Predicting the effect of drought and climate change on the composition and extractibility of flavonoids in Cabernet sauvignon

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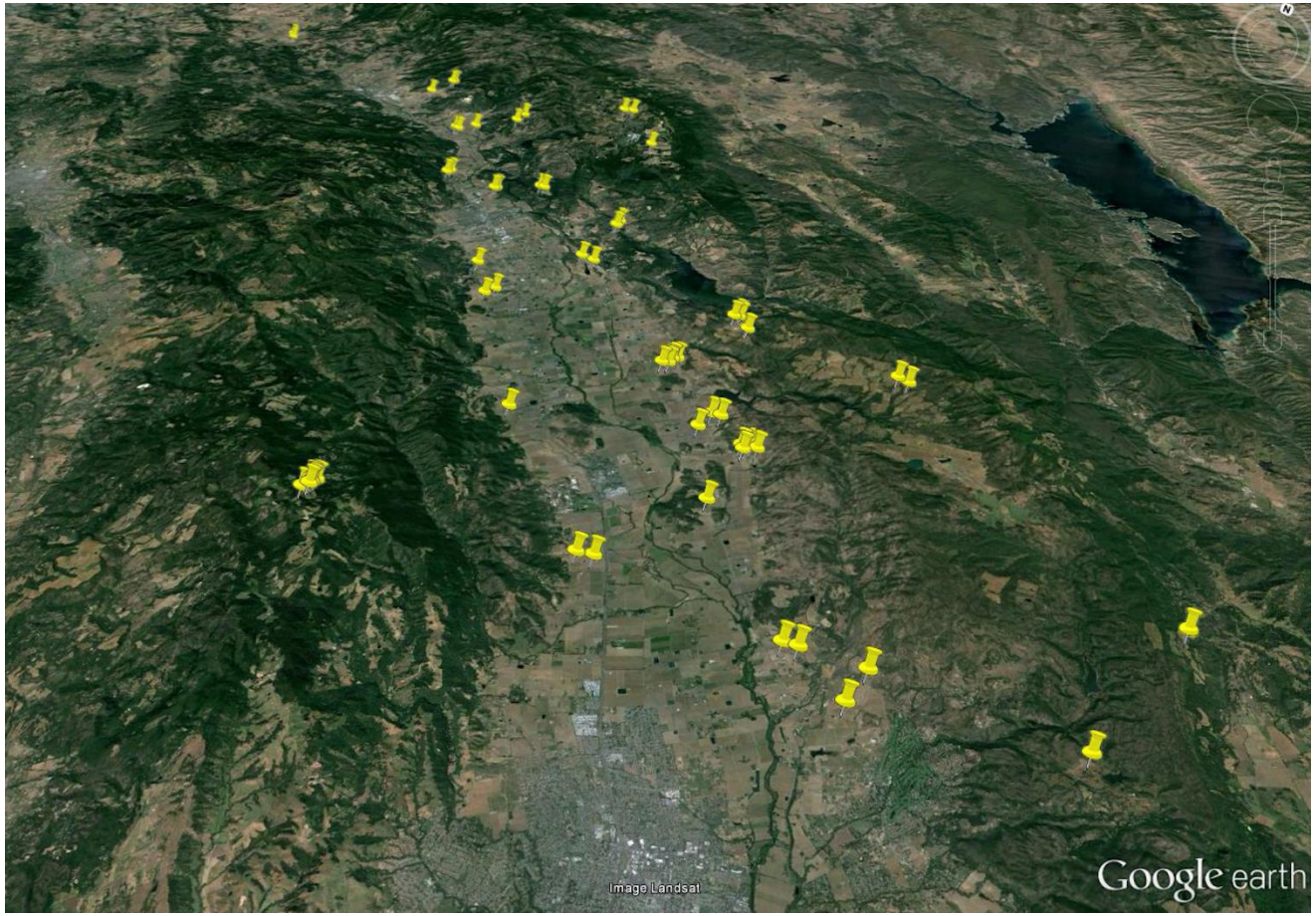
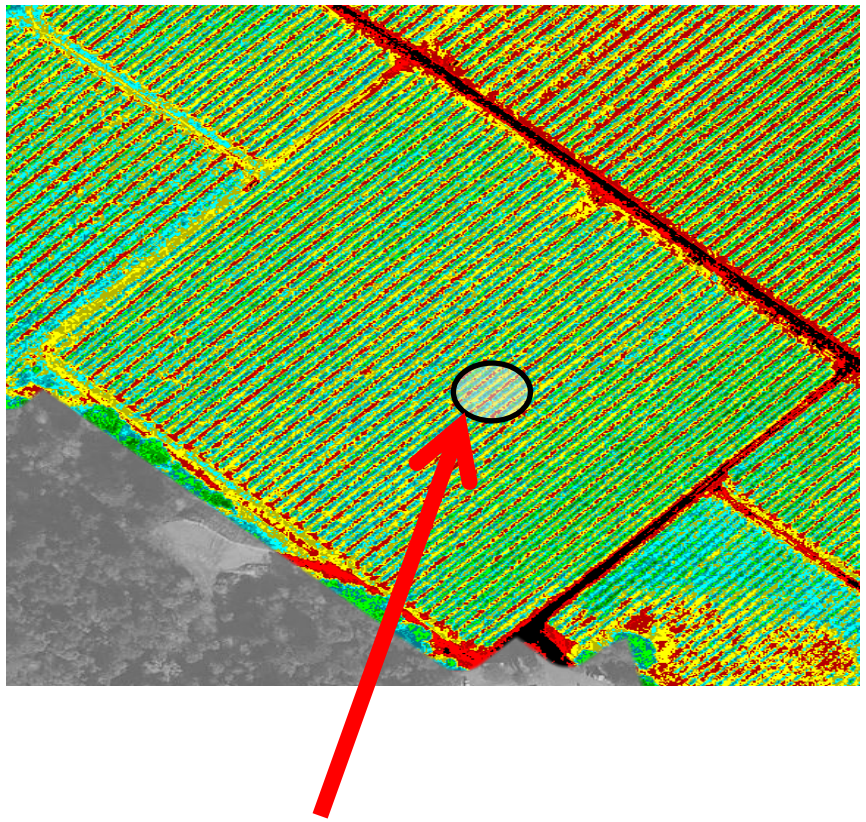
58 Irrigated Vineyard Sites located across 9 AVA in Napa valley



