Redeveloping Vineyards
What to Consider

UC Davis and UC ANR Grapevine Short Course
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Photo and Slide Acknowledgements

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Redeveloping vineyards: what to consider

- Factors to consider when deciding if an established vineyard should be redeveloped.
- How subsequent vineyard design and plant material decisions are informed by previous vineyard's performance
- Assessing the need for pre-plant fumigation
- Rootstock choices based on site concerns
- Spacing and trellising considerations

Factors to consider when deciding an established vineyard should be redeveloped.

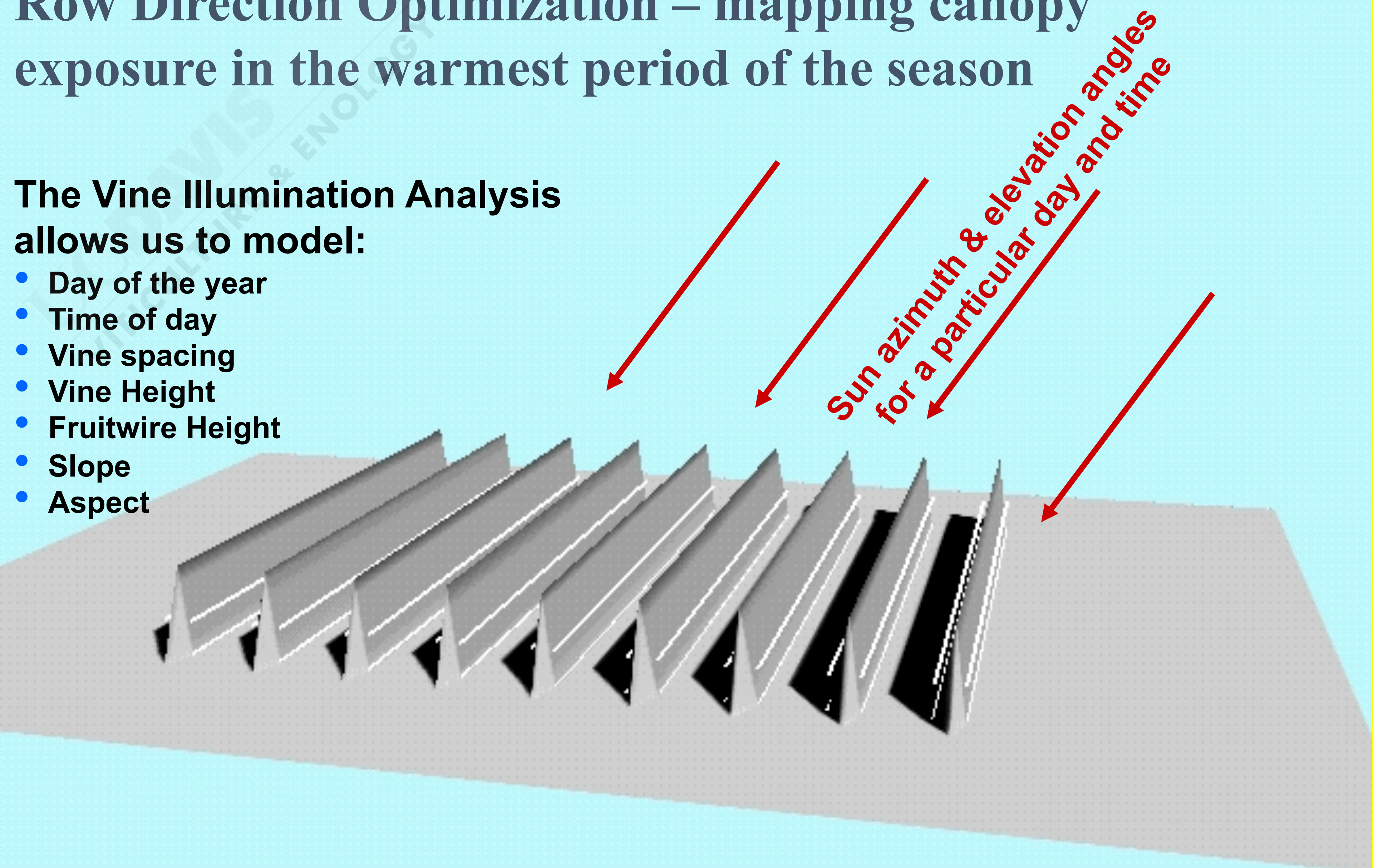
- Yield reduction due to pests and disease
  - Grapevine trunk disease
  - Virus disease
  - Soil borne pests
- Fruit quality is negatively affected by grapevine virus diseases *
- Vine growth is restricted by soil factors
- Cultivar is in less demand and/or grown in a region not considered optimal; price per ton is not sustainable

Uniform canopies
Acceptable yields

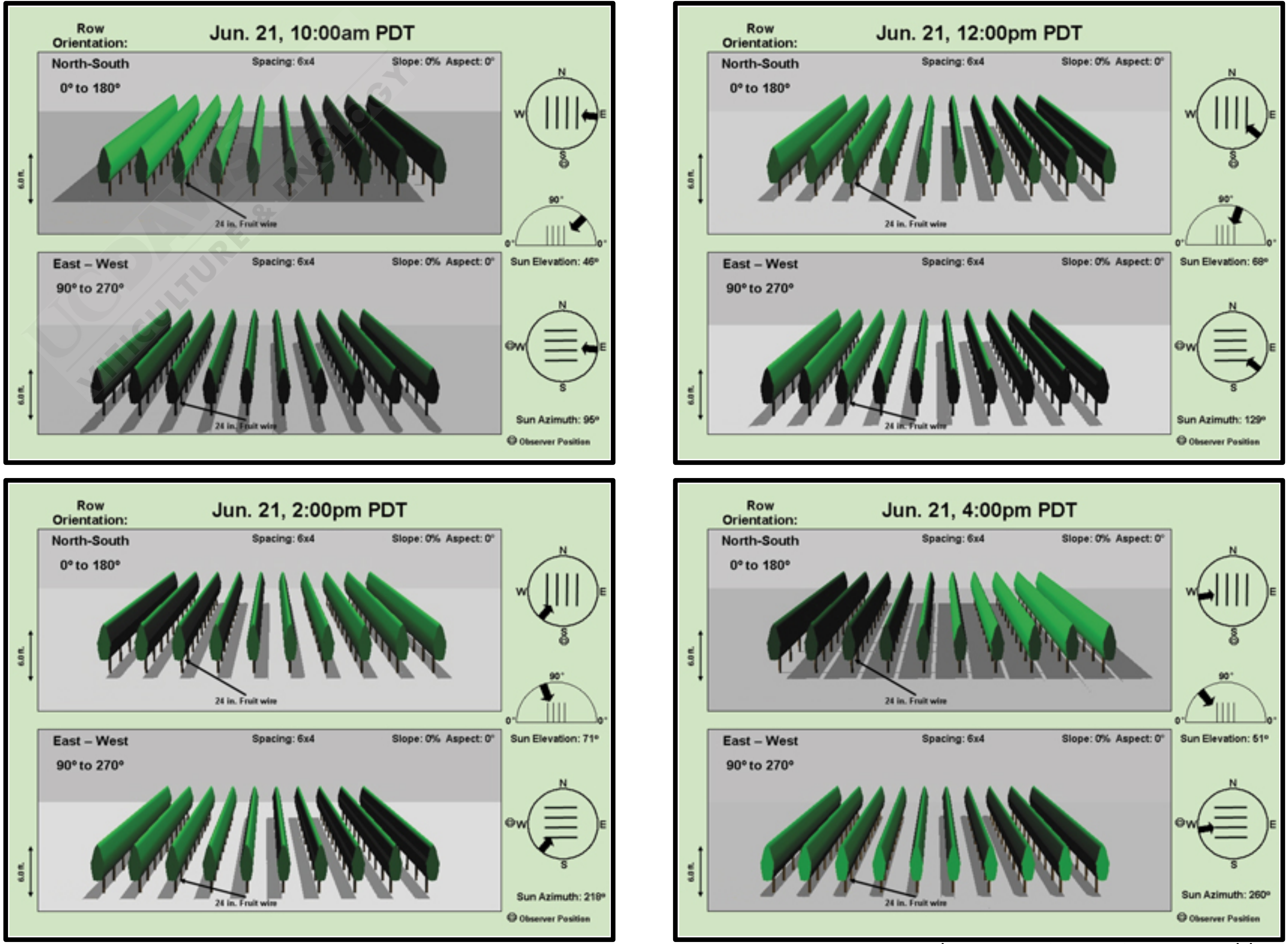
Row Direction Optimization – mapping canopy exposure in the warmest period of the season

The Vine Illumination Analysis allows us to model:

- Day of the year
- Time of day
- Vine spacing
- Vine Height
- Fruitwire Height
- Slope
- Aspect



