Metadata for NWB LCC Benchmark Networks and Upstream Area Shapefiles

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Introduction

Benchmark networks comprised of protected area and new ecological benchmarks were identified for ecoregions in the Northwest Boreal LCC planning region. This document describes the attributes for shapefiles comprised of (1) benchmarks, (2) benchmark networks, and (3) upstream areas associated with benchmarks and benchmark networks. Each shapefile has an associated csv table that stores the attributes. Tables can be joined to the shapefiles in a GIS platform or viewed separately.

Shapefiles:
- *eco_xx_Benchmarks.shp* (Table 1) – All benchmarks identified in the ecoregion. Can include both new benchmarks and existing protected area benchmarks. Attributes are stored in *eco_xx_Benchmarks_attributes.csv*.
- *eco_xx_Networks_byBenchmark.shp* (Table 2) - All networks built for the ecoregion. Can include networks composed of protected area benchmarks, new benchmarks, and a mix of both existing protected area and new benchmarks. Benchmark level attributes are reported and grouped by network. Attributes are stored in *eco_xx_Networks_byBenchmark_attributes.csv*.
- *eco_xx_Networks_byNetwork.shp* (Table 3) - All networks built for the ecoregion. Can include networks composed of protected area benchmarks, new benchmarks, and a mix of both existing protected area and new benchmarks. Benchmarks are dissolved into networks and network level attributes are reported. Attributes are stored in *eco_xx_Networks_byNetwork_attributes.csv*.
- *eco_xx_Upstream_Benchmarks.shp* (Table 4) – Upstream areas for all benchmarks that appear in at least one network solution. Attributes are stored in *eco_xx_Upstream_Benchmarks_attributes.csv*.
- *eco_xx_Upstream_Networks.shp* (Table 5) – Upstream areas for all networks. Attributes are stored in *eco_xx_Upstream_Networks_attributes.csv*.
- *eco_xx_Protected_Areas_HU.shp* (Table 1) – Protected area benchmarks clipped to the ecoregion and its overlapping hydrology units (i.e., HUC8s and FDAs). Only provided in cases where networks use existing protected area benchmarks clipped to the ecoregion. Attributes are stored in *eco_xx_Protected_Areas_HU_attributes.csv*.
- *eco_xx_Upstream_Protected_Areas_HU.shp* (Table 4) – Upstream areas for protected area benchmarks clipped to the ecoregions overlapping hydrology units (i.e., HUC8s and FDAs). Only provided in cases where networks use existing protected area benchmarks clipped to the ecoregion. Attributes are stored in *eco_xx_Upstream_Protected_Areas_HU_attributes.csv*.

CSV tables:
- *Gap_table_eco_xx.csv* (Table 6) – table showing gaps in cases where networks have a single representation gap.

Data dictionary

Shapefiles: *eco_xx_Benchmarks.shp, eco_xx_Protected_Areas_HU.shp*

Associated csv tables: *eco_xx_Benchmarks_attributes.csv, eco_xx_Protected_Areas_HU_attributes.csv*

Table 1. Attributes of the shapefile and associated csv table. The shapefiles and csv tables contain a row for each benchmark in the ecoregion. The shapefile and csv table can be joined on the attribute **PB**. Both new benchmarks and existing protected area benchmarks are included.

Attribute	Definition
ecoregion	Ecoregion in which the benchmark was built.
scenario	Combination of minimum catchment-level intactness and minimum target size (e.g., i80_t100).
PB	Unique identifier for ecological benchmark.
area_PB_km2	Benchmark area in km^2.
area_PB_mi2	Benchmark area in $miles^2$.
Up_PB_km2	Area of catchments upstream of the benchmark in km^2.
Up_PB_mi2	Area of catchments upstream of the benchmark in $miles^2$.
Up_PB_AWI	Mean area-weighted intactness of catchments upstream of the benchmark.
PB_holes	A measure of internal vulnerability. The proportion of the area falling within the outer boundary of the benchmark made up of low (<80%) intactness catchments.
SI	Shape Index, the shape of the benchmark relative to a circle. Irregular shapes are avoided during benchmark design to minimize edge effects and vulnerability to external influences. Shape is measured with a standard edge/area ratio metric that measures the complexity of patch shape as the ratio of patch perimeter to that of a circular patch of equal area (McGarigal and Marks 1994[1]). Thus SI = 1 for a circular patch, and increases without bound as patch shape becomes increasingly irregular.
cmi_PB_gaps	The number of CMI classes where MDR-based representation targets were not met.
cmi_PB_gaps_5	The number of CMI classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
led_PB_gaps	The number of LED classes where MDR-based representation targets were not met.
led_PB_gaps_5	The number of LED classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
gpp_PB_gaps	The number of GPP classes where MDR-based representation targets were not met.
gpp_PB_gaps_5	The number of GPP classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.

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[1] McGarigal K, Marks BJ (1994). Fragstats. Spatial pattern analysis program for quantifying landscape structure. Version 2.0. Corvallis: Forest science department, Oregon State University.

