

Instructions

Climate Change Vulnerability Assessment for Shorebird Habitat

Coastal Version

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Introduction

The Climate Change Vulnerability Assessment for Shorebird Habitat, Coastal Version, is an Excel workbook-based tool designed to help managers make informed decisions about shorebird management, for habitats and species, relative to climate change effects. The assessment first guides participants in assessing the vulnerability of shorebird habitats at their site. The categories of climate change effects that are assessed include:

1. sea-level rise;
2. habitat degradation due to other climate effects such as new invasive species, changes in precipitation, temperature changes, and water availability; and
3. increased frequency and intensity of coastal storms.

The assessment also includes a section on “habitat value.” This section helps participants to define what value is placed on each type of habitat *at their site* in terms of usefulness to shorebirds and other wildlife and the ecosystem goods and services each habitat type provides. Participants also evaluate the value based on the regional predictions of loss or gain for each habitat. Following that, both climate change and traditional stressors are listed and threat level is determined, and the final section allows participants to define adaptation options and explicit strategies, or remedies, for each listed stressor, and determine the chance of success for the various options.

The Climate Change Vulnerability Assessment may be done as a “module” of the Western Hemisphere Shorebird Reserve Network (WHSRN)’s Site Assessment Tool, or on its own. It is best done with a facilitator from WHSRN who will guide the participants through the process, explain scoring and habitat definitions, assist with GIS, and facilitate discussions. The facilitator will be able to fine tune the assessment to the site, if necessary. However, if a facilitator is not available, these instructions will guide the designated site representative(s) in the completion of the assessment.

The assessment may be completed entirely or partially in a workshop format, with participation from site staff, partners, and stakeholders. These participants could include representatives from federal agencies, state agencies, private non-profit organizations, academic institutions, research organizations, and volunteers familiar with the site. It is extremely useful to get subject matter experts to participate, such as experts in shorebird species, marsh accretion, dynamic coastal systems, geomorphology, invasive species, and so forth. By inviting the participation of all partners and stakeholders, the site will benefit two-fold: first, from the breadth of knowledge they contribute and, second, by the opportunity to educate and engage them, encouraging further collaboration.

The assessment should be seen as taking a snapshot in time, of both the current conditions and the expectations of future conditions. It is designed to be completed without the need for additional data-gathering (*see possible exception noted below*). In the future, as more data, better models, and the knowledge of the carbon-emissions and ice-melt trajectories are available, the assessment may be re-done or updated, if needed and desired.

Baseline data needed: It is recommended that a sea-level rise (SLR) scenario of one meter by the year 2100 be the benchmark used, although other scenarios may be more appropriate. Most sites will have an annual increment of relative SLR to add to this, due to local subsidence. However, sites in Alaska and elsewhere may be experiencing isostatic rebound, and thus may subtract an annual increment. *It is important to know your site’s relative SLR before you begin the assessment.*

Tab-by-Tab Instructions

An important note: any cell that has a red triangle in the upper right corner has a comment. Scroll over the cell and the comment box will appear. Some cells will contain instructions on scoring, other contain more details.

Tab 1: About

The “About” tab credits the organizations responsible for the creation of the assessment. There is nothing to fill out.

Tab 2: Site & Assessor Info. (fill out)

Fill out the “Site & Assessor Info” worksheet with basic information about the site and the people involved in the assessment. In the space provided at the bottom, please include a bibliography of any publications, internal reports, or other reference materials that were used to inform the assessment; or, this list may be provided as a separate document.

Tab 3: Habitat Definitions

The shorebird habitat types used in the assessment are based on those in the Sea Level Affecting Marsh Model (SLAMM), which are based on National Wetland Inventory (NWI) classifications. The reasons for using these are three-fold:

1. The habitat types make sense in terms of shorebird use;
2. They are based on NWI classifications which have concrete definitions; and
3. Many WHSRN sites that are national wildlife refuges will have had a SLAMM analysis done and will have acreages of each habitat calculated, as well as predicted changes under several sea-level rise scenarios.

There is nothing to fill out in this “Habitat Definitions” worksheet. Rather, it defines each habitat type and gives its minimum and maximum elevations, if applicable. Habitat types important for shorebirds, and therefore to be considered in the assessment, are highlighted in yellow; however, not all may be assessed, depending on the factors at each site. The other habitat types on this list (i.e., developed dry land, open water types) are for the benefit of assessments that may consider other species besides, or in addition to, shorebirds.

It is worth noting that the NWI classification “Estuarine Intertidal Emergent” is divided into two habitats in the SLAMM: salt marsh and brackish marsh. For the assessment, they are treated as one since they are used similarly by shorebirds. If considering other species in the assessment (e.g. Seaside Sparrow), it may be better to assess the two types separately.

