



Climate Change Scenario Development Workshop

November 13, 2012
Burlington, Sheraton

The goals of this workshop are threefold:

- 1.) To educate participants on our region's growing capacity to develop and use regional downscaled climate models for resiliency planning purposes.
- 2.) To generate a series of scenarios regarding the possible and/or anticipated impacts of climate change on our region and to envision ways to use these scenarios to assess risk, determine how to allocate resources, and undertake adaptation strategies to improve the resiliency of our region.
- 3.) To use these scenarios to develop coupled human-natural systems models to inform decision-making and basic science.

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Definitions of Terms **for Research on Adaptation to Climate Change (RACC)** **Climate Change Scenario Development Workshop**

For the purposes of this workshop we will rely on a set of terms that participants may or may not be familiar with. These terms are provided here to ensure that we are referring to a shared language.

Drivers: In the context of our afternoon breakout sessions, drivers imply a causal relation. A “driver” causes, or contributes to the cause of, some reaction in or to the system. Drivers can force unwanted or welcomed changes in the system.

Climate drivers: For the purposes of this workshop, drivers associated with climate change will be envisioned. A climate driver may be considered as any climatic or meteorological change to the current (or recent past) conditions. We recognize that climate influences meteorological events and meteorological events shape climate characteristics. Meteorological events will include increases in extreme weather such as floods, hurricanes and droughts.

Internal climate change drivers: For purposes of this exercise we are placing boundaries around our system at the regional level defined here as the Lake Champlain Basin, including Vermont, New York and Quebec. Internal climate drivers are the realized and potential climatic and meteorological changes forecasted for our region. Drivers such as changes in precipitation, temperature, ice and snow cover, and extreme weather events will serve as the internal climate drivers implicated in our scenario development.

External climate change drivers: For the purposes of our workshop here, an external climate driver will be construed as the extra-regional (or outside of region) effects of global climate change occurring in other regions of the globe. For instance, a region experiencing protracted droughts or loss of reliable water supplies may experience a loss of population that could drive immigration to our region. The resulting population shifts would be an external climate driver into the region. Other external drivers may include shocks to the global economy, regional and national tensions resulting from scarce and/or shifting resources, and other worst case scenarios that may be envisioned.

Climate change impacts: An impact results from a driver, implying that a causal relationship exists. At this juncture, during the early phases of scenario development, we encourage participants to consider causal relationships freely within the context of brainstorming and loose-thinking. Over the course of the project, certain causal relationships may eventually be questioned scientifically and removed from further consideration.

Categories of impacts: For our purposes we frame impacts into one of five categories:

- **Environmental:** the processes of natural ecosystems and their responses to changing climate conditions in the region.
- **Economic:** the economic consequences of changing climate conditions for the region.

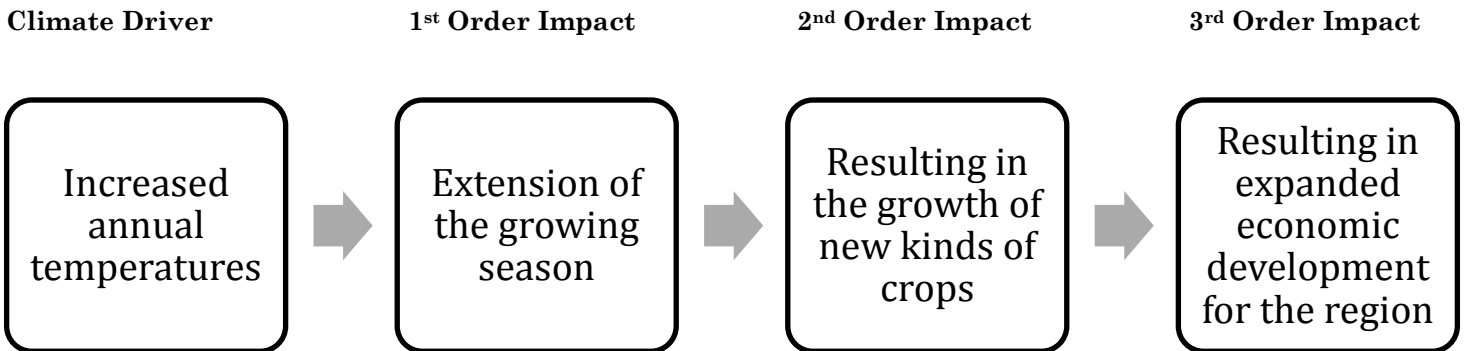
- **Social:** the social (public health, safety and quality of life) consequences of changing climate conditions for the region.
- **Agricultural:** the material implications of climate change on the region’s rural, agricultural base.
- **Infrastructure:** the implications of climate change on the built infrastructure of the region (roads, bridges, houses, utility and telecom lines, etc.).

