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

INTRODUCTION

The US Environmental Protection Agency's (EPA's) Total Maximum Daily Loads (TMDL) Program, in cooperation with state water quality programs, released a long-term TMDL Vision document in December 2013. Part of the TMDL Vision involves increasing states' identification of priority watersheds for restoration and protection efforts over a several-year time frame, and better linkage of TMDLs to these priorities. Previously, a 2011 Office of Water policy memorandum on nutrients had also recommended systematic watershed analysis, comparison and priority setting to obtain better results. 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 Iowa, to jointly carry out RPS assessments and develop results to help states consider their watershed nutrient management options systematically with consistent data. These RPS assessments were designed to address primary nutrient-related issues identified by each state using state-specific indicators and data relevant for watershed comparison. This report summarizes the Iowa project approach and findings, and identifies multiple additional products (e.g., RPS Tools and data files) that were developed along with this overview document.

Background

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 RPS approach involves identifying a group of watersheds to be compared and a specific purpose for comparison, selecting appropriate indicators in three categories (Ecological, Stressor, Social), calculating index values for the watersheds, and applying the results in strategic planning and prioritization. EPA developed RPS to provide states and other restoration planners with a systematic, flexible tool that could help them compare watershed differences in terms of key environmental and social factors affecting prospects for restoration success. As such, RPS provides water programs with 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 (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. EPA developed the RPS tools with embedded indicator data for each of the conterminous states and other selected geographic areas of interest.

Iowa Department of Natural Resources (DNR) requested assistance from EPA in 2014 to further the State's efforts to compare watersheds for potential nutrient management efforts at statewide and watershed management authority (WMA) scales. An RPS assessment project was jointly undertaken by EPA's TMDL program, Tetra Tech and Cadmus (EPA contractors), and DNR. Base, ecological, stressor, and social indicators were measured from State and federal data sources (262 at HUC12 scale, 95 at the HUC8 scale), and compiled in an Iowa Statewide RPS tool (Excel file). DNR contributed to the development of the tool by providing readily available statewide data for indicators relevant to the focus on nutrients management, and by helping craft the analysis stages and issues/questions that were used to illustrate potential use of the tool. Demonstrations within this report were contractor-designed, and the assessment findings and figures in this document were generated by the Iowa RPS tool.

APPROACH

As a starting point, each RPS nutrient project was designed to apply recommendations from the [EPA Office of Water 2011 nutrient 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) and 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 and P load reduction activities. Prioritization of sub-watersheds should reflect an evaluation of receiving water problems, public and private drinking water supply impacts, N and P loadings, opportunity to address high-risk N and P problems, or other related factors.*

The two-stage approach implicit in the text above fits well with the RPS tool, which supports comparing HUC8 watersheds in an initial targeting stage and then focuses on screening and comparing HUC12s in a second, implementation-oriented stage, as illustrated in Figure 1. All of the RPS nutrient projects utilize the same general two stage approach (HUC8 or similar larger-scale unit in Stage 1, HUC12 in Stage 2), while encouraging state-specific customization of the approach in identifying stage 1 scenarios, establishing state approaches for priority watershed identification, and selection and weighting of the most nutrient-relevant indicators for use in both stages. In this project, the data sources and indicators compiled in the RPS tool, the selections of indicators, choice of demonstration watersheds, and weighting of indicators in the nutrient-related screening runs all took place collaboratively among DNR, EPA and its contractor. Nevertheless, this technical project's findings and outputs are not meant to represent decisions or policies of DNR, EPA, or any other entity.

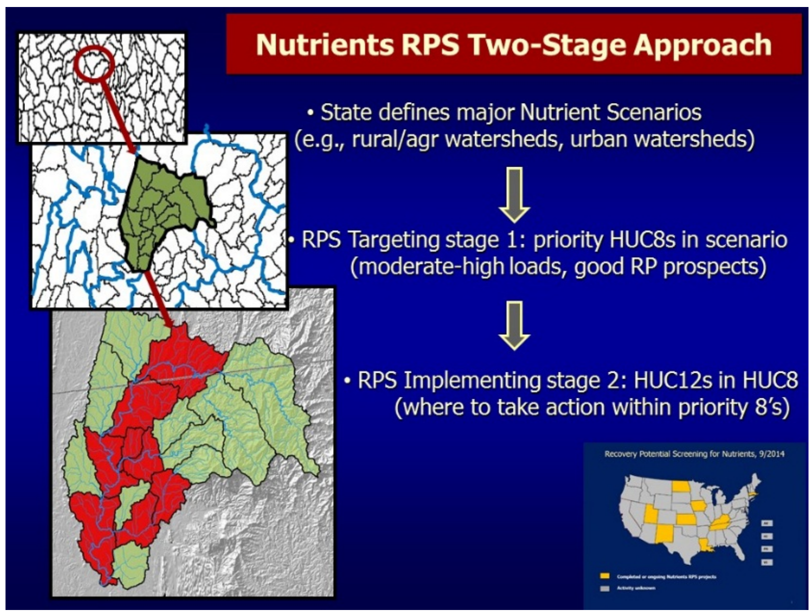


Figure 1. Two-stage conceptual approach utilized in RPS projects for supporting state nutrient management.

Use of RPS Screening Results

Any comparisons made with multi-metric combinations of indicators are highly dependent on the indicators selected and the way they are combined to yield a score. The availability of high quality data and good indicator choices relevant to the screening purpose can substantially improve usefulness; nevertheless, multi-metric tool products such as RPS outputs are best considered to be generalized results. Further, the value of the RPS screening results is not in a single, bottom-line score (although that is available as the RPI score), but rather in producing separate ecological, stressor, and social index scores as well as individual indicator scores, any one of which might be the most appropriate choice for making a more focused watershed comparison. Also, RPS index scores represent a gradient of relative values across only the watersheds being screened, and do not in themselves identify absolute thresholds such as healthy/unhealthy or restorable/unrestorable.

The directionality of RPS scores (i.e., why certain watersheds score "better") also needs to be well understood to use RPS results appropriately. The better scoring watersheds from a basic, statewide RPS analysis will be those that are either currently healthy or relatively closer than most to meeting water quality standards, based on higher ecological and social scores and lower stressor scores. Lightly to moderately impaired watersheds score as better prospects for restoration than severely impaired, but this initial result needn't imply inability to consider more impaired watersheds. The RPS tool's flexibility still enables comparisons among watersheds with substantial pollution problems by screening as a group only the watersheds that exceed a threshold, such as those exceeding the statewide median values for nutrient loading estimates. Even though comparing significantly impaired watersheds, RPS results in this case still reveal differences in their likelihood of restorability based on the degree to which ecologically and socially positive traits may help counteract the magnitude of impairment. This approach was used in some parts of this study because of the importance of addressing relatively high loading levels as well as restorability-related traits in Iowa.

Stage 1: Defining Screening Scenarios

The RPS tool is most effective in comparing groups of watersheds that share some commonalities, 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, usually at the HUC8 scale (Figure 2), with something in common regarding their primary nutrient management challenges. The term "scenario" is used here to describe these sets of shared characteristics that provide a basis for groups of similar watersheds to be compared and contrasted with one another effectively.

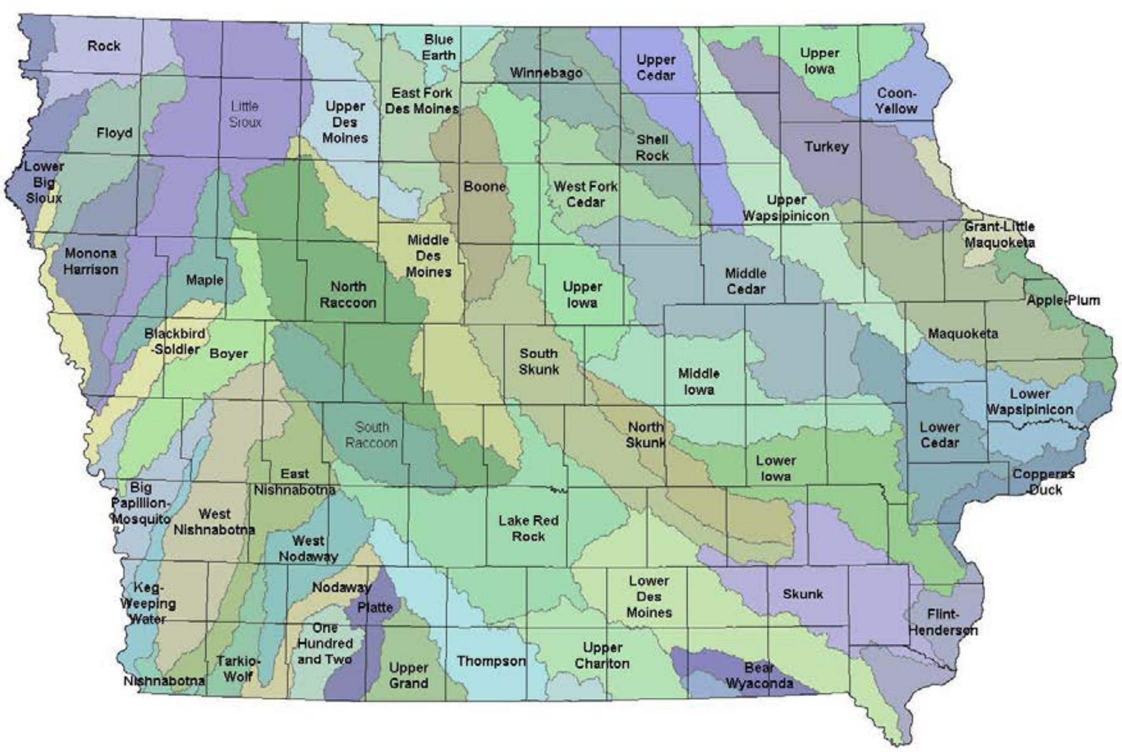


Figure 2. Iowa HUC8 watersheds.

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 (e.g., all mainly agricultural watersheds in one group and all urban/suburban-influenced watersheds in another) and focusing on scenarios most relevant to each group enables a better focus on their respective nutrient issues and possible solutions. For Iowa, three Stage 1 scenarios of interest were initially selected during a series of conference calls between EPA, DNR, and Tetra Tech. Each of these scenarios are at the HUC8 watershed scale.

Scenario 1: Comparison with an Existing Iowa Watershed Prioritization. The purpose of this scenario is to compare the State's Water Quality Initiative (WQI) watershed prioritization developed in the Nutrient Reduction Strategy with those watersheds typically identified through RPS when using similar indicators to the extent possible. All HUC8 watersheds in the State were initially included in this scenario to allow comparison to the nine WQI priority watersheds. This scenario's results show and discuss the similarities and differences between the RPS higher-scoring watersheds based on each of four indices (although RPS priorities were not selected) and the WQI priority watersheds. Further, the nine WQI watersheds are comparable to one another via the RPS screening and scoring.

The WQI priority watersheds (Figure 3) were selected because they have high nutrient loads and concentrations, more than one major point source in the watershed, are geographically distributed around the State, and have a range of activities in the watershed. Although these WQI criteria could not be duplicated exactly in the choice of RPS indicators, plausible substitutes were used wherever possible in the RPS stressor and social indicator categories. In addition, ecological indicators (not part of the WQI criteria) had to be added to the RPS for proper tool function. Actual scenario 1 indicator selections are further discussed in the upcoming section, Stage 1 Results.

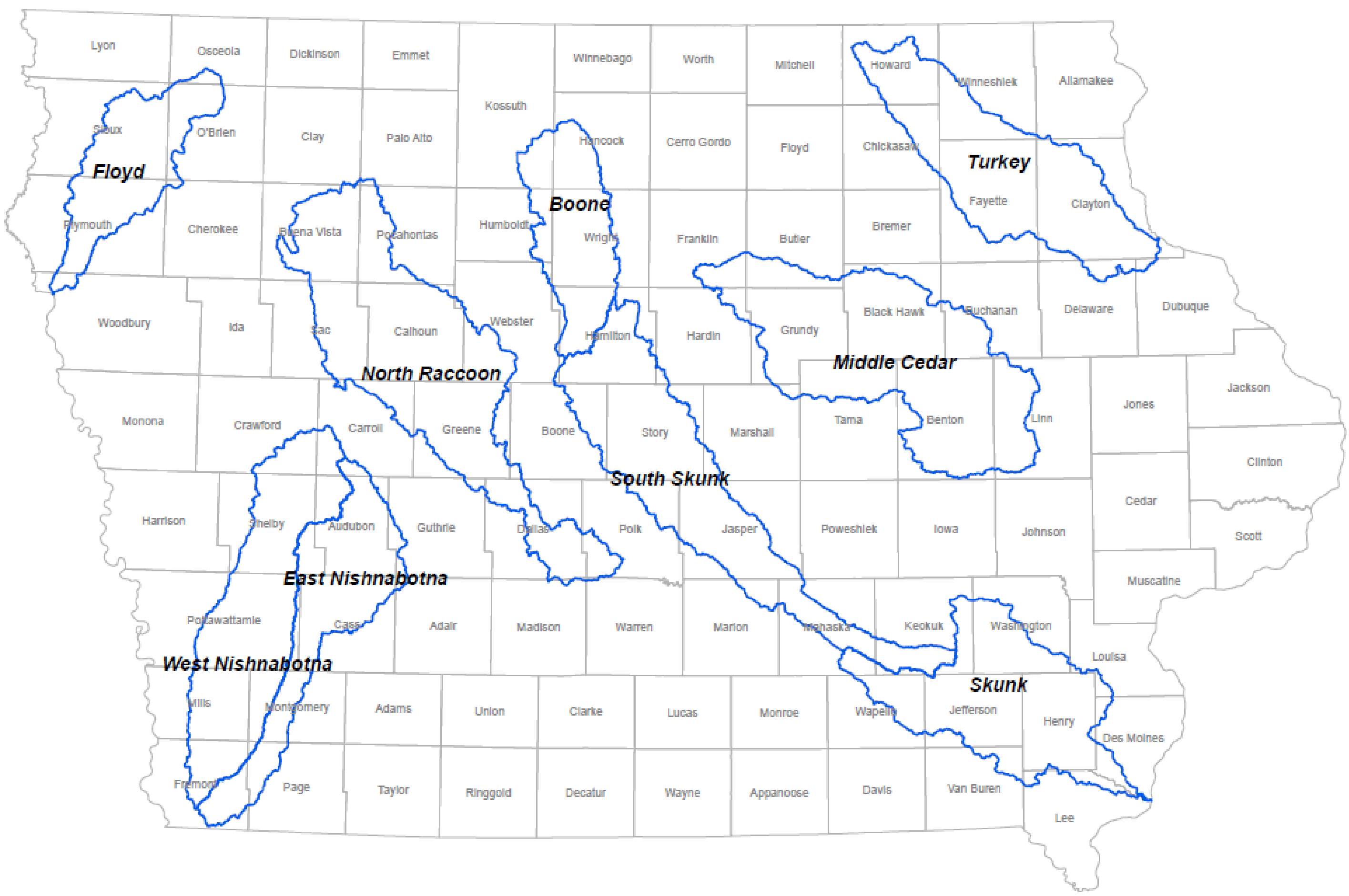


Figure 3. Iowa's WQI priority watersheds.

Scenario 2: Watersheds with Elevated Nitrogen Loading. This scenario includes and compares HUC8 watersheds with estimated high levels of nitrogen loading that are of higher interest for rural nutrient management efforts. Figure 4 illustrates the nitrogen yields by HUC8 watershed as monitored and reported by the State; yields greater than the State-wide median provide the basis for selection for this scenario. Nitrogen sources and pathways in these watersheds are primarily driven by intensity of row crop production and the degree of agricultural subsurface (tile) drainage. This scenario includes watersheds with high levels of row crops, potentially tile drained lands and higher rates of nitrogen fertilizer application. High-nitrogen watersheds which have relatively good ecological indicators (higher level of natural cover in the watershed and riparian area and lower level of human disturbance) and signs of social readiness to implement nutrient management actions generally scored as having higher recovery potential.

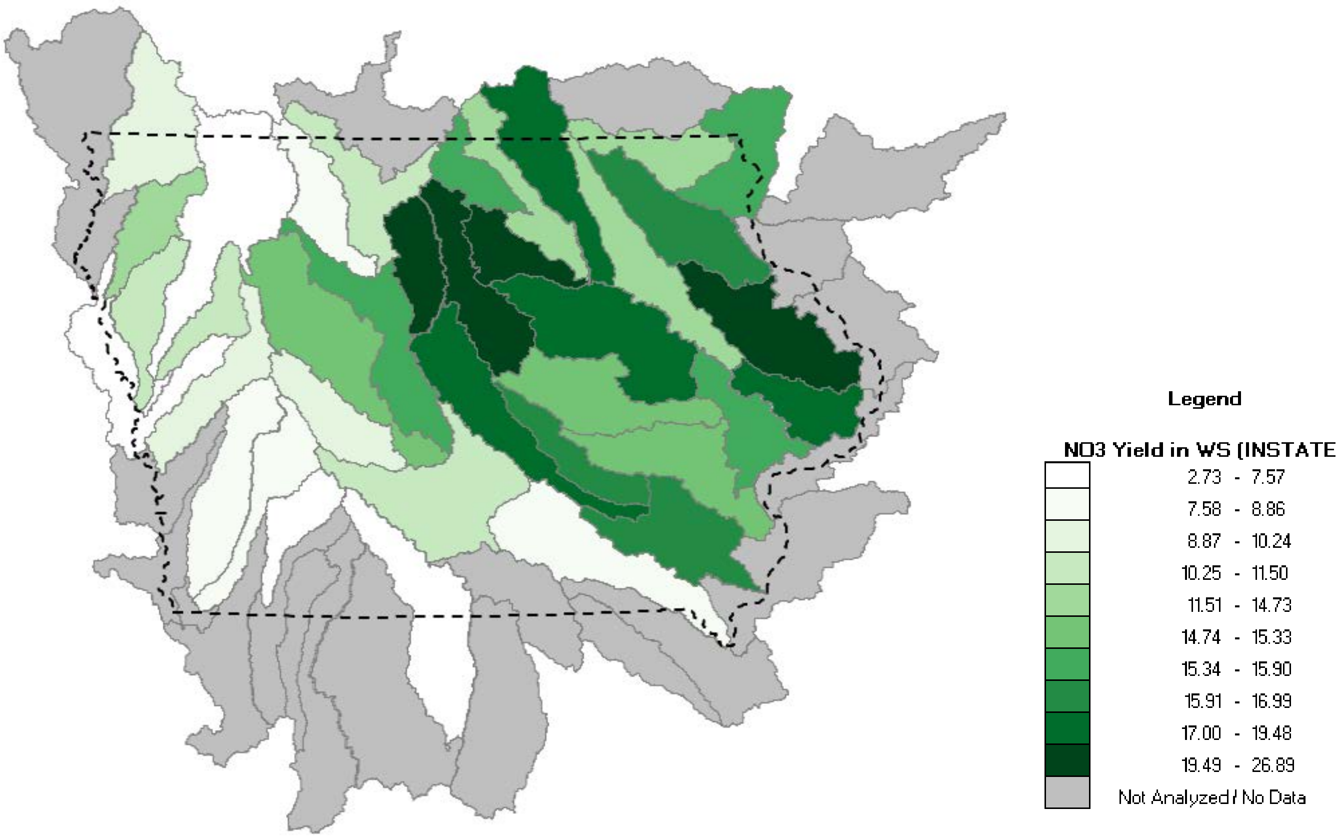


Figure 4. Nitrogen (NO3) yields from monitored watersheds.

Scenario 3: Watersheds with Elevated Phosphorus Loading. Watersheds in this scenario may present opportunities for phosphorus reduction. Figure 5 illustrates the phosphorus yields by HUC8 watershed as monitored and reported by the State, with those greater than the statewide median selected for this scenario; one HUC8 (Upper Chariton) without reported phosphorus yield data was added by the State due to high interest and past activity in phosphorus management. Phosphorus sources and pathways are primarily driven by sediment transport and a mix of non-point and point sources. Row crops, animal agriculture activities, phosphorus in the soils, and point sources that discharge nutrients are potential stressors in these watersheds. Watersheds which have relatively good ecological indicators (higher level of natural cover in the watershed and riparian area and lower levels of human disturbance) and signs of social readiness to implement are ranked higher.

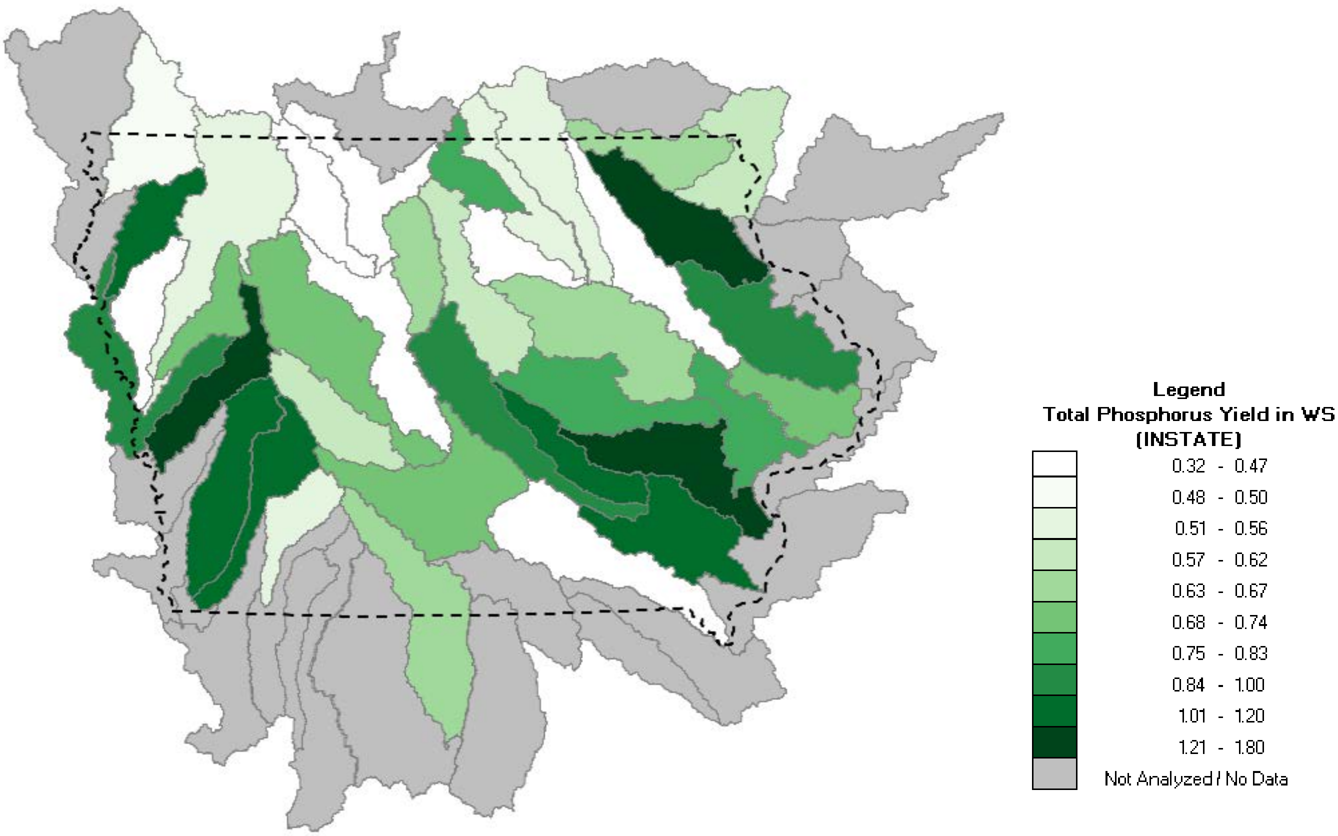


Figure 5. Phosphorus yields from monitored watersheds.

