Version 1.1

City of Boulder Open Space and Mountain Parks

North Trail Study Area Plan

INVENTORY AND ASSESSMENT REPORT

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Photo credit: Phillip Yates (OSMP)

Introduction

Purpose of the Inventory and Assessment Report

The overall purpose of the North Trail Study Area (TSA) Plan is to provide management direction, and describe strategies and actions that will improve visitor experiences and increase the physical and environmental sustainability of trails, trailheads and visitor infrastructure in the North TSA while conserving natural, cultural and agricultural resources. The North TSA Plan will articulate the community's long-term vision and identify on-the-ground management actions directed at achieving that vision.

North Trail Study Area Plan Goal

The North Trail Study Area Plan seeks to improve visitor experiences and increase the sustainability of trails and trailheads while conserving the area's natural, cultural and agricultural resources.

The Inventory and Assessment Report is a compilation and analysis of information about existing conditions of the recreational, natural, cultural and agricultural resources in the North TSA. The information is based on field work, research, surveys, resource inventories, system-wide monitoring programs and on-the-ground knowledge. The sources of information are as varied as the data, with community members, the Open Space Board of Trustees (OSBT), university researchers, partner agencies and OSMP staff members all contributing to the picture of the North TSA drawn in this report.

The purpose of the Inventory and Assessment Report is to inform discussions and decisions about how to achieve the goal of the North TSA Plan and assess how various plan recommendations could affect OSMP resources. The Inventory and Assessment Report provides information and analysis to help identify the most valuable and vulnerable natural areas, cultural sites and agricultural lands. Most of this information is shown on maps, so it can be overlain with proposed improvements to the designated trail system, possible new trail connections and decisions on how best to manage undesignated trails and entry points. In previous TSA planning efforts, the information from the inventory reports was

essential in developing and establishing a sense that the overall set of recommendations was well-balanced and compatible with OSMP's multiple purposes.

The North TSA Inventory and Assessment Report is comprised of an introduction, four resource sections (recreational, natural, cultural and agricultural), a section on property specific information and a section summarizing information shared by the public about current conditions in the TSA.

photo: OSMP

Description of the North Trail Study Area

The North TSA has diverse landscapes including ponderosa pine topped hogback ridges, open grasslands, springs, creeks and small lakes. In many places, farming and ranching activities overlay these features. The TSA also includes cultural resources that paint a picture of the history and stories of Boulder's early inhabitants and settlers as well as its mining and agricultural past.

photo: OSMP

The rise of the Southern Rocky Mountain's foothills from the flats of the Central Great Plains is a continental scale environmental change that sets the stage for diverse natural resources and allows for a variety of recreational opportunities. The North TSA contains some very popular and frequently visited areas such as Wonderland Lake, the Foothills Trail corridor, Boulder Valley Ranch and some more remote and less frequented locations such as the Lefthand and Hogback Ridge trails. The North TSA receives approximately one fifth of the visitation to OSMP. It shares boundaries with city and county neighborhoods and is a recreation destination for many people who live there as well those travelling from elsewhere in the city, county and beyond.

© Gary Stevens

Location and Acreage

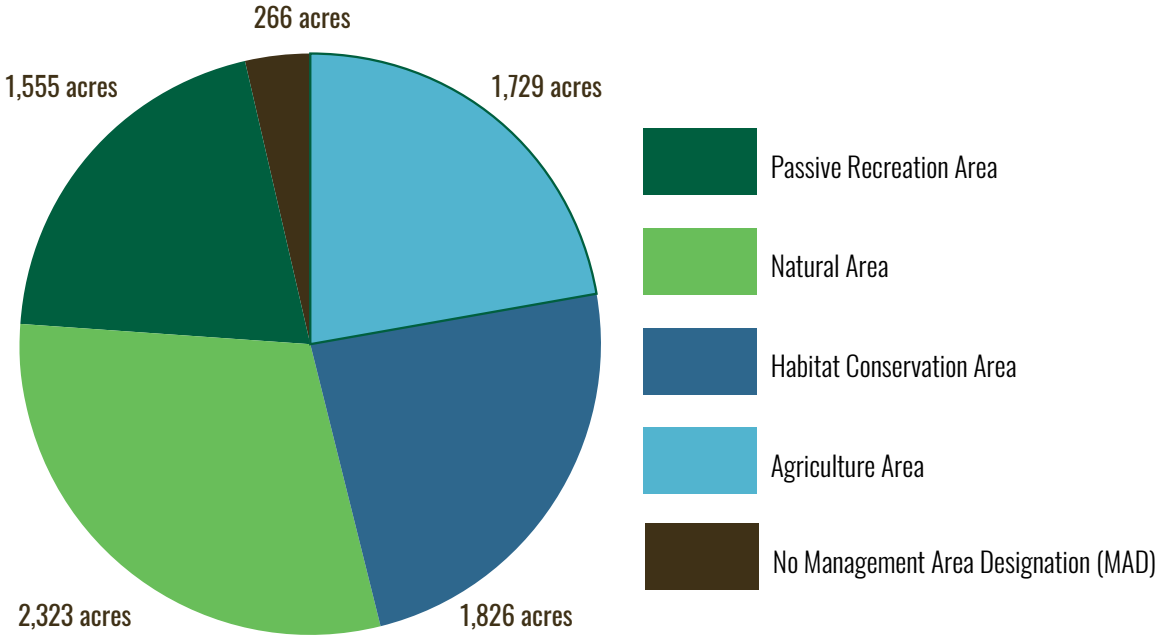
The North TSA plan will address approximately 7,700 acres of OSMP-managed lands north of Linden Avenue and the Diagonal Highway (Hwy 119) (Map G1). The TSA includes OSMP-managed properties adjacent to lands managed by Boulder County Parks and Open Space and areas managed by the city's Parks and Recreation Department including Boulder Reservoir. The North TSA Plan will include consideration of the larger geographic context and neighboring public lands as potential regional or interagency trail connections and plant and wildlife habitat conservation opportunities are considered.

Recreation Resources

Recreational opportunities occur throughout the North TSA and include a wide range of activities—such as hiking, bike riding, running, horseback riding, dog walking, hang gliding/paragliding, fishing, picnicking and nature study. Most visitors to OSMP (and likely to the North TSA) report a high quality of experience and enjoy the natural setting for passive recreation. A goal for the North TSA Plan is to maintain the factors that are currently contributing to a high quality visitor experience and take additional actions to improve the quality of visitors' experiences.

The OSMP Visitor Master Plan (VMP) established an area-based framework for implementing management strategies, policies and priorities for visitor infrastructure improvements and service delivery. The management area designations are shown on Map R1.

photo: OSMP



19+
miles of designated trails in the North TSA

35+
miles of undesignated (visitor-created) trails

Trails and Entry Points

The North TSA contains a 19-mile designated trail system that provides opportunities for visitor activities and connectivity to the Wonderland Lake, North Foothills and Boulder Valley Ranch areas. Several of the designated trails have stretches where the trail location or design can be improved to increase the physical sustainability and reduce impacts on ecological resources. There are also approximately 35 miles of visitor-created undesignated trails which may not be physically or environmentally sustainable. Some undesignated trails provide access to destinations not served by designated trails, while others parallel designated trails or provide an alternate route to a destination already served by a designated trail.

A focus for the North TSA Plan will be making the existing trail system more sustainable and reducing the network of undesignated trails to lessen resource impacts. In addition, in 2005 the VMP identified several specific improvements in what is now the North TSA, including trail and trailhead improvements, priority new trail connections and critical road crossings. These improvements were identified in the VMP to improve the visitor experience, infrastructure sustainability, safety and resource protection. A trail or visitor facility is considered sustainable when principles of ecology and economics have been incorporated into the design in an effort to achieve ecological and biological integrity, a quality visitor experience and persistent performance with a minimum of maintenance and upkeep.


© Dan Baldwin

Natural Ecosystems

Many of the ecosystems west of US Highway 36 (Hwy 36) in the North TSA are generally healthy and function naturally. Areas to the east of Hwy 36 are more intertwined with properties that have historically been altered for agricultural production and contain important wildlife habitat and native plant populations. The North TSA provides habitat and refuge to several sensitive species such as Bell's twin pod (plant), bobolink (bird), Northern harrier (raptor), ottoe skipper, arogos skipper, and the prairie rattlesnake. More information about these species is available in the natural resource chapter of the report. Some of these rare or uncommon species

are or can be threatened by high levels of or dispersed visitor activities. A focus of the North TSA Plan is to maintain or increase the level of natural resource protection and restoration in order to continue achieving natural resource conservation goals. The Grassland Ecosystem Management Plan (Grassland Plan) and the Forest Ecosystem Management Plan (FEMP) provide information on natural resource conservation priorities and goals.

Cultural Resources

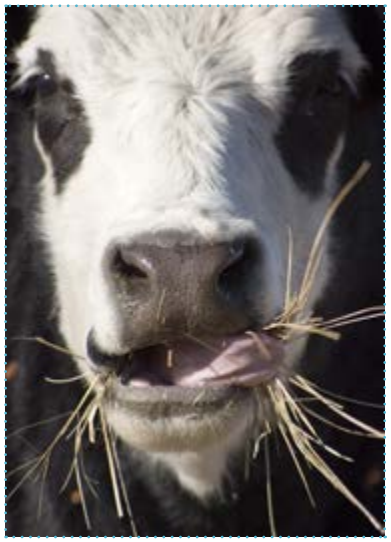
The North TSA contains important paleontological, archaeological and historic resources. There are cultural features and sites that are important to indigenous people, sites and structures indicative of Euro-American settlement, agriculture, transportation and mining. Some well-known North TSA historic sites include the Old Lime Kiln on the Old Kiln Trail and north-south grade built for the failed Lefthand and Middle Park Railroad west of Hwy 36.

Old Lime Kiln, © Sue Hirschfeld

The wide variety of paleontological, archaeological and historic resources creates a fascinating backdrop for people who enjoy the lands of the North TSA. Some of these cultural resources require a higher level of protection, in order to ensure their long-term sustainability.

Agricultural Resources

Historically, agricultural lands in the North TSA have included beef production, dairy farms, sheep, along with poultry operations, horse boarding, dry land grain production, irrigated forage, irrigated grain harvesting and vegetable production. Today, typical agriculture in the TSA is cattle grazing and hay production. In response to an uptick in interest in local foods, there is now a diversified organic farm in the TSA as well. OSMP leases properties to local farmers and ranchers to run agricultural operations, and just over 3,000 acres are part of OSMP agricultural leases in the North TSA. The Grassland Plan and an Agricultural Resources Management Plan—which is in development — provide information on agricultural resources, policies and goals.



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TSA Plans

In 2005, the Boulder City Council approved the Visitor Master Plan (VMP). The VMP created policies, strategies and actions for the department to implement and manage for high-quality visitor experiences while ensuring that the lands are protected and preserved for future generations.

An integral strategy included in the VMP to assist in the implementation of the plan was the creation of TSA Plans. TSA Plans establish visitor access and recreation resource management priorities and projects for specific areas of the OSMP system. To date, three TSA Plans have been completed and are in various stages of being implemented:

- Marshall Mesa/Southern Grasslands TSA;
- Eldorado Mountain/Doudy Draw TSA; and
- The West TSA

Three TSA plans remain—the North, East and South TSAs. The South TSA will integrate the first two plans listed above and adjacent OSMP-managed lands that were not covered in these original plans.

The North TSA Planning Process

The planning process for the North TSA has four phases (Figure I1). The first phase is focused on collecting and compiling information about the TSA. This phase will help inform the development of planning options and scenarios, which in turn will be refined into the draft plan's recommendations. The primary deliverable for the first phase is the North TSA Inventory and Assessment Report.

The second phase identifies the interests in the North TSA and its future management, as well as any specific issues that need to be addressed in the plan. The exploration of interests and issues will further inform and guide the development of plan alternative scenarios. This phase will result in a list of criteria and desired actions to help direct the development of scenarios.

During the third phase, OSMP staff, the community and the Open Space Board of Trustees (OSBT) will generate and assess potential scenarios that achieve planning objectives and community interests. This part of the planning process will conclude with the completion of a draft plan.

The fourth and final phase includes the review of the draft plan by the community, the OSBT and recommendation and acceptance of the plan by the Boulder City Council.

PLANNING PROCESS

Figure 11: Planning Process

Phase 1 Inventory and Assessment

PURPOSE: Share knowledge of the current conditions of recreational, natural, cultural and agricultural resources.

RESULTS: Inventory and Assessment Report.

KEY INPUTS:

- Community knowledge of visitor experiences, resources, what is functioning well in the North TSA and what needs improvement.
- Staff-prepared information on recreational, natural, cultural and agricultural resources.

Phase 2 Interests and Issues

An interest is the WHY behind the WHAT.
An issue is WHAT may need to be changed.

PURPOSE: Share knowledge about desired outcomes and topics that will guide the development and assessment of alternative scenarios and recommendations for the draft plan.

RESULTS: Desired actions for consideration in scenario development.

KEY INPUTS:

- Community interests about desired plan outcomes and why the outcomes are wanted.
- Discussion of issues that could pose a challenge in the North TSA.
- Community dialogue about what is learned and can be implemented in the North TSA and why.

Phase 3 Draft Plan Development

A scenario is a set of potential actions that addresses interests and issues.

PURPOSE: Assess alternative scenarios and integrate preferred recommendations into a draft plan.

RESULTS: Preferred scenarios compiled into a draft plan.

KEY INPUTS:

- Draft alternative scenarios developed by staff to achieve identified interests and objectives.
- Community feedback on draft scenarios to inform preferred scenarios and recommendations.

Phase 4 Plan Acceptance

PURPOSE: Review draft plan and approve final plan.

RESULTS: Final North Trail Study Area Plan.

KEY INPUTS:

- Community review.
- Open Space Board of Trustees review and approval.
- City Council review and acceptance.

The North TSA after the 2013 Flood

The September 2013 flood brought unprecedented rainfall to the region and caused severe flooding and extensive damage to the Boulder Valley and OSMP trails, trailheads, irrigation facilities, fences. The floods also caused ecological changes to areas inundated with water and debris. Landscapes and visitor infrastructure within or adjacent to streams and drainages were significantly impacted and in some locations irreversibly altered. After the flood, the Boulder community actively engaged in recovery efforts to repair and restore OSMP resources.

OSMP promptly restored nearly all visitor access to OSMP lands. In most areas, visitor access was restored after rapid action was taken to mitigate hazards and implement temporary repairs. Longer-term and lasting repairs of OSMP trails and trailheads has proceeded at a slower, yet steady pace as funding, staffing, contracting resources and environmental conditions allow. The number of sites and extensive amount of work necessary means that repair and restoration work will continue into the future.

The flood also made the information about conditions of designated trails and locations of undesignated trails in the North TSA instantly out of date. Trail condition monitoring of designated trails was prioritized over the re-surveying of undesignated (unmanaged) trails after the flood when staffing capacity was unavailable to do both. Thus, most of the undesignated trail information presented in the North TSA inventory is derived from pre-flood data. Similarly, the available data on trails accessible for people with disabilities was assessed prior to changes resulting from flood impacts.

Foothills South Trail before 2013 flood, photo: OSMP

Foothills South Trail after 2013 flood, photo: OSMP

Community Assessment

This report includes a section summarizing information shared by the public about their knowledge of current conditions in the North TSA and their experience about what is valued and is important to retain, maintain and improve. Input from community members was gathered through the following engagement opportunities:

- The city's internet-based participatory platform called **Inspire Boulder**
- The North TSA website comment form and/or email
- On-site and local store-front engagement
- Community workshops
- Youth engagement via the Youth Opportunities Advisory Board (YOAB)

Inspire Boulder is a digital town hall and community engagement platform that has been successfully used by the City of Boulder in numerous planning efforts and allows feedback through a variety of online input tools. Additionally, staff went out to trailheads in the North TSA and area coffee shops and stores. Staff set up posters and had outreach information on the TSA Plan to encourage community members to provide their input. OSMP staff and the OSBT hosted two facilitated workshops where participants shared their collective knowledge about the North TSA and their experiences (Table I1).

Table I1. North TSA Assessment Workshop Purpose and Deliverable

Workshop Topic	Workshop Purpose	Workshop Deliverable
Assessment	Learn about the community's knowledge of conditions in the North TSA. Answer the question: "Where are problems and where are great things to be maintained in the North TSA?"	Community information on the condition of recreational, natural, cultural and agricultural resources. Identified areas of concern and areas of importance.

Photo: Phillip Yates (OSMP)

Post Acquisition Property Planning and Area Management Designations

Newly acquired properties need to be integrated into the OSMP system and determinations made about how best to manage the properties' resources and visitor access opportunities. This is accomplished by assessing the natural, cultural and agricultural resources of the property, compatibility with visitor access opportunities and any constraints that need to be addressed. The assessment then allows determinations on how the property can best contribute to the conservation of resources and the delivery of community services as guided by the policies and strategies of the VMP, Grassland Plan and FEMP as well as other community adopted plans.

The VMP established the policy that plans would be developed for newly acquired properties. The process would include an assessment of the property and recommendations for public access, and any appropriate infrastructure and services necessary for managing access. Newly acquired property would remain closed to the public until the relevant planning had been completed and on the ground actions had been implemented. Planning would also recommend the VMP management area designations if that step had not been taken previously.

The OSMP Acquisition Update 2013-2019 included the option of using a more system-wide framework for integrating new properties into the OSMP system by including them in a broader planning process such as TSA plans. The North TSA includes properties that fit into various stages of assessment, planning and management area designation.

The North TSA Plan will include three general types of property-specific outcomes:

1. Recent acquisitions currently closed to public access;
2. Acquisitions without management area designations; and
3. A property complex (Joder and Cox properties) with a management area designation that will be reviewed.

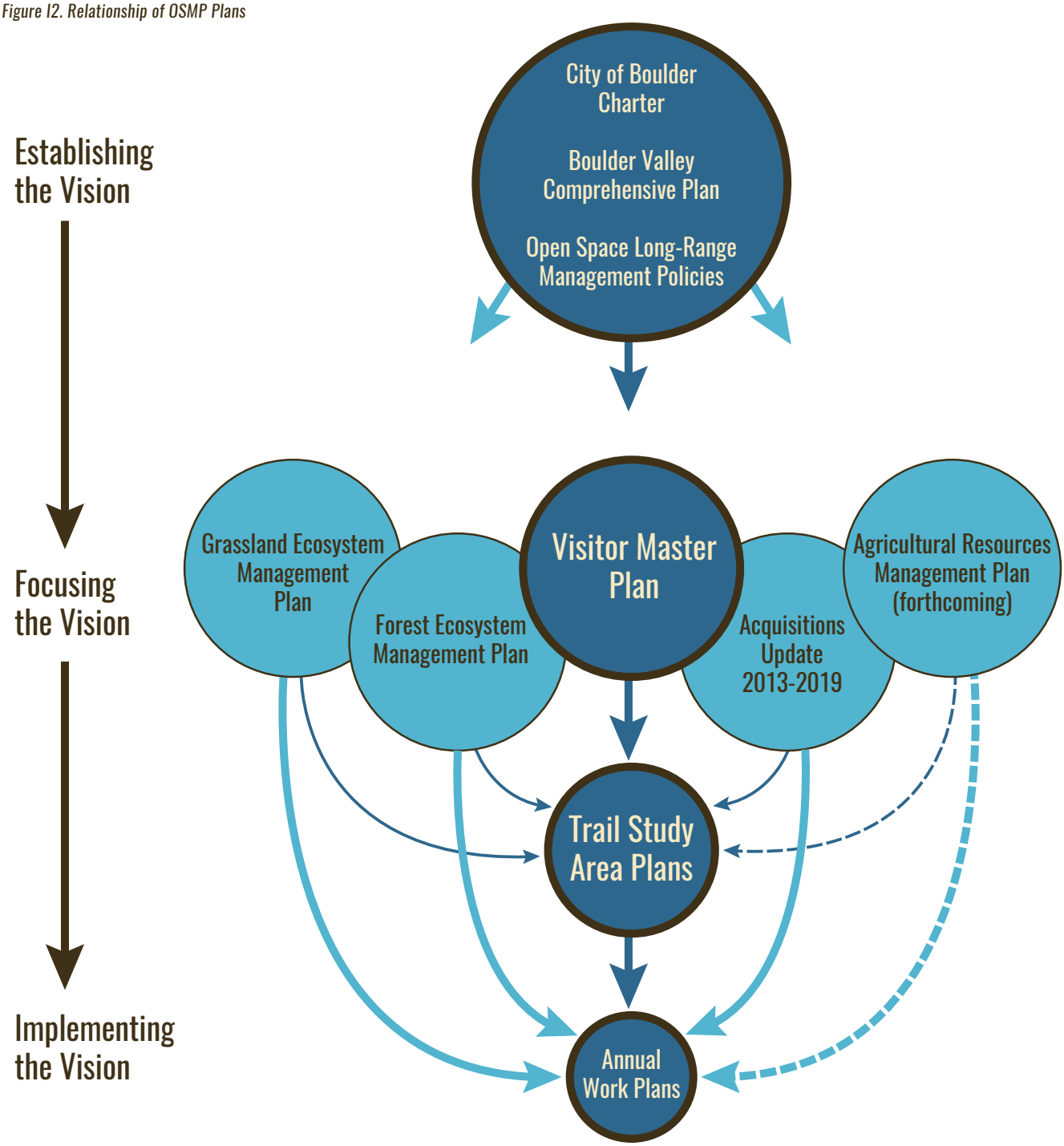
The North TSA Plan will include recommendations for these properties to determine management area designations and public access.

Existing Planning and Policy Guidance

The North TSA Plan will be affected and influenced by other OSMP departmental master, area, resource and program management plans. Other shared community visions that must be considered and, as appropriate, integrated into recommendations in the North TSA Plan include City of Boulder master plans and the Boulder Valley Comprehensive Plan. OSMP staff will also be consulting with partner agencies and looking at other relevant plans in the North TSA to determine how to best coordinate with them.

The VMP developed a framework to deliver visitor services and manage visitor facilities in a manner consistent with the conservation of natural, cultural and agricultural resources. TSA Plans provide a means for area-specific implementation of the strategies and policies contained in the VMP. TSA Plans are also the way to integrate the goals and objectives relevant to visitor access and infrastructure management from OSMP resource plans including the Grassland Plan, FEMP and the forthcoming Agricultural Resource Management Plan (Figure I2). A complete list of the plans and policies and their specific guidance relevant to the North TSA planning process can be found in I-Appendix A.

Figure I2. Relationship of OSMP Plans



North TSA Properties, Easements and Legal Agreements

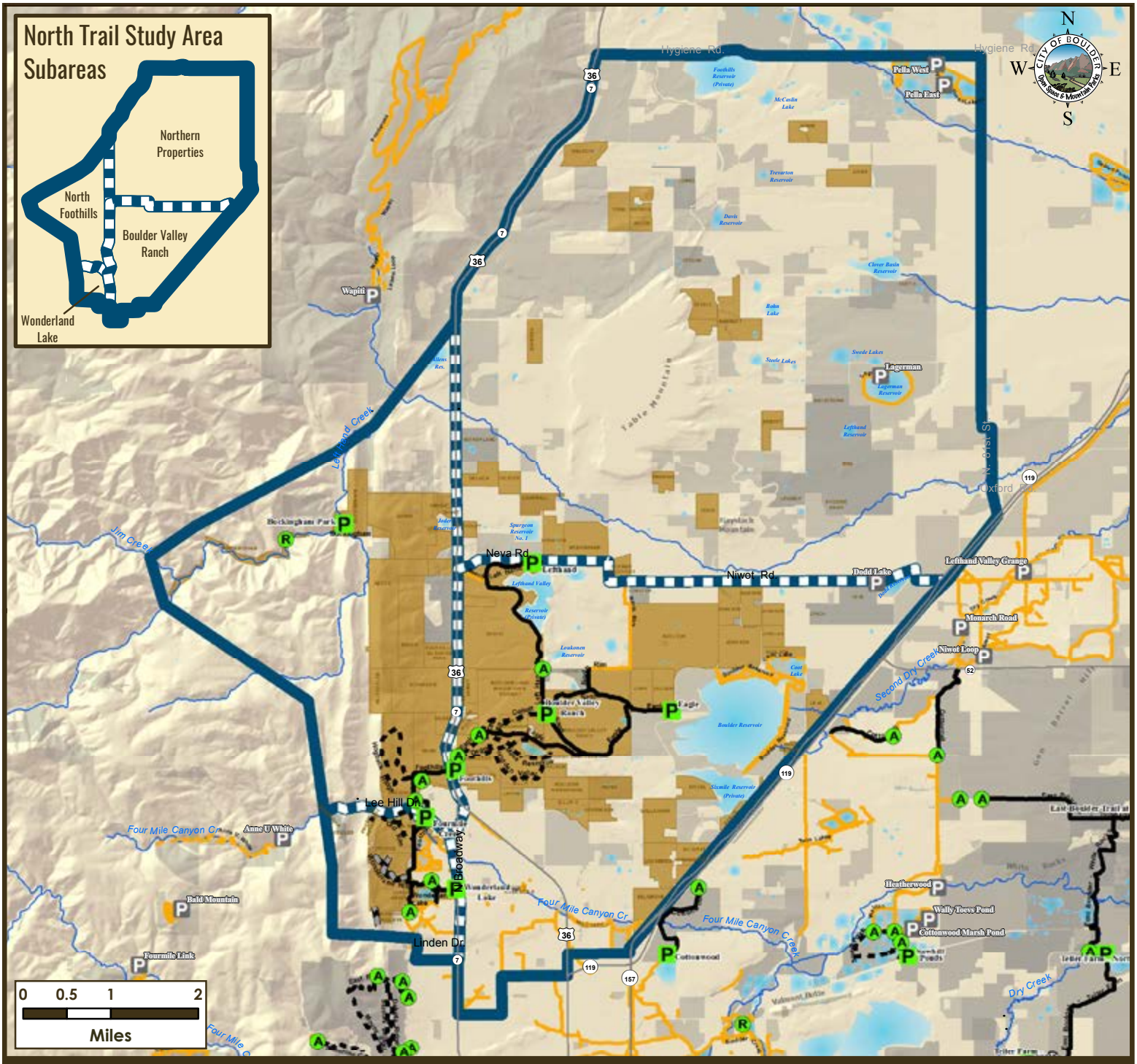
Acquisition of four key properties in 1973—known as the Boulder Valley Ranch/Lore, Boulder Land Irrigation and Power, Gilbert and Mann properties—encompassed the nearly 1,400-acre foundation around which most of the North TSA properties have since been added. The city has been acquiring land through purchases, donations and easements. OSMP uses a number of real estate techniques to acquire and protect lands as city open space. Techniques include:

- fee acquisitions;
- conservation easements and development rights agreements;
- trail easements;
- dedications;
- grants; and
- partnerships.

Details about how properties are acquired and acquisition priorities can be found in the **Open Space and Mountain Parks Acquisition Update 2013-2019**.

The North TSA map includes OSMP fee owned or managed properties included in the North TSA planning area (Figure I3). Properties owned jointly with Boulder County are included in the North TSA when an intergovernmental agreement identifies OSMP as the property manager and therefore, the rules, regulations, policies and plans of the managing agency apply to the property. In some cases OSMP has acquired properties where the seller has kept or another entity owns certain property rights. Information about North TSA properties with easements, right-of-ways or legal agreements that may be relevant to recreation and visitor access planning is included in this inventory report.

(opposite) Figure I3. North TSA Plan Property Map



MAP G1: PROPERTY MAP

- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

User: GardE1 Date: 6/12/2015 Path: E:\MapFiles\TSA\NorthTSA\InventoryReport\Other\NorthTSA_SimpleBasemap_8x11.mxd

Next Steps after the Inventory and Assessment

As the first phase of the North TSA planning process concludes with the completion of the Inventory and Assessment Report, the next phase begins. The next phases will capture interests and issues for alternative scenario building and evaluation that will ultimately lead to the recommendations in the draft plan. The plan is to provide a cohesive set of on-the-ground actions that will provide overall improvement in conditions for recreational, natural, cultural and agricultural resources.

Once the plan is adopted, management actions are prioritized for implementation, and scheduled for completion in the OSMP budget and work plan. Success of the recommended management strategies and actions are assessed over time and adjusted if necessary to improve effectiveness. The plan implementation recommendations and actions could be revised with course corrections as needed.

Next Steps

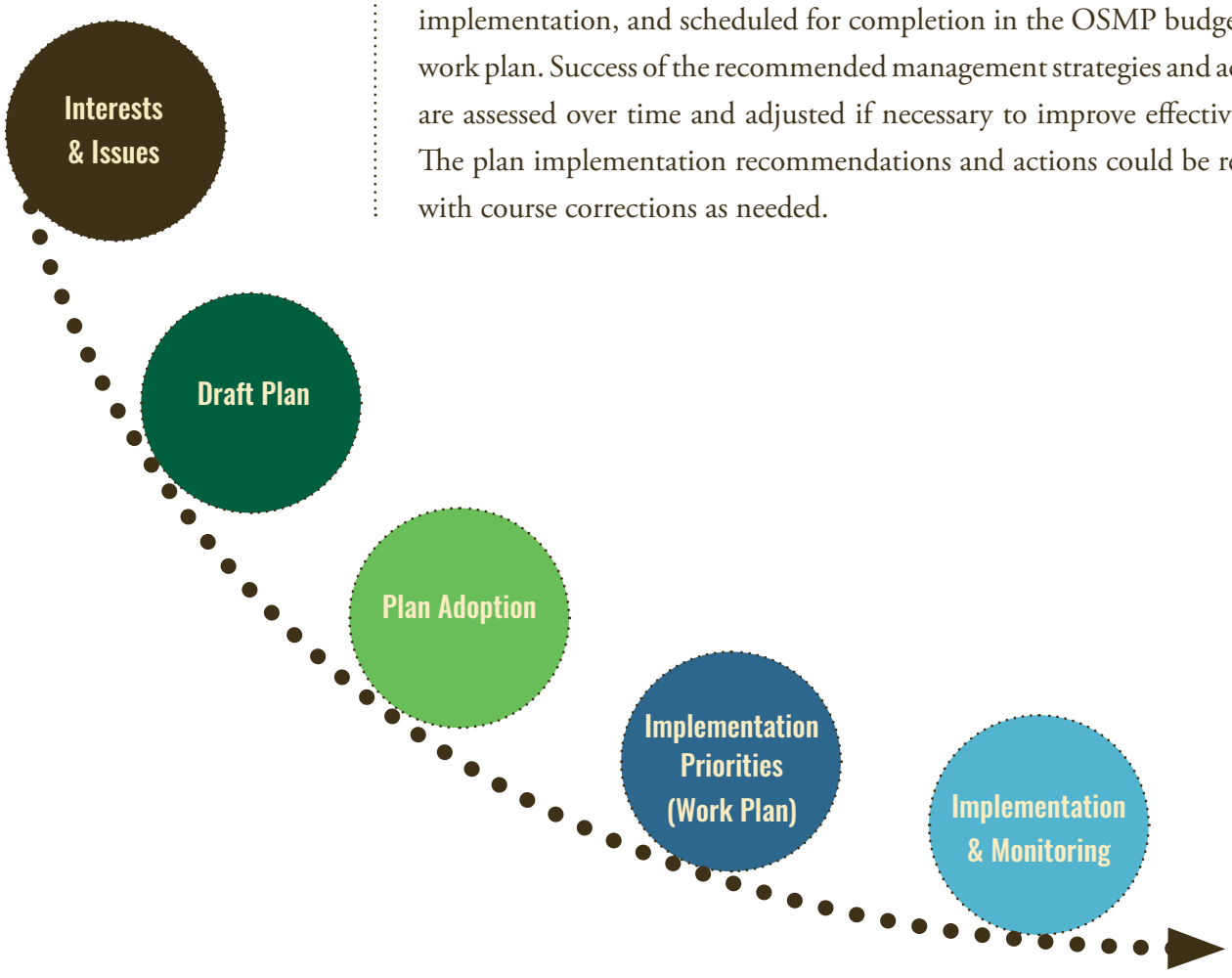


Photo credit: Phillip Yates (OSMP)

Recreational Resources

Introduction

OSMP manages a system of trails, trailheads, access points and other recreational facilities to support and enhance the visitor's experience in the North TSA. The TSA is popular for an assortment of recreational activities including hiking, biking, running, dog walking, horseback riding, picnicking and nature study. There are **19 miles of designated trails** that provide access to a variety of destinations and make connections within the TSA and with neighboring trails managed by other agencies. Entry into the North TSA is supported by seven trailheads and seven access points for visitors to experience the activities they enjoy. Approximately one fifth or nearly 1 million of the total annual person-visits to OSMP occur in the North TSA.

photo: Deryn Wagner (OSMP)

The diversity of landscapes in the North TSA offers a range of recreational experiences and settings for visitors. Settings include the Wonderland Lake area with trails circling around the lake interconnecting access to several adjacent neighborhoods. Foothills Trail connects Wonderland Lake to the trails of Boulder Valley Ranch and serves as a connecting trail for visitors seeking to explore the more rugged Old Kiln or Hogback trails that climb the adjoining foothills. The expanse of the greater Boulder Valley Ranch area includes agricultural settings and rolling grasslands and trails interconnecting through this area.

The Recreation Resource chapter of the North TSA Inventory and Assessment Report offers an overview of factors that contribute to visitors' experiences, access to the TSA and the recreational setting. Factors include the physical, social and managerial settings visitors experience and the infrastructure and services that support recreational opportunities. The recreation resource information will be presented using guidance from a recreation management framework developed to manage settings for specific visitor experiences. The Recreation Opportunity Spectrum (ROS) focuses on what land managers can do to manage visitor experience through facilities, social and ecological conditions. The ROS framework will be used in combination with VMP management area designations to assess and describe North TSA recreational resources.

Recreation Opportunity Spectrum Framework

The ROS Framework (Figure R1) was primarily developed by the United States Forest Service in the late 1970s in response to regulations mandating the consideration of recreation effects when making management decisions. ROS provides a logical framework for planning, decision-making and managing for a diversity of recreation experiences by creating zones of opportunity (R-Appendix A). The ROS is based upon the idea that a recreation setting is made up of three types of attributes, each occurring along a range, or spectrum, of values. The types of attributes are biophysical, social and managerial.

photo: Phillip Yates (OSMP)

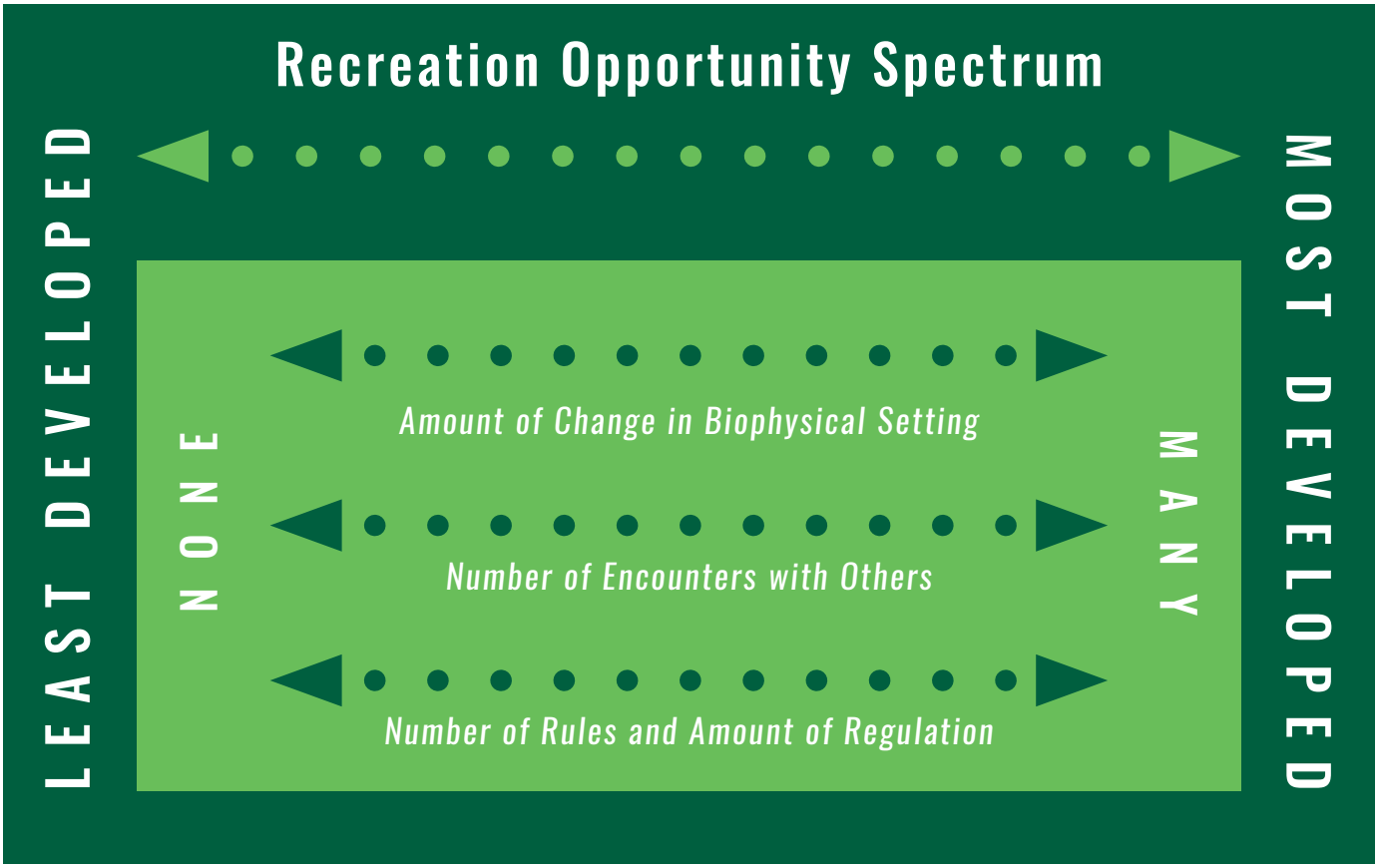


Figure R1. The ROS represents a range of biophysical, social and managerial attributes, the combination of which give rise to a spectrum of recreational settings (McCool et al. 2007)

According to the ROS framework, taken together an area's attributes and characteristics:

- » contribute to a range of conditions with a range of potential recreational outcomes and benefits;
- » can facilitate or hinder experiences, outcomes and satisfaction levels; and
- » are a major factor affecting the choices by visitors about where they go and the activities they enjoy on OSMP lands (Clark & Stankey 1979).

The ROS framework when applied to a geographic area allows policies and programs to be targeted to area-specific interests and recreation services. This approach can provide land managers with a context for deciding which visitor activities are most suitable in a particular location and what conditions will maximize both resource sustainability and quality visitor experiences. The VMP management area designations can help provide the foundation for which recreational opportunities are considered and where they are considered.

VMP Management Area Designations

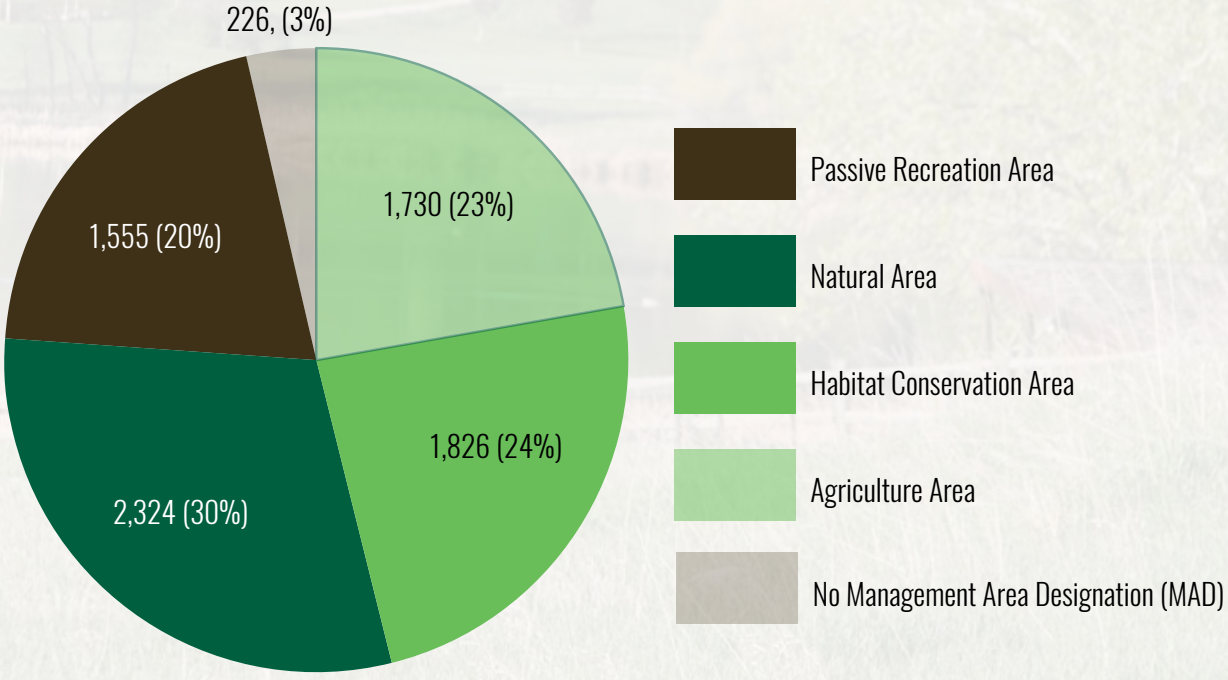
Managing recreation on public lands using management area designations has been common on public lands for several decades (Clark & Stankey 1979, USDI NPS 1997, Stankey et al. 1985). Protection, preservation, and management of city lands and provision of passive recreation opportunities, as defined by the City Charter, are fundamental goals for OSMP. When drafting the VMP, OSMP developed an area management system to guide implementation of visitor services and future TSA planning processes (City of Boulder 2005). Management area designations describe a management emphasis for different areas within the OSMP land system, based on open space charter purposes (e.g., provision of quality passive recreational opportunities, preservation of agriculture and protection and restoration of natural systems) (R- Appendices B and C).

The OSMP management area system includes four unique area designations—Passive Recreation, Natural, Habitat Conservation and Agricultural. It provides a structure for the development and implementation of management strategies along with setting priorities for visitor infrastructure improvements and service delivery (Map R1).

Management area designations also describe the strategies designed to enhance visitor experiences and foster compatibility of visitor activities with resource protection. These strategies, as applied in a given management area, are based on each area's characteristics and management needs.

Most of the lands in the North TSA (97 percent) are categorized under one of four management area designations that were identified in the VMP (Figure R2). (See Map R1).

Figure R2. Percent of North TSA Acres within each OSMP Management Area Designation



When planning for recreation activities in the North TSA, the biophysical, social and managerial attributes and characteristics will be discussed as visitor experience factors. Visitor experience factors that are important to assess include:

- visitation levels;
- visitor characteristics;
- level of access;
- level of development (trails, facilities, access roads);
- designated trail extent and density;
- undesignated trail extent and density;
- regulatory setting;
- remoteness;
- on-/off-trail access;
- dog management;
- ecosystem block size;
- motivation for visit;
- recreation conflict; and
- visitor infrastructure condition.

photo: Deryn Wagner (OSMP)

Visitor Experience Factors

Visitation and Recreation Opportunities

OSMP and North TSA Visitation Numbers

Across Entire North TSA

Approximately 20 years ago, the North TSA received an estimated 315,000 annual visits (City of Boulder 1994, Zeller et al. 1993). The North TSA is estimated currently to receive approximately one fifth of the total number of person-visits annually to OSMP, which is estimated to be roughly one million visits (Vaske, Shelby & Donnelly 2009). The majority of these visits occur in the areas around Wonderland Lake, Boulder Valley Ranch (BVR) and the North Foothills Trail. The North TSA has a relatively high level of visitation (20 percent of all OSMP visitation) as a function of trails (13 percent of all OSMP designated trail miles).

Visitation at Select Locations

From Aug. 11, 2006 to Aug. 10, 2007 OSMP staff conducted a visitation study along the undesignated trail known as the Beech railroad grade in anticipation of the North TSA. The results of that study estimated the number of annual visits at approximately 8,000. Because the start of the North TSA Plan was delayed, visitation on this trail was re-monitored in a later study.

From 2012 to 2014, OSMP staff and researchers conducted two new visitation studies to understand current visitation levels at specific locations within the North TSA.

- A year-long study conducted during 2012/2013 at one designated and eight undesignated locations in the North TSA to estimate baseline visitation numbers (Figure R3).
- A six-month long study conducted during 2014 at 13 designated locations in the North TSA to update the 2004/2005 visitation data and estimate activity distributions and parking lot/area visitation (Figure R4).