Additionally, please note that “Managed Impoundment” has been added as a separate habitat type. For the purpose of the assessment, it is defined as a pool of water of any salinity surrounded by a human-made dike that is managed for one or more of the following attributes: water level or volume; water salinity; or plant species, density, or type.

Be sure to consult the minimum and maximum elevations provided (from SLAMM) to understand the exact vertical boundaries of the habitat types. For instance, “Estuarine Beach” has a minimum elevation

of mean tide level so it will include intertidal, non-vegetated, sandy beach used for foraging (rather than nesting). Its maximum elevation is mean spring high tide, or “mean high water spring inland.” Areas above this elevation may be very similar and if not developed will be included in “undeveloped dry land.”

Undeveloped dry land, as defined by SLAMM, will include forested areas and has no NWI classification. For the purpose of the assessment, you should consider a subset of this habitat - those undeveloped, non-wetland areas adjacent to beaches with little vegetation that are being used by shorebirds, or have potential to be. Also, include any existing or potential high-tide roost sites that may not be adjacent to beaches. If you would like to know the exact acreage of this habitat type relevant to shorebirds, you will have to use your GIS. Keep in mind that climate change is likely to cause greater effects to lower elevation undeveloped dry land (area used by shorebirds); thus, any percentage change calculated from an unmodified SLAMM area estimate is likely to be too low.

Tab 4: Habitat Area Calculator (fill out)

The “Habitat Area Calculator” worksheet is for those sites (predominantly national wildlife refuges) that have had a SLAMM report completed and wish to use the results to inform the assessment. Acreages from the site’s SLAMM report are entered here, converted into percentages in the calculator, and used in scoring in the following worksheet. *For sites that do **not** have a SLAMM report, skip to the last paragraph below.*

At the top of the worksheet (cell C1), enter the area units (e.g., acres, sq. meters), then enter the values in the yellow-bordered habitat cells. Entering values in the other habitat cells is optional. Columns H, I, J, and K (green headings) will automatically be populated with the **percent** change from the initial condition to the year indicated. Columns L, M, N, and O (purple headings) likewise will automatically calculate the **area** change. You may use this in assessing the importance of a change, or of a habitat type. For instance, you may see a 50% loss of a habitat type predicted by 2050, but if the initial size is 4 acres (dropping to 2 acres), it may not warrant assessment.

The percentages are meant to inform you of possible future scenarios of habitat areas based on one particular model (SLAMM). This is just one input to your assessment. It is encouraged that you use any other available models, as well as expert opinion to inform the assessment. You should involve local coastal geologists and geomorphologists from partner organizations if at all possible. If other models and/or expert opinion disagree with the results of SLAMM, analyze whether SLAMM input data are inadequate (e.g. coarse elevation data, non-local marsh accretion rates, default sedimentation rate used) or whether it models unique attributes of your site correctly. Then, decide what the most likely scenario is, under a SLR scenario of one meter by 2100. You will be able to assess your certainty in the following section (Tab 5. Habitat Vulnerability).

*If your site has **not** had a SLAMM analysis, you might have an inundation model to use, or another habitat conversion model. Check to see if there are any useful models for your location. If not, you can do a basic GIS analysis by digitizing your habitats, incorporating a digital elevation model, then, calculating the areas lost by simple inundation. This will give you a rough estimate of loss of habitat. To do so, use a specific elevation based on your area’s predicted, relative SLR in whatever time horizon you have chosen. This will be a coarse prediction, and should be augmented by consultation with experts in marsh accretion and barrier island dynamics. Remember that this assessment is based on the best*

available data and knowledge at the time of its completion, so utilize what is available and try to engage research partners to fill in the gaps in the future.

Tab 5: Habitat Vulnerability (fill out)

The “Habitat Vulnerability” worksheet will guide you through assessing the vulnerability of each shorebird habitat type at your site that you consider useful to shorebirds. First, in row A, select a time horizon (year) from the drop-down menu.. Remember that sea-level rise is predicted to be exponential rather than linear, that is, the amount of SLR you will experience at your site from 2000 to 2050 will be less than half of what is expected by 2100 (see Figure 1).

Many of the habitat types under consideration will change in area according to a consistent trend. That is, they will either increase or decrease in area over the years. However, certain habitats may increase for a while, then decrease (or vice-versa). You will want to be familiar with the trends for each of your habitat types no matter what your time horizon is. The SLAMM calculator is a good place to start, and you and your partners may have additional information or knowledge to refine or even refute the SLAMM. As the time horizon increases, certainty decreases. Because it’s not known which emissions scenario is the most likely, nor what the verifiable rate of ice melt is from ice sheets, there is much uncertainty surrounding what to expect in terms of the amount of sea-level rise, and some uncertainty in changes in temperature and precipitation. The further distant in time you go, the more uncertain are the outcomes.

