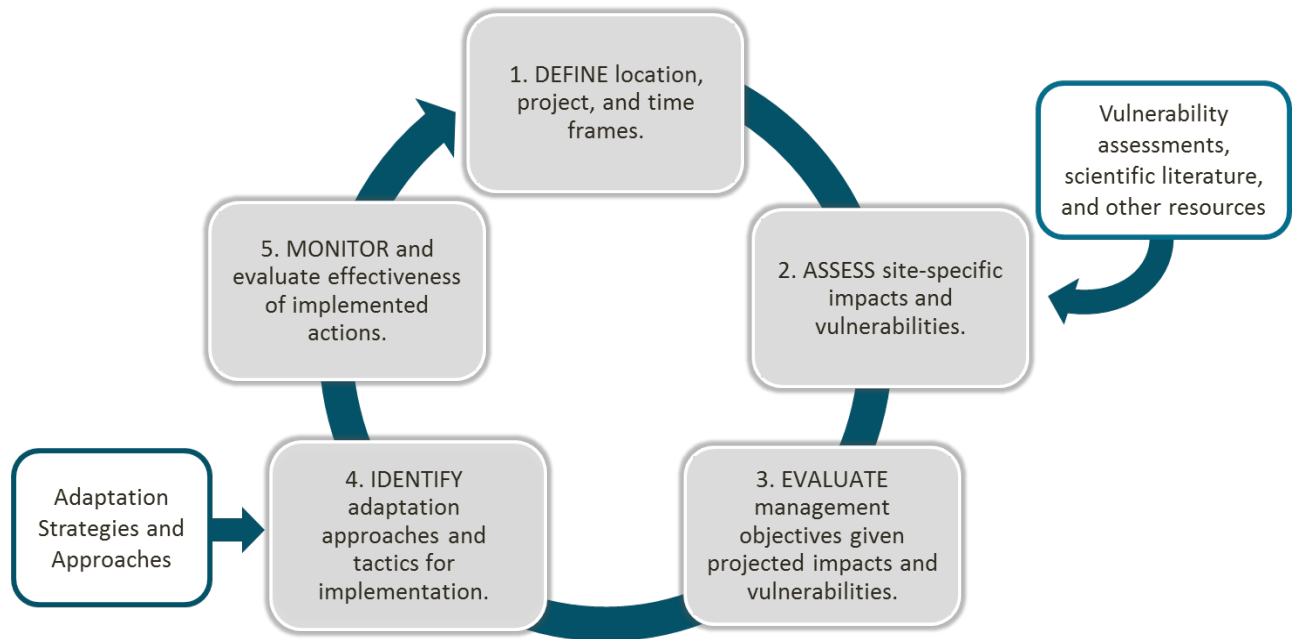




### Role-Playing Activity: Planning for the Future

**Group Activity:** Your group represents a committee established by your Refuge Manager in **LOCATION**. They are highly concerned about the future of **SPECIES NAME**. Your job is to work through the first four adaptation planning steps for your Refuge and species. In doing so, you will define your management objectives, assess future climate impacts, evaluate current objectives, and identify adaption actions utilizing a menu of management strategies.



**Initial Tasks:** Before you start the activity, identify who within your group will serve in the following roles:

- Team Lead
- Timekeeper
- Notetaker(s)
- Group Spokesperson

**Background information for your Refuge and species:** The Refuge currently contains 100 acres of suitable habitat for your species of concern. There has already been an adaptive capacity assessment done for your species of concern (provided). You will use this information to help you in the steps below. In addition, your Refuge currently uses prescribed fire and livestock grazing as management tools for conservation. While both methods may be used in the future, the timing, intensity and frequency of implementation may change. Lastly, there is currently an intact ecosystem with suitable habitat for your species 75 miles north of the Refuge.

## STEP 1 (20 min) – Identifying Management Goals & Objectives

- **List management goals and objectives for your Refuge and species of concern.**
  - Identify your refuge's management goals and objectives for this species of concern and write them in **Table 1**.
  - Goals may be Refuge or species focused. However, if your goals are more habitat focused, make sure you tie specific objectives back to your species of concern.

