



*New Paltz, NY*

# Vulnerability Assessment and Climate Adaptation Planning

July 10, 2019

# ICLEI Sustainability Pathways

## SCALE UP

AND EXPAND THE MODEL OF  
**SUSTAINABLE**  
CITIES AND REGIONS

MAKE SUSTAINABILITY A  
**FUNDAMENTAL**  
PART OF ALL LOCAL AND  
GLOBAL DEVELOPMENT

TACKLE THE MOST  
**PRESSING ISSUES**  
OF OUR TIME TO PROTECT THE  
LONG-TERM INTERESTS OF  
**CITIZENS**

UNDERTAKE A  
**COLLECTIVE**  
**EFFORT**  
FOR GLOBAL CHANGE ACROSS ALL  
SECTORS AND LEVELS OF GOVERNMENT

**LOW EMISSION**  
DEVELOPMENT



**RESILIENT**  
DEVELOPMENT



**CIRCULAR**  
DEVELOPMENT



**EQUITABLE AND**  
**PEOPLE-CENTERED**  
DEVELOPMENT

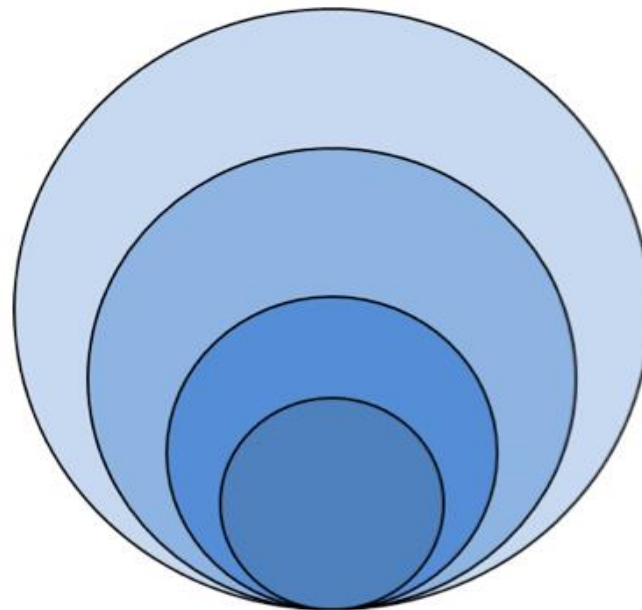


**NATURE-BASED**  
DEVELOPMENT



# What is the relationship between sustainability and resilience?

“A **sustainable city** can be seen as a growing, livable city that is inclusive, vibrant, well-serviced and contains talented and passionate people. A **resilient city** is one that stays that way!”



Sustainability

Resilience

Climate Change  
Adaptation/Mitigation

Disaster Risk Reduction





# Five Milestones for Resilience Framework



# Adaptation frameworks overview

[Overview of New York adaptation efforts from Georgetown](#)

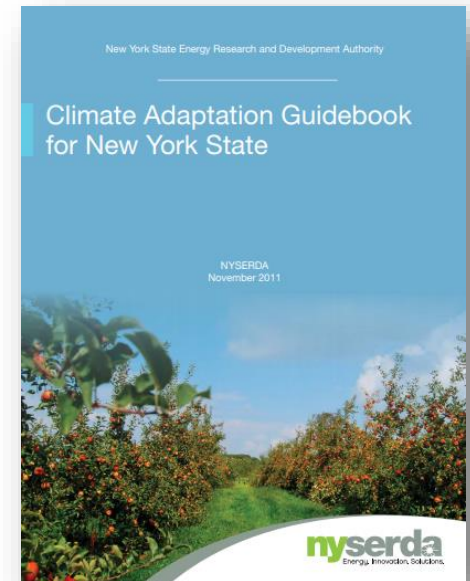
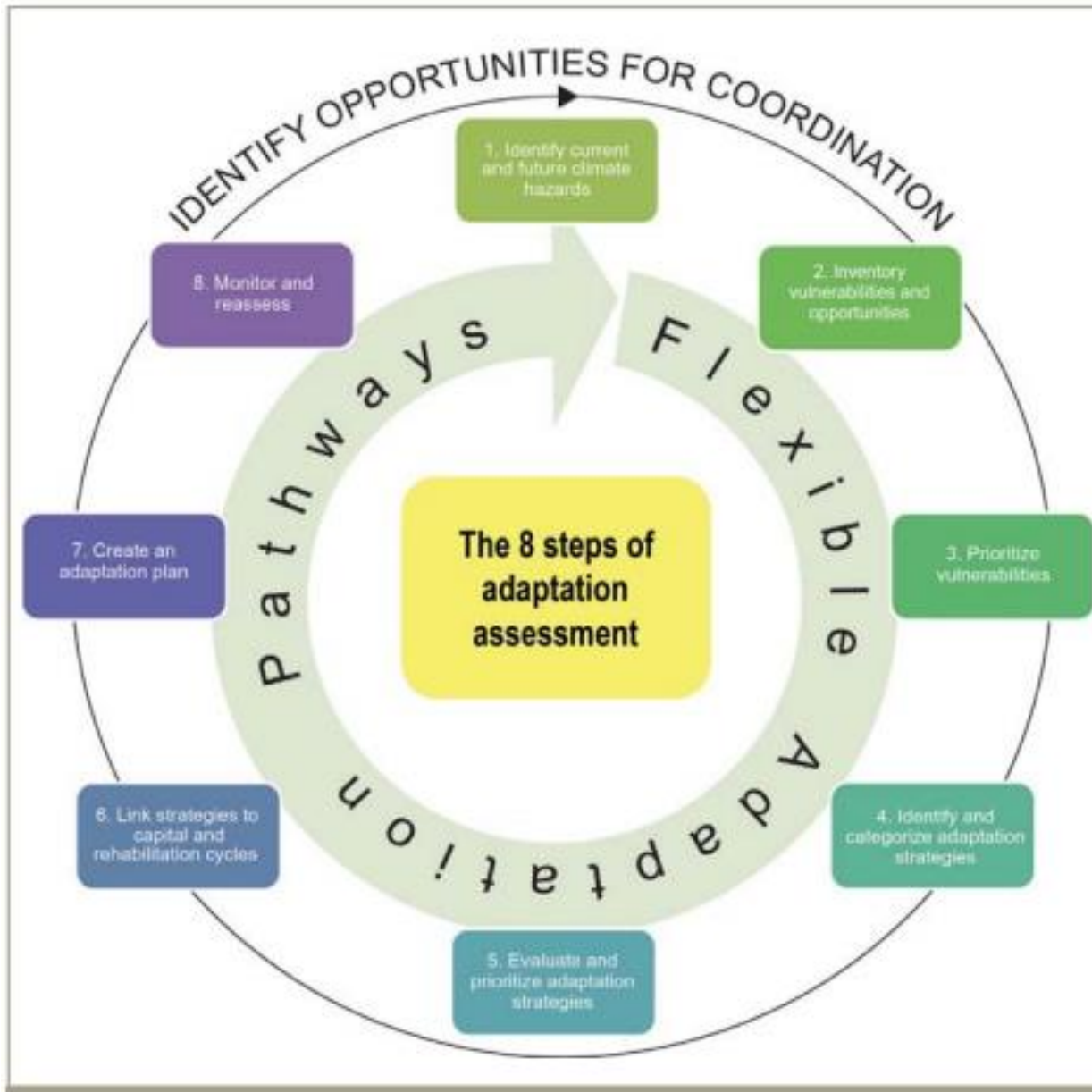
Links to state policies, local/regional plans, other resources

[NYS Climate Science Portal](#)

[NYSERDA's Responding to Climate Change in New York State \(ClimAID\)'s 8 Steps for Climate Assessments](#)



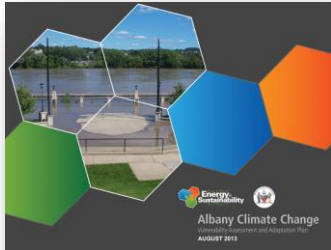
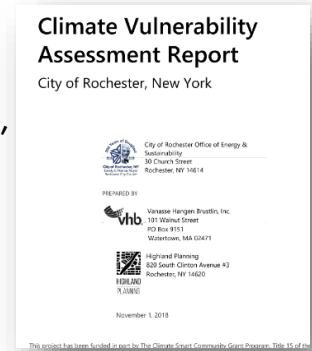
# Adaptation Frameworks: NYS Guidelines



# Regional Vulnerability Assessments

## Rochester

- 2018: Vulnerability assessment includes infrastructure (transportation, energy/utilities, water, buildings), natural resources, socioeconomic (health, economy). Summary profile of regional impacts. Recommendations made.

