

EES PRESENTATION

Thank you for the opportunity to speak to my submission

My qualifications are in nutrition and I worked in the public health system for a couple of decades, then started my own consultancy business providing regular nutrition services into the residential aged care sector and did that for a couple of decades. Now I am developing a SAAS startup. What all this means is that today I shall be presenting as a business owner, investor, clinician, and concerned community member, and giving a food and nutrition perspective.

My presentation is in 4 parts

- Housekeeping
- Food security
- Nutrition issues
- Lost opportunity

Housekeeping

Housekeeping covers a number of concerns about which I wish to make a brief comment only.

One. Data collection. The inadequacy and unreliability of the data collected and presented has been more than adequately addressed by Professor Parkington, and I add my support to her summary and conclusions.

Two. The proponent's lack of familiarity with fundamental numbers is a concern. For 7 years the proponent claimed they only needed about 3 gigs of water, and even although the locals said that is incorrect and that they require nearly double that, the proponent was adamant; more recently the proponent realised they "had made a mistake" and now admit their water requirements are much higher. I related this excerpt to a friend and colleague who ran nursing homes for decades and said this is the same as you not knowing the number of beds in your facility – her response was both colourful and unrepeatable! The water requirement is one of those basic numbers that a business that knows what it is doing has at its finger tips, and is also one of those basic numbers from which many other assumptions, deductions and decisions are made. How can there be confidence in any of the numbers the proponent has provided in the EES given the inaccuracy of this fundamental

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number. In fact, how much of the EES document is based on the reliability of this number and is now redundant? Further, are there similar mistakes with other fundamental numbers?

I don't know whether the error was unintentional which indicates incompetence, or intentional which indicates misrepresentation, however regardless of scenario the error indicates the proponent is unlikely to have adequate capability for managing a mine, and especially one with the added complexity of our dispersive soils.

The combination of inadequate and unreliable data collection and a flawed fundamental number means the decisions based on these numbers are also compromised, therefore there is very little content in the EES document that can be considered reliable or credible.

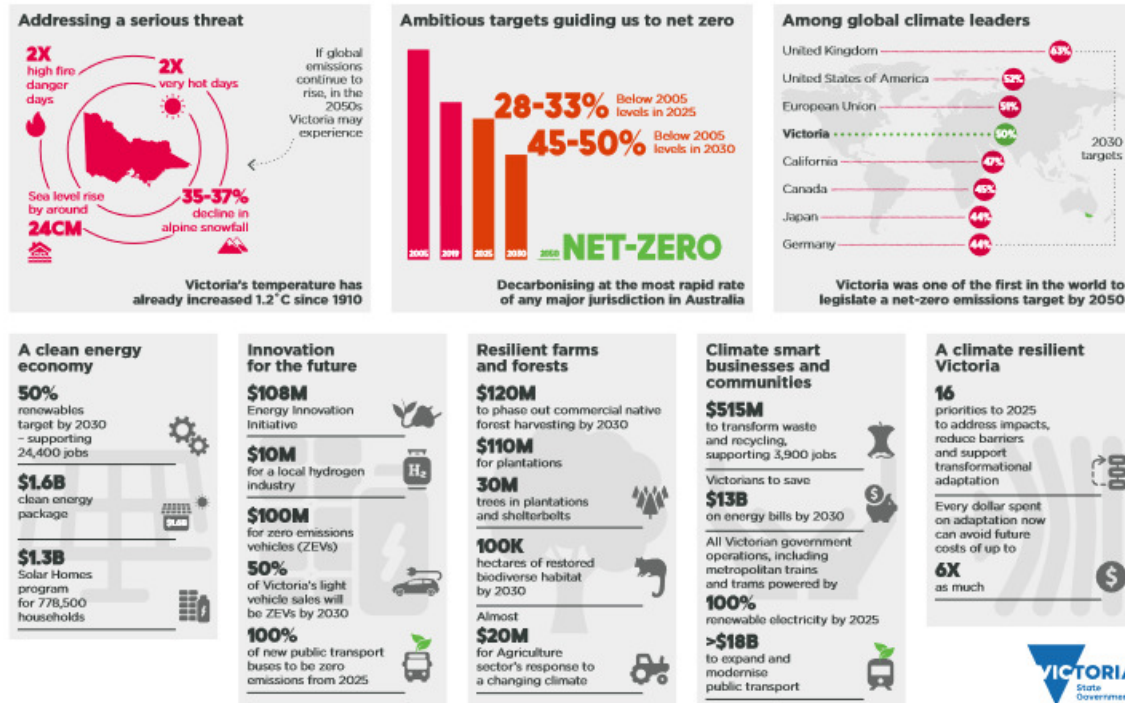
Three. Climate change. In the EES the proponent states “the risk of the project exacerbating the climate change risks facing the area was not assessed as part of the EES risk assessment, as a risk pathway was not identified.” Climate change is a significant environmental issue - this response is inadequate.

Further, in the EES, there is a statement “the projected effects of climate change have been considered in the modelling for year 15 of operations.” This is at the point when the mine will be closing, and therefore the actual projected impacts during the construction and actual mining periods are not provided. My expectation would be for a table that identifies year and function eg year 1 construction, and response of several parameters to different climate change modelling outcomes, and that it would apply from commencement of construction through to closure of the minesite. Certainly, the current comment is inadequate for a document on Environmental Effects.

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VICTORIA'S CLIMATE CHANGE STRATEGY

Our pathway to achieve net-zero emissions by 2050 and build resilience to the impacts of climate change



Given the State Govt's strategy, what initiatives will the proponent be introducing to minimise their climate change impact throughout the life of the mine? I suggest the proponent be required to submit their policy and procedures in relation to this matter in such a timely manner that it is available for at least some public comment prior to conclusion of these panel hearings.

Four. Media comment.

Mine opponents view farm plan with scepticism

31/05/2021

However, in a statement to the media, Kalbar Operations chief executive Jozsef Patarica said the company "want to look after the land" around the mine site and did not want to see it degenerate or become overtaken by feral animals or weeds.

<https://www.gippslandtimes.com.au/news/2021/05/31/mine-opponents-view-farm-plan-with-scepticism/>

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I was fascinated to read in the 31st May 2021 edition of the Gippsland Times that Kalbar Operations CEO Jozsef Patarica said “the company wanted to look after the land around the mine site ...”. If that is correct then this would not have happened **15 times**.



Bogged drill rig

Note

- Two tracked vehicles positioned to stop drill rig from rolling over
- Depth of hole at rear of drill rig is up to the workman's bottom – and he looks like a tall man
- Strategically positioned traffic cones ...

Then, to stop further bogging, after 15 episodes, they then used a tracked vehicle to drag the drill rig from site to site – 4 months after this, the tracks where the drill rig had been dragged were still bare dirt – and yet the surrounding grass was knee-height. I do not consider actions such as these as evidence of support for the claim of “looking after the land” – do you?

Further, reparations for the damage caused by the bogged and dragged drill rig remain outstanding – 8 months later.

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Five. Economics. What are the projected economics of the proposed mine? The proponent claims it will generate \$4.9 billion revenue over 20 years – so what will be the costs of generating that revenue?

Given the proponent's lack of familiarity with fundamental numbers, what is the reliability of the projected economic benefits? And where are the financial documents to support their financial claims? I suggest the financial statements leading to these projected financial outcomes are not commercial in confidence and should therefore be part of the documents submitted for the panel hearings.

Six. Projected Heavy Metal Concentrate (HMC) levels.

