AGENDA ITEM or FINAL CONTRACT REVIEW SUBMITTAL FORM

Agenda Item: West Region Wildfire Council Update

Action Requested: Discussion

Parties to the Agreement:

Term Begins: **Term Ends:** **Grant Contract #:**

Summary:

West Region Wildfire Council - Gunnison County Activities & Updates. The CO State Forest Service would also like to provide the BOCC with updates during the allotted hour timeframe.

Fiscal Impact:

Submitted by: Liz Mense for Scott Morrill **Submitter's Email Address:** EMense@gunnisoncounty.org

Finance Review: ○ Required ◉ Not Required

Comments:

Reviewed by: Discharge Date:

County Attorney Review: ○ Required ◉ Not Required

Comments:

Reveiwed by: Discharge Date: Certificate of Insurance Required

Yes ○ No ○

County Manager Review:

Comments:

Reveiwed by: GUNCOUNTY1\mbirnie Discharge Date: 9/6/2019

○ Consent Agenda ○ Regular Agenda ○ Worksession Time Allotted: 60

Agenda Date: 9/10/2019

Revised April 2015

West Region Wildfire Council
Gunnison County Accomplishment Report

To: Gunnison County Board of County Commissioners
From: West Region Wildfire Council
Date: September 10 2019
Re: Report on West Region Wildfire Council (WRWC) accomplishments

Dear Gunnison Board of County Commissioners-

This year has seen some record high temperatures and record high snowfalls. Although the fire season has been relatively quiet in Gunnison County we are beginning to see an increase in fire danger as the moisture has dropped off but temperatures remain high. The West Region Wildfire Council remains committed to working to reduce wildfire risk in Gunnison County. On behalf of the West Region Wildfire Council (WRWC) Staff, Steering Committee & Membership, we'd like to thank Gunnison County for its continued support as well as its leadership and forward thinking in the arenas of wildfire mitigation, preparedness and adaptation. Council resources and programs have been available to Gunnison County residents since 2011 and have had measurable, tangible and lasting impacts. Since that time, WRWC has worked with the Colorado State Forest Service, local fire protection districts, homeowners associations, community leaders and individual homeowners to identify wildfire risk and take proactive steps towards reducing those risks *ahead* of a future wildfire event. While there is lots more work to be accomplished, *thus far*, these collaborative efforts have resulted in:

WRWC Cost-Share Program – Gunnison County 2011 to Date

- Continued availability of the WRWC Cost-Share Program, which provides up to 75% cost-share funding for defensible space and strategic landscape- scale fuels reduction projects.
- **223** acres of hazardous fuels reduction projects have been coordinated and funded by WRWC in Gunnison County. These projects serve to increase the amount of defensible space within fire prone areas of the county.
- **$225,338.05** in WRWC Cost-Share Program funding has been awarded to Gunnison County residents to incentivize hazardous fuels reduction work. Of that investment in mitigation projects:
    - **$101,910.53** has come from Gunnison County Title III funding
      and
    - **$123,427.50** of additional grant funding has been brought to match that funding
- Homeowners have contributed **$132,054.95** in cash-match as well as an additional **$56,825.96** of in-kind match.
- WRWC has applied for and administered several grants that have brought additional resources in to Gunnison County.

Community Chipping Program – Gunnison County 2011 to Date

- Continued availability of the WRWC Community Chipping Program, providing free curb-side service to participating communities and residents of fire-prone areas in Gunnison County
- Since 2011 the West Region Wildfire Council has worked with residents of Quartz Creek Properties, Blue Mesa HOA, and the Rainbow Subdivision to coordinate community chipping projects. To date:
    - 40 residents have participated in these events
    - 166 piles of slash have been chipped
    - 29,050 cubic yards of slash have been chipped
    - 879 hours of work by residents to cut trees and shrubs and construct piles for chipping

- $9,412.50 have been spent on contracted chipping services

Home Site Visits and Wildfire Risk Assessments

- 133 one-on-one homeowner site visits to discuss Home-Hardening, Defensible Space, & Wildfire Risk with residents within high wildfire risk areas throughout the county

Targeted Outreach and Planning Efforts

- Assistance with the development and implementation of the following plans:
  - Gunnison County CWPP (2011)
  - Arrowhead CWPP (2007)
  - Blue Mesa CWPP (2007) & Community Assessment Update (2018)
  - Gold Basin Subdivision CWPP (2008)
  - Ohio City CWPP (2009)
  - Quartz Creek CWPP (2015)
  - Rainbow Services Incorporated CWPP (2013)
  - Star Mountain Ranch CWPP (2009)
  - Upper Crystal River Valley CWPP (2011)
  - Wilderness Streams CWPP (2009)
  - DRAFT Hazard Mitigation Plan (2018)
- Rapid Wildfire Risk Assessments in the Blue Mesa Subdivision, the community of Tincup as well as a variety of homes in within the Taylor Canyon watershed.
- Coordination, attendance and participation in numerous outreach events in the following communities and/or affiliations:
  - Pitkin (Rosebud Fire Information Meeting & Annual Meeting)
  - Quartz Creek
  - Rainbow Estates
  - Trappers Crossing
  - Wilderness Streams
  - Blue Mesa
  - Arrowhead
  - Crested Butte
  - Star Mountain Ranch
  - Gunnison Basin Wildfire Council
  - Gunnison County Electric Association Annual Meeting

Jamie Gomez
West Region Wildfire Council

The 2018 Aerial Detection Survey Summary for the Rocky Mountain Region (R2) of the US Forest Service

Tornado damage on the Black Hills National Forest, South Dakota, 2018. Photo taken by Justin Backsen of the U.S. Forest Service.

For more information or additional data requests, please contact:

Brian Howell, Aerial Survey Program Manager
303-236-8001 behowell@fs.fed.us
Justin Backsen, Aerial Surveyor
303-236-3760 jbacksen@fs.fed.us
Jennifer Ross, GIS Specialist
719-488-1242 jross@fs.fed.us

Last updated: 11/6/2018

Table of Contents

Introduction 3

Interpreting the Tables 4

Acres Affected by Mountain Pine Beetle **5**

Acres Affected by Spruce Beetle **9**

Acres Affected by Douglas-fir Beetle **12**

Acres Affected by Western Balsam Bark Beetle **15**

Acres Affected by Western Spruce Budworm **17**

Acres Affected by Aspen Defoliation **19**

Acres Affected by Fir Engraver **21**

Acres Affected by CO - Unknown Bark Beetle in Ponderosa **22**

Acres Affected by Diplodia **23**

Acres Affected by Abiotic Factors **24**

Introduction

Acreage figures are rounded as follows:

X < 10 acres- to the nearest acre
10 < X < 1,000 acres- to the nearest 10 acres
1,000< X < 10,000 acres- to the nearest 100 acres
X > 10,000 acres- to the nearest 1,000 acres

These tables provide summaries for the major damage agents detected in the 2018 aerial detection survey for the Rocky Mountain Region (R2) of the Forest Service.

Counties or National Forests that have zero mapped acres for all categories in the tables are omitted.

Wyoming acres include only damage recorded from the Region 2 aerial survey. Data from Regions 1 and 4 are included in a different version of this table that summarizes all of Wyoming.

CO plus S.WY numbers include all of Colorado and the six Wyoming counties that encompass the Medicine Bow NF: Albany, Carbon, Converse, Laramie, Natrona, and Platte.

Certain calculations using these data should be avoided. Adding numbers from different categories in an attempt to produce a total of acres impacted by multiple agents, for example will produce inaccurate, inflated results because acres experiencing multiple damages are double-counted. Producing totals for multiple agents is a separate GIS exercise.

Caution should be exercised when making year to year comparisons using these data, the survey area is not identical from year to year and extent flown each year may not equal 100 % of the forested acres in a given area. A GIS dataset of area flown is available and provides information on the spatial extent of the aerial survey for a particular year.

The county summaries include all ownerships within the county boundary. National Forest summaries are based on the Forest's proclamation boundary and include inholdings of all ownership types.

Interpreting the 2018 Aerial Detection Survey Summary Tables

The 2018 aerial detection survey summary tables for the Rocky Mountain Region of the USDA Forest Service have been prepared to answer the majority of questions concerning the aerial survey data and to provide consistent answers to questions from our clients. Raw GIS files are available for analysis; however minor differences in query structure can result in multiple “correct” answers to the same question. Therefore the numbers provided in these tables are to be considered final. The numbers reported here are the results of GIS queries that remain consistent from year to year. In these tables, the major forest pests that were detected in the region’s forests are summarized by state, county, and national forest. County totals include all ownerships within a counties’ boundary. Forest totals include all acres within the forest’s proclamation boundary.

For bark beetles including mountain pine beetle, spruce beetle and Douglas-fir beetle the aerial survey tables provide the number of acres where some level of trees were detected that were currently dying (fading) from bark beetle attack. Fading occurs one year after initial attack so trees mapped in a given year were killed by bark beetles the previous year. Information from the prior year (2017 Acres Affected) is also provided to assess the trend of the epidemic over the last year in a given area. Because bark beetles may be active in an area for multiple years there is considerable overlap of acres from year to year. Cumulative acres affected since 1996 through the current and through the prior year are provided to determine the area affected by the ongoing epidemic. By subtracting the current cumulative acres (1996-2018 Cumulative Acres Affected) for a given area from the prior year’s cumulative acres (1996-2017Cumulative Acres Affected) for that area, the expansion of the beetle epidemic onto new (not previously mapped) acres can be determined. .

For western balsam bark beetle and associated subalpine fir disease problems, western spruce budworm, aspen defoliation, and aspen dieback and mortality caused by a combination of insects and diseases only the current and prior years acres detected are provided. For these pests, general trend information about the population of the insect or disease affects can be determined by comparing acres affected with the prior year.

2018 Mountain Pine Beetle Activity

Includes All Hosts

	2017Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Colorado	880	470	3,375,000	3,375,000
Wyoming – R2	3,000	210	2,043,000	2,043,000
CO plus S.WY	1,300	490	4,284,000	4,284,000
South Dakota	2,900	210	433,000	433,000
Nebraska	8	0	470	470

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Adams	0	0	1	1
Alamosa	0	0	430	430
Archuleta	0	0	16,000	16,000
Boulder	9	0	140,000	140,000
Chaffee	6	3	83,000	83,000
Clear Creek	10	0	82,000	82,000
Conejos	0	0	4,800	4,800
Costilla	0	0	4,600	4,600
Custer	50	70	36,000	36,000
Delta	0	0	8	8
Dolores	0	0	1,200	1,200
Douglas	270	7	35,000	35,000
Eagle	0	0	194,000	194,000
El Paso	70	1	13,000	13,000
Elbert	1	0	540	540
Fremont	8	3	35,000	35,000
Garfield	0	0	11,000	11,000
Gilpin	0	0	56,000	56,000
Grand	5	0	581,000	581,000
Gunnison	0	0	4,300	4,300
Hinsdale	0	0	3,200	3,200
Huerfano	0	0	26,000	26,000

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Jackson	0	8	364,000	364,000
Jefferson	90	140	36,000	36,000
La Plata	0	0	12,000	12,000
Lake	0	0	11,000	11,000
Larimer	100	20	809,000	809,000
Las Animas	0	0	13,000	13,000
Mesa	1	0	6,100	6,100
Mineral	0	0	840	840
Moffat	0	0	16,000	16,000
Montezuma	0	0	690	690
Montrose	0	0	3,500	3,500
Ouray	0	0	2,000	2,000
Park	130	40	138,000	138,000
Pitkin	0	0	22,000	22,000
Pueblo	0	0	21,000	21,000
Rio Blanco	10	0	44,000	44,000
Rio Grande	0	0	3,400	3,400
Routt	0	0	345,000	345,000
Saguache	100	180	43,000	43,000
San Miguel	0	0	4,000	4,000
Summit	0	0	143,000	143,000
Teller	10	1	9,900	9,900

Nebraska County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Banner	1	0	230	230
Dawes	0	0	20	20
Morrill	1	0	10	10
Scotts Bluff	0	0	170	170
Sheridan	0	0	20	20
Thomas	5	0	5	5

South Dakota County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Butte	0	0	120	120
Custer	1,900	170	55,000	55,000
Fall River	0	1	1,400	1,400
Lawrence	860	10	154,000	154,000
Meade	10	4	26,000	26,000
Pennington	130	20	197,000	197,000

Wyoming County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Albany	90	2	296,000	296,000
Big Horn	0	1	24,000	24,000
Campbell	0	0	190	190
Carbon	40	3	528,000	528,000
Converse	20	0	17,000	17,000
Crook	1,800	90	36,000	36,000
Fremont	600	30	525,000	525,000
Goshen	0	0	110	110
Hot Springs	5	0	52,000	52,000
Johnson	6	50	60,000	60,000
Laramie	0	0	15,000	15,000
Lincoln	0	0	6	6
Natrona	270	10	50,000	50,000
Niobrara	0	0	200	200
Park	50	0	372,000	372,000
Platte	0	0	3,100	3,100
Sheridan	20	3	12,000	12,000
Sublette	70	3	2,800	2,800
Sweetwater	0	0	3,900	3,900
Teton	0	0	2,400	2,400
Uinta	0	0	1	1
Washakie	30	6	35,000	35,000
Weston	20	6	8,400	8,500

National Forest	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Arapaho National Forest	4	0	456,000	456,000
Bighorn National Forest	20	50	27,000	27,000
Black Hills National Forest	4,700	230	451,000	452,000
Grand Mesa National Forest	0	0	20	20
Gunnison National Forest	0	50	6,100	6,200
Medicine Bow National Forest	90	4	681,000	681,000
Nebraska National Forest	5	0	30	30
Pike National Forest	160	40	149,000	149,000
Rio Grande National Forest	80	80	37,000	37,000
Roosevelt National Forest	50	20	810,000	810,000
Routt National Forest	0	8	613,000	613,000
San Isabel National Forest	50	70	152,000	153,000
San Juan National Forest	0	0	28,000	28,000
Shoshone National Forest	570	30	697,000	697,000
Thunder Basin National Grassland	0	0	310	310
Uncompahgre National Forest	0	0	11,000	11,000
White River National Forest	10	0	386,000	386,000

2018 Spruce Beetle Activity

	2017Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Colorado	206,000	178,000	1,782,000	1,841,000
Wyoming – R2	11,000	9,000	568,000	570,000
CO plus S.WY	208,000	178,000	1,903,000	1,962,000
South Dakota	30	0	130	130

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Alamosa	820	1,100	2,900	3,300
Archuleta	8,100	3,400	53,000	55,000
Boulder	830	1,400	5,600	6,100
Chaffee	12,000	7,500	33,000	35,000
Clear Creek	160	580	330	910
Conejos	18,000	19,000	102,000	104,000
Costilla	4,800	8,900	9,700	16,000
Custer	11,000	4,400	34,000	36,000
Delta	810	90	34,000	34,000
Dolores	1,000	1,300	26,000	27,000
Douglas	100	7	360	370
Eagle	20	0	6,300	6,300
El Paso	30	120	90	210
Fremont	9,000	4,800	20,000	22,000
Garfield	2	1	4,700	4,700
Gilpin	0	2	100	100
Grand	8,500	17,000	65,000	70,000
Gunnison	40,000	20,000	134,000	140,000
Hinsdale	22,000	19,000	272,000	275,000

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Huerfano	2,100	3,200	11,000	12,000
Jackson	230	2,800	94,000	94,000
Jefferson	6	7	100	110
La Plata	9,200	13,000	35,000	41,000
Lake	6	0	690	690
Larimer	9,500	18,000	87,000	92,000
Las Animas	10	6	800	800
Mesa	270	120	51,000	51,000
Mineral	590	1,400	236,000	236,000
Moffat	0	0	750	750
Montezuma	130	0	6,700	6,700
Montrose	0	2	570	580
Ouray	190	80	3,600	3,600
Park	5,300	8,700	6,900	13,000
Pitkin	80	4	12,000	12,000
Pueblo	200	170	3,200	3,300
Rio Blanco	0	0	3,800	3,800
Rio Grande	18,000	9,900	93,000	95,000
Routt	0	170	85,000	85,000
Saguache	18,000	4,400	217,000	217,000
San Juan	4,800	6,000	23,000	25,000
San Miguel	50	200	5,100	5,200
Summit	5	1	1,600	1,600
Teller	60	1,600	370	2,000