Mike Bobbitt & Associates
http://www.mikebobbitt.com



From: Greenspan. July 2008, Wine Business Monthly


UCDAVIS
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Grapevine trunk disease

Trunk Diseases in California

- Caused by fungal pathogens (Ascomycetes)
- Infect grapevines through wounds and openings
- Symptoms include:

  Grapevine decline

  Dead arms, cordons and trunk

  Blockage of vascular system

  Yield losses / Death of the plant

- **Arm and Trunk dieback -** *Eutypa spp.* and other Diatrypaceae

Converting vines from cordon trained and spur pruned to cane pruned


Chardonnay


Cab Sauvignon

Percentage of planted acres producing fruit

Virus disease: Grapevine red blotch disease

Caused by Grapevine red blotch-associated Virus

Chardonnay

Merlot

Virus disease: Grapevine leafroll disease

Caused by species of Grapevine leafroll-associated Virus

Spread documented by Golino & Weber (*California Agriculture*, 2008)

Insect vectors: *Mealybugs and scale*

Fanleaf degeneration

Caused by:
Grapevine fanleaf virus

Nematode vector:
Xiphinema index

Merlot on 110R

Zinfandel on
St. George

Ring nematode abundance prevented adequate cane growth; reduced yields

Six year old Pinot noir vineyard removed

Grape Phylloxera

Daktulosphaira vitifoliae

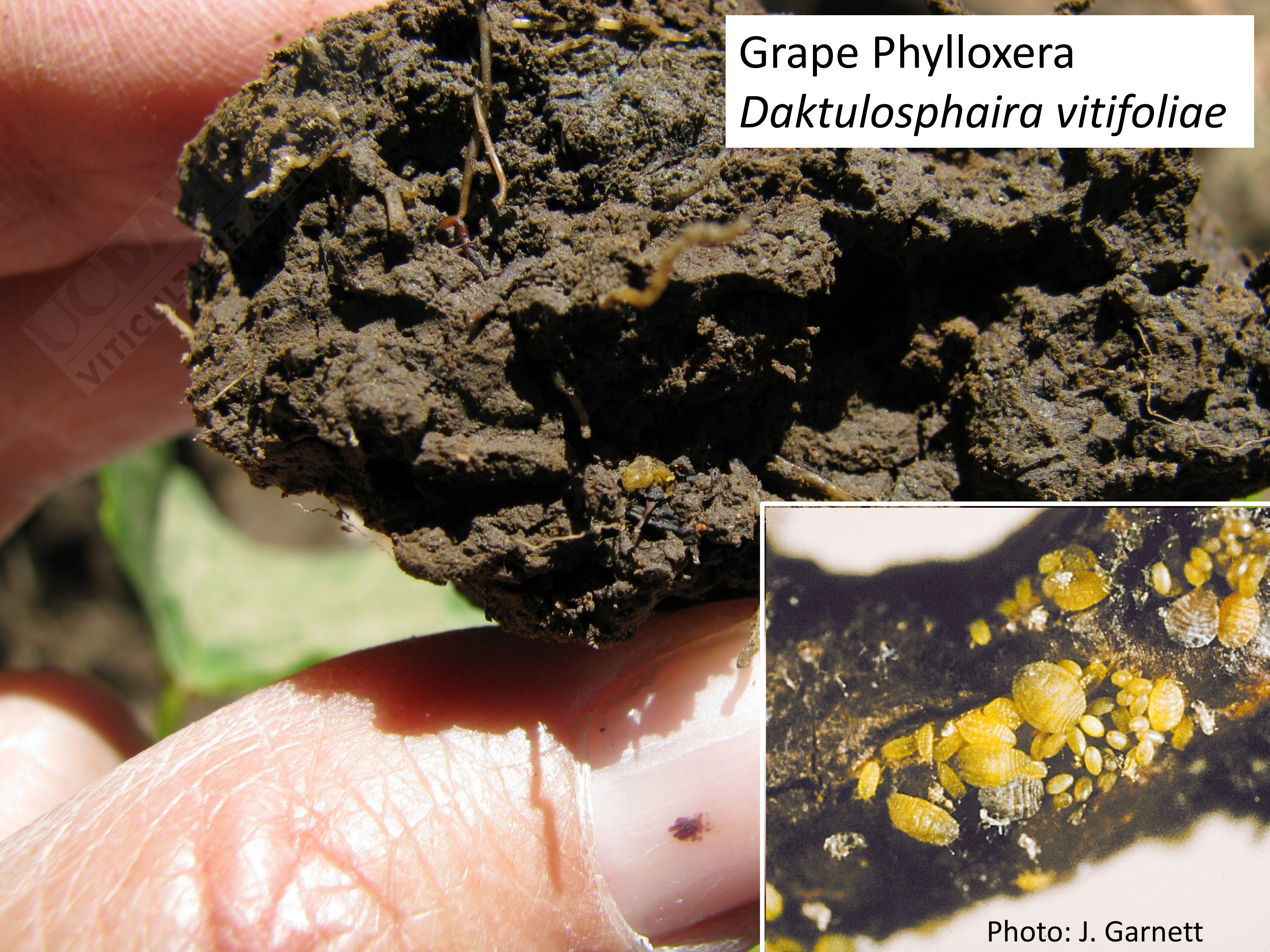


Photo: J. Garnett

2005; Phylloxera infested 101-14

1989; Phylloxera infested Chardonnay on AXR#1

Damage

Tuberosities

Nodosities

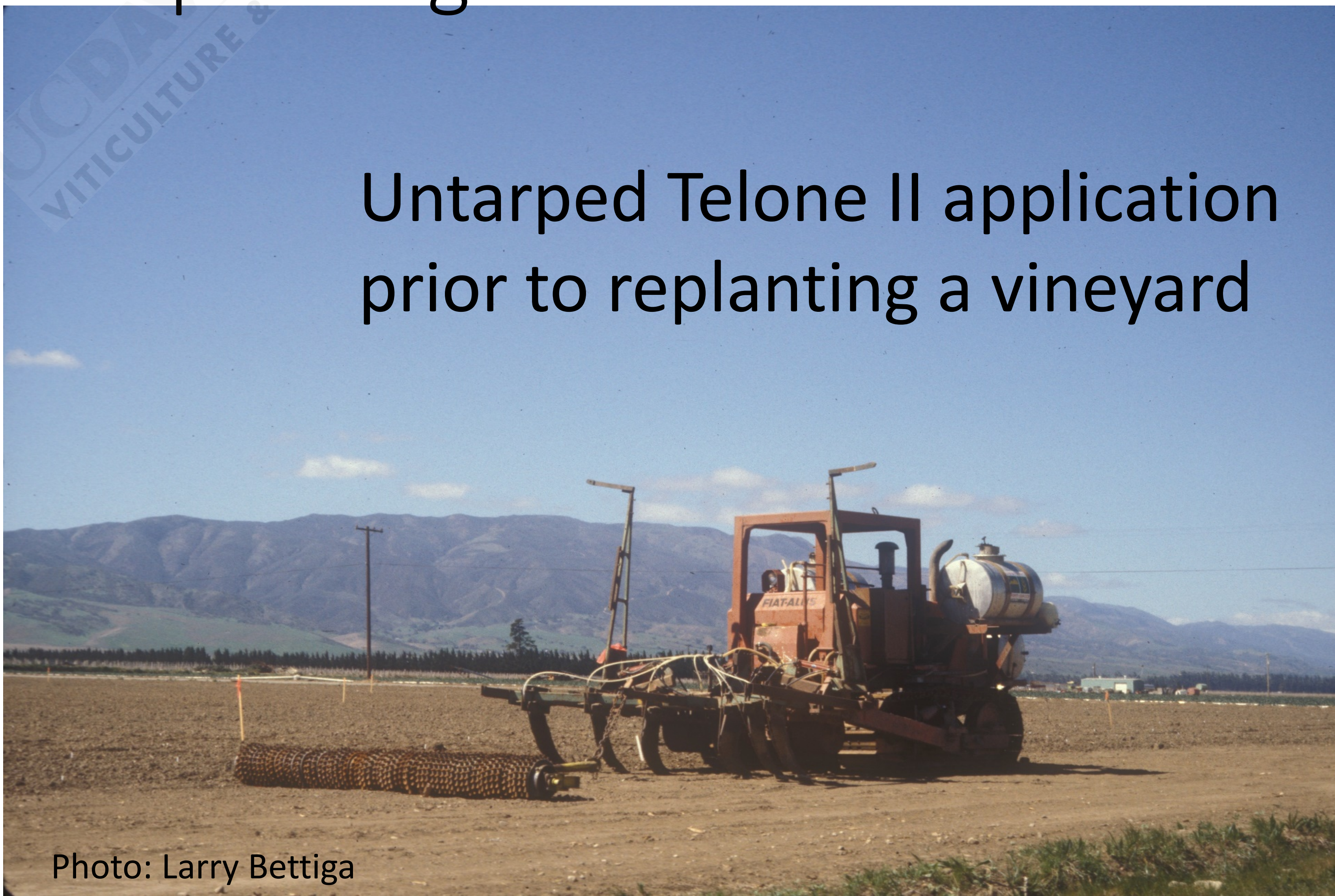
Shorter rootlet lifespan

Fungal necrosis

Root death

Vine stunting, yield decline, vine death

When should you fumigate prior to planting for nematodes?