We may decide to break these categories into other sub categories in future workshops.

Integration of Impacts: For our purposes, we will view these categories as having implications for impacts from other categories. An environmental impact, for example, may have an agricultural impact, which in turn may have an economic impact. Not all impacts will be of the same intensity or direction, leading to the potential to view impacts as trade-offs.

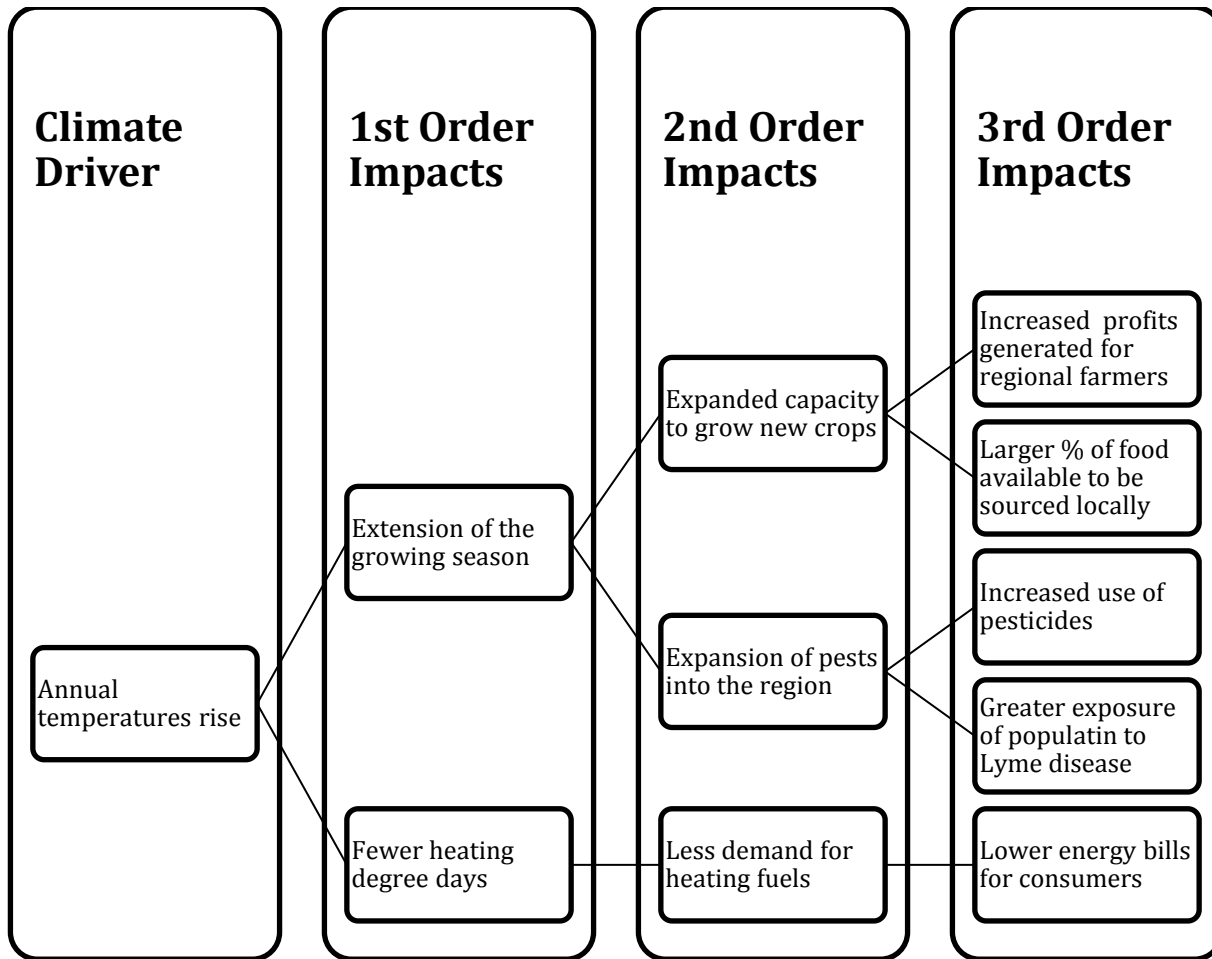
Orders of Impact: For this workshop, a “1st order impact” is one that directly results from a climate driver. Subsequent impacts may result: second, third and even fourth order impacts are derived one from the other in a causal chain. For example, an increase in annual temperature for the region results in longer growing seasons. In this storyline, the longer growing season is a 1st order impact. To elaborate on this example, a longer growing season may result in the region’s capacity to grow new kinds of crops. The capacity to grow new kinds of crops becomes one (of many) “2nd order impacts” possible. For purposes of this exercise, 2nd order impacts may be construed as driving another impact (a “3rd order impact”). In our example, the capacity to grow new kinds of crops could stimulate greater economic development for the region. This potential economic development becomes the 3rd order impact in this one potential scenario.