Figure R3. North TSA 2012/2013 Visitation Study Locations

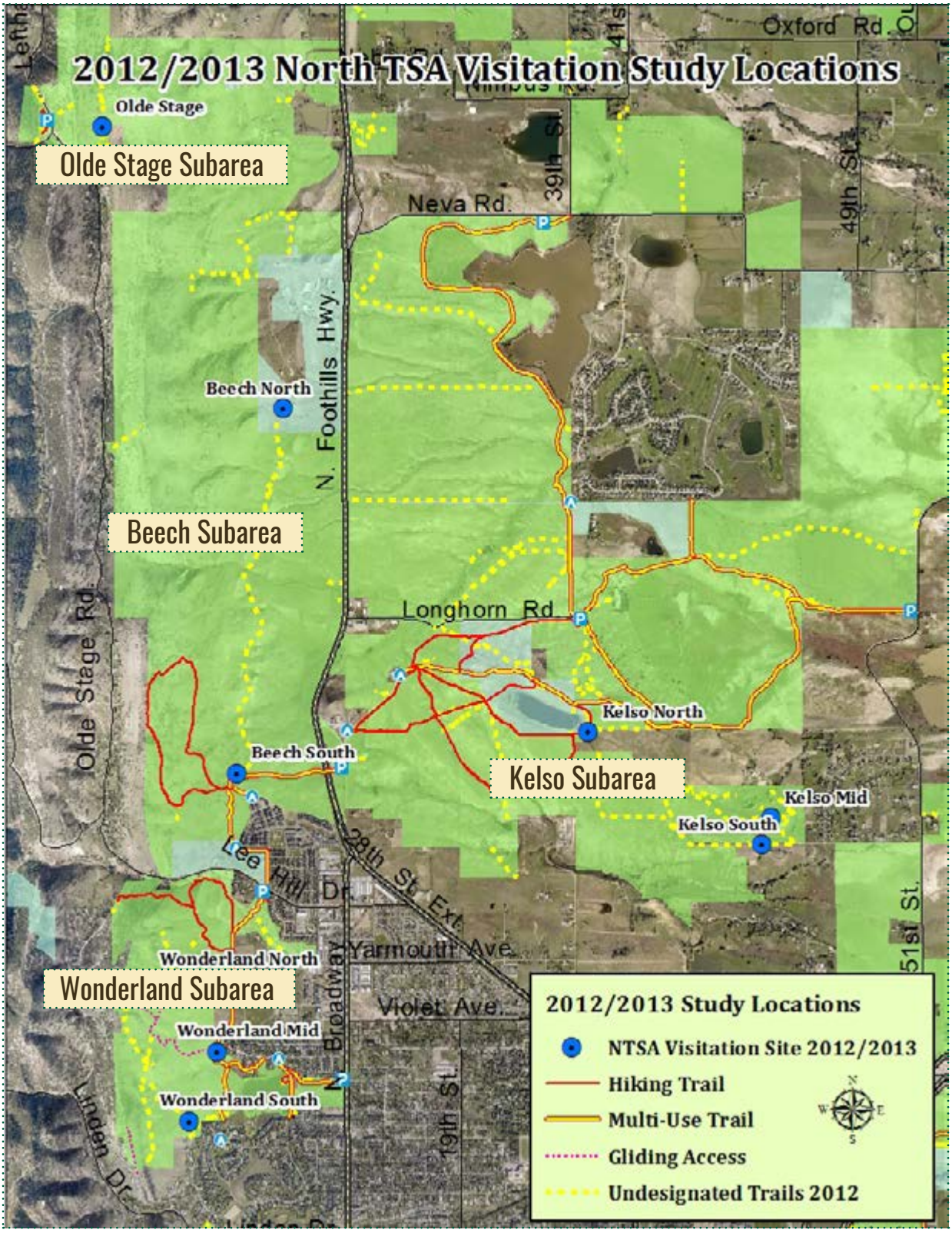


Figure R4. North TSA 2014 Visitation Study Locations

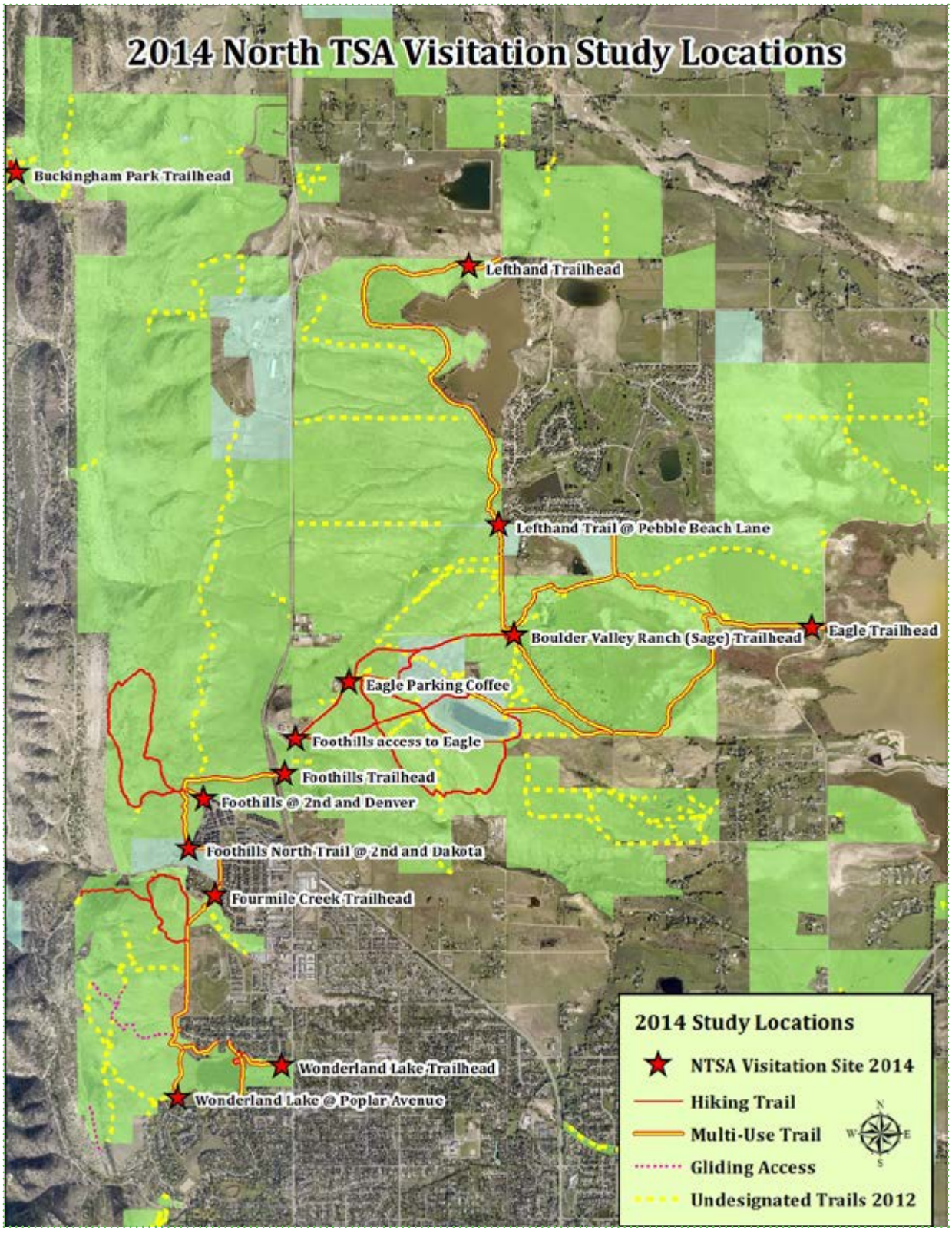


photo: Phillip Yates (OSMP)

2012/2013 Visitation Study

Data for this project were collected 24 hours per day using automated trail monitors at nine locations from June 9, 2012 to June 8, 2013 (Figure R3). For analysis and reporting, these nine locations were grouped into four subareas of the North TSA.

All four of the subareas had similar day-of-week visitation distributions, and had greater visitation on weekend days and had the greatest visitation on Sundays (Table R1). Observed day of week distributions were also very similar to OSMP system-wide distributions.

Table R1. Estimated Annual Person-visits per North TSA Subarea by Day of Week

Day of week	Beech	Kelso	Olde Stage	Wonderland
Monday	1,243	826	207	2,573
Tuesday	1,364	966	237	2,626
Wednesday	1,304	832	199	2,647
Thursday	1,534	928	227	2,658
Friday	1,417	920	254	2,890
Saturday	2,317	1,192	310	3,967
Sunday	2,598	1,282	348	4,818
*Annual Total**	*11,776*	*6,946*	*1,782*	*22,178*

**Annual total estimates are based on counts from eight undesignated and one designated trail. Estimates do not represent visitation for all entry points or the entire North TSA.*

These four subareas also had fairly similar seasonal visitation distributions (Figure R5), with each season receiving between 20-30 percent of the total visitation.

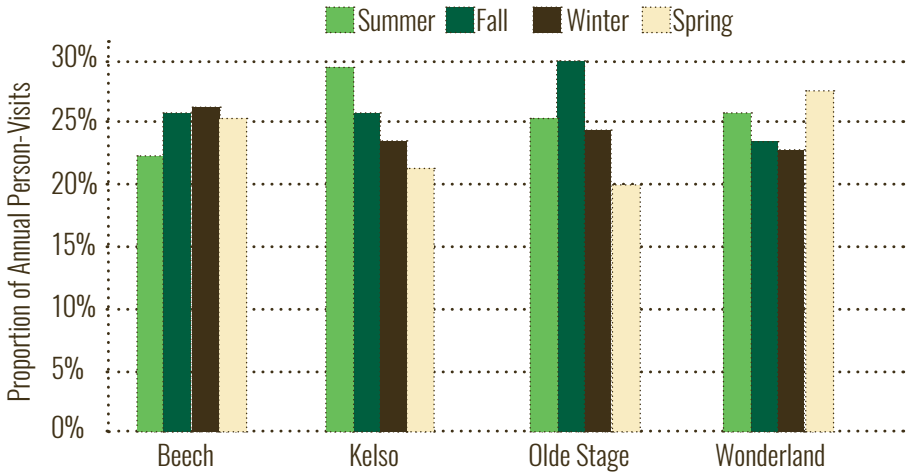


Figure R5. North TSA Visitation Distribution by Season During 2012/2013

2014 Visitation Study

Data for this project were collected with direct observations during sampled daylight hours at 13 locations from June 1, 2014 to Nov. 30, 2014 (Figure R4). Night-time visitation was not observed and these hours were estimated using the hourly OSMP system-wide average visitation rate results from the 2004/2005 visitation study (R-Appendix D).

Estimated Visitation

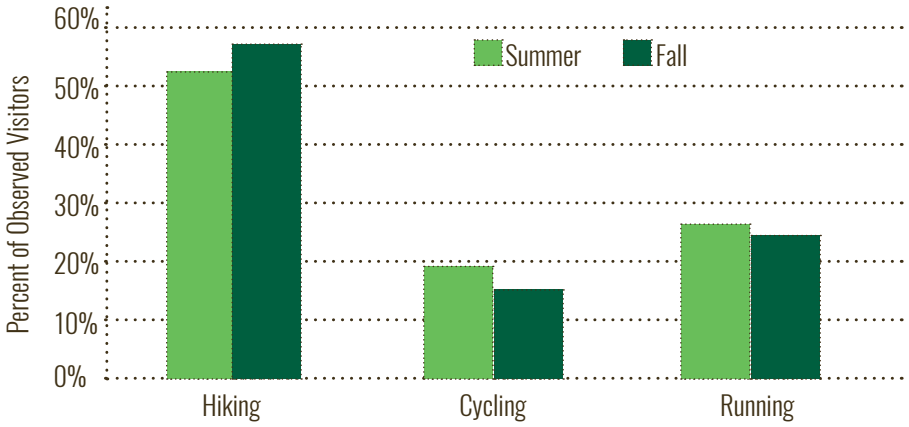
Most 2014 locations had fairly similar visitations levels during the summer and fall seasons (Table R2). Between June and November 2014 the fall season afternoon/evening hours were the busiest followed by the summer season morning hours. Across all sites, weekend days were generally 50- to 100-percent busier than weekdays. Notable differences occurred at the "Eagle Parking Coffee" and Buckingham Park Trailhead sites where fall visitation levels were much lower than summer levels. The Wonderland Lake sites were the busiest and the Lefthand Trail sites were the least visited.

Results from the 2014 and 2004/2005 can be compared relatively as two snapshots in time (Table R2). Visitation levels at Fourmile, BVR (Sage) and Lefthand trailheads had fairly similar visitation rates in 2004/2005 and 2014. The Wonderland Lake Trail at Poplar Avenue, Eagle Trailhead and Foothills Trailhead had more recorded visits.

Activity Distribution

Overall, hiking was the dominant activity followed by running and cycling (Figure R6). All three activities were fairly consistent across the summer and fall seasons. Of the more than 9,000 visitors observed during the 2014 study, less than one percent were equestrians and about two percent were visitors engaged in other activities (e.g., fishing) or OSMP staff. Dog walking was not considered a unique activity for this project.

Figure R6. Estimated percentage of total visitors observed for each activity during each monitoring season (2014)



Site Name	2004/2005 Entire Year	2004/2005 Summer	2014 Summer	2004/2005 Fall	2014 Fall
Wonderland Lake Trail at Poplar Avenue	98,435	27,256	45,462	25,040	41,229
Fourmile Trailhead	90,654	23,517	24,550	22,370	26,609
BVR (Sage) Trailhead	69,180	19,028	18,052	16,732	20,325
Eagle Parking Coffee	52,726	14,950	11,662	13,092	6,601
Eagle Trailhead	38,911	9,112	16,216	8,605	14,155
Foothills Trailhead	23,774	6,485	8,314	5,654	9,471
Lefthand Trailhead	11,780	3,366	3,978	3,216	3,853
Buckingham Park Trailhead	N/A	N/A	8,485	N/A	4,394
Wonderland Lake Trailhead	N/A	N/A	32,074	N/A	28,148
Foothills at Second and Denver	N/A	N/A	4,675	N/A	5,348
Lefthand Trail at Pebble Beach Lane	N/A	N/A	2,459	N/A	731
Foothills access to Eagle	N/A	N/A	5,965	N/A	9,838
Foothills at Second and Dakota	N/A	N/A	13,440	N/A	6,281

Table R2. Number of Person-visits for the 2014 Study Sites During Summer and Fall Seasons for the 2004/2005 and 2014 Visitation Studies and for the Entire Year of 2004/2005

Estimated Dog Visitation

Across the six-month study period, the Boulder Valley Ranch (Sage) Trailhead, followed by the Wonderland Lake sites received the greatest numbers of dog visits (Table R3). The Lefthand Trail sites had the fewest dog visits (and recreation visits). The Lefthand Trail sites also had the lowest compliance with on-leash regulations. Where voice and sight control is an option—dogs can always be leashed where they are allowed on OSMP lands — the Eagle Trail sites had the highest proportions of off-leash dogs and the "Foothills at Second and Dakota" site had the fewest.

During the summer season, about 20 percent of all visitors observed had one or more dogs with them. During the fall season this proportion was 26 percent. These percentages are somewhat lower than the 2010/2011 visitor self-reported average of 30 percent (Table R10) (Giolitto 2012). The 2010/2011 survey project was not designed to analyze dog visit data at the site level. For more information about the 2010/2011 Visitor Survey see R-Appendices E and F.

Table R3. Estimated Number of Dog Visits and the Percent Off-leash During the Summer and Fall Seasons of the 2014 Visitation Study

Site Name	2014 Summer Number of Dog Visits	2014 Fall Number of Dog Visits	Six-month Total Number of Dog Visits	2014 Summer Percent Off Leash	2014 Fall Percent Off-Leash
*Wonderland Lake Trail at Poplar Ave**	7,169	6,766	13,935	5	4
*Fourmile Trailhead**	2,295	4,229	6,524	9	1
BVR (Sage) Trailhead	5,683	8,433	14,116	48	41
Eagle Parking Coffee	3,605	4,094	7,698	61	65
Eagle Trailhead	2,603	3,577	6,181	45	57
Foothills Trailhead	833	1,377	2,209	47	54
*Lefthand Trailhead**	626	321	948	31	0
*Buckingham Park Trailhead**	1,019	314	1,333	6	0
*Wonderland Lake Trailhead**	4,325	5,968	10,293	0	4
Foothills at Second and Denver	770	1,075	1,845	38	56
*Lefthand Trail at Pebble Beach Lane**	363	240	603	0	18
Foothills access to Eagle	1,861	4,379	6,240	41	63
Foothills at Second and Dakota	2,825	1,878	4,703	35	30

* Dog on leash requirements in effect at this site.

Parking Lot Capacity

Across all locations and more than 200 monitoring shifts, parking areas were observed at or exceeding capacity a total of 14 times (Figure R7).

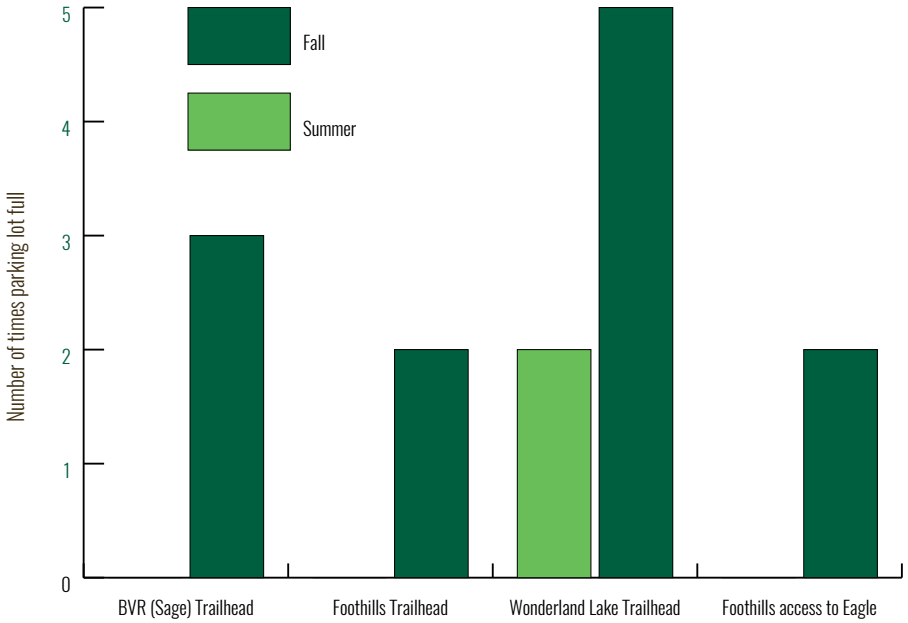


Figure R7. Number of Times Parking Lot was at or Exceeding Capacity During Entire Study Period and the Locations Where this Occurred

Horse trailers and large occupancy vehicles

Six 10- to 15-passenger vans (three at Fourmile Trailhead and three at Wonderland Lake Trailhead) and 10 horse trailers (three at Eagle Trailhead and seven at Lefthand Trailhead) were counted during the summer 2014 data collection period.

For the fall data collection period, there were a total of eight horse trailers observed (four at Fourmile Trailhead, two at Lefthand Trailhead and two at Eagle Trailhead) and no large occupancy vehicles (i.e. 10-15 passenger vans) recorded.

Visitor Characteristics

Compared to the system-wide averages, the North TSA has many more visitors arriving from within the City of Boulder and fewer visitors from out of county areas (Table R4); (Giolitto 2012). See R-Appendix G for additional visitor characteristic information for all TSAs.

Table R4. OSMP Visitor Residency by TSA (2012)

Area	Type of Measure	Visitor Residency						
		Boulder Within City Limits	Boulder County Outside city limits	Metro Denver	Other area in CO	Out of State	Out of Country	Total
North TSA	Count	312	73	13	9	19	2	428
	Percent	72.9%	17.1%	3.0%	2.1%	4.4%	.5%	100%
All TSAs Combined	Count	1493	471	220	92	209	37	2522
	Percent	59.2%	18.7%	8.7%	3.6%	8.3%	1.5%	100%

As shown in Table R5, the North TSA is visited by more people over 30 years of age and fewer people between <20-29 years compared to all OSMP areas (Giolitto 2012).

Table R5. Proportion of Visitors in each Age Group by TSA (2012)

Area	Type of Measure	Age Category							
		<20	20-29	30-39	40-49	50-59	60-69	70+	Total
North TSA	Count	2	34	94	94	110	65	20	419
	Percent	.5%	8.1%	22.4%	22.4%	26.3%	15.5%	4.8%	100%
All TSAs Combined	Count	51	423	505	526	534	319	89	2,447
	Percent	2.1%	17.3%	20.6%	21.5%	21.8%	13.0%	3.6%	100%

Visitors that completed a visitor survey at a North TSA data collection site were more likely, compared to the average of all visitors surveyed across OSMP, to report visiting OSMP more than 12 times a month and were the most likely of any individual TSA to report more than 20 monthly visits. However, because respondents were not asked where all of their monthly visits took place, it cannot be determined with certainty how many of their total reported visits occurred in the North TSA. It is known that visitors in the North TSA on the day of the survey reported the most frequent OSMP visitation (Table R6).

Table R6. Number of Visits to OSMP per Month by TSA (2012)

Area	Type of Measure	Number of Visits per Month					Total
		0-1	>1-4	>4-12	>12-20	>20	
North TSA	Count	36	49	110	106	126	427
	Percent	*8.4%*	*11.5%*	*25.8%*	*24.8%*	*29.5%*	*100%*
All TSAs Combined	Count	432	435	676	518	457	2,518
	Percent	*17.2%*	*17.3%*	*26.8%*	*20.6%*	*18.1%*	*100%*

photo: Deryn Wagner (OSMP)

More survey respondents in the North TSA also reported visiting OSMP for more than 20 years compared to survey respondents from all other TSAs (Giolitto 2012) (Table R7). Again, because visitors were not asked to describe where their visits took place, it is not known how many of their reported years visiting OSMP included visits to the North TSA. It is known that visitors in the North TSA on the day of the survey reported visiting OSMP for a longer number of years than survey respondents from other TSAs.

Table R7. Number of Years Visiting OSMP by TSA (2012)

Area	Type of Measure	Number of Years Visiting OSMP						Total
		1 or less	>1-2	>2-5	>5-10	>10-20	>20	
North TSA	Count	54	19	60	71	107	118	429
	Percent	*12.6%*	*4.4%*	*14.0%*	*16.6%*	*24.9%*	*27.5%*	*100%*
All TSAs Combined	Count	389	160	342	403	619	601	2,514
	Percent	*15.5%*	*6.4%*	*13.6%*	*16.0%*	*24.6%*	*23.9%*	*100%*

photo: Phillip Yates (OSMP)

Visitor Trip Characteristics

North TSA visitors include more bikers and runners, fewer hikers and about an equal proportion of dog walkers compared to the entire OSMP system (Giolitto 2012) (Table R8).

Table R8. Visitor Self-reported Primary Activity by TSA (2012)

Area	Type of Measure	Primary Activity							Total
		Biking	Climbing/ Bouldering	Hiking	Horseback Riding	Running	Walking Dogs	Other*	
North TSA	Count	57	1	141	1	103	77	26	406
	Percent	*14.0%*	*.2%*	*34.7%*	*.2%*	*25.4%*	*19.0%*	*6.4%*	100%
All TSAs Combined	Count	241	46	940	1	412	427	208	2,275
	Percent	*10.6%*	*2.0%*	*41.3%*	*.0%*	*18.1%*	*18.8%*	*9.1%*	100%

**Includes activities such as wildlife viewing, socializing or picnicking*

Compared to all TSAs combined, visitors to the North TSA are more likely to arrive alone and less likely to have two or more people in their group (Giolitto 2012) (Table R9).

Table R9. Number of People in Group by TSA (2012)

Area	Type of Measure	Number of People in Group				Total
		1	2	3 or 4	5+	
North TSA	Count	264	143	23	2	432
	Percent	*61.1%*	*33.1%*	*5.3%*	*.5%*	*100%*
All TSAs Combined	Count	1,187	934	282	123	2,526
	Percent	*47.0%*	*37.0%*	*11.2%*	*4.9%*	*100%*

Almost one third of North TSA visitors had a dog in their party while on their visit. Slightly more than 5 percent of visitors have two or more dogs in their party and this is slightly less than the system-wide estimate of dogs with visitor parties (Giolitto 2012) (Table R10).

Table R10. Number of Dogs with Visitor by TSA (2012)

Area	Type of Measure	Number of Dogs				Total
		0	1	2	3+	
North TSA	Count	303	110	19	3	434
	Percent	*69.8%*	*25.3%*	*4.4%*	*.7%*	*100%*
All TSAs Combined	Count	1,726	607	154	35	2,516
	Percent	*68.6%*	*24.1%*	*6.1%*	*1.4%*	*100%*

Visitors to the North TSA are more likely to arrive to OSMP on foot and less likely to arrive by car (Giolitto 2012) when compared to all visitors. The North TSA has more visitors arriving on foot than any other TSA (Table R11).

Table R11. Mode of Transportation to OSMP (2012)

Area	Type of Measure	Mode of Transportation					Total
		Car	Walk/ Run	Bike	Bus	Other	
North TSA	Count	167	217	46	0	1	431
	Percent	*38.7%*	*50.3%*	*10.7%*	*0.0%*	*.2%*	*100%*
All TSAs Combined	Count	1,424	854	232	1	7	2,518
	Percent	*56.6%*	*33.9%*	*9.2%*	*.0%*	*.3%*	*100%*

Recreation Opportunities

Providing "passive recreation" is one of several OSMP purposes identified in the City of Boulder Charter. Although not precisely defined, the Charter does mention several "passive" recreational activities including hiking, nature study and photography. Three other recreational activities are listed as approved under certain conditions: bicycling, fishing and horseback riding. Table R12 summarizes the current status of recreational activities system-wide and where they are allowed.

In the North TSA, the type of recreation opportunities provided will be based on their compatibility with natural, agricultural and cultural resource conservation, the management area designations and other allowed activities in the area.

Dog Walking

Dogs are allowed under voice-and-sight control on 54.7 percent (10.49 miles) of trails in the North TSA. In other areas of the North TSA, dogs are required to be on leash on 36 percent (6.91 miles) of trails and are not permitted on 9.3 percent (1.79 miles) of trails. The North TSA has no seasonal dog regulations or on corridor voice and sight trails (Map R2).

Horseback Riding

Horses are permitted on 100 percent (19.2 miles) of trails in the North TSA (Map R3).

Bicycling

Bikes are allowed on 53.3 percent (10.23 miles) of trails in the North TSA (Map R3).

Fishing

Fishing is allowed at Wonderland Lake from the dam and peninsula on the east side of the lake. Use of boats or flotation devices, and wading into the water are not allowed. The City of Boulder Parks and Recreation Department provides fishing opportunities nearby the North TSA at Boulder Reservoir and Coot Lake.

Equestrians at Lefthand, photo: OSMP

Hang Gliding and Paragliding

The Wonderland Hill hang glider and paraglider launch site, located west of Wonderland Lake, has four launch zones. There are no designated landing sites on OSMP property for this site. The landing area for these launch sites is often in the neighboring Foothills Community Park.

Paragliders preparing to launch from Wonderland Hill (identified as key destination), photo: OSMP

Table R12. Current Status of Recreational Activities on Open Space and Mountain Parks

Current Status of Recreational Activities on Open Space and Mountain Parks			
Allowed on OSMP-Managed Lands	**Allowed only on Designated Trails**	**Allowed only in Specifically Designated Areas or Sites**	**Examples of activities not Considered Passive Recreation**
At current levels of visitation, these activities are generally compatible with OSMP visitor access and resource protection goals. The lower the impact, the greater degree of compatibility. Whenever possible, staying on trail will minimize impact. In HCAs, all visitor activities are required to be on trail unless approved under an off-trail permit.	*To provide high-quality recreation opportunities in locations that can handle the impacts, these activities are allowed only on appropriate trails.*	*To provide high-quality recreation opportunities in locations that can handle the impacts, these activities are allowed only at appropriate sites.*	*These activities do not fit the criteria for passive recreation and therefore, are not allowed on OSMP-managed lands.*
• Hiking • Trail running/jogging • Wheel-chair use • Nature study • Photography • Picnicking • Traditional climbing/ bouldering • Cross-country skiing • Snowshoeing • Virtual geocaching • Orienteering	• Bicycling • Dog sleds • Strollers/joggers • In-line skates • Wheeled boards (e.g. skateboards, mountain boards)	• Fishing • Wading • Tubing • Boating • Sledding • Hang gliding/ paragliding • Bolted climbing • Dog walking • Camping (at 4th of July campground only) • Swimming (in creeks only) • Model glider flying • Horse-drawn wagons or sleds* • Horseback riding*	• Motorized vehicles • Hunting • Organized sports • Paintball games • Swimming (prohibited in lakes and ponds) • Geocaching (when cache is left on OSMP property)

** The TSA planning program began the process of designating trails for horseback riding consistent with the language in Section 176 of the City Charter which includes among the purposes of city open space lands: Preservation of land for passive recreation use, such as hiking, photography or nature studies, and if specifically designated, bicycling, horseback riding or fishing. It is OSMP's intent to include designation of trails suitable for horseback riding in all TSA plans. Horseback riding is allowed on OSMP-managed trails that have not been part of a TSA planning process unless specifically prohibited.*

19.2
miles of designated trails in the North TSA

Access to Destinations

Designated Trails

OSMP manages 19.2 miles of designated trails in the North TSA (Maps R3 and G1). See R-Appendix H for a complete list of trail names and mileages. These trails vary in difficulty level and offer a variety of activities and scenery. Some trails are wide enough to allow people to walk side-by-side and offer sweeping prairie views. Other trails are narrow and climb or drop steeply. Combined, these trails provide an opportunity to enjoy passive recreational activities, increase physical health, build a sense of community and connect with the natural beauty of the North Boulder area.

Trails provide visitors the opportunity to access destinations and enjoy recreational activities. When designing a trail, many factors such as trail sustainability are considered. However, existing visitor access patterns and access to destinations are also considered. A sustainable trail takes visitors to where they want to go, can encourage visitors to stay on trail and help protect sensitive natural, agricultural and cultural resources.

Entry Points

OSMP manages and maintains a variety of entry points including trailheads, overlooks, picnic areas and access points. These facilities are the point at which a visitor enters the OSMP land system and are often the first impression a visitor has of OSMP. Entry point signs and kiosks provide important information about visitor opportunities, current conditions, regulations and other relevant information. Depending on the type of entry point, infrastructure such as trashcans, bike racks and dog stations may also be present.

Designated Entry Points

In the North TSA, there are seven trailheads, seven access points and one recreational facility (Map G1). The complete list can be found in R-Appendix I. Trailheads have a higher level of services and development,

including informational kiosks, trashcans, dog stations and potentially an outhouse. They also have designated parking available on OSMP-managed lands. Access points do not have designated parking which often occurs on neighboring public streets or right-of-ways. Access points also have a lower level of service and development. The one recreation feature access, Cottonwood Picnic Area, offers a place for visitors to picnic and recreate, but does not provide access to the OSMP designated trail system.

Undesignated Entry Points

Although there are 15 designated entry points in the North TSA, there are 291 undesignated entry points (Map R4). Some, 62 of the total, are located where an undesignated trail originates at the OSMP property boundary. These signify a point at which visitors are accessing the North TSA where there is no designated trail. Since these points are undesignated (not managed by OSMP), infrastructure is typically not provided. However, in cases where visitation is high, OSMP may place infrastructure to reduce impacts and alert visitors to regulations for the area. The remaining 229 undesignated access points occur at gates along the OSMP property boundary. Gates are used for many purposes, such as agricultural operations, maintenance and access to utility right-of-ways, and emergency access. They also may be a location where visitors access the OSMP system.

Undesignated trail, photo: OSMP

Regional Trail Concepts from Public Agency Plans and Efforts

While the North TSA plan deals only with OSMP-managed lands in the trails study area, the boundaries of the TSA include lands owned and managed by multiple public agencies and private landowners. This creates both challenges and opportunities for regional trail planning. Prior to the beginning of the North TSA planning process, potential regional trail corridors through the study area have been identified and advanced through public planning processes, some led by departments or agencies other than OSMP. Relevant regional trail concepts put forward by these planning processes are described here and represented on Map R5.

For lands owned and managed by OSMP, two previous OSMP plans put forward guidance about regional trails that will be reconsidered during the North TSA planning process:

» Visitor Master Plan (2005)

The VMP prioritized a new multi-jurisdictional trail from Lyons to Boulder along the Boulder Feeder Canal. The alignment was drawn from the Boulder Valley Comprehensive Plan (BVCP) and the concept was a path with gentle grades attractive to all ages, users and abilities. Subsequent planning for this corridor was led by Boulder County until 2009 when the Boulder County Commissioners suspended further planning for this trail corridor in response to public concerns and land ownership issues. The VMP also identified a trail through the IBM open space easement and a corresponding underpass at the Diagonal Highway, both of which were included in the BVCP. Plans are in place to build this trail and underpass.

Photo: Phillip Yates (OSMP)

» North Boulder Valley Area Management Plan (1997)

The North Boulder Valley Area Management Plan (NBVAMP) recommended a conceptual east-west trail corridor through the Axelson property. A trail constructed in this corridor would connect to the North Rim Trail, which is managed by Boulder County Parks and Open Space. The NBVAMP also recommended further evaluation of a potential north-south trail corridor through the West Beech property, Six-Mile Fold (owned and managed by Boulder County) and Buckingham Park. Other relevant recommendations in the NBVAMP – the Lefthand Trail and a trailhead on the East Beech property – have already been constructed.

For lands outside OSMP jurisdiction, other city departments and Boulder County have adopted the following plans containing relevant regional trail concepts:

» Boulder County Comprehensive Plan (Boulder County – Land Use Planning, 1999)

The Boulder County Comprehensive Plan (BCCP) advances several concepts for regional trails in the area, including the Lyons-to-Boulder Trail (or Boulder Feeder Canal Trail), which is now on hold. It also recommends a conceptual north-south trail corridor connecting the Joder property to Heil Ranch and beyond to Lyons, as well as an east-west corridor between Olde Stage Road, the Joder property, Lefthand Trailhead, Lagerman Reservoir and Longmont. The bulk of the Joder property was acquired by OSMP in 2013, and an interim trail is under construction now that could fulfill the westernmost section of this larger regional trail concept. More information on the BCCP can be found **here**.

» Lagerman/Imel/AHI Open Space Complex Management Plan (Boulder County – Parks and Open Space, 2012)

In 2012, Boulder County Commissioners approved and adopted the Lagerman/Imel/AHI Open Space Complex Management Plan, which creates a framework for protecting a working agricultural landscape, wetlands, riparian habitat and other resources, while providing sustainable trails and recreational amenities. The proposed new trail network and infrastructure includes new trails that are primarily internal to the county's open space complex, although it also acknowledges the potential for external connections into the City of Longmont to the northeast. For more information, their plan can be found **here**.

» Boulder Valley Comprehensive Plan (City of Boulder – Community Planning and Sustainability, 2010, update underway)

The Boulder Valley Comprehensive Plan (BVCP) includes several conceptual trail alignments and proposed underpasses within the present North TSA, including many described above that were included in past OSMP plans. These concepts include the east-west connection across the Axelson property, the OSMP portion of the proposed Lyons-to-Boulder Trail through the Johnson and Dawson properties, a trail through IBM and an underpass at the Diagonal Highway. The plan also proposed a connection between Reservoir Road on the southeast side of Boulder Reservoir and neighborhoods east of the Diagonal Highway, including an underpass, as well as another underpass under the Diagonal at the Fourmile Canyon Creek Trail. More information on the plan can be found **here**.

» Boulder Reservoir Master Plan (City of Boulder – Parks and Recreation, 2012)

City of Boulder Parks and Recreation adopted the Boulder Reservoir Master Plan in 2012, laying the groundwork for conceptual trail corridors on the east and south sides of the reservoir. Specifically, the plan proposes a multi-use trail generally along the 55th Street and 51st Street corridors, as well along the south shore within the Reservoir Road corridor. More information on the plan can be found **here**.

» Greenways Master Plan (City of Boulder – Greenways Program, 2011)

The city's Greenways Master Plan supports relevant proposals in other plans, including a trail connection and underpass connecting Reservoir Road under the Diagonal with the Gunbarrel community. It also recommends an underpass at Fourmile Canyon Creek Trail, similar to the BVCP. More information on the plan can be found **here**.

Boulder Reservoir, © Jack Sasson

In addition, Colorado Parks and Wildlife and the U.S. Department of the Interior are exploring the following potential trail corridors through this study area:

» Rocky Mountain Greenway Project (U.S. Department of the Interior – America's Great Outdoors)

An outgrowth of President Obama's America's Great Outdoors Initiative, the Rocky Mountain Greenway is a federal, state, local and community partnership to create uninterrupted trails and transportation linkages connecting three National Wildlife Refuges in the Denver metro region, Rocky Mountain National Park and community trails systems along the way. Still in the early stages of planning, this truly regional concept has not yet developed feasible trail alignments or corridors in the Boulder Valley. Some desired connections, such as the one between the Foothills Trail, Heil Ranch and Lyons, may or may not align with portions of this larger regional vision.

» Colorado Front Range Trail (Colorado Parks and Wildlife)

The Colorado Front Range Trail (CFRT) project has been developed by Colorado State Parks and Great Outdoors Colorado in partnership with local governments. The trail would connect Fort Collins and further north to Wyoming with Trinidad and south to New Mexico. The general alignment of the Boulder Feeder Canal Trail would have satisfied the segment of the proposed CFRT through much of Boulder County. With that project on hold, proposed trail corridors to the north and northeast of the Boulder Reservoir would generally coincide with the desired north-south CFRT corridor.

These trail concepts are summarized in R-Appendix J and referenced on Map R5.

Key Connections Not Being Served by a Designated Trail

OSMP staff reviewed an undesignated trail map and used knowledge of existing visitor access patterns to identify potential new connections that could be important to the community (Map R6). These visitor access patterns across OSMP represent areas with the potential for designated trail connections to be constructed – or may already be in the process of being addressed such as the interim Joder Trail. Whether to serve key connections needs to be considered with other factors such as trail sustainability, safety and impacts to resources.

General areas identified as key connections include:

- Joder property to Buckingham/Lefthand Canyon
- North Foothills Trail to Joder property
- Sage Trailhead to Eagle Trail
- Cobalt Trail to Eagle Trail
- Kelso Road to Hidden Valley Trail
- Wonderland Hill Trail to Old Kiln/South Foothills Trail
- South Foothills Trail (Wonderland Lake) to high ridge loop
- Spring Valley Road area to high ridge loop

Areas with connections underway include:

- 63rd Street to Cottontail Trail
- Fourmile Creek Greenway to Cottonwood Trail

Access to Key Destinations

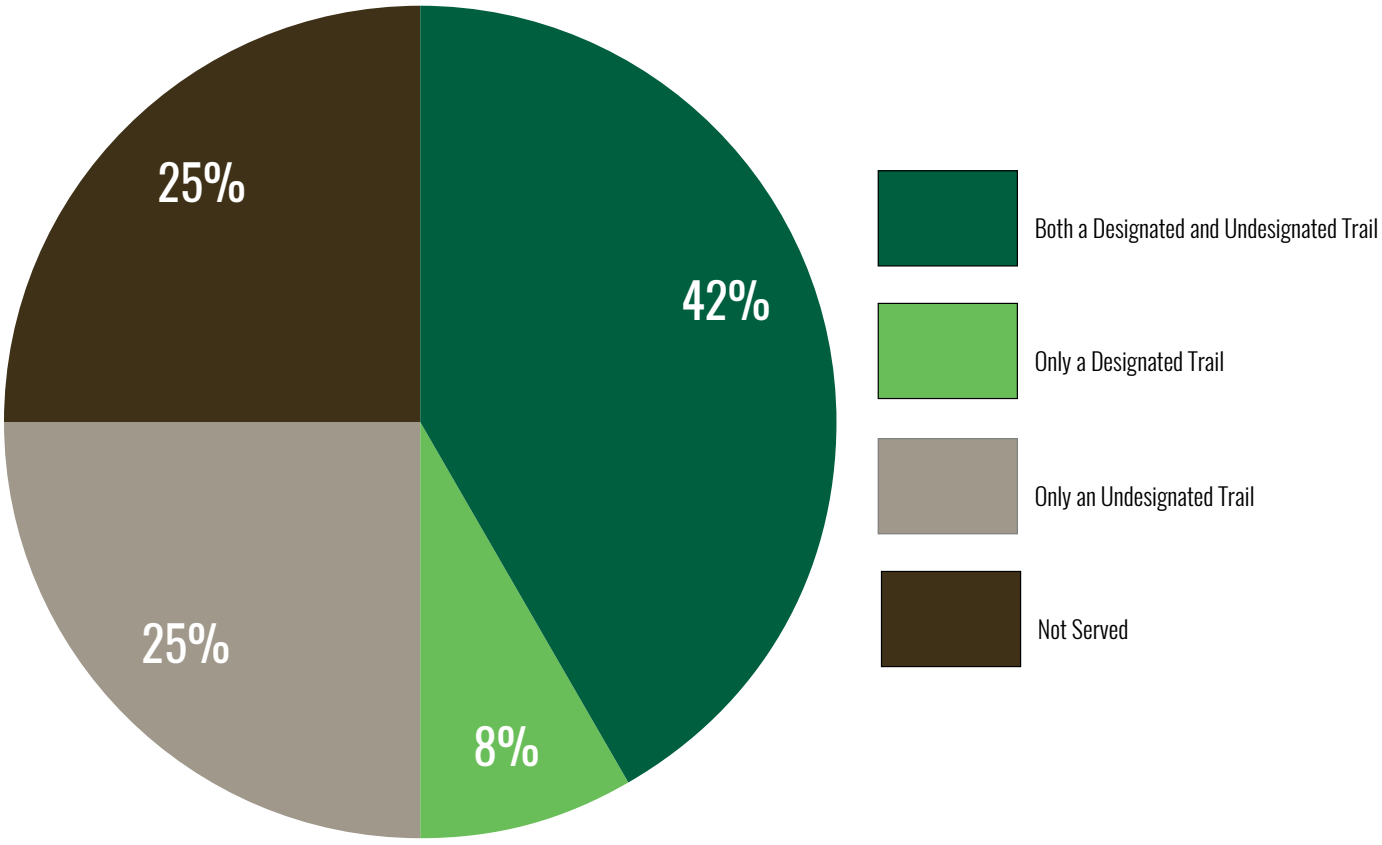
Key destinations are distinct landscape features, sites or infrastructure that have special appeal for attracting visitors and/or provide a point or place to linger for those traveling along a trail (Map R7). Access to key destinations is an important element contributing to the quality of the visitor experience. However, providing access to a destination needs to be considered with other factors such as trail sustainability, safety, impacts to resources and people's opportunity for solitude or to get away from the crowd.

For the North TSA, staff identified 12 key destinations based on historic knowledge and by looking at the undesignated trail system. In situations where undesignated trails departed from a designated trail and seemed to end at a "random" spot on the map, staff looked to see if the undesignated trail actually ended at some key destination. If so, it was identified as a key destination.

Locations of key destinations are shown on Map R7. All key destinations within 100 feet of a designated trail are considered to be already "served" by a trail. Each point on the map represents a key destination. For the purpose of accurately analyzing spatial data, reservoirs were best described as geographic features – rather than points. For those exceptions, a polygon was created around the point to encompass the entire feature.

See R-Appendix K for a list of key destinations, what they are and how they are served (e.g. by both a designated trail and undesignated trail; only a designated trail; only an undesignated trail; and those not served). Of the 12 key destinations identified, three are not served and three are served by an undesignated trail (See Figure R8). Five of the 12 key destinations are served by both a designated and undesignated trail. One destination is served by only a designated trail.

Figure R8: Key Designations Served or Not Served



Undesignated Trails

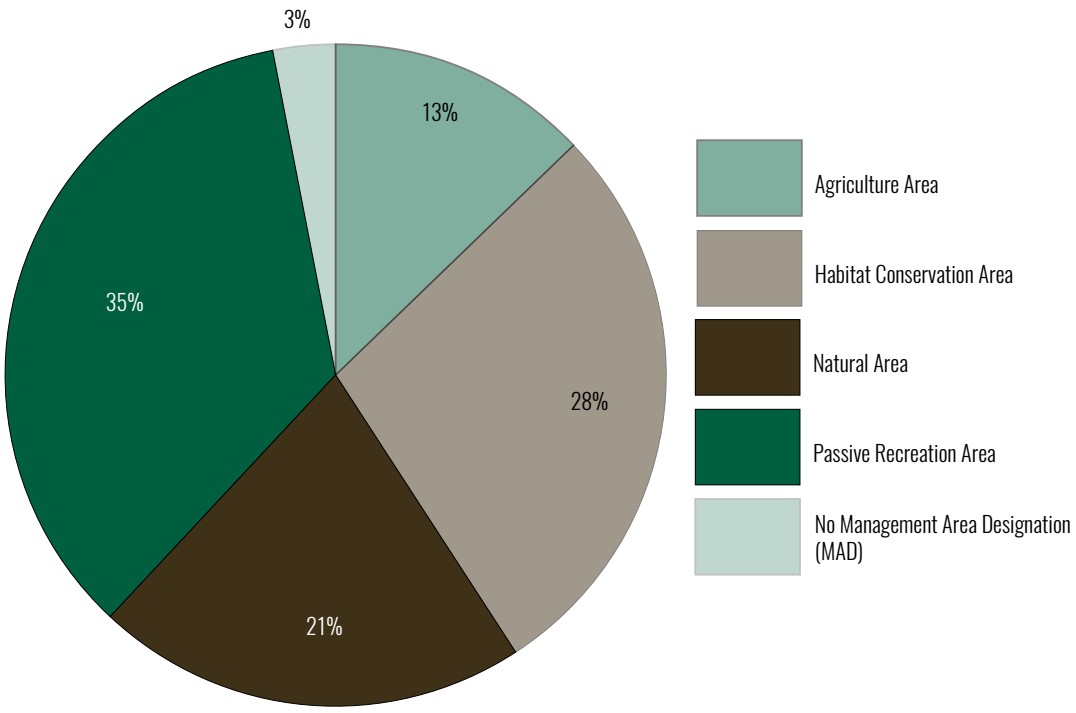
Undesignated trails are typically formed by repeated visitor travel in parks, natural areas, open spaces and other public land landscapes. Undesignated trails arise because trail systems developed by land managers usually cannot lead to all desired destinations or create all of the travel experiences sought by visitors (e.g., opportunities for solitude, exploration or nature observation) (Byers et al. 2000; Park et al. 2008; Hockett et al. 2010; Marion et al. 2011; Wimpey & Marion 2011). Undesignated trails may develop when visitors lose the formal trail and/or inadvertently travel along wildlife or cattle trails. They may also develop when visitors choose to follow alternative routes to short cut trail switchbacks, avoid muddy, rutted or crowded conditions or bypass obstacles or rough patches on the formal designated trails (Turner & LaPage 2002; Park et al. 2008; Hockett et al. 2010).

