Forest Management
in the
Era of Climate Change

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Some basic facts – assumptions – projections…

1. Climate change (CC) is real, and it will affect different regions in different ways – FACT and PROJECTION

2. In Nova Scotia, CC will lead to warmer average and seasonal temperatures – PROJECTION

3. In Nova Scotia, CC will lead to higher precipitation levels, but with relatively more winter precipitation and less evenly distributed rainfall – PROJECTION

Centre for Forest Conservation Genetics
•CFCG•

ClimateNA_MAP

-- An Interactive Platform for Visualization and Data Access

Coordinates Input (**click on the map** or type in coordinates)

Latitude 48.98 Longitude -115.02

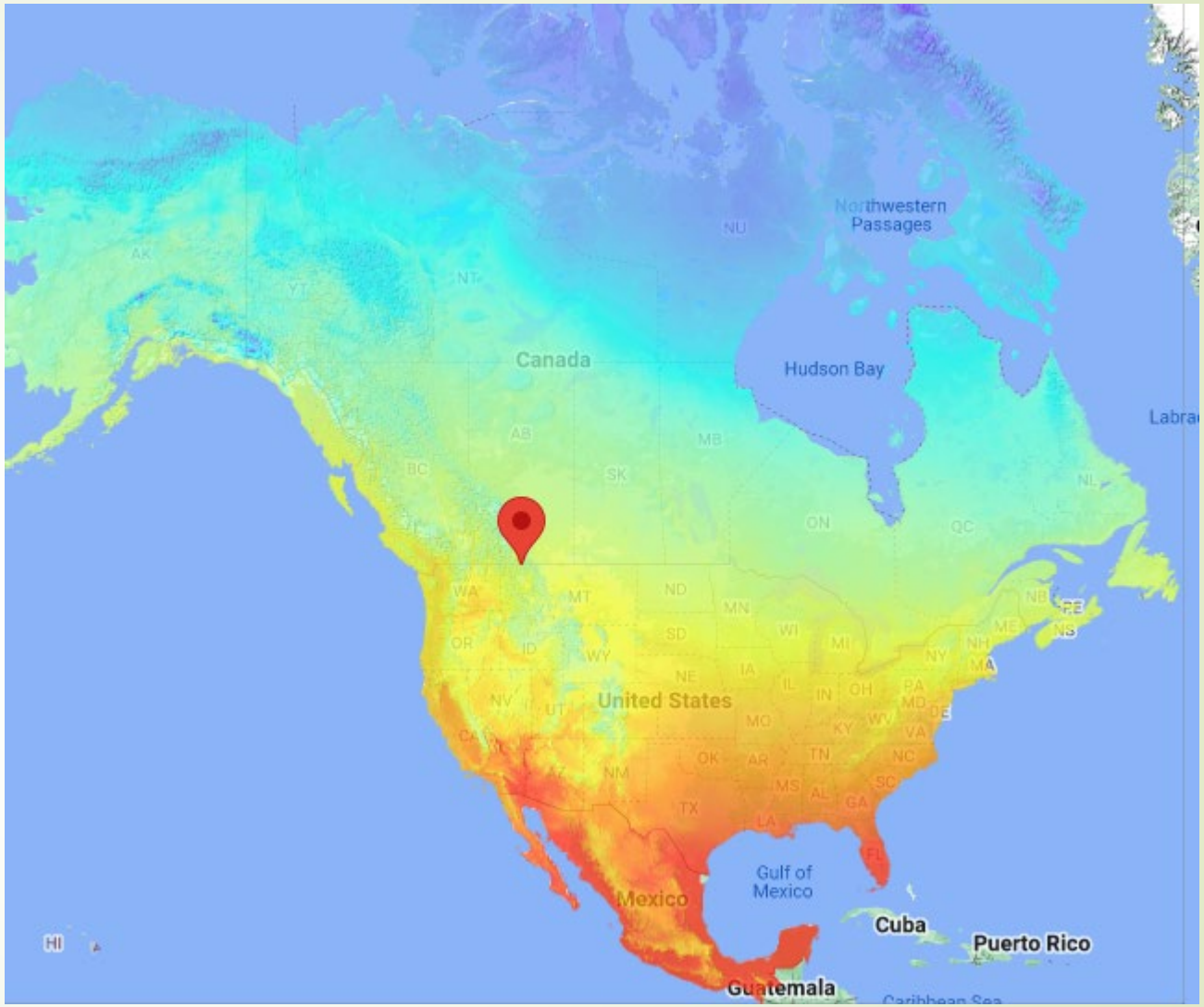
Elev (m) 1000 Historical Normal_1961_1990