Attribute	Definition
lcc_PB_gaps	The number of LCC classes where MDR-based representation targets were not met.
lcc_PB_gaps_5	The number of LCC classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
ks_PB_cmi	Kolmogorov-Smirnov dissimilarity statistic (cmi – benchmark vs. ecoregion).
ks_PB_led	Kolmogorov-Smirnov dissimilarity statistic (led – benchmark vs. ecoregion).
ks_PB_gpp	Kolmogorov-Smirnov dissimilarity statistic (gpp – benchmark vs. ecoregion).
bc_PB_lcc	Bray-Curtis dissimilarity statistic (lcc – benchmark vs. ecoregion).

Shapefiles: eco_xx_Networks_byBenchmark.shp

Associated csv tables: eco_xx_Networks_byBenchmark_attributes.csv

Table 2. Attributes of the shapefile and associated csv table. The shapefile and csv table can be joined on the attribute **join_id**. This shapefile displays networks such that each row is a benchmark, and benchmarks are grouped into networks via the attribute net_name. If a benchmark is in multiple networks it will appear multiple times. Attributes are at the benchmark level. **All attributes in Table 1 are present**, as well as the additional attributes displayed below.

Attribute	Definition
net_name	Unique identifier for each network. Combines PB names (see Table 1) of the benchmarks making up the network.
group	Categorical variable grouping networks by spatial groups.
report_ID	Identifies networks illustrated in the ecoregion summary report.
lwDCI	Mean length-weighted Dendritic Connectivity Index. DCI describes the hydrologic connectedness of the stream network within a benchmark. Developed by Cote et al. (2009)[2], DCI quantifies "longitudinal connectivity of river networks based on the expected probability of an organism being able to move freely between two random points of the network." The index ranges from 0 to 1, low to high longitudinal connectivity, respectively. DCI was measured using National Hydrology Dataset (1:24,000) (USGS 2014[3]). Length-weighted DCI calculates a DCI values for each stream basin in the benchmark and calculates the weighted mean based on the length of streams in each basin. Note that due to processing limitations, this attribute was only calculated for benchmarks that appear in networks.
join_id	Unique identifier for each row in the shapefile and csv tables. To be used for joining the csv table to the shapefiles.

[2] Cote, D., G. Dan, C. Bourne, and Y.F. Wiersma. 2009. A new measure of longitudinal connectivity for stream Networks. Landscape Ecology 24:101–113.
[3] USGS (U.S. Geological Survey). 2014b. National Hydrography Dataset, Alaska.
[Available online ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/NHDH_AK_931v210.zip]

Shapefiles: *eco_xx_Networks_byNetwork.shp*

Associated csv tables: *eco_xx_Networks_byNetwork_attributes.csv*

Table 3. Attributes of the shapefile and associated csv table. This shapefile display networks such that each row is a complete network where the benchmarks within the network have been dissolved together. Attributes are at the network level. The shapefile and csv table can be joined on the attribute **net_name**.

Attribute	Definition
ecoregion	Ecoregion in which the network was built.
scenario	Combination of minimum catchment-level intactness and minimum target size (e.g., i80_t100).
net_name	Unique identifier for each network. Combines PB names (see Table 1) of the benchmarks making up the network.
group	Categorical variable grouping networks by spatial groups.
report_ID	Identifies networks illustrated in the ecoregion summary report.
area_net_km2	Network area in km^2.
area_net_mi2	Network area in $miles^2$.
Up_net_km2	Area of catchments upstream of the network in km^2.
Up_net_mi2	Area of catchments upstream of the network in $miles^2$.
Up_net_AWI	Mean area-weighted intactness of catchments upstream of the network.
Up_net_km2_noPA	Area of catchments upstream of the network in km^2, minus any area currently under high protection. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.
Up_net_mi2_noPA	Area of catchments upstream of the network in $miles^2$, minus any area currently under high protection. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.
Up_net_AWI_noPA	Mean area-weighted intactness of catchments upstream of the network that do not have high protection.
net_holes	A measure of internal vulnerability. The proportion of the area, falling within the outer boundary of the network, made up of low (<80%) intactness catchments.
max_SI	Maximum shape index (SI in Table 1) for benchmarks in the network.
min_lwDCI	Minimum length-weighted DCI value (lwDCI in Table 2) for benchmarks in the network.

Attribute	Definition
cmi_net_gaps	The number of CMI classes where MDR-based representation targets were not met.
cmi_net_gaps_5	The number of CMI classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
led_net_gaps	The number of LED classes where MDR-based representation targets were not met.
led_net_gaps_5	The number of LED classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
gpp_net_gaps	The number of GPP classes where MDR-based representation targets were not met.
gpp_net_gaps_5	The number of GPP classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
lcc_net_gaps	The number of LCC classes where MDR-based representation targets were not met.
lcc_net_gaps_5	The number of LCC classes that make up >= 5% of ecoregion where MDR-based representation targets were not met.
ks_net_cmi	Kolmogorov-Smirnov dissimilarity statistic (cmi – network vs. ecoregion).
ks_net_led	Kolmogorov-Smirnov dissimilarity statistic (led – network vs. ecoregion).
ks_net_gpp	Kolmogorov-Smirnov dissimilarity statistic (gpp – network vs. ecoregion).
bc_net_lcc	Kolmogorov-Smirnov dissimilarity statistic (lcc – network vs. ecoregion).
mean_DS	Mean of *ks_net_cmi*, *ks_net_led*, *ks_net_gpp* and *bc_net_lcc* values.
net_distance	A representation index calculated as the Euclidean distance of the *ks_net_cmi*, *ks_net_led*, *ks_net_gpp* and *bc_net_lcc* values. The representativity of a network increases as the distance gets closer to 0. Likewise, the closer the distance is to 1, the greater the distance between distributions, and the less representative a network is.
per_eco_overlap	Percent overlap between the network and the ecoregion.
per_PA_overlap	Percent overlap between the network and the existing high protection protected area network. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.

