







Natural Resource Management

Adaptation Checklist for Climate Smart Projects

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IDENTIFY | **EVALUATE** | **ADAPT**

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Adaptation Checklist for Climate Smart Projects: A Tool for Natural Resource Agencies

Climate change has implications for both the effectiveness and hazard risk potential of many projects and activities undertaken or reviewed by natural resource management agencies. Failing to evaluate the potential vulnerability of a project or action prior to implementation or approval can lead to missed opportunities to improve design, optimize siting or otherwise reduce risk. While this tool is most easily used in evaluating a place-based project, it can be used to assess the climate savviness of many types of actions as well as policies.

How can I use the Checklist?

This tool is designed to help you determine if, given climate change, your project will continue to deliver intended benefits.

The Checklist supports your ability to:

- Explicitly evaluate the implications of future conditions on project function, longevity and impact
- Build climate consideration directly into funding, permitting and planning phases
- Reduce liabilities or avoid actions that will be ineffective under future conditions

STEP 1: Climate Quick Check
Identify which aspects of climate change will be relevant to the project over its lifetime by considering a range of indicators.

STEP 2: Evaluation of Climate Impact on a Project
Explore how those relevant aspects of climate change may affect the project by answering specific questions and considering available data.

STEP 3: Synopsis & Adaptation Options
For each identified vulnerability in STEP 2, develop adaptation options to avoid, minimize or mitigate future negative impacts, while delivering intended benefits. Use adaptation support resources to find potential options.

What projects can I use the Checklist for?

Project Types	Value of completing the Checklist for this type of project
Restoration	Assess the suitability of restoration project design for species, habitat or ecosystem function under future conditions.
Habitat /Species Conservation	Determine if a location will be suitable habitat for target species or as a habitat loss/damage mitigation for the long-term. If conditions will not remain suitable, the location may be deprioritized or an alternative site may be preferred.
Permits	Consider how climate change will affect the ability of the project to meet the requirements of a regulatory permit over the project's lifetime.
Grant Review	Systematically compare the ability of a proposal to deliver on its goals given the implications of climate change. Compare between proposals.
Infrastructure	Assess the suitability of infrastructure siting, design and function for future conditions.
Scientific Research	Consider how climate change may affect the results of the research if not incorporated into the study design.
Other	For any project, you can use the Checklist to assess how climate change will affect long-term sustainability and effectiveness, in order to better design or site a project for intended benefits.

STEP 1: Climate Quick Check

Type of project

❑ Restoration
❑ Habitat/Species Conservation (e.g., land acquisition, mitigation)
❑ Permits
❑ Grant Review
❑ Scientific Research
❑ Infrastructure (e.g., structures, fences, roads, boat launch, hatcheries)
❑ Other:

Describe your Project (purpose, goals, location, scope/scale, timeframe, partners, management context):

If your project is...	Might it be affected now or in the future by...	YES	NO	DON'T KNOW	If you answered YES or DON'T KNOW, then...
Near a shoreline	...sea level rise or lake level change?	❒	❒	❒	complete **STEP 2 Evaluation B**
	...flooding?	❒	❒	❒	complete **STEP 2 Evaluation C**
	...erosion or slope stability?	❒	❒	❒	complete **STEP 2 Evaluation C**
Aquatic	...increased water temperatures?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...diminished dissolved oxygen levels?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...algal blooms?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...change in total flow?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...altered pH?	❒	❒	❒	complete **STEP 2 Evaluation E**
	...change in flow timing?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
Marine or estuarine	...increased water temperatures?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...diminished dissolved oxygen levels?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...algal blooms?	❒	❒	❒	complete **STEP 2 Evaluation A & C**
	...reduced pH?	❒	❒	❒	complete **STEP 2 Evaluation E**
	...changes in salinity?	❒	❒	❒	complete **STEP 2 Evaluation E**
In terrestrial, vegetated habitat	...changes in temperature?	❒	❒	❒	complete **STEP 2 Evaluation A**
	...changes in precipitation?	❒	❒	❒	complete **STEP 2 Evaluation C**
	...drought?	❒	❒	❒	complete **STEP 2 Evaluation C**
	...wildfire?	❒	❒	❒	complete **STEP 2 Evaluation D**
	...changes in vegetation composition?	❒	❒	❒	complete **STEP 2 Evaluation E**
Infrastructure	...changes in temperature?	❒	❒	❒	complete **STEP 2 Evaluation A**
	...loss of utilities (water, sewer, power)?	❒	❒	❒	complete **STEP 2 Evaluations A, C, D & F**
	....sea level rise or lake level change?	❒	❒	❒	complete **STEP 2 Evaluation B**
	...flooding?	❒	❒	❒	complete **STEP 2 Evaluation C**
	..stormwater or water control failure?	❒	❒	❒	complete **STEP 2 Evaluation C**
	...drought?	❒	❒	❒	complete **STEP 2 Evaluation C**
	...wildfire?	❒	❒	❒	complete **STEP 2 Evaluation D**
	...greenhouse gas emissions reduction policies?	❒	❒	❒	complete **STEP 2 Evaluation F**