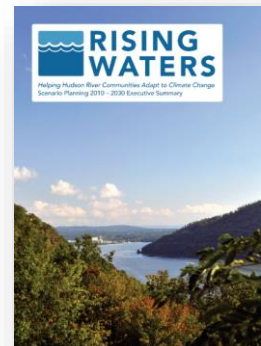


## Albany

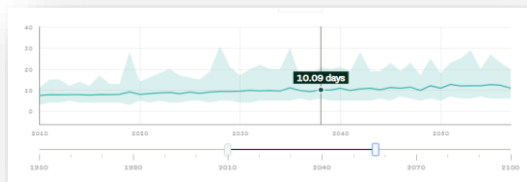
- 2013: vulnerability assessment includes economic, social, health, infrastructure, natural resources. Risk profiles and recommendations developed for each sector

## Hudson River Estuary Watershed

- 2009: stakeholder engagement workshop of 4 different scenarios and their associated potential actions, political climate, trends, economy. Final recommendations and findings from the stakeholder engagement shown



# Work Plan: Town of New Paltz Vulnerability Assessment



Acquire raw data [June 2019]



Develop and administer community survey [July-Aug 2019]



CSC Reporting Section 1 [Aug 2019]



Identify assets, Public Comment, & Identify Actions [Sept - Nov 2019]



CSC Reporting Section 2 [Aug 2019]



Internal Stakeholders Workshop [Sept 2019]







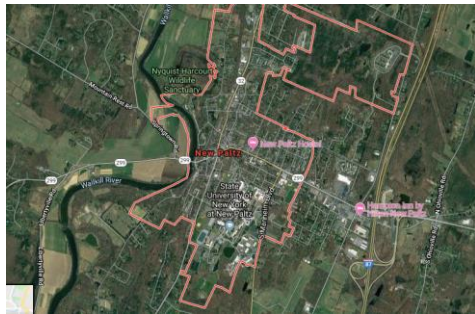
**TEMPERATE**  
your adaptation planning companion

# Climate data review

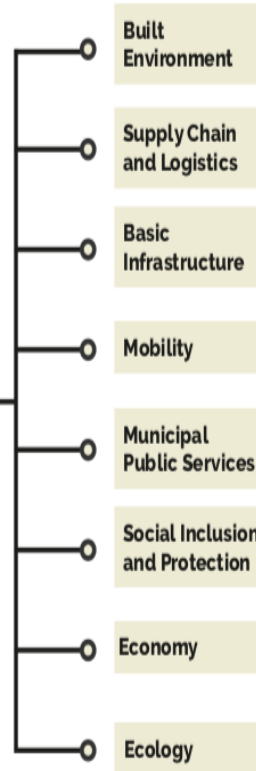


# Methodology

New Paltz's geographic  
location



**URBAN  
ELEMENTS**

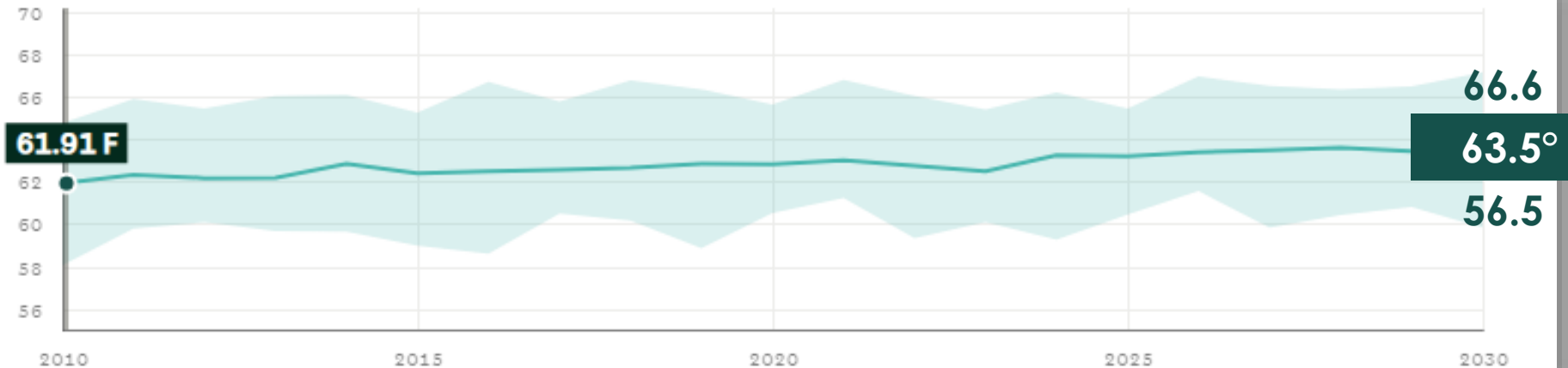


## Select Models

[Use all models](#) [Clear all models](#)

<input checked="" type="checkbox"/> ACCESS1-0	<input checked="" type="checkbox"/> CNRM-CM5	<input checked="" type="checkbox"/> HadGEM2-ES
<input checked="" type="checkbox"/> ACCESS1-3	<input checked="" type="checkbox"/> CSIRO-Mk3-6-0	<input checked="" type="checkbox"/> Inmcm4
<input checked="" type="checkbox"/> bcc-csm1-1	<input checked="" type="checkbox"/> EC-EARTH	<input checked="" type="checkbox"/> IPSL-CM5A-LR
<input checked="" type="checkbox"/> bcc-csm1-1-m	<input checked="" type="checkbox"/> FGOALS-g2	<input checked="" type="checkbox"/> IPSL-CM5A-MR
<input checked="" type="checkbox"/> BNU-ESM	<input checked="" type="checkbox"/> GFDL-CM3	<input checked="" type="checkbox"/> MIROC5
<input checked="" type="checkbox"/> CanESM2	<input checked="" type="checkbox"/> GFDL-ESM2G	<input checked="" type="checkbox"/> MIROC-ESM
<input checked="" type="checkbox"/> CCSM4	<input checked="" type="checkbox"/> GFDL-ESM2M	<input checked="" type="checkbox"/> MIROC-ESM-CHEM
<input checked="" type="checkbox"/> CESM1-BGC	<input checked="" type="checkbox"/> GISS-E2-H	<input checked="" type="checkbox"/> MPI-ESM-LR
<input checked="" type="checkbox"/> CESM1-CAM5	<input checked="" type="checkbox"/> GISS-E2-R	<input checked="" type="checkbox"/> MPI-ESM-MR
<input checked="" type="checkbox"/> CMCC-CM	<input checked="" type="checkbox"/> HadGEM2-AO	<input checked="" type="checkbox"/> MRI-CGCM3
<input checked="" type="checkbox"/> CMCC-CMS	<input checked="" type="checkbox"/> HadGEM2-CC	<input checked="" type="checkbox"/> NorESM1-M

## Data outputs example: Avg High Temperature [Low-emissions scenario, 2030]



### Scenario

Low emissions

High emissions

### Models

All available models

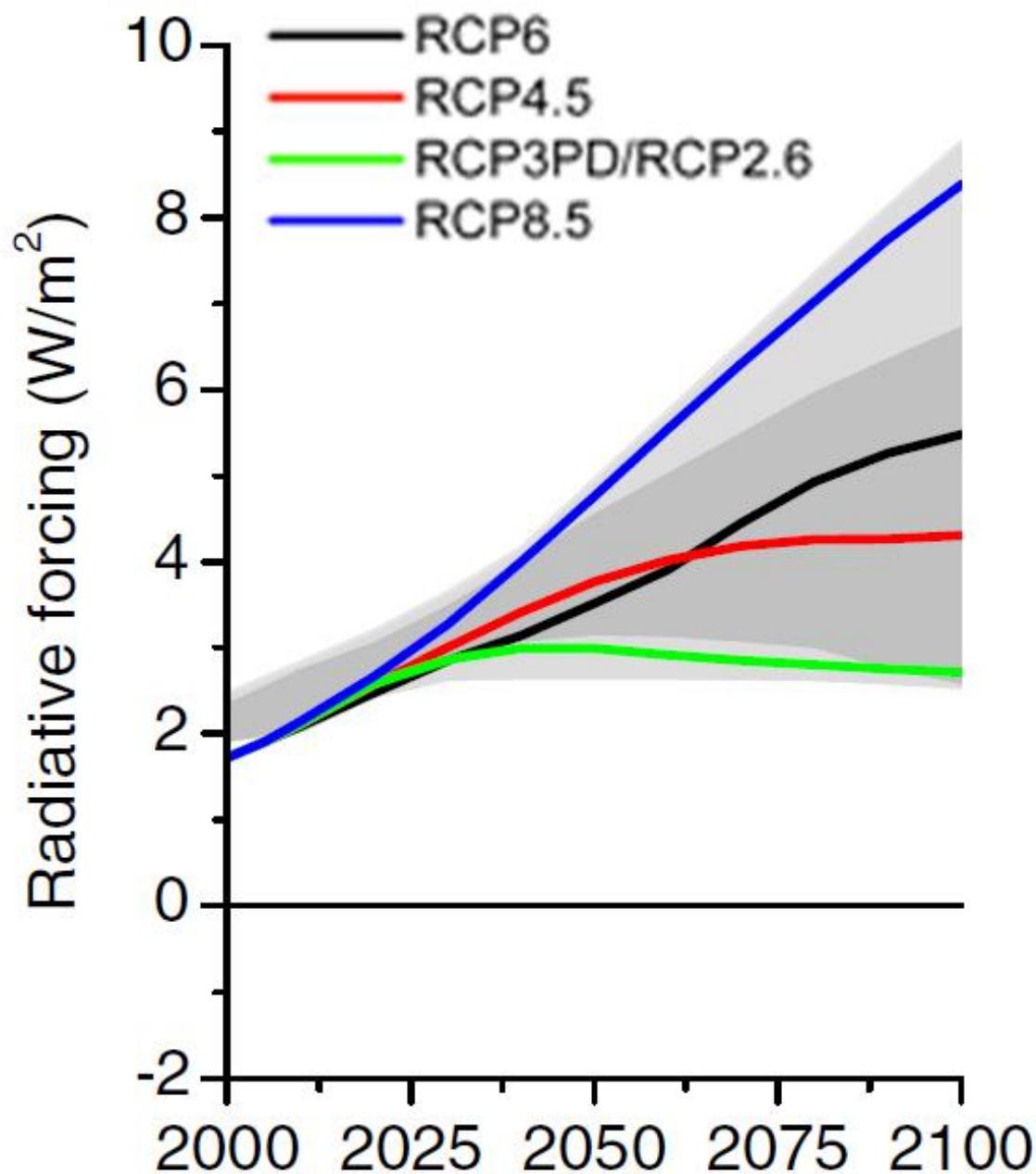
### Units

F ▼

### Dataset

LOCA

NEX-GDDP



Representative  
concentration  
pathways  
(RCPs)



