

Regenerative Agriculture - Manna Hill Estate



Manna Hill Estate - About

- ~ 2500 olive trees in dryland grove near Ballarat, Victoria
 - Also have agroforestry (mixed species), sheep
- Olive trees planted in 2002
 - Start of Millennium Drought
 - First commercial crop in 2012
- Certifications
 - Organic (NASAA) 2004
 - Biodynamic (NASAA) 2020
 - Regenerative (AGW) 2023

Agenda

Part 1:

- What's wrong with conventional agriculture?
- What is regenerative agriculture?
- How does regenerative agriculture address some of the key issues?

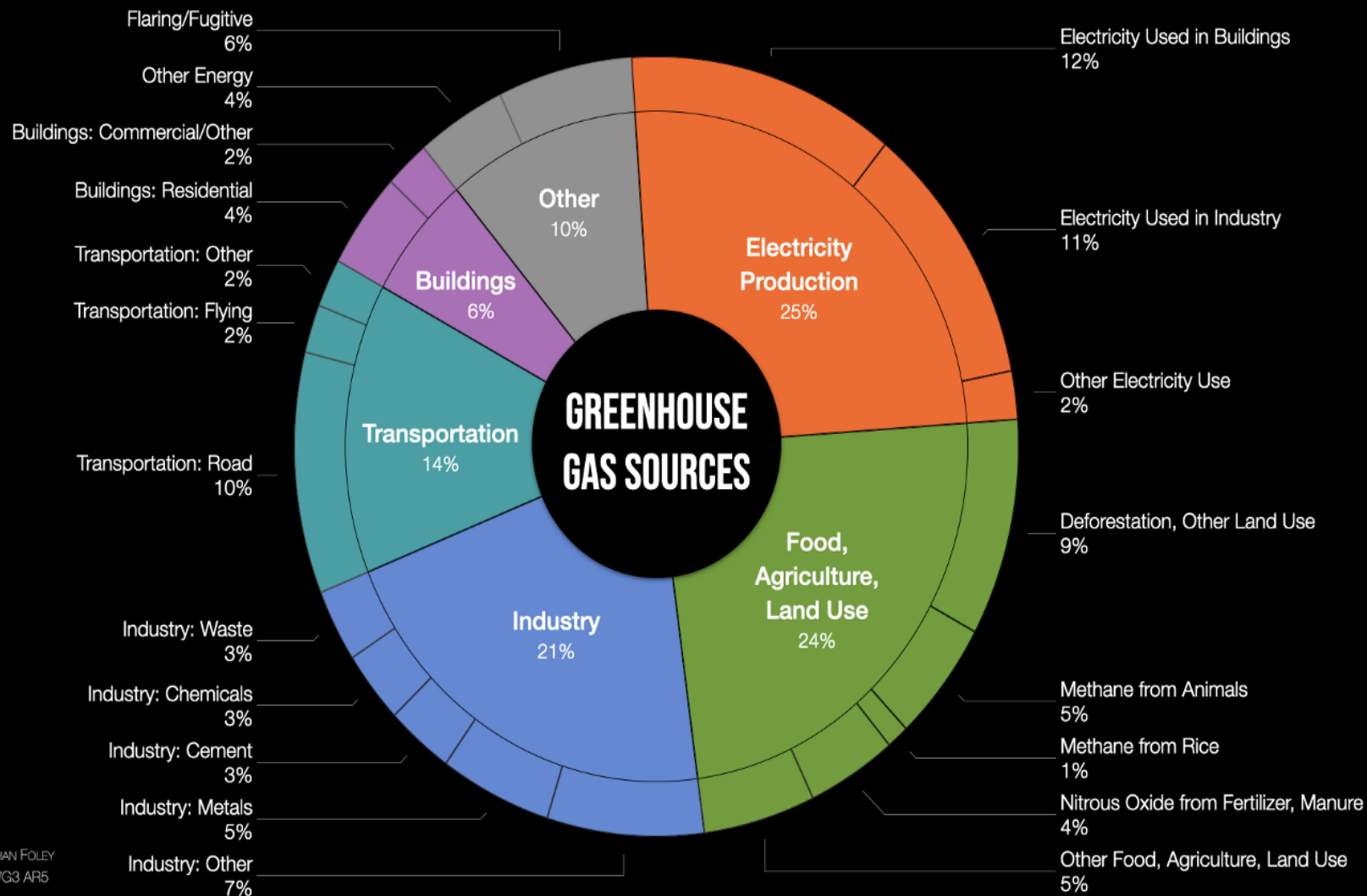
Part 2:

- What have we done on Manna Hill Estate?
- Results
- Monitoring
- Certification
- Carbon market

What's wrong with conventional agriculture?

- Diminishing biodiversity among plants and animals
- Soil, water, and air pollution
- Quickened pace of soil erosion
- Release of CO₂ from the soil to the atmosphere
- Unsustainable rates of water consumption
- Development of chronic diseases, cancers, and pathogens
- Resistance to antibiotics
- Lack of nutritional value in foods
- Increasing salinity

Greenhouse gases



- Agriculture equal largest source of greenhouse gases
- Also ~ 45% of transport emissions
- Require >10 units of energy input for every 1 unit of food energy output

Soil carbon



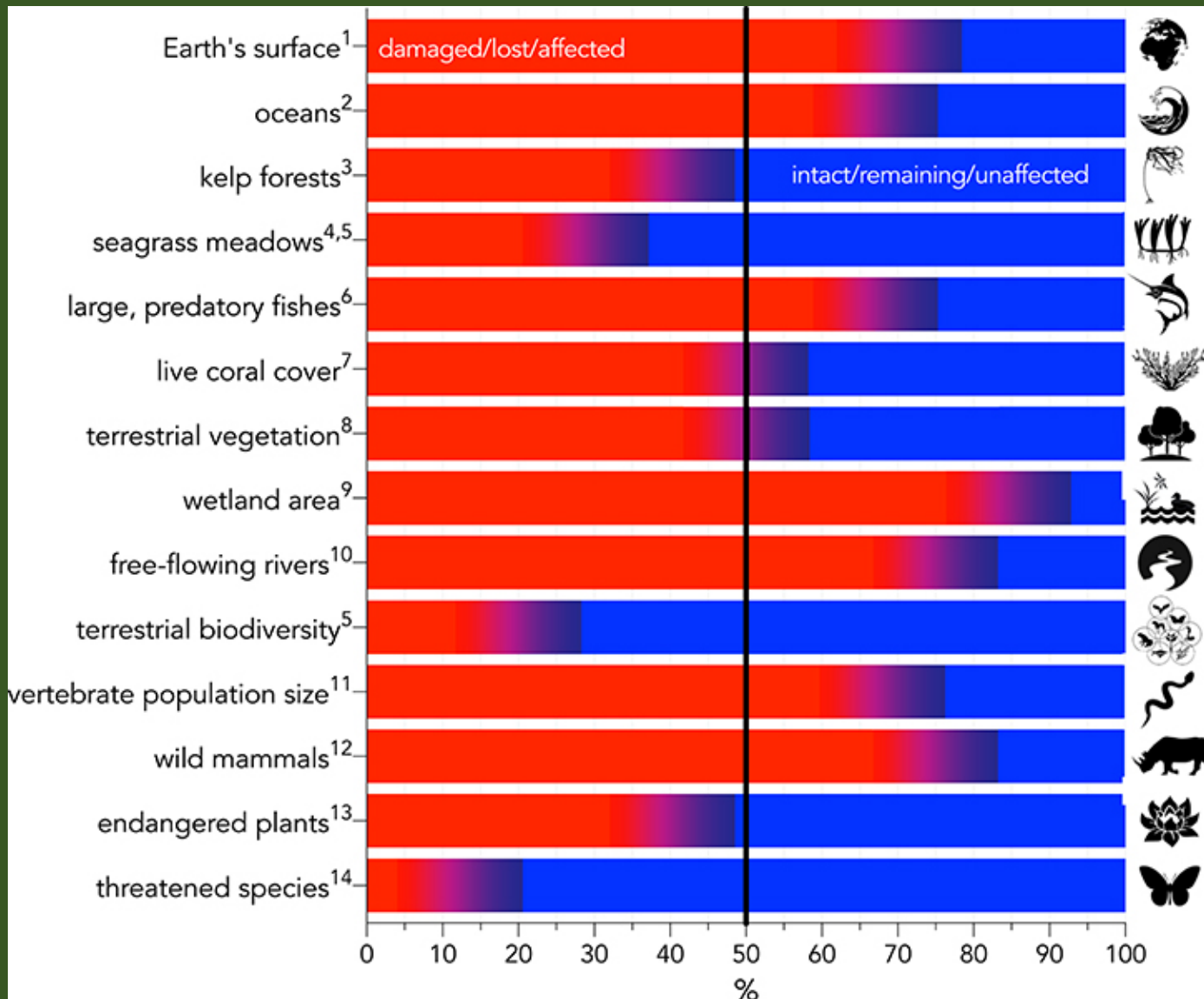
- Soil contains more carbon than all terrestrial plants and the atmosphere combined
- Farming (largely tillage) estimated to have released 133 GT of CO₂
 - ~ amount released by burning of fossil fuels since industrial revolution
- Currently agriculture emitting ~ 5GT CO₂ / yr
- Cultivated soils estimated to have lost more than 70% of their carbon

Pollution



- 30% of oceans are now HNLC (High Nutrient, Low Chlorophyll) creating dead zones.
 - Farming lead cause
- Farming used 12.5 MT of plastic
 - Another 37.3 MT used in food packaging
 - ~20% of global plastic production
 - Increasing rapidly
 - ~50% of ocean plastic is from fishing

