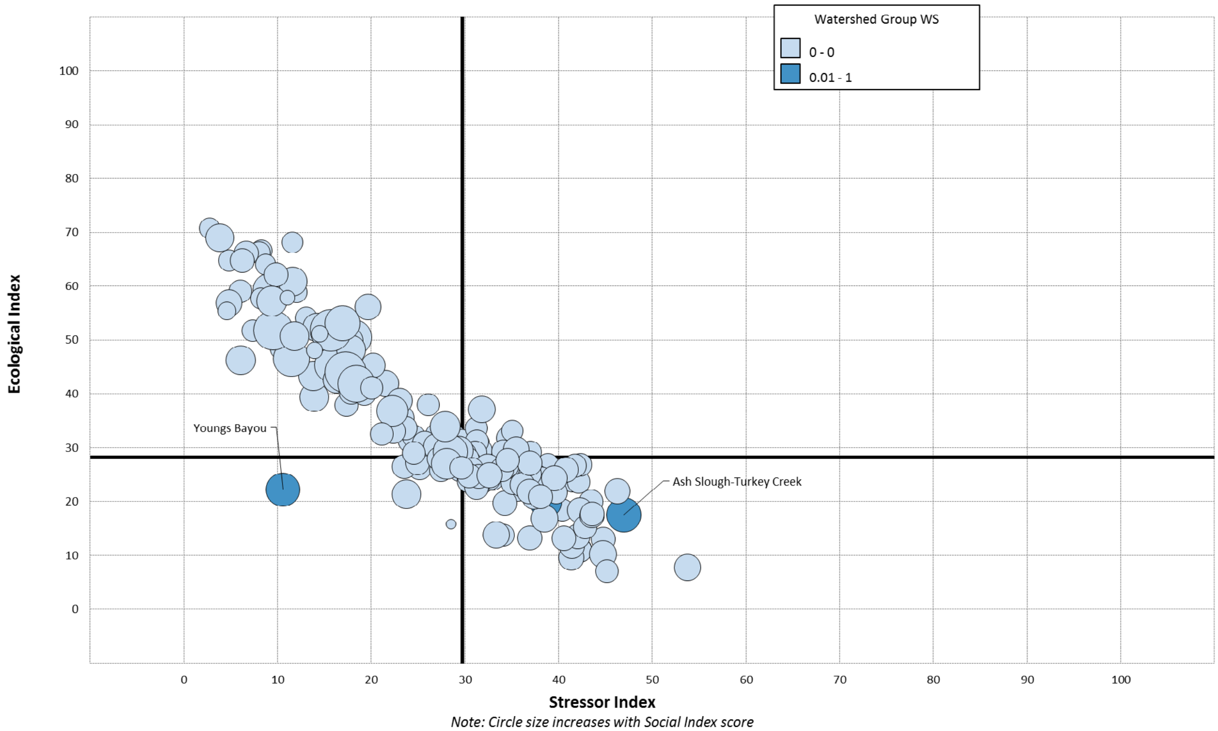


Figure 17. Bubble plot output showing the HUC12s with highest number of watershed groups in the UMRAP.

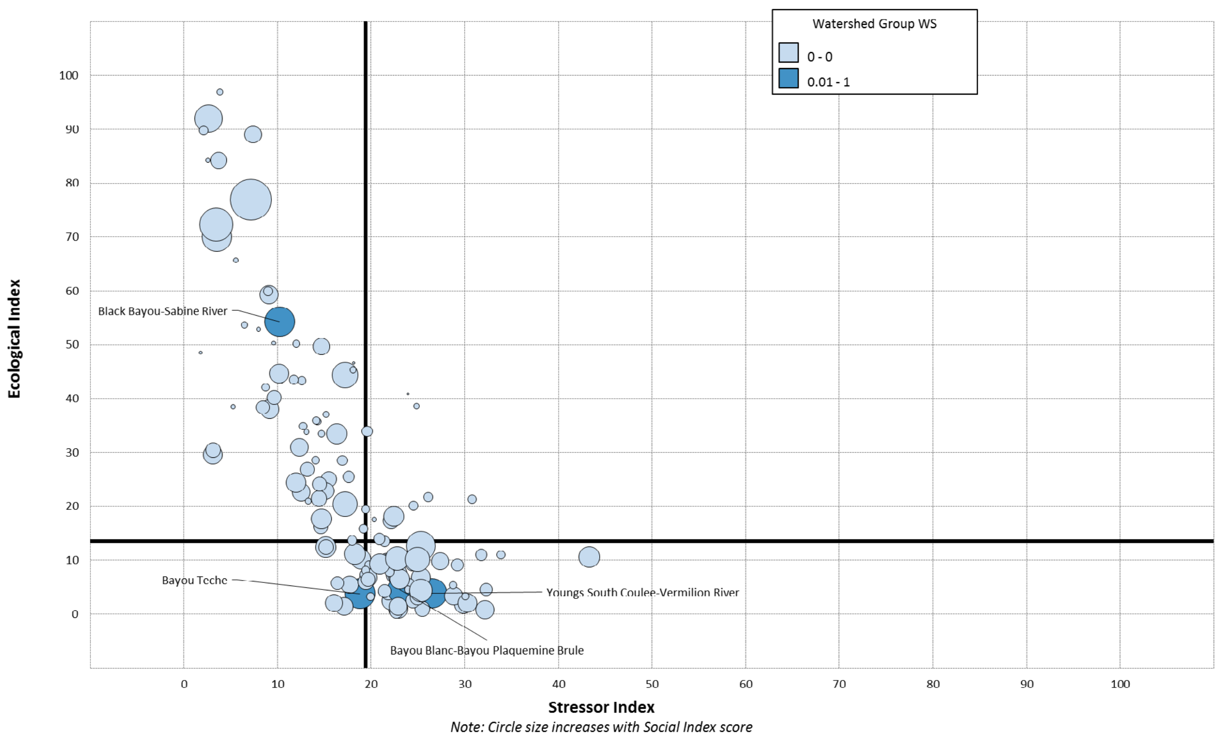


Figure 18. Bubble plot output showing the HUC12s with highest number of watershed groups in the GCP.

Screening results can also be compared to the index scores of a social indicator that would generally be considered of high importance to the community. Maintenance of clean drinking water is an example of an element of high importance that can be a community motivator. In the watersheds with the highest proportions of drinking water source protection areas inhabitants might be more likely to be motivated to take action. Figure 19 through Figure 22 show the bubble plot outputs with color assignment based on the percent of the watershed that is a drinking water source protection area. As evidenced by the high values (over 100 percent) for some watersheds, several of the watersheds have overlapping drinking water source protection areas, indicating that there are likely strong drivers of action in these watersheds, since the area serves as a drinking water source for multiple communities. Several watersheds are identified in each figure to illustrate where there may be stronger community support for watershed protection or water quality improvement.

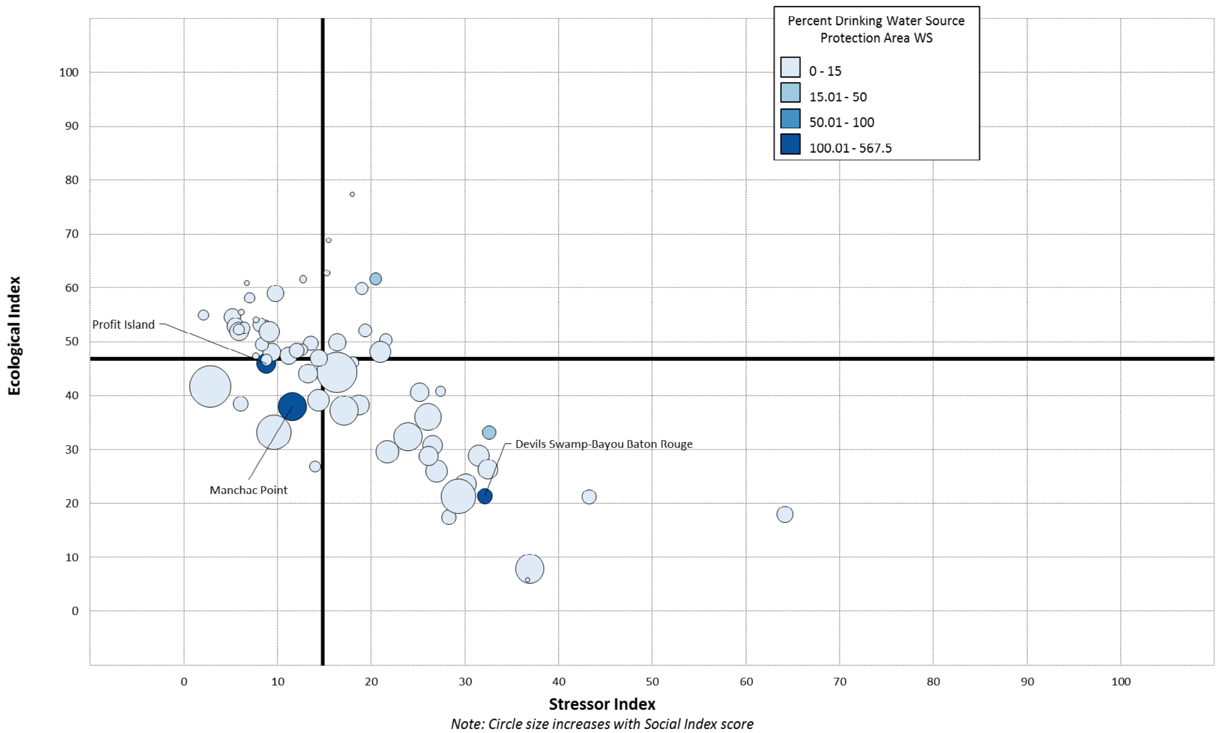


Figure 19. Bubble plot output showing the SPTF watersheds color coded by the percentage of the watershed that is a drinking water source protection area (values over 100 represent overlapping protection areas).

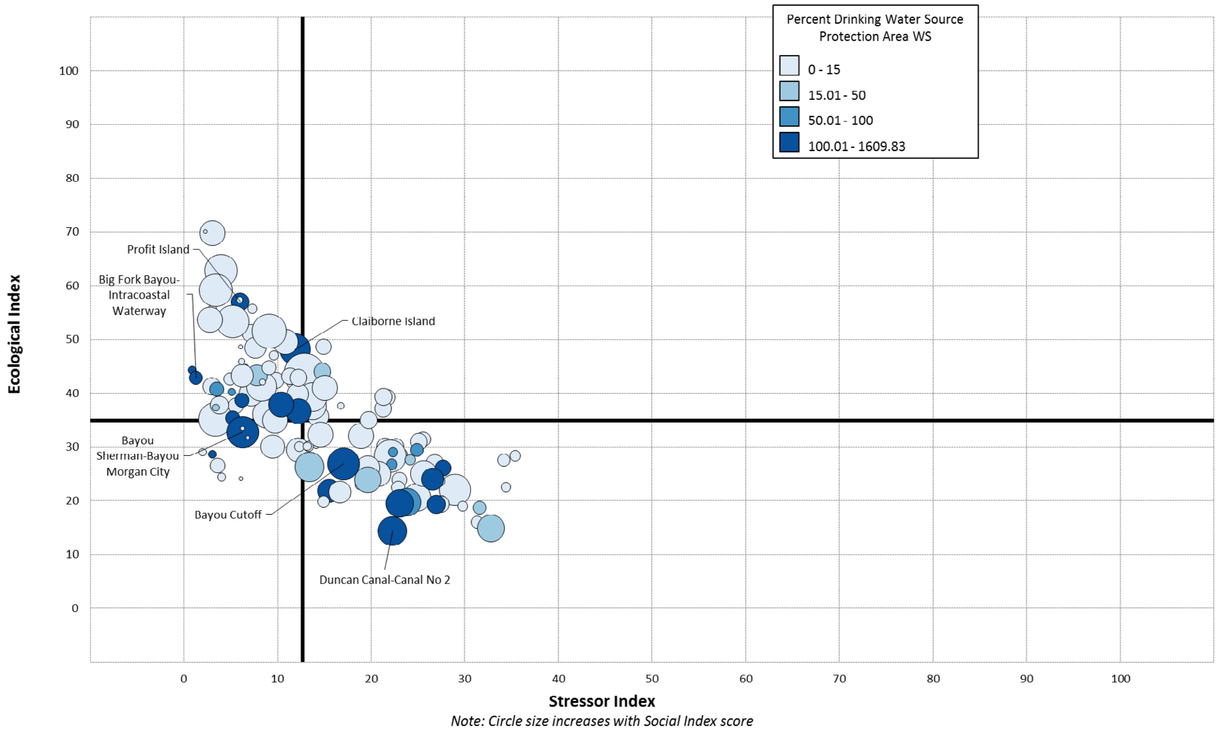


Figure 20. Bubble plot output showing the LMRAP watersheds color coded by the percentage of the watershed that is a drinking water source protection area (values over 100 represent overlapping protection areas).

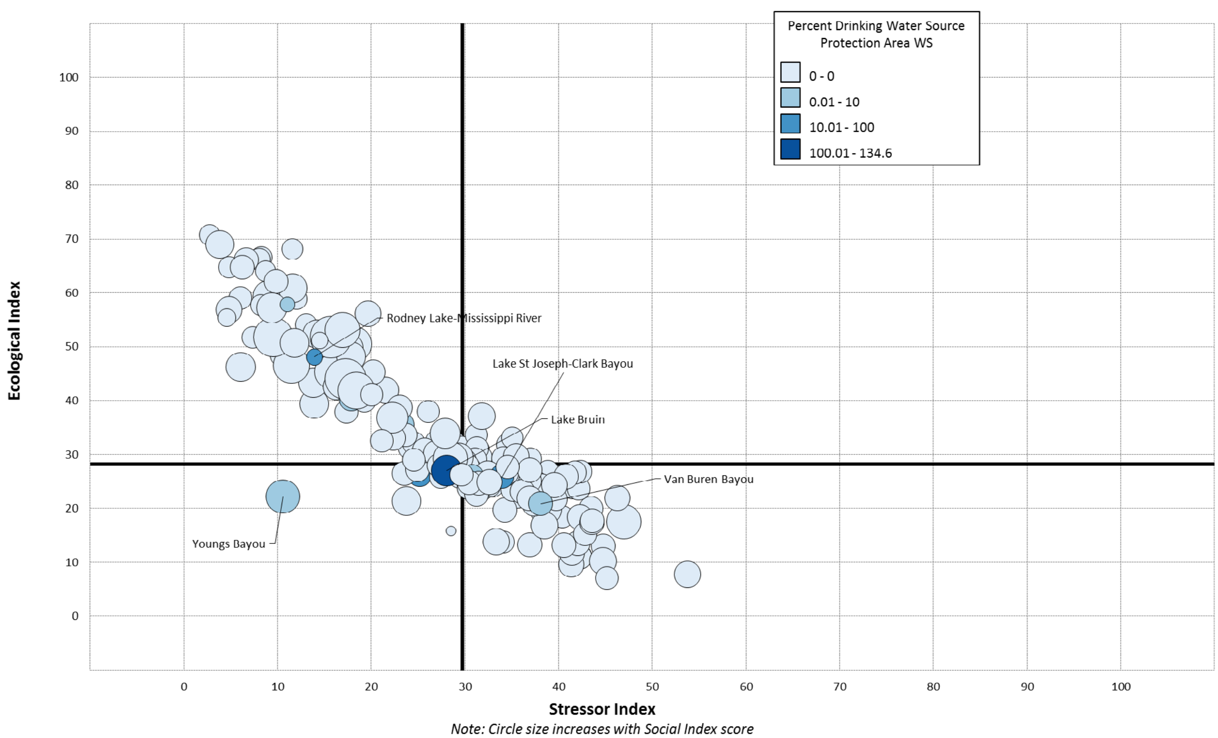


Figure 21. Bubble plot output showing the UMRAP watersheds color coded by the percentage of the watershed that is a drinking water source protection area (values over 100 represent overlapping protection areas).

