

Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans



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Being Prepared for Climate Change

Workbook

- Step-by-step guide to creating a risk-based vulnerability assessment (Steps 1-5) and writing an action plan (Steps 6-10).
- Tool to help an organization achieve its goals...even as the climate changes.

Methodology

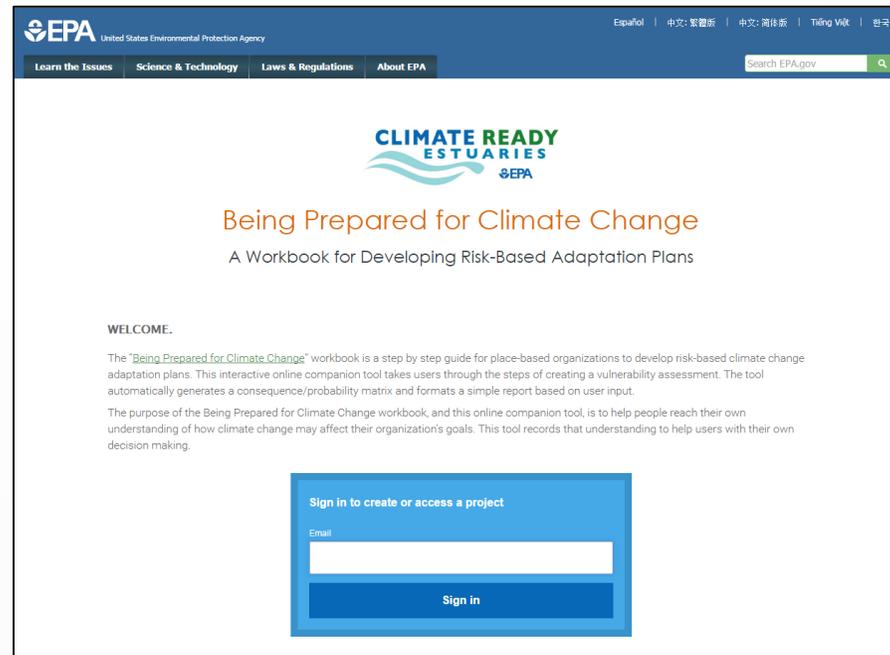
- By taking a risk-based approach to assessing vulnerability, users have a formal way to prioritize their climate change risks.
- By the end of the vulnerability assessment, users will have a Consequence/Probability matrix which highlights the biggest climate change risks.

RECREATIONAL ACTIVITIES IN AND ON THE WATER

Likelihood (probability) of Occurrence	High	<ol style="list-style-type: none"> Open seasons and fish may become misaligned (place or region; decades) 	<ol style="list-style-type: none"> Increased occurrence of Ciguatera fish poisoning (extensive; already occurring or soon to occur) Desired fish may not be around (extensive; decades) More frequent or more intense bad weather may decrease recreational opportunities and reduce the activity of bathers (place or region; within the next 15-30 years) Increased recreational fishing charter ships (place or region; decades) Critical clearance under bridges may decrease (site; decades) 	<ol style="list-style-type: none"> Increase in solid waste – more people using the beach and recreational activities (extensive; already occurring) Greater NPS pollution may impair recreation as a result of bacterial contamination (extensive; already occurring) Beaches or public access sites may be threatened by coastal erosion or inundation (place or region; already occurring) Impacts to hotel infrastructure as a product of erosion (site; already occurring) Increased aquatic security risks (place or region; within the next 15-30 years) Harmful algal blooms may be more likely (extensive; within the next 15-30 years) Increase in nautical activities (place or region; within the next 15-30 years)
	Medium	<ol style="list-style-type: none"> Decrease of dry days in winter impacting tourism industry (place or region; within the next 15-30 years) Freshwater flows in streams may not support recreational uses like boating, kayaking, fishing or stand-up paddleboarding (SUP) (place or region; decades) Less tourism due to northern areas being warmer, less recreational use of water bodies (place or region; already occurring or soon to occur) Too hot for enjoyment of outdoor recreational activities (place or region; already occurring or soon to occur) 	<ol style="list-style-type: none"> Eco-tourism resources or attractions may be degraded (e.g., birding, diving, fishing) (extensive; decades) 	
	Low	<ol style="list-style-type: none"> Recreational shellfish harvesting may be lost (place or region; decades) 	<ol style="list-style-type: none"> Increased estuary salinity may drive away targeted recreational fish (place or region; decades) 	<ol style="list-style-type: none"> Invasive plants may clog creeks, canals and waterways reducing public access (extensive; decades) Jellyfish may be more common (place or region; within the next 15-30 years) Increased use of vessels (place or region; decades)
		Low	Medium	High
		Consequence of Impact		

