

5.4.2 Drought

This section provides a hazard profile and vulnerability assessment of the drought hazard for Tompkins County.

The hazard profile is organized as follows:	The vulnerability assessment is organized as follows:
<ul style="list-style-type: none"> • Description • Extent • Previous Occurrences and Losses • Probability of Future Occurrences • Climate Change Impacts 	<ul style="list-style-type: none"> • Impact on Life and Safety • Impact on General Building Stock • Impact on Community Lifelines • Impact on Economy • Impact on Environment • Cascading Impacts on Other Hazards • Future Change that may Impact Vulnerability • Changes Since 2014 HMP • Identified Issues

5.4.2.1 Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, and probability of future occurrences for the drought hazard. In addition, as wildfire is considered a cascading impact of drought conditions, it will be discussed in this section.

Description



Drought is a period of time characterized by long durations of below-normal precipitation levels. It is a temporary irregularity that differs from aridity (permanent low rainfall). Drought conditions occur in virtually all climatic zones, but drought characteristics vary significantly by region. Drought adversely affects agriculture, water supply, aquatic ecology, wildlife, and plant life.

Droughts can be a contributing factor to wildfire/brush fire risk due to dry vegetation providing fuel for fires. Wildfire can spread rapidly especially during periods of dry weather and droughts. It is defined as an uncontrolled fire spreading through natural or unnatural vegetation that can threaten lives and property if not contained. Wildfire can also be referred to as forest fire, brush fire, grass fires, wildland urban interface (WUI) fire, range fire, or ground fire (NYS DHSES 2019).



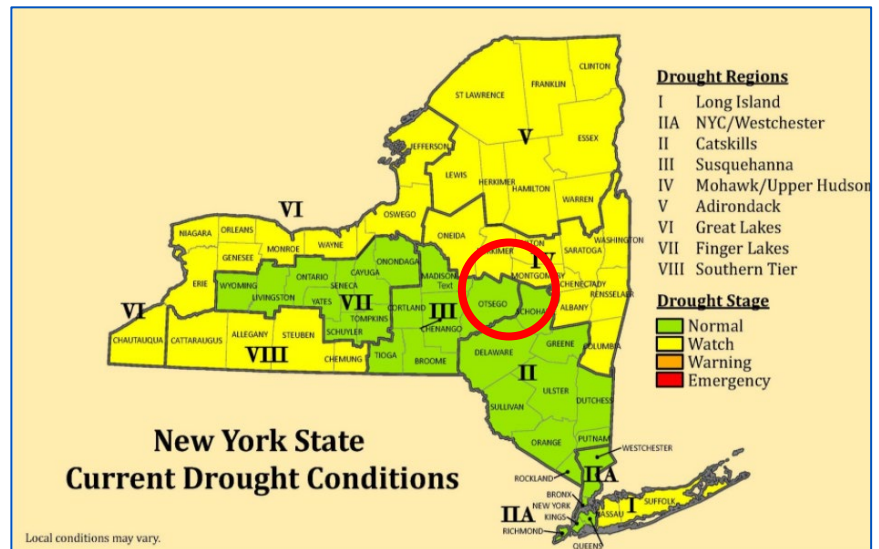
Extent

Drought

The severity of a drought depends on the degree of moisture deficiency, the duration of the event, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. New York State applies two methodologies to identify the different drought stages - the Palmer Drought Severity Index (PDSI) and the State Drought Index (SDI). The two indices show us different things about drought.

The Palmer Index, with its emphasis on soil moisture, helps us understand agricultural impacts. The State Index helps assess the impact on human welfare and the regional economy (NYSDEC 2020).

Figure 5.4.2-1. NYSDEC Region Map



State Drought Index (SDI)

The New York State Department of Environmental Conservation (NYSDEC) divides New York State into nine drought management regions, with divisions roughly following drainage basin contours and county lines. Tompkins County is located within the Finger Lakes Drought Region (Region VII). NYSDEC monitors precipitation, stream flow, lake and reservoir levels, and groundwater levels at least monthly in each region and more frequently during periods of drought. NYSDEC uses these data to assess the condition of each region through the SDI, which can range from *normal* to *drought disaster*.

The SDI compares four parameters to historic or "normal" values to evaluate drought conditions: stream flows, precipitation, lake and reservoir storage levels, and groundwater levels. New York's Drought Management Task Force uses those factors as well as water use, duration of the dry period, and season to assess drought in different parts of the state. (NYSDEC 2020).

Figure 5.4.2-2. NYSDEC Drought Stages

Drought Stage	Description
Drought Watch	The least severe of the stages, a drought watch is declared when a drought is developing. Public water suppliers begin to conserve water and urge customers to reduce water use.
Drought Warning	Voluntary water conservation is intensified. Public water suppliers and industries update and implement local drought contingency plans. Local agencies make plans in case of emergency declaration.
Drought Emergency	The Governor may declare emergency. The Disaster Preparedness Commission coordinates response. Mandatory local/county water restrictions may be imposed. Communities may need to tap alternative water sources to avoid depleting water supplies, protect public health and provide for essential uses.
Drought Disaster	Disaster plans are implemented. Water use is further restricted. The Governor may declare disaster and request federal disaster assistance. Emergency legislation may be enacted. The state provides equipment and technical assistance to communities.



