PREDICTING BIOGEOCHEMICAL ECOSYSTEM PROCESSES IN THE COLUMBIA RIVER BASIN USING THE BGC MODEL

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Preface

The following report was prepared by University scientists through cooperative agreement, project science staff, or contractors as part of the ongoing efforts of the Interior Columbia Basin Ecosystem Management Project, co-managed by the U.S. Forest Service and the Bureau of Land Management. It was prepared for the express purpose of compiling information, reviewing available literature, researching topics related to ecosystems within the Interior Columbia Basin, or exploring relationships among biophysical and economic/social resources.

This report has been reviewed by agency scientists as part of the ongoing ecosystem project. The report may be cited within the primary products produced by the project or it may have served its purposes by furthering our understanding of complex resource issues within the Basin. This report may become the basis for scientific journal articles or technical reports by the USDA Forest Service or USDI Bureau of Land Management. The attached report has not been through all the steps appropriate to final publishing as either a scientific journal article or a technical report.

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INTRODUCTION

Mechanistic ecosystem process modeling can provide insight into the causal mechanisms that control landscape dynamics. An assessment of ecosystem

productivity and water, carbon and nutrient cycling can provide a means for determining ecosystem health and integrity. Mapping the spatial distribution of fundamental ecosystem processes such as photosynthesis, transpiration and respiration can identify areas that act as sinks for carbon, have high productivity or are at risk from insect and disease attacks.

In May 1994, Dr. Steven Running, University of Montana, Missoula, Montana, entered into a Research Joint Venture Agreement with the Intermountain Fire Sciences Lab, Intermountain Research Station, Missoula, Montana to simulate trends in ecosystem processes as a result of alternative, broad-scale land management strategies for the Interior Columbia River Basin (ICRB) scientific assessment under the guidance of the Landscape Ecology Group. Dr. Running and his staff of Joseph White and Peter Thornton then developed a strategy to use mechanistic process model called BGC (A biome BioGeoChemical process model) (Running and Hunt 1993) to model elemental ecosystem processes on the ICRB landscape. The objective of this modeling effort was to characterize coarse-scale changes in fundamental ecosystem processes as a consequence of various management scenarios. Results from the simulations would be integrated into the Environmental Impact Statement (EIS) for the entire ICRB.

This paper contains three sections. A description of the procedure used to simulate ecosystem process relationships using BGC for the entire ICRB is detailed in the first section. The second section contrasts Biome-BGC simulation results for the historical and current ICRB landscape to describe consequences of management policies for the last 90 years. The last section describes, in general, the results of the application of the BGC model to predictions of future landscapes as generated by the CRBSUM succession model (Keane and others 1996).

The BGC Model

The BGC is a mechanistic, ecosystem process model that simulates the fundamental relationships that govern vegetation dynamics. It is a carbon, nitrogen and water cycling model using daily and annual timesteps to simulate these flows across ecosystem compartments. A detailed discussion of the BGC model and its inputs is contained in Thornton and others (1996), which was used to develop this chapter. BGC recognizes several compartments where carbon, nitrogen and water can be transported including the leaf, root, stem, soil and air compartments. The model simulates the flow of carbon, nitrogen and water across these compartments using physiological process relationships. For example, carbon is transferred from the air to the leaves, stems and roots via photosynthesis. Carbon lost from leaves, stems and roots is transferred to the soil and air via litterfall and decomposition. The driving variables used to simulate the physiological relationships are primarily the weather variables of precipitation, temperature and radiation. Carbon is fixed daily using photosynthetic equations that are based on temperature, water and humidity factors. Carbon is released to the air from autotrophic (live plant) and heterotrophic (microbial) respirational processes that are primarily dependent on temperature. Water is taken into the plants based on soil water potential and released to the air via transpiration which is mostly governed by humidity, temperature and available soil water.

BGC has its roots in a single-tree, single-year, daily water balance model called H_2OTRANS. Then a stand-level, big-leaf model called Forest-BGC was developed from H_2OTRANS logic (Running and Coughlan 1988, Running and Gower 1991). A spatial, landscape-level, multi-year application of Forest-BGC was implemented in the model RESSys (Regional Ecosystem Simulation System). However, these three models were for only forested ecosystems. BGC was developed to simulate ecosystem processes across all biomes. BGC has some of the original Forest-BGC logic, but most algorithms have been refined to incorporate recent research findings.

The logical foundations of the CRB application of the BGC model are unchanged from its predecessor models. The spatial dimension is resolved as discrete units of area, with no explicit scaling of processes for horizontal spatial scale. A regular Cartesian grid with gridcell spacing of two kilometers was used for all simulations referenced here. The model is implemented independently over each of these discrete units of area; with no interactions occurring between units. The vertical dimension in the canopy is described as a "big leaf" model, with a single estimate of daily fluxes for the entire canopy compartment. The vertical dimension below-ground is modeled as a single unit of homogeneous soil with a specified depth and uniform rooting density.

The basic temporal resolution is one day (24 hours), and for a given unit there is an explicit time dependency established by the maintenance of state variables between daily timesteps. As an example, the soil moisture of two adjacent gridcells are independent of one another, but for a single gridcell the initial soil moisture for a given timestep is transmitted as the soil moisture diagnosed at the end of the preceding timestep. In addition to the daily estimation of such processes as transpiration, maintenance respiration, and photosynthesis, the Forest- and BGC descriptions include the maintenance of state variables for the assessment of carbon allocation and nutrient dynamics at an annual time-step. This dual-timestep logic is implicit to the CRB-BGC implementation insofar as all simulations have been performed for one year, with prescribed initial values for the annual state variables.

Carbon enters into a carbon budget, when a canopy is present, as the result of photosynthetic assimilation. Daily estimates of assimilation are based on a modified version of the Farquhar model of photosynthetic biochemical pathways (Farquhar and others, 1980). Principal factors controlling assimilation are canopy absorbed radiation, leaf nitrogen concentration, leaf nitrogen

allocation to the RuBisCO enzyme, leaf maintenance respiration rate, and conductances to CO_2 at the leaf and canopy scale. Assimilated carbon is added each day to a photosynthate pool. Leaf, stem and root carbon pools were specified as constant for the one-year duration of the simulations.

Daily estimates of maintenance respiration from leaves, stems, coarse roots, and fine roots are based on an exponential function of daily average temperature, using coefficients which specify the proportion of living biomass which would be respired in one day at a reference temperature. Maintenance respiration is totalled over a simulated year, and subtracted from the photosynthate pool at the end of the year to estimate the annual net primary productivity. It is possible for this value to be negative, indicating a net loss of photosynthate. Plants which have carbon storage reserves maintained between growing seasons could be expected to withstand a limited negative productivity. For plants without significant storage of photosynthate between seasons, this condition most likely indicates mortality.

Because the simulations were limited to a duration of one year, growth respiration and turnover of leaf, stem and root compartments were not modeled. Soil and litter carbon pools were not employed, in part because of the difficulty of parameterizing these pools without resorting to prohibitively time-demanding multi-decadal model initialization runs. As a result, soil and litter decomposition were not explicitly modeled. In order to provide a surrogate estimate of the nutrient availability which would result from organic matter decomposition, scalars which are typically used to estimate the decomposition of soil and litter organic matter were calculated (modification from Biome-BGC). These scalars describe the modeled influence of temperature and soil moisture on the rates of decomposition in the litter and soil.

APPLICATION OF BGC TO THE ICRB

Input Data Sources

BGC needs several data files and spatial data layers to quantify ecophysiological parameters and initialize the model. Listed below is a general description of the methods and data sources used to create or modify the various data files and data layers required for a BGC simulation. A detailed discussion of these tasks is provided in Thornton and others (1996).

Vegetation characterization--The CRBSUM model was the main tool used to predict vegetation dynamics and future ICRB landscapes as a consequence of management actions at a 1 km pixel resolution (Keane and others 1996). CRBSUM was parameterized using the Vegetation Dynamics Development Tool (VDDT) model developed by Beukuma and Kurtz (1995). CRBSUM generated various tables and spatial data layers at selected years during a 100 year simulation (10, 50 and 100 years). Landscape changes were characterized using simulated cover type and structural stage digital map layers. Forest cover type naming convention follows Eyre (1980), and rangeland cover types follow Shiftlet (1994). Cover type and structural stage data layers for the current and historical ICRB landscape, as well as those generated by CRBSUM, were imported into BGC for each of the simulation years (i.e., 10, 50, 100) and then BGC was executed for only one year. In addition, all input parameters related to vegetation were stratified by the cover type and structural stage categories. The BGC modeling effort reduced the structural stages into the categories of Table 1 and it reduced cover types to the categories presented in Table 2.

The vegetation type descriptions from the CRB vegetation type data layers were aggregated into modeling types based on drought tolerance (Appendix 1) (SAF, 1984; Lassoie and others 1985). The rationale for this aggregation is that most of the Upper CRB vegetation communities are water-limited, as opposed to light limited, and therefore can be described by water limitation gradients.

This is also a functional grouping as most physiological responses of these communities are water-stress adaptations.

Some difficulties arose in the aggregation process because the groupings were also based on a definition of lifeform (e.g. tree, shrub, grass). Some community type descriptions naturally fell into two or more of these categories such as the juniper/big sage/bluebunch wheat grass. The CRB is designed at present to model single life form types because there are assumptions about the homogeneity of canopy conditions, carbon and nitrogen pools, and other specific physiological processes. Where the vegetation type contained more than one lifeform type, grouping was based on the dominance of respiring biomass. In mixed classes, if woody vegetation was present, then the class was aggregated as a forest or shrub type.

The initial structural stage definitions included definitions for forests, woodlands, and shrub communities. For simplicity, these were aggregated into early, middle, and late series (Appendix 2). Also, shrub development/structure definitions were aggregated into a single definition because no ecophysiological evidence could be found to support modeling more specific shrub categories.

Weather Data--The following meteorological variables are the principal driving inputs for CRB-BGC: daily maximum and minimum temperatures, daytime average temperature, daily average soil temperature, daily total precipitation, daytime average vapor pressure deficit, daytime average radiative flux density, and daylength. These variables are provided as daily estimates interpolated from surface observations onto a regular grid. For the simulations described here, three complete years of these daily gridded surfaces were employed, 1982, 1988, and 1989, corresponding to a relatively cool and wet year, a relatively warm and dry year, and a normal year,

respectively. In addition, the results of an assessment of various numerical predictions of a likely future climate under conditions of twice current atmospheric [CO_2] (Ferguson 1996) were used to construct a fourth year of daily meteorological variables which represented a likely normal year under projected future climate conditions.

The spatial daily weather data was generated using the MTCLIM-3D computer application (Thornton and others 1996). This method involved compiling base station data for the three weather years from approximately 800 National Weather Service weather stations in and around the ICRB. The local contribution from each base station was delineated using topography and climatic trends. The daily base station data was then interpolated to a 2 km grid layer using MTCLIM-3D logic.

Ecophysiological Parameters--BGC requires an extensive set of ecophysiological parameters to simulate photosynthesis, respiration and the other basic ecological processes such as decomposition, evaporation and transpiration. The value of each parameter depends on ecosystem condition. A set of ecophysiological parameters were developed for each combination of structural stage and cover type that occurred historically, presently or in the future on the ICRB landscape.

The approach to modeling the difference between vegetation types was to reduce the classification scheme employed at the level of the CRBSUM routines (Keane and others 1996) to a smaller number of classes with similar ecophysiological characteristics. The most general division was between tree, shrub, and herbaceous types. Each type was then divided again, first based on leaf morphology (needle vs. broadleaf) and finally on drought tolerance classes (Appendix 1). A set of parameters were developed based on the processes of interest in this analysis and the ecophysiological variation represented by

the vegetation types in the study area. Four classes of such parameters (referred to here as ecophysiological constants) were used in this analysis: canopy constants, conductance constants, phenological constants, and maintenance respiration constants.

A variety of ecophysiological parameters are needed to constrain various sub-components of the BGC model. These constants define leaf and plant physiognomy, photosynthetic capacity, leaf conductance to water vapor and carbon dioxide, phenology, and cellular metabolism rates. These "constants" are actually average values that vary more or less constantly across vegetation types and species associations with some sensitivity to shade and drought tolerance. For the CRB-BGC model, constant values were defined from literature sources for the selected 14 modeled vegetation types (Appendix 3). In some instances, absolute constant values could not be derived from the literature, in which case, values were scaled linearly across vegetation types based on drought tolerance associations.

Certain key ecophysiological parameters were varied across cover type, structural stage and Leaf Area Index (LAI). For example, specific leaf area (SLA, m^2 kg^{-1}) was assigned for each cover class based on the relationship of LAI to SLA (Pierce and others 1994). Likewise, the proportion of living stem tissue (P_{dl}) was calculated from LAI based on cross-sectional water conducting tissue as inferred from cover type and structural stage (Waring and Schlesinger 1985). SLA and stem tissue values were used to estimate the proportion of live carbon to the total carbon for a pixel. This parameter is important because it dictates the amount of maintenance respiration needed to sustain all living tissue on the pixel. High P_{dl} values usually result in higher maintenance respiration rates to keep the cells alive. This parameter changes mostly because of structural stage and biome type.

Canopy constants included specific leaf area, or all sided leaf area per unit of leaf mass (m^2 kg^{-1}); the ratio between all sided and projected leaf area; the water interception coefficient, maximum mass of water per unit of leaf area per day that can be intercepted and held on the canopy; the light extinction coefficient (employed in the Beer's law representation of radiation attenuation); and the proportion of leaf nitrogen which is incorporated in the RuBisCO enzyme.

Conductance constants are actually a sub-category of the canopy constants, and are required in the estimation of canopy-scale conductances to water vapor and sensible heat transport. These include: a shape parameter describing the relationship between photosynthetically active photon flux density and stomatal conductance; optimum and maximum temperatures for stomatal conductance, as well as a coefficient describing the shape of the temperature-conductance response curve; leaf water potentials for initial and complete stomatal closure in response to soil water stress; vapor pressure deficits for initial and complete stomatal closure in response to atmospheric humidity; a value for maximum stomatal conductance under optimal conditions; an estimate of leaf-scale cuticular conductance; and an estimate of leaf-scale boundary layer conductance.

Phenological constants consist simply of yeardays for leaf-on, leaf-off, fine root-on, and fine root-off. Maintenance respiration constants include; coefficients representing proportions of biomass respired in one day under reference temperature conditions for leaf, stem, coarse root, and fine root; and a Q_{10} coefficient describing the response of all these proportions to changes in temperature from the reference state.

Soil Parameters--Soil parameters required by BGC were taken mostly from the STATSGO spatial data layer developed by the Natural Resource Conservation

Service (SCS 1991). Soil depth, texture and water holding capacity input values were estimated from the STATSCO data layer using available literature and computer modeling. Soil water holding characteristics were derived from STATSGO textural classes using techniques presented by Cosby and others (1984).

Soil depth was calculated for the CRB study area by extracting the maximum depth per soil sequence from the STATSGO database and weighting these values by area for a maximum average soil polygon depth. A TSI value (Equation 1) for the CRB area was calculated by first calculating the upslope drainage area and then the slope. The TSI value was calculated using the above formula and the derived topographic data layers. TSI values ranged from 0.1 to 18.0 from this process. The STATSGO maximum depth data layer and the TSI data were merged using a rule-base where for each STATSGO polygon, the minimum and maximum TSI values were found. The maximum TSI depth value was equal to the polygon (*i*) depth value and depth values for smaller TSI values were found by a logarithmic scaling:

$$Soil\ Depth_i = STATSGO\ Depth \left(\frac{TSI_i}{Max\ TSI_i} \right)^{0.5} \qquad \text{Equation 1.}$$

where the coefficient 0.5 was derived empirically by looking at the shift in frequency plots of the resultant depth values. The result of this process was a new map of soil depth in meters.

The texture information required by the BGC model includes percent coarse fragment, sand, silt, and clay. These attributes are not directly defined in the STATSGO attribute list; however, information exists in the database that make them extractable with some manipulation. Three STATSGO attributes were

used to define all textural categories: 1) percent by weight particles passing No. 10 sieve, 2) percent by weight particles passing No. 200 sieve, and 3) percent clay content.

Site soil texture is used to calculate the soil water holding capacity and the soil water potential (ψ_{soil}) at various water contents. Physical soil characteristic information was obtained primarily from the STATSGO database (SCS, 1991). This database is composed of digitized polygons from 1:250,000 scale state soils maps. Soil attributes of each polygon are based on field surveys with no spatial reference. Polygons are therefore a loose conglomerate of various types with the polygonal structure derived from climatic, vegetation, and topographic features.

Leaf Area Index--LAI was estimated by first dividing the ICRB landscape into various biomes (e.g., conifers, broadleaf, shrublands, herblands, rock) using the current ICRB cover type and structural stage data layers. Then, LAI values for each pixel was computed by biome from the Normalized Difference Vegetation Index (NDVI) using equations taken from the literature. The NDVI data layer was computed from a May 1990 AVHRR scene acquired from EROS (Spanner and others 1990, Pierce and others 1993, Asrar and others 1984).

The minimum and maximum projected LAI values from this study were 1.0 and 13.0 for the evergreen, 1.0 and 8.0 for the deciduous, and 0.5 and 3.0 for the grass groups. These values were converted into total LAI using the all-sided to projected ratios described previously. To simplify model calculation, LAI values were averaged by modeling class and structural stage (Appendix 1 and 2). The purpose of this summarization was to provide a methodology for predicting LAI values in the non-current scenarios. Analysis of LAI frequency plots by modeling class and structural stage showed that the NDVI-LAI transformation process yielded extreme and average values that were somewhat

higher than values expected for the CRB region (Waring and Franklin, 1979). LAI values were lowered calculating correction coefficients that were expected LAI values over the average NDVI-LAI values by modeling class. Corrected LAI values were calculated by multiplying the NDVI-LAIs coefficients across all structural stages (Appendix 4). In the case of missing LAI values by structural class, modeling class average values were used to interpolate. Structural variance was assumed to only influence LAI in the coniferous and deciduous forest communities and, therefore, non-forest types were given uniform LAIs across structural stages. These new LAI values were used in all modeling scenarios using vegetation cover and structural classes as indexes for LAI assignment.

Stem carbon--Modelling class specific coefficients were derived for estimating living sapwood carbon from LAI. Coefficient values were calculated based on maximum LAI, species LAI to sapwood are ratios, maximum height, density of mature community, specific gravity of wood, and proportion living cell volume of total sapwood tissue. This was a reasonable approximation given that a) the amount of sapwood volume supported by a species is linearly related to diameter at breast height (dbh) and b) dbh is logrithmically related to sapwood cross-sectional area (Snell and Brown, 1978). Maximum LAI values were found for each modeling class in the CRB from the NDVI regression. LAI to sapwood are ratios were found in various literature sources (Snell and Brown, 1978; Kaufmann and Troendle, 1981; Waring and others 1982; Waring and Schlesinger, 1985; Gower and others 1987). Maximum height values were extracted from site index curves for the study area using the height value of stands with a site index value of 80 at year 160 (McArdle and Meyer, 1930; Haig, 1932; Meyer, 1938; Barnes, 1962; Jones, 1967; Milner, 1992). Density values were used to estimate tree/shrub level sapwood volume (Peet, 1988; Keeley and Keeley, 1988). Specific gravity values were used to convert sapwood volume to sapwood mass (Fahey, 1976) on kg C given a dry weight to

carbon conversion factor of 0.5. Proportion of living tissue of total sapwood volume were taken from Waring and Schlesinger (1985).

