

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



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#1



#1



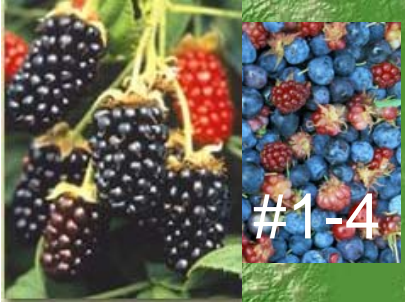
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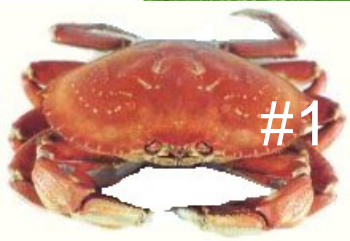
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Oregon's Agricultural Diversity



#2



#3



#4



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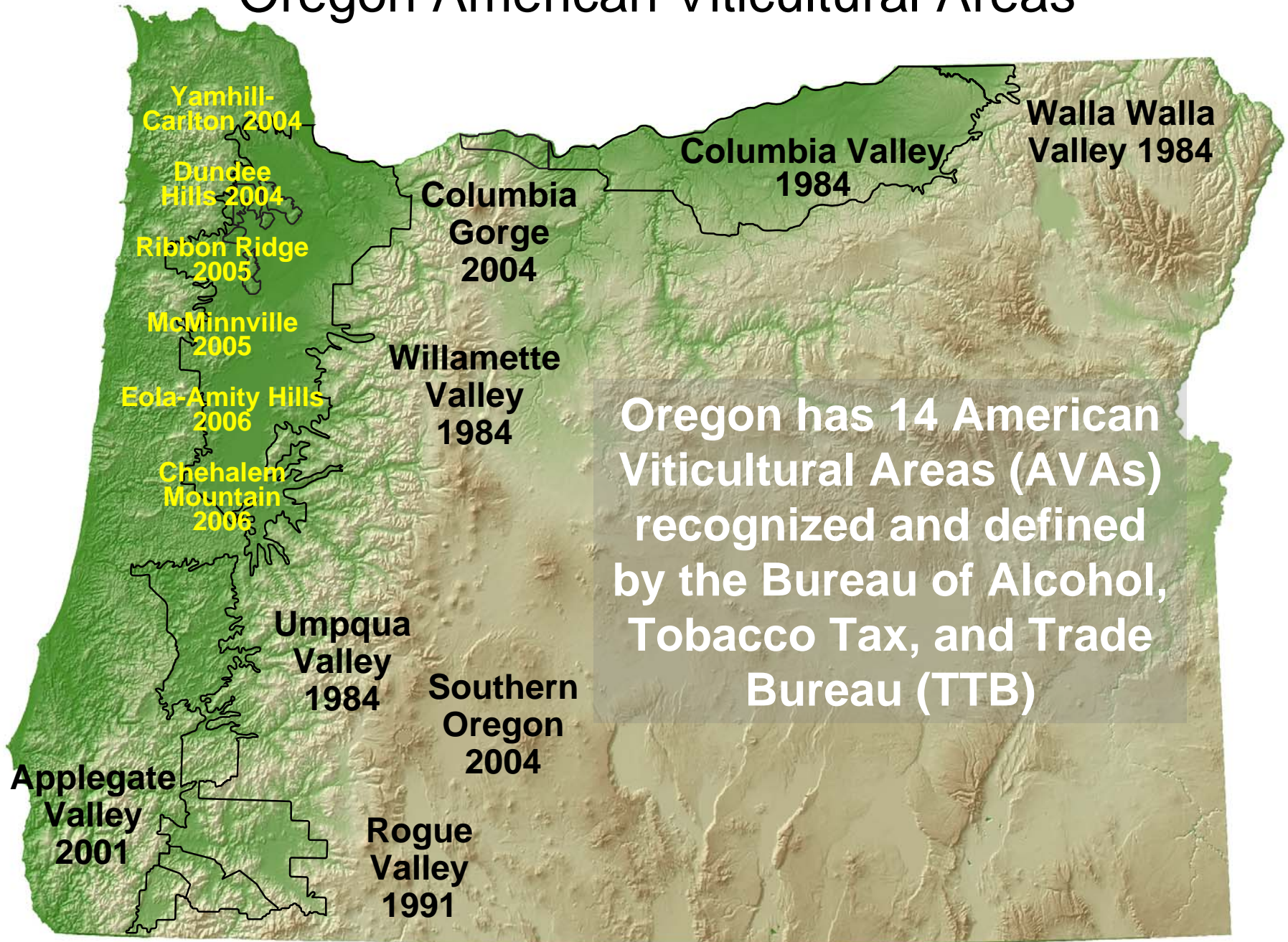
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Oregon Produces a Diversity of Wines

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

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

**Columbia Gorge,
Walla Walla &
Columbia Valleys**

7% of acreage/production
Warm to Hot Climate Varieties
Virtually all Irrigated
Winter Freeze Problems

**Willamette
Valley**

72% of acreage/production
Cool Climate Varieties
Low % Irrigated

**Umpqua
Valley**

7% of acreage/production
Cool to Intermediate
Climate Varieties
Low % Irrigated North
High % Irrigated South

**Rogue &
Applegate Valleys**

14% of acreage/production
Cool, Intermediate,
and Warm Climate Varieties
High % Irrigated

2005 Statistics

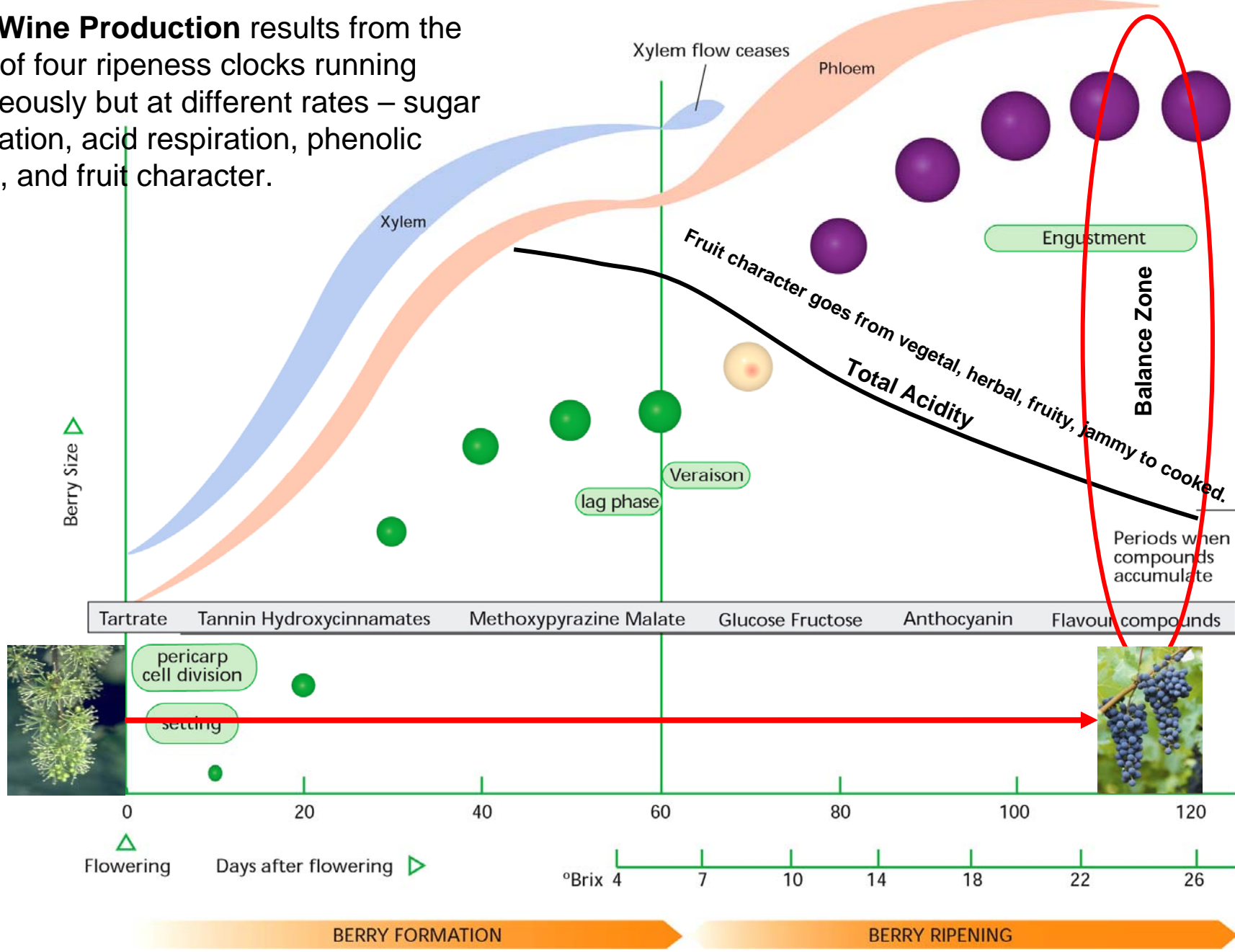
14100 acres (6th)

