Great Basin Naturalist

Volume 44 | Number 4 Article 11

10-31-1984

A preliminary classification of the natural vegetation of Colorado

William L. Baker
Colorado Natural Heritage Inventory, Denver, Colorado

A PRELIMINARY CLASSIFICATION OF THE NATURAL VEGETATION OF COLORADO

William L. Baker[1]

Abstract.— A classification of the natural vegetation of Colorado is presented. This classification, which uses the Plant Association as the basic unit, was developed by sorting data in the scientific literature, supplemented by field research. The classification uses a standardized nomenclature. Citations are given for the literature from Colorado and adjoining states for each Association. The classification includes a total of 403 Plant Associations, with 28 Angiosperm Forests/Woodlands, 2 Mixed Angiosperm–Gymnosperm Forests/Woodlands, 114 Gymnosperm Forests/Woodlands, 100 Shrub Associations, 74 Grassland Associations, 38 Graminoid Associations, and 47 Herb Associations.

In completing a state flora, a species taxonomist (systematist) would compile existing collection records from herbaria, resolve pertinent taxonomic questions, adopt and synonymize nomenclature, and complete field collections in undercollected parts of the state. The syntaxonomist aiming at a state compilation of vegetation types would need to take analogous steps. In the western United States, however, there are additional problems specific to syntaxonomy: (1) There is no herbarium analog for vegetation records; the vegetation analog of a plant specimen is a sample (stand) record. Although these are often published in the scientific literature, in some states, such as Colorado, a substantial amount of stand data is not available in the published literature. (2) There is no single, widely utilized method of stand data collection. Stand attributes measured may include cover, frequency, biomass, percent composition, density, or other measures. These may be recorded for each species of plant, or plants may be grouped by life form or other criteria. Data may be collected using visual estimates on large plots, or by more detailed quadrat methods. (3) Many sample plot data are collected but never analyzed, or the analysis includes ordination but not classification. Although ordination procedures may assist in elucidating relationships among samples and in relation to environmental gradients, they are of less value than clustering procedures in determining meaningful vegetation units. (4) In the western U.S., with few exceptions, vegetation classifications are developed for a limited geographic area, usually on the order of a mountain range or basin, and the classification, although made internally consistent, is not often correlated with available regional vegetation data or other classifications. This is analogous to desribing species based on specimens in only one herbarium or museum. If the correlation is completed, rarely is the nomenclature adjusted accordingly. (5) There is no standardized system of nomenclature in wide use in the western U.S. The closest approach to such a system is the system used in habitat type studies supported primarily by the U.S. Forest Service (Pfister 1982). Although there are no formal nomenclatural rules for this system comparable to those of the International Code of Phytosociological Nomenclature (Barkman et al. 1976), correlation efforts have resulted in fairly consistent names. There are also scattered studies in the region that have followed the nomenclatural procedures in the International Code (e.g., Komárková 1976). (6) There is disagreement about whether the classification should be of

[1]Colorado Natural Heritage Inventory, 1550 Lincoln Street, Suite 110, Denver, Colorado 80203.

existing vegetation, potential natural vegetation, presettlement vegetation, or climax vegetation. Also there is no agreement as to whether the latter three of these can be determined, or if they are different. (7) There is no formal agreement on the appropriate level of detail for classifications, though there is wide support for a hierarchy of levels of detail. Finally, (8) though vegetation data have now been collected in the western U.S. for 80 or more years, no one has attempted to systematically revise classifications on a broad scale using a monographic approach, such as is widely and successfully applied in species taxonomy and has been widely used in European syntaxonomy (e.g., Kovář 1981).

If vegetation varies continuously along environmental gradients, as has been shown by many studies (e.g., Whittaker 1956, Curtis 1959), there may be no unique classification possible, and the situation outlined above may not be subject to remedy. But, as Shimwell (1971) observed, similar concerns have been raised regarding the validity of the taxonomic species concept (Grant 1971), and there is continuing discussion about which attributes (morphological, genetic, biochemical, behavioral, etc.) or combination of attributes should be used to classify individuals into species. One author (Hoog 1981) even suggests that the relevant taxonomic decisions should be left to a committee, who would presumably weigh the evidence and make a majority determination. The need for professional judgment or committee determination in the face of conflicting evidence belies the objectivity of the taxonomic species concept, though it remains a viable global organism classification unit in spite of known deficiencies—probably because of its utility.

There may be compelling biological arguments for not classifying species or vegetation, but the absence of comprehensive detailed vegetation classifications has unfortunate results: (1) While species diversity patterns are beginning to be understood on a general level (Peet et al. 1983), and the contribution of species diversity to stability is being elaborated (Pimm 1984), there have been few studies of the diversity of vegetation units, causes of vegetation diversity, its contribution to landscape stability, or its change over time (but see Romme 1982). (2) There have been few studies examining the distribution and abundance of vegetation units in the landscape. Do landscapes contain common as well as unique vegetation types? How are these dispersed in the landscape? (3) Even less is known about vegetation uniqueness. Can vegetation endemism occur in a region that has low species endemism? (4) Little is known about geographic variation within a particular vegetation unit and what environmental basis there is for the variation (analogous to an ecotype study for a species). Does geographic variation manifest itself in compositional variation, changes in abundance, changes in structure, or some combination (cf Peet 1978)? (5) Can management prescriptions be applied uniformly to all examples of a particular vegetation type? What is the appropriate level of the hierarchy for this to occur? And (6) which vegetation units are being modified by human land uses, which are being irretrievably lost, which are already protected by some means? If individual parts of the vegetation continuum are not named, it is much more difficult to monitor the rate of their loss, or to evaluate their importance for preservation.

The foregoing are among the questions that cannot be addressed effectively without a more systematic classification of vegetation applied over a broad region. Ideally, such a classification would have the following features: (1) a hierarchical system with several levels of detail, (2) within each level of the hierarchy, each unit would encompass a similar amount of variation, (3) standardized nomenclature, (4) a standardized system for revision, and (5) units that are geographically independent. If units are delimited by regions, their total geographic range cannot be studied. In addition, an ideal classification scheme should include a (6) moderately standardized system of data collection, (7) publication of actual stand data, delimitation of type stands, and provision for perpetuation of type stands in natural areas, and (8) classification of presettlement vegetation as much as is still possible, with the closest extant successional stage substituting where no records of presettlement composition and structure remain.

The classification presented here differs from this ideal in several ways. All available stand data on Colorado vegetation (Baker 1983, 1984) are used. These data have been collected in a variety of ways for a variety of purposes. Although it would be desirable to quantitatively analyze this full spectrum of data and objectively divide it into vegetation units, the heterogeneity of data, as well as the size of the matrix that would result, preclude this approach. An effort has been made to define units that encompass similar amounts of variation, but it is not currently possible to evaluate the success of this attempt quantitatively. The classification is not currently a complete hierarchy; only the finest level of the classification, the Plant Association level, is fully developed. Though the Series names listed are in most cases not different from names that have been used in the literature, the Series level presented here is primarily of value as an indexing mechanism. A more meaningful next level for the hierarchy is needed, but its development is beyond the scope of this paper. Most available higher level classificatons (e.g., Brown 1983, UNESCO 1973) have been constructed from the top down and have units that are geographically defined. Although there is value in this approach for many uses, the Plant Associations listed here would overlap several higher level categories in the Brown or UNESCO systems.

For example, the *Agropyron spicatum–Poa sandbergii* grassland is a well-known and internally consistent unit that occurs over a wide geographic range from southern British Columbia in Canada to northern California, and from Montana to central Colorado (see classification for references). This Plant Association would have to be treated in the Brown system by separating it into at least two units, one under the Great Basin Shrub–Grassland Regional Formation, and one under the Rocky Mountain Montane Grassland Regional Formation. To circumvent this problem it would be desirable to modify such systems, or develop new systems that are derived by grouping similar Plant Associations into higher-level units. This development from the bottom up would insure that higher levels of the hierarchy would be additive upward rather than independent classifications at increasingly broad levels.

The classification uses a standardized nomenclature, but this nomenclature has not been developed with a view toward use outside the western U.S. and does not include many features of a needed formal nomenclatural process (Barkman et al. 1976). It is derived largely from general nomenclatural approaches most in use in this region and would require modification to be useful, for example, in regions containing vegetation with species-rich canopies, such as in some forests of the eastern United States. In those regions floristically based nomenclatures are probably more appropriate (cf Braun-Blanquet 1965) and have been widely utilized in similar forests in Europe. Some features of this floristically based approach are used here in vegetation with more species-rich canopies. Though species-rich canopies present nomenclatural problems for dominance-based nomenclatures, species-poor vegetation presents nomenclatural problems for floristically based nomenclatures. It is likey that the two approaches, or perhaps others, will need to be dovetailed if a comprehensive national classification is to be effectively developed in the U.S. On a local basis the data and most of the syntaxa derived by Komárková (1976) using a floristically based approach have been incorporated in this classification with only some nomenclatural adjustment. That such direct conversion is possible attests to the general consistency of the syntaxonomic process up to the point of naming. Though Komárková's names are different, her vegetation units are congruent in level-of-detail and amount of homogeneity with other studies of similar vegetation in Colorado. If this is the case in other parts of the U.S., then developing a national scale classification may be partly a matter of devising a broad nomenclatural process.

It is important to emphasize that the nomenclature does not drive the classification system. Regardless of nomenclatural approach, vegetation units are derived by grouping stands using some set of criteria, perhaps either floristic similarity or similarity in dominants. A name is then applied to the resultant unit. If a stand is then located that has slightly different floristic composition, or

different dominants, the stand may be used as the basis for revising the nomenclature of a particular unit, or it may be the basis for additional data collection to determine if a new vegetation unit is warranted. If new data are automatically placed into new units without reference to previously described syntaxa, a proliferation of poorly demarcated syntaxa will result.

The primary purpose of this paper is to sort and revise extant data into a reasonably internally consistent classification that will be useful as a starting point for more quantitative systematic revision. A basic premise of this paper is that methods of classification used in a variety of natural resources taxonomies such as species taxonomy (Hoog 1981), soil taxonomy (USDA Soil Conservation Service 1975), geologic stratigraphy, and others, all utilize similar methodology involving several steps: (1) collection of field data, (2) grouping into taxa, (3) nomenclature, and (4) revision. In the western United States, syntaxonomies are incomplete, not because the process lacks meaning or is more difficult than in other natural resource fields, but because development has not proceeded systematically. Although it will always be possible to develop classifications of the vegetation in the western U.S., the opportunities for classifying vegetation reflecting as nearly as possible presettlement conditions are decreasing as natural vegetation is subjected to increasing land use pressures, and as remnants of the presettlement vegetation spectrum are altered or lost.

METHODS

Approach

The focus of this classification is on the natural vegetation of the state of Colorado. The term *natural* here means the vegetation that existed prior to the changes that have accompanied European settlement, essentially the presettlement vegetation. Excluded from the classification, as a consequence, are newly created vegetation types such as lawns, pastures, gardens, and agricultural fields, or vegetation types that are dominated by exotic species, unless these exotic species now dominate all stands of a particular vegetation type and there is no record of composition prior to the replacement. Currently there are no vegetation types in Colorado that have been completely replaced, so far as I am aware, though there are some vegetation types where the majority of stands are now dominated in the understory by exotics (e.g., *Atriplex confertifolia/Hilaria jamesii*).

The classification does not include only "climax" vegetation types, in the sense used by Daubenmire (1952), because it is likely that large parts of the presettlement landscape contained fire-maintained grasslands and forests or vegetation types whose structure was extensively affected by large native ungulates (e.g., *Bouteloua gracilis* Shortgrass Prairie). These fire and grazing-"disclimaxes" are here considered to be a part of the natural presettlement spectrum and worthy of classification where this is still possible. Much recent evidence (White 1979) suggests that natural disturbances are a part of the natural environmental setting of many kinds of vegetation and may even be promoted by the structure of the vegetation or by the adaptations of its component species. A recently burned but revegetated site, for example, may represent two possible successional states, depending on the natural fire frequency: (1) a state that is compositionally and structurally relatively fixed by recurrent fires, or (2) a state that is temporarily present but will disappear due to a low natural fire frequency and a long period between fires. Though there is a range of possibilities between these extremes, they serve to illustrate the successional perspective taken here. In the first case most stands in the landscape will be in the state common not long after a fire. A few stands will have escaped the average high frequency and perhaps have changed compositionally toward a less fire-adapted structure and composition. In the second case most stands in the landscape will be in a state that develops after a long period without a fire, though a few stands may be in a temporary postfire state.

In the first case, the Association would be described and named based on the most common state, the early postfire state. An example of this would be a fire-maintained montane grassland in Colorado. In the second

case the Association would be described and named also based on the most common state, a state after a long period without fire. Other states than those that are the basis for naming would be treated as "Plant Communities," which could be included in the future as a level in the hierarchy under each Plant Association (e.g., Arno 1982). A consequence of this approach is that the number of Plant Associations is finite, but the number of Plant Communities is nearly unlimited, and recently is being dramatically increased as the number of kinds and intensities of human-related environmental effects increases.

This approach assumes a priori knowledge about natural disturbance frequencies that is not completely available, though sufficient information may be available for generalization. General ranges of fire frequencies, for example, have been worked out for the region (Martin 1982) so that we know, for example, that fire return intervals are roughly 5–20 years in dry pine forests and 200–500 years in the subalpine forest. The Plant Associations in subalpine forests would then be described and named based on stands at least 200 years old, and pine forest Associations would be based on stands burned within 20 years. In this context, stands not burned within 20 or so years, if different compositionally, would be considered successional. This approach, though different from Daubenmire's (1952) conception, is implicit in some recent work (e.g., Hess 1981) following that tradition and was suggested in a Working Group report at a workshop on habitat typing in the southwest (Moir and Hendzel 1983). An advantage of this approach is that Plant Associations are real, extant (except where all remnants have been extirpated) kinds of vegetation, rather than a theoretical end point that is seldom reached on most sites due to natural disturbances. In this regard, Daubenmire and Daubenmire (1968:7) remark that "relatively few of our study sites represent climax stands that appear to have reached a completely homeostatic equilibrium."

The Plant Associations in this classification must be considered preliminary because some of the natural disturbance regimes in the region have been altered since settlement. Fire suppression, though, may be less of a factor here than in other areas because, even in dry pine forests here, the natural fire return interval is apparently quite long (Laven et al. 1980); even with suppression, the interval decreased from 66 years prior to settlement to 27 years following initiation of suppression. By the same reasoning, plains Plant Associations that are largely no longer affected by bison or elk grazing must be considered preliminary. Cattle grazing is now prevalent, but cattle differ substantially in diet and grazing behavior from bison (Schwartz and Ellis 1981), with cattle having a more selective diet and spending more time grazing in low areas of the landscape. These differences extended over a long time period would likely result in compositional differences between bison-grazed and cattle-grazed ranges. Although bison-grazed sites are no longer available for sampling, the closest extant successional state would be on sites as free as possible of livestock effects. Extant vegetation on such sites would have to substitute for the presettlement vegetation unless, or until, a natural grazing regime could be reestablished on some sites for study.

The Plant Association is considered here to be a state determined by the prevailing presettlement environmental conditions, including a natural disturbance regime, with some human-related effects. It is primarily a classification unit derived for human purposes, lacking organismic properties, and probably lacking emergent properties. Its primary purpose is for organizing information. It is unlikely that the Plant Associations named here would have retained their composition or structure in perpetuity in the absence of the disturbances associated with settlement. Though the evidence is not extensive, Van Devender and Spaulding (1979) report that the elevational displacement of vegetation associated with the end of the Pleistocene resulted in completely new assemblages. Communities were not simply displaced intact, but were reordered.