Interpreting Stage 1 RPS Screening Outputs

Several products are generated through the screening runs for each scenario. Each watershed in a scenario screening run receives ecological, stressor, and social index scores and ranks. There is also an aggregate Recovery Potential Integrated (RPI) score and rank for each watershed. Each of these four index values have a possible range from 0 to 100. The ecological, stressor and social indices 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. Note that all scores represent a relative gradient of values only across the watersheds being screened, and do not by themselves define thresholds of condition (e.g., impaired/unimpaired) or restorability.

A higher index score implies a watershed may be better suited than others for restoration in the case of the ecological and social indices and the overall RPI. On the other hand, a higher stressor index score implies lower relative recovery potential. In the case of rank order, all four indices (ecological, stressor, social and RPI) are rank ordered so that a smaller number (e.g., #1 ranked) always implies higher relative recovery potential. Index and single indicator values per watershed can be viewed in the RPS Tool as tables of numeric values, color coded maps, or bubble plots.

Maps illustrating the watersheds in the screening run are generated by the RPS Tool. The map can be customized to display values for each of the watersheds based on any index or single indicator, and map images can be saved and downloaded. The RPI score is the default map display and provides a commonly used parameter to illustrate the spatial distribution of scores around the State among the watersheds and their general ranking in the screening run. The map can display every index, rank order, and single indicator value within the Tool, even those not used in the screening.

Bubble plots are also produced for each screening run. These provide a second type of visual tool for comparing the distribution of ecological, stressor and social indices across all watersheds in the screening run. Each watershed is represented by a bubble symbol on the plot, and individual watersheds can be color coded and labeled for specific display purposes. The Y and X axes represent the Ecological and Stressor Index scores respectively and the size of the symbol indicates each watershed's social score. The bubble plot's set of extra axes are the median stressor and ecological scores. These axes split the plot into four quadrants that offer a simple starting point for comparing watersheds. For example, watersheds in the upper left quadrant have high ecological scores and low stressor scores, thus implying they may be easier than most to protect or restore; the upper right quadrant's high ecological and high stressor scores, on the other hand, may imply a growing risk of degradation and urgency for action before currently good conditions further degrade. Users may also reset these axes to represent statewide median values or user-defined values, providing more reference context to the relative value gradient of the screened watersheds. Like the map, bubble plot images can be saved and downloaded for later use in documents and presentations. Whereas there is no absolute rule dictating what the actual recovery potential of a watershed is based on these plots, the relative position of HUC8s within these plots may help guide discussion.

For additional information on using the RPS Tool and any of these product formats please see the RPS Tool User Manual and other user support resources online.

STAGE 1 RESULTS

Screening results for each of the three stage 1 scenarios are presented below. The RPS Tool outputs include tabular indices and rank ordering, bubble plots, and maps. Screening results in all these formats are presented for each scenario, as each format offers different insights as to how the watersheds compare. All products were generated by the RPS Tool. Archived copies of the RPS Tool containing the saved results of each scenario's screening run are being delivered to the State along with this project report.

Selection of Stage 1 Indicators

Watersheds within each scenario can be compared to one another with scenario-specific indicator selections since each scenario differs in nutrient source types and exposure pathways. Indicators for Stage 1 need only to be sufficient for generally comparing watersheds across the State, identifying which watersheds to include in each scenario, and revealing major differences in condition and estimated nutrient loading magnitude as a State selects its first watersheds to assess within each scenario. Using the RPS tool, three different, scenario-specific selections of recovery potential indicators (see indicator lists in Table 1 and definitions in Attachment 2) were used to screen Iowa HUC8 watersheds. In all of these scenarios, indicators are weighted equally. In future analyses, weighting indicators can be used to refine this screening analysis. Indicator weights can be adjusted depending on the purpose of the analysis.

*Table 1. Stage 1 RPS indicator selections and weights for screening and comparing HUC8 watersheds for three Iowa scenarios. See Attachment 2 for indicator definitions. Those indicators with a * are derived from State-specific datasets.*

Scenario 1: Comparison with WQI Watershed Prioritization					
Ecological Indicators	**wt**	**Stressor Indicators**	**wt**	**Social Indicators**	**wt**
% Natural Cover in Watershed*	1	% Row Crop in Watershed*	1	% of HUC8 in Iowa	1
% Natural Cover in Hydrologically Connected Zone*	1	% Cut Hay in Watershed*	1	% Watershed Management Authorities in Watershed*	1
National Fish Habitat Partnership Habitat Condition Index	1	Total Phosphorus Concentration in Watershed*	1	% of Watershed Covered by Conservation Activities*	1
		Total Phosphorus Yield in Watershed*	1	Nutrient TMDL Count	1
		Nitrate Yield in Watershed*	1		
		Nitrate Concentration in Watershed*	1		
		Sum of Maximum Flow from Wastewater Treatment Plants in Watershed*	1		

Scenario 2: Nitrogen Loading					
Ecological Indicators	**wt**	**Stressor Indicators**	**wt**	**Social Indicators**	**wt**
% Natural Cover in Watershed*	1	% Row Crop in Watershed*	1	% of HUC8 in Iowa	1
% Natural Cover in Hydrologically Connected Zone*	1	% Tile Drained Soil in Watershed*	1	% Watershed Management Authorities in Watershed*	1
National Fish Habitat Partnership Habitat Condition Index	1	Nitrate Yield in Watershed*	1	Percent Drinking Water Source Protection Area in Watershed	1
		Total Nitrogen Applied in Watershed*	1	Nutrient TMDL Count	1
Scenario 3: Phosphorus Loading					
Ecological Indicators	**wt**	**Stressor Indicators**	**wt**	**Social Indicators**	**wt**
% Natural Cover in Watershed*	1	% Row Crop in Watershed*	1	% of HUC8 Iowa	1
% Natural Cover in Hydrologically Connected Zone*	1	Count of Animals in Watershed*	1	% Watershed Management Authorities in Watershed*	1
National Fish Habitat Partnership Habitat Condition Index	1	Total Phosphorus Yield in Watershed*	1	% GAP Status 1, 2, and 3 in Watershed	1
		Median Bray Phosphorus Value in Watershed*	1	Nutrient TMDL Count	1
		Sum of Maximum Flow from Wastewater Treatment Plants in Watershed*	1		
		Count of Nutrient-Related Stream Impairments in Watershed*	1		
		Count of Nutrient-Related Lake Impairments in Watershed*	1		

Scenario 1: Comparison with Existing Iowa WQI Watershed Prioritization

This scenario compares all HUC8 watersheds in the State according to RPS characteristics similar but not identical to Iowa's prioritization criteria used in the State's selection of Water Quality Initiative (WQI) watersheds. The HUC8 statewide values for each of the four RPS indices (ecological, stressor, social, and integrated) are used below to compare and contrast RPS results statewide with the results of the WQI prioritization. Throughout these results, the nine WQI priority watersheds can be compared with one another as a group as well as compared and contrasted with non-WQI watersheds based on the RPS analysis.

Recovery Potential Integrated (RPI) scores for scenario 1 are displayed in map form in Figure 6 for all Iowa watersheds, including the 9 State WQI HUCs (yellow borders). The RPI score is a composite of scores for the Ecological, Stressor, and Social Indices that generalizes overall restorability. The figure shows that the highest RPS scores (darkest blue) have limited overlap with the WQI priority HUCs. This is to be expected due to the fact that in a statewide screening RPS naturally highlights the less-impacted watersheds, whereas WQI priorities were influenced by targeting higher-loading scenarios. One of the key differences between the RPS screening and Iowa's WQI prioritization is the addition of ecological indicators to the RPS ranking. The RPS approach also did not include consideration of watershed distribution around the State, ranking watersheds on scores alone. The WQI prioritization completed as part of the State's Nutrient Reduction Strategy targeted watersheds with high nutrient losses/concentrations, and intentionally distributed watershed selections around the State.

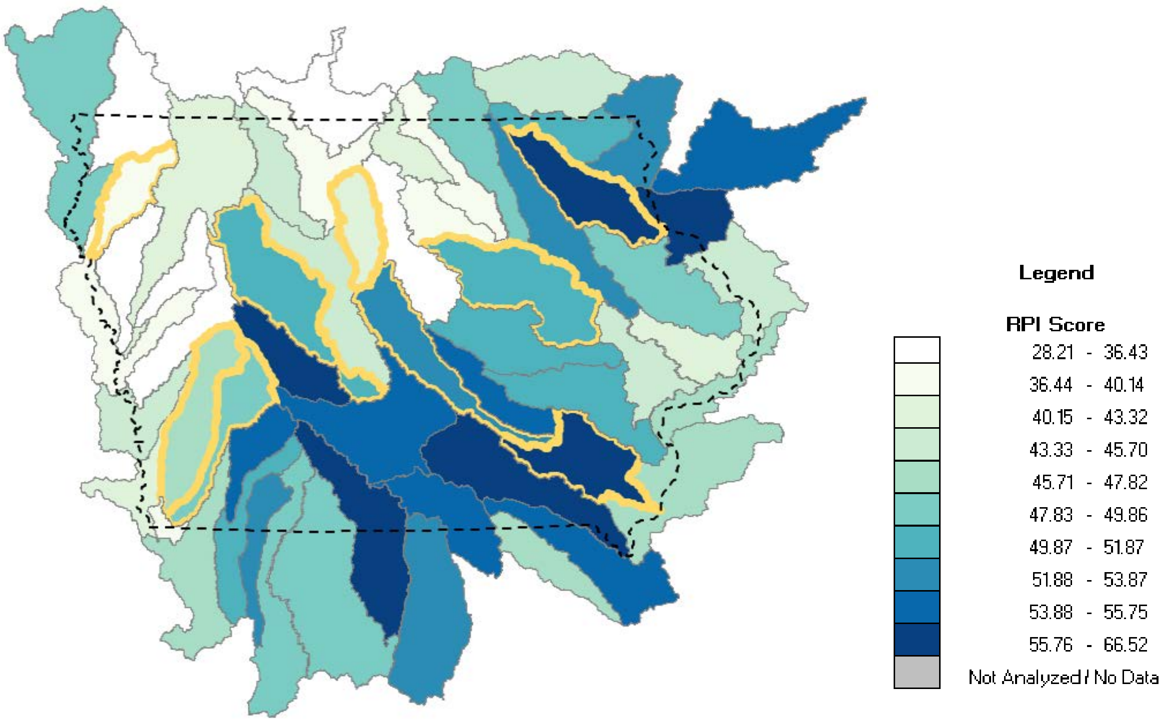


Figure 6. Scenario 1 comparison of a statewide watershed ranking by RPI score (darker blue implies better for restoration) to existing Iowa WQI priority watersheds (outlined in yellow).

Table 2 compares rank order of Iowa's nine WQI watersheds based on the RPI score for all HUC8s statewide. The nine WQI HUCs have a remarkably wide span in RPI rank (from #2 to #51 of 57 HUC8s statewide), suggesting that the WQI priorities were open to selecting watersheds with substantial nutrient loading reduction needs and did not exclusively seek watersheds that may be easier to restore. Turkey and Skunk were the two WQI HUCs that scored very highly, whereas Boone and Floyd were the lowest scoring in the RPS comparative screening.

Table 2. Comparison of Iowa priority watersheds and RPI score rank order.

Iowa Prioritized Watersheds	Statewide RPI Score Rank (out of 57 HUC8s Statewide)
Turkey	2
Skunk	6
South Skunk	17
North Raccoon	19
Middle Cedar	22
East Nishnabotna	24
West Nishnabotna	33
Boone	43
Floyd	51

The RPI score may add insight to the existing Iowa WQI prioritization in showing that "recovery" in some of the WQI watersheds may be more challenging than others because they have higher magnitude loading changes to accomplish. On the other hand, the goal of the WQI prioritization is to maximize nutrient reductions, not achieve "recovery," thus the top-ranked watersheds from RPS are expected to be different. The nine Iowa priority watersheds vary substantially in RPI score in comparison to all 57 HUC8s Statewide. Four of nine do rank in the top third, which shows some agreement between RPS and State results. Five others, however, scored significantly lower -- because the State WQI targeted watersheds with the highest nutrient loads in order to maximize reductions of nutrients, rather than fully "restore" watersheds. Although these RPS results aren't meant to challenge the State WQI selections, they may reveal that some of the lowest-scoring State WQI HUC8s could represent more difficult settings in which to make progress in nutrients management while others may be much better prospects that nevertheless still have significant nutrient management needs. Also, the results reveal other HUC8s that score well and might be suitable additional candidates for future restoration investments.

Examining the individual index maps (Ecological, Stressor, Social) for this screening reveals more about each watershed than its overall RPI score alone, and their strengths or weaknesses in a specific index may be relevant to their relative standing statewide. Maps of Ecological and Stressor Index scores for scenario 1 are displayed in Figure 7 and Figure 8. Most of the WQI watersheds score low on the Ecological index as ecological factors were not directly considered in the WQI choices. Some non-WQI watersheds with higher Ecological scores or lower (better) Stressor scores may be of interest. One notable watershed is Lake Red Rock that includes the city of Des Moines. This watershed has a fairly high Ecological Index score and also a high (poor) Stressor Index score. This watershed is approximately 54% natural cover, 38% row crop, 8% developed, and has the highest wastewater flow in the State. In contrast, the Little Sioux watershed has a low Ecological Index score and a lower (fairly good) Stressor Index score. This watershed is 22% natural cover, 72% row crop, and 6% developed with lower than average nutrient yields and average maximum wastewater flow. Additional indicators or different screenings may be warranted to refine interpretation of the relative differences in recovery potential among other non-WQI watersheds.

Figure 9 displays the Social Index score for scenario 1. This index tracks particularly well with the state's priority watersheds. The state's priority watersheds rank in the top quartile for Social Index scores. Each of these watersheds are 100% covered by conservation activities in the watershed (e.g., Active Mississippi River Basin Healthy Watersheds Initiative, Watershed Improvement Review Board, approved Section 319 Watershed Management Plans, Water Quality Initiative Targeted Watershed Demonstration Projects, and Watershed Protection Fund initiatives).

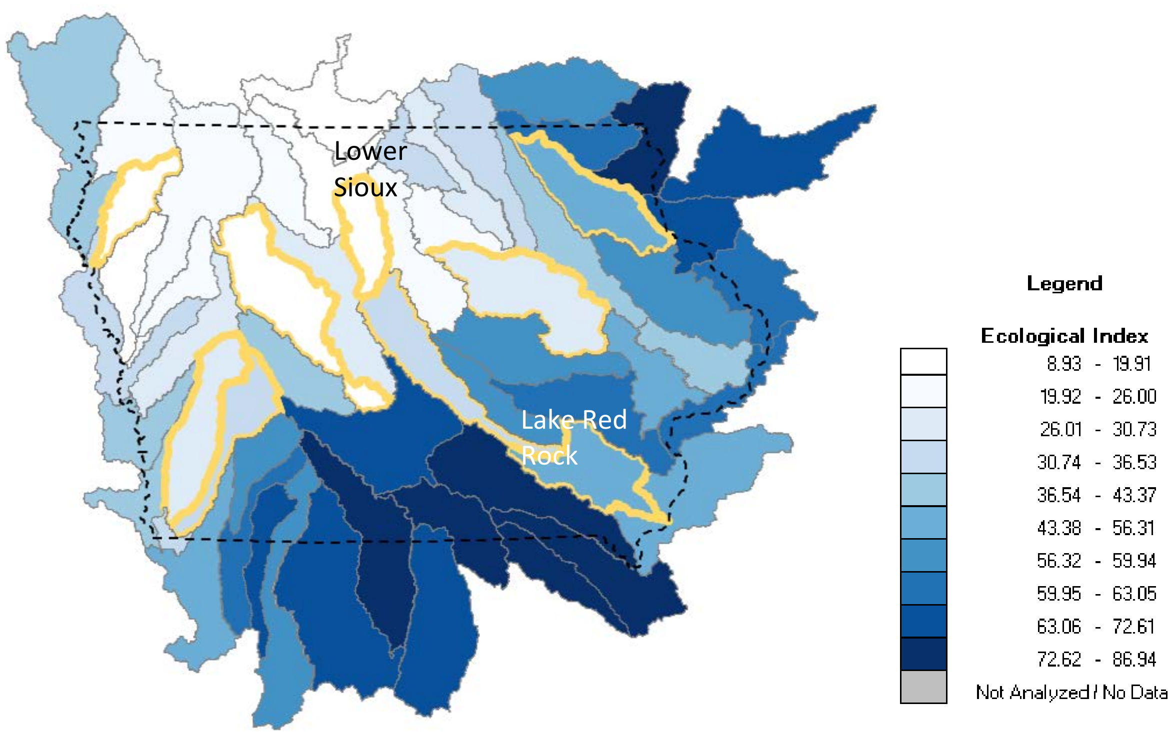


Figure 7. Ecological ranking (darker blue implies better for restoration or greater ecological function); yellow outlines are existing WQI priority watersheds.

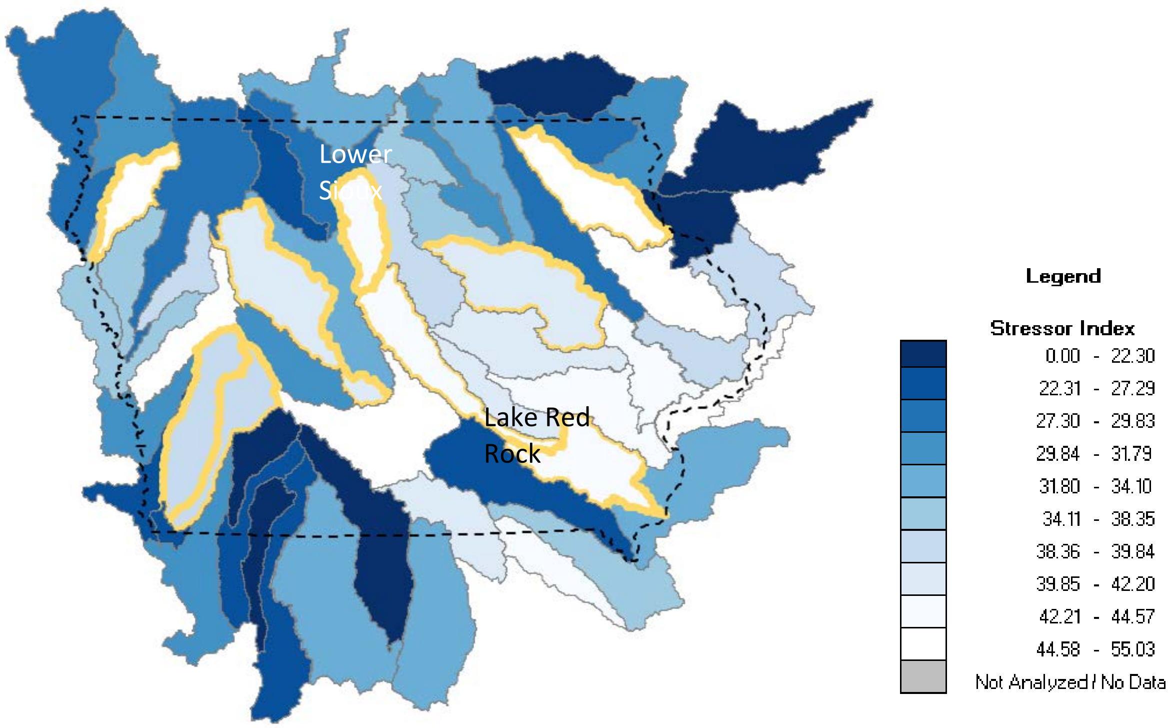


Figure 8. Stressor ranking (darker blue implies better for restoration or less watershed stress); yellow outlines are existing WQI priority watersheds.