Table 8.3 Maximum metal concentrations in topsoil, overburden and ore samples within the project area

Element		Units [†]	Topsoil	Overburden	Ore	HIL A [*]
Arsenic	As	ppm	5	76	89	100
Bismuth	Bi	ppm	0.3	0.6	0.5	NA [‡]
Cadmium	Cd	ppm	BD [‡]	0.4	BD [‡]	20
Cobalt	Co	ppm	7	33	10	100
Chromium (III)	Cr	ppm	97	279	1,497	NA [‡]
Copper	Cu	ppm	15	36	42	6,000
Mercury (inorganic)	Hg	ppm	BD [‡]	0.14	0.03	40
Nickel	Ni	ppm	62	64	28	400
Lead	Pb	ppm	10	17	16	300
Selenium	Se	ppm	ND [‡]	0.8	BD [‡]	200
Thorium	Th	ppm	19	79	137	NA [‡]
Thallium	Tl	ppm	ND [‡]	0.1	0.2	NA [‡]
Uranium	U	ppm	4	14	24	NA [‡]
Vanadium	V	ppm	62	600	871	NA [‡]
Tungsten	W	ppm	10	25	7	NA [‡]
Zinc	Zn	ppm	275	190	75	7,400

^{*} Health Investigation Level A for residential gardens and accessible soil (NEPC, 2013b).

[†] Units in parts per million (ppm).

[‡] NA: Not applicable (HIL A level has not been defined). BD: Below detection limit. ND: Not detected.

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Whilst the proponent has very carefully included maximum toxic metal concentrations in the topsoil, overburden and ore, AND included HILA limits, they have not included the projected HMC data. Concentration of the toxic metals increases human and environmental harm risks, so why is this data not included?

Further, only trivalent chromium levels have been tested on the basis that hexavalent chromium is a man-made product. However, this is not correct as a source of natural hexavalent chromium has been identified in California. Given the negative attention that hexavalent chromium attracted in the film Erin Brokovich, will the proponent be required to test for hexavalent chromium?

Seven. Road contamination. One of the poorly known, but significant threats to health and environment is the accumulation of heavy metals in roadside soils, and their subsequent movement and accumulation into groundwater systems used for human consumption and agriculture. Heavy metals that commonly accumulate include cadmium, copper, iron, lead, mercury, nickel, titanium, zinc. Their accumulation is due to vehicular degradation eg rust, brake and tyre wear, leaking fluids, and legacy effects of lead used in petrol. The accumulation is dependent upon level of traffic. Given there will be 80 trips per day, what actions will the proponent be initiating to minimise roadside contamination, and how will the effectiveness of those actions be measured and monitored, and who, as in an independent body, will conduct these audits? (Schuler, 2018).

Inhalation exposure to cadmium compounds can be significant in occupational settings such as transport drivers, and is associated with increased risk of death from lung cancer (Schaefer et al, 2020)

The conclusions of a paper on Health risk in road transport workers are (Gromadzinska et al, 2019)

- Occupational exposure to chemicals even when low and does not exceed occupational exposure limits, may result in adverse health effects in exposed workers,
- The identified chemical substances may have sensitizing, irritating and carcinogenic effects, and impair the proper functioning of the nervous system,

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- Monitoring of the identified compounds in the air during working hours of drivers is reasonable.

Eight. Water pipeline position. How will the water pipeline be positioned in relation to the land in order to minimise impacts on small animal movements? If positioned on the ground then many small animals are at risk of being unable to access food and/or water.

Nine. Drilling depth. As I found some of the proponent's data difficult to either locate and/or to understand, I reviewed the Metallica Resources data as I found it much clearer in presentation.

The proponent claims (3-18) that the thickness of the ore is likely to vary between 10-30 metres, and that the mine voids will average 29 m deep with a maximum depth of 50 m.

Metallica data shows that for most of the drill sites the ore started between 0.0-31.5 m to a depth of 33.0-82.5 m, with the higher percentage of the ore load between 9.0-78 m

VVG water table mapping shows the depth to the water table typically ranges from 20-50 m and even from 5 m in some areas.

As both disruption and contamination of the watertable have profound implications for both the wildlife, and especially the smaller wildlife species, and for food production – how will the proponent minimise disruption to the water table? Further, how will they prevent contamination of the watertable?

10. Cadmium and lead intake levels. PTW1 – is an estimate of the amount of a given chemical that can be ingested weekly over a lifetime without an appreciable health risk (Satarug et al, 2020).

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PTW1 – is an estimate of the amount of a given chemical that can be ingested weekly over a lifetime without an appreciable health risk (Satarug et al, 2020). These figures were first provided for Cd and Pb in 1989 and have been subsequently amended in 1993 and 2010. (Satarug et al, 2020)

The 2010 PTW1 for Cd was 25 ug/kg body wt/month (Satarug et al, 2020).

The 2010 PTW1 for Pb was 25 ug/kg body wt/week – this was withdrawn as it did not afford health protection, and a new tolerable level has not been established as a dose-response analysis indicates no threshold levels exist for neurotoxicity of Pb (Satarug et al, 2020). However the US FDA has proposed 12.5 ug/day as an interim safe intake (Satarug et al, 2020)

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The EES does not contain/I have been unable to locate any data, on estimated ingestion quantities of any of the identified toxic metals.

Given the presence of the HMC, what strategies will the proponent be introducing to minimise direct (water, air) and indirect (foodstuffs, skin exposure) ingestion of the many toxic metals? How will the proponent demonstrate effectiveness of their strategies? Whom, as in an independent third party preferably nominated by the Auditor General's office, will monitor the data collection and analysis?

Food security

Food security is defined as all people, always having access to enough, safe, nutritious food to meet their dietary needs and food preferences for a healthy, active life.

Food insecurity exists whenever access to and/or availability of, nutritionally adequate and safe food is limited or uncertain.

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According to the United Nations World Food Summit in 1996, food security is a right for all people.

The 2017 FoodBank Hunger Report stated

- 3.6 million Australians ie 15% experienced food insecurity in the previous 12 months;
- Of those experiencing food insecurity the experience is at least monthly for 3 out of 5 ie 60%,
- 4% experience food insecurity daily,
- less than half have sought assistance from a food assistance charity;
- FoodBank provides food assistance to over 650,000 people every month, of which 27% are children.

Water security is both essential itself and is also essential for food security, and includes - availability, access, utilisation, and stability of supply regardless of external impacts.

Water insecurity is defined as inconsistent access to a sufficient amount of safe and clean water for an active and healthy life

We also need to consider food and water security for our wildlife – the proponent's plan to dam the many creeks and gullies in the area will be introducing food and especially water insecurity for the smaller species.


Food insecurity includes both food production and dietary quality.


- **Food production.** There is an estimate that increased surface temperatures in the tropical and subtropical regions will reduce production of staple cereal crops such as rice and maize by 20-40%, and that is excluding extreme weather events. Food production realistically requires an unpolluted environment (land, water, air) however industrialisation, waste management, and mining strategies are not well managed and are significant long term polluters, and therefore diminish availability of unpolluted land mass for food production (Fanzo, 2020 – my summary)
- **Dietary quality.** There is an inverse correlation between carbon dioxide levels and protein content of plant foods; other nutrients are also

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similarly impacted. What this actually means is that the higher the carbon dioxide levels, the lower the protein and other nutrient content of the plant-based foodstuff. This results in increased hidden malnutrition to both humans, especially those with high plant food intakes, and to wildlife; and an overall increase in disease risk. (Zhu et al, 2018).

KWASHIORKOR VS MARASMUS

<ul style="list-style-type: none"> • In preschool children (1-5 years of age) • Due to low protein intake • Mild growth retardation • Mild reduction in body weight • Protruding abdomen and subcutaneous fat reserved • Ribs not very prominent • Poor appetite • Enlarged fatty liver • Oedema present • Moonfacies • Sparse hair • Flaky paint-like skin • Lethargic • Requires adequate amount of protein 	 <p style="text-align: center;">Kwashiorkor</p>	<ul style="list-style-type: none"> • In weakened infants (<1 year old) • Due to low calorie intake • Severe growth retardation • Severe reduction in body weight • Shrunken abdomen and subcutaneous fat not preserved • Prominent ribs • Voracious feeder • No fatty liver • Oedema not present • An old man like face • No hair changes noted • Dry and wrinkled skin • Alert but irritable • Requires adequate amount of protein, fat and carbohydrate 	 <p style="text-align: center;">Marasmus</p>
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There are 2 main forms of malnutrition -

Marasmus – inadequate intake of energy (calories), protein and nutrients, and the people are wasted – typically described as skin and bones. These are the children we see on TV.

