Sunrise over the Absaroka Mountains from Strickland Creek. Photo credit: Livingston NRCS, 04 March 2022.

"Change on the Range:" Trail Creek Watershed Climate Resiliency Project

Targeted Implementation Plan for Montana Focused Conservation
FY24 – FY26

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OVERVIEW AND BACKGROUND

Walker et. al (2002) define ecological **resilience** as the capacity of a system to tolerate change while maintaining some level of functionality and provision of ecological goods and services; whereas Agard and Schipper (2014) define ecological **vulnerability** as the susceptibility of a system to harm under changing conditions due to an inability to respond to change (as cited by Maczko et al., 2019). The foremost purpose of this Targeted Implementation Plan (TIP) is to increase the resiliency of grazing lands vulnerable to changing local climate patterns in Park County. These areas include forest lands as well as rangelands under threat of conversion from increasing conifer range and density. Addressing climate resiliency on important grazing lands will also assist ongoing efforts in creating defensible space for areas of exurban sprawl and wildland-urban interface.

These lands of socioeconomic importance are situated in a unique setting that encompasses various ecotones, or areas of ecological transition between plant community types. Ecotones of particular concern are buffers between Lodgepole Pine (*Pinus contorta*) forest and upland sagebrush steppes with refuges for Douglas-fir (*Pseudotsuga menziesii*) and Rocky Mountain juniper (*Juniperus scopulorum*). Altered seasonal precipitation patterns and increased mean daily temperatures, combined with fire suppression as a predominant land management practice in the West over the last century, have compounding detrimental effects on the composition of grass-shrubland plant communities. The loss or degradation of these ecosystems' structural integrity is accompanied by a significant loss in ecosystem goods and services including available water, animal feed and forage, terrestrial wildlife habitat, atmospheric carbon sequestration, and natural protections against large-scale wildfire outbreaks.

PROBLEM STATEMENT

In comparison to heterogeneous plant communities, homogenized plant communities have a reduced capacity to respond to both short- and long-term changes in local climate. If seasonal climate patterns trend toward unfavorable conditions for one species in a diverse ecosystem, another species more suited to the current conditions can often temporarily fill the same role in its absence. The capacity to respond to change, afforded by species diversity, ensures that some level of ecosystem function is maintained even in cycles of abnormal seasonal conditions. This is no longer the case when one species begins to dominate the plant community, as often occurs when conifers encroach into historically grass- and shrub-dominated systems. An increase in range and density of conifers leads to a decrease in available resources for native grasses and shrubs, shifting the plant community to a conifer-dominated, or homogenized, system. Unfavorable conditions in a homogenized plant community effectively result in failure of normal ecosystem functions and inhibited plant recovery, decreasing herbaceous biomass production. Agricultural producers grazing in areas affected by conifer encroachment, then, are potentially

left dealing with the ramifications of an exceptionally unfavorable forage production year long after conditions return to normal.

GOALS AND OBJECTIVES

The ecosystem goods and services previously discussed in the **overview and background** are listed in The Park County Long Range Plan (LRP) as priority resource concerns defined by the Livingston Natural Resources Conservation Service (NRCS) field office. Actions for consideration are also described in the LRP (pg. 7-9, 31, 34, 38).

Actions selected for this TIP will achieve desirable outcomes as defined by local work groups. NRCS-facilitated meetings with the Upper Yellowstone Watershed Group (UYWG) and its Working Lands Committee (WLC) have identified conifer encroachment, forest overstocking, and associated fire risk as the highest priority resource concerns for private landowners in the focus area. Local work group members requested assistance in managing grazing lands impacted by increased range and density of conifers to compensate for reduced forage production. Data collected by NRCS in 2022 to validate these concerns and describe benchmark conditions include transects documenting conifer stem density (stems/ac) or canopy cover (ocular % estimate); tree spacing; mean diameter at breast-height (DBH); mean age (Figure 1); forage production (lbs. dry matter/ac); and a comprehensive plant species inventory.

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Figure 1. Using an increment borer to examine tree cores and estimate ages. Photo credit: Livingston NRCS, 01 April 2022.

Through forest stand thinning, brush management, prescribed grazing, and supporting conservation practices, this TIP will address the primary resource concern of **feed and forage imbalance**. Private landowners who depend on the threatened ecological goods and services of these grazing lands for their livelihood have potential to gain financial stability from increases in forage production yielded by improvements to the landscape's climate resilience.

The conservation practices used to address the primary resource concern will also serve to benefit efforts in addressing two identified secondary resource concerns: restoration and long-term preservation of **plant community structure and composition** and mitigation of **wildfire hazard from biomass accumulation**. Each of the resource concerns directly addressed in this TIP, along with their associated causes and effects, are intrinsically linked. Careful consideration of such complex interactions on the landscape when planning the strategic implementation of conservation practices is integral to the success of the project.

The project proposed is intended as the first phase of a multi-phase plan to treat similar resource concerns in other areas of State and Local priority in the near future. NRCS will use conservation planning to:

- Create a positive trend in **rangeland** health on enrolled acres, demonstrated by pre- and post-treatment observations recorded using the NRCS MT-ECS-2 Rangeland Health Assessment form.
- Create a positive trend in **forest** health on enrolled acres, demonstrated by pre- and post-treatment observations recorded using methods described in the NRCS MT-FOR-01 Tech Note.
- Where applicable, create a positive trend in **riparian** health on enrolled acres, demonstrated by pre- and post-treatment observations recorded using either the NRCS MT-ECS-14 Riparian Assessment Worksheet, or Stream Visual Assessment Protocol Version 2 (SVAP2).
- Improve forage production and/or forage utilization on grazing units of **all land use** types. The Rangeland Analysis Platform (RAP) (Appendix A) or a comparable geospatial data repository (Appendix B) will be used as a support tool.

Development of specific goals for each grazing unit based on benchmark conditions and individual management needs is critical.

Figure 2. Expansion of Rocky Mountain juniper onto rangeland near Strickland Creek. Photo credit: Livingston NRCS, 04 March 2022.

FOCUS AREA

The focus area for the Trail Creek Watershed Climate Resiliency (TCWCR) TIP extends North to South from Billman Creek along US Interstate 90 E to the confluence of Dry Creek and Trail Creek. Old Yellowstone Trail S demarcates the Eastern boundary of the focus area. The Western boundary lies along the Gallatin-Park County line (Figure 3). The aformentioned area encompasses the bulk of the 2001 Fridley Fire burn scar referenced in the wildfire statistics of the Park County LRP (Pg 8). Management of stand regeneration on burned lands is crucial more than 20 years post-burn; escpecially in the prolonged absence of natural fire return intervals or comparable stand thinning practices.