Objectives

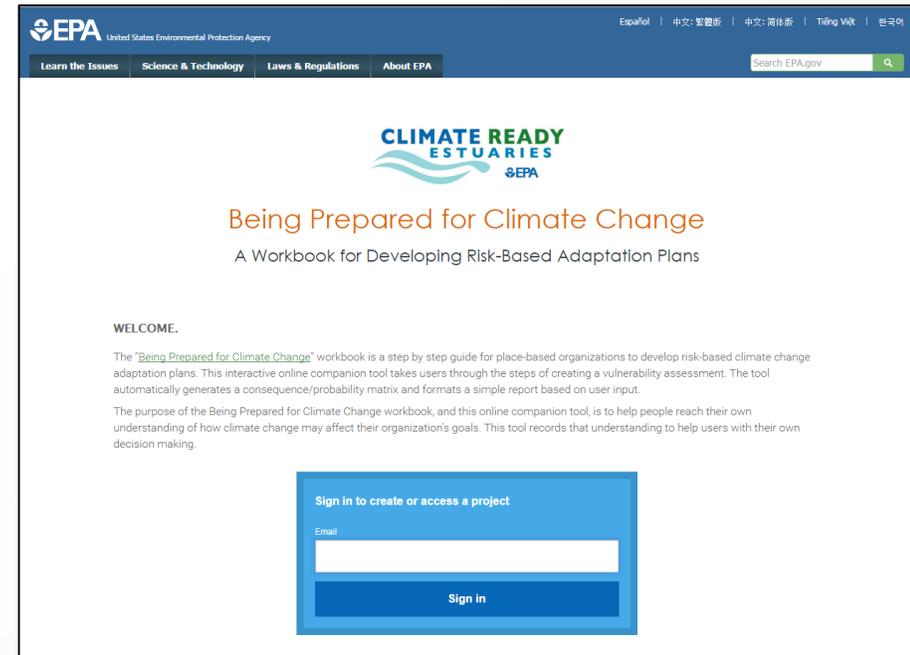
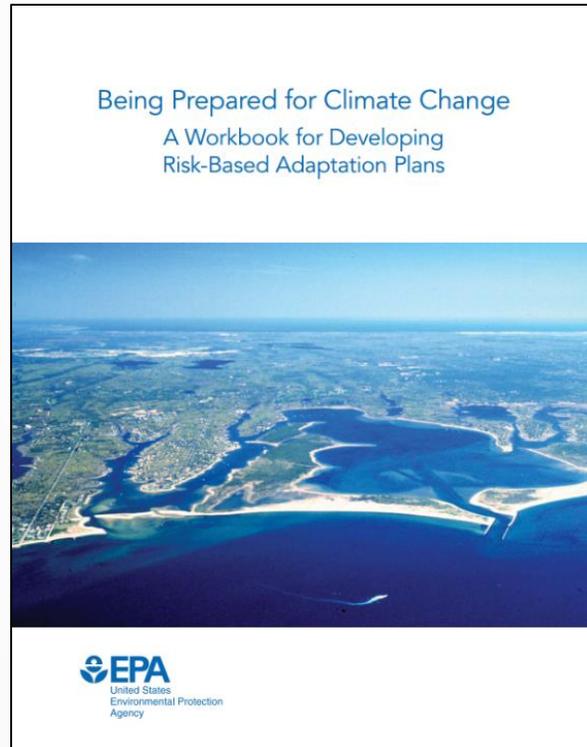
- ▶ Work through Steps 1-5 for hands on learning of the workbook methodology
- ▶ Learn the risk management methodology to implement for your organization
 - ▶ You will not walk away with a vulnerability assessment for your organization today but an understanding of the process so you can go back and apply it
- ▶ Online tool demonstration



The screenshot shows the EPA website interface for the 'Climate Ready Estuaries' program. The header includes the EPA logo and navigation links for 'Learn the Issues', 'Science & Technology', 'Laws & Regulations', and 'About EPA'. A search bar is located in the top right. The main content area features the 'CLIMATE READY ESTUARIES' logo and the title 'Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans'. Below this, a 'WELCOME' section provides an overview of the workbook and the online companion tool. At the bottom, there is a blue sign-in form with the text 'Sign in to create or access a project', an email input field, and a 'Sign in' button.

