Weathering Change in WNY

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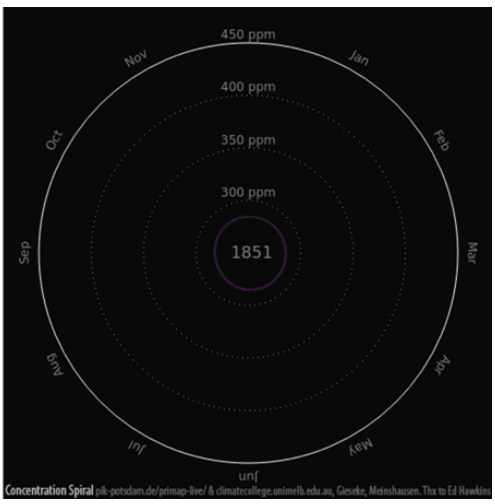
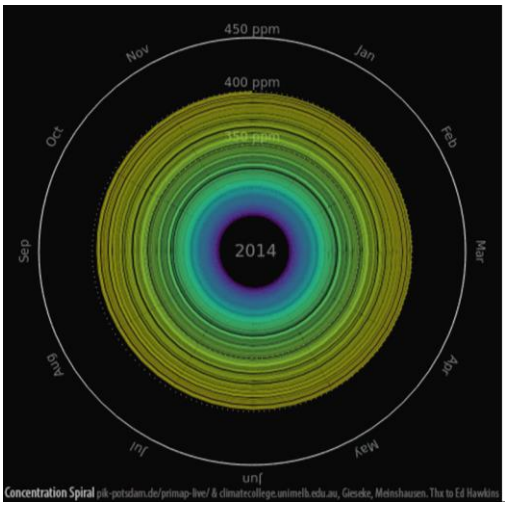
Thank you for the introduction, thank you for the invitation to speak, and good morning all. What I say today are my own thoughts. Today, I'm going to take you down 3 paths.

Background

CO_2 Concentrations



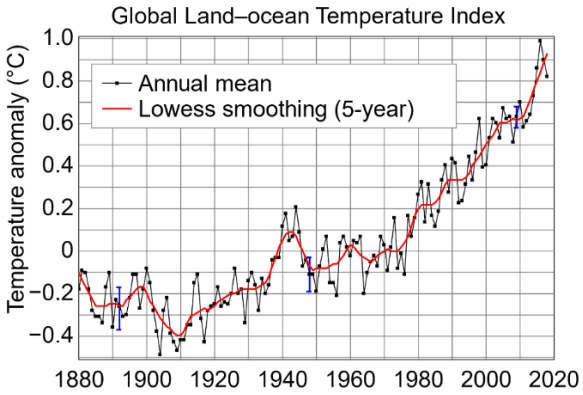


Let me start by stating something that most of you already know: our climate is changing, and it is changing due to the anthropogenic (human caused) emissions of greenhouse gases. Allow me to decipher this last statement. Whatever you might think of climate change, the workings of the greenhouse effect cannot be disputed. It is the greenhouse effect that traps heat which keeps our planet livable. It has been around for billions of years and its "human discovery" goes as far back as the year 1824.

The obvious problem is that adding more greenhouse gases (referred to as the enhanced greenhouse effect) will only trap more heat – a warming world is the outcome, with all its connected consequences.

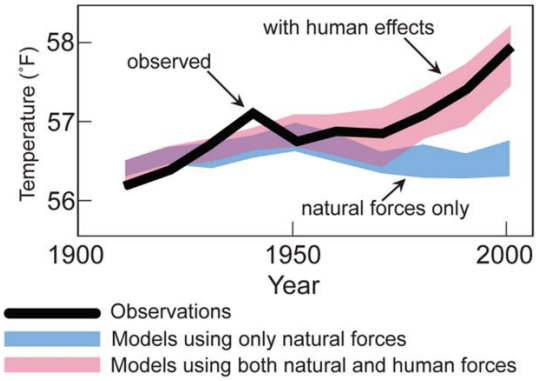
Let me provide you a simple analogy. Laying in bed, a blanket laid over you helps trap your body heat to keep you warm (greenhouse effect). Now add 2 or 3 more blankets and you will overheat (enhanced greenhouse effect).

