United States
Department
Of Agriculture

Forest
Service

Northern
Region

Kootenai
National
Forest

Vegetation Response Unit Characterizations and Target Landscape Prescriptions 1999

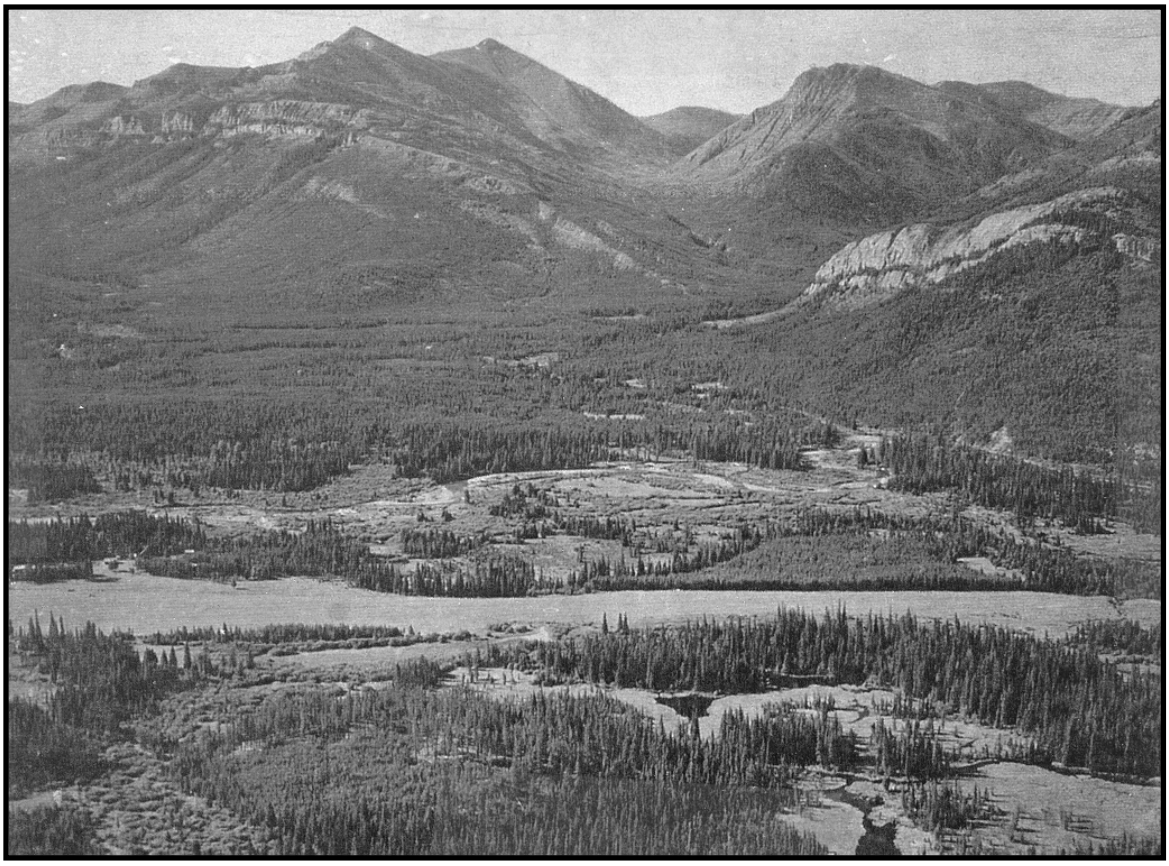


Table of Contents

Introduction 1
Kootenai National Forest VRU Map 5
Summary of Key VRU Attributes 6

Vegetation Response Unit Descriptions
VRU 1 Warm and Dry 9 9
VRU 2 Moderately Warm and Dry 21 21
VRU 3 Moderately Warm and Moderately Dry 39 39
VRU 4 Moderately Warm and Moist 57 57
VRU 5 Moderately Cool and Moist 73 73
VRU 6, 8 Moderately Cool and Wet, Cool and Wet 91 91
VRU 7 Cool and Moist 103 103
VRU 9 Cool and Moderately Dry 123 123
VRU 10 Cold and Moderately Dry 137 137
VRU 11 Cold 145 145