25000 tons (5th)

734 vineyards (4th)

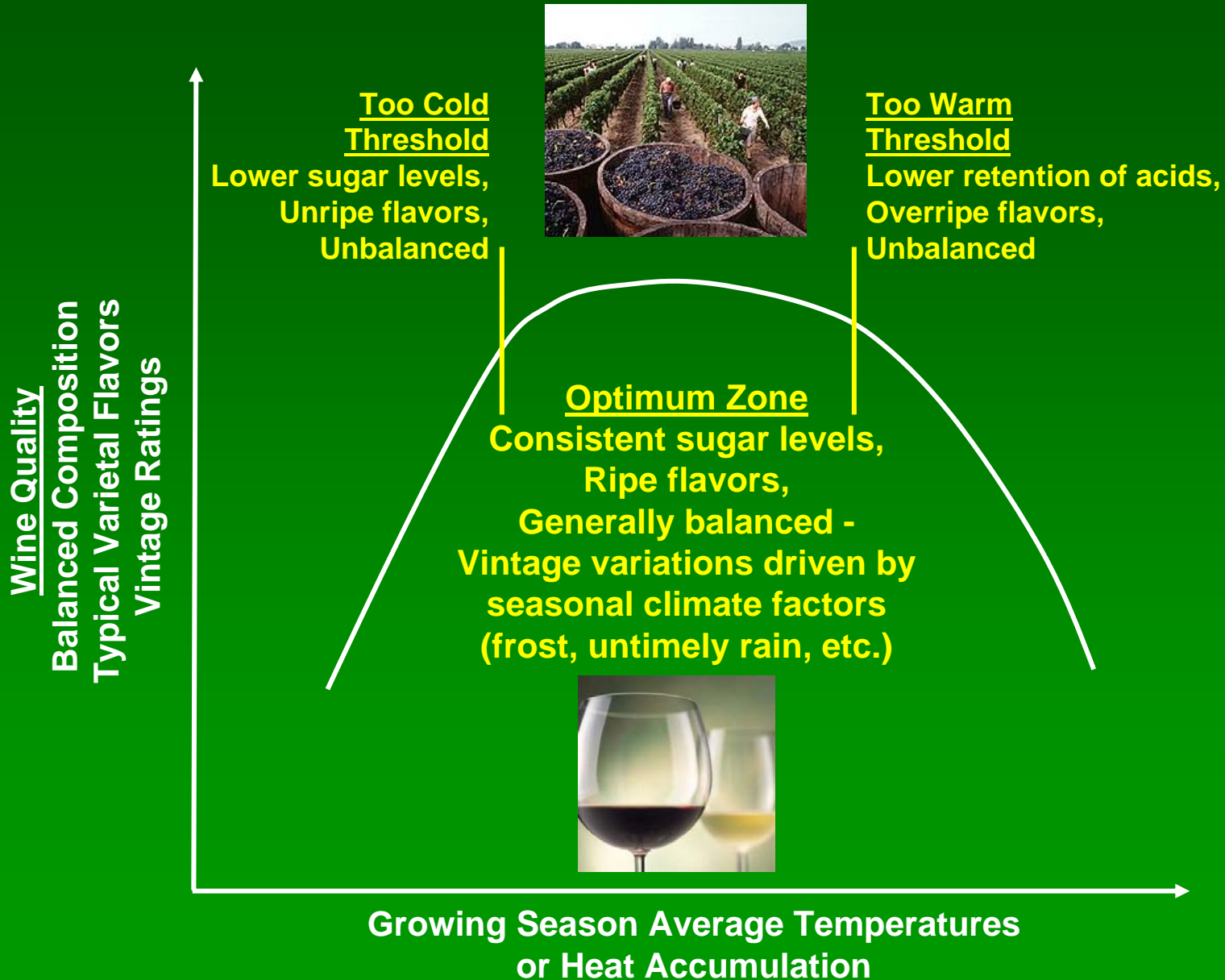
303 wineries (3rd)

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.



