


Food = Energy^3

Markus Mager
Alaska Center for Energy and Power
Community Energy Lecture Series
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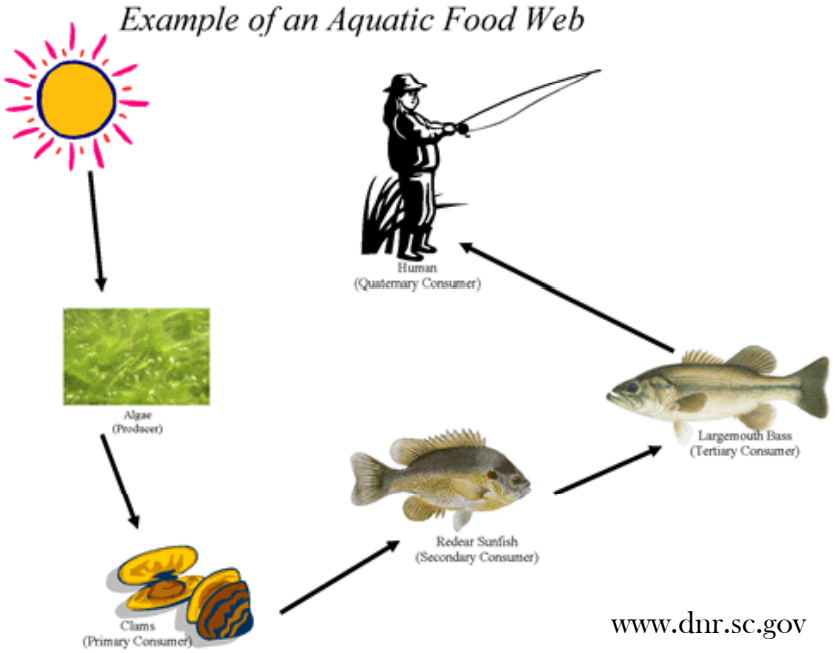
Outline

- Food = Energy
  - Back to the Basics
    - Food = Energy^2
      - Production
        - Food = Energy^3
          - Externalities

Food = Energy

Back to the Basics



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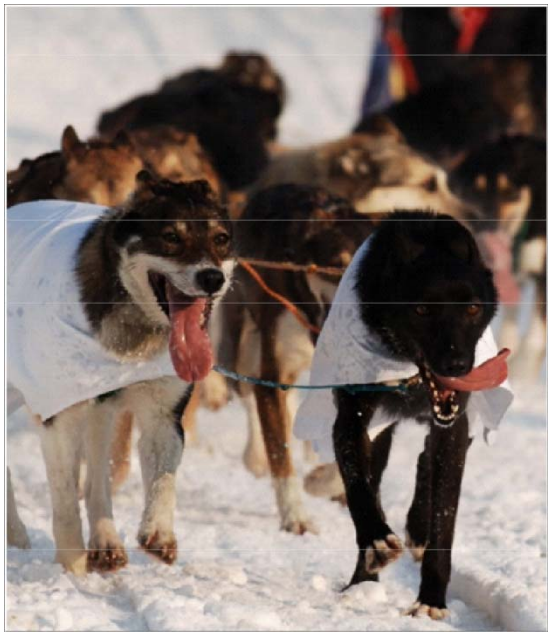

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- First Law of Thermodynamic
  - energy can be transformed (changed from one form to another), but cannot be created or destroyed

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Food = Energy

Back to the Basics

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Food = Energy^2

Chena Hot Springs Resort (CHSR) - greenhouse

- 72 ft x 60 ft hydroponic greenhouse
- year-round production

after 7 days

- conservative 32 day growing period
- economic analysis of the greenhouse operation at CHSR

