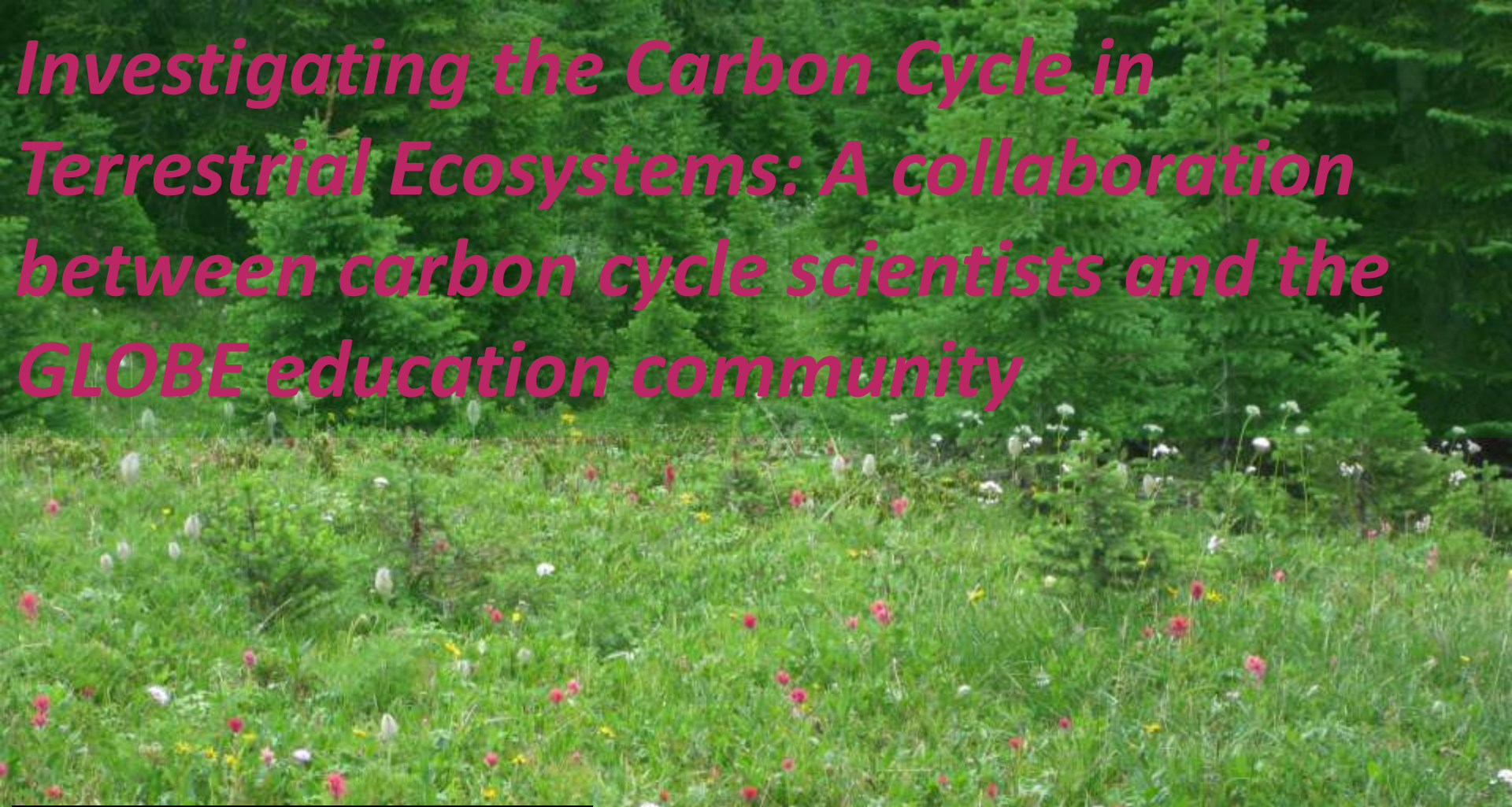
Investigating the Carbon Cycle in Terrestrial Ecosystems: A collaboration between carbon cycle scientists and the GLOBE education community



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NSF NASA GLOBE Carbon Cycle Sdružení TEREZA

