

# Natural Resource Navigator Habitat Explorer & Recommendations Background

## *What is the Habitat Explorer for?*

The Habitat Explorer allows you to explore data behind the recommended conservation objectives for forests and streams and their likelihood of success in light of climate change risk.

The aim of the Habitat Explorer is to help you:

- quickly view recommendations for what conservation objectives to pursue for forests and streams and their likelihood of success in light of climate change risk, based on habitat assessments
- examine data components used to create those recommendations by clicking on each of the tabs
- if desired, adjust the weighting of data components to create custom summary maps and recommendations on the fly
- save, share, and print custom analyses to communicate with others and help develop and refine work plans, either in conjunction with the Course Adjustment Worksheets in our Navigator Guidebook or through the users' own processes.

## *How were the Recommendation Maps created?*

The recommendation maps shown in the Habitat Explorer (and also available in Map Layers under the Streams and Forests folders) incorporate four primary types of information that are key to identifying appropriate climate change strategies. The Habitat Explorer summarizes and displays each of these four factors on a separate tab. Each factor was assessed differently for each habitat type using a set of indicators which were selected based on data availability, best available science, and expert opinion:

- **Current Condition:** Current health or status of the target. Condition directly or indirectly measures the existing degree of human modification of the system, which alters conditions beyond a range of naturally occurring variation. *Natural systems with high condition are expected to be more diverse and productive, with greater ability to sustain function over time without intervention*

Indicators of habitat condition (for details see Data Documentation):

### **Streams**

Flow Alteration  
Percent Impervious Cover  
Floodplain Connectivity  
Functioning Floodplains  
Fragmentation by Roads  
Water Quality Impairments

### **Forests**

Patch Size  
Regeneration  
Large Snag Density  
Relative Canopy Diversity  
Invasives Prevalence

- **Future Threat:** The expected trend in condition due to human activities through the 2050s. Future threats may be *ongoing* (having contributed to a past decline in condition that is expected to persist or get worse) or *new* (not previously encountered or significant but expected to cause future declines in condition). The threats can include indirect impacts of climate change, such as increased severity of nutrient pollution impacts due to warmer water temperatures, but direct climate change exposure, such as drought stress on forests, is considered separately under Exposure.

Indicators of habitat threat (for details see Data Documentation):

**Streams**

- Change in Percent Impervious
- Change in Floodplain Connectivity
- Connectivity Threat from Additional Roads
- Flood Pollution Risk
- Acid Deposition Sensitivity

**Forests**

- Pests and Pathogens
- Invasive Plants
- Loss of Connectedness
- Fragmentation

- **Sensitivity to Climate Change:** The degree to which the target is likely to change in response to climate change, based on both inherent attributes of the system or species, and additional risk factors related to the landscape or management context. Sensitivity is separate from exposure, in that it represents attributes of the target system or species. If climate conditions change but sensitivity is low, then we would expect a lesser degree of climate change impacts. Thus, sensitivity is not a direct prediction of specific climate impacts, but indicates the relative risk of experiencing impacts if exposure changes. Sensitivity may be considered the inverse of what is often referred to as “resilience” to climate change. Many frameworks for assessing vulnerability to climate change further distinguish between inherent sensitivity factors, such as temperature thresholds related to mortality (i.e., in freshwater fish) that are relatively fixed, from others that may indicate “adaptive capacity” or potential to vary or respond in a way that promotes adaptation. These “adaptive capacity” factors may be the focus of efforts to influence through management actions the likelihood of adaptation. We roll both sets of indicators into our sensitivity index in order to make a high-level assessment of climate risk; the components of this composite score can then be examined for a variety of opportunities to reduce sensitivity through management activities.

Indicators of habitat sensitivity to climate change (for details see Data Documentation):

**Streams**

- Connected Network Length
- Size Variety
- Slope Variety
- Temperature Variety

**Forests**

- Landform Variety
- Elevation Range
- Connectedness
- Tree Species Richness
- Habitat Vulnerability Rating

- **Direct Climate Change Exposure:** The degree of direct changes in climate, such as temperature or moisture regime, that the location or target is predicted to experience. Exposure is evaluated as amount of change, independent of direction. Exposure to temperature change most likely represents an amount of warming, as most places in New York are expected to be exposed to temperature increases. However, projections for precipitation change are much more variable over space, and the same degree of exposure can represent conditions becoming wetter or drier.

