Using Mapping as a Recovery Potential Screening Tool

Mapping is a versatile tool in Recovery Potential Screening assessments that allows users to visualize the distribution and location of watersheds as well as the relative differences in their scores. Along with bubble plots and rank-ordering, mapping offers a way to organize complex information about restorability, stimulate discussion and insights about differences, communicate about results and alternatives, or if desired, prescribe a clear basis for assigning priorities or decisions. Unlike bubble plots and rank-ordering, mapping allows a user to observe spatial relationships among waters or watersheds that may influence restoration strategies and priorities.

Below are techniques and a few brief examples of how mapping can be used in Recovery Potential Screening. These are hypothetical examples that may use real data for demonstration purposes, but they do not constitute final analyses, policies or decisions by the US EPA or its collaborators. Mention of commercial products or trade names does not constitute endorsement for use.

Mapping Recovery Potential Scores. ArcGIS software allows for joining the spatial data with the results generated in the autoscoring spreadsheet based on a common field, which, typically, is the watershed or water body ID. This way the user can copy indicator values from an Excel spreadsheet into the attribute table of the watersheds' geospatial data set. Consequently, the user can use any attribute measured in Recovery Potential Screening to display in a map format. The user can display the range of values for individual indicators, for Ecological, Stressor, or Social Indices, or to map out the Recovery Potential Integrated Score (RPI score).

Mapping Grouped Scores. Besides mapping the actual indicator values and index scores, a user can use either MS Excel or ArcGIS attribute table functionalities to group the scores for specific display purposes and assign new attributes to classify the groups. The grouped data attributes can be mapped with the help of color schemes to communicate information clearly.

Figure 1(a): Displaying RPI Score with a random color scheme.

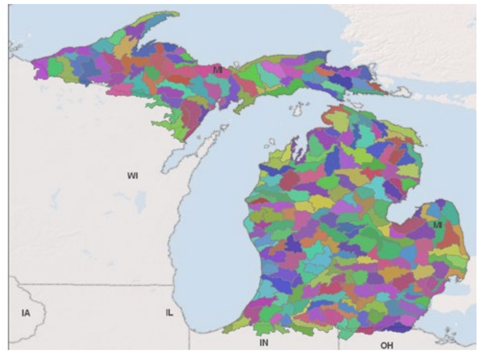


Figure 1(b): Displaying RPI Score with a gradient color scheme. The darker colors represent the higher RPI values.

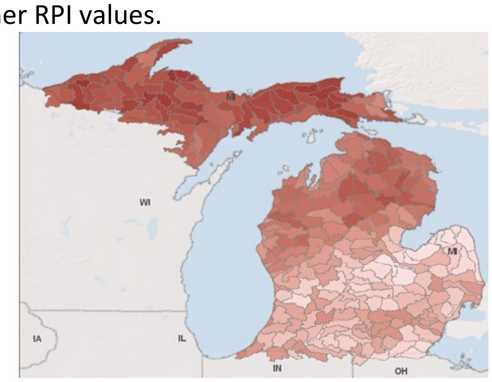


Figure 1(c): Displaying the top 10% (in red) of watersheds with the highest RPI score.

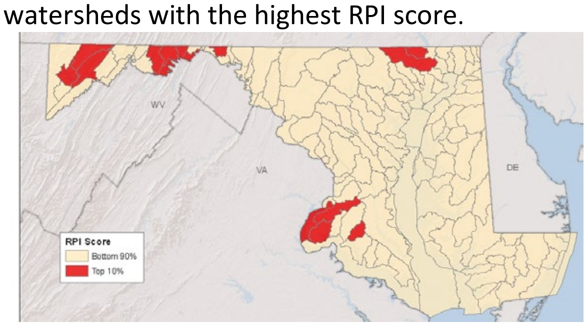
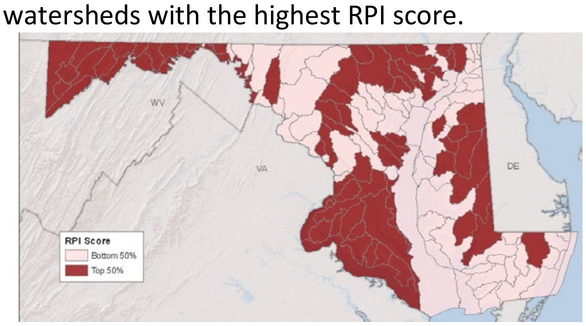


Figure 1(d): Displaying the top 50% (in dark red) of watersheds with the highest RPI score.



