# Climate Change: Trends, Influences, and Potential Impacts for the Wine Industry

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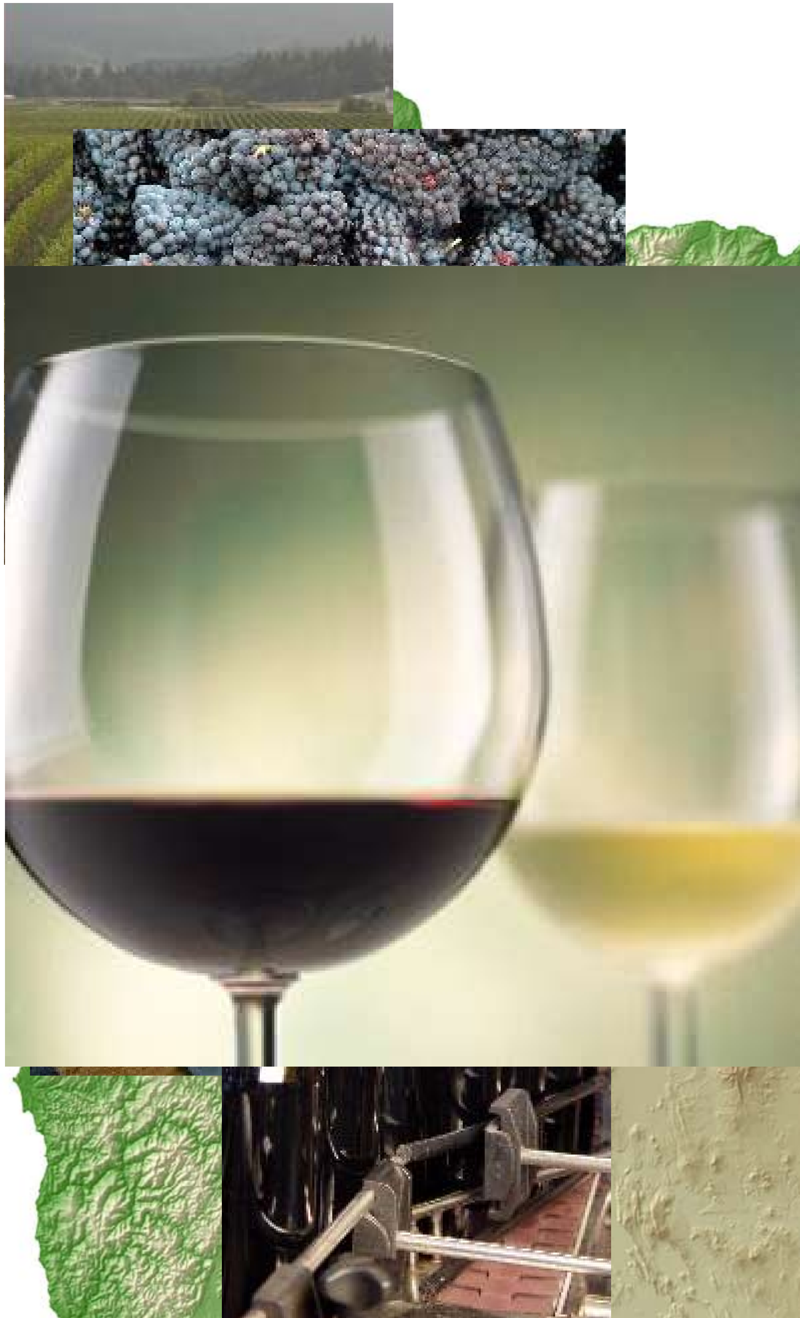
Multiple Sources: see author for details

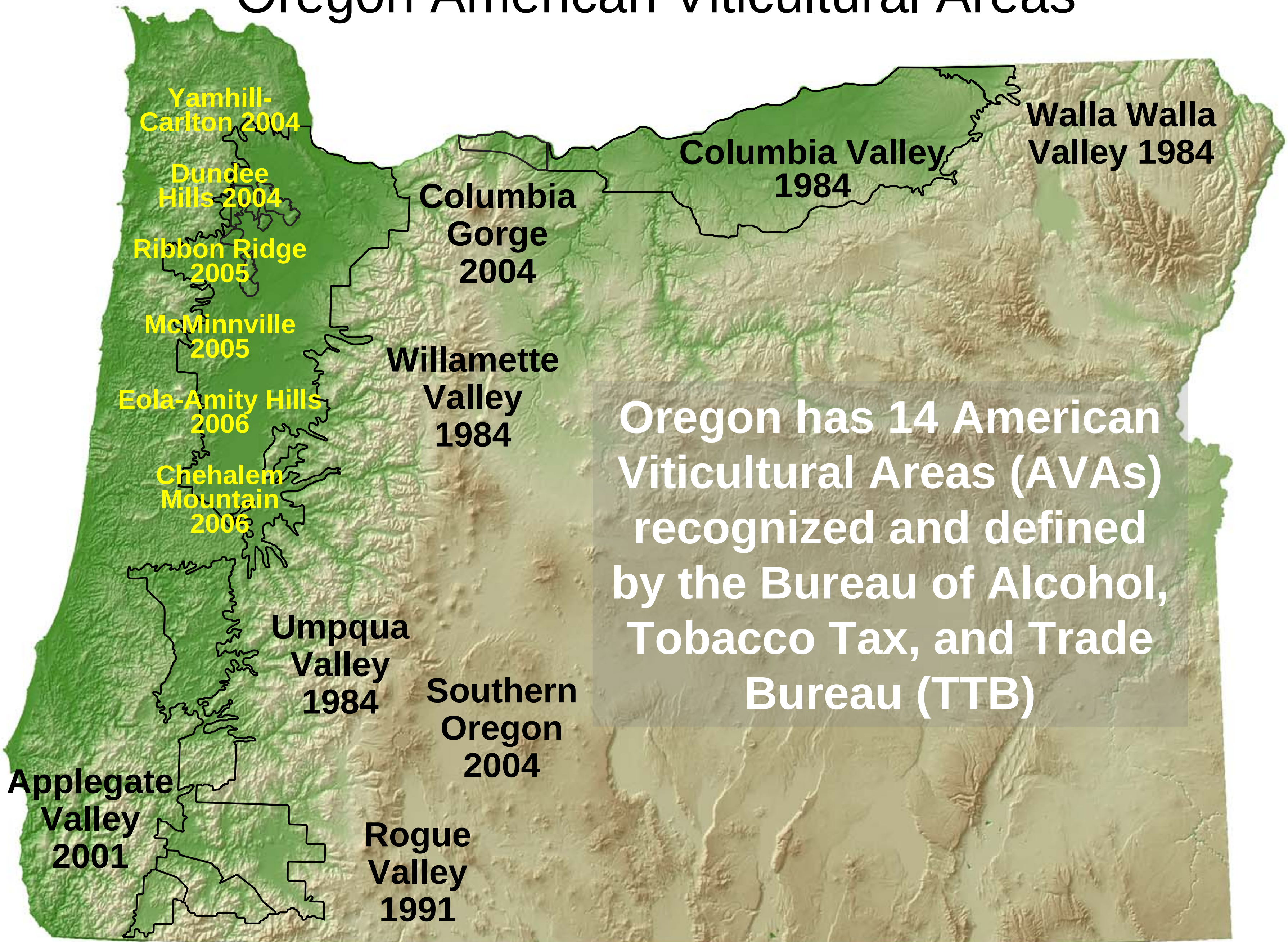


# Oregon Produces a Diversity of Wines

Single Varietal
Traditional Blends
Creative Blends
Sparkling
Late Harvest
Port-Style

