Ecoregion 180 – Boreal Mountains and Plateaus

Area of ecoregion km² (mi²)	Area of planning region km² (mi²)	Minimum Dynamic Reserve km² (mi²)	Number of protected area benchmarks	Number of new system-level benchmarks	Number of candidate benchmark networks (groups)
105,582 (40,765)	242,118 (93,482)	1,089 (420)	6	1,543	146 (20)

The identification of candidate benchmark networks is a three-step process. First, potential benchmarks are identified based on size, intactness, and hydrologic connectivity. Next, benchmarks are assembled into candidate networks that are representative of the planning region, where the number of benchmarks required to achieve representation may vary amongst planning regions (*e.g.*, ecoregions). Finally, if multiple benchmark network options exist, to assist with the selection process, the networks are ranked using additional criteria such as fundamental benchmark properties, climate change, and focal species, as done below.

Benchmark potential of existing protected areas and regions that support the construction of benchmarks

The planning region for ecoregion 180 is defined by the ecoregion and intersecting hydrologic units (FDAs). Prior to identifying new benchmarks, existing protected areas (PAs) were clipped to the planning region and evaluated for their potential to serve as system- and subsystem-level benchmarks for the ecoregion (Figure 1). System-level benchmarks are assemblages of intact catchments that are of sufficient size to capture large-scale processes and maintain habitats vulnerable to natural disturbance (*i.e.*, Minimum Dynamic Reserve or MDR). There are two levels of benchmark intactness, I and II, which denote a minimum catchment intactness of 100% and 80%, respectively. Subsystem-level benchmarks do not meet the size and/or intactness criteria for system-level benchmarks. For this study, subsystem benchmarks are no less than 80% MDR in size. Nine potential PA system-level II benchmarks were identified in ecoregion 180 (Figure 1; Table 1). However, only six had sufficient overlap with the ecoregion (≥ 80% MDR) to be included as explicit benchmarks in the design of benchmark networks. While these six PA benchmarks achieve representation targets, we identified new benchmarks to provide land managers with additional options. Ecoregion 180 has high benchmark potential with benchmarks identified over 93% of the ecoregion (Figure 1).
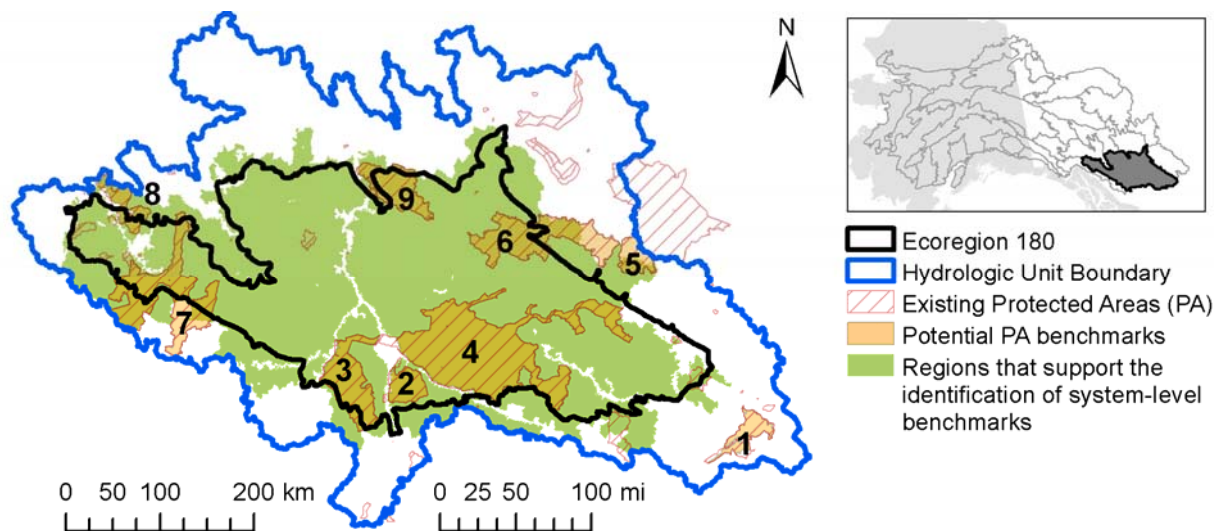

Figure 1: The planning region for ecoregion 180 is defined by the ecoregion (black outline) buffered by FDAs (blue outline). Potential protected area (PA) system-level II benchmarks are shown in orange; labels correspond to the PA ID in Table 1. Regions that support the identification of new system-level benchmarks (≥80% catchment-intactness) are shown in green.

Table 1: Characteristics of the nine system-level II protected area (PA) benchmarks identified in ecoregion 180 (Figure 1). To be included in the design of benchmark networks, the ecoregion portion of PA benchmarks must be ≥ 80% MDR in size.