Bibliography 155 155

Appendices
Appendix A: Common and Scientific Plant Names 159 159
Appendix B: Glossary of Terms 163 163
Appendix C: Recommended Age Class Distribution 165 165
Appendix D: Vegetation Response to Disturbance 167 167

Maps
Kootenai Planning Units & Subunits Map 1
Stillwater Planning Unit Map 2
Koocanusa Planning Unit Map 3
Tobacco Planning Unit Map 4
Fisher Planning Unit Map 5
Kootenai Planning Unit Map 6
Yaak Planning Unit Map 7
Bull Planning Unit Map 8
Clark Planning Unit Map 9

Ecosystem-based Planning and Landscape Prescriptions

Background

In 1991, the Kootenai National Forest (KNF) began developing target stands to assist silviculturists and others in the preparation of site specific prescriptions. These target stands were designed for stand level application to meet Forest Plan objectives of maintaining growth and yield at 90% of potential on fully stocked, suitable lands. It was intended that target stands would be the mechanism to direct management opportunities that came out of a diagnostic process that compares existing conditions with desired.

In 1993, the EM Core Group recommended that community based target stands be written with the objective of emulating processes that occurred on the landscape within the context of a representative range of variation. Essentially the focus was on outcome-oriented prescriptions rather than output. Building on the concepts of ecosystem management, projects such as Bristow and Miller Creek began developing a process for delineating ecological land units (ELUs) and designing future landscapes. Subsequent projects (1994 Fire Assessment, South Fork EIS, Trego EA, etc.) provided further characterization of the landscape utilizing ELUs as the basis. In general, these projects modified traditional timber target stands to meet broader, landscape-level objectives.

The information presented in this paper is an attempt to continue the documentation necessary to further our understanding of ecosystem-based management, within the context of landscape level prescriptions. It is intended as a reference at the broad scale and assumes that more site-specificity would be added at the project level to compliment this work. At this time, these are simply management recommendations, not directives or standards. A draft of this report was released for review by Kootenai National Forest personnel in December of 1997. It is assumed that subsequent efforts will build on this foundation as relevant information becomes available.

Discussion

Forest and project level assessments that emphasize ecosystem-based management focus on strategies for sustaining natural processes and promoting long term forest health while producing a sustainable flow of goods and services for public needs. One of the primary vehicles for doing this is the conservation of biodiversity. This strategy requires an understanding of ecosystem function, composition, and the ecological processes that occur across the landscape. A healthy ecosystem is considered to be more resilient to natural and human-caused disturbances, and is less likely to result in irretrievable loss of species populations.

The vegetation response unit (VRU) is suggested as the basic environmental stratification for relating repeatable landscape patterns to predictable ecological processes. Additionally, it provides a mechanism to interpret existing vegetation in the context of natural disturbance processes and enables a projection of future landscape conditions and a foundation for landscape design. With an adequate description of the individual response units within a project area, an interdisciplinary team would be able to interpret the existing ecological trends, with an understanding of the inherent ecological role, and consider what management opportunities are necessary to achieve some level of a desired future condition. Our awareness and understanding of disturbance ecology, the role of disturbance in ecosystem dynamics, and our ability to communicate that understanding internally and to the public is very important. Along with that, we also appreciate that ecosystems are constantly changing in ways that are only partially predictable. To ignore the eventuality of disturbance or presume some sort of steady state condition may only compromise ecological resiliency.

The vegetation response unit is an analysis scale that is equivalent to the land unit, as described in the National Hierarchical Framework of Ecological Units (USDA 1993), and is also analogous to ecological land units. The term vegetation response unit has been adopted throughout Region 1 as it appears to better convey the intent of this land unit as a means to characterize the landscape within the context of disturbance processes that initiate change.