This classification does not include only "potential natural vegetation" in the sense used by Küchler (1964) (the vegetation that would result if man were removed from the landscape and the resulting succession telescoped into a short period). Native human cultures, in their use of fire (Moore 1972,

Barrett 1980) and their impact on large mammal populations, may have had a significant indirect effect on the structure of many Colorado plant associations since their inception. There is increasing evidence that both human culture and presettlement vegetation in Colorado have a primarily late-Pleistocene or post-Pleistocene origin (Martin and Mehringer 1965, Van Devender and Spaulding 1979). Total removal of humans would likely result in a new kind of vegetation that has never been extant in the region. A premise of the approach aimed at here is that human effects are "natural," in that they have been potentially partly a controlling factor in vegetation development in the region, but European settlement has resulted in a dramatically increased rate of change in the vegetation, accompanied in many cases by wide-scale replacement by agricultural crops or other less-desirable exotic plants, as well as by dramatic changes in structure or composition of many other vegetation types. Although this change is in a sense "natural," the vegetation existing prior to the change is of more than historical interest, because in many cases knowing its composition and structure will be essential if disturbed lands are to be effectively rehabilitated, and if the extinction of the many native plant and animal species poorly adapted to the new cultural vegetation is to be prevented.

This classification is not an integrated classification, combining several attributes of an ecosystem, such as vegetation, soils, and landform, into one system. It is intended to be a classification of the vegetation component of Colorado ecosystems only. An integrated classification system could be developed using this classification for the vegetation component.

Limitations

The classification was developed by sorting actual stand data in the scientific literature identified in Baker (1983, 1984). The classification is preliminary for several reasons: (1) The sorting and evaluating process may result in errors and omissions that can only be corrected with refinement through use and review. (2) Gaps exist in the literature for certain parts of the state (Baker 1982) and for certain kinds of vegetation. Some vegetation types have not been studied in detail and cannot be classified below the Series level. (3) A few new Plant Associations are proposed for the first time here that were not previously described in the literature, but appear reasonable when all available data are examined en masse (e.g., several *Deschampsia* associations). (4) As classifications are completed in other parts of the western U.S., Colorado Associations that extend into those areas may need to be revised. And (5), though stand data were excluded from consideration if disturbance effects were reported or could be inferred, it is possible that a few of the Associations do not represent presettlement conditions. The list should be viewed as a first approximation.

Hierarchical Structure

The classification is structured hierarchically, with four levels of specificity. The upper three levels and the units within them are designed primarily to facilitate organization.

1. System: Overall physiognomy of vegetation. The following are the Systems:
   - Angiosperm Forests/Woodlands
   - Gymnosperm Forests/Woodlands
   - Shrub Associations
   - Grassland Associations
   - Graminoid Associations
   - Herb Associations
2. Cover Class: The dominant genus in the top stratum of the association (e.g., *Pinus*).
3. Series: The dominant species in the top stratum of the association (e.g., *Pinus ponderosa*).
4. Plant Association: This term, which has been widely used in a variety of contexts, is used here to mean a vegetation unit: (1) that is representative of presettlement conditions, (2) that has internal homogeneity in the composition of its component strata (tree, shrub, and herb strata, if present), (3) that is a grouping of several stands, and (4) that has a definable environmental location.

Level of Detail

The definition of a Plant Association above does not specify just how much variation is

encompassed in each Association. Though quantitative means have been developed and utilized to define vegetation units within a limited geographic area, objective methods were impractical for this classification. Even with objective methods, only the consequences of choosing a particular level of detail are objectively illustrated. The researcher still must choose the level. Ultimately, the researcher is guided by the purpose for which the classification is designed, or by previous research results and interpretation. This classification extends and modifies the classification method begun by Daubenmire (1952), which has now been completed on many of the National Forests in the western U.S. (Pfister 1982). It is congruent in scale with comparable efforts in Oregon and Washington (Franklin and Dyrness 1973) and Alaska (Viereck and Dyrness 1980). If extended Nationally, classification on this scale would probably result in some 6,000 Plant Associations, assuming about a 250 per state average, and a 50% overlap between states. This level of detail has been used successfully to map vegetation (Komárková and Webber 1979), though, as with soil mapping, some complexes must be used as mapping units. This level of detail is comparable in magnitude to that in soil classification at the Series level, where some 10,500 Series have been described (USDA Soil Conservation Service 1975).

Nomenclature

Development of nomenclature is the final step in classification prior to testing. Nomenclature used here is similar to that used in many studies of vegetation in the western U.S. No formal rules are proposed, but some steps toward standardization are taken. Names used here generally reflect rather closely the composition and structure of the Plant Association, but individual stands may differ somewhat from that composition implied by the name. The range of variation encompassed under a particular name can only be known by consulting the data in the cited references. Although it would be desirable to summarize the variation inherent in each Association, this is beyond the scope of this paper.

Names are generally based on the dominant species (species with the greatest percent canopy cover) in each stratum of most stands of the Association. If a stratum consistently contains co-dominant species (species generally with at least 10% relative cover in a stratum and high constancy in the Association), the most important two or three co-dominants may be included in the name, and are so indicated by being separated by a dash (—). Co-dominants are listed alphabetically within a stratum. If an Association has co-dominants in the top stratum, it would be listed only under the generic name of the first co-dominant (e.g., a *Pinus ponderosa–Pseudotsuga menziesii/Carex rossii* Association would be listed only under PINUS). This nomenclatural approach differs from that of Daubenmire (1952) in that the apparent reproductive potential of the overstory species is not used to determine a potential climax species. If mature, relatively undisturbed stands consistently have co-dominance, that co-dominance is generally recognized here in the nomenclature. Names may occasionally include differential or characteristic species. These are species that are virtually always present, but not necessarily dominant in the Association, though usually absent from related Associations. These species are identified by a star (*) following the species name. Associations are assumed to contain potentially three strata: tree, shrub, and herb. A particular species is here assumed to only belong to one of these strata (e.g., *Picea engelmannii* is always considered a tree, so the shrubby *Picea engelmannii* Associations that characterize krummholz are listed only in the Gymnosperm Forest/Woodland System, not with Shrub Associations). Strata are separated in names by a slash (/). Slashes are not used to separate a dominant from a subdominant. Some associations are heterogenous in a stratum. Their composition may consist of a core species that is always present and an additional species that may be absent from many stands, but that in many stands may be co-dominant with the core species. Because these species lack the high constancy required of a full co-dominant, they are distinguished in names by enclosing them in parentheses (e.g., the *Pinus ponderosa–(Pseudotsuga menziesii)/Carex*

rossii Association). Physiognomic or environmental descriptors have often been added to names to clarify and add meaning to the name (e.g., *Carex microglochin* Alpine Wetland).

Names listed here may differ substantially, in some instances, from names used in the sources of information cited. This occurs because ecologists use different naming conventions, or may not have incorporated all available data prior to naming. In addition, the standardization applied here results in some new names for some familiar associations. It is hoped that scientists whose work is cited here will understand that this standardization of names and sorting of data is a necessity if a statewide, and eventually a regionwide, classification is to be developed. The nomenclature proposed here may not be the best for such a regionwide classification, but it is intended to illustrate that standardization can be accomplished, and does serve to clarify a proliferation of names for the same vegetation unit.

Species nomenclature generally follows Kartesz and Kartesz (1980). *Agropyron spicatum* var. *inerme* is retained, because it forms grasslands in Colorado that are ecologically very distinct from grasslands formed by *A. spicatum* var. *spicatum*. *Amelanchier* from the same location has been identified as both *A. utahensis* and *A. alnifolia*. Until this taxonomy is resolved, only the name *A. utahensis* is used for all Colorado *Amelanchier*.

Testing

The classification has been under development since 1981 and has been tested in the field during three field seasons. The current classification changed only about 5% from the previous year's version, in spite of about a 10% expansion in the literature and available data. There is no question that additional modification will need to occur as new data accumulate, but it appears unlikely the classification would ever be expanded much beyond about 500 Associations. This is so because new data may just as well result in the alteration of existing Associations as in the creation of new ones. In this sense the classification is not open ended. Additional testing and revision will improve the definition of the Associations listed here, but not necessarily result in many new ones.

Use of the Classification

References pertaining to each Association are listed by number in parentheses following the name. Numbers following "CO:" correspond to the numbered references in two bibliographies of Colorado vegetation description (Baker 1983, 1984). For reference 587 in the Colorado literature, all entries are followed immediately by an additional number. This is the number of the Range Site description. CNHI is included in the list of citations if Colorado Natural Heritage Inventory (CNHI) has additional unpublished data on file. Standard two-letter postal abbreviations indicate literature from adjoining states. These include AZ = Arizona, CA = California, ID = Idaho, IL = Illinois, KS = Kansas, MT/Montana, OK = Oklahoma, OR = Oregon, ND = North Dakota, NE = Nebraska, NM = New Mexico, NV = Nevada, SD = South Dakota, TX = Texas, UT = Utah, WA/Washington, WI = Wisconsin, WY = Wyoming. Numbers following these abbreviations correspond to numbered references listed in the Literature Cited section following the classification. It may on occasion be difficult to locate the actual data in the cited sources because they may be listed under a different name or occur in a data table. A general idea of the range of each Association can be gained by scanning the state abbreviations following the name. It is important to note that the coverage of literature is incomplete, because much unpublished and some published literature was unavailable to me. Coverage is generally best for adjoining states.

Acknowledgments

This paper benefited from the review and comments of many ecologists. I would most like to thank Robert K. Peet, Vera Komárková, John Marr, Jane Bunin, Mark Heifner, Walt Kelley, Dieter Wilken, Mike Figgs, Karen Wiley-Eberle, Richard Driscoll, Scott Ellis, Jim Ebersole, S. Reid Schuller, John Pearson, Bonnie Heidle, Ellen Collins, Tamara Naumann, Susan Kennedy, Barry

Johnston, the Piceance Basin field crew, and the staff of the White River Resource Area, Bureau of Land Management. This work was improved by critical discussion with Robert E. Jenkins and the staff of The Nature Conservancy. This work could not have been completed without the support of The Nature Conservancy, and without the encouragement, in particular, of J. Scott Peterson. Other organizations that contributed information and assistance include the Colorado Native Plant Society, the Colorado National Areas Program, the U.S. Forest Service, the Bureau of Land Management, the Soil Conservation Service, and the Boulder County Nature Association.

LITERATURE CITED

ARNO, S. F. 1982. Classifying forest succession on four habitat types in western Montana. Pages 54–62 *in* J. E. Means, ed., Forest Succession and Stand Development Research in the Northwest, Forestry Sci. Lab., Oregon State Univ., Corvallis. 170 pp.

BAKER, W. L. 1982. Vegetation description in Colorado: where are the gaps? J. Colorado-Wyoming Acad. Sci. 14(1):39 (Abstract).

———. 1983. A bibliography of Colorado vegetation description. Great Basin Nat. 43(1):45–64.

———. 1984. Additions to a bibliography of Colorado vegetation description. Great Basin Nat. 44(4):000.

BARKMAN, J. J., J. MORAVEC, AND S. RAUSCHERT. 1976. Code of phytosociological nomenclature. Vegetatio 32:131–185.

BARRETT, S. W. 1980. Indian fires in the pre-settlement forests of western Montana. Pages 35–41 *in* M. A. Stokes, and J. H. Dieterich, tech. coords., Proceedings of the Fire History Workshop [20–24 October 1980, Tucson, Arizona], USDA For. Serv. Gen. Tech. Rep. RM-81, Rocky Mt. For. and Range Exp. Sta., Fort Collins, Colorado. 142 pp.

BRAUN-BLANQUET, J. 1965. Plant Sociology: the study of plant communities. English translation of Pflanzensoziologie by G. D. Fuller and H. S. Conard. Hafner Publ. Co., New York. 439 pp.

BROWN, D. E. (ed.) 1983. Biotic communities of the American Southwest–United States and Mexico. Desert Plants 4(1–4):1–342.

CURTIS, J. T. 1959. The vegetation of Wisconsin: an ordination of plant communities. Univ. of Wisconsin Press, Madison. 657 pp.

DAUBENMIRE, R. 1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecol. Monogr. 22:301–330.

DAUBENMIRE, R., AND J. B. DAUBENMIRE. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington Agric. Expt. Sta. Tech. Bull. 60. 104 pp.

FRANKLIN, J. F., AND C. T. DYRNESS. 1973. Natural vegetation of Oregon and Washington. USDA Forest Service Gen. Tech. Rep. PNW-8, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 417 pp.

GRANT, V. 1971. Plant speciation. Columbia Univ. Press, New York. 435 pp.

HESS, K. 1981. Phyto-edaphic study of habitat types of the Arapaho-Roosevelt National Forest, Colorado. Unpublished dissertation. Colorado State Univ., Fort Collins. 558 pp.

HOOG, G. S. DE. 1981. Methodology of taxonomy. Taxon 30:779–783.

KARTESZ, J. T., AND R. KARTESZ. 1980. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Univ. of North Carolina Press, Chapel Hill. 498 pp.

KOMÁRKOVÁ, V. 1976. Alpine vegetation of the Indian Peaks area, Front Range, Colorado Rocky Mountains. Unpublished dissertation. Univ. of Colorado, Boulder. 655 pp.

KOMÁRKOVÁ, V., AND P. J. WEBBER. 1978. An alpine vegetation map of Niwot Ridge, Colorado. Arct. and Alpine Res. 10:1–29.

KOVÁŘ, P. 1981. The grassland communities of the southeastern basin of the Labe River. 1. Syntaxonomy. Folia Geobot. Phytotax. 16:1–43.

KÜCHLER, A. W. 1964. The potential natural vegetation of the conterminous United States. Amer. Geogr. Soc. Spec. Publ. 361. 116 pp., map.

LAVEN, R. D., P. N. OMI, J. G. WYANT, AND A. S. PINKERTON. 1980. Interpretation of fire scar data from a ponderosa pine ecosystem in the central Rocky Mountains, Colorado. Pages 46–49 *in* M. A. Stokes, and J. Dieterich, tech. coords., Proceedings of the Fire History Workshop [20–24 October 1980, Tucson, Arizona], USDA For. Serv. Gen. Tech. Rep. RM-81, Rocky Mountain For. and Range Exp. Sta., Fort Collins, Colorado.

MARTIN, P. S., AND P. J. MEHRINGER, JR. 1965. Pleistocene pollen analysis and biogeography of the southwest. Pages 433–451 *in* H. E. Wright, Jr., and D. G. Frey, eds., The Quaternary of the United States, Princeton Univ. Press, Princeton, New Jersey. 922 pp.

MARTIN, R. E. 1982. Fire history and its role in succession. Pages 92–99 *in* J. E. Means, ed., Forest succession and stand development research in the Northwest, Forestry Sci. Lab., Oregon State Univ., Corvallis. 170 pp.

MOIR, W. H., AND L. HENDZEL, tech. coord. 1983. Proceedings of the Workshop on Southwestern Habitat Types [6–8 April 1983, Albuquerque, New Mexico], USDA Forest Service, Southwestern Region, Albuquerque, New Mexico. 110 pp.

MOORE, C. T. 1972. Man and fire in the central North American grassland 1535–1890: a documentary historical geography. Unpublished dissertation, Univ. of California, Los Angeles. 155 pp.

PEET, R. K. 1978. Latitudinal variation in southern Rocky Mountain forests. J. Biogeog. 5:275–289.

PEET, R. K., D. C. GLENN-LEWIN, AND J. W. WOLF. 1983. Prediction of man's impact on plant species diversity: a challenge for vegetation science.

Pages 41–54 *in* W. Holzner, M. J. A. Werger, and I. Ikusima, eds., Man's impact on vegetation. Dr. W. Junk Publishers, The Hague.

PFISTER, R. D. 1982. Designing succession models to meet management needs. Pages 44–53 *in* J. E. Means, ed., Forest succession and stand development research in the Northwest. Forestry Sci. Lab., Oregon State Univ., Corvallis. 170 pp.

PIMM, S. L. 1984. The complexity and stability of ecosystems. Nature 307:321–326.

ROMME, W. H. 1982. Fire and landscape diversity in subalpine forests of Yellowstone National Park. Ecol. Monogr. 52:199–221.

SCHWARTZ, C. C., AND J. E. ELLIS. 1981. Feeding ecology and niche separation in some native and domestic ungulates on the shortgrass prairie. J. Appl. Ecol. 18:343–353.

SHIMWELL, D. W. 1971. The description and classification of vegetation. Univ. of Washington Press, Seattle. 322 pp.

UNESCO. 1973. International classification and mapping of vegetation, Series 6, Ecology and conservation. United Nations Educational, Scientific and Cultural Organization, Paris, France. 93 pp.