**TABLE 1**

| Management Goals                                                                                         | Management Objectives                                                                       |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <i>Increase area of occupancy for species X within the refuge to support greater gene flow/diversity</i> | <i>Restore 1000 acres of marginal cropland to mixed-grass and tallgrass prairie by 2050</i> |
|                                                                                                          |                                                                                             |
|                                                                                                          |                                                                                             |
|                                                                                                          |                                                                                             |
|                                                                                                          |                                                                                             |

## STEP 2 (20 min) – Assessing Possible Climate Impacts

- Assess the climate change impacts that could affect the habitat of your species of concern.
  - Based on what you currently know, select the top 3 climate change concerns that are the greatest risk for the habitat for your species of concern and fill out **Table 2a**.

**TABLE 2a**

**Which of these regional climate change impacts is likely to affect the habitat? Select your top 3 concerns.**

**How could these regional climate change impacts affect your habitat of concern?**

- ☐ Warmer temperatures (annual and seasonal)
- ☐ More days with extreme heat
- ☐ Fewer days with extreme cold
- ☐ Uncertain annual precipitation
- ☐ Altered seasonal changes in precipitation
- ☐ More frequent heavy precipitation events
- ☐ Less snow/shorter winter season
- ☐ Altered stream flows
- ☐ Reduced soil moisture in summer
- ☐ Longer growing season
- ☐ Potential for early spring thaws/late frosts
- ☐ Declines in streams, riparian areas, and wetland ecosystems
- ☐ Lack of regeneration post-disturbance
- ☐ More frequent and intense storms
- ☐ Potential changes in wildfire frequency and severity
- ☐ Increases in insect pests and pathogens
- ☐ Increases in nonnative plant species
- ☐ Changes in patterns of herbivory
- ☐ Other:

## STEP 2 Cont.

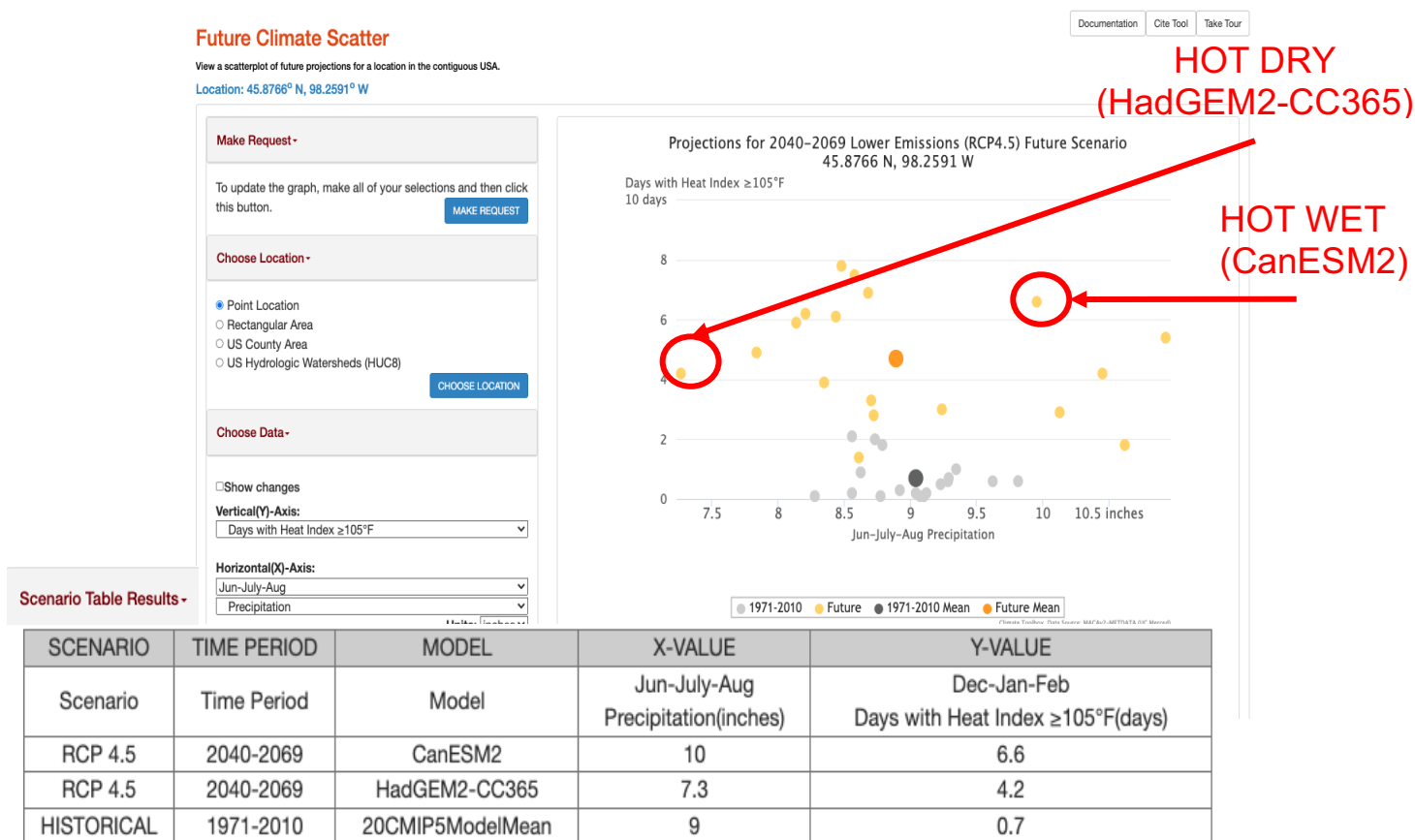
- **Assess the climate change impacts that could affect your species of concern.**
  - Based on what you currently know, select the top 3 climate change concerns that are the greatest risk for your species of concern and fill out **Table 2b**.