Figure 1: Causal Consequences between drivers and impacts



Impact Mapping: A scenario may be created by branching out from a root impact. A first order impact may have a wide range of impacts—from positive to negative. For example, an extended growing season may also result in another kind of impact: longer growing seasons mean that new pests are introduced to the region.

Figure 2.: Example of Climate Change Impact for Annual Temperature Rise



Scenario: For our purposes, a “scenario” is a string of climate drivers and ordered impacts. In the example above, five possible scenarios are identified. By the end of the workshop we will have dozens of scenarios to use to generate risk assessments, develop adaptation strategies and model alternative futures. These scenarios should be relevant, plausible, distinct, and scientifically credible.

Adaptation Strategy: These are any concerted attempts by people to respond to the changes in the environment, society, the economy, infrastructure or agriculture resulting from climate change. These strategies may be planned or envisioned.

Climate Impact Assessment Workshop Afternoon Breakout Protocols

Breakout Session #1: Identifying 1st Order Impacts (Homogeneous Grouping)

The goal of this breakout session is to brainstorm a list of 1st order impacts within a specific issue area.

Deliverable: By the end of this 1 hour session this group will have generated a list of impacts relative to the thematic area.

PROTOCOL:

- 1.) Have each member of the group give his/her name and organizational affiliation. Have this part last no more than 10 minutes.
- 2.) Review the expectations for the group, the definition of terms, and this protocol. Review the theme of this issue area. Remind the group to not worry too much about overlapping with other groups. If the impact feels like it is associated with this theme, list it. Have this part last no more than 5 minutes.
- 3.) Have each participant write down as many climate change impacts for this issue area as they can envision in 5 minutes using **worksheet #1**. [Some participants will have completed their list of anticipated 1st order impacts ahead of time. If so, ask them to review their list.]
- 4.) Going around in a round robin fashion have each person share one impact of climate change on this issue area. Invite at least one impact from each group member before entertaining a second impact. Avoid allowing people to comment on the impact (e.g. is relevance or importance—this will come later). After 20 minutes or less-- close the brainstorming part of the session. Have scribe record list on newsprint.
- 5.) Refine the brainstormed list. Combine similar impacts. Remove suspect impacts (e.g. impacts that are not easily identified as resulting from climate change). When in doubt, keep the impact on your list. This should take no more than 20 minutes. Have scribe transfer list of impacts onto “1st order impact” post-it and adhere to wall. About 8 to 12 impacts should be transferred to the post-its. Please note that all impacts appearing on worksheets will be identified and included in the final report. Be sure to collect the completed worksheet #1 from all participants.

