Northern Idaho and Western Montana Nutrition Guidelines By Rock Type

Nutrition guidelines for use in conjunction with current digital geology for Idaho and Montana

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Intermountain Forest Tree Nutrition Cooperative
Forest Resources Department
University of Idaho

Authors: **Mariann T. Garrison-Johnston, Research Scientist, IFTNC**
Reed Lewis, Associate Research Geologist, Idaho Geological Survey
Leonard R. Johnson, Interim Director, IFTNC

Reviewers: **Jeff Collins, Montana Department of Natural Resources and Conservation**
Jeff Lonn, Montana Bureau of Mines and Geology
John Mandzak, Potlatch Forest Holdings
Scott McLeod, Washington Department of Natural Resources
Terry Shaw, Intermountain Forest Tree Nutrition Cooperative

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Introduction

This document was prepared as a guideline to help forest managers determine appropriate nutrient management strategies for stands on various rock types in western Montana and northern Idaho. Digital geologic maps provided through the Idaho Geological Survey (IGS), Montana Bureau of Mines and Geology (MBMG) and the United States Geological Survey (USGS) were utilized in the development of these guidelines. The maps were viewed using ArcView 3.3, and rock unit codes and descriptions were compiled from attribute tables and map documentation. An electronic lookup table was created for each geologic quadrangle (tables provided on accompanying CD), and may be linked to the respective digital geology map attribute table to assign the Intermountain Forest Tree Nutrition Cooperative (IFTNC) categorization to the individual map units. Further information as to map sources and lookup table structure, as well as hard copies of the lookup tables for use with paper maps, are provided in the Appendix.

This report incorporates 516 map units in western Montana and 779 map units in northern Idaho. The map units were categorized into five major categories (major units), and further assigned to one of 27 subcategories (minor units) within the five major units. The lithology and expected weathering behavior of the rocks comprising each minor unit are discussed, and recommendations as to nutrient management guidelines and strategies are provided. These guidelines are based on our current state of knowledge regarding rocks and forest growth in the inland northwest. Our information on fertilization response for Montana forest types in particular is currently very limited. **Therefore, these nutrient management recommendations will be conservative and should not be viewed as absolute. We fully expect these guidelines to be further refined with additional research and experience.**

IMPORTANT: Geologic maps are a useful tool for forest management as long as we recognize that geologic maps were not developed for use at the forest stand scale. We have found the IGS, USGS and MBMG maps to be very good for providing a general idea of the rocks likely to be found in a particular area, and often the maps are reasonably precise to the stand level. **Nonetheless, rock type should always be verified in the field as part of nutrient management planning. The information included in this report is intended only to provide general guidelines towards the formulation of silvicultural prescriptions. Managers will also need to take into account stand history and conditions, organizational objectives and other relevant information when formulating site-specific prescriptions.**

How To Use This Document

Every map unit in each geologic quadrangle was assigned a major unit, minor unit and lithology grouping. Each lithology grouping was then assigned a weathering susceptibility estimate and a tree value (e.g. good rock/bad rock) rating. Specific details as to the creation and assignment of these groupings are further described in the main text of this report, along with observations regarding ash effects on stand growth rate and fertilization response. Silvicultural recommendations, including nutrient management and fertilizer recommendations, are also provided in the text. A summary of the weathering susceptibility, tree value and ash cap effects by major and minor unit is provided in **Appendix A**.

The geologic maps used in this report must be obtained from their respective publishers. Paper and digital maps for Montana are available through the Montana Bureau of Mines and

Geology website (http://www.mbmg.mtech.edu/stmap.htm). Publicly available maps for northern Idaho are available through the Inside Idaho website[1] (http://www.insideidaho.org), otherwise paper and preliminary digital releases are available by contacting Loudon Stanford at the Idaho Geological Survey (email: stanford@uidaho.edu, telephone: 208-885-7991). Quadrangles that were used in the compilation of this report are shown in **Appendix B**.

This document may be used in conjunction with a GIS by using the accompanying dBASE lookup tables (*.dbf files). A description of the information included in the dBASE tables is provided in **Appendix C**, along with details on how to merge each table with its respective digital geologic map attribute table. This document may also be used in conjunction with paper maps by using the tables provided in **Appendix D**. To use this document with paper maps, users should find the map unit of interest on one of the geologic maps referenced in this report, and then look up the associated major unit, minor unit and lithology in Appendix D. The paper map lookup tables have been alphabetized by map unit code in order to facilitate use by non-geologists. In both cases, refer to the text of this report for discussion of geology and silvicultural recommendations.

Rationale and Recommended Reading

The Intermountain Forest Tree Nutrition Cooperative (IFTNC) has been studying forest nutrition in the Inland Northwest since 1980. Initial studies focused on nitrogen (N) nutrition, and subsequent findings suggested that potassium (K) also plays an important role in forest health (Entry et al. 1991, Mika et al. 1993, Moore et al. 1994). Nitrogen tends to promote growth by increasing foliage biomass production, thereby providing for increased stem growth via increased photosynthetic capacity. In contrast, K appears to decrease mortality by promoting production of biochemical defense compounds. The source of K and most plant nutrients other than N is the underlying rock, which in some cases may be augmented or replaced by surficially deposited parent materials. To further determine the potential role of K in decreasing tree mortality, a region-wide N and K trial known as the Forest Health and Nutrition Study was implemented by the IFTNC in the mid-1990s. The study design incorporated bedrock geology and site moisture status (as indicated by potential climax vegetation) as the principal experimental effects. While rock and vegetation series had routinely been noted as factors affecting forest growth response to fertilization in earlier studies (Shen et al. 2000), the Forest Health and Nutrition Study was the first to require that stands meeting certain rock and vegetation series criteria be included in the study. The subsequent discovery that certain stand types (drier vegetation series) could not be found on certain rock types (metasedimentary) stimulated a more in-depth look at rocks and the effect of geology on soil conditions and stand growth and health (Moore and Mika 1997, Garrison-Johnston et al. 2003, Garrison-Johnston et al. 2003, Moore et al. 2004). While these findings led to the establishment of additional studies to observe the effects of rock type on the growth and health of seedlings and young stands, they also resulted in the incorporation of rock type as a major factor influencing forest management and fertilization recommendations (Garrison and Moore 1998, Garrison-Johnston and Moore 2001, Garrison-Johnston and Johnson 2004).

This report was developed to provide regional resource managers with the best information currently available based on the experiences and observations of IFTNC staff.

[1] For this report we utilized the newest geology for the Kooskia 1:100K Quadrangle, which should be available in preliminary digital form in late 2007. As such, the Kooskia lookup tables accompanying this report WILL NOT correspond with the map units on the prior Kooskia geologic map (Lewis and Stanford, 2002).

Because our past studies in Montana have been somewhat limited, much of this information is a 'best guess' for that region. At the suggestion of Montana DNRC personnel, we have included some additional information about rocks and soils based on the Montana Agricultural Extension Station publications *Geologic Parent Materials of Montana Soils* (Veseth and Montagne 1980) and *Soils of Montana* (Montagne et al. 1982). These publications are currently available from Montana State University and are recommended accompaniments to this report. Users will also benefit from a *Dictionary of Geologic Terms*, particularly when interpreting the terminology used on geologic maps (American Geological Institute 1984). Two excellent books for learning about the geology of Montana and the northwest are *Roadside Geology of Montana* (Alt and Hyndman 1982) and *Northwest Exposures: A Geologic Study of the Northwest* (Alt and Hyndman 1995). Numerous textbooks on introductory geology are available through on-line book sellers. A recent review of currently available texts showed *The Practical Geologist: The Introductory Guide to the Basics of Geology and to Collecting and Identifying Rocks* (Dixon 1992) as being of potential interest to those interested in developing a deeper understanding of geology, and the *Smithsonian Handbooks: Rocks & Minerals* (Pellant 2002) as a nice field handbook, with numerous photographs and descriptive geology basics.

Geology Overview

This document assumes a certain level of familiarity with geological classification and terminology. The aforementioned recommended readings should provide useful background information for this report. A very brief review of geologic classification is also presented below, along with a description of how the IFTNC categorizes rock types. Volcanic ash is also briefly discussed.

Basic Classification: Rocks are classified into three broad groups: Igneous, Sedimentary and Metamorphic:

1. **Igneous** rocks are those derived from magma that rises from the earth's interior, cooling as it rises to the surface. There are two broad categories of igneous rock based on where and how quickly the magma crystallizes. Magma that is extruded onto the earth's surface cools rapidly, forming fine-grained crystalline rocks called *extrusive or volcanic.* Basalt is a good example of a volcanic rock common to the Inland Northwest. Magma that is intruded or emplaced beneath the earth's surface cools slowly, forming large-grained crystalline rocks known as *intrusive or plutonic* rocks. Granite is a good example of a plutonic rock.
2. **Sedimentary** rocks are those formed from the transported fragments of other rocks that have broken down through either chemical or physical weathering, and been transported by mechanisms such as water (alluvial/lacustrine), wind (eolian), gravity (colluvial), or snow and ice (glacial). Glaciation and glacial deposits are common features of Montana's and Idaho's history and that of the Inland Northwest. Sedimentary deposits may become cemented together, or lithified, such as a sandstone or conglomerate rock. Other deposits may remain unconsolidated, such as alluvial, glacial or landslide deposits.
3. **Metamorphic** rocks are rocks that have been altered by heat and pressure, such as that which might occur following deep burial by sediments in a marine environment, or by tectonic or volcanic activity of a mountain-building event. These intense forces often result in deformation of the rock texture and changes in the rock's mineral composition. A weakly metamorphosed rock in which the parent rock is still recognizable is

considered to have undergone low-grade metamorphism. In other cases the rock is so strongly metamorphosed that the parent rock is not identifiable, and textural descriptors such as 'gneiss' or 'schist' are used, perhaps with mineral modifiers such as 'mica' (mica schist) or 'biotite' (biotite gneiss). This level of alteration is the result of high-grade metamorphism. A very common group of metamorphic rocks in northern Idaho and western Montana is the Belt Supergroup of metasedimentary rocks. These rocks that occur as layers of sediment were deposited in a shallow inland sea environment in ancient (Precambrian) times, over a very long period of time. The pressure caused by the increasing burial of these sediments led to a low-grade metamorphic transformation of these rocks in which the parent rock is still identifiable. Thus, sedimentary rocks classed as sandstone, siltstone and claystone often underwent a low-grade metamorphosis to become quartzite, siltite and argillite, respectively. These rocks were subsequently brought to the surface during later geologic events in the Inland Northwest. Other rocks common to the Belt Supergroup include calcareous or dolomitic argillite, siltite and quartzite, and even some schists and gneisses in the older rocks. Belt rocks have been classified as belonging to various formations that were named based on the locality in which they were first mapped.

Tree Nutrition Cooperative Classification: The IFTNC has traditionally categorized the geology underlying its research sites into four major groups (Granitic, Basaltic, Mixed and Metamorphic), based largely on the occurrence of rocks in its Inland Northwest research area. The Granitic and Basaltic units represent the intrusive and extrusive igneous rocks, respectively. The Mixed unit includes all sedimentary rocks, but relative to IFTNC research sites is dominated by glacial deposits. Similarly, the Metamorphic unit includes all metamorphic rocks, but tends to be dominated by the metasedimentary rocks, often Belt rocks, found at many research sites.

As information relative to the effects of rock type on forest productivity increased, there was a need to expand the classification categories used by IFTNC. For the purposes of this report, five major groups have been established. The original 'Granitic' and 'Basaltic' groups were renamed 'Intrusive' and 'Extrusive and Subvolcanic' to accommodate other igneous rocks besides granite and basalt. The Metamorphic unit was retained. The Mixed unit was divided into Sedimentary Rocks (for lithified or consolidated rocks) and Unconsolidated Deposits. Several Minor Units were then created within each of these five Major Units to allow additional detail within this classification system for the many rock types found in Idaho and Montana. In many instances the IFTNC does not have research sites on these rock types, and in some cases forest stands may not even occur on these rock types. Therefore, the nutrition management guidelines included in this report are based only on IFTNC experiences with forest growth and soil conditions on rocks with which we have familiarity. For the many rocks where we do not have research information, we state that the effects of that rock type on forest growth and fertilization response are 'unknown,' and offer a conservative nutrient management recommendation along with a recommendation for further research such as screening trials, if warranted. A rock type would warrant additional research if it is a common geologic parent material underlying the ownerships of our members.

Not included in this report are recommendations based on surficially-deposited parent materials, such as volcanic ash or loess deposits. This is partly because such deposits are often not noted on bedrock geology maps, though in some cases a deposit may be so deep as to become the effective parent material for the forest stand. Site reconnaissance is usually necessary to establish the presence of surficial deposits. If a shallow surficial deposit is present, that deposit may be expected to modify the effects of the underlying residual soils, but may also manifest itself in other site characteristics. For example, in northern Idaho, western red cedar or western hemlock vegetation series are often associated with deep ash deposits over various rock types. Nutrient management guidelines, in turn, rely in part on the moisture regime (as represented by vegetation series) in addition to underlying bedrock type.

Weathering Susceptibility: Field observation of soil development on various rocks suggests that deeper soils develop on some rocks than on others, even when other conditions (topographic, climatic, biotic, time) appear to be similar. This seems particularly evident amongst the Belt metasedimentary rocks, and appears related to the carbonate or calc-silicate component. In order to quantify these perceived differences in potential weathering susceptibility, an analysis of rock geochemical data from 446 samples collected throughout northern Idaho was performed by IFTNC, IGS and USGS personnel (Garrison-Johnston et al. 2003). A modification of Reiche's (1943) **weathering potential index (WPI)**[2] was selected to evaluate the potential variation in rock weathering rates due to rock geochemical composition. The WPI values were tabulated by lithology, and for most rocks ranged from a low of about 4 ('pure' quartzite, low weathering potential) to a high of about 22 (basalt, high weathering potential). It should also be noted that some rocks attained high WPI ratings based on geochemistry, but are not considered to have high weathering susceptibility because of other factors such as lack of permeability. Some examples of this would be dolomite (WPI: 72) and marble (WPI: 47). Weathering potential indices for the various lithologies are noted throughout this report, and additional commentary is included if the assigned weathering susceptibility rating varied from that suggested by the WPI analysis.

Volcanic Ash and other Surficial Deposits: Volcanic ash and other surficial deposits such as loess and alluvium tend to be more common in northern Idaho than in western Montana, particularly when associated with flat, flood-basalt plateaus. When present, these materials may dominate the soil profile and associated nutritional characteristics. Loess deposits tend to be more common in northern Idaho's Palouse region and areas to the south, decreasing in influence as we move towards the east and north across the landscape. A few geologic maps include overlays showing loess and alluvial deposits, as well as areas of deep rock weathering (saprolite). However, many geologic maps do not show these deposits, nor do geologic maps show ash presence and depth.

Ash caps in northern Idaho and western Montana resulted from past eruptions of Glacier Peak (WA), Mt. Mazama (Crater Lake, OR) and Mt. St. Helens (WA). Climatic conditions contribute to ash weathering, such that Montana ash caps are likely to show a less weathered appearance than their northern Idaho counterparts. In cooler and drier areas, the ash cap is likely to have a grayish hue, but as moisture and temperature increase the ash may start to display a yellowish to reddish tint as chemical weathering commences. Ash cap soils are likely to show low bulk density, good porosity and high moisture-holding capacity. The nutritional value of ash is not particularly high, being composed primarily of silicon and aluminum. Potassium may comprise 2-3% of volcanic ash, and if plants are available on-site to take up that potassium then it may be a K source. However, due to a relatively low cation exchange capacity, ash cap soils do not tend to have a strong nutrient-holding capacity, and its nutritional behavior is somewhat complicated by the development of variable-charge minerals as weathering progresses. The

[2] Weathering Potential Index (WPI) is referred throughout this report as an index of weathering susceptibility.

primary value of volcanic ash seems to be in its moisture-holding capacity, which often improves site productivity (Figure 1), and may affect fertilizer response (Figure 2). Volcanic ash will not be directly referenced as a parent material in this report, but is often referred to in the context of the improved site productivity and/or fertilization response associated with these deposits.

Figure 1. Douglas-fir site index (ft at 50 years) by base parent material and ash cap presence. Parent materials include basalt, glacial deposit (glacial), granite, metasedimentary (metased), sedimentary (sed), modern sedimentary deposits (mod sed) and tertiary sedimentary deposits (tert sed).