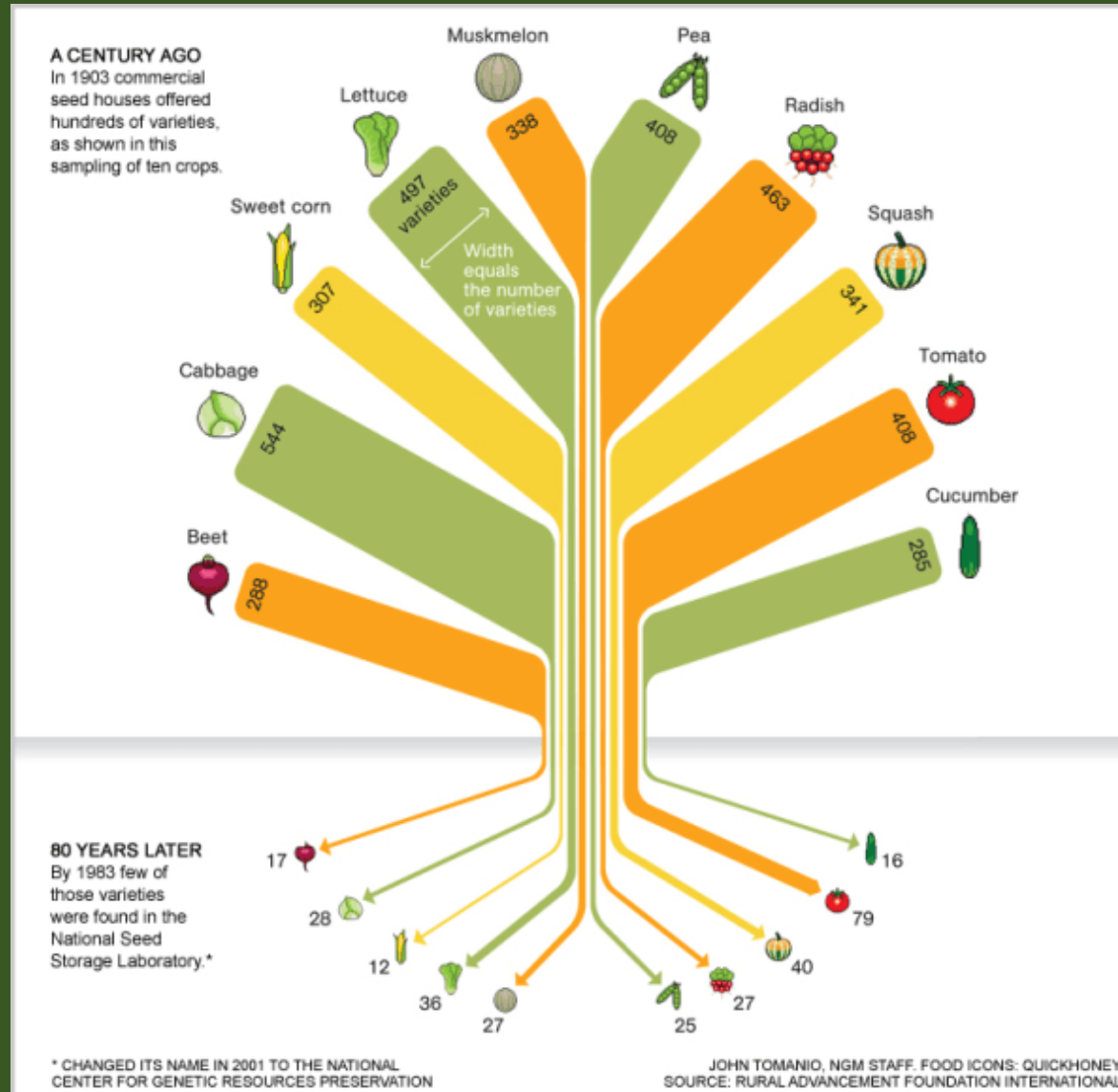
Biodiversity loss – off farm



Off farm (last 50 years):-

- Marine life > 50%
 - Large fish > 90%
- Wild mammals > 85%
- Insects >75% in last 30 years
 - Bogong moth > 99.5%

Biodiversity loss – on farm



- In 80 years we lost 93% of our seed diversity
- 90%+ of milking cows in US now have genetics from just 2 bulls
- 4 companies control 90% of global grain trade
- 3 companies control 60% of ag chemicals and seed

Soil erosion



- 10T of topsoil lost for every 1T of grain produced
- Likely insufficient topsoil to grow a crop within 50 years

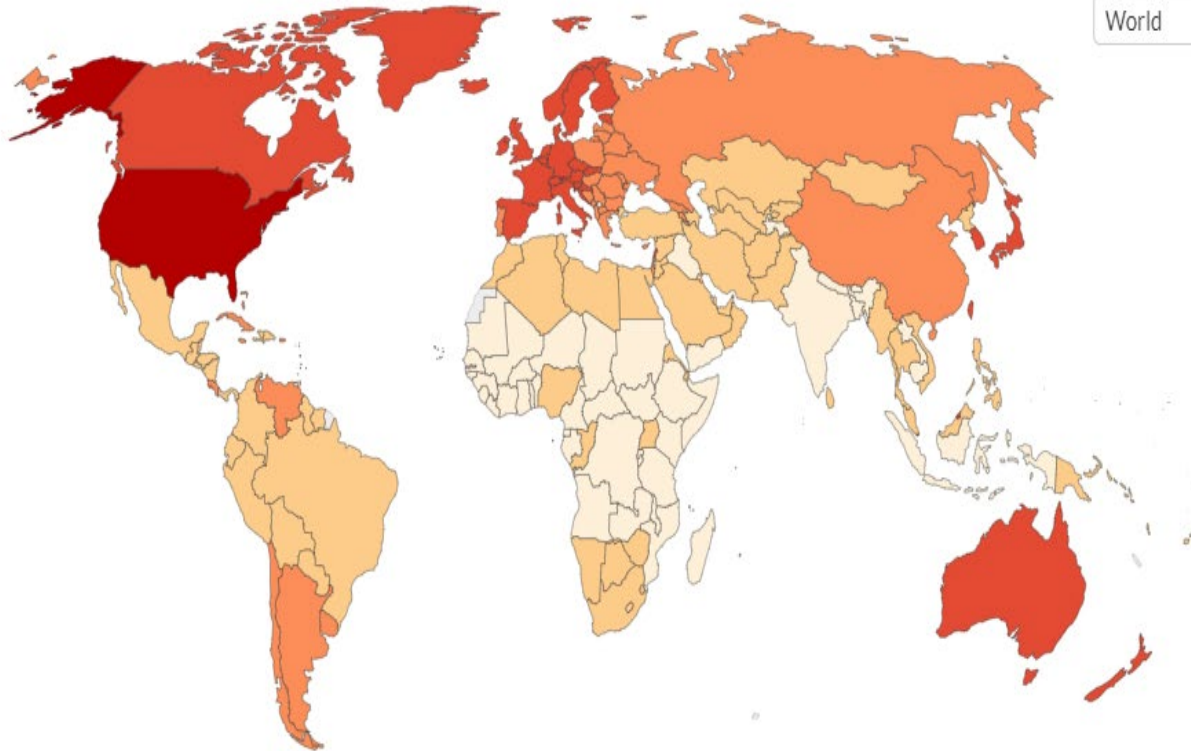
Chronic diseases, cancers, pathogens

Share of population with cancer, 2017

Share of total population with any form of cancer, measured as the age-standardized percentage. This share has been age-standardized assuming a constant age structure to compare prevalence between countries and through time.