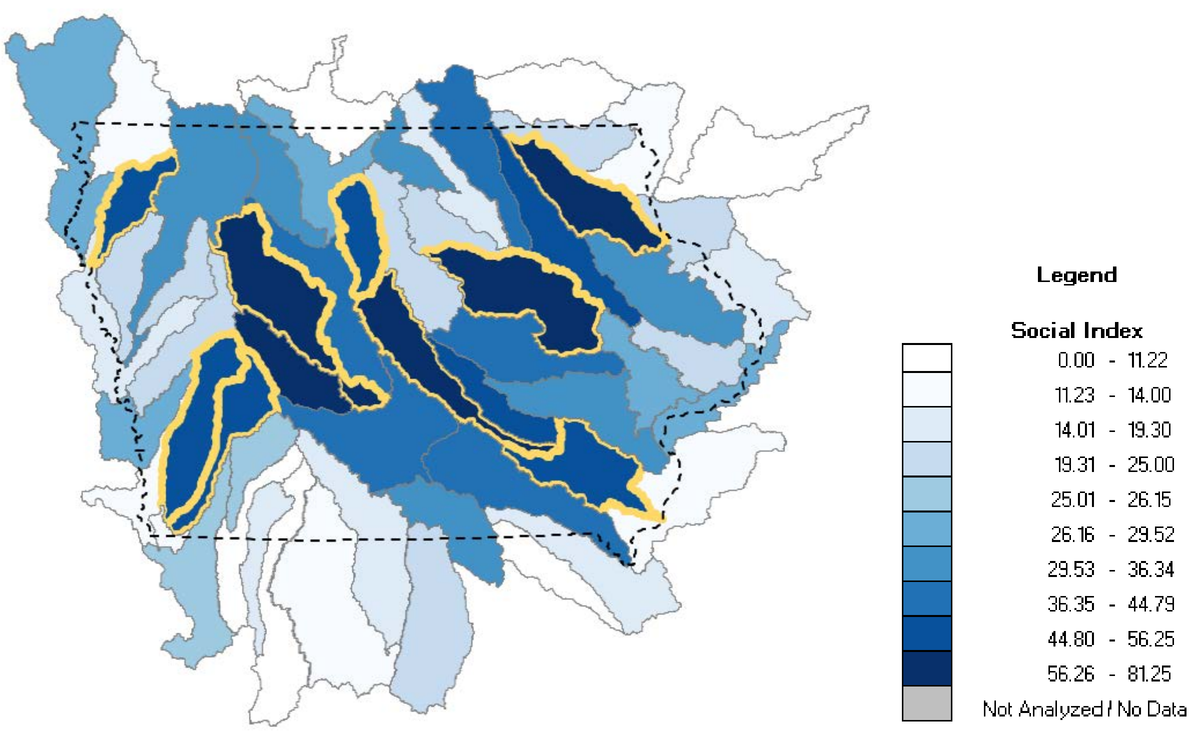


Figure 9. Social ranking (darker blue have higher social scores); yellow outlines are existing WQI priority watersheds.

The bubble plot in Figure 10 provides a further opportunity to compare and contrast HUC8 differences among watersheds in scenario 1. The plot displays the relative value differences among all the Iowa HUC8 watersheds in Ecological, Stressor and Social Index scores by each bubble's size and position on the graph, also showing how these compare to Statewide Ecological and Stressor medians (the horizontal and vertical median lines). This figure also highlights (orange bubbles) the existing WQI watersheds, and provides an effective comparison of the WQI as a group with the rest of the State's watersheds. All but one of Iowa's priority watersheds have Stressor Index scores that are higher than the State median (to the right of vertical median line), but with varying Ecological Index scores. Social Index scores of State priority watersheds are fairly consistent, and higher than many of the other watersheds in the State. Skunk and Turkey are both good examples, based on this screening analysis, of watersheds that have higher potential for restoration. If selection of priority watersheds were ever to be expanded, this analysis suggests it could take into account those watersheds with higher Ecological Index scores such as Lake Red Rock, Cooperas-Duck, or Maquoketa that plot in the upper right quadrant. These watersheds exhibit higher than average stressor levels but potentially have better ecological function, which may make them better prospects for restoration. In contrast, Floyd has both a low ecological score and a high level of stressors, indicating a very challenging watershed from a full-restoration perspective; nevertheless, Floyd's highest-in-state stressor index might imply that significant loading reductions could be targeted there even if complete restoration is difficult.

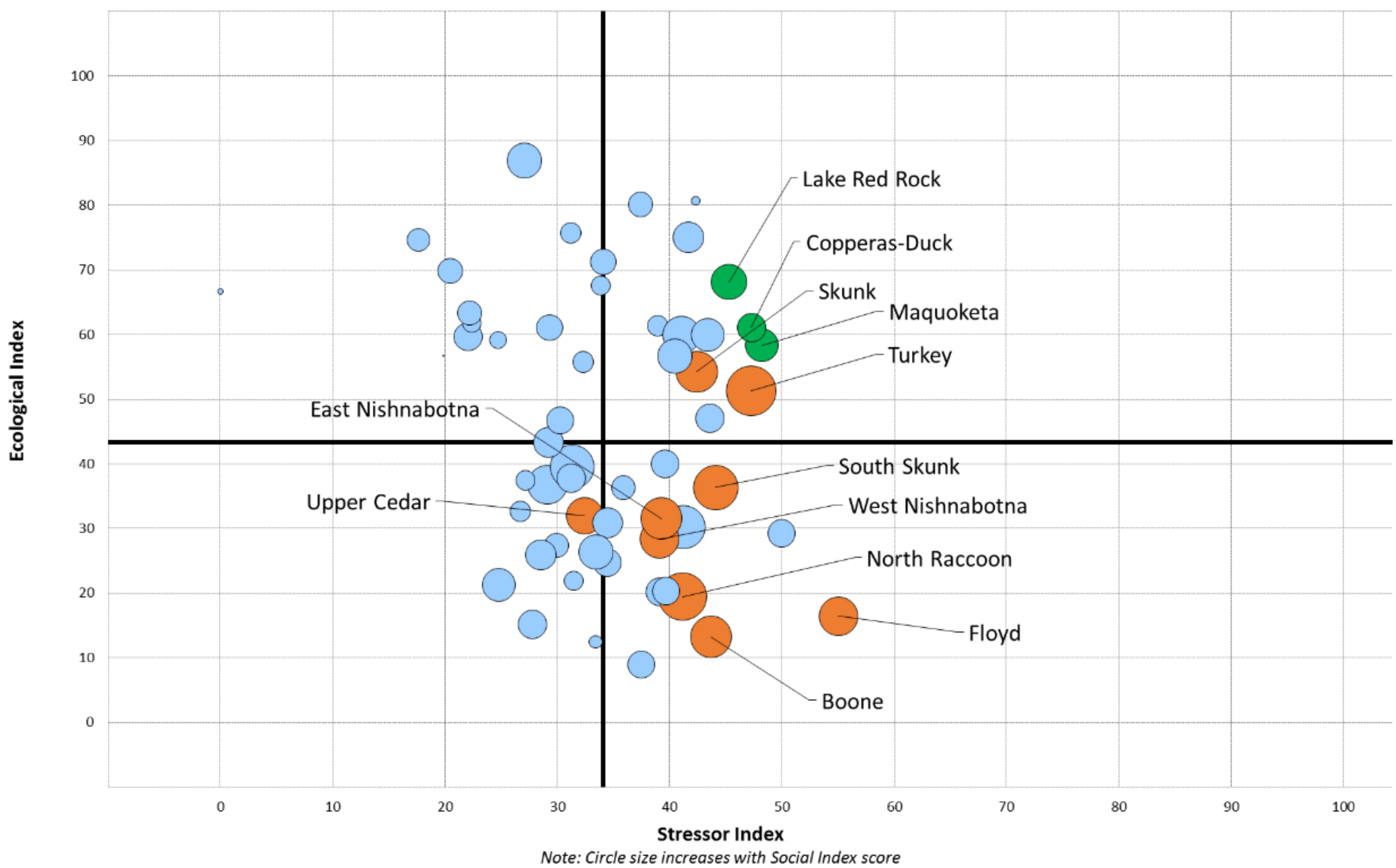


Figure 10. Bubble plot for all Iowa HUC8 watersheds based on scenario 1 indicators. This plot highlights Iowa priority watersheds (orange bubbles with labels) and other potential priority watersheds (green bubbles). Axes are set to Statewide median Ecological Index and Stressor Index scores.

Table 3 contains Ecological, Stressor, Social, and RPI scores and rank orders by index for all HUC8 watersheds, color-coded by quartile per Index score. This tabular format is another option for presentation of Stage 1 results that can be used to review, compare and contrast HUC8 watersheds. In interpreting this table, preferred HUC8 watersheds for nutrient management do not necessarily have to be those with the highest RPI scores, but instead the user could consider one or more of the component index scores. For example, a watershed with poor stressor scores may be a good restoration priority candidate if its ecological or social index scores are good; this would not be revealed by examining the RPI score alone. One noteworthy finding that stands out in the quartile-shaded table is the strong correlation of all nine priority watersheds with the top-quartile watersheds by RPS Social Index.

Table 3. Index and rank order scores for scenario 1. HUC8s are rank ordered by RPI score. Cells are shaded according to rank (black = 76 -100th percentile; dark gray = 51-75th percentile; light gray = 26-50th percentile; white = 0-25th percentile). WQI priority watersheds are marked with an asterisk (*).

Watershed ID	Watershed Name	Ecological Index	Ecological Rank	Stressor Index	Stressor Rank	Social Index	Social Rank	RPI Score	RPI Rank
07100009	Lower Des Moines	86.93	1	27.09	11	39.70	15	66.52	1
07060004	**Turkey***	51.33	26	47.29	53	81.25	1	61.77	2
10280102	Thompson	74.63	6	17.63	2	17.18	44	58.06	3
07100007	South Raccoon	39.53	31	31.31	22	63.48	4	57.23	4
07060003	Grant-Little Maquoketa	69.87	8	20.47	4	19.78	39	56.39	5
07080107	**Skunk***	54.27	25	42.41	47	56.25	6	56.03	6
07070005	Lower Wisconsin	66.67	11	0.00	1	0.00	57	55.56	7
10280201	Upper Chariton	75.07	5	41.67	45	32.00	21	55.13	8
07080106	North Skunk	59.93	18	41.07	42	45.00	12	54.62	9
10240009	West Nodaway	59.67	19	22.07	5	26.15	29	54.58	10
07100008	Lake Red Rock	68.13	9	45.29	52	40.83	14	54.56	11
07110001	Bear-Wyaconda	80.13	3	37.40	33	19.28	41	54.00	12
10240013	One Hundred and Two	63.37	12	22.20	6	18.83	43	53.33	13
10280103	Lower Grand	71.27	7	34.10	29	21.80	38	52.99	14
07080102	Upper Wapsipinicon	36.77	34	29.13	15	51.05	9	52.90	15
07060001	Coon-Yellow	75.70	4	31.19	20	13.83	48	52.78	16
07080105	**South Skunk***	36.37	35	44.09	51	65.63	3	52.64	17
07080208	Middle Iowa	56.67	23	40.47	41	38.83	17	51.67	18
07100006	**North Raccoon***	19.47	52	41.16	43	75.83	2	51.38	19
07060002	Upper Iowa	61.07	16	29.31	17	22.38	37	51.38	20
07080209	Lower Iowa	59.97	17	43.37	48	35.65	19	50.75	21
07080205	Middle Cedar	30.20	41	41.23	44	62.50	5	50.49	22
10240010	Nodaway	61.80	13	22.37	7	10.83	52	50.09	23
10240003	**East Nishnabotna***	31.57	39	39.27	38	56.25	6	49.52	24
07060006	Maquoketa	58.33	21	48.23	55	35.73	18	48.61	25
10280101	Upper Grand	67.63	10	33.87	28	11.95	50	48.57	26
10240012	Platte	59.17	20	24.73	8	9.53	53	47.99	27
10170203	Lower Big Sioux	43.37	29	29.23	16	29.38	24	47.84	28
07080201	**Upper Cedar***	31.97	38	32.44	25	43.95	13	47.83	29
10240005	Tarkio-Wolf	46.73	28	30.27	19	25.05	30	47.17	30
07080101	Copperas-Duck	61.10	15	47.30	54	27.65	25	47.15	31
07110002	North Fabius	80.70	2	42.33	46	2.73	55	47.03	32
10240002	**West Nishnabotna***	28.37	43	39.13	37	50.00	10	46.41	33
07080104	Flint-Henderson	55.77	24	32.30	24	13.95	46	45.81	34
07040008	Root	56.73	22	19.90	3	0.08	56	45.64	35
07060005	Apple-Plum	61.40	14	38.93	35	14.20	45	45.56	36
10230006	Big Papillion-Mosquito	37.77	32	31.23	21	27.30	27	44.61	37
07100004	Middle Des Moines	26.40	45	33.44	27	39.05	16	44.00	38

Watershed ID	Watershed Name	Ecological Index	Ecological Rank	Stressor Index	Stressor Rank	Social Index	Social Rank	RPI Score	RPI Rank
07100002	Upper Des Moines	21.27	49	24.80	9	35.50	20	43.99	39
07080206	Lower Cedar	47.10	27	43.60	49	27.15	28	43.55	40
10230003	Little Sioux	25.90	46	28.53	14	29.88	22	42.42	41
07080203	Winnebago	30.87	40	34.51	31	29.63	23	41.99	42
07100005	**Boone***	13.23	55	43.69	50	56.25	6	41.93	43
07080103	Lower Wapsipinicon	39.97	30	39.59	39	25.00	31	41.79	44
10240001	Keg-Weeping Water	37.43	33	27.17	12	12.50	49	40.92	45
10240004	Nishnabotna	32.60	37	26.70	10	13.93	47	39.94	46
10230001	Blackbird-Soldier	36.33	36	35.89	32	18.85	42	39.77	47
07080202	Shell Rock	27.37	44	29.96	18	19.30	40	38.90	48
07080204	West Fork Cedar	24.73	47	34.47	30	25.00	31	38.42	49
07100003	East Fork Des Moines	15.17	54	27.80	13	27.40	26	38.26	50
10230002	**Floyd***	16.43	53	55.03	57	50.00	10	37.14	51
07080207	Upper Iowa	20.20	51	39.10	36	25.00	31	35.37	52
10230005	Maple	20.30	50	39.69	40	25.00	31	35.21	53
10230007	Boyer	29.27	42	49.97	56	25.00	31	34.77	54
10170204	Rock	21.90	48	31.46	23	11.48	51	33.97	55
10230004	Monona-Harrison Ditch	8.93	57	37.49	34	25.00	31	32.15	56
07020009	Blue Earth	12.47	56	33.43	26	5.60	54	28.21	57

Scenario 2: Nitrogen Loading

This scenario identifies HUC8 watersheds with the potential to have high levels of nitrogen loading and that are of higher interest for rural nutrient management efforts. Unlike scenario 1, which screened all Iowa HUC8s without pre-selecting for any factor, this scenario is limited to HUC8s with higher nitrogen loading. A subset of HUC8s that have nitrogen yields (reported by the State) greater than the State median (13.57 pounds per acre) are selected for this scenario and include:

- Coon-Yellow
- Upper Iowa (-07)
- Turkey
- Maquoketa
- Upper Wapsipinicon
- Lower Wapsipinicon
- North Skunk
- South Skunk
- Skunk
- Upper Cedar
- Shell Rock
- Winnebago
- West Fork Cedar
- Middle Cedar
- Lower Cedar
- Upper Iowa (-02)
- Middle Iowa
- Lower Iowa
- Middle Des Moines
- Boone
- North Raccoon

RPI scores for scenario 2 watersheds are displayed in map format in Figure 11. All of these watersheds have higher than average nitrogen yields. Lower Iowa, Middle Iowa, and Coon-Yellow HUC8 watersheds are the highest ranked scenario 2 watersheds for generalized recovery potential. These watersheds have smaller amounts of likely tile drainage and more natural cover in riparian areas. Lower Iowa is in part covered by a watershed management authority (WMA), the other two do not have a current WMA although could potentially be good watersheds to target for new WMA creation.

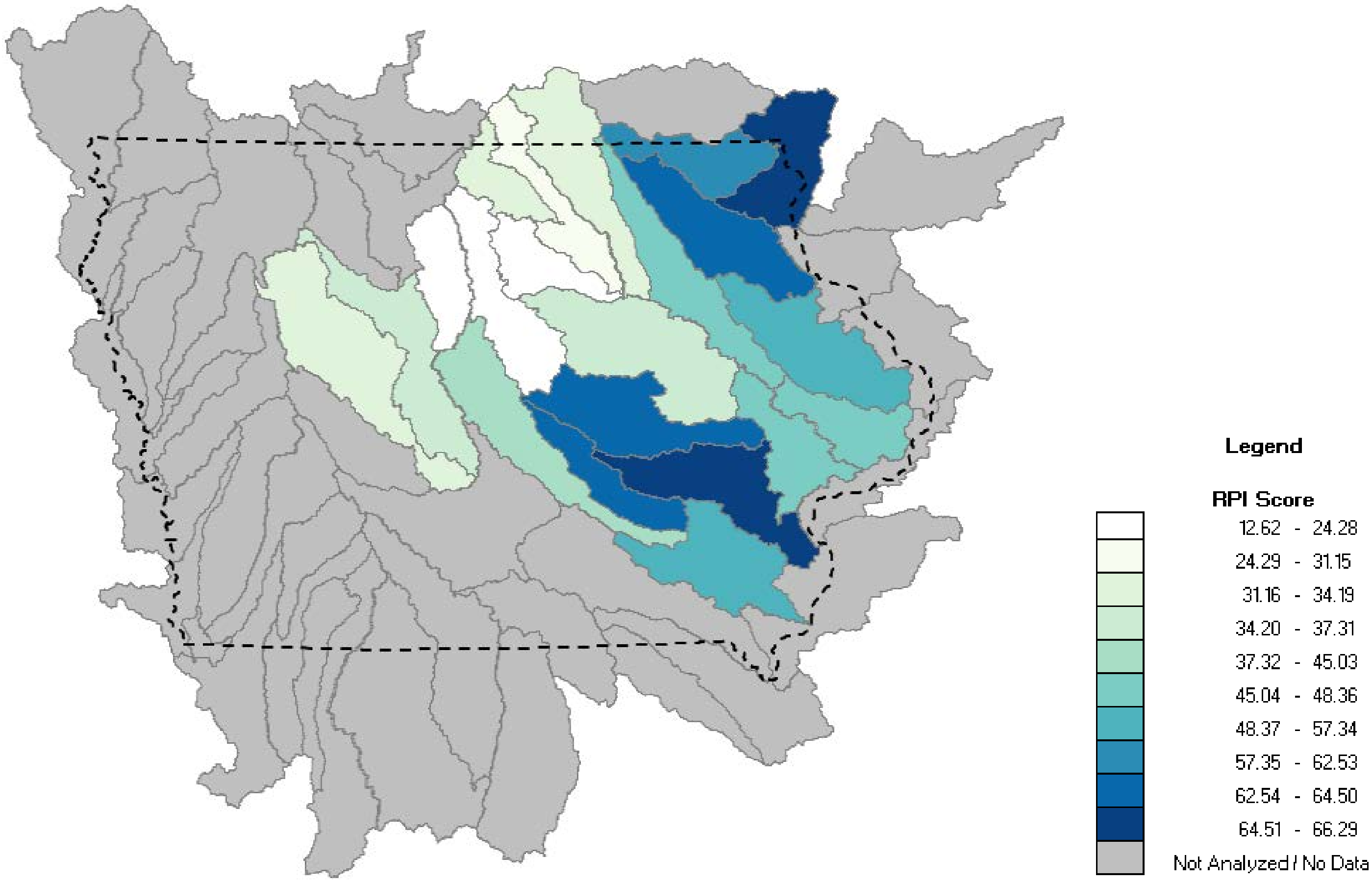


Figure 11. Scenario 2 RPI scores (darker blue implies better for restoration).

Maps of Ecological and Stressor Index scores for scenario 2 are displayed in Figure 12 and Figure 13. HUC8 watersheds with higher Ecological Index scores are clustered in the eastern part of the State where natural areas are more prominent and row crops comprise less of the landscape. Stressor Index scores follow the same pattern. Higher stressor scores are found in the northcentral part of the State where corn and soybean production is extensive (e.g., Boone and Upper Iowa).

Note that color intensity of these different indices is always 'the darker blue the better' for restorability in general. In all three index maps, several watersheds generally in the eastern half of the state scored more highly and may be better candidates for strategic actions to address nitrogen pollution in areas with higher than average yields paired with at least some ecological, social or stressor traits that might make them more responsive in general to loading reduction efforts.

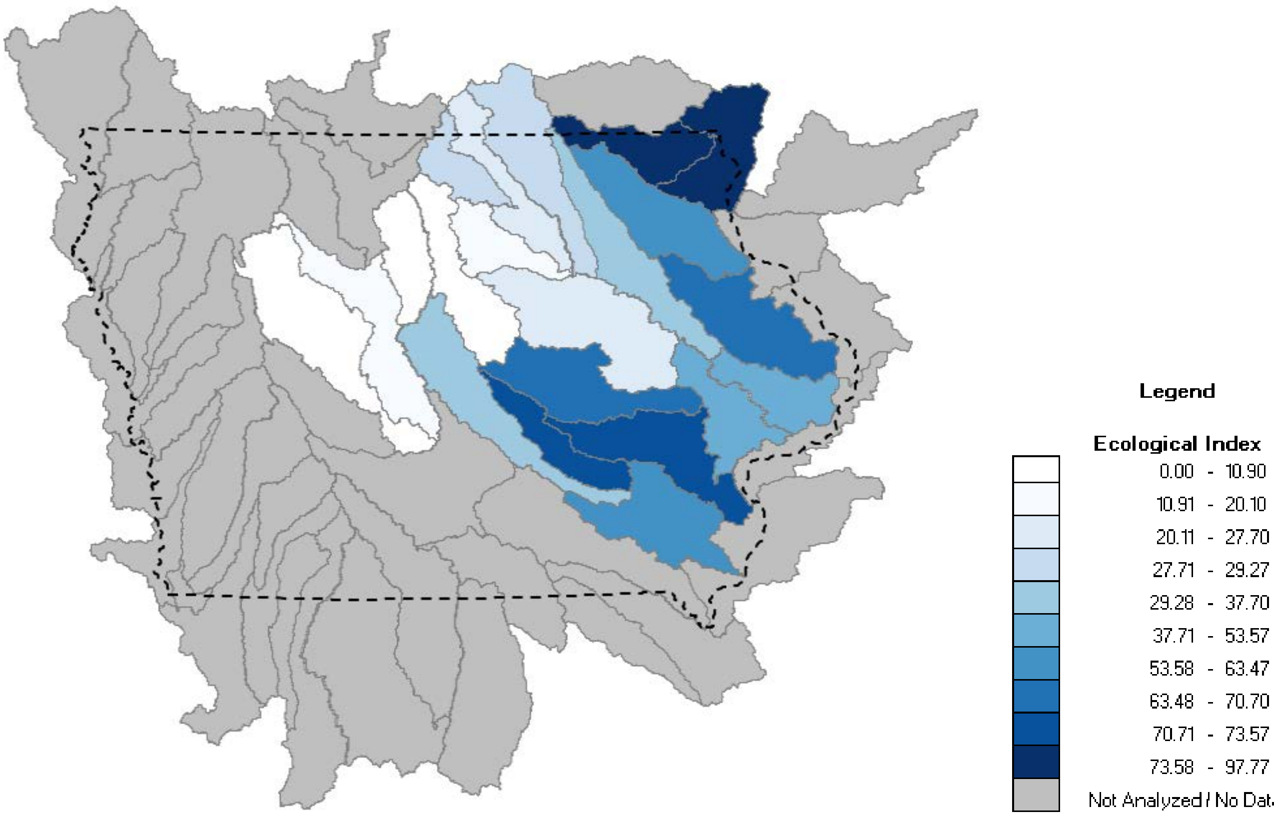


Figure 12. Scenario 2 Ecological Index (darker blue implies better for restoration).

