



CITY OF CARMEL-BY-THE-SEA

California's Fourth Climate Change Assessment

Central Coast Region Report

Climate Committee Meeting

December 10, 2019



4th Climate Assessment

How should we use it?

- Identify the classes of impacts that are applicable to Carmel.
 - Sea Level Rise, Trees and Plants, Wastewater, etc.
 - Also identify additional areas of specific Carmel concern: e.g. tourism, 2nd homes
- Within each class, identify Carmel specific impacts
 - Sea Level Rise: loss of beach, city infrastructure, etc.
 - Trees and Plants: endangered species, urban forest, etc.
 - Wastewater: sewer lines, CAWD facility



4th Climate Assessment

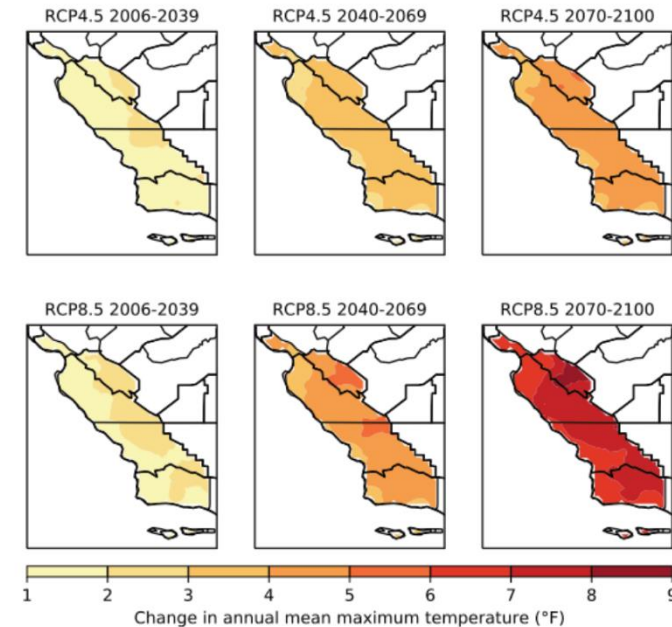
How should we discuss this today?

- First, this presentation
- Second, public comment
- Third, committee review of classes of impacts and bullet items, including new entries
- Next month: more formal list to review



Climate Science: Temperature Rise (page 13)

- RCP 4.5: a mitigation scenario where global CO2 emissions peak by 2040.
- RCP 8.5: business-as-usual scenario where CO2 emissions continue to rise throughout the 21st century
- Carmel data from cal-adapt:
 - RCP 4.5 / +2.7 degrees F (2050), +3.9 (2100)
 - RCP 8.5 / +3.4 degrees F (2050), +6.4 (2100)



Change in annual mean maximum temperature (°F)



Climate Science: Precipitation (page 16)

Gradual (but slight) increase in the amount of yearly rain totals

- Increase in variability from year to year
- Fewer “wet days” (e.g. more rain on those wet days)
- Leads to: More risk of localized flooding



Climate Science: Precipitation (page 16)

<https://cal-adapt.org/tools/annual-averages/>

- Choose RCP
- Choose Location
- Choose Models

Vis-à-vis precipitation, the first 4 models listed are not that different from each other

- Slightly wetter
- Slightly more variable

Settings

SCENARIO ⓘ

RCP 4.5
 Emissions peak around 2040, then decline

RCP 8.5
 Emissions continue to rise strongly through 2050 and plateau around 2100

LOCATION ⓘ CHANGE

MODELS ⓘ

GCM	Display
● HadGEM2-ES * (Warm/Drier)	<input checked="" type="checkbox"/>
● CNRM-CM5 * (Cooler/Wetter)	<input type="checkbox"/>
● CanESM2 * (Average)	<input checked="" type="checkbox"/>
● MIROC5 * (Complement)	<input type="checkbox"/>
● ACCESS1-0	<input type="checkbox"/>
● CCSM4	<input type="checkbox"/>
● CESM1-BGC	<input type="checkbox"/>
● CMCC-CMS	<input type="checkbox"/>
● GFDL-CM3	<input type="checkbox"/>

Annual Average Precipitation

Data is shown for Grid Cell (36.53125, -121.90625) under the RCP 4.5 scenario in which emissions peak around 2040, then decline.