Indicators of habitat climate change exposure (for details see Data Documentation):

**Streams**

- Change in Stream Temperature Class
- Change in Extreme Precipitation
- Change in Annual Aridity
- Change in Summer Maximum Temperature
- Change in Number of Days Below Freezing
- Change in Growing Degree Days
- Change in Total Annual Precipitation
- Change in Total Summer Precipitation

**Forests**

- Change in Annual Aridity
- Change in Summer Maximum Temperature
- Change in Number of Days Below Freezing
- Change in Growing Degree Days
- Change in Total Annual Precipitation
- Change in Total Summer Precipitation
- Canopy Decline

The selected indicators were scored and normalized from 0-100 in order to be combined into an index. Where possible, this scoring is based on ecological thresholds and the natural range of variation. When such thresholds are not well-established, the data were scored relative to the possible range of values or the range of values occurring in the project area. In these cases, the assumption is that the full range of conditions exists within the project area, and that the trait varies linearly without critical thresholds.

Once the indicator scores were assigned to defined occurrences of forests and streams, the indicators were combined to calculate an average summary score for each factor of Condition, Threat, Exposure and Sensitivity. These scores ranged from 0-100 and represented a unit-less index of the status of each occurrence within the project area. Thresholds were applied to designate classes for ‘high’ and ‘low’ values of the index, as shown in Table 1. **These combined summary scores are what are shown on the Habitat Explorer tabs.**

**Table 1. Rating Thresholds for Component Scores.** The Condition, Threat, Exposure & Sensitivity scores were rated as either ‘low’ or ‘high’ based on these ranges, which are designed to increase the sensitivity of the assessment.

Factor	‘Low’ Score Range	‘High’ Score Range
Condition	0 - < 67	67 – 100
Threat	0 - < 33	33 – 100
Exposure	0 - < 50	50 – 100
Sensitivity	0 - < 50	50 – 100

A higher threshold was used for assigning a “high” condition rating and a lower threshold for assigning a ‘low’ condition; this intentional bias was used to increase the sensitivity of the analysis to problems with condition and

threat, such that a small number of low-rated condition indicators would lead to a ‘low’ overall score for condition, and a small number of high-rated threat indicators would lead to a ‘high’ overall score for threats.

These low and high classes were used to identify a general conservation objective (based on the Current Condition and Future Threat) and the relative level of climate risk (using Climate Change Exposure and Sensitivity). The matrix found in Figure 1 illustrates how the classes for each of the four factors were combined to assign one of sixteen possible management objectives. These recommendations, which are described briefly below the legend in Figure 2, and described in more detail in the Technical Report, are based on our understanding of the literature and our own expertise, and are intended only as a general guide and screening tool. (Citations for each individual recommendation are not included, but a list of the literature we reviewed to develop this approach is found in the Technical Report.). In particular, due to the uncertainties in the underlying data and the averaging nature of the summary algorithms, *these recommendations should not override local knowledge or expertise*. The Course Adjustment Worksheets in the Natural Resource Navigator Guidebook provide a methodology for refining these objectives based on other information in the Navigator, additional data that may be available to you, and your own professional judgment.