Experimental Layout



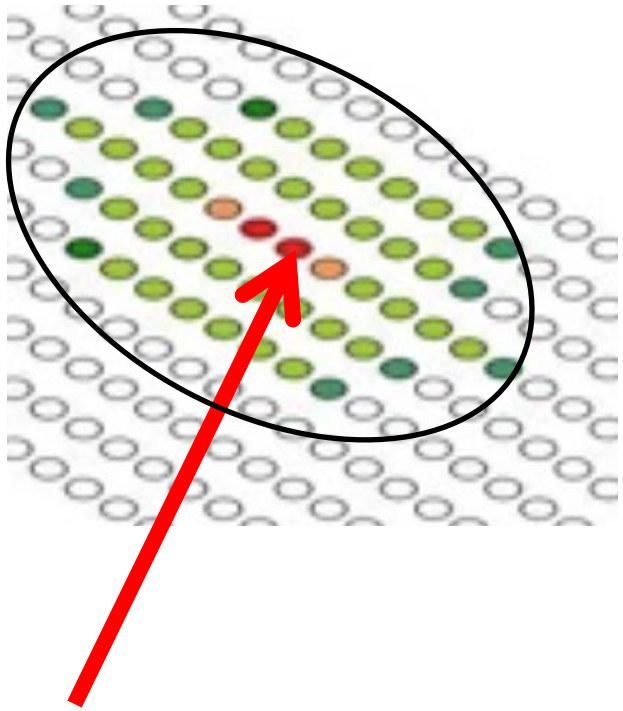
Smart point

WATER MONITORING
2 Sap flow sensors
Connected to the web
+

FRUIT MONITORING
50 vines
(5-6 dates)
+

Yield <6 tons/Ha

Smart point design



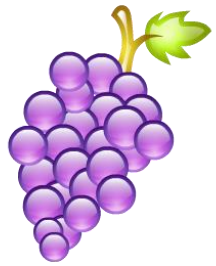
2 vines equipped with sap flow sensor

Sap Flow Sensor
(2 vines per plot)

Berry Analysis Methods

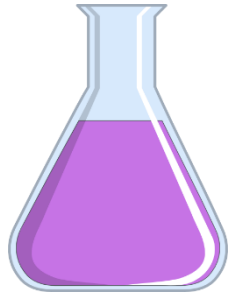
Sampling

- 200 berries
- 5+ dates.



Extraction

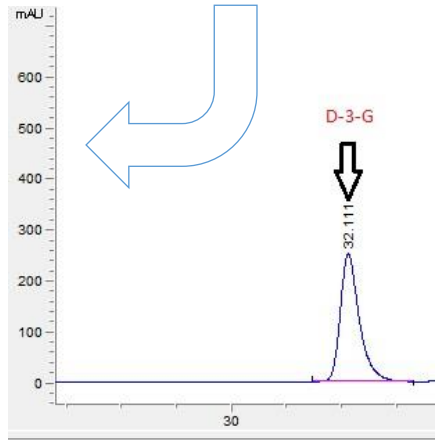
- Soft crushing (stomacher)
- 48 hour **partial extraction** in 16% v/v ethanol



Analysis

- Berry weight/volume
- Total anthocyanins
- Tannins
  - Concentration
  - Prodelphinidin
  - Activity

Molar Absorbance



Tannin Activity

The concept of measuring Tannin Activity in relation to wine astringency quality is new: **Barak and Kennedy, 2013; Revelette et al., 2014; Yacco et al., 2016**

