

# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 22:

Modeled River Seasonal  
Productivity






Ministry of  
Environment

This map is illustrative only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation. This map may contain omissions or errors.

Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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Cartography by Colin Anderson

-  High Degree Days
-  Moderate Degree Days
-  Low Degree Days

0 100 200 400 km

# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 23:

Modeled River Water  
Temperature and Seasonal  
Productivity



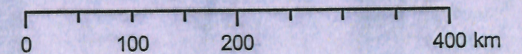
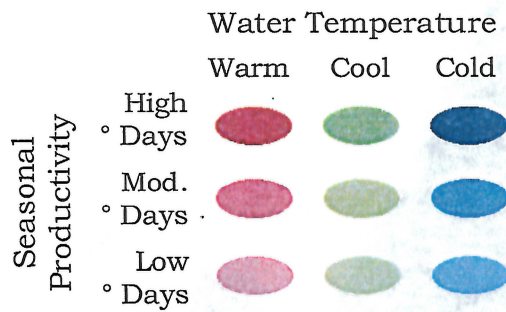
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Nature Conservancy of Canada 2007

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# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 24:

Modeled River Nutrients  
(Underlying Bedrock  
Geology)










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Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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-  Intrusive and Metamorphic
-  Volcanic
-  Hard Sedimentary
-  Soft Sedimentary
-  Carbonate Sediments
-  Serpentine and Other Chemical Sediments
-  Alluvium and Till

0 100 200 400 km

# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 25:

Modeled Lake  
Flushing Rates



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Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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Cartography by Colin Anderson

- Very Low
- Low
- Moderate
- High
- Very High

Note: Lake polygons have been buffered to increase legibility.

0 100 200 400 km

# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 26:

Modeled Lake Surface  
Temperature (Summer)



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-  Cold
-  Cool
-  Warm

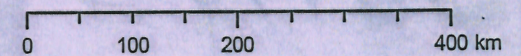
Note: Lake polygons have been buffered to increase legibility.

This map is illustrative only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation. This map may contain omissions or errors.

Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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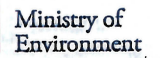


# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 27:

## Modeled Lake Seasonal Productivity







This map is illustrative only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation. This map may contain omissions or errors.

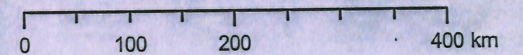
Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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-  Very Low Degree Days
-  Low Degree Days
-  Moderate Degree Days
-  High Degree Days

Note: Lake polygons have been buffered to increase legibility.



# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 28:

## Modeled Lake Water Temperature and Seasonal Productivity



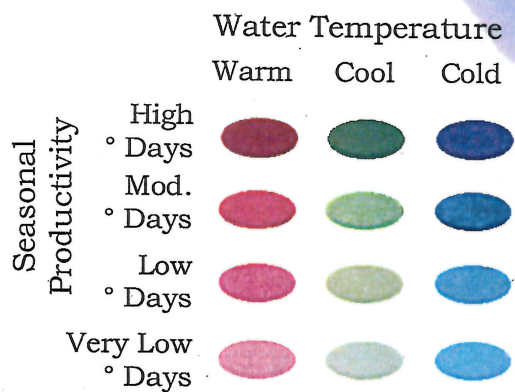
Ministry of  
Environment

This map is illustrative only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation. This map may contain omissions or errors.

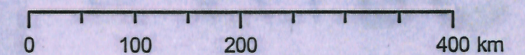
Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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Cartography by Colin Anderson



Note: Lake polygons have been buffered to increase legibility.



# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 29:

Modeled Lake Nutrients  
(Underlying Bedrock  
Geology)











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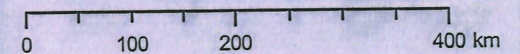
Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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-  Intrusive and Metamorphic
-  Volcanic
-  Hard Sedimentary
-  Soft Sedimentary
-  Carbonate Sediments
-  Serpentine and Other Chemical Sediments
-  Alluvium and Till
-  Mixed (No Geology Type >50% of Lake Surface Area)

Note: Lake polygons have been buffered to increase legibility.

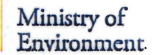


# EAU BC

ECOLOGICAL AQUATIC UNITS  
OF BRITISH COLUMBIA

Map 30:

Modeled Lake Dissolved  
Nutrients



- Low
- Moderate
- High
- Not Modeled

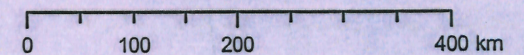
This map is illustrative only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation. This map may contain omissions or errors.

Data Sources: BC Ministry of Environment 2006  
Nature Conservancy of Canada 2007

Projection: BC Environment Albers, NAD 1983

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Note: Lake polygons have been buffered to increase legibility.



## Appendix B: Ecological Models

### Rivers

#### Stream Gradient

Database  
Field Name  
GRAD1\_M  
GRAD2\_M  
GRAD3\_M  
GRAD4\_M  
GRAD5\_M  
GRAD6\_M  
GRAD1\_T  
GRAD2\_T  
GRAD3\_T  
GRAD4\_T  
GRAD5\_T  
GRAD6\_T

- <2%
- 2-8%
- 8-12%
- 12-16%

Stream gradient is strongly correlated with flow velocity, erosive force, substrate particle size, turbidity, pool/riffle ratios, and sinuosity (e.g., Hack 1957; Wheeler 1979; Rosgen 1994). Shallow stream gradients are associated with higher habitat heterogeneity, thus favoring higher species richness (Reyjol *et al.* 2003). Stream reaches within each river ecosystem were coded into one of the following six standard provincial gradient classes:

- 16-20%
- >20%

Stream reaches were classified into mainstem and tributary reaches within each river ecosystem. A nonmetric multi-dimensional scaling (NMS) analysis is run on the percent of stream reaches within each gradient class per mainstem and tributary reaches per river ecosystem. The first axis of each mainstem and tributary NMS is divided into three gradient classes (steep, moderate, shallow), based on natural breaks in variability of the data (Jenk's optimization). Appendix A: Maps 17 and 18 depict mainstem and tributary gradient classes per river ecosystem. Mainstem and tributary gradient classes were crossed to produce nine overall river ecosystem gradient classes (Table 32, Appendix A: Map 19).

Database  
Field Name  
GRAD\_MOD

Table 32: Summary of the number of rivers by their modeled stream gradient class.

Tributary Gradient / Mainstem Gradient	Steep	Moderate	Shallow
	<ul style="list-style-type: none"> <li>▪ High water velocities</li> <li>▪ Relatively coarse substrates</li> <li>▪ Relatively straight channel</li> </ul>	<ul style="list-style-type: none"> <li>▪ Broad and shallow channel with some meandering pattern</li> <li>▪ Varied morphology typically a pool-riffle-run sequence</li> </ul>	<ul style="list-style-type: none"> <li>▪ Low water velocities</li> <li>▪ Relatively fine substrates</li> <li>▪ Relatively greater meandering, greater depth relative to width</li> <li>▪ Generally connected to its floodplain</li> </ul>
<b>Steep</b> (V-shaped valley)	6,364	859	361
<b>Moderate</b> (U-shaped)	2,752	946	803
<b>Shallow</b>	1,824	1,355	2,836

### Flow Regime

The flow regime is a key 'driver' of the ecology of rivers and their associated floodplains (e.g., Richter *et al.* 1996, 1997; Poff *et al.* 1997; Puckridge *et al.* 1998; Naiman *et al.* 2002). Every river system has an individual or 'signature' flow regime with particular characteristics relating to flow quantity, and temporal attributes such as a seasonal pattern of flow, the timing, frequency and duration of extreme events (e.g., floods and droughts), rates of change and other aspects of flow variability (Poff *et al.* 1997; Olden & Poff 2002). Each of these flow characteristics has individual (as well as interactive) influences on the physical nature of river channels, sediment regime and water quality, and key ecological processes sustaining river ecosystems (Naiman *et al.* 2002). Flow regime of a river ecosystem also influences the life history patterns of

its freshwater biodiversity, especially the seasonality and predictability of its overall flow pattern, and the timing of particular flow events (Junk *et al.* 1989; Pusey *et al.* 2001). Some flow events trigger longitudinal dispersal of migratory aquatic organisms, and other large events allow access to otherwise disconnected floodplain habitats. These processes govern the ecological health of rivers and underpin the ecosystem goods and services that rivers provide to humans (e.g. flood attenuation, water purification, production of fish and other foods and marketable goods).

The following flow regime model was developed to examine coarse, regional river flow regime patterns across the province in the absence of hydrometric data. It is based on large-scale

patterns of precipitation and temperature. Broad flow regime patterns for each river are modeled using a thirty meter grid of precipitation data acquired from ClimateSource. Precipitation data from climate stations across the province are interpolated using a PRISM algorithm. Monthly mean precipitation is normalized by annual mean precipitation per river ecosystem. Monthly mean precipitation is grouped and totaled by season:

- Winter (December, January, February)
- Spring (March, April, May)
- Summer (June, July, August)
- Fall (September, October, November)

For each season three classes of precipitation (high, intermediate, and low), are derived based on natural breaks in variability within the data set (Jenk's optimization). The model is further refined by taking into consideration the following precipitation – temperature relationships:

- If mean minimum November, December, January or February temperatures are  $< 0^{\circ}\text{C}$ , then the winter flow category for that river ecosystem unit is moved into lowest flow [1] category (i.e., snow does not flow), spring flow is moved into the highest flow category [3],

and summer flow is moved up into the next highest flow category.

- If mean minimum October, November, December, January or February temperatures are between  $0 - 5^{\circ}\text{C}$ , then the flow category for fall and/or winter, depending on the month(s) in question, is moved into next lower flow category (i.e., rain on snow events are not all converted into run-off), and spring is moved into the next highest flow category.
- If mean maximum July temperatures are classified as warm, then the flow category for summer is moved into next lowest flow category due to high evapotranspiration rates.

Database Field  
Name  
HYDRO\_MOD

In summary, a broad flow regime pattern based on seasonal flow patterns is created for each river ecosystem with a total of seven flow regime patterns identified across BC. Appendix A: Map 20 summarizes river ecosystems by their broad flow regimes. Table 33 summarizes the number of river ecosystems per flow regime class.

Table 33: Summary of the number of rivers per modeled flow regime class.

# Watersheds / Seasonal Flow Class	Winter	Spring	Summer	Fall
	L = low flow, M = moderate flow, H = high flow			
3,955	L	H	L	L
3,014	L	H	L	M
6,961	L	H	M	L
1,857	L	H	M	M
1,190	M	H	L	M
271	H	M	L	M
852	H	H	L	M

## Water Temperature

Water temperature affects freshwater biota directly by controlling rates of feeding, metabolism and growth (Fry 1971; Hokanson *et al.* 1977; Brett 1979; Brett *et al.* 1982; Velsen 1987; Murray and McPhail 1988; Selong *et al.* 2001), or indirectly by mediating biotic interactions (DeStaso and Rahel 1994; Hinz and Wiley 1998). As a result, spatial and temporal variations in river temperatures are likely important factors contributing to the differences in species assemblages between river ecosystems. For example, water temperature has been shown to influence fish distribution (Torgersen *et al.* 1999; Welsh *et al.* 2001), abundance (Holtby 1988) and community composition (Wehrly *et al.* 2002).

Temperature is also an important influence on water chemistry. The rate of chemical reactions generally increases at higher temperatures, which in turn affects biological activity. An important example of the effects of temperature on water chemistry is its impact on oxygen. Warm water holds less oxygen than cold water, so even though it may be saturated with oxygen, it may not contain a sufficient saturation for the survival of many freshwater biota.

Air temperature is an important factor in the thermal regime of river ecosystems. Rivers whose watersheds have warm air temperatures have consequently warmer water temperatures. In addition to seasonal variations in water temperature caused by

changing air temperatures, many other physical aspects of a river ecosystem cause natural variation in temperature, i.e., whether it is fed from a glacier, a lake, wetland or aquifer.

Thermal regimes in river ecosystems have been traditionally described in terms of cold, cool and warm water categories based on the dominant fish species present. Numerous studies have described changes in species composition along longitudinal temperature gradients from cold, headwater reaches to warm, downstream reaches (Burton and Odum 1945, Huet 1959; Hynes 1970; Moyle and Nichols 1973; Cech *et al.* 1990; Rahel and Hubert 1991). Recently, ecological assessment protocols have been developed that incorporate the influence of these broad-scale temperature categories based on differences in expected species assemblage structure across sites (e.g., development of a coldwater index of biotic integrity (Lyons *et al.* 1996).

Water temperature is modeled using thirty meter grid air temperature data acquired from ClimateSource. Air temperature data from climate stations across the province are interpolated using a PRISM algorithm. Average maximum July air temperature over the past thirty years is calculated for each river ecosystem by averaging buffered grid cells to stream reaches for each river ecosystem. Mean maximum July air temperature is chosen based on current literature surrounding stream temperature classification (e.g., Magnuson *et al.* (1979); Lyons (1996); Stonemann and Jones (1996); Washington State (1997); Nelitz (2004)). Given the diverse physiography of BC, river ecosystems are subdivided into warm, cool and cold classes based on natural breaks in the range of variability of the

data (Jenk's optimization). The following steps are taken to further refine the model by considering the effect of cold water resource areas and lake/wetland systems on river water temperature:

- If 5 – 100% of the river ecosystem is currently glacially influenced or exists within Alpine Tundra BEC zone, then it is given a cold water designation;
- If 1 - 5% of the river ecosystem is currently glacially influenced or exists within Alpine Tundra BEC zone, then it is moved down one cooler temperature designation, i.e., from warm water to cool water;
- If 25 – 100% of the river's watershed is covered by lakes and wetlands, then it is given a warm water designation; and
- If 10 - 25% of the river's watershed is covered by lakes and wetlands, then it is moved up to one warmer temperature designation, i.e., from cold water to cool water.

Appendix A: Map 21 illustrates the distribution of water temperature classes across BC.

### *Seasonal Productivity*

The number of degree days above 0°C is calculated for each river ecosystem using an average of air temperature per buffered stream reach within each river ecosystem.

This is used as an estimate of the duration of seasonal productivity in river ecosystems. Three classes of seasonal

Database Field Name
TEMP_MOD

productivity are calculated based on natural breaks in variability of the data (Appendix A: Map 22).

Water temperature classes and seasonal productivity classes are crossed to produce an overall water temperature model for river ecosystems in BC (Table 34, Appendix A: Map 23).

Table 34: Summary of the number of rivers per modeled water temperature / seasonal productivity class.

Ddays above 0 °C / Temperature	Cold	Cool	Warm
Low Ddays	7,643	1,188	1,351
Moderate Ddays	1,475	1,575	1,743
High Ddays	235	947	1,943

### ***Underlying Bedrock Geology***

Watershed geology controls groundwater storage capacity and transmissivity (Bugliosi 1988, Siegel 1989). Underlying geology is a major influence on a river's base flow. Watershed geology is also the dominant factor of a river's water chemistry and also strongly influences erosion rate, substrate size and sediment supply (Hack 1957).

Bedrock geology dataset from BC Energy and Mines is subdivided from seventy seven rock types into seven classes based on groundwater storage capacity and transmissivity, chemistry and solubility. Percent of each nutrient class per river ecosystem upstream drainage area is calculated for each river ecosystem. A summary of the number of river ecosystems by their dominant nutrient class is found in Table 35 and illustrated in Appendix A: Map 24.

Database  
Field Name  
NUTR\_MOD

Table 35: Summary of geology class properties and the number of rivers per their dominant geology class.

Geology Class	# of River Ecosystems	Properties
Alluvium	536	Rainfall infiltration is high which tends to reduce flood frequency. There tends to be a high degree of surface water and ground water interaction. Base flows may be sustained by seepage or springs or may reduce in the downstream direction as water flows into the groundwater system. Water chemistry reflects the nature of the parent material.
Serpentine and other chemical sediments	191	Infiltration rate of rainfall is variable. High chemical sediment concentration. Variable substrate.
Carbonates	806	High rainfall infiltration. High degree of surface and groundwater interaction. High nutrient concentrations of Calcium carbonate. Because of the relatively soft parent material suspended sediment concentrations tend to be high. In addition, substrates tend to be relatively fine.
Hard sedimentary rocks	3,272	Infiltration of rainfall is variable. Where geology is fractured, infiltration is high resulting in infrequent floods but sustained base flow. Low natural nutrient concentration. Low suspended sediment. Relatively coarse substrates (cobble, gravel, sands) depending on local morphology.
Soft sedimentary rocks	4,300	Low infiltration resulting in increased floods and low base flow. High natural phosphorous concentration. Because of the relatively soft parent material suspended sediment concentration tends to be high. In addition, substrates tend to be relatively fine (silts and mud).
Volcanic	4,314	This is a broad category within which considerable variation may exist. Phosphorous concentration tends to be high relative to other geology categories. Substrates tend to be finer and well packed.
Intrusives & Metamorphics	4,681	Infiltration of rainfall tends to be low. Low natural nutrient concentration. Low suspended sediment. Substrates tend to be bimodal, either large (boulder to cobble) or fine (sands) depending on local morphology.

## Lakes

### *Flushing Rate*

Flushing rate is defined as the mean flow into the lake divided by the volume of the lake. It is the inverse of a lake's water retention time. The flushing rate depends on lake morphology, water budget, and hydrologic variability. There has been very sparse flushing rate data collected for BC lakes (total of only 412 lakes in BC). Flushing rate is modeled using accumulative precipitation yield and modeled lake volume (known surface area X modeled mean depth) of each lake.

### *Accumulative Precipitation Yield*

Accumulative precipitation yield is used as a surrogate for mean water flow into a lake. It is modeled using thirty meter grid of precipitation data acquired from ClimateSource. Precipitation data from climate stations across the province are interpolated using a PRISM algorithm.

Database Field  
Name  
ACC\_PPT\_YL

Average total annual precipitation over the last thirty years is accumulated for each lake's drainage area.

### *Mean Depth*

Mean depth is predictive of lake thermal stratification which may be one of the most important factors in determining

species diversity in lakes (Marshall and Ryan 1987). Salmonids such as Lake Trout and Lake Whitefish, require cold water temperatures found in hypolimnetic water. These species are unable to survive in shallow lakes which do not stratify thermally (e.g., Harvey and Coombs 1971), thereby precluding the existence of these hypolimnetic species (e.g., Magnuson *et al.* 1979). Winter oxygen levels also vary depending on lake depth. In shallow lakes, depleted oxygen levels in the winter may lead to winter fish kills (Casselmann and Harvey 1975; Tonn and Magnuson 1982; Robinson and Tonn 1989).

A total of 2,660 lakes in BC have been surveyed for mean depth. These lakes are used to model lake mean depth using a multiple linear regression building on the work of Trainor and Church (1996). Log of lake elevation, outflow order, outflow magnitude, perimeter and surface area are found to be significantly correlated with known mean depth ( $P = 0.0001$  for all independent variables). The resultant regression equation:

$$\text{Log mean depth} = 3.530 - 0.168(\text{log elevation}) - 0.305(\text{log order}) + 0.117(\text{log magnitude}) - 0.284(\text{log perimeter}) + 0.457(\text{log surface area}),$$

has an  $R^2$  of 0.594 and is highly significant ( $P = 0.0001$ ).

This equation is used to model mean depth for lakes with unknown mean depth values.

