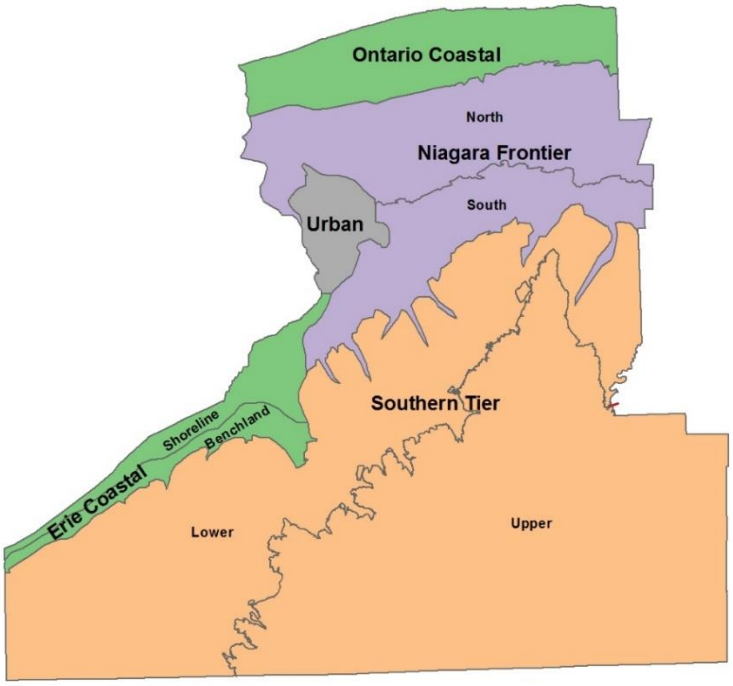
Stephen Vermette Department of Geography & Planning, SUNY Buffalo State vermetsj@buffalostate.edu

Western New York's (WNY's) Five Climate Zones

Stephen Vermette
Department of Geography & Planning
SUNY Buffalo State



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GEOGRAPHY & PLANNING
BUFFALO STATE

WEATHERING CHANGE
IN WESTERN NEW YORK

DESIGNING SUSTAINABLY

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INTRODUCTION

Western New York (WNY) is a political region defined here collectively as the eight westernmost counties of New York State (NYS): Niagara, Erie, Chautauqua, Cattaraugus, Allegany, Wyoming, Genesee, and Orleans (Figure 1). The characterization of the region's climate is often based on aggregate weather data collected at the National Weather Service (NWS) weather station located on the grounds of the Buffalo-Niagara International Airport (KBUF). And while it may loosely be considered to represent a regional average, this station does not convey the region's climate variability. Where climate variability is reported, using cooperative sites, other networks, weather radar, and observation, it is reported at the county level.

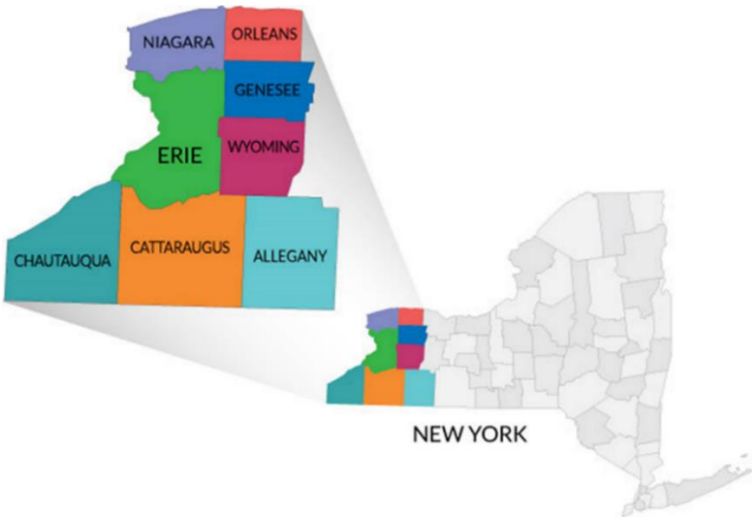


Figure 1: The Eight Counties of Western New York (WNY) (Image Source: unknown).

It is widely recognized that the study of a region's natural characteristics and boundaries are not confined by political boundaries and are not effectively defined by them. By way of example, the study of rivers and other water-related resources are delineated by 'watersheds', a 'habitat' defines the natural environment of an animal, and an 'airshed' describes a part of the atmosphere exposed to similar pollutants. This same approach – avoiding political boundaries − should apply to climate. The objective of this report is to characterize and define the climate of WNY, not by a single weather station nor by political boundaries, but rather by identifying local climate controls and establishing natural climate boundaries to identify unique climate zones within WNY. The only non-climate related boundaries used in this report is the outer most boundary, used to delineate the overall region.

A description of the Climate Zones (skipping the methodology and validation descriptions) can be found starting on page 8.

WNY's CLIMATE HETEROGENEITY

Weather is defined as atmosphere conditions (hotness or coldness, calm or stormy) at a place, over a short period of time, whereas climate is defined as the aggregate of weather (averages and extremes), for a given location, over an extended period of time. The standard period for climate description is 30 years, referred to as a 'Normal'. A simple way to separate weather and climate is to consider the aphorism *"climate is what you expect, and weather is what you get"* (attributed to Robert Anson Heinlein, an

American novelist and science fiction writer), or as one of Mark Twain's students remarked, *"Climate lasts all the time and weather only a few days".*

The climate of WNY is characterized as a mid-latitude warm-summer, humid continental climate (Dfb), based on the Köppen climate classification criteria – a global classification developed by Wladimir Köppen using vegetation boundaries to identify boundaries. Dfb is a type of climate typically found in the interior of a continent, north of latitude 40°N. Another term is 'Hemiboreal' which refers to an ecosystem and climate occurring halfway between the temperate and subarctic zones.

The classification of global climates, whether using the Köppen Climate classification, or other approaches such as the characterization of air masses, provide a broad-brush approach to classification, suitable on a global scale. However, the Dfb designation does not take into consideration the heterogeneous nature of the WNY region. WNY is bounded by two Great Lakes (Erie and Ontario) which moderate near-shore temperatures. Contrasting lake/land temperatures, prevailing southwest winds, and lake-land breezes mute the frequency and intensity of extreme heat and generally keep temperatures cooler in the spring/early summer and warmer in late summer/autumn than inland locations. Lake-induced atmospheric stability in the spring brings more sunshine and fewer thunderstorms to near-shore and downwind locations, while lake-induced instability brings more cloud cover and precipitation in the late summer/autumn. Over half of WNY's annual snowfall comes from the 'lake effect' process – Lake Effect Snow (LES) – with locations in the region's southern areas receiving much more lake effect snow than locations to the north.

