

## Lesson Plan: Insect Behavior and Climate Change

Teacher-contributed lesson plan by Dr Namita Nayyar, Assistant Professor, Sri Venkateswara College (University of Delhi), India.

As a **high school** or **undergraduate Biological Sciences** teacher, you can use these set of computer-based tools to help you in teaching about **insects, insect biodiversity** and the **impact of climate change on insects** and **insect behavior**.

The lesson plan allows students to study about insects and the role they play in the ecosystem. The students will be able to link the impact climate change has on the existence as well as behavior of insects. The hands-on activity will enable the students to understand the impact of changing temperature on insect behavior.

Thus, this lesson plan helps to integrate the teaching of a climate science topic with a core topic in the Biological Sciences.

Use this lesson plan to find answers to:

- What are insects? What roles do they play in the ecosystem?
- What are the possible impacts of climate change on insects?
- What are the possible impacts of climate change on insect behavior?

### About the Lesson Plan

**Grade Level:** High School, Undergraduate

**Discipline:** Biological Sciences

**Topic(s) in Discipline:** Insects, Arthropods, Ecology, Animal Behavior, Insect Behavior, Insect Biodiversity, Food Web, Food Security, Invasive Species, Vector-borne Diseases, Impact of temperature variation on Insects

**Climate Topic:** Climate and the Biosphere

**Location:** Global, North America, Puerto Rico

**Access:** Online, Offline

**Language(s):** English

**Approximate Time Required:** 110-120 min

## 1 Contents

### 1. Reading (30 min)

A reading that introduces the biology and ecology of insects.

This can be accessed at:

<https://biocontrol.entomology.cornell.edu/bio.php>

## **2. Reading (15 min)**

A report that links the impact of climate change on insect populations.

This can be accessed at:

<https://www.entsoc.org/climate-change-impact-insects-simply-cannot-be-ignored>

## **3. Reading (10 min)**

A reading that describes altered insect behavior in response to temperature fluctuations.

This can be accessed at:

[http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers\\_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf](http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf) (Read only Page 42-43: Main concepts and Skills)

## **4. Laboratory Activity (45-60 min)**

A hands-on classroom/laboratory activity to study insect responses (behavior) to temperature variations.

This can be accessed at:

[http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers\\_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf](http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf) (Page 48)

## **5. Suggested questions/assignments for learning evaluation**

- What are insects? What roles do they play in the ecosystem?
- What are the possible impacts of climate change on insects?

- What are the possible impacts of climate change on insect behavior?

## 2 Step-by-step User Guide

Here is a step-by-step guide to using this lesson plan in the classroom/laboratory. We have suggested these steps as a possible plan of action. You may customize the lesson plan according to your preferences and requirements.

### 1. Topic introduction and discussion

Use this reading, '[Insect Biology and Ecology: A Primer](#)', by Anthony Shelton, Professor of Entomology, Cornell University, to introduce the topic of insects. First, discuss its classification within Class Insecta, Phylum Arthropoda. Next, use the reading to explain basic insect anatomy and insect growth and development. Deliberate upon the different types of insects (bugs, mosquitoes, houseflies, grasshoppers, spiders, etc.) to highlight the existence of a vast variety of insects in the biosphere. Discuss the roles that insects play in the ecosystem (pollinators, commercial importance, natural enemy of pests, scavengers, etc.). Thus, explain the importance of maintaining a balance in the insect populations for the wellbeing of an ecosystem. Finally, stress on the delicately balanced interactions and the inter-dependence of insects and the environment that are ubiquitous in the natural world.

This can be accessed at:

<https://biocontrol.entomology.cornell.edu/bio.php>

### 2. Explain the link between climate change and insects

Use the report, '[Climate-Change Impact on Insects 'Simply Cannot be Ignored'](#)', by the Entomological Society of America, to discuss the findings of several studies on the impacts of climate change on insect survival. Begin by discussing a study that has reported a dramatic loss of insect populations in Puerto Rico's Luquillo rainforest over a span of approximately 35 years. Highlight the associated decline in the population of lizards, frogs, etc. that consume arthropods and therefore, the intrinsic balance within food webs. Compare this study with other studies mentioned in the report. Explain the adverse impacts of climate related rapid decline in the global insect populations on insect biodiversity, food security, vector-borne diseases, invasive species, etc. Finally, facilitate a discussion among the students about the urgency of finding solutions to this problem as climate change can affect global biodiversity.

This can be accessed at:

<https://www.entsoc.org/climate-change-impact-insects-simply-cannot-be-ignored>

### 3. Discuss the possible effect of global warming on insect behavior

Use the reading, '[Interesting Insects' \(Chapter 1, Lesson 3, Pages 42-43: Main Concepts and Skills\)](#) from 'Integrating Climate Change Issues in Southeast Asian Schools; A Teachers' Guide' by Southeast Asian Ministers of Education Organization (SEAMEO), to understand the implications of climate change related increase in the average temperature of the Earth on insect behavior. Explain to your students how environmental temperature variations can show an immediate effect on insect behavior due to their cold-blooded physiology. Also discuss the long-term effects of varying temperatures on insect populations such as changes in insect phenology and life cycles.

