Southeastern Forests and Climate Change

Project Learning Tree® (PLT) and PINEMAP have partnered to develop a new secondary module on climate change impacts on southern forest ecosystems, the role of forests in sequestering carbon, and strategies for reducing greenhouse gas emissions and adapting to changing climatic conditions. PINEMAP is an integrated research, education, and extension project focused on climate change adaptation and mitigation in southern pine forests (www.pinemap.org), and the 14 engaging activities included in this supplemental teaching resource echo every dimension of PINEMAP's research. The module is designed for use in life science, environmental science, and agriculture courses in grades 9-12, with potential use in middle school or community college courses with easy suggested adaptations.

The module activities help students understand climate change, the carbon cycle, forest health, forest management strategies, how consumers can make a difference through purchasing choices and the interactions among these ideas. These concepts are explored using current research and systems thinking with engaging teaching methods such as a role play and debate, webquests, small group discussions, and a service-learning action project. The activities focus on increasing student knowledge, building systems-thinking and decision-making skills, and instilling confidence that individual and community actions can help address climate change.

Activities contain teacher background information and instructions, student handouts, extension and assessment ideas, and additional resources. The module website (http://sfrc.ufl.edu/extension/ee/climate) provides online access to the activity materials, and includes training resources, slide presentations, and videos with researchers. In total, more than 80 people have helped in the development of these materials, through writing or reviewing activities, participating in the module's advisory committee, or providing feedback during the expert content review.

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Section	Theme	Activity
1. Climate Change and Forests	Three activities introduce the module theme by conveying how scientists currently understand observed changes in weather and climate that are impacting forest ecosystems.	**1. Stepping through Climate Science** – Students walk along a timeline of climate science and policy initiatives and then explore connections between forests and climate. **2. Clearing the Air** – After an introduction to the evidence of climate change, students explore common confusions and role-play a community discussion with the goal to reach consensus on strategies to reduce greenhouse gas emissions. **3. Atlas of Change** – Students are introduced to climate modeling to understand past changes and project future possibilities, and then use Web resources to consider how forest ecosystems might change over the next 100 years.
2. Forest Management and Adaptation	Climate changes are projected to affect surface temperature, precipitation patterns, and frequency of storm events. As scientists study how forests might change as a result, forest managers can be encouraged to alter management practices to help create resilient forests that will survive these challenges.	**4. The Changing Forests** – Students review how scientists are monitoring forest changes and exploring adaptive strategies to keep forests healthy. **5. Managing Forests for Change** – Students develop and use a systems diagram to model a forest so they can advise a forest land-owner how to manage a pine plantation in light of climate projections. **6. Mapping Seed Sources** – Across the native range of loblolly pine, variations in genotype create trees that may do better under new climatic conditions. This activity helps students analyze data from three trials to determine the origin of the seeds.
3. Carbon Sequestration	Sequestering carbon in trees, soil, and wood products keeps it out of the atmosphere. Scientists are exploring if we can sequester more carbon in these carbon pools.	**7. Carbon on the Move** – Students become familiar with the carbon cycle and pathways that increase and decrease atmospheric carbon. **8. Counting Carbon** – Students measure trees near their schools and calculate the amount of carbon stored in individual trees. Students then compare the carbon sequestration potential for land-use types in their state, compare this to the estimated amount of carbon released by human activities, and discuss forests' ability to sequester atmospheric carbon.
4. Life Cycle Assessment	Consumer choices can play a role in reducing and preventing greenhouse gas emissions. These activities introduce the concept of externalities to consider the environmental problems that can occur from the production, shipping, and disposal of various products. Greenhouse gas emissions are one of the many criteria that students can use to assess products as they develop their own personal code for deciding what to purchase.	**9. The Real Cost** – Through a simulated shopping activity, students learn about the impact, or externalities, of consumer choices on the environment. **10. Adventures in Life Cycle Assessment** – Students investigate life cycle assessment data for three types of outdoor dining furniture to determine which type would generate the lowest amount of greenhouse gases. This detailed analysis of inputs and outputs is another tool for systems thinking. **11. Life Cycle Assessment Debate** – Students debate four pairs of similar products to develop their own sets of questions about product life cycles that can help guide consumer choices.
5. Solutions for Change	Three activities that help teachers summarize the concepts in this module. These can be adapted to reflect the activities that teachers selected. Students can be empowered with the knowledge and hope that all of us can help work toward healthy, sustainable forests and communities.	**12. The Carbon Puzzle** – Students use a series of facts to realize how forest plantations, wood products, and wood substitution can reduce atmospheric carbon, and then interpret a graph published by the researchers who explored this concept. **13. Future of Our Forests** – Student teams review information from the module and share their knowledge with an appropriate audience. **14. Starting a Climate Service-Learning Project** – Students select and complete an action project to mitigate climate change or help their communities adapt to projected changes.