Untarped Telone II application prior to replanting a vineyard

Photo: Larry Bettiga

California Grapes: Co-distribution of Nematode species

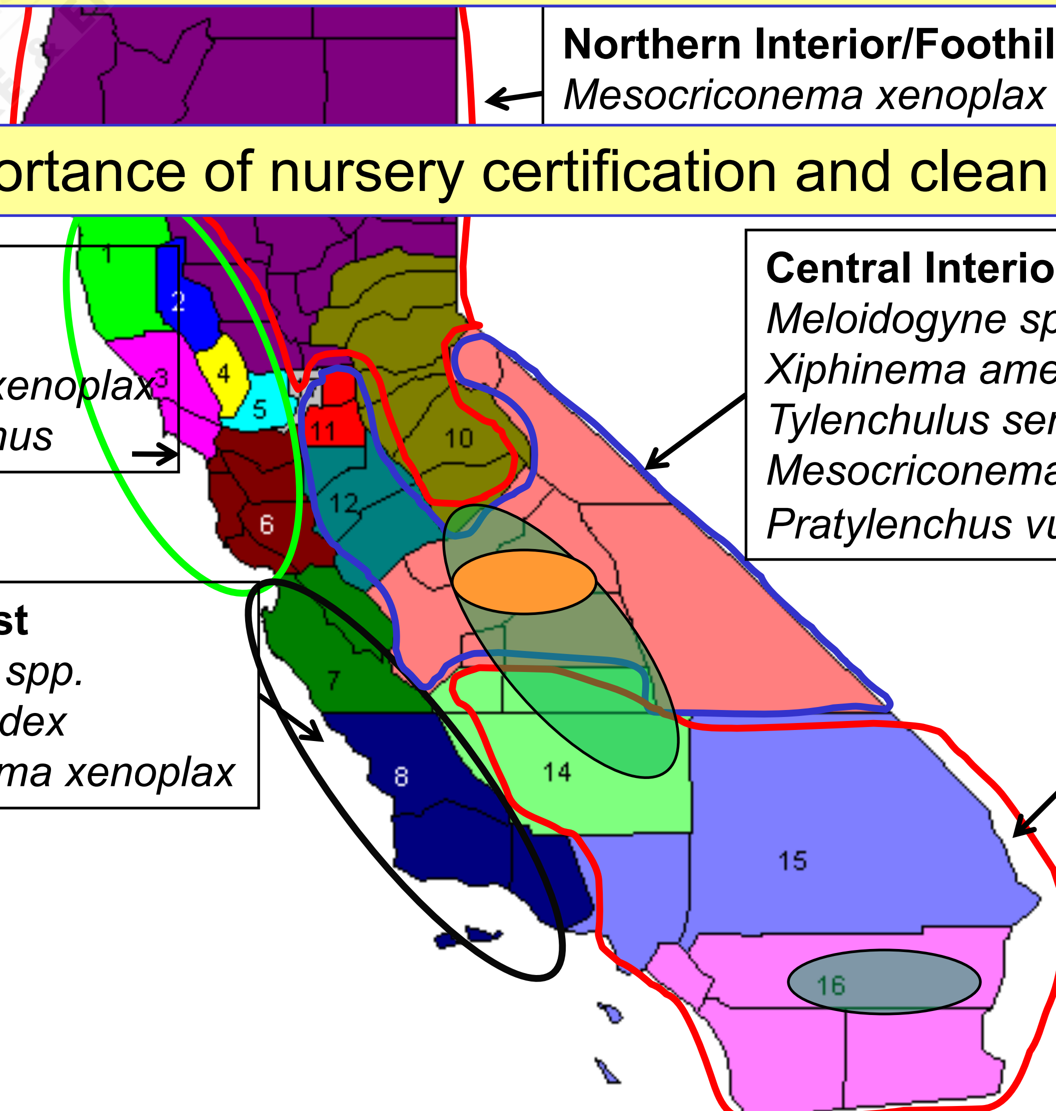
Many of these are not native species. Why are they there?

Northern Interior/Foothills
Mesocriconema xenoplax

…..the importance of nursery certification and clean planting stock

North Coast
Xiphinema index
Mesocriconema xenoplax
Pratylenchus vulnus

Central Interior
Meloidogyne spp.
Xiphinema americanum
Tylenchulus semipenetrans
Mesocriconema xenoplax
Pratylenchus vulnus



Central Coast
Meloidogyne spp.
Xiphinema index
Mesocriconema xenoplax

Southern Interior
Meloidogyne spp.
Xiphinema americanum
Tylenchulus semipenetrans
Mesocriconema xenoplax

Slide source: Howard Ferris

Host status of grape rootstocks to nematodes

Genotype	Parentage	*M. incognita* Race 3	*M. javanica*	*Meloidogyne* pathotypes Harmony A&C	*M. chitwoodi*	*X. index*	*M. xenoplax*	*P. vulnu*	*T. semipenetrans*	*X. ameriacanum*	*Para. hamatus*
101-14Mgt	*V. riparia, V. rupestris*			R		S	S	MR			S
1103Paulsen	*V. solonis x V. riparia*			S		S	S	MS			S
110Richter	*V. berlandieri, V. rupestris*			MR		S	S	S			S
140Ruggeri	*V. berlandieri, V. rupestris*			MR		S	S	S			MS
1613Couderc	*V. solonis, V. othello*	R	R	S	S	MR	S	MS	S	S	
1616Couderc	*V. solonis, V. riparia*			MR		S	S	MS			S
3309Couderc	*V. riparia, V. rupestris*	S	S	S		MS	S	S	S	S	S
420A	*V. berlandieri, V. riparia*			R		S	S	MS			S
44-53Malegue	*V. riparia, V. cordifolia, V. rupestris*			S		S	MR	MS			S
AxR1	*V. vinifera, V. rupestris*			S		S	S	S			S
Borner	*V. riparia, V. cinerea*			R		R	S	MS			
Dog Ridge	*V. champinii*	R	R	S		S	S		MR	MR	MS
Freedom	*V. champinii, V. longii, V. vinífera, V. riparia, V. labrusca*	R	R	S	S?	R	MS	MS	S	MS	MR
Harmony	*V. champinii, V. longii, V. vinífera, V. riparia, V. labrusca*	R	R	S	S	MS	S	S	S	S	S
K51-32	*V. champinii, V. rupestris*	MR				MS	S	R	S		S
Kober 5BB	*V. berlandieri, V. riparia*			R		S	S	MS			MR
Ramsey	*V. champinii*	R	R	S	S?	MR	S	MS	MSS	S	S
Riparia Gloire	*V. riparia*			R		R	S	MR			S
RS-3	*V. candicans, V. riparia, V. rupestris*	R	R	MR	MR	S	S	MR			S
RS-9	*V. candicans, V. riparia, V. rupestris*	R	R	R	R	S	S	MS			S
Schwarzmann	*V. riparia, V. rupestris*	S	MR	S		MR	MS	S	S	MS	S
St. George	*V. rupestris*	S		S		S	S	MS			MS
Teleki 5C	*V. berlandieri, V. riparia*	MS	MR	S		MR	MS	S	S	S	MS
USDA 10-17A	*V. simpsoni, M. rotundifolia*	R	R	R	R	R	MS	R	R		
USDA 10-23B	*V. doanianna*	R	R	R	R	R	MR	R	R		
USDA 6-19B	*V. champinii*	R	R	MS	R	MR	MR	R	R	R	
VR O39-16	*V. vinifera, M. rotundifolia*	S	S	S		R	R	MR	S	MR	MR

Ferris, Zheng and Walker. 2012. Journal of Nematology 4(4)

GRN Rootstocks

	Root lesion Nematode	Citrus Nematode	Ring Nematode	Phylloxera Nodosities
GRN-1	MR	R	R	HR
GRN-2	MR	MS	MS	HR
GRN-3	MR	MR	MR	R
GRN-4	MR	MR	MR	R
GRN-5	MR	MR	R	MS