The Dfb definition of WNY's climate also does not consider the rolling higher elevations in the southern counties of WNY where the terrain is an extension of the Allegany Plateau. The Allegany Plateau is dissected by numerous valley and hills, with maximum elevations of 2,400 to 2,500 ft above sea level (asl). These higher elevations bring cooler temperatures and additional LES to the region, as compared to other WNY locations. In addition, down-sloping southerly winds moving across the Allegany Plateau bring enhanced warming to the lower elevations north of it, attributed to adiabatic warming (decreasing altitude increases pressure, and heats air).

The Dfb definition of WNY's climate also does not consider the impact of large urban areas on climate (i.e. the City of Buffalo). The 'Urban Heat Island' describes an urban area that is consistently warmer than surrounding rural areas, the urban warming enhanced by the concentration of waste heat, building materials (e.g. asphalt, brick, cement) that effectively absorb and later release heat, and the lack of evaporation (a cooling process) attributed to the redirecting of rainwater by storm sewers.

CREATING LOCAL CLIMATE ZONES

For the purposes of this study, we considered the influence of local 'climate controls' in defining WNY's climate zones. Four climate controls were considered: 1) elevation, where places at higher elevations would be expected to be cooler than places located at lower elevations, and winds passing over elevated terrain will cool as they rise, and warm as they descend; 2) proximity to large bodies of water, as lakes moderate climates and promote clouds, rainfall, and snow; 3) prevailing winds; and 4) population density (urban area), where concentrated human activity creates an urban heat island effect.

Constructing WNY's climate zones first involved mapping the shoreline boundaries of Lakes Erie and Ontario. WNY's terrain ranges in elevation from 237 ft (above sea level: asl) along the Lake Ontario shoreline to 2,500 ft asl in the Allegany Plateau. Elevational boundaries were initially defined by the 500

ft contour, delineating the Niagara Escarpment, and the 1000 ft contour delineating the Chautauqua Ridge in Chautauqua County, and the Portage Escarpment east into Erie and Genesee Counties. Two additional elevational boundaries were added after superimposing climate data as part of a validation process. These two additional boundaries included the Onondaga Escarpment and the 1,500 ft asl elevation contour (Figure 2). A boundary for the urban zone was defined from an image acquired using enhanced thematic mapping on NASA's Landsat 7 Satellite (Figure 3).

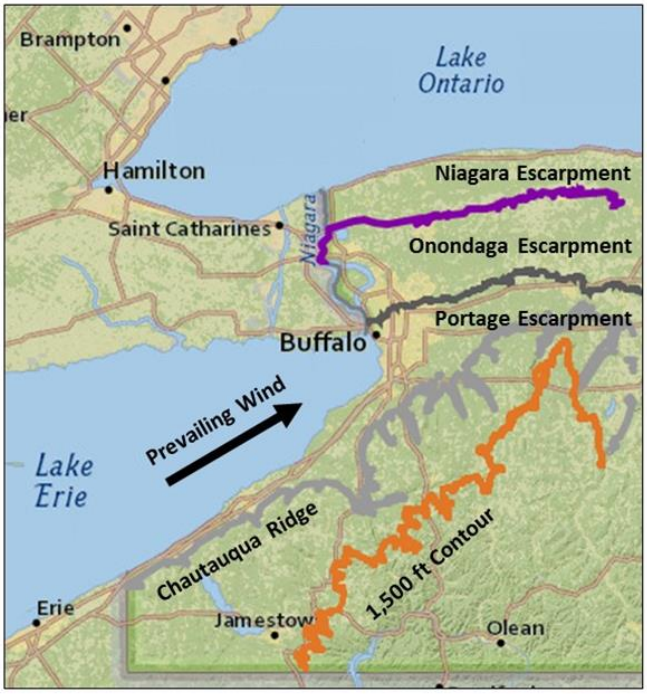


Figure 2. Climate controls, including the Lakes Erie and Ontario shorelines, Niagara Escarpment and Chautauqua Ridge, Prevailing Winds, and the City of Buffalo.

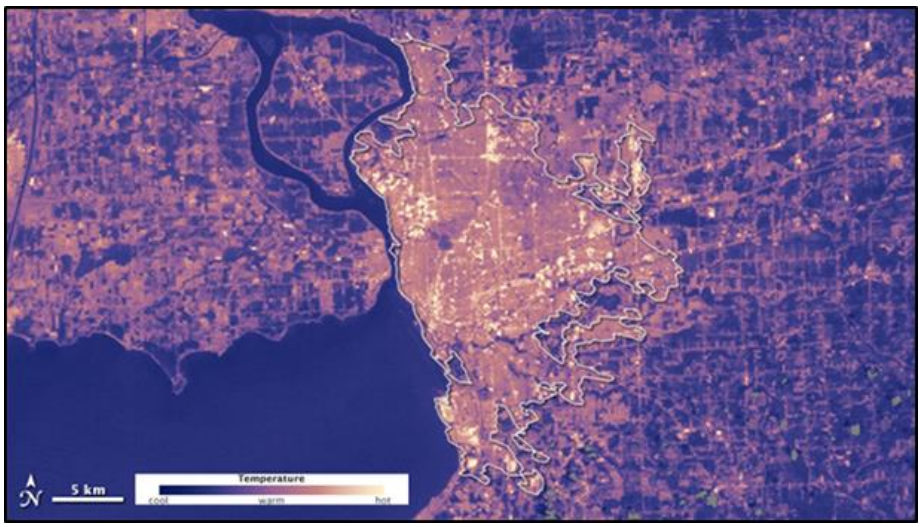


Figure 3: Buffalo's urban heat island. Image acquired on August 3, 2002 from enhanced thematic mapping on NASA's Landsat 7 satellite.

Modeled climate data and USDA plant hardiness zones (PRISM data), using the 1981-2010 Normal, were superimposed over the controls to validate these boundaries and to characterize the climate within each zone. These long-term average datasets were modeled using a digital elevation model (DEM) as the predictor grid. Individual weather station data obtained through the National Weather Service (NWS) Cooperative Observer Program (COOP) were used to further validate the modeled data and climate zones. The maps used in this report are map overlays created by this author, based on originals created by Mary Perrelli (Department of Geography & Planning at SUNY Buffalo State) for a GIS course module "Climate Classification Based on Climate Controls" (http://arcg.is/2tSIvoJ).

INITIAL CLIMATE ZONES

Constructing Climate Zones (Initial Attempt)

Based on the initial controls, five WNY climate zones were delineated: Ontario Coastal, Erie Coastal, Niagara Frontier, Urban, and Southern Tier (Figure 4).