PA ID	Area km² (mi²)	Benchmark Type	% MDR area intersecting ecoregion
PA_1	1,070 (413)	System-level II	0
PA_2	1,191 (460)	System-level II	109 (1.1 x MDR)
PA_3	3,034 (1,171)	System-level II	251 (2.5 x MDR)
PA_4	11,892 (4,592)	System-level II	1090 (10.9 x MDR)
PA_5	1,048 (405)	System-level II	0
PA_6	4,463 (1,723)	System-level II	224 (2.2 x MDR)
PA_7	5,576 (2,153)	System-level II	246 (2.5 x MDR)
PA_8	1,102 (425)	System-level II	29
PA_9	2,345 (905)	System-level II	155 (1.6 x MDR)

Identification of candidate benchmark networks

Candidate benchmark networks for the planning region were identified based on the representation of four indicators of environmental variation: Climate Moisture Index (CMI), Gross Primary Productivity (GPP), Lake-Edge Density (LED), and Land Cover. Representation was assessed using MDR-based representation targets for indicator classes. Representation targets were derived for each class by multiplying the MDR for the ecoregion by the proportion of the class in the ecoregion. For example, if the class makes up 10% of the ecoregion, the target would be 0.1 x MDR. For ecoregion 180, the existing protected area (PA) benchmarks achieve representation targets for all indicator classes (N1-N7; Figure 2). Only the ecoregion portion of the PA networks N1-N7 is needed to achieve representation and satisfy the size and intactness requirements of a system-level benchmark. As such, only the ecoregion portion of N1-N7 was used to assess fundamental benchmark properties and resilience to climate change. However, the full extent of N1-N7 was used when evaluating the representation of focal species habitat. In addition to the PA benchmark networks, we identified 139 benchmark networks comprised of two new system-level benchmarks (N8-N20). All networks were assigned to 20 spatial groups (Figure 2). For reporting, the set of candidate benchmark networks was reduced to the top network from each spatial group (Figure 2, Table 2). The top networks were selected using the same criteria and methods as described below for ranking candidate benchmark networks. For a full description of the methods, see the main report.