HR
Highly
Resistant

R
Resistant

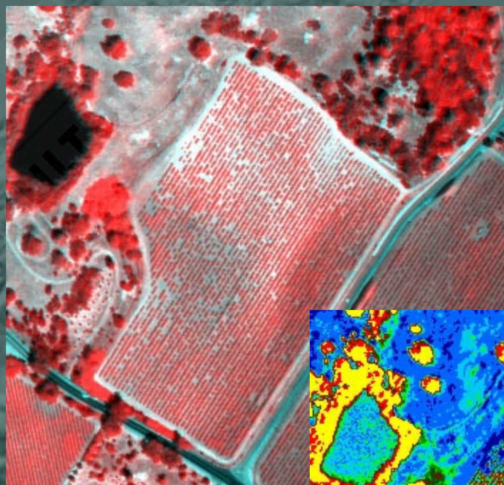
MR
Moderately
Resistant

MS
Moderately
Susceptible

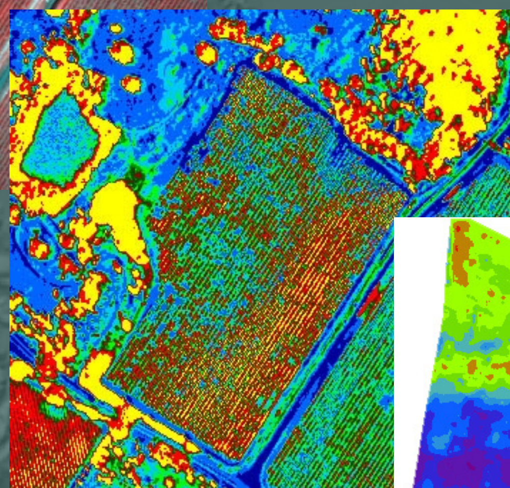
All GRN rootstocks are resistant to *Xiphenema index,* 3 strains of root-knot nematodes, these combined, and at high soil temperatures.

Ferris, Zheng and Walker. 2012. Journal of Nematology 4(4)

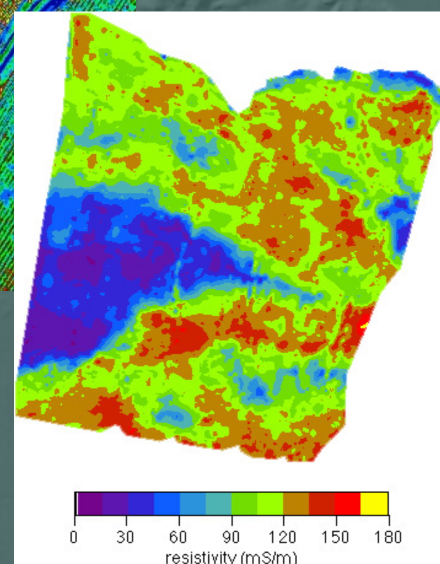
Remote Sensing In Vineyards



Infrared Imagery



NDVI Imagery



Soil Electrical Conductivity

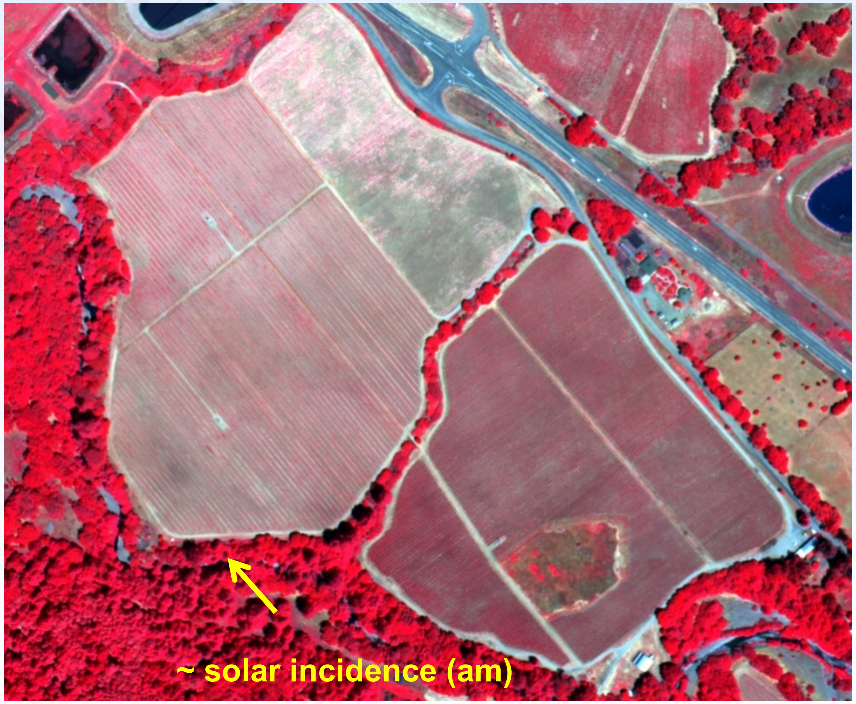
Goal: Reduce the variability in the block

Vine capacity and site vigor are the primary considerations for vineyard design and canopy management

- Vineyard design
  - Row orientation
  - Row & vine spacing
  - Trellising
  - Rootstock

Comparison of row direction & shading effects on NDVI and EVI Images

Color Infrared 5/30/14



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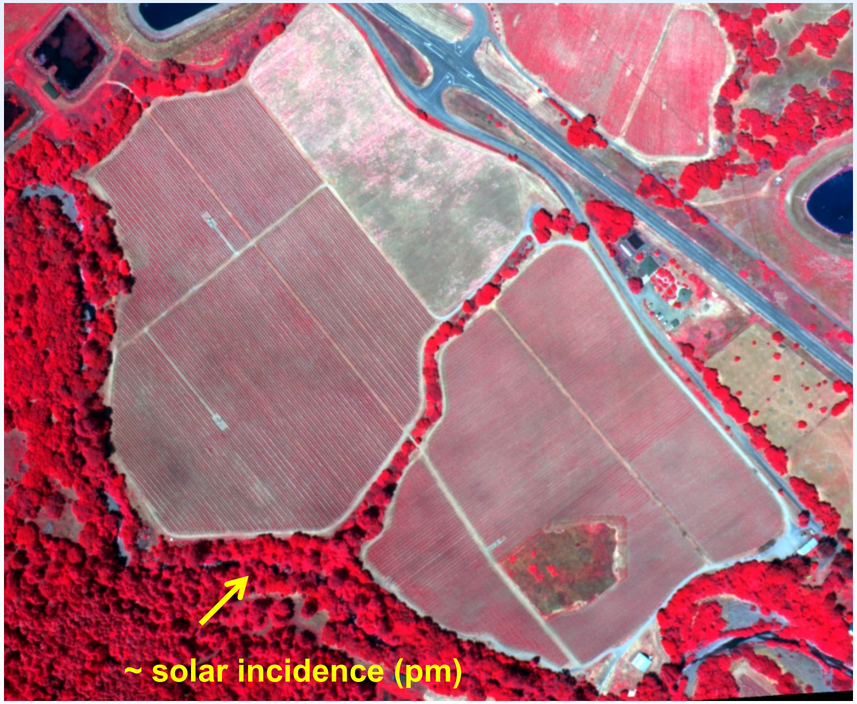


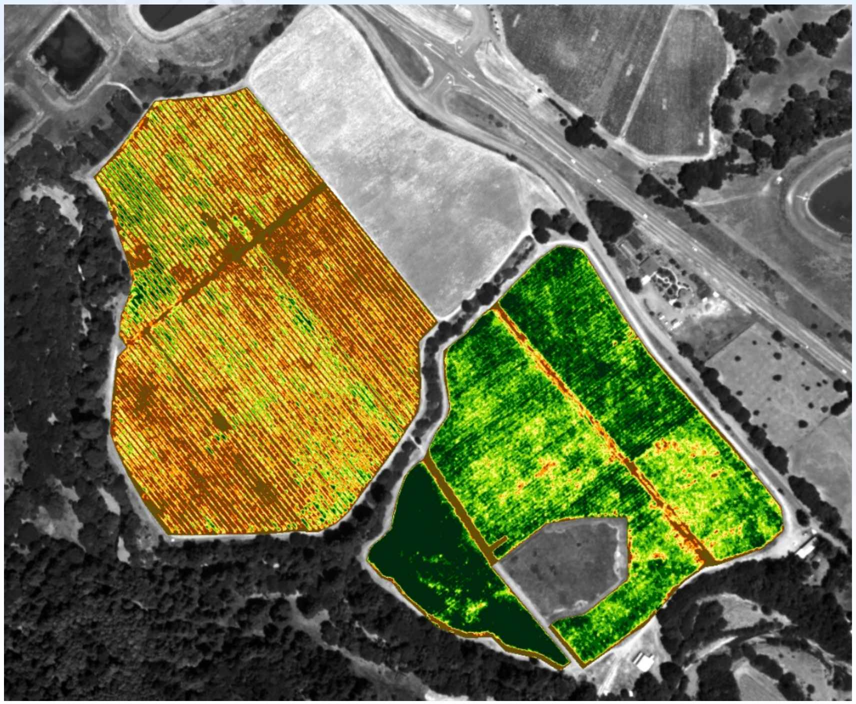
2:09 pm

Sun aligned with, or perpendicular to, rows can cause false apparent vigor differences