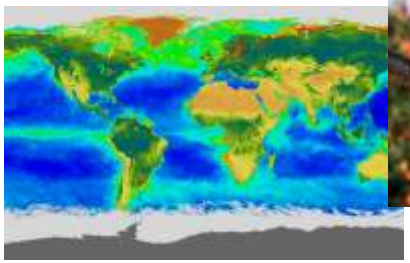
Carbon Cycle Project Goals

Students will…

- Learn why carbon is such an important element, how it cycles through ecosystems and how it is affected by humans.
- Gain skills in current carbon cycle research techniques (field work, modeling & plant experiments).
- Understand the nature of scientific research, learn to ask questions and think critically about problems.
- Gain the confidence that seemingly complicated subjects are within their grasp.



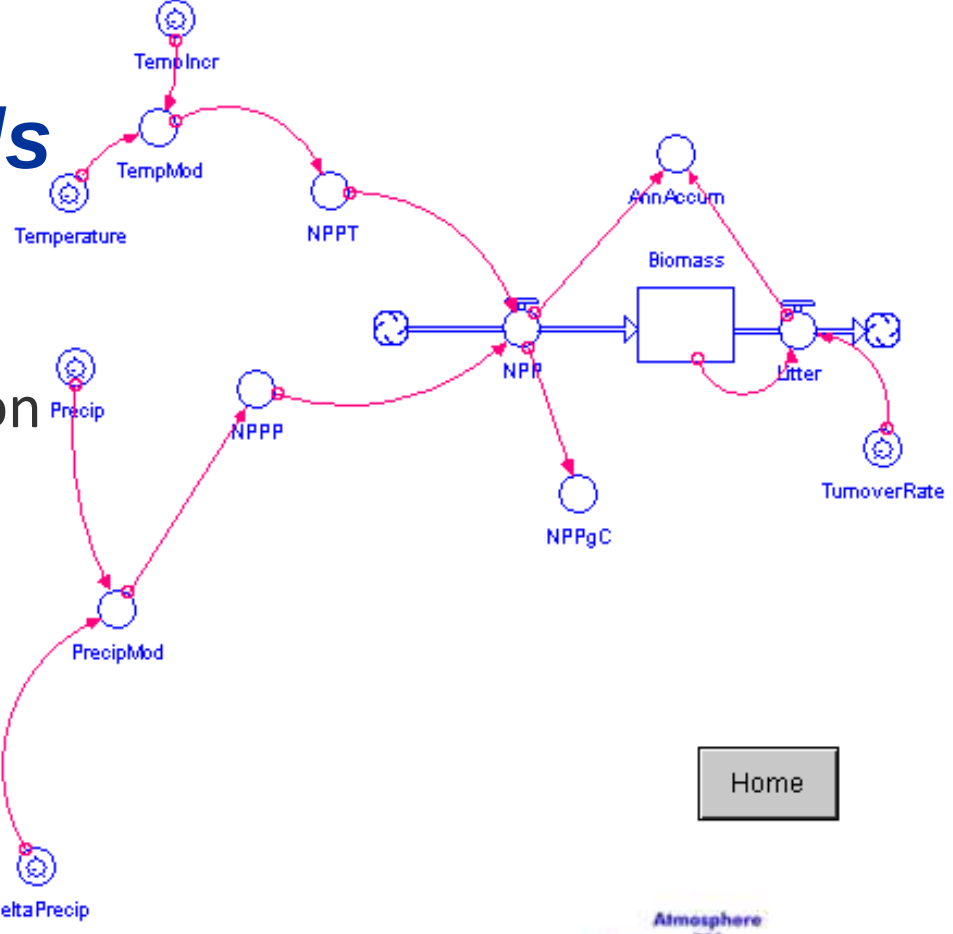


Activities to Meet Goals

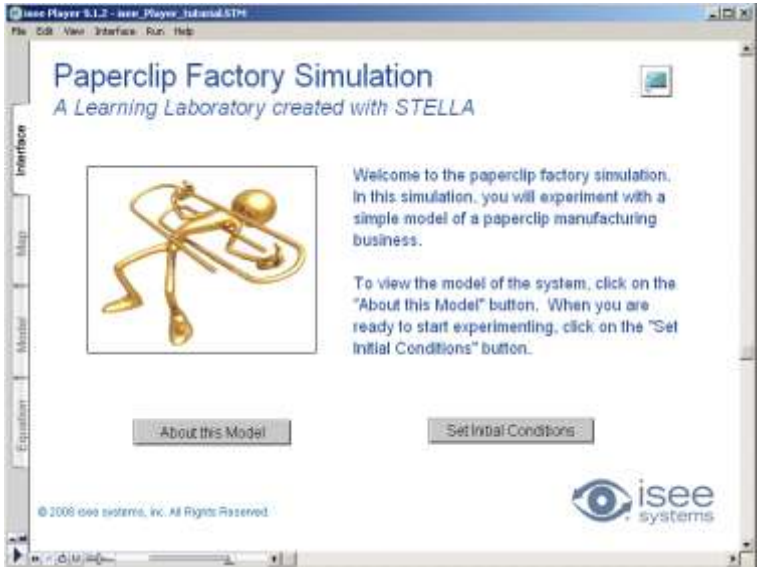
4 Major Categories:

- Global Carbon Cycle Introduction
- Classroom Experiments
- Modeling & Problem Solving
- Field Measurements



Skill and Knowledge-Building Exercises

- Background materials and field manuals
- The Carbon Adventure Story
- The Paper Clip Factory and ISee Systems Tutorial
- How Big is a Petagram?
- Human Allometry (not “A Llama Tree”)
- Modeling with paper and pencils
- Field-site setup: pacing, compass, GPS



Classroom Experiments: Plant-a-Plant

- Hands-on cultivation experiments with plants
- Experimental Variation in:

  CO2, Light, Water, Mineral Nutrients, Temperature

- Demonstrate that plant biomass comes from atmospheric CO_2.
- Understand changes in carbon storage at the plant level
- Opportunity to go from highly structured labs to open inquiry

