

Climate Structure, Phenology, and Change in Pinot Noir Wine Regions



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ASEV Joint
Burgundy-California-Oregon
Symposium
June 16-17, 2008
Portland, Oregon

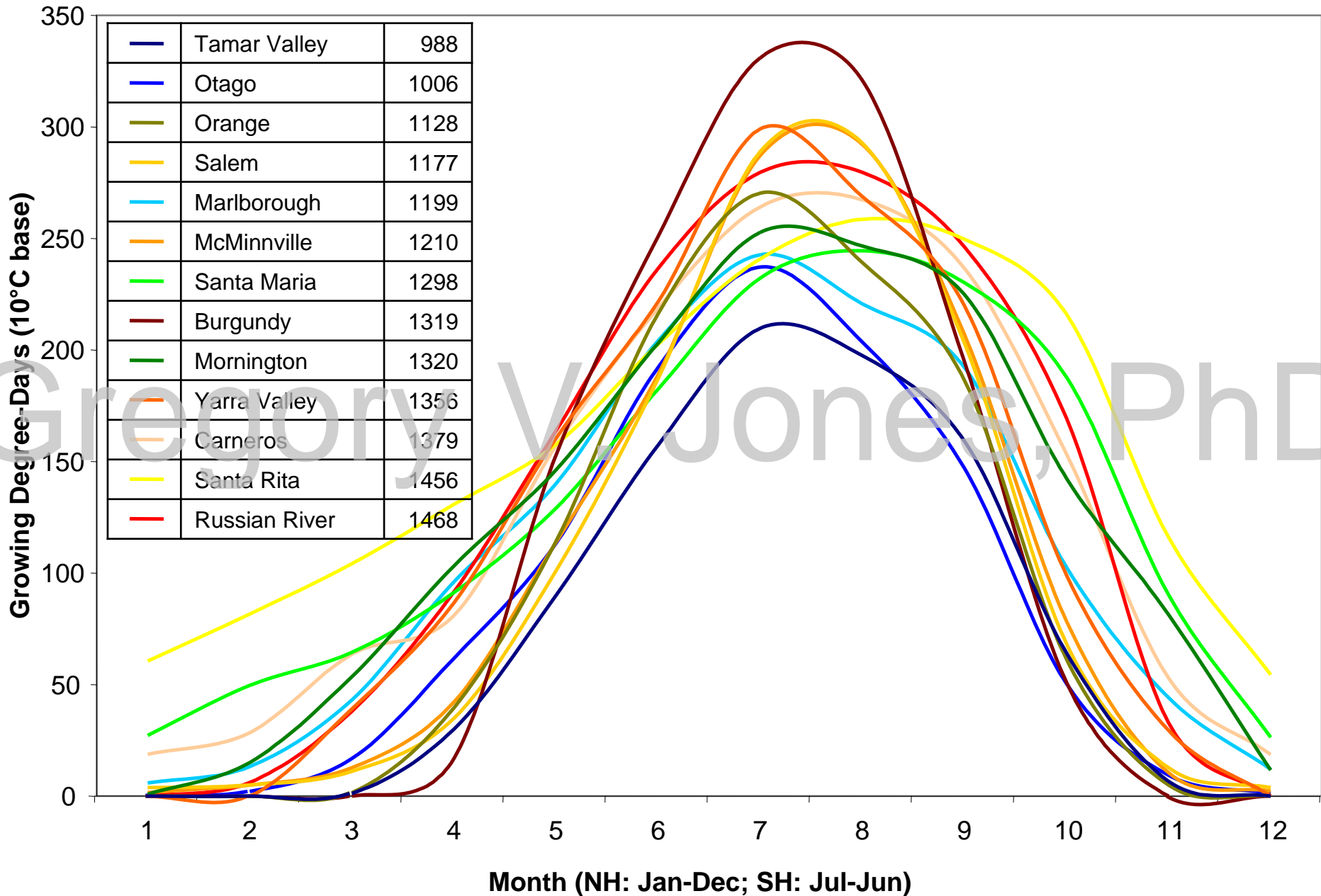
Talk Outline

- Pinot Noir Regions, Climates, and Vine Phenology
- Climate Change, Viticulture, and Wine
- Observed Trends
- Projected Trends
- Summary/Conclusions

