CHECKLIST OF MAMMALS ON CITY OF BOULDER OPEN SPACE AND MOUNTAIN PARKS

Prepared by Carron Meaney and OSMP Staff, February 2018

Introduction

This document is a checklist of mammals on City of Boulder Open Space and Mountain Parks (OSMP) properties, including species that are documented, potential, extirpated, or unlikely. Documentation herein is defined as species for which records of their presence on OSMP properties could be found since 2000. Development along the Front Range is ongoing and creates a reduction in available habitat for most species. This checklist provides a snapshot of mammalian faunal presence in 2017 (and since 2000), and a quick reference to where a species was last observed should it fail to be observed or documented in future years.

Methods

The following sources were employed to document a species' presence on OSMP properties and the date of last observation:

- SciColl – Scientific collection data provided by Colorado Parks and Wildlife from annual reports submitted by scientists who received a scientific collecting license. These records typically represent live captures of mammals that are released.
- UCM – University of Colorado Museum specimen records as reported on the database Arctos (https://arctos.database.museum/).
- DMNS – Denver Museum of Nature and Science specimen records as reported on the database Arctos (https://arctos.database.museum/).
- "OSMPa": Observations by OSMP staff.
- "OSMPb": Species observed on remote cameras deployed by OSMP staff.
- "OSMPc": Species observed during OSMP small mammal trapping efforts.
- "OSMPd" library – Reports submitted to OSMP and maintained in their library from researchers who conducted fieldwork on OSMP properties.
- Peer-reviewed publications, as available.

Mammals for which there are no known records on OSMP properties post-2000 are addressed by indicating the most recent records and the Boulder County location, if available.

Under the column labeled "Documentation", there are three possible entries: D = documented by records as defined above; P = potential, whereby the species may be present on OSMP properties because suitable habitat is available but no records exist to document their presence post-2000 or specifically on OSMP; E = extirpated, indicating the species occurred in Boulder County historically but is no longer present; and U = unlikely present due to the lack of suitable habitat or suitable elevation (American pikas, for example). The latter group is included in order to address curiosity about relatively well-known species and what their likelihood of presence is. These entries are conservative, and include only traceable records or sources. There is no doubt that additional sightings have been made that do not tier to the sources listed here.

Five habitat types are included that are present on OSMP properties: upland grassland (includes shrubs), plains riparian and wetlands, ponderosa pine forest, mixed conifer forest (up to 8,100 feet elevation), and foothills riparian. An X is noted in each habitat type in which professional opinion indicates that the listed species would find suitable habitat.

Locations are listed by OSMP property names when those are available. Otherwise they are listed by common terms for location. Nomenclature for scientific and common names follows Armstrong et al. (2011). The last column provides citation, notes, documentation of locations not on OSMP properties, and/or records prior to 2000.

Results

For the records listed in the checklist, the 98 sources that provided documented records for the 65 documented species (native and introduced) are listed below with percent contribution and tally of entries in parentheses.

- SciColl – 21% (24)
- Arctos (UCM and DMNS) – 10% (12)
- OSMPa (Observations by OSMP staff) – 12% (14)
- OSMPb (remote cameras used by OSMP) – 14% (16)
- OSMPc (small mammal trapping efforts) – 10% (11)
- OSMPd (OSMP library) – 13% (15)
- Armstrong (1972), other publications, Rick Adams and Steve Jones – 2% (2)

- Readily Observed – 18% (21)

Note that some of these documented records are duplicates, as reflected in the checklist table when two locations and/or years are provided.

There are 92 native species and 4 introduced species listed. Of the native species on OSMP properties, 62 are documented (D), 20 have the potential to occur but no records are available since 2000 or specifically on OSMP properties (P), 5 are extirpated (E), and 5 are unlikely and/or suitable habitat is not available on OSMP properties (U). Of the 4 introduced species, 3 are documented (house mouse, *Mus musculus*; Norway rat, *Rattus norvegicus*; and moose, *Alces alces*) and 1 is unlikely (mountain goat, *Oreamnos americanus*.