After selecting your time horizon, go to Column J and enter how each habitat type is used by shorebirds (e.g., nesting, roosting, foraging) and during which seasons. If you have completed the WHSRN Site Assessment Tool, the information you collected on key ecological attributes in the “State” tab will be relevant here.

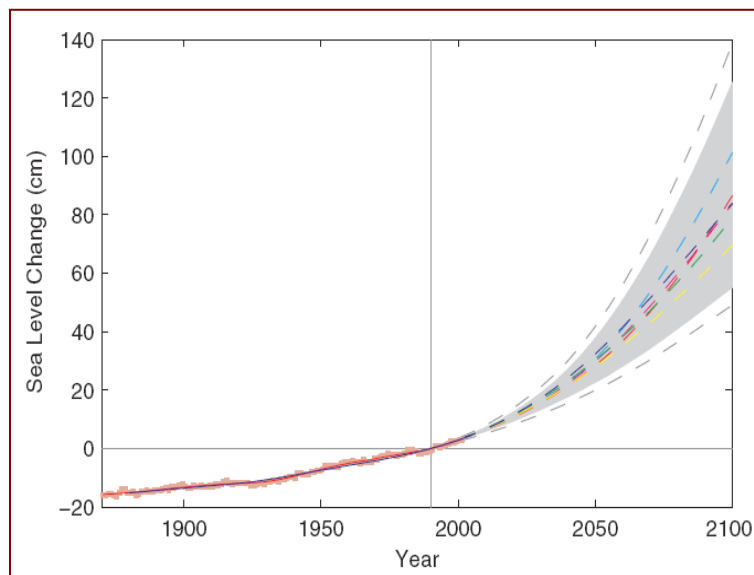


Figure 1. Sea-level rise projection for several emissions scenarios. The light blue line represents the scenario used in the assessment: one meter of global sea-level rise by the year 2100 (from Rahmstorf 2007).

Next, go to column A and select “yes” or “no” from the drop-down menu in answer to the question: “Is habitat included in assessment?” The major reasons that you would not include a habitat type in the assessment are: shorebirds do not use it, or the use is minimal; the habitat type is not present at your site; or its area is so small as to be inconsequential on a site level.

Now you are ready to expand some of the columns. Start with the first habitat type that has a “yes” in column A. Click on the gray square (Excel 2007) or “+” symbol (Excel 97-2003) in the gray area to the left of the habitat name to view the three types of vulnerability that you will assess. The first of these is “**1.1 Loss or conversion to different habitat type due to sea-level rise.**” You will assess this vulnerability by examining scope, severity, timing, and certainty (Columns F– I), using the information from the SLAMM calculator, other models you may have, and expert opinion and knowledge. Keep in mind that some habitat types will gain in area, and this can be accounted for in the scoring.

First, consider what the scope of habitat loss or gain will be in terms of percentage of area; this includes loss by conversion to, or gain by conversion from, another habitat type as well as loss of land to inundation or erosion. In this case, we consider only changes in area, rather than impact of effect. Scroll over cell F3, “Scope”, for the scoring or see Box 1 below. It is permissible to estimate changes in area if no models are available; for this reason, wide ranges of percentages are given.

Box 1: Scoring for “SCOPE”

- 3 = Loss of, or detrimental effect upon, whole area (>90%)
- 2 = Loss of, or detrimental effect upon, most of area (50–90%)
- 1 = Loss of, or detrimental effect upon, some of area (10–49%), or unknown negative effect
- 0 = Loss or gain of, or detrimental or positive effect upon, small area (<10%), or no change
- 1 = Increase in, or positive effect on, some of area (+10–49% of original), or unknown positive effect
- 2 = Increase in, or positive effect on, much of area (+50–90% of original)
- 3 = Increase in, or positive effect on, all of area (+90% or greater of original)

Next, consider the severity of the effect. Given the scope of the expected loss or gain, how severe will the effects be on the shorebirds that use the habitat? It is possible that a loss of some of the area would have a small effect on shorebirds because they only use a small area, or there aren’t enough birds in the population to actually need a large area. If there are benefits to shorebirds because of the predicted change in area, select a negative number. Scroll over cell G3, “Severity,” or see Box 2 below for details.

Box 2: Scoring for “SEVERITY”

3 = Will render habitat unable to support shorebirds during any time of the year

2 = Will greatly diminish habitat's usefulness to shorebirds during any time of the year, or render habitat unable to support shorebirds during part of the year.

1 = Will slightly diminish habitat's usefulness to shorebirds during any time of the year, or greatly diminish habitat's ability to support shorebirds during part of the year, but still be very useful at other times, or negative effect of unknown severity.