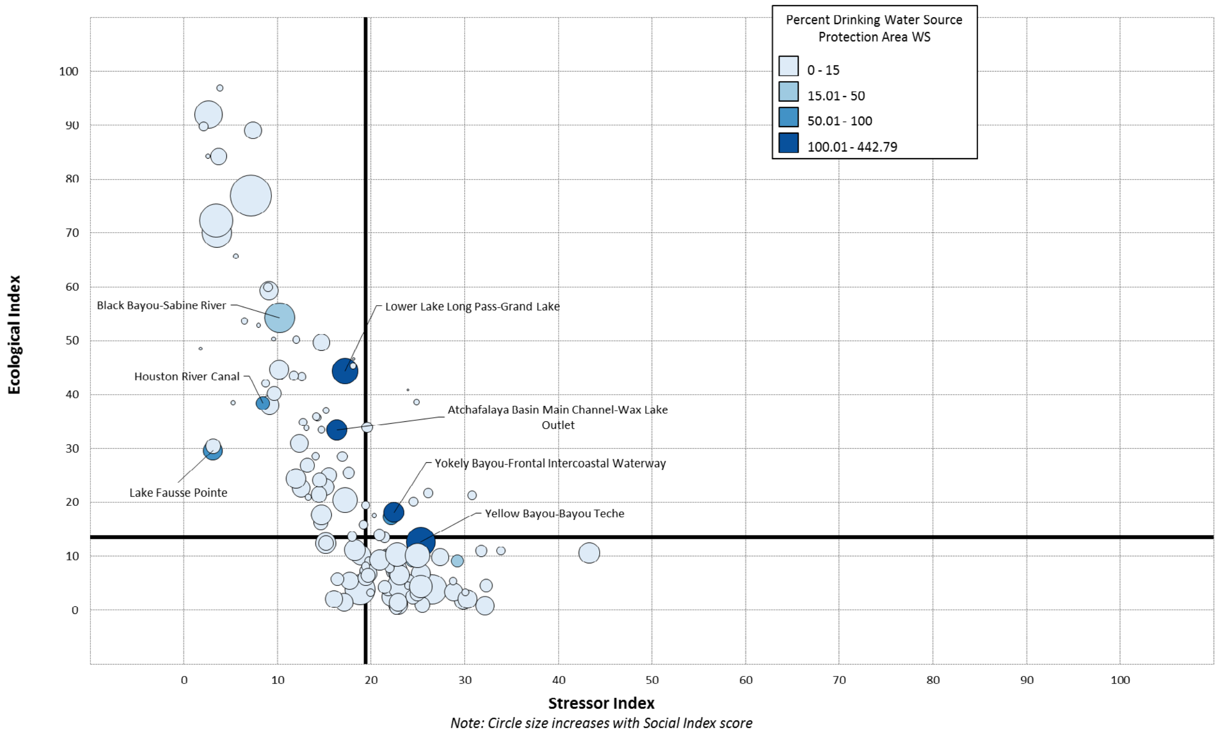


Figure 22. Bubble plot output showing the GCP watersheds color coded by the percentage of the watershed that is a drinking water source protection area (values over 100 represent overlapping protection areas).

<u>Where would specific types of control practices be appropriate, or effective</u>?

Additional scenario analysis includes the use of the RPS Tool results to evaluate which specific categories of nutrient control practices are likely to be most appropriate for each HUC12 in the context of the other factors in the analysis. For example, in Table 2, selected indicator values of all the SPTF HUC12s are compared across five selected indicators from the RPS screening. Each indicator is color-assigned in quartiles from highest to lowest value by shades of blue, where the darkest represents the highest quartile values.

For the five stressor metrics, the highest values (darkest blue cells) help identify watersheds with the greatest amount of specific activities that may be nutrient sources. The portions of the SPTF ecoregion that are impacted by human use are dominated by developed land, so several indicators that can clarify the degree of intensity of development were chosen. Percent urban in the watershed gives an overall measure of how much of the watershed is developed, while percent urban change between 2001 and 2006 helps identify the more rapidly urbanizing watersheds. Impervious cover greater than 15 percent helps to identify watersheds where there is high density development. These three indicators can help identify watersheds where a focus on urban runoff control practices or green infrastructure might be most effective at addressing nutrient reductions. In watersheds that are not largely developed but show a relatively high change in urban areas through time, effective strategies might include ensuring that the proper runoff controls are in place through development and planning requirements before additional land is developed. In contrast, in heavily urbanized watersheds with high levels of imperviousness, stormwater retrofits might be a more appropriate strategy to address urban nutrient loading.

Since the SPTF ecoregion was evaluated using a mixed land use with a developed lands focus screening scenario, not all watersheds in this ecoregion are predominantly developed. For that reason, two additional indicators are shown in Table 2 (percent contiguous agriculture in the watershed and synthetic nitrogen (N) fertilizer application), to easily identify watersheds where agricultural nutrient reduction practices are likely more relevant than urban runoff control. These selected indicators are just one example of how the results of the RPS

Tool can be used to compare watersheds across different combinations of indicators. Table 2 provides the full list of watersheds in the SPTF ecoregion and the watersheds are colored according to which quartile their value for each indicator falls in. The LMRAP ecoregion, which was subject to the same screening run, has roughly twice as many watersheds as the SPTF. For clarity, Table 3, which highlights the same select indicators for the LMRAP, only displays the watersheds falling into the top 10 percent for at least one of the indicators in the table.

Table 2. Watershed values for five selected indicators from the SPTF ecoregion screening that may help identify more appropriate nutrient reduction and management strategies based on land use characteristics of the watersheds. Shading is by quartile, with darkest blue being the highest quarter of HUC12 values.

Watershed ID	Watershed Name	% Urban (2011) in Watershed	% Urban Change 2001-06 WS	Impervious Cover (2006) IC ≥ 15%, PCT of Watershed	% Contiguous Agriculture (2006) in Watershed	Synthetic N fertilizer application (kg N/ha/yr) WS
031800040703	Talisheek Creek	3.38	-0.03	0.83	6.41	3.98
031800040705	West Pearl River-Pearl River	1.68	-0.01	0.58	0.23	0.49
031800041001	Old Channel-Pearl River	11.22	0.03	4.55	0.19	1.49
031800041004	Middle River-Pearl River	14.53	0.31	7.09	0.02	0.11
080701000103	Profit Island	2.48	0.00	1.11	0.75	1.24
080701000104	Manchac Point	5.12	0.13	3.53	1.54	1.70
080702010306	Hammer Creek-Thompson Creek	5.31	0.00	1.22	9.72	4.77
080702010307	Alligator Bayou	6.74	0.00	2.39	11.69	4.88
080702010308	Sandy Creek-Thompson Creek	4.66	0.00	1.37	11.30	6.20
080702010401	Cypress Bayou-Bayou Baton Rouge	17.87	1.40	8.29	16.59	12.89
080702010402	Devils Swamp-Bayou Baton Rouge	63.23	0.47	48.04	0.65	0.96
080702020406	Kidds Creek-Amite River	6.24	0.45	2.13	5.03	4.13
080702020502	Mill Creek-Sandy Creek	2.69	0.00	0.44	8.13	4.86
080702020503	Little Sandy Creek-Sandy Creek	3.45	0.00	1.17	17.33	11.04
080702020504	Beaver Creek-Sandy Creek	3.10	0.00	0.85	5.95	5.38
080702020604	Knighton Bayou-Comite River	3.54	0.00	0.93	20.19	10.85
080702020605	Doyle Bayou-Redwood Creek	4.23	0.00	1.04	26.28	12.89
080702020606	White Bayou-Comite River	11.65	0.16	4.91	36.76	16.32
080702020607	Blackwater Bayou-Comite River	13.22	0.01	6.63	22.70	14.48
080702020608	Hurricane Creek-Comite River	47.82	0.96	29.80	6.63	4.76
080702020701	Hornsby Creek-Colyell Creek	8.37	0.03	3.13	1.31	1.46
080702020702	West Colyell Creek-Middle Colyell Creek	14.89	2.16	7.15	4.57	4.14
080702020703	Middle Colyell Creek-Colyell Creek	17.58	1.02	8.72	2.87	2.73
080702020704	Little Colyell Creek-Colyell Creek	8.15	0.00	3.61	0.97	1.76
080702020803	Ward Creek-Bayou Manchac	89.07	2.33	65.74	0.15	0.45
080702020804	Bayou Fountain-Bayou Manchac	40.53	4.13	26.55	21.36	13.21
080702020901	Jones Creek-Amite River	88.08	2.41	71.74	0.54	0.44
080702020902	Beaver Creek-Amite River	28.40	3.52	17.88	9.51	6.34

Watershed ID	Watershed Name	% Urban (2011) in Watershed	% Urban Change 2001-06 WS	Impervious Cover (2006) IC ≥ 15%, PCT of Watershed	% Contiguous Agriculture (2006) in Watershed	Synthetic N fertilizer application (kg N/ha/yr) WS
080702020903	Grays Creek-Amite River	25.69	3.00	16.64	6.45	4.51
080702020904	Clay Cut Bayou-Amite River	31.56	2.79	22.61	6.69	7.03
080702030201	Beaver Dam Creek	5.09	0.00	1.11	0.21	2.33
080702030202	West Hog Branch	5.24	-0.02	1.04	2.35	3.48
080702030203	Bear Creek-East Hog Branch	4.90	-0.03	1.10	2.60	2.75
080702030204	Beaver Pond Branch-Hog Branch	7.85	0.00	3.12	0.10	1.08
080702030205	Flat Creek-Tickfaw River	7.26	0.00	2.49	3.17	4.41
080702030301	Natalbany Creek-Natalbany River	7.95	0.10	3.77	11.94	15.91
080702030302	Taylor Branch-Little Natalbany River	6.67	0.03	2.33	3.98	4.34
080702030303	East Ponchatoula Creek-Ponchatoula Creek	22.68	0.03	12.68	5.93	13.42
080702030304	Yellow Water River	41.08	0.35	20.57	5.58	9.98
080702030305	Ponchatoula Creek	49.25	1.28	27.88	0.71	5.94
080702030306	Still Branch-Natalbany River	13.63	0.14	5.42	4.08	8.57
080702030401	Wall Bayou-Tickfaw River	4.36	0.00	1.42	0.05	0.46
080702030402	Lizard Creek-Blood River	8.61	0.04	3.27	2.41	1.76
080702040501	Selsers Creek	23.56	0.32	9.04	3.28	9.07
080702040502	Anderson Canal	12.56	0.01	7.87	0.03	0.82
080702050302	Chappepeela Creek	3.20	0.00	0.98	18.78	23.34
080702050303	Sweetwater Creek-Tangipahoa River	6.45	0.00	2.77	13.18	20.68
080702050401	Washley Creek	4.07	0.00	1.81	10.87	13.94
080702050402	Bedico Creek	9.89	0.17	2.48	0.99	1.76
080702050403	Skulls Creek-Tangipahoa River	7.11	0.02	2.40	3.02	5.98
080902010103	Little Bogue Falaya River	5.18	0.00	1.16	0.10	8.68
080902010104	English Branch	4.65	0.00	0.87	2.23	1.49
080902010105	Abita River	15.62	0.38	5.00	0.18	1.41
080902010106	Lower Bogue Falaya River	16.66	0.20	7.11	7.70	5.27
080902010203	Savannah Branch-Tchefuncta River	5.05	0.00	1.13	11.71	9.53
080902010204	Soap and Tallow Branch-Tchefuncta River	19.03	1.21	6.85	2.83	2.98
080902010206	Ponchitalawa Creek-Tchefuncta River	32.02	0.85	13.64	0.90	0.40
080902010301	Lacombe Bayou	3.01	0.00	0.61	0.00	0.28
080902010302	Bayou Chinchuba	40.29	0.55	20.87	0.96	0.43
080902010303	Bayou Castine-Cane Bayou	25.38	0.73	11.61	0.00	0.13
080902010304	Big Branch Bayou-Lacombe Bayou	11.42	0.03	3.18	0.13	0.23
080902010305	Liberty Bayou-Bayou Bonfouca	14.13	0.56	6.05	0.40	0.31
080902010306	Bayou Vincent-Bayou Bonfouca	40.24	1.03	24.36	6.31	2.69
080902010307	Salt Bayou	30.56	0.80	19.75	0.00	0.18

Table 3. Watershed values for five selected indicators from the LMRAP ecoregion screening that may help identify more appropriate nutrient reduction and management strategies based on land use characteristics of the watersheds. Shading represents watershed in the top 10 percent for a given indicator. Only watersheds making top 10 percent for at least one of the indicators is shown.

Watershed ID	Watershed Name	% Urban (2011) in Watershed	% Urban Change 2001-06 WS	Impervious Cover (2006) IC ≥ 15%, PCT of Watershed	Synthetic N fertilizer application (kg N/ha/yr) WS	% Contiguous Agriculture (2006) in Watershed
080702020702	West Colyell Creek-Middle Colyell Creek	14.89	2.16	7.15	4.14	4.57
080702020801	Bayou Braud	17.26	2.15	13.18	25.71	26.97
080702020802	Byou Braud-Bayou Manchac	16.76	2.67	10.89	20.28	19.87
080702020803	Ward Creek-Bayou Manchac	89.07	2.33	65.74	0.45	0.15
080702020804	Bayou Fountain-Bayou Manchac	40.53	4.13	26.55	13.21	21.36
080702020903	Grays Creek-Amite River	25.69	3.00	16.64	4.51	6.45
080702020904	Clay Cut Bayou-Amite River	31.56	2.79	22.61	7.03	6.69
080702030304	Yellow Water River	41.08	0.35	20.57	9.98	5.58
080702030305	Ponchatoula Creek	49.25	1.28	27.88	5.94	0.71
080702040101	Bayou Francois	37.23	2.34	26.10	12.27	14.25
080702040102	Black Bayou-Saveiro Canal	40.89	4.27	25.27	11.44	8.41
080702040103	Grand Goudine Bayou-New River	39.48	6.69	26.78	8.69	9.10
080702040201	St James Parish Canal	13.93	0.53	14.77	32.76	38.27
080702040202	Bayou Des Acadiens-Pipeline Canal	17.78	1.56	16.14	24.62	0.00
080702040302	Hope Canal-Pipeline Canal	15.40	2.48	15.63	6.56	0.15
080703000101	False River	8.07	-0.01	4.66	28.16	43.28
080703000102	Portage Canal No 1-Portage Canal No 2	8.74	0.00	4.95	34.09	57.04
080703000104	Bayou Fordoche-Bayou Grosse Tete	12.55	0.00	8.70	38.29	66.77
080703000201	Bayou Grosse Tete-Bayou Cholpe	4.78	0.00	2.79	27.64	47.05
080703000202	Bayou Poydras-Stumpy Bayou	9.18	0.00	6.12	29.29	59.91
080703000203	Bayou Clause-Grand Bayou	7.15	0.00	4.77	25.73	62.44
080703000204	Alligator Bayou-Choctaw Bayou	11.76	0.01	8.59	19.10	43.59
080703000206	Gulf Intracoastal Waterway-Choctaw Basin Drainage Canal	27.88	0.14	21.69	12.97	12.05
080703000208	Bayou Plaquemine	17.94	1.18	12.69	37.94	12.90
080703000301	Bayou Maringouin	7.70	0.00	5.35	34.39	41.80
080703000302	Bayou Grosse Tete-Grand Bayou	8.24	0.00	5.13	31.55	36.88
080703000401	Bayou La Butte-Logging Canal	12.76	0.35	9.70	34.29	18.06
080902010206	Ponchitalawa Creek-Tchefuncta River	32.02	0.85	13.64	0.40	0.90
080902010302	Bayou Chinchuba	40.29	0.55	20.87	0.43	0.96
080902010306	Bayou Vincent-Bayou Bonfouca	40.24	1.03	24.36	2.69	6.31

Watershed ID	Watershed Name	% Urban (2011) in Watershed	% Urban Change 2001-06 WS	Impervious Cover (2006) IC ≥ 15%, PCT of Watershed	Synthetic N fertilizer application (kg N/ha/yr) WS	% Contiguous Agriculture (2006) in Watershed
080902030102	Duncan Canal-Canal No 2	99.28	0.30	96.55	0.02	0.00
080903010101	Bayou Napoleon-Bayou Verret	24.11	0.18	23.44	36.05	38.28
080903010102	Baker Canal North	8.46	0.00	6.82	31.51	43.92
080903010103	St James Canal	12.08	0.01	11.11	41.87	47.20
080903010105	Bayou Petit Chackbay	8.25	0.31	6.86	20.41	40.81
080903010302	Des Allemands-Crawford Canal	16.00	0.00	14.76	15.53	49.38
080903010304	Town of Mathews-Bayou Lafourche	10.57	0.00	9.11	22.31	46.72
080903010307	Westwego-Main Canal	43.03	3.57	39.84	4.87	0.00
080903010309	Gretna-Intracoastal Waterway	74.52	1.47	69.38	0.19	0.02
080903020301	Bayou Sigur-Rocky Canal	9.09	0.14	7.81	47.14	67.32
080903020305	Canal Cancienne	6.47	0.00	5.22	34.45	0.01
080903020501	Bayou Terrebonne	31.81	2.93	27.21	8.68	4.90

The UMRAP ecoregion screening was focused on a rural row crop scenario. Table 4 provides some key indicators that may be useful in determining appropriate management actions in the watersheds. As with the LMRAP, only the top 10 percent of watersheds for each indicator are shown. Since the ecoregion is predominantly rural row crop agriculture, the indicators below were selected to help break out other potential nutrient management needs within the ecoregion. For these watersheds, non-point source oriented nutrient source reduction best management practices (BMPs) such as tailwater recovery, treatment wetlands, reduced fertilizer application rates, etc. might be most beneficial. There are some significantly urban watersheds within the ecoregion that would be better served by urban stormwater management retrofit BMPs.