Taxonomically, the list of natives comprises 1 opossum species, 38 rodents, 7 lagomorphs (rabbits, hares, and pika), 7 shrews, 12 bats, 21 carnivores, and 6 hoofed mammals. Compared to the 125 species of native mammals listed for Colorado (Armstrong et al. 2011), the 92 species listed here represent 74 percent of the total for the state. The 62 documented species on OSMP represent 51 percent of the state's 122 species currently extant in the state (i.e., not including 3 extirpated species that have not been reintroduced: gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos*), and wolverine (*Gulo gulo*).

Discussion

Boulder residents are fortunate to have very high mammalian biodiversity as a consequence of the county's location and the open space programs. The county straddles the Great Plains and the southern Rocky Mountains. As a result, five diverse habitat types and their associated mammalian fauna occur on the OSMP properties: Upland grassland (UG), plains riparian and wetlands (PR), ponderosa pine forest (PP), mixed conifer forest (MC), and foothills riparian corridors (FR). The public lands secured as a result of the OSMP program as well as the Boulder County Parks and Open Space program mean that Boulder's citizens are surrounded by natural areas that support the county's diverse mammalian fauna. This checklist of 96 total species represents 74 percent of Colorado's total mammal species (Armstrong et al. 2011); it includes extirpated species (from both sources) and unlikely species (from this checklist).

Populations of many species would have declined or been extirpated were it not for the citizens of Boulder approving sales tax to purchase and manage natural areas surrounding the City. This checklist, with the details on documentation of records for species' presence, documents

species presence on OSMP for comparison into the future, and provides a reference for where a species was detected most recently. A decline in mammalian biodiversity continues to be of concern as development and human population numbers increase across the Front Range and available habitat is reduced.

Considering that OSMP properties are a miniscule proportion of Colorado's geographic area, 62 native species (65 if introduced species are included) listed as documented represent a high value for mammalian biodiversity. For example, Rocky Mountain National Park lists 63 species as present or probably present in an area of 415 square miles (Rocky Mountain National Park 2018), whereas OSMP comprises 70 square miles! It is notable that 15 of the 21 carnivores extant in Colorado (Armstrong et al. 2011) are documented on OSMP.

Around 1995, Jim Fitzgerald prepared an analysis of furbearer management (Fitzgerald undated). In it he questioned the high harvest numbers allowable, indicating for many species that trapping should be discontinued, allowable numbers reduced, or further research required to justify the harvests. This marked the beginning of changes in regulations, and a reduction in trapping activity. Harvest regulations allow for unlimited bag and possessions limits in winter for mink, pine marten, badger, gray fox, red fox, swift fox, raccoon, ringtail, striped skunk, western spotted skunk, long-tailed weasel, short-tailed weasel, opossum, and muskrat (CPW 2018). However, a review of harvest records indicates that for many species, the harvest numbers are in fact very low, the season was closed for many years, or the harvest records were not surveyed (CPW 2016).

A number of mammalian species have experienced a successful comeback since 1970 or so. Some examples of species present or more abundant now than almost 50 years ago are carnivores, and include American mink (*Neovison vison*), northern river otter (*Lontra canadensis*, thanks to reintroduction efforts by Colorado Parks and Wildlife), American black bear (*Ursus americanus*), and mountain lion (*Puma concolor*), among others.

A decline in mink numbers was noted around 1995 as determined from harvest numbers (Fitzgerald undated). Mink have become more abundant locally in the past 50 years, due to reduction in harvest (CPW 2016), the restoration of creeks and rivers, and the preservation of open spaces.

River otters were extirpated from Colorado in the early 1900s (Armstrong et al. 2011), and reintroduced by the Colorado Division of Wildlife (now Colorado Parks and Wildlife, CPW) with

120 animals between 1976 and 1991 to the Colorado, Gunnison, Piedra, and Dolores river basins. These reintroductions have been very successful throughout the state. River otters made their way to Boulder County from the Colorado River and observations and/or sign have now been recorded at multiple sites along Boulder Creek and St. Vrain Creek.

