2014 Rocky Flats, Colorado, Site Central Operable Unit Vegetation Map Project

Historical Background

An early vegetation map of the Rocky Flats area was produced by Clark et al. (1980). It showed the vegetation as of 1974. Today, this map provides a good historical perspective of what the plant communities and vegetation were like in the early 1970s. However, over the past four decades, many activities have altered the vegetation and plant communities present at the site and the 1974 map no longer accurately represents the current site conditions. Many of the areas on the map did not belong to U.S. Department of Energy (DOE) at the time and were heavily grazed. After DOE obtained the property in the mid-1970s, grazing was no longer allowed, which altered the plant communities.

In 1991, as part of the baseline ecological characterization at the site (DOE 1992), an updated vegetation map was produced. It more accurately represented the plant communities at the site at that time, but the usefulness of the maps was limited by numerous errors.

During the 1994–1995 time frame, an attempt was made to use multispectral imagery taken of the site during an aerial flyover to produce a vegetation map (unpublished data). The resulting map was not as accurate as previous maps and was of limited value for ecological work at the site.

The most recent vegetation map of the Rocky Flats areas was produced in 1996 and was based on a high-resolution image taken during an aerial flyover (KH 1997). Updated vegetation classifications were developed based on the 1991 classification system and the final map was field truthed for accuracy. This map has been in use for nearly two decades. However, significant changes to plant communities during the last two decades have resulted from stream channel and flow alterations, breaching of dams, weed control activities, and land reconfiguration and reclamation activities that were part of cleanup and closure of the site.

Each of the previous mapping efforts included limited mapping of vegetation in the former Industrial Area (IA). With site closure and the removal of the man-made structures in the former IA, the area was reconfigured and seeded with native species creating grasslands, wetlands, and riparian areas. As of 2014, most of the vegetation in the former IA has become well established and a vegetation map is needed for resource management and to document the current conditions.

Purpose

The purpose of this project is to document the current status of the vegetation and plant communities in the Central Operable Unit (COU; the retained area that DOE manages), which includes the former IA. This mapping effort will provide a snapshot of the current condition of the vegetation, which can be used to assist in resource management and to evaluate long-term successional plant community change. Comparisons to past vegetation maps can show the dynamic nature of plant communities in response to varying environmental conditions and

management activities. It is also useful for evaluating the success of past revegetation activities and can provide a good indication of how future vegetation projects may do given the varying soil types present at different locations in the former IA. The vegetation map can also provide useful information for project planning and minimizing impacts to specific sensitive plant communities (i.e., Preble's meadow jumping mouse habitat, wetlands).

Methods

For continuity, the 2014 vegetation map update uses the same classification categories as the 1996 vegetation map with a few modifications. The 1996 vegetation map classification system was based on the units delineated on the 1991 maps, interpretation of additional vegetation monitoring information, and the classifications (habitat-type categories) that had been used for much of the other ecological monitoring at the site. Because it had been used on past maps and in past databases, a general wildlife habitat–type classification system was selected. In the 2014 classification system, the former reclaimed grassland is split into four subcategories to capture the differences in reclaimed areas based on the seed mixes that were used at different locations. Also, an upland deciduous woodland classification was added to capture this category of trees. The descriptions for each classification were updated as needed and the classification system used for the 2014 Rocky Flats Site vegetation map is provided in Appendix A.

The COU was divided up into multiple "units" in the geographic information system (GIS) using the 2012 aerial photograph of the site. The units were scaled to provide appropriate level mapping for grasslands versus riparian areas. Approximately sixty 11 inch × 17 inch natural color field maps were generated to provide coverage of the COU. Ecologists traversed the entire site on foot to field check the maps, and polygons representing vegetation coverage were hand drawn in the field. The minimum size of map units varied depending on community type. Greater mapping detail was achieved along riparian corridors than in the grasslands. In the riparian woodlands, shrublands, and some wetland areas, where structural differences in vegetation were more easily visible in the photographs, more detailed mapping of smaller unit sizes was possible. Field maps were scanned and rectified in the GIS. A vegetation coverage was generated by tracing the polygons from the electronic field maps in the GIS. The results were proofed, cleaned up, and labeled with the classification units. Draft maps were produced and checked for accuracy before the final vegetation map was produced.

Results and Discussion

The final updated 2014 Rocky Flats COU vegetation map is shown in Figure 1. Table 1 shows the total acreage by vegetation classification. The total acreage in the COU is approximately 1,308 acres. The grassland communities accounted for approximately 91 percent of the vegetation cover. The remaining habitats and their approximate acreages consist of wetlands (2 percent), woodlands (1 percent), shrublands (3 percent), open water (0.3 percent), and disturbed areas (3 percent).