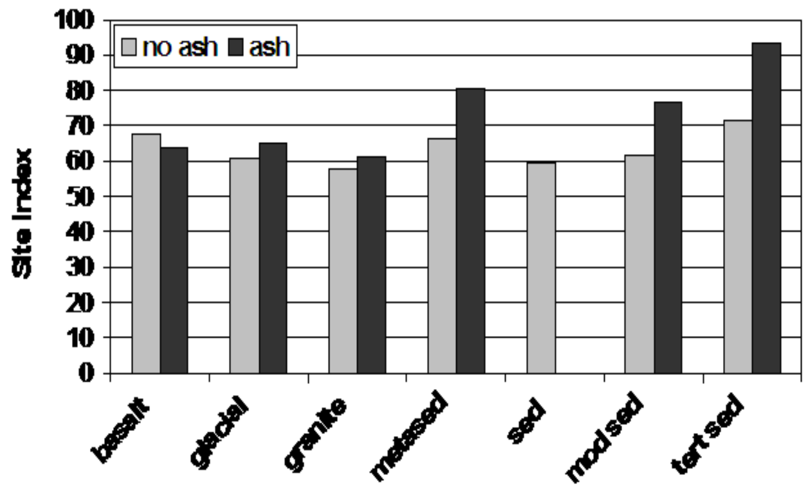
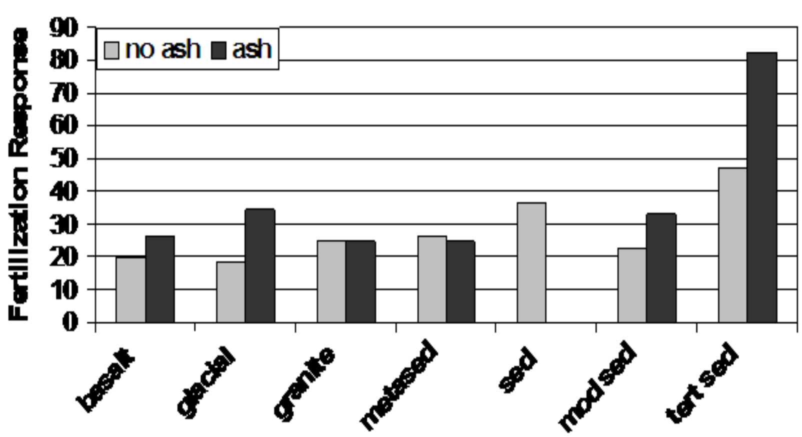


Figure 2. Six-year nitrogen fertilization response (ft^3 ac^{-1} yr^{-1}) by base parent material and ash cap presence. Parent materials include basalt, glacial deposit (glacial), granite, metasedimentary (metased), sedimentary (sed), modern sedimentary deposits (mod sed) and tertiary sedimentary deposits (tert sed).



Nutrition Overview

The term “nutrient” is used to denote any of seventeen naturally-occurring elements that are considered essential for plant growth. Three of these elements, carbon (C), hydrogen (H), and oxygen (O), are abundantly available in air, earth and water, and are not considered limiting factors to plant growth. Six elements, nitrogen (N), potassium (K), phosphorus (P), calcium (Ca), sulfur (S), and magnesium (Mg), occur in limited quantities, and because plants require these in relatively large quantities (500-14000 ppm) to grow and function adequately, they are referred to as “macronutrients.” A number of other elements which occur in limited quantities are required by plants only in trace amounts (usually <100 ppm), and these are known as “micronutrients.” Eight elements are currently considered micronutrients, and more will probably be added to this list over time as equipment detection levels and research techniques improve. Tables 1a and 1b respectively list the macro and micronutrients, their principal functions in higher plants, and their sources. Two non-nutritive elements that are occasionally referenced in this report are the common silicate mineral constituents, silicon (Si) and aluminum (Al).

Nutrient Diagnostics: Tests of foliage and soil chemistry may be performed as site-specific indicators of productivity and potential fertilization response. Most of our long-term results of fertilization research focus on N. Foliage N has been shown to be a better predictor of *site productivity* than soil N tests, while soil mineralizable N may be a better predictor of *fertilizer response* than foliage N tests (Garrison-Johnston et al. 2006). If satisfactory information on site productivity is available and the parent material/ash combination suggests that the site may be responsive to fertilization, managers should consider focusing on tests of soil mineralizable N. If mineralizable N is below 70 ppm, then the site should show a 6-year volume response of 10% or more to N-fertilization, with the potential response increasing as mineralizable N decreases. Foliage N may be tested as an indicator of overall site productivity; however the time and expense of this test make it less desirable than performing simple site height/age measurements.

Nutrient Management: “Nutrient management" refers to silvicultural activities as they affect the nutrient capital of a forest stand. Nutrient management strategies may be cultural in nature, including stand improvement, harvesting and planting, or they may be more manipulative in nature, such as by adding nutrients in the form of fertilizer.

- **Harvesting**: Most nutrients are held in limbs and foliage (Cole et al. 1967, Pang et al. 1987, Miller et al. 1993, Moller 2000); therefore, a conservative nutrient management strategy will leave the tops and limbs on-site during harvesting operations. Because the actual amount of material removed during a harvesting operation depends on the season of the year as well as the harvesting system, some consideration as to treatment timing can have an effect on management decisions. Whole-tree operations in late fall and winter, when breakage is more likely, should be more effective at leaving nutrients on the site than those which take place in spring and summer. Bole-only extraction includes tree-length operations where trees are limbed and topped in the woods, and is considered to be a conservative nutrient management strategy year-round. The level of nutrient removal during any harvest operation also depends on the merchantability standards in effect during the harvest, and whether the sub-merchantable trees are also harvested and removed. For purposes of this report, commercial thinning and regeneration harvest operations have been designated as ‘whole-tree’ or ‘bole-only’ extraction. We recognize

Tables 1(a): The macronutrients -- their function and source, and 1(b): The micronutrients -- their function and source. Most nutrient functions are from Marschner (1995). An asterisk indicates that a nutrient is available in fertilizer form.

Table 1(a): The macronutrients -- their function and source

Symbol	Element	Function	Source
N*	Nitrogen	Biomass production Photosynthesis (proteins)	Organic matter N-cycle
K*	Potassium	Disease resistance Osmotic potential, turgor Enzymatic transfer of glucose to starch Nitrate synthesis Photosynthesis and CO_2 fixation	Parent material
P*	Phosphorus	Structural constituent of DNA and RNA Basal metabolism (ATP and energy transfer) Photosynthesis (carbon partitioning)	Parent material
S*	Sulfur	Photosynthesis (proteins) Membrane structure Some defense substances	Atmosphere Parent material
Ca*	Calcium	Structural component (cell walls, membranes)	Parent material
Mg*	Magnesium	Chlorophyll Protein synthesis Enzymes and enzymatic reactions Carbohydrate partitioning	Parent material

Table 1(b): The micronutrients -- their function and source

Symbol	Element	Function	Source
Fe*	Iron	Chloroplast development, photorespiration Enzymatic reactions	Parent material
Mn*	Manganese	Enzymatic reactions Photosynthetic O_2 evolution	Parent material
Cu*	Copper	Nitrogen metabolism (NOTE: High N rates can induce Cu deficiency) Cell wall lignification Pollen formation and fertilization Carbohydrate and lipid content Enzymatic reactions	Parent material
Zn*	Zinc	Metabolic functions Complexes with N, O and S DNA replication Regulation of gene expression (NOTE: High P rates can induce Zn deficiency)	Parent material
Ni	Nickel	N metabolism	Parent material
Mo*	Molybdenum	N metabolism N_2-fixation May affect pollen formation/fruit formation Critical level increases with increasing N supply	Parent material
B*	Boron	Cell wall biosynthesis and structure Plasma membrane integrity Root elongation, apical dominance Deficient B associated with Eucosma sp. borer	Parent material
Cl*	Chlorine	Photosynthetic O_2 evolution Stomatal regulation	Parent material Atmosphere

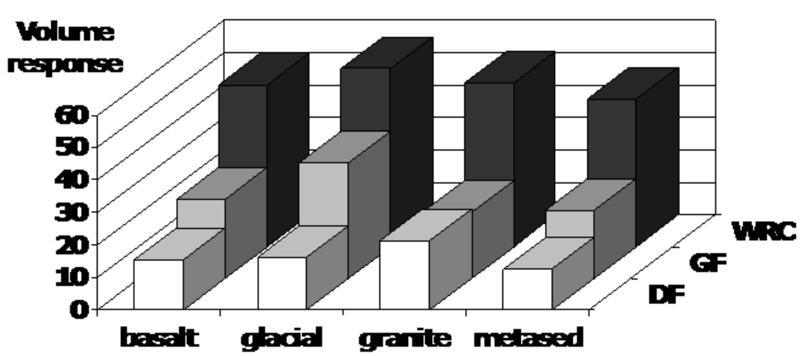
that there is a gradient in the amount of material that may be left on-site, ranging from removal of most materials during 'whole-tree' operations, to leaving most materials during 'bole-only' operations. By specifying particular types of harvesting systems and timing of the operation, foresters should be able to target operations to fall somewhere within this range of variability. A recommendation of 'bole-only removal' in these guidelines would suggest that as much material be left on-site as possible. A recommendation of 'whole-tree acceptable' would suggest that the site may be resilient to the removal of a greater quantity of material.

- **Species Ecology**: Species differ in nutrient demand (Gordon 1983, Gower et al. 1993, Miller et al. 1993, Garrison and Moore 1995, Moore et al. 2004), therefore planting a nutritionally-challenged site with less-demanding species would be a good nutrient management strategy. In the experience of the IFTNC, species may be ranked from high to low demand as follows:

Species	Demand
Grand fir	very high
Douglas-fir	high
White pine	moderate to high
Ponderosa pine	moderate
Lodgepole pine	low
Western larch	low
Western hemlock	low? (based on our observations)

- **Fire**: Fire suppression has increased the presence of shade-tolerant, nutrient-demanding species and has also altered the cycle by which nutrients were naturally returned to the system through fire (Little and Klock 1985, Feller 1988). Furthermore, a cool fire can effectively return much of the on-site nutrient capital to the soil. Therefore, using cool burns for slash control, site preparation or intermediate treatments would be a good nutrient management strategy.

Figure 3. Six-year nitrogen fertilization response (ft^3 ac^{-1} yr^{-1}) by base parent material and vegetation series. Parent materials include basalt, glacial deposit (glacial), granite and metasedimentary (metased). Vegetation series include Douglas-fir (DF), grand fir (GF) and western red cedar (WRC).



- **Fertilization**: Fertilization is an additional nutrient management strategy which may be used to improve the health or increase the productivity of a forest stand. Based on existing IFTNC research, a broad pattern of N fertilization response based on vegetation series and rock type has been detected (Figure 3), and has been incorporated into this report. As noted earlier, our fertilization experience in Montana is somewhat limited. Therefore the recommendations shown in this report will be based largely on our experiences in other IFTNC regions, including central and northeastern Washington, northeastern Oregon and northern and central Idaho.

- **Fertilization Strategies:** Things to consider when developing a fertilization regime:
  - → ***Moisture***: The first criteria to consider when contemplating fertilization is site moisture regime. In our experience, vegetation series is a good proxy for site moisture regime. Moist site types, characterized by western red cedar, western hemlock and western white pine, are the highest priority for fertilization, followed in descending order by sites on the grand fir vegetation series and those habitat types on the moist end of the Douglas-fir series. We have no fertilization response data for drier site types such as true ponderosa pine types, and at this time do not recommend fertilization of such sites. Furthermore, our fertilization response data for Montana is limited even on presumably moist site types. Therefore, we strongly recommend further research in the form of short-term screening trials and long-term fertilization rate trials prior to scheduling operational fertilization treatments.

  - → ***Parent Materials***: When selecting sites for potential fertilization or fertilization rate trials, if the vegetation series is appropriate for fertilization then rock type should next be considered along with surficial deposits. Use the guidelines in this report to determine whether a rock type is appropriate for fertilization, and what elements are recommended for application. It is assumed that the forest stand under consideration has been assessed and, based on moisture regime and organizational/financial objectives, has been deemed appropriate for fertilization. The decision of how much of each element to apply will be dictated by our current state of knowledge, as well as financial and other operational constraints. The IFTNC staff can provide guidance on application rates and expected responses.

  - → ***Management History***: Recent experience suggests that young stands, particularly plantations established after high levels of biomass removal and mechanical site preparation, are often deficient in S and B. This seems to be true for all rock types, but the nutrient status is relatively worse on “bad” rock types. Thus, stand management history should also be considered when assigning fertilization priorities for any site.

Acknowledgements

This report represents our first effort at classifying western Montana rocks for nutrient management purposes, and is a major rework of our initial effort at classifying northern Idaho rocks. We greatly appreciate the continued support and interest of all of our Cooperators in this effort. From the northern Idaho region we are especially grateful to Loudon Stanford and the Idaho Geological Survey for their extensive map work, technical advice and encouragement. John Mandzak of Potlatch Corporation also provided valuable technical review and silvicultural input. In western Montana we appreciate the support of the Montana DNRC, as well as that of Plum Creek Corporation and our other Montana cooperators. A special thanks to geologist Jeff Lonn of the Montana Bureau of Mines and Geology for taking the time to review this report and to help clarify the geology terminology and descriptions. We also thank Scott McLeod (now with Washington DNR) and Jeff Collins of the Montana DNRC for their time and effort in reviewing the draft version of this document with special reference to western Montana. All of our reviewers provided significant improvements to this report.

Nutrient Management Guidelines

Major Unit: Extrusive and Subvolcanic Rocks

Minor Units
- **Felsic Volcanic and Subvolcanic Rocks**
- **Mafic Volcanic and Subvolcanic Rocks**

Overview: Extrusive and subvolcanic igneous rocks form when magma reaches the earth's surface either as a flow, explosive eruption or feeder dike or sill. Extrusive rocks cool rapidly, producing a fine grain size. Extrusive rocks may be broadly categorized based on the mineralogic composition as mafic (dark-colored) or felsic (light-colored). Basalts are the most common extrusive rock in western Montana and northern Idaho, though rhyolites, dacites, andesites and some trachytes also occur. However as a general rule, extrusive rocks do not occupy extensive areas in either region. In western Montana, small bodies of extrusive rocks are found around Deer Lodge and Butte, and also to the south and north of Helena. Additional bodies are located south of Bozeman and east of Livingston. In northern Idaho, basalts associated with the Columbia River flows are found along the Clearwater River and tributaries as far east as Weippe, and some as far north as the Santa and to the south of St. Maries. Some older basalts are also found along the Clearwater River and in the Potlatch area.

Rock Descriptions

Felsic Volcanic and Subvolcanic Rocks

Dacite, trachyte and rhyolite are light-colored extrusive rocks that are higher in silicon content than basalt. Rhyolite has a higher silicon content than trachyte or dacite, and is likely to occur as ash flows/falls, but only rarely as a lava flow. Dacite and trachyte are likely to occur as both lava flows and as ash flows/falls. A generalized technical explanation for this is that the higher silicon content, the more viscous the magma, and the more viscous the magma, the more explosive the eruption.The more explosive eruptions form ashes, tuffs, breccias and similar materials often referred to in geologic maps as *volcanics*. However, flow rocks are also considered volcanics, so particular attention should be paid to the map description when encountering this term. Rhyolite, dacite and trachyte do not comprise significant land areas in western Montana or northern Idaho. Weatherability is poor compared to mafic volcanic rocks (WPI: Rhyolite 8.9, Dacite 13.7, Trachyte 12.7). Felsic dikes and sills have been mapped in a number of Montana and Idaho locations. Based on research experiences throughout the IFTNC region, we have not generally found these rock types to produce conditions suitable for tree growth. In the context of this report, volcanics generally consist of felsic airfall ash and debris, lava flows and reworked volcanic deposits such as breccia and tuffs. Landscapes underlain by felsic volcanic rocks often display a bouldery, rubbly topography with occasional outcrops of resistant materials. Felsic volcanic rocks are not common in northern Idaho, but do occur in some areas of Montana around Helena and Butte, as well as south of Bozeman.

Mafic Volcanic and Subvolcanic Rocks

Typical basalts are composed mainly of plagioclase feldspar and clinopyroxene, and contain no quartz. Plagioclase feldspars contain Si and Al along with Ca and/or Na, but little or no K. A clinopyroxene is one of a group of minerals that contain Si, Ca, and some combination of Mg and/or Fe. Grain size and mineral composition affect the formation of clays in residual soils formed from these rocks. Basalts tend to form clay-rich soils with good moisture-holding capacity. Basaltic soils should also be fairly rich in several important nutrients, including Mg and Ca. While K content of basalt rocks is fairly low, the K-retention of basaltic soils should be quite good, again due to the clay content and resulting good cation exchange capacity (CEC). High CEC and base saturation are important qualities of basaltic soils. Expected weathering potential is high (WPI: 22.9). Andesites are very similar in composition and appearance to basalt, but contain more silicon and are likely to have a slightly lower weathering potential (WPI 20.9). Despite the similarity to basalt, andesitic soils do not seem to support high tree growth rates or strong fertilization response. In some cases this may be a topography issue, as discussed below. Mafic dikes and sills are localized areas of rock at points where mafic volcanic magma intruded into small cracks and crevices in the earth's crust, or in some cases were vents for magma flows. Dikes and sills often occur as outcrops, indicating poor weatherability.

Basalts and Topography

The 'good rock' reputation of basalts seems to have originated with the relatively flat topography of the Columbia River flood basalts in northeastern Oregon, southeastern Washington and portions of northern Idaho. The gentle slopes associated with those flood basalts appear to be accompanied by deeper in-place weathering than is associated with steeper topographies, as well as accumulation of overlying erosional materials resulting from blocked stream drainages during flow events, and in some cases accumulation of loess and ash caps. The soils are deep and generally have good water-holding capacity and high CEC, resulting in good tree growth and good fertilization response. Some of the northern Idaho basalts do follow this pattern, and those basalts would receive a 'good' rating. However, as we approach the edges of the Columbia River flows along canyons, we find steeper topography. Associated with the steeper topography is a much lower degree of in-place weathering and less accumulation of deposited materials. Some basalts are resistant to weathering to the extent that rounded cliffs may form, and tree growth is virtually non-existent. The same is often true for dikes, sills or otherwise resistant materials, regardless of lithology. Sites which are topographically unsuitable for supporting trees are not intended for consideration in this report.