Undesignated trails are of concern because their development can result in unwanted changes to the landscape through vegetation loss, soil erosion, weed proliferation, disturbance to wildlife and fragmentation of habitat blocks (National Park Service 2008; D'Antonio 2010; Wimpey & Marion 2011). Undesignated trails also tend to have unplanned or historically planned (e.g., deer trail, old wagon road bed or railroad track excavation) alignments that can make them particularly unstable physically and susceptible to erosion with repeated human travel. From a social perspective, a web of informal trails creates a visually scarred landscape and may lead to safety concerns (Marion et al. 2006). These conditions can create confusing conditions for visitors and preventable maintenance expenses for land managers. Such concerns have prompted land managers to commonly choose undesignated trail development as an indicator of the contiguity and ecological health of an ecosystem and the quality of visitor experiences (Leung et al. 2002; Marion et al. 2006; Monz & Leung 2006; National Park Service 2008, 2010).

In 2011, OSMP completed a system-wide mapping of undesignated trails (City of Boulder, 2015), using methods summarized in R-Appendix L. This mapping was prior to conditions which may have changed after the 2013 flood event. In 2015, staff mapped several additional recently acquired properties in the North TSA (Joder property and Berman Brothers). Data from these projects were used to create North TSA specific maps and summaries, illustrating undesignated trail locations (Map R8).

There is a total of 35.7 miles of undesignated trails in the North TSA and this indicates that the designated trail system (19.2 miles) does not provide access to some places visitors want to access. Nearly two-thirds of these miles (63 percent) are located within Passive Recreation or Habitat Conservation Areas and the remainder is split between Natural (21 percent) and Agricultural Areas (13 percent) (Figure R9). A few of these miles serve as vehicle access routes and/or are located on properties currently closed to the public.

Figure R9. Percent of Total Undesignated Trail Miles within Each Management Area in the North TSA



The extent and location of undesignated trails are often closely associated with several factors including:

- The location of designated trails;
- The location of key destinations; and
- Whether desired connections are adequately served by a designated trail.

Designated Entry along the Urban Interface

In the **West TSA Plan**, OSMP proposed that it would be appropriate to provide access to OSMP lands at intervals of at least .5 mile, or about a five minute walk along the urban boundary to the nearest entry point which would be a distance of no more than .25 mile. Most people can walk a quarter mile in about five minutes, and in the West TSA it was determined by staff, community members, the OSBT and City Council that providing entry points to OSMP at quarter mile intervals was an acceptable level of service. For the North TSA, OSMP focused an analysis of the distance between entry points to seven entry points located along the urban boundary which consisted of North TSA lands adjacent to Boulder city limits. As Map R9 shows, 71 percent of the entry points are within 0.5 mile of each other. There are two entry points that are farther than 0.5 mile apart, Fourmile Trailhead and the access point Wonderland Lake at Utica.

Multimodal Access to Entry Points

Overview

Accessing trails by foot, bike, bus or shared rides promotes city-wide sustainability goals, helps reduce greenhouse gas emissions and further promotes healthy, active living. According to a system-wide OSMP visitor survey in 2010-2011, most visitors to the North TSA do not arrive by car. In fact, far fewer respondents (39 percent) arrive at trailheads or other entry points in the North TSA by car, compared to a much larger proportion (57 percent) throughout the entire OSMP system.

Half of the North TSA visitors arrive by walking or running, and 11 percent arrive by bike – together far out-pacing private automobile use. In addition, most North TSA visitors live in the City of Boulder (73 percent), and 80 percent of all North TSA visitors visit this part of the system four or more times per month. Studied together, these statistics suggest that many of the visitors to North TSA trails live and/or work close by and that many leave their cars behind when they choose to recreate here on a regular basis. Designated entry points that facilitate easy neighborhood access via walking, running or biking are represented on Map R9. Primarily, neighborhoods surrounding Wonderland Lake and the Foothills Trail are best served by this type of entry point, as well as those near Lefthand Valley and Loukonen reservoirs. Once the IBM connector trail and underpass are built to the east of Boulder Reservoir, these improvements will facilitate bike and pedestrian access from neighborhoods east of the Diagonal Highway.

The same survey suggests that less than a single percent of North TSA visitors arrive by other means such as bus. However, public transportation is often the only way that those without cars, bikes and supervision/assistance can access OSMP trails, lands and waters. In fact, the lack of meaningful transportation choices is often described as a primary barrier for these demographic groups, preventing access to parks, open space and opportunities for physical activity. Since transit is important in creating

Bus stop at Joder property, photo: Deryn Wagner (OSMP)

a sense of community, connecting people and the landscape as well as providing an alternative to the environmentally damaging practice of driving, staff analyzed the availability of transit in the North TSA.

This analysis sets the foundation for sustaining and improving existing transportation patterns, as well as access to open space for residents of all ages, abilities and income levels. Because the level of bike and pedestrian access to trailheads in the southeastern part of the study area is already successful, the analysis focuses on available transit service in order to understand ways more visitors may access this part of the system by bus. Since Regional Transportation District (RTD) buses prohibit dogs, except service animals, this analysis deals only with visitors unaccompanied by dogs. This represents a significant portion of OSMP visitation as nineteen percent of North TSA visitors report dog-walking as their primary activity.

The multimodal infrastructure surrounding access points served by transit is also explored to identify opportunities to work with partner agencies to improve multimodal access. To that end, the presence and quality of surrounding sidewalks, crosswalks, bike lanes, multi-use paths and neighborhood pedestrian access are also addressed.

Fixed-Route Transit Service

For the North TSA, existing bus routes operated by RTD serve the southern Wonderland Lake subarea most effectively, with some service to the southern-most entry points into the North Foothills subarea. The two remaining subareas, Boulder Valley Ranch and Northern Properties, are not served by transit. Bus service along the Diagonal Highway is frequent and geographically adjacent to some North TSA properties. However, there are no trails connecting bus stops along the Diagonal to OSMP lands or the greater OSMP trail system. Many of the OSMP properties along the Diagonal do not have visitor amenities and consequently are not particularly attractive destinations.

Bus stop near Wonderland Lake trailhead, photo: Deryn Wagner (OSMP)

Map R10 illustrates that only the Wonderland Lake and Fourmile trailheads are within a 0.5 mile of a bus stop; with only Wonderland Lake being within .25 mile (the distance used for assessing adequate convenience to an entry point). The SKIP bus route offers highly convenient service for both of these trailheads. The Y route (Lyons-Boulder) also serves both trailheads, and the "204" serves Fourmile Trailhead. In addition, the interim trailhead at the Joder property will, when constructed, be within .25 mile of north- and south-bound stops for the Y route. However, as Table R13 demonstrates, schedules for the Y route do not accommodate peak recreational use. Vehicle traffic on US 36 in the vicinity of the interim Joder trailhead creates hazards for visitors who would need to cross the road to board a bus, or access OSMP.

Table R13 Bus Routes and Schedules that Serve North TSA Entry Points

RTD Route	Route/Key Destinations	Weekday Frequency	Weekend Frequency	North TSA Entry Point(s) Served
SKIP	Connects South Boulder, University of Colorado and North Boulder via Broadway; Connects with many other routes	Every 10-15 minutes, 5:30a.m. to 12:30a.m.	Every 15-30 minutes, 7a.m. to 11:30p.m.	Wonderland Lake Trailhead, Four Mile Creek Trailhead
Y	Connects South Boulder, University of Colorado and North Boulder via US 36, Broadway and 19th St.; Connects with many other routes	Every half hour, 6a.m. to 9p.m.	Every hour, 7:30a.m. to 9:30p.m.	Four Mile Creek Trailhead
204	Connects Boulder Transit Center with downtown Lyons via Broadway and Foothills Highway; Connects with other routes in Boulder	Every half hour, 6a.m. to 9p.m.	None	Wonderland Lake Trailhead, Fourmile Creek Trailhead, Interim Joder Trailhead (forthcoming)

Pedestrian underpass at Foothills trailhead, not connected to bus stop, photo: Deryn Wagner (OSMP)

Although other designated entry points into the North TSA are within a 0.5 mile aerial distance of other bus stops, physical or perceived barriers such as connections unsafe for pedestrians or winding neighborhood roads affect people's inclination to take the bus to reach trails. For example, the access point into Boulder Valley Ranch near Silver Canyon Coffee is within a 0.5 mile of a stop for the Y route; however, private property separates the two and no convenient pathways connect them. Other access points, although within a half a mile of a bus stop, would not be perceived as the primary entry point for most visitors arriving by bus. For example, someone taking the SKIP to Wonderland Lake is far more likely to enter the system at the main trailhead than to take a winding route to enter at the access point off Poplar Avenue.

Multimodal Infrastructure

Safe road crossing at Fourmile Creek trailhead, photo: Deryn Wagner (OSMP)

Understanding the built environment surrounding trailheads and transit stops helps uncover additional obstacles that may prevent visitors from walking, running, biking or taking the bus to trailheads. For example, while the distance between Fourmile Trailhead to the 204, Y and SKIP bus stops is roughly one-third of a mile—and pedestrian infrastructure connecting them is generally welcoming and safe—some visitors may perceive this distance as too far to walk. The most commonly cited standard is that a destination should be no further than 0.25 mile from a bus stop to encourage bus ridership. In addition, on the south side of Lee Hill Drive, sidewalks are continuous between transit stops, nearby homes and the trailhead. However, on the north side, there are gaps in the sidewalk immediately east of the trailhead, further discouraging transit or pedestrian access to this trailhead. Bike access from the east is sufficient, with striped bike lanes on both sides of the road to the east of the trailhead – not to the west. Traffic calming measures near the trailhead, including a signalized crosswalk across Lee Hill Drive, support pedestrians who use the bus to access this part of the system, for those continuing on the Foothills Trail or those in surrounding neighborhoods.

Wonderland Lake Trailhead is within 0.25 mile of north- and south-bound stops for the SKIP and Y routes, suggesting that transit could be an attractive way to get here, especially for residents living north or south of the area along Broadway who would not have to make a transfer. The SKIP also connects with many other routes through the city, providing additional options for residents living elsewhere in Boulder. However, there is no marked or signalized crosswalk across Broadway near the bus stops where the speed limit is 35 mph, which could deter visitors from taking the bus. Access between the bus stops and the underpass to the south is neither signed nor convenient for bus riders. Boulder Journey School teachers, who often use the 204 and SKIP buses to reach Wonderland Lake with preschool students in the summer, have expressed safety concerns for this very reason. Anecdotally, they sometimes walk an extra 20 minutes to use the light at Violet or the underpass to cross safely.

Unsafe crossing at Broadway between Wonderland Lake trailhead and northbound bus stop, photo: Deryn Wagner (OSMP)

Accessible Trails and Entry Points for People with Disabilities

Whether we are born with a disability, become an older adult, sustain an injury, develop health problems, or care for someone with disabilities, at some point accessibility becomes important to us all.

In 2000 OSMP, in conjunction with City of Boulder Parks and Recreation EXPAND Program and Boulder County Parks and Open Space, published a guidebook called Boulder Accessible Trails and Natural Sites (revised in 2006). This guidebook can be found at https://bouldercolorado.gov/osmp/visitors-with-disabilities. The intent of this guidebook is to provide visitors with a trail narrative and difficulty rating so they can make their own determination of their ability to access a trail.

A total of 5.7 miles of trail located within the North TSA has been identified with a difficulty rating (Map R11). Factors in determining difficulty ratings include trail out-slope, trail grade, tread obstacles, surface material and trail width. The four ratings are defined as:

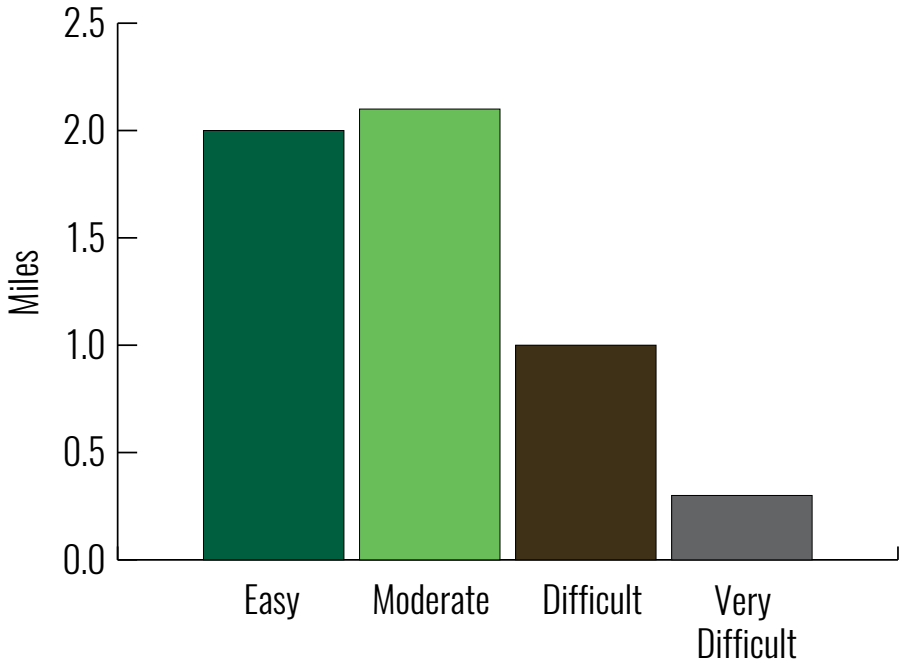
1. **Easy** — Most people who use wheelchairs should be able to use with little or no difficulty.
2. **Moderate** — Some wheelchair users may find it difficult to maneuver.
3. **Difficult** — Many wheelchair users may have difficulty and constructed or natural barriers exist.
4. **Very Difficult** — Most wheelchair users will probably not be able to use this trail. Difficult terrain or lack of usable features exists.

Many of these trails sustained damage in the September 2013 floods and may not be as easy to navigate as they were before the flooding when trails were evaluated. Figure R10 shows the difficulty rating of North TSA trails.

Trail segments around Wonderland Lake and Buckingham Park make up the one mile of trail that OSMP manages for wheelchair access in the North TSA. The accessible trails in both of these areas fall into the very poor trail condition category with 80-100 percent non-compliance. Trail condition non-compliance may not affect accessibility as one factor contributing to non-compliance is where trails are wider than design parameters and thus accessibility is not impaired. Non-compliance factors that do affect accessibility include such as grade, out-slope, surfacing material and erosion. These factors are generally within the compliance standards in this area. Trails managed for accessibility have rigorous standards so small changes in conditions such as ice, snow and mud can make trails not accessible.

Non-compliance is defined as existing trail conditions that do no meet trail design standards.

Figure R10. Difficulty Levels of Trails that are Accessible for People with Disabilities



Density of Trails

Designated Trails

Currently in the North TSA, the Mesa Reservoir area has high density of designated trails. These trails allow visitors to make loops of various distances. However, despite the high density of designated trails in the area, there are also many undesignated trails. This indicates that visitors are not able to use the designated trails to access some areas of interest. The high density of trails in this area has a negative impact on resources and thus during the planning process this trail system will be looked at to see if a better configuration of designated trails can provide access for visitors to important areas while ultimately decreasing trail density.

Undesignated Trails

Undesignated trail density is highest in the North TSA within the vicinities of Wonderland Lake (Figure R11), Boulder Valley Ranch and the Joder property (Figure R12).

Figure R11. Undesignated trail density in the Wonderland Lake area

Figure R12. Undesignated trail density on the Joder property

Wonderland Lake: The designated trail system in this area generally goes around Wonderland Lake and then connects north along the city boundary. The undesignated trail network in this area would indicate that people want to explore the foothills area and are potentially using this network to make longer loops in the area.

Boulder Valley Ranch: The flat terrain and clay heavy soils at Boulder Valley Ranch, make the designated trail system susceptible to muddy conditions, which is reflected in the high density of undesignated trails. Many of the undesignated trails parallel designated trails in this area.

Joder property: Although OSMP considers these trails to be undesignated, a portion of these trails were built or used by the Joder family when the Joder Arabian Ranch (JAR) was operational. The JAR website http://www.joderranch.com/Mission.html) advertises 8 miles of trails on the property, which was subsequently confirmed by a map provided by the Joder family. Of the 8 miles of historic trails, approximately 6 miles meet the undesignated trail criteria as defined by the monitoring methodology included in R-Appendix L. Many miles of the legacy trails did not meet the criteria for undesignated trail monitoring because the trails were not evident to staff conducting the undesignated trail inventory was conducted in the spring of 2015. Vegetation growth—enhanced by recent higher precipitation levels—and reduced visitor access to the property both prior to and after its acquisition have likely reduced the degree to which these legacy trails fall within mapping criteria. Extreme precipitation leading to the flood of September 2013 is also likely responsible for the severe erosion evident on some of the trails that run along or across local drainages.

OSMP is in the process of completing a trail condition assessment on the 8 miles of legacy trails and roads found on the property. Data collection is in progress for common indicators such as grade, incision depth, soil type, drainage, vegetation cover, alignment, erosion and multiple treads. Original design or construction standards used on the ranch are unknown, but the legacy trails range in character from wide dispersed use corridors to contoured bench trails.

Horse, bike and human footprints in mud, photo: OSMP

Post flood damage to legacy trail on Joder property, photo: OSMP

Motivation for Visit to OSMP

An understanding of visitor motivations for participating in outdoor activities on OSMP is fundamental to plan for meeting related recreational goals. Understanding visitor motivations is also helpful in identifying and understanding recreation conflict.

In the North TSA, more visitors expressed an interest in coming to OSMP to participate in particular activities as the most important reason for their visit, and fewer identified a desire to experience the place itself or to socialize with family or friends (Giolitto 2012) (Table R14).

Table R14. Most Important Reason for Visiting OMSP Today by TSA (2012)

Area	Type of Measure	Reason for Visit			Total
		Activities	Place Itself	Family or Friends	
North TSA	Count	212	151	15	378
	Percent	*56.1%*	*39.9%*	*4.0%*	*100%*
East TSA	Count	267	107	17	391
	Percent	*68.3%*	*27.4%*	*4.3%*	*100%*
South TSA	Count	137	86	21	244
	Percent	*56.1%*	*35.2%*	*8.6%*	*100%*
West TSA	Count	469	582	157	1,208
	Percent	*38.8%*	*48.2%*	*13.0%*	*100%*
All TSAs Combined	Count	1,085	926	210	2,221
	Percent	*48.9%*	*41.7%*	*9.5%*	*100%*

Recreation Conflict

Recreation conflict — based upon the goal interference model — results when the behaviors of one or more visitors interfere with other visitors' ability to achieve desired experiences. Conflicts experienced on the trail can affect the quality of the visitor experience (Jacob & Schreyer, 1980). Recreation conflict results from common situations, such as hikers walking side by side-blocking others from passing, runners startling other visitors, loud yelling or noises, cyclists not yielding or dogs jumping on other visitors. Monitoring the level of experienced conflict helps land managers understand visitor satisfaction, particularly in front country environments like OSMP lands (Graefe and Thapa, 2004). Recognizing the effect conflict has upon the quality of the visitor experience, the VMP includes a "Visitor Conflict Reduction Initiative," and has several management strategies designed to reduce visitor conflicts.

The level of recreation conflict in the North TSA is the same as the system average (Giolitto 2012) (Table R15). The daily conflict rate is also very similar to ranges reported by Jefferson County Parks and Open Space and Boulder County Parks and Open Space (local peer agencies) (Bowie 2010, Jefferson County 2006).

Area	Type of Measure	Conflict Today		Total
		Yes	No	
North TSA	Count	28	395	423
	Percent	*6.6%*	*93.4%*	*100%*
East TSA	Count	37	411	448
	Percent	*8.3%*	*91.7%*	*100%*
South TSA	Count	12	261	273
	Percent	*4.4%*	*95.6%*	*100%*
West TSA	Count	88	1250	1,338
	Percent	*6.6%*	*93.4%*	*100%*
All TSAs Combined	Count	165	2,317	2,482
	Percent	*6.6%*	*93.4%*	*100%*

Table R15. Recreation Conflict on the Day of the Survey by TSA (2012)

Regulation Setting and Compliance

The regulatory (managerial) setting is one of the three primary components making up the recreation setting as defined by ROS. The managerial component includes things such as the amount, type and perceived intrusiveness of rules, regulations and presence of law enforcement and other agency staff, and the level of facility development (McCool et al. 2007). Within the ROS framework, the level of managerial presence is represented on a continuum, typically ranging from little/low presence to extensive presence. The four OSMP management areas also include an intended continuum of visitor regulations with the most restrictive regulations in Habitat Conservation Areas and the least restrictive in Passive Recreation Areas—modifications and exceptions may be needed to meet context-specific circumstances.

Visitor Access Regulations

In the North TSA, there are several regulations currently governing visitor activities (Map R12). Ongoing, year-round regulations include things such as:

- properties closed to visitors;
- overnight parking lot closures between 11 p.m. and 5 a.m.;
- trailhead leash requirements at all trailheads;
- off-trail dog management/access varies from dogs prohibited to voice and sight control;
- on-trail dog management varies from dogs prohibited to voice and sight control;
- dogs prohibited on the Hogback Ridge Trail; and
- restricted off-trail access to the Mesa Reservoir.

There are also seasonal wildlife closures in a few areas of the North TSA. See the Natural Resource chapter for information on these closures.

Dog Regulations (Designated Trails and Areas)

Of the 19.2 miles of designated trails in the North TSA, 17.4 miles (91 percent) are open to dogs (Table R16). More than half of these 17.4 miles (55 percent) provide the option for voice and sight control, while the other 6.9 miles have on-leash requirements (Maps R2 and R12).

Table R16. North TSA Dog Regulations on Designated Trails by Management Area

Dog Regulation By Management Area	Miles (%)
Leash or Voice and Sight—Agriculture Area	1.4
Leash or Voice and Sight—Passive Recreation Area	9.0
Leash or Voice and Sight—No Designation	0.1
Leash or Voice and Sight Total	10.5 (55%)
Leash Required—Natural Area	2.9
Leash Required—Passive Recreation Area	4.0
Leash Required Total	**6.9 (36%)**
No Dog Total (All Habitat Conservation Area)	**1.8 (9%)**

The North TSA includes several off-trail dog access regulations (Map R12) including:

- Dogs are prohibited off trail on the Beech and Axelson properties;
- Dogs are required on leash whether on or off trail in the Wonderland Lake and Fourmile Creek areas; and
- Dogs may be under voice and sight control in areas such as the Boulder Valley Ranch and Mesa Reservoir area and the area along North Foothills Trail north of Lee Hill Drive, and on other, more dispersed properties.

Dog Regulation Compliance Levels

OSMP staff conducted a dog regulation monitoring project during 2014 including observation of Voice and Sight Tag (Tag) Program and leash regulation compliance (VanderWoude & Bitume 2015). See R-Appendix M for additional information about dog regulation compliance.

Voice and Sight Tag Program

Visitors to the North TSA have a lower compliance rate with Tag Program requirements compared to the overall compliance rate including all OSMP areas (Table R17). The compliance rate in the North TSA was greater than the East, but less than the South and West TSAs.

Table R17. Tag Program Compliance Rates by TSA and System-wide

TSA	Number non-compliant visitor parties	Number compliant visitor parties	Total number of visitor parties	Overall compliance
North	19	21	40	53%
East	17	13	30	45%
South	15	21	36	59%
West	53	151	204	74%
Total	103	207	310	67%

Leash Required

North TSA visitors with dogs were the most likely to comply with the leash required regulation (compared to other TSAs) (Table R18). During the dog compliance study, 93 percent of observed parties with dogs had every dog in their party leashed through the observation zone. Comparatively, visitors to the South TSA were the least likely to comply with the leash regulations with 58 percent of observed parties following the regulation.

Table R18. Leash Regulation Compliance Rates by TSA and System-wide

Trail Study Area	Number compliant visitor parties	Number non-compliant visitor parties	Total number of visitor parties	Overall compliance
North	116	9	125	93%
East	25	4	29	86%
South	15	11	26	58%
West	39	19	58	67%
Total	195	43	238	82%

OSMP maintains a ranger database which stores information about the summons and warnings written by rangers. Each summons or warning has specifics about the violation, location and includes a narrative written by the ranger. Since 2012, the top five most common summons written in the North TSA have been:

- Lack of a valid Voice and Sight Program tag — 92
- Illegal camping — 55
- Dog running at large, not on leash — 48
- Dog running at large, not in voice and sight control — 34
- Tent, net, structure prohibited — 30

Leashed dog at trailhead, photo: Phillip Yates (OSMP)

Remoteness

One factor of the ROS that is used to inform an area's management classification is the potential for a visitor to have a "remote" experience. The concept of remoteness can include things such as being removed from sights and sounds of human activity, minimal evidence of human activity on the landscape or the total size of an area with minimal development. Within the OSMP management area classifications, HCAs are intended to be the areas of the system with the greatest potential for a "remote" experience.

Undesignated Trails in Habitat Conservation Areas

In the North Foothills HCA there are a total of 11.7 miles of trails. Only 1.8 miles are designated trails while the remaining 9. 9 miles are undesignated trails. The majority of the undesignated trail miles are within the newly acquired Joder property with undesignated trails also occurring on the Buckingham Park property and along the north-south railroad grade west of US Highway 36. The densest area of undesignated trails occurs on the Joder property (Figure R12) where a dominant land use prior to OSMP acquisition was as a recreational equestrian facility.

As discussed previously, undesignated trails can contribute positively to the visitor experience by providing access to key destinations. However, undesignated trails can detract from a visitor's sense of remoteness or visually representing ecological impacts.

The VMP specifically calls for the elimination of all undesignated trails in HCAs unless they are made part of the designated trail system. OSMP has developed a system to address undesignated trails. This system includes categorizing all undesignated trails into one of the following categories:

- **Designate** (the connection the trail provides is maintained either using the current trail alignment or by rerouting the alignment to improve resource protection or trail sustainability);
- **Restore** (close and restore); and
- **Retain** (cannot be feasibly restored or designated).

Sign Structures per Trail Mile in HCAs

Structures along a trail can add to or detract from the trail experience and sense of remoteness. Signs are one of the most visible forms of human intrusion associated with trails. They are intended to inform, provide directions or elicit a certain behavior. Typically land management agencies that provide trails seek to ensure that sign structures fulfill the intended purpose and add to the character of the trail. Simple sign structures tend to be most harmonious in natural settings where visitors are seeking escape from the built environment and are most interested in viewing natural landscapes.

The North TSA has a total of 19.2 designated trail miles with a total of 297 sign structures. Of those signs, 14 are located along the 1.8 trail miles in the HCA (Table R19).

Table R19. Sign Structure per Trail Mile by Management Area Designation

Management Area Designation	Designated Trail Miles	Number of Sign Structures	Sign Structures Per Trail Mile
Agricultural Area	1.4	5	3.6
Passive Recreation Area	13.0	229	17.6
Natural Area	2.9	44	15.1
Habitat Conservation Area	1.8	14	7.8
No Designation	.1	5	62.5
Total	*19.2*	*297*	*21.3*

Multiple sign structures in close proximity, photo: OSMP

Visitor Infrastructure/Amenities Condition and Sustainability

OSMP maintains a system of trails, trailheads, access points and other facilities to support and enhance the visitor experience. Although all development impacts the natural system, either directly (e.g. a trailhead) or indirectly (e.g. changes to surrounding hydrologic patterns) sustainable infrastructure can reduce those impacts. OSMP has adopted a set of ecological best management practices to help maintain the ecological integrity of OSMP lands. These practices help avoid or minimize damage to natural resources during trail planning, construction, maintenance and closure.

The Ecological Best Management Practices for Trail Planning and Design, Construction, Maintenance and Closure

provides recommendations on how to minimize:

- soil erosion,
- the introduction and spread of invasive species,
- effect upon native wildlife and plants, and
- effects upon aquatic areas.

Carefully designed, constructed and maintained infrastructure endures over time and can reduce the likelihood that visitors will encounter hazardous situations, can increase visitor enjoyment, provide access and reduce the impact of litter. However, even carefully designed infrastructure requires maintenance to remain sustainable. In the absence of regular maintenance and upgrades, the infrastructure degrades, eventually to the point where it is more costly to restore than replace. A recreational facility or trail is considered physically sustainable when it is able to accommodate all physical forces acting upon it—both natural and human caused— requires less maintenance and encourages visitors to use it as designed (Minnesota Department of Natural Resources, 2006).

Some infrastructure is installed to make conditions safer for visitors. For example, infrastructure, such as road striping, flashing cross-walk signs and underpasses, are intended to reduce hazards for visitors where trails cross a road. The VMP identified three critical road crossings in the North TSA:

- Foothills Trail at Lee Hill Drive
- Underpasses at the Diagonal Highway for IBM Connector Trail; and
- Underpass at the Diagonal Highway connecting Cottonwood Trail and Fourmile Canyon Creek Greenway

Boulder County is managing projects to complete the two Diagonal Highway underpasses and cross-walk signs and road striping have been added to the Foothills Trail crossing at Lee Hill Drive.

Condition of Entry Points

In 2008, OSMP established a system of Classes and Standards for entry points based on visitation levels (R-Appendix N). Information from the 2004/2005 Visitor Survey/Visitation Estimate and staff knowledge was used to estimate visitation levels. Each classification has associated amenities that must be present for that entry point to comply with the standard. Table R20 displays the number of entry points in each category and provides a brief description.

Table R20. Entry Point by Classification

Estimated Visition by Entry Point Classification	
1-999	Very very low
1,000-9,999	Very low
10,000-24,999	Low
25,000-74,999	Medium
75,000+	High

TRAILHEADS (n=7)			
Classification of Entry Point	**Description**	**Estimated Use**	**Number in North TSA**
TH 1	Simple/Minor Developed Trailhead	Very Low to Low Use	5
TH2	Developed/Improved Trailhead	Medium Use	1
TH3	Fully Developed Trailhead	High to Very High Use	1
ACCESS POINTS (n=7)			
Classification of Entry Point	**Description**	**Estimated Use**	**Number in North TSA**
AP1	Access to Trail	Very Low to Low Use	4
AP2		Medium to High Use	1
AP3		Very High Use	2
ACCESS TO RECREATIONAL FACILITIES (n=7)			
Classification of Entry Point	**Description**	**Estimated Use**	**Number in North TSA**
RF1	Provides no designated trail access. Includes picnic areas, viewpoints and bench sites	Very Low to Medium Use	0
RF2		High to Very High Use	1
		Total	**15**

Photo: Phillip Yates (OSMP)

Staff completed an analysis of entry points located in the North TSA in May 2015. The Classes and Standards for Trailheads, Access Points and Recreation Sites (R-Appendix N) identify the classification for each entry point. Each classification has associated standard facilities that must be present, and a list of optional facilities, that might be present given each site's unique characteristics. For example, the only standard facility at an AP1 is a wayfinding/regulatory sign post. The standard facilities at a TH2 include fence, parking area (road base surface), trailhead signs, a trash can, dog stations and bike racks.

OSMP compared existing infrastructure to the infrastructure required based on the classification for all entry points in the North TSA. All of the entry points are in compliance with the assigned classification.

Although all entry points have the appropriate infrastructure based on classification, much of it is in disrepair or outdated and needs to be replaced. Examples include: outdated outhouse technology, signs that are not current with OSMP sign design standards and trailheads that lack parking delineation for both passenger vehicles and large vehicle/trailer parking.

In preparation for the North TSA Plan, OSMP installed visitor counters at many trailheads and access points to develop current information about visitation. This information will be used during the planning process to determine if an entry point should be re-classified. For each entry point that is re-classified, infrastructure would need to be adjusted to bring it into compliance.

Foothills North pre-flood (April 2010), photo: Nan Wilson

Foothills North post-flood, photo: OSMP

Condition of Trails

OSMP has conducted two comprehensive assessments of designated trail conditions in the North TSA. Designated trails were surveyed during October and November 2007, then again in September and October 2012. Additionally, trails heavily damaged by the 2013 flood were re-assessed in March and April of 2015 in preparation for the North TSA planning process. OSMP merged the post-flood condition data with the 2012 assessment data.

OSMP trails are categorized into six designed use classes:

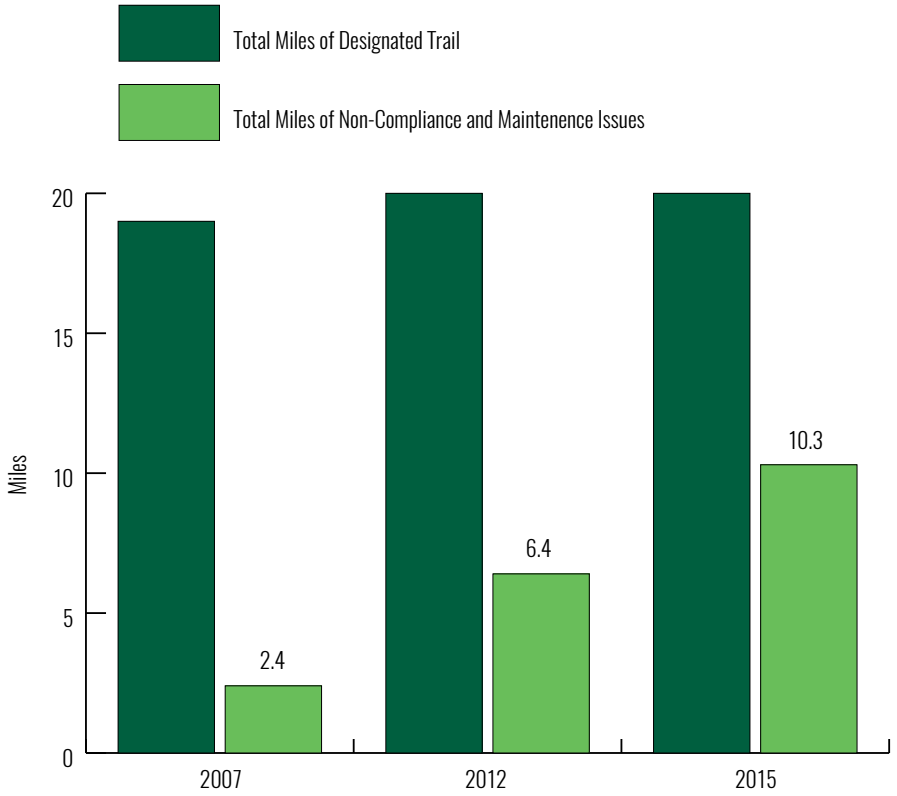
1. **Official Vehicle;**
2. **Accessible;**
3. **Equestrian;**
4. **Biking;**
5. **Hiking (Pedestrian); and**
6. **Climbing/Gliding Access.**

The repeated trail condition assessments used a protocol developed to allow comparisons of trail sustainability over time. The protocol divided trails into segments based on their combined trail class and designed use. Trail class refers to a trail's level of development and designed use refers to the one allowed trail activity for which the trail is designed, built and maintained. A specific set of design parameters were identified based on each trail segment's combined trail class and designed use, to be used as guidelines for trail sustainability (R-Appendix O). The trail design parameters include: trail grade, tread width, tread outslope, clearing width and height, surface material and turn radius.

Trails are divided into and managed by segments. Each trail segment was surveyed in the field. OSMP measured trail characteristics and compared the measurements to the trail's specific design standards to identify out-of-compliance locations. In addition to measuring compliance with design standards, OSMP also collected information about maintenance issues such as drainage, erosion and braiding.

A trend of increasing trail miles with non-compliance and maintenance issues is shown in Figure R13.

Figure R13. Trail Non-compliance and Maintenance Issues



The 2015 data shows 10.3 designated trail miles with areas of concern, up 3.9 miles since 2007. Although the data shows a trend of increasing miles of unsustainable trail, the large increase in 2015 can be attributed to significant damage caused by the 2013 flood.

Example of trail braiding and erosion, photo: OSMP

Trail Management Objective Compliance (Map R13) shows the general condition of trails by condition class using the 2015 data. Condition class was determined by identifying the percent of trail segment length that has one or more indicators of non-compliance or maintenance issues. This analysis does not reflect severity by showing where multiple out-of-compliance issues exist.

By utilizing the same monitoring protocol, OSMP is able to compare the percent of trail segments and total trail mileage in each condition class over time (Tables R21 and R22).

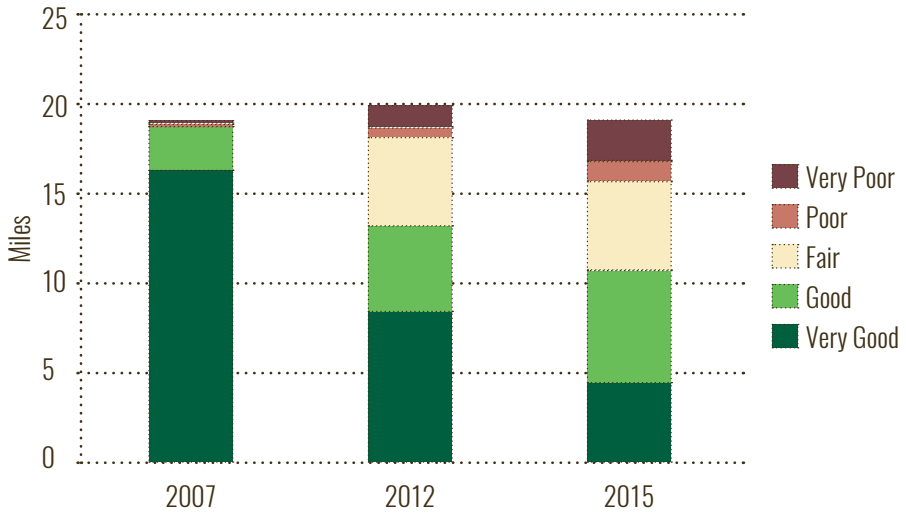
Table R21. Percent of Trail Segments in each Condition Class

% of Segment Length Out-of-Compliance	Condition Class	% of Trail Segments in Class		
		2007	2012	2015
0-19%	Very Good	74%	45%	28%
20-39%	Good	19%	23%	18%
40-59%	Fair	0%	18%	15%
60-79%	Poor	3%	5%	13%
80-100%	Very Poor	3%	9%	26%

Table R22. Miles of Trail Segments in each Condition Class

% of Segment Length Out-of-Compliance	Condition Class	Total Mileage of Trail Segments in Class		
		2007	2012	2015
0-19%	Very Good	16.4	8.5	4.6
20-39%	Good	2.4	4.8	6.2
40-59%	Fair	0	4.9	4.9
60-79%	Poor	0.1	0.5	1.3
80-100%	Very Poor	0.2	1.3	2.2

Figure R14. Trail Management Objective Compliance Trend



* Total trail miles fluctuate between 2012 and 2015 because the area of analysis was clipped to include only OSMP fee managed land. Actual designated trail mileage has not changed.

Figure R14 indicates that the designated trails in the North TSA are trending towards being in worse condition since the monitoring started. However, half the trails remain in good or very good condition.

Figures R15 and R16 show the breakdown of indicators used to determine non-compliance and maintenance issues.

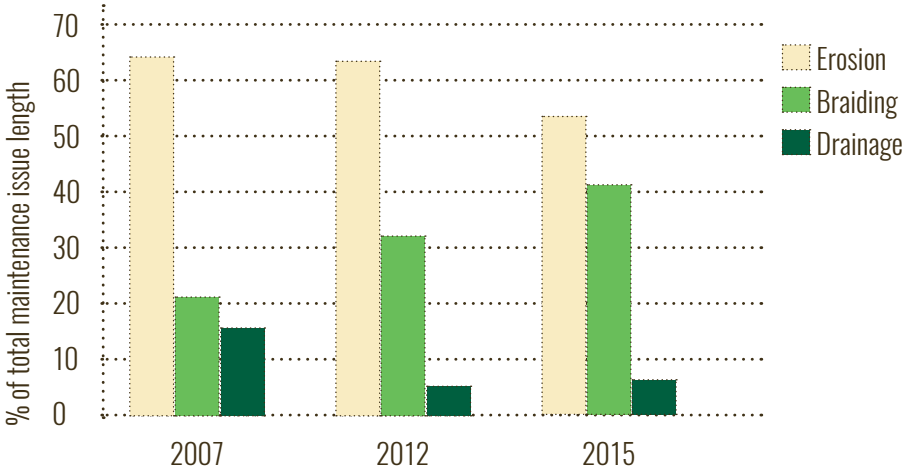


Figure R15. Maintenance Issues

Trail Condition Trends

- Problems with outslope and clearing height and width have reduced over eight years due to maintenance.
- The percent of trail with non-compliance tread width has increased over eight years; ***trails are getting wider***.
- The trend shows that the percent of trail with non-compliant grade has decreased over eight years. However, this may be misleading because grade hasn't changed substantially over time. The trend could be explained by the proportional rise in length of other areas of concern.
- ***Grade, tread width, erosion and braiding are the most common issues***.

Trail braiding, © Gary Stevens

Figure R16. Design Parameter Non-compliance

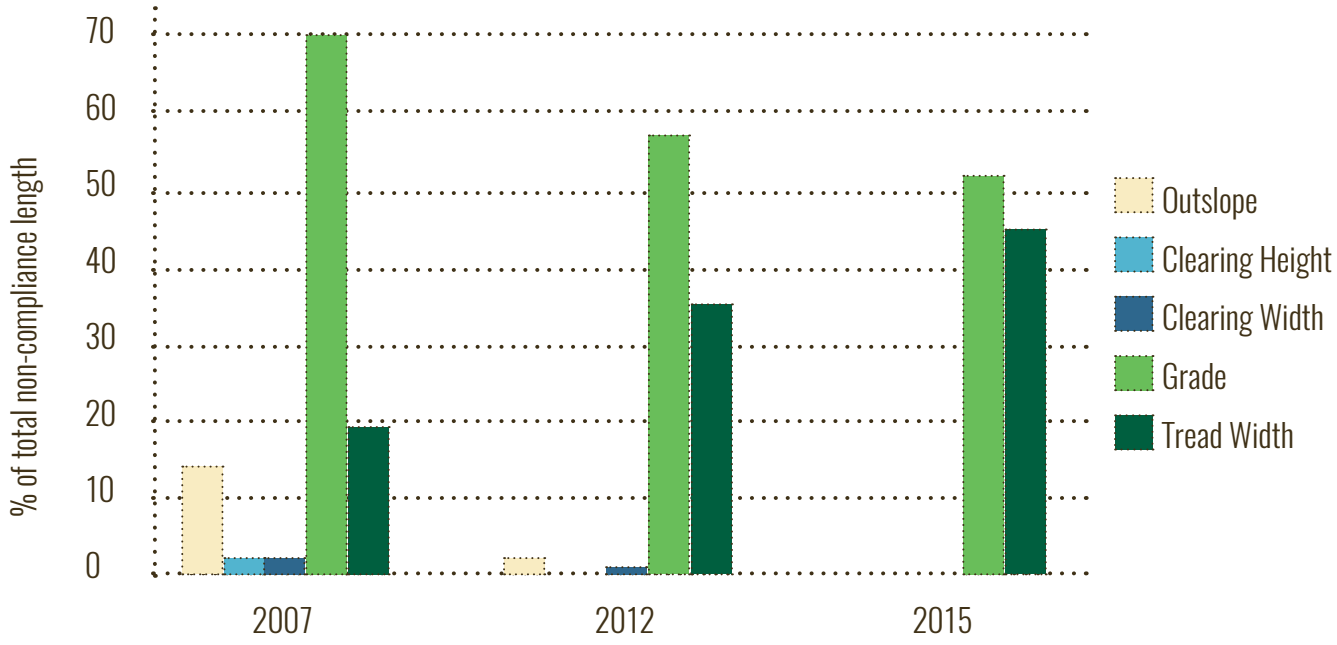
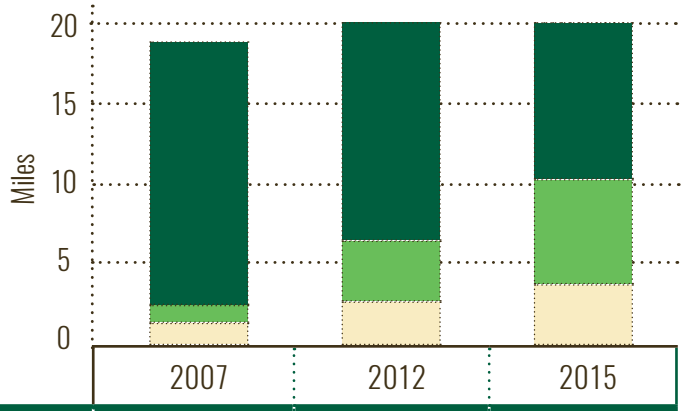


Figure R17 shows the relative distance of trail with maintenance issues, non-compliance issues or trail in good condition.

Figure R17. Condition of Trail by Trail Distance



	2007	2012	2015
Total miles of designated trail in good condition	16.6	13.6	9.8
Total miles of designated trail with maintenance issues	1.3	3.8	6.6
Total miles of designated trail with non-compliance issues	1.1	2.6	3.6

During each round of trail condition monitoring, information about constructed features was also gathered. Constructed features include:

- steps,
- retaining wall,
- fence,
- raised tread ways, and
- water diversion structures.

