

# THE LAKE EFFECT ON THE SURROUNDING CLIMATE OF THE FINGER LAKES IN NEW YORK

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## INTRODUCTION

*Terroir* is a French term for the multitude of factors that affect the character and quality of wine. One of the most important aspects of *terroir* is climate and nowhere is the effect of climate more important than in the Finger Lakes of central New York; a region that at first glance would seem inhospitable for the growth of high quality wine grapes. But the climate of central New York is influenced by its geologic history in ways that are both profound and complex. This can be illustrated by comparing mean monthly maximum and minimum temperatures of the Finger Lakes region to other viticultural areas of the world (Table 1).

The Finger Lakes was granted American Viticulture Area (AVA) status in 1987. AVAs are appellations of origin for American wines as designated by the Alcohol and Tobacco Tax and Trade Bureau (TTB) formerly called the Bureau of Alcohol, Tobacco and Firearms (BATF). The Finger Lakes AVA is roughly 940,000 hectares and is named for the 11 Finger Lakes (Conesus, Hemlock, Canadice, Honeoye, Canandaigua, Keuka, Seneca, Cayuga, Owasco, Skaneateles, and Otisco Lakes, from west to east). They are oriented north-south and range in volume from 35 to more than 15,000 m<sup>3</sup> (Table 2).

The lakes not only give the Finger Lakes AVA its name but also play a central role in the region's climate. Most of the vineyards in the Finger Lakes AVA are located close to the lakes, particularly the deeper ones such as Seneca Lake. This is due to what is

informally known as the lake effect, a moderation in temperature and precipitation near the lakes. Although the term "lake effect" is commonly used in the region, it is not known exactly how the lakes affect local climate and how this is related to vineyard performance.

The landscape of the Finger Lakes has been shaped by glaciation. Glacial lobes of the Laurentide Ice Sheet carved the individual lake valleys (Fig. 1) and some of the lake bottoms are below sea level (Mullins and Hinchey, 1989). Subsequently, the glacial valleys were filled with sediment and glacial till (Easterbrook, 1999).

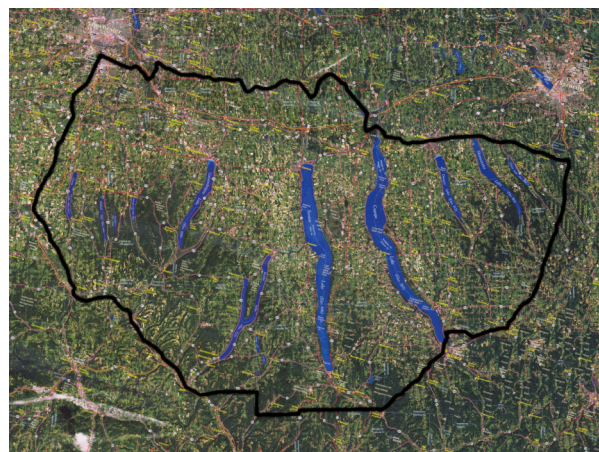


Figure 1. Satellite image of the 11 Finger Lakes of central New York and the boundary of the Finger Lakes AVA.

	Bordeaux, France	Bad Durkeim, Germany	Verona, Italy	Ciudad Real, Spain	Napa, CA	Walla Walla, WA	Finger Lakes, NY
APRIL MEAN	53.1	50.2	55.6	54.5	55.6	53.1	44.7
MAX	77.0	74.8	77.0	79.0	81.1	79.0	84.8
MIN	33.1	42.6	33.1	35.1	40.1	33.1	17.3
MAY MEAN	59.7	58.1	61.9	61.5	59.4	60.1	59.3
MAX	84.9	84.4	84.0	87.1	88.3	87.1	85.2
MIN	39.0	43.5	43.0	39.9	40.3	38.8	34.1
JUNE MEAN	64.9	63.9	69.6	70.0	64.6	66.6	67.5
MAX	90.0	88.2	91.0	96.1	94.6	97.3	90.8
MIN	45.0	41.2	48.9	46.9	39.0	46.0	40.7
JULY MEAN	68.9	67.1	72.3	77.0	66.4	75.0	71.0
MAX	93.0	92.5	93.9	102.0	94.3	104.0	90.4
MIN	48.9	40.1	54.0	53.1	38.1	52.0	48.1
AUG MEAN	68.9	65.5	70.5	77.0	66.0	73.9	71.6
MAX	93.9	89.4	91.9	100.9	92.7	101.0	92.0
MIN	48.0	41.2	51.1	54.0	38.7	51.1	46.4
SEPT. MEAN	64.9	59.2	65.5	68.5	65.1	64.0	64.2
MAX	89.1	82.6	87.1	95.0	93.7	91.0	87.3
MIN	43.0	43.0	46.0	45.0	39.6	42.1	38.8
OCT. MEAN	56.8	49.5	55.0	59.0	61.3	54.0	51.4
MAX	78.1	71.2	77.0	82.9	89.2	80.1	77.8
MIN	34.0	44.4	34.0	37.0	40.5	33.1	27.7