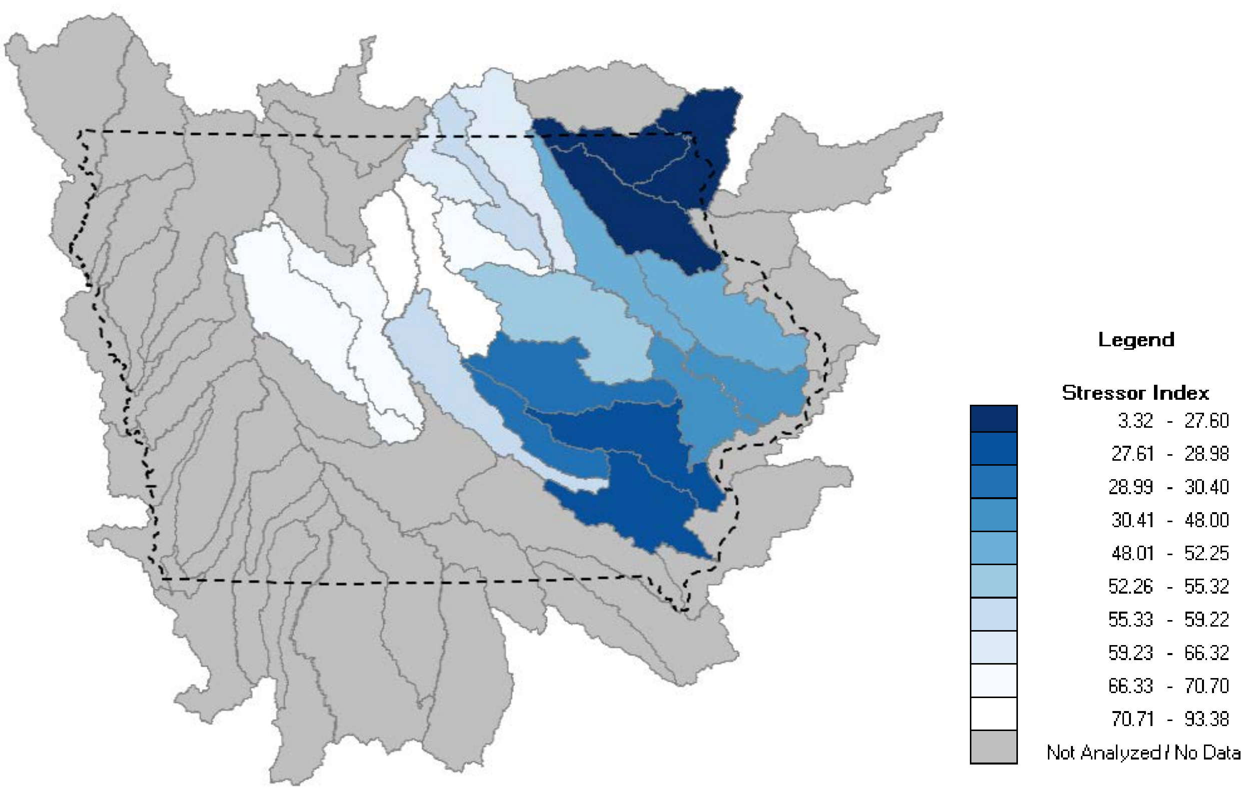


Figure 13. Scenario 2 Stressor Index (darker blue implies better for restoration).

Two bubble plots are presented for scenario 2 (Figure 14) and reflect the relative value differences among HUC8 watersheds in Ecological, Stressor and Social Index scores by each bubble's size and position on the graph, also showing how these compare to scenario 2 medians (the horizontal and vertical median lines). Those watersheds that plot in the upper left quadrant could be good prospects for nitrogen reduction because they have fewer stressors and a higher level of ecological function, while still having higher than average nitrogen loading. Maquoketa has one of the highest nitrogen loads and concentrations, but also has a high Ecological Index score, indicating a watershed that could potentially be a priority for nitrogen reduction. In contrast, the watersheds that plot in the lower right quadrant may be more difficult to address due to the high level of stressors paired with probably lower ecological condition. Boone has the highest Stressor Index score, indicating it may be very challenging to restore; however, conservation activities in this watershed may still have a significant effect on nutrient loads. In fact, reduction of nitrogen loads may be most efficiently obtained in high stressor watersheds such as the Boone even as full recovery would be more challenging to accomplish.

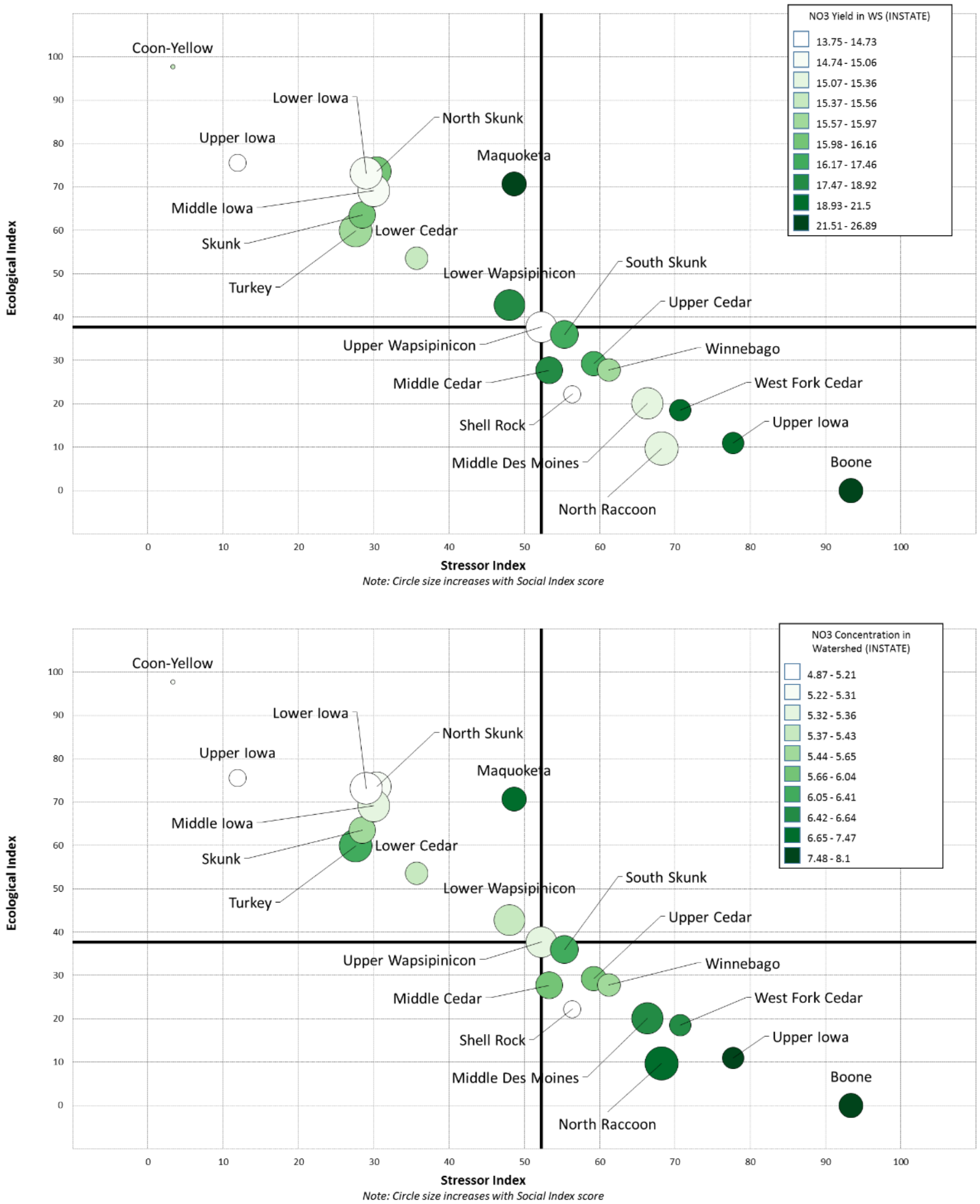


Figure 14. Scenario 2 bubble plots: Top: color-ordered by nitrogen yield; bottom: color-ordered by instream nitrogen concentration. Axes are set to median Ecological and Stressor Index scores for the scenario 2 HUCs only.

Table 4 contains Ecological, Stressor, Social, and RPI scores and ranks for scenario 2, in order of descending RPI score and color-coded by quartile per RPI score. This tabular format is another option for presentation of Stage 1 results that can be used to compare and identify HUC8 watershed differences based on the four RPS indices and ranks, and make choices of specific HUC8s for scenario 2 screening and nutrient management efforts.

Table 4. Index and RPI scores for scenario 2. HUC8 watersheds are ordered by RPI score. Cells are shaded according to rank (black = 76 -100th percentile; dark gray = 51-75th percentile; light gray = 26-50th percentile; white = 0-25th percentile).

Watershed ID	Watershed Name	Ecological Index	Ecological Rank	Stressor Index	Stressor Rank	Social Index	Social Rank	RPI Score	RPI Rank
07080209	Lower Iowa	73.17	4	28.98	5	54.68	3	66.29	1
07060001	Coon-Yellow	97.77	1	3.33	1	0.00	21	64.81	2
07080208	Middle Iowa	69.17	6	30.00	6	54.33	4	64.50	3
07060004	Turkey	59.93	8	27.60	3	56.25	2	62.86	4
07080106	North Skunk	73.57	3	30.40	7	44.43	8	62.53	5
07060002	Upper Iowa	75.57	2	11.90	2	16.00	19	59.89	6
07080107	Skunk	63.47	7	28.45	4	37.00	11	57.34	7
07060006	Maquoketa	70.70	5	48.65	10	31.25	13	51.10	8
07080206	Lower Cedar	53.57	9	35.70	8	27.20	15	48.36	9
07080103	Lower Wapsipinicon	42.80	10	48.00	9	50.00	6	48.27	10
07080102	Upper Wapsipinicon	37.70	11	52.25	11	49.65	7	45.03	11
07080105	South Skunk	35.97	12	55.33	13	40.65	9	40.43	12
07080205	Middle Cedar	27.70	15	53.28	12	37.50	10	37.31	13
07100004	Middle Des Moines	20.10	17	66.33	17	52.95	5	35.58	14
07080201	Upper Cedar	29.27	13	59.23	15	32.53	12	34.19	15
07100006	North Raccoon	9.70	20	68.23	18	58.33	1	33.27	16
07080203	Winnebago	27.73	14	61.23	16	26.95	16	31.15	17
07080202	Shell Rock	22.23	16	56.35	14	15.53	20	27.14	18
07080204	West Fork Cedar	18.53	18	70.70	19	25.00	17	24.28	19
07080207	Upper Iowa	10.90	19	77.73	20	25.00	17	19.39	20
07100005	Boone	0.00	21	93.38	21	31.25	13	12.63	21

Scenario 3: Phosphorus Loading

This scenario identifies HUC8 watersheds with the potential to have high levels of phosphorus loading and that are of higher interest for rural nutrient management efforts. A subset of 15 HUC8s -- 14 that have phosphorus yields reported by the State greater than the State median (0.75 pounds per acre) and 1 added at State request due to heightened interest in phosphorus management -- are selected for membership in this scenario and include:

- Turkey
- Maquoketa
- South Skunk
- North Skunk
- Skunk
- Winnebago
- Lower Cedar
- Lower Iowa
- Middle Iowa
- Floyd
- Blackbird-Soldier
- Boyer
- East Nishnabotna
- West Nishnabotna
- Upper Chariton

RPI scores for scenario 3 are displayed in map format in Figure 15. The highest RPI score is seen in the Upper Chariton, which did not have reported phosphorus concentration values but had all the other scenario 3 indicators. The Skunk, North Skunk and Turkey are the HUC8s with the highest RPI scores that also have phosphorus yields greater than the State median. These three watersheds all have lower soil phosphorus concentrations (measured as median Bray concentration in watershed) and higher percentages of natural cover in the watershed and riparian area.

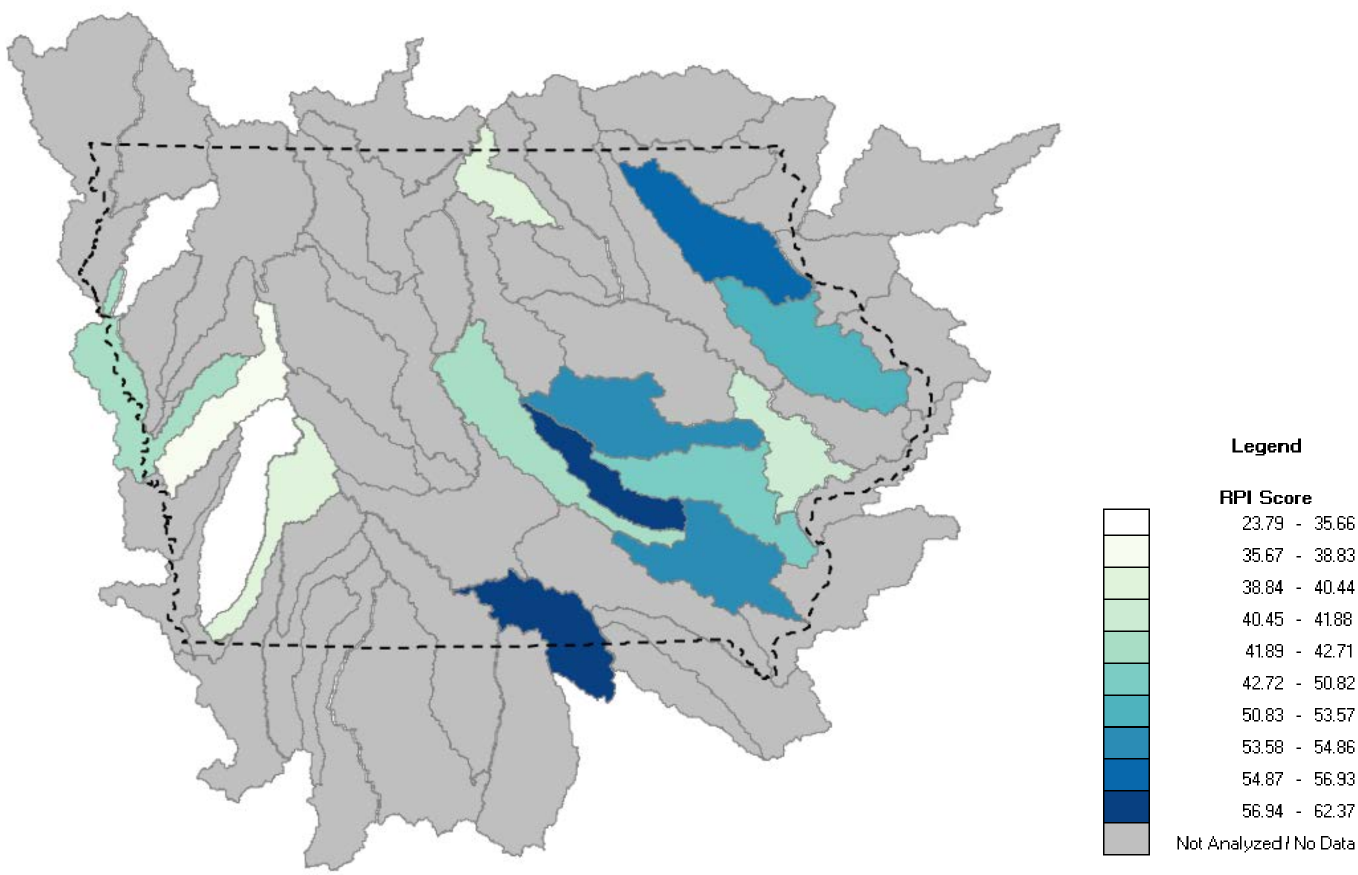


Figure 15. Scenario 3 RPI scores (darker blue implies better for restoration).

Maps of Ecological, Stressor, and Social Index scores for scenario 3 are displayed in Figure 16 through Figure 18. HUC8 watersheds with high Ecological and Social index scores are in the eastern part of the State. Stressor Index scores do not reveal this same pattern, as watersheds throughout the State have varying levels of stressors. Those watersheds in the eastern part of the State with lower Stressor Index scores and higher Ecological and/or Social Index Scores may be good candidates for recovery from phosphorus related impairments. Especially in the Stressor index, some watersheds in the western part of the state also score well and could be considered favorable choices for nutrient management efforts. The Upper Chariton scores very well for both Ecological and Stressor indices among the scenario 3 HUC8s; however, this watershed does not score as well on the Social index based on the limited social indicators used.

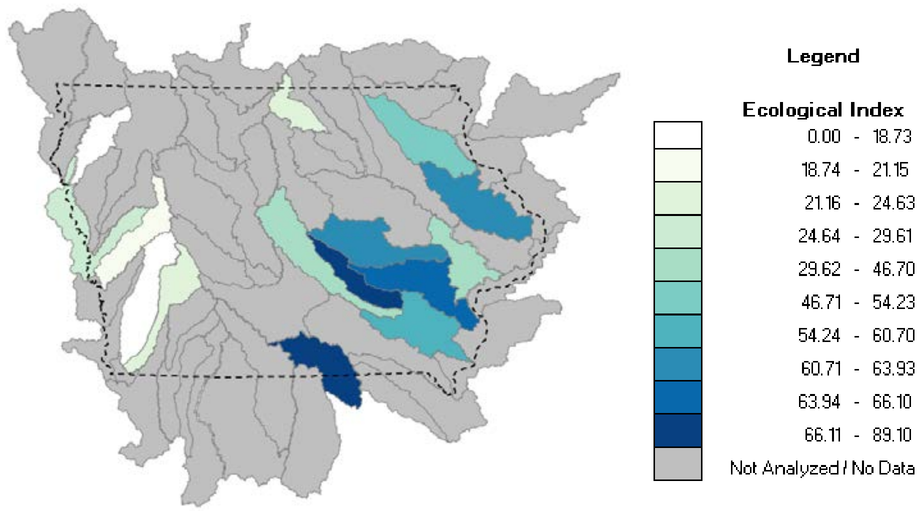


Figure 16. Scenario 3 Ecological Index (darker blue implies better for restoration)

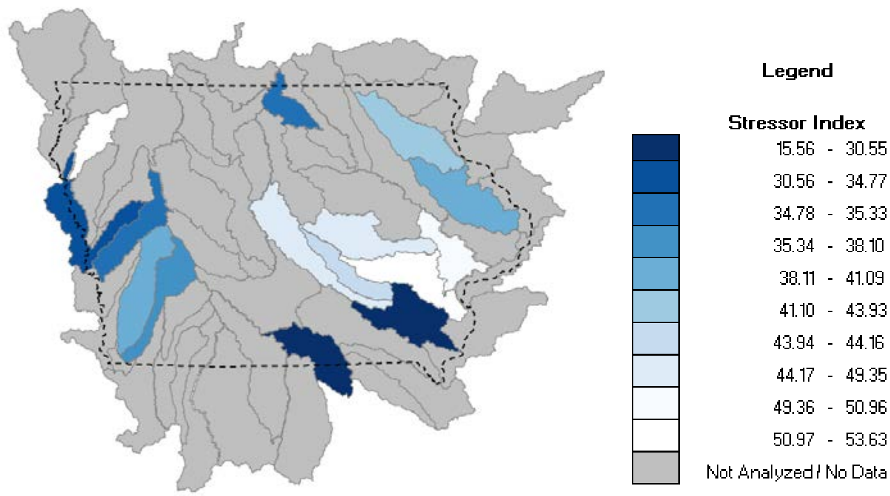


Figure 17. Scenario 3 Stressor Index (darker blue implies better for restoration).

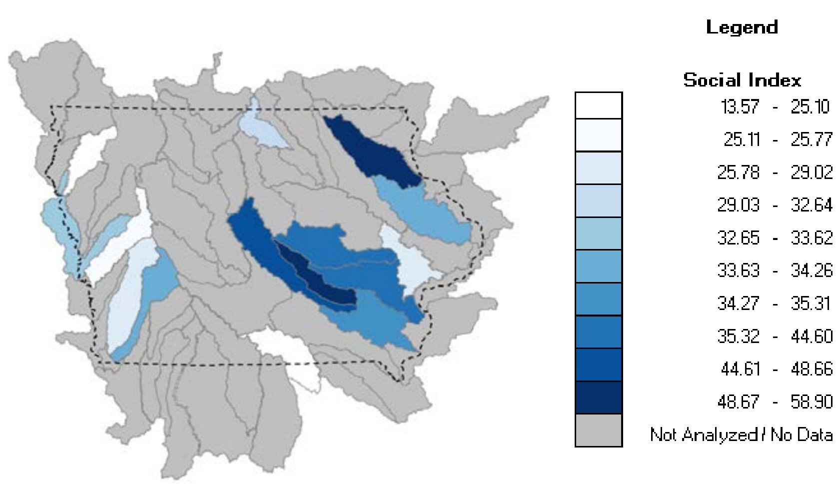


Figure 18. Scenario 3 Social Index (darker blue implies better for restoration).