South Dakota County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Lawrence	30	0	120	120
Pennington	1	0	1	1

Wyoming County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Albany	10	0	29,000	29,000
Big Horn	0	50	12,000	12,000
Carbon	1,200	20	92,000	92,000
Converse	0	0	80	80
Fremont	7,300	8,600	127,000	128,000
Hot Springs	550	40	22,000	22,000
Johnson	0	3	4,400	4,400
Lincoln	0	0	2	2
Natrona	0	0	60	60
Park	2,000	210	272,000	272,000
Sheridan	0	40	6,600	6,700
Sublette	130	80	440	440
Sweetwater	0	0	30	30
Teton	220	3	2,700	2,700
Uinta	0	0	20	20
Washakie	0	0	670	670

National Forest	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Arapaho National Forest	4,500	7,400	47,000	49,000
Bighorn National Forest	0	90	23,000	23,000
Black Hills National Forest	30	0	130	130
Grand Mesa National Forest	460	70	62,000	62,000
Gunnison National Forest	39,000	14,000	236,000	239,000
Medicine Bow National Forest	1,200	20	119,000	119,000
Pike National Forest	4,400	9,200	6,400	13,000
Rio Grande National Forest	47,000	34,000	617,000	622,000
Roosevelt National Forest	3,400	6,300	54,000	56,000
Routt National Forest	240	3,000	177,000	178,000
San Isabel National Forest	29,000	16,000	100,000	105,000
San Juan National Forest	25,000	23,000	246,000	257,000
Shoshone National Forest	9,300	8,800	373,000	375,000
Uncompahgre National Forest	12,000	13,000	44,000	48,000
White River National Forest	160	7	31,000	31,000

2018 Douglas-fir Beetle Activity

State	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Colorado	14,000	14,000	433,000	444,000
Wyoming – R2	210	20	330,000	330,000
CO plus S. WY	14,000	14,000	448,000	459,000

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Alamosa	4	10	170	180
Archuleta	420	280	38,000	38,000
Boulder	0	1	280	280
Chaffee	20	40	3,100	3,200
Clear Creek	0	1	1,100	1,100
Conejos	140	10	6,100	6,100
Costilla	120	300	2,800	3,100
Custer	2	20	6,700	6,800
Delta	20	30	4,100	4,200
Dolores	270	160	5,300	5,400
Douglas	190	30	45,000	45,000
Eagle	500	1,500	11,000	12,000
El Paso	50	8	5,500	5,500
Elbert	0	0	1	1
Fremont	230	30	16,000	16,000
Garfield	2,200	160	35,000	36,000
Gilpin	0	0	60	60
Grand	60	2	1,300	1,300
Gunnison	1,900	2,600	34,000	37,000
Hinsdale	1,100	1,800	15,000	16,000

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Huerfano	10	110	2,900	3,000
Jackson	3	0	570	570
Jefferson	160	10	11,000	11,000
La Plata	610	260	17,000	18,000
Lake	0	0	120	120
Larimer	5	1	2,500	2,500
Las Animas	80	50	6,100	6,200
Mesa	70	40	9,100	9,100
Mineral	900	800	12,000	13,000
Moffat	0	8	1,000	1,000
Montezuma	40	80	8,000	8,100
Montrose	290	200	10,000	10,000
Ouray	290	190	18,000	19,000
Park	0	70	1,700	1,700
Pitkin	590	1,400	12,000	13,000
Pueblo	0	0	4,300	4,300
Rio Blanco	600	20	9,700	9,700
Rio Grande	340	340	9,600	9,800
Routt	50	30	5,100	5,100
Saguache	2,500	2,700	39,000	42,000
San Juan	10	20	2,000	2,000
San Miguel	360	680	16,000	17,000
Summit	0	0	500	500
Teller	0	10	1,800	1,800

Wyoming County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Albany	0	0	5,400	5,400
Big Horn	60	0	33,000	33,000
Carbon	10	3	9,500	9,500

Wyoming County	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Converse	0	0	10	10
Crook	0	0	1	1
Fremont	4	0	49,000	49,000
Hot Springs	0	0	27,000	27,000
Johnson	40	2	1,600	1,600
Lincoln	0	0	370	370
Natrona	2	0	160	160
Park	20	0	196,000	196,000
Sheridan	40	0	1,000	1,000
Sublette	0	0	2	2
Sweetwater	0	0	670	670
Uinta	0	0	40	40
Washakie	30	10	6,300	6,300

National Forest	2017 Acres Affected	2018 Acres Affected	1996-2017 Cumulative Acres Affected	1996-2018 Cumulative Acres Affected
Arapaho National Forest	0	0	520	520
Bighorn National Forest	120	1	27,000	27,000
Grand Mesa National Forest	10	3	2,400	2,400
Gunnison National Forest	2,400	2,000	30,000	32,000
Medicine Bow National Forest	10	3	12,000	12,000
Pike National Forest	220	110	52,000	52,000
Rio Grande National Forest	2,200	2,800	44,000	46,000
Roosevelt National Forest	6	2	1,800	1,800
Routt National Forest	20	0	2,400	2,400
San Isabel National Forest	140	110	18,000	18,000
San Juan National Forest	1,700	1,900	83,000	84,000
Shoshone National Forest	20	0	204,000	204,000
Uncompahgre National Forest	600	950	32,000	33,000
White River National Forest	2,300	2,300	31,000	33,000

2018 Western Balsam Bark Beetle Activity

State	2017 Acres Affected	2018 Acres Affected
Colorado	50,000	24,000
Wyoming – R2	8,500	3,900
CO plus S.WY	56,000	27,000

Colorado County	2017 Acres Affected	2018 Acres Affected
Boulder	2,000	1,400
Chaffee	740	400
Clear Creek	2,500	960
Conejos	50	0
Custer	0	20
Delta	450	6
Dolores	7	20
Eagle	4,600	980
Fremont	3	20
Garfield	3,100	170
Gilpin	580	280
Grand	4,400	2,800
Gunnison	6,400	3,600
Hinsdale	30	500
Huerfano	30	0
Jackson	820	940
La Plata	10	0
Lake	760	510
Larimer	4,400	2,600
Las Animas	60	70
Mesa	380	20
Mineral	50	330
Moffat	560	460
Montezuma	0	6
Montrose	120	0
Ouray	370	20
Park	2,200	410
Pitkin	7,900	660
Rio Blanco	2,500	1,900

Colorado County	2017 Acres Affected	2018 Acres Affected
Rio Grande	0	40
Routt	2,400	2,500
Saguache	620	0
San Juan	210	200
San Miguel	120	0
Summit	1,900	2,700

Wyoming County	2017 Acres Affected	2018 Acres Affected
Albany	300	340
Big Horn	220	270
Carbon	5,000	2,200
Converse	150	160
Fremont	660	40
Hot Springs	6	0
Johnson	310	320
Natrona	500	200
Park	1,100	9
Sheridan	290	280
Washakie	80	60

National Forest	2017 Acres Affected	2018 Acres Affected
Arapaho National Forest	6,000	3,800
Bighorn National Forest	810	870
Grand Mesa National Forest	570	20
Gunnison National Forest	4,700	3,300
Medicine Bow National Forest	4,200	2,300
Pike National Forest	2,100	440
Rio Grande National Forest	380	990
Roosevelt National Forest	4,800	2,100
Routt National Forest	4,200	3,400
San Isabel National Forest	1,900	950
San Juan National Forest	140	110
Shoshone National Forest	1,600	50
Uncompahgre National Forest	470	20
White River National Forest	20,000	5,200

2018 Western Spruce Budworm Activity

State	2017 Acres Affected	2018 Acres Affected
Colorado	252,000	131,000
Wyoming- R2	12,000	30,000
CO plus S.WY	253,000	132,000

Colorado County	2017 Acres Affected	2018 Acres Affected
Alamosa	1,700	1,600
Archuleta	4,200	20
Chaffee	7,700	7,000
Conejos	4,600	2,600
Costilla	6,000	5,600
Custer	11,000	5,900
Delta	580	3
Dolores	5,000	13,000
Eagle	160	0
El Paso	720	1,300
Fremont	11,000	12,000
Garfield	3,800	4
Grand	910	200
Gunnison	42,000	11,000
Hinsdale	560	720
Huerfano	13,000	1,200
Jefferson	540	150
La Plata	3,700	40
Larimer	3,900	430
Las Animas	11,000	710
Mesa	780	210
Mineral	2,600	830
Montezuma	3,900	5,100
Montrose	2,300	410
Ouray	3,200	2,100
Park	12,000	14,000
Pitkin	1,200	340
Pueblo	780	0

Colorado County	2017 Acres Affected	2018 Acres Affected
Rio Blanco	11,000	430
Rio Grande	1,900	220
Routt	1,700	1,000
Saguache	75,000	30,000
San Juan	120	90
San Miguel	3,900	11,000
Teller	1,300	2,200

Wyoming County	2017 Acres Affected	2018 Acres Affected
Albany	790	420
Big Horn	0	120
Carbon	140	500
Fremont	590	1,200
Johnson	1,900	2,000
Park	8,800	21,000
Sheridan	0	4,500
Washakie	280	130

National Forest	2017 Acres Affected	2018 Acres Affected
Arapaho National Forest	480	170
Bighorn National Forest	0	4,700
Grand Mesa National Forest	480	170
Gunnison National Forest	42,000	8,200
Medicine Bow National Forest	320	490
Pike National Forest	7,900	8,100
Rio Grande National Forest	50,000	20,000
Roosevelt National Forest	1,900	270
Routt National Forest	5,900	970
San Isabel National Forest	35,000	18,000
San Juan National Forest	16,000	18,000
Shoshone National Forest	9,400	21,000
Uncompahgre National Forest	9,200	14,000
White River National Forest	13,000	780

2018 Aspen Defoliation

State	2018 Acres Affected
Colorado	12,000
South Dakota	50
Wyoming – R2	590
CO plus S.WY	12,000

Colorado County	2018 Acres Affected
Alamosa	3
Archuleta	2,300
Chaffee	20
Conejos	1,400
Costilla	70
Custer	10
Delta	2
Dolores	400
Eagle	20
El Paso	140
Fremont	170
Garfield	60
Gilpin	4
Grand	6
Gunnison	1,000
Hinsdale	670
Huerfano	190
Jackson	10
Jefferson	10
La Plata	1,200
Larimer	6
Mesa	100
Mineral	1,000
Moffat	7
Montezuma	460
Montrose	110
Ouray	110
Park	410

Colorado County	2018 Acres Affected
Pitkin	30
Rio Blanco	20
Rio Grande	130
Routt	140
Saguache	650
San Juan	40
San Miguel	390
Teller	780

South Dakota County	2018 Acres Affected
Lawrence	50
Pennington	8

Wyoming County	2018 Acres Affected
Albany	9
Big Horn	2
Carbon	170
Converse	1
Fremont	390
Johnson	1
Natrona	20

National Forest	2018 Acres Affected
Arapaho National Forest	6
Bighorn National Forest	1
Black Hills National Forest	50
Grand Mesa National Forest	2
Gunnison National Forest	1,200
Medicine Bow National Forest	120
Pike National Forest	410
Rio Grande National Forest	3,100
Roosevelt National Forest	4
Routt National Forest	30
San Isabel National Forest	100
San Juan National Forest	4,400
Shoshone National Forest	350
Uncompahgre National Forest	590
White River National Forest	70

2018 Fir Engraver

State	2017 Acres Affected	2018 Acres Affected
Colorado	2,500	1,400

Colorado County	2017 Acres Affected	2018 Acres Affected
Alamosa	0	10
Archuleta	400	70
Custer	9	40
Dolores	3	0
Gunnison	0	150
Hinsdale	380	60
Huerfano	0	50
La Plata	10	0
Las Animas	0	2
Mineral	100	20
Ouray	1,600	950
Pitkin	0	7
Rio Grande	0	1
Saguache	0	30

National Forest	2017 Acres Affected	2018 Acres Affected
Rio Grande National Forest	60	4
San Isabel National Forest	9	80
San Juan National Forest	820	140
Uncompahgre National Forest	1,500	1,000
White River National Forest	0	7

2018 Unknown Bark Beetle in Ponderosa Pine

Also Includes Western and Roundheaded Beetles

Colorado County	2017 Acres Affected	2018 Acres Affected
Dolores	11,000	27,000
La Plata	110	20
Montezuma	10	70
Montrose	40	20
San Miguel	100	250

National Forest	2017 Acres Affected	2018 Acres Affected
San Juan National Forest	11,000	27,000
Uncompahgre National Forest	140	260

2018 Diplodia

State	2018 Acres Affected
NE	2,600
SD	5,400
WY	4,100

Nebraska County	2018 Acres Affected
Sheridan	2,600
Sioux	6

South Dakota County	2018 Acres Affected
Bennett	40
Butte	1,100
Custer	290
Fall River	5
Lawrence	480
Meade	1,500
Pennington	380
Shannon	1,600

Wyoming County	2018 Acres Affected
Crook	4,100

National Forest	2018 Acres Affected
Black Hills National Forest	1,100
Nebraska National Forest	3

2018 Red Belt

State	2018 Acres Affected
Wyoming	1,600

Wyoming County	2018 Acres Affected
Albany	6
Natrona	90
Park	520
Sheridan	1,000

National Forest	2018 Acres Affected
Bighorn National Forest	1,000
Medicine Bow National Forest	6
Shoshone National Forest	2

2018 Wind/Tornado

State	2018 Acres Affected
SD	6,300
WY	12,000

South Dakota County	2018 Acres Affected
Lawrence	6,300

Wyoming County	2018 Acres Affected
Big Horn	80
Crook	12,000

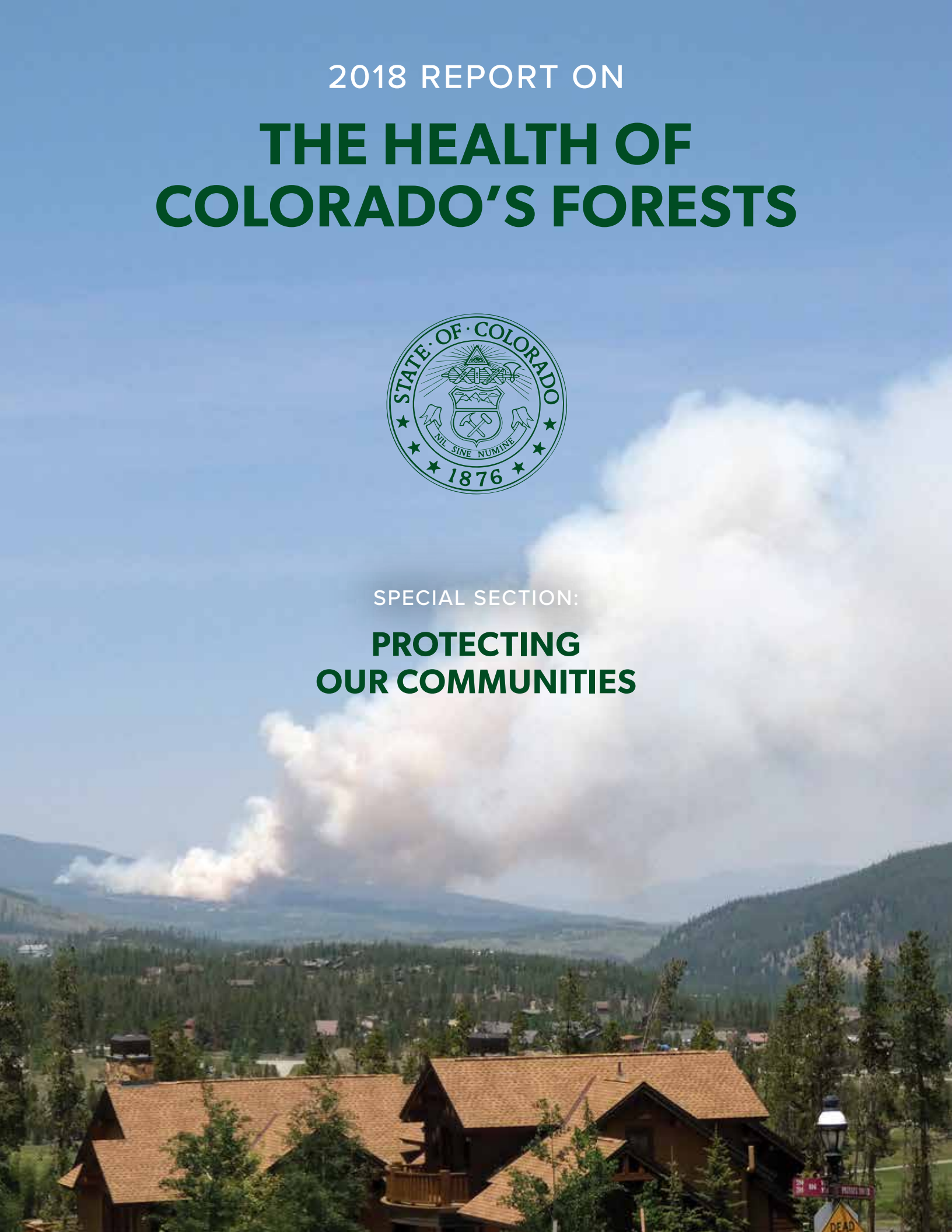
National Forest	2018 Acres Affected
Bighorn National Forest	80
Black Hills National Forest	16,000

2018 REPORT ON

THE HEALTH OF COLORADO'S FORESTS

SPECIAL SECTION:

PROTECTING OUR COMMUNITIES



Director's Message

December 2018

Michael B. Lester, State Forester and Director. Photo: Ryan Lockwood, CSFS

It's been another year of large wildfires in the West, and in Colorado. What does this mean for the future of our state and the forests that sustain our way of life? When we think about community protection, the first people who may come to mind are the dedicated firefighters, police officers and other emergency services personnel who are always there when we need them. But foresters and land managers are also ensuring our protection – by addressing potential disasters before they ever happen.