Nutrient management recommendations

Good-to-medium: Basalt

Basalts associated with gentle topography are generally considered good rocks and good candidates for fertilization. Sites with slopes less than about 20% are likely to have some sort of accumulated deposit or deeply weathered-in-place soils. We recommend that conservative nutrient management strategies be followed. However, because of the high quality of these sites, they may be more resilient than other sites to nutrient-depleting management strategies such as intensive whole-tree removal. Research on IFTNC study sites in central Washington and northeast Oregon indicates that good response may be expected when N-only is applied, but that in some cases S may be necessary to elicit a growth response to N-fertilization.

Basalts associated with steeper topographies should be considered medium or even poor sites, and should be treated more conservatively. We would still expect moderate tree growth and moderate-to-good fertilization response.

- Expected Soil Development: Moderate to deep, fine loamy soils

- Expected Nutrient Status: Good (gentle slopes) to Medium (moderate slopes)
- Ash Effect: Ash presence does not seem to affect productivity unless associated with moister climatic conditions, in which case productivity does improve. Improved response to N-fertilization is also associated with ash cap.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only preferred, but whole-tree removal probably OK on gentle slopes
    - Regeneration Harvest: bole-only preferred, but whole-tree removal probably OK on gentle slopes
    - Species Selection: most species will do well on this rock type
- Expected Fertilization Response: Moderate to good response to N
- Fertilizer Recommendation:
    - Recommended only for moist-end Douglas-fir habitat types and grand fir or moister vegetation series
    - Recommended formulation: Research suggests N or NK will probably produce a positive response; observation suggests NKSB will produce a better response.
    - Good multi-nutrient blend candidates; consider screening trials

Bad: Other mafic and felsic extrusive rocks

These rock types are considered to have poor tree-growing value and to be poor candidates for fertilization. Conservative nutrient management practices should be followed.

- Expected Soil Development: Poor
- Expected Nutrient Status: Poor
- Ash Effect: None
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended, but whole-tree may be OK for thinning from below or other light thinning
    - Regeneration Harvest: bole-only
    - Species Selection: select for low nutrient-demanding species
- Expected Fertilization Response: Poor
- Fertilizer Recommendation:
    - If objectives are economic: Not recommended
    - If objectives are health- and productivity-related: Optional, grand fir or moister site types only
    - Rationale: We have not yet determined an appropriate fertilization regime to counter the “bad-rock” effect, though it will almost certainly involve various macro- and micro-nutrients besides N and K. The cost of these additional elements is not likely to justify their use, particularly if the cost must be carried

over a number of years. The application of NK *may* reduce mortality in some cases; however, our understanding of when and why mortality may be affected is not yet clear. Consultation with IFTNC staff would be appropriate.

Major Unit: Intrusive Rocks

Minor Units

- **Felsic Intrusive Rocks**
- **Mafic Intrusive Rocks**

Overview: Intrusive rocks are igneous rocks formed when magma cools inside the earth's crust. Because of the associated slow cooling process, intrusive rocks form large grains which are usually visible in a hand sample. Granites are the most common example of intrusive rocks. Felsic intrusive rocks are dominated by silicate minerals and tend to occur in relatively large bodies. Mafic and ultramafic rocks tend to be dark, heavy, silicon-poor rocks that occur in dikes, sills and other small localized bodies. The major exposure of granitic rock in the northern Idaho/western Montana region is the Idaho batholith located in southwestern Montana and central to north-central Idaho. Another major body occurs southwest of Helena (Boulder batholith), while numerous smaller granitic bodies occur locally in northern Idaho and western Montana.

Rock Descriptions

Felsic Intrusive Rocks

Granite, quartz monzonite, monzonite and monzogranite contain mostly quartz and potassium feldspar, with some plagioclase feldspar, and very few dark minerals. Those granites that are dominated by potassium feldspars may be pinkish in appearance. Weathering susceptibility of these rocks is rather low (WPI: ‘Pink’ granite 8.6). Granodiorite, monzodiorite, and tonalite contain primarily quartz and plagioclase (non-potassium) feldspar, with some potassium feldspar and an abundance of dark minerals. They will probably be grayish in color or have a salt-and-pepper appearance. Tonalite will have more plagioclase feldspar than granodiorite or monzodiorite, but otherwise will be difficult to distinguish from granodiorite and monzodiorite in the field. Weathering susceptibility of these rocks is somewhat higher than the potassium feldspar-dominated ‘pink’ granites (WPI: Granite 10.3, Granodiorite 11.4, Tonalite 14.6). In general, granitic rocks weather to coarse, well-drained soils with low water-holding and low nutrient-holding capacity. Soil particles will be largely composed of quartz, feldspars and mica. Clay content and cation exchange capacity (CEC) of granitic soils are expected to be low. One of the black minerals often contained in granites is biotite, a K-bearing mica. Biotite expands when it weathers, which contributes to a faster breakdown of the granite. Another dark mineral commonly found in granites is hornblende. Hornblende does not have the same weathering properties as biotite, and is not a major K source. In a hand sample, biotite appears very shiny and breaks easily into sheets. Hornblende is blocky, not as sparkly in the sun, and does not break into sheets.

Pegmatite is a very coarsely-crystalline granitic rock, often dominated by feldspar, and often occurs in dikes. Other single-mineral-dominated rocks include syenite and anorthosite, both of which are relatively rare. Syenite is made up principally of orthoclase (potassium feldspar), which has a framework mineral structure that does not readily weather, despite a moderate WPI rating (WPI: Syenite 10.3). Syenites display the coarse-grained characteristic typical of granites, and therefore will likely form similarly coarse-grained soils, except that the soil particles will be predominantly potassium feldspar with little or no quartz. Clay content and CEC are expected to be low. Anorthosite is made of principally of anorthite, a Ca-rich plagioclase feldspar. While anorthosite is expected to weather more readily than syenite (WPI: Anorthosite 20.8), the soil texture will still be coarse, and clay content and CEC low. Due to the mono-mineralic nature of syenite and anorthosite, overall nutritive value for both is expected to be low. Quartz veins were mapped in a few locations. Quartz is a mineral comprised of silicon and oxygen, and is generally considered the most stable of all the silicate minerals. It does not weather readily, occurring often as veins in association with granitic rocks. Quartz is not volumetrically significant in Idaho or Montana. On its own, quartz is not a valuable nutrient source for tree growth, and is unlikely to support forest vegetation.

Mafic Intrusive Rocks

Quartz diorite is the intrusive equivalent of andesite, while diorite and gabbro are the intrusive equivalents of basalt. Because of the similarity in chemical composition, weathering potential of these rocks is also similar to their extrusive equivalents (WPI: Quartz diorite 17.9, Diorite 22.4). Mafic dikes and sills in the Intrusives category have the same composition as those described under Extrusives and Subvolcanics, but have been mapped as intrusive rocks. Pyroxenites are mafic igneous rocks consisting chiefly of iron, calcium and magnesium-rich minerals (pyroxenes), and often occur in dikes and sills.

Nutrient management recommendations

Medium: All intrusive rocks except dikes, sills, pegmatite, quartz veins, diorite, gabbro, pyroxenite

Granitic rocks are generally considered ‘medium’ for tree growth, and conservative nutrient management strategies are recommended. Whole-tree removals on these rock types may run the risk of depleting some of the limited nutrients available on these sites. Generally, moderate to poor results have been obtained through fertilization with N-only on intrusive rock types. The addition of K to the blend is expected to give a better response than N alone, especially on the felsic intrusives. Multinutrient fertilization is an option; however, fertilization screening trials would be recommended to evaluate the potential response and cost-effectiveness of such an operation, in conjunction with growth response studies. Field evaluation of sites on syenites and anorthosites is recommended before proceeding with nutrient management planning.

- Expected Soil Development: Moderate to deep coarse soils
- Expected Nutrient Status: Moderate (slightly better for mafic)
- Ash Effect: Slight improvement in productivity with ash presence, but no observed effect on fertilization response
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended, but whole-tree may be OK for thinning from below, especially on mafics

    - Regeneration Harvest: bole-only recommended
    - Species Selection: select for moderate to low nutrient-demanding species
- Expected Fertilization Response: Moderate (syenite and anorthosite unknown). Ash presence does not seem to affect response. On lower-productivity sites, even a low response may be of some value relative to the poor growth rates of unfertilized trees. Balance economic feasibility of return with management objectives.
- Fertilizer Recommendation:
    - All: Recommend grand fir or moister vegetation series.
    - Felsic intrusive rocks: Do not fertilize with N-only. A minimum formulation of NK is recommended. Observation suggests that NKSB may be preferred.
    - Mafic intrusive rocks: N-only or NSB might be acceptable if rock contains biotite. Otherwise NK or NKSB is recommended.
    - Syenite and anorthosite: Unknown response, no recommendation at this time
    - Possible multi-nutrient blend candidates -- recommend screening trials.

Bad: Dikes, sills, pegmatite, quartz veins, diorite, gabbro, pyroxenite

These rocks are considered to be poor candidates for fertilization. Conservative nutrient management practices should be followed.

- Expected Soil Development: Poor
- Expected Nutrient Status: Poor
- Ash Effect: None noted.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only
    - Regeneration Harvest: bole-only
    - Species Selection: select for low nutrient-demanding species
- Expected Fertilization Response: Unknown
- Fertilizer Recommendation:
    - If objectives are economic: Not recommended
    - If objectives are health- and productivity-related: Optional, grand fir or moister site types only.
    - Rationale: We have not yet determined an appropriate fertilization regime to counter the "bad-rock" effect, though it will almost certainly involve various macro- and micro-nutrients besides N and K. The cost of these additional elements is not likely to justify their use, particularly if the cost must be carried over a number of years. The application of NK *may* reduce mortality in some cases; however, our understanding of when and why mortality may be affected is not yet clear. Consultation with IFTNC staff would be appropriate.

Major Unit: Metamorphic Rocks

Minor Units

- *Carbonate-bearing and calc-silicate metasedimentary rocks*
  - **Calc-silicate Rocks**
  - **Metamorphosed Carbonate Rocks**
  - **Carbonate-bearing Metasedimentary Rocks**
- *Low-grade metasedimentary rocks (Non-carbonate/non-calc-silicate)*
  - **Feldspathic quartzite**
  - **Quartzite** *(may also be high-grade metasedimentary)*
  - **Siltite-Argillite**
- *High-grade metasedimentary or meta-igneous rocks (Non-carbonate/non-calc-silicate)*
  - **Metamorphosed Felsic Intrusive Rocks**
  - **Metamorphosed Mafic Intrusive Rocks**
  - **Schist-Gneiss**
- *Greenstone and ultramafics*
  - **Greenstone**
  - **Ultramafic Rocks**

Overview: Large areas of northern Idaho and western Montana are dominated by metamorphic rocks. These rocks are challenging to classify from a geology-forest nutrition standpoint because they are so diverse in origin. The metamorphic map units in these regions often contain mixed lithologies resulting from variation in original composition, reflecting sedimentary and/or igneous origins. Metamorphic rocks are classified either by their texture, which in turn is related to the degree of pressure and temperature changes (e.g. metamorphism) that they have undergone, or by composition. Some are weakly metamorphosed (low-grade metamorphic) rocks such as Belt argillite, siltite and quartzite. Strongly metamorphosed (high-grade metamorphic) rocks include schist and gneiss. Some rocks, such as quartzite, may be either high- or low-grade metamorphic rocks. Metamorphic rocks are sometimes further described by color, with ‘felsic’ referring to light-colored and ‘mafic’ referring to dark-colored rocks. Further description is provided by mineral-content modifiers placed in order of increasing abundance, such as muscovite schist or quartz-feldspar gneiss. Many of the metamorphic map units in northern Idaho and western Montana are of mixed lithology. For this report, the major and minor units were assigned based on the dominant lithology. At the moment, we do not have strong fertilization recommendations for metamorphic rocks largely because we don't have a significant number of trials on these rock types, especially in western Montana. This is particularly tre for the suspected ‘bad’ rocks, as we were unlikely to establish research plots in the associated poor-quality stands. We do, however, have some theories based on observation of weathering characteristics of these rocks that helped guide our selection of nutrient management guidelines.

Rock Descriptions

Carbonate-bearing and calc-silicate metasedimentary rocks

The carbonate rocks include limestone (calcium carbonate), dolomite (calcium-magnesium carbonate) and marble (metamorphosed limestone or dolomite). For a carbonate rock, which is normally classified as sedimentary, to be included in the metamorphic unit of this report, some heating and/or apparent alteration must have occurred. The limestones and dolomites of western Montana and northern Idaho mostly formed in marine environments, largely during the Paleozoic era (just after the Precambrian eon). Because sands, silts and muds also occupied those marine environments, mixing between the carbonate and non-carbonate components often occurred. These rocks lithified (became cemented together), and some then underwent subsequent metamorphic processes. For this report, if the carbonate portion dominated an otherwise clearly metamorphic rock, the ***metamorphosed carbonate rock*** designation was used. If the non-carbonate component dominated the resulting rock according to the map description, then it was labeled as a ***carbonate-bearing metasedimentary rock***. As with all metamorphic rocks in northern Idaho and western Montana, mixing and interlayering are common. Based on our experience with fertilization research trials, metamorphosed carbonate rocks are considered poor candidates for tree growth and fertilization, likely because of the mono-mineralic nature of the rock (and therefore limited nutrient diversity), and low weathering rates, particularly in dry environments. In contrast, the more diverse mineral composition of the carbonate-bearing metasedimentary rocks leads us to categorize them as good rocks with high weathering potential (WPI: Carbonate-bearing quartzite 15.7, Carbonate-bearing siltite-argillite 18.1, Carbonate-bearing siltite 21.8). While ash cap presence may lead to improved productivity on carbonate-bearing metasedimentary rocks, ash cap does not seem to have a marked effect on fertilization response.

Calc-silicate rocks include rocks formed by the metamorphism of impure calcareous or dolomitic rocks (carbonate-bearing metasedimentary rocks). The metamorphism of those carbonate-bearing minerals resulted in the formation of calcium-bearing silicate minerals such as diopside, wollastonite and actinolite. In the Belt rocks of western Montana and northern Idaho, there are a number of formations that originated as calcareous or dolomitic siltites and argillites (similar to the Shepard, Helena or Empire formations of western Montana), that subsequently underwent a high degree of metamorphic activity resulting in the formation of calc-silicate rocks (such as the calc-silicate portions of the lower/middle Wallace formation of northern Idaho). This unit also includes calc-silicate gneiss and schist. Calc-silicate rocks may or may not contain layers of dolomitic or calcitic marble, as the original carbonate minerals may or may not have transformed during metamorphosis. However, the calcareous or dolomitic influence may lend a soft, weatherable character to the rock, particularly to the siltites and argillites (WPI: Calc-silicate quartzite 18.3, Calc-silicate schist 19.5, Calc-silicate gneiss 21.2). As a result, deeply weathered soils and productive stands may occur on rocks in this category. Ash cap may lead to improved productivity, but does not seem to affect fertilization response of stands on calc-silicate rocks.

Low-grade metasedimentary rocks (Non-carbonate/non-calc-silicate)

Argillite, siltite and quartzite predominate the Belt Supergroup rocks, and are low-grade metamorphic rocks. This means that the original 'parent' rock is usually still distinguishable, and these rocks underwent only slight pressure and temperature changes. Argillites originate from claystones, are somewhat 'silky' in appearance and texture, have indistinguishable grains, and can be scratched sometimes with a fingernail and more easily with a knife. Argillites have a somewhat low weathering susceptibility (WPI: Argillite 8.0), and are likely to weather to flat, sharp-edged plates and form very shallow soils, particularly on steeper slopes. Some argillites have a high potassium content, but little else in the way of nutrients. The IFTNC has one seedling establishment trial on a northeast Washington argillite from a group of rocks known as the Deer Trail group. This is considered a bad rock site, with very thin soils and poor tree growth. Siltites originate from siltstones, and are slightly coarser-grained than argillites, and can also be scratched with a knife, but with more difficulty than argillite (WPI: Siltite 9.0). Siltites and argillites were jointly assigned to a '***Siltite-argillite***' minor unit. ***Quartzites*** originate from sandstone and contain sand-sized grains mostly of quartz, and cannot be scratched with a knife. Quartzites in particular are very low in nutrients, containing mostly quartz sand (WPI: Quartzite 4.2). Although described here with low-grade metamorphic rocks, quartzites may have undergone either a high or low degree of metamorphism. ***Feldspathic quartzites*** are those that originated from feldspathic sandstones, and contain feldspars and mica in addition to quartz sand. Most Belt Supergroup quartzites contain from 10 to 25 percent feldspar. Since feldspathic sandstones in central Washington have been found to show very good productivity and fertilization response, we carried the feldspathic designation through to these quartzites. However, we have also seen stands on quartzites show very poor productivity. Feldspathic quartzites received a low weathering/bad rock rating unless evidence of micaceous mineralogy was evident, in which case a medium weathering/medium rock rating was assigned. We recommend a field check and site height/age measurements to verify the productivity potential of stands on sites mapped as feldspathic quartzite.