Future Select a GCM period

Quick Tutorial | Help | Calculate

Annual Variables | Seasonal Variables | Monthly Variables

Append to ClimateData.csv Count 0 Save Clear



https://climatena.ca/mapVersion (Google: ClimateNA map)

ClimateNA_MAP

-- An Interactive Platform for Visualization and Data Access

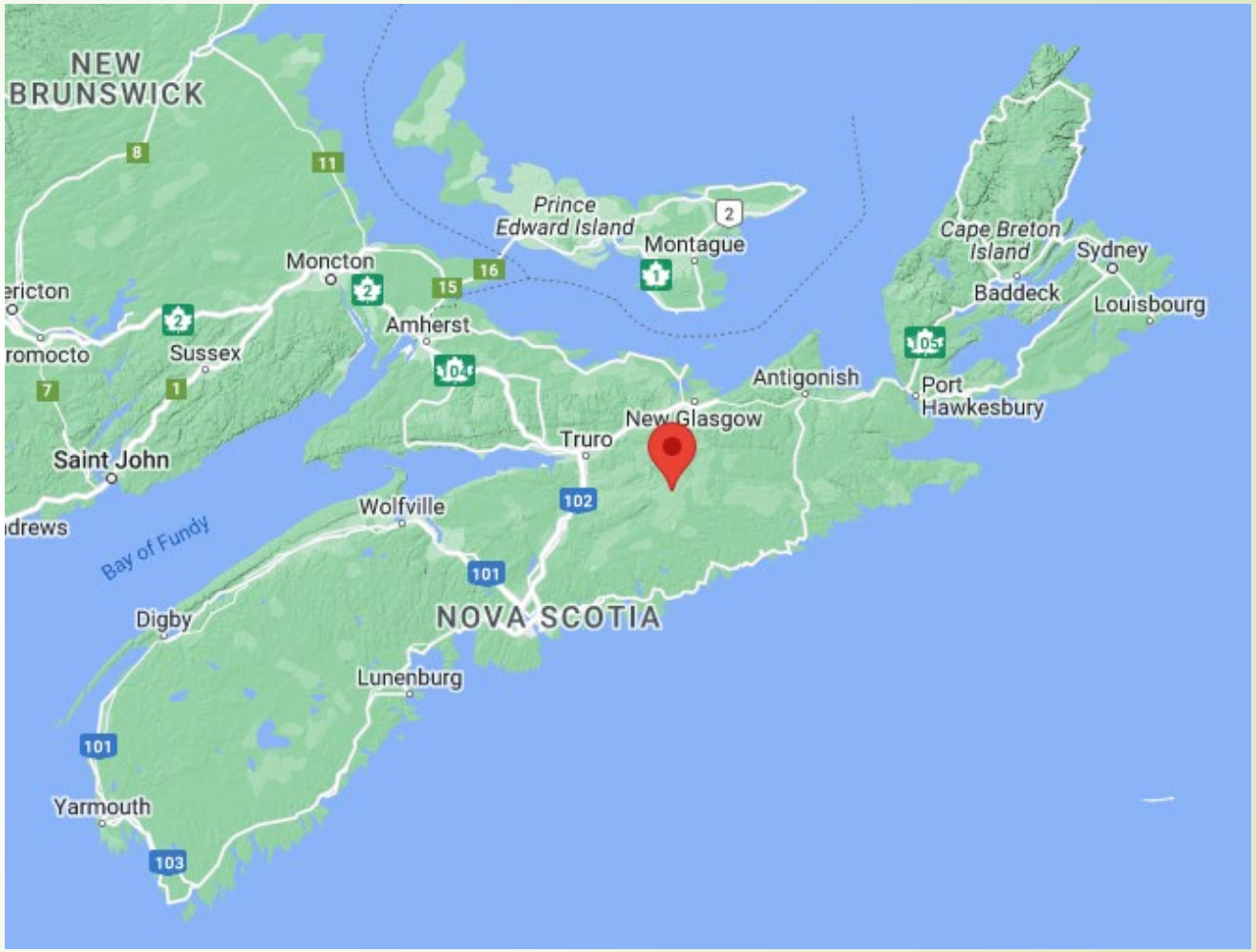
Coordinates Input (**click on the map** or type in coordinates)