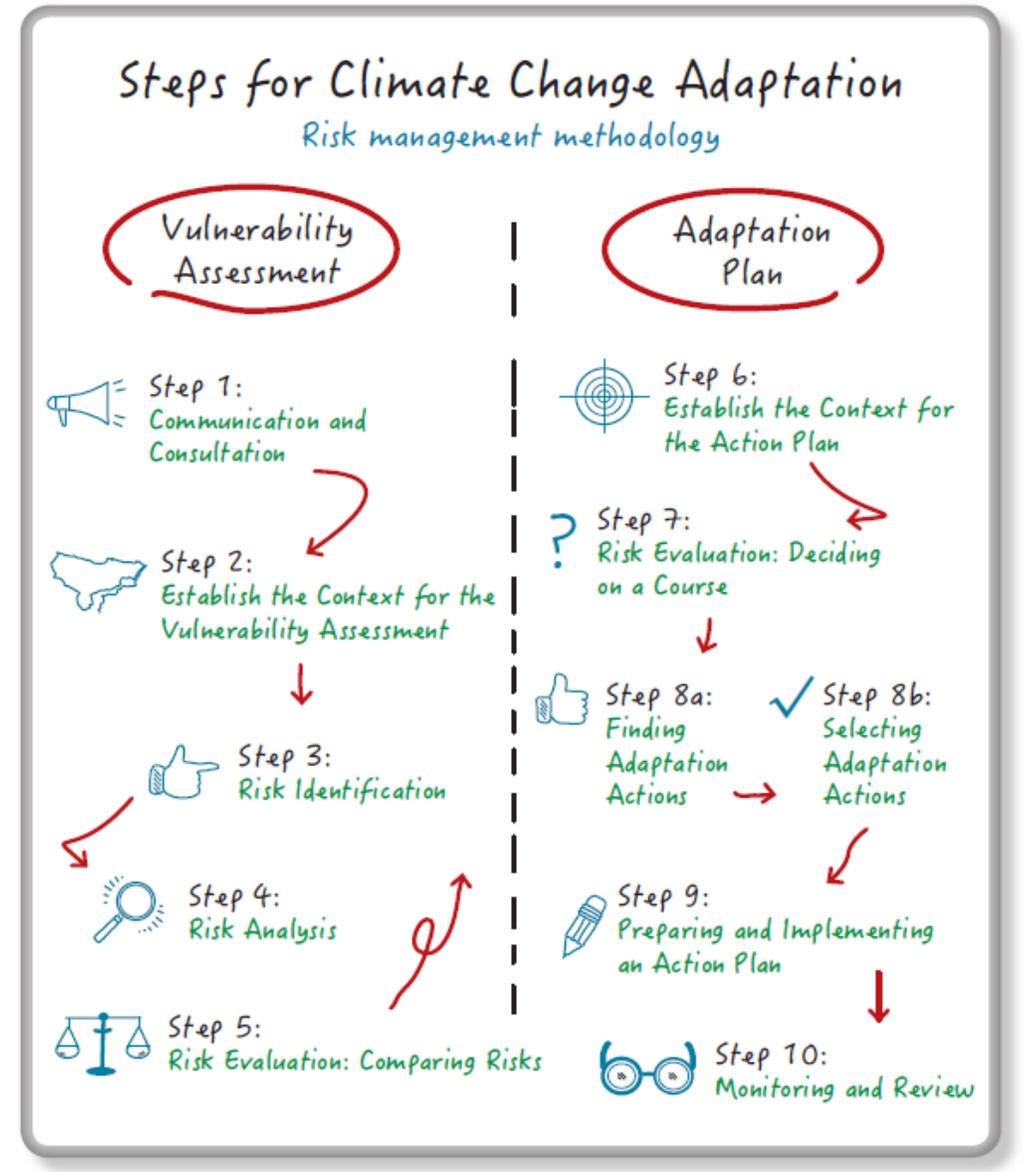
Scenario

- ▶ You are going to produce a risk-based climate change vulnerability assessment.
- ▶ You will be using EPA's *Being Prepared for Climate Change* workbook methodology.



Workbook Steps

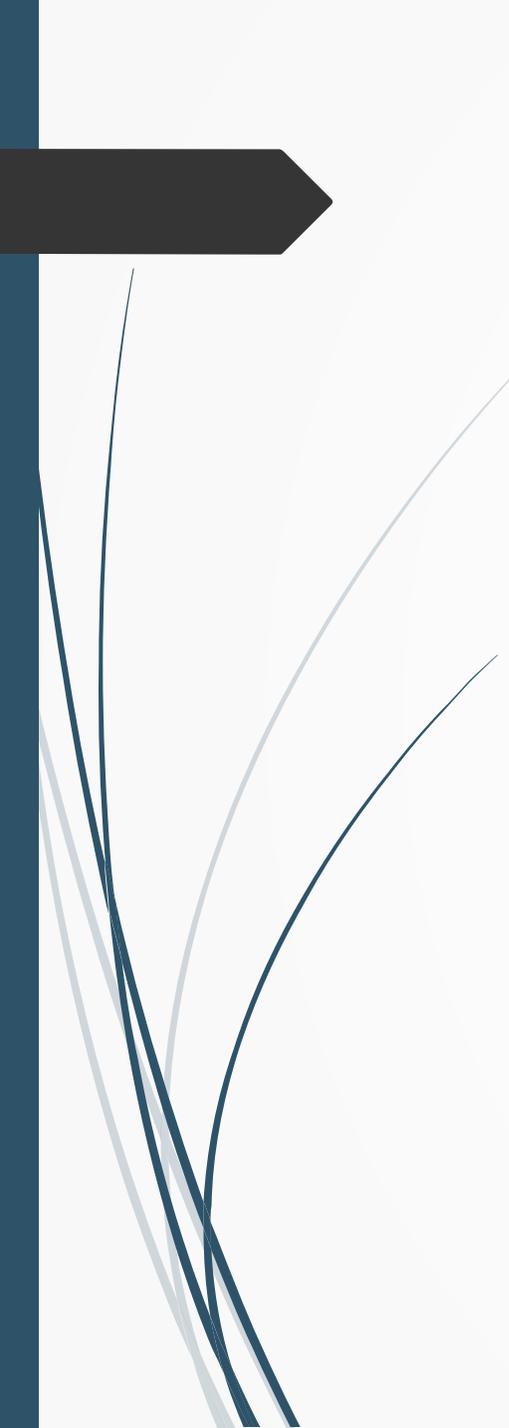
- **Step 1** – Communication and Consultation
- **Step 2** – Establishing the Context
- **Step 3** – Risk Identification
- **Step 4** – Risk Analysis
- **Step 5** – Risk Evaluation



The screenshot shows a web browser window displaying a YouTube video. The address bar shows the URL <https://www.youtube.com/watch?v=rdlWakSnvww>. The browser's menu bar includes File, Edit, View, Favorites, Tools, and Help. The YouTube interface features a search bar, a 'Sign in' button, and a video player. The video player shows a thumbnail with the text 'PROTECTING SAN JUAN THE CITY OF WATERS' over a coastal cityscape. The video progress bar indicates 1:07 / 4:00. Below the video, the title 'Climate Change Vulnerability Assessment for San Juan Bay, Puerto Rico' is displayed, along with the U.S. Environmental Protection Agency logo and a 'Subscribe 8K' button. The video has 1,159 views, 11 likes, and 3 comments. The browser's status bar at the bottom shows 100% zoom.

<https://youtu.be/rdlWakSnvww?t=1m4s>

screenshot
10/19/2015



Setup

- ▶ Today you will channel all the experts, scientists, or stakeholders, and play their roles in this exercise.
- ▶ This is a demonstration of how the Workbook works. We are simulating reality. We want it to be like the real world, but it is alright to be imperfect today.
- ▶ We will need to move quickly to get through all the steps, so don't think too much about any one thing.

Workbook Step 1: Communication and Consultation

- **Inform** your key stakeholders and partners
- **Describe** the process and expected products
- **Build support** for adaptation
- **Develop agreement** on the outcome of this process
- **Gain knowledge and information** from them





Perfect!

