

Food Security in Challenging Times

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FOOD SECURITY



From Excess to Enough

Background

Earth's Story in One Year **Ch 11**

4.5 billion yrs ago, Jan. 1 Earth forms

3.9 bil yrs ago, Feb. 18 **Photosynthetic** bacteria

2.5 bil yrs ago, June 11 O₂ and ozone

600 million yrs ago, Nov 12 Multicellular
organisms, animals

440 mil yrs ago, Nov 25 Plants emerge from sea

145 mil yrs ago, Dec 19 Dinosaurs thrive



67 mil yrs ago, Dec 25, 10:30 am – Extinctions,
including dinosaurs Ch 11

65 mil yrs ago, Dec 25, 5:30 pm – Cenozoic era
of creativity

200,000 yrs ago, Dec 31, 11:37 pm Homo sapiens





10,000 yrs ago, Dec 31, 23:58:50 or 70 seconds
before midnight – **Agriculture**

Ch 11

100 yrs ago – Dec 31, 23:59:59, 0.7 seconds before
midnight – Modern Ag, a blink in time

Modern ag part of Earth's self-regulating biology



Ch 3 Photo: doubleportioninheritance.blogspot.com

Geological Impact of Humans Ch 11



Has the Holocene epoch already become the Anthropocene?



Thomas Berry

Do we continue to set our course for the **Technozoic** or go the other way to the path of the **Ecozoic**?

Era	Period	Epoch	Time Scale
			Present
CENOZOIC	QUATERNARY	HOLOCENE	10,000 years ago
		PLEISTOCENE (ICE AGE)	1.8 million years ago
	TERTIARY	PLIOCENE	5.3 million years ago
		MIOCENE	23.8 million years ago
			33.7 million years ago
		OLIGOCENE	54.8 million years ago
		EOCENE	65 million years ago
		PALEOCENE	

For over 90% of our existence,
humans lived in egalitarian societies

...

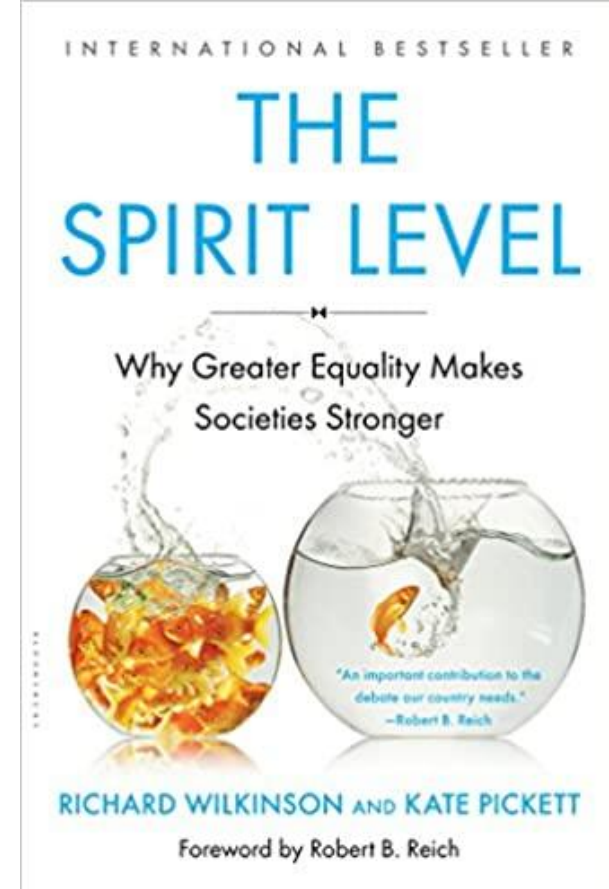
Modern inequality arose and spread
with the development of agriculture

Ch 4



“I have it and you don’t”

[Photo of gannet in Guardian](#)



Disasters occur when Hazards meet Vulnerability – Recognize human-made components of hazards and vulnerabilities (due to inequality)

Haber-Bosch Synthetic N Fertilizer Ch 8



Fritz Haber – in 1908 filed patent on the “synthesis of ammonia from its elements.” Awarded Nobel Prize in Chemistry in 1918.



Carl Bosch – from 1909 to 1913, scaled up synthetic N fixation with **high energy input** for high gas pressures at high temperatures in industrial N production.

WWII - 19.5 mil military deaths; 20 mil died from **starvation**.

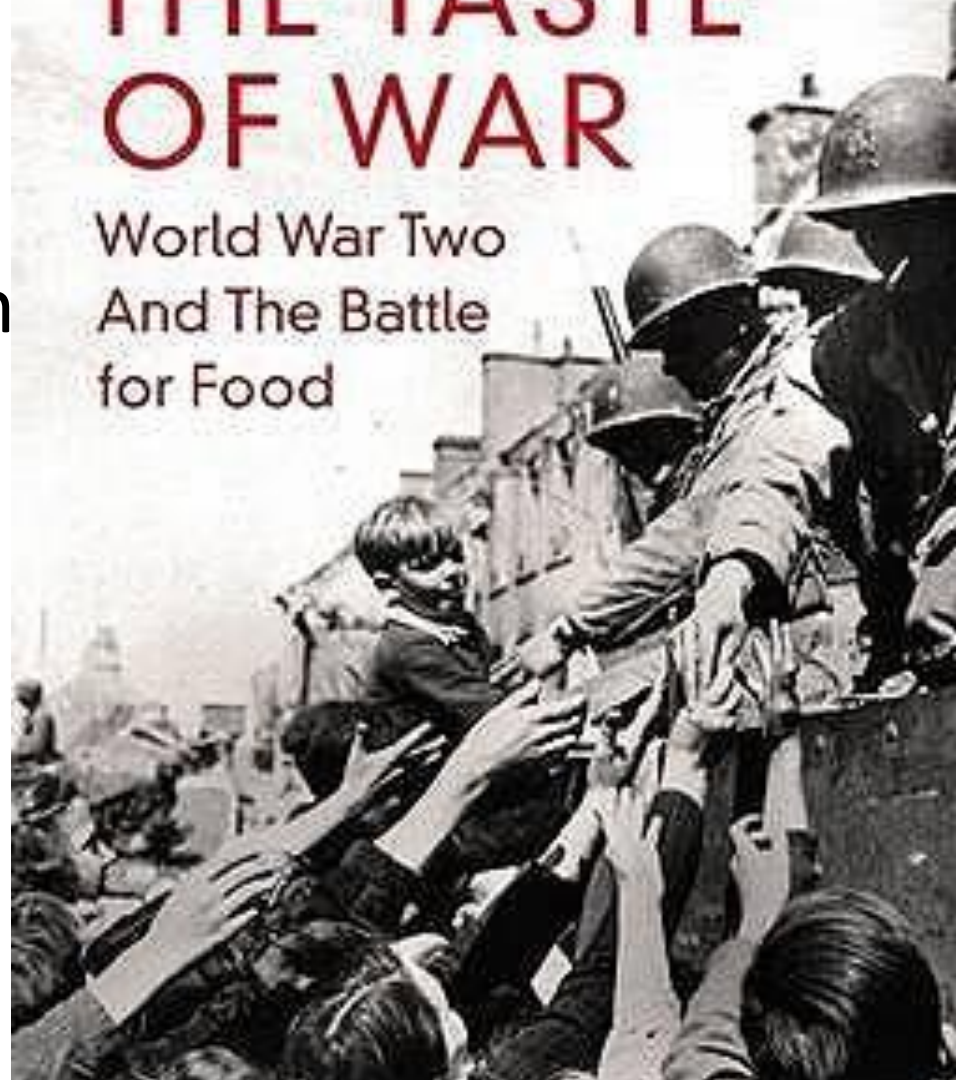
Nazi goal was '*Lebensraum*' **and** to eliminate useless eaters in East, i.e. Soviet and Polish Jews.

