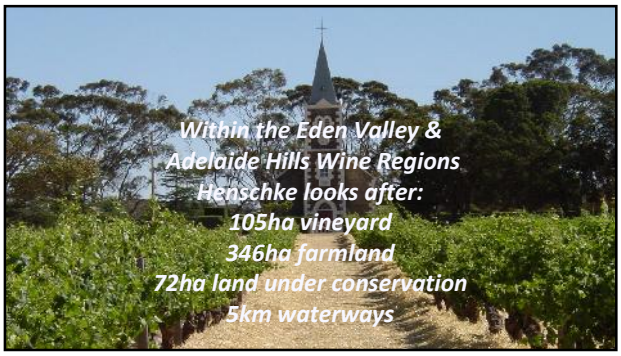
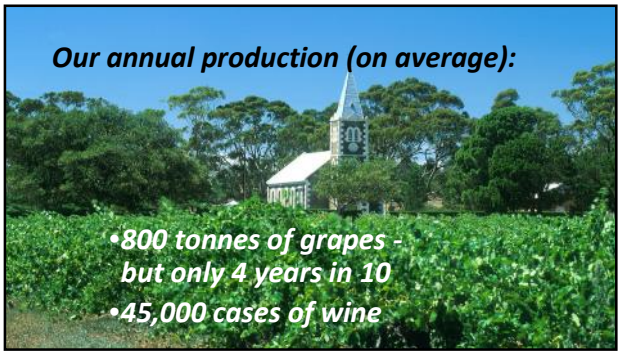




The Environmental Challenges we are experiencing

- Extreme weather events - frost, drought, heat waves
- Water availability
- Soil Management
- Pest control
- Vineyard Management Costs
- Energy Use

Extreme Weather Events
Frost events

Huge increase even in very old vineyard sites

- *Fixed Frost fans cover ~ 5-10ha - $60,000*
- ***S**elected **I**nverted **S**ink fan is mobile, no development approval needed - $19,000*

Extreme Weather Events
Drought - annual rainfall < 80% of average

1950-1959 – 3 years
1960-1969 – 2 years
1970-1979 – 2(3) years
1980-1989 – 1 year
1990-1999 – 1 year
2000-2010 – 3 years

Are drought years increasing?

Implications for surface water catchment in dams

Extreme Weather Events
Heat Waves

January – 9 years in 52

February – 5 years in 52

March – 1 year in 52

(1968-2014)

- *Prior to veraison – less damage but need to irrigate to prevent stress*
- *Scorched fruit, loss of flavour and acidity – protect with Kaolite sprays (Surround)*
- *? Adjust harvest, E-W rows*

How do we improve water availability?

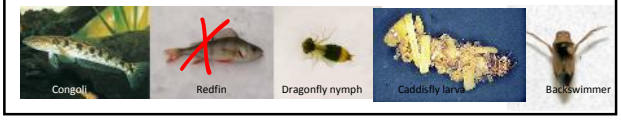
1. *Imported water for dry grown vineyards – expensive ($20/KL with transport ~ 10km, 70L/vine)*
2. *Off-peak imported water cheaper but need access*
3. *Rollover credits for previous year's unused portion – 30% (if there is anything left in the dam!) for Mt Lofty Ranges*
4. *Issues with conjunctive use between groundwater and surface water – separate allocations but useful backup*

How do we improve water availability?

5. *Subsurface irrigation – 20-40% water saving*
6. *Dam lining and covering, saving 30% of resource*
7. *Mulching helps preserve soil moisture short term*

Water Availability
Environmental flows for river health?

- *Environmental flow trial on South Para to release sub-catchment flow model*
- *Sub-catchment 'hot spots' of ecological significance – native fish, macro invertebrates, water health, surrounding native vegetation (red gums, reeds and sedges)*
- *Wine industry should aspire to recognise impact of water catchment but socio-economic study yet to be done*



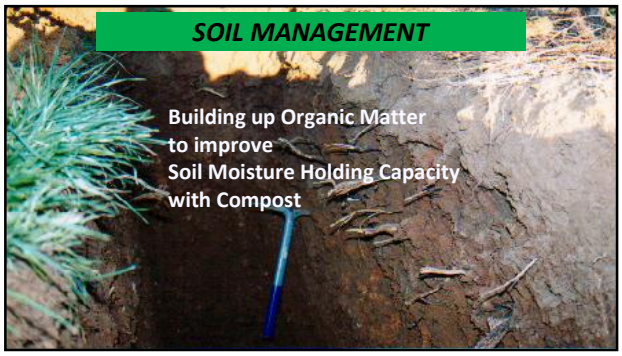
Macro-invertebrate population variability in a natural system

For the Upper Saunders Creek east of Springton:

- *Pollution Sensitivity varies from a score of 5 (poor health) to 91 (good)*
- *Species Diversity ranges from 1 species to 18 species*

Variability is seasonal – high numbers of sensitive macro-invertebrates occur with the first creek flows in April/May/June and again in September as the temperatures rise.

