CHAPTER 3. LANDSCAPE DISTURBANCES

Influence of Mineral Exploration and Development

Historic and current mineral exploration and development activities are generally described in Chapter IV, Landscape Disturbances and Anthropogenic Influences, Mineral Development. This section evaluates the pattern of mineral exploration and development on the Grand Mesa, Uncompahgre and Gunnison National Forests (GMUG) and the associated influences of these activities on vegetation and habitat. Both direct and indirect effects are discussed.

Forest-wide

Mining Activities

Mining site information was gathered from the U.S. Geological Survey MAS/MILS (Causey, 1998) database for the GMUG and surrounding areas. Mine site locations were generated from location information within the database. Figure 1 shows the current status of these mine sites. Locations are classified as:

1. Historic – indicates past mineral development
2. Prospect – indicates past prospecting but no development
3. Recent – indicates recent or active development
4. Unknown – indicates possible prospecting and/or development, likely historical.

Table 1 lists the status of these mine sites and whether they are on or off National Forest System land (NFSL) in the GMUG area. The vast majority of mine sites in this database occur off NFSL, and very few sites are classified as having recent activity.

Table 1. Status of Mining Sites in GMUG area.

Status	Off NFSL	On NFSL	Total
Historic	483	603	1086
Prospect	106	38	144
Recent	81	14	95
Unknown	634	268	902
Grand Total	1304	923	2227

Areas with the largest concentration of mining activity in the GMUG area include the northwest portion of the Uncompahgre Plateau, below the Forest boundary, and the southern portion of the San Juans Geographic Area near Ouray and Telluride.

Figure 2 displays the mining sites by the type of mineral that occurred at each site. Table 2 lists this same information. Uranium was the dominant mineral found west of the Uncompahgre Plateau; while gold, silver and lead were the dominant minerals found in the San Juans.

Figure 1. Status of Mining Sites in GMUG area.