Palmer Drought Severity Index

The Palmer Drought Severity Index (PDSI) is primarily based on soil conditions calculated by the National Weather Service. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 5.4.2-1 lists the PDSI classifications. At the one end of the spectrum, 0 is used as normal and drought is indicated by negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI can reflect excess precipitation using positive numbers; however, this is not shown in the table. The PDSI is commonly converted to the Palmer Drought Category (National Drought Mitigation Center [NDMC] 2013). As a reference point, the drought experienced in late summer early fall 2020 in Tompkins County was D1 (Moderate Drought).

Table 5.4.2-1. Palmer Drought Category and Palmer Drought Index Descriptions

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting and growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.99
D1	Moderate drought	Some damage to crops and pastures; fire risk high; streams, reservoirs, or wells low; some water shortages developing or imminent; voluntary water-use restrictions requested.	-2.0 to -2.99
D2	Severe drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.99
D3	Extreme drought	Major crop or pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.99
D4	Exceptional drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Source: NDMC 2013

Wildfire

Wildfire events can range in size and intensity; much of which depends on weather and human activity. Wildfire severity depends on the interaction of fuel, weather, and topography. There is no universal scale to measure the extent or severity of a wildfire, but the acreage burned can be calculated to determine the size of the fire (NYS DSHES 2019).

The **Fire Danger Rating** in New York State is established using information from the National Fire Danger Rating System (NFDRS) and takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS, n.d.) in each of the 10 regions of New York State. The NFDRS is particularly utilized in those areas in Tompkins County adjacent State Forest Land. Tompkins County is located in Region 7, as shown in Figure 5.4.2-1. Details about this rating system can be found online: <https://www.dec.ny.gov/lands/68329.html>



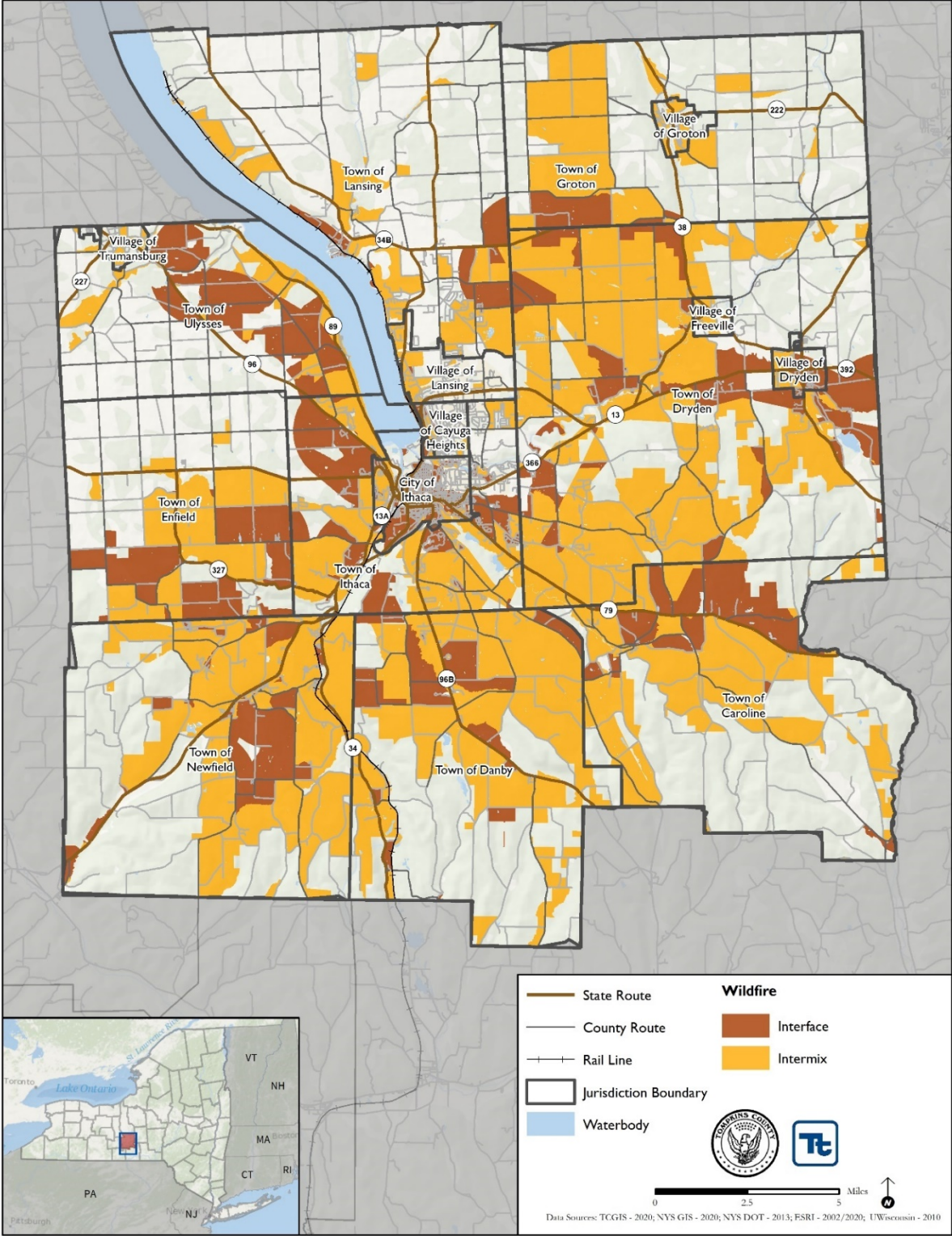
Location

Droughts are a regional phenomenon that have the potential to directly or indirectly impact every person in Tompkins County. In general, droughts can occur at any given time of the year in Tompkins County, though most often occurs late summer to early fall. When compared to other parts of the country, this hazard is relatively less likely to occur in this region and most of New York State (NYSDHSES 2019).

