

United States
Department of
Interior

Bureau of Land
Management

March 2003



Wildland-Urban Interface Assessment

Thermopolis, Wyoming



For Information Contact: Bureau of Land Management
Worland Field Office
101 South 23rd
P.O. Box 119
Worland, WY 82401-0119

Prepared by: North Wind, Inc.
603 Greybull Avenue
Greybull, Wyoming 82426



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1.0 Background

Wildfire risk assessments are important tools to determine the threat of wildfires at the wildland-urban interface. These assessments are used to develop wildfire protection strategies throughout the western United States. Increased urban development in rural areas, costly fire seasons like 2000 and 2002, new national directives that increased funding for wildfire protection, and a recognition of a change in fire fuel composition, structure, and loading has provided the impetus for wildfire risk assessments for communities “at risk”. As a result of the 2000 fire season, which burned 8.4 million acres, cost 1.3 billion dollars, and destroyed 861 homes, the President of the United States directed the Departments of Agriculture and Interior to develop a report that “recommends how best to respond to the year’s severe fires, reduce the impacts of these wildland fires on rural communities, and ensure sufficient firefighting resources in the future” (USDA and USDI 2000). The result was the National Fire Plan (NFP), a 2.9 billion dollar program (FY 2001) to assist federal, state, and local firefighting agencies and programs. The report focused on 5 key areas: 1) firefighting; 2) rehabilitation and restoration; 3) hazardous fuel reduction; 4) community assistance; and 5) accountability (USDA and USDI 2000). The NFP puts particular emphasis on protecting homes at the wildland-urban interface, which is the transition zone between urban development and the natural landscape.

This assessment was funded by NFP money and selected by BLM managers due to recent large fires near Thermopolis, Wyoming (183,000-acre Kate’s Basin Fire and 22,000-acre Mud Creek Fire), the proximity of homes to federal land, and the need to assess fuels at the wildland-urban interface.

The purpose of this assessment is to determine the level of wildland fire risk to homes west and southwest of Thermopolis.

1.1 Area Description

The town of Thermopolis (pop. 3,500) is located in north-central Wyoming. ([Appendix C, Map 1](#)). It is the county seat of Hot Springs County and is located four miles north of Wind River Canyon along the Big Horn River. The Owl Creek Mountains are to the south. The wildfire risk assessment area described in this report is west and southwest of Thermopolis, where new development has occurred over the last decade.

The Sage Valley Subdivision consists of 13 homes, including house trailers, manufactured homes, log homes, and conventional wood-frame homes. Lots are one to three acres in size. Roads are graveled with cul-de-sacs. Bureau of Land Management (BLM) ownership surrounds the subdivision to the south, east, and west. Most of the homes are within one-half mile of the highway.

The Sable Run Subdivision is south of Thermopolis and west of Highway 20. There are 24 homes on the loop formed by Lane 12 and Rimrock Road. Coyote Run Road (11 homes) is a developed gravel road that spurs west of Lane 12. Home types include house trailers, manufactured homes, log homes, and conventional wood-frame homes. All have either composite or metal roofs. BLM land is located to the west, north, and south. The Wind River Indian Reservation and Owl Creek Mountains are to the south.

1.2 Firefighting Resources

Thermopolis has a 25-person volunteer fire department (VFD). Equipment includes two Class A engines, two Class B structure engines, one 800-gallon water tender, two military 6 x 6 trucks each with a 1,400 gallon capacity, and three Type 6 engines. The department is the primary fire response for Hot Springs County. The majority of dispatch calls received are for wildland fires. The average response time to the Sage Valley or Sable Run Subdivision is 10 minutes.

