

Confronting the Grand Challenge of Climate Change

Mike Hoffmann

Professor Emeritus

(but not retired!)

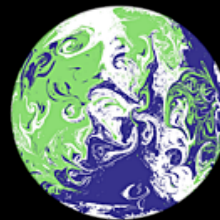
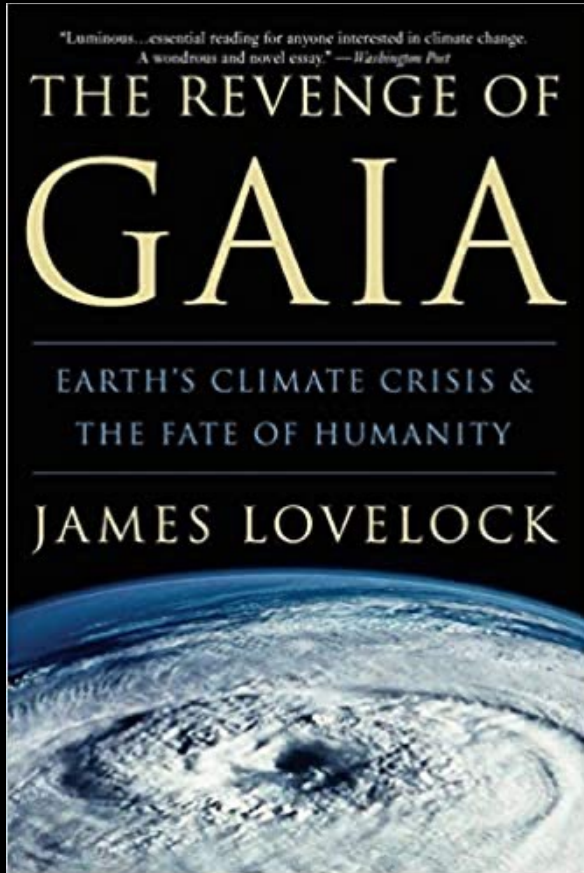
Cornell University

Functional Fabric Fair

November 18, 2021



Why Me?



**UN CLIMATE
CHANGE
CONFERENCE
UK 2021**

IN PARTNERSHIP WITH ITALY



A NAME



***Better a Cruel Truth than a
Comfortable Delusion***

**COMFORTABLE DELUSION
BETTER A CRUEL TRUTH THAN A**

Edward Abbey (1990)

*Our planet is a lonely speck in the
great enveloping cosmic dark. In
our obscurity, in all this vastness,
there is no hint that help will come
from elsewhere to save us from
ourselves.*

Carl Sagan, Pale Blue Dot





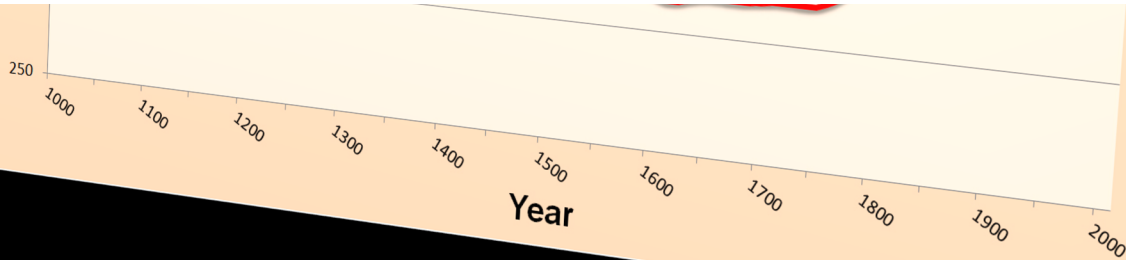
← The blanket is getting denser

Atmospheric CO₂ Variations

over the past 1,000 years



Stabilize





IPCC Report

- Humans are unequivocally the cause
- The scale of change is unprecedented
- Weather and climate extremes are occurring everywhere
- Many of the changes are irreversible
- And it's going to get worse.

IPCC, Sixth Assessment Report

The evidence
is all around us.





It's Tough

- Nearly 75% of 16-25 year olds, describe the future as “frightening.”
- 40% are hesitant to have children of their own.
- Eco-anxiety is on the rise.
- How are you?