Table 4. Watershed values for four selected indicators from the UMRAP ecoregion screening that may help identify more appropriate nutrient reduction and management strategies based on land use characteristics of the watersheds. Shading represents watershed in the top 10 percent for a given indicator. Only watersheds making top 10 percent for at least one of the indicators is shown.

Watershed ID	Watershed Name	% Cultivated Crops (2011) in Watershed	Agricultural water use WS	% Urban (2011) in Watershed
080402050802	Walkers Slough	61.41	11041016.00	5.51
080402070203	Tupawek Bayou-Ouachita River	3.41	221991.00	57.61
080403010101	Crackets Bayou	71.43	3889950.00	11.74
080403010102	Hibbs Bayou	87.01	6404463.00	2.31
080403010105	Big Bayou	88.23	6048294.00	3.51
080403010407	Bayou Friejon-Prairie Bayou	83.16	28586121.00	2.47
080403040702	Hemphill Creek	0.82	720.00	13.17
080403060101	Lake St John-Black Bayou Lake	63.88	9979090.00	7.69
080403060107	Vidalia Canal-Bayou Cocodrie	66.49	11132720.00	8.67
080403060202	Wyches Bayou-Bayou Cocodrie	89.83	10358340.00	2.03
080403060203	Greens Bayou	76.78	13025115.00	3.10
080500010502	Caney Bayou	58.76	15841624.00	5.77
080500010702	Camp Bayou	74.81	28700185.00	5.69

Watershed ID	Watershed Name	% Cultivated Crops (2011) in Watershed	Agricultural water use WS	% Urban (2011) in Watershed
080500010703	Camp Bayou Canal-Boeuf River	84.32	14488288.00	2.76
080500010704	The Swale	88.97	6115258.00	2.06
080500010705	Cypress Bayou	86.82	16735084.00	2.31
080500010706	Coffee Bayou-Boeuf River	86.00	11568709.00	2.83
080500010707	Fivemile Slough-Boeuf River	82.93	15131534.00	3.23
080500010905	Lower Big Colewa Creek	84.36	8714417.00	3.62
080500011003	Cypress Creek	85.18	8506001.00	5.21
080500011005	Dry Fork Creek-Bee Bayou	74.73	6578082.00	9.66
080500011007	Turkey Creek	41.09	1863574.00	7.64
080500011010	Cane Bayou-Little Creek	72.34	7346227.00	8.24
080500011101	Upper Bayou Galion	78.12	15176544.00	4.55
080500011103	Bayou Coulee	71.95	12355974.00	5.35
080500011203	Lower Little Bayou Boeuf	36.61	2127251.00	9.82
080500011304	Crew Lake-Bayou Lafourche	53.74	3266277.00	8.30
080500011305	Youngs Bayou	3.06	122388.00	83.87
080500011306	Gourd Bayou	33.43	4844959.00	17.06
080500011307	Youngs Bayou-Petticoat Bayou	52.69	4098479.00	12.14
080500011501	Ash Slough-Turkey Creek	66.04	6631530.00	9.89
080500020402	Grand Lake	81.62	23489251.00	5.17
080500020403	Hill Bayou-Bayou Macon	90.08	13591734.00	3.06
080500020502	Long Lake Bayou-Bayou Macon	83.16	15095380.00	2.86
080500020504	Bogzack Creek	62.74	2877713.00	8.81
080500020601	Upper Joes Bayou	87.82	7696375.00	4.18
080500030101	Lake Providence-Tensas Bayou	77.80	10373875.00	8.08
080500030102	Duckpond Bayou-Tensas Bayou	84.27	9489625.00	4.45
080500030103	Talla Bena Bayou-Willow Bayou	88.76	3835128.00	4.61
080500030104	Maiden Doe Bayou-Tensas Bayou	93.44	9168500.00	3.62
080500030105	Little Tensas Bayou-Bull Bayou	84.81	5279371.00	3.90
080500030106	Graveyard Bayou-Tensas Bayou	92.25	15797298.00	2.33
080500030201	Brushy Bayou-Walnut Bayou	63.63	4591840.00	11.55
080500030203	Macon Slough-Panota Bayou	78.28	2387968.00	16.28
080500030405	Cypress Bayou	86.97	7852572.00	5.98
080500030408	Dean Bayou-Tensas River	84.73	6509232.00	1.62

The GCP ecoregion screening was focused on a mixed use but predominantly rural, non-row crop scenario. Table 5 provides some key indicators that may be useful in determining appropriate management actions in the watersheds. As with the LMRAP and UMRAP, only the top 10 percent of watersheds for each indicator are shown. Since the ecoregion contains a significant amount of rice cultivation, the fertilizer application rate to rice fields was used as a key indicator of rice cultivation intensity in the watersheds. The higher the rate, the more likely the watershed could be a focus for BMPs that address the particular nutrient issues associated with rice cultivation. There are also several highly urbanized watersheds within the ecoregion, these are identified with the % urban in watershed indicator. These watersheds would be more likely candidates for urban stormwater BMPs, such as stormwater retrofits.

Table 5. Watershed values for four selected indicators from the GCP ecoregion screening that may help identify more appropriate nutrient reduction and management strategies based on land use characteristics of the watersheds. Shading represents watershed in the top 10 percent for a given indicator. Only watersheds making top 10 percent for at least one of the indicators is shown.

Watershed ID	Watershed Name	% Pasture/Hay (2011) in Watershed	% Cultivated Crops (2011) in Watershed	Rice - Nitrogen Fertilizer App Rate (lb/km/yr)	% Urban (2011) in Watershed
080801020602	Bayou Petite Passe	23.50	54.15	231.41	9.75
080801020604	Bayou Carron-Bayou Little Teche	25.01	10.77	2.80	23.62
080801020705	Bayou Teche	27.01	33.15	0.00	24.98
080801020804	Loreauville Canal-Bayou Teche	7.41	41.28	0.00	25.73
080801030101	Bayou Bourbeux	27.25	34.81	6.75	20.59
080801030102	Bayou Carencro	32.34	46.84	120.03	9.18
080801030103	Bayou Bourbeux-Grand Coteau	31.14	32.89	50.97	8.96
080801030105	Francois Coulee-Vermilion River	37.58	14.52	0.72	32.12
080801030106	Coulee Mine	20.88	16.04	7.67	58.46
080801030108	Coulee Ile Des Cannes	29.28	44.06	2.56	21.72
080801030109	Anselm Coulee-Vermilion River	14.41	20.93	0.39	56.33
080801030302	Bayou Tortue-La Salle Coulee	18.24	37.10	0.00	26.39
080802010206	Bayou Blanc-Bayou Plaquemine Brule	4.84	59.07	27.07	22.78
080802010207	Bayou Jonas	7.92	72.03	57.63	7.28
080802010301	Bayou Joe Marcel-Bayou Des Cannes	24.70	54.80	71.96	16.09
080802010304	Tiger Point Gully-Bayou Des Cannes	6.31	54.65	233.61	12.47
080802010401	Sonnier Bayou-Bayou Blue	9.30	43.50	181.25	6.66
080802010406	Jennings Norwood Canal-Bayou Nezpique	13.43	22.05	0.00	24.98
080802020101	Indian Bayou-Bayou Queue De Tortue	16.58	65.40	49.63	11.34
080802020102	Prime Gully-Bayou Queue De Tortue	8.42	72.35	123.70	4.71
080802020103	Bayou Grand Marais	9.13	83.09	67.77	3.94
080802020104	Lyons Point Gully	2.61	81.83	69.69	5.12
080802020105	Lazy Point Canal-Bayou Queue De Tortue	5.11	74.99	0.00	4.85
080802020201	Gum Gully-West Bayou Grand Marais	16.31	74.78	0.82	5.29
080802020203	West Bayou Grand Marais-Middle Bayou Grand Marais	7.14	74.14	1.32	13.47
080802020401	Indian Bayou Canal	26.06	61.40	0.00	3.05
080802020402	Bell City Drainage Canal-Wild Island	14.94	75.61	0.81	4.60
080802020501	Sledge Canal-Frontal Intercoastal Waterway	10.52	74.70	50.21	11.85

Watershed ID	Watershed Name	% Pasture/Hay (2011) in Watershed	% Cultivated Crops (2011) in Watershed	Rice - Nitrogen Fertilizer App Rate (lb/km/yr)	% Urban (2011) in Watershed
080802020503	Seventh Ward Canal-Frontal Intercoastal Waterway	12.67	72.94	3.60	4.23
080802020602	Cameron Canal-Frontal Intercoastal Waterway	8.30	79.29	0.89	3.18
080802020603	Latanier Bayou-Frontal Intercoastal Waterway	2.72	79.84	0.00	1.61
080802020604	Warren Canal-Frontal Intercoastal Waterway	6.13	85.34	2.12	4.70
080802030603	Little Bayou	10.61	74.54	6.59	7.24
080802030702	Kinder Ditch-Calcasieu River	10.12	31.22	308.25	10.80
080802030705	Kayouche Coulee	13.73	20.55	26.92	51.30
080802030706	English Bayou	26.33	33.90	0.00	17.03
080802050504	Moss Gully-West Fork Calcasieu River	3.64	0.37	0.00	22.67
080802060102	Sabine Canal-Spring Gully	48.33	20.53	0.00	3.27
080802060104	Wing Gully-Bayou Choupique	29.67	7.16	0.00	9.35
080802060105	Sabine Canal	53.43	16.15	0.00	2.20
080802060106	Bayou Choupique	32.51	11.95	0.52	12.71
080802060201	Coulee Hippolyte	28.77	22.08	0.00	29.96
080802060203	Government Ditch-South Fork Black Bayou	35.23	49.46	15.90	3.74
080802060301	Maple Fork-Bayou D'Inde	4.91	4.73	0.00	55.41
080802060302	Bayou Verdine-Calcasieu River	0.90	1.24	0.00	66.74
080802060303	Calcasieu River-Prien Lake	8.37	5.04	0.00	33.08

Which HUC12s should be protected while others are restored? Although the RPS Tool is often used to assist restoration planning, it can also be used to identify watersheds that are likely in good condition and candidates for protection. The healthier HUC12s can attenuate nutrient loads from upstream or contribute cleaner flows that may dilute loads from other HUC12s downstream. They can also serve as reference watersheds when looking to conduct restoration in more degraded watersheds. Using available data in the RPS Tool, the HUC12s in relatively better condition can be found using the RPI score or an indicator related to absence of impairment or presence of ecological attributes associated with ability to process nutrients.

Three prospective indicators appear in the figures below, and all are color-assigned to highlight the best prospects for protection (top quartile) with the darkest shade of blue.

The bubble plots in Figure 23 through Figure 26 are color-coded by the RPI Index scores for the ecoregions, where higher scores may serve as a simple predictor of the best protection candidates given all the factors in each watershed.

Although most of the highest scoring watersheds in the SPTF ecoregion are focused in the upper left quadrant of the plot, having high ecological indicator scores and low stressor scores, some overall RPI scores were buoyed by very high social index scores. This is evident in the large dark blue bubbles in the lower left quadrant. The darkest blue watershed in the lower left quadrant has the highest social index score of all the watersheds in the SPTF ecoregion. All things being equal, watersheds with high social scores can be more promising for protection. A few other watersheds with high social indicators also appear in the lower left and right quadrants. These

HUC12s should be investigated further to determine if they are suitable candidates for protection, while those in the upper left quadrant would seem the most likely candidates for protection. Some of these potential candidates are identified in Figure 23, though this list is not exhaustive and local knowledge should be used in conjunction with the results here to identify good candidates for protection.

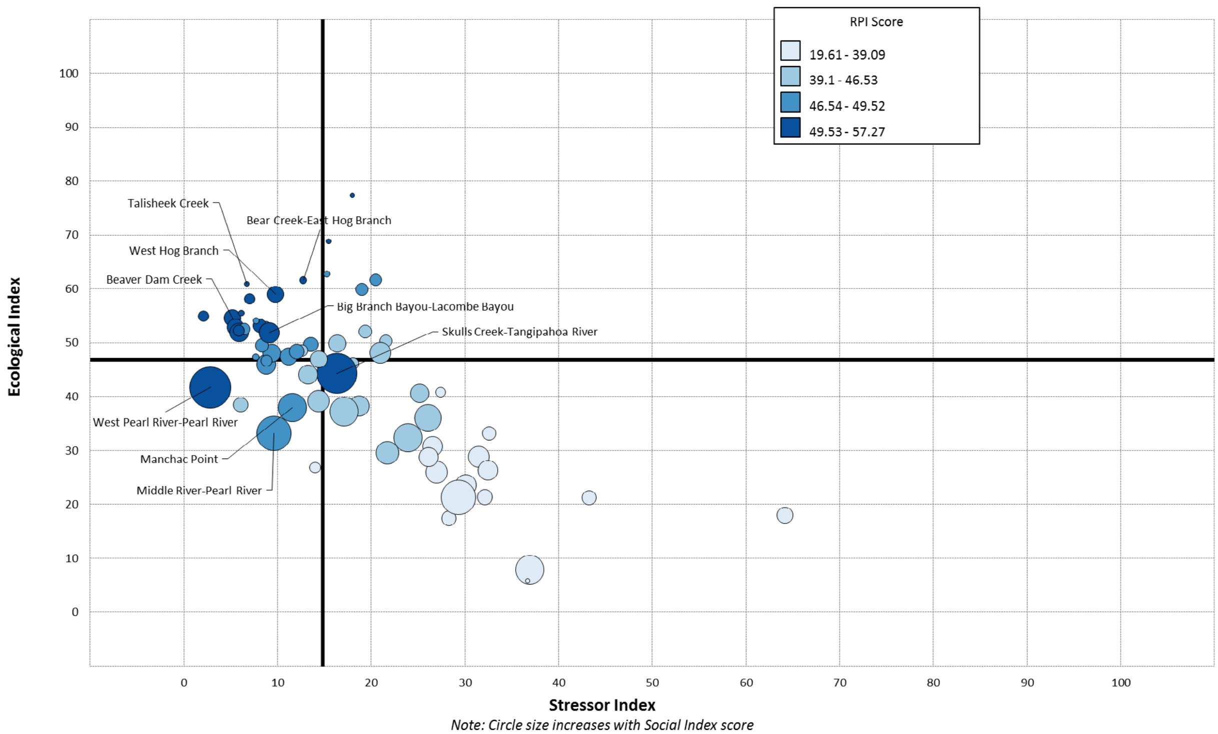


Figure 23. SPTF watersheds color coded by RPI score quartiles.

The RPI score distribution for LMRAP is shown in Figure 24. These watersheds show a fairly consistent gradient of the highest score in the upper left quadrant down to the lowest RPI scores in the lower right quadrant. Some of the likely suitable candidates for watershed protection are identified on the bubble plot.

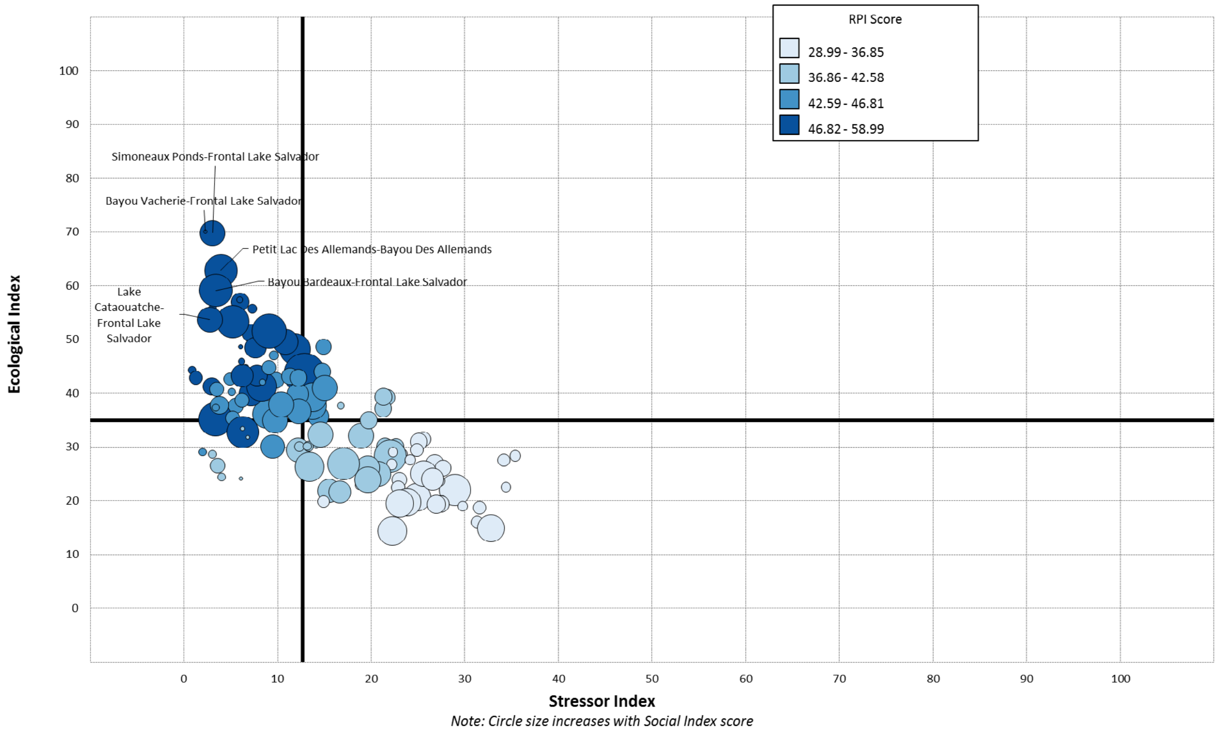


Figure 24. LMRAP watersheds color coded by RPI score quartiles.