Kwashiorkor – there is a marginally adequate intake of energy (calories) but insufficient protein.

For those with a limited range of dietary choices, the reduction in protein in their staple cereal crop such as rice or maize, has a profound impact on health and socioeconomic parameters. This is not just a developing nations problem – it is also a problem in wealthy countries

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like Australia for the particularly socially disadvantaged and for those with a high plant food intake such as vegans and vegetarians.

Food security can be considered from international and national perspectives

International perspective

Climate change, agriculture, and nutrition are interconnected (Fanzo, 2018). Climate change and its resultant variability affects temperature and precipitation, as well as frequency and severity of extreme weather events. Increases in temperature, heat waves, and droughts will impact agriculture, with the largest effects being both decreased crop yields and livestock productivity, as well as declines in fisheries and agro-forestry in areas already vulnerable to food insecurity.

There is strong evidence that climate change will impact overall calorie consumption and consumption of healthful foods through mechanisms such as (Fanzo, 2018)

- food quality ie diversity, nutrient density, and safety,
- food prices ie accessibility to safe, affordable, and sufficient food,
- food variety ie diversity of choice and quantity

Much of the global warming has been absorbed by the oceans – water expands as it warms which means warming oceans result in rising sea levels, and also means declining populations of fish stocks due to the water becoming too warm for their survival. Many coastal villages are dependent upon fish stocks as their primary food source and the combination of warming oceans and declining fish stock populations means their food requirements, especially protein, will not be met and so they will look to land-produced foodstuffs for their survival.

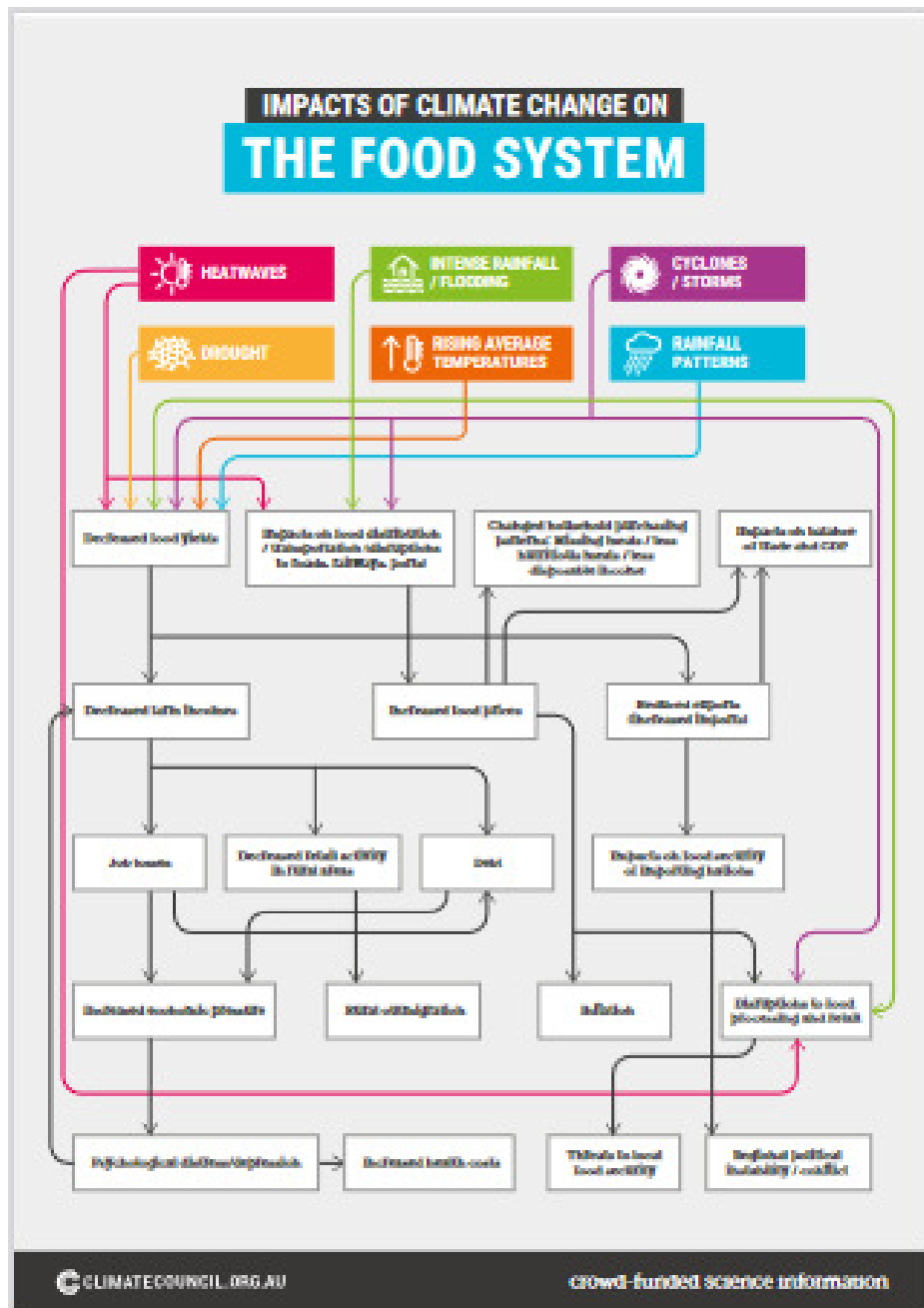
Global warming also means there is an increased rate and volume of melting ice, further contributing to rising sea levels. This in turn means reduced land mass for increased housing and food production demands.

There is a global phenomenon that we build cities on river deltas ie the most fertile land – this is partly because historically shipping was our only transport

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for sending goods and people overseas. Cities attract people and generate jobs and so expand, and the expansion continues on the most fertile lands which in turn pushes food production back onto the more marginal lands.

National perspective



My only concern with this infographic is that it does not include the negative impacts of carbon dioxide on nutrient content of plant foods

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Ultimately food security in Australia is reliant upon a number of factors such as

- **Dependence upon imported foodstuffs to meet basic requirements for staples.** In 2019, due to the extent and duration of the drought, Australia had to import high-quality grain from Canada to meet food production requirements (personal communication, 2019). If Australia is, or does become, dependent upon overseas suppliers for provision of the basic staples, then there is increased risk to our food security as international unrest increases, and surplus food supplies in other countries decrease. Climate change is a global phenomenon and thus most countries will be unlikely or unwilling to export surplus food supplies.
- **Increasing frequency of extreme weather events such as droughts, floods, fires, storms.** The last 10 years were critical for containing our warming to 1.5 degrees – Australia did not act and so we lost that opportunity; the next 10 years are critical to keeping the warming below 2 degrees – the question is - will we act? Our temperature has already risen by 1.0 – 1.1 degrees - and look at the erratic weather that has been experienced globally over the last couple of years. If this is what our weather is like with a 1.0-1.1 degree temperature increase then what will it be like at 2.0 degrees? And if we don't act then 3.0 degrees of warming is likely and what will that mean?
- **Water availability and pricing.** Privatisation of water means high-end products are being produced at the cost of staple foods eg wine is being grown in historically predominant dairying areas, cotton and rice are the 2 biggest water consumers in Australia, and the ultimate cost is reduced availability of water for production of essential staples.
- **Biosecurity.** The inspection rate for food coming into Australia is < 5% due to inadequate staff resourcing, funding and prioritisation (personal communication, 2019) therefore there is increased risk to both population health and safety of the food supply with regards to animal and plant health. Examples of food produced in a contaminated environment in one country being the cause of significant outbreaks of illness in another country are increasing in frequency. Failure of our biosecurity processes could result in absolute devastation of our food production such that it would take years to re-establish production levels