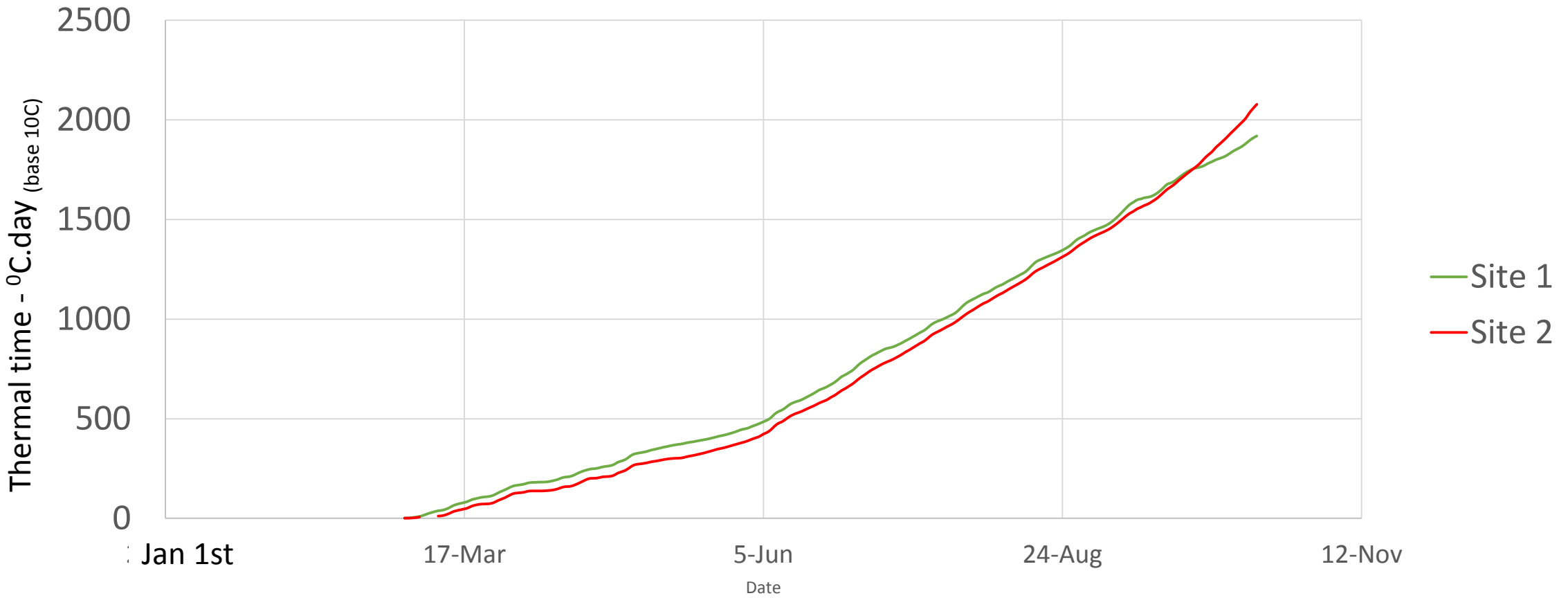
Analytically related to the potential for interaction with salivary protein (astringency).
Increase in interaction is associated with increased potential for drying tannins.

Tannin Activity is related to:
1) Tannin structure variation (grape and wine)
2) Anecdotal perception of red wine astringency

One goal of the study: “Determine utility of tannin activity measurement in the vineyard”

