Climate Change and Rangelands:

Change on the range

Matthew Braun, MSc, PAg

Ministry of Forests and Range

Range Branch

Outline

- Effects of climate change on range
- Rangeland mitigation and adaptation
- Sleeping with an elephant

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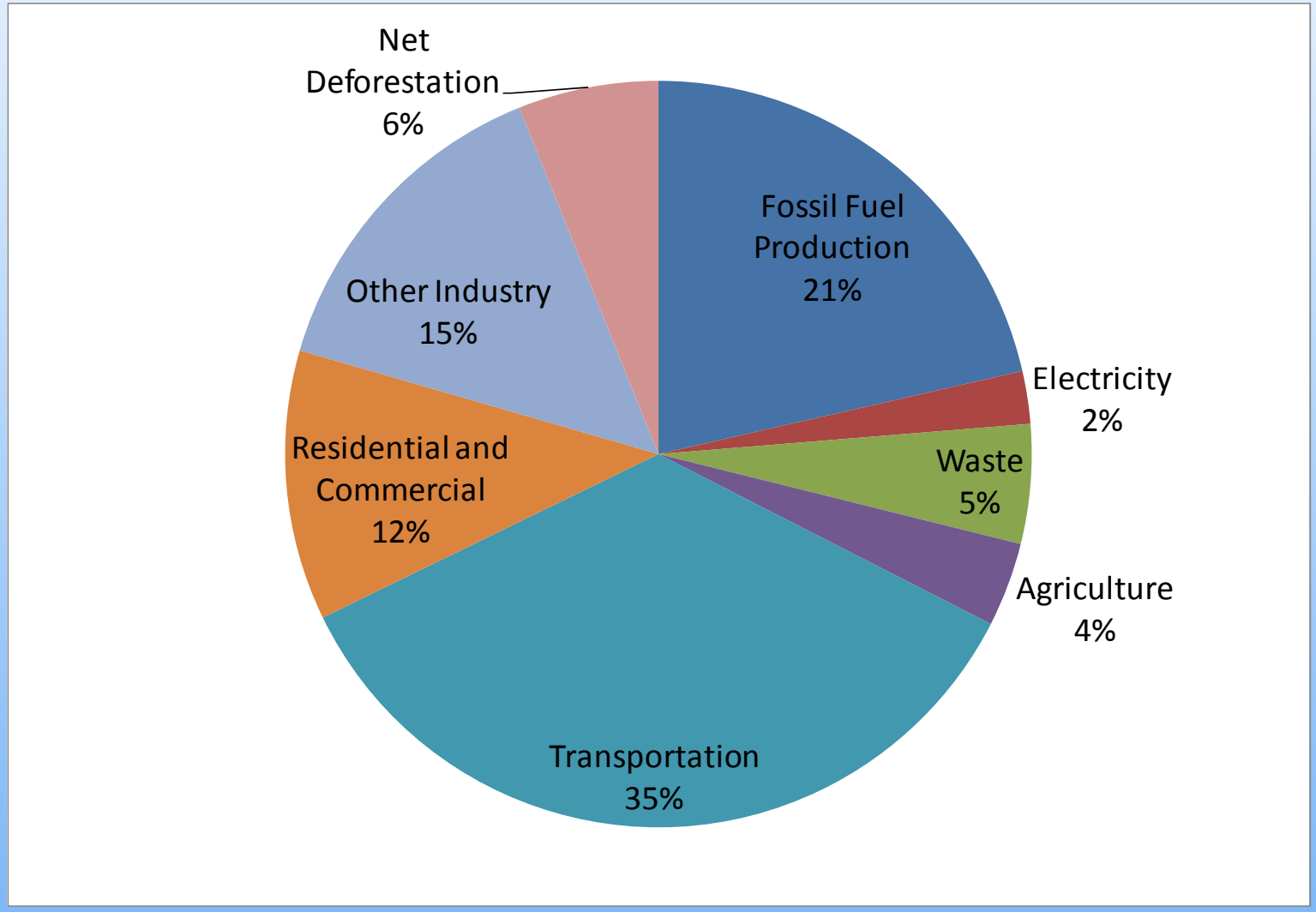
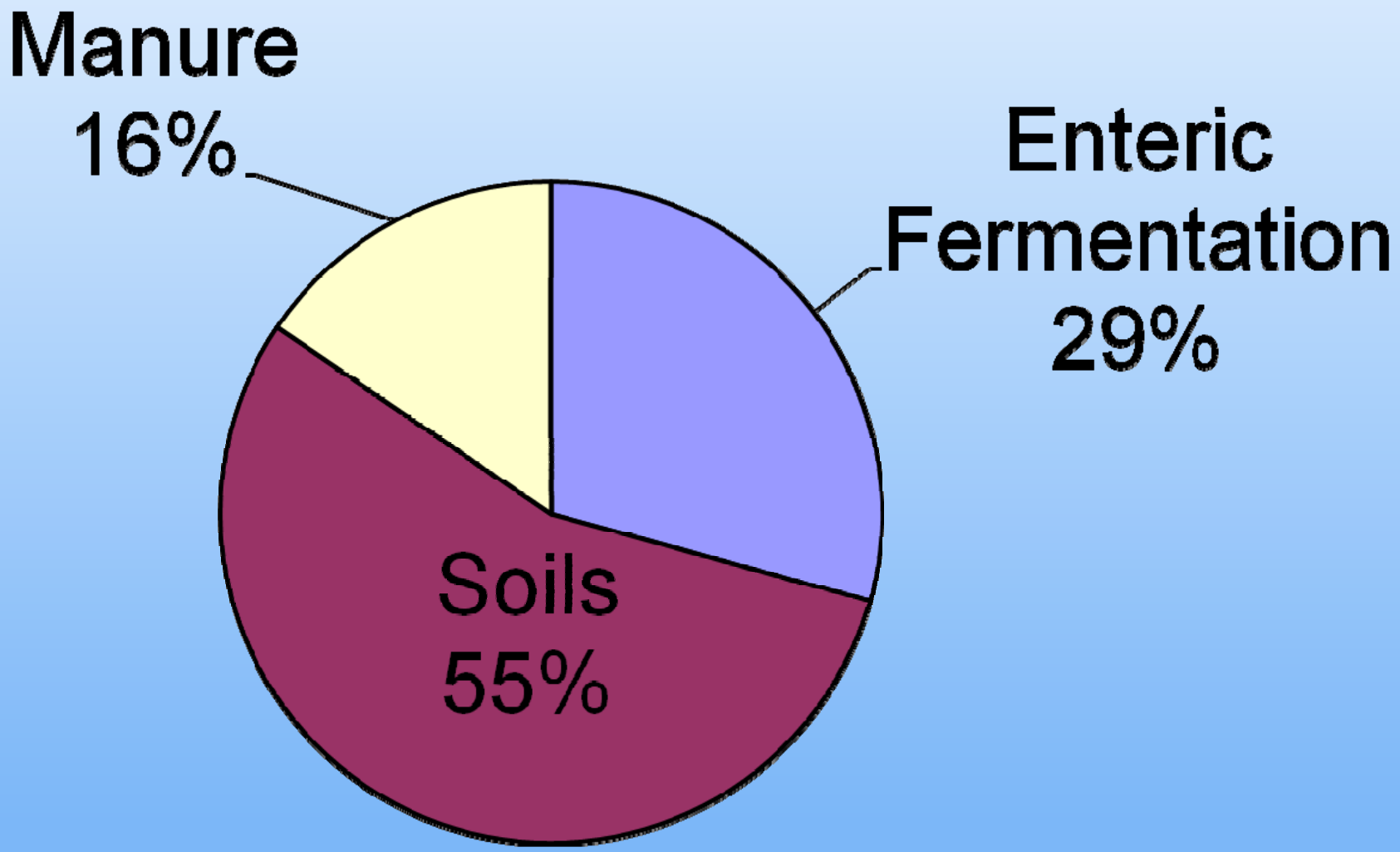
BC GHG Emissions