High-grade metasedimentary or meta-igneous rocks (Non-carbonate/non-calc-silicate)

Metamorphosed felsic (light-colored) and mafic (dark-colored) intrusive rocks, schists, gneisses and some quartzites and marbles are generally grouped together as 'hard coarse-grained metamorphic rocks' in the Geologic Parent Materials of Montana Soils (Veseth and Montagne, 1980). Some of these rocks are very old, highly metamorphosed intrusive and sedimentary rocks that were emplaced and metamorphosed between 2.5 billion and 1.0 billion years ago. They are difficult rocks to classify because of the mixed igneous, sedimentary and metamorphic nature of the rocks and the processes that have acted on them over time.

High-grade metamorphic rocks underwent strong pressure and/or temperature changes. Because of this high degree of metamorphism and mixing of the original 'parent' rocks, that parent rock is often very difficult to distinguish. Schists usually contain aligned layers of mica, leading to a fine-layered appearance and platy breakage patterns, and are most often felsic in coloration. Gneisses are coarser and less friable rocks, with grain sizes of several millimeters, and usually contain alternating light and dark bands of felsic and mafic minerals. A few breccia units occurred as well, and were grouped with gneisses and schists because a high degree of metamorphism was associated with these otherwise normally volcanic rocks. If a mafic (dark-colored) or felsic (light-colored) intrusive rock was identified as the precursor of the mapped unit, then the rock was assigned to the '***metamorphosed mafic intrusive rock***' or '***metamorphosed felsic intrusive rock***' minor unit, respectively. If the precursor of the rock was not clearly identifiable as intrusive, then a broader '***schist-gneiss***' minor unit was assigned. The 'metamorphosed mafic intrusive rocks' unit included quartz diorite gneiss and amphibolite. Amphibolites are gneisses that are rich in plagioclase feldspar and hornblende, and low in quartz and potassium feldspar. They tend to be darker-colored in appearance than other gneisses due to the dominance of mafic minerals like hornblende. The 'metamorphosed felsic intrusive rocks' unit includes metamorphosed granitic rocks and mylonite, both identified as felsic gneiss. Mylonites are very fine-grained rocks that occur in conjunction with metamorphic margins. In a broad sense, mylonites are ground-up rocks containing mixtures of igneous (e.g. granitic and basaltic) and metamorphic minerals, depending on the rocks present at the interface of the metamorphic event. True mylonites are limited in distribution, and much of the mylonite that appears on geologic maps is really mylonitic gneiss, a type of quartz-feldspar gneiss. Otherwise, the rocks in the 'schist-gneiss' minor unit may refer to either sedimentary- or igneous-origin, mafic or felsic rocks. Schists and gneisses usually contain quartz, potassium feldspar and plagioclase feldspar, along with mica and/or hornblende (WPI: Schist 8.3, Gneiss 9.1).

Greenstone and ultramafics

Highly metamorphosed rocks containing green minerals such as chlorite and epidote were included in the ***greenstone*** category. Greenstones were not mapped in Montana. They were mapped in the Seven Devils region of north Idaho. While greenstones were conservatively treated as 'bad' rocks in this report, they are thought to be good nutrient sources in the moist, acidic climate of the northeastern United States. Greenstone is not a common rock type in the Inland Northwest. ***Ultramafic rocks*** are dark-colored rocks consisting principally of high amounts of pyroxene or olivine and little or no quartz. Ultramafic rocks are very localized in occurrence in both the Idaho and Montana mapping areas, and found largely in conjunction with the Idaho batholith or other intrusive bodies. In the field, ultramafic rocks appear as massive and relatively slow-weathering rocks, often in outcrops which don't weather as easily as surrounding rocks. In our experience, ultramafic rocks and others comprising dikes and sills don't tend to support good tree growth, and forest stands on those rocks may be particularly susceptible to harboring forest insect populations during endemic years (Garrison-Johnston et al. 2003).

Nutrient management recommendations

Good: Carbonate-bearing metamorphic rocks and calc-silicate rocks

Field examination of stands on these rock types should be performed prior to determining silvicultural activities. If these sites show poor soil development, then refer to the nutrient management guidelines for argillites, siltites and quartzites. If these sites show moderate to deep soil development, then they are considered medium to good for tree growth, especially if associated with ash cap. Conservative nutrient management strategies are recommended, however the higher quality sites in this category may be more resilient to higher levels of harvesting removals. Stands on these rock types are likely to be good fertilization candidates.

- Expected Soil Development: Moderate to deep, fine sandy to loamy soils, some cobbles
- Expected Nutrient Status: Moderate to good
- Ash Effect: Slight improvement in productivity with ash presence, but ash has no apparent effect on fertilization response.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended, but whole-tree may be OK
    - Regeneration Harvest: bole-only recommended, but whole tree probably OK

    - Species Selection: select for moderate to low nutrient-demanding species, but most species should do reasonably well on this rock
- Expected Fertilization Response: Moderate to good
- Fertilizer Recommendation:
    - Recommended only for moist-end Douglas-fir habitat types and grand fir or moister vegetation series
    - Recommended formulation: NKSB
    - Recommended for multinutrient (w/micronutrient) screening trials.

Medium: Siltite-argillite, some feldspathic quartzites, quartz diorite gneiss, felsic gneiss, schist and gneiss

Rocks in this category are expected to form fine sandy or loamy soils, and often contain colluvial and residual cobbles. Soil particles will be largely composed of quartz, muscovite and feldspars. Moisture and nutrient-holding capacity are thought to be low. Site productivity is likely to be low to moderate, though an overlying ash cap may boost productivity if present. Field examination should be performed to assess soil depth, ash presence and stand performance. Extensive whole-tree removals are discouraged, as they may run the risk of depleting some of the limited nutrients available on these sites.

- Expected Soil Development: Moderate to deep sandy to loamy soils, cobbles may be present
- Expected Nutrient Status: Low to Moderate; better if ash present
- Ash Effect: Slight improvement in productivity with ash presence, but ash has no apparent effect on fertilization response.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended
    - Regeneration Harvest: bole-only recommended
    - Species Selection: select for moderate to low nutrient-demanding species
- Expected Fertilization Response: Moderate. On poor sites, response may be relatively good when compared to the poor growth rates of unfertilized trees. Consider economic feasibility of return if objectives are financially-based.
- Fertilizer Recommendation:
    - Recommended only for grand fir or moister vegetation series
    - Recommended minimum formulation is NK, but consider S and B as well
    - Recommended for multinutrient (w/micronutrient) screening trials.

Bad: Metamorphosed carbonate rocks, most feldspathic quartzites, quartzite, amphibolite, ultramafic rocks, greenstone

These rocks are not expected to support productive softwood stands. In southwestern Montana, carbonate rocks tend to support stands of poorly-performing Douglas-fir and ponderosa pine. If site shows deep soils and productive stand, refer to prior recommendations for siltite-argillite, schist and gneiss, etc.. Otherwise, consider these as bad rocks, and follow conservative nutrient management strategies.

- <u>Expected Soil Development</u>: Poor
- <u>Expected Nutrient Status</u>: Poor
- <u>Ash Effect</u>: None noted. We have few research sites on these rock types, except for some feldspathic quartzites, which may behave similarly to siltite and argillite in terms of ash effect.
- <u>Recommended Nutrient Management Strategies:</u>
    - Thinning: bole-only recommended
    - Regeneration Harvest: bole-only recommended
    - Species Selection: select for low nutrient-demanding species
- <u>Expected Fertilization Response</u>: May be significant in comparison to the low, unfertilized growth rates on these rock types; may not be economically desirable
- <u>Fertilizer Recommendation</u>:
    - If objectives are economic: Not recommended
    - If objectives are health- and productivity-related: Optional, NKSB recommended on grand fir or moister vegetation series only.
    - Rationale: We have not yet determined an appropriate fertilization regime to counter the “bad-rock” effect, though it will almost certainly involve various macro- and micro-nutrients besides N and K. The cost of these additional elements is not likely to justify their use, particularly if the cost must be carried over a number of years. The application of NK *may* reduce mortality in some cases; however, our understanding of when and why mortality may be affected is not yet clear. Consultation with IFTNC staff would be appropriate.

Major Unit: Sedimentary Rocks

Minor Units

- *Non-carbonate sedimentary rocks*
  - **Sandstone**
  - **Feldspathic Sandstone**
  - **Conglomerate**
  - **Mudstone**
- *Carbonate and carbonate-bearing sedimentary rocks*
  - **Carbonate Rocks**
  - **Carbonate-bearing Sedimentary Rocks**

Overview: Sedimentary rocks generally consist of weathered and transported remnants of other rocks. To be included in this category, those transported materials must have been lithified or cemented together to form a consolidated rock.

Rock Descriptions

Non-carbonate sedimentary rocks

These rocks consist of mineral grains or rock fragments that originated from the weathering of igneous, metamorphic or other sedimentary rocks, and were transported to another location and cemented together (lithified). ***Conglomerates*** consist of rounded pebbles, cobbles and boulders of various rock types and sizes in a fine-grained and lithified matrix, while ***sandstones*** and ***mudstones*** (shales) consist of cemented sand-sized and clay-sized grains, respectively. Potassium is often a component of the cement which holds the mineral grains and rock fragments together in a sedimentary rock. The mineral grains most commonly found in sedimentary rocks are quartz, feldspar and mica, all of which are common rock-forming minerals resistant to weathering. Weathering susceptibility of these rocks is generally low (WPI: Phyllite 8.4).

Some sandstones in western Montana and north-central Idaho are noted as being ***feldspathic sandstones***, meaning that they are high in feldspar composition. IFTNC experience in central Washington suggests that forest stands on feldspathic sandstones may be high responders to N fertilization. Therefore, these rocks have been categorized separately from non-feldspathic sandstones in this report. Field examination and fertilization screening trials should be carried out to determine whether stands on these rocks respond as well to N-fertilization. Sandstones rich in mica and/or biotite have been included in this category.

Carbonate and carbonate-bearing sedimentary rocks

As previously discussed for metamorphic rocks, limestones and dolomites occurred in western Montana and northern Idaho in association with Paleozoic era marine environments. Extensive mixing of the carbonate component with non-carbonate materials such as the silts, sands and clays found in these environments also occurred. The ***carbonate rocks*** unit includes the mostly pure limestones and dolomites (WPI: Dolomite 72.1 based on geochemistry, but does not weather readily under field conditions). Mixed-lithology rocks that are dominated by the carbonate component were included here as well. The ***carbonate-bearing sedimentary rocks*** unit includes rocks dominated by the non-carbonate fraction, as well as calcareous sedimentary rocks.

Weathering and behavior of the carbonate-bearing sedimentary rocks is expected to be similar to that of the carbonate-bearing metasedimentary rocks, that is high weathering and good tree value on moister site types. However, in a dry forest environment, the carbonate rock units can be slow-weathering and form soils high in pH, which in turn can result in micronutrient deficiencies such as Fe and Mn. Site visit recommended.

Nutrient management recommendations

Good: Carbonate-bearing sedimentary rocks

Field examination of stands on these rock types should be performed prior to determining silvicultural activities. If these sites are dry or show poor soil development, then refer to the nutrient management guidelines for sandstones and conglomerates. If these sites are moist and show moderate to deep soil development, then they are considered medium to good for tree growth, with the better sites likely to be associated with ash cap. Conservative nutrient management strategies are recommended, though higher quality sites may be resilient to whole-tree removal.

- Expected Soil Development: Moderate to deep, sandy to loamy soils, some cobbles
- Expected Nutrient Status: Moderate; better if ash present
- Ash Effect: Ash presences improves both productivity and fertilization response.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended, but whole-tree probably OK
    - Regeneration Harvest: bole-only recommended, but whole tree probably OK
    - Species Selection: select for moderate to low nutrient-demanding species, but most species should do reasonably well on this rock
- Expected Fertilization Response: Moderate to good
- Fertilizer Recommendation:
    - Recommended only for moist-end Douglas-fir habitat types and grand fir or moister vegetation series
    - Recommended formulation: NKSB
    - Recommended for multinutrient (w/micronutrient) screening trials.

Medium: Feldspathic sandstone, mudstone

Rocks in this category are expected to form fine sandy or loamy soils, and often contain colluvial and residual cobbles. Moisture and nutrient-holding capacity are thought to be moderate to low. Site productivity is also likely to be moderate to low, though an overlying ash cap may boost productivity if present. Field examination should be performed to assess soil depth, ash presence and stand performance. Well-performing stands may be treated as for carbonate-bearing rocks. Poor performing stands and those with poor soil development should be treated as for sandstone and conglomerate rocks. Whole-tree removals are discouraged, as they may run the risk of depleting some of the limited nutrient availability on these sites.

- Expected Soil Development: Moderate to deep sandy to loamy soils, cobbles may be present
- Expected Nutrient Status: Moderate to Poor
- Ash Effect: Expect some improvement in productivity and fertilization response with ash presence.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended
    - Regeneration Harvest: bole-only recommended
    - Species Selection: select for moderate to low nutrient-demanding species
- Expected Fertilization Response: Moderate (mudstone) to good (feldspathic sandstone).
- Fertilizer Recommendation:
    - Recommended only for grand fir or moister site types
    - Recommended formulation:
        - Feldspathic sandstone: Research shows that N may be sufficient, particularly on deeper soils and in the presence of ash cap, however recent observations suggest that NSB may stimulate a better response.
        - Mudstone: Research supports application of NK, however observations suggest NKSB may stimulate a better response.
    - Recommended for multinutrient (w/micronutrient) screening trials.

Bad: Sandstone, conglomerate, carbonate rocks

These rocks are not widespread. They tend to occur in parts of central Idaho, and are scattered but not uncommon throughout Montana. Carbonate rocks in southwestern Montana tend to support stands of poorly-performing Douglas-fir, and even worse-performing stands of ponderosa pine. We generally consider these as poor rocks, slow-weathering and forming high pH soils. We recommend conservative nutrient management strategies. We do not currently recommend fertilization on any of these rock types, especially if they have shallow soils.

- Expected Soil Development: Poor
- Expected Nutrient Status: Poor
- Ash Effect: None noted.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended
    - Regeneration Harvest: bole-only recommended
    - Species Selection: select for low nutrient-demanding species
- Expected Fertilization Response: Unknown
- Fertilizer Recommendation:
    - If objectives are economic: Not recommended

- If objectives are health- and productivity-related: Optional, NKSB recommended. Only fertilize grand fir or moister site types.
- Rationale: We have not yet determined an appropriate fertilization regime to counter the “bad-rock” effect, though it will almost certainly involve various macro- and micro-nutrients besides N and K. The cost of these additional elements is not likely to justify their use, particularly if the cost must be carried over a number of years. The application of NK *may* reduce mortality in some cases; however, our understanding of when and why mortality may be affected is not yet clear. Consultation with IFTNC staff would be appropriate.

Major Unit: Unconsolidated Deposits

Minor Units:

- **Glacial Till**
- **Lake Deposits**
- **Landslide Deposits**
- **Older Sediments**
- **Stream Deposits**
- **Also includes 'Loess' overlays (where available) on Idaho geologic maps**

Overview: The 'unconsolidated deposits' unit consists of deposits of weathered rock transported from another site to the present site, either by wind, water, gravity, glacial activity, tectonic activity, volcanic activity, other geomorphic processes, or some combination thereof. These deposits did not undergo subsequent lithification or cementation. Because of the variety in source material, site quality is likely to vary widely in this category. Recommendations for these sites are based on IFTNC research results, and research installations were highly likely to have been located on the better quality sites. Therefore, careful evaluation of sites in this category must be carried out prior to assigning a nutrient management strategy.

Rock Descriptions

Many of the units in this subcategory are relatively young, Quaternary era occurrences. ***Stream deposits*** were emplaced by running water, and include both poorly-sorted debris flow and better-sorted stream flow deposits. This category includes gravel deposits, alluvial deposits and fluvioglacial deposits. The gravel deposits are generally well-sorted and composed of resistant, transported materials. Alluvial deposits may be comprised of pure to mixed rock types and sizes, depending on the source and distance of transport.

Lake deposits are associated with old or modern lakebeds, and include the deposits associated with Glacial Lake Missoula. Likely components of lacustrine deposits are sand, silt and clay-sized particles of the stable minerals quartz, potassium feldspar and mica as well as clay minerals. The Lake Missoula deposits are dominated by silt-sized particles. Organic-rich rocks can also form in lacustrine environments. Research suggests that moderate growth rates and fertilization response to N and NK can occur in forest stands on lake deposits in the Missoula region of Montana, and strong responses have occurred in response to NKSB fertilization.

Older sediments may include gravel or other deposits that occurred in western Montana and northern Idaho during the Tertiary (preglaciation) period. These deposits were erosional in origin and occurred when drainages were blocked by either mountain-building events (western Montana to northern Idaho) or Columbia River Basalt flows (northern Idaho to northeastern Oregon). The Tertiary sediments (often labeled Ts) can vary from water-deposited volcanic ash, to clay, to fluvial gravels to debris flow deposits. These undivided deposits are often indeterminate in origin and can vary widely in nutrient value. In all cases, soil development and tree growth should be evaluated in the field on a site-specific basis.

