

# Life Cycle Assessment as a Tool for Agriculture

*Taking the First Steps*

Biomass: Securing a Sustainable Supply  
Kerrienne Koehler-Munro  
March 5, 2012



# Outline

- Setting the Context
- Why an LCA Approach
- Applications of LCA in Agriculture
- Environmental Footprinting in Alberta

# Agriculture on Display

## THE COSTCO CONNECTION

August 2011 • Volume 26 • Number 8

A lifestyle magazine for Costco members



# Sustainability

Big lessons from a little egg 22

THE TEA PARTY'S BIBLE • HAMAS TALKS PEACE  
OCTOBER 25, 2010

# Newsweek

Want to Save the Planet?  
**MAKE A GREENER BURGER\***



## CANCER IMMUNITY HIDDEN IN A RARE GENETIC DEFECT ...

# DISCOVER

Science, Technology, and The Future



# CROP WARS

How activists are halting genetically modified crop research in Europe — and why they say it's too late for America...

**PLUS**  
DANGER ON THE WAY TO PLUTO ...

THE BAD BOSS CURE ...  
WHY THE CAVEMAN DIET IS A MYTH ...  
INSIDE TEMPLE GRANDIN'S BRAIN

## Labeling Genetically Modified Food

THE PHILOSOPHICAL AND LEGAL DEBATE



Joe Klein: How Al Gore Could Save The Democrats



Hillary Clinton On Why She Won't Quit



R.E.M. Rises from The Dead

APRIL 7, 2008

# TIME

## The Clean Energy Myth

BY MICHAEL GRUNWALD

Politicians and Big Business are pushing biofuels like corn-based ethanol as alternatives to oil. All they're really doing is driving up food prices and making global warming worse — and you're paying for it



# Is it all about GREEN

- There's **MORE**:
  - Population 9 billion by 2050 with higher incomes
  - Meat- and dairy-based diets (70% more food by 2050)
  - Global warming and extreme climate events
  - Competition for grains and oilseeds (food versus fuel)
  - Food wastage in developed countries
  - Consumers, governments, NGO's, food industry, our children concerned about food sustainability issues



- And, globally, there's **LESS**:
  - Water (75% global water usage is in agriculture)
  - Land available for agriculture (10% less by 2050)
  - Fossil fuels (if not “peak” oil, higher cost oil)
  - Public investment in agricultural R&D
  - Old growth forests
  - Food stocks

# Who is Interested in a Sustainable Image?

- Retailers
  - **Walmart** – #1 in world
    - Locally sourced products
    - Support 3<sup>rd</sup> world farmers
    - Track pesticides, fertilizer and water use
  - **Carrefour** – France, #2 in world
    - Carbon legislation
    - Social welfare
  - **Tesco** – UK, #3 in world
    - Carbon labeled products
  - **Sobeys**





**MACLEAN'S**

We hope you enjoy this clean reading mode:

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# Woody Harrelson breaks from 'Hunger Games' to promote Canadian wheat-based paper

by Dirk Meissner, The Canadian Press on Thursday, October 25, 2012 9:48am -

2012



# Values: The Other Half of the Equation



PRICE



PROMOTIONS



ETHICS



SUSTAINABILITY

VALUE



VALUES



PACK SIZE



PERFORMANCE



PROVENANCE



HERITAGE





CONTROVERSIAL  
FOODS

CONTROVERSY-  
FREE FOODS



## Global Sustainability Megaforces

Climate Change

Material Resource  
Scarcity

Wealth

Ecosystem Decline

Food Security

Energy & Fuel

Population Growth

Urbanization

Water Scarcity

Deforestation

### Impacts on business

Price increases  
and volatility

New regulations

Physical and  
weather changes

Changes in consumer  
preferences

Resource constraints  
on production

### Emerging risks

Regulatory

Reputational

Physical

Market

Litigation

Social

*The global sustainability megaforces result in both risks and opportunities. Businesses can design effective strategies to address the risk while simultaneously taking advantage of the opportunities.*

### Emerging opportunities

Reputation and brand

Innovation and learning

New products, services and  
markets

Cost reduction

Access to capital



# Environmental Labels

**Casino COOKIES**  
PÉCAN Pépites Choco

**L'INDICE CARBONE de ce produit**  
450g

Faible impact environnemental / Fort impact environnemental

Plus d'informations : [www.produits-casino.fr](http://www.produits-casino.fr)  
ou SERVICE CONSOMMATEURS



Environmental Facts	
Overall Weighted Score	6 / 10
<b>Energy</b>	
Embedded energy	2,800kWhr
Type of energy used: 2,090kWhr coal, 806kWhr solar PV	
Energy usage, avg. est.	1,500kWhr/yr
Transportation origin	
Product: USA	
Materials: USA, China, Korea, South Africa	
<b>Resources</b>	
Product	
Mass	10kg
Non-virgin material	6%
Recyclable/Compostable material	30%
Ingredients: Polyethylene terephthalate (PET), aluminum, steel, glass, copper, fiberglass, acrylonitrile-butadiene styrene (ABS), lead-free solder, nematic liquid crystals, polyimide, indium-tin oxide, Polycarbonate, Poly(methyl methacrylate) (PMMA), Styrene-butadiene co-polymer, Polyethylene ether, Triphenyl phosphite, polybrominated flame retardant, silicon, silicon dioxide, silicon nitride, selenium, cadmium, antimony, dopants	
Life Expectancy	4-7yrs
End-of-life	return to manufacturer
<b>Packaging &amp; Misc.</b>	
Mass	800g
Non-virgin material	20%
	100%