USDA SOIL CONSERVATION SERVICE. 1975. Soil taxonomy. USDA Agric. Handbk. 436. 754 pp.

VAN DEVENDER, T. R., AND W. G. SPAULDING. 1979. Development of vegetation and climate in the southwestern United States. Science 204:701–710.

VIERECK, L. A., AND C. T. DYRNESS. 1980. A preliminary classification system for vegetation of Alaska. USDA For. Serv. Gen. Tech. Rep. PNW-106, Pacific Northwest Forest and Range Expt. Sta., Portland, Oregon. 38 pp.

WHITE, P. S. 1979. Pattern, process, and natural disturbance in vegetation. Bot. Rev. 45:229–299.

WHITTAKER, R. H. 1956. Vegetation of the Great Smoky Mountains. Ecol. Monogr. 26:1–80.

PRELIMINARY CLASSIFICATION OF THE NATURAL VEGETATION OF COLORADO

ANGIOSPERM FORESTS/WOODLANDS

ACER	
Acer negundo	*Acer negundo* Great Basin Riparian (CO:133, 210; UT:33)
Acer negundo–Populus angustifolia	*Acer negundo–Populus angustifolia/Cornus sericea*° (CO:CNHI)
ALNUS	
Alnus incana ssp. *tenuifolia–Betula occidentalis*	*Alnus incana* ssp. *tenuifolia–Betula occidentalis* Montane Riparian (CO:202, 209, 595, 598, 733; WY:112)
CERCOCARPUS	
Cercocarpus ledifolius	*Cercocarpus ledifolius/Artemisia tridentata* ssp. *wyomingensis–Symphoricarpos orcophilus/Agropyron spicatum* (CO:667)
POPULUS	
Populus angustifolia	*Populus angustifolia/Amelanchier utahensis* (CO:133, 210, 733)
	Populus angustifolia/Lonicera involucrata (CO:285, 481)
	Populus angustifolia/Salix exigua (CO:36, 133, 209, 266, 458, 648, 733; WY:35, 113)
	Populus angustifolia/Salix scouleriana (CO:334, 656; ID:109)
Populus angustifolia–Populus deltoides ssp. *monilifera–Salix amygdaloides* (CO:36, 85, 575)	
Populus deltoides ssp. *monilifera*	*Populus deltoides* ssp. *monilifera/Distichlis spicata* var. *stricta* (CO:88–91, 116–120, 162, 236–238, 274, 309–316, 330, 364)
	Populus deltoides ssp. *monilifera/Panicum virgatum* (CO:389, CNHI)
Populus deltoides ssp. *monilifera–Salix amygdaloides*	*Populus deltoides* ssp. *monilifera–Salix amygdaloides/Salix exigua/Spartina pectinata*° (CO:89–91, 116–120, 162, 236–238, 311–315)
Populus deltoides ssp. *wislizenii*	*Populus deltoides* ssp. *wislizenii/Rhus trilobata*° (CO:266, 267, 589, CNHI)
Populus tremuloides	*Populus tremuloides/Amelanchier utahensis–Prunus virginiana* var. *melanocarpa–Symphoricarpos orcophilus/Carex geyeri* (CO:59, 157, 213, 271a, 271b, 272, 662, 695)
	Populus tremuloides/Arctostaphylos patula (CO:659)
	Populus tremuloides/Arctostaphylos uva-ursi–Juniperus communis (CO:417, 522, 709)
	Populus tremuloides/Calamagrostis canadensis (CO:391)
	Populus tremuloides/Carex geyeri–Lathyrus leucanthus (CO:50, 173, 209, 213, 272, 355, 695, 733; UT:66, 77; WY:35, 171)
	Populus tremuloides/Ceanothus velutinus° (CO:78, 79)

Populus tremuloides/Festuca thurberi (CO:107, 111, 209, 210, 301, 413, 506, 522, 540, 733)
Populus tremuloides/Heracleum sphondylium (CO:59, 78, 79, 210, 213, 272, 355, 695, 733; WY:35, 174)
Populus tremuloides/Juniperus communis (CO:123, 355; UT:66; WY:35, 174)
Populus tremuloides/Pteridium aquilinum (CO:78, 79, 213, 385, 392, 695, 733; UT:66; WY:35)
Populus tremuloides/Rosa woodsii (CO:245, 272; WY:35)
Populus tremuloides/Rubus parviflorus (CO:59, 78, 355; SD:134; WY:35)
Populus tremuloides/Symphoricarpos oreophilus/Carex geyeri (CO:59, 210, 540, 571, 662, 681, 695, 733; ID:133)
Populus tremuloides/Thalictrum fendleri° (CO:59, 78, 79, 209, 210, 213, 272, 301, 675, 695; WY:35, 174)
Populus tremuloides/Thermopsis divaricarpa (CO:304, 334, 339, 346, 417, 660)
Populus tremuloides/Veratrum tenuipetalum° (CO:213, 733)

MIXED ANGIOSPERM-GYMNOSPERM FORESTS/WOODLANDS

POPULUS-CONIFER

Populus angustifolia–Picea pungens (CO:417, 557, 649; WY:35)
Populus angustifolia–Pseudotsuga menziesii (CO:356, CNHI)
Populus tremuloides–Picea pungens (CO:243, 245)
Populus angustifolia–Picea pungens/Alnus incana ssp. *tenuifolia–Amelanchier utahensis–Salix* ssp. (CO:173, 247)
Populus tremuloides–Picea pungens/Arnica cordifolia (CO:209, 733; WY:CO REF 733)

GYMNOSPERM FORESTS/WOODLANDS

ABIES

Abies concolor–Pinus ponderosa–Pseudotsuga menziesii
Abies concolor–Pinus ponderosa–Pseudotsuga menziesii/Arctostaphylos uva-ursi (CO:676, 677; AZ:103; NM:CO REF 676, 677)
Abies concolor–Pinus ponderosa–Pseudotsuga menziesii/Quercus gambelii (CO:676, 677; NM:106)

Abies concolor–Pseudotsuga menziesii
Abies concolor–Pseudotsuga menziesii/Acer glabrum (CO:676, 677; AZ:106; NM:106)
Abies concolor–Pseudotsuga menziesii/Erigeron eximius (CO:676, 677; NM:106, CO REF 676, 677)
Abies concolor–Pseudotsuga menziesii/Vaccinium sp. (CO:676, 677; NM:CO REF 676, 677)

Abies lasiocarpa
Abies lasiocarpa/Carex geyeri (CO:210, 733; ID:77, 133, 138, 139, 152; MT:120; UT:67; WY:35, 36, 139, 171)

Abies lasiocarpa–Picea engelmannii
Abies lasiocarpa–Picea engelmannii Ribbon Forest (CO:75, 78, 349, 632; MT:13; ID:13)
Abies lasiocarpa–Picea engelmannii Tree Island (CO:45, 190, 227, 341, 342, 347–349, 403, 547, 606)
Abies lasiocarpa–Picea engelmannii/Arnica cordifolia (CO:59, 136, 173, 213, 304, 417; ID:138, 139; MT:120; UT:66; WY:35, 70, 77, 139)
Abies lasiocarpa–Picea engelmannii/Calamagrostis canadensis (CO:209, 733; ID:133, 138, 139, 152; MT:120; UT:66; WY:35, 36, 139)
Abies lasiocarpa–Picea engelmannii/Cardamine cordifolia (CO:417, 540, 625, 676, 733)
Abies lasiocarpa–Picea engelmannii/Carex geyeri (CO:209, 210, 213, 540, 695)
Abies lasiocarpa–Picea engelmannii/Equisetum arvense (CO:417, 733; ID:138, 139, 152; MT:120; WY:35, 36, 112, 139)
Abies lasiocarpa–Picea engelmannii/Erigeron eximius (CO:676, 677; NM:CO REF 676, 677)
Abies lasiocarpa–Picea engelmannii/Linnaea borealis (CO:417, 676, 677, 733; ID:138, 139; MT:120; NM:106; WY:35, 36, 139)

Abies lasiocarpa–Picea engelmannii/Moss (CO:417, 540; NM:CO REF 676, 677; WY:35, 139)
Abies lasiocarpa–Picea engelmannii/Pachistima myrsinites (59, 210, 355, 540, 733)
Abies lasiocarpa–Picea engelmannii/Polemonium delicatum (CO:136, 417, 540, 676, 677, 733; NM:CO REF 676, 677)
Abies lasiocarpa–Picea engelmannii/Ribes lacustre (CO:59, 417)
Abies lasiocarpa–Picea engelmannii/Ribes montigenum (CO:301, 417, 522, 733; ID:138, 139; MT:120; UT:66, 67, 83, 137; WY:35, 36, 139)
Abies lasiocarpa–Picea engelmannii/Ribes wolfii (CO:59, 301)
Abies lasiocarpa–Picea engelmannii/Salix brachycarpa Krummholz (CO:417)
Abies lasiocarpa–Picea engelmannii/Salix glauca Krummholz (CO:209, 210, 733)
Abies lasiocarpa–Picea engelmannii/Senecio triangularis (CO:209, 417, 733)
Abies lasiocarpa–Picea engelmannii/Vaccinium myrtilus (CO:8, 59, 246, 272, 301, 344–346, 355, 417, 733; AZ:106)
Abies lasiocarpa–Picea engelmannii/Vaccinium myrtilus–Vaccinium scoparium (CO:173, 209, 213, 355, 377, 417, 625, 676, 677, 695; AZ:106; NM:106)
Abies lasiocarpa–Picea engelmannii/Vaccinium scoparium (CO:8, 59, 136, 167, 202, 210, 213, 301, 417, 466, 625, 656, 695, 733; AZ:106; ID:77, 133, 138; MT:77, 120; NM:106; OR:53, 55; UT:66, 67, 77, 142; WA:43; WY:35, 36, 70, 77, 114, 128, 129, 139, 171)

JUNIPERUS

Juniperus monosperma–Pinus edulis

Juniperus monosperma–Pinus edulis/Bouteloua curtipendula° (CO:733)
Juniperus monosperma–Pinus edulis/Cercocarpus montanus–Ribes cereum (CO:587N0286)
Juniperus monosperma–Pinus edulis/Quercus × *pauciloba*° (CO:486, 487; NM:82; OK:19, 131, 162)
Juniperus monosperma–Pinus edulis/Stipa neomexicana (CO:CNHI)
Juniperus monosperma–Pinus edulis/Stipa scribneri (CO:97, 517, 587N0279)

Juniperus osteosperma

Juniperus osteosperma/Agropyron spicatum (CO:667; UT:165; WY:44, 169)
Juniperus osteosperma/Amelanchier utahensis–Philadelphus microphyllus/Elymus salina (CO:CNHI)
Juniperus osteosperma/Elymus salina (CO:662; UT:137)

Juniperus osteosperma–Pinus edulis

Juniperus osteosperma–Pinus edulis/Agropyron smithii (CO:226, 733)
Juniperus osteosperma–Pinus edulis/Agropyron spicatum var. *inerme* (CO:226, 662, 666; UT:137)
Juniperus osteosperma–Pinus edulis/Amelanchier utahensis–Artemisia tridentata ssp. *wyomingensis–Cercocarpus montanus–Symphoricarpos oreophilus/Agropyron spicatum* var. *inerme* (CO:226, 662)
Juniperus osteosperma–Pinus edulis/Amelanchier utahensis–Cercocarpus montanus Marlstone Barren (CO:267, 271a, 662, 666)
Juniperus osteosperma–Pinus edulis/Amelanchier utahensis–Quercus gambelii–Symphoricarpos oreophilus/Carex geyeri (CO:210, 733)
Juniperus osteosperma–Pinus edulis/Artemisia nova/Agropyron spicatum (CO:667; ID:77; UT:140)
Juniperus osteosperma–Pinus edulis/Artemisia nova/Agropyron spicatum var. *inerme* (CO:226, 662)
Juniperus osteosperma–Pinus edulis/Artemisia tridentata ssp. *wyomingensis/Oryzopsis hymenoides–Stipa comata* (226, CNHI)
Juniperus osteosperma–Pinus edulis/Cercocarpus ledifolius var. *intricatus* (CO:659, 667; UT:46)
Juniperus osteosperma–Pinus edulis–Cercocarpus montanus/Agropyron spicatum (CO:667)

	Juniperus osteosperma–Pinus edulis/Cercocarpus montanus/Elymus salina (CO:CNHI)
	Juniperus osteosperma–Pinus edulis/Cercocarpus montanus/Oryzopsis hymenoides (CO:210, 226, 358, 597, 662, 733)
	Juniperus osteosperma–Pinus edulis/Cercocarpus montanus/Poa fendleriana (CO:150, 152, 153, 226)
	Juniperus osteosperma–Pinus edulis/Cercocarpus montanus–Peraphyllum ramosissimum (CO:210, 733)
	Juniperus osteosperma–Pinus edulis/Cowania mexicana (CO:CNHI; UT:111)
	Juniperus osteosperma–Pinus edulis/Hilaria jamesii–Oryzopsis hymenoides–Stipa comata (CO:CNHI)
	Juniperus osteosperma–Pinus edulis/Oryzopsis hymenoides (CO:133, 226, 597, 733)
	Juniperus osteosperma–Pinus edulis/Poa fendleriana (CO:150, 226, 662, 733)
	Juniperus osteosperma–Pinus edulis/Purshia tridentata/Poa fendleriana (CO:150, 153, 226)
	Juniperus osteosperma–Pinus edulis/Quercus gambelii (CO:201, 210, 226, 355, 542, 597, 733)
Juniperus scopulorum	*Juniperus scopulorum/Agropyron spicatum* (CO:552, 564, 689, 733; MT:27; WY:9, 35)
	Juniperus scopulorum/Artemisia tridentata (CO:209, 243, 245, 733; WY:35)
	Juniperus scopulorum/Cercocarpus montanus (CO:209, 733; WY:102)
	Juniperus scopulorum/Muhlenbergia filiculmis (CO:733)
	Juniperus scopulorum/Purshia tridentata (CO:209, 733)
	Juniperus scopulorum/Quercus gambelii (CO:533, 733)
	Juniperus scopulorum–(Pinus flexilis)–(Pinus ponderosa)/Schizachyrium scoparium Scarp Woodland (CO:15, 142, 176, 384, 438, 439, 449, 619–621, CNHI)
PICEA	
Picea engelmannii	*Picea engelmannii/Geum rossii* Krummholz (CO:522; AZ:106, 132; UT:66)
	Picea engelmannii/Trifolium dasyphyllum (CO:167, 209, 417, 733)
Picea engelmannii–Pinus aristata (CO:97, 211, 234, 509, 522, 631)	*Picea engelmannii/Pinus aristata/Festuca thurberi* (CO:676, 677)
Picea pungens	*Picea pungens/Amelanchier utahensis–Cornus sericea/Carex geyeri* (CO:210, 733)
Picea pungens–Pseudotsuga menziesii	*Picea pungens–Pseudotsuga menziesii/Arctostaphylos uva-ursi* (CO:676, 677; NM:106)
	Picea pungens–Pseudotsuga menziesii/Erigeron eximius (CO:676, 677; NM:CO REF 676, 677)
	Picea pungens–Pseudotsuga menziesii/Festuca arizonica (CO:676, 677; NM:CO REF 676, 677)
	Picea pungens–Pseudotsuga menziesii/Linnaea borealis/Carex foenea (CO:676, 677, 733; NM:106)
PINUS	
Pinus aristata	*Pinus aristata/Calamagrostis purpurascens* (CO:733)
	Pinus aristata/Trifolium dasyphyllum (CO:209, 733)
	Pinus aristata–(Pinus ponderosa)–(Pseudotsuga menziesii)/Festuca arizonica–Muhlenbergia montana (CO:522, 548, 676, 677, 733; NM:CO REF 676, 677)
Pinus contorta	*Pinus contorta/Arctostaphylos uva-ursi* (CO:305, 380, 417, 540, 656, 733; OR:53; UT:66, 77; WY:35, 77)
	Pinus contorta/Arctostaphylos uva-ursi–Juniperus communis (CO:8, 305, 339, 380, 417, 522, 554; WY:70, 128)
	Pinus contorta/Carex geyeri (CO:209, 210, 380, 540, 733; ID:77, 138; WY:35, 139, 171)
	Pinus contorta/Juniperus communis (CO:209, 355, 380, 417, 733; WY:35, 44, 128, 139)
	Pinus contorta/Pachistima myrsinites (CO:59, 173, 272, 540, 733)