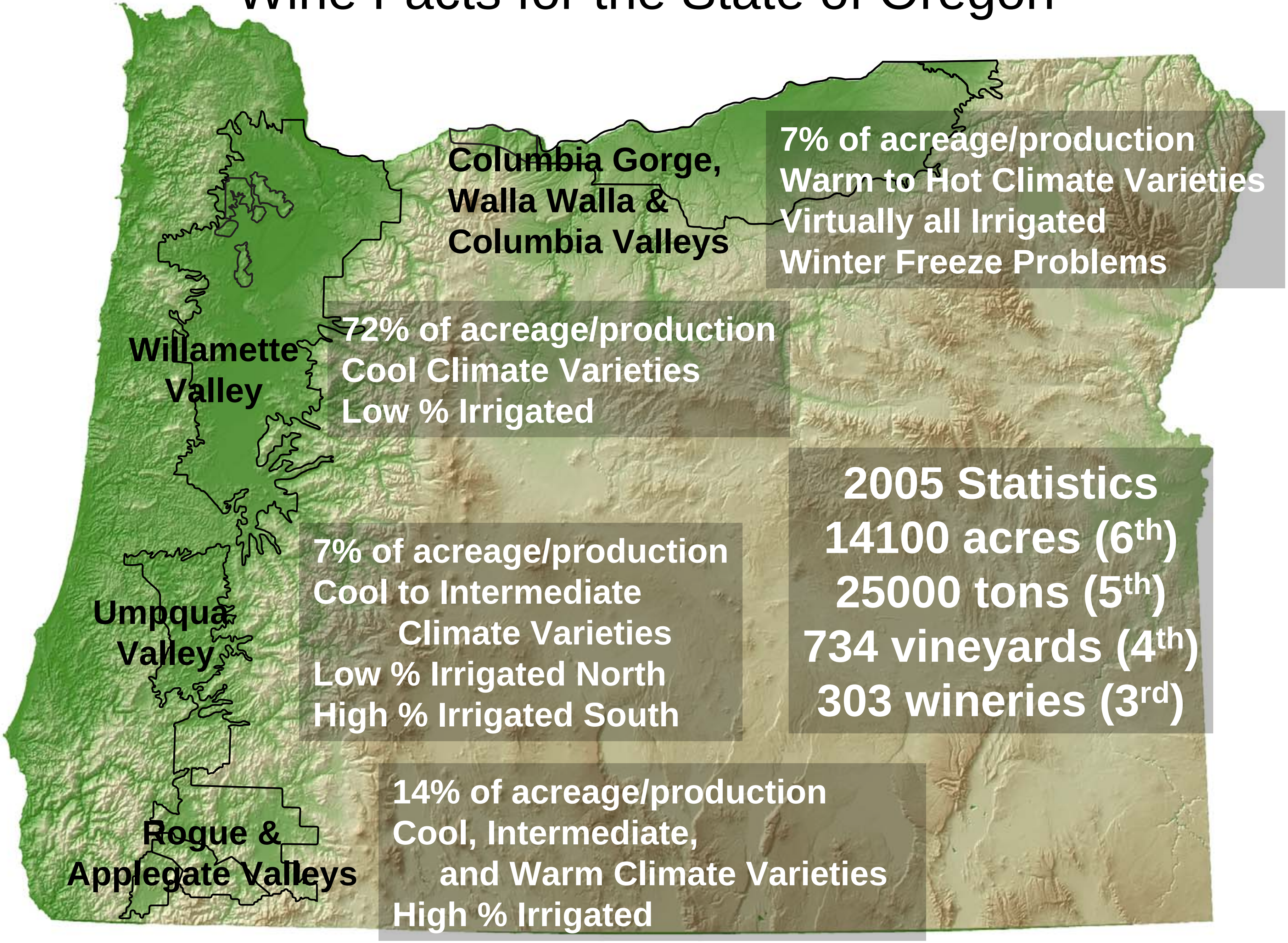
Multiple Sources: see author for details

# Oregon American Viticultural Areas

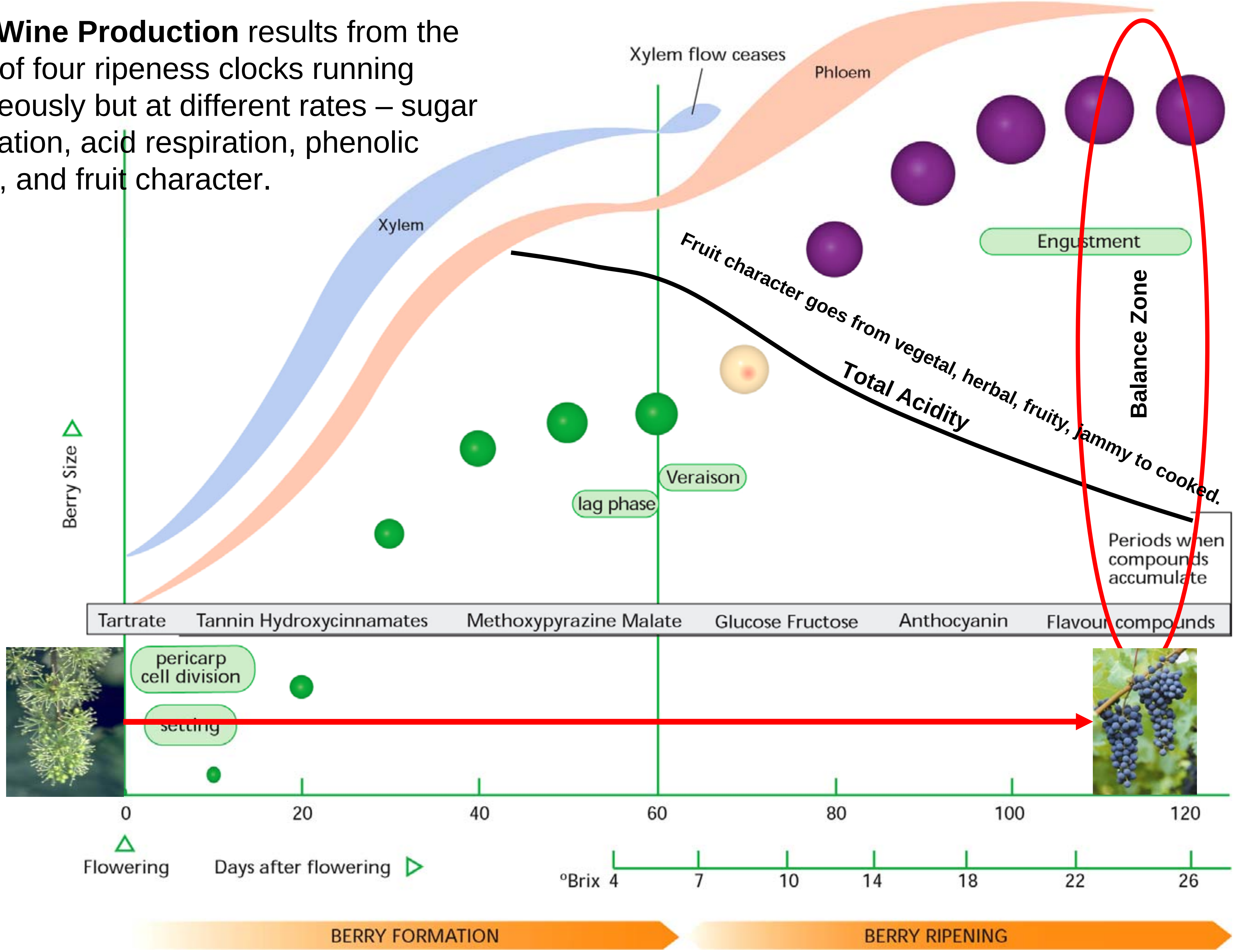



Oregon has 14 American Viticultural Areas (AVAs) recognized and defined by the Bureau of Alcohol, Tobacco Tax, and Trade Bureau (TTB)

# Wine Facts for the State of Oregon

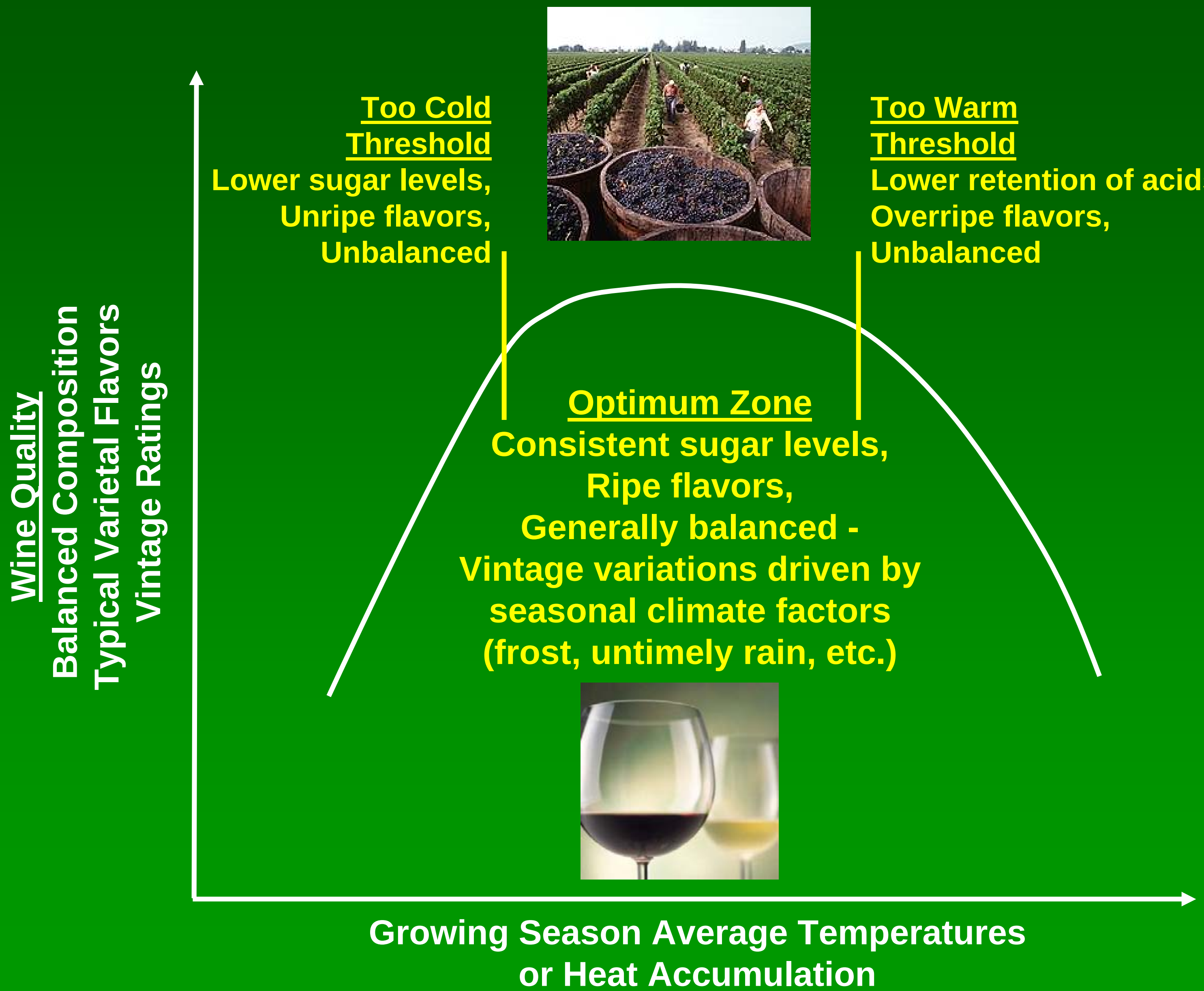


**Quality Wine Production** results from the balance of four ripeness clocks running simultaneously but at different rates – sugar accumulation, acid respiration, phenolic ripeness, and fruit character.



