

Improving the Understanding of Smoke Taint



Ian Porter, 18-20 July, 2017
DEDJTR/La Trobe University

Acknowledgements

- Dept Agriculture and Water Resources (DAWR)
- Wine Australia, AGWA
- Wine Victoria
- Regional Wine Associations (e.g. King, Yarra Valley, Brown Bros, etc.)
- Liam Fogarty and huge number of DELWP, CFA, Vic Forests staff
- Mark Krstic and Steering Committee
- DEDJTR/La Trobe Team: 5 Staff (Porter, Plozza, Zhang, Bui, Allen)



Smoke taint is Brown Brothers No 1 agricultural risk factor!



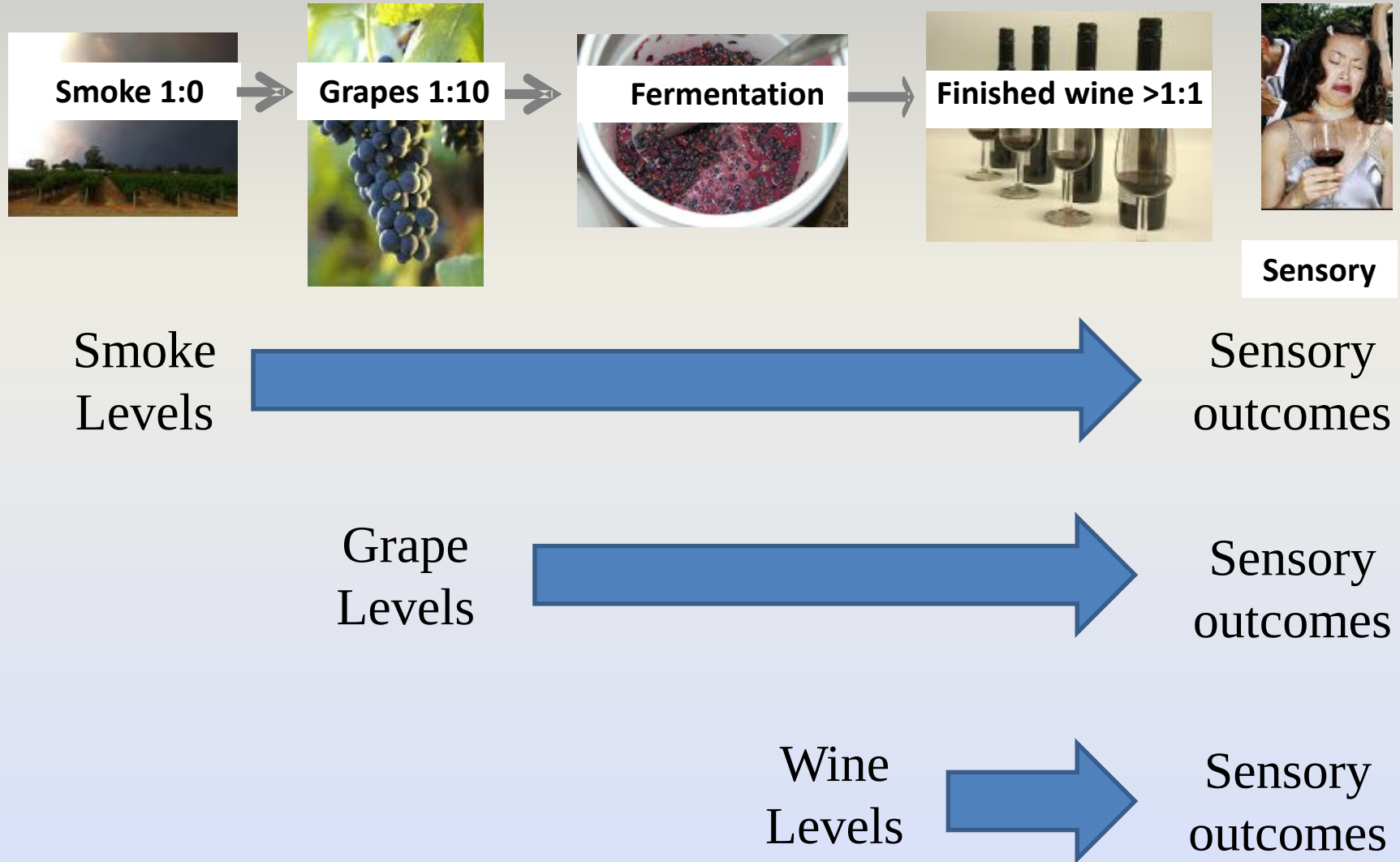
Industry Cost:- \$100 Million/yr since 2003,
Can't market produce from affected regions for fear of
smoke taint, testing not enough!!

Royal Commission 2009

- To burn 275,000 ha/yr
- CESTR: \$4 million (2011-2015)
- Industry/DELWP/DEDJTR Project (2016)
- DAWR Project (DEDJTR/AWRI/La Trobe) (2016-2020)



How to Predict Smoke Taint?



Smoke Taint: Seven Key Compounds (Bound/Free): (Smoke, Berries, Wine)

Assessing Smoke Taint Risk



Volatile phenols – lignin by-pyrolysis products

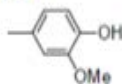
Guaiacol

'smoky', 'sweet smoke', 'smoky bacon'



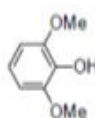
4-Methylguaiacol

'smoky', 'spicy'



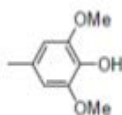
Syringol

'smoky', 'charry' (Weaker odorant)



4-Methylsyringol

'smoky', 'charry' (Weaker odorant)



o-Cresol

'phenol', 'plastic'



m-Cresol

'smoky, phenolic', 'smoky bandaid', 'faecal, plastic'



p-Cresol

'faecal, horse stable-like', 'medicinal'



Smoke compound	Elevated in grapes and wine after smoke
Cineole	No
Phenol	Yes
o-Cresol	Yes
m-Cresol	Yes
p-Cresol	Yes
2,4-Dimethylphenol	Yes
Guaiacol	Yes
4-Ethylphenol	Yes
4-Methylguaiacol	Yes
4-n-Propylphenol	No
4-Ethylguaiacol	Yes
Syringol	Yes
4-Vinylguaiacol	No
Eugenol	No
4-n-Propylguaiacol	No
4-Methylsyringol	Yes
(z)-Isoeugenol	No
Vanillin	No
(e)-Isoeugenol	No
Acetovanillin	No
Allylsyringol	No
Syringaldehyde	No
Acetosyringone	No??

Phenological stage-sensitivity to smoke



Berries pea size



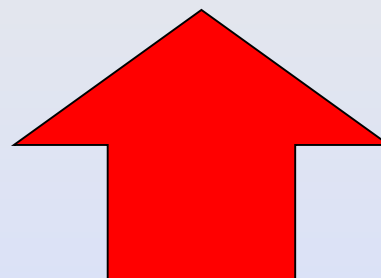
Veraison



Post veraison



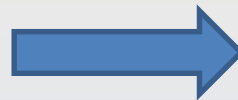
Harvest



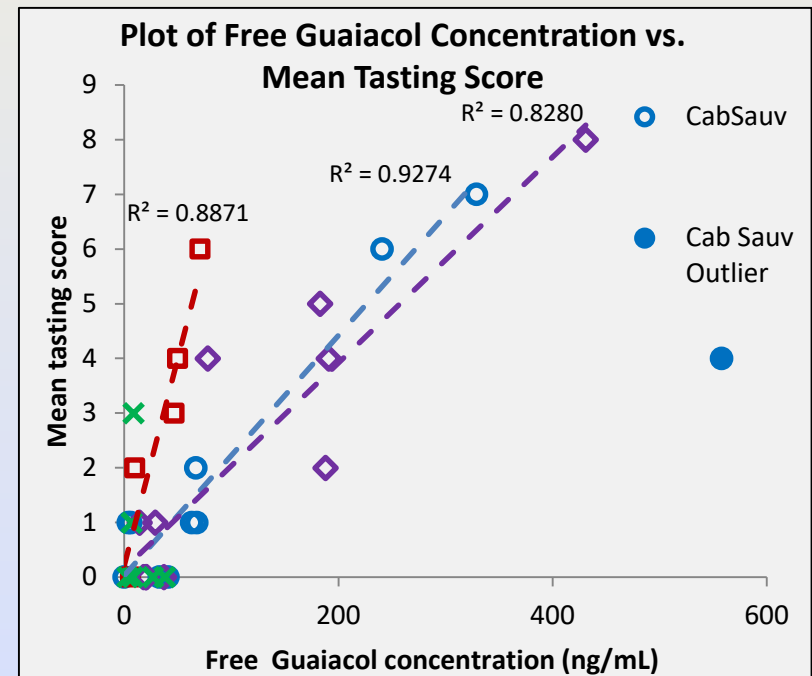
CESTR: Controlled studies linking threshold levels to sensory



Smoke Levels	Analyte concentration (pg/L of air pumped)				
	Nil	2.50%	10%	20%	>30%
Cineole	0	0	0	0	2267
Phenol	14	113	243	766	621
o-Cresol	4	35	74	229	482
m-Cresol	4	26	51	150	380
p-Cresol	3	21	40	116	263
Guaiacol	10	90	193	665	512
4-Ethylphenol	4	25	48	131	294
4-Methylguaiacol	3	18	35	101	25
4-Ethylguaiacol	5	29	51	136	2532
Syringol	3	50	118	361	11288
4-Vinylguaiacol	42	412	853	2285	59