**innocent** pure fruit smoothie  
pineapples, bananas & coconuts

**360g CO2 per 250ml serving**  
Compared to Long-Life Juice

**240g**

The carbon footprint of this juice is 360g CO2 per 250ml serving and we have committed to reduce it. By comparison, the footprint of Tesco long-life orange juice is 240g per 250ml serving. This is because more energy is used to chill and transport 100% pure juice.

working with the Carbon Trust

GREEN INDEX® 4		INDICE VERT® 4		Our Green Index
<b>FACTORS</b>	<b>LOWER IMPACT</b>	<b>HIGHER IMPACT</b>	<b>REPERCUSSION NEGATIVE</b>	<b>REPERCUSSION POSITIVE</b>
<b>Climate Impact through production</b>	0 4 10	0 4 10	0 4 10	0 4 10
<b>Chemicals Used: Presence of hazardous substances (PVC and Solvent adhered)</b>	0 10	0 10	0 10	0 10
<b>Resource Consumption: Reduced by the use of recycled, organic and renewable materials</b>	0 9	0 9	0 9	0 9
<p>For more information about the Green Index® rating, visit <a href="http://www.timberland.com/legrand">www.timberland.com/legrand</a></p> <p>Green Index® is a trademark of Timberland North America ©2005 The Timberland Company. All rights reserved.</p>		<p>Pour plus de renseignements à propos de l'Indice Vert®, veuillez vous rendre à <a href="http://www.lesmagasins.com/legrand">www.lesmagasins.com/legrand</a></p> <p>L'Indice Vert® est une marque déposée de Timberland, Les Magasins Verts.</p>		<p>We rate our products on a scale from 0 to 10 using a system created to compare the environmental impact of Timberland products. The lower the score, the smaller environmental footprint associated with making it - from raw materials to finished product.</p>
				<p>ycle, compost</p> <p>mum,</p> <p>num,</p> <p>sts (CF,</p> <p>2,600L</p> <p>2/10</p>

**Timberland**

8/10  
4/10  
5/10

# Certified Labeling



carbonZero Cert™  
certified organisation





# Momentum is Growing



**THE GLOBAL PACKAGING PROJECT  
PART OF THE CONSUMER GOODS  
FORUM SUSTAINABILITY PILLAR**

**Retailers**

- ASDA
- Loblaw
- Harris Teeter
- METRO Group
- M&S
- MIGROS
- SAFeway
- SUPERVALU
- TESCO
- Wegmans
- Walmart

**Manufacturers**

- The Coca-Cola Company
- RECKITT BENCKISER
- L'ORÉAL
- Freudenberg
- GENERAL MILLS
- Kiwi
- Henkel
- SMUCKERS
- COLGATE-PALMOLIVE
- eski
- Masterfoods
- Sara Lee
- Unilever
- Nestlé
- Beiersdorf
- DANONE
- JOHNSON
- PEPSICO
- Heineken
- Johnson & Johnson
- Campbell's
- ConAgra Foods

**Associations**

- AIM
- FPE
- GS1
- EUROPEN
- FCPC
- IGD
- EUROPEAN
- SUSTAINABLE PACKAGING COALITION
- WRAP
- Packaging manufacturers
- Sealed Air
- ExonMobil
- CROWN
- NOVELIS
- MWV
- ALCAN
- Tetra Pak

**Consultant support**

- Quantis
- GreenBlue

## Sustainable Apparel Coalition

- Adidas
- Arvind Mills
- C&A
- Duke University
- Environmental Defense Fund
- Esprit
- Esquel
- Gap Inc.
- H&M
- HanesBrands
- Intradeco
- JC Penney
- Kohl's Department Stores
- Lenzing
- Levi Strauss & Co.
- LF USA, a division of Li & Fung Limited
- Marks & Spencer
- Mountain Equipment Co-op
- New Balance
- Nike
- Nordstrom
- Otto Group
- Outdoor Industry Association
- Patagonia
- Pentland Brands
- REI
- TAL Apparel
- Target
- Timberland
- U.S. Environmental Protection Agency
- Verité
- VF Corp
- Walmart