The focus of this year's report is on the use of forest management actions and programs to protect our communities. Just as building a levee far in advance of a storm can help protect a neighborhood from flooding years later, proactive forest management work has very real implications when a catastrophic event occurs. By constantly working to reduce future risks from wildfire, insects and other concerns, we have the opportunity to proactively enhance public health and safety.

Citing examples from 2018, we address the protection of human life from dangers such as catastrophic wildfire and hazard trees prone to coming down in community settings. We demonstrate how our efforts can also protect property, infrastructure, water supplies, and even forests and trees themselves, to ensure the benefits they provide.

There are significant economic and health implications to utilizing forest management to protect our communities, and Coloradans in general. We all suffer when tourism, air and water quality, wildlife habitat and other values are negatively impacted by poor forest health and wildfires. Record-breaking fires or insect outbreaks drive away tourists, fill the air for weeks with noxious smoke and impact other values. The economic implications of unhealthy forests also are very real. The State of Colorado alone spent an estimated $40 million for fire suppression efforts in 2018 – and this figure does not include what federal and other agencies spent, nor add in vastly greater financial impacts due to property losses, reduced tourism and potential future damage to water supplies and infrastructure. Of note is that these suppression figures also far exceed what was spent in 2018 on proactive forest management work across Colorado, including to reduce wildfire risk.

In addition to our special focus this year, as always we offer a snapshot of the conditions of our forestlands around the state. Spruce beetle continues to be the most destructive insect impacting our forest resources, and for the seventh year in a row an outbreak of roundheaded pine beetle continues to expand in southwest Colorado. Proactive forest management treatments continue to be utilized to address insect and disease threats, as well as wildfires and other threats.

We all need to remember that healthy forests are not free. We need to invest in forest management, fuels mitigation and our forest products industry to help protect ourselves and our resources. And to be successful in our efforts, we also need to work together. The CSFS can best achieve its mission by working with landowners and communities and through collaborations with our many partners, including the U.S. Forest Service, Colorado Division of Fire Prevention and Control, water providers, local governments and many other federal, state and local partners.

I hope you find the information contained in this year's report useful, so you can effectively participate in conversations with others regarding the health, management and future of our forests. We are your Colorado State Forest Service and our staff are available to assist you in your efforts.

The management activities we perform in the coming decades will have profound consequences for Colorado's forests, and the communities within them, for generations to come.

Michael B. Lester
State Forester and Director
Colorado State Forest Service

Table of Contents

Executive Summary 2
Statewide Insect and Disease Update 4
Special Section: Protecting Our Communities 13
Managing Forests, Protecting Communities Requires a Team Effort 21

On the cover: *The Buffalo Fire burning near Silverthorne, Colo., June 2018. Photo: Andrew Bottomley*

The Role of the Colorado State Forest Service

Forester Kelsey Lesniak (second from left) and Supervisory Forester Jodi Rist (right), CSFS Southwest Area, provide a tour of a Good Neighbor Authority project in Gunnison County to State Rep. Marc Catlin and his wife, Kerri. Photo: Joe Duda, CSFS

CSFS foresters use various tools to gather data on forest inventory, such as this wedge prism that helps to estimate timber volume within a given area. Photo: Kelsey Lesniak, CSFS

The mission of the Colorado State Forest Service (CSFS) is "to achieve stewardship of Colorado's diverse forest environments for the benefit of present and future generations." Each year, the CSFS assists thousands of landowners and hundreds of communities throughout the state. The agency offers leadership, resources and guidance to accomplish forest management; wildfire mitigation and community planning; wood utilization and marketing; outreach and education; and insect and disease detection, surveys and response.

As a service and outreach agency of the Warner College of Natural Resources at Colorado State University, the CSFS also fulfills the responsibilities of the Division of Forestry within the Colorado Department of Natural Resources. For more than 60 years, CSFS accomplishments have only been possible through strong partnerships and collaborative relationships with landowners, communities, nonprofits, local governments, state and federal agencies, and many others.

As demonstrated in this year's report, the CSFS provides guidance on creating effective fuelbreaks and other forest management treatments that reduce wildfire risk and help protect people, property and water supplies. The agency also offers professional forestry services in urban and community settings, and serves as Colorado's primary provider of seedling trees for conservation purposes. From its headquarters in Fort Collins, the CSFS offers a statewide reach through 18 field offices and more than 100 full-time staff.

CSFS funding sources are diverse, with approximately 40 percent of its budget coming from the U.S. Forest Service; the state supporting another 30 percent; and the remainder being self-generated or other revenues, or coming from severance taxes. Without this range of funding, the agency's broad annual accomplishments would not be possible.

Starting in January 2018, the agency underwent an organizational restructure designed to best translate its Five-Year Strategic Plan into focused actions; prioritize work to increase impact; create a more integrated agency; and better serve Colorado's citizens. The most significant changes include a field reorganization into four areas covering the quadrants of the state, rather than having more numerous districts, and adding a new Science and Data Division to keep current on forestry-related research; best communicate applied forestry science and data needs both internally and externally; and ensure that management actions taken are science and data-driven. The agency remains committed to providing timely, relevant forestry information and education to the citizens of Colorado to achieve resilient forests and communities.

Executive Summary

Annual reports on the health of Colorado's forests summarize the current health and condition of forests across the state. The primary measures for assessing broad forest health conditions are the severity and scope of insect and disease issues impacting forest ecosystems. For this reason, the backbone of this report offers a detailed summary of 2018 insect and disease activity in Colorado. This year's report also offers a special focus on how the Colorado State Forest Service (CSFS), working with key partners, is able to help protect communities from wildfires and other threats, through the use of forest management.

Colorado's 24.4 million acres of forestland provide immeasurable social, economic and ecological benefits. These forests offer a sustainable wood products industry, diverse wildlife, fresh water and ample recreation opportunities. But they face numerous threats, and can present risks to both residents and visitors. As a service and outreach agency of the Warner College of Natural Resources at Colorado State University, the CSFS works with partners, communities and landowners to address these threats and achieve stewardship of Colorado's forests. Every year, the CSFS assists thousands of landowners and hundreds of communities throughout the state, providing leadership, resources and guidance to accomplish forest management; wildfire mitigation; wood utilization and marketing; outreach and education; and insect and disease detection and response.

A key aspect of forest management is the regular monitoring for damage caused by forest pests. In Colorado, the primary source of information on forest insect and disease conditions is an annual aerial forest health survey conducted by the CSFS and U.S. Forest Service (USFS), Rocky Mountain Region. This year's survey was conducted as Colorado was experiencing the warmest annual temperatures on record, and also historically low precipitation levels. These dramatic climatic deviations played a powerful role in shaping forest insect and disease activity in 2018.

For the seventh consecutive year, Colorado's most widespread and destructive forest insect pest was the spruce beetle. This insect has now affected more than 1.8 million cumulative acres since 2000, with a total of 178,000 acres of active infestations occurring in high-elevation Engelmann spruce forests in 2018. A four-year trend of tens of thousands of new acres being infested annually indicates a continuing spread of spruce beetle into previously uninfested forests.

Another native bark beetle – roundheaded pine beetle, along with closely associated bark beetles – continues to affect ponderosa pine forests in Dolores County, with 27,000 acres impacted in 2018. Impacts from this "bark beetle complex" have significantly increased since 2012. For the past several years, Douglas-fir beetle also has continued to attack and kill mature Douglas-fir trees in the central and southern portions of the state. In 2018, approximately 14,000 total acres were impacted statewide, with Gunnison, Hinsdale and Saguache counties heavily affected. Though less destructive than these bark beetles, western spruce budworm defoliated 131,000 acres of spruce and fir, primarily in central and southwest Colorado, in 2018. Western balsam bark beetle and associated root disease fungi also persisted throughout Colorado's spruce-fir forests.

In addition to insect impacts in Colorado's native forests, introduced exotic pests continued to impact trees in urban and community areas. The CSFS and its partners are working to slow the spread and mitigate impacts of the highly destructive emerald ash borer (EAB), which has caused billions of dollars in damage in North America. Although this pest still has not been detected outside of Boulder County, new EAB detections in 2018 occurred in the communities of Lyons and Superior. Infestations from another significant community forest pest – Japanese beetle – were at the highest levels ever reported in Colorado, primarily impacting Boulder, Denver and Pueblo.

Besides damage from insects and disease, destructive wildfires represent an ever-present threat to Colorado's forests, and also

to life and property. The 2018 fire season saw more acres burned in Colorado than any other year except 2002. Many of these burned acres were within the wildland-urban interface (WUI) – any area where human improvements are built close to, or within, natural terrain and flammable vegetation. The historic wildfire season was due to factors that include overly dense and unhealthy forest conditions; ongoing drought; and increasingly warmer weather linked to climate change. A recent update to the CSFS-administered Colorado Wildfire Risk Assessment Portal (CO-WRAP) indicated that the population living in areas at risk to wildland fire in Colorado increased approximately 50 percent from 2012 to 2017, surpassing 2.9 million people.

In 2018, several wildfire incidents demonstrated the effectiveness of the

CSFS Northwest Area Manager Ron Cousineau describes the value of interagency fuels mitigation work to reduce wildfire risk, utilized by firefighters on the Buffalo Fire (pictured on the cover), in an August 2018 tour for U.S. Sen. Michael Bennet. Photo: U.S. Forest Service

CSFS's broader efforts to reduce wildfire risk to communities. Two wildfires burning toward Colorado subdivisions provided a perfect example of how proactive forest management can work in tandem with suppression efforts to minimize the impacts of fire. Firefighters made clear that a key reason they were able to protect communities in Grand Lake and Silverthorne from these fires was prior mitigation work by the CSFS and partners, which include the U.S. Forest Service (USFS), Denver Water, Northern Colorado Water and Grand and Summit counties. Fire management teams halted the progress of the Buffalo and Golf Course fires in fuelbreaks where vegetation had previously been thinned or removed to alter fire behavior and make fires less intense. As a result, these fires did not result in the loss of life or destruction of property.

Two communities in southern Colorado, also impacted by the 2018 fires, benefited from prior engagement with the CSFS in the form of becoming Firewise USA® communities, and working together to take action to reduce wildfire risk. Work completed by a neighborhood northwest of Durango paid off during the 416 Fire, when the incident management team took advantage of prior efforts to make structures more defensible. And another Firewise USA community in the Sangre de Cristo Mountains, though not as fortunate in the face of the massive 108,000-acre Spring Creek Fire, likely lost fewer homes than it could have if the community had not taken steps to help protect homes.

Trees in urban and community forests present a different sort of threat when they eventually fail, putting neighborhood residents at risk. One of the key steps to protecting community trees, and those who benefit from them, is conducting a tree inventory. Inventories, including those completed by CSFS staff, help city foresters and others determine which trees pose potential risks to people and property.

Agencies including the CSFS, USFS and Bureau of Land Management are largely responsible for addressing forest health and wildfire risk at a larger scale, but these agencies cannot be successful working alone. Besides joining together to address cross-boundary concerns through use of the Good Neighbor Authority – a program utilized for a 2018 project near Steamboat Springs featured in this report – they rely on the insights and assistance of numerous other partners, from water providers and local governments to other state and federal agencies, local fire protection districts, the wood products industry and nonprofits. Homeowners and communities also must take steps to reduce wildfire risk to help protect life and property, and provide safer conditions for firefighters during a wildfire.

The CSFS works closely with landowners and communities around the state to not only provide resources and assistance, but also to determine needs and concerns to better inform broader forest management priorities. Also guiding CSFS efforts is Colorado's Forest Health Advisory Council, created in 2016 to advise the state forester on how to effectively respond to forest health challenges.

The Colorado General Assembly and other decision-makers likewise play a key role in enabling forest managers to have the greatest positive impacts toward the health of Colorado forests, and the protection of its communities.

Statewide Insect and Disease Update

Forest insects and diseases are primary natural drivers in the dynamics of forest ecology. A primary example in Colorado is tree-killing bark beetles. During outbreaks, these beetles attack trees in mature, often overly dense forests, setting the stage for the replacement of older, less healthy trees with younger, more vigorous ones. These outbreaks, on the other hand, also can affect many of the values that humans place on forests, including timber production, wildlife habitat, recreation and watershed protection.

A key part of forest management is the regular monitoring for damage caused by forest pests. In Colorado, the primary source of information on forest pest conditions is an annual aerial forest health survey. This is a cooperative program that involves specialists from the U.S. Forest Service (USFS), Rocky Mountain Region and the Colorado State Forest Service (CSFS). Trained aerial observers from both agencies fly over the majority of the state's 24.4 million acres of native forests in small aircraft, to map and classify the intensity of the current year's damage. When necessary, some areas flown also are ground-checked to verify the agent (i.e., insect) responsible for the damage and/or the severity of damage.

Another important source of information for this report is field visits made by CSFS foresters. These experts identify and assess forest pest activity, while advising private landowners – who together own 30 percent of the state's forests – on how to best manage their forests. CSFS foresters also are directly responsible for management of state-owned forestlands, including State Trust Lands, and for conducting statewide forest inventories. Additionally, in cooperation with other agencies such as the Colorado Department of Agriculture, USDA Animal and Plant Health Inspection Service (APHIS) and USFS, the CSFS is involved in the design and implementation of special surveys to ensure early detection of exotic insect species that threaten both urban and native forests.