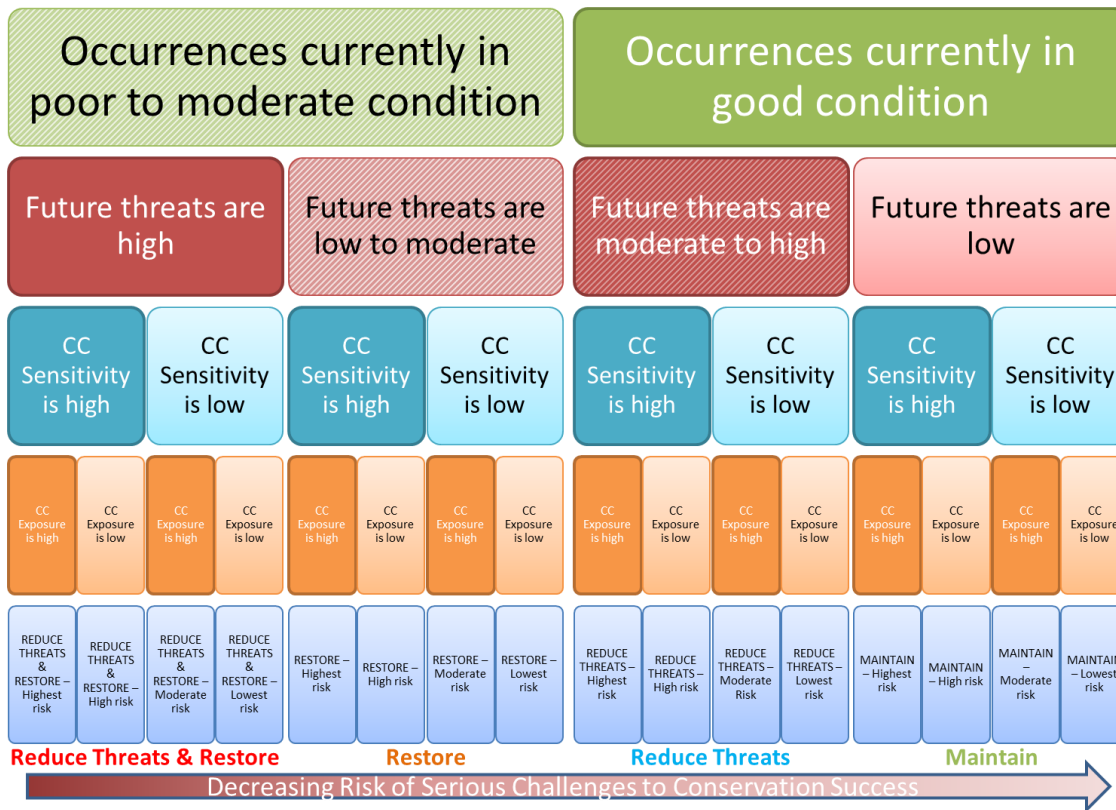


Figure 1. Conceptual matrix used to generate recommended conservation objectives maps.

## Using the Habitat Explorer & Recommendations Map

If you are using the Habitat Explorer in conjunction with our Natural Resource Navigator Guidebook to help develop climate smart approaches, use the Recommendations Map to identify which Course Adjustment Worksheets from our Guidebook to complete as well as to help you dig more into the Condition, Threat, Sensitivity and Exposure data (by clicking on those tabs) when you are filling out those Course Adjustment Worksheets. Then use the climate risk information from the Recommendations Map as well as information from the Sensitivity and Exposure tabs to further hone your strategies with the [Preparing for Climate Change Course Adjustment Worksheet](#).

Zoom to your area of interest to begin, or click the hyperlinks on the Instructions tab to get more detailed steps from the Wayfinder section of our Navigator Guidebook.

Here are brief descriptions of each of the recommendations shown, along with hyperlinks to the corresponding Course Adjustment Worksheets from our Navigator Guidebook:

[Maintain](#): Good current condition & low future non-climate threats; these places are more likely to maintain their current conditions with minimal intervention.

[Reduce Threats](#): Good current condition but some future non-climate threats; these places may require intervention to prevent declines.

[Restore](#): Poor current condition but relatively low future threat; these may be good places to invest in restoration or ecological management.

[Reduce Threats & Restore](#): Poor current condition and further threatened in the future; these places are likely to require greater ongoing investment and have more uncertain outcomes.