0 = Will not affect habitat's ability to support shorebirds, or effects will be minor, or no change, or positive and negative effects may cancel each other out

-1 = Will slightly increase habitat's usefulness to shorebirds during any time of the year, or greatly increase habitat's ability to support shorebirds during part of the year, and be unchanged at other times, or positive effect of unknown degree

-2 = Will moderately increase habitat's usefulness to shorebirds during any time of the year, or greatly increase habitat's usefulness to shorebirds during part of the year

-3 = Will greatly increase habitat's usefulness to shorebirds during entire year

If either “Scope” or “Severity” receive a “0”, then the total score becomes “0”. Otherwise, the scores are added together to provide the total score.

Next, consider the timing of the effects. In some instances, you will select the year corresponding to your selected time horizon. However, in other instances, you have already seen the effects of climate change on the habitat. Additionally, to the best of your knowledge, there may be some habitats that won't be affected until the end of the century. Scroll over H3, “Timing,” for scoring or see Box 3 below. If you don't think there will be any effects until after 2100, if at all, choose zero.

Box 3: Scoring for “TIMING”

3 = Happening now

2 = Will happen by selected time horizon

1 = Do not know when it will happen

0 = Do not expect it to happen by 2100

Lastly, estimate your certainty of the climate change effect happening and the predicted response of the habitat. You must consider these two factors together to come up with one score for certainty. Certainty ranges are broad because it is difficult in many cases to judge. Scroll over cell I3, “Certainty,” or see Box 4 below for scoring. Do your best in selecting a score and remember that the assessment has been designed so that the difference of a point or two is not significant. If you are unsure, select “1.”

Box 4: Scoring for “CERTAINTY”

3 = HIGH (70% or greater probability of occurrence)

2 = MEDIUM (30% - 69% probability of occurrence)

1 = LOW (<30% probability of occurrence) or don't know

Now, you will move on to the next category of climate change effect, “**1.2 Degradation (of original habitat type).**” In many cases, a habitat type will not be lost, nor converted to another type during your time horizon. However, it may degrade (or possibly improve) due to climate change effects such as:

- Range shifts, introductions, or population changes of nonnative invasive species
- Range shifts or population changes of native species
- Precipitation changes
- Temperature changes
- Change in water availability
- Other, such as ocean acidification or shifts in fire regimes.

First, list what you know in these categories, or solicit this information from your partners. At a minimum, you should know the basics of predicted precipitation and temperature changes for your site. To get general patterns, go to: <http://globalchange.gov/publications/reports/scientific-assessments/us-impacts> and check out the chapter covering your region. In general, both the average and extreme land temperatures will increase; however, precipitation changes are not as straightforward.

For each habitat type, you may either fill out the category-level scores (i.e., “1.2 Degradation...”) or the subcategory-level, but not both. Try to fill out the subcategories if you have any pertinent information. You do not have to fill out all subcategories. If either “Scope” or “Severity” receives a “0” then the row receives a “0” as the total; otherwise the scores are added up. The subcategory scores are averaged to produce a category score; however, any score of “0” is not included, thus the score will reflect only those climate change variables that have an effect, either negative or positive.

The third and final category of climate change effects to assess is “**1.3 Coastal Storms.**” Remember that you must consider the effects of greater frequency and intensity of storms, not the baseline of storm activity. Coastal storms – hurricanes, nor’easters, tropical storms, and others – are an important ecosystem process along the coast. In fact, they are necessary for producing certain attributes of the habitats important to shorebirds, such as washovers that produce the type of nesting habitat preferred by Piping Plover.

Tab 6: Habitat Value

To aid in prioritizing habitats for conservation, you will also assess the value of each habitat type to shorebirds and other species, as well as its value in terms of ecosystem goods and services. This section goes beyond shorebird value because decisions about habitat are rarely based on its value to one species or guild. Also, the public, to whom you must “sell” your results, will want to know other values. You will also assess the relative importance of each habitat type in a broader landscape by the time horizon of year 2100. Results from this assessment are combined with habitat vulnerability and charted in Tab 8. All habitat types will appear in column B before you complete tab 5. Afterwards, (only the habitat types you choose to assess will remain.

First, assess each habitat type in terms of the following **ecosystem goods and services** that it provides: storm buffer, filtration, recreation, carbon sequestration, aesthetic scenery, and fisheries. Some of the categories have more details available by scrolling over the cell containing the category name. This score provides 19% of the total. The scoring is deliberately simple: scroll over “Ecosystem Goods and Services” cell or see Box 5 below.