Wildfires can occur anywhere; however, they are more common in forested areas. In Tompkins County, areas that are heavily forested or contain large tracts of brush or shrubs are susceptible to fires. During drought conditions, drier vegetation can increase the probability of wildfire occurrences throughout the County. The wildland-urban interface (WUI) is the area where houses and wildland vegetation meet and where wildfire problems are most pronounced (Radeloff et al 2018). Intermix WUI are areas where housing and vegetation intermingle; interface WUI are areas with housing in the vicinity of contiguous wildland vegetation. Approximately 38-percent of the County's land area is within the WUI interface and 34-percent of the County's land is within the WUI intermix. Figure 5.4.2-3 shows the WUI areas throughout Tompkins County. During a drought, these areas may be more susceptible to wildfires.



Figure 5.4.2-3. Wildland-Urban Interface and Intermix Hazard Area in Tompkins County



Previous Occurrences and Losses

Tompkins County does not typically experience severe or extreme drought due to its proximity to the Finger Lakes and overall proximity to the Great Lakes and Atlantic Ocean. Based on available historical records, Tompkins County communities are however still susceptible to drought events and should mitigate to an extent of moderate drought.

FEMA Disaster Declarations

Between 1954 and 2020, Federal Emergency Management Agency (FEMA) declared that New York State experienced one drought-related disaster declaration that was classified as a water shortage. Tompkins County was however not included in that disaster declaration.

USDA Agricultural Disaster Declarations

The U.S. Department of Agriculture (USDA) keeps different drought records which are specific to agricultural disasters. In 2012, USDA Agricultural Disasters S3427 and S3441 were declared for drought. In 2016, USDA Agricultural Disasters S4023, S4031, and S4062 were declared for drought. The USDA-reported crop losses provide another indicator of previous events. The USDA records indicate that Tompkins County has not experienced crop losses from drought events from 2014 to 2020. Crop losses prior to 2014 were unavailable.

Previous Events

Table 5.4.2-2 lists known drought events between 2012 and 2020 that have affected Tompkins County and its municipalities based on all sources researched.

Table 5.4.2-2. Drought and Wildfire Events in Tompkins County, 2012 to 2020

Date(s) of Event	Event Type*
July 17–October 23, 2012	According to the PDSI , conditions were classified at D1, or moderate drought status across Tompkins County from July 17–October 23, 2012.
July 10 th , 2012 - December 18 th 2020	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from July 10–December 18, 2012.
January 27–June 2, 2015	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from January 27–June 2, 2015.
September 8 – September 29, 2015	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from September 8 – September 29, 2015.
June 7, 2016–February 21, 2017	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from June 7–June 28, 2016; D1 or moderate drought status from June 28–July 12, 2016; D2 or severe drought from July 12–August 16, 2016; D3 or extreme drought status from August 16–October 18, 2016; D2 or severe drought status from October 18, 2016–November 22, 2016; D1 or moderate drought status from November 22–February 7, 2017; and D0 or abnormally dry from February 7 – February 21, 2017. Surveying of New York farmers showed significant crop losses and pastures were dry. Apples were reported as being smaller and sweeter and grapes were slightly small and less acidic throughout the state. New York dairy farmers and Christmas tree farms struggled. Discolored water was reported in Ithaca, NY from June 20–September 17, 2016. Shallow wells in the Northeast went dry. A drought watch and warning was issued for New York in



Date(s) of Event	Event Type*
	July. Drought resulted in shallow marshes, negatively impacting duck and goose hunting in the state. Many of the gorges and streams throughout Ithaca were recorded dry.
September 26–October 24, 2017	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from October 3–October 24, 2017.
July 3, 2018–July 24, 2018	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from June 26, 2018–July 24, 2018.
September 24- October 1, 2019	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from September 24, 2019–October 1, 2019.
June 23, 2020 – October 6 th 2020	According to the PDSI, conditions were classified at D0, or abnormally dry status across Tompkins County from June 23, 2020 – August 11 th , 2020 and D1 or moderate drought between August 18 th , 2020 – October 6 th , 2020 (as of October 13 th , 2020)