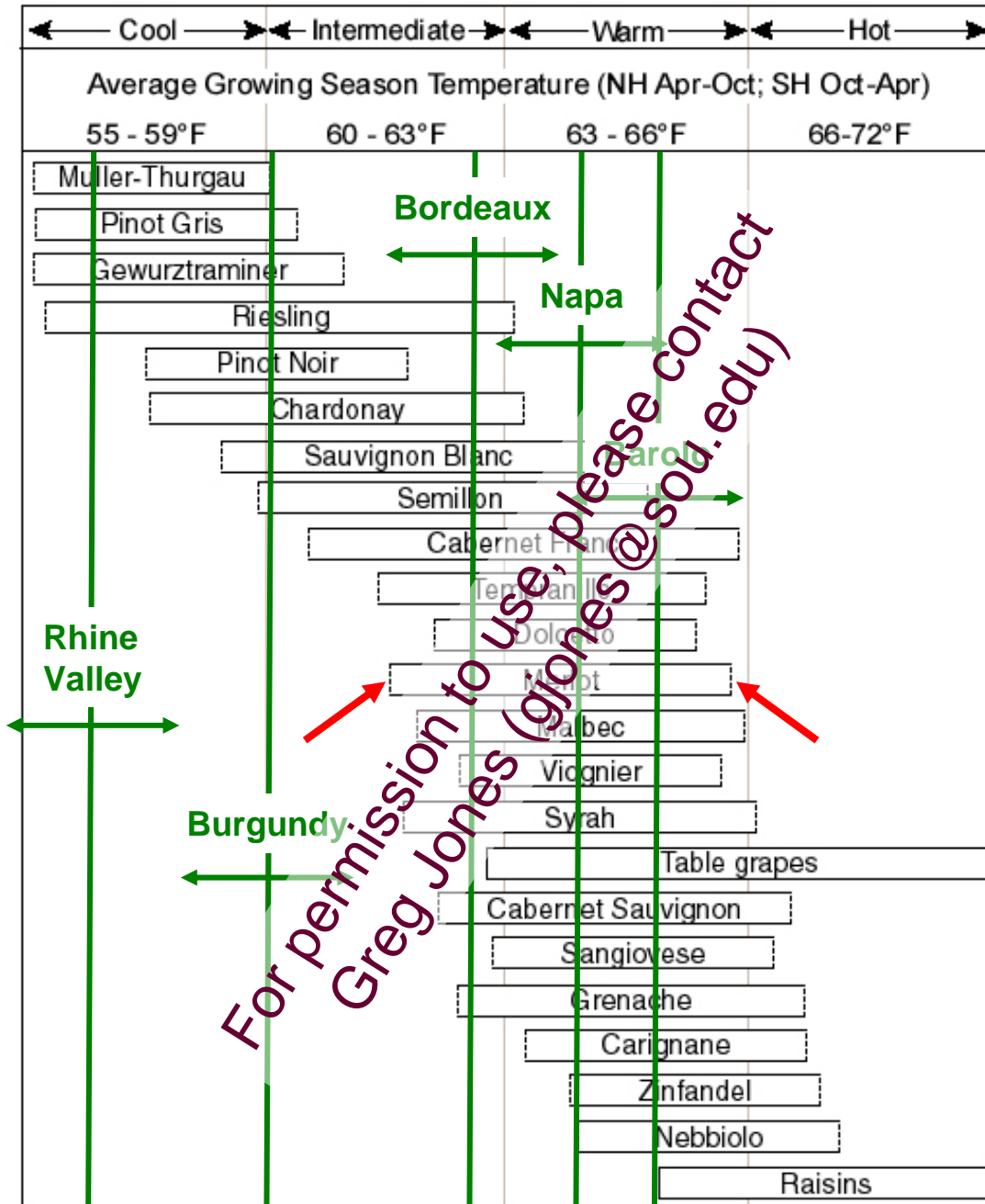
Australian Viticulture from text: "Ripening berries – a critical issue" by Dr. Bryan Coombe and Tony Clancy (Editor, *Australian Viticulture*), March/April 2001. Illustration by Jordan Koutroumanidis and provided by Don Neel *Practical Winery and Vineyard*

Varietal-Climature Thresholds



Grapevine Climate/Maturity Groupings

- 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



Length of retangle indicates the estimated span of ripening for that varietal

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
- CO₂ 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



Observed Changes in Europe

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



6 days earlier



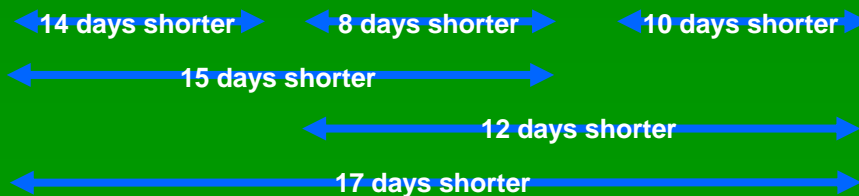
11 days earlier



15 days earlier



17 days earlier



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

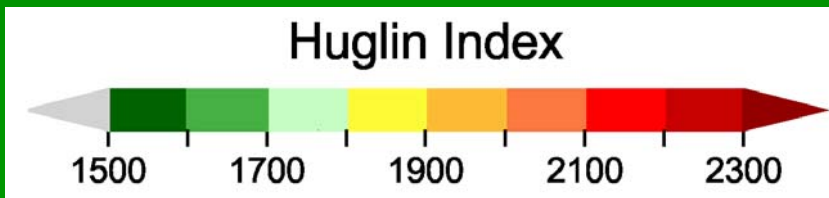
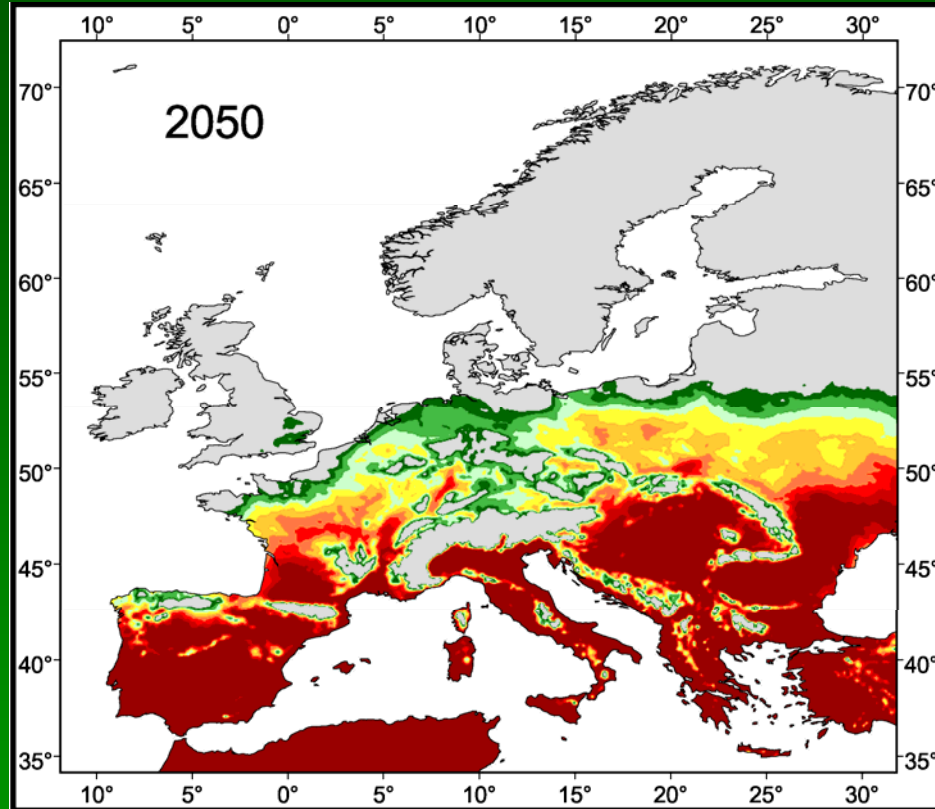
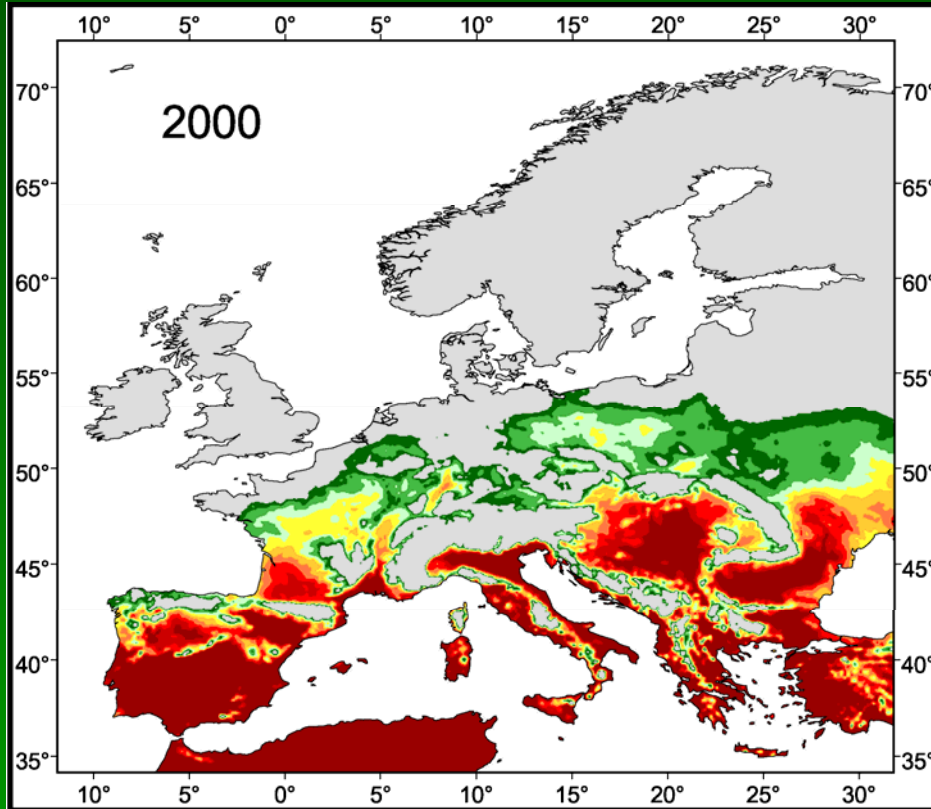
Predicted Changes across the Globe