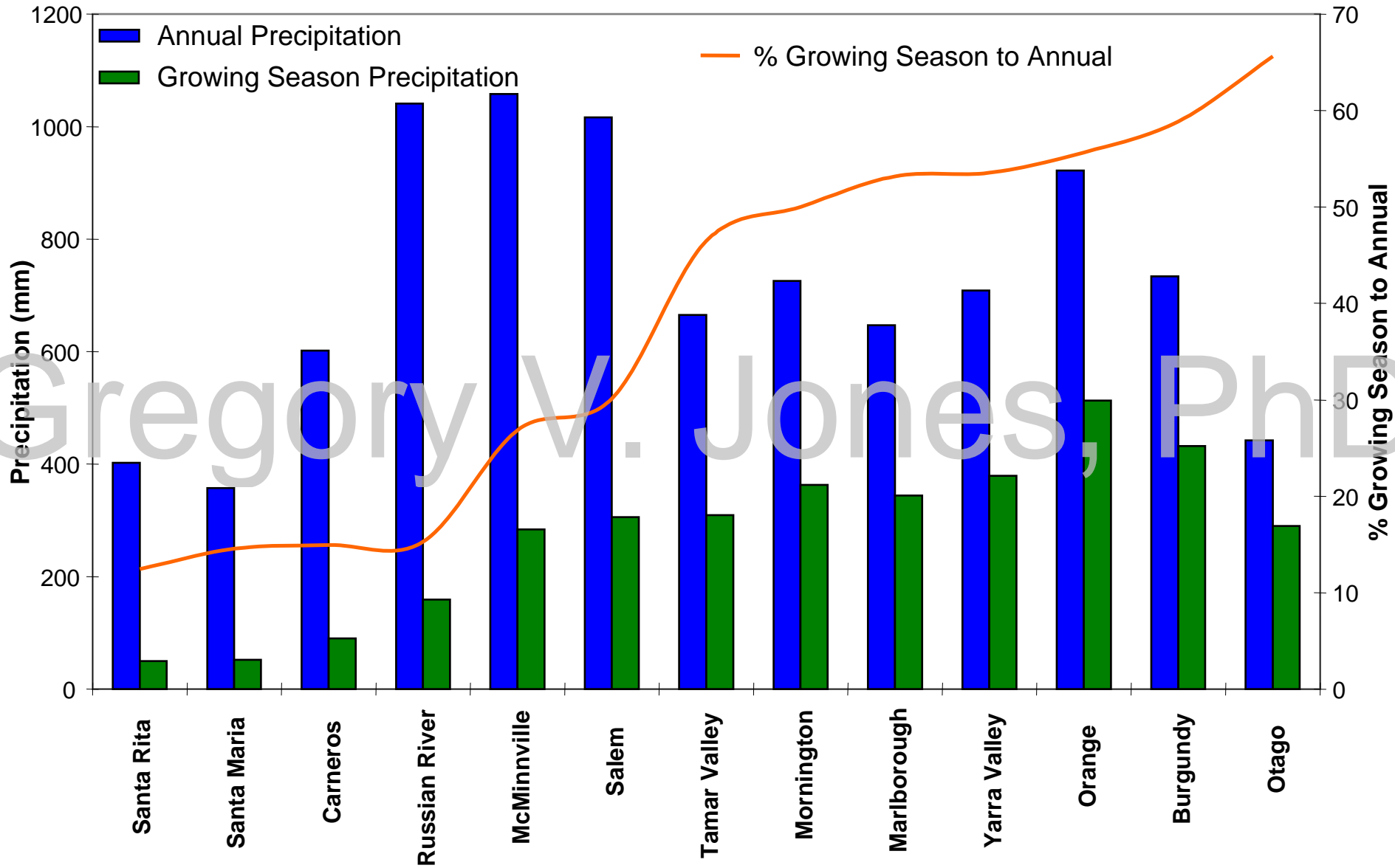


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Growing Degree-Days in Pinot Noir Regions



Precipitation in Pinot Noir Regions



Comparison of Pinot Noir Phenology

Burgundy

Willamette

North Coast



Apr 18th (10)

Apr 10th (12)

Mar 20th (15)



June 14th (10)

June 15th (10)

May 25th (14)



Aug 9th (8)

Aug 17th (9)

Aug 4th (12)



Sept 26th (10)

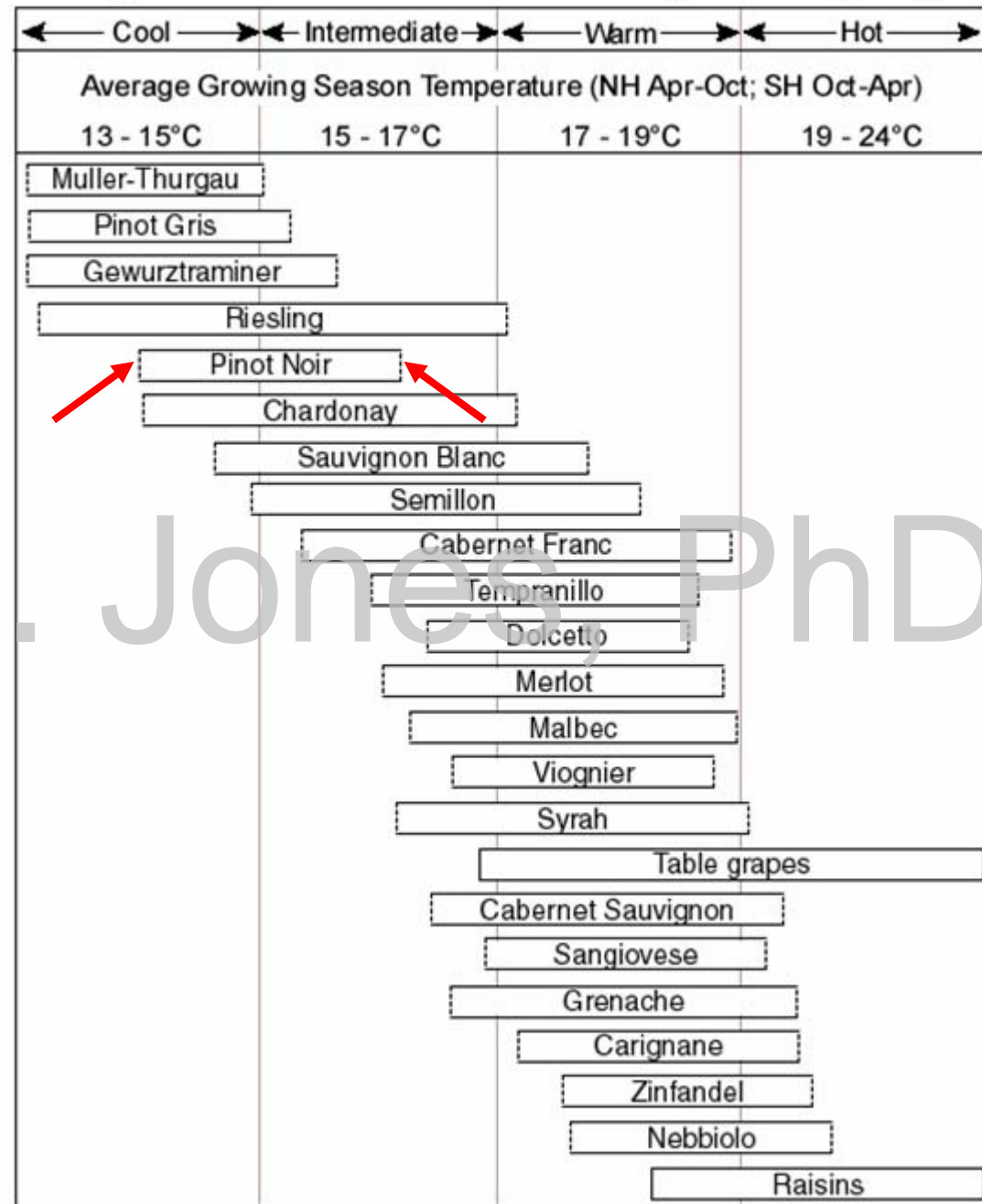
Oct 1st (12)

Sept 15th (13)