Table 2: Area and representation characteristics of the top networks selected from the 20 spatial groups in Figure 2. The networks differ in area due to variable overlap of benchmarks within networks. All networks achieved MDR-based representation targets for CMI, LED, GPP, and land cover, but representation varied amongst networks when evaluated using Kolmogorov-Smirnov (KS; continuous indicators CMI, LED, and GPP) and Bray-Curtis (BC; categorical indicator land cover) dissimilarity metrics (DMs). DMs range from 0 to 1, with values closer to 0 indicating better representation.

| Network ID	Area km² (mi²)	Upstream area km² (mi²)	KS & BC Dissimilarity Metrics				
			CMI	GPP	LED	Land Cover	Mean Dissimilarity
N1	11,869 (4,583)	13,276 (5,126)	0.234	0.127	0.043	0.104	0.127
N2	3,633 (1,403)	10,660 (4,116)	0.100	0.062	0.154	0.109	0.106
N3	5,163 (1,993)	37,347 (14,420)	0.158	0.210	0.127	0.131	0.156
N4	14,549 (5,617)	17,884 (6,905)	0.166	0.117	0.046	0.080	0.102
N5	5,122 (1,978)	12,866 (4,968)	0.242	0.070	0.076	0.105	0.123
N6	4,130 (1,595)	10,343 (3,993)	0.152	0.231	0.130	0.125	0.160
N7	22,590 (8,722)	51,760 (19,985)	0.123	0.040	0.050	0.061	0.068
N8	2,180 (842)	593 (229)	0.070	0.058	0.053	0.062	0.061
N9	2,183 (843)	1,416 (547)	0.125	0.068	0.072	0.095	0.090
N10	2,152 (831)	999 (386)	0.060	0.137	0.081	0.181	0.115
N11	2,183 (843)	1,900 (734)	0.105	0.030	0.064	0.073	0.068
N12	2,179 (841)	2,426 (937)	0.087	0.114	0.051	0.062	0.078
N13	2,180 (842)	4,921 (1,900)	0.070	0.142	0.062	0.079	0.088
N14	2,181 (842)	2,687 (1,037)	0.161	0.108	0.128	0.222	0.155
N15	2,181 (842)	1,290 (498)	0.151	0.030	0.109	0.030	0.080
N16	2,177 (841)	2,660 (1,027)	0.179	0.038	0.128	0.085	0.108
N17	2,184 (843)	1,284 (496)	0.125	0.069	0.105	0.114	0.103
N18	2,178 (841)	4,385 (1,693)	0.109	0.201	0.115	0.094	0.130
N19	2,180 (842)	1,582 (611)	0.120	0.126	0.160	0.159	0.141
N20	2,091 (808)	367 (142)	0.067	0.063	0.111	0.133	0.094
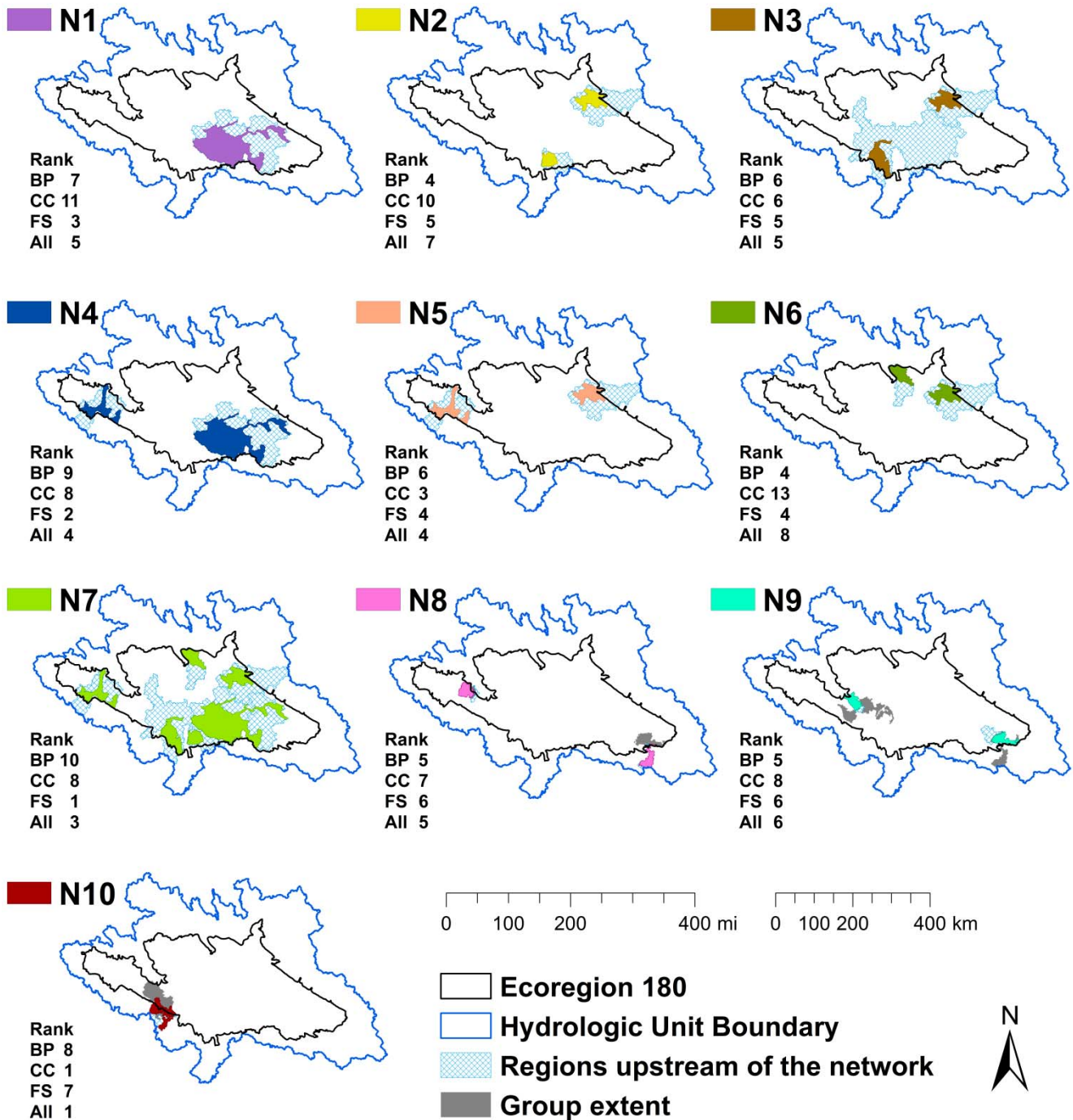
Figure 2a: Benchmark networks for ecoregion 180 (N=146) were assigned to 20 spatial groups. The top network selected from each group is shown in color. Networks N1-N7 are comprised of PA benchmarks. N8-N10 are comprised of two new system-level benchmarks. The benchmarks in N10 are overlapping. Catchments upstream of networks are shown in blue cross-hatching. The group extent (grey) is the area covered by all networks in the group. Ranks based on fundamental benchmark properties (BP), resilience to climate change (CC), amount of focal species habitat (FS), and overall rank (ALL) are reported (Tables 3-6).

