

6 The Nature of New York's Climates

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Definitions

WEATHER and CLIMATE

- Weather** – the state of the atmosphere at one point in time.
The elements of weather are **temperature, air pressure, wind and moisture.**
- Climate** – the average of all weather over a very long period (>50 yrs.) of time.



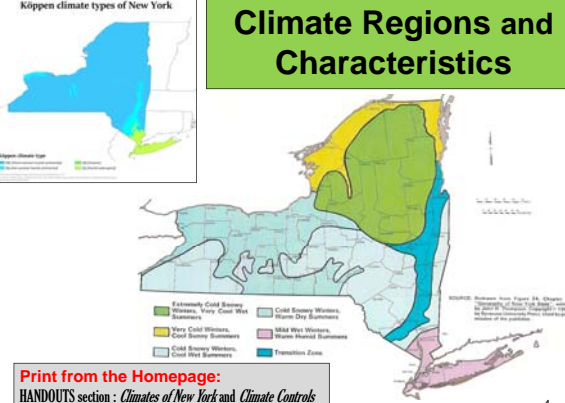


The NYS Climate Office is located at Cornell University.

It partners with the National Climatic Data Center (NCDC) and National Weather Service (NWS) at NOAA.

- <http://gardening.cals.cornell.edu/garden-guidance/weather-climate/> - W&C data
- <https://www.ncdc.noaa.gov/cag/> - NYS Climate at a Glance (interactive maps)
- <http://www.nrcc.cornell.edu/> - Northeast Regional Climate Center at Cornell Univ.
- <http://www.weather.gov/okx/> - National Weather Service (NWS)
- <https://www.nyclimatescience.org/> - NY Climate Change Science Clearinghouse (NYCCSC)
- <http://www.dec.ny.gov/about/43166.html> - NYSDEC Office of Climate Change
- <http://www.dec.ny.gov/energy/50399.html> - DEC list of information sources

Climate Regions and Characteristics



Print from the Homepage:
HANDOUTS section: *Climates of New York and Climate Controls*
MAPS section: *Climate Map Sets*