A total of 563 constructed features were identified in 2015 on designated trails in the North TSA. Features were categorized as functioning within standard, needing repair or needing replacement. More constructed features need repair or replacement than in 2012.

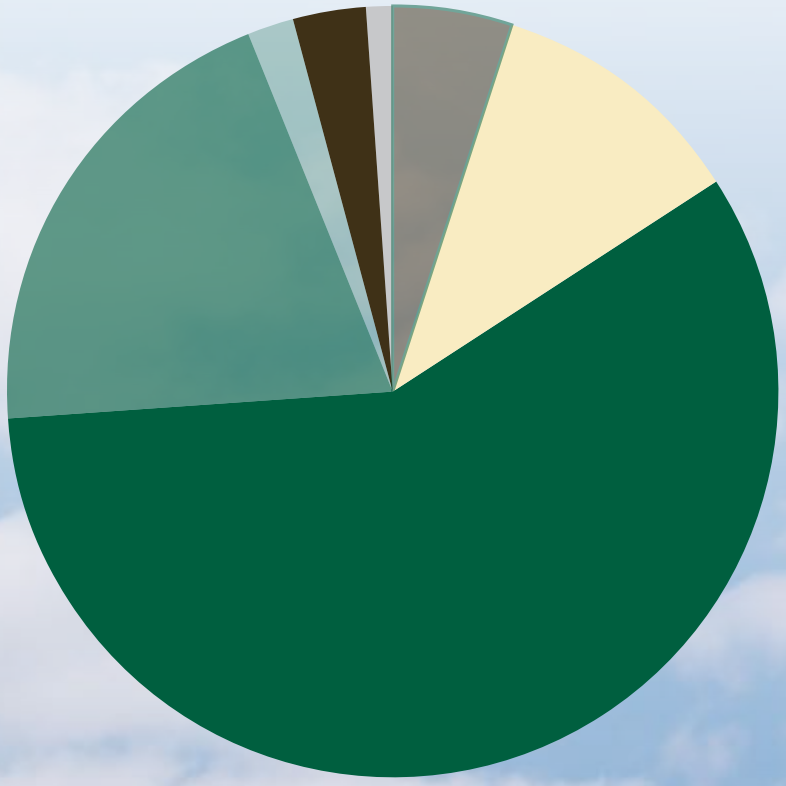
	2012	2015
Functioning within Standard	73%	58%
Needs Repair	20%	34%
Replace Feature	6%	8%

**2007 data were unavailable for analysis*

One notable comparison between constructed feature data from 2012 to 2015 is that the total number of constructed features went from 871 to 563. The biggest decrease occurred in the number of steps or staircases. In 2012, 43 percent of all constructed features were steps/staircases. In 2015, only 20 percent of constructed features were steps/staircases. This decrease is generally explained by the loss of infrastructure in the 2013 flood.

Photo: Deryn Wagner (OSMP)

Figure R18. Percent of Each Constructed Feature Type in 2015



5%	Bar/Side Ditch
11%	Culvert
58%	Waterbar/Grade Reversal
20%	Log/Stone Steps
2%	Retaining Wall
3%	Wood Fence
1%	Other

Example of wayfinding sign, photo: OSMP

Photo: Deryn Wagner (OSMP)

Condition of Signs

In 2009, OSMP created a Sign and Graphics Guidelines Manual. The goal of the manual was to provide a distinct graphic language and infrastructure standard so that all signs would be immediately recognized by the public as OSMP. The manual provides information on the following types of signs: rules and regulations, wayfinding and location, dog regulations, land area regulations, property boundaries, safety and wildlife information, interpretive signs and accessibility information.

Wayfinding signs provide useful information at decision points along a trail and usually consist of a trail name with directional arrows or a map. Wayfinding signs mark the designated trail system, reassuring the visitor they are on a designated and managed trail, and inform visitors where trail connections lead. They also help visitors navigate and decrease confusion. Being able to easily navigate the trail system without confusion, contributes greatly to the quality of visitor experience.

Information regarding sign structure location and sign type(s) was gathered during the 2012 Designated Trail Monitoring effort. Using that information, a GIS analysis was performed to determine if designated trail intersections have a wayfinding sign present (Map R14). There are a total of 50 designated trail intersections in the North TSA, 20 percent (10) of those intersections have a way finding sign present. The other 80 percent of designated trail intersections might have sign structures present; however, they do not have a map or directional arrow with the associated trail name.

Photo credit: Christian Nunes (OSMP)

Natural Resources

Introduction

The North TSA's natural environment encompasses the biologically rich convergence of the western-most edge of the Great Plains and the eastern edge of the Southern Rocky Mountain foothills. In this part of OSMP, the several-mile wide ecotone formed by the meeting of the two physiographic provinces is largely composed of grassland and shrubland, in contrast to the forest communities that dominate the foothills in areas to the south. Topography, geology, soils and natural processes in this transition zone contribute to a mosaic of habitats and an ecologically diverse setting. Habitats in the North TSA range from narrow forest patches, rock outcrops, xeric tallgrass prairie and deep canyons in the west to large mixedgrass prairie stands, shale barrens, plains wetlands and riparian areas, and lands converted to agricultural use to the east.

Areas of the North TSA have ***very high or high biodiversity,*** *according to the Colorado Natural Heritage Program.*

In the North TSA, the area from Wonderland Lake north through the Joder property and east to Lefthand Valley Reservoir is identified as a potential conservation area by the Colorado Natural Heritage Program (CNHP) with a B2 ranking—**very high biodiversity** significance—because of the presence of intact native mixedgrass and tallgrass prairie and the associated rare grassland-dependent skippers that require the presence of native prairie grasses like big and little bluestem to complete their life cycle (Map N1). CNHP also considers Left Hand Canyon a high biodiversity area.

Photo credit: Christian Nunes (OSMP)

Skippers are very closely related to butterflies but distinguished by features of their antenna. They are often characterized by their quick and darting flight. They have thick bodies and short wings, giving them fast and powerful flight. They seldom fly far and few migrate.

The Boulder County Comprehensive Plan (BCCP) identifies five areas on OSMP-managed lands in the North TSA as Critical Wildlife Habitat—an area of unique habitat that has a crucial role in sustaining populations of native wildlife, and in perpetuating and encouraging a diversity of native species in the county (Map N1). *Boulder Valley Ranch and Beech were also identified as an Environmental Conservation Area—areas of the county that possess a relatively low amount of fragmentation, contain high-quality natural resources or habitats, are designated at a sufficient size to provide ecological benefit, and/or have significant potential for restoration—in the BCCP*. Therefore, diversity of wildlife species and vegetation types is high in portions of the North TSA. The ecological integrity of the North TSA and the associated wildlife and vegetation communities will be described further in the conservation target sections of this chapter.

Boulder Valley Ranch and **Beech** have low habitat fragmentation, high-quality natural resources or habitat, and are a sufficient size to provide ecological benefit.

Grassland Conservation Framework

The natural resources chapter of the North TSA Inventory Report presents an overview of the physical, biological and ecological setting for this planning process and provides the best available information for use in conserving the natural environment while developing plans for improved recreation infrastructure and experiences. Since most of the TSA is within the Grassland Plan area, this chapter incorporates relevant information and conservation and restoration guidance from the Grassland Plan. Several **conservation targets** are identified in the Grassland Plan, each representing a portion of the biological diversity within OSMP grasslands. ***The Grassland Plan conservation targets form the basis for assessing conditions, setting desired future conditions, identifying conservation issues, developing and applying strategies, and measuring success.*** Key attributes and indicators are used to assess the condition of the Grassland Plan targets. The West TSA developed a similar conservation framework for forested habitats to assist with that TSA planning project and overall forest conservation.

Conservation Targets

Conservation targets form the basis for assessing conditions in the North TSA. They also help setting desired future conditions, identifying conservation issues, developing/applying strategies and measuring success.

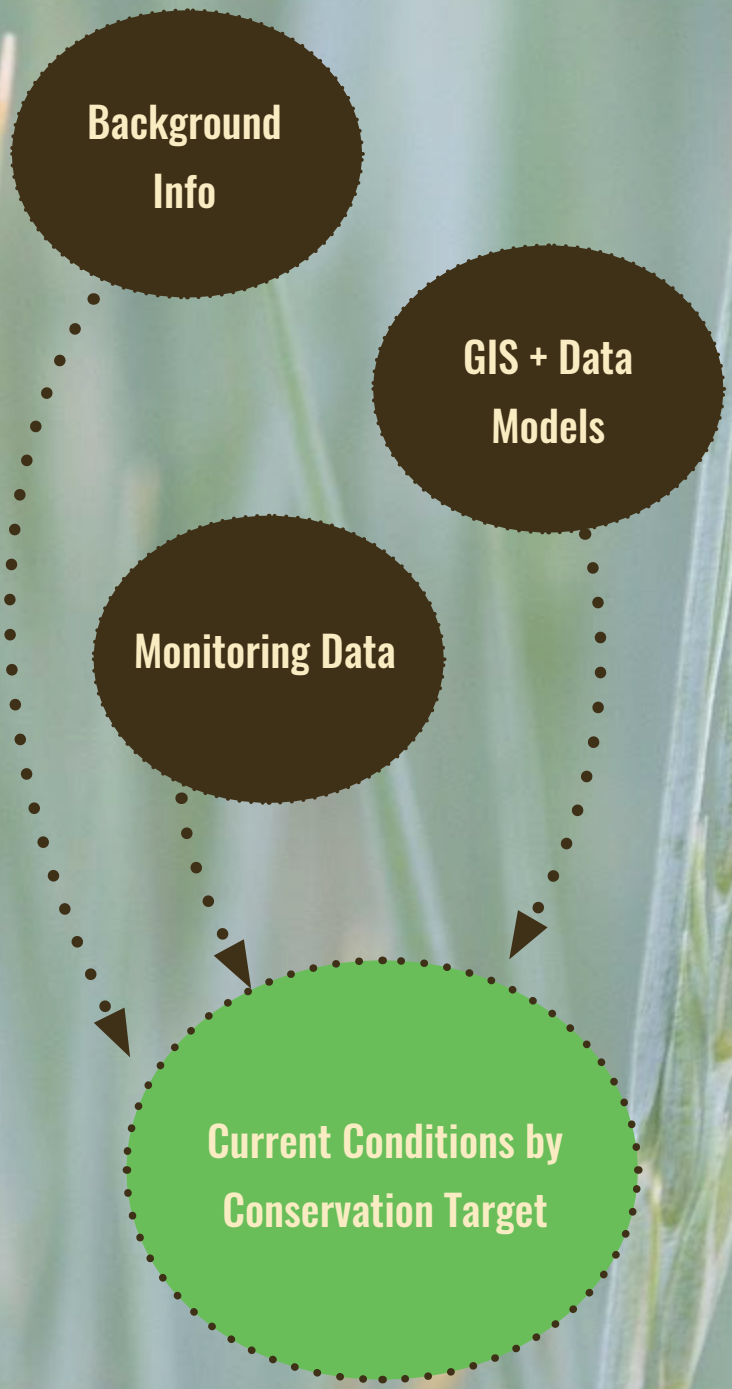
Indicators

Indicators are used to assess the condition of conservation targets and to monitor current/future success.

Conservation Targets	Indicators
Mixedgrass Prairie Mosaic	*Percentage of North TSA with highly suitable habitat* ***for lark sparrow.*** *Percentage of North TSA with highly suitable habitat* ***for prairie rattlesnake***
Xeric Tallgrass Prairie	*Percentage of North TSA with highly suitable habitat* ***for grassland-dependent butterflies***
Wetlands and Riparian Areas	*Relative cover of native species* **Spatial extent and relative abundance of* ***invasive species*** **Number and acres of* ***rare plant populations and communities***
Upland Shrublands	*Percentage of North TSA with highly suitable habitat* ***for lazuli bunting (shrub-nesting birds)***
Exposed Rock and Cliff Areas	**Spatial extent and relative abundance of* ***invasive species*** **Number and acres of* ***rare plant populations and communities***

*Indicator is common to all conservation targets.

Natural Resources Assessment Inputs



Five conservation targets are used in the North TSA, three derived from the Grassland Plan and two selected specifically for characterizing important wildlife habitat in the North TSA. Map N2 shows the conservation targets. The targets include the large habitat blocks formed by the **Mixedgrass Prairie Mosaic** (MGPM) and the **Xeric Tallgrass Prairie** (XTP), and smaller patches that constitute the **Wetlands and Riparian Areas**, **Upland Shrublands** and **Exposed Rock and Cliffs Areas** (Table N1). The Natural Resources chapter integrates background information, data models and GIS and monitoring data into an assessment of current conditions for the conservation targets.

Table N1. Percentage and Acreage of Conservation Targets with the North TSA

Conservation Target	Acreage	Percent of North TSA
Mixedgrass Prairie Mosaic*	4,925	64
Xeric Tallgrass Prairie*	621.8	8.1
Wetlands and Riparian Areas*	552	7.2
Upland Shrublands	374.4	4.9
Exposed Rock and Cliffs	39	0.5

*Conservation Targets derived from Grassland Plan

Conservation Objectives and Strategies

The Grassland Plan sets objectives for addressing conservation issues identified in the plan and for restoring the viability of the conservation targets. Strategies have been formulated for accomplishing the objectives, and are grouped into a set of strategic initiatives. The initiatives most applicable to the North TSA planning process are: 1) Large Block Habitat Effectiveness, 2) Ecological Restoration and 3) Aquatic System Management. N-Appendix B summarizes the Grassland Plan conservation issues and strategies that are most relevant to the North TSA planning process.

Best Opportunity Areas for Conservation and Restoration

The Grassland Plan identifies areas that represent the best opportunities for conservation or restoration within and across multiple targets. This best opportunity analysis helps set priorities about the places where conservation action is likely to have the greatest benefit when implementing the Grassland Plan, and in developing TSA plans and other management plans. Specific considerations for identifying best opportunity areas were developed by grouping some of the Grassland Plan targets to form the Upland Grassland Complex and the Wetland and Riparian Complex. Map N3 displays the resulting Grassland Plan Best Opportunity Areas within the North TSA. Examples of criteria used to assess conservation and restoration opportunity include:

Evening Primrose, © Greg Joder

Conservation:

- » High occurrence of rare or sensitive species or communities (plants, reptiles, amphibians, birds, mammals, fish);
- » High occurrence of native species or communities and low occurrence of non-native species;
- » High ecological functioning, little or no change in management needed to maintain viability; and
- » Large block of habitat connected to or contiguous with other "Good" quality habitat.

Restoration:

- » Remnants of previously high functioning ecosystems;
- » Restoration of area would buffer and/or increase the extent of high-quality wildlife habitat;
- » Area is contiguous with high-quality vegetation or near one or more rare plant occurrences;
- » Areas where partnerships are possible or funding for restoration is available; and
- » Areas where restoration has been successful in the past and additional efforts would likely be effective.

Photo: OSMP

Natural Resource Inventory Components

Conservation Target Descriptions and Current Conditions

The main body of the Natural Resource Inventory presents an overview of each conservation target, providing information on the background and setting of the target and the characteristic species and communities within the target. The ecological processes that influence the ecosystems and shape the target are described as current conditions. Current conditions are based on assessments of the status of invasive species, rare plant species and communities, wildlife composition and focal wildlife species. The methods and specific data used to develop the current conditions are described in the Natural Resource chapter appendices. Habitat suitability analyses were conducted for a subset of focal wildlife species within the Mixedgrass Prairie Mosaic, Xeric Tallgrass Prairie and Upland Shrubland conservation targets.

Natural Resource Inventory Appendices

The Natural Resource Inventory appendices contain details about the data, techniques and information collected and analyzed for assessing the current conditions of conservation targets.

On-going Wildlife Monitoring Projects (N-Appendix A)

The diversity of habitats in the North TSA supports a rich variety of wildlife species. Summaries contained in this section emanate from recent and on-going research, as well as monitoring projects conducted by OSMP staff and contracted researchers in the North TSA. These studies provide empirical information on occurrence, distribution, and species abundance in the North TSA.

Rare Plant and Community Inventory, Vegetation Mapping and Monitoring (N-Appendix B)

The methods used to inventory and document rare plant species and communities across the OSMP system are described. The number of subpopulations and the sensitivity ranking is reported for each rare plant

species. Total acreage and sensitivity ranking is presented for rare plant communities. Vegetation mapping methods and the Grassland Plan upland grassland vegetation monitoring project are described.

Invasive Species (N-Appendix C)

The OSMP approach to preventing and managing invasive species is presented. The Colorado Noxious Weed Act species lists, eradication requirements and management objectives are summarized. OSMP rapid assessment weed mapping methods are described and results for selected species are reported. The list of invasive plant species tracked and/or treated by the OSMP Integrated Pest Management (IPM) program is provided—highlighting species that have been documented in the North TSA.

Habitat Suitability Indices and Trail Effects (N-Appendix A)

The wildlife focal species identified for the North TSA planning process are nested targets that, like conservation targets, represent the habitat conservation needs of additional species. A subset of the focal species was used for creating species-specific habitat quality indices. Species were selected because sufficient baseline data and relevant research to accurately model habitat needs are available and the species are sensitive to human activity. Table N2 shows the selected focal species and their associated conservation targets.

Habitat suitability indices were created to map the potential habitat of a focal species within a conservation target. The models are based on multiple OSMP Geographic Information System (GIS) data sources and incorporate species-specific information from research and monitoring results. The resulting habitat indices are a coarse-scale tool used to characterize and visualize suitable habitat, evaluate current conditions and identify areas in the TSA where existing natural resource conditions could be improved. These broad assessments will be followed by finer scale

evaluations when specific projects are identified through the planning process.

Existing literature and research was reviewed to identify human impacts related to each of the focal species and these potential impacts were incorporated into the indices. The trail and road effects portion of the models use the best available information to make general assumptions about potential effects. At the coarse level, the included trail effects provide a tool to identify areas where natural resource values may be impacted, and where changes to existing infrastructure and undesignated trails could improve natural resource target conditions.

Table N2. North TSA Focal Species and their Associated Conservation Targets

Target	Focal Species
Mixedgrass Prairie Mosaic	Prairie Rattlesnakes*, Lark Sparrow*
Xeric Tallgrass Prairie	Ottoe, Arogos, Dusted Skippers*
Wetlands and Riparian Areas	Northern Harrier, Plains topminnow
Upland Shrublands	Lazuli Bunting*
Exposed Rock and Cliffs	Rock Wren

**Habitat Suitability Index created*

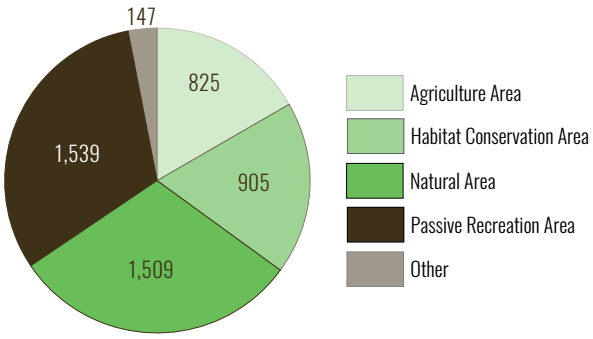
Photo: Gary Stevens

Conservation Target:
Mixedgrass Prairie Mosaic (MGPM)

Background and Setting

The **mosaic of mixedgrass communities** on OSMP includes plant associations similar to those occurring in the central, southern and northern Great Plains, as well as in the southwestern and intermountain regions of the western U. S. In the Boulder area, mixedgrass prairie communities occur in larger matrix-forming stands or in small patches intermingled with xeric tallgrass or other vegetation types.

Mixedgrass Prairie Mosaic Acreage by Management Area Designation in the North TSA



This conservation target covers about 40 percent of the entire Grassland Plan area and ***some of the largest habitat blocks of the Mixedgrass Prairie Mosaic (MGPM) within OSMP occur in the North TSA*** (Figure N1.)

Key Statistics

4,925
total acres of the mixedgrass prairie mosaic in the North TSA

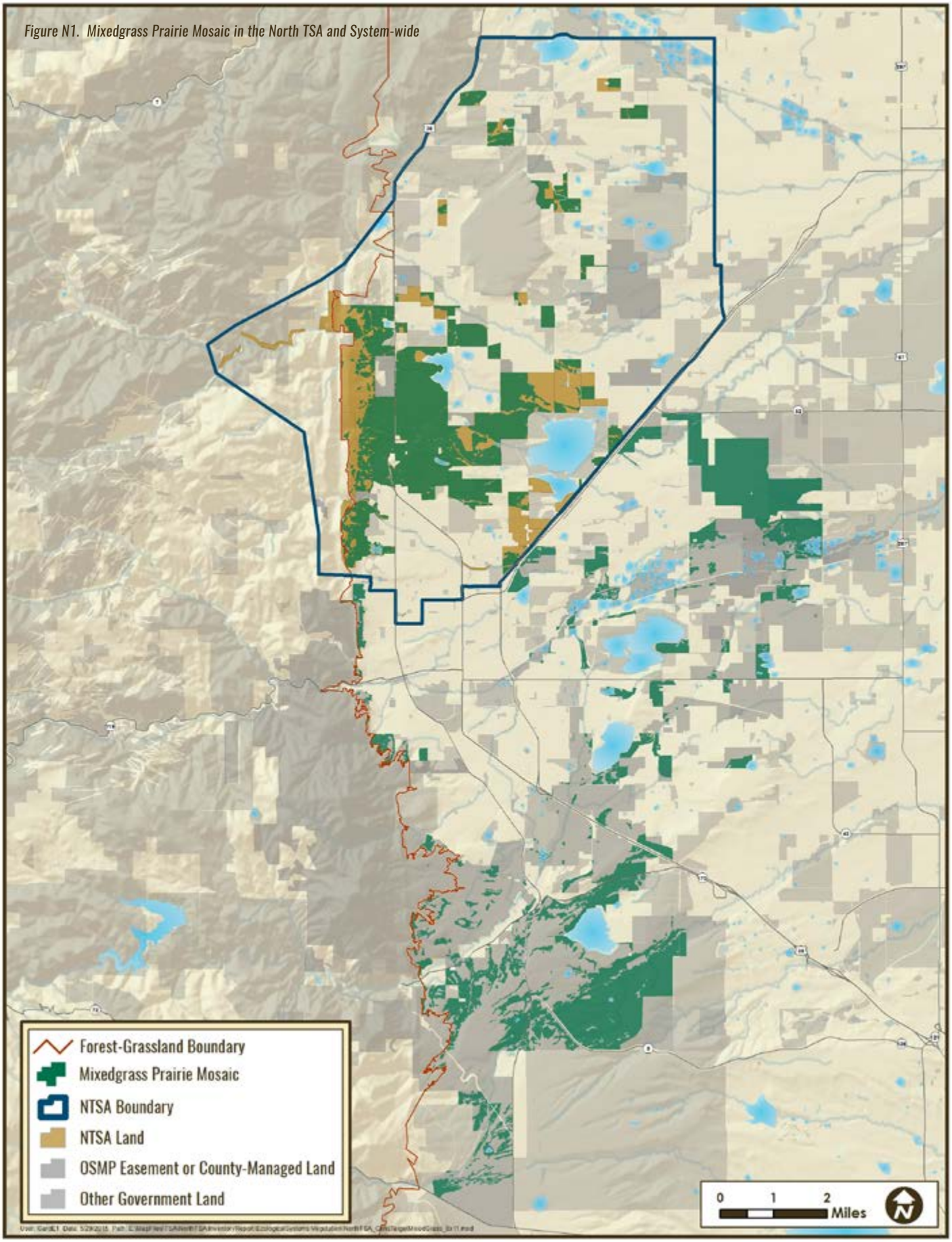
64
percent of the target in the North TSA

137
feet per acre of designated trails in the MGPM target in the North TSA

242
feet per acre of undesignated trails in the MGPM target in the North TSA

Photo: © Gary Stevens

Figure N1. Mixedgrass Prairie Mosaic in the North TSA and System-wide



Composition

In the western portions of the North TSA, mixedgrass communities combine with xeric tallgrass prairie patches to form a biologically rich foothills grassland mosaic. At the foot of the mountains, diverse topography, soils and geology combine with climate to create habitat for grassland plant associations characterized by mid-height species such as western wheatgrass, needle-and-thread grass, green needlegrass, New Mexico feathergrass, sideoats grama, little bluestem and Rocky Mountain bluegrass. The mixedgrass prairie also includes shortgrass species such as blue grama and buffalograss. Lists of the most frequent native and non-native species documented by Grassland Plan monitoring in the Xeric Tallgrass and MGPM are included in N-Appendix B.

The most common communities in the MGPM are dominated by western wheatgrass and occur in fine-textured clay soils on mid- to lower-hill slopes, valley bottoms and shallow, seasonally wet drainages. In rocky sites, needle-and-thread grass co-dominates with western wheatgrass and/or blue grama. New Mexico feathergrass dominates small patches of calcium-rich soils, and little bluestem and sideoats grama are characteristically dominant on north facing edges of low mesas.

Sub-shrubs such as fringed sage, dwarf rabbitbrush and snakeweed are common in western wheatgrass plant communities. Three-leaved sumac has a widespread distribution in mixedgrass prairie in the North TSA and throughout OSMP-managed lands. Winter fat and four-winged saltbush occur in small patches in the North TSA mixedgrass, and are only found in a few other OSMP areas. Upland shrubland communities embedded in the North TSA grasslands serve as habitat and produce food for many bird and small mammal species, and are treated as a distinct conservation target in the North TSA inventory report.

Western Wheatgrass, photo: Dave Sutherland (OSMP)

The MGPM supports a diverse fauna including uncommon species such as the short-horned lizard, olive-backed pocket mouse and several grassland-dependent rare butterfly species (City of Boulder 2010). Large blocks of mixedgrass prairie provide habitat for numerous grassland nesting songbirds, the American badger and elk. Much of the land inhabited by black-tailed prairie dogs in the planning area occurs within this conservation target. Prairie dog colonies contribute to increased landscape heterogeneity and grassland biodiversity (Kretzer and Cully 2001, Shipley and Reading 2006), and more than 100 species of vertebrates are known to associate with prairie dog colonies (Kotliar et al. 1999). Prairie dog colonies support nesting burrowing owls, provide important foraging habitat for other raptors, and provide vital foraging, over-wintering and habitat for prairie rattlesnakes, in addition to other ecological services. Mixedgrass patches with high native plant species diversity also provide for a species-rich invertebrate fauna.

Wetlands, riparian corridors, streams and small water bodies that are contiguous with the MGPM support amphibians and other wildlife that require both upland and wetland or aquatic habitat to complete their life cycles. Wetlands and riparian areas are included in a separate conservation target in the North TSA.

The MGPM includes some areas that were under agricultural cultivation or mined in the past, and are in various stages of restoration.

Photo: Gary Stevens

Shale Barrens

Shale barrens are an important patch type in the MGPM, contributing significantly to the biological diversity of the North TSA (Figure N2). Outcrops of the Niobrara and Pierre geologic formations north of Boulder form the barrens that provide habitat for Bell's twinpod, a Colorado Front Range endemic plant. This globally rare, state imperiled species occurs exclusively in shale barrens in Boulder and Larimer County, and nowhere else in the world (Kothera 2006). Two rare plant communities, the Indian Ricegrass Shale Barrens and the New Mexico Feathergrass Herbaceous Associations, are also affiliated with the shale barrens.

Bell's Twinpod rosette, Photo: Gary Stevens

Bell's Twinpod, © Nan Wilson

Currently about 60 acres within the North TSA are mapped as shale barrens. Barrens range in character from very sparsely vegetated areas (<10 percent plant cover) in dark, coarse shaley soils, to areas of moderate vegetation cover (>50 percent) in finer soils. Many "barrens" plant species have extensive root systems and are well adapted to the water-limited environment created by coarse, shallow soils over shale bedrock (Kelso et al. 2003). The amount of suitable habitat for plants that are poor competitors for resources such as Bell's twinpod varies over time with the dynamics of natural disturbance regimes. As visitation increases on OSMP-managed lands in the North Boulder Valley, undesignated trail development and new designated trails have the potential to affect shale barrens.

The flora of shale barrens includes a variety of forb species, grasses and small shrubs. The diversity of wildflower species offers good habitat for bees and other pollinators. Bell's twinpod, rough sunflower, prairie sage, sidebells penstemon, three-fingered milk vetch, woolly hymenopappus and spike gilia are characteristic forbs. Common grasses are Indian ricegrass, New Mexico feathergrass, needle-and-thread grass, blue grama, sideoats grama, little bluestem and purple threeawn. Shrubs and sub-shrubs include sand cherry, three-leaved sumac, serviceberry, yucca, snakeweed and yellow buckwheat. Western hackberry trees sometimes occur in small, stunted stands on some barrens.

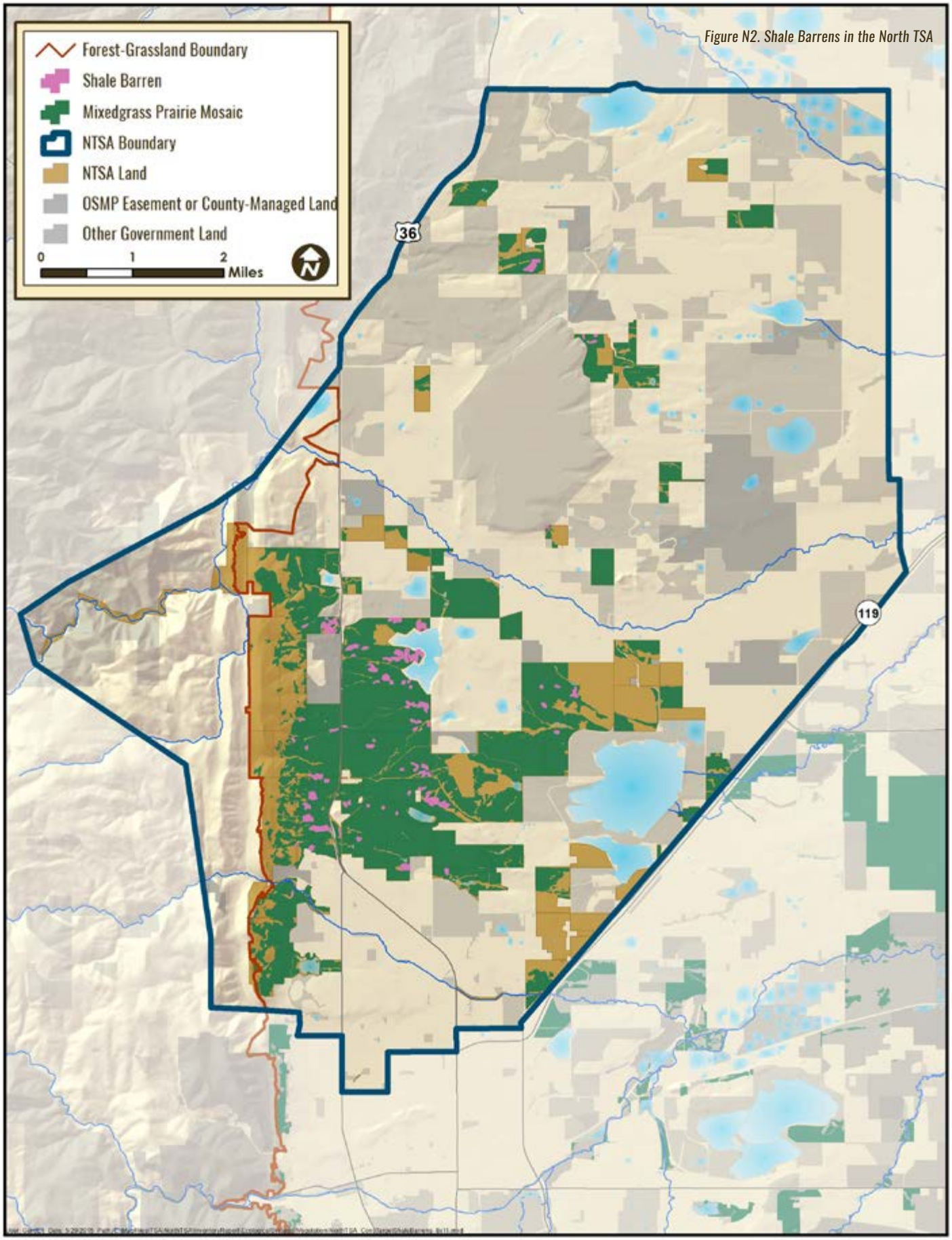


Figure N2. Shale Barrens in the North TSA

Ecological Processes

The major ecological processes influencing mixedgrass prairie are fire, ungulate grazing, black-tailed prairie dog burrowing and grazing. Natural disturbance regimes have been significantly altered with European settlement. Historically, natural and human set fires probably occurred more frequently and covered larger areas than in today's landscapes where fuel loads are reduced by livestock grazing and people actively suppress wildfires (Sherriff and Veblen 2007). Spatial patterns, seasonality and intensities of pre-settlement grazing by bison, deer, elk and prairie dogs differ from those of post-settlement livestock grazing, pasture fencing and water source redistribution. These changes combine with additional biotic and abiotic factors to affect the resilience and resistance of mixedgrass plant communities in the face of stresses such as drought and the invasion of aggressive non-native plant species.

Olde Stage Fire, photo: Dave Sutherland (OSMP)

During the last 25 years, two large wildfires, prairie dog population fluctuations and shifts in precipitation patterns have influenced the mixedgrass prairie communities in the North TSA, resulting in shifting vegetation patterns. Mixedgrass communities became dominated by sub-shrubs and grazing tolerant forbs in the 2000s as prairie dog colonies expanded along with periods of drought. From the late 2000s to the present, a major prairie dog die-off, the 2009 Olde Stage Fire and higher precipitation levels have resulted in a transition to grass dominance. As prairie dog colonies expand and precipitation patterns fluctuate, the native mixedgrass plant communities will shift between different vegetation patterns. Variation in vegetation composition in response to ecological processes, such as in this example, creates a spatial and temporal prairie mosaic that contributes to this target's high biological diversity.

Current Conditions

Vegetation

Invasive species abundance, rare plant and community populations and subpopulations and other aspects of plant community composition are used to evaluate the condition of MGPM grassland habitat, and will be used to inform the TSA planning process. The Grassland Plan characterizes the condition of the MGPM as fair, based on assessments of vegetation composition and structure and other key attributes (N-Appendix B). Best Opportunity Areas (BOAs) for conservation and restoration of the MGPM and the Xeric Tallgrass Prairie are identified in the Grassland Plan to highlight the places where conservation actions are likely to have the greatest benefit. In the North TSA, the Upland Grassland Complex BOAs include large areas of contiguous grassland in the western part of the planning area (Figure N3).

3,467

acres of the MGPM target in the North TSA that have been mapped for selected invasive species (70%)

648

acres are invaded (19% of the MGPM target in the North TSA)

Invasive Species Prevalence

System-wide mapping data that includes species, percent cover and patch size were used to identify areas in the North TSA with relatively high invasive species cover. An **invasive species** is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration, and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (U.S. Department of Agriculture 2012). A list of the management priority invasive plant species used in this target analysis, along with all North TSA target analyses and a description of the mapping methodology used for all targets, can be found in N-Appendix C.

Future mapping and monitoring will increase data on invasive species prevalence in each of the North TSA targets. Map N4 displays invasive species densities across the mapped portions of the TSA and relative concentrations based on patch size and density. Maps N5 and N6 depict the species occurring in the TSA that are included in Colorado Noxious Weed Act (35-5.5 CRS) lists A and B. Noxious weed species on these lists are required under the Act to be eradicated, contained or controlled.

Mediterranean Sage, an invasive weed

Photo: OSMP

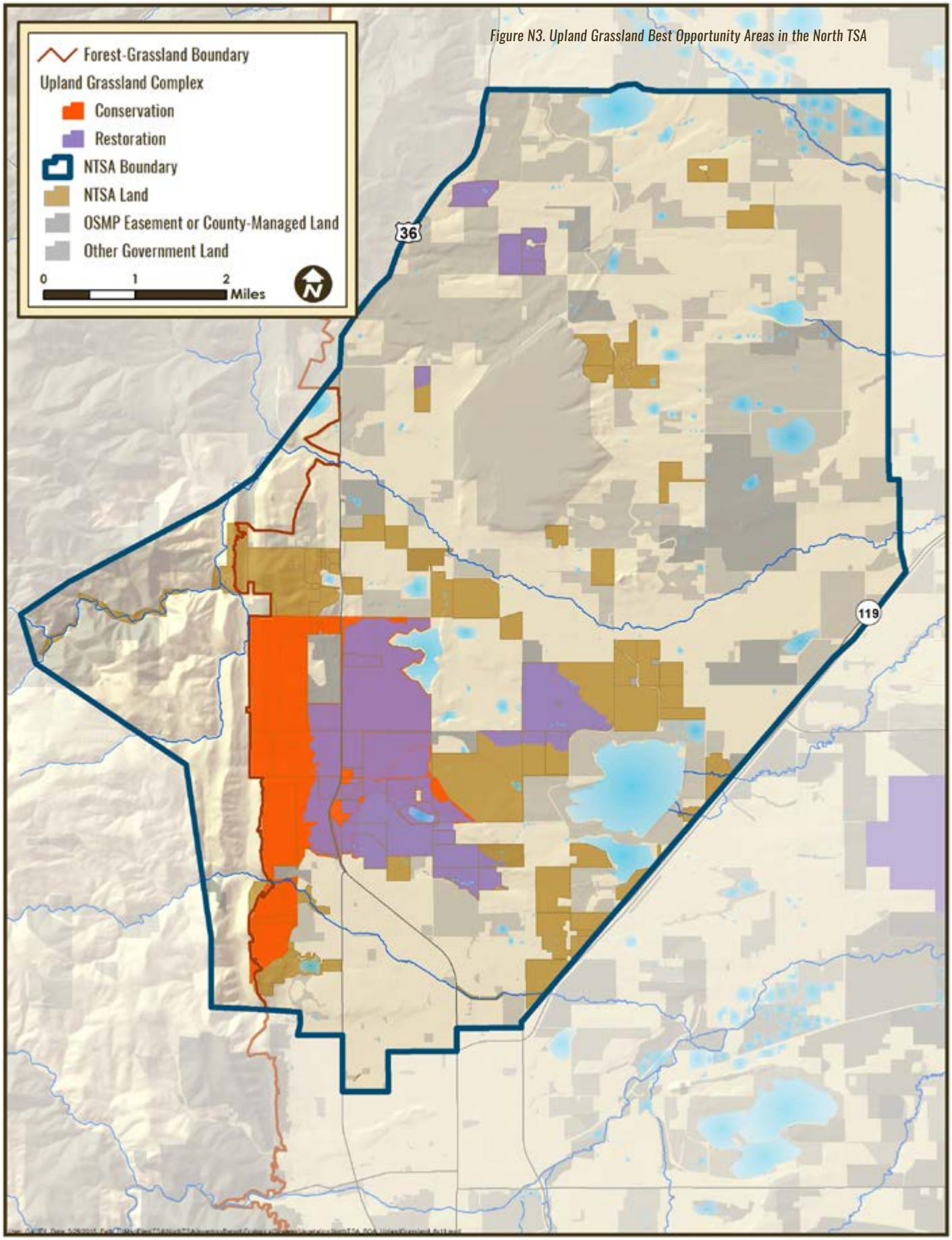


Figure N3. Upland Grassland Best Opportunity Areas in the North TSA

Number of Populations and Subpopulations of Rare Plant Species and Communities

Rare plant occurrences are documented across the OSMP land system using a standard methodology. A list of the rare and sensitive plant species and communities, and the survey methods can be found in N-Appendix B. Documented occurrences of rare plants and communities have been generalized in Map N7.

Within the MGPM target area in the North TSA, there are currently **seven known populations of rare plant species,** with a total of 127 subpopulations. In addition, there are 10 rare plant populations with a total of 711 subpopulations in areas that span across the MGPM and XTP targets. There are **393 acres of rare plant communities in the Mixedgrass Prairie Mosaic**.

Bell's Twinpod, © Claudia Van Wie

Wildlife

The MGPM habitats within the North TSA support a rich and varied wildlife community. The close proximity of a variety of habitats within this target supports a diverse fauna, including mountain lions, black-tailed prairie dogs, burrowing owls, American elk, bobcats, coyotes, foxes (gray and red), grassland-nesting songbirds and at least 6 species of snake, including prairie rattlesnakes and the rarely observed plains black-headed snake.

Black-tailed Prairie Dogs

The northern portion of the North TSA supports substantial populations of black-tailed prairie dogs which have far-reaching effects on the grassland that they inhabit. Although prairie dogs can be found in xeric tallgrass and agricultural environments within the TSA, the majority of the population is concentrated in the mixedgrass prairie areas of the TSA. The presence of prairie dogs provides prey and landscape structure necessary for the presence of associated species. Because of these far-reaching effects, prairie dogs are often considered "keystone" species (Kotliar et al. 1999, Hoogland 2006).

Some prairie dog colonies support a healthy native plant community and several animal species associated with prairie dogs. Others are characterized by a high density of burrows, diminished native vegetation, localized soil loss and no evidence of the vertebrate species considered dependent upon prairie dogs. In many cases, surrounding land use, underlying vegetation communities and other factors are, along with prairie dog burrowing and grazing, important contributing factors to the degraded ecological status of these colonies.

Populations of prairie dogs in the North TSA and across the OSMP system increase and decrease through time, due largely to epizootics of sylvatic plague. When plague impacts a colony, populations decrease rapidly followed by both prairie dog population and vegetation recovery over time.

Black-tailed prairie dog, © Perry Conway

The existence of several other closely associated species that rely on the black-tailed prairie dogcontributes to its function as a keystone species. These associated species benefit from the prairie dogs directly as prey, indirectly through use of their burrows, or both. These associated species are considered nested targets and include species that are common on OSMP as well as some less common and several extirpated species.

Burrowing owls, American badgers, ferruginous hawks and golden eagles are animal species associated with intact prairie dog colonies. These species include predators (American badgers, ferruginous hawks and golden eagles), which are sensitive to human disturbance and are frequently found to be using only prairie dog towns distant from development and human disturbance. Other associated species use prairie dog burrows as habitat, most notably burrowing owls. Burrowing owls are most frequently found using abandoned prairie dog burrows for shelter and nesting. Many other species, including a variety of insects, small mammals, reptiles and amphibians, may also use the burrows in prairie dog colonies.

Because of the significant influence of prairie dogs on plant communities, support for associated species, and value to the Boulder community, black-tailed prairie dogs were included in the Grassland Plan as a stand-alone conservation target. However, in the North TSA, management of prairie dogs is largely independent of recreational use, so they are included as one aspect of the grassland communities they inhabit, rather than a conservation focus themselves.

Prairie Dog Monitoring

Each fall, OSMP staff maps the black-tailed prairie dog colonies on OSMP-managed lands. This allows staff to track the total acreage of colonies on the system. During the mapping effort, evidence of other wildlife species that are associated with prairie dog colonies is also recorded. In 2014, the North TSA contained 2,073 acres of active prairie dog colonies (Map N8). These colonies are situated within five management designations created in the Grassland Plan, including approximately 148 acres in Removal Areas,

323 acres in Transition Areas, 181 acres in Multiple Objective Areas, 27 acres in Prairie Dog Conservation Areas and 1,394 acres in Grassland Preserves. Monitoring information is presented in N-Appendix A.

Burrowing Owls

Burrowing owls are small owls that nest in abandoned prairie dog burrows. In Boulder County, burrowing owls are a rare and isolated breeding species and are listed as Threatened by the State of Colorado. Because of their use of prairie dog burrows for nesting, burrowing owls are tied closely to prairie dog colonies on the system. Mapping of prairie dog colonies defines the potential available habitat for owls on OSMP. Burrowing owls are only found in a few locations on OSMP and generally select remote locations away from trails and recreational use. Like many raptors, burrowing owls are often tolerant of vehicles, but not of humans or dogs on foot. Each year staff monitors prairie dog colonies for presence of burrowing owls. Seasonal closures are used to protect the nest sites and minimize disturbance to nesting burrowing owls. Information on burrowing owl nesting and sightings can be found in N-Appendix A and Map N8.