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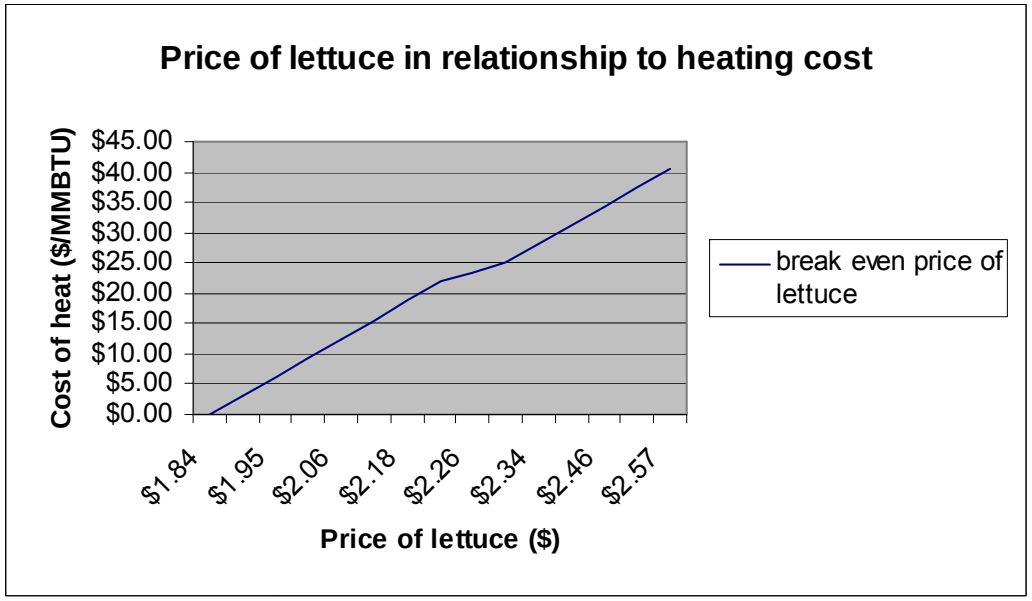
Food = Energy^2

Chena Hot Springs Resort (CHSR) - greenhouse

- costs $2.01 to produce a head of lettuce (optimized benchspace)
- **electricity:** 10 c/kWh
- **transport:** -
- **heat:** $1.50 per gallon of heating oil
  - Application: waste heat utilization



Scenarios

$0.50 price
per gallon of heating fuel

$0.05 price
per head of lettuce

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        - **Food = Energy^3**
          - Externalities

Food = Energy^3

Local Egg Production vs. "Importing" Eggs to Fairbanks

- Is "Buying Local" Better?

- Greenhouse gas emissions associated with:
  - Electricity use
  - Transporting chicken feed or eggs