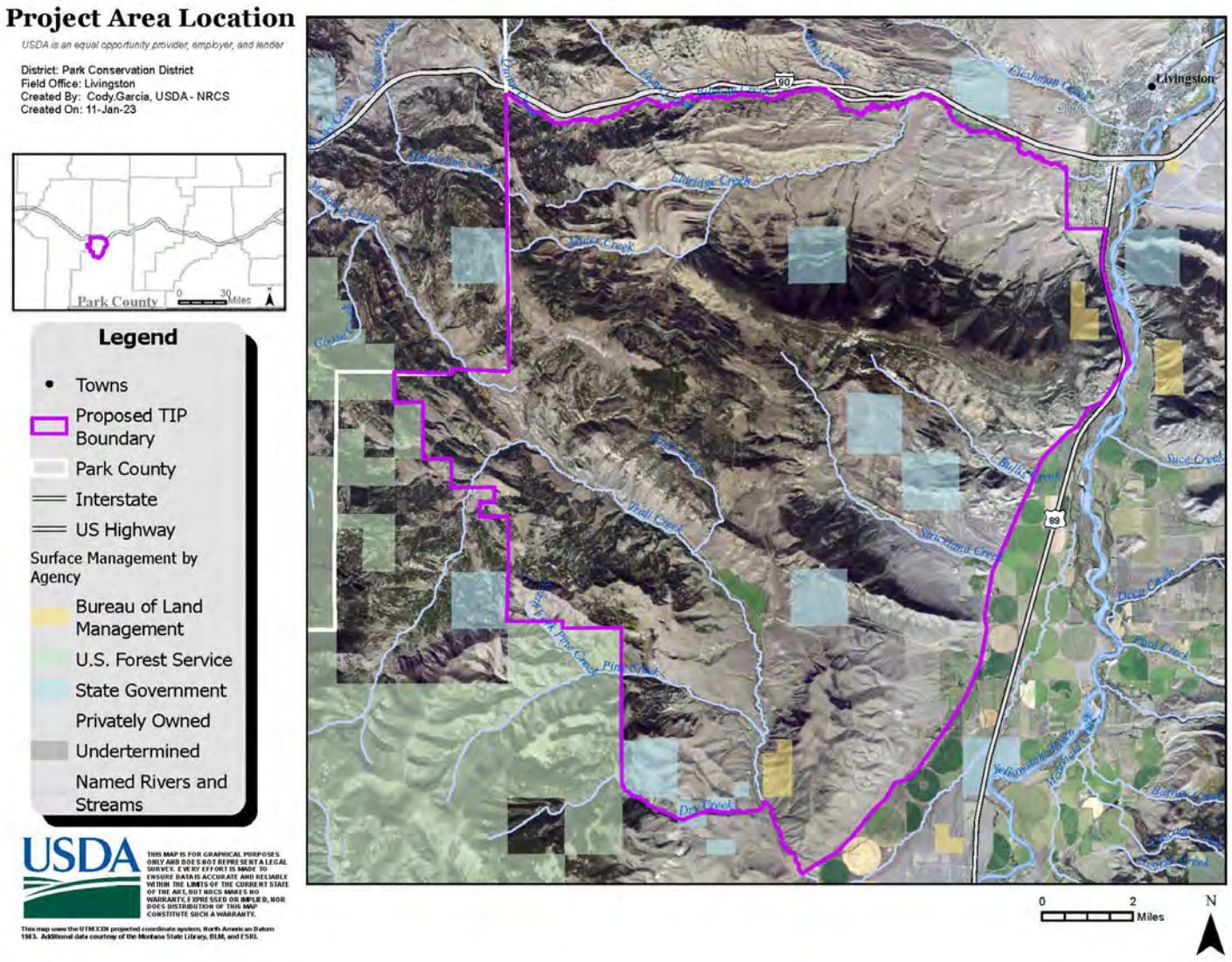


Figure 3. Project Area Location Map.

Lands immediately North of the Fridley burn scar include grazing lands with potential to provide fuels and, consequently, a corridor extending future wildfire outbreaks to private lands as far North as the Wineglass and Livingston proper. Canyon Mountain and the Wineglass contain the only current Census Designated Place (CDP), and the largest residential community, within the focus area. As of July 2022, the US Census Bureau reported a population of 301 residing in a total of 141 housing units for the Wineglass CDP. The median home value at the time of the most recent census report is estimated at $357,143.

Approximately 67,483 privately owned acres are included in the proposed TIP boundary. Using sattelite imagery analysis (Appendix B), NRCS estimates tree cover within the TIP boundary has increased by 10,848 acres in the last 30 years. The Livingston NRCS field office expects to treat up to 7,500 (70%) of those acres by 2026. The extent of the proposed TIP boundary is due to the scope of conifer encroachment along the margins between the Gallatin National Forest and the Yellowstone River Valley. Land-uses with similar resource concerns and management needs (e.g., small, private agroforest lands; grazing lands threatened by conifer encroachment; and subdivisions in wildand-urban interface) are also fragmented throughout the focus area.

The focus area of the TCWCR TIP was chosen to address urgent resource concerns on forest grazing lands and rangelands under threat of conversion from increased conifer range and density in the Trail Creek Watershed. Working within this area also creates continuity in land management and treatment efforts planned by Bozeman Natural Resources Conservation Service (NRCS), US Forest Service, and Montana Department of Natural Resources (DNRC). The TCWCR TIP boundary borders the Bozeman NRCS Joint Chief's Initiative with US Forest Service near Timberline Creek and Meadow Creek. The boundary also overlaps with Montana DNRC's State Priority Area for Fire Hazard on Miner Creek and Eldridge Creek (Figure 4). The intent of this synergy between project areas is to build climate resiliency on grazing lands of socioeconomic importance, while also benefitting residential structures in wildland-urban interface by creating defensible and/or survivable space.