Our World
in Data

World



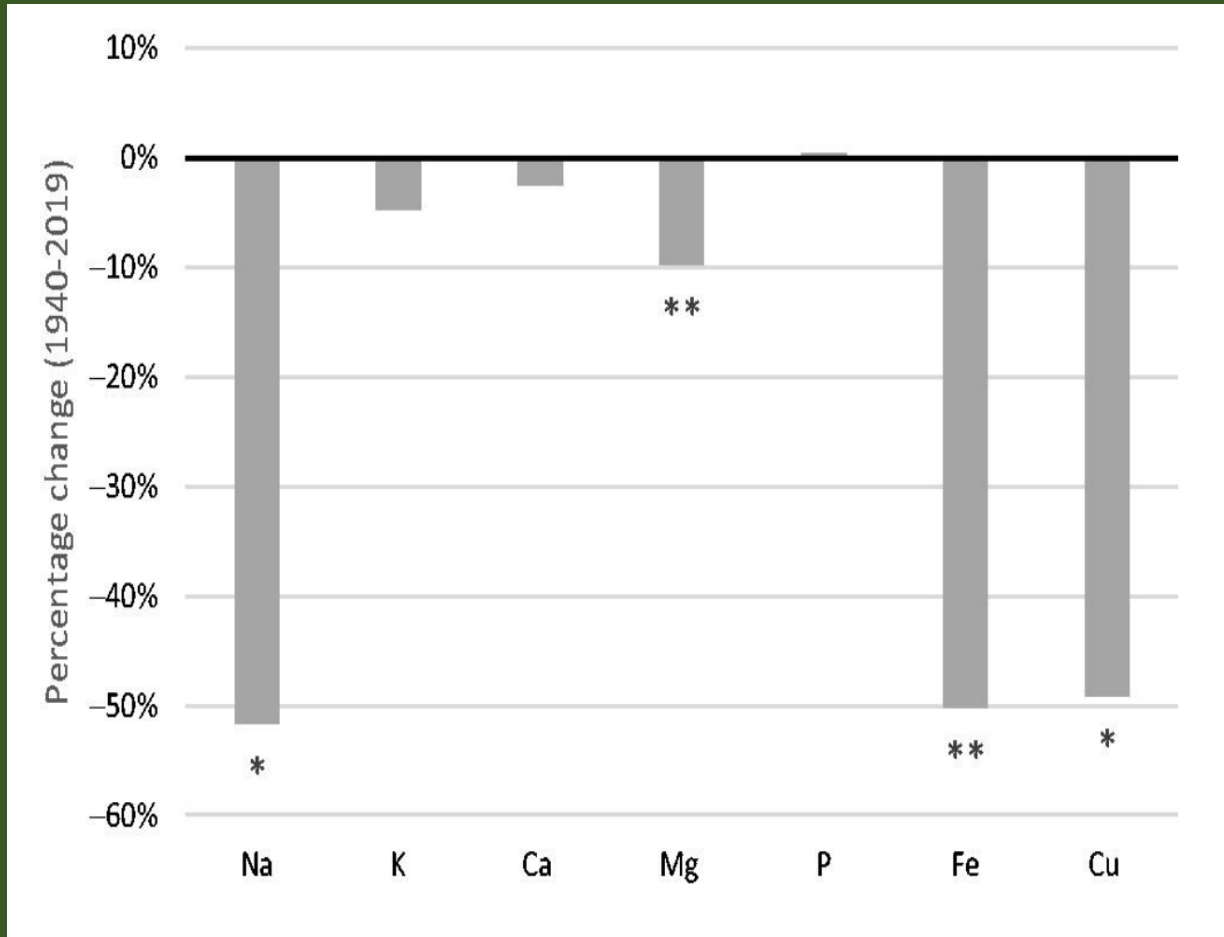
No data 0% 0.5% 1% 2% 5% 10%

Source: IHME, Global Burden of Disease

OurWorldInData.org/cancer • CC BY

- > 80% of population (US) now have detectable levels of glyphosate
- >80% of population (UK) have detectable levels of microplastics
- Closer to home....
 - Spring Creek & Lal Lal Creek flow into Lal Lal reservoir – supplies 30% of Ballarat water
 - MCPA (herbicide similar to 2,4 D)
 - Triclopyr (systemic herbicide)
 - High doses cause reproductive and developmental abnormalities

Loss of nutritional value



- Foods have lost nutritional value over time (fruits, vegetables, meat)
 - Need to eat 21 oranges today to achieve the same level of Vit A that you did in 1950
- Driven by number of factors
 - Impoverished soil
 - Higher yield
 - Longer storage
 - Higher CO2 concentrations

What is 'regenerative agriculture'

Farming in synchrony with nature to repair, rebuild, revitalize and restore ecosystem function

A holistic approach to agriculture that focuses on the interconnection of farming systems and the ecological system as a whole.

Three definitional approaches:-

1. Process based
 - Use of cover crops,
 - Integration of livestock,
 - Reducing or eliminating tillage
2. Outcome based
 - Improve soil health,
 - Sequester carbon,
 - Increase biodiversity
3. Combination of the two.

Regenerative Agriculture – 5 key practices

1. Minimize disturbance: minimize / eliminate tillage and use of chemicals
2. Keep living roots in the soil
3. Keep the soil covered
4. Integrate animals (planned grazing - AMPG)
5. Enhance biodiversity (above and below ground)

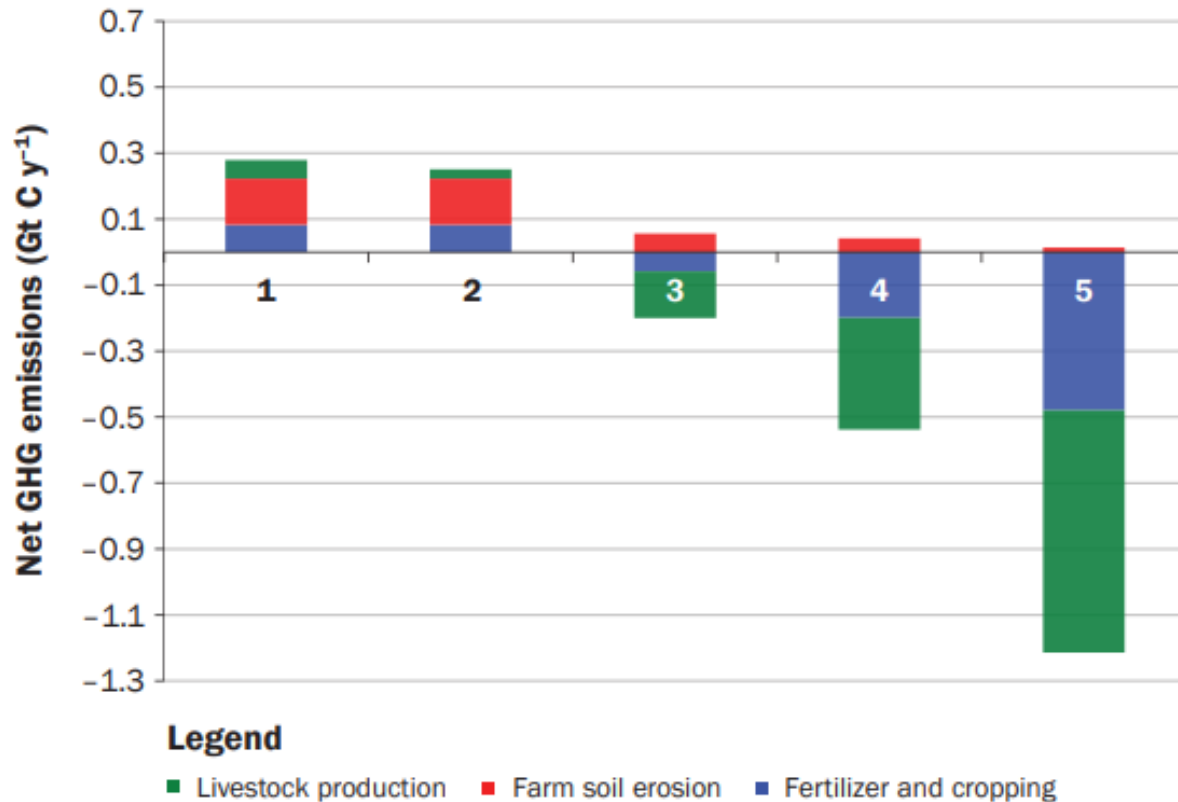
Advantages of regenerative agriculture

- Improved soil health and fertility
- Increased carbon absorption
- Better soil water holding capability
 - Greater resilience to both droughts and floods
- Enhanced biodiversity – insects, birds, bees, plant life, soil microorganisms
- Water quality & quantity
- Less chemical pollution
- More nutritious food

Advantages - increased soil carbon

Figure 2

Hypothetical North American net greenhouse gas (GHG) emission scenarios for: (1) current agriculture; (2) current agriculture with 50% current ruminants; (3) 25% conservation cropping and adaptive multipaddock (AMP) grazing with current numbers of ruminants; (4) 50% conservation cropping and AMP grazing with current numbers of ruminants; and (5) 100% conservation cropping and AMP grazing with current numbers of ruminants.



- Reduction in GHG emissions
 - 1% increase in soil carbon ~ annual global GHG emissions
- Reduces soil erosion
- Better nutrient holding capacity
- Better water holding capacity –
 - 1% increase in soil organic matter
 - Increases soil water holding capacity by ~230 kl / Ha
 - Equivalent to an extra 23 mm of rainfall