Latitude	45.220	Longitude	-62.780
Elev (m)	194	Historical	Normal_1961_1990
Future	Select a GCM period		

Quick Tutorial | Help | Calculate

Annual Variables	Seasonal Variables	Monthly Variables
MAT=5.3	Tmax_wt=-1.1	Tmax_01=-1.8
MWMT=17.3	Tmax_sp=7.8	Tmax_02=-1.8
MCMT=-6.6	Tmax_sm=21.4	Tmax_03=1.9
TD=23.9	Tmax_at=12.5	Tmax_04=7.5
MAP=1338	Tmin_wt=-10.2	Tmax_05=13.9
MSP=496	Tmin_sp=-1.9	Tmax_06=19
AHM=11.4	Tmin_sm=10.4	Tmax_07=22.8
SHM=34.9	Tmin_at=3.3	Tmax_08=22.2
DD_0=734	Tave_wt=-5.6	Tmax_09=18.4
DD5=1558	Tave_sp=2.9	Tmax_10=12.5
DD_18=4691	Tave_sm=15.9	Tmax_11=6.5
DD18=72	Tave_at=7.9	Tmax_12=0.3
NFFD=154	PPT_wt=375	Tmin_01=-11.2
bFFP=148	PPT_sp=307	Tmin_02=-11.4
eFFP=271	PPT_sm=301	Tmin_03=-7

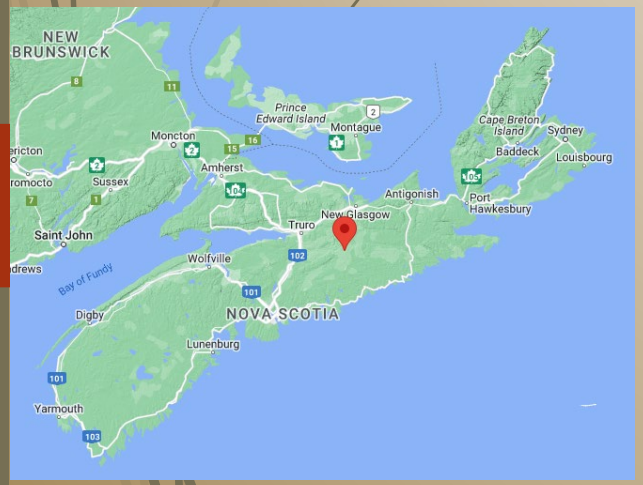
Append to | ClimateData.csv | Count | 0 | Save | Clear



Sample Location Data – Recorded and Projected

* 13GCMs_ensemble_ssp126

** 13GCMs_ensemble_ssp585



Climate Variable	Normals 1960-1990	Decade 2011-2020	Projection Current Best Scenario* 2041-2070	Projection Current Worst Scenario** 2041-2070
Mean Annual Temp (°C)	5.3	6.2	7.9	9.0
Winter Avg	-5.6	-4.3	-2.6	-1.4
Winter Min	-10.2	-9.0	-7.5	-6.4
Winter Max	-1.1	+0.5	+2.3	+3.6
Summer Avg	15.9	16.8	18.4	19.6
Summer Min	10.4	11.2	13.0	14.1
Summer Max	21.4	22.4	23.9	25.0
Mean Annual Precip (mm)	1,338	1,464	1,427	1,443
Winter	375	394	407	422
Summer	301	327	324	322