Glacial till often contains a wide array of rocks that vary in lithology, size and nutrient value. Much of the glacial till in northern Idaho and western Montana was deposited by continental glaciers that carried rocks across a wide geographic region, and is characterized by hummocky topography. Unconsolidated deposits containing a variety of rocks of different mineralogies and at different stages of weathering may provide a fair to good nutrient environment for tree growth. Current stand condition and stand history should be assessed. For example, sites on the glacial flats in the Rathdrum Prairie area of northern Idaho were subjected to agricultural activities such as plowing and discing prior to forest stand establishment. These activities displaced and/or removed organic materials and topsoil to the extent that the nutrient environment was considerably altered. Forest plantations on these glacial flats often show signs of nutrient stress at or shortly after crown closure.

Landslide deposits are rock fragments that have been transported downslope as either a slow gravity-driven creep or as a more rapidly occurring landslide or avalanche deposit. This category includes talus as well. They are likely to be somewhat homogenous in composition though not necessarily in size, and localized in distribution depending on the source rock. They may be modern or older in age. Whereas recent scree-type deposits will obviously not provide much in the way of soil development for tree growth, older deposits may have well-developed soils and support forest stands. The recommended approach is to treat the site based on the lithology of the deposited material, taking soil development and the presence of any surficial deposits into account as well. Landslide composition should be verified in the field, however localized information will often be available in the literature which accompanies the area geology map.

Other Mapped Units

Several other geologic units that were mapped but are not specifically assigned nutrient recommendations in this report include loess deposits, saprolite and "made ground" in northern Idaho, and iron formation rocks, mature soils and mine dumps in western Montana. Loess deposits are wind-deposited silts common to the Palouse and into the forest fringes to the east, while saprolites are very deeply weathered rocks. The loess deposits and saprolites in northern Idaho were included on some maps (but not all) as patterned overlays. Other units are volumetrically insignificant (e.g. there's not many of these) and were mapped as base geologic units. These include "made ground" units in northern Idaho, which refer to fill. An ancient marine environment is the likely source of the iron formation rocks on the Dillon 1:250K quadrangle, and the mature soil category occurs as the Ledford Pass Soil on the Lima 1:100K quadrangle, and is simply noted as being a pre-glacial, mature soil. Mine dumps occur on the Butte 1:250K quadrangle.

Nutrient management recommendations

Medium: Glacial till, lake deposits, stream (alluvial) deposits

Sites on these deposits should be checked for soil depth and development as well as productivity. Poor-performing sites or those with shallow soils should be treated as for sandstones, conglomerates, etc. (Sedimentary Rocks major unit). Good fertilization response has been obtained on some glacial tills and lake deposits. In the case of prior agricultural use or other management history involving extensive alteration, preliminary data indicate that P and B may also be necessary.

- Expected Soil Development: Moderately deep to deep, loamy and cobbly (glacial till) to sandy and cobbly (alluvial and lake deposits)

- Expected Nutrient Status: Moderate to Good
- Ash Effect: Expect better productivity and fertilization response with ash presence.
- Recommended Nutrient Management Strategies:
    - Thinning: bole-only recommended, but whole-tree may be OK for thinning from below or other light thinning
    - Regeneration Harvest: bole-only recommended
    - Species Selection: Select for moderate to low nutrient-demanding species. Areas that tend to be frost-influenced may be favorable for lodgepole pine.
- Expected Fertilization Response: Glacial till good, lake and stream deposits variable
- Fertilizer Recommendation:
    - Recommended only for grand fir or moister site types
    - Research suggests that N-only is probably OK, but NKSB and perhaps P would be preferable.
    - Multi-nutrient (including P and micronutrient) blend screening trials recommended.
    - Extensive agricultural use prior to forest stand establishment may dictate a need for P and B in the fertilization blend

Variable: Other unconsolidated deposits

Many unconsolidated deposits are not predictable from a forest nutrition standpoint. Weathering potential ranges from high (older deposits) to low (gravels). Nutritional value depends on the composition and size of the deposited materials. Sites with a greater variety of size classes and rock compositions will likely support more productive forest stands than those with a homogenous mix of materials. We have detected very good growth and fertilization response on some sites underlain by unconsolidated deposits, but have seen others that are unable to be successfully regenerated. Because of the large degree of variability encompassed by unconsolidated deposits, site visits are highly recommended to evaluate soil depth and productivity potential prior to selecting nutrient management strategies.

Recommended Nutrient Management Strategies:

- Poor quality site (poor soil development, poor tree growth): Treat as for sandstones, conglomerates etc. (Sedimentary Rocks major unit).
- Better quality site: Treat as for glacial till (above)

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APPENDICES

Appendix A: Quick Reference

Major Unit	Minor Unit	Weathering susceptibility	Tree value	Ash effect on growth rate	Ash effect on fertilization response
Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	medium	bad	no change	no difference
	Mafic volcanic/subvolcanic rock	high	good (basalt, gentle slope) to bad (andesite, dikes)	better (moist) to no change (dry)	better
Intrusive rocks	Felsic intrusive rocks	medium (most) to low (quartz veins)	medium (most) to bad (pegmatite, dikes, quartz veins, syenite)	slightly better	no change
	Mafic intrusive rocks	high	medium (quartz diorite) to bad (most)	slightly better (most) to no information (dikes)	no change
Metamorphic rocks	Calc-silicate rocks	high	good	better	no change
	Carbonate-bearing metasedimentary rocks	high	good	better	no change
	Feldspathic quartzite	low (most) to medium	bad (most) to medium	better	no change
	Greenstone	medium	bad	no information	no information
	Metamorphosed carbonate rocks	medium	bad	no information	no information
	Metamorphosed felsic intrusive rocks	medium	medium	better	no change
	Metamorphosed mafic intrusive rocks	medium	medium (quartz diorite gneiss) to bad (amphibolite)	better	no change

Appendix A Quick Reference Continued:

Major Unit	Minor Unit	Weathering susceptibility	Tree value	Ash effect on growth rate	Ash effect on fertilization response
Metamorphic rocks (continued)	Quartzite	very low	bad to very bad	better	no change
	Schist-gneiss	medium	medium	better	no change
	Siltite-argillite	medium	medium	better	no change
	Ultramafic rocks	high	bad	no information	no information
Sedimentary rocks	Carbonate rocks	medium	bad	no information	no information
	Carbonate-bearing sedimentary rocks	high	good	better	better
	Conglomerate	low	bad	no information	no information
	Feldspathic sandstone	medium	medium	better	better
	Mudstone	medium	medium	better	better
	Sandstone	low	bad	no information	no information
Unconsolidated deposits	Glacial till	low	medium	slightly better	better
	Lake deposits	medium	medium	slightly better	better
	Landslide deposits	medium	variable	slightly better	better
	Older sediments	high	variable	better	better
	Other deposits	variable	not evaluated	no information	no information
	Stream deposits	low	medium (most) to bad (gravels)	slightly better	better

Appendix B: Map Availability

Idaho

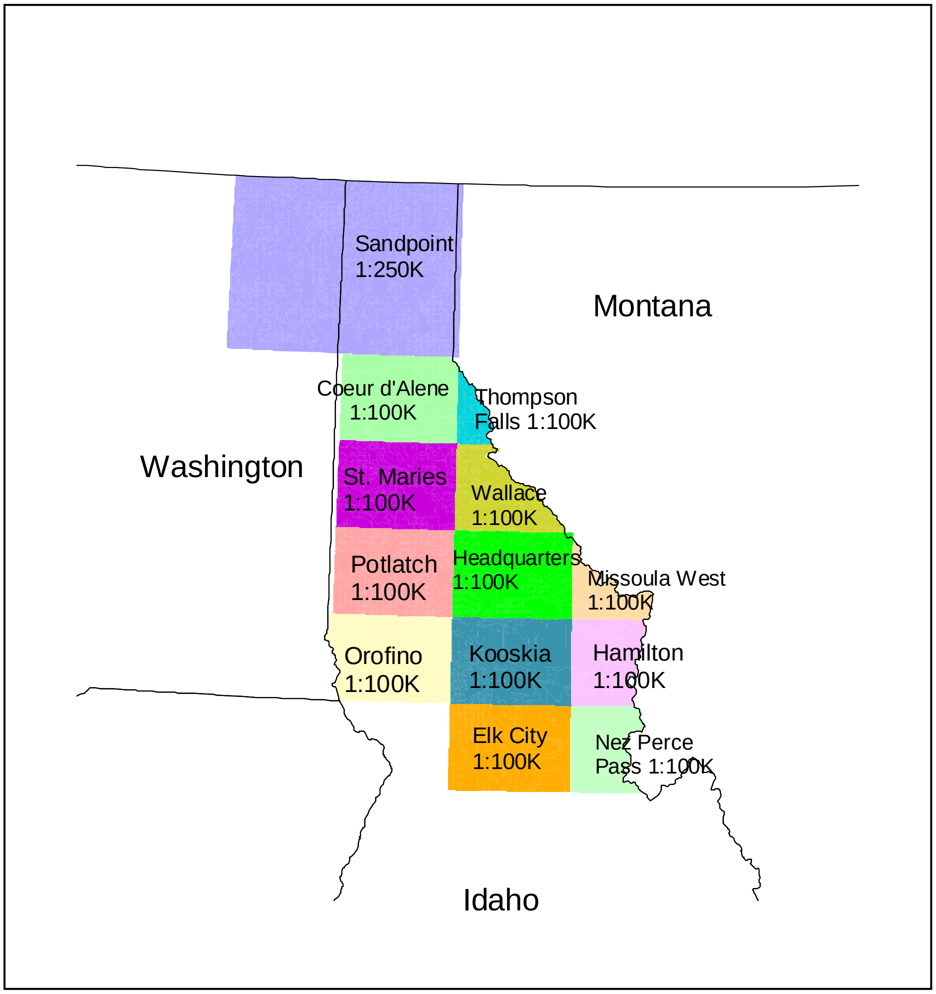
Digital and paper maps are available from the Idaho Geological Survey. As digital maps are officially released, they will be available on the Inside Idaho website:

http://www.InsideIdaho.org

Paper copies and preliminary digital copies of the maps referenced in this report are available directly from the IGS:

Loudon Stanford
Idaho Geological Survey
email: stanford@uidaho.edu
phone: (208)-885-7991
website: http://www.idahogeology.org

Figure B: *Idaho map quadrangles utilized in this report.*



Status of Idaho maps included in this document (As of August 2007):

Coeur d'Alene 1:100,000: IGS Geologic Map series (online pdf or paper copy from IGS); Currently available in digital form from IGS; estimated Inside Idaho posting Fall 2007

Elk City 1:100,000: *Currently available through Inside Idaho*

Lewis, R. S. and Stanford, L. R. 2002. Digital geologic map compilation of the Elk City 30 x 60 minute quadrangle, Idaho. Idaho Geological Survey Digital Geologic Map 5, Version 2.2002.06, Idaho Geological Survey, University of Idaho, Moscow, ID.

Hamilton 1:100,000: *Currently available through Inside Idaho*

Lewis, R. S. and Stanford, L. R. 2002. Digital geologic map compilation of the Hamilton 30 x 60 minute quadrangle, Idaho. Idaho Geological Survey Digital Geologic Map 3, Version 2.2002.06, Idaho Geological Survey, University of Idaho, Moscow, ID.

Headquarters 1:100,000: Unpublished; estimated Digital Web map publication (online PDF) is July or August; preliminary digital form currently available from IGS

Kooskia 1:100,000: Unpublished; estimated Digital Web map publication(online PDF) for Fall 2007; preliminary digital form available from IGS in Fall 2007 ***Note: Because the digital geologic version of this map was unavailable at the time of this report, the associated dBASE file has not been verified against that map. When that map becomes available, a revised dBASE file will be made available if necessary.***

Missoula West 1:100,000: *Currently available through Inside Idaho*

Lewis, R. S. and Stanford, L. R. 2002. Digital geologic map compilation of the Missoula West 30 x 60 minute quadrangle, Idaho. Idaho Geological Survey Digital Geologic Map 2, Version 2.2002.06, Idaho Geological Survey, University of Idaho, Moscow, ID.

Nez Perce Pass 1:100,000: *Currently available through Inside Idaho*

Lewis, R. S. and Stanford, L. R. 2002. Digital geologic map compilation of the Nez Perce Pass 30 x 60 minute quadrangle, Idaho. Idaho Geological Survey Digital Geologic Map 4, Version 2.2002.06, Idaho Geological Survey, University of Idaho, Moscow, ID.

Orofino 1:100,000: Digital Web map publication(online PDF); Currently available in digital form from IGS; estimated Inside Idaho posting 2008

Potlatch 1:100,000: IGS Geologic Map series (online pdf or paper copy from IGS); Currently available in digital form from IGS; estimated Inside Idaho posting Fall 2007

Sandpoint 1:250,000 *Currently available through USGS*

Miller, F.K., Burmester, R.F., Powell, R.E., Miller, D.M., and Derkey, P.D., 1999. Digital geologic map of the Sandpoint 1 degree X 2 degree quadrangle, Washington, Idaho, and Montana: U.S. Geological Survey, Open-File Report OF-99-144, scale 1:250000. Online: http://ngmdb.usgs.gov/Prodesc/proddesc_22659.htm

St. Maries 1:100,000 *Currently available through Inside Idaho*
Burmester, R.F., Frost T.P., Kauffman, J.D., and Lewis, R. S, 2000. Geologic Map of the St. Maries 30 x 60 Minute Quadrangle, Idaho, Idaho Geological Survey Geologic Map GM-28, Idaho Geological Survey, University of Idaho, Moscow ID, scale 1:100000.

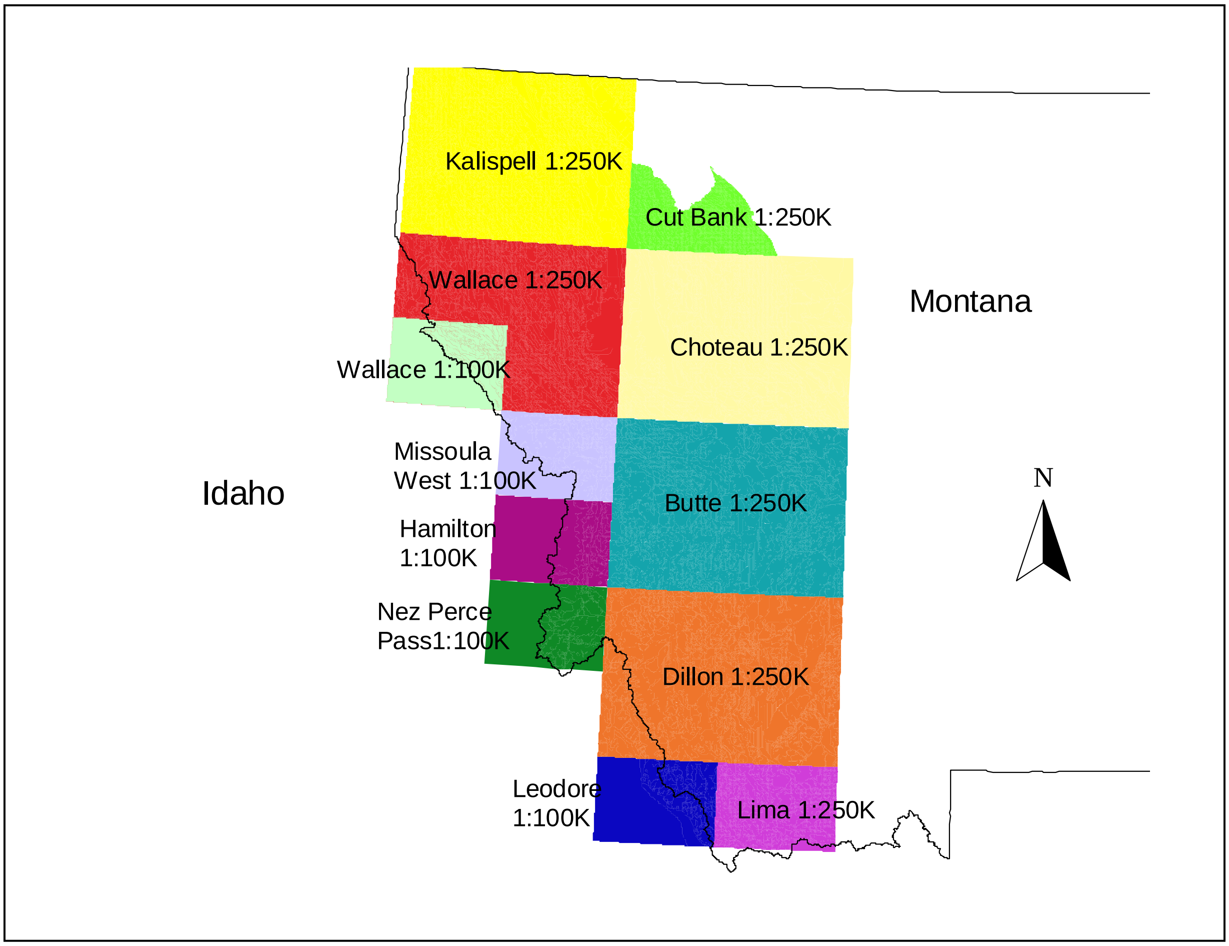
Thompson Falls 1:100,000 *Currently available through the USGS*
Lewis, R.S. and Derkey, Pamela, 1999, Digital geologic map of part of the Thompson Falls 1:100,000 quadrangle, Idaho: U.S. Geological Survey, Open-File Report OF-99-438, scale 1:100000. Online: http://ngmdb.usgs.gov/Prodesc/proddesc_22795.htm

Wallace 1:100,000 *Currently available through the USGS*
Lewis, R.S., Burmester, R.F., McFaddan, M.D., Derkey, P.D., and Oblad, J.R., 1999, Digital geologic map of the Wallace1:100,000 quadrangle, Idaho: U.S. Geological Survey, Open-File Report OF-99-390, scale 1:100000. Online: http://ngmdb.usgs.gov/Prodesc/proddesc_22505.htm

Montana

All Montana maps available for download from: http://www.mbmg.mtech.edu/stmap.htm

Figure A: *Montana map quadrangles utilized in this report.*



Appendix C: Content of dBase Lookup Tables

Introduction: The accompanying tables were produced to supplement the report entitled "*Northern Idaho and Western Montana Nutrition Guidelines By Rock Type: Nutrition guidelines for use in conjunction with current digital geology for Idaho and Montana*" produced by the Intermountain Forest Tree Nutrition Cooperative at the University of Idaho. One dBASE file (*.dbf) is provided for each of the twelve Montana geographic quadrangles and thirteen Idaho included in the report. Each dBASE file contains a 'Join_ID' column to be used for joining with the digital geology map. The respective 'join' field in the map attribute table for each geology map is as follows:

Table C-1: Dbase file names and corresponding map attribute labels used to join IFTNC ratings with digital geologic map attribute tables.