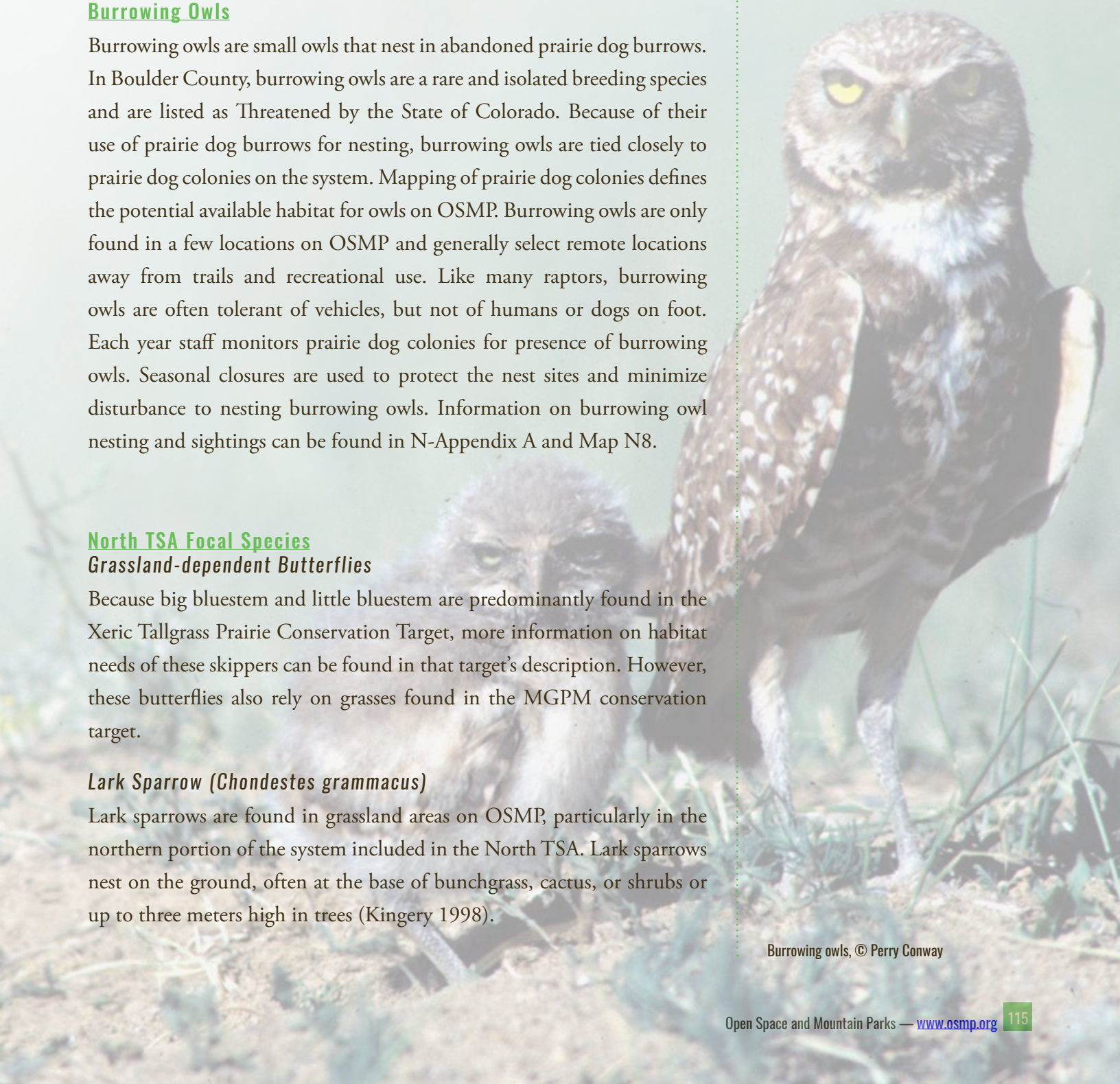
North TSA Focal Species

Grassland-dependent Butterflies

Because big bluestem and little bluestem are predominantly found in the Xeric Tallgrass Prairie Conservation Target, more information on habitat needs of these skippers can be found in that target's description. However, these butterflies also rely on grasses found in the MGPM conservation target.

Lark Sparrow (Chondestes grammacus)

Lark sparrows are found in grassland areas on OSMP, particularly in the northern portion of the system included in the North TSA. Lark sparrows nest on the ground, often at the base of bunchgrass, cactus, or shrubs or up to three meters high in trees (Kingery 1998).



Burrowing owls, © Perry Conway

Lark Sparrow, Photo: Gary Stevens

In Colorado, the lark sparrow may be found in various suitable habitats, including grasslands with yucca and western wheatgrass, grasslands within cottonwood stands and short-grass prairie. Two main components are required for lark sparrows to nest: a variety of vegetation heights and open views (Kingery 1998). Both low- to modest-density herbs and grasses and scattered woody vegetation are also required (Renwald 1977).

Lark sparrows were observed in OSMP-managed plots northeast of the City of Boulder in mixedgrass prairie (Haire et al. 2000). Haire et al. (2000) found the lark sparrow geographic distribution to be associated with shale plant communities on OSMP-managed lands.

The lark sparrow has experienced sharp population declines over the last 50 years (Knopf 1996, Sauer et al. 2014). Both the Breeding Bird Survey (BBS) and the Christmas Bird Counts (CBC) showed significant declines in lark sparrow populations (Knopf 1996). These declines are described using the annual rate (expressed as a percent) of change in population numbers (-3.45 for BBS and -2.0 for CBC).

Lark sparrows in Boulder County occurred more frequently on interior plots (200 meters from an edge) than edge plots (defined as the interface between suburban development and native habitat), but the difference was not significant because of a high variation in numbers of lark sparrows in the plots (Bock et al. 1999).

Monitoring of the OSMP grassland ecosystems found very high abundance of lark sparrows in the North TSA as compared to the rest of the system. Areas on East Beech, north of the Foothills Trail and south of Joder, and Boulder Warehouse all supported high numbers of lark sparrows. Monitoring results within the TSA and system-wide are detailed in N-Appendix A and Map N9. Habitat suitability indices for lark sparrows are included in N-Appendix A.

Prairie Rattlesnake

The North TSA contains high-quality habitat for snakes as the grasslands and associated prairie dog colonies provide shelter and food while the hogbacks and exposed rocks, intermingled with shrub patches, create ideal hibernacula locations (City of Boulder 1996). OSMP partnered with Vernalis, Inc., a non-profit organization specializing in studying herpetiles, to learn more about snake distribution and abundance, and identify important snake habitats in the North Boulder Grasslands (NBG). The project included conducting snake surveys and attaching radio transmitters to prairie rattlesnakes (Maps N10 and N11).

In years past, OSMP staff has consistently observed prairie rattlesnakes, sometimes in groups of six or more, on the grasslands adjacent to Highway 36 north of Boulder. Because the TSA process involves improving visitor experience, OSMP staff chose prairie rattlesnakes as a focal conservation species, and one which required further study to effectively manage important rattlesnake habitat and increase visitor safety. Although observations of snakes is useful for planning purposes, the use of radio telemetry allowed staff to learn more about rattlesnake habitat use and locate hibernacula of over-wintering rattlesnakes.

Unlike other snake species, about half of the 60 opportunistic detections of prairie rattlesnakes in grassland habitat types occurred in prairie dog colonies, confirming other studies that found prairie dog colonies provide important habitat for rattlesnakes (Shipley et al. 2013). Walkabout surveys also revealed the importance of specific core areas for plains black-headed snakes in the North TSA (N-Appendix A).

In 2013-2014, 15 prairie rattlesnakes were outfitted with radio transmitters. One snake moved at least 1,309 feet in two days, and one traveled at least 436 feet and gained 200 feet in elevation in two days across an intermittent stream en route to an over-wintering site. These observations suggest that rattlesnakes can move relatively long distances

in short time frames. Rattlesnake telemetry also provided unique insight into the use of shrub communities by this species as 23 percent of the observations of marked snakes were in shrublands even though this habitat type constitutes approximately 11 percent of our designated study area (N-Appendix A). Using telemetry, seven rattlesnake hibernacula were located during this study—five of which were in prairie dog colonies and the remaining two in shrub communities.

Prairie Rattlesnake,
photo credit: Christian Nunes (OSMP)

Indicators

Lark Sparrow Habitat Suitability

Suitable habitat for the lark sparrow in the North TSA consists of grasslands with vegetative structural diversity, such as a shrub or yucca component and shale communities. The habitat analysis in the North TSA was done in two steps. The first simply scored all habitat based on the environmental variables in the model (i.e., without a trail effect). The second step was to incorporate existing designated and undesignated trail and road influence into the model to map the current habitat conditions. Habitat scores were reduced incrementally up to 600 feet of habitat edges (roads and urban areas) and up to 300 feet out from existing designated and undesignated trails because research suggests that these features on the landscape impact habitat quality and habitat use out to these distances. For more information about specific variables and methods used in the habitat suitability index and analysis, see N-Appendix A.

Lark Sparrow, photo: Bill Schmoker

Analysis shows that 26% of the entire North TSA is highly suitable habitat for the lark sparrow (Map N12). However, existing designated and undesignated **trails reduce highly suitable habitat available for the lark sparrow in the North TSA from 26% to 8% of OSMP-managed lands** (Map N13).

Indicator

Percentage of North TSA with highly suitable habitat for the lark sparrow.

Indicator

Percentage of North TSA with highly suitable prairie rattlesnake habitat

Prairie Rattlesnake Habitat Suitability

Suitable habitat for prairie rattlesnakes in the North TSA consists of areas of shrubland, exposed rock outcroppings and prairie dog colonies within the mixedgrass prairie mosaic and xeric tallgrass prairie. The habitat analysis for prairie rattlesnakes in the North TSA was done in two steps. The first scored suitable habitat based only on the environmental variables in the model (i.e., without a trail effect).

The second step was to incorporate existing designated and undesignated trail and road influence into the model to map the current habitat conditions. A 25 meter buffer was removed from each side of existing designated and undesignated trails and roads to account for movement barriers and impacts of visitors on rattlesnake behavior and presence near trails. For more information about specific variables and methods used in the habitat suitability index and analysis, see N-Appendix A.

Analysis shows that 18% of the entire North TSA is highly suitable habitat for the **prairie rattlesnake** (Map N14). Existing designated and undesignated **trails reduce available habitat by 12%** (from 17.9% to 15.8%, Map N15).

Conservation Target:
Xeric Tallgrass Prairie (XTP)

Tallgrass, photo: Dave Sutherland (OSMP)

Background and Setting

Upland tallgrass plant communities, dominated by big bluestem, are found in the Boulder Valley and vicinity from the forest edge out onto the mesas and some valleys a few miles east of the foothills. In Colorado, tallgrass communities are found in rocky soils at elevations between 5,400 and 7,600 feet along the northern Front Range at the foot of the mountains, and in the southeastern part of the state. Some of the largest areas of tallgrass remaining in the state are in the Boulder area. The Colorado Tallgrass Prairie State Natural Area in the southern part of the OSMP land system was designated in 1984, in recognition of the statewide importance of Boulder's tallgrass prairies. The foothills tallgrass communities in the Boulder area share similarities with the tallgrass prairies of the eastern Great Plains, but also have distinctive characteristics of their own (Baker and Galatowitsch 1985, Bock and Bock 1998, Buckner 1994, Hanson and Dahl 1957, Livingston 1952, Moir 1969, Vestal 1914). Tallgrass prairie occurs in the western parts of the North TSA, where prairie and mountain species often intermingle (Figure N4).

Tallgrass prairie is considered rare and imperiled globally, and is one of the most endangered vegetation types in the world (Hoekstra et al. 2005). The conservation rankings for the tallgrass communities that occur in Colorado range from "critically imperiled" to "imperiled" (CNHP 2015).

Key Statistics

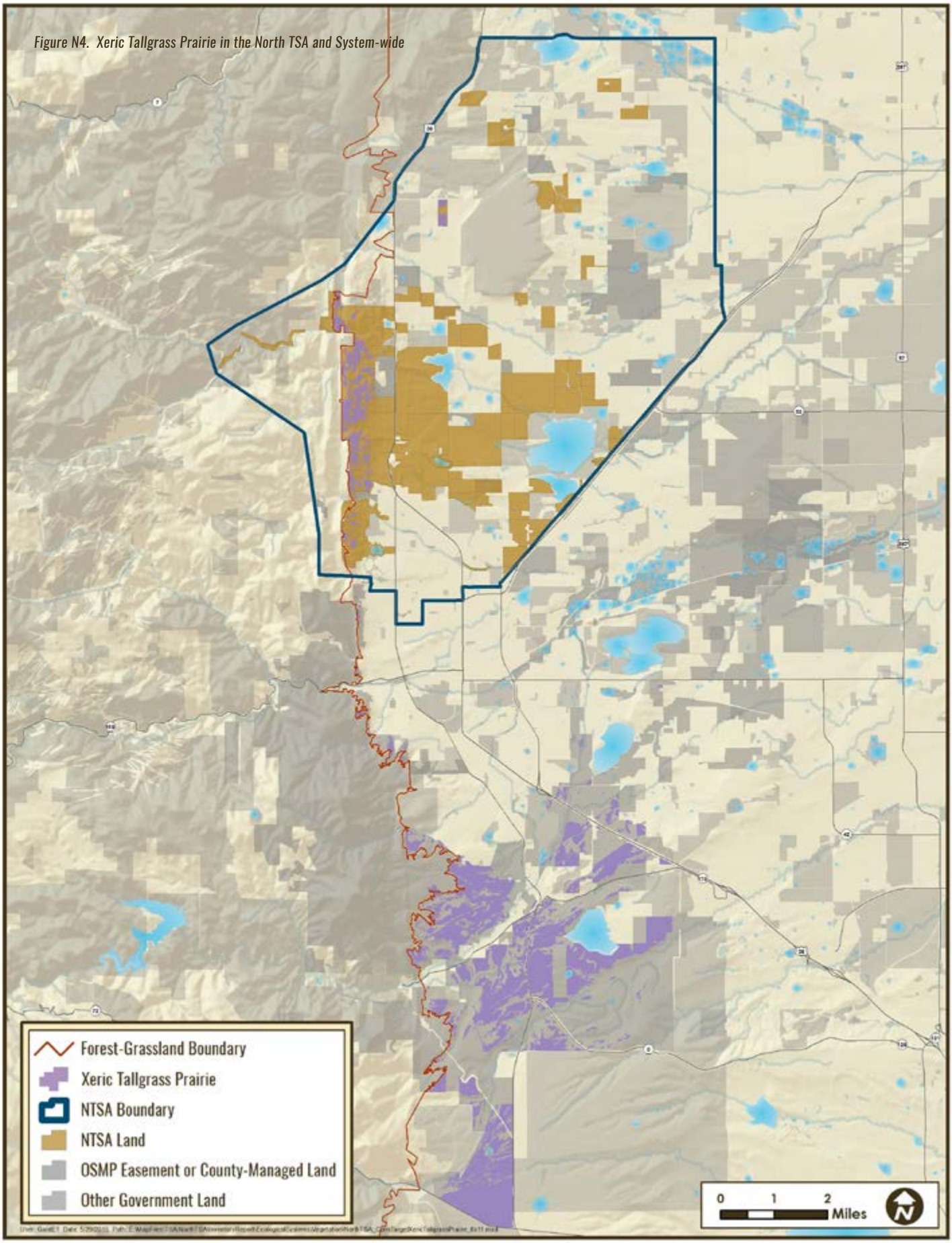
622
total acres of xeric tallgrass prairie in the North TSA

8
percent of the target in the North TSA

90
feet per acre of designated trails in the XTP target in the North TSA

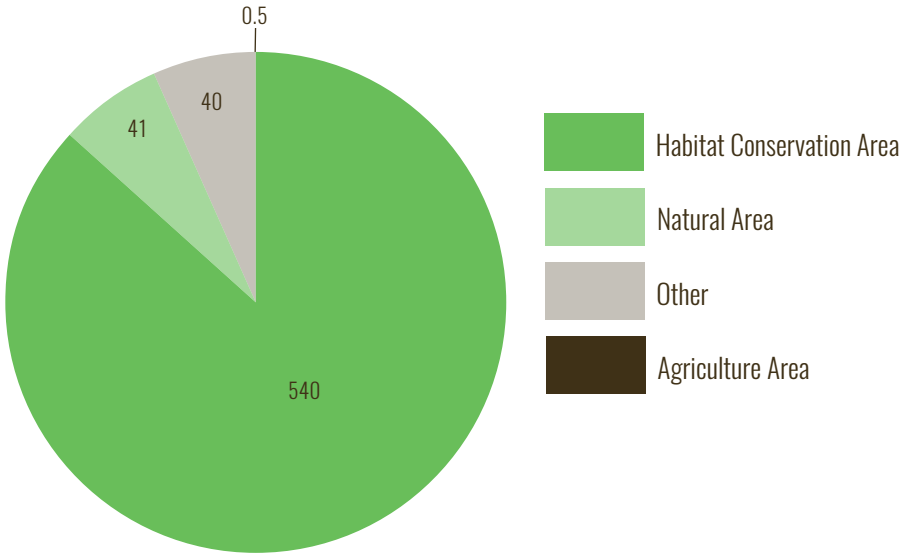
106
feet per acre of undesignated trails in the XTP target in the North TSA

Figure N4. Xeric Tallgrass Prairie in the North TSA and System-wide



Precipitation levels at the base of the mountains, combined with supplemental irrigation, and geology and soils, provide habitat for tallgrass plant communities in the Boulder area. Xeric tallgrass stands occur in soils with large amounts of rock in the upper profile. The high rock content on slopes, mesas and ridges in the western North TSA allows for rapid infiltration of rainfall and snowmelt resulting in more available soil moisture when compared to adjacent finer textured soils supporting other plant associations (Branson et al. 1965). The abundance of coarse materials near the surface also reduces evaporation, and concentrates moisture and soil in spaces among the rocks. Beneath this "rock mulch," clay-rich soils absorb and retain enough moisture to support tallgrass prairie and montane plant species. The coarseness of these soils made plowing impractical or impossible, leaving native prairie intact.

Xeric Tallgrass Prairie Acreage by Management Area Designations in the North Trail Study Area



Composition

The Xeric Tallgrass Prairie in the North TSA is characterized by open meadows and savannas at the prairie-forest interface, and as smaller patches on lower elevation mesas and rock outcrops. Patches along the prairie-forest interface vary in size from three to more than 100 acres.

Tallgrass and mixedgrass prairie plant species blend with higher elevation species, forming unique ecotonal grassland plant communities. These distinctive prairie communities have species in common with Great Plains tallgrass prairie (big bluestem, yellow Indiangrass, little bluestem, prairie dropseed and porcupine grass) as well as plant species more typical of the Rocky Mountain montane life zone (Porter aster, mountain muhly grass and Scribner's needlegrass). Ponderosa pine, mountain mahogany and big bluestem form a rare grassland plant community known from the outer Front Range foothills in southern Wyoming and northern Colorado (CNHP 2008). Lists of the most frequent native and non-native species documented by Grassland Plan monitoring in the Xeric Tallgrass and Mixedgrass Prairie Mosaic are included in N-Appendix B.

Dwarf leadplant and prairie violet are CNHP-tracked plant species occurring in the North TSA xeric tallgrass prairie. These are central and northern Great Plains species at the western edge of their range.

Tallgrass species provide habitat necessary for state-imperiled butterflies to successfully breed. The Ottoe skipper, Arogos skipper and dusted skipper are three species of butterflies that are tracked by CNHP and dependent on big bluestem, little bluestem and sideoats grama (Sovell 2013, 2014). Because these skippers have limited ability to disperse between isolated fragments of prairie, preserving larger, unfragmented patches of xeric tallgrass provides consistently high-quality habitat for these rare species as well as for a suite of grassland nesting songbirds.

Ecological Processes

Big bluestem prairie communities are shaped and maintained by fire, grazing, drought, wind and other natural processes. Elk, pronghorn, bison and other native grazing animals were previously more common in the Boulder Valley. Based on fire frequency estimates derived from nearby forests, natural and human-set fires probably burned foothills grassland communities every five to 30 years (Sherriff and Veblen 2007).

Changes to ecological processes have accompanied the urban development and mining that have degraded or eliminated much of the xeric tallgrass along the northern Front Range. The influences of grazing, fire and drought on tallgrass communities have been modified with the alteration of natural disturbance regimes since fire suppression, irrigation and the introduction of domestic livestock. Prior to widespread and regular fire suppression activities, fires occurred more frequently and covered larger areas than in the fragmented post-settlement landscapes where wildfires have been suppressed. Pre-settlement ungulate grazing patterns and intensities would have been different from post-settlement livestock grazing regimes after fencing fragmented the landscape and water sources were redistributed. The seasonal timing of these disturbances has also been altered since settlement. In the North TSA, a large portion of xeric tallgrass habitat has burned twice over the last 25 years, improving conditions for this rare community.

Dwarf Leadplant, © Bill May

Current Conditions

Vegetation

Invasive species abundance, rare plant and community populations and subpopulations and other aspects of plant community composition are used to evaluate the condition of Xeric Tallgrass Prairie (XTP) and will be used to inform the TSA planning process. The Grassland Plan characterizes the condition of the XTP as fair, based on assessments of vegetation composition and structure and other key attributes (N-Appendix B). Best Opportunity Areas (BOAs) for conservation and restoration of the MGPM and the XTP are identified in the Grassland Plan to highlight the places where conservation actions are likely to have the greatest benefit. In the North TSA, the Upland Grassland Complex BOAs include large areas of contiguous grassland in the western part of the planning area (Figure N3).

568

acres of the XTP target in the North TSA that have been mapped for selected invasive species (91%)

59

acres are invaded (10% of the XTP target in the North TSA)

Invasive Species Prevalence

System-wide mapping data were used to identify areas in the TSA with relatively high invasive species cover. N-Appendix C includes a list of the management priority invasive plant species used in this target analysis and a description of the mapping methodology. Map N4 displays invasive species densities across the mapped portions of the TSA and relative concentrations based on patch size and density. Maps N5 and N6 depicts the species occurring in the TSA that are included in Colorado Noxious Weed Act lists A and B.

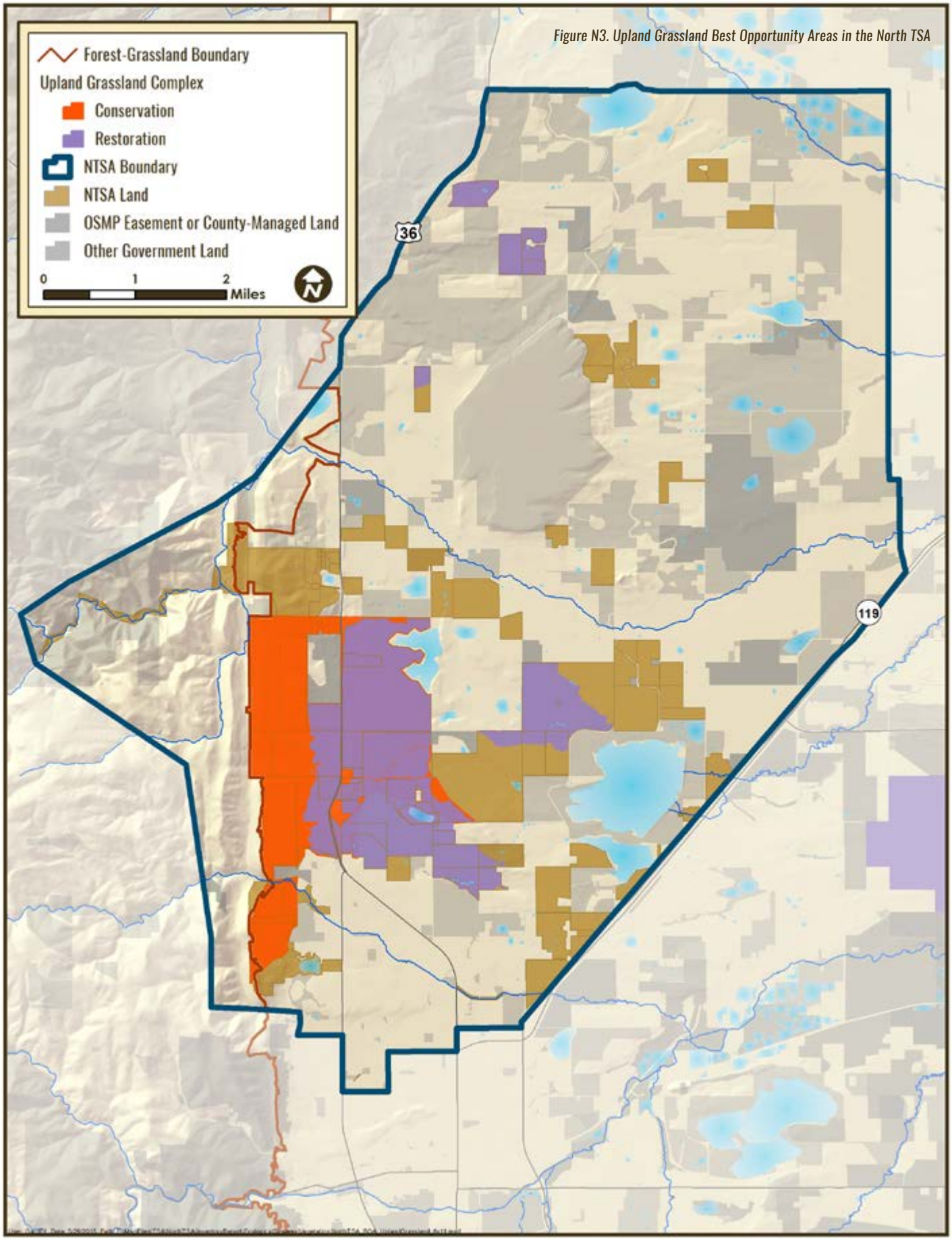


Figure N3. Upland Grassland Best Opportunity Areas in the North TSA

Rare Plant Species and Communities

Rare plant occurrences are documented across the OSMP land system using a standard methodology. A list of the rare and sensitive plant species and communities and the survey methods can be found in N-Appendix B. Documented occurrences of rare plants and communities have been generalized in Map N7.

Within the MGPM and XTP target areas in the North TSA, there are ten rare plant populations with a total of 711 subpopulations. There are **464 acres of rare plant communities in the Xerix Tallgrass Prairie**.

Dwarf Leadplant, © Bill May

Wildlife

North TSA Focal Species

Three species of grassland-dependent butterflies were chosen as a focal conservation group because of their specific, but similar, habitat needs. The **Ottoe skipper, Arogos skipper and dusted skipper are considered state-imperiled by CNHP** (Arogos skipper is also considered globally-vulnerable), sensitive by the US Forest Service and identified as species of special concern in the Boulder County Comprehensive Plan (Boulder County 2013) because of habitat loss and fragmentation of native grassland ecosystems.

All three species depend on big bluestem, little bluestem or side-oats grama to complete their lifecycle. Female skippers will lay eggs on these grasses and the grasses serve as larval host plants. The unstable conservation status of the skippers is largely due to the loss of 99 percent of tallgrass prairie since European settlement in North America (Swengel and Swengel 2013). Staff chose to use bluestem-dependent skippers as an indicator of this target's ecological integrity because big and little bluestem are predominantly found in this target and because of the tight association between host plant abundance and butterfly presence.

OSMP has partnered with CNHP to conduct butterfly surveys in the grasslands adjacent to Highway 36 (Pineda and Ellingson 1998, Sovell 2013, 2014). In the Grassland Plan (City of Boulder 2010), a list of 20 grassland-specialist lepidoptera (butterflies, moths and skippers) were identified as important species to track grassland health and these species were the targets of the recent CNHP surveys. During 2013-2014, there were 59 observations of rare butterflies that were tracked by CNHP including 20 records of the globally-vulnerable Arogos skipper, two state-imperiled Crossline skippers (G4G5S2), 34 state-imperiled dusted skippers and three records of the globally-vulnerable Ottoe skipper (N-Appendix A, Map N16). ***The results of the CNHP surveys indicate that the North Boulder Grasslands represent one of OSMP's best opportunities to conserve threatened butterfly species and their native grassland habitats.***

Among the threats to the conservation of rare skippers and their habitats are habitat loss via vegetation trampling, fire suppression, incompatible grazing practices, and invasive plant infestations via roads, recreational trails and parking lots (Pineda and Ellingson 1998, Sovell 2014). The current presence of non-native plants is of conservation concern within the study area and recreational trails are known to be avenues for invasive plant infestations (Cole 1978, Hammit and Cole 1987, Benninger-Truax et al. 1992, Jordan 2000). If host plants and nectar resources are lost due to the effects of crowding by invasive plants, then butterfly diversity and abundance will decline (Pineda and Ellingson 1998, Sovell 2013, 2014).

Arogos Skipper,
photo: Christian Nunes (OSMP)

Ottoe Skipper,
photo: Christian Nunes (OSMP)

Indicator:
Grassland Dependent Butterfly Habitat Suitability

Suitable habitat for the Ottoe, Arogos and dusted skippers in the North TSA consists of vegetation communities that contain big bluestem, little bluestem or side-oats grama—the larval host plants for these species—and relatively large habitat patches. The habitat analysis in the North TSA was done in two steps. The first simply scored all habitat based on the environmental variables in the model (i.e., without a trail effect). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. A 25 meter buffer was removed from each side of existing designated and undesignated trails and roads because recreational trails are known avenues for weed colonization. For more information about specific variables and methods used in the habitat suitability index and analysis, see N-Appendix A.

Indicator

Percentage of North TSA with highly suitable habitat for grassland-dependent butterflies

Analysis shows that 5% of the entire North TSA is highly suitable habitat for **grassland-dependent butterflies** (Map N17). Existing designated and undesignated **trails reduce available habitat by 11%** (from 5.3% to 4.7%, Map N18).

Dusted Skipper,
photo: Christian Nunes (OSMP)

Key Statistics

552
total acres of wetlands and riparian areas in the North TSA

7
percent of the target in the North TSA

40
feet per acre of designated trails in the target in the North TSA

151
feet per acre of undesignated trails in the target in the North TSA

Conservation Target:
Wetlands and Riparian Areas

Background and Setting

While wetlands and riparian areas can be distinct habitat types, there is overlap between the two. Both are directly shaped by the presence of water: flowing water in the case of riparian areas and standing surface and/or groundwater in the case of wetlands. Given this shared influence of water, OSMP has grouped wetlands and riparian areas into a single target for the purposes of the North TSA Inventory and Assessment Report. Ponds and creeks, which are natural extensions of wetlands and riparian areas, are also included in the target.

Wetlands occur where soil is inundated or saturated periodically during the growing season. Wetland soils are saturated long enough to create anaerobic (oxygen free) conditions within the rooting zone of plants. These conditions limit the types of plants that are capable of growing to those adapted to low oxygen environments.

Riparian areas occupy the transitional areas between flowing water and upland terrestrial areas where morphological and ecological processes are shaped by the flow of water. Water flow can be permanent (e.g. perennial creeks), intermittent (e.g. irrigation ditches) or ephemeral (e.g. foothills drainages). Given the proximity to water, some wetland habitat (as described above) occurs within riparian corridors.

In the semi-arid climate of the Boulder Valley, places where the ground is saturated or flooded are relatively uncommon. Within the North TSA,

wetland habitat is most likely located in the headwater regions of ephemeral drainages or in locations where these drainages have been dammed. The larger wetland complexes on the Bennett and Boulder Valley Ranch properties are examples of wetlands that exist where drainages have been dammed. Other common locations for wetlands in the North TSA include the fringes of ponds (e.g. wetlands on the Beech and Stratton properties) and near irrigation ditches and laterals (e.g. wetlands on the Gallagher property). In several places in the North TSA, irrigation practices and seepage from irrigation ditches have introduced sufficient water for long enough to create wetland habitat in areas that would otherwise be dry.

Riparian areas are equally rare. Riparian habitat lies adjacent to the perennial creeks that cross the North TSA: Four Mile Canyon and Lefthand Creeks. Riparian habitat also exists along the unnamed foothills drainages that lie between the two creeks. Although artificial in nature, many of the TSA's irrigation ditches also support riparian habitat. Combined there are currently about 552 acres of wetland and riparian habitat target in the North TSA; this accounts for only 7.2 percent of the total acreage in the North TSA. (Figure N5) shows the approximate location and extent of wetland and riparian habitat within the North TSA and system-wide.

Wetland and Riparian Areas Acreage by Management Area Designations in the North Trail Study Area

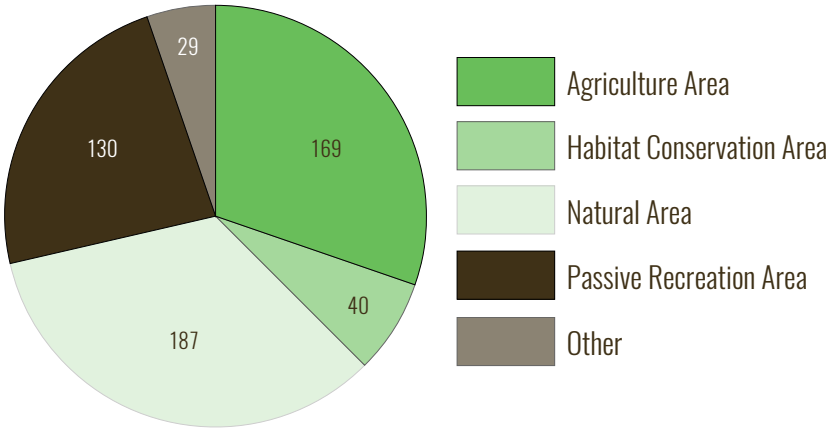
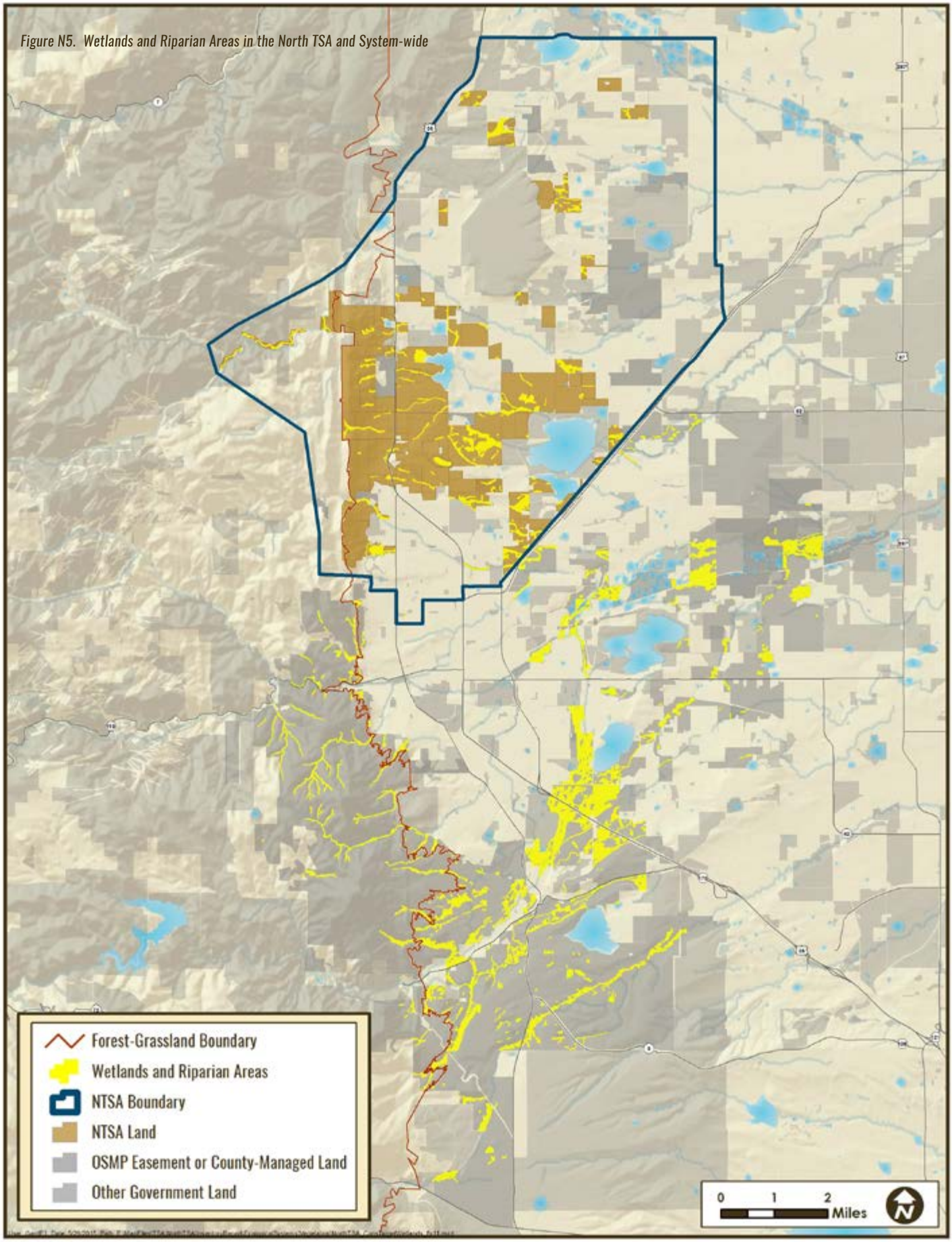


Figure N5. Wetlands and Riparian Areas in the North TSA and System-wide



Wetlands

Ecological Processes

Local and landscape-scale hydrology are the major physical factors influencing wetlands. All wetlands depend on water for their existence. Although wetlands can withstand natural periods of drought, permanent dewatering, prolonged lowering of the water table, or removal of a wetland's water source results in a shift toward upland ecological communities. For wetlands that rely on surface water, changes in the frequency and duration of flooding can alter wetland community composition and structure. Changes in the frequency and intensity of flooding can also alter the flow of nutrients and sediment to riparian wetlands further affecting their community composition and structure.

The provision of water to wetlands is an important beneficial use of the department's water rights portfolio. While natural precipitation and ground water discharge support some wetlands outside the floodplains and lower creek terraces, inputs of irrigation water often support both agriculture and wetland vegetation in these areas. In addition, "tail-water" or water that drains from irrigated fields also supports wetland vegetation where it accumulates as it flows back to the creeks. Several water sources support wetlands. In many irrigated areas, wetlands and agriculture coexist and provide mutual benefit.

While their influence is not as great as the hydrologic regime in shaping wetlands, fire and grazing play a role in maintaining wetland composition and structure. Periodic fires, particularly in the wet meadows, influence the community composition and structure often by limiting woody growth. Ungulate grazing has a similar effect. Fire suppression and replacing native ungulates with domestic livestock has modified these natural disturbance regimes.

Despite their many values, most wetlands in the Boulder Valley have been significantly degraded or destroyed by land use practices, contamination,

gravel mining, and dewatering. In recognition of their functions and values, and the significant conservation issues facing wetlands, Boulder has adopted a wetland protection program, which includes the protection of wetlands through acquisition as open space, and regulatory protection of wetlands in the City of Boulder and on city-owned lands. This program regulates most activities in wetlands. Like the corresponding federal program, the city's program requires individuals seeking to disturb wetlands to make every effort to avoid impacts to wetland habitat (by changing design typically). If impacts are unavoidable, the program requires that impacts be minimized to the greatest possible extent and then mitigated. The City of Boulder wetlands policy is articulated in the BVCP (City of Boulder 2005), regulatory provisions of the city's land use code (the wetlands protection ordinance), and Open Space and Mountain Parks' Long Range Management Policies.

Wetland Composition

Vegetation

Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, irrigation, ditch seepage and other factors, including human disturbance. These differences create a diversity of wetland types. The most common wetland types found on OSMP-managed lands are marshes, wet meadows and riparian wetlands. Seeps and springs also exist on OSMP-managed lands, but are much less common and cover a smaller portion of the landscape.

Marshes are characterized by the presence of permanent or semi-permanent shallow water (less than 6.6 feet in depth). Marshes often exist where ground water or irrigation water accumulates. On OSMP-managed lands, marshes commonly occupy the edges of ponds and reservoirs, and although rarer, marshes also occur in some depressions with fine textured soils. Some water bodies referred to as ponds, lakes or reservoirs, such as Mesa Reservoir, are actually marshes. Most marshes within the North TSA are characterized by emergent plants, such as cattails and bulrush.

Wet meadows are drier than marshes having seasonally or permanently high water tables but lack permanent standing water. They often occur due to flood irrigation practices and are common in low-lying floodplains adjacent to creeks and seasonal drainages. Soil type and water chemistry influence the type of vegetation found in wet meadows. Sedge meadows form in the larger grassland matrix where organic soils are present and mineral rich groundwater is near the surface. The most common sedge meadow type on OSMP-managed lands is the Nebraska sedge meadow, covering just over 20 acres of the North TSA. Clustered field sedge and wooly sedge meadows are also found within the North TSA, but these meadows comprise a smaller portion of the planning area. Nebraska sedge meadows are relatively rare in Colorado and are tracked by the CNHP. Nebraska sedge also serves as the larval host plant for the state-imperiled two-spotted skipper, found in the North TSA just west of Lefthand Valley Reservoir by Pineda and Ellingson (1998) [Map N16].

Nebraska Sedge,
photo: Christian Nunes (OSMP)

OSMP's mineral soils also support wet meadows. Arctic rush meadows, the most common wet meadow type on OSMP-managed lands, occur where high fresh groundwater tables saturate mineral soils. Arctic rush meadows account for more than a quarter of the wetland and riparian habitat in the North TSA. Inland salt flats can develop in mineral soils infused with an alkali water source. Depressional basins often support inland salt flats. Saltgrass typically dominates the vegetation of inland salt flats. The Hart-Jones property supports one of the only inland salt flats in the North TSA.

Riparian wetlands occur adjacent to running water. Within the North TSA planning area, riparian wetlands are most common along the ephemeral drainages flowing from the foothills. The adjacent drainage is often the major, if not the sole, source of hydrology to riparian wetlands. Erosional and depositional forces of the adjacent drainage and floodplain topography influence the soil conditions and vegetation in these wetlands. Riparian wetlands on OSMP-managed lands contain herbaceous vegetation, woody vegetation or a combination of these two vegetation types.

Seeps and springs are found where hydrology, geology and topography allow groundwater to reach the soil surface. In the planning area, these are typically associated with sediments and terraces where the upper layers consist of Pleistocene alluvial deposits and are underlain by low permeability Pierre shale formations. Precipitation infiltrates the upper coarse sediments and percolates downward until reaching the impermeable shale layer. As groundwater reaches the edges of the mesas where the alluvial soils and shale meet, water seeps out and creates small wetlands typically dominated by coarse herbaceous vegetation. This wetland type is relatively uncommon in the planning area.

Spring-fed wetlands also occur in the western portion of the North TSA and in low-lying areas where shallow groundwater flows are interrupted by impermeable soil or bedrock and percolate to the soil surface. Several small spring-fed wetlands dot the eastern edge of the foothills west of Highway 36. Water chemistry in spring-fed wetlands is strongly influenced by contact with soil or bedrock of marine origin and often has high concentrations of dissolved minerals. Salt tolerant plants dominate the plant communities in these wetlands.

Wildlife

Several rare butterfly species, including the Arogos skipper, Ottoe skipper and dusted skipper, rely on wetland plant species for habitat. Bobolink, savannah sparrow, American bittern, and northern harrier, all species of special concern in Boulder County (Boulder County 2013), nest in lowland areas containing wetlands and wet meadows.

Open water in the form of lakes and ponds constitute 53 acres, or approximately 10 percent, of the wetland and riparian conservation target. Open water provides important habitat for bats, which require water when they emerge at night. Volunteers monitored bat activity at nine water sources and one roost in the North TSA over the past 10 years (Map N19) and identified several important areas for bats (N-Appendix A).

Several water bodies in the North TSA support breeding and migrating waterfowl. Staff has conducted sporadic waterfowl counts at six waters in the North TSA in an effort to collect baseline data for a pilot project that may grow into an organized volunteer survey. Wonderland Lake supported the greatest number of species on the OSMP-managed properties which have been examined to date (N-Appendix A).

Photo: Deryn Wagner (OSMP)

Although northern leopard frogs—a species in marked decline throughout the western United States—are not abundant in the North TSA (N-Appendix A), the Grassland Plan provides management guidance on improving amphibian habitat in the North TSA. Specifically, the Grassland Plan identifies non-native American bullfrogs as a conservation threat to native wetland species, and outlines a conservation objective to increase native frog presence in suitable habitat and reduce undesignated trail density in high-quality amphibian habitat. As part of a system-wide monitoring program, OSMP staff conducts visual encounter surveys to assess amphibian distribution and abundance in the North TSA (Map N20)

North TSA focal wildlife species

Plains topminnow (Fundulus sciadicus). OSMP staff assists Colorado Parks and Wildlife (CPW) with annual surveys of ponds and creeks in the North TSA (Map 21) and system-wide. Several ponds in the North TSA provide refuge for plains topminnow, a native fish of great conservation need in Colorado (CPW 2014). According to Pasbrig et al. (2012), this species has been eliminated from 72 percent of its historical range. Although plains topminnow's natural habitat in Boulder County is transitional streams, CPW biologists routinely use isolated ponds that meet specific habitat requirements as broodstock refugia to conserve native fish. In 2014, five ponds, totaling 3.6 acres, supported plains topminnow in the North TSA (N-Appendix A. This species was only located in two other ponds on OSMP, suggesting that the ponds in the North TSA represent an important opportunity to cooperate with CPW to conserve this species.

Northern Harrier, © Claudia Van Wie

Northern Harrier. Northern harriers are ground nesting raptors also known as "marsh hawks" and are dependent upon wetlands. They are considered a sensitive species by the United States Forest Service and a species of conservation need by CPW. Northern harriers require large, undisturbed blocks of wetland habitat to nest and grasslands for foraging. Because of this, they are habitat-limited in Boulder County. Populations of this uncommon raptor are in significant decline (Sauer et al. 2014). The North TSA contains all of the known Northern harrier nesting attempts on OSMP and three of the four known 2015 nesting attempts in Boulder County (N-Appendix A). This suggests that wetlands in the North TSA represent an important opportunity to conserve northern harrier breeding habitat.

Bobolink. Bobolinks are ground-nesting songbirds that nest primarily in wet meadows in the Boulder Valley (Thompson and Strauch 1987). They are protected under the Migratory Bird Treaty Act and are considered "vulnerable to extirpation" ("S3B") by CNHP and a species of special concern by the Boulder County Comprehensive Plan. Bobolink populations in the western United States are unique in that they are separated from the main breeding range of bobolinks further to the East (Hamilton 1962). Due to water diversion and loss of native wet prairies, bobolink nesting habitat is largely restricted to irrigated hayfields on OSMP. Bobolink monitoring is summarized in N-Appendix A and shown on Map N22. Additional information on bobolink management on OSMP is presented in the agricultural resources chapter.