Most of 1 mil German prisoners of Soviets died of **starvation**.

Concl. Ch

LIZZIE COLLINGHAM **THE TASTE OF WAR**

World War Two
And The Battle
for Food



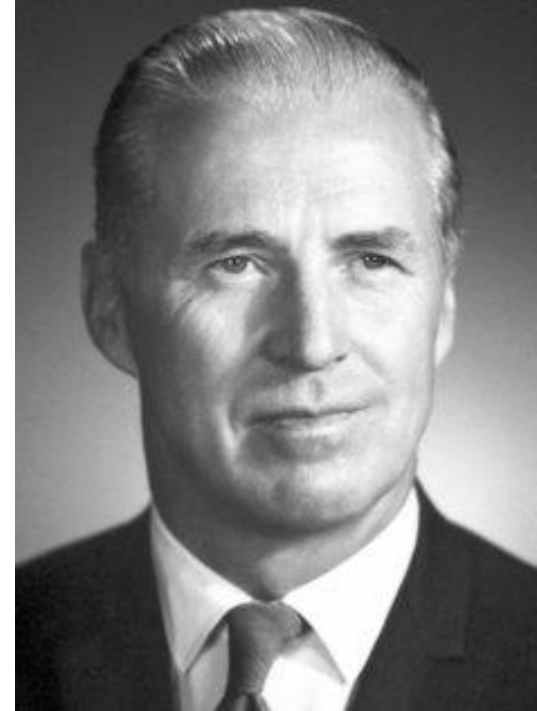
Excess Food

1960's Green Revolution - plant breeder, Norman Borlag, allowed more N to be applied to cereal crops with less stem growth and thus less lodging. More N went to grain and thus higher grain yield.

He also won Nobel prize.

As N fertilizer increased, energy for ag increased, grain yields increased, human pop'n increased.

Ch 8



Dwarf wheat variety. [Photo](#) credit

Between 1961 and 2014 the world's production of cereals rose by 280%. This is twice the increase in the global population during that period (136%). **Ch 3**



Photo by
John
Glover

Mass death by hunger – In 1920s, rate was 82 per 100,000 people; 1930s was 56, 1940s was 79, 1950s was 32, 1960s was 50, 1970s was 8.4, and recently at < 1 .

Mainstream Ag Goal; More and More

8.2 bil people today; by 2050 expect **9 - 10**
billion people (<25 % increase)

*“By 2050, must increase ‘food’ production by **70 – 100%** - in developing countries, average incomes will rise; thus more meat consumption.”*

Intro Ch.



“Farmers produce so much more, with long-distance trade easier ... system based on ever-productive specialized regions shipping food everywhere ... miraculous in so many ways, also needs **cheap energy** for fertilizer, tractors, irrigation, and fleets of trucks, planes and ships, all over the world.” Evan Fraser

Ch 3



Production > Food Sales > Consumption **Ch 3**

Sustaining Sufficient Production =
Adequate, Healthy Consumption (food and
medicine)



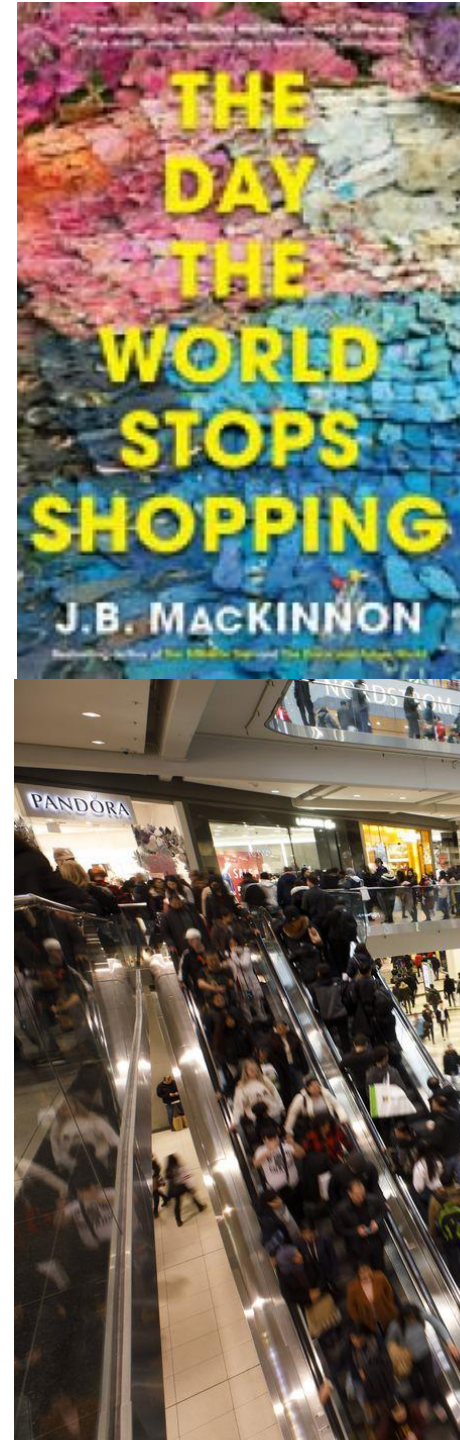
Photo by J Ball

UN panel – Overconsumption
surpassed overpopulation as the
greatest driver of our eco-crises,
about 2000.

Avg person in a rich country now
consumes **13x** as much as avg person
in poor country

Need **more than four Earths** if
everyone lived like avg Canadian. Ch 4

Consume Like Your Kids Live Here



“Inheritance in India follows gender. Women grow up to 80% of India's food, but only own 11% of its farmland.”