Box 5: Scoring for “ECOSYSTEM GOOD AND SERVICES”

2 = Provides a lot of this good or service

1 = Provides some of this good or service

0 = Provides none, or extremely little, of this good or service

The next category is “**Habitat Importance to Wildlife and Plants**,” which provides 52% of the total score. It has two subcategories: “Shorebirds” and “Other Trust Resources” (USFWS trust resources are migratory birds, threatened and endangered plants and animals, interjurisdictional fish and many marine mammals). Each subcategory is scored for value on the site level and on a landscape level of importance to shorebirds, defined as your site’s Bird Conservation Region, or BCR. To see a map of your BCR if your site is in the U.S. or Canada, go to: <http://www.nabci-us.org/map.html>, if in Mexico, visit: <http://www.nabci-us.org/mxbcrmap.html>

The scoring at the site level and the BCR level differ and are presented in Box 6, or you may scroll over the cells I3, J3, K3, and L3 for scoring.

Box 6: Scoring for “HABITAT IMPORTANCE TO WILDLIFE”**Shorebirds****Site Level**

2 = Of critical importance to all or some shorebirds. Without this habitat type, the site's ability to support all or some shorebirds would be totally or almost totally compromised.

1 = Important to shorebirds. Without this habitat type the site's ability to support shorebirds would be partially compromised

0 = Not important to shorebirds, or minimally important

BCR Level

2 = The site's portion of this habitat type is critically important to shorebirds on a BCR level (e.g. supports a large percentage of the BCR's nesting birds, supports a large percentage of a particular species' population during migration)

1 = The site's portion of this habitat type is important to shorebirds on an BCR level (e.g. supports some of the BCR's nesting birds, supports a modest percentage of a particular species' population during migration)

0 = The site's portion of this habitat type is inconsequential to shorebirds, or nearly so, on an BCR level

Other Trust Resources**Site Level**

2 = Of critical importance to all or some trust species (besides shorebirds) that are present on the refuge. Without this habitat type, the site's ability to support all or some trust species would be totally or almost totally compromised.

1 = Important to trust species, other than shorebirds. Without this habitat type the site's ability to support trust species would be somewhat compromised

0 = Not important to trust species, or minimally important

BCR Level

2 = The site's portion of this habitat type is critically important to trust species other than shorebirds on a BCR level (e.g. supports a large percentage of the BCR's nesting trust species, supports a large percentage of a particular species population during migration)

1 = The site's portion of this habitat type is important to trust species other than shorebirds on a BCR level (e.g. supports some of the BCRs nesting trust species, supports a modest percentage of a particular species population during migration)

0 = The site's portion of this habitat type is inconsequential to trust species other than shorebirds, or nearly so, on an BCR level.

The last category is “Change in Area of Habitat Type in Bird Conservation Region: In general by the year 2100,” which provides 29% of the total score for the assessment. This reflects the value of the site's portion of the habitat on a landscape scale meaningful in terms of shorebirds. Thus, if a habitat type such as salt and brackish marsh will decrease in the region due to climate change effects or other factors (such as development), the value of the portion remaining on the site will increase. A habitat type that will see increase in area within the region will receive a lesser score. Scroll over cell M1 or see Box 7 for scoring details.

Box 7: Scoring for “CHANGE IN AREA OF HABITAT TYPE IN BIRD CONSERVATION REGION”

3 = There will be much less of this habitat type (due to climate change, development, or other factors) in terms of area within the BCR by 2100

2 = There will be less of this habitat type (due to climate change, development, or other factors) in terms of area within the BCR by 2100

1 = This area of this habitat type will be about the same in terms of area within the BCR by 2100

0 = This habitat type will increase in terms of area within the BCR by 2100

Tab 7: Vuln. x Value Scores

Tab 7 is automatically populated with the scores from both assessments (Tabs 5 and 6).

Tab 8: Vuln. x Value Chart

The chart on Tab 8 will be automatically populated with the scores from Tab 7. To fine tune the chart, you will need to remove the habitat types that you have chosen not to assess, otherwise, they will appear on the chart lumped together with scores of $x=0, y=0$. To remove them, click on the gray chart area, then right-click and select “Select Data” from the menu that appears. A box will appear (see Figure 2 for Excel 2007 example). *For older versions of Excel, select “Source Data” from this menu. A box similar to Figure 2 will appear; click on the “Series” tab.*

