

# HS Life in a Biodiversity Hotspot Literature Dive Lesson Plan

## At a Glance

Students practice reading scientific articles to better understand the current scientific research related to global biodiversity, biodiversity hotspots, and the southern California coastal sage scrub community.

## Advance Preparation

- Decide how you want students to view articles (on a computer/tablet or printed out).
- Follow the link below to an infographic on how to read a scientific paper. Decide whether you will have your students read the infographic individually or go through it as a class.

<https://www.elsevier.com/connect/infographic-how-to-read-a-scientific-paper>

## Objectives

- Learn the process of reading a scientific article
- Learn how to pull out relevant information from scientific articles to share with others

## Materials

- PDF's of articles for each student to read
- "Check for Understanding" questions for each student (online or print-out)

## Lesson

- Introduce your students to the process of reading a scientific paper utilizing the infographic provided or any other documents that you find helpful.
- Provide your students with the two articles related to global biodiversity, biodiversity hotspots, and the southern California coastal sage scrub community.
- There are vocabulary words provided in the Teacher Summary section. You can introduce them before or after students read the articles, whenever you feel it fits best in the lesson for your students.
- Provide each student with the "Check for Understanding" questions. These questions could be done while reading the article (worksheet style) or after students are done reading the articles (quiz style). We suggest going through the "Check for Understanding" questions as a class after students have completed individually to see if there are any concepts in the questions that need more clarification.

## Teacher Summary

**Pre-Lesson Article:** Mittermeier et al. (2011). Global biodiversity conservation: the critical role of hotspots.<sup>1</sup>

**ABSTRACT:** Global changes, from habitat loss and invasive species to anthropogenic climate change, have initiated the sixth great mass extinction event in Earth's history. As species become threatened and vanish, so too do the broader ecosystems and myriad benefits to human well-being that depend upon biodiversity. Bringing an end to global biodiversity loss requires that limited available resources be guided to those regions that need it most. The biodiversity hotspots do this based on the conservation planning principles of irreplaceability and vulnerability. Here, we review the development of the hotspots over the past two decades and present an analysis of their biodiversity, updated to the current set of 35 regions. We then discuss past and future efforts needed to conserve them, sustaining their fundamental role both as the home of a substantial fraction of global biodiversity and as the ultimate source of many ecosystem services upon which humanity depends.

### KEY POINTS:

- There is a long list of anthropogenic threats causing global biodiversity loss
- Biodiversity loss is a direct threat to human wellbeing as well as to ecosystems
- Conservation is local - it's what people care about most and have most control over
- How do we prioritize where funds and effort is spent? By focusing on areas with high levels of endemism.
- A history of determining hotspots is given, including how it started with 10 hotspots but no solid criteria for what constituted a "hotspot." They mention marine hotspots too!
- A large percentage of the world's plants, mammals, birds, amphibians and reptiles are found within the 35 recognized biodiversity hotspots.
- Many people also live in these hotspots which means they're hotspots for cultural diversity, languages and conflict.
- Habitat destruction is projected to remain the dominant threat to biodiversity even in the era of climate change.
- A rallying cry to increase funding, research and political action because the future of life on Earth depends on it.
- Think, what can you do to help save biodiversity where you live?

**Vocabulary:**

- Anthropogenic - (chiefly of environmental pollution and pollutants) originating in human activity<sup>3</sup>
- Myriad - a countless or extremely great number<sup>3</sup>
- Biodiversity hotspot - large regions containing exceptional concentrations of plant endemism and experiencing high rates of habitat loss<sup>4</sup>
- Ecosystem services - benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits<sup>4</sup>
- Incursions - an invasion or attack, especially a sudden or brief one<sup>3</sup>

**Check for Understanding Questions:** (Answers are bolded for teacher reference)

1. How many recognized biodiversity hotspots are there in the world?
  - A. 25
  - B. 11
  - C. 35**
  - D. 53
  - E. I don't know
2. The current rate of extinction is currently \_\_\_ more than the natural rate.
  - A. 2 times
  - B. 10 times
  - C. 1,000 times**
  - D. 1 million times
  - E. I don't know

3. According to Table 1.1, the California Floristic Province was added to the list of known biodiversity hotspots in:

A. 1988

**B. 1990**

C. 2000

D. 2004

E. I don't know

4. Why are biodiversity hotspots important for human beings?

**Answer:** Biodiversity hotspots are important for human being for multiple reasons. These areas contain a large percentage of human populations and are culturally important as well. So they're important because people live in them. They also contain a high percentage of biodiversity which is important to humans because we benefit from biodiversity through bio-inspiration, food, medicine and ecosystem services.

