Geological Diversity Blocks

Description

Geological Diversity Blocks (which have also been referred to as enduring features, or physical landscape diversity) are the parts of the landscape that resist change. They are the hills and valleys, the underlying bedrock, and the deposits left behind by glaciers. They remain largely unaffected when changes in land cover and wildlife occur, as plants and animals move, and even as the climate changes. Geological Diversity Blocks are able to help drive ecological processes or support plants, animals, or natural communities when they are not developed or otherwise significantly altered by human activities.

If nature is likened to a dramatic play, it's possible to think of the physical landscape as the stage and the individual species as the actors. The play is the natural communities, habitats and species that occur in a given place at a given time, but regardless of the action, the stage does not change. The importance of "conserving nature's stage" is that we can be much more confident in our ability to conserve biological diversity and maintain a functional landscape into the future, with the capacity to adapt and be resilient to climate change, if all elements of physical landscape diversity are represented in a landscape-scale conservation design (Anderson & Ferree 2010; Beier and Brost 2010; Beier et al. 2012).

Geologic Diversity Blocks has two key elements. First it is an assessment of the representation of geological and physical landscape settings in the Highest Priority area of all the other 2023 landscape scale components (Interior forest blocks, Connectivity blocks, Surface Waters and Riparian Areas, and Riparian Connectivity). Second, because it adds additional selections beyond what is highest priority for other components, it is in and of itself, a selection of habitat blocks that represent the range of physical landscapes across VT. See Selection Criteria.

BioFinder recognizes three broad categories of Geological Diversity Blocks.

> ***Representative Physical Landscapes***: those that occur commonly in Vermont, based on percent of the landscape covered. Examples include Low Rolling Upland and Mountain Slopes. Areas mapped as Representative Physical Landscapes have been included in Vermont Conservation Design because of their contribution to another landscape scale component. They represent important interior forest blocks, connectivity blocks, or surface waters and riparian areas. In some cases, they also include the forest that surrounds a rare or responsibility physical landscape. Representative Physical Landscapes are important to consider alongside rare and responsibility landscapes because the majority of Vermont species occur in these areas. The areas mapped here represent high-priority lands and waters that contain these common landscape types.
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> ***Rare Physical Landscapes***: those that are least commonly found in Vermont, based on percent of the landscape covered. Examples include the Vermont Escarpment and waterd-eposited sediments along major rivers and streams. Because rare physical landscapes often correspond with the presence of rare species or natural communities, they can be used as a

filter for maintaining the state's overall biodiversity. This is particularly important because there are many species about which we know very little—insects, plants, or mosses, for example—and identifying rare physical landscapes can help us to predict where diversity among these unstudied species may occur.

Responsibility physical landscapes: those that occur more commonly in Vermont than in other areas of the northeastern United States and adjacent Canada, and for which we therefore have a regional responsibility to protect. Examples include Calcareous Metamorphic High Hills/Low Mountains and Ct River Valley-Hitchcock sediments.

Ecological Importance

Diversity in the physical landscape corresponds with diversity in species present. Therefore, understanding where there is physical landscape diversity can serve as a surrogate for information on natural communities and species diversity when that information is not available. This is particularly important in the face of global climate change. As changes occur over time, plant and animal species adjust their ranges to more climatically suitable conditions. Conserving and providing stewardship for a connected network of diverse physical landscapes physical landscapes will allow for these adjustments to be made more easily and in turn help protect the diversity of natural communities and species.

Some physical landscapes are helpful in locating specific natural communities and species. For example, the Valley Clayplain Forest is a natural community that is associated with Valley Floor Glacial Lake/Marine Plains and is found exclusively on clay soils. Two of its component plant species, bur oak and barren strawberry, are also most common on those soils. Therefore, it is possible to examine information on surficial geology to determine where clay deposits exist and, with that information, predict the potential location of a Valley Clayplain Forest and its component species. Conservation scientists and practitioners have used specific physical landscape features successfully to locate places to search for particular natural communities or rare species.

Geological Diversity Conservation Goal

Represent all of the geophysical settings that occur in Vermont in a naturally vegetated network of connected lands to provide the "stage" for present and future biota and natural ecological processes (the "actors" and the "play").

Specifically, each of the three broad categories of physical landscapes included in BioFinder has a conservation goal.

Rare Physical Landscapes: In the design, capture 100% of these whenever possible.

Representative Physical Landscapes: In the design, capture 70% of these whenever possible.