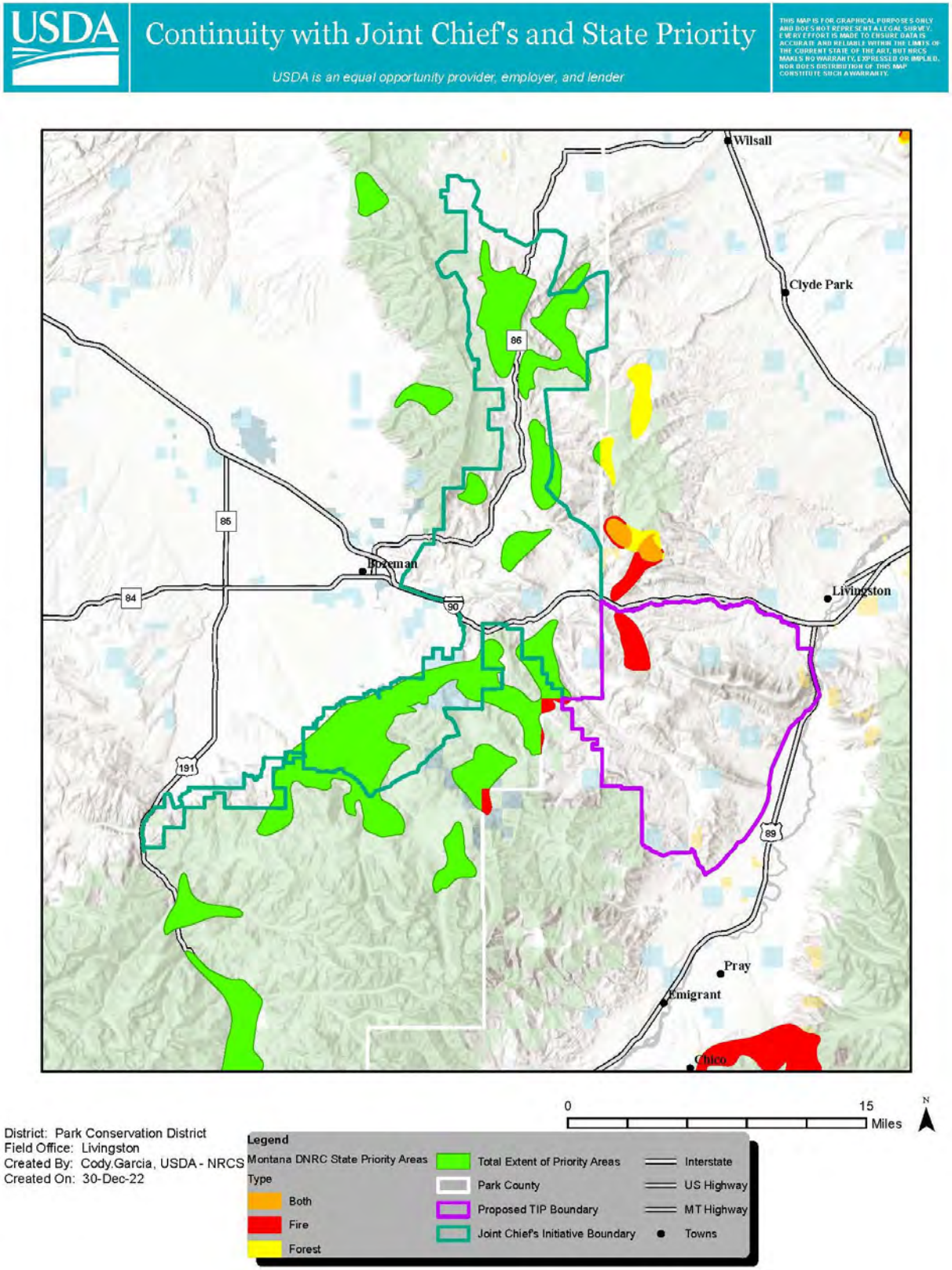


Figure 4. Proximity of the TCWCR TIP to Bozeman NRCS Joint Chief's Initiative Project Area and Montana DNRC State Priority Area

TARGETED RESOURCE CONCERNS

FEED AND FORAGE IMBALANCE

Forests and rangelands in the West evolved with fire on the landscape. According to Burkhardt and Tisdale (1976), and Miller et al. (1999), pre-settlement fire return intervals on mountain big sagebrush-steppes in southwest Montana historically ranged from 10 to 25 years. Miller and Rose (1995) conclude that low-intensity fire events of a 10 to 25-year frequency would have prohibited long-term increases to conifer range and density in sagebrush communities, namely Western juniper in the Great Basin. More than 40-50 years of tree growth are typically required to attain a height and diameter affording resilience to fire mortality. A similar response to natural disturbance is expected from Rocky Mountain juniper in southwest Montana. The absence of fire on the landscape has allowed for the increases in conifer range and density observed today (Davies et al., 2019).

Since 1990, tree cover has increased on 25% of rangelands in the Western United States. Morford et al. (2022) estimate cumulative tree cover expansion over the last 30 years in the West at 77,323 km^2 (greater than 19.1 million acres). This net increase in tree cover is equivalent to an area more than 8 ½ times the size of Yellowstone National Park (2.2 million acres).

The total amount of herbaceous biomass lost to tree cover expansion over a 30-year period is an estimated 332.9 million US tons (Morford et al., 2022). Accounting for variability in livestock biomass utilization and forage value, total loss in agricultural production is approximately $4.1 to $5.6 billion USD (Morford et al., 2022). This averages to an annual foregone revenue of more than $136 to $186 million USD.

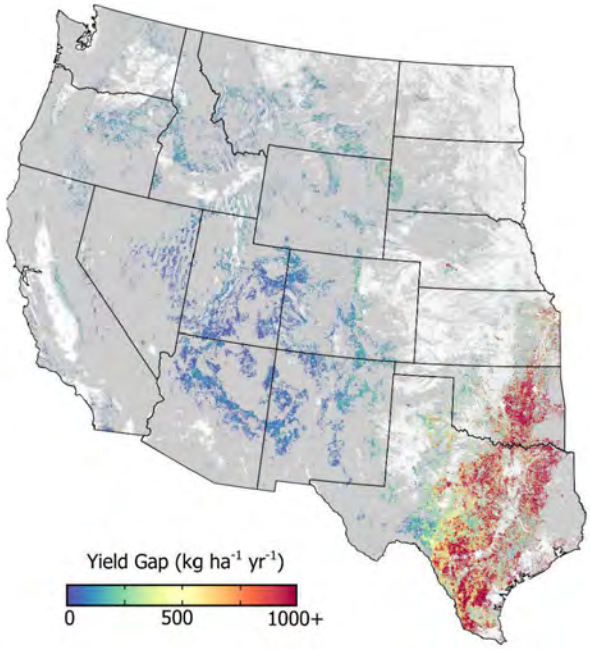
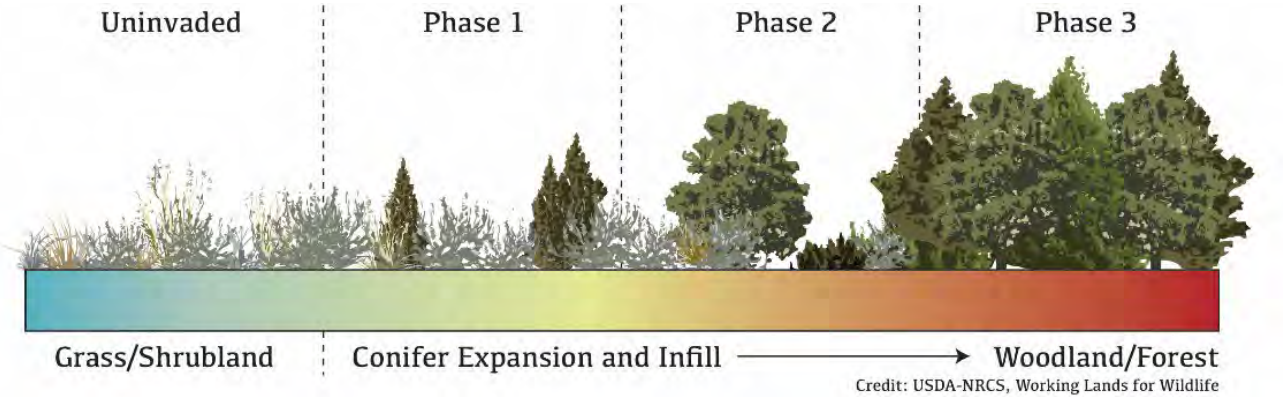