The bubble plots in Figure 19 display the relative value differences among HUC8 watersheds in Ecological, Stressor and Social Index scores by each bubble's size and position on the graph, also showing how these compare to scenario 3 medians (the horizontal and vertical median lines). These bubble plots are color-ordered according to phosphorus yield and instream phosphorus concentration. Skunk has among the best Ecological and Stressor Index scores in this plot while Floyd has the lowest Ecological Index score and highest level of stressors. Those watersheds found in the upper quadrants (e.g., Skunk, Turkey, Lower Iowa, etc.) have better than the median Ecological Index score while still having higher than average phosphorus yields, and could be good candidates for restoration.

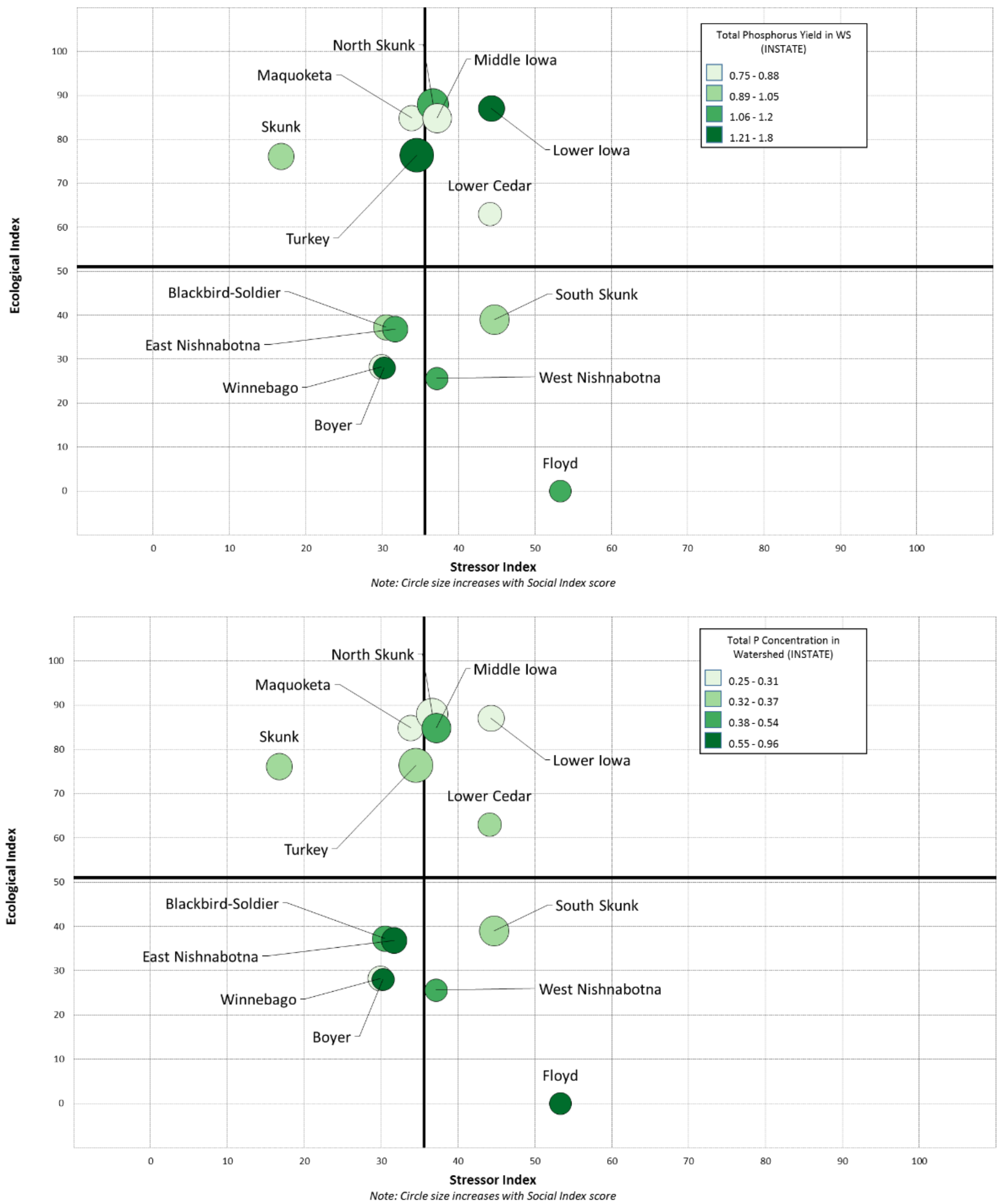


Figure 19. Scenario 3 bubble plots. Top: color-ordered by phosphorus yield; bottom: color-ordered by instream phosphorus concentration. Axes are set to median Ecological and Stressor Index scores for the scenario 3 HUCs only.

Table 5 contains Ecological, Stressor, Social, and RPI scores and rank orders for scenario 3, in order of descending RPI score and color-coded by quartile per RPI score. This tabular format is another option for presentation of Stage 1 results that can be used to compare and identify HUC8 watersheds for scenario 3 nutrient management efforts.

Table 5. Index and RPI scores for scenario 3. HUC8 watersheds are ordered by RPI score. Cells are shaded according to rank (black = 76 -100th percentile; dark gray = 51-75th percentile; light gray = 26-50th percentile; white = 0-25th percentile).

Watershed ID	Watershed Name	Ecological Index	Ecological Rank	Stressor Index	Stressor Rank	Social Index	Social Rank	RPI Score	RPI Rank
07080106	North Skunk	87.97	1	36.66	8	50.58	2	67.30	1
07060004	Turkey	76.37	5	34.51	7	58.90	1	66.92	2
07080107	Skunk	76.13	6	16.74	1	35.15	6	64.85	3
07080208	Middle Iowa	84.87	3	37.19	10	44.30	4	63.99	4
07060006	Maquoketa	84.87	3	33.86	6	33.63	8	61.55	5
07080209	Lower Iowa	87.03	2	44.30	12	35.35	5	59.36	6
07080206	Lower Cedar	63.03	7	44.11	11	28.38	11	49.10	7
10230001	Blackbird-Soldier	37.27	9	30.50	4	33.33	9	46.70	8
07080105	South Skunk	38.97	8	44.70	13	45.78	3	46.68	9
10240003	East Nishnabotna	36.83	10	31.70	5	33.68	7	46.27	10
07080203	Winnebago	28.20	11	29.89	2	31.60	10	43.31	11
10230007	Boyer	28.00	12	30.24	3	25.25	13	41.00	12
10240002	West Nishnabotna	25.60	13	37.13	9	25.90	12	38.12	13
10230002	Floyd	0.00	14	53.33	14	25.00	14	23.89	14

STAGE 2 RESULTS

Stage 2 screenings are performed on HUC8s (or other large geographic unit, such as ecoregion) individually to compare the HUC12s subwatersheds within a single HUC8 to each other. The more extensive menu of indicators available at HUC12 scale enables the selection of indicators to include in a screening to more specifically target factors that are relevant to nutrient management activities. Under Stage 2, one or more Stage 1 HUC8 watersheds are selected as an initial demonstration of how the RPS assessment approach can be used to compare its component HUC12 subwatersheds. The choice of demonstration HUC8s may target high-interest watersheds, but is not meant to assign priority or preclude future assessment of the remaining watersheds. Selections can be based on whether a HUC8 shows promising characteristics during a Stage 1 screening, expert opinion or knowledge about the watershed, or a combination of both. Ideally, indicators, criteria and expert judgment combine to identify watersheds that not only have nutrient loading issues, but also show traits relevant to better restorability.

For this report, Stage 2 screenings were completed on two demonstration HUC8 watersheds that were of high interest to the State: Boone (HUC 07100005) and Turkey (HUC 07100005). Screening results summarized and discussed in this document serve as an example of how RPS can be used to compare and consider nutrient management priorities at a smaller watershed scale. As with the Stage 1 screenings, a separate copy of the RPS tool for each of the demonstration HUC8s has been archived for delivery to DNR with other products (see Attachment 4).

DNR selected the Boone watershed for Stage 2 demonstration to provide information on nitrogen loading and the potential for nitrogen reductions. The Turkey watershed was selected to focus on phosphorus loading and reductions. Both watersheds are WQI priority watersheds and were included in scenario 1 and scenario 2 of Stage 1 screening; Turkey also appeared in scenario 3. In the scenario 1 screening (comparison to WQI), Boone scored well on Social Index but was among the poorest scores in RPI, Ecological, and Stressor Index; Turkey scored well in the RPI, Ecological and Social Indices. In the scenario 2 screening (nitrogen loading), Boone was among the poorest scoring HUC8s due to particularly high Stressor Index scores; Turkey was among the top scoring watersheds. In the Scenario 3 screening (phosphorus loading), Turkey ranked well among the HUC8s with potential phosphorus control needs, with high RPI, Ecological, and Social Index scores paired with relatively lower stressor score; Boone was not included in the scenario 3 screening. Overall, the two watersheds present contrasting conditions – with Boone showing high nutrient loads and relatively poor ecological conditions, and Turkey showing moderate stressor levels but promising ecological and social characteristics. This section demonstrates how RPS can be used to gain further insight into HUC12 management priorities within these different settings.

Selection of Stage 2 Indicators

Indicators selected for Stage 2 screenings are listed in Table 6 (see also definitions in Attachment 3). The Boone and Turkey HUC8s are primarily agricultural, therefore the same set of initial indicators were selected for both watersheds. A preliminary review of indicator data showed that some had the same value for all HUC12s within the Boone watershed. These are termed “equal-value” indicators and were not used for the Stage 2 Boone screening because they do not provide information on recovery potential differences between HUC12s. Similarly, indicators with equal values for all HUC12s in the Turkey watershed were not included in the Stage 2 screening.

All indicators selected for Stage 2 screenings were weighted equally. Users of the RPS tool can assign indicators different weights if their screening includes indicators that of greater interest for setting management priorities or if there are known differences in data quality between indicators. Indicators that are assigned higher weights have a greater influence on index scores calculated for the screening.

Table 6. Stage 2 indicators and weights. Indicators marked with an asterisk (*) are derived from state-specific datasets; other indicators are derived from national datasets.

	Boone Nitrogen	Turkey Phosphorus
Ecological Indicators		
% Natural Cover in Watershed*	1	1
% Natural Cover in Hydrologically Connected Zone*	1	1
National Fish Habitat Partnership Habitat Condition Index	1	1
Mean Benthic Macroinvertebrate IBI in Watershed*	1	1
Stressor Indicators		
% Corn and Corn/Soy Rotations in Watershed*	1	1
Count of Animals in Watershed*	1	1
% Tile Drained Soil in Watershed*	1	1
TP Load from Major Dischargers in Watershed *	1	1
TN Load from Major Dischargers in Watershed*	1	1
Count of Segments Impaired for Nutrients*	-	1
Soil Erodibility, Mean in Watershed	1	1
Social Indicators		
Watershed Segments with TMDLs, Count	1	1
% Watershed Management Authorities in Watershed*	-	1
% of Watershed Covered by Conservation Activities *	-	1
% Potentially Restorable Wetlands	1	1
% Land with Any IUCN Status in Watershed	1	1

General Summary of Stage 2 Screening Results

Bubble plots displaying Stage 2 screening results are shown in Figure 20. The RPS Tool is able to generate two separate bubble plots for any screening run: a “subset” version and a “statewide” version. The subset version displays Ecological, Stressor, and Social Index scores exactly as calculated with user-supplied screening settings (HUCs, indicators, and weights). The statewide version displays scores that are based on the same indicators and weights but includes all of a state's watersheds in the index score calculations. This allows users to evaluate index scores for the watersheds selected for screening when compared to all other watersheds in the state.

The statewide bubble plot for the Boone watershed screening (top left; Figure 20) shows that its HUC12s all have above average Stressor Index scores and most have below average Ecological Index scores relative to other HUC12s in Iowa. The Turkey HUC12s cover a wider range of scores, with many HUC12s showing above average Ecological Index scores and below average Stressor Index scores on the statewide bubble plot (bottom left; Figure 20). These results provide context for interpreting the subset bubble plots for Boone HUC12s (top right; Figure 20) and Turkey HUC12s (bottom right; Figure 20). For example, this suggests that HUC12s with top Ecological Index scores in the Boone subset plot are not in pristine ecological condition despite scoring much higher than other HUC12s in the Boone watershed.

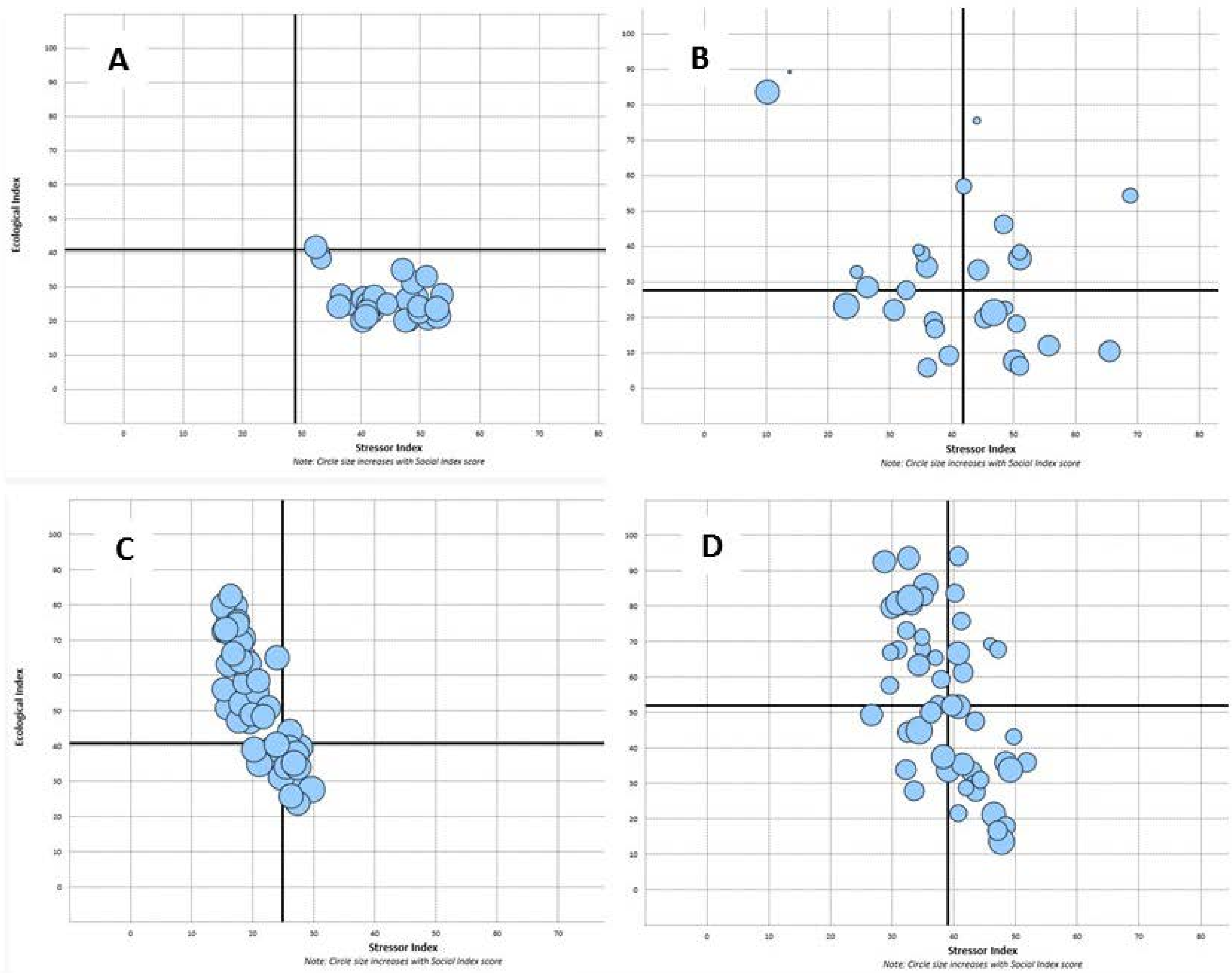


Figure 20. Bubble plots for HUC12s in the Boone (top) and Turkey (bottom) watersheds. Bubble plots on the left show statewide screening scores (i.e., scores from a screening that includes all HUC12s in the state). Bubble plots on the right show subset screening scores (i.e., scores from a screening that only includes HUC12s in Boone/Turkey watersheds). Plots A and C reveal conditions in the HUC8 compared with the whole state. B and D emphasize differences between the HUC12s within the HUC8 alone.

Specific questions to be addressed by this Stage 2 analysis include:

1) Which HUC12s have high nutrient stressors paired with poor versus good ecological metrics?
2) Which HUC12s have favorable stressor and/or ecological indices, but weaker social index scores?
3) Where might certain types of watershed practices be generally appropriate or effective?
4) Which HUC12s might be protected while others are restored?

1. <u>Which HUC12s have high nutrient stressors paired with poor versus good ecological metrics?</u>

The purpose of this question is to identify HUC12s that could offer substantial loading reduction, and further discern which among them might be easier or harder to restore (based on current ecological condition). In the Boone watershed, the following HUC12s have the highest level of stressors and poor Ecological Index scores (red outlined bubbles): East Branch Boone River, Headwaters Otter Creek, West Otter Creek, and Middle Branch Boone River (Figure 21). These subwatersheds cluster in the lower right corner of the bubble plot and have the lowest overall RPI scores. These lowest ranked subwatersheds have low natural cover in the HUC12 and natural cover in the hydrologically connected zone (less than 8%), over 80% tile drained soils, high amounts of farmland with corn and corn-soybean rotations (over 90%) and high numbers of animals (over 200,000). Nutrient management efforts in these HUC12s could result in a large magnitude reduction in nutrient loading in the Boone watershed, however, significant and sustained effort would likely be needed to attain nutrient water quality standards in these HUC12s. They may therefore be good prospects for action if management objectives focus on improving the overall condition of the Boone watershed, but less favorable prospects if the objective were to fully restore individual HUC12s.

In the Turkey watershed, Silver Creek, North Branch Turkey River, Howard Creek, and South Branch Turkey River-Turkey River have high levels of stressors and poor Ecological Index scores (red outlined bubbles; Figure 22). In these watersheds, all of the lowest ranked watersheds have low natural cover in the watershed and in the hydrologically connected zone and high soils with tile drainage compared to other subwatersheds.

This question guides the user to highly stressed HUC12s that may have very high nutrient loading. Where some of these have poor ecological scores, it may imply that these subwatersheds are less apt to be capable of enlisting natural processes (e.g., filtration and retention of nutrients in the watershed or riparian areas) to the point of recovery. Reducing loads may be possible in these HUC12s, and that may benefit downstream conditions, but there are likely other HUC12s with substantial nutrients that are in better condition to respond to restoration investments. On the bubble plots, HUC12s in the upper right (green outlined bubbles), whose ecological scores are among the highest and yet their stressor scores suggest that substantial nutrient sources exist there and might be more effectively addressed (e.g., Drainage Ditch 32-Boone River, Drainage Ditch 46-Boone River, Otter Creek, White Fox Creek in the Boone watershed).

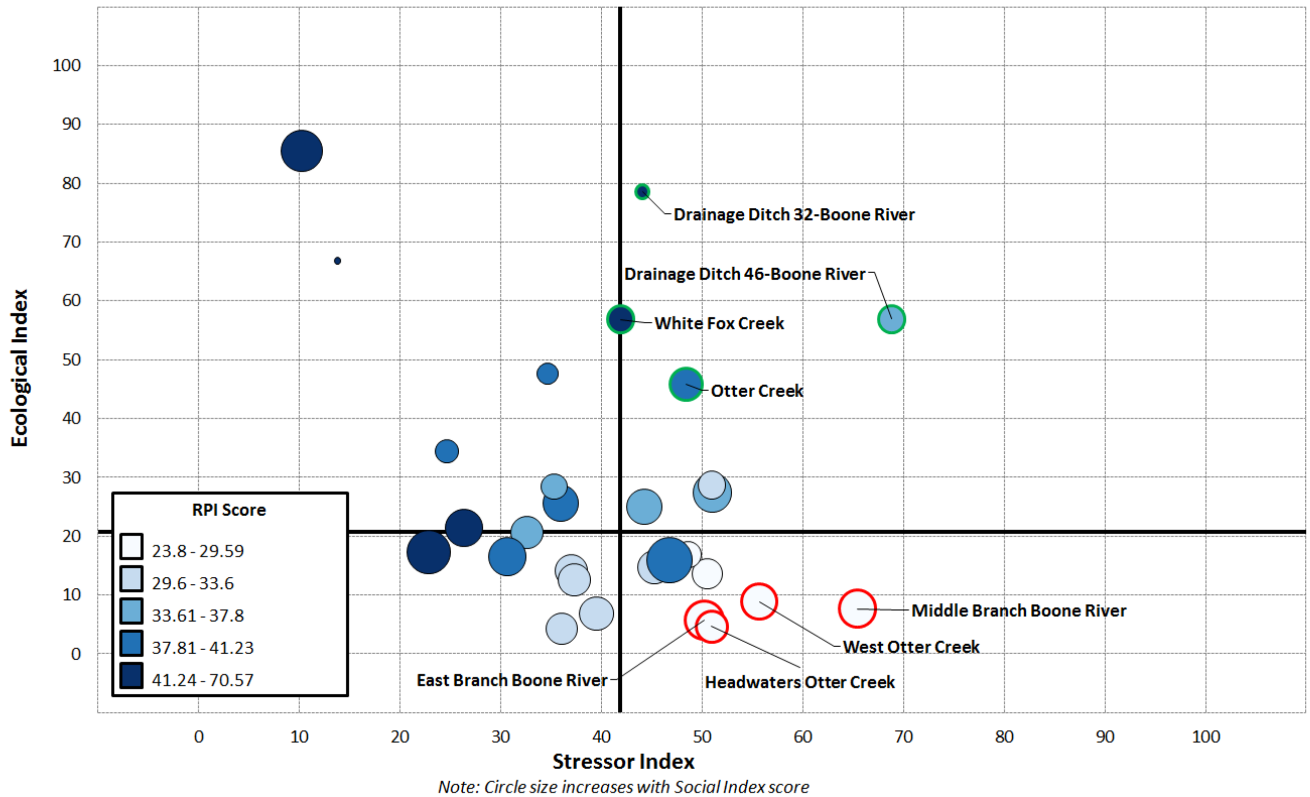


Figure 21. Boone bubble plot color-sorted by RPI score. Red outlined bubbles have high nutrient stressors and low ecological metrics. Green outlined bubbles have high nutrient stressors and good ecological metrics.