→ Carbon Footprint

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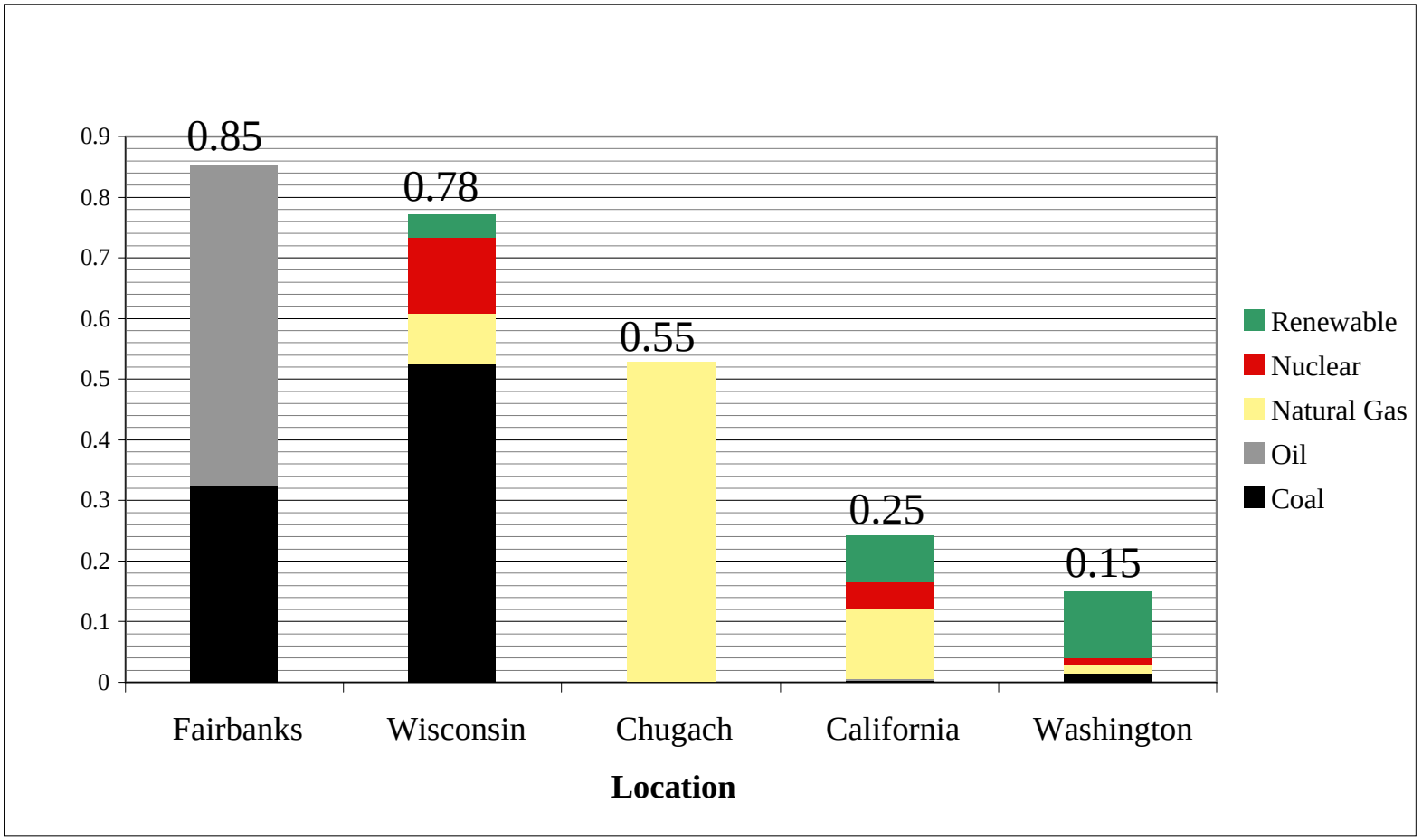
Food = Energy[3]



Greenhouse gas emissions per kilowatt-hour resulting from electricity generation in different locations, in $kgCO_2e/kWh$.

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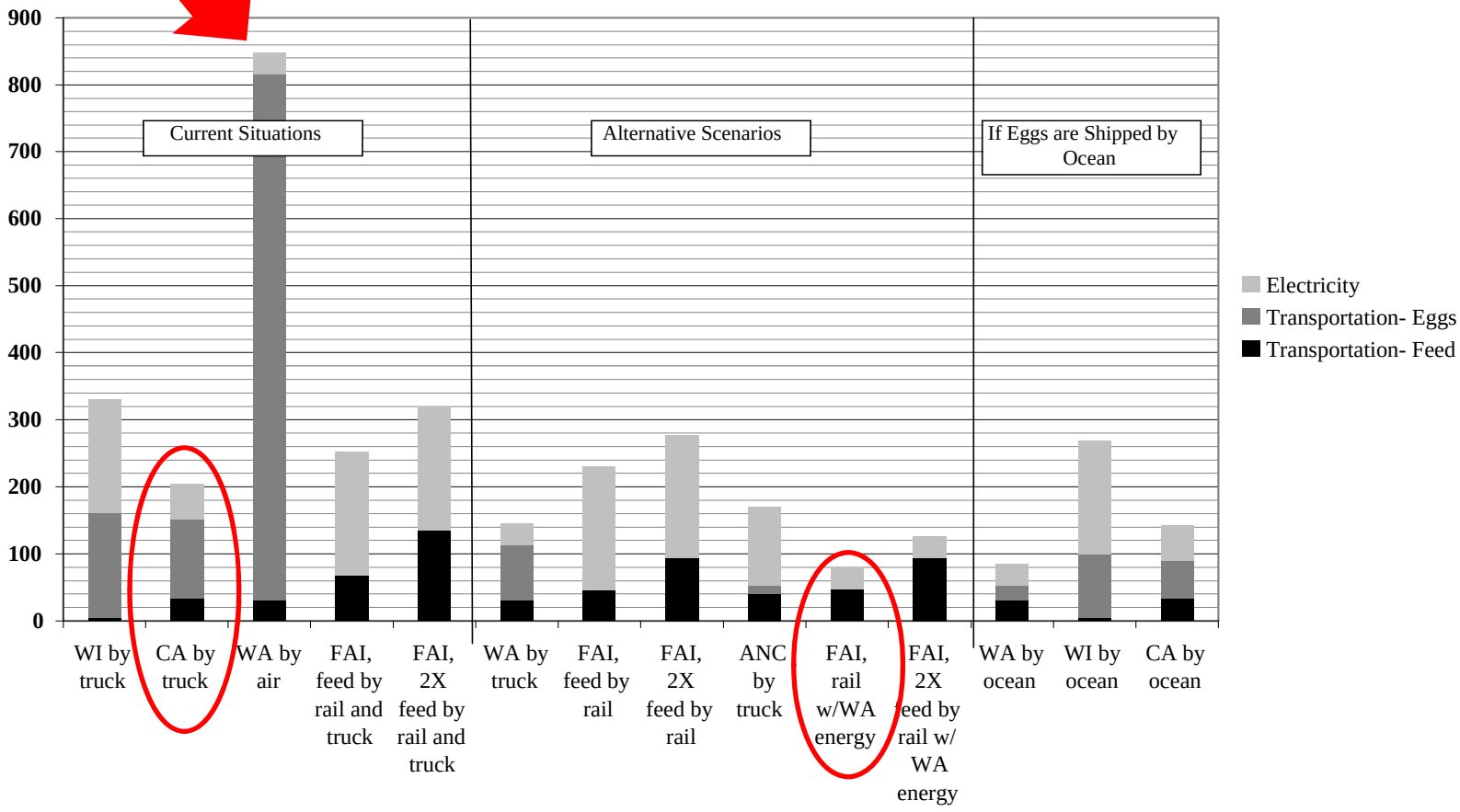