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to pre-devastation levels. We only have to look at the impact of swine flu on the pig population, and therefore food supply, in China. And we only have to watch the course of covid to see how the impacts change

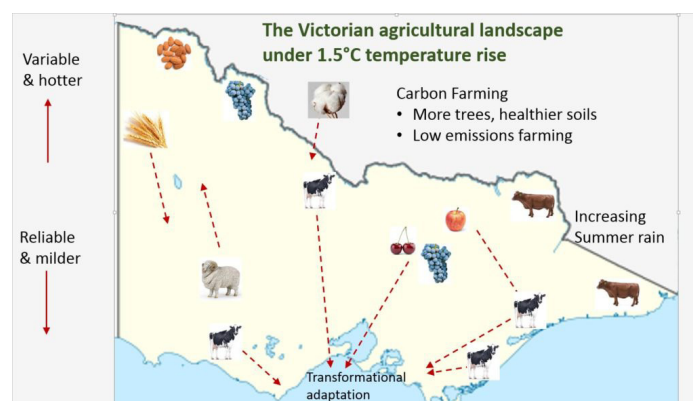
- **Availability of food-producing land.** Available food producing land in Australia has consistently diminished from about 3.5 hectares per person in the early 1960s to the current 1.9 hectares. This loss of food producing land is due to 4 predominant factors
 - Urbanisation – both metropolitan and regional urban sprawl,
 - Increasing population,
 - Conservation – examples include national parks – land and sea,
 - Mining impacts that include
 - losses of soil fertility, soil biota, soil structure,
 - loss of hydrology and consequent altered water tables,
 - increased likelihood of exposure to contaminants such as toxic metals, polluted water and soils,
 - salinity impacts,
 - impacts can encompass a broad area beyond the immediate minesite;

So what does food security have to do with this EES submission?

Perhaps you have already guessed – protection of our food producing land. From a food security point of view we local, national and global citizens, can no longer afford any ventures that will impact the safety of our food and water supply.

Victoria's Environment: Adapting to the New Normal

The Governor's Environmental Science Public Lecture 2019



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In 2019, the Victorian Governor's Environmental Science Public Lecture was titled Victoria's Environment: Adapting to the New Normal. One of the Speakers was Agricultural scientist Professor Richard Eckhardt from Melbourne University, who summarised some of the impacts on Victoria's agricultural sector. Professor Eckhardt explained that the food producing belt up through central and northern Victoria will become hotter, and for a longer duration, and with reduced access to water which is a scenario that is not supportive of many of the current food-producing sectors such as grain, dairy, wine and fruit. Consequently, those wishing to remain in these sectors will migrate south to areas such as coastal Victoria and Tasmania because of their milder temperatures and more reliable rainfall. Whilst Professor Eckhardt was referring specifically to Victoria, this scenario is also applicable to NSW, and Landline aired a story on how some of the forward-thinking vignerons are already developing vineyards in Tasmania in anticipation of having to move south.

I actually emailed Professor Eckhardt and asked him specifically about which sectors would particularly suit this area and his reply indicated that both dairying, and the Goulburn Valley Fruit Industry would find this area suitable for their requirements.

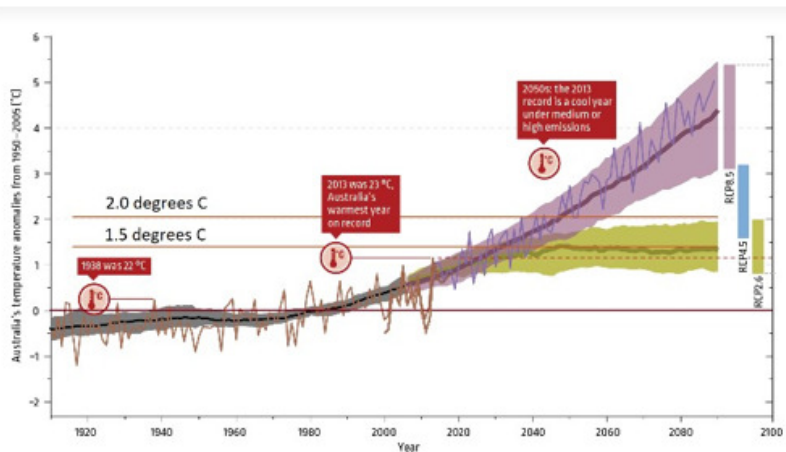
Professor Eckhardt also discussed carbon farming options and the positive contributions it makes to both reducing carbon emissions and increasing productivity, and of course carbon farming generates income as well.

Also at this same symposium,

- Professor Ros Gleadow commented on the inverse correlation between atmospheric carbon dioxide and protein levels in relation to both human and wildlife diets, and
- Professor Pandora Hope discussed the non-temperature climate change implications in relation to changes to rainfall (variable), drought frequency (increasing), seasonal changes relating to when the rain falls, and increasing summer storms and with increasing intensity.

Seasonal changes will impact food production quantity and quality. All these factors impact our food production.

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IPCC modelling of average global temperatures, 1910 to 2100. The green zone represents the range of temperature extremes anticipated under a regime of 1.5 degree warming above pre-industrial averages. The purple zone is to be avoided under any circumstances.

We locally, nationally and globally, cannot afford to lose food producing land to ventures that do not generate food, and that result in contamination of that land such that food can not nor can ever be produced on it.

Recently (2021) Landline aired a story on the increasing scarcity of uncontaminated land for food production on a global basis, and that in Australia this scarcity was already adding a premium to the value of the land.

There is a lack of understanding of the enormous challenges to creating a sustainable and safe future for everyone at all levels of society ie political, industrial and social. Globally

- we consume more than we produce,
- the rate of biodiversity loss is increasing exponentially,
- no political will to address the issues now which means the redress will be much harsher the later it is introduced,
- the climate is steadily becoming more unreliable and extreme,
- lobby groups continue to act for self-interest

We're currently seeing all of these points in Australia.

I understand some of the proponent's owners were also involved in a mine at Balmoral, that the EES document for that project stated no mining on windy days, and that mining did continue on windy days. Therefore, if the mining license is approved then a number of conditions are required

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- On any day that is deemed, by an independent third party perhaps appointed by the Auditor Generals department, to be windy, then mining is to cease until the all clear is signalled.
- If the mining company chooses to disregard the advice and to continue mining then, for each episode of noncompliance
 - the penalties will be eye-wateringly high and non-tax deductible – not a tut tut, tap on the hand approach,
 - The mining company will be required to also pay significant compensation to all those people downwind and impacted.

If the mining license is approved then the cost of food production will increase significantly and negate the current geographic advantage; there will also be a likely loss of production and therefore employment. Some of the costs of production will include

- Water decontamination infrastructure to minimise contaminated water exposure, and
- Physical barrier infrastructure such as “glasshouses” to maintain their zero physical contamination accreditation requirements.

Nutrition/health

A number of concerns relating to the research on mining impacts on environments and health are gaining traction (Brisbois et al, 2019), and are all well represented in this EES document:-

- there is a disproportionate focus on direct exposures to toxic substances only and neglect of cumulative impacts. The submitted EES identifies 2 key health issues, being radiation and dust impacts and, unsurprisingly, is quite dismissive of any impacts,
- there are commonly inequitable power relationships – the proponent has demonstrated a number of intimidatory and bullying strategies such as “if you don’t do as we say (eg sell us your land) we shall take you to VCAT”,
- the direct influence of the resource extraction industry on the setting of research priorities and even how the research is conducted. An example from local experience: - a report requested by Victorian Farmers Federation on the impact of the mine on the local horticultural industry

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is quite compromised because the proponent refused to pay for the original report and required a more favourable rewrite,

- health impacts on non-mine workers and the impacted communities are not addressed – neither identified nor addressed in this EES,
- there is minimal research on mental health and well-being – neither identified nor addressed in this EES,
- experts may present opinions biased to their own specialisation that may be at the expense of the local community, as well as probable financial conflicts of interest. Both factors present in this EES.