Nature of NY's Climates

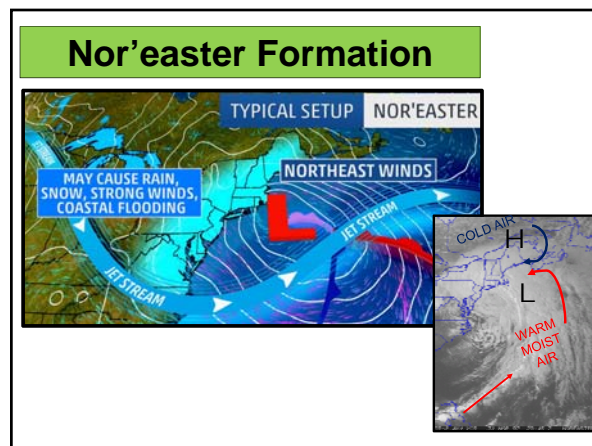
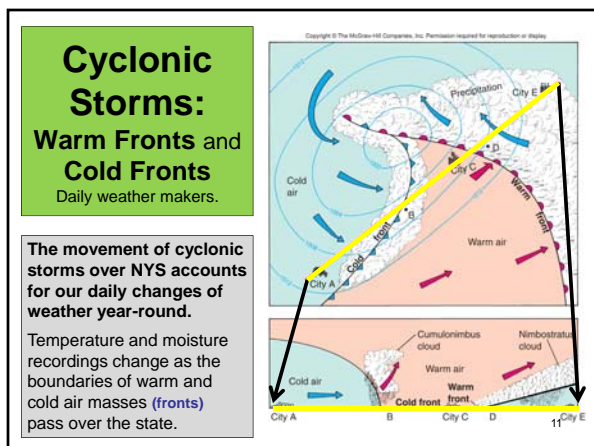
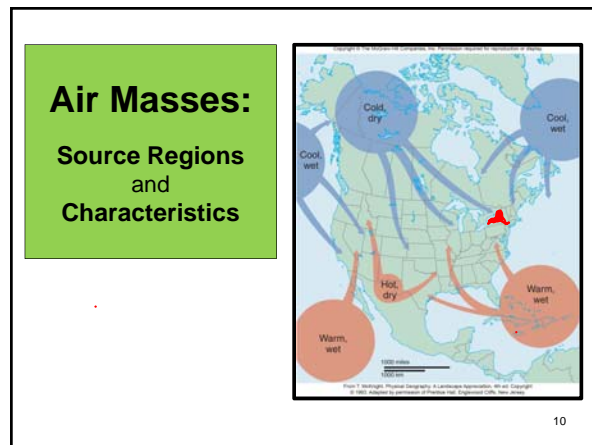
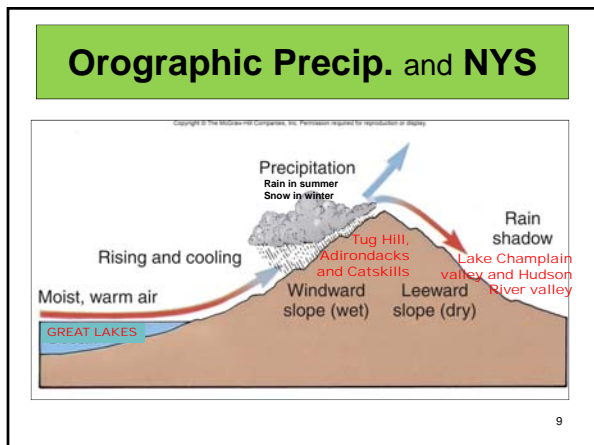
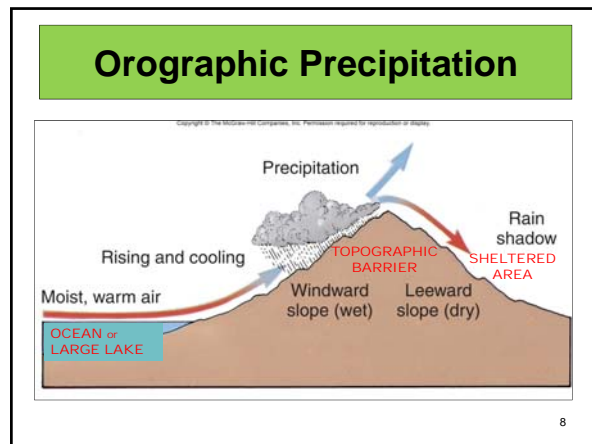
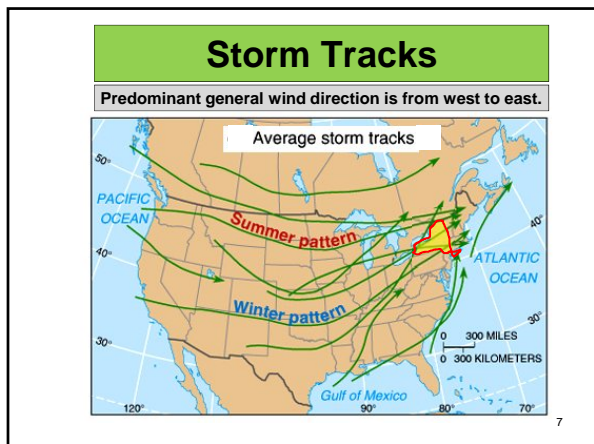
- Humid Continental** climate except for the SE portion (NYC and LI) where it is **Humid Subtropical**.
- Generally cool to hot summers and warm to very cold winters.**
- Statistically, it has been on average warmer since 1950s and wetter since the 1970s.**
- Predominant wind** direction is from the west.
- Regional temperature/precipitation is influenced by relative location** (elevation/wind facing/water bodies).
- No dry season.** Frontal precipitation year-round.
- Greatest storm hazard is heavy snow.** Thunderstorms affect the state in summer; "Nor'easters" in winter. Hurricanes and tornados are rare.
- Microclimates** develop in valleys, urban areas and other unique areas.

Extra credit Exercise 8:
Air Quality and Wind Power

Climate Controls

The development of a climate is influenced by a combination of factors. NYS has them all!

- Latitude** – amount of solar energy received
- Surface** (land or water) – heat exchange
- Ocean Currents** – temperature; flow direction
- Wind** – direction; characteristics
- Topographic Barriers** – orientation; height
- Elevation** – lapse rate (1°F for each 300 ft change in elevation)
- Air Masses** – source region; characteristics



The Nor'easter



The waters of the U.S. East Coast provides an ideal breeding ground for coastal storms.

The polar jet stream transports **cold Arctic air** southeastward toward the Atlantic Ocean where **moist warm air** is moving north along the Gulf Stream.

This difference in temperature between the warm air over the water and cold Arctic air over the land creates a **low pressure cell** that intensifies in rotation and is the "fuel" for Nor'easters.

The counterclockwise rotation sends wind-blown moisture inland from a northeast direction, hence the name.