Annual carbon footprint for eggs consumed in Fairbanks, in $kgCO_2e/yr$.

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- Is "Buying Local" Better?
- Greenhouse gas emissions associated with:
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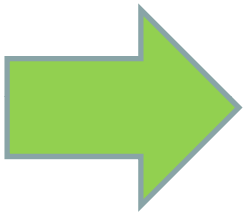
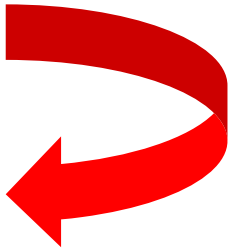
  - Transporting chicken feed and eggs



Carbon Footprint



Where was the food produced?

What were the energy inputs?

vs.

How far did the food travel?

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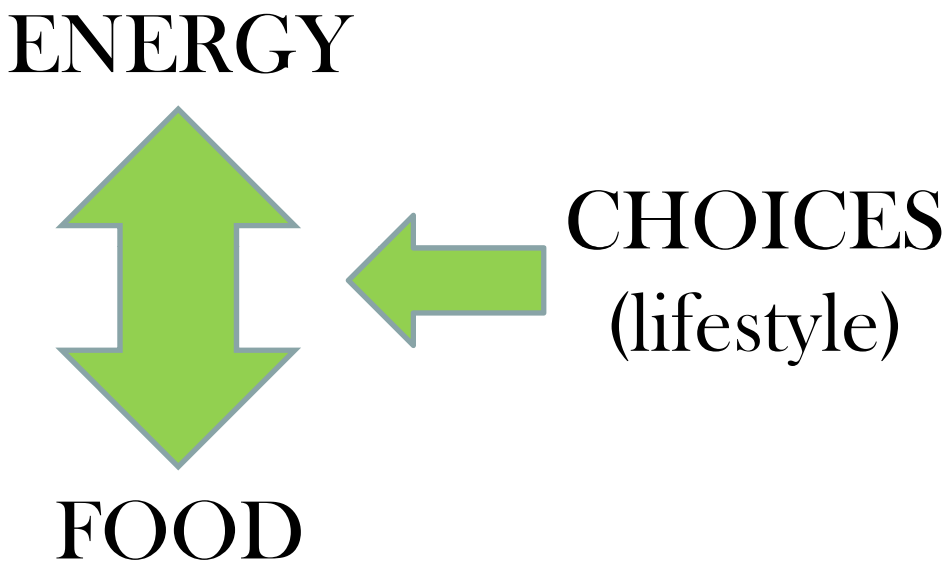
Conclusion



- It's your **choice** because it's your time and money!