Hoffmann, *Young voices must echo throughout Glasgow climate meeting*, [The Hill](#), 10/31/21



COP26

- Already 1.1°C
- Goal - 1.5°C
- Need 45% decrease in emissions by 2030
- 1.8°C if all promises kept

COP26



Reality

- 2.4°C – few countries on track, few plans
- US – depends on “Build Back Better” - \$1.75 Tril.
- China-US to cooperate
- Pledges...
- Rich countries need to help

This IS serious!

*Without ice cream,
there would be
darkness and chaos.*

Don Kardong



*Melting glaciers are
bad enough but the
loss of coffee is
downright
terrifying!*



**Climate
Change**
Plant- and
animal-
based fibers



What's Happening to the Plants We Depend on for Fiber and Food?

Plants need:

- ✓ Air – CO₂
- ✓ Water
- ✓ Warmth
- ✓ Soil
- ✓ Sunlight



It's all changing, except sunlight!



Increasing CO₂

- Beneficial to 95% crops, but offset by extremes
- Weeds harder to control
- 30% less protein in pollen
- Insects eat more
- Less protein, vitamins, minerals in many crops
- Plant-based fibers?

Ziska, USDA, ARS; Evich, 2017, Dong 2018, Smith and Myers, 2018

Say what?



Increases in CO₂ and Veggies

8 to 59% higher concentrations of:

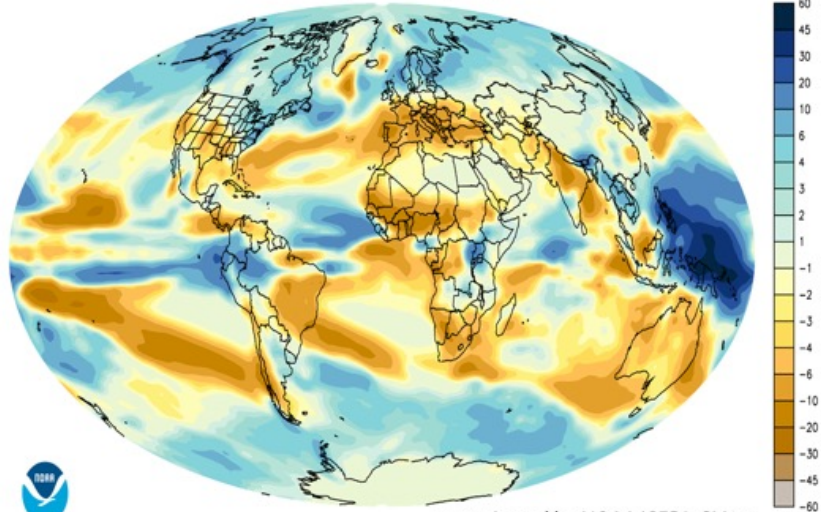
- fructose
 - glucose
 - total soluble sugar
 - total antioxidant capacity
 - total phenols
 - total flavonoids
 - ascorbic acid
-
- Plant-based dyes?

Changes in Water

- Global shifts in patterns
- More extremes
 - Downpours, droughts
 - SW megadrought
- More rain, less snow
- Ice melts