Empower small farmers, especially women, with education and secure tenure of land they farm **Ch 6**





“There are more people who suffer illnesses from overeating than those who suffer from not getting enough food.”

Intro Ch

Too Much Unhealthy Food Ch 5

- Two-thirds of health-care costs can now be attributed to chronic diseases associated with unhealthy eating



[Dube et al. 2009](#). Building Convergence: Toward an Integrated Health & Agri-Food Strategy for Canada.

Livestock Tail Wagging Entire Food System

1.4 bil cattle, 0.9 bil pigs and 24 bil chickens require **feed**. Furthermore,
i) often fed **food**
ii) release methane



Photos by K Lightburn

From 2015 to 2021, global meat
production rose 9%; dairy
production increased 13%

Photo: <https://bit.ly/3wlOp22>



Ch 7



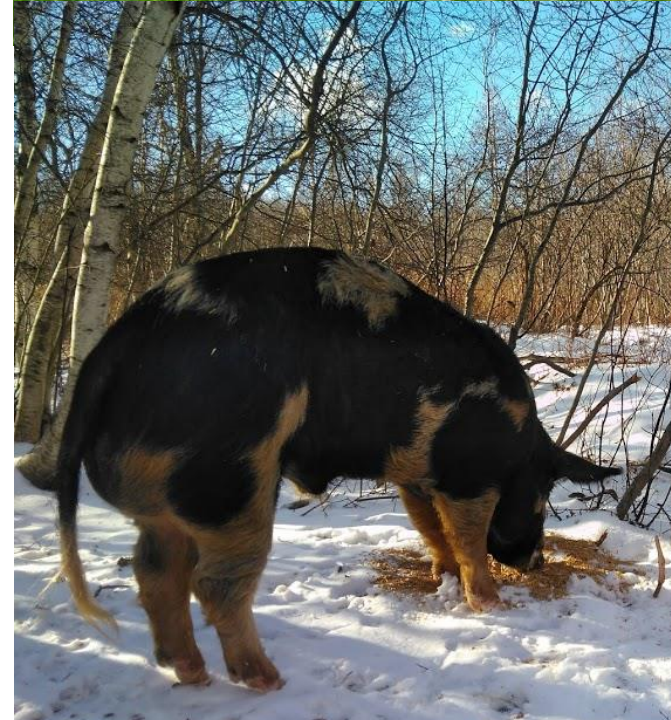
i) Livestock consume **forages** and **feed**

ii) **Feed** = failed food crops, crop residue, by-products & *'unavoidably wasted food'*..

Ontario uses 40% more crop land for **feed** than necessary. That 40% could instead grow **food**, while having sufficient animal protein for an adequate human diet, according to the Canada Food Guide. [Wyngaarden et al. 2020](#) Ch. 7



Photos by J. Duynisveld



Biodiversity in Ag?

- 350,000 plant species, 195,000 flowering plants, most have edible parts useful to humans.
< 300 plant species for food;
only 17 species (0.009% of 195,000) provide 90% of human food.
- 3 species (corn, rice and wheat) are > 50% of all food crops.



In 40 years, fertilizer N, P and K use increased **5 to 7x** , while global food production increased **2x**
([Hirel et al.](#) 2007) **Ch 8**



Photo by K. Lightburn

Eating Fossil Fuels? Ch 8

About **48%** of people today depend directly on the Haber-Bosch process for basic food
N fertilizer is 30 – 50% of global ag energy use



[Woods et al et al. 2010.](#)



U of Guelph

Wasted Food Audit

- Unavoidable (36%) – not edible under normal circumstances (e.g. apple cores, melon rinds)
- Avoidable (53%) – thrown away prior to disposal and still edible (e.g. heel of bread, half summer sausage) + 11% possibly avoidable
- **\$58 Billion** - value of wasted food in Canada and 46.5% of all food in Canada is wasted.

[Nikkel, Gooch et al. 2024.](#)

Ch 6



Wasted Food Curbside Data

- Total wasted food per household per day = 500 g.
By extrapolation, total wasted food per household per yr = 182.5 kg, and if the 12 mil households in Canada are similar, then about 2.2 mil tonnes of food is wasted each year
- Total wasted vegetable and fruit waste per household per day = 270 g or 53% of wasted food

Ch 6



Not Enough Food



In [Gaza](#), a Palestinian girl holds a piece of bread in Rafah refugee camp after Israeli strikes.
Photograph: Mohammed Abed/AFP/Getty



[Weight-loss drugs](#) could bolster US GDP (\$27 tril) by 0.4% with 30 million users, rise to 1% with 60 million users.
Guardian, Feb 22-24

A farmer, Abdalla was forced to leave his lands because of the conflict and failed crops. Across Sudan, fierce fighting has devastated agricultural production. In some areas yield reductions of up to 80%. Nationwide, cereal production plummeted by 46%. **Concl Ch**



U.S. food industry **targets \$2 billion/yr to market to children**; 73% promotes food and beverages high in sugars and fats, yet low in recommended nutrients.

Ch 5

<http://foodtank.com/>

Annual global spending on soft drinks is \$200 – 400 billion. **Food?**
Where should we aim?



[Photo](#) in Guardian

The Kids are Not Alright Ch 5

Heart and Stroke Fndn



Canadian children & youth spend 8 hrs /d on screens and view > 25 million food and beverage ads; > 90% for unhealthy foods. Before age 5, most children not distinguish ads from unbiased programming.

Industry should pick on someone its own age

Annual Health Care Costs (AHCC) in contrast to **Food-Secure Households**

[Tarasuk et al. 2015](#). CMAJ. Ch 5

- Marginal food insecurity, AHCC 23% higher
- Moderate food insecurity, AHCC 49% higher
- Severe food insecurity, AHCC 121% higher



Food insecurity is caused by **poverty**; not lack of food

Land and Money



Photo by Terry Tindall

Smallholder farms produce 80% of world's food supply with only 12% of arable land. **Ch 10**

1% of world's farms control 70% of world's farmlands. Bill Gates is biggest private owner of farmland in US

Increasing Risk of Killing Goose That Lays Golden Eggs



“Canadian farmers are price-takers trapped in the middle of a U-shaped power asymmetry between the companies from which they buy inputs and the companies to whom they sell their products.” Ch 2



Farm equipment sales are now dominated by three giant corporations



JBS packing plant in Brooks. 99% federally inspected beef, controlled by JBS and Cargill

On Ontario farmland:

- 1) SOM levels are now decreasing on 82% of fields
- 2) 54% fields have an erosion risk that is too high
- 3) Only 20% of cropland has very high cover (i.e. > 300 days covered). When bare ground is pounded by rain, it erodes and loses SOM.