Reclaimed grasslands account for approximately 75 percent of the grasslands within the COU. Within the reclaimed classification, the desirable reclaimed grassland classifications (mesic, xeric, and riparian) (Table 1) account for approximately 50 percent of the cover. These are the areas seeded with native mixes after cleanup activities were completed. The undesirable, reclaimed mixed grassland classification, which accounts for the other 50 percent of the

reclaimed classification, is dominated by non-native graminoid species (such as smooth brome [*Bromus inermis*], intermediate wheatgrass [*Agropyron intermedium*], and crested wheatgrass [*Agropyron cristatum*]). These species were common revegetation grasses used at the site prior to the 1990s, and many areas around the previous IA and former and existing ponds were reclaimed with these species at that time. Comparisons with previous vegetation maps of the Rocky Flats area show that due to the aggressive nature of these non-native species, some areas of former native grassland have been lost (outcompeted by the non-native species) and are now dominated or are becoming dominated by these non-native graminoid species.

Conclusions

The 2014 Rocky Flats COU vegetation map provides a snapshot in time of the vegetation that currently exists at the site and is useful for comparisons to past and future vegetation maps. The map shows the successful establishment of different native seed mixes that were used during and since site closure to mimic the native plant communities. The map is also useful to illustrate the successful establishment and reestablishment of sensitive habitats such as Preble's mouse habitat and wetlands. Additionally, it also provides useful information regarding the increase of non-native species such as smooth brome.

References

Clark, S.V., P.J. Webber, V. Komarkova, and W.A. Weber, 1980. "Map of Mixed Prairie Grassland Vegetation, Rocky Flats, Colorado, Occasional Paper No. 35," Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado.

DOE (U.S. Department of Energy, 1992. *Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at Rocky Flats Plant Final Report*, Golden, Colorado, September.

K-H (Kaiser-Hill Company LLC), 1997. *Site Vegetation Report: Terrestrial Vegetation Survey (1993-1995) for the Rocky Flats Environmental Technology Site*, prepared by Kaiser-Hill Company LLC for the U.S. Department of Energy, Rocky Flats Field Office, Golden, CO, June.

Appendix A

2014 Vegetation Map Habitat Codes

000   Aquatic and Wetlands Habitat Group

Terrestrial Subgroup

010   Wet Meadow/Marsh Ecotone

Typified by the presence of *Agrostis stolonifera*, *Festuca pratensis*, *Spartina pectinata*, or occasionally solid stands of *Poa compressa* or *Agropyron smithii*. Solid stands of *Hordeum jubatum* on old mudflats are also classified here. Other common plants found in this classification type include *Asclepias speciosa*, *Iris missouriensis*, *Cirsium arvense*, *Rumex* spp., and sometimes *Arnica fulgens*. These areas are commonly found on the edges of the streams, ponds, seeps, and other wetter areas at the site, often just beyond the short marsh and tall marsh classifications.

020   Short Marsh

Typified by stands of *Carex* spp., *Juncus* spp., or both. This classification is usually wet and underwater for parts of the year.

030   Tall Marsh

Typified by stands of *Typha* spp., *Scirpus* spp., or both. These areas are usually under water much of the year.

Open Water Subgroup

050   Ponds and Impoundments

054   Open Water

This classification was used for the ponds and other open water bodies at the site.

Emergent Subgroup

090   Mudflats

This classification represents areas that often become exposed between the high and low water marks along the pond margins. It also includes small pool areas that completely dry out during the summer. Vegetation is usually sparse, but may include such species as *Echinochloa crusgallii*, *Rumex* spp., *Polygonum* spp., or a few other grasses or sedges.

<center>**100   Woodlands Habitat Group**</center>

110   Riparian Woodland

This classification is typified by stands of *Populus deltoides*, *Salix amygdaloides*, *Ulmus pumila*, *Populus albus*, and other tree species. There may also be an understory of *Prunus* spp., *Symphoricarpos* spp., *Salix* spp., or other woody species. This classification is used where these species occur along the streams, wetland and pond edges, and along old ditches at the site.

120   Ponderosa Woodland

Typified by scattered stands of *Pinus ponderosa* with some occasional *Pseudotsuga menziesii*. This classification is found primarily on the western edge of the Peripheral Operable Unit on the northern edges of ridgetops. It is also common along the old railroad grade that runs through the Rocky Flats area. It is often surrounded by xeric mixed grassland. There are only a few locations of this classification within the COU.