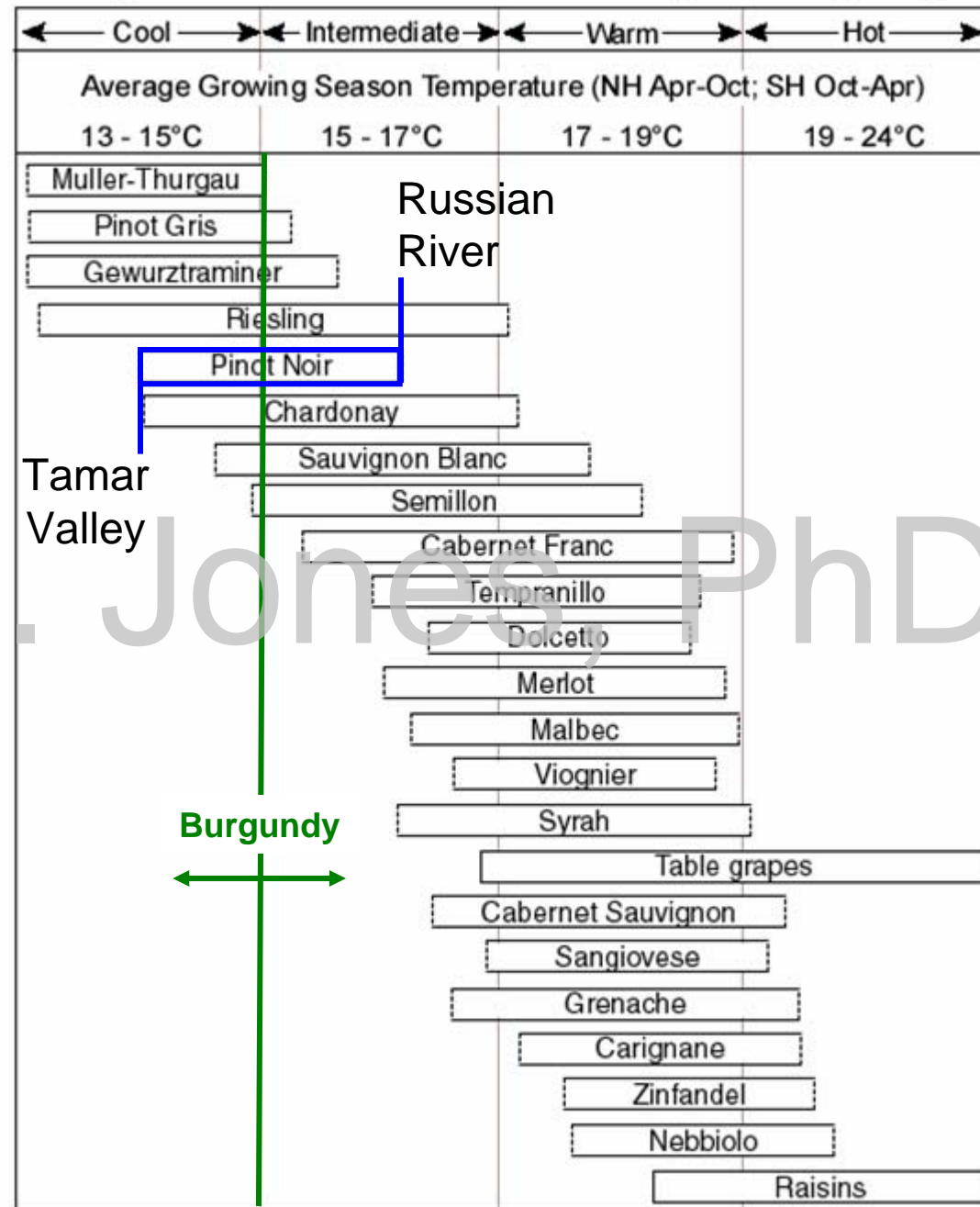
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Grapevine Climate/Maturity Groupings

- All varieties have inherent climatic thresholds for optimum quality and production characteristics
- Pinot Noir exhibits one of the most narrow climatic niches for premium quality production



Grapevine Climate/Maturity Groupings



- All varieties have inherent climatic thresholds for optimum quality and production characteristics
- Pinot Noir exhibits one of the most narrow climatic niches for premium quality production
- From what we know about today's Pinot Noir regions, growing season average temperatures range from ~14-16°C, or ~ a 2°C climatic niche

Climate Change, Viticulture, and Wine

- Changes in average climate structure and variability
- Warmer and longer growing seasons
- Warmer dormant periods
- Reduced frost damage (in some areas)
- Altered ripening profiles
- Earlier phenology (plant growth events)
- Altered disease/pest timing and severity
- Changes in soil fertility and erosion
- CO₂ fertilization ... but wine effects?
- Water availability and timing of irrigation
(some places drier, some wetter)