Figure 25 shows the RPI score quartiles for the UMRAP ecoregion. Whereas some of the other ecoregions have more scattered results, the watersheds in this region show a very strong trend with the highest quartile RPI scores being consistently in the upper left quadrant and the lowest quartile RPI scores in the lower right quadrant. Youngs Bayou is the most prominent exception to this trend. Despite a low ecological index score, it still received remained in the upper quartile of watersheds because of its high social and low stressor scores.

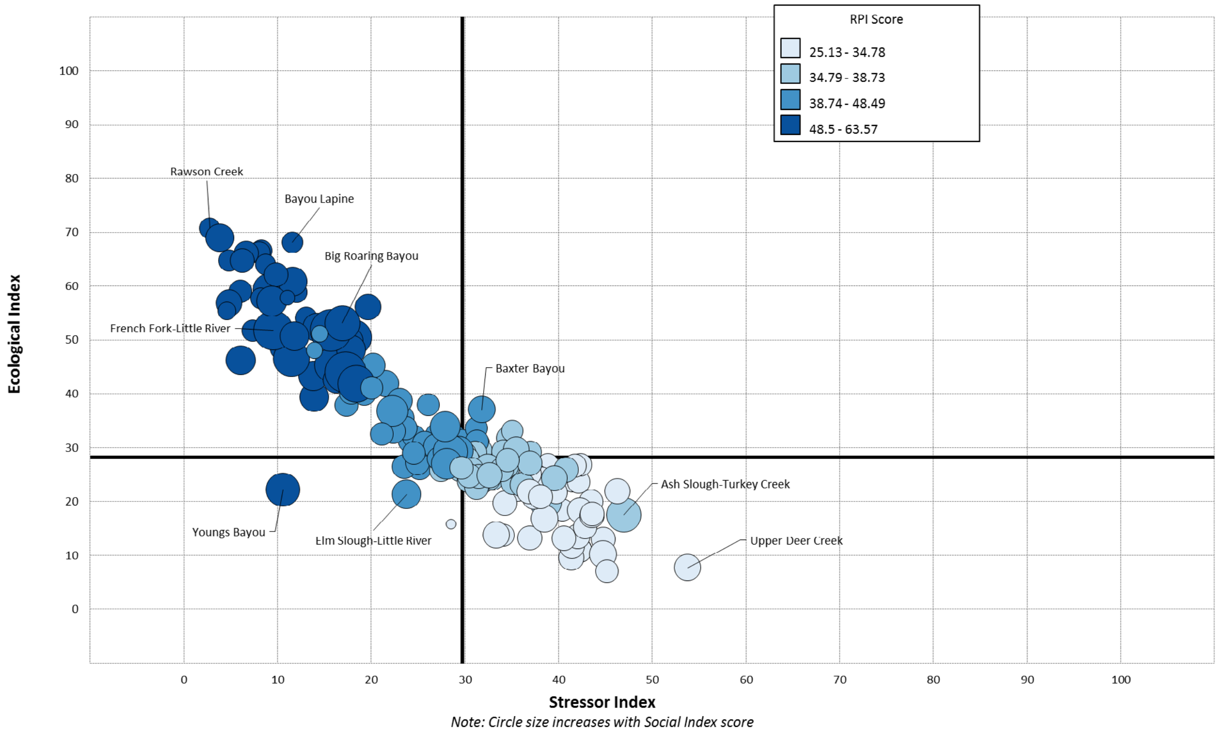


Figure 25. UMRAP watersheds color coded by RPI score quartiles.

Figure 26 illustrates the distribution of RPI scores in the GCP ecoregion. While the top quartile is prominently in the upper left quadrant of the bubble plot, the lower three quartiles show significant mixing within the quadrants. The second highest quartile of RPI scores is still predominantly in the upper left quadrant but shows significant overlap with the other watersheds that have lower RPI scores because of low ecological scores in many of these watersheds.

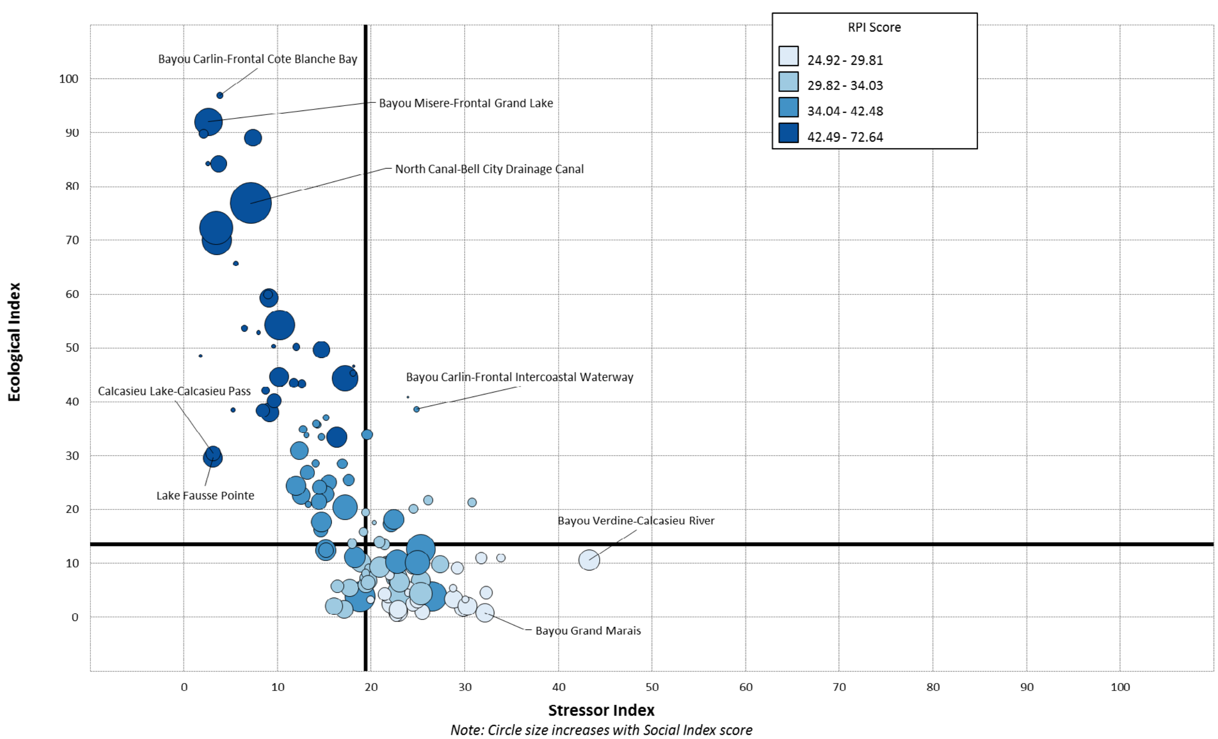


Figure 26. GCP watersheds color coded by RPI score quartiles.

Another indicator that is a potentially good metric for identifying good candidates for watershed protection is the percent natural cover in the watershed. Figure 27 through Figure 30 illustrate the quartile distribution of the percent natural cover in the watersheds by ecoregion. Watersheds with the highest natural cover are logical candidates for protection. In watersheds with high proportions of natural cover, additional analysis should be done to eliminate watersheds that are already protected lands through existing programs or ownership. As with the overall RPI index scores, most of the promising candidates for watershed protection tend to be located in the upper left quadrant of each plot.

While this trend holds in the SPTF, LMRAP and GCP, the UMRAP watershed presents somewhat different results (Figure 29). Although the watersheds with higher proportion of natural cover are located in the upper left quadrant, with above the median ecological indices and below the median stressor indices, the ecoregion as a whole seems to have very little natural cover. Roughly 75 percent of the watersheds in the ecoregion have 10 percent or less natural cover. It is noteworthy that many of the watersheds with low levels of natural cover still have relatively high ecological indices and low stressor indices.

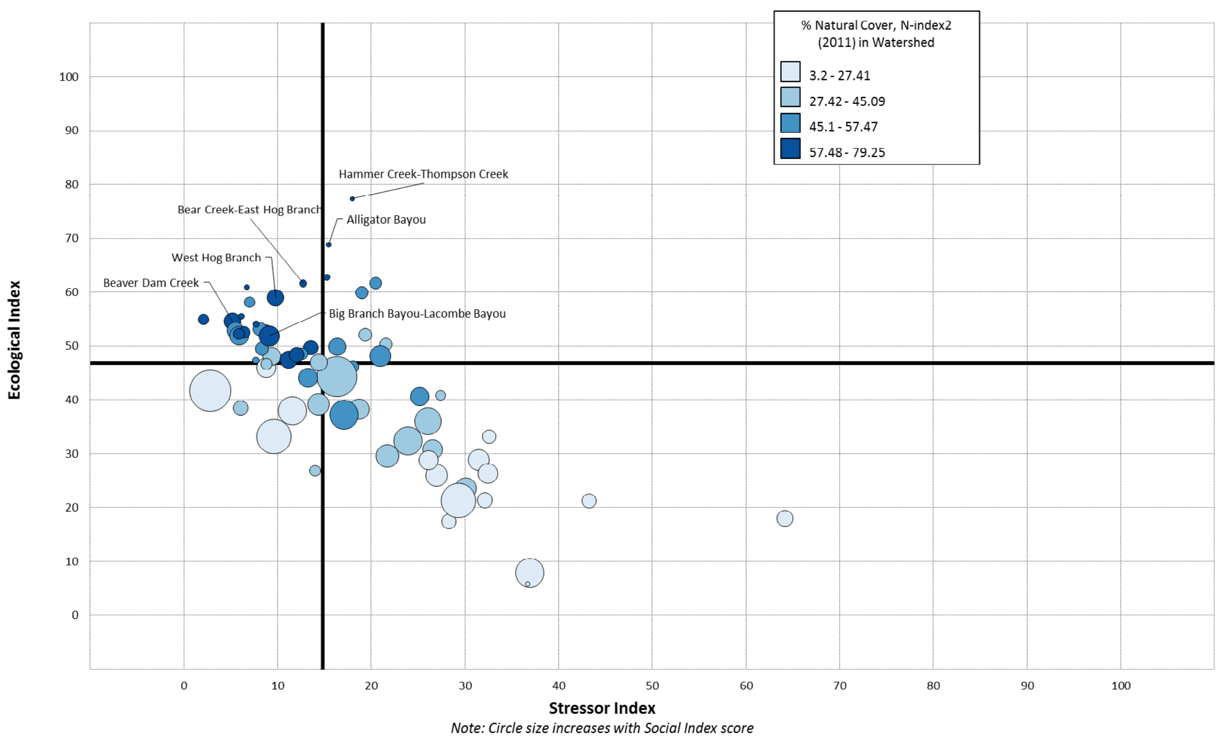


Figure 27. SPTF watersheds color coded by percent natural cover in the watershed quartiles.

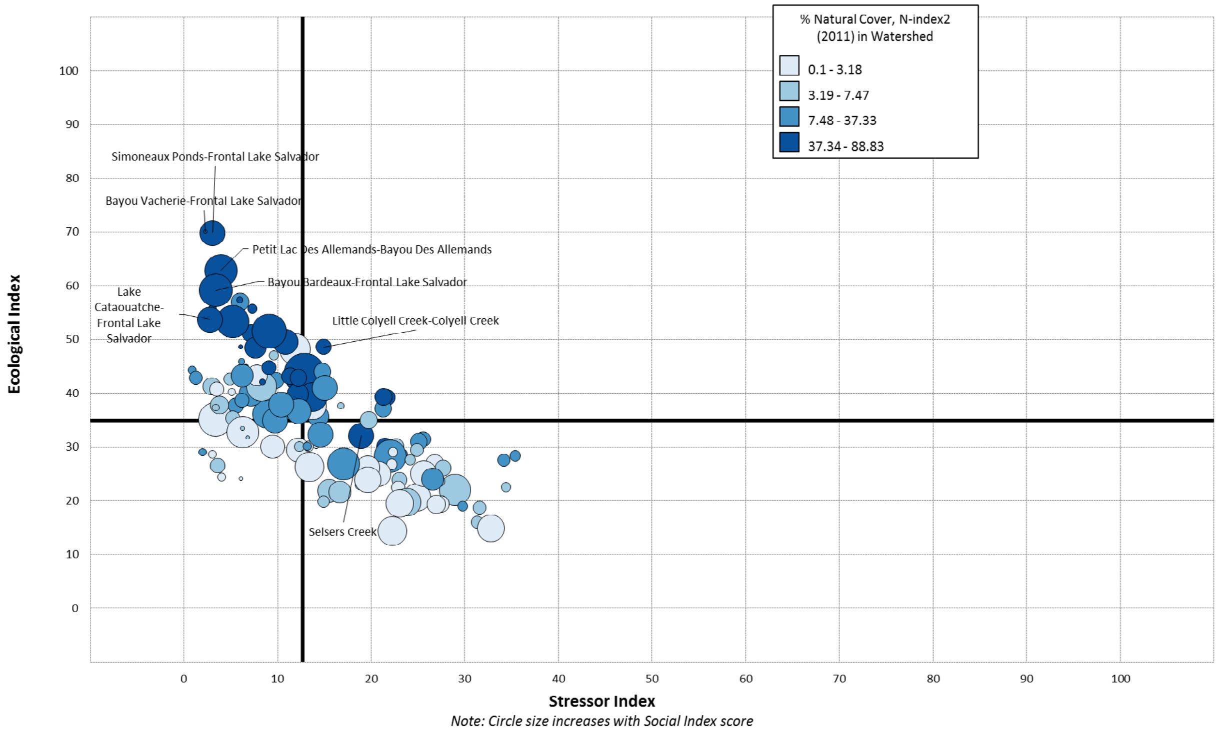


Figure 28. LMRAP watersheds color coded by percent natural cover in the watershed quartiles.

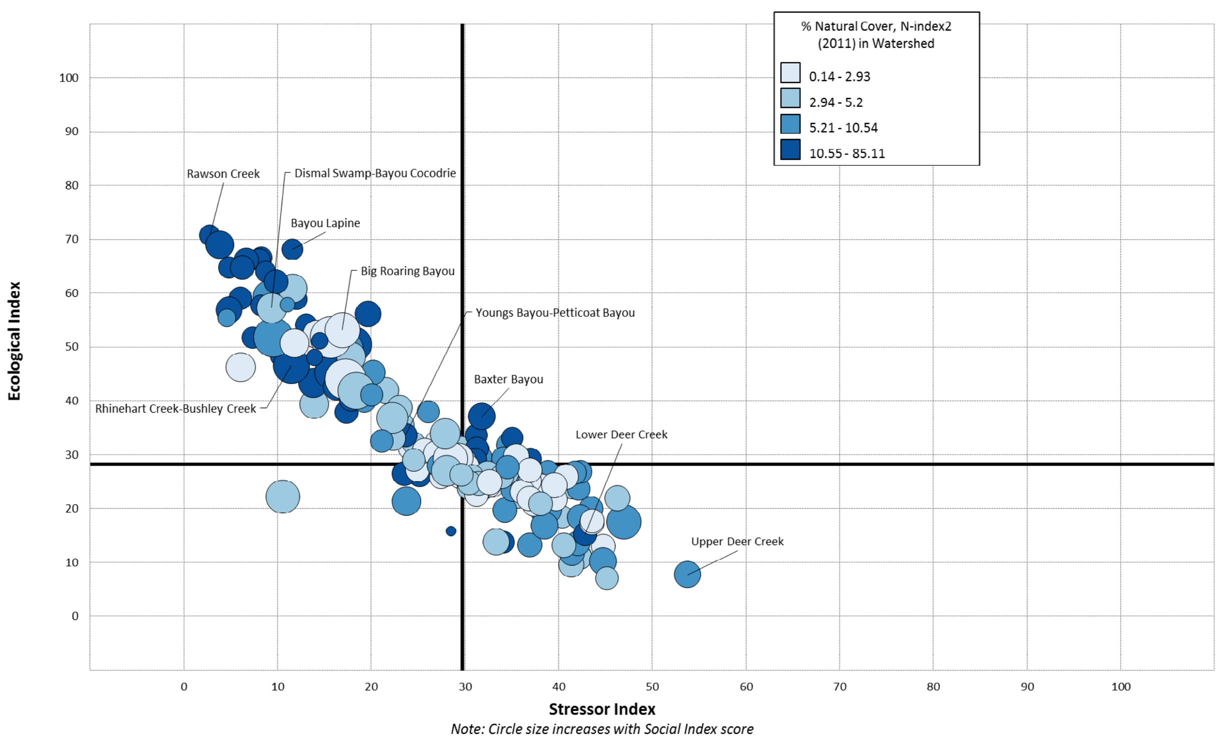


Figure 29. UMRAP watersheds color coded by percent natural cover in the watershed quartiles.