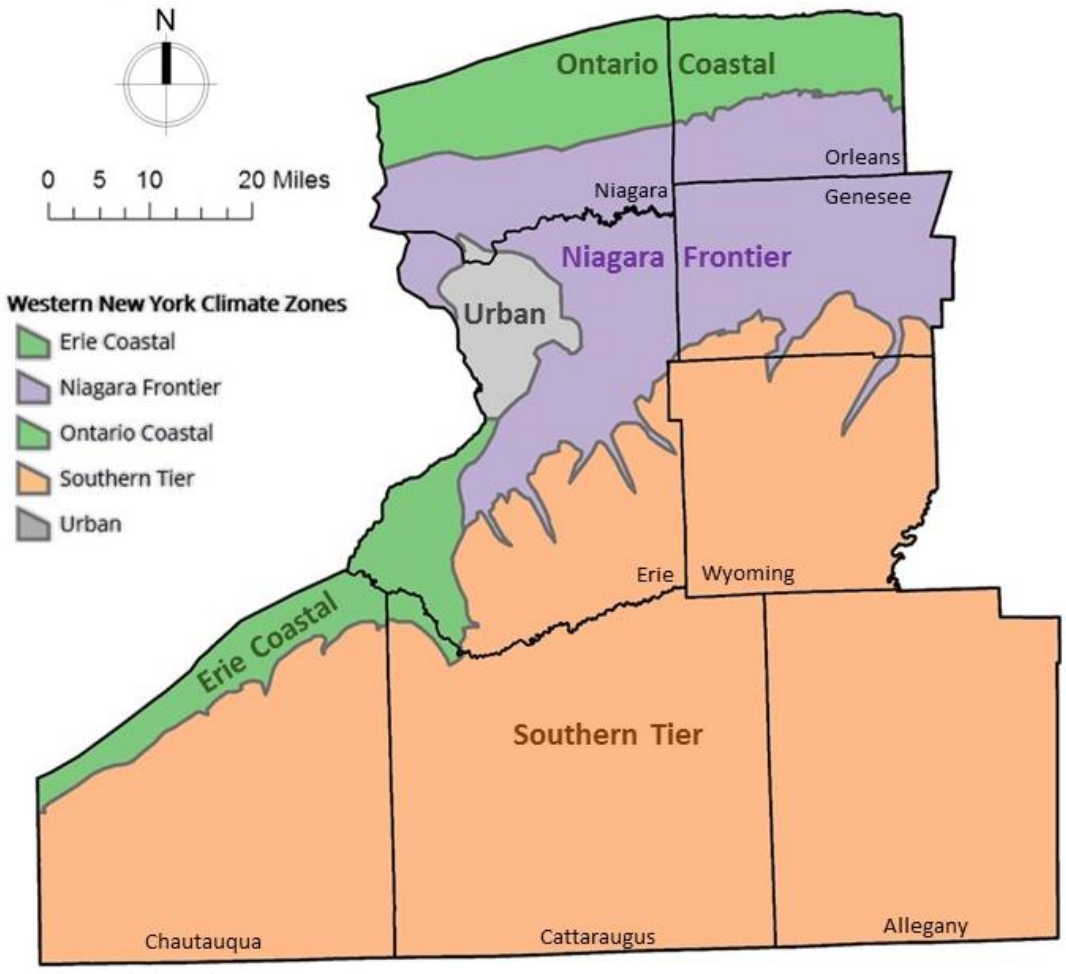


Figure 4. WNY's five climate zones. County boundaries are shown for reference.

Temperature Validation

Annual and seasonal temperature data, using the 1981-2010 Normal obtained from PRISM, were superimposed on the proposed climate zones. The temperature data show a good fit with the initial boundaries, with some exceptions (Figure 5).

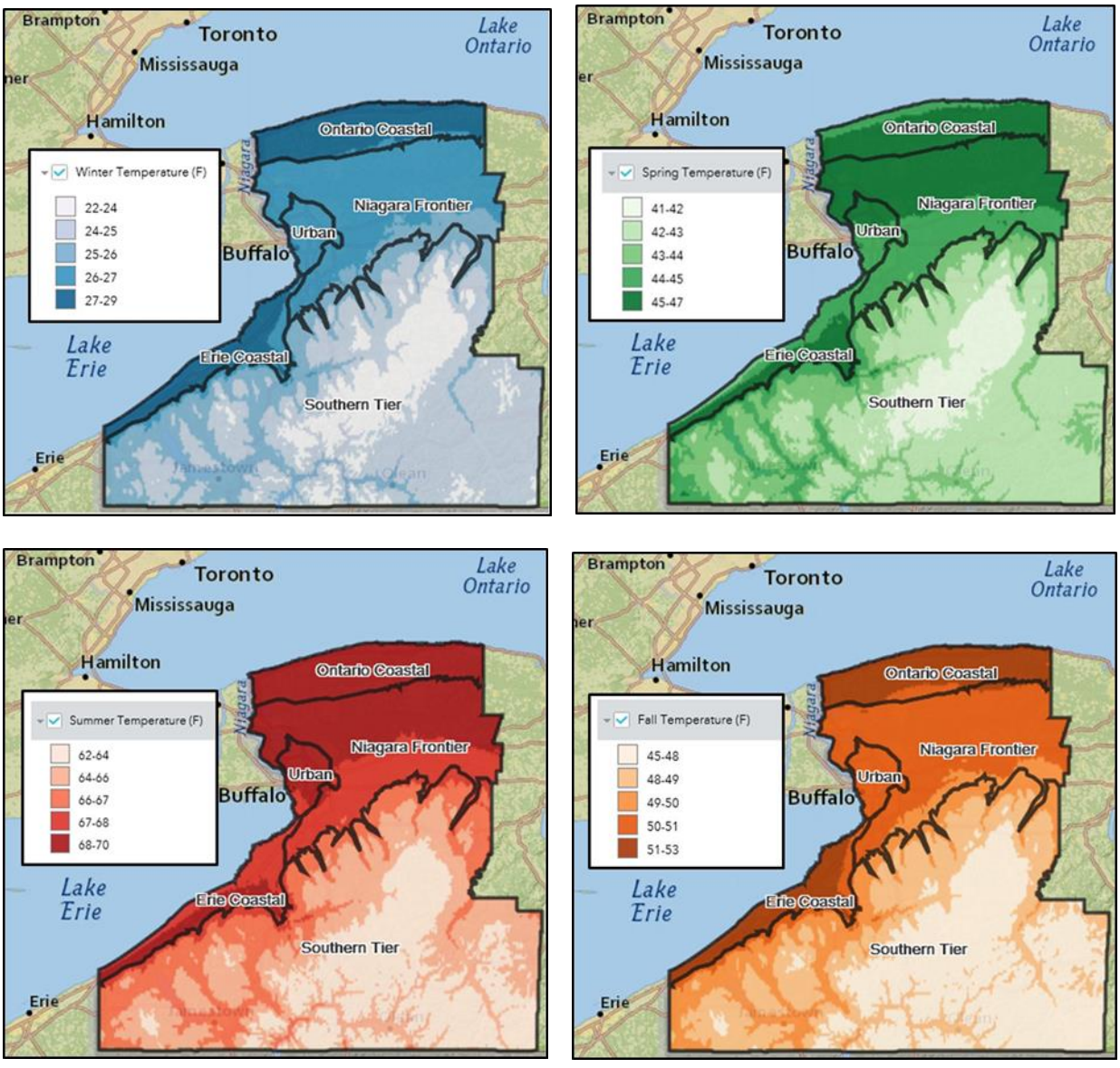


Figure 5. Seasonal temperature data (PRISM data) superimposed on WNY's five climate zones.