- ▶ Your communication and consultation campaign is proceeding perfectly.
- ▶ On to Step 2

Workbook Step 2: Establishing the Context

- Identify your organization's goals
 - These goals will **establish the scope** and boundaries for the vulnerability assessment process.
 - This information will **keep you focused**: climate changes that do not affect your organization's goals would not be part of your assessment.

STEP 2—ESTABLISHING THE CONTEXT FOR THE VULNERABILITY ASSESSMENT



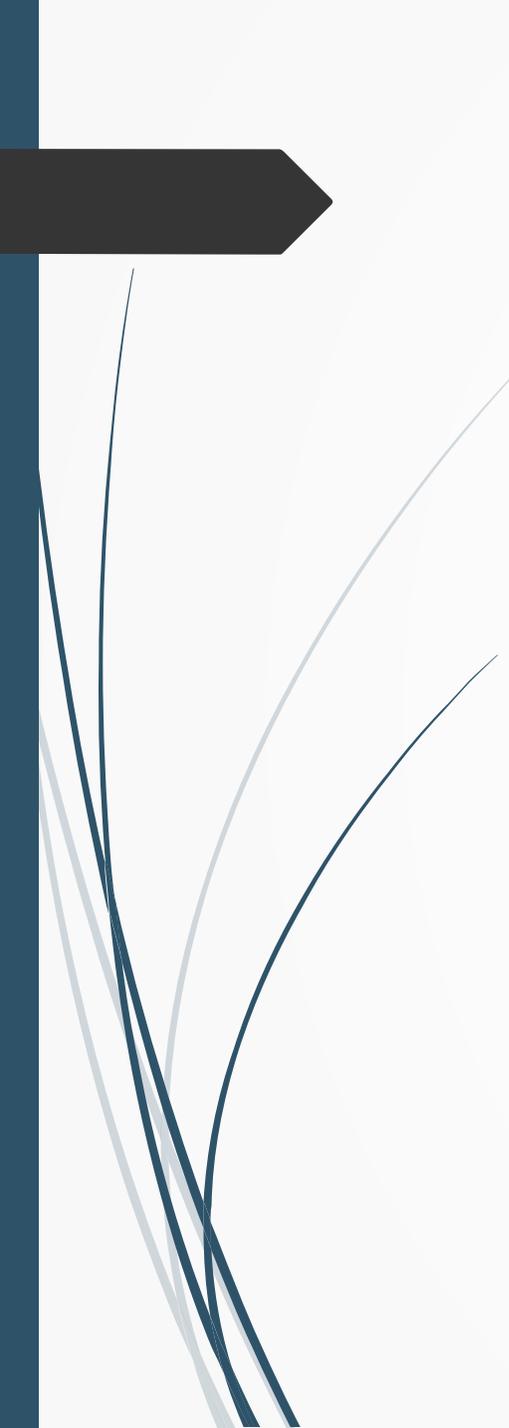
Eric Vance, EPA

What Is "Establishing the Context for the Vulnerability Assessment"?

In this step you will explicitly identify your organization's goals. These goals will establish the scope and boundaries for the vulnerability assessment process. This information will help keep you focused: climate changes that do not affect your organization's goals would not be part of your assessment.

Objective of This Step

The objective of this step is to find and list your organizational goals.



Watershed organizations working under the Clean Water Act have four big overarching goals in their strategic plans.

- Control point and nonpoint sources of pollution and clean up pollution
 - Maintain and improve estuarine habitat
 - Protect and propagate fish, shellfish and wildlife, including control of nonnative species
 - Protect public water supplies and recreational activities, in and on the water
-
- They want to know they can achieve these goals even as the climate changes.
 - On to Step 3

Step 3: Risk Identification

- Process of **generating a broad list** of reasonably foreseeable ways that climate change stressors could keep your organization from achieving its goals.
- **Consider all potential risks** during this step. If risks are not identified in this step, they will not be analyzed and evaluated in the steps that follow.

STEP 3—RISK IDENTIFICATION



John Fleck, FEMA

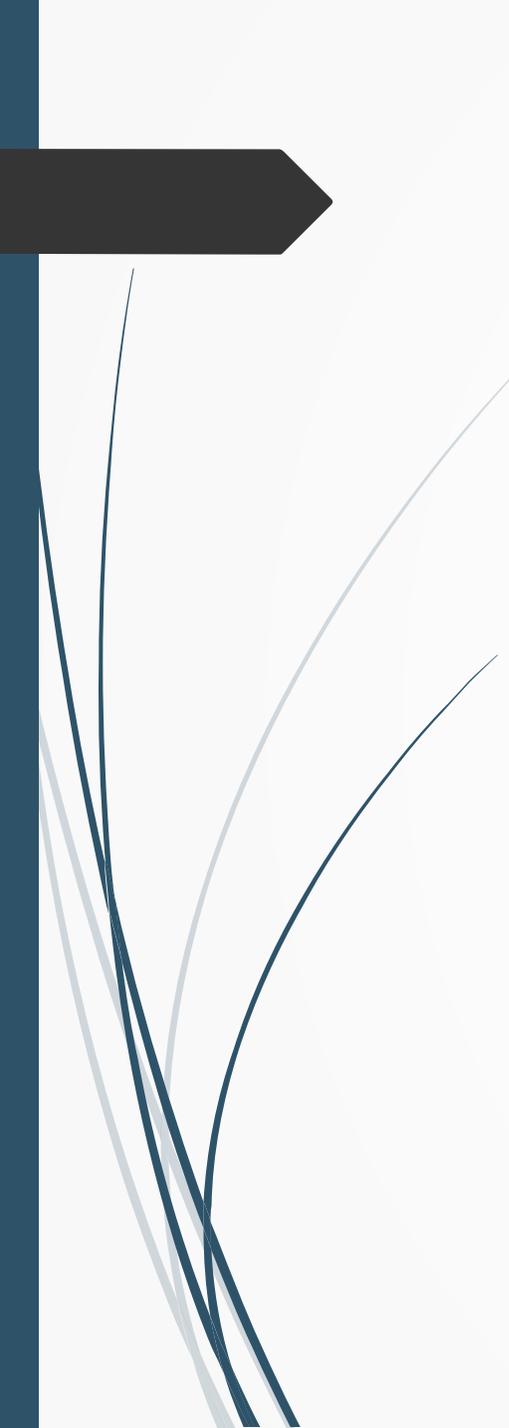
What Is “Risk Identification”?