## Sustainability Consortium



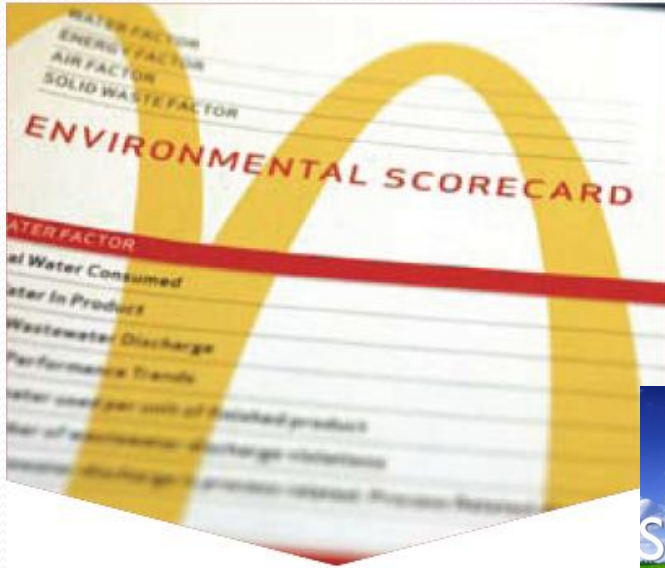
**Tier 1 Members**

- ALCCA
- BASF
- Bayer
- BEST BUY
- Cargill
- THE COCA-COLA COMPANY
- Coca-Cola
- COLGATE-PALMOLIVE
- DMG
- DARDEN
- defra
- DELL
- Disney
- General Mills
- Georgia-Pacific
- Henkel
- hp
- Kimberly-Clark
- KPMG
- L'ORÉAL
- MARS
- MillerCoors
- MONSANTO
- NICE+PAK
- novozymes
- NSF
- OCTAL
- PE AMERICAS
- PEPSICO
- P&G
- PRé
- Quantis
- SAP
- SAFeway
- Johnson & Johnson
- SCS
- Stonefield
- syngenta
- Tyson
- U Environment
- Unilever
- Walmart
- WMA

**Tier 2 Members**

- 3M
- Ahold
- Alberto Culver
- Campbell's
- DANISCO
- ECOLAB
- Forest Products Association of Canada
- intel
- Johnson & Johnson
- KIK CUSTOM PRODUCTS
- MARKS & SPENCER
- Sun
- TOSHIBA
- BSR
- WWF
- defra

# Retail Sector Moving Quickly



## KEEPING SCORE WITH THE ENVIRONMENTAL SCORECARD



Jessica Droste Yagan  
Senior Manager, Sustainable Supply Chain

**OBJECTIVE:** Work with our suppliers to help them become more aware of the resources they are using and drive continuous reduction of environmental impacts in the production process.

**SOLUTION:** About five years ago, McDonald's began working with Conservation International and some

## Heinz 2011 Heinz Corporate Social Responsibility Report

### GHG Emission Reductions

#### Goal

Greenhouse Gas (GHG) Emissions – Overall 20% reduction per metric ton of production by Fiscal Year 2015.

#### Progress<sup>a</sup>

Since 2005, we have reduced our GHG emissions by 13.2% per metric ton of production globally.

<sup>a</sup> As of Fiscal Year 2011

On Target

Percentage Reduction per Unit of Production



2 Heinz U.K. facilities saved more than **17,600** metric tons CO<sub>2</sub>e in **4** years

At Wal-Mart, we believe in creating a sustainable environment that supports growers, emphasizes the use of renewable resources and the conservation of our environment.

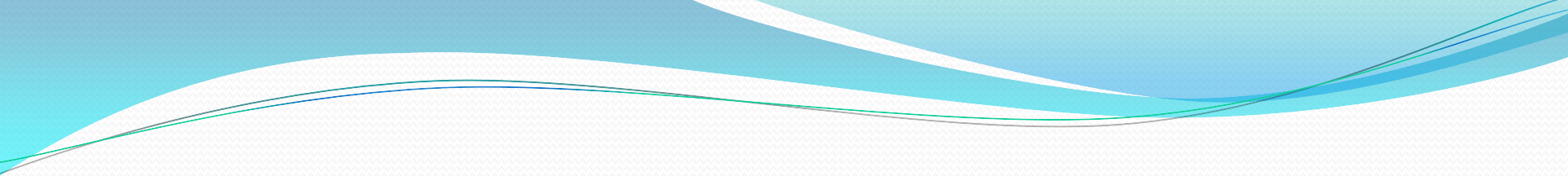
**WAL\*MART**  
SUPERCENTRE



# General Mills

“An estimated 90 to 95 percent of the food industry’s environmental footprint occurs in commodity production.”

*-2009 Corporate Social Responsibility Report*

- 
- Market demand for food safety and environmental sustainability assurance programs has become a global reality
  - The phenomenon will only increase as more companies implement their own social responsibility (SR) programs





- Many challenges and opportunities for farmers, society & the food sector





# Life Cycle Assessment (LCA)

- A decision-making tool to identify environmental burdens and evaluate the environmental consequences of a product, process or service over its life-cycle from cradle to grave
- Standardized by ISO (14040)