For any time where you answered...

"YES", continue to STEP 2 to explain how.

"NO", checklist is not required.

"DON'T KNOW", follow instructions in STEP 2 to find out.

STEP 2: Evaluation of Climate Impact on a Project

A Evaluate suitability of project site, species and/or infrastructure to future air & water temperature patterns and determine impact

Explain your project's suitability to future temperatures referring to data sources and local knowledge. When answering, consider how this may interact with other aspects of climate change you are evaluating.

- Does future temperature look different than present?
- Will the amount of change projected affect your project site, species, or infrastructure?
- How may water quality be affected (pH, dissolved oxygen, temperature, turbidity, salinity, contaminants, nutrients, sedimentation)?
- Will temperature change affect crucial functions (e.g., evapotranspiration)?
- Will invasive species benefit from new conditions?

To answer these questions, use regional temperature projections.

Possible Data Sources (use local data if available*):

NOAA Climate Explorer: https://crt-climate-explorer.nemac.org

NOAA ENSO Status & Predictions: https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

Projected Sea Surface Temperatures: https://online.ucpress.edu/elementa/article/doi/10.1525/elementa.191/112778/Projected-sea-surface-temperatures-over-the-21st

Future climate projections for Pacific Northwest and Great Basin Tribes: https://climate.northwestknowledge.net/NWTOOLBOX/tribalProjections.php

*Possible sources of local data include products from the Climate Adaptation Science Centers (https://www.usgs.gov/products/web-tools), the Climate Resilience Toolkit (https://toolkit.climate.gov/#tools), regional universities, regional climate research groups, and state and federal agencies.

STEP 2: Evaluation of Climate Impact on a Project

B Evaluate local sea level rise and/or lake level change projections relevant to project area and determine impact

Explain how sea level rise may affect your project. When answering, consider how this may interact with other aspects of climate change you are evaluating.

- Does future sea level look different than present?
- Will the amount of change projected affect your project site, species or infrastructure?
- Will it affect slope stability or coastline erosion?

To answer these questions, use regional sea and/or lake level projections for 2100 (or other date relevant for the project) and local knowledge related to coastal flooding.

Map these projections for your project area (inclusive of its access corridors and key infrastructure) in relation to projected future coastal flood zones and frequently flooded areas (both episodic and chronic) based on the sea level rise projections. You can use a sea level rise and/or lake level change viewer or your own GIS. If options exist, use high greenhouse gas emissions scenarios (e.g., RCP8.5 or similar), likely or 50% assessed probability.

Possible Data Sources (use local data if available):

NOAA Sea Level Rise Viewer: https://coast.noaa.gov/slr/
(only shows ‹6 feet. If your scenario shows ›6 feet, use Coastal Risk Finder: https://coastal.climatecentral.org/coastal-risk-finder

Lake Level Viewer: https://coast.noaa.gov/llv/

NOAA Coastal Flood Exposure Maps: https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html

FEMA Flood Maps: https://www.fema.gov/flood-maps

NOAA Sea Level Rise Technical Report: https://earth.gov/sealevel/us/resources/2022-sea-level-rise-technical-report/

STEP 2: Evaluation of Climate Impact on a Project

C Evaluate project suitability for future precipitation patterns and determine impact

Explain your project's suitability to future precipitation patterns referring to data sources and local knowledge. When answering, consider how this may interact with other aspects of climate change you are evaluating.