This can be accessed at:

[http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers\\_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf](http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf) (Read only Page 42-43: Main concepts and Skills)

### 4. Classroom/Laboratory Activity

Use this laboratory activity, '[Interesting Insects' \(Chapter 1, Lesson 3, Page 48: A COLD BLOODED BUG'S LIFE\)](#) from 'Integrating Climate Change Issues in Southeast Asian Schools; A Teachers' Guide' by SEAMEO, to investigate the immediate responses of insects to varying external temperatures. Using the worksheet provided, direct your students to firstly collect all relevant material and follow the instructions for the experiments. Ask your students to record all their observations of insect responses to temperature changes. Finally, use the 'Guide Questions' to analyze the observations on changes in insect behavior due to temperature variations.

This can be accessed at:

[http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers\\_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf](http://www.seameo.org/SEAMEOWeb2/images/stories/Publications/Centers_pub/2011RECSAM-ClimateChange-TeachersGuidebook/RECSAM-ClimateChange.pdf) (Page 48)

### 5. Questions/Assignments

Use the tools and the concepts learned so far to discuss and determine answers to the following questions:

- What are insects? What roles do they play in the ecosystem?

- What are the possible impacts of climate change on insects?
- What are the possible impacts of climate change on insect behavior?

## 3 Learning Outcomes

The tools in this lesson plan will enable students to:

- describe insects and their role in the ecosystem.
- explain the possible impacts of climate change on the survival and distribution of insects.
- discuss the possible impacts of climate change and variations in temperature on insect behavior.
- apply this knowledge of insect behavior to all living animals in response to climate change.

## 4 Additional Resources

If you or your students would like to explore the topic further, these additional resources will be useful.

### 1. Reading

This reading, 'Behavioral Effects of Temperature on Insects' (Page 214, Temperature Preferendum), by Muhammad Abdullah, Department of Entomology, University of Illinois (THE OHIO JOURNAL OF SCIENCE 61(4): 212, July 1961), emphasizes on the role of temperature in affecting changes in insect behavior.

This can be accessed at:

[https://kb.osu.edu/bitstream/handle/1811/4789/V61N04\\_212.pdf](https://kb.osu.edu/bitstream/handle/1811/4789/V61N04_212.pdf)

## 2. Video

The video, 'Why are Insects Important' by the Royal Entomological Society, explains the ecological role of insects and why they are important. This can be used as a main teaching tool while teaching middle school students.

This can be accessed at:

<http://www.nationalinsectweek.co.uk/why-are-insects-important>

## 3. Reading

This news article, '“Hyperalarming’ study shows massive insect loss’, published in Washington Post, speaks about the rapid decline in the bug population in a rain forest in Puerto Rico due to climate change.

This can be accessed at:

[https://www.washingtonpost.com/science/2018/10/15/hyperalarming-study-shows-massive-insect-loss/?noredirect=on&utm\\_term=.c104b6623132](https://www.washingtonpost.com/science/2018/10/15/hyperalarming-study-shows-massive-insect-loss/?noredirect=on&utm_term=.c104b6623132)

5 Credits/Copyrights

All the teaching tools in our collated list are owned by the corresponding creators/authors/organizations as listed on their websites. Please view the individual copyright and

ownership details for each tool by following the individual links provided.

We have selected and analyzed the tools that align with the overall objective of our project and have provided the corresponding links. We do not claim ownership of or responsibility/liability for any of the listed tools.

**1. Reading; 'Insect Biology and Ecology: A Primer'**

By [Anthony Shelton, Professor of Entomology](#), Cornell University. Hosted by the College of Agriculture and Life Sciences, Cornell University.  
Taken from: Hoffmann, M.P. and Frodsham, A.C. (1993) Natural Enemies of Vegetable Insect Pests. Cooperative Extension, Cornell University, Ithaca, NY. 63 pp.

**2. Report; 'Climate-Change Impact on Insects 'Simply Cannot be Ignored''**

Published by the [Entomological Society of America](#)

**3. Reading and Associated Classroom/Laboratory Activity; 'Interesting Insects'**

Published in 'Integrating Climate Change Issues in Southeast Asian Schools; A Teachers' Guide' by [Southeast Asian Ministers of Education Organization \(SEAMEO\)](#)

**4. Additional Resources**

Muhammad Abdullah, Department of Entomology, University of Illinois. Paper published: THE OHIO JOURNAL OF SCIENCE 61(4): 212, July 1961.  
Provided by [Ohio State University Knowledge Bank](#)

[Royal Entomological Society](#)

[The Washington Post](#)