Some basic facts – assumptions – projections…

4. In Nova Scotia, CC will lead to more frequent and/or more severe wind disturbance events (hurricanes, tropical storms, other) – PROJECTION

5. Projected changes in temperature and precipitation patterns will mean wetter, warmer winters with little to no reliable frozen ground conditions – FACT and ASSUMPTION

6. Higher spring-fall temperatures combined with uneven rainfall will lead to increased risk and frequency of summer drought – PROJECTION and ASSUMPTION

Some basic facts – assumptions – projections…

7. Tree species (and all plants) are adapted to finite and optimal ranges of climate conditions related to temperature and precipitation patterns – FACT

8. Climatic "niches" will change more for some tree species than others, and/or will change faster than species can adapt – PROJECTION

9. This means there will be tree species "winners" and "losers" as CC impacts progress – ASSUMPTION and PROJECTION

Potential Winners and Losers….

Species	Projection
Balsam Fir	Decline
Black Spruce	Decline?
Hemlock	Persevere*
Jack Pine	Decline?
Larch	Unclear
Red maple	Proliferate
Red Oak	Proliferate
Red Pine	Decline
Red Spruce	Isolated Patches?
Sugar Maple	Persevere
Trembling Aspen	Unclear
White Ash	Propser*
White Birch	Decline
White Pine	Prosper
White Spruce	Decline
Yellow Birch	Isolated Patches?

Source: de Graaf, M. 2018. *Climate Change Resilience in the Acadian Forest: A Review*. 2018. Community Forests International.

Reviewed and interpreted projections from three different studies.

Some basic facts or assumptions or projections…

10. CC will cause new stresses (or exacerbate existing stresses) that can (or will) reduce overall forest vigour and health – FACT and PROJECTION

11. A healthy, diverse forest is the best defence against climate change and other stresses – FACT

12. We can start to manage forests now to be more CC resilient – FACT

Some basic facts – assumptions – projections…

13. CC adaptive management may mean thinking outside the box and trying new harvest and silviculture approaches – FACT

14. CC adaptive management may mean accepting that future forests will look different than current forests – FACT

15. We don't have all the answers, so we need to continually monitor, evaluate, and adapt as we move forward – FACT

A healthy, diverse forest is the best defence against climate change and other stresses….

This means managing for:

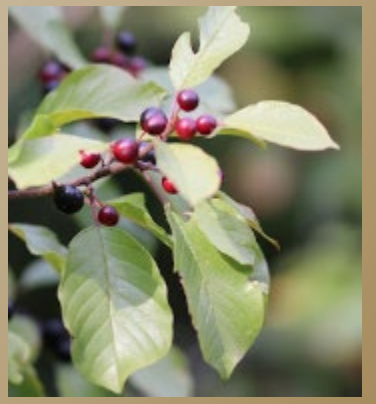
- Biodiversity (maintenance/enhancement)
- Healthy soils
- Multiple tree species that are ecologically adapted to the site
- Multiple age classes and/or diverse vertical and horizontal structure
- Wind firmness/resilience

A healthy, diverse forest is the best defence against climate change and other stresses….

This also means being on the lookout for:

- New or worsening changes in tree vigour
- New insect or disease threats
- Invasive plant species
- Changes in tree phenology

In summary, we need active and adaptive ecological forest management



Some “newer” management options and ideas…

- High or medium retention irregular shelterwood harvests (continuous or gap) with focus on restoration and/or climate adaptation
- Underplanting stands with LIT hardwood species
- Liming to offset lingering impacts of acid rain on forest soil nutrient levels (especially calcium)
- Restoration thinning in “too-tall” regenerating stands to favour LIT species and build future wind resilience
- Actively managing for carbon storage

Some other initiatives we are pursuing…

In addition to ecological forestry research that is the focus of the FFN project, we are also looking at other complimentary initiatives:

- A woodland owner focussed climate vulnerability and adaptation (CVA) assessment in collaboration with experts at UBC
- A new, multi-partner, province-wide forest soil sampling and health assessment program
- Promoting an active wild seed collection program in collaboration with the Federal/Provincial 2-Billion Trees (2BT) program

Thank You

Questions…

Don’t treat soil like dirt!