Sources: USDA 2020; NDMC 2020

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

Probability of Future Occurrences

In the past, Tompkins County has experienced a range of drought conditions from *abnormally dry* to *extreme*, or D0 to D3, in accordance with the PDSI. In contrast, records of wildfires in the region are less frequent. Based on the historic record and climate projections for the region, it is anticipated that Tompkins County will continue to experience added, regular drought events in the future. By the end of this century, the number of droughts is likely to increase, as the effect of higher temperatures on evaporation is likely to outweigh the increase in precipitation, especially during the warm months (NYSERDA). Along with drier weather will likely follow a potential increase in wildfires. According to the New York Climate Smart Farming (<http://climatesmartfarming.org/>), while projections show that overall precipitation levels are likely to increase over time, the patterns will shift to more intense and infrequent storms, as depicted in the curve graph below. Subsequently, the number of days without any precipitation will likely increase and could increase drought and wildfire in the region (Caroline Climate Vulnerability Assessment, 2020). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate change can contribute to increased chances of drought and its secondary impacts such as decreased water supply and higher threat of wildfires. Temperatures and precipitation amounts are expected to increase within the Southern Tier region. Precipitation totals will change between 4 and 10 percent by the 2050s and between 6 and 14 percent by the 2080s (baseline of 35 inches). Table 5.4.2-3 lists projected seasonal precipitation changes within the Southern Tier ClimAID Region (NYSERDA 2014). These projections have the potential to create conditions more favorable to droughts and also leading to increased risk of wildfires in Tompkins County.

Table 5.4.2-3. Projected Seasonal Precipitation Change in Region 3, 2050s (percent change)

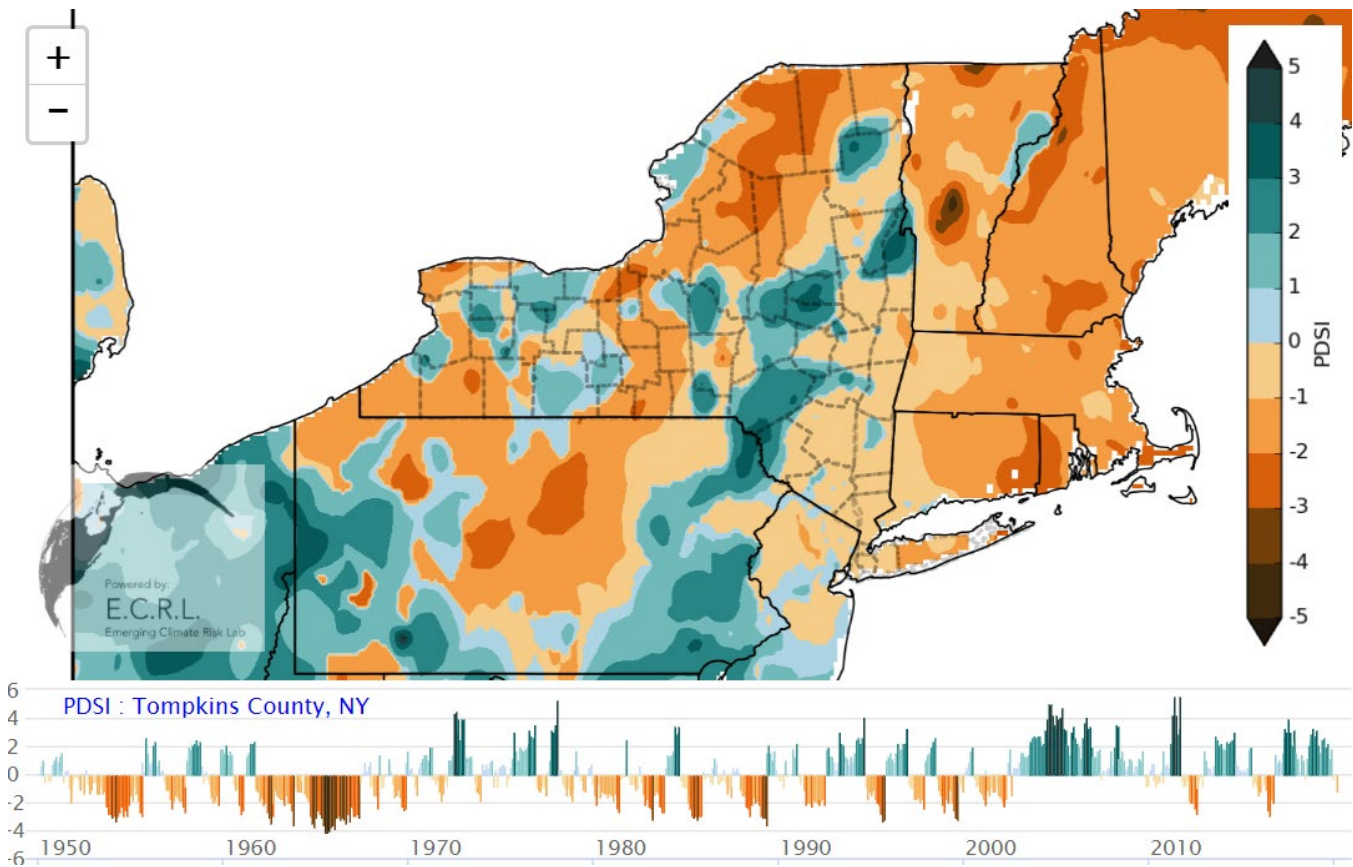
Winter	Spring	Summer	Fall
5 to +15	0 to +10	-5 to +5	-10 to +5

Source: NYSEDA 2014



Current trends also show an increase in precipitation over time, based on historic data, as noted below.