**TABLE 2b**

| Which of these regional climate change impacts is likely to affect your <u>species of concern</u> ? Select your top 3 concerns.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | How could these regional climate change impacts affect your species of concern? |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <input type="checkbox"/> Warmer temperatures (annual and seasonal)<br><input type="checkbox"/> More days with extreme heat<br><input type="checkbox"/> Fewer days with extreme cold<br><input type="checkbox"/> Uncertain annual precipitation<br><input type="checkbox"/> Altered seasonal changes in precipitation<br><input type="checkbox"/> More frequent heavy precipitation events<br><input type="checkbox"/> Less snow/shorter winter season<br><input type="checkbox"/> Altered stream flows<br><input type="checkbox"/> Reduced soil moisture in summer<br><input type="checkbox"/> Longer growing season<br><input type="checkbox"/> Potential for early spring thaws/late frosts<br><input type="checkbox"/> Declines in streams, riparian areas, and wetland ecosystems<br><input type="checkbox"/> Lack of regeneration post-disturbance<br><input type="checkbox"/> More frequent and intense storms<br><input type="checkbox"/> Potential changes in wildfire frequency and severity<br><input type="checkbox"/> Increases in insect pests and pathogens<br><input type="checkbox"/> Increases in nonnative plant species<br><input type="checkbox"/> Changes in patterns of herbivory<br><input type="checkbox"/> Other: |                                                                                 |

## STEP 3 (45 min) – Assessing the Future Climate

- Assess your Refuge's future climate for the mid-Century (2040-2069).
  - Go to the Climate Data Portal – Future Climate Scatter Tool (<https://climatetoolbox.org/tool/future-climate-scatter>).
    - Select your location and variables of interest (look back at **Table 2** to help inform your selection).
    - Choose RCP 4.5 as the emissions scenario.
    - After the map updates, look at the spread of the model results.
      - Choose 2 divergent models in the scatter of results and record the model name and data in the Scenario Table.
      - Save the Scenario Table.