2.0 Fuel Assessment

The assessment area is separated into two sections. The first is a 400-acre parcel in all or parts of Section 29, T43N, R95W. This parcel extends north to highway 120. The second is a 2,000-acre parcel, south of Sage Valley Subdivision in all or parts of Section 4, 5, 6, 7, 8, and 9, T42N R95W). Vegetation consists of bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and Rocky Mountain juniper (*Juniperus scopulorum*). Juniper is encroaching into the sagebrush steppe from the draws and ridges. For the purposes of clarification, survey points are referenced by general vicinity, legal description, and dominant vegetation ([Appendix C, Map 2](#)). For photos of the assessment points, see [Appendix B](#). Copies of original field forms are included in [Appendix D](#).

2.1 Points 23, 24, 25, 26; Section 29, T43N, R95W.

These points are northwest of the Sage Valley Subdivision, immediately south of Highway 120, and cover approximately 400 acres of open rangeland. Two plateaus rise from the highway with three short drainages flowing northeast. Slopes are moderate (10-30%) with north, south, and west aspects. Drainage vegetation consists of a moderate cover of Wyoming big sagebrush, snowberry (*Symphoricarpos albus*), greasewood (*Sarcobatus vermiculatus*), yucca (*Yucca glauca*), and bluebunch wheatgrass. The plateau has areas of brittle clay and is sparsely occupied by bluebunch wheatgrass and Idaho fescue. Under low to moderate weather and fuel conditions, these sites may locally block surface fire spread to the south on the top of the drainages. The north also has discontinuous surface fuels due to an abundance of bare ground (~ 40%). Grazing keeps the fine fuels to less than three inches. Wildfires could run up the drainages from the highway but spread would be reduced at the ridgetops. A home with a large garage is northeast about 100 yards from the highway.

2.2 Points 21, 22; Section 6, T42N, R95W.

These points are located predominately on the west side of a north-south ridge. Slopes are moderately steep (10-30%). Dominant fuels include bluebunch wheatgrass and moderately dense Wyoming big sagebrush, with Rocky Mountain juniper along the

ridgeline. Juniper density is 50 to 100 stems per acre with an average height of five to six feet. The south slopes have fewer shrubs than the north-facing slopes. The east side of the ridge is moderately dense with 100 stems per acre of juniper. No sample points exist to the east. Two homes lie immediately to the north of BLM property.

2.3 Points 1, 5, 6, 7, 8; Section 8, T42N, R95W.

These points are located southeast of the road dividing the west and east ridges. The road is narrow and high crowned, but easily accessed. A two-track access road enters the area and ends at an old, partially burned shack. Slopes are predominately west-facing with four deep drainages flowing southeast to northwest. Slope steepness is highly variable at these points and ranges from flat (0%) to steep (>30%). Vegetation is a mosaic of juniper and Wyoming big sagebrush, with bluebunch wheatgrass and Idaho fescue in the interspaces. Thirty to 60% bare ground is present within the deep drainages. Upland areas have a higher occurrence of bare ground (80%). Point 5 occurs in a continuous bed of 15 inch tall sagebrush. Under low to moderate fire hazard conditions, fire could make localized runs up the slope in sagebrush, but will slow as it crests the east ridge.

2.4 Points 2, 3, 4; Section 8, T42N, R95W.

These points are located on a south and west-facing steep slope (10-30%), one mile southeast toward Coyote Run Road. Soils consist of red-colored highly eroded, silt and loam formations. Idaho fescue occurs sparsely throughout the area with a high (70+ %) occurrence of bare ground. Declining (40% dead stems in a crown) juniper occupies the drainages that rise from the rural residential area to the southeast. There is little surface vegetation to carry a fire under most conditions. High winds and low humidity could contribute to crown fire runs in drainages, however bare slopes are common and would limit the extent of the burned areas.