## Available climate models are averaged for New Paltz

<input checked="" type="checkbox"/> ACCESS1-0	<input checked="" type="checkbox"/> CNRM-CM5	<input checked="" type="checkbox"/> HadGEM2-ES
<input checked="" type="checkbox"/> ACCESS1-3	<input checked="" type="checkbox"/> CSIRO-Mk3-6-0	<input checked="" type="checkbox"/> Inmcm4
<input checked="" type="checkbox"/> bcc-csm1-1	<input checked="" type="checkbox"/> EC-EARTH	<input checked="" type="checkbox"/> IPSL-CM5A-LR
<input checked="" type="checkbox"/> bcc-csm1-1-m	<input checked="" type="checkbox"/> FGOALS-g2	<input checked="" type="checkbox"/> IPSL-CM5A-MR
<input checked="" type="checkbox"/> BNU-ESM	<input checked="" type="checkbox"/> GFDL-CM3	<input checked="" type="checkbox"/> MIROC5
<input checked="" type="checkbox"/> CanESM2	<input checked="" type="checkbox"/> GFDL-ESM2G	<input checked="" type="checkbox"/> MIROC-ESM
<input checked="" type="checkbox"/> CCSM4	<input checked="" type="checkbox"/> GFDL-ESM2M	<input checked="" type="checkbox"/> MIROC-ESM-CHEM
<input checked="" type="checkbox"/> CESM1-BGC	<input checked="" type="checkbox"/> GISS-E2-H	<input checked="" type="checkbox"/> MPI-ESM-LR
<input checked="" type="checkbox"/> CESM1-CAM5	<input checked="" type="checkbox"/> GISS-E2-R	<input checked="" type="checkbox"/> MPI-ESM-MR
<input checked="" type="checkbox"/> CMCC-CM	<input checked="" type="checkbox"/> HadGEM2-AO	<input checked="" type="checkbox"/> MRI-CGCM3
<input checked="" type="checkbox"/> CMCC-CMS	<input checked="" type="checkbox"/> HadGEM2-CC	<input checked="" type="checkbox"/> NorESM1-M

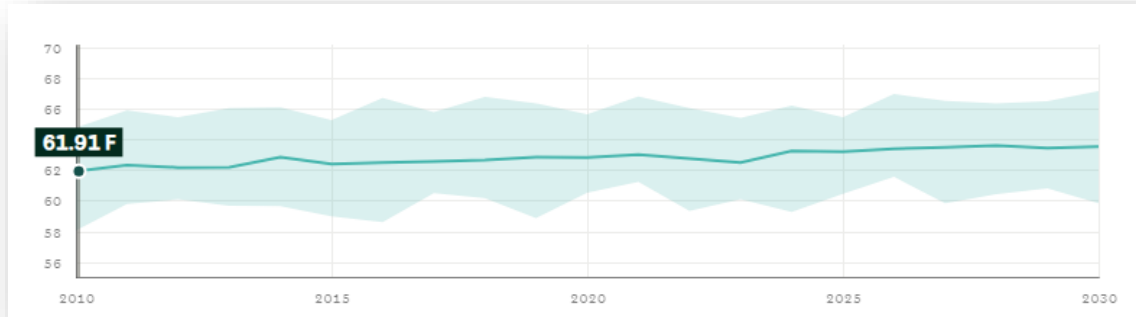
# New Paltz climate indicators overview

## [High-emissions scenario over 100 years, compared to 1970s]

Significant change	Some change	Little change
Avg & max high temp	Extreme cold events	Diurnal temp range
Avg & min. low temp	Extreme precipitation events	Dry spells
Freezing degree days	Heating degree days	Max consecutive dry days
Cooling degree days		Total precipitation
Extreme heat events		
Frost days		
Heat wave duration		
Heat wave incidents		