130   Tree Plantings

This classification represents areas where trees were historically planted for landscaping or shelterbelt purposes. The species mapped in this classification include *Pinus ponderosa*, *Picea pungens*, *Juniperus scopulorum*, *Gleditsia tricanthos*, *Fraxinus pennsylvanica*, various horticultural *Juniper* spp., and other species. This mapping unit is common in the former Industrial Area where trees were planted around buildings and were left standing after the buildings were removed. Many of these plantings have been slowly dying off since site closure due to the lack of available water.

140   Upland Deciduous Woodland

This classification is typified by deciduous trees growing in upland areas. The species of trees can include *Populus deltoides*, *Pyrus malus*, *Ulmus pumila*, *Elaeagnus angustifolia*, and other species. The key difference between this and the Riparian Woodland classification is that the trees in this classification are growing in upland areas, not along the streams or ditches, or adjacent to ponds or wetlands.

<h1 style="text-align:center">200   Shrublands Habitat Group</h1>

210   Riparian Shrubland

This classification is composed of stands of *Salix exigua*, *Amorpha fruticosa*, or both. It is found primarily along the stream channels or around former pond edges at the site. This classification was broken down into two other subdivisions, depending on which species was dominant.

211   **Riparian Shrubland:** Stands dominated by *Amorpha fruticosa*.

212   **Riparian Shrubland:** Stands dominated by *Salix exigua*.

220   Short Upland Shrubland

This classification is dominated by stands of *Symphoricarpos occidentalis* and occasionally *Rosa* spp. This classification is typically found in an environment wetter than the Savannah Shrubland habitat described below. The short upland shrub is often found in association with or adjacent to wet meadows and other aquatic, riparian, or wetland classifications.

230   Tall Upland Shrubland

This classification is typified by stands of *Crataegus erythropoda*, *Prunus virginiana*, and *Prunus americana*. It is often found on north-facing slopes at the site or along the streams.

260   Savannah Shrubland

This classification represents areas of open shrubland with grassland between the scattered shrubs. The predominant shrub for this classification is *Rhus aromatica*, but patches of *Ribes* spp., *Atriplex canescens*, *Chrysothamnus* ssp., or other shrub species are also classified here.

300   Grassland Habitat Group

310   Short Grassland

This classification is typified by stands of short grass prairie species, *Buchloe dactyloides* and *Bouteloua gracilis*. Very little of this classification is found at the site.

320   Mixed Grassland

This classification is broken down into three subdivisions found at the site. These subdivisions often intermix, making boundary delineations difficult between the classification types.

322   Mesic Mixed Grassland

This classification is dominated by *Agropyron smithii*, *Poa pratensis*, and *Bouteloua gracilis*. A few locations dominated by *Aristida purpurea* var. *longiseta* were also classified with this classification. Other common species include *Stipa viridula*, *Poa compressa*, *Bromus japonicus*, and *Alyssum minus*, the latter three of which are non-native. The soils are considered to be clay loams and do not have the cobbly appearance at the surface that is typical of the xeric mixed grassland soils. This classification is most common on the hillsides at the site. The quality of the mesic mixed grassland varies considerably. At some locations, exotic non-native invaders, such as *Bromus japonicus*, *Alyssum minus*, and *Carduus nutans*, are not uncommon. At other locations, *Bromus inermis* is present in small patches and is invading, slowly replacing the native prairie. For classification purposes, small inclusions of these non-native species were considered part of this classification due to the difficulty of trying to "tease" them out during mapping. As long as an understory of *Agropyron smithii*, *Poa pratensis*, or *Bouteloua gracilis* was dominant and present beneath the exotic non-native species, the grassland was still classified as mesic mixed grassland. Therefore, for example there may be small patches of *Bromus inermis* present within the mesic mixed grassland.