Figure 3b: Benchmark networks for ecoregion 180 (N=146) were assigned to 20 spatial groups. The top network selected from each group is shown in color. N11-N20 are comprised of two new system-level benchmarks. The benchmarks in N16, N18, and N20 are overlapping. Catchments upstream of networks are shown in blue cross-hatching. The group extent (grey) is the area covered by all networks in the group. Ranks based on fundamental benchmark properties (BP), resilience to climate change (CC), amount of focal species habitat (FS), and overall rank (ALL) are reported (Tables 3-6).
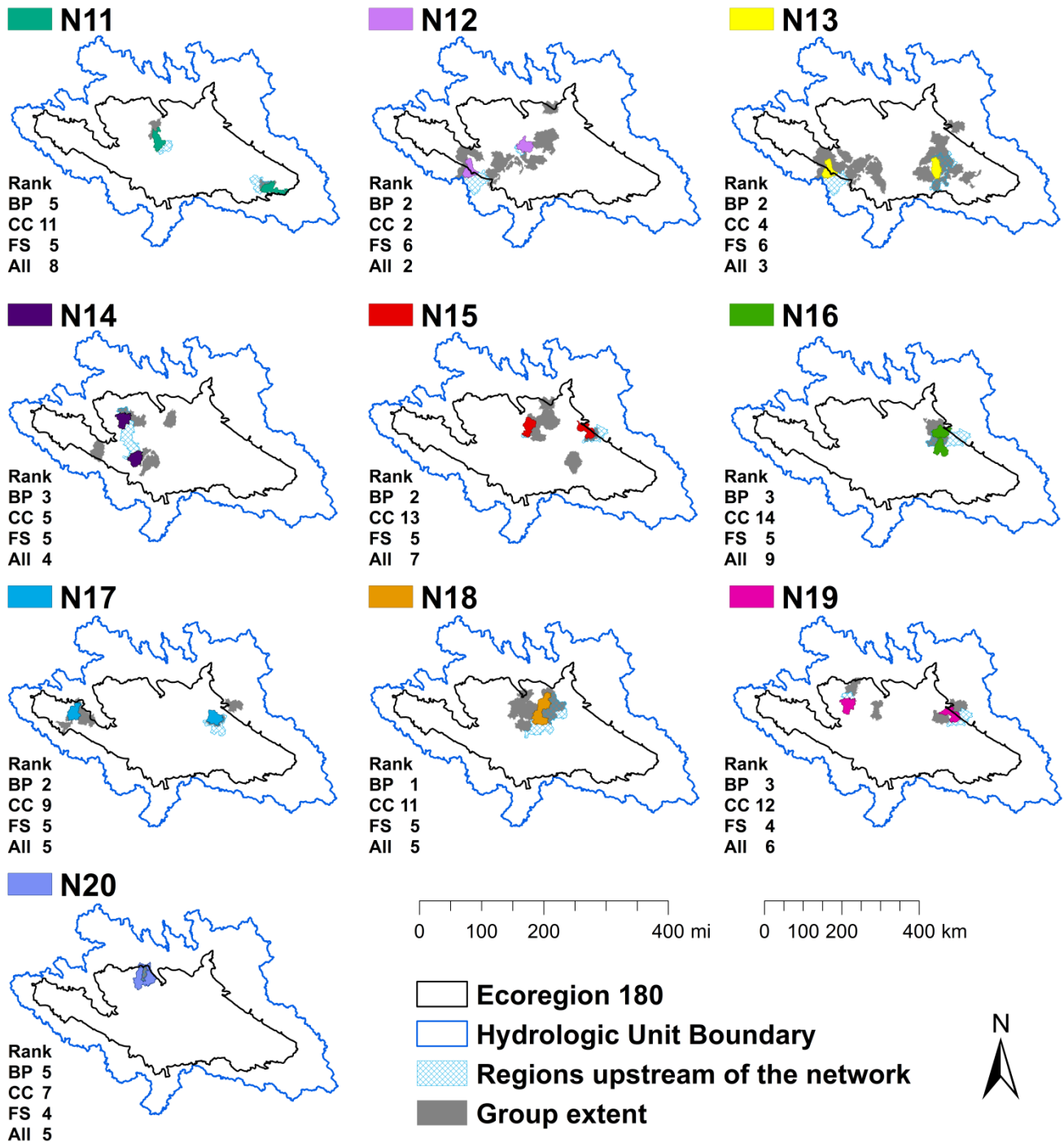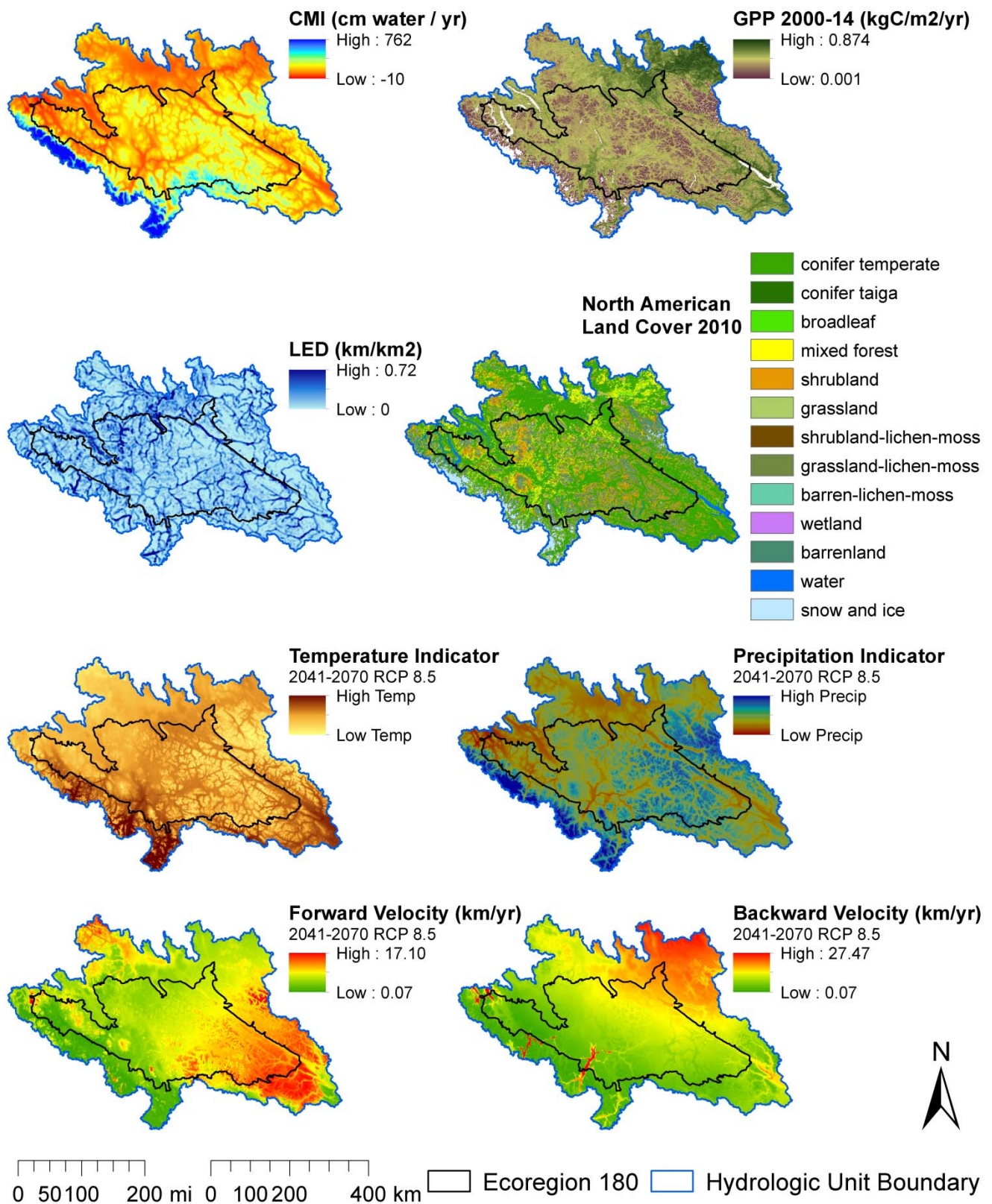
Figure 3: Distribution of the four indicators of environmental variation and four climate change datasets in the ecoregion, which include Climate Moisture Index (CMI, Wang *et al.* 2016), Gross Primary Productivity 2000-14 (GPP, BEACONs 2015), Lake-Edge Density (LED, BEACONs 2015), and North American Land Cover 2010 (CEC 2013), and the climate-projected datasets: Temperature and Precipitation Indicators, and Forward and Backward Velocity (AdaptWest Project 2015).