**Table 1. Comparison of mean monthly maximum and minimum temperatures and daily means of the Finger Lakes region to other world viticultural areas (Gladstones, 1992 and NEWA).**

Lake	Mean Depth (m)	Max Depth (m)	Length (km)	Volume (m <sup>3</sup> )	Surface Area (km <sup>2</sup> )	Watershed (km <sup>2</sup> )	Elevation (m above MSL)
Seneca	88.6	198.4	56.6	15539.5	175.4	1180.6	135.6
Cayuga	54.5	132.6	61.4	9379.4	172.1	1145.2	116.4
Candaigua	38.8	83.5	24.9	1640.1	42.3	476.6	209.7
Skaneateles	43.5	90.5	24.2	1562.8	35.9	154	263
Keuka	30.5	55.5	31.6	1433.7	47	404.6	217.9
Owasco	29.3	54	17.9	780.7	26.7	470	216.7
Conesus	11.5	18	12.6	156.83	13.67	180.5	249
Hemlock	13.6	27.5	10.8	105.89	7.2	96.2	275.8
Otisco	10.2	20.1	8.7	77.8	7.6	93.8	240.2
Canadice	16.4	25.4	5.1	42.6	2.6	31.8	334
Honeoye	4.9	9.2	6.6	34.81	7.05	95	245

**Table 2. Physical characteristics of the Finger Lakes (after Bloomfield, 1978).**

## CLIMATE

Climate can be measured on many different scales, from macroclimate to mesoclimate to microclimate. Macroclimate refers to large areas such as continents or extensive regions that might include or constitute an AVA (Gladstones, 1992). Mesoclimate refers to definable regions within this larger area, such as a watershed, valley, or perhaps individual vineyard. Microclimate refers to smaller domains ranging from parts of vineyards to individual grape cluster.

The Finger Lakes AVA has a macroclimate that is fairly cool and wet. Annual rainfall ranges from 21 to 31 inches. The area averages about 2500 growing degree-days (summation of hours of effective photosynthesis above 50°F) with a mean

	Valois	Groveland
JAN. MAX	56.9	58.9
MIN	1.8	3.3
FEB. MAX	54.9	58.2
MIN	3.1	-2.0
MAR. MAX	67.4	68.4
MIN	8.7	7.3
APRIL MAX	85.3	84.3
MIN	13.7	20.8
MAY MAX	84.8	85.5
MIN	35.8	32.3
JUNE MAX	90.4	91.1
MIN	43.0	38.4
JULY MAX	89.3	91.4
MIN	49.9	46.2
AUG MAX	91.5	92
MIN	48.8	43.9
SEPT. MAX	86.7	87.9
MIN	40.5	37.0
OCT. MAX	75.8	79.8
MIN	29.1	26.3

**Table 3. A comparison of mean monthly maximum and minimum temperatures from the Valois and Groveland weather stations. (NEWA)**

temperature of 60°F. It is within this large macroclimate that the lake effect can be identified relative to individual mesoclimates associated with specific lakes. To illustrate this two study areas were chosen: one close to Seneca Lake, and another far from any body of standing water.

## TEMPERATURE DATA

There are fifteen weather stations in the Finger Lakes AVA. Most are named for the closest town. The Groveland weather station is located near the western boundary of the AVA, and is at 591 ft above sea level. The Valois weather station is within 100 ft of Seneca Lake on the eastern side and 800 ft above sea level. Table 3 shows monthly maximum and minimum temperature values from these two stations and illustrates that the Valois maximum monthly temperatures are consistently lower than the corresponding values from the Groveland weather station, whereas the Valois minimum monthly temperatures are consistently higher than the corresponding values from the Groveland weather station. The lake effect also affects precipitation, as can be seen in the satellite photograph of Figure 2.