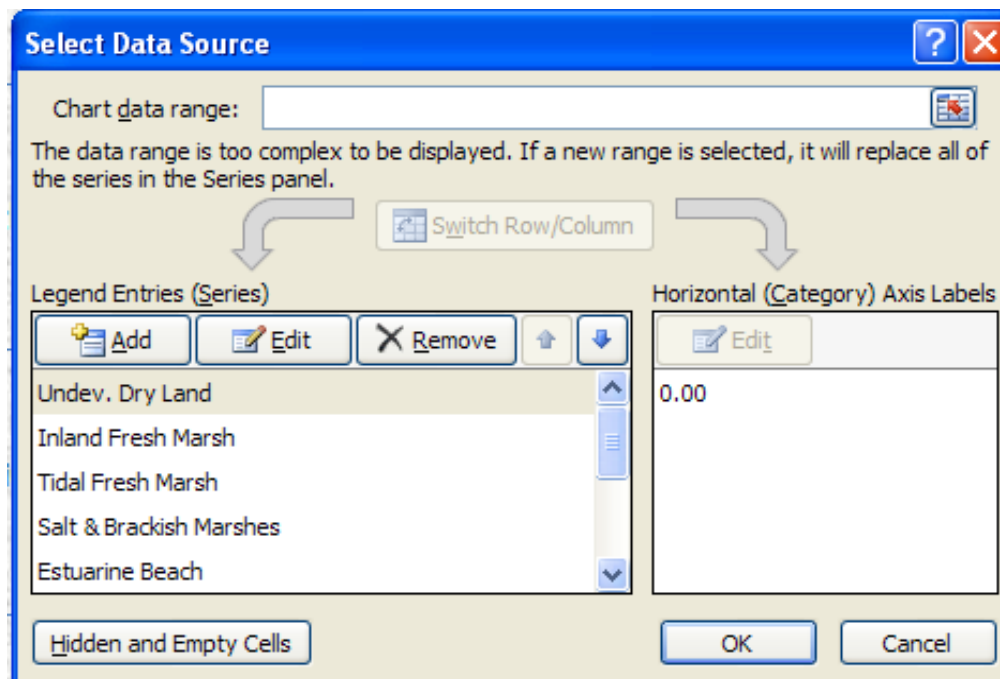


Figure 2: Select data source box

Select (click on) the habitat type in the left window that you wish to remove, then click on the “Remove” button. Do this for each habitat type you wish to remove.

On the chart, the data labels will automatically appear to the right of the data point. If the labels overlap, you may change their location by selecting each data label and right clicking. A menu will come up; choose "Format Data Labels" and make your selections. You may also edit other aspects of the chart, such as the format of data points, if so desired.

The chart shows the relative vulnerability and value of each habitat type at your site. This will aid you in prioritizing habitat for adaptation options and management decisions. For example, if a habitat type falls into the "low" vulnerability range, then it will be of lower priority for adaptation options. If a habitat type is of low vulnerability and medium to high value, you might consider trying to restore this habitat if the opportunity exists. High value and high and medium vulnerability habitat types may be the ones you choose to concentrate efforts on.

Tab 9: List of Stressors (fill out)

There are two ways to complete the "List of Stressors" worksheet. If you have filled out the SAT, read on from here. *If **not**, skip down one paragraph.*

You may cut and paste information from the "Threats" section of the SAT. Any listed threat with a timing score of "0" (past and unlikely to return) does not need to be included. First, go through the threats, line by line. For each listed threat, select the threat category from the drop-down menu. In the SAT, these have orange headings. Number 2 from the SAT, "Invasive alien species," has been changed to "invasive nonnative species" in the climate change assessment. Cut and paste (or retype) the details of the threat or stressor; you might have to take information from the threat subcategory as well as from the "comments and details" column. Cut and paste, or retype the score from the "Impact" column. Or, you may rescore using the slightly different scoring categories of the assessment. Now, you may continue to Tab 10.

*For those sites that have **not** completed the SAT,* you will list your site's stressors in this worksheet. (If you would like to reference the SAT's exhaustive list of potential stressors, go to: <http://www.whsrn.org/tools>, click on [Site Assessment Tool](#), then open the tab entitled "Threats.") In the assessment's "List of Stressors" worksheet, list all of the stressors to shorebird habitat and species in column B (Source of stressor and details) and pick the closest matching "threat category" from the drop-down menu in column A. Next, you will score the stressor by the "threat" it poses and the "risk" of it happening.

"Threat" is scored in three categories: scope, severity and duration of effects. "Scope" addresses the effects on area or percentage of population. "Severity" deals with the level of stressor effect on the ability of the habitat to support shorebirds, or the level or harmful effects (mortality, sub-lethal effects, effect on reproduction) placed on the shorebirds themselves. "Duration of effects" addresses the length of time that effects on habitat or species are felt. See scoring in Box 8.

"Risk" addresses the probability of occurrence of stressor events within a certain number of years. For instance, the risk of human disturbance is generally high; however, the risk of an oil spill is low (but scope, severity and duration of effects are high). See box 8 for scoring. Please use the comments box to write details pertaining to stressors so that future users of the assessment will be able to follow your thought processes. The last thing you should do is use your mouse to select all the cells that are filled out, except for the colored header rows. Then, select the "Data" tab from the menu ribbon and click on the "Sort" tab. Sort by column G (total) from largest to smallest (see Figure 2). This will order your

stressors from the highest to lowest in terms of score, causing them to be presented this way in the following worksheet.