CHANGE IN PRECIPITATION BY END OF 21st CENTURY
inches of liquid water per year



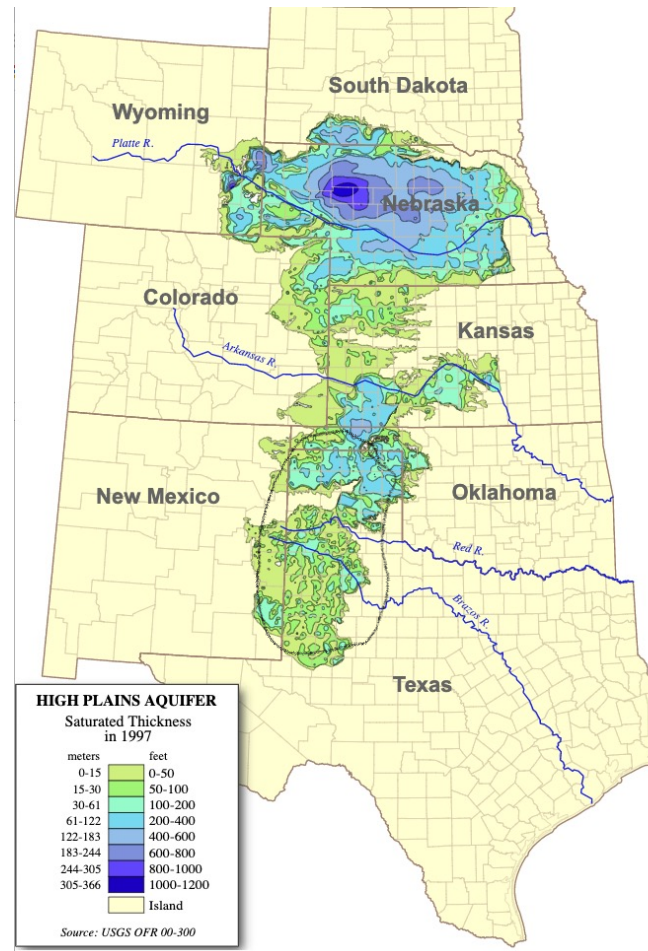
Hurricane Harvey - Houston

How; where it falls



But Let's Use Groundwater!

Ogallala Aquifer



- Texas is largest producer of cotton in US
- Most in Panhandle, South Plains
- 50-60% irrigated

Changes in Temperature

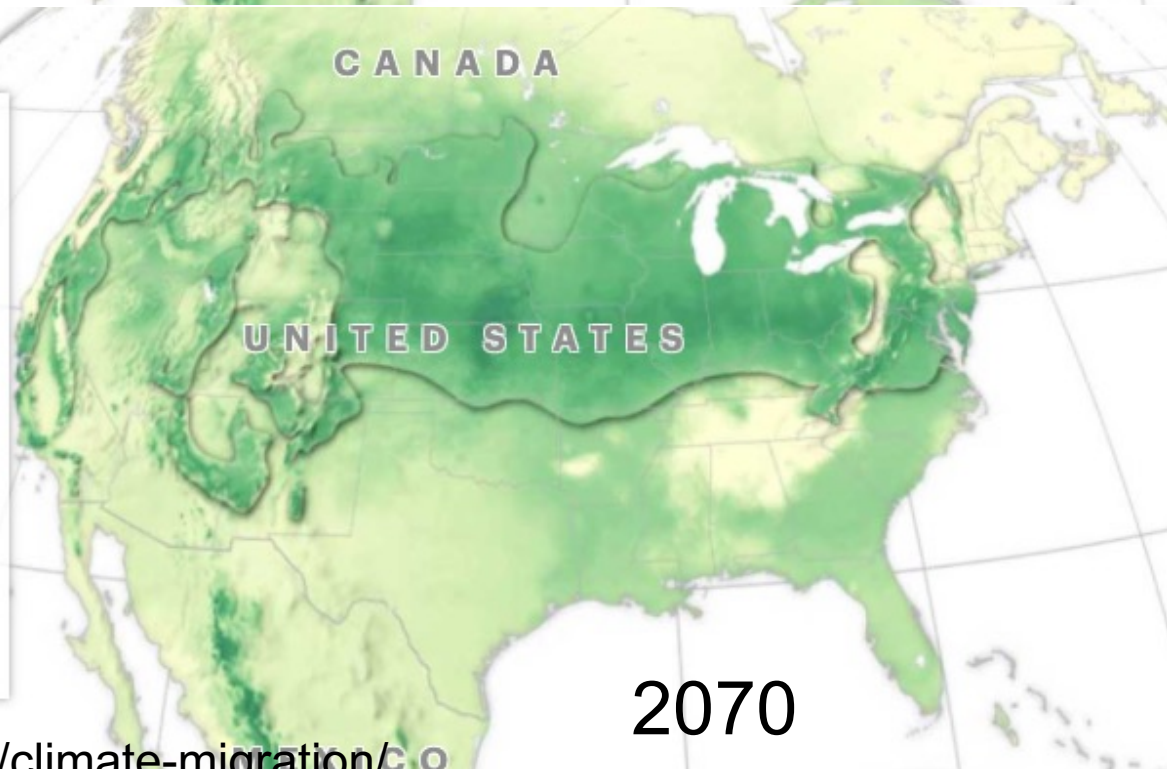


- **Warming, but it's not simple**
 - Cool regions warm faster than warm regions
 - US winters warming 2X faster than summers
 - Loss of winter chill
 - Nights warming 20% faster than days
 - Warm nights reduce yields
- More heat waves

In the United States, that niche today blankets the heart of the country, from the Atlantic seaboard through northern Texas and Nebraska, and the California coast.