Bobolink,
photo: Dave Sutherland (OSMP)

Riparian Areas

Ecological Processes

The major ecosystem processes influencing riparian areas is the availability of moisture, grazing and periodic flooding (by both overbank flows and irrigation). These factors have changed significantly since European settlement. Water diversions and impoundments have had the direct effect of de-watering creeks, thereby altering the extent, composition and structure of riparian vegetation. The redistribution of water has created riparian vegetation in formerly dry areas along ditches and in areas where irrigation water accumulates. Reduced flows have also reduced or eliminated flooding, which in turn has altered patterns of erosion and deposition needed for riparian vegetation establishment and succession. The lack of flooding, and perhaps fire suppression, may be responsible for development of continuous stands of riparian forests, where in the past creeks may have been characterized by smaller stands of trees interspersed with herbaceous or shrub vegetation.

Streambank stabilization and channelization projects have also reduced riparian extent and changed aquatic habitat. In pre-settlement times, periodic, intense grazing by native ungulates probably occurred from time to time in riparian areas. With European settlement and the concurrent extirpation of many native ungulates, riparian areas were grazed by domestic livestock. This likely resulted in prolonged and intense grazing regimes outside the range of natural variability. Agricultural practices have also resulted in changes to water quality from the runoff of soil, manure and agricultural chemicals. Irrigation practices introduced water to some areas in greater amounts and made water locally available later in the growing season than under previous conditions.

The riparian areas in the Grassland Planning Area have been negatively impacted by incompatible agricultural practices, road construction, flood management, and water development projects, as well as residential,

Plains Cottonwood, Photo: OSMP

commercial and industrial development. Consequently, properly functioning (in the sense of Prichard et al. 1993, 1994) foothills transitional and plains riparian systems are rare along the Colorado Front Range and in the Boulder Valley (Wohl 2001).

Riparian Area Composition

Vegetation

Like wetlands, riparian areas vary widely across the North TSA due to differences in landscape position, topography, climate, soil type, hydrology, water chemistry, irrigation practices, land use and other factors, including human disturbance. The riparian corridors surrounding the two perennial (or nearly perennial) creeks in the North TSA exemplify these differences. The riparian corridor around Lefthand Creek is more typical of mountain streams. The narrow, steep canyon restricts the width of the riparian area and higher elevation species such as narrow leaf cottonwood, Douglas fir, and water birch dominate the vegetation community. In contrast, the riparian corridor bordering Fourmile Canyon Creek is more typical of plains streams, with a broader, flatter floodplain dominated by the plains cottonwood, peach-leaved willow and coyote willow vegetation community. The riparian corridors along both Fourmile Canyon Creek and Lefthand Creek experienced significant disturbance during and after the September 2013 flood event.

Many of the larger irrigation ditches that carry water for longer periods also support the plains cottonwood, peach-leaved willow and coyote willow vegetation community that is typical of plains creeks. Some irrigation ditches only support coyote willow communities as ditch companies often actively removed larger woody vegetation. The state rare waterthread pondweed has been found in at least one irrigation ditch in the North TSA.

Many ephemeral drainages, particularly those in the western portion of the North TSA, lack sufficient moisture levels to support trees. The vegetation in these communities is characterized by chokecherry and American plum

or occasionally just American plum shrublands along drainage side slopes. These denser shrublands give way to the patchier three leaved sumac shrublands located along the drier portions of the riparian corridor.

Wildlife

Despite their relative scarcity on the landscape, riparian corridors have ecological importance well out of proportion to their size or abundance. Knopf (1985) notes that although they comprise less than 2 percent of the state's land cover, riparian areas supply habitat for approximately 80 percent of birds, mammals, reptiles, amphibians and fish native to Colorado. Many of these species depend almost entirely on these streamside and aquatic habitats for their survival. Riparian shrublands support the highest breeding bird densities of any OSMP ecosystem. Riparian areas were also identified as important habitat for rare butterflies because of the diversity of plants serving as nectar sources found there (N-Appendix A) and the presence of wild hops in two riparian areas west of Hwy 36 (N-Appendix A). Wild hops serve as the host plant for the globally-imperiled hops feeding azure butterfly. Schneider Draw, a riparian drainage in the North TSA, west of Hwy 36 was identified in the Grassland Plan (City of Boulder 2010) as being one of the best opportunities to conserve riparian habitat on OSMP-managed lands (Figure N6).

Several uncommon bird species, some of which are declining in Colorado, depend on shrubs to provide a nesting substrate and protection for their nestlings. These include: spotted towhee, lazuli bunting, blue grosbeak, yellow-breasted chat and blue-gray gnatcatcher.

Riparian areas also serve as important movement corridors for wide-ranging mammals like elk, bobcat, mule deer, coyote and fox. Creeks provide habitat for aquatic organisms, including native and non-native fish, amphibians, invertebrates and birds that depend on lotic waters such as the American dipper. Creek hydrology and associated in-stream habitat in the North TSA were modified during the flood event of 2013 as described for Lefthand Creek by Pitlick et al. (unpublished data). Creeks

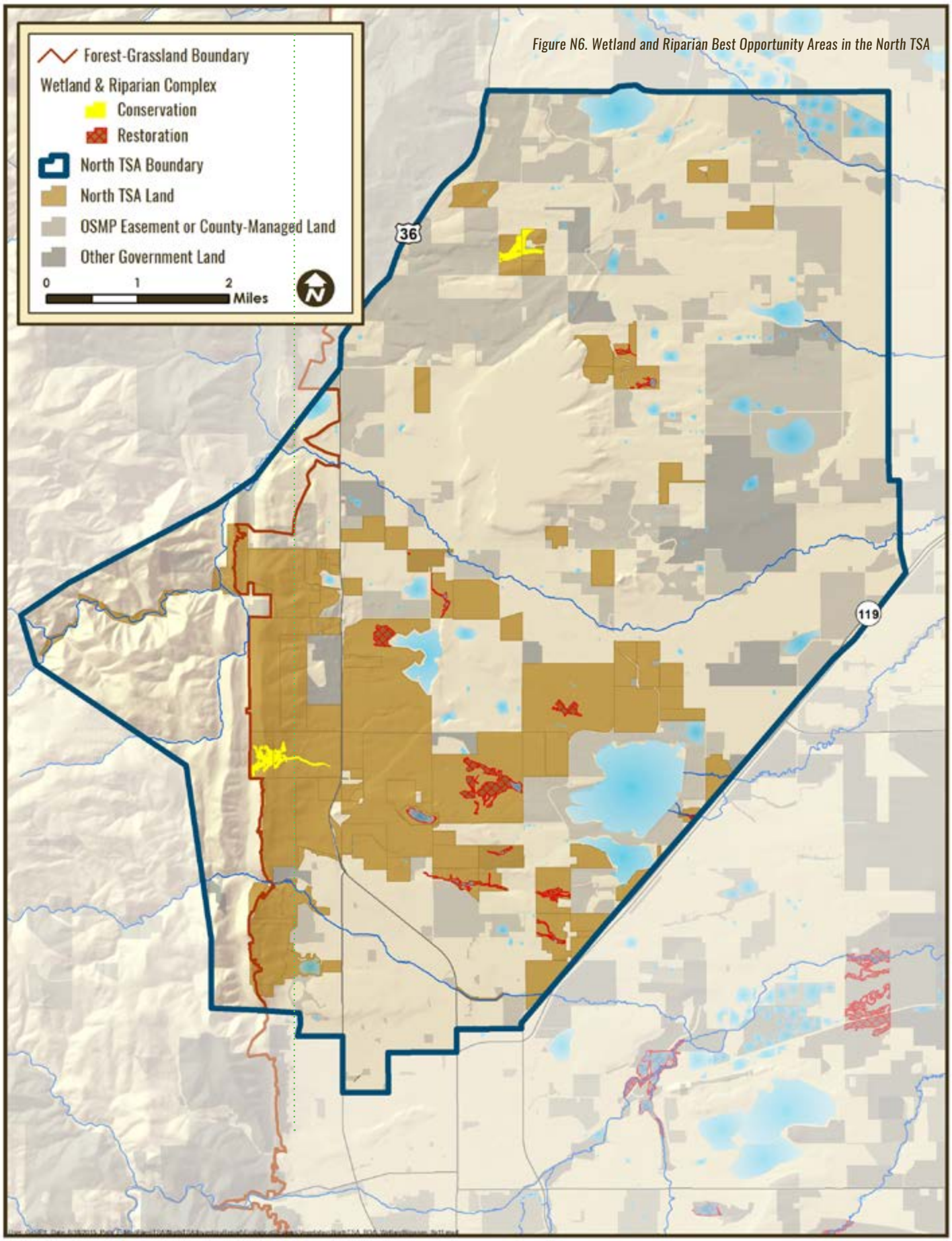


Figure N6. Wetland and Riparian Best Opportunity Areas in the North TSA

in the planning area may support a number of uncommon or rare native fish species, including central stoneroller, plains killifish, northern red belly dace, common shiner and plains topminnow. Post-flood surveys of these waters should be conducted in cooperation with CPW to learn more about the fish communities in North TSA creeks.

Current Conditions

OSMP uses various key attributes and indicators to assess the condition of its conservation targets. This approach is explained more fully in the Grassland Plan. Below are a few select indicators that help convey the general condition of the North TSA.

Vegetation

Relative Cover of Native Species

Relative cover of native species serves as an indicator of the quality of vegetation occurring in the target. However, taken alone, relative cover does not provide a full picture of community composition because it only refers to that portion of the target that is vegetated.

75

percent of the wetlands/riparian area target in the North TSA has a relative cover of native species (46%)

Spatial Extent and Relative Abundance of Invasive Species

Like relative cover of native species, the extent and abundance of invasive species serves an indicator of the quality of vegetation occurring in the target. It also suggests the degree of disturbance to which target is subjected.

55

percent of the target in the North TSA has been mapped for selected invasive species

39

percent of mapped target area is invaded

One
known population of rare plant species exists within the wetlands/ riparian target area, with a total of
19
subpopulations and
138
acres of rare plants communities

Number and Acres of Rare Plant Populations and Communities

The presence of rare plant populations and communities is an indicator of high-quality habitat.

There is one known population of rare plant species with a total of 19 subpopulations and 138 acres of rare plant communities. (N-Appendix B, Map N7)

Wildlife

The North TSA contains all of the known **Northern Harrier** nesting attempts on OSMP and three of the four known 2015 nesting attempts in Boulder County (N-Appendix A). This suggests that **wetlands in the North TSA represent an important opportunity to conserve northern harrier breeding habitat.**

In 2014, five ponds, totaling 3.6 acres, supported **plains topminnow** in the North TSA (N-Appendix A). This species was located in only two other ponds on OSMP, suggesting that the **ponds in the North TSA represent an important opportunity to cooperate with Colorado Parks and Wildlife to conserve this species**.

Best Opportunities for Conservation and Restoration

During development of the Grassland Plan, OSMP staff identified specific wetland and riparian areas that represent the best opportunities for conservation or restoration. Specific considerations for identifying wetland and riparian best opportunities for conservation included:

- » High occurrence of rare or sensitive species or communities (plants, reptiles, amphibians, birds, mammals, fish);
- » High occurrence of native species or communities and low occurrence of non-native species;
- » High ecological functioning;
- » Little or no change in management needed to maintain viability;
- » Conservation issues are few and of low intensity; and
- » Large block of riparian or wetland habitat connected to or contiguous with other "Good" quality habitat

Many wetland and riparian areas have been degraded by past or present land use. To identify best opportunities for restoration, staff used the following criteria:

- » Remnants of previously high functioning ecosystems
- » Indicator ratings of "Fair" or better
- » Areas where partnerships are possible or funding for restoration is available
- » Areas where restoration has been successful in the past and additional efforts would likely be effective

A few wetland and riparian areas in the North TSA were identified as a best opportunity for either conservation or restoration. Schneider Draw, located on the western edge of the North TSA, was recognized as one of only two foothills drainages in the Grassland Planning Area as a best opportunity for conservation. This draw supports a diverse shrub community that is

in good condition. Although it is bisected by an undesignated trail, the remaining habitat block to the west of the undesignated trail is large relative to other blocks of foothills riparian corridor. Wetland areas identified as best opportunities to restore in the North TSA include wetlands on the Hart Jones, Lousberg, Gallagher, East Beech and Boulder Valley Ranch properties, as well as Mesa Reservoir, Papini, BLIP, Bennett, Andrea and Stratton ponds; and the Axelson hillside seeps.

Mesa Reservoir, photo: Bob Crifasi

Conservation Target:
Upland Shrublands

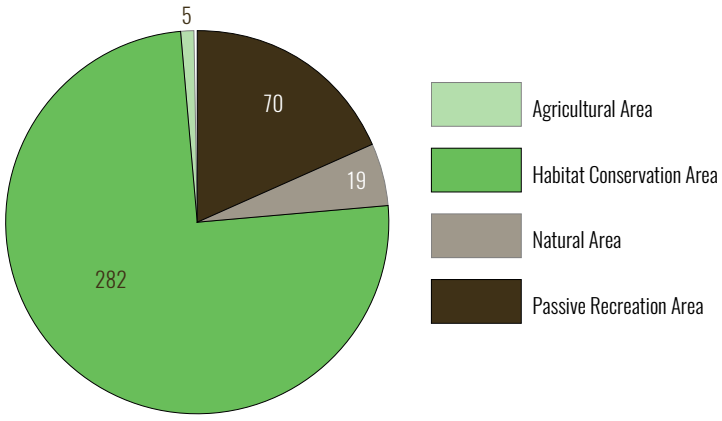
photo: Gary Stevens

Background and Setting

Shrubland communities form important wildlife habitat in upland, wetland and riparian areas in the North TSA. This section covers upland shrublands which mainly occur in the western portions of the TSA (Figure N7). At the eastern edge of the outer Front Range foothills, shrubland communities often dominate transitional zones where plains and mountain floras intermingle. One of the widest, east-west bands of transitional shrublands within the OSMP system occurs in the North Boulder Valley area. Upland shrublands typically grow in dry, rocky sites, providing food and sheltered sites for bird nesting and denning or burrowing animals.

The Grassland Plan includes most upland shrubland communities in the Mixedgrass Prairie Mosaic and Xeric Tallgrass Prairie conservation targets, and the North TSA treats these shrublands as a distinct target. Minimizing impacts to shrubland habitat is an important objective when planning trails on OSMP.

Upland Shrublands Acreage by Management Area Designations in the North Trail Study Area



Key Statistics

374
total acres of upland shrublands in the North TSA

5
percent of the target in the North TSA

39
feet per acre of designated trails in the target in the North TSA

84
feet per acre of undesignated trails in the target in the North TSA

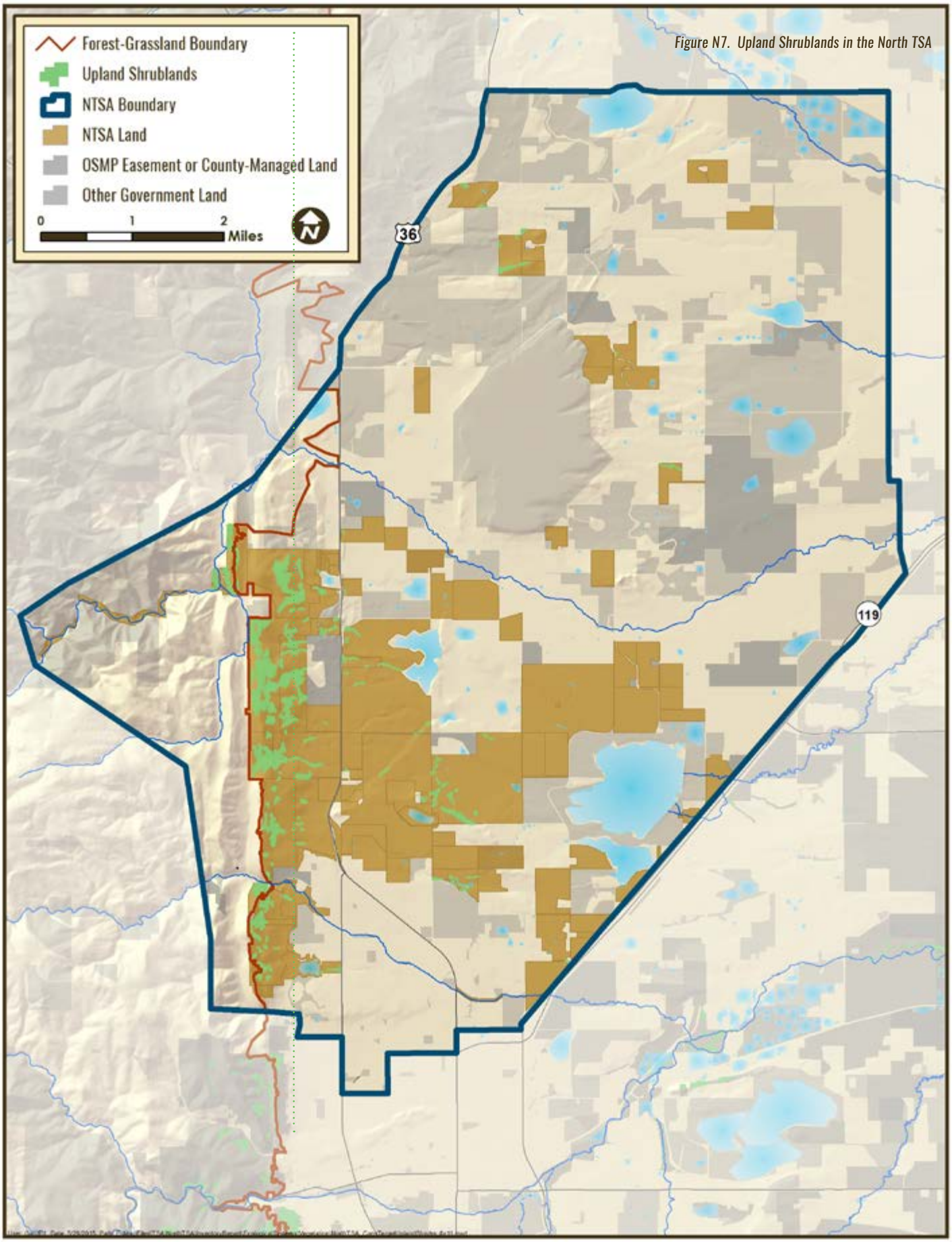


Figure N7. Upland Shrublands in the North TSA

Composition

In the western portions of the TSA, mixedgrass communities combine with xeric tallgrass prairie patches to form a biologically rich foothills grassland and shrubland mosaic. Smaller patches of shrubland types more typical of the Colorado Eastern Plains occur in the lower elevations of the TSA.

Mountain mahogany forms large, dense stands on coarse-textured, well-drained soils and is also scattered in rocky outcrops. Three-leaved sumac, chokecherry, wild plum and ninebark also occur in relatively large patches and provide important foraging habitat for black bears, small mammals and many species of birds. Colorado Eastern Slope shrublands below 8,000 feet have higher wildlife species diversity than other mountain shrub communities (Mutel and Emerick 1992). The deer mouse, a common native, nests in the rocky substrate of mountain mahogany shrublands, occurring more commonly in this habitat than in other regional ecosystems. Upland shrubland habitats are important for other small rodent species, rabbits, bobcats, mountain lions, grey and red fox, mule deer and other mammals (Cushman et al. 1993). Mountain mahogany stands provide particularly good winter habitat for mule deer and overwintering birds. Foothills shrublands form distinctive, species-rich bird communities with excellent nesting habitat. Spotted towhees are a signature shrub nesting bird species in the North TSA, and the yellow-breasted chat and many other shrub nesters frequent this part of OSMP. The less common lazuli bunting is highlighted as a focal wildlife species and indicator of habitat effectiveness in North TSA upland shrubland habitats.

Mountain mahogany shrublands are often associated with New Mexico needlegrass and big bluestem plant associations, both considered rare in Colorado.

Mountain Mahogany,
photo: Dave Sutherland (OSMP)

Yellow-breasted chat,
© Michael Morton

Native netleaf hackberry woodlands, while not technically a shrubland type, form small patches in the western portions of the TSA, contributing to wildlife habitat and plant species diversity.

Sub-shrubs such as fringed sage and snakeweed, and the shrubs, such as dwarf rabbitbrush and yucca, are common in western wheatgrass associations in lower elevation areas of the TSA, and are often associated with active prairie dog colonies. Three-leaved sumac occurs frequently in mixedgrass prairies, either in small, dense stands or in lower cover. Winter fat and saltbush shrublands, which provide good elk and deer foraging habitat, are uncommon in the North TSA and OSMP, but are more widespread in the Colorado High Plains just to the east of Boulder.

Ecological Processes

The major ecological processes influencing shrublands are fire, drought and ungulate grazing. Natural disturbance regimes have been significantly altered with European settlement. Historically, natural and human set fires probably occurred more frequently and covered larger areas than in today's landscapes where fuel loads are reduced by livestock grazing and people actively suppressing wildfires (Sherriff and Veblen 2007). Mountain mahogany, three-leaved sumac and most other shrub species in the TSA are well-adapted to periodic fire. Shrublands have recovered well after the two major fires that occurred in the western portions of the TSA during the last 25 years.

Post-settlement livestock grazing, pasture fencing and water source redistribution have likely affected the distribution and abundance of shrublands. Heavy browsing by livestock or native ungulates can reduce shrub cover. Four-winged saltbush and winterfat are particularly susceptible to overgrazing. Yucca, dwarf rabbitbrush, snakeweed and fringed sage increase in abundance under grazing pressure because these species are generally unpalatable for livestock, native ungulates and prairie dogs.

Upland shrublands on exposed, rocky hillsides are influenced by winds, intense solar radiation, and swings in temperature and moisture regimes. Most upland shrublands have extensive root systems that help with survival in a low moisture environment and add to substrate stability on steep slopes. Like many other foothills shrub species, mountain mahogany is adapted to drought and low nutrient conditions. Mountain mahogany roots have nodules that contain nitrogen-fixing bacteria which convert atmospheric nitrogen into a water-soluble form of nitrogen that can be used by plants. In this way, the symbiosis between the bacteria and mountain mahogany provides soil nutrients that can be used by other plant species (Benedict 1991).

Current Conditions

Vegetation

Invasive species abundance, rare plant and community populations and sub-populations, along with other aspects of plant community composition, are used to evaluate the condition of MGPM and XTP within which the Upland Shrublands target is embedded. Information about these conditions will be used in the TSA planning process. The Grassland Ecosystem Management Plan characterizes the condition of the MGPM and XTP as fair, based on assessments of vegetation composition and structure, and other key attributes (N-Appendix B). Best Opportunity Areas (BOAs) for conservation and restoration of the MGPM and Xeric Tallgrass Prairie are identified in the Grassland Plan to highlight the places where conservation actions are likely to have the greatest benefit. In the North TSA, the Upland Grassland Complex BOAs include large areas of contiguous grassland and associated shrublands in the western part of the planning area.

323
acres (86%) of the Upland Shrublands target in the North TSA has been mapped for selected invasive species

18
acres (6%) of mapped target area is invaded

123
acres of rare plant communities in the target area

Invasive Species Prevalence

System-wide mapping data were used to identify areas in the TSA with relatively high invasive species cover. N-Appendix -C includes a list of the management priority invasive plant species used in this target analysis and a description of the mapping methodology. Map N4 displays invasive species densities across the mapped portions of the TSA and relative concentrations based on patch size and density. Maps N5 and N6 depict the species occurring in the TSA that are included in Colorado Noxious Weed Act lists A and B.

Rare Plant Species and Communities

Rare plant occurrences are documented across the OSMP land system using a standard methodology. A list of the rare and sensitive plant species and communities, and the survey methods can be found in N-Appendix B. Documented occurrences of rare plants and communities have been generalized in Map N7.

Wildlife

Upland shrublands provide habitat for a variety of species. Many species of birds use shrublands for nesting and foraging. Small mammals and snakes use shrublands for cover and larger mammals including elk, deer, bobcat, bear and mountain lion, use shrublands as travel corridors. Within this habitat type, one particular community- shrub nesting birds- rely entirely on upland and/or riparian shrublands for nesting and raising their young.

North TSA Focal Species

Lazuli bunting

In Colorado, the lazuli bunting has a close association with transitional shrublands between 5,500 and 7,000 feet and riparian areas that intersect the transitional area from the plains that provide a diversity of shrub and tree species and vegetative structure (Andrews and Righter 1992, Kingery 1998). Arid brushy hillsides, open scrub, thickets and post-fire habitats are

used (Greene et al. 2014, Leidolf et al. 2007). The North TSA, especially on the western portions, offers substantial amounts of these habitats including upland shrublands and shrubby drainages interspersed with grassland habitat types.

Although globally secure, lazuli bunting has higher conservation priority both regionally and locally. Partners in Flight ranks the lazuli bunting as a priority species in the Southern Rockies/Colorado Plateau which encompasses portions of the North TSA to the west of Hwy 36 (Beidleman 2000, Blakesley et al. 2010). In addition, within Colorado, lazuli buntings are ranked as level 2 priority species for conservation (Colorado Division of Wildlife 2006). Locally, the Boulder County Comprehensive Plan (Boulder County 2013) lists the lazuli bunting as a species of special concern.

Lazuli buntings first arrive in early May in Colorado and most have departed Colorado by late August (Greene et al. 2014), coincident with breeding (Kingery 1998). Lazuli buntings nest in dense vegetation in a wide variety of shrub species averaging 3 meters above the ground (Greene et al. 2014).

Lazuli buntings are a focal species for the North TSA because of their affinity for shrub patches and riparian areas, both habitats that support diverse bird communities and a wide variety of other wildlife. Monitoring in the North TSA showed that areas west of Hwy 36 including North Boulder transects and Joder supported the highest abundance of lazuli buntings detected in grassland sampling. Overall in the TSA, an average abundance of 0.22 lazuli buntings per transect is far higher than the system average of 0.07. The reason for this high level of detection is the unique habitat in the North TSA, especially west of Hwy 36. In this area, patches of upland and riparian shrub communities are interspersed with grassland habitat. Although lazuli buntings occur in riparian areas across the system,

Lazuli Bunting,
© Ben Johnston

their presence within the grassland matrix is unique in the North TSA. Monitoring information can be found in N-Appendix A.

To help inform management decisions with in the TSA, habitat suitability indices were developed for the lazuli bunting to focus on the upland and riparian shrubland habitats. Index results are presented in N-Appendix A and on Maps N23 and N24.

Prairie Rattlesnake

Rattlesnakes are often found in or near shrublands, likely due to the cover provided and small mammal prey that live within the shrubs. On OSMP-managed lands within the North TSA, rattlesnakes were monitored using radio telemetry and 23 percent (n=44) of the observations were in shrublands (N-Appendix A, Map N11). This suggests that rattlesnakes are using this habitat type disproportionately to its availability in the study area (shrublands comprise 11 percent of the rattlesnake telemetry study area). Habitat suitability indices were also developed for rattlesnakes and are presented in N-Appendix A.

Indicator: Lazuli Bunting Habitat Suitability

Suitable habitat for the lazuli bunting in the North TSA consists of shrubby vegetation communities in upland areas as described in this target description and those associated with riparian or drainage areas which provide adequate structure for nesting and foraging. In addition, relatively large habitat patches are more likely to support lazuli buntings. The habitat analysis in the North TSA was done in two steps. The first simply scored all habitat based on the environmental variables in the model (i.e., without a trail effect). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. A 50 meter buffer (50 meters plus 20 feet on voice and sight trails to account for larger area used by dogs in trail corridor) was removed from each side of existing designated and undesignated trails and roads because the use of recreational trails has been shown to influence bird abundance and nesting. For more information about specific variables and methods used in the habitat suitability index and analysis, see N-Appendix A.

Analysis shows that 1% of the entire North TSA is highly suitable habitat for **Lazuli Bunting** (Map N23). Existing designated and undesignated **trails reduce available habitat by 12%** (from 1.3% to 1.2%, Map N24).

Indicator

Percentage of North TSA with highly suitable habitat for Lazuli Bunting (Shrub-nesting birds)

Lazuli Bunting,
photo: © David Mendosa

Conservation Target:
Exposed Rock and Cliffs

Dakota Ridge, photo: Jack Sasson

Key Statistics

39
total acres of exposed rock and cliffs in the North TSA

0.5
percent of the target area in the North TSA

8
feet per acre of designated trails in the target in the North TSA

15
feet per acre of undesignated trails in the target in the North TSA

Background and Setting

Rock outcrops and cliffs add to the overall habitat diversity in the North TSA and support some wildlife species that are dependent on exposed rock habitats. Along the mountain front, layers of older sedimentary rock have been sharply upturned by the rise of the Rocky Mountains. These differentially eroded layers form conspicuous hogback ridges of hard sandstone and limestone. The Geology section provides an overview of the geology in the TSA.

Composition

Vegetation is restricted to shelves, cracks and crevices in the rock outcrops where soil is concentrated (Mutel and Emerick 1992). Where the soil is slightly developed and less erodible, some grass and shrub species can occur with greater coverage. Common plant species include shrubs and grasses such as mountain mahogany, three-leaved sumac, wax current, chokecherry, needle and threadgrass, blue grama and sideoats grama. Ponderosa pine, Rocky Mountain juniper and netleaf hackberry are also scattered in rock outcrops (Colorado Natural Heritage Program 2007).

Crevices within cliffs and rock outcrops create protected habitat for wildlife, offering nest sites for golden eagles, rock wrens and other bird species. Rock wrens nest in rock outcrops in the western portions of the North TSA and few other places within the OSMP land system. Deer mice, shrews, snakes, yellow-bellied marmots, bats and other small

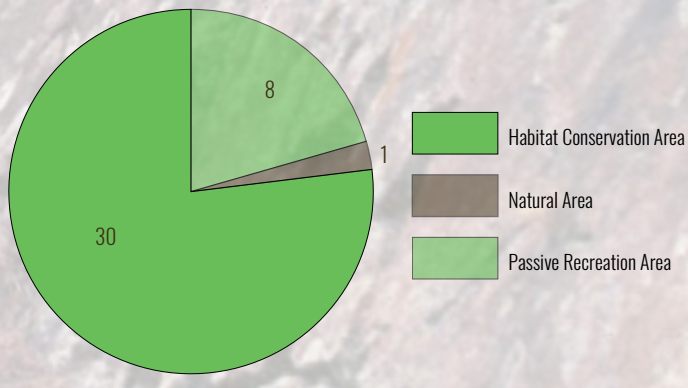
mammals also use rocky habitats. A number of species with distributions further south in Colorado such as the Colorado chipmunk, rock squirrel and gray fox reach the northern limits of their ranges in Boulder and Larimer counties where south-facing rocky sites provide the necessary micro-climate, food and shelter (Mutel and Emerick 1992).

Dakota Formation, photo: Mary Reilly-McNellan

Ecological Processes

Drought and wind erosion are the most common natural dynamics affecting these cliff and rock outcrop systems. The lack of vegetation on many sites protects larger rock outcrops from fire. The specialized conditions of rocky habitats are often dependent on the maintenance of ecological processes in the surrounding large patch communities (Colorado Natural Heritage Program 2007). Overall productivity is generally low due to soil nutrient and moisture limitations. As a result, rocky habitats are dominated by the few species that can utilize barren areas with limited soil development.

Exposed Rock and Cliffs Acreage by Management Area Designations in the North TSA



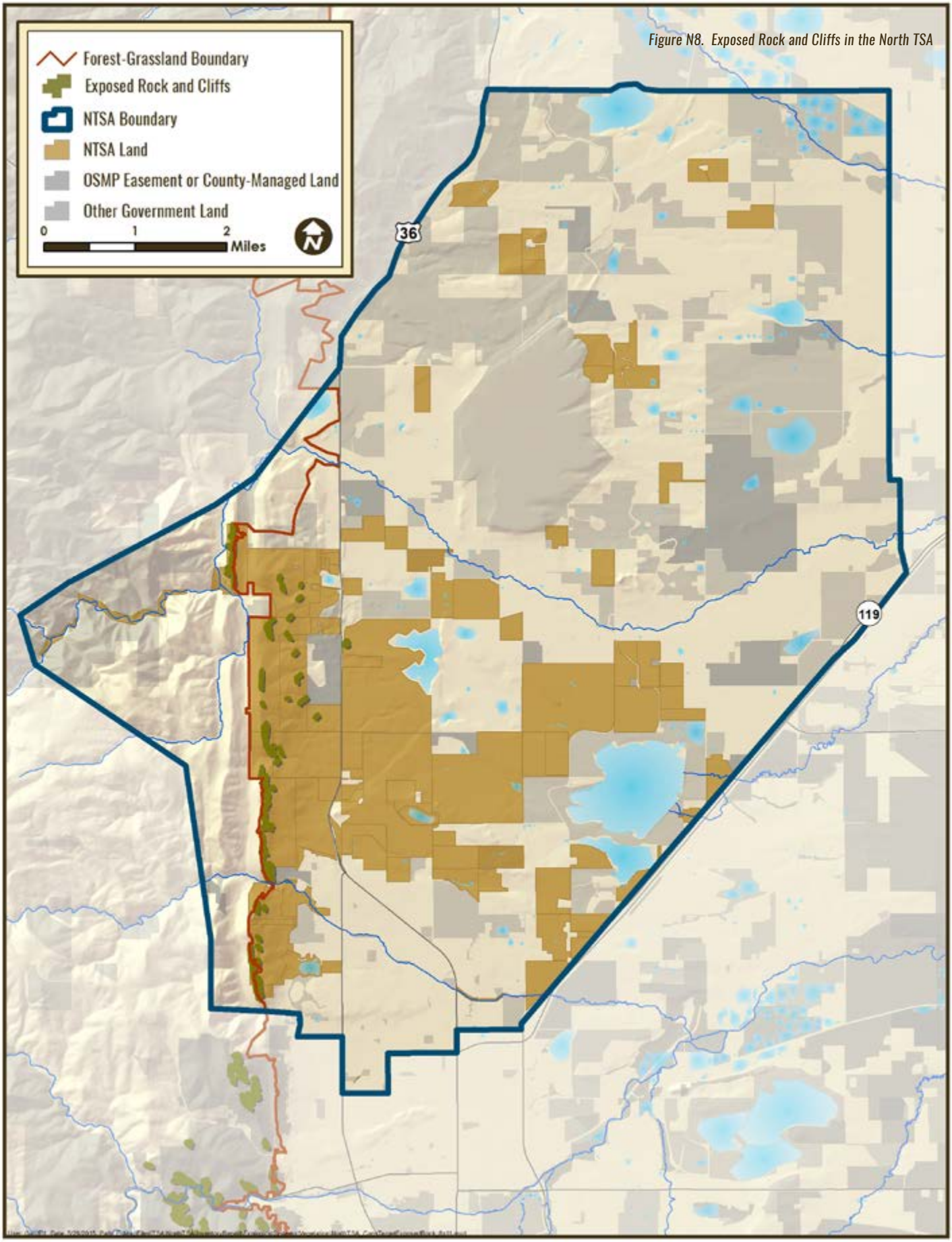


Figure N8. Exposed Rock and Cliffs in the North TSA

Current Conditions

Vegetation

Invasive Species Prevalence

System-wide mapping data were used to identify areas in the TSA with relatively high invasive species cover. N-Appendix C includes a list of the management priority invasive plant species used in this target analysis and a description of the mapping methodology. Map N4 displays invasive species densities across the mapped portions of the TSA and relative concentrations based on patch size and density. Maps N5 and N6 depict the species occurring in the TSA that are included in Colorado Noxious Weed Act lists A and B.

32
acres (81%) of the Exposed Rock and Cliffs target in the North TSA has been mapped for selected invasive species

1.5
acres (5%) of mapped target area is invaded

Rare Plant Species and Communities and Best Opportunity Areas

There are no known rare plant occurrences within the Exposed Rock and Cliffs target; however, rare plant species and communities are documented in adjacent XTP and MGPM grassland communities. In the North TSA, the Upland Grassland Complex BOAs cover areas of contiguous grassland in the western part of the planning area (Map N3), and include most of the exposed rock and cliff habitat.

Wildlife

Golden Eagles

The North TSA management area contains one golden eagle nesting territory—the Lefthand Palisades (Map N25). Occupancy of Lefthand Palisades by golden eagles was first described by Denis Gale in the 1880s and a handful of known nesting outcomes date as far back as 1904 (Henderson 1907). The Lefthand territory was one of 10 Front Range golden eagle territories described by Jollie in his master's thesis, published in 1943 (Jollie 1943). These sources suggest that the Lefthand Palisades has been consistently occupied by golden eagles for over 130 years. Nesting success and productivity of golden eagles at the Lefthand Palisades was lower than at other sites on OSMP-managed lands but comparable with other sites in the western United States (N-Appendix A).

North TSA Focal Species

Rock Wrens

In Colorado rock wrens nest on rocky slopes and cliffs between 5,500 and 9,000 feet. Rock wrens have no particular association with any vegetation community type but inhabit cliffs, outcrops and talus slopes with open areas and little surrounding or overhanging vegetative cover within their elevation range (Kingery 1998,Warning 2013). Outcrops are often isolated patches within other larger habitats (Kingery 1998).

Although globally secure, rock wrens have higher conservation priority both regionally and locally. Partners in Flight ranks the rock wren as a priority species in the Southern Rockies/Colorado Plateau which encompasses portions of the North TSA to the west of Hwy 36 (Beidleman 2000, Blakesley 2010). Locally, the Boulder County Comprehensive Plan (Boulder County 2013) lists the rock wren as a species of special concern.

Within the North TSA, rock wrens are found frequently within the rock outcroppings common along the hogback areas included in the exposed rocks and cliffs target. Across the OSMP system, rock wrens are infrequently observed in cliff, talus and burn areas in the western parts of OSMP. However, the types of rock outcrops interspersed with grassland and shrubland habitats are unique to the North TSA and areas to the north of the OSMP land system. During annual, system-wide grassland bird surveys conducted by OSMP staff, rock wrens were detected only within North TSA transects on Joder and the North Boulder area (west of Highway 36) (N-Appendix A). Due to the unique ability of these rock outcrop habitats to support an abundance of rock wrens, they are a focal species of the North TSA. Sustainability through preservation of this

target within the North TSA will support the isolated and important rock wren habitat contained within it.

Prairie Rattlesnake

In addition to other habitat types including xeric tallgrass prairie, upland shrublands and mixedgrass prairie mosaic, prairie rattlesnakes are found in the rock outcroppings and exposed rock in this conservation target. Additional information about rattlesnakes and habitat suitability indices

Rock Wren, © Rich Wolf

for rattlesnakes in the North TSA can be found in the xeric tallgrass conservation target description, and in N-Appendix A.

Soils

The information used for description and analysis of the soils of the North TSA are derived from soil survey data available from Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture (2015) and excerpted from the North Boulder Valley Area Management Plan (City of Boulder 1997).

Soil Orders

Soils are classified based upon similarity of origin, moisture regime, temperature, color, texture and structure. Important chemical and mineralogical properties include pH, soil depth, and the presence of organic matter, clay, iron and salts. At the broadest level, soils are classified into a variety of orders. Orders are related to soil-forming processes and are determined in the field by the presence or absence of diagnostic layers, or horizons, in the soil. There are four soil orders in North TSA: mollisols, entisols, inceptisols and ardisols (Map N26).

Mollisols are dark grassland soils characterized by a thick dark surface horizon. Most of the important agricultural soils in North America are mollisols and developed under prairie vegetation.

In the North Boulder Valley there are three types of mollisols: 1) those which dominate the generally flat dry mesa tops, characterized by well developed layers of clay in the soil profile, 2) the soils dominating the east facing slope of the Dakota Ridge although these soils are just barely classified as mollisols because of their rockiness and relatively thin dark surface horizon, and 3) some small areas at the base of mesa slopes characterized by the presence of clay and the dry setting. Entisols cover more than 30 percent of the North Boulder Valley. These are mineral soils which lack

diagnostic horizons, or where horizons are just beginning to develop. There are two areas dominated by entisols: 1) the shallow soils which are slowly accumulating on the Dakota Ridge and 2) the soils developing on the side slopes of the mesas and Dakota Ridge. In all cases, there are areas where aspect, slope, climate, underlying bedrock and erosion establish conditions which limit soil development. Although some entisols are very fertile, such as recent river deposits, the hot and dry entisols of the North Boulder Valley tend to be relatively sparsely vegetated.

The third soil order in the North Boulder Valley is the inceptisol group. Like entisols, inceptisols are characterized by relatively poor horizon development. Although inceptisols show horizons, these are thought to develop relatively quickly rather than from extreme or prolonged weathering. For example, soil saturation resulting from flooding can quickly alter underlying rocks and sediment forming soils. In the North Boulder Valley, inceptisols are restricted to areas of poor drainage, tend to be areas of salt accumulation and often underlie wetlands.

Less than 5 percent of the North Boulder Valley contains aridisols. As indicated by the name, aridisols are mineral soils in dry climates. They are typically characterized by surface horizons with little organic accumulation and light yellow/tan colors. Aridisols are not usually subject to intensive leaching either because of low levels of precipitation or a sheltered location. Aridisols are scattered throughout the North Boulder Valley in steep

narrow draws and along mesa-sides. The Ditzel property is completely underlain by aridisols.

Soil Series and Phases

Although soil orders provide good general information regarding soil properties, soils are classified at increasingly finer levels to help farmers, ranchers, engineers and land managers develop plans for conservation and land use. The soil series is a useful level of classification because most soil surveys provide maps showing the approximate boundaries of soil series. Each soil series has major horizons, or layers, that are similar in thickness, arrangement and other important characteristics.

Further refinement is often provided in a soil survey to differentiate when soils of one series differ in texture, slope, stoniness or other characteristics that affect the use of a soil. On the basis of such differences, soil series are divided into phases. Map N26 shows the North TSA at the soil series level with some phases included.

Soil Characteristics

While soil classification alone provides a great deal of useful information for land managers, soil scientists have also conducted detailed evaluations of soils to better understand their suitability and limitations for particular uses.

Wind and Water Erosion

The Natural Resource Conservation Service has developed technical information regarding the susceptibility of each soil phase to wind and water erosion. (Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture 2015) The relative vulnerability of soils to erosional forces is shown in Figure N9. Wind erosion is a more serious problem where vegetation has been removed; e.g. in areas used as annual cropland, overgrazed areas or burned areas. Farming practices such

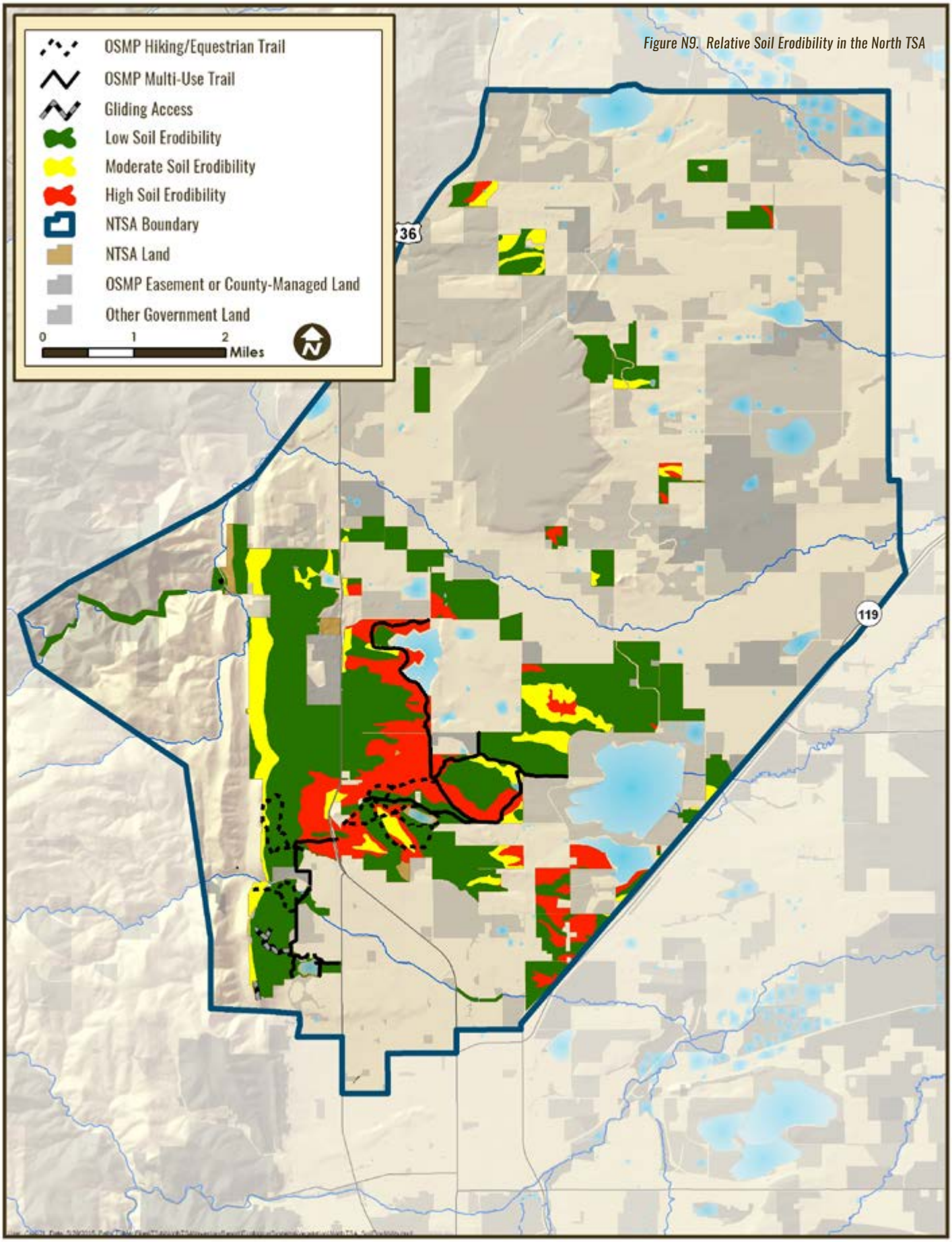


Figure N9. Relative Soil Erodibility in the North TSA

as strip cropping, stubble mulch, reduced tillage, no tillage and treatment of critical areas (re-seeding, planting, etc.) can reduce the extent of wind (and water) erosion of soil in cropped systems.