Pinus contorta/Shepherdia canadensis° (CO:209, 210, 213, 285, 380, 540, 625, 733; WY:35, 128, 139)
Pinus contorta/Vaccinium myrtilus (CO:8, 137, 140, 173, 301, 339, 380, 417, 550, 625, 733)
Pinus contorta/Vaccinium scoparium (CO:202, 209, 355, 733; ID:77, 138; MT:120; OR:55; UT:66; WY:8, 35, 44, 70, 77, 128, 139)

Pinus edulis
Pinus edulis/Amelanchier utahensis–Arctostaphylos patula–Cercocarpus montanus/Carex pityophila (CO:662, 666)
Pinus edulis/Elymus ambiguus (CO:CNHI)

Pinus flexilis
Pinus flexilis/Arctostaphylos uva-ursi (CO:676, 677; NM:CO REF 676, 677)
Pinus flexilis/Calamagrostis purpurascens (CO:209, 417, 733)
Pinus flexilis/Juniperus communis (CO:140, 165, 209, 213, 417, 660, 733; ID;138, 139; MT:77, 120; WY:35, 44, 77, 139)
Pinus flexilis/Trifolium dasyphyllum (CO:209, 733)

Pinus ponderosa
Pinus ponderosa/Carex geyeri (CO:59, 733; UT:66; WY:35, 171)
Pinus ponderosa/Carex heliophila (CO:318, 319, 346)
Pinus ponderosa/Ceanothus fendleri° (CO:417, 554, 595)
Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii (CO:CNHI)
Pinus ponderosa/Cercocarpus montanus/Carex rossii (CO:209, 264, 733)
Pinus ponderosa/Cercocarpus montanus/Muhlenbergia montana (CO:417)
Pinus ponderosa/Festuca idahoensis (CO:107, 108, 122, 733; ID:138; MT:120; OR:53; UT:66; WY:35, 70)
Pinus ponderosa/Muhlenbergia montana (CO:106, 209, 417, 676, 677; NM:CO REF 676, 677)
Pinus ponderosa/Oryzopsis hymenoides (CO:676)
Pinus ponderosa/Purshia tridentata–Ribes cereum]Muhlenbergia montana (CO:24, 304, 417, 490, 733)
Pinus ponderosa/Quercus gambelii (CO:16, 78, 201, 207, 210, 355, 417, 508, 533, 542, 733; NM:48, 173; UT:46)
Pinus ponderosa/Quercus × *pauciloba* (CO:486, 487)
Pinus ponderosa/Stipa scribneri (CO:CNHI)
Pinus ponderosa–(Pseudotsuga menziesii)/Arctostaphylos uva-ursi (CO:304, 318, 319, 325, 417, 554, 676, 677; NM:CO REF 676, 677; UT:142; SD-WY:144)
Pinus ponderosa–(Pseudotsuga menziesii)/Carex rossii (CO:209, 417, 733)
Pinus ponderosa–(Pseudotsuga menziesii)/Festuca arizonica–Muhlenbergia montana (CO:96, 106–108, 255–261, 522, 530, 560, 676, 677, 733; AZ:34, 57, 103, 110; NM:106)
Pinus ponderosa–(Pseudotsuga menziesii)/Leucopoa kingii (CO:209, 370, 417, 422, 733)

PSEUDOTSUGA

Pseudotsuga menziesii
Pseudotsuga menziesii/Amelanchier utahensis–Quercus gambelii–Symphoricarpos oreophilus/Carex geyeri–Poa fendleriana (CO:157, 355, 568, 571, 597, 662, 666, 681)
Pseudotsuga menziesii/Arctostaphylos uva-ursi–Juniperus communis (CO:85, 304, 392, 522, 554, 595, 733; MT:120; WY:CO REF 733)
Pseudotsuga menziesii/Carex geyeri (CO:59, 173, 209, 733; ID:138; MT:77, 120; UT:66; WY:35)
Pseudotsuga menziesii/Cercocarpus montanus (CO:733)
Pseudotsuga menziesii/Juniperus communis (CO:173, 597, 709, 733; ID:77, 138, 139; MT:77, 120; WY:35, 44, 77, 139)
Pseudotsuga menziesii/Pachistima myrsinites° (CO:78, 210, 213, 695, 733)
Pseudotsuga menziesii/Quercus gambelii (CO:16, 59, 508, 676, 677, 733)
Pseudotsuga menziesii/Symphoricarpos oreophilus/Carex geyeri–Poa fendleriana (CO:210, 267, 571, 662, 733)

Pseudotsuga menziesii–(Pinus ponderosa)/Jamesia americana–Physocarpus monogynus (CO:209, 304, 417, 733)
Pseudotsuga menziesii–(Pinus ponderosa)/Physocarpus monogynus (CO:14, 209, 417, 733; NM:106; WY:35, 70)

SHRUB ASSOCIATIONS

AMELANCHIER

Amelanchier utahensis–Artemisia tridentata ssp. *wyomingensis–Cercocarpus montanus–Purshia tridentata–Symphoricarpos oreophilus*
Amelanchier utahensis–Artemisia tridentata ssp. *wyomingensis–Cercocarpus montanus–Purshia tridentata–Symphoricarpos oreophilus/Carex geyeri* (CO:271a, 597, 662)
Amelanchier utahensis–Artemisia tridentata ssp. *wyomingensis–Cercocarpus montanus–Purshia tridentata–Symphoricarpos oreophilus/Oryzopsis hymenoides–Stipa comata* (CO:157, CNHI)

Amelanchier utahensis–Cercocarpus montanus
Amelanchier utahensis–Cercocarpus montanus/Oryzopsis hymenoides (CO:597, 662)

Amelanchier utahensis–Symphoricarpos oreophilus
Amelanchier utahensis–Symphoricarpos oreophilus/Agropyron spicatum (CO:564, 587N0237, 689)
Amelanchier utahensis–Symphoricarpos oreophilus/Carex geyeri (CO:597, 662)

ARTEMISIA

Artemisia arbuscula
Artemisia arbuscula/Festuca idahoensis (CO:733; OR:53; WY:35)

Artemisia bigelovii–Frankenia jamesii
Artemisia bigelovii–Frankenia jamesii/Oryzopsis hymenoides–Stipa neomexicana (CO:587N058, CNHI)

Artemisia cana
Artemisia cana/Festuca idahoensis (CO:733; ID:20, 68, 133; MT:107; WY:20, 35, 108(
Artemisia cana/Festuca thurberi (CO:209, 564, 578, 689, 733)

Artemisia cana–Purshia tridentata
Artemisia cana/Purshia tridentata/Stipa comata (CO:121, 587N0293, CNHI)

Artemisia filifolia
Artemisia filifolia/Andropogon gerardii var. *paucipilus–Calamovilfa longifolia–Stipa comata* (CO:1, 106, 124, 125, 135, 154, 180, 486, 487, 503, 518, 527, 587N0016, 587N0019, 733)

Artemisia longiloba
Artemisia longiloba/Agropyron smithii (CO:587N0296; WY:35, 153)
Artemisia longiloba/Agropyron spicatum (CO:485, 562; ID:107; WY:20, 35)
Artemisia longiloba/Poa sandbergii (CO:564, 689)

Artemisia nova
Artemisia nova/Agropyron spicatum (CO:587N0301, 667; CA:4; ID:68, 77, 118, 135; NV:15–17, 20, 175; WY:35, 143, 153)
Artemisia nova/Stipa comata (CO:667; CA:4; NV:15–17, 20, 175)

Artemisia tridentata ssp. *tridentata*
Artemisia tridentata ssp. *tridentata/Agropyron smithii* (CO:268, 552, 564, 689)
Artemisia tridentata ssp. *tridentata/Elymus cinereus* (CO:209, 587N0285, 662, 667, 733; CA:4; ID:20, 68, 77; NV:18; OR:53, 68; WA:68; WY:20, 35)
Artemisia tridentata ssp. *tridentata/Hilaria jamesii* (CO:66; CA:4; NM:48, 52; UT:111)

Artemisia tridentata ssp.*tridentata Sarcobatus vermiculatus*
Artemisia tridentata ssp. *tridentata–Sarcobatus vermiculatus/Agropyron smithii* (CO:532, 564, 571, 662, 689)

Artemisia tridentata ssp. *vaseyana*
Artemisia tridentata ssp. *vaseyana/Agropyron smithii* (CO:532, 562)
Artemisia tridentata ssp. *vaseyana/Agropyron spicatum* (CO:532, 562, 667; ID:20, 68, 77, 133, 135; MT:20; OR:20, 68; WY:8, 20)
Artemisia tridentata ssp. *vaseyana/Festuca idahoensis* (CO:209, 210, 532, 552, 562, 689, 733; ID:20, 68, 77, 133, 135, 152; MT:20; NV:93; OR:20, 68; WY:8, 20, 153)
Artemisia tridentata ssp. *vaseyana/Festuca thurberi* (CO:59, 173, 209, 210, 564, 689, 733)
Artemisia tridentata ssp. *vaseyana/Leucopoa kingii* (CO:209, 733; WY:35)
Artemisia tridentata ssp. *vaseyana/Poa fendleriana* (CO:564)

Artemisia tridentata ssp.*vaseyana–Purshia tridentata*
Artemisia tridentata ssp. *vaseyana–Purshia tridentata/Agropyron spicatum* (CO:564)

	Artemisia tridentata ssp. *vaseyana–Purshia tridentata/Festuca idahoensis* (CO:564, 689; OR:53; WY:8)
	Artemisia tridentata ssp. *vaseyana–Purshia tridentata/Poa fendleriana* (CO:564)
Artemisia tridentata ssp. *wyomingensis*	*Artemisia tridentata* ssp. *wyomingensis/Agropyron dasystachyum* ssp. *albicans* (CO:173, 187, 358, 733)
	Artemisia tridentata ssp. *wyomingensis/Agropyron smithii* (CO:552, 564, 662, 667, 681, 689)
	Artemisia tridentata ssp. *wyomingensis/Agropyron spicatum* (CO:209, 552, 564, 667, 733; ID:20, 68, 77, 133, 135; MT:20, 107; OR:20, 53, 68; WY:153)
	Artemisia tridentata ssp. *wyomingensis/Elymus ambiguus* (CO:209, 733)
	Artemisia tridentata ssp. *wyomingensis/Stipa comata* (CO:209, 733; CA:4; ID:20, 68, 135; NV:150; OR:53; UT:91; WA:42, 68; WY:35)
	Artemisia tridentata ssp. *wyomingensis/Stipa occidentalis* (CO:564, 689; CA:4; OR:53)
Artemisia tridentata ssp.*wyomingensis–Atriplex confertifolia*	*Artemisia tridentata* ssp. *wyomingensis–Atriplex confertifolia/Elymus salina* (CO:662)
Artemisia tridentata ssp.*wyomingensis–Atriplex confertifolia–Grayia spinosa*°	*Artemisia tridentata* ssp. *wyomingensis–Atriplex confertifolia–Grayia spinosa*°*/Stipa comata* (CO:667)
Artemisia tridentata ssp.*wyomingensis–Purshia tridentata*	*Artemisia tridentata* ssp. *wyomingensis–Purshia tridentata/Agropyron spicatum* (CO:564)
	Artemisia tridentata ssp. *wyomingensis–Purshia tridentata/Stipa comata* (CO:CNHI; CA:4)
Artemisia tridentata ssp.*wyomingensis–Symphoricarpos oreophilus*	*Artemisia tridentata* ssp. *wyomingensis–Symphoricarpos oreophilus/Elymus cinereus* (CO:662, 666)
	Artemisia tridentata ssp. *wyomingensis–Symphoricarpos oreophilus/Oryzopsis hymenoides* (CO:157, 568, 569, 662)
Artemisia tripartita	*Artemisia tripartita/Festuca idahoensis* (CO:209, 733; ID:20, 68, 77, 133, 135, 147; MT:20, 107; WA:20, 42, 68; WY:8, 35, 153)
ATRIPLEX	
Atriplex canescens	*Atriplex canescens/Agropyron smithii–Bouteloua gracilis* (CO:1, 224, 284, 366, 587N09, 587N042, 587N0317)
	Atriplex canescens/Sporobolus airoides (CO:587N034, 587N037; NM:52)
Atriplex confertifolia	*Atriplex confertifolia/Agropyron spicatum* (CO:667)
	Atriplex confertifolia/Agropyron spicatum var. *inerme–Oryzopsis hymenoides* (CO:662, 666)
	Atriplex confertifolia/Elymus salina (CO:571, 662, 667; UT:CNHI)
	Atriplex confertifolia/Hilaria jamesii (CO:66, 67, 135, 324, 587N0401, 587N0404, 587N0406, 587N0410, 588, 589; UT:75, 137, 165–167)
	Atriplex confertifolia/Oryzopsis hymenoides (CO:267, 268, 604, 662; CA:4; NV:12; UT:50, 137, 165)
	Atriplex confertifolia/Sporobolus airoides° (CO:733)
	Atriplex confertifolia/Stipa comata (CO:667)
Atriplex confertifolia–Sarcobatus vermiculatus (CO:239, 266, 267, 597)	
Atriplex corrugata	*Atriplex corrugata* Shale Barren (CO:66, 177, 324, 589; UT:24, 75, 137, 142, 165, 166; WY:35)
Atriplex cuneata–Frankenia jamesii (NM:52)	*Atriplex cuneata–Frankenia jamesii* Shale Barren (CO:CNHI)
Atriplex gardneri	*Atriplex gardneri/Elymus salina* (CO:66, 667; UT:CNHI)
	Atriplex gardneri/Hilaria jamesii (CO:589, 591; UT:75, 166)
	Atriplex gardneri/Oryzopsis hymenoides (CO:667)
CERATOIDES	
Ceratoides lanata	*Ceratoides lanata/Agropyron smithii–Bouteloua gracilis* (CO:587N039, 587N0281)
	Ceratoides lanata/Oryzopsis hymenoides (CO:587N0276; CA:4; NV:12; UT:50)

CERCOCARPUS	
Cercocarpus ledifolius var. *intricatus*	*Cercocarpus ledifolius* var. *intricatus/Agropyron spicatum* (CO:667)
Cercocarpus montanus	*Cercocarpus montanus/Agropyron dasystachyum* ssp. *albicans* (CO:209, 733) *Cercocarpus montanus/Agropyron spicatum* (CO:667, 733; WY:35) *Cercocarpus montanus/Agropyron spicatum* var. *inerme* (CO:662) *Cercocarpus montanus/Oryzopsis hymenoides* (CO:133, 649) *Cercocarpus montanus/Stipa comata* (CO:209, 488, 489, 733) *Cercocarpus montanus/Stipa occidentalis* (CO:733)
Cercocarpus montanus–Rhus trilobata	*Cercocarpus montanus–Rhus trilobata/Andropogon gerardii* (CO:587N0204, CNHI; SD–WY:144)
COLEOGYNE	
Coleogyne ramosissima (General:23)	*Coleogyne ramosissima/Hilaria jamesii* (CO:591; NV:167; UT:99, 167)
CRATAEGUS	
Crataegus douglasii (CO:94, 95)	
Crataegus spp.–mixed (CO:332, 478, 479)	
DRYAS	
Dryas octopetala	*Dryas octopetala/Carex rupestris* (CO:112, 146, 167, 209, 210, 217, 219, 222, 278, 287, 290, 526, 618, 636, 639, 733; WY:35)
OPUNTIA	
Opuntia imbricata (CO:88, 107, 135, 181, 279, 280, 349, 481, 520)	*Opuntia imbricata/Hilaria jamesii* (CO:CNHI)
POTENTILLA	
Potentilla fruticosa (CO:59, 68, 112, 285, 349, 440, 464, 522, 526, 631)	
PURSHIA	
Purshia tridentata	*Purshia tridentata/Muhlenbergia montana* (CO:83, 209, 349, 488, 489, 733) *Purshia tridentata/Stipa comata* (CO:209, 733; CA:4; OR:53; WA:42)
QUERCUS	
Quercus gambelii–Amelanchier utahensis°	*Quercus gambelii–Amelanchier utahensis*°*–(Artemisia tridentata* ssp. *wyomingensis–Cercocarpus montanus–Symphoricarpos oreophilus)/Carex geyeri* (CO:157, 271a, 568, 597, 662, 681) *Quercus gambelii–Amelanchier utahensis*°*–(Cercocarpus montanus–Fendlera rupicola–Purshia tridentata–Symphoricarpos oreophilus)–Carex geyeri* (CO:134, 150, 201, 508) *Quercus gambelii–Amelanchier utahensis*°*–(Prunus virginiana* var. *melanocarpa–Rosa woodsii–Symphoricarpos oreophilus)/Carex geyeri* (CO:150, 210, 213, 587N0238, 597, 662)
Quercus gambelii–Cercocarpus montanus°	*Quercus gambelii–Cercocarpus montanus*°*–(Rhus trilobata)/Carex heliophila* (CO:318, 319)
RHUS	
Rhus trilobata–Ribes cereum	*Rhus trilobata–Ribes cereum/Schizachyrium scoparium* (CO:15, 384)
RIBES	
Ribes montigenum	*Ribes montigenum* Alpine Talus (CO:287)
ROBINEA	
Robinea neomexicana (CO:421)	
RUBUS	
Rubus idaeus ssp. *sachalinensis*	*Rubus idaeus* ssp. *sachalinensis* Alpine Scree (CO:287)