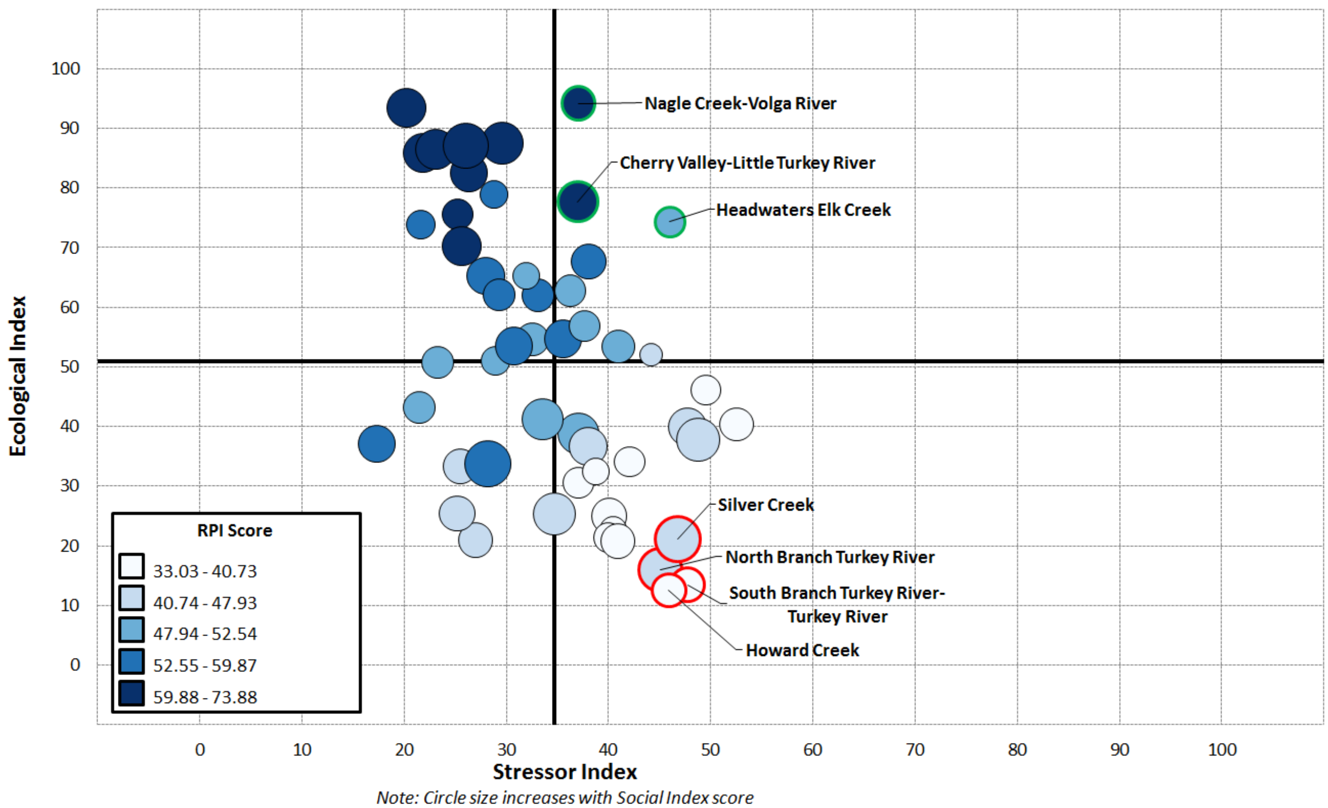


Figure 22. Turkey bubble plot color-sorted by RPI score. Red outlined bubbles have high nutrient stressors and low ecological metrics. Green outlined bubbles have high nutrient stressors and good ecological metrics.

2. **Which HUC12s have favorable stressor and/or ecological indices, but weaker social index scores?**

The purpose for this analysis is to identify HUC12s that have relatively positive ecological and stressor traits that might imply greater potential for restoration or loading reduction activities, but score lower on the social context that often aids overall success of watershed management efforts. These HUC12s might be targeted for improving the social metrics that scored low, if they are otherwise good candidates for action. Although this demonstration was limited by the few social metrics available, conceptually this type of analysis can yield more useful results with better social indicators.

In the case of Boone and Turkey watersheds, all of the HUC12 watersheds have *conservation projects* (100% coverage). The Boone watershed does not have any *watershed management authority* and Turkey is covered 100% by a watershed management authority, therefore these indicators do not help to rank the HUC12 watersheds (all scores being equal). There are no *drinking water source protection areas* in either watershed. Social Index ranking is therefore based on the number of *segments with TMDLs*, *% of the watershed that is protected by IUCN status*, and the *% of watershed with potentially restorable wetlands*. These social indicators identify Drainage Ditch 68-Boone River and Drainage Ditch 4-Boone River as having better ecological and stressor indicator combination, but lower Social Index scores in the Boone watershed (Figure 23). In addition, Drainage Ditch 32-Boone River which is located in the upper right quadrant could be identified as potentially threatened (good ecological scores and high level of stressors), and therefore in need of additional protection or social organization. In the Turkey watershed, Bell Creek-Turkey River, Nutting Creek, Bluebell Creek-Turkey River, and Grannis Creek-Volga River have lower Social Index scores and favorable ecological and stressor index scores. Additional social indicators could be further added to these screening runs that better represents "social momentum" in order to effectively address this question.

Contrasting with these HUC12s are subwatersheds that have high Social Index scores along with favorable ecological and stressor index scores, including Prairie Creek-Boone River (Boone River watershed) and Carlan Creek-Turkey River and Honey Creek-Volga Creek (Turkey River). These subwatersheds that plot in the upper left quadrant could also be a focus of nutrient reduction activities given their Social Index scores and potential for restoration.

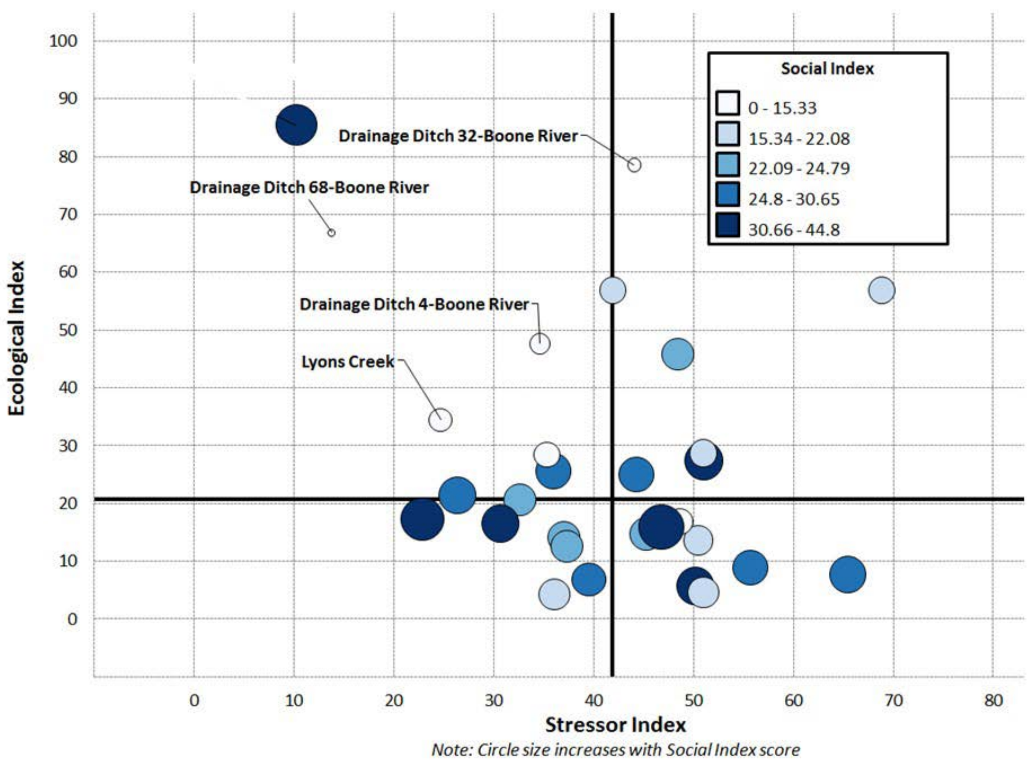


Figure 23. Boone bubble plot color-coded for Social Index score. Labeled watersheds have favorable ecological and stressor index scores and lower Social Index scores.

3. **Where might certain types of watershed practices be generally appropriate or effective?**

The purpose of this analysis is to consider which HUC12s might be better suited to generalized families of pollution control practices. This type of RPS application is appropriate for 'a quick look' at generalized options rather than for actual selection of specific control practices and best watersheds in which to use them.

In the Boone and Turkey watersheds, which are both heavily agricultural, it would be most relevant to compare the HUC12s' values for selected agricultural indicators. Selected indicator values of all the Boone HUC12s are compared via a data table with three selected stressor indicators (Table 7). Each indicator is color-assigned in quartiles from highest to lowest value. Figure 24 through Figure 26 provide a summary of each indicator in map format for the Boone watershed.

Table 7. Boone HUC12 watershed values for three stressor indicators that may be useful in watershed choices for management activities. Each indicator is color-assigned in quartiles from highest (dark green) to lowest value (white).

Watershed ID	Watershed Name	Example Management Activity and Associated Indicator		
		Nitrogen Fertilizer Management	Manure Management	Drainage Water Management
		% Corn and Corn/Soy Rotations in Watershed	Count of Animals in Watershed	% Tile Drained Soil in Watershed
71000050101	Drainage Ditch 117	89.5	11777.73	85.93
71000050102	Headwaters Prairie Creek	90.3	97859.09	84.87
71000050103	Drainage Ditch 116-Prairie Creek	89.2	32035.24	87.46
71000050104	Drainage Ditch 18-Prairie Creek	91.4	137621.22	74.09
71000050201	Headwaters Boone River	91.3	420196.91	82.07
71000050202	Middle Branch Boone River	92.9	349406.97	91.84
71000050203	East Branch Boone River	92.8	239136.04	91.34
71000050204	Drainage Ditch 44-Boone River	89	296800.88	93.33
71000050205	Drainage Ditch 1-Boone River	89.3	317930.81	87.44
71000050301	West Otter Creek	93.3	431452.45	90.7
71000050302	Headwaters Otter Creek	94.9	231662.65	83.74
71000050303	Otter Creek	91.4	320631.39	85.28
71000050401	Little Eagle Creek	94.5	345073.88	84.85
71000050402	Headwaters Eagle Creek	88.3	406350.98	76.8
71000050403	Eagle Creek	86.5	560146.89	82.01
71000050501	Headwaters White Fox Creek	90	586788.13	69.98
71000050502	Buck Creek	84.7	202258.28	73.51
71000050503	White Fox Creek	87.7	341588.42	76.07
71000050601	Joint Drainage Ditch 3-Boone River	88.6	181723.73	71.76
71000050602	Drainage Ditch 9	94.7	53326.45	74.04
71000050603	Drainage Ditch 3	91.3	74629.09	78.31
71000050604	Drainage Ditch 4-Boone River	78.8	321800.4	72.46
71000050605	Drainage Ditch 46-Boone River	81.2	493866.32	78.82
71000050606	Drainage Ditch 68-Boone River	69.6	20979.77	66.83
71000050701	Lyons Creek	83.8	18435.36	73.13
71000050702	Brewers Creek	85	27027.81	90.43
71000050703	Drainage Ditch 206	87.2	27139.99	66.41
71000050704	Drainage Ditch 32-Boone River	66.2	35511.5	63.83
71000050705	Prairie Creek-Boone River	62.9	38806.9	65.82

The highest indicator values (darker cells) help identify HUC12s with the greatest amount of specific activities that may be nutrient sources. For example, *percent of watershed with corn and corn/soybean rotation* can indicate areas where nitrogen fertilizer may be more heavily used as compared to those areas that are rotating crops with soybeans or other nitrogen-fixing crops. These areas may be appropriate for a variety of fertilizer management best management practices. Manure management planning activities could be targeted for those watersheds that have the highest proportion of livestock (i.e., Headwaters White Fox Creek) and drainage water management practices such as controlled drainage, bioreactors, and saturated buffers could be best targeted in watersheds with the highest proportion of tile drained lands (i.e., Drainage Ditch 44-Boone River). These are selected examples of how, due to the ease of data retrieval from the RPS tool, any indicators for any set of watersheds can be compared in numerous ways with limited effort in the desktop environment.

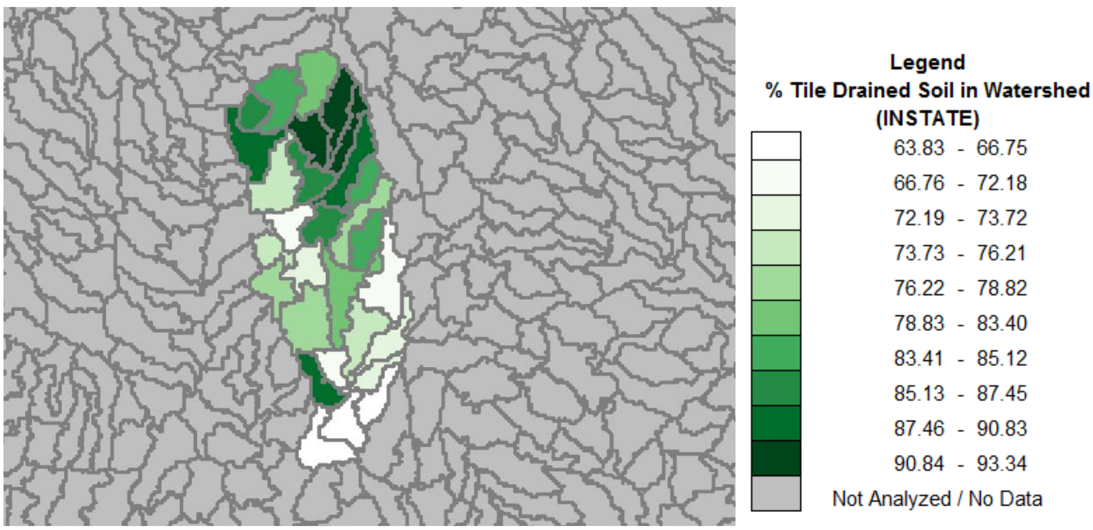


Figure 24. HUC12 watersheds with the highest proportion of tile drained soil include: Brewers Creek, West Otter Creek, Middle Branch Boone River, Drainage Ditch 44-Boone River, and East Branch Boone River.

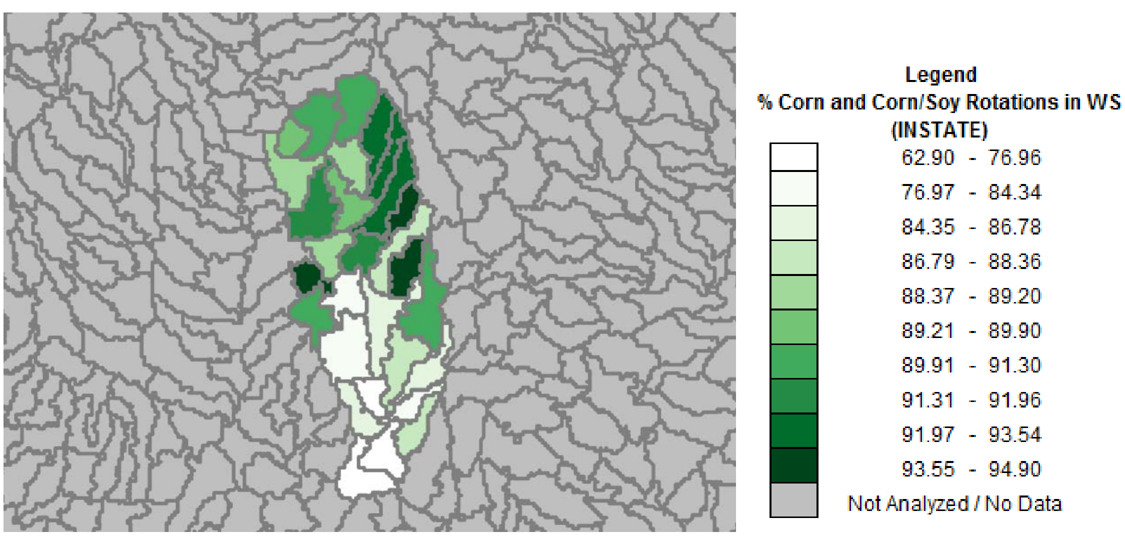


Figure 25. HUC12 watersheds with the highest proportion of corn and soybeans in rotation include: Headwaters Otter Creek, Drainage Ditch 9, Little Eagle Creek, West Otter Creek, Middle Branch Boone River, East Branch Boone River, Drainage Ditch 18-Prairie Creek, Otter Creek, Headwaters Boone River, Drainage Ditch 3, Headwaters Prairie Creek, Headwaters White Fox Creek.

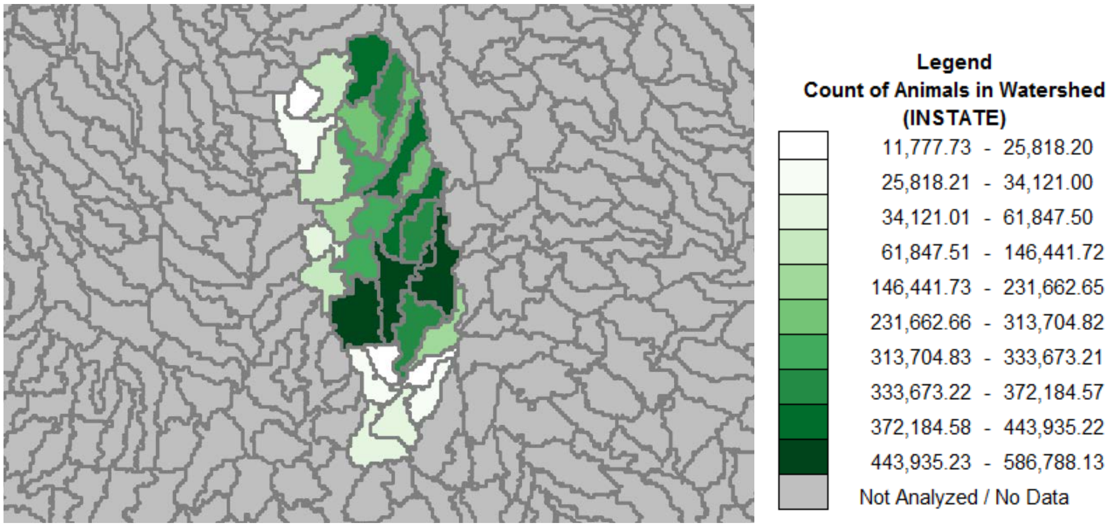


Figure 26. HUC12 watersheds with the highest number of animals (livestock) include: Headwaters Boone River, West Otter Creek, Drainage Ditch 46-Boone River, Headwaters White Fox Creek, and Eagle Creek.

In the Turkey watershed where phosphorus reduction is needed, fertilizer management could be an important management activity in watersheds with the highest level of corn production (e.g., Silver Creek) while manure management could be best focused in watersheds with the highest number of animals (e.g., Headwaters Elk Creek) (Table 8). Note, there are no point sources of phosphorus in this watershed.

Table 8. Turkey HUC12 watershed values for two selected stressor indicators that may be useful in choice of management strategies and targeted subwatersheds. Each indicator is color-assigned in quartiles from highest (dark green) to lowest value (white). Specific stressor indicators can inform selection of those HUC12 watersheds where different types of control practices may be most effective (e.g., fertilizer management).