The 1,000 ft contour appears to be a good boundary, separating the Southern Tier climate zone from the Niagara Frontier and Erie Coastal zones. The 500 ft contour boundary (Niagara Escarpment) separates the Ontario Coastal and Niagara Frontier climate zones during the winter and fall seasons but does not appear for the spring and summer seasons. In spring, the influence of Lake Ontario appears to be confined to a narrower near-shore zone, while this zone disappears altogether during the summer months. This narrow spring cold zone is also apparent along the nearshore of the Lake Erie Coastal zone, with a graduated

warming occurring further inland, until reaching the Chautauqua Ridge. In both spring and summer, the Niagara Frontier zone appears to be bifurcated − the northern section exhibiting warmer temperatures than that of the southern. This temperature boundary appears to align with the Onondaga Escarpment, which is less prominent than the Niagara Escarpment. This 'hard' boundary may be a relic of PRISM modeling. It is more likely that a broader north-south temperature gradient exists, reflecting a down-sloping terrain. In addition, the Southern Tier appears to include internal differentiation, based on higher elevations.

The temperature data does not appear to identify an Urban zone, with the possible exception of spring and summer where warm temperatures show in the north of the urban area and, as in the case of summer, dip further south within the Urban zone. PRISM data likely does not include a sufficient number of weather stations to differentiate the urban heat island from its surrounding rural area.

Precipitation Validation

Annual and seasonal temperature data, using the 1981-2010 Normal obtained from PRISM, were superimposed on the proposed climate zones (Figures 6). The precipitation data shows a reasonable fit, although the relationship is not as strong as that of the temperature data.

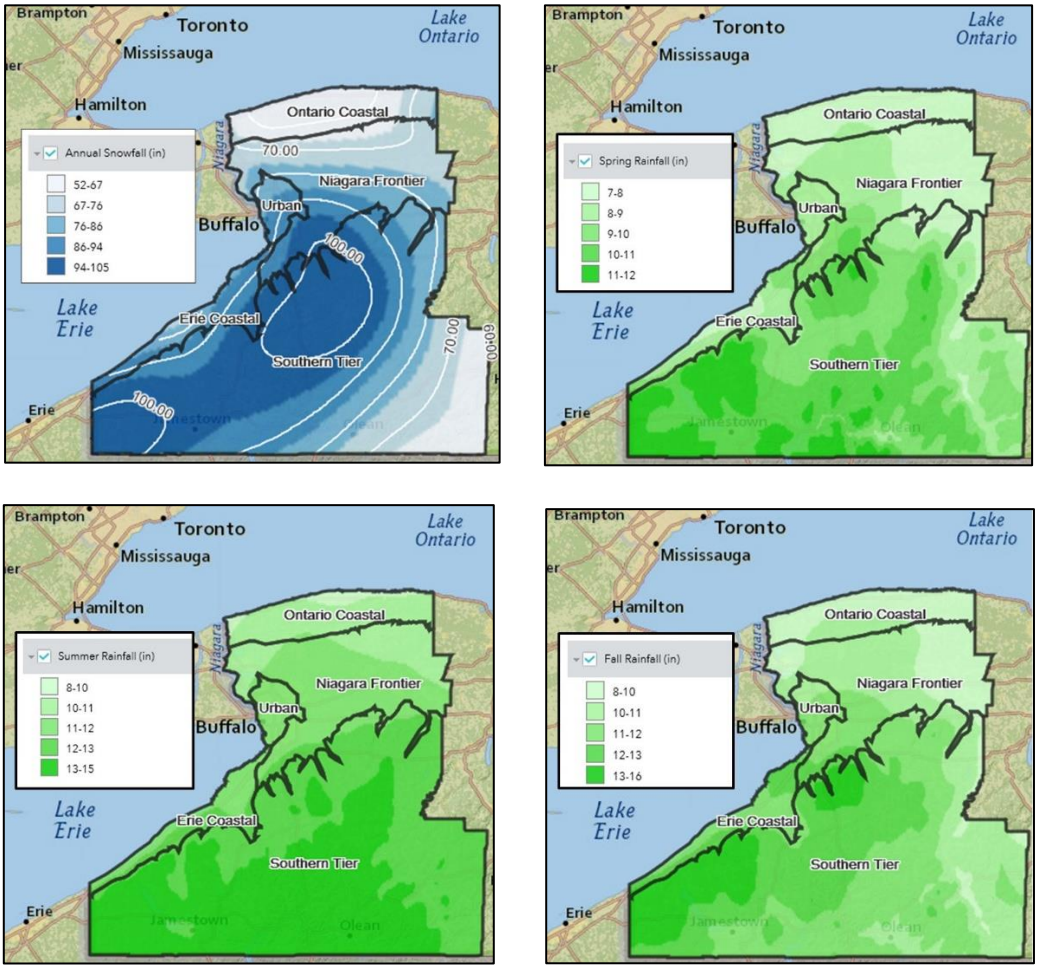


Figure 6. Seasonal Precipitation data (PRISM data) superimposed on WNY's five climate zones.

A north-south and east-west precipitation gradient clearly exists in WNY, where rain and snow increase as one travels south, and decreases to the east. The 1,000 ft contour appears to be the boundary confining the higher precipitation (annual and seasonal) to the Southern Tier climate zone. The precipitation contrast at the Southern Tier and Erie Coastal boundary is most striking at the 1,000 ft contour along the Chautauqua Ridge. The 500 ft contour (Niagara Escarpment) also appears to be a boundary, delineating the lesser precipitation, especially snowfall, that occurs north of the Escarpment.

The Urban Zone does not show an urban-influenced precipitation pattern. In addition, a general decrease in precipitation appears on the eastern edge of the Ontario Coastal, Niagara Frontier, and Southern Tier climate zones. This decrease may be explained, at least in part, by distance from Lake Erie. Moisture obtained from Lake Erie instability, falling as rain or snow downwind, appears to dissipate with distance from the lake.

