PINEMAP
Pine Integrated Network: Education, Mitigation, and Adaptation Project

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# Understanding Southeastern Science Teachers' Interest in Climate Change Education

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## Executive Summary

A survey of secondary science teachers in southeastern United States (n=746) suggests that a unit on climate change in life science and environmental science classes should connect science to students' lives with critical thinking and data analysis skills. Controversy over climate change can be addressed by presenting the data associated with various perspectives and discussing the nature of science.

## Background

An audience assessment was conducted to help develop instructional materials that address the challenges and barriers teachers perceive to teaching about climate and deliver exercises that meet their needs (Jacobson, McDuff, & Monroe, 2006). A recent assessment of science teachers' perceptions in Colorado suggests that while 87% of the respondents address the topic, many only do so through informal discussions; Earth science teachers most frequently use planned lessons (Wise, 2010). They cited several barriers to teaching about climate change, including that there is not enough time and that the topic does not fit the curriculum standards. PINEMAP's proposed secondary curriculum can be shaped to best meet teachers' needs and overcome perceived barriers with input from secondary science teachers across the Southeast.

## Research Questions

- How do secondary science teachers in the Southeast currently cover climate change in their classrooms?
- What characteristics do secondary science teachers desire in a science module on climate change?

## Methods

An online survey was developed and pilot tested in SurveyMonkey®. Based on comments and pilot test results from 14 educators and 7 curriculum or climate experts, the 28-question survey was revised to improve clarity, reduce length, and include appropriate wording. Invitations to complete the survey were distributed through 13 email lists of science coordinators and teachers from April 30 through July 8, 2012. Because we did not have access to the email lists, it is not possible to know the population size or to assess non-response bias. This is a significant limitation to generalizing these results to the population of secondary science educators. We suspect that the results over-report educators who are interested in teaching about climate because of their interest in responding to the survey. The findings are useful, however, in guiding the development of the curriculum, since we want to learn what teachers who might use these materials will find helpful.

It is very or somewhat important to the largest percentage of respondents for the module to help them meet the following goals:

| | |
|---|---|
| Connecting science to students' everyday lives | 98% |
| Emphasizing critical thinking | 98% |
| Developing data analysis skills | 94% |
| Emphasizing choices that affect sustainability | 92% |
| Emphasizing systems thinking | 92% |
| Enabling students to use technology | 88% |
| Connecting science issues with policy | 83% |
| Exploring careers | 83% |
| Building group skills | 82% |
| Implementing action projects | 74% |
| Teaching about technology | 72% |

## Results

A total of 746 surveys were received; 675 of those were fully completed. Most respondents teach 11th and 12th grades (61% each); 57% teach 10th graders and 48% teach 9th graders. As with the Wise study (2010), fewer middle school teachers responded; 16%, 21%, and 21% teach 6th, 7th, or 8th grades, respectively. More than 75% of the respondents came from FL, NC, OK, and VA with the remainder from AL, AR, LA, SC, and TX. Most respondents (77%) already cover climate change in their secondary science courses. In agriculture, chemistry, and physical science courses, the largest percentage of respondents do so with informal discussions. Planned lessons lasting one week or less are used by the largest percentage of respondents teaching biology, AP biology, earth science, integrated science, and marine science. Teachers use planned lessons lasting more than a week in ecology, environmental issues, environmental science, and AP environmental science classes. A large majority (82%) of the respondents are interested in continuing to cover climate change in future courses.

Only 2% of respondents believe they have little understanding of the issue; 28% report having a basic understanding; 46% have a moderate understanding; and 24% report having a detailed understanding. Because some students and parents may disagree with climate change science, only 37% of the respondents are very comfortable teaching about climate change; 35% are somewhat comfortable, 15% are neutral, 9% are somewhat uncomfortable, and 5% are very uncomfortable.