Breakout Session #2: Integrated Assessment of 2nd and 3rd Order Impacts (Heterogeneous Group)

The goal of this breakout session is to have a diverse group of stakeholder with core interests from other areas envision possible “impact of impacts” using a 1st, 2nd and 3rd order framework.

Deliverable: By the end of this one hour session a impact map linking anticipated impacts of one issue area (environment, agriculture, social wellbeing, economic development, or infrastructure) to other issue areas will be generated for 5 to 10 impacts that were identified in the previous session.

PROTOCOL:

- 1.) Have each member of the group give his/her name and organizational affiliation. Review the expectations for the group, the definition of terms, and this protocol. Have this part last no more than 10 minutes.
- 2.) Remind the group that the designation of 1st, 2nd and 3rd order impacts is subjective—that one person’s 1st order is another’s 2nd order, etc. Have one 1st order impact for the far left hand box on **worksheet #2**. Have group members pair up and select one 1st order impact and complete a set of 2nd and 3rd order impacts using worksheet #2. Have the pairs complete successive worksheets for other 1st order impacts if time permits. This part should take no longer than 20 minutes and should be completed in pairs.

An example of the kind of products to be generated during this phase of the session:

“As a result of an increase in flooding events, the region’s rivers jump their banks with increasing frequency; resulting in loss of fertile soils in flood plain farms; resulting in the economic collapse of agricultural businesses located in flood plains.”

- 3.) In round robin fashion have each pair share one completed worksheet. Have scribe record scenarios using the appropriate post-its. Be sure that each pair has a chance to share at least one completed worksheet. Proceed to additional scenarios as time allows. This should take no more than 30 minutes.

Breakout Session #3: Scenario Evaluation and Adaptation Strategy Brainstorming (Homogenous Group)

The goal of this third and final breakout session is to review the scenarios generated in the previous breakout session and collectively envision adaptation strategies relative to each scenario.

Deliverable: A revised set of scenarios will be created. A set of possible adaptation strategies that may be pursued should be identified for each scenario. The strategy may address one or all of the anticipated 1st, 2nd or 3rd order impacts.

PROTOCOL:

1.) Review protocol instructions. As a group review the work of the previous breakout session relative to each scenario. A critique of the work of the prior group is undertaken, making notes regarding the ways in which they can be/need to be modified. These observations are recorded. Modifications to each storyline can be made at this point. This section should last no longer than 20 minutes.

Draw on the following probing questions to guide this part of the discussion:

- Did the prior group surface anything surprising?
- Are these scenarios factually accurate? Are the assumptions correct?
- What scenarios might keep you up at night?

2.) Individually, ask each member of the group to identify at least two scenarios on which to focus on adaptation strategies. Using the adaptation strategy **worksheet #3**, have each person record the scenario on the page and write about existing or possible adaptation strategies that are possible to either limit the negative impacts of the scenario or to ensure the positive impacts assumed in the positive scenario. Have them note the status of the strategy (e.g. implemented, in progress, planned, not yet envisioned, etc.). This section should take 10 minutes.

3.) As a group, in round robin fashion have as many people as possible share their adaptation strategies. This section should take no more than 20 minutes.

4.) Have the group nominate scenarios to report out on during the closing plenary session. Be sure to identify and work participant to report out on these scenarios during the closing plenary. This part should take no more than 10 minutes.

- a. Blue skies: share the most optimistic scenario developed for your theme
- b. The lowest hanging fruit: share the scenario that poses the most readily available solution.
- c. Highest priority: share the most pressing scenario to emerge from your theme
- d. Biggest scare: share the most devastating/troubling scenario to emerge from your theme.

