

Conserving and Sustaining as Food Security Emerges

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Earth's Story in One Year

4.5 <u>b</u> illion yrs ago, Jan. 1,	Earth forms
3.9 <u>b</u> illion yrs ago, Feb 18,	single cell life
2.5 <u>b</u> illion yrs ago, June 11,	O ₂ and ozone
600 million yrs ago, Nov 12,	animals
440 million yrs ago, Nov 25,	plants and fungi
145 million yrs ago, Dec 19,	dinosaurs
5 million yrs ago, Dec 31, 9:44	humans
10,000 yrs ago, Dec 31, 23:59:59	agriculture

Modern agriculture has existed for about 100 years. In Earth's history, that's 1% of a blink

Earth's self-regulating biological systems selected for redundancy, resilience and well balanced nutrition of plants, animals, humans



I thank the
‘Ojibwe,’ for
caring for the
land in this
region of Earth,
prior to the
arrival of
Europeans and
others.



Starvation Can Happen

- In WW II, 19.5 million military deaths, while 20 million died from starvation and associated diseases (L. Cunningham. 2011. The Taste of War)
- In China's 'Great Leap Forward' (1958-62) at least 45 million people were worked, starved or beaten to death (F. Dikotter. 2010. Mao's Great Famine)

The Task

- How to build a resilient, nutrient secure food system even while competing in a market of low budget allocations for food.
 - We need the courage to act without all the answers
To create the future we need:
 - i) vision of future ii) grasp of present reality
- Peter Senge (MIT) et al 2008, The Necessary Revolution



It's Our Problem, All of Us

- Over 7 billion people (0.8 billion cats, dogs)
- 0.9 billion people receive too little food
- 1.6 billion people suffer from eating too much
- Wasting about 40% of food



Pedal to the Metal and Eating Poorly

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



- CAPI. 2009. Toward an Integrated Health & Agri-Food Strategy for Canada. http://capi-icpa.ca/pdfs/BuildingConvergence_Aug2009.pdf

Option to Reduce Chronic Diseases and Health Costs

- Hypothesis - It is cheaper to provide free Ontario fruits and vegetables for all low income citizens *than to continue paying their health costs if they continue with their current diet*



Photo by P. Pauls

There's Waste and Waist

The average American consumes about 3747 kcal per day (not including junk food) compared to the recommended 2000 to 2500 kcal per day

23 July 2008
NewScientist.com news service



Plan A for 2050

- 9 - 10 billion people (30 – 40 % increase)
- In developing countries, average incomes rise, consume more meat and richer foods
- Thus increase food production by 70 – 100%



Plan B for 2050

- More and improved education for women in developing countries with goal of < 9 billion people (< 30% increase?)
- In developed countries, **reduce** food waste
- less meat (higher quality), more pulses, (insects?)
- less fat, salt and sugar
Decrease food requirement here by 30%?



International Integration



- Give women equal access to farmland and materials and 100 – 150 million fewer people in hunger (Report of UN Women (2011) – Michelle Bachelet)
- How does our consumption and waste affect the developing world?

Criticism and Context



- We need **80** billion cal /d for 35,000,000 Canadians.
- If eat 1.2 x need, then must provide **96** billion cal/d
- Furthermore, with carelessness of wasting 40%, must provide **160** billion cal/d

\$ and healthy food

- Households in Canada spend \$140/wk on food. If we assume 20% of food wasted in households, then the cost of tossing is **\$28/wk**
- Can consumers buy more nutrients and healthy food with **\$28/wk**, rather than wasting? Spend the same amount, but eat less, with more nutrient density



Preliminary Findings at Ontario Curbs

<http://guelphfoodwaste.wordpress.com/>

- Total food waste per household per day = 500 g. By extrapolation, total food waste 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 vegetable and fruit waste per household per day = 270 g or 53% of food waste



JK to 12 curriculum of **food skills** and
food literacy in each Ontario school
Is this really beyond implementation?