Shapefiles: *eco_xx_Upstream_Benchmarks.shp, eco_xx_Upstream_Protected_Areas_HU.shp*

Associated csv tables: *eco_xx_Upstream_Benchmarks_attributes.csv,*
eco_xx_Upstream_Protected_Areas_attributes.csv

Table 4. Attributes of the shapefile and associated csv table. Each row in these shapefiles is the upstream area for each benchmark that appears in the networks of *eco_xx_Benchmarks.shp* and *eco_xx_Protected_Areas_HU.shp*. The shapefile and csv table can be joined on the attribute **PB**.

Note: For PA benchmarks, the catchments used to calculate upstream area do not align with the PA benchmark boundaries. For the purposes of calculating upstream area, catchments are assigned to the PA benchmark if their centroid falls within the PA benchmark. Upstream catchments are then identified and clipped to line up with the PA benchmarks. For this reason the Up_PB_km2 values do not match the exact area of the upstream polygons.

Attribute	Definition
ecoregion	Ecoregion in which the network was built.
PB	Unique identifier for ecological benchmark.
Up_PB_km2	Area of catchments upstream of the benchmark in km^2.
Up_PB_mi2	Area of catchments upstream of the benchmark in $miles^2$.
Up_PB_AWI	Mean area-weighted intactness of catchments upstream of the benchmark.
Up_PB_km2_noPA	Area of catchments upstream of the benchmark in km^2, minus any area currently under high protection. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.
Up_PB_mi2_noPA	Area of catchments upstream of the benchmark in $miles^2$, minus any area currently under high protection. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.
Up_PB_AWI_noPA	Mean area-weighted intactness of catchments upstream of the benchmark that do not have high protection.

Shapefiles: *eco_xx_Upstream_Networks.shp*

Associated csv tables: *eco_xx_Upstream_Networks_attributes.csv*

Table 5. Attributes of the shapefile and associated csv table. Each row in the shapefile is the upstream area of a network in the shapefile *eco_xx_Networks.shp*. The shapefile and csv table can be joined on the attribute **net_name**.

Note: For networks that include PA benchmarks, the catchments used to calculate PA benchmark upstream areas do not line up with the PA benchmark boundaries. For the purposes of calculating upstream area, catchments are assigned to the PA benchmark if their centroid falls within the PA benchmark. Upstream catchments are then identified and clipped to line up with the PA benchmarks. For this reason the Up_net_km2 values do not always match the exact area of the upstream polygons.

Attribute	Definition
Ecoregion	Ecoregion in which the network was built.
net_name	Unique identifier for each network. Combines PB names (see Table 1) of the benchmarks making up the network.
Up_net_km2	Area of catchments upstream of the network in km^2.
Up_net_mi2	Area of catchments upstream of the network in $miles^2$.
Up_net_AWI	Mean area-weighted intactness of catchments upstream of the network.
Up_net_km2_noPA	Area of catchments upstream of the network in km^2, minus any area currently under high protection. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.
Up_net_mi2_noPA	Area of catchments upstream of the network in $miles^2$, minus any area currently under high protection. High protection was assigned to National Parks, Designated Wilderness Areas, and Fish and Wildlife Refuges. Protected areas with low protection were assigned high protection when encompassed within high protection areas. A Wild and Scenic River within a National Park for example.
Up_net_AWI_noPA	Mean area-weighted intactness of catchments upstream of the network that do not have high protection.

CSV table: *Gap_table_eco_xx.csv*

Table 6. This table contains benchmark networks that failed to achieve the MDR-based representation target for one class (e.g., CMI class 2). Each row in this table represents a single benchmark network. The table is only provided in ecoregions where networks have a gap in representation. **Note**: In the representation analysis, each target has to be met in full by a single benchmark in the network, except when benchmarks overlap. The gapClassProp and missing_km2 values reported are for the benchmark in the network that has the most of the missing class. This table can be joined to the shapefile via the attribute **net_name**.

Attribute	Definition
net_name	Unique identifier for each benchmark network.
gaps	The criteria (cmi, gpp, led, or lcc) and class number where the representation target is not met.
target_km2	The target value for the missing representation class.
gapClassProp	The highest proportion of the target met by a benchmark in the network.
missing_km2	The lowest difference between the target and the amount of the missing class represented by a benchmark in the network.