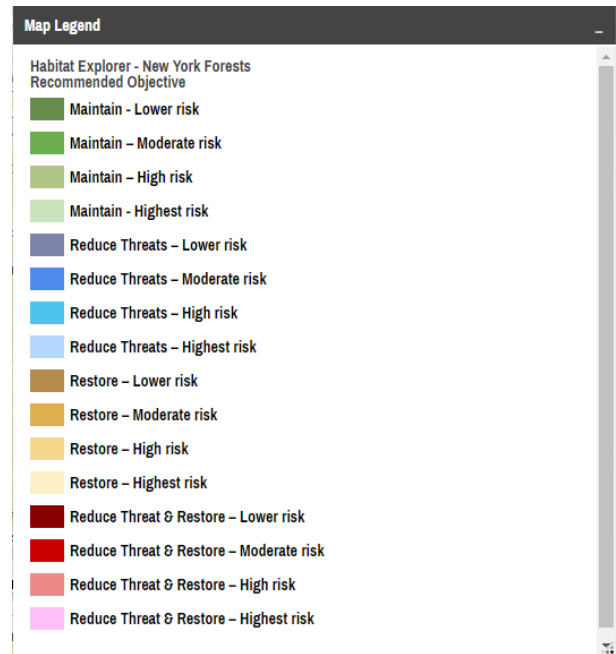


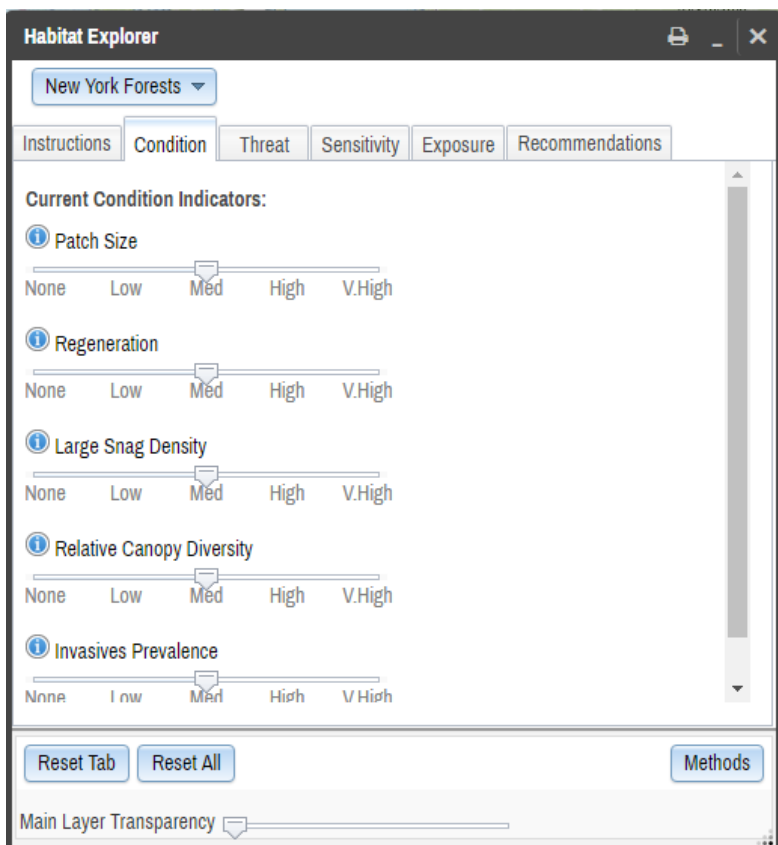
Figure 2. Example legend from Habitat Explorer Recommendations tab

Shading within each group indicates the likelihood of conservation success in light of climate change due to the risks of exposure and/or sensitivity. Darker shades indicate that the climate risk is low, and actions may have more reliable outcomes. Lighter shades indicate a greater degree of uncertainty due to climate change. Note that we used this shading to emphasize the places with the best chances of success—so while it might be counterintuitive to have darker shading indicating lower risk, we hope it will help users more readily focus on appropriate places for adaptation action. The [Preparing for Climate Change Course Adjustment Worksheet](#) will help users identify actions to address this risk.

You can also use the Habitat Explorer to customize the Recommendations analysis to indicators most important for your project by adjusting the sliders under each indicator to change the weighting or remove it entirely. These slider adjustments will alter the corresponding summary score map on the fly. Then, by clicking on the Recommendations tab, you can see the impacts those changes have had on the recommendations map, which is also generated on the fly to respond to those slider adjustments. The default settings of “Medium” on the sliders correspond to a weight of 2 and each step on the slider alters the weight by 1. (See the Table below). Slider adjustments on one tab will remain adjusted when you move to another tab. To reset to the defaults for the current tab, click Reset Tab. To reset all slider adjustments to the default, click Reset All. If you want to maintain your settings but hide the Explorer, minimize it. **Closing the Habitat Explorer window with the “X” will erase your slider adjustments.**

Indicator Slider Position	Weight
None	0
Low	1
Medium (default)	2
High	3
Very High	4

**Table 2. Variable weights set by the Habitat Explorer sliders.**



Finally, note that you can print maps from any of the tabs using the print button at the top right. Printouts will show the variable weights used based on the slider positions.