Thank you for your attention!

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Sources

Mager 2008: Economics of Greenhouse Production in Alaska – Using the Greenhouse at Chena Hot Springs Resort as a Model.

Smith 2010: Is "Buying Local" Better? A Literature Review and Comparison of Production Locations and Greenhouse Gas Emissions for Chicken Eggs Consumed in Fairbanks, Alaska.

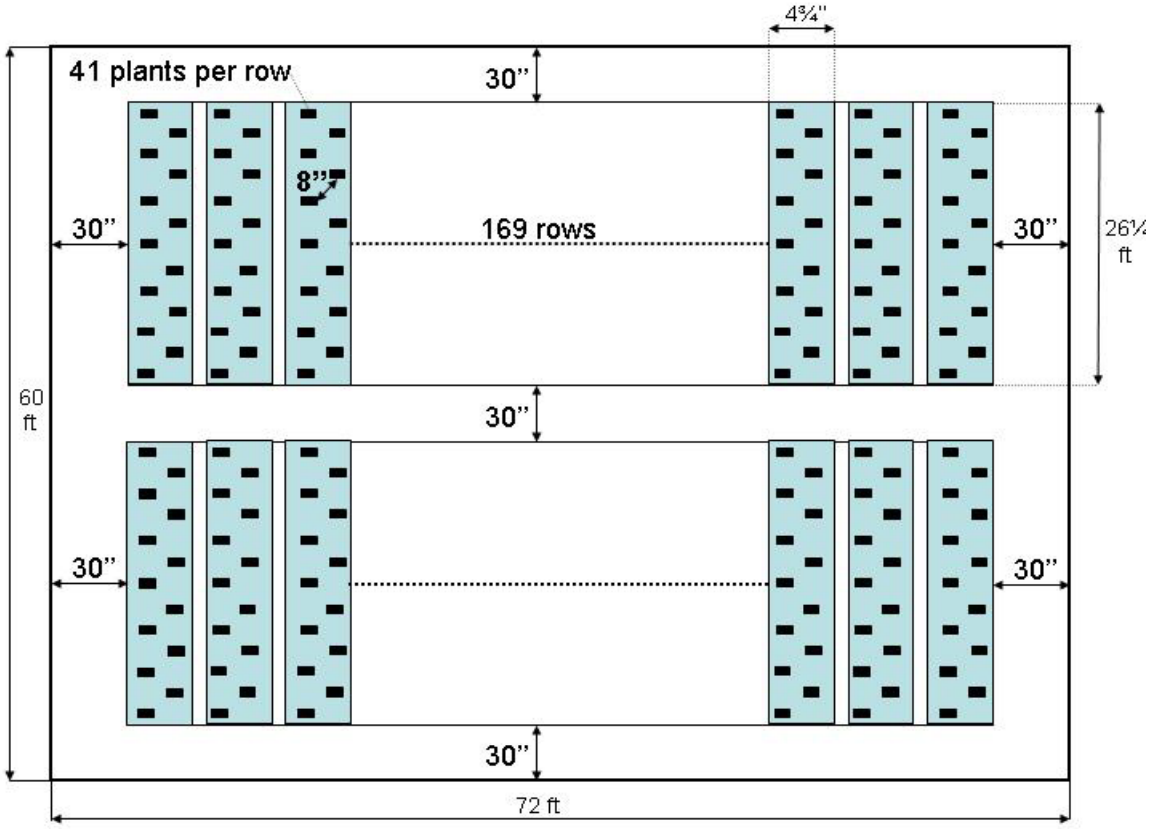
Alaska Energy Wiki
http://energy-alaska.com/