Advantages: – better water holding ability

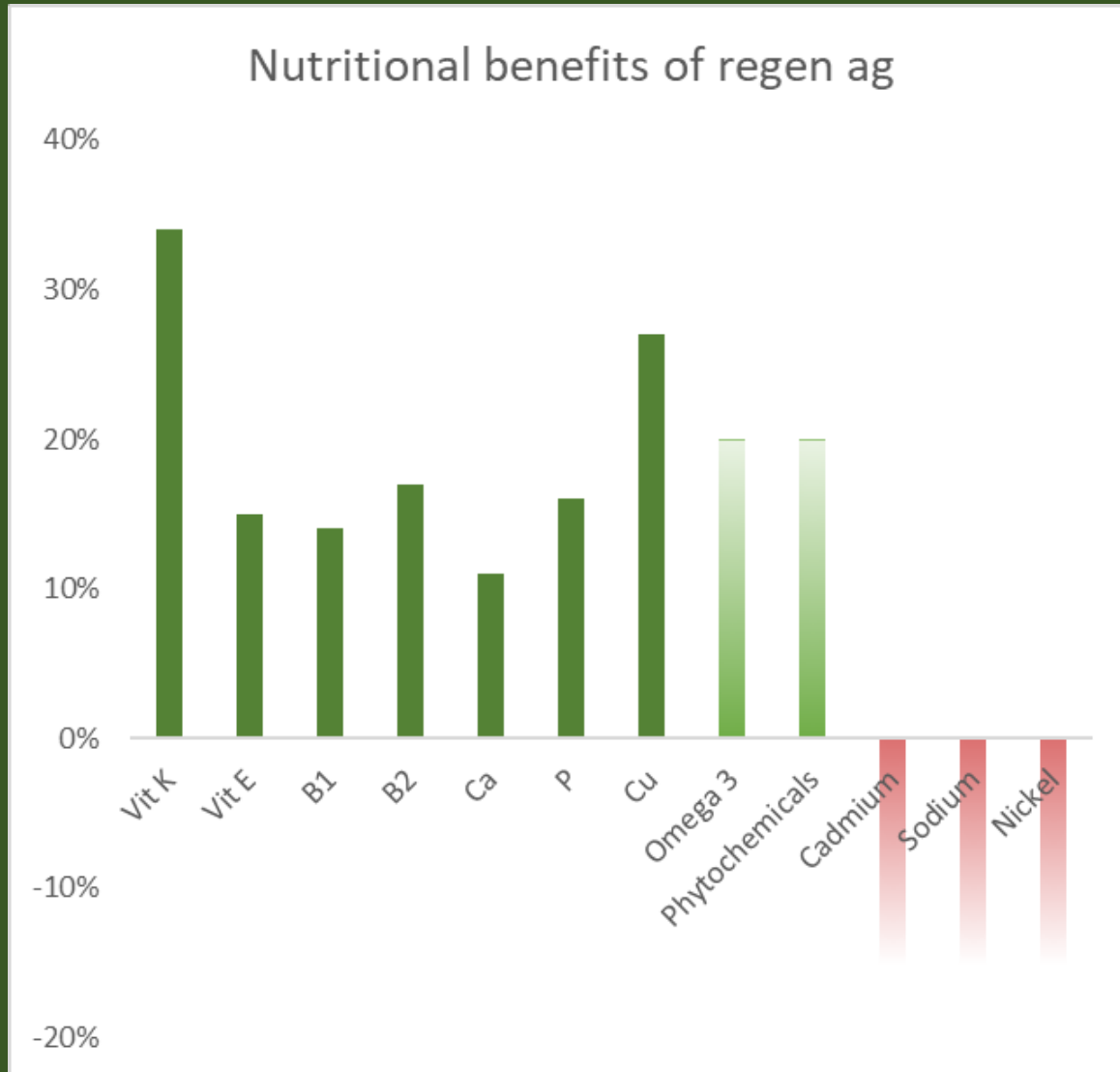
Flood



Drought



Advantages – increased nutrition



- Organic regenerative farming increases the nutritional value of food
- Increases in phytochemicals
- Increases Omega 3s in animal based foods
- Reduction in take up of heavy metals
- Elimination of herbicides, pesticides, industrial chemicals

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What have we done on Manna Hill Estate?

- Keep the soil covered
- Keep living roots in the soil
- Minimise disturbance
 - No 'cides (herbicides, pesticides, fungicides, etc)
 - No synthetic fertilisers
 - No tillage
- Enhance biodiversity
 - Multispecies cover crops
 - Multispecies shelter belts, agroforestry
 - Biochar
 - Biological products
 - Compost, compost teas / extracts (Johnson-Su)
 - Vermicast extract
 - BD500
 - Kelp, Fish Hydrolysate,
 - Other
- Integrate animals
 - Sheep

Establishing cover crops



- Currently utilising pre-mixed multispecies (14 species) cover crops
- Direct drilling into existing pasture
- Germination generally good
 - Competition can be an issue
 - Grazing by non-domesticated animals

Biochar

Why biochar?

- Enhanced soil structure
- Huge surface area and complex pore structure (a single gram can have a surface area of over 1000 m²) provides a secure habitat for micro-organisms and fungi
- Retains nutrients
- Improves soil water holding capacity (can absorb 3X its own weight of water)
- Reduces soil acidity, NO_x emissions, N leaching
- Slow decomposition rate – potentially 1000's of years



Johnson Su compost



Biological products

- 4 main types of biological products
 - Inoculants
 - Contain living microbes (eg Rhizobia, compost teas / extracts)
 - Biostimulants
 - Contain non-nutrient compounds that stimulate soil or plants
 - Seaweed, humic acid
 - Biofertilisers
 - Contain nutrients or micronutrients for plant growth (eg blood & bone, chicken manure)
 - Nutrients in biofertilisers are available in a biological form – attached to a carbon chain
 - More stable
 - Better for soil health
 - Compound biologicals
 - Provide more than one function - eg may contain beneficial microbes as well as stimulant compounds
 - Some worm liquids

Biological products



- Composts
 - Compost
 - J/S compost
 - Compost teas / extracts
 - BD500
- Biostimulants
 - Seaweed extract
 - Fish hydrolysate
 - Humic & Fulvic acid
- Fermentation cultures
 - EM
 - Bioferments
- Vermiproducts
 - Worm liquids / extracts

Spray equipment



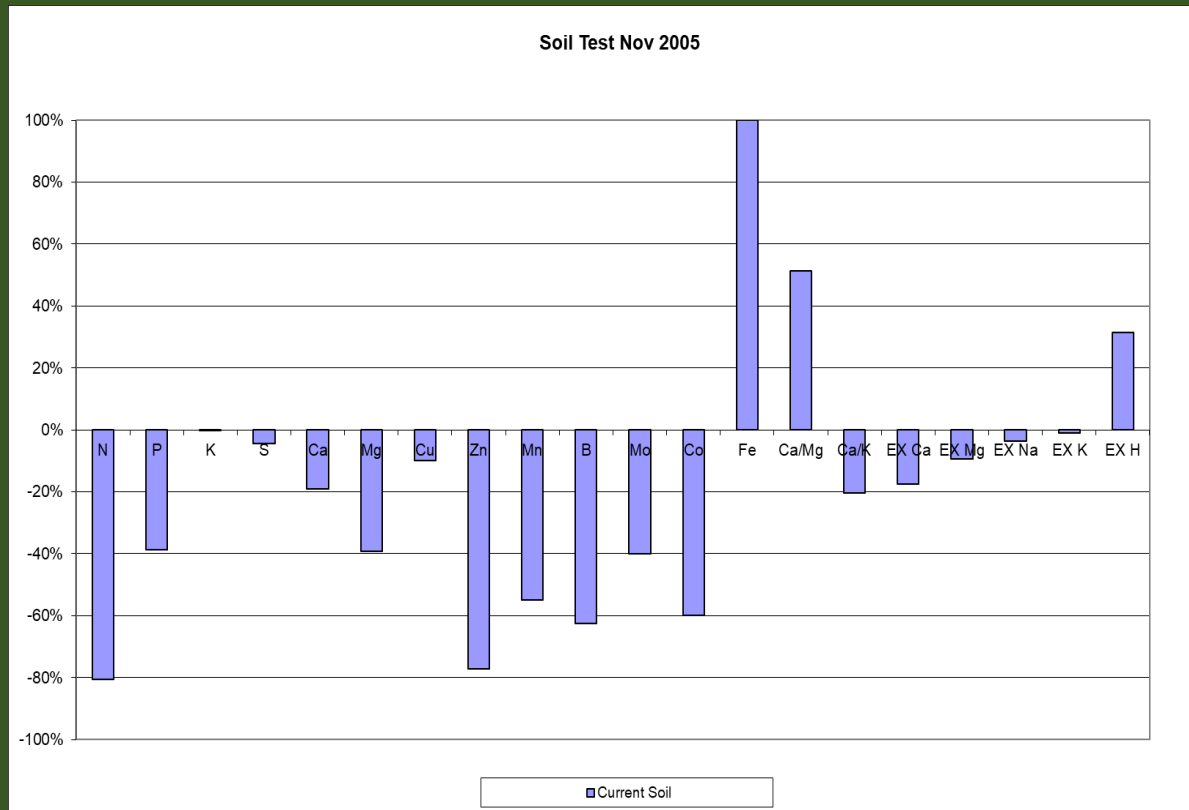
Animal integration



- AMPG
 - Dick Richardson's 'Grazing Naturally' approach
 - High density, frequent moves
 - Portable electric fencing, water
- Resource intensive
- Work in progress