2.5 Points 10-20, 27; Section 4 & 5, T42N, R94W.

These points are located on 10-20%, north-facing slopes. Steep slopes extend from the west, south, and east sides of this parcel. A home is one mile east of the subdivision uphill from Highway 120. Vegetation consists of approximately 60% Wyoming big

sagebrush. Bluebunch wheatgrass and Idaho fescue dominate the understory. Rocky Mountain juniper occupies the drainages. Juniper density averages 100 stems per acre, reaching a maximum of 350 stems per acre in the drainages and slopes to the west. Several small, dry reservoirs are found in the drainages. An eroded two-track road accesses the area and proceeds to the ridgeline. There are several natural firebreaks and exposed rocks throughout the area. Prescribed fire could be used to reduce juniper encroachment. Livestock grazing could be used to maintain grass at a height that reduces the likelihood of surface fire spread.

3.0 Home Assessment

3.1 Sage Valley Hills and Thermopolis West

Home types in this area include modular, trailer, and traditional designs, all with asphalt or metal roofs. Homes have few decks, are covered with lattice, metal, etc., to the ground, and have irrigated landscaping. Little native or introduced vegetation is located next to the homes, however, yard debris (e.g., cars, wood piles) is of concern. Wood sheds, barns, and car ports are in close proximity to native vegetation. Ignitions of these structures from a wildfire are of significant concern (Cohen 2000). Involvement of these structures may contribute to the loss of the home.

3.2 Lane 7, 8, 10, & 12 / Coyote Run and Rimrock

Homes in the area are of modular, trailer, and traditional design, all with asphalt or metal roofs. Most yards provide an adequate fuel break between structures and the juniper. Bare soil will limit surface spread into homes, but ember showers from torching junipers could ignite the surrounding homes. Localized crown fires could burn through drainages or flat ground where adequate fuel continuity exists. Homes have few decks, are covered with lattice, metal, etc. to the ground, and have irrigated landscaping. Little native or introduced vegetation is located next to the homes, however, yard debris (e.g. cars, wood piles) is of concern. Wood sheds, barns, and car ports are in close proximity to native vegetation. Ignitions of these structures from a wildfire are of significant concern. Involvement of these structures may contribute to the loss of the home.

3.3 Homeowner Feedback

North Wind conducted two public meetings for approximately 50 landowners in the Sage Valley and Sable Run Subdivisions. Thermopolis and county officials were also invited to discuss this assessment and give feedback regarding emergency response time, historical fires, and possible fuels management strategies. The first public meeting was held on January 16, 2003 and the second public meeting was held on March 21, 2003. Public meeting announcements were sent to the Thermopolis Independent Record newspaper and KDNO and KWYW FM radio stations. Flyers were posted at various businesses and public locations around Thermopolis, including Ben Franklin's, The Storyteller, Pumpernick's, One Eyed Jack's, Manhattan Cafe, IGA, Consumers, and Granny's Donuts. Ten people attended the first meeting and six people attended the second meeting.

In addition to the two public meetings, questionnaires addressing this assessment were mailed to all landowners prior to the first public meeting. Questionnaires received by North Wind are included in [Appendix E](#). North Wind received only eight questionnaires from landowners. Most landowners chose not to return questionnaires. Most homeowners who did respond indicated "yes" to the following questions: (1) Do you believe a wildfire assessment is needed in the Thermopolis area? (2) Are you interested in the findings of the wildfire assessment? (3) Do you believe wildfires pose a risk to your residence? and (4) Are you aware that there are things homeowners can do to protect their homes from wildfires? Public meeting participants were also interested in learning about potential fuels management strategies planned on BLM lands adjacent to their properties. No homeowners indicated their property was at great risk to wildfires. One person whose family homesteaded the area noted that they had never seen a large fire in the Sage Valley area. Emergency vehicle access to BLM lands was an issue mentioned by several landowners.

4.0 Weather Assessment

The Grass Creek Divide Remote Automated Weather Station (RAWS) was used to document wind and weather for the Thermopolis assessment. The RAWS (Latitude 43:53:37, Longitude 108:51:20) station has been operational since 1991. Historical weather information was downloaded and analyzed by Fire Family Plus (Bradshaw and McCormick 2000), a fire climatology and occurrence program. The analysis period was June 1 to Sept. 30, 1991-2002. The results of weather data analyses using Fire Family Plus is contained in Appendix A, Tables 1-3.