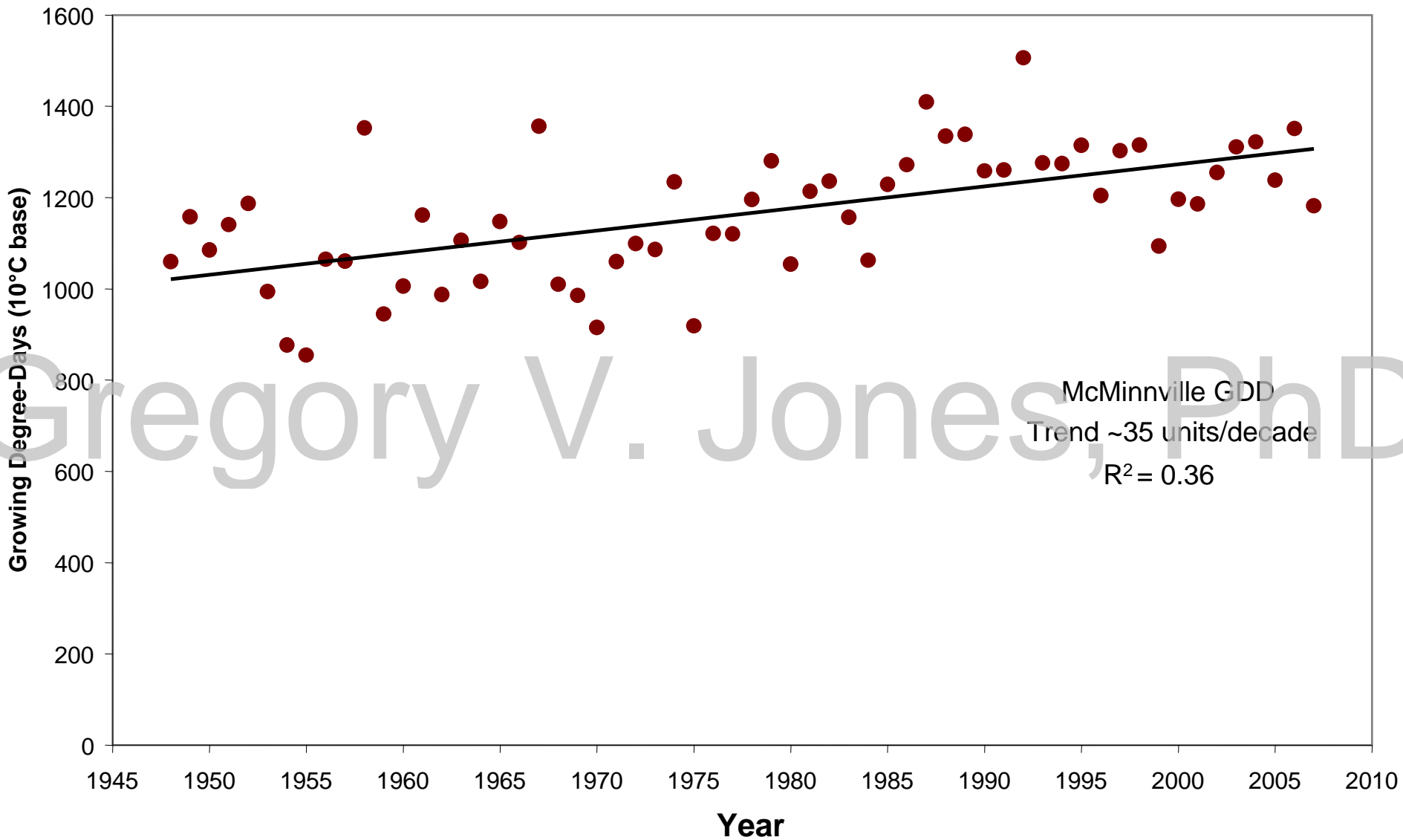
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Observed Climate Trends for the Western U.S. 1948-2005 and Burgundy 1945-2005

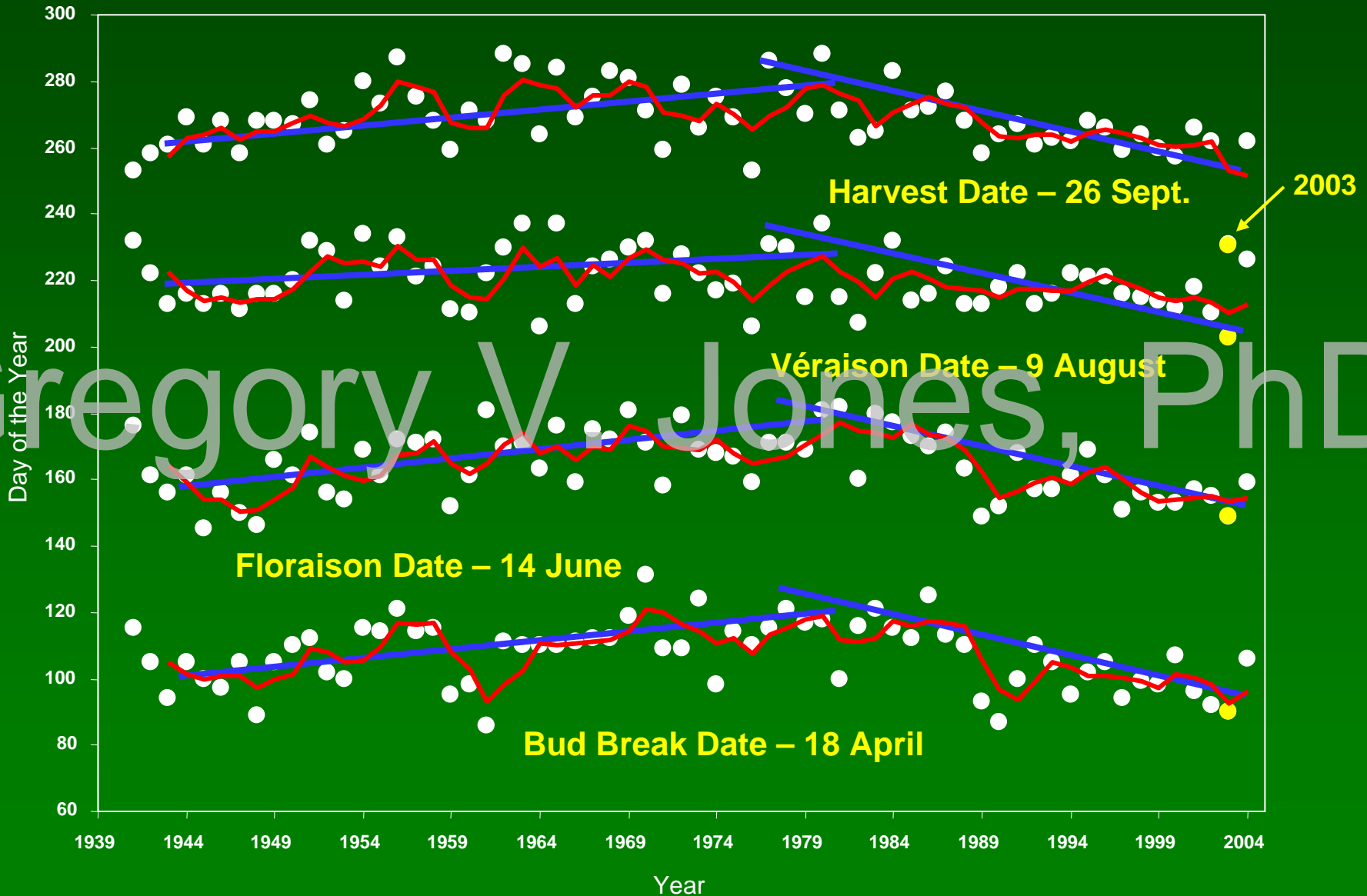
Variable	Willamette Valley	North Coast	Central Coast	Burgundy
Growing Season Tavg	+1.1°C	+0.9°C	+0.9°C	+1.3°C
Ripening Period Tavg	+1.2°C	+0.5°C	+0.6°C	+1.1°C
Growing Degree-Days	+215	+171	+160	+165
Precipitation (Ann & GS)	NS	NS	NS	NS