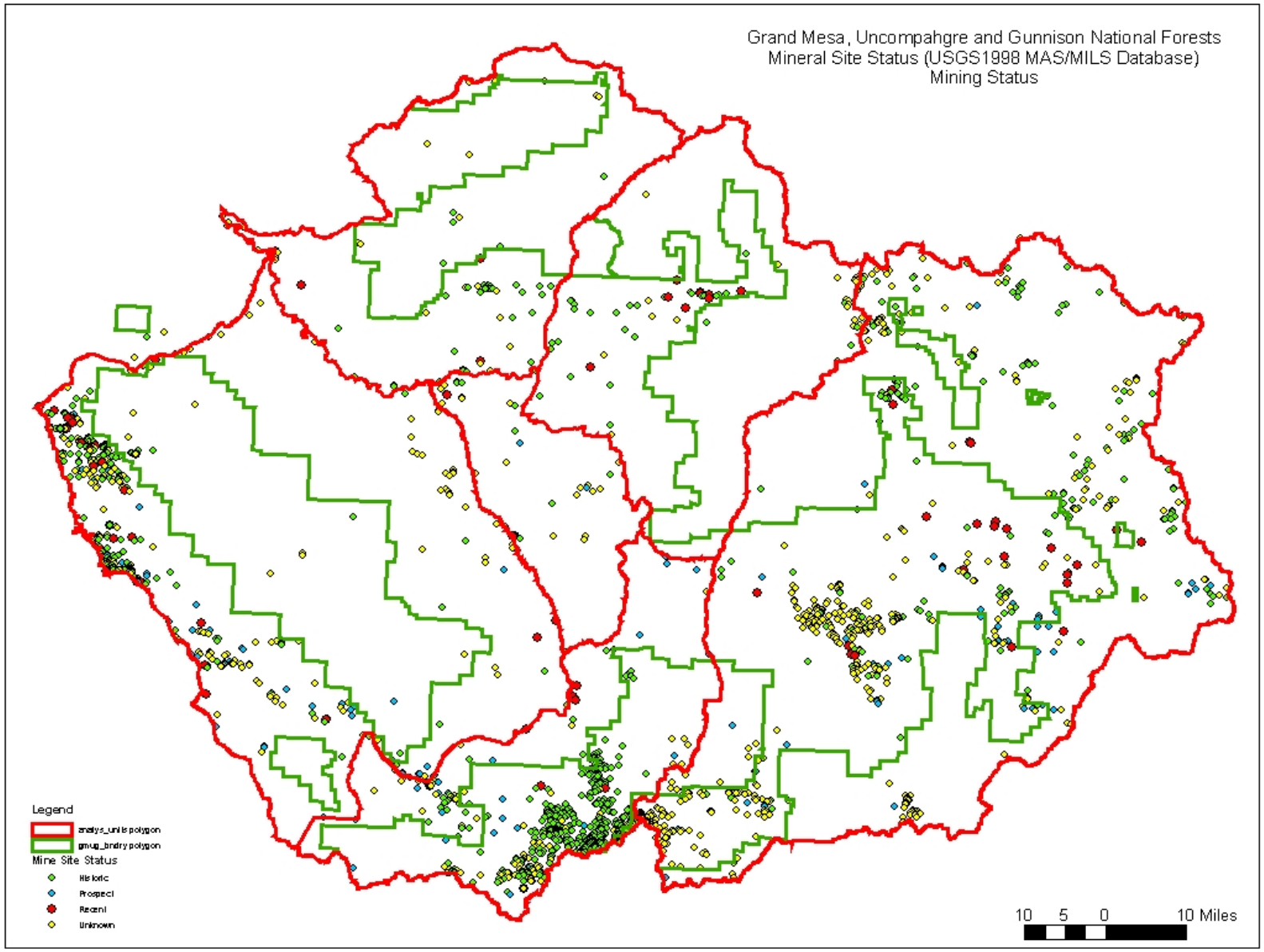


Table 2. Mining Sites by Mineral Type for GMUG Area

Mineral Type	Off NFSL	On NFSL	Total
Base Metals:			
Aluminum	3		3
Manganese	16	11	27
Mercury	3	1	4
Molybdenum	2	4	6
Sodium	1		1
Tin	1		1
Titanium	2		2
Tungsten	2	4	6
Vanadium	159	8	167
Common Variety:			
Clay	6	2	8
Sand & Gravel	159	20	179
Stone	5	1	6
Coal	64	15	79
Copper	17	28	45
Gemstone	1		1
Geothermal	3	3	6
Gold	116	229	345
Iron	4	13	17
Lead	40	95	135
Non-Metal:			
Barite	1	5	6
Beryllium	2	8	10
Calcium	3	3	6
Cobalt		1	1
Diatomite	1		1
Feldspar	3	1	4
Fluorine	8	7	15
Graphite	1	2	3
Gypsum	4	1	5
Kyanite Group	2	1	3
Lithium		1	1
Mica	5	3	8
Perlite	4	3	7
Pumice	4		4
Quartz Crystal	2	1	3
Rare Earth	1	3	4
Silicon	1		1
Sulfur	3		3
Tantalum	2		2
Thorium	2		2
Vermiculite	3		3
Zeolites	1	1	2
Zirconium	1		1
Radium	3		3
Silver	34	159	193
Uranium	248	33	281
Zinc	35	97	132
Unknown	326	159	485
Total	1304	923	2227