Watershed ID	Watershed Name	Example Management Activity and Associated Indicator	
		Fertilizer Management	Manure Management
		% Corn and Corn/Soy Rotations in Watershed	Count of Animals in Watershed
70600040101	Headwaters Crane Creek	69	26777.54
70600040102	Spring Creek-Crane Creek	66.1	26673.31
70600040103	Village of Lawler-Crane Creek	67.7	17642.26
70600040104	Simpson Creek-Crane Creek	69.3	19839.26
70600040105	Dry Run-Crane Creek	70.8	17636.06
70600040201	Headwaters Little Turkey River	61.3	24747.87
70600040202	Upper Little Turkey River	65.1	15373.31
70600040203	Middle Little Turkey River	49.9	12699.63
70600040204	Lower Little Turkey River	41.8	16330.52
70600040301	North Branch Turkey River	69.7	20952.7
70600040302	South Branch Turkey River-Turkey River	79	16320.64
70600040303	Chihaks Creek-Turkey River	36.4	11596.66
70600040304	Bohemian Creek	66.9	14353
70600040305	Otter Creek-Turkey River	44.8	19629.14

70600040306	Wonder Creek	64.6	10539.35
70600040307	Rogers Creek	63.3	10434.28
70600040308	Burr Oak Creek-Turkey River	28.4	14592.27
70600040309	Brockamp Creek-Turkey River	26	24812.69
70600040401	Silver Creek	76.1	14068.92
70600040402	Headwaters Roberts Creek	69.7	17324.54
70600040403	Howard Creek	73	15591.05
70600040404	Dry Mill Creek	64.4	11076.26
70600040405	Roberts Creek	41.3	12085.73
70600040501	North Branch Volga River	84.7	11407.67
70600040502	Headwaters Volga River	85.3	11633.02
70600040503	Little Volga River	83.1	17168.13
70600040504	Coulee Creek-Volga River	76	13485.13
70600040505	Frog Hollow	38.2	7553.47
70600040506	Grannis Creek-Volga River	36.5	15965.97
70600040601	Brush Creek	55.2	15131.47
70600040602	Mink Creek	27.7	8820.36
70600040603	Hewett Creek	19.3	8143.36
70600040604	Nagle Creek-Volga River	14.1	25856.21
70600040605	Cox Creek	10	14400.26
70600040606	Honey Creek-Volga River	10.5	18790.62
70600040607	Bear Creek	10.2	11741.1
70600040608	Doe Creek-Volga River	7.2	9524.1
70600040701	Dry Branch	35.2	11410.36
70600040702	Nutting Creek	32.6	13202.62
70600040703	Village of Eldorado-Turkey River	29.4	11171.37
70600040704	Dibble Creek	31.4	8288.03
70600040705	Fitzgerald Creek-Turkey River	22.6	8166.61
70600040706	Otter Creek	46.9	20983.26
70600040707	Bell Creek-Turkey River	14.1	9431.09
70600040708	Beaver Creek-Turkey River	18.3	23811.9
70600040709	French Hollow-Turkey River	19.1	23325.4
70600040710	Panther Creek-Turkey River	21.6	15532.55
70600040801	Headwaters Elk Creek	29.8	30780.58
70600040802	Elk Creek	12	13504.65
70600040901	South Cedar Creek	38.8	17909.07
70600040902	Carlan Creek-Turkey River	10.3	15489.32
70600040903	Cherry Valley-Little Turkey River	23.2	23582.16
70600040904	Bluebell Creek-Turkey River	15.6	16279.02

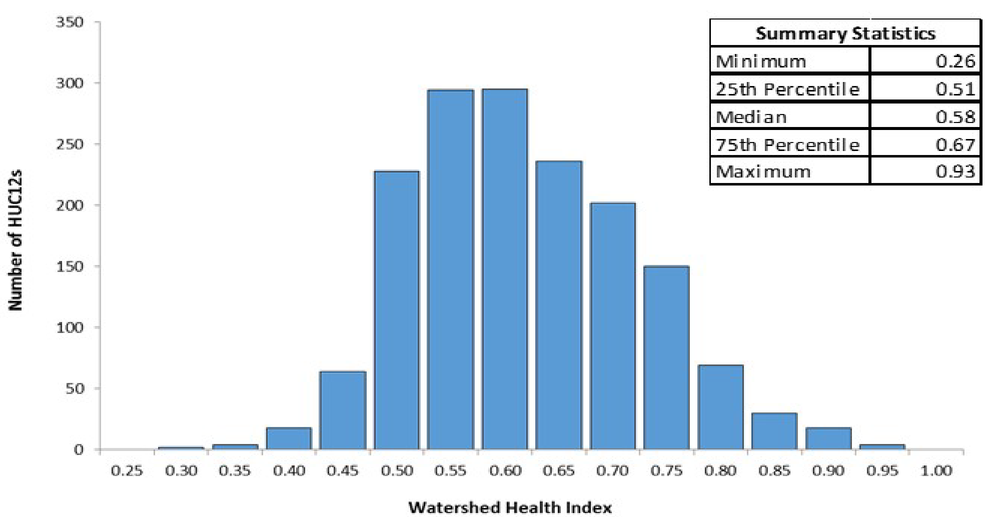
4. Which HUC12s might be protected while others are restored?

Although the RPS Tool is most often used to guide restoration planning, it can also be applied to identify possible priority watersheds for protection efforts. Identifying suitable prospects for protection at the subwatershed scale can be part of a strategy to help restore the greater HUC8 watershed due to downstream effects, while also maintaining ecological and human benefits from the healthy subwatershed itself. Regarding nutrient management, healthy subwatersheds can play an important role in attenuating nutrient loads from upstream sources and routing clean water to dilute downstream nutrient loads. This demonstration question shows how the RPS Tool can help identify possible protection priority watersheds based on an EPA healthy watersheds multi-metric assessment score or by using single indicators of interest.

The EPA Healthy Watersheds Program recently initiated the Preliminary Healthy Watersheds Assessment (PHWA) to assess relative watershed health across HUC12s statewide in each of the conterminous US states. The PHWA uses many of the same indicators available in the RPS Tool to characterize the potential for a HUC12 to possess the attributes of a healthy watershed, including natural land cover that supports hydrologic and geomorphic processes within their natural range of variation, good water quality, and habitats of sufficient size and connectivity to support healthy, native aquatic and riparian biological communities. Indicators used in the PHWA are combined into six sub-index scores for each HUC12 that describe the relative condition of six primary watershed health attributes: landscape condition, aquatic habitat, hydrology, geomorphology, water quality, and biology. Sub-index scores are combined into an overall Watershed Health Index that serves as an integrated measure of relative watershed health. The PHWA separately also compiles a Watershed Vulnerability Index from three sub-indices based on land use change, water use change, and wildfire risk.

The Iowa RPS Tool includes statewide PHWA Watershed Health Index and sub-index scores as HUC12 scale ecological indicators, and Vulnerability Index and sub-index scores as stressor indicators. These scores can be added to the RPS bubble plot or mapped within the tool, relating any screening for any purpose to the relative differences in watershed health. Although it is possible to run a screening based entirely on selecting PHWA indicators, the demonstration below uses the same Stage 2 screening indicator selections for Turkey and Boone to remain consistent with the rest of Stage 2.

Interpreting the Watershed Health Index can be aided by reviewing the distribution of scores and summary statistics for Iowa HUC12s (Figure 27). Scores for Iowa HUC12s range from 0.26 to 0.93, with higher scores reflecting a greater potential for a HUC12 to have the structure and function in place to support healthy aquatic ecosystems. HUC12s in the top 25th percentile have Watershed Health Index scores greater or equal to 0.67, while bottom 25th percentile HUC12s have scores less than or equal to 0.51. Note that, as a relative gradient of scores statewide, no specific healthy/unhealthy threshold values have been identified.



Summary Statistics	
Minimum	0.26
25th Percentile	0.51
Median	0.58
75th Percentile	0.67
Maximum	0.93

Figure 27. Histogram of statewide Watershed Health Index scores for Iowa HUC12s. Summary statistics are displayed in the upper right corner of the plot.

Bubble plots for the Boone and Turkey watersheds are shown in Figure 28 and Figure 29, respectively, with bubbles shaded according to Watershed Health Index scores. The Boone watershed contains five HUC12s that are in the top 25th percentile of statewide Watershed Health Index scores, while the Turkey watershed contains twenty-two HUC12s in the top 25th percentile of statewide Watershed Health Index scores (shaded dark blue and labeled in Figure 28 and Figure 29). The high Watershed Health Index scores for these HUC12s suggest they are more likely to contain high-quality aquatic ecosystems than other HUC12s included in the Stage 2 screenings and may therefore be better candidates for watershed protection efforts.

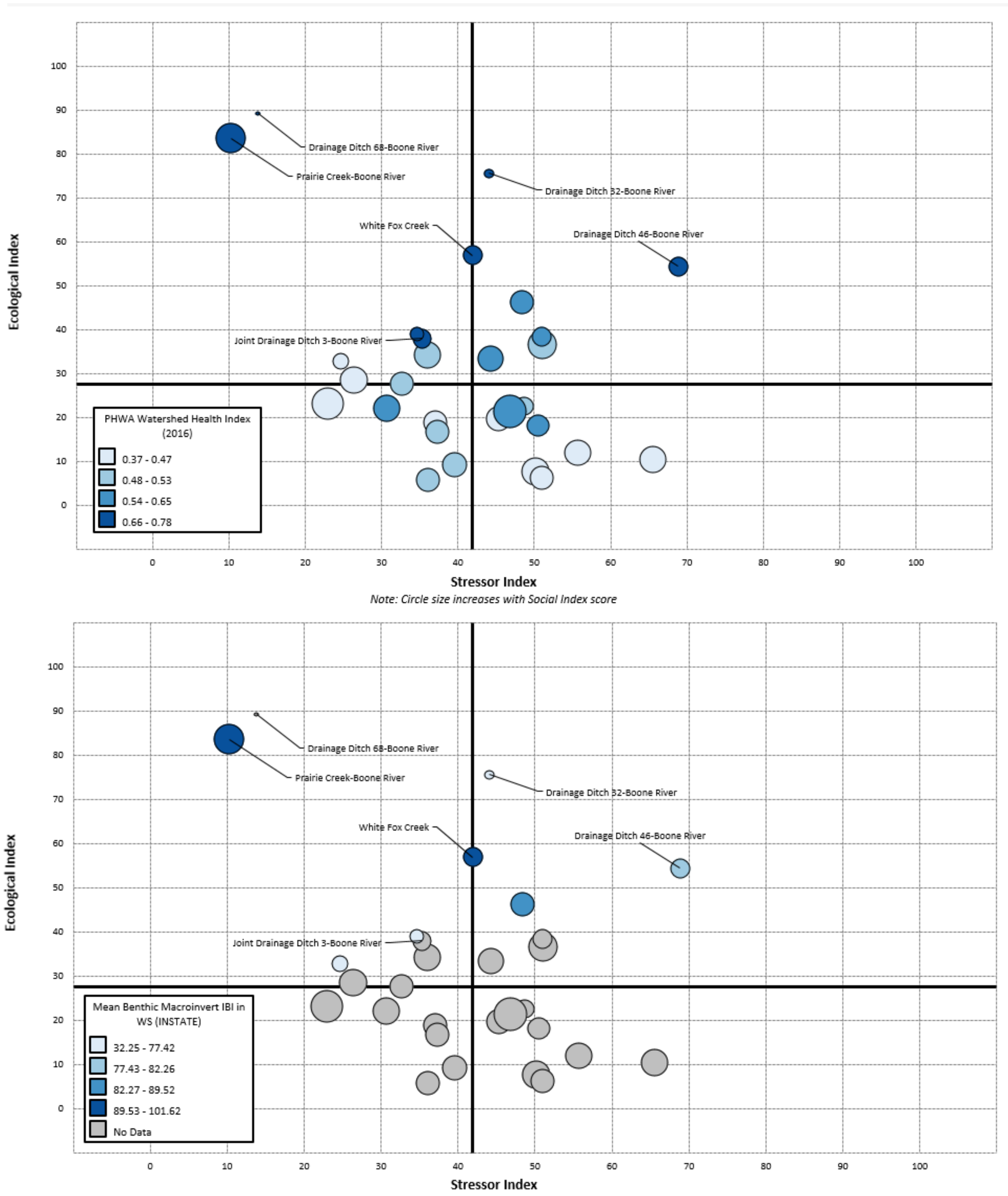
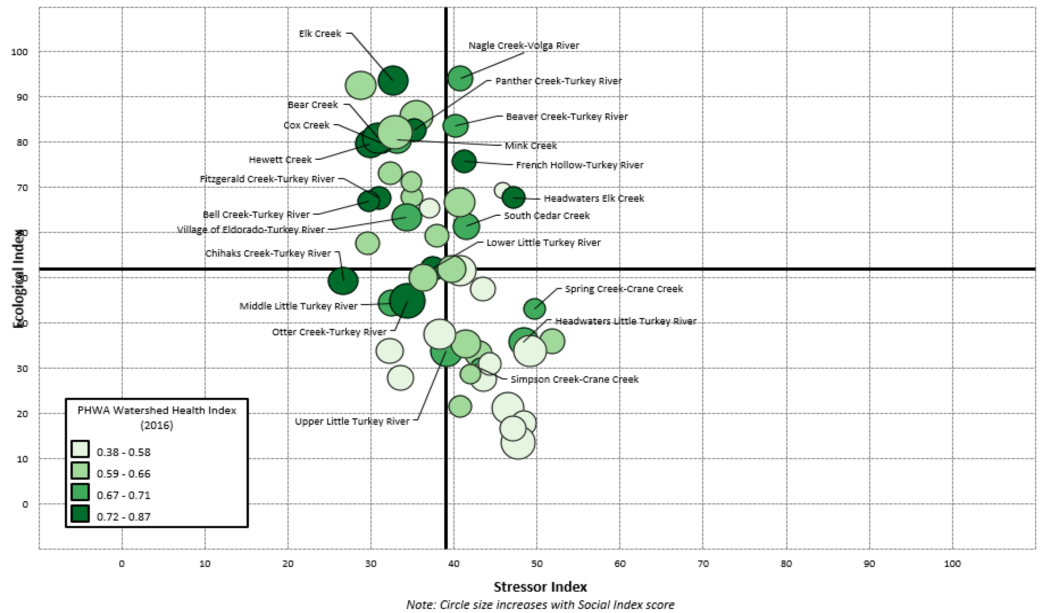


Figure 28. Bubble plots for HUC12s in the Boone watershed with bubbles shaded according to PHWA Watershed Health Index scores (top) and mean benthic macroinvertebrate IBI scores (bottom). HUC12s that fall in the top 25% of statewide Watershed Health Index scores (6 of 29 HUC12s in Boone) are labeled in both plots.

Additional review of data on aquatic ecosystem conditions for HUC12s with high Watershed Health Index scores can validate and further refine protection priorities. For example, benthic macroinvertebrate Index of Biotic Integrity (IBI) scores for Boone and Turkey HUC12s (bottom plots in Figure 28 and Figure 29) can be used as a line of evidence to confirm that Watershed Health Index scores accurately capture gradients of ecosystem conditions. As shown in Figure 28 and Figure 29, many of the same HUC12s with high Watershed Health Index scores also have high mean benthic macroinvertebrate IBI scores. Furthermore, some of these HUC12s also have high Stressor Index scores (e.g., Drainage Ditch 46-Boone River in the Boone watershed and Headwaters Elk Creek in the Turkey watershed). The combination of high Watershed Health Index scores, high IBI scores, and high Stressor Index scores points to greater resilience to nutrient loading in these HUC12s but also suggests they may be susceptible to future degradation without intervention to prevent additional nutrient loading.



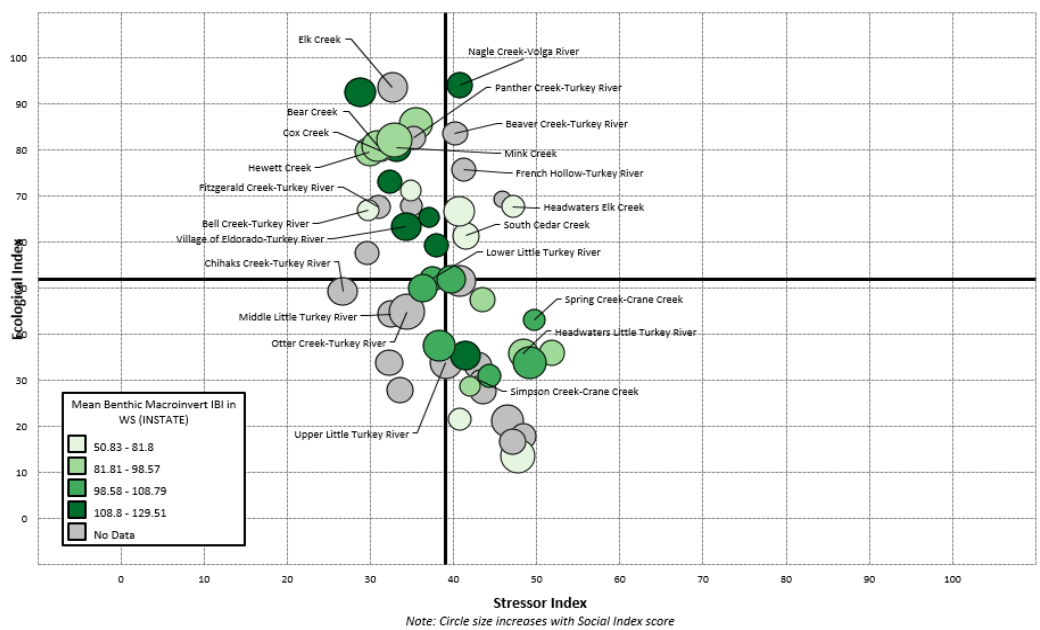


Figure 29. Bubble plots for HUC12s in the Turkey watershed with bubbles shaded according to PHWA Watershed Health Index scores (top) and mean benthic macroinvertebrate IBI scores (bottom). HUC12s that fall in the top 25% of statewide Watershed Health Index scores (22 of 53 HUC12s in Turkey) are labeled in both plots.

SUMMARY AND RECOMMENDATIONS

This document summarizes the use of Recovery Potential Screening (RPS) to compare watersheds at two scales (HUC8 and HUC12) for purposes of informing possible watershed management options and priorities for nutrient management. Utilizing georeferenced data provided primarily by DNR, EPA and additional sources, this project compiled 357 indicators (base, ecological, stressor and social) at one or both watershed scales that were used to screen and compare watersheds in a two-stage process. In the first stage, Iowa's HUC8s were screened with three separately developed sets of indicators selected to identify initial focus groups with nutrient management challenges. Based on these first stage screenings and other criteria, two watersheds were selected as demonstration HUC8s for further analysis in the second stage.

Stage 2 screenings were performed on each of the demonstration HUC8s for which component HUC12s were scored using more detailed sets of indicators that drew from HUC12-scale metrics. Whereas the purpose of Stage 1 was to compare and recognize like groups of scenario watersheds at the larger scale, the purpose of Stage 2 analysis was to examine and reveal potential opportunities for nutrient management action at the more localized HUC12 scale. As a demonstration of the RPS Tool, no priorities among HUC12s were selected in this project but numerous alternatives and analytical techniques were presented. Products include this summary report, a master RPS Tool file, and several separate screening files that archived the results from the Stage 1 and Stage 2 screenings. Opportunities from this point forward may include:

Become adept at RPS Tool desktop use. Despite the extensive amount of data it holds and the wide variety of comparisons among watersheds that these data can support, the RPS Tool is actually a fairly simple spreadsheet tool. This tool opens the door to simple but useful forms of spatial data analysis, systematic comparisons among watersheds, and a variety of visualization tools – on their own desktops without the need for specialized GIS skills or software. A wider circle of users will be able to perform quick 'what-if' screenings to compare watersheds on the spur of the moment and gain insights on what may be worth a greater investment of time and effort with more technical analytical tools.

Apply the RPS Tool to other screening topics. Although this application of the RPS Tool focused on nutrients, the Iowa dataset could support numerous other screening themes and purposes that can be explored in the interest of long-term priority setting for restoration and protection. Other screening topics might include sediment, metals, pathogens, or any other prominent water quality concerns. Or in contrast, screenings might focus on a valued resource such as watersheds with coldwater fisheries, or drinking water sources, or major outdoor recreational sites. The RPS Tool might be used to develop a first-cut identification of healthy watersheds for protection, or rank likely eligibility for specific types of pollution control incentives. With both the TMDL Program and the Non-Point Source Control Program promoting watershed priority-setting, the range of opportunities is widespread.

Refine the available data and selection of indicators. Even within this nutrient application of RPS, opportunities always exist to add more relevant data or refine previous screenings as new insights are gained. The RPS Tool is structured to accept additional indicator data from a user that can then be made part of future screenings. For example, DNR may want to expand the social indicators to represent those organizations in the State that have a high level of interest in water resources (e.g., fishing organizations). New data needn't be statewide, and a local user may still use the tool after adding new data for a limited set of their local subwatersheds. Further, previous analyses can be refined by structured group processes to assign consensus weights to indicators, or by correlation analyses designed to narrow down indicator selections and better differentiate watersheds. For example, varying Iowa's available HUC8 indicators and re-screening could allow for considering nutrient delivery to the Gulf of Mexico as well as comparing HUC8s based on instate effects.

Galvanize State/local restoration and protection dialogue and partnering. RPS offers a mechanism for State-local collaboration. Rather than assume that the RPS indicators are a static dataset, or that the HUC8 screenings shouldn't be additionally adjusted or customized, further tailoring to the circumstances and data of each locale (e.g., in WMAs) is appropriate and encouraged. Some HUC8s may host watershed groups, researchers and other sources of continued analysis and refinement of the available indicators and techniques that can be accommodated by this versatile tool. Further, if local organizations do engage with DNR and enhance their RPS Tool copies, they may provide valuable dialogue on addressing local as well as Statewide interests in watershed priority-setting and improved nutrient management.

Attachment 1

Recovery Potential Screening

***New in 2016*: Updated Statewide RPS Tools Released for Lower 48 States and Preliminary Healthy Watersheds Assessments Being Added to RPS Data**

Recovery Potential Screening (RPS) is a systematic method and tool for comparing watersheds based on characteristics relevant to successful restoration or protection.

With limited restoration resources, strategic planning and priority-setting are a must. EPA Office of Water developed RPS to provide restoration planners with a systematic, flexible tool for comparing watersheds in terms of key factors affecting restoration. To date, 25 States have engaged in different types of RPS projects, and 48 States have Statewide RPS Tools containing data drawn from a national indicators library.

Ecological Indicators

Measure the capacity to maintain or reestablish natural structure and processes

Stressor Indicators

Measure the extent of anthropogenic sources of impaired water quality

Social Indicators

Measure relevant community, regulatory, informational or motivational factors

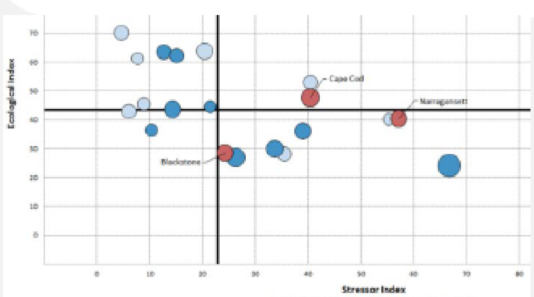
RPS uses three categories of indicators to compare watersheds. Indicators are combined to calculate Ecological Index, Stressor Index, and Social Index scores as well as an overall Recovery Potential Integrated (RPI) Index score. Users choose different indicators for different screening purposes.

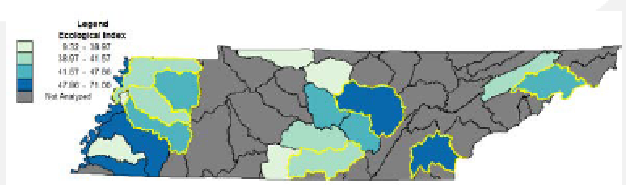
The RPS Tool is a custom-coded Excel spreadsheet that performs all RPS calculations and generates RPS outputs. RPS Tools are now available for each of the lower 48 States.