Benchmark network ranking

Candidate benchmark networks were ranked using three sets of criteria: fundamental benchmark properties (Table 3), resilience to climate change (Table 4), and the amount of focal species habitat (Table 5). Ranks were determined using weighted-rank methods as described in the main report. The ranks across the three sets of criteria were combined to provide an overall rank (Table 6). The results for all benchmark networks (N=146) are available at www.beaconsproject.ca/nwb.

Fundamental Benchmark Properties

In addition to being large and intact, benchmarks are designed to have high internal hydrologic connectivity (*e.g.*, DCI), minimal vulnerability to external and internal disturbances (*e.g.*, Upstream Area), and a compact shape (*e.g.*, Shape Index), and selected to be representative of environmental variation. The 20 candidate networks vary with regards to these properties. While all benchmark networks satisfy MDR-based representation targets, representation varies when measured using dissimilarity metrics (DMs). Mean Dissimilarity ranges from 0.061 to 0.160, with higher values indicating greater dissimilarity and poorer representation (Tables 2 & 3). Fourteen networks have moderate to high representation across the four indicators of environmental variation with DM < 0.2 (Table 2). Networks differ widely in the amount of upstream area (367 –51,760 km^2), although in all cases the upstream area is largely intact (92-100%; Table 3). Networks are similar with regards to internal vulnerability, but differ with regards to shape (2.0-3.9) and internal hydrologic connectivity with minimum lwDCI ranging from 0.184 to 0.807 (Table 3), with values closer to 1 indicating greater connectivity. Overlapping benchmarks within networks were treated as a single benchmark when calculating Shape and lwDCI.

Table 3: Benchmark networks were ranked using a suite of fundamental benchmark properties. **Mean Dissimilarity** is the mean dissimilarity metric for the four indicators of environmental variation, and ranges from 0 to 1, with values closer to 0 indicating better representation, and ranking higher. **Upstream Area** is a measure of vulnerability to external influences via the stream network; lower values rank higher. **Upstream AWI** is the mean area-weighted intactness of catchments upstream of the network; higher values rank higher. **Internal Vulnerability** is the proportion of low (<80%) intact areas within the network; lower values rank higher. **Maximum Shape** is the shape index for the benchmark in the network that most deviates from a circle (shape index = 1); lower values rank higher. **Minimum lwDCI** is the mean length-weighted Dendritic Connectivity Index (0-1; low to high connectivity) for the benchmark with the lowest internal hydrologic connectivity in the network; higher values rank higher. **Benchmark Properties Rank** is a network-level mean weighted rank across all properties, shown in (). The highest ranked network within each individual benchmark property is highlighted in grey. All metrics are described in the main report. **Overlapping benchmarks within a network were treated as a single benchmark when calculating Shape and lwDCI.**

Network ID	Mean Dissimilarity	Upstream Area km² (mi²)	Upstream AWI (%)	Internal Vulnerability	Maximum Shape	Minimum lwDCI	Benchmark Properties Rank
N1	0.127	13,276 (5,126)	98	**0.000**	3.7	0.606	7 (0.046)
N2	0.106	10,660 (4,116)	99	**0.000**	2.3	0.184	4 (0.050)
N3	0.156	37,347 (14,420)	98	**0.000**	2.5	0.219	6 (0.047)
N4	0.102	17,884 (6,905)	98	**0.000**	3.7	0.188	9 (0.044)
N5	0.123	12,866 (4,968)	**100**	**0.000**	3.1	0.188	6 (0.047)
N6	0.160	10,343 (3,993)	**100**	**0.000**	2.3	0.232	4 (0.050)
N7	0.068	51,760 (19,985)	98	**0.000**	3.7	0.184	10 (0.042)
N8	**0.061**	593 (229)	94	**0.000**	3.2	0.344	5 (0.048)
N9	0.090	1,416 (547)	97	0.001	3.0	0.303	5 (0.048)
N10	0.115	999 (386)	92	0.015	3.9	0.197	8 (0.045)
N11	0.068	1,900 (734)	98	**0.000**	3.0	0.303	5 (0.048)
N12	0.078	2,426 (937)	97	**0.000**	2.2	0.676	2 (0.053)
N13	0.088	4,921 (1,900)	98	0.001	2.3	0.807	2 (0.053)
N14	0.155	2,687 (1,037)	**100**	0.001	2.3	0.636	3 (0.052)
N15	0.080	1,290 (498)	**100**	**0.000**	2.5	**0.885**	2 (0.053)
N16	0.108	2,660 (1,027)	**100**	**0.000**	2.3	0.404	3 (0.052)
N17	0.103	1,284 (496)	**100**	**0.000**	2.1	0.540	2 (0.053)
N18	0.130	4,385 (1,693)	**100**	**0.000**	**2.0**	0.779	1 (0.055)
N19	0.141	1,582 (611)	**100**	0.002	2.4	0.636	3 (0.052)
N20	0.094	**367 (142)**	99	**0.000**	3.0	0.296	5 (0.048)