Indicators for decisions with a science-based aggregation



CARBON FOOTPRINT



WATER FOOTPRINT



ECOSYSTEMS

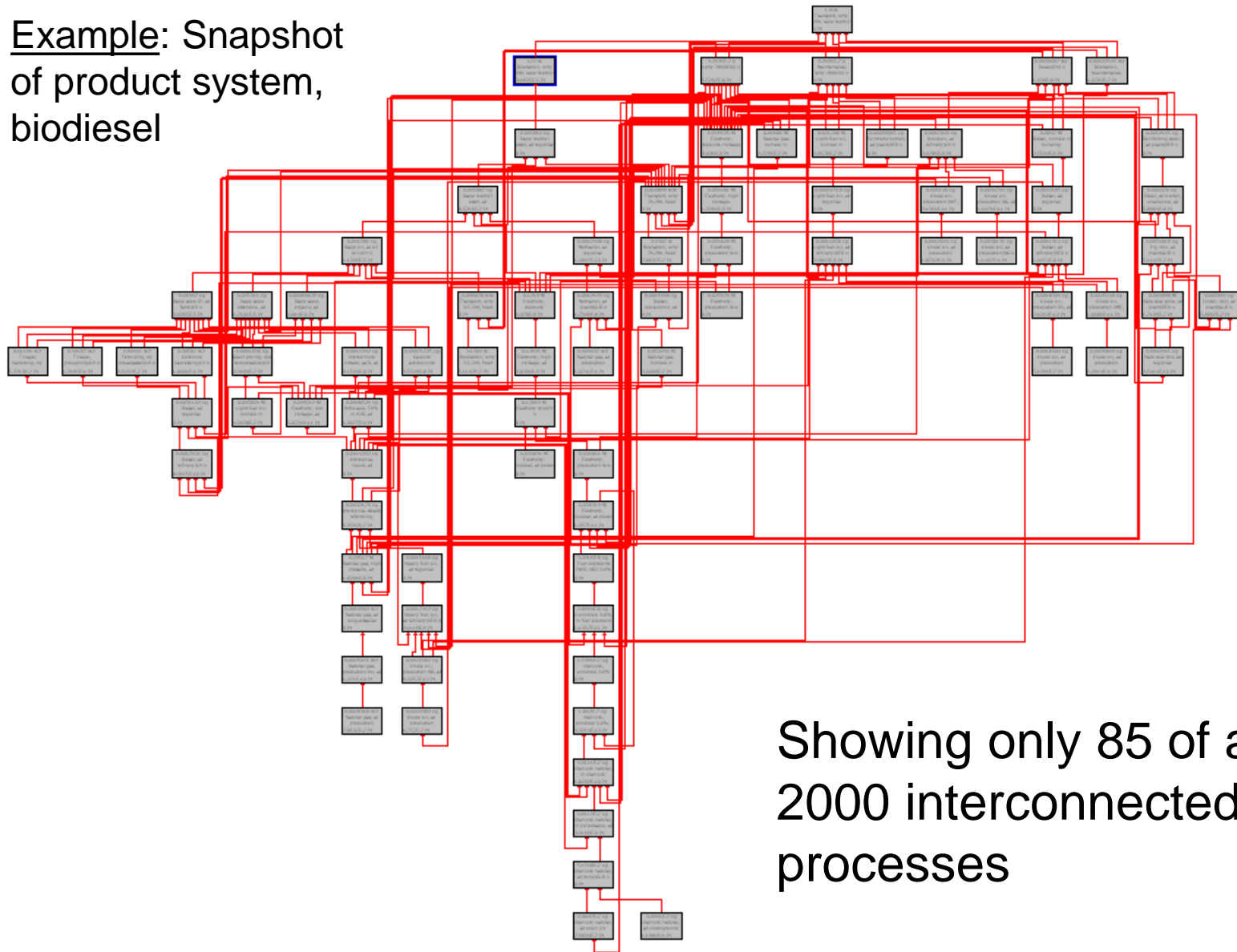


NATURAL RESSOURCES



HUMAN HEALTH

Example: Snapshot  
of product system,  
biodiesel



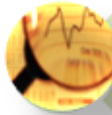
Showing only 85 of about  
2000 interconnected unit  
processes



# Some Uses of LCA



Compare alternatives



Identify “hot spots”



Invest resources intelligently



Set goals & measure progress



Benchmark performance



Manage risk



Communicate & substantiate



And more...

# Carbon Footprint Analysis for Wood & Agricultural Residue Sources of Pulp

- carbon footprint of wood and agricultural residue sources of pulp
- determine whether the use of crop residue had the potential to reduce the environmental “load” associated to pulp production

Carbon Footprint Analysis for Wood &  
Agricultural Residue Sources of Pulp

**FINAL REPORT**

Summer 2011

SUBMITTED TO:

Alberta Agriculture and Rural Development  
Environmental Stewardship Division  
306, 7000-113 Street, Edmonton, Alberta, T6H 5T6

SUBMITTED BY:

Jennifer Fix and Sean Tynan  
HB Lanarc Consultants  
Vancouver, BC

with  
Dr. Meidad Kivinger  
Department of Geography and Environmental Development  
Ben-Gurion University of the Negev

# Value Added Opportunities for Straw in Alberta

- Opportunities for industrial use of straw exist in the Lamont, Minburn, Two Hills, Beaver and Camrose counties.
- There is some opportunity in the Clear Water, Mountain View, Rocky View and Foothills county and municipal districts as well.
- Straw supply is variable over time and space in Alberta.

# The Margaret Atwood Straw Paper Trial



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## Welcome to Canopy!

We work with the forest industry's biggest customers to protect the world's forests, species and climate.

WITH BUSINESS LEADERSHIP  
ANYTHING IS POSSIBLE  
EVEN PROTECTING



GO

"THERE ARE FEW ORGANIZATIONS THAT CAN MATCH CANOPY IN ITS UNFLINCHING COMMITMENT TO SAVE THE WORLD'S FORESTS AND THE MANY SPECIES THAT DEPEND ON THEM..."