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)

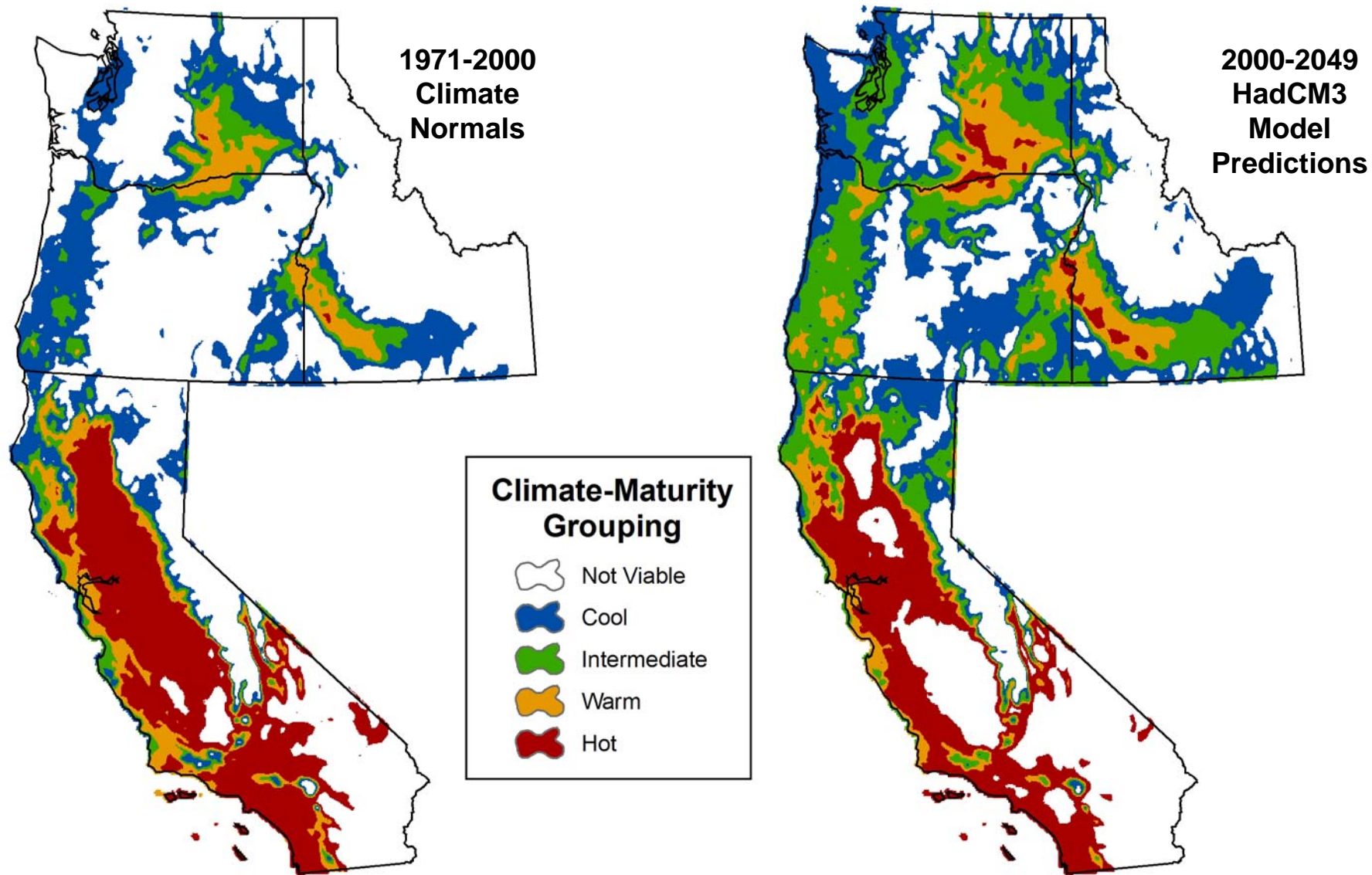


Climate Change Impact Assessment for Viticulture in Europe

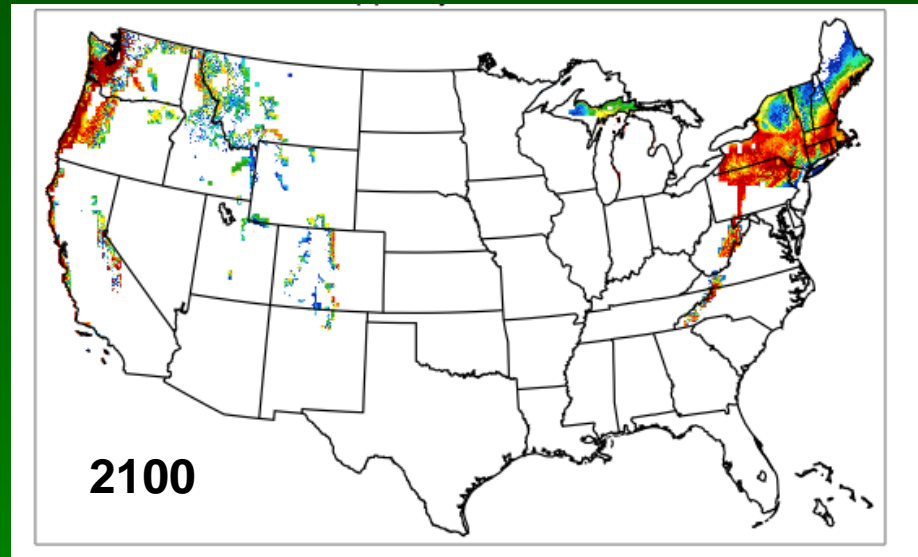
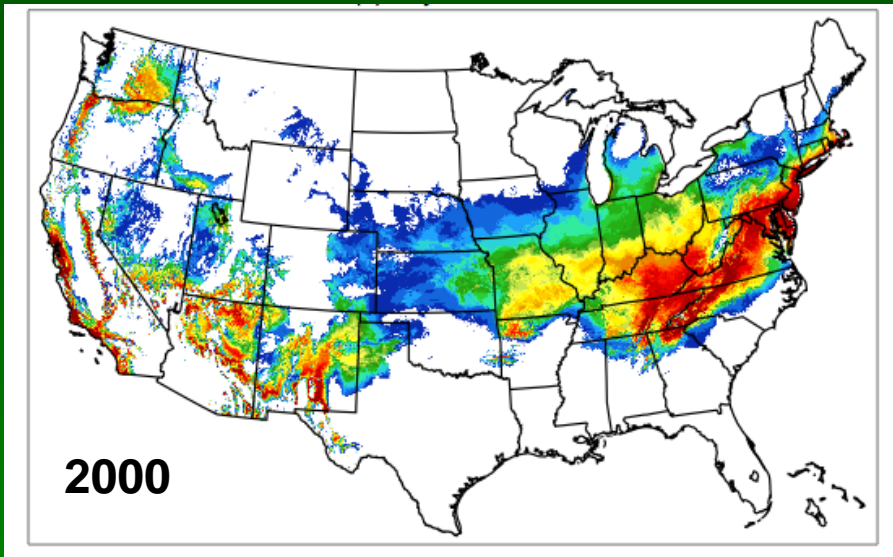