Ch 10

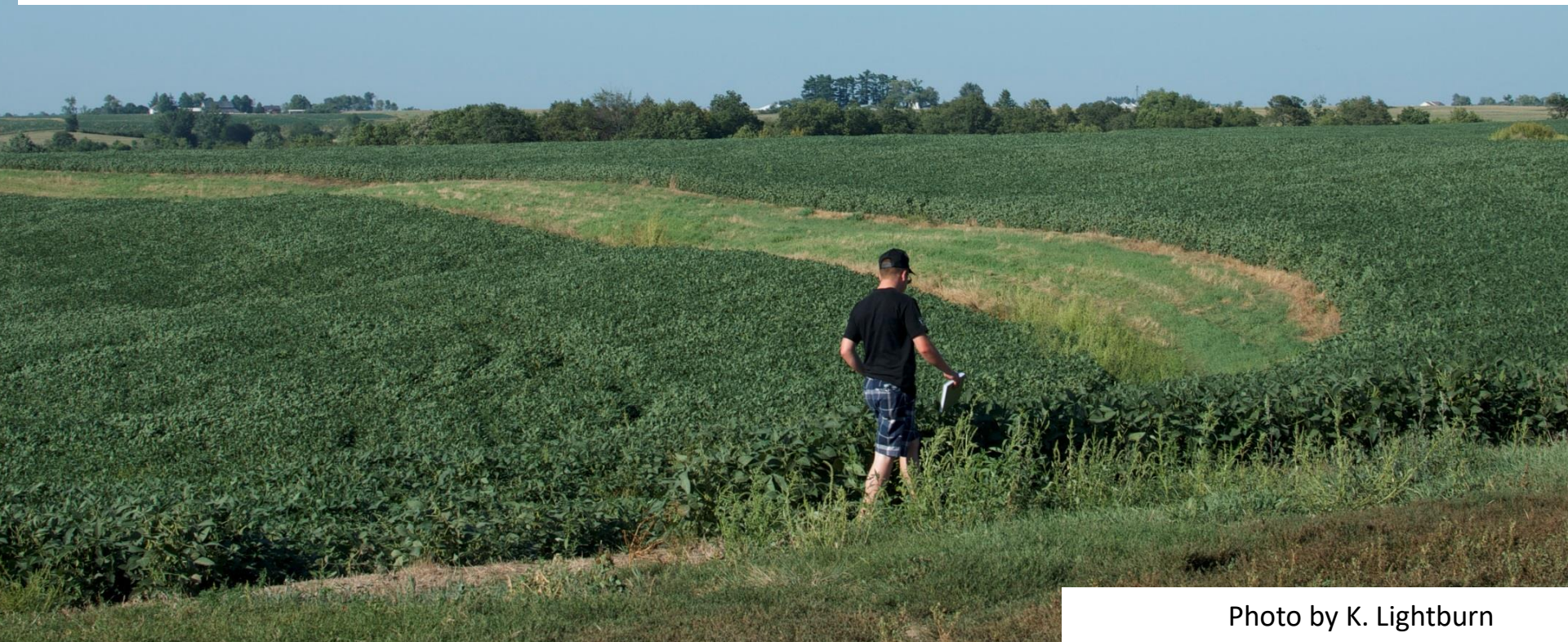


Photo by K. Lightburn

- Classes 1, 2 and 3 - dependable ag land or prime farmland; needed for stable yields, especially as climate changes Ch 1
- Classes 4, 5, 6 and 7 – constraints for ag, lower yields; filters water, habitat for bio-diversity
- [Ontario loses 319 acres](#) of farmland and productive ag soil every day



“Defined prime agricultural areas are where development should not occur.” [CFFO](#)

“[OFA](#) believes that ON government should designate all lands in ON, outside of current urban boundaries as Greenbelt.”

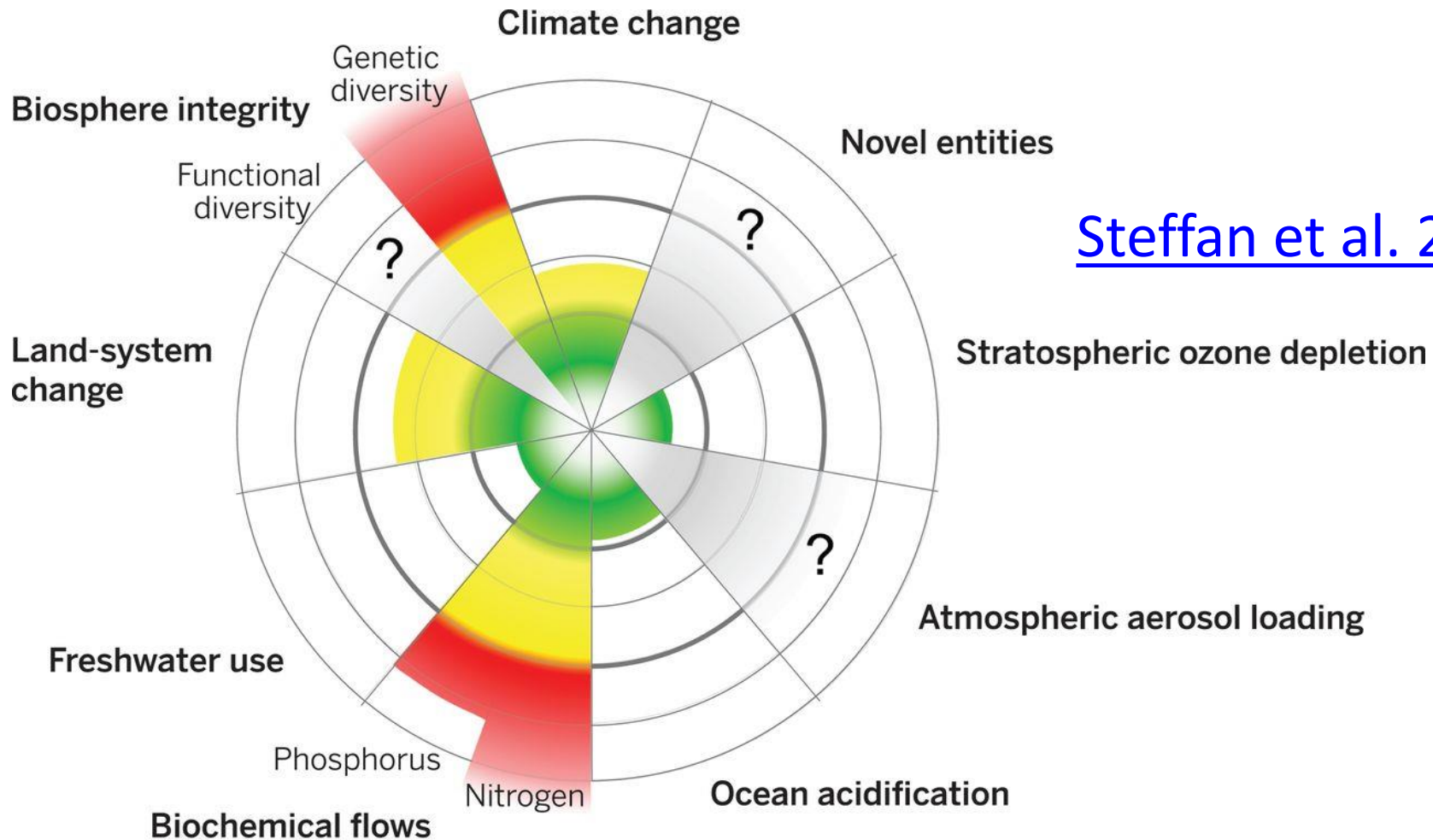
Near urban areas, rotations of corn, soy, corn, soy and then concrete.