Flushing rate is modeled as a lake’s accumulative precipitation yield divided by modeled lake volume (known surface area X modeled mean depth). Five classes are derived based on equal

area intervals of the flushing rate gradient. If a lake is isolated (no inflow or outflow), then it is given a flushing rate value of 1.00 and is placed within the lowest flushing rate category. Table 36 and Appendix A: Map 25 summarizes the number of lakes per flushing rate category.

Database Field Name  
MOD\_MDEPTH  
MOD\_VOL  
FLRATE\_CLA

Table 36: Summary of number of lakes per flushing rate class.

Very Low	Low	Moderate	High	Very High
12,706	3,640	5,969	11,885	33,284

### Temperature

Maximum July epilimnion temperature and seasonal productivity greatly affect the overall productivity of a lake and the duration of time between spring and autumn mixing. Classes of maximum July epilimnion temperature and seasonal productivity are delineated and crossed for a summary of epilimnion temperature variability classes for BC.

Maximum July epilimnion temperature is modeled using thirty meter grid air temperature data acquired from ClimateSource. Air temperature data from climate stations across the province are interpolated using a PRISM algorithm. Average maximum July air temperature over the past thirty years is calculated for each lake in BC. Lakes are subdivided into warm, cool and

cold classes based on natural breaks in the range of variability of the data (Jenk’s optimization). Maximum July epilimnion temperatures are further refined by considering the effects of cold water source regions on lake temperature (Appendix A: Map 26):

- If 5 – 100% of a lake’s drainage area is glacially influenced or within alpine tundra BEC zone, then it is moved into the cold temperature class;
- If 1 – 5% of the lake’s drainage area is glacially influenced or within alpine tundra BEC zone, then is moved down into the next coldest temperature class.

*Degree Days above 4 °C*

Degree days above 4 °C (maximum density of water which influences turn-over), are calculated for each lake using an average of air temperature per grid cells encompassing each lake’s surface area. Three classes of seasonal productivity are

calculated based on natural breaks in variability of the data (Appendix A: Map 27).

Maximum July epilimnion temperature classes are crossed with seasonal productivity classes to develop overall epilimnion temperature classes for lakes in BC (Table 37, Appendix A: Map 28).

Database Field Name  
DD4\_CLASS  
TEMP\_CLASS

Table 37: Summary of lakes per temperature class in BC.

Seasonal Productivity / Epilimnion Temperature	Cold	Cool	Warm
Zero	18,470	14,914	20,208
Low Ddays	154	98	649
Moderate Ddays	1061	1,645	1,817
High Ddays	2284	4,352	1,832

***Dissolved Nutrients***

Dissolved nutrients in a lake are a function of the lake’s geology, climate, and hydrology (Adams *et al.* 1991; Schupp 1992, Tonn *et al.* 1983). It is a primary factor in determining levels of lake productivity. For example, in areas of high precipitation and low evaporation rates (such as the coast and insular mountain areas of BC), rapid flushing of lakes and the relative insolubility of the surrounding rocks, contribute to low dissolved nutrients in lakes (Northcote and Larkin 1956). Conversely, low annual precipitation and the hot dry summers of the southern interior plateau area create high concentrations

of dissolved nutrients in lakes which frequently have no evident flow (Northcote and Larkin 1956). Dissolved nutrient levels in lakes are modeled using the geology of a lake’s drainage area and its flushing rate.

***Geology***

Bedrock geology dataset, 1:250,000 from BC Energy and Mines is subdivided from seventy-seven rock types into seven classes

Database Field Name  
GEO\_CLASS

based on nutrient availability, i.e., groundwater storage capacity and transmissivity, chemistry and solubility. Percent of lake drainage area within each of the seven geology classes

is calculated for each lake in BC. A summary of the number of lakes by their dominant geology class is found in Table 38, Appendix A: Map 29.

Table 38: Summary of geology class properties and the number of lakes per dominant geology class.

Geology Class	Number of Lakes	Properties	Nutrient Availability
Alluvium	4,434	There tends to be a high degree of surface water and ground water interaction. Lake levels may be sustained by seepage or springs. Generally high dissolved nutrients.	High
Serpentine and other Chemical sediments	1,300	High chemical sediment concentration.	High
Carbonates	2,659	High degree of surface and groundwater interaction. High nutrient concentrations of Calcium carbonate.	High
Hard sedimentary rocks	7,594	Low natural nutrient concentration.	Low
Soft sedimentary rocks	13,464	High natural phosphorous concentration.	High
Volcanic	16,663	This is a broad category within which considerable variation may exist. Phosphorous concentration tends to be high relative to other geology categories.	High
Intrusives & Metamorphics	20,632	Low natural nutrient concentration.	Low
Mixed (No dominant geology type (i.e., at least 50% of lake surface area))	738	NA	NA

Database Field Name  
DISSNUTR\_C

Flushing rate classes are crossed with geology classes to create dissolved nutrient classes (Table 39, Appendix A: Map 30).

Table 39: Summary of number of lakes per dissolved nutrient class (high, moderate, low).

Nutrient (Availability) / Flushing Rate	Very Low	Low	Moderate	High	Very High
Alluvium (High)	1,392 High	255 High	441 Moderate	647 Low	1,699 Low
Chemical sediments (High)	241 High	108 High	154 Moderate	260 Low	537 Low
Carbonates (High)	487 High	143 High	263 Moderate	482 Low	1,284 Low
Soft sedimentary rocks (High)	3,159 High	996 High	1,362 Moderate	2,305 Low	5,672 Low
Volcanic (High)	3,118 High	1,067 High	1,706 Moderate	3,172 Low	7,600 Low
Hard sedimentary rocks (Low)	1,590 Low	446 Low	644 Low	1,283 Low	3,631 Low
Intrusives & Metamorphics (Low)	2,697 Low	623 Low	1,347 Low	3,619 Low	12,346 Low
Mixed (NA)	22	32	52	117	515

# RIVER APPENDICES

## Appendix C: Environmental Summary of River Ecosystem Types and Sub-Types

### Headwater Rivers

H1	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (km <sup>2</sup> )	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	880.65	283.18	3080.76	4.48	27353621.62	3.77	0.29	0.91	0.57	4.79
Median	919.00	288.92	2996.26	4.78	12663670.00	0.00	0.00	0.08	0.00	2.00
Standard Deviation	430.52	126.78	1096.64	2.91	52254071.07	11.42	1.26	2.19	2.07	8.20
Standard Error	9.30	2.74	23.69	0.06	1129042.78	0.25	0.03	0.05	0.04	0.18
Range	2258.00	686.60	5866.46	14.51	1380999218.10	97.72	19.45	19.20	30.00	85.00
Minimum	7.00	1.63	888.51	-4.37	260781.90	0.00	0.00	0.00	0.00	0.00
Maximum	2265.00	688.23	6754.97	10.14	1381260000.00	97.72	19.45	19.20	30.00	85.00
Confidence Level (95.0%)	18.24	5.37	46.47	0.12	2214134.83	0.48	0.05	0.09	0.09	0.35

H2	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m <sup>2</sup> )	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	993.65	99.24	612.33	0.88	39678857.00	0.02	7.86	1.31	7.15	10.93
Median	976.00	82.26	573.06	1.23	26002875.00	0.00	1.59	0.42	4.00	6.00
Standard Deviation	291.72	72.33	163.06	1.87	159487698.97	0.59	19.58	2.25	9.81	19.41
Standard Error	4.78	1.18	2.67	0.03	2611396.25	0.01	0.32	0.04	0.16	0.32
Range	1759.00	493.35	2247.23	12.13	9192211459.90	25.49	100.00	36.41	94.00	457.00
Minimum	289.00	1.92	278.94	-4.31	570640.10	0.00	0.00	0.00	0.00	0.00
Maximum	2048.00	495.27	2526.16	7.82	9192782100.00	25.49	100.00	36.41	94.00	457.00
Confidence Level (95.0%)	9.36	2.32	5.23	0.06	5119904.28	0.02	0.63	0.07	0.32	0.62

H3	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1521.43	245.48	1026.89	-0.28	23273435.46	1.57	0.24	0.33	0.64	3.82
Median	1521.00	232.71	966.13	-0.44	15509135.00	0.00	0.00	0.04	0.00	1.00
Standard Deviation	308.17	89.58	393.55	1.95	25689182.04	7.55	0.96	0.91	2.23	6.71
Standard Error	3.82	1.11	4.87	0.02	318194.81	0.09	0.01	0.01	0.03	0.08
Range	2210.00	640.69	3422.14	12.13	339691218.50	98.72	20.93	18.16	68.00	93.00
Minimum	308.00	5.61	298.18	-4.92	159581.50	0.00	0.00	0.00	0.00	0.00
Maximum	2518.00	646.30	3720.32	7.21	339850800.00	98.72	20.93	18.16	68.00	93.00
Confidence Level (95.0%)	7.48	2.18	9.56	0.05	623766.21	0.18	0.02	0.02	0.05	0.16

River Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
H1	0.53		0.07	0.26	20.82	48.90	0.93	0.22	0.01	0.09	26.72				0.01	0.22
H2	3.47	0.46	31.36			0.04	11.28	2.63	4.17		0.01	4.62	0.24	4.08	28.33	8.43
H3	24.20	0.05	3.21		0.12	0.19	40.23	6.61	2.12	3.61	0.10	2.62	0.13	0.02	2.59	12.98

River Type	Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H1	16.94	30.88	11.33	8.06	5.28	27.52
H2	54.72	38.26	3.98	1.57	0.70	0.77
H3	7.87	37.20	17.22	11.71	8.13	17.83

River Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H1	7.40	10.62	5.88	5.06	5.18	65.20
H2	33.83	46.73	9.64	3.94	2.15	2.85
H3	3.10	11.19	10.75	11.08	10.26	53.05

River Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
H1	50.82	37.45	8.30	2.30	1.00	0.11	0.03
H2	12.13	26.44	18.96	29.18	4.04	1.89	7.36
H3	17.66	14.89	25.53	32.04	7.39	0.92	1.57

## Headwater River Ecosystem Sub-Types

### H1

H1a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1201.97	363.65	2676.83	1.88	40829079.84	7.98	0.15	0.44	0.27	4.39
Median	1205.00	364.39	2474.84	1.82	20779080.00	0.00	0.00	0.04	0.00	1.00
Standard Deviation	291.09	97.11	980.66	1.70	71202637.26	15.57	1.00	1.26	1.39	7.53
Standard Error	9.15	3.05	30.83	0.05	2238235.73	0.49	0.03	0.04	0.04	0.24
Range	2168.00	649.07	5866.46	10.74	1380999218.10	97.72	17.34	19.20	28.00	72.00
Minimum	97.00	39.16	888.51	-4.37	260781.90	0.00	0.00	0.00	0.00	0.00
Maximum	2265.00	688.23	6754.97	6.37	1381260000.00	97.72	17.34	19.20	28.00	72.00
Confidence Level (95.0%)	17.96	5.99	60.49	0.11	4392119.43	0.96	0.06	0.08	0.09	0.46

H1b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	592.89	211.12	3442.50	6.81	15285335.15	0.00	0.42	1.33	0.83	5.15
Median	609.00	221.34	3393.37	6.97	9092782.50	0.00	0.00	0.15	0.00	2.00
Standard Deviation	316.52	105.05	1068.74	1.39	18153145.73	0.13	1.44	2.70	2.50	8.74
Standard Error	9.42	3.13	31.79	0.04	540023.52	0.00	0.04	0.08	0.07	0.26
Range	1436.00	635.39	5562.64	8.41	158310960.50	4.38	19.45	18.09	30.00	85.00
Minimum	7.00	1.63	1123.21	1.72	439839.50	0.00	0.00	0.00	0.00	0.00
Maximum	1443.00	637.03	6685.85	10.14	158750800.00	4.38	19.45	18.09	30.00	85.00
Confidence Level (95.0%)	18.47	6.13	62.38	0.08	1059562.52	0.01	0.08	0.16	0.15	0.51

River Sub-Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
H1a	1.11		0.14		39.81	19.22	1.97	0.45	0.03	0.20	35.14				0.02	0.46
H1b				0.49	3.80	75.47		0.01			19.18					

River Sub-Type	Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H1a	11.09	28.69	13.72	8.94	5.54	32.03
H1b	22.18	32.84	9.18	7.27	5.06	23.47

River Sub-Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H1a	3.13	4.99	4.47	4.28	5.44	76.60
H1b	11.23	15.66	7.14	5.76	4.95	54.99

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
H1a	57.29	28.64	10.40	2.55	1.06		0.05
H1b	45.02	45.35	6.42	2.07	0.94	0.20	

## H2

H2a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	890.71	82.25	554.03	-0.71	47758758.16	0.03	14.64	1.02	4.53	11.71
Median	848.00	64.49	526.84	-0.84	29001900.00	0.00	1.72	0.24	2.00	5.00
Standard Deviation	305.25	64.53	111.80	1.36	237747377.25	0.71	27.91	2.15	6.34	22.82
Standard Error	7.54	1.59	2.76	0.03	5872543.71	0.02	0.69	0.05	0.16	0.56
Range	1459.00	380.66	1821.85	7.71	9192211459.90	25.49	100.00	36.41	65.00	457.00
Minimum	297.00	1.92	347.66	-4.31	570640.10	0.00	0.00	0.00	0.00	0.00
Maximum	1756.00	382.58	2169.51	3.40	9192782100.00	25.49	100.00	36.41	65.00	457.00
Confidence Level (95.0%)	14.79	3.13	5.42	0.07	11518485.11	0.03	1.35	0.10	0.31	1.11

H2b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1074.34	112.55	658.02	2.13	33345543.76	0.02	2.55	1.53	9.20	10.33
Median	1057.00	95.55	620.07	2.02	23865680.00	0.00	1.53	0.61	5.00	6.00
Standard Deviation	252.94	75.27	181.36	1.13	31510436.55	0.49	3.04	2.29	11.44	16.22
Standard Error	5.53	1.65	3.97	0.02	689092.31	0.01	0.07	0.05	0.25	0.35
Range	1759.00	490.11	2247.23	8.92	343675752.10	17.57	24.49	19.60	94.00	269.00
Minimum	289.00	5.16	278.94	-1.11	614247.90	0.00	0.00	0.00	0.00	0.00
Maximum	2048.00	495.27	2526.16	7.82	344290000.00	17.57	24.49	19.60	94.00	269.00
Confidence Level (95.0%)	10.85	3.23	7.78	0.05	1351378.68	0.02	0.13	0.10	0.49	0.70

River Sub-Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
H2a	6.30		70.93		0.01		2.44	0.11							0.29	19.17
H2b	1.25	0.83	0.35			0.07	18.21	4.61	7.44	0.01	0.03	8.24	0.43	7.28	50.31	0.01

River Sub-Type	Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H2a	63.02	32.62	2.49	1.08	0.30	0.48
H2b	48.23	42.67	5.15	1.94	1.01	0.99

River Sub-Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H2a	40.80	42.79	8.30	3.43	1.70	2.00
H2b	28.37	49.82	10.68	4.34	2.50	3.52

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
H2a	5.36	9.50	29.80	46.43	4.77	4.15	
H2b	17.43	39.72	10.46	15.65	3.48	0.12	13.13

### H3

H3a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1628.26	293.09	1254.83	0.05	25331546.21	3.67	0.21	0.41	0.46	4.42
Median	1658.00	289.81	1235.03	0.01	16032410.00	0.00	0.00	0.06	0.00	2.00
Standard Deviation	357.93	94.11	443.49	1.60	29461436.60	11.39	0.89	1.10	1.69	7.57
Standard Error	7.17	1.89	8.89	0.03	590292.22	0.23	0.02	0.02	0.03	0.15
Range	2210.00	640.69	3386.47	11.85	339691218.50	98.72	20.93	15.86	28.00	93.00
Minimum	308.00	5.61	333.85	-4.92	159581.50	0.00	0.00	0.00	0.00	0.00
Maximum	2518.00	646.30	3720.32	6.93	339850800.00	98.72	20.93	15.86	28.00	93.00
Confidence Level (95.0%)	14.06	3.70	17.42	0.06	1157514.11	0.45	0.03	0.04	0.07	0.30

H3b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1449.55	207.68	884.74	-1.32	20328502.92	0.35	0.20	0.26	0.42	3.18
Median	1465.00	201.71	813.65	-1.60	14304510.00	0.00	0.00	0.02	0.00	1.00
Standard Deviation	239.31	62.06	263.69	1.44	20407201.83	3.15	0.95	0.76	1.39	5.80
Standard Error	4.34	1.12	4.78	0.03	369758.79	0.06	0.02	0.01	0.03	0.11
Range	1653.00	473.76	1494.23	7.25	196209615.80	56.83	20.48	18.16	30.00	79.00
Minimum	574.00	9.61	424.56	-4.68	316184.20	0.00	0.00	0.00	0.00	0.00
Maximum	2227.00	483.37	1918.79	2.58	196525800.00	56.83	20.48	18.16	30.00	79.00
Confidence Level (95.0%)	8.50	2.20	9.37	0.05	725002.08	0.11	0.03	0.03	0.05	0.21

H3c	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1473.31	241.95	889.44	2.09	27191387.16	0.05	0.45	0.33	1.73	4.26
Median	1479.00	226.57	849.27	1.97	18090770.00	0.00	0.00	0.04	0.00	2.00
Standard Deviation	284.06	93.17	316.81	1.71	28915790.51	0.78	1.16	0.83	4.29	6.88
Standard Error	9.07	2.97	10.12	0.05	923210.14	0.02	0.04	0.03	0.14	0.22
Range	1691.00	546.27	2177.68	10.13	309361158.20	18.24	10.52	9.60	68.00	49.00
Minimum	583.00	39.47	298.18	-2.92	729071.80	0.00	0.00	0.00	0.00	0.00
Maximum	2274.00	585.74	2475.86	7.21	310090230.00	18.24	10.52	9.60	68.00	49.00
Confidence Level (95.0%)	17.80	5.84	19.85	0.11	1811696.10	0.05	0.07	0.05	0.27	0.43

River Sub-Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
H3a	18.80		1.38		0.31	0.42	51.25	8.69	0.62	8.85	0.25	2.21	0.01		2.63	3.27
H3b	34.84		5.71				28.91	1.56							2.78	25.07
H3c	4.88	0.34	0.05			0.21	47.37	17.01	12.49	1.54		11.79	0.87	0.14	1.90	0.10

River Sub-Type	Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H3a	8.19	29.04	15.29	12.92	9.55	25.02
H3b	7.93	43.15	17.94	10.66	7.07	13.21
H3c	6.87	39.46	19.90	11.90	7.83	13.94

River Sub-Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
H3a	3.19	7.96	6.88	8.20	7.76	65.45
H3b	2.75	12.70	12.40	12.90	11.58	47.22
H3c	3.94	14.74	15.49	12.77	12.48	39.67

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
H3a	19.70	16.00	21.78	29.69	9.21	0.57	3.04
H3b	9.04	10.28	31.49	40.77	7.32	1.09	
H3c	39.20	26.41	16.54	10.89	2.97	1.25	2.73