There is an assumption that because we have access to a broad diversity of good food that most Australians generally eat well ie a reasonably nutritionally-balanced diet.

This assumption is not supported by evidence such as a comparison of supermarket food sales with either the Dietary Guidelines or the Healthy Eating food guides.

The evidence is steadily increasing that there is an inverse correlation between toxic metal uptake and adequacy of nutritional intake. What this means is that more toxic metals are absorbed when there are poor food choices resulting in inadequate nutrient intake.

Instead of displaying eye-glazing charts of toxic metals and which bits of the body they impact, I shall briefly comment on thyroid function as it is a special case for this area, and then use a couple of examples to outline some key points of concern.

Thyroid

This is brown coal country. Water from brown coal country contains higher levels of goitrogens ie substances that interfere with iodine uptake. Excessive selenium intake has been consistently found to enhance the negative impacts of inadequate iodine availability and intake.

Hypothyroidism can be directly related to dietary selenium deficiency or can be secondary to selenium deficiency caused by mercury toxicity (Zehra, 2018)

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Mercury is commonly present in the thyroid and its presence is likely to contribute to several thyroid disorders. There seems to be an inverse correlation between mercury and thyroid function with mercury exposure inhibiting various pathways of thyroid hormone synthesis (Zehra, 2018).

Cadmium and lead are also found in the thyroid suggesting synergistic interactions between toxic metals could enhance mercury toxicity in thyroid cells. (Pamphlett et al, 2021)

Cadmium can disrupt the thyroid at low environmental doses, and has a significant role in thyroid cancer (Buha, 2018)

Zinc - low levels of zinc are associated with underactive function, and high levels with overactive function (Jain, 2016)

There is an increased risk that exposure to the high levels of selenium identified in the mineral sands toxic metals chart (Table 8.3) will compromise thyroid function in those who may already be at risk due to likely marginal availability of iodine. What this means is that if the mining license is approved then it is likely there will be a significant increase in the number of people with altered thyroid function in this area.

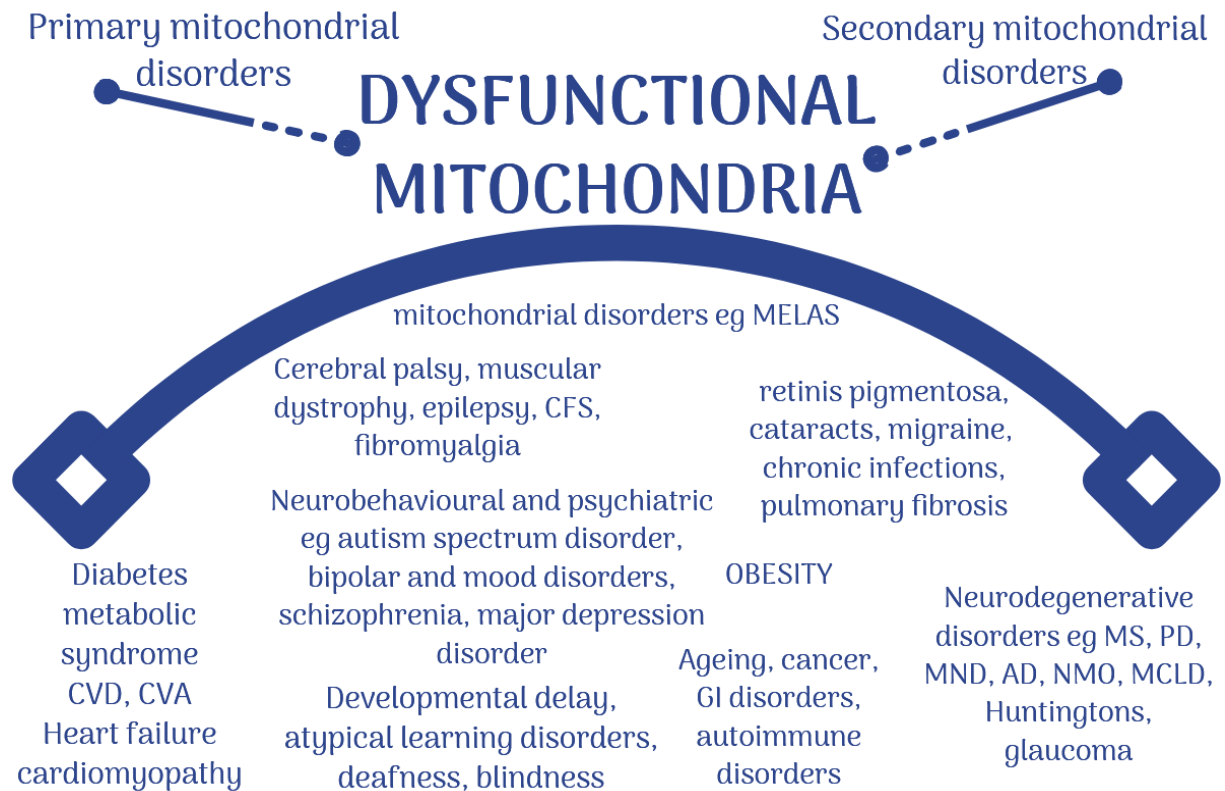
Dysfunctional mitochondria

Mitochondria are the power houses of the cells ie they generate the energy for the cells to function.

Many of the toxic metals access the mitochondria via molecular mimicry (Thevenod et al, 2020) which means they use the transporters of other essential nutrients.

Mercury, titanium and cadmium all adversely impact mitochondrial function via various mechanisms - if mitochondrial function is disrupted then the body doesn't function properly (Pamphlett et al, 2018), (Wilson et al, 2016).

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Proposed mechanisms of action of toxic metals include

- production of Reactive Oxygen Species (ROS) – an analogy would be effectively the flame of the bushfire
- increasing oxidative stress – an analogy would be the damage caused as a consequence of the bushfire

Physiological transporters

Transporters are euphemistically called “drug transporters” however actually have physiological roles transporting necessary physiological substances.

There is a lot of drug company interest in transporters for 2 reasons

- US FDA now requires this information in drug discovery submissions, and
- Drug companies consider they may be a vehicle for accessing bits of the body they currently can't.

Transporters can alter outcomes in 3 ways

Inducer – enhance the effectiveness of a substance. For example many prescribed medicines contain the warning “do not take with grapefruit juice”.

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Research in the early 1990's found that grapefruit juice could enhance the effectiveness of some medicines; this was used by some American hospitals in the 1990's to administer smaller doses of chemotherapy drugs in conjunction with grapefruit juice to gain the same therapeutic benefit at lower financial cost, and with fewer side effects.

Inhibitor – blocks the transporter from functioning for a period of time – seemingly typically about 3 hours.

Substrate – can be carried by that transporter. For example cadmium and metformin can both be carried (separately) by some of the thiamine transporters.

Toxic metals have a capacity for molecular mimicry and can be carried by the same transporters as nutrients however are not regulated in the same way as the essential elements and therefore can cause harm. It also means that once absorbed, toxic metals can be transported throughout the body

What makes many of the toxic metals even more harmful is that they are stored in the body such as the liver and bone. Using bone as an example, osteoclasts munch up the bone and thus release into the bloodstream the toxic metals stored there, and the osteoblasts rebuild the bone with the readily available materials which may include more or less of the toxic metals.

A hidden form of harm is the competition between toxic metals, prescribed medicines and nutritional factors for access to relevant transporters, and seemingly it all depends upon which one gets to the transporter first. Using thiamine, metformin, cadmium as an example:

1. thiamine is typically absorbed during the meal, and so if there is no competition, will be first on the transporter,
2. metformin is typically administered before meals therefore is likely to be first and so will fill the transporter slots and therefore thiamine will not be transported
3. if cadmium is first then it will fill the transporter slots and neither metformin nor thiamine will be transported. Cadmium is likely to be mostly first because of its long duration in the body (10-30 years) and also because it is always in a state of flux ie being released and taken up by various body processes. In this example, the longterm consequences

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are altered therapeutic benefit from the metformin and hidden malnutrition due to sustained chronic inadequate thiamine uptake.