Figure 5. Map of annual forage productivity lost to conifer encroachment across the Western US (Morford et al. 2022).



Once conifers mature to a fire-resistive age in grass-shrubland, herbaceous species are quickly outcompeted for available resources. Bates et al. (2000) and Miller et al. (2005) estimate a moderately stocked (*30 stems/ac) stand of Western juniper could extract up to 2 inches of soil water in "dry" years and up to 5.6 inches of soil water in "wet" years, not accounting for precipitation intercepted by canopy. Due to this difference in available water for herbaceous species, the understory growing season in a moderately stocked Western juniper stand is reduced by as much as six weeks (Bates et al., 2000). Similar extraction of soil water is expected from Rocky Mountain juniper.

Figure 6 illustrates the transition over time of grass-shrubland to forest as conifers outcompete herbaceous species and shrubs for resources. In semi-arid systems, this transition gradually takes place for several reasons. The leading cause is reduced water availability. Photosynthesis requires atmospheric CO_2 and H_2 molecules from water. Less available water inhibits the photosynthetic process, resulting in a drastic reduction to carbon assimilation of understory species (Haygood, 2022). Without intervention, this transition is inevitable and often irreversible because herbaceous species lack the capacity to recover from a continuously increasing resource deficit.

Hydrologic function and other natural processes are altered as conifers increase in range and density, leading to the loss of many ecosystem goods and services provided by grass-shrublands. Treating the current extent of conifer encroachment across the West, however, is a daunting task. The sheer scale of losses thus far, and the scope of lands under threat of future conversion, is unmanageable. Morford et al. (2022) argue for a strategy of treatment that relies on identifying core areas of pristine grazing lands to defend from conifer encroachment and infill. Targeting treatments toward areas of increased conifer range and density contiguous with intact grass-shrubland grows the overall acreage of pristine core grazing land.

*Stands of Rocky Mountain juniper inventoried by Livingston NRCS throughout the focus area averaged 608 stems/ac. Mixed stands of Douglas-fir/Limber Pine/Engelmann Spruce averaged 1, 890 stems/ac.

WILDFIRE HAZARD FROM BIOMASS ACCUMULATION

Fire suppression policies were first implemented in the Western United States well over a century ago: beginning with partial fire suppression - or "let-burn" - policies such as that adopted by the US Army upon procuring control of Yellowstone National Park in 1886. This type of land management was reinforced with more stringent provisions in the National Parks Act of 1916 (Kilgore, 2017). Trends toward an increasing scope of management against fire on the landscape continued well beyond the institution of a national fire suppression policy by the United States Forest Service (USFS) in the 1930s. At this time, the USFS instated an objective of complete containment by 10 a.m. the morning following initial discovery of an outbreak (Forest History Society, 2022).

Despite an increased awareness of fire as a necessary ecological process and recent changes to policy, such as the 2014 National Cohesive Wildland Fire Management Strategy included in the FLAME Act, (Barrett, 2020) fire events continue to trend upward in size and intensity from their historic models. While reactionary measures remain a necessity to protect residences and lands of socioeconomic importance, it is readily apparent that reaction alone will not suffice in contending with the growing threat.

During the last 25 years in Park County, six wildland fire outbreaks reached a size greater than 5,000 acres; the Fridley Fire previously mentioned was the largest. In late August of 2001, the Fridley Fire burned more than 26,873 acres of the Gallatin National Forest. The most recent extensive wildland fire outbreak in Park County occurred during the 2021 American Fork Fire, where more than 21,892 acres burned in and around the Crazy Mountains. According to the Executive Summary Report filed by the Albuquerque Zone Type 3 (ABQ Zone - T3) Incident Management Team (IMT), costs of suppression efforts, excluding costs incurred by community recovery and land restoration efforts, totaled over $7.25 million.

The intensity and severity of fire events today is attributed to a combination of factors. These factors include accumulation of fuels from long-term suppression of high-frequency, low-intensity fires that would otherwise remove excess vegetative material from forest understories and rangelands, and alterations in local climate patterns that exacerbate the landscape's susceptibility to ignition of above-normal fuel loads. While overall annual precipitation in the Western United States is forecasted to increase by as much as 15-20% in the next 20-50 years, so too are mean daily temperature expected to increase by as much 5-8 degrees Fahrenheit (Maczko et. al., 2019). Deviation from historic seasonal precipitation patterns and increased mean temperatures will likely lead to higher peak flows during spring runoff events and lower amounts of snowpack to carry through the early summer seasons. Drier conditions during "fire-season," in combination with seasonal peak temperatures

amplified by increased carbon emissions, compounds the inherent risk and severity of wildfire outbreaks. Table 1 portrays data compiled by USFS on pyrogenic CO_2 emissions.

Table 1. *Estimated annual wildfire-burned area and pyrogenic emissions of CO_2 for Montana, 2003-2015. Source: Montana Business Quarterly, based on Urbanski, et. al. (2011) and personal communications from Urbanski (2016). Average pyrogenic CO_2 emission calculated from the dataset is 19.4 thousand US tons/acre. That is more than the annual emissions of 2,743 Chevrolet Tahoes!*

Year	Total Annual Area Burned (acres)	Total Annual CO_2 Emitted (thousand US tons)	Total Annual Biomass Consumed (kg per m^2)
2003	681,885	16,848.9	3.43
2004	21,088	272.5	1.80
2005	95,517	2,058.9	3.00
2006	683,370	9,445.9	1.92
2007	580,353	16,172.1	3.87
2008	133,175	1,101.0	1.15
2009	48,899	1,068.7	3.04
2010	61,808	738.1	1.66
2011	173,178	3,310.6	2.66
2012	954,347	12,747.8	1.86
2013	89,962	2,533.3	3.91
2014	24,772	258.8	1.45
2015	337,715	8,698.4	3.58
13-Year Average	298,931	5,788.8	2.56

Projections for future environmental conditions, trends in woody species expansion, and the growing rate of ex-urban sprawl, are causes for concern relative to inherent risk associated with wildfire outbreaks. More wildland-urban interface creates more opportunity for loss of life and property. Thus, preventative measures are necessary to build defensible and survivable spaces. It is imperative to manage key areas for appropriate stocking rates according to early-intermediate plant community successional stages, and utilize fuel breaks where the scope of thinning or clearing required is otherwise impractical.