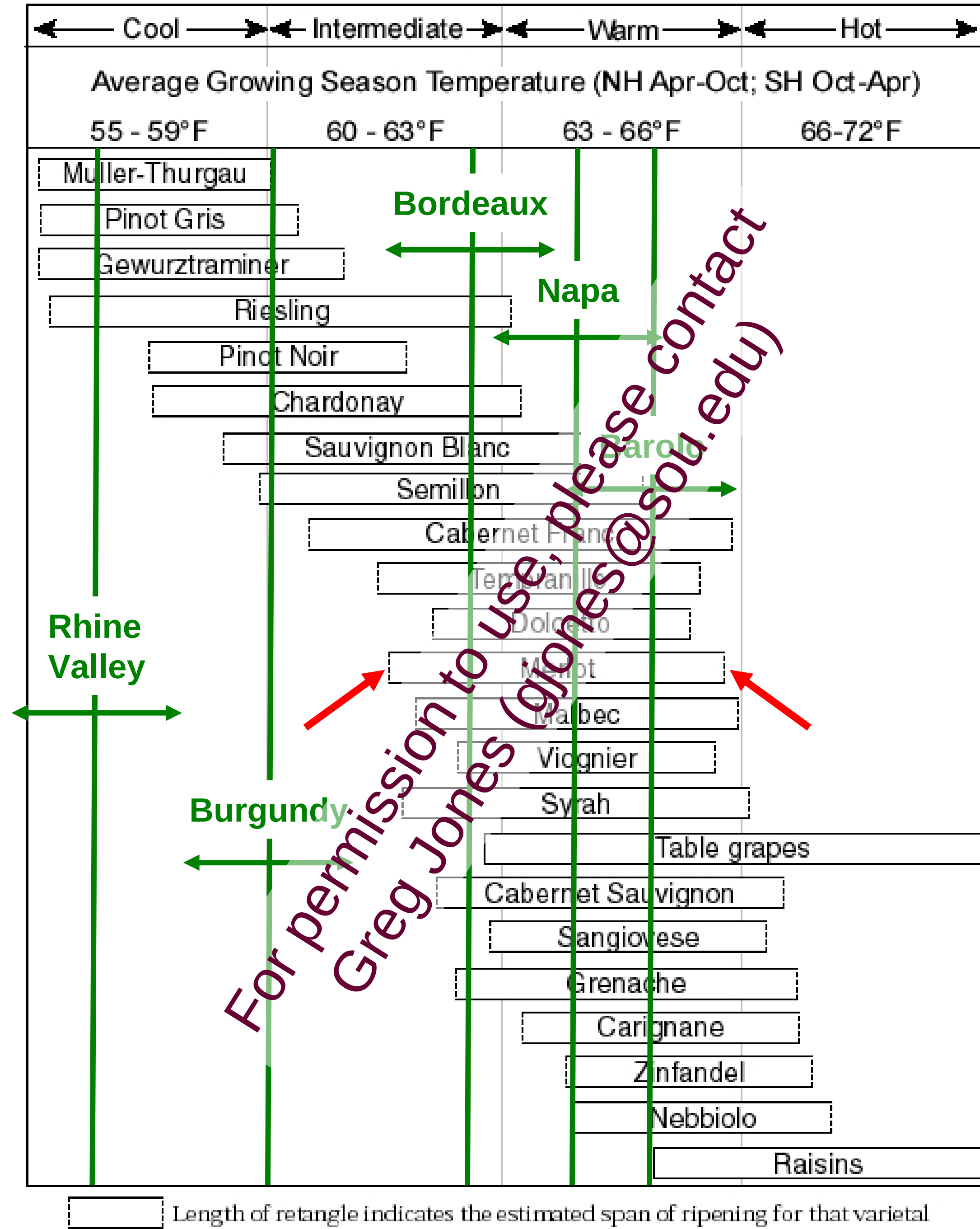

*Australian Viticulture* from text: “Ripening berries – a critical issue” by Dr. Bryan Coombe and Tony Clancy (Editor, *Australian Viticulture*), March/April 2001. Illustration by Jordan Koutroumanidis and provided by Don Neel *Practical Winery and Vineyard*

# Varietal-Climate Thresholds



- Climate influences the style of wine an area can produce
- Maturity groupings give an indication of the span of potential ripening period for different varieties based on phenology requirements
- Each variety is generally grown in specific regions and narrow climatic zones for optimum quality and production

## Grapevine Climate/Maturity Groupings



# Climate Change and its Effects on Viticulture/Wine

- Grapevines are generally grown in narrow climatic zones for a specific variety's optimum quality, putting them at great potential risk from climatic variations and change

Observed/Potential Effects include:

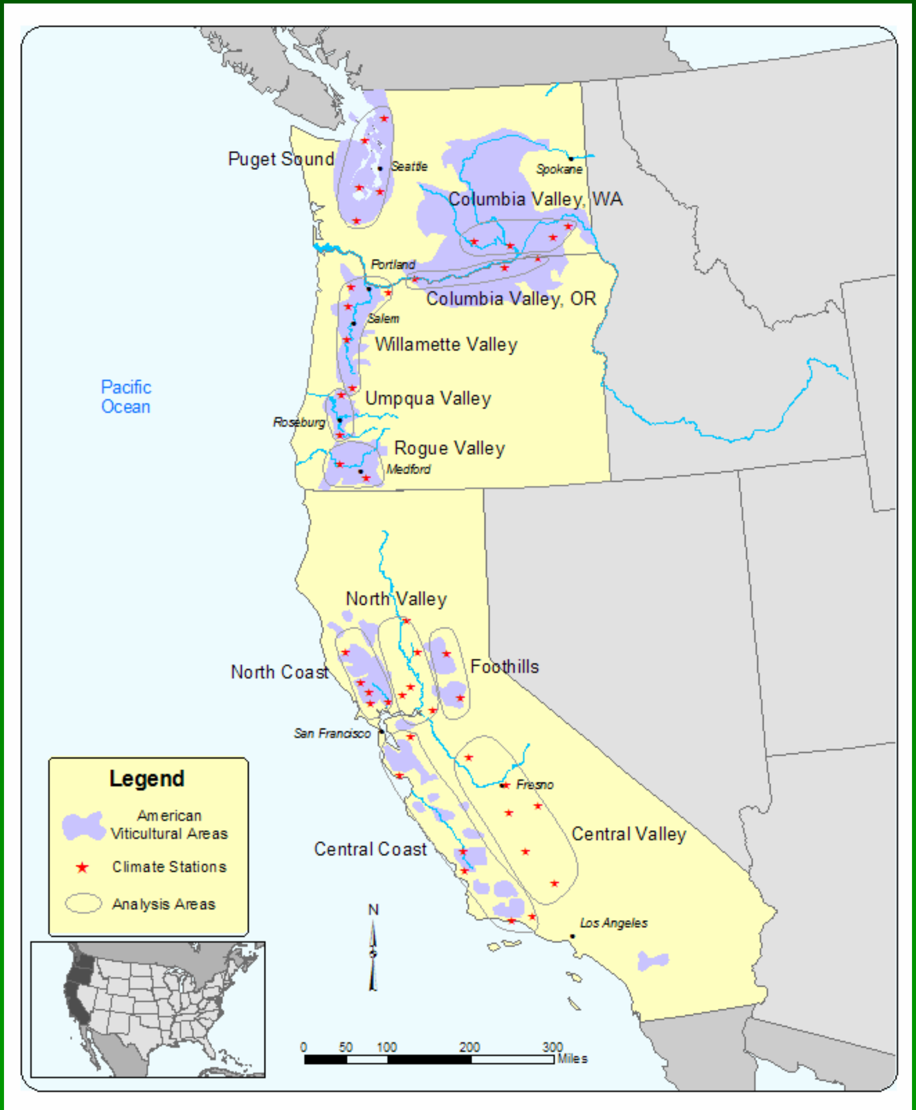
- Warmer and longer growing seasons
- Altered phenological timing
- Altered ripening profiles
- Climatic thresholds
- Altered water needs
- $CO_2$ issues (growth and quality)
- Altered disease and/or pest timing and severity

# Observed Changes across the Globe

## 1950-2000

- Average growing season warming of 2.3°F
- Average dormant season warming of 2.5°F
- Warming trends are more significant and of greater magnitude in the N. Hemisphere vs. S. Hemisphere

# Observed Changes in the Western U.S.




## 1948-2004

- Growing Season Temperatures +2.0°F
- Driven by changes in minimum temperatures not maximum temperatures
- Decline in the # of days below freezing in all seasons (9-35 days)
- Earlier last spring frost (12-52 days)
- Later first fall frost (6-22 days)
- Longer frost-free period (18-65 days)
- Annual and seasonal precipitation levels are highly variable (no trends)
- Phenology trends range 6-20 days earlier over numerous varieties and locations