- Does future precipitation (annual or seasonal) look different than present? Is timing and intensity of precipitation projected to change? Will there be a change from snow to rain?
- Will the amount of change projected diminish project benefits, negatively impact the ability to meet project goals, negatively affect design integrity, or otherwise affect the project?
- Will there be flooding or other peak flow challenges?
- Will there be slope instability or erosion?
- Will water control or stormwater management design still function?
- Will needed utility (water, sewer, power, broadband) services be available during flooding?
- Will there be unacceptable low flow, or prolonged seasonal, annual or multi-year drought?
- Will invasive species benefit from new conditions?
- How may water quality be affected (pH, dissolved oxygen, temperature, turbidity, salinity contaminants, nutrients, sedimentation)?

To answer these questions, use regional precipitation, stream flow, and flood projections.

Possible Data Sources (use local data if available):

Precipitation Data
NOAA Climate Explorer: https://crt-climate-explorer.nemac.org

Drought Data
National Integrated Drought Information System: https://www.drought.gov/forecasts

Stream Flow Data
Calculate or locate stream flow projections for your project site with a time horizon relevant to the lifetime of the project (10 years, 25 years, 50 years, or 100 years). Consider not just annual flow, but also temperature, seasonal variability, high flow and low flow periods.

Streamflow Metrics: https://research.fs.usda.gov/rmrs/projects/us-stream-flow-metrics#archived-western-steam-flow-metrics

Flood Data
Map your project area (inclusive of its access corridors, key infrastructure) in relation to flood zones , frequently flooded areas (both episodic and chronic) and implications for slope stability and erosion.

NOAA Coastal Flood Exposure Maps: https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html

FEMA Flood Maps: https://www.fema.gov/flood-maps

Local flood zone or wetland data–if available

Slope Stability Data
Local slope stability or geological hazard data–if available

STEP 2: Evaluation of Climate Impact on a Project

D Evaluate project vulnerability to wildfire and determine impact

Explain how your project may be affected by or affect wildfire. When answering, consider how this may interact with other aspects of climate change you are evaluating.

- Will long-term temperature and precipitation trends cause shifts in vegetation and habitats affecting your project's vulnerability to wildfire or the ability to use land management techniques that rely on fire (e.g., prescribed burn)?
- Will needed utility (water, sewer, power, broadband) services be available during fire, under fire prevention measures (planned power outages), and/or fire response measures (fuel breaks, water harvest)?

To answer these questions, map project area and its access corridors against Wildfire Hazard Areas or other local wildfire risk mapping tools.

Possible Data Sources (use local data if available):

Projected fire regime changes:
https://research.fs.usda.gov/download/treesearch/80979.pdf

Wildfire Risk Explorer (for communities but could inform regionally):
https://wildfirerisk.org/explore/

STEP 2: Evaluation of Climate Impact on a Project

E Evaluate project vulnerability to changes in ecological function (e.g., shifts in phenology, range, composition, connectivity, fitness, predation)

Explain how future conditions could affect ecological function, including ecosystem services, vital to the project and how that change could adversely affect project success. When answering, consider how this may interact with other aspects of climate change you are evaluating.

For marine projects: In addition to previously mentioned impacts, explain how ocean acidification might affect ecological function.

Possible Data Sources (use local data if available):

Restoration
Seedlot Selection Tool: https://seedlotselectiontool.org/sst/

Forest vegetation change
Climate Forest Vegetation Simulator:
https://www.fs.usda.gov/fvs/whatis/climate-fvs.shtml

Climate Change Tree Atlas:
https://www.fs.usda.gov/nrs/atlas/tree/

Invasive Species
Invasive Range Expander Listing Tool:
https://www.eddmaps.org/rangeshiftlisting/

Ocean Acidification
NOAA Ocean Acidification Buoy Data:
https://oceanacidification.noaa.gov/ocean-acidification-data/

STEP 2: Evaluation of Climate Impact on a Project

F Evaluate project contribution to greenhouse gas emissions and sequestration

Explain your project's contribution (during implementation and maintenance) to greenhouse gas emissions and carbon sequestration. When answering, consider how this may interact with other aspects of climate change you are evaluating.

- Does the project require use of an energy source (e.g., transportation, infrastructure)?
- Will this result in greenhouse gas emissions from fossil fuel use?
- Could there be greenhouse gas emissions from land use change or fire?
- Could the affordability or availability of utilities (water, sewer, power) change given changing carbon policies and/or extreme events (fire, flood, wind)?
- Is carbon sequestration a consideration for your project (If so, discuss potential risks to permanence, leakage, additionality)?