This is the process of generating a broad list of reasonably foreseeable ways that climate change stressors could keep your organization from achieving its goals. It is important to consider all potential risks during the risk identification step. If risks are not identified in this step, they will not be analyzed and evaluated in the steps that follow.

Objective of This Step

The objective of this step is to create a broad list of climate change risks that might affect your organization’s ability to achieve its goals.

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What is a risk?

- ▶ In the context of climate change, **a risk is the possibility that a given climate stressor will affect your organization's ability to meet its goals.**
- ▶ A risk is a problem to be managed by finding ways to lower its principal characteristics: likelihood and consequence.
- ▶ In this step, you will **cross your goals with climate change stressors to identify risks.**

Climate Change Stressors

Warmer summers

Warmer winters

Warmer water

Increasing drought

Increasing storminess

Sea level rise

Ocean acidification

- ▶ For each combination of climate change stressor and organizational goal:
- ▶ Can you imagine that the given stressor,
Acting in any manner
At any given time
could affect to any degree,
the organization's ability to meet the given goal?
- ▶ If yes, then what you imagined is a risk.



Stressors in 7 columns

TABLE 3-1A. POTENTIAL CLIMATE CHANGE RISKS FOR POLLUTION CONTROL

Clean Water Act goals	Warmer summers	Warmer winters	Warmer water	Increasing drought	Increasing storminess	Sea level rise	Ocean acidification
Controlling point sources of pollution and cleaning up pollution		<ul style="list-style-type: none"> Loss of melting winter snows may reduce spring or summer flow volume, and raise pollutant concentration in receiving waters 	<ul style="list-style-type: none"> Temperature criteria for discharges may be exceeded (thermal pollution) Warmer temperatures may increase toxicity of pollutants 	<ul style="list-style-type: none"> Critical-low-flow criteria for discharging may not be met Pollutant concentrations may increase if sources stay the same and flow diminishes 	<ul style="list-style-type: none"> Combined sewer overflows may increase Treatment plants may go offline during intense floods 	<ul style="list-style-type: none"> Treatment plants may not be able to discharge via gravity at higher water levels Treatment infrastructure may be susceptible to flooding Sewage may mix with seawater in combined sewer systems Contaminated sites may flood or have shoreline erosion Sewer pipes may experience more inflow (floods) or infiltration (higher water table) 	
Controlling nonpoint sources of pollution	<ul style="list-style-type: none"> Wildfires may lead to soil erosion 	<ul style="list-style-type: none"> Longer growing season can lead to more lawn maintenance with fertilizers and pesticides 	<ul style="list-style-type: none"> Higher temperatures may increase pollutant concentrations Warmer temperatures may lead to stratification Greater algae growth may occur Parasites, bacteria may have greater survival or transmission 	<ul style="list-style-type: none"> Higher temperatures may lead to increased evaporation and less dissolved oxygen Higher surface temperatures may lead to stratification Greater algae growth may occur Parasites, bacteria may have greater survival or transmission 	<ul style="list-style-type: none"> Urban areas may be subject to more floods Flood control facilities (e.g., detention basins, manure management) may be inadequate High rainfall may cause septic systems to fail 	<ul style="list-style-type: none"> Tidal flooding may extend to new areas, leading to additional sources of pollution 	<ul style="list-style-type: none"> Decomposing organic matter releases carbon dioxide, which may exacerbate the ocean acidification problem in coastal waters

