Climate Change Considerations in Federal Risk Assessments

ESAM

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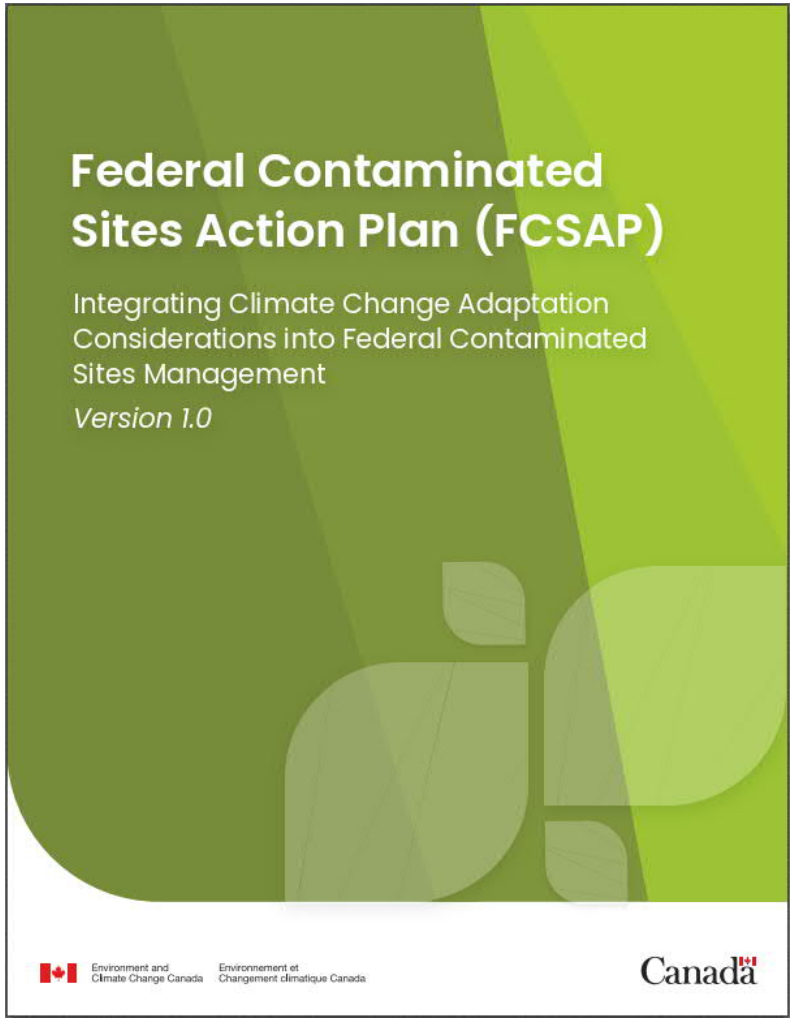
FCSAP Climate Change Guidance Document Notes

- Written by ECCC to support FCSAP consultants, custodian etc. with considerations related to climate change adaptation.
- Designed to help implement activities in line with Canada's climate plan.
- As risk assessors are expected to address three questions for risk assessment during the 10 step process of the FCSAP Decision Making Framework:

1. What climate change hazards are relevant for the site?
2. What are the climate projections regarding those hazards?
3. How might those hazards influence contaminant distribution?



Adapting 10-step Decision Making Framework to Consider Climate Change

Step 1 – Identify Site

- NA

Step 2 – Historical Review (Phase I)

- Identify climate change hazards (answers question 1)

Steps 3-6 – Initial Testing (Phase II)/ Classify Site/ Testing Program (Phase III)/ Re-Classify Site

- Compile climate projections data (answers question 2)
- Create CSM(s) incorporating climate hazards (answers question 3)