Results – starting point

- Ordovician soil



- Soil pH: 4.6

- Soil organic matter: 3.9
 - Soil carbon ~2%

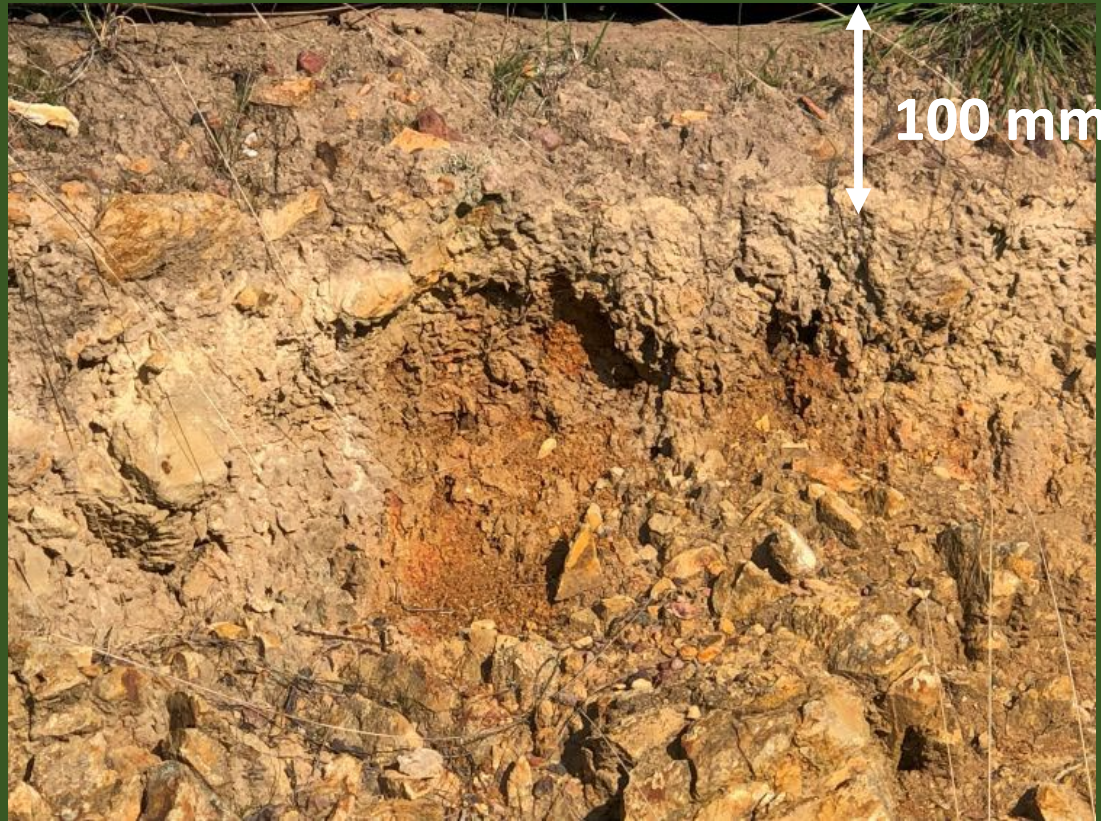
- Shallow topsoil

- Poor plant biodiversity

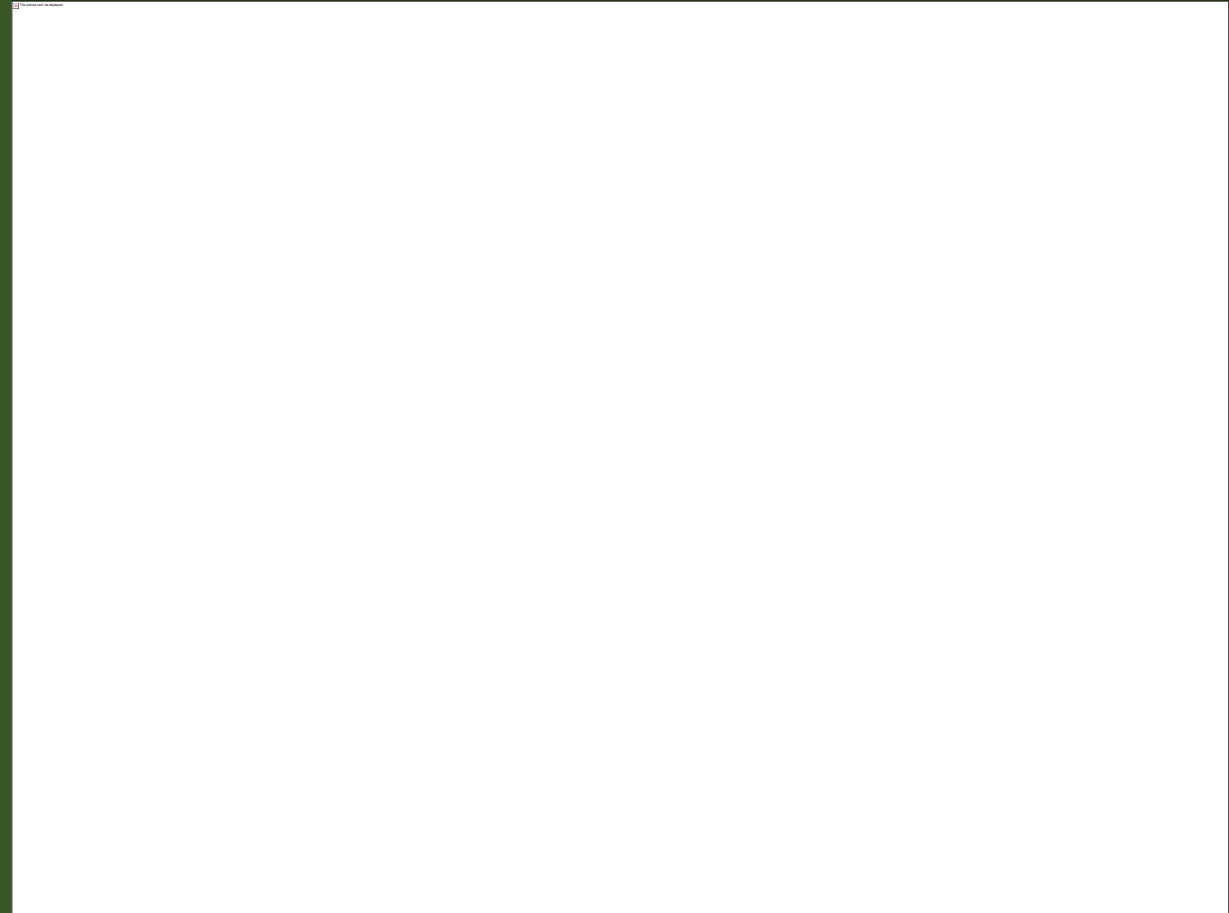
Results

- Soil pH: 4.6 → 6.8
- Soil organic matter: 3.9 → 7.8
- Depth of soil
- Ecological biodiversity
- Soil biodiversity
 - Microbiometer -Fungal to Bacteria ratio
 - DNA analysis

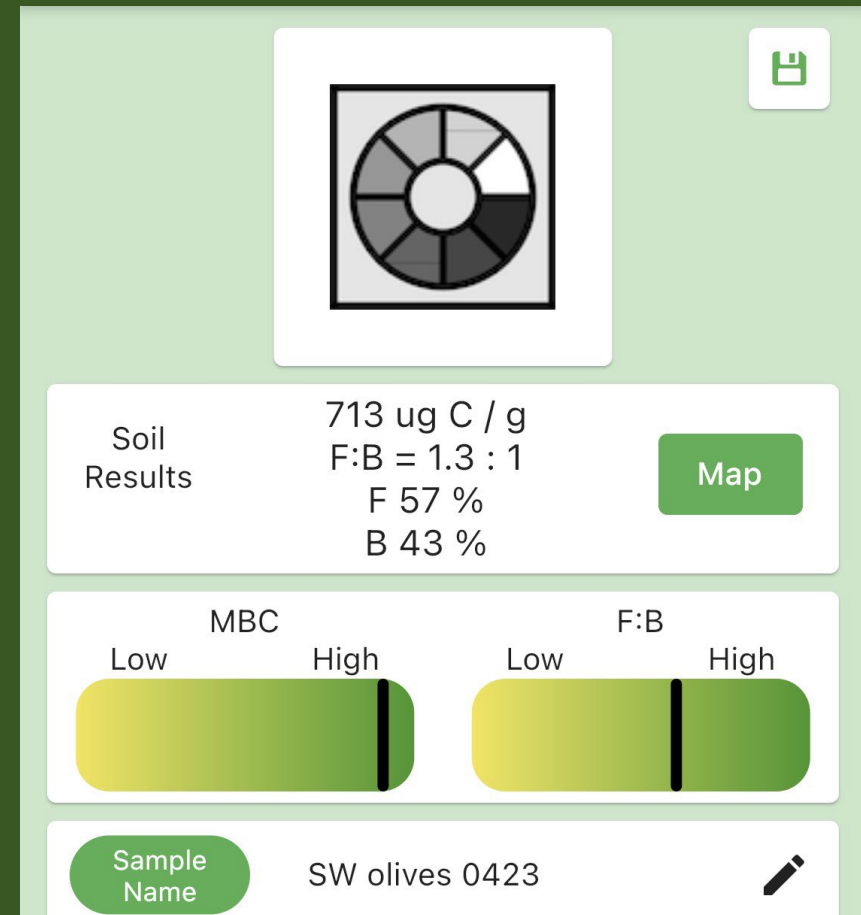
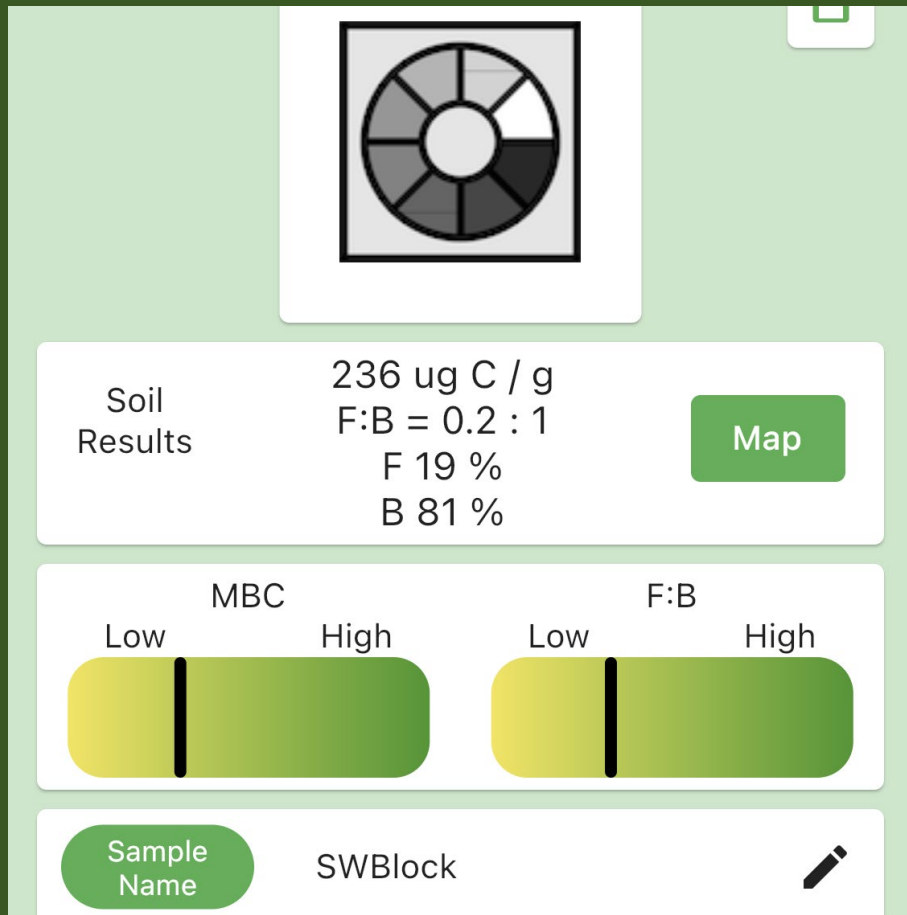
Improvements in soil depth