**Jones (2005) Acta Horticulturae**

# Observed Changes in Europe



6 days earlier


11 days earlier


15 days earlier


17 days earlier

14 days shorter
8 days shorter
10 days shorter
15 days shorter
12 days shorter
17 days shorter

## 1950-2004

- Growing Season Temperatures +3.1°F
- Driven by changes in minimum not maximum temperatures
- Decline in the # of days below freezing in all seasons (6-32 days)
- Earlier last spring frost (9-38 days)
- Later first fall frost (4-18 days)
- Longer frost-free period (13-41 days)
- Annual and seasonal precipitation levels are highly variable (no trends)
- Phenology relationships over numerous varieties and locations show a 3-6 day response per 1°F of warming

**Jones et al (2005) GESCO**

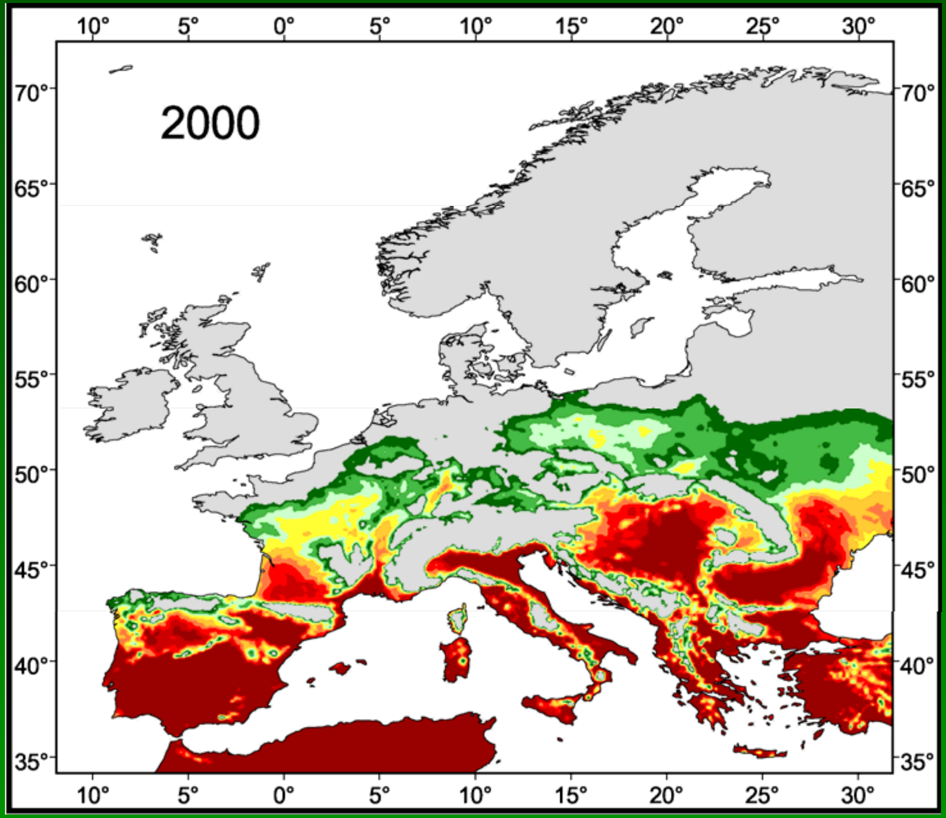
# From Observations to Climate Model Projections for the Western U.S., Europe, and the rest of the Globe

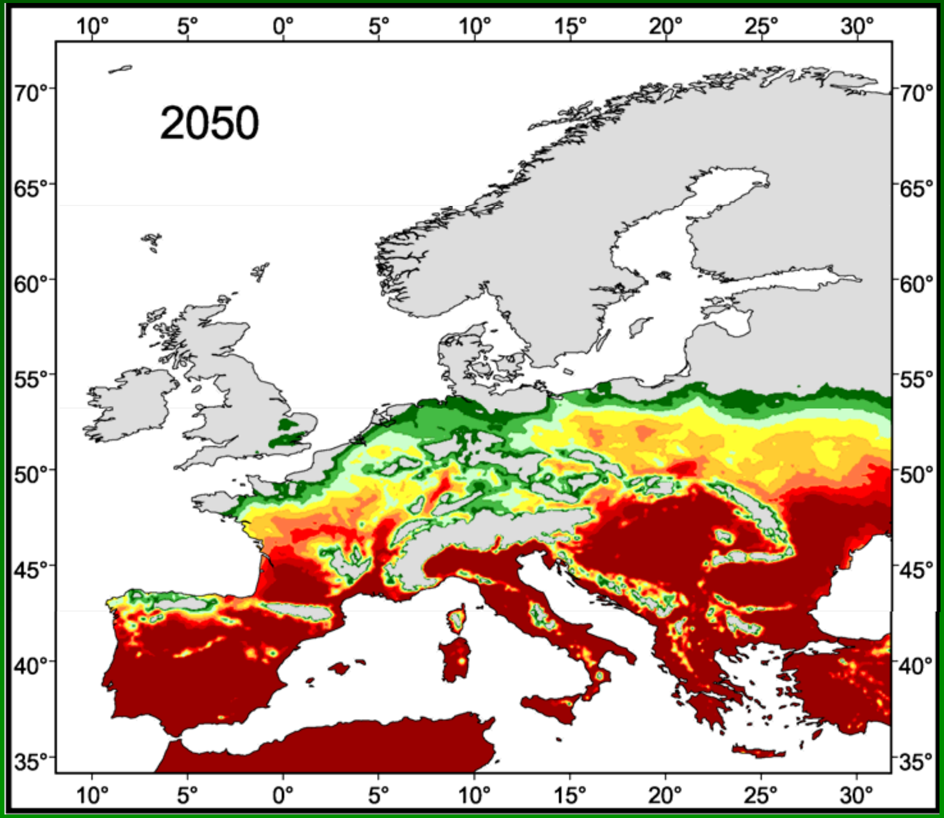
# Predicted Changes across the Globe

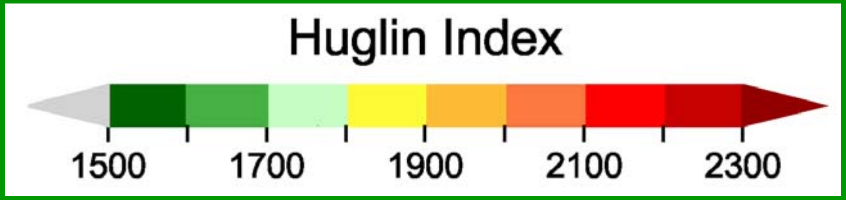
## 2000-2050

- All regions show growing season warming with trends ranging 0.4-1.1°F per decade, with an average warming of 3.6°F/50 years
- South Africa lowest (1.6°F/ 50 years), Portugal highest 5.1°F/ 50 years)
- N.H. (3.8°F/50 years) > S.H. (3.1°F/50 years)