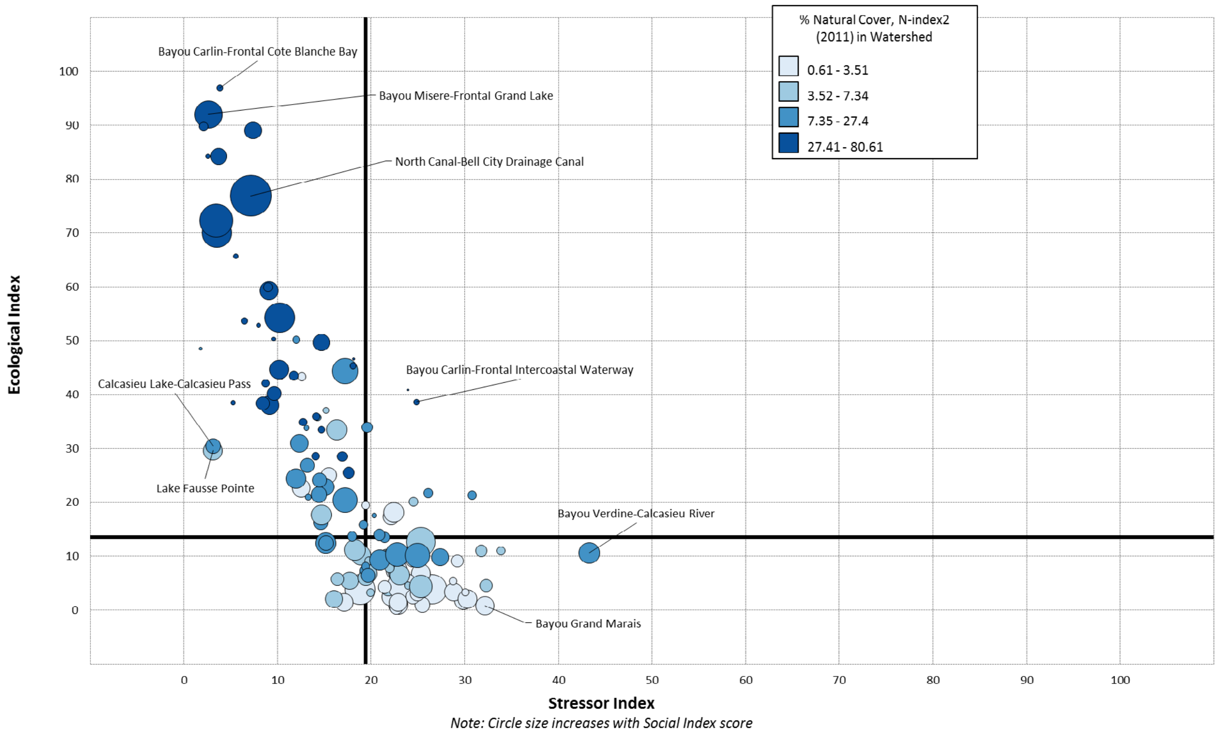
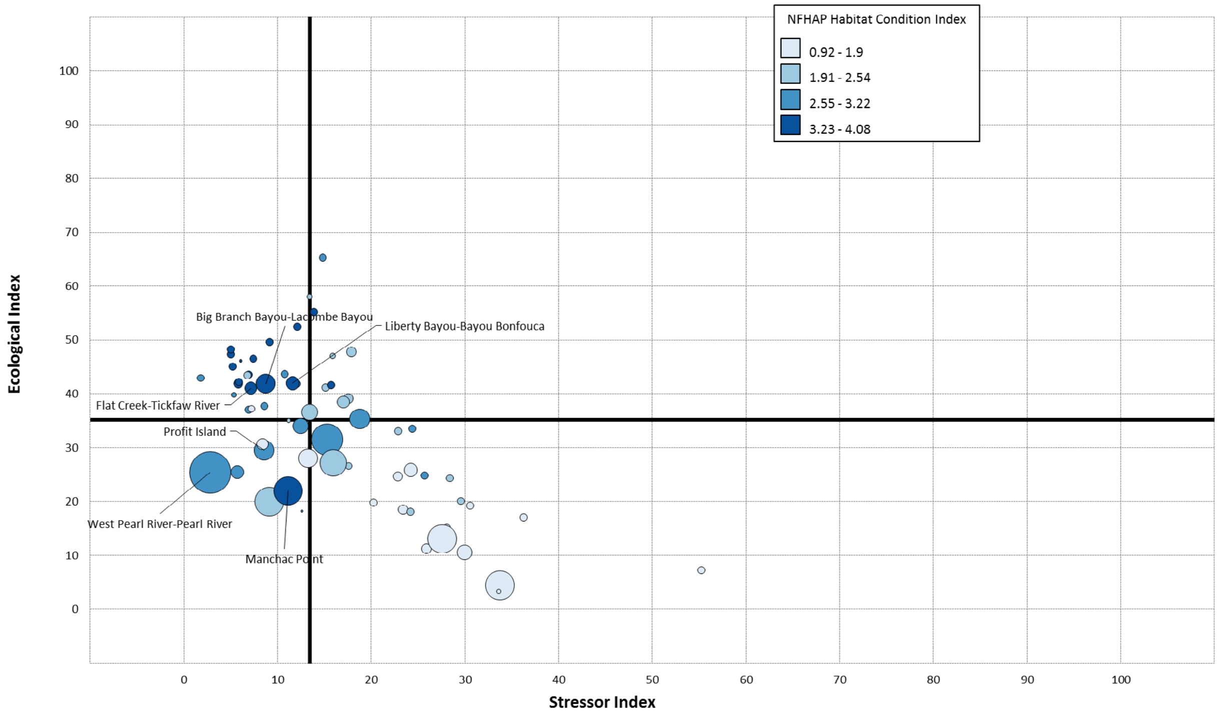


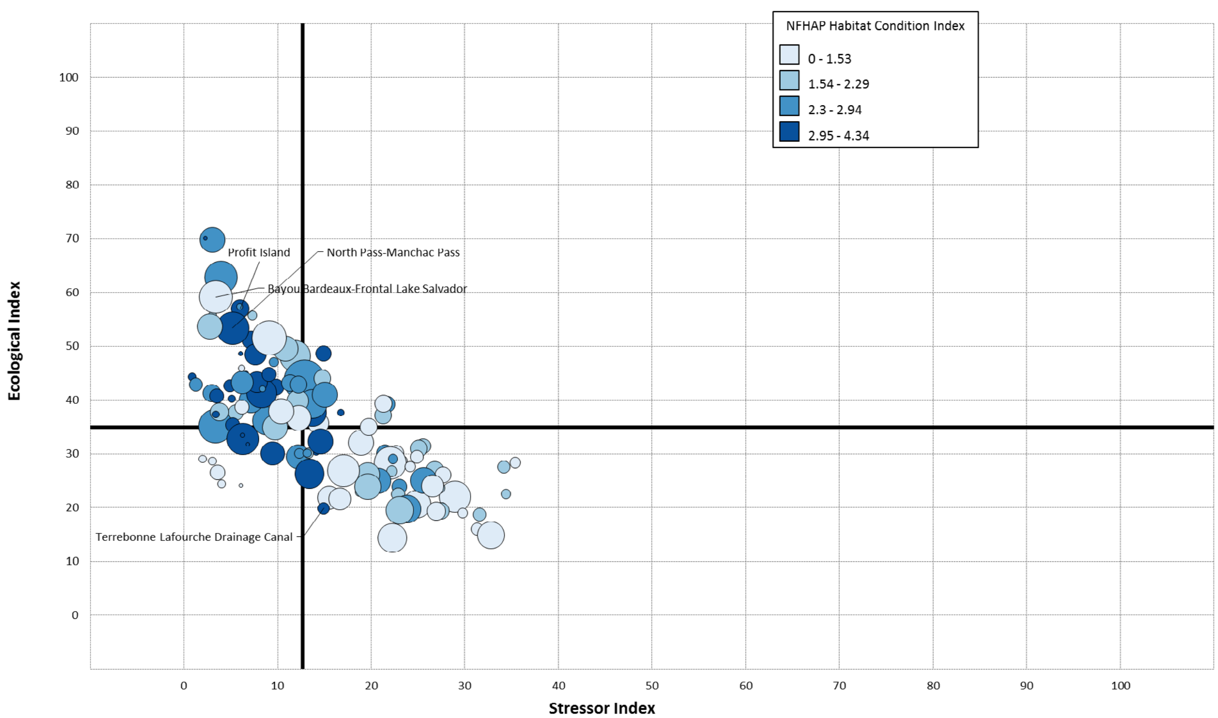
Figure 30. GCP watersheds color coded by percent natural cover in the watershed quartiles.

Figure 31 through Figure 34 illustrate the quartile scores for NFHAP Habitat Condition Index in the watersheds of the ecoregions, respectively. This indicator is a measure of the condition of the aquatic habitat condition where higher scores equate to a lower likelihood of habitat degradation. Watersheds with lower likelihood of habitat degradation would likely also be stronger candidates for protection. Unlike the RPI scores and percent natural cover in the watershed indicators above, the highest quartile watersheds seem to be more broadly scattered throughout the quadrants. Although they seem to trend towards the left two quadrants, indicating possibly that these watersheds have low stressor levels making it unlikely that they will be subject to additional degradation; however they may or may not have strong existing ecological indicators. There are still a fair number of watersheds in the upper quartiles of the NFHAP Habitat Condition Index that appear on the right quadrants of the bubble plots, indicating that the stressors on these watersheds may not be directly related to habitat condition or that the overall stressor scores in the watershed are relatively low to being with, as appears to be the case for the LMRAP ecoregion.



Note: Circle size increases with Social Index score

Figure 31. SPTF watersheds color coded by NFHAP Habitat Condition Index quartiles.



Note: Circle size increases with Social Index score

Figure 32. LMRAP watersheds color coded by NFHAP Habitat Condition Index quartiles.

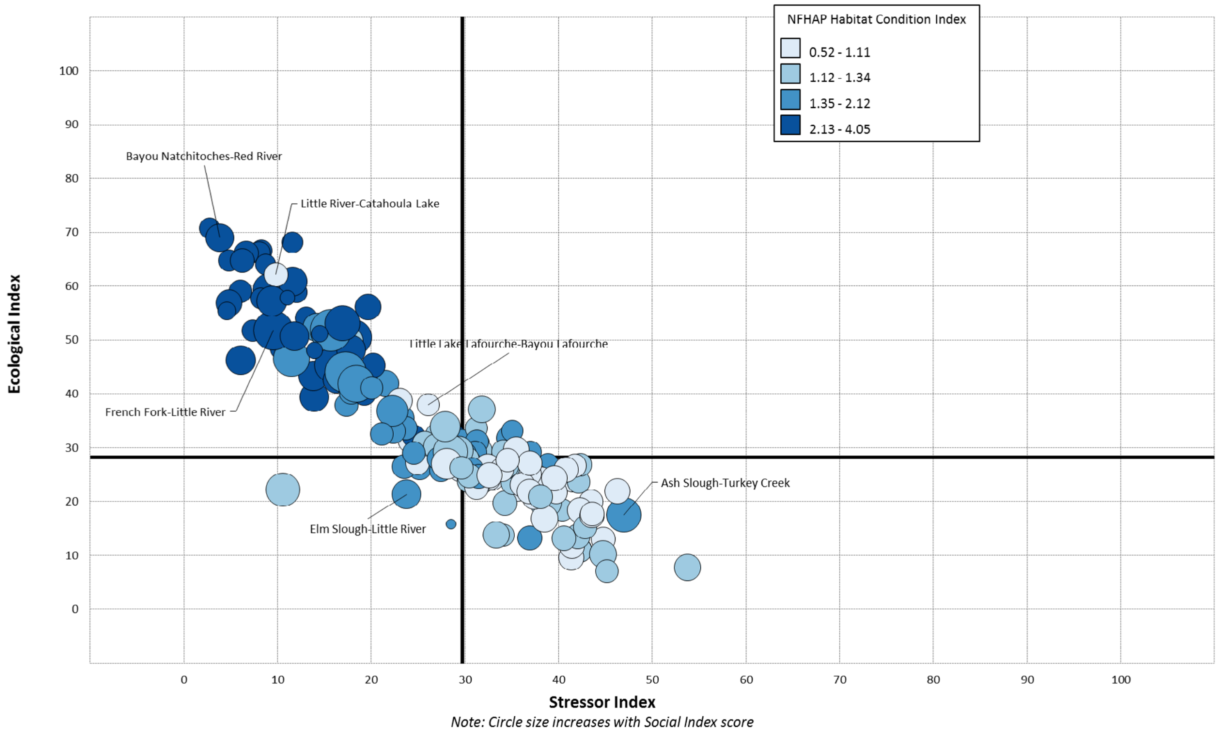


Figure 33. UMRAP watersheds color coded by NFHAP Habitat Condition Index quartiles.

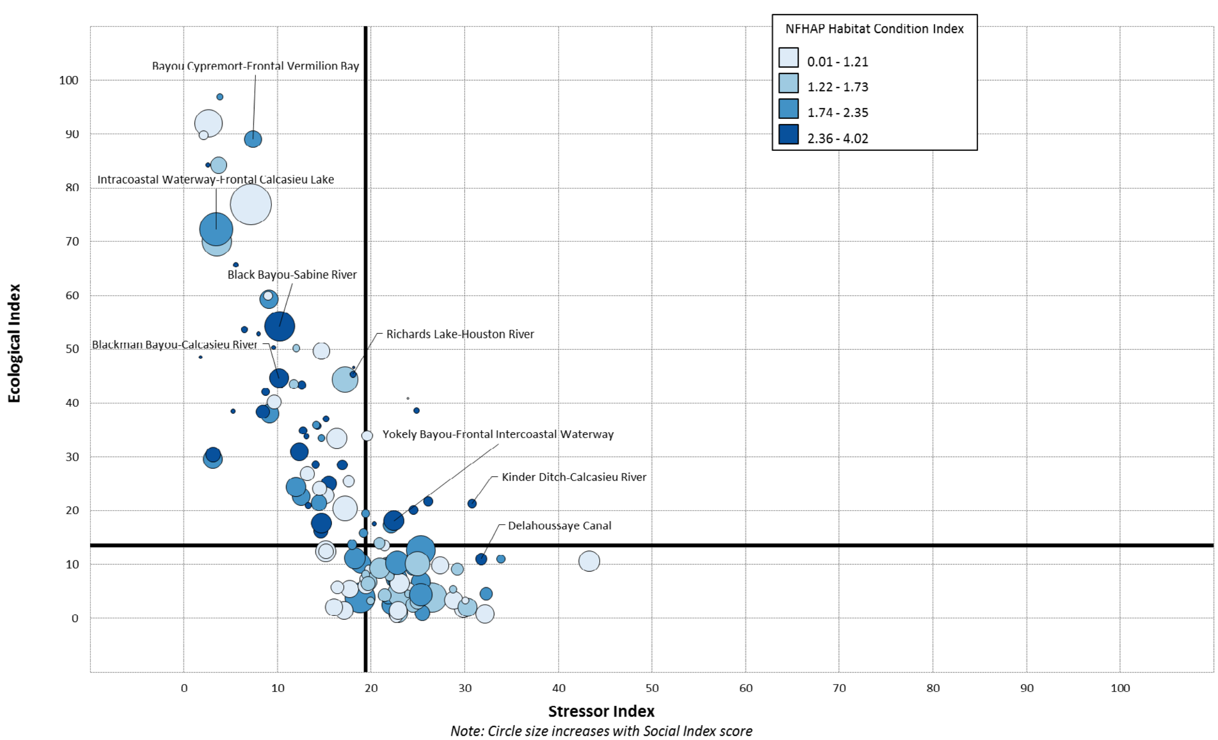


Figure 34. GCP watersheds color coded by NFHAP Habitat Condition Index quartiles.

<u>Does soil stability affect the outcome of the analysis?</u>

When the ecoregion scenarios were developed by LA DEQ, there was some debate as to whether watershed soil stability was an important indicator to include in the row crop agriculture scenario for the UMRAP ecoregion. To help answer that question, the screening run was conducted with and without that ecological factor and the results were compared. Based on the plots below, the effect of removing soil stability was generally to depress the overall ecological indicator scores for many of the watersheds. The median ecological index value dropped by more than 10. The soil stability range was 0.55 to 0.71 across the ecoregion. In watersheds with relatively high soil stability values, removing that indicator from the screening had the effect of lowering the overall rank and ecological index for those watersheds. Removing soil stability resulted in an average change in rank for the watersheds with soil stability values of 0.7 or higher of a decrease of 27 rank positions. The average change in rank for the watersheds with soil stability values of 0.6 or lower was an increase in rank by 53 positions. The watersheds with high soil stability (>= 0.7) or low soil stability (<=0.6) represented only 37 of the 172 watersheds in the ecoregion. The remaining watersheds changed rank by about 15 positions on average, with lower ranks for watersheds with somewhat higher soil stability values and higher ranks for watersheds with somewhat lower soil stability values once soil stability was removed from the screening.