A cursory analysis indicates that about 80% of the time, winds are out of the NE to SW with an average hourly windspeed of 7-13 mph. The probability of having a relative humidity (RH) of less than 30% and a 20-foot wind greater than 15 miles per hour (mph) is approximately 8%. Therefore, conditions that might initiate torching and crowning in juniper stands occur less than 10% of the time each fire season. This probability is even lower when one considers an ignition has to occur *during* this time frame, at a receptive site, and in an area able to sustain fire growth.

5.0 Fire Growth and Ignition History

Fire starts to the south, southwest, and west of Thermopolis are of particular concern due to the wildland-urban areas, the prevailing wind patters, fuels, and limited large barriers to fire spread (highway, rivers). Under low to moderate weather and fuel conditions, fire starts in these areas would encounter barriers to surface spread such as bare ground, rock, and secondary roads. Fire spread would be localized and fire suppression forces should be able to control fires within a single burning period. However, under high (85+ percentile weather and fuel conditions) and extreme conditions, surface fire will transition to torching and crowning in juniper stands; thus contributing to short- and long-range spotting, high flame lengths, and high intensities. Under these conditions, hand crews will only be able to work the rear and flanks of the fire, with assistance from engines, as aerial forces concentrate on the advancing head(s).

6.0 Findings and Recommendations

Based on the: (1) discontinuous nature of surface and aerial fuels; (2) low occurrence of severe weather and fuel conditions; (3) low to moderate fuel loading; (4) occurrence of primary and secondary roads; (5) availability of federal, state, and local suppression forces; and (6) existing home defensibility,

North Wind, Inc. concludes that the risk of wildfire destroying homes located south, southwest, and west of Thermopolis is low.

Moreover, the possibility of a large fire spreading into the wildland-urban areas does exist (less than 10%). A more likely scenario could be a small fire starting in a grass-sage flat or juniper draw which could impact an isolated structure(s).

6.1 Homeowner Recommendations

- Reduce juniper cover in the vicinity of homes.
- Pile slash in open areas away from structures. Burn when deep snow covers the ground and cold temperatures are expected for several days.
- Remove yard debris next to the home.
- Remove decadent vegetation and debris next to wood garages and sheds.
- Maintain large wood fences and keep them away from the home.
- Irrigate around the home.
- Improve roads and driveways to allow for emergency vehicle access and allow space for large firefighting vehicles to turn around.
- Develop ponds, fire hydrants, or other water sources to aid firefighting efforts.
- Use non-combustible roofing materials (e.g. tin, steel, asphalt, composite shingles).
- Remove flammable debris from rain gutters.
- Contact the Wyoming State Forestry Division for technical assistance and information on funding opportunities for creating defensible space around the home (<http://lands.state.wy.us/forestry.htm>).
- Review wildfire prevention tactics and other fire resources from www.firewise.org.

6.2 Agency Recommendations

- BLM and Thermopolis VFD should work with homeowners to assist with mitigation measures and encourage fire prevention efforts.
- Grazing of fine fuels may reduce fire growth into populated areas.
- An inventory and analysis of existing secondary roads could be used to develop a matrix of fire breaks to the west and southwest to aid suppression forces in the advent of a wildfire.
- A series of prescribed fires in juniper and some big sagebrush areas will create mosaics of grass and less decadent brush, thus decreasing the likelihood of continuous crown fire runs in juniper stands.

7.0 Literature Cited

Bradshaw, L.; McCormick, E. 2000. FireFamily Plus user's guide, version 2.0. Gen. Tech. Rep. RMRS-GTR-67WWW. Ogden, UT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Cohen, Jack. 2000. Preventing Disaster: Home ignitability in the wildland-urban interface. *Journal of Forestry*. 98(3):15-21.

U.S. Department of Agriculture, Forest Service; U.S. Department of Interior. 2000. A Report to the President: In Response to the Wildfires of 2000. Washington, D.C.