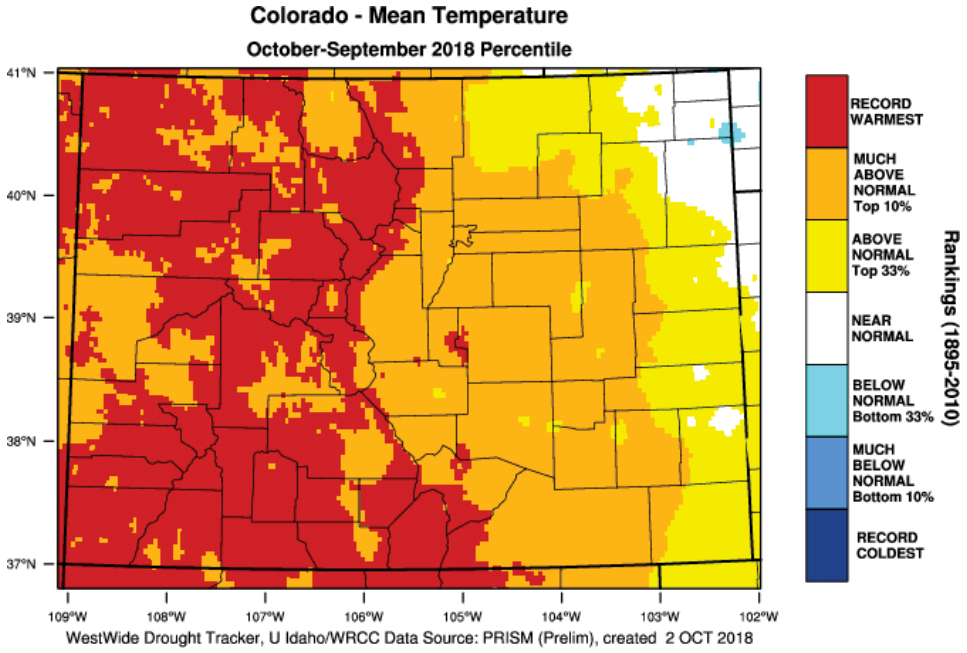
Highlights for 2018

According to the National Oceanic and Atmospheric Administration, Colorado experienced the warmest annual temperatures on record (spanning the last 124 years) during the water year of October 2017 through September 2018. During that same period, precipitation levels statewide plummeted to the second driest on record, dating back to 1895. The southwest quadrant of the state was the warmest and driest region, while precipitation in the northeast quadrant of the state was near average. The Western Slope saw a record number of days with highs exceeding 90 degrees F, and record-low precipitation values.

These dramatic shifts in annual temperature and precipitation levels have real implications for forest insect and disease activity. Forest disturbance from epidemic bark beetle populations tracks closely with long-term precipitation levels and temperature patterns. Warmer temperatures during the winter months also reduce over-winter beetle and larvae mortality, while lower than average precipitation may reduce one important line of tree defense: the ability to produce enough sap to resist insects attempting to enter through the bark.

The warmer temperatures and drought conditions in 2018 thus played a powerful role in shaping forest insect and disease activity in the state, which included the following impacts:

- For the seventh consecutive year, Colorado's most widespread and destructive forest insect pest was the spruce beetle. This insect has now affected more than 1.8 million cumulative acres since 2000, or approximately 40 percent of the state's spruce-fir forests. A total of 178,000 acres of active infestations occurred in high-elevation Engelmann spruce forests throughout the state in 2018. Of those, a total of 59,000 new, or previously uninfested, acres were affected. An ongoing four-year trend of a high number of newly infested acres indicates a continuing spread of spruce beetle into previously uninfested forests. Susceptible Engelmann spruce forests exist in the northern and central portions of the state, indicating that this insect has the potential to affect more new areas in the upcoming year.



Colorado experienced the warmest annual temperatures on record during the water year from October 2017 through September 2018. Image: Western Regional Climate Center

- Roundheaded pine beetle and associated native bark beetles continue to affect more acres of ponderosa pine in Dolores County, with 27,000 acres impacted in 2018. Although not all acres are intensely infested, impacts in affected acres have significantly increased since 2012. Record-low precipitation values in the county have weakened tree defenses, providing an environmental window favoring increased beetle populations in the coming year.
- For the past several years, Douglas-fir beetle has continued to attack and kill mature Douglas-fir trees in the central and southern portions of the state. In 2018, Gunnison, Hinsdale and Saguache counties were heavily affected in the south-central portion of the state, while Eagle, Mineral and Pitkin counties also were heavily affected. Approximately 14,000 total acres were impacted statewide, with 11,000 acres being new.
- Western spruce budworm defoliated 131,000 acres of Douglas-fir, white fir and spruce in central and southern Colorado. Chaffee, Dolores, Freemont, Gunnison, Park and Saguache counties experienced heavy and widespread defoliation. Pocket activity also occurred in many other southern Colorado counties.
- White fir mortality declined across all affected areas, and for the fourth consecutive year, mortality from the fir engraver beetle declined in and around Ouray. Localized activity occurred in Archuleta County and continues to be at only background levels elsewhere. Tree mortality occurred on 1,400 acres statewide.
- Western balsam bark beetle and associated root disease fungi persisted throughout Colorado's spruce-fir forests, causing tree mortality over 24,000 acres of high-elevation subalpine fir.
- Emerald ash borer, an exotic pest, still has not been detected outside of Boulder County, where it was first confirmed in 2013. Early detection of this invasive remains challenging, but new detections in 2018 occurred in the communities of Lyons and Superior.

Spruce beetle-caused mortality of high-elevation Engelmann spruce in the San Juan National Forest. Photo: Dan West, CSFS

- Japanese beetle infestations in Boulder, Denver and Pueblo were at the highest levels ever reported in Colorado. Most communities from Fort Collins and Greeley south to Pueblo, along the Front Range, are now affected.

Indigenous Pests

Conifer Forests

Spruce Beetle
(Dendroctonus rufipennis)

Spruce beetle is the most damaging pest of mature spruce forests in North America, and was the most damaging forest pest in Colorado for the seventh consecutive year. These small, native bark beetles infest the state's high-elevation Engelmann spruce, usually above 9,000 feet in elevation, and occasionally Colorado blue spruce. They live and develop in a thin layer of inner bark, between the thicker sapwood and outer bark. Feeding by developing larvae girdles the tree, causing spruce needles to fade in color from green to light yellow, and eventually to an off reddish-brown color.

Spruce beetles typically produce another generation within two years. Adults emerge and fly to seek new host trees from late May through July, preferring large-diameter trees until these have been depleted from the forest. As the spruce beetle moves through contiguous stands of Engelmann spruce, its host type is depleted, which has resulted in less actively affected acreage since 2014.

In 2018, severe outbreaks continued in portions of the San Juan Mountains, West Elk Mountains and Sawatch Range; the southern reaches of the Sangre de Cristo Mountains through the Culebra Range; and portions of north-central Colorado west of the Continental Divide, in and around Rocky Mountain National Park, in Grand and Larimer counties. Susceptible contiguous Engelmann spruce forests exist between expanding outbreaks in the northern and central portions of the state, indicating that the spruce beetle has the potential to affect new areas in the upcoming year.

- Spruce beetle has affected 1.84 million cumulative acres in Colorado from 2000 to 2018.
- Although some acres are more intensely affected than others, approximately 40

Boring dust on a downed Engelmann spruce tree on the Alpine Plateau, Gunnison County. The dust results from spruce beetles entering the tree. Photo: Kelsey Lesniak, CSFS

percent of the state's spruce-fir forest ecosystems have been affected since 2000.

- 178,000 actively affected acres of Engelmann spruce forest were observed in 2018, compared with 206,000 acres in 2017.
- 59,000 "new," or previously uninfested, acres were detected statewide in 2018, compared to 67,000 new acres in 2017.
- Infestations intensified in 2018 in Rocky Mountain National Park and in the Sawatch Range, Culebra Mountains and San Juan Mountains.
- Notable counties affected by new acres in 2018:

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2018 Cumulative Acres Affected	Previously Uninfested Acres
Costilla	4,800	8,900	16,000	6,300
Park	5,300	8,700	13,000	6,100
Gunnison	40,000	20,000	140,000	6,000
La Plata	9,200	13,000	41,000	6,000
Larimer	9,500	18,000	92,000	5,000
Grand	5,800	17,000	70,000	5,000
Hinsdale	22,000	19,000	275,000	3,000

- Counties affected by the most cumulative acres through 2018:

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2018 Cumulative Acres Affected
Hinsdale	22,000	19,000	275,000
Mineral	590	1,400	236,000
Saguache	18,000	4,400	217,000
Gunnison	40,000	20,000	140,000
Conejos	18,000	19,000	104,000
Rio Grande	18,000	9,900	95,000

For data on all counties, go to:
csfs.colostate.edu/forest-insects-diseases

Mountain Pine Beetle
(Dendroctonus ponderosae)

Another native bark beetle, mountain pine beetle, infests all pine species naturally found in Colorado. Populations reproduce once every year, requiring new, live trees to complete development. Adults fly to green trees typically from late June into early August in Colorado.

Aside from localized spot activity, populations remain at endemic – or background – levels statewide. Infestations in ponderosa, limber and bristlecone pines continued at low levels in the northern and central Sangre de Cristo Mountains. Localized spot activity occurred throughout the Front Range, impacting ponderosa and lodgepole pines, although other native bark beetles in the *Ips* genus may also have contributed to some localized impacts.

- Less than 500 acres of native pine forests were affected in 2018.
- 2018 saw the lowest acreage impacted by mountain pine beetle statewide in two decades.
- Notable counties with mountain pine beetle-caused mortality in 2018:

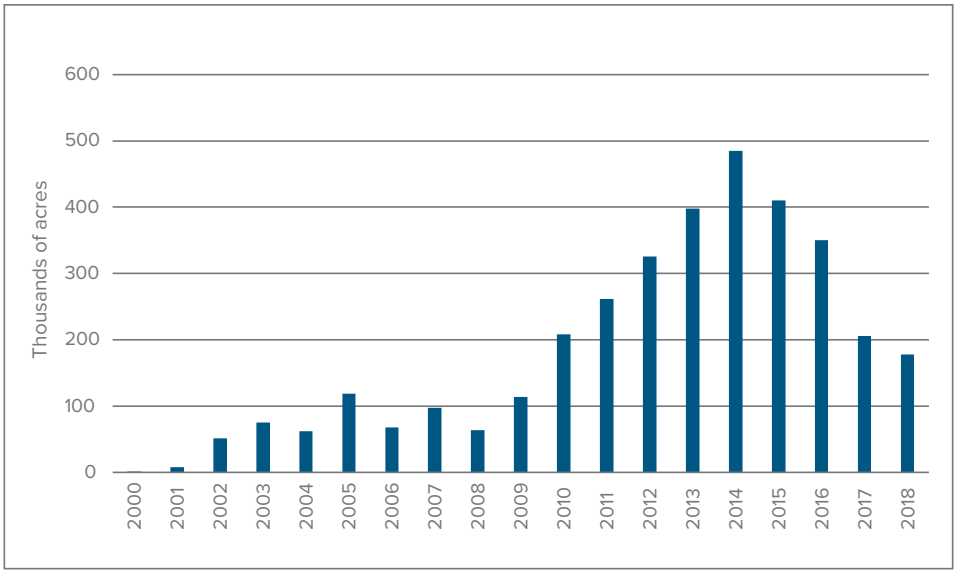
Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2018 Cumulative Acres Affected
Saguache	100	180	43,000
Jefferson	90	140	36,000
Custer	50	70	36,000

Roundheaded Pine Beetle
(Dendroctonus adjunctus)

The roundheaded pine beetle is also native to Colorado, being a bark beetle closely related to mountain pine beetle, spruce beetle and Douglas-fir beetle. The range of this bark beetle extends north into Colorado from as far south as Guatemala; southern Colorado is the northernmost extent of its range. Ponderosa pine is the only primary host tree species in the United States, though other pine species are attacked throughout Mexico and into Central America.

In Colorado, trees are attacked later in the year than with other Colorado bark beetles, from late August through November. With only one generation flying per year, these beetles attack a wide range of tree sizes and ages, typically after a prolonged drought period. Outbreaks south of Colorado's border are typically short in duration, though contiguous ponderosa pine forests in Dolores

Forested Acreage Affected by Spruce Beetle in Colorado, 2000-2018



County have sustained increased mortality for the seventh consecutive year.

Roundheaded pine bark beetles are often associated with several other species of bark beetles, typically western pine beetle (*D. brevicomis*), pine engraver beetles (*Ips* spp.) and mountain pine beetle (*D. ponderosae*). These associated bark beetles, working in conjunction with one another, produce a "bark beetle complex" that results in tree injury and death.

Approximately 27,000 acres were affected in 2018, compared to 11,000 acres in 2017, as the infestation intensified in Dolores County. However, many of those acres were of low intensity, where the complex affected only small groups of trees.

Douglas-fir Beetle *(Dendroctonus pseudotsugae)*

Douglas-fir beetle, another close relative of spruce beetle and mountain pine beetle, is an important native bark beetle of mature Douglas-fir forests across most of the West. Outbreaks tend to be associated with overly dense forests containing mature Douglas-fir, during extended periods of below-normal precipitation. Adults typically seek new trees to attack from May through September.

Widespread groupings of tree mortality occurred in 2018, in portions of the northern Sawatch Range near the community of Carbondale; northern areas of the La Garita Mountains, south of the community of Gunnison; the Needle Mountains near Lake City; and the San Miguel River drainage around the community of Telluride in the San Juan Mountains.

- 14,000 acres of forests comprising Douglas-fir were impacted in 2018.
- 11,000 new, previously uninfested acres of Douglas-fir were impacted statewide.
- Notable counties with the most newly infested acres in 2018:

Colorado County	2017 Acres Affected	2018 Acres Affected	1996-2018 Cumulative Acres Affected	Previously Uninfested Acres
Saguache	2,500	2,700	42,000	2,700
Gunnison	1,900	2,600	37,000	2,600
Hinsdale	1,100	1,800	16,000	1,000
Eagle	500	1,500	12,000	1,000
Pitkin	590	1,400	13,000	1,000

Western Balsam Bark Beetle/ Root Disease Complex

Disturbance caused by western balsam bark beetle (*Dryocoetes confusus*) and several species of fungi that cause root decay has remained persistent for many years now, in Colorado's high-elevation subalpine fir. Actively affected acres from western balsam bark beetle decreased by approximately 50 percent in 2018. This is not highly significant, however, as the area affected may vary from year to year, though is typically relatively low in intensity in the absence of localized drought conditions.

A grouping of ponderosa pines killed by roundheaded pine beetle/associated native bark beetles in San Juan National Forest, Dolores County. Photo: Dan West, CSFS

Several areas of significant damage occurred in the Flat Tops Wilderness and Mount Zirkel Wilderness near Steamboat Springs; the Sawatch Range near the town of Aspen; and along the northern portion of the Front Range in 2018.

- 24,000 acres of high-elevation, mixed-conifer forests comprising subalpine fir were affected in 2018, compared to 50,000 acres in 2017.
- Notable counties affected in 2018:

Colorado County	2017 Acres Affected	2018 Acres Affected
Gunnison	6,400	3,600
Grand	4,400	2,800
Summit	1,900	2,700
Larimer	4,400	2,600
Routt	2,400	2,500
Rio Blanco	2,500	1,900

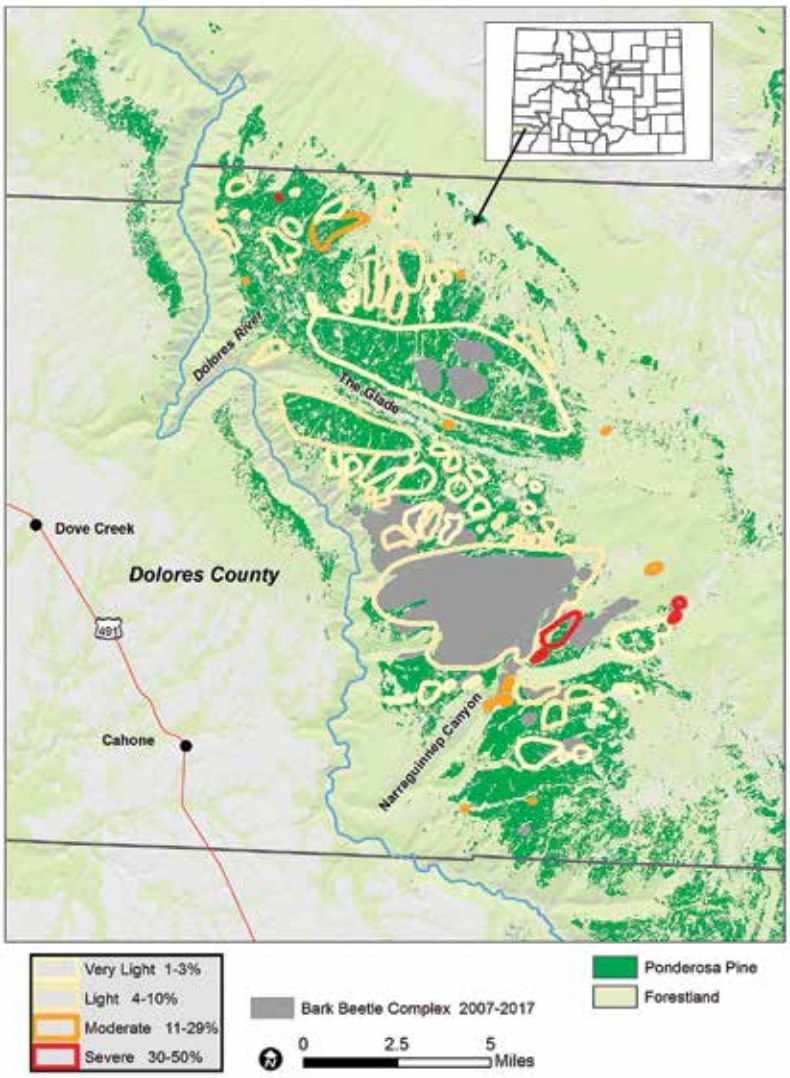
Fir Engraver Beetle
(Scolytus ventralis)

Fir engraver beetle is a native bark beetle that primarily impacts white fir, and occasionally subalpine fir, Douglas-fir and Engelmann spruce. Outbreaks often are associated with below-normal precipitation or defoliation. Adults typically disperse to seek new trees in which to lay eggs under the bark during a peak time of July and August. In 2018, tree mortality continued to decrease statewide, and occurred in southern and central Colorado where white fir grows in mixed-species forests, often alongside Douglas-fir.