Looking back, a 1965 White House report by the Johnson administration, wrote *"By the year 2000 the increase in atmospheric CO_2 ... may be sufficient to produce measurable and perhaps marked changes in climate."* It is now 2019, and clearly this prognostication has come true!

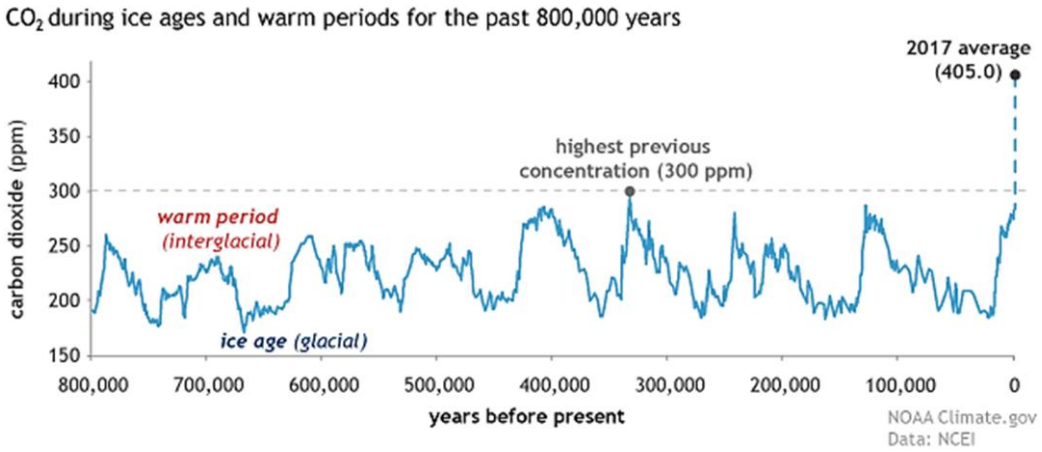


Some of you might think that the temperature increase appears small on the graph. I give you another analogy to consider. Given a body temperature of 98.6oF, what would a 2- or 3-degree temperature increase do to you? Two degrees Fahrenheit is equivalent to just over 1°C!

Climate change did not sneak up on us! Do not accept *"shifting blame to some other cause"* or the argument that *"climate has changed in the past"* as excuses to dismiss the current warming.



Shifting blame to some other cause, as some are prone to do, would require two lines of evidence: implicating another mechanism to account for the current warming; AND providing an explanation as to why CO_2 and other greenhouse gases (the enhanced Greenhouse Effect) is not culpable. Attempts to do this have been made. All have fallen short.



And, it is no secret that our past climate has changed but this fact too should not distract from the urgency of the current warming. These past changes can be attributed to a variety of identifiable natural mechanisms: changes in Earth's orbital characteristics, changes in solar output, and continental drift, to name a few. Clearly the culprit today is the enhanced greenhouse effect due to anthropogenic emissions– something we are responsible for and something that is within our control to mitigate.

Some have referred to our current geological age as the "Anthropocene" – a period when human activity is the dominant influence of Earth's environment. If that is the case, and I believe it is, there is hope. We are not at the mercy of some uncontrollable natural force. It is us, and it is more important than ever for "us" to be good stewards of our planet.

The evidence of a changing climate is all around us and it has been within sight for many decades. I once served as the Assistant Director of The Climate Change Program for the State of Illinois. Even back in the late 1980's, I thought the evidence was indisputable. Now, 30 years later, the supporting evidence has only compounded. How long do we talk ourselves into circles, how much convincing is needed, before we act decisively?