Step 7 – Develop RM Strategy

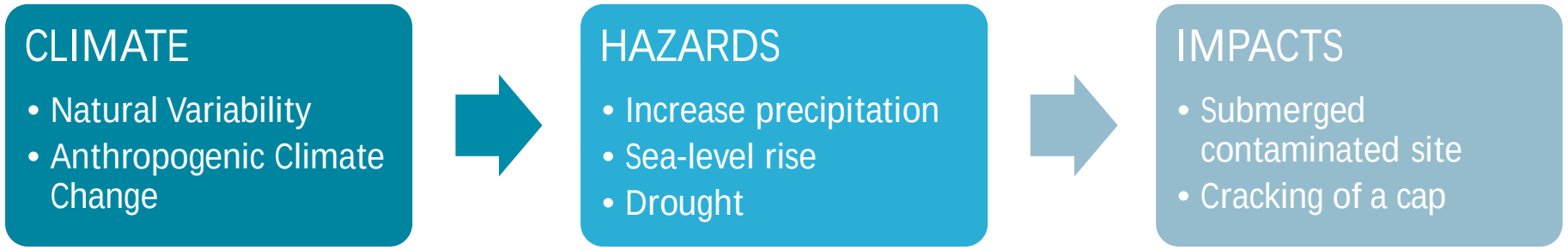
- Refine CSM (optional)
- Integrate Climate Change into R/RM strategy

Steps 8-10 – Implement RM Strategy/ Confirmatory Sampling/ LTM

- Implement the chosen R/RM method
- Ensure risks have been addressed

Climate Change Hazards and Impacts

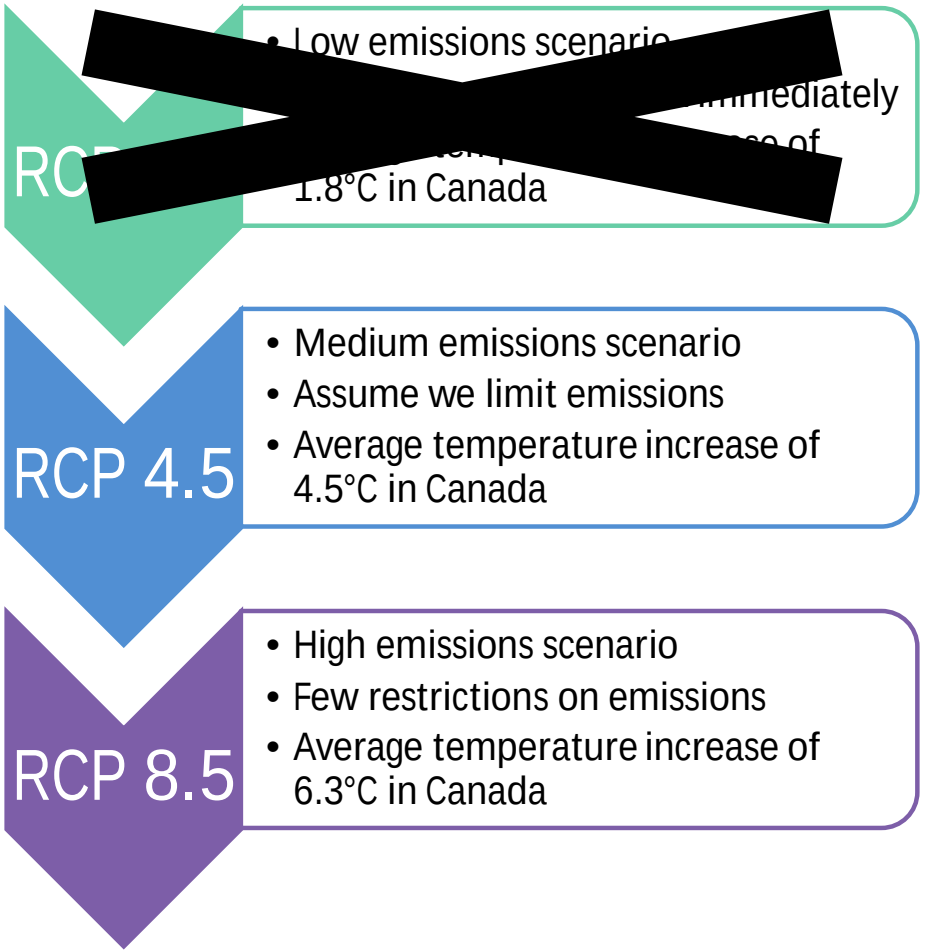
- Climate change **hazard** is the **event**
- Climate change **impact** is the **effect**