- 1,400 acres of white fir in southern Colorado were affected in 2018, whereas 2,500 acres were impacted in 2017 and 6,300 acres in 2016.
- Portions of the Sangre de Cristo Mountains were impacted in localized areas in 2018.
- Archuleta County, within the San Juan National Forest, continues to see low-level, localized fir mortality.
- Infestations near the mountain town of Ouray declined, but continue to affect the few remaining white firs in the area, in an infestation that is ongoing for the sixth straight year.
- Notable counties affected in 2018:

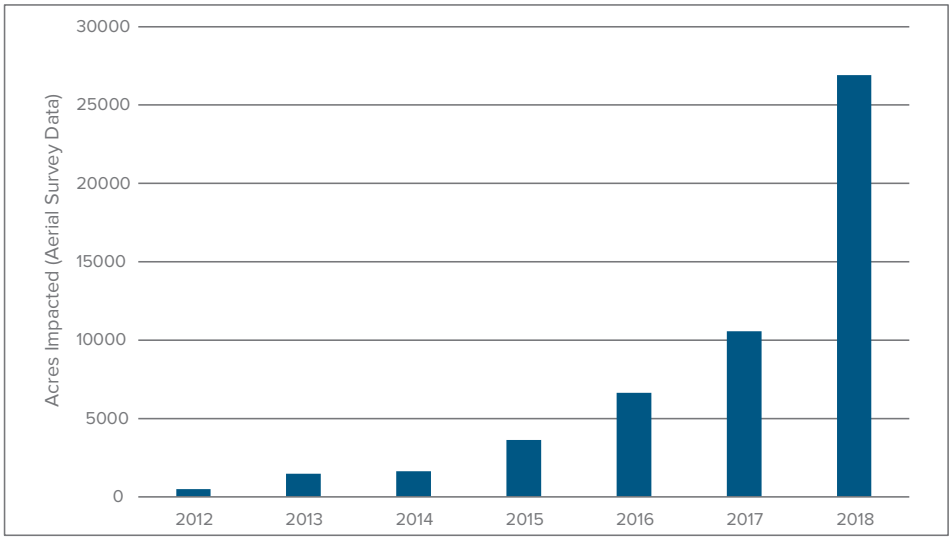
Colorado County	2017 Acres Affected	2018 Acres Affected
Ouray	1,600	950
Gunnison	–	150
Archuleta	400	70
Hinsdale	380	60

Intensity of Roundheaded Pine Beetle/Bark Beetle Complex, 2018



Roundheaded pine beetle and associated native bark beetle-caused mortality has increased exponentially in total area in Dolores County over the past six years.

Roundheaded Pine Beetle and Associated Bark Beetle-Caused Mortality in Colorado, 2012-2018



Western Spruce Budworm
(Choristoneura freemani)

Larvae of the western spruce budworm feed in the buds and on new shoots of Douglas-fir, true firs (*Abies* spp.) and spruce. Feeding on the needles causes a reddish-brown color in the branch tips and terminal ends of affected trees. Larval damage occurs from early in the spring through mid-summer, at which time the insects pupate and emerge as adult moths. Adults are typically active in July and August.

This moth has been Colorado's most damaging and widespread forest defoliator for a number of consecutive years. Heavy damage occurred in 2018 in most of the Douglas-fir forests in the southern portion of the state.

- 131,000 acres of Douglas-fir, true firs and spruce were impacted statewide in 2018.
- Significant areas affected included the southern Front Range; the Sawatch Range and West Elk Wilderness in the central portion of Colorado; the Culebra Range in the southern Sangre de Cristo Mountains; the Mosquito Range and Tarryall Mountains surrounding South Park; along the southern portions of the Rampart Range; and the western edge of the San Juan Mountains.
- Notable counties affected in 2018:

Colorado County	2017 Acres Affected	2018 Acres Affected
Saguache	75,000	30,000
Park	12,000	14,000
Dolores	5,000	13,000
Freemont	11,000	12,000
Gunnison	42,000	11,000
San Miguel	3,900	11,000
Chaffee	7,700	7,000
Custer	11,000	5,900

Piñon Engraver Beetle
(Ips confusus)

Piñon pines typically grow in harsh, low-elevation sites below the mixed-conifer/ponderosa pine forests of Colorado. Piñons often grow in proximity to juniper trees and shrubs, where conditions are dry and precipitation fluctuations are the norm. During prolonged periods of below-average precipitation, populations of the piñon engraver beetle can build in already-stressed piñon trees.

Isolated or localized tree mortality was observed in 2018 near the Colorado National Monument around Glade Park; and along the I-70 corridor near Rifle, Carbondale and Grand Junction. Record-warm temperatures and record-low precipitation along the Western Slope and in the southwest corner of Colorado are likely to produce continued dieback/die-off of piñon pines in these areas in the coming year.

A late-stage caterpillar of the large aspen tortrix, which is responsible for defoliating aspens in Colorado. Photo: Dan West, CSFS

A piñon pine expressing symptoms of attack from piñon engraver beetle, Chaffee County. Photo: Dan West, CSFS

Deciduous Forests

Defoliating Insects/Leaf Diseases of Aspen

Two insect species, western tent caterpillar (*Malacosoma californicum*) and large aspen tortrix (*Choristoneura conflictana*), can defoliate Colorado's aspen forests when at higher population levels. Western tent caterpillars produce and live within silken tents, typically in the crowns of affected aspen and cottonwood trees, although mountain mahogany, chokecherry and plums also are occasionally affected. The caterpillars are typically present in spring, though can be seen as late as September. Large aspen tortrix also feed upon the leaves of aspen, and roll the leaves into shelters in which they pupate. Adult tortrix are typically present in July and August.

- 12,000 acres of aspen forests were defoliated statewide in 2018, compared to 38,000 acres the prior year.

At a workshop in Montezuma County, Dr. Dan West, CSFS forest entomologist, describes to stakeholders and private landowners how bark beetles attack and kill ponderosa pines. Photo: Amy Lockner, U.S. Forest Service

- Notable counties affected by aspen-defoliating insects in 2018:

Colorado County	2017 Acres Affected	2018 Acres Affected
Archuleta	3,400	2,300
Conejos	2,300	1,400
La Plata	1,600	1,200
Gunnison	4,400	1,000
Mineral	1,600	1,000

Several species of leaf fungi are responsible in some years for the thinning or discoloration of aspens, poplars and cottonwoods in Colorado; in severe cases this damage forces affected trees to drop their leaves early. However, record-dry conditions in 2018 were not conducive to these fungal pathogens in the summer months, and no significant damage was observed in the aerial survey.

Other Broadleaf Disturbance

Thousand Cankers Disease/ Walnut Twig Beetle *(Pityophthorus juglandis)*

Thousand cankers disease is native to the Western United States and is the result of small twig beetles (*Pityophthorus juglandis*) feeding on primarily black walnut trees, and in the process spreading a canker-causing fungi (*Geosmithia morbida*). Black walnut trees continue to die off along the Front Range and Eastern Plains of Colorado. The most recent new detection occurred in 2017 in the community of Brush, in Morgan County. No additional detections occurred across the state in 2018.

Exotic Pests

The introduction and establishment of exotic – and potentially invasive – insects, fungi, plants and other organisms threatens forests worldwide. Invasive species can cause severe damage in their new habitats, as unfamiliar host trees may have little or no resistance to the introduced pest, and natural enemies may not be present to help keep invasive populations in check. Once established, invasive pests can be inadvertently spread by humans over long distances, via the transport of firewood, nursery stock and other plant material. Several exotic, invasive insects and diseases pose a threat to both native and urban forests in Colorado; two of primary significance are described below.

Japanese Beetle *(Popillia japonica)*

Japanese beetle is an invasive pest that affects hundreds of species of trees, grasses and plants in North America. The adult beetles damage flora by feeding on leaves, flowers and fruit, with larvae feeding on roots. This beetle was first detected in the U.S. more than a century ago. Although first detected in Colorado in the mid-1990s, populations had not established until 2003, initially in the Palisade, Colo., area. Eradication attempts there were successful after a seven-year effort. Meanwhile, discoveries of the beetle occurred in Denver in 2005 and subsequently in Pueblo in 2009.

Japanese beetles are a metallic-green color with copper-colored wing covers. Most insects have a primary feeding stage, being either larvae or adults. However, the challenge with Japanese beetles is that both larvae and adults cause significant damage to affected trees or plants. The larvae are white, C-shaped grubs that feed underground on the roots of grasses. Upon completing their development, adult beetles feed on the foliage and flowers of a wide range of plants. Foliage damage appears "skeletonized" as the adults typically feed between, but not on, the structural leaf veins.

In Colorado, linden, apple, crabapple, cherry, plum and peach trees are most affected. Grape, Virginia creeper, rose, raspberry, hollyhock and Rose of Sharon are plants that are also heavily affected. In 2018, Boulder, Denver and Pueblo had high Japanese beetle populations, while the remainder of Front Range communities experienced varying degrees of infestation, ranging from moderate to low. No new detections in 2018 occurred north of Fort Collins and Greeley, nor south of Pueblo.

Emerald Ash Borer *(Agrilus planipennis)*

Emerald ash borer (EAB) is an insect native to Asia, introduced into North America sometime during the 1990s. Since its initial discovery in Michigan in 2002, this insect has killed millions of true ash trees (*Fraxinus* spp.) throughout the central and northeastern U.S. and eastern Canada. EAB is now considered the most destructive tree insect ever to be introduced into North America.

Infestations were first detected in Colorado in the City of Boulder, in 2013. Approximately 15 percent of all trees in Colorado's urban and community forests are ash, making EAB a major threat to these forests statewide. New detections in 2018 occurred in the towns of Lyons and Superior, still within an established quarantine that primarily encompasses the generally infested County of Boulder. No additional detections in Colorado were reported outside of the county, though early detection of this pest remains difficult.

A collaborative Colorado EAB Response Team has been working together to coordinate surveys and pest management activities designed to limit

The invasive Japanese beetle infests a wide variety of flora in Colorado. The highest populations of this pest are in Boulder, Denver and Pueblo. Photo: David Cappaert, Bugwood.org

the spread and reduce the impact of this extremely destructive insect. Agencies and organizations represented on this team include the CSFS, Boulder County, City of Boulder, Colorado Department of Agriculture, Colorado State University Extension, Colorado Tree Coalition, Green Industries of Colorado, USFS, University of Colorado, USDA Animal and Plant Health Inspection Service (APHIS) and various municipalities. Representatives of this team have been instrumental in: evaluating traps designed to attract flying adult beetles for early detection of infestations; the release of four species of parasitic wasps that prey on EAB; maintenance of the quarantine for Boulder County and adjoining areas, intended to help restrict movement of infested plant materials; and providing up-to-date information on the insect's status and the most effective ways to protect trees.

Other Damaging Agents

Juniper Die-Back/Die-Off

The piñon pine-juniper forest cover type occupies more area than any other forest type in Colorado, at approximately 5.1 million acres of the state's 24.4 million forested acres. Below-average precipitation for numerous years in southern Colorado has predisposed Rocky Mountain juniper, one-seed juniper and Utah juniper to branch die-off and dieback. Cedar bark beetles (*Phloeosinus* spp.), juniper borers (*Atimia* spp.), the black-horned juniper borer (*Callidium texanum*) and the juniper twig pruner (*Styloxus bicolor*) are typically associated with dead and declining juniper trees.

Extreme springtime temperature fluctuations, coupled with numerous years of below-average precipitation, have resulted in some juniper dieback and die-off in the Four Corners region. No other causal agent has been associated with observed damage.

Pine Needle Scale *(Chionaspis pinifoliae)*

Pine needle scale feeds on the needles of most pine species, Douglas-fir, Engelmann spruce and Colorado blue spruce. During outbreaks, insects can settle on every surface of the needles, robbing the affected tree of nutrients. Heavy infestations can cause premature needle drop, branch dieback, increased susceptibility to other insects or disease, or even tree death. Lodgepole pines of every size, from small saplings to mature trees, can be heavily infested during outbreaks.

Pine needle scale has been active in many areas of the Fraser Valley and Vail Valley for the past several years. Activity declined in 2018 throughout Grand County, where the scale had caused significant tree damage from 2015 through 2017, though remained persistent in the communities of Grand Lake, Granby, Fraser, Winter Park and portions of Summit County. Communities along the I-70 corridor (including Empire, Vail, Breckenridge and Frisco) also had noticeable insect populations in both native and transplanted spruce, likely a result of prior heavy and sustained chemical preventive spraying for bark beetles. While chemical use to protect trees from bark beetles is effective, prolonged spraying also diminishes populations of beneficial insects that naturally keep scale infestations in check.

Dwarf and Leafy Mistletoes

Five species of dwarf mistletoe (*Arceuthobium* spp.) and one leafy mistletoe occur in Colorado. Dwarf mistletoes are leafless "holoparasites," deriving

An adult emerald ash borer on an ash leaf, Boulder County. Photo: Dan West, CSFS

both necessary carbohydrates and water exclusively from their host trees by sinking roots down into tree branches and stems. Shoots develop and produce flowers and seeds within five to six years. Seeds are dispersed locally from shoots, while long-range dispersal occurs via animals and birds. All native pines and Douglas-fir trees in the state are susceptible to dwarf mistletoe.

Dwarf mistletoes cause branches to swell at the infection site, subsequently forming large "witches brooms" that appear as densely clumped twigs, and eventually cause trees to become stunted and deformed. Infections can result in loss of tree growth and vigor, and susceptibility to other insects and diseases. Infested trees often are targeted for removal to improve overall stand health.

A range of infection severity regularly occurs across the state, from localized pockets and stand-level occurrence to severe infections that impact entire drainages and forests. Dwarf mistletoes continue to be a persistent problem for communities and forests statewide.

The only leafy mistletoe in Colorado, commonly known as the juniper mistletoe (*Phoradendron juniperinum*), occurs in the southwest corner of the state on several juniper varieties. This mistletoe is considered less aggressive than dwarf mistletoes, though is still impactful in harsh conditions where many junipers occur. Leafy mistletoes are "hemiparasites," deriving water and only partial carbohydrate needs from their tree hosts. Infection rates for this mistletoe are low in southwest Colorado; however, affects are noticeable in areas throughout Dolores, Montezuma and La Plata counties.