Additional trends include – earlier last spring frosts, later first fall frosts, longer frost-free periods, and increases in the number of days above 35°C during the growing season and ripening period

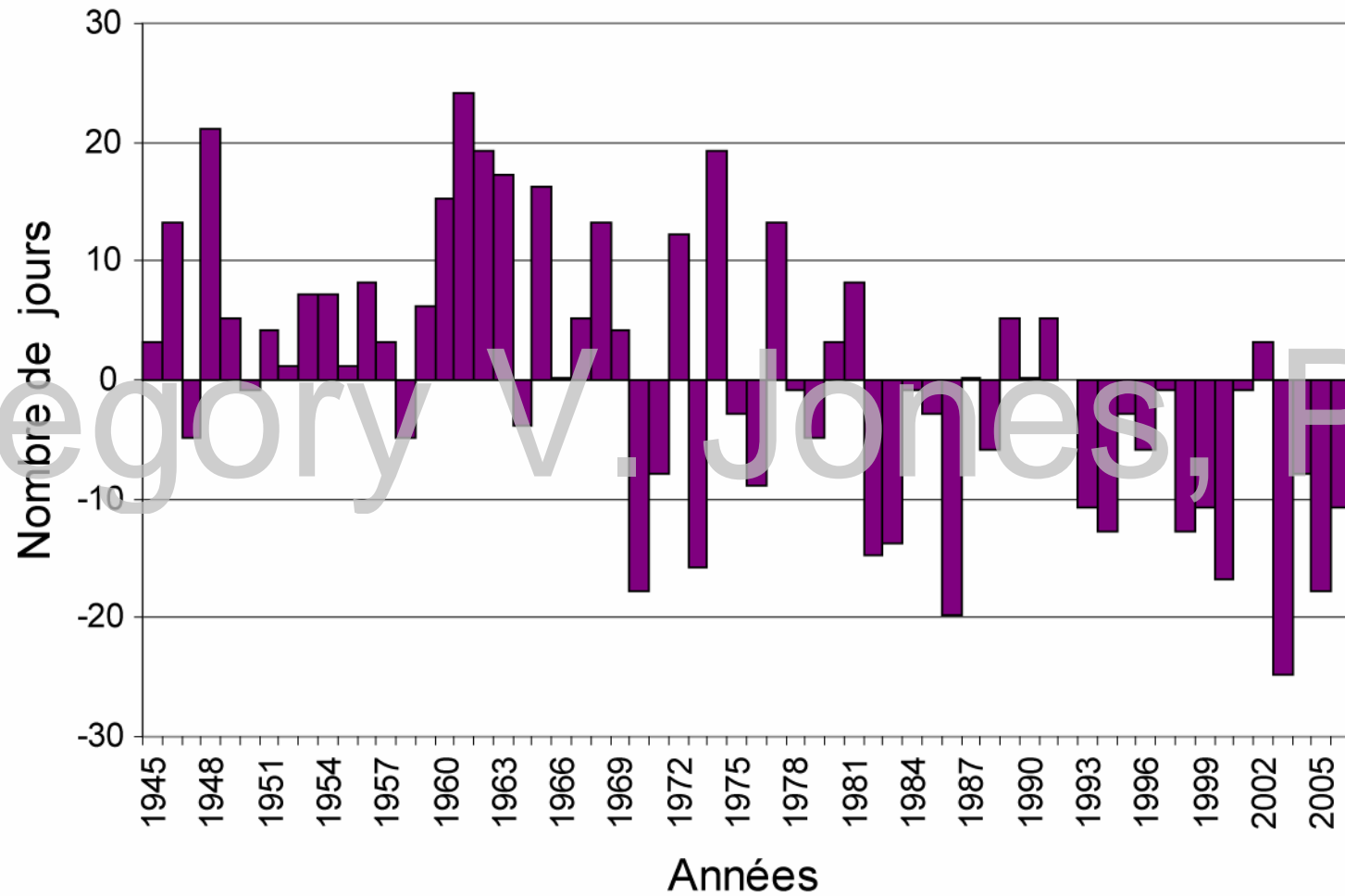
Observed Degree-Day Changes in McMinnville



Observed Phenological Changes in Burgundy



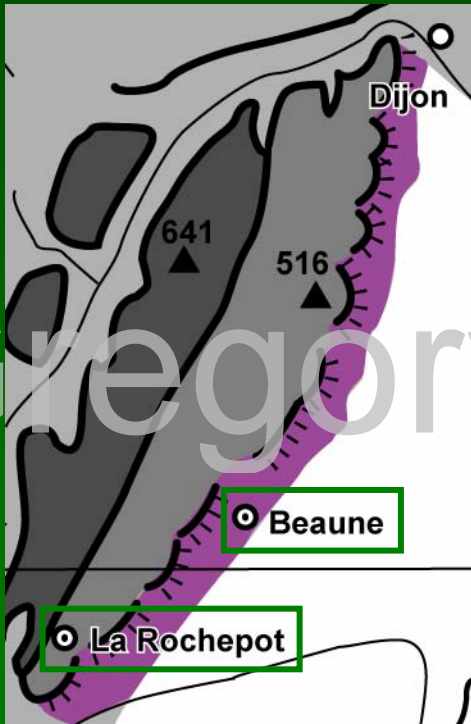
Observed Changes in the Bud Break to Harvest Period in Burgundy