Sealing farmland with concrete, increases risk of food insecurity, biodiversity loss and vulnerability to weather extremes as climate changes



Planetary boundaries: Guiding human development on a changing planet Ch 9

[Steffan et al. 2015.](#)



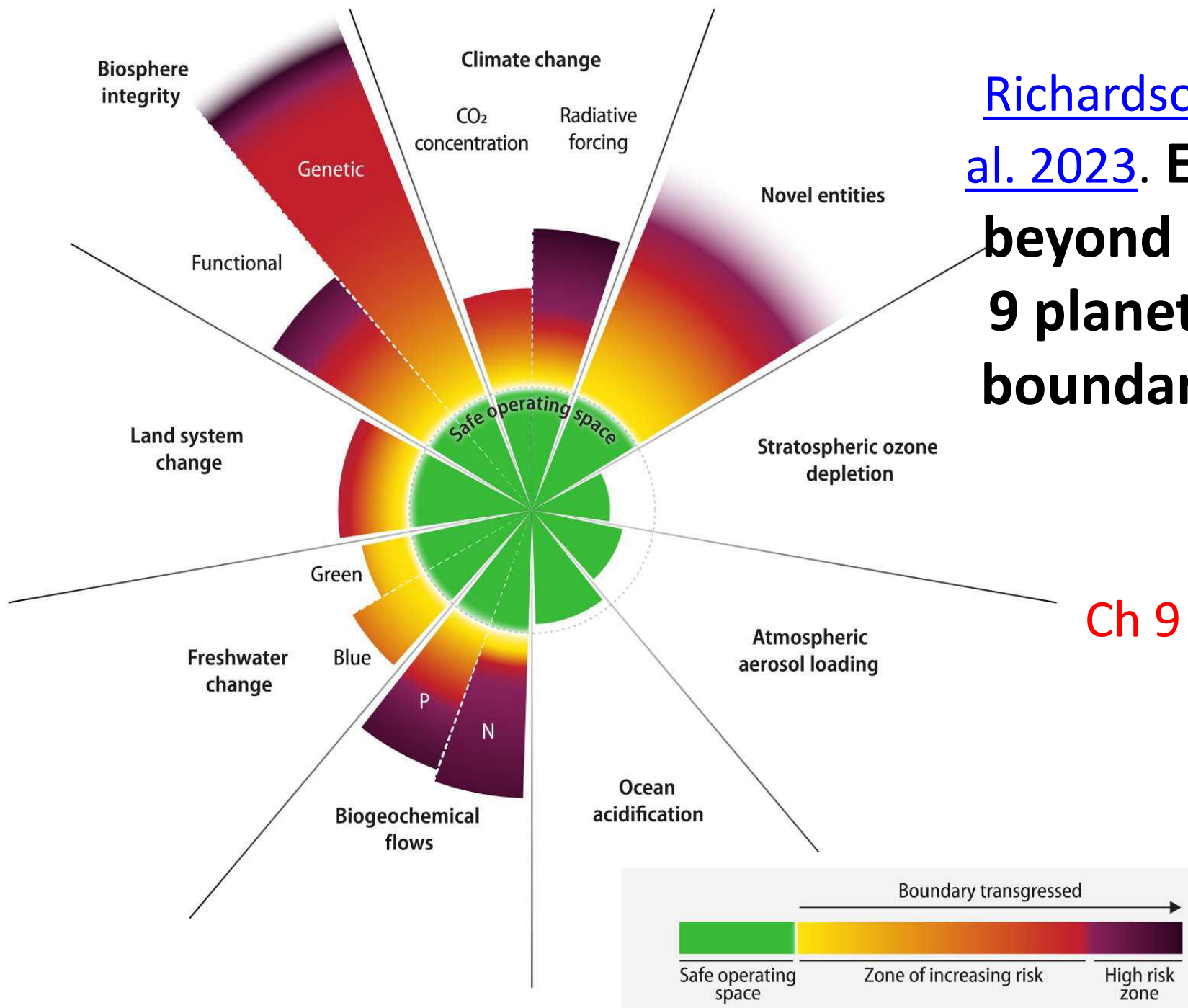
■ Beyond zone of uncertainty (high risk)

■ In zone of uncertainty (increasing risk)

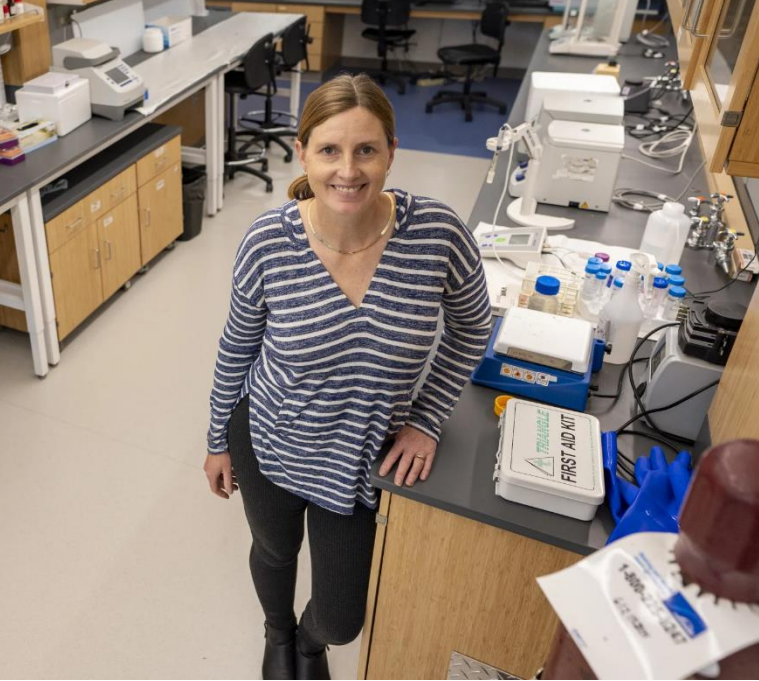
■ Below boundary (safe)

■ Boundary not yet quantified

[Richardson et al. 2023](#). Earth beyond 6 of 9 planetary boundaries.