How to use? ⓘ

Observed Historical (in inches)		
1961–1990		
MIN	AVG	MAX
10.3	17.9	36.3

Modeled Historical (in inches)		
1961–1990		
MIN	AVG	MAX
7.3	19.1	34.5

Modeled Projections (in inches)		
2070–2099		
MIN	AVG	MAX
6.3	20.1	35.6

How to use? ⓘ Get Data Save Chart

Modeled Variability (range of annual average values from all 32 LOCA downscaled climate models)
■ Observed (1950-2005) ■ HadGEM2-ES (Warm/Drier) ■ CanESM2 (Average)

Annual Average Precipitation (inches)

Year



Climate Science: Other Weather Effects (page 18)

- Fog: Unknown
- Extreme Storm events: Atmospheric Rivers expected to increase
- El Nino events: inconclusive
- Extreme Drought events: already variable. Maybe a bit more variable?



Physical Impacts: Sea Level Rise (page 24)

- Very Fuzzy Projections:
 - 1 meter? SF: 42-166 cm?
- Shoreline Impacts in Carmel
 - Loss (drowning) of beach against the hard barriers
 - Sand erosion and retreat of sandy slopes
 - Cliff retreat
- More frequent localized high surf flooding



Physical Impacts: Sea Level Rise (page 24)

- Impacts
 - City Infrastructure
 - Restroom facilities
 - Other Shoreline Facilities (stairs, seawalls, storm drains, etc.)
 - Buried utility infrastructure (gas, electric, communications)
 - Sewer lines
 - Private property



Physical Impacts: Wildfire (page 30)

- Carmel Wildfire risk currently unknown
 - Areas of special concern: Mission Trail Park and Pescadero Canyon



Natural Resources: Plants (page 35)

- Native Plants
 - Tidestrom's Lupine and Hickman's Onion
 - How will other native plants around the city fare?
 - New native plantings in the North Dunes for example
 - Shrubs in Mission Trail
 - Do we need to adjust for a "new native" population?



Natural Resources: Forests and Wildlife (page 42)

- What is the future of our urban forest?
 - Current species: coast live oak, Monterey pine, Monterey cypress, coast redwood
- What about nearby forests?
- Reptiles on the ground
- Birds in the water and in the air



Natural Resources: Riparian Areas (page 48)

Mission Trail Nature Preserve



Impacts: Water Supplies (page 57)

MPWMD

- Is our water supply secure?
- Should we adapt our community to a decreasing supply?



Impacts: Public Health (page 64)

- Carmel has a significant population of the elderly
 - Extreme Heat Events
- Vector Borne and Infectious Disease Transmission



Impacts: Energy (page 68)

Unknown impacts but could be severe

- Temperatures affect energy production – “everything is worse as temperatures rise”
- Storm impacts on generation and distribution, especially in Carmel
- Wildfire (or threats of wildfire) impacts - Transmission lines shutdown for safety reasons
- Electric Cars are a big unknown, increasing our reliance on electricity in general
- Energy prices (may) increase as electricity becomes greener

Should we plan for increased unreliability in the future?



Impacts: Transportation (page 71)

Into Carmel - Resiliency of the regional transportation infrastructure

- Roads, railways, airports

Within Carmel

- Some roads closed already – 2nd avenue
- Some roads at risk from Sea Level Rise – Scenic Road
- Others...



Impacts: Wastewater (page 71)

Carmel Area Wastewater District

CAWD Sea Level Rise Report

<https://www.cawd.org/files/f1e63596e/CAWD-WWTP-SLR-Study-with-Appendices.pdf>



Impacts: Regional Lands

How do we exist in the region around us?

- Central Coast Climate Collaborative - <https://www.centralcoastclimate.org/>
- Reach out to other regional agencies
 - Monterey Peninsula Regional Parks District
 - Others
- Work with other local municipalities



Impacts: Other Impacts Not Listed

- Economic Impacts - Tourism
- Second Homes



Final Question: Which scenario(s) to use?

- RCP 4.5 at 2050 and 2100?
- RCP 8.5 at 2050 and 2100?
- Some combination or something else?

Thank you - Questions?