Forests and upland sagebrush-steppe grasslands in early-intermediate seral stages carry lighter fuel loads, maintain their natural hydrologic functions, sequester more carbon in the soil profile as opposed to overstocking carbon in vegetative matter above-ground (Morford et. all, 2022), and therefore release significantly less of their carbon stores during a burn event. The perceived benefit lies in promoting active carbon sinks with low risk of volatilization to help mitigate pyrogenic CO_2 emissions feedback.

Figure 7. Severe conifer encroachment (foreground) on rangeland in the Trail Creek drainage (northeast orientation). Ecological site descriptions for the area in this photo do not include Rocky Mountain juniper in the climax plant community. Conifer infill (background) is evident from consultation of the RAP. Photo credit: Livingston NRCS, 04 March 2022.

Figure 8. Conifer encroachment in the Trail Creek drainage (southwest orientation from the same location as pictured in Figure 8). Photo credit: Livingston NRCS, 04 March 2022.

PROPOSED ALTERNATIVES AND ACTIONS

ALTERNATIVE ONE – CROSS-BOUNDARY COORDINATION

The most idealistic alternative is to garner enough support and cooperation from partner agencies to treat all impacted acres within and adjacent to the focus area. This would involve intensive collaboration with other federal, state, and non-government agencies to coordinate cross-boundary efforts to treat the landscape outside of NRCS jurisdiction.

Priority areas for both USFS and DNRC are in alignment with NRCS objectives. Various barriers exist, however, that inhibit immediate action on behalf of either entity within the focus area for this TIP. Several agencies are interested in developing integrated management plans and working jointly in proximity to the focus area, but the means are not presently available. This alternative relies heavily on multiple-source funding, and will require more time to generate sufficient interest amongst private landowners to participate with NRCS in providing continuity to future USFS, DNRC, and/or BLM management. Successful implementation of alternative two may prove the next step toward realizing this goal in future projects.

ALTERNATIVE TWO – STRATEGIC CONSERVATION PRACTICE IMPLEMENTATION

Alternative two requires NRCS financial assistance to participants through funding available in the Environmental Quality Incentive Program (EQIP). Financial assistance will alleviate much of the participants' burden of high costs associated with the actions proposed herein. Strategic implementation of the following NRCS conservation practices in key areas with treatable acres (e.g., core sagebrush-steppe grasslands or high-fuel-load forest stands in proximity to vulnerable infrastructure and/or resources) will address both the immediate and long-term identified resource concerns:

Primary Practices

- **Forest Stand Improvement** (Practice Code 666) – This practice thins coniferous forest stands to appropriate spacing according to ecological site characteristics and desired overstory-understory composition. Further guidance is provided in NRCS practice specifications and standards. Appropriate spacing is crucial to mitigate crown-to-crown spread of fire and reduce the amount of competition for resources amongst desirable understory species.
- **Brush Management** (Practice Code 314) – This practice removes, or reduces the density of, conifer stands not endemic to rangeland ecological sites. Clearing areas of woody species encroachment will release historic meadows from a resource deficit and mitigate the consequent suppression of cool season perennial grasses and shrubs. With careful planning and use of this treatment in strategic locations, this practice will create defensible space for other lands of socioeconomic importance, residential structures, and key infrastructure (e.g., ingress/egress routes).
- **Prescribed Grazing** (Practice Code 528) – This practice serves as a follow-up management system to encourage reestablishment of desirable forage species, enhance overall rangeland health, and improve riparian conditions. A prescribed grazing plan is recommended, but not required for participation in the TIP. NRCS may provide financial assistance or CTA for prescribed grazing.

Supporting Practices

- **Fuel Break** (Practice Code 383) – This practice creates defensible and/or survivable space around residential structures at high risk of significant damage or total loss from wildfire.
- **Woody Residue Treatment** (Practice Code 384) –This practice manages the residual woody material, or slash, that is generated from thinning and clearing activities. Slash will be burned, chipped, or removed for off-site use.
- **Herbaceous Weed Control** (Practice Code 315) – This practice controls noxious weeds before they can invade areas disturbed by thinning and clearing practices. NRCS will

plan and implement this treatment as conservation technical assistance (CTA) only. NRCS will not provide financial assistance but will collaborate with willing participants and partners to apply other sources of funding. NRCS and partners will monitor the progress of herbaceous weed control post-treatment.

- **Fence** (Practice Code 382) – This practice provides grazing infrastructure development to facilitate a prescribed grazing rotation.
- **Watering Facility** (Practice Code 614) - This practice provides grazing infrastructure development to facilitate a prescribed grazing plan.
- **Livestock Pipeline** (Practice Code 516) - This practice provides grazing infrastructure development to facilitate a prescribed grazing plan.
- **Spring Development** (Practice Code 574) - This practice provides grazing infrastructure development to facilitate a prescribed grazing plan.

NRCS may provide financial assistance or CTA for grazing infrastructure to facilitate a prescribed grazing plan that meets NRCS practice specifications and standards. NRCS **will not** provide financial assistance for grazing infrastructure without also contracting Prescribed Grazing (Practice Code 528). Fencing and off-stream water development serve as effective tools for improving riparian conditions in post-treatment areas by alleviating livestock grazing pressure from sensitive riparian vegetation.

ALTERNATIVE THREE – NO ACTION

If no action is implemented, conifer range and density will continue to increase in the absence of disturbance or perturbation events, moving historically grass- and shrub- dominated systems towards late successional stages dominated by conifers. Fuel loads will remain high in impacted forests, with changes in predominant forest habitat type from Lodgepole Pine/twinflower and Douglas-fir/ninebark to Douglas-fir/twinflower or Douglas-fir/snowberry. Grazing lands of socioeconomic importance and interspersed residential structures will remain at risk of significant damage or total loss from wildfire.

PROPOSED SOLUTION

The solution proposed to address the identified resource concerns is alternative two (strategic conservation practice implementation) because it is the most comprehensive **and** presently feasible treatment of the identified resource concerns. Targeting core areas of rangeland and forest to restore and utilize for the preservation of contiguous lands under threat is the most cost-effective method of intervention. Attempting to expend the financial resources required to treat all impacted acres within and adjacent to the focus area without external support is impractical. NRCS financial assistance will increase the accessibility of the proposed

actions in alternative two by mitigating a portion of the associated costs. Table 2 lists the core practices and current payment rates.

