PEEBEDU Simpson Diversity Index Calculator

Name: _____ **Period:** _____ **Date:** _____

> Open **peebedu.com** and navigate to **Simpson Diversity Index Calculator**. Read the **Learn About Biodiversity** popup, which introduces biodiversity, Simpson's Diversity Index, ecosystem resilience, and the formula $D = 1 - \Sigma(n/N)^2$. Click **Start Learning** to begin.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Simpson Diversity Index Calculator as a scientific model.

M — Mode

What type of model is the Simpson Diversity Index Calculator? Describe how this computational simulation represents biodiversity in ecological communities. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about community ecology.

A — Accuracy

(a) Identify two things this simulation represents **accurately** about how ecologists measure and compare biodiversity. For each, name the specific simulation feature and explain what aspect of community ecology it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about real-world biodiversity assessment. Consider what factors beyond species counts and relative abundance would be important for a complete understanding of ecosystem diversity.

P — Purpose

What is the learning goal of this simulation? Explain how the Simpson Diversity Index Calculator is designed to help you understand how species composition and relative abundance determine community diversity. In your answer, connect at least one specific simulation feature to a real-world example of why quantifying biodiversity matters for ecosystem management or conservation.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries about ecosystem dynamics or community ecology might change or improve a simulation like the Simpson Diversity Index Calculator. Explain why scientific models, including mathematical indices of biodiversity, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for measuring and comparing biodiversity?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does comparing two communities side by side help you understand the relationship between diversity and ecosystem health?

Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — Species Diversity and Ecosystem Vulnerability

> *Simulation Task: In the Simpson Diversity Index Calculator, complete all four phases for the randomly loaded community pair. Record the Simpson's Diversity Index (D) for both Community A and Community B. Note which community has higher species richness and which has more even species distribution.*

(A) (1 pt) **Describe** how the structure of a community is measured in terms of species composition and species diversity.

(B) (1 pt) **Explain** why the community with fewer species in your simulation received a lower Simpson's Diversity Index value.

(C) (1 pt) **Predict** what would happen to the Simpson's Diversity Index of the higher-diversity community if an invasive species were introduced that outcompeted three of the native species, causing their populations to decline to zero while the invasive species grew to dominate the community.

(D) (1 pt) **Justify** your prediction by explaining how ecosystems with fewer component parts and less diversity among those parts are often less resilient to further changes in the environment.

EK 8.5.A.1, 8.6.A.1

Analyze Model / Visual Representation

Question 2 — Biodiversity, Keystone Species, and Ecosystem Stability

> *Simulation Task: Click "Try New Communities" to load a new scenario. Before entering any counts, observe both visual community displays. Note the visual difference in how organisms are distributed — one community appears to have many different types of organisms while the other is dominated by one or two types. Complete Phase 1 (counting) for both communities.*

(A) (1 pt) **Describe** the role that keystone species, producers, and essential abiotic factors play in maintaining the diversity of an ecosystem.

(B) (1 pt) **Explain** how the removal of a keystone species or a major change in an abiotic factor could shift a community from resembling the high-diversity community in your simulation to resembling the low-diversity community.

(C) (1 pt) **Represent** the relationship between species diversity and ecosystem stability.

Draw your diagrams here.

(D) (1 pt) **Connect** the loss of biodiversity to how reduced species diversity within a community limits the raw material available for natural selection to act upon.

EK 8.6.A.2, 8.5.A.1