The final coefficient values from this process indicated an increase in sapwood mass per unit leaf area across a drought tolerance gradient (Appendix 5). However, because sapwood hydraulic conductivity decreases with age (Whitehead and others 1984) the amount of sapwood mass per unit LAI was reduced linearly for all classes across using structural class as a proxy for age. The impact of this scaling was to reduce the respiration load on younger stands. Living sapwood (kg C m^{-2}) was calculated for each modeling unit by multiplying the coefficients by the appropriate LAI value and coefficient specific for each modeling class and structural stage. Non-woody vegetation types were assigned a minimum sapwood tissue as a substitute for reproductive and storage compartments not defined in the model.

BGC Outputs

The purpose of the CRB-BGC simulations were to provide a broad summary of both the productivity and the ecophysiological robustness for historic, current, and projected future vegetation over a large area under a variety of climatic conditions. Because of the broad scale of the analysis and the large data volume associated with spatial outputs, a limited number of the many potential output variables were selected for inclusion in further analysis. These raw outputs included: gross photosynthesis, maintenance respiration for each carbon compartment, evaporation, transpiration, hydrologic outflow, and the scalars controlling soil and litter decomposition. Annual totals for each of these variables, for each climate year, and for each vegetation scenario, were generated for each simulation gridcell, resulting in a collection of annual summary maps. These summary maps were used to generate the final output products, each of which is discussed in a following section.

BGC generates several spatial data layers describing the state of ICRB ecosystem processes for each simulation run. To reduce complexity and emphasize brevity, only four of these data layers will be discussed in this chapter.

The ICRB EIS team posed several questions they wanted answered from ecosystem process modeling:

1. What is the productivity across the ICRB, how has it changed from historical conditions, and how will it change as a consequence of our current and future management actions?

2. Where are the risks for increased insect, disease or fire disturbances under various management strategies? How do we quantify ecosystem "health" or integrity?

3. What areas are at risk for declines in long-term site productivity? Where do we have high nutrient availability?

White and others (1996) developed four indices that can be used to answer these questions. Table 3 presents these indices and provides general statistics about these indices across the ICRB. The following is a detailed description of each variable.

Net primary production--From annual summaries of gross photosynthesis (GPSN) and maintenance respiration for all carbon compartments ($\sum MR$), net primary production (NPP) was estimated as:

$$NPP = GPSN - \sum MR \quad \text{Equation 2.}$$

As noted above, growth respiration was not estimated, and our estimates of NPP

should therefore be reduced by 20-40% for comparison to field estimates. In general NPP indicates how fast the vegetation is growing. This number is a good index to describe the growth potential of an ecosystem.

Carbon stress index--In order to summarize the influence of respiration costs on the productive potential of the vegetation, a ratio of maintenance respiration to gross photosynthesis was calculated called the carbon stress index (CSI). This index describes the balance between annual gross productivity and maintenance costs. Values close to 1.0 indicate that most of the annual production of photosynthate is being consumed in the maintenance of living tissue, while values close to 0.0 indicate that a large surplus of the annual photosynthate production remains after maintenance costs are met, allowing, for example, allocation to new growth, production of protective compounds or reproduction.

This index is designed as an estimator of ecophysiological health and relative susceptibility to disease or insect attack. It is more diagnostic in these respects than, for example, NPP, because it places vegetation types with different productive potentials on the same scale for the comparison of relative robustness or, alternatively, susceptibility. For example, in the comparison of a mature forest type with a shrub/regeneration type, NPP estimates might be higher for the forest than for the shrub, with the potential interpretation that the forest is more robust or less susceptible to disease or drought. Depending on the amount of live tissue being supported in each of these communities, the CSI might reveal that the forest uses 80 percent of its annual photosynthate production in maintenance costs, while the shrubs are using only 40 percent, providing an alternative interpretation of the relative health of the two communities. CSI values of greater than 80

percent indicate high carbon stress and poor ecosystem health. CSI values of 60-80 percent indicate moderate stress and values less than 60 percent describe healthy, unstressed ecosystems. Strong carbon balances (CSI < 60%) have plenty of carbon available for growth, reproduction and defensive chemistry. Weak carbon balances will have less energy allocated to the carbon sinks.

There are regions in the CSI outputs which have values greater than 1.0, indicating maintenance respiration costs for the year were higher than the gross production of photosynthate. Perennial vegetation types with storage reserves can be expected to withstand such conditions for a limited time. For example, a mature forest may be able to withstand a particularly dry year or an insect defoliation event which results in a net loss of photosynthate by using carbohydrate reserves stored in stem and root tissue, but these reserves are reduced and successive years with low production or high maintenance costs are more likely to cause mortality. Vegetation without adequate reserves, annual plants or tree saplings for example, would not be expected to withstand these conditions for even a single year. Because the vegetation types and structural stages for the CRB-BGC simulations were determined externally, with no mechanistic feedbacks between vegetation type and climate or soils, some instances of CSI > 1.0 are likely to be the result of a mismatch between estimated site conditions and designated vegetation type or structural stage. In other cases the spatial and temporal variability of meteorological conditions and vegetation communities could result in accurate predictions of high values for the CSI. Without a mechanistic interaction between meteorology, soils, and vegetation type or structural stage or biomass, it is difficult to discern between these cases.

Water stress index--Water availability is a key limiting factor for much of the study region, and this limitation is summarized in terms of the ratio of

total annual evapotranspiration (ET) to total annual precipitation, the water stress index (WSI). Values close to 1.0 are generally indicative of arid conditions, with low soil moisture content and very likely limitations to production imposed by water stress. Values close to 1.0 can also indicate regions of substantial precipitation and high evaporative demand, which would not typically be considered arid, but which make water stress susceptibility for vegetation with high leaf area a consideration. Low values are indicative of a water surplus, which under annual soil water equilibrium conditions is manifested as hydrologic outflow. Very low values of the WSI are characteristic of upper elevation sites with abundant winter precipitation, and sparsely vegetated sites at lower elevations that receive precipitation in excess of bare soil evaporation. Low WSI values (<65 percent) indicate an excess of water available to the vegetation on the pixel and are generally associated with regions of high outflow such as subalpine, timberline and alpine areas. Moderate WSI values of 65 to 85 percent signify water may be limiting to plant growth during some part of the growing season. High values (>85 percent) indicate water is limiting to plant growth and most precipitation is being used by the vegetation or lost through evaporation, and there is little to no hydrologic outflow or groundwater recharge.

Nutrient availability index--Although the current analysis lacks many of the components required for a realistic estimation of nutrient availability, a few of the most relevant factors were summarized into the nutrient availability index (NAI). Note that the term "nutrient" means principally nitrogen, although some of what follows is applicable to other nutrients as well. The decomposition of organic matter in the litter and in the soil is the principal nutrient source for vegetation which lacks the ability to fix atmospheric N_2. Described above is the estimation of a composite decomposition scalar, which integrates the effects of both soil moisture and temperature on the relative decomposition rate. The most important pool acted upon by this scalar is the

litter organic matter, since its high N:C ratio provides a good substrate for the heterotrophs that do the work of decomposition. The soil organic carbon pool, although typically many times larger than the litter organic carbon pool, is of a poorer quality (lower N:C) and so decomposes more slowly and is of less importance in the release of nutrients to the plant available pools. The single best estimate of inputs to the litter organic matter pool, from the choices available under the constraints of these simulations, is NPP. This argument rests on an assumption of equilibrium, that on an annual basis all the organic matter resulting from NPP will be returned to the litter, either as leaf, stem, or root turnover. This is clearly not entirely accurate, since conditions of net growth and net decline of live biomass are very common. However, it is likely that these non-equilibrium components (growth and decline) will be correlated with NPP, and so as a relative scalar of potential decomposition, NPP seems a logical choice. By multiplying the annual average decomposition scalar by the annual NPP, a value for the NAI was created which is comparable across vegetation types.

This index is a crude approximation of the potential nutrient availability from the rate of decomposition and productivity. NAI is defined as a decomposition scalar (d_s) multiplied by NPP as defined above. The decomposition scalar is a function of daily soil temperature and soil water content summed over the year (Running and Hunt 1993). High values are associated with wet, warm soils and low values can indicate cold and/or dry soils. The decomposition scalar represents the potential rate of decomposition on a pixel. The actual rate of decomposition is dependent on the supply of litter and other organic material to the forest floor. A reasonably good representation of the potential organic material supply can be portrayed by NPP since NPP is directly proportional to litter production. The product of NPP and decomposition scalar describes the likely amount of decomposition for that year. The connection between this index and nutrient

availability is a function of litter quality or lignin content. No attempt was made to integrate lignin interactions into NAI. Low values (>0.05) signify low rates of decomposition and high amounts of nutrients tied up in the forest floor and plant parts. High values (<0.25) indicate rapid decomposition rates and highly productive environments and more nutrients available for plant growth.

BGC Limitations

Most limitations of the ICRB BGC application results concern problems of scale. The scale of independently created layers of vegetation did not always compare to the scale of the ecophysiological parameters, soils layers or digital elevation model. As a result, it was difficult to get some spatial locations to agree across all data layers, and it was difficult to parameterize the ecophysiological file to agree to the vegetation and site layers. Therefore, there are some areas at the extreme parts of a species or lifeform's range that are not modeled with high accuracy. However, areas representing modal conditions of a particular ecosystem are simulated quite well using BGC.

It was especially difficult to mesh the independently-created weather data layers with vegetation data layers and expect complete correspondence. There will be groups of pixels where climate and soils do not support the vegetation depicted in the cover type and structural stage data layers. The result are negative NPP calculations because the ecophysiological file does not match the weather data and/or soils layers. An example of this was produced for the zone between lodgepole pine and sagebrush shrublands. The weather data for the lodgepole pine stands was more typical of sagebrush shrublands and there probably wasn't enough water available to support trees. However, ecophysiological parameters for lodgepole pine forests were used in BGC and

negative productivity values were calculated. All negative values for NPP were set to 1.0 in the data layers for subsequent analysis.

Another serious scale limitation for this application of BGC is that each unique combination of cover type and structural stage was assigned a single LAI value based on the average for the spatial extent of that combination as derived from the 1990 AVHRR satellite image. Because cover types and structural stages are rather broad, a distribution of LAI around an average value for each combination is expected. The lower range of this LAI distribution would most likely occur on the more water- or temperature stressed ranges of the cover type/structural stage combination, and higher LAI values occur the wetter/warmer sites. As a result, these simulations most likely over-predict stress on the poorest sites (e.g., dry sites with artificially high LAI) and under-predict productivity on the best sites (e.g., high NPP because too low an LAI). These limitations can be addressed by a more sophisticated land cover and structural stage classification, a more detailed representation of the ecological parameters, and perhaps most effectively through iterative model simulations which allow some degree of equilibration between weather, soils and vegetation input values.

One last scale limitation is the obvious problem of meshing 2 km BGC output to the other 1 km ICRB data layers. The composition of the four, 1 km pixels comprising a 2 km pixel can be quite diverse, especially on the edges of biomes changes. This was an unavoidable consequence of using a highly sophisticated, computer-resource intensive ecosystem process model on such a large landscape.

The ICRB Application

BGC was applied to all lands within the ICRB for each of the four management

futures designed for the ICRB scientific assessment (Table 4) for each selected simulation year (10, 50, 100) for each weather year (82, 88, 89). The model was also run for the current and historical (circa 1900) landscape conditions. As mentioned, the developed or predicted cover type and structural stage data layers used to describe the vegetation were either created for CRBSUM input data layers (current and historical conditions) or generated from CRBSUM directly (simulation years 10, 50, 100). BGC simulated ecosystem trends across all vegetation types and geographic areas with the same level of intensity. This included human-altered land types such as agricultural lands and exotic-dominated forblands. Ecosystem processes were simulated at a 2 km pixel resolution which was the resolution of the weather data. It was difficult to initialize BGC with reasonable site conditions, so the model was executed for one year and the conditions simulated at the end of that year were used as starting conditions for the actual simulation year that output was reported. This paper will only present the BGC simulation results for the current and historical conditions for the 1989 weather year for brevity.

EVALUATION OF ECOSYSTEM PROCESSES FROM HISTORICAL TO CURRENT CONDITIONS

ICRB Input Data Layers

Current and historical cover type and structural stage maps were used to develop the input layers required by BGC. The current data layers describe conditions as they occurred circa 1990 while the historical layers describe conditions as they occurred around the turn of the century (circa 1900). Land management policies have changed drastically during the last 90 years. Major land areas were burned during the 1910 and 1929 fire years. Grazing pressure remained quite high during the first part of this century. The harvest of the region's timberlands was probably highest from the 1950's to 1970's.

Current conditions--The current cover type map was created by Hardy and others (1995) by revising and refining a land cover characterization map that was constructed from a classification of AVHRR satellite imagery (Loveland and Ohlen 1993, Loveland and others 1991). This map was further refined using information gained from workshops attended by ICRB ecologists (Keane and others 1996). The current structural stage map was created from a discriminant analysis of mid-scale data layers extrapolated to the coarse scale (Keane and others 1996).

Historical conditions--An historical cover type map was produced by Losensky (1994) using archived maps and government records published near the turn of the century. Because this map was compiled from many maps of varying scales and quality, it was difficult to cross-reference historical to current cover types. This was especially true for urban and agricultural areas. Consequently, many historical cover type classes were changed to current cover type categories. The historical structural stage map was stochastically generated from historical information compiled by Losensky (1994) where structural stages were proportioned by historic cover type and county. This information was summarized to compute structural stage percentages by cover type by ecological section (Baily 1995) using GIS overlay techniques (Keane and others 1996) to determine the structural stage of each pixel based on the percentages in historic cover type and section.

BGC Simulation Results

PVG summary--Simulation results of the four described indices are contrasted across current and historical conditions in Appendices 6 through 9 for the entire ICRB. Ecosystem process changes within the Potential Vegetation Groups (PVG) are primarily a consequence of changes in Species Physiognomic Groups (SPG) that reflect landscape management in the last 90 years (Tables 5 and 6).

There are major decreases (about 5%) in productivity (NPP) in several ICRB PVG's with the primary losses in Urban, Alpine, Cool Shrub and Dry Grasslands. There is an average of -0.1 decrease in NPP across all PVG's excluding Urban, Water, Rock and Agriculture. Woodland PVG's experienced an increase in NPP, probably a result of the conversion of fire-maintained upland grasslands and shrublands to woodland types. All non-forest PVG's experienced a decline in NPP, but only the Moist Forest PVG had NPP decreases (Appendix 6).

Nearly all decreases in productivity were accompanied by increases in carbon stress (CSI) which would indicate that these forests are also at risk for insect and disease infestations. An interesting exception are the Alpine and Rock PVG's where the increase in NPP has caused more carbon stress, presumably because these environments are already highly stressed. Usually, gains in NPP also meant more water being used by the plants and higher water stress (WSI). This indicates less water available for runoff and irrigation. The PVG's that experienced in increase in water availability are Alpine, Cool Shrub, and Rock, presumably because of thin soils and low water holding capacity. These PVG's are minor components of the ICRB landscape. In general, ICRB vegetation are using much more water now than historically. Nutrient availability has decreased for many PVG's, except Cold Forest and Woodland types. This means more nutrients are trapped in the litter and unavailable for plant growth. Low NAI indices are an indication of declines in long-term site productivity.

Ownership and PVG summary--Appendix 7 shows that the biggest losses in productivity on BLM/FS lands occur in the Dry Grass PVG (19% decline) while the biggest loss on all other ownership occurs in the Urban PVG. Woodlands increased in productivity on non-BLM/FS lands and decreased on BLM/FS lands with a corresponding decrease in forest health (CSI decline). Overall, declines in NAI or long-term site productivity are less in BLM/FS lands.

Species Physiognomic Group (SPG) summary--Most SPG's (12 of 17) experienced declines in productivity (NPP) over the last 90 years (Appendix 8). Major losses (>10% decline) occurred in the Late Seral Intolerant Multistrata Forests, Mid Seral Intolerant Forests, Riparian Herb and Woodland Upland. These NPP declines were the result of land area losses and conversions to other PVG's. The major increases in carbon stress (CSI) are in Riparian Herb and most late seral forests. Water availability increased (decrease in WSI) in all but Riparian Herb and Mid Seral Tolerant Forests, with the major increases in early seral types presumably because of lower leaf areas. SPG's with the biggest declines in long-term site productivity are the two herblands (Upland and Riparian) and Mid Serial Intolerant Forests. Most SPG's (10 of 17) had declines in nutrient availability.

SPG and ownership summary--There is very little difference between ownerships for most SPG (Appendix 9).

Landscape Shifts

This section deals the consequences of the conversion of one SPG to another within a PVG. Only the major shifts will be evaluated using Appendix 10. Most Cold Forests went from late seral conditions to early seral conditions resulting in declines of NPP, increases in CSI, higher water availability and higher decomposition rates. Cool Shrub PVG's mostly experienced changes from herb or shrublands to woodlands that caused a decrease in NPP, higher carbon stress, less water and less nutrient cycling. Dry Forest PVG went mostly from fire-maintained grass/shrub to early seral forests and from early seral forests to late seral forests with multiple strata. This resulted in minimal gains in productivity but increases in carbon stress and water stress and decreases in nutrient availability. Dry Shrub PVG stayed mostly the same with most changes to grasslands or exotics. However, changes from herblands to

shrublands caused a high increase in NPP and decrease in CSI. Moist Forest PVG had advances in succession usually causing some increase in NPP but higher carbon stress and lower cycling potential. Riparian Woodland PVG made great gains from herblands to woodlands resulting in increases of NPP and decreases in carbon stress and NAI.

SUMMARY

General Results Statements -- Historical to Current

The following set of statements summarize the BGC simulation results contrasting current and historical conditions. These statements were derived from results shown in Appendix 11 and Appendix 12.

Concerning Productivity (NPP):

1. Intolerant forest SPG's are less productive than tolerant SPG's probably because of lower leaf areas and high stem respiration costs.

2. Early seral forests are more productive than late seral forests and mid seral forests are often very productive.

3. Riparian communities are much more productive than upland sites.

4. Exotics have less productivity than native vegetation and also have higher carbon stresses and lower nutrient turnover.

5. Ecosystem processes simulated for Water, Urban and Agriculture do not compare well with the other vascular plant dominated ecosystems because of the broad assumptions used to quantify the parameters that

describe these land classifications.

6. In general, productivity across PVG's seems to follow conventional wisdom with NPP values lowest in the driest or coldest ranges of a biome and increasing as moisture or temperature increases. However, grasslands, shrublands and forests have comparable NPP values.