As evidenced in recent flooding events, water erosion can significantly influence soil conservation because: 1) well-established vegetation does not always protect an area from soil loss due to water erosion and 2) sedimentation resulting from erosion can have far-reaching impacts on the ecological and agricultural function of wetlands, ponds, creeks and ditches.

Soil Characteristics Related to Trail Planning in the North TSA

Areas with fine-textured, clay rich soils in the North TSA present a challenge for trail planning. Undesignated trails usually lack erosion control treatments, such as water bars and specially prepared trail surfaces. These trails tend to become wider and deeper over time as clay soils erode. Once the vegetation is killed by trampling, there is little to hold this fine-textured soil together. Water and wind carry the soil particles downstream and downwind. Unmanaged trails in areas with a high erosion hazard result not only in the removal of native vegetation but sedimentation of

Landslide, after 2013 flood, photo: OSMP

the creeks, ponds and wetlands that lie downstream. Native vegetation is also more likely to be replaced by weedy species where soils are unstable.

Geology

The geology of the Boulder Valley and vicinity has been mapped by Wrucke and Wilson (1967), and several stratigraphic depictions of the Boulder area exist (Evanoff 2001, Mieras 2002, Bridge 2008). The Cultural Resources chapter of the North TSA Inventory Report discusses sedimentary layers in the section on fossil-bearing formations.

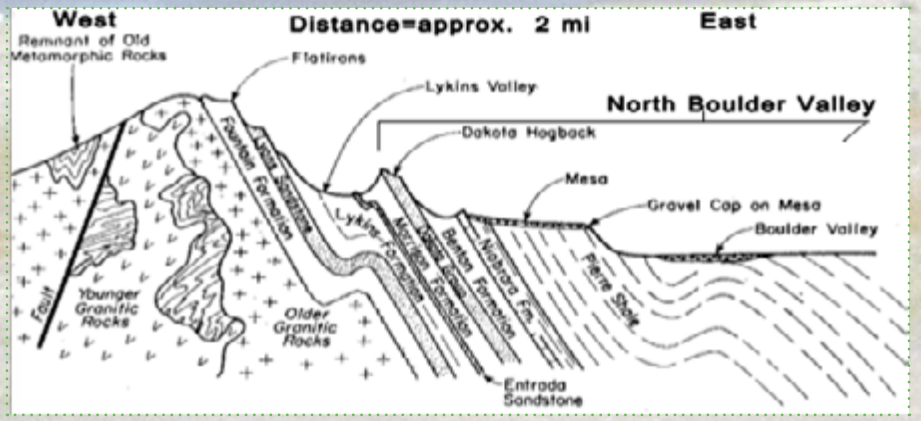
Fountain Formation cross-bedding, Lee Hill Rd., photo: Frank Beck

The North Boulder Valley is geologically diverse, providing good opportunities for viewing and studying the geology of the Boulder area. Two episodes of mountain building are recorded in the North TSA: the Ancestral Rockies were uplifted about 300 million years ago and the current Rocky Mountains began uplifting about 70 million years ago. Erosion and burial of the Ancestral Rocky Mountains is recorded in the sedimentary rocks, which are particularly evident in the western and northern areas of the TSA. The large Denver Basin subsided to accommodate the sediments eroding from these ancient mountains. During the Laramide uplift, which formed the Rocky Mountains that we see today, molten magma was injected into the sedimentary layers where the magma cooled and solidified to form sills and dikes (Boone 1990), which are evident in the northern areas of the TSA. Following the formation of the Ancestral Rockies and since the uplift of the current Rockies, erosion has been a major process shaping the landscape.

The oldest sedimentary rock in the North TSA is the Fountain Formation which occurs below the Lyons Formation cliffs (Palisade cliffs) along Lefthand Creek. These and younger layers were formed in a wide range of ancient environments, including deltas and sandy beaches (Dakota sandstones), limestone and shale deposits (Niobrara Formation) and deep marine deposits (Pierre Shale). In places, the lower Dakota consists of sand and gravel carried eastward by streams and rivers draining mountains in Utah and Nevada. Later, an inland sea developed in the interior of

North America connecting the Arctic Ocean and the Gulf of Mexico. Beach sands and deeper marine shales were deposited along the edge of this sea, forming the upper part of the Dakota Group. Between 10,000 and 15,000 feet of sediments are preserved from prolonged periods of deposition (Braddock undated, Runnells 1976).

As the current Rocky Mountains formed, sandstones, siltstones and limestones were tilted and bent (Figure N10). A complete section of sedimentary layers with folds and faults, making a complex sequence of sedimentary rocks from the Fountain through to the Niobrara, can be observed in the TSA on the Joder property and areas to the west. The



old railroad grade west of Highway 36 exposes the Niobrara and Pierre formations, as well as pediments and terraces.

Figure N10.Geology Cross Section (Runnells 1976)

Significant episodes of rapid erosion and deposition resulted in an accumulation of erosional material in the foothills and plains as the Rocky Mountains rose. Rivers deposited coarse gravel across the upturned strata. Remnants of these deposits north of Boulder include the isolated butte of Haystack Mountain and the large mesas found along the base of the foothills (e.g., Table Mountain). Many of these recent, relatively unconsolidated deposits, as well as the underlying bedrock layers are being cut into by the numerous east/west trending drainages in the TSA. Over the last few hundred thousand years, these erosional processes have

produced nested erosion surfaces or pediments that slope eastward from the foothills ridges. These erosional surfaces are capped by layers of gravel washed out from the more resistant ridges or hogbacks (Harlan, Casey and Assoc. 1993). East of the Dakota hogback ridge, the Benton Formation, which is composed mostly of shales and mudstones, forms a steep, grass-

photo: OSMP

covered slope. The Benton is covered with large landslides of different ages and debris from the Dakota ridge, including those generated during the September 2013 flooding.

Six-Mile Fold

Six-Mile Fold is a designated County Natural Area and Natural Landmark in the Boulder County Comprehensive Plan. Most of the Six-Mile Fold geologic area is managed by Boulder County Parks and Open Space and is located north of the OSMP West Beech property and southeast of the Joder property. The southern edge is on OSMP fee land and a portion of the Foothills Business Park conservation easement.

This geologic feature is a long anticline on the east and syncline on the west, plunging to the southeast and the south. Six-Mile Fold is visual evidence of the results of the uplift of the Rocky Mountain Front Range. The relative resistance of the Niobrara limestones to erosion and the erosion of the less resistant strata of this plunging fold, produces a Z-shaped pattern where the whitish Fort Hays limestone is visible from the air and shown on geologic maps (Braddock undated). The geology of Six-Mile Fold is not unique to the Front Range. This geologic feature is important because the representative features, resulting from the Rocky Mountain uplift, are easily viewed and studied at this site due to the low density of vegetation and the relatively intact ground surface.

Photo credit: © Jack Sasson

Cultural Resources

Introduction

People have lived on and enjoyed the lands of the North TSA for thousands of years. Their stories and the evidence left behind are the cultural resources of the area.

The study of cultural resources promotes the appreciation and preservation of historic structures and archaeological sites. At OSMP, the study of paleontology, which includes organic and mineralized remains of prehistoric life, is also discussed as part of cultural resources. This wide variety of historic resources creates a fascinating backdrop for people with an interest in the North TSA.

This cultural resource inventory is comprised of four categories:

1. **Paleontological Sites and Features** — organic and mineralized remains in body or track form.
2. **Aboriginal Archaeological Sites** — sites and artifacts such as gaming walls and projectile points.
3. **Historical Archaeological Sites** — manifestations of Euro-American settlement.
4. **Historic Buildings, Structures and Objects (BSOs)** — cultural resources constructed by humans that are present on the land.

Photo: Julie Johnson (OSMP)

Information on paleontology in the North TSA was compiled for OSMP by Dr. Sue Hirschfeld, a professor of geology for over 30 years. Information for aboriginal and historical archaeological sites and historic buildings, structures and objects was derived from the following inventories:

- Class III Cultural Resources Survey of the Joder II, Lappin and Papini Open Space in Boulder County, Colorado. Killam, David for RMC Consultants, Inc., City of Boulder (2014).
- Cultural Resources of City of Boulder Open Space: North Boulder Valley, Boulder County, Colorado. Gleichman, Peter J. and Phillips, Scott C. for Native Cultural Resources. City of Boulder (1996).
- A Cultural Resource Inventory of City of Boulder Open Space Wonderland Lake to Lee Hill Road, Boulder County, Colorado. Gleichman, Peter J. for Native Cultural Resources, City of Boulder (1992).

Many parcels in the North TSA have not been surveyed. If ground disturbances are proposed for those areas, a thorough survey may be appropriate beforehand.

Cultural Overview of the North TSA

The following is an excerpt from *Cultural Resources of City of Boulder Open Space, North Boulder Valley*, Peter Gleichman and Scott Phillips, 1996:

> *Prehistoric groups are known to have occupied northeastern Colorado since at least 11,500 years ago. The* ***Paleo-Indian Period*** *existed from ca. 9500–5500 B.C., and subsistence practices at this time included both hunting and gathering of wild resources. Most known Paleo-Indian sites are big game kill sites where large and occasionally fluted lanceolate projectile points are associated with the animal remains.*
>
> *The period from ca. 5500 B.C. to A.D. 1 in northeastern Colorado is known as the* ***Plains Archaic Period*** *and coincides with a significant change in subsistence to a more generalized broad-spectrum hunting-gathering strategy. It has been hypothesized that the foothills and mountains of Colorado were occupied during the Early Archaic as a refugium from a severe warming and drying climatic episode then taking place on the plains (Benedict and Olson 1978). Middle Archaic sites with McKean Complex tool assemblages are known from the region, as are some Late Archaic manifestations. The Plains Archaic is followed by the Ceramic Period (A.D. 1–1550), also known as the Late Prehistoric Period. In this area a hunting-gathering lifestyle was retained, with seasonal movements of people into the Front Range. Sites relating to this period are known from eastern Boulder County.*
>
> *The* ***Protohistoric Period*** *refers to the era after European contact and before widespread EuroAmerican settlement, ca. A.D. 1600–1800. European trade items began to be used by indigenous peoples and horses became available. During the 18th century Colorado was occupied by the Comanche in the plains and the Ute in the foothills and mountains. By the early 19th century the Cheyenne and Arapaho began to occupy most of the plains of eastern Colorado. The Native Americans were forced out of the area by the late 1860s.*

Although fur trappers were attracted to Boulder County in the early 1800s, their numbers were limited, and it was not until the ***discovery of gold*** *in California in 1849 that large numbers of Euro-Americans began to migrate to the west. The first encampment of Euro-American settlers in Boulder County was in 1858 when a small group in search of gold camped at the mouth of Boulder Canyon. In 1859, the first major discovery of gold in Boulder County was made and soon hundreds of prospectors rushed into the area. Agriculture and the irrigation associated with it were underway by 1860.*

The productive soils of northern Boulder County were well suited to ***agriculture****. By the 1860s, scattered farms appeared on the plains east of Boulder and man-made lakes and ditches were constructed to improve the agricultural productivity of the land. The North Boulder Valley also experienced an '****oil boom****' – extensive exploration and production of oil began in the early 1900s.*

photo: National Register of Historic Places

Boulder Oil Fields circa 1909; photo: National Register of Historic Places

Paleontological Sites and Features

Paleontological sites and features include organic and mineralized remains in body or track form. According to Open Space Long Range Management Policies (COB OS 1995), paleontological resources will be protected and preserved for educational and scientific purposes in accordance with management plans and scientific research programs. Paleontological resources are also protected under Colorado Statute CRS 24-80-401-411, whereby permits approved by the State Archaeologist are required for the 'investigation, excavation, gathering or removal of the natural state of any historical, prehistorical and archaeological resource within the state."

Fossil-bearing Formations in the North TSA

West of Buckingham Park along Lefthand Canyon Drive the rocks are igneous and metamorphic. No fossils are expected or known from those rocks.

The oldest sedimentary rock formations of the North TSA are found east of Buckingham Park.

The oldest sedimentary rock formations of the North TSA are found east of Buckingham Park. These include the **Fountain and Lyons Formations**. Neither of these formations is fossiliferous. Occasional footprints (trace fossils) are found in the Lyons Formation. Both formations formed in terrestrial environments (rivers and sand dunes).

East of Buckingham Park and Old Stage Road, the **Lykins Formation** was deposited atop the Lyons Formation. The Lykins formed in a shallow marine environment and consists of bright red mudstones. This formation includes the Forelle Limestone Member that contains stromatolite fossils that probably formed on tidal flats. Stromatolites are mats of bacteria and bluegreen algae that form mounds. Over time, these are fossilized into mounds irregularly layered limestone. In most places, the Lykins Formation occurs in valleys because the mud and clay of which it is composed is easily eroded. Since it forms relatively rich soils, outcrops are uncommon becasue the rock is typically covered by vegetation.

The **Jelm and the Sundance formations** may be encountered at the Joder property on the west side of Dakota Ridge. These formations tend to be thin and less prominent. They contain no fossils.

Stratigraphically above the Jelm and Sundance formations is the Morrison Formation. The Morrison Formation is composed of brightly colored green, red and yellow clay and occasional limestone. This formation was deposited in a terrestrial environment of rivers and lakes. The Morrison Formation is famous for dinosaur bones and tracks. Like the Lykins, it too is rarely usually covered by vegetation and infrequently exposed.

Above and east of the Morrison Formation is the **Dakota** (called either a formation or a group by different authors). This layer forms a prominent north-south Dakota hogback ridge from the Joder property south to Linden Drive. The Dakota is composed of well-cemented sandstones and softer shales formed as near-shore/off-shore marine deposits. Although there are excellent exposures of Dakota, it is largely unfossiliferous. The Dakota is called the "dinosaur freeway" by paleontologists. There are dinosaur footprints in other sections of the Dakota including one near Golden, Colorado.

The Dakota is called the "dinosaur freeway" by paleontologists. There are dinosaur footprints in other sections of the Dakota including one near Golden, Colorado.

East and stratigraphically above the Dakota is the **Benton** (also called either a formation or a group by different authors). The Benton is composed of off-shore marine mudstones and shales. Ammonites are known to occur in the Benton but these are difficult to find as the Benton is typically well vegetated.

The **Niobrara Formation** consists of the lower Fort Hays Limestone Member and upper Smoky Hills Member. Both members have excellent fossil bivalve mollusks (oysters and clam-like animals). The Fort Hays Limestone Member is beautifully exposed at Six-Mile Fold and in the road cut on the west side of N. Foothills Highway. At road level, the Fort Hays Limestone


© Gary Stevens


© Jane Larson


Photo: OSMP

Member lies above the Codell Member of the Benton. There are records of shark teeth, fish bones and trace fossils (burrows) in the Codell Member at this location. The Fort Hays Limestone Member is exposed in road cuts to the north of the Joder property on the east side of Highway 36 north of Neva Road.

The upper part of the Niobrara Formation is the Smoky Hills Shale that has three prominent carbonate-rich ridge-forming beds. The Smoky Hills Shale is well exposed on the east and west side of Highway 36 near Neva Road. In addition to fossil "oysters," blue-gray fish scales and small fish bones can also be found in the Smoky Hills Shale.

South of Joder Ranch and west of Highway 36, the Fort Hays Limestone Member is easily followed across the hillside. Fossil "oysters" and inoceramid clams can be found everywhere the Fort Hays is exposed. There are also good exposures of Smoky Hills Shale north of the Dakota Ridge Housing complex and along the old railroad grade to the north.

The **Pierre Shale** is exposed to the east of the Smoky Hills Shale and underlies much of the TSA. The Pierre Shale is a deeper marine sedimentary deposit than the Niobrara Formation. Fossils likely to occur in the Pierre are ammonites.

In many areas, the Pierre Shale is covered by pebble and cobble gravel that had been carried by rivers from glaciers in the mountain or by wind-blown sand. Mammoth teeth or other fossil remains have very rarely been found in gravel mines.

In summary, the fossil-bearing formations are the Fort Hays Limestone, Smoky Hills Shale and the Pierre Shale.

Aboriginal Archaeological Sites

Aboriginal archaeological sites include sites and artifacts, such as gaming walls and projectile points. Previous cultural resource surveys of the North TSA have identified a few prehistoric sites and isolated artifacts. The low number of aboriginal archaeological sites known from this area is perhaps, in part, accounted for by heavy vegetation growth leaving ground visibility poor. It may also be, in part, a reflection of the intensive historic use of the area and the proximity of urban development, with prehistoric material being lost to collection and otherwise obliterated by plowing and other development.

All prehistoric and aboriginal archaeological sites, isolated finds and artifacts are protected by the Memorandum of Understanding (MOU) between OSMP and the United Tribes of Colorado (UTC) adopted in 2002. Further protection of these resources is provided by state law (CRS 2480-401-4)1. They are also protected by City of Boulder regulations (Boulder Revised Code 5-4-2) which prohibits removal or damage of public property. According to the MOUs with the Colorado Office of Archaeology and Historic Preservation (OAHP) and UTC, the locations of aboriginal prehistoric archaeological sites are protected information and cannot be divulged to the public. However, the State Archaeologist has made the exception in the case of the Teegarden Wall (see description below). Because the wall is quite visible from Highway 36, it was determined it is an excellent educational opportunity, and that divulging location information was in the best interest of the community and risked little damage to the site.

Photo: OSMP

Teegarden Wall, photo: OSMP

Teegarden Wall

5BL.6611: This site is a low stone wall that spans 1,312 linear feet down a slope on Dakota Ridge overlooking Highway 36. It was constructed of local fieldstone and is curved in many areas, incorporating standing boulders and natural outcrops.

According to Pete Gleichman, the recording archaeologist, this wall was first thought to be a boundary similar to various rock walls in the Front Range, including those near the Doudy/Dunn/DeBacker property near the South Mesa Trailhead. However, a Boulder native and history enthusiast, Dock Teegarden, offered to accompany Gleichman on a field trip where he would attempt to make the case that the wall was actually a game drive feature (or wall).

Dock was born in Boulder and spent his life hiking and exploring the area around it. His love of history and the outdoors made him an outstanding OSMP volunteer contributing over 8,000 hours, mostly in historic research and trail guiding. His belief that this was a gaming wall was based primarily on its configuration. In comparison, historic stone fences are coursed or stacked, not jumbled, and they are generally straight, demarcating property boundaries or pastures. Dock enlisted the help of noted local geologist, Jim Benedict. Jim was a geologist by trade and a self-taught archaeologist. He founded the Center for Mountain Archaeology in 1971 and was an expert on gaming walls in the Front Range, having researched and documented over 50 in the area. Jim agreed with Dock – that this wall was most likely an aboriginal gaming wall. To honor Dock's work and tenacity, Gleichman named the wall the 'Teegarden Wall' when submitting the cultural resource survey to the Colorado State Office of Archaeology and Historic Preservation in 1996.

Historical Archaeological Sites

Historical archaeological sites are manifestations of Euro-American settlement within the North TSA. Because of the history of farming, ranching, mining and recreation within and adjacent to the study area, resources related to these activities can be found on every parcel in this area. The City of Boulder through the Open Space Long Range Management Policies and the Colorado OAHP both direct that archaeological resources should be protected.

According to the Open Space Long Range Management Policies, archaeological resources will be left undisturbed unless removal of artifacts or digging in the site is justified by the need for protection. The details, including location of historical archaeological resources, is protected in a 2003 MOU between OSMP and OAHP. Two historical archaeological sites are listed below because they are both historical structures with an archaeological component. The resources are very visible to visitors in the area. It is hoped that explaining their historical significance will help protect their historical integrity and help to enrich the visitors' experience.

Boulder, Left Hand and Middle Park Railroad and Telegraph Company

BL.417: This unfinished railroad grade on the Joder property represents one of several failed railroad attempts in Boulder County. The grade was developed in the 1880s to serve the gold camps of Left Hand Canyon and the ranches of Middle Park. Much of the route was surveyed, but this is the only section that was actually excavated. The route was to follow the hogback north to Left Hand Canyon, then proceed west to Indiana Gulch, over Buchanan Pass to Middle Park. By spring of 1881, the grade was being constructed along the hogback, the grade from Boulder to Left Hand Canyon was completed in the summer of 1883. Funding had run out by 1892, and the project was abandoned.

The abandoned grade of the Boulder, Left Hand and Middle Park Railroad, photo: Dave Killam

Cobalt Mine, near Cobalt Trail, © Jack Sasson

Cobalt Gold Mining Company Smelter

5BL.5044: These ruins along Cobalt Trail are accessible from BVR trailhead. The building was timber frame covered by sheet metal and the ruins are all that is left of this smelter operation used to process nickel ore collected from the Cobalt Gold Mining Company in Gold Hill in the 1930s. The ore was hauled down from Gold Hill where it was processed in a series of operations that used gravity to move the ore from one process to the next. Acids and litharge were added after ore was pulverized, and reduced to powder by stamp mill and then ball mill. After acid treatment, the flour went over a flotation table and then to a coal-fired drum drier into the furnace. The nickel and silver were drawn off and the slag dumped, completing the process. The venture was not very successful and the building was torn down in the early 1940s (Cultural Resources of COB Open Space North Boulder Valley, Gleichman and Phillips 1996).

Additional Historical Archaeological Sites in the North TSA

OSMP cannot disclose specific locations of significant archaeological sites. However, sites are known to exist on the North TSA properties listed below and shown on Map C1. It is feasible that new aboriginal resources could be discovered in the course of trail work or other development. Should that occur, cultural resource professionals should be alerted immediately so that it can be documented and every effort made to avoid impact to the resource.

- Waldorf
- Ryan
- Bennet
- DeLuca
- Beech
- Foothills Business Park
- Schneider
- Gilbert
- Mann
- Parsons
- Eisenberg
- Mesa Reservoir
- Boulder Valley Ranch
- Lore
- Ellison
- Axelson
- Johnson
- Papini
- Henrikson
- Wonderland Lake
- M. Moore

Historic Buildings, Structures and Objects

Historic buildings, structures and objects (BSOs) are cultural resources constructed by humans that are currently extant (present on the land). They can reveal a great deal about past human activity and the environment.

A ***building*** is a resource created principally to shelter any form of human activity, such as a house. A ***structure*** is built for purposes other than creating shelter, such as a bridge or ditch. ***Historic objects*** could include, but are not limited to, construction which is primarily artistic in nature or small in scale, such as a statue or milepost.

Lands in the North TSA have provided a backdrop for construction even before the Homestead Act of 1862. The North TSA is home to a wide variety of historic BSOs. These physical manifestations of our past serve as educational tools as well as aesthetic backdrops for visitors who enjoy OSMP-managed lands.

Johnson house (historic building), photo: OSMP

Not all resources have been surveyed for historic significance. The following information has been collected from cultural resource surveys and visual investigations by staff. Resources formally surveyed have been assigned State Site Numbers that begin with "5BL." Sites not formally surveyed will be labeled only by a site name. Sites are listed according to their location in the North TSA (North to South) and shown on Map C2. The sites and their conditions can be seen in Table C1.

State Site Number	Historic BSO	Condition
5BL.9038	Waldorf agricultural complex	good (2002)
N/A	Bennett Buildings	not assessed
N/A	Abbott Historic Barn	not assessed
N/A	Campbell Loafing Sheds	not assessed
N/A	Schooley buildings	poor
N/A	Joder Ranch	good
5BL.4127	Axelson Dairy Farm	dwelling very poor condition; other buildings fair to poor
5BL.6630	Axelson 2	good
5BL.6629	Axelson 1	good
5BL.4126	Ellison farm	good
5BL.3875	Johnson House	poor
5BL.6628	Boulder Valley Ranch	Dance Hall poor condition; others in good to fair
N/A	Eisenberg buildings	good
N/A	Lappin Parcel	good to fair
N/A	Seigle Storage Shed	not assessed
5BL.6059	Foothills Nature Center (Anna Dunn Farm)	good to moderate
5BL.490	Old Lime Kiln	fair, but threatened by flood damage

Table C1. North TSA Historic Buildings, Structures and Objects and their Conditions

Summary of North TSA Historic Buildings, Structures and Objects

5BL. 9038 **Waldorf agricultural complex**: Loafing shed, circa 1949. Some historical archaeology possible.

5BL.6632 **Farmer's Ditch**; 5BL.3877.1; **Hinman Ditch** 5BL.3813 **Silver Lake Ditch**: Some of Colorado's settlers came north from New Mexico and brought centuries-old irrigation culture, with roots going back still further in the Old World. Others came from the humid East and Midwest of the United States and found an unfamiliar climate here, but learned from those among them who had experienced irrigation in California, Utah, New Mexico or Texas. In 1860, in the early stages of both Hispano and Anglo settlement in Colorado, about 35,000 acres were irrigated by a few dozen ditches. By 1890, the total was over a million acres, and more than 4,000 ditch owners had filed for adjudication of water rights. Ten years later, Colorado passed California as the state irrigating the greatest land area. Farmers and entrepreneurs in the Boulder area brought water to crops by a series of ditches that delivered water to the plains. Several of these ditches flow through the North TSA, including the Farmer's Ditch (1862), Hinman Ditch (1870) and Silver Lake Ditch (1889). (Historic Context for Irrigation and Water Supply, Ditches and Canals in Colorado, Michael Holleran, University of Colorado at Denver and Health Sciences Center, June 2005)

Farmer's Ditch,
Schneider Ranch 2014
photo: Katy Waechter (OSMP)

Bennett Buildings: This resource has not been surveyed. A cultural resource survey should be performed before any disturbance to ground or structures occurs in the vicinity.

Abbott Historic Barn: This resource has not been surveyed. A cultural resource survey should be performed before any disturbance to ground or structures occurs in the vicinity.

Campbell Loafing Sheds: This resource has not been surveyed. A cultural resource survey should be performed before any disturbance to ground or structures occurs in the vicinity.

Schooley Buildings: Former agricultural complex. This property has not been surveyed. A cultural resource survey should be performed before any disturbance to ground or structures occurs in the vicinity.

Riding lessons at Joder Ranch circa 2002, photo: Erik Johnson

Joder Ranch: Anna Best Joder began Joder Arabian Ranch (JAR) in 1954 with the purchase of 600 acres of land in Boulder County on the east and west sides of Highway 36, approximately 3 miles north of Boulder's city limits. She was a woman ahead of her time—a published playwright, expert in Arabian horse breeding and lineage, founding editor of the national Arabian Horse News magazine, and owner and operator of the Hobby Horse Gift Shop as well as the matriarch of JAR for many years. At one point during her tenure, JAR was home to the Rocky Mountain School of Horsemanship, the Gift Shop, a controlled breeding program, a boarding operation and 90 Arabian horses. In the late 1970s, Anna Best passed the reins over to her son, Robert Joder and his wife, Eloise Witt Joder. Robert Joder, upon reassessing the carrying capacity of the pastures, began reducing the size of the herd, expanding the ranch boarding operation, and developing an extensive array of associated equine activities to bring the community into contact with the horse. These activities included beginner-oriented horse shows, costume horse shows, equine-assisted therapy and equine workshops, to name a few—always with the natural horsemanship techniques as the foundational philosophy. (Joder Ranch website http://www.joderranch.com/JARhistory.html)

Two residences remain on today's Joder property, one of which was a bunkhouse for summer youth programs. This building will be used by volunteer groups who travel to the Boulder area to help with OSMP projects. The other residence will house tenants. Both the barn and riding arena were demolished before OSMP purchased the property in 2008. A concrete wall decorated with horse related art, which was once part of the riding center, is among the reminder of the riding legacy of Joder Ranch.

5BL.4127 **Axelson Dairy Farm**: Agricultural complex no longer in use. Dwelling circa 1890. Supporting agricultural buildings were built between the 1920s and 1960. Dwelling is a 'salt box' design, rare in Boulder County. It is in very poor condition, and other buildings are in poor to moderate condition. The history of this farm also includes oil development, which is prominent in the Boulder Valley. Sometime before 1900 the land came into the hands of James Cowie, a local politician. At the turn of the century Cowie sold the land to Eunice Crawford, who was connected with Crawford Oil, Gas and Coal Company and the land was integrated into what is now known as the "Boulder Oil Fields." Inland Oil and Gas Company held mineral rights here, as well as with many surrounding lands. Nels Axelson purchased the property, including the residence, in 1926. As late as 1955, Axelson leased mineral rights to the Haystack Dome Oil Company.

'Grandma Axelson's House' on Axelson Farm during a volunteer project in 2012, photo: Julie Johnson (OSMP)

Boulder Oil Fields: These oil fields were discovered north of Boulder in 1901 at what is now known as the McKenzie Well on Highway 119 near Independence Road. Dowsing with a forked stick led to the discovery at McKenzie, which is the second oldest field in the state and one of the oldest productive sites in the West. About 100 wells were drilled in this area in the first few years following discovery and nearly 200 have been drilled in all. At its peak in 1909, the Boulder Oil Fields reached an output of 85,000 barrels of oil. The McKenzie Well, also known as McKenzie #1, was placed on the National Register of Historic Places in 2005.

McKenzie Well circa 2005, photo: National Register of Historic Places

5BL.6630 **Axelson #2**: Agricultural complex, currently leased to tenants. Complex has six buildings, one of which is a dwelling built circa 1910. Good condition.

5BL.6629 **Axelson #1**: Agricultural complex with 10 buildings. Dwellings built circa 1910. Tenant occupied. Good condition.

5BL.4126 **Ellison Farm**: Agricultural complex with six buildings, circa 1926 –1930. The buildings are part of the OSMP lease program and are currently leased to tenants.

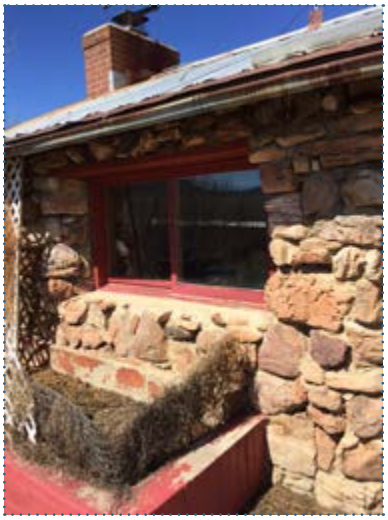
Johnson House 2012,
photo: Julie Johnson (OSMP)

5BL.3875 **Johnson House**: This brick house is located on 55th Street south of the intersection with Monarch Road. It was built sometime between 1880 and 1890. It has elements of the Victorian Italianate style, which distinguishes it from many other farmhouses in the area. Precisely who built the house is unclear – it could have been J. G. Rutter, an early mining investor, or Thomas Shires, who purchased the property from Rutter in 1886. The house changed hands several times until Frank Ardner Johnson purchased the property for his operation in 1943. The land is currently leased to agricultural tenants. There are 13 other agricultural buildings on the property. The granary was built circa 1890. The house is in poor condition and unoccupied.

5BL.6628 **Boulder Valley Ranch**: The Boulder Valley Ranch Trail is named after this ranch. Most of the buildings are modern, even though ranching has occurred here since the 1880s. The exception is a stone garage and shop thought to be built before 1900. Other modern structures include a horse barn and corrals, a hay barn, the 'Silver Nickel' dance hall barn and ranch house. The property is currently leased to tenants who raise cattle and horses. The Dance Hall is in poor condition, other buildings are in good condition.

Stone garage at Boulder Valley Ranch, photo: Julie Johnson (OSMP)

Eisenberg Buildings: Former residence with barns. Currently used as a guest house for volunteers who travel to Boulder and work with OSMP. This property has not been surveyed. A cultural resource survey should be performed before any disturbance to ground or structures occurs in the vicinity. Buildings are in good condition.



Main residence on Lappin,
photo: Deryn Wagner (OSMP)

Lappin Parcel: This property was formerly a small farm/ranch/livestock operation. The property contains at least one main residence, currently unoccupied, along with several outbuildings that appear to have also served as habitation and livestock enclosures and shelters. While the main residence may originally date to the historic period, it has been heavily altered and modified in modern times, so that any potentially historic elements are no longer evident. The same is true for the outbuildings. Buildings are in good to moderate condition.

Seigle Storage Shed: This resource has not been surveyed. A cultural resource survey should be performed before any disturbance to ground or structures occurs in the vicinity.

5BL.6059 **Foothills Nature Center** (Anna Dunn Farm): Site consists of historic farmhouse, circa 1926, belonging to Anna Dunn (the Dunns were a prominent early homesteading family in the Boulder area). A shed is located behind the house. It is thought to have been built the same time as the house. A large garage of modern construction is also on the property. Foothills Nature Center is currently undergoing a Design Review by students from the University of Colorado Denver, Preservation Research, Architecture and Planning Program.

Old Lime Kiln before 2013 flood,
© Sue Hirschfeld

5BL.490 **Old Lime Kiln**: This kiln was probably constructed in the 1880s. It is noted for its crudity of construction, which led to much waste due to over or under burned lime. The kiln was abandoned shortly after its construction. The kiln was damaged heavily during the 2013 flood, and plans are in place to stabilize and repair it in 2015 and 2016.

Old Lime Kiln after 2013 flood,
photo: Dave Sutherland (OSMP)

Photo: OSMP

Agricultural Resources

Introduction

Agriculture has been a cornerstone of the North Boulder Valley for the last 150 years. The preservation of agricultural lands and uses—and ensuring on-going agricultural production in the Boulder Valley—is a well-established function and a charter purpose for OSMP. Whether cows are roaming the open range or farmers are harvesting their crops, agriculture's presence and relevance in the North Boulder Valley is thriving. Within the boundaries of the North TSA, the relevance is no different. OSMP manages 3,032 acres dedicated to agricultural operations in the North TSA by leasing land to local farmers and ranchers. Agricultural operations occur on 39 percent of the North TSA properties. OSMP has 26 leases in the North TSA, ranging in size between 19 and 1,365 acres.

3,032
OSMP acres dedicated to agricultural operations in the North TSA

The dominant types of agricultural activities found in the North TSA are cattle grazing and hay production. Cattle are typically found in this area during the fall and winter months when they graze the aftermath on hayfields. Cows are then usually sent to mountain pastures during the spring and summer months as the farmers and ranchers give their hayfields a chance to grow. One operation in the North TSA is a diversified organic farm. This operation produces organic vegetables, sheep and hay.

OSMP enters into lease agreements with the farmers and ranchers to support and efficiently manage local agricultural operations. The lease system helps match each property with the most appropriate type of agricultural operation. An agricultural lease also spells out how many shares, and from what ditch company, irrigation water can be used.

Agricultural properties may also be inhabited by rare and/or sensitive plant and wildlife species. Leases for properties with rare or sensitive natural resources include restrictions for species protection. Examples in the North TSA include special lease conditions that help preserve rare plants such as Bell's twinpod or the nesting of rare birds such as bobolinks while

Hay photo: Bob Crifasi

Bell's Twinpod, © Bill May

allowing for a successful and productive agricultural operation. Farmers and ranchers that sign lease agreements with OSMP pay the city a fee based on the type of operation described in the lease. Due to the number of special conditions that can be put on an OSMP agricultural lease, lease rates are normally below the market value of private property leases in the area. Since a healthy and functional balance between conservation of the natural and agricultural systems are community goals, maximizing lease revenues or crop production are not the primary objectives for OSMP's agricultural operations.

Because the North TSA is a popular destination for visitors, opportunities for visitor access and recreation fit within a broader set of open space purposes including the conservation of agricultural resources. Agricultural operations may enhance the visitor experience when trails provide access to agricultural settings and offer opportunities for visitors to see, experience and learn about agriculture. This could include seeing livestock in open fields, watching newborn calves, watching the various phases of the hay harvest and simply enjoying the view of historic agricultural structures. Some agricultural functions may be directly aligned with supporting recreation, such as horse boarding facilities, corrals and the outdoor riding arena located at Boulder Valley Ranch.

Visitor activities have the potential for adverse impacts to agricultural operations; however, historically they have been relatively uncommon. The biggest challenges faced by ranchers are dogs off leash chasing or harassing livestock—especially cattle. There have been examples of calf fatalities associated with domestic dog attacks when visitors are unable to maintain control of their dogs. City Council has identified an interest in increasing the amount of locally produced food available in Boulder. OSMP has responded by increasing the number of diversified vegetable farms on OSMP land. Vegetable farming is an example of an agricultural operation that can be sensitive to the impacts of visitors. While visitors

have generally been respectful of farming operations, the potential for impacts and vulnerabilities may need to be considered in the North TSA Plan.

In the North TSA, the conservation of agricultural resources is an important goal. The North TSA Plan will consider opportunities for compatibility between improving recreational experiences and opportunities while also ensuring the sustainability of agricultural resources and operations. The agricultural resource information that follows is intended to provide details about agricultural lands and operations in the North TSA to help inform the development of plan recommendations that are compatible with the conservation of agriculture.

In the North TSA, the conservation of agricultural resources is an important goal.

Significant Agricultural Lands

In 1982 federal land use policy was put into place to protect significant agricultural lands in the United States. Part of the policy was to identify these lands of national significance and disseminate that information through extension agents so that 1) local landowners and policy makers could understand where these lands were located, and 2) they could be protected and kept in agricultural production. The Colorado Departments of Agriculture and Natural Resources followed suit and identified a similar map showing areas that did not meet federal standards,but were deemed important for agricultural production. Boulder County also identified areas of local significance. All three levels of agriculturally significant lands have been adopted as part of the Boulder County Comprehensive Plan's (BCCP) Environmental Resources Element and shown on the BCCP Map of Significant Agricultural Lands.

Cultivation photo: Kristen Weinberger (OSMP)

The categories that appear in the Boulder County Comprehensive Plan are:

- Agricultural Lands of National Importance (also known as Prime or Unique Farmlands);
- Agricultural Lands of Statewide Importance; and
- Agricultural Lands of Local Importance. (See Map A1)

The main criteria to classify significant agricultural lands at the federal level were soil quality, water availability and growing season. The state level classification includes irrigated lands, lands that would have met the federal standard except for adequate water supply, and "high potential" dry croplands. The lands of local importance were developed by Boulder County based upon land use and soil properties and include irrigated croplands, dry croplands and rangeland (Figure A1).

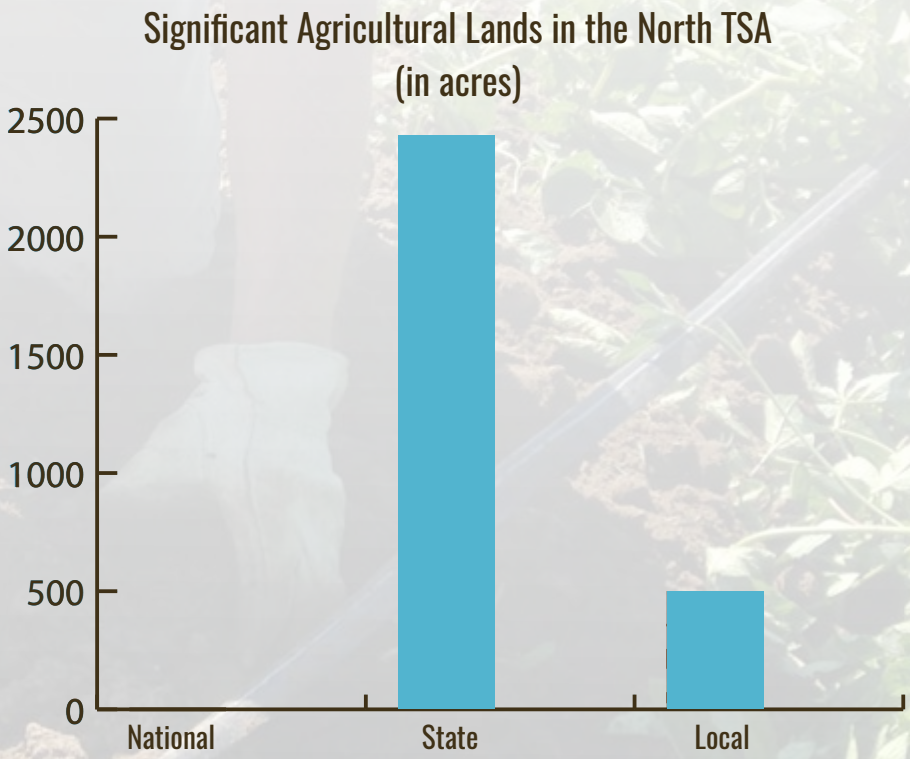


Figure A1. North TSA acres designated as significant agricultural lands

Agricultural Lands of National Importance

Agricultural Lands of National Importance (ALNI) is land that has the best combination of physical, chemical and biological characteristics for producing food, feed, fiber and oilseed crops. The land is available for these uses, even though it may currently be devoted to use as pastureland, rangeland, forestland or as other land (but not urban "built up" land or water areas). Areas designated as ALNI have the soil quality, moisture supply and growing season to economically produce sustained high yields of crops when those lands are treated and managed, including water management, according to acceptable farming methods. These lands are irrigated with an adequate and dependable supply of water. Within the North TSA, there are no farmlands classified as ALNI.

OSMP lands with this designation are more commonly associated with properties located on the east side of the OSMP system.

Agricultural Lands of Statewide Importance

Agricultural Lands of Statewide Importance (ALSI) is land, in addition to ALNI designated lands that is of statewide importance for the production of food, feed, fiber and oilseed crops. Generally, ALSI includes lands that are nearly lands of national importance and that produce high yields of crops when treated and managed according to acceptable farming methods. There are 2,428 acres of land that fall in this category. Most of the irrigated hay fields in the North TSA fall into this category.

Agricultural Lands of Local Importance

Agricultural Lands of Local Importance (ALLI) is the third category of significant agricultural lands used to identify certain additional lands that are important to the local community but do not qualify as of national or state wide importance. Lands with this designation are of key importance to the local agricultural economy. This designation is determined based on criteria devised by the Longmont Office of the Soil Conservation Service

Irrigation photo: © Jack Sasson

and the Boulder County Extension Office based on local knowledge of farms. These are mostly acres that have high soil quality or have good irrigation water, but not both. There are 498 acres of Agricultural Lands of Local Importance within the North TSA.

Grassland Plan Agricultural Best Opportunity Areas

As part of the Grassland Plan, OSMP staff sought to provide special recognition for the most important agricultural lands on city managed open space. The plan, approved by the OSBT and accepted by City Council, identified irrigated lands as the best opportunity for agriculture. Even though variations in soil and water availability create a diversity of conditions in irrigated fields, taken as a whole, irrigated lands are the most agriculturally productive on OSMP.

In addition to their level of productivity, managing irrigated lands for agriculture also lowers OSMP's management costs and protects the value of the city's water rights. Applying irrigation water is time-consuming, difficult work that requires special skills and knowledge. Although staff irrigates some areas, it would be extremely expensive to hire staff to run water on the extensive areas of irrigated land.

Managing irrigated lands for agriculture protects the value of OSMP's water rights by helping to ensure the water will be used. However, water rights can be endangered when they are not exercised. Water rights can also be jeopardized when irrigated fields are managed in a manner that is incompatible with agricultural production and lessees do not irrigate or irrigate fully.

Visitor Master Plan (VMP) Agricultural Management Area Designation

The VMP management area designation framework established the agricultural designation specifically for properties or groups of properties where agricultural operations were the dominant land use consideration. The main criteria in designating an area as an Agricultural Management Area are:

- Areas where active crop production, irrigated hayfields and/or livestock grazing is occurring;
- Areas where conflicts with visitors and their animal companions could or do adversely affect the efficiency of agricultural production and/or endanger the agricultural operations or endanger visitor safety; and
- Compatibility with adjacent land use.

The types of agricultural operations in the North TSA are predominantly cattle grazing and hay production. In the North TSA, there are 1,729 acres of Agricultural Management Areas, which is 23 percent of the total lands with area management designations. (See Map R1).

1,729

OSMP acres in the North TSA designated as Agricultural Management Areas

Goals of Agricultural Management Areas

- Maintain the efficiency of agricultural operations;
- Make sure agricultural operations are being managed to ensure the safety of operators and visitors in the vicinity;
- Provide public access and passive recreation opportunities that have minimal impacts on agricultural operations when appropriate;
- Manage visitor access in areas of intensive agricultural production to ensure visitor safety; and
- Eliminate undesignated trails when they are redundant and/or damaging to agricultural resources.

Cows, photo: Bob Crifasi

Agricultural Operations in the North TSA

OSMP manages agricultural properties by leasing land to local farmers and ranchers. The types of agricultural operations occurring, properties involved, timing, irrigation resources and fence infrastructure necessary are best described by summarizing this information by lease area. Agricultural areas that involve irrigation, and the location of ditches and agricultural water sources are indicated on Map A2. The types of agricultural operations are shown on Map A3. This section provides a brief description of the North TSA agricultural leases and the properties involved. Additional information is available in A-Appendix A.