10-year running means of the
Huglin Index
based on the CRU data set,
IPCC A1 Scenario
& PCM Model

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



Spatial Changes in Viable Production Zones

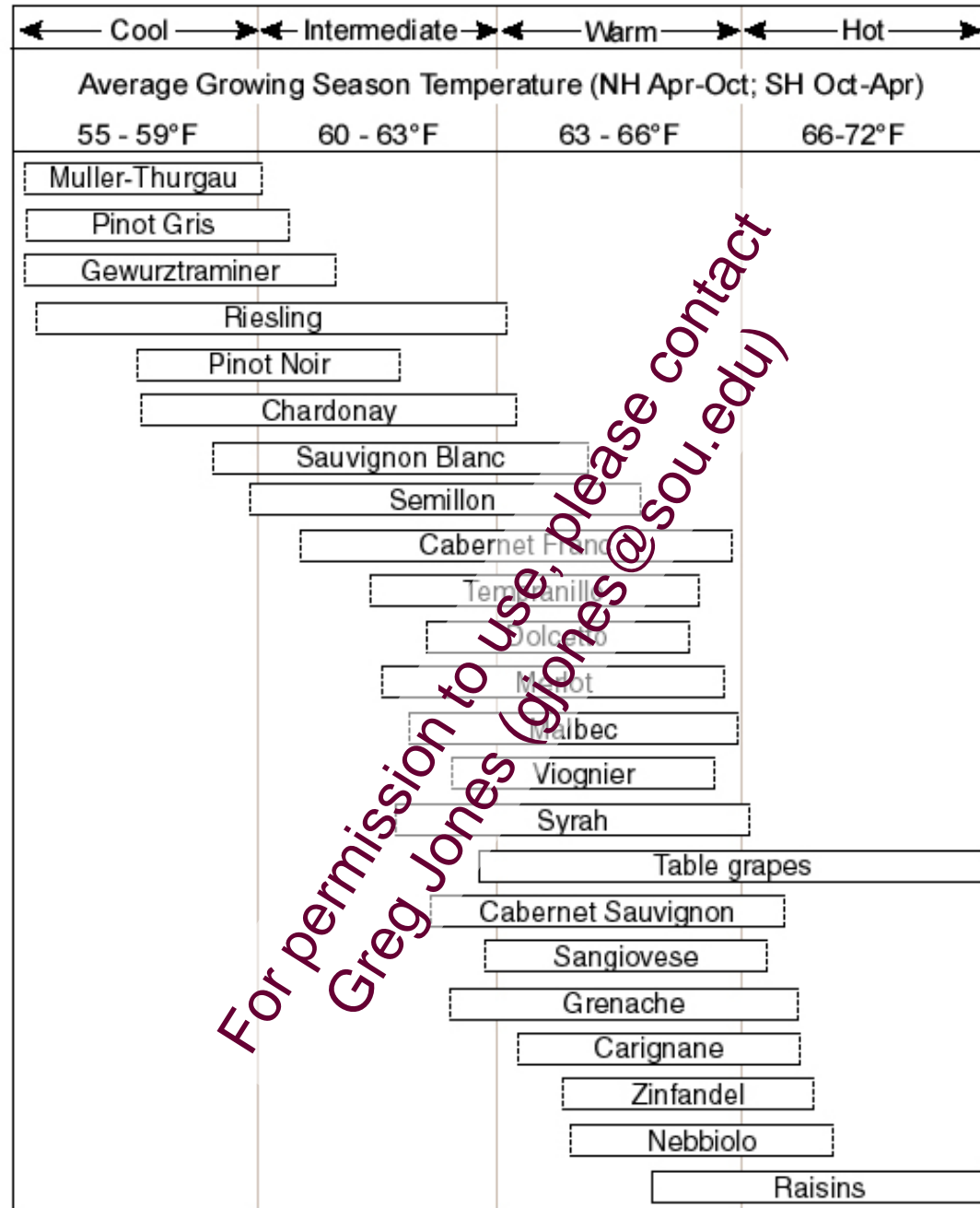


Average warming and increases in temperature extremes (days with $T_{max} > 95^{\circ}\text{F}$) by 2100:

- 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

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

Grapevine Climate/Maturity Groupings

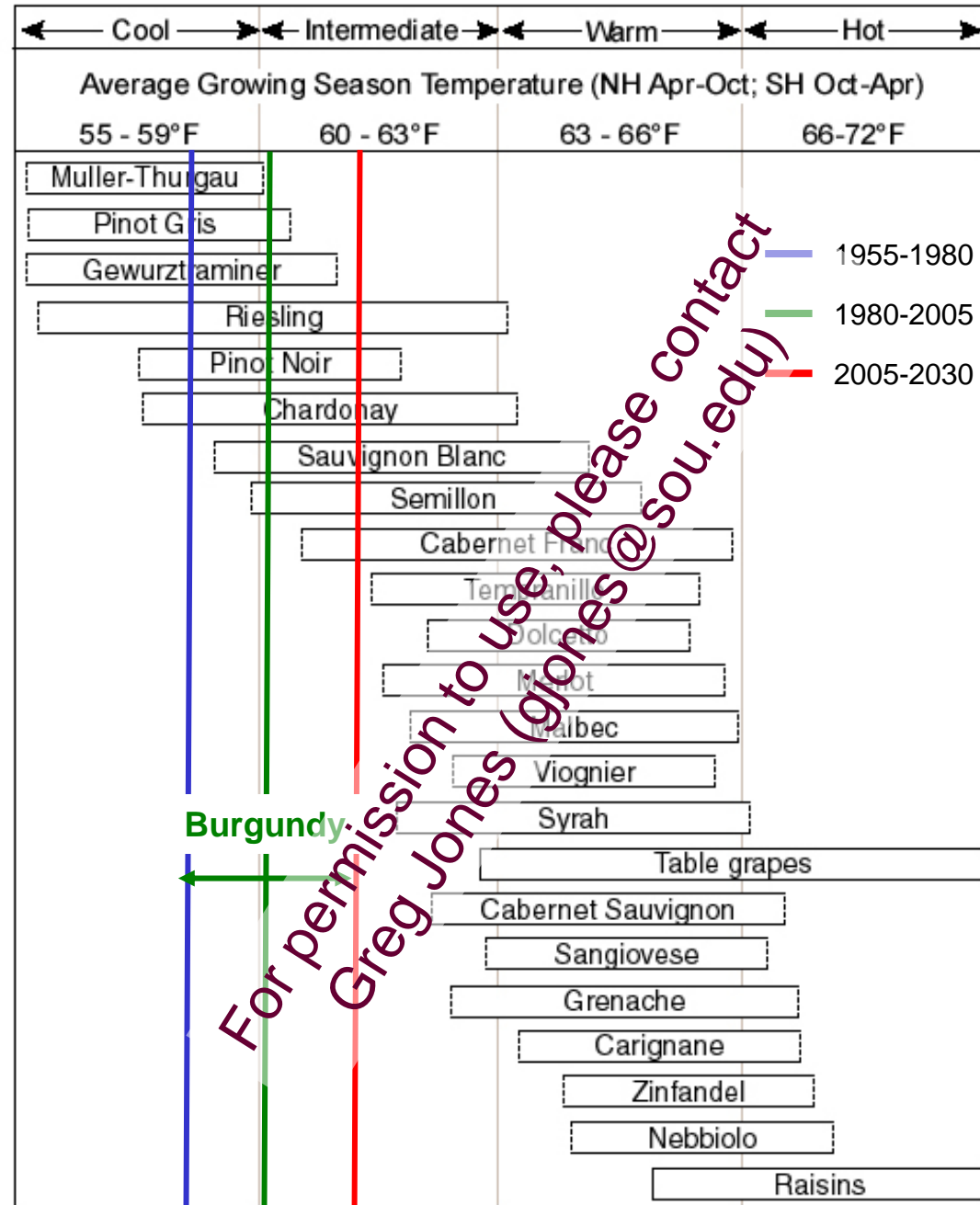


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Length of rectangle indicates the estimated span of ripening for that varietal

Grapevine Climate/Maturity Groupings

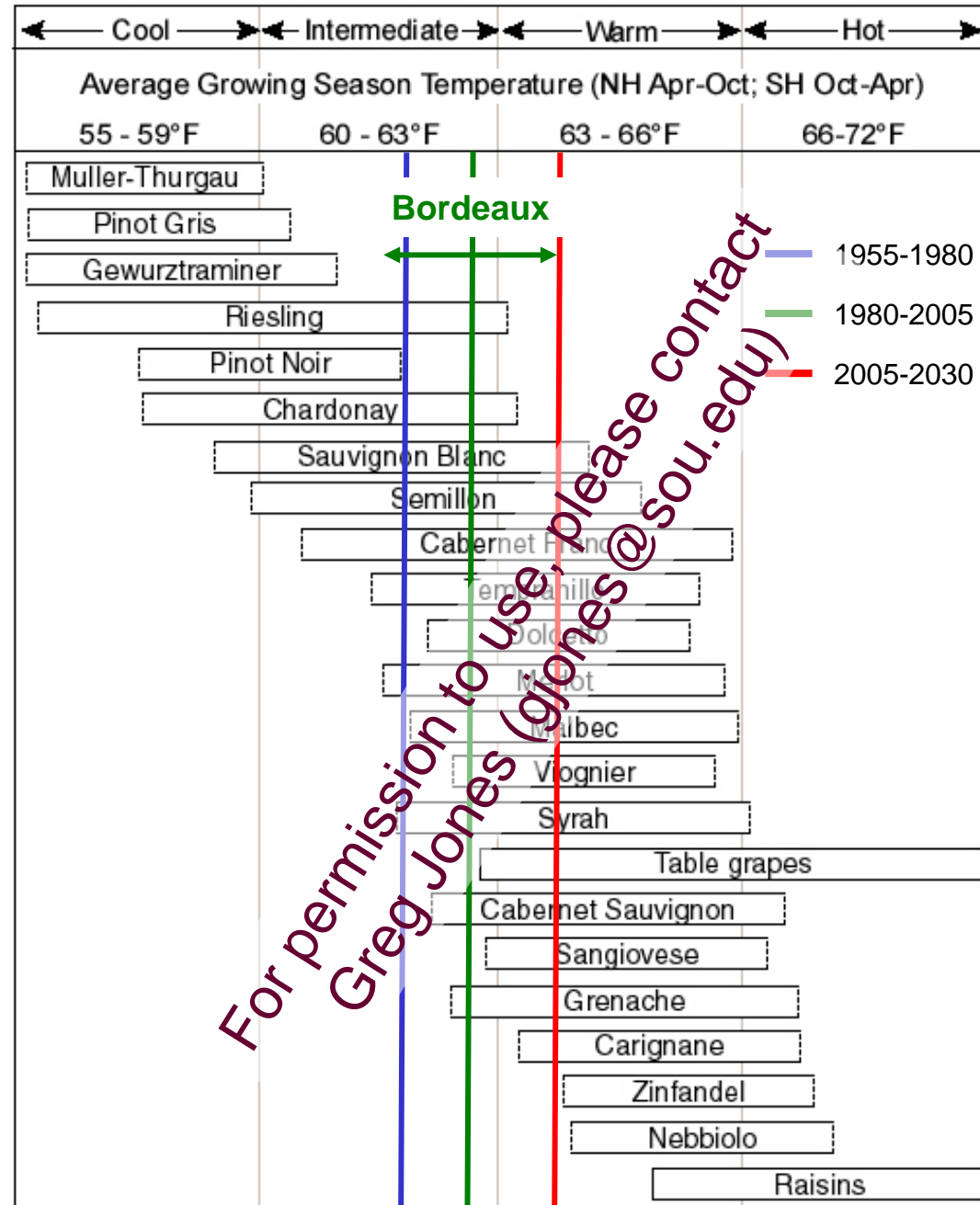
- Burgundy –
 chapitalization used to
 be the rule, today it's
 more the exception