7. Conversion of native grass and shrublands to agriculture has generally increased productivity but that increase is mainly due to fertilization and irrigation influencing the high leaf areas on agricultural lands.

8. Riparian ecosystems have high productivity but high carbon and water stress because BGC does not simulated subsurface water use by plants. The riparian ecophysiologic parameters have high leaf area indices but the weather data does not support this much leaf area. As a consequence, there are much higher WSI values due to the high water usage.

Concerning Carbon Stress (CSI):

1. The highest carbon stressed PVG's occur in the driest areas. The productive moist forests, however, have some of the lowest CSI values, indicating less stress.

2. Intolerant forests have higher carbon stress than tolerant forests because tolerant forests have lower respiring live stem tissue.

3. Upland shrub and herblands have higher CSI values than riparian sites.

Concerning Water Stress (WSI):

1. Water stress usually increases with successional status, with more water available in early seral communities probably due to the lower leaf areas.

2. The highest water stress values are in riparian environments because of high leaf areas.

Concerning Long-Term Site Productivity (NAI):

1. In general, nutrients are more available in early to mid seral forest settings.

2. Single-layer forests have higher rates of decomposition than multistrata forests.

3. Herb and shrublands have higher nutrient turnover than forests.

BGC Attributes for ICRB Vegetation Types

A synthesis of the four BGC output variables for all PVG's and SPG's is presented by forested and non-forested environments in Tables 5 to 12. These tables provide a means for extrapolating BGC results from this effort to the interpretation of management alternatives in the development of the EIS.

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Table Captions

Table 1-- Cross-reference of Biome-BGC forest structural stages with those used in the ICRB scientific assessment.

Table 2-- Cross-reference of Biome-BGC cover types with those used in the ICRB scientific assessment.

Table 3-- Description of Biome-BGC output indices used to describe ecosystem trends across the ICRB. Statistics are for current vegetation conditions for the normal weather year (1989).

Table 4-- General description of the four management futures simulated by CRBSUM. These futures were designed by altering disturbance probabilities.

Table 5-- Average net primary productivity (NPP) estimates for forested ecosystems.

Table 6-- Average net primary productivity (NPP) estimates for forested ecosystems.

Table 7-- Average estimates for carbon stress index (CSI) in the forested environments.

Table 8-- Average carbon stress index (CSI) estimates for non-forested ecosystems.

Table 9-- Average water stress (WSI) estimates for forested ecosystems.

Table 10-- Average water stress index (WSI) for non-forest environments.

Table 11-- Average nutrient availablity index (NAI) estimates for forested environments.

Table 12-- Average nutrient availability index (WAI) estimates for non-forested ecosystems.

Appendix Captions

Appendix 1-- Aggregation of the CRB Vegetation Types into Modeling Types Based on Drought Tolerance.

Appendix 2-- Aggregation of the CRB Structural Stages into Simple Modelling Stages.

Appendix 3-- Ecophysiological Constants Used for the CRB BGC Analysis.

Appendix 4-- NDVI derived LAI Values, Corrected LAI values, and Correction Coefficients.

Appendix 5-- Sapwwod Mass to Total Leaf Area Coefficients.

Appendix 6-- Change Between Historic and Current by PVG.

Appendix 7-- Change Between Historic and Current by Ownership and Physiognomic Type.

Appendix 8-- Change Between Historic and Current by Physiognomic Type.

Appendix 9-- Percent Change Between Historic and Current by Ownership and Physiognomic Type.

Appendix 10-- Percent Change Between Historic and Current by PVG and Physiognomic Types.

Appendix 11-- Current Conditions (1989 Weather Year) -- Using Current PVG and Physiognomic Type.

Appendix 12-- Historic Conditions (1989 Weather Year) -- Using Current PVG and Historic Physiognomic Type.

Appendix 1: Aggregation of the CRB Vegetation Types into Modeling Types Based on Drought Tolerance

Model Vegetation Types & Drought Tolerance (Abbreviation)	CRB Vegetation Types (GIS #)
Coniferous Forest Intolerant (CFI)	Western redcedar/western hemlock (29)
Coniferous Forest Moderate (CFM)	Pacific silver fir/mt. hemlock (5), Mixed conifer woodlands (33), Grand fir/white fir (13), Red fir (15), Mt. hemlock (20), Englemann spruce/subalpine fir (21), Interior Douglas fir (23), Western larch (24), Western white pine (25), Sierra Nevada mixed conifer (33)
Coniferous Forest Tolerant (CFT)	White bark pine/alpine larch (14), White bark pine (22), Lodgepole pine (27), Limber pine (28), Interior ponderosa pine (32), Pacific ponderosa pine (34)
Coniferous Forest Very Tolerant (CFVT)	Juniper woodlands (6), Juniper/big sage/bluebunch wheatgrass (8), Western juniper Juniper/big sage/bluebunch wheatgrass (37)
Deciduous Forest Intolerant (DFI)	Cottonwood/willow (31)
Deciduous Forest Moderate (DFM)	Aspen (26)
Deciduous Forest Tolerant (DFT)	Oregon white oak (30)
Shrub Intolerant (SI)	Herbaceous wetland/shrub (9)
Shrub Moderate (SM)	Seral shrub-regen (1), Mountain mahogany (39), Mountain shrub (45)
Shrub Intolerant (SI)	Antelope bitterbrush/bluebunch wheatgrass (36), Basin big sage (40), Mountain big sagebrush (41), Wyoming big sagebrush (42), Low sage (43), Salt desert shrub (44)
Grassland/Forbs (G/F)	Open grassland (10), Native forb (11), Exotics (12), Urban (18), Bluebunch wheatgrass (35), Idaho fesue/bluebunch wheatgrass (38)
Herbaceous wetland (W)	Herbaceous wetlands (4)
Alpine Tundra (T)	Alpine tundra (2)
Agriculture (A)	Irrigated cropland and pasture (16), Dry cropland and pasture (17)

Appendix 2: Aggregation of the CRB Structural Stages into Simple Modeling Stages

Modeling Stage	CRB Structual Stage (GIS #)
Early	Stand initiation (1), Woodland stand initiation (11)
Middle	Stem exclusion open canopy (2), Stem exclusion closed canopy (3), Understory reinitiation (4), Young forest multi-strata (5), Woodland stem exclusion (12), woodland understory reinitiation (13), Young woodland multi-strata (14)
Late	Old forest multi-strata (6), Old-forest single-strata (7), Old woodland multi-strata (15), Old woodland single-strata (16)
Shrub	Closed low shrub (23), Open low shrub (24), Open mid shrub (25), Closed mid shrub (26), Open tall shrub (27), Closed tall shrub (28)

Appendix 3: Ecophysiological Constants Used for the CRB BGC Analysis

Constant	CFI	CFM	CFT	CFVT	DFI	DFM	DFT	SI	SM	ST	G/F	W	T	A
SLA (kg C m^{-2})	35.0	25.0	15.0	10.0	45.0	45.0	40.0	45.0	35.0	25.0	45.0	45.0	30.0	45.0
Total/projected Leaf area	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Precipitation interception (kg H_2O m^{-2} d^{-1})	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Light extinction coefficient (sec m^2 μmol^{-1})	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
% of Leaf N in RuBisCo	0.12	0.10	0.08	0.06	0.15	0.15	0.12	0.15	0.08	0.08	0.10	0.15	0.10	0.15
Shape parameter for PPFD curve	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
T_{opt} for leaf conductance (°C)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
T_{max} for leaf conductance (°C)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Temperature coefficient	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ψ_{leaf} at start of conductance reduction (MPa)	-0.2	-0.3	-0.4	-0.5	-0.2	-0.4	-0.4	-0.2	-0.3	-0.5	-0.3	-0.2	-0.5	-0.5
ψ_{leaf} at stomatal closure (MPa)	-1.5	-2.0	-2.5	-3.0	-1.5	-2.0	-2.0	-2.0	-2.5	-3.0	-2.0	-1.5	-3.0	-1.5
VPD at start of conductance reduction (Pa)	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
VPD at stomatal closure (Pa)	2000.0	2000.0	2000.0	2000.0	4000.0	2000.0	2000.0	4000.0	2000.0	2000.0	2000.0	4000.0	2000.0	2000.0
Maximum stomatal g_{leaf} (m sec^{-1})	0.008	0.006	0.006	0.004	0.010	0.008	0.006	0.010	0.008	0.006	0.008	0.010	0.006	0.010
Cuticular g_{leaf} (m sec^{-1})	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boundary layer conductance g_{leaf} (m sec^{-1})	0.08	0.08	0.08	0.08	0.02	0.04	0.04	0.01	0.02	0.04	0.04	0.01	0.03	0.02
Leaves on/off	0/365	0/365	0/365	0/365	110/300	110/300	110/300	110/300	110/300	0/365	110/300	110/300	110/300	110/300
Fine roots on/off	0/365	0/365	0/365	0/365	110/300	110/300	110/300	110/300	110/300	0/365	110/300	110/300	110/300	110/300
Leaf R_m coefficient at 20 °C (day^{-1})	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Stem R_m coefficient at 20 °C (day^{-1})	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Coarse root R_m coefficient at 20 °C (day^{-1})	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Fine root R_m coefficient at 20 °C (day^{-1})	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Q_{10} for all R_m	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Appendix 4 : NDVI derived LAI Values, Corrected LAI values, and Correction Coefficients

		CFI	CFM	CFT	CFVT	DFI	DFM	DFT	SI	SM	ST	G/F	W	T	A
Early	NDVI-LAI	20.7	9.6	6.9	4.9	NA	8.4	7.6	2.0	6.0	1.5	2.2	2.2	1.6	2.3
Early	Corr-LAI	12.0	6.0	4.0	1.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	2.2	0..5	2.3
Middle	NDVI-LAI	22.7	13.7	8.7	3.3	8.2	8.6	7.7	2.0	6.0	1.5	2.2	2.2	1.6	2.3
Middle	Corr-LAI	14.0	9.0	6.0	2.3	3.0	3.0	3.0	2.0	1.5	1.5	1.5	2.2	0..5	2.3
Late	NDVI-LAI	25.4	12.1	7.2	NA	8.8	NA	8.4	2.0	6.0	1.5	2.2	2.2	1.6	2.3
Late	Corr-LAI	15.5	7.0	5.0	2.0	3.5	3.5	3.5	2.0	1.5	1.5	1.5	2.2	0..5	2.3
	Ratio	0.62	0.66	0.69	0.70	0.37	0.35	0.39	1.0	0.25	1.0	0.68	1.0	0.31	1.0

Appendix 5: Sapwwod Mass to Total Leaf Area Coefficients

Stage	CFI	CFM	CFT	CFVT	DFI	DFM	DFT	SI	SM	ST	G/F	W	T	A
Early	0.00752	0.00930	0.01044	0.02027	0.01525	0.01304	0.01353	0.00500	0.09740	0.00600	0.00001	0.00001	0.00001	0.00001
Middle	0.00986	0.01315	0.01438	0.02658	0.02778	0.02140	0.02271	0.00500	0.09740	0.00600	0.00001	0.00001	0.00001	0.00001
Late	0.01420	0.02263	0.02609	0.05217	0.04348	0.06030	0.07135	0.00500	0.09740	0.00600	0.00001	0.00001	0.00001	0.00001

APPENDIX 6

Change Between Historic and Current by PVG

OBS	CUR_PVG	HIS_KM	CUR_KM	PERCHKM	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG
1	AGRICULT	118363	118363	0	5.55	5.22	8.54	12.94	-18.21
2	ALPINE	3727	3727	0	-7.36	-7.03	-0.41	-1.88	-4.49
3	COLD FOR	99153	99153	0	2.12	2.80	-5.34	0.30	3.05
4	COOL SHB	56952	56952	0	-6.00	-4.22	7.95	-0.32	-5.38
5	DRY FOR	146615	146615	0	4.21	4.78	4.01	4.88	-6.14
6	DRY GRS	41059	41059	0	-4.41	-6.54	3.05	1.70	-9.11
7	DRY SHR	209953	209953	0	-4.84	-2.16	4.00	0.48	-2.51
8	MOIST FOR	112104	112104	0	-2.14	-2.21	1.25	1.55	-5.51
9	RIP SHR	5500	5500	0	-3.82	-3.29	2.00	3.60	-14.83
10	ROCK	2299	2299	0	-5.26	-5.71	-3.63	-2.61	-0.71
11	URBAN	1143	1143	0	-18.04	-23.03	39.81	9.51	-32.78
12	WATER	7550	7550	0	3.95	4.74	-2.02	2.80	0.40
13	WOODLAND	4748	4748	0	8.09	10.54	-2.39	1.60	10.63
14	RIP WDLND	12194	12194	0	13.48	13.15	-9.60	3.18	3.10

APPENDIX 7

Change Between Historic and Current by Ownership and Physiognomic Type.

OBS	OWN	CUR_PVG	KM	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG
1	BLM/FS	AGRICULT	2188	-11.55	-12.18	19.10	7.92	-31.44
2	BLM/FS	ALPINE	3209	-9.24	-8.05	-0.11	-2.10	-4.64
3	BLM/FS	COLD FOR	80076	1.96	2.56	-5.72	0.00	3.41
4	BLM/FS	COOL SHB	34759	-5.58	-3.75	5.89	-0.50	-3.79
5	BLM/FS	DRY FOR	77257	3.22	3.79	-0.96	1.45	1.24
6	BLM/FS	DRY GRS	13657	-14.91	-18.99	0.23	-2.85	-11.23
7	BLM/FS	DRY SHR	134521	-5.92	-3.33	5.57	0.41	-3.77
8	BLM/FS	MOIST FOR	68765	-3.14	-3.14	-0.17	0.11	-4.20
9	BLM/FS	RIP SHR	2806	-5.19	-5.27	2.07	3.81	-19.63
10	BLM/FS	ROCK	2050	-5.91	-6.55	-3.24	-2.52	-1.85
11	BLM/FS	URBAN	2	10.65	10.65	39.22	17.31	-31.25
12	BLM/FS	WATER	1214	2.19	3.62	-4.63	-1.35	7.98
13	BLM/FS	WOODLAND	2144	-3.93	-4.60	6.22	0.08	-3.82
14	BLM/FS	RIP WDLND	5976	10.38	8.52	-7.51	2.49	1.48
15	Other	AGRICULT	116175	6.21	5.51	8.34	13.03	-18.02
16	Other	ALPINE	518	0.89	-2.44	-1.82	-0.62	-4.34
17	Other	COLD FOR	19077	2.80	3.90	-3.69	1.47	1.76
18	Other	COOL SHB	22193	-6.51	-5.02	11.08	-0.02	-7.90
19	Other	DRY FOR	69358	5.54	6.04	9.87	8.28	-12.66
20	Other	DRY GRS	27402	2.57	0.11	4.60	3.57	-8.37
21	Other	DRY SHR	75432	-3.32	-0.12	1.33	0.60	-0.50
22	Other	MOIST FOR	43339	-0.11	-0.32	3.35	3.34	-7.77
23	Other	RIP SHR	2694	-2.59	-1.47	2.01	3.37	-10.45
24	Other	ROCK	249	-2.01	-0.19	-6.33	-2.87	5.17
25	Other	URBAN	1141	-18.11	-23.05	39.84	9.38	-32.70
26	Other	WATER	6336	4.76	5.20	-1.13	3.83	-1.95
27	Other	WOODLAND	2604	18.36	21.18	-9.47	2.67	18.90
28	Other	RIP WDLND	6218	16.83	18.15	-11.36	3.67	4.55

APPENDIX 8

Change Between Historic and Current by Physiognomic Type

OBS	PHYSG	HIS_KM	CUR_KM	PERCHKM	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG
1	Agricultural	.	118363	.	.	.	.	.	.
2	Exotics	.	11378	.	.	.	.	.	.
3	Rock/Barren	2299	2299	0.00	-5.26	-5.71	-3.63	-2.61	-0.71
4	Urban	.	1143	.	.	.	.	.	.
5	Water	7561	7550	-0.15	3.75	4.74	-1.98	2.85	0.37
6	Alpine	3729	3727	-0.05	-7.42	-7.06	-0.48	-1.94	-4.55
7	Upland Herb	122962	46156	-62.46	-59.65	-9.00	6.33	-5.02	-31.73
8	Upland Shrub	311641	236839	-24.00	-32.78	-5.26	5.34	-1.53	-9.63
9	EarSerIntFor	72024	49849	-30.79	-31.06	-3.30	-8.19	-19.76	-1.37
10	LatSerIntFoMultL	36992	16654	-54.98	-63.61	-13.35	4.05	3.56	-11.34
11	LatSerIntFoSingL	44987	25863	-42.51	-40.28	8.01	-6.58	-16.39	9.24
12	MidSerIntFor	97756	110603	13.14	-1.12	-14.84	6.05	17.10	-16.31
13	EarSerTolFor	16809	21301	26.72	20.47	3.90	-12.48	-19.08	1.80
14	LatSerTolFoMultL	20609	18986	-7.88	-17.76	-9.34	7.28	8.19	-0.04
15	LatSerTolFoSingL	4873	7496	53.83	31.70	1.31	1.49	-6.26	33.10
16	MidSerTolFor	44620	100006	124.13	117.95	-0.89	3.47	20.10	3.15
17	Riparian Herb	1999	1316	-34.17	-37.63	-29.21	15.26	11.99	-46.66
18	Riparian Shrub	5309	2906	-45.26	-40.69	-6.80	-2.95	-3.64	-10.50
19	Riparian Woodlnd	8972	17283	92.63	148.06	8.84	-1.88	-3.19	1.50
20	Woodland Upland	18218	21642	18.79	-10.12	-21.96	1.61	8.20	11.77

