# A Course Integrating Math and the Environment

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## INTEGRATED COURSE

- Liberal arts mathematics and environmental science
- Intermediate algebra pre-requisite
- 10 credits total
- 8 Hours per week in class
- Two weekend field trips
- Technology

## ATTRACTIONS

- Real-world mathematics in context
  - –field trips, data collection, etc.
- Capstone course for many
- Fulfills graduation requirements
  - –Q, Lab, IS, etc.
- Early exposure to quantitative science

## MODULES

1. Units, Percents + Earth's Hydrosphere
2. Linear Functions + Ecology
3. Exponential Functions + Agriculture

Field Trip # 1: River Ecology

4. Difference Equations + World Population
5. Affine Diff. Eqns. + Hazardous Waste

Field Trip # 2: Forest Practices

6. Logistic Diff. Eqns. + Forestry
7. Descriptive Statistics + Water Pollution

## EACH MODULE CONTAINS:

- Math and science lectures
  - –just-in-time approach
- An integrated project
- Traditional math homework
- Traditional environmental readings
- End-of-module quiz

## PROJECTS ANCHOR COURSE

## PROJECT DETAILS

- Extended exercises based on real data
  - USDA, EPA, UN, etc.
  - Field trip measurements
  - Modeling
- 6-10 pages of questions and answers
- 3 in-class hours per module
- One submission/grade per small group

## PROJECT TOPICS

1. Units, Percents + Earth's Hydrosphere
   Melting of the Ice Caps
2. Linear Functions + Ecology
   Biometrics of Clam Shells
3. Exponential Functions + Agriculture
   Broiler Chicken Production

continued….

## PROJECT TOPICS

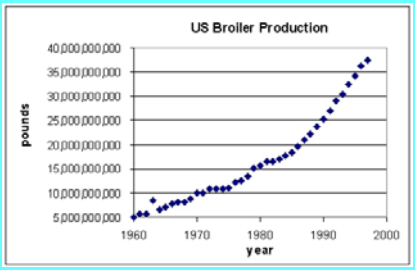
4. Difference Equations + Population
   Human Population and Migration
5. Affine Diff. Eqns. + Toxic/Hazardous Waste
   Lead in the Body
6. Logistic Diff. Eqns. + Forestry
   Tropical Forests Forever?
7. Descriptive Statistics + Water Pollution
   Urban Runoff Scorecard

**All projects at *enviromath.com***

## Project #3: Broiler Chickens

Exponential functions, regression, and quantitative reasoning

**Curve-fitting exercise**




Linear or exponential? Good fit or poor fit?

## Guided Inquiry

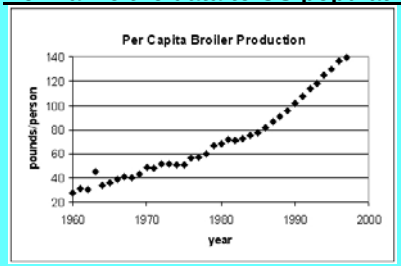
Broiler production has increased exponentially in the United States in the last 40 years.

Think of at least two different reasons for this exponential increase

a.

b.

## Normalize the data to US population




Can growth of the US population explain **all** the change in broiler chicken production? If not, **what else** happened over the last 40 years? Discuss using equations, graphs, tables, values, etc.

## FIELD EXCURSIONS

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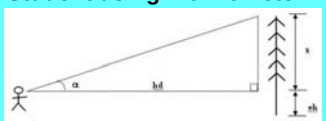
- Two weekend field trips per quarter
- Class management
- Transportation
- Equipment and supplies
- Extra logistics

## FIELD EXCURSION #1: Forest Practices

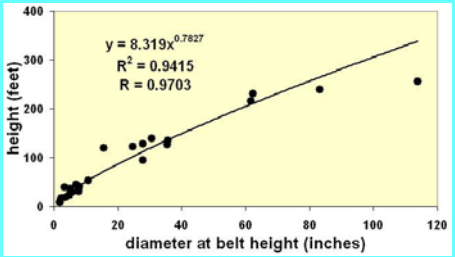
- Measure sizes of Douglas fir trees
- Field area: near Mt. Rainier National Park
- Tools: inclinometer, 50 m tape

## Douglas fir biometrics

**Student using inclinometer**



## Exploratory data analysis



## Douglas fir in PNW forests

- Forest practices in PNW
- Clear cutting versus sustainable forestry
- Impact of logging on forest ecology

## FIELD EXCURSION #2: Stream Discharge

## STREAM DISCHARGE

- More involved field activity
  - More technology, supplies, logistics
  - Weather a major factor
- There's a stream in your backyard
- Ties with salmon viability, water resources

## Why connect math and environmental science?

- Increase student motivation and success
- Quantitative reasoning examples galore
- Socially relevant mathematics
- Deeper math/science connections
- Converts! New math/science majors
- Don't forget instructors….

## SUGGESTIONS

- **Start small**
  - **teach stand-alone course**
- **Resources on learning communities**
  - **http://www.evergreen.edu/washcenter/home.asp**
- **Visit *enviromath.com***
  - **all projects posted on Web**
  - **more data at *QELP***
- **Team up with science faculty**
  - **local expertise**
  - **experienced at running field trips**