Low flow releases at the beginning of the creek flows are important to the system's health.



Jeff Baldock's AWIC 2011 presentation on the Carbon Farming initiative
Why increase soil organic matter:

Biological roles	Physical roles	Chemical roles
• biochemical energy • reservoir of nutrients • increased resilience	• structural stability • water retention • thermal properties	• cation exchange • pH buffering • complexes cations

Soil Organic Carbon is a balance of:
Inputs – plant growth, addition of organic materials from offsite
Losses – conversion of organic carbon to CO_2, cultivation

Australian soils do have a place in Carbon accounting
- *Capacity is finite and largest changes occur early*
- *Relative increases are typically <0.5 Mg C/ha/y*
- *Absolute increases - negative for cropping systems and <0.5 Mg C/ha/yr for conversion to grasslands*

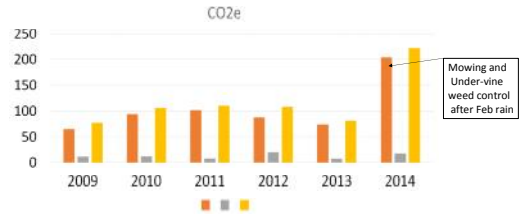
Opportunities to capture additional carbon exist where:
- *Inefficiencies in current production systems can be removed or reduced*
- *Alternative systems with higher carbon capture per increment of resource use are available*
- *Economic outcomes are favourable*

Jeff Baldock,2011

Where are we with Carbon Farming Initiative?

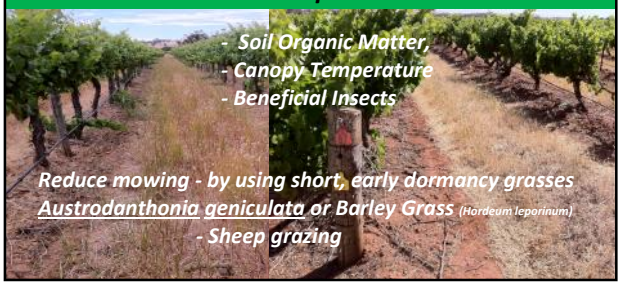
- *Increase in % Organic Matter from <1% to >6% over 10 years*
- *Costs of importing green waste compost and straw - $5,000/ha*
- *No recognition or price for sequestering Carbon*
- *What is our balance between diesel and electricity use and C input?*
- *What has happened to the CFI?*

VINEYARD ENERGY USE, 2010-2014



2013-14 Diesel usage	204 CO2e	75,591L Mowing, U/V weeding, 3 Frost fans
2013-14 Electricity usage	18 CO2e	27MWh Pumping water

SOIL MANAGEMENT
Permanent Swards protect & enhance



- Soil Organic Matter,
- Canopy Temperature
- Beneficial Insects

Reduce mowing - by using short, early dormancy grasses
Austrodanthonia geniculata or Barley Grass (Hordeum leporinum)
- Sheep grazing

Soil Management
Species Diversity to Attract Beneficial Insects


Bursaria spinosa
End of row


Goodenia pinnatifida
plus many others
in sward


Lomandra spp
Under-vine

Pest Control

- Fungal diseases - PM,DM, Botrytis, Eutypa – all becoming more problematic
  - Better coverage with more frequent spraying
  - Join the PIWI (PilzWiderstandfähige varieties) movement www.piwi-international.org that uses over 40 fungus 'resistant' varieties in a parallel market across the world
- Insect pests - build up habitat and food supply with flowering plants for beneficial insects
- Birds – netting at veraison is the best option where bird pressure is high

Future Directions

Invest in
- Frost machines
- Sub-surface irrigation to save on water resource
- Low-growing perennial grasses in the mid-row
- Native seed collections to expand diversity in permanent swards

Respond to early warnings of heatwaves with
- Irrigation
- Kaolite sprays

Follow up on
- Carbon Farming Initiative
- Environmental flows

……and keep mulching.