Figure 5.4.2-4. Precipitation Projection Trends for New York State



Based on research conducted by Cornell Cooperative Extension, these precipitation events are likely to intensify, thus leading to higher levels of precipitation during a shorter period of time. The trend between 1950 and 2020 shows an increase in precipitation and there have been intensifying storms over the course of 70 years (Cornell, 2020). As projections show, increased precipitation intensity may be coupled with a higher number of droughts and wildfire events.

5.4.2.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Tompkins County's vulnerability, in a qualitative nature, to the drought hazard.

Impact on Life, Health and Safety

The entire population of Tompkins County is exposed to drought events (population of 102,962 people, according to the 2014-2018 American Community Survey population estimates). Drought conditions can



cause a shortage of potable water in both urban and rural areas for human consumption, both in quantity and quality. An increase in drought will result in a disproportionate burden on agricultural producers in the county.

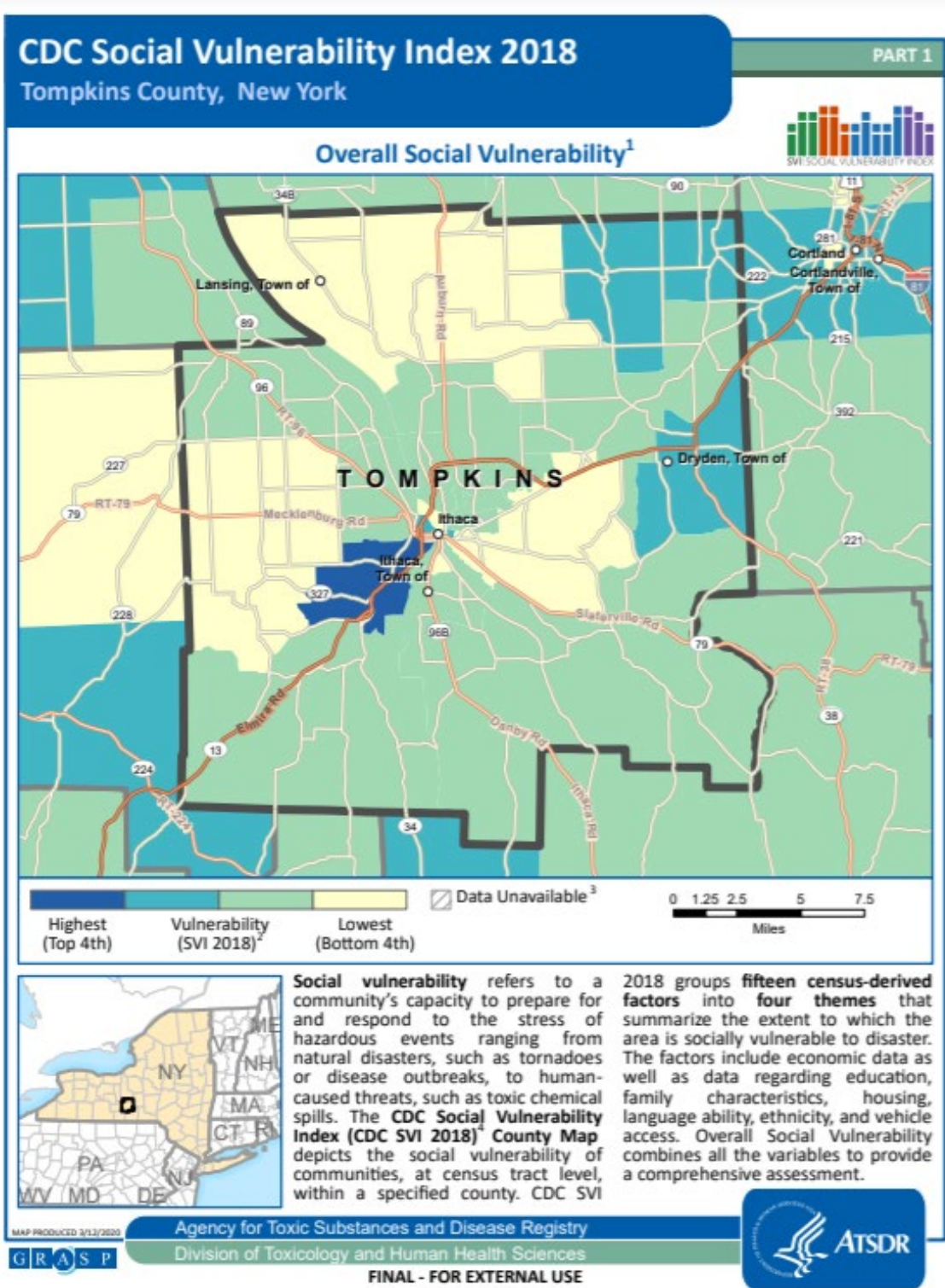
Public health impacts may include an increase in heat-related illnesses, waterborne illnesses, recreational risks, and reduced food availability. Vulnerable populations could be particularly susceptible to the drought hazard and cascading impacts especially those over 65, those with underlying health conditions, and those limited ability to mobilize to shelter, cooling and medical resources. Other possible impacts to health due to drought include increased recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Overall, the health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term (CDC 2020).