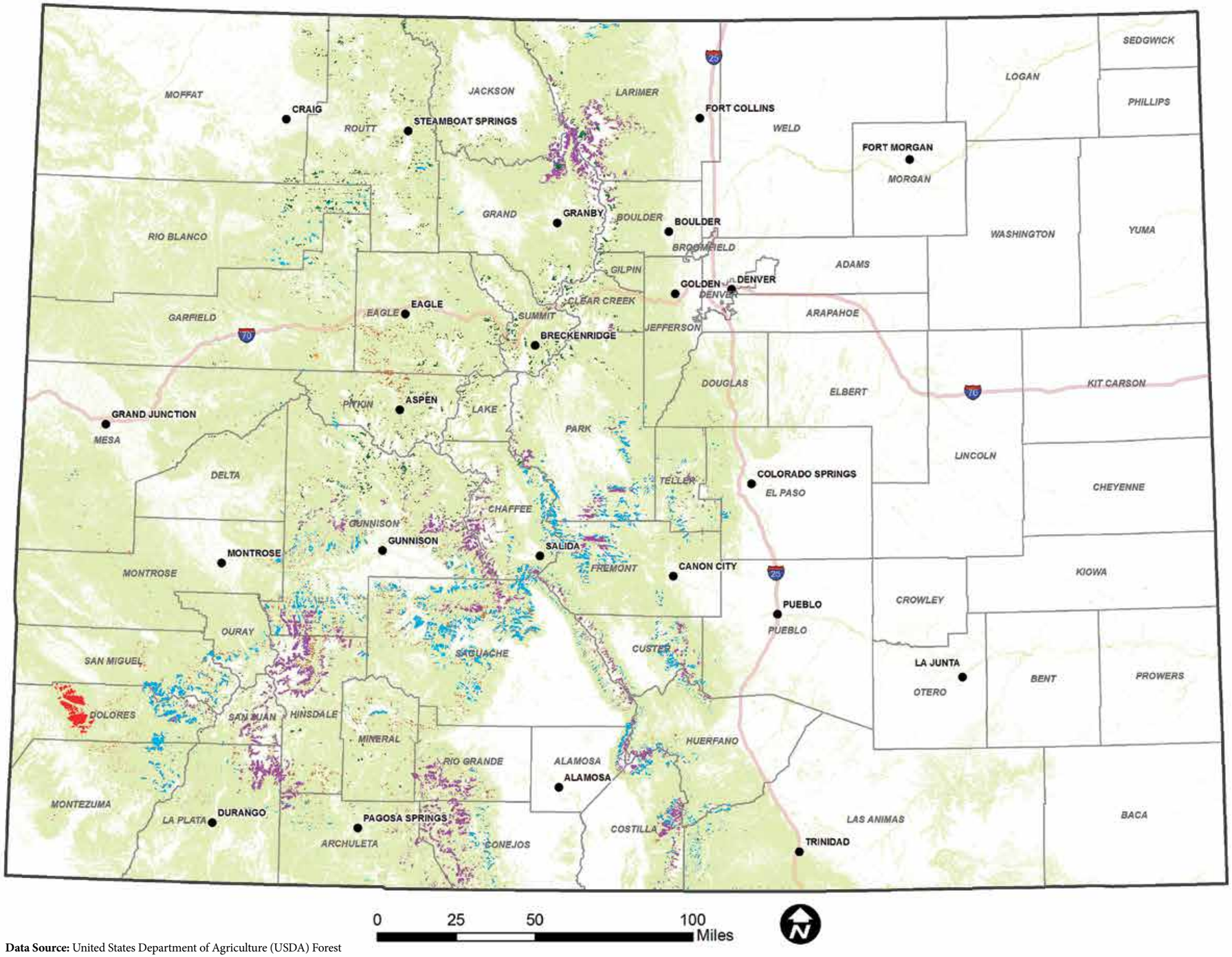
Lodgepole Pine Needle Cast

Lodgepole pine forests along I-70 over Vail Pass, and over Monarch Pass in Saguache County, were discolored by a needle cast disease in 2017. Premature needle drop of older needles and discoloration of older and new needles was caused by two species of fungi of the genus *Lophodermella* due to above-average precipitation in the spring of that year. Environmental conditions were unfavorable to these and other fungi throughout Colorado in 2018, and no new reports of incidence were recorded.

Juniper die-off and die-back in the Four Corners region, Montezuma County. Photo: Dan West, CSFS

A juniper tree infected with juniper mistletoe, Dolores County. Photo: Dan West, CSFS

2018 Insect and Disease Activity in Colorado Forests



Data Source: United States Department of Agriculture (USDA) Forest Health Assessment & Applied Sciences Team (FHAAST)

- **Forestland** — *24.4 million acres*
- **Western Spruce Budworm** — *131,000 acres*
- **Douglas-fir Beetle** — *14,000 acres*
- **Spruce Beetle** — *178,000 acres*
- **Western Balsam Bark Beetle** — *24,000 acres*
- **Bark Beetle Complex** — *27,000 acres*

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Some destructive diseases are not represented on the map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as an indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable, and not all trees in shaded areas are dead or defoliated.

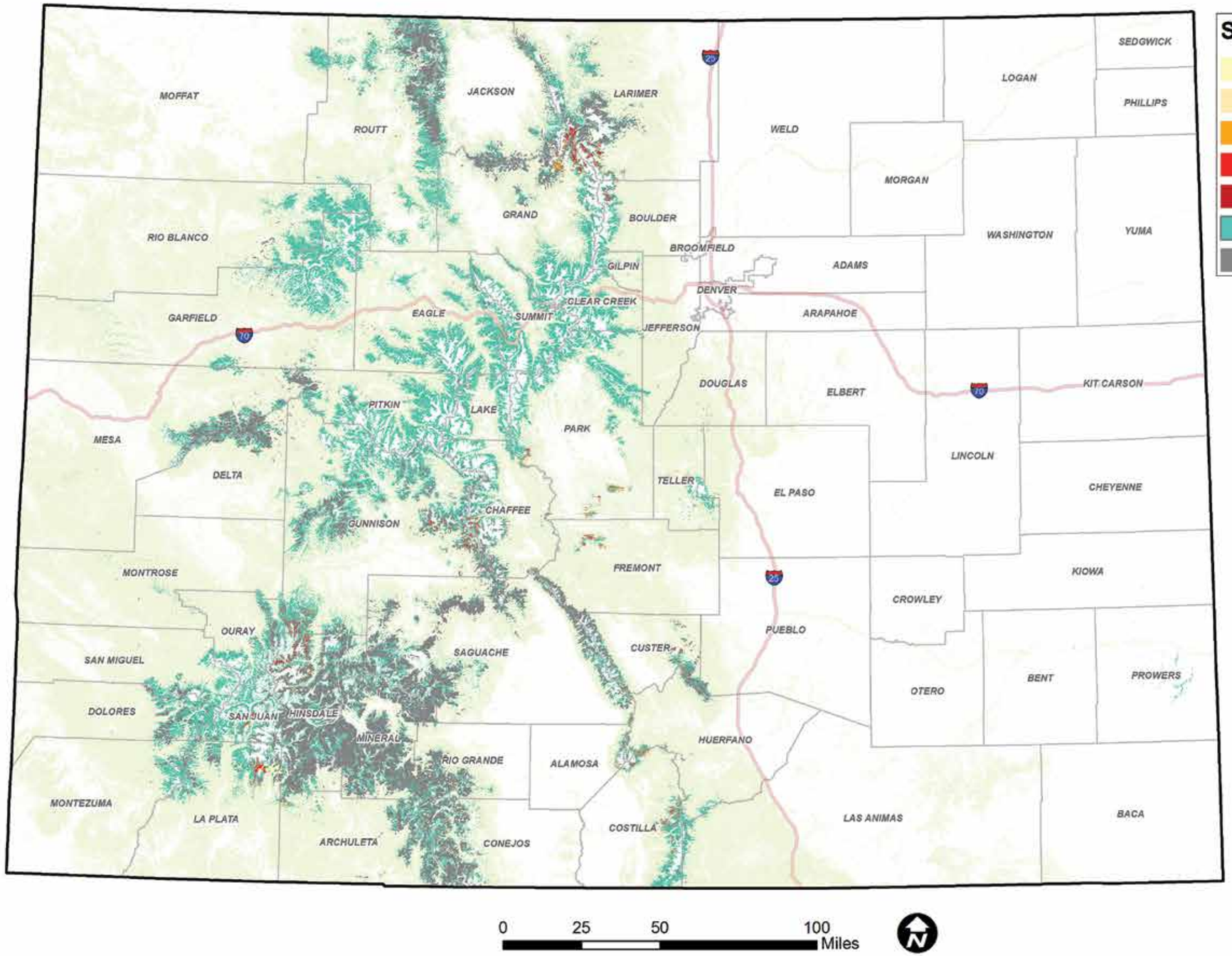
The insect and disease data represented on this map are available digitally from the USDA Forest Service, Region 2 Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this map for purposes other than those for which it was intended may yield inaccurate or misleading results.

Caution should be used when comparing this year's data to prior years, due to slightly differing sampling tools and variability between observers.

Map created December 2018
For more information:
www.csfs.colostate.edu
©CSFS

COLORADO STATE FOREST SERVICE
COLORADO STATE UNIVERSITY

Spruce Beetle Activity in Colorado Forests, 2000-2018



Spruce Beetle Intensity, 2018

- Very Light (1-3%)
- Light (4-10%)
- Moderate (11-29%)
- Severe (30-50%)
- Very Severe (>50%)
- Spruce-Fir Forest
- Spruce Beetle, 1996-2017

Spruce beetle intensity percent classes denote the number of dead trees relative to the total forested area within the polygon. Contiguous spruce forests susceptible to spruce beetle exist in the central part of the state, between the advancing fronts of separate ongoing outbreaks in the north and south.

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. The data presented on this map should only be used as an indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable, and not all trees in shaded areas are dead or defoliated.

The insect and disease data represented on this map are available digitally from the USDA Forest Service, Region 2 Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this map for purposes other than those for which it was intended may yield inaccurate or misleading results.

Caution should be used when comparing this year's data to prior years, due to slightly differing sampling tools and variability between observers.

Spruce-fir type represents Engelmann and/or blue spruce occurrence with basal area >1 (based on basal area data FHAAST*).

Map created December 2018
For more information:
www.csfs.colostate.edu
©CSFS

COLORADO STATE FOREST SERVICE
COLORADO STATE UNIVERSITY

***Data Source:** United States Department of Agriculture (USDA) Forest Health Assessment & Applied Sciences Team (FHAAST)

Special Section: Protecting Our Communities

Throughout Colorado and the West, 2018 proved to be another year of historical wildfires, expanding insect and disease challenges – including in urban and community settings – and increasing risks to water supplies and other benefits forests provide. For decades, forest management has played a key role in addressing these types of challenges by pre-emptively implementing actions that reduce negative impacts when a wildfire ignites or an invasive pest arrives in a new area. Many success stories related to proactive forest management can be demonstrated in any year, and 2018 was no exception. In this section are several examples of how actions taken by the Colorado State Forest Service and its partners are achieving safer communities and healthier forests.

Risk Reduction Efforts Prove Successful in 2018 Wildfires

The 2018 fire season saw more acres burned in Colorado than any other year except 2002. The state also witnessed five of the 20 largest wildland fires in recorded history. Many of the burned acres were within the wildland-urban interface (WUI) – any area where human improvements are built close to, or within, natural terrain and flammable vegetation.

The reasons for a historic wildfire year were complex, and included factors such as overly dense and unhealthy forest conditions; ongoing drought; wind and weather events that coincided with ignitions; and increasingly warmer weather linked to climate change. Of these factors, only one can be directly addressed by land managers. Working together, foresters and communities/ landowners are able to proactively address forest conditions with goals that include reducing forest stand densities to decrease insect and disease risk and the risk of intense wildfire, through targeted treatments.

To meet these goals, one of the best approaches is engaging landowners with information and resources that inform and enable them to implement the most effective treatments. The Colorado State Forest Service (CSFS), which is the lead state agency for providing fuels reduction and wildfire mitigation assistance, offers many resources and programs to help address risk to communities and ensure they are increasingly fire-adapted. These include guidance in developing Community Wildfire Protection Plans (CWPPs) and targeted fuelbreaks, leadership for the Firewise USA®

The blackened aftermath of the 2018 Buffalo Fire, which was halted in fuelbreaks buffering adjacent subdivisions. Photo: U.S. Forest Service

program in Colorado, and through creating and updating the Colorado Wildfire Risk Assessment Portal. But in 2018, a year of major wildfires in the state, these programs and efforts would be tested.

Fuelbreaks Help Save Mountain Subdivisions

In June of 2018, two fires burned perilously close to Colorado subdivisions in Grand and Summit counties, but did not result in the loss of life or destruction of property. One thing the Golf Course and Buffalo fires had in common was that besides highly capable fire management teams, they both encountered forests previously managed to alter fire behavior – and both fires were prevented from being highly destructive as a result.

The 20-acre Golf Course Fire, despite causing the evacuation of 300 homes as it burned west of Grand Lake, provided a perfect example of how proactive forest management can work in tandem with suppression efforts to minimize the impacts of wildfire. Firefighters and emergency responders made clear that a key reason they were able to protect the community was mitigation work by the CSFS intended to reduce wildfire risk.

"The forestry work and fuels mitigation the Colorado State Forest Service has administered in the Grand Lake community without a doubt saved the Columbine subdivision," said Chief Mike Long, Grand Lake Fire, immediately after the fire made its run.

Since 2015, the CSFS and its partners – which include the Grand County Wildfire Council, Grand Lake Metropolitan Recreation District, Northern Colorado Water and local forest products businesses – had completed 217 acres of targeted fuels treatments adjacent to subdivisions that were impacted by the fire. Treatments involved removing beetle-killed trees and the creation of fuelbreaks to reduce wildfire risk. Fuelbreaks are areas 300 or more feet wide, located near values at risk, where vegetation is thinned or removed to alter fire behavior and make fires less intense and more manageable for responders. In this case, the forest was composed chiefly of lodgepole pine trees previously killed by mountain pine beetles.

Firefighters were able to control the Buffalo Fire (footprint in red), before it destroyed any homes, within fuelbreaks (green and blue) created previously through proactive, interagency forest management efforts. Image: Zach Wehr, CSFS

Not far to the south, forest management work near Silverthorne, largely to create a 900-acre fuelbreak around subdivisions, also was attributed by fire managers as a major reason homes did not burn in the Buffalo Fire. Firefighters were able to stop the 81-acre fire within the fuelbreak, before it burned into many of the 1,400 evacuated homes and infrastructure worth nearly $1 billion. The fuelbreak also provided a safe and effective location for the more than 100 firefighters on-scene. Again, fire managers indicated that without the proactive fuels mitigation work, homes there likely would have been lost.

"The fuelbreaks reduced the number of trees available to burn next to homes, gave firefighters safe spots to aggressively fight the fire and provided for effective fire-retardant drop zones," said Bill Jackson, district ranger, White River National Forest, U.S. Forest Service.

Similar to the work done at Grand Lake, partnerships were key to completing the forest management work utilized to fight the Buffalo Fire. Proactive, cross-boundary work adjacent to Silverthorne communities completed over the past decade was only possible through a partnership between the CSFS, U.S. Forest Service, Denver Water and Summit County.

Firewise USA® Sites Benefit from Awareness, Actions

Firewise USA® is a national recognition program that provides instructional resources to inform people how to adapt to living with wildfire, and encourages neighbors to work together and take action to reduce their wildfire risk. The CSFS and National Fire Protection Association work together to implement the program in Colorado, with the CSFS providing technical assistance and education to interested landowners, homeowners and communities to help them take action and ownership in preparing their homes against the threat of wildfire.

The Falls Creek Ranch neighborhood, northwest of Durango, provides a perfect example of the benefits of increased awareness and action via the Firewise USA program. The neighborhood is one of many Colorado communities proactively working to reduce wildfire risk. A Firewise site since

2011, its residents have been actively doing fire mitigation work on the 100 private properties and forested community areas since 2002, after the Valley Fire destroyed 10 homes.

Years of fire mitigation work paid off for the neighborhood in 2018, when the 416 Fire struck on June 1. The fire surged toward it from the surrounding San Juan National Forest, but a spokesman for the fire's management team indicated that the firefighters assigned to protect homes took advantage of the mitigation work done by residents. Their efforts had made structures more defensible and created a safer work environment for emergency responders. The firefighters were better able to focus on home protection and setting up hose lines and sprinklers, because significant amounts of flammable natural fuels had already been removed to reduce risk.

Adam Moore, a supervisory forester for the CSFS Southwest Area, can personally attest that this has been one of the area's most active Firewise USA sites.

Community efforts likely helped protect many of the homes that were saved.