BC Ministry of Environment, 2006

Agricultural GHG Emissions



Environment Canada Fact Sheet, 2002

Effects Of Climate Change

- More CO_2
  - Increase plant efficiency
  - Change in species composition
- Migration of species
  - Higher elevation
  - Further north
  - Increased invasive plants

Effects On The Livestock Industry

- Earlier spring = change in calving
- Warmer summer = need for shade and water
- Wetter winter = early start for weeds
- Drier summer = more fire

Heather Thomas

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Livestock Mitigation Efforts

- Store more soil carbon
- Improve feed efficiency
- Improve waste management

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Carbon Sequestration

- Removing carbon (CO_2) from the atmosphere
  - Water absorbs CO_2
  - CO_2 recovery in coal fired power plants
  - Plants accumulating biomass

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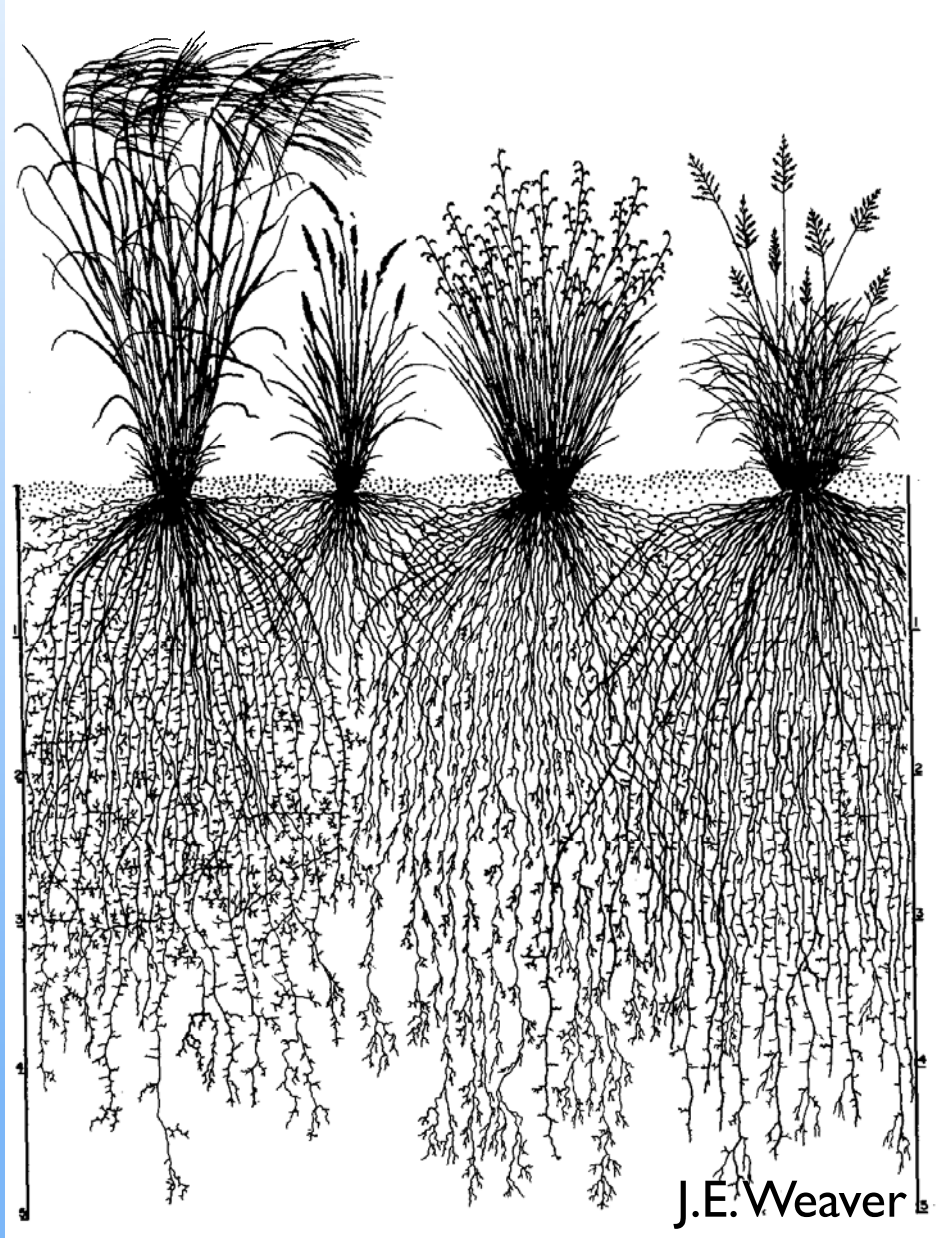
Carbon Sinks