Box 8: Scoring for TAB 9 - "LIST OF STRESSORS"

THREAT

Scope

3 = Detrimental effect upon entire area (>90%) of one or more habitat types or upon entire population (>90%) of one or more shorebird species

2 = Detrimental effect upon most (50-90%) of area of one or more habitat types or upon most (50-90%) of population of one or more shorebird species

1 = Detrimental effect upon some (10-49%) of area of one or more habitat types, or upon some (10-49%) of population of one or more shorebirds species, or unknown negative effect

0 = Detrimental effect upon small area (<10%), or upon few shorebirds (<10%) in a population or populations

Severity

3 = Will render habitat unable to support shorebirds during any time of the year, or will harm shorebirds severely (e.g., prevent or greatly diminish reproduction, prevent accumulation of fat reserves, greatly increase mortality)

2 = Will greatly diminish habitat's usefulness to shorebirds during any time of the year, or render habitat unable to support shorebirds during part of the year, or will harm shorebirds substantially (e.g., diminish reproduction, lower rate of accumulation of fat reserves, increase mortality)

1 = Will slightly diminish habitat's usefulness to shorebirds during any time of the year, or greatly diminish habitat's ability to support shorebirds during part of the year, but still be very useful at other times, or will slightly harm shorebirds (e.g., increase disturbance, decrease fitness) or negative effect of unknown severity

0 = Will not affect habitat's ability to support shorebirds, or effects on habitat and shorebirds will be minor.

Duration of Effects

3 = Affects habitat and/or shorebirds for >5 years

2 = Affects habitat and/or shorebirds for 2-5 years

1 = Affects habitat and/or shorebirds for 1 year or less

RISK

3 = >90% chance of happening within 5 years

2 = >90% chance of happening within 15 years

1 = >90% chance of happening within 50 years, or don't know

0 = <90% chance of happening within 50

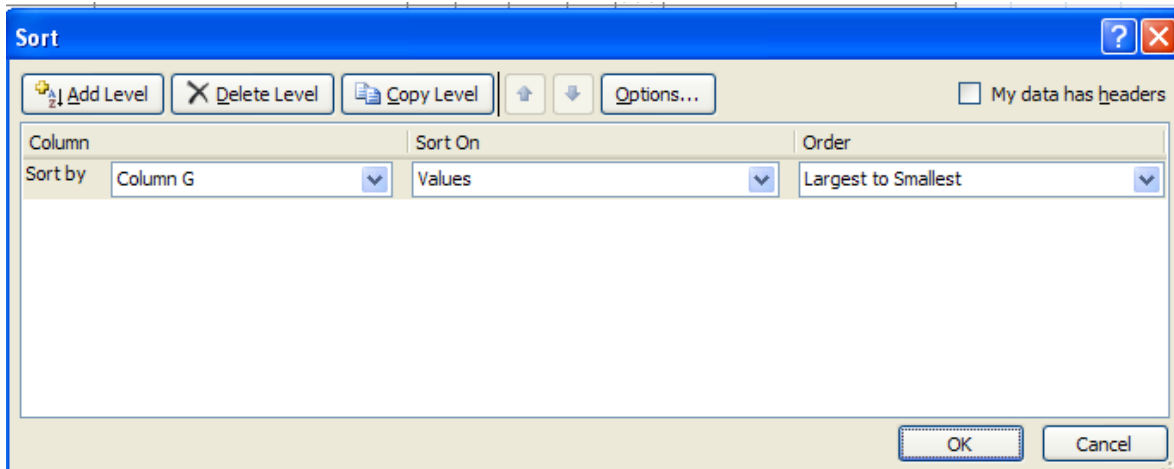


Figure 3: Sort menu box

Tab 10: Adaptation Options (fill out)

The information you provided in tab 9, along with the results of the assessments of vulnerability and value will be used to complete the adaptation (to climate change) options worksheet and plan your strategies. This will include both strategies that directly address climate change effects and those that increase the resilience of habitat and species. If you haven't already done so, begin by sorting the list of stressors in tab 9 by score from highest to lowest (see the last paragraph of the previous section for instructions). The first three columns of tab 10 will be automatically populated from your answers in tab 9. Column A lists the "stressor category." Column B reproduces the "source of stressor and details", and column C will show the total score for each stressor. In planning adaptation options, it is recommended that you address the highest scoring ones first. Any stressor that received a low score (<4) will not appear in tab 10.

Start by describing an explicit strategy or "remedy" in column E to address the stressor. From column D, select which of the seven categories of adaptation options the remedy best fits into. You may also type in your own category, if none seems applicable. The categories and some examples of general remedy categories are listed below. Please use more detail in describing specific remedies for your site. Some remedies may fit into more than one category, in which case you should pick the one that seems most applicable.