Responsibility geophysical settings: In the design, capture 100% of these where possible.

Component Mapping Goal

To identify Vermont's enduring physical features, especially those places with considerable landscape diversity that may continue to foster biological diversity in the future, even as the climate changes and species composition shifts.

Data Source(s) & Selection Criteria

Unlike other BioFinder components, Geological Diversity Blocks was created using a multi-step, iterative process to incorporate physical landscape settings into the design. This began with an assessment of Land Type Associations (LTA). LTAs are landscape scale map units defined by multiple biotic and abiotic factors. See table 5.1 for a list. The proportion LTAs across all of Vermont (regardless of land cover) was compared with LTAs represented in the Highest Priority area of all the other 2023 landscape scale components.

Goals were set for representation of these settings. Goals for Rare and Responsibility settings were set at 100% because of their regional significance, While goals for more common, Representative settings, were set at 70% because that's the area of VT included in the 2023 Highest Priority Landscape Scale components.

After assessing the representation of these different settings within the 2023 Highest Priority Landscape Scale components, an additional 956 Habitat Blocks were selected as Highest Priority for Geological Diversity because they included a high percentage of LTA types that were underrepresented in the other Highest Priority component area. These were largely Valley Floor Glacial Lake/Marine Plains, Marine-lacustrine-glaciofluvial coarse sediments, Ct River Valley-Hitchcock sediments, & Water-deposited glacial sediments along major riverways.

The remaining 603 Habitat Blocks (first selected as Highest Priority for Interior Forest and Connectivity Blocks) were then split into Highest Priority and Priority. This was done using a finer unit, Elevationally grouped-Ecological Land Unit (EELU). Ecological Land Units are a modeled product for use as analysis units to organize small areas by suitability, identify restoration priorities, and serves as a coarse filter for protecting biodiversity. First each EELU was put into categories of Rare, Representative and Responsibility. Then we calculated % rare, % responsibility & % representative for every habitat block. For each Habitat Block we also calculated the Shannon Diversity Index for their composition of EELU. Highest Priority Blocks were selected based on the following:

- Shannon index >2.5
- % Rare >0.5
- % responsibility >0.5

In total there are 1,301 Highest Priority Geological Diversity blocks (= 956 + 345) and 258 Priority Geological Diversity Blocks.

Habitat Blocks, Hawkins-Hilke et al. 2023. **Vermont Fish & Wildlife Department**

1. Land Type Associations, Ferree & Thompson 2008.

Description

Land Type Associations are a modeled product for use as analysis units to organize broad areas by suitability, identify restoration priorities, and serves as a coarse filter for protecting biodiversity. LTAs are landscape scale map units defined by multiple biotic and abiotic factors.

Selection Criteria

Land Type Associations (LTA) were used to compare the proportion statewide with their proportion within other 2023 Highest Priority landscape scale components, to add 956 Habitat Blocks as Highest Priority for Geological Diversity to ensure all geological settings were represented.

Figure 5.1 Land Type Associations

Land Type Associations	Statewide Proportion of each LTA type	REPRESENTATION GOAL
Valley Floor Glacial Lake/Marine Plains	4.4%	100.0%
Marine-lacustrine-glaciofluvial coarse sediments	0.9%	100.0%
Ct River Valley-Hitchcock sediments	0.8%	100.0%
Water-deposited glacial sediments along major riverways	2.0%	100.0%
Precambrian Plateau	2.2%	100.0%
Granitic Mid-Elevation Hills	1.1%	100.0%
Low rolling upland	9.4%	70.0%
Rolling low to mid-elev calc/metamorphic hills	12.3%	70.0%
Enriched slopes	0.6%	100.0%
Temperate oaky hills of southeastern Vermont	6.1%	70.0%
Granitic basin	0.4%	100.0%
Granitic high hills/low mtns	0.5%	100.0%
Upper Mtn Slopes/Mountaintops	2.7%	100.0%
Calcareous Metamorphic High Hills/Low Mountains	0.3%	100.0%
Vermont Escarpment	0.8%	100.0%
Lake/reservoir gt 200 acres	3.4%	100.0%
Hills/footslopes; Bedrock hills (Champlain Valley)	22.7%	70.0%
Dissected low to mid-elev calc/metamorphic hills	5.3%	70.0%
Mountain Slopes	16.2%	70.0%
Valley bottom; Floodplain-riparian (Champlain Valley)	8.0%	70.0%