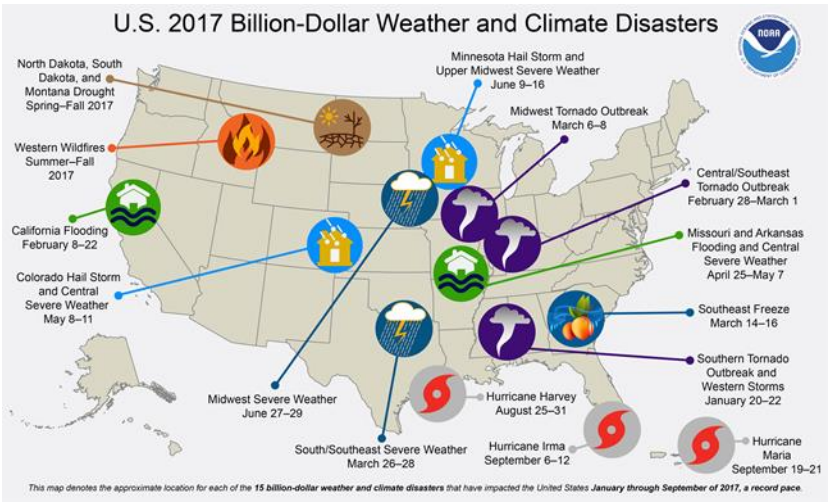
Let me lay it out here. The first 18 years of the 21st Century all have been warmer than any year in the 20th Century, save 1998. The year 2018 ranks as the 4th warmest (2016 being the warmest). At its time, the warmest decade was 1980-89, warmer still was the next decade (1990-99); warmer still was the decade that followed: 2000-2009. And 2010-2019 is on track to be the warmest decade on record. The trend is painfully obvious.

Earlier I said, *"within our control to prevent"*. To be honest, climate change is already happening, and so are its consequences. Thus, it cannot be prevented. What can be prevented are the even greater climatic consequences. We know of these as: rising sea levels, acidification of oceans, melting glaciers and ice pack, the growing intensity of rain events, the greater frequency of flooding, strengthening hurricanes, more frequent and strengthening droughts and heat waves, and more intense wildfires, to name but a few. This is not to mention the countless environmental and human consequences that have and will arise from a changing climate. It is for this reason the world community, at all levels, has called for a mitigation strategy – limiting the increases in the concentration of greenhouse gases. This is what the 2016 Paris Climate Agreement, and all earlier agreements, is and are about.

How are we doing? We have far exceeded the earlier maximum 300 ppm ceiling for atmospheric CO_2 looking back 800,000 years. In 1950 CO2 levels were at about 315 ppm. An earlier goal to lessen climate change impacts was set at one time to 350 ppm. Since 1950 CO_2 concentrations skyrocketed to over 400 ppm. Our new goal – as prescribed in the Paris Climate Agreement – is to keep a global temperature rise this century to well below 2 degrees Celsius. Let me just say this about that – given our slow pace in limiting carbon releases, achieving this goal will be a challenge.

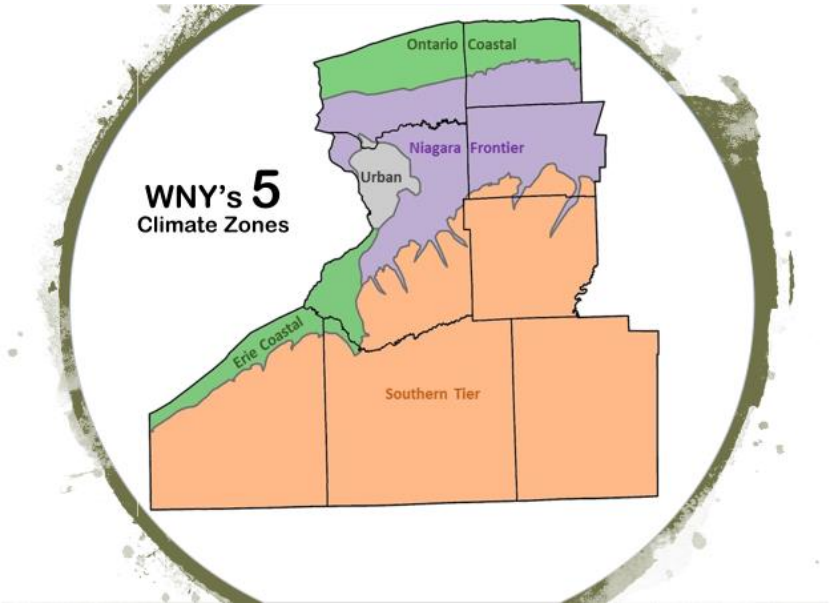
Our Local Story

Let me now take that 2nd path, switching my focus to the local story, and the meaning of my title "Weathering Change in WNY".