Figure 2. Mining Sites by Mineral Type for GMUG Area

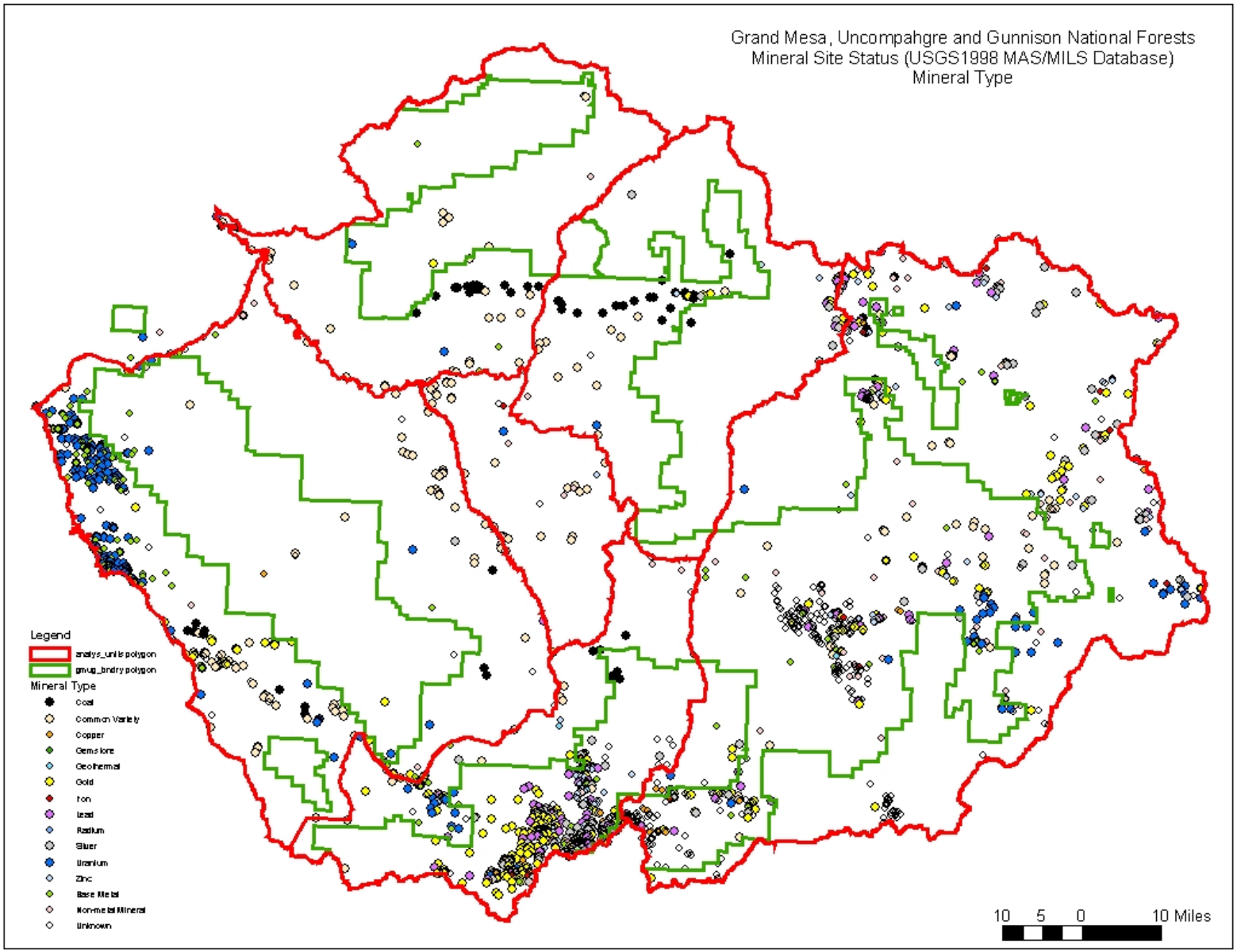


Figure 3. Recently Active Mining Sites by Mineral Type for GMUG Area

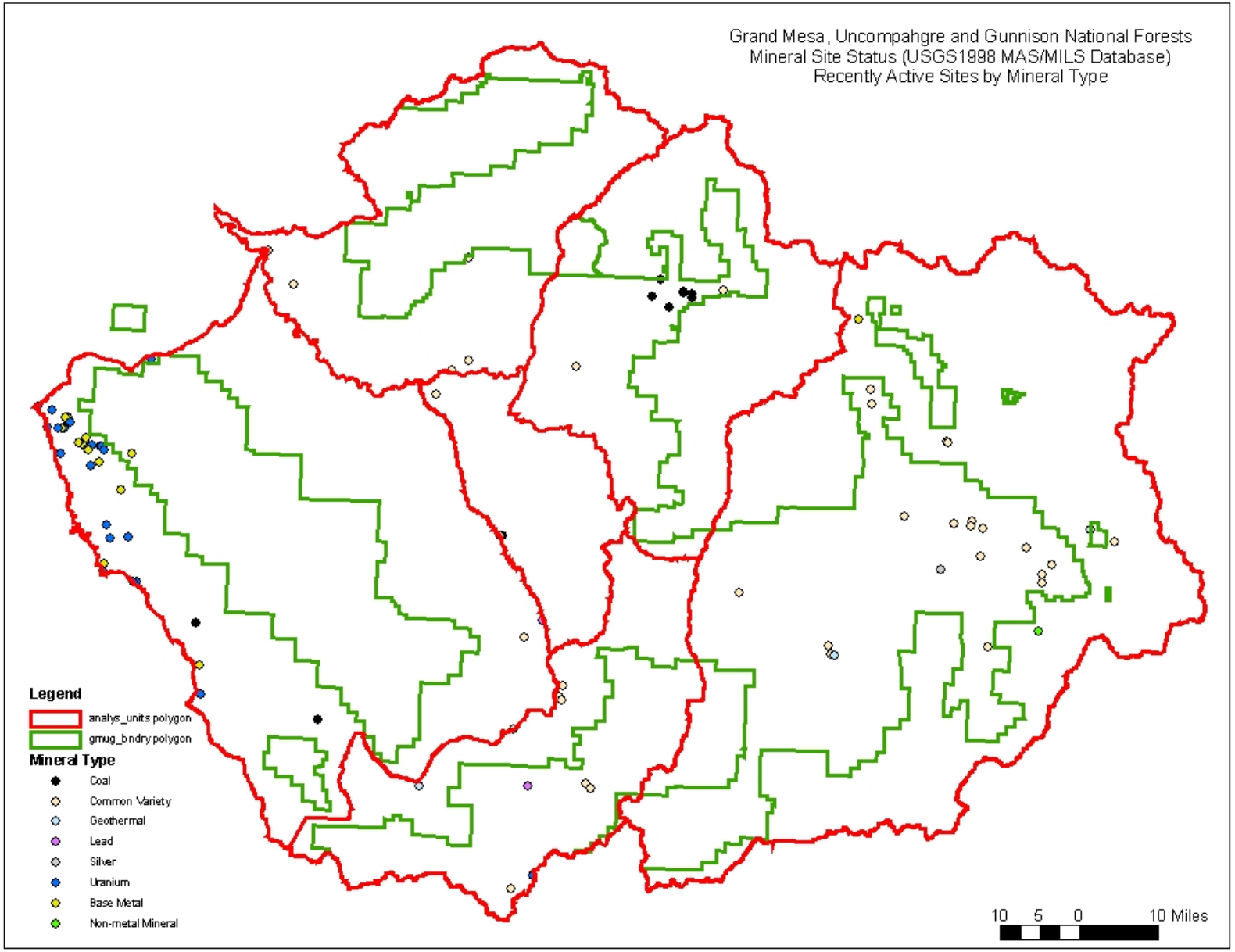


Figure 3 displays only those mining sites in the USGS MAS/MILS database (Causey, 1998) that were determined to have recent activity. Table 3 lists the dominant mineral that occurs at these sites.

Table 3. Recently Active Mining Sites by Mineral Type for GMUG Area

Mineral Type	Off NFSL	On NFSL	Total
Base Metals: Molybdenum		1	1
Vanadium	13	1	14
Common Variety: Sand & Gravel	30	8	38
Stone	1		1
Coal	11		11
Geothermal	2	1	3
Lead	1	1	2
Non-Metal: Calcium		1	1
Silver	1		1
Uranium	22	1	23
Total	81	14	95

The USGS MAS/MILS database does not appear to contain all known mining activity locations; however, this database is a good compilation to evaluate the pattern and extent of mining activity that has occurred in the GMUG area.