Opportunity:
Smoke
(Comp, int.),
Berries,
Wine, Variety,
Thresholds
Sensory



Wine No	4-MG	Cr rut	Gu	Gu ru	m-Cres	Me-Syr.	Me-Gu rutin	MeSyr gentio	o-CR	p-CR	Ph-rutin.	Syr	Syr- gentioy biosid	variet	vintag e	Free Gu	Bound Gu	Total Gu	notes	taint mean t	tain sd	indicative taint
#139	1	7	28	9	2	0	3	1	4	0	4	56	10	Shiraz	2014	29	87	116	High TA	1	1.2	low
#046	0	1	10	1	1	0	1	1	2	3	1	25	1	Chard.	2014	46.7	13.7	60	Sl. ox	3	3.1	moderate
#158	0	4	11	1	0	0	1	1	1	1	3	48	2	Cab Sauv.	2014	6.2	19.4	26	Lw alc 12.4, TA 7	1	2.1	low
#178	2	10	27	4	4	3	2	1	10	1	9	102	4	Cab Sauv	2014	67	26	93	Alc 12.9, high TA	2	1.5	low
#187	0	2	27	3	0	0	1	1	2	0	1	89	1	Shiraz	2013	18	25	43	No analysis	0	1.1	negligible
#239	5	85	71	17	8	2	10	3	19	2	53	90	39	Shiraz	2013	78	77	155	No analysis	4	2.9	moderate
#220	13	95	110	20	22	8	16	12	51	5	39	110	142	Shiraz Chard.	2013	191	154	345		4	2.4	moderate
#175	0	1	12	1	2	1	1	1	3	3	1	23	16			10	5	15	High Brix fruit, VA, yeasty	2	1.8	low
#261	2	16	29	4	4	2	3	1	11	0	10	108	3	Cab Sauv	2013	41		46	V high Brix	0	0.7	negligible
#265	3	26	48	6	6	3	4	1	19	0	14	217	9	Cab Sauv	2013			88	26.8 Brix	1	1.5	low
#269	26	56	210	19	32	18	14	1	94	1	16	352	42	Cab Sauv	2013			386	Brix 29	7	1.1	high
#212	1	4	26	2	2	0	3	1	5	1	4	107	5	Pinot	2013			18	sulfide	3	2.3	moderate
#215	2	12	38	6	1	2	9	6	2	0	8	95	28	Merlot				25	sulfide	1	1.3	negligible
#276	0	11	29	7	1	0	6	1	3	2	8	43	14	Sangio				25	Low Brix, h. tan	0	0.6	negligible
#332	0	2	19	1	0	0	1	1	0	0	1	38	1			4	12	16	V low Brix, VA	1	1.9	low
#162	34	195	85	191	9	85	273	224	17	5	130	347				158	620	778				
#179	70	178	157	212	18	58	297	211	47	8	196	220			2007	280	348	628				
#172	33	128	181	389	9	48	366	50	33	4	114				2007	371	612	983	27.4 Brix	6		2 high
#175	89	149	379	504	27	49	469	169	71	5	180			Sangiove	2007	699	392	1091				
#170	32	118	164	284	9	48	297	81	31	3				Shiraz	2007	19	566	765				
#161	14	92	34	79	6	61	111	140	8	3				Merlot	2007	75	357	432				
#193	0	3	7	1	0	1	1	1	0				1	Shiraz?	2008	46	9	55	No analysis	2	2.2	low
#194	0	3	8	1	0	2	1	1				56	1	Shiraz?	2008	68	5	73	High TA, dev.	1	0.8	low
#174	1	3	5	1	0	0	1	1			2	28	1	Merlot	2009	27	13	40	High TA, Dev.	0	0.5	negligible
#177	0	7	15	7	0	0	3			0	10	43	2	Shiraz	2009	37	45	82	High TA, dev.	0	0.7	negligible
#209	0	1	2	1	0	0				0	1	3	7	Verdelho	2013	3	7	10	High Brix	0	0	negligible
#214	0	9	5	4	0	0			2	0	9	40	8	Cab.Sauv	2009	33	12	45-		0	0.4	negligible
#168	0	2	5	1	0	0				0	2	32	1	Merlot	2009	38	17	55	High TA, Dev.	0	0.3	negligible
#282	0	22	2	11	0	0		3	0	0	16	3	5	Nebiololo	2013	4	21	25				
#103	0	1	0	1	0	0	1	1	0	0	1	0	1	Chard.	2013	0	0	0	27.5 Brix	2	3.1	low
#189	4	1	27	1	8	5	1	6	19	2	1	29	66	Chardon Chard.	2013	28	20	48	25.1 Brix	8	1.2	high
#190	2	1	16	1	5	4	1	2	10	2	1	22	31			50	26	76	High Brix fruit, VA, sulfide	4	2.4	moderate
#163	28	145	70	128	5	166	126	82	16	5	125	595	4810	Merlot	2007	188	1058	1246		7	1.7	
#168	1	2	4	1	0	0	1	1	0	2	2	29	6	Merlot	2009	38	17	55		1	0.8	low
#169	24	76	123	294	8	54	216	1	29	4	113	210	1510	Shiraz	2007	211	835	1046		5	2.1	moderate
#171	53	23	241	66	15	56	66	20	42	8	14	195	457	Shiraz	2007	328	387	715		5	2.6	moderate
#173	75	74	270	171	23	70	119	1	75	8	91	201	1455	Sangiove	2007	655	379	1034		6	2.4	high
#174	65	1	260	73	16	44	48	1	60	7	84	115	858	Sangiove	2007	411	403	814		4	2.4	moderate
#177	126	73	228	129	34	198	101	39	76	12	135	514	1678	Cab.Sauv	2007	458	177	635		4	2.9	moderate
#178	84	22	167	25	21	112	44	70	47	9	26	299	459	Cab.Sauv	2007	474	149	623		3	1.9	moderate
#172	32	93	176	297	11	48	257	39	37	4	73	187	802	Shiraz	2007	371	612	983	27.4 Brix	6		2 high
#143	30	92	252	30	25	13	32	16	60	27	24	144	318	Shiraz	2014	431	723	1154	High TA	8	1.3	high
#105	0	3	7	5	0	0	2	1	1	1	2	7	4	Shiraz	2014	14.5	43.1	57.7	High TA	1	1.8	low
#174	9	16	90	5	14	12	5	1	50	2	8	125	11	Cab Sauv.	2014	240.8	42.6	249	V low alc 10.6 Low alc 12.4, TA	6	1.6	high
#158	0	6	3	4	0	0	3	1	1	2	3	17	7	Cab Sauv.	2014	6.2	19.4	267		1	2.1	low

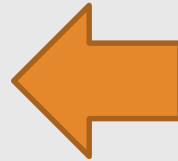
Centre for Expertise in Smoke Taint Research

Agriculture Research and Development
Final Project Report

June 2015



Department of
Economic Development,
Jobs, Transport & Infrastructure
VICTORIA



128 km Melbourne Ra... eBay Australia Sitemap B Markets - Bloomberg ... Equity Prices

Smoke taint in wine

AGRICULTURE VICTORIA

Information sheet 1 of a series of 5

Fact sheet 2:

Smoke taint risk and management in vineyards

AGRICULTURE VICTORIA

Information sheet 2 of a series of 5

Fact sheet 3:

Measuring smoke density and smoke composition in vineyards

AGRICULTURE VICTORIA

Information sheet 3 of a series of 5

Fact sheet 4:

Protocols for vineyard managers to minimise smoke taint from prescribed burns

AGRICULTURE VICTORIA

Information sheet 4 of a series of 5

Fact sheet 5:

Protocols for fire managers to minimise smoke taint in wine

AGRICULTURE VICTORIA

<http://www.hin.com.au/projects/centre-for-expertise-in-smoke-taint-research2>

Industry Needs – 2016 (DELWP)

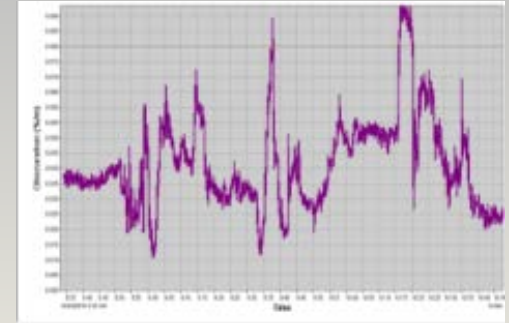
What smoke, how much and for how long?

What distance - Up/down wind?

What levels in grapes/wine?

Impact of climate (cool temp, UV)

- Smoke particles (Obscuration) (2016/2017)
- Smoke composition (Tenax) (2016/2017)
- Grape and wine levels (2017)



Planned Burn Notification System

VICTORIA State Government | Environment, Land, Water and Planning

[Home](#) > [Fire and emergencies](#) > Planned burning notification system

Planned burning notification system

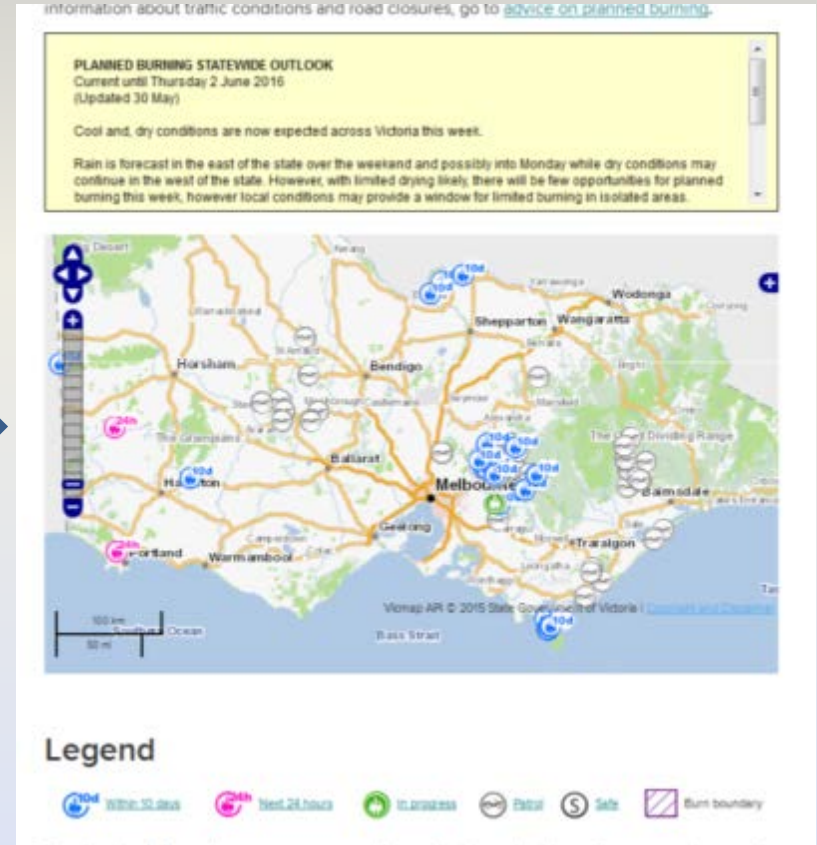
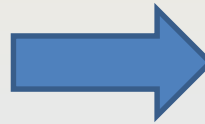
The Planned Burning Notification System notifies people when a planned burn in a park or forest is close to being ignited.

[Access the Planned burning notification system](#)

The system has been designed to assist people who would like advance notice of upcoming planned burns to make informed decisions about managing the effects of planned burns.

