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Kelseya

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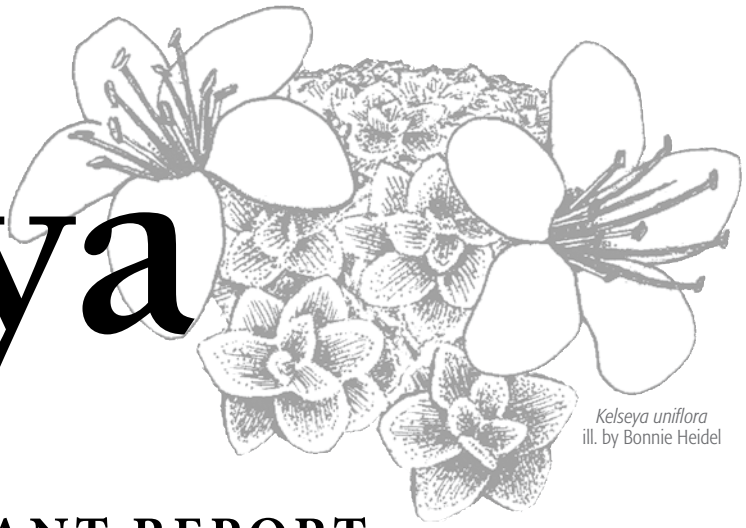

Kelseya uniflora
ill. by Bonnie Heidel

SMALL GRANT REPORT

Appraising the Crown Jewel

By Jeff Copeland, Valley of Flowers Chapter

Burke Park, looking north across the Burke Park ridge top toward the Bridger Mountains.
Photo courtesy of Matt Lavin.

Burke Park, the crown jewel of Bozeman's parks, is located at the east end of the old town, just south of Main Street. Covering about 40 acres, the park consists of a portion of a north-south trending ridge and west-facing slope that continues south to the foothills of the Hyalite Mountains. An integral part of Bozeman's trail system and a beloved spot for viewing sunsets, the park is one of the few remaining — and by far most spectacular — native landscapes left within the city limits of Bozeman.

Obsidian tools still found on the site indicate the long span of human presence here. European settlers occupied the area by the late 1860s. Peet's Hill, as it still is locally known, was named for John M. Peet, whose family ran a dairy on the property, which the city shut down after an outbreak of typhoid fever in Bozeman's water supply. The property was used as a horse pasture for decades until the City purchased it in 1993.

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The grazing and other land uses apparently were not too detrimental to the vegetation or its recovery, because a survey conducted in 2005 found that the park harbored a rich flora of more than 270 vascular plant species, including a diversity of shrubs, perennial grasses, and forbs. The ridge top contains a remnant piece of mountain big sagebrush steppe that is representative of sagebrush habitat found throughout Southwestern Montana. The dominant subspecies of sagebrush is *Artemisia tridentata ssp. vaseyana*, while the habitat can be classified following Mueggler and Stewart (1980) as the mountain big sagebrush and Idaho fescue *(Artemisia tridentata/ Festuca idahoensis)* habitat type.

Although livestock are long gone, the wildflowers of Burke Park again are under threat, this time by a rapidly growing urban and suburban community. Use of the park is sky-rocketing and many fear the park is being loved to death — at least the plants. Trampling by dogs, people and bikes that stray off the trail, dog excrement, and invasion by exotic species are all cause for concern. Some of these concerns have been addressed to varying degrees by the Parks Department. At some point fences were erected to guide people back to the trails when they strayed, but these were removed years ago. Now signs merely suggest that people stay on the trails and not trample the flowers. Dogs are still allowed off-leash. The city sprayed herbicides on portions of Burke Park in 2012 and 2013 to control sulphur cinquefoil and other state-listed noxious weeds.

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So, are the flowers disappearing? Luckily, the park has been popular with plant researchers as well as recreationists, so data exists to help answer this question. As part of the research conducted in 2005, Tim Seipel, a Ph.D. student in Ecology at Montana State University, established 15 permanent 50- by 10-meter plots. Within each plot he marked 15 one-half by one-meter quadrats stratified along a 50-meter transect with metal spikes and blue road whiskers. Among the data gathered for each quadrat was plant species. This sampling yielded 134 vascular plant species from the 15 plots.

In 2013, MSU ecologists repeated the vegetation monitoring for Transects 1 through 7, which included Transects 1 through 4 located in the area targeted with herbicides. In the summer of 2017, transects 1 through 10 were more permanently marked and accurately mapped, and the monitoring methodology repeated by volunteers with financial help from a Montana Native Plant Society grant.

The simplest measure of diversity is plant richness, or an overall list of species found. By noting the occurrence of species in the monitoring quadrats (since the 15 transects total 100 quadrats, each species can have a maximum occurrence of 100), a measure of relative abundance — how rare or common a species is — is also created. The monitoring data can then be used to explore the overall diversity of the area sampled.

These three snapshots in time (2005, 2013 and 2017) of a small area provide only a limited view of a natural landscape that is continually changing. For this short discussion, just the presence/ absence data for the 100 quadrats of Transects 1 through 7 was examined. Even so, making sense of the data is daunting. In order to more fully explore changes in diversity, and the possible causes of the decline, more robust statistical modeling and additional research is required.

Liatris punctata. *Photo courtesy of Matt Lavin.*

Results

A preliminary examination of the data reveals an overall decline in biodiversity over 12 years, mainly the result of a decline in native perennial forbs, the charismatic flora with colorful flowers so loved by the public. While this decline was the most pronounced in the northern transects sprayed with herbicides in 2012 and 2013 (after the 2013 sampling), the other quadrats also experienced a decline.