2. Ecological Land Units, Ferree & Anderson 2008.

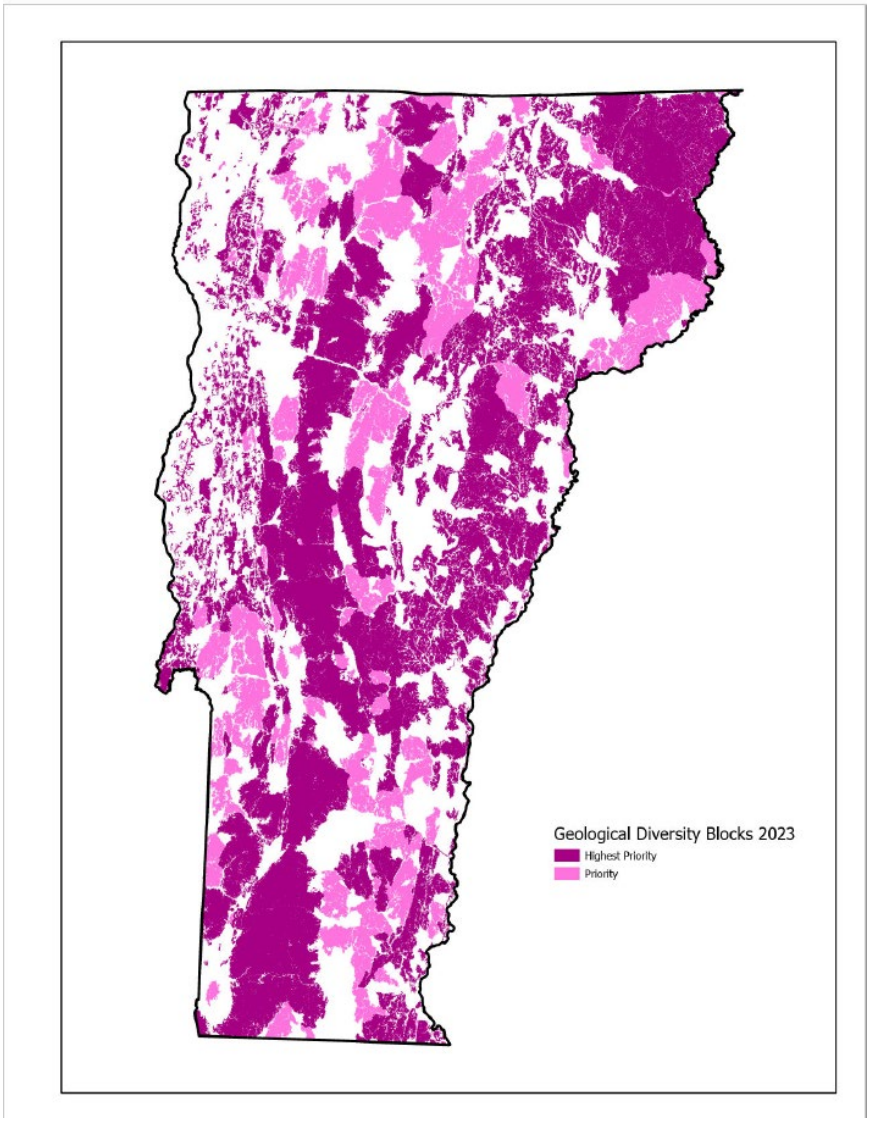
Description

Ecological Land Units are a modeled product for use as analysis units to organize small areas by suitability, identify restoration priorities, and serves as a coarse filter for protecting biodiversity. LTAs are fine-scale map units defined by multiple biotic and abiotic factors.

Selection Criteria

Elevationally grouped-Ecological Land Unit (EELU) were used to divide 603 Habitat Blocks that were selected for Interior Forest and Connectivity values into Highest Priority and Priority for Geological Diversity.

Figure 5.2 Map of Geological Diversity Blocks Component



Component Priority & Justification

Geological Diversity Blocks are divided into Highest Priority and Priority.

Priority Geological Diversity Blocks are Habitat Block with a Shannon index <2.5, or % Rare <0.5, or % responsibility <0.5.

Highest Priority Geological Diversity Blocks are Habitat Blocks that contain high percentages of under-represented LTA types or are Habitat Block with a Shannon index >2.5, or % Rare >0.5, or % responsibility >0.5.

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For more information

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