Individuals most vulnerable to drought include those over 65, with underlying medical conditions, with mobility concerns.

The Centers for Disease Control and Prevention's (CDC) 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. An indication of the distribution of socially vulnerable populations is provided in Figure 5.4.2-5. Being aware of the County's overall ranking can help inform how the communities may react to a drought event based upon available resources. Areas with low to moderate vulnerability may experience minor issues responding to drought events.



Figure 5.4.2-5 Tompkins County Social Vulnerability Index



Source: CDC, 2021



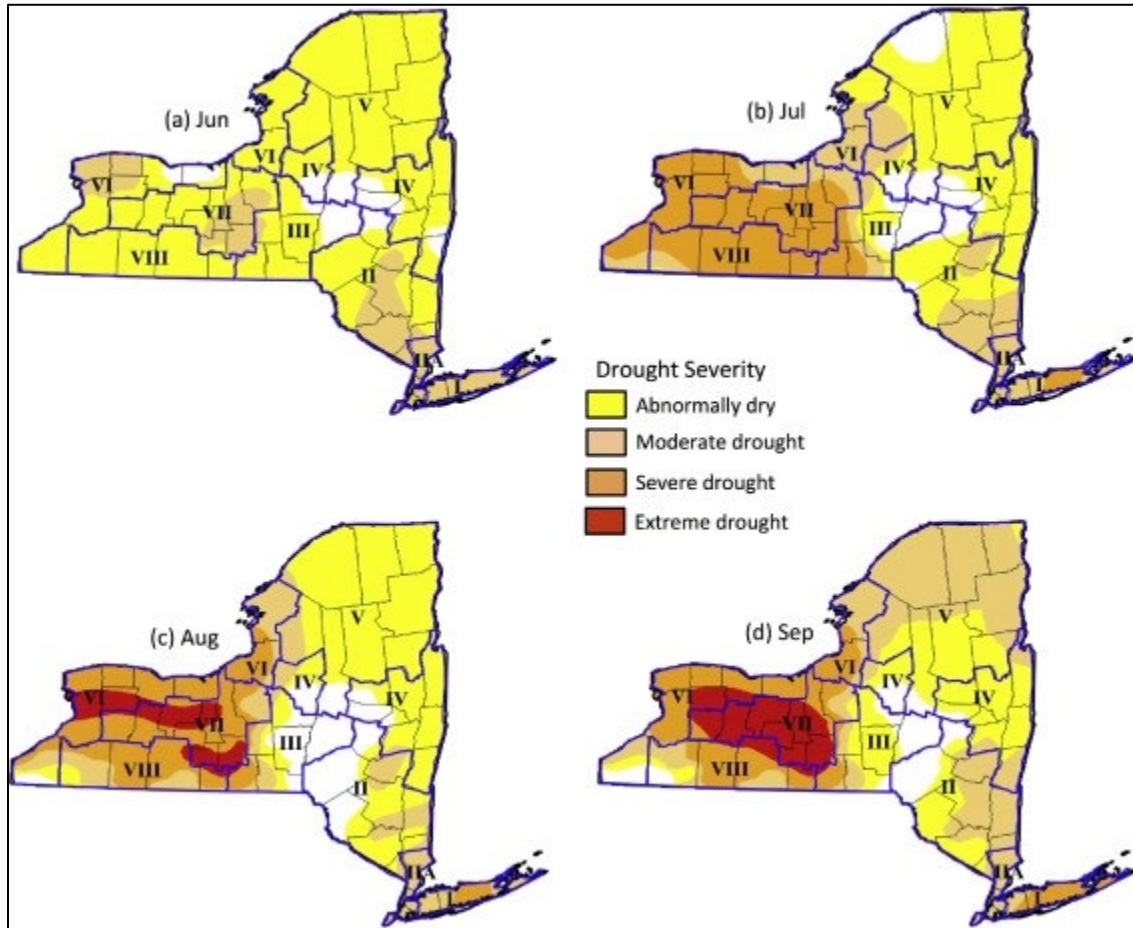
In addition to those noted vulnerable groups, local water suppliers are of course vulnerable to drought. There are 98 community water supply systems, 46 non-community transient water supply systems, and 9 non-transient, non-community water supply systems in Tompkins County (New York State Department of Health 2019). Additionally, there are at least 464 water wells in Tompkins County (New York State Department of Environmental Conservation 2014).

Regarding wildfires, according to ClimAID, it can be difficult to predict how the number of these events will change over time, as Tompkins County and most of the northeast region has historically been known for relatively damp weather. This trend is not expected to change significantly over time. However, there are regions within the state that are more prone to wildfires. Based on the 2016 summer drought, Tompkins County and much of the Finger Lakes region was subject to severe droughts as indicated in the map below, which depicts the stages of the drought between June and September (New York Climate Change Science Clearinghouse). Tompkins County experienced drought like conditions early on, compared to surrounding regions and as a result had 2 reported wildfire events. These events were not major when comparing the event to a national wildfire events, however these were more than the region was used to. It is likely that Tompkins County is more vulnerable to wildfires than other parts of upstate New York. There is no direct evidence of the cause of wildfires in Tompkins County, however some potential factors could include immature landcover, increased development/land use change, agriculture, and higher levels of careless recreational activity in forested regions.