SALIX	
Salix arctica–Salix reticulata ssp. *nivalis*	*Salix arctica–Salix reticulata* ssp. *nivalis* Dwarf Alpine Thicket (CO:112, 123, 210, 249, 278, 287, 362, 534, 611, 631, 636, 639; NM:3; UT:92)
Salix bebbiana	*Salix bebbiana* Montane Carr (CO:662; ID:133; UT:46; WY:136, 144)
Salix brachycarpa	*Salix brachycarpa/Carex aquatilis°–Carex rostrata°* Wet Carr (CO:47)
Salix brachycarpa–Salix wolfii–Betula glandulosa°	*Salix brachycarpa–Salix wolfii–Betula glandulosa°/Calamagrostis canadensis* Mesic Carr (CO:47, 285)
Salix exigua	*Salix exigua/Carex* sp. Plains Riparian (CO:236, 238, 314)
Salix geyeriana–Salix lutea	*Salix geyeriana–Salix lutea/Carex rostrata* Wet Carr (CO:733)
Salix geyeriana–Salix monticola	*Salix geyeriana–Salix monticola/Achillea millefolium* ssp. *lanulosa°* Dry Carr (CO:429)
	Salix geyeriana–Salix monticola/Calamagrostis canadensis° Mesic Carr (CO:209, 429, 733; ID:109, 152; WY:35, 113)
Salix glauca	*Salix glauca–(Salix brachycarpa)/Deschampsia cespitosa* Mesic Alpine Thicket (CO:209, 210, 733)
	Salix glauca–(Salix brachycarpa)/Geum rossii Dry Alpine Thicket (CO:206, 522)
Salix glauca–Salix planifolia	*Salix glauca–Salix planifolia* Lacustrine Thicket (CO:112, 250–254; WY:58)
Salix planifolia	*Salix planifolia/Caltha leptosepala* Wet Carr/Alpine Thicket (206, 210, 355, 367, 534, 733)
	Salix planifolia/Carex scopulorum Wet Alpine Thicket (CO:209, 210, 287, 733)
	Salix planifolia/Deschampsia cespitosa Mesic Carr (CO:209, 733)
	Salix planifolia–(Salix brachycarpa)/Deschampsia cespitosa Mesic Alpine Thicket (CO:206; WY:35)
Salix planifolia–Betula glandulosa°–Salix spp.	*Salix planifolia–Betula glandulosa°–Salix* ssp./*Carex aquatilis°–Carex rostrata°* Wet Carr (CO:209, 429, 733; ID:109, 152; WY:35)
Salix wolfii–Betula glandulosa°–Potentilla fruticosa°	*Salix wolfii–Betula glandulosa°–Potentilla fruticosa°/Achillea millefolium* ssp. *lanulosa°* Dry Carr (CO:47; WY:112)
SARCOBATUS	
Sarcobatus vermiculatus	*Sarcobatus vermiculatus/Distichlis spicata* var. *stricta–(Sporobolus airoides)* (CO:106, 107, 135, 193, 349, 733; CA:4; MT:107; OR:37, 38, 53; WA:42; WY:35, 160)
	Sarcobatus vermiculatus/Suaeda torreyana (CO:66, 355, 589; NV:11; OR:38; UT:50, 165; WY:35)
SYMPHORICARPOS	
Symphoricarpos occidentalis (CO:94, 95, 595, 596; CANADA:41; SD:144; WY:35, 144)	
Symphoricarpos oreophilus	*Symphoricarpos oreophilus/Festuca thurberi* (CO:733)
VACCINIUM	
Vaccinium caespitosum	*Vaccinium caespitosum* Alpine Heath (CO:217, 219, 221, 287, 534; UT:92)
Vaccinium scoparium	*Vaccinium scoparium* Alpine Thicket (CO:45, 287, 403; UT:92)
	GRASSLAND ASSOCIATIONS
AGROPYRON	
Agropyron scribneri	*Agropyron scribneri* Alpine Grassland (CO:45, 403, 407, 631)
Agropyron smithii	*Agropyron smithii* Great Basin Grassland (CO:353, 667; AZ:110; NV:104; UT:32, 33)
	Agropyron smithii° Mixed Prairie (CO:63–65, 76, 84, 189, 195, 197–200, 224, 264, 381, 392, 449, 486, 516, 518, 520, 538, 539, 587N01, 587N02, 587N04, 587N08, 587N0202, 587N0208, 592, 593, 596, 609, 733; CANADA:41; KS:65; NE:123; NM:48, CO REF 609; ND:59, 124; OK:28; SD:90; WY:7, 35)
	Agropyron smithii Montane Grassland (CO:443, 446, 458, 515, 576, 587N0233, 587N0243, 587N0247, 587N0257, 587N0317)
	Agropyron smithii Plains Swale Grassland (CO:107, 193, 383, 587N010; CANADA:41; NM:CO REF 609; TX:100; WY:7)

Agropyron spicatum

Agropyron spicatum–Arenaria hookeri° (CO:667)

Agropyron spicatum–Bouteloua gracilis Montane Grassland (CO:564, 689; MT:107)

Agropyron spicatum–Poa fendleriana Montane Grassland (CO:564, 689, 733; WY:35, 74)

Agropyron spicatum–Poa sandbergii Palouse Grassland (CO:210, 733; CANADA:145; ID:146; MT:107; OR:53; WA:42; WY:9, 44, 153)

Agropyron spicatum var. *inerme*

Agropyron spicatum var. *inerme* Great Basin Grassland (CO:662, 666; UT:60, 73, 117, 121)

Agropyron spicatum var. *inerme–Oryzopsis hymenoides* Great Basin Grassland (CO:662, 666)

ANDROPOGON

Andropogon gerardii

Andropogon gerardii–Bouteloua curtipendula–Bouteloua gracilis–Schizachyrium scoparium Xeric Tallgrass Prairie (CO:46, 97, 135, 195, 198, 240, 344, 392, 459, 582, 587N053, 587N070, 587N0206, 587N0210, 733; KS:1, 69, 72, 89; NM:CO REF 609; OK:131, 162; WY:63)

Andropogon gerardii–Bouteloua gracilis–Muhlenbergia montana–Schizachyrium scoparium Xeric Tallgrass Prairie (CO:63–65, 189, 587N0213, 587N0216)

Andropogon gerardii–Panicum virgatum–Schizachyrium scoparium–Sorghastrum nutans Mesic Tallgrass Prairie (CO:381, 382, 390, 587N036, 587N038, 593, 733; CANADA:96; KS:2, 89; NE:148, 160; OK:19, 28, 29, 64, 81, 126, 130)

Andropogon gerardii var. *paucipilus*

Andropogon gerardii var. *paucipilus–Calamovilfa longifolia–Stipa comata* Sandhills Prairie (CO:205, 453, 455, 491, 503, 587N020, 587N022, 733; NE:5, 30, 123, 172; ND:168; WY:35)

Andropogon gerardii var. *paucipilus–Calamovilfa longifolia–Panicum virgatum–Sorghastrum nutans* Sandhills Tallgrass Prairie (CO:587N029, 587N031, CNHI)

BOUTELOUA

Bouteloua gracilis

Bouteloua gracilis Shortgrass Prairie (CO:12, 166, 198, 200, 223, 224, 349, 366, 520, 555, 592, 593, 595, 596, 653, 733)

Bouteloua gracilis–Buchloe dactyloides Shortgrass Prairie (CO:12, 15, 54, 55, 76, 100, 106, 107, 110, 135, 160, 181, 205, 241, 283, 364, 366, 378, 383, 389, 392, 441, 482, 511, 518, 520, 538, 592, 593, 733; KS:1, 65, 89; NE:122; NM:48; OK:19, 28; WY:35)

CALAMAGROSTIS

Calamagrostis canadensis

Calamagrostis canadensis Wetland (CO:188, 287, 391, 392, 646; CANADA:96; ID:109; NE:148; WY:35)

CALAMOVILFA

Calamovilfa longifolia

Calamovilfa longifolia Sandhills Prairie (CO:455, CNHI; NE:80, 123, 148; WY:35)

DANTHONIA

Danthonia intermedia

Danthonia intermedia–Deschampsia cespitosa Alpine Grassland (CO:146, 202; UT:115)

Danthonia intermedia–Sibbaldia procumbens° Alpine Grassland (CO:219, 287, 290, 354, 733)

Danthonia intermedia–Solidago multiradiata° Subalpine Grassland (CO:210, 733)

Danthonia parryi

Danthonia parryi Montane Grassland (CO:209, 443, 444, 473, 483, 581, 733; CANADA:96)

DESCHAMPSIA

Deschampsia cespitosa

Deschampsia cespitosa–Achillea millefolium ssp. *lanulosa*° Dry-mesic Alpine Meadow (CO:52, 56, 400, 409, 522)

Deschampsia cespitosa–Caltha leptosepala° Very Wet Meadow (CO:52, 56, 209, 210, 249, 367, 407, 646, 733)

Deschampsia cespitosa–Carex nebrascensis° Wet Montane Meadow (CO:587N0241, 587N0315)

Deschampsia cespitosa–Geum rossii Wet Alpine Meadow (CO:52, 56, 146, 155, 209, 210, 217, 219–222, 249, 367, 534, 618, 633, 733; UT:92)
Deschampsia cespitosa–Ligusticum tenuifolium Snow Glade (CO:75)
Deschampsia cespitosa–Potentilla diversifolia° Mesic Alpine Meadow (CO:52, 56)

DISTICHLIS

Distichlis spicata var. *stricta*

Distichlis spicata var. *stricta* Salt Meadow (CO:458, 515, 583, 584, 587N0314; CANADA:47, 97; KS:155, 156; NE:126, 148, 159; NV:11, 24, 104; ND:127, 168; OK:157; OR:38; UT:21, 24, 51, 116; WA:42)
Distichlis spicata var. *stricta–Sporobolus airoides–(Agropyron smithii)* Salt Meadow (CO:106, 107, 117, 126, 135, 177, 224, 284, 311, 318, 331, 405, 486, 487, 538, 585, 587N035, 587N0261, 587N0263, 587N0265, 587N0266, 587N0267, 593, 609, 733; KS:54, 89, 155; NM:CO REF 609; OK:119, 157; UT:21, 51; WY:35)

ELYMUS

Elymus ambiguus

Elymus ambiguus Montane Grassland (CO:97, 209, 733)

Elymus cinereus

Elymus cinereus Great Basin Grassland (CO:1, 157, 568, 587N0245, 597, 598, 662, 733; MT:107; UT:33, 73, 141, 161; WA:42; WY:35)

FESTUCA

Festuca arizonica

Festuca arizonica–Festuca thurberi Montane Grassland (CO:733)
Festuca arizonica–Muhlenbergia filiculmis Montane Grassland (CO:522, 548)
Festuca arizonica–Muhlenbergia montana Montane Grassland (CO:96, 122, 256, 257, 259–261, 379, 515, 522, 530, 548, 576, 587N0222, 587N0228, 587N0230, 587N0311, 733; AZ:132; NM:48)

Festuca idahoensis

Festuca idahoensis Alpine Grassland (CO:249)
Festuca idahoensis–Agropyron trachycaulum° Montane Grassland (CO:210, 733; ID:152; MT:107; WY:35, 153)
Festuca idahoensis–Festuca thurberi Montane Grassland (CO:50, 71, 202, 210, 285, 413, 579, 600, 733)

Festuca thurberi

Festuca thurberi Subalpine Grassland (CO:59, 111, 135, 173, 209, 210, 249, 253, 272, 281, 282, 285, 299, 301, 373, 385, 412, 414, 415, 458, 496, 572, 579, 587N0250; NM:3, 105)

HILARIA

Hilaria jamesii

Hilaria jamesii Great Basin Grassland (CO:86, 208, 355, 591; AZ:110; NM:48, 52, CO REF 609; UT:86, 140; WY:35)
Hilaria jamesii° Mixed Prairie (CO:107, 486, 587N06, 733; NM:CO REF 609; OK:162; TX:100)
Hilaria jamesii–Oryzopsis hymenoides–Stipa comata Great Basin Grassland (CO:CNH1; UT:84–87, 140)

HORDEUM

Hordeum jubatum

Hordeum jubatum Plains Grassland (CO:474, 585, 593; CANADA:47, 97; KS:156; NE:159; ND:127, 168; UT:51, 116)

MUHLENBERGIA

Muhlenbergia asperifolia

Muhlenbergia asperifolia Salt Meadow (CO:474, 589; UT:21, 46)

Muhlenbergia filiculmis

Muhlenbergia filiculmis Montane Grassland (CO:458, 522, 548, 733)

Muhlenbergia montana

Muhlenbergia montana Montane Grassland (CO:322, 323, 334, 442–444, 474, 515, 733; AZ:103)
Muhlenbergia montana–Stipa comata Montane Grassland (CO:31, 83, 161, 209, 392, 733)

Muhlenbergia pungens

Muhlenbergia pungens Sandhill Mixed Grassland (CO:455, CNH1; NE:30, 80, 122, 123, 148)

Muhlenbergia torreyi

Muhlenbergia torreyi Shortgrass Prairie (CO:12, 100, 107, 516)

ORYZOPSIS

Oryzopsis hymenoides

Oryzopsis hymenoides Shale Barren (CO:552, 564, 689, CNHI)
Oryzopsis hymenoides–Psoralea lanceolata° Loose Sand Grassland (CO:349, 450, 453, 455, 458; UT:22, 31)
Oryzopsis hymenoides–Stipa comata Montane Grassland (CO:587N0273, 587N0275, 587N0282; UT:73, 141; WY:35)

PHIPPSIA

Phippsia algida

Phippsia algida Alpine Grassland (CO:CNHI; WY:35)

PHRAGMITES

Phragmites australis

Phragmites australis Wetland (CO:662; CANADA:97, 101; NE:123, 148; ND:45, 127; UT:21; WY:35)

POA

Poa arctica ssp. *grayana*

Poa arctica ssp. *grayana* Alpine Grassland (CO:287)

Poa fendleriana

Poa fendleriana Alpine Grassland (CO:321, 400, 401)

Poa lettermanii

Poa lettermanii Alpine Grassland (CO:287)

Poa rupicola

Poa rupicola Alpine Grassland (CO:403, 636)

PUCCINELLIA

Puccinellia nuttalliana

Puccinellia nuttalliana Salt Meadow (CO:583, 585; CANADA:47, 97, 101; UT:51; WY:35; GENERAL:158)

REDFIELDIA

Redfieldia flexuosa

Redfieldia flexuosa Sandhills Blowout Grassland (CO:449, 518; NE:30, 80, 122, 123, 148; WY:35)