Comparison of row direction & shading effects on NDVI and EVI Images

$$\frac{NIR - Red}{NIR + Red}$$

Relative NDVI 5/30/14



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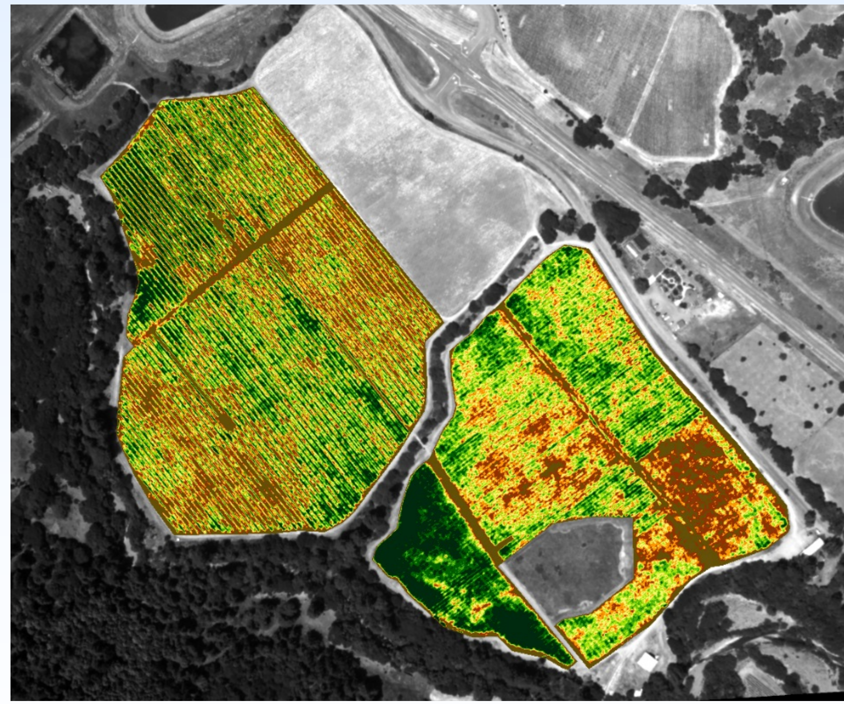

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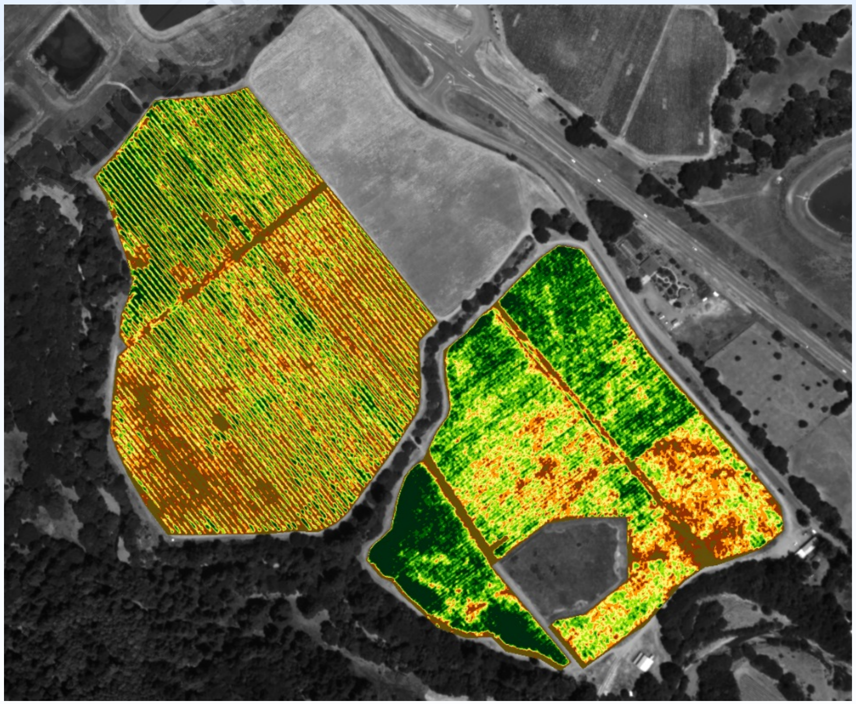
Shadows related to row direction can cause apparent changes in vigor at specific times of day (between morning and afternoon NDVI images)

$$\frac{G \times (\mathbf{NIR} - \mathbf{Red})}{\mathbf{NIR} + (c1 \times \mathbf{Red} - c2 \times \mathbf{Blu} + L)}$$

Coefficients:
c1,c2 = aerosol resistance
G = Gain factor
L = Canopy background adj. for non-linearity in NIR & Red

Relative EVI
5/30/14



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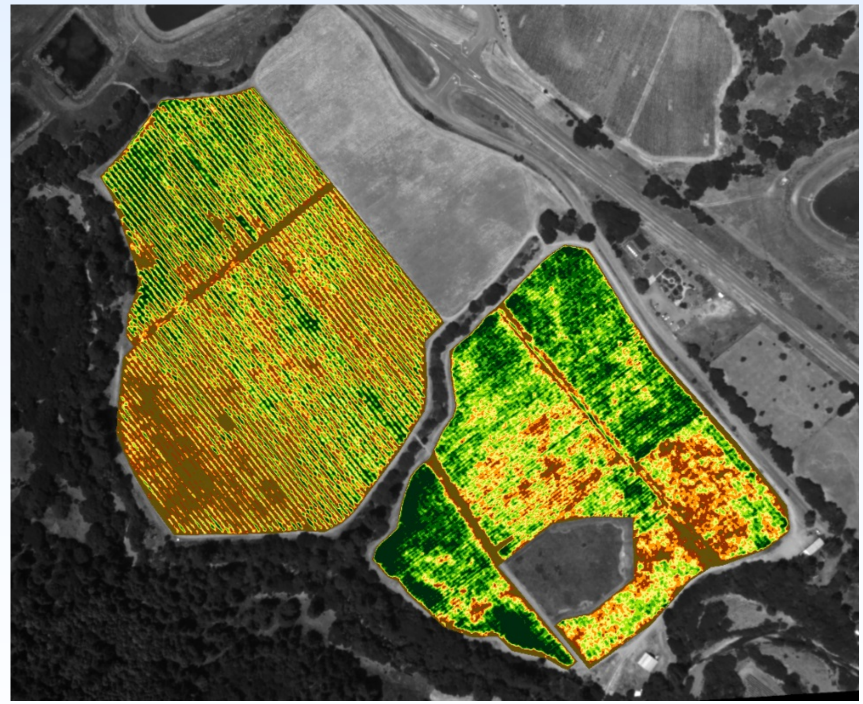


2:09 pm

EVI is much less sensitive to shadows & soil boundaries & more directly sensitive to Leaf Area Index