Axelson-Johnson-Cowles-Dawson (AJCD)

Johnson house, photo: OSMP

The Axelson-Johnson-Cowles-Dawson (AJCD) lease area consists of 210 acres on the Axelson properties (East and West), 250 acres on the Johnson property and 38 acres on the Cowles property for a total of 498 acres. An additional 230 acres on the west side of West Axelson property can be prescriptively grazed as needed but are not included in the lease. The AJCD area is used for grass/alfalfa hay and cattle grazing. Hay is grown on the Axelson and Johnson properties during the growing season (mid-April–October), and cattle then graze the hayfields during the winter (November–March). The Cowles and Dawson properties are currently completely occupied by prairie dogs and offer little forage for cattle. The Cowles property is still used during the cattle grazing time period but mostly as a route to move livestock from the Johnson and East Axelson properties.

Viceroy butterfly on Dawson property, photo: Julie Johnson (OSMP)

All of the 498 acres in the AJCD lease area are irrigable. Due to prairie dog colonization on the Cowles and some of the Johnson property, roughly 60 acres are not currently irrigated. The AJCD lease area is irrigated with water rights from the Left Hand Ditch Company. The two main ditches off of Left Hand Creek that service this area are the Johnson Ditch and the Star Ditch. Each ditch has many earthen laterals that allow the irrigation

water to cover the extent of the properties. The Johnson Ditch serves as the primary source of irrigation water during the growing season to the hay crops. The Star Ditch primarily runs in the off season (November–March) to serve as stock water for the grazing livestock in the fall and winter.

Boulder Valley Ranch (BVR) Complex

The Boulder Valley Ranch agricultural lease area consists of about 1,365 acres on 10 different properties. The properties included in this lease are: Boulder Valley Ranch-103 corp, Boulder Valley Ranch-Lore, Ellison, Schneider, Schneider Family, B.L.I.P II, Boulder Land, Irrigation, and Power, Mesa Reservoir and Ditzel.

Boulder Valley Ranch, photo: OSMP

BVR is currently used for cow/calf production as well as to grow grass hay. The hayfields (190 acres) are located on the BVR property (67 acres), the Lore/Ellison property (93 acres) and the Ditzel property (30 acres). The BVR property also has 92 acres of irrigated pasture. The rest of the 1,083 acres are used for cattle grazing. Cattle are rotated around the complex year-round. From late April through September cattle are rotated through the 1,000 acres of unirrigated grasslands and then spend the fall/winter (October–April) on the three hayfields.

There is also a lease to operate a horse boarding facility at Boulder Valley Ranch for approximately 20 horses. Horses are boarded on pasture or in fenced runs.

Gallagher-Nu-West-Harrington

The Gallagher-Nu-West-Harrington lease area consists of 138 acres on the Gallagher property and 77 acres on the Nu-West-Harrington properties for a total of 215 acres. The area is used as a cow/calf production operation as well as for growing grass hay on the Gallagher property. Cattle are grazed in the lease area in the spring and fall seasons. Cattle graze the Gallagher hayfield in the fall/winter only.

Boulder Valley Ranch, photo: © Jack Sasson

Bennett-Steele

The Bennett-Steele lease area consists of 118 acres on the Bennett property and 56 acres on the Steele property for a total of 174 acres. This area is used for cow/calf production and grass hay production. Cattle graze on both the Bennett and Steele properties during the fall and winter months. The Bennett property is the main calving area for the agricultural tenant.

Campbell-Hester

The Campbell-Hester lease area consists of 56 acres on the Campbell property and 39 acres on the Hester property for a total of 95 acres. This area is used as a cow/calf operation as well as for grass hay production. Cattle graze on both properties starting in the fall and are moved off in mid-winter (January–February) to calve off of OSMP lands. Portions of both properties are irrigated for hay production.

DeLuca-Stratton

The DeLuca-Stratton lease area consists of 60 acres on the DeLuca property and 80 acres on the Stratton property for a total of 140 acres. Both lease areas are used as pasture for a cow/calf operation. Stratton is used as a summer pasture for cattle. Livestock typically begin grazing the property in late May or early June and remain into August. Approximately 20 acres around the three ponds were fenced in 2012 to allow grazing in this area to be managed to promote the conservation values of the ponds and surrounding wetlands. The DeLuca property is grazed in the fall. Cattle are moved off OSMP lands in mid-winter (January–February) when the cows calve elsewhere. DeLuca is also cut for grass hay.

Bruning

The Bruning lease area is 22 acres in size and is used only for hay production.

Seigle

The Seigle lease area is 55 acres in size, and is used for both a cow/calf operation and for grass hay production. Twelve cows graze the property year round and are rotated through three separate fields at different times of the year.

Lousberg

The Lousberg lease is 46 acres in size. The operation on the Lousberg property is a mixed production organic farm. There are 5 acres in the south end of the property that are tilled for organic vegetables. The remaining 41 acres are used for sheep/lamb production and for grass hay. Sheep graze the property year-round. They graze the hayfields and vegetable field aftermath in the fall and winter months and then graze the ditch lateral corridors and a large pasture in the northwest section of the property during the growing season.

Volunteers on Gallagher/Lousberg properties, photo: Kristin Weinberger (OSMP)

Dagle

The Dagle lease area consists of 22 irrigated acres that are used solely for year-round horse pastures. A recent OSMP purchase now includes the house and barns associated with the horse pastures. Horses are rotated through a two pasture system during the growing season to accommodate irrigation on the property. Horses then spend time between pastures and the horse barn during the winter months.

Bison

The Bison property lease area consists of 65 acres and is used as a cow/calf operation as well as for grass hay production. Cattle graze the property during the fall and winter months to remove the aftermath of the previous season's hayfield. Cattle are strategically moved through the 62 acres of hayfields using electrical fencing to concentrate the grazing for short periods of time. The idea behind this style of grazing is to get a uniform use of the grass across the entire hayfield to maximize the yield capacity of the hay the following year. Cattle are moved off the property starting in midwinter (January–February) to calve elsewhere. Three acres house two

large barns and a corral area that is occasionally grazed while cattle are present on the property.

Ryan

The Ryan property lease area consists of 19 acres of dryland pasture that is used for cattle grazing. Cattle are only present on the property from early spring to mid-summer.

Oasis

Oasis, photo: Deryn Wagner (OSMP)

The Oasis property is 71 acres in size. Due to past land shaping efforts and prairie dog occupation, the property is not well-suited for agricultural production. Significant rehabilitation efforts will need to take place to make the Oasis property a viable and productive agricultural property. This property is best suited for haying and grazing.

Berman Brothers

The Berman Brothers property is 40 acres in size. It was purchased by OSMP in 2014. This property had been hayed by the previous owner and is best suited for haying and grazing.

photo: Jeff Holland

Grassbanks

A **grassbank** is a large area of land that is not leased for agricultural operations, is predominantly grassland, and could be made available for cattle grazing during times of need. The main idea behind the establishment of grassbanks on OSMP is to provide current lease holders an opportunity for alternative pastures when drought conditions occur, and there are no other immediate alternative pastures available. The success of a grassbank is typically correlated with its size. The large contiguous blocks of land in the North TSA are more likely to have adequate and abundant grass forage available for cattle grazing should the need arise. Another advantage of large contiguous areas where grazing can occur is that cattle can be evenly distributed over the large area. This practiceh has the potential to maximize the time an area can be grazed with reducing its ecological condition. It also allows greater opportunity for the restoration of pastures not being grazed.

Four properties or property complexes in the North TSA meet the criteria for grassbanks and have the potential to be considered as grassbanks (See Table A1). To be viable as a grassbank, a large area of unleased land is required to include vegetation consisting largely of grass/graminoid plants and either established livestock water sources or sites with a high potential to have water made available.

East Beech

The East Beech property is 650 acres. The property has historically been grazed, so adequate livestock watering facilities (wells) are present on the property. Although these wells have not been used in the last 15 years, minimal effort and cost would be associated with renewing these water sources. The entire boundary of the East Beech property is fenced. The fencing consists of five strand barbed wire fencing as well as 10 strand high tensile fencing. Fencing conditions on the property vary from good to very poor condition. Fencing infrastructure needs would be moderate to high.

Grassland, photo: OSMP

West Beech

The West Beech property is 347 acres. This property has also been historically grazed and has the infrastructure for livestock water. Currently, there is a dugout livestock pond as well as access to several seasonal drainages on the property. Although these facilities may be adequate on a normal precipitation year, a drought year may make these water facilities less available or useful. In order to obtain adequate livestock water on the West Beech property, wells would need to be established to ensure a reliable water supply. Livestock water infrastructure needs would be high on the West Beech property. Only parts of the West Beech property are fenced. Most fencing is five strand barbwire. The current fencing on the property is in poor condition. Fencing infrastructure needs would be significant.

Joder

The Joder property is 351 acres. The property was historically used as a horse ranch and livestock water infrastructure is in place. There are wells located in the old barn/arena area. The current condition of these facilities has not been assessed. Livestock water infrastructure needs would be moderate. The majority of the Joder property boundary is fenced. There is a significant amount of internal fencing on the property as well. This fencing consists of four strand barbed wire fencing as well as four strand smooth wire fencing. The condition of this fencing ranges from fair to poor. Fencing infrastructure needs would be moderate to high.

Joder entrance, photo: Deryn Wagner (OSMP)

West Schneider/Mann/Gilbert/Parsons Complex

The West Schneider complex, consisting of the West Schneider property (238 acres), the Mann property (177 acres), the Gilbert property (33 acres) and the Parsons property (236 acres) is 684 acres in total size. This area has had historical agricultural use—including agriculture use when managed by the city as open space. Most of the bottom lands (West Schneider/Mann/Gilbert) are historic hayfields that could support springtime and/or fall grazing. Livestock water facilities were located around the Schneider homestead as well as from the natural drainages. The wells around the Schneider home are domestic wells, so livestock use would be limited. Livestock water infrastructure needs would be low to moderate. Roughly 60 percent of the West Schneider complex perimeter is fenced. That fencing is five strand barbed wire. The fencing is in poor to very poor shape. Fencing infrastructure needs would be significant.

Table A1. Summary of Potential North TSA Grassbanks

Potential Grassbank	Size (acres)	Property Status
East Beech	650	Historically grazed, water infrastructure present, fully fenced, repairs necessary.
West Beech	347	Historically grazed, water infrastructure but wells needed, only partially fenced and repairs necessary.
Joder	351	Historically grazed, water infrastructure present and needs additional assessment, perimeter and internal fencing with repairs necessary.
West Schneider/ Mann/Gilbert/Parsons Complex	684	Parts historically grazed, water infrastructure present, partially fenced with significant repairs necessary.

Agriculture and Bobolinks

Bobolink, photo: © Michael Morton

Bobolinks are ground-nesting songbirds which nest primarily in wet meadows in the Boulder Valley (Thompson and Strauch 1987). They are protected under the Migratory Bird Treaty Act and are considered "vulnerable to extirpation" ("S3B") by CNHP and are a species of special concern by the BCCP. Bobolink populations in the western United States are unique in that they are separated from the main breeding range of bobolinks further to the east (Hamilton 1962).

Bobolinks originally nested in tallgrass or mixedgrass prairie of the mid-western United States and south-central Canada (Bent 1958), but because of land conversion, have now increased their use of irrigated hayfields throughout their range (Martin and Gavin 1995). The use of this habitat creates a potential management challenge as irrigated hayfields may be managed to produce several harvests (i.e., cuttings) each season. The bobolink is of particular interest because of its extreme population decline during the past 30 years, and its affinity to breed late in the summer when hay cutting typically occurs (Martin and Gavin 1995). Bollinger et al. (1990) documented a 90-100 percent failure rate of bobolink nests because of hayfield cutting. On OSMP hayfields, Roeder (1998) documented no breeding bobolink mortality at 4 nests, and attributed this to the fact that hay harvesting did not occur until after the young had fledged and parental activity ceased.

OSMP seeks to maintain traditional agricultural land use (haying, grazing) while preserving and maintaining natural systems and native species. As part of the Grassland Plan, the highest density breeding areas were designated as "Class A Bobolink Management Areas" where hay cutting is delayed until after July 15, and "Class B Bobolink Management Areas" where hay cutting is delayed until after July 15 in at least one out of every three years.

Agricultural Resources

Within the North TSA, staff and volunteers monitor 43 hayfields which support one-third of the total bobolink populations detected across OSMP. The DeLuca property within the North TSA supports the highest densities of bobolinks anywhere on the system. Hester, Campbell and Lore/Ellison also support very high densities. Additional information on monitoring is available in N-Appendix A in the Natural Resources Inventory.

Bobolink, photo: © Michael Morton

Photo credit: Deryn Wagner (OSMP)

Post-acquisition Property Planning & Property Ownership

Post-acquisition Property Planning

Planning Framework for Property Acquisitions

The Visitor Master Plan (VMP) states that OSMP will develop management plans for newly acquired properties before opening them to the public. New property assessments and management plans typically make recommendations and may:

- Summarize the physical/ecological characteristics and conditions of the property;
- Document and record existing conditions and open space values;
- Identify and prioritize management needs and opportunities;
- Prescribe management actions;
- Classify the property into a management area if not already completed as part of the acquisition process; and
- Recommend opening or closing the property to the public for the short- or long-term.

In 2013, City Council adopted the Open Space and Mountain Parks Acquisition Update 2013-2019, which described a framework for integrating new properties into the OSMP system. Accordingly, OSMP now prepares rapid resource assessments and recommendations for short-term management before determining public access to new properties. For longer-term, broader management direction, OSMP integrates new properties into broader planning processes such as the North TSA Plan. OSMP has been successful looking at community service delivery and resource conservation at broad scales (VMP, Grassland Plan and FEMP), rather than relying on property-specific plans. This approach is consistent with the policy direction contained in the department's Long Range Management Policies, which recommend OSMP uses an "ecosystem approach." This approach has helped OSMP balance competing community interests while making effective and efficient use of staff time, available information and contributions from other agencies and members of the community.

Post-acquisition Property Planning Process

Recent Acquisitions Currently Closed to Public Access Year-round

According to Section 8-8-6 of the Boulder Revised Code, all new acquisitions shall become available for public use only after OSMP has assessed the property and designated public access where appropriate. The department's Long Range Management Policies also permit temporary or permanent area closures when evidence of disturbance exists or when an activity is likely to cause damage to open space lands or their ecological viability. On a temporary, seasonal or year-round basis, the Boulder Valley Comprehensive Plan 3.08 (Public Access to Public Lands) also recommends public land managers close lands in order to protect areas from unacceptable degradation or impacts to agriculture, habitat or wildlife, as well as for public safety or to place limits on access necessary to preserve the quality of the visitor experience.

For properties acquired before 2008, consultants to OSMP incorporated this guidance into individual management plans they prepared using the property-specific planning process laid out in the VMP. On Sept. 10, 2008, the Open Space Board of Trustees (OSBT) approved the recommendations contained in these plans, including proposed management area designations and property closures. In their discussions, board members and public testimony clarified that these decisions could be revisited in forthcoming trail study area plans. Specifically, OSBT recommended that staff keep remote and isolated properties in the northern part of the system closed, with the option to open them up in a future planning process when there might be more contiguous OSMP land in the area. Concerns about potential resource impacts from dispersed, unmanaged visitor access informed this decision, as well as the lack of existing visitor infrastructure to manage access, such as trails, fencing or parking lots. These properties can be found on the year-round public closures map (Map G2). In addition, OSBT clarified that the management area designations assigned

to these properties could be reviewed during the future TSA process. All management area designations can be found on Map R1.

To satisfy this direction, up-to-date descriptions of the following 10 properties, acquired before 2008 and in the North TSA, are listed in P-Appendix A in order to facilitate any potential changes in management or public access as part of the North TSA planning process. Recent planning and data collection for these properties have been incorporated into each summary, such as information from the Grassland Plan, vegetation and wildlife monitoring and agricultural operations. Acreage for these properties totals 683 acres:

1. Abbott
2. Andrea
3. Jacob
4. Ryan
5. Bennett
6. Steele
7. Bison
8. Dodd
9. Oasis
10. Waldorf

Abbott property, photo: Deryn Wagner (OSMP)

Ryan property, photo: Deryn Wagner (OSMP)

Properties in the North TSA without Management Area Designations

Overview

There are 10 additional properties or 619 acres in the North TSA for which management area designations and public access requirements need to be reviewed or finalized (See Map R1). Property-specific plans have not been developed or approved by the OSBT prior to the North TSA planning process. Therefore, analysis and decision-making for these properties has been incorporated into the North TSA planning process.

Lappin property, photo: Deryn Wagner (OSMP)

Joder property, photo: Deryn Wagner (OSMP)

The following four properties were acquired since 2008, when the last group of individual plans for new properties was brought to the OSBT for approval and need management area designations:

1. **Berman Brothers** — acquired in 2014;
2. **Lappin** — acquired in 2010;
3. **Stratton** — acquired in 2007, but management planning was not completed in time for the 2008 submission to OSBT; and
4. **Dagle II** — acquired over a period of ten years, 2004 – 2014.

In addition, the Joder property (acquired in 2013) and the Cox property (acquired in 2014) were approved for designation as HCAs by the OSBT and Boulder City Council during the acquisition of the properties. With the subsequent timing of the North TSA planning process, the OSBT requested that the plan include a review of this designation.

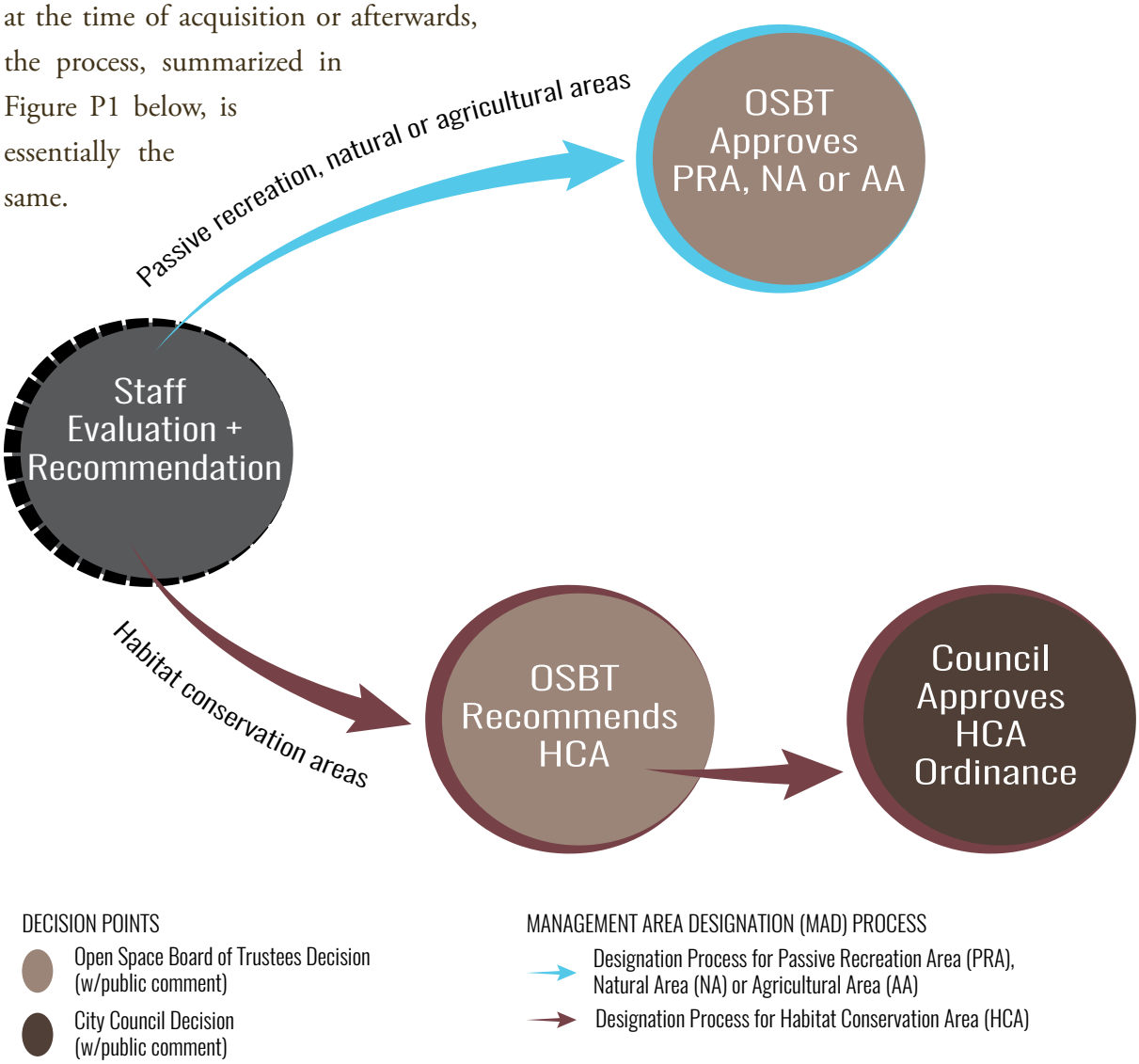
Until the North TSA plan is approved, these six properties will remain closed to the public. These properties can be found on the public closures map (Map G2). An exception to this requirement is the interim trail through the Joder property which is under construction.

The remaining four properties – Dakota Ridge Village, Hart-Jones Exchange, IBM Open Space Easement and Palo Park Trail – were not designated within the 2005 Visitor Master Plan process, during which management area designations were first defined and assigned. These properties are open to the public and do not require property-specific planning.

Current conditions related to factors helpful in assessing management recommendations are summarized in P-Appendix B to inform decision-making about management, area designations and public access for these properties. More detailed information about recreational, natural, cultural or agricultural resources on these properties can also be found in other sections of the inventory report.

Process for Finalizing Management Area Designations within the North TSA Plan

The standard work flow for designating management areas on newly acquired properties was approved by the OSBT in September 2013. Generally, that process involves staff making recommendations to the OSBT and if necessary, City Council, regarding the appropriate designation for properties either at the time of acquisition or, if necessary, after a period of planning. The work flow varies depending on whether staff is recommending an HCA designation, in which case City Council makes final approval. Whether recommendations from staff come at the time of acquisition or afterwards, the process, summarized in Figure P1 below, is essentially the same.



When making management area recommendations for new properties, staff considers many of the same factors described in the VMP for initial management area development, including:

- Condition of infrastructure
- Trail density
- Levels of visitation
- Regional trails and trail linkage opportunities
- Diversity of recreational opportunity
- Habitat blocks size
- Rare or unique plant communities
- Habitat for threatened, endangered or rare species
- Nature and concentration of biological diversity
- Nature and intensity of nearby development
- Crop production/irrigated hay fields/grazing areas
- Agricultural efficiency/visitor safety conflicts
- Opportunities for coordinating recreational access/trail linkages with habitat or agricultural conservation

Staff also considers the setting of the new property and the adjacent management area designations. When neighboring properties have similar natural resources, historical land uses or management opportunities, staff tends to recommend the same designation for the new acquisition. This approach fosters integrated and contiguous management of areas.

North TSA Property Ownership, Easements and Legal Agreements

Information on North TSA Easements and Legal Agreements

The North TSA basemap (Map G1) shows both OSMP fee-owned and OSMP-managed properties in the North TSA planning area. Properties where OSMP and Boulder County have a shared undivided fee interest are included in the North TSA if OSMP is the property manager. See the next section for more information regarding these jointly owned properties. If OSMP is not the manager, the property is not included in the North TSA or this inventory report.

The North TSA includes other properties where OSMP is identified as the land manager. The Mesa Reservoir property is owned by the State of Colorado and the city has an easement establishing the city's management of natural resources and visitor access. Additionally, OSMP manages visitor access and resources on portions of the IBM property in accordance with an open space easement.

OSMP has conservation easements or other types of easements on 1,233 acres of properties within the North TSA. The easements typically are in place to preclude most or all new development and require protection of the natural or agricultural values on the property. These property easements do not allow public access. Therefore, the management of these properties is not part of the North TSA Plan.

1,233

acres under OSMP conservation easements in the North TSA

When OSMP acquires lands, they may include pre-existing easements, legal access agreements or other right-of-ways that encumber the property and may affect or constrain visitor access or the placement of trails, trailheads or other visitor infrastructure. Details about how properties are acquired and acquisition priorities can be found in the Open Space and Mountain Parks Acquisition Update 2013-2019. Several North TSA

properties had already been encumbered by a conservation easement held by Boulder County prior to acquisition by the city. Easements and other legal agreements may affect plan recommendations. A summary of properties with easements, access agreements and other legal access considerations is included in P-Appendix C.

City of Boulder and Boulder County Jointly Owned Open Space

2,171

acres in the North TSA jointly-owned by City of Boulder OSMP and Boulder County

In 2005 the City of Boulder and Boulder County entered into an intergovernmental agreement (IGA) to clarify each agency's management responsibilities for jointly owned open space properties. The IGA identifies a lead agency for each of the jointly owned properties. The lead agency is responsible for the management of the property and that agency's rules, regulations, policies and plans apply to the management of the property. In the North TSA planning area, Boulder County is the lead agency on the Imel (576 acres), Suitts (142 acres) and IBM-Monarch (186 acres) properties. The city is the lead agency for the Beech, Beech Aircraft and Foothill Business Park properties—which lie adjacent to each other and form a 1,267 acre complex typically referred to as the Beech Property.

As part of the agreement each agency commits to provide the other an opportunity to participate in the development of the management plan for the property. A property management plan for the Beech property was finalized in 2013 after being reviewed by Boulder County and the OSBT. Because the North TSA Plan could result in management changes to the jointly-owned Beech property, Boulder County Parks and Open Space staff is participating in the plan's development and review.

Property Planning & Ownership

Joder Reservoir, photo: Deryn Wagner (OSMP)

Photo credit: Phillip Yates (OSMP)

Community Assessment

Background and Purpose

OSBT member Kevin Bracy Knight welcomes workshop attendees, photo: Phillip Yates (OSMP)

OSMP is committed to giving the community a strong voice in each stage of the development of the North TSA plan. This Community Assessment is a compilation of the perspectives and feedback provided during the first phase of the North TSA planning process. During this phase, members of the public were invited to participate in the discussion about the current conditions and management actions in the North TSA in four ways:

1. Community workshops
2. Inspire Boulder, the city's internet-based participatory platform
3. On-site and local store-front engagement with OSMP staff
4. Email and social media submission to OSMP staff

Each type of participation is described in greater detail below. The vast majority of comments emerged during community workshops, though there was good participation in the online, on site, and email/social media submissions as well. Each engagement avenue provided an opportunity for the community to reflect on the recreational, natural, cultural and agricultural resources within the North TSA, and share their views about the current conditions in the North TSA, areas of concern and areas of importance. Many participants also provided their views about what

they would like to see in the North TSA in the future. These additional comments are included in this Community Assessment Report, but are listed separately as they will be addressed more directly in the second phase of the North TSA planning process when discussing interests and future management, and in the third phase that is focused on developing management options and scenarios for the future.

Common Themes Across All Input Avenues: Current Conditions

Whether people participated in the assessment discussion in a community workshop, online or in a discussion with OSMP staff, several common themes emerged. Regarding recreation, many people reported appreciating the current opportunities for quiet and solitude in the North TSA, noting that the area does not get the high volume of visitors that some other OSMP areas experience. People also appreciate the access to key recreational opportunities that exist in the North TSA. This includes access to specific sites like Boulder Valley Ranch and Wonderland Lake, as well as access for multiple types of recreational activities, such as hiking, mountain biking, dog walking, bird watching, nature appreciation, horseback riding, fishing and hang gliding /paragliding. However, participants repeatedly commented on a desire for more trails, with a greater variety and length also commonly cited as something they would like to see. In addition, there was frequent mention of the lack of regional trail connections to areas north, west and east from the North TSA. Additionally, there was consistent concern raised over current trail conditions, with many believing that they could be improved throughout the TSA. Some viewed the current trail conditions as a factor contributing to visitor conflicts by forcing different types of activities to share narrow trails.

In terms of natural resources, common themes centered around the importance of the wildlife habitats, native species and natural features that occur in the North TSA. There was particular attention paid to the prairie

243 people

reached through workshops, youth engagement and outreach at trailheads and coffee shops

105 comments

received through emails and Inspire Boulder (approximate)

Photo: Phillip Yates (OSMP)

Photo: Phillip Yates (OSMP)

ecosystem, the raptor populations, geological formations and the water resources. Many people expressed concern about current and potential future impacts to these resources from recreational access. Some people suggested that Habitat Conservation Areas (HCAs) and Natural Areas (NAs) as effective tools for management, while others questioned whether they have unnecessary and/or negative impacts on recreation. A need for balance in managing for natural resources and providing recreation opportunities was frequently stated. Some people also suggested that natural resource protection could be inhibited by the current lack of information about what species or habitats are being protected, why they are important, and how management prescriptions help maintain those resources. It was suggested that additional signage about these issues could improve adherence to natural resource rules and regulations, and thereby improve resource protection without changing existing access or management prescriptions.

Regarding cultural and agricultural resources, participants identified many highly valued sites, including Boulder Valley Ranch, the Joder property, the Old Cobalt Mill, and the Old Kiln. In general, people would like to see the historic structures in the North TSA preserved and maintained for the future. Some participants questioned whether all of the existing fences and gates are truly necessary and noted how they negatively impact some recreational activities. Additionally, many lamented the lack of interpretative information about these resources, suggesting that visitors to the area are missing opportunities to learn more about Boulder's natural and cultural history, including its important agricultural roots. Some people also raised concerns about whether the agricultural resources in the North TSA are being appropriately managed in the public interest and whether additional recreational access to these areas should be permitted.

Community comments varied greatly depending on the manner in which they were collected. Different engagement avenues drew out different North TSA visitors and stakeholders. The community workshops had the most diverse feedback and represented a wide range of North TSA visitors

and stakeholders. Many of the Inspire Boulder comments focused around mountain bike access and desires, with some focus on natural resources as well. Email and website comments often mentioned the need to equally weigh the needs of all recreation groups, especially of those that are not as vocal as others.

A majority of the comments throughout the process focused on recreation, especially trail connections and the logistics of where potential new trails could be constructed. This is especially true in the discussions that took place within Inspire Boulder. The online platform allows people to comment on others' ideas, and there were lengthy discussions about the need for more trails and connections in the region. Equestrian, mountain bike, and hiking access and whether and how these activities lead to visitor conflicts are topics of concern that were mentioned in all four types of public engagement.

Many participants were concerned about finding a balance between access to recreational opportunities and the protection of natural resources. Some wanted more recreational access while protecting the most sensitive resources, while others wanted the protection of natural resources to dictate the type and amount of recreation in a given area. Education about natural resources was often mentioned as a necessary way for OSMP to inform the public about safety hazards, management decisions and recreational activity etiquette.

Photo: Phillip Yates (OSMP)

Community Workshops: Overview

Two community workshops were held that detailed the North TSA process and allowed community members to give their feedback. Community members were asked the following questions:

Recreation

- What types of recreation are important in the North TSA?
- Regarding recreation opportunities in the North TSA, what would you like to see remain the same and why?
- Where have you seen recreation opportunities managed well within the North TSA?
- Where are areas within the North TSA that you would like to see improvements made to the management of recreation opportunities and why?

Natural Resources

- What natural resources are important in the North TSA?
- What is currently working well with the protection and management of natural resources within the North TSA and what would you like to see improved?
- Please give an example of location(s) in the North TSA where you have observed good management practices with the protection of natural resources being balanced well with the protection of other resources and access to recreation opportunities.
- Where are location(s) within the North TSA that you would like to see the management of natural resources improved and why?
- What opportunities are there to foster a greater connection between people and natural resources in the North TSA?
- What natural resources would you like to have more information about?
- What agricultural resources are important in the North TSA?

Agricultural Resources

- In relation to agricultural resources, what existing management practices would you like to see remain the same in the North TSA and why?
- What existing management practices of agricultural resources would you like to see improved or changed in the North TSA and why?
- What agricultural resources would you like to have more information about?

Cultural Resources

- What cultural or historical resources, sites or uses are important in the North TSA?
- What is currently working well with the protection and management of cultural resources within the North TSA, and what would you like to see improved?
- What opportunities are there to foster a greater connection between people, and cultural and historical resources in the North TSA?
- What cultural or historical resources would you like to have more information about?

Community Workshop Key Themes: Current Conditions

Recreation

Valued trails and sites for recreational access:

- Boulder Valley Ranch
- Wonderland Lake
- The Joder property
- Foothills Trail
- Eagle Trail
- Boulder Reservoir (Managed by Boulder Parks and Recreation)
- Old Kiln Trail
- Mesa Trail
- Lefthand Valley
- Social trails
- Rock formations

Valued types of recreational access:

- Hiking and walking
- Mountain biking
- Horseback riding
- Dog walking
- Bird and nature watching
- Fishing
- Hang/paragliding
- Access to natural resources
- Night access for stargazing

Valued characteristics noted for recreation:

- Undeveloped, natural area
- Quiet and solitude
- Relatively flat landscape for equestrian access

General concerns or shortcomings noted regarding recreation:

- Degraded trail conditions
- Insufficient trail numbers, miles, variety of types
- Lack of regional trail connections
- Visitor conflicts (possibly facilitated by current trail design)
- Lack of sufficient signage (to explain rules and regulations, to encourage good visitor behavior, to interpret natural resources)
- Insufficient fishing access
- Insufficient equestrian access

Valued natural resources:

- Fossils
- Shale plant communities
- Landscape
- Water sources
- Geological features
- Prairie ecosystems
- Vegetation
- Osprey
- Prairie dogs
- Raptors
- Large predators
- Eagles
- Rabbits
- Coyotes
- Pronghorn
- Native vegetation along trail corridors
- Unique landscapes

General concerns or shortcomings noted regarding natural resources:

- Current and potential impacts to natural resources from recreational use, particularly in HCAs
- Uncertainty about the impacts and benefits of HCAs
- Lack of sufficient signage that educates visitors about wildlife, vegetation, natural features and management practices (including natural and prescribed fire)

Agricultural and Cultural Resources

Valued agricultural and cultural resources: • Boulder Reservoir (Managed by Boulder Parks and Recreation) • Mesa Reservoir • Agricultural operations and structures • Cattle • Boulder Valley Ranch • Old farms between 75th and St. Vrain • Ditches and irrigation	Valued agricultural and cultural structures: • Old Cobalt Mine • Old Kiln • Joder Ranch • Boulder Valley Ranch • Lappin Cabin • Old town sites
General concerns or shortcomings noted regarding agricultural and cultural resources: • Lack of explanation of agricultural and cultural resources • Concerns about how agricultural practices on OSMP land affect visitor experience and recreational opportunities • Unnecessary fencing and closed gates	

Specific Comments on Current Conditions

» Front Range is prone to landslides (e.g., Wonderland Lake, Lee Hill).
» Eagle Trail around reservoir is alluvial and holds up well to erosion.
» North of Sage Trail and west of North Rim are not getting enough water due to improper diversions.
» Inactive cattle shipping area in Boulder Valley Ranch is not needed.
» Trailheads lack amenities (e.g., bike racks, benches, restrooms).
» Humans negatively impact the raptor habitat on the hogbacks.
» Current weed management program is working.
» Weeds are pervasive, especially east of Boulder Valley Ranch on mesa tops.
» Parking is an issue, especially for horse trails and off Longhorn Road.
» Boulder Valley Ranch trails east of Highway 36 are dull and uninteresting.
» Lefthand Valley is uninteresting.

Inspire Boulder: Overview

Inspire Boulder is a digital town hall and community engagement platform that OSMP uses to explain the North TSA planning process and gather additional feedback. The online experience was designed to replicate the in-person experience at the community workshops as much as possible; it was available for community participation and input for 19 days. Visitors to the website were encouraged to consider the recreational, natural, cultural and agricultural resources in the North TSA while answering the following questions:

» What about the North TSA do you value/enjoy and why?

» What could be improved and why? Please be specific (e.g., location).

Inspire Boulder Key Themes: Current Conditions

Recreation

Valued recreational resources:

- Trails
- Multi-use access
- Social trails (undesignated)
- Mountain bike access
- 24-hour access
- Equestrian access

General concerns or shortcomings noted regarding recreational resources:

- Lack of loop trails
- Lack of regional trail connections
- Lack of interesting trail design for mountain bikers
- Visitor conflicts (could be managed better through trail design or management prescription)
- Insufficient information about voice-and-sight control for dogs, as well as insufficient dog waste disposal opportunities and insufficient enforcement for dog guardians not following regulations
- Trail crossings and gates that impact access and mitigate conflict

Natural Resources

Valued natural resources:

- Native habitats
- Unfragmented areas
- Geological features

General concerns or shortcomings noted regarding natural resources:

- Concerns about protecting natural resources while providing recreation opportunities
- Need for more water flowing in North TSA creeks

Agricultural and Cultural Resources

General concerns or shortcomings noted regarding agricultural and cultural resources:

- Insufficient information available about cultural and agricultural resources
- Cattle overgrazing

Specific Comments on Current Conditions

» Sight lines at Wonderland Hill entrance need to be improved.

» Pella Crossing should be restored. (Managed by Boulder County Parks and Open Space)

On-Site and Local Store-Front And Youth Engagement: Overview

Over a two week period, OSMP staff went into the community to collect information from public participants at trail heads and local coffee shops. They made contact with 167 people and prompted discussion with the following questions:

» What about the North TSA do you value or enjoy and why?

» What could be improved and why?

As part of OSMP's effort to broaden participation in the North TSA, staff reached out to the city's Youth Opportunities Advisory Board (YOAB), comprised of 16 diverse high-school students who advise municipal government on youth-related policies and issues. Staff presented the basic purpose and process for the North TSA and sought feedback on effective ways to involve youth. The same discussion questions outlined above provided the foundation for the discussion with the YOAB.

On-Site and Local Store-Front And Youth Engagement Key Themes: Current Conditions

Recreation

Valued recreational resources:

- Dog access (on and off leash)
- Mountain bike access

General concerns or shortcomings noted regarding recreational resources:

- There are insufficient bathroom facilities at trailheads.
- There are not enough connections between existing trails.
- Current levels of voice-and-sight regulation are adequate and should be retained.
- Dog guardians are responsible within the North TSA.
- OSMP management of North TSA is working and meeting visitor needs.
- The current experience in the North TSA is satisfactory.

Specific Comments on Current Conditions

» The Hogback Trail steps need to be improved.

» The road to Boulder Valley Ranch needs to be improved.

Photo: Phillip Yates (OSMP)

Email And Social Media Comments: Overview

All of the communication with the public encouraged participants to submit comments via the North TSA website and email account. Below are key themes from these comments.

Email And Social Media Comments: Current Conditions

Recreation

Valued recreational resources:

- Existing trail access
- Existing recreation access and balance of activities
- Off-leash areas for dogs
- Mountain biking access
- Equestrian access
- Family-friendly access
- Equal access for all visitors

General concerns or shortcomings noted regarding recreation resources:

- Visitor conflicts (particularly between mountain bikers and hikers and equestrian visitors)
- Need for more trails, trail connections and recreation opportunities
- Concern about more new trails and recreation opportunities
- Need for more education and enforcement of rules and restrictions for all visitors
- Need to maintain equal access for all visitors
- Need to manage current trail maintenance essentials before constructing more trails
- Need for new family-friendly recreation opportunities
- Need for enhanced safety measures for all visitors

Natural Resources

Valued natural resources:	General concerns or shortcomings noted regarding natural resources:
• Water quality • Wildlife habitats	• Need for balance between natural habitat preservation and recreational access • Need to base conservation needs on quantitative data • Need to align management practices with public interests

Agricultural and Cultural Resources

Valued cultural and agricultural resources:

- Agricultural land that can be preserved as refugia for native species
- Boulder Valley Ranch as a buffer between development and recreational access

Specific Comments on Current Conditions

» Trail erosion at Boulder Valley Ranch is a problem.

» Northwest gate at Boulder Valley Ranch is continuously breaking.

» Longhorn Road needs to be graded.

» Repairs to trails accessing Foothills dog parks are necessary. (Managed by Boulder Parks and Recreation)

Proposed Future Management Actions

The tables below capture the suggestions for future management actions that emerged from the four types of public engagement outlined above. Because these comments relate directly to the management prescriptions or the provision of new amenities, they will be carried forward into the staff and community discussions during the second and third phase of the North TSA planning process focused on discussing interests, and developing management options and scenarios for the future.

Community Workshop Key Themes: Future Management Actions

Recreation

Maintain access to key recreation opportunities:

- Boulder Valley Ranch
- Wonderland Lake
- The Joder property
- Foothills Trail
- Eagle Trail
- Boulder Reservoir (Managed by Boulder Parks and Recreation)
- Old Kiln Trail
- Mesa Trail
- Lefthand Valley Trail
- Social trails

Maintain multi-use recreational access:

- Hiking and walking
- Mountain biking
- Horseback riding
- Dog walking
- Bird and nature watching
- Fishing
- Hang/paragliding

- Maintain current access levels to natural resources.
- Maintain and improve current trail conditions.
- Maintain and increase current levels of access.
- Improve gates and trail access points.
- Coordinate with other agencies to create more recreational opportunities.
- Increase recreation without altering the quiet nature of North TSA.
- Evaluate social trails for official designation.
- Create regional trail connections, especially from Boulder to Lyons.
- Create as much non-road access to OSMP properties and features as possible.
- Explain management decisions to encourage visitors to follow rules.
- Utilize trail design and regulation to mitigate visitor conflict and overcrowding.
- Educate visitors about visitor conflict etiquette and how to report incidents.
- Consider natural resources when creating new trails.
- Allow 24-hour access to North TSA trails.
- Create new trails for a variety of visitors with different purposes.
- Maintain and expand recreational access for all types of visitors.
- Address parking issues at trailheads.
- Utilize geology when designing new trails.
- Design trails that are interesting and sustainable.
- Designate trails for only certain activities, or certain activities on specific days.
- Educate visitors about multi-use trails and the related rules and regulations.
- Impose access restrictions equally across all visitor/activity groups.
- Enforce restrictions equally across all visitor/activity groups.
- Consider greater access for horses, dogs and mountain bikers.
- Utilize signage only when necessary.
- Explore solutions to discourage overcrowding and concentrated activities.
- Balance recreational activities to allow natural resources to thrive.

Recreation, continued

- Retain quiet environment of North TSA.
- Acquire more land to create more access.
- Document social trails and other agencies' properties on maps at trailheads.
- Increase fishing access.
- Utilize flat landscape for horse access.

Inspire Boulder Key Themes: Future Management Actions

Recreation

- Design trails to meet visitor needs, with a strong emphasis on loop trails.
- Grow access to resources within North TSA.
- Increase voice-and-sight signage, waste disposal and enforcement for dog guardians.
- Maintain and improve current trails.
- Create a direct, exciting, multi-use trail connecting Boulder and Lyons to alleviate traffic and access more terrain.
- Improve trail crossings and gates to increase access and mitigate conflict.
- Vastly expand trail connections and utilize existing social trails.
- Focus on maintaining multi-use access to the trail system.
- Increase mountain bike-specific access as they represent much of the activity.
- Develop advanced features for mountain bikers.
- Model the trail system after South Boulder.
- Alleviate parking issues with more trail connections and broad visitor access.
- Maintain 24-hour access to North TSA trails.
- Consider visitor-dedicated trails or day closures to alleviate conflicts.
- Allow more recreation areas for equestrian usage.

Natural Resources

- Allow natural resources to thrive while maximizing recreation.
- Protect and maintain natural resources, especially from recreation impacts.
- Purchase more water rights to increase flow and make area more appealing.
- Maintain native habitats, unfragmented areas and geological features.

Agricultural and Cultural Resources

- Provide more information about cultural and agricultural resources.
- Manage against cattle overgrazing.

On-Site And Local Store-Front And Youth Engagement Key Themes: Future Management Actions

Recreation

- Construct more bathroom facilities at any and all trails heads.
- Expand dog-friendly access to the entire North TSA trail system.
- Maintain the current levels of voice-and-sight regulations.
- Maintain and increase current access levels for dogs, both on- and off-leash.
- Create more trail connections between existing trails.
- Expand trail offerings for all visitors.
- Consider designated trails for mountain bikers.
- Allow more mountain bike racing in North TSA for school teams and organizations.
- Dog guardians are responsible within the North TSA.

Additional Comments

- OSMP management of North TSA is working and meeting visitor needs.
- Communicate with youth through targeted social media usage.
- Engage additional stakeholders, such as youth organizations that use North TSA.
- Reach out to the Wildland Restoration Volunteers for more information.

Email and Social Media Comments: Future Management Actions

Recreation

- Segregate mountain bikers from hikers and equestrian visitors.
- Create more trail connections.
- Collaborate with all visitors equally to find the best use for recreational resources.
- Improve and maintain existing trails and conditions for all visitor types.
- Do not develop new recreation opportunities.
- Develop additional recreation opportunities.
- Maintain and expand off-leash areas for dogs without future restrictions.
- Address the needs and concerns of all visitors equally.
- Expand mountain biking opportunities and trail access.
- Open more parking for equestrian visitors.
- Increase rule and restriction education and enforcement for all visitors.
- Allow equal access for all visitors if restrictions are enacted in the future.
- Equally weigh recreation needs with ecological protection.
- Manage current trail maintenance needs before constructing more trails.
- Develop family-friendly recreation opportunities.
- Enhance safety measures for all visitors.

Natural Resources

- Equally weigh impacts of animals (both cattle and dogs) on water quality.
- Balance natural habitat preservation with recreational access.
- Use quantitative data to address conservation needs.
- Align management practices with public interests.

» Find agricultural land that must be preserved as refugia for native species.

» Maintain Boulder Valley Ranch as a buffer between development and recreational access.

OSBT member Molly Davis speaks with community member, photo: Phillip Yates (OSMP)

Photo: Phillip Yates (OSMP)

Community Assessment

Photo: Phillip Yates (OSMP)

Photo: Phillip Yates (OSMP)

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