**MARGARET ATWOOD, AUTHOR**



### About Canopy

Canopy is an award winning environmental not-for-profit organization, known around the world for our cutting edge campaigns and successes. [»Read More](#)



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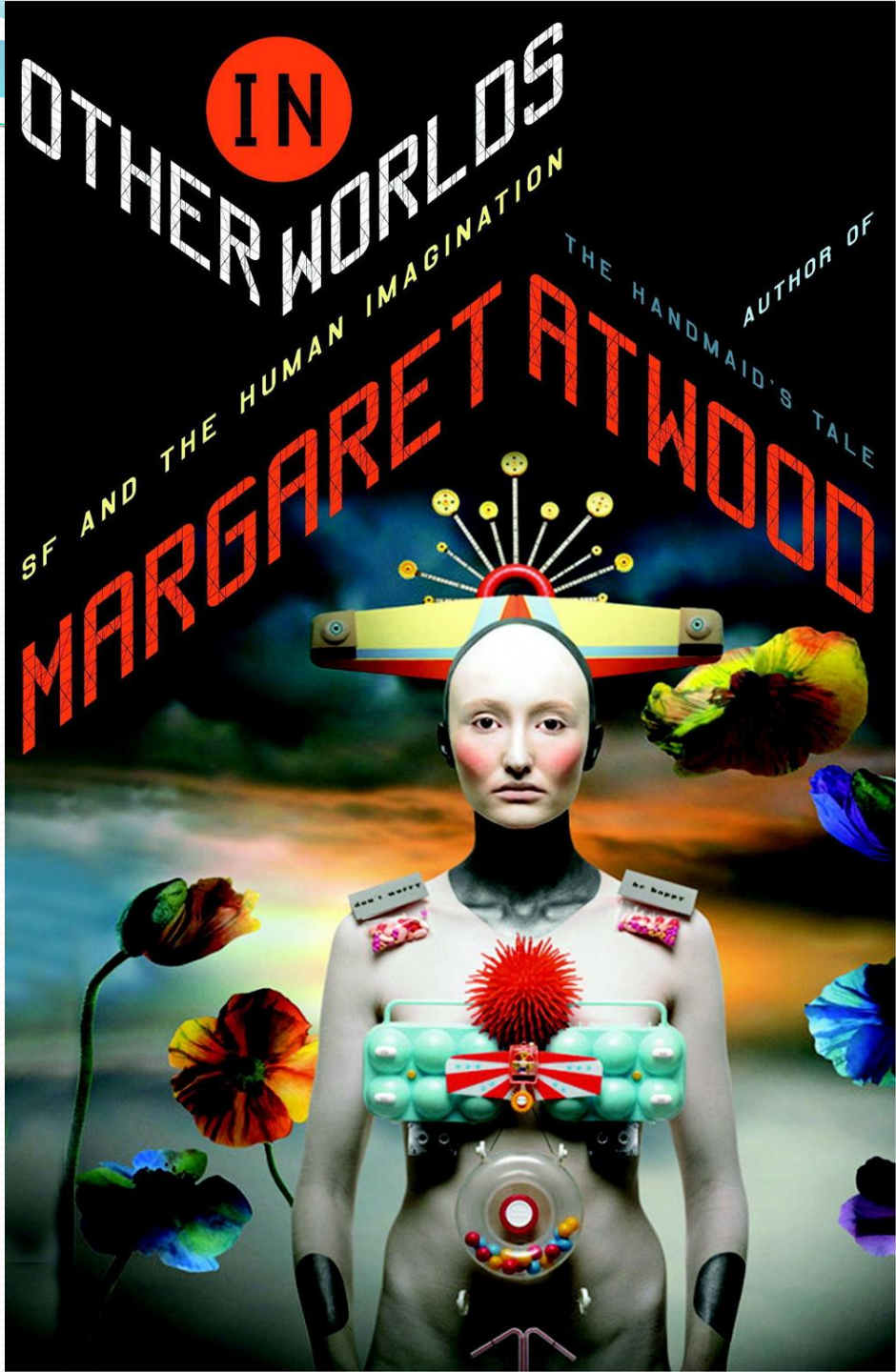
the  
**ECO  
PAPER  
DATABASE**

**CLICK  
HERE**



***“HUMAN BEINGS  
REQUIRE OXYGEN AND  
FORESTS PRODUCE IT;  
PRINTED BOOKS  
REQUIRE PAPER BUT  
PAPER NEED NOT BE  
MADE FROM VIRGIN  
FORESTS.”***

**MARGARET ATWOOD**



# Eco Paper Database



»Go To Canopy's Website



## Ecopaper Database

Welcome to Canopy's list of the most environmentally friendly paper available in North America.

Criteria for inclusion are based on the **Paper Steps**, developed with and endorsed by the Environmental Paper Network.

This list includes Ancient Forest Friendly™ papers, and other eco papers that are category leaders. So, whether you're looking for paper with recycled, FSC or agricultural residue content, you can be sure that the printing and writing grades, copy paper, newsprint and packaging options below are the greenest Canopy has found on the market.

If you manufacture or sell eco paper you think should be added to this list, or have an update to include, please email [neva@canopyplanet.org](mailto:neva@canopyplanet.org).

Canopy is a not-for-profit forest conservation organization. We do not sell paper.

### How to use the database:

Narrow your search by filtering the list. Fewer filters will result in a larger list.

Click on a paper's Brand Name to see more details.