Climate Change Resilience

Changes in patterns of environmental variation are expected under climate change. To address this, we ranked benchmark networks based on their ability to maintain representation, as measured by dissimilarity metrics (DM), using climate-projected indicators of temperature and precipitation (2041-2070, RCP 8.5)[1], which we refer to as Temperature and Precipitation Indicators given the explanatory power of temperature and precipitation variables in each indicator, respectively. Ten networks maintain representation with moderate to high values for both indicators (DM < 0.2; Table 4), while the remaining networks (except N16) maintain representation of at least one indicator. To address the vulnerability of benchmark networks and their support of biodiversity under climate change, we evaluated the ability of species to persist within, and colonize, benchmark networks, using forward and backward climate velocity (2041-2070, RCP 8.5)[1], respectively. Higher velocities indicate greater vulnerability to species loss. Across networks, mean forward and backward velocities range from 1.2 to 5.6 km/yr (ecoregion-level mean = 3.7 km/yr) and 0.6 to 3.8 km/yr (ecoregion-level mean = 1.8 km/yr), respectively (Table 4). Lower forward velocities indicate higher refugia potential for species, whereas lower backward velocities indicate higher colonization potential. In all networks (except N20), backward velocity is lower than forward velocity, suggesting that networks favour colonization potential. The output is available such that users have the flexibility to select a subset of climate datasets to rank networks.

Table 4: Benchmark networks were ranked based on their capacity to represent future climatic conditions (temperature and precipitation indicators) and vulnerability to changing climatic conditions (forward and backward velocity). **Temperature and Precipitation Indicators** were assessed using the Kolmogorov-Smirnov (KS) dissimilarity metric, which ranges from 0 to 1; lower values indicate better representation, and rank higher. **Climate Velocities** are calculated as the geometric mean across all benchmarks from each network; lower values rank higher. **Climate Change Rank** is a network-level mean weighted rank across the four climatic measures, shown in (). The highest ranked network within each indicator/velocity is highlighted in grey. For dataset details, see the main report.

Network ID	KS Dissimilarity Metric		Mean Forward Climate Velocity km/yr (mi/yr)	Mean Backward Climate Velocity km/yr (mi/yr)	Climate Change Rank
	Temperature Indicator	Precipitation Indicator			
N1	0.096	0.155	5.6 (3.5)	1.8 (1.1)	11 (0.042)
N2	0.091	0.165	4.7 (2.9)	2.2 (1.4)	10 (0.043)
N3	0.281	0.115	3.2 (2.0)	2.0 (1.3)	6 (0.051)
N4	0.101	0.104	4.4 (2.8)	1.5 (0.9)	8 (0.049)
N5	0.079	0.226	2.7 (1.7)	1.4 (0.8)	3 (0.060)
N6	0.186	0.187	4.0 (2.5)	3.8 (2.3)	13 (0.039)
N7	0.156	0.089	4.0 (2.5)	1.6 (1.0)	8 (0.049)
N8	0.240	0.124	5.2 (3.2)	0.9 (0.5)	7 (0.050)
N9	**0.078**	0.177	4.3 (2.7)	1.5 (0.9)	8 (0.049)
N10	0.425	0.172	**1.2 (0.7)**	**0.6 (0.4)**	1 (0.086)
N11	0.134	0.098	5.4 (3.4)	2.0 (1.2)	11 (0.042)
N12	0.216	0.089	2.3 (1.4)	1.4 (0.8)	2 (0.064)
N13	0.196	0.095	2.8 (1.8)	1.3 (0.8)	4 (0.059)
N14	0.130	0.262	2.7 (1.7)	1.7 (1.1)	5 (0.056)
N15	0.177	0.193	4.4 (2.7)	3.2 (2.0)	13 (0.039)
N16	0.286	0.296	5.2 (3.3)	3.4 (2.1)	14 (0.034)
N17	0.445	0.185	4.4 (2.8)	1.4 (0.9)	9 (0.046)
N18	0.120	**0.077**	3.9 (2.4)	3.1 (2.0)	11 (0.042)
N19	0.365	0.133	4.1 (2.6)	2.7 (1.7)	12 (0.041)
N20	0.299	0.107	2.7 (1.6)	3.3 (2.0)	7 (0.050)

[1] All climate-projected datasets used to rank networks were for the period 2041-2070 and were created using RCP 8.5, the Representative Concentration Pathway with the highest greenhouse gas emissions from IPCC (2014). Additional rankings based on 2011-2040 and 2071-2100 and RCP 4.5 are available at www.beaconsproject.ca/nwb.

Focal Species

An extensive review of management plans for the NWBLCC did not reveal specific conservation targets for focal species (see focal species report). As such, the objective for all focal species was to maximize the protection of current and future habitat when ranking benchmark networks. For some species, there are multiple datasets (N=3-15). When multiple datasets were used, the network rank for the species (or guild) is a mean of the weighted ranks generated for each dataset. Within each network, the ranks vary across species (Table 5a). **For this evaluation, Networks N1-N7 include the full extent of the PA benchmarks (Figure 1), not just the ecoregion portion (Figure 2).** The top ranks of networks N7, N4, & N5, composed of PA system-level benchmarks, are likely due to network size, which range from 4.5 to 13 times larger than the new system-level benchmarks networks (N8-N20).