Photo from Screaming
Avocado website

13 challenges in Canadian agriculture rated for **urgency** and **type of change** required

[www.albertaagrologists.ca/files/conferences/2013%20AIA%20Conference/2013%20Green%20Paper Final Booklet April2 2013.pdf](http://www.albertaagrologists.ca/files/conferences/2013%20AIA%20Conference/2013%20Green%20Paper%20Final%20Booklet%20April2%202013.pdf)

- The **urgency** rating or timeline
 - 1) *urgent* - within the next 10 yrs
 - 2) *medium* - in 15-20 yrs
 - 3) *eventual* - in 30-50 yrs
- **Type of change** (magnitude until resolution of challenge)
 - 1) *incremental* - small changes using existing practices,
 - 2) *moderate* - modification to the existing system
 - 3) *transformative* - substantially different if challenge is resolved, may require new tech or paradigm shift



Photo by N. Camp

2 Challenges, Both Transformative and Urgent

1) Adaptation to the effects of climate change

www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

2) Ecosystem function and resilience of agro-ecosystems

www.ecologyandsociety.org/vol14/iss2/art32



Changes in weather and climate may affect the incidence and severity of insect pests (or products), pathogens and invasive species (Dukes et al., 2009)

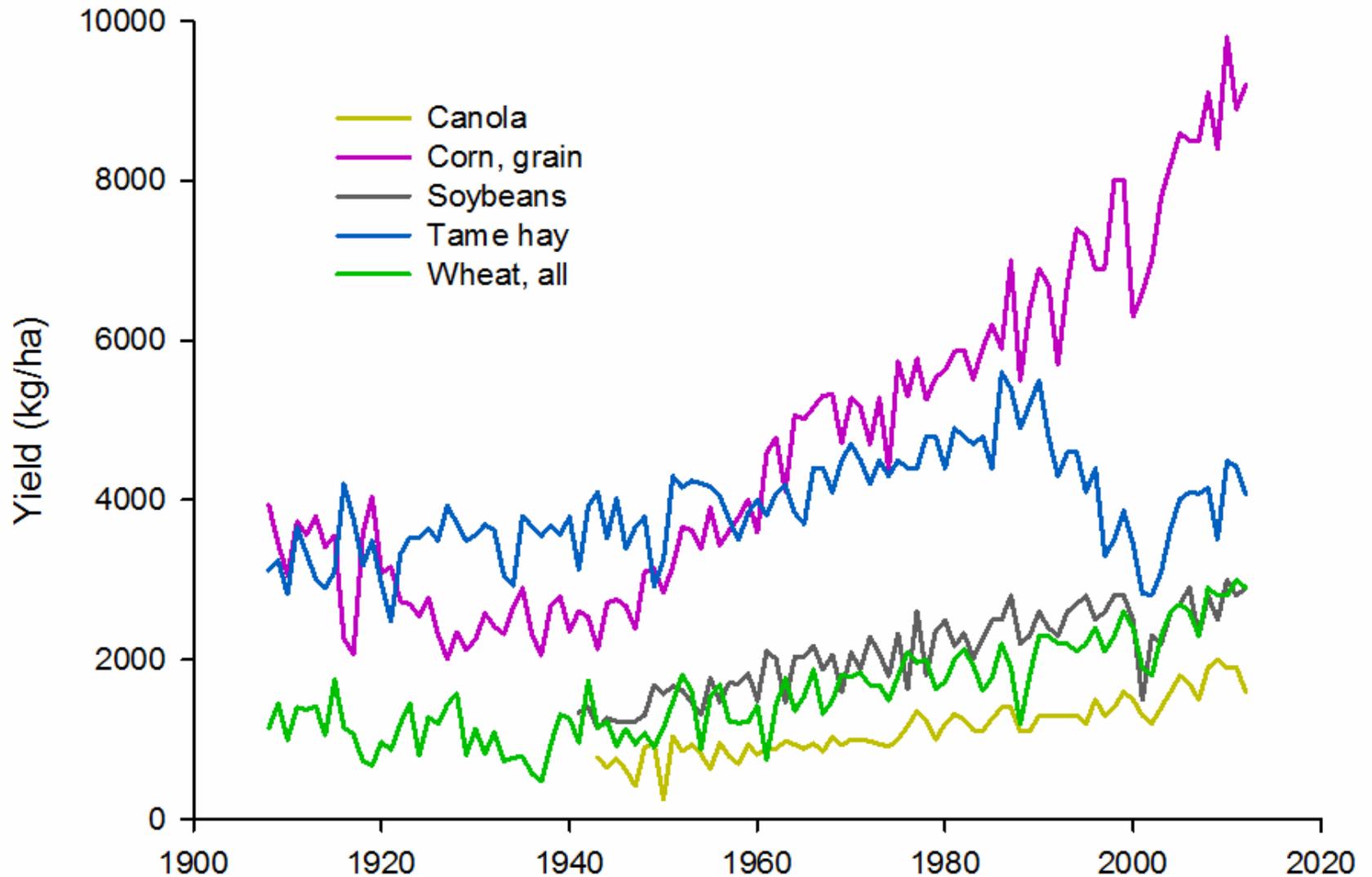


Li et al. (2009) estimate that global risk of drought will double by 2050 and heavy rainfall events may also increase (Gornall et al., 2010).