APPENDIX 9

Percent Change Between Historic and Current by Ownership and Physiognomic Type

7

OBS	OWN	PHYSG	HIS_KM	CUR_KM	PERCHKM	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG
1	BLM/FS	Agricultural	.	2188	.	.	.	.	.	.
2	BLM/FS	Exotics	.	7532	.	.	.	.	.	.
3	BLM/FS	Rock/Barren	2050	2050	0.00	-5.91	-6.55	-3.24	-2.52	-1.85
4	BLM/FS	Urban	.	2	.	.	.	.	.	.
5	BLM/FS	Water	1214	1214	0.00	2.19	3.62	-4.63	-1.35	7.98
6	BLM/FS	Alpine	3209	3209	0.00	-9.24	-8.05	-0.11	-2.10	-4.64
7	BLM/FS	Upland Herb	20833	18303	-12.14	-8.16	3.61	2.57	-5.24	-9.62
8	BLM/FS	Upland Shrub	163376	152386	-6.73	-15.35	-1.58	2.35	-0.24	-1.99
9	BLM/FS	EarSerIntFor	38608	33563	-13.07	-21.18	-10.14	-8.70	-15.16	-0.11
10	BLM/FS	LatSerIntFoMultL	22458	12084	-46.19	-57.69	-15.21	5.97	5.81	-10.95
11	BLM/FS	LatSerIntFoSingL	25770	16865	-34.56	-36.25	-0.22	-4.56	-17.56	-1.49
12	BLM/FS	MidSerIntFor	65378	60968	-6.75	-11.89	-9.46	4.69	9.69	-14.32
13	BLM/FS	EarSerTolFor	13316	17650	32.55	24.71	2.61	-11.99	-19.23	1.47
14	BLM/FS	LatSerTolFoMultL	15944	14435	-9.46	-17.91	-7.67	7.00	10.47	2.24
15	BLM/FS	LatSerTolFoSingL	3455	4242	22.78	10.54	3.48	0.87	-7.02	37.09
16	BLM/FS	MidSerTolFor	35338	60469	71.12	80.08	4.00	0.90	12.82	5.91
17	BLM/FS	Riparian Herb	118	626	430.51	429.69	7.19	-22.08	27.48	43.23
18	BLM/FS	Riparian Shrub	910	1426	56.70	38.47	1.71	-12.52	-1.09	4.42
19	BLM/FS	Riparian Woodlnd	5395	10622	96.89	167.68	9.24	-5.74	-3.96	3.02
20	BLM/FS	Woodland Upland	11252	8790	-21.88	-43.73	-24.84	0.48	8.74	15.87
21	Other	Agricultural	.	116175	.	.	.	.	.	.
22	Other	Exotics	.	3846	.	.	.	.	.	.
23	Other	Rock/Barren	249	249	0.00	-2.01	-0.19	-6.33	-2.87	5.17
24	Other	Urban	.	1141	.	.	.	.	.	.
25	Other	Water	6347	6336	-0.17	4.46	5.17	-1.10	3.89	-2.00
26	Other	Alpine	520	518	-0.38	0.52	-2.53	-2.22	-0.96	-4.52
27	Other	Upland Herb	102129	27853	-72.73	-70.58	-4.60	3.46	0.59	-25.94
28	Other	Upland Shrub	148265	84453	-43.04	-47.58	-7.98	9.43	-1.72	-14.23
29	Other	EarSerIntFor	33416	16286	-51.26	-45.80	6.95	-8.51	-18.57	3.17
30	Other	LatSerIntFoMultL	14534	4570	-68.56	-73.85	-12.48	2.40	4.42	-11.32
31	Other	LatSerIntFoSingL	19217	8998	-53.18	-46.37	21.53	-8.39	-12.00	29.24
32	Other	MidSerIntFor	32378	49635	53.30	22.99	-19.20	5.63	20.59	-18.96
33	Other	EarSerTolFor	3493	3651	4.52	4.55	9.98	-13.97	-14.80	6.06
34	Other	LatSerTolFoMultL	4665	4551	-2.44	-17.25	-14.72	7.94	1.12	-7.07
35	Other	LatSerTolFoSingL	1418	3254	129.48	85.20	-0.43	0.41	-9.42	22.50
36	Other	MidSerTolFor	9282	39537	325.95	259.05	-7.39	5.43	19.83	-7.19
37	Other	Riparian Herb	1881	690	-63.32	-58.87	-13.72	1.59	1.47	-34.98
38	Other	Riparian Shrub	4399	1480	-66.36	-63.09	-16.12	9.83	-4.56	-19.99
39	Other	Riparian Woodlnd	3577	6661	86.22	118.01	8.07	4.28	-1.36	-0.29
40	Other	Woodland Upland	6966	12852	84.50	40.33	-21.19	3.91	3.20	0.58

Percent Change Between Historic and Current by PVG and Physiognomic Types
Eq: (((CUR_NPP - HIS_NPP) / HIS_NPP) * 100)

OBS	CUR_PVG	HIS_PHY	CUR_PHY	KM_SUM	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG
1	AGRICULT	Upland Herb	Agricultural	45718	40.49	47.26	-24.21	7.42	22.38
2	AGRICULT	Upland Shrub	Agricultural	59745	-23.26	-24.43	55.24	20.33	-50.17
3	AGRICULT	EarSerIntFor	Agricultural	2728	26.13	28.45	-23.00	4.95	16.94
4	AGRICULT	LatSerIntFoMultL	Agricultural	902	40.92	41.46	-39.48	-10.18	77.26
5	AGRICULT	LatSerIntFoSingL	Agricultural	1438	56.01	62.56	-39.95	-7.87	104.15
6	AGRICULT	MidSerIntFor	Agricultural	1517	50.14	54.11	-41.49	-9.36	99.98
7	AGRICULT	EarSerTolFor	Agricultural	98	-1.55	0.17	-27.25	-8.71	28.74
8	AGRICULT	LatSerTolFoMultL	Agricultural	205	4.15	5.91	-31.80	-10.88	42.27
9	AGRICULT	LatSerTolFoSingL	Agricultural	102	8.19	9.10	-35.94	-13.36	44.84
10	AGRICULT	MidSerTolFor	Agricultural	289	3.85	4.99	-30.86	-10.85	39.69
11	AGRICULT	Riparian Herb	Agricultural	1335	10.34	4.17	7.53	1.81	3.04
12	AGRICULT	Riparian Shrub	Agricultural	3325	-18.92	-23.65	54.75	-0.16	-18.86
13	AGRICULT	Riparian Woodlnd	Agricultural	45	3.42	4.63	5.24	6.98	-0.55
14	AGRICULT	Woodland Upland	Agricultural	916	3.18	3.71	-29.55	-1.78	11.58
15	ALPINE	Alpine	Alpine	3727	-7.36	-7.03	-0.41	-1.88	-4.49
16	COLD FOR	EarSerIntFor	EarSerIntFor	3304	1.81	2.34	-5.48	-0.94	4.29
17	COLD FOR	EarSerIntFor	LatSerIntFoMultL	280	-1.44	-0.83	10.72	3.98	-9.20
18	COLD FOR	EarSerIntFor	LatSerIntFoSingL	1861	8.35	12.16	19.57	6.31	-1.05
19	COLD FOR	EarSerIntFor	MidSerIntFor	4485	-1.67	-1.69	14.78	6.23	-14.10
20	COLD FOR	EarSerIntFor	EarSerTolFor	1346	25.80	27.81	-14.91	6.22	21.16
21	COLD FOR	EarSerIntFor	LatSerTolFoMultL	263	23.64	27.20	-4.74	7.81	16.67
22	COLD FOR	EarSerIntFor	LatSerTolFoSingL	30	5.95	4.48	30.51	10.14	-35.16
23	COLD FOR	EarSerIntFor	MidSerTolFor	5614	23.57	25.65	11.12	14.13	-5.60
24	COLD FOR	EarSerIntFor	Riparian Woodlnd	709	27.33	30.51	-43.55	1.73	29.46
25	COLD FOR	LatSerIntFoMultL	EarSerIntFor	1379	2.02	2.59	-20.09	-6.95	16.54
26	COLD FOR	LatSerIntFoMultL	LatSerIntFoMultL	386	1.66	1.60	-3.72	-1.64	4.60
27	COLD FOR	LatSerIntFoMultL	LatSerIntFoSingL	464	-0.79	-0.49	-0.79	0.39	-0.53
28	COLD FOR	LatSerIntFoMultL	MidSerIntFor	2388	-0.30	-0.51	1.35	1.48	-3.19
29	COLD FOR	LatSerIntFoMultL	EarSerTolFor	691	24.51	26.03	-25.09	1.25	26.56
30	COLD FOR	LatSerIntFoMultL	LatSerTolFoMultL	130	30.45	29.44	-15.36	4.70	25.58
31	COLD FOR	LatSerIntFoMultL	LatSerTolFoSingL	9	26.44	26.44	-22.91	3.59	23.40
32	COLD FOR	LatSerIntFoMultL	MidSerTolFor	1579	27.08	28.45	-12.45	9.14	17.65
33	COLD FOR	LatSerIntFoMultL	Riparian Woodlnd	494	36.62	38.21	-58.96	-1.16	54.42
34	COLD FOR	LatSerIntFoSingL	EarSerIntFor	207	-4.13	-3.46	-12.75	-6.02	4.77
35	COLD FOR	LatSerIntFoSingL	LatSerIntFoMultL	82	-1.83	-1.04	-2.61	-1.62	1.65
36	COLD FOR	LatSerIntFoSingL	LatSerIntFoSingL	5756	-3.51	-3.08	-1.28	-1.30	-0.35
37	COLD FOR	LatSerIntFoSingL	MidSerIntFor	370	-0.07	-0.67	2.35	2.18	-4.93
38	COLD FOR	LatSerIntFoSingL	EarSerTolFor	423	23.81	27.90	-24.93	3.15	26.98
39	COLD FOR	LatSerIntFoSingL	LatSerTolFoMultL	97	25.19	25.23	-18.84	2.70	26.09
40	COLD FOR	LatSerIntFoSingL	MidSerTolFor	444	23.97	25.37	-9.72	15.05	13.78
41	COLD FOR	MidSerIntFor	EarSerIntFor	5560	0.85	1.58	-21.77	-8.45	18.73
42	COLD FOR	MidSerIntFor	LatSerIntFoMultL	842	1.92	1.72	-5.37	-2.97	7.22
43	COLD FOR	MidSerIntFor	LatSerIntFoSingL	1162	-0.81	-1.38	-2.39	-1.65	-0.37
44	COLD FOR	MidSerIntFor	MidSerIntFor	11278	1.00	0.54	0.33	1.28	-2.17
45	COLD FOR	MidSerIntFor	EarSerTolFor	2957	25.41	28.32	-25.72	0.14	29.67
46	COLD FOR	MidSerIntFor	LatSerTolFoMultL	698	22.11	23.73	-16.96	1.63	21.35
47	COLD FOR	MidSerIntFor	LatSerTolFoSingL	26	28.49	29.95	-25.83	0.69	33.58
48	COLD FOR	MidSerIntFor	MidSerTolFor	8370	22.51	25.93	-11.67	7.26	15.57
49	COLD FOR	MidSerIntFor	Riparian Woodlnd	1711	30.67	36.31	-55.03	-1.53	52.77
50	COLD FOR	EarSerTolFor	EarSerIntFor	1163	-24.76	-25.67	-2.17	-12.79	-10.25
51	COLD FOR	EarSerTolFor	LatSerIntFoMultL	310	-24.76	-25.31	17.64	-5.27	-18.31
52	COLD FOR	EarSerTolFor	LatSerIntFoSingL	8	-26.08	-26.08	5.11	-6.21	-13.89
53	COLD FOR	EarSerTolFor	MidSerIntFor	1146	-24.46	-25.33	20.82	-2.11	-24.72
54	COLD FOR	EarSerTolFor	EarSerTolFor	713	0.83	0.86	-9.00	-4.05	4.72

1[illegible]	COLD FOR	EarSerTolFor	LatSerTolFoMultL	[illegible]	-6.10	-6.36	1.72	-1.98	-4.52
[illegible]	COLD FOR	EarSerTolFor	LatSerTolFoSingL	[illegible]	-0.34	-0.30	7.23	2.74	-13.56
5[illegible]	COLD FOR	EarSerTolFor	MidSerTolFor	1[illegible]	-3.63	-3.63	9.11	3.80	-9.20
58	COLD FOR	EarSerTolFor	Riparian Woodlnd	407	6.16	6.03	-46.87	-5.90	26.18
59	COLD FOR	LatSerTolFoMultL	EarSerIntFor	1942	-25.65	-27.78	-10.18	-12.26	-11.48
60	COLD FOR	LatSerTolFoMultL	LatSerIntFoMultL	107	-24.20	-24.54	12.30	-5.90	-13.50
61	COLD FOR	LatSerTolFoMultL	LatSerIntFoSingL	27	-19.42	-20.11	8.52	-9.39	-8.66
62	COLD FOR	LatSerTolFoMultL	MidSerIntFor	1695	-21.47	-22.15	15.67	-3.63	-20.09
63	COLD FOR	LatSerTolFoMultL	EarSerTolFor	1289	2.09	2.56	-12.67	-4.60	5.50
64	COLD FOR	LatSerTolFoMultL	LatSerTolFoMultL	218	-5.64	-5.68	-2.83	-4.08	-1.27
65	COLD FOR	LatSerTolFoMultL	LatSerTolFoSingL	23	5.32	5.05	-9.23	0.00	12.82
66	COLD FOR	LatSerTolFoMultL	MidSerTolFor	3008	2.61	3.28	1.10	3.07	-0.95
67	COLD FOR	LatSerTolFoMultL	Riparian Woodlnd	483	11.65	12.62	-50.52	-5.77	38.09
68	COLD FOR	LatSerTolFoSingL	EarSerIntFor	397	-19.15	-19.60	-7.98	-13.27	-2.29
69	COLD FOR	LatSerTolFoSingL	LatSerIntFoMultL	42	-21.76	-21.92	13.19	-5.71	-13.77
70	COLD FOR	LatSerTolFoSingL	MidSerIntFor	351	-21.21	-21.30	13.39	-3.11	-20.42
71	COLD FOR	LatSerTolFoSingL	EarSerTolFor	59	2.87	2.81	-7.88	-3.08	10.31
72	COLD FOR	LatSerTolFoSingL	LatSerTolFoMultL	16	-8.93	-8.27	-2.96	-4.16	1.22
73	COLD FOR	LatSerTolFoSingL	LatSerTolFoSingL	16	0.78	0.75	-5.71	-0.11	4.88
74	COLD FOR	LatSerTolFoSingL	MidSerTolFor	372	-1.69	-1.47	2.28	1.84	-4.68
75	COLD FOR	LatSerTolFoSingL	Riparian Woodlnd	320	11.45	12.50	-54.91	-7.21	44.85
76	COLD FOR	MidSerTolFor	EarSerIntFor	3278	-24.30	-25.80	-9.90	-14.60	-6.86
77	COLD FOR	MidSerTolFor	LatSerIntFoMultL	920	-24.40	-25.29	9.73	-10.37	-13.62
78	COLD FOR	MidSerTolFor	LatSerIntFoSingL	53	-19.89	-20.65	4.86	-10.24	-5.15
79	COLD FOR	MidSerTolFor	MidSerIntFor	4207	-22.76	-24.74	14.33	-5.12	-20.11
80	COLD FOR	MidSerTolFor	EarSerTolFor	2276	-0.29	-0.38	-12.66	-6.95	6.34
81	COLD FOR	MidSerTolFor	LatSerTolFoMultL	553	-7.85	-7.64	-3.30	-5.85	0.07
82	COLD FOR	MidSerTolFor	LatSerTolFoSingL	35	2.14	1.88	-7.03	-0.50	9.14
83	COLD FOR	MidSerTolFor	MidSerTolFor	4875	-1.69	-1.54	1.47	0.68	-2.87
84	COLD FOR	MidSerTolFor	Riparian Woodlnd	1255	9.42	10.53	-51.85	-8.38	41.18
85	COLD FOR	Riparian Woodlnd	EarSerIntFor	4	-26.16	-29.46	98.52	-0.85	-36.84
86	COLD FOR	Riparian Woodlnd	MidSerIntFor	13	-2.70	-6.36	42.82	4.65	-15.69
87	COLD FOR	Riparian Woodlnd	LatSerTolFoSingL	15	-18.62	-16.66	78.96	5.29	-47.56
88	COLD FOR	Riparian Woodlnd	MidSerTolFor	187	-11.00	-15.21	96.75	5.74	-39.28
89	COLD FOR	Riparian Woodlnd	Riparian Woodlnd	326	9.13	7.61	-18.28	1.16	8.27
90	COOL SHB	Upland Herb	Exotics	558	18.46	16.18	-0.90	1.11	6.17
91	COOL SHB	Upland Herb	Upland Herb	406	8.41	7.25	-0.57	1.53	-0.05
92	COOL SHB	Upland Herb	Upland Shrub	5824	52.33	54.51	-37.08	-13.61	101.03
93	COOL SHB	Upland Herb	Woodland Upland	1142	55.09	68.12	-15.71	-5.89	103.82
94	COOL SHB	Upland Shrub	Exotics	841	-36.67	-41.84	78.75	14.26	-57.46
95	COOL SHB	Upland Shrub	Upland Herb	1740	-41.80	-44.07	74.88	12.82	-57.01
96	COOL SHB	Upland Shrub	Upland Shrub	31650	-3.62	-2.14	4.04	0.99	-3.13
97	COOL SHB	Upland Shrub	Woodland Upland	8608	-26.90	-28.54	69.96	3.47	-33.55
98	COOL SHB	Woodland Upland	Exotics	77	-0.21	-3.41	2.29	16.90	-24.45
99	COOL SHB	Woodland Upland	Upland Herb	145	-40.34	-42.08	33.42	8.10	-54.95
100	COOL SHB	Woodland Upland	Upland Shrub	761	-13.34	-18.72	-33.20	-29.22	33.53
101	COOL SHB	Woodland Upland	Woodland Upland	5200	-2.28	-0.10	3.28	2.11	-2.24
102	DRY FOR	Upland Herb	Exotics	28	-0.05	-3.94	15.37	10.77	-24.38
103	DRY FOR	Upland Herb	Upland Herb	146	6.93	5.28	5.26	5.26	-4.24
104	DRY FOR	Upland Herb	Upland Shrub	90	59.97	61.39	-37.50	-3.58	58.57
105	DRY FOR	Upland Herb	EarSerIntFor	3447	24.85	25.55	-6.55	2.79	20.70
106	DRY FOR	Upland Herb	LatSerIntFoMultL	1029	16.11	15.49	32.28	24.84	-22.80
107	DRY FOR	Upland Herb	LatSerIntFoSingL	1376	19.41	20.54	30.43	28.37	-14.69
108	DRY FOR	Upland Herb	MidSerIntFor	10106	3.82	1.12	33.52	13.49	-29.97
109	DRY FOR	Upland Herb	EarSerTolFor	204	74.26	88.37	-0.31	17.71	32.36
110	DRY FOR	Upland Herb	LatSerTolFoMultL	90	37.33	40.06	23.73	24.60	-9.63
111	DRY FOR	Upland Herb	LatSerTolFoSingL	23	66.10	85.91	11.15	51.31	31.35
112	DRY FOR	Upland Herb	MidSerTolFor	5137	43.72	50.64	26.36	16.83	-9.51
113	DRY FOR	Upland Shrub	Exotics	2	-27.92	-27.92	35.24	34.15	-50.00
114	DRY FOR	Upland Shrub	Upland Herb	4	-24.57	-24.57	91.74	44.44	-41.18
115	DRY FOR	Upland Shrub	Upland Shrub	6	-11.42	-11.42	17.73	4.39	-17.65