- **Predictions** is used to discuss events within the **next few months**
- **Projections** is used to discuss events **years in the future**

Emission Scenarios

- The emission scenarios describe the potential future greenhouse gas emissions and concentration trends.
- Each scenario assumes different future: population growth, economic activity, energy intensity and socioeconomic data.
- Climate scenarios in the FCSAP document come from the Intergovernmental Panel on Climate Change (IPCC) climate models, and are based on Representative Concentration Pathway (RCP) scenarios.

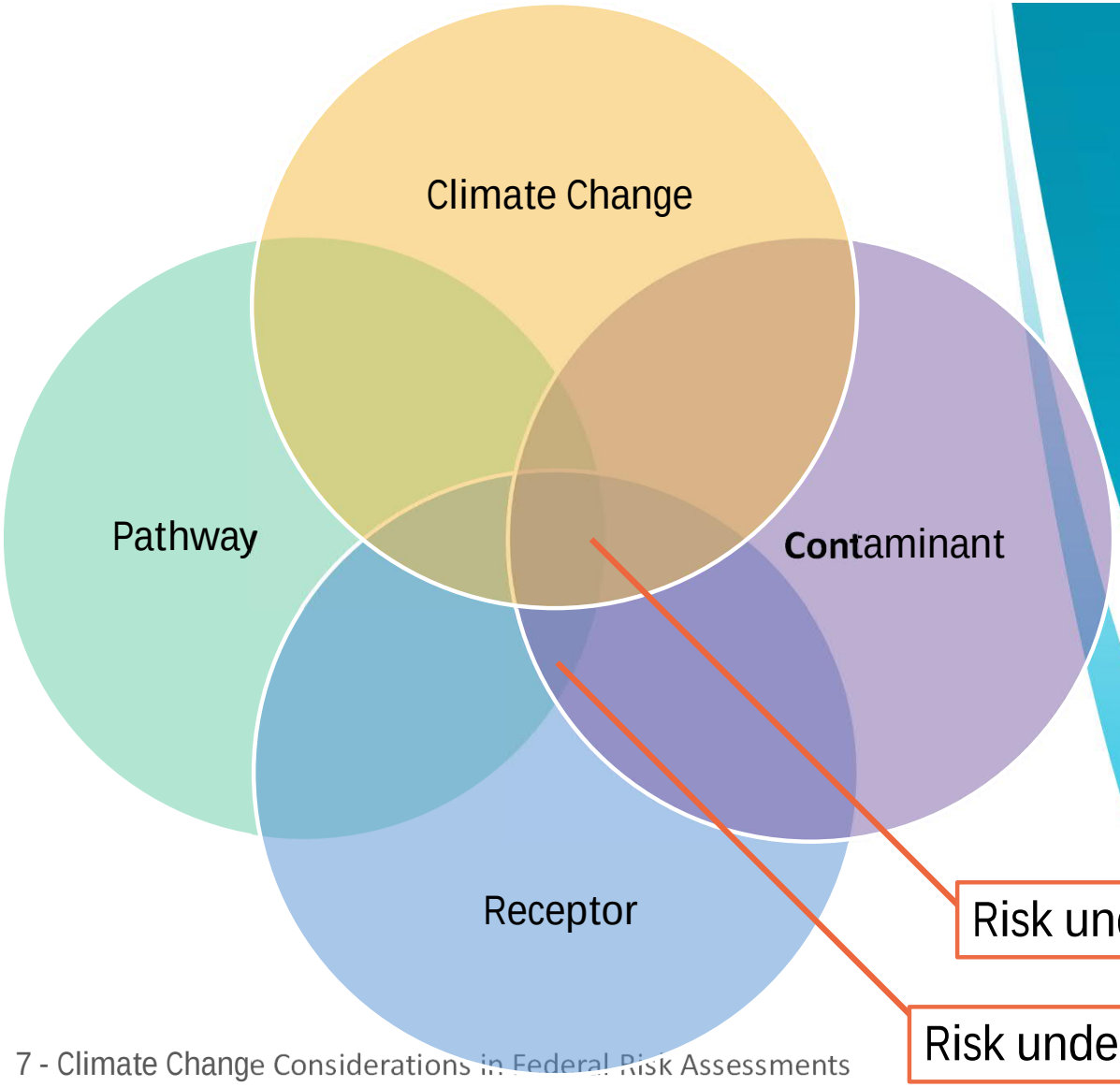


Timeframes for Climate Projections

- Climate change hazards are considered in 30-year timeframes
  - Historical (1981-2010)
  - Near-term (2011-2040)
  - Mid-term (2041-2070)
  - Long-term (2071-2100)

- Prioritize assessing the worst case scenario (2100 under a high emission scenario).
- Some climate variables (e.g. freeze-thaw cycles) may not necessarily be at their worst in 2100 and may have a greater impact in the near term representing a higher priority for adaptation or remediation.