Google Earth
©2018 Google
Google Earth
©2018 Google
Lazzeretti Rd
N

FLIGHT INFORMATION

Calibrated EVI - Absolute

Data Product

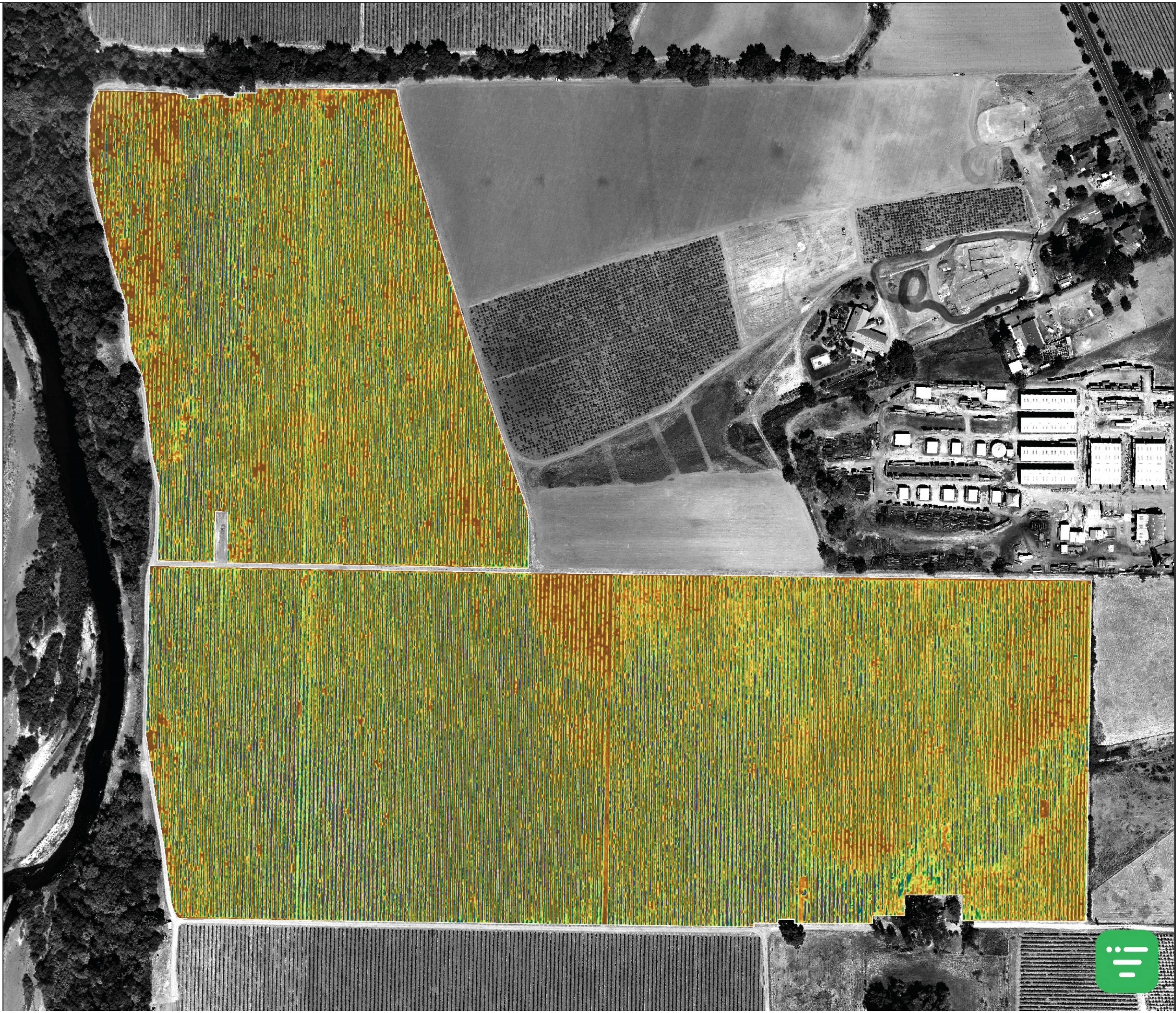
Sept. 14, 2018

Date Flown

EVI Values

- 0.80 +
- 0.75
- 0.70
- 0.65
- 0.60
- 0.55
- 0.50
- 0.45
- 0.40
- 0.35
- 0.30
- 0.25
- 0.20
- 0.15