Additional information related to mining activity on the GMUG was collected through an abandoned mine land inventory project conducted jointly with the Colorado Geological Survey (Fehlmann 1997, Fehlmann 1998, Fehlmann et al. 1998, Lawson et al. 1996, Netbert and Harris 1996, Neubert 1998). Information was collected on both mine openings and dump areas based on field inventory. This inventory ranked sites for environmental degradation (related to water quality, pH, erosion, acid mine runoff) and physical hazards posed to human life. Sites exhibiting environmental degradation will eventually undergo further investigation to determine what corrective measures may be needed. Mine openings with physical hazard ratings of extreme danger or dangerous should be capped or closed in some way. Mine openings with a potential danger ranking should also be considered for some access restrictions. Tables 4 and 5 below summarize the environmental degradation and physical hazard ratings for the GMUG.

Table 4. Environmental Degradation Ratings for Abandoned Mine Land Inventory on the GMUG (counts of tailings, dumps and openings combined)

Rating	Extreme	Significant	Potentially Significant	Slight	None
Number of Sites	4	99	252	421	3976

Table 5. Physical Hazard Ratings for Abandoned Mine Land Inventory on the GMUG (counts of tailings, dumps and openings combined)

Rating	Extreme Danger	Dangerous	Potential Danger	No Significant Danger
Number of Sites	14	167	672	3902

Due to differences in the way locations were determined (GPS for the abandoned mine land inventory, point layer generated from coordinate system for the USGS MAS/MILS data) there is not direct correlation between the field inventoried points and the USGS MAS/MILS database; however areas of concentrated activity are similar. Figure 4 displays the abandoned mine land inventory sites. The abandoned mine land inventory data was used to determine the effects to cover types from past mining activities. This information is summarized in Table 6.

Figure 4. Abandoned Mine Land Inventory, Grand Mesa, Uncompahgre and Gunnison National Forests