Update of Risk Components



Risk under future climate conditions

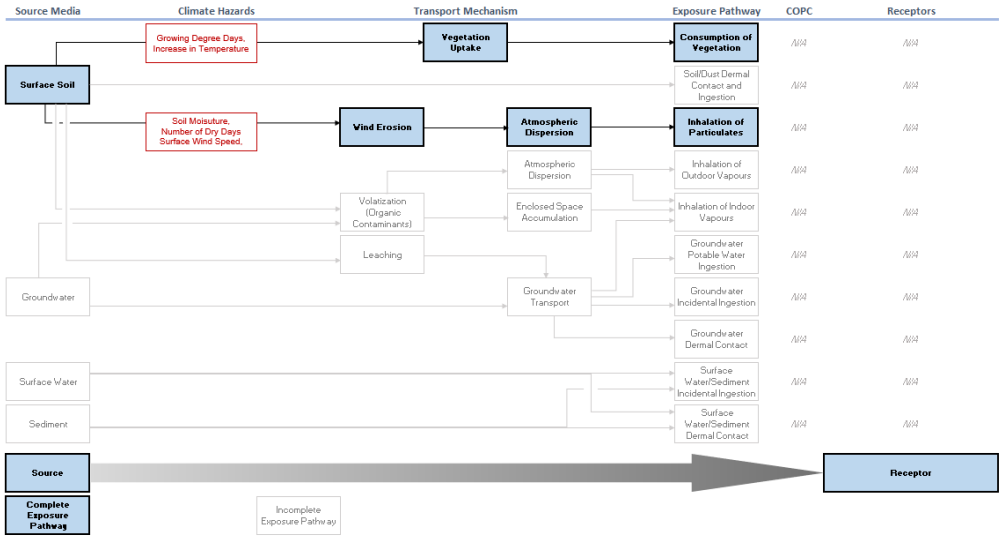
Risk under current climate conditions

Identification of Climate Change Hazards

Category	Climate Change Hazards	Units	Historical Data 1981-2010	Projected Change						Summary Table			
				Near-term (2011-2040)[a]		Mid-term (2041-2070)[a]		Long-term (2071-2100)[a]		Change by 2100		% Change by 2100	
				RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Changes in Fire Weather	Fire season Length b	days	220	18.5	21.9	26.7	22.1	34.8	27.5	34.8	27.5	16%	13%
Changes in Plant Growth Conditions	Number of Growing Degree Days (>0°C)	# of degree-days	3113.6	3444.5	3471	3716.3	3986.6	3886.8	4602.8	773.2	1489.2	25%	48%
	Number of Growing Degree Days (>5°C)	# of degree-days	1969.6	2234.3	2255.9	2431.9	2653.2	2605	3144.2	635.4	1174.6	32%	60%
	Number of Growing Degree Days (>10°C)	# of degree-days	1076.1	1278.3	1304	1438.8	1605.8	1572.9	2050.5	496.8	974.4	46%	91%
Changes in Rainfall and Snowfall Regime	Total Precipitation	mm	997.7	1031.2	1021.3	1061.6	1077.2	1072.4	1137.7	74.7	140	7%	14%
	Number of wet days (>1 mm)	# of days	152.2	152.3	153	153.5	153.5	153.8	153	1.6	0.8	1%	1%
	Number of wet days (>10 mm)	# of days	28.6	30.8	30.2	32.1	32.5	31.9	34.9	3.3	6.3	12%	22%
	Number of wet days (>20 mm)	# of days	6.2	7	7	8	8	8.1	9.2	1.9	3	31%	48%
	Maximum 1-Day Total Precipitation	mm	37.8	40.4	40.9	42.6	43.5	42.6	45.4	4.8	7.6	13%	20%
	Maximum 5-Day Total Precipitation	mm	66.9	71.8	72.6	75.6	76.7	74	80.3	7.1	13.4	11%	20%
Changes in Temperature	Mean Temperature (°C)	°C	6.2	7.5	7.7	8.6	9.4	9	11.6	2.8	5.4	45%	87%
	Maximum Mean Temperature (°C)	°C	11	12.4	12.6	13.6	14.3	14	16.3	3	5.3	27%	48%
	Minimum Mean Temperature (°C)	°C	1.3	2.6	2.8	3.6	4.6	4.1	6.9	2.8	5.6	215%	431%