# Climate Change Impact Assessment for Viticulture in Europe



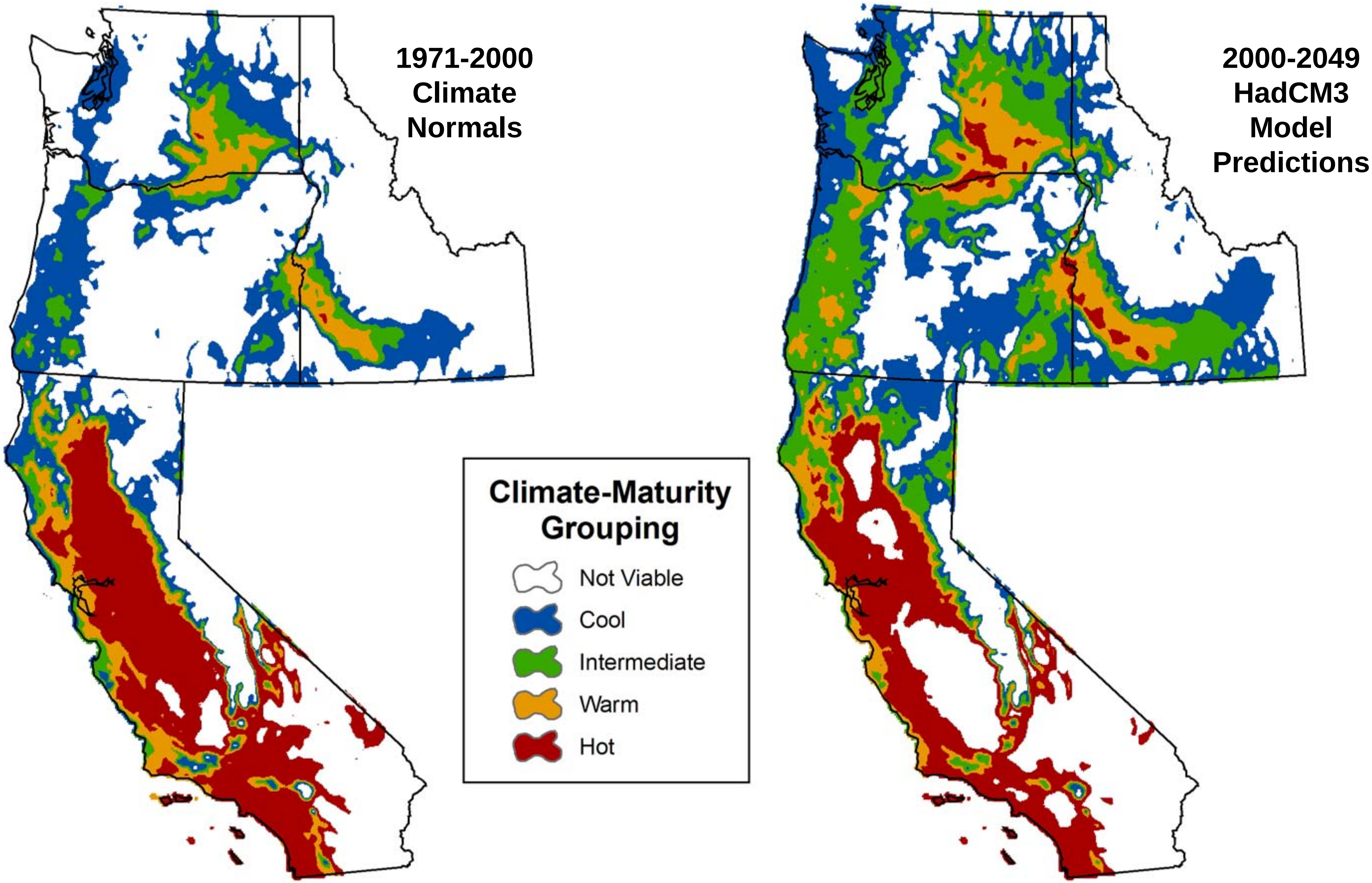




10-year running means of the **Huglin Index** based on the CRU data set, IPCC A1 Scenario & PCM Model

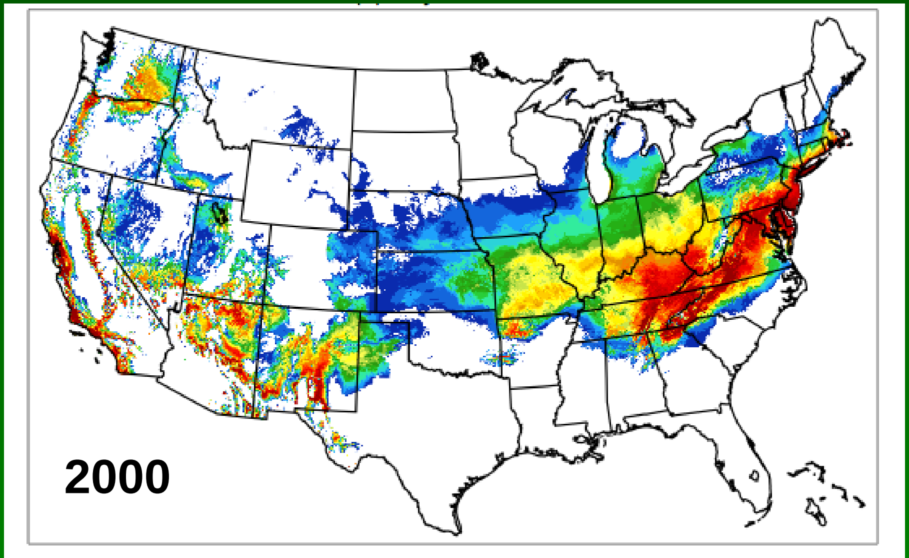
**Stock, 2004**

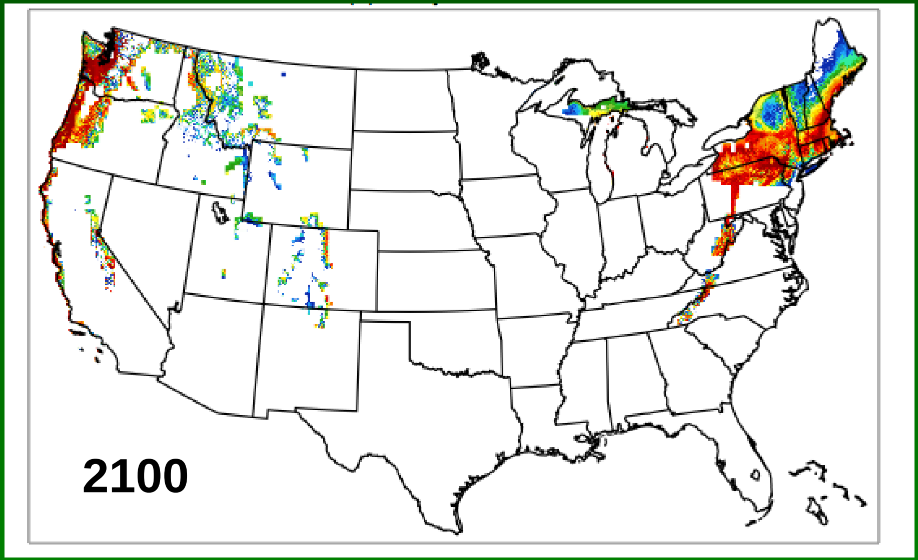
# Changes in Climate-Maturity Potential in the Western U.S.




Jones and Myers (in preparation)

# Spatial Changes in Viable Production Zones



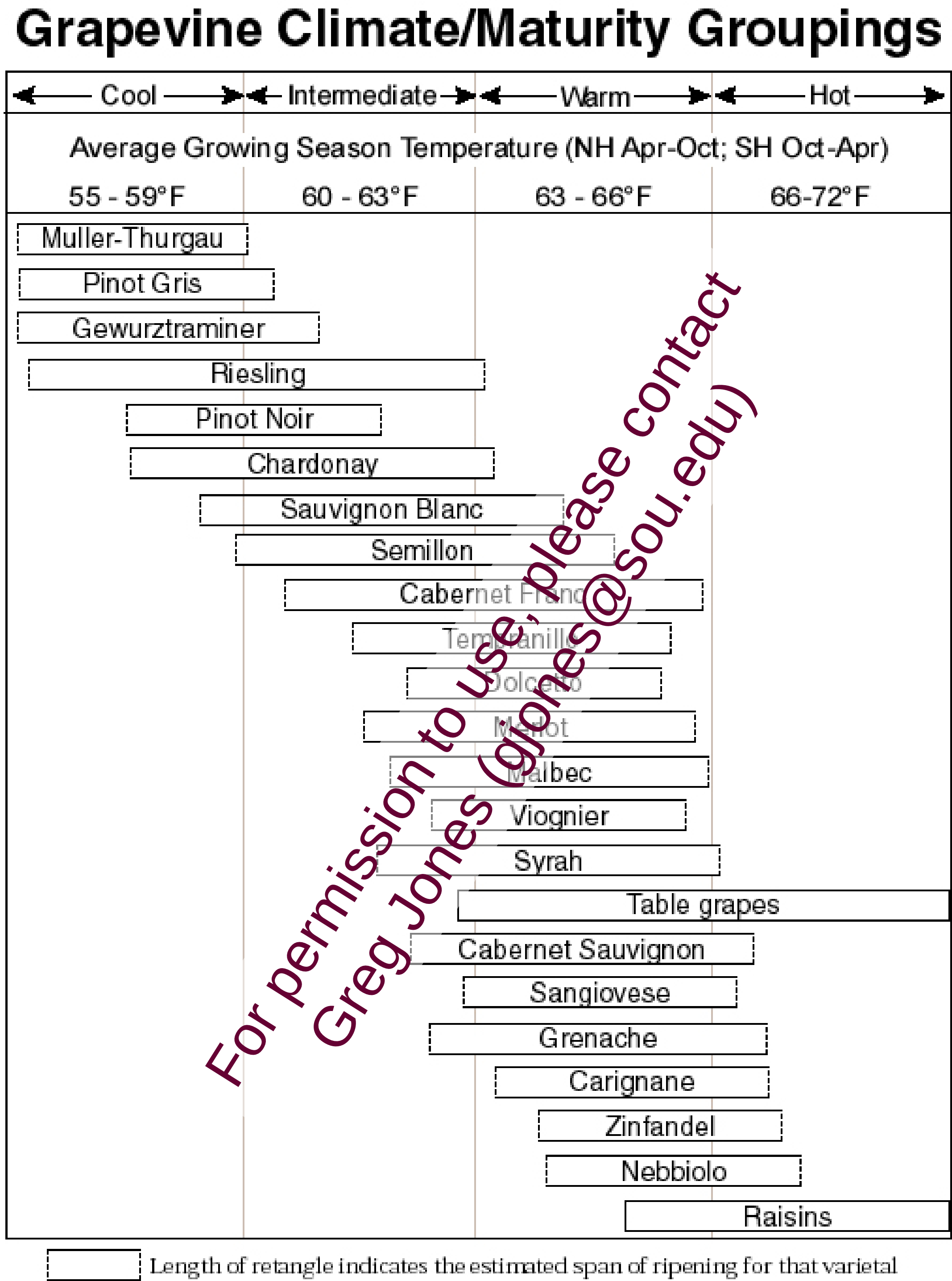




Average warming and increases in temperature extremes (days with Tmax > 95°F) by 2100:

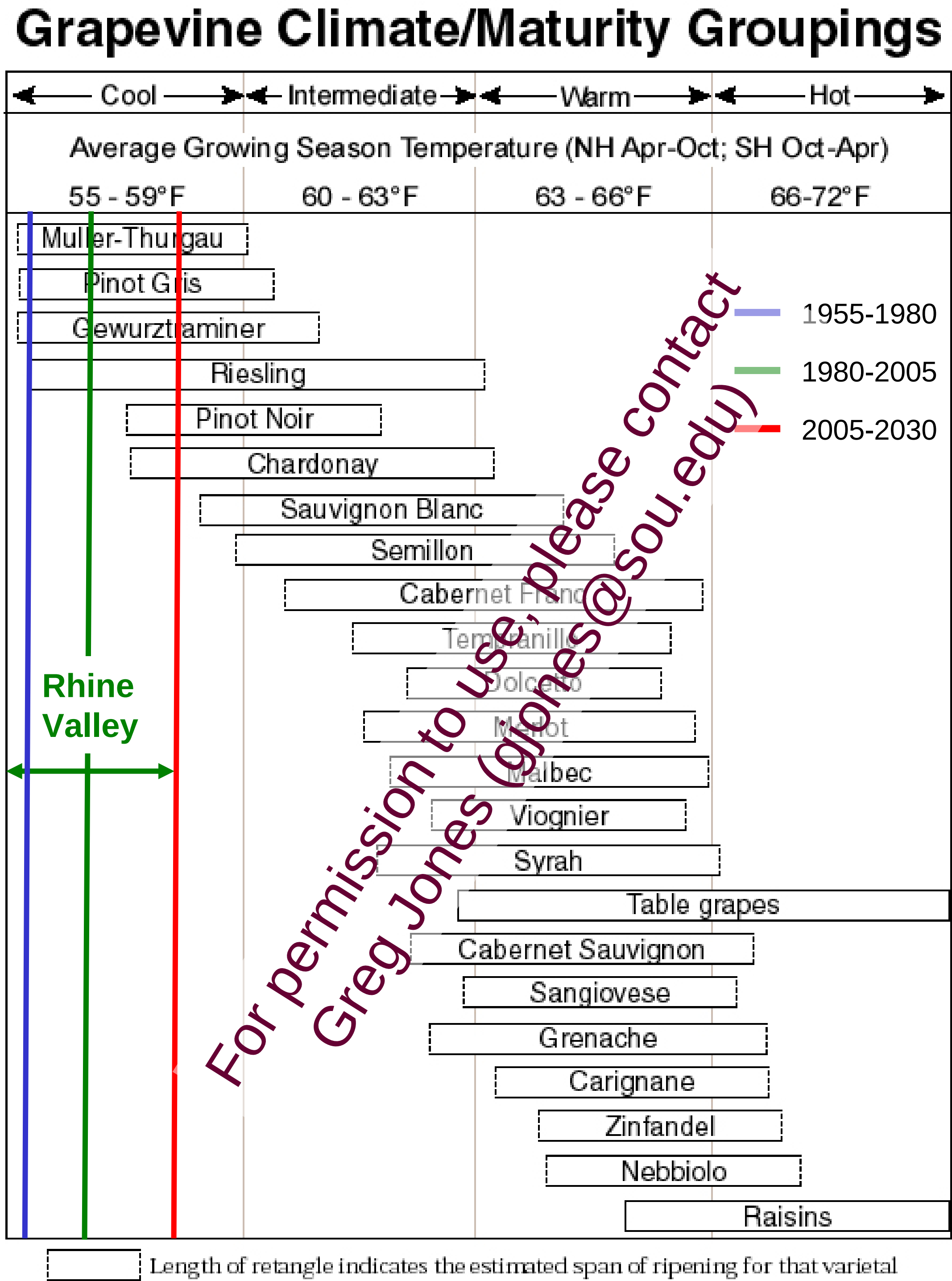
- Indicate potential reduction of viable production acreage for high to premium quality wine by up to 81%
- Resulting in shifting of viable zones occurs toward the coast, upward in elevation, and to the north
- Problems with coastal moisture could preclude some of the shift

**White et al (2006) PNAS**

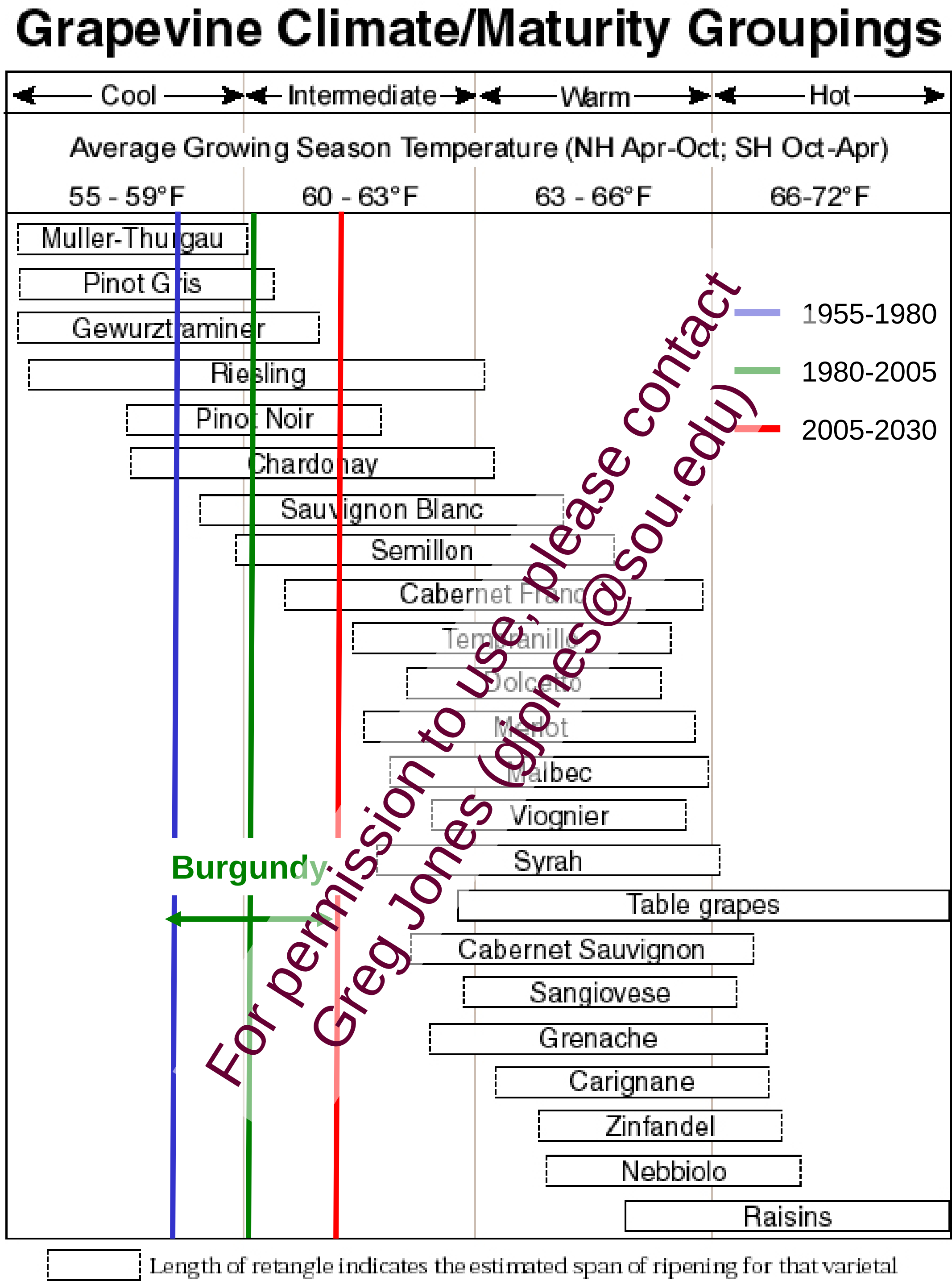
To place viticulture and wine in the context of climate change …