Currently, the U.S. has more extreme weather-related events, and variety of events, than any other country in the world. These events will likely increase in number and intensity as the consequence of a warming world. This has led some to question whether places in this country will be inhospitable – outright miserable to live in. Consider the rising sea levels submerging our coastal areas, the increasing strength of hurricanes along the east- and Gulf of Mexico coasts (and their penetration inland), the increased frequency of severe thunderstorms and tornado outbreaks and increased flooding in the Midwest (Arkansas being the most recent example), the growing severity of droughts and wildfires in the West, and the South baked by longer and more intense heat waves. This country, including WNY, will certainly be reshaped by climate change. But, how might WNY fare in comparison to the regions I just described?

'Designing to Live Sustainably' is a local community group. They initially contacted me with their interest in preparing Buffalo and WNY for the effects of climate change. Let me underline "preparing" and "effects". So, let me now speak on "effects", at least as it relates to WNY's climate record. I'll come back to "preparing" in a bit.



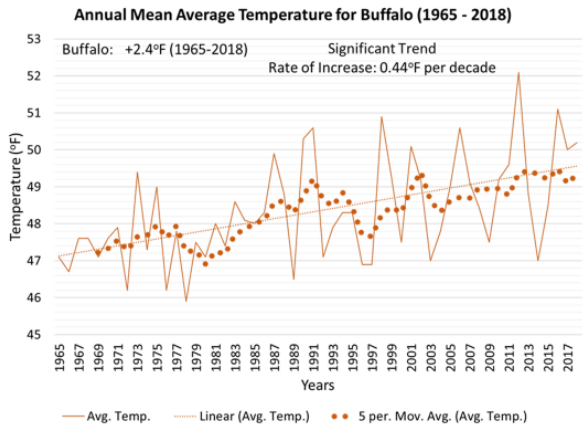
Western New York (WNY) is defined here collectively as the eight westernmost counties of New York State (NYS): Niagara, Erie, Chautauqua, Cattaraugus, Allegany, Wyoming, Genesee, and Orleans. Okay, but let us now ignore these borders. For just as water resources are not defined by political boundaries – but rather by watersheds − climate is best described by climate zones defined by interacting forces driven by atmospheric processes. I have identified five (5) basic climate zones for WNY. This is the lens through which we should view climate and climate change in WNY.

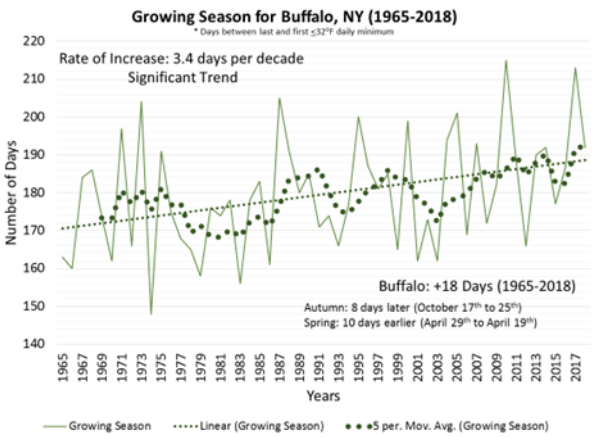
With this lens comes the realization that It should not be taken as a matter of course that regions will respond to global warming equally or with similar intensity. Whether we are looking at WNY in comparison to the rest of the country, or to climate zones within WNY, simply adding a projected temperature increase to a given location may not be correct – too simple. Similarly, what constitutes severe weather in one place may not be found at another place. The local atmospheric processes must be considered. I like to refer to WNY as *"the land between the lakes",* as Lakes Erie and Ontario influence a great deal of control on our weather and climate.

As I have already noted, climate change/global warming is not something that will be suddenly triggered in 2050 or 2100, but rather is occurring today, and has been occurring for decades. So, modeled climate projections, whether they be warming temperatures or increases in the intensity of precipitation, are usually reflected in the existing climate record.

Given the interest of 'Designing to Live Sustainably' in exploring climate-change related adaptation strategies, I analyzed the climate record for WNY using a trend analysis (starting in 1965 - recall my earlier references to 1965). I looked at the data to identify significant statistical trends.