Potential Applications of Mapping in Recovery Potential Screening

Example 1: Use of color schemes and gradients to understand high/low priority. Figure 1(a) shows an example of mapped RPI score with a random color scheme. With such display it is difficult to grasp the range of values, even with a very long key in the legend. The only subject this example communicates clearly is the spatial location of the watersheds. One possible alternative is to create a color gradient for the score of interest, ranging from lightest to darkest colors, as the values increase (Figure 1(b)). Another approach is to set a threshold to answer such questions as, "where are the top 10% of watersheds with the highest RPI score?" or "Where are the top half of watersheds with the highest RPI score?" In these examples, the data can be grouped based on their RPI score, and the map would display either the top 10% or 50% in one color and everything else in a different color (see Figures 1(c) and 1(d)). In addition, the user can classify the scores based on four equal-sized groups or quartiles, and display the four groups in a gradient color scheme where the more intense colors signify the better watersheds for restorability. This approach makes it easier for the human eye to pick up any patterns over a large spatial area (see Figure 1(e)).

Figure 1(e): Displaying Eco Index in quartiles. The darker colors represent the higher Eco Index values.

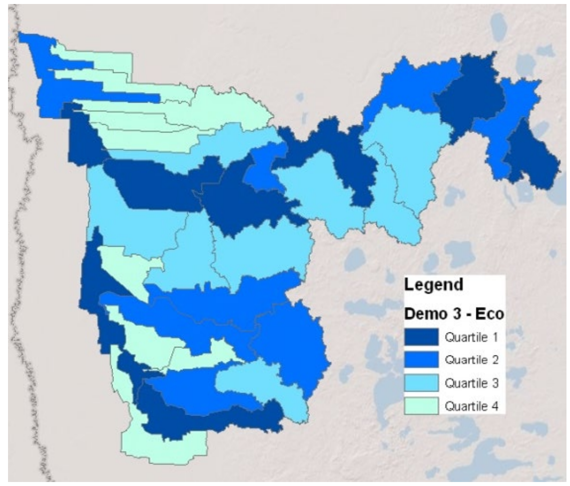


Figure 2 (a): Identifying possible connection corridors based on clustering of highly scored watersheds in Eco Index.

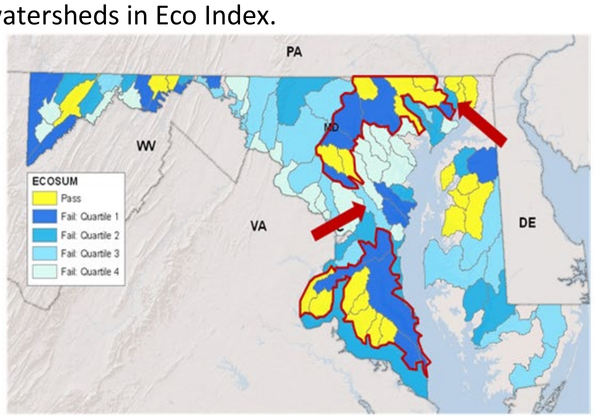
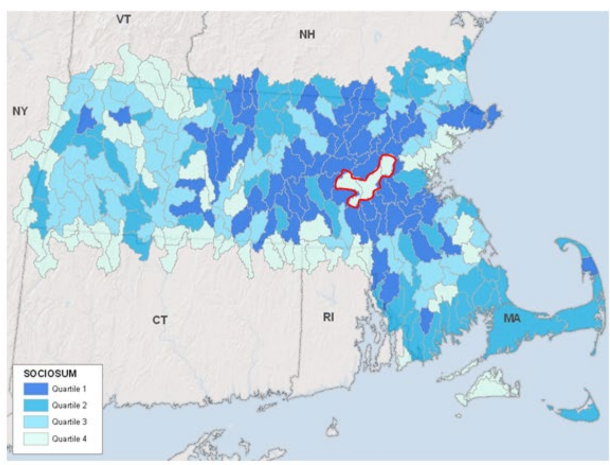


Figure 2(b): Identifying a target watershed to improve social indicators for its recovery potential.



Example 2: Using patches and corridors in restoration strategies. One of the main advantages of mapping over the bubble plots and rank-ordering is that mapping allows the user to identify any spatial clustering and potentially important corridors. Larger patches of healthy ecosystems, and corridors that connect these patches, are two well-known components of large-scale ecologically sustainable planning. Figure 2(a) shows

where several healthy watersheds in the northern part of the study area form a large patch with several of the highest Eco Index-scored impaired watersheds. A similar situation is identified in the southern part of the study area. One restoration strategy would be to prioritize the impaired waters in these two patches, not only because they have high recovery potential but also because their recovery would significantly increase two large patches of healthy watersheds. Mapping can also reveal opportunities to connect or extend ecological corridors. Two watersheds marked with red arrows are in the second highest quartile for the Eco Index score, and are located where their restoration would extend high quality ecological corridors. Thus both of these watersheds represent reasonable targets to connect healthy/highly recoverable habitats. Similarly, Figure 2(b) shows the Social Index quartiles for a dataset. The watershed marked with the red boundary has a low Social Index but is surrounded by watersheds from the quartile with the highest Social Index score. This might prompt questions like, "Why does this watershed differ from its neighbors? Does it represent emerging risks that could degrade the watersheds nearby? Or on the other hand, how can its social context be improved to increase its recovery potential?"