SCHIZACHYRIUM

Schizachyrium scoparium

Schizachyrium scoparium Loess Prairie (CO:12, 15, 284, 390, 587N051, 587N052, CNHI; KS:71, 149)
Schizachyrium scoparium° Mixed Prairie (CO:195, 198, 318, 320, 516, 587N056, 587N060, 587N062, 587N063, 592, 593, 733; IL:49; KS:1, 65, 89; NE:62; ND:59, 125; OK:28; SD:144; WY:35, 144)
Schizachyrium scoparium Sandhills Prairie (CO:1, 106, 154, 518, CNHI; NE:80, 122, 123, 142)
Schizachyrium scoparium–Eriogonum flavum° (CO:CNHI; CANADA:95)

SPARTINA

Spartina gracilis

Spartina gracilis Salt Meadow (CO:193, CNHI; CANADA:97; UT:21; WA:42, 53)

SPOROBOLUS

Sporobolus airoides

Sporobolus airoides Salt Meadow (CO:311, 585, 587N046, 587N047, 733; NM:52)

Sporobolus heterolepis

Sporobolus heterolepis Tallgrass Prairie (CO:318, 320; IA:26; NE:164; ND:125; WY:35)

STIPA

Stipa comata

Stipa comata° Mixed Prairie (CO:1, 15, 99, 194, 195, 198, 318, 381, 539, 575, 593, 609; CANADA:41, 95; MT:107; NE:62, 123; ND:59, 124, 125; OK:19, 28; WY:35)
Stipa comata Montane Grassland (CO:209, 443, 733)

Stipa neomexicana

Stipa neomexicana° Mixed Prairie (CO:381, CNHI; NM:6)

Stipa spartea

Stipa spartea Tallgrass Prairie (CO:46, 318, 320; CANADA:170; NE:164; ND:125)

Stipa viridula

Stipa viridula Plains Grassland (CO:592, 609; CANADA:96)

GRAMINOID ASSOCIATIONS

CAREX	
Carex aquatilis	*Carex aquatilis* Wetland (CO:47, 78, 112, 173, 250–254, 287, 445, 448, 483, 667, 733; CANADA:98; ID:109; OK:119; UT:92; WY:14, 88)
	Carex aquatilis–Carex rostrata Wetland (CO:47, 209, 210, 253, 301, 646, 733; ID:109, 152; WY:58, 112)
Carex arapahoensis	*Carex arapahoensis* Alpine Talus (CO:287, 534, 733)
Carex bipartita	*Carex bipartita* Alpine Wetland (CO:287)
Carex ebenea	*Carex ebenea* Wetland (CO:400, 401, 445)
Carex eleocharis	*Carex eleocharis* Montane Turf (CO:443, 445, 446, 458)
Carex elynoides	*Carex elynoides* Alpine Turf (CO:45, 68, 145, 146, 209, 249, 287, 290, 301, 321, 362, 403, 412, 445, 513, 618, 636, 639, 727, 733; NM:3; UT:92; WY:78)
Carex festivella	*Carex festivella* Montane Wetland (CO:168, 445, 458, 483)
Carex foenea	*Carex foenea* Alpine Talus (CO:287, 400, 401, 445, 733)
Carex haydeniana	*Carex haydeniana* Alpine Wetland (CO:287, 733)
Carex illota	*Carex illota* Alpine Wetland (CO:287)
Carex lanuginosa	*Carex lanuginosa* Montane Wetland (CO:391–393, 445, 548)
Carex microglochin	*Carex microglochin* Alpine Wetland (CO:287, 733)
Carex nardina var. *hepburnii*	*Carex nardina* var. *hepburnii* Alpine Talus (CO:287)
Carex nebrascensis	*Carex nebrascensis–Catabrosa aquatica–Juncus balticus* Spring Wetland (CO:662)
	Carex nebrascensis–Juncus balticus Wetland (CO:94, 95, 163, 318, 455; ID:109; UT:40; WY:108, 144)
Carex nelsonii	*Carex nelsonii* Alpine Wetland (CO:278)
Carex nigricans	*Carex nigricans–(Juncus drummondii)* Alpine Wetland (CO:112, 287, 445, 534, 733; ID:133; OR:53)
Carex pachystachya	*Carex pachystachya* Montane Wetland (CO:253, 254, 445)
Carex perglobosa	*Carex perglobosa* Alpine Rock Outcrop (CO:287, 733)
Carex pyrenaica	*Carex pyrenaica* Alpine Wetland (CO:278, 287, 290, 367, 409, 513, 636, 639)
Carex rossii	*Carex rossii* Subalpine Turf (CO:445)
Carex rostrata	*Carex rostrata* Wetland (CO:391–393, 445, 464; CANADA:98; CA:10; ID:109, 133; OR:53; UT:83; WY:108)
Carex rupestris var. *drummondiana*	*Carex rupestris* var. *drummondiana* Alpine Turf (CO:45, 97, 99, 112, 210, 278, 362, 367, 412, 430, 513, 631, 633, 639, 640, 733; NM:3; UT:25, 92)
Carex scopulorum	*Carex scopulorum–Agropyron trachycaulum*° Alpine Wetland (CO:287)
	Carex scopulorum–Caltha leptosepala° Alpine Wetland (CO:97, 210, 367, 409, 513, 633, 636; WY:35)
Carex vernacula	
Carex vernacula Alpine Wetland (CO:287)	
ELEOCHARIS	
Eleocharis acicularis	*Eleocharis acicularis* Montane Wetland (CO:445, 483, 548)
Eleocharis palustris	*Eleocharis palustris* Wetland (CO:147, 163, 391, 393, 445, 458, 539, 548, 667; NV:11; OK:119; WY:35, 113)
Eleocharis pauciflora	*Eleocharis pauciflora* Wetland (CO:287, 646; CA:10; OR:53; WY:35)
JUNCUS	
Juncus balticus	*Juncus balticus* Wetland (CO:163, 209, 391, 467, 548, 733; ID:109, 152; NV:104; UT:21, 39, 40; WY:35, 108, 113)
Juncus drummondii	*Juncus drummondii* Alpine Wetland (CO:45, 287, 290, 362, 403, 409, 513, 534, 636, 639, 733; ID:133)
KOBRESIA	
Kobresia myosuroides	*Kobresia myosuroides–Carex rupestris* var. *drummondiana*° Alpine Turf (CO:68, 278, 287, 636, 639)
	Kobresia myosuroides–Geum rossii° Alpine Turf (CO:68, 112, 146, 155, 209, 210, 346, 367, 407, 522, 534, 633, 639, 733; NM:3; UT:92; WY:35)
	Kobresia myosuroides–Trifolium dasyphyllum Alpine Turf (CO:522, 733)

SCIRPUS	
Scirpus americanus	*Scirpus americanus* Wetland (CO:455, 539; CANADA:96; KS:155, 156; NE:148; NV:11; OK:119; UT:21, 51; WY:35; GENERAL:158)
Scirpus maritimus	*Scirpus maritimus* Wetland (CO:474, 585; CANADA:94, 97; KS:155, 156; NV:11; ND:45; OK:119, 157; UT;21, 51; GENERAL:158)
Scirpus tabernaemontanii (*S. validus*)	*Scirpus tabernaemontanii–Typha latifolia* Wetland (CO:99, 177, 455; OR:53)
	HERB ASSOCIATIONS
ALETES	
Aletes anisatus	*Aletes anisatus–Scutellaria brittonii* Gravel Slide (CO:97)
ANTENNARIA	
Antennaria alpina	*Antennaria alpina* Alpine Wetland (CO:287, 733)
AQUILEGIA	
Aquilegia caerulea	*Aquilegia caerulea–Cirsium scopulorum* Alpine Talus (CO:278, 287, 733)
Aquilegia micrantha	*Aquilegia micrantha–Mimulus eastwoodiae* Hanging Gardens (CO:CNHI; UT:99)
ARENARIA	
Arenaria hookeri	*Arenaria hookeri*° Barrens (CO:15, 384; NE:123)
ARTEMISIA	
Artemisia arctica ssp. *saxicola*	*Artemisia arctica* ssp. *saxicola* Alpine Meadow (CO:167, 287, 633, 636, 639, 733)
ATHYRIUM	
Athyrium distentifolium	*Athyrium distentifolium* Alpine Talus (CO:287)
CALTHA	
Caltha leptosepala	*Caltha leptosepala* Wetland (CO:9, 287, 522, 526, 534, 612, 631, 646, 733; WY:35)
CARDAMINE	
Cardamine cordifolia	*Cardamine cordifolia* Alpine Wetland (CO:287; UT:46)
CIRSIUM	
Cirsium scopulorum	*Cirsium scopulorum–Polemonium viscosum* Alpine Talus (CO:287, 733)
CLAYTONIA	
Claytonia megarhiza	*Claytonia megarhiza* Alpine Rock Outcrop (CO:278, 287, 321, 494, 733; WY:78)
ERIGERON	
Erigeron peregrinus ssp. *callianthemus*	*Erigeron peregrinus* ssp. *callianthemus–Ligusticum tenuifolium–Trollius laxus* ssp. *albiflorus* Alpine Wetland (CO:287, 733)
GEUM	
Geum rossii	*Geum rossii–Polygonum bistortoides* Alpine Meadow (CO:209, 210, 534, 733) *Geum rossii–Sibbaldia procumbens* Alpine Meadow (CO:44, 45, 135, 146, 409, 534, 618)
HEUCHERA	
Heuchera spp.	*Heuchera bracteata–Heuchera parviflora* var. *nivalis* Alpine Rock Crevice (CO:287, 657, 733)
IVA	
Iva axillaris	*Iva axillaris* Salt Meadow (CO:667; WY:160)

KOENIGIA
Koenigia islandica — *Koenigia islandica* Alpine Wetland (CO:287, 362, 513, 636, 639)

LEWISIA
Lewisia pygmaea — *Lewisia pygmaea* Alpine Meadow (CO:287)

LIGUSTICUM
Ligusticum porteri — *Ligusticum porteri–Lupinus parviflorus* ssp. *myrianthus* Subalpine Meadow (CO:301, 733)
Ligusticum porteri–Vicia americana Subalpine Meadow (CO:210)
Ligusticum tennifolium — *Ligusticum tennifolium–Deschampsia cespitosa*° Snow Glade (CO:75)

MERTENSIA
Mertensia ciliata — *Mertensia ciliata* Alpine Wetland (CO:287, 733; ID:109; WY:112)

MINUARTIA
Minuartia obtusiloba — *Minuartia obtusiloba–Paronychia pulvinata–Silene acaulis* var. *subacaulis–Trifolium nanum* Alpine Fellfield (CO:44, 45, 68, 97, 99, 112, 128, 135, 145, 146, 182, 183, 185, 202, 209, 210, 287, 290, 321, 343, 344, 346, 349, 362, 367, 392, 403, 407, 513, 618, 636, 639, 733; NM:3; UT:92; WY:88)

MYRIOPHYLLUM
Myriophyllum exalbescens — *Myriophyllum exalbescens* Wetland (CO:253, 254; CANADA:101)

NUPHAR
Nuphar luteum ssp. *polysepalum* — *Nuphar luteum* ssp. *polysepalum* Wetland (CO:349, 464; OK:119)

POLEMONIUM
Polemonium viscosum — *Polemonium viscosum* Alpine Meadow (CO:403, 636)

POLYGONUM
Polygonum amphibium — *Polygonum amphibium* Montane Wetland (CO:250–254, 451, 458)
Polygonum viviparum — *Polygonum viviparum–Carex capillaris*° Alpine Wetland (CO:287, 733; CANADA:98)

POTAMOGETON
Potamogeton filiformis — *Potamogeton filiformis* Montane Wetland (CO:253, 254)

PRIMULA
Primula parryi — *Primula parryi* Alpine Wetland (CO:287, 409, 526, 733; AZ:132)

RANUNCULUS
Ranunculus aquatilis — *Ranunculus aquatilis–Callitriche verna*° Montane Wetland (CO:168, 483)

RORIPPA
Rorippa curvipes var. *alpina* — *Rorippa curvipes* var. *alpina* Alpine Wetland (CO:287)

SALICORNIA
Salicornia rubra — *Salicornia rubra* Salt Meadow (CO:1, 583–585; CANADA:47, 97, 101; KS:155, 156; NE:123, 159; NV:11, 24; ND:127, 168; UT:24, 51; WY:35)

SAXIFRAGA
Saxifraga chrysantha — *Saxifraga chrysantha* Alpine Rock Outcrop (CO:278, 287)
Saxifraga odontoloma — *Saxifraga odontoloma* Alpine Wetland (CO:287, 733)
Saxifraga rivularis — *Saxifraga rivularis* Alpine Rock Outcrop (CO:287)

SEDUM
Sedum spp. — *Sedum integrifolium–Sedum rhodanthum* Alpine Wetland (CO:287, 526)

SENECIO
Senecio taraxacoides — *Senecio taraxacoides–Oxyria digyna*° Alpine Talus (CO:287)
Senecio triangularis — *Senecio triangularis* Alpine Wetland (CO:287, 733)

SIBBALDIA
Sibbaldia procumbens — *Sibbaldia procumbens* Alpine Snowbed (CO:68, 249, 278, 287, 290, 321, 344, 346, 354, 362, 367, 392, 403, 409, 513, 636, 639, 727, 733; WY:78, 88)
Sibbaldia procumbens Snow Glade (CO:75)

SPARGANIUM
Sparganium emersum — *Sparganium emersum* Wetland (CO:97, 168, 445, 464, 483)

TRIFOLIUM
Trifolium dasyphyllum — *Trifolium dasyphyllum* Alpine Fellfield (CO:45, 68, 217, 219, 221, 278, 287, 290, 321, 362, 367, 403, 522, 612, 633, 636, 639, 733; NM:3; UT:61)
Trifolium parryi — *Trifolium parryi* Alpine Fellfield (CO:68, 123, 167, 287, 290, 343, 346, 367, 392, 403, 522, 636, 733; UT:61)

TRIGLOCHIN
Triglochin maritima — *Triglochin maritima* Salt Meadow (CO:583, 585; CANADA:47, 97; UT:21, 51; GENERAL:158)

TYPHA
Typha domingensis — *Typha domingensis* Wetland (CO:662; AZ:56)
Typha latifolia — *Typha latifolia* Wetland (CO:91, 312, 13, 330, 364; NV:11; ND:45, 79; UT:21; WY:35)

LITERATURE CITED

Numbers preceded by CO correspond to reference numbers listed in the following two publications:

BAKER, W. L. 1983. A bibliography of Colorado vegetation description. Great Basin Nat. 43(1):45–64.

BAKER, W. L. 1984. Additions to a bibliography of Colorado vegetation description. Great Basin Nat. 44(4):00–00.

Numbers preceded by other state abbreviations are listed below:

1. Albertson, F. W. 1937. Ecology of mixed prairie in west central Kansas. Ecol. Monogr. 7:481–547.

2. Anderson, K. L., and C. L. Fly. 1955. Vegetation-soil relationships in Flint Hills bluestem pastures. J. Range Mgmt. 8:163–169.

3. Baker, W. L. 1983. Alpine vegetation of Wheeler Peak, New Mexico, USA: gradient analysis, classification, and biogeography. Arctic and Alp. Res. 15:223–240.

4. Barbour, M. G., and J. Major, eds. 1977. Terrestrial vegetation of California. John Wiley and Sons, New York. 1002 pp.

5. Barnes, P. W., and A. T. Harrison. 1982. Species distribution and community organization in a Nebraska sandhills mixed prairie as influenced by plant/soil-water relationships. Oecologia 52:192–201.

6. Beavis, W. D., J. C. Owens, J. A. Ludwig, and E. W. Huddleston. 1982. Grassland communities of east-central New Mexico and density of the range caterpillar, *Hemileuca oliviae* (Lepidoptera: Saturniidae). Southwest Nat. 27:335–343.

7. Beetle, A. A. 1952. A relic area on the Wyoming shortgrass plains. J. Range Mgmt. 5:141–143.

8. Beetle, A. A. 1961. Range survey in Teton County, Wyoming. Part 1. Ecology of range resources. Univ. of Wyoming, Agric. Expt. Sta. Bull. 376. 38 pp.

9. Beetle, A. A. 1962. Range survey in Teton County, Wyoming. Part 2. Utilization and condition classes. Univ. of Wyoming, Agric. Expt. Sta. Bull. 400. 38 pp.

10. Benedict, N. B. 1983. Plant associations of subalpine meadows, Sequoia National Park, California. Arctic and Alp. Res. 15:383–396.