5. What are some of the threats that biodiversity face on our planet face?

**Answer:** Biodiversity on our planet is threatened with increasing human populations, agricultural expansion, urbanization and industrial development which leads to habitat loss. Invasive species, climate change, pollution, and spreading diseases also threaten biodiversity on Earth.

**Post-Lesson Article:** Rubinoff (2001). Evaluating the California gnatcatcher as an umbrella species for conservation of southern California coastal sage scrub.<sup>2</sup>

#### KEY POINTS:

- Coastal southern California is global hotspot of endemism, nearly 100 species proposed or currently under legislation protection
- Some indications that California gnatcatcher does not function as umbrella for vertebrates, no evaluation of function as umbrella for invertebrates
- California coastal sage scrub originally encompassed 1.2 million ha, lost more than 85% of this area by 1980 to agriculture and urban development
- Multiple Habitat Conservation Plan and Multiple Species Conservation Program both designed to preserve habitat with most California gnatcatcher, making these effectively single-species plans
- Larvae of all three study insects (Mormon metalmark - MM, Bernardino blue - BB, and Electra buckmoth - EB) only feed on California buckwheat (*Eriogonum fasciculatum*)! CA buckwheat is host plant for both butterflies, meaning they oviposit, court, mate, perch, and gather nectar almost exclusively on or near it.
- Results: California gnatcatcher occurred at 48 or 50 patches, MM in 38, BB in 33, and EB in just 11; EB was present only on sites of >12.5 ha and always with both other insects; frequency of Lepidoptera increased with size site, not true with California gnatcatcher
- Defined occupancy for Lepidoptera very generously, just siting a single individual once sufficed.
- Time since isolation of habitat patches seems to have effect on success of insect population in that patch - example of delayed extinction

#### Vocabulary:

- Umbrella species - species that have either large habitat needs or other requirements whose conservation results in many other species being conserved at the ecosystem or landscape level<sup>4</sup>
- Lepidoptera - an order of insects that comprises the butterflies and moths. They have four large scale-covered wings that bear distinctive markings, and larvae that are caterpillars.<sup>3</sup>
- Endemism - the state or quality of being native and restricted to a certain area<sup>3</sup>
- Vertebrate - an animal of a large group distinguished by the possession of a backbone or spinal column, including mammals, birds, reptiles, amphibians, and fishes<sup>3</sup>

- Invertebrate - an animal lacking a backbone, such as an arthropod, mollusk, insect, etc. The invertebrates constitute an artificial division of the animal kingdom, comprising 95 percent of animal species.<sup>3</sup>
- Mitigation - the action of reducing the severity, seriousness, or painfulness of something<sup>3</sup>
- Frequency - the rate at which something occurs or is repeated over a particular period of time or in a given sample<sup>3</sup>

**Check for Understanding Questions:** (Answers are bolded for teacher reference)

1. Why is coastal sage scrub (CSS) of such conservation concern?
  - F. It is a global hotspot of endemism
  - G. It has lost over 85% of its original area
  - H. Most of the remaining CSS is owned by private landowners
  - I. All of the above**
  - J. I don't know
2. What order of insects were studied in this research project?
  - A. Hymenoptera
  - B. Lepidoptera**
  - C. Orthoptera
  - D. Hemiptera
3. This study found a direct relationship between \_\_\_\_\_ and the number of species that occurred in it.
  - A. amount of food sources
  - B. patch size**
  - C. accessibility to water
  - D. proximity to human development
4. Is the California Gnatcatcher a suitable umbrella species for insects in the coastal sage scrub community? Why or why not?

**Answer:** Not based off of the evidence in this paper. The results indicated that presence of the gnatcatcher was a poor indicator of the presence of the insect species. While the gnatcatcher was found at every site, it was the largest patches or most recently separated habitat patches that had all three species of Lepidoptera present.

5. Do you think the Multiple Habitat Conservation Plan and Multiple Species Conservation Program were successful in the case of coastal sage scrub? Why or why not?

**Answer:** Many answers could be provided, student must justify their opinion with evidence from the article.

## References

1. Mittermeier, R. A., Turner, W. R., Larsen, F. W., Brooks, T. M., & Gascon, C. (2011). Global biodiversity conservation: the critical role of hotspots. *In Biodiversity hotspots* (pp. 3-22). Springer, Berlin, Heidelberg.
2. Rubinoff, D. (2001). Evaluating the California gnatcatcher as an umbrella species for conservation of southern California coastal sage scrub. *Conservation Biology*, 15(5), 1374-1383.
3. <https://en.oxforddictionaries.com/>
4. <http://www.biodiversitya-z.org>