Some prescribed medicines can be specific transporter inhibitors and increase susceptibility to cadmium toxicity (George et al, 2017) and likewise cadmium can increase production of some transporters and thus alter organ uptake of various substances (Shu, 2018)

Lead can travel on calcium and zinc transporters (Orr, 2017)

Cadmium (Cd) can be transported on thiamine, zinc (Orr, 2017), iron, magnesium and calcium transporters (Schaefer et al, 2020), (Banca et al, 2020), and albumin.

Arsenic can travel on glucose transporters, water channels, thiamine (Orr, 2017), and phosphate transporters (Hu et al, 2020)

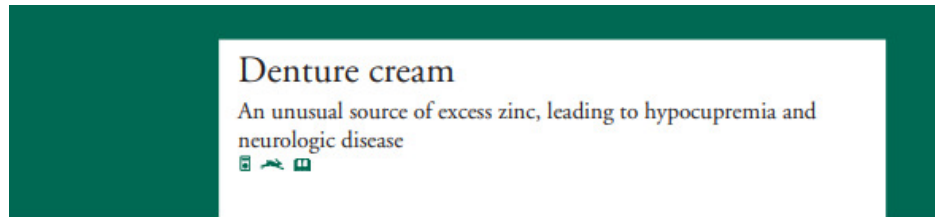
Mercury

- can be transported by albumin, homocysteine (George et al, 2017), and a range of other substances (Lepist et al, 2017), (George et al, 2017),
- inhibits aquaporins (water channels) (Pamphlett et al, 2018),
- is a substrate for some transporters (George et al, 2017).

Zinc (Zn)

- is important in growth, development and cell functioning, and is important in a range of functions including immunity, and sense of taste;
- can be displaced by cadmium and lead and thus result in zinc deficiencies (George et al, 2017), (Satarug et al, 2020);
- displacement by lead impairs heme production which is a functional component of haemoglobin, (Satarug et al, 2020); haemoglobin is important for the transport of oxygen around the body ie lead reduces the body's capacity to carry oxygen;
- if consumed in excess will cause harm both directly, and indirectly by decreasing copper absorption. For example a case study was published that identified a chronic excessive zinc ingestion caused a copper deficiency that ultimately resulted in a myelopathy; the source of the excessive zinc was denture cream.

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Denture cream

An unusual source of excess zinc, leading to hypocupremia and neurologic disease



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ABSTRACT

Background: Chronic, excess zinc intake can result in copper deficiency and profound neurologic disease. However, when hyperzincemia is identified, the source often remains elusive. We identified four patients, one previously reported, with various neurologic abnormalities in the setting of hypocupremia and hyperzincemia. Each of these patients wore dentures and used very large amounts of denture cream chronically.

Objective: To determine zinc concentration in the denture creams used by the patients as a possible source of excess zinc ingestion.

Methods: Detailed clinical and laboratory data for each patient were compiled. Tubes of denture adhesives were analyzed for zinc content using dynamic reaction cell-inductively coupled plasma-mass spectrometry. Patients received copper supplementation. Copper and zinc levels were obtained post-treatment at varying intervals.

Results: Zinc concentrations ranging from about 17,000 to 34,000 µg/g were identified in Fixo-dent and Poli-Grip denture creams. Serum zinc levels improved in three patients following cessation of denture cream use. Copper supplementation resulted in mild neurologic improvement in two patients who stopped using denture cream. No alternative source of excess zinc ingestion or explanation for hypocupremia was identified.

Conclusion: Denture cream contains zinc, and chronic excessive use may result in hypocupremia and serious neurologic disease. *Neurology* 2008;71:639-643

Neurodegeneration

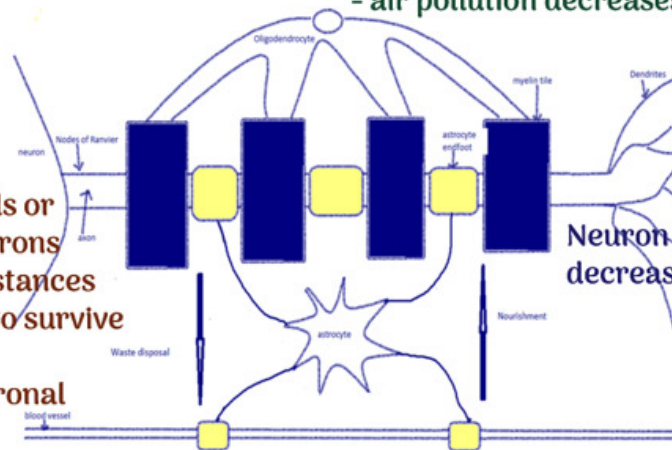
Arsenic, lead, cadmium and mercury impact neurological function by damaging cellular mitochondria (power house)

Oligodendrocytes

- service hundreds or thousands of neurons
- produce and maintain the myelin sheath
- mercury decreases B12 availability
- air pollution decreases vit D availability

Astrocytes

- service hundreds or thousands of neurons
- provide the substances neurons require to survive and thrive
- remove the neuronal garbage
- cadmium decreases thiamine availability
- mercury decreases B12 availability



Astrocytes are VERY susceptible to thiamine status, then B12 status

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Oligodendrocytes

Dysfunctional oligodendrocytes can be caused by sub-toxic concentrations of several heavy metals including copper, hexavalent chromium, nickel, cobalt, lead, cadmium (Maiuolo, 2019), mercury (Pamphlett et al, 2018).

Both the presence of lead and/or the inadequacy of vitamin D status delay maturation of oligodendrocytes – this means that the chronic presence of lead and/or chronic inadequate vitamin D status will result in insufficient oligodendrocytes achieving maturity and so the myelin sheath will not be maintained and nerve conduction will be negatively impacted (Ma et al, 2015), (Mousavi, 2019).

Air pollution interferes both directly and indirectly in vitamin D production

- Directly – reduces access to sunlight and so reduced stimulation of the skin to produce vitamin D; cadmium, lead, uranium and cesium are capable of interfering with hormonal systems including Vitamin D and thyroid function (Mousavi, 2019)
- Indirectly – people go inside to avoid exposure to the pollution and thus further reduce exposure of skin to the sun

Arsenic and mercury cause neurotoxicity by targetting the myelin sheath thus causing both decreased myelination and nerve transmission, both of which contribute to negative impacts on cognition and likely later neurodegeneration; mechanisms of action include oxidative stress, epigenetic alterations, and chemical signalling disturbances (Nino, 2020), (Banca et al, 2020), (Pamphlett et al, 2018)

Oxidative stress is the equivalent of a bushfire and we put it out, or quench it with water, in the body we quench the oxidative stress with antioxidants, and a common antioxidant is vitamin C.

Epigenetics are the interactions between the person's genetics and the environment. For example babies are tested at age 5 days with a heel prick test that checks for phenylketonuria and galactosaemia amongst other concerns; both of these diagnoses require significant dietary manipulation to modify the genetic expression on the person's development and growth.

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Early evidence indicates mercury also interferes with the release of gastric acidity from the acid-producing cells (Asar et al, 2000 x 2). Reduced secretion of, or no secretion of gastric acidity means reduced digestion of foodstuffs and therefore reduced release of nutrients. Further, B12 is unable to be transported to its site of absorption, and B12 is important in both oligodendrocyte and astrocyte function

Astrocytes

Arsenic, titanium, silicon and mercury all adversely affect the viability of astrocytes via a range of mechanisms of action (Hitke et al, 2016), (Kushwaha, 2018), (Wilson, 2016), (Limon-Pacheco, 2020), (Pamphlett et al, 2018)

Health impacts

Whilst I have only mentioned thyroid function and the potential impacts of toxic metals on transporters and neurological function, the ultimate health consequences are profound.