- After you have selected your two models, you will download your climate scenarios using the Climate Data Portal – Future Climate Scenarios Tool (Beta Tool) for your location. (<https://climate.northwestknowledge.net/NWTOOLBOX/climateScenarios.php>).
  - Under the scenarios section of the tool, put in the model information from the previous step, choose RCP 4.5 for both, and make sure you are looking at the Mid-Century data.
  - On the next step, select metrics that are most important to your species of concern (look back at **Table 2** to help inform your selection).
    - Select at least 3 metrics for both the seasonal and annual data.
  - Click on **View Report** to see the data for your location.
    - Download the data as either a CSV or PNG file (should look something like the figure shown).

## Climate Scenarios

The summary table below describes changes in the future climate by 2050 (2040-2069) relative to the 1971-2000 period under climate scenarios: **Scenario 1** (20CMIP5ModelMean.rcp85), **Scenario 2** (20CMIP5ModelMean.rcp45)

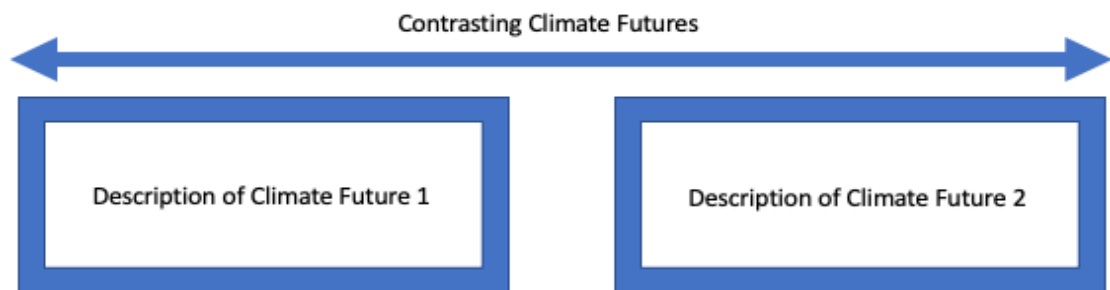
| Climate Metric                                                                  | Scenario 1                 | Scenario 2                | Historical Value |
|---------------------------------------------------------------------------------|----------------------------|---------------------------|------------------|
| <b>Winter Mean Temperature(°F)</b><br>(change relative to historical by °F)     | <b>38.76</b><br>(5.47)     | <b>37.37</b><br>(4.08)    | <b>33.29</b>     |
| <b>Winter Precipitation</b><br>(% change relative to historical)                | <b>1.80</b><br>(17.65)     | <b>1.73</b><br>(13.07)    | <b>1.53</b>      |
| <b>Winter Potential Evapotranspiration</b><br>(% change relative to historical) | <b>4.43</b><br>(38.87)     | <b>4.11</b><br>(28.84)    | <b>3.19</b>      |
| <b>Winter Maximum Temperature(°F)</b><br>(change relative to historical by °F)  | <b>51.48</b><br>(5.01)     | <b>50.17</b><br>(3.70)    | <b>46.47</b>     |
| <b>Coldest Winter Day</b><br>(relative to historical by °F)                     | <b>1.49</b><br>(7.54)      | <b>0.96</b><br>(5.09)     | <b>6.05</b>      |
| <b>Hottest Summer Day</b><br>(relative to historical by °F)                     | <b>104.39</b><br>(6.70)    | <b>102.64</b><br>(4.95)   | <b>97.69</b>     |
| <b>Day of First Fall Freeze</b><br>(relative to historical by days)             | <b>Oct. 17</b><br>(12.80)  | <b>Oct. 13</b><br>(8.70)  | <b>Oct. 4</b>    |
| <b>Day of Last Spring Freeze</b><br>(relative to historical by days)            | <b>Apr. 13</b><br>(-15.00) | <b>Apr. 19</b><br>(-9.80) | <b>Apr. 28</b>   |

Quantities and projected changes described above are for the location at 39.7392°N; 104.9903°W and a mean elevation of ?? ft.. Winter is Dec, Jan, Feb; Spring is Mar, Apr, May; Summer is Jun, Jul, Aug and Fall is Sep, Oct, Nov.