Methodology for Delineation of Vegetation Response Units

The VRU is intended to be an aggregation of land having similar capabilities and potentials for management. As mapped polygons these units have similar patterns in potential natural communities (habitat types), soils, hydrologic function, landform and topography, lithology, climate, air quality, and natural disturbance processes (fire regimes, succession, productivity, nutrient cycling). The interaction of all these processes creates a mosaic across the area landscape. Within individual polygons of any VRU over time, the proportion of age and size classes, successional stage, impacts of fire and/or disease will be dynamic as natural and managed disturbances occur.

The Forest has identified 15 primary VRUs (see below). Labelled with a generic classification, they reflect biogeoclimatic influences such as habitat type, landtype and aspect. The Region 1 Habitat Type Groups were the foundation for this classification. It is felt that because of the abundance of available water in our ecological zone, geologic material is weakly correlated with vegetation patterns and processes. Consequently, to a large degree, the habitat type groups do a very good job of discriminating disturbance probabilities and vegetation responses. Originally, there was interest in distinguishing between VRUs containing soils with volcanic ash-influenced loess and those without loess. While there is a significant difference in site productivity, on a broadscale these differences were not easily mapped. In effect, non-loess soils on the KNF represent less than 0.5% of the land area so did not justify differentiation as a separate VRU.

REGIONAL HABITAT GROUPING / KOOTENAI VRU CRITERIA - CODES

Habitat Group	Climate Modifier (Regional Grouping)	Generalized Characterization KNF Criteria	Vegetation Response Unit
HG 1	Warm and Dry	Habitat Group	VRU 1
HG 2	Moderately Warm and Dry	Habitat Group, Aspect	VRU 2N,VRU 2S
HG 3	Moderately Warm and Moderately Dry	Habitat Group	VRU 3
HG 4	Moderately Warm and Moist	Habitat Group, Aspect	VRU 4N, VRU 4S
HG 5	Moderately Cool and Moist	Habitat Group, Aspect	VRU 5N, VRU 5S
HG 6	Moderately Cool and Wet	Habitat Group	VRU 6
HG 7	Cool and Moist	Habitat Group, Aspect	VRU 7N, VRU 7S
HG 8	Cool and Wet	Habitat Group	VRU 8
HG 9	Cool and Moderately Dry	Habitat Group	VRU 9
HG 10	Cold and Moderately Dry	Habitat Group	VRU 10
HG 11	Cold	Habitat Group	VRU 11

At this time, VRUs have been mapped for all Planning Subunits (formerly physiographic areas) on the Forest, in support of district landscape assessments. Based on Regional protocol, the Forest mapped the VRUs with a minimum polygon size of approximately 100-200 acres and a map scale of 1:24,000. In order to be useful as an analysis tool, the number of polygons had to be small enough to allow comprehension and yet large enough to allow the unique functioning of ecosystems to be identified. Likewise, the size of the mapping units had to be large enough to allow visualization and yet small enough to be relatively pure.

The VRU characterizations in this paper were written to provide a forestwide scale of reference to land units having a given set of characteristics. VRUs were evaluated for their unique characteristics and given relevant descriptors and criteria. The descriptions included information on habitat features, landtype, aspect, fire intensity and frequency, Fire Group, wildlife habitat characteristics, vegetative succession, nutrient cycling, etc. As valley segment response units (VSRUs) are mapped, it is likely that characterizations will be written to describe conditions by valley bottom type, Rosgen type, downed woody debris recruitment, streamflow patterns, etc.

There is Regional consistency in the overall design and interpretation of vegetation response units. Forests such as the Kootenai, Idaho-Panhandle, Flathead and Lolo share many common ecological conditions, and a consistent methodology for characterizing VRUs would allow districts bordering other forests a mechanism to conduct large scale planning efforts and a means for applying successional pathway models that are being developed for the region. Models such as Simpplle will facilitate our efforts in managing the processes of natural and managed change on the landscape. Results will be helpful to interdisciplinary teams and managers in understanding the risks inherent in alternative approaches to land management.