The Statewide RPS Tool nationwide series was first released in July 2014 and updated in June 2016 as a set of ready-to-use RPS tools for each of the lower 48 States. Each Tool has indicator data already embedded for all HUC12 watersheds that are wholly or partially within the State's boundary. In addition to storing pre-calculated data for over 200 indicators, each Statewide Tool:

- Contains a user-friendly interface for setting up a screening
- Automatically calculates RPS index scores and ranks for the HUC12 watersheds of interest
- Displays results in customizable table, plot and map form
- Can be readily updated with new, user-generated indicator data

The RPS Tool is designed for use by anyone familiar with the basics of Microsoft Excel. Directions for each step are contained within the Tool file, and a user manual with more detailed directions is on the website. EPA provides technical assistance to States, Tribes and Territories through RPS projects (over).





The RPS Tool displays customizable plots, maps and data tables of screening results completely within Excel. No additional software is needed.

For more information visit the RPS website at: *www.epa.gov/rps*
Download a copy of the RPS Tool for your State or contact Doug Norton, EPA Office of Water (norton.douglas@epa.gov)

STATE	EPA RECOVERY POTENTIAL SCREENING TOOLS AND TECHNICAL SUPPORT FOR STATES (2005 - PRESENT)
AK	None requested
AL	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Custom State Tool and Assistance Project
AR	RPS Statewide Tool 2014, RPS Statewide Tool 2016
AZ	RPS Statewide Tool 2014, RPS Statewide Tool 2016
CA	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop, 9 Water Board Custom Tools
CO	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop, Healthy Watersheds Pilot State
CT	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop, Custom State Tool and Assistance Project
DC	Covered in MD, VA Statewide Tools
DE	RPS Statewide Tool 2014, RPS Statewide Tool 2016
FL	RPS Statewide Tool 2014, RPS Statewide Tool 2016, State-led Applications
GA	RPS Statewide Tool 2014, RPS Statewide Tool 2016
HI	None requested
IA	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
ID	RPS Statewide Tool 2014, RPS Statewide Tool 2016
IL	RPS Statewide Tool 2014, RPS Statewide Tool 2016, RPS Pilot State, Custom State Tool and Assistance Project
IN	RPS Statewide Tool 2014, RPS Statewide Tool 2016
KS	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool
KY	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
LA	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
MA	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
MD	RPS Statewide Tool 2014, RPS Statewide Tool 2016, RPS Pilot State, Custom State Tool and Assistance Project
ME	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop
MI	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Custom State Tool and Assistance Project
MN	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Custom State Tool and Assistance Project
MO	RPS Statewide Tool 2014, RPS Statewide Tool 2016
MS	RPS Statewide Tool 2014, RPS Statewide Tool 2016
MT	RPS Statewide Tool 2014, RPS Statewide Tool 2016
NC	RPS Statewide Tool 2014, RPS Statewide Tool 2016
ND	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
NE	RPS Statewide Tool 2014, RPS Statewide Tool 2016
NH	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop, State-led Applications
NJ	RPS Statewide Tool 2014, RPS Statewide Tool 2016
NM	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
NV	RPS Statewide Tool 2014, RPS Statewide Tool 2016
NY	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Tool Demonstration
OH	RPS Statewide Tool 2014, RPS Statewide Tool 2016
OK	RPS Statewide Tool 2014, RPS Statewide Tool 2016
OR	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Tool Demonstration
PA	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop, Custom State Tool and Assistance Project
PR/Terr	None requested
RI	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop
SC	RPS Statewide Tool 2014, RPS Statewide Tool 2016, State-led Applications
SD	RPS Statewide Tool 2014, RPS Statewide Tool 2016
TN	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
TX	RPS Statewide Tool 2014, RPS Statewide Tool 2016, State-led Applications
UT	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Nutrients Demo Project, Custom State Tool, Workshop
VA	RPS Statewide Tool 2014, RPS Statewide Tool 2016
VT	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Workshop, Custom State Tool and Assistance Project
WA	RPS Statewide Tool 2014, RPS Statewide Tool 2016
WI	RPS Statewide Tool 2014, RPS Statewide Tool 2016
WV	RPS Statewide Tool 2014, RPS Statewide Tool 2016, Healthy Watersheds Pilot State
WY	RPS Statewide Tool 2014, RPS Statewide Tool 2016
Tribes	Tribal & Tribal-adjacent HUC12 watersheds flagged in every RPS Statewide Tool to enable Tribe-specific usage
Other	Interstate RPS Tools for Potomac, Delaware, Mobile Bay, L I Sound Basins (HUC12) and entire Lower 48 (HUC8)

Attachment 2: Iowa Stage 1 Scenario Indicator Descriptions

Green denotes ecological indicators, red are stressor indicators, and blue are social indicators. All Iowa-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.

HUC8 METRIC	DESCRIPTION
% Natural Cover in Watershed (2009 Hi-Res)*	The percentage of the watershed within the state classified as 'Forest', combining 'Coniferous Forest', 'Deciduous Short', 'Deciduous Medium', 'Deciduous Tall', 'Grass 1', and 'Grass 2' (grid codes 3, 4, 5, 6, 7 and 8) by the 2009 Iowa High Resolution Land Cover dataset. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries. (See also 2009 Iowa High Resolution Land Cover glossary definition).
% Natural Cover in Hydrologically Connected Zone (2009 Hi-Res)*	The percentage of the HCZ, within the watershed within the state classified as 'Forest', combining 'Coniferous Forest', 'Deciduous Short', 'Deciduous Medium', 'Deciduous Tall', 'Grass 1', and 'Grass 2' (grid codes 3, 4, 5, 6, 7 and 8) by the 2009 Iowa High Resolution Land Cover dataset. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries. (See also Hydrologically Connected Zone and 2009 Iowa High Resolution Land Cover glossary definitions).
Habitat Condition Index Watershed (2015)	Mean Habitat Condition Index (HCI) score for the HUC12 from the National Fish Habitat Partnership (NFHP) 2015 National Assessment. Scores range from 1 (high likelihood of aquatic habitat degradation) to 5 (low likelihood of aquatic habitat degradation) based on land use, population density, roads, dams, mines, and point-source pollution sites. Source data were NFHP 2015 National Assessment Local Catchment HCI scores for NHDPlus Version 1 catchments (acquired via personal communication with NFHP in March 2016). NHDPlus Version 1 catchments are local drainage area delineations for surface water features in the NHDPlus Version 1 database. Catchment HCI scores were aggregated to HUC12 scores by calculating the area-weighted mean of HCI scores for catchments that intersect the HUC12. See http://ecosystems.usgs.gov/fishhabitat/nfhap_download.jsp for more information on the NFHP National Assessment.
% Row Crop (Corn+Soybeans) in Watershed (2009 Hi-Res)*	The percentage of the watershed, within the state classified as 'Row Crop' combining 'Corn' and 'Soybeans' (grid codes 10 and 11) by the 2009 Iowa High Resolution Land Cover dataset. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries. (See also 2009 Iowa High Resolution Land Cover dataset glossary definition).
% Cut Hay in Watershed (2009 Hi-Res)*	The percentage of the watershed, within the state classified as 'Cut Hay' (grid code 9) by the 2009 Iowa High Resolution Land Cover dataset. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries. (See also 2009 Iowa High Resolution Land Cover dataset glossary definition).
Nitrate Concentration in Watershed*	Average Nitrate (NO3) concentration in streams within the watershed, within the state. Source data was provided by the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Total Phosphorus Concentration in Watershed*	Total Phosphorus (TP) concentration in streams within the watershed, within the state. Source data was provided by the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Nitrate Yield in Watershed*	Average Nitrate (NO3) yield, or loads, in pounds per acre from the watershed, within the state. Source data was provided by the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Total Phosphorus Yield in WS*	Total Phosphorus (TP) yield, or loads, in pounds per acre from the watershed, within the state. Source data was provided by the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Sum of Max Flow from WWTPs in Watershed*	The total maximum flow from waste water treatment plants within the watershed, within Iowa. Created using the Iowa Natural Resource Geographic Information Systems

	(NRGIS) Library. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
% Tile Drained Soil in Watershed*	The percentage of the watershed, within the state having soils requiring tile drainage for full productivity. Created using the Iowa Natural Resource Geographic Information Systems (NRGIS) Library. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Total Nitrogen Applied in watershed*	Total tons of nitrogen fertilizer applied by Major Land Resource Area (see Table 12 in Iowa Nutrient Reduction Strategy) were used to estimate values for the watershed, within Iowa, in short tons (i.e., tons) - equivalent to 2,000 pounds. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Count of Animals in Watershed*	The number of animal units per county was translated to HUC-scale using the 2012 USDA Census of Agriculture which identifies pastured animals by subtracting the total minus animals in AFOs or CAFOs (see other related indicator descriptions for data sources). An area weighted analysis was used to convert the provided county-level data to HUC-scale data. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Mean Bray Phosphorus Value in Watershed*	The median phosphorus (P) concentration within the watershed, within the state. These values were derived by an area-weighting method used to assign county-level data to each HUC. Source data was derived from soil tests performed by (Bray-1 method) the Iowa State University Soil Testing and Plant Analysis Laboratory on selected soil samples submitted by Iowa farmers. Soil test results are from 2006-2010. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Count of Nutrient-Related Stream Impairments in Watershed*	The number of nutrient-related impairments from Iowa's 2012 Listing of Clean Water Act Section 303(d) and 305(b) Impaired Streams within the HUC. Created using the Iowa Natural Resource Geographic Information Systems (NRGIS) Library. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Count of Nutrient-Related Lake Impairments in Watershed*	The number of nutrient-related impairments from Iowa's 2012 Listing of Clean Water Act Section 303(d) and 305(b) Impaired Lakes within the HUC. Created using the Iowa Natural Resource Geographic Information Systems (NRGIS) Library. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
% of HUC in Iowa	Percent of total HUC area that is comprised by a specific named state. Source data was the US Census Bureau 2013 TIGER state boundary dataset from http://www2.census.gov/geo/tiger/TIGER2013/STATE/ downloaded in July 2013. Equation used: Instate Area / HUC12 Area * 100.
% WMA in Watershed*	The percentage of the watershed, within the state, covered by a Watershed Management Authority (WMA). Source data was received from the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
% Covered by Conservation Activities*	The percentage of the watershed, within the state, covered by a "Social Activity" as identified by multiple geospatial coverages provided by DNR. These coverages were merged to create one seamless coverage for this indicator: Active Mississippi River Basin Healthy Watersheds Initiative (MRBI), Watershed Improvement Review Board (WIRB), approved Section 319 Watershed Management Plans (WMP), Water Quality Initiative Targeted Watershed Demonstration Projects (WQI), and Watershed Protection Fund (WSPF) initiatives, WQI_Water_Quality_Initiative_Priority_HUC8s (WQI_Priority). Source data was received via personal communication with Andy Asell (Iowa DNR). "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Segments with Nutrient TMDL Count	Count of surface water segments with a nutrient-related TMDL in the HUC12. Calculated as the number of unique state-assigned surface water segment IDs in the HUC12 from the EPA Office of Water TMDL Waters geospatial dataset with "Nutrients", "Organic Enrichment/Oxygen Depletion", "Algal Growth", or "Noxious Aquatic Plants" listed as a parent TMDL pollutant. (See also TMDL Waters glossary definition).
Drinking Water Source Protection Area, Cumulative	Percent of the HUC12 that is classified as a source water protection area (SWPA) for one or more public water system (PWS) drinking water sources. Source data was a SWPA

	geospatial dataset from the EPA Safe Drinking Water Information System (SDWIS; extracted December 2014). Calculated from the area of all SWPAs in the HUC12; overlapping SWPAs are counted separately and percentages can therefore exceed 100% if the HUC12 contains multiple overlapping SWPAs. Equation used: SWPA Area / HUC12 Area * 100.
% Any IUCN Status	Percent of the HUC12 that is designated as protected by the International Union for Conservation of Nature (IUCN). Lands considered protected by the IUCN have long-term protections in place to conserve ecosystem services and cultural values; they include lands held by national, state, or local governments, non-profit organizations, and voluntarily protected private land. Source data was the Protected Areas Database of the United States Version 1.2 from the USGS Gap Analysis Program (http://gapanalysis.usgs.gov/). Includes all lands that have been classified by the IUCN as protected areas; IUCN categories include Ia, Ib, II, III, IV, V, and VI. Equation used: IUCN Protected Land Area / HUC12 Area * 100. This indicator was calculated for EPA EnviroAtlas. Additional information on source data and calculation methods can be found at: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7BC5FFDE8E-7C27-4F50-AFEF-082E8A08C00A%7D.

Attachment 3: Iowa Stage 2 Screening Indicator Descriptions

Green denotes ecological indicators, red are stressor indicators, and blue are social indicators. All Iowa-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.

SCENARIO INDICATORS	DESCRIPTION
Habitat Condition Index (2015)	Mean Habitat Condition Index (HCI) score for the HUC12 from the National Fish Habitat Partnership (NFHP) 2015 National Assessment. Scores range from 1 (high likelihood of aquatic habitat degradation) to 5 (low likelihood of aquatic habitat degradation) based on land use, population density, roads, dams, mines, and point-source pollution sites. Source data were NFHP 2015 National Assessment Local Catchment HCI scores for NHDPlus Version 1 catchments (acquired via personal communication with NFHP in March 2016). NHDPlus Version 1 catchments are local drainage area delineations for surface water features in the NHDPlus Version 1 database. Catchment HCI scores were aggregated to HUC12 scores by calculating the area-weighted mean of HCI scores for catchments that intersect the HUC12. See http://ecosystems.usgs.gov/fishhabitat/nfhap_download.jsp for more information on the NFHP National Assessment.
% Natural Cover in Watershed (2009 Hi-Res)*	The percentage of the watershed within the state classified as 'Forest', combining 'Coniferous Forest', 'Deciduous Short', 'Deciduous Medium', 'Deciduous Tall', 'Grass 1', and 'Grass 2' (grid codes 3, 4, 5, 6, 7 and 8) by the 2009 Iowa High Resolution Land Cover dataset. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries. (See also 2009 Iowa High Resolution Land Cover glossary definition).
% Natural Cover in HCZ (2009 Hi-Res) *	The percentage of the HCZ, within the watershed within the state classified as 'Forest', combining 'Coniferous Forest', 'Deciduous Short', 'Deciduous Medium', 'Deciduous Tall', 'Grass 1', and 'Grass 2' (grid codes 3, 4, 5, 6, 7 and 8) by the 2009 Iowa High Resolution Land Cover dataset. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries. (See also Hydrologically Connected Zone and 2009 Iowa High Resolution Land Cover glossary definitions).
Mean Benthic Macroinvertebrate IBI in Watershed*	The mean "%RefCriterion" within the watershed within the state, that is used as the primary IBI indicator in the benthic macroinvertebrate IBI dataset, 2000 - present timeframe. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
TN Load from Major Dischargers in Watershed*	The total load of Total Nitrogen (TN) in pounds per day (lbs/day) from major NPDES dischargers in the watershed, within the state. Source data was provided by the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
TP Load from Major Dischargers in Watershed*	The total load of Total Phosphorus (TP) in pounds per day (lbs/day) from major NPDES dischargers in the watershed, within the state. Source data was provided by the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
% Tile Drained Soil in Watershed*	The percentage of the watershed, within the state having soils requiring tile drainage for full productivity. Created using the Iowa Natural Resource Geographic Information Systems (NRGIS) Library. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
% Corn and Corn/Soy Rotations in Watershed (INSTATE)	Percent of the watershed in Iowa with continuous corn or corn-soybean crop rotations. Source data was the 2008-2013 Agricultural Conservation Planning Framework (ACPF) spatial database for Iowa (acquired from Iowa DNR via personal communication in October 2016). The ACPF spatial database was developed by the US Department of Agriculture and includes a map layer depicting agricultural field boundaries and a table of field-scale land use information. Fields with continuous corn or corn-soybean crop rotations were defined as fields with general land use classified as 'Continuous Corn', 'Corn/Soybeans', or 'C/S with Continuous Corn' in the ACPF database. Calculated as the area of fields with continuous corn or corn-soybean crop rotations in the HUC divided by HUC area in Iowa, multiplied by

SCENARIO INDICATORS	DESCRIPTION
	100. "(INSTATE)" denotes that the indicator was only calculated for the HUC areas within Iowa.
Count of Animals in Watershed*	The number of animal units per county was translated to HUC-scale using the 2012 USDA Census of Agriculture which identifies pastured animals by subtracting the total minus animals in AFOs or CAFOs (see other related indicator descriptions for data sources). An area weighted analysis was used to convert the provided county-level data to HUC-scale data. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.
Nutrients 303d-Listed Segments Count	Count of surface water segments listed as impaired due to nutrients and requiring a TMDL under Section 303(d) of the Clean Water Act in the HUC12. Calculated as the number of unique state-assigned surface water segment IDs with "Nutrients", "Organic Enrichment/Oxygen Depletion", "Algal Growth", or "Noxious Aquatic Plants" listed as a parent cause of impairment in the HUC12 from the EPA Office of Water 303(d) Listed Waters geospatial dataset. (See also 303(d) Listed Waters glossary definition).
Soil Erodibility, Mean in Watershed	Average soil erodibility (K) factor in the HUC12. Source data was a 100-meter resolution grid of soil map units and attributes in the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (STATSGO2) database, acquired from the US Geological Survey in July 2013. Calculated as the mean of soil erodibility values in the HUC12.
Segments with TMDLs Count	Count of surface water segments with TMDLs in the HUC12. Calculated as the number of unique state-assigned surface water segment IDs in the HUC12 from the EPA Office of Water TMDL Waters geospatial dataset. (See also TMDL Waters glossary definition).
% Any IUCN Status	Percent of the HUC12 that is designated as protected by the International Union for Conservation of Nature (IUCN). Lands considered protected by the IUCN have long-term protections in place to conserve ecosystem services and cultural values; they include lands held by national, state, or local governments, non-profit organizations, and voluntarily protected private land. Source data was the Protected Areas Database of the United States Version 1.2 from the USGS Gap Analysis Program (http://gapanalysis.usgs.gov/). Includes all lands that have been classified by the IUCN as protected areas; IUCN categories include Ia, Ib, II, III, IV, V, and VI. Equation used: IUCN Protected Land Area / HUC12 Area * 100. This indicator was calculated for EPA EnviroAtlas. Additional information on source data and calculation methods can be found at: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7BC5FFDE8E-7C27-4F50-AFEF-082E8A08C00A%7D.
% Potentially Restorable Wetlands	Percent of the HUC12 that is classified as a potentially restorable wetland. Potentially restorable wetlands are lands with agricultural cover that naturally accumulate water and historically had poor drainage and hydric soils. Source data for mapping potentially restorable wetlands were the National Land Cover Database (NLCD) 2006 Land Cover dataset, the National Elevation Dataset (NED), and the Natural Resources Conservation Service (NRCS) 2009 SSURGO and STATSGO soil attributes datasets. Potentially restorable wetlands were mapped as areas with: (1) pasture/hay or cultivated crop cover in NLCD 2006 (classes 81 & 82); (2) a compound topographic index (CTI) greater than 550 calculated from the NED; and (3) areas with poorly drained or very poorly drained soils from the SSURGO/STATSGO datasets. Equation used: Area of Potentially Restorable Wetlands in HUC12 / HUC12 Land Area * 100. This indicator was calculated for EPA EnviroAtlas. Additional information on source data and calculation methods can be found at: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B80AFCF1D-0C2B-4E4A-B07A-B2B57E6772D5%7D.
% WMA in Watershed*	The percentage of the watershed, within the state, covered by a Watershed Management Authority (WMA). Source data was received from the Iowa DNR. "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.

SCENARIO INDICATORS	DESCRIPTION
% Covered by Conservation Activities*	The percentage of the watershed, within the state, covered by a "Social Activity" as identified by multiple geospatial coverages provided by DNR. These coverages were merged to create one seamless coverage for this indicator: Active Mississippi River Basin Healthy Watersheds Initiative (MRBI), Watershed Improvement Review Board (WIRB), approved Section 319 Watershed Management Plans (WMP), Water Quality Initiative Targeted Watershed Demonstration Projects (WQI), and Watershed Protection Fund (WSPF) initiatives, WQI_Water_Quality_Initiative_Priority_HUC8s (WQI_Priority). Source data was received via personal communication with Andy Asell (Iowa DNR). "(INSTATE)" denotes that the indicator was only calculated for HUC areas within Iowa state boundaries.

Attachment 4: Iowa RPS Tool file names and contents

The following are RPS Tool files completed during this project and delivered to DNR for statewide and HUC8-specific use. Except for MASTER IA RPS, all these files contain archived results for each geographic area and scenario as named. Other than differences in their screening results, these files are otherwise identical to the master file.

RPS Tool File Name	Content
161212MASTER IA RPS-Scoring-Tool-121216.xlsm	Most current Iowa RPS Tool with all HUC8 and HUC12 data, no screening content saved (master copy for all new screening statewide or on HUC subsets). Numeric at the front end of the file is the date the file was last saved; the numeric at the end of the name is the date of the Tool version. As the master tool file remains updatable with new indicators, a file copy that has a different 6-digit date numeric at the beginning of the file name from that shown here probably implies new indicators saved in the latest tool version.
161006IA RPS-Scoring-Tool-052416_SCENARIO1*	Iowa RPS Tool with screening results for HUC8 Iowa Existing Prioritization Scenario (Scenario 1)
161006IA RPS-Scoring-Tool-052416_SCENARIO2*	Iowa RPS Tool with screening results for HUC8 Nitrogen Loading Scenario (Scenario 2)
161006IA RPS-Scoring-Tool-052416_SCENARIO3*	Iowa RPS Tool with screening results for HUC8 Phosphorus Loading Scenario (Scenario 3)
161212IA RPS-Scoring-Tool-121216_Boone	Iowa RPS Tool with Stage 2 results for HUC12 screening for Boone HUC8
161212IA RPS-Scoring-Tool-121216_Turkey	Iowa RPS Tool with Stage 2 results for HUC12 screening for Turkey HUC8

* Stage 1 HUC8 indicators did not change between version of 052416 and version of 121216.