Dataset: MACA-METDATA v2 (4-km downscaled climate projections), VIC (v4.1.2) forced by MACAv2-LIVNEH (6-km hydrology projections) and gridMET (4-km historical).

## STEP 3 Cont.

- **Build out the narrative for your contrasting, yet plausible, climate futures.**
  - Design your climate futures such that they characterize different ends of the climate spectrum.
    - Using the information from the Climate Toolbox and your knowledge of the species, identify critical climate uncertainties (e.g., drier conditions versus wetter conditions) that are important to consider in your decision making.
      - Evaluate the adaptative capacity of your species of concern using the report provided:  
[https://drive.google.com/drive/folders/1OE6ULiZokjuDzDC2L6VLKIMBdOkIWX-N?usp=share\\_link](https://drive.google.com/drive/folders/1OE6ULiZokjuDzDC2L6VLKIMBdOkIWX-N?usp=share_link)
      - Consider using this tool to look at potential for drought:  
[https://nccasc.shinyapps.io/SPEI\\_Projections/](https://nccasc.shinyapps.io/SPEI_Projections/)
  - Develop creative names (e.g., Hot & Humid, Desert Heat, etc.) and write up descriptions for your two possible climate futures in **Table 3**.



**TABLE 3**

| Title of Climate Future 1              | Title of Climate Future 2              |
|----------------------------------------|----------------------------------------|
| <i>Description of Climate Future 1</i> | <i>Description of Climate Future 2</i> |

## STEP 4 (20 min) – Re-Evaluating Management Objectives

- **Evaluate current management objectives under your two climate futures.**
  - Bring up Table 1 for review.
  - Think about how your current management objectives might be impacted by a changing climate. What management challenges and opportunities may occur as a result of climate change?
  - Based on the risks from climate change over the next 20-50 years, do you have confidence that your current management objectives will be successful using current (business-as-usual) management actions? What about over the next 100 years?
  - Are there any new management objectives that need to be considered? Fill out **Table 4**.

**TABLE 4**

| Objective # from Table 1                                                                    | Impacts on objective under Climate Future 1 | Impacts on objective under Climate Future 2 | Keep, revise, or remove the management objective? Write out objectives.                                                                      |
|---------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Restore 1000 acres of marginal cropland to mixed-grass and tallgrass prairie by 2050</i> | <i>Low vegetation production.</i>           | <i>High vegetation production.</i>          | <i>Revise - Identify areas where it is not feasible to restore grasslands to focus efforts elsewhere and restore 1000 acres to grassland</i> |
|                                                                                             |                                             |                                             |                                                                                                                                              |
|                                                                                             |                                             |                                             |                                                                                                                                              |
|                                                                                             |                                             |                                             |                                                                                                                                              |
|                                                                                             |                                             |                                             |                                                                                                                                              |
|                                                                                             |                                             |                                             |                                                                                                                                              |

- **After completing Table 4, talk with your group members about the question below.**
  - Based on what your group wrote in the table above, do you think your management goals are still feasible? Why or why not?

## STEP 5 (45 min) – Identifying Adaptation Strategies and Tactics

- Select adaptation strategies and approaches from the draft grasslands menu and/or the species-specific adaptation menu based on your updated management objectives from Step 3, your species' adaptive capacity, and your climate futures from Step 2.
  - Consider actions that may be available to counter, alleviate, or avoid the worst effects of a future climate. Review the full suite of options provided on the next two pages to get started.
    - Think about adaptation actions that would be helpful in multiple scenarios and write them in **Table 5**.
      - Keep in mind that monitoring strategies may be appropriate to list here as well.
    - Use these strategies and approaches to develop your adaptation actions (i.e. tactics) in **Table 6**. These are your prescriptive actions based on your local knowledge and expertise.