Results

Comparison of Two Sites
Thermal Time Profile



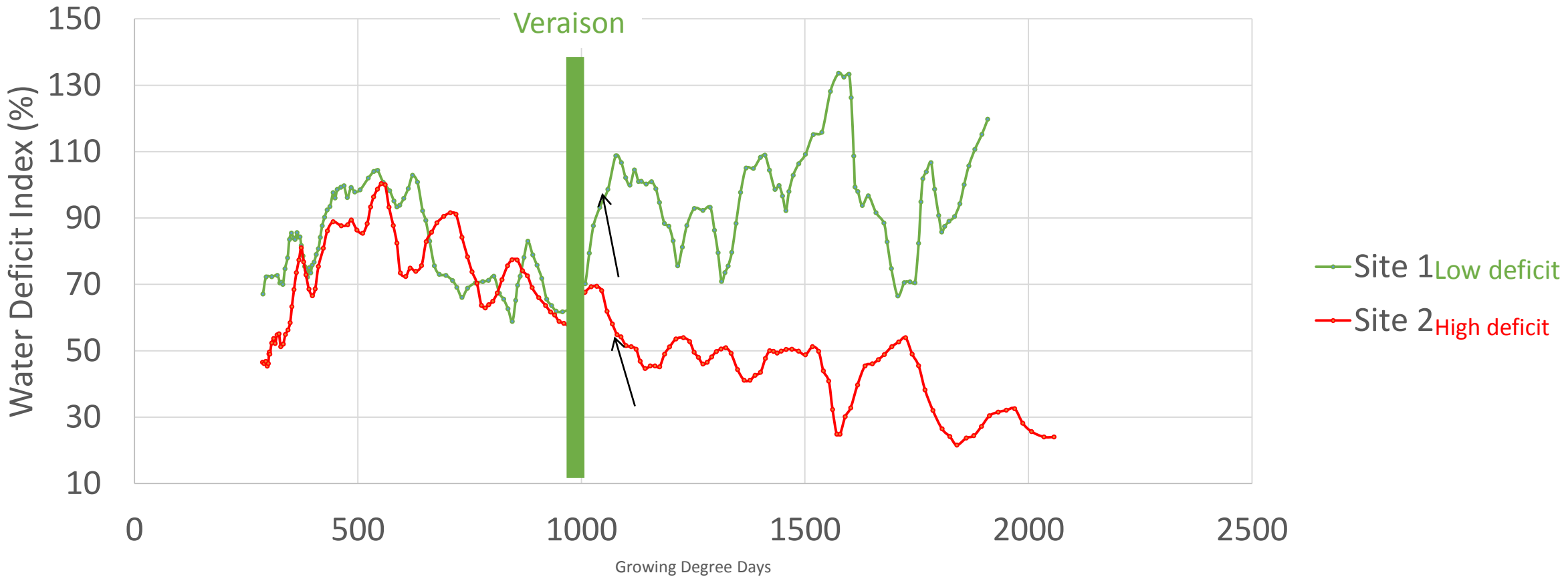
TT range: 1450 to 2050 ^{0}C.day

Winter rain : 400-500 mm

Highest maximum temperatures : 38 to 46^{0}C

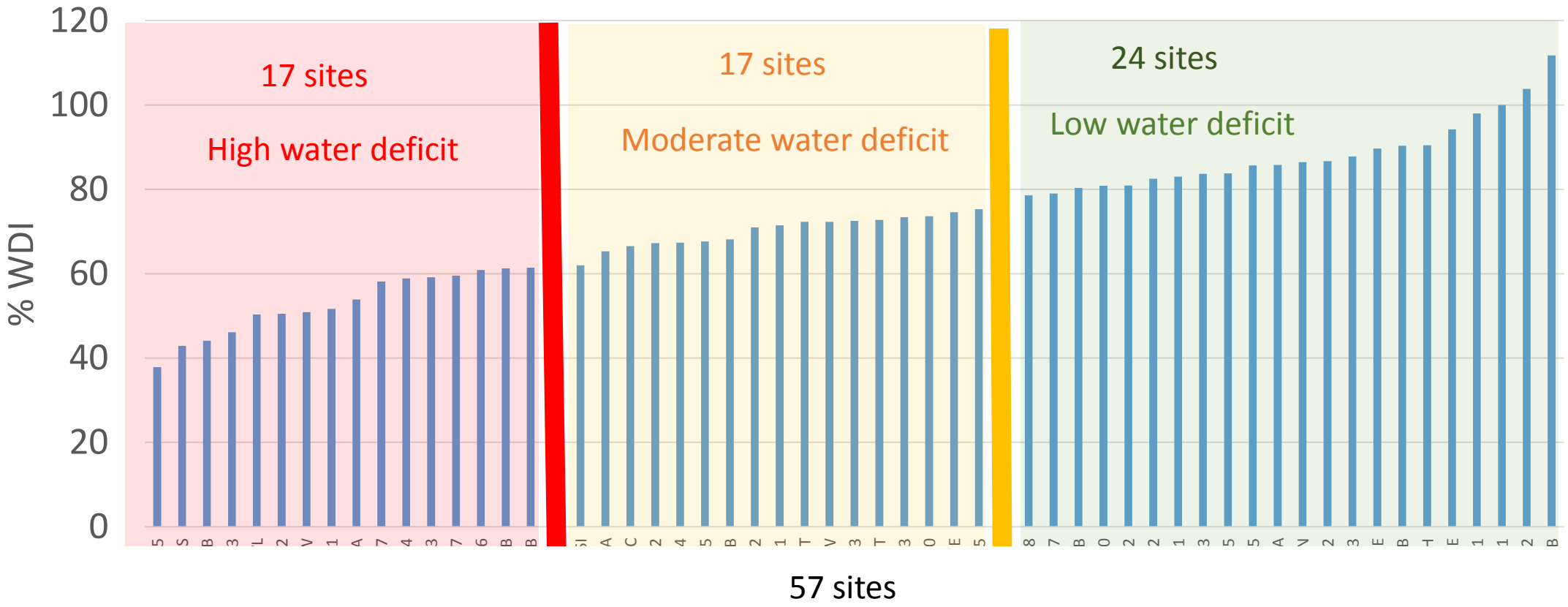
Highest maximum VPD : 5.5 to 7.2 kPa

Comparison of Two Sites
Water Deficit Via Sap Flow



All sites -Water Deficit Index

(Average post veraison period)