Brand Name	<input type="text" value="Select All"/>	Paper Type	<input type="text" value="Copy Paper"/>	Ancient Forest Friendly™	<input type="text" value="Yes"/>	Web rolls or sheets	<input type="text" value="Sheets"/>	Coated/Uncoated	<input type="text" value="C"/>
Paper Step	<input type="text" value="Select All"/>	Grade	<input type="text" value="#1"/>	Minimum Recycled Content	<input type="text" value="50%"/>	Certifications	<input type="text" value="FSC"/>	<a href="#">Reset Search</a>	<input type="text" value="Search"/>

Brand Name	Manufacturer	Paper Type	Coated/Uncoated	Grade	Ancient Forest Friendly	Paper Step	Post-Consumer Recycled Content	Second Harvest	Bleaching	Certifications	Basis Weight (lb)	Web rolls or sheets
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# Environmental Footprinting for Agriculture in Alberta Project

- Funded by the Federal Provincial Agricultural Flexibility Agreement
- March 2014





# Environmental Footprinting Project

- Primary production level sustainability assessment and reporting using a life cycle approach for four agriculture commodities in Alberta
  - **Canola**
    - *The functional unit for this study is the production of one (1) kg of Alberta-grown canola at the farm gate.*
  - Potato
  - Chicken

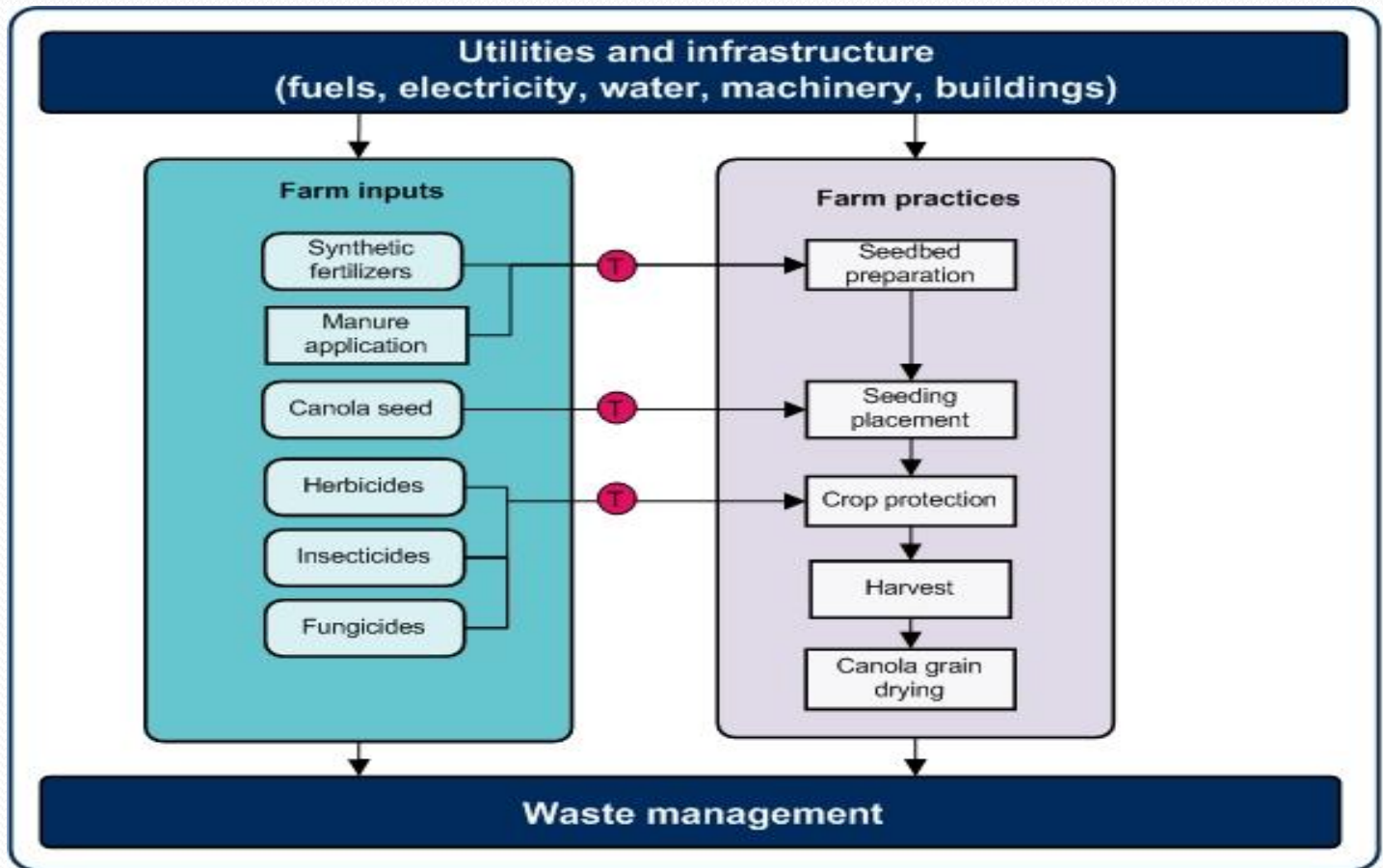


# Project Goals

- Build capacity to understand, develop and utilize environmental footprints
- Develop data inventories that are applicable to the prairie region
- Processes and methodologies that are recognized nationally and internationally