## Tributary Rivers

T1	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	878.60	360.80	2938.55	4.01	172293301.00	4.49	0.42	1.31	2.43	14.41
Median	894.50	373.74	2808.00	3.88	82273749.00	0.00	0.00	0.25	0.00	6.50
Standard Deviation	360.76	128.31	1054.01	2.81	261716370.19	9.68	1.90	2.78	6.71	21.43
Standard Error	17.04	6.06	49.80	0.13	12364936.24	0.46	0.09	0.13	0.32	1.01
Range	1900.00	663.30	5019.32	11.69	2253283747.40	81.02	34.76	21.39	63.00	184.00
Minimum	37.00	10.53	1156.66	-1.78	1853029.60	0.00	0.00	0.00	0.00	0.00
Maximum	1937.00	673.84	6175.98	9.91	2255136777.00	81.02	34.76	21.39	63.00	184.00
Confidence Level (95.0%)	33.50	11.91	97.87	0.26	24300625.62	0.90	0.18	0.26	0.62	1.99

T2	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	946.67	115.76	586.13	0.86	315539552.14	0.00	9.36	2.07	31.19	43.03
Median	944.50	102.98	552.25	1.16	151614245.00	0.00	2.92	0.88	19.00	21.00
Standard Deviation	264.53	71.71	135.33	1.74	848832324.86	0.07	19.04	3.10	41.12	82.04
Standard Error	8.32	2.25	4.25	0.05	26682815.52	0.00	0.60	0.10	1.29	2.58
Range	1369.00	505.20	795.57	8.78	19609897636.00	1.72	100.00	25.81	548.00	1369.00
Minimum	345.00	3.48	345.28	-3.65	4752185.00	0.00	0.00	0.00	0.00	0.00
Maximum	1714.00	508.69	1140.85	5.14	19614649821.00	1.72	100.00	25.81	548.00	1369.00
Confidence Level (95.0%)	16.32	4.42	8.35	0.11	52360040.14	0.00	1.17	0.19	2.54	5.06

T3	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (km2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1428.57	301.18	989.85	-0.22	184510103.83	1.66	0.47	0.70	4.25	15.76
Median	1422.00	285.05	931.43	-0.40	99851297.00	0.00	0.06	0.14	1.00	7.00
Standard Deviation	276.02	96.53	367.33	1.88	259181232.23	5.76	1.03	1.82	9.19	24.93
Standard Error	6.23	2.18	8.29	0.04	5852814.42	0.13	0.02	0.04	0.21	0.56
Range	1949.00	592.56	2888.58	10.95	3336229016.00	73.31	11.57	21.52	116.00	303.00
Minimum	459.00	53.17	339.18	-4.36	1715592.00	0.00	0.00	0.00	0.00	0.00
Maximum	2408.00	645.73	3227.76	6.60	3337944608.00	73.31	11.57	21.52	116.00	303.00
Confidence Level (95.0%)	12.22	4.27	16.27	0.08	11478393.38	0.26	0.05	0.08	0.41	1.10

River Type		Mean Percent BEC Zones															
		BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
T1		0.57		0.03	0.05	22.38	48.47	1.25	0.68	0.13	0.12	24.60				0.09	0.19
T2		2.13	0.22	35.33			0.02	7.53	2.19	5.46			4.08	0.09	7.05	28.94	6.00
T3		19.16	0.06	5.21		0.21	0.35	36.49	8.29	3.33	2.78	0.08	3.30	0.25	0.12	3.89	15.03

River Type		Mean Percent Mainstem Gradient Class					
		<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T1		35.92	42.75	6.32	5.19	2.19	7.64
T2		80.80	17.45	1.08	0.37	0.15	0.16
T3		35.90	44.54	9.25	5.10	2.02	3.18

River Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T1	6.41	10.07	6.29	5.65	5.16	66.20
T2	41.51	43.54	7.80	3.48	1.58	2.08
T3	4.65	15.72	11.54	10.81	9.59	47.65

River Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
T1	47.85	38.93	9.59	2.38	1.04	0.18	0.03
T2	11.47	25.89	17.78	28.99	4.22	1.94	9.70
T3	17.93	16.97	24.82	30.17	7.08	0.99	2.03

## Tributary River Sub-Types

### T1

T1a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1045.72	419.46	2692.48	2.23	221547338.31	7.09	0.41	1.04	1.89	15.05
Median	1048.00	432.35	2383.98	2.01	120401577.00	1.77	0.00	0.21	0.00	7.00
Standard Deviation	303.41	109.18	1015.70	1.87	300066258.10	11.39	2.33	2.32	5.75	20.54
Standard Error	18.16	6.54	60.81	0.11	17964496.97	0.68	0.14	0.14	0.34	1.23
Range	1862.00	663.30	5019.32	9.89	2253283747.40	81.02	34.76	18.51	55.00	137.00
Minimum	75.00	10.53	1156.66	-1.78	1853029.60	0.00	0.00	0.00	0.00	0.00
Maximum	1937.00	673.84	6175.98	8.11	2255136777.00	81.02	34.76	18.51	55.00	137.00
Confidence Level (95.0%)	35.76	12.87	119.70	0.22	35363721.53	1.34	0.28	0.27	0.68	2.42

T1b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	602.70	263.96	3344.80	6.95	90980422.83	0.20	0.44	1.77	3.33	13.35
Median	604.00	278.57	3280.28	6.92	50974860.00	0.00	0.02	0.41	1.00	6.00
Standard Deviation	266.45	94.49	991.04	1.16	150241520.42	2.16	0.76	3.36	7.98	22.85
Standard Error	20.50	7.27	76.23	0.09	11557040.03	0.17	0.06	0.26	0.61	1.76
Range	1282.00	426.82	4418.34	5.66	1629540086.00	27.89	3.87	21.39	63.00	184.00
Minimum	37.00	24.85	1534.27	4.25	3196311.00	0.00	0.00	0.00	0.00	0.00
Maximum	1319.00	451.67	5952.62	9.91	1632736397.00	27.89	3.87	21.39	63.00	184.00
Confidence Level (95.0%)	40.46	14.35	150.50	0.18	22815736.84	0.33	0.12	0.51	1.21	3.47

River Sub-Type Mean Percent BEC Zones																
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
T1a	0.91		0.05		33.78	30.58	2.01	1.09	0.20	0.20	29.11	0.01			0.14	0.30
T1b				0.14	3.54	78.00					17.16					

River Sub-Type Mean Percent Mainstem Gradient Class						
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T1a	35.62	41.56	7.24	5.64	2.42	7.52
T1b	36.41	44.71	4.80	4.43	1.81	7.84

River Sub-Type Mean Percent Tributary Gradient Class						
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T1a	5.41	7.75	5.62	5.05	4.81	71.00
T1b	8.05	13.88	7.40	6.63	5.74	58.29

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
T1a	56.95	27.95	11.90	2.22	0.92		0.05
T1b	32.83	57.06	5.77	2.64	1.23	0.47	

## T2

T2a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	804.64	95.57	531.16	-0.65	403916197.73	0.00	16.75	1.31	19.91	45.48
Median	771.00	78.50	512.73	-0.74	171635136.00	0.00	3.81	0.41	12.00	20.00
Standard Deviation	262.34	63.86	68.38	1.26	1230690048.85	0.00	26.63	2.45	26.75	101.25
Standard Error	12.44	3.03	3.24	0.06	58340303.42	0.00	1.26	0.12	1.27	4.80
Range	1123.00	291.17	524.64	6.15	19609897636.00	0.00	100.00	25.81	239.00	1369.00
Minimum	345.00	3.48	355.73	-3.65	4752185.00	0.00	0.00	0.00	0.00	0.00
Maximum	1468.00	294.66	880.38	2.51	19614649821.00	0.00	100.00	25.81	239.00	1369.00
Confidence Level (95.0%)	24.44	5.95	6.37	0.12	114657435.41	0.00	2.48	0.23	2.49	9.43

T2b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1058.13	131.61	629.27	2.05	246178692.73	0.01	3.55	2.67	40.04	41.11
Median	1047.00	123.75	591.88	2.01	137684100.00	0.00	2.61	1.35	25.00	21.00
Standard Deviation	206.64	73.58	157.50	0.98	296496164.51	0.09	3.81	3.41	47.76	63.02
Standard Error	8.68	3.09	6.61	0.04	12451668.51	0.00	0.16	0.14	2.01	2.65
Range	1250.00	495.10	795.57	5.85	1902203245.00	1.72	50.13	21.85	548.00	719.00
Minimum	464.00	13.59	345.28	-0.72	6770425.00	0.00	0.00	0.00	0.00	0.00
Maximum	1714.00	508.69	1140.85	5.14	1908973670.00	1.72	50.13	21.85	548.00	719.00
Confidence Level (95.0%)	17.04	6.07	12.99	0.08	24457119.19	0.01	0.31	0.28	3.94	5.20

River Sub-Type Mean Percent BEC Zones																
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
T2a	4.04		80.10				1.00								0.45	13.66
T2b	0.63	0.39	0.20			0.04	12.66	3.92	9.75	0.01		7.28	0.16	12.57	51.30	

River Sub-Type Mean Percent Mainstem Gradient Class						
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T2a	87.86	10.99	0.66	0.20	0.12	0.16
T2b	75.26	22.51	1.41	0.49	0.17	0.15

River Sub-Type Mean Percent Tributary Gradient Class						
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T2a	48.31	38.96	6.82	2.99	1.35	1.56
T2b	36.18	47.13	8.57	3.87	1.77	2.48

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
T2a	5.02	5.54	30.62	49.15	5.37	4.30	
T2b	16.54	41.85	7.71	13.17	3.32	0.09	17.31

### T3

T3a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1528.01	371.14	1221.25	-0.16	199701227.85	4.26	0.45	0.83	2.98	16.29
Median	1537.00	371.13	1199.66	-0.20	99234320.00	0.00	0.00	0.14	1.00	8.00
Standard Deviation	328.09	97.51	409.55	1.42	291504392.22	8.81	1.03	2.29	6.27	25.05
Standard Error	12.65	3.76	15.79	0.05	11236668.55	0.34	0.04	0.09	0.24	0.97
Range	1949.00	592.56	2888.58	9.16	3165170220.00	73.31	8.53	21.52	62.00	303.00
Minimum	459.00	53.17	339.18	-4.34	1715592.00	0.00	0.00	0.00	0.00	0.00
Maximum	2408.00	645.73	3227.76	4.82	3166885812.00	73.31	8.53	21.52	62.00	303.00
Confidence Level (95.0%)	24.83	7.38	31.00	0.11	22063202.85	0.67	0.08	0.17	0.47	1.90

T3b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1383.06	254.93	833.11	-1.55	162007054.45	0.37	0.47	0.54	3.03	15.79
Median	1411.00	248.86	760.19	-1.76	92574755.00	0.00	0.03	0.13	1.00	7.00
Standard Deviation	216.60	64.69	237.17	1.15	213032689.98	2.12	1.12	1.26	6.02	24.19
Standard Error	7.70	2.30	8.43	0.04	7569787.02	0.08	0.04	0.04	0.21	0.86
Range	1426.00	444.52	1391.15	6.58	2099757093.00	38.00	11.57	16.49	61.00	197.00
Minimum	634.00	68.25	409.74	-4.36	5018632.00	0.00	0.00	0.00	0.00	0.00
Maximum	2060.00	512.77	1800.89	2.23	2104775725.00	38.00	11.57	16.49	61.00	197.00
Confidence Level (95.0%)	15.11	4.51	16.54	0.08	14859246.18	0.15	0.08	0.09	0.42	1.69

T3c	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1366.32	280.11	926.17	1.83	199830242.23	0.20	0.53	0.77	7.92	15.02
Median	1335.00	273.31	889.54	1.69	117085422.00	0.00	0.18	0.14	3.00	6.50
Standard Deviation	244.79	82.33	317.04	1.43	277029977.75	2.20	0.85	1.86	14.32	25.92
Standard Error	10.99	3.70	14.24	0.06	12439013.21	0.10	0.04	0.08	0.64	1.16
Range	1385.00	484.50	2128.09	8.13	3330629160.00	43.57	6.31	14.57	116.00	284.00
Minimum	668.00	56.67	353.51	-1.53	7315448.00	0.00	0.00	0.00	0.00	0.00
Maximum	2053.00	541.18	2481.60	6.60	3337944608.00	43.57	6.31	14.57	116.00	284.00
Confidence Level (95.0%)	21.60	7.26	27.97	0.13	24439773.96	0.19	0.08	0.16	1.26	2.29

River Sub-Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
T3a	17.77		2.81		0.62	0.62	45.48	12.04	1.07	7.65	0.23	2.71	0.07		2.99	4.37
T3b	29.08		9.48				22.67	2.68							1.26	33.51
T3c	5.19	0.24	1.67			0.54	46.36	12.16	11.71	0.60		9.38	0.89	0.47	9.31	

River Sub-Type Mean Percent Mainstem Gradient Class						
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T3a	31.95	42.60	10.96	6.56	2.61	5.31
T3b	38.66	45.13	8.01	4.51	1.69	2.00
T3c	36.85	46.24	8.92	4.06	1.75	2.18

River Sub-Type Mean Percent Tributary Gradient Class						
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
T3a	3.61	8.66	7.84	7.33	7.02	3.61
T3b	4.57	18.97	13.12	12.29	10.40	40.65
T3c	6.17	20.10	14.02	13.18	11.78	34.55

River Sub-Type Mean Percent Geology Class							
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
T3a	65.55	21.48	16.93	21.15	28.72	8.41	0.68
T3b	11.50	13.21	29.25	38.28	6.22	1.53	
T3c	23.38	23.03	22.72	19.21	6.65	0.53	4.45

## Mainstem Rivers

M1	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (km2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	710.75	467.60	1927.56	4.03	40793929775.30	6.12	1.15	3.43	13.35	61.25
Median	712.50	433.14	1870.46	3.55	7231408906.00	3.04	0.13	0.39	6.50	44.00
Standard Deviation	340.88	110.40	713.71	2.44	71678877258.18	9.33	3.29	8.01	20.70	49.26
Standard Error	76.22	24.69	159.59	0.55	16027884210.02	2.09	0.73	1.79	4.63	11.01
Range	1099.00	367.30	3274.57	9.05	227563154374.30	41.37	14.73	31.94	88.00	167.00
Minimum	259.00	327.10	426.53	-0.06	507496984.70	0.00	0.00	0.01	0.00	3.00
Maximum	1358.00	694.41	3701.11	8.99	228070651359.00	41.37	14.73	31.95	88.00	170.00
Confidence Level (95.0%)	159.54	51.67	334.03	1.14	33546747119.85	4.36	1.54	3.75	9.69	23.05

M2	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	769.37	159.53	545.42	1.48	23200841310.72	0.27	8.82	5.34	91.10	128.19
Median	760.00	133.47	508.70	1.87	7028980787.40	0.00	2.10	0.87	64.50	94.00
Standard Deviation	206.80	94.21	122.87	2.19	39383624607.50	0.65	17.26	10.06	90.62	136.12
Standard Error	19.54	8.90	11.61	0.21	3721402729.99	0.06	1.63	0.95	8.56	12.86
Range	963.00	407.95	677.29	9.68	193738961183.00	3.50	73.66	48.44	471.00	910.00
Minimum	331.00	10.23	357.20	-2.50	283286726.00	0.00	0.00	0.03	0.00	4.00
Maximum	1294.00	418.19	1034.49	7.18	194022247909.00	3.50	73.66	48.47	471.00	914.00
Confidence Level (95.0%)	38.72	17.64	23.01	0.41	7374207710.21	0.12	3.23	1.88	16.97	25.49

M3	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1153.91	357.32	803.54	0.60	6749352363.57	1.39	0.89	5.15	38.50	93.49
Median	1142.00	353.07	733.02	0.38	3302379914.00	0.37	0.55	0.54	29.00	71.00
Standard Deviation	242.41	94.58	265.10	2.09	12423277369.22	2.93	1.16	12.09	38.03	94.17
Standard Error	20.56	8.02	22.49	0.18	1053728633.49	0.25	0.10	1.03	3.23	7.99
Range	1203.00	524.33	1495.51	9.78	89449581540.10	21.78	8.95	76.84	173.00	777.00
Minimum	587.00	129.50	434.84	-3.51	167089254.00	0.00	0.00	0.00	0.00	0.00
Maximum	1790.00	653.82	1930.34	6.27	89616670794.10	21.78	8.95	76.84	173.00	777.00
Confidence Level (95.0%)	40.66	15.86	44.46	0.35	2083541328.05	0.49	0.20	2.03	6.38	15.79

River Type		Mean Percent BEC Zones														
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
M1	4.30		3.55		11.35	43.55	5.10	5.70	4.35	0.15	11.55	0.30	2.20		4.35	1.40
M2	0.46	2.00	35.82			0.23	3.53	4.54	8.60	0.03	0.01	1.27	1.48	5.24	33.52	2.12
M3	8.59	0.09	18.54		0.17	0.46	21.12	15.01	5.29	1.14	0.04	3.50	0.75	1.06	7.71	14.79

River Type		Mean Percent Mainstem Gradient Class				
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
M1	89.91	7.03	0.54	0.49	0.70	1.33
M2	97.03	2.79	0.09	0.06		0.04
M3	89.95	7.70	0.90	0.99	0.12	0.34

River Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
M1	10.72	10.32	7.46	5.39	6.23	59.88
M2	37.56	39.05	9.47	5.25	2.78	5.88
M3	9.72	22.23	11.62	9.28	7.86	38.57

River Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
M1	38.10	34.10	16.55	6.65	2.10	1.00	1.55
M2	11.79	27.63	19.46	28.54	3.19	0.81	8.59
M3	16.06	16.97	23.65	31.68	6.83	1.09	3.73

## Mainstem River Sub-Types

### M1

M1	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	710.75	467.60	1927.56	4.03	40793929775.30	6.12	1.15	3.43	13.35	61.25
Median	712.50	433.14	1870.46	3.55	7231408906.00	3.04	0.13	0.39	6.50	44.00
Standard Deviation	340.88	110.40	713.71	2.44	71678877258.18	9.33	3.29	8.01	20.70	49.26
Standard Error	76.22	24.69	159.59	0.55	16027884210.02	2.09	0.73	1.79	4.63	11.01
Range	1099.00	367.30	3274.57	9.05	227563154374.30	41.37	14.73	31.94	88.00	167.00
Minimum	259.00	327.10	426.53	-0.06	507496984.70	0.00	0.00	0.01	0.00	3.00
Maximum	1358.00	694.41	3701.11	8.99	228070651359.00	41.37	14.73	31.95	88.00	170.00
Confidence Level (95.0%)	159.54	51.67	334.03	1.14	33546747119.85	4.36	1.54	3.75	9.69	23.05

River Sub-Type		Mean Percent BEC Zones														
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
M1	4.30		3.55		11.35	43.55	5.10	5.70	4.35	0.15	11.55	0.30	2.20		4.35	1.40

River Sub-Type		Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20	
M1	89.91	7.03	0.54	0.49	0.70	1.33	

River Sub-Type		Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20	
M1	10.72	10.32	7.46	5.39	6.23	59.88	

River Sub-Type		Mean Percent Geology Class					
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
M1	38.10	34.10	16.55	6.65	2.10	1.00	1.55