The evidence is steadily increasing on mining-associated short and long term negative health impacts. Further, some of the mechanisms of action of the toxic metals are being identified through the pharmaceutical companies' investigations of physiological transporters.

I wouldn't be surprised if at some not so distant point in time, mining companies end up facing a huge class action based on negligence of care to the community.

Ultimately mining can negatively impact people by (Impacts of mining – Oxfam)

- Forcing them from their homes and land
- Preventing them from accessing clean land and water
- Impacting on their health and livelihoods
- Causing divisions in communities over who benefits from the mine and who doesn't
- Changing the social dynamics of a community
- Exposing them to harassment by mine or govt security

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All of these factors negatively impact health either directly or indirectly

The last 2 points are already manifest in the local community.

Lost opportunity

So what IS the cost to the Australian economy if these food-producing lands are lost?

There are 3 parts to this question –

1. what happens to this land as a consequence of the mining?
2. what happens to the community once the mine is closed?
3. what are likely alternatives for this community if the mine does not proceed?

1. **Mining impact on food-producing lands** – ultimately the net effect is loss of safe, food-producing capability via mechanisms such as
 - losses in the soil such as fertility, biota, structure,
 - negatively impacted hydrology,
 - losses in safety of produce grown on the soils due to contamination from mobilised and/or introduced toxic metals;

If the mining license is approved then the cost of food production will increase significantly and negate the local horticultural sector's current geographic advantage; there will also be a likely loss of production and therefore employment. Some of the introduced costs of production would include

- a. Water decontamination infrastructure to minimise contaminated water exposure, and
 - b. Physical barrier infrastructure such as “glasshouses” to maintain their zero physical contamination accreditation requirements
2. **Mining impact on the community** – many communities experience deep divisions between the locals and the miners, the presence of the miners drives up the cost of living, and miners often don't spend time or money

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in the community which further exacerbates the local community's resentment of their presence. Mudgee is an excellent example of these issues.

Once the mine closes it is unlikely other industries will become established in an area that has become contaminated due to mining, therefore other forms of employment will not be available, and thus loss of income; further, the community breaks down as people move away, and government support becomes essential for those who remain. Commonly there is also significant chronic ill-health that further impedes ability to work and further increases requirement for government support.

3. **Non-mining alternatives** – will this community gain greater advantage if the mine does not proceed?

One of the big arguments for supporting mining in regional Australia is the perception of job creation – and yes jobs are created, and perhaps some of the local community members are employed in jobs that do not require specialist skill sets. However many of the specialist jobs will necessitate expertise being brought in from elsewhere, and so most of the employment is for people from outside the local, impacted community.

A submission to the IAC Panel Hearing 2021 addressed the issue of local employment, based on 3 gigs water becoming available, to which I have added comments relating to skill set and community impact

Direct jobs created with 3 x gigs water – from a submission to the IAC Panel Hearing 2021

Employer	Direct jobs	Flow-on jobs	Skill level	Indirect community impact
mine	200	? 200	Whilst there will be unskilled jobs eg truck drivers, many will require specific skills that are unlikely to be readily available in this community	Money spent mostly outside the community ie minimal indirect growth impact which means fewer community jobs generated
Veggie	600	2,400	Whilst there will be a range of skill	Money mostly spent locally ie

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growers consortium			requirements, many can be learned onsite, and there is a greater likelihood of relevant skilled personnel being available within the community as it is an already established industry in this precinct	significant indirect growth impact which means more local jobs generated
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Flow-on – related jobs to the industry

Based on these employment numbers, one can only assume that approval of the mine will disadvantage the local area and region by restricting employment and growth opportunities.

Food production is sustainable in the longterm ie inter-generational whilst mining is a one-off event that leaves the land in a damaged state and typically unable to produce at the same or greater level than prior to the mine event.

There are 2 very likely consequences if the mining license application is not approved

1. Increased food production and likely commencement of related new local and regional industries at both industrial and artisan levels, and
2. increased tourism –general, endurance, adventure.

1. Increased food production

The Lindenow Flats were predominantly dairying and summer beans until Lex Busch and Howard Boucher introduced tomato growing in the mid 1970s; all the locals said “they’re mad” and looked over the fence to watch progress. From then on dairying steadily diminished and vegetable production steadily increased, and by the late 1970’s Vegro was also in production.

The current local horticultural industry has already created the supply lines and infrastructure to create a benefit from its geographical location, as exemplified by the fact that they now transport their produce to many parts of Australia as well as exporting into SE Asia.

There is still some local dairying and consequently much of the infrastructure to support that sector is still in place ie a return to dairying would be relatively easy.

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Climate change is predicted to result in increasing temperatures and decreasing water availability in the food producing areas in QLD, NSW, and central and northern Victoria and the prediction is that many food producers will steadily move south to the more temperate climates of coastal Victoria and Tasmania.

Consequently, the land in this area is likely to become very valuable as it is geographically well-located, has significant support infrastructure (road, rail, air, water), uncontaminated fertile land, and now – increased water availability.

One of the proponent's expert witnesses claimed the proposed mine site land was of poor quality and minimal value. However, along with a likely conflict of interest (being paid by the proponent), it is likely the expert witness did not fully understand that lack of water availability has limited the range of choices for farming on the plateau. The recent release of licenses for up to 6 gigs water means an increase in the range of choices and that it is likely this land will now become high-density food producing land.

The range of food production options is also likely to become more diverse and encompass

- vegetable production – broader diversity of produce,
- fruit production - blueberries, raspberries and other brambles, grapes, sapeote (soft, fruit salad-tasting fruit), jojoba, gooseberries, etc
- dairying – including commercial and artisan products
- herbs -food, health,
- nuts - almonds, pecans, walnuts, etc
- legumes - peanuts, etc
- other - olives, coffee, fresh water fisheries (smoked), emus (meat, fashion, health, lenses from eyes), etc;
- non-food production could possibly include sandalwood, hemp, cotton.

The horticultural industry is now mature so if the producers decide to expand into value-adding in the form of food processing then it will likely result in the area becoming a significant food producing and processing region for much of

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East Gippsland produce; and of course there would be a consequent increase in local employment.

Where and how the food is produced is mostly anonymous to the consumer at present. However aware middle class Australia is increasingly questioning the origins and processes of the production of their food such as the treatment of animals prior to slaughter, whether the foodstuffs are grown and produced sustainably – and the answers to these questions are increasingly influencing their purchasing patterns. This increasing consumer awareness and demand supports the concept of regional or precinct “provenance” (Grover et al, 2019)

I suggest there is a unique opportunity for this precinct to add a premium to their produce through the development of a precinct brand. What comes to mind when I say “Coonawarra?” Yarra Valley? Margaret River? Hunter Valley? In each case it is either a region identified by wine trails or food and wine trails. Although the area is defined, there is no regional branding included on product branding from the areas I identified.

The recent release of up to 6 gigs water means an entirely new area of land can now be farmed more intensively – the area being, approximately Fernbank turnoff to the Fingerboards and into Bairnsdale – and could be known as The Triangle. This precinct could espouse a range of values and philosophies that appeal to aware, middle class Australia, and all products produced within it would subscribe to the values and philosophies it represents and which would be widely broadcasted and monitored for compliance. There would also be precinct branding ie inclusion of the precinct’s logo on products produced in the precinct. This would all add an intrinsic premium to the land, to the products, and to the community, and also provide a “provenance’ that reassures the aware middle class of Australia.

There is also the possibility that The Triangle could specifically become a 3-tier income-generating area – food production +/- processing, + carbon farming, + energy production from wind or solar.

Let me paint you a picture.