In the case of extreme warming (represented as RCP 8.5), the niche moves sharply toward Canada, leaving much of the lower half of the U.S. too hot or dry for the type of climate humans historically have lived in. Both scenarios suggest massive upheavals in where Americans currently live and grow food.



Greatest Climate Risk for You; Your Company 2040-2060

County ↕	Heat ↕	Wet Bulb ↕	Farm Crop Yields ↕	Sea Level Rise ↕	Very Large Fires ↕	Economic Damages ↕
Beaufort County, SC	6	9	8	7	3	9
Pinal County, AZ	10	6	8	1	6	7
St. Martin Parish, LA	7	10	8	4	3	7
Colleton County, SC	6	9	8	6	3	8
Wakulla County, FL	7	9	8	4	1	9
Assumption Parish, LA	6	9	7	7	2	9
Jefferson Davis Parish, LA	7	10	8	4	1	8
Livingston Parish, LA	7	9	8	6	1	8
St. John the Baptist Parish, LA	6	9	8	6	2	8
Jackson County, MS	6	9	8	4	3	8
Hyde County, NC	4	7	7	10	2	9

<https://projects.propublica.org/climate-migration/>



A Few Examples



Cotton

Major producers:

- India, China, US, Brazil - 75% globally
- **CO₂**
 - Beneficial, but need water/nutrients
 - But offset with small T increase
 - Weeds benefit, insects eat more
- **Water**
 - Rainfall patterns changing
 - Worst affected - Africa
 - 73% irrigated, but competition increasing
 - Less available – China, Australia, W. US



Cotton

- **Increasing Temperature**
 - High temps - 60% yield decline by 2100
 - Fibers shorter, weaker; micronaire and uniformity decline
 - Longer growing seasons
- **Solutions**
 - Resilient varieties - tap wild genes
 - Transgenic technology
 - Climate smart agriculture

Silk

- 95% – China and India
- In India – employs 7.3 million
- Climate change will:
 - Reduce mulberry leaf yield
 - Reduce raw silk production
 - Increase breakage
 - Increase diseases of worms
 - Increase weed competition
 - 20% drop in Muga silk - 2009

Wool

- Top exporter – Australia
- 1.1 billion sheep
 - Weather extremes, droughts, floods, rising temps, variable water availability
 - Animal health – less forage, high T, pests
 - Decrease in fine quality wool
 - Overall, significant challenges but can minimize negative impacts





Alpaca

- Peru – 3.7 million, 87%
 - Cold weather
 - Erratic rains, droughts
 - Grazing lands compromised
 - Revived historic waterways, installed small reservoirs



Cashmere

- Mongolia – 1.2 million nomadic herders - 40% of population
- Overgrazing of 70% of land
- Fast warming
- Droughts, floods, sandstorms
- Desertification