8.0 Appendices

8.1 Appendix A - FireFamily Plus Output

Table 1. Minimum Relative Humidity vs. Wind Speed

Station: 480804 - GRASS CREEK

1991 - 2002
June 1 - September 30
1-Day Analysis Period

		Wind Speed					
		0.00	3.00	5.00	10.00	15.00	25.00
Min RH		-	-	-	-	-	-
		3.00	5.00	10.00	15.00	25.00	35.00
1.00 - 5.00		0	1	2	0	1	0
5.00 - 10.00		1	2	16	14	16	1
10.00 - 20.00		7	22	210	118	57	2
20.00 - 30.00		6	24	220	103	35	1
30.00 - 60.00		12	41	234	91	14	1
60.00 - 100.00		8	8	34	7	1	0
		Joint Probability Table (%)					
1.00 - 5.00		0.00	0.08	0.15	0.00	0.08	0.00
5.00 - 10.00		0.08	0.15	1.22	1.07	1.22	0.08
10.00 - 20.00		0.53	1.68	16.03	9.01	4.35	0.15
20.00 - 30.00		0.46	1.83	16.79	7.86	2.67	0.08
30.00 - 60.00		0.92	3.13	17.86	6.95	1.07	0.08
60.00 - 100.00		0.61	0.61	2.60	0.53	0.08	0.00

Table 2. Wind Speed vs. Direction

Station:480804

1991 - 2002
June 1 - September 30
28-Day Period Beginning 6/1

Dir	Wind Speed, MPH												TOTAL N PCT	AVG SPEED	
	0 - 3		4 - 7		8 - 12		13 - 18		19 - 24		>24				
	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT			
NE	3	1.0	12	4.0	27	9.0	7	2.3					49	16.4	8.8
E	8	2.7	32	10.7	14	4.7	1	0.3					55	18.4	6.4
SE	1	0.3	24	8.0	33	11.0	5	1.7					63	21.1	8.3
S	1	0.3	13	4.3	14	4.7	14	4.7	1	0.3			43	14.4	10.7
SW	1	0.3	8	2.7	3	1.0	21	7.0	5	1.7	2	0.7	40	13.4	13.7
W	1	0.3	4	1.3	3	1.0	3	1.0	3	1.0			14	4.7	11.5
NW			7	2.3	3	1.0	3	1.0					13	4.3	8.7
N	1	0.3	8	2.7	10	3.3	3	1.0					22	7.4	8.6
CLM															
TOT	16	5.4	108	36.1	107	35.8	57	19.1	9	3.0	2	0.7	299	100.0	9.3

28-Day Period Beginning 7/1

Dir	Wind Speed, MPH												TOTAL N PCT	AVG SPEED	
	0 - 3		4 - 7		8 - 12		13 - 18		19 - 24		>24				
	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT			
NE	1	0.3	15	4.6	41	12.5	7	2.1					64	19.5	9.4
E	2	0.6	26	7.9	25	7.6	1	0.3					54	16.5	7.5
SE	2	0.6	36	11.0	21	6.4	2	0.6					61	18.6	7.2
S	5	1.5	22	6.7	14	4.3	16	4.9	1	0.3			58	17.7	9.3
SW	2	0.6	4	1.2	15	4.6	10	3.0	3	0.9	1	0.3	35	10.7	11.9
W			5	1.5	9	2.7	7	2.1	2	0.6			23	7.0	12.0
NW	1	0.3	3	0.9	3	0.9	1	0.3	2	0.6			10	3.0	10.5
N	1	0.3	3	0.9	14	4.3	5	1.5					23	7.0	9.7
CLM															
TOT	14	4.3	114	34.8	142	43.3	49	14.9	8	2.4	1	0.3	328	100.0	9.2