Mountain lion bounties were abolished in 1965, when the species was re-classified as a game animal. As a result, populations have increased. CPW has in recent years conducted a research project along the Front Range to test conflict prevention methods and lion demographic behavior in human-altered environments. One of the findings is that mountain lions near the urban interface obtained 20 percent of their diet from alternative prey and not mule deer, *Odocoileus hemionus*, their typical historical diet in environments little or not affected by humans. The alternative prey comprised wildlife that is associated with humans and domestic animals (Moss et al. 2015). In contrast, twenty-five years ago their diet was intermediate between the largely mule deer diet and alternative prey, indicating that over time mountain lion diets experience a niche expansion in areas of human expansion (Moss et al. 2016). With every 10 percent increase in housing density, the risk of mortality increased by 6.5 percent as a consequence of human intolerance (Moss 2015).

Ringtails (*Bassariscus astutus*), western spotted skunks (*Spilogale gracilis*), and pine martens (*Martes americana*) have been increasingly noted in recent years. However, it is doubtful that this reflects any change in distribution or abundance. Some increase may be due to declines in trapping (see above), but it is likely that the use of non-intrusive trail cameras and an interested and informed public (informal citizen scientists) with ready access to reporting media are the source of an increased awareness of the occurrence of these species. Ringtails and western spotted skunks are secretive, being nocturnal and occurring in roughlands where visibility is broken up by rocks and vegetation. Pine martens occur in coniferous forests in the higher mountains of Colorado (Armstrong et al. 2011), habitat that has been less impacted by anthropogenic development than most other habitats in Colorado.

Moose are not native to Colorado. They were occasionally known to come into North Park, but never bred in the state. Hence they are considered introduced. They were first introduced in 1978, when 12 moose were brought to North Park from Utah, and another 12 were brought in from Wyoming in 1979. The introduced animals have done extremely well and have expanded

their range in the state to include very regular occurrence in Boulder County and on OSMP properties.

Grassland ecosystems have experienced the greatest decline in species presence. Of note are the very few records of American badgers (*Taxidea taxus*), the long-standing decline of black-tailed prairie dogs (*Cynomys ludovicianus*), and the single record of the white-tailed jackrabbit (*Lepus townsendii*). Badgers are fairly common in western North America in undisturbed grasslands, and occur on the alpine tundra as well. They are expanding their range eastwards in Canada. In Colorado, however, the conversion of grasslands to agricultural cultivation and anthropogenic development has reduced the amount of habitat available to them. This has also contributed to the well-known decline of prairie dogs and thus reduced a significant badger prey item. Any resurgence of badgers in Boulder County will be tied to healthy and large prairie dog colonies. White-tailed jackrabbits were more abundant 20 to 30 years ago on Boulder's eastern plains (OSMP wildlife sightings database). They have also disappeared from western Kansas and parts of Nebraska. Their extirpation in both Yellowstone and Grand Teton national parks has been discussed in terms of the ecological role of undetected species losses (Berger 2008). The decline of white-tailed jackrabbits had gone undetected for many years, and the ecological impacts of changes in coyote (*Canis latrans*) diets, a major predator of jackrabbits, have also gone unrecognized.

Seldom seen grassland species include the three pocket mice: silky (*Perognathus flavus*), olive-backed (*P. fasciatus*), and plains pocket mice (*P. flavescens*). These three species are not documented on OSMP properties at present; the closest records come from baseline trapping conducted in the mid-1990s at what is now Rocky Flats National Wildlife Refuge (U.S. DOE 1993, 1995).

Two species with a puzzling few records are the long-tailed weasel (*Mustela frenata*) and the North American porcupine (*Erithizon dorsatum*). The weasel is a habitat generalist that feeds on a large variety of small mammals. In turn, red foxes prey on them, and this may be the cause of their lack of abundance. Red foxes in particular are very abundant in the urban/wildland interface as well as in Boulder city limits. The porcupine seems to have disappeared from large parts of the Front Range in the past 20 to 30 years. The cause of this decline remains unknown, and research on this species would be beneficial for the ecological role that it plays (foraging on

mistletoe, for example). Individual mountain lions can become adept at capturing porcupines and this may have contributed to the decline but is unlikely to be the main cause.