Worksheet 1: SENTENCE STEM EXERCISE

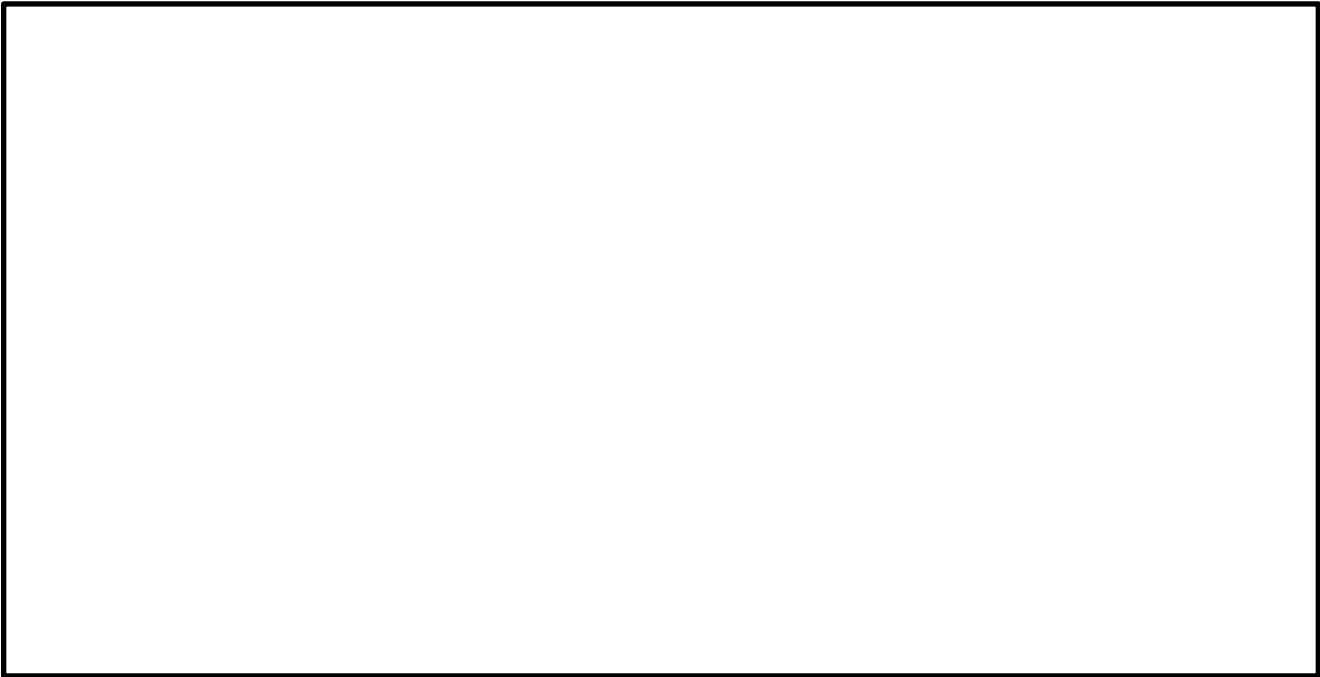
Consider the scope of your thematic area. Brainstorm a set of consequences from the thematic area resulting from a climate driver. Generate as many bulleted responses for each stem as you like.