## CONCLUSIONS

Although the macroclimate of the Finger Lakes region is not suitable for growing of *Vinifera* grapes, as illustrated in Table 1, the moderating effect of the deeper lakes in the Finger Lakes AVA allows fine wine grapes to be produced. This "lake effect" is directly related to the volume and thermal mass of the lakes such that the maximum and minimum temperatures near the lake are moderated relative to locations distal to the lakes. This effect averages a difference of 1.72 degrees for the two studied locations at Valois and Groveland. The lake effect also affects precipitation, both winter snowfall and summer rain. The combined effects of moderated temperature and precipitation are responsible for viticultural subregions such as the southeastern shore of Seneca Lake, which locally is known as the "banana belt" of the Finger Lakes.

## REFERENCES CITED

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Figure 2. Another satellite image of the Finger Lakes, showing the reduction in the amount of snow accumulated near the larger lakes, such as Seneca.

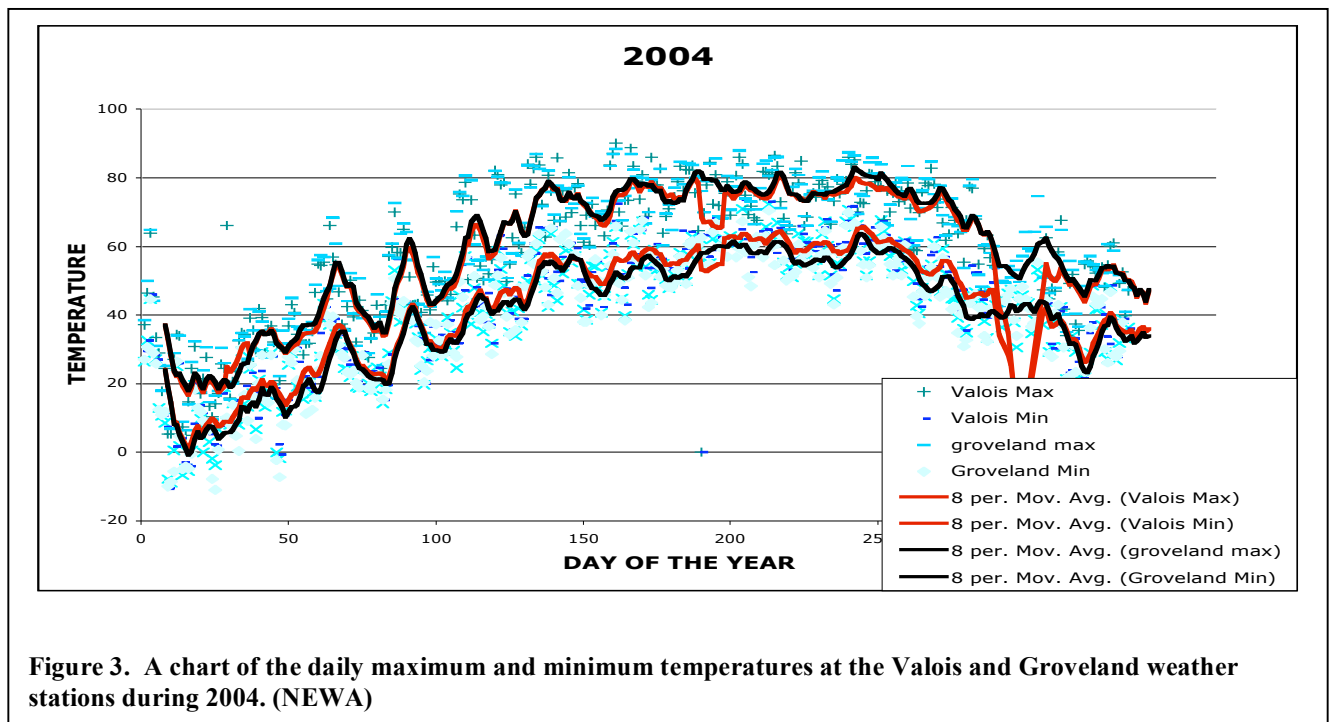


Figure 3. A chart of the daily maximum and minimum temperatures at the Valois and Groveland weather stations during 2004. (NEWA)