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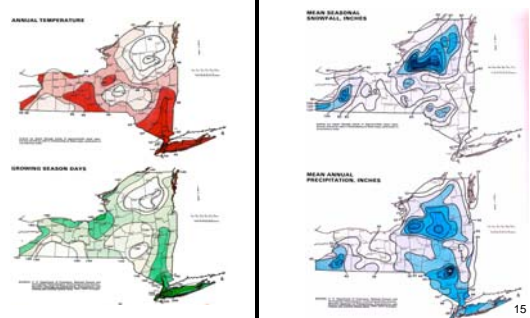
Microclimates

❖ **Microclimates develop locally due to changes in an area's physical characteristics.**

- **Rural areas** – from changes in the biosphere local conditions change as an area goes from forest to large farm to suburb and malls.
- **Urban areas** – from artificial conditions
 - Concrete and asphalt surfaces (warmer)
 - Limited soil and vegetation (less humid)
 - Tall buildings (shadows and wind channels)
- **Temperature inversions** – created when air temp increases with elevation instead of decreasing
 - Frequently occurs in N-S trending valleys.
 - Warm air "cap" prevents the rising air from mixing with upper level air, keeping valley air (and any pollutants) within the valley.

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Present-day Patterns of Temperature and Precipitation

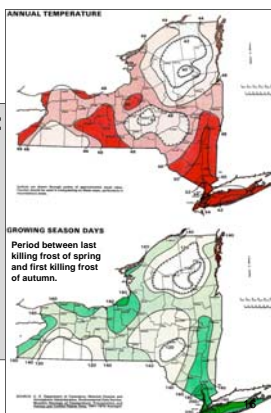


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Temperature

Temperature varies with:

- **Latitude** (about 1°F for each degree of latitude).
- **Altitude** (about 1°F for each 300 ft of elevation or 3½°F for each 1,000 ft of elevation).
- **Bodies of water** (water is slow to heat up and slow to cool down).

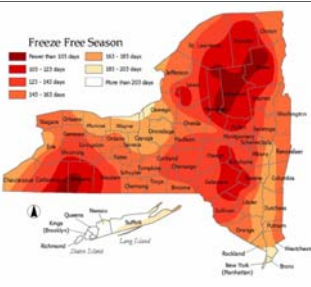


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Freeze Free Season


The **"freeze free"** or **"frost free"** season is the period in days between the last killing frost of the spring and the first killing frost of the autumn.

It is especially important for agricultural activities (length of growing season) as well as other outdoor venues that require temperatures above freezing.



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USDA Plant Hardiness Zones in NYS



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Precipitation

Precipitation varies with:

- **Elevation** (orographic cooling)
- **Wind-facing slope** (windward = wet side; leeward or rain shadow = dry side)
- **Source areas** (weather fronts, evaporation from lakes and ocean)
- **Atmospheric heating and cooling** (evaporation and orographic cooling)

Lake-effect Snowfall

Upstate New York digs out after 10 days of heavy lake-effect snow; another storm on the way.

Posted: 02/12/07 at 7:10 pm

REDFIELD, N.Y. -- The lake-effect squalls that have buried parts of upstate New York in nearly 12 feet of snow finally ended Monday, leaving road crews with the task of clearing snow piled as high as street signs.

The squalls pushed along the shore of eastern Lake Ontario, leaving behind up to three inches of new snow before tapering off. Forecasters warned that another storm system was on the way.

Redfield received 11 feet, 9 inches of snow, but residents were unfazed in a community where the economy thrives on snowmobilers and cross-country skiers. The area receives an annual average of more than 22 feet (270 inches).

Oswego Snowfall

11 feet of snow received over 8 days in February 2007

2007 Oswego Co. Record Snowfall

Windward slope of Tug Hill Plateau

Month	Record	Year
Jan	147"	1954
Feb	107"	1957
Mar	107"	1957
Apr	107"	1957
May	95"	1954
Jun	95"	1954
Jul	95"	1954
Aug	95"	1954
Sep	95"	1954
Oct	95"	1954
Nov	95"	1954
Dec	95"	1954
Annual	1407"	1954

“Incomplete records prevent the National Weather Service from calling the **11 feet, 9 inches** of snow that fell in this upstate village over the past ten days an official record, **but it does beat the 10 feet, 7 inches** that fell in nearby **Montague over seven days ending Jan. 1, 2002.**”

Democratic Underground, 2/13/07

Redfield received 21 feet of snow between October 2006 and February 2007 and 11+ feet from the Feb. 3-11, 2007 in a series of snow squalls off Lake Ontario.

Lake-effect Snow

Lake Effect Snow Formation

Warmer Air

Capping Inversion

Arotic Air

Heat and Moisture

Cool land

Warm Lake

Cool land

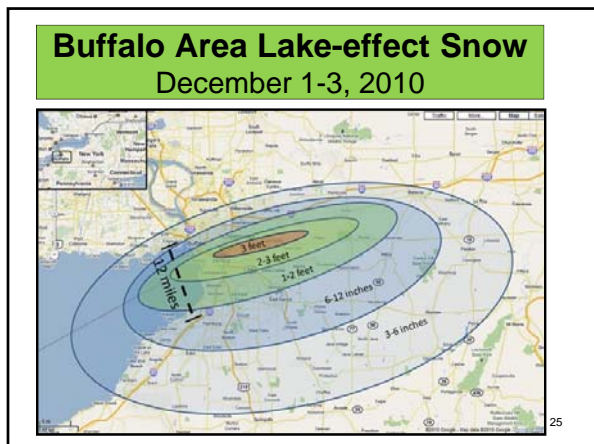
Lake-effect snowstorms can last for many days over a local area.