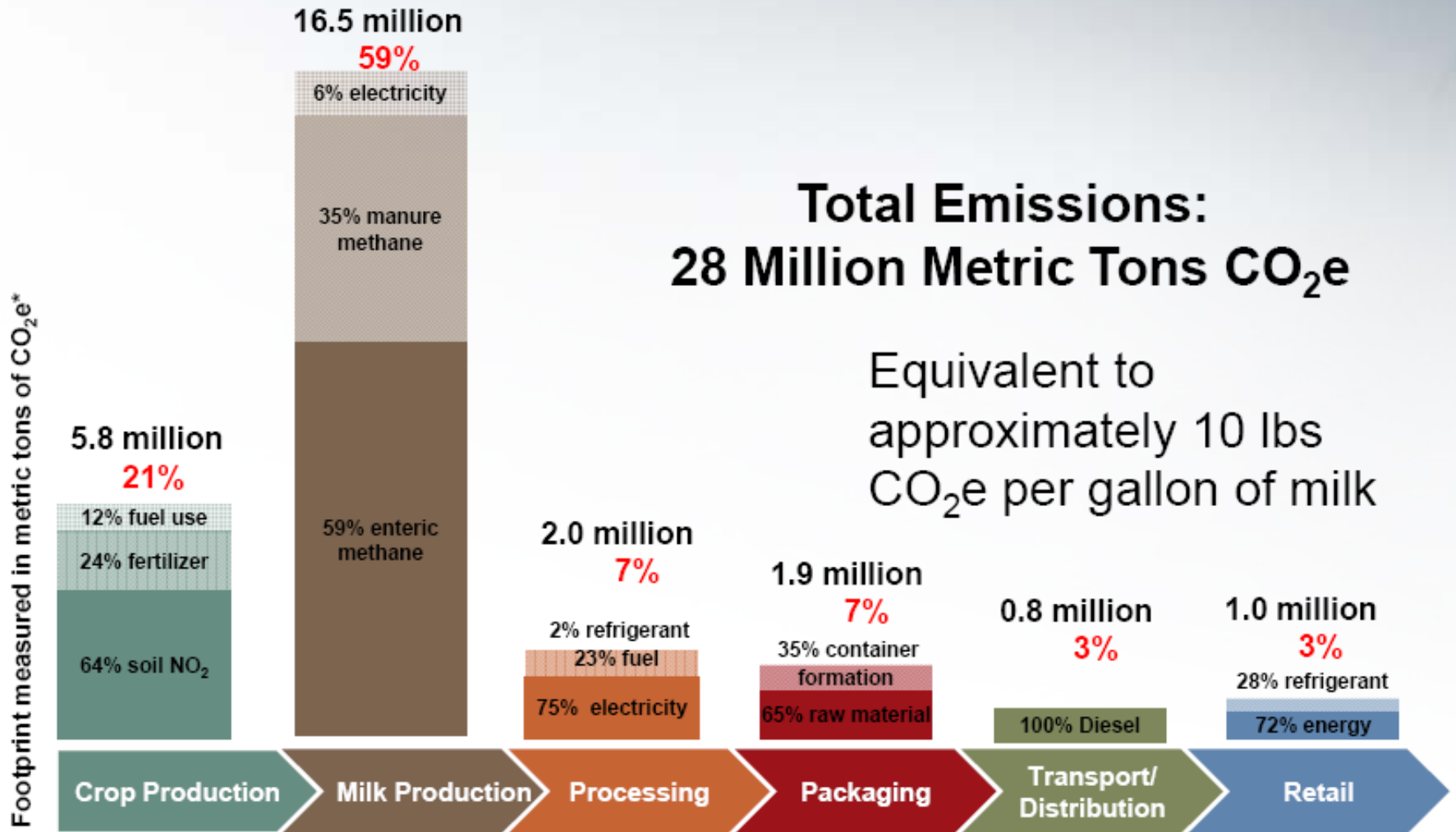


# Canola Boundaries





# Milk Production LCA Results Example



# Footprinter Example: Milk

**Intended use:** help US milk farmers understand their environmental impacts and prioritize their efforts for reducing them



Total annual milk production	10000 lbs
Average milk fat content	10 %
Average milk protein content	20 %
Annual average of total cows in the herd (includes lactating and dry cows) ?	1000
Annual average of dry cows in herd (% of total cows) ?	20 %
Annual average number of heifer calves (less than 2 months)	raised on-farm: 50 raised off-farm: 50
Annual average number of heifers (2 months to first calf) ?	raised on-farm: 50 raised off-farm: 50
Total annual number of mature cows culled for beef	50
Average weight per cow	400 lbs
Total annual number of calves sold for beef	50
Average weight per calf, at time of sale	300 lbs



## Carbon footprint

emissions for 1 kg of milk (FPCM)

Your footprint
  Region average
  U.S. average

S.I. (Metric)

Feed print [\(view breakdown\)](#)

	kg CO <sub>2</sub> -eq	% of total footprint
Your footprint	0.16	31
Region average	0.3	27
U.S. average	0.33	27

Enteric print ?

Your footprint	0.17	35
Region average	0.41	37
U.S. average	0.43	35

Manure print

Your footprint	0.13	25
Region average	0.33	30
U.S. average	0.41	33

Fuel print [\(view breakdown\)](#)