Local Vernacular Validation

When providing weather forecasts and weather-related watches, warnings, and advisories, the NWS delineates along county boundaries. One exception is Erie County, which is often subdivided into a northern and southern section. This division, it can be assumed, is based on accumulated weather-related observational experience. This division generally reflects the separation of Erie County in this study, placing northern Erie County in the Niagara Frontier zone, and southern Erie County in the Southern Tier zone, bisected by the 1,000 ft contour. In addition, forecast wording couched as “warmer or cooler near the lake” (dependent on season) or use of the well-established geographic monikers ‘southtowns’, ‘northtowns’, and ‘ski-country’, generally reflect the climate zone boundaries established in this study.

REVISED CLIMATE ZONES

Climate Zone Adjustments

While the climate zones held up based on initial climate controls, there were variations, as noted in the validation discussion, which required some tweaking of boundaries. This was done by either noting the seasonality of the climate zone, as for the Ontario Coastal (OC) zone (confined near the shoreline in spring and absent in summer), or by establishing subzones, as for the Niagara Frontier (NF), Erie Coastal (EC), and Southern Tier (ST) zones (Figure 7)

The Urban zone, as previously noted, is shown to be warmer than the surrounding countryside based on a NASA Landsat image, but the PRISM data likely did not include a sufficient number of weather stations to differentiate the Urban zone from the surrounding Niagara Frontier and Erie Coastal zones.

To address this, a ‘quick study’ was undertaken utilizing 2016 and 2017 temperature data obtained from Weather Underground personal weather stations (PWS) located within the urban area. A comparison was obtained by subtracting the average temperatures of each zone and subzone from the Urban zone (Table 1). As shown in Table 1, the Urban zone, with one exception (a comparison of winter temperatures with Erie Coastal showing no difference), was repeatedly warmer than the other climate zones, including the Niagara Frontier. These temperature differences reinforce the Urban zone as a unique climate zone within WNY. This scaling was used, in part, to quantify 1981-2010 temperatures and precipitation within the Urban climate zone.

Table 1. Personal Weather Station (PWS) temperature data (°F) from 2016 and 2017. Values shown are differences taken from Urban climate zone weather stations.

Zone	Winter	Spring	Summer	Autumn	Annual
Niagara Frontier	+1.5	+1.0	+1.1	+1.4	+1.3
Ontario Coastal	+0.9	+1.3	+0.4	+0.2	+0.7
Erie Coastal	0.0	+0.5	+1.3	+0.3	+0.6
Southern Tier	+2.5	+1.1	+2.5	+2.6	+2.2

The mapped PRISM temperatures were not adjusted for the Urban annual, spring and summer seasons – here the Urban zone temperatures should be considered at the upper limit on the mapped scale. The winter and autumn mapped PRISM temperatures were adjusted upward to match the Erie Coastal and Ontario Coastal climate zone temperatures and, as with the case of the other seasons, should be considered at the upper end of the scale. No adjustments were made for the PRISM precipitation values.

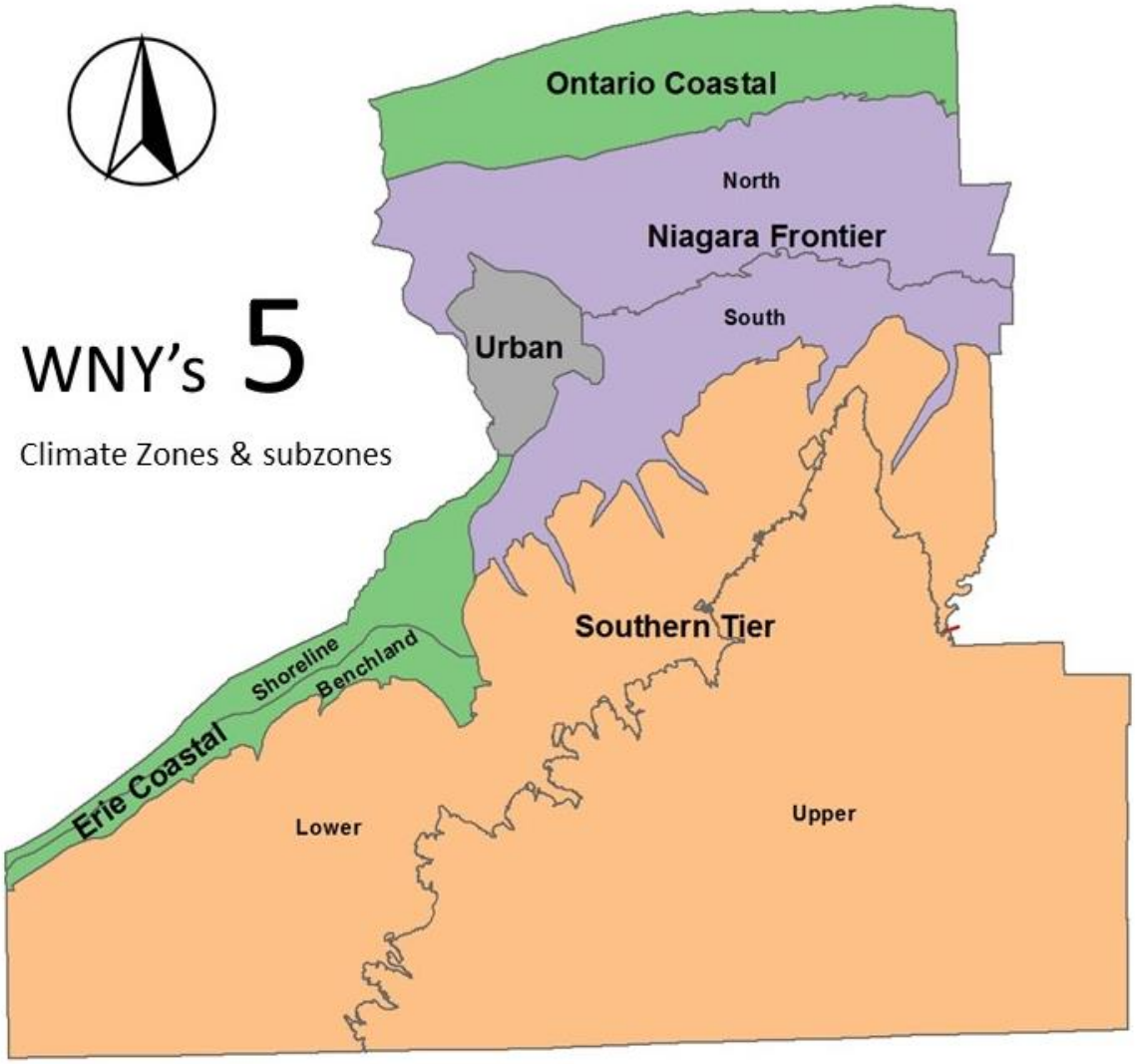


Figure 7: WNY's Climate Zones and Subzones.