Projections from the County Comprehensive Plan indicate that water demand will continue to increase for the communities in Tompkins County, which could be further strained during a drought event. Generally, surface water supplies are affected more quickly during droughts than groundwater supplies; however, groundwater supplies generally take longer to recover. Increasing diverse, redundant water supplies throughout the county could help to protect and mitigate against the impacts of drought events.



Figure 5.4.2-6. Drought Severity in New York State



Impact on General Building Stock

No structures are anticipated to be directly affected by a drought event. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Risk to life and property is greatest in those areas where forested areas adjoin urbanized areas (high density residential, commercial and industrial) also known as the wildland-urban interface and wildland-urban intermix hazard areas (WUI). Therefore, all assets in and adjacent to, the WUI zone, including population, structures, community lifelines, and businesses are considered vulnerable to wildfire.

Table 5.4.2-4. Number of Buildings Located Within the WUI

Municipality	Number of Buildings – WUI	Percent of Total	RCV of Buildings – WUI	Percent of Total
Caroline (T)	1,016	31.2%	\$843,977,508	33.4%
Cayuga Heights (V)	104	8.8%	\$91,215,787	5.9%
Danby (T)	671	22.3%	\$469,159,299	21.4%
Dryden (T)	2,083	24.5%	\$1,477,992,753	16.9%



Municipality	Number of Buildings – WUI	Percent of Total	RCV of Buildings – WUI	Percent of Total
Dryden (V)	655	64.1%	\$712,425,186	62.8%
Enfield (T)	807	22.7%	\$432,750,638	15.8%
Freeville (V)	95	23.2%	\$62,477,398	17.5%
Groton (T)	166	4.6%	\$108,323,384	3.9%
Groton (V)	0	0.0%	\$0	0.0%
Ithaca (C)	6,181	83.0%	\$12,107,220,542	61.4%
Ithaca (T)	1,858	30.6%	\$4,635,260,118	42.6%
Lansing (T)	459	7.6%	\$403,246,778	6.4%
Lansing (V)	6	0.6%	\$3,056,388	0.1%
Newfield (T)	1,145	24.5%	\$827,497,313	21.5%
Trumansburg (V)	0	0%	\$0	0%
Ulysses (T)	950	26.7%	\$786,678,885	23.3%
Tompkins County (Total)	16,196	29.1%	\$22,961,281,977	31.9%

Impact on Community Lifelines

Water supply facilities may be affected by short supplies of water. As mentioned, drought events generally do not impact buildings; however, droughts have the potential to impact agriculture-related facilities and community lifelines that are associated with potable water supplies. Also, those facilities in and adjacent to the WUI zone are considered vulnerable to wildfire.

Table 5.4.2-5. Community Lifelines Located in the WUI

Facility Name	Jurisdiction	Hazard Zone
WOOD ST PUMP STATION	Ithaca (C)	Wildfire Urban Interface
CAYUGA HEIGHTS SEWAGE PLANT	Ithaca (T)	Wildfire Urban Interface
CITY WATER AND SEWER DIV	Ithaca (C)	Wildfire Urban Interface

Impact on Economy

Drought can produce a range of impacts that span many economic sectors and can reach beyond an area experiencing physical drought. Water withdrawals are not only used for potable water but for use in the commercial/industrial/mining sectors and power generation. When a state of water emergency is declared by the State (when a potential or actual water shortage endangers the public health, safety and welfare), the New York Department of Environmental Conservation may impose mandatory water restrictions and require specific actions to be taken by water suppliers.

A prolonged drought can have serious direct and indirect economic impacts on a community. As noted in the 2019 New York State Hazard Mitigation Plan, Tompkins County does not have reported damages from previous drought events (NYS DHSES 2019). However, economic impacts that could occur include the following:

- Decreased land prices



- Loss to industries directly dependent on agricultural production (e.g., machinery and fertilizer manufacturers, food processors, dairies, etc.)
- Unemployment from drought-related declines in production
- Strain on financial institutions (foreclosures, more credit risk, capital shortfalls)
- Revenue losses to Federal, State, and Local governments (from reduced tax base)
- Reduction of economic development and tourism
- Fewer agricultural producers (due to bankruptcies, new occupations)
- Rural population loss.
- Short term water use restrictions for businesses and thus underperformance of respective businesses operation.

When a drought occurs, the agricultural industry is most at risk for economic impact and damage. A large majority of the state's agriculture is rain-fed without irrigation; however, summer precipitation currently is not sufficient to fully meet crop water needs during most years (NYSERDA 2011). Based on information from the 2017 Census of Agriculture, 523 farms were present in Tompkins County, encompassing 91,277 acres of total farmland. The average farm size was 175 acres. Products sold from Tompkins County farms had a total market value of \$64.7 million (\$41 million: milk from cows, \$6.4 million: cattle and calves, \$5.1 million: grains, oilseeds, dry beans, dry peas, averaging \$123,713 per farm (USDA 2017). It is worth noting, however, based on community input that Tompkins County is unique in that a vast number of communities have access to Cayuga Lake for water supply, while smaller inland municipalities that only have a single source of water, that is ground water, are more susceptible to droughts.