11[illegible]	DRY FOR	Upland Shrub	EarSerIntFor	[illegible]	-16.96	-11.01	38.66	18.72	-26.05
1178	DRY FOR	Upland Shrub	LatSerIntFoMultL	857	-24.22	-22.70	83.31	39.65	-56.53
1179	DRY FOR	Upland Shrub	LatSerIntFoSingL	[illegible]	-9.74	-9.09	87.03	56.68	-48.26
119	DRY FOR	Upland Shrub	MidSerIntFor	3273	-45.60	-51.65	101.70	32.18	-70.90
120	DRY FOR	Upland Shrub	EarSerTolFor	98	55.78	76.96	44.73	34.07	8.13
121	DRY FOR	Upland Shrub	LatSerTolFoMultL	21	40.01	42.95	75.17	35.41	-22.93
122	DRY FOR	Upland Shrub	LatSerTolFoSingL	283	2.14	6.14	114.76	37.01	-49.50
123	DRY FOR	Upland Shrub	MidSerTolFor	1660	4.11	4.83	102.03	31.29	-53.37
124	DRY FOR	EarSerIntFor	Exotics	34	-13.10	-13.75	-19.87	-16.05	10.91
125	DRY FOR	EarSerIntFor	Upland Herb	62	-16.90	-16.31	-1.83	-2.33	-14.25
126	DRY FOR	EarSerIntFor	Upland Shrub	37	-26.61	-27.01	-35.46	-30.99	-2.88
127	DRY FOR	EarSerIntFor	EarSerIntFor	5198	-0.49	0.08	0.55	1.29	-0.92
128	DRY FOR	EarSerIntFor	LatSerIntFoMultL	1190	-4.23	-5.62	13.78	7.94	-16.49
129	DRY FOR	EarSerIntFor	LatSerIntFoSingL	1401	-5.33	-5.58	19.96	12.70	-24.41
130	DRY FOR	EarSerIntFor	MidSerIntFor	5390	-12.79	-15.29	22.88	10.48	-32.96
131	DRY FOR	EarSerIntFor	EarSerTolFor	495	35.30	38.43	-0.39	13.26	12.34
132	DRY FOR	EarSerIntFor	LatSerTolFoMultL	1103	28.44	29.27	8.78	17.54	-3.80
133	DRY FOR	EarSerIntFor	LatSerTolFoSingL	711	32.37	36.77	15.03	34.50	-1.25
134	DRY FOR	EarSerIntFor	MidSerTolFor	6280	16.77	18.16	18.07	14.57	-16.66
135	DRY FOR	LatSerIntFoMultL	Exotics	99	5.48	4.29	-24.06	-15.49	33.66
136	DRY FOR	LatSerIntFoMultL	Upland Herb	110	-4.48	-5.94	-12.96	-11.18	12.59
137	DRY FOR	LatSerIntFoMultL	Upland Shrub	19	-20.67	-16.27	-35.84	-24.35	7.22
138	DRY FOR	LatSerIntFoMultL	EarSerIntFor	902	4.86	3.87	-24.14	-13.90	32.04
139	DRY FOR	LatSerIntFoMultL	LatSerIntFoMultL	1238	3.58	3.36	-1.29	0.08	3.47
140	DRY FOR	LatSerIntFoMultL	LatSerIntFoSingL	3495	2.85	2.15	-1.48	-0.59	3.82
141	DRY FOR	LatSerIntFoMultL	MidSerIntFor	4196	-4.70	-5.09	2.35	1.84	-8.86
142	DRY FOR	LatSerIntFoMultL	EarSerTolFor	155	36.64	37.46	-21.58	1.25	32.95
143	DRY FOR	LatSerIntFoMultL	LatSerTolFoMultL	1518	34.10	34.83	-14.56	3.03	26.61
144	DRY FOR	LatSerIntFoMultL	LatSerTolFoSingL	622	29.00	30.14	-14.72	2.04	25.08
145	DRY FOR	LatSerIntFoMultL	MidSerTolFor	1831	23.41	24.25	-7.28	5.96	8.15
146	DRY FOR	LatSerIntFoSingL	Exotics	121	3.43	4.01	-21.42	-12.32	33.84
147	DRY FOR	LatSerIntFoSingL	Upland Herb	161	5.86	9.10	-18.17	-10.98	36.12
148	DRY FOR	LatSerIntFoSingL	Upland Shrub	13	-19.92	-1.64	-39.86	-20.95	62.86
149	DRY FOR	LatSerIntFoSingL	EarSerIntFor	1346	5.13	5.31	-25.11	-12.64	34.38
150	DRY FOR	LatSerIntFoSingL	LatSerIntFoMultL	3063	4.14	3.20	-1.08	0.19	3.73
151	DRY FOR	LatSerIntFoSingL	LatSerIntFoSingL	3903	2.99	2.33	-1.17	-0.33	2.97
152	DRY FOR	LatSerIntFoSingL	MidSerIntFor	8405	-2.89	-4.51	2.56	2.40	-9.95
153	DRY FOR	LatSerIntFoSingL	EarSerTolFor	293	39.89	40.46	-21.57	1.93	35.09
154	DRY FOR	LatSerIntFoSingL	LatSerTolFoMultL	3497	31.55	33.00	-14.16	3.16	23.94
155	DRY FOR	LatSerIntFoSingL	LatSerTolFoSingL	827	23.66	24.90	-12.64	2.89	16.87
156	DRY FOR	LatSerIntFoSingL	MidSerTolFor	4094	30.88	32.49	-9.41	6.00	16.26
157	DRY FOR	MidSerIntFor	Exotics	158	0.96	1.68	-26.81	-17.34	42.07
158	DRY FOR	MidSerIntFor	Upland Herb	194	4.29	3.18	-20.10	-11.80	37.12
159	DRY FOR	MidSerIntFor	Upland Shrub	88	-24.18	-26.97	-34.68	-31.77	8.14
160	DRY FOR	MidSerIntFor	EarSerIntFor	2601	-0.01	-1.26	-25.52	-15.55	29.86
161	DRY FOR	MidSerIntFor	LatSerIntFoMultL	3036	3.46	3.83	-2.78	-0.92	6.97
162	DRY FOR	MidSerIntFor	LatSerIntFoSingL	3914	4.29	4.75	-2.74	-1.33	8.28
163	DRY FOR	MidSerIntFor	MidSerIntFor	10809	-1.73	-1.92	1.02	1.01	-3.57
164	DRY FOR	MidSerIntFor	EarSerTolFor	514	32.93	33.65	-21.68	1.79	33.19
165	DRY FOR	MidSerIntFor	LatSerTolFoMultL	2916	31.80	33.02	-14.72	2.45	27.08
166	DRY FOR	MidSerIntFor	LatSerTolFoSingL	1129	24.73	25.56	-14.73	1.18	22.24
167	DRY FOR	MidSerIntFor	MidSerTolFor	6288	22.17	23.44	-8.35	5.15	9.07
168	DRY FOR	EarSerTolFor	Upland Herb	9	-26.77	-24.37	-7.92	-10.22	-8.33
169	DRY FOR	EarSerTolFor	EarSerIntFor	776	-27.20	-27.96	-9.82	-14.34	0.64
170	DRY FOR	EarSerTolFor	LatSerIntFoMultL	73	-32.59	-32.15	15.66	-5.49	-22.60
171	DRY FOR	EarSerTolFor	LatSerIntFoSingL	50	-33.67	-34.02	19.21	-6.16	-24.53
172	DRY FOR	EarSerTolFor	MidSerIntFor	500	-32.84	-33.56	23.64	-1.47	-32.50
173	DRY FOR	EarSerTolFor	EarSerTolFor	492	3.60	3.26	-9.64	-2.52	7.07
174	DRY FOR	EarSerTolFor	LatSerTolFoMultL	323	-7.00	-6.91	2.31	-1.11	-6.93
175	DRY FOR	EarSerTolFor	LatSerTolFoSingL	165	-10.41	-10.77	3.48	-3.01	-9.92
176	DRY FOR	EarSerTolFor	MidSerTolFor	2045	-6.36	-6.87	10.25	2.76	-13.52

1[illegible]	DRY FOR	LatSerTolFoMultL	Upland Herb	[illegible]	-18.08	-17.06	-24.08	-20.72	15.96
178	DRY FOR	LatSerTolFoMultL	EarSerIntFor	857	-20.47	-20.81	-16.81	-16.65	10.45
179	DRY FOR	LatSerTolFoMultL	LatSerIntFoMultL	64	-28.28	-28.35	10.75	-6.42	-14.76
180	DRY FOR	LatSerTolFoMultL	LatSerIntFoSingL	407	-21.29	-24.18	11.58	-5.62	-14.28
181	DRY FOR	LatSerTolFoMultL	MidSerIntFor	401	-26.18	-26.72	15.47	-2.17	-23.11
182	DRY FOR	LatSerTolFoMultL	EarSerTolFor	456	6.29	6.57	-14.71	-3.91	12.77
183	DRY FOR	LatSerTolFoMultL	LatSerTolFoMultL	833	-3.97	-3.82	-1.81	-2.93	0.87
184	DRY FOR	LatSerTolFoMultL	LatSerTolFoSingL	474	-4.83	-4.36	-2.37	-4.30	-0.88
185	DRY FOR	LatSerTolFoMultL	MidSerTolFor	1877	-1.80	-1.82	3.96	2.40	-7.77
186	DRY FOR	LatSerTolFoSingL	Upland Herb	6	8.62	8.62	-1.66	4.04	14.04
187	DRY FOR	LatSerTolFoSingL	EarSerIntFor	503	-22.81	-23.33	-15.83	-16.90	4.93
188	DRY FOR	LatSerTolFoSingL	LatSerIntFoMultL	41	-28.37	-28.65	13.69	-4.00	-19.89
189	DRY FOR	LatSerTolFoSingL	LatSerIntFoSingL	13	-28.31	-28.31	11.57	-11.21	-13.19
190	DRY FOR	LatSerTolFoSingL	MidSerIntFor	277	-29.27	-29.90	14.97	-2.66	-24.20
191	DRY FOR	LatSerTolFoSingL	EarSerTolFor	173	8.13	8.09	-13.38	-2.71	14.60
192	DRY FOR	LatSerTolFoSingL	LatSerTolFoMultL	256	-3.19	-2.90	-3.33	-3.55	1.82
193	DRY FOR	LatSerTolFoSingL	LatSerTolFoSingL	246	-6.19	-5.62	-2.89	-5.52	-0.87
194	DRY FOR	LatSerTolFoSingL	MidSerTolFor	1030	-4.47	-4.61	5.65	2.56	-11.27
195	DRY FOR	MidSerTolFor	Upland Herb	36	-24.52	-27.11	-19.00	-20.16	8.95
196	DRY FOR	MidSerTolFor	EarSerIntFor	2498	-22.07	-23.89	-16.04	-15.67	10.32
197	DRY FOR	MidSerTolFor	LatSerIntFoMultL	239	-27.38	-27.88	9.74	-7.18	-12.48
198	DRY FOR	MidSerTolFor	LatSerIntFoSingL	361	-18.97	-19.14	6.53	-9.23	-6.73
199	DRY FOR	MidSerTolFor	MidSerIntFor	1568	-27.85	-30.00	14.96	-2.85	-23.43
200	DRY FOR	MidSerTolFor	EarSerTolFor	1013	6.02	5.86	-15.31	-5.28	14.66
201	DRY FOR	MidSerTolFor	LatSerTolFoMultL	1190	-4.18	-4.23	-4.21	-5.04	3.52
202	DRY FOR	MidSerTolFor	LatSerTolFoSingL	803	-3.42	-2.64	-5.76	-5.96	5.48
203	DRY FOR	MidSerTolFor	MidSerTolFor	5559	-1.76	-1.68	1.92	1.05	-4.46
204	DRY GRS	Upland Herb	Exotics	1359	4.53	3.85	2.57	3.18	-3.54
205	DRY GRS	Upland Herb	Upland Herb	28311	2.77	0.45	5.18	2.80	-8.38
206	DRY GRS	Upland Herb	Woodland Upland	3233	24.14	29.56	21.34	21.49	-19.10
207	DRY GRS	Woodland Upland	Exotics	208	-32.60	-37.08	-16.07	-23.99	-12.50
208	DRY GRS	Woodland Upland	Upland Herb	7267	-26.56	-32.76	-11.08	-11.70	-8.77
209	DRY GRS	Woodland Upland	Woodland Upland	681	-1.62	-0.96	0.17	1.48	-2.22
210	DRY SHR	Upland Herb	Exotics	415	0.50	2.82	1.30	0.12	-1.94
211	DRY SHR	Upland Herb	Upland Herb	795	17.20	13.66	-6.53	-0.29	8.99
212	DRY SHR	Upland Herb	Upland Shrub	9148	107.25	138.25	-46.92	-9.14	227.36
213	DRY SHR	Upland Herb	Woodland Upland	4	0.00	0.00	0.00	0.00	0.00
214	DRY SHR	Upland Shrub	Exotics	7170	-50.92	-57.08	107.51	9.39	-67.06
215	DRY SHR	Upland Shrub	Upland Herb	6483	-46.19	-51.13	85.18	8.22	-59.49
216	DRY SHR	Upland Shrub	Upland Shrub	184514	-2.93	-1.52	2.51	0.41	-2.30
217	DRY SHR	Upland Shrub	Woodland Upland	252	-6.12	-13.04	55.98	3.63	-24.23
218	DRY SHR	Woodland Upland	Upland Shrub	854	18.59	27.01	-35.61	-2.54	35.02
219	DRY SHR	Woodland Upland	Woodland Upland	318	-2.22	-7.14	-7.86	-12.65	-9.77
220	MOIST FOR	EarSerIntFor	EarSerIntFor	3864	-8.59	-8.11	-8.36	-6.08	3.01
221	MOIST FOR	EarSerIntFor	LatSerIntFoMultL	309	-2.71	-3.23	11.60	8.29	-15.56
222	MOIST FOR	EarSerIntFor	LatSerIntFoSingL	75	3.82	5.51	12.47	10.42	-8.33
223	MOIST FOR	EarSerIntFor	MidSerIntFor	11114	-11.42	-13.43	19.52	6.47	-26.93
224	MOIST FOR	EarSerIntFor	EarSerTolFor	1240	18.82	21.09	-6.04	8.15	7.01
225	MOIST FOR	EarSerIntFor	LatSerTolFoMultL	581	16.89	17.35	1.49	12.28	-2.81
226	MOIST FOR	EarSerIntFor	LatSerTolFoSingL	174	14.04	17.90	6.24	19.20	-5.97
227	MOIST FOR	EarSerIntFor	MidSerTolFor	10807	4.05	4.85	14.67	10.80	-19.11
228	MOIST FOR	LatSerIntFoMultL	EarSerIntFor	1885	-6.50	-6.67	-18.62	-14.91	22.85
229	MOIST FOR	LatSerIntFoMultL	LatSerIntFoMultL	482	0.36	0.70	-1.89	-0.42	1.92
230	MOIST FOR	LatSerIntFoMultL	LatSerIntFoSingL	175	2.06	1.71	-2.20	-0.57	3.52
231	MOIST FOR	LatSerIntFoMultL	MidSerIntFor	5970	-9.93	-10.20	6.47	1.05	-13.36
232	MOIST FOR	LatSerIntFoMultL	EarSerTolFor	419	12.01	12.32	-13.80	-1.75	17.53
233	MOIST FOR	LatSerIntFoMultL	LatSerTolFoMultL	397	27.22	28.00	-11.17	4.12	21.78
234	MOIST FOR	LatSerIntFoMultL	LatSerTolFoSingL	206	25.09	25.56	-12.64	3.03	22.32
235	MOIST FOR	LatSerIntFoMultL	MidSerTolFor	4843	0.12	0.15	1.87	4.28	-8.42
236	MOIST FOR	LatSerIntFoSingL	EarSerIntFor	755	18.36	19.68	-21.47	-10.31	49.40
237	MOIST FOR	LatSerIntFoSingL	LatSerIntFoMultL	573	3.05	2.75	-0.90	0.57	1.08