Ch 9



Water sampling data collected on the Prairies by Dr. Christy [Morrissey, U of S](#) was basis for a national ban, proposed in 2016, on imidacloprid and two other related neonicotinoid pesticides

Ch 11

Eliminating Morrissey's data enabled controversial decision of federal regulators by pointing to water quality datasets (66% from chem and ag co.) where dangerous levels of neonics occurred 2/3 less frequently than if Morrissey's data was included

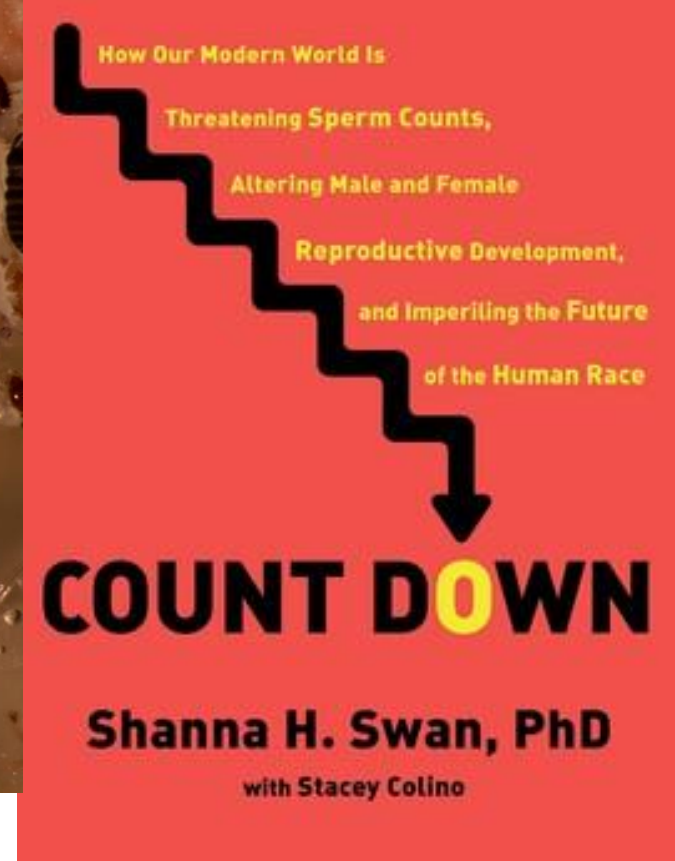


Photo: <https://bit.ly/33ZZWb1>

Pesticides of all types pose a clear hazard to soil invertebrates.

[Hyland et al. 2019.](#)

Ch 10 and 11



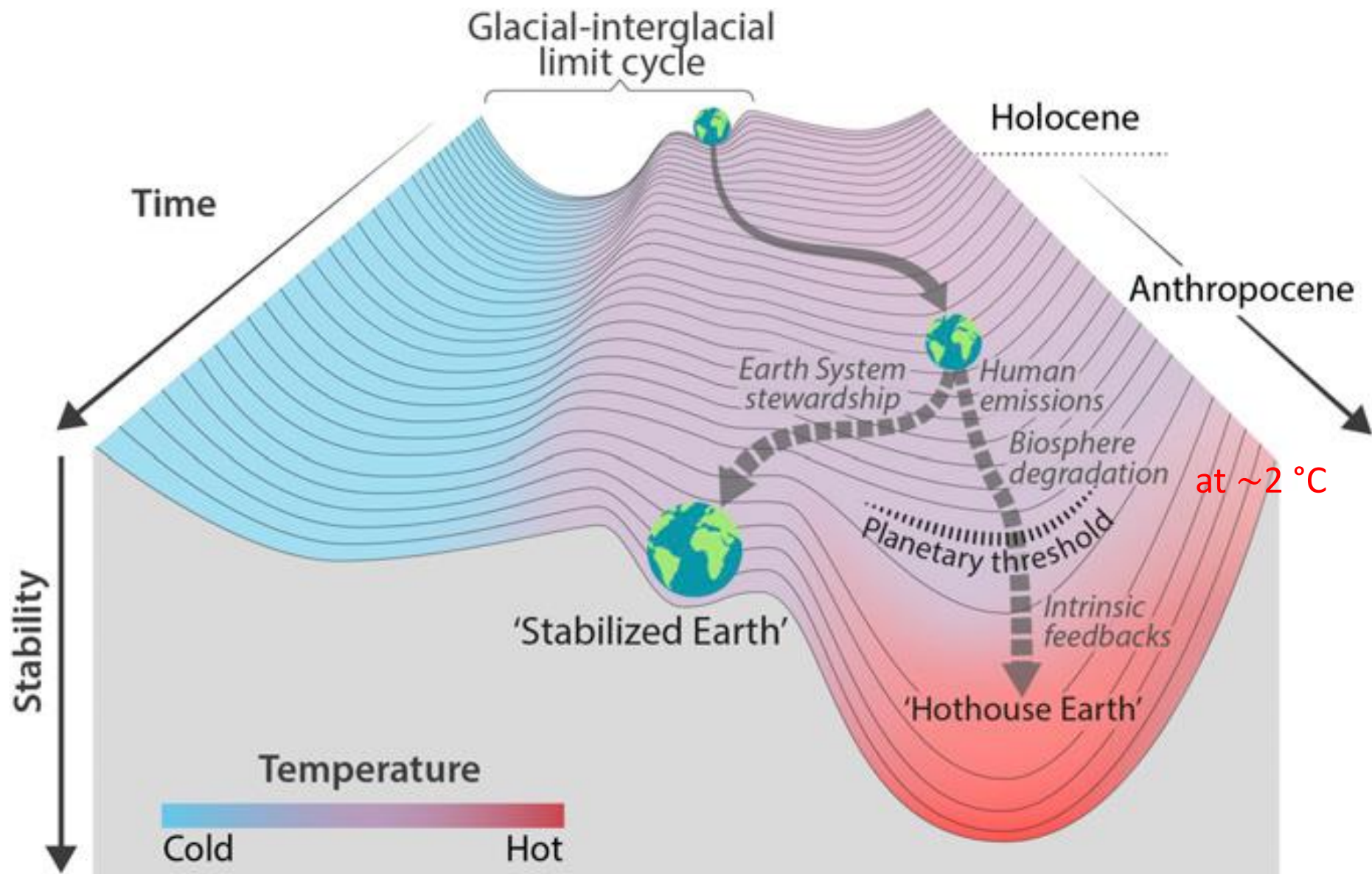
By 2045 median human sperm count may be zero, given BPAs, other chemicals.