**M2**

M2a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	612.33	119.84	486.22	-0.79	28621331975.87	0.06	19.95	1.25	68.72	128.91
Median	606.00	109.55	478.58	-1.03	9538610840.00	0.00	8.04	0.44	52.00	73.00
Standard Deviation	169.46	65.62	35.84	0.99	43754014494.15	0.14	23.97	2.80	57.27	159.71
Standard Error	25.84	10.01	5.46	0.15	6672424656.67	0.02	3.66	0.43	8.73	24.36
Range	683.00	300.87	178.03	4.22	193110350171.00	0.75	73.66	17.34	183.00	908.00
Minimum	331.00	10.23	424.33	-2.50	911897738.00	0.00	0.00	0.03	0.00	6.00
Maximum	1014.00	311.10	602.36	1.72	194022247909.00	0.75	73.66	17.37	183.00	914.00
Confidence Level (95.0%)	52.15	20.20	11.03	0.31	13465497953.21	0.04	7.38	0.86	17.62	49.15

M2b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	867.23	184.27	582.31	2.89	19822854374.47	0.40	1.88	7.89	105.04	127.74
Median	859.00	148.91	550.26	2.45	5280096044.50	0.00	1.17	1.49	76.00	98.00
Standard Deviation	163.58	101.05	142.32	1.38	36322214016.82	0.79	2.02	11.97	104.24	120.37
Standard Error	19.69	12.16	17.13	0.17	4372680720.38	0.10	0.24	1.44	12.55	14.49
Range	845.00	373.55	677.29	6.58	147176163781.00	3.50	8.04	48.43	470.00	577.00
Minimum	449.00	44.63	357.20	0.59	283286726.00	0.00	0.01	0.04	1.00	4.00
Maximum	1294.00	418.19	1034.49	7.18	147459450507.00	3.50	8.05	48.47	471.00	581.00
Confidence Level (95.0%)	39.30	24.27	34.19	0.33	8725548418.74	0.19	0.49	2.88	25.04	28.92

River Sub-Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
M2a	0.40		93.30													5.51
M2b	0.51	3.25				0.38	5.72	7.38	13.96	0.04	0.01	2.06	2.41	8.51	54.41	

River Sub-Type	Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
M2a	99.28	0.69	0.01			0.02
M2b	95.62	4.10	0.13	0.10		0.05

River Sub-Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
M2a	50.79	33.65	8.39	3.62	1.41	2.15
M2b	29.32	42.42	10.15	6.27	3.64	8.21

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
M2a	6.56	3.02	29.58	52.88	5.88	2.02	
M2b	15.04	42.97	13.14	13.38	1.51	0.06	13.94

**M3**

M3a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1237.18	409.99	884.04	2.53	8339499395.69	1.79	0.66	6.63	38.24	82.36
Median	1186.00	416.94	852.37	2.09	3885213115.50	0.54	0.24	3.86	22.50	63.50
Standard Deviation	267.77	99.22	260.09	1.61	14969046979.66	2.81	0.94	7.74	43.81	72.68
Standard Error	37.87	14.03	36.78	0.23	2116942925.44	0.40	0.13	1.09	6.20	10.28
Range	1108.00	524.33	1318.57	6.12	89442116008.10	14.24	5.05	25.27	166.00	306.00
Minimum	682.00	129.50	450.47	0.14	174554786.00	0.00	0.00	0.02	0.00	1.00
Maximum	1790.00	653.82	1769.04	6.27	89616670794.10	14.24	5.05	25.29	166.00	307.00
Confidence Level (95.0%)	76.10	28.20	73.92	0.46	4254156001.35	0.80	0.27	2.20	12.45	20.66

M3b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	1107.12	327.73	758.31	-0.48	5856011334.29	1.17	1.02	4.32	38.65	99.74
Median	1111.00	313.97	676.62	-0.74	2973100797.00	0.33	0.68	0.39	31.00	73.00
Standard Deviation	214.65	78.01	258.44	1.45	10724662357.88	2.98	1.26	13.93	34.64	104.18
Standard Error	22.75	8.27	27.39	0.15	1136811936.31	0.32	0.13	1.48	3.67	11.04
Range	950.00	364.23	1495.51	6.98	71916832120.00	21.78	8.95	76.84	173.00	777.00
Minimum	587.00	166.79	434.84	-3.51	167089254.00	0.00	0.00	0.00	0.00	0.00
Maximum	1537.00	531.02	1930.34	3.47	72083921374.00	21.78	8.95	76.84	173.00	777.00
Confidence Level (95.0%)	45.22	16.43	54.44	0.31	2259174791.86	0.63	0.27	2.93	7.30	21.95

River Sub-Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
M3a	1.02	0.24			0.06	1.28	26.34	30.02	14.70	3.16	0.10	9.72	2.08	2.96	6.26	
M3b	12.84		28.96		0.22		18.18	6.57							8.52	23.10

River Sub-Type	Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
M3a	90.47	8.36	0.56	0.29	0.12	0.20
M3b	89.66	7.33	1.09	1.38	0.11	0.42

River Sub-Type	Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
M3a	9.23	18.23	9.87	8.19	7.08	47.39
M3b	9.99	24.48	12.61	9.89	8.30	33.61

River Sub-Type	Mean Percent Geology Class						
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
M3a	25.26	17.54	18.50	22.14	6.04	0.22	10.32
M3b	10.89	16.65	26.54	37.03	7.28	1.57	0.02

## Coastal Rivers

C1	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m <sup>2</sup> )	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	181.87	117.97	3012.43	7.99	222199753.00	0.00	0.65	2.72	1.78	18.06
Median	161.00	114.45	2995.49	7.96	14659075.00	0.00	0.00	0.82	0.00	5.00
Standard Deviation	129.91	82.73	970.94	0.76	6473284189.51	0.01	2.97	4.15	6.39	35.56
Standard Error	3.62	2.31	27.08	0.02	180511215.04	0.00	0.08	0.12	0.18	0.99
Range	730.00	409.32	4772.45	5.07	232133984737.26	0.34	45.82	31.19	100.00	347.00
Minimum	0.00	0.83	825.58	5.00	85721.74	0.00	0.00	0.00	0.00	0.00
Maximum	730.00	410.15	5598.03	10.07	232134070459.00	0.34	45.82	31.19	100.00	347.00
Confidence Level (95.0%)	7.11	4.53	53.12	0.04	354129026.91	0.00	0.16	0.23	0.35	1.95

C2	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (km <sup>2</sup> )	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	642.98	343.29	3576.31	5.58	239930143.42	2.03	0.12	1.37	1.34	11.12
Median	603.00	332.48	3423.44	5.80	29490555.00	0.00	0.00	0.30	0.00	5.00
Standard Deviation	248.71	99.42	1004.47	1.49	2223396445.51	7.02	0.46	3.02	8.76	21.91
Standard Error	9.19	3.67	37.13	0.06	82179097.31	0.26	0.02	0.11	0.32	0.81
Range	1731.00	736.54	5316.01	7.48	54431485789.30	63.63	5.70	26.30	193.00	254.00
Minimum	6.00	0.58	1016.45	0.91	467998.60	0.00	0.00	0.00	0.00	0.00
Maximum	1737.00	737.13	6332.46	8.38	54431953787.90	63.63	5.70	26.30	193.00	254.00
Confidence Level (95.0%)	18.05	7.21	72.89	0.11	161335193.24	0.51	0.03	0.22	0.64	1.59

River Type		Mean Percent BEC Zones														
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
C1				3.88	0.09	94.07					1.25					
C2	0.03			0.01	8.73	68.77	0.05	0.05	0.05	0.02	20.90	0.02		0.06	0.03	

River Type		Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20	
C1	39.84	34.61	7.68	3.73	2.71	10.11	
C2	21.84	23.15	9.41	6.79	4.43	34.38	

River Type		Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20	
C1	21.62	28.32	10.52	5.68	3.94	21.51	
C2	4.57	6.41	5.22	4.34	5.28	71.45	

River Type		Mean Percent Geology Class					
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
C1	58.86	28.55	10.14	1.72	0.48	0.09	0.15
C2	82.10	14.71	2.01	1.01	0.07		0.11

## Coastal River Sub-Types

### C1

C1a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	181.29	116.99	3223.50	7.85	33640717.74	0.00	0.55	2.93	1.29	19.27
Median	164.00	119.64	3184.39	7.86	13487620.00	0.00	0.00	1.11	0.00	6.00
Standard Deviation	124.73	78.27	840.20	0.65	98176744.29	0.00	2.83	4.28	6.08	37.51
Standard Error	3.74	2.34	25.16	0.02	2940161.54	0.00	0.08	0.13	0.18	1.12
Range	721.00	347.76	4296.74	4.60	2085318667.66	0.00	45.82	31.19	100.00	347.00
Minimum	5.00	1.24	1301.29	5.00	85721.74	0.00	0.00	0.00	0.00	0.00
Maximum	726.00	349.00	5598.03	9.60	2085404389.40	0.00	45.82	31.19	100.00	347.00
Confidence Level (95.0%)	7.33	4.60	49.37	0.04	5768878.38	0.00	0.17	0.25	0.36	2.20

C1b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	185.65	124.39	1636.12	8.88	1451692877.63	0.00	1.33	1.35	4.99	10.21
Median	128.00	91.64	1487.37	9.00	27044080.00	0.00	0.50	0.25	2.00	5.00
Standard Deviation	159.96	107.45	549.81	0.80	17746085906.92	0.03	3.65	2.87	7.42	16.43
Standard Error	12.23	8.22	42.05	0.06	1357077107.22	0.00	0.28	0.22	0.57	1.26
Range	730.00	409.32	2603.27	4.72	232133822918.40	0.34	41.75	18.38	45.00	101.00
Minimum	0.00	0.83	825.58	5.36	247540.60	0.00	0.00	0.00	0.00	0.00
Maximum	730.00	410.15	3428.85	10.07	232134070459.00	0.34	41.75	18.38	45.00	101.00
Confidence Level (95.0%)	24.15	16.22	83.00	0.12	2678892830.66	0.00	0.55	0.43	1.12	2.48

River Sub-Type		Mean Percent BEC Zones															
		BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
C1a						0.10	97.98					1.22					
C1b					29.21	0.04	68.58					1.41					

River Sub-Type		Mean Percent Mainstem Gradient Class					
		<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
C1a		38.59	34.82	7.87	3.65	2.86	11.14
C1b		48.02	33.23	6.41	4.26	1.75	3.41

River Sub-Type		Mean Percent Tributary Gradient Class					
		<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20
C1a		20.71	27.76	10.72	6.06	4.04	23.17
C1b		27.60	31.94	9.23	3.21	3.31	10.68

River Sub-Type		Mean Percent Geology Class						
		Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
C1a		64.54	27.73	5.88	1.40	0.46		
C1b		21.84	33.88	37.92	3.83	0.64	0.71	1.16

## C2

C2a	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	863.42	430.05	3254.70	4.13	628847130.06	6.29	0.19	1.09	2.58	14.34
Median	858.50	424.97	3164.21	4.05	66620055.00	0.00	0.00	0.25	0.00	6.00
Standard Deviation	241.91	100.45	944.32	1.29	3904066299.85	11.30	0.68	2.58	14.65	27.27
Standard Error	15.81	6.57	61.73	0.08	255216798.02	0.74	0.04	0.17	0.96	1.78
Range	1731.00	736.54	5316.01	7.48	54431306063.30	63.63	5.70	19.44	193.00	254.00
Minimum	6.00	0.58	1016.45	0.91	647724.60	0.00	0.00	0.00	0.00	0.00
Maximum	1737.00	737.13	6332.46	8.38	54431953787.90	63.63	5.70	19.44	193.00	254.00
Confidence Level (95.0%)	31.16	12.94	121.62	0.17	502827509.16	1.46	0.09	0.33	1.89	3.51

C2b	Mean Elevation (m)	Std Dev. Elevation	Mean Annual Precipitation (mm)	Mean Annual Temperature (oC)	Drainage Area (m2)	Glacial Influence (%)	Wetland Influence (%)	Lake Influence (%)	# Wetlands	# Lakes
Mean	539.39	302.53	3727.43	6.26	57186017.17	0.03	0.09	1.50	0.76	9.60
Median	519.50	299.84	3617.44	6.35	23402345.00	0.00	0.00	0.33	0.00	4.00
Standard Deviation	172.95	67.82	997.18	1.02	144263942.22	0.31	0.31	3.19	3.35	18.72
Standard Error	7.75	3.04	44.68	0.05	6464621.83	0.01	0.01	0.14	0.15	0.84
Range	1148.00	461.69	4171.10	4.98	1753974327.40	4.48	3.64	26.30	42.00	246.00
Minimum	54.00	33.78	1850.73	3.30	467998.60	0.00	0.00	0.00	0.00	0.00
Maximum	1202.00	495.47	6021.83	8.28	1754442326.00	4.48	3.64	26.30	42.00	246.00
Confidence Level (95.0%)	15.23	5.97	87.79	0.09	12701356.24	0.03	0.03	0.28	0.30	1.65

River Sub-Type		Mean Percent BEC Zones														
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
C2a	0.10				20.73	48.18	0.15	0.15	0.17	0.05	28.64	0.06		0.18	0.08	
C2b				0.01	3.09	78.44					17.27					

River Sub-Type		Mean Percent Mainstem Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20	
C2a	28.36	28.61	10.92	9.03	3.19	19.89	
C2b	18.78	20.58	8.70	5.74	5.01	41.19	

River Sub-Type		Mean Percent Tributary Gradient Class					
	<0.02	0.02 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	>0.20	
C2a	4.96	5.85	4.25	4.19	3.95	74.23	
C2b	4.39	6.67	5.67	4.41	5.91	70.14	

River Sub-Type		Mean Percent Geology Class					
	Intrusives – Metamorphics	Volcanic	Hard Sediments	Soft Sediments	Carbonate Sediments	Serpentine and other Chemical Sediments	Alluvium
C2a	81.54	14.34	3.08	0.64	0.05		0.35
C2b	82.36	14.88	1.50	1.18	0.08		

## APPENDIX D: Principal Component Analysis Ordinations of River Ecosystem Types and Sub-Types

Principal component analysis (PCA) (Hotelling 1933) is performed on each of the river connectivity classes to illustrate how the ecosystem types and sub-types vary based on all environmental variables combined. PCA is a multivariate statistic that reduces the environmental variable data set into a reduced set several independent vectors defining river associations according to the greatest cumulative variation.

The first two eigenvalues are significant for each of the PCAs using the Broken Stick model (Frontier 1976). Table 40 summarizes the amount of variance summarized in the first two axis of each PCA. Bartlett's Test of Sphericity is highly significant ( $p < 0.0001$ ) for all PCAs. Figures 7 to 21 summarize how the ecosystem types and sub-types vary based on their environmental characteristics summarized within the first two PCA axes or eigenvectors.

Table 40: Percent environmental variance summarized by the first two axes of each river ecosystem PCA.

Ecosystem Type / Sub-Type	Percent of variance summarized in first two PCA axes
<b>Headwater Rivers</b>	41.62%
H1 sub-types	41.15%
H2 sub-types	31.93%
H3 sub-types	29.71%
<b>Tributary Rivers</b>	41.22%
T1 sub-types	41.12%
T2 sub-types	33.25%

<b>Ecosystem Type / Sub-Type</b>	<b>Percent of variance summarized in first two PCA axes</b>
T3 sub-types	34.38%
<b>Mainstem Rivers</b>	38.51%
M2 sub-types	42.48%
M3 sub-types	35.53%
<b>Coastal Rivers</b>	42.54%
C1 sub-types	35.20%
C2 sub-types	41.09%

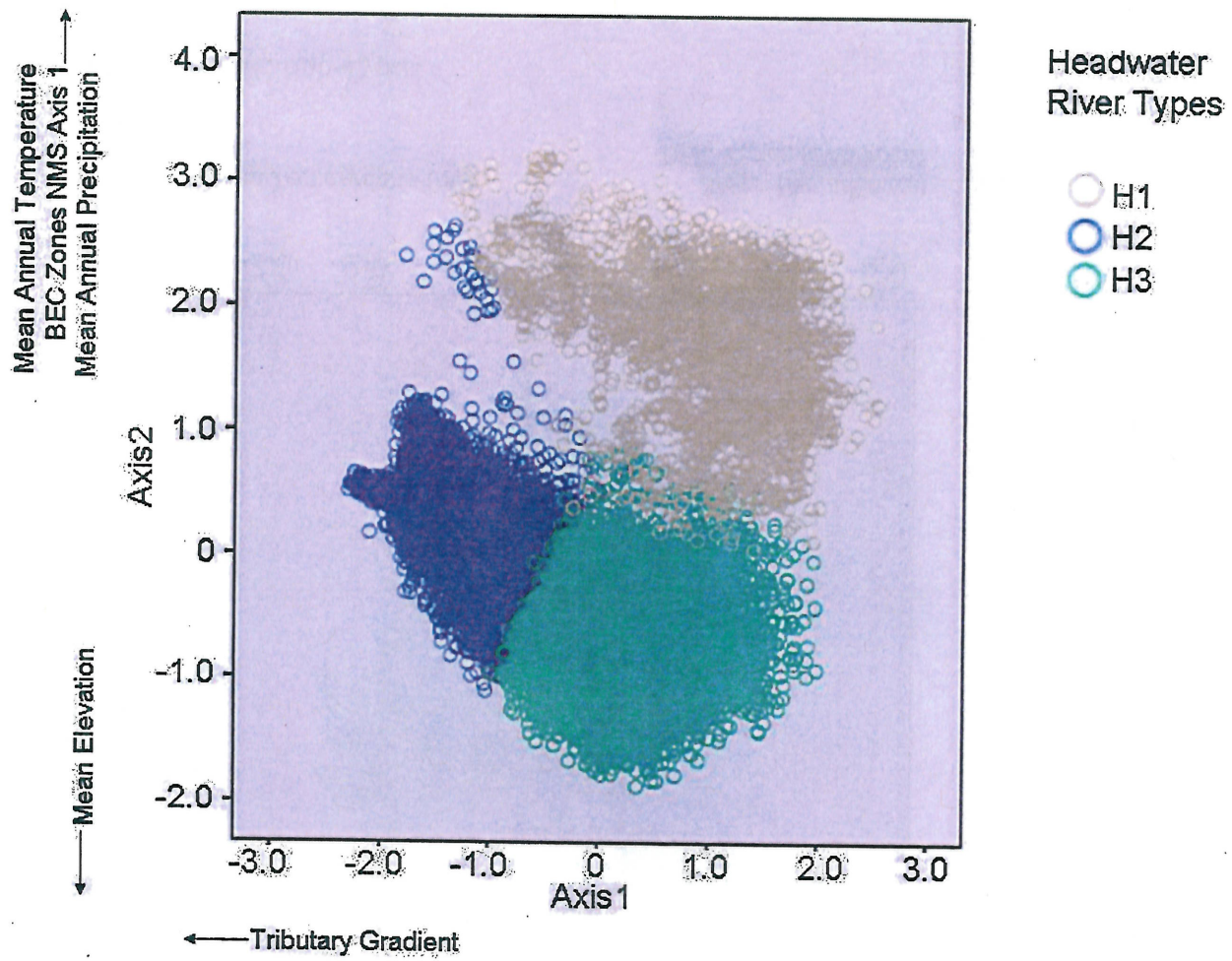


Figure 7: PCA of Headwater River Ecosystem Types.