Improvements in biodiversity

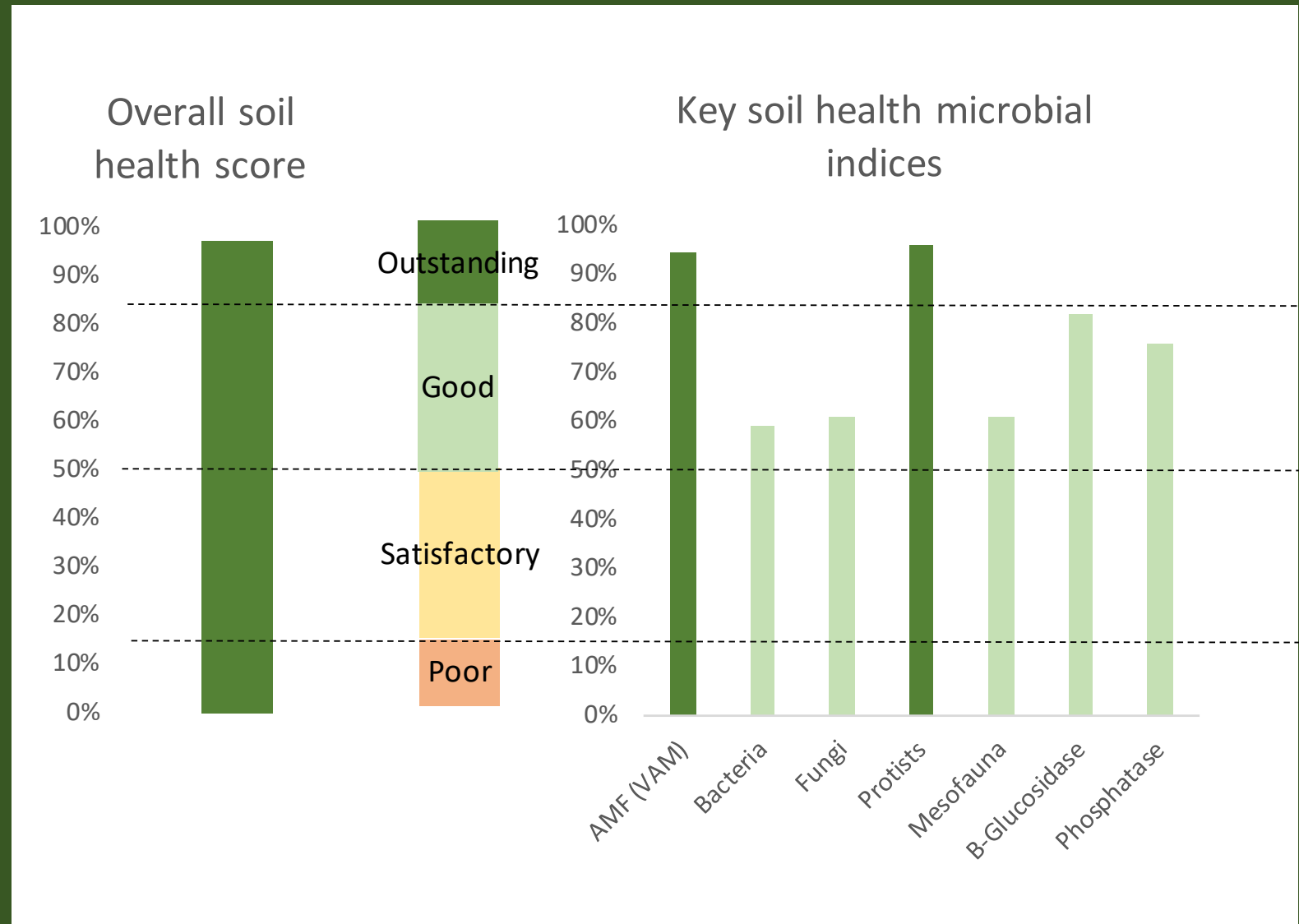


Improvements in soil microbial activity, F/B ratio



DNA analysis

- Active carbon 1281 (mg/kg)
 - >700 considered 'exceptional'
- Overall soil health score: 97%
 - > 84 considered 'exceptional'
 - 50 – 84 "Good"



Monitoring

- Soil test (biannual)
- DNA analysis (possibly annual)
- Microbiometer (Spring & Autumn)
- Soil health check (Spring & Autumn)
 - Porosity
 - Sward diversity & density
 - Macro species diversity & number
 - Smell
 - Texture

Regenerative certification (AGW)

- 1 of 79 farms in a global pilot (2020)
 - Only farm from ANZ selected
- Only certified olive grove globally
- 9 key elements
 - Soil
 - Water
 - Air
 - Livestock
 - Land use and cropping
 - Biodiversity
 - Buildings
 - Human
 - Financial
- Focus
 - Where are you now
 - Where do you need to be in 5 / 10 years
 - What are you going to do to get there
 - How will you monitor progress

Carbon market

- Potential opportunity in two areas for olive growers:-
 - Olive trees
 - Soil carbon
- Commercial traders typically looking for large opportunities
 - >500 Ha, >500 mm rainfall for soil carbon
 - Smaller groves / land holdings not of interest
- Forestry
 - Reforestation
 - Revegetation, or
 - Protecting native forest or vegetation that is at imminent risk of clearing
 - Needs to represent “additional or accretive” cuts in emissions

How does it work?

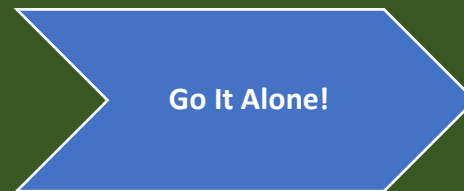
- Requires consent from person/ organisation with specific legal interest in land

- Apply
- Est. a contract
- Reporting and auditing

- Who wants them?



OR



- Developer = expensive
- DIY = lots of paperwork/reading/time

- ACCUs are a financial product
- Requires a financial service licence to buy, sell and trade in the carbon market

- Read the Clean Energy Regulator's [website](#)
- Tools like [LOOC-C](#) and the [National Stewardship Trading Platform](#) can assist in estimating carbon (use with **caution!**)

Risks

Economic/legislative:

- **Locks up land** for 25 to 100 years
- Significant **market/price uncertainty**
- **Legal obligation**/risk of paying back the CER if not meeting project obligations
 - Current ACCU scheme insurance (for sequestration projects):
 - **5%** risk-of-reversal buffer
 - **20%** permanence discount for projects 25 years or less
 - Wildfires have burned through California's 100 year carbon insurance in 10 years!
- **Changes to rules** can be applied retroactively
- By selling carbon credits you sell your rights to make claims re carbon neutrality Scope 3 emissions
- Tax implications
 - Capital Gains