The monitoring conducted in 2005 found 83 plant species — 62 native and 21 non-native. By 2017, only 67 species were found — a decline of almost 20 percent — while native forbs declined by over 25 percent. Many other species were found in fewer quadrats, so that total occurrences fell overall by approximately 10 percent, from 1,186 in 2005 to 1,060 in 2017. Native forbs declined even more drastically — these species were found 23 percent less often. Exotic forbs increased, but slowly. While two fewer species were found in 2017, the occurrence of the remaining species increased by 14 percent.

What do these numbers represent? Examining the interim 2013 sampling data — as well as looking at the species that grew more common from 2005 to 2017, even as many wildflowers declined — helps us understand how the landscape is changing not only in Burke Park but in similar habitat throughout the West. In 2013 the data revealed a drastic decline in forbs in the sprayed area — the herbicides worked as designed. *Potentilla recta*, found in 10 quadrats in 2005, was only found in three by 2013, while *Centaurea stoebe*, formerly found in two quadrats, occurred in only one by 2013. Although the herbicides were spot-sprayed, the impacts to non-target species in the spray zone was also significant. The big

losers were the native forbs, declining by more than 25 percent. This represents a loss of 14 species, including *Fritillaria pudica, Besseya wyomingensis* and *Helianthus rigida*. Many other native forbs were less common, including *Gaura coccinea, Liatris punctata* and *Solidago missouriensis*.

Even in 2017, four years after the herbicide treatment, the sprayed quadrats had almost 30 percent fewer species of native forbs than were found in the original 2005 sample, while the other quadrats had a decline of 12 percent. The remaining native forbs were less common, declining by approximately 43 percent in the sprayed quadrats, while the other quadrats actually saw an increase in the occurrence of native forbs of over 15 percent. This however, is the result of a few number of species becoming more widespread.

Stepping back from the numbers, what seems to be happening? The amount of bare ground is not increasing; instead, the quadrats in general are growing less diverse, and the remaining species are dominating the space and spreading through the area. The winners are the exotic grasses and to a lesser degree the exotic annuals. Although trampling and the input of dog excrement cannot be written off, it appears that exotic grasses are playing a role in the conversion of the plant community.

Exotic Grasses

Exploring the role of exotic grasses in the changes discussed above will require the use of the canopy cover data, complex statistical analysis thus far beyond me, as well as other research data, some of which is currently underway by ecologists at MSU. However, some preliminary and rudimentary conclusions can be made. While the native forbs were growing rarer, exotic grasses increased in occurrence by more than 35 percent. Of the seven species of exotic grasses found in the study area — *Bromus inermis, B. tectorum, B. japanicus, Dactylis glomerata, Phleum pratense, Poa compressa* and *P. pratensis* — smooth brome *(Bromus inermis)* is the most likely to be correlated with a decline in other species. Smooth brome expanded from six quadrats in 2005 to 37 in 2017, an increase of over 500%! Of course correlation is not causation. When a quadrat is free of smooth brome and has a diversity of native forbs in 2005 — but by 2017 has fewer species and is dominated by *B. inermis* — did smooth brome displace the original species or merely move into an available niche? The ecologists involved in Burke Park research have yet to reach a consensus, although they do agree that smooth brome is persistent — and doesn't like company.

Bromus inermis. *Photos courtesy of Matt Lavin.*

Montana Listed Noxious Weeds and Other Exotic Forbs

Although much of what is happening to the natives in Burke Park remains unexplained and perhaps unexplainable with the available data, Montana Noxious Weeds cannot take the blame. *Potentilla recta*, the prime target of the city's herbicide campaign in 2012, was found in 10 quadrats in 2005. In 2013, P. recta was only found in five quadrats, two outside the spray area, and by 2017 this had further declined to just two occurrences. Canada thistle *(Cirsium arvense)*, an exotic thistle hated by the barefooted, was found in five quadrats outside the spray zone in 2005, and hasn't been found since. Spotted knapweed *(Centaurea stoebbe)* is the only listed exotic that is increasing, from four occurrences in 2005 to seven in 2017. If spotted knapweed spreads like a wildfire, it is an extremely slow moving one.

Of course, other than the time, money, and herbicides spent on controlling them, Montana Noxious Weeds are not particularly special compared to many of the other exotic plants already found in Montana or on their way. The world is growing smaller, and this is as true for plants as for people.

Tim Seipel and Matt Lavin discovered *Thesium arvense*, an herbaceous perennial from Eurasia, in Burke Park in 2004, the first documented discovery in Montana. The plant has since been found in six counties in Western Montana. In Burke Park the species has spread from the original one quadrat to six quadrats along three transects and beyond the study area.

While the Park still preserves a small piece of exemplary sagebrush steppe, the diversity is in decline as native plants are replaced by a smaller cast of species dominated by non-native grasses. These trends, more pronounced in areas where herbicides are used, are consistent with other research and should not be surprising. But research needs to be read to be useful. Will Burke Park continue to draw in people to enjoy the profuse blooms of native wildflowers? Or will the vegetation monitoring get easier, as the wildflowers are replaced with a field of smooth brome, the monotony broken by an occasional yellow salsify bloom?

Jeff Copeland has been an environmental consultant for 20 years, focusing on weed management and vegetation monitoring. His partner on the MNPS Small Grant project was Jeannie Knox, with help from Matt Lavin; Tim Seipel, MSU Extension; Lisa Rew and Bruce Maxwell, Professors in LRES land resources and environmental sciences.