Camel



I'll be okay

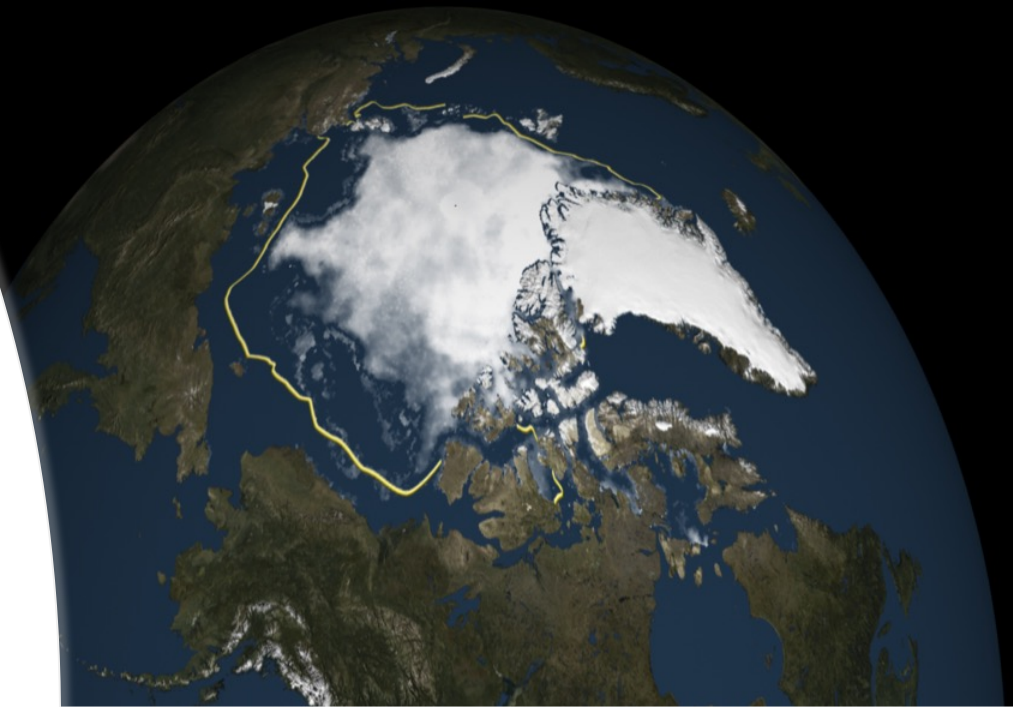
Getting it to our closet



<https://reader.chathamhouse.org/chokepoints>

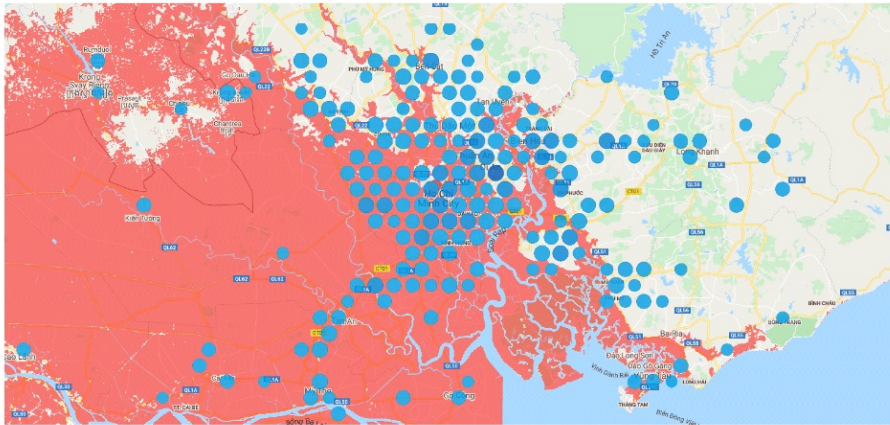
-vulnerabilities-global-food-trade#

Hoffmann. 2021. *Is a choked up Suez Canal just a taste of the future?* Fortune.com



Sea Level Rise - 2030

Figure 10: Apparel and Footwear Manufacturing Sites and 2030 Projected Sea Level Rise in the Ho Chi Minh City, Vietnam and Mekong Delta region.

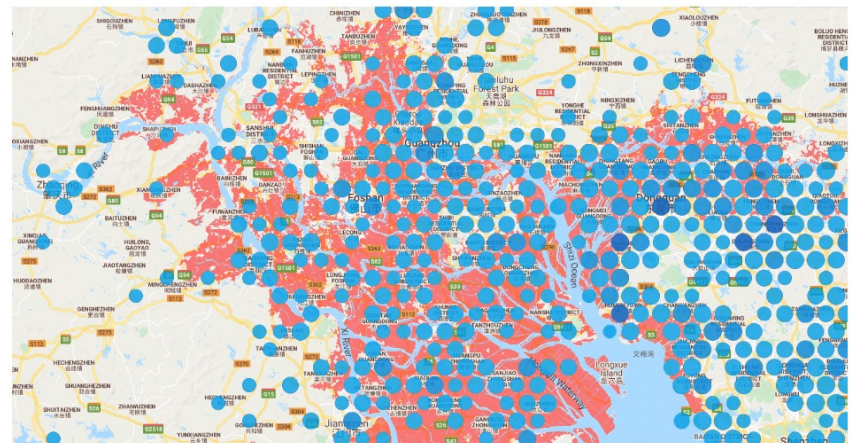


Major apparel-producing areas will be under-water.