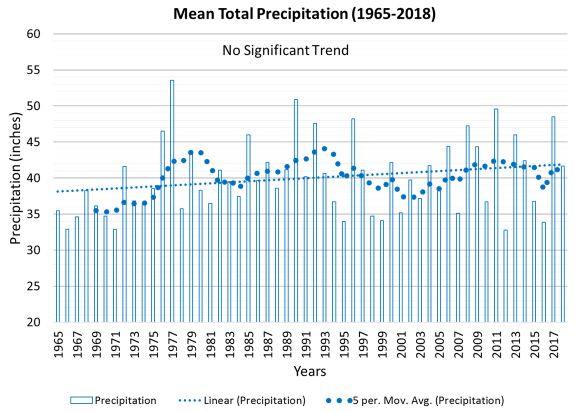
What we found was that on matters related to temperature, Buffalo and WNY is certainly experiencing a warming, at a rate consistent with the U.S. average. Parameters related to temperature all reinforce what would be expected in a warming world: our daily average, minimum, and maximum temperatures are increasing, there is a lengthening of our growing season, the need to heat less in the winter and cool more in the summer, and the warming of Lake Erie's waters, and less ice coverage on the lake, to name a few.

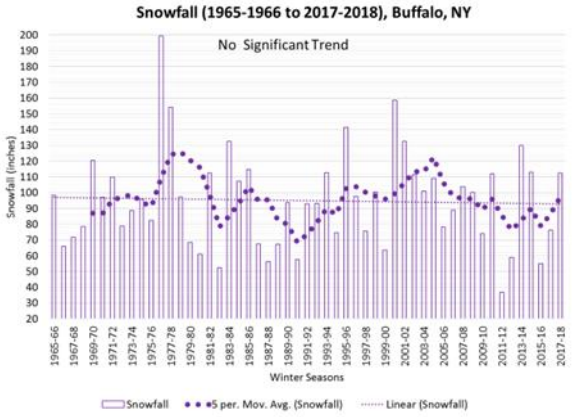




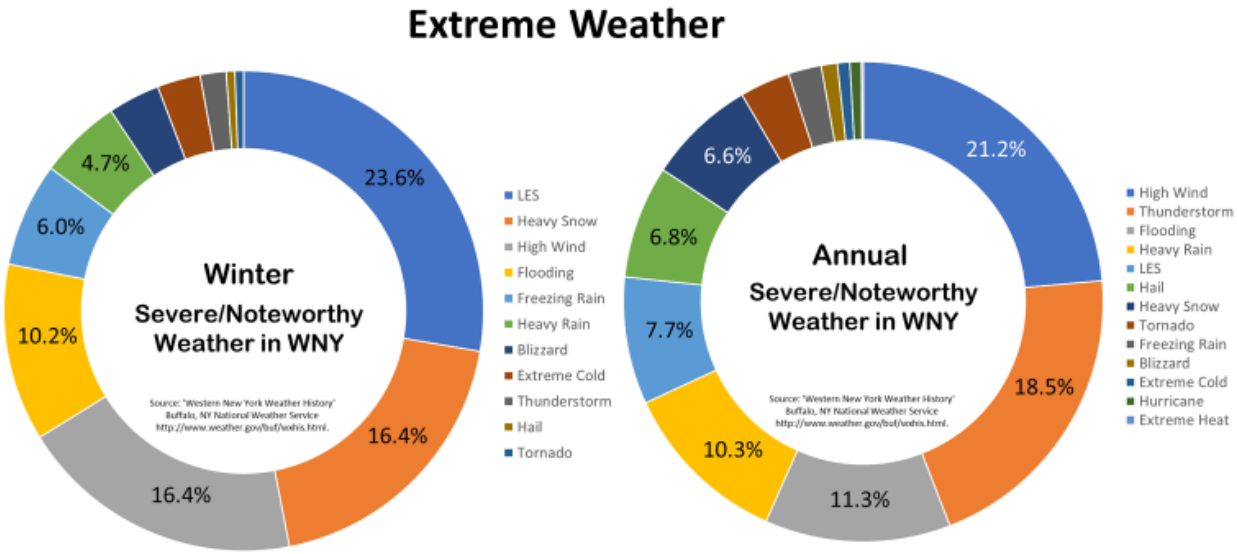
One additional trend is worth noting. Daily average wind speeds show a significant decreasing trend over the years.