2[illegible]	MOIST FOR	LatSerIntFoSingL	LatSerIntFoSingL	[illegible]	4.59	3.99	-2.43	-0.01	4.82
2[illegible]	MOIST FOR	LatSerIntFoSingL	MidSerIntFor	[illegible]	-3.50	-4.32	2.10	2.27	-10.47
240	MOIST FOR	LatSerIntFoSingL	EarSerTolFor	174	44.00	44.77	-18.21	2.00	42.20
241	MOIST FOR	LatSerIntFoSingL	LatSerTolFoMultL	758	39.69	42.04	-13.57	4.90	36.14
242	MOIST FOR	LatSerIntFoSingL	LatSerTolFoSingL	542	34.63	36.95	-13.55	5.47	29.91
243	MOIST FOR	LatSerIntFoSingL	MidSerTolFor	2754	28.33	29.86	-7.57	6.25	13.85
244	MOIST FOR	MidSerIntFor	EarSerIntFor	4124	-5.56	-6.33	-22.61	-17.23	23.83
245	MOIST FOR	MidSerIntFor	LatSerIntFoMultL	914	3.36	3.96	-3.62	-0.83	5.84
246	MOIST FOR	MidSerIntFor	LatSerIntFoSingL	429	4.75	5.60	-4.14	-1.05	9.50
247	MOIST FOR	MidSerIntFor	MidSerIntFor	12227	-6.05	-6.19	3.54	0.93	-9.05
248	MOIST FOR	MidSerIntFor	EarSerTolFor	1254	19.08	19.94	-20.15	-1.91	25.45
249	MOIST FOR	MidSerIntFor	LatSerTolFoMultL	1247	21.76	20.54	-11.85	1.67	20.25
250	MOIST FOR	MidSerIntFor	LatSerTolFoSingL	482	29.14	30.94	-14.41	3.37	29.27
251	MOIST FOR	MidSerIntFor	MidSerTolFor	11087	7.12	8.74	-3.02	4.92	-0.65
252	MOIST FOR	EarSerTolFor	EarSerIntFor	1073	-21.36	-23.51	-6.50	-16.87	-5.26
253	MOIST FOR	EarSerTolFor	LatSerIntFoMultL	178	-25.43	-26.63	18.10	-5.15	-22.65
254	MOIST FOR	EarSerTolFor	LatSerIntFoSingL	25	-30.97	-31.42	20.94	-7.06	-26.46
255	MOIST FOR	EarSerTolFor	MidSerIntFor	1470	-17.62	-18.73	19.76	0.45	-21.58
256	MOIST FOR	EarSerTolFor	EarSerTolFor	1073	1.42	1.36	-8.10	-4.52	5.18
257	MOIST FOR	EarSerTolFor	LatSerTolFoMultL	528	-10.52	-11.50	5.50	0.10	-12.77
258	MOIST FOR	EarSerTolFor	LatSerTolFoSingL	143	-9.31	-11.48	10.10	12.77	-19.91
259	MOIST FOR	EarSerTolFor	MidSerTolFor	2391	-6.26	-6.76	10.30	5.16	-14.29
260	MOIST FOR	LatSerTolFoMultL	EarSerIntFor	775	-13.80	-14.35	-14.15	-16.41	7.88
261	MOIST FOR	LatSerTolFoMultL	LatSerIntFoMultL	456	-21.09	-22.25	11.42	-5.86	-14.72
262	MOIST FOR	LatSerTolFoMultL	LatSerIntFoSingL	28	-19.59	-21.35	12.82	-7.54	-16.38
263	MOIST FOR	LatSerTolFoMultL	MidSerIntFor	1648	-12.76	-13.18	12.30	-0.38	-14.57
264	MOIST FOR	LatSerTolFoMultL	EarSerTolFor	847	4.72	5.83	-13.84	-8.83	15.17
265	MOIST FOR	LatSerTolFoMultL	LatSerTolFoMultL	397	-5.36	-4.88	-0.12	-2.01	-1.79
266	MOIST FOR	LatSerTolFoMultL	LatSerTolFoSingL	156	-5.99	-5.98	4.22	5.65	-10.07
267	MOIST FOR	LatSerTolFoMultL	MidSerTolFor	1920	-1.64	-1.47	4.01	3.91	-7.30
268	MOIST FOR	LatSerTolFoSingL	EarSerIntFor	58	-21.90	-22.38	-26.62	-24.27	24.04
269	MOIST FOR	LatSerTolFoSingL	LatSerIntFoMultL	5	-2.79	-2.79	-2.31	-9.44	0.00
270	MOIST FOR	LatSerTolFoSingL	MidSerIntFor	66	-15.27	-17.13	12.13	0.10	-21.17
271	MOIST FOR	LatSerTolFoSingL	EarSerTolFor	35	0.33	1.16	-3.59	-1.39	3.48
272	MOIST FOR	LatSerTolFoSingL	LatSerTolFoMultL	43	-1.04	-1.02	-5.23	-1.73	9.87
273	MOIST FOR	LatSerTolFoSingL	LatSerTolFoSingL	64	-0.81	-0.77	-1.69	-2.01	2.19
274	MOIST FOR	LatSerTolFoSingL	MidSerTolFor	382	-2.48	-2.56	3.50	1.89	-7.31
275	MOIST FOR	MidSerTolFor	EarSerIntFor	1813	-15.02	-15.81	-14.37	-17.09	11.02
276	MOIST FOR	MidSerTolFor	LatSerIntFoMultL	688	-20.23	-21.89	7.63	-8.66	-11.97
277	MOIST FOR	MidSerTolFor	LatSerIntFoSingL	90	-19.42	-19.53	1.29	-10.68	-2.23
278	MOIST FOR	MidSerTolFor	MidSerIntFor	2874	-15.12	-16.39	11.00	-2.28	-14.91
279	MOIST FOR	MidSerTolFor	EarSerTolFor	2612	3.48	4.04	-15.49	-11.88	13.44
280	MOIST FOR	MidSerTolFor	LatSerTolFoMultL	1188	-2.73	-2.83	-4.44	-5.06	3.73
281	MOIST FOR	MidSerTolFor	LatSerTolFoSingL	281	-2.86	-2.52	0.65	3.67	-4.31
282	MOIST FOR	MidSerTolFor	MidSerTolFor	4059	-2.51	-2.28	2.51	1.84	-6.01
283	RIP SHR	Upland Shrub	Upland Shrub	1057	-1.56	-1.13	0.13	-0.08	-1.72
284	RIP SHR	Upland Shrub	Riparian Herb	377	-25.42	-25.47	31.45	7.01	-44.61
285	RIP SHR	Upland Shrub	Riparian Shrub	1623	-0.34	-1.58	-5.03	9.94	-25.43
286	RIP SHR	Riparian Herb	Exotics	31	-18.18	-27.76	16.26	-7.04	-24.09
287	RIP SHR	Riparian Herb	Upland Shrub	146	55.40	62.52	-4.82	-3.56	84.85
288	RIP SHR	Riparian Herb	Riparian Herb	447	7.96	7.37	-5.88	3.02	1.88
289	RIP SHR	Riparian Herb	Riparian Shrub	31	40.90	32.99	-15.74	-3.07	29.56
290	RIP SHR	Riparian Shrub	Upland Shrub	88	13.48	18.27	0.87	-0.30	34.85
291	RIP SHR	Riparian Shrub	Riparian Herb	492	-12.58	-12.35	21.62	-0.86	-8.92
292	RIP SHR	Riparian Shrub	Riparian Shrub	1208	-3.91	-2.67	2.18	0.24	-5.20
293	ROCK	Rock/Barren	Rock/Barren	2299	-5.26	-5.71	-3.63	-2.61	-0.71
294	URBAN	Water	Urban	11	138.68	273.73	290.29	290.48	337.50
295	URBAN	Alpine	Urban	2	0.00	0.00	0.00	0.00	0.00
296	URBAN	Upland Herb	Urban	382	14.08	10.82	-0.17	2.79	3.26
297	URBAN	Upland Shrub	Urban	520	-46.44	-50.11	101.67	17.36	-64.30
298	URBAN	EarSerIntFor	Urban	126	-10.92	-14.37	11.88	3.19	-19.06

2[illegible]	URBAN	LatSerIntFoMultL	Urban	[illegible]	-1.90	-4.23	-21.20	-8.58	22.47
3[illegible]	URBAN	LatSerIntFoSingL	Urban	[illegible]	155.54	185.49	-35.76	-8.61	264.86
301	URBAN	MidSerIntFor	Urban	19	18.75	16.19	-19.21	-6.10	29.03
302	URBAN	EarSerTolFor	Urban	1	-31.36	-31.36	-16.42	-28.57	-9.09
303	URBAN	LatSerTolFoMultL	Urban	2	9.18	9.18	-33.77	-25.49	125.00
304	URBAN	MidSerTolFor	Urban	6	7.93	9.55	-14.88	-7.14	47.06
305	URBAN	Riparian Herb	Urban	9	-28.18	-39.58	113.38	-8.29	-32.51
306	URBAN	Riparian Shrub	Urban	41	-40.46	-42.87	71.81	0.11	-32.73
307	URBAN	Riparian Woodlnd	Urban	2	-27.76	-27.76	180.95	12.40	-48.39
308	URBAN	Woodland Upland	Urban	1	0.00	0.00	0.00	0.00	0.00
309	WATER	Water	Water	7550	3.95	4.74	-2.02	2.80	0.40
310	WOODLAND	Upland Herb	Upland Shrub	1339	30.27	28.93	-12.67	0.92	22.94
311	WOODLAND	Upland Herb	Woodland Upland	88	62.91	75.36	-19.10	-5.08	131.92
312	WOODLAND	Upland Shrub	Upland Shrub	1205	-12.71	-12.39	21.93	4.40	-18.51
313	WOODLAND	EarSerIntFor	Woodland Upland	326	49.28	58.15	-8.83	23.51	40.98
314	WOODLAND	Woodland Upland	Woodland Upland	1790	2.34	4.37	-5.47	-2.11	13.13
315	RIP WDLND	Upland Herb	Exotics	12	15.89	14.61	7.24	4.13	-3.03
316	RIP WDLND	Upland Herb	Upland Herb	68	12.38	10.89	3.31	2.94	-0.34
317	RIP WDLND	Upland Herb	EarSerIntFor	1	1.17	1.17	76.32	11.84	-54.55
318	RIP WDLND	Upland Herb	Riparian Woodlnd	2483	66.49	79.09	-39.89	5.16	48.77
319	RIP WDLND	EarSerIntFor	Exotics	51	-13.78	-16.77	24.73	4.69	-29.34
320	RIP WDLND	EarSerIntFor	Upland Herb	200	-13.56	-18.00	13.32	0.81	-20.94
321	RIP WDLND	EarSerIntFor	EarSerIntFor	5	9.05	6.74	6.45	2.82	-2.38
322	RIP WDLND	EarSerIntFor	Riparian Woodlnd	631	28.74	34.72	-22.55	8.74	11.49
323	RIP WDLND	LatSerIntFoMultL	Riparian Woodlnd	1	-30.96	-30.96	-26.53	-33.33	0.00
324	RIP WDLND	MidSerIntFor	Exotics	191	-17.69	-20.74	-34.41	-11.30	10.47
325	RIP WDLND	MidSerIntFor	Riparian Woodlnd	14	6.53	8.26	-29.27	-1.14	20.27
326	RIP WDLND	LatSerTolFoMultL	Riparian Woodlnd	1	19.16	19.16	-47.95	-4.08	100.00
327	RIP WDLND	MidSerTolFor	Riparian Shrub	1	0.00	0.00	0.00	0.00	0.00
328	RIP WDLND	Riparian Shrub	Exotics	21	-22.48	-29.50	47.79	-3.66	-26.92
329	RIP WDLND	Riparian Shrub	LatSerIntFoSingL	18	-78.05	-84.35	139.00	27.61	-86.09
330	RIP WDLND	Riparian Shrub	MidSerIntFor	1	0.00	0.00	0.00	0.00	0.00
331	RIP WDLND	Riparian Shrub	Riparian Shrub	9	7.48	9.64	16.59	17.35	-10.88
332	RIP WDLND	Riparian Shrub	Riparian Woodlnd	106	-40.44	-41.13	69.20	4.59	-54.33
333	RIP WDLND	Riparian Woodlnd	Exotics	2	-63.88	-63.88	96.88	-10.00	-50.00
334	RIP WDLND	Riparian Woodlnd	MidSerIntFor	2	-56.80	-56.80	161.54	0.00	-75.00
335	RIP WDLND	Riparian Woodlnd	Riparian Shrub	34	78.59	74.35	-27.91	0.58	100.00
336	RIP WDLND	Riparian Woodlnd	Riparian Woodlnd	8342	3.44	1.68	4.68	2.45	-6.40

Percent Change Between Histori[illegible] Current by Physiognomic Types

Eq: (((CUR_NPP - HIS_NPP) / HIS_NPP) * 100)

OBS	HIS_PHY	CUR_PHY	KM_SUM	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG
1	Rock/Barren	Rock/Barren	2299	-5.26	-5.71	-3.63	-2.61	-0.71
2	Water	Urban	11	138.68	273.73	290.29	290.48	337.50
3	Water	Water	7550	3.95	4.74	-2.02	2.80	0.40
4	Alpine	Urban	2	0.00	0.00	0.00	0.00	0.00
5	Alpine	Alpine	3727	-7.36	-7.03	-0.41	-1.88	-4.49
6	Upland Herb	Agricultural	45718	40.49	47.26	-24.21	7.42	22.38
7	Upland Herb	Exotics	2372	5.91	5.38	1.46	2.13	-2.75
8	Upland Herb	Urban	382	14.08	10.82	-0.17	2.79	3.26
9	Upland Herb	Upland Herb	29726	3.28	0.81	4.70	2.70	-7.96
10	Upland Herb	Upland Shrub	16401	73.32	88.24	-41.54	-9.77	146.82
11	Upland Herb	EarSerIntFor	3448	24.83	25.54	-6.53	2.80	20.67
12	Upland Herb	LatSerIntFoMultL	1029	16.11	15.49	32.28	24.84	-22.80
13	Upland Herb	LatSerIntFoSingL	1376	19.41	20.54	30.43	28.37	-14.69
14	Upland Herb	MidSerIntFor	10106	3.82	1.12	33.52	13.49	-29.97
15	Upland Herb	EarSerTolFor	204	74.26	88.37	-0.31	17.71	32.36
16	Upland Herb	LatSerTolFoMultL	90	37.33	40.06	23.73	24.60	-9.63
17	Upland Herb	LatSerTolFoSingL	23	66.10	85.91	11.15	51.31	31.35
18	Upland Herb	MidSerTolFor	5137	43.72	50.64	26.36	16.83	-9.51
19	Upland Herb	Riparian Woodlnd	2483	66.49	79.09	-39.89	5.16	48.77
20	Upland Herb	Woodland Upland	4467	30.16	37.12	9.50	13.91	3.79
21	Upland Shrub	Agricultural	59745	-23.26	-24.43	55.24	20.33	-50.17
22	Upland Shrub	Exotics	8013	-49.05	-55.45	104.35	9.81	-66.02
23	Upland Shrub	Urban	520	-46.44	-50.11	101.67	17.36	-64.30
24	Upland Shrub	Upland Herb	8227	-45.22	-49.65	82.95	9.07	-58.99
25	Upland Shrub	Upland Shrub	218432	-3.15	-1.67	2.81	0.50	-2.51
26	Upland Shrub	EarSerIntFor	134	-16.96	-11.01	38.66	18.72	-26.05
27	Upland Shrub	LatSerIntFoMultL	107	-24.22	-22.70	83.31	39.65	-56.53
28	Upland Shrub	LatSerIntFoSingL	268	-9.74	-9.09	87.03	56.68	-48.26
29	Upland Shrub	MidSerIntFor	3273	-45.60	-51.65	101.70	32.18	-70.90
30	Upland Shrub	EarSerTolFor	98	55.78	76.96	44.73	34.07	8.13
31	Upland Shrub	LatSerTolFoMultL	21	40.01	42.95	75.17	35.41	-22.93
32	Upland Shrub	LatSerTolFoSingL	283	2.14	6.14	114.76	37.01	-49.50
33	Upland Shrub	MidSerTolFor	1660	4.11	4.83	102.03	31.29	-53.37
34	Upland Shrub	Riparian Herb	377	-25.42	-25.47	31.45	7.01	-44.61
35	Upland Shrub	Riparian Shrub	1623	-0.34	-1.58	-5.03	9.94	-25.43
36	Upland Shrub	Woodland Upland	8860	-26.18	-28.02	69.59	3.47	-33.17
37	EarSerIntFor	Agricultural	2728	26.13	28.45	-23.00	4.95	16.94
38	EarSerIntFor	Exotics	85	-13.46	-15.50	2.59	-3.15	-11.66
39	EarSerIntFor	Urban	126	-10.92	-14.37	11.88	3.19	-19.06
40	EarSerIntFor	Upland Herb	262	-14.68	-17.65	8.66	0.07	-19.63
41	EarSerIntFor	Upland Shrub	37	-26.61	-27.01	-35.46	-30.99	-2.88
42	EarSerIntFor	EarSerIntFor	12371	-3.19	-2.55	-3.90	-1.43	1.73
43	EarSerIntFor	LatSerIntFoMultL	1779	-3.48	-4.46	12.94	7.47	-15.49
44	EarSerIntFor	LatSerIntFoSingL	3337	2.60	4.89	19.59	9.53	-13.42
45	EarSerIntFor	MidSerIntFor	20989	-9.41	-11.26	19.44	7.56	-26.32
46	EarSerIntFor	EarSerTolFor	3081	24.24	26.54	-9.25	8.47	13.19
47	EarSerIntFor	LatSerTolFoMultL	1947	23.83	25.21	4.70	15.07	-1.41
48	EarSerIntFor	LatSerTolFoSingL	915	25.94	31.30	13.82	30.61	-2.73
49	EarSerIntFor	MidSerTolFor	22701	11.97	13.24	14.76	12.70	-15.60
50	EarSerIntFor	Riparian Woodlnd	1340	27.91	32.45	-34.60	5.00	20.22
51	EarSerIntFor	Woodland Upland	326	49.28	58.15	-8.83	23.51	40.98
52	LatSerIntFoMultL	Agricultural	902	40.92	41.46	-39.48	-10.18	77.26
53	LatSerIntFoMultL	Exotics	99	5.48	4.29	-24.06	-15.49	33.66
54	LatSerIntFoMultL	Urban	7	-1.90	-4.23	-21.20	-8.58	22.47
55	LatSerIntFoMultL	Upland Herb	110	-4.48	-5.94	-12.96	-11.18	12.59

54

[illegible]	LatSerIntFoMultL	Upland Shrub	19	[illegible].67	-16.27	-35.84	-24.35	7.22
[illegible]	LatSerIntFoMultL	EarSerIntFor	4166	[illegible].53	-1.72	-20.36	-12.31	23.21
[illegible]	LatSerIntFoMultL	LatSerIntFoMultL	2106	2.33	2.30	-1.84	-0.31	3.26
59	LatSerIntFoMultL	LatSerIntFoSingL	4134	2.05	1.68	-1.45	-0.52	3.19
60	LatSerIntFoMultL	MidSerIntFor	12554	-6.66	-7.05	4.05	1.43	-10.61
61	LatSerIntFoMultL	EarSerTolFor	1265	21.47	22.18	-20.88	0.10	23.68
62	LatSerIntFoMultL	LatSerTolFoMultL	2045	32.43	33.12	-13.94	3.30	25.63
63	LatSerIntFoMultL	LatSerTolFoSingL	837	27.96	28.98	-14.29	2.28	24.44
64	LatSerIntFoMultL	MidSerTolFor	8253	10.04	9.87	-2.92	5.51	-1.22
65	LatSerIntFoMultL	Riparian Woodlnd	495	36.35	37.97	-58.91	-1.22	54.06
66	LatSerIntFoSingL	Agricultural	1438	56.01	62.56	-39.95	-7.87	104.15
67	LatSerIntFoSingL	Exotics	121	3.43	4.01	-21.42	-12.32	33.84
68	LatSerIntFoSingL	Urban	14	155.54	185.49	-35.76	-8.61	264.86
69	LatSerIntFoSingL	Upland Herb	161	5.86	9.10	-18.17	-10.98	36.12
70	LatSerIntFoSingL	Upland Shrub	13	-19.92	-1.64	-39.86	-20.95	62.86
71	LatSerIntFoSingL	EarSerIntFor	2308	7.13	7.92	-22.87	-11.53	35.51
72	LatSerIntFoSingL	LatSerIntFoMultL	3718	3.76	3.02	-1.09	0.21	3.27
73	LatSerIntFoSingL	LatSerIntFoSingL	10163	-0.56	-0.96	-1.29	-0.77	1.43
74	LatSerIntFoSingL	MidSerIntFor	13148	-2.96	-4.29	2.40	2.36	-9.97
75	LatSerIntFoSingL	EarSerTolFor	890	32.37	34.44	-22.22	2.35	32.36
76	LatSerIntFoSingL	LatSerTolFoMultL	4352	32.65	34.10	-14.14	3.43	25.76
77	LatSerIntFoSingL	LatSerTolFoSingL	1369	27.35	29.08	-13.01	3.81	21.19
78	LatSerIntFoSingL	MidSerTolFor	7292	29.24	30.96	-8.70	6.39	15.24
79	MidSerIntFor	Agricultural	1517	50.14	54.11	-41.49	-9.36	99.98
80	MidSerIntFor	Exotics	349	-8.93	-12.98	-30.62	-14.35	25.15
81	MidSerIntFor	Urban	19	18.75	16.19	-19.21	-6.10	29.03
82	MidSerIntFor	Upland Herb	194	4.29	3.18	-20.10	-11.80	37.12
83	MidSerIntFor	Upland Shrub	88	-24.18	-26.97	-34.68	-31.77	8.14
84	MidSerIntFor	EarSerIntFor	12285	-1.90	-1.91	-22.86	-13.15	23.50
85	MidSerIntFor	LatSerIntFoMultL	4792	3.14	3.45	-3.37	-1.19	6.79
86	MidSerIntFor	LatSerIntFoSingL	5505	2.74	2.93	-2.78	-1.35	6.10
87	MidSerIntFor	MidSerIntFor	34314	-2.75	-2.77	1.69	1.06	-5.51
88	MidSerIntFor	EarSerTolFor	4725	24.24	26.45	-23.78	-0.20	28.73
89	MidSerIntFor	LatSerTolFoMultL	4861	27.57	28.28	-14.27	2.19	24.46
90	MidSerIntFor	LatSerTolFoSingL	1637	26.06	27.06	-14.79	1.75	24.12
91	MidSerIntFor	MidSerTolFor	25745	15.15	17.61	-7.08	5.69	6.12
92	MidSerIntFor	Riparian Woodlnd	1725	30.45	36.11	-54.83	-1.53	52.55
93	EarSerTolFor	Agricultural	98	-1.55	0.17	-27.25	-8.71	28.74
94	EarSerTolFor	Urban	1	-31.36	-31.36	-16.42	-28.57	-9.09
95	EarSerTolFor	Upland Herb	9	-26.77	-24.37	-7.92	-10.22	-8.33
96	EarSerTolFor	EarSerIntFor	3012	-24.09	-25.35	-5.70	-14.60	-5.67
97	EarSerTolFor	LatSerIntFoMultL	561	-25.91	-26.45	17.51	-5.26	-19.88
98	EarSerTolFor	LatSerIntFoSingL	83	-32.16	-32.50	18.44	-6.47	-24.60
99	EarSerTolFor	MidSerIntFor	3116	-22.26	-23.10	20.83	-0.93	-24.00
100	EarSerTolFor	EarSerTolFor	2278	1.73	1.63	-8.70	-3.87	5.44
101	EarSerTolFor	LatSerTolFoMultL	976	-8.58	-9.15	4.05	-0.60	-9.85
102	EarSerTolFor	LatSerTolFoSingL	319	-9.69	-10.84	6.60	3.13	-14.44
103	EarSerTolFor	MidSerTolFor	5949	-5.58	-5.97	9.99	3.82	-12.83
104	EarSerTolFor	Riparian Woodlnd	407	6.16	6.03	-46.87	-5.90	26.18
105	LatSerTolFoMultL	Agricultural	205	4.15	5.91	-31.80	-10.88	42.27
106	LatSerTolFoMultL	Urban	2	9.18	9.18	-33.77	-25.49	125.00
107	LatSerTolFoMultL	Upland Herb	13	-18.08	-17.06	-24.08	-20.72	15.96
108	LatSerTolFoMultL	EarSerIntFor	3574	-21.35	-23.02	-12.77	-14.30	-0.72
109	LatSerTolFoMultL	LatSerIntFoMultL	627	-22.53	-23.22	11.50	-5.94	-14.55
110	LatSerTolFoMultL	LatSerIntFoSingL	462	-20.96	-23.69	11.50	-5.97	-14.09
111	LatSerTolFoMultL	MidSerIntFor	3744	-17.81	-18.24	14.15	-2.10	-17.37
112	LatSerTolFoMultL	EarSerTolFor	2592	3.76	4.29	-13.43	-5.64	10.10
113	LatSerTolFoMultL	LatSerTolFoMultL	1448	-4.69	-4.41	-1.47	-2.86	-0.14
114	LatSerTolFoMultL	LatSerTolFoSingL	653	-4.75	-4.46	-0.98	-2.11	-2.88
115	LatSerTolFoMultL	MidSerTolFor	6805	0.05	0.60	2.77	3.06	-4.88
116	LatSerTolFoMultL	Riparian Woodlnd	484	11.66	12.63	-50.51	-5.77	38.13