[Kortenkamp et al. 2022](#)

Global water crisis leaves half of world food production at risk in next 25 years. Guardian **Ch 3**

“Every 1C increase in global temperatures adds another 7% of moisture to the atmosphere, which has the effect of “powering up” the hydrological cycle far more than would happen under normal variation”





[Steffen et al. 2018](#). Trajectories of the Earth System in the Anthropocene. Ch 9.

UN finds 'no credible pathway to 1.5C in place'



“We have to **stop** filling our atmosphere with greenhouse gases, and stop doing it fast. Our chance to make incremental changes is over.”

“It’s not as if we don’t know what to do – it’s rather that we’re not doing what is necessary.”

[Johan Rockström](#), Dir, Potsdam Inst for Climate Impact Research in Germany

Ch 9

CO₂ reached 420 ppm in 2023, 51% greater than before the Industrial Revolution. Methane concentrations hit 1,934 ppb, a rise of 165% from preindustrial levels, and nitrous oxide hit 336.9 ppb, a rise of 25%. [Guardian, 2024](#) Ch 9





Collapse of Atlantic meridional overturning circulation (AMOC), “greatly underestimated” with devastating and irreversible impacts, [letter](#), Oct, 2024, by 44 experts from 15 countries. ...

[AMOC is weakening](#) and a tipping point exists.

Uncertainty is about when we will cross that threshold. ... also massive CO₂ forcing this time – CO₂ is higher than any time in 15 mil years **Ch 9**

Canada's climate is warming at twice the global rate—and 3 to 4 x faster in the North. This means hotter and drier conditions in our forests, which increases forest flammability. Dr. Jennifer [Baltzer](#), [WLU](#), Oct. 2024

Ch 9



Swiss glaciers lost 4% of volume in 2023, 2nd biggest annual decline. Largest decline was 6% in 2022. Experts have stopped measuring ice on some Swiss glaciers because none left. Ch 9



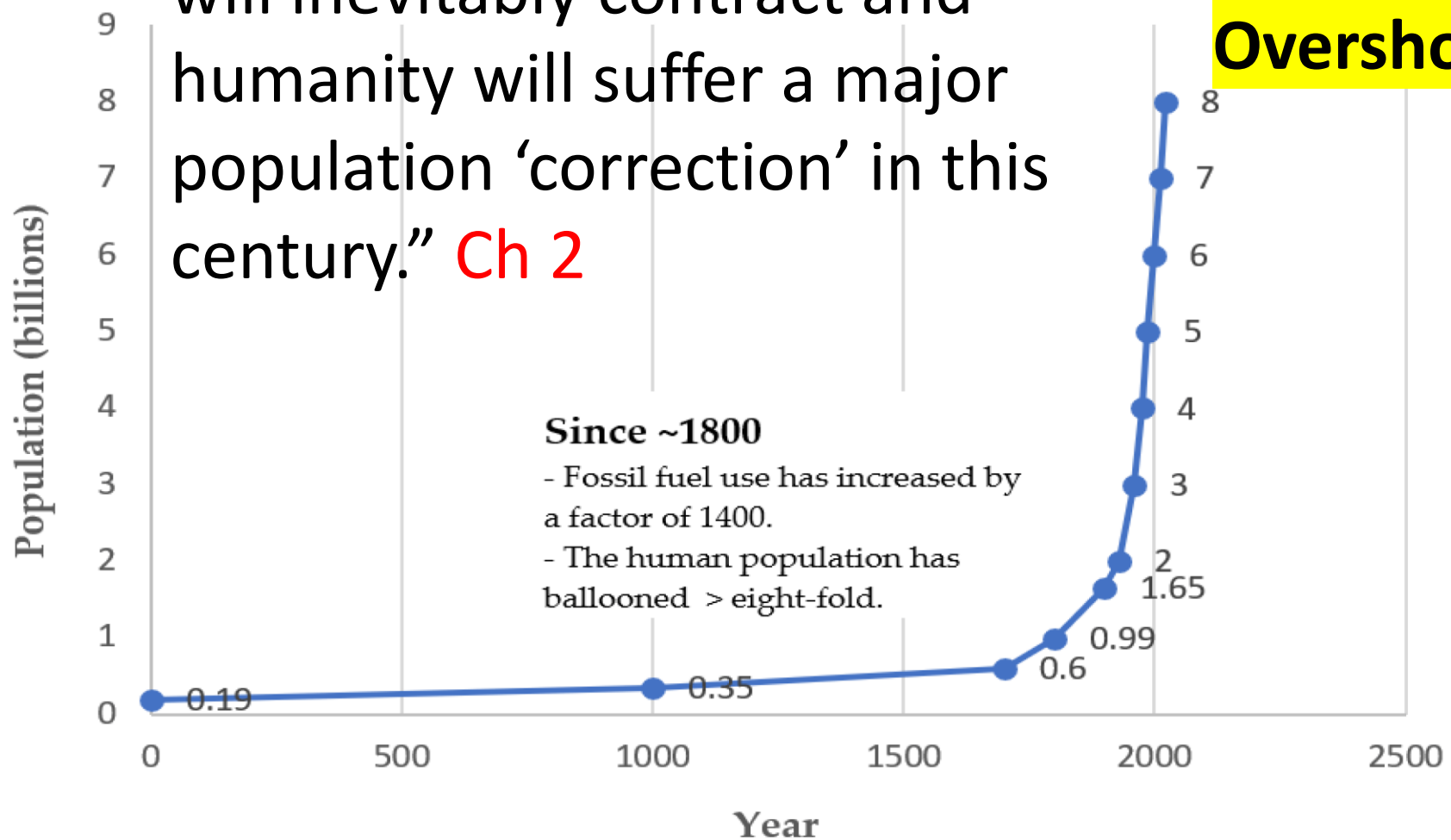
About 80% of countries failed to submit plans to preserve nature ahead of global summit. Countries promised to save 30% of land and sea for nature - only 24 have followed through

The world has never yet met a single target set in the history of UN biodiversity **Ch 11**



“We are consuming and polluting the biophysical basis of our own existence. ... The global economy will inevitably contract and humanity will suffer a major population ‘correction’ in this century.” Ch 2

[Rees, W. 2023.](#) **The Human Ecology of Overshoot**



Can we escape overshoot, given that **96%** of the mass of all mammals are humans, our livestock and our pets? **Ch 7**

Uses sound economics to map a path out of overshoot. Highly recommended.