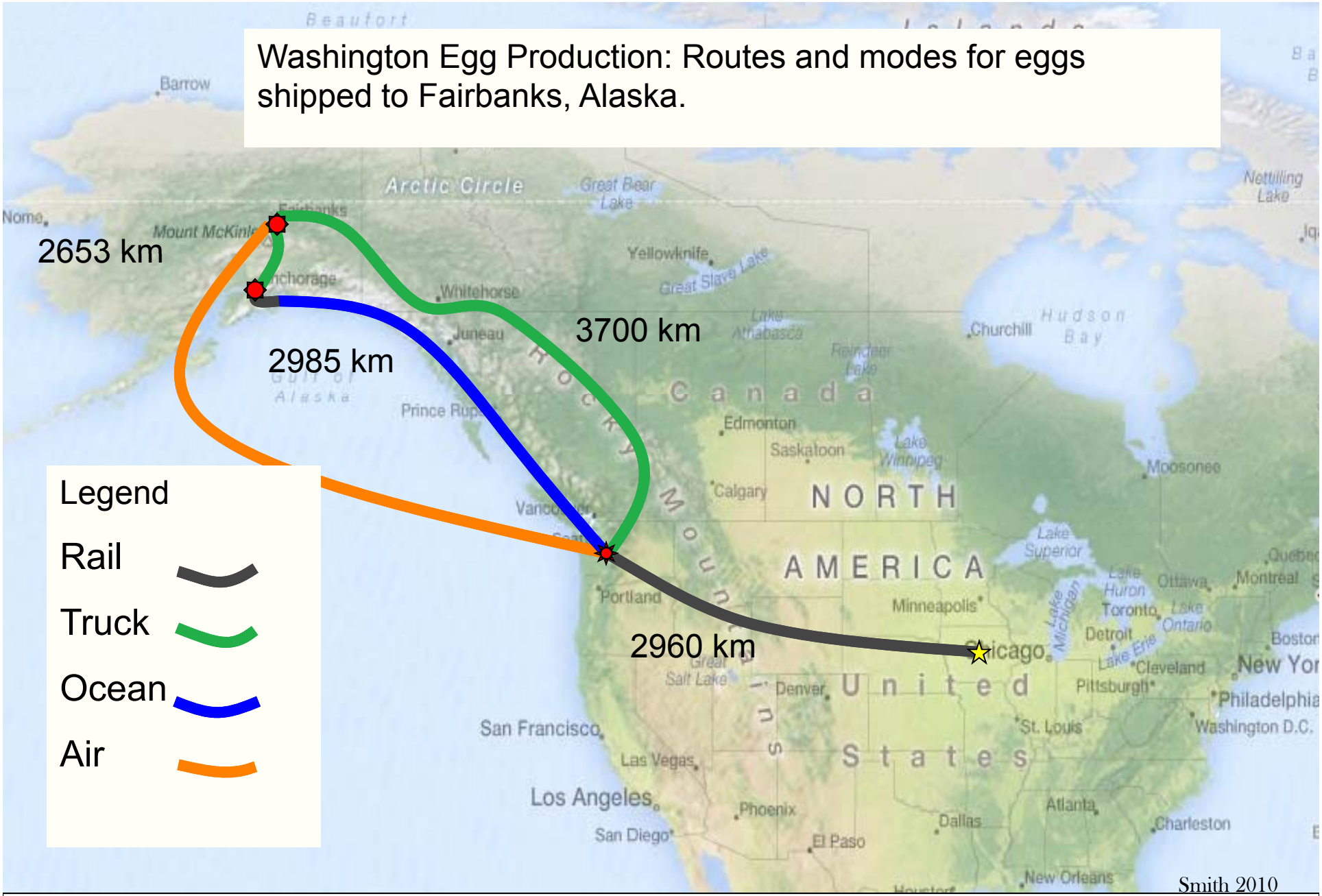
South Carolina Department of Natural Resources
http://www.dnr.sc.gov/