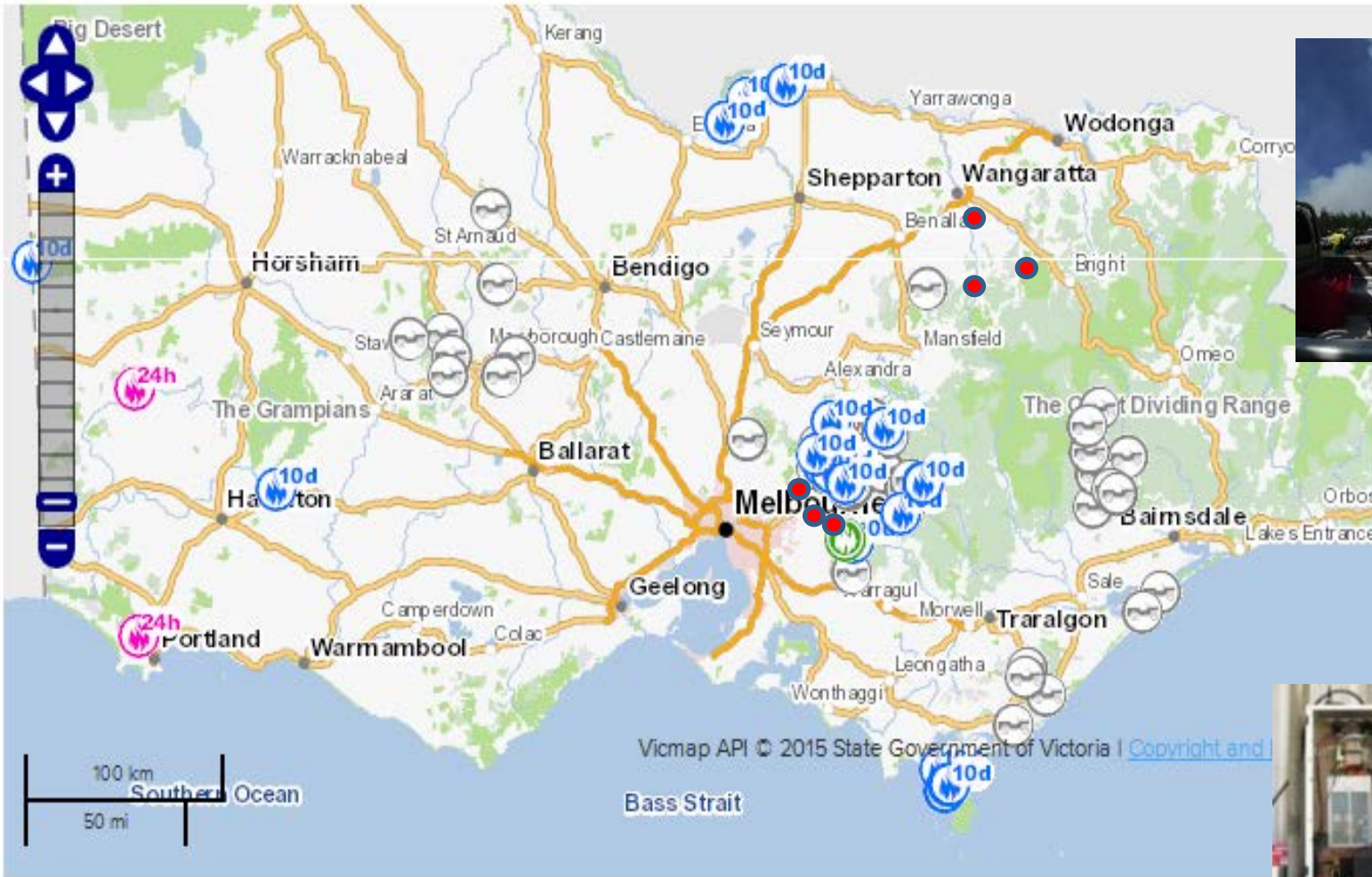
It complements the DELWP [planned burns now and next 10 days](#) web page, the [VicEmergency website](#) and [FireReady app](#) for information about current planned burning activity.

The Planned Burning Notification System is an opt-in system that you can customise to suit your particular notification needs. It displays all burns that are intended to be carried out in parks and forests in Victoria over the next three years and shows their statuses - these are the planned



<http://delwp.vic.gov.au/fire-and-emergencies/planned-burning-notifications-system>

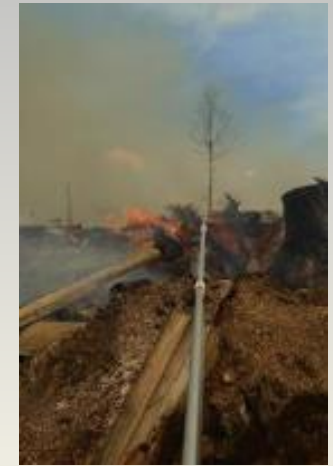
6 Stationary Smoke Detectors in Vineyards, 6 Roaming Detectors



27 Fires Sampled Directly (Different fuels)



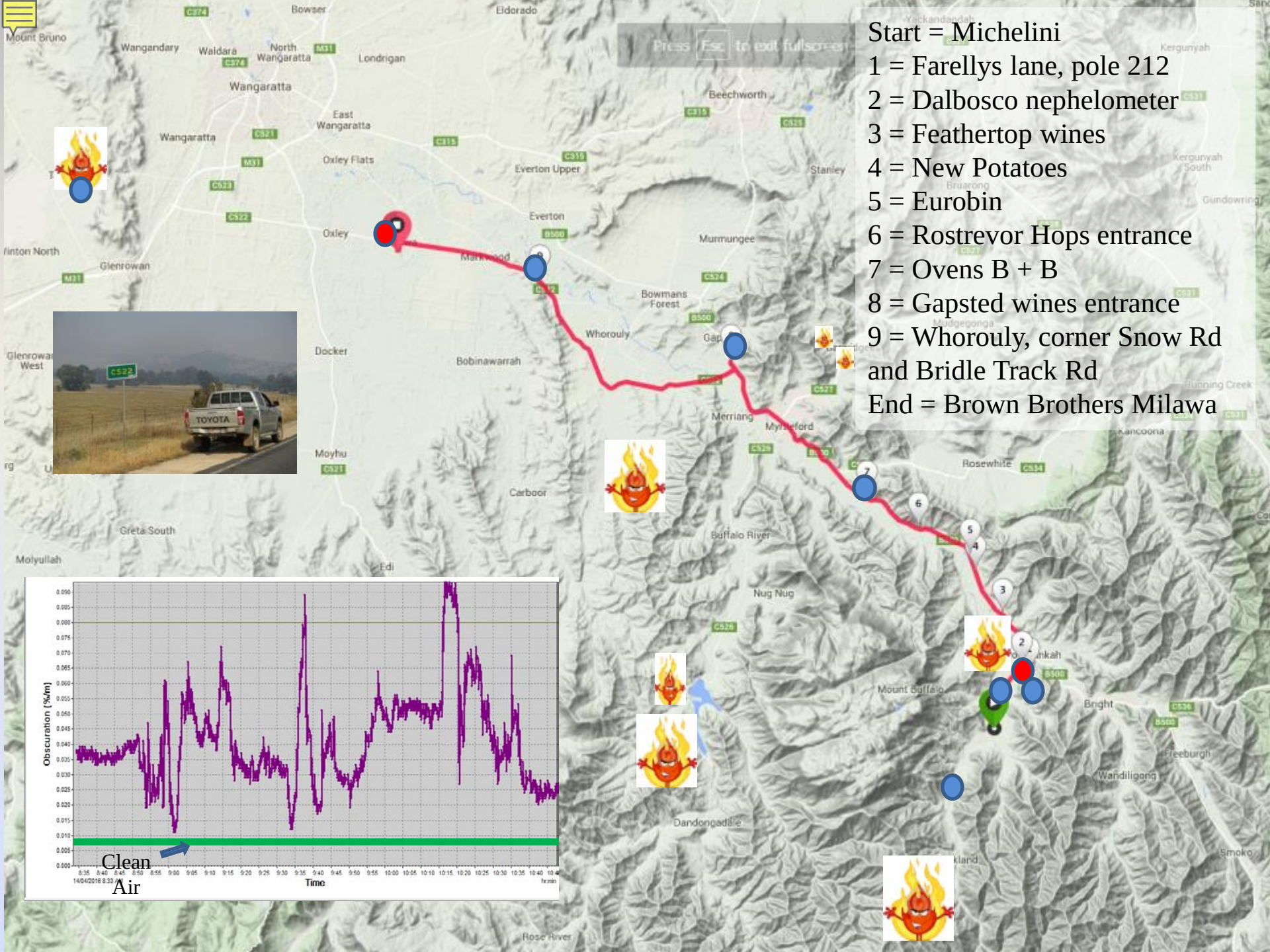
Fire Location (2016)	Type	Ha (17,000)
Forest (New Turkey)	Forest Coup	27
Eildon	Light bush litter	272
Craigeburn	Grass	100
Lysterfield	Mod bush	63
Lyrebird Track	Heavy bush	250
Yackandandah	Mod bush	212
Stanley	Mod bush	140
Lake Buffalo	Mod bush	320
Arthurs Seat	Light bush	50
Tawonga (Mt Beauty)	Mod bush	660
Woragee (Beechworth)	Heavy timber	85
Dandongadale	Large (bush)	6,800
Harris Lane (Porepunkah)	Mod (bush)	620
Bucklands	Large (bush)	6,000
Silvan	Mod bush	120
Warburton	Light bush	60
Warby (Wangaratta)	Light bush	807