Goals in rows

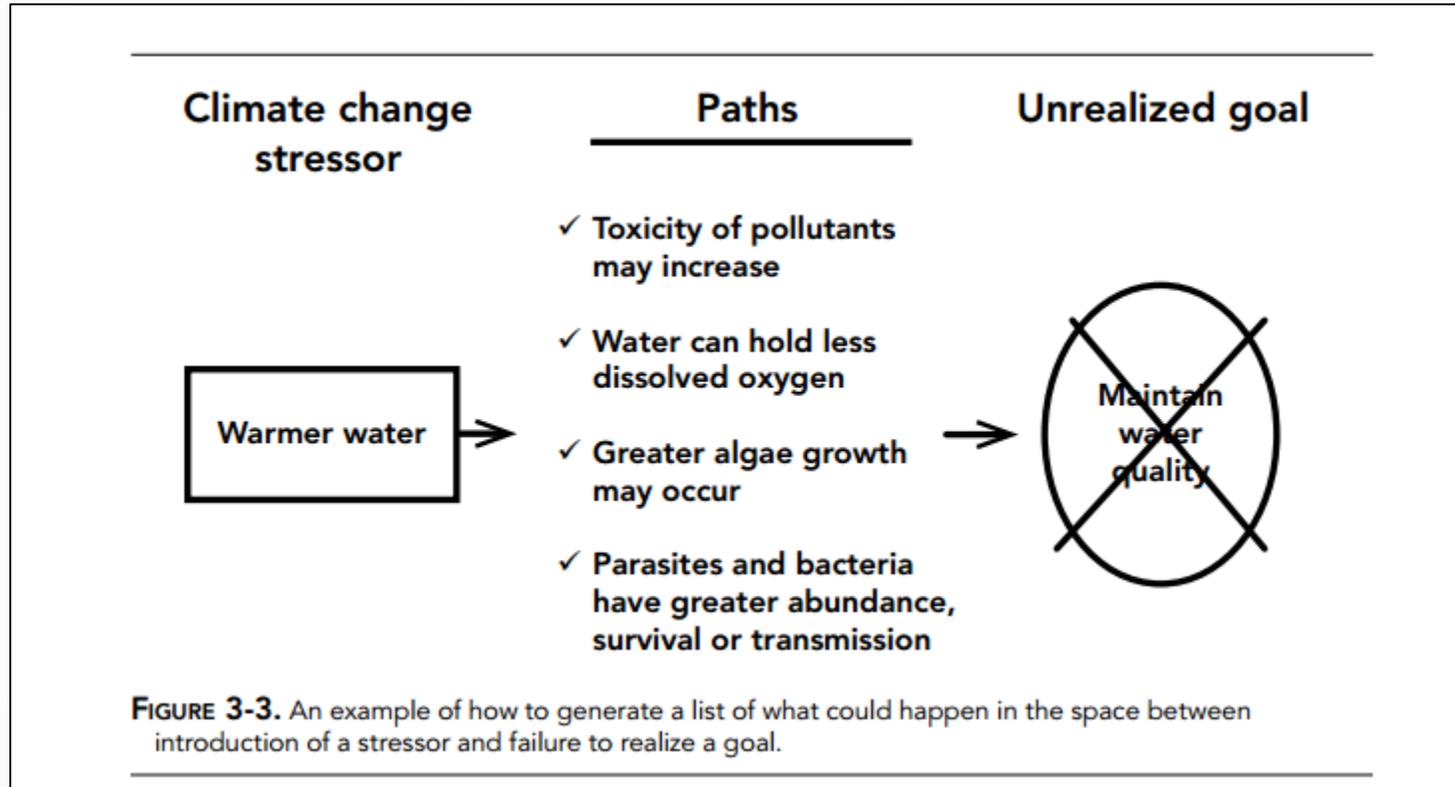
Potential risks where stressors and goals intersect

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TABLE 3-2. ADDITIONAL GOALS

Organizational goals	Warmer summers	Warmer winters	Warmer water	Increasing drought	Increasing storminess	Sea level rise	Ocean acidification
Goal _____							
Goal _____							
Goal _____							

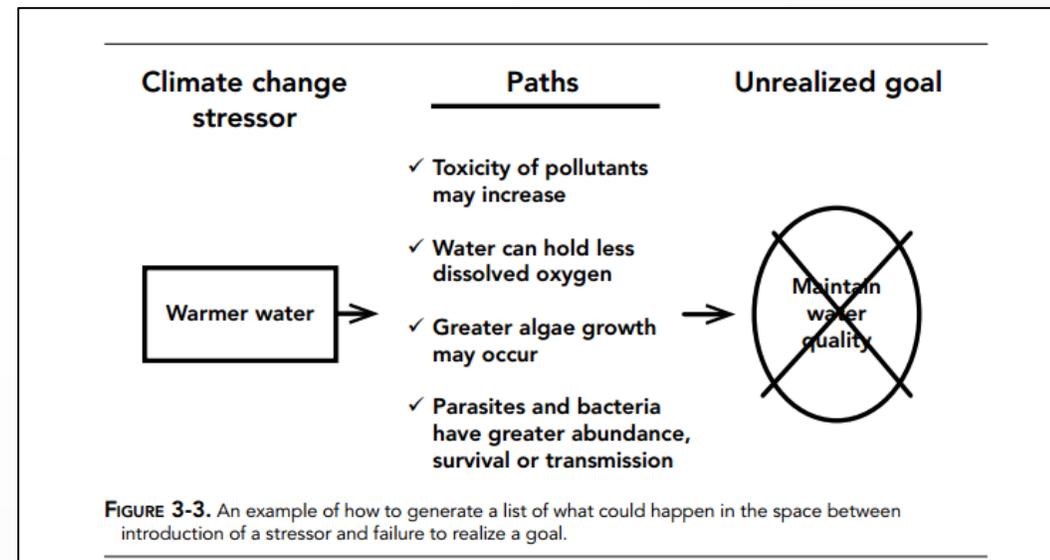


- With your knowledge of climate change, cross each goal with each climate change stressor.
- The risk identification checklist aids can help you find relevant risks.
- Can you imagine that the given stressor,
 - Acting in such a manner,
 - At any time in the future,
 - Could affect to any degree,
 the organization's ability to meet the given goal?
- If yes, check the box.

Columns

Checklist items

Rows



Workbook Step 4: Risk Analysis

- Process of understanding a risk, which includes
 - Being aware of the driving force of the risk,
 - Assessing the likelihood (probability) of it occurring,
 - And Assessing the consequence if it were to occur
- Risk analysis is essential to making decisions about which risks will become organizational priorities.