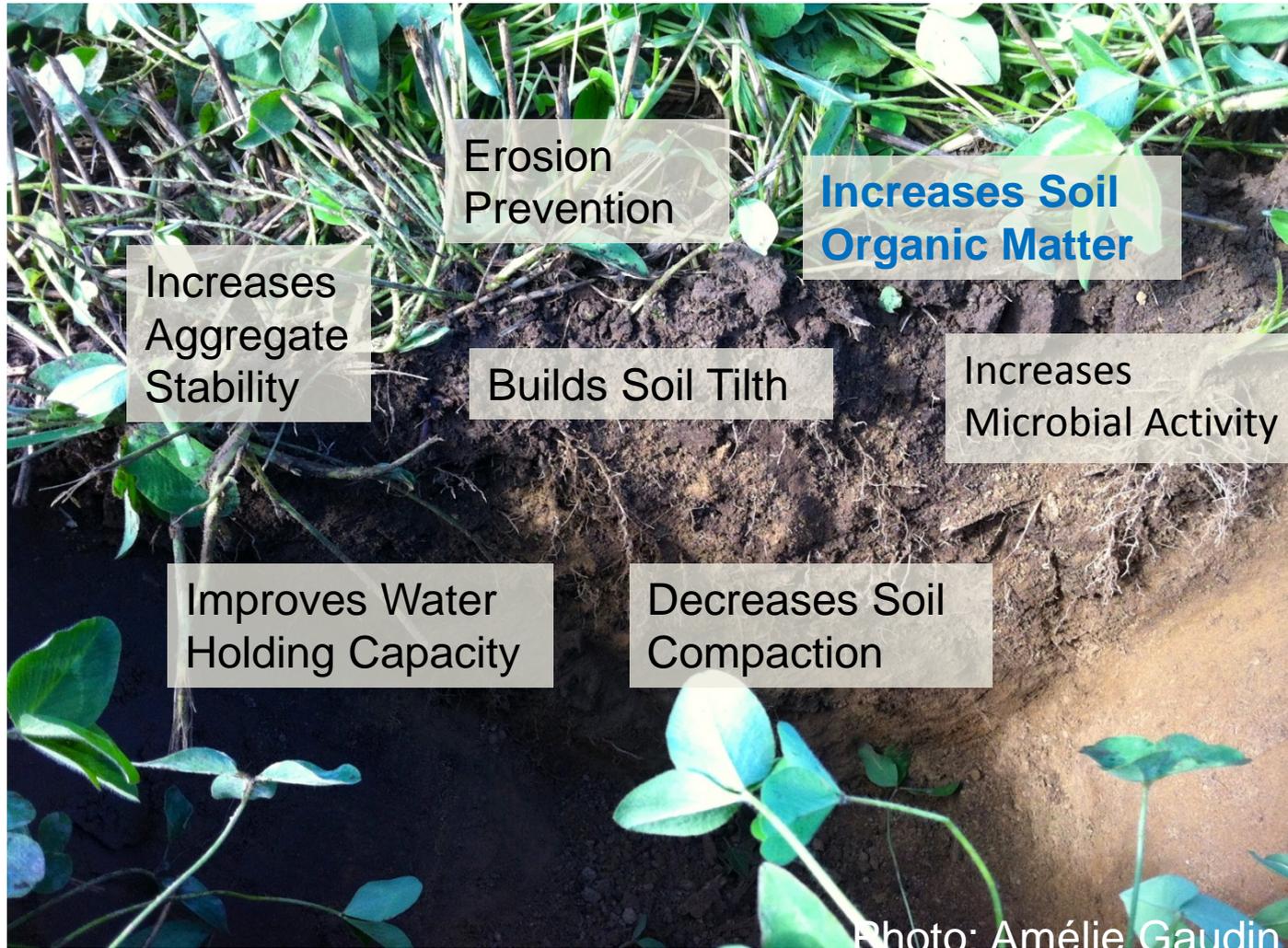
Ontario in May, 2013



Historic yields of major crops in Canada



Beneficial Management Practices, especially with legume forages