Burn dynamics





Effect of Distance

Wind light and
variable

At Fire

13.00%, 600,000

0.1 km

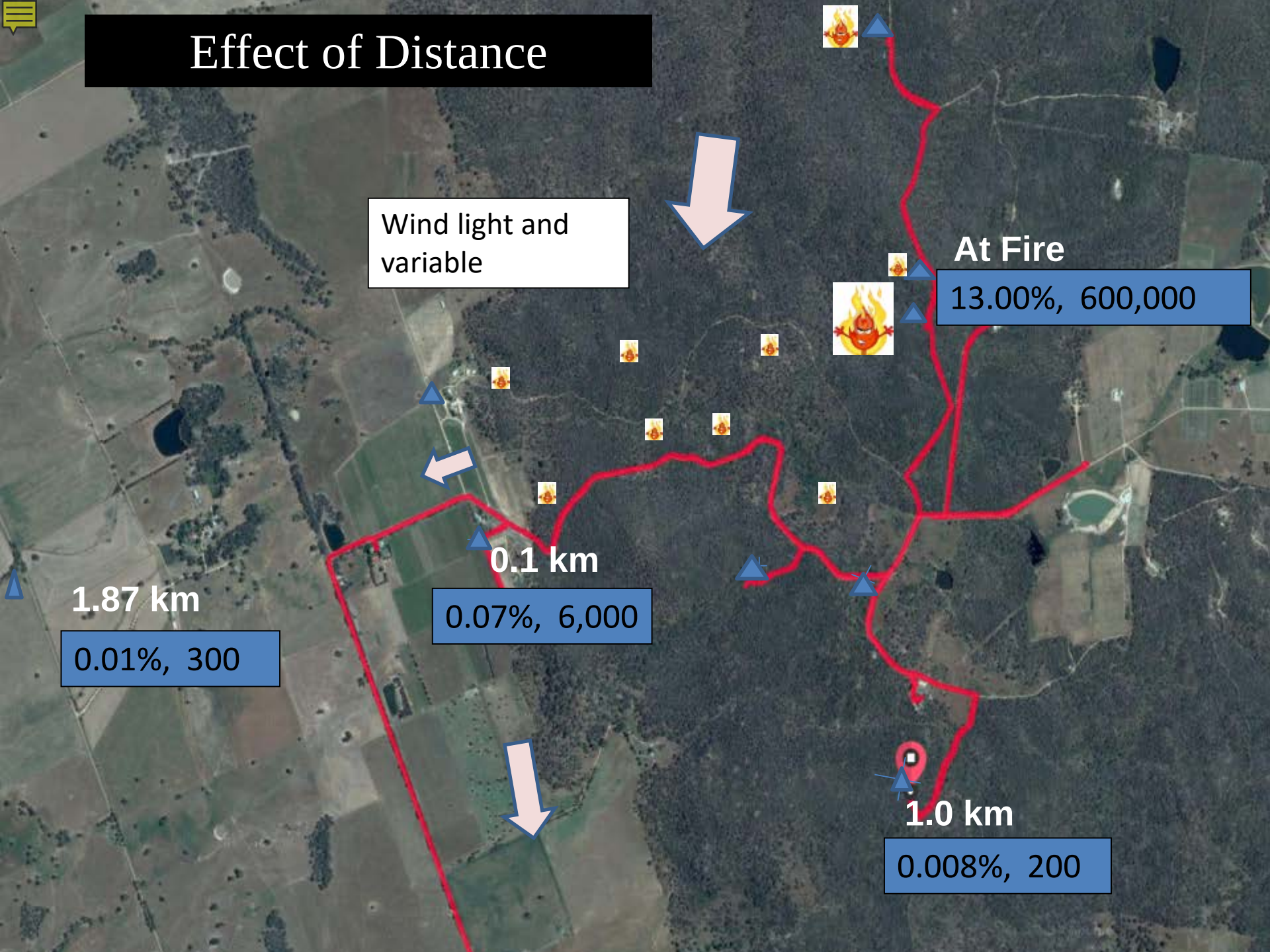
0.07%, 6,000

1.87 km

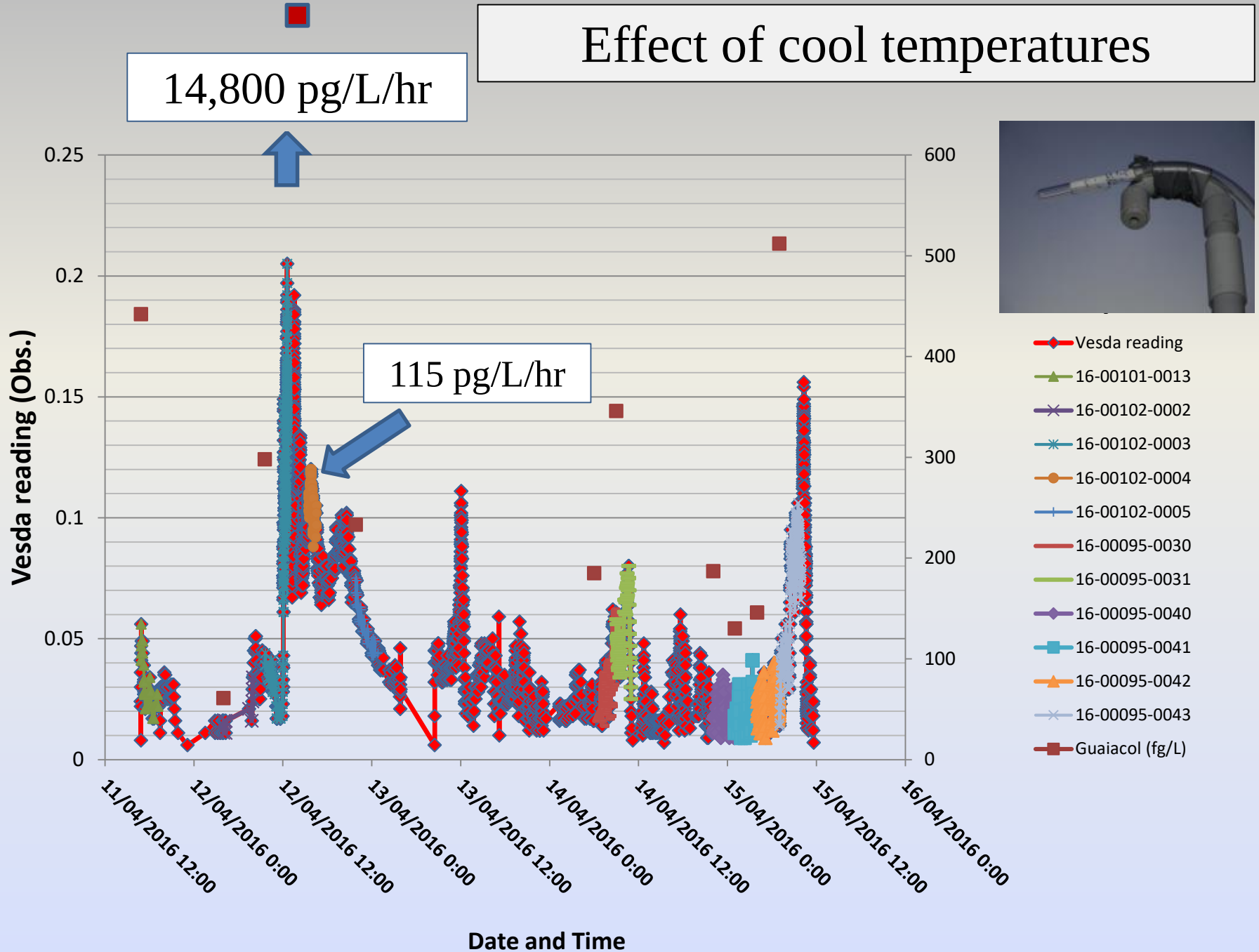
0.01%, 300

1.0 km

0.008%, 200



Effect of cool temperatures

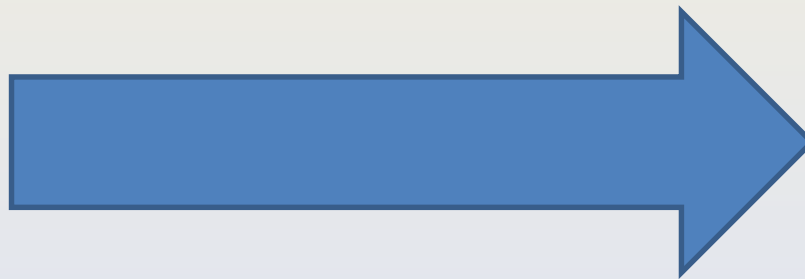


New Research Program 2017-2020 (DAWR/AGWA)

Project Aims	Responsibility
1. Early warning system for smoke exposure, and Protective sprays in vineyards	DEDJTR/LaTrobe
2. Smoke composition studies	DEDJTR/LaTrobe
3. Mitigation in the vineyard (grapes). (Sensory studies)	DEDJTR/LaTrobe/ AWRI
4. Baseline studies - reference datasets	AWRI
5. Desktop review of mitigation products	AWRI
6. Mitigation in the winery (grape must, wine). (Sensory studies)	AWRI
7. Economic cost of mitigation.	ALL

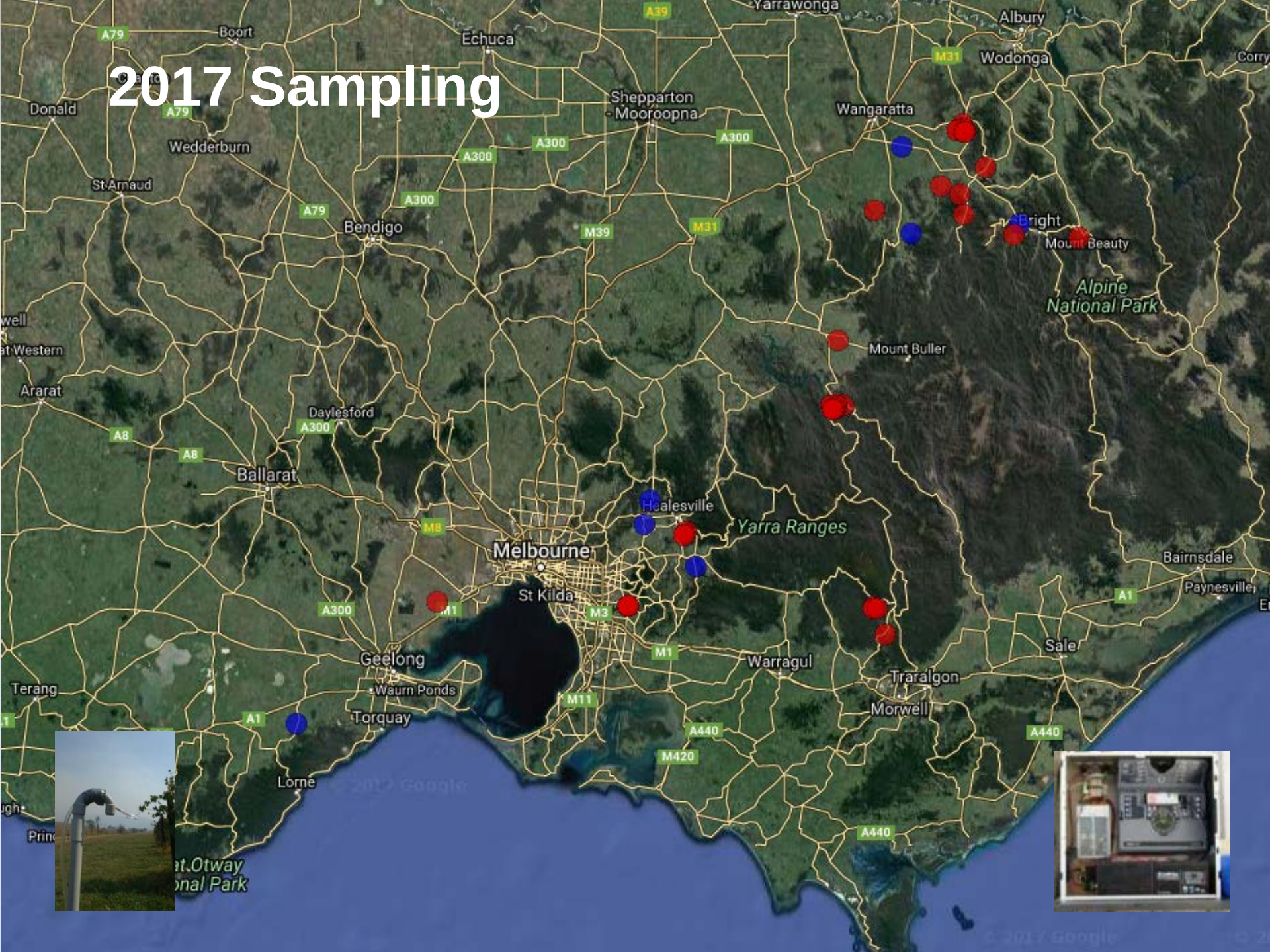
How to Predict Smoke Taint?