Table 2. *Core conservation practices and payment rates for all treatment acres and grazing infrastructure. FY23 EQIP rates based on standard payment schedule. *Designated practices may be offered as CTA **OR** as part of an EQIP contract.*

Conservation Practices	Payment Rate ($)	Unit
Forest Stand Improvement (666)	$696.92	Acres (ac)
Brush Management (314)	$339.18	Acres (ac)
Fuel Break (383)	$1,243.84	Acres (ac)
Woody Residue Treatment (384)	$405.50	Acres (ac)
Herbaceous Weed Treatment (315)	CTA ONLY	Acres (ac)
Prescribed Grazing (528)*	$3.35	Acres (ac)
Fence (382)*	$2.39	Linear Feet (ft)
Watering Facility (614)*	$2.76	Gallons (gal)
Livestock Pipeline (516)*	$1.97	Linear Feet (ft)
Spring Development (574)*	$4,350.11	Number (no.)
Water Well (642)	$50.80	Linear Feet (ft)
Pumping Plant (533)	$5,699.51	Number (no.)

PARTNERSHIPS

- The **Upper Yellowstone Watershed Group**'s (UYWG) Working Lands Committee (WLC) will assist NRCS with public outreach to garner interest and support for the proposed project. The UYWG will provide meeting space and staff for review of the TIP with their membership. Members of the WLC will also provide "in-kind" assistance with forest and range inventory as well as follow-up monitoring efforts.
- Park County's **Cooperative Weed Management Area** (CWMA) will assist NRCS in outreach and marketing by providing drone footage of sites pre-and-post-treatment to visually demonstrate changes on the landscape resulting from the project. CWMA will also provide "in-kind" assistance with noxious weed management and monitoring efforts.
- At current capacity, the **Park Conservation District** (Park CD) and **Park County Environmental Council** (PCEC) have sufficient funding and staff to provide NRCS with assistance in establishing photo monitoring plots. As future funding allows, partners from the Park CD and PCEC will assist with educating landowners on the methodologies and benefits of monitoring to ensure the continuation of close observation and recording of post-treatment conditions long after NRCS and partners are no longer directly involved.
- The **Montana Department of Natural Resources**' (DNRC) Central Land Office (CLO) will provide personnel to assist NRCS in writing Forest Management Plans, where applicable, for forest units receiving thinning treatment.

- The **National Wild Turkey Federation** (NWTF) will provide personnel to assist NRCS in collecting forest inventory data and planning conservation practices in forest units receiving thinning treatment.
- The **United States Forest Service**'s (USFS) Fire Management Team in the Yellowstone Ranger District will provide NRCS with technical assistance where applicable. USFS was queried for relevant data and cost-analysis of fire suppression efforts. Agency personnel will provide NRCS with carbon stocking and sequestration models produced by the Forest Vegetation Simulator (FVS).

IMPLEMENTATION

Livingston NRCS will administer this TIP for a duration of three years, beginning in 2024. NRCS will rank and select first-year participants from a pool of previously submitted applications, with completed inventories, and new applications received during the FY24 batching period. NRCS will coordinate outreach efforts to recruit future applicants in cooperation with UYWG and CWMA. NRCS field staff and partnered employees available through NWTF will conduct the required conservation planning.

To facilitate timely treatment of identified resource concerns, NRCS will plan contract schedules of operation as follows:

- Completion of **Forest Stand Improvement** (Practice Code 666) and **Brush Management** (Practice Code 314) in Contract Year 1 with minimal need for additional thinning or clearing.
- Completion of **Woody Residue Treatment** (Practice Code 384) in Contract Year 1 or 2, depending on timing of preceding treatment and method of slash disposal.
- Initiation of **Prescribed Grazing** (Practice Code 528), if included, immediately after installation of any necessary grazing infrastructure.

NRCS will require participants who receive financial assistance for prescribed grazing and associated infrastructure to maintain NRCS grazing standards for a duration of 3 years. NRCS **will not** provide financial assistance for grazing infrastructure without contracting Prescribed Grazing (Practice Code 528). Areas receiving mechanical treatment for high density conifer encroachment (> 15% canopy cover) will require grazing deferment, according to NRCS practice specifications for Brush Management (314), regardless of whether or not prescribed grazing is contracted. NRCS field staff will complete initial inventories prior to contract obligation and partners will conduct follow-up efforts to monitor post-treatment conditions on an annual basis for a period of 3 years.

Program budget projections are based on standard scenarios from the 2023 NRCS payment schedule. Actual program costs may differ by fiscal year with variability in applied practices,

overall program participation, and adjustments to the payment schedule to account for changes in economic costs.

Table 3 below summarizes expected funding requirements for upcoming fiscal years based on current costs, participant interest, and landowner-engagement. An average cost of $599.89 per acre in NRCS financial assistance is calculated based on the following estimates and assumptions:

- 10 acres of Fuel Break (Practice Code 383) included in Program Year One. 20 acres of Fuel Break (Practice Code 383) in each of Program Years Two and Three.
- Approximately 25% of acres identified for treatment will include Forest Stand Improvement (Practice Code 666) and Woody Residue Treatment (Practice Code 384).
- Approximately 75% of acres identified for treatment will include Brush Management (Practice Code 314).
- All acres treated with brush management or forest stand improvement **may** follow-up with Prescribed Grazing (Practice Code 528).
- For every section (640 acres) treated with brush management or forest stand improvement, a spring development or water well with solar pump; watering facility with up to 4,500 gal of storage; up to 1,000 ft of livestock pipeline; and up to 1 mile of fence **may** be installed to facilitate prescribed grazing.

Table 3. *Estimated costs of projects in the TIP from Fiscal Years 2024-2026*

Fiscal Year	Brush Management (est. acres)	Forest Sand Improvement (est. acres)	Fuel Break (est. acres)	Total Acres Treated (est.)	NRCS Financial Assistance (est.)
2024	1,490	500	10	2,000	**$1,199,780.^{00}**
2025	2,045	685	20	2,750	**$1,649,697.^{50}**
2026	2,045	685	20	2,750	**$1,649,697.^{50}**
Total	**5,580**	**1,870**	**50**	**7,500**	**$4,499,175.^{00}**

The most probable challenge in successful implementation of this TIP is availability, or lack thereof, of contractors to complete the required work. Efforts to coordinate with participating landowners to procure contractors capable of completing each year's total scheduled workload for all participants is critical. Another potential obstacle is discrepancy between rapidly increasing economic costs and the financial assistance available to offset those costs. Even with financial assistance, costs associated with conservation management practices are often prohibitive to landowners. Significant operating capital is required to cover initial costs

prior to reimbursement and/or the remaining difference. Analysis of the economic returns from increases in forage production and protections gained from wildfire damages may attenuate the hesitancy of prospective participants in this instance.

