M E M O R A N D U M

To: VCSI Science and Policy Group

From: Robert Zaino, Vermont Fish and Wildlife Department; Gus Goodwin, The Nature Conservancy; and Elizabeth Thompson, Independent Ecologist

Date: March 6, 2024

Subject: ***Defining Biodiversity in Act 59***

Act 59 (10 VSA Chapter 89 Section 2801-2803) is "An act relating to community resilience and biodiversity protection." The term "biodiversity" is not defined in the Act.

We propose the VCSI Science and Policy Group adopt a definition and conceptual understanding of biodiversity to assist in the interpretation and implementation of Act 59.

After reviewing several definitions of biodiversity, we noted many common themes. The definitions we reviewed are included below as an appendix. Based on that review, we recommend adopting the definition used in the Vermont Biodiversity Project (Thompson 2002)[1]:

> *Biodiversity, or Biological Diversity, is the variety of life in all its forms, and all the interactions between living things and their environment. It includes ecosystem diversity, landscape diversity, community diversity, species diversity, and genetic diversity.*

Biodiversity, as used generally, is a very broad concept. The term does not ascribe relative value to particular species, ecosystems, or interactions. For example, it encompasses both native and non-native species. A definition of biodiversity does not tell us what to conserve, or why. In addition, there is no single metric that describes the biodiversity of a place. It encompasses concepts that are easily measured, such as species richness (the number of species in a particular area), but other aspects of biodiversity are difficult, if not impossible, to measure. A definition of biodiversity does not help us measure the relative conservation contributions of particular places.

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[1] Thompson, Elizabeth H. 2002. Vermont's Natural Heritage: Conserving Biodiversity in the Green Mountain State. A Report from the Vermont Biodiversity Project. 48 pp.

For these reasons, we think a definition of biodiversity, while helpful, is by itself inadequate to inform the ongoing work directed by Act 59. Therefore, we propose that the VCSI Science and Policy Group also adopt the following statement:

> *The best measure of Vermont's ability to conserve, support, and restore biological diversity is our progress in maintaining and restoring an ecologically functional landscape. The best measure of a particular place's role in supporting and restoring biodiversity is whether it contributes to maintaining the ecologically functional landscape envisioned in Vermont Conservation Design.*[2]

Maintaining and enhancing ecological function across the landscape is fundamental to conserving biological diversity. Ecological function—the ability of plants and animals to thrive, reproduce, migrate, and move in response to land-use changes and climate changes, and the ability of ecosystems to function under natural processes—is served by high-quality terrestrial and aquatic habitat, natural connections across the landscape, a wide variety of habitat features from low elevation to high, clean water, and healthy rivers, streams, lakes, ponds, and wetlands.

An ecologically functional landscape contains all the native species in Vermont and the full range of native habitats and natural communities known to occur in the state. It also contributes to regional conservation, by maintaining species and habitat conditions that may be in regional decline (such as grassland birds and their habitat), or that may be well-represented in Vermont but are regionally rare (such as habitats resulting from calcium-rich bedrock). It must be well-connected at multiple scales, allowing species movement and gene flow across the landscape. An ecologically functional landscape is also resilient, allowing species to shift distributions and natural communities to rearrange themselves in response to a changing climate and other stressors.

Importantly, this framework links biodiversity and community resilience. An ecologically functional landscape is essential to community resilience, and the well-being of all who live in Vermont. It is critical for storing and slowing flood waters, for storing carbon, and for providing the fuel, fiber, and other resources that are necessary to sustain our communities. An ecologically functional landscape provides the vital backdrop for recreation and tourism that stimulates local economies, and that nourishes traditions, community connections, and our long-term resilience.

We believe the definition and conceptual understanding of biodiversity presented here are consistent with the intent of Act 59 and provide a useful framework for undertaking the tasks prescribed in the Act.

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[2] Sorenson, E., and R. Zaino. 2018. Vermont Conservation Design: Maintaining and Enhancing and Ecologically Functional Landscape. Summary Report. Vermont Fish and Wildlife Department.

Appendix: Other definitions of biodiversity reviewed

E. O. Wilson in JSTOR Daily:
The rise of the term "biodiversity" to prominence can be attributed to the entomologist E. O. Wilson, who was one of the first scientists to describe the biodiversity crisis in the 1980s and work to find solutions to it. He explored the meaning of the word in a 1996 interview with *The American Biology Teacher*:

> *"Biologists define biodiversity in the broadest sense as meaning all of the variety of life—from the different genes at the same chromosome position within populations, up through different species of organisms, on up to different aggregations of species in ecosystems…It is very important to study each one in turn and to understand fully how they are related to each other: the genes, the species and the ecosystems."*

National Geographic Society:
Biodiversity is a term used to describe the enormous variety of life on Earth. It can be used more specifically to refer to all of the species in one region or ecosystem. Biodiversity refers to every living thing, including plants, bacteria, animals, and humans.

World Wildlife Fund:
Biodiversity is all the different kinds of life you'll find in one area—the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world. Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life. Biodiversity supports everything in nature that we need to survive: food, clean water, medicine, and shelter.

American Museum of Natural History:
The term biodiversity (from "biological diversity") refers to the variety of life on Earth at all its levels, from genes to ecosystems, and can encompass the evolutionary, ecological, and cultural processes that sustain life.

Smithsonian:
Biodiversity is the extraordinary variety of life on Earth — from genes and species to ecosystems and the valuable functions they perform. E.O. Wilson, the noted biologist and author who coined the term "biodiversity," explains it as "the very stuff of life." Biodiversity — short for biological diversity — is the variety of all living things and their interactions. Biodiversity changes over time as extinction occurs and new species evolve.