Table 5a: Benchmark networks were ranked based on the amount of focal species habitat they capture. Data were not available for Beaver, Broad Whitefish, and Chinook and Chum Salmon. Rusty Blackbird datasets do not intersect the networks. Values in () are weighted ranks. When multiple datasets were used for a species (*e.g.*, Waterfowl N=3), networks were ranked using the mean of weighted ranks from across datasets. The highest ranked network within each individual species is highlighted in grey. **Focal Species Rank** is based on the network-level mean weighted rank across all species. For further details on the datasets and methods see main and focal species reports. Additional information on each focal species and their datasets is available at www.beaconsproject.ca/nwb**.**

Network ID	Area km² (mi²)	Rank (mean weighted rank)					Focal Species Rank
		Caribou (N=1)	Dall Sheep (N=1)	Moose (N=1)	Old-Forest Birds (N=15)[1]	Waterfowl (N=3)[2]	
N1	11,892 (4,591)	3 (0.060)	3 (0.060)	3 (0.062)	3 (0.053)	4 (0.050)	3 (0.057)
N2	5,654 (2,183)	6 (0.046)	4 (0.047)	5 (0.047)	6 (0.049)	5 (0.049)	5 (0.047)
N3	7,497 (2,895)	4 (0.048)	4 (0.047)	4 (0.048)	8 (0.047)	5 (0.049)	5 (0.047)
N4	17,468 (6,744)	2 (0.063)	2 (0.064)	2 (0.065)	3 (0.053)	2 (0.055)	2 (0.060)
N5	10,039 (3,876)	4 (0.048)	4 (0.047)	4 (0.048)	8 (0.047)	3 (0.053)	4 (0.048)
N6	6,808 (2,628)	4 (0.048)	4 (0.047)	5 (0.047)	6 (0.049)	5 (0.049)	4 (0.048)
N7	28,500 (11,004)	1 (0.073)	1 (0.075)	1 (0.074)	1 (0.057)	1 (0.058)	1 (0.067)
N8	2,180 (842)	5 (0.047)	5 (0.046)	6 (0.046)	8 (0.047)	6 (0.048)	6 (0.046)
N9	2,183 (843)	5 (0.047)	4 (0.047)	7 (0.045)	8 (0.047)	6 (0.048)	6 (0.046)
N10	2,152 (831)	8 (0.044)	6 (0.045)	7 (0.045)	9 (0.046)	6 (0.048)	7 (0.045)
N11	2,183 (843)	5 (0.047)	4 (0.047)	7 (0.045)	6 (0.049)	6 (0.048)	5 (0.047)
N12	2,179 (841)	6 (0.046)	5 (0.046)	6 (0.046)	7 (0.048)	6 (0.048)	6 (0.046)
N13	2,180 (842)	7 (0.045)	4 (0.047)	6 (0.046)	7 (0.048)	6 (0.048)	6 (0.046)
N14	2,181 (842)	5 (0.047)	4 (0.047)	4 (0.048)	6 (0.049)	6 (0.048)	5 (0.047)
N15	2,181 (842)	5 (0.047)	5 (0.046)	6 (0.046)	5 (0.050)	4 (0.050)	5 (0.047)
N16	2,177 (841)	5 (0.047)	5 (0.046)	6 (0.046)	6 (0.049)	6 (0.048)	5 (0.047)
N17	2,184 (843)	5 (0.047)	4 (0.047)	6 (0.046)	7 (0.048)	6 (0.048)	5 (0.047)
N18	2,178 (841)	6 (0.046)	5 (0.046)	6 (0.046)	4 (0.051)	5 (0.049)	5 (0.047)
N19	2,180 (842)	5 (0.047)	4 (0.047)	4 (0.048)	4 (0.051)	5 (0.049)	4 (0.048)
N20	2,091 (808)	5 (0.047)	5 (0.046)	7 (0.045)	2 (0.054)	5 (0.049)	4 (0.048)

[1] Guild composed of Boreal Chickadee, Brown Creeper, Pine Grosbeak, Swainson's Thrush, and White-Winged Crossbill. The weighted rank shown in parenthesis is the mean across 15 datasets (3 per species).

[2] Guild composed of Lesser Scaup (1 dataset), White-Winged Scoter (1 dataset), and Trumpeter Swan (1 dataset). The weighted rank shown in parenthesis is the mean across all species.

To remove the influence of the large networks N1-N7 on the weighted rank values, the ranking process with focal species was repeated with N1-N7 excluded (Table 5b). The relative ranks of networks N8-N20 may differ from Table 5a, as differences masked by the large networks are revealed. The output is available such that users have the flexibility to select a subset of species datasets to rank networks.

Table 5b. Benchmark networks designed from **new system-level benchmarks only** were ranked based on the amount of focal species habitat they capture. Data were not available for Beaver, Broad Whitefish, and Chinook and Chum Salmon. Rusty Blackbird datasets do not intersect the networks. Values in () are weighted ranks. When multiple datasets were used for a species (*e.g.*, Waterfowl N=3), networks were ranked using the mean of weighted ranks from across datasets. The highest ranked network within each individual species is highlighted in grey. **Focal Species Rank** is based on the network-level mean weighted rank across all species. For further details on the datasets and methods see main and focal species reports. Additional information on each focal species and their datasets is available at www.beaconsproject.ca/nwb.