STEP 4—RISK ANALYSIS



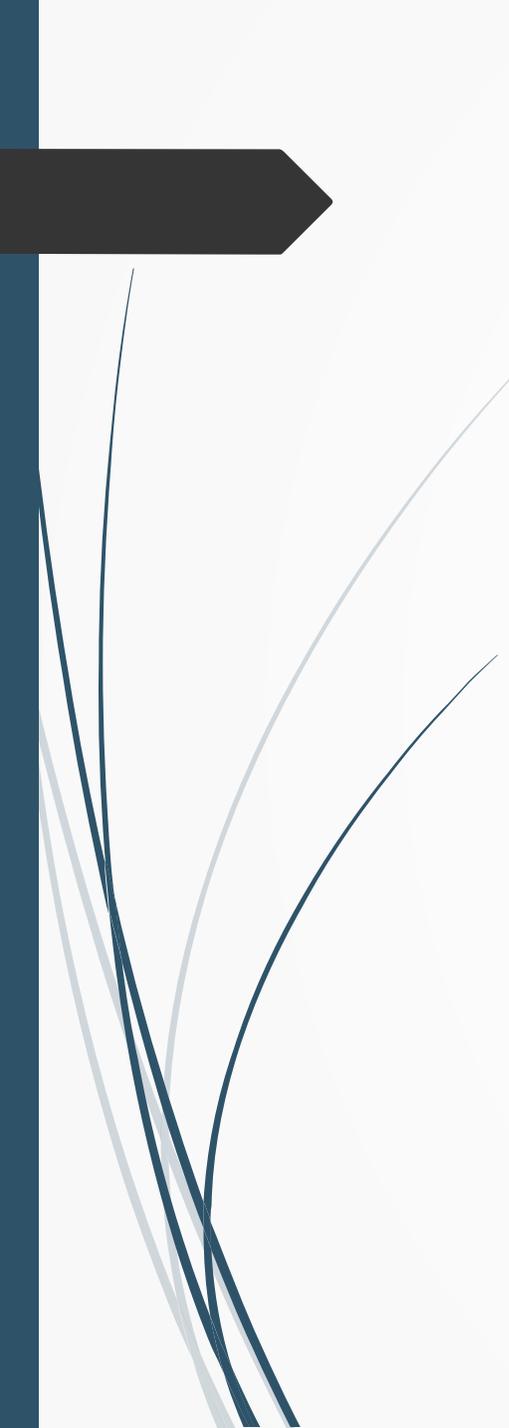
Nancy Laurson, EPA Office of Water

What Is "Risk Analysis"?

Risk analysis is the process of understanding a risk, which includes being aware of the driving force of the risk, assessing the likelihood (probability) of it occurring, and assessing the consequence if it were to occur. Risk analysis is essential to making decisions about which risks will become organizational priorities.

Objective of This Step

The objective of this step is to make an initial, high-level determination of the consequence, likelihood, spatial scale of the impact, and the time horizon until a problem begins for the climate change risks you identified in Step 3, so they can be sorted into high-medium-low qualitative categories of impact.



Consequence is the effect the risk would have on your organization's goal if it were to occur.

Likelihood is the chance of the risk actually occurring (i.e. probability). For the risk, you determine how likely it is to affect the goal.

- For each risk you checked, separately analyze its Consequence and Likelihood, using qualitative High, Medium, or Low categories.
- Write the ratings onto the checklists.

Consequence and Likelihood are determined for a business-as-usual scenario.



Let's reanalyze what you just did. Two things...

- ▶ For both Consequence and Likelihood, let's define the upper and lower limits of "Medium" so that about 1/3 of the risks you checked will fall into each of the High, Medium, and Low categories. Re-rate risks if necessary.
- ▶ Be sure that –
 - ▶ Everything rated High is worse than everything rated Medium
 - ▶ Everything rated Medium is worse than everything rated Low

Workbook Step 5: Risk Evaluation

- Opportunity for you to **reach agreement** about the assessment of risks that your organization is facing.

STEP 5—RISK EVALUATION: COMPARING RISKS



U.S. Geological Survey

What Is "Risk Evaluation: Comparing Risks"?

This portion of risk evaluation is an opportunity for you to reach agreement about the assessment of risks that your organization is facing. After the vulnerability assessment is complete you will pick up the rest of risk evaluation in [Step 7—Risk Evaluation: Deciding on a Course](#) of the action planning process.

Objective of This Step

The objective of this step is to develop a consequence/probability matrix and review it with stakeholder input. After you have agreement about your risk assessment, you will have the opportunity to further evaluate your vulnerabilities by looking at goals and habitat types.

Consequence/Probability Matrix



High

Medium

Low

Consequence of impact

High

Medium

Low

Likelihood (probability) of occurrence

Using the information you have on the checklists...

- Take the risks you checked and analyzed, and write each of them into the C/P matrix box that matches its consequence and likelihood.

Likelihood (probability) of occurrence	High	1. Warmer water may stress immobile biota 2. Warmer water may lead to changes in drinking water treatment processes n. _____	1. Warmer water may hold less dissolved oxygen 2. Sea level rise may cause bulkheads, sea walls and revetments to become more widely adopted n. _____	1. Shoreline erosion from sea level rise may lead to loss of beaches, wetlands and salt marshes 2. Combined sewer overflows may increase from more intense precipitation n. _____
	Medium	1. Increased wildfires from warmer summers may lead to soil erosion 2. Warmer winters may lead species that once migrated through to stop and stay n. _____	1. Parasites and bacteria may have greater abundance, survival or transmission due to warmer water 2. Warmer summers may drive greater water demand n. _____	1. More frequent drought may diminish freshwater flow in streams 2. More intense precipitation may cause more flooding n. _____
	Low	1. Warmer water may lead open seasons and fish to be misaligned 2. Warmer winters may lead to more freeze/thaw cycles that impact water infrastructure n. _____	1. Warmer water may lead jellyfish to be more common 2. Ocean acidification may cause the recreational shellfish harvest to be lost n. _____	1. Contaminated sites may flood from sea level rise 2. Warmer water may promote invasive species n. _____
		Low	Medium	High
Consequence of impact				

- 
- ▶ The C/P matrix is a communications tool, and a tool for reaching agreement.
 - ▶ Hand your worksheet to someone sitting next to you.
 - ▶ Discuss your reasoning for the categories you assigned for your risks.
 - ▶ Talk about risks you are unsure about.