55% of apparel factories in Ho Chi Minh City's affected.

Increasing heat stress for workers

Figure 9: Apparel and Footwear Manufacturing Sites and 2030 Projected Sea Level Rise in the Guangzhou, China region.



Depressed

Overwhelmed

Ignore

Deny





- Confront Climate Change
- Challenge
- Tackle
- Threaten
- Meet head-on
- Face up to
- Defy

What Needs to be Done

Rapid, fundamental changes, at
unprecedented scale

Massive shift away from fossil fuels and
sources of other greenhouse gases,

Collective and individual actions
"All hands on deck"

Requires government action

Corporations lead a transformation to a
net zero economy

It's up to the wealthy countries

A Challenge

**An
Opportunity**

- **Accelerated abatement – 50% cut in GHG emissions by 2030**
 - Upstream renewable energy – 60%
 - Brand operations – 20%
 - Consumer behavior – 20%
- **Requires**
 - Bold commitments, actions, collaboration, joint investments
 - Beyond 2030, fundamental change in business models, economic growth, consumerism

A Challenge

**An
Opportunity**

Supply chain risk assessment

Invest in suppliers to ensure
productivity & resiliency

Mitigate impact on climate

Proactive/plan

Emergency plans

What Stewards of the Land are Doing

- Farmers,
Ranchers -

- **Climate smart farming**
 - Focus on soil health
 - Water management
 - Diversify for resiliency
 - Reduce animal stress
 - Plan & adapt

What Science is Doing

Resilient Crops, including GE

Soil Health

Water & Pest Management

Climate Modeling

Decision Tools

Communication

Economics

Science

Genetic Engineering

Gene editing: It's precise, like removing a single gene from the 32,000 in a corn plant or one key from a piano with 32,000 keys.



...no substantiated evidence that foods from GE crops were less safe than foods from non-GE crops.

National Academy of Science (2016)

What We Can All Do - A Greater Purpose -



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- Talk about it
- Become climate change literate
- Get involved - Raise your voice – scream, vote...
- Do what you are best at
- A more plant-based diet
- Be courageous

No one is too small to make a difference.

Greta Thunberg

Hoffmann. 2021. Depressed about climate change? Turn your despair into your greater purpose (Commentary).
Syracuse.com

Talk About It!

- First step in tackling climate change
- Incorporate climate change language into your life
- Suggestions:
 - Listen
 - Focus on solutions
 - Avoid too many facts
 - Make it relevant – food, apparel
 - Don't use fear
 - Find a common ground



Talk about Food and Apparel?

- It's relevant
- It's essential
- Enjoyable
- Important to the economy
- Easy to talk about
- Stories to tell