Sources: Lupwayi et. al , 1998; Snapp et. al, 2005; Queen et. al, 2009; Blaser et. al, 2011

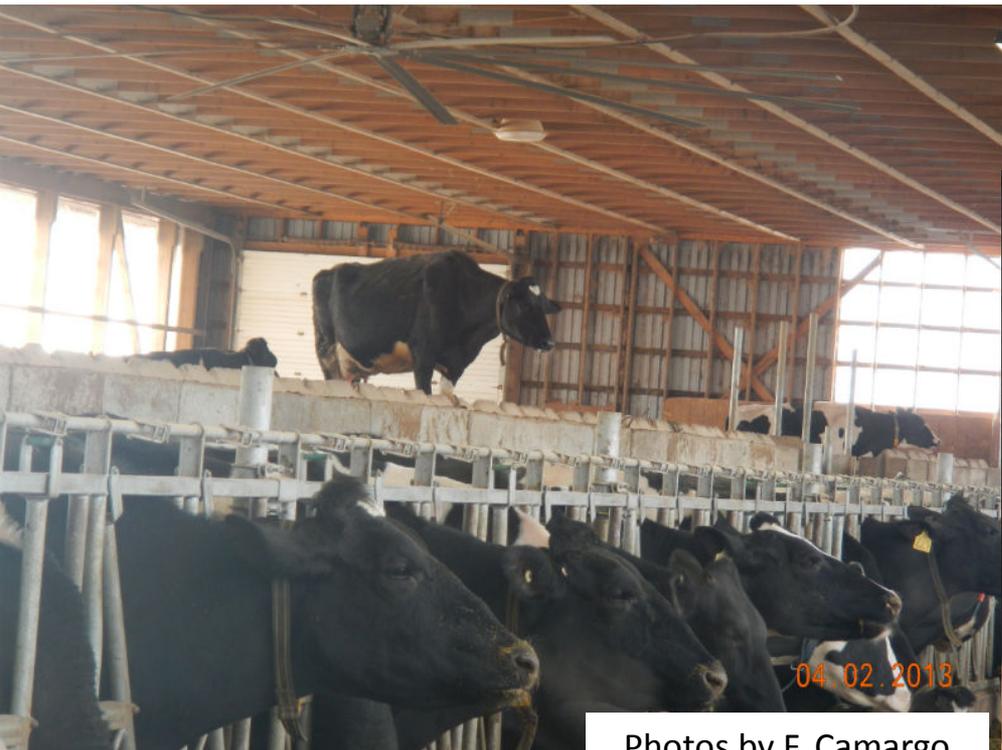
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Production within Agro-ecosystems