# Climate data: Avg High Temperature [Low-emissions scenario]

2030

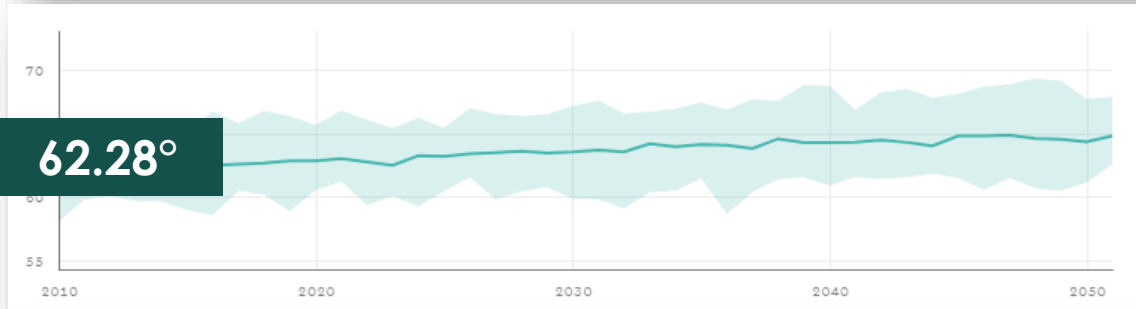


66.6

63.5°

56.5

2050

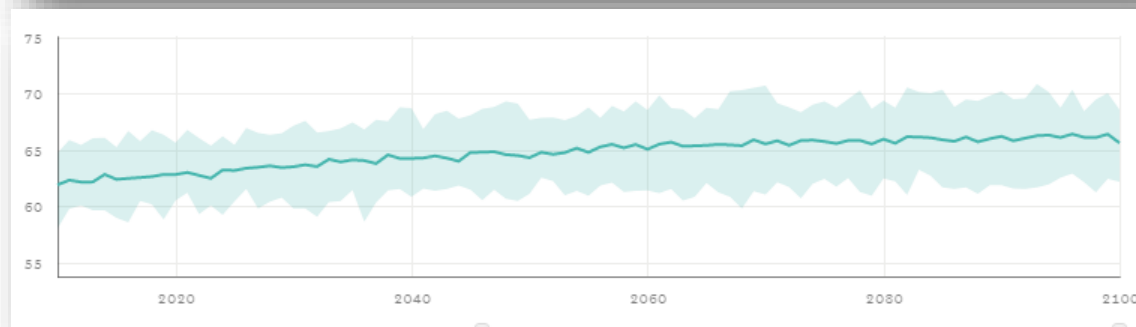


67.5

64.3°

59.3

2100



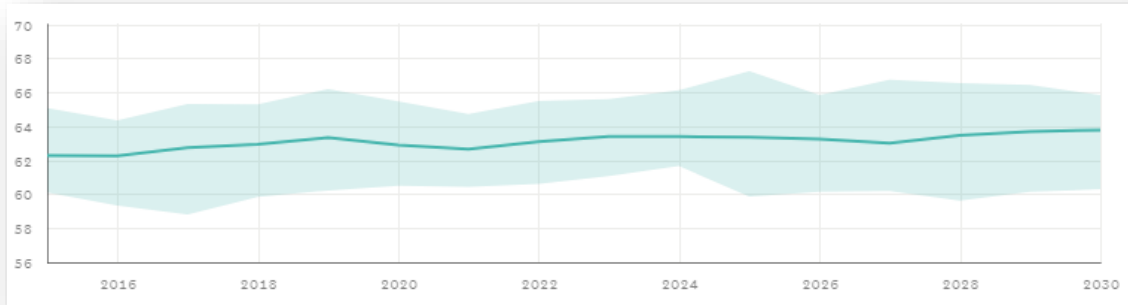
68.6

65.6°

53.3

# Climate data: Avg High Temperature [High-emissions scenario]

2030



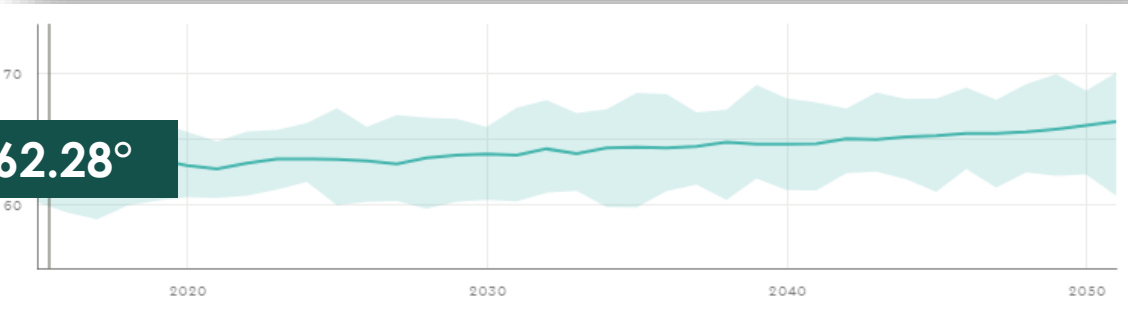
66.0

63.8°

60.1

2050

62.28°

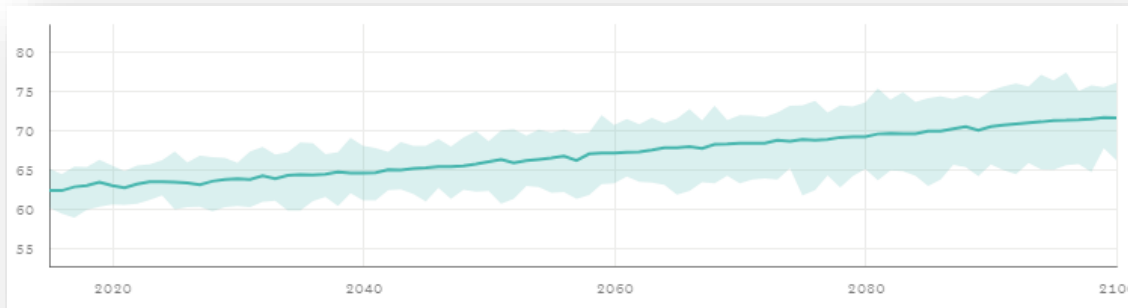


68.5

65.9°

63.3

2100



76.6

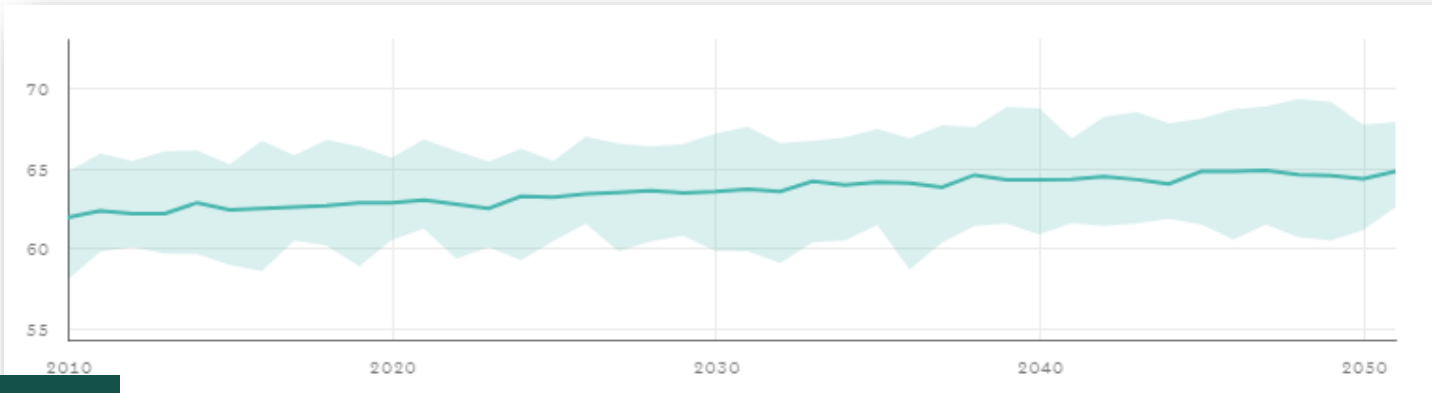
71.6°

66.3



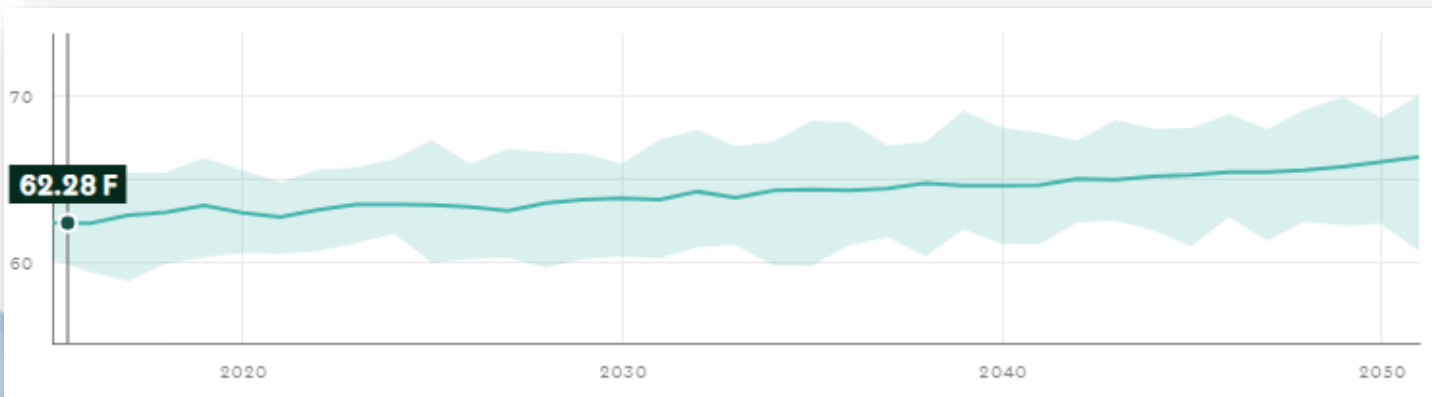


# Climate data: Comparing high- vs. low-emissions scenarios [Avg high temp to 2050]



**62.28°**

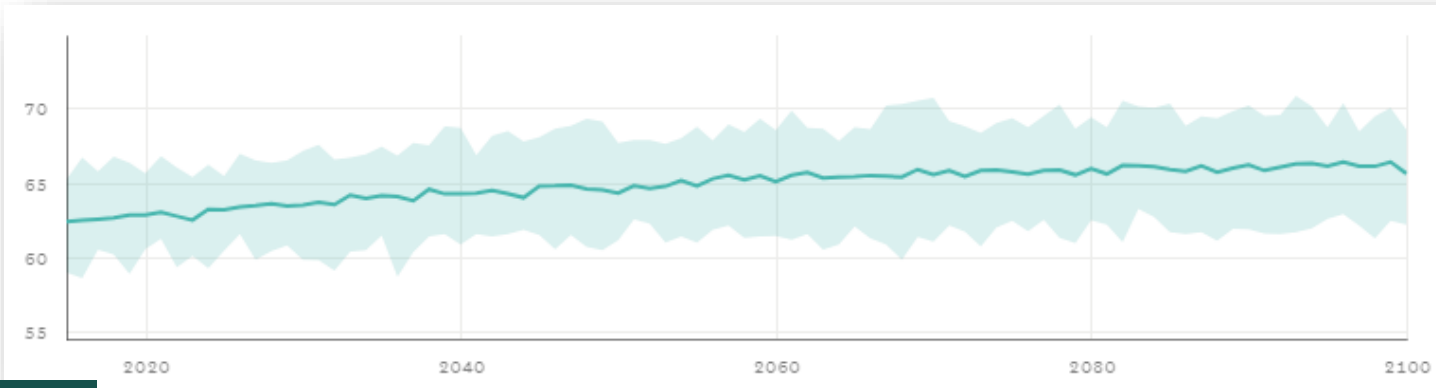