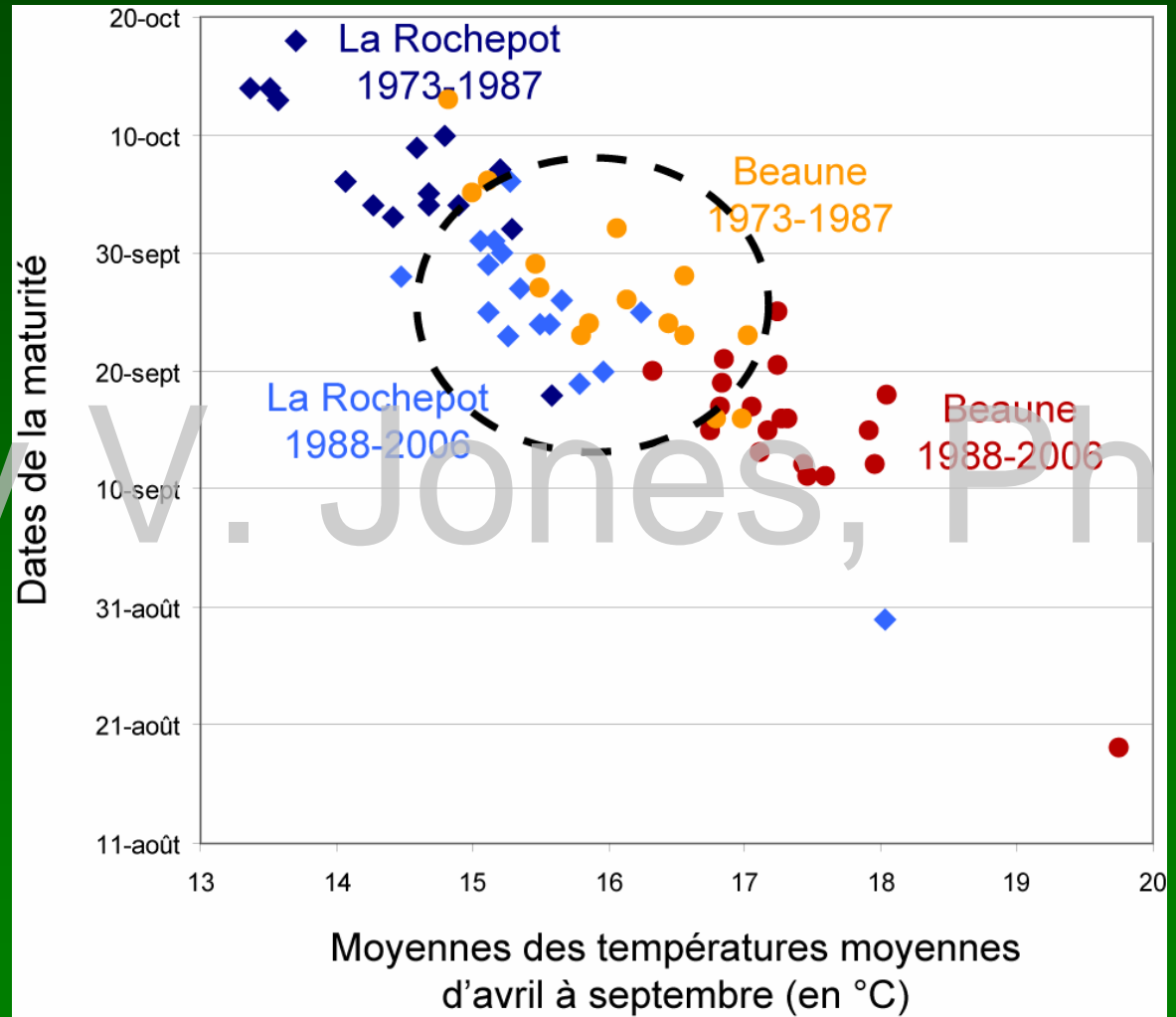
Sources : SRPV Beaune

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Observed Elevational Changes in Burgundy



~ 200 m elevation difference

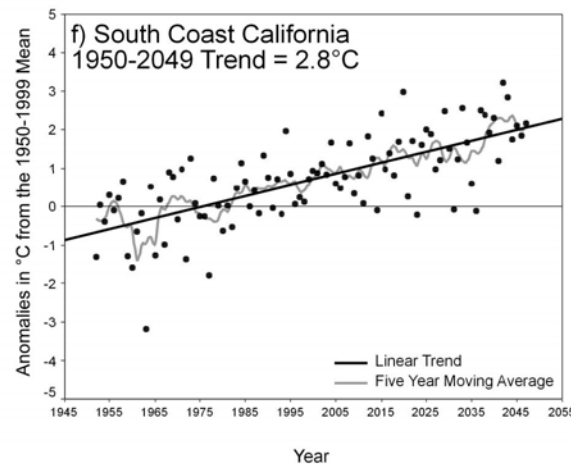
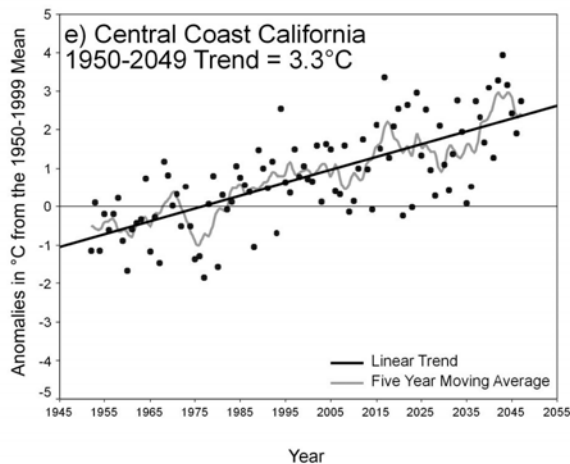
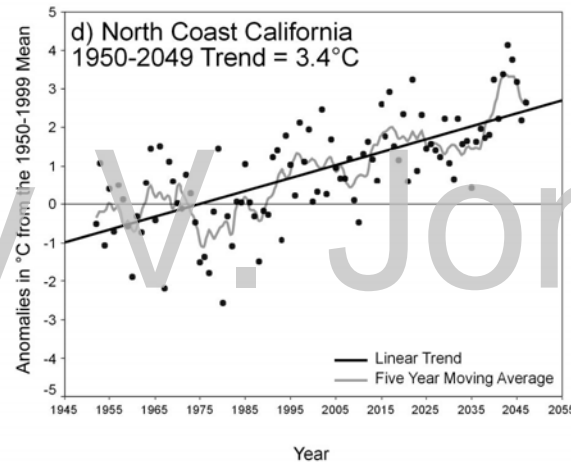
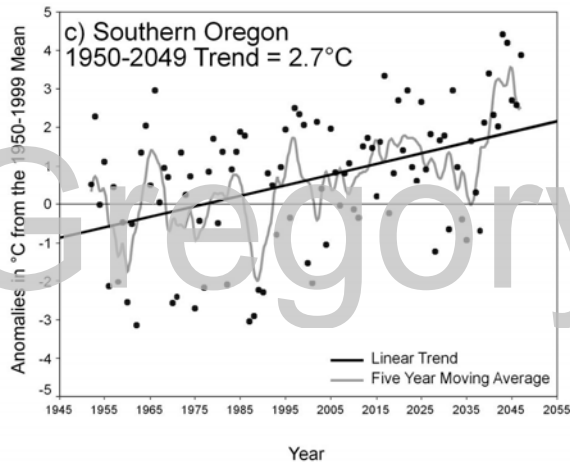
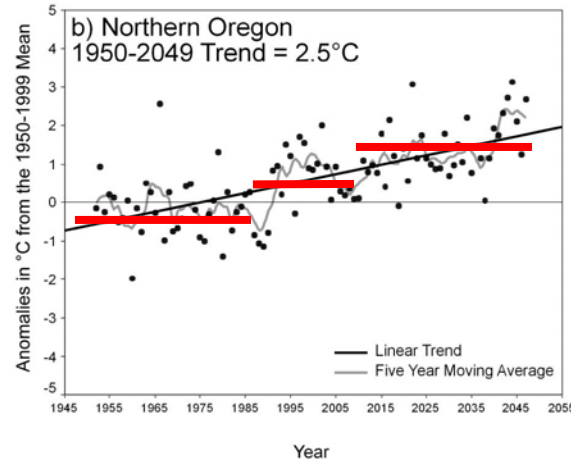
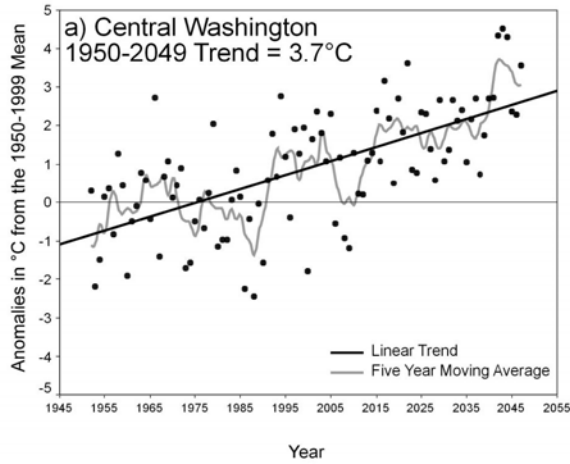