Smoke Levels
Controlled
Burns and
Bushfires



Sensory
outcomes

2017 Sampling



Reducing Industry Risk: Remote Connectivity, Regional Monitoring

Combine with Sensor which raises an alarm

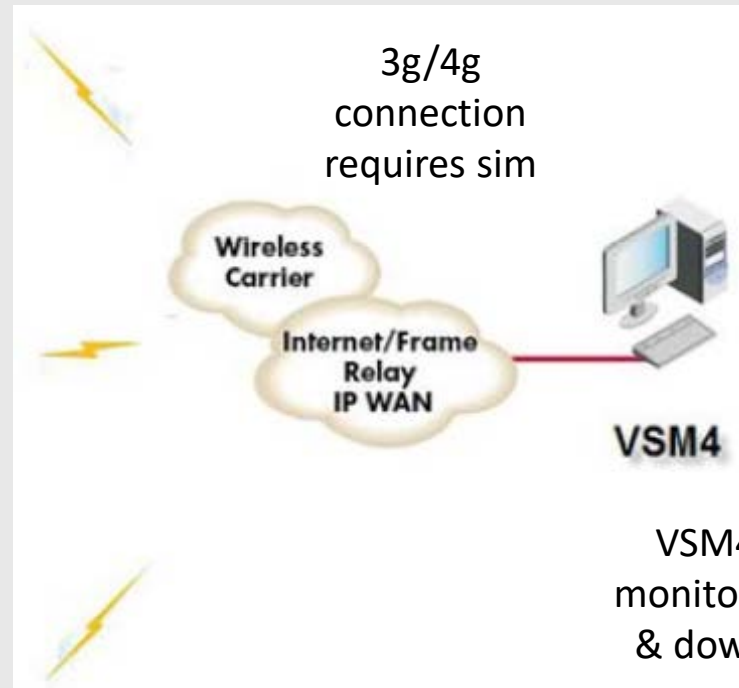
Yarra
Valley



Ovens
Valley



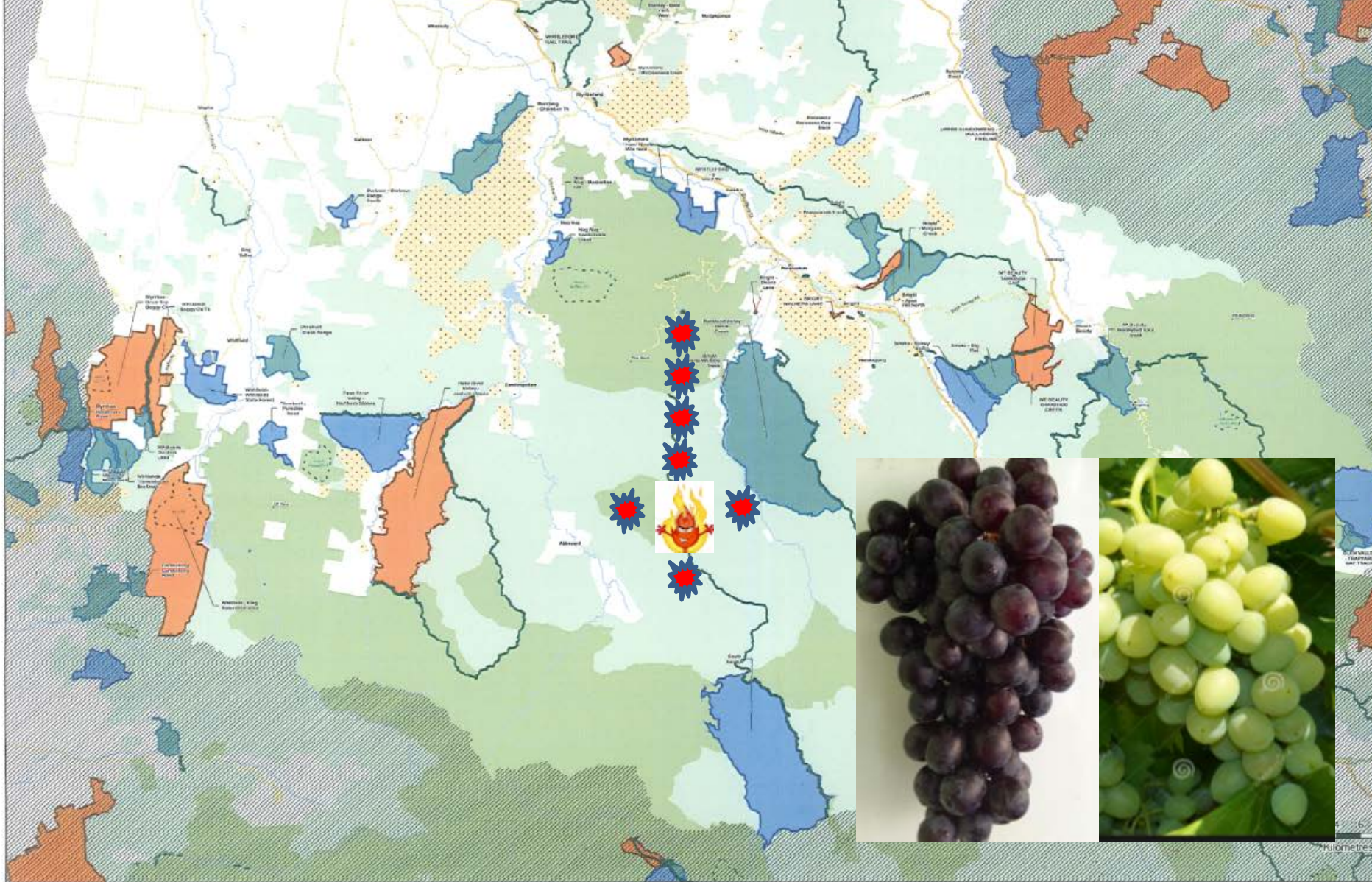
Grampians



VSC - for dial in and
data log download

OR

VSM4 - for detector
monitoring, data logging
& download, and data
base.



Map Legend

Transportation

- Freeway
- Highway
- Major Road
- Collector Road
- Local Road
- Railway Line
- Strategic Fuel Break

Map Notes:

Fire Operations Plan

- 2016 - 2017
- 2017 - 2018
- 2019 - 2020
- Fire Infrastructure
- Mineral Earth Disturbance
- Vegetation Modification
- Melbourne Water Activity

Lakes, Rivers and Streams

- Waterbody
- Wetland or Swamp
- River / Stream

Land Management

- Parks and Reserves
- State Forest
- Timber Plantation
- Other Public Land
- Reference Areas

Map Produced by Communities and Services, Forest Fire and Regions, 25 July 2016
Copyright © The State of Victoria, Department of Environment, Land, Water and Planning 2006

Map Source: Geoprocessing Division of Geomatics 10/06 (G4604)
Map Projection: VicCRS 1984 (G2004)
Map Scale: 1:140,000 when printed at A3 or viewed at 100%

Disclaimer:

This publication may be of assistance to you, but the State of Victoria and its employees do not guarantee that the publication is without error or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

Accessibility:

If you want this publication in an accessible format, such as large print or braille-and-white, please phone 136 186, or email customer.service@delwp.vic.gov.au.
(Don't, or leaving no speech impaired?) Call us via the National Relay Service on 130 077 or visit www.relayservice.com.au