Application of Vegetation Response Units

The information presented in this paper is intended for consideration by interdisciplinary teams working on landscape assessments and project-level planning that have an overall objective of determining the health of a project area, the kind of treatments that may be feasible, implementation concerns, and how to monitor the status of the ecosystem. Using this interpretation in conjunction with the revised Forest Plan and similar efforts, managers should be able to analyze ecosystems, develop diagnoses and alternatives, and implement prescriptive treatments to improve ecosystem health.

The vegetation response unit descriptions that follow are framed within an outline that includes vegetation structure (patch size, horizontal/vertical diversity), ecological function (interior habitat, habitat linkage, special habitats, snags, unique ecological roles) and vegetative composition (cover type, habitat type, understory) as primary elements. In addition, some discussion of the relationship between historic age class distributions and desirable future conditions is described. In order for an analysis to consider the impacts of varying management scenarios, a depiction of the most typical successional pathway for each VRU is also included. It is by no means intended to convey all scenarios possible.

In addition, I have attempted to interpret the existing ecological trends, with respect to the inherent ecological role, and list some silvicultural strategies to begin a process of meeting desired conditions. The VRU descriptions in this paper should provide sufficient detail to facilitate diagnostic and prescriptive efforts while remaining broad enough to allow for site-specific interpretation at the project level. It is assumed that users will apply personal knowledge of the area,

project level inventory data, and more refined target stands to further develop the management strategies depicted here.

Interdisciplinary teams can also utilize information collected from archeological studies, paleobotanical records, faunal analysis, etc. to accompany findings from fire scar studies, tree ring dating and forest inventories. It is recommended that interdisciplinary teams utilize a matrix to display the resource attributes for each VRU with respect to the historic, existing and desired future conditions of a project area. This profile will facilitate the development of management opportunities to meet desired conditions and should include a description of what consequences can be expected if no action is taken. The examples of this methodology have been utilized by most districts with positive results.

Suggestions for Additional Work

I think it would be important to utilize the archeological record in order to better understand the human role in ecosystem development. Understanding human processes, and the resulting extensive cumulative effects on ecosystems, will provide land managers with a more accurate temporal and physiographic range of ecosystem capabilities. Knowledge concerning the human processes that altered landscapes over thousands of years is as important to ecosystem management as understanding hydrological, geological, and climatological influences (Periman et al. 1997). Investigations in areas such as West Fork Yaak and Sheldon Flats illustrate the value of using prehistoric and historic records research to support project-specific management.