If the average production (dollar value) per crop type could be identified on a per-acre basis, loss estimates could be developed based on assumed percent damage that could result from a drought. If a drought impacted 40-percent of the agricultural products sold from Tompkins County farms, losses would be estimated at \$25.8 million based on 2017 market values.

As for Wildfires, effects can be more immediate and severe, contrast to drought. Effects of these wildfires can be catastrophic including property losses, decreased tourism, even changes in the long-term structure of the local economy (US Forest Service, 2020). As a result, mitigation measures include the protection of existing property and investment in direct response to wildfires, including investments in the important and regularly strained volunteer fire departments. The sooner fire departments can respond, the lesser the economic impact.

Impact on Environment

Drought can impact the environment because it can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (NOAA 2020). Drought can also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness. As a



cascading effect of these droughts, wildfires can also have detrimental effects on the environment, including pollution from the smoke of the fire, ecological damage and loss of habitat, and water contamination due to damaged/ burnt vegetative cover (US Forestry Service, 2020).

Cascading Impacts on Other Hazards

As discussed in earlier sections, drought can lead to increasing temperatures and evaporation of moisture, which are ideal dry conditions for wildfire events to occur. Dry, hot, and windy weather combined with dry vegetation is more susceptible to sparking wildfires when met with a spark created by humans or natural events, such as lightning (National Integrated Drought Information System 2020).

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Any areas of growth could be potentially impacted by the drought hazard as the entire County is exposed and vulnerable to droughts. On the other hand, wildfires are more likely to occur in areas where vegetative cover is young, and greenspace isolated from waterbodies with low-lying brush is an ideal setting for a wildfire to occur. Future growth and development could impact the amount of potable water available due to a drain on the available water resources. An increased use of water resources would not only impact the County's population, but it would also exacerbate impacts to other areas of the County as discussed above, including agriculture and recreational facilities. Refer to Sections 4 and 9 (Jurisdictional Annexes) for a discussion on potential new development.

Projected Changes in Population

According to population projections from the Cornell Program on Applied Demographics, Tompkins County will experience a continual population increase from 2020 through 2040 (over 6,040 people in total by 2040). The U.S. Census Bureau also shows that the population in Tompkins County has increased 0.6-percent between 2010 and 2019 (U.S. Census Bureau 2020). An increase in the population throughout Tompkins County will increase the number of persons exposed to drought events and may put more stress on the available water supplies in the County. Refer to Section 4 (County Profile), for additional discussion on population trends.



Climate Change Impact

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures. Additionally, the State is further projected to experience more frequent droughts which may affect the availability of water supplies, primarily placing an increased stress on the population and their available potable water. A decrease in water supply, or increase in water supply demand, may increase the county's vulnerability to structural fire and wildfire events. Critical water-related service sectors may need to adjust management practices and actively manage resources to accommodate for future changes.

Droughts can cause deficits in surface and groundwater used for drinking water. The New York State Water Resources Institute at Cornell University (<https://wri.cals.cornell.edu/>) conducted a vulnerability assessment of drinking water supplies and climate change. To assess water supplies in New York State, it was assumed that long-term average supply will remain the same, but the duration and/or frequency of dry periods may increase. Both types of water supplies, surface water and groundwater, were divided into three categories: sensitive to short droughts (two to three months), sensitive to moderate and longer droughts (greater than six months), and relatively sensitive to any droughts. Major reservoir systems are presumed to have moderate sensitivity to drought because there is a likelihood of decreases in summer and fall water availability (NYSERDA 2014). The greatest likelihood of future water shortages is likely to occur on small water systems.

Change of Vulnerability Since the 2014 HMP

For this HMP update, a qualitative assessment was conducted using data from the 2017 USDA Census of Agriculture to assess potential economic impacts. According to the American Community Survey 2018 Population Estimates, the population of Tompkins County has increased slightly since the 2010 Census; therefore, the number of people exposed to the drought hazard has increased. The number of farms however has decreased by 6-percent but the total acreage of farmland has slightly increased by 1-percent since the 2012 USDA Census of Agriculture reports; therefore, an increased area of agricultural land is exposed to the drought hazard. Overall, the entire County will continue to be exposed and vulnerable to drought events. As for wildfires, wooded land is relatively young in Tompkins County and as private and public land preservation efforts continue to increase with increased local conservation efforts to protect mature woodland it may result in less vulnerability to drought and wildfires.

Identified Issues

- Due to the history of drought events, some municipalities within the County (Town of Caroline, Town of Ulysses) are investigating how diverse water supplies can help protect and mitigate against the impacts of drought events.
- Droughts contribute to conditions conducive to wildfires, reduce fire-fighting capabilities, and have negative impacts on agriculture throughout the County.
- Per the FEMA Mitigation Ideas guidance, in order to mitigate drought impacts communities may develop drought emergency plans, develop criteria for triggers for drought-related actions, develop a



drought communication plan and early warning protocol, develop agreements for secondary water sources to be used during drought conditions, or to establish an agricultural water usage schedule to support recharge of ground water. (FEMA, 2013).

- Agricultural producers and rural homeowners continue to be on the front lines of drought risk due to their reliance on precipitation and groundwater. Strategies to help these communities combat these stresses are important.