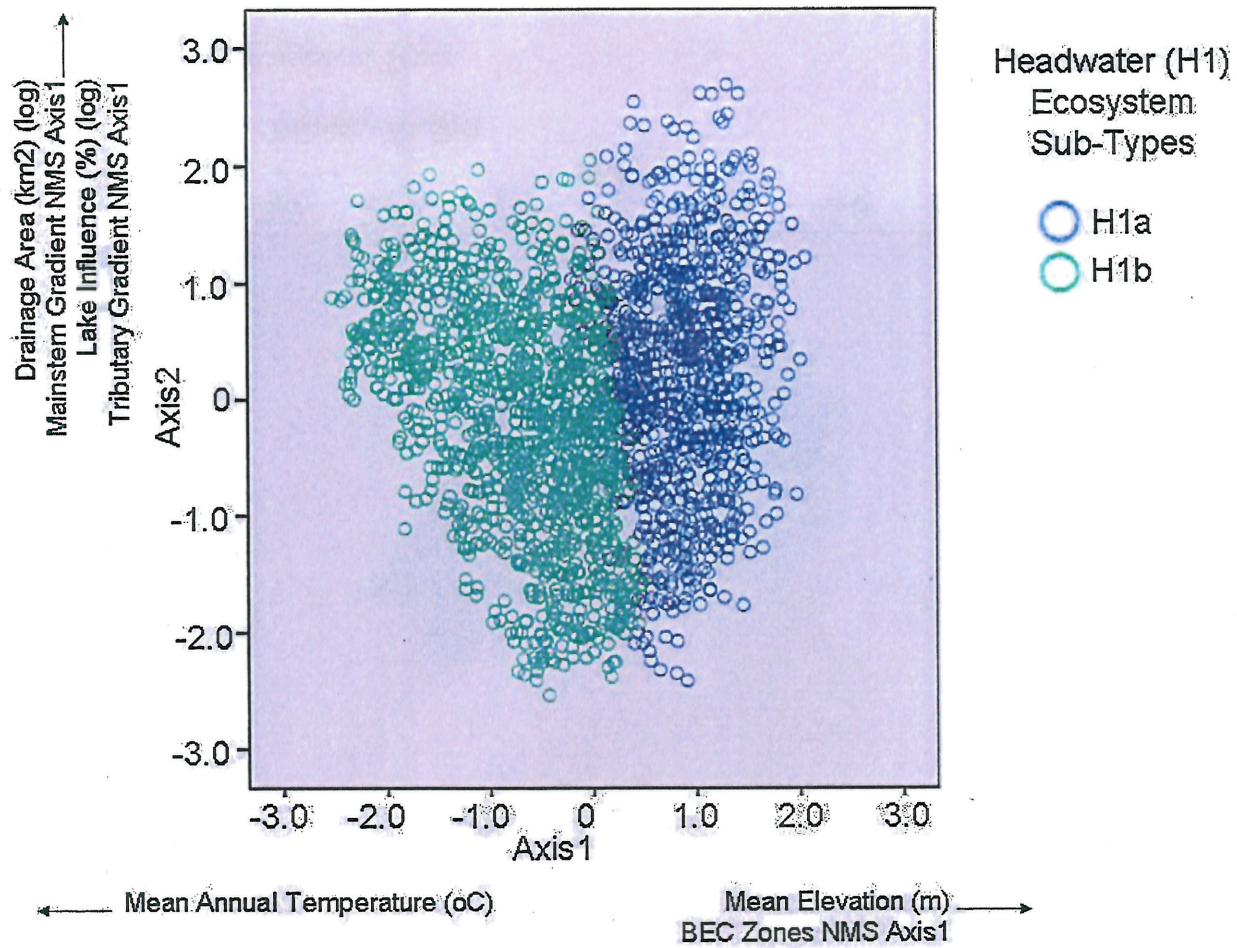


Figure 8: PCA of River Ecosystem H1 Sub-Types.

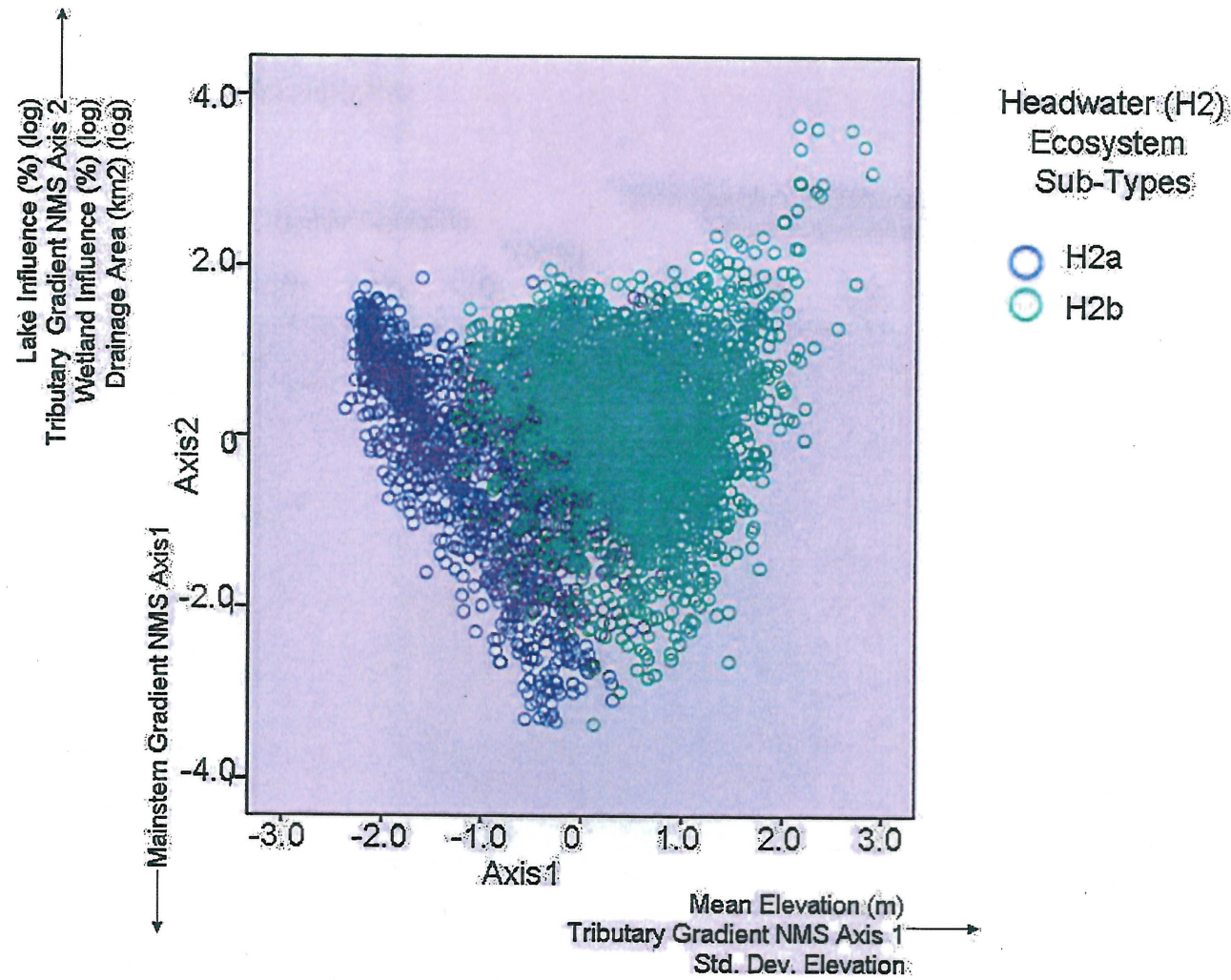


Figure 9: PCA of River Ecosystem H2 Sub-Types.

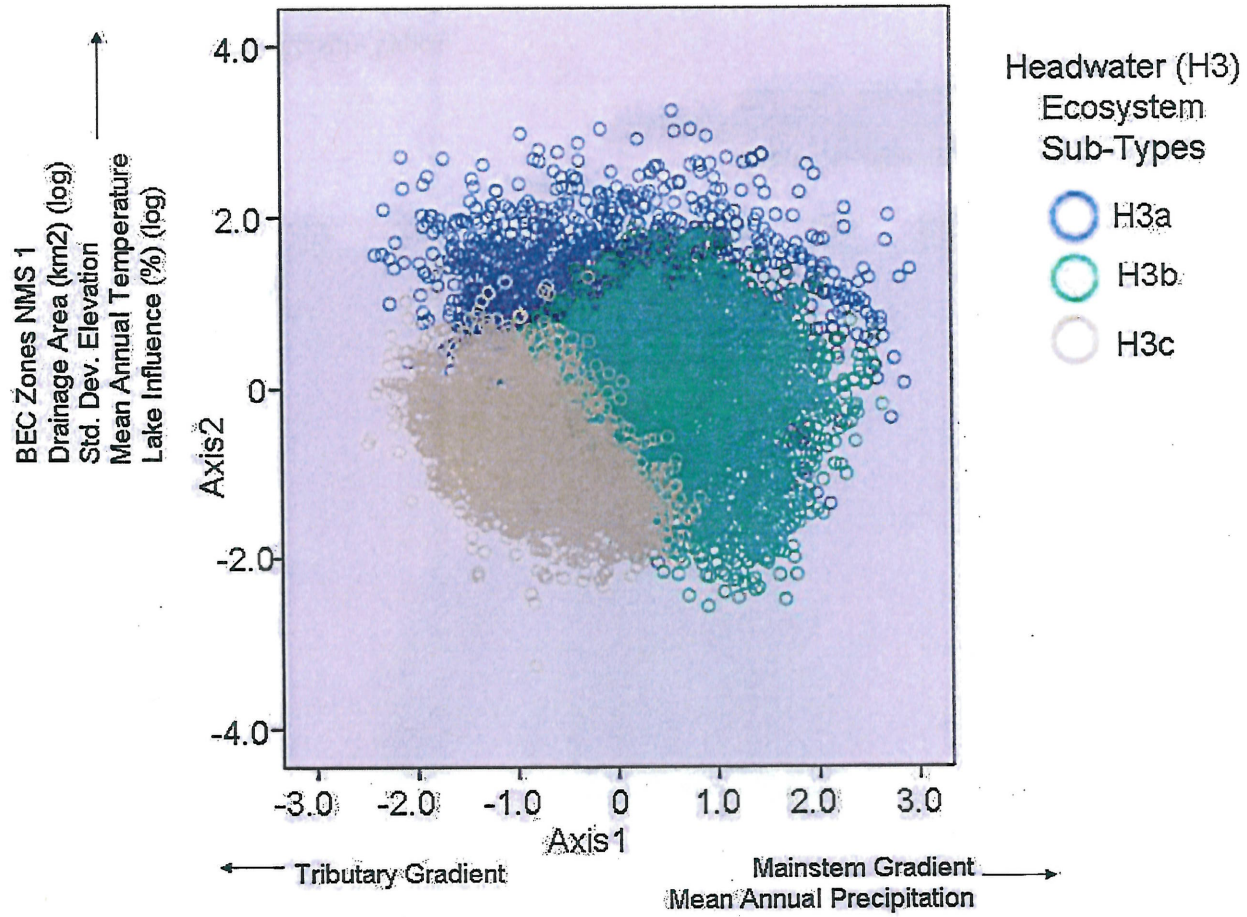


Figure 10: PCA River Ecosystem H3 Sub-Types.

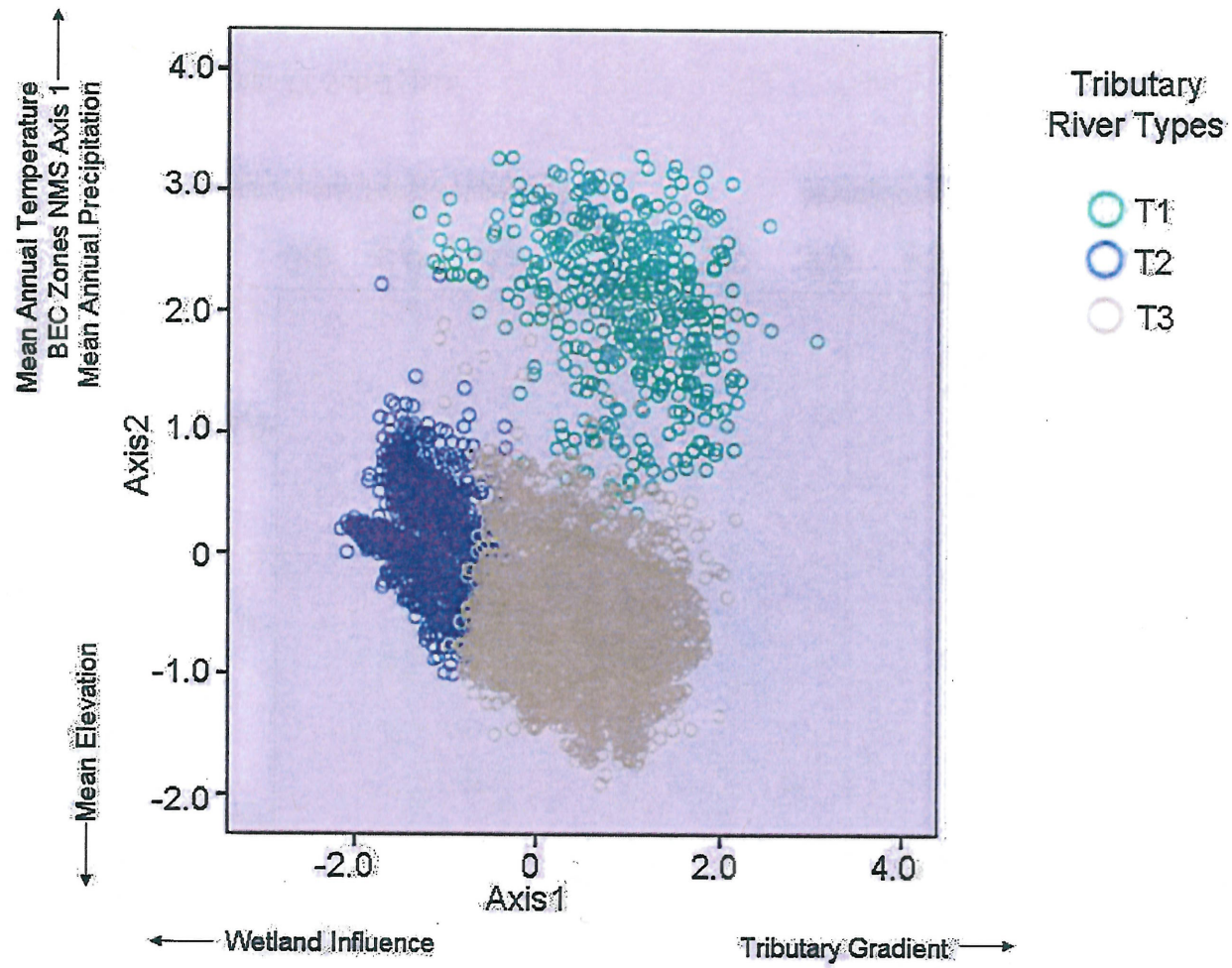


Figure 11: PCA of Tributary River Ecosystem Types.

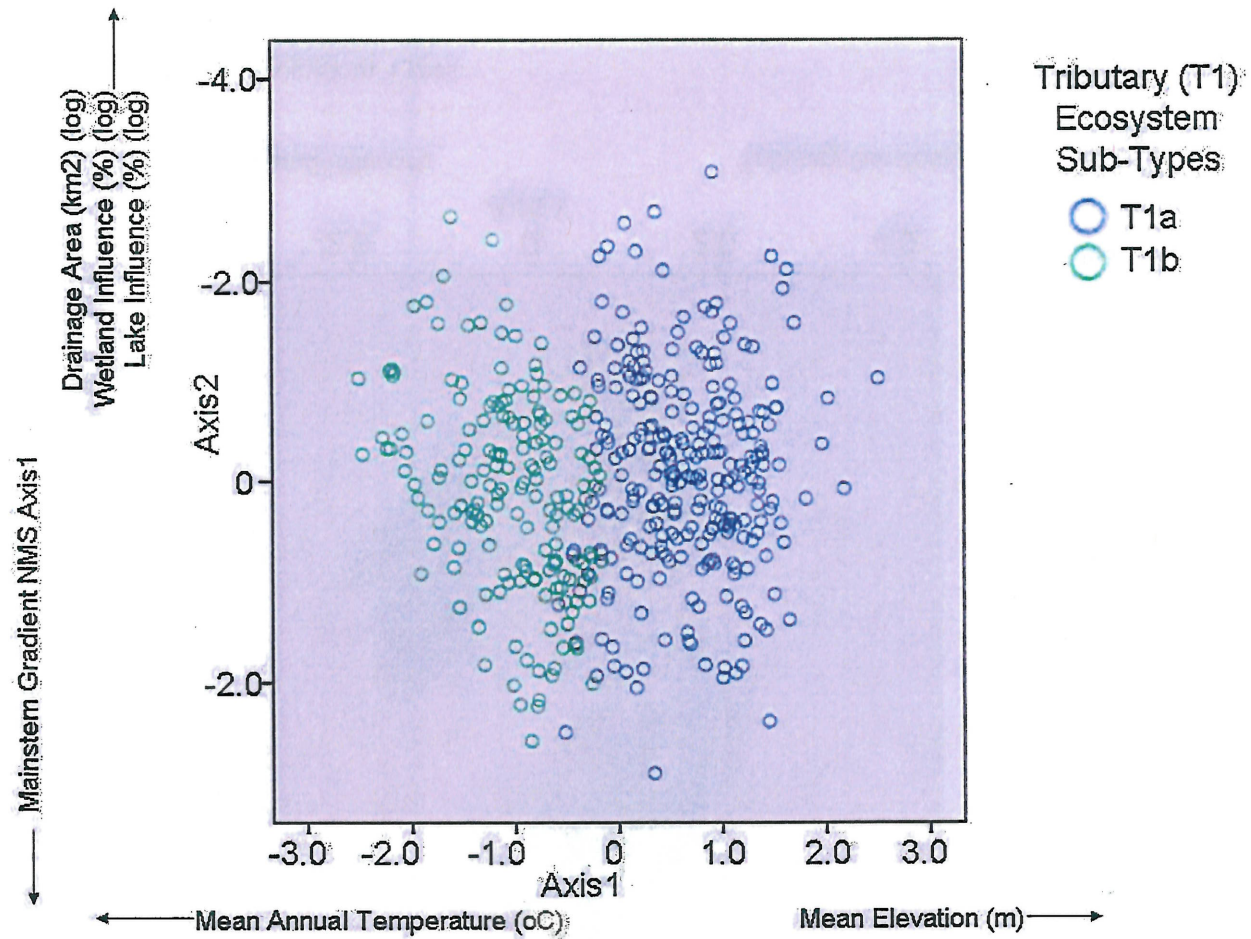


Figure 12: PCA of River Ecosystem T1 Sub-Types.