Length of rectangle indicates the estimated span of ripening for that varietal

Grapevine Climate/Maturity Groupings

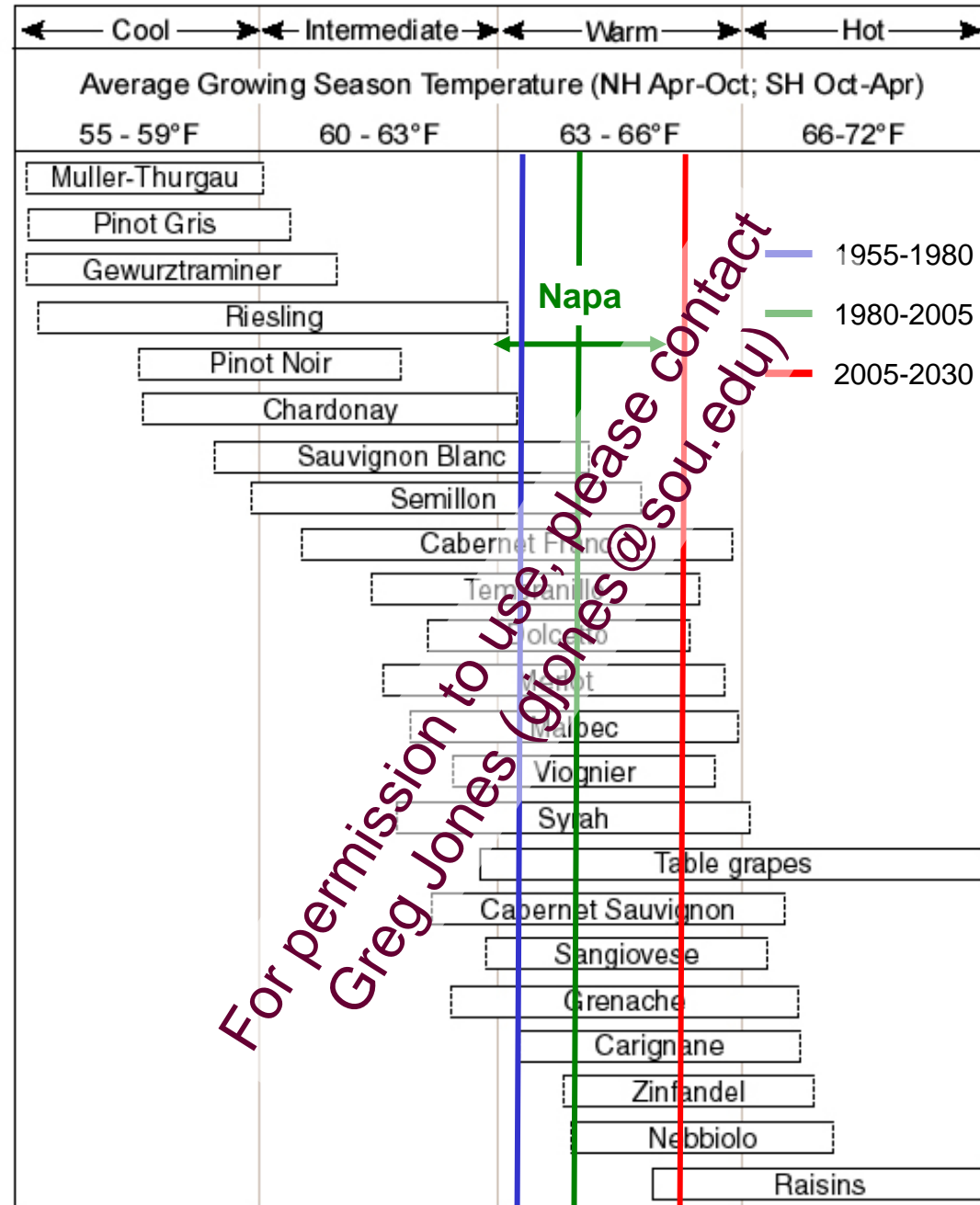
- Bordeaux – more consistent inter-varietal ripening today



Length of rectangle indicates the estimated span of ripening for that varietal

Grapevine Climate/Maturity Groupings

- Napa Valley – ultraripe fruit, dealcoholization common

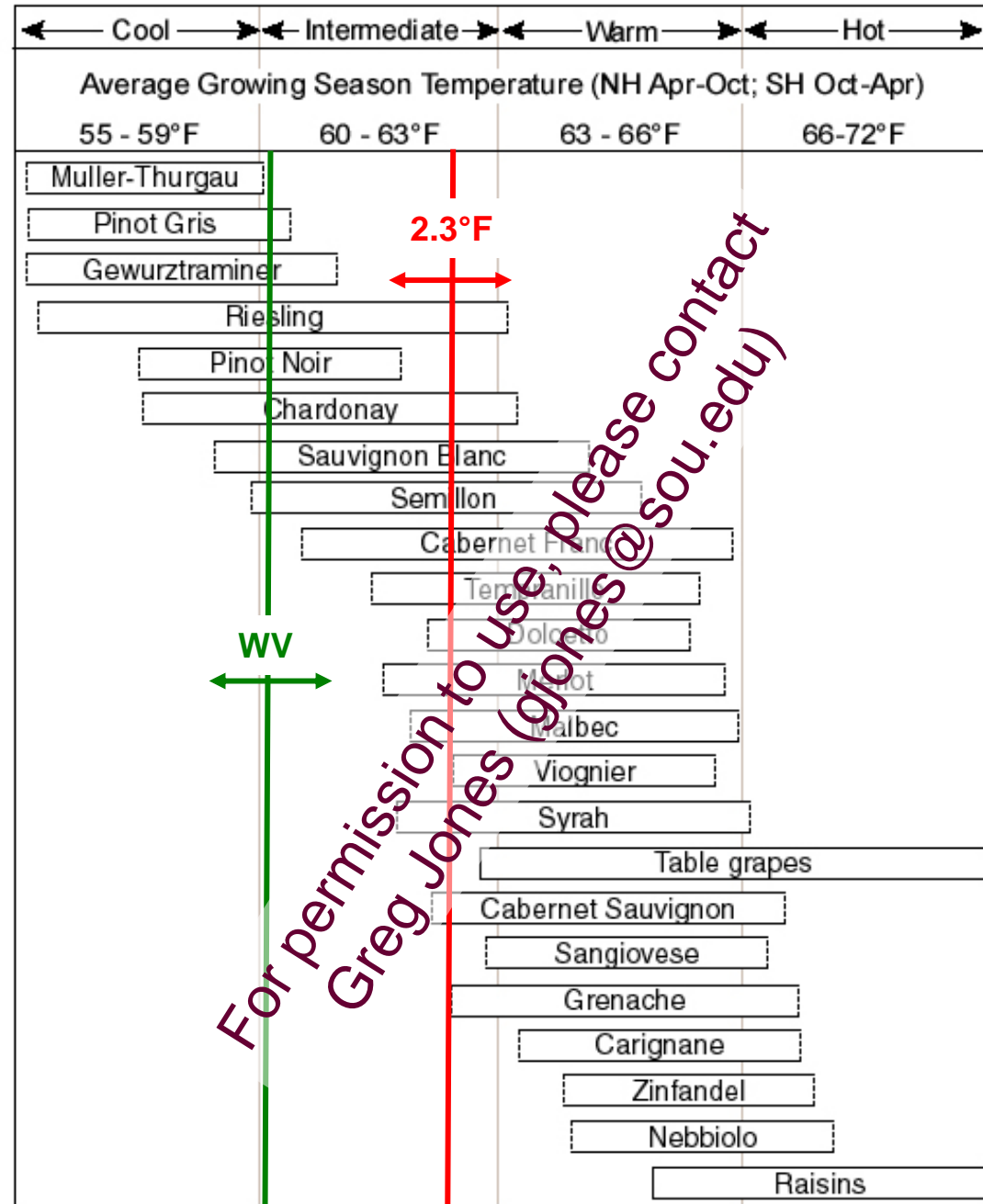


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Length of retangle indicates the estimated span of ripening for that varietal