[illegible]	LatSerTolFoSingL	Agricultural	102	[illegible].19	9.10	-35.94	-13.36	44.84
[illegible]	LatSerTolFoSingL	Upland Herb	6	[illegible].62	8.62	-1.66	4.04	14.04
[illegible]	LatSerTolFoSingL	EarSerIntFor	958	[illegible]21.21	-21.69	-13.33	-16.06	3.22
120	LatSerTolFoSingL	LatSerIntFoMultL	88	-23.45	-23.62	12.40	-4.97	-15.20
121	LatSerTolFoSingL	LatSerIntFoSingL	13	-28.31	-28.31	11.57	-11.21	-13.19
122	LatSerTolFoSingL	MidSerIntFor	694	-23.69	-24.10	13.92	-2.67	-21.89
123	LatSerTolFoSingL	EarSerTolFor	267	6.04	6.12	-10.81	-2.58	12.18
124	LatSerTolFoSingL	LatSerTolFoMultL	315	-3.14	-2.89	-3.57	-3.34	2.68
125	LatSerTolFoSingL	LatSerTolFoSingL	326	-4.95	-4.61	-2.77	-4.73	-0.29
126	LatSerTolFoSingL	MidSerTolFor	1784	-3.47	-3.51	4.52	2.28	-9.17
127	LatSerTolFoSingL	Riparian Woodlnd	320	11.45	12.50	-54.91	-7.21	44.85
128	MidSerTolFor	Agricultural	289	3.85	4.99	-30.86	-10.85	39.69
129	MidSerTolFor	Urban	6	7.93	9.55	-14.88	-7.14	47.06
130	MidSerTolFor	Upland Herb	36	-24.52	-27.11	-19.00	-20.16	8.95
131	MidSerTolFor	EarSerIntFor	7589	-21.21	-22.67	-13.06	-15.57	3.41
132	MidSerTolFor	LatSerIntFoMultL	1847	-23.19	-24.36	8.94	-9.27	-12.96
133	MidSerTolFor	LatSerIntFoSingL	504	-19.15	-19.36	5.44	-9.61	-5.85
134	MidSerTolFor	MidSerIntFor	8649	-20.75	-22.63	13.35	-3.74	-18.52
135	MidSerTolFor	EarSerTolFor	5901	2.43	2.61	-14.42	-8.42	11.01
136	MidSerTolFor	LatSerTolFoMultL	2931	-4.38	-4.41	-4.15	-5.20	2.97
137	MidSerTolFor	LatSerTolFoSingL	1119	-3.10	-2.49	-4.15	-3.74	3.20
138	MidSerTolFor	MidSerTolFor	14493	-1.96	-1.80	1.94	1.13	-4.45
139	MidSerTolFor	Riparian Shrub	1	0.00	0.00	0.00	0.00	0.00
140	MidSerTolFor	Riparian Woodlnd	1255	9.42	10.53	-51.85	-8.38	41.18
141	Riparian Herb	Agricultural	1335	10.34	4.17	7.53	1.81	3.04
142	Riparian Herb	Exotics	31	-18.18	-27.76	16.26	-7.04	-24.09
143	Riparian Herb	Urban	9	-28.18	-39.58	113.38	-8.29	-32.51
144	Riparian Herb	Upland Shrub	146	55.40	62.52	-4.82	-3.56	84.85
145	Riparian Herb	Riparian Herb	447	7.96	7.37	-5.88	3.02	1.88
146	Riparian Herb	Riparian Shrub	31	40.90	32.99	-15.74	-3.07	29.56
147	Riparian Shrub	Agricultural	3325	-18.92	-23.65	54.75	-0.16	-18.86
148	Riparian Shrub	Exotics	21	-22.48	-29.50	47.79	-3.66	-26.92
149	Riparian Shrub	Urban	41	-40.46	-42.87	71.81	0.11	-32.73
150	Riparian Shrub	Upland Shrub	88	13.48	18.27	0.87	-0.30	34.85
151	Riparian Shrub	LatSerIntFoSingL	18	-78.05	-84.35	139.00	27.61	-86.09
152	Riparian Shrub	MidSerIntFor	1	0.00	0.00	0.00	0.00	0.00
153	Riparian Shrub	Riparian Herb	492	-12.58	-12.35	21.62	-0.86	-8.92
154	Riparian Shrub	Riparian Shrub	1217	-3.76	-2.55	2.24	0.34	-5.28
155	Riparian Shrub	Riparian Woodlnd	106	-40.44	-41.13	69.20	4.59	-54.33
156	Riparian Woodlnd	Agricultural	45	3.42	4.63	5.24	6.98	-0.55
157	Riparian Woodlnd	Exotics	2	-63.88	-63.88	96.88	-10.00	-50.00
158	Riparian Woodlnd	Urban	2	-27.76	-27.76	180.95	12.40	-48.39
159	Riparian Woodlnd	EarSerIntFor	4	-26.16	-29.46	98.52	-0.85	-36.84
160	Riparian Woodlnd	MidSerIntFor	15	-10.76	-12.65	58.35	3.68	-23.73
161	Riparian Woodlnd	LatSerTolFoSingL	15	-18.62	-16.66	78.96	5.29	-47.56
162	Riparian Woodlnd	MidSerTolFor	187	-11.00	-15.21	96.75	5.74	-39.28
163	Riparian Woodlnd	Riparian Shrub	34	78.59	74.35	-27.91	0.58	100.00
164	Riparian Woodlnd	Riparian Woodlnd	8668	3.72	1.91	3.80	2.41	-5.89
165	Woodland Upland	Agricultural	916	3.18	3.71	-29.55	-1.78	11.58
166	Woodland Upland	Exotics	285	-26.98	-31.79	-11.01	-11.65	-15.46
167	Woodland Upland	Urban	1	0.00	0.00	0.00	0.00	0.00
168	Woodland Upland	Upland Herb	7412	-26.77	-32.86	-10.32	-11.39	-9.70
169	Woodland Upland	Upland Shrub	1615	-0.98	-1.55	-34.38	-17.95	34.29
170	Woodland Upland	Woodland Upland	7989	-0.79	0.66	0.64	0.53	1.36

Current Conditions (1989 Weather Year) -- Using Current PVG and PHYSG

OBS	PVG	PHYSG	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG	KM_SUM
1	AGRICULT	Agricultural	53255080	450.21	44.34	80.58	11.09	118363
2	ALPINE	Alpine	665978	179.65	36.92	22.08	2.20	3727
3	COLD FOR	EarSerIntFor	7930696	462.54	48.68	37.82	6.42	17234
4	COLD FOR	LatSerIntFoMultL	1357714	462.75	63.85	40.78	6.56	2969
5	COLD FOR	LatSerIntFoSingL	4316935	462.69	57.52	35.48	5.47	9331
6	COLD FOR	MidSerIntFor	12584748	486.44	62.80	50.56	5.41	25933
7	COLD FOR	EarSerTolFor	6528530	672.07	44.88	34.19	8.24	9754
8	COLD FOR	LatSerTolFoMultL	1209695	579.91	53.44	38.82	7.27	2100
9	COLD FOR	LatSerTolFoSingL	80406	487.31	55.93	54.78	5.35	165
10	COLD FOR	MidSerTolFor	16787481	647.62	54.54	52.15	7.19	25962
11	COLD FOR	Riparian Woodlnd	3710463	651.19	26.13	48.85	9.01	5705
12	COOL SHB	Exotics	307882	208.59	66.33	67.86	3.88	1476
13	COOL SHB	Upland Herb	473054	206.48	64.41	57.96	3.99	2291
14	COOL SHB	Upland Shrub	14843939	388.66	34.52	56.84	10.83	38235
15	COOL SHB	Woodland Upland	4554315	304.76	57.02	63.72	8.78	14950
16	DRY FOR	Exotics	141762	322.19	55.54	47.88	7.96	442
17	DRY FOR	Upland Herb	218101	296.74	59.87	49.44	6.23	741
18	DRY FOR	Upland Shrub	112198	443.47	37.19	36.87	11.24	253
19	DRY FOR	EarSerIntFor	7812641	428.65	49.41	49.06	8.62	18262
20	DRY FOR	LatSerIntFoMultL	3847611	381.71	71.31	57.91	6.06	10080
21	DRY FOR	LatSerIntFoSingL	5465482	361.45	72.86	54.29	6.40	15188
22	DRY FOR	MidSerIntFor	14789662	329.62	73.81	70.11	5.16	44925
23	DRY FOR	EarSerTolFor	2670139	686.06	46.93	45.92	8.81	3893
24	DRY FOR	LatSerTolFoMultL	6517188	556.45	59.99	54.80	8.00	11747
25	DRY FOR	LatSerTolFoSingL	3073173	586.15	58.92	51.89	10.72	5283
26	DRY FOR	MidSerTolFor	20233509	566.05	61.48	67.59	7.39	35801
27	DRY GRS	Exotics	550238	351.81	50.95	59.34	8.00	1567
28	DRY GRS	Upland Herb	11761149	332.13	52.74	65.29	6.79	35578
29	DRY GRS	Woodland Upland	1491873	382.43	68.13	77.80	6.46	3914
30	DRY SHR	Exotics	1230834	162.29	71.04	72.53	3.25	7585
31	DRY SHR	Upland Herb	1351614	185.79	66.70	68.88	4.18	7278
32	DRY SHR	Upland Shrub	72508881	373.01	37.03	66.28	10.54	194516
33	DRY SHR	Woodland Upland	241848	421.34	48.94	51.26	13.45	574
34	MOIST FOR	EarSerIntFor	7428221	518.95	49.32	38.49	10.16	14347
35	MOIST FOR	LatSerIntFoMultL	1569622	435.64	67.59	45.75	6.28	3605
36	MOIST FOR	LatSerIntFoSingL	691195	521.26	64.91	45.68	9.84	1326
37	MOIST FOR	MidSerIntFor	18748626	472.81	68.30	52.77	6.65	39742
38	MOIST FOR	EarSerTolFor	5039667	666.27	48.91	33.33	9.63	7654
39	MOIST FOR	LatSerTolFoMultL	2625111	511.42	62.53	43.15	7.25	5139
40	MOIST FOR	LatSerTolFoSingL	1148093	561.96	62.06	44.03	9.27	2048
41	MOIST FOR	MidSerTolFor	22227694	582.58	62.31	53.51	8.00	38243
42	RIP SHR	Exotics	12594	406.26	46.13	57.48	5.39	31
43	RIP SHR	Upland Shrub	230378	178.45	70.12	61.57	4.59	1291
44	RIP SHR	Riparian Herb	557100	423.97	40.68	77.68	9.03	1316
45	RIP SHR	Riparian Shrub	1122830	392.74	35.64	78.53	8.09	2862
46	ROCK	Rock/Barren	392501	171.85	17.24	21.20	2.14	2299
47	URBAN	Urban	380677	333.63	57.32	82.39	9.37	1143
48	WATER	Water	818108	108.44	12.77	15.04	2.44	7550
49	WOODLAND	Upland Shrub	998690	392.57	46.78	72.73	9.35	2544

5[illegible]	[illegible]DLAND Woodland Upland	946087	436.59	50.4[illegible]	[illegible]7.51	12.35	2204
5[illegible]	[illegible] WDLND Exotics	106892	385.89	43.6[illegible]	[illegible]5.20	5.82	277
52	RIP WDLND Upland Herb	87943	328.15	45.66	59.43	5.66	268
53	RIP WDLND EarSerIntFor	2771	461.83	49.67	68.83	7.67	6
54	RIP WDLND LatSerIntFoSingL	947	52.61	90.56	75.50	1.17	18
55	RIP WDLND MidSerIntFor	1276	425.33	73.33	89.67	4.33	3
56	RIP WDLND Riparian Shrub	12786	290.59	49.32	91.48	4.61	44
57	RIP WDLND Riparian Woodlnd	6644247	574.46	30.78	62.69	8.40	11578

Current(89) -- Using Current PVG

OBS	PVG	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG	KM_SUM
1	AGRICULT	53255080	450.21	44.34	80.58	11.09	118363
2	ALPINE	665978	179.65	36.92	22.08	2.20	3727
3	COLD FOR	54506668	551.32	53.63	45.10	6.62	99153
4	COOL SHB	20179190	354.62	42.46	58.98	9.84	56952
5	DRY FOR	64881466	443.43	64.95	61.65	6.87	146615
6	DRY GRS	13803260	337.69	54.14	66.25	6.81	41059
7	DRY SHR	75333177	359.03	39.32	66.55	10.06	209953
8	MOIST FOR	59478229	532.05	62.07	48.97	7.87	112104
9	RIP SHR	1922902	349.94	45.01	74.22	7.48	5500
10	ROCK	392501	171.85	17.24	21.20	2.14	2299
11	URBAN	380677	333.63	57.32	82.39	9.37	1143
12	WATER	818108	108.44	12.77	15.04	2.44	7550
13	WOODLAND	1944777	412.82	48.46	65.73	10.73	4748
14	RIP WDLND	6856862	562.87	31.57	62.36	8.25	12194

Current(89) -- Using Current PHYSG

OBS	PHYSG	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG	KM_SUM
1	Agricultural	53255080	450.21	44.34	80.58	11.09	118363
2	Exotics	2350202	206.67	66.33	68.45	4.24	11378
3	Rock/Barren	392501	171.85	17.24	21.20	2.14	2299
4	Urban	380677	333.63	57.32	82.39	9.37	1143
5	Water	818108	108.44	12.77	15.04	2.44	7550
6	Alpine	665978	179.65	36.92	22.08	2.20	3727
7	Upland Herb	13891861	302.13	55.61	65.20	6.23	46156
8	Upland Shrub	88694086	374.76	36.91	64.77	10.54	236839
9	EarSerIntFor	23174329	466.36	49.14	42.14	8.30	49849
10	LatSerIntFoMultL	6774947	407.71	69.19	52.25	6.19	16654
11	LatSerIntFoSingL	10474559	406.07	66.92	47.06	6.24	25863
12	MidSerIntFor	46124312	417.80	69.25	59.30	5.76	110603
13	EarSerTolFor	14238336	672.57	46.70	36.04	8.84	21301
14	LatSerTolFoMultL	10351994	546.83	59.95	49.88	7.71	18986
15	LatSerTolFoSingL	4301672	577.33	59.72	49.80	10.20	7496
16	MidSerTolFor	59248684	593.55	60.00	58.20	7.57	100006
17	Riparian Herb	557100	423.97	40.68	77.68	9.03	1316
18	Riparian Shrub	1135616	391.19	35.85	78.73	8.03	2906
19	Riparian Woodlnd	10354710	599.79	29.24	58.12	8.60	17283
20	Woodland Upland	7234123	335.13	58.15	65.31	8.84	21642