"Their committee monitors fire mitigation projects, identifies areas for future hazardous fuels reduction, recommends updates to their Community Wildfire Protection Plan, contributes volunteer hours to mitigation projects and works with neighbors to educate them on wildfire dangers," he said.

Another Firewise USA community Moore works with was impacted during the destructive 2018 wildfire season. The Forbes Park community, located in the Sangre de Cristo Mountains on the eastern edge of the San Luis Valley, was not as fortunate as Falls Creek Ranch. Nonetheless, community efforts likely helped protect many of the homes that were saved.

The last fire to burn through the area had occurred more than a century ago, and some forested areas were so thick with deadfall that they were difficult to walk through. To address the concern of excessive woody fuels, landowners in the 14,000-acre community had been working with the CSFS on fire mitigation efforts over the past two decades. One challenge that existed in that community was that many of the landowners are absentee. Also, the majority of the

The 416 Fire ultimately burned 54,000 acres as it surged toward the Falls Creek Ranch neighborhood, but no homes were lost – in part because firefighters were able to take advantage of prior fuels mitigation work. Photo: Kyle Miller, Wyoming Interagency Hotshot Crew

Advisory Council Addresses Wildfire Impacts to Colorado Communities

House Bill 16-1255 created the Forest Health Advisory Council (FHAC) to advise the Colorado State Forester on how the state can effectively respond to forest health challenges. The makeup of the council includes a wide range of local and regional representatives from across the state. Members are appointed by the Governor or state legislative leadership, and include representatives from wood products businesses, environmental organizations, county commissioners, public utilities, municipal drinking water providers and wildlife organizations.

Due to the strategic makeup of the council, members are able to provide critical insights on the varying issues related to forest health and wildfire risk in local communities throughout the state; discuss strategies to mitigate these effects; and convey related messages to legislators at the State Capitol.

According to a 2018 study by Headwaters Economics, almost half of the community costs of wildfire are paid for at the local level, including by homeowners, businesses and government agencies. The FHAC recognizes this problem and seeks to encourage and incentivize planning at the community level, to reduce the costs of forest health and wildfire concerns to local communities.

"The makeup of the membership of the Forest Health Advisory Council is key to developing statewide approaches to plan for and recover from wildfires," said State Rep. Jeni Arndt. "The members of the council inform members of the Colorado General Assembly on how we can help mitigate these issues on a statewide level moving forward."

Members of the FHAC can draw upon their local relationships to identify issues and solutions involving forest health and wildfire risk. Through a collaborative process, these contacts and relationships aid in the formation of recommendations from the council to mitigate effects of wildfires to citizens, property and infrastructure throughout the state.

Actions identified by the FHAC for the state to improve forest health and reduce wildfire risks include coming up with new sources of funding for forest management treatments, shifting funding to active management in an attempt to decrease fire suppression costs, and increasing the use of prescribed fire as an aspect of forest management.

properties did not have homes built on them, nor mitigation work completed.

In 2016, the community worked with the CSFS to become a Firewise USA site, primarily to engage more of its residents and landowners in mitigation efforts. The CSFS Alamosa Field Office completed a Community Assessment that year, which indicated that despite the completed mitigation work by many residents, much of the community still required significant efforts to be better protected in the event of an intense wildfire. Then in June 2018, the Spring Creek Fire ignited just two miles away.

The fire ran through the community under severe conditions compounded by extreme drought, high winds and steep terrain – in many areas, as a crown fire burning with flames towering hundreds of feet. It ultimately became the third largest fire in state history at 108,045 acres, and destroyed 134 of the 321 homes in Forbes Park. Thankfully, no lives were lost.

"We do feel the additional mitigation efforts residents had taken since becoming a Firewise USA community in 2016 helped save many of the homes in Forbes Park," said Robert J. Vannerson, president of the Forbes Park Landowners Association. "Our landowners now wish we had become a Firewise community much sooner, so maybe more homes could have been saved."

Good Neighbor Authority Addresses Fire, Watershed & Wildlife Concerns

The Good Neighbor Authority is a national program that allows cross-boundary forest treatments on federal lands, and effective sharing of limited resources between federal and state agencies, to achieve landscape-scale impacts. The authority is providing a mechanism through which the Colorado State Forest Service (CSFS) is currently working on numerous projects on both private and National Forest lands, utilizing state contracting procedures for increased efficiency. One such project is located near Steamboat Springs.

The CSFS began working with the U.S. Forest Service (USFS) in the spring of 2016 to address wildland fuels reduction and improve

The feller-buncher is a common type of harvesting equipment, used during larger forest management projects and to help create fuelbreaks. Photo: Kelsey Lesniak, CSFS

wildlife habitat adjacent to the City of Steamboat Springs. The USFS had identified and completed environmental assessments on 38 areas in need of treatments as part of a larger project known as the "Steamboat Front." The proposed treatments included logging dead lodgepole pine forests and thinning and mulching trees in areas of dead/dying aspen and dense Gambel oak and other shrubs. The treatments were designed to reduce the risk of wildfire to the community and its water supplies and, in the process, improve critical wildlife habitat.

These projects have been especially timely, as the area has experienced drought and large fires over the past several years.

An agreement was signed between the CSFS and the USFS, and funding for the project was initially provided entirely by the USFS. Almost immediately, the project became a success. In the first season alone, managers met the total original project target acres, at lower than anticipated costs. The interagency agreement was then extended and the project acquired new partners and funding from the City of Steamboat Springs, Colorado Parks and Wildlife, the Habitat Partnership Program and private landowners.

The current focus of the project has been to establish fuelbreaks in the forest and brush lands along the eastern side of Steamboat Springs' wildland-urban interface (WUI), where USFS lands meet and intermingle with private lands. These areas also include critical winter range habitat for wildlife. Fuels

Colorado Wildfire Risk Assessment Portal Updated in 2018

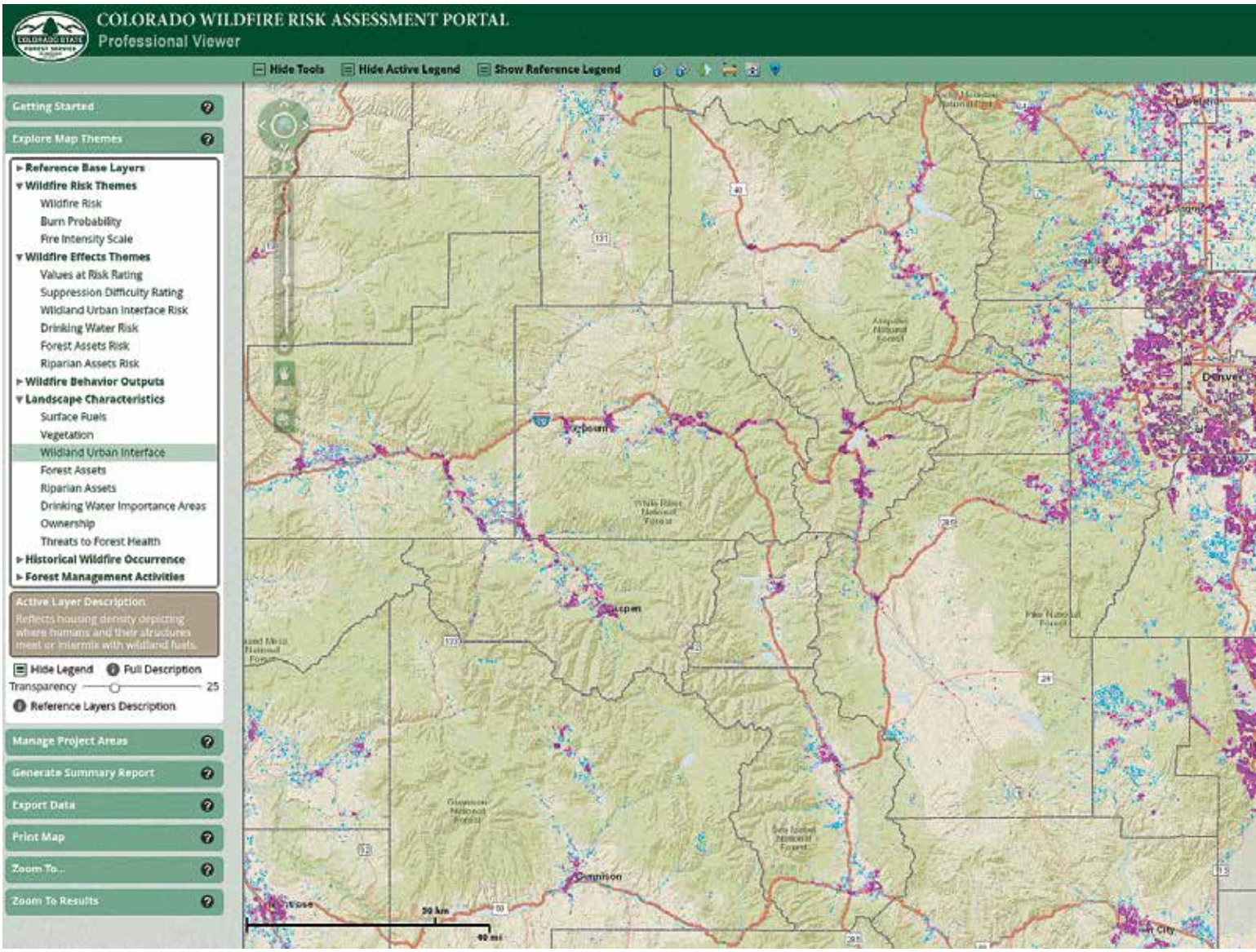
As Colorado's population continues to grow, particularly in the wildland-urban interface (WUI), wildfire risk management is increasingly important. Both inside and outside the WUI, risk management should involve stakeholders from the community; local, county and state governments; and federal agencies. The Colorado State Forest Service (CSFS) first developed the Colorado Wildfire Risk Assessment Portal (CO-WRAP; www.coloradowildfirerisk.com) in 2013 to help stakeholders assess wildfire risk and evaluate resources and assets, including developed areas, forests, riparian habitats and drinking water, which all can be impacted by wildfire. CO-WRAP hosts data from the Colorado Wildfire Risk Assessment, first produced in 2012 using the best available science and data to tailor a West-wide quantitative risk assessment framework developed by the U.S. Forest Service.

The number of Coloradans living in areas at risk to wildfire increased from 2 million people in 2012 to 2.9 million in 2017.

Recognizing the increasing challenges to wildfire risk management and changing landscapes across Colorado, the CSFS completed a major update to the risk assessment in 2017 using new population, vegetative fuels, burn probability and other ancillary data. Among the key findings from new data was that the number of people living in areas at risk to wildland fire increased from approximately 2.0 million people in 2012 to approximately 2.9 million people in 2017. This increase is due to multiple factors, including advancements in data derived from the Landscan (i.e., population) and Landfire (i.e., vegetative fuels) programs and increasing suburban development in low-risk WUI areas of Colorado.

CO-WRAP has now been updated by the CSFS to provide access to the data and information associated with the 2017 Colorado Wildfire Risk Assessment. The CO-WRAP website features two online applications: one for the public and one for registered professional users. These applications can be used to create public awareness about wildfire risk; provide land managers with information to support mitigation and prevention efforts; identify areas that may require additional planning; assist in the development of Community Wildfire Protection Plans (CWPPs); complement forest management plans; and inform decision-making at local and state levels.

More information about how to reduce wildfire risk to homes and communities is available from a local CSFS field office or csfs.colostate.edu/wildfire-mitigation.

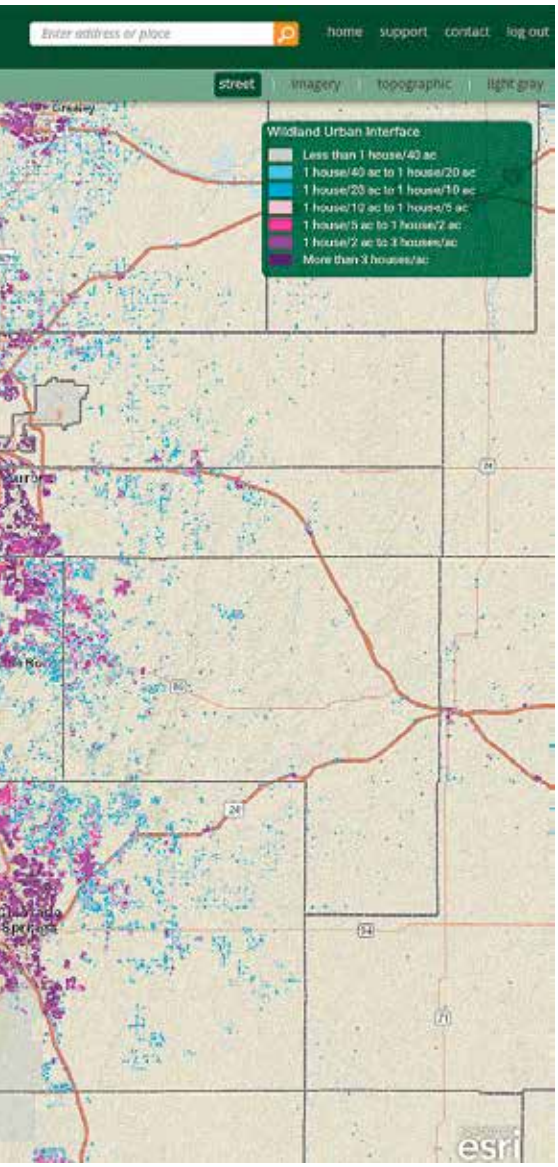


CO-WRAP allows users to view numerous data layers at different scales, such as the wildland-urban interface on Colorado's Front Range. Image: CSFS

Tree inventories require not only recording tree species and locations, but also attributes such as trunk diameter and overall health. Photo: Grace Mirzeler, Council of Western State Foresters

treatments that change forest structure assist in renewing important plant food sources for elk, deer and other wildlife. Treatment units were selected in all cases through a collaborative process between the partners to meet as many beneficial goals as possible. Although the majority of the funds to implement these treatments have come from the USFS, the CSFS has since coordinated funding from a variety of other stakeholders to meet the project goals.

This project has now treated more than 300 acres of federal land in the Steamboat Springs WUI and approximately 60 acres



CSFS Begins Long-Term Inventory of Community Trees

Many people may be unaware of all the benefits neighborhood trees provide. They help moderate air and water pollution, reduce heating and cooling costs, and increase property values. Having trees in parks, green spaces and backyards provides wildlife habitat, improves mental health and strengthens social connections.

To understand how community forests positively influence neighborhood pride and provide economic benefits and ecosystem services, the U.S. Forest Service is currently collaborating with the Colorado State Forest Service (CSFS) to conduct a thorough inventory to understand the impact trees have on Colorado residents' daily lives. This systematic and sample-based urban inventory is the newest extension of the national Forest Inventory and Analysis (FIA) Program, which has been sampling Colorado's 24 million acres of forestland for the past 20 years. With over 500 plots in Denver, Colorado Springs and other communities in the state, the CSFS is working with city foresters, private landowners and small businesses to collect detailed data on tree and ground cover.

By quantifying the structure of neighborhood trees and environmental services that community forests provide, foresters can ascertain emerging trends related to tree health, diversity, and size; wood usage; hazard assessments; stormwater flow; carbon flow estimates; energy conservation; air pollution impacts; and insect and disease threats. From permanent plots that will be re-measured every five to 10 years, these data and subsequent reports can highlight the impacts of urban growth; changes in land use; fire hazards and risk; droughts; storm events; and regional changes in Colorado's climate. City planners will also be able to compare Colorado's urban forests to other states to better allocate resources and implement water conservation strategies.

on adjacent private lands. These projects have been especially timely, as the area has experienced drought and large fires over the past several years. Most importantly, the Steamboat Front Project provides an example of federal and state natural resource agencies working in closer partnership with private landowners to address landscape-scale issues of common concern.

"Working with the Colorado State Forest Service on the Steamboat Front Project has been an excellent experience," said Kevin Thompson, South Zone Fire Management Officer, USFS, "from working with their Steamboat Springs Field Office staff, to the ability to treat lands on National Forest and private land to create more effective breaks in the fuels."