Name of the person completing this worksheet: _____

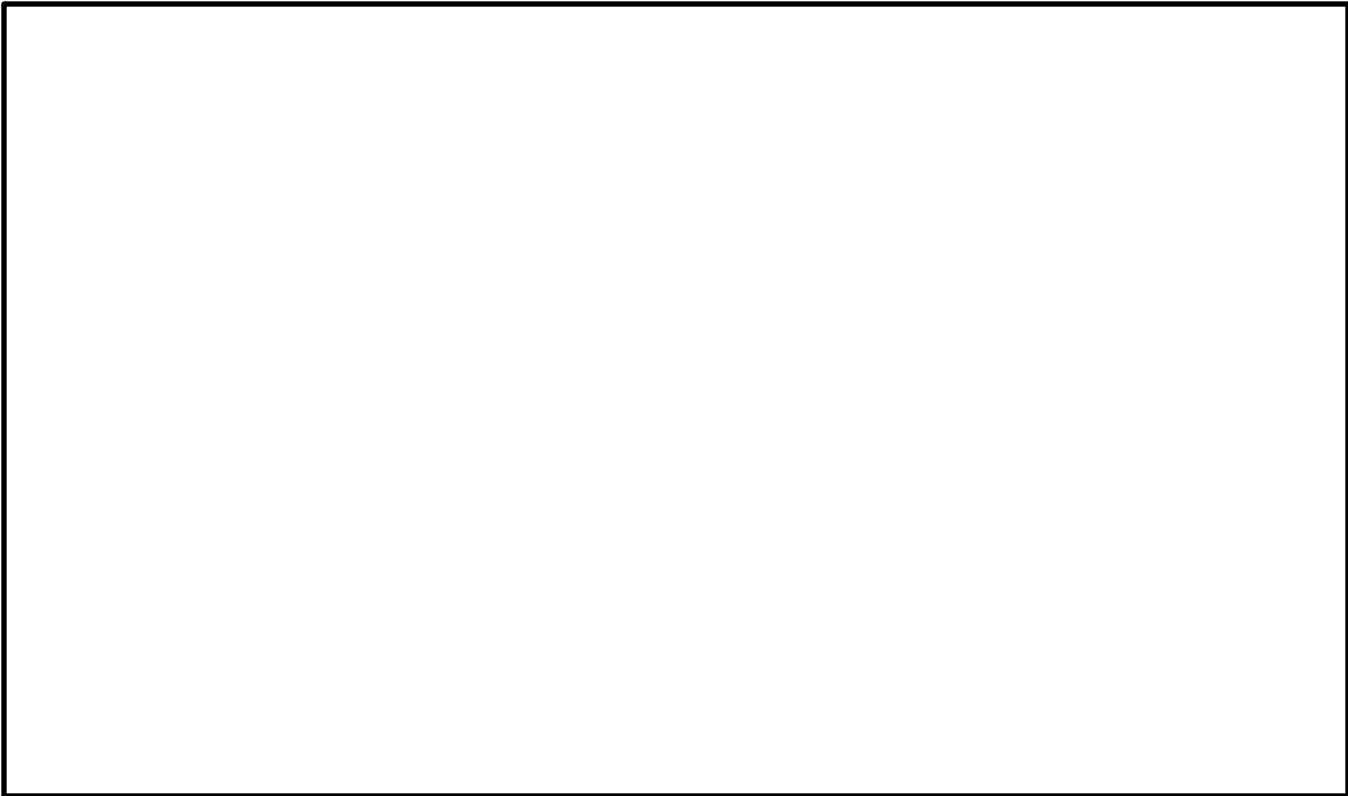
As a result of anticipated increased temperatures
[the following impacts are possible]:

As a result of anticipated increased seasonality in precipitation