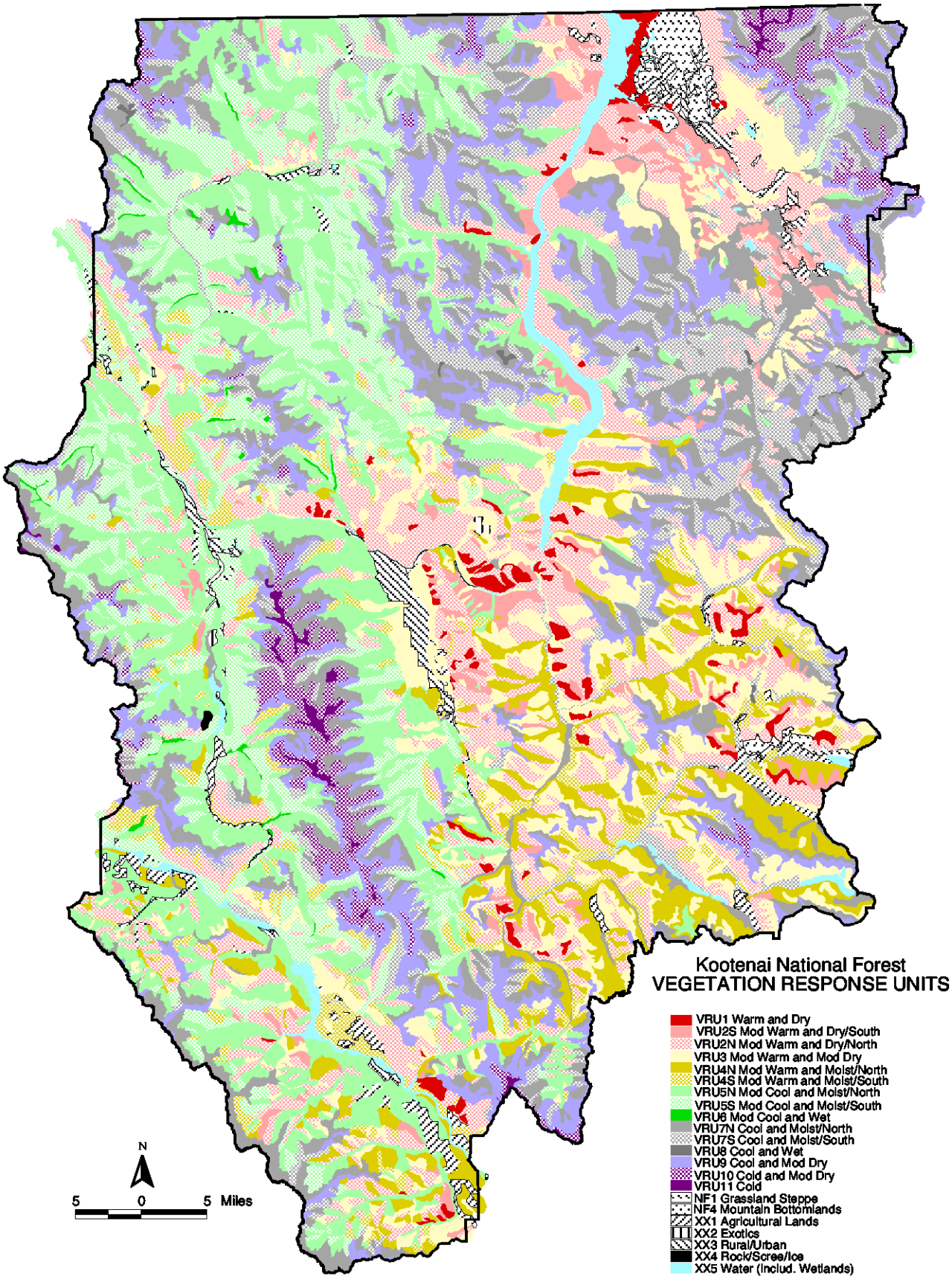
At the project level, it may be relevant to further break down some VRUs by slope class, in cases where it may be a driving variable for predicting fire regimes and fire behavior. If this is done, the use of DEMs is recommended to delineate the slope classes into breakdowns such as: 0-10%, 11-30%, and 31%+. These slope classes would be coded as 'A', 'B', or 'C' for flat, moderately steep, and steep landforms, respectively.

It is assumed that additional target stands with a higher degree of specificity may be developed at the project level. These stand-level attributes would reflect specific project and resource objectives that are expected to change with time and the application of very specific silvicultural activities.

In describing silvicultural systems and vegetation management the use of approved R-1 terminology was emphasized. It is hoped that additional efforts will be made to broaden the scope of silvicultural terms to include ecosystem-based practices such as that described in Kohm and Franklin 1997.

Russ Gautreaux

Silviculturist, Three Rivers District


Kootenai National Forest
VEGETATION RESPONSE UNITS
VRU1 Warm and Dry
VRU2S Mod Warm and Dry/South
VRU2N Mod Warm and Dry/North
VRU3 Mod Warm and Mod Dry
VRU4N Mod Warm and Moist/North
VRU4S Mod Warm and Moist/South
VRU5N Mod Cool and Moist/North
VRU5S Mod Cool and Moist/South
VRU6 Mod Cool and Wet
VRU7N Cool and Moist/North
VRU7S Cool and Moist/South
VRU8 Cool and Wet
VRU9 Cool and Mod Dry
VRU10 Cold and Mod Dry
VRU11 Cold
NF1 Grassland Steppe
NF4 Mountain Bottomlands
XX1 Agricultural Lands
XX2 Exotics
XX3 Rural/Urban
XX4 Rock/Scree/Ice
XX5 Water (includ. Wetlands)
N
5 0 5 Miles