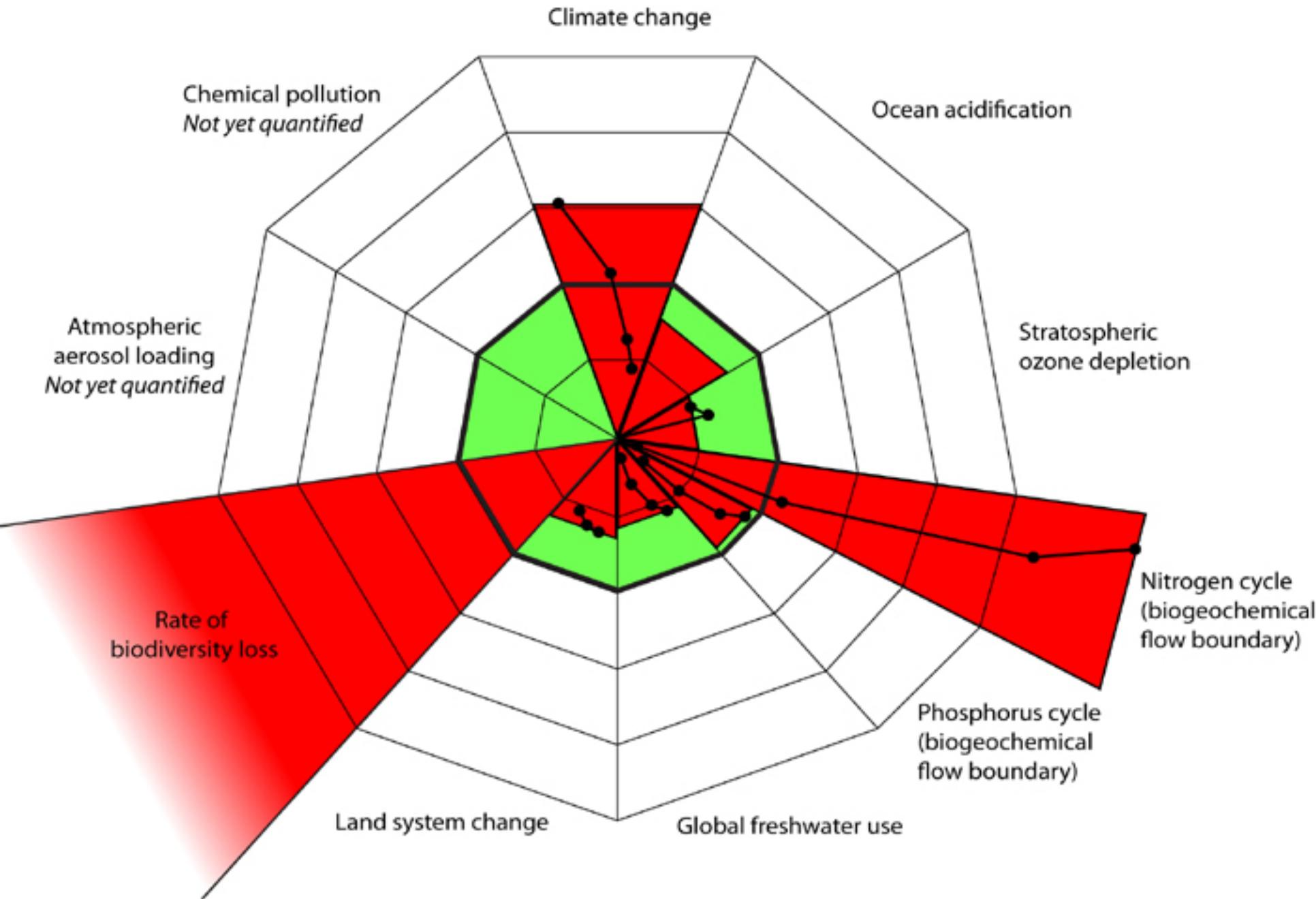
Prevention and then intervention

Integrate crops and livestock

Our responsibility is to help maintain the **F**unctions of Farm Ecosystems. Resilience is a result of health at the ecosystem level of organization



Photo by P. Pauls



From Many to Few

- 350,000 plant species, 195,000 flowering plants - most have edible parts useful to humans
- < 300 plant species used for food, only 17 species provide 90% of human food and these occupy 75% of total tilled land on earth
- Globally, in 2006, corn, wheat and rice were 85% of 2 billion t/yr grain production.