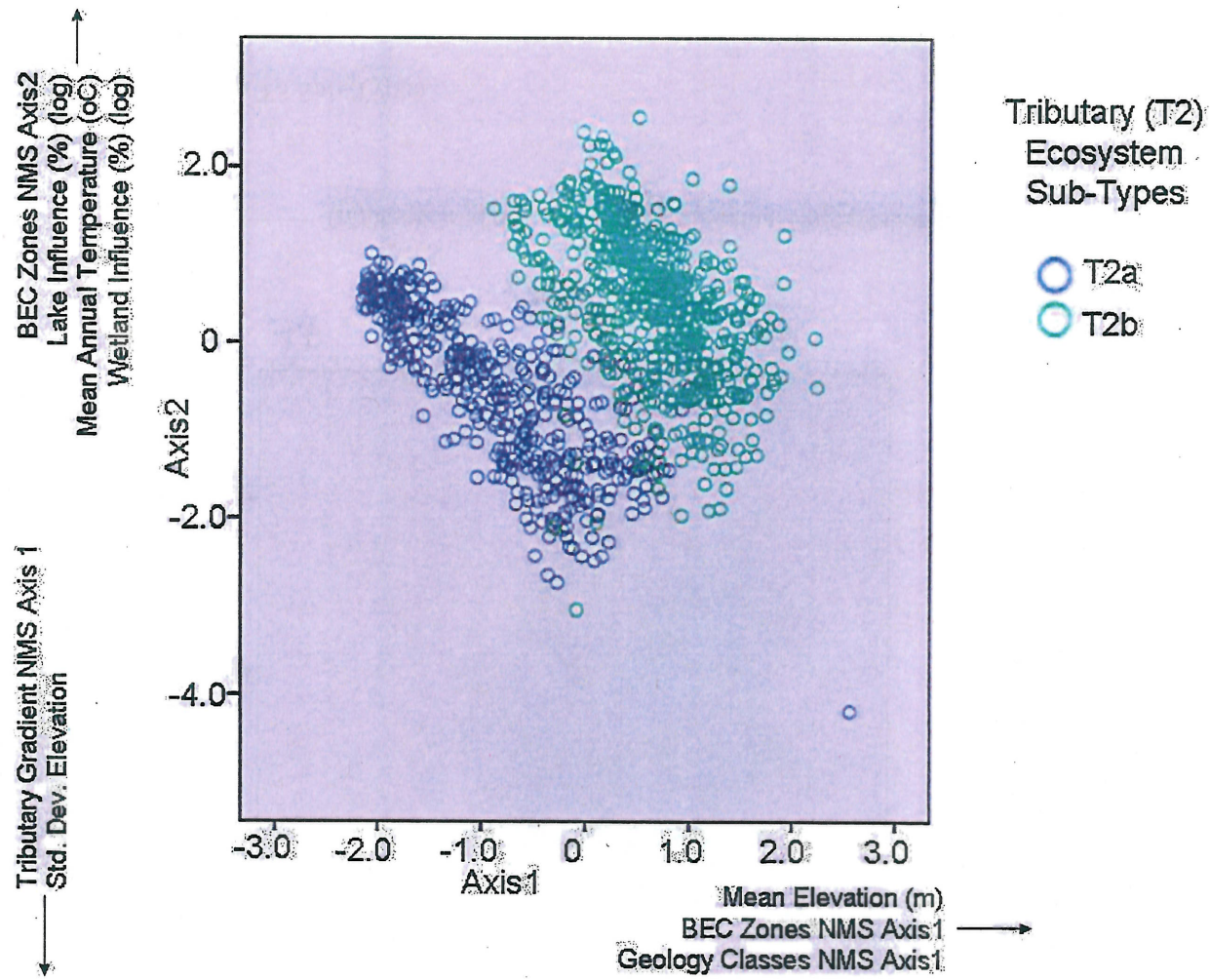


Figure 13: PCA of River Ecosystem T2 Sub-Types.

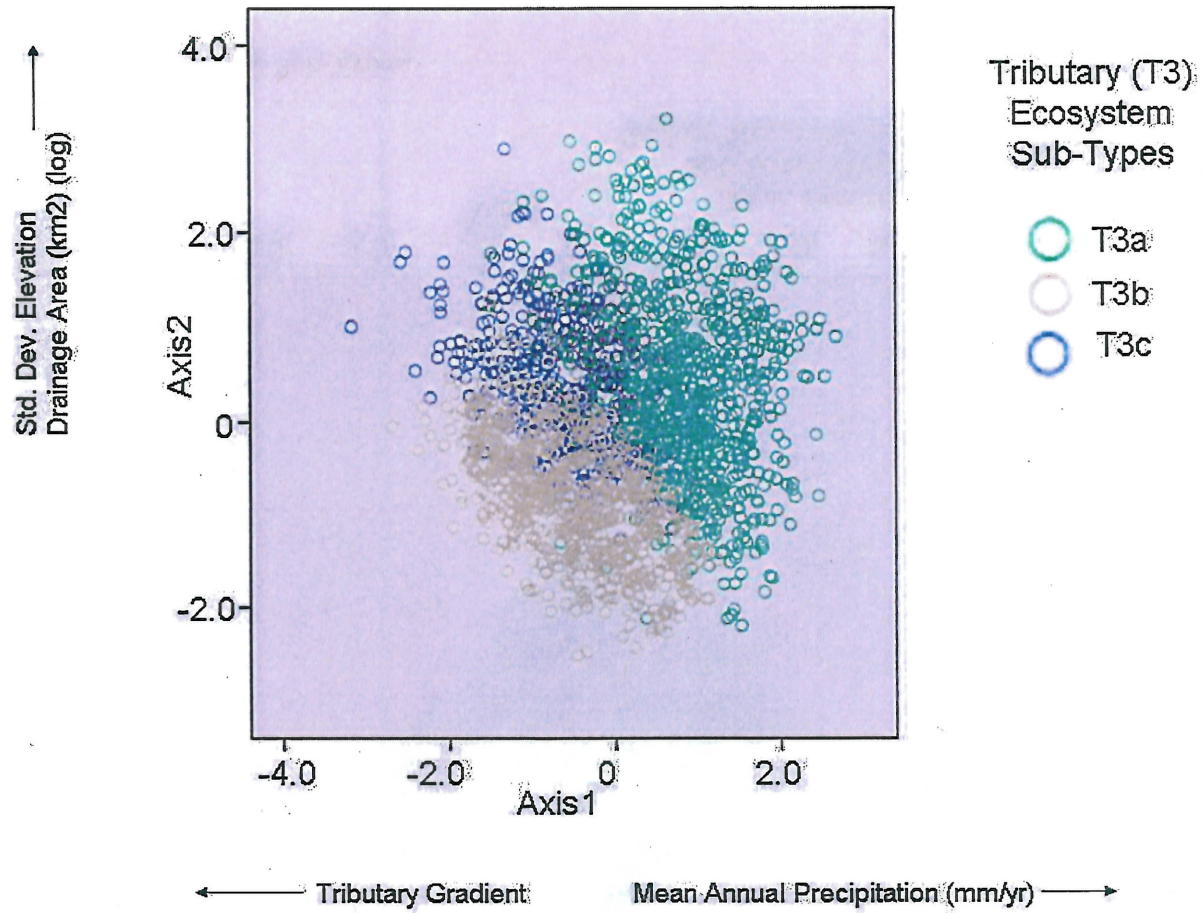


Figure 14: PCA of River Ecosystem T3 Sub-Types.

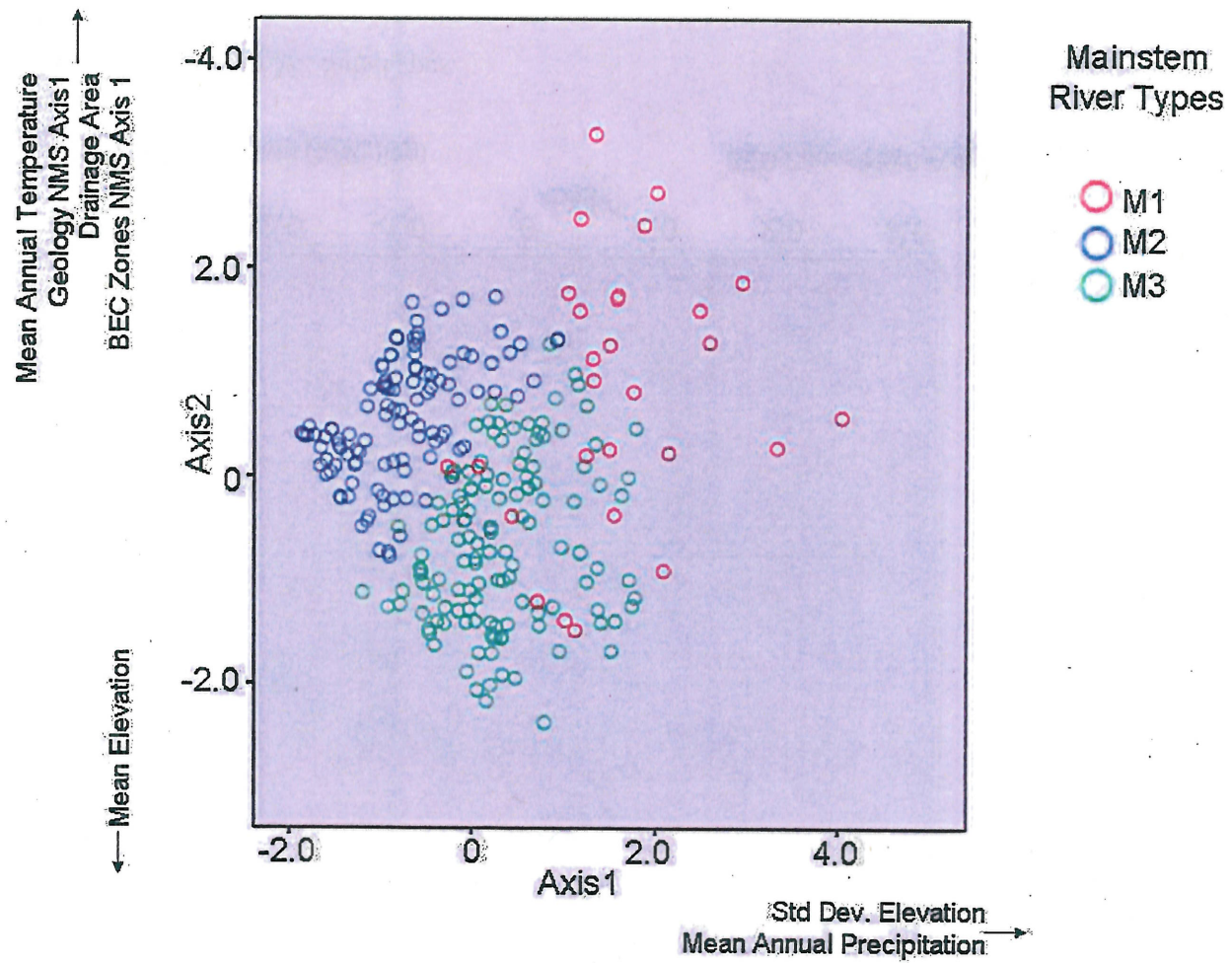


Figure 15: PCA of Mainstem River Ecosystem Types.

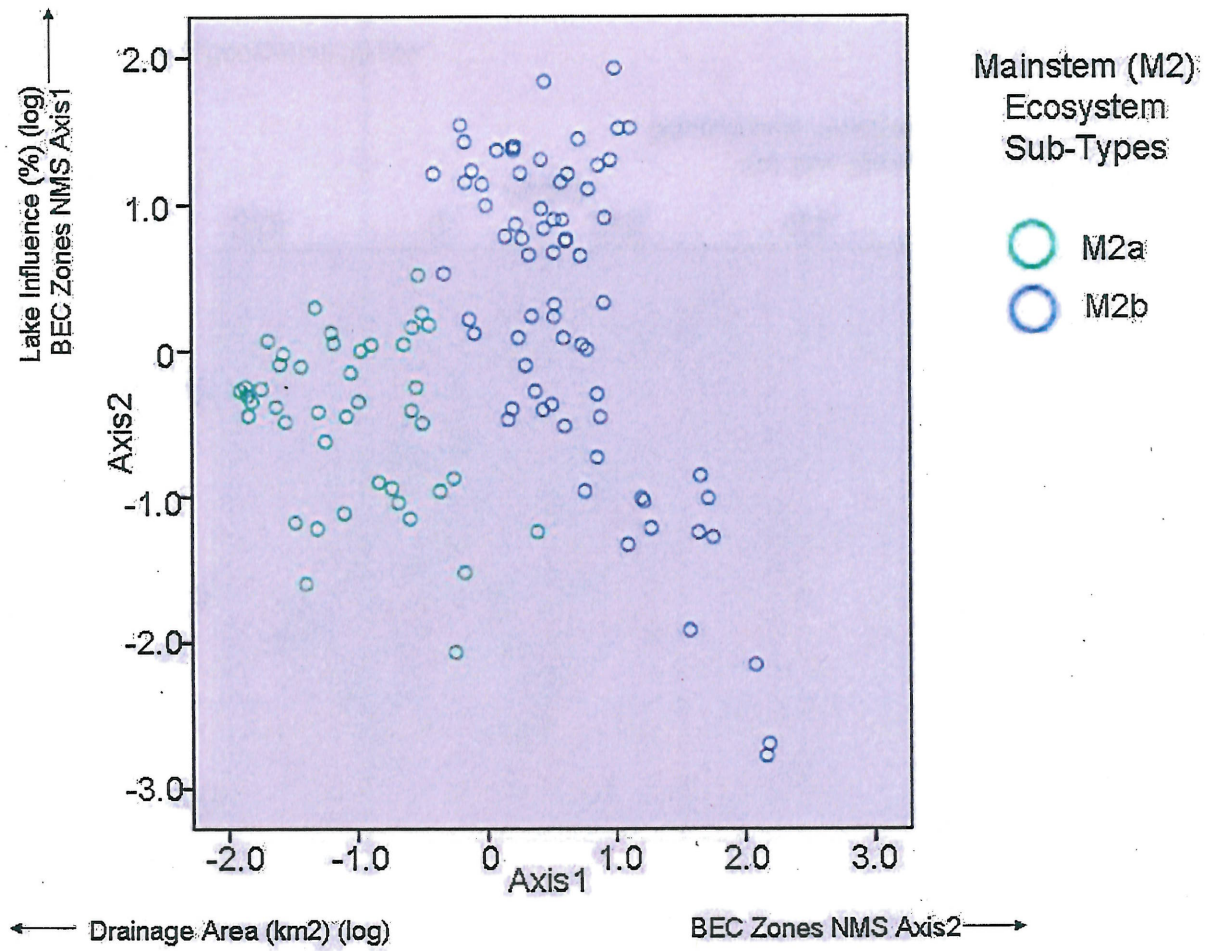


Figure 16: PCA of River Ecosystem M2 Sub-Types.

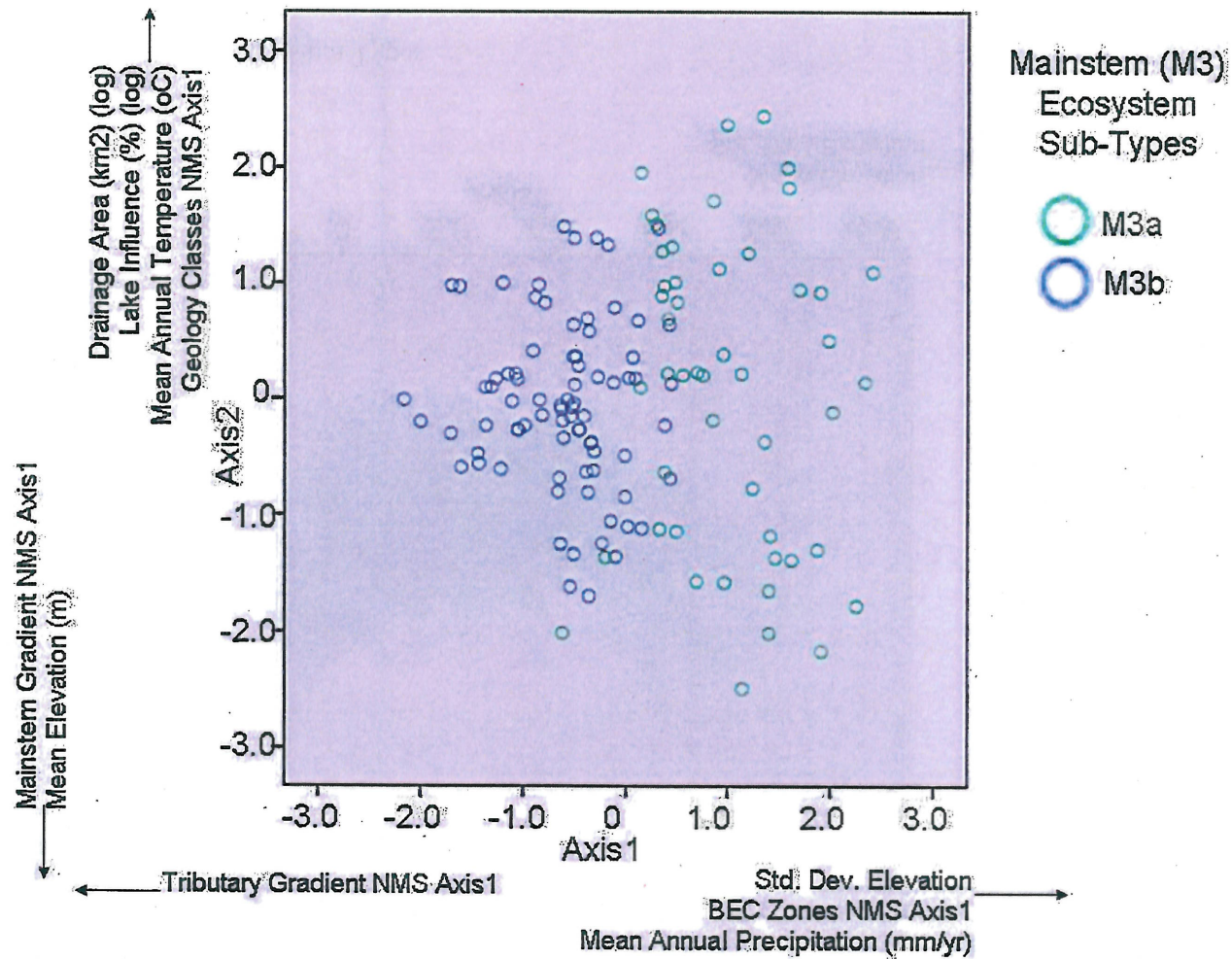


Figure 17: PCA of River Ecosystem M3 Sub-Types.