- Atmosphere 750 Pg C
- Ocean 40,000 Pg C
- Vegetation 610 Pg C
- Soils
  - Organic carbon – 1,550 Pg C
  - Inorganic carbon – 750 to 950 Pg C

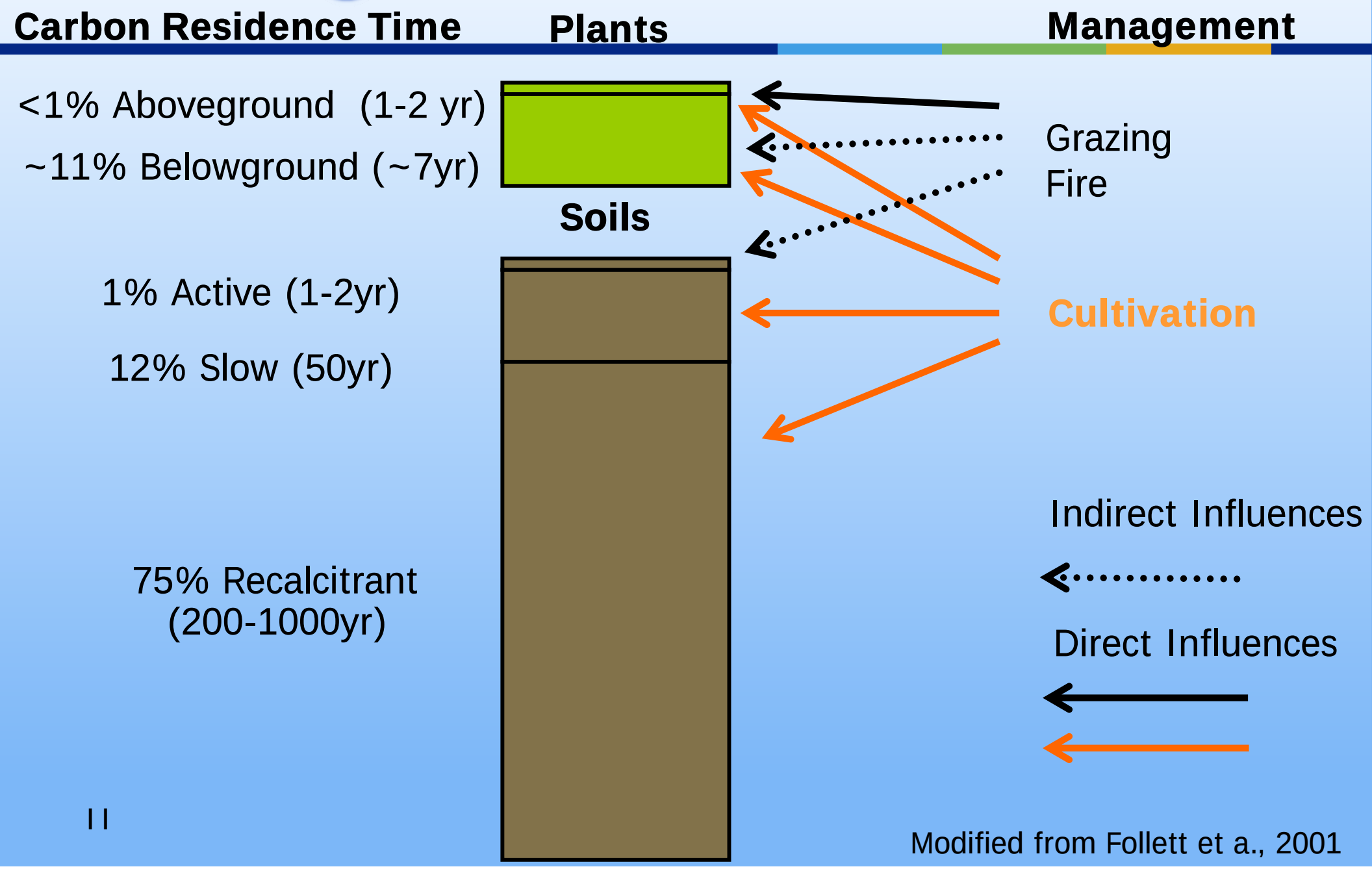
Schimel, 1995

Soil Organic Carbon

- C input > C output
- Death of root hairs
- Root turnover in dry land is up to 75% yr^{-1}
- Diversity above = diversity below