11. Billings, W. D. 1945. The plant associations of the Carson Desert region, western Nevada. Butler Univ. Bot. Studies 7:89–123.

12. Billings, W. D. 1949. The shadscale vegetation zone of Nevada and eastern California in relation to climate and soil. Amer. Midl. Natur. 42:87–109.

13. Billings, W. D. 1969. Vegetational pattern near alpine timberline as affected by fire-snowdrift interactions. Vegetatio 19:192–207.

14. Billings, W. D., and H. A. Mooney. 1959. An apparent frost hummock-sorted polygon cycle in the alpine tundra of Wyoming. Ecology 40:16–20.

15. Blackburn, W. H., R. E. Eckert, Jr., and P. T. Tueller. 1969a. Vegetation and soils of the Cow Creek watershed. Coll. Agric., Univ. of Nevada Bull. R49. 77 pp.

16. Blackburn, W. H., R. E. Eckert, Jr., and P. T. Tueller. 1969b. Vegetation and soils of the Coils Creek watershed. Coll. Agric., Univ. of Nevada Bull. R48. 82 pp.

17. Blackburn, W. H., R. E. Eckert, Jr., and P. T. Tueller. 1969c. Vegetation and soils of the Crane Springs watershed. Coll. Agric., Univ. of Nevada Bull. R55. 63 pp.

18. Blackburn, W. H., R. E. Eckert, Jr., and P. T. Tueller. 1971. Vegetation and soils of the Rock Springs watershed. Coll. Agric., Univ. of Nevada Bull. R83. 115 pp.

19. Blair, W. F., and T. H. Hubbell. 1938. The biotic districts of Oklahoma. Amer. Midl. Natur. 20:425–454.

20. Blaisdell, J. P., R. B. Murray, and E. D. McArthur. 1982. Managing intermountain rangelands. USDA For. Serv. Gen. Tech. Rep. INT-134, Intermt. For. & Range Expt. Sta., Ogden, Utah. 41 pp.

21. Bolen, E. G. 1964. Plant ecology of spring-fed salt marshes in western Utah. Ecol. Monogr. 34:143–166.

22. Bowers, J. E. 1982. The plant ecology of inland dunes in western North America. J. Arid Environ. 5:199–220.

23. Bowns, J. E., and N. E. West. 1976. Blackbrush (*Coleogyne ramosissima*) on southwestern Utah rangelands. Utah Agric. Expt. Sta. Res. Rep. 27. 30 pp.

24. Branson, F. A., R. F. Miller, and I. S. McQueen. 1967. Geographic distribution and factors affecting the distribution of salt desert shrubs in the United States. J. Range Mgmt. 20:287–296.

25. Briggs, G. M., and J. A. MacMahon. 1982. Structure of alpine plant communities near King's Peak, Uinta Mountains, Utah. Great Basin Nat. 42:50–59.

26. Brotherson, J. D., 1983. Species composition, distribution, and phytosociology of Kaslow prairie, a mesic tall-grass prairie in Iowa. Great Basin Nat. 43:137–167.

27. Brown, R. W. 1971. Distribution of plant communities in southeastern Montana badlands. Amer. Midl. Natur. 85:458–477.

28. Bruner, W. E. 1931. The vegetation of Oklahoma. Ecol. Monogr. 1:99–188.

29. Buck, P., and R. W. Kelting. 1962. A survey of the tall-grass prairie in northeastern Oklahoma. Southwest Nat. 7:163–175.

30. Burzlaff, D. F. 1962. A soil and vegetation inventory and analysis of three Nebraska sandhills range sites. Nebraska Agric. Expt. Sta. Res. Bull. 206. 32 pp.

31. Castle, E. S. 1954. The vegetation and its relationship to the dune soils of Kane County, Utah. Unpublished thesis. Brigham Young Univ., Provo, Utah.

32. Christensen, E. M., and H. B. Johnson. 1964. Presettlement vegetation and vegetational change in three valleys in central Utah. Brigham Young Univ. Sci. Bull., Biol. Ser. 4(4):1–16.

33. Christensen, E. M., and S. L. Welsh. 1963. Presettlement vegetation of the valleys of western Summit and Wasatch counties, Utah. Proc. Utah Acad. Sci. 40:163–174.

34. Clary, W. P., and H. A. Pearson. 1969. Cattle preferences for forage species in northern Arizona. J. Range Mgmt. 22(2):114–116.

35. Collins, E. 1. 1984. Classification of Wyoming plant communities. Wyoming Natural Heritage Program, The Nature Conservancy, Cheyenne, Wyoming.

36. Cooper, S. V. 1975. Forest habitat types of northwestern Wyoming and contiguous portions of Montana and Idaho. Unpublished dissertation. Washington State Univ., Pullman. 190 pp.

37. Copeland, W. N. 1979. Harney Lake Research Natural Area. Suppl. 9 to Franklin, J. F., et al. 1972. Federal Research Natural Areas in Oregon and Washington: a guidebook for scientists and educators. USDA For. Serv., Pacific Northwest For. and Range Expt. Sta., Portland, Oregon. 21 pp.

38. Copeland, W. N., and S. E. Greene. 1982. Stinking Lake Research Natural Area. Suppl. 12 to Franklin, J. F., et al. 1972. Federal Research Natural Areas in Oregon and Washington: a guidebook for scientists and educators. USDA For. Serv., Pacific Northwest For. and Range Expt. Sta., Portland, Oregon. 21 pp.

39. Cottam, W. P. 1929. Man as a biotic factor illustrated by recent floristic and physiographic changes at Mountain Meadows, Washington County, Utah. Ecology 10:361–363.

40. Cottam, W. P., and G. Stewart. 1940. Plant succession as a result of grazing and of meadow dessication by erosion since settlement in 1862. J. For. 38:613–626.

41. Coupland, R. T. 1950. The ecology of mixed prairie in Canada. Ecol. Monogr. 20:271–315.

42. Daubenmire, R. 1970. Steppe vegetation of Washington. Washington Agric. Expt. Sta. Tech. Bull. 62. 131 pp.

43. Daubenmire, R., and J. B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington Agric. Expt. Sta. Tech. Bull. 60. 104 pp.

44. Despain, D. 1973. Vegetation of the Big Horn Mountains, Wyoming, in relation to substrate and climate. Ecol. Monogr. 43:329–355.

45. Dix, R. L., and F. E. Smeins. 1967. The prairie, meadow, and marsh vegetation of Nelson County, North Dakota. Can. J. Bot. 45:21–58.

46. Dixon, H. 1935. Ecological studies on the high plateaus of Utah. Bot. Gaz. 97:272–320.

47. Dodd, J. D., and R. T. Coupland. 1966. Vegetation of saline areas in Saskatchewan. Ecology 47:958–968.

48. Donart, G. B., D. Sylvester, and W. Hickey. 1978. A vegetation classification system for New Mexico, USA Pages 488–490 *in* D. N. Hyder, ed., Proc. 1st Intern. Rangeland Congr., Denver, Colorado, 14–18 August 1978, Soc. Range Mgmt., Denver, Colorado.

49. Evers, R. A. 1955. Hill prairies of Illinois. Ill. Natur. Hist. Surv. Bull. 26:367–374.

50. Fautin, R. W. 1946. Biotic communities of the northern desert shrub biome in western Utah. Ecol. Monogr. 16:251–310.

51. Flowers, S. 1934. Vegetation of the Great Salt Lake region. Bot. Gaz. 95:353–418.

52. Francis, R. E., and E. F. Aldon. 1983. Preliminary habitat types of a semiarid grassland. Pages 62–66 *in* W. H. Moir, and L. Hendzel, tech. coord., Proceedings of the Workshop on Southwestern Habitat Types. USDA For. Serv., Southwestern Region, Albuquerque, New Mexico.

53. Franklin, J. F., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA For. Serv. Gen. Tech. Rep. PNW-8, Pacific Northwest For. and Range Exp. Sta., Portland, Oregon. 417 pp.

54. Geskink, R. W., G. W. Tomanek, and G. K. Hulett. 1970. A descriptive survey of wood phreatophytes along the Arkansas River in Kansas. Trans. Kans. Acad. Sci. 73(1):55–69.

55. Greene, S. E. 1983. Indian Creek Research Natural Area. Suppl. 14 to Federal Research Natural Areas in Oregon and Washington: a guidebook for scientists and educators, by J. F. Franklin, F. C. Hall, C. T. Dyrness,

and C. Maser. Pacific Northwest For. and Range Expt. Sta., Portland, Oregon. 15 pp.

56. Haase, E. F. 1972. Survey of floodplain vegetation along the lower Gila River in southwestern Arizona. J. Ariz. Acad. Sci. 7:75–81.

57. Hanks, J. P., E. L. Fitzhugh, and S. R. Hanks. 1983. A habitat type classification system for ponderosa pine forests of northern Arizona. USDA For. Serv. Gen. Tech. Rep. RM-97, Rocky Mt. For. and Range Exp. Sta., Fort Collins, Colorado. 22 pp.

58. Hanna, L. A. 1934. The major plant communities of the headwater area of the Little Laramie River, Wyoming. Univ. of Wyom., Publ. in Sci., Botany 1:243–266.

59. Hanson, H. C., and W. Whitman. 1938. Characteristics of major grassland types in western North Dakota. Ecol. Monogr. 8:57–114.

60. Hanson, W. R., and L. A. Stoddart. 1940. Effects of grazing upon bunch wheat grass. J. Amer. Soc. Agron. 32:278–289.

61. Harper, K. T., W. K. Ostler, K. B. McKnight, and D. L. Hunter. 1981. Effects of late-lying snow on an alpine herbland in the Uinta Mountains. Pages 179–203 *in* K. T. Harper, ed., Potential ecological impacts of snowpack augmentation in the Uinta Mountains, Utah. Report for Utah Div. Wat. Resources, and Water and Power Resources Serv., by Dept. Botany & Range Sci., Brigham Young Univ., Provo, Utah.

62. Harrison, A. T. 1980. The Niobrara Valley Preserve: its biogeographic importance and description of its biotic communities. Unpublished report prepared for The Nature Conservancy by the Univ. of Nebr., Lincoln.

63. Harrison, A. T., and E. Limbach. 1974. *Andropogon gerardii*: a native tall grass prairie species in eastern Wyoming. J. Colo.-Wyom. Acad. Sci. 7(5):39 (Abstract).

64. Hefley, H. M. 1937. Ecological studies on the Canadian River floodplain in Cleveland County, Oklahoma. Ecol. Monogr. 7(3):345–402.

65. Heitschmidt, R. K., G. K. Hulett, and G. W. Tomanek. 1970. Vegetational map and community structure of a west central Kansas prairie. Southwest Nat. 14:337–350.

66. Henderson, J. A., R. L. Mauk, D. L. Anderson, T. A. Davis, and T. J. Keck. 1977. Preliminary forest habitat types of the Uinta Mountains, Utah. Dept. of For. and Outdoor Recreation, Utah State Univ., Logan. 94 pp.

67. Henderson, J. A., R. L. Mauk, D. L. Anderson, R. Ketchie, P. Lawton, S. Simon, R. H. Sperger, R. W. Young, and A. Youngblood. 1976. Preliminary forest habitat-types of northwestern Utah and adjacent Idaho. Dept. of For. and Outdoor Recreation, Utah State Univ., Logan. 99 pp.

68. Hironaka, M. 1978. Basic synecological relationships of the Columbia River sagebrush type. Pages 27–32 *in* The Sagebrush Ecosystem: a symposium. Utah State Univ., Coll. of Natur. Resources, Logan.

69. Hladek, K. L., G. K. Hulett, and G. W. Tomanek. 1972. The vegetation of remnant shale-limestone prairies in western Kansas. Southwest Nat. 17(1):1–10.

70. Hoffman, G. R., and R. R. Alexander. 1976. Forest vegetation of the Bighorn Mountains, Wyoming: a habitat type classification. USDA For. Serv. Res. Paper RM-170, Rocky Mt. For. and Range Expt. Sta., Fort Collins, Colorado. 38 pp.

71. Hulett, G. K., C. D. Sloan, and G. W. Tomanek. 1968. The vegetation of remnant grasslands in the loessial region of northwestern Kansas and southwestern Nebraska. Southwest Nat. 13:377–391.

72. Hulett, G. K., and G. W. Tomanek. 1969. Remnant prairies on the shallow limy range site in north central Kansas. J. Range Mgmt. 22:19–23.

73. Hull, A. C., Jr., and M. K. Hull. 1974. Presettlement vegetation of Cache Valley, Utah and Idaho. J. Range Mgmt. 27:27–29.

74. Hyde, R. M., and A. A. Beetle. 1964. Range survey in Sunlight Basin, Park County, Wyoming. Univ. of Wyoming, Agric. Expt. Sta. Bull. 423. 42 pp.

75. Ibrahim, K. J., N. E. West, and D. L. Goodwin. 1972. Phytosociological characteristics of perennial *Atriplex*-dominated vegetation of southeastern Utah. Vegetatio 24:13–22.

76. Irvine, J. R., and N. E. West. 1979. Riparian tree species distribution and succession along the lower Escalante River, Utah. Southwest Nat. 24(2):331–346.

77. Johnson, J. L., and R. D. Pfister. 1982. A survey of potential ecological natural landmarks of the middle Rocky Mountains. Unpublished report prepared for the National Park Service by Intermt. For. and Range Expt. Sta., Ogden, Utah. 197 pp.

78. Johnson, P. L., and W. D. Billings. 1962. The alpine vegetation of the Beartooth Plateau in relation to cryopedogenic processes and patterns. Ecol. Monogr. 32:105–135.

79. Keammerer, W. R., W. C. Johnson, and R. L. Burgess. 1975. Floristic analysis of the Missouri River bottomland forests in North Dakota. Can. Field Natur. 89:5–19.

80. Keeler, K. H., A. T. Harrison, and L. S. Vescio. 1980. The flora and sandhills prairie communities of Arapaho Prairie, Arthur County, Nebraska. Prairie Nat. 12:65–78.

81. Kelting, R. W. 1954. Effects of moderate grazing on the composition and plant production of a native tallgrass prairie in central Oklahoma. Ecology 35:200–207.

82. Kennedy, K. L. 1983. A habitat type classification of the pinyon-juniper woodlands of the Lincoln National Forest, New Mexico. Pages 54–61 *in* W. H. Moir, and L. Hendzel, tech. coord., Proceedings of the Workshop on Southwestern Habitat Types, USDA For. Serv., Southwestern Region, Albuquerque, New Mexico.

83. Kerr, C. W., and J. A. Henderson. 1979. Upland potential vegetation classification and map for a test area, Manti-LaSal National Forest. App. Rep. 15 *in* J. A. Henderson, L. S. Davis, and E. M. Rydberg, eds., ECOSYM-a classification and information system for wildland resource management. Dept. of For. and Outdoor Recr., Utah State Univ., Logan, Utah. 68 pp.

84. Kleiner, E. F. 1968. Comparative study of grasslands of Canyonlands National Park. Unpublished dissertation. Univ. of Utah, Salt Lake City.

85. Kleiner, E. F. 1983. Successional trends in an ungrazed, arid grassland over a decade. J. Range Mgmt. 36(1):114–118.

86. Kleiner, E. F., and K. T. Harper. 1972. Environment and community organization in grasslands of Canyonlands National Park. Ecol. 53:299–309.

87. Kleiner, E. F., and K. T. Harper. 1977. Occurrence of four major perennial grasses in relation to

edaphic factors in a pristine community. J. Range Mgmt. 30:286–289.

88. Knight, D. H., and J. Thilenius. 1975. Vegetation ecology. Pages 37–59, 99–104 *in* D. H. Knight et al., eds., The Medicine Bow Ecology Project: the potential sensitivity of various ecosystem components to winter precipitation management in the Medicine Bow Mountains, Wyoming. Report to the Office of Atmos. Wat. Res., Bur. of Reclam. by the Univ. of Wyoming, Laramie.

89. Kuchler, A. W. 1974. A new vegetation map of Kansas. Ecology 55:586–604.

90. Larson, F., and W. Whitman. 1942. A comparison of used and unused grassland mesas in the badlands of South Dakota. Ecology 23:438–445.