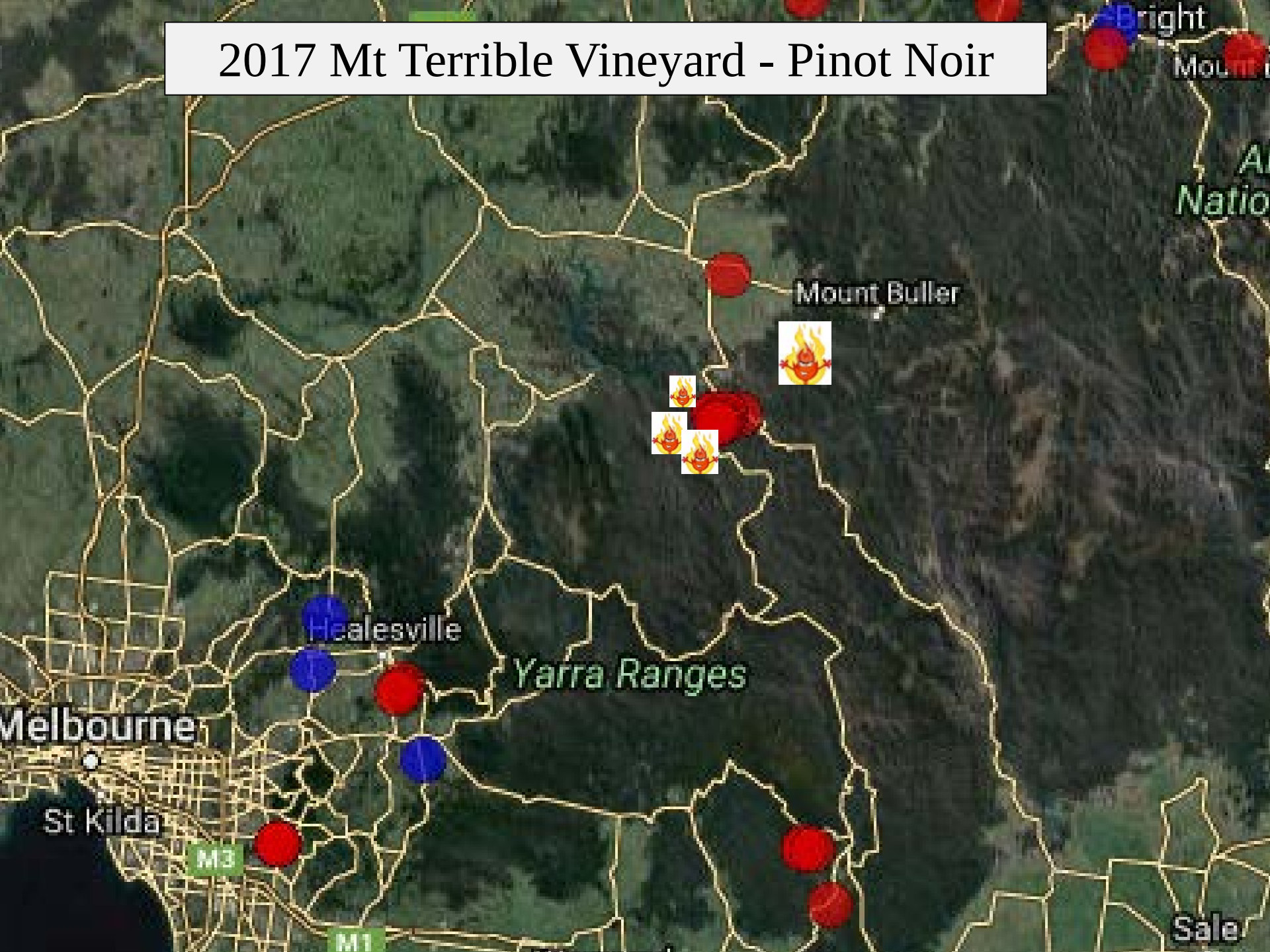
Fire Operations

OVENS DISTRICT

2016-2017 TO 2018-

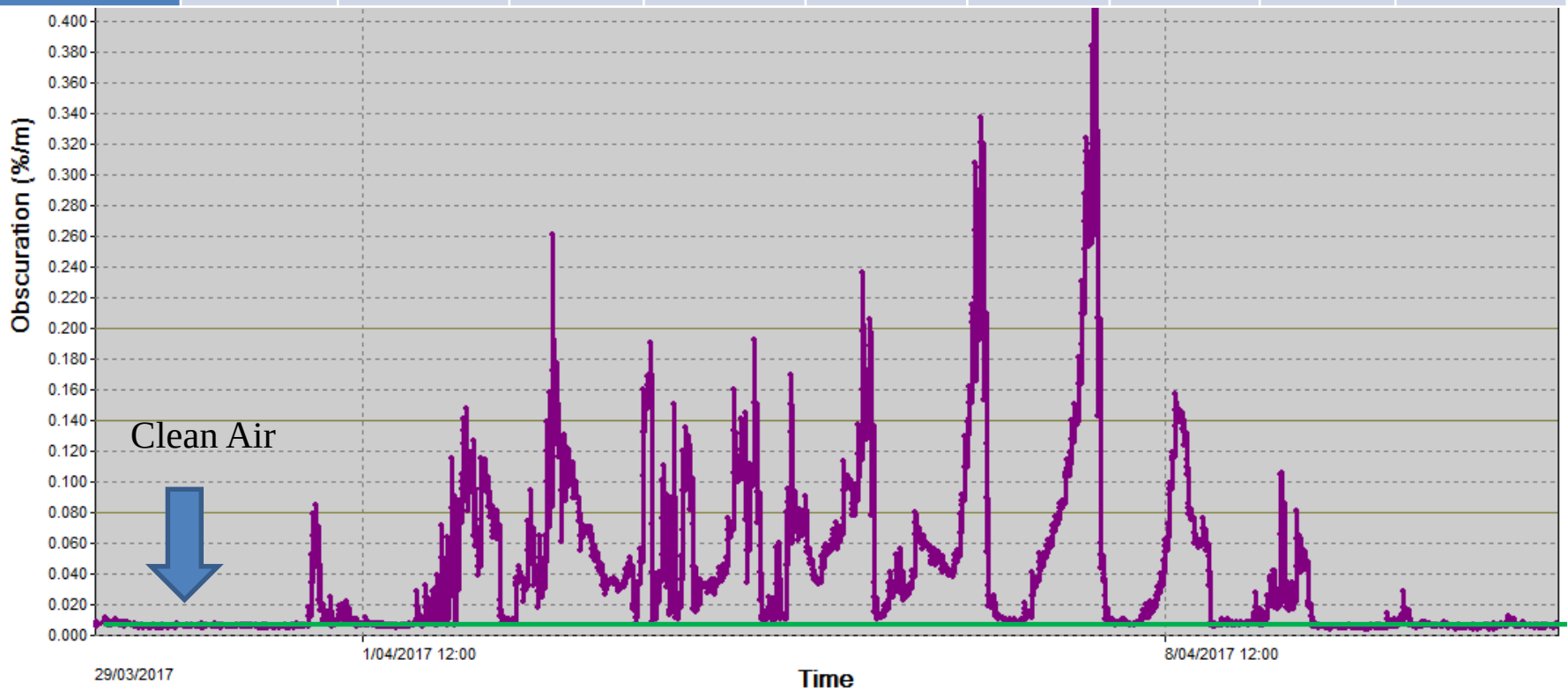
N

2017 Mt Terrible Vineyard - Pinot Noir

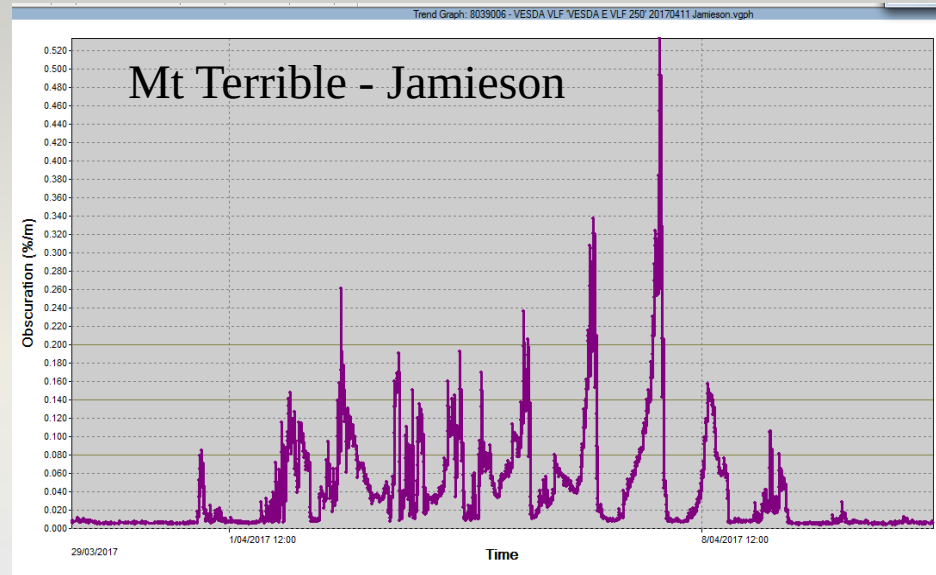
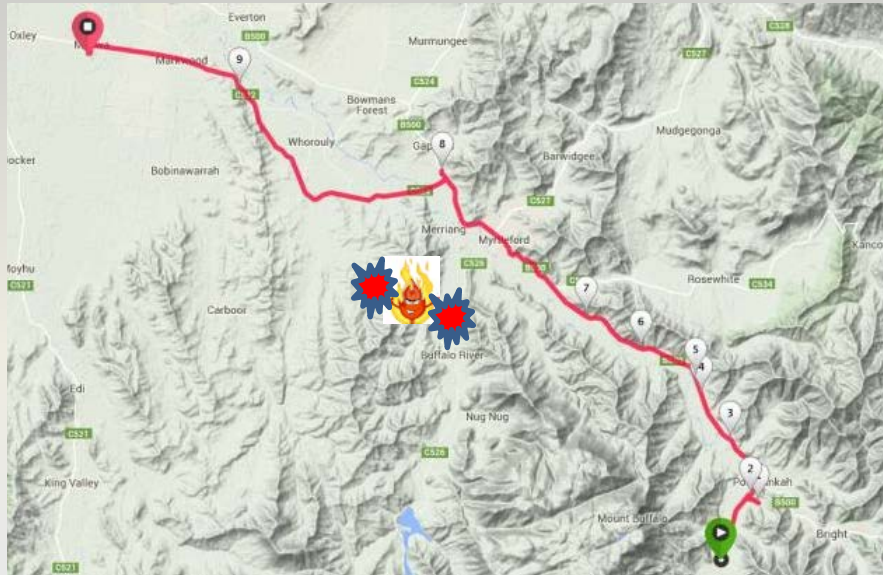


2017 Mt Terrible Vineyard - Pinot Noir

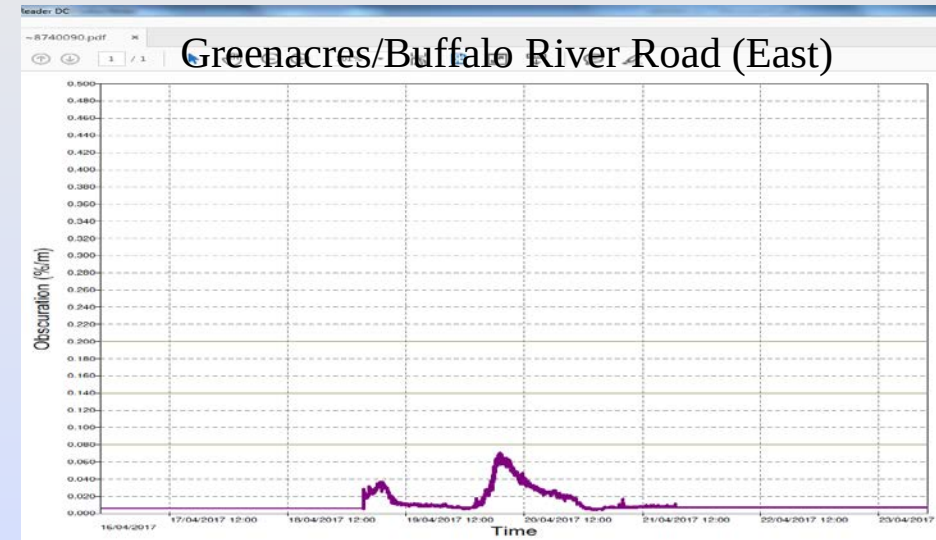
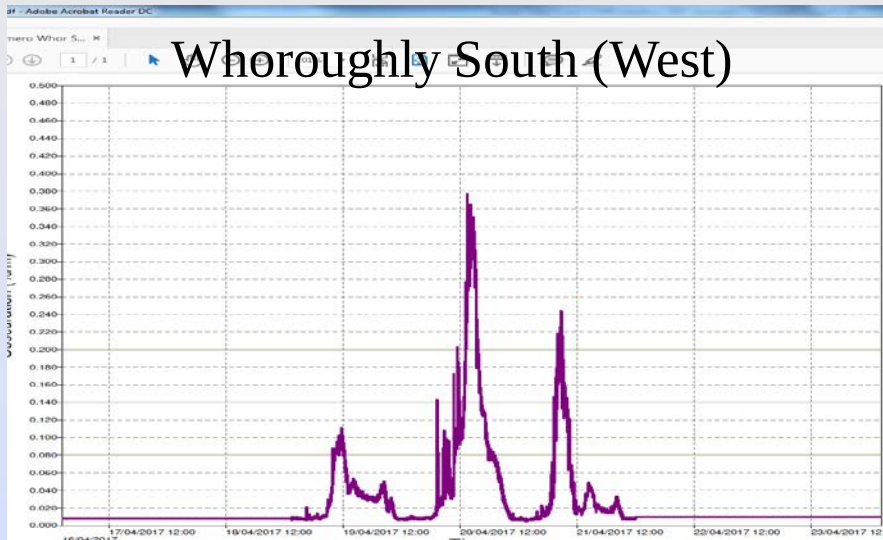
Year	Smoke Total	Smoke Ave Obs	Smoke (Tenax)		Grapes		Wine		
	Dose	[Dose]	Guaiacol ng/L	Syringol ng/L	Guaiacol ng/g	Syringol ng/g	Guaiacol ng/ml	Syringol ng/ml	Taint Score (0-9)
No Smoke	0	0	-	-	61	15	40	15	0
Smoked	42,800	0.05	3.2	1.0	73	16	49	23	1?