As far as the effect on the overall watershed rank, about 60 percent of the watersheds did not change overall rank by more than 10 positions, but the remainder had larger jumps.

For comparison, the top 10 percent of highly ranked watersheds from the original screening that included soil stability are provided in Table 6 with their new ranks in the screening without soil stability. When watersheds were ranked high overall, there was less of an impact of removing one indicator from the screening. None of the top 10 percent watersheds changed rank by more than 9 positions. Figure 35 and Figure 36 compare the positions of the top 5 ranked watersheds and illustrate the overall ecological rank changes. While there is modest movement, the overall change did not appear to significantly affect the relative position of high scoring watersheds. Whether the soil stability indicator should be removed or included in a screening run will ultimately depend on the management question that is being explored.

Table 6. Top 10 percent of ranked watersheds with soil stability included in the screening (original) and without soil stability included (new)

Watershed ID	Watershed Name	Original RPI Rank	New RPI Rank	Rank Position Change
080402050805	Lower Overflow Creek	17	22	-5
080402070205	Cypress Creek	16	9	7
080402070401	Bayou De Chene-Ouachita River	13	11	2
080402070404	Gastis Creek	15	15	0
080402070405	Rawson Creek	4	5	-1
080402070406	Big Creek-Ouachita River	14	10	4
080403010501	Bayou Milligan-Red River	5	6	-1
080403010503	Long Bayou-Alligator Bayou	10	17	-7
080403010504	Bayou Natchitoches-Red River	2	1	1
080403040605	Greens Creek	7	8	-1
080403040608	Rhinehart Creek-Bushley Creek	11	18	-7
080403040704	Big Saline Bayou	8	3	5
080403040705	French Fork-Little River	1	2	-1
080403040706	Little River-Catahoula Lake	18	13	5
080403060206	Dismal Swamp-Bayou Cocodrie	9	16	-7
080500030304	Tensas River	6	12	-6
080500030401	Fool River-Tensas River	3	4	-1
080500030403	Big Roaring Bayou	12	21	-9

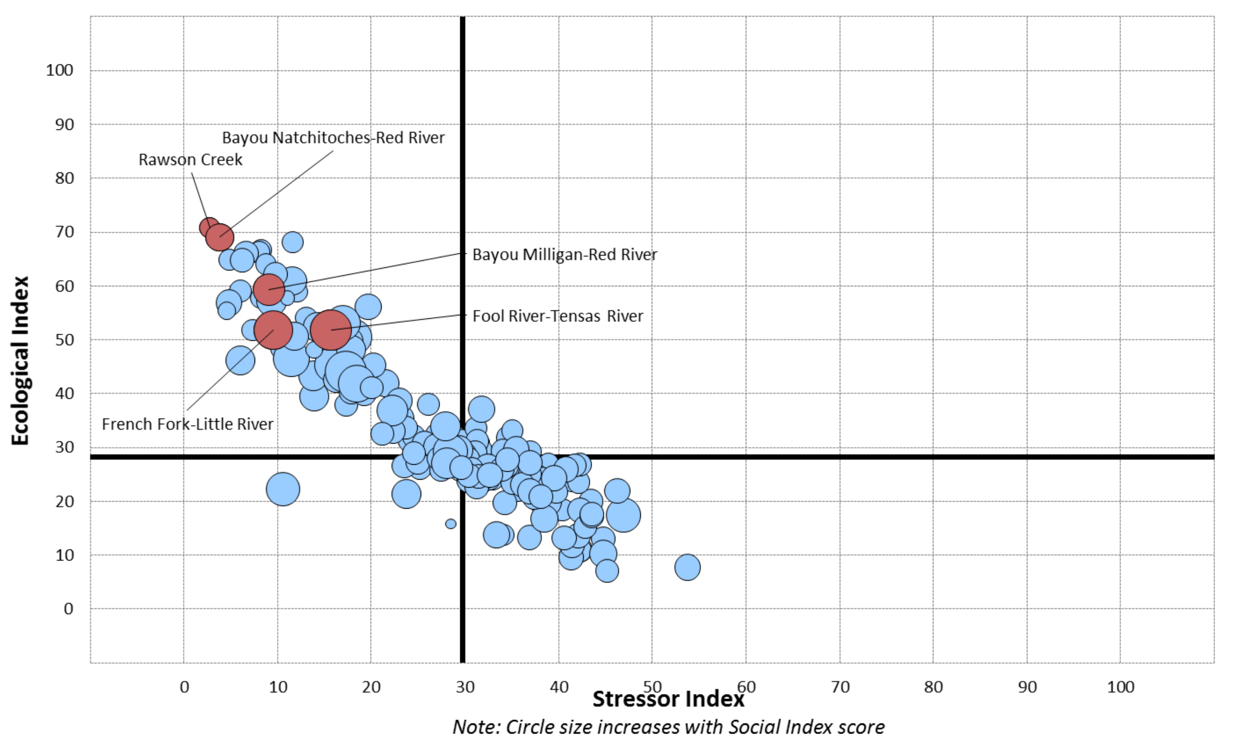


Figure 35. Bubble plot with soil stability indicator included in screening run for UMRAP.

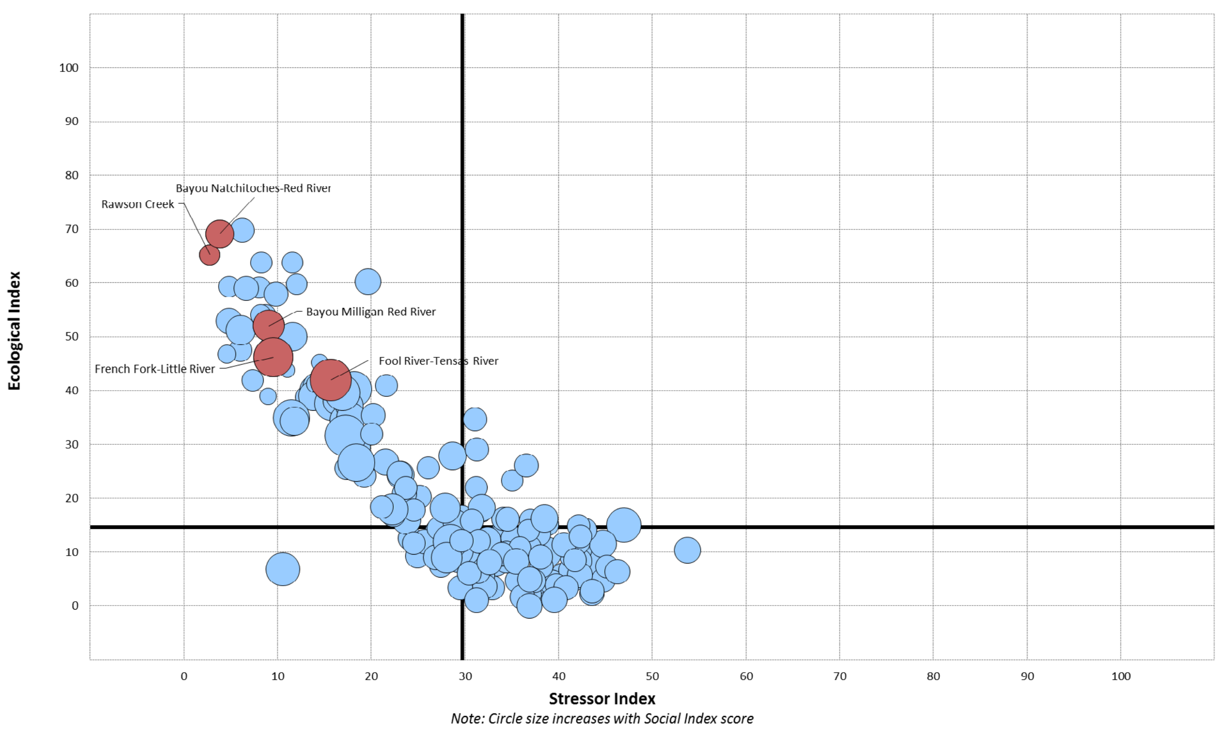


Figure 36. Bubble plot with soil stability indicator not included in screening run for UMRAP.

Can the number of Stressor Indicators be simplified and still yield similar results?

Ideally, a screening run only contains a handful of indicators in each category: ecological, stressor and social. Because so many stressor indicators were selected for the developed lands scenario, one of the questions asked was, does simplifying the suite of stressor indicators still yield similar results?

The stressor indicator set for the SPTF and LMRAP ecoregions was condensed from 20 in the original screening run developed by Louisiana to nine stressor indicators in the simplified set shown in Table 7. The stressors chosen for the simplified set were selected to maintain representation of the various land uses and specific nutrient sources while eliminating duplicative or potentially correlated indicators. A simple correlation analysis was performed on several of the stressor indicators using data from the entire state. Notable correlations, or lack of correlations are shown in Table 8. Many of the stressors in the original set were found to be highly correlated. For example, % cultivated crops in the watershed and % cultivated crops in the riparian zone have an R^2 of 0.85; % contiguous agriculture in the watershed and % cultivated crops in the riparian zone have an R^2 of 0.75; and % urban change 2001-2006 in the watershed and % urban change 2001-2006 in the HCZ have an R^2 of 0.93. Others were found to be less correlated then might be expected. For example, percent developed, high intensity in the riparian zone was only weakly correlated with percent urban in the riparian zone (R^2= 0.38). Although this is a simplified correlation screening, it presents an uncomplicated way of quickly evaluating which indicators might be overweighting the impacts of a stressor by representing the true stressor multiple times in slightly different ways.

Table 7. Comparison of original stressor indicators and the simplified set of stressor indicators for SPTF Ecoregion.

Original Stressor Indicators	Simplified Set of Stressor Indicators
% pasture/hay (2011) in riparian zone	x
% cultivated crops (2011) in watershed	
% cultivated crops (2011) in riparian zone	x
% Contiguous Agriculture (2006) in Watershed	
% urban (2011) in watershed	
% urban (2011) in riparian zone	x
% Developed, High intensity (2011) Riparian Zone	
% Developed, Medium intensity (2011) Riparian Zone	
% urban change 2001-06 in watershed	x
% urban change 2001-06 in HCZ	
Impervious cover (2006) IC ≥ 15%, % of watershed	x
Agricultural water use in watershed	
HCZ mean soil erodibility	
Synthetic nitrogen fertilizer application (kg N/ha/yr) in watershed	x
Row Crop (no wheat) - Nitrogen Fertilizer App Rate (lb/km/yr)	
Row Crop (no wheat) - Phosphorus Fertilizer App Rate (lb/km/yr)	
% watershed stream length 303d-listed nutrients	x
% watershed waterbody area 303d-listed nutrients	
Incr Load from LA (SPARROW)	x
Area Weighted Count of Nutrient-Related Non-compliant Watershed Inspections (#/sq mi)	x

Table 8. Indicator Correlation– higher R^2 values are more highly correlated.

Indicator	Indicator	R^2 Value
% cultivated crops (2011) in watershed	% cultivated crops (2011) in riparian zone	0.85
% Contiguous Agriculture (2006) in Watershed	% cultivated crops (2011) in riparian zone	0.75
% urban (2011) in watershed	% urban (2011) in riparian zone	0.64
% Developed, Medium intensity (2011) Riparian Zone	% urban (2011) in riparian zone	0.72
% Developed, High intensity (2011) Riparian Zone	% urban (2011) in riparian zone	0.38
% Developed, High intensity (2011) Riparian Zone	% Developed, Medium intensity (2011) Riparian Zone	0.62
% urban change 2001-06 in watershed	% urban change 2001-06 in HCZ	0.93
Agricultural water use in watershed	Synthetic nitrogen fertilizer application (kg N/ha/yr) in watershed	0.49
Synthetic nitrogen fertilizer application (kg N/ha/yr) in watershed	Row Crop (no wheat) - Nitrogen Fertilizer App Rate (lb/km/yr)	0.54
Synthetic nitrogen fertilizer application (kg N/ha/yr) in watershed	Row Crop (no wheat) - Phosphorus Fertilizer App Rate (lb/km/yr)	0.65

Not all the indicators that were removed were highly correlated with other indicators still in the screening; however, as the results show, with numerous indicators in a screening, the overall results do not necessarily change dramatically with refinement of the indicator set.

In the simplified stressor screening runs, the ecological and social indicators remained the same as in the original scenario. As shown in Figure 37 through Figure 40, the results for SPTF and LMRAP have a very similar distribution, if not exactly the same index scores across the original and simplified screening runs. As shown in Table 9, the top 10 RPI ranked watersheds are relatively consistent between the original and simplified stressor screening run for the SPTF ecoregion. There is some minor movement within the top 10 ranking, with only two watersheds substantially changing rank (highlighted in orange in Table 9). The results of the simplified screening for the LMRAP show even more consistent results (Table 10). Only one of the top 10 RPI ranked watersheds changed by more than two positions, and the top five ranked watersheds did not change rank at all from the original to the simplified screening run.

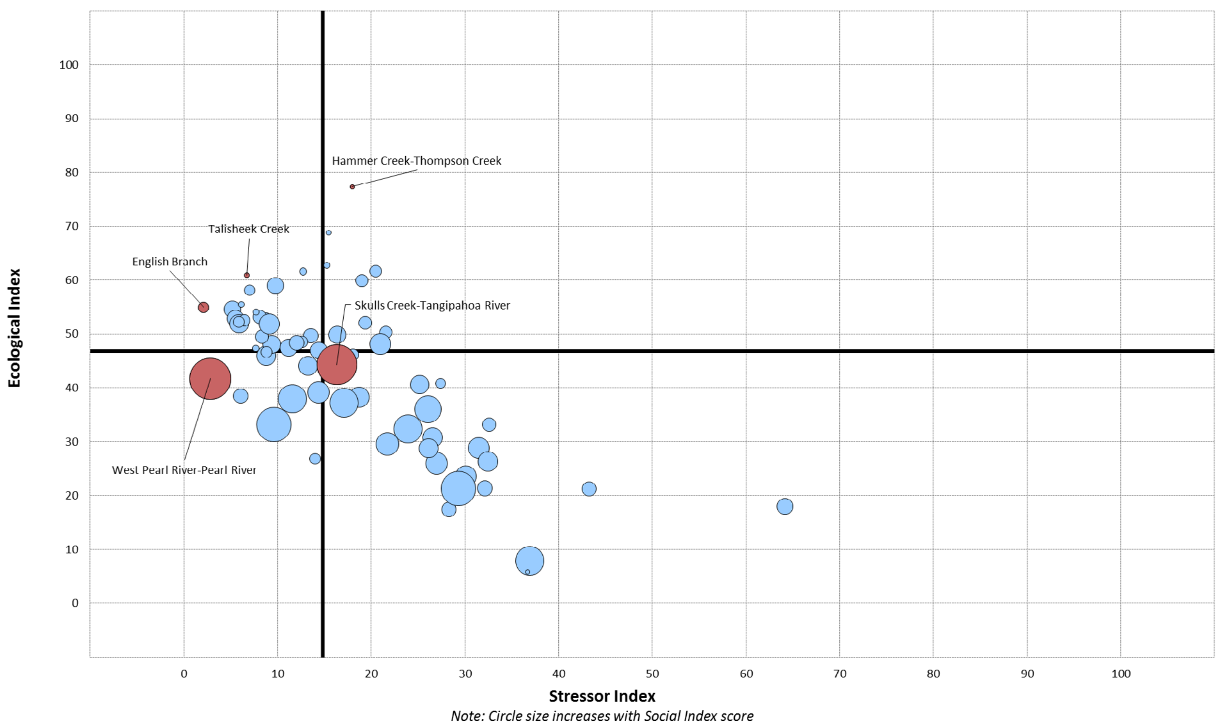


Figure 37. Bubble Plot distribution of watersheds in the original SPTF screening.