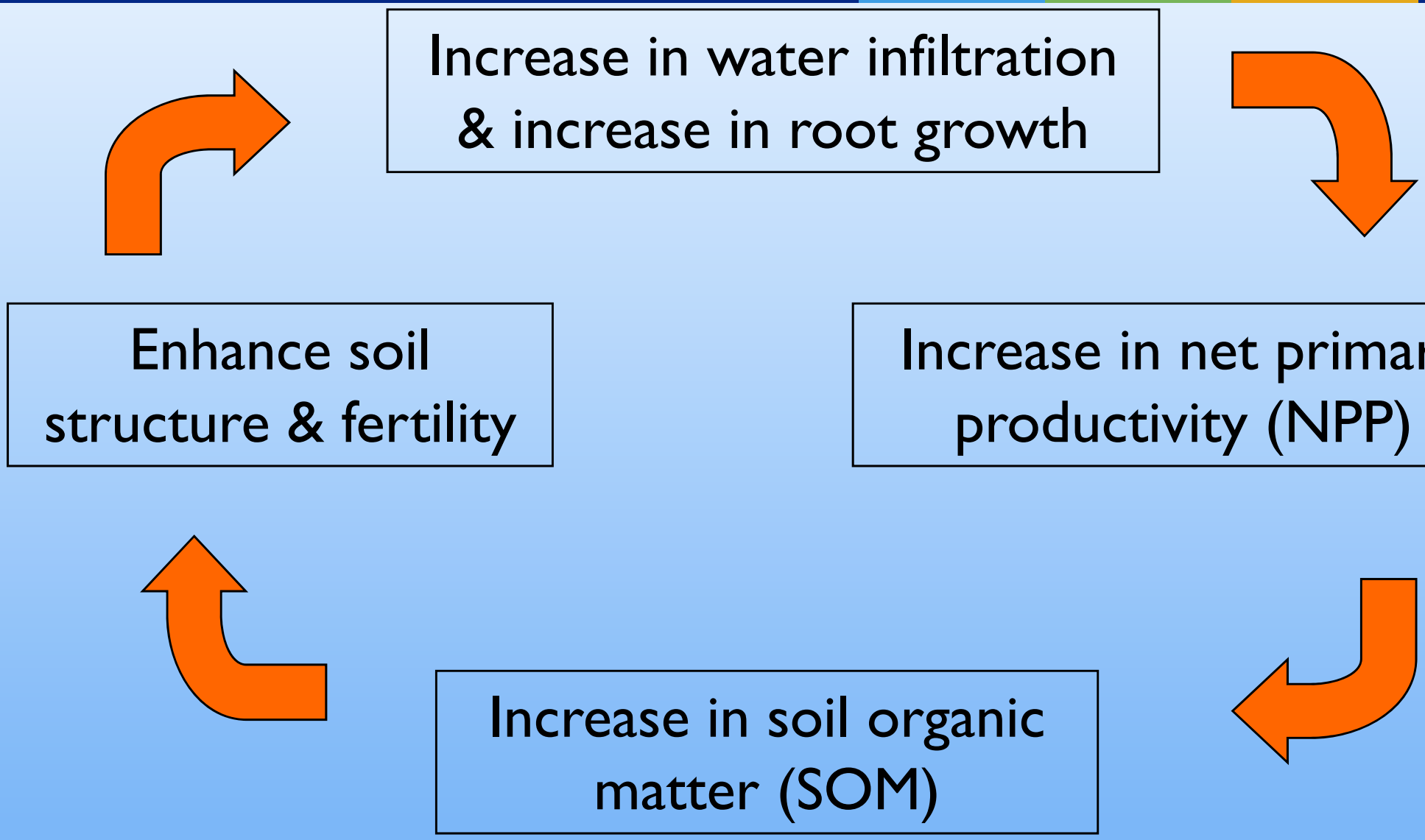


Soil Organic Carbon



Modified from Follett et a., 2001

Positive Feed Back



Modified from Bird et al., 2001

Carbon Pumping/Pay Dirt

"If it sounds too good to be true . . ."

- Root death contributes to soil carbon inputs
- Plants need above ***and*** below ground parts to live
- "key to . . . increasing soil C stocks in grazing lands is to maintain grass productivity and root inputs into the soil . . ." Reeder et al., 2001
- Most rangeland soils are at or near soil C equilibrium

Range Management And Soil Organic Carbon

- 40 to 85% of grass production is below ground
- Plants require above ground material to grow
- Defoliation suppresses below ground

Internalizing Externalities

- Permits to pollute create property rights

" . . . greenhouse gas absorption capacity of the atmosphere become[s] scarce and valuable by incorporating them into the economic system." – Sterner and Muller, 2008

- Property rights create financial incentive to decrease

Chicago Climate Exchange

- Carbon Financial Instruments = 100 Mg of CO_2 equivalent
- Trade allowances and offsets
- Voluntary, but legally binding
- Requires 3rd party verification

Actually Signing Up

- Minimum 10,000 Mg CO_2
- Registered Offset Aggregator
  - Agent between CCX and land manager
  - Collect participants, ensure compliance, sell CFI on CCX, make payment to producers
- C-Green Aggregators Ltd.
  - Regina, SK based
  - Only agricultural aggregator in Canada

Rangeland Offset Projects

- Non-degraded rangelands
  - Increase C sequestration
- Degraded rangelands
  - Restoration of degraded rangelands
- Sequestration rates are predetermined
  - 0.3 to 1.3 Mg CO_2 ha^{-1} yr^{-1}

Cost Of Increasing Carbon

- Wyoming ranch case study
- Four techniques for increasing C sequestration
  - Interseeding alfalfa on native range
  - Increased salting
  - Sagebrush thinning
  - Increased water developments

Cost Of Increasing Carbon

- Increases from 0.12 to 0.60 Mg CO_2 ha^{-1} yr^{-1}