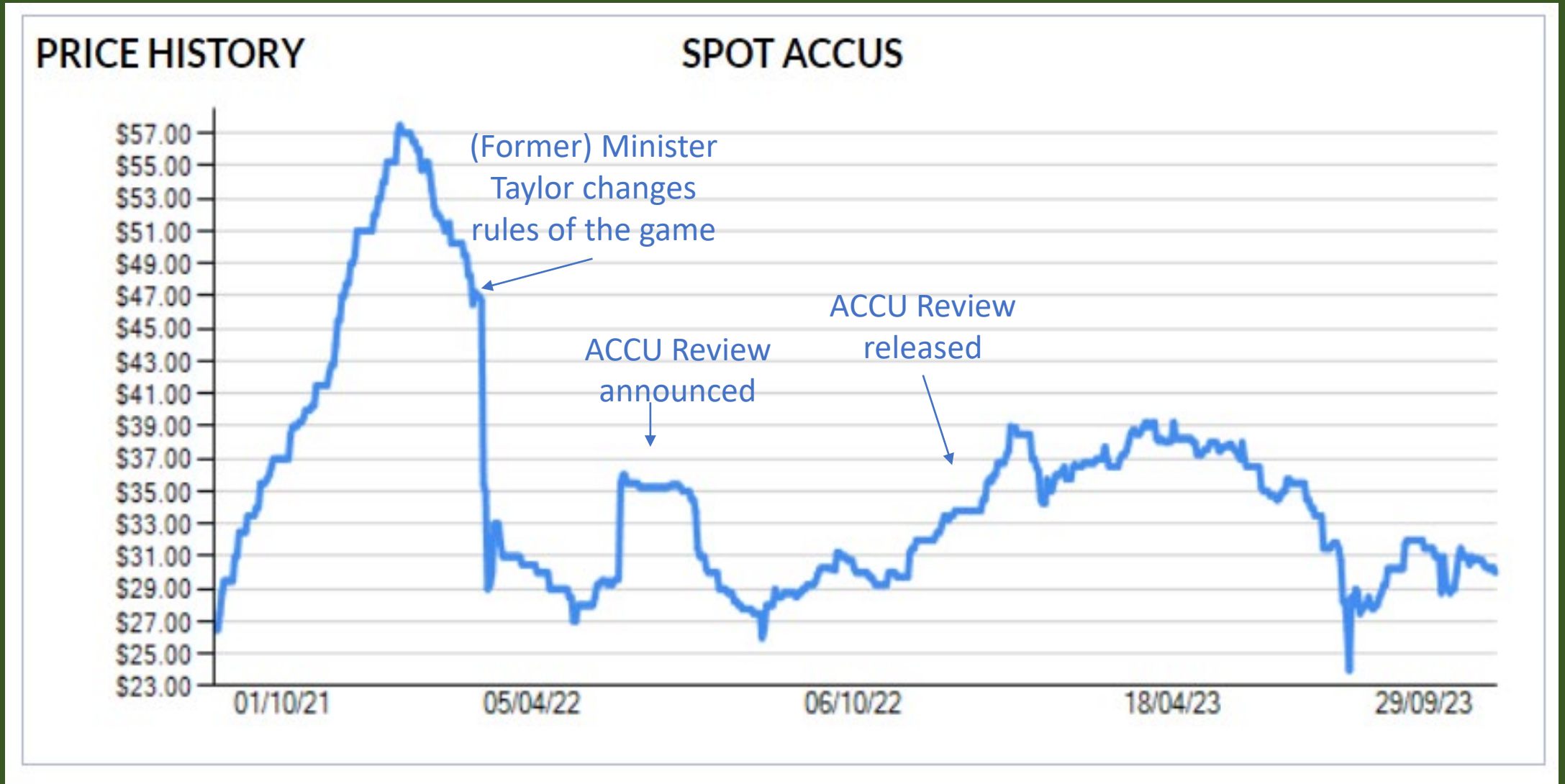
Social:

- **Restricts decisions** available to family (especially children)
- **Poor "social licence"** – carbon farming seen as "locking up land", bad neighbours

Environmental

- **Mono-culturing** (negative biodiversity impacts, increase susceptibility to pest attack)
- Vegetation projects **increase water demand**
- **Climate change** will likely negatively impact vegetation and soil carbon projects, especially in southern Australia

Pricing



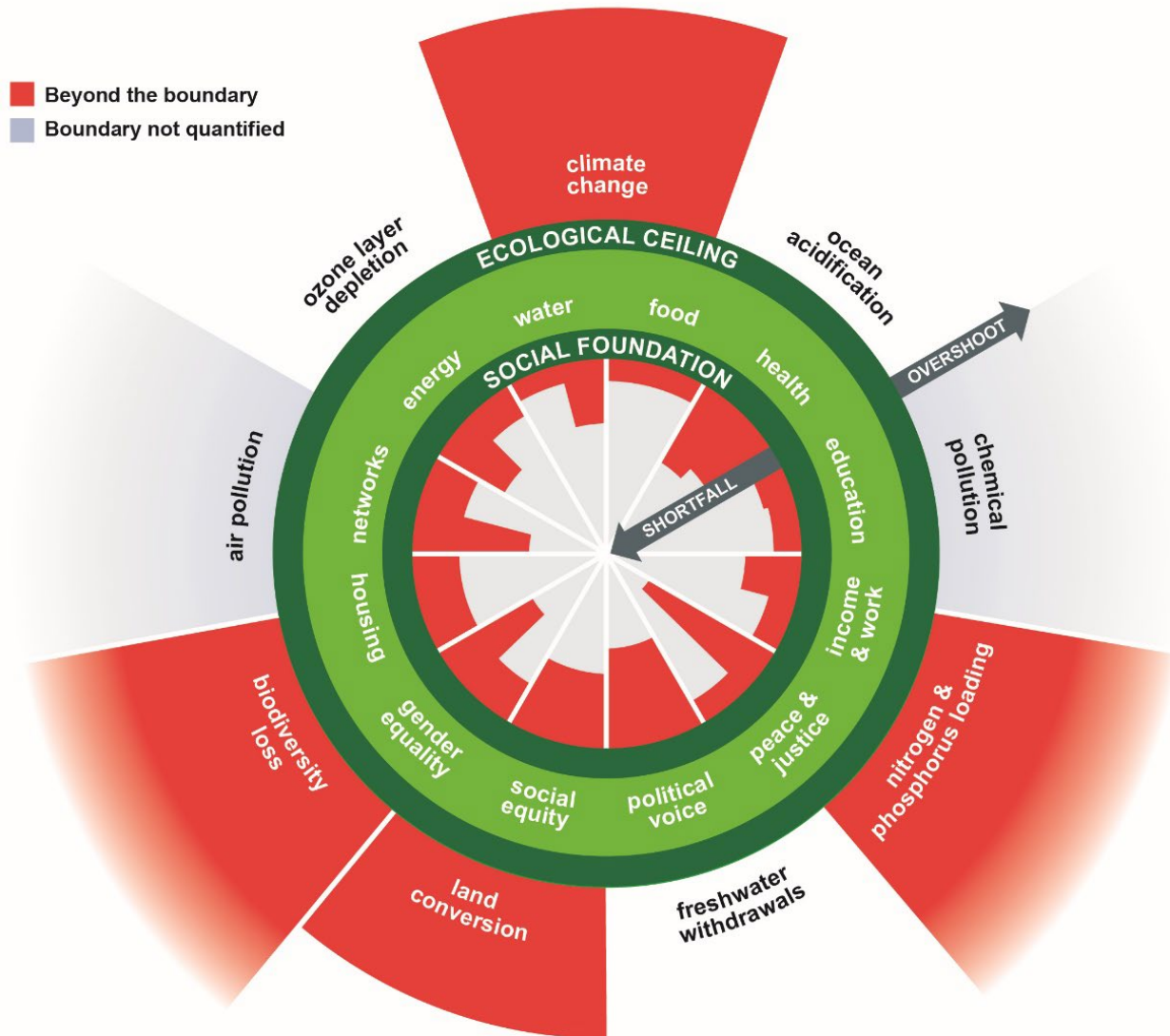
Carbon farming summary

- Participating in a carbon market can provide new income, deliver co-benefits - but tread with CAUTION!
- Although carbon farming is a climate change solution, it will still be impacted by a changing climate (so adapt)
- You don't have to participate in the carbon market to reap the benefits of carbon farming