Network ID	Rank (mean weighted rank)					Focal Species Rank
	Caribou (N=1)	Dall Sheep (N=1)	Moose (N=1)	Old-Forest Birds (N=15)[1]	Waterfowl (N=3)[2]	
N8	5 (0.077)	10 (0.069)	7 (0.072)	10 (0.069)	11 (0.070)	7 (0.071)
N9	1 (0.085)	5 (0.080)	8 (0.068)	8 (0.073)	7 (0.075)	3 (0.076)
N10	9 (0.052)	13 (0.057)	10 (0.063)	9 (0.070)	2 (0.083)	8 (0.065)
N11	1 (0.085)	6 (0.078)	9 (0.067)	5 (0.077)	6 (0.076)	3 (0.076)
N12	7 (0.068)	7 (0.077)	7 (0.072)	8 (0.073)	3 (0.080)	5 (0.074)
N13	8 (0.061)	3 (0.088)	6 (0.075)	7 (0.074)	4 (0.078)	4 (0.075)
N14	5 (0.077)	1 (0.094)	1 (0.101)	5 (0.077)	5 (0.077)	1 (0.085)
N15	1 (0.085)	8 (0.072)	4 (0.079)	4 (0.080)	1 (0.085)	2 (0.080)
N16	3 (0.081)	11 (0.068)	3 (0.080)	5 (0.077)	9 (0.073)	4 (0.075)
N17	4 (0.078)	2 (0.093)	3 (0.080)	6 (0.076)	8 (0.074)	2 (0.080)
N18	6 (0.076)	9 (0.070)	5 (0.076)	2 (0.082)	10 (0.071)	4 (0.075)
N19	2 (0.084)	4 (0.086)	2 (0.099)	3 (0.081)	4 (0.078)	1 (0.085)
N20	2 (0.084)	12 (0.063)	11 (0.061)	1 (0.087)	9 (0.073)	6 (0.073)

[1] Guild composed of Boreal Chickadee, Brown Creeper, Pine Grosbeak, Swainson's Thrush, and White-Winged Crossbill. In this case, the weighted rank shown in parenthesis is the mean across 15 datasets (3 per species).

[2] Guild composed of Lesser Scaup (1 dataset), White-Winged Scoter (1 dataset), and Trumpeter Swan (1 dataset). The weighted rank shown in parenthesis is the mean across all species.

Overall Rank

Candidate benchmark networks were assigned an overall rank based on fundamental benchmark properties (Table 3), resilience to climate change (Table 4) and the amount of focal species habitat (Table 5a). Attributes were given equal weighting. However, users may wish to prioritize some attributes over others. The results are available in a format that gives users the flexibility to modify and re-rank networks. Additional attributes can also be considered. For example, if the conservation priority is the protection of focal species habitat within the ecoregion, networks with greater overlap with the ecoregion are more likely to achieve this objective. Greater overlap with protected areas may facilitate implementation, given existing protection. Overlap with the ecoregion and existing protected areas ranges from 33-100% and 0-100% across benchmark networks, respectively (Table 6). While benchmark networks that most overlap with the ecoregion may best reflect the environmental variation of the ecoregion, networks that extend beyond the ecoregion boundary may contribute to the benchmark networks of neighbouring ecoregions, leading to greater efficiency in the design of a protected areas network for the NWBLCC planning region.

Table 6: **Overall Rank** is a network-level mean weighted rank for fundamental benchmark properties (Table 3), climate change (Table 4) and focal species (Table 5a). Values in () are weighted ranks. **Overlap with ecoregion** and **Overlap with existing PAs** with high levels of protection may be used as additional ranking criteria.

Network ID	Overlap with Ecoregion	Overlap with Existing PAs	Mean Dissimilarity	Benchmark Properties Rank	Climate Change Rank	Focal Species Rank[1]	Overall Rank
N1	100.0%	100.0%	0.127	7 (0.046)	11 (0.042)	3 (0.057)	5 (0.048)
N2	100.0%	100.0%	0.106	4 (0.050)	10 (0.043)	5 (0.047)	7 (0.046)
N3	100.0%	100.0%	0.156	6 (0.047)	6 (0.051)	5 (0.047)	5 (0.048)
N4	100.0%	100.0%	0.102	9 (0.044)	8 (0.049)	2 (0.060)	4 (0.051)
N5	100.0%	100.0%	0.123	6 (0.047)	3 (0.060)	4 (0.048)	4 (0.051)
N6	100.0%	100.0%	0.160	4 (0.050)	13 (0.039)	4 (0.048)	8 (0.045)
N7	100.0%	100.0%	0.068	10 (0.042)	8 (0.049)	1 (0.067)	3 (0.052)
N8	50.1%	2.9%	0.061	5 (0.048)	7 (0.050)	6 (0.046)	5 (0.048)
N9	96.6%	0.0%	0.090	5 (0.048)	8 (0.049)	6 (0.046)	6 (0.047)
N10	33.0%	0.0%	0.115	8 (0.045)	1 (0.086)	7 (0.045)	1 (0.058)
N11	99.2%	0.0%	0.068	5 (0.048)	11 (0.042)	5 (0.047)	8 (0.045)
N12	76.0%	0.0%	0.078	2 (0.053)	2 (0.064)	6 (0.046)	2 (0.054)
N13	76.0%	30.3%	0.088	2 (0.053)	4 (0.059)	6 (0.046)	3 (0.052)
N14	100.0%	0.2%	0.155	3 (0.052)	5 (0.056)	5 (0.047)	4 (0.051)
N15	89.1%	29.6%	0.080	2 (0.053)	13 (0.039)	5 (0.047)	7 (0.046)
N16	95.1%	42.5%	0.108	3 (0.052)	14 (0.034)	5 (0.047)	9 (0.044)
N17	100.0%	31.3%	0.103	2 (0.053)	9 (0.046)	5 (0.047)	5 (0.048)
N18	100.0%	2.0%	0.130	1 (0.055)	11 (0.042)	5 (0.047)	5 (0.048)
N19	88.0%	27.9%	0.141	3 (0.052)	12 (0.041)	4 (0.048)	6 (0.047)
N20	90.1%	0.0%	0.094	5 (0.048)	7 (0.050)	4 (0.048)	5 (0.048)

[1] Focal species rank from Table 5a