Primary Metabolites and Berry Size

Peak berry weight: 0.6 to 1.4 g

Peak sugar: 150 to 350 mg/berry

Harvest date: August 27th to October 15th

Polyphenols

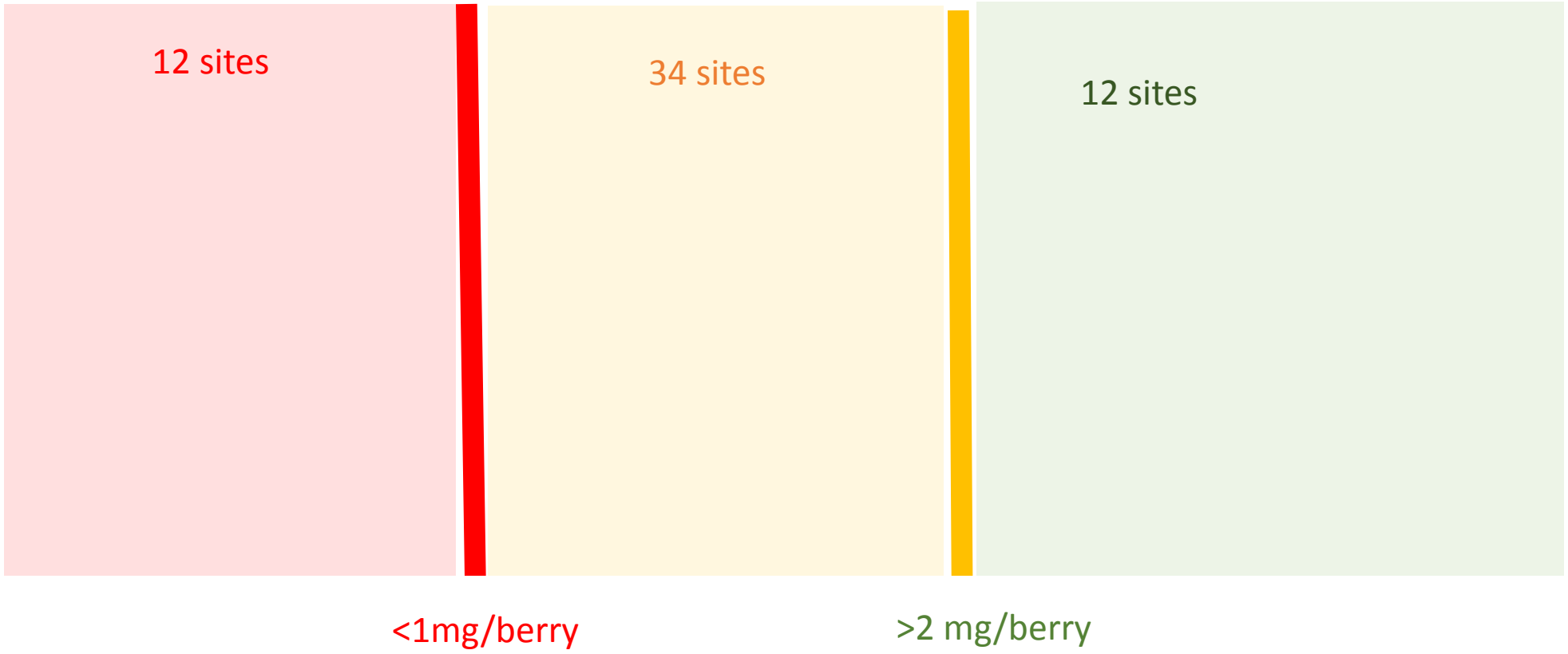
Total anthocyanin concentration

Tannin

- Concentration (mg/berry)
- Mol fraction of prodelphinidin
- Activity

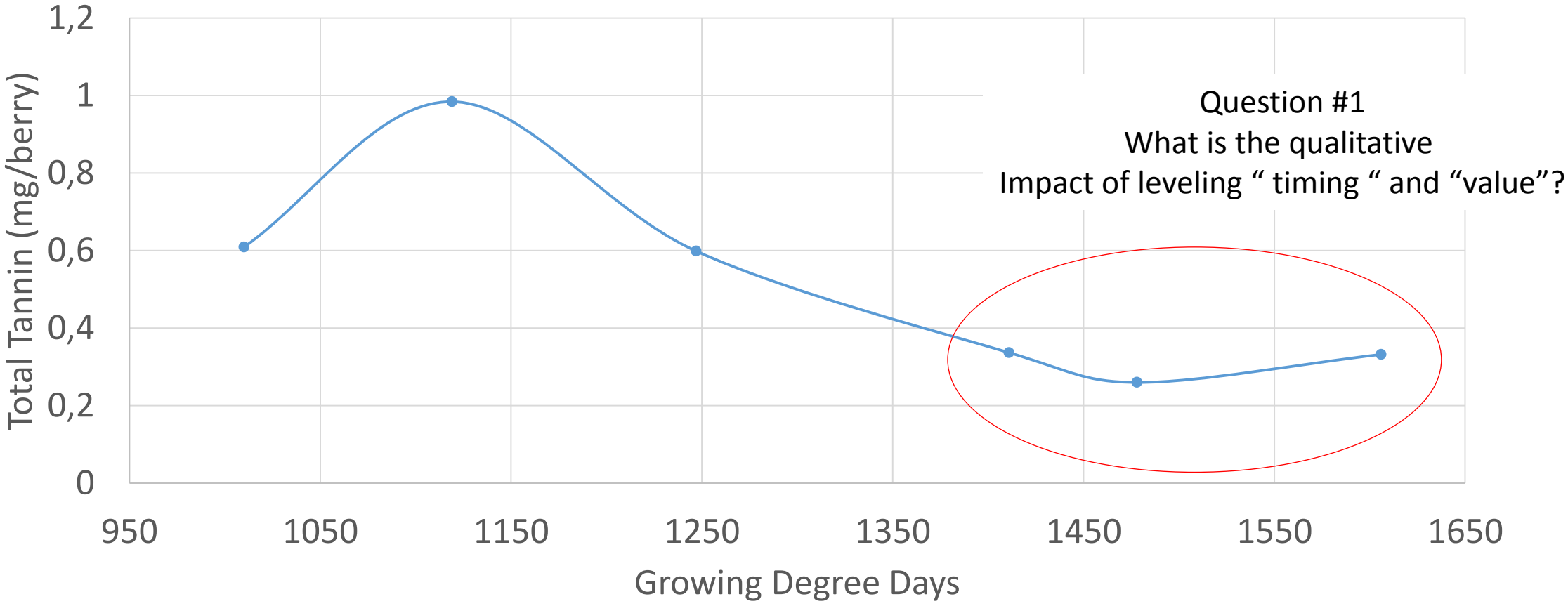
Partial Extracts – Anthocyanins Concentration (mg/berry)

(peak value)



No relation was found with WDI

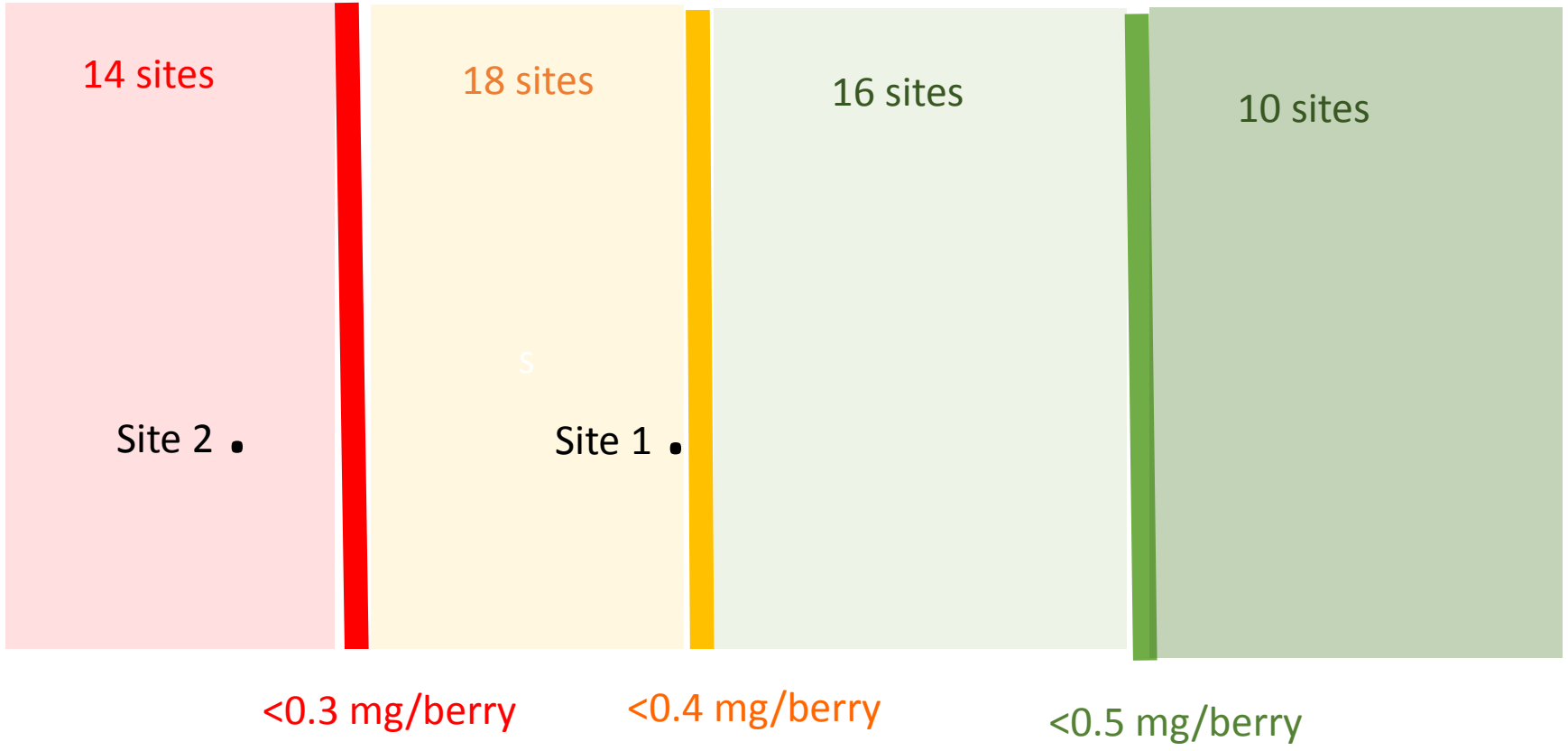
- Partial Extracts -
Total Tannin Concentration (mg/berry)