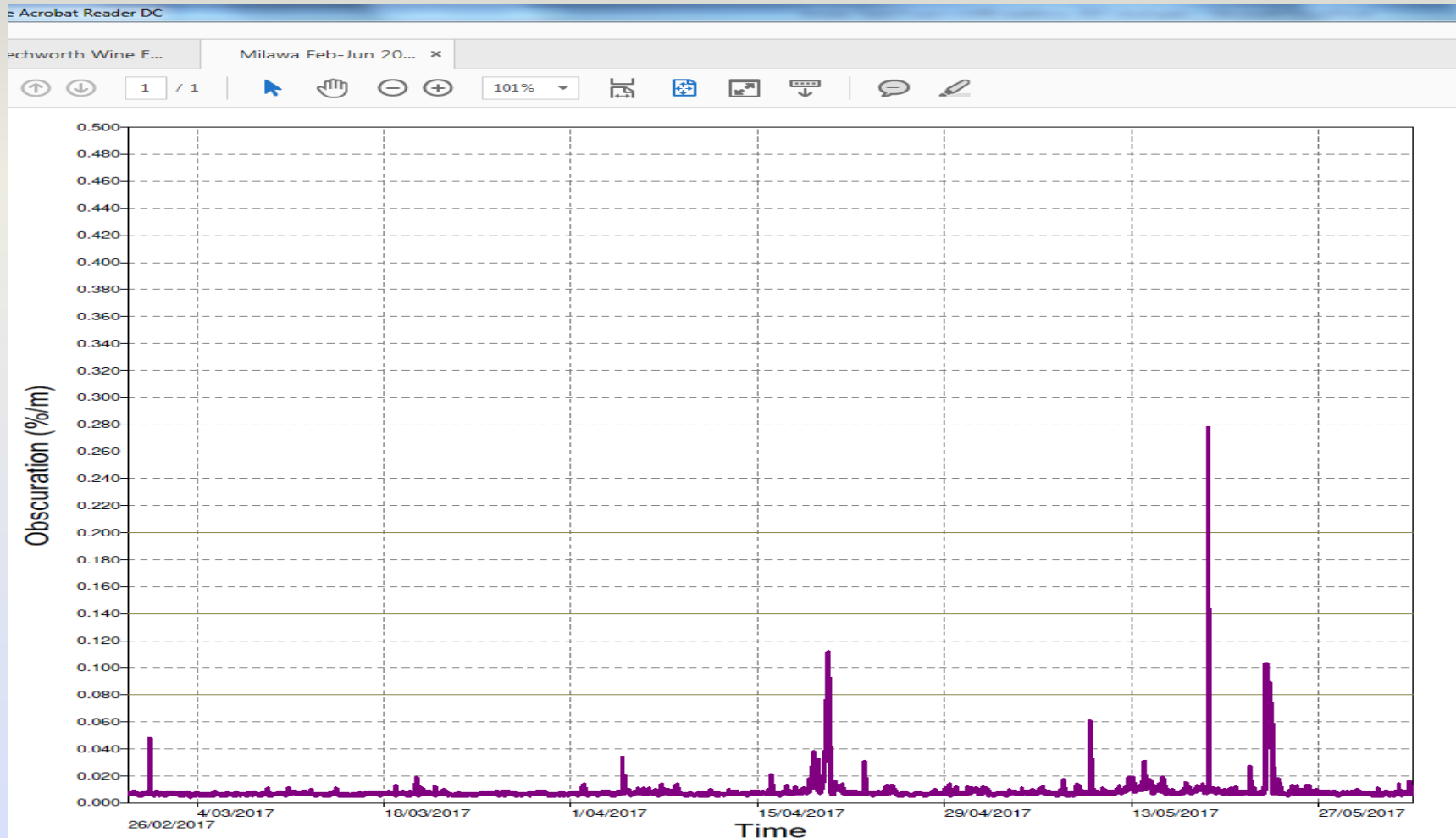
2017 – Vesda outputs



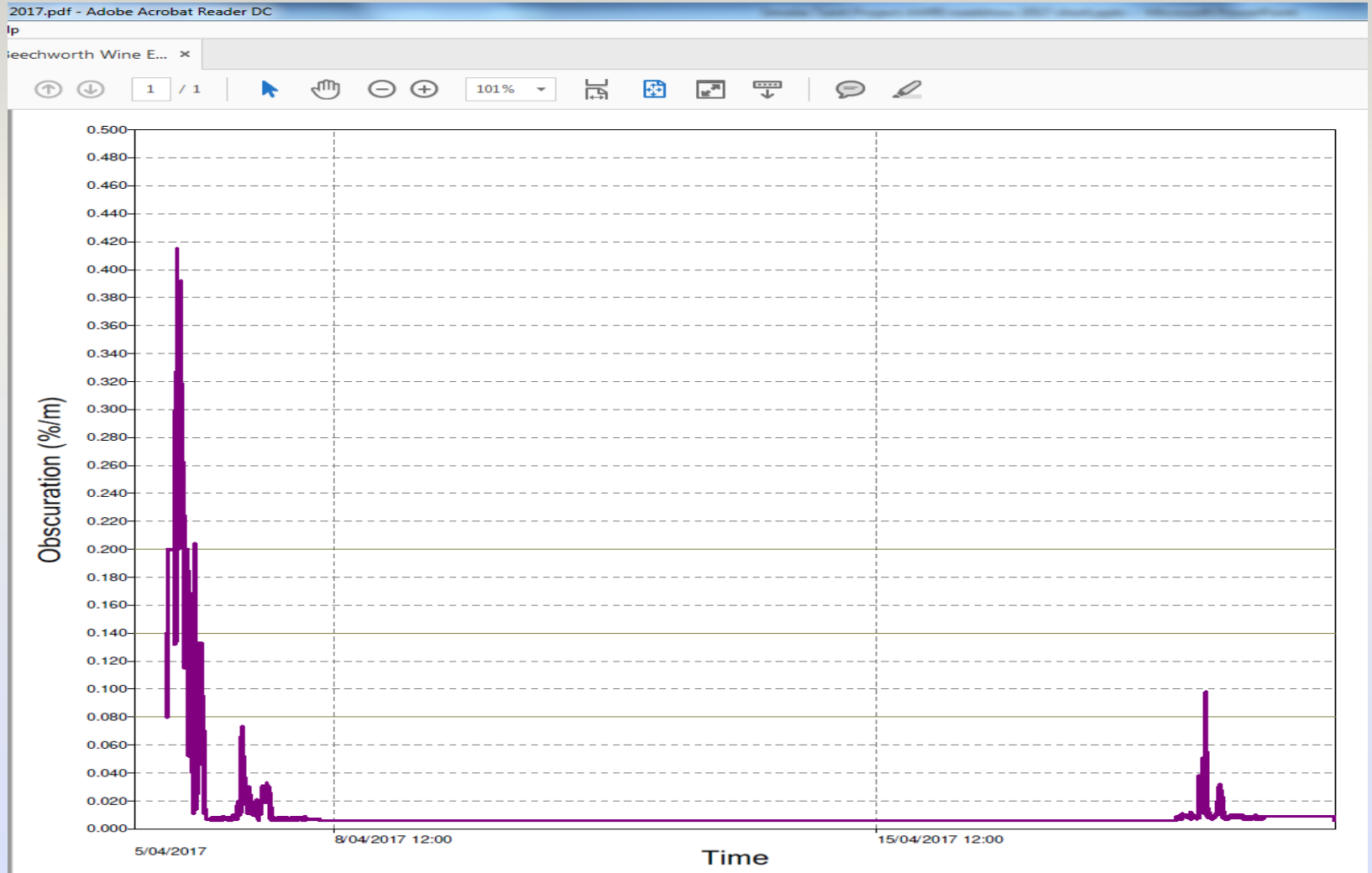
< 5kms



2017 - Milawa



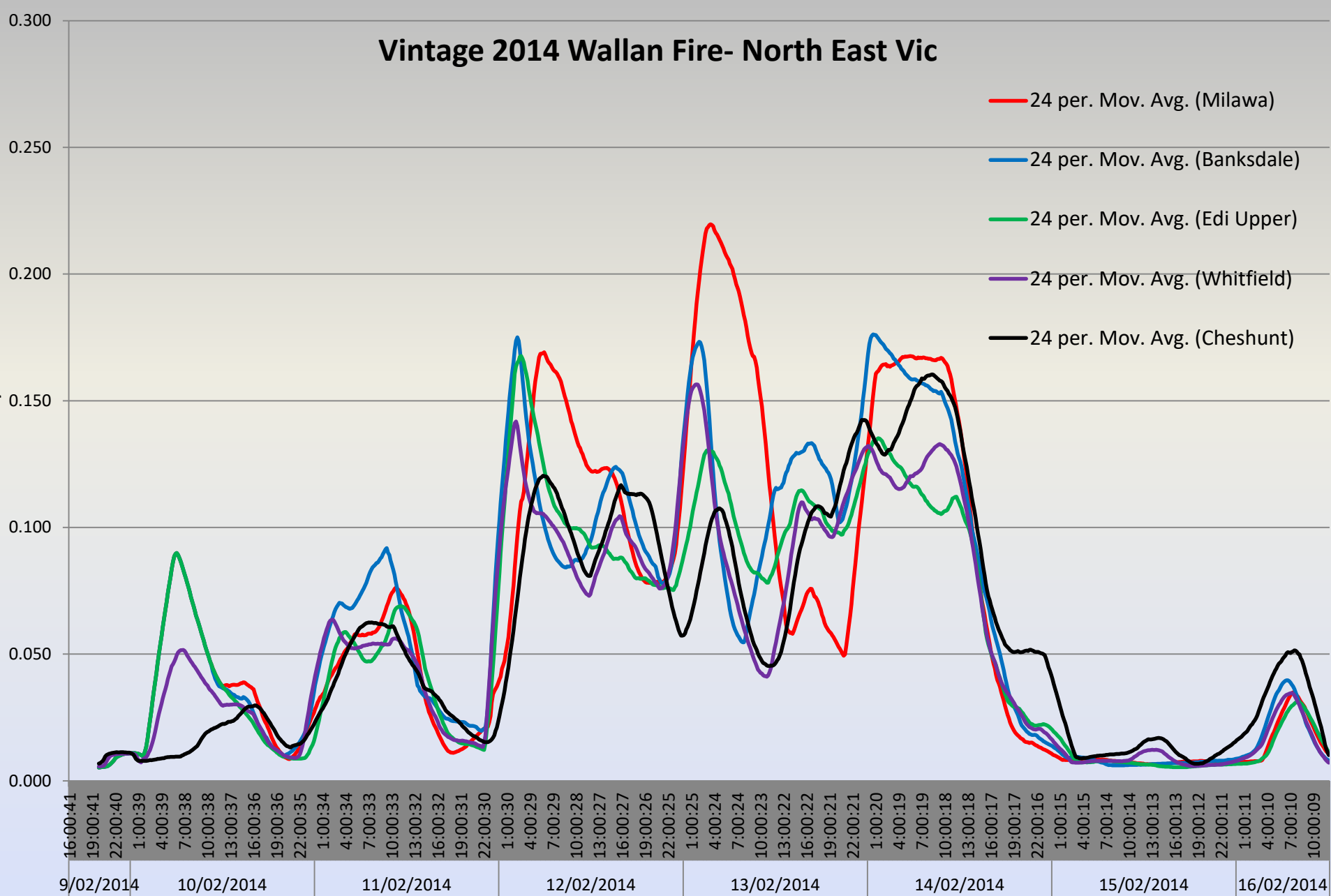
2017 - Beechworth



Wallan Grass Fire - 2014



Vintage 2014 Wallan Fire- North East Vic



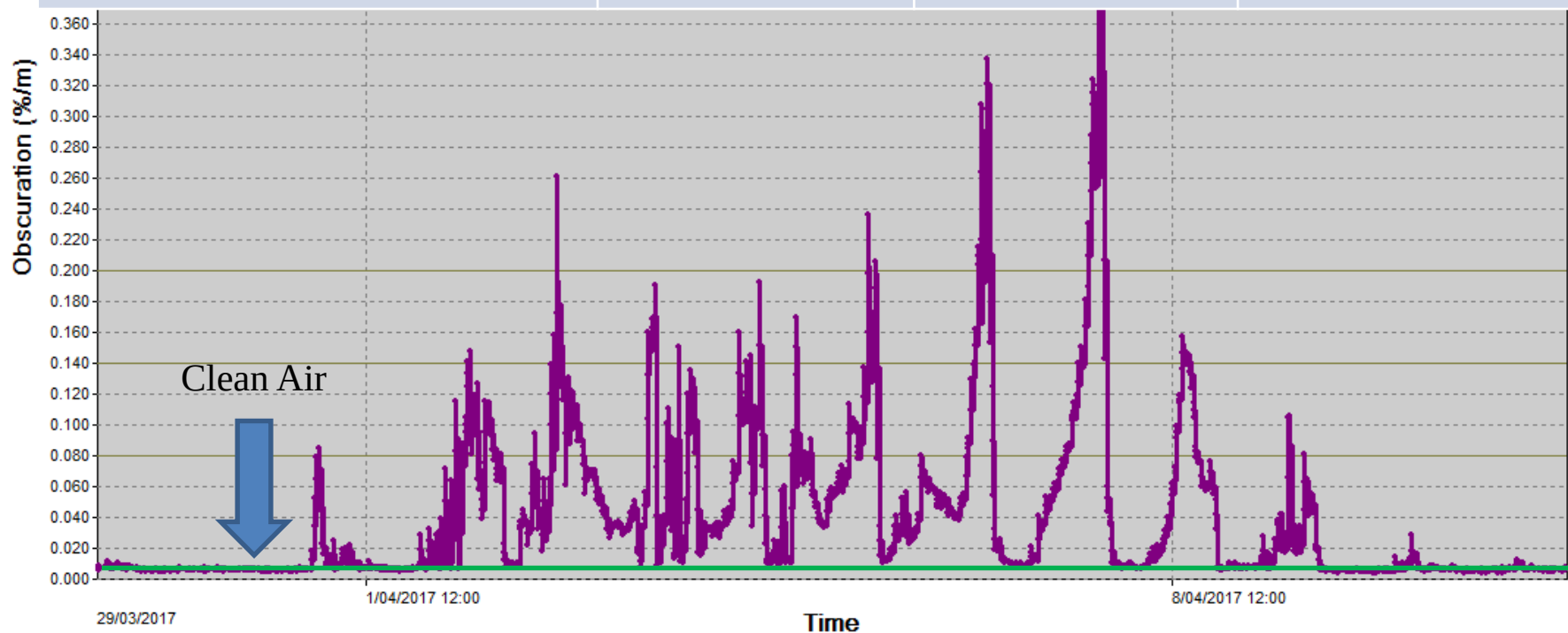
Bushfire - Lima South 'Shiraz' Samples (2009, 2010)

Variety	Shiraz 2009 	Shiraz 2010	Threshold Concs (ppb) for Sensory 2
1. Guaiacol (ng/ml)	150	60	150-250
2. Syringol (ng/ml)	238	55	80
3. Methyl Guaiacol (ng/ml)	25	0	
4. Total Cresol (ng/ml)	74	35	
Taint	Yes	No	
Comment	(strong ashy flavour)	No taint	

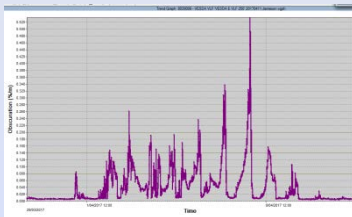
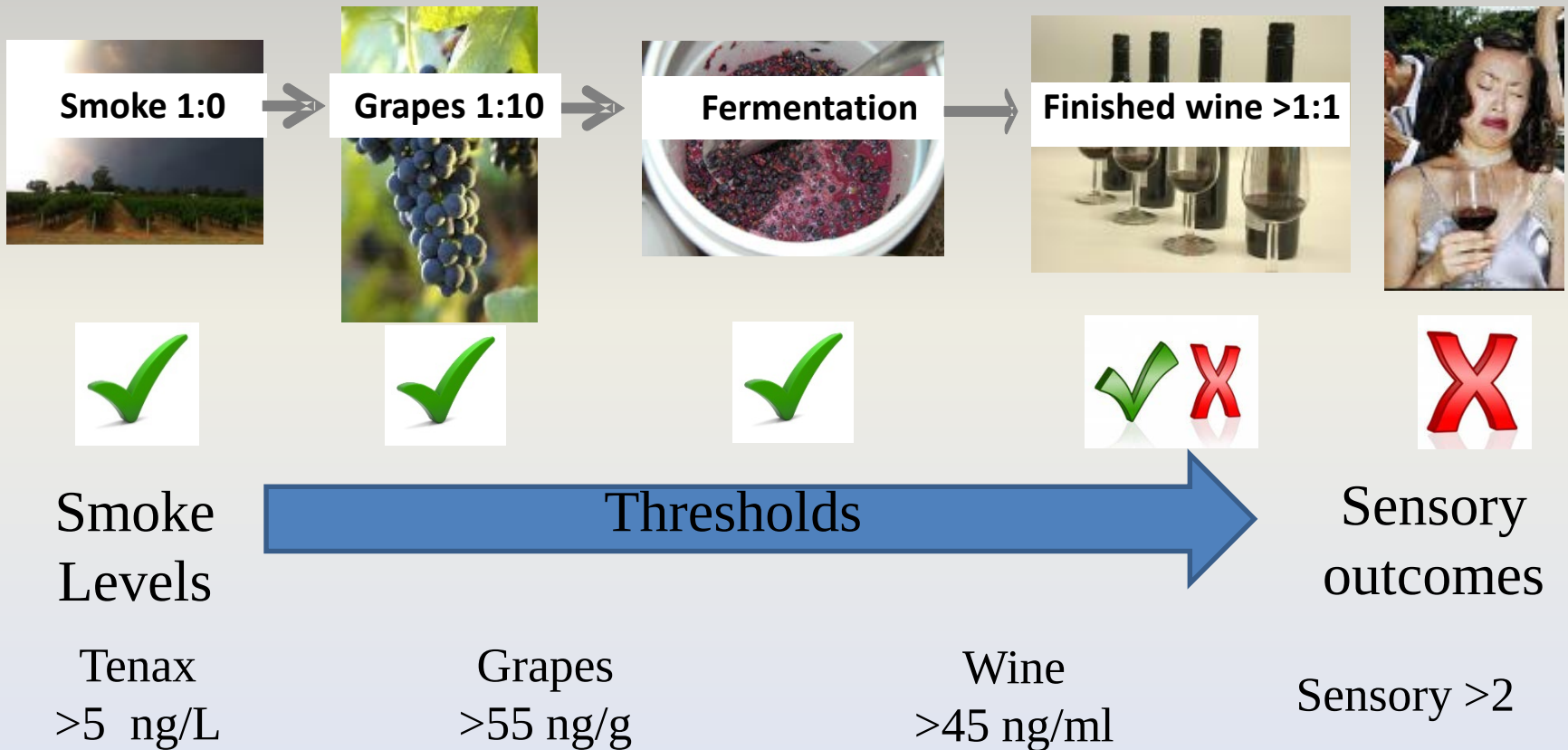


2017 Yarra Valley and NE

Sample (Grapes/Wine)	Guaiacol (ng/g)	Syringol (ng/g)	ST -Sensory (0-9)
Pinot Noir 2017 (NE) Nil	61	15	0
Pinot Noir 2017 (NE) Smoked	73	23	1?