**TABLE 5**

| Current/revised/new objectives<br>from Table 4                                                                                      | Adaptation Strategies                                                                | Adaptation Approaches                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <i>Identify areas where it is not feasible to restore grasslands to focus efforts elsewhere and restore 1000 acres to grassland</i> | <i>Strategy 4: Restore or maintain the extent of grasslands across the landscape</i> | <i>Approach 4.2 Restore or establish grasslands in locations that are expected to remain suitable under future conditions</i> |
|                                                                                                                                     |                                                                                      |                                                                                                                               |
|                                                                                                                                     |                                                                                      |                                                                                                                               |
|                                                                                                                                     |                                                                                      |                                                                                                                               |
|                                                                                                                                     |                                                                                      |                                                                                                                               |
|                                                                                                                                     |                                                                                      |                                                                                                                               |

**Notes:** What things concern you? What do you wish you knew more about?

# **Grassland Adaptation Menu: Strategies & Approaches**

## **Strategy 1: Sustain fundamental functions in grasslands**

- Approach 1.1. Maintain or restore soils and nutrient cycling
- Approach 1.2. Emulate natural disturbances from grazing
- Approach 1.3. Emulate disturbances from natural and indigenous fire
- Approach 1.4. Maintain or restore hydrology

## **Strategy 2: Reduce the impact of physical and biological stressors on grassland communities**

- Approach 2.1: Reduce impacts from extreme rainfall and drought
- Approach 2.2: Reduce the risk of unacceptably severe wildfire
- Approach 2.3. Reduce the impacts of climate change on grassland-dependent wildlife
- Approach 2.4. Prevent or reduce encroachment of woody species
- Approach 2.5. Prevent the introduction, establishment, and spread of non-native invasive plants
- Approach 2.6. Promote compatible management practices on agricultural land adjacent to grasslands
- Approach 2.7. Promote compatible management practices on rangelands

## **Strategy 3: Enhance plant genetic, species, and functional diversity and structural heterogeneity**

- Approach 3.1. Maintain and restore genetic diversity of grassland species
- Approach 3.2. Maintain and restore a diversity of native plant species and functional groups (C4 and C3 grasses, forbs, and legumes)
- Approach 3.3. Increase and retain heterogeneous vegetation structure
- Approach 3.4. Maintain and restore wetland vegetation within grasslands

## **Strategy 4: Restore or maintain the extent of grasslands across the landscape**

- Approach 4.1. Protect or conserve existing grasslands that are functionally intact or ecologically valuable
- Approach 4.2. Restore or establish grasslands in locations that are expected to remain suitable under future conditions
- Approach 4.3. Protect existing grasslands in locations that are expected to remain suitable under future conditions.
- Approach 4.4. Enlarge existing grassland habitats and protected areas
- Approach 4.5. Create or maintain habitat that includes a wide variety of sites and conditions, including wetlands
- Approach 4.6. Discourage or prevent conversion of grasslands for agriculture or development

## **Strategy 5: Provide for landscape-scale grassland resilience under future climate scenarios**

- Approach 5.1. Protect habitats along species' range edges
- Approach 5.2. Maintain or create corridors for species migration
- Approach 5.3. Increase connectivity and reduce landscape fragmentation
- Approach 5.4. Preemptively protect non-grassland habitats projected to convert to grassland

## **Strategy 6: Adjust management actions to account for changing conditions**

- Approach 6.1: Adjust the timing, frequency, or intensity of prescribed fire to align with current and projected climate conditions
- Approach 6.2: Adjust the timing, frequency, or intensity of grazing to align with current and projected climate conditions

- Approach 6.3: Adjust the application of mechanical treatments such as haying, mowing, and brush removal to align with current and projected climate conditions.
- Approach 6.4: Adjust planting practices and timing to promote germination and establishment of grassland vegetation under changing conditions
- Approach 6.5: Adjust management of wetlands to align with current and projected climate conditions.