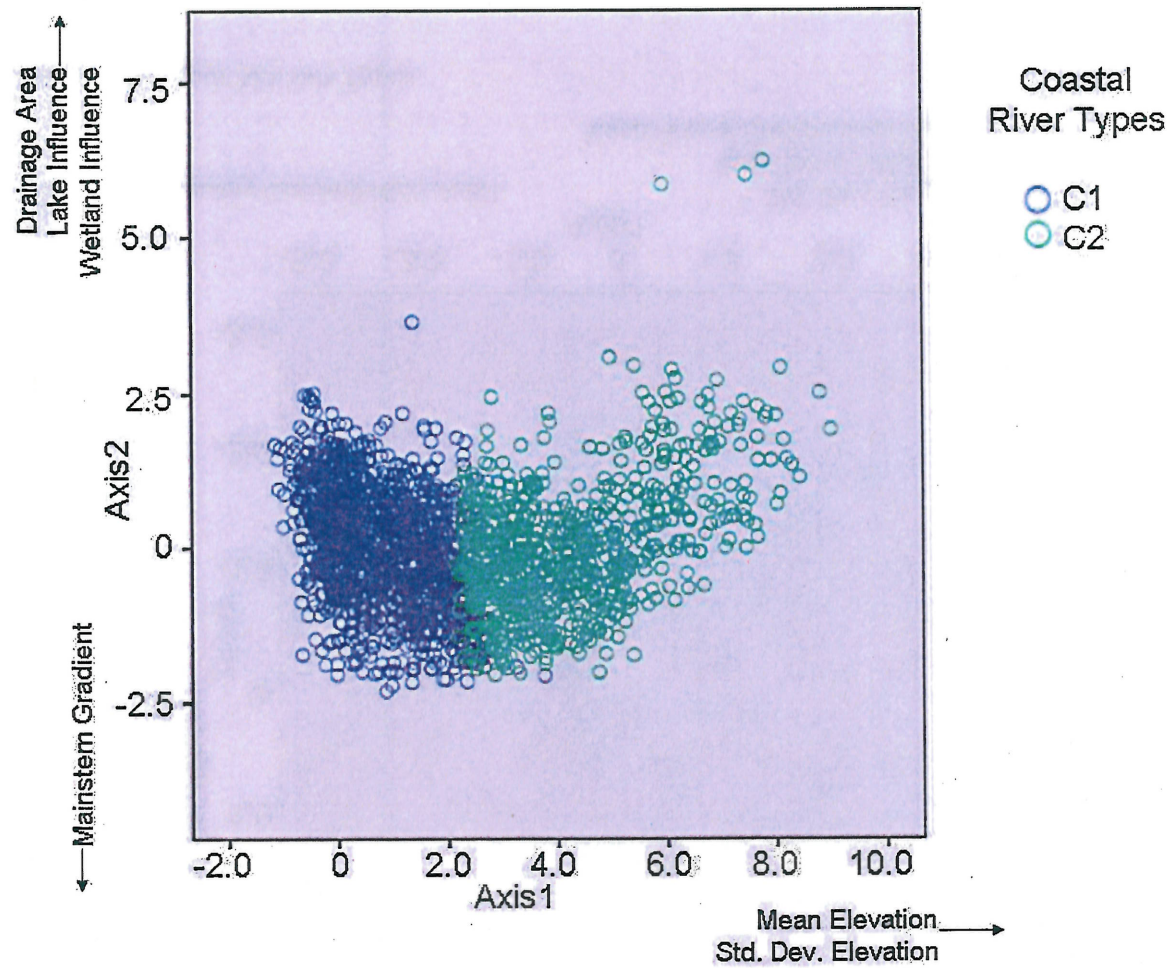


Figure 18: PCA of Coastal River Ecosystem Types.

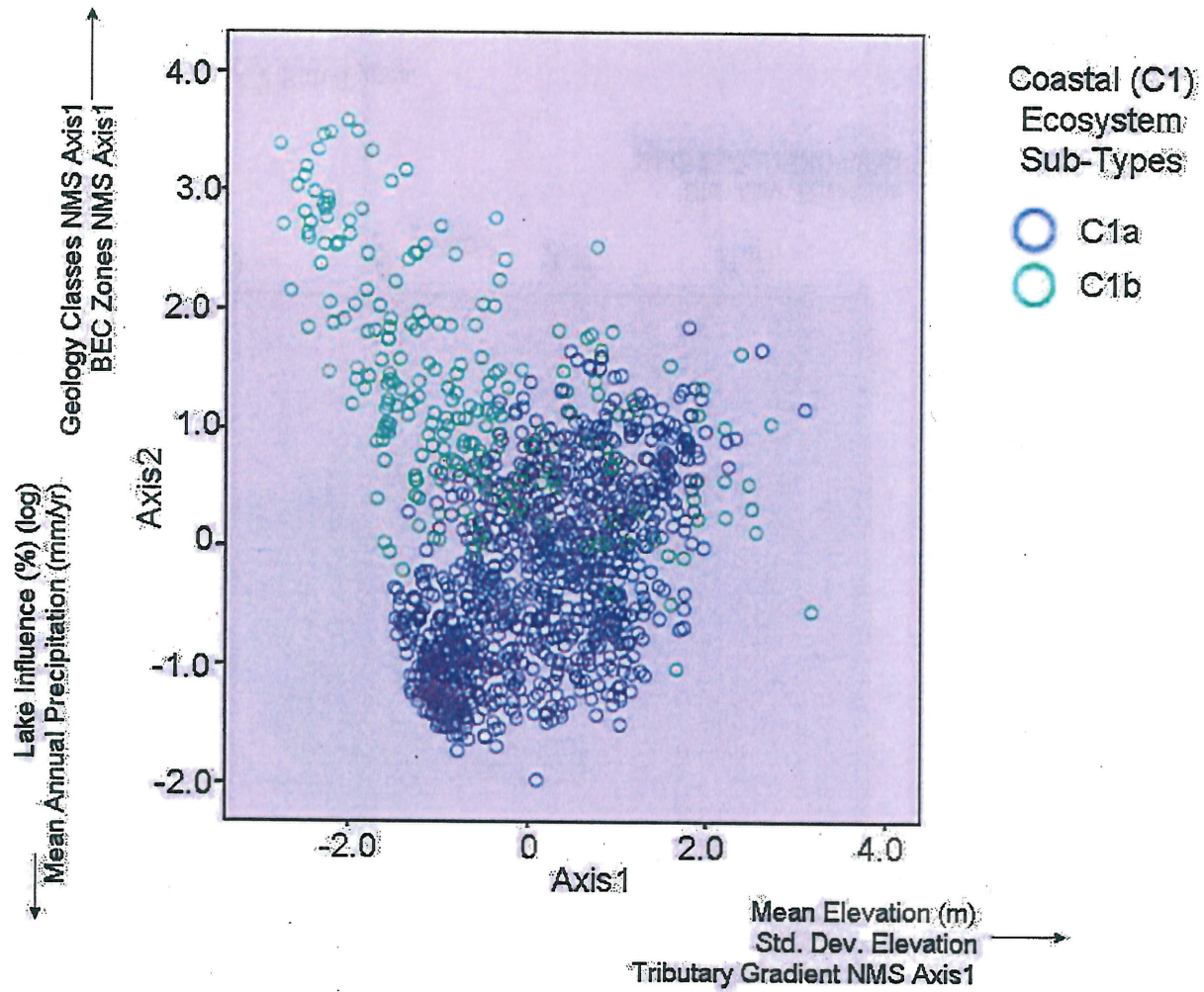


Figure 19: PCA of River Ecosystem C1 Sub-Types.

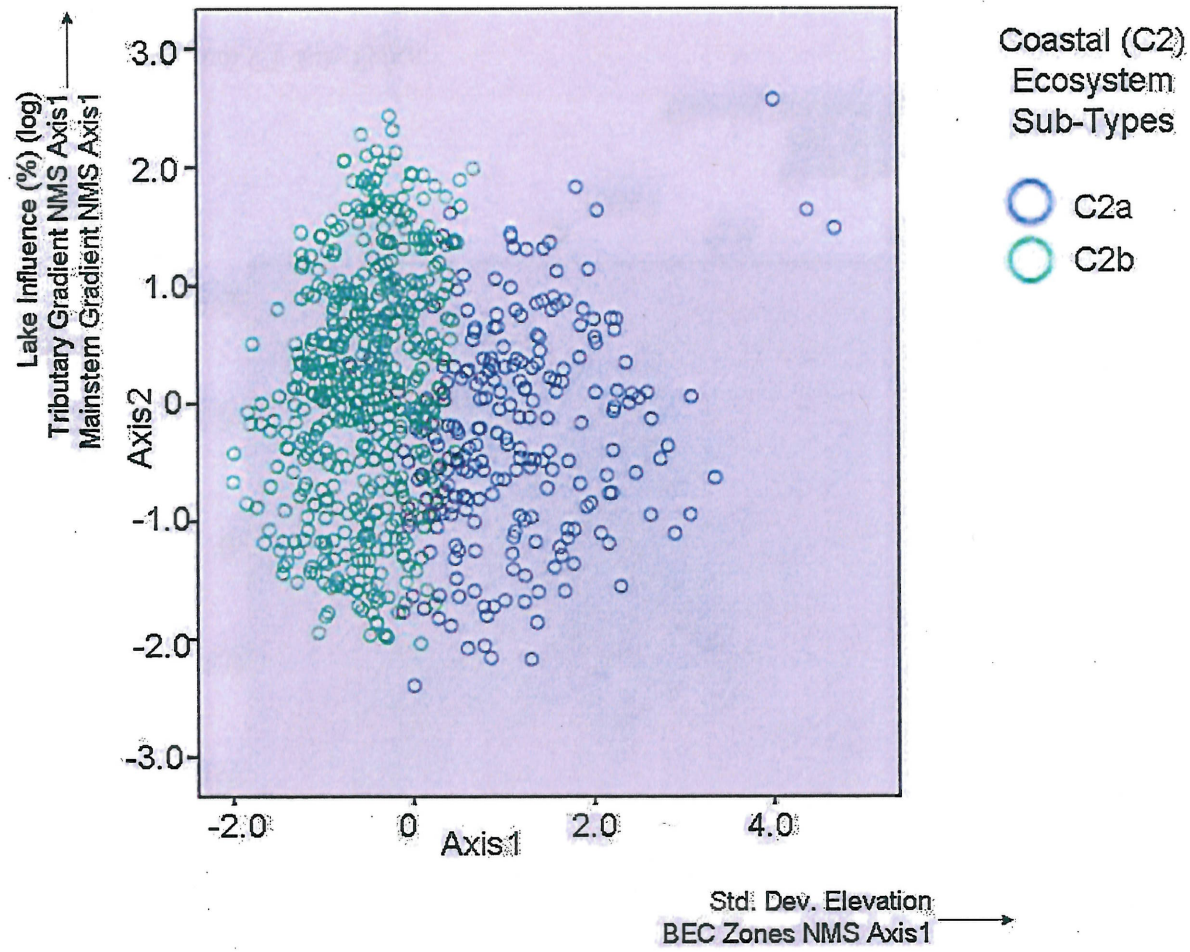


Figure 20: PCA of River Ecosystem C2 Sub-Types.

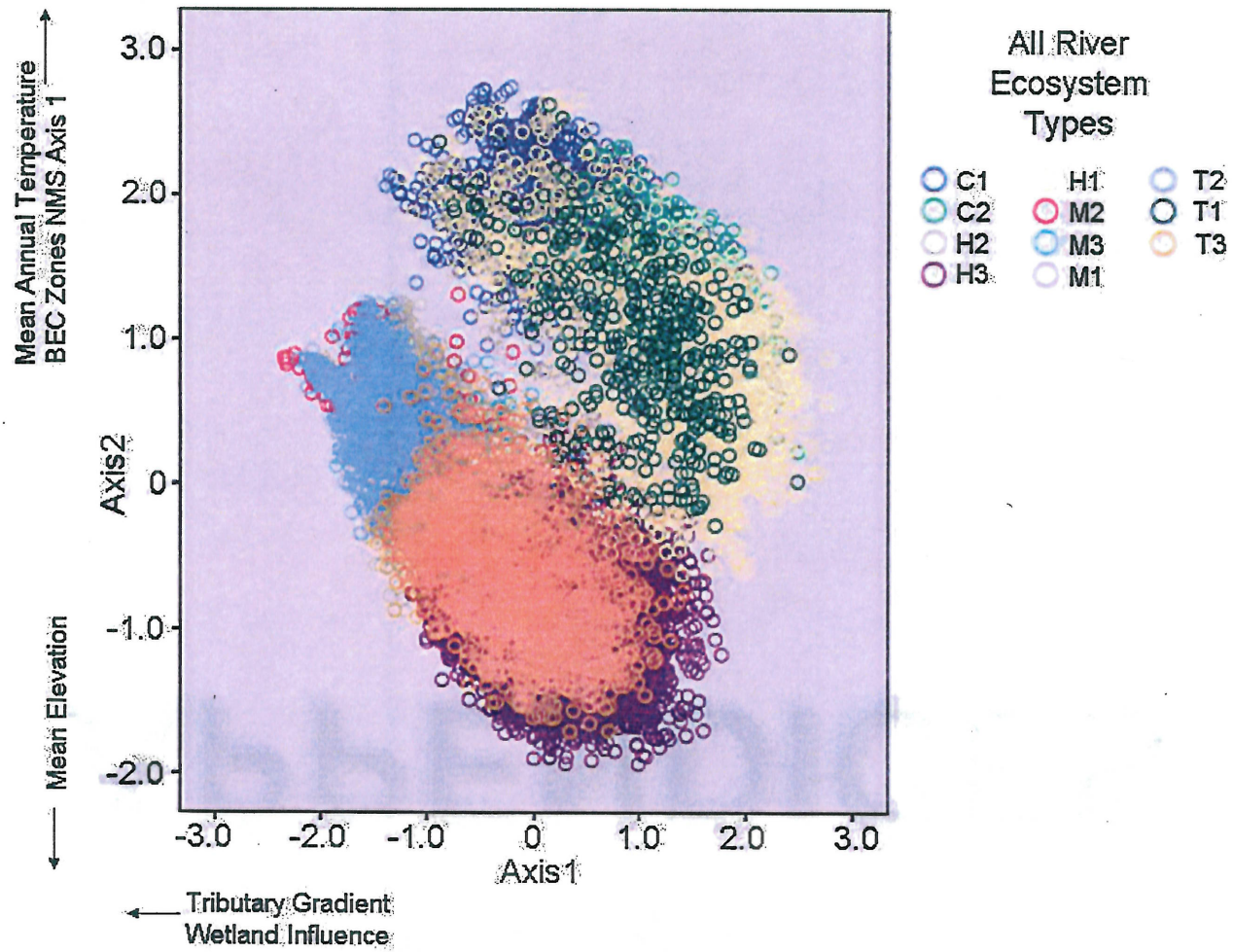


Figure 21: PCA of all River Ecosystem Types combined.

# LAKE APPENDICES

## Appendix E: Environmental Summary of Lake Ecosystem Types

### Isolated Lakes

I1	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation
Mean	1.95	1.50	0.02	1290.06	174.34
Median	1.61	1.44	0.01	1350.50	63.00
Standard Deviation	1.01	0.33	0.07	445.96	243.32
Standard Error	0.03	0.01	0.00	11.51	6.28
Range	8.69	2.25	2.27	2234.89	1105.00
Minimum	1.00	1.02	0.01	0.00	0.00
Maximum	9.69	3.27	2.28	2234.89	1105.00
Confidence Level (95.0%)	0.05	0.02	0.00	22.57	12.32

I2	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation
Mean	2.17	1.38	0.17	8.05	631.81
Median	1.78	1.24	0.01	0.00	623.50
Standard Deviation	1.21	0.41	0.83	96.03	201.51
Standard Error	0.03	0.01	0.02	2.06	4.32
Range	15.94	2.69	16.93	1800.18	1728.00
Minimum	1.00	1.01	0.01	0.00	17.00
Maximum	16.94	3.70	16.93	1800.18	1745.00
Confidence Level (95.0%)	0.05	0.02	0.03	4.03	8.46

I3	Surface Area (ha)	Shoreline Complexity (ha/m)	Drainage Area (km2)	Degree Days above 4oC	Elevation (m)
Mean	1.92	1.31	0.02	40.60	1204.58
Median	1.61	1.24	0.01	0.00	1142.00
Standard Deviation	0.91	0.24	0.01	157.19	388.59
Standard Error	0.01	0.00	0.00	1.99	4.92
Range	6.56	1.92	0.10	1458.54	2606.00
Minimum	1.00	1.01	0.01	0.00	30.00
Maximum	7.56	2.93	0.11	1458.54	2636.00
Confidence Level (95.0%)	0.02	0.01	0.00	3.90	9.64

Lake Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
I1		0.40		2.00		96.87		0.13			0.20		0.40			
I2	0.34	0.18	95.86	0.05	0.05	0.55	0.30	0.70	0.23		0.14	0.03	0.05	0.05	0.50	0.97
I3	9.40	0.27	0.01		2.47	0.11	14.60	3.10	19.67	1.57	3.16	5.22	0.85	12.71	16.30	10.55

## Headwater Lakes

U1	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation
Mean	6.77	1.49	0.43	1250.82	234.20
Median	2.77	1.41	0.17	1340.28	112.00
Standard Deviation	13.76	0.35	0.81	450.45	250.53
Standard Error	0.22	0.01	0.01	7.28	4.05
Range	274.52	2.89	18.00	2249.13	1223.00
Minimum	1.00	1.02	0.00	0.00	0.00
Maximum	275.52	3.91	18.00	2249.13	1223.00
Confidence Level (95.0%)	0.44	0.01	0.03	14.28	7.94

U2	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation
Mean	4.18	1.30	0.48	0.68	1627.86
Median	2.41	1.23	0.25	0.00	1657.00
Standard Deviation	5.86	0.23	0.91	16.08	379.41
Standard Error	0.09	0.00	0.01	0.25	5.99
Range	121.14	2.16	26.06	686.20	2006.00
Minimum	1.00	1.02	0.00	0.00	450.00
Maximum	122.14	3.18	26.06	686.20	2456.00
Confidence Level (95.0%)	0.18	0.01	0.03	0.50	11.74

U3	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation
Mean	2.43	1.25	0.30	51.41	1223.98
Median	1.92	1.21	0.14	0.00	1177.00
Standard Deviation	1.50	0.17	0.51	183.74	404.09
Standard Error	0.02	0.00	0.01	1.98	4.35
Range	11.91	1.01	13.41	1435.91	2501.00
Minimum	1.00	1.01	0.00	0.00	118.00
Maximum	12.91	2.02	13.41	1435.91	2619.00
Confidence Level (95.0%)	0.03	0.00	0.01	3.87	8.52

U4	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation
Mean	12.11	1.50	1.06	30.63	906.84
Median	7.49	1.40	0.58	0.00	883.00
Standard Deviation	16.18	0.40	1.74	129.56	314.10
Standard Error	0.19	0.00	0.02	1.51	3.66
Range	290.79	3.55	55.19	1332.25	2383.00
Minimum	1.01	1.01	0.01	0.00	76.00
Maximum	291.80	4.56	55.20	1332.25	2459.00
Confidence Level (95.0%)	0.37	0.01	0.04	2.96	7.17

Lake Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
U1		0.13		1.41		97.98		0.03			0.32		0.13			
U2	0.30						99.15	0.03		0.39	0.01	0.02			0.05	0.01
U3	22.74	0.20	9.75		6.41	0.32	0.11	4.60	7.07	2.81	8.96	3.61	0.28	3.16	14.72	15.21
U4	4.19	0.16	33.94		2.81	0.16	0.12	5.16	7.68	0.35	7.19	2.32	0.31	4.43	24.48	6.66

## Drainage Lakes

D1	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation	Outflow Stream Order
Mean	37.36	1.69	135.04	1252.21	182.27	1.79
Median	4.72	1.55	1.84	1334.44	77.00	2.00
Standard Deviation	373.99	0.54	4999.52	418.70	221.09	0.82
Standard Error	5.28	0.01	70.58	5.91	3.12	0.01
Range	22191.39	7.16	204403.08	2199.12	1116.00	5.00
Minimum	1.00	1.03	0.01	0.00	0.00	1.00
Maximum	22192.39	8.19	204403.09	2199.12	1116.00	6.00
Confidence Level (95.0%)	10.35	0.02	138.38	11.59	6.12	0.02