**67.5**  
**64.3°**  
**59.3**



**62.28 F**

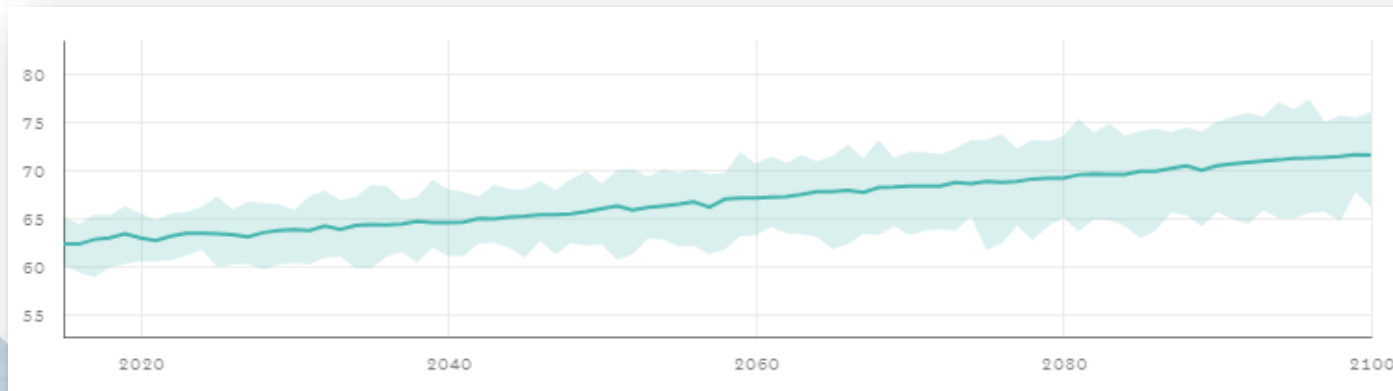
**68.5**  
**65.9°**  
**63.3**

# Climate data: Comparing high- vs. low-emissions scenarios [Avg high temp to 2100]



678.2  
65.6°  
63.0

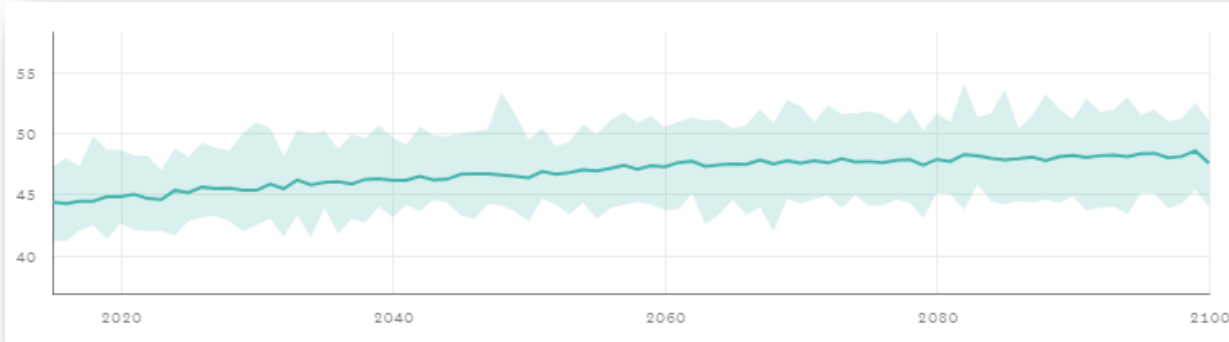
62.28°



75.2  
71.6°  
66.3

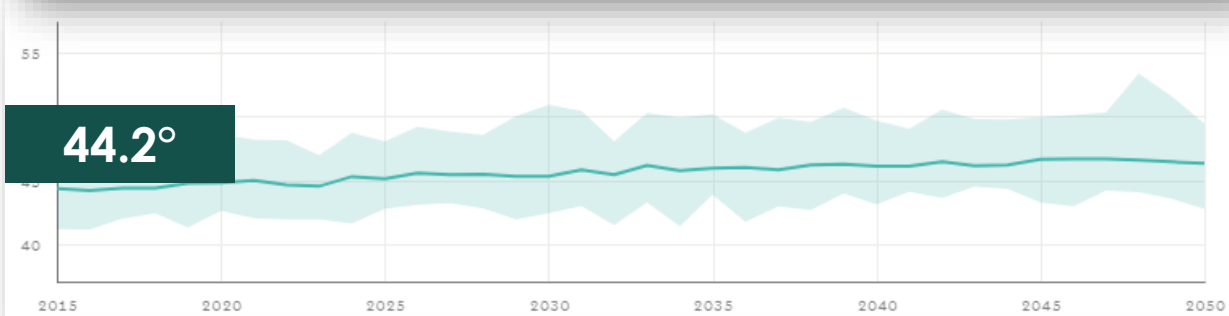
# Climate data: Avg Low temperature [Low-emissions scenario]

2030



45.3°

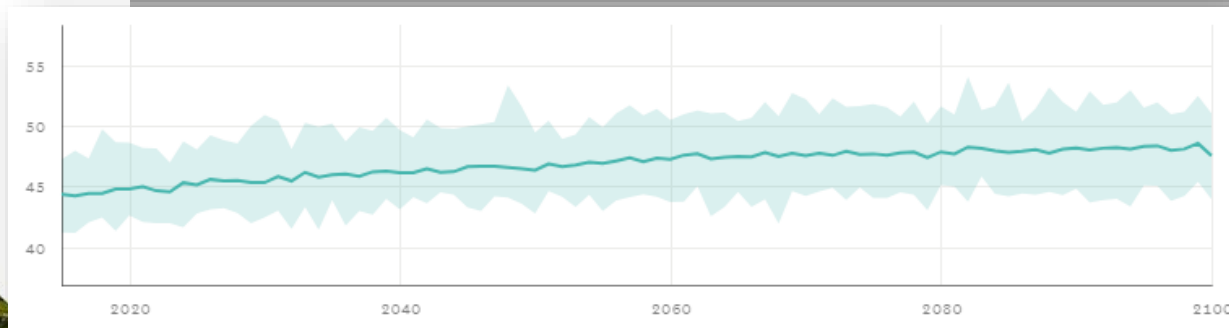
2050



44.2°

46.3°

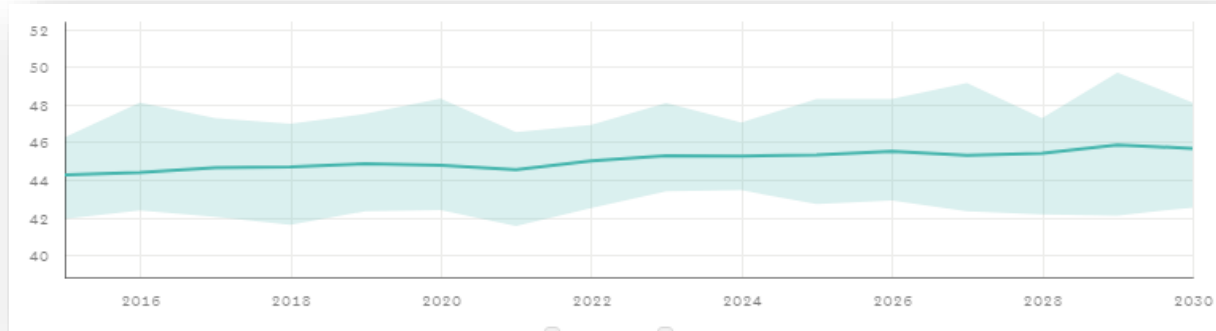
2100



47.5°

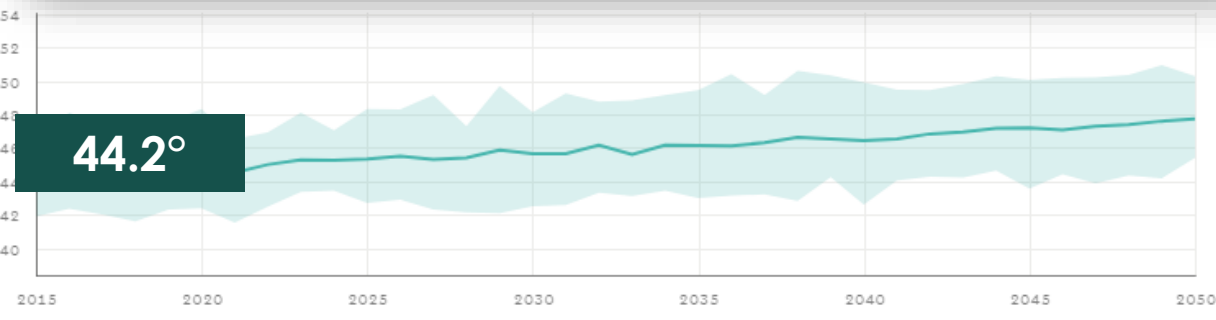
# Climate data: Avg Low temperature [High-emissions scenario]