**Strategy 7: Facilitate species or community transitions to align with expected climate conditions**

- Approach 7.1. Promote plant species or genotypes expected to be adapted to future conditions
- Approach 7.2. Move at-risk species to locations expected to provide habitat
- Approach 7.3: Facilitate shifts in grassland community type to align with future conditions
- Approach 7.4: Convert non-grassland systems to grasslands if the climate can no longer support the current land cover (forest, savanna, marginal ag)
- Approach 7.5. Identify areas where it does not seem feasible to restore or maintain grassland habitat, in order to focus efforts elsewhere

**Strategy 8: Engage human communities in grassland conservation and adaptation**

- Approach 8.1. Develop outreach and technical assistance programs for private landowners
- Approach 8.2. Increase local community involvement in grassland management
- Approach 8.3. Respect and incorporate values of indigenous communities in management decisions
- Approach 8.4. Develop economic incentives for grassland adaptation and conservation on private lands
- Approach 8.5. Coordinate across landowners and scales to make sure adaptation actions are complementary

## **Species Specific Adaptation Menu**

**Accessible here:** [https://drive.google.com/drive/folders/1OE6ULiZokjuDzDC2L6VLKIMBdOkIWX-N?usp=share\\_link](https://drive.google.com/drive/folders/1OE6ULiZokjuDzDC2L6VLKIMBdOkIWX-N?usp=share_link)

## STEP 5 Cont.

- Develop adaptation tactics associated with your selected adaptation strategies/approaches (from Table 5). These are the prescriptive actions you would recommend based on your local expertise and knowledge, your management objectives, the location, the species of concern, your species' adaptive capacity, and your climate futures.
- Fill out **Table 6**, focusing on columns 1-3.
  - If time permits, write down your thoughts regarding the benefits and barriers of your tactics (columns 4-6).

**TABLE 6**

| Adaptation Actions                                                                                                            |                                                                                                                     | Time Frame    | Benefits                               | Barriers                                                         | Endorse Tactic? (Y/N) | Leave column blank for last task |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------|------------------------------------------------------------------|-----------------------|----------------------------------|
| Approach                                                                                                                      | Tactic                                                                                                              |               |                                        |                                                                  |                       |                                  |
| <i>Approach 4.2 Restore or establish grasslands in locations that are expected to remain suitable under future conditions</i> | <i>Convert agricultural land that is declining in productivity or frequently flooded to natural grassland cover</i> | <i>30 yrs</i> | <i>Increased habitat for Species X</i> | <i>Not all land will be suitable for grassland establishment</i> | <i>Yes</i>            |                                  |
|                                                                                                                               |                                                                                                                     |               |                                        |                                                                  |                       |                                  |
|                                                                                                                               |                                                                                                                     |               |                                        |                                                                  |                       |                                  |
|                                                                                                                               |                                                                                                                     |               |                                        |                                                                  |                       |                                  |
|                                                                                                                               |                                                                                                                     |               |                                        |                                                                  |                       |                                  |

## STEP 6 (30 min) – Pulling it all Together

- Propose a management strategy recommendation to your Refuge Manager.
  - Based on Steps 1-4, develop a management strategy proposal using the template provided.

### MANAGEMENT STRATEGY PROPOSAL TEMPLATE

**What are the major climate concerns for your species? Why are these your primary concerns?**

**What are the management actions you propose moving forward? Why did you choose these actions?**

**Go back to Table 6. In the last column, mark your tactics as Resist, Accept, or Direct.**

Definitions from NPS

(<https://www.nps.gov/subjects/climatechange/resistacceptdirect.htm>)

- To **accept** is to lower the sails and allow the boat to move with the winds, arriving wherever they lead.
- To **direct** is to use the winds, via sails and rudder, to steer the boat to a specific new, preferred destination, both far from home port and from where the winds alone would take it.
- To **resist** is to lower the sail and fight the prevailing winds, using a motor to attempt to return to home port.



**Based on your proposed management tactics, do you see a trend towards accepting, directing, or resisting change in general? Is there a strategic reason for your selected tactics?**

**Do you think a longer-range plan (e.g., end-of-century) would be helpful to ensure persistence of your species of concern?**

**What might be the implications of your near-term actions on longer-range planning? Are they helpful or hurtful for future adaptive pathways?**