Question #2:
Why most blocks show a leveling of tannin extraction
while few blocks show a spike in tannin concentration towards the end of maturity?

- Partial Extracts –
Tannin Concentration (mg/berry) at “leveling” Phase

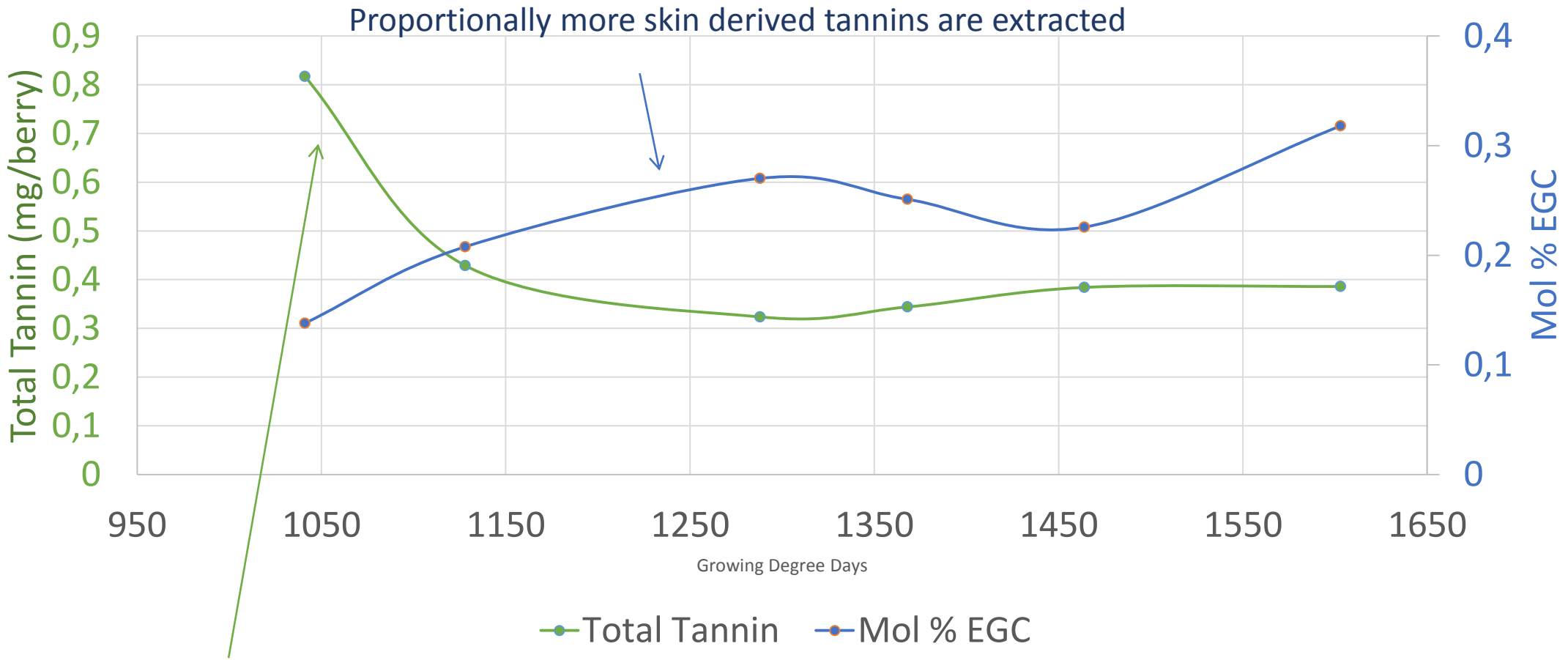
(average value over last 3 sets)