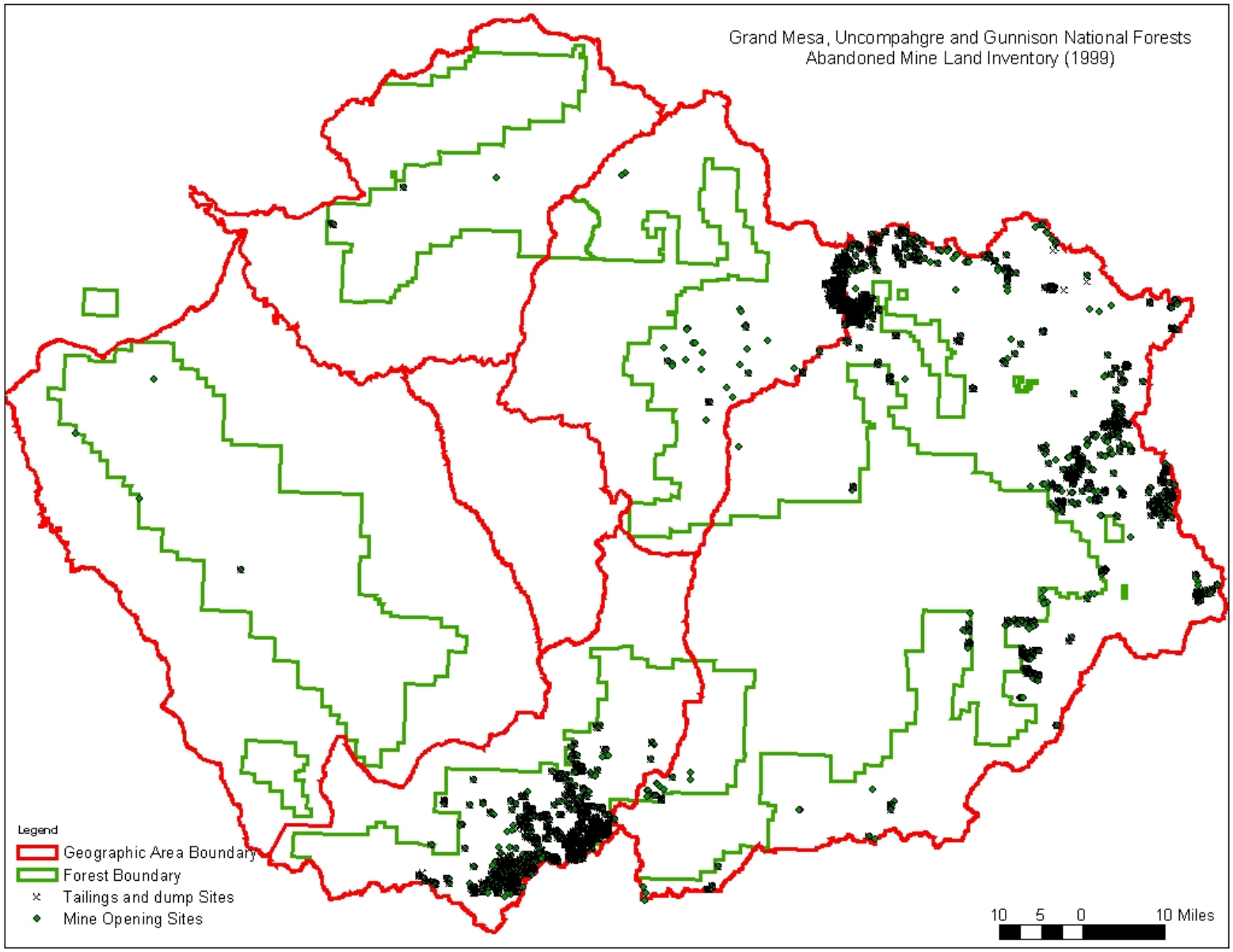


Figure 5. Areas of Potential Future Mining Activity, Grand Mesa, Uncompahgre and Gunnison National Forests