As a result of anticipated increases in extreme flooding events...



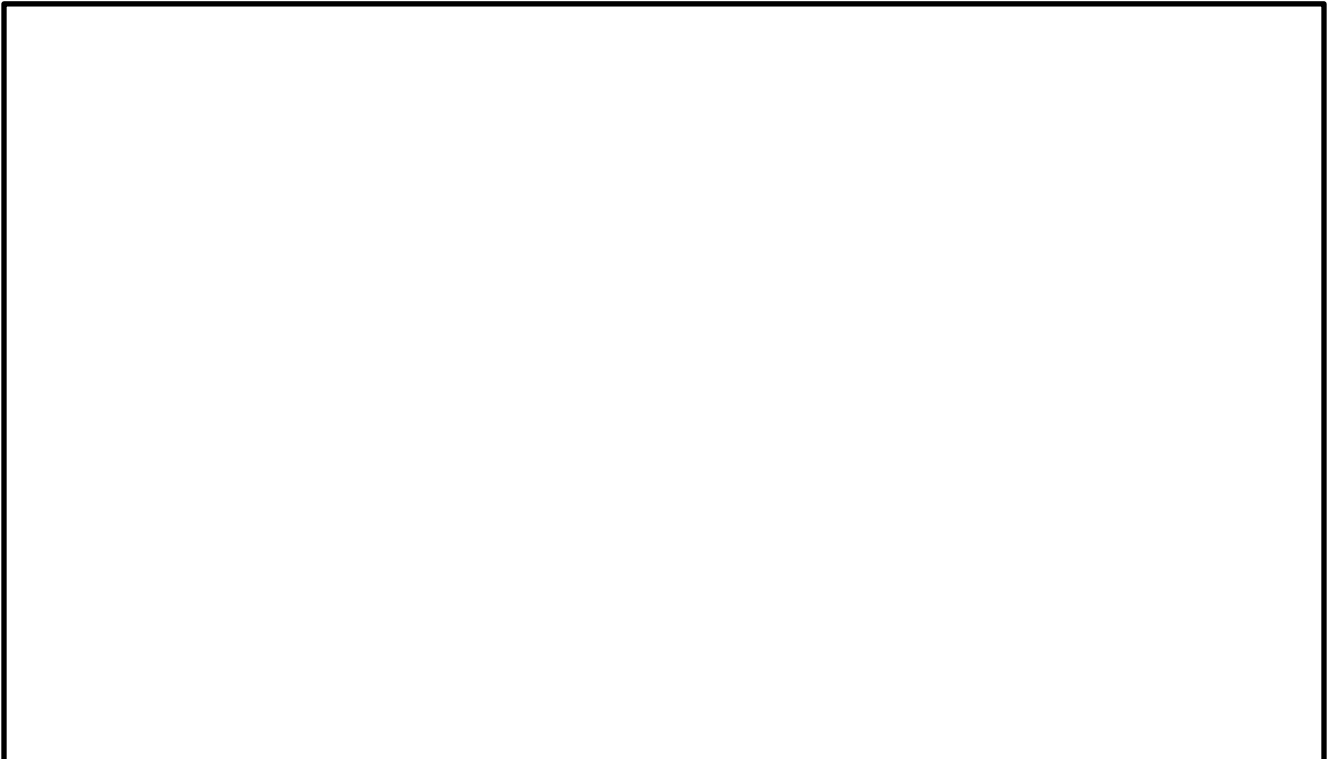
As a result of anticipated increases in extended periods of seasonal drought