Summary of VRU Attributes

VRU	Climatic Modifier	% on KNF	Primary Fire Groups	Predominant Fire Regime	Historic Patch Size	Species Composition	Historic Stand Structure	Coarse Woody Material
1	Warm and Dry	1	4	* nonlethal low severity 5-25 yr. FRI (see note)	<5 ac small openings, within 20-200 ac patches	PP with lesser amounts of WL and DF	diverse mix, open stand, well spaced trees (5-20 tpa) interspersed with larger openings and dense patches, multi-aged, 1-2 stories. Ave. basal area 50-80 sq.ft/ac	5-9 tons/ac
2S 2N	Moderately Warm and Dry	16	6	* VRU 2S- nonlethal, low severity 15-45 yr. FRI * VRU 2N- nonuniform mixed severity 15-45 yr. FRI * nonuniform lethal stand replacement ave. 225 yr. FRI	variable size small openings (0-5 ac), within 20-200 ac patches created by mixed and lethal fires	PP/DF dry, lower elevations WL/LP with PP moist upland	diverse mix, open stand well spaced trees (15-30 tpa) interspersed with larger openings and dense patches, multi-aged and 1-2 stories. north slopes more even-aged and single storied with some variety in size/age. Ave. basal area 60-100 sq.ft/ac	5-9 tons/ac Psme/Phma 12-25 tons/ac Psme/Caru
3	Moderately Warm and Moderately Dry	9	6,11	* nonlethal, low severity 25-50 yr. FRI * mixed severity, 70-250 yr. FRI on cool, wet sites. 30 yr. FRI on warm, moist sites. 75-80 yrs in LP stands * nonuniform, lethal stand replacement 100-250 yr. FRI	5 to 50 ac 20-200 ac	WL/DF/PP dry, lower elev WL/DF/LP moist, uplands	variable, gaps to large even-aged single storied patches to larger area multi-aged multistory and single story open grown stands. ave. basal area 80-120 sq ft/ac, more in riparian areas. tpa ranged from 15-60	10-20 tons/ac
4S 4N	Moderately Warm and Moist	9	11	* VRU 4S- nonuniform, mixed severity 30-85 yr. FRI * VRU 4N- nonuniform, lethal stand replacement, ave. 200 yr. FRI	20-75 ac 100-300 ac or more	WL/DF with LP,GF,WP, PP	varies with topography. two storied, even and uneven-aged in lowlands. single and two storied, even-aged in upland areas. basal area ave. 150-200 sq ft/ac and 30-50 overstory tpa in upland areas to over 200 sq ft/ac in valley bottoms	15-30 tons/ac
5S 5N	Moderately Cool and Moist	27	11	* VRU 5N- nonuniform, lethal stand replacement 250+ FRI (110-340 yr. range) * VRU 5S- nonuniform, mixed severity 75 yr. FRI (17-113 yr. range)	100-300 ac potential for larger 100 ac or less	WL/DF with WP, ES,LP,GF,WRC,WH	varies with topography. two storied, even and uneven-aged in lowlands. often two-aged and storied in upland areas. basal area ave. 150-200 sq ft/ac and 30-50 overstory tpa in upland areas to over 200 sq ft/ac in valley bottoms	15-32 tons/ac
6	Moderately Cool and Wet	**<1**	11	fire is not a significant disturbance agent infrequent, low severity or stand replacement 300-400 yr. FRI	varies with stream channel and disturbances from adjacent stands	WRC,WH,WP,WL, ES	old growth characteristics, multi-aged, fairly dense but multi-storied canopy of large trees with shade tolerant understory	15-32 tons/ac