October, 2006 Lake-effect Snowstorm over Buffalo, NY

Snowfall Map

Satellite View

RECORD: 23 inches of snow in two days in middle October 2006.



Climate Change

- ❖ Climate variation is a natural phenomenon.
- ❖ The Earth has experienced numerous periods of natural **global cooling** and **global warming**.
- ❖ Current global warming experience is unique.
 - a) It is human-induced.
 - b) Visible change is happening quickly.
 - c) It is being closely monitored – statistically.

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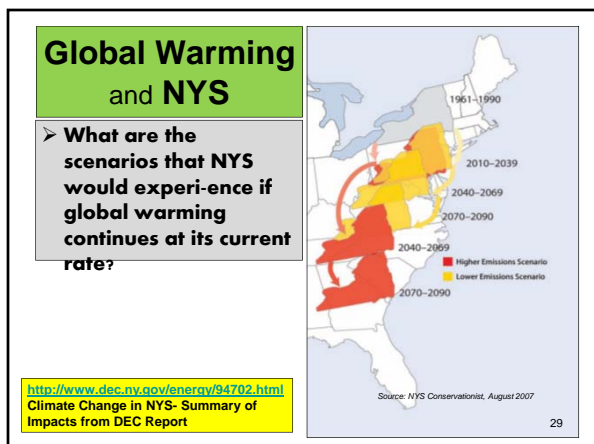
Global Warming and Repopulation

As soon as glacial ice left an area, **plants then animals return to repopulate the area**, even though it was still very cold (tundra conditions).

Nearly complete skeletons of large animals, preserved in lake mud from c.10,000+ yrs ago, have been found in various areas of the state. (Cohoes, Watkins Glen, Hyde Park and in Orange County.)

<http://exhibitions.nysm.nysed.gov/cohoesmastodon/>

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Global Warming and NYS

Habitat disruption/destruction:

- ✓ NYS's 'equivalent' earth position will move toward the equator as the earth warms.
- ✓ "Southern state" flora and fauna will move into NYS.
- ✓ "NYS biomes" will exist in southern Canada – current wildlife will move north.
- ✓ Drought/wildfire/heat waves

Source: NYS Conservationist, August 2007

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Global Warming and NYS

Changes to the physical environment:

- ✓ Winter storms will increase in number/intensity.
- ✓ The number of snow storms will increase.
- ✓ Increased numbers of mass movements - mudflows, landslides and avalanches – in upland areas
- ✓ Quality of surface water supplies may be compromised due to increased runoff, turbidity and sedimentation... therefore increasing the cost to provide clean water.

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Global Warming and NYS

Health-related aspects:

- ✓ Air quality will be affected: ozone, asthma, pollen, CO₂.
- ✓ Heat-related illnesses will increase: heat-stroke, heart attack, etc.
- ✓ Non-native vector-borne diseases will appear: transmission by new species, as mosquitoes and ticks, and bacteria/viruses able to survive in a warmer setting.

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Global Warming and NYS

Economic aspects:

- ✓ Areas of SE NYS and the Hudson valley - north to Albany - will be prone to **periodic tidal and storm surge flooding** and eventually they will be under water.
- ✓ Coastal areas will see **greater wave erosion**.
- ✓ **Infrastructures will have to be adapted to different conditions:** retrofitting buildings, forestry, agricultural products, ski areas, coastal properties, flood control, transportation networks, power production, etc.

❖ What will be the “monetary cost” of global warming?

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RECAP: Nature of Global Warming on NYS

1. Shrinking glaciers/rising sea level
2. Ecosystem destruction/ecosystem replacement
3. Loss of biodiversity/introduction of replacement species
4. Heat waves in summer with poorer air quality
5. Warmer winters with more storms, both rain and snow
6. Increase in severe storms (hurricanes, flooding rains, blizzards)
7. Drought and wildfire from uneven precip. and hot temps.
8. Economic consequences
9. Increased demand for energy in summer (A/C and refrigeration)
10. Agricultural production will change (products /shipping)
11. Increased occurrences of mass movements with more rain
12. Coastal evacuations, loss of property, cost repair
13. Quality of water supplies may be adversely affected runoff
14. Spread of warm weather diseases poleward and upslope

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The Nature of New York

NEXT TIME:

WATER RESOURCES

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