PROGRESS EVALUATION AND ASSESSMENT

Pre-and post-treatment inventories are necessary to establish baseline conditions and evaluate changes on the landscape resulting from the project. Inventories will document total acreage, conifer stem densities and/or estimated canopy cover, tree spacing, mean DBH and age, forage production, and a comprehensive species inventory. NRCS will base certification of practice completion on predetermined, site-specific metrics for conifer stem densities, or canopy cover, and the timely removal of slash utilizing appropriate methods.

Monitoring is necessary to document changes in plant community structure and composition. NRCS field staff and/or partners will establish photo-plot transects prior to treatment and re-visit plots annually to capture visual representations of the post-treatment changes in plant species and forage production. Personnel conducting monitoring activities will use NRCS standard forms to record observations and upload Geo-referenced photos to a GIS database. NRCS will provide technical assistance on an as-needed basis to address concerns such as trends in the plant community toward noxious weeds in areas of ground disturbance.

USFS partners will utilize Forest Vegetation Simulator (FVS) carbon modeling software to provide NRCS with data on assumed changes to carbon stocking and carbon sequestration caused by the conservation management activities undertaken in this project. Total carbon assimilation is expected to decrease with conifer removal while carbon sequestered and incorporated into restored grazing land soils as either Soil Organic Carbon (SOC) or carbonates, as opposed to more volatile vegetative material in forest overstory, is expected to increase. Modeling these changes will help substantiate and quantify the benefit of long-term carbon storage.

OUTCOMES

The Carbon Management & Emissions Tool (COMET) developed by NRCS to evaluate changes in carbon sequestration and greenhouse gas emissions predicts an increase of 171.87 US tons of annual carbon sequestration per acre of prescribed grazing. Up to 7,500 acres of prescribed grazing yields approximately 1.29 million US tons of carbon sequestered annually, or the equivalent CO_2 emissions savings of 66,445 gallons of gasoline (assuming one gallon of ethanol-free gasoline emits 19.4 lbs of CO_2).

The Planner version of COMET does not have appropriate parameters to assess long term changes in carbon sequestration associated with conifer removal. USFS' VFS will replace COMET for this purpose. Reducing the fuel load of up to 7,500 acres has potential to prevent substantial

pyrogenic CO_2 emissions and correlated social costs, however. The cost of damages incurred by one additional US ton of CO_2 emissions is difficult to calculate. The most conservative estimates calculated by current integrated assessment models is $5/US ton. With 19.4 thousand US tons CO_2 released per acre burned in the state of Montana (Table 1), social costs of wildfire are estimated at $97,000/ac.

Utilizing fuel breaks in conjunction with other forestry practices in areas of wildland-urban interface has potential to help prevent significant damages to private property. With a reported total number of 141 housing units at a median home value of $357,143; an estimated $50,357,163 in property value is at risk in the Wineglass subdivision alone. This does not account for additional property value of outbuildings or land associated with reported housing units.

If forage production is increased by 75 lbs/ac, every 27 acres treated will yield an additional ton of feed. With grass hay valued at a median price of $192.50 per ton, up to 7,500 acres of conifer encroachment and/or prescribed grazing treatment will supply an **annual** added value of $53,472.22 in increased forage throughout the focus area.

Figure 9. Conifer encroachment on rangeland near Strickland Creek. Ecological site descriptions for the area in this photo do not include Rocky Mountain juniper, Douglas-fir, or Limber Pine. These species have expanded from historic refuges in adjacent forest proper. Photo credit: Livingston NRCS, 01 April 2022.

Figure 10. Expansion of Rocky Mountain juniper onto rangeland between Strickland Creek and Trail Creek. Photo credit: Livingston NRCS, 01 April 2022.

APPLICATION RANKING QUESTIONS

1. **Are the acres proposed for treatment in proximity to any previous forest thinning, fuels reduction, or conifer encroachment treatment projects that have been completed in the last 5 years?**

   a) Project area is 1,000 feet or less from previously treated acres
   b) Project area is between 1,000 and 2,000 feet from previously treated acres
   c) Project area is greater than 2,000 feet from previously treated acres

2. **Are the acres proposed for treatment in proximity to a priority area (designated by the State of Montana, Bureau of Land Management, or US Forest Service) where the opportunity for partner assistance would enhance practices in the application?**

   a) Project area is within a priority area boundary
   b) Project area is within 2 miles of a priority area
   c) Project area is greater than 2 miles from a priority area

3. **Are the acres proposed for treatment in proximity to primary ingress/egress routes (state highways, or county roads – paved or unpaved – that would be critical to residents or first responders in the event of wildfire? Or are the acres proposed for treatment in proximity to residential structures?**

   a) Project area is 1,000 feet or less critical infrastructure
   b) Project area is between 1,000 and 2,000 feet from critical infrastructure
   c) Project area is greater than 2,000 feet from critical infrastructure

4. **What extent of treatable acres identified in the project area will the program participant address with Brush Management (314) and/or Forest Stand Improvement (666)?**

   a) Greater than 75%
   b) Between 50% and 75%
   c) Less than 50%

Figure 11. Late sunrise over the Absaroka Mountains. Photo credit: Livingston NRCS, 04 March 2022.