However, on matters related to precipitation, Buffalo and WNY are <u>not</u> experiencing what might be expected. There is not a statistically significant change, over the last 50+ years, in the amount of precipitation, the number of precipitation days, the number of records related to rain or snow, the amount of snow, and the frequency of Lake Effect Snow events, again, to name a few.





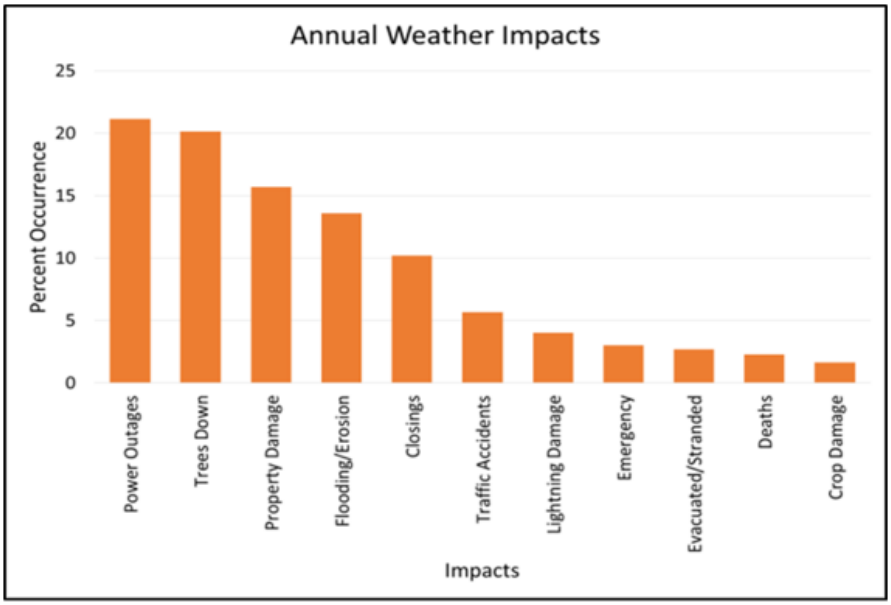
I previously noted that extreme weather in one part of the country is not the same as extreme weather in other parts of the country. Let us look at what makes up extreme weather in WNY. By doing this, we will have a better idea how a warming world might impact us. Remember, not all regions will respond to global warming equally or with similar intensity.



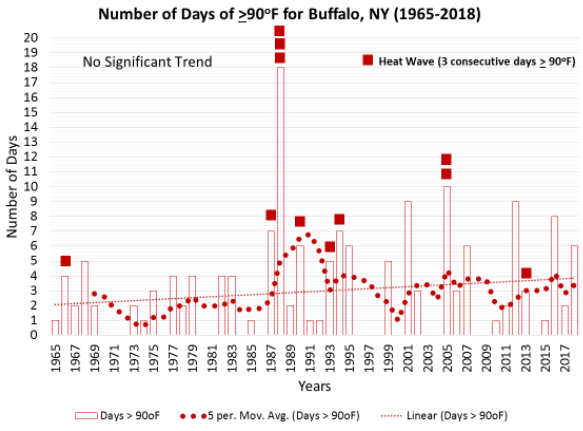
Let us look at severe weather during our winter months. The top five severe weather events in winter are lake effect snow (LES), heavy snow, high winds, flooding, and freezing rain.

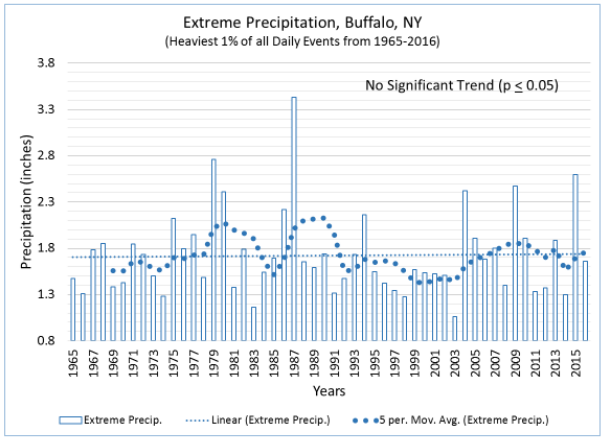
For the year, the top five types of severe weather events are high winds, thunderstorms, flooding, heavy rain, and lake effect snow.