Tree Inventories Safeguard Communities, Ensure Benefits

The benefits trees provide to urban and community settings are almost too numerous to count. From cleaning the air to reducing energy costs and increasing property values, they are a key part of Coloradans' lives and neighborhoods. However, trees, like all living things, have a finite life. Managers must not only plant trees to take advantage of future benefits and fill gaps created by those that succumb to diseases, insects and old age, but also address dead and dying trees – and the potential threat these "hazard trees" pose to life and property when they fail. And because it can take decades for a newly planted tree to reach a size that provides the maximum benefits to a community, steps also must be taken to protect existing community trees.

Hazard Tree Assessments

One of the key steps to protecting community trees, and those who benefit from them, is conducting a tree inventory. In a typical inventory, a community tree manager will contract a professional forester or certified arborist to assess community-owned trees to determine their exact locations on a map, component species, sizes, conditions, placement and management needs. Most managers also want to know if any trees pose potential risks to people, property or activities. A frequent public park visitor may not perceive dead or hanging

branches in a large tree as problematic, but to the park manager this condition may be of serious concern.

To correctly determine the level of risk for a tree, a professional forester or certified arborist needs to know several specifics about the tree and how they interact with each other: life expectancy, biology, the presence of pests, wood strength, failure tendencies, and structure and growth patterns. This knowledge is acquired through personal experience, specific education on trees (e.g., forestry, horticulture or arboriculture coursework), or industry-based courses on specific subjects, such as tree risk or plant pathology. Any competent tree risk assessor will possess all of the above skills, or know where to find someone with a particular skill.

Working through its field offices, the Colorado State Forest Service (CSFS) has trained staff capable of completing tree inventories that include a risk assessment component to identify hazard trees. CSFS foresters annually provide tree inventory and tree risk services to many local communities, school districts, HOAs, special districts and state parks. The goal of every tree inventory that includes a risk assessment is to provide definitive data that will help managers prioritize work, as they endeavor to mitigate risks and enhance public safety.

Vince Urbina, CSFS urban and community forestry specialist, leads a hazard tree risk training for staff. Photo: Grace Mirzeler, Council of Western State Foresters

Inventories Help Manage an Invasive Pest

Aside from viewing tree risk from a public safety perspective, there is another significant risk now building in the urban and community forests in Boulder County: a highly destructive, invasive tree pest called emerald ash borer (EAB). This wood-boring pest, which was first detected in Colorado in 2013 and has since spread throughout Boulder County, will attack and ultimately kill all untreated, true ash trees (genus *Fraxinus*) it encounters. EAB has already caused billions of dollars in damage in the U.S. and is responsible for the death of millions of ash trees in 35 states and five Canadian provinces. Detailed tree inventories are providing one means to best manage this pest in Colorado.

Information gathered from urban tree inventories has allowed managers to view species diversity in a defined area, including the prevalence and location of ash trees. In most of Colorado's non-mountain communities, ash trees represent a significant percentage of individual trees in the community, and an even more significant portion of the urban tree canopy – a sometimes overlooked but vital resource in cities and towns. Ash in many municipalities are the predominant tree type, accounting for 15 percent or more of all species, and for canopy cover that may exceed 30 percent of the total provided by all trees. Through inventories, city foresters and others have been able to determine where ash are located and which they intend to treat, remove or replace.

The CSFS role with EAB and other urban tree pests continues to focus on outreach, education, detection, assessment and planning, to ultimately protect and make the future urban forest more resilient to invasive insect and disease attacks. CSFS staff have been part of the interagency Colorado EAB Response Team since 2013, serving varied roles in the response effort. The Colorado Tree Coalition is another engaged partner to manage EAB in the state, providing programs and tools that help communities inventory, assess, plan and manage for ash tree treatments, removals and replacements.

The response to EAB in Colorado has gotten off to a good start. CSFS survey data from 2018 show that nearly 18,000 public ash trees have been treated or removed, another 17,000 trees planted to replace ash, and $9.2 million spent on EAB management by responding communities. These figures make it clear that EAB is already having a major impact on both communities that have already detected EAB and those that haven't yet, but which have begun implementing proactive management plans.

Managing Forests, Protecting Communities Requires a Team Effort

Each year, Colorado's population continues to increase. Most of this population increase is occurring in areas where forests, community trees and related processes can have significant impacts on Colorado residents: in the wildland-urban interface (WUI), which as of 2017 has 2.9 million residents, and urban or suburban areas, which rely heavily on the benefits that planted trees and healthy forests provide. Wildfire remains the most significant risk for homeowners where homes and forested land intermix. As demonstrated in this report, we are already seeing how forestry and wildfire mitigation efforts are able to effectively and pre-emptively address risks posed in the face of an increasing population.

In the face of such pervasive change, we must remain dynamic in our approaches to achieve forest stewardship.

Forest management efforts must be both proactive and responsive to the impacts of population and land use changes, to ensure that our forests continue to provide numerous benefits while minimizing associated risks that can impact lives, property, water supplies, recreation, wildlife and the availability of wood products. Agencies including the Colorado State Forest Service (CSFS), U.S. Forest Service and Bureau of Land Management are largely responsible for addressing forest health and wildfire risk at a larger scale, but we cannot be successful working alone. Besides joining together to address cross-boundary concerns through use of tools like the Good Neighbor Authority, our agencies rely on the insights and assistance of numerous partners, from water providers and local governments to other state and federal agencies, local fire protection districts, the wood products industry and nonprofits.

With nearly a third of Colorado's forestlands being privately owned, homeowners and communities also are vital partners in collective efforts to address forest management and wildfire mitigation concerns. It is important for homeowners to take steps to ensure that trees and shrubs are thinned near structures to reduce wildfire risk and, when possible, utilize fire-resistant building materials. Living in the WUI entails a personal responsibility to mitigate risk, and taking these measures will help protect life and property and provide safer conditions for firefighters during a wildfire.

The CSFS works closely with citizens around the state to not only provide resources and assistance, but also to determine needs and concerns to better inform broader forest management priorities and strategies. Ultimately, the Colorado General Assembly – as well as lawmakers and decision-makers at the national and local levels, who have the ability to determine policies and ensure necessary resources – plays a key role in enabling forest managers and their partners to have the greatest positive impacts.

Our forests are growing and changing in real-time, just as populations in forested and urban areas alike continue to expand. At the same time, we are observing shifts in our regional climate and related impacts to our forests, largely in the form of insect and disease issues. In the face of such pervasive change, we must remain dynamic in our approaches to achieve forest stewardship. The partnerships we cultivate and resulting actions we take in this ever-fluctuating setting will ensure that we are able to achieve stewardship of our state's forests, and maintain the benefits they offer to all citizens of Colorado for generations to come.

Max Erickson, CSFS Golden Field Office forester, leads a site tour of the Heavens Project in Jefferson County. The project is designed to address forest restoration, wildfire risk and protection of water resources on private lands, as part of the larger Upper South Platte Partnership. Photo: Nate Beckman, CSFS

References

Colorado Emerald Ash Borer Response Team. 2018. *Colorado Community Emerald Ash Borer Management Update.* Survey response data obtained from city foresters, April/May 2018.

Colorado State Forest Service. 2018. Urban FIA Program overview for Colorado. Accessed Oct. 10, 2018 from https://csfs.colostate.edu/forest-management/forest-inventory-analysis/urban-fia/.

Colorado State Forest Service and Colorado Division of Fire Prevention and Control. 2018. Colorado's 20 Largest Historical Fires by Acreage, document as of Dec. 6, 2018.

Headwaters Economics. 2018. The Full Community Costs of Wildfire (research report), May 2018, 44 pp.

Inciweb – Incident Information System. 2018. Spring Creek Fire (online incident information). Final update, July 27, 2018.

Martin, B. 2018. Recent fuels mitigation 'without a doubt' saved Columbine subdivision from Golf Course Fire, fire chief says. *Sky-Hi News,* July 2, 2018.

Moore, A. 2016. Forbes Park Landowners Association Community Assessment. Colorado State Forest Service, 28 pp.

National Interagency Fire Center. 2018. Historical year-end fire statistics by state. Accessed Dec. 12, 2018 from https://www.nifc.gov/fireInfo/fireInfo_statistics.html.

Rocky Mountain Area Coordination Center. 2018. GACC Detailed Situation Report - by Protection. Report Date: Dec. 11, 2018, https://gacc.nifc.gov/rmcc/intell.php.

Romeo, J. 2018. Years of fire mitigation pays off in Falls Creek Ranch. *The Durango Herald,* June 21, 2018.

Scott, J.H.; Thompson, M.P.; Calkin, D.E. 2013. A wildfire risk assessment framework for land and resource management. Gen. Tech. Rep. RMRS-GTR-315. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83 pp.

University of Washington. 2018. Green Cities: Good Health (research compilation on urban forestry topics). Accessed Oct. 15, 2018 from https://depts.washington.edu/hhwb/.

USDA Forest Service. 2018. Proactive fuel breaks protect nearly $1B in homes, infrastructure during wildfire (news release). June 28, 2018.

USDA Forest Service. 2018. Urban FIA Program overview. Accessed Oct. 10, 2018 from https://www.nrs.fs.fed.us/fia/urban/.

USDA Forest Service, Rocky Mountain Region, Forest Health Protection. 2010. Field guide to diseases & insects of the Rocky Mountain Region. Gen. Tech. Rep. RMRS-GTR-241. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 336 pp.

Western Regional Climate Center. 2018. Climate Anomaly Maps and Tables, Colorado. Accessed Oct. 2, 2018 from https://wrcc.dri.edu/anom/col_anom.html.

Acknowledgments

Special thanks to the following Colorado State Forest Service (CSFS) State Office personnel for providing leadership in the production of this report:

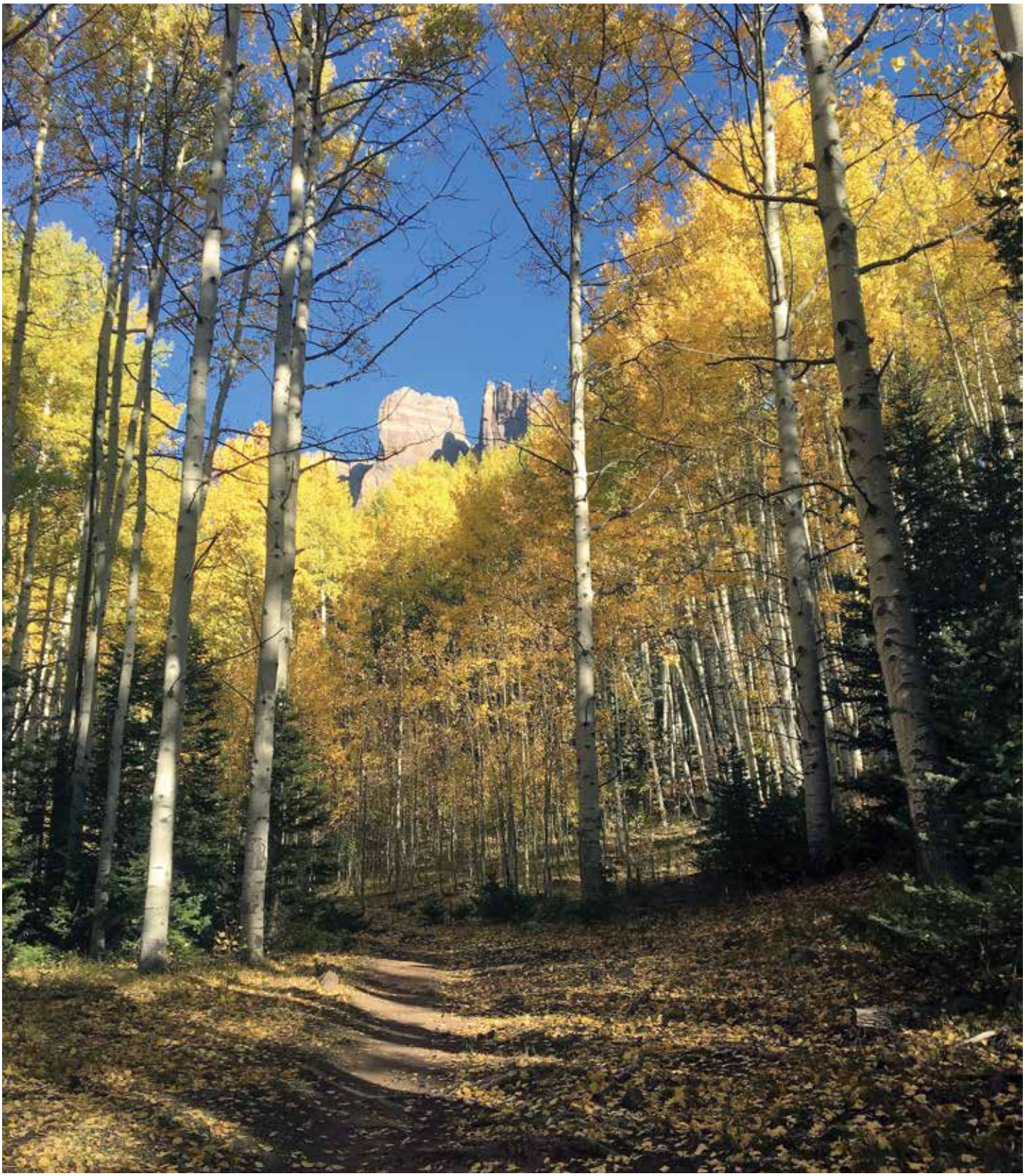
- Carolyn Aspelin, Policy Specialist
- Pete Barry, GIS Specialist
- Joseph Duda, Deputy State Forester
- Kristin Garrison, Fire, Fuels and Watersheds Manager
- Ryan Lockwood, Communications Manager
- Susan Matthews, Associate Director of Forestry Services
- Wilfred Previant, Forest Inventory & Analysis (FIA) Manager
- Jeff Underhill, Associate Director of Science and Data
- Amanda West, Science Information Manager
- Dan West, Entomologist

The following individuals provided additional content, information, guidance and technical review:

- Dan Beveridge, Wildfire Mitigation Specialist, Forest Planning and Implementation Division, CSFS
- Jason Lawhon, Director of State & Private Forestry and Tribal Relations, Rocky Mountain Region, U.S. Forest Service
- Carolina Manriquez, Forester, Northwest Area, CSFS
- Adam Moore, Supervisory Forester of Communications and Communities, Southwest Area, CSFS
- Vince Urbina, Urban and Community Forestry Specialist, Communications and Communities Division, CSFS
- Doug Vilsack, Legislative Liaison, Colorado Department of Natural Resources
- Madeleine West, Assistant Director for Parks, Wildlife and Lands, Colorado Department of Natural Resources
- Keith Wood, Urban and Community Forestry Manager, Communications and Communities Division, CSFS

The following individuals reviewed and/or provided information for the aerial survey results presented in this report:

- Justin Backsen, Aerial Surveyor, U.S. Forest Service, Lakewood, Colo.
- Brian Howell, Aerial Survey Program Manager, U.S. Forest Service, Lakewood, Colo.
- Roy Mask, Assistant Director, Forest Health Protection, U.S. Forest Service, Lakewood, Colo.
- Jennifer Ross, Geographic Information Systems Specialist, U.S. Forest Service, Monument, Colo.



In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

01183000

Above: *Colorado aspens in fall splendor, along the Mill-Castle Trail in the West Elk Wilderness. Photo: Kelsey Lesniak, CSFS*

Back cover photo: *The 2018 Ryan Fire burned more than 28,000 acres northwest of Walden, in both Colorado and Wyoming. Photo: Kyle Miller, Wyoming Interagency Hotshot Crew*

THE MISSION OF THE COLORADO STATE FOREST SERVICE IS TO ACHIEVE STEWARDSHIP OF COLORADO'S DIVERSE FOREST ENVIRONMENTS FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.

COLORADO STATE FOREST SERVICE
COLORADO STATE UNIVERSITY

Colorado State University
5060 Campus Delivery
Fort Collins, CO 80523-5060
(970) 491-6303
csfs.colostate.edu

COLORADO
Department of Natural Resources

Division of Forestry
1313 Sherman Street, Room 718
Denver, Colorado 80203
(303) 866-3311
dnr.state.co.us

WARNER COLLEGE OF NATURAL RESOURCES
COLORADO STATE UNIVERSITY

Colorado State University
1401 Campus Delivery
Fort Collins, CO 80523-1401
(970) 491-4994
warnercnr.colostate.edu