28-Day Period Beginning 8/1

Dir	Wind Speed, MPH												TOTAL N PCT	AVG SPEED	
	0 - 3		4 - 7		8 - 12		13 - 18		19 - 24		>24				
	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT			
NE			18	5.5	32	9.7	5	1.5					55	16.7	8.7
E	2	0.6	30	9.1	27	8.2							59	17.9	7.1
SE	3	0.9	41	12.4	31	9.4							75	22.7	7.1
S			14	4.2	18	5.5	10	3.0	2	0.6			44	13.3	10.3
SW	6	1.8	8	2.4	11	3.3	12	3.6	4	1.2	2	0.6	43	13.0	11.0
W			4	1.2	4	1.2	10	3.0	3	0.9			21	6.4	13.0
NW	1	0.3	5	1.5	8	2.4	2	0.6					16	4.8	8.4
N	1	0.3	7	2.1	9	2.7							17	5.2	6.7
CLM															
TOT	13	3.9	127	38.5	140	42.4	39	11.8	9	2.7	2	0.6	330	100.0	8.7

28-Day Period Beginning 9/1

Dir	Wind Speed, MPH												TOTAL N PCT	AVG SPEED	
	0 - 3		4 - 7		8 - 12		13 - 18		19 - 24		>24				
	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT			
NE			16	4.8	27	8.2	4	1.2					47	14.2	9.0
E	6	1.8	27	8.2	23	7.0							56	17.0	6.8
SE	4	1.2	45	13.6	42	12.7	5	1.5					96	29.1	7.4
S	3	0.9	17	5.2	18	5.5	5	1.5			1	0.3	44	13.3	8.7
SW			9	2.7	9	2.7	10	3.0	5	1.5	1	0.3	34	10.3	12.5
W	2	0.6	2	0.6	2	0.6	7	2.1					13	3.9	10.6
NW	1	0.3	2	0.6	4	1.2	1	0.3	1	0.3			9	2.7	9.9
N			9	2.7	20	6.1							29	8.8	8.6
CLM	2	0.6											2	0.6	0.0
TOT	18	5.5	127	38.5	145	43.9	32	9.7	6	1.8	2	0.6	330	100.0	8.5

Table 3. 10-Hour Fuel Moisture vs. Wind Speed

Station: 480804 - GRASS CREEK

1991 - 2002

June 1 - September 30

1-Day Analysis Period

		Wind Speed					
		0.00	3.00	5.00	10.00	15.00	25.00
10-Hour Fuel Moisture		-	-	-	-	-	-
		3.00	5.00	10.00	15.00	25.00	35.00
1.00 - 10.00		17	60	567	269	111	4
10.00 - 20.00		11	17	90	38	6	1
20.00 - 30.00		0	0	8	3	0	0
30.00 - 40.00		6	21	51	23	7	0
40.00 - 50.00		0	0	0	0	0	0
50.00 - 100.00		0	0	0	0	0	0
		Joint Probability Table (%)					
1.00 - 10.00		1.30	4.58	43.28	20.53	8.47	0.31
10.00 - 20.00		0.84	1.30	6.87	2.90	0.46	0.08
20.00 - 30.00		0.00	0.00	0.61	0.23	0.00	0.00
30.00 - 40.00		0.46	1.60	3.89	1.76	0.53	0.00
40.00 - 50.00		0.00	0.00	0.00	0.00	0.00	0.00
50.00 - 100.00		0.00	0.00	0.00	0.00	0.00	0.00