DESCRIPTION OF WNY's CLIMATE ZONES

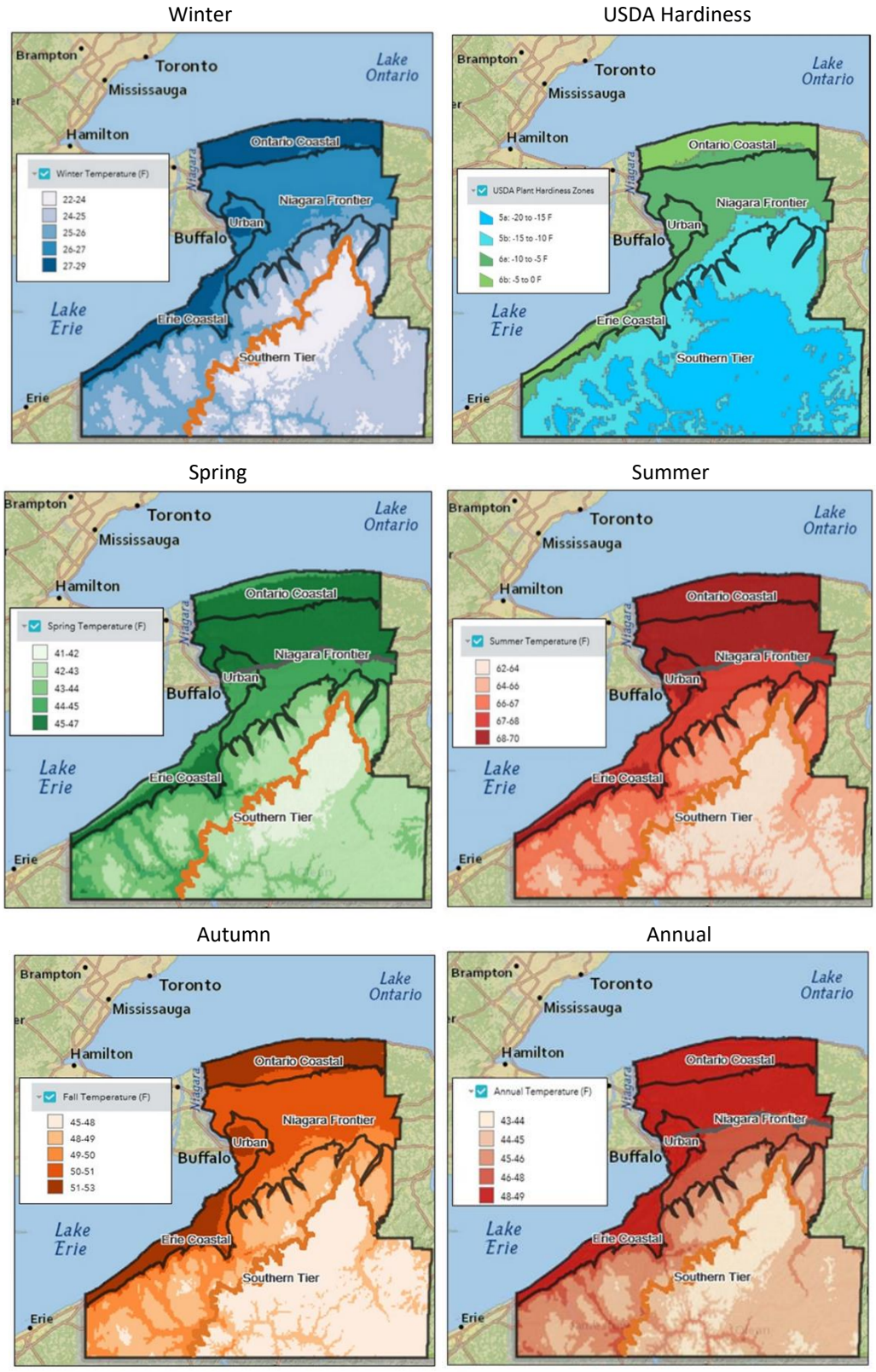
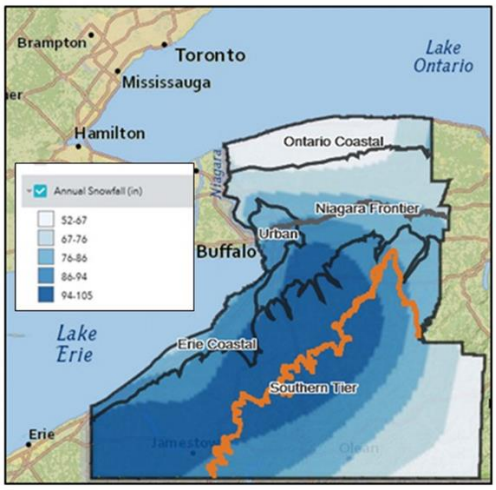
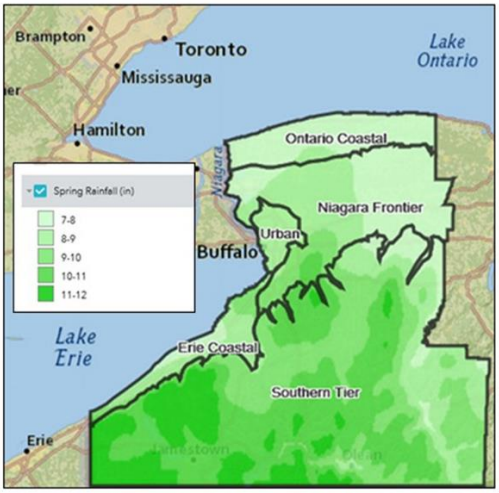


Figure 8. Season, annual, and hardiness zone temperatures superimposed on WNY climate zones and subzones.