Regarding teaching strategies, over 85% of the respondents believe it is appropriate or very appropriate to: explain scientific uncertainty; present the rationale for how people interpret climate change differently; discuss advantages and disadvantages of climate related policies, and discuss the history of climate change science. One item—presenting all perspectives as valid—evoked the greatest disagreement, with 36% viewing this strategy is very inappropriate or inappropriate and 41% as appropriate or very appropriate. Just over half of the respondents are most interested in covering climate change impacts related to their local area (50.5%), their state (54%), and the nation (50%). Most, however, would like to cover climate change as it relates to the world (81%).

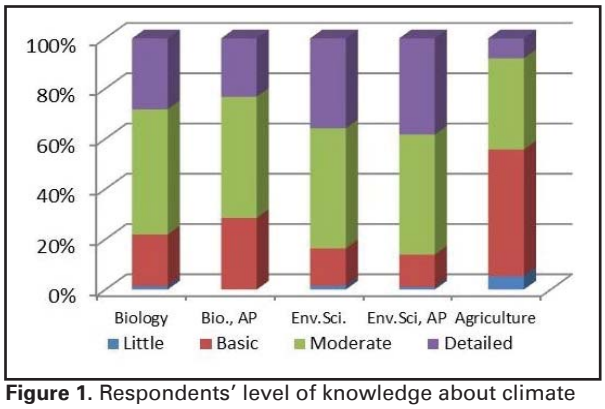


**Figure 1**. Respondents' level of knowledge about climate change.

All of the supplemental resources listed in the survey will be very useful to the largest percentage of respondents with hands-on student activities (80%) and lab exercises (76%) collecting the most votes. Background information, data sets to analyze, short videos of scientists, and photographs were also marked as very useful resources.

Comparing the responses of biology (n=246), AP biology (n=57), environmental science (n=138), AP environmental science (n=108), and agriculture (n=131) teachers highlighted several significant differences among teachers. Regarding self-reported level of knowledge, about 80% of the biology and AP biology teachers and 90% of the environmental science and AP environmental science claim to have a moderate or detailed knowledge of climate change; only 50% of the agriculture respondents make the same claim (Figure 1, $p<0.01$). Similarly, where 80% of the biology and environmental science teachers (regular and AP) are somewhat to very comfortable teaching about climate change, only 54% of agriculture educators are ($p<0.01$). Responding to the question "at what scale would you like to teach about climate?" agriculture educators had no strong preference, considering the state level to be slightly more interesting than the world. All others strongly favored the world scale over local, state, regional, and national levels.

### Addressing Controversy

*"It is also very important for students to learn about and ANALYZE different perspectives. This allows them to interpret and separate media hype from sound science."*

*"I would not refrain from discussing all perspectives but look at it through the lens of 'what is science? what is valid in science? what is bias?' in addition to teaching students about what a conflict of interest is. I would also focus less on the reasons why and talk more about the evidence and what to do to mitigate the effects."*

*"I believe that validating 'junk science' is teaching kids that any opinion is OK, even if data is not there. That is not science and I teach science---studying data and basing conclusions on that data."*

## Implications

These results suggest that life science and environmental science educators in the southeastern U.S. could be interested and willing to teach about climate and climate change in their high school classes. These respondents are willing to address multiple perspectives through the lens of science, allowing students to critique the data and come to their own conclusions. Lesson plans that actively engage students in exploring the concepts are desired. Since these respondents are likely more knowledgeable and interested in teaching about climate, new resources should provide sufficient background information as well as data sets and sample discussion questions to assist teachers who are less familiar with the topic. Despite the media-based rhetoric about conveying all perspectives as valid, these respondents are comfortable standing on the science.

These results do not speak for all teachers, however. Those teaching agriculture were less willing to teach about climate change and less knowledgeable. Much like the general population, there are a variety of opinions among educators, and resources developed for educators need to be cognizant of this diversity of perspectives.

### References

Jacobson, S. K., McDuff, M. D., & Monroe, M. C. (2006). *Conservation education and communication techniques*. Oxford: Oxford Press.

Wise, S. B. (2010). Climate change in the classroom: Patterns, motivations, and barriers to instruction among Colorado science teachers. *Journal of Geoscience Education*, 58(5), 297-309.

For more information on this research contact Martha Monroe at mcmonroe@ufl.edu or access the complete manuscript:
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