vineview



FLIGHT INFORMATION

Calibrated EVI - Relative

Data Product

Sept. 14, 2018

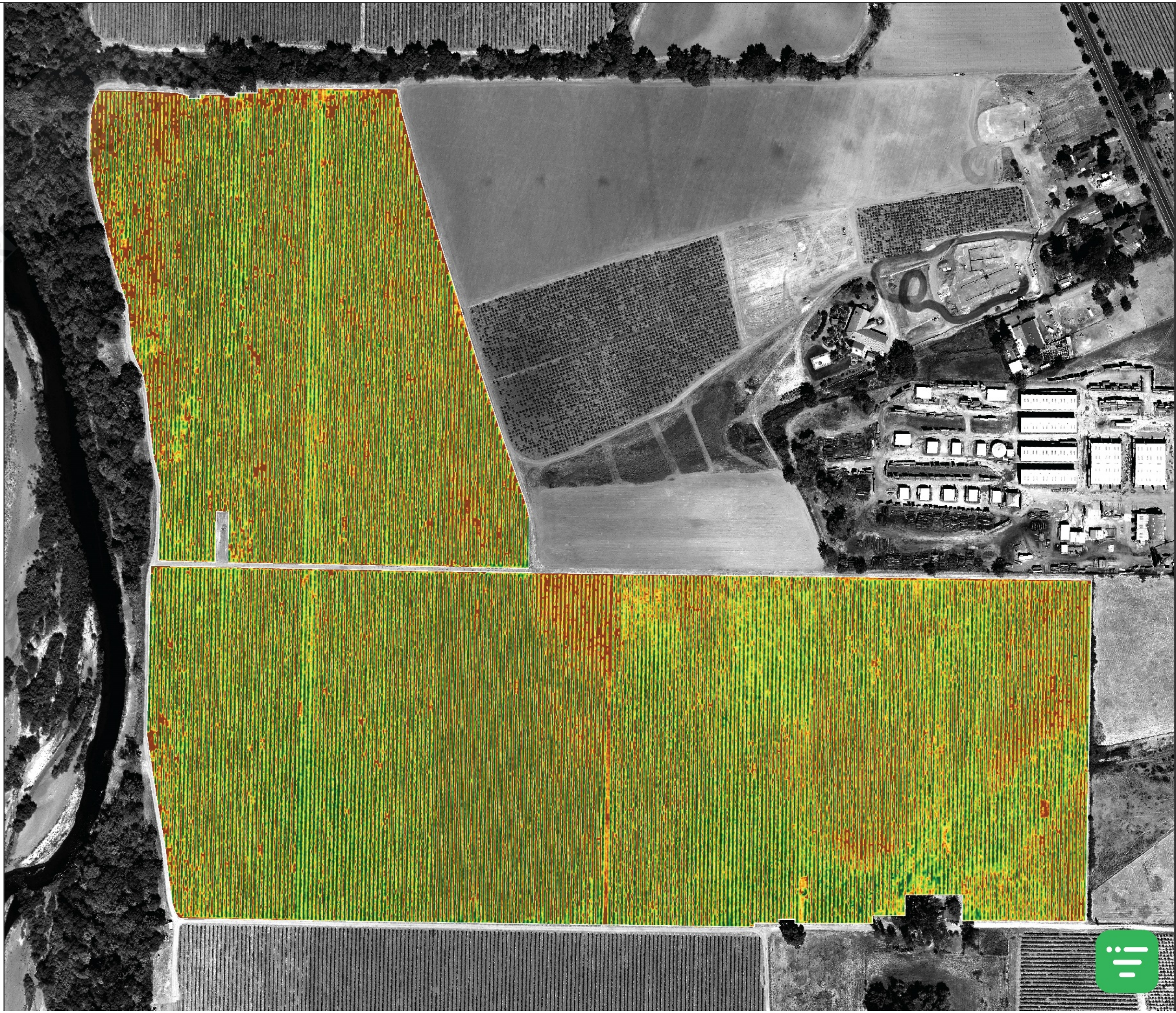
Date Flown

EVI Values

- Highest Vigor
- Lowest Vigor

Equal Area Classification

vineview



FLIGHT INFORMATION

Pure Vine Zones - Relative

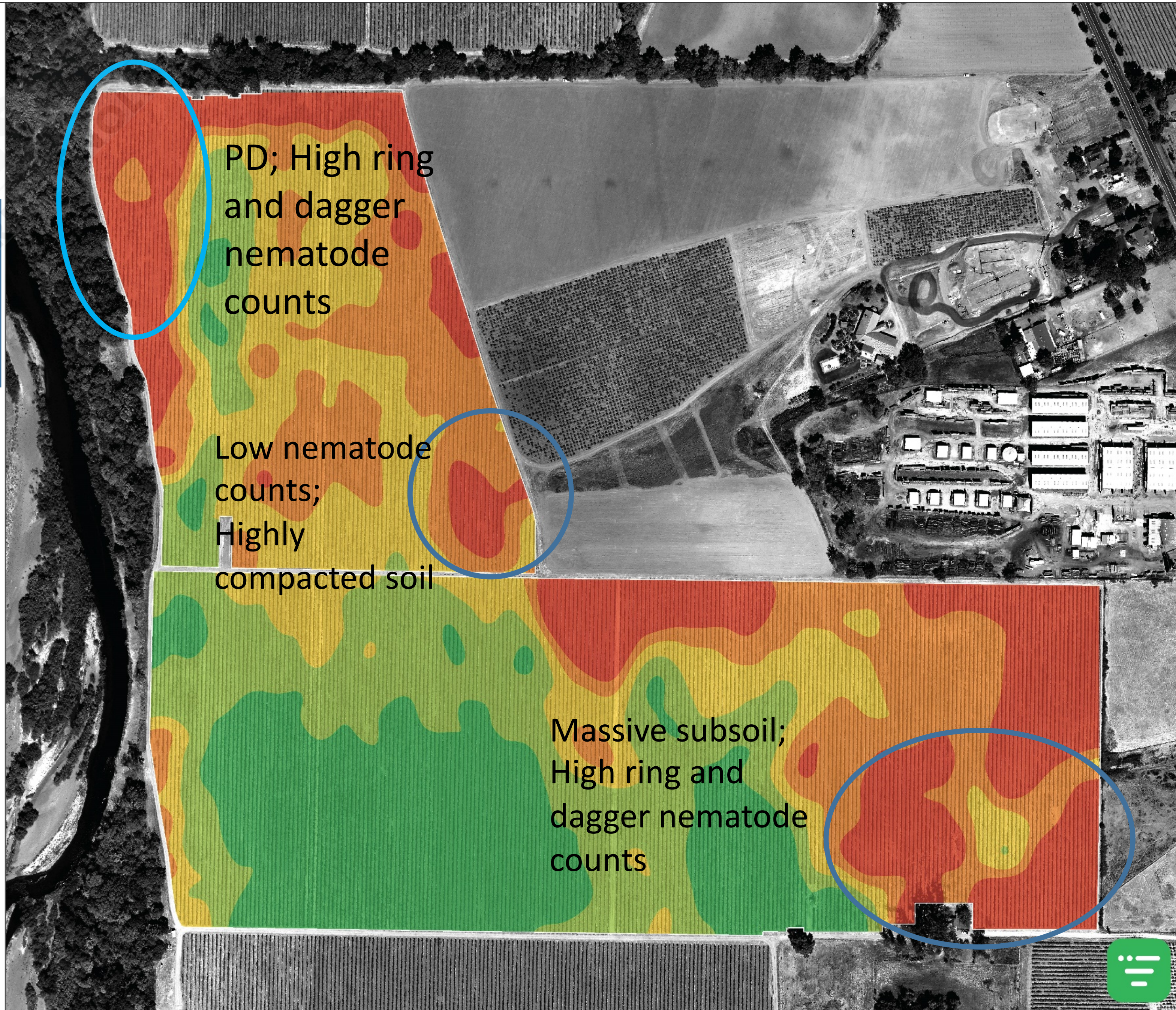
Sept. 14, 2018
Date Flown

EVI Values

- Highest Vigor
-
-
-
- Lowest Vigor

Equal Area Classification

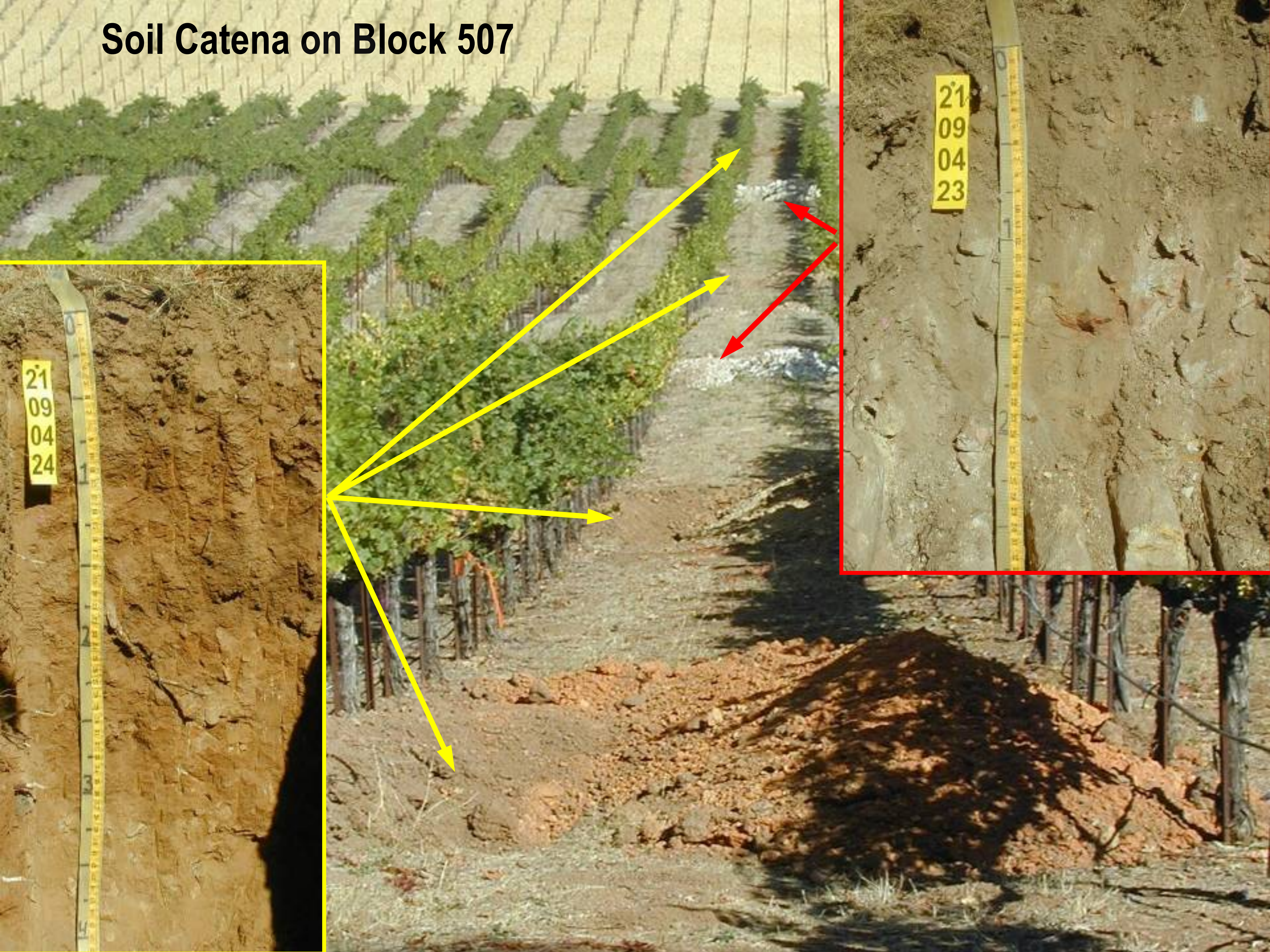
vineview



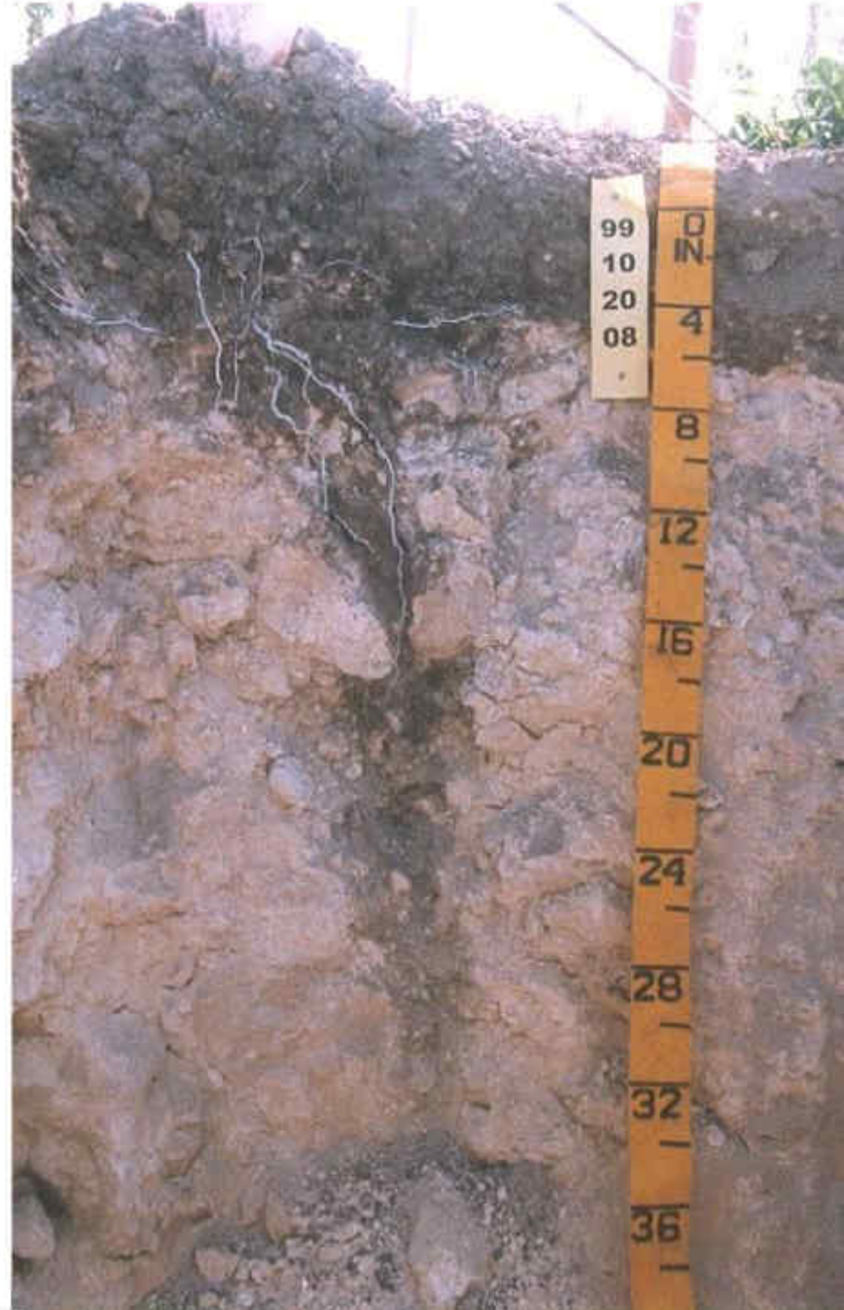

Soil Profile


Massive, unstructured subsoil. Not penetrated by roots

- Where is the root zone?
- Structure, texture, rock content by depth
- Chemistry by depth
- Sample for nematodes