Coastal Sea Level Rise	Relative sea-level change	cm	0	0	0	0	0	0	0	0	0	-	-
Declines in Ice and Snow Extent and Duration	Sea ice concentration	%	0	0	0	0	0	0	0	0	0	-	-
	Sea ice thickness	m	0	0	0	0	0	0	0	0	0	-	-
	Snow depth	m	0.054	0.049	0.043	0.03	0.026	0.029	0.014	-0.025	-0.04	-46%	-74%
	Maximum Number of Consecutive Dry Days	# of days	14.4	14.3	14.7	14.2	14.7	14.2	14.6	-0.2	0.2	-1%	1%

How Do Climate Hazards Affect Risk?

- May **directly** impact risk through by changing the Conceptual Site Model
  - Transport Mechanisms
  - Source Media
  - Exposure Pathways and Receptors
- May **indirectly** affect the risk by changing how receptors interact with the site
- **Extreme weather events** are more likely to drive changes to the conditions at a site



Limitations / Considerations

- Most data are based on gridded data which may over/underestimate the changes at a specific site
- Contaminated sites with their own microclimates or are at a different elevation than the rest of the grid cell may not be accurately represented

Climate stations which collect the data are not always near our site

Source: ClimateData.ca

Limitations / Considerations

- We don’t know what the future conditions at the site will be…
  …so we should avoid making very precise predictions assuming we do.
- However, we can identify trends in the projected data to help identify what hazards will likely cause the most change.

Climate Resources

- Canadian Centre for Climate Services (CCCS) Climate Data Portals
- Climate Atlas of Canada
- ClimateData.ca
- The Power Analytics and Visualization for Climate Science
- Reports
  - Canada's Changing Climate Report (Bush and Lemmen, 2019)
  - National Issues Report (Warren and Lulham, 2021)

- Dillon has it's own set of climate tools developed by our climate team and is continuing to develop them