Assessing regional irrigation usage for grapevines

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Why the interest?

• Can aid regional water management
  – Entering new era in California with SGMA
  – Groundwater use needs to be managed

• Aid to farmers
  – Can evaluate own practices by comparing to others
  – Starting point for how much to irrigate
Scale of measurements

- Large region, many different operations
  - To provide baseline information to industry
  - Data for agency use
- Within an operation
  - To track their own practices
  - Are directives carried out properly?
- By some external entity
  - Independent overseer, consultant
Can we just ask growers?

- May not know themselves
- Difference between records and reality
- Automated measurements provide more data
Estimating from flow meters

- Costly if not already installed
- All pumping may not be irrigation use
- Data not specific to a block
Estimating from electricity use

- Only electric pumps
- Values from pump test – kWh/ac-ft
- Uses other than irrigation?

Powwow Energy
Estimating from remote sensing data

- Estimated evapotranspiration

Landsat 8
IrriSAT chart output

Crop Water Use - via GridMET

Cumulative ETc (mm)

Daily ETc (mm)

0 1 2 3 4 5 6 7

0 200 400 600 800

Jul Sep Nov Jan Mar May

1 year
Estimating from pressure switches

• Cheap, reliable, minimal disturbance
• Assumption: actual flow rate is the design rate
  – i.e. the ½ gph emitters are providing ½ gph
• Not a bad assumption for a properly operated and maintained system
• Many automated devices now incorporate
  – Soil moisture loggers, weather stations, Tule, etc.
Pressure switches

4 psi activation pressure
Example pressure switch data

Aug 7  Aug 12  Aug 17  Aug 21

Irrigation Off

Irrigation On

Aug 7  Aug 12  Aug 17  Aug 21

Irrigation Off
### Example pressure switch data

<table>
<thead>
<tr>
<th>Time, GMT-08:00</th>
<th>Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/06/12 09:14:37 AM</td>
<td>0.00</td>
</tr>
<tr>
<td>08/07/12 10:36:40 AM</td>
<td>1.00</td>
</tr>
<tr>
<td>08/07/12 10:36:41 AM</td>
<td>0.00</td>
</tr>
<tr>
<td>08/07/12 10:36:47 AM</td>
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<td>08/07/12 10:36:50 AM</td>
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<td>08/07/12 04:53:37 PM</td>
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<tr>
<td>08/08/12 04:37:41 AM</td>
<td>1.00</td>
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<tr>
<td>08/08/12 04:45:54 AM</td>
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<td>08/09/12 05:02:46 PM</td>
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<td>08/10/12 04:46:27 AM</td>
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</tr>
<tr>
<td>08/10/12 04:58:25 AM</td>
<td>0.00</td>
</tr>
</tbody>
</table>

- **1 second run time**
- **6+ hours run time**

Using a Hobo “State” data logger
Data anonymity

• Why the concern?

• How to address

• Limits incorporating other data later
  – Example: can’t compare to IrriSAT afterward
Paso Robles study, 2010-2013

• “Paso Robles vineyard irrigation study provides benchmark data to assist future area groundwater management”

• http://calag.ucanr.edu/archive/?article=ca.2018a0003
84 vineyard sites
7 rain gauges
Cumulative irrigation

Cumulative applied irrigation (inches)

Day of year

2010
2011
2012
2013

Jan 1
Apr 1
Jul 1
Oct 1
Dec 31

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Annual irrigation vs. preceding winter rainfall

Average annual applied irrigation (inches)

Rainfall the preceding winter (inches)
Extrapolated chart

Annual irrigation vs. preceding winter rainfall

<table>
<thead>
<tr>
<th>Year</th>
<th>Rainfall the preceding winter (inches)</th>
<th>Average annual applied irrigation (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>2011</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>2012</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>2013</td>
<td>40</td>
<td>4</td>
</tr>
</tbody>
</table>
“Recipe” from the Paso Robles study

Applied irrigation and ETo (inches/month)

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Cumulative irrigation

Cumulative applied irrigation (inches)

Day of year

2010
2011
2012
2013

Jan 1   Apr 1   Jul 1   Oct 1   Dec 31

2013
All have essentially the same ETo and winter rainfall
Coarser/shallower soil
Larger canopy, yield
Cover crop depletion

Finer/deeper soil
Smaller canopy, yield
Less cover crop use

Day of year
Cumulative irrigation (mm)
Same soil, same ETo, very different irrigation needs
Adding value to measured data

• Other measurements can add value:
  – Soil water holding capacity
  – Soil moisture levels
  – Estimated Kc values
  – Crop yields
  – Irrigation water quality, soil salinity

• But the above add time, cost to effort
Planned studies

• More areas of San Luis Obispo County
• Areas of Sonoma County

• Update method; intend long-term operation without being accessed
A real-time tool for management?

• Can real-time measurements of regional irrigation applications be turned into a useful tool for farmers?
• Future groundwater management agencies may collect for their needs
• Able to provide additional benefit to growers?
Value for irrigation management

• Wisdom of the crowds
  – Our collective knowledge often exceeds that of most individuals

• Being able to see what is being done on average in real time will help inform the outliers
Where we are coming from

How many hours per week to irrigate?

18 hours for me
12 is plenty!
More than 10 is plonk
Um...24 hours...

14 hours since ‘75
Conversation evolving

What method to use to manage irrigation?

- Soil moisture
- ET rules!
- Love my pressure bomb
- Shoot tips speak to me
- Porometer for me

https://corncorps.files.wordpress.com/2014/07/coffee-shop.jpg
Indexing on mass data?
What proportion of regional average to use

My banker says 1.1
0.9 for me
0.75 is golden
1.5 on my quads
I’m sticking with 1.0
How much to irrigate this week?

- Visual observations
- Past experience
- Input from others
- Educated guessing
- Some measurements

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How much to irrigate this week?

- Weed control
- Disease control
- Canopy management
- Fertilizing
- Harvest
- Etc.

- Visual observations
- Past experience
- Input from others
- Educated guessing
- Some measurements

- Running the business
- Employees
- Paying bills
- Etc.

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