0.1 g/l fertilizer 0.2 g/l fertilizer 0.5 g/l fertilizer

Systems Modeling

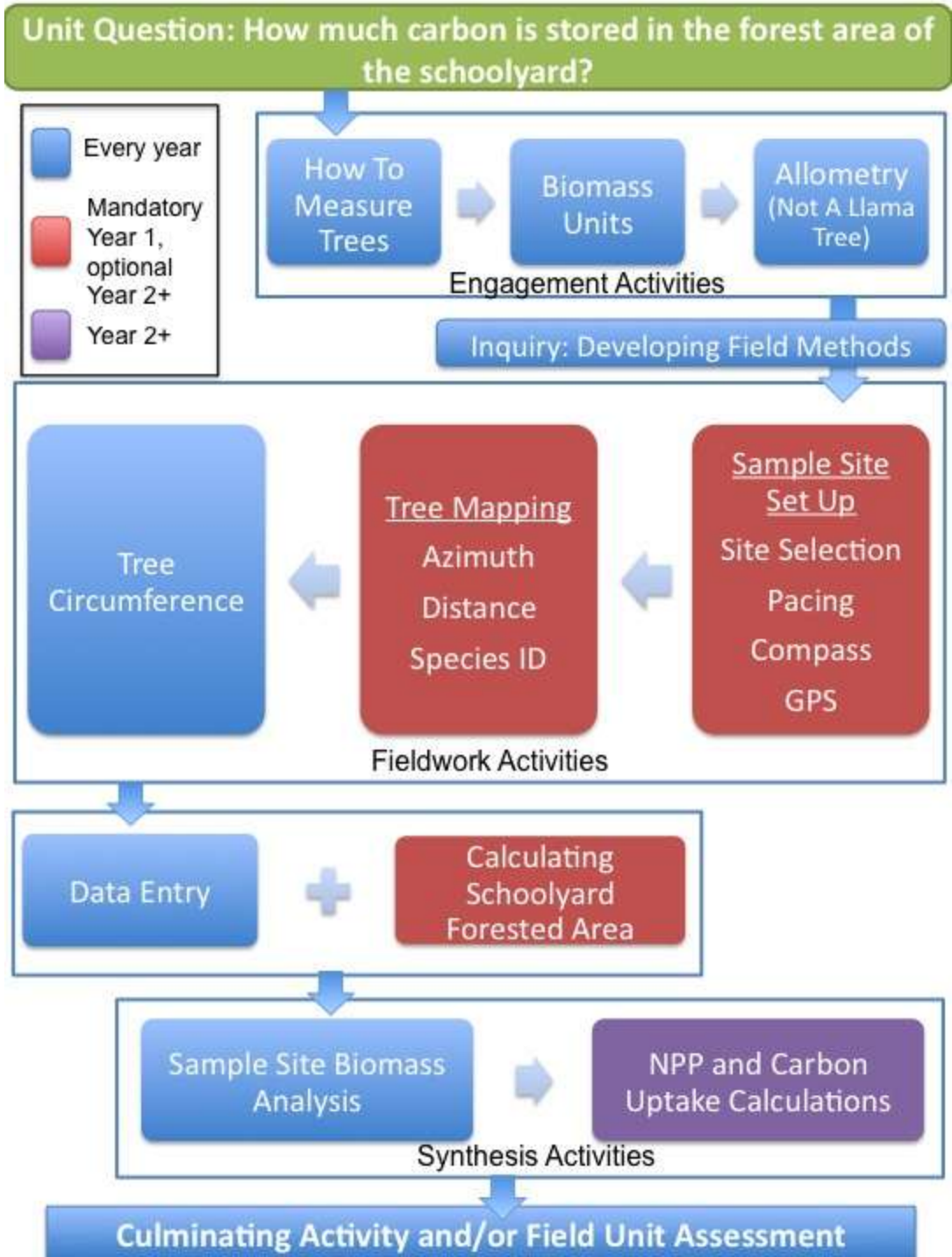
GLOBE Carbon Cycle

- Introduce basic concepts of systems: Pools, fluxes & feedbacks.
- Gain familiarity with the use of models in science: conceptual models, paper and pencil models and computer models
- Learn how carbon is cycled in local ecosystems and at the global level
- Understand how carbon and climate can change in response to human activities
- Learn to think across a range of spatial and temporal scales
- Use models as a tool to ask and answer questions including comparisons to field collected data

Field Measurements

- Designed to match USDA Forest Service measurements and those implemented in the North American Carbon Program
- Complement existing GLOBE protocols
- Students set up permanent plots including mapping trees to track individual tree change over time
- Students measure tree circumference in order to calculate biomass and carbon storage using allometric equations
- Problem solving exercises help students make connections between the global C cycle, their local environment and their own behavior

Field Measurements: Trees



Make it Meaningful Locally…

- **How would the carbon storage at my site change if:**
  - trees were cleared for a sports field?
  - trees were cleared for a parking lot?
  - trees were cleared for a new building (wood vs. not wood)?
  - trees were cleared for an animal grazing area?