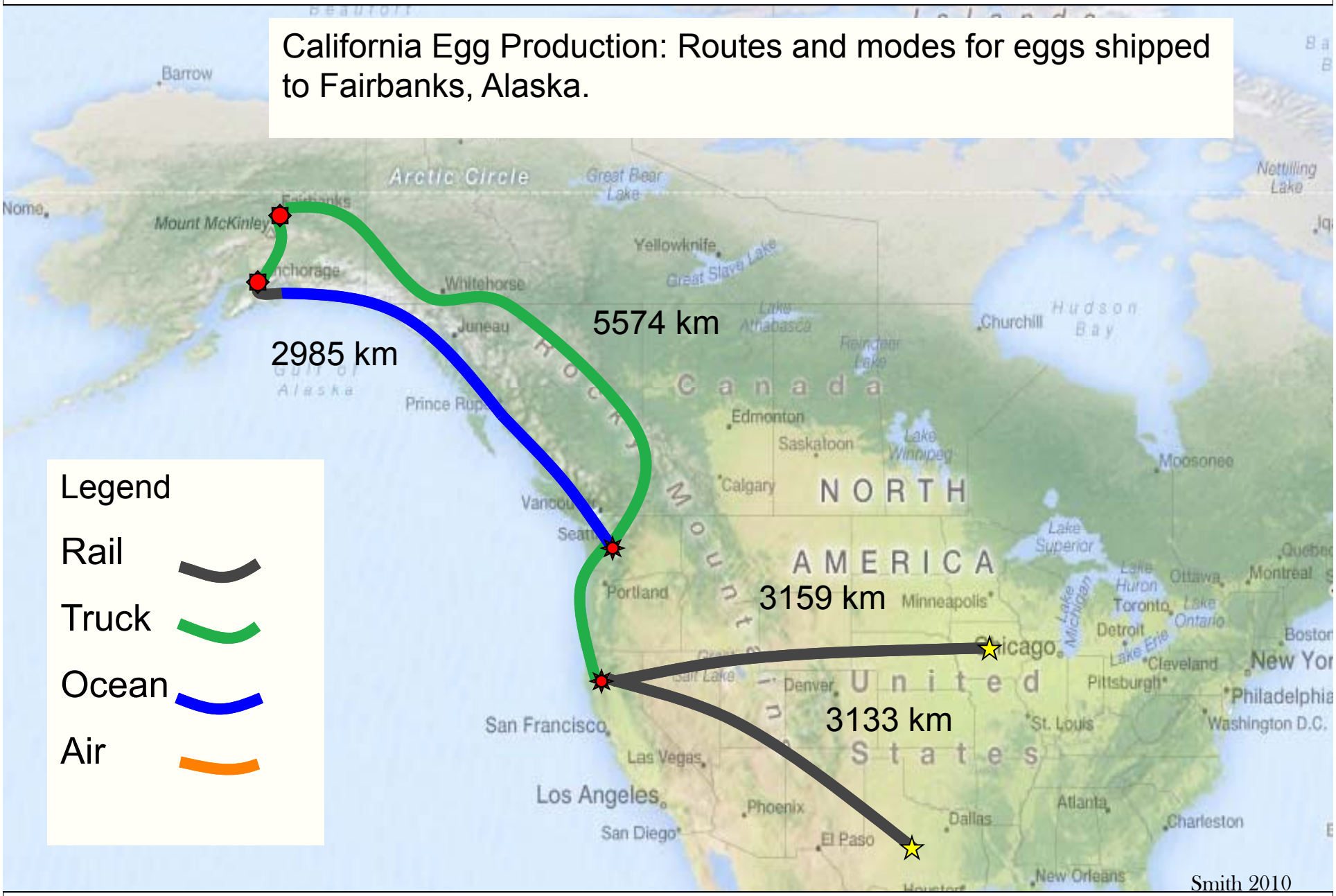
Greenhouse - ECONOMIC ANALYSIS

- Model
  - -> Enterprise Budget
  - -> producing a lettuce-only crop in the greenhouse
  - -> optimized production

-> plant capacity
13,858




Washington Egg Production: Routes and modes for eggs shipped to Fairbanks, Alaska.
2653 km
2985 km
3700 km
2960 km
Legend
Rail
Truck
Ocean
Air
Smith 2010


California Egg Production: Routes and modes for eggs shipped to Fairbanks, Alaska.
Legend
Rail
Truck
Ocean
Air
5574 km
2985 km
3159 km
3133 km
Smith 2010