8.2 Appendix B - Photos



Point 1



Point 2



Point 3



Point 4



Point 5



Point 6



Point 7



Point 8



Point 9



Point 10



Point 11



Point 12



Point 13



Point 14



Point 15



Point 16



Point 17



Point 18



Point 19



Point 20



Point 21



Point 22



Point 23



Point 24



Point 25



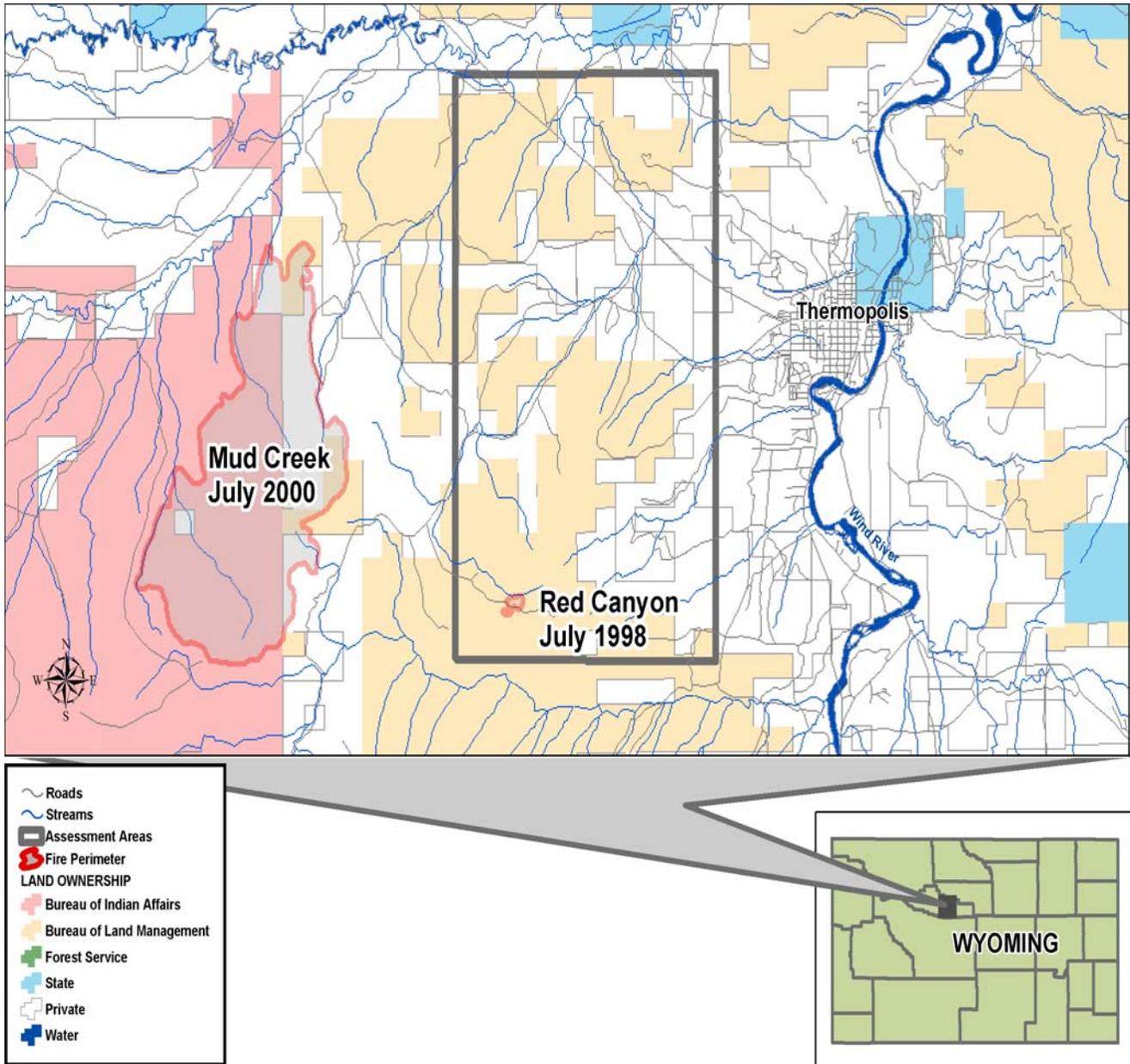