As a result of anticipated loss of snow and ice cover...



As a result of any combination of internal climate drivers ...

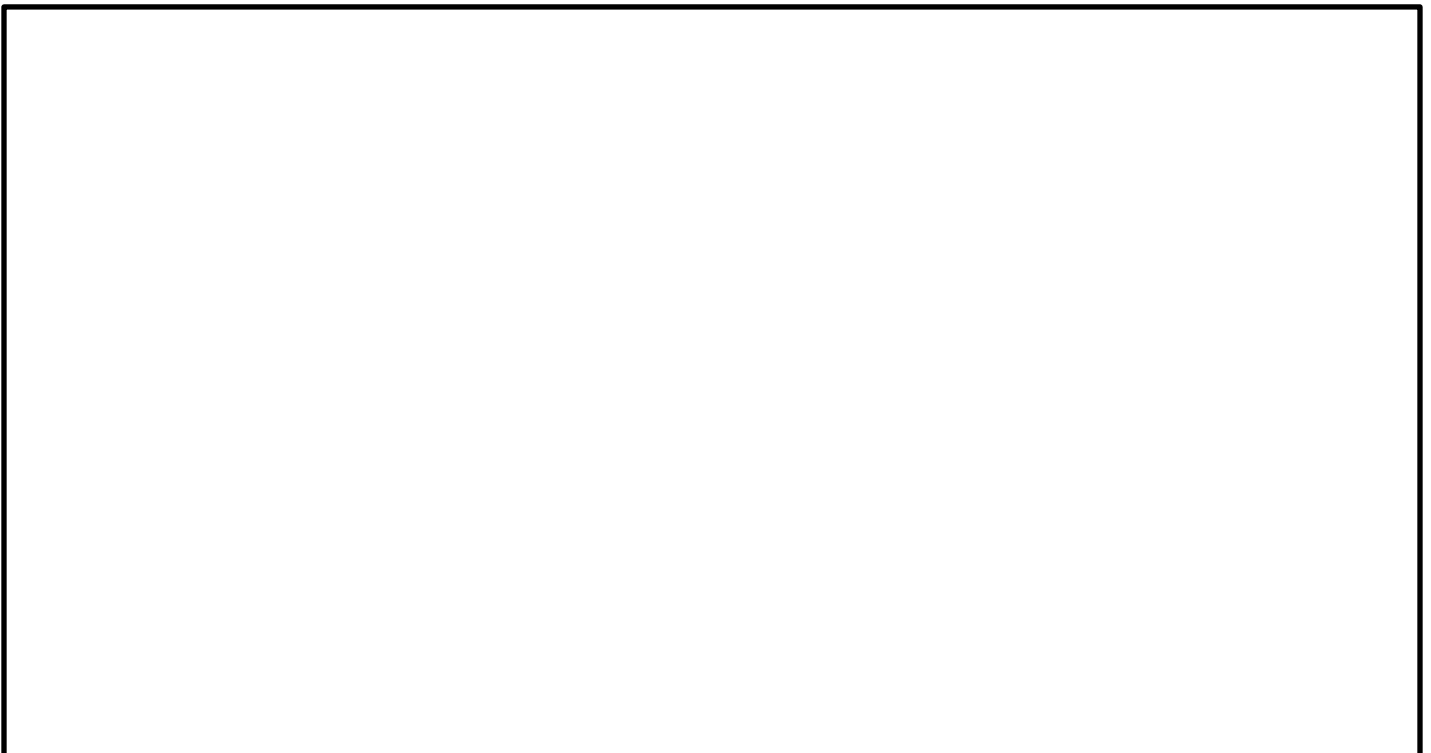


For “external” climate drivers:

As a result of potential large population migrations resulting from drought conditions and sea level rises ...

A large, empty rectangular box with a black border, intended for a drawing or response related to the text above.

As a result of any other imagined internal or external climate drivers

A large, empty rectangular box with a black border, intended for a drawing or response related to the text above.

Worksheet #2: CLIMATE CHANGE SCENARIO GENERATION

Record a 1st order impact from a worksheet #1 or from lists generated in your group during the workshop. Surmise how 2nd and 3rd order impacts result from the impact in the square. Draw arrows connecting impacts. Feel free to draw arrows as one or two tailed arrows.

Please return this and all worksheet to workshop facilitator.

Name of person completing this worksheet: _____

1st order impact

2nd order impacts

3rd order impacts



Some examples of potential scenarios:

Internal climate drivers:

As a result of an increase in flooding events:

1 st order impact	2 nd order impact	3 rd order impact
The region's rivers jump their banks with increasing frequency;	resulting in loss of fertile soils in flood plain farms;	resulting in the economic collapse of agricultural businesses located in flood plains.
The region's rivers are channelized;	resulting in loss of biodiversity;	resulting in lost tourism dollars

Other examples include:

The region's rivers jump their banks with increasing frequency; resulting in loss of critical road infrastructure in flood plains; resulting in incapacity of emergency responders to reach flood victims

As a result of increased temperatures in the region:

The growing season is extended; leading to the proliferation of new kinds of crops; resulting in an expansion of agricultural products exported from the region.

Warmer winters; cause the maple sugar industry to collapse; forcing maple syrup producers to go out of business

External climate driver:

As a result of population migrations stemming from sea level rise and severe drought conditions in the southern and western US:

The region's population doubles by 2040; resulting in stressed transportation, energy and telecommunications infrastructure; resulting in poorer economic develop opportunities

The region's population doubles by 2040; leading to increased urban development; leading to more stormwater runoff into Lake Champlain



Worksheet #3: ADAPTATION STRATEGIES GENERATION

Name of person completing this worksheet: _____

For selected scenarios, complete the 1st, 2nd and 3rd order impacts table for each set of adaptation strategies envisioned. Please return completed worksheets to workshop facilitators.

Record a scenario from worksheet #2 or from scenarios generated from your working group. Generate as many adaptation strategies to address each scenario as possible. These strategies may address any or all impacts identified in the scenario.

Example

Scenario:

1 st order impact	2 nd order impact	3 rd order impact
The region's rivers jump their banks with increasing frequency;	resulting in loss of fertile soils in flood plain farms;	resulting in the economic collapse of agricultural businesses located in flood plains.

Adaptation strategies to mitigate against or to better support positive impacts of this scenario:

Status

<ul style="list-style-type: none"> - Change zoning of flood plains to prohibit new development - Advance soil and nutrient management plans on farms - etc. 	
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Name of person completing this worksheet: _____

Scenario:

1 st order impact	2 nd order impact	3 rd order impact

Adaptation strategies:

Status

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