Soil Catena on Block 507
21
09
04
23
21
09
04
24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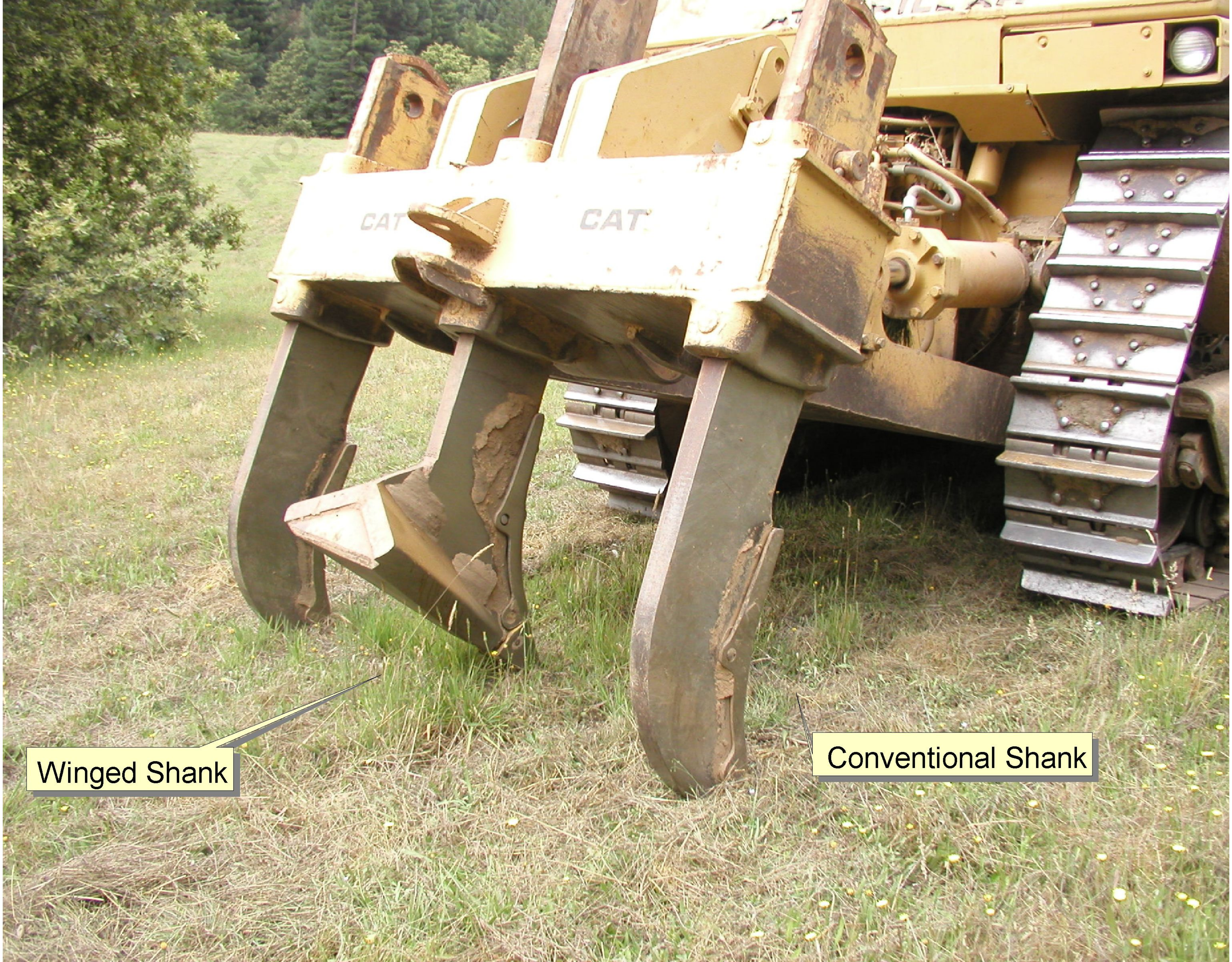

Winged Shank
Conventional Shank

Slide source: Paul Anamosa


1000 mm
40 in
20 inches - 500 mm
20 °
Winged tine

Vibrosoiler

All photos: Doug Beck, Monterey Pacific, Inc.

Vibrosoiler

Vibrosoiler

Vibrosoiler

Vibrosoiler

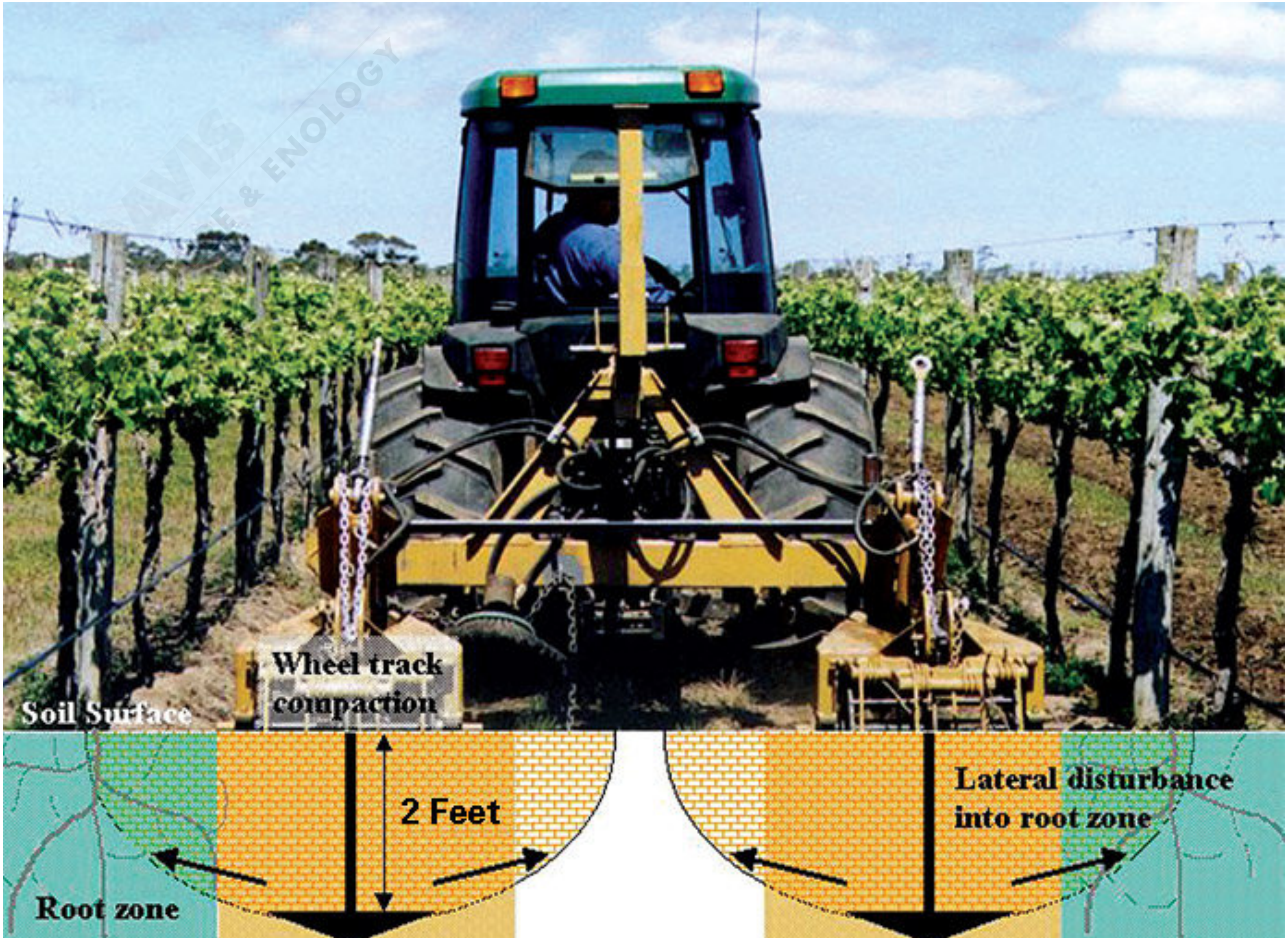
Vibrosoiler

Vine removal

Pluck and Plant

Infrastructure remains intact

Vibrosoiler for mid-row ripping


Wheel track compaction
Soil Surface
2 Feet
Lateral disturbance into root zone
Root zone

Vibrosoiler for mid-row ripping

Spacing and trellising considerations

Mechanizing more farming practices will allow you perform practices on time

Practices occur later than optimal


Thank you