Syrah 2009 (YV) Bushfire	179	156	3?
Shiraz 2009 (Lima S) Bushfire	149	207	4?
Shiraz 2007 (NE) Bushfire	983	1410	6



Linking smoke to grape and wine levels (e.g. guaiacol)?



Vesda - >0.14 (obs) for 2 weeks (Dose 50,000/hr) ??

Key Findings

- Fresh 'Cooler' smoke essential to Smoke Taint compounds building up in grapes
- ST Compounds (CBs) decrease quickly with distance
- Smoke (haze) does not necessarily contain smoke taint compounds
- Most controlled burns – low volume smoke cf major bushfires
- Guaiacol and syringol are good markers for ST

The Future?



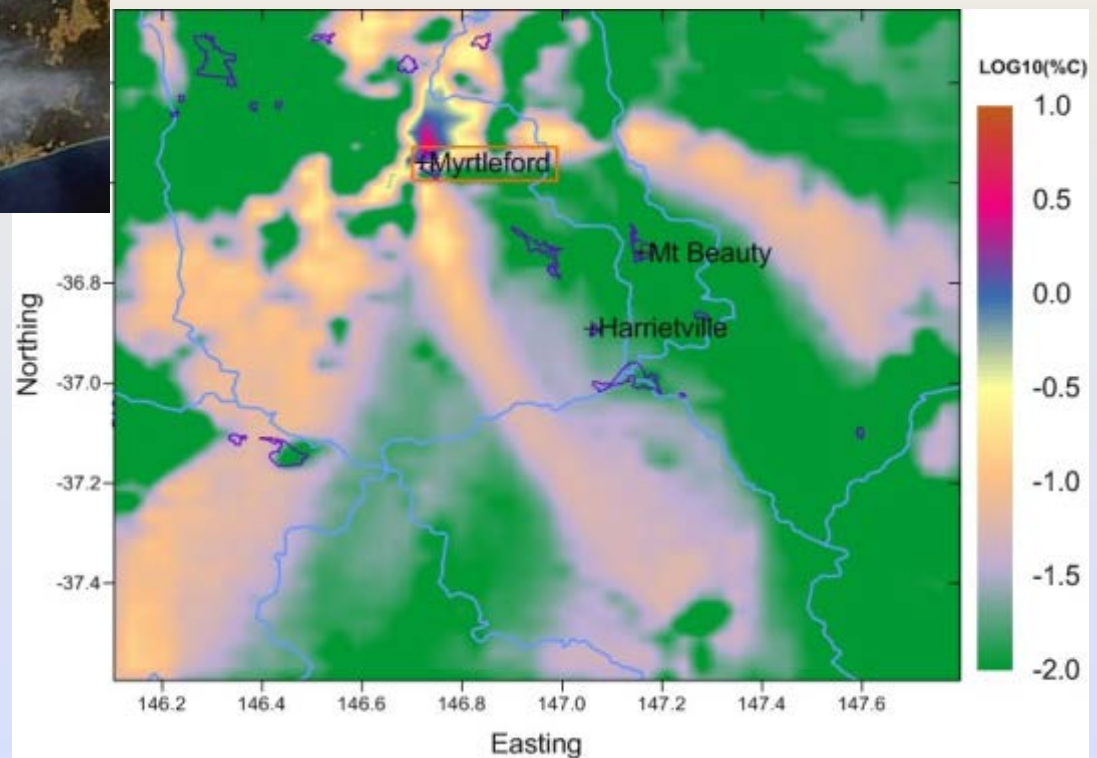
Controlled Burns:

- Link with models of weather events (eg wind direction) to predict timing/distance of burns.
- Alarm sensor when ST thresholds reached



Outcome: Reduced concern and losses to industry

Link with CSIRO (M. Cope and C. Meyers)



The End