Quadrangle	Publisher	Dbase file name	Map attribute to merge with 'Join_ID' column in .dbf table
Idaho			
Coeur d'Alene 1:100K	IGS	ID-CDA100.dbf	Value
Elk City 1:100K	IGS	ID-ElkCity100.dbf	Value
Hamilton 1:100K	IGS	ID-Hamilton100.dbf	Value
Headquarters 1:100K	IGS	ID-Headquarters100.dbf	Value
Kooskia 1:100K	IGS	ID-Kooskia100.dbf	Value
Missoula West 1:100K	IGS	ID-MissWest100.dbf	Value
Nez Perce Pass 1:100K	IGS	ID-NezPerceP100.dbf	Value
Orofino 1:100K	IGS	ID-Orofino100.dbf	Value
Potlatch 1:100K	IGS	ID-Potlatch100.dbf	Value
Sandpoint 1:250K	USGS	ID-Sandpoint250.dbf	Label
St. Maries 1:100K	IGS	ID-StMaries100.dbf	Value
Thompson Falls 1:100K	USGS	ID-ThompFalls100.dbf	Label
Wallace 1:100K	USGS	ID-Wallace100.dbf	**Unit
Montana			
Butte 1:250K	MBMG	MT-Butte250.dbf	Mbmg_code
Choteau 1:250K	USGS	MT-Choteau250.dbf	Label
Cut Bank 1:250K	USGS	MT-CutBank250.dbf	Label_alph
Dillon 1:250K	USGS	MT-Dillon250.dbf	Polycode
Hamilton 1:100K	MBMG	MT-Hamilton100.dbf	Mbmg_code
Kalispell 1:250K	USGS	MT-Kalispell250.dbf	Label
Leodore 1:100K	MBMG	MT-Leodore100.dbf	Mbmg_code
Lima 1:100K	MBMG	MT-Lima100.dbf	Mbmg_code
Missoula West 1:100K	MBMG	MT-MissWest100.dbf	Polycode
Nez Perce Pass 1:100K	MBMG	MT-NezPerceP100.dbf	Mbmg_code
Wallace 1:100K	MBMG	MT-Wallace100.dbf	Mbmg_code
Wallace 1:250K	USGS	MT-Wallace250.dbf	Label

**In the Wallace 1:100K (Idaho side), the Join_ID and UNIT fields are numeric.*

Electronic Tables Description: The dBASE lookup tables contain nine columns[3]. The first column lists the '*Quadrangle*' and includes the map name and scale. The second column is labeled '*Join_ID*' and matches the lookup tables to the map unit labels found on paper and digital maps from the IGS, MBMG and USGS. This field may be used to join the electronic dBASE lookup table to the map attribute table in a GIS (see Table C-1 for appropriate join column). For Montana maps, the third column is the '*New_IFTNC_ID*', which for most units is the same as the USGS Label/Polycode or MBMG Code. The only exception is when the same rock unit code was used for different rock types on different maps, in which case we assigned a slightly different code to avoid confusion across maps. For Idaho maps, the third column is '*New_IGS_ID*,' which is a revised code assigned by the IGS and used throughout this report. The fourth column for both states gives the '*Major_Unit*' and identifies each map unit as Intrusive, Extrusive, Metamorphic or Mixed. The fifth column, '*Minor_Unit*', assigns the rock to an IFTNC subcategory grouping for nutrient management guidelines. The sixth column is entitled '*Lithology*' and provides an abbreviated lithology, which in some cases may be the same as the Minor Unit. Expected '*Weathering_Susceptibility*' and '*Tree_Value*' ratings are assigned in the seventh and eighth columns. The final '*Description*' column includes a brief description of the mapped geologic unit. For nutrient management recommendations, refer to the appropriate section of this report.

Map Lookup Tables Description: The hard-copy map lookup tables (Appendix D) are arranged by geologic quadrangle, and each table contains seven columns[4]. The first column is labeled using the same map unit code heading as the digital map attribute table (see Table C-1). The next column shows the revised code used in this report (corresponding to the *New_IGS_Code* (ID) or *New_IFTNC_Code* (MT) described above). Next are the '*Major_Unit,*' '*Minor_Unit*', '*Lithology,*' '*Weathering_Susceptibility*' and '*Tree_Value*' ratings, respectively. For discussion of nutrient management recommendations, refer to the appropriate section of this report.

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[3] Except for the dBASE table corresponding to the Idaho portion of the Wallace 1:100K map, for which the *Join_ID* column carries a list of numerical codes that corresponds to the digital map attribute table, and a tenth column is included showing the *USGS_Code* assigned to that unit on the paper map.

[4] Except for the lookup table corresponding to the Idaho portion of the Wallace 1:100K map, which contains an additional column labeled '*USGS_Code*' that provides the paper map unit identification and associates it with the revised code assigned by the IGS (*New_IGS_Code*) and used throughout this report.

Appendix D-ID: Lookup Tables for Idaho

Coeur d'Alene 1:100K Quadrangle (IGS):

Value	New_IGS_ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Cl	Cl	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Crg	Crg	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Kbgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Khgd	Khgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kog	Kog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kphgd	Kphgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kqd	Kqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KYam	KYam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
TYqd	KYmi	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qdg	Qdg	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qds	Qds	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qfg	Qfg	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgb	Qgb	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgc	Qgc	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgcd	Qgcd	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgdg	Qgdg	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgf	Qgf	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgg	Qgg	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgga	Qgga	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qggb	Qggb	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qggf	Qggf	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qghcm	Qghcm	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qghco	Qghco	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qghcy	Qghcy	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qghl	Qghl	Unconsolidated deposits	Stream deposits	gravels	low	bad

Coeur d'Alene 1:100K Quadrangle (IGS) *continued*:

Value	New_IGS_ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Qgm	Qgm	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgmb	Qgmb	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgrp	Qgrp	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgs	Qgs	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgslo	Qgslo	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgsly	Qgsly	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgtl	Qgtl	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qgtow	Qgtow	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Qgu	Qgu	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qla	Qla	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qp	Qp	Overlying materials or weathered surface	Loess deposits	loess deposits	low	medium
Tbgf	Tbgf	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Td	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tgn2	Tgn2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr2	Tgr2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
TKdd	TKdd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad
TKg	TKg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKla	TKla	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	mafic dikes and sills	high	bad
Tmfb	Tmfb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tpr	Tpr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable

Coeur d'Alene 1:100K Quadrangle (IGS) *continued*:

Value	New_IGS_ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Yb	Yb	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yl	Yl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yp	Yp	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypl	Ypl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypu	Ypu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yqp	Yqp	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysp	Ysp	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysp1	Ysp1	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysp2	Ysp2	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Ysp3	Ysp3	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ysp4	Ysp4	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysr	Ysr	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywml	Ywml	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu	Ywu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywu1	Ywu1	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywu2	Ywu2	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu3	Ywu3	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium

Coeur d'Alene 1:100K Quadrangle (IGS) *continued*:

Value	New_IGS_ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
YXgn	YXgn	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
YXq	YXq	Metamorphic rocks	Quartzite	quartzite	very low	very bad
YXs	YXs	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Elk City 1:100K Quadrangle (IGS):

Value	New_IGS_ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Kgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbgdt	Kbgt	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbgtm	Kbgtm	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbtm	Kbtm	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kbt	Kbtm	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kbtmr	Kbtm	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kfgd	Kfmgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgt	Kgt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kht	Khtm	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Khtm	Khtm	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
KJai	KJi	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
KJgn	KJm	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Kgdmg	Kmgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kmig	Kmig	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
TKpgd	Kpgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Ktr	Ktr	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Mzcsr	Mzrcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate schist	high	good
Mzsr	Mzrs	Metamorphic rocks	Schist-gneiss	schist	medium	medium
--	Mzsrg	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Mzum	Mzum	Metamorphic rocks	Ultramafic rocks	ultramafic rocks	high	bad
PzZu	PzZu	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qu	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
T_Psd	T_Psd	Metamorphic rocks	Greenstone	greenstone	medium	bad
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tdr	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad

Elk City 1:100K Quadrangle (IGS) *continued*:

Value	New_IGS_ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Tdap	Tdap	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tds	Tds	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgn1	Tgn1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr1	Tgr1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Thqd	Thd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KJqd	Thd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Tim	Tim	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
--	Tla	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tlgd	Tlg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tpr	Tpr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tqm	Tqm	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Taw	Tsa	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tu	Tu	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tvt	Tvt	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Twe	Twe	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Yag	Yag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium

Elk City 1:100K Quadrangle (IGS) *continued*:

Value	New_IGS_ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
KYam	Yam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
pCbs	Ybse	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ycsm	Ycsm	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Ycss	Ycss	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss and schist	high	good
pCfq	Yfqe	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
pCbg	Yge	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
--	Ymqm	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
pCq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqm	Yqm	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
YXqcs	Zcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
YXqs	Zqs	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
pCmsg	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium
YXss	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Hamilton 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ka	Ka	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Kbgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kdi	Kdi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Kgd	Kgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgdmg	Kgdmg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kmg	Kmg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kmig	Kmig	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kht	Kt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgc	Tgc	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgf	Tggf	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgm	Tgm	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgp	Tgp	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKa	TKa	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
TKdi	TKdi	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trdr	Trdr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqcw	Yqcw	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good

Headquarters 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kap	Kpeg	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
Kbgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbt	Kbt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kbtg	Kbtg	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kfg	Kfg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kmg	Kmg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpgd	Kpgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tpgd	Kpgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kqd	Kqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Kqdg	Kqdg	Metamorphic rocks	Metamorphosed mafic intrusive rocks	quartz diorite gneiss	medium	medium
KYam	KYam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
KYamg	KYamg	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
KYgb	KYgb	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
KYum	KYum	Metamorphic rocks	Ultramafic rocks	ultramafic rocks	high	bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Taw	Taw	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tb	Tb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	mafic dikes and sills	high	bad
Tbrgd	Tbrgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tcg	Tcg	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tdi	Tdi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Tdu	Tdu	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad

Headquarters 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Tfc	Tfc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tfcd	Tfcd	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgb	Tgb	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Tggd	Tggd	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tggf	Tggf	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgr1	Tgr1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tli	Tli	Unconsolidated deposits	Older sediments	older sediments	high	medium
Tls	Tls	Unconsolidated deposits	Older sediments	older sediments	high	medium
Tpd	Tpd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tqs	Tqs	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trp	Trp	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tsap	Tsap	Overlying materials or weathered surface	Saprolite	saprolite	NA	medium
Twe	Twe	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Xan	Xan	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
--	Ycg	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ycs	Ycs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Ycsw	Ycsw	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ycwu2	Ycwu2	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
--	Ygs	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Yqcw	Yqcw	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Yqg	Yqgn	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Headquarters 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Yqp	Yqp	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Yqrv	Yqrv	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqw	Yqw	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yrb	Yrb	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ysg	Ysg	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysgp	Ysgp	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysqp	Ysqp	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ysqw	Ysqw	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysr	Ysr	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ysrv	Ysrv	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Yswu1	Yswu1	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu1	Ywu1	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywu2	Ywu2	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
YXqcb	YXqcb	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
YXsb	YXsb	Metamorphic rocks	Schist-gneiss	schist	medium	medium
ZXcs	Zcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
ZXqs	Zqs	Metamorphic rocks	Quartzite	quartzite	very low	very bad
ZXss	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Kooskia 1:100K Quadrangle (IGS) :

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kbgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbt	Kbt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kbtg	Kbtg	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kbtgc	Kbtgc	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kbtog	Kbtog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kgdf	Kgdf	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgdg	Kgdg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgdmg	Kgdmg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
KJdg	KJdg	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
KJqd	KJqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KJqdg	KJqdg	Metamorphic rocks	Metamorphosed mafic intrusive rocks	quartz diorite gneiss	medium	medium
TKmg	TKmg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kmig	Kmig	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
KPi	KPi	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kqd	Kqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Kdgq	Kdgq	Metamorphic rocks	Metamorphosed mafic intrusive rocks	quartz diorite gneiss	medium	medium
Kt	Kt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Ktrg	Ktrg	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Ktt	Ktt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Mzum	Mzum	Metamorphic rocks	Ultramafic rocks	ultramafic rocks	high	bad
Mzam	Mzam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Mzcs	Mzcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Mzgo	Mzgo	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Mzgs	Mzgs	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Mzmo	Mzmo	Metamorphic rocks	Metamorphosed carbonate rocks	marble	medium	bad
Mzrg	Mzrg	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium

Kooskia 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Qaf	Qaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qalc	Qalc	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qgo	Qgo	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qgow	Qgow	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qpg	Qpg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qtg	Qtg	Unconsolidated deposits	Stream deposits	gravels	low	bad
T_Psd	T_Psd	Metamorphic rocks	Greenstone	greenstone	medium	bad
T_Pc	T_Pc	Metamorphic rocks	Greenstone	greenstone	medium	bad
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Taw	Taw	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tb	Tb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	mafic dikes and sills	high	bad
Tcsc	Tcsc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tdi	Tdi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Tdu	Tdu	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgc	Tgc	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgf	Tgf	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tggd	Tggd	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgm	Tgm	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgn1	Tgn1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr1	Tgr1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr2	Tgr2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
TKa	Tka	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tkdi	Tkdi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
TKbgd	TKbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
TKpgd	TKpgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium

Kooskia 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Tli	Tli	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tls	Tls	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tpd	Tpd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tpg	Tpg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tpr	Tpr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tsap	Tsap	Overlying materials or weathered surface	Saprolite	saprolite	NA	medium
Twe	Twe	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Yag	Yag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Yam	Yam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Ycg	Ycg	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ycsg	Ycsg	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Ycsm	Ycsm	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Yge	Yge	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Ygg	Ygg	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Ymqm	Ymqm	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Yqg	Yqg	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqm	Yqm	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqs	Yqs	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ygs	Ygs	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Zcss	Zcss	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Zqs	Zqs	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Zss	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Yqgq	Yqgq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Missoula West 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Kbgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kdi	Kdi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Kgdmg	Kgdmg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kmg	Kmg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kqd	Kqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KYam	Kyam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Kyum	Kyum	Metamorphic rocks	Ultramafic rocks	ultramafic rocks	high	bad
Pzm	Pzm	Metamorphic rocks	Metamorphosed carbonate rocks	marble	medium	bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tb	Tb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tbrgd	Tbrgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tv	Tcv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Td	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tggd	Tggd	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tka	Tka	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tqs	Tqs	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trb	Trb	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trp	Trp	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad

Missoula West 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Yamw	Yamw	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Ycsw	Ycsw	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ymil	Ymil	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yms2	Yms2	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqcw	Yqcw	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Yqg	Yqg	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Yqrv	Yqrv	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqw	Yqw	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ysgp	Ysgp	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good

Nez Perce Pass 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
--	Kdi	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Kfgdm	Kgdf	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgdmg	Kmgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kmig	Kmig	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
TKpgd	Kpgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kht	Kt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
pCbg	Yge	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Ymqm	Ybq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
--	Ycsm	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
pCgs	Yqbsg	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Yqm	Yqm	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
YXqcs	Zqs	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qu	Qu	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tcv	Tcv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tdr	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tds	Tds	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgg	Tgg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKdi	Tgz	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
Thqd	Thd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Tlgd	Tlg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tmg	Tggd	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium

Nez Perce Pass 1:100K Quadrangle (IGS) ***continued*****:**

Value	New IGS ID	Major_Unit	Minor_ Unit	Lithology	Weathering Susceptibility	Tree Value
Tpmg	Tgp	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trpr	Trp	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Tsg	Tsg	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Yag	Yag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
KYam	Yam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Orofino 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Jch	Jch	Sedimentary rocks	Mudstone	mudstone	medium	medium
JPap	JPap	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
--	$JPap_d$	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
JPg	JPg	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
JT_h	JT_h	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kbt	Kbt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kbtg	Kbtg	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
KJdg	KJdg	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
KJfqd	KJfqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KJhqdt	KJhqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
--	KJpeg	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
KJqd	KJqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
--	KJqdd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KJqdg	KJqdg	Metamorphic rocks	Metamorphosed mafic intrusive rocks	quartz diorite gneiss	medium	medium
--	KPd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Kpeg	Kpeg	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
KPi	KPi	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Ktr	Ktr	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Ktt	Ktt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
m	m	Unconsolidated deposits	Made ground	made ground	low	NA
Mzao	Mzao	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
--	Mzco	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Mzcso	Mzcso	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Mzgo	Mzgo	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Mzmo	Mzmo	Metamorphic rocks	Metamorphosed carbonate rocks	marble	medium	bad
Mzqo	Mzqo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium

Orofino 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Pwr	Pwr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Qaf	Qaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qag	Qag	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qb	Qb	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
--	Ql (pattern)	Overlying materials or weathered surface	Loess deposits	loess deposits	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qlsa	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
--	Qm (pattern)	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
QTcg	QTcg	Unconsolidated deposits	Stream deposits	gravels	low	bad
QTch	QTch	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qtg	Qtg	Unconsolidated deposits	Stream deposits	gravels	low	bad
T_dc	T_dc	Sedimentary rocks	Feldspathic sandstone	feldspathic sandstone	medium	medium
T_mb	T_mb	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
--	Tab	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tak	Tak	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
--	Tak_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Taw	Taw	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tbrk	Tbrk	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tcg	Tcg	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tcsc	Tcsc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tem	Tem	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good

Orofino 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Tgn1	Tgn1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr1	Tgr1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr2	Tgr2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
--	Tgr_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgv	Tgv	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tif	Tif	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tim	Tim	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
--	Tim_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tli	Tli	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tlm	Tlm	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
--	Tlm_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	mafic dikes and sills	high	bad
Tls	Tls	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ton	Ton	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tp	Tp	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
--	Tpd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tpr	Tpr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tprd	Tpr_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Trk	Trk	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
T_Psd	T_Psd	Metamorphic rocks	Greenstone	greenstone	medium	bad

Orofino 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
T_ws	T_ws	Metamorphic rocks	Greenstone	greenstone	medium	bad
T_wsm	T_wsm	Metamorphic rocks	Greenstone	greenstone	medium	bad
--	Tsc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tt	Tt	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Twe	Twe	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Twl	Twl	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
--	Twl_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Zss	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Potlatch 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree_Value
Cqk	Cqk	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
JPg	JPg	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Kam	Kam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Kbgd	Kbgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbt	Kbt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
KJbtg	Kbtog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kgdg	Kgdg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgu	Kgu	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Khgd	Khogd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
KJdg	KJdg	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
KJqd	KJqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
KJqdg	KJqdg	Metamorphic rocks	Metamorphosed mafic intrusive rocks	quartz diorite gneiss	medium	medium
Kog	Kog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kap	Kpeg	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
Kphgd	Kphgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpx	Kpx	Intrusive rocks	Mafic intrusive rocks	pyroxenite	high	bad
Kqd	Kqd	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Kqdg	Kqdg	Metamorphic rocks	Metamorphosed mafic intrusive rocks	quartz diorite gneiss	medium	medium
Ksy	Ksy	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Kht	Ktt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Ktt	Ktt	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
KYam	Kyam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Mzao	Mzao	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Mzco	Mzco	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Mzgo	Mzgo	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss and schist	high	good

Potlatch 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree_Value
Mzmo	Mzmo	Metamorphic rocks	Metamorphosed carbonate rocks	marble	medium	bad
Mzqo	Mzqo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qp	Qp	Overlying materials or weathered surface	Loess deposits	loess deposits	low	medium
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tpa	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Taw	Taw	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tb	Tb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tcsc	Tcsc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tfc	Tfc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgg	Tgg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tggd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgn1	Tgn1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr1	Tgr1	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr2	Tgr2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tif	Tim	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tim	Tim	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tli	Tli	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tls	Tls	Unconsolidated deposits	Older sediments	older sediments	high	variable

Potlatch 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ton	Ton	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tpd	Tpd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Tpr	Tpr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tprd	Tpr_d	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tprs	Tprs	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trdv	Trdv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tsap	Tsap	Overlying materials or weathered surface	Saprolite	saprolite	NA	medium
Tsc	Tsc	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tsm	Tsm	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tth	Tth	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	trachyte	medium	bad
Ttr	Ttr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	trachyte	medium	bad
Twed	Twed	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Twe	Twep	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Twl	Twl	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Yag	Yag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Ycs	Ycs	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ycwu2	Ycwu2	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Yl	Yl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yqcw	Yqcw	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
Yqr	Yqr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqs	Yqs	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Ysg	Ysg	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysgp	Ysgp	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Potlatch 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Ysp	Ysp	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysqw	Ysqw	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Yssr	Yssr	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysw	Ysw	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Yswu1	Yswu1	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Yswu3	Yswu3	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ywu3	Ywu3	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
--	Zcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
ZXcs	Zcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
--	Zqs	Metamorphic rocks	Quartzite	quartzite	very low	very bad
ZXqs	Zqs	Metamorphic rocks	Quartzite	quartzite	very low	very bad
--	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium
ZXss	Zss	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Sandpoint 1:250K Quadrangle (USGS) Idaho Side:

Label	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Cgc	Cgc	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Clr	Clr	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Csu	Csu	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Jcm	Jcm	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
JTRpl	JT_pl	Intrusive rocks	Felsic intrusive rocks	monzonite	medium	medium
JT_pl	JT_pl	Intrusive rocks	Felsic intrusive rocks	monzonite	medium	medium
JTRw	JT_w	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
JT_w	JT_w	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Kag	Kag	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kbc	Kbc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kbf	Kbf	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kbm	Kbm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kcl	Kcl	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kco	Kco	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kcu	Kcu	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kdc	Kdc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kg	Kg	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kgm	Kgm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kgp	Kgp	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgpl	Kgpl	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kh	Kh	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Khm	Khm	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kjl	Kjl	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kk	Kk	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kkp	Kkp	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Klc	Klc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Klm	Klm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kmg	Kmg	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Ynl	Knl	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium

Sandpoint 1:250K Quadrangle (USGS) Idaho Side *continued*:

Label	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kpbc	Kpbc	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpbi	Kpbi	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpcb	Kpcb	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpcc	Kpcc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpcp	Kpcp	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpdc	Kpdc	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kpfc	Kpfc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpgb	Kpgb	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kph	Kph	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kphc	Kphc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kpkm	Kpkm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kplc	Kplc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpll	Kpll	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Kplm	Kplm	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpm	Kpm	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpml	Kpml	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpms	Kpms	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpsh	Kpsh	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kpsl	Kpsl	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kpsp	Kpsp	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Kptc	Kptc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Krc	Krc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Krl	Krl	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kru	Kru	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Ksg	Ksg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kslc	Kslc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Ktc	Ktc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Ktmc	Ktmc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kv	Kv	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kw	Kw	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium

Sandpoint 1:250K Quadrangle (USGS) Idaho Side *continued*:

Label	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Qag	Qag	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Ql	Ql	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Tcb	Tcbx	Metamorphic rocks	Schist-gneiss	breccia	medium	medium
Tcg	Tcgl	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Tcr	Tcr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Thd	Thd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tsp	Tsp	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
Ttp	Ttp	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
Tw	Tw	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Ylg	Yag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Ybk	Yb	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ye	Ye	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yhm	Yhm	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yl	Yl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ymi	Ymi	Intrusive rocks	Mafic intrusive rocks	mafic intrusive rocks	high	bad
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yp	Yp	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypm	Ypm	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yru	Yrv	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yss	Ysn	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ysr	Ysr	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium

Sandpoint 1:250K Quadrangle (USGS) Idaho Side *continued*:

Label	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Yssw	Yssw	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yw	Yw	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yb	Zbh	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Zl	Zl	Metamorphic rocks	Greenstone	greenstone	medium	bad
Ym	Zm	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Zm	Zm	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Ys	Zs	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Zsc	Zsc	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Zsg	Zsg	Metamorphic rocks	Greenstone	greenstone	medium	bad
Zsp	Zsp	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Zt	Zt	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Yt	Zt	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywcu	Zwcu	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
ZYmi	ZYmi	Intrusive rocks	Mafic intrusive rocks	mafic intrusive rocks	high	bad

Sandpoint 1:250K Quadrangle (USGS) Washington Side:

Label	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Cmc	Cmc	Sedimentary rocks	Carbonate rocks	carbonate rocks	medium	bad
Cmp	Cmp	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
CZq	CZq	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Ddl	Ddl	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Ds	Ds	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Dv	Dv	Metamorphic rocks	Greenstone	greenstone	medium	bad
Jlm	Jlm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Jrg	Jrg	Metamorphic rocks	Greenstone	greenstone	medium	bad
Jrs	Jrs	Metamorphic rocks	Greenstone	greenstone	medium	bad
Kb	Kb	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
Kbgm	Kbgm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kbr	Kbr	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kbu	Kbu	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kc	Kc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kfl	Kfl	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgp	Kgp	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kgs	Kgs	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kh	Kh	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Klcc	Klcc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Klgs	Klgs	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kli	Kli	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Klr	Klr	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Km	Km	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kmc	Kmc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kmm	Kmm	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kmo	Kmo	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Knb	Knb	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Knc	Knc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Koc	Koc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium

Sandpoint 1:250K Quadrangle (USGS) Washington Side *continued*:

Label	New IGS ID	Major_Unit	Minor_ Unit	Lithology	Weathering Susceptibility	Tree Value
Kpl	Kpl	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Ksc	Ksc	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Kse	Kse	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Ksh	Ksh	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Ksha	Ksha	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Ksm	Ksm	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Ksv	Ksv	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kwm	Kwm	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kyl	Kyl	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
MCu	Mcu	Sedimentary rocks	Carbonate rocks	carbonate rocks	medium	bad
MDs	MDs	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ml	Ml	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
MZPZf	MzPzf	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
MzPzf	MzPzf	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
OCgc	OCgc	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
OCm	OCm	Sedimentary rocks	Carbonate rocks	carbonate rocks	medium	bad
Ol	Ol	Sedimentary rocks	Mudstone	mudstone	medium	medium
Ps	Ps	Sedimentary rocks	Feldspathic sandstone	feldspathic sandstone	medium	medium
Sc	Sc	Sedimentary rocks	Conglomerate	conglomerate	low	bad
sgg	sgg	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Sms	Sms	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
TRft	T_ft	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
TRs	T_ms	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Tam	Tam	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium

Sandpoint 1:250K Quadrangle (USGS) Washington Side *continued*:

Label	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Tcc	Tcc	Metamorphic rocks	Schist-gneiss	breccia	medium	medium
Tcs	Tcs	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tll	Tll	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
To	To	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Tot	Tot	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
QTs	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ybmh	Ybmh	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yshs	Yshs	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywr	Ywr	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yc	Zc	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ydtu	Zdt	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ydt	Zdt	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Zhc	Zhc	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Zhg	Zhg	Metamorphic rocks	Greenstone	greenstone	medium	bad
Zsl	Zsl	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Ywd	Zwd	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad

St. Maries 1:100K Quadrangle (IGS):

Value	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kog	Kog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
KYam	KYam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
TKgb	KYmi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
m	m	Unconsolidated deposits	Made ground	made ground	low	NA
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qp	Qp	Overlying materials or weathered surface	Loess deposits	loess deposits	low	medium
Td	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
Ted	Ted	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgn2	Tgn2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tgr2	Tgr2	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
TKdd	TKdd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad
TKla	TKla	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	mafic dikes and sills	high	bad
Ton	Ton	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tpr	Tpr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Yb	Yb	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yl	Yl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yp	Yp	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypl	Ypl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypu	Ypu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqp	Yqp	Metamorphic rocks	Quartzite	quartzite	very low	very bad
Yqrv	Yqrv	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

St. Maries 1:100K Quadrangle (IGS) *continued*:

Value	New IGS ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
Yqw	Yqw	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yrb	Yrb	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ys	Ysgp	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysp	Ysp	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysp1a	Ysp1a	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ysp1q	Ysp1q	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ysp4	Ysp4	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysr	Ysr	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ysrv	Ysrv	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysw	Ysw	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywml	Ywml	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu	Ywu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywu1	Ywu1	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywu2	Ywu2	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu3	Ywu3	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
YXq	YXq	Metamorphic rocks	Quartzite	quartzite	very low	very bad
YXs	YXs	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Thompson Falls 1:100K Quadrangle (USGS):

Label	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kms	Kms	Intrusive rocks	Felsic intrusive rocks	monzonite	medium	medium
Qa	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Tsm	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ybk	Yb	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypl	Ypl	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ypu	Ypu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysp	Ysp	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysr	Ysr	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
Ywml	Ywml	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu	Ywu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium

Wallace 1:100K Quadrangle (USGS):

Join_ID	USGS Code	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
614	Kgd	Kgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
631	Kog	Kog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
600	Qa	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
601	Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
609	Qog	Qog	Unconsolidated deposits	Stream deposits	gravels	low	bad
610	Tcr	Tcr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
611	Tdp	Tpd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
612	Tgd	Tggd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
613	TKgb	KYmi	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad
0	Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
602	Tsm	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
616	Yam	Yam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
615	Yan	Xan	Intrusive rocks	Felsic intrusive rocks	anorthosite	medium	medium
226	Ybk	Yb	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
630	Yc	Ycs	Metamorphic rocks	Calc-silicate rocks	calc-silicate rocks	high	good
607	Ypu	Ypu	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
629	Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
626	Yqrv	Yqrv	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
623	Yqw	Yqw	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
236	Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
628	Ys	Ysgp	Metamorphic rocks	Schist-gneiss	schist	medium	medium
604	Ysp	Ysp	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
634	Ysp1	Yms2	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
633	Ysp2	Yms3	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
632	Ysp3	Ysp4	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
206	Ysr	Ysr	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
625	Ysrv	Ysrv	Metamorphic rocks	Schist-gneiss	schist	medium	medium
622	Ysw	Ysw	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Wallace 1:100K Quadrangle (USGS) *continued*:

Join_ID	USGS Code	New IGS ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
621	Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
620	Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
606	Ywml	Ywml	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
619	Ywu1	Ywu1	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium
618	Ywu2	Ywu2	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
617	Ywu3	Ywu3	Metamorphic rocks	Siltite-argillite	siltite-argillite	medium	medium

Appendix D-MT: Lookup Tables for Montana

Butte 1:250K Quadrangle (MBMG):

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
^s	^s	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ka	Ka	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
Kem	Kem	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Kg	Ki	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kgb	Kgb	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Kgd	Kgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
KJs	KJs	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kl	Kl	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Kmd	Kmd	Intrusive rocks	Felsic intrusive rocks	monzodiorite	medium	medium
md	md	Unconsolidated deposits	Made ground	mine dumps	low	NA
PDs	PDs	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Qs	Qs	Unconsolidated deposits	Stream deposits	gravels	low	bad
Tab	Tab	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tgd	Tgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
TKa	TKa	Intrusive rocks	Mafic intrusive rocks	pyroxenite	high	bad
TKab	TKab	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
TKg	TKg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKgb	TKgb	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
TKgd	TKgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tlc	Tlc	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Trv	Trv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad

Butte 1:250K Quadrangle (MBMG) *continued*:

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ts	Ts	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yc	Yc	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Ye	Ye	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yg	Yg	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ygr	Ygr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ymb	Ymb	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ypi	Ypi	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ys	Ys	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yss	Yss	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
ZYg	ZYg	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad

Choteau 1:250K Quadrangle (USGS):

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Cu	Cu	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Du	Du	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kh	Kh	Sedimentary rocks	Sandstone	sandstone	low	bad
KJ	KJ	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kl	Kl	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Km	Km	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ksmr	Ksmr	Sedimentary rocks	Mudstone	mudstone	medium	medium
Ktm	Ktm	Sedimentary rocks	Mudstone	mudstone	medium	medium
Ktv	Ktv	Sedimentary rocks	Sandstone	sandstone	low	bad
Ku	Ku	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kvt	Kvt	Sedimentary rocks	Mudstone	mudstone	medium	medium
Mu	Mu	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Pz	Pz	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Qa	Qa	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Glacial till	glacial till	low	medium
Ql	Ql	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qs	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
QTog	Qtog	Unconsolidated deposits	Stream deposits	gravels	low	bad
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tb	Tb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Td	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tki	Tki	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rocks	mafic dikes and sills	high	bad
TKp	TKp	Intrusive rocks	Felsic intrusive rocks	quartz monzonite	medium	medium
TKr	TKr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tla	Tla	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Tm	Tmonz	Intrusive rocks	Felsic intrusive rocks	monzonite	medium	medium
Tmp	Tmp	Intrusive rocks	Felsic intrusive rocks	monzonite	medium	medium
Tva	Tva	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad

Choteau 1:250K Quadrangle (USGS) *continued*:

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Yb	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ybe	Ybe	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ydi	Ydi	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Ye	Ye	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yes	Yes	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yg	Yg	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ygr	Ygr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Yh	Yh	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ymi	Ymi	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ys	Ys	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Zd	Zd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad

Cut Bank 1:250K Quadrangle (USGS):