Q & A

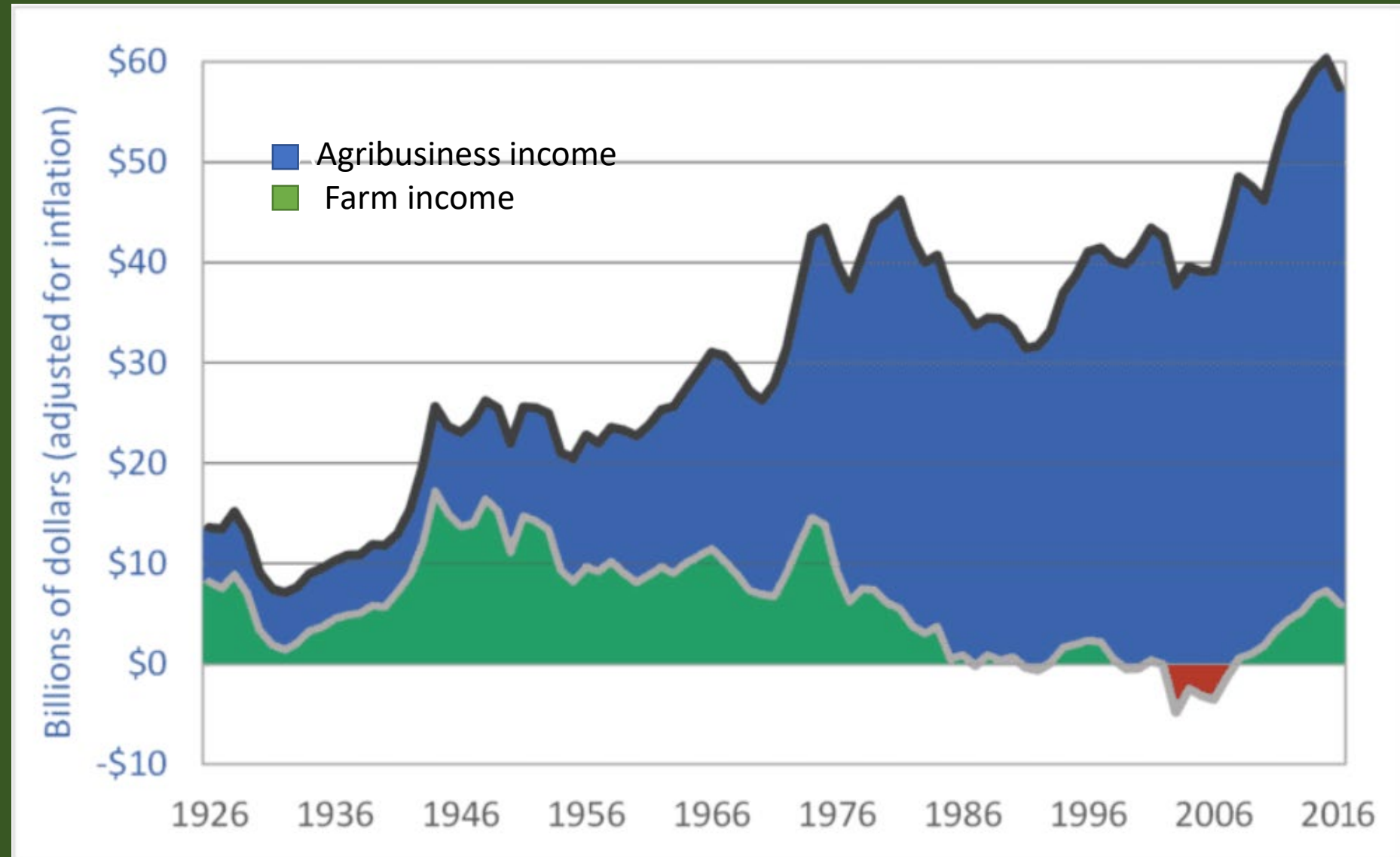
Backup

Current issues – holistic approach



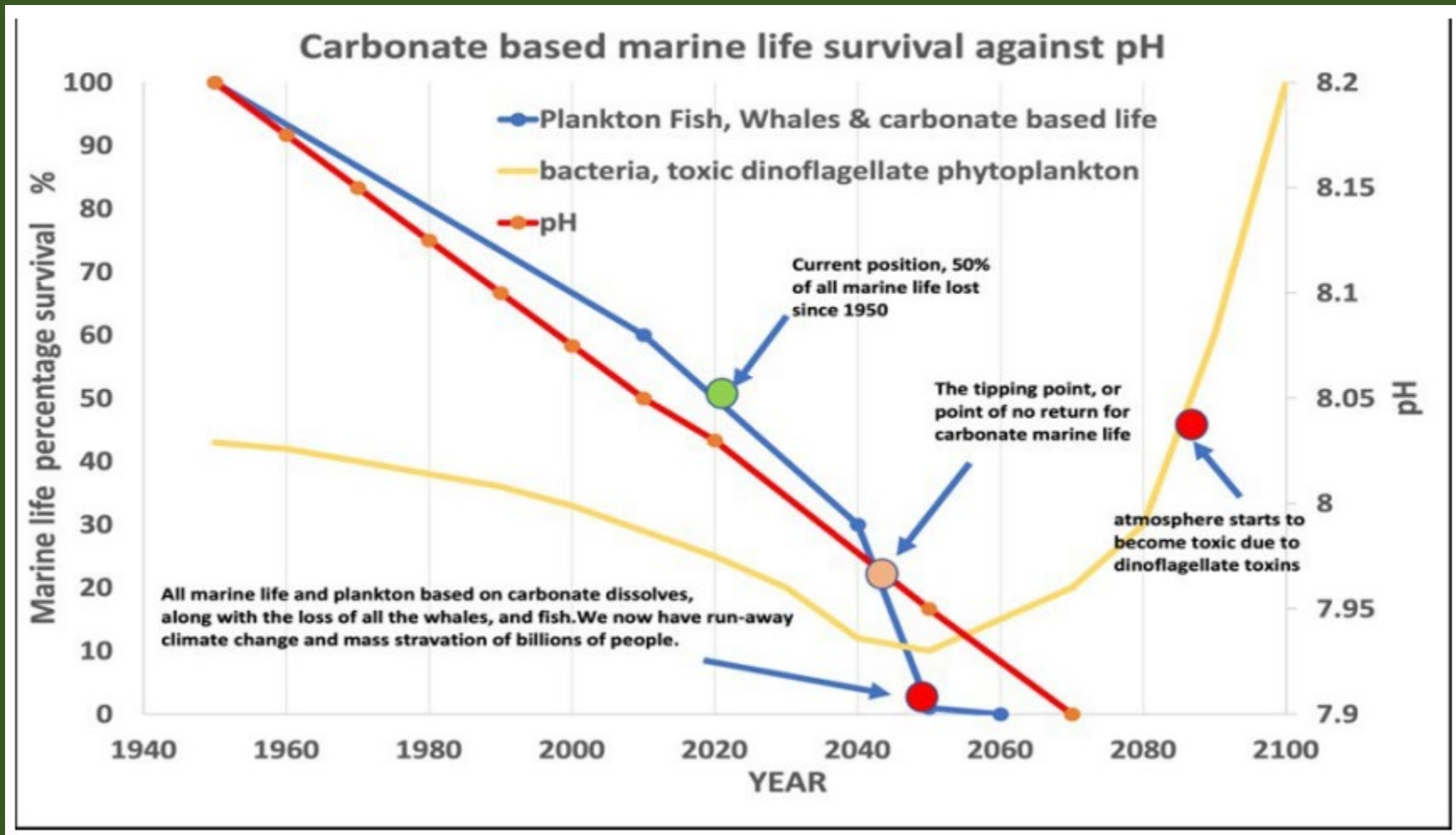
- Climate change
- Ocean acidification
- Chemical pollution
- Nitrogen and phosphorous loading
- Freshwater
- Land conversion
- Biodiversity loss
- Air pollution
- Ozone layer depletion

Farm income – who gets what?

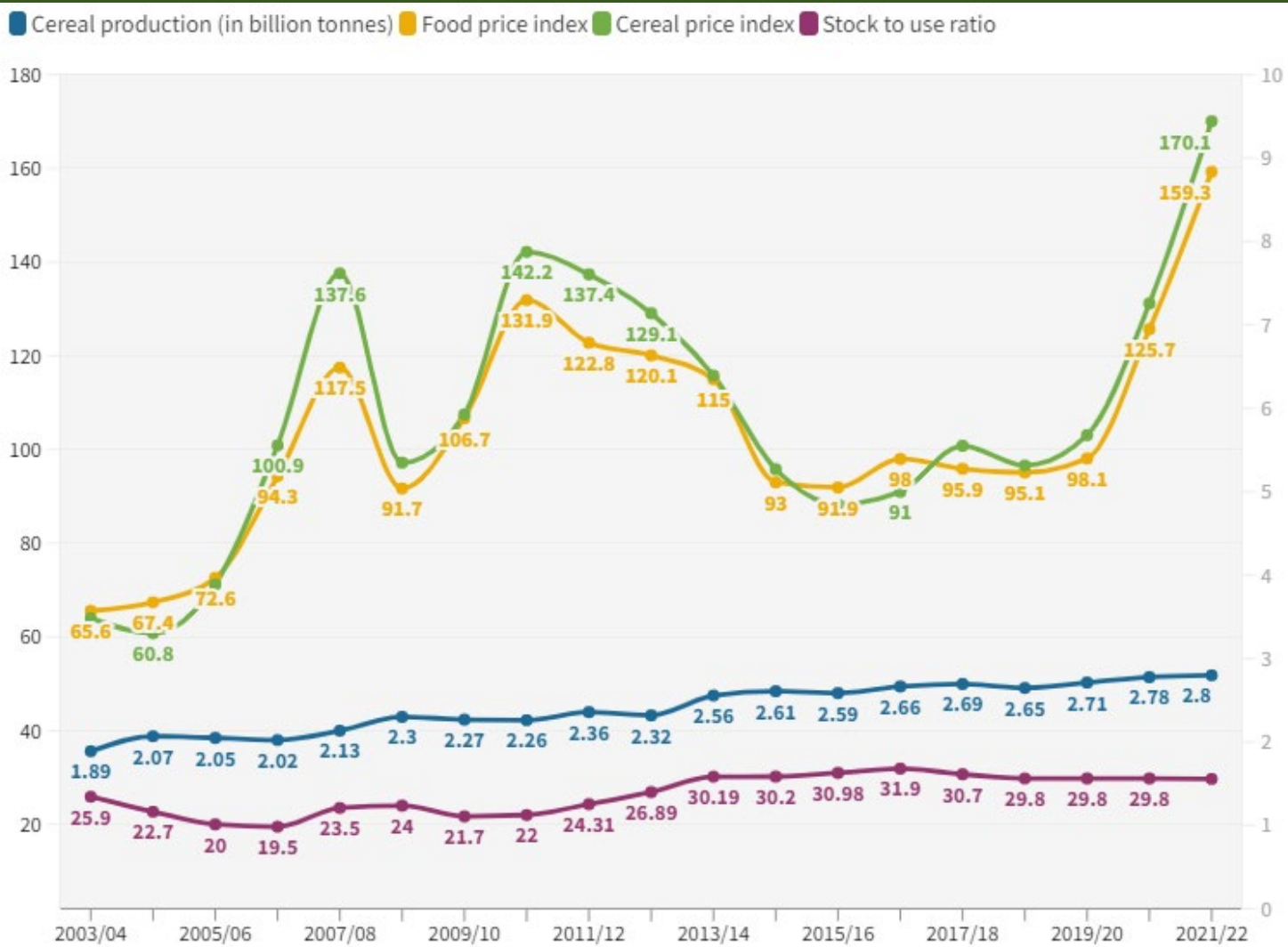


Canadian net farm income and gross revenue, inflation adjusted, net of government payments, 1926–2016.

Impact of ocean acidification



Grain price versus supply and demand



Source: [FAO](#), [FAO](#) • Data for 2021/22 are estimates

What can you do?

- You get to choose what sort of world you want
 - Vote 3 times / day!
- Buy SOUL food
 - Seasonal
 - Organic – regenerative
 - Avoid fish, grain-fed / intensive animal products
 - Unprocessed
 - Local
- Avoid plastic – particularly packaging, chemical use (household & garden products)

Loss of food nutrition