323   Xeric Mixed Grassland

This classification is dominated by *Andropogon gerardii*, *Andropogon scoparius*, *Stipa comata*, *Muhlenbergia montana*, *Carex heliophila*, *Arenaria fendleri*, *Aster porteri*, *Koleria pyramidata*, and *Liatris punctata*. Stands of *Yucca glauca*, which are found in a few spots primarily on ridgetops on the eastern side of the site, are also included in the xeric mixed grassland classification because they are often surrounded and intermixed with this classification type. Small inclusions of *Bromus inermis* may also be found in this classification (see the description for the Mesic Mixed Grassland above). This classification is found on nearly all the pediments and ridgetops at the site and is underlain by Rocky Flats Alluvium. The soils are considered to be sandy clay loams with lots of cobbles. The surface of the ground is usually very rocky. Two subdivisions of xeric mixed grassland were recognized:

331   Xeric Tallgrass Prairie

This subdivision is dominated by *Andropogon gerardii* and *Andropogon scoparius*. It also contains high cover of *Muhlenbergia montana*, *Carex heliophila*, *Arenaria fendleri*, and *Aster porteri*. Other tallgrass prairie species include *Sorghastrum nutans*, *Sporobolus*

heterolepis, and *Panicum virgatum*. *Poa compressa*, a non-native perennial grass, is also fairly common at many locations. The soils are usually visibly cobbly on the surface.

332   Xeric Needle and Thread Grass Prairie

This subdivision is dominated by *Stipa comata* and *Stipa neomexicana*. It contains very little *Andropogon gerardii* and *Andropogon scoparius*. The soils are not quite as visibly cobbly as the xeric tallgrass prairie.

340   Reclaimed Grassland

Since closure of the Rocky Flats Site in 2005, considerable effort has been made to restore disturbed areas to their more natural ecological state (i.e., prairie, wetlands, and riparian areas). As a result, various seed mixes have been used at different locations based on slope, aspect, soils, and moisture regimes to attempt to mimic the native plant communities in the area. Since the mid-1990s, only native plant species have been used in seed mixes at the site. However, prior to that, a common, non-native rangeland mix that included such species as *Bromus inermis*, *Agropyron intermedium*, and *Agropyron cristatum* was typically used for revegetation projects. As a result, many areas of the site are dominated by these species. The 1996 vegetation map classified all reclaimed grassland areas into one classification, Reclaimed Mixed Grassland. However, the current update of the vegetation map subdivides the reclaimed grassland classification into four classifications to more accurately represent the various seed mixes that were used at different locations and the current vegetation communities that are present.

341   Reclaimed Mixed Grassland

This classification is dominated by *Bromus inermis*, *Agropyron intermedium*, *Agropyron cristatum*, *Festuca ovina*, and other non-native planted or adventive species. This classification covers all site areas that were revegetated with various non-native graminoid seed mixtures. Large areas of this habitat type are found around the former and current ponds and surrounding the former Industrial Area.

342   Reclaimed Mesic Grassland

This classification is dominated by *Agropyron smithii*, *Agropyron caninum*, *Bouteloua gracilis*, *Bouteloua curtipendula*, *Buchloe dactyloides*, and *Stipa viridula*. This classification differs from the Mesic Mixed Grassland (322) classification in the fact that this is a reclaimed area. The upland seed mix used in this classification was designed to mimic the native hillsides at the site.

343   Reclaimed Xeric Grassland

This classification is dominated by *Andropogon gerardii*, *Andropogon scoparius*, *Sorghastrum nutans*, *Agropyron smithii*, *Agropyron caninum*, *Bouteloua gracilis*, *Bouteloua curtipendula*, and *Buchloe dactyloides*. This classification differs from the Xeric Mixed Grassland (323) classification in the fact that it is also a reclaimed area. It was seeded with a native upland seed mix designed to mimic the grasslands on the pediment tops at the site.

344   Reclaimed Riparian Grassland

This classification is similar to the Reclaimed Mesic Grassland (342) or Reclaimed Xeric Grassland (343) areas with the exception that it also includes significant cover of either *Panicum virgatum* or *Elymus canadensis*. These two species were often added to the other two seed mixes and used along streams, ponds, and wetland margins. Areas dominated by either of these two species were classified as this category.

<center>**400   Disturbance Habitat Group**</center>

410   Annual Grass/Forb

This classification is dominated by a plant community of annuals such as *Bromus japonicus*, *Bromus tectorum*, *Centaurea diffusa*, *Helianthus annus*, and other associated species. This category was used when little or no other native plant community existed beneath the annual community. These areas were often disturbed, unrevegetated areas or areas where reclamation efforts had failed and an annual, early successional stage had established.

420   Roads/Disturbed/Barren Lands/Structures

This classification was used for the roads, parking areas, buildings or other structures, and other disturbed non-riprap or rock areas.

500   Structures and Structure Association Habitat Group

530   Rock and Gravel Piles

This classification was used for riprap piles along stream channels and on dam faces and other rock or storage areas.