Climate Model Predictions HadCM3

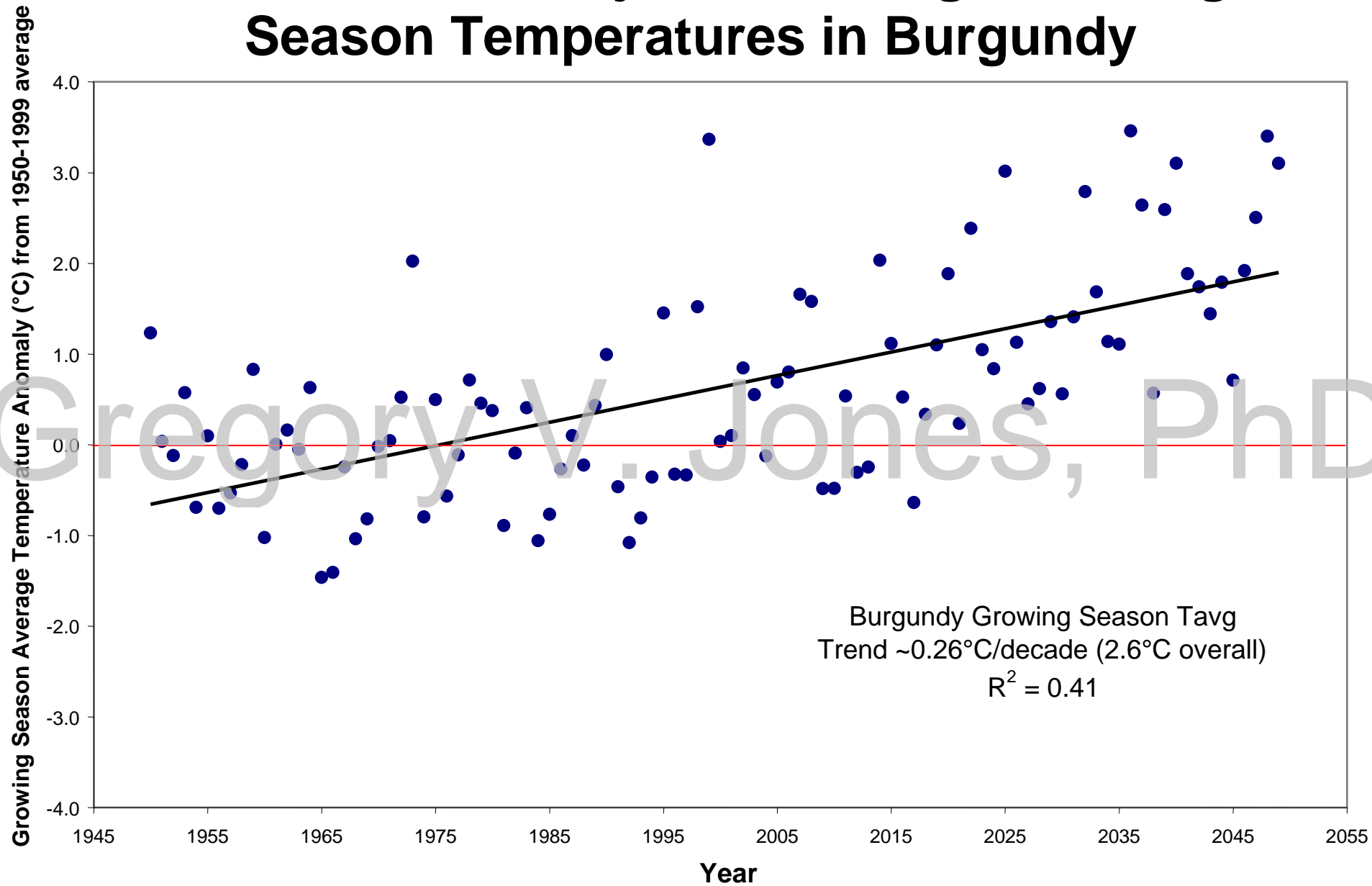
1950-2049 observed and modeled growing season temperature changes