Photo by E Tavakouli

Looking for stability

- **yield stability** using work horse crop varieties rather than race horse varieties, with assumption of benign weather
- **a wider variety of crop species**
Plus insects?
- **dependable Class 1, 2 and 3 land** for agriculture as climate changes. Know that Classes 4 and 5 are less dependable



Dependable Agricultural Land (DAL)

- Classes 1, 2 and 3 are DAL and classes 4, 5 and 6 are less dependable
- DAL needed for stable yields, especially as climate changes
- 1971, 6,900 sq km DAL was urbanized
2001, 14,300 sq km DAL was urbanized

Hofmann et al. 2005. Rural and Small Town Canada Analysis Bulletin, Vol. 6, No. 1

by 2021 ..? 2031 ...? 2041?



Reflecting on Secure Food Systems Under Climate Change

- Why is there personal resistance to adapting to climate change?
- Why is there institutional resistance to adapting to climate change?
- What insight(s) will help to overcome resistances to adapting to climate change?



Photo by K. Lightburn

Principles of Addressing Food Waste

- Waste hierarchy – **Reduce** (prevent), Redistribute, Recycle (nutrients, caloric energy)

1) **Reduction**

2) Feed hungry people
(food rescue)

3) Feed animals

4) Anaerobic digestion (energy and nutrients)

5) Industrial (e.g. bio-diesel) or compost (nutrients)

6) Landfill (diverting from landfill, not 1st principle)



Ag Energy Ratio: 10 cal input per 1 cal in food

Intern. Energy Agency – “Now on track for temperature increase of **3.5°C** ... Fossil fuels still receive subsidies of \$400 bil/yr plus subsidy of excluding pollution from pricing.”



“The stone age did not end because we ran out of stone”

Michael Jacobs

It's not only about personal choices By reducing food waste, society saves

Food

CO₂, CH₄, N₂O

Energy

Water

Biodiversity

Soil quality

Labour

Money

Future capacity

Respect



Photo by K. Howe

Degrees of Waste



- Avoidable – thrown away prior to disposal and still edible (e.g. slice of bread, apples)
- Possibly avoidable – some people eat (e.g. bread crusts), or edible when prepared one way but not another (e.g. potato skins)
- Unavoidable – not edible under normal circumstances (e.g. apple cores, egg shells)

www.wrap.org.uk

Guelph households (270 x 3.3 people) 60 surveys in 2013

<http://guelphfoodwaste.wordpress.com/category/audit/>

31.2 kg total waste/wk (high variability)

12.5 kg organics/wk (3.5 kg in previous study)

11.6 kg recyclables/wk

7.1 kg garbage/wk

Cheaters (put food
waste in garbage)
no less food waste



Guilt

- Prior to survey Qs on waste, asked about significant environmental issues. 33% - none, 20% - waste
- Most feel guilty about wasting food and if feel guilty, then waste less food. Most say it is a **social issue**, more than an economic or environmental issue
- Large majority say **individuals** are responsible to reduce food waste and then stores and manufacturers



Identifying Waste



Most common criterion is appearance, followed by smell and best before date.

Those who use more criteria to determine what is no longer edible or desirable tend to waste more. **Having more criteria makes it more possible to find a reason to toss food.**

Food Awareness

- 38% - vegetable garden
- 74% - flower garden
- 51% - preserved or canned food
- 44% - household member on special diet



Photo by P. Pauls

**People who paid more attention to food,
wasted less of it**

Planning

- 80% shop with list
- 80% do food inventory
- 65% review flyers
- 40% menu plan
- < 30% within specific budget
- 60% review nutrition labels sometimes
- < 10% buy organic regularly, 35% sometimes
- **Higher food waste of impulse buyers**



Faith-based Responses

- Reducing food waste supported by all the main religious groups
- Many religions have traditions and feasts when food waste is of more concern



Photo by J St Clair

"The most remarkable thing about my mother is that for 30 years she served the family nothing but leftovers. The original meal has never been found." Calvin Trillin