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You have arrived at the Fernbank turnoff and as you turn off the highway you see a series of big signs – Welcome to The Triangle – we grow and make food we like to eat safely. Our values include

- food production in conjunction with carbon farming and energy production
- wildlife corridors through the entire precinct for safe wildlife movement – this is why our speed limit is 50 km/h, and strictly enforced – speed now and the speeding fine is in the mail tomorrow!
- no high intensity industrial animal production,
- business model based on community-based membership so everyone benefits
- 25% all profit returned to the community in the form of community development grants, contributions to support local services (CFA, Rotary, Lions, Lionesses, CWA, Red Cross, etc), and full scholarships for tertiary education for X students
- tours of this precinct are 2 hours and can be booked online or in person through Ferndale tours; they are scheduled for Mondays, Wednesdays and Fridays at 2 pm. Ferndale tours are located in Lindenow
- purchase of local artisan produce and products is encouraged!
- enjoy your stay here
- AND REMEMBER – DRIVE SLOWLY ...

This sign would also be positioned at all access points into the precinct.

This area is in a very strong position to contribute to Australia's increasingly fragile food security as the vagaries of climate change are fully experienced and understood.

Tourism

A predicted consequence of climate change is increased exposure to opportunistic infections and vectors on a global basis that will be a cause of and subsequently consequence of population movements – the stories from the Spanish flu epidemic, and more recently of Covid 19 demonstrate the extent of personal, commercial and national hardship that is likely to occur. Closed borders means holidaymakers will be looking for experiences within

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their borders and this area can offer many different experiences ranging from endurance to comfort.

This is a currently under-represented area for tourism and yet so many experiences can be offered, with 3 main scenarios – endurance sports, adventure tourism, and general tourism.

1. Endurance sports

- are generally episodic ie annually, biannually, etc, and generate significant tourism dollars
- can encompass a broad range of participation periods such as overnight, several nights, weeks (Dhakar Car Rally)
- can encompass a broad range of events
 - **physical, human** - marathons, triathlons (cycle, canoe, run), decathlons, endurance runs, fun runs, etc
 - **physical, animal** - endurance horse events (eg Mongolia), etc
 - **vehicle** - motocross, cars, old vehicles, rally driving events eg cars, bikes, trucks, etc

2. Adventure tourism

Can encompass wilderness experiences through treks and tours and various modalities and durations

- Variable periods of time – overnight, over several nights
- Variable forms of accommodation – camping (tents, caravans), huts, B&B, lodges, hotels, motels
- Variable modes of transport – walk, run, drive (car, bus), ride (horse, motorbike, bicycle), water (canoe, raft)
- Variable forms of participation – self-guided, tours
- Variable forms of activity – include
 - “view and do” activities such as enjoy the view as you abseil down the cliff, surf and ski days, craft in the morning, adventure in the afternoon
 - rock climbing, abseiling, caving, gold panning
 - could include walking the High Country from hut to hut, walk part of the way from Melbourne to Canberra, canoeing/rafting from Billy Goat Bend or Den of Nargun to Lindenow or Bairnsdale

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- travel from Stratford or Briagolong or Stockdale to Dargo along the gold diggers route – beautiful scenery, challenging drive (especially if you meet a large semi-trailer!)

Some activities would require improvement in relevant camping spots and amenities.

3. General tourism

Could be self-guided or guided, and include

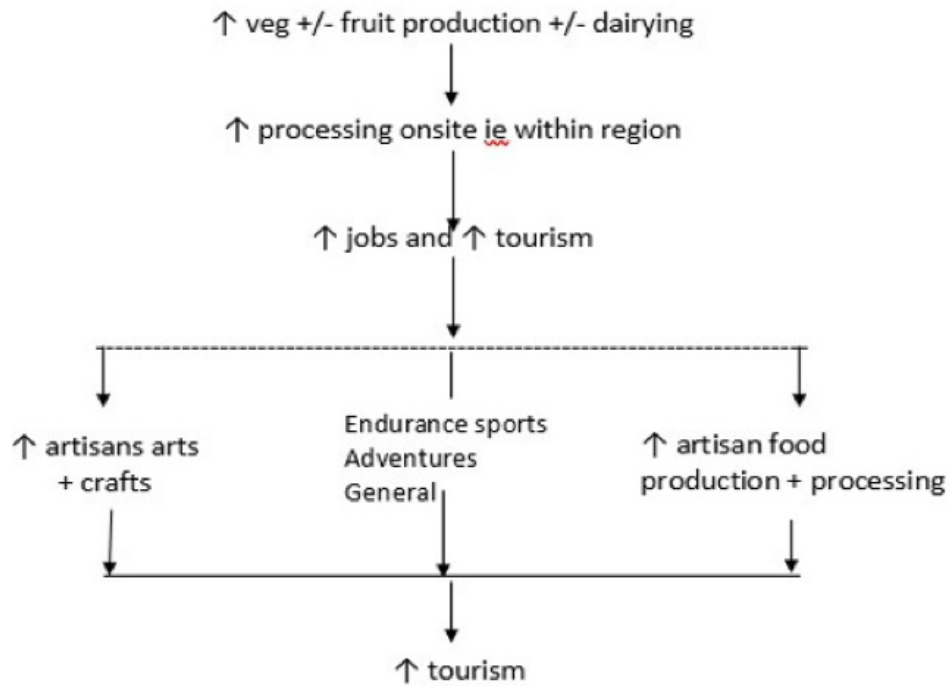
- unique flora and fauna
- gold history and include panning for gold
- aviation/military history
- local history
- indigenous visits – culture, food, fibre, ceremonies, history
- combination tours eg paint a silk scarf in the morning and canoe/boat trip on the river in the afternoon
- artisan food trails
- artisan craft trails

The increased expansion of vegetable production and the inclusion of fruit production and dairying are also likely to generate value-adding at both commercial and artisan levels and likewise attract tourism. Tourists like to see how food is produced and processed, and to visit local cottage industries and savour their unique flavours, and enjoy their stories and experiences.

The flow-on effect of increased food production and processing would likely lead to increased tourism to visit the food producing and processing sites, and is also likely to generate interest in the work of the local craft artisans

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Tourism opportunity flow chart



Conclusions



This little cutie heard me coming and so burrowed; I stayed still so the head has popped out to check if it is safe

In any health scenario, especially if there is minimal, if any research, one is guided by 5 key tenets, and I have applied the tenets to this mining license application

1. will doing nothing cause harm? If the mining license is not granted then no harm caused, and in fact the recent increase in water allocation permits a significant opportunity for growth for the area.

2. will the proposed intervention(s) cause harm? Yes, significant and

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irrevocable harm done to individuals, community, immediate and greater environment (wildlife, land and water contamination, decreased access to, and availability to water and possibly food security).

3. will the proposed intervention(s) confer benefit? Only short term and immediate financial benefit to the proponents.

4. will the benefit of the proposed intervention be greater than its harm?
No - the harm caused is of far greater consequence with immediate and long term negative impacts on health, community dynamics and socioeconomics, and the environment (land, water, air, rivers, wildlife, plant life)

5. What is the quality of the evidence? As with most evidence where financial gain is involved, it depends upon the financial inducement to the expert witnesses, and the impartiality of those making the decisions. We have seen some excellent examples of poor quality proffered by the proponent. The quality of the evidence from the Climate Council publications and the research published in the scientific literature that has been referred to in this presentation are all of very high standard.

Ultimately support of the mining license application will mean this community will be disadvantaged

- Directly by the negative impacts on health, lifestyle, community, and the environment
- Indirectly by denying the opportunity to expand the food producing opportunities now available as a consequence of the recent release of 6 gigs water ie ultimately contributing to Australia's food security

The inadequate and unreliable data collection in combination with the incorrect calculation of water requirements, and all the assumptions, deductions, and decisions made on these numbers means this document has no credibility.

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Useful open source articles

Fanzo, J., Bellows, A.L., Spiker, M.L., Thorne-Lyman, A.L. & Bloem, M.W. 2021. The importance of food systems and the environment for nutrition. **The American Journal of Clinical Nutrition** **113**:7-16.

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