Relation with WDI under investigation

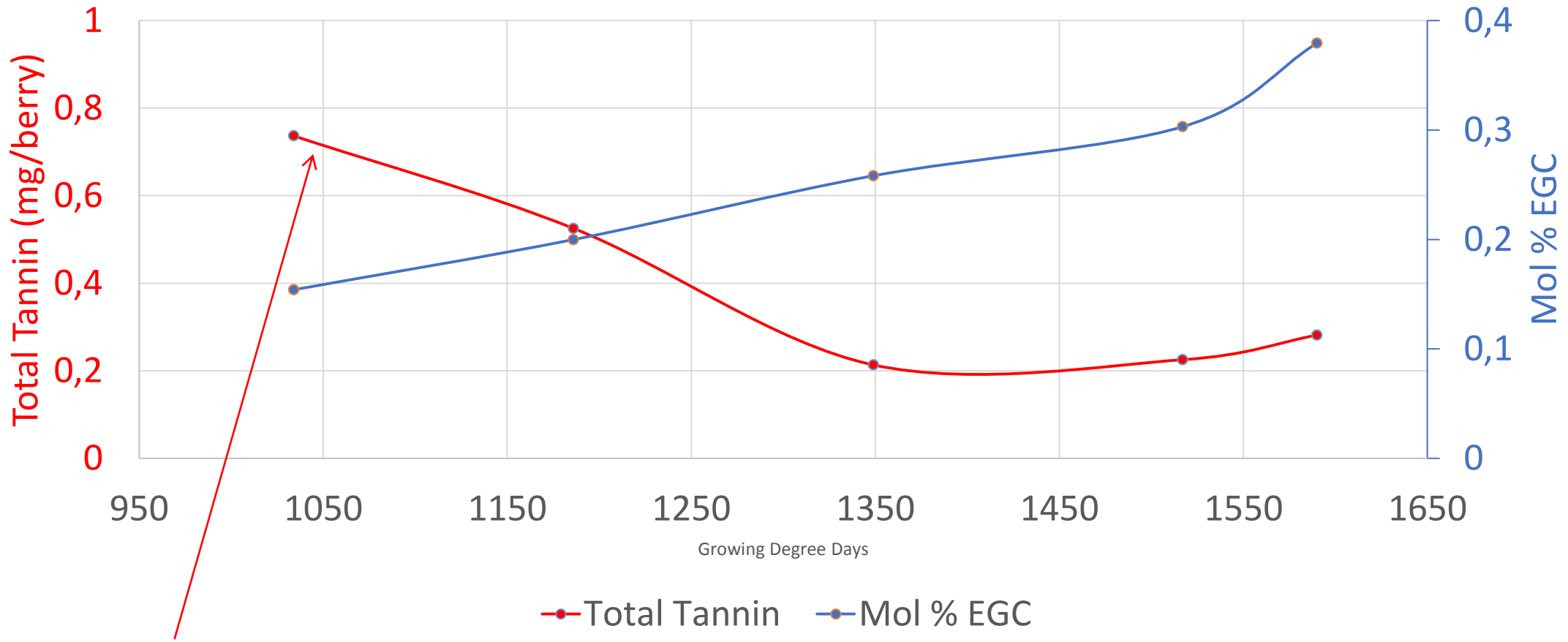
Tannin Composition Changes

SITE 1 (low water deficit)



Total tannins concentration declines rapidly and levels off near 0.4 mg/berry

Tannin Composition Changes
Site 2 (High water deficit)



Total tannins concentration declines more gradually, levels off near 0.2 mg/berry and increases near the end

Take home on Tannin Composition Changes

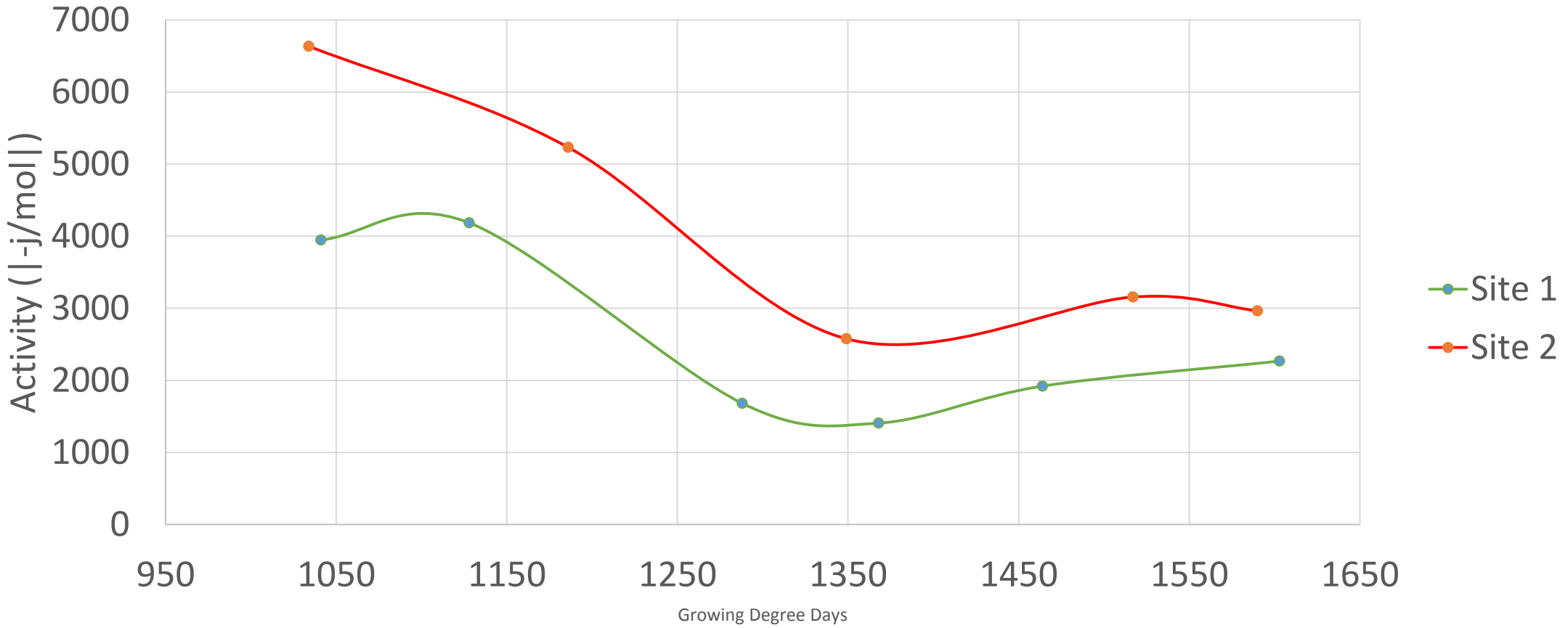
- As seed lignifies, extraction of seed derived tannins decreases.