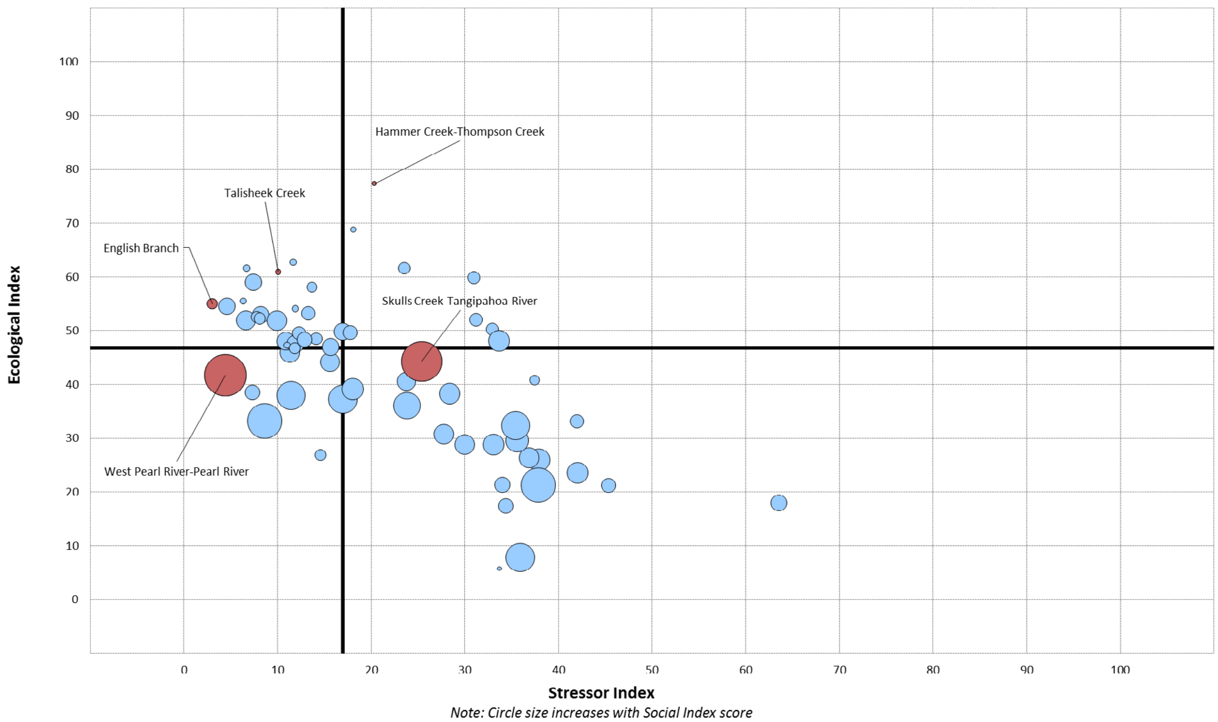


Figure 38. Bubble Plot distribution of watersheds in the simplified SPTF Screening.

Table 9. Comparison of RPI Ranks for Original and Simplified SPTF Screening

HUC	Watershed Name	Ecological Rank	Social Rank	Original Stressor Rank	Simplified Stressor Rank	Original RPI Rank	Simplified RPI Rank
031800040703	Talisheek Creek	6	60	10	11	5	7
031800040705	West Pearl River-Pearl River	38	1	2	4	1	1
080702010306	Hammer Creek-Thompson Creek	1	62	38	37	2	2
080702010307	Alligator Bayou	2	60	34	34	8	9
080702030201	Beaver Dam Creek	12	29	3	2	6	4
080702030202	West Hog Branch	8	29	22	5	7	3
080702030401	Wall Bayou-Tickfaw River	20	23	6	10	10	11
080702050403	Skulls Creek-Tangipahoa River	36	2	35	44	3	14
080902010103	Little Bogue Falaya River	9	52	11	28	9	18
080902010104	English Branch	11	52	1	1	4	6

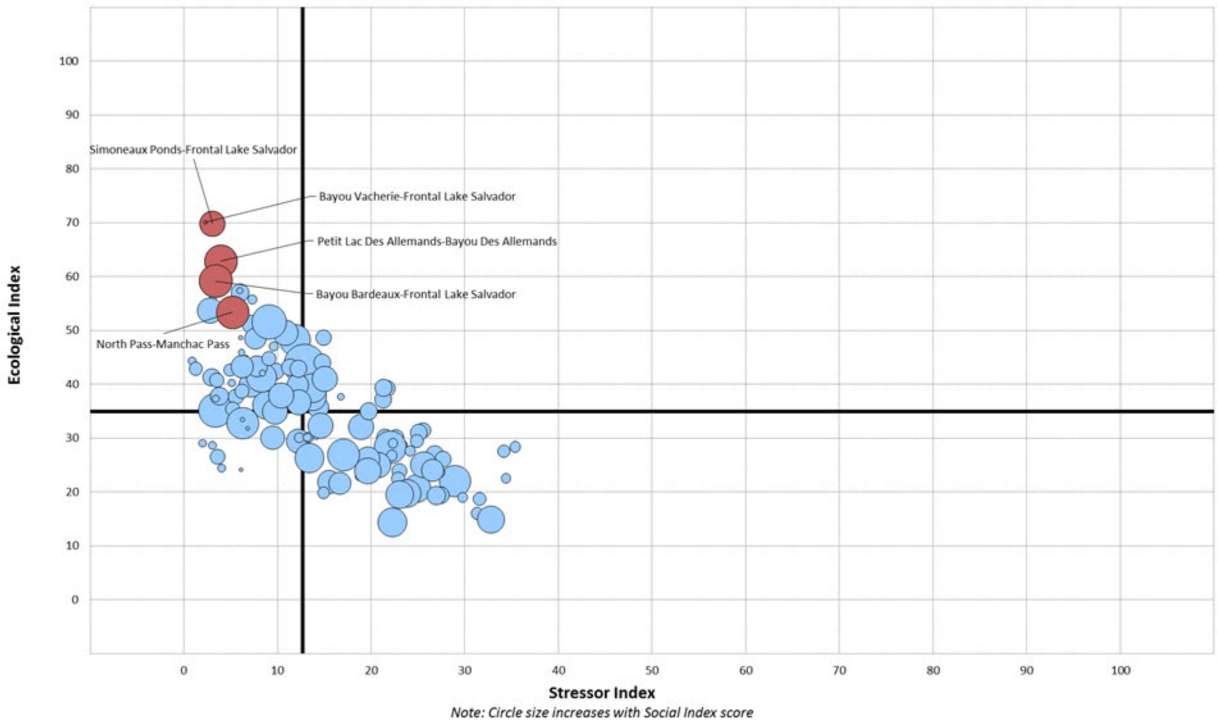


Figure 39. Bubble Plot distribution of watersheds in the original LMRAP screening.

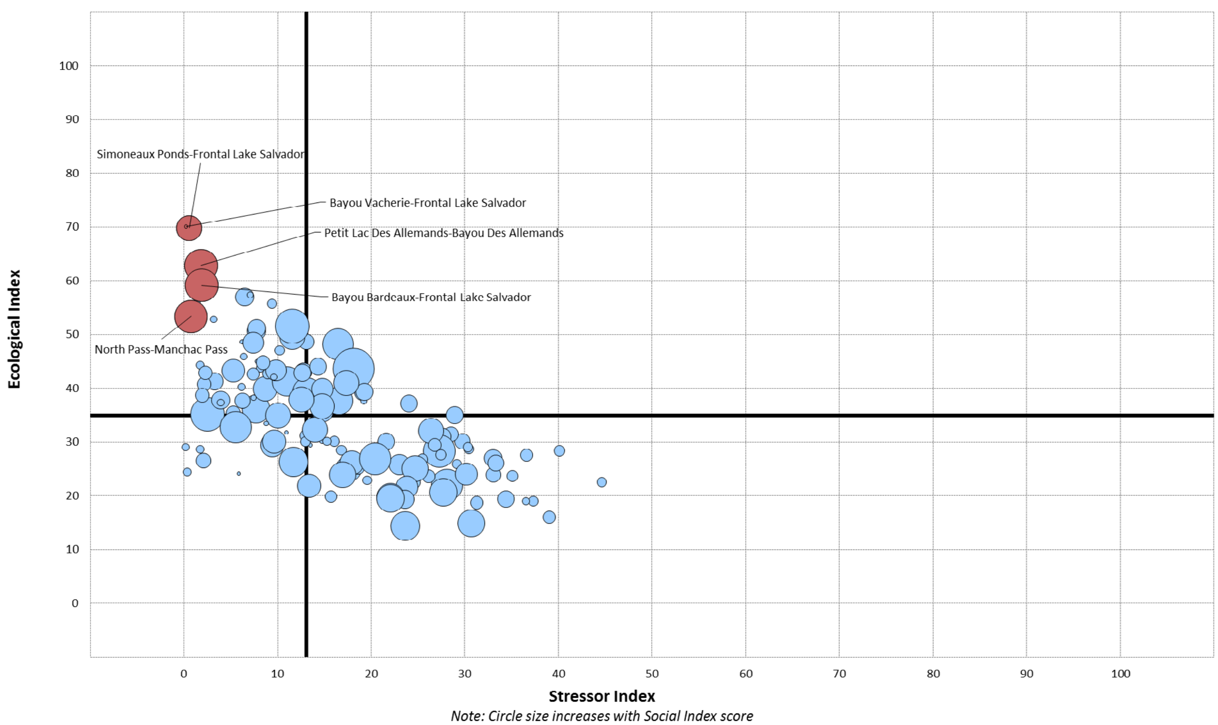


Figure 40. Bubble Plot distribution of watersheds in the simplified LMRAP screening.

Table 10. Comparison of RPI Ranks for Original and Simplified LMRAP Screening

Watershed ID	Watershed Name	Ecological Rank	Social Rank	Original Stressor Rank	Simplified Stressor Rank	Original RPI Rank	Simplified RPI Rank
080701000103	Profit Island	7	51	28	33	9	9
080702040504	North Pass-Manchac Pass	13	6	24	5	5	5
080702050403	Skulls Creek-Tangipahoa River	32	1	70	89	8	13
080903010207	Pipeline Canal-Frontal Lac des Allemands	5	133	5	5	10	8
080903010301	Petit Lac Des Allemands-Bayou Des Allemands	3	5	20	13	2	2
080903010305	Lake Cataouatche-Frontal Lake Salvador	11	29	8	9	7	6
080903010306	Simoneaux Ponds-Frontal Lake Salvador	2	27	12	4	1	1
080903010310	Bayou Bardeaux-Frontal Lake Salvador	4	4	14	14	3	3
080903010311	Bayou Vacherie-Frontal Lake Salvador	1	128	4	2	4	4
080903020108	Hanson Canal-Intracoastal Waterway	15	2	54	59	6	7

SUMMARY AND RECOMMENDATIONS

This project demonstrated the application of the LA statewide RPS Tool and a customized dataset developed for and with LA DEQ, relative to comparing watersheds for nutrients management purposes. Ecoregions and nutrient issues of interest to the State were identified by LA DEQ and utilized in developing the demonstration analyses and products contained in this report. These demonstrations highlighted many watersheds as potentially better or worse selections for nutrient management efforts, but the intent was to demonstrate the many options and methods for using the tool rather than point to specific watershed priority selections. Whereas watershed priority identification may be aided by use of the LA RPS Tool and the analyses conducted during this project, we have assumed that priority selections and decisions are to be made by the State rather than captured in the content of this report. Further, although this project focused on nutrients management, it should be noted that many other topics for watershed comparison may be supported at a basic screening level by using the LA RPS Tool, providing the same general approach is used: identifying the screening purpose of interest, identifying the scenario and its group of ‘best fit’ watersheds, selecting and weighting the most relevant indicators from the extensive data table, and then choosing from among the different indices and other outputs for the results that best support taking action.

Although all RPS data are checked for accuracy during data processing and indicator development, the RPS results should also be evaluated for reasonableness. A scenario can only be as useful as the indicators and weighting provided. It is important to select indicators relevant to the questions to be answered, and evaluate the results against what is reasonably expected. As experts in local watershed conditions, LA DEQ should review the results of the ecoregion scenario screening runs to determine whether the watersheds that are known to have high ecological integrity and relatively low stressors appear in the upper left quadrant of the bubble plot. Similarly, if there are watersheds known to be severely impaired and have degraded ecological resources, one should expect that these watersheds are located in the lower right quadrant. If the results do not bear a reasonable resemblance to expected results from known conditions and expert judgement, the scenario should be re-evaluated. The selected indicator combination or weighting may need to be adjusted. It is also possible that outlier data can skew results producing unexpected but still accurate results and insight. Many useful data sources are periodically updated, and thus LA DEQ is encouraged to watch for new or updated data sources that can be added to the RPS Tool and may also improve their screening results.

In addition to providing some nutrient-specific watershed restoration and protection information for several ecoregions, this report and the associated screening runs are intended to emphasize that RPS is a flexible methodology that synthesizes a great deal of complexity and results in a rapid, repeatable and transparent process that yields results consistent with expert judgment based on both local experience and objective outside consideration of factors important in nutrient stress and protection/recovery. This process is intended to support discussion and decision-making, not replace it.

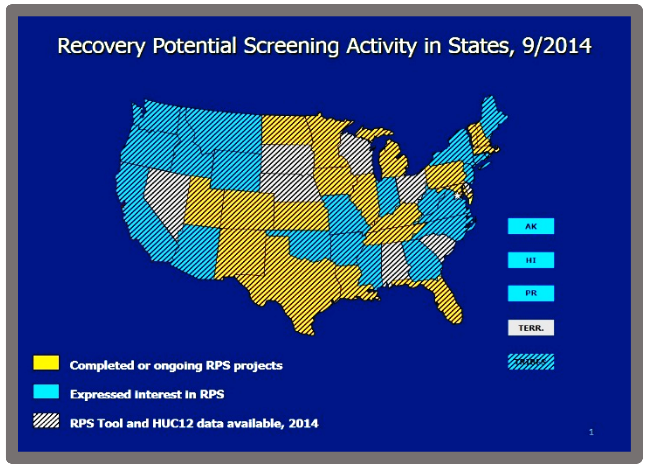
A separate copy of the RPS Tool for each of the four ecoregions in the scenarios has been archived for delivery to LA DEQ (see Attachment 4). A blank copy of the RPS Tool is also provided.

ATTACHMENTS

1. Recovery Potential Tool Fact Sheet
2. Recovery Potential Screening Tool Definitions and Louisiana Indicator definitions
3. Full HUC12 scores and ranking results
4. Supporting RPS Tool files outside of the report, including RPS Tool file copies archiving each screening performed in Stage 2, plus a blank master statewide Stage 2 file, including all new and updated indicators.

Attachment 1

RECOVERY POTENTIAL SCREENING: SUMMARY



- Recovery Potential Screening (RPS) is a systematic, comparative method for identifying differences among watersheds that may influence their relative likelihood to be successfully restored or protected. The EPA Office of Wetlands, Oceans and Watersheds (OWOW) created RPS jointly with the EPA Office of Research and Development (ORD) in 2004 to help states and others use limited restoration resources wisely, with an easy to use tool that is customizable for any geographic area of interest and a variety of specific comparison and prioritization purposes.

- The main programmatic basis for RPS includes the TMDL Program (e.g., prioritized schedule for listed waters; where best to implement TMDLs; Integrated Reporting of Priority waters under the TMDL Vision) and the Nonpoint Source Program (e.g., annual program strategies; prioritization to aid project funding decisions; collaboration with Healthy Watersheds), but several other affiliations also exist.

- Since 2005, several hundred RPS indicators have been incrementally compiled through literature review, identifying states' indicator needs and preferences, and collaboration with others (ORD EnviroAtlas, Region 4 Watershed Index). Most have been applied in a series of statewide RPS projects. In 2009, an RPS paper was published in the refereed journal *Environmental Management*. The one-stop RPS Website hosts a library of indicators, RPS Tools, case studies and step by step RPS instructions.

- As of September 2014, RPS projects and statewide databases have been either initiated or completed in 20 states (**see figure**). Approximately that many additional states have expressed interest in RPS usage, but Branch resources have not previously been able to support these requests.

- The RPS Tool is key to RPS' ease of use, widespread applicability and speed. This tool is an Excel spreadsheet that contains all watershed indicators, auto-calculates key indices, and generates rank-ordered tables, bubble plot graphics and maps that can be user-customized. Any novice Excel user can quickly become fluent in using the RPS Tool.

- Statewide RPS Tools and data have now been developed for each of the lower 48 states. These contain 207 indicators measured for every HUC12, and enable customizable desktop screening, rank ordering, graphics plotting and mapping without advanced software or training. Individual, state-specific RPS Tools were distributed to every lower 48 state and all EPA Regions in July 2014 (HI and AK in planning).

- RPS is playing/may soon play a pivotal role in each of the following:
  - Prioritizing watersheds for nutrient management (projects in 9 states)
  - Identifying state priority watersheds for TMDL Vision/Integrated Reporting 2016-2022
  - Improving state/local interactions in states with RPS projects
  - Enabling Tribes to screen and compare their watersheds for purposes similar to states
  - Helping the Healthy Watersheds program by providing a national preliminary assessment
  - Jointly (OW and EPA Region 4) creating the Watershed Index Online (WSIO) interactive tool

- Contact: Doug Norton, WB/AWPD/OWOW at norton.douglas@epa.gov or 202-566-1221.