D2	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation	Outflow Stream Order
Mean	9.30	1.44	9.16	0.00	671.98	1.59
Median	2.98	1.32	4.03	0.00	686.00	1.00
Standard Deviation	19.39	0.40	14.96	0.00	194.19	0.68
Standard Error	0.26	0.01	0.20	0.00	2.63	0.01
Range	318.60	3.62	198.75	0.00	1217.00	3.00
Minimum	1.00	1.01	0.01	0.00	106.00	1.00
Maximum	319.60	4.63	198.76	0.00	1323.00	4.00
Confidence Level (95.0%)	0.52	0.01	0.40	0.00	5.16	0.02

D3	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation	Outflow Stream Order
Mean	11.01	1.42	6.31	0.91	880.02	1.57
Median	4.55	1.34	2.92	0.00	861.00	1.00
Standard Deviation	17.74	0.31	10.37	14.37	140.64	0.67
Standard Error	0.24	0.00	0.14	0.19	1.90	0.01
Range	236.59	2.97	180.34	428.87	1348.00	3.00
Minimum	1.00	1.01	0.01	0.00	56.00	1.00
Maximum	237.59	3.98	180.35	428.87	1404.00	4.00
Confidence Level (95.0%)	0.47	0.01	0.27	0.38	3.72	0.02

D4	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation	Outflow Stream Order
Mean	5.58	1.37	3.89	26.57	1306.10	1.35
Median	3.05	1.31	1.80	0.00	1240.00	1.00
Standard Deviation	7.31	0.26	7.94	113.50	360.69	0.50
Standard Error	0.07	0.00	0.07	1.02	3.25	0.00
Range	124.40	1.95	138.52	1044.63	2459.00	2.00
Minimum	1.00	1.02	0.00	0.00	68.00	1.00
Maximum	125.40	2.97	138.52	1044.63	2527.00	3.00
Confidence Level(95.0%)	0.13	0.00	0.14	2.01	6.38	0.01

D5	Surface Area	Shoreline Complexity	Drainage Area	Degree Days above 4oC	Elevation	Outflow Stream Order
Mean	293.31	2.01	330.61	28.96	992.20	3.05
Median	25.93	1.84	33.32	0.00	1000.00	3.00
Standard Error	3009.95	0.75	3949.79	131.03	298.81	1.04
Standard Deviation	40.83	0.01	53.58	1.78	4.05	0.01
Range	164768.33	9.39	156515.69	1643.59	2165.00	7.00
Minimum	1.00	1.03	0.21	0.00	6.00	1.00
Maximum	164769.33	10.42	156515.90	1643.59	2171.00	8.00
Confidence Level (95.0%)	80.04	0.02	105.03	3.48	7.95	0.03

Lake Type	Mean Percent BEC Zones															
	BAFA	BG	BWBS	CDF	CMA	CWH	ESSF	ICH	IDF	IMA	MH	MS	PP	SBPS	SBS	SWB
D1		0.37		1.10	0.04	94.98		0.64	0.97		1.24		0.65			
D2			99.91				0.03									0.05
D3	0.02						0.06	0.02						0.03	99.85	
D4	12.76	0.32	0.03		2.57	1.07	26.16	5.74	15.34	1.14	6.49	5.38	0.26	8.75	0.04	13.92
D5	4.52	0.65	9.86		0.72	3.50	10.11	7.99	14.50	0.06	2.86	4.63	0.42	12.63	13.42	14.06

## APPENDIX F: Principal Component Analysis Ordinations for Lake Ecosystem Types

Principal component analysis (PCA) (Hotelling 1933) is performed on each of the lake connectivity classes to illustrate how the ecosystem types vary based on all environmental variables combined. PCA is a multivariate statistic which reduces the environmental variable data into a reduced set of independent vectors defining lake associations according to the greatest cumulative variation. PCAs are also performed on all lake ecosystem types to illustrate how the sub-types vary based on all combined environmental variables used to delineate ecosystem types and sub-types.

The first two eigenvalues are significant for each of the PCAs using the Broken Stick model (Frontier 1976). Bartlett's Test

of Sphericity is highly significant ( $p < 0.0001$ ) for all three lake connectivity class PCAs and as well as combined PCA of all twelve lake types. The first two axes of the PCAs summarize 59.71% of the variance for isolated lakes, 59.00% of the variance for headwater lakes and 56.40% of the variance for drainage lakes. PCA of all lake types combined summarized 58.44% of the environmental variance.

All three PCAs for isolated, headwater and drainage lakes as well as the PCA of all lake ecosystem types combined have their first and second components correlating highly with climate and lake size gradients (Figures 22 to 25).

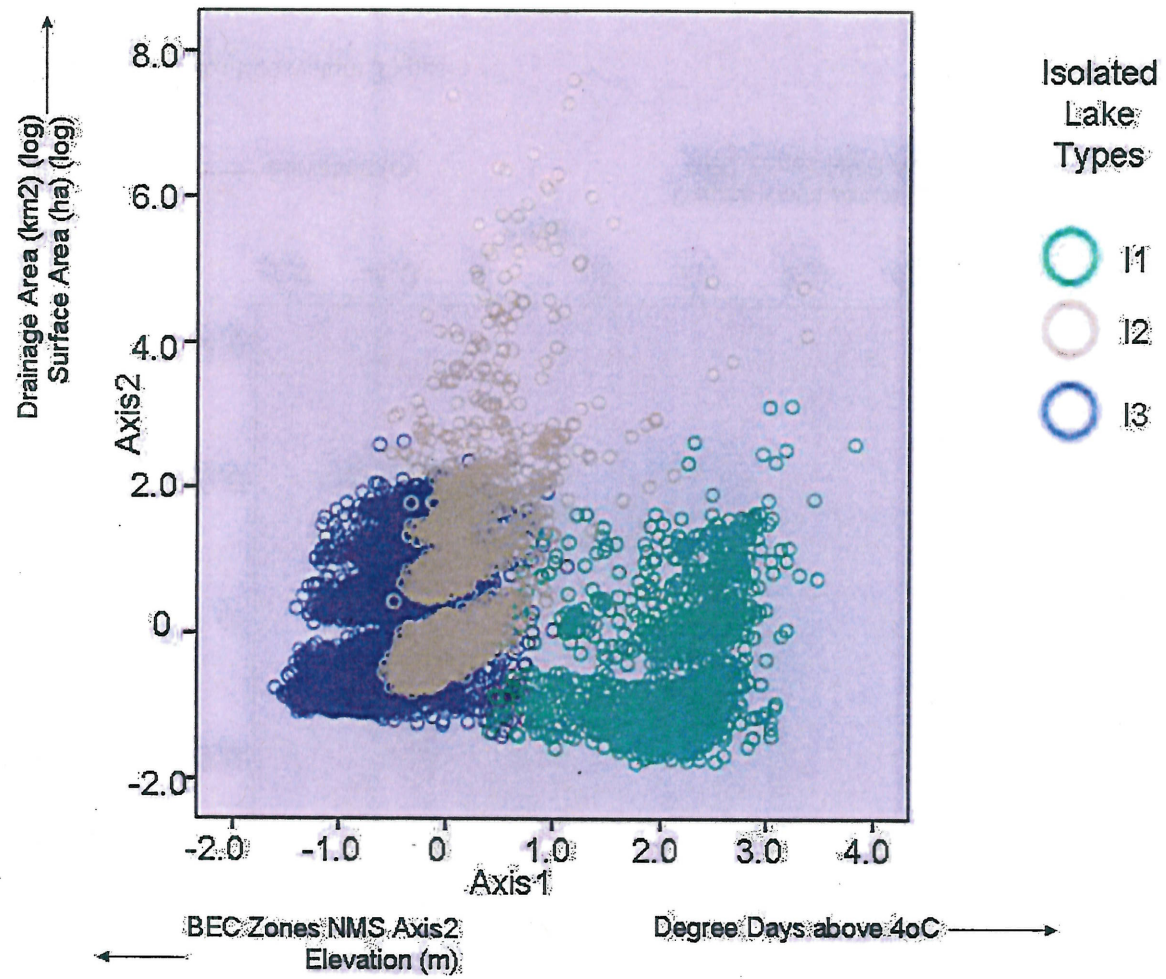


Figure 22: PCA of Isolated Lake Ecosystem Types.

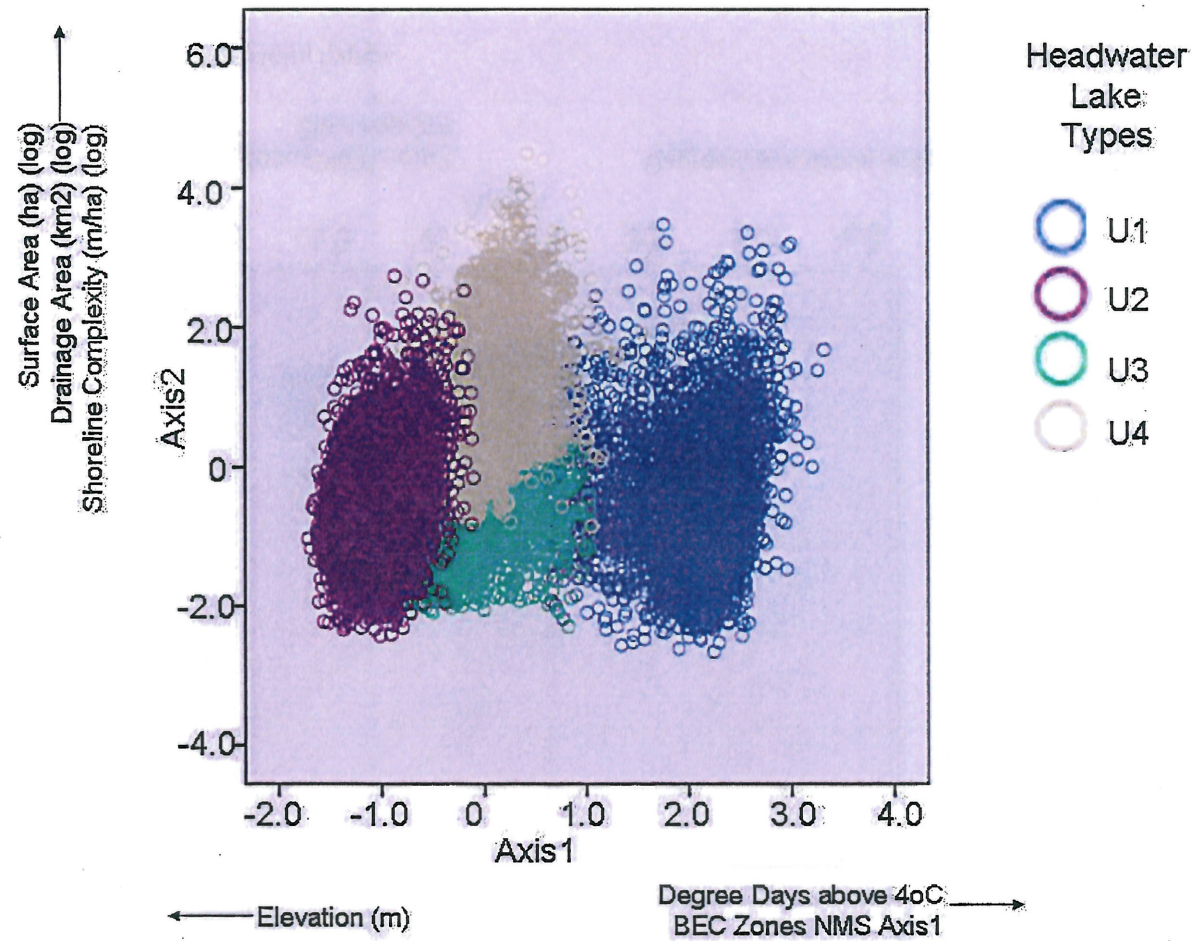


Figure 23: PCA of Headwater Lake Ecosystem Types.

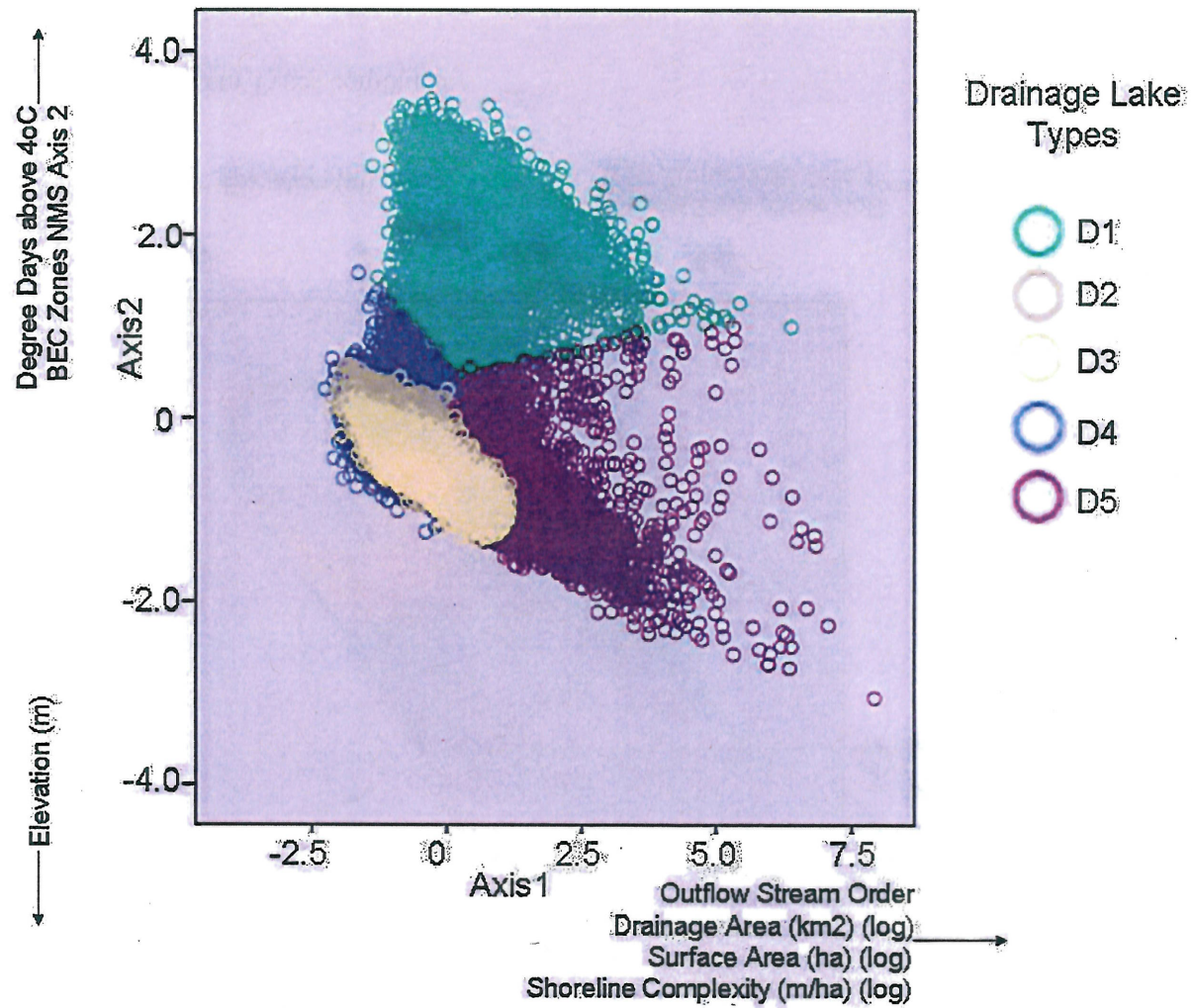


Figure 24: PCA of Drainage Lake Ecosystem Types.

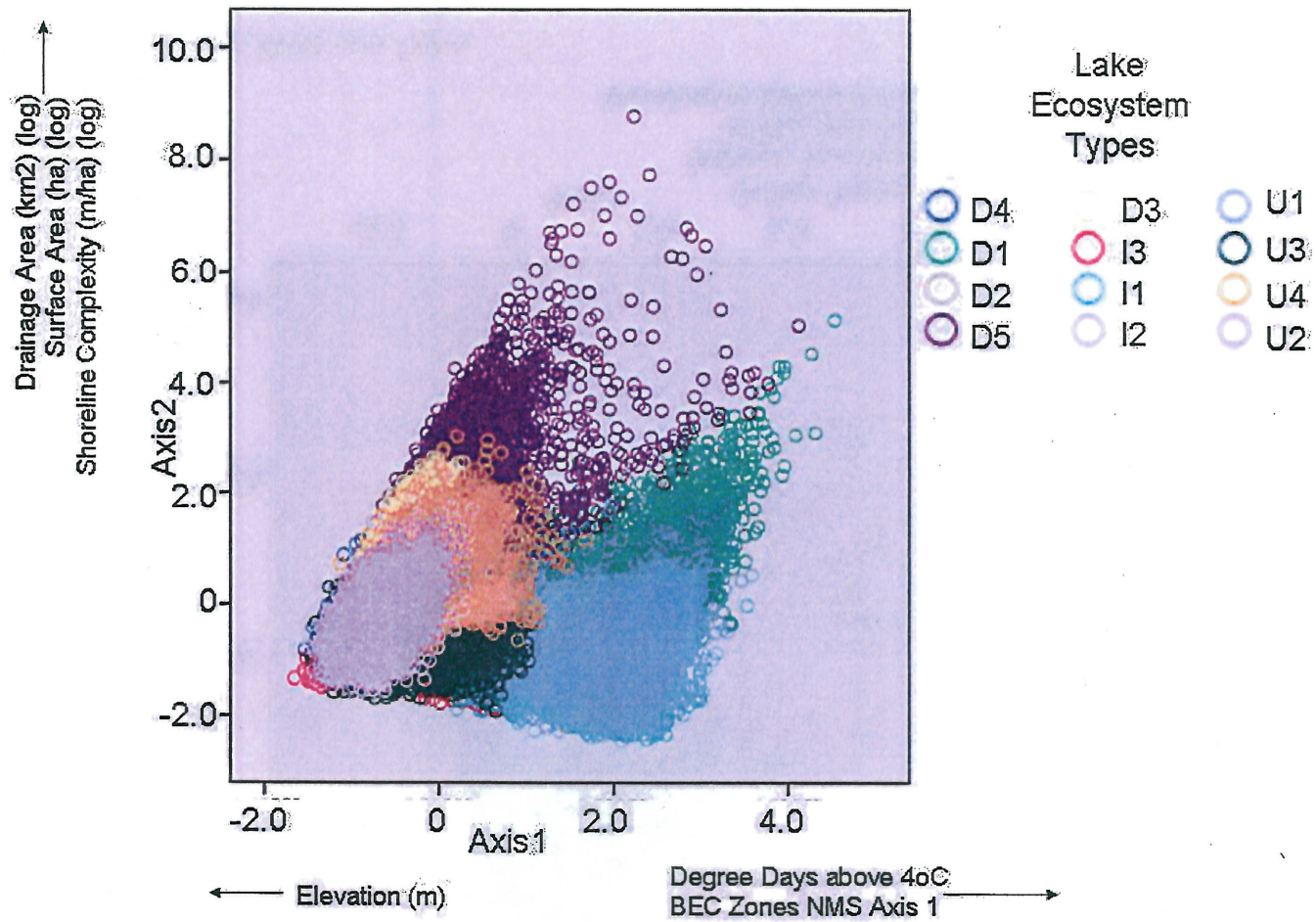


Figure 25: PCA of all Lake Ecosystem Types combined.