Point 26



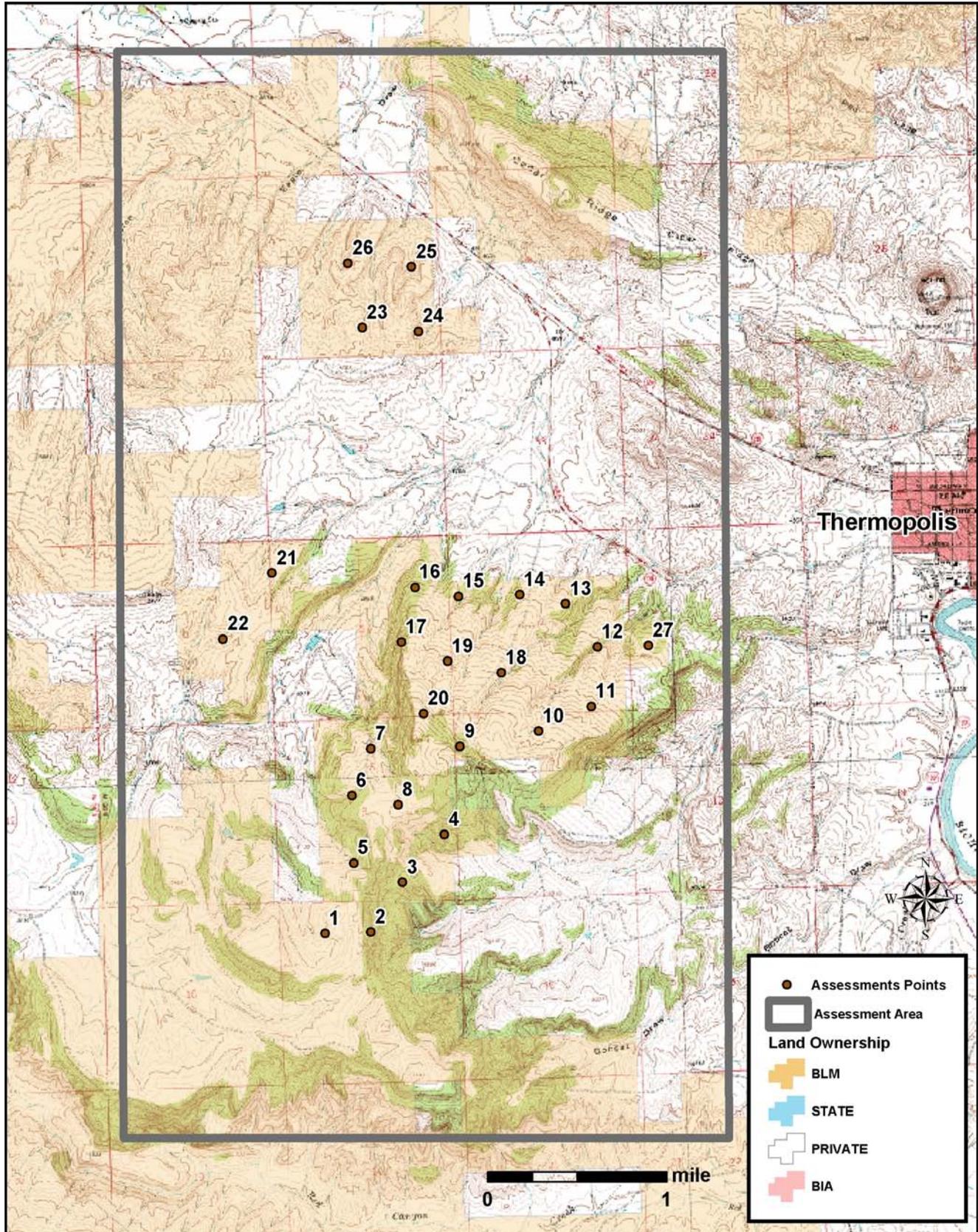
Point 27

8.3 Appendix C - Maps

Map 1. General Area Map, Ownership, and Recent Fires



Map 2. Fuel Assessment Point Locations



8.4 Appendix D - Field Forms

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8.5 Appendix E – Questionnaires

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