  - trees were cleared and used to make several sports equipment sheds for the school, but the area was then allowed to re-grow?
  - Additional trees were planted around the school courtyard, at parking lot edges, or elsewhere on school property?

What is the Context of Student Measurement?

- **Based on my field data what is the estimate of carbon storage in my state, region, country?**
- **Is my school, town or country a source or a sink for carbon?**
- **How does the carbon storage on my site compare to:**
  - the carbon storage on my site last year?
  - the carbon storage of a site at the same latitude?
  - the carbon storage of a site in the same MUC class or Biome?
  - the carbon storage predicted using satellite imagery?
  - the carbon storage estimated using national monitoring records (e.g. FIA)?

Extended Research Questions

- **How does the uptake of carbon by schoolyard vegetation compare to the emissions of carbon (carbon footprint) by the school?**
  - How many acres of trees are needed to offset my own carbon emissions?
- **How would schoolyard carbon storage change…**
  - over time as the forest moves through natural stages of succession?
  - if pollutants such as tropospheric ozone, acid rain or nitrogen deposition become more prevalent?
  - if climate change increases temperature and/or increases/decreases precipitation?
- **What does a change in forest cover in my state, region, or country mean for the global carbon cycle?**
- **If climate changes how would you expect vegetation & carbon storage to change? Globally? Locally?**