And now the impacts of severe weather. How does WNY extreme weather trend over the past 50+ years?

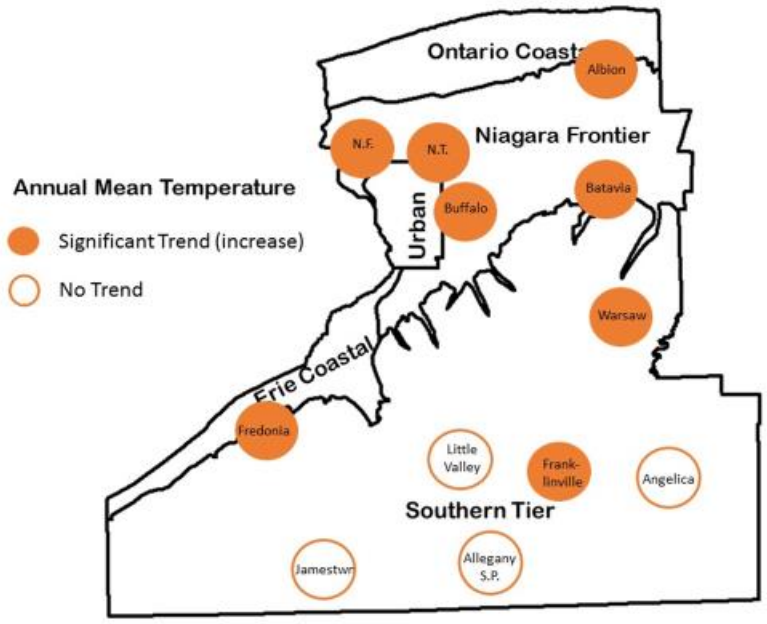


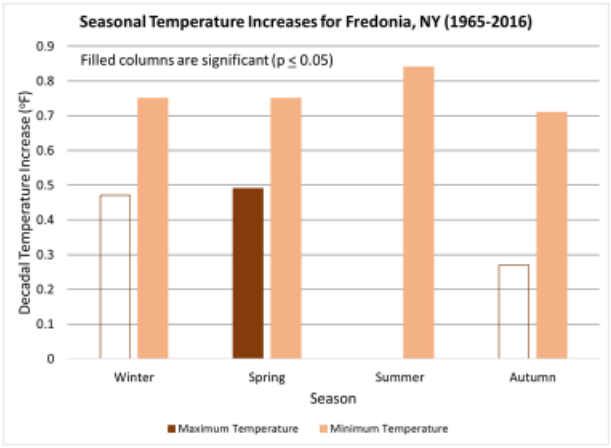
Measures of severe weather-types including days ≥ 90°F, heat waves, drought, intense precipitation events, the frequency of thunderstorms, hail, as well as the number and frequency of tornadoes, do not show a significant statistical change.

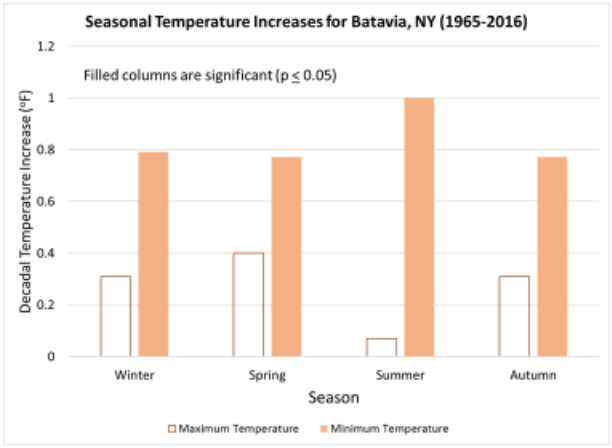




Remember not all regions will respond to global warming equally or with similar intensity – look at the Southern Tier! And comparing increase in maximum and minimum temperatures. Consider the response to temperature in the Southern Tier, as compared to other regions of WNY. Or, as in the case of Fredonia and Batavia (as examples), the response of daily maximum temperatures versus daily minimum temperatures.







Adaptation

Let me now travel along the third and final path: speaking on adaptation strategies. If the world community had acted sooner mitigation strategies are all that we need have concerned ourselves with. Unfortunately, we dithered our time away, and now that climate change is upon us, we are forced to consider both mitigation and adaptation strategies. If we wait too much longer, adaptation strategies are all that will remain.