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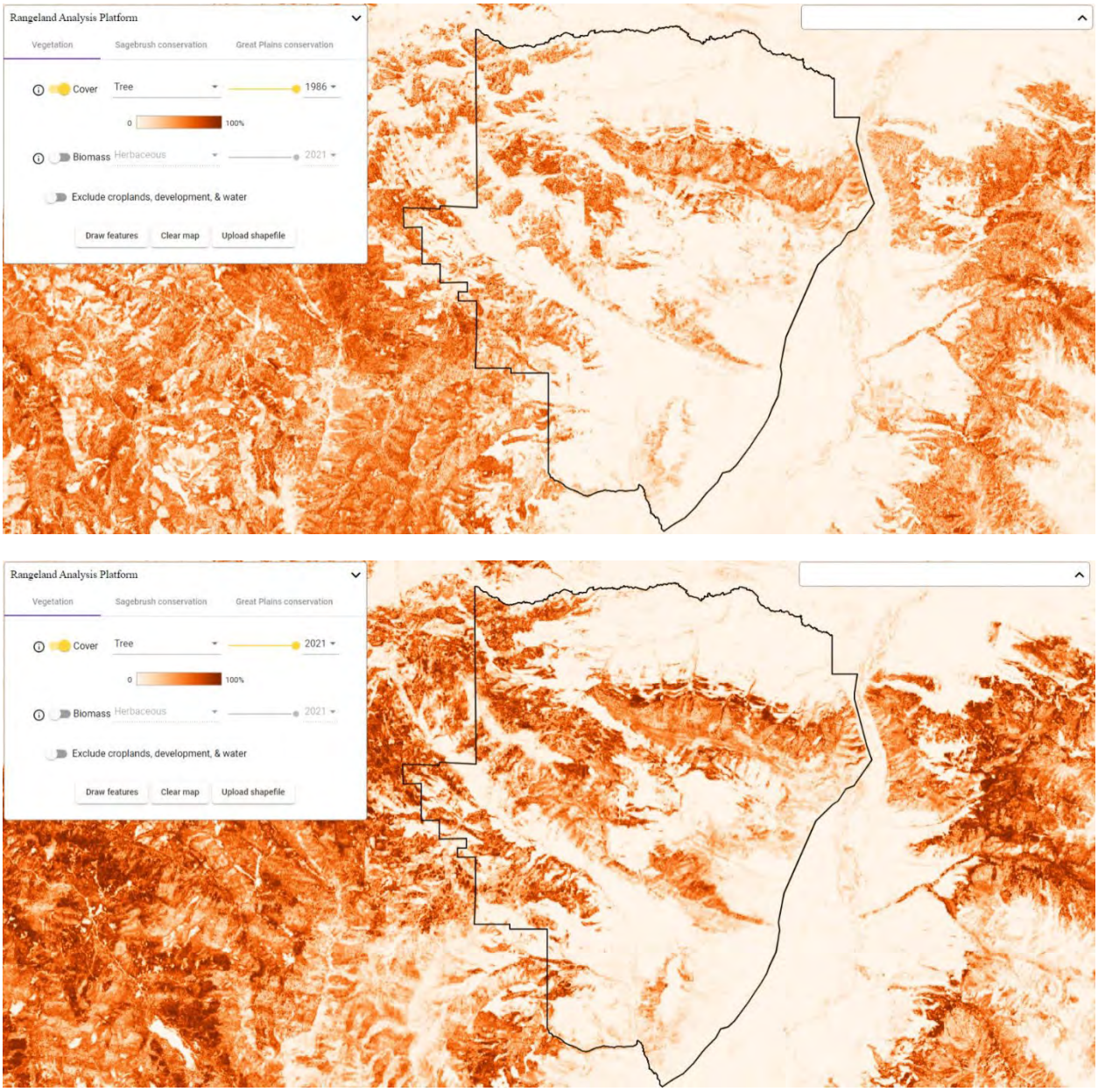
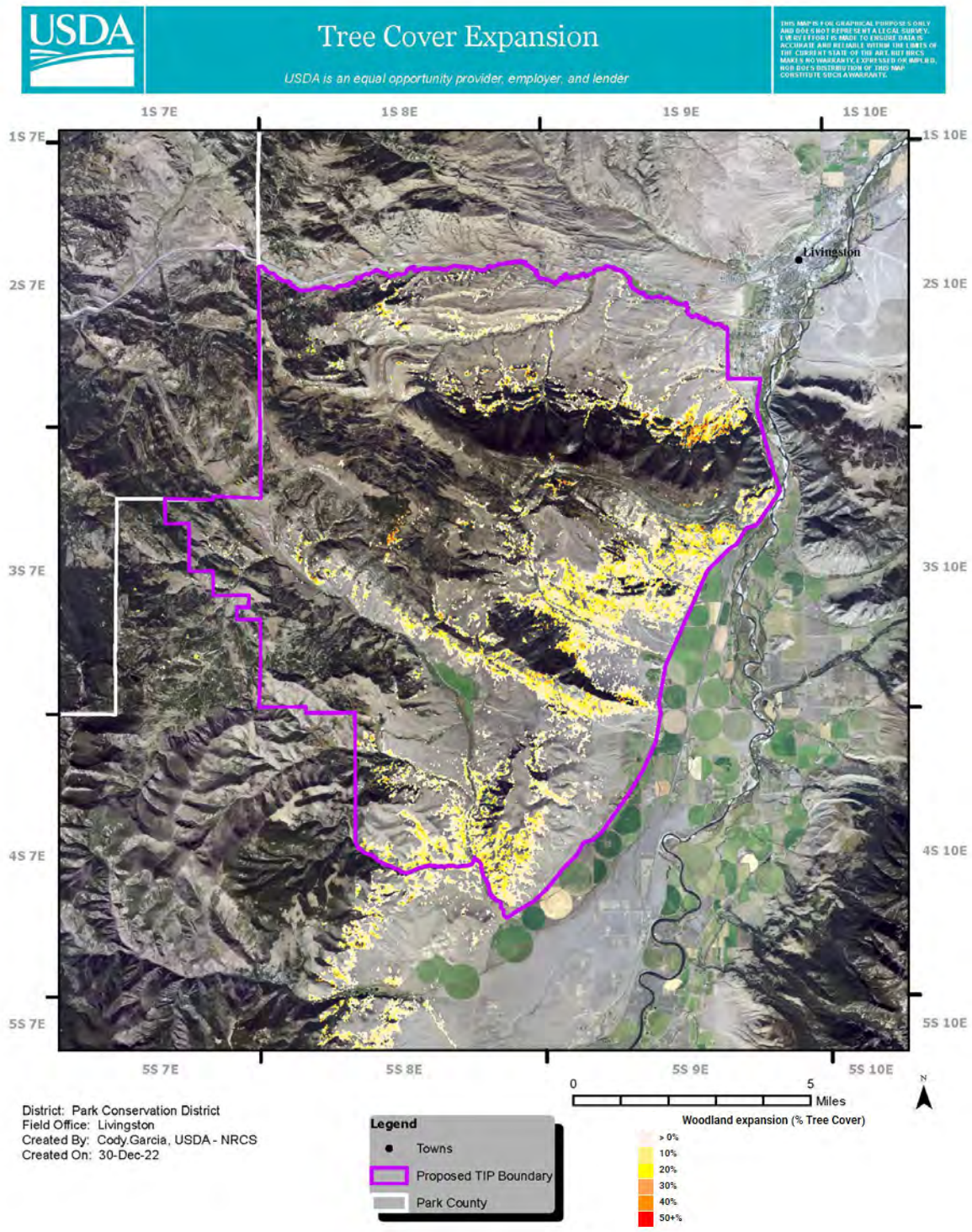
APPENDICES



Appendix A. Imagery from the RAP showing increases in conifer range and density within the focus area from 1986 to 2021.



Appendix B. Map of tree cover expansion. Raster layer file from the University of Montana geospatial data repository in cooperation with the Morford et al. satellite imagery analysis project. Tree cover expansion in the proposed TIP boundary totals 10,848 acres.