The advent of remote cameras has greatly facilitated the ability to detect mammals whose presence or distribution might otherwise be underestimated. This non-invasive tool is also used in many back yards, and will continue to be a useful tool for determining mammalian presence and activity. OSMP staff operates a fleet of these cameras to assess wildlife use throughout their properties, and these data have contributed immensely to the current checklist.

Chipmunks and Cottontails

Some interest was expressed regarding the difficulty of distinguishing the three species of chipmunks (*Neotamius*) and of cottontails (*Sylvilagus*) that converge in Boulder County. These two species groups occur on OSMP properties and are very difficult to distinguish in the field. Some characteristics to look for, albeit with difficulty, are discussed in Appendix A.

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Appendix A

Chipmunks

Five species of chipmunks occur in Colorado, three of which occur on OSMP properties. The Colorado (*Neotamias quadrivittatus*) and Uinta (*N. umbrinus*) chipmunks are larger bodied than the widespread least chipmunk (*N. minimus*). Thus size is a first clue, and elevation can also be useful. A confounding issue is that throughout the West, chipmunks that co-occur in the same habitat tend to look very similar due to local habitat and ecological pelage convergence. For example, the least chipmunk can appear a lot like a smaller version of the Uinta or Colorado, though those two tend to have bushier tails. Along the Front Range, mitochondrial DNA cannot be used to differentiate the Uinta and Colorado chipmunks because of introgression. Yet nuclear DNA and genital bones clearly differentiate both species. The least chipmunk does not appear to hybridize with its larger cousins.

Least chipmunk, *Neotamius minimus*: Occurs from around 5,800-6,000 feet to just above treeline at about 10,500 feet in most habitats with some available cover. They are smaller than the other two species, typically have a distinct, dark outer stripe (black or dark brown), five dark dorsal stripes alternating with paler stripes, and smaller ears relative to the head. They are also less likely to be arboreal than the other two.

Colorado chipmunk, *Neotamius quadrivittatus*: Occurs in more open forest up to about 7,500-8,000 feet. This is a larger chipmunk, with darker stripes than the Uinta chipmunk, but the outer stripe is not as dark or distinct as in the least chipmunk. The ears are large relative to the head. The central dorsal stripe is black and quite distinct, and the dark side stripes are more reddish brown. Also, the Colorado chipmunk tends to be lighter in overall coloration than the Uinta chipmunk.

Uinta chipmunk, *Neotamius umbrinus*: In Boulder County, the Uinta chipmunk typically occurs at higher elevations (up to treeline), and in denser forests than the other two. Overall, it is a darker chipmunk than the Colorado Chipmunk, with a more diffuse outer brown stripe, although similar in size. It seems to go more readily to trees.

Cottontails

The three species of cottontails in Colorado, and on OSMP properties, are more readily identifiable by cranial characters than by external field marks. Elevation can be useful. The differences described below are not necessarily apparent.

Desert cottontail, *Sylvilagus audubonii:* Occurs below 7,000 feet, with relatively long hindlegs and long, sparsely-furred ears. The dorsum is pale grayish brown with a few blackish hairs on mid-dorsum. The sides are paler than the back. The underparts are white, except for an orangish brown spot on throat and chest.

Eastern cottontail, *Sylvilagus floridanus*: Occurs below 6,500 feet. The eastern cottontail is larger and darker than the other two species, with shorter ears relative to body size.

Mountain cottontail, *Sylvilagus nuttallii*: Occurs at 6,000 to 11,500 feet. The mountain cottontail differs from the desert cottontail in being darker with more blackish hairs dorsally, and smaller ears and hindlegs. It differs from the eastern cottontail by paler dorsal color, duller brownish shoulder patch, and more densely furred ears.