STEP 3: Impact Summary & Adaptation Options

Check the Issues for which your STEP 2 evaluation indicates an impact:		Implications of this issue for the project being assessed are:	Adaptation actions to increase the suitability of the project to future conditions. (If needed, use Resources for Identifying Adaptation Options on the next page.)
❒	**Temperature (A)**		
❒	**Sea Level Rise/ Lake Level Change (B)**		
❒	**Precipitation (C)**		
❒	**Wildfire (D)**		
❒	**Ecological Function (E)**		
❒	**Greenhouse Gas Emissions (F)**		

Resources for Identifying Adaptation Options

For any assessments that indicate that there is a climate change vulnerability or risk to the project, policy, permit or site, the Climate Adaptation Knowledge Exchange (www.CAKEx.org) can help identify ways to minimize or ameliorate that risk or vulnerability. The CAKE database is designed to identify examples of adaptation strategies for conditions that match your findings from the Checklist. To conduct a targeted search for case study examples and other resources:

1. Open www.CAKEx.org
2. From the green left-hand navigation bar select RESOURCE › CASE STUDIES
3. In the blue right-hand navigation bar select the CLIMATE CHANGE & IMPACTS that match the identified issues from STEP 2 (consider doing these one at a time or in combinations that interact). Also select the SECTOR, REGION, and HABITAT that best describe the project, policy or site being considered with the Checklist.
4. Browse the results of this focused search to glean ideas regarding how others have addressed challenges similar to what you have identified in STEP 2.
5. If you do not find any suitable results, consider expanding the scope of the search by adding RESOURCE TYPES (DOCUMENTS, TOOLS) in the blue right hand navigation bar.

Additional Resource List

Can't find what you need on CAKE? Consider exploring these collections and guidance tools.

General Collections

- Resist-Accept-Direct (RAD)—A Framework for the 21st-century Natural Resource Manager: https://irma.nps.gov/DataStore/DownloadFile/654543
- Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu: https://glifwc.org/ClimateChange/TribalAdaptationMenuV1.pdf
- Tribal Climate Adaptation Guidebook: https://pnwcirc.org/sites/pnwcirc.org/files/tribal_climate_adaptation_guidebook.pdf
- Adaptation Clearinghouse-California: https://resilientca.org/case-studies/
- Adaptation Clearinghouse (for policy examples): www.adaptationclearinghouse.org
- U.S. Climate Resilience Toolkit: https://toolkit.climate.gov/case-studies
- Report to the Secretary of the Interior from the Advisory Committee on Climate Change and Natural Resource Science: https://www.cakex.org/documents/report-secretary-interior-advisory-committee-climate-change-and-natural-resource-science
- Northern Insitute of Applied Climate Science Adaptation Workbook: https://forestadaptation.org/adapt/adaptation-workbook
- Climate Impacts Research Consortium Climate Toolbox: https://climatetoolbox.org/
- Resilient Lands Mapping Tool: https://maps.tnc.org/resilientland/
- Climate Change Scenario Planning Showcase: https://www.nps.gov/subjects/climatechange/scenarioplanning.htm

Species

- Readying California Fisheries for Climate Change: https://www.oceansciencetrust.org/in-practice/climate-change-and-california-fisheries
- California 2015 State Wildlife Action Plan: https://swap.wildlife.ca.gov/
- A Three-Step Decision Support Framework for Climate Adaptation: Selecting climate-informed conservation goals and strategies for native salmonids in the northern U.S. Rockies.: https://www.cakex.org/documents/three-step-decision-support-framework-climate-adaptation-selecting-climate-informed-conservation-goals-and-strategies-native-salmonids-northern-us-rockies

Drought

- Extremes to Ex-Streams: Ecological Drought Adaptation in a Changing Climate: https://www.cakex.org/documents/extremes-ex-streams-ecological-drought-adaptation-changing-climate

Sea Level Rise

- State of California Sea Level Rise Guidance: https://opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf
- Available Science Assessment Process: Sea Level Rise in the Pacific Northwest and Northern California: https://www.cakex.org/documents/available-science-assessment-process-asap-sea-level-rise-pacific-northwest-and-northern-california

Natural Resource Agency

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Find this and other versions of the Checklist online.

EcoAdapt provides support, training, and assistance to make planning and management less vulnerable and more Climate Savvy. EcoAdapt, founded by a team of some of the earliest adaptation thinkers and practitioners in the field, has one goal—creating a robust future in the face of climate change. We bring together diverse players to reshape planning and management in response to rapid climate change. **www.EcoAdapt.org**

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