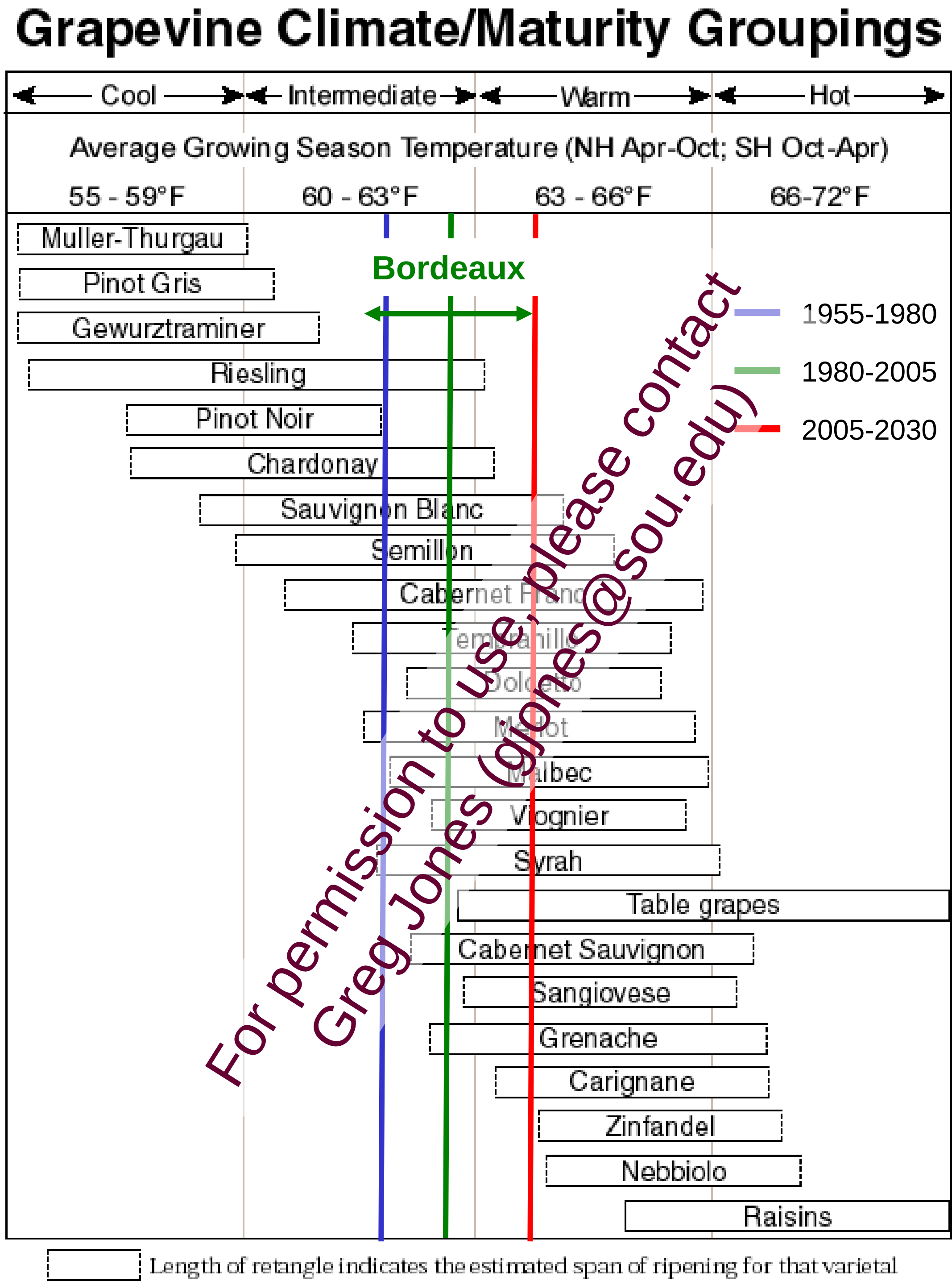
- Rhine Valley – declassification used to be 8 in 10 years, today 1 in 10 years



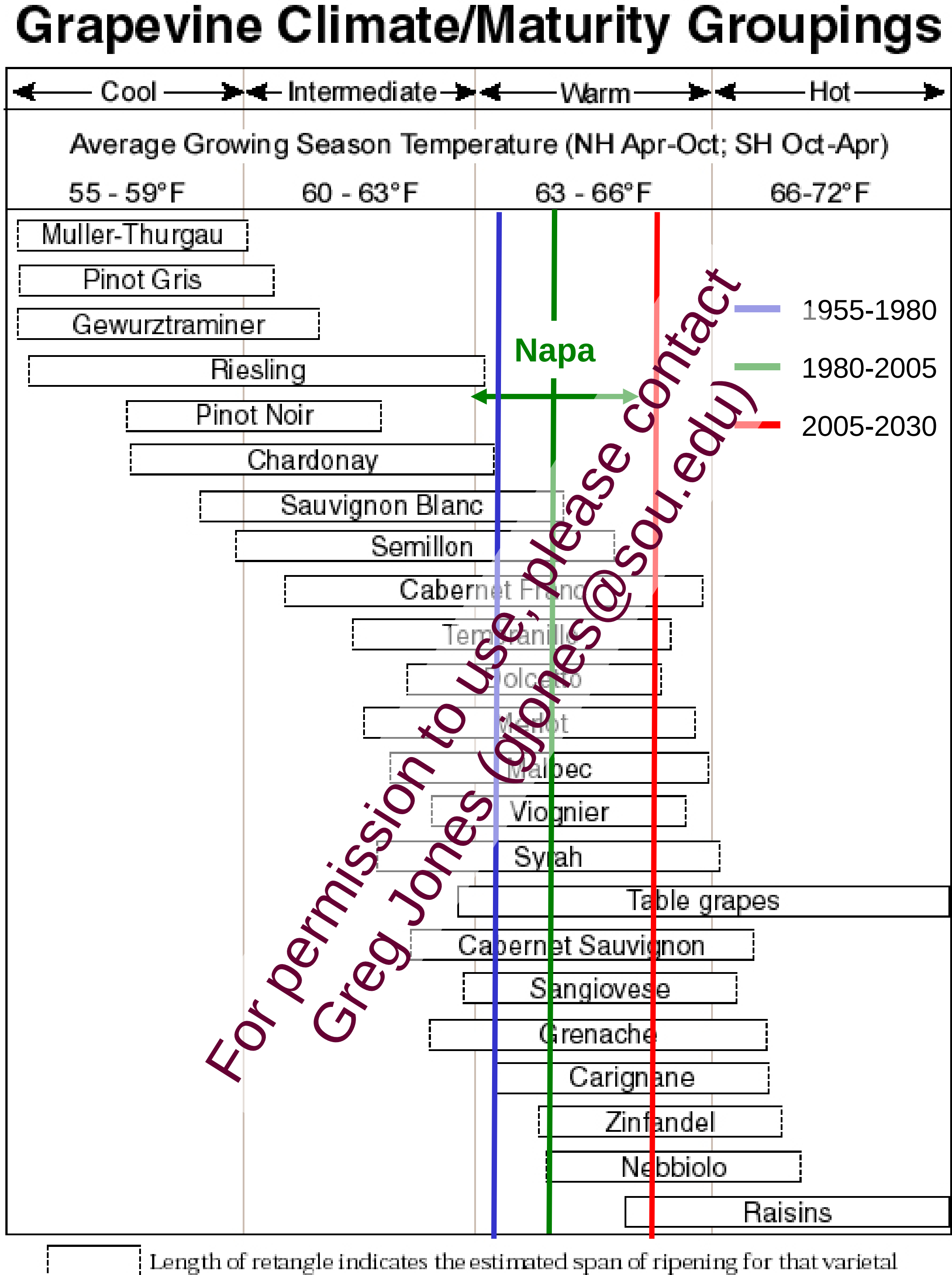
- Burgundy – chapitalization used to be the rule, today it's more the exception