Historic Conditions (1989 Weather Year) -- Using Current PVG and Historic PHYSG

OBS	PVG	PHYSG	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG	KM_SUM
1	AGRICULT	Upland Herb	17892056	391.59	48.75	71.69	12.68	45718
2	AGRICULT	Upland Shrub	27042636	452.82	32.17	71.35	14.99	59745
3	AGRICULT	EarSerIntFor	1182148	433.66	51.47	64.04	11.12	2728
4	AGRICULT	LatSerIntFoMultL	343431	383.29	72.41	57.33	7.44	902
5	AGRICULT	LatSerIntFoSingL	454648	316.39	75.95	62.85	5.97	1438
6	AGRICULT	MidSerIntFor	538649	356.25	74.80	63.72	6.50	1517
7	AGRICULT	EarSerTolFor	55644	567.80	57.73	63.30	9.62	98
8	AGRICULT	LatSerTolFoMultL	107854	526.12	62.49	66.06	8.74	205
9	AGRICULT	LatSerTolFoSingL	52946	519.08	63.36	64.73	8.83	102
10	AGRICULT	MidSerTolFor	146779	511.43	62.91	66.47	8.08	289
11	AGRICULT	Riparian Herb	915873	686.05	29.27	71.67	20.68	1335
12	AGRICULT	Riparian Shrub	1424421	428.53	36.09	84.37	9.42	3325
13	AGRICULT	Riparian Woodlnd	20196	448.80	41.58	54.47	12.07	45
14	AGRICULT	Woodland Upland	437906	480.16	57.75	73.26	9.12	916
15	ALPINE	Alpine	716785	193.36	37.06	22.50	2.30	3727
16	COLD FOR	EarSerIntFor	8495832	475.88	51.35	47.13	6.62	17892
17	COLD FOR	LatSerIntFoMultL	3808262	507.77	60.13	43.20	6.13	7520
18	COLD FOR	LatSerIntFoSingL	3460895	469.27	58.89	36.74	5.25	7379
19	COLD FOR	MidSerIntFor	16641920	512.09	61.01	44.92	6.05	32604
20	COLD FOR	EarSerTolFor	3438468	637.82	52.18	43.05	7.83	5396
21	COLD FOR	LatSerTolFoMultL	5343056	608.55	52.85	45.69	6.76	8792
22	COLD FOR	LatSerTolFoSingL	889455	567.98	56.05	48.48	6.56	1573
23	COLD FOR	MidSerTolFor	10634144	612.64	55.71	46.60	6.86	17452
24	COLD FOR	Riparian Woodlnd	303098	556.14	31.00	57.79	7.98	545
25	COOL SHB	Upland Herb	1769822	223.91	59.20	69.00	4.27	7930
26	COOL SHB	Upland Shrub	17255481	402.97	33.23	57.42	11.77	42839
27	COOL SHB	Woodland Upland	2047650	331.39	56.10	58.59	8.71	6183
28	DRY FOR	Upland Herb	7288523	337.07	51.80	65.20	8.29	21676
29	DRY FOR	Upland Shrub	2362556	403.72	35.63	55.61	12.11	5856
30	DRY FOR	EarSerIntFor	9304159	425.86	54.25	55.78	8.39	21901
31	DRY FOR	LatSerIntFoMultL	5325979	375.86	72.41	55.53	5.96	14185
32	DRY FOR	LatSerIntFoSingL	9374095	364.61	73.44	62.17	5.90	25723
33	DRY FOR	MidSerIntFor	13405884	424.18	70.10	58.66	6.58	31647
34	DRY FOR	EarSerTolFor	2743179	620.21	54.90	54.60	8.16	4433
35	DRY FOR	LatSerTolFoMultL	3072160	573.49	58.63	51.60	7.94	5382
36	DRY FOR	LatSerTolFoSingL	1446686	573.63	59.69	55.53	8.24	2545
37	DRY FOR	MidSerTolFor	7587369	574.50	59.50	56.66	7.16	13267
38	DRY GRS	Upland Herb	10553576	322.26	50.92	65.76	7.78	32903
39	DRY GRS	Woodland Upland	4218910	519.12	59.06	62.69	6.33	8156
40	DRY SHR	Upland Herb	1749909	169.09	69.19	70.64	3.74	10362
41	DRY SHR	Upland Shrub	74870764	377.56	36.07	66.13	10.67	198419
42	DRY SHR	Woodland Upland	376428	321.18	54.75	44.92	9.23	1172
43	MOIST FOR	EarSerIntFor	15112331	537.54	55.01	52.28	9.29	28164
44	MOIST FOR	LatSerIntFoMultL	7911884	550.70	63.57	48.73	8.43	14377
45	MOIST FOR	LatSerIntFoSingL	3611200	346.23	75.59	54.75	5.54	10433
46	MOIST FOR	MidSerIntFor	17154442	541.10	64.49	47.93	8.06	31764
47	MOIST FOR	EarSerTolFor	4617172	672.96	53.25	38.78	9.68	6881
48	MOIST FOR	LatSerTolFoMultL	3857392	624.38	57.52	41.25	8.85	6227
49	MOIST FOR	LatSerTolFoSingL	367869	565.08	61.57	53.09	7.82	653

50 MOIST FOR	MidSerTolFor	8186000	606.95	59.31	42.57	8.09	13605
51 RIP SHR	Upland Shrub	993411	324.96	46.56	69.70	9.08	3057
52 RIP SHR	Riparian Herb	273381	418.65	47.77	64.75	9.21	655
53 RIP SHR	Riparian Shrub	722081	404.53	38.57	77.50	8.11	1788
54 ROCK	Rock/Barren	416017	182.14	17.90	21.76	2.16	2299
55 URBAN	Water	1104	100.36	9.36	9.55	2.91	11
56 URBAN	Alpine	596	298.00	81.00	47.00	5.00	2
57 URBAN	Upland Herb	152908	400.28	48.50	77.27	13.27	382
58 URBAN	Upland Shrub	233529	449.09	32.59	76.70	15.18	520
59 URBAN	EarSerIntFor	61870	491.03	45.62	71.86	14.49	126
60 URBAN	LatSerIntFoMultL	3887	647.83	56.50	49.50	13.67	7
61 URBAN	LatSerIntFoSingL	1813	129.50	89.29	73.86	2.64	14
62 URBAN	MidSerIntFor	6801	377.83	67.61	61.61	8.67	19
63 URBAN	EarSerTolFor	440	440.00	67.00	56.00	11.00	1
64 URBAN	LatSerTolFoMultL	610	305.00	77.00	51.00	4.00	2
65 URBAN	MidSerTolFor	1801	300.17	76.17	65.33	5.67	6
66 URBAN	Riparian Herb	7343	815.89	15.78	61.67	22.56	9
67 URBAN	Riparian Shrub	20150	491.46	37.46	85.59	12.15	41
68 URBAN	Riparian Woodlnd	1185	592.50	21.00	64.50	15.50	2
69 URBAN	Woodland Upland	297	297.00	81.00	99.00	4.00	1
70 WATER	Water	781113	103.54	13.04	14.64	2.43	7550
71 WOODLAND	Upland Herb	483831	339.05	51.67	78.98	8.54	1427
72 WOODLAND	Upland Shrub	448551	372.24	40.88	61.78	9.30	1205
73 WOODLAND	EarSerIntFor	106113	341.20	49.36	41.80	9.86	326
74 WOODLAND	Woodland Upland	724240	409.64	53.83	59.24	10.95	1790
75 RIP WDLND	Upland Herb	871726	340.39	47.91	64.67	6.45	2564
76 RIP WDLND	EarSerIntFor	406215	457.97	40.85	51.45	8.39	887
77 RIP WDLND	LatSerIntFoMultL	885	885.00	49.00	51.00	21.00	1
78 RIP WDLND	MidSerIntFor	105762	515.91	60.58	46.86	5.67	205
79 RIP WDLND	LatSerTolFoMultL	287	287.00	73.00	49.00	2.00	1
80 RIP WDLND	MidSerTolFor	496	496.00	38.00	76.00	12.00	1
81 RIP WDLND	Riparian Shrub	60233	388.60	36.20	71.94	8.55	155
82 RIP WDLND	Riparian Woodl	4114686	551.27	29.67	60.22	8.48	8380

Historic(89) -- Using Current PVG

OBS	PVG	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG	KM_SUM
1	AGRICULT	50615187	427.89	40.85	71.35	13.56	118363
2	ALPINE	716785	193.36	37.06	22.50	2.30	3727
3	COLD FOR	53015130	536.23	56.66	44.97	6.42	99153
4	COOL SHB	21072953	370.32	39.32	59.16	10.40	56952
5	DRY FOR	61910590	423.13	62.45	58.77	7.32	146615
6	DRY GRS	14772486	361.40	52.54	65.15	7.49	41059
7	DRY SHR	76997101	366.96	37.81	66.24	10.32	209953
8	MOIST FOR	60818290	544.04	61.31	48.21	8.33	112104
9	RIP SHR	1988873	361.94	44.10	71.65	8.78	5500
10	ROCK	416017	182.14	17.90	21.76	2.16	2299
11	URBAN	494334	433.25	40.99	75.31	13.93	1143
12	WATER	781113	103.54	13.04	14.64	2.43	7550

13	OODLAND	1762735	374.17	49.57	[illegible]	9.72	4748
14	RIP WDLND	6060290	497.48	34.92	60.44	8.00	12194

Historic(89) -- Using Historic PHYSG

OBS	PHYSG	NPP_SUM	NPP_AVG	CSI_AVG	WSI_AVG	NAI_AVG	KM_SUM
1	Rock/Barren	416017	182.14	17.90	21.76	2.16	2299
2	Water	782217	103.54	13.03	14.63	2.43	7561
3	Alpine	717381	193.42	37.08	22.51	2.30	3729
4	Upland Herb	40762351	332.25	52.28	68.66	9.13	122962
5	Upland Shrub	123206928	395.56	35.04	65.77	11.66	311641
6	EarSerIntFor	34668668	482.41	53.52	52.49	8.42	72024
7	LatSerIntFoMultL	17394328	470.88	66.48	50.42	6.99	36992
8	LatSerIntFoSingL	16902651	375.90	71.64	56.30	5.71	44987
9	MidSerIntFor	47853458	490.60	65.30	50.65	6.88	97756
10	EarSerTolFor	10854903	647.13	53.37	44.47	8.68	16809
11	LatSerTolFoMultL	12381359	603.29	55.86	46.10	7.72	20609
12	LatSerTolFoSingL	2756956	569.50	58.84	53.11	7.65	4873
13	MidSerTolFor	26556589	598.85	57.98	48.50	7.33	44620
14	Riparian Herb	1196597	599.20	35.25	69.37	16.94	1999
15	Riparian Shrub	2226885	419.77	36.94	81.71	8.98	5309
16	Riparian Woodlnd	4939165	551.06	29.80	60.04	8.47	8972
17	Woodland Upland	7805431	429.84	57.20	60.35	7.92	18218

Biome-BGC Classes	ICRB Scientific Assessment Categories
	Structural Stages
1	1-Stand Initiation
2	2-Stem Exclusion Open, 3-Stem Exclusion Closed 4-Stand Reinitiation, 5-Young Forest, Multistrata
3	6-Old Forest, Multistrata, 7-Old Forest, Single Strata

Table 1 -- Cross-reference of Biome-BGC forest structural stages with those used in the ICRB scientific assessment.

BiomeBGC Classes	ICRB Scientific Assessment Categories
	Cover Types
1-Cedar/Hemlock	SAF227
2-Douglas-fir/ White Pine	CRBS09, CRBS11, SAF205, SAF206, SAF210, SAF212, SAF215, SAF243, CRBS02, CRB008
3-Ponderosa Pine/ Lodgepole Pine	CRBS10, SAF208, SAF218, SAF219, SAF237, SAF245
4-Juniper/shrub	CRBS01, CRBS03
5-Cottonwood/Willow	SAF235
6-Aspen	SAF217
7-White Oak	SAF233
8-Wetland shrub	CRBS05
9-Mountain Shrub	CRB003, SRM322, SRM421
10-Sage shrub	SRM104, SRM402, SRM406, SRM414, CRBS04
11-Grass	CRBS06, CRBS07, CRBS08, CRBS19, CRBS13
12-Wetland Herbaceous	CRB007
13-Alpine	CRB005
14-Agriculture	CRBS12
15-Barren	CRB006
16-Water	CRBS20

Table 2 -- Cross-reference of Biome-BGC cover types with those used in the ICRB scientific assessment.

Heading	NPP[1]	CSI	WSI	NAI
Definition				
Formula[2]	GPP-R_m	100(R_m/GPP)	100(ET/PPT)	d_s(NPP)
Statistics				
Mean	432	50	61	9
Std. Deviation	217	22	24	6
Minimum	0	0	0	0
Maximum	1716	100	100	56
Categories				
High	550+	80+	85+	25+
Moderate	400-550	60-80	65-85	5-25
Low	0-400	0-60	0-65	0-5

[1]NPP is Net Primary Productivity (g C m^{-2}), CSI is Carbon Stress Index (index between 0 and 100), WSI is Water Stress Index (index between 0 and 100), NAI is Nutrient Availability Index (g C m^{-2}).

[2]GPP is gross annual photosynthesis (g C m^{-2}), R_m is annual maintenance respiration (g C m^{-2}), ET is annual evapotranspiration (cm), PPT is annual precipitation (cm), d_s is the decomposition scalar (dimensionless), NPP is net primary productivity (g C m^{-2})

Table 3 -- Description of Biome-BGC output indices used to describe ecosystem trends across the ICRB. Statistics are for current vegetation conditions for the normal weather year (1989).

Name	Description	Code
Consumptive Demand	Designed to meet social demands of consumptive use of all resources. Maximize harvests, roads, livestock grazing, and mining and include exotics.	CD
Historical	Designed to mimic pre-industrial historical, native american influences and ecosystem processes. No exotics or livestock.	HI
Passive Management	Designed to eliminate consumptive use of resources on Federal lands. No harvests, livestock, mining, hunting, and road-building. Assume same level fire protection as CD.	PM
Active Management	Designed to mimic ecosystem function and restore various ecosystems. Harvests and prescribed fire are used to mimic ecosystem disturbance. Fire suppression is included.	AM

Table 4 -- General description of the four management futures simulated by CRBSUM. These futures were designed by altering disturbance probabilities.

Net Primary Productivity (NPP, g C m^{2})

Potential Veg Groups	EIF[1]	LIM	LIS	MIF	ETF	LTM	LTS	MTF
Cold Forest	462	463	463	486	672	580	487	648
Dry Forest	429	382	361	330	686	556	586	566
Moist Forest	519	436	521	473	666	511	562	583
Riparian Woodland	462		53	425				

[1]EIF-Early seral, Intolerant Forest, LIM-Late seral, Intolerant Multistrata Forest, LIS-Late seral, Intolerant, Single Strata Forest, MIF-Mid seral, Intolerant Forest ETF-Early seral, Tolerant Forest, LTM-Late seral, Tolerant Multistrata Forest, LTS-Late seral, Tolerant, Single Strata Forest, MTF-Mid seral, Tolerant Forest

Table 5 -- Average net primary productivity (NPP) estimates for forested ecosystems.

Net Primary Productivity (NPP, g C m^2)

Pot. Veg Groups	UH[1]	RH	US	RS	EIF	WU	RW
Cold Forest							651
Dry Forest	297		443				
Moist Forest							
Riparian Shrub		424	178	393			
Cool Shrub	206		389			305	
Dry Shrub	186		373			421	
Riparian Woodland	328			291	462		574
Woodland			393			437	
Dry Grassland	332					382	

[1]UH-Upland Herb, RH-Riparian Herb, US-Upland Shrub, RS-Riparian Shrub, EIF-Early seral, Intolerant Forest, WU-Woodland Upland, RW-Riparian Woodland

Table 6 -- Average net primary productivity (NPP) estimates for non forest environments.

Carbon Stress Index (CSI)

Pot. Veg Groups	EIF[1]	LIM	LIS	MIF	ETF	LTM	LTS	MTF
Cold Forest	49	64	58	63	45	53	56	54
Dry Forest	49	71	73	74	47	60	59	61
Moist Forest	49	68	65	68	49	62	62	62
Riparian Woodland	50		91	73				

[1]EIF-Early seral, Intolerant Forest, LIM-Late seral, Intolerant Multistrata Forest, LIS-Late seral, Intolerant, Single Strata Forest, MIF-Mid seral, Intolerant Forest ETF-Early seral, Tolerant Forest, LTM-Late seral, Tolerant Multistrata Forest, LTS-Late seral, Tolerant, Single Strata Forest, MTF-Mid seral, Tolerant Forest

Table 7 -- Average estimates for carbon stress index (CSI) in the forested environments.

Carbon Stress Index (CSI)

Pot. Veg Groups	UH[1]	RH	US	RS	EIF	WU	RW
Cold Forest							26
Dry Forest	60		37				
Moist Forest							
Riparian Shrub		41	70	36			
Cool Shrub	64		35			57	
Dry Shrub	67		37			49	
Riparian Woodland	46			49	50		31
Woodland			47			50	
Dry Grassland	53					68	

[1]UH-Upland Herb, RH-Riparian Herb, US-Upland Shrub, RS-Riparian Shrub, EIF-Early seral, Intolerant Forest, WU-Woodland Upland, RW-Riparian Woodland

Table 8 -- Average carbon stress index (CSI) estimates for non-forested ecosystems.

Water Stress Index (WSI)

Potential Veg Groups	EIF[1]	LIM	LIS	MIF	ETF	LTM	LTS	MTF
Cold Forest	38	41	36	51	34	39	55	52
Dry Forest	49	58	54	70	46	55	52	68
Moist Forest	39	46	46	53	33	43	44	54
Riparian Woodland	69		76	90				

[1]EIF-Early seral, Intolerant Forest, LIM-Late seral, Intolerant Multistrata Forest, LIS-Late seral, Intolerant, Single Strata Forest, MIF-Mid seral, Intolerant Forest ETF-Early seral, Tolerant Forest, LTM-Late seral, Tolerant Multistrata Forest, LTS-Late seral, Tolerant, Single Strata Forest, MTF-Mid seral, Tolerant Forest

Table 9 -- Average water stress (WSI) estimates for forested ecosystems.

Water Stress Index (WSI)

Pot. Veg Groups	UH[1]	RH	US	RS	EIF	WU	RW
Cold Forest							49
Dry Forest	49		37				
Moist Forest							
Riparian Shrub		78	62	79			
Cool Shrub	58		57			64	
Dry Shrub	69		67			51	
Riparian Woodland	59			91	69		63
Woodland			73			58	
Dry Grassland	65					78	

[1]UH-Upland Herb, RH-Riparian Herb, US-Upland Shrub, RS-Riparian Shrub, EIF-Early seral, Intolerant Forest, WU-Woodland Upland, RW-Riparian Woodland

Table 10 -- Average water stress index (WSI) for non-forest environments.

Nutrient Availability Index (NAI)

Pot. Veg Groups	EIF[1]	LIM	LIS	MIF	ETF	LTM	LTS	MTF
Cold Forest	6	7	5	5	8	7	5	7
Dry Forest	9	6	6	5	9	8	11	7
Moist Forest	10	6	10	7	10	7	9	8
Riparian Woodland	8		1	4				

[1]EIF-Early seral, Intolerant Forest, LIM-Late seral, Intolerant Multistrata Forest, LIS-Late seral, Intolerant, Single Strata Forest, MIF-Mid seral, Intolerant Forest ETF-Early seral, Tolerant Forest, LTM-Late seral, Tolerant Multistrata Forest, LTS-Late seral, Tolerant, Single Strata Forest, MTF-Mid seral, Tolerant Forest

Table 11 -- Average nutrient availablity index (NAI) estimates for forested environments.

Nutrient Availability Index (CSI)

Pot. Veg Groups	UH[1]	RH	US	RS	EIF	WU	RW
Cold Forest							9
Dry Forest	6		11				
Moist Forest							
Riparian Shrub		9	5	8			
Cool Shrub	4		11			9	
Dry Shrub	4		11			14	
Riparian Woodland	6			5	8		8
Woodland			9			12	
Dry Grassland	7					7	

[1]UH-Upland Herb, RH-Riparian Herb, US-Upland Shrub, RS-Riparian Shrub, EIF-Early seral, Intolerant Forest, WU-Woodland Upland, RW-Riparian Woodland

Table 12 -- Average nutrient availability index (WAI) estimates for non-forested ecosystems.