2030



45.6°

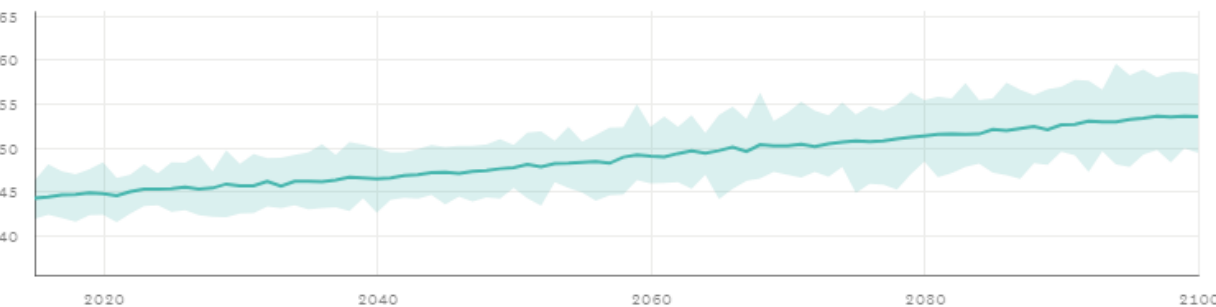
2050



44.2°

47.7°

2100



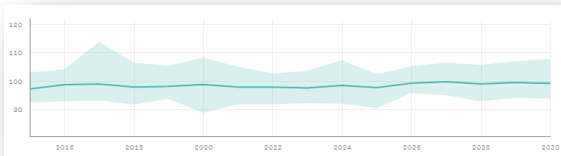
53.5°



# Climate data: Max / Min Temperatures [Low-emissions scenario]

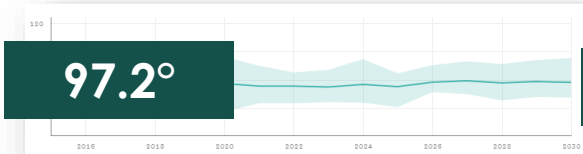
## MAX

2030



99.1°

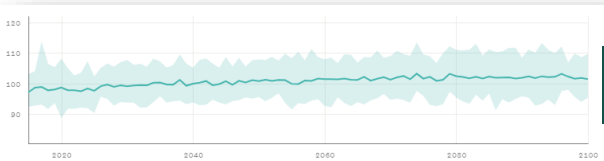
2050



97.2°

99.1°

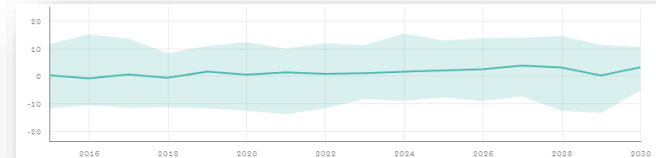
2100



101.4°

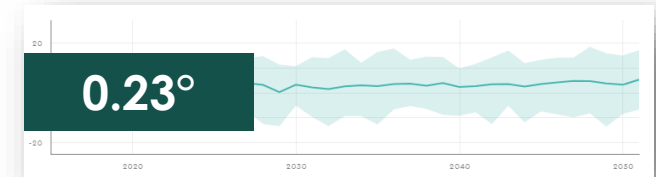
## MIN

3.12°

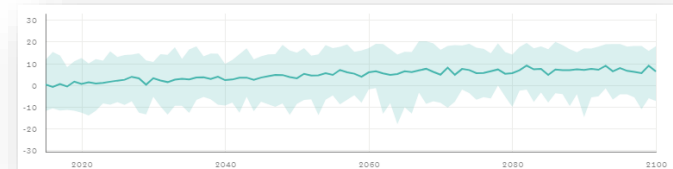


0.23°

5.15°



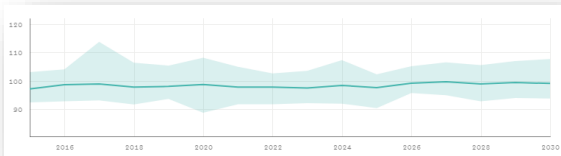
6.22°



# Climate data: Max / Min Temperatures [High-emissions scenario]

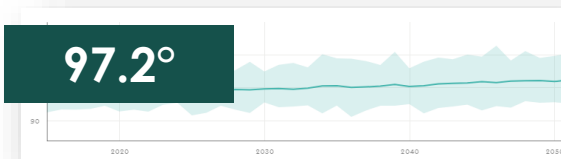
## MAX

2030



99.5°

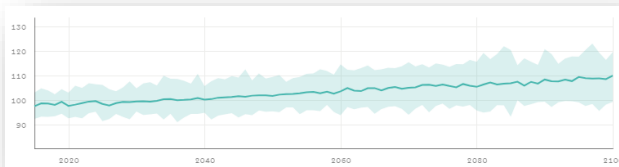
2050



97.2°

102.3°

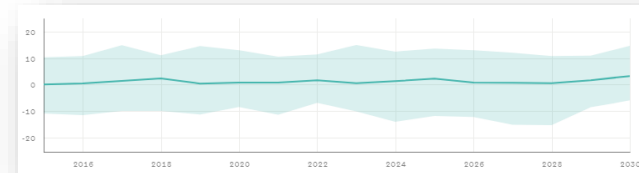
2100



110°

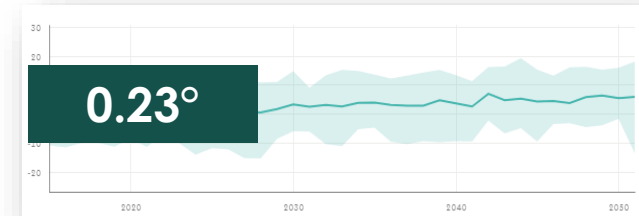
## MIN

3.25°

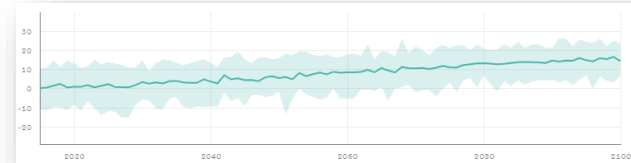


0.23°

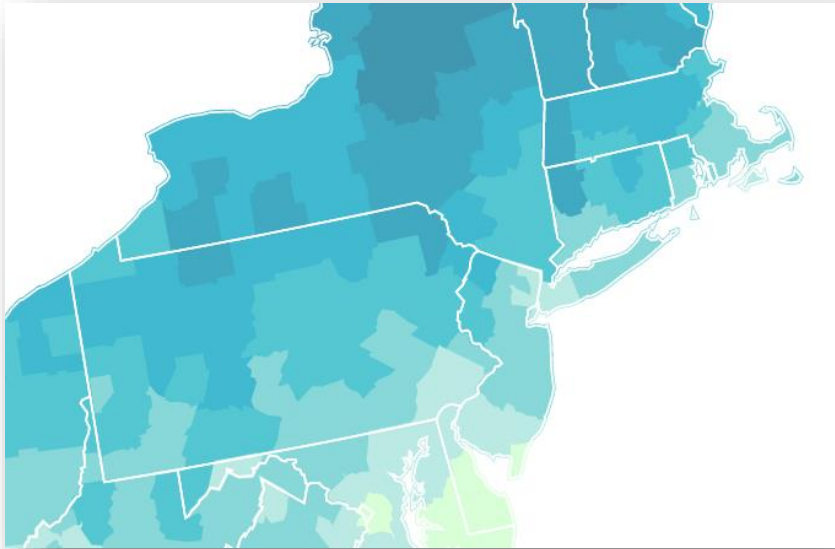
5.9°



14.1°

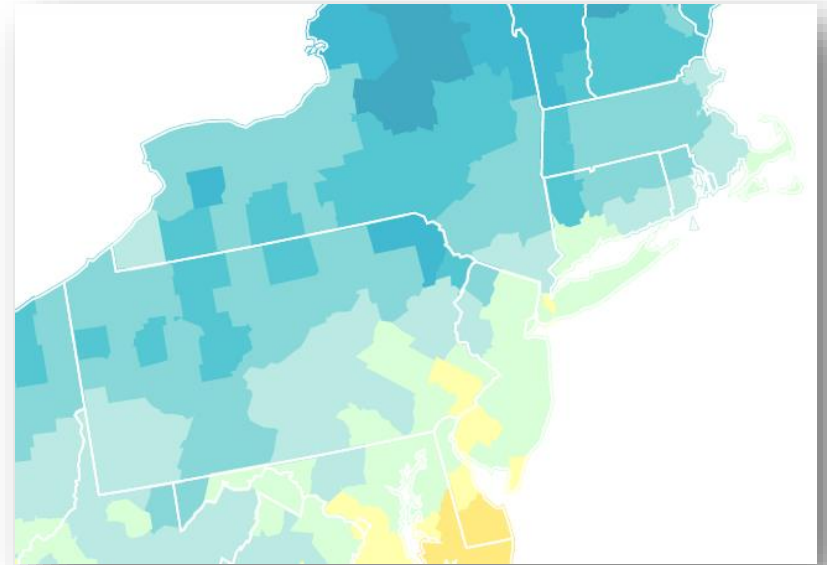


# Climate shift: New Paltz Winter avg temp to 2050 feels like current Maryland/Virginia



Historical

28°



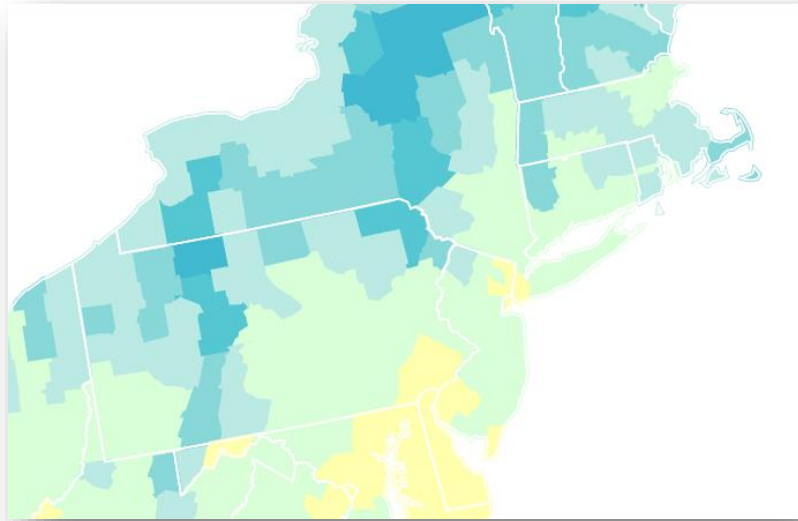
Mid-Century

34°



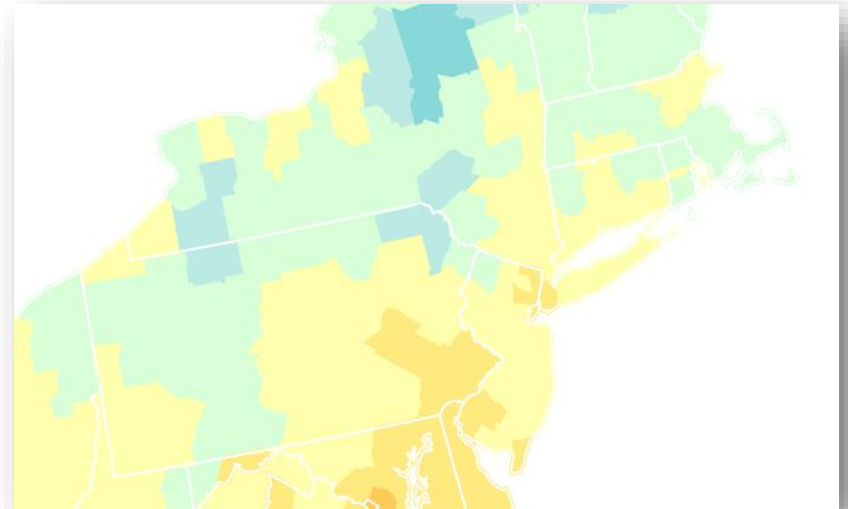
<http://www.impactlab.org/map/>

# Climate shift: New Paltz Summer avg temp to 2050 feels like current Washington DC



Historical

74°



Mid-Century

80°

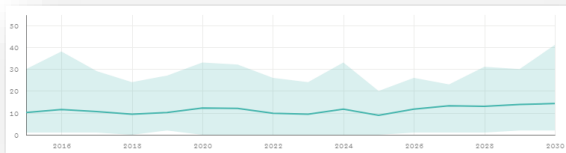




# Climate data: Extreme Heat Events

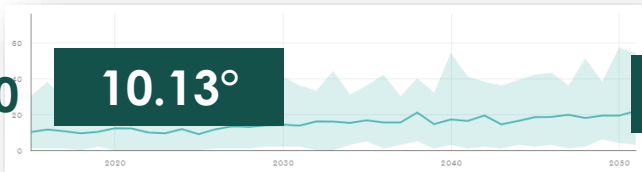
## Low-emissions scenario

2030