—HERMAN DALY

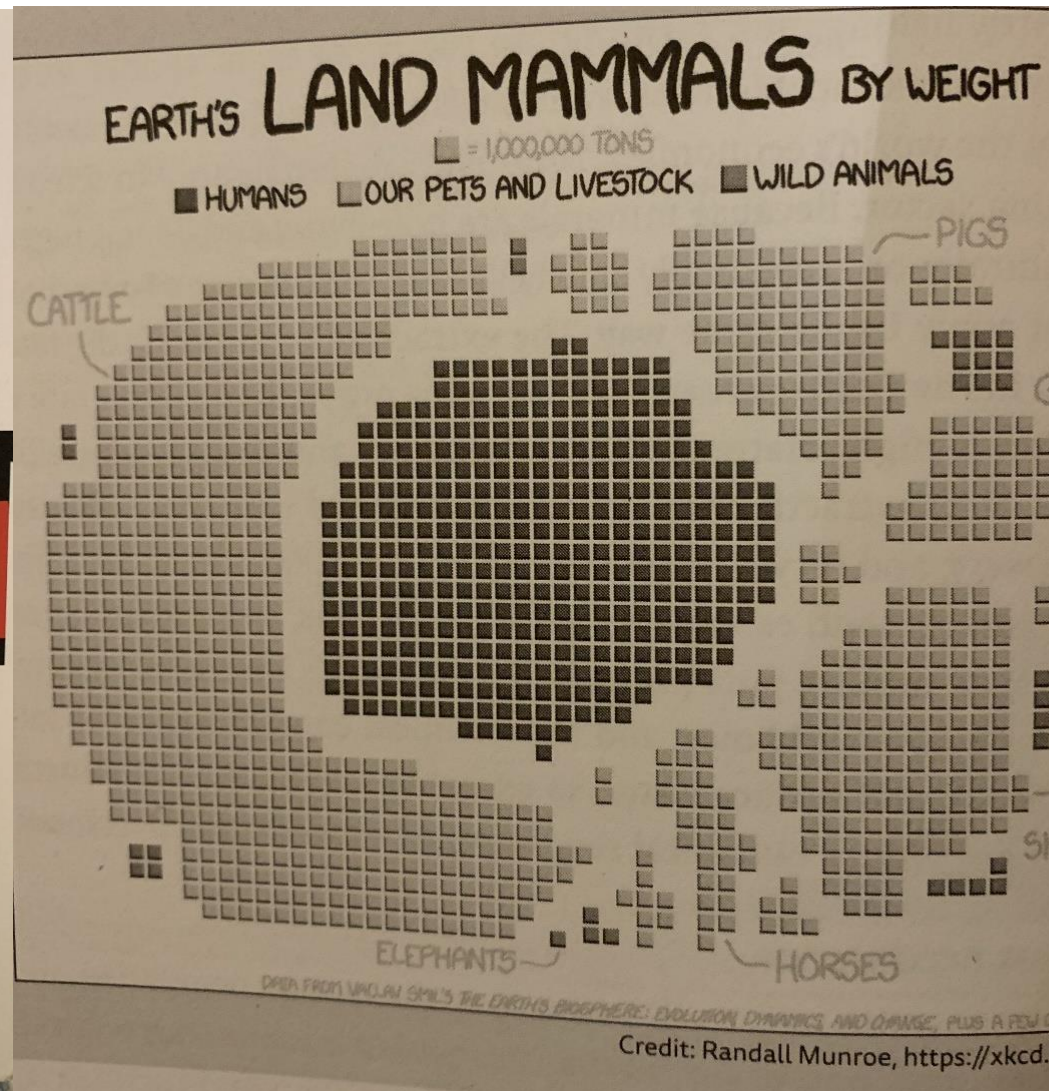
ESCAPE FROM OVERSHOOT



ECONOMICS FOR
A PLANET IN PERIL

PETER A. VICTOR

FOREWORD BY TIM JACKSON, AUTHOR, *POST GROWTH*



“Of all the dangers we face, from climate chaos to nuclear war, none is so great as the deadening of our response.”

Joanna Macy

Ch 12



Mother Earth provided a gentle warning with the pandemic.

Both excess pessimism and excess optimism may sabotage appropriate action.

“Whatever you do will be insignificant, but it is very important that you do it.”
Mahatma Gandhi



[Svalbard](#) Global Seed Bank. “Doomsday vault” or “Noah’s ark of seeds”



Photo: Journey of the
Universe Project

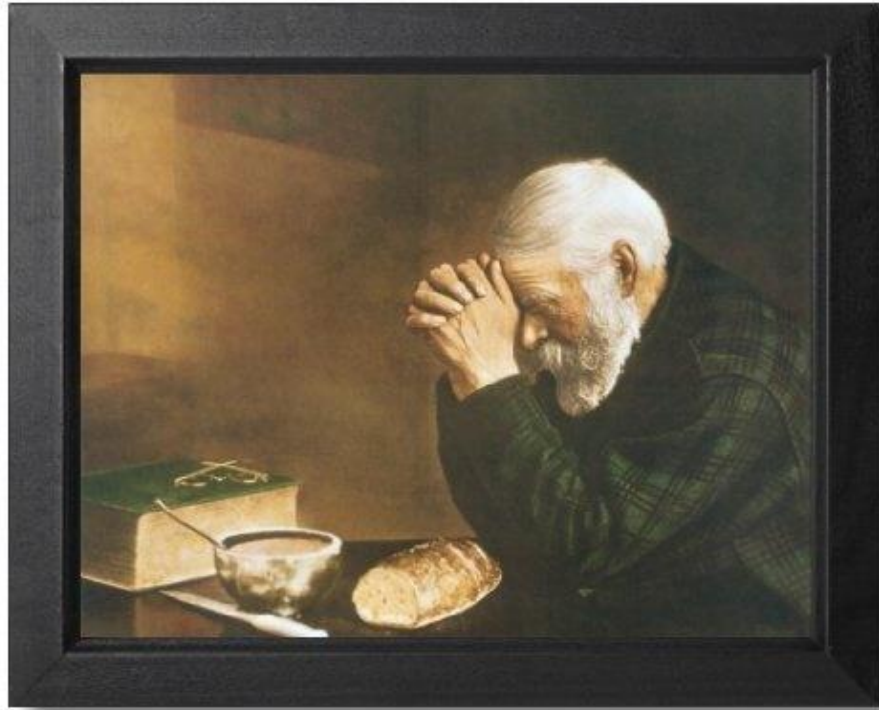
We are gifted children of Mother Earth, inheriting a 4.5 billion year reverie of grace. We participate in an interconnected web of stunning beauty and exquisite functioning.

Ch 11

We are on the ancestral
lands of the Attawandaron,
Anishinaabe, and
Haudenosaunee peoples
and the treaty lands of the
Mississaugas of the Credit.
Settlers derived a living from
this land for **centuries**.
Indigenous peoples lived
on and with their land, for
millennia. We can
appreciate, learn and
adapt. **Ch 1**



Attitude of Gratitude **Concl. Ch**



Be thankful, especially for healthy ecosystems and healthy food.

Appreciate when we have enough and treasure it.

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