We did it!

- 
- ▶ This was a quick demonstration of the Workbook process for a broad, risk-based climate change vulnerability assessment.
 - ▶ If you intensify what you did here in your real Steps 1-5, then you will achieve what we have in mind:
 - ▶ Planning-level, qualitative risk analysis by experts and stakeholders who know your system and a scientifically credible product.

Morro Bay National Estuary Program

- ▶ The Morro Bay NEP in central California conducted a risk-based vulnerability assessment using the methodology of the EPA workbook.



Figure 3: Estuary Program goals.



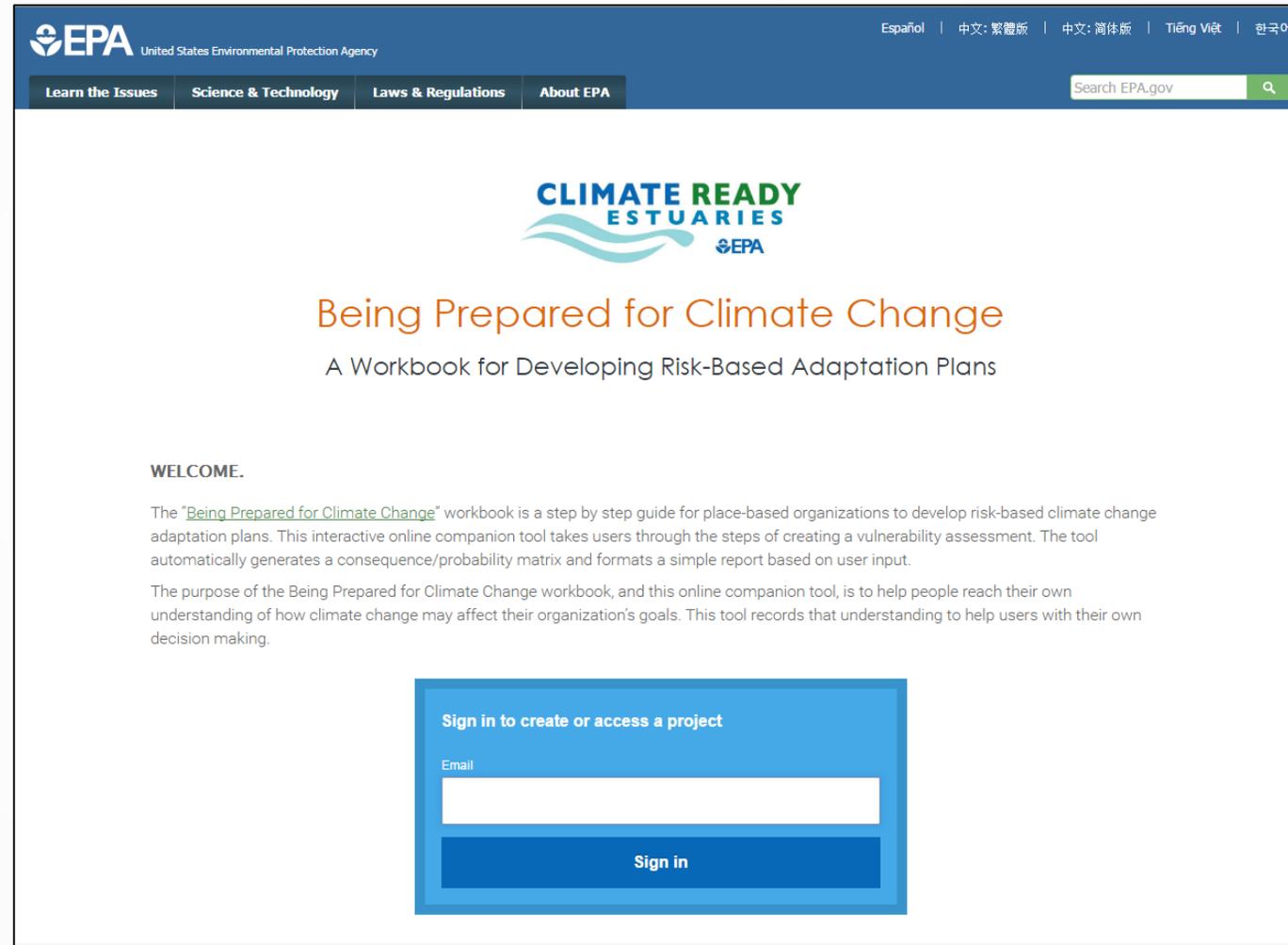
CLIMATE VULNERABILITY ASSESSMENT REPORT

Prepared by the Morro Bay National Estuary Program for submittal to the US EPA

Part of the Climate Ready Estuaries Program

February 2016

Online Companion Tool



The screenshot shows the EPA website header with the logo and navigation menu. The main content area features the 'CLIMATE READY ESTUARIES' logo and the title 'Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans'. Below the title is a 'WELCOME.' section with two paragraphs of text. At the bottom, there is a blue sign-in box with an email input field and a 'Sign in' button.

EPA United States Environmental Protection Agency

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CLIMATE READY ESTUARIES EPA

Being Prepared for Climate Change

A Workbook for Developing Risk-Based Adaptation Plans

WELCOME.

The "[Being Prepared for Climate Change](#)" workbook is a step by step guide for place-based organizations to develop risk-based climate change adaptation plans. This interactive online companion tool takes users through the steps of creating a vulnerability assessment. The tool automatically generates a consequence/probability matrix and formats a simple report based on user input.

The purpose of the Being Prepared for Climate Change workbook, and this online companion tool, is to help people reach their own understanding of how climate change may affect their organization's goals. This tool records that understanding to help users with their own decision making.

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Email

Sign in

<https://www.epa.gov/cre>