91. Laycock, W. A., and P. W. Conrad. 1981. Responses of vegetation and cattle to various systems of grazing on seeded and native mountain rangelands in eastern Utah. J. Range Mgmt. 34:52–58.

92. Lewis, M. E. 1970. Alpine rangelands of the Uinta Mountains, Ashley and Wasatch National Forests. USDA Forest Service, Ogden, Utah. 75 pp.

93. Lewis, M. E. 1971. Flora and major plant communities of the Ruby-East Humboldt Mountains, with special emphasis on Lamoille Canyon. Unpublished report, Humboldt National Forest, Region IV, USDA Forest Service. 62 pp.

94. Lieffers, V. J., and J. M. Shay. 1982. Distribution and variation in growth in *Scirpus maritimus* var. *paludosus* on the Canadian prairies. Can. J. Bot. 60:1938–1949.

95. Looman, J. 1980. The vegetation of the Canadian prairie provinces. II. The grasslands, Part 1. Phytocoenologia 8:153–190.

96. Looman, J. 1981a. The vegetation of the Canadian prairie provinces. II. The grasslands, Part 2. Mesic grasslands and meadows. Phytocoenologia 9(1/2):1–26.

97. Looman, J. 1981b. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation. Phytocoenologia 9(4):473–497.

98. Looman, J. 1982. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation, Part 2: Freshwater marshes and bogs. Phytocoenologia 10(4):401–423.

99. Loope, W. L., and N. E. West. 1979. Vegetation in relation to environments of Canyonlands National Park. Vol. I, Pages 195–199 *in* R. M. Linn, ed., Proc. 1st Conf. Sci. Res. in the Nat. Parks, USDI, National Park Service, Transactions and Proceedings Series 5.

100. Lotspeich, F. B., and M. E. Everhart. 1962. Climate and vegetation as soil forming factors on the Llano Estacado. J. Range Mgmt. 15:134–141.

101. Love, A., and D. Love. 1954. Vegetation of a prairie marsh. Bull. Torr. Bot. Club 81:16–34.

102. Maxwell, M. H., and L. N. Brown. 1968. Ecological distribution of rodents on the High Plains of eastern Wyoming. Southwest Nat. 13(2):143–158.

103. Merkle, J. 1962. Plant communities of the Grand Canyon area, Arizona. Ecology 43(4):698–711.

104. Miller, R. F., F. A. Branson, I. S. McQueen, and C. T. Snyder. 1982. Water relations in soils as related to plant communities in Ruby Valley, Nevada. J. Range Mgmt. 35:462–468.

105. Moir, W. H. 1967. The subalpine tall grass, *Festuca thurberi*, community of Sierra Blanca, New Mexico. Southwest Nat. 12:321–328.

106. Moir, W. H., and J. A. Ludwig. 1979. A classification of spruce-fir and mixed conifer habitat types of Arizona and New Mexico. USDA For. Serv. Res. Paper RM-207, Rocky Mt. For. and Range Expt. Sta., Fort Collins, Colorado. 47 pp.

107. Mueggler, W. F., and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA For. Serv. Gen. Tech. Rep. INT-66, Intermt. For. and Range Expt. Sta., Ogden, Utah. 154 pp.

108. Mutz, K. M., and R. Graham. 1982. Riparian community type classification: Big Piney Ranger District, Wyoming. Unpublished report prepared for the U.S. For. Serv. Region IV, by Meiiji Resource Consultants, Layton, Utah. 88 pp.

109. Mutz, K. M., and J. Queiroz. 1983. Riparian community classification for the Centennial Mountains and South Fork Salmon River, Idaho. Unpublished report prepared for the U.S. For. Serv., Region IV, by Meiiji Resource Consultants, Layton, Utah. 168 pp.

110. Nichol, A. A. 1937. The natural vegetation of Arizona. Univ. of Arizona, Agric. Expt. Sta. Tech. Bull. 68:177–222.

111. Northcutt, B. E. 1978. The plant ecology of Butler Wash, southeastern Utah. Unpublished thesis. Univ. of Colorado, Boulder. 135 pp.

112. Norton, B. E. 1981. Riparian community classification for the Greys River, Wyoming. Unpublished report prepared for the U.S. For. Serv., Region IV, by the Dept. of Range Sci., Utah State Univ., Logan. 190 pp.

113. Olson, R. A., and W. A. Gerhart. 1982. A physical and biological characterization of riparian habitat and its importance to wildlife in Wyoming. Wyoming Fish and Game Dept., State of Wyoming, Cheyenne. 188 pp.

114. Oosting, H. J., and J. F. Reed. 1952. Virgin spruce-fir of the Medicine Bow Mountains, Wyoming. Ecol. Monogr. 22:69–91.

115. Ostler, W. K., K. T. Harper, and K. B. McKnight. 1981. The effects of late lying snow on a subalpine *Danthonia-Deschampsia-Carex* meadow in Utah. Pages 136–178 *in* K. T. Harper, ed., Potential ecological impacts of snowpack augmentation in the Uinta Mountains, Utah. Unpublished Report prepared for the Utah Div. of Wat. Resources and Water and Power Resources Service, by Dept. of Botany and Range Sci., Brigham Young Univ., Provo, Utah.

116. Pammel, L. H. 1903. Some ecological notes on the vegetation of the Uintah Mountains. Proc. Iowa Acad. Sci. 10:57–68.

117. Passey, H. B., and V. K. Hugie. 1963. Variation in bluebunch wheatgrass in relation to environment and geographic location. Ecology 44:158–161.

118. Passey, H. B., V. K. Hugie, E. W. Williams, and D. E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain West. USDA Soil Conservation Service Tech. Bull. 1669. 123 pp.

119. Penfound, W. T. 1953. Plant communities of Oklahoma lakes. Ecology 34:561–583.

120. Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Presby. 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34, Intermt. For. and Range Expt. Sta., Ogden, Utah. 174 pp.

121. Pickford, G. D. 1932. The influence of continued grazing and of promiscuous burning on spring-fall ranges in Utah. Ecology 13:159–171.

122. Pool, R. J. 1913. A study of the vegetation of the sandhills of Nebraska. Minnesota Bot. Studies 4(3):184–312, + figures.

123. Pound, R., and F. E. Clements. 1900. The phytogeography of Nebraska. 2d ed. Univ. of Nebraska, Bot. Surv. of Nebr., Lincoln, Nebraska. 442 pp.

124. Quinnild, C. L., and H. E. Cosby. 1958. Relicts of climax vegetation on two mesas in western North Dakota. Ecology 39:29–32.

125. Ralston, R. D. 1968. The grasslands of the Red River Valley. Unpublished dissertation. Univ. of Saskatchewan, Saskatoon.

126. Ray, R. J. 1959. A phytosociological analysis of the tall-grass prairie in northeastern Oklahoma. Ecology 40:255–261.

127. Redmann, R. E. 1972. Plant communities and soils of an eastern North Dakota prairie. Bull. Torr. Bot. Club 99:65–76.

128. Reed, R. M. 1969. A study of forest vegetation in the Wind River Mountains, Wyoming. Unpublished dissertation. Washington State Univ., Pullman. 77 pp.

129. Reed, R. M. 1976. Coniferous forest habitat types of the Wind River Mountains, Wyoming. Amer. Midl. Natur. 95:159–173.

130. Rice, E. L. 1952. Phytosociological analysis of a tall-grass prairie in Marshall County, Oklahoma. Ecology 33:112–116.

131. Rogers, C. M. 1954. Some botanical studies in the Black Mesa region of Oklahoma. Rhodora 56:205–212.

132. Rominger, J. M., and L. A. Paulik. 1983. A floristic inventory of the plant communities of the San Francisco Peaks Research Natural Area. USDA For. Serv. Gen. Tech. Rep. RM-96, Rocky Mt. For. and Range Expt. Sta., Fort Collins, Colorado. 9 pp.

133. Schlatterer, E. F. 1972. A preliminary description of plant communities found on the Sawtooth, White Cloud, Boulder, and Pioneer mountains. USDA Forest Service, Intermt. Region, Ogden, Utah. 111 pp.

134. Severson, K. E., and J. F. Thilenius. 1976. Classification of quaking aspen stands in the Black Hills and Bear Lodge Mountains. USDA For. Serv. Res. Paper RM-166, Rocky Mt. For. and Range Expt. Sta., Fort Collins, Colorado. 24 pp.

135. Sharp, L. A., and K. D. Sanders. 1978. Rangeland resources of Idaho. Univ. of Idaho, Wildl. and Range Expt. Sta. Contr. 141. 74 pp.

136. Shute, D. A. 1981. Classification and ecology of *Salix* (willow) communities in southwestern Wyoming. J. Colo.-Wyom. Acad. Sci. 13(1):15 (Abstract).

137. Shute, D. A., and N. E. West. No date. The application of ECOSYM vegetation classifications to rangelands near Price, Utah. App. Reports 14 and 16 *in* J. A. Henderson, and L. S. Davis, eds., ECOSYM—an ecosystem classification and data storage system for natural resources management. 53 pp.

138. Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. USDA For. Serv. Gen. Tech. Rep. INT-114, Intermt. For. and Range Expt. Sta., Ogden, Utah. 138 pp.

139. Steele, R., S. V. Cooper, D. M. Ondov, D. W. Roberts, and R. D. Pfister. 1983. Forest habitat types of eastern Idaho–western Wyoming. USDA For. Serv. Gen. Tech. Rep. INT-144, Intermt. For. and Range Exp. Sta., Ogden, Utah. 122 pp.

140. Stewart, G., W. P. Cottam, and S. S. Hutchings. 1940. Influence of unrestricted grazing on northern salt desert plant associations in western Utah. J. Agric. Res. 60:289–316.

141. Stoddart, L. A. 1941. The Palouse grassland association in northern Utah. Ecology 22:158–163.

142. Svihla, R. D. 1932. The ecological distribution of the mammals on the north slope of the Uinta Mountains. Ecol. Monogr. 2:47–73.

143. Thatcher, A. P. 1959. Distribution of sagebrush as related to site differences in Albany County, Wyoming. J. Range Mgmt. 12:55–61.

144. Thilenius, J. F. 1971. Vascular plants of the Black Hills of South Dakota and adjacent Wyoming. USDA For. Serv. Res. Paper RM-71, Rocky Mt. For. and Range Expt. Sta., Fort Collins, Colorado.

145. Tisdale, E. W. 1947. The grasslands of the southern interior of British Columbia. Ecology 28:346–382.

146. Tisdale, E. W. 1979. A preliminary classification of Snake River Canyon grasslands in Idaho. Univ. of Idaho, For. Wildl. and Range Expt. Sta. Note 32. 8 pp.

147. Tisdale, E. W., M. Hironaka, and M. A. Fosberg. 1965. An area of pristine vegetation in Craters of the Moon National Monument, Idaho. Ecology 46:349–352.

148. Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecol. Monogr. 12:255–292.

149. Tomanek, G. W., and F. W. Albertson. 1957. Variations in cover, composition, production, and roots of vegetation on two prairies in western Kansas. Ecol. Monogr. 27:267–281.

150. Tueller, P. T., and W. H. Blackburn. 1974. Condition and trend of the big sagebrush/needle and thread habitat type in Nevada. J. Range Mgmt. 27:36–40.

151. Tuhy, J. S. 1981. Stream bottom community classification for the Sawtooth Valley, Idaho. Unpublished thesis. Univ. of Idaho, Moscow. 230 pp.

152. Tuhy, J. S., and S. Jensen. 1982. Riparian classification for the upper Salmon/Middle Fork Salmon River drainages, Idaho. Unpublished report prepared for the U.S. For. Serv., Region IV, by White Horse Associates, Smithfield, Utah.

153. Tweit, S. J., and K. E. Houston. 1980. Grassland and shrubland habitat types of the Shoshone National Forest. Unpublished report on file at the Shoshone Nat. For. Headquarters. 143 pp.

154. Ungar, I. A. 1964. A phytosociological analysis of the Big Salt Marsh, Stafford County, Kansas. Trans. Kansas Acad. Sci. 67:50–64.

155. Ungar, I. A. 1965. An ecological study of the vegetation of the Big Salt Marsh, Stafford County, Kansas. Univ. of Kansas Sci. Bull. 46:1–98.

156. Ungar, I. A. 1967. Vegetation-soil relationships on saline soils in northern Kansas. Amer. Midl. Natur. 78:98–120.

157. Ungar, I. A. 1968. Species-soil relationships on the Great Salt Plains of northern Oklahoma. Amer. Midl. Nat. 80:392–406.

158. Ungar, I. A. 1972. The vegetation of inland saline marshes of North America, north of Mexico. Pages 397–411 *in* E. Van der Maarel, and R. Tuxen, eds., Basic problems and methods in phytosociology. Verlag, Dr. W. Junk N.V., Den Haag.

159. Ungar, I. A., W. Hogan, and M. McClelland. 1969. Plant communities of saline soils at Lincoln, Nebraska. Amer. Midl. Nat. 82:564–577.

160. Vass, A. F., and R. Lang. 1938. Vegetative composition, density, grazing capacity and grazing land values in the Red Desert area. Univ. of Wyoming, Agric. Expt. Sta. Bull. 229. 72 pp.

161. Walker, G. R., and J. D. Brotherson. 1982. Habitat relationships of basin wildrye in the high mountain valleys of central Utah. J. Range Mgmt. 35(5):628–633.

162. Waterfall, U. T. 1949. Some results of a summer's botanizing in Oklahoma. Rhodora 51:18–28.

163. Weaver, J. E. 1960. Comparison of vegetation of Kansas-Nebraska driftless hills and loess plains. Ecology 41:73–88.

164. Weaver, J. E., and T. J. Fitzpatrick. 1934. The prairie. Ecol. Monogr. 4:109–295.

165. Welsh, S. L. 1957. An ecological survey of the vegetation of the Dinosaur National Monument, Utah. Unpublished thesis. Brigham Young Univ., Provo, Utah.

166. West, N. E, and K. I. Ibrahim. 1968. Soil-vegetation relationships in the shadscale zone of southeastern Utah. Ecology 49:445–456.

167. West, N. E., R. T. Moore, K. A. Valentine, L. W. Law, P. R. Ogden, F. C. Pinkney, P. T. Tueller, J. H. Robertson, and A. A. Beetle. 1972. Galleta: taxonomy, ecology, and management of *Hilaria jamesii* on western rangelands. Utah Agric. Expt. Sta. Bull. 487. 38 pp.

168. Whitman, W. C., and M. K. Wali. 1975. Grasslands of North Dakota. Pages 53–73 *in* M. K. Wali, ed., Prairie: A Multiple View. Univ. of North Dakota Press, Grand Forks.

169. Wight, J. R., and H. G. Fisser. 1968. *Juniperus osteosperma* in northwestern Wyoming, their distribution and ecology. Univ. of Wyoming, Agric. Expt. Sta., Sci. Monogr. 7. 31 pp.

170. Wilkinson, K., and E. A. Johnson. 1983. Distribution of prairies and solonetzic soils in the Peace River District, Alberta. Can. J. Bot. 61:1851–1860.

171. Wirsing, J. M., and R. R. Alexander. 1975. Forest habitat types on the Medicine Bow National Forest, southeastern Wyoming: preliminary report. USDA For. Serv. Gen. Tech. Rep. RM-12, Rocky Mt. For. and Range Expt. Sta., Fort Collins, Colorado. 11 pp.

172. Wolfe, C. W. 1973. Effects of fire on a sand hills grassland environment. Proc. Tall Timbers Fire Ecol. Conf. 12:241–255.

173. Wright, H. E., Jr., A. M. Bent, B. S. Hansen, and L. H. Maher, Jr. 1973. Present and past vegetation of the Chuska Mountains, northwestern New Mexico. Geol. Soc. Amer. Bull. 84:1155–1180.

174. Youngblood, A. P., and W. F. Mueggler. 1981. Aspen community types on the Bridger-Teton National Forest in western Wyoming. USDA For. Serv. Res. Paper INT-272, Intermt. For. and Range Expt. Sta., Ogden, Utah. 34 pp.

175. Zamora, B., and P. T. Tueller. 1973. *Artemisia arbuscula*, *A. longiloba*, and *A. nova* habitat types in northern Nevada. Great Basin Nat. 33:225–242.