Attachment 2: RPS Tool Definitions and Louisiana Stage 2 Scenario Indicator Definitions

RPS Tool Definitions

Term	Definition
Scenario	An RPS Scenario is the basis for identifying a group of similar watersheds of highest interest for a specific screening purpose and analyzing them based on their common characteristics. Applying the RPS tool involves identifying a specific screening purpose and related watershed setting, selecting and weighting indicators that are relevant to that setting and purpose, and calculating index scores. Using scenarios is a technique for targeting fewer, more relevant watersheds of interest for a specific purpose. For example, if agricultural nutrient pollution issues are of interest, high-agricultural watersheds with nutrient problems would be identified as fitting within the scenario, and indicators specifically relevant to agricultural nutrient sources, stressors, effects, and control options would be selected for screening and comparing these watersheds.
Screening	An RPS analysis of a set of ecological, stressor and social indicators applied to group of watersheds to help answer questions about the watersheds. To address different questions individually, multiple screenings can be run by using the same group of watersheds while changing the indicator selections or weights to be most relevant to the question at hand.
Ecological Indicator	Measure of a property that is related to the capacity to maintain or reestablish natural structure and processes. Higher values for ecological indicators imply higher recovery potential.
Stressor Indicator	Measure of a property or characteristic associated with reduced natural function due to the negative impacts of pollutants and other stressors. Higher values for stressor indicators imply lower recovery potential.
Social Indicator	Measure of a community, regulatory, economic, or behavioral characteristic that often has a profound influence on restoration success independent of the environmental factors. Higher values for social indicators imply higher recovery potential.
Index	Ecological, stressor, and social index values have a range from 0 to 100. They are each calculated by summing weight-adjusted, normalized indicator values, dividing by the total weight, and multiplying by 100. A higher index value implies higher recovery potential for ecological and social indices and the RPI score. A higher stressor index value implies a lower recovery potential.
Rank	Order of watersheds by index value. Rank of 1 is the highest ecological index, highest social index, highest RPI index or lowest stressor index value.
Recovery Potential Integrated Score	An integration of all three indices using the formula [Ecological Index + Social Index + (100 - Stressor Index)] / 3.

Louisiana Stage 2 Scenario Indicator Descriptions

Green denotes ecological indicators, red are stressor indicators, and blue are social indicators. All Louisiana specific indicators are denoted with a *. These indicators are based on data that end at the state-line, therefore watersheds were clipped to the state line and all metrics were calculated based on this area.

Indicator	Definition
% natural cover, N-index 2 (2011) in watershed	The percent of the HUC12 with natural cover (excludes barren, urban or agricultural classifications). N-index 2 cover classifications include 'Deciduous Forrest' (code 41), 'Evergreen Forest' (code 42), 'Mixed Forest' (code 43), 'Shrub/Scrub' (code 52), 'Grassland/Herbaceous' (code 71), ' Woody Wetlands' (code 90), and 'Emergent Herbaceous Wetlands' (code 95) by the 2011 National Land Cover Database. Source data used was NLCD2011 version 1.
% natural cover, N-index 2 (2011) in riparian zone	The percent area of the HUC12 boundary that is within the Riparian Zone* and classified as natural cover (excluding urban and agriculture) by the 2011 National Land Cover Database. N-index land cover classifications include 'Barren Land (Rock/Sand/Clay)' (code 31), 'Deciduous Forrest' (code 41), 'Evergreen Forest' (code 42), 'Mixed Forest' (code 43), 'Shrub/Scrub' (code 52), 'Grassland/Herbaceous' (code 71), ' Woody Wetlands' (code 90), and 'Emergent Herbaceous Wetlands' (code 95). Source data used was NLCD2011 version 1, (see metadata for more information). N-index is consistent with the Analytical Tools Interface for Landscape Assessments (ATtILA) version 2004. ATtILA user guide can be found here: http://www.epa.gov/esd/land-sci/attila/pdf/user_guide.pdf. Region 4 WSIO Version 1, October 2013. *The Riparian Zone (RZ, see metadata for more information) is determined using grid analysis to combine surface water features from NLCD2006 and NHD Plus version 2; then an approximate 100 meter buffer is placed around these features. The combination of these two datasets and all cells with a distance of 108 meters or less from surface water are included in the Riparian Zone (RZ).
% wetlands (2011) in HCZ	% of HUC12 with wetland cover in the hydrologically connected zone (2011 National Land Cover Dataset version 1; Land classes 90, 95)
% NEF2001, National Ecological Framework, WS	% of HUC12 that is National Ecological Framework 2001. NEF is the combination of Hubs & Corridors.
Watershed Mean Soil Stability	Average soil stability in HUC12. Calculated as one minus average K factor (WS_KFACTOR).
Slope, Mean Values of Watershed	Mean Slope in Watershed
Slope, Standard Deviation of Values in Watershed	Standard Deviation of Slope values in Watershed
% pasture/hay (2011) in watershed	% of HUC12 with pasture/hay cover (2011 National Land Cover Dataset version 1)
% pasture/hay (2011) in riparian zone	% of HUC12 with pasture/hay cover in the Riparian Zone (2011 National Land Cover Dataset version 1)
% cultivated crops (2011) in watershed	The percent area in a HUC12 boundary classified as 'Cultivated Crops' (code 82) by the 2011 National Land Cover Database. Source data used was NLCD2011 version 1,
% cultivated crops (2011) in riparian zone	The percent area of the HUC12 boundary that is within the Riparian Zone* and classified as 'Cultivated Crops' (code 82) by the 2011 National Land Cover Database. Source data used was NLCD2011 version 1, *The Riparian Zone (RZ, see metadata for more information) is determined using grid analysis to combine surface water features from NLCD2006 and NHD Plus version 2; then an approximate 100 meter buffer is placed around these features. The combination of these two datasets and all cells with a distance of 108 meters or less from surface water are included in the Riparian Zone (RZ).
% Contiguous Agriculture (2006) in Watershed	The percent of the HUC12 that is classified as agriculture by the 2006 National Land Cover Database and contiguous to surface water as identified by the Water Mask*. Agricultural land cover classifications include 'Pasture/Hay' (code 81), and 'Cultivated Crops' (code 82). Source data used was NLCD2006 version 1, downloaded February 2011 (see metadata for more information). Region 4 WSIO Version 1, October 2013. *The Water Mask (see metadata for more information) is determined using grid analysis to combine surface water features of NLCD2006 and NHD Plus version 2. The combination of these two datasets represents surface water and is referred to as the Water Mask.
% urban (2011) in watershed	The percent of the HUC12 classified as urban by the 2011 National Land Cover Database. Urban land cover classifications include 'Developed, Open Space' (code 21), 'Developed, Low Intensity' (code 22), 'Developed, Medium Intensity' (code 23), 'Developed, High Intensity' (code 24). Source data used was NLCD2011 version 1

Indicator	Definition
% urban (2011) in riparian zone	The percent of the HUC12 that is within the Riparian Zone* and classified as urban by the 2011 National Land Cover Database. Urban land cover classifications include 'Developed, Open Space' (code 21), 'Developed, Low Intensity' (code 22), 'Developed, Medium Intensity' (code 23), 'Developed, High Intensity' (code 24). Source data used was NLCD2011 version 1, (see metadata for more information). *The Riparian Zone (RZ, see metadata for more information) is determined using grid analysis to combine surface water features from NLCD2006 and NHD Plus version 2; then an approximate 100 meter buffer is placed around these features. The combination of these two datasets and all cells with a distance of 108 meters or less from surface water are included in the Riparian Zone (RZ).
% Developed, High intensity (2011) Riparian Zone	The percent of the HUC12 that is within the Riparian Zone and classified as high intensity developed (code 24) by the 2011 National Land Cover Database. Source data used were NLCD2011 Version 1. *The Riparian Zone (RZ, see metadata for more information) is determined using grid analysis to combine surface water features from NLCD2006 and NHD Plus version 2; then an approximate 100 meter buffer is placed around these features. The combination of these two datasets and all cells with a distance of 108 meters or less from surface water are included in the Riparian Zone (RZ).
% Developed, Medium intensity (2011) Riparian Zone	The percent of the HUC12 that is within the Riparian Zone and classified as medium intensity developed (code 23) by the 2011 National Land Cover Database. Source data used were NLCD2011 Version 1. *The Riparian Zone (RZ, see metadata for more information) is determined using grid analysis to combine surface water features from NLCD2006 and NHD Plus version 2; then an approximate 100 meter buffer is placed around these features. The combination of these two datasets and all cells with a distance of 108 meters or less from surface water are included in the Riparian Zone (RZ).
% urban change 2001-06 in watershed	The percent of HUC12 change in urban classifications from 2001 to 2006. Change was determined by comparing the 2001 and 2006 National Land Cover Change Datasets; version 1. Urban land cover classifications include 'Developed, Open Space' (code 21), 'Developed, Low Intensity' (code 22), 'Developed, Medium Intensity' (code 23), and 'Developed, High Intensity' (code 24) by the 2006 National Land Cover Database. Source data used was NLCD2006 version 1,
% urban change 2001-06 in HCZ	The percent of HUC12 change in urban classifications within the Hydrologically Connected Zone*. Change was determined by comparing the 2001 and 2006 National Land Cover Change Datasets; version 1. Urban land cover classifications include 'Developed, Open Space' (code 21), 'Developed, Low Intensity' (code 22), 'Developed, Medium Intensity' (code 23), and 'Developed, High Intensity' (code 24) by the 2006 National Land Cover Database. Source data used was NLCD2006 version 1, downloaded February 2011 (see metadata for more information). Region 4 WSIO Version 1, October 2013. *The Hydrologically Connected Zone (HCZ, see metadata for more information) is determined using grid analysis to combine surface water features from NLCD2006 and NHD Plus version 2. It also includes areas contiguous to surface water that also has a wetness index value of 550 or greater. The combination of these three datasets represents the Hydrologically Connected Zone (HCZ).
Impervious cover (2006) IC ≥ 15%, % of watershed	The percent of HUC12 with ≥ 15% impervious cover (IC). Equation: (Sum of IC pixels ≥ 15% /All HUC12 pixels) x 100. Source data used was NLCD2006 version 1 (see metadata for more information). Reference: Wickham, J. D.; Wade, T. G.; Norton, D. J.; 2014; Spatial patterns of watershed impervious cover relative to stream location; Ecological Indicators; Volume 40, May 2014, Pages 109–116.
Agricultural water use in watershed	An estimate of the water used daily for agricultural irrigation for a HUC12 in the contiguous United States (million gallons/day). Estimates include self-supplied surface and groundwater, as well as water supplied by irrigation water providers, which may include governments, companies, or other organizations. Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7BD5113083-CFCD-48EC-BC24-0ADA5B9BDDB7%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014). Region 4 WSIO Version 1.

Indicator	Definition
Watershed mean soil erodibility	Average soil erodibility (K) factor in HUC12. Calculated from the "STATSGO2" soil attribute dataset.
HCZ mean soil erodibility	Average soil erodibility (K) factor in HCZ. Calculated from the "STATSGO2 "soil attribute dataset.
Total nitrogen deposition in watershed	An estimate of the 2006 annual deposition of reduced nitrogen a HUC12 (kilograms per hectare). This map includes both dry and wet deposition of reduced nitrogen. Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B07E5D507-E1DA-40F6-8357-5A62990B0667%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014).
Synthetic nitrogen fertilizer application (kg N/ha/yr) in watershed	The mean rate of synthetic nitrogen fertilizer application to agricultural lands within a HUC12 (kg N/ha/yr). Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B09DF9B39-6CC8-4DFF-A14D-1BA14C06321F%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014).
Nitrogen/Phosphorus Fertilizer Application Rate (lb/km/yr) by Crop Type (rice, row crop no wheat, row crop with wheat)	The estimated amount of nitrogen/phosphorus fertilizer applied, in lbs/year and in lbs/km/year, by major agricultural land use groups (predominantly using 2013 USDA NASS CDL data) within each HUC-12. Average fertilizer rates were estimated from either Louisiana State University application recommendations or survey responses from USDA NASS surveys, ranging from 1998 to 2013 (depending on crop type).
% watershed stream length 303d-listed nutrients	Percent of stream features in HUC12 listed as impaired due to nutrient-related causes and requiring a TMDL under Section 303(d) of the Clean Water Act. Calculated as length of 303(d) listed nutrient impaired streams (STREAMLGTH_303D_NUTRIENTS) divided by total stream length (STREAMLGTH_NHD + STREAMLGTH_303D_CUSTOM).
% watershed waterbody area 303d-listed nutrients	Percent of assessed lakes, estuaries, and other areal water features in HUC12 listed as impaired due to nutrient-related causes and requiring a TMDL under Section 303(d) of the Clean Water Act. Calculated as area of 303(d) listed nutrient impaired waterbodies (WBAREA_303D_NUTRIENTS) divided by total waterbody area (WBAREA_NHD + WBAREA_303D_CUSTOM).
Incr Load from LA (SPARROW)	Loading contributions from instate land areas - Estimated TN or TP Load contributed from only the area within each HUC-12 that is from land within the state of Louisiana for each particular HUC-12 in kg/yr. Derived from SPARROW regional models http://cida.usgs.gov/sparrow/
Area Weighted Count of Nutrient-Related Non-compliant Watershed Inspections (#/sq mi)	Count of only nutrient-related, non-compliant watershed inspections divided by the Watershed Segment area for weighting purposes. Note that multiple Watershed Segment areas were sometimes grouped together for Inspection Counts and were therefore merged into one polygon for this analysis. Also, Watershed Segment areas, or merged Watershed Segment areas, often include many HUC-12 watersheds and so each HUC-12 will get assigned the same area-weighted count.
% watershed that is protected lands (any IUNC status watershed)	The percentage of land within a HUC12 that is protected. It includes all lands that have been classified by International Union for Conservation of Nature (IUCN) as protected areas. Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7BC5FFDE8E-7C27-4F50-AFEF-082E8A08C00A%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014).

Indicator	Definition
% watershed that is protected lands (GAP status 1 and 2, 3)	The percent of land within a HUC12 that is designated as Status 1 or 2 under the USGS Gap Analysis Program. These lands have permanent protections in place limiting visitation, use, and human impacts. Lands with status 1 have more restrictions in place to minimize disturbance and maintain the land's natural state. Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7BC5FFDE8E-7C27-4F50-AFEF-082E8A08C00A%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014).
% watershed that is protected lands (GAP status 3)	The percent of land within a HUC12 that is designated as Status 3 under the USGS Gap Analysis Program. These areas have permanent protection from conversion of natural land cover for the majority of area. Subject to extractive uses of either broad, low-intensity type (e.g.. Logging) or localized intense type (e.g.. Mining). Confers protection to federally listed endangered and threatened species throughout the area. Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7BC5FFDE8E-7C27-4F50-AFEF-082E8A08C00A%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014).
Percent potentially restorable wetlands in watershed	An estimate of the percent of land within a HUC12 that may be suitable for wetland restoration. Metadata can be found here: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B80AFCF1D-0C2B-4E4A-B07A-B2B57E6772D5%7D. This dataset was created through the EnviroAtlas development effort. EnviroAtlas is a collection of interactive tools and resources that allows users to explore the many benefits people receive from nature, often referred to as ecosystem services. Additional information can be found here: http://enviroatlas.epa.gov/enviroatlas/atlas.html and http://enviroatlas.epa.gov/EnviroAtlas/DataFactSheets. Method: The EnviroAtlas HUC12 table was translated to WBD HUC12s (August 2014).
% of HUC12 Instate (LA)	Percent of the HUC that is contained within the state of Louisiana.
% drinking water source protection area in watershed	Percent of total watershed area designated as drinking water source protection area (SPA). Based on state data consolidated by EPA in SDWIS SAFE DRINKING WATER INFORMATION SYSTEM (http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/index.cfm) processed March 2014. Includes areas protecting surface drinking water sources but not groundwater drinking sources. Multiple drinking water sources and their individual SPAs can occur and overlap. Each SPA % of area is counted individually and added, thus total values can exceed 100%.
Watershed Group WS	Count of groups listed under EPA's Adopt-a-Watershed Program website (http://water.epa.gov/action/adopt/index.cfm) as well as those provided by Louisiana within each watershed.
Area Weighted Count of Watershed Inspections (#/sq mi)	Count of watershed inspections divided by the Watershed Segment area for weighting purposes. Note that multiple Watershed Segment areas were sometimes grouped together for Inspection Counts and were therefore merged into one polygon for this analysis. Also, Watershed Segment areas, or merged Watershed Segment areas, often include many HUC-12 watersheds and so each HUC-12 will get assigned the same area-weighted count.
Area Weighted Count of Nutrient-Related Watershed Inspections (#/sq mi)	Count of only nutrient-related watershed inspections divided by the Watershed Segment area for weighting purposes. Note that multiple Watershed Segment areas were sometimes grouped together for Inspection Counts and were therefore merged into one polygon for this analysis. Also, Watershed Segment areas, or merged Watershed Segment areas, often include many HUC-12 watersheds and so each HUC-12 will get assigned the same area-weighted count.