The question of "What location will fare better?" about climate change is already on people's radar. Companies grow concerned about the risks of climate change. Companies study climate risks and consult with customers to reduce those risks. The New York Times reported about a venture capital company which provides mapping data at the city block level, allowing customers to make business decisions, including location choices, based on the predicted effects of climate change.

"Designing to Live Sustainably" has long advocated a local adaptation strategy, recently branded under the banner "Weathering Change in WNY". Their strategy first involves obtaining a better understanding of what changes may be expected in WNY and outside of our region – as WNY cannot be considered an island − and engaging our community to explore adaptation strategies. An adaptation strategy not only prepares us for the physical effects of a changing climate but also the economic consequences, as well as the consequences to the human condition, including issues addressing climate justice.

Initially I was apologetic that I could not identify expected trends in many climate parameters, other than basic temperature trends. Additional to helping 'Designing to Live Sustainably', and by extension WNY, fine-tune possible coping strategies, the data took me to a new place - a realization that these lack of trends (unchanging parameters) suggested that Buffalo and WNY may be better suited to survive climate change than other parts of the country. Clearly, we are fortunate, as this favorable position is not of our doing. Nonetheless, is it possible that we can both: adapt and thrive?

The first part of this message (adapt) has met with some local resistance. In WNY we correctly focus on a mitigation strategy and Erie County is to be applauded for their efforts, as described in the "Erie County Commits to Paris Report". However, we have, for the most part, overlooked an adaptation (coping or resiliency) strategy. It has been argued that we can't do both. I believe the thinking goes something like: *"an adaptation strategy is an admission of defeat"*. I disagree. As I said; climate change is already

happening, and we need to prepare for it – we certainly can chew gum and walk at the same time. What I mean is that mitigation and adaptation can, and should, be pursued in tandom.

The second part of this message (thrive) has met with greater resistance; that is until the Guardian newspaper recently interviewed Harvard climate adaptation specialist, Jesse Keen, who indicated that he liked the chances of Buffalo and WNY in a warming world. The story of Buffalo thriving in a changing climate was picked up by the Buffalo News, and most recently was the topic of an interview I had with NBC News and the New York Times.

Keen referred to our region's relatively cooler temperatures, fewer extreme weather events, access to plenty of freshwater, inexpensive land prices, and a well-educated and skilled labor force, among other advantages.

This finding likely was made independent of the climate trend analysis that I have just spoken of. The coming together of these two threads, however, suggests that there may be something to this. As often is the case: It is unthinkable until someone else does it (or in this case "says it"), and then we may find that it was inevitable.

By way of example, the city of Duluth, as part of an economic development and marketing package, has marketed itself as "The most climate-proof city in America". Mayor Byron Brown, in his recent state-of-the-city speech declared Buffalo as a "Climate Refuge City". The problem with the Mayor's declaration is that it is hollow – it is reactive (come what may), and not a product of a well thought out plan.

Will WNY be a location that will fare better, and thus attract positive attention? How will WNY prepare for the consequences of climate change? Will climate change spur growth? How will we position our economy to grow? How will WNY prepare to deal with new agri-business? How will WNY consider vulnerable populations? How will WNY prepared to deal with climate migrants (and with them new businesses and skills) and refugees? There are innumerable social, policy, and planning issues that need to be considered if Buffalo and WNY is to cope. These are compounded by an order of magnitude if we plan to thrive. To-date, as a city, as a region, we have done nothing! Other than declare us a climate refuge city, It is time to act!

Conclusion

Without doubt, Buffalo and WNY will be, and is currently being, stung by climate change. The point of this presentation is that the pain of this sting can be lessened if we start now to identify how WNY will respond to a warming world and consider well-thought-out adaptation strategies that will allow us to weather the change. And, also, how we, as a region, might position ourselves to not only cope but, I dare say, benefit from the change or, as 'Designing to Live Sustainably' would say – "to adapt and thrive."

My charge to you is twofold. First, along with advocating for mitigation strategies, advocate for adaptation strategies that may best prepare WNY to cope with (adapt to) the changes ahead. Second, consider how WNY may take advantage of its better position (to thrive) in comparison to other parts of the country.