Trends range from 2.5-3.7°C

Average growing season temperatures increase 1.8°C between the 1950-1999 and 2000-2049 50-year periods



Observed and Projected Average Growing Season Temperatures in Burgundy



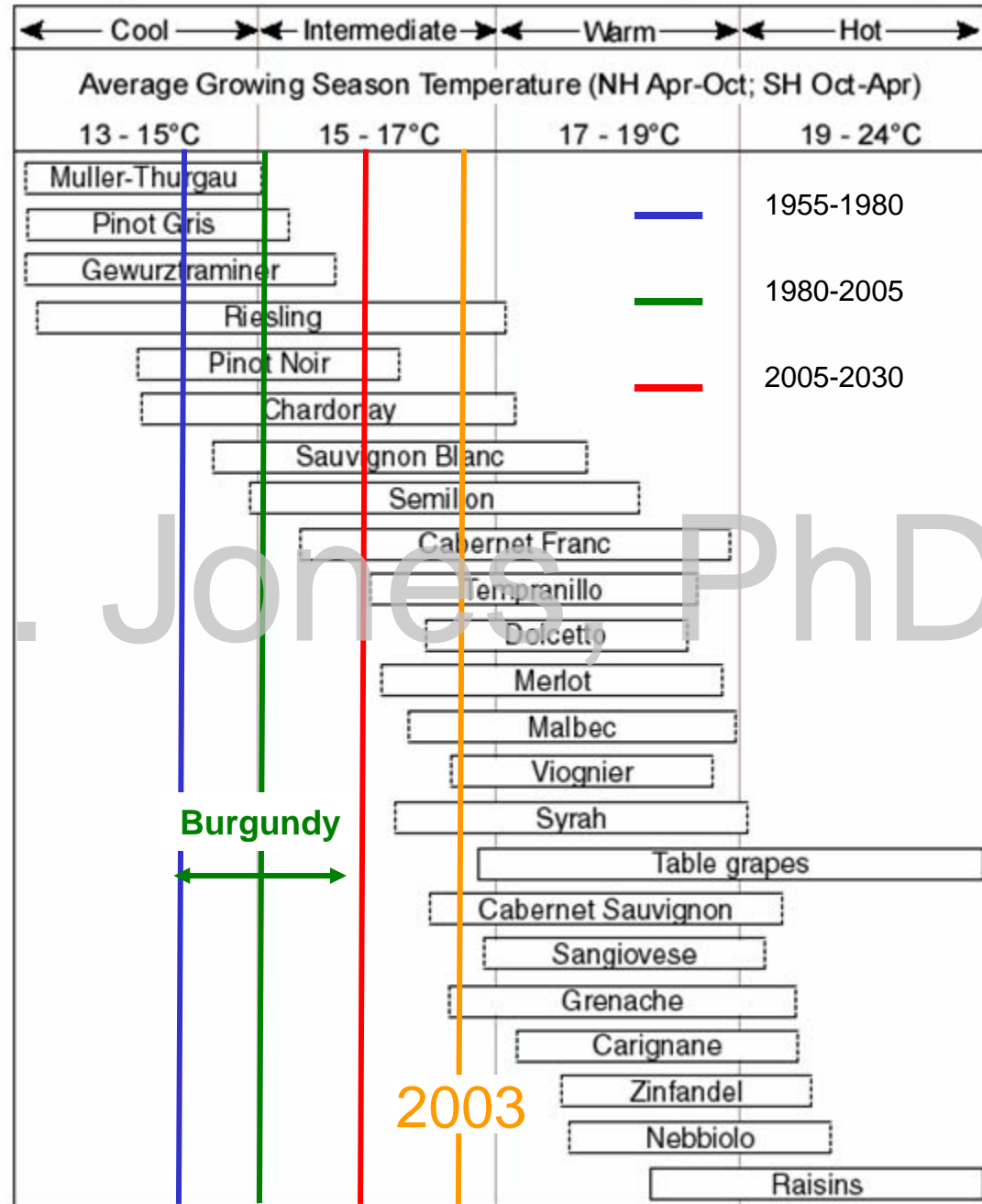
Burgundy's past and projected future climate change ...

Average growing season temperatures from 1955-1980 where on average like the coldest years during 1980-2005

Average growing season temperatures in 2005-2030 are projected to be like the warmest of years during 1980-2005

Is 2003 an analog of future conditions?

Grapevine Climate/Maturity Groupings



Summary

- Pinot Noir has a narrow climatic niche for best suitability, quality, and production
- Pinot Noir climates today are found at ~14-16°C (~1000-1500 GDD)
- Warming of ~1.0-1.9°C (~160-220 GDD) has occurred over the last 40-50 years in Pinot Noir regions
- Grapevines have responded with earlier phenology of ~5-10 days per 1°C of warming, plus a shortening of the intervals between events

Summary

- Meta-Analysis: ~1.1-4.5°C warming in wine regions globally by 2050
- Best estimate ~1.7-2.2°C with plants likely showing an additional 9-22 day shift
- Warming of this magnitude would push many existing regions outside of what is considered suitable today
- Uncertainty issues include:
 - Climate system sensitivity
 - Emission scenario (already at upper end)
 - Changes in extremes (↑ frost, heat, precipitation, etc)
 - Variability in the climate system (↑↑)

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Conclusions

- Climates have clearly changed ... along with temperature we are seeing more evidence of coherent changes in many aspects of Earth's systems
- What is absolutely clear from history is that the viticultural climates of tomorrow will not be like the those of today ... terroirs as we know them will change
- We view our social and economic systems as static today, however history shows that change should be expected
- The wine industry has tremendous adaptive capacity, but can not achieve it without agreeing there is an issue and developing clear strategies associated with a portfolio of research, policy, adaptation, and mitigation

Acknowledgements

- Jean-Pierre Chabin and Malika Madelin, Université de Bourgogne
- Allen Holstein, Argyle Winery
- Molly Hodgins, Chehalem
- Joel Myers, VineTenders
- Glenn McGourty, UC Extension
- Zac Robinson, Husch Vineyards
- Bob Gibson, Roederer Estate
- Mike Trought, Marlborough Wine Research Centre
- Andrew Hall, Charles Sturt University
- Kevin Bell, Mornington Peninsula Vignerons Association

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