US/Rich countries

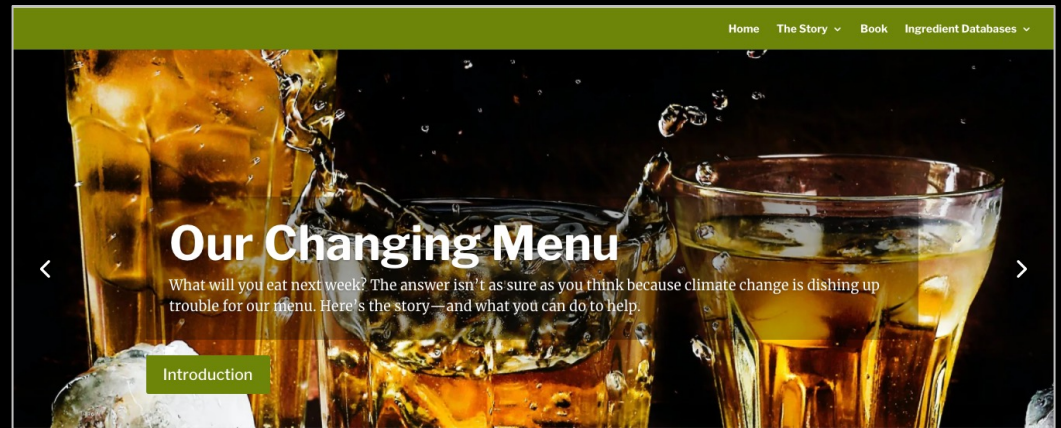
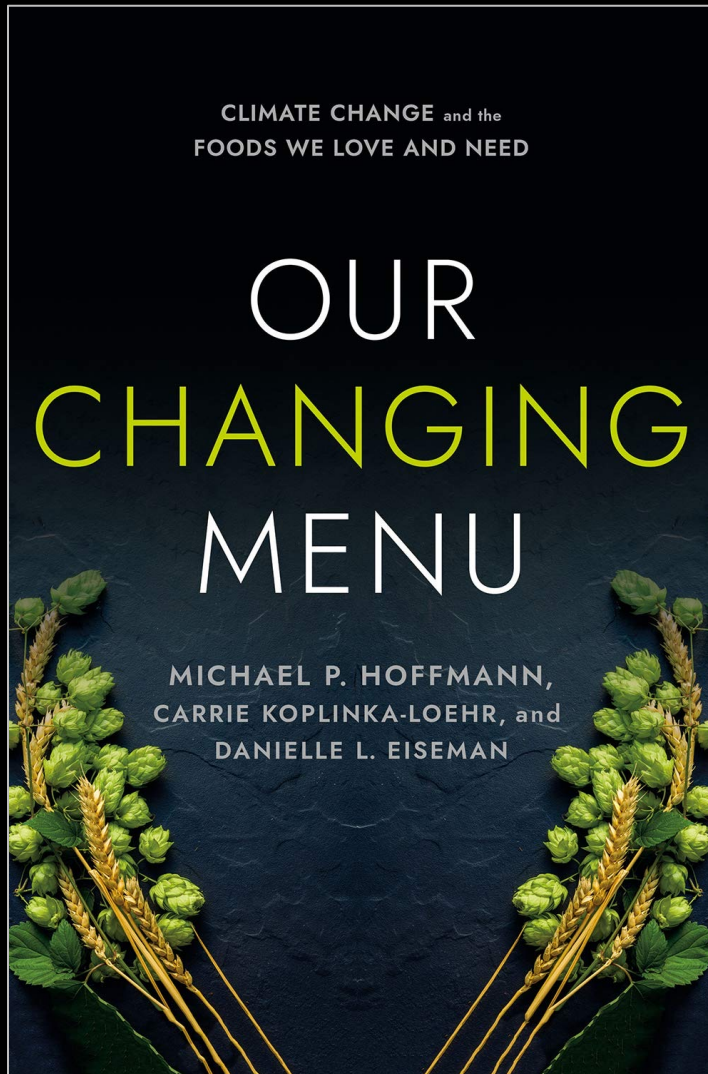


Become Climate Change-Literate

- Understand:
 - Earth's climate system
 - impacts of climate change
 - costs & impacts of confronting climate change
- Assess credible information
- Communicate effectively
- Make informed decisions.



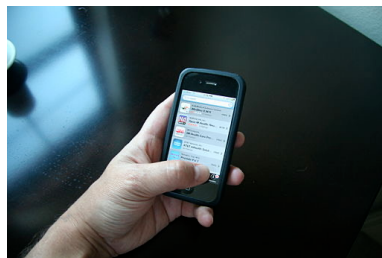
A Campaign; A Social Movement



Databases

eCornell –
Climate change leadership course

- Climate Change - A grand challenge we can tackle If we have the will



A Name

What will they
say about us in
2030? 2040?

Did we try?



Thank You

Now be a force of nature!

Mike Hoffmann

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***TEDx: Climate Change: It's time to
raise our voices***

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and Scholarship and the Towards Sustainability Foundation

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