➔a decline in the total tannin concentration with a relatively stable concentration following the decline.

- Although there is a decrease, we see an **increase in prodelphinidin** = a tannin subunit strictly synthesized in the skin of the grape.

➔suggests that although the concentration being extracted is lower, there is more skin-derived tannin within that concentration.

- Partial Extracts – Tannin Activity

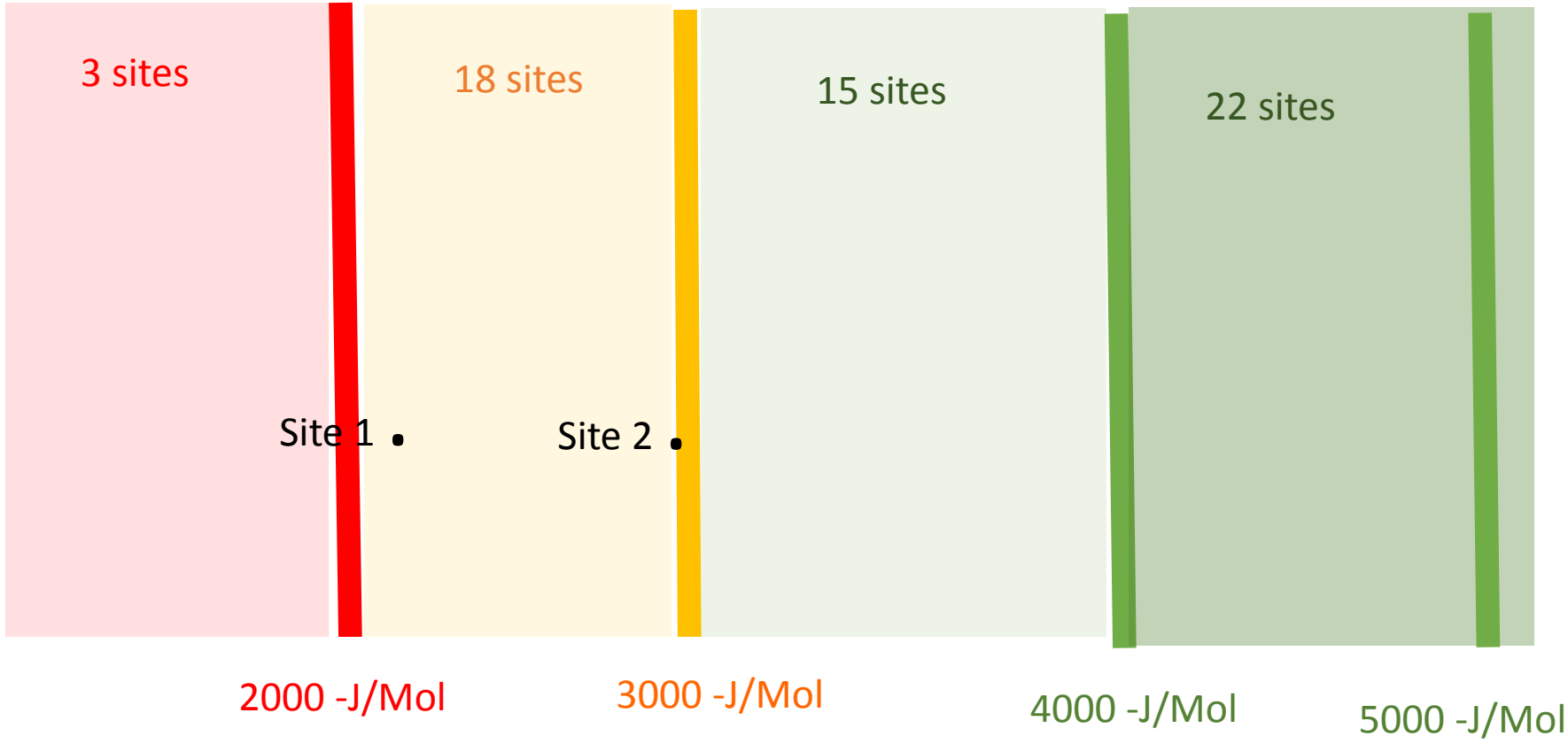


As tannin activity decreases, tannins are considered to be less “drying”

Once fruit is harvested and fermented, activity again increases as apparent tannin size increases

This gives wine astringency.

- Partial Extracts – Tannin Activity



Relation with WDI under investigation

Next steps

- Analyzing the data set we try to address the following questions
  - Water deficit index vs. GDD :
    - **What is their relative impact on polyphenols extractability kinetics and end of season values?**
  - Effect on Hang time and maturation length on polyphenol extraction and last set variation
    - **Why do most blocks show a late-season leveling in tannin extraction?**
    - **Why do a few blocks show a late-season spike in tannin concentration?**
  - Effect of seed

thanks

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