1. Increase resilience – decrease anthropogenic stressors
 - a. Reduce human disturbance (pedestrians, bicyclers, fishermen, vehicles, kiteboarders, dogs)
 - b. Decrease pollution
 - c. Reduce erosion from motorboat wake
2. Increase resilience – decrease non-anthropogenic stressors
 - a. Reduce predation (mammalian, avian)
 - b. Control nonnative invasive plants
3. Replicate
 - a. Increase fee title land
 - b. Increase conservation easements
 - c. Coordinate management across jurisdictions
 - d. Create or augment land (e.g., with dredge spoil)

4. Mitigate effects of climate change on habitat or species
 - a. Remove barriers to habitat migration
 - b. Ensure sediment delivery to coastal areas
 - c. Use prescribed fire to help marshes accrete
5. Relocate
 - a. Move managed impoundment system to upland area
6. Restore habitats that are resilient to climate change
7. Manage for the future
 - a. Change conservation targets
 - b. Redefine site mission, vision, goals and objectives
 - c. Acquire lands that will convert to shorebird habitat in the future

Add an “X” in column F if the strategy is currently in place. Select an “H” and/or an “S” in columns G and H, respectively, to indicate if the strategy is directed toward habitat and/or species. Next, select the habitats to which the strategy applies. Only those habitats that you chose to assess will appear in row 2. Following that, choose at what level or levels the work would be best coordinated. You may either choose from the dropdown menu or add your own level. Next, you will evaluate the strategy’s chance of success in six areas.

First, you will consider feasibility. If you had all the time, money and support necessary, what is the likelihood that what you set out to do can be accomplished? An example of a strategy that might receive a low feasibility score is “raise oystercatcher nest sites to a high enough elevation to reduce flooding of future nests by 50%.” Because this is dependent on where the oystercatchers choose to nest and they might not choose the elevated traditional sites, and also dependent on amount and timing of precipitation, amount of sea level rise, and timing, intensity and direction of storms, the feasibility will be low. See Box 9 for details.

Box 9: Scoring for “CHANCE OF SUCCESS”

Feasibility

0 = Even if time, money and support were no problem, it still has little or no chance of success

1 = If time, money and support were no problem, it has some chance of success (1% to 33%)

2 = If time, money and support were no problem, it has a moderate chance of success (34%-66%)

3 = If time, money and support were no problem, it has a high chance of success (67%-99%)

Monetary Cost

0 = Far beyond usual funding requests

1 = Will challenge site funding opportunities

2 = Manageable with present site funding

3 = Easily incorporated into budget, or negligible cost

Staff Time

0 = Impossible to do with present site staff level

1 = Can do with present site staff level, but it will be a challenge

2 = Can do with present site staff level without much hardship

3 = Will take little or no site staff time to accomplish

Next, consider monetary cost of the strategy, excluding staff time and budget necessary to hire new staff. Do include intern support in this. If the strategy might be carried out by an intern, rather than a paid staff member, think about the funding necessary to support the intern. Staff time is the next factor to consider. See Box 9 above for scoring.

Other factors to consider in chance of success are conservation partner support and local community support. Your site's conservation partners may include government and non-government agencies, academia, private nonprofit organizations, volunteers and local landowners. Local community is comprised of the people living near the site, or using the site to support a livelihood. See Box 10 for scoring. The last item to consider is the effect of the strategy on other species or habitats *of concern*. This would include Federal and State threatened and endangered species, species identified as "of concern" due to diminishing habitat or population, other vulnerable or valuable habitats, and so forth, but not common species with wide ranges. See Box 10 for scoring.

Box 10: More Scoring for "CHANCE OF SUCCESS"

Conservation Partner Support

0 = Opposed by conservation partners

1 = Accepted by conservation partners, but not supported, or varying responses from different partners

2 = Supported by conservation partners

3 = Conservation partners take on major responsibility for action

Community Support

0 = Actively opposed by community

1 = Local community is ambivalent, or don't know

2 = Some local community support

3 = Actively supported by community

Effect on Other Species or Habitats of Concern

0 = Very negative effect on other species or habitats of concern (threatens existence)

1 = Somewhat negative effect on other species or habitats of concern, but effects can be mitigated, or don't know, or some positive and some negative effects

2 = No negative effects on other species or habitats of concern

3 = Positive effects on other species or habitats

The total score possible for Chance of Success ranges from 0 to 18. The higher the score the better chance of success for the explicit strategy. However, no matter how high the score, if a strategy receives a score of zero under any column heading, that may be the limiting factor, and should be closely examined to see if it is surmountable or not.

Continue through the entire list of stressors. You may add more rows if necessary.