- Bordeaux – more consistent inter-varietal ripening today

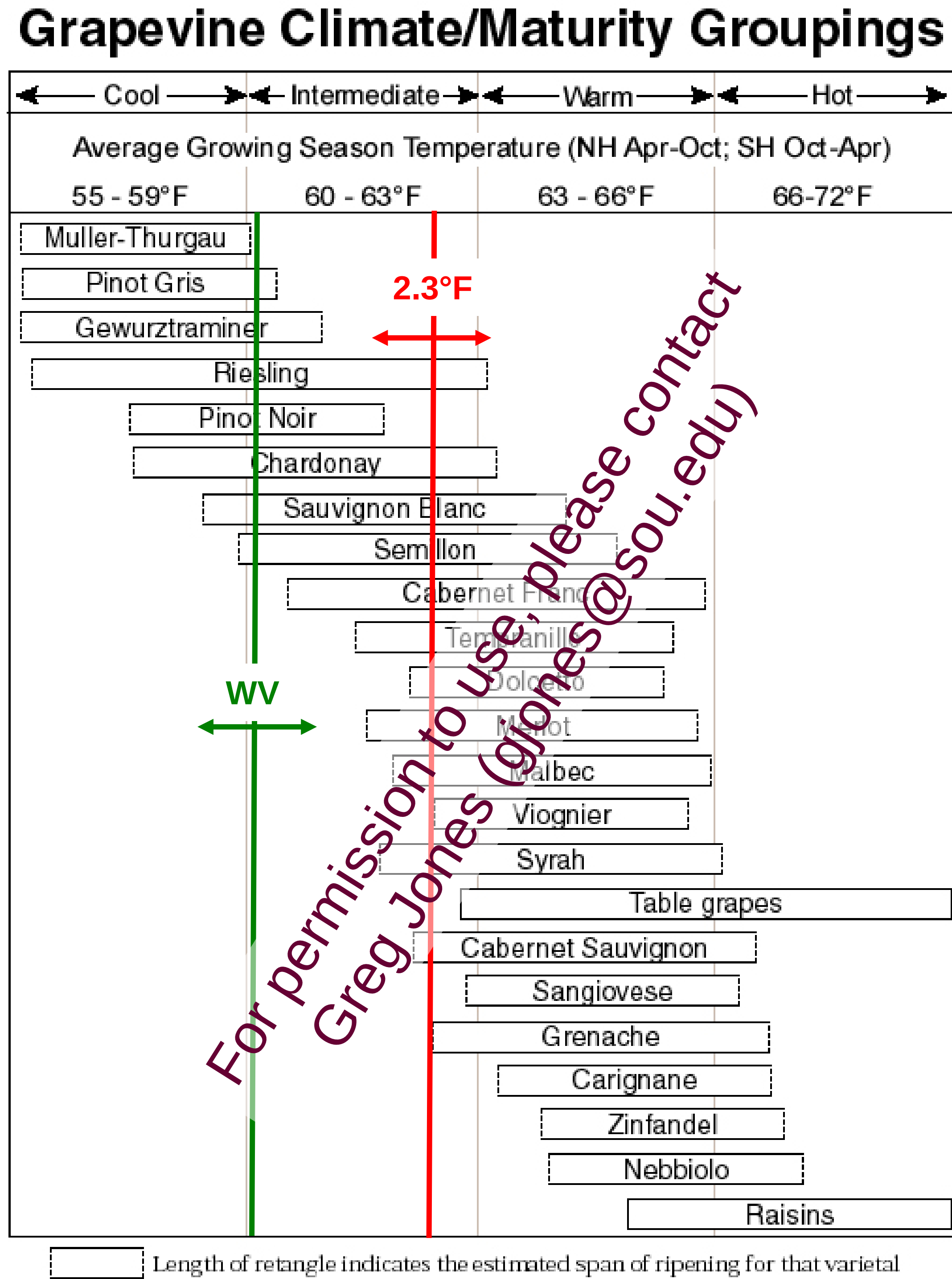


- Napa Valley – ultraripe fruit, dealcoholization common



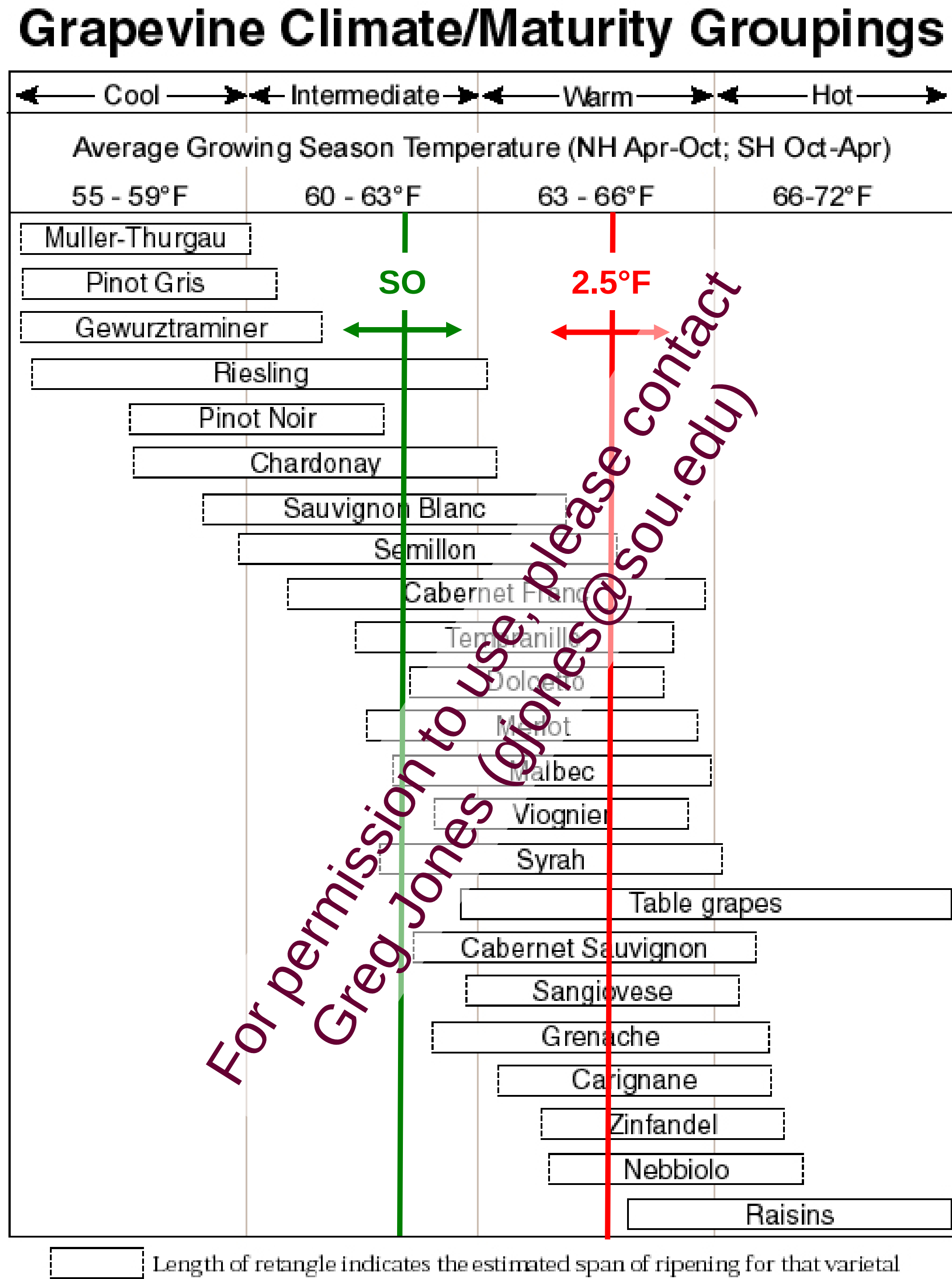
# Predicted Changes for:

# Willamette Valley



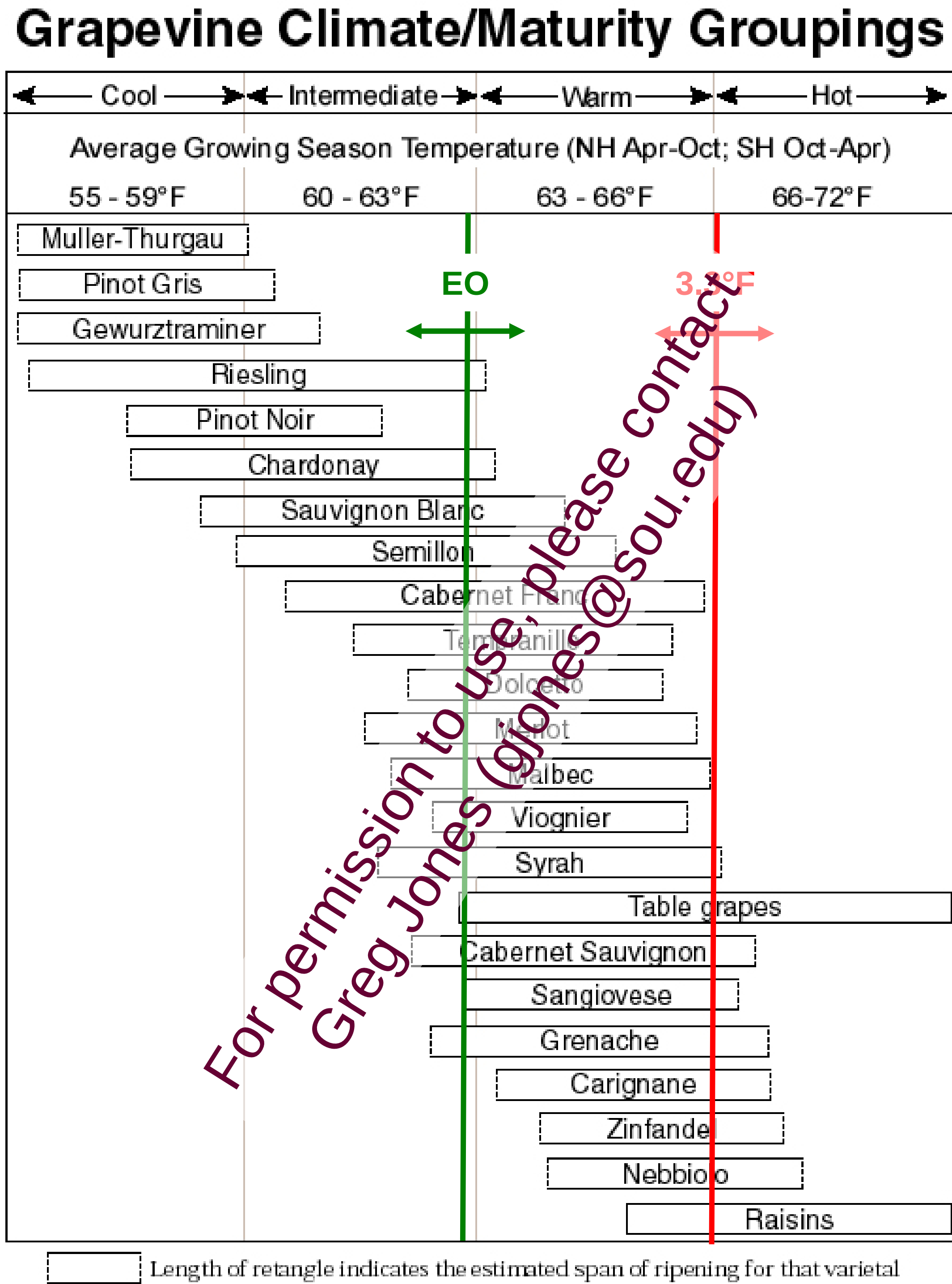
# Predicted Changes for:

# Southern Oregon



# Predicted Changes for:

# Eastern Oregon



# Overview and Potential Implications

- Wine production is a climatically sensitive endeavor, with narrow zones providing the most optimum production and quality characteristics, which therefore puts the industry at great risk from climate variations and change.

- The observed warming of the past 50 years appears to have mostly benefited the quality of wine grown worldwide through:
    - Longer and warmer growing seasons
    - Generally less frost risk
    - More consistent ripening climates

- However, the predicted warming in the next 50-100 years presents numerous potential impacts and challenges to the wine industry.

# Conclusions

- Awareness
- Willingness
- Uncertainties
- Urgency
- Mitigation
- Adaptation

**For a pdf copy of this presentation: gjones@sou.edu**