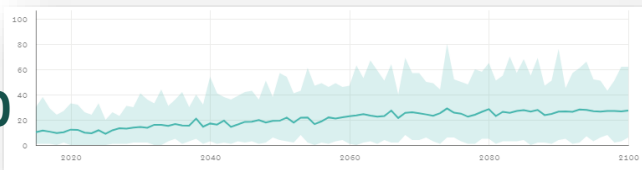
14.25

2050



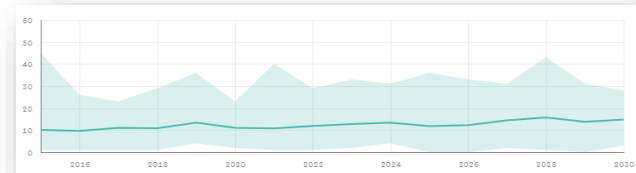
21.72

2100

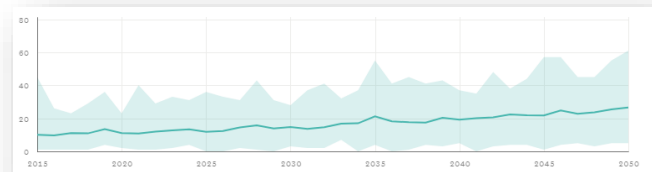


27.41

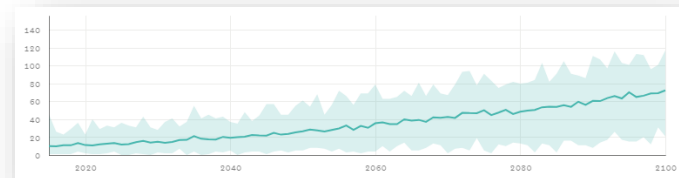
## High-emissions scenario



14.78



26.53



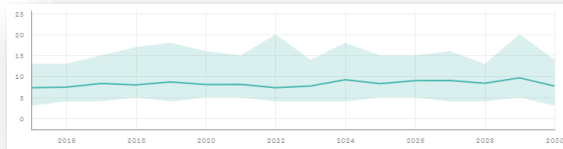
72.34°

# Climate data: Heat wave duration

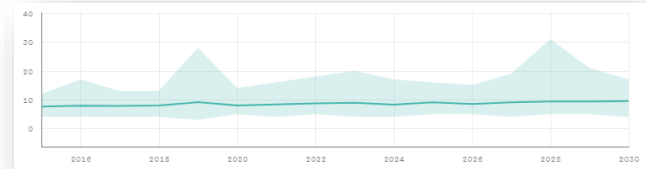
## Low-emissions scenario

## High-emissions scenario

2030

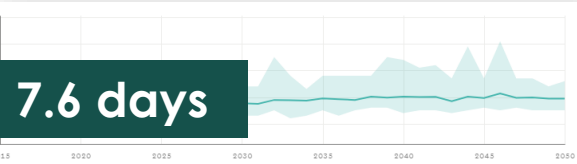


7.7



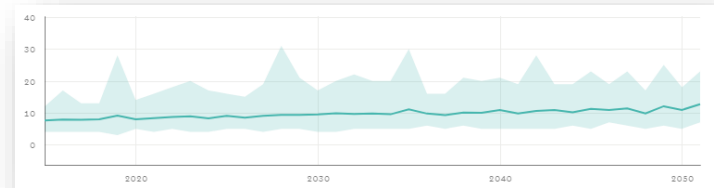
9.5

2050



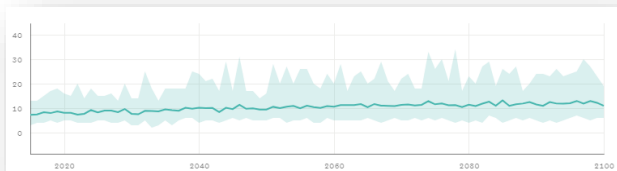
7.6 days

9.4

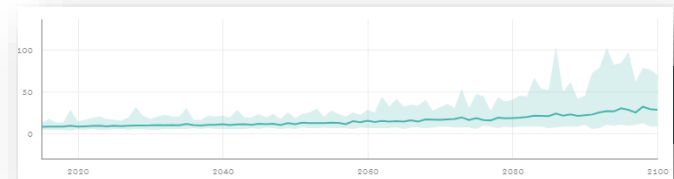


12.7

2100



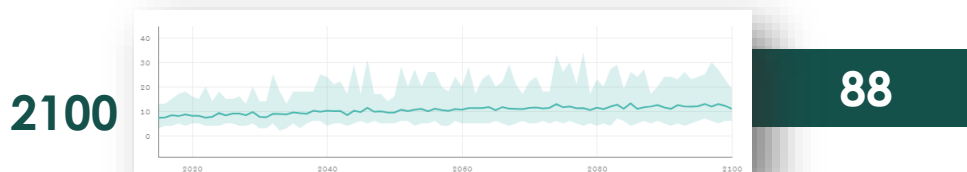
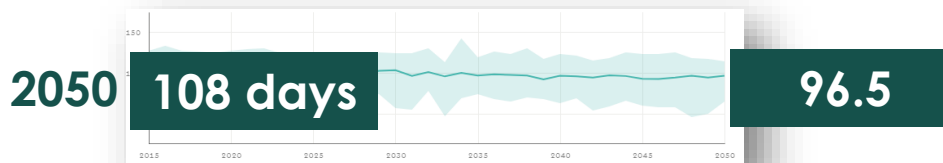
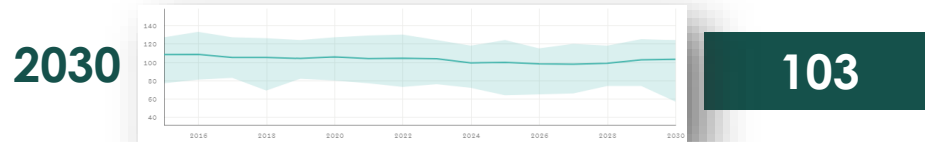
11



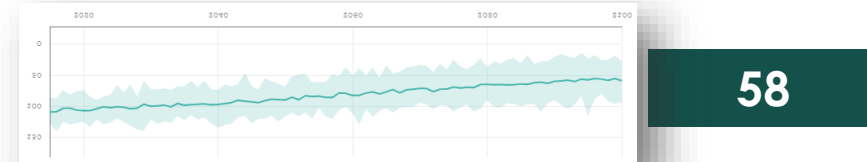
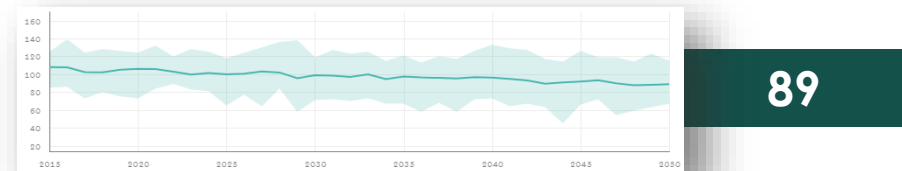
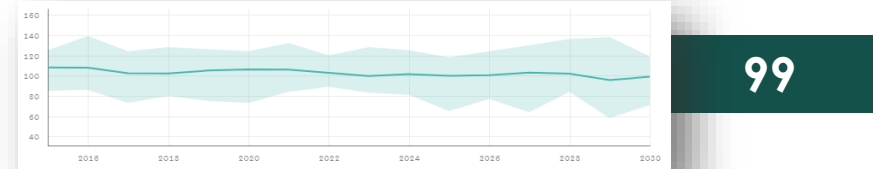
28

# Climate data: Frost days

## Low-emissions scenario



## High-emissions scenario



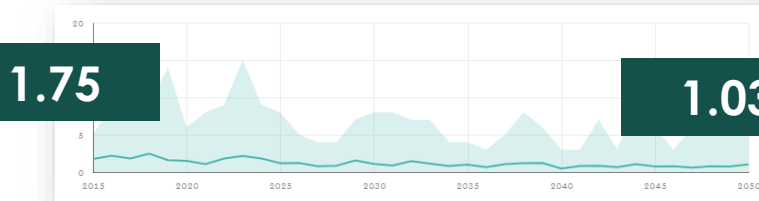
# Climate data: Indicators with moderately significant change [2050]

## Low-emissions scenario

### Extreme cold events

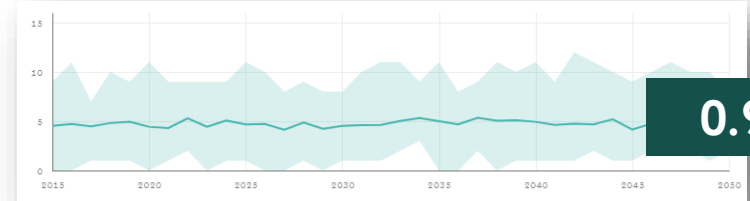
1.75

1.03



## High-emissions scenario

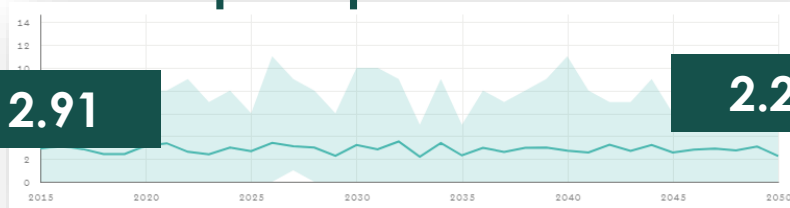
0.91



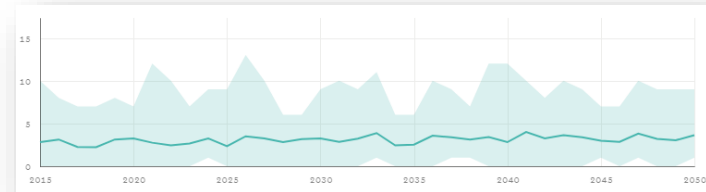
### Extreme precipitation events

2.91

2.25



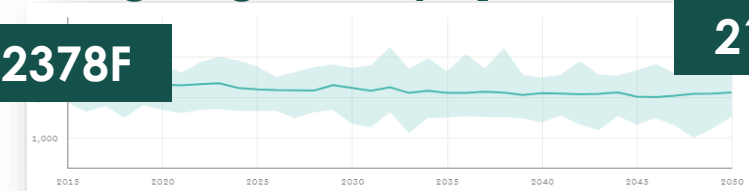
3.63



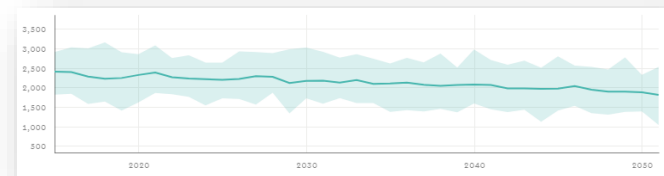
### Heating degree days [from 50F]