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Cu	Cu	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Du	Du	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kju	Kju	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kl	Kl	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ku	Ku	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Mm	Mm	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Qs	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Tk	Tk	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Yap	Yap	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ye	Ye	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ygl	Ygl	Metamorphic rocks	Quartzite	quartzite	very low	bad
Ygr	Ygr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Yh	Yh	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ypt	Ypt	Metamorphic rocks	Siltite-argillite	siltite, quartzite	medium	medium
Ys	Ys	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Zyd	Zyd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad

Dillon 1:250K Quadrangle (USGS):

Polycode	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
&Mq	&Mq	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
&Mu	&Mu	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
@u	@u	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
^u	^u	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Aa	Aa	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Aas	Aas	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ag	Ag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Aif	Aif	Sedimentary rocks	Iron-formation	iron-formation	NA	NA
Am	Am	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Aq	Aq	Metamorphic rocks	Quartzite	quartzite	very low	bad
Aqf	Aqf	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Asg	Asg	Metamorphic rocks	Schist-gneiss	schist	medium	medium
J@u	J@u	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Jm	Jm	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
Kal	Kal	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
Kbgg	Kbgg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kem	Kem	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Kfgt	Kfgt	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kfm	Kfm	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kfr	Kfr	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Kgd	Kgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium

Dillon 1:250K Quadrangle (USGS) *continued*:

Polycode	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kgtd	Kgtd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Khbg	Khbg	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Khg	Khg	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Ki	Ki	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kk	Kk	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Km	Km	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kmg	Kmg	Intrusive rocks	Felsic intrusive rocks	monzodiorite	medium	medium
Ks	KJs	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kvu	Kvu	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	dacite	medium	bad
MDu	MDu	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Oq	Oq	Metamorphic rocks	Quartzite	quartzite	very low	bad
PMu	PMu	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Pp	Pp	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Qa	Qa	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qf	Qaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Ql	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qm	Qm	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qo	Qo	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Qs	Qs	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
QTg	QTg	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Tbmg	Tbmg	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tbz	Tbz	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tc	Tc	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tgd	Tgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium

Dillon 1:250K Quadrangle (USGS) ***continued*****:**

Polycode	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ti	Ti	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tibd	Tibd	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rocks	mafic dikes and sills	high	bad
TKb	TKb	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
TKg	TKg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKgd	TKgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tq	Tq	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Trd	Trd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Ts	Tbas	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tsi	Tsi	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tvu	Tvu	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
X(A)b	X(A)b	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
X(A)g	X(A)g	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
X(A)m	X(A)m	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
X(A)q	X(A)q	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
X(A)qf	X(A)qf	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
XAu	XAu	Metamorphic rocks	Ultramafic rocks	ultramafic rocks	high	bad
Xg	Xg	Intrusive rocks	Felsic intrusive rocks	pegmatite	medium	bad
Xga	Xga	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Xi	Xi	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Xmb	Xmb	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Ycg	Ycg	Sedimentary rocks	Conglomerate	conglomerate	low	bad

Dillon 1:250K Quadrangle (USGS) *continued*:

Polycode	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Yd	Yd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad
Yg	Yg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Yhe	Yhe	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Yl	Yl	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ym	Ymis	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ymm	Ymm	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ynl	Ynl	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Yq	Yq	Metamorphic rocks	Quartzite	quartzite	very low	bad
Ys	Ysw	Metamorphic rocks	Quartzite	quartzite	very low	bad
Ysc	Ysc	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysg	Ysg	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ytm	Ytm	Metamorphic rocks	Quartzite	quartzite	very low	bad
Yy	Yy	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Hamilton 1:100K Quadrangle (MBMG):

Mbmg code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Qaf	Qaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qat	Qat	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qc	Qc	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qgt	Qgt	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Taf	Taf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgc	Tgc	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tgs	Tgs	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgw	Tgw	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
TKag	TKag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
TKg	TKg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKp	TKp	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tm	Tm	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Tra	Tra	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Tv	Tv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Yam	Yam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Yan	Yan	Intrusive rocks	Felsic intrusive rocks	anorthosite	medium	medium
Ybm	Ybm	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Yc	Yc	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Ycg	Ycscg	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ymi	Ymis	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yog	Yog	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Yq	Yq	Metamorphic rocks	Quartzite	quartzite	very low	bad
Yqf	Yqf	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium

Kalispell 1:250K Quadrangle (USGS):

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Cu	Cu	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
DCu	DCu	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Du	Du	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Jf	Jf	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kg	Kg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Kpy	Kpy	Intrusive rocks	Mafic intrusive rocks	pyroxenite	high	bad
Ks	Ks	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Mu	Mu	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
PPr	PPr	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Ql	Ql	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qs	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Tk	Tk	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Yap	Yap	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yb	Yb	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ybos	Ybos	Metamorphic rocks	Siltite-argillite	siltite	medium	medium
Yd	Yd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad
Ye	Ye	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ygl	Ygl	Metamorphic rocks	Quartzite	quartzite	very low	bad
Yh	Yh	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Yhl	Yhl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good

Kalispell 1:250K Quadrangle (USGS) *continued*:

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Yhw	Yhw	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Yl	Ylib	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ylu	Ylu	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ymsu	Ymsu	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ypa	Ypa	Metamorphic rocks	Siltite-argillite	argillite	medium	medium
Ypl	Ypl	Metamorphic rocks	Quartzite	quartzite	very low	bad
Ypq	Ypq	Metamorphic rocks	Quartzite	quartzite	very low	bad
Ypr	Ypr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Ypt	Ypt	Metamorphic rocks	Siltite-argillite	siltite, quartzite	medium	medium
Ypu	Ypu	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ys	Ys	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ysng	Ysng	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ysr	Ysr	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysw	Yssw	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yu	Yu	Metamorphic rocks	Siltite-argillite	siltite, quartzite	medium	medium
Yw	Yw	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good

Kalispell 1:250K Quadrangle (USGS) *continued*:

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywu	Ywu	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Zyd	ZYd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad
Zyd	Zyd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad

Leodore 1:100K Quadrangle (MBMG):

Mbmg Code	New IFTNC ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
&Ms	&Ms	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
&Msb	&Msb	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
@d	@d	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
Aqfg	Aqf	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
DOs	DOs	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
MDtj	MDtj	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ok	Ok	Metamorphic rocks	Quartzite	quartzite	very low	bad
Os	Os	Sedimentary rocks	Feldspathic sandstone	feldspathic sandstone	medium	medium
Pp	Pp	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qgt	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
QTs	QTs	Unconsolidated deposits	Older sediments	older sediments	high	variable
SOg	SOg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
SOm	SOm	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Tcv	Tcv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Ths	Ths	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
Tmlv	Tmlv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tqdm	Tqdm	Intrusive rocks	Mafic intrusive rocks	quartz diorite	high	medium
Ts	Ts	Sedimentary rocks	Sandstone	sandstone	low	bad
Yac	Yac	Metamorphic rocks	Siltite-argillite	siltite, quartzite	medium	medium
Ybc	Ybc	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ygs	Ygs	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yl	Yl	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysw	Ysw	Metamorphic rocks	Quartzite	quartzite	very low	bad
Yy	Yy	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Lima 1:100K Quadrangle (MBMG):

Mbmg Code	New IFTNC ID	Major_Unit	Minor_Unit	Lithology	Weathering Susceptibility	Tree Value
&Msr	&Msr	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
&q	&q	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
@td	@td	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
^pf	^pf	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
^ppm	^ppm	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
^s	^s	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
^sr	^sr	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
^wf	^wf	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
Ag	Ag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Agn	Ag	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Aqm	Aqm	Metamorphic rocks	Quartzite	quartzite	very low	bad
Aum	Aum	Metamorphic rocks	Ultramafic rocks	ultramafic rocks	high	bad
DOs	DOs	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Dtm	Dtm	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Jmet	Jmet	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
Js	Js	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kbdc	Kbdc	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kbl	Kbl	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Kblc	Kblc	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kblq	Kblq	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kbm	Kbm	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good

Lima 1:100K Quadrangle (MBMG) *continued*:

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Kbmc	Kbmc	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kbml	Kbml	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kbmo	Kbmo	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kbsn	Kbsn	Sedimentary rocks	Carbonate-bearing sedimentary rocks	calcareous sedimentary rocks	high	good
Kf	Kf	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Kfb	Kfb	Sedimentary rocks	Mudstone	mudstone	medium	medium
KJke	KJke	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kk	Kk	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
MDmt	MDmt	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
MDtj	MDtj	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ml	Ml	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mlm	Mlm	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mm	Mm	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mmc	Mmc	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mmd	Mmd	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mmg	Mmg	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Mrc	Mrc	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mrm	Mrm	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Ms	Ms	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Msp	Msp	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Mtd	Mtd	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
O^s	O^s	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Ob	Ob	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Oks	Oks	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good

Lima 1:100K Quadrangle (MBMG) *continued*:

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Pp	Pp	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Ppp	Ppp	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Qa	Qaval	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qaf	Qaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qafo	Qafo	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qao	Qao	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qc	Qc	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qgl	Qgl	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qgm	Qgm	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qgo	Qgo	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Qgr	Qgr	Unconsolidated deposits	Stream deposits	gravels	low	bad
Qle	Qle	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qlk	Qlk	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Qta	Qta	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
QTba	QTba	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
QTgr	QTgr	Unconsolidated deposits	Stream deposits	gravels	low	bad
QTl	QTl	Unconsolidated deposits	Mature soil	mature soil	low	NA
QTlt	QTlt	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Ta	Ta	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tba	Tba	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tcab	Tcab	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Tcan	Tcan	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	andesite	high	bad
Tcb	Tcb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Tcbs	Tcbs	Sedimentary rocks	Sandstone	sandstone	medium	medium
Tcbt	Tcbt	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tccs	Tccs	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Tcqt	Tcqt	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tcr	Tcr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad

Lima 1:100K Quadrangle (MBMG) *continued*:

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Tcs	Tcs	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Tct	Tct	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tcts	Tcts	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tcv	Tcv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tgr	Tgr	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ti	Ti	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tj	Tj	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
TKb	TKb	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
TKbl	TKbl	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
TKbq	TKbq	Sedimentary rocks	Conglomerate	conglomerate	low	bad
TKbr	TKbr	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
TKgr	TKgr	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tos	Tos	Sedimentary rocks	Mudstone	mudstone	medium	medium
Tqtz	Tqtz	Intrusive rocks	Felsic intrusive rocks	quartz veins	low	bad
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trbt	Trbt	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Trc	Trc	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tre	Tre	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Trsd	Trsd	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Trvb	Trvb	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Trvh	Trvh	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Trvp	Trvp	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Trvr	Trvr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Trw	Trw	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Ts	Ts	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Tsc	Tsc	Sedimentary rocks	Sandstone	sandstone	low	bad
Tsca	Tsca	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tsct	Tsct	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good

Lima 1:100K Quadrangle (MBMG) *continued*:

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ttr	Ttrav	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Tts	Tts	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
ZYs	ZYs	Sedimentary rocks	Feldspathic sandstone	feldspathic sandstone	medium	medium

Missoula West 1:100K Quadrangle (MBMG):

Polycode	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
^f	^f	Metamorphic rocks	Quartzite	quartzite	very low	bad
^h	^h	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
^rl	^rl	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
^sh	^sh	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Kgd	Kgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Kto	Kto	Intrusive rocks	Felsic intrusive rocks	tonalite	medium	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qao	Qao	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qat	Qat	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qgl	Qgl	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qgt	Qgt	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Taf	Taf	Unconsolidated deposits	Older sediments	older sediments	high	variable
Td	Td	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgc	Tgc	Unconsolidated deposits	Older sediments	older sediments	high	variable
TKgb	TKgb	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
TKgd	TKgd	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tm	Tm	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Tr	Tr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Tsf	Tsf	Unconsolidated deposits	Older sediments	older sediments	high	variable
Ttr	Ttr	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Tvf	Tvf	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Yan	Yan	Intrusive rocks	Felsic intrusive rocks	anorthosite	medium	medium
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ygr	Ygr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Missoula West 1:100K Quadrangle (MBMG) *continued*:

Polycode	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Yms2	Yms2	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yms3	Yms3	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ypi	Ypi	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Yq	Yq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Yqfg	Yqfg	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Ysgn	Ysgn	Metamorphic rocks	Schist-gneiss	schist	medium	medium
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yw	Yw	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywcs	Ywcs	Metamorphic rocks	Calc-silicate rocks	calc-silicate gneiss	high	good
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good

Nez Perce Pass 1:100K Quadrangle (MBMG):

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Qaf	Qaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qat	Qat	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qgt	Qgt	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Tgb	Tgb	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tgc	Tgc	Unconsolidated deposits	Older sediments	older sediments	high	variable
Tgpi	Tgpi	Intrusive rocks	Felsic intrusive rocks	monzogranite	medium	medium
Tgpr	Tgpr	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKg	TKg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
TKgc	TKgc	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
TKh	TKh	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	felsic dikes and sills	medium	bad
TKp	TKp	Intrusive rocks	Felsic intrusive rocks	granodiorite	medium	medium
Tm	Tm	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Tra	Tra	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	rhyolite	medium	bad
Tv	Tv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Yagn	Yagn	Metamorphic rocks	Metamorphosed felsic intrusive rocks	felsic gneiss	medium	medium
Yam	Yam	Metamorphic rocks	Metamorphosed mafic intrusive rocks	amphibolite	medium	bad
Ybm	Ybm	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Ymg	Ymg	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Yq	Yq	Metamorphic rocks	Quartzite	quartzite	very low	bad
Yqf	Yqf	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Yqs	Yqs	Metamorphic rocks	Schist-gneiss	schist	medium	medium

Wallace 1:100K Quadrangle (MBMG):

Mbmg Code	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qao	Qao	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qgl	Qgl	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qgt	Qgt	Unconsolidated deposits	Glacial till	glacial till	low	medium
Qls	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
QTaf	QTaf	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Tgc	Tgc	Unconsolidated deposits	Older sediments	older sediments	high	variable
TKgb	TKgb	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Yb	Yb	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ygr	Ygr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yms2	Yms2	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yms3	Yms3	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Yp	Yp	Sedimentary rocks	Carbonate-bearing sedimentary rocks	carbonate-bearing sedimentary rocks	high	good
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ysr	Ysr	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good

Wallace 1:250K Quadrangle (USGS):

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Cl	Cl	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Cs	Cs	Sedimentary rocks	Carbonate rocks	limestone	medium	bad
Csq	Csq	Sedimentary rocks	Mudstone	mudstone	medium	medium
Kg	Kg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Ks	Ks	Intrusive rocks	Felsic intrusive rocks	syenite	medium	bad
Qal	Qal	Unconsolidated deposits	Stream deposits	alluvial deposits	low	medium
Qg	Qg	Unconsolidated deposits	Stream deposits	fluvioglacial deposits	low	medium
Ql	Ql	Unconsolidated deposits	Lake deposits	lake deposits	medium	medium
Qs	Qls	Unconsolidated deposits	Landslide deposits	landslide deposits	medium	variable
QTg	QTg	Unconsolidated deposits	Stream deposits	gravels	low	bad
Tcr	Tcr	Extrusive and subvolcanic rocks	Mafic volcanic/subvolcanic rock	basalt	high	good
Td	Tdi	Intrusive rocks	Mafic intrusive rocks	diorite and gabbro	high	bad
Tg	Tg	Intrusive rocks	Felsic intrusive rocks	granite	medium	medium
Ts	Ts	Sedimentary rocks	Conglomerate	conglomerate	low	bad
Tv	Tv	Extrusive and subvolcanic rocks	Felsic volcanic/subvolcanic rocks	volcanic	medium	bad
Xan	Xan	Intrusive rocks	Felsic intrusive rocks	anorthosite	medium	medium
Xgn	Xgn	Metamorphic rocks	Schist-gneiss	gneiss	medium	medium
Yb	Yb	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ybo	Ybo	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ye	Ye	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ygr	Ygr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Yh	Yh	Metamorphic rocks	Metamorphosed carbonate rocks	metamorphosed carbonate rocks	medium	bad
Yl	Ylib	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ym	Ym	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yms	Yms	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad
Ypi	Ypi	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ypl	Ypl	Metamorphic rocks	Quartzite	quartzite	very low	bad
Ypu	Ypu	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Yr	Yr	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	low	bad

Wallace 1:250K Quadrangle (USGS) *continued*:

Label	New IFTNC ID	Major_Unit	Minor _Unit	Lithology	Weathering Susceptibility	Tree Value
Ys	Ys	Metamorphic rocks	Siltite-argillite	siltite, argillite	medium	medium
Ysh	Ysh	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ysn	Ysn	Metamorphic rocks	Siltite-argillite	argillite, siltite	medium	medium
Ysp	Ysp	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yspp	Yspp	Sedimentary rocks	Carbonate rocks	dolomite	medium	bad
Ysr	Ysr	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Yw	Yw	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywl	Ywl	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywm	Ywm	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
Ywq	Ywq	Metamorphic rocks	Feldspathic quartzite	feldspathic quartzite	medium	medium
Ywu	Ywu	Metamorphic rocks	Carbonate-bearing metasedimentary rocks	carbonate-bearing metasedimentary rocks	high	good
ZYd	ZYd	Intrusive rocks	Mafic intrusive rocks	mafic dikes and sills	high	bad