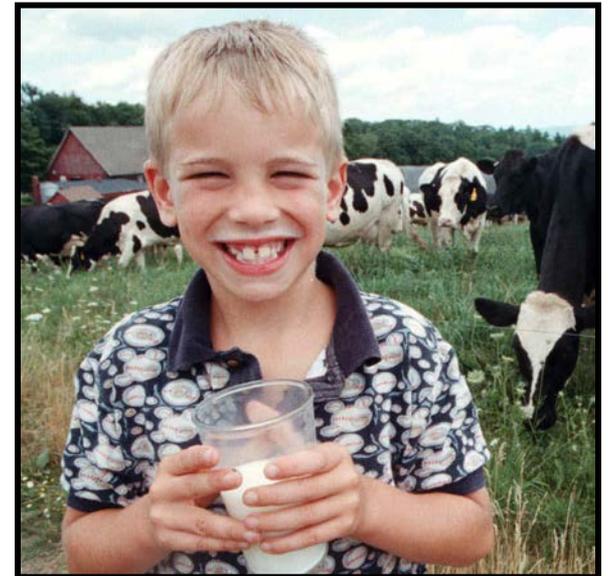
Hugh Segals' Reminder About Poverty

- In 2009, about 10.8% of Canadians were below poverty line i.e. > 3 million have inadequate income to provide their families with sufficient **food**, shelter, clothing or other necessities.
- GAI project in MB (1974 – 78) - almost no reduction in hours worked except for women who chose to stay home with young children, elderly parents or disabled family members.

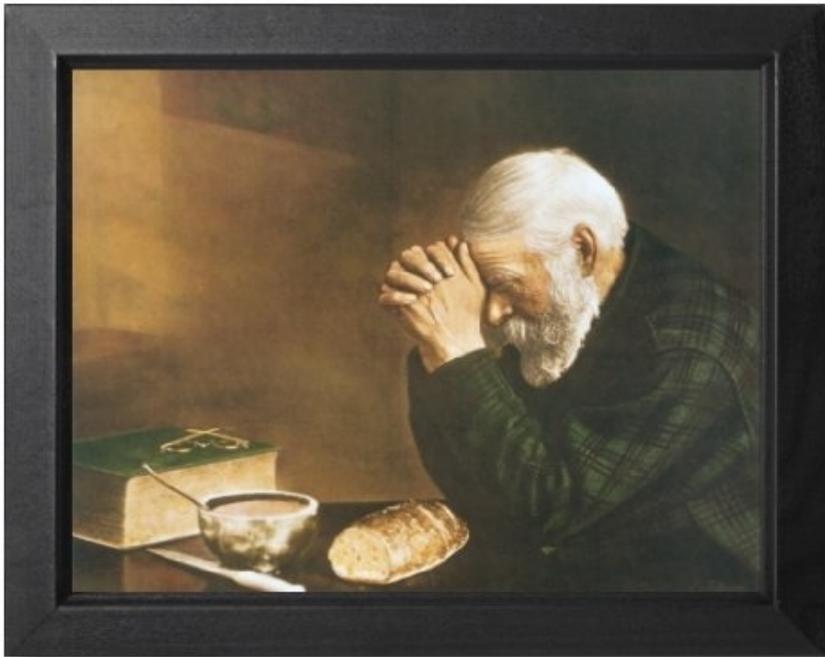
Goals for Canadian Ministry of Food

Rod MacRae (2011): A Joined-Up Food Policy for Canada,
J. Hunger & Environmental Nutrition, 6:4, 424-457

- 1) Everyone has enough healthy food **and knowledge** to optimize nutritional health
- 2) Food production, processing and consumption are **regionally** appropriate and food supply and quality are dependable.



Attitude of Gratitude



Take moments to be thankful, especially for good land and food.

Appreciate what we have and be open to emergent solutions

Vision to Sustain Food

A food system, based on healthy soil, clean air and water, minimal waste and regenerative energy, to support profitable and resilient farming and fishing communities and a healthy food supply for all.

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