2378F

2114F

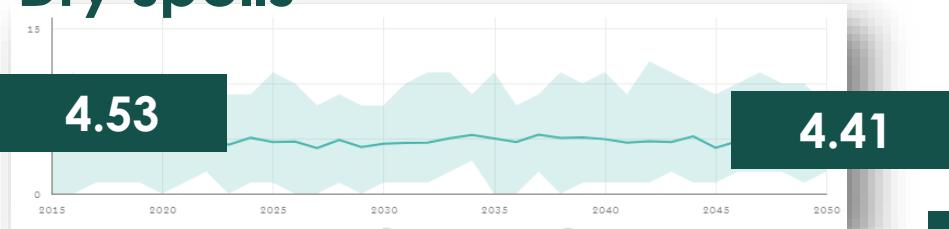


1808F

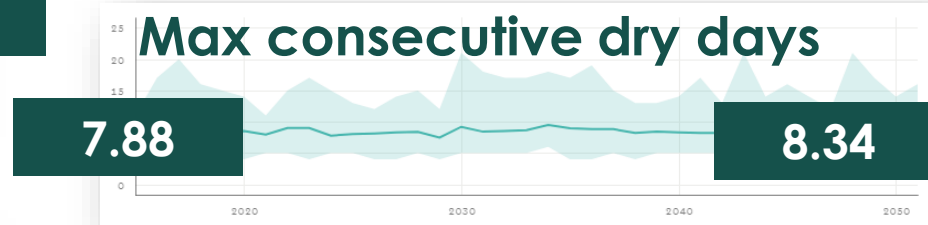


# Climate data: Indicators with little significant change [2050]

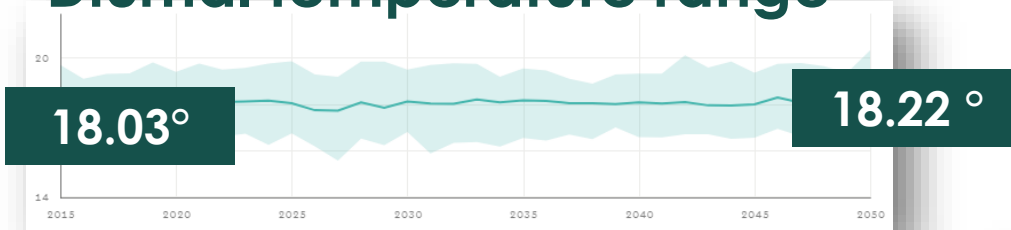
## Dry spells



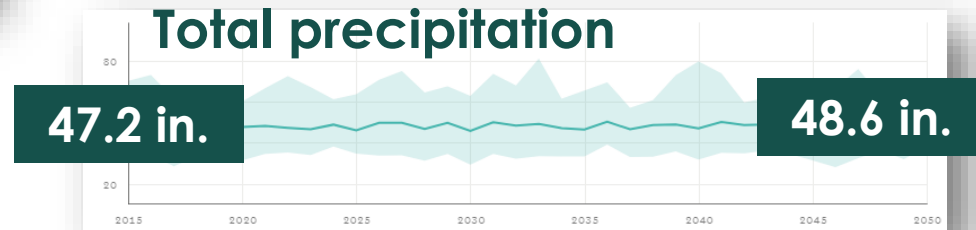
## Max consecutive dry days



## Diurnal temperature range



## Total precipitation



# New Paltz climate indicators overview

## [High-emissions scenario over 100 years, compared to 1970s]

Significant change	Some change	Little change
Avg & max high temp	Extreme cold events	Diurnal temp range
Avg & min. low temp	Extreme precipitation events	Dry spells
Freezing degree days	Heating degree days	Max consecutive dry days
Cooling degree days		Total precipitation
Extreme heat events		
Frost days		
Heat wave duration		
Heat wave incidents		



# Next Steps: Stakeholder Input



# Work Plan: Town of New Paltz Vulnerability Assessment



Acquire raw data [June 2019]



Develop and administer community survey [July-Aug 2019]



CSC Reporting Section 1 [Aug 2019]



Internal Stakeholders Workshop [Sept 2019]



CSC Reporting Section 2 [Aug 2019]



Identify assets, Public Comment, & Identify Actions [Sept - Nov 2019]



# Temperate identifies 11 top hazards for New Paltz

## Top hazards

All calculations shown on the Hazards use the average of the projections for the years 2025-2035. Select individual indicators to see more projections.



### Extreme hot days

3.7F above current hottest day



### Heat waves

2.7 more heat waves each year



### Rain storms

0.68 more intense storms each year



### River flooding

0.68 more intense storms each year



### Wildfires

0.52 more days in the longest yearly dry spell



### Changed seasonal patterns



### Drought

0.32 more dry spells each year



### Flash / surface flooding

0.68 more intense storms each year



### Forest fire

0.52 more days in the longest yearly dry spell



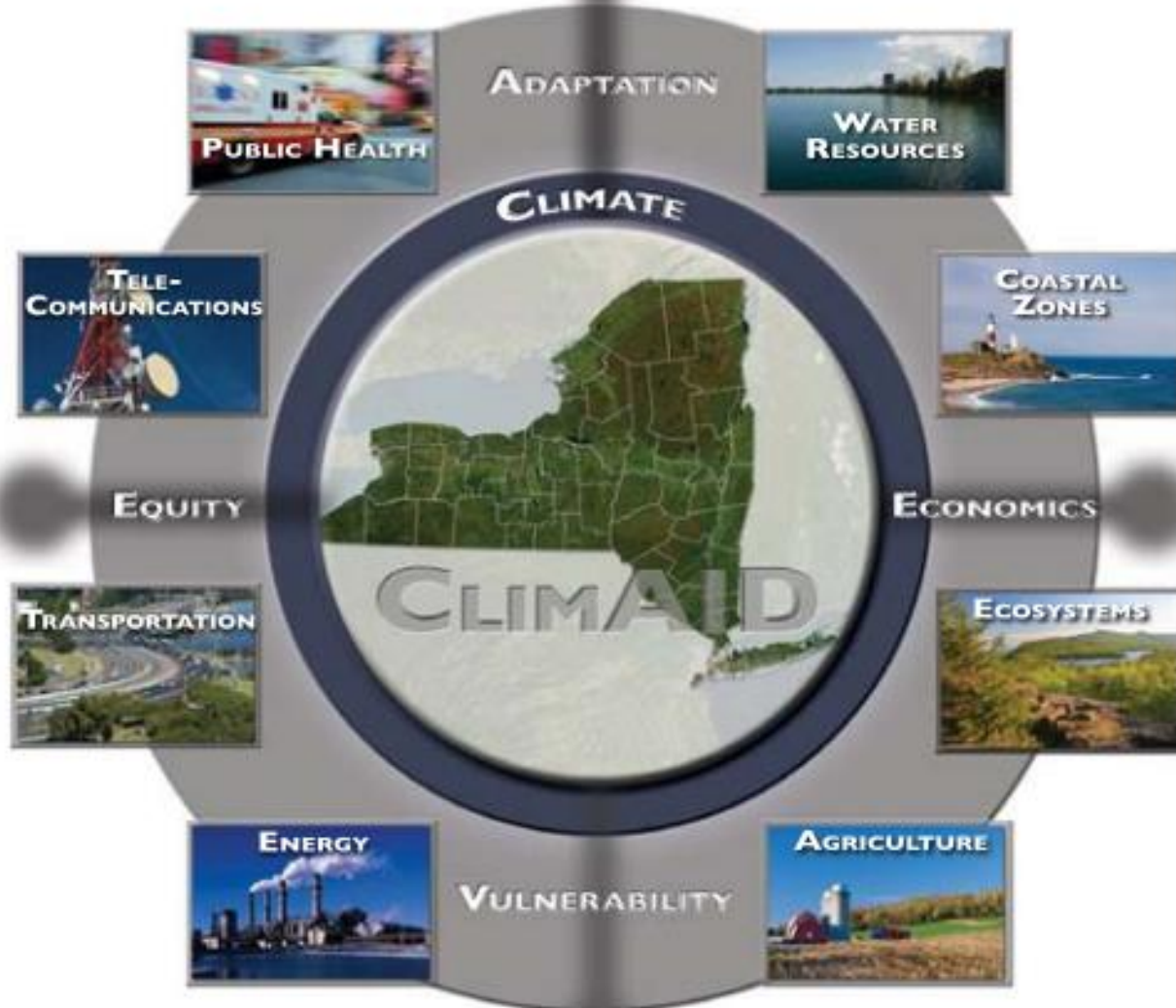
### Groundwater flooding

0.68 more intense storms each year



### Insect infestation





**NYS advises to consider several community systems**

Kale Roberts  
Senior Program Officer  
Garrison, New York  
845-464-3682  
kale.roberts@iclei.org



ICLEI USA Headquarters  
1536 Wynkoop St #901  
Denver, CO 80202

(510) 844-0699

[icleiusa.org](http://icleiusa.org)

@ICLEI\_USA