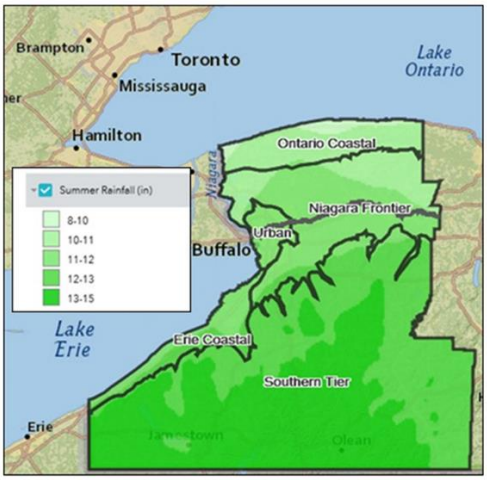
Winter (snow)



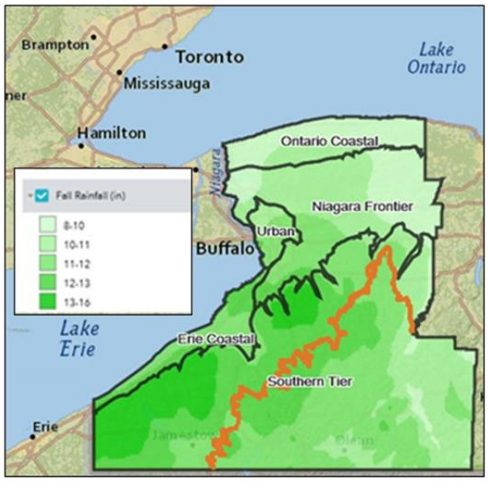
Spring



Summer



Autumn



Annual

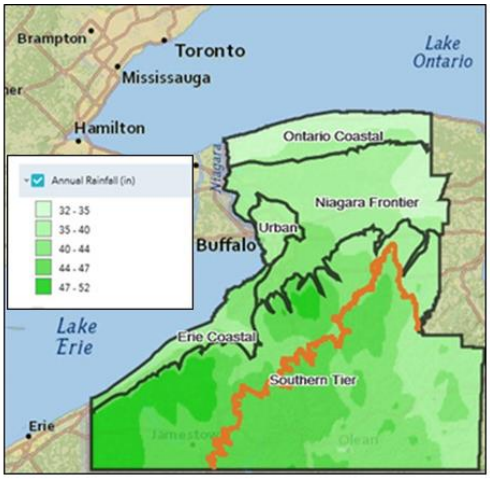


Figure 8. Season and annual precipitation (snow) superimposed on WNY climate zones and subzones.

Ontario Coastal (OC)

In Brief	Size and presence vary with seasons. Most fully present in the autumn and winter, restricted to a narrow strip along the shoreline in the spring, and all together absent in the summer. Experiences the warmest autumn and winter seasons (comparable to Erie Coastal and Urban), and the least amount of precipitation (rain and snow).

The Ontario Coastal (OC) zone is WNY's northern most climate zone, bounded to the north by the Lake Ontario shoreline and to the south by the Niagara Escarpment. The western and eastern boundaries are political ones − the western boundary is delineated by the Niagara River (western boundary of Niagara County), while the eastern boundary runs along Orleans County's eastern edge.

Temperature in the OC zone are, for the most part, moderated by proximity to Lake Ontario (cooled in the spring and warmed in the autumn and winter seasons), but its presence and size is seasonal (Table 2). The OC zone is most fully present (boundaries as described above) in the autumn and winter seasons (including USDA Hardiness Zone extreme temperatures). The autumn and winter temperatures are comparable to 'Erie Coastal' and, together, both zones represent the warmest autumn and winter temperatures of WNY.

In the spring season, the OC zone is confined to a narrow strip along the Lake Ontario shoreline, and is all together absent in both the summer and when expressed as an annual average. It is during these periods that temperatures appear as an extension of the northern section of the 'Niagara Frontier' climate zone. In these two cases, the Niagara Escarpment does not appear as a climate control – a climatological boundary.

Ontario Coastal experiences the least precipitation (rain and snow) of any other WNY climate zones. Snowfall is dominated by synoptic events with some Lake Ontario generated lake effect, but the OC zone generally escapes Lake Erie's lake effect snow bands.

Table 2. Ontario Coastal zone temperature and precipitation.

Ontario Coastal	Temperatures (°F)	Precipitation (inches)
Winter	27 to 29	52 to 67 (snow)
USDA Hardiness	-5 to 0 (6a)	n/a
Spring	51 to 53	7 to 8
Summer	67 to 68 (extension of NF Zone)	10 to 11
Autumn	51 to 53	8 to 10
Annual	46 to 48 (extension of NF Zone)	32 to 35

Southern Tier (ST)

In Brief	WNY's largest climate zone, bifurcated into a 'lower' and 'upper' subzones based on elevation. WNY's coolest and wettest climate zone. Experiences the greatest spatial temperature and precipitation variability of any WNY climate zone.

The Southern Tier (ST) zone is bounded by the Chautauqua Ridge to the west (running along a SW to NE axis) and the extension of the Portage Escarpment to the north, running east to west following the 1,000-foot contour line. The southern and eastern boundaries are political − New York's border with Pennsylvania and the eastern boundary of Allegany County, respectively.

The ST zone is influenced primarily by elevation (> 1,000 feet), as well as by prevailing winds (SW, WSW) off Lake Erie. Temperatures are generally cooler on hill tops and warmer in valleys. The 1,000-foot contour (elevations greater than 1,000 feet) precisely delineates the ST zone, especially along the Chautauqua Ridge (referred to as the 'Lower' subzone). However, a separate cooler subzone may be defined within the ST zone, delineated by the 1,500-foot contour (elevations greater than 1,500 feet) located within the Southern Tier center and to the east (referred to as the 'Upper' subzone). Overall, the ST zone experiences the coolest temperatures and greatest spatial temperature variability of any WNY climate zone.

The ST zone experiences the most precipitation of any of the WNY climate zones due, in part, to lake effect rain and snow off of Lake Erie, and to orographic lifting. The greatest amount of precipitation consistently occurs just to the east of the Chautauqua Ridge, decreasing progressively eastward and southeastward, while the summer season exhibits a more uniform rainfall distribution. The precipitation gradient is most pronounced for snow, where about half is lake effect snow formed off Lake Erie. The lower and upper subzones crudely delineate the decreasing eastward precipitation, but elevation is not the dominant control here, rather it is distance − the loss of moisture with increasing distance from Lake Erie. This intensification, just east of the Chautauqua Ridge, can be attributed to prevailing winds off Lake Erie and orographic lifting (spring and early summer), and to the generation of lake effect rain and snow (autumn and winter). Spring experiences the least amount of rainfall, while summer and autumn exhibit greater amounts.

Table 3. Southern Tier zone temperature and precipitation.

Southern Tier	**Temperature (°F)**		**Precipitation (inches)**	
	Lower	**Upper**	**Lower**	**Upper**
Winter	24 to 26	22 to 24	86 to 105 (snow)	42 to 105 (snow)
USDA Hardiness	-15 to -10 (5b)	-20 to -15 (5a)	n/a	n/a
Spring	42 to 44	41 to 42	9 to 12	9 to 11
Summer	64 to 67	62 to 64	12 to 15	12 to 15
Autumn	48 to 50	45 to 48	12 to 16	10 to 12
Annual	44 to 46	43 to 44	44 to 52	35 to 44

Niagara Frontier (NF)

In Brief	Represents a temperature and precipitation transition between the Southern Tier (ST) and Ontario Coastal (OC) zones. The NF zone is bifurcated into 'northern' and 'southern' subzones, where the boundary between the two zones is not set (represents a transition) which, depending on seasons, may not be apparent. The northern NF zone generally tends to be drier than the southern zone and the southern subzone experiences substantial lake effect snow.