Figure 3: Displaying the RPI score quartiles overlaid with watersheds with impaired waters (bordered in red) can reveal likely level of effort needed for different TMDL implementation strategies.

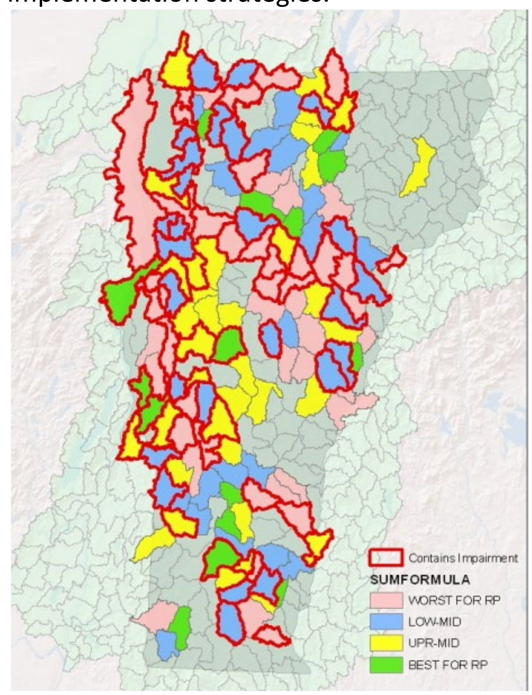
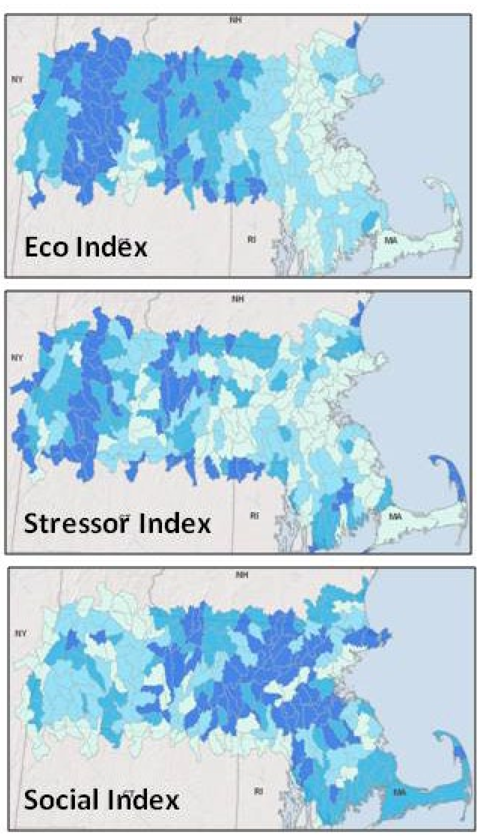


Figure 4: Mapping each index score separately for comparison.



Example 3: Identifying the relationship to specific program actions. A user might run an analysis on the entire state but they might be interested in seeing what the results look like for a subset of watersheds, mainly to inform actions that a specific water program needs to take. Overlaying the key data layers can highlight the watersheds of interest. Figure 3 displays an example of a map showing results of the RPI score broken down into quartiles with watersheds that contain known impairments highlighted in red. The impaired watersheds are likely to need TMDLs developed and/or implemented as part of their restoration. By layering these watersheds with their RPI scores, the relative differences in level of restoration effort are estimated. The user can then observe where there might be better prospects for restoration, as well as gaining a sense of where the most challenging regions of the state might be for restoration.

Example 4: Comparing spatial distribution of summary scores. Mapping can be used for comparing results of index scores for each group of indicators similarly to the bubble plot. If the user displays the results for each index score side-by-side, it is possible to observe and compare the spatial distribution for each indicator group and the range of values (Figure 4). One frequent observation is that Ecological and Stressor indices often point to many of the same highly ranked watersheds, whereas Social index scores may be highest in a different region.

Example 5: Identifying potential sub-areas for separate screenings. It is possible that after running an initial statewide screening, the mapping of the RPI score reveals distinct zones that differ substantially in scoring range. For example, all the highly scoring watersheds may appear in one portion of the state whereas another portion is almost entirely low-scoring. This setting can raise the undesirable prospect of a statewide program working exclusively in one region and remaining inactive in another; nevertheless, targeting more restorable watersheds would be beneficial to both areas if done equitably. Under such circumstances, the user might choose to run a separate screening analysis on each of these two zones. Figure 5 shows an example of mapped RPI scores that suggests such an approach. Rather than target the highest-scoring watersheds as exclusive restoration priorities, which could result in working exclusively in the northernmost part of the state, separate regionalized screenings could reveal the best restoration prospects in each region and allow for a more statewide presence of restoration program activity.

Figure 5: Mapping can sometimes reveal substantial differences among regions that may suggest screening them separately and comparing recovery potential within each region.