Predicted Changes for: Willamette Valley

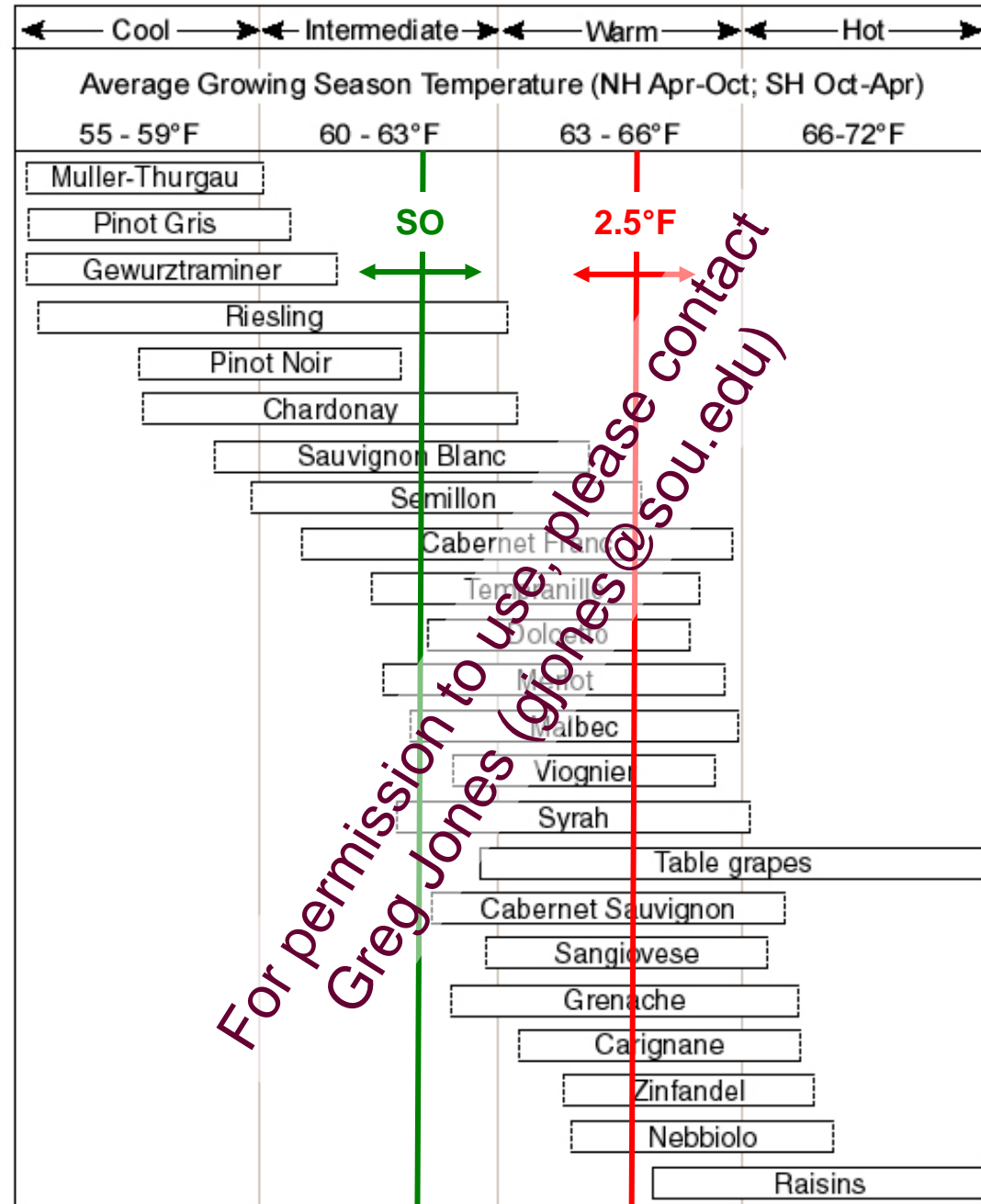
Grapevine Climate/Maturity Groupings



Length of rectangle indicates the estimated span of ripening for that varietal

Predicted Changes for: Southern Oregon

Grapevine Climate/Maturity Groupings

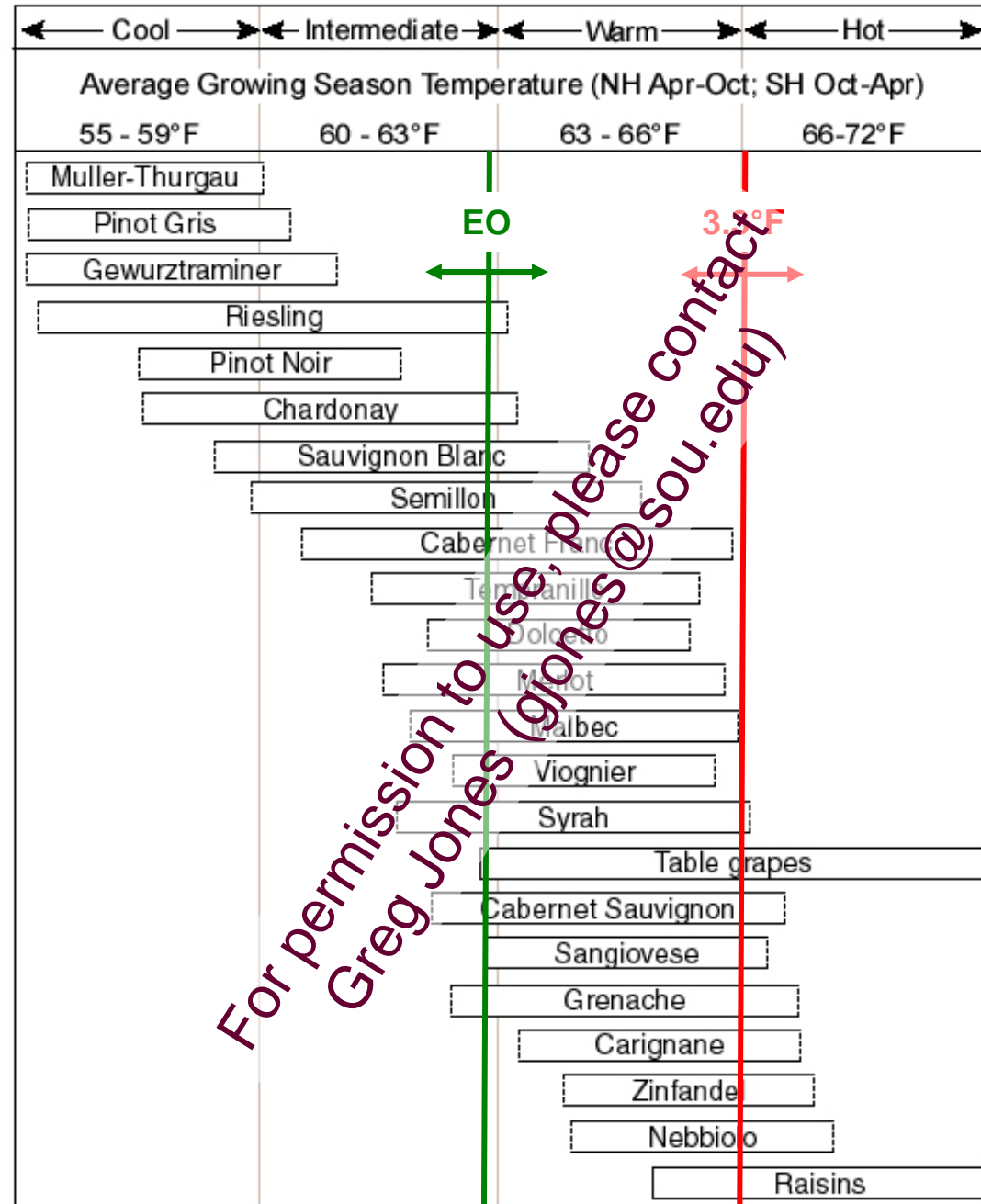


Length of rectangle indicates the estimated span of ripening for that varietal

Predicted Changes for:

Eastern Oregon

Grapevine Climate/Maturity Groupings



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Length of rectangle indicates the estimated span of ripening for that varietal

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

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