The Niagara Frontier (NF) zone is sandwiched between two escarpments: the Niagara Escarpment (500-foot contour) to the North and the Portage Escarpment (1,000-foot contour) to the south. The western boundary abuts two climate zones: Erie Coastal and Urban, as well as the Niagara River, while the eastern boundary is defined by the eastern boundaries of Orleans and Genesee counties.

The NF zone is primarily influenced by elevational down-sloping (decreasing elevations from South to North) between the two escarpments, and SW prevailing winds which pass over Lake Erie. The average

temperature of this zone conforms to the prescribed boundaries (as above) in the autumn and winter seasons, as well as for the USDA Plant Hardiness zones. The spring and summer seasons, and annual temperature averages show an increasing south-to-north temperature gradient. The climate data suggests that the NF zone can be divided into two subzones ('north' and 'south'). A convenient (mappable) inflection boundary between the two subzones is the Onondaga Escarpment. The temperature differences between the two zones is slight and gradual. As noted with the OC zone discussion, the northern NF subzone extends north of the Niagara Escarpment in the spring and summer seasons – confining the OC zone to the immediate Lake Ontario shoreline in spring and supplanting the OC zone in the summer.

Table 4. Niagara Frontier zone temperature and precipitation.

Niagara Frontier	**Temperature (°F)**		**Precipitation (in)**	
	North	**South**	**North**	**South**
Winter	26 to 27 (snow)	26 to 27 (snow)	67 to 76 (snow)	76 to 95 (snow)
USDA Hardiness	-10 to -5 (6a)	-10 to -5 (6a)	n/a	n/a
Spring	44 to 45	45 to 47	7 to 9	7 to 11
Summer	67 to 68	68 to 70	8 to 11	10 to 11
Autumn	50 to 51	50 to 51	8 to 11	8 to 12
Annual	46 to 48	48 to 49	32 to 40	32 to 44

Precipitation is not homogenous within the prescribed boundaries of the NF zone; rather it reflects a transition of decreasing precipitation within the climate zone, from the southwest toward the east and northeast. The elevated precipitation in the southwest can be attributed to prevailing southwest winds and resulting lake effect precipitation (rain and snow) off of Lake Erie. Rain and snow totals decrease eastward due, in part, to the dissipation of moisture and energy with increasing distance from the lake. An additional control may be attributed to the Canadian Niagara Peninsula which provides a precipitation shadow (limits the lake effect off of Lake Erie) across the northern reaches of the NF zone. As a result, the northern NF zone generally tends to be drier than the southern zone.

Erie Coastal (EC)

In Brief	Confined to the Lake Erie shoreline, but divided into a temperature-controlled 'shoreline' and 'benchland' subzones for the spring and summer seasons. Temperatures are comparable to the OC zone, although the 'shoreline' subzone is cooler in the spring. Experiences greater precipitation and snow than the OC zone.

The Erie Coastal (EC) zone follows a SW to NE axis, sandwiched between the Lake Erie shoreline to the west and the Chautauqua Ridge (1,000-foot contour) to the east. The northern boundary abuts the Urban climate zone and a somewhat arbitrary line separates it from the NF climate zone.

Temperatures in this zone are moderated by proximity to Lake Erie, showing a sharp temperature contrast with the adjacent ST zone, most notably along the Chautauqua Ridge. Th EC climate zone temperatures conform to the prescribed boundaries (as indicated above) for the autumn and winter seasons, as well as for annual temperatures. The USDA Plant Hardiness temperatures are segregated between the narrow southern reach (-5 to 0°F, 6b), and the wider northern reach (-10 to -5°F, 6a). Two narrow subzones ('shoreline' and 'benchland') become established in spring and summer. Here the temperatures are cooler along the Lake Erie shoreline, but warm up inland near the base of the Chautauqua Ridge.

As with temperatures, the EC zone exhibits a notable precipitation contrast with the ST zone, especially along the Chautauqua Ridge − exhibiting substantially less rain and less snow. The EC zone is prone to lake effect precipitation and snow (receives more precipitation that the OC zone) but amounts tend to be less (absent orographic lifting) than that of its neighboring ST zone.

Table 5. Erie Coastal zone temperature and precipitation.

Erie Coastal	Temperature (°F)		Precipitation (in)
	Shoreline	Benchland	
Winter	27 to 29 (snow)	27 to 29 (snow)	67 to 76 (snow)
USDA Hardiness	-5 to 0 (zone 6b) and -10 to -5 (6a)		n/a
Spring	42 to 45	45 to 47	7 to 9
Summer	67 to 68	68 to 70	11 to 13
Autumn	51 to 53	51 to 53	11 to 12
Annual	48 to 49	48 to 49	35 to 40

Urban (U)

In Brief	Confined to the 'Buffalo' urban complex. Generally, experiences the warmest temperatures – all seasons – across WNY, although the intensity of the heat island effect varies with building density within the Urban zone (U), and is moderated by proximity to Lake Erie. Precipitation is similar to the NF zone. The U zone is prone to lake effect snow.

The Urban zone (U) is defined as the City of Buffalo and its first ring suburbs, bordering the Niagara Frontier and Erie Coastal zones, to the east and north, and south, respectively. The western border is along the Niagara River and the northeastern shoreline of Lake Erie

Temperatures in this zone are controlled by the urban heat island effect and proximity to Lake Erie. The Urban zone consistently experiences the warmest temperatures in WNY, although temperatures near the U zone Lake Erie shoreline are moderated by the Lake.

Precipitation is similar to the median values of the NF zone, specifically the southern subzone. The region is prone to lake effect snow – including significant events – as the urban zone is downwind of Lake Erie's longest fetch across Lake Erie.

Table 6. Urban zone temperature and precipitation.

Urban	Temperature (°F)	Precipitation (in)
Winter	27 to 29	76 to 94 (snow)
USDA Hardiness	-10 to -5 (6a)	n/a
Spring	44 to 47	8 to 9
Summer	68 to 70	11 to 12
Autumn	51 to 53	10 to 12
Annual	48 to 49	35 to 40

CONCLUSION

Five unique climate zones are identified in this report, with subzones identified where appropriate. These climate zones are consistent with WNYer's understanding of spatial climate variability within WNY.

Defined climate zones, delimited and characterized by local climate controls, provides for a better approach to characterize and to study the effects of WNY's local climate, then on one built from a global approach (Köppen system) or one defined by political (county) boundaries. The applications of climate zones are numerous – used to better understand vegetation regions and animal habitats, to catalog severe weather events (current practice is to do so by county), and to study local climate change, provide a few examples.

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