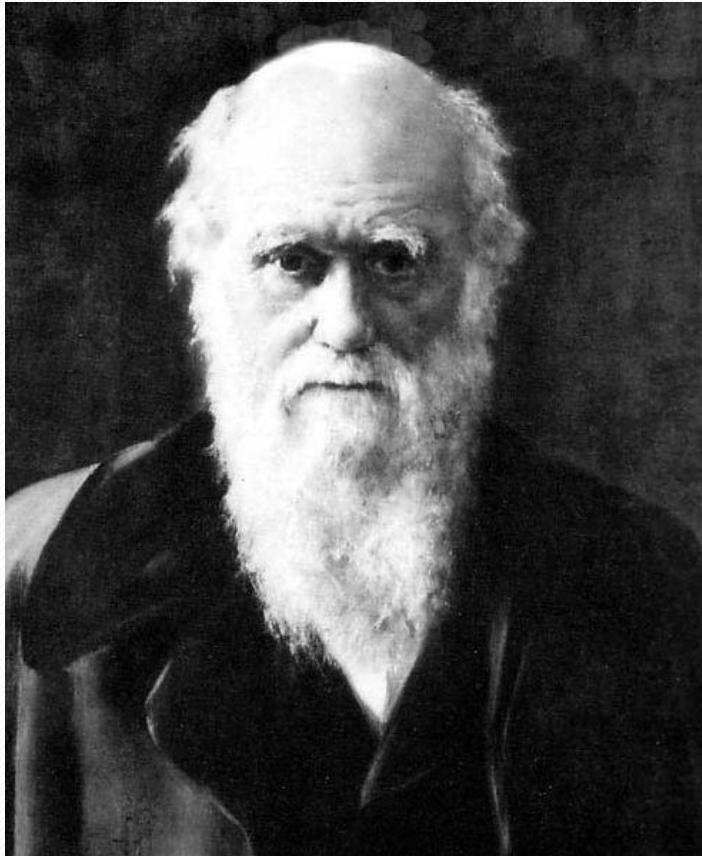
Your footprint	0.05	9
Region average	0.07	6
U.S. average	0.06	5

**TOTAL**

Your footprint	0.5	100
Region average	1.1	100
U.S. average	1.22	100

[view the FAQ](#)

# Times have changed



*“It is not the strongest species that survive, nor the most intelligent, but the ones who are most responsive to change.”*

- Charles Darwin

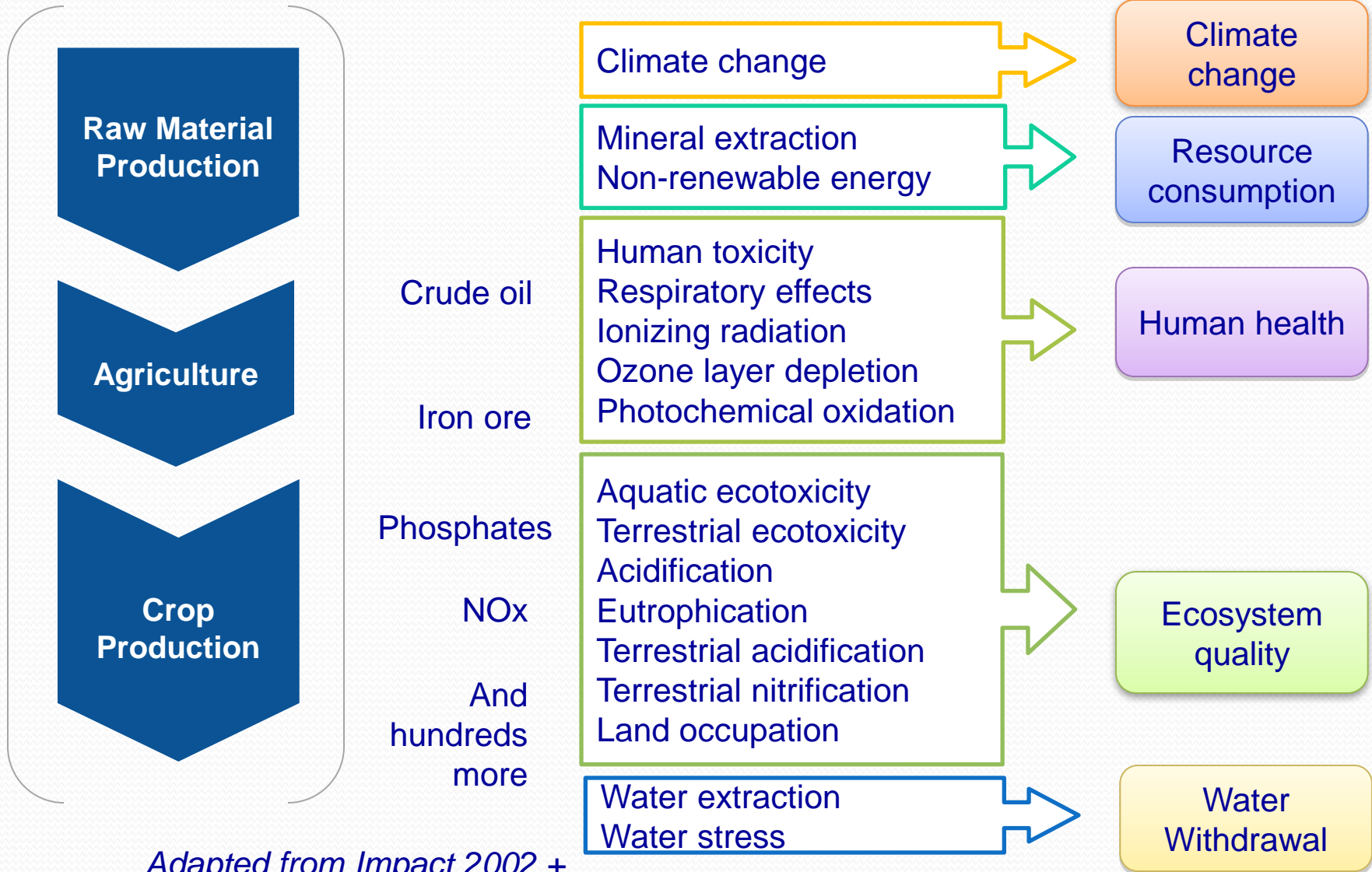




# Thank you...

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# Life Cycle Impact Assessment



Adapted from Impact 2002 +