VRU	Climatic Modifier	% on KNF	Primary Fire Groups	Predominant Fire Regime	Historic Patch Size	Species Composition	Historic Stand Structure	Coarse Woody Material
7S 7N	Cool and Moist	**20**	9	* lethal, stand replacement >100 yr. FRI in LP/DF, 120-268 yr. in L/DF, up to 300 yrs in spruce bottoms * less prevalent nonuniform mixed severity, 50-70 yr. FRI in LP/DF, 38-120 yrs in L/DF, up to 120 yr. in ES	5,000 to 100,000 ac 100 ac or less	WL,LP,WP,ES,DF with GF,SAF	mostly even-aged single storied and two storied, some dense LP stands basal area ave. 80-120 sq ft	12-25 tons/ac
8	Cool and Wet	**<1**	9	fire is not a dominant disturbance agent infrequent low severity or stand replacement 150-250 yr. FRI (ave. 220 yrs)	varies with stream channel and disturbances from adjacent stands	WRC,WH,WP,WL, ES	old growth characteristics, multi-aged, fairly dense but multi-storied canopy of large trees with shade tolerant understory	12-25 tons/ac
9	Cool and Moderately Dry	**10**	7,8	* nonuniform stand replacement 100-115 yr. FRI * some mixed severity, nonuniform burns 50-71 yr. FRI	5,000 to 100,000 ac 50-300 ac	LP,SAF in frost pockets LP,SAF,ES,DF,WL on moist upland sites	even-aged LP with scattered relic overstory WL, some stands mixed with DF, SAF basal area ave.. 80-120 sq ft	12-25 Abla/Xete Abla/Libo 7-15 Abla/Vasc
10	Cold and Moderately Dry	**2**	10	* low -mixed severity 35-300+ years * stand replacement 200+ years	overall 200-30,000 ac, averages 2,400 ac	WBP, ES, LP with SAF,MH	fairly open stands with clustered trees uneven-aged, mosaic	7-15 tons/ac
11	Cold	**<1**	10	* low-mixed severity 35-300+ yrs * stand replacement 200+ years	overall 200-30,000 ac, averages 2,400 ac	alpine larch, WBP, ES,SAF	mosaic vegetative patterns, open stands with clustered and shrublike trees, uneven-aged	ave.. 11 tons/ac

* **Note**: mgmt. intended to emulate the fire regime in VRU 1 (NL 5-25 yr. FRI) would likely be in the 15-25 yr. return interval in order for a new cohort to become established prior to burning

Glossary

PATCH SIZE. Continuous areas of similar forest structure considered to be the area regenerated, at one time, following a fire.

FIRE SEVERITY. The degree to which a site has been altered or disrupted by fire; a product of fire intensity, fuel consumption, and residence time.

FIRE REGIME. The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, seasonality and extent in an ecosystem. At least three fire regime classes can be described for the forested ecosystems of the project area:

Nonlethal Fire Severity. A low-severity or cool fire with minimal impact on the site. It burns in surface fuels consuming only the litter, herbaceous fuels, foliage and small twigs on woody undergrowth. Little heat travels downward through the duff. nonlethal fires can be expected to result in up to 20% canopy cover loss.

Lethal (Stand Replacing) Fire Severity. A high-severity fire that burns through the overstory and understory consuming large woody surface fuels and potentially the entire duff layer. Following this type of fire, anywhere from 70-90% of the mature canopy cover is killed, stand development is set back to an initiation stage, and stand replacement begins. Despite the intensity of these disturbances, it is common for scattered islands of unburned vegetation to remain in areas that are protected.

Mixed Fire Severity. A broad category of moderate fires which includes the characteristics of both lethal and nonlethal fires. Mixed severity fires can consume litter, upper duff, understory plants and foliage on understory trees. Individuals and groups of overstory trees may torch out if fuel ladders exist. This fire regime may result in anywhere from 20-70% loss in tree canopy occurring within a mosaic of stand conditions. .