- Stocking rate increased by 30%
- Cost of sequestering a ton of carbon was between $7.81 and $17.01/ton of carbon

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What Does It All Mean?

- $1/acre for good grazing management
- Politics and ownership are obstacles
- Increasing sequestration is difficult
- Rangelands are good at storing carbon

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Adaptation of Livestock Industry

- Manage for a healthy and diverse ecosystem
- Respond to changes quickly

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Adaptation of Livestock Industry

- Prepare for less water
  - Drought proofing
  - Water developments
- Prepare for unpredictable productivity

Andrew Pantel

Sleeping With An Elephant

- Range shares a long history with forestry
- Range interacts very closely with forestry
- Range is affected by every twitch and grunt

JeanMarie Mouveroux

Forestry Mitigation Efforts

- Plant trees
- Prevent fires
- Promote the use of wood
- Drought tolerant species

Range Concerns

- Potential pressure on ecological restoration
- Pressure on water use
- Enhance range profile

How MFR Can Respond

- Ecological Restoration to fire-proof
- Range Reference Areas
- Flexible policy
- Invasive Plant containment lines
- Functionality assessments

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How MFR Can Respond

- Increased infrastructure
- Better coordination of all activities
- Expect broad ecosystem change

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How MFR Can Respond

- FFEI Scientific Council research projects:
  - Ecological & socioeconomic effects on rangelands
  - Water in the Okanagan
  - Wildfire risk assessment
  - Changes in high elevation plant communities
  - Competition of invasive plants

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Summary

- Rangelands store carbon too
- Rangelands will continue to produce
- Range management is inherently flexible

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Dick Braun