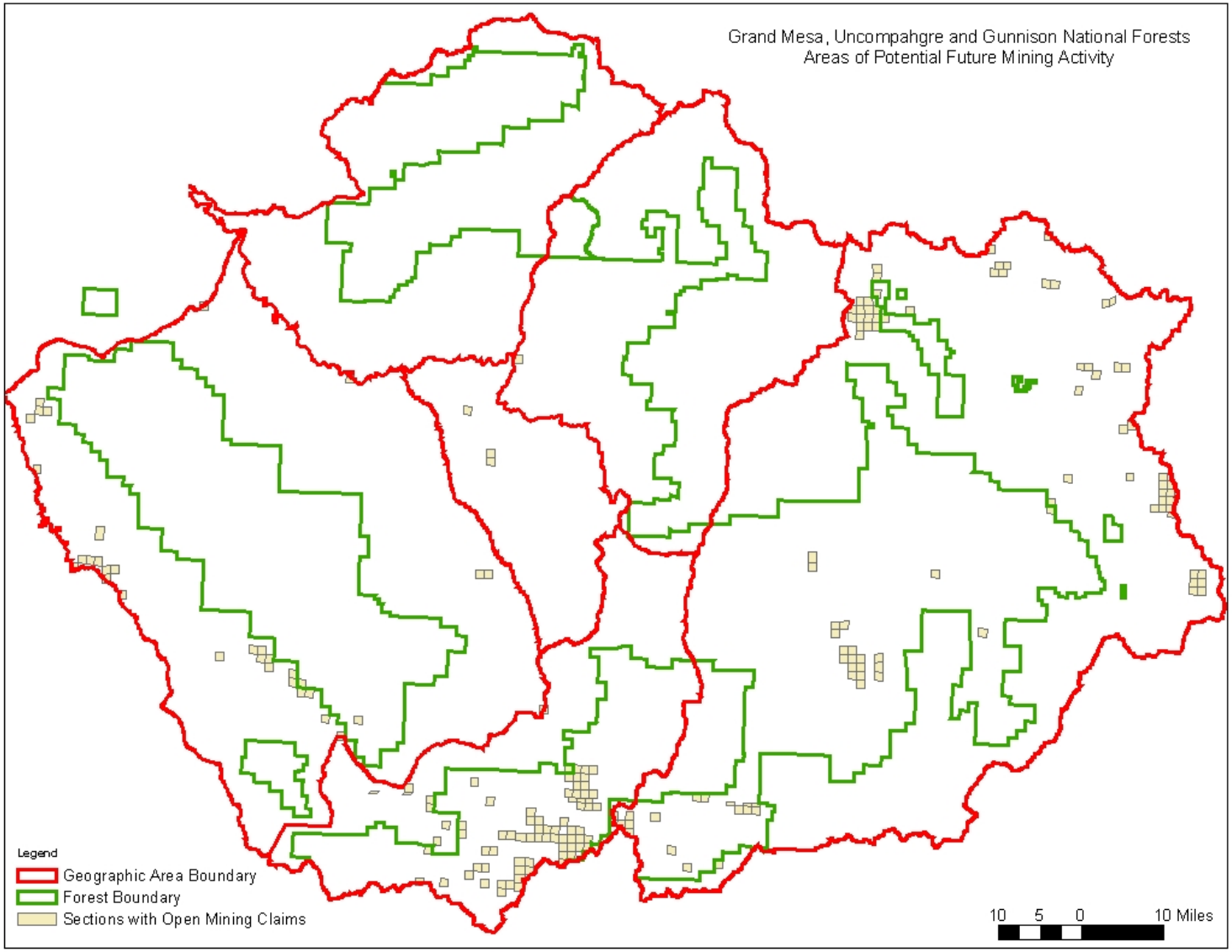


Table 6. Acres by Cover Type within ½ mile Buffer around Abandoned Mine Land Inventory Sites (Openings and Tailings), Grand Mesa, Uncompahgre and Gunnison National Forests

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	51,109	20	12
Sagebrush	8,765	3	10
Gambel Oak	3,201	1	1
Mixed Mountain Shrub	2,612	1	5
Snowberry		0	0
Willow	12,915	5	15
Cottonwood	136	0	4
Aspen	28,410	11	4
Pinyon/Juniper	1,597	1	1
Ponderosa Pine	2,111	1	2
Lodgepole Pine	35,212	14	13
Limber Pine	53	0	9
Douglas-fir	1,585	1	4
Blue Spruce	29	0	1
Spruce/Fir	62,323	24	8
Bristlecone Pine	710	0	9
Bare/Rock	45,409	18	21
Water	395	0	4
Total	256,569		8

Approximately eight percent of the total forest cover has been influenced by past mining activities. Forest-wide most of the area affected by past mining activities is in the spruce/fir cover type (24 percent of the area affected by mining sites), but only eight percent of the total spruce/fir cover type on the GMUG has been affected by mining activities. The majority of this has occurred in the San Juans Geographic Area near Ouray and Telluride.

An indication of potential future areas of mining activity or development can be gained by reviewing where active mining claims occur. Figure 5 displays sections with one or more open mining claim (Hyndman and Campbell 1999). Areas with active claims also correspond to areas of past activity.

More specific discussion on mining activity and influences is continued in the individual Geographic Area sections.

Oil and Gas Exploration and Development

Data for oil and natural gas exploration and development was obtained from the Colorado Oil and Gas Conservation Commission (COGCC) online data set (2005). Within the GMUG area 668 wells have been drilled. Table 7 identifies the current status of these wells and whether they occur on NFSL, or not.

Table 7. Status of Oil and Gas Wells in and around GMUG

Status	Off NFSL	On NFSL	Total
Abandoned	341	76	417
Producing	149	12	161
Waiting Completion	3		3
Shut-in	33	9	42
Temporarily Abandoned	2	1	3
Permit Location	30	12	42
Total	558	110	668

Abandoned wells have been reclaimed. Producing wells are currently producing oil and/or gas. Waiting completion wells are currently being drilled. Shut-in and temporarily abandoned wells have the potential to be reworked to become producing wells. Permit locations are sites where applications for permit to drill have been received but wells have yet to be commenced. Figure 6 displays well locations summarized in the above table.

On average, approximately three acres are cleared for each wellpad. However, the influence of activities that on and around the area can extend up to ½ mile away. The amount and type of cover or habitat that have been influenced by oil and gas wells on the GMUG is listed in Table 8. Well pads are not the only facilities associated with oil and gas exploration and development. Roads used to access well sites have been addressed in the Roads and Trails chapter. Pipelines to transport oil and gas are included in the Utility Corridor discussion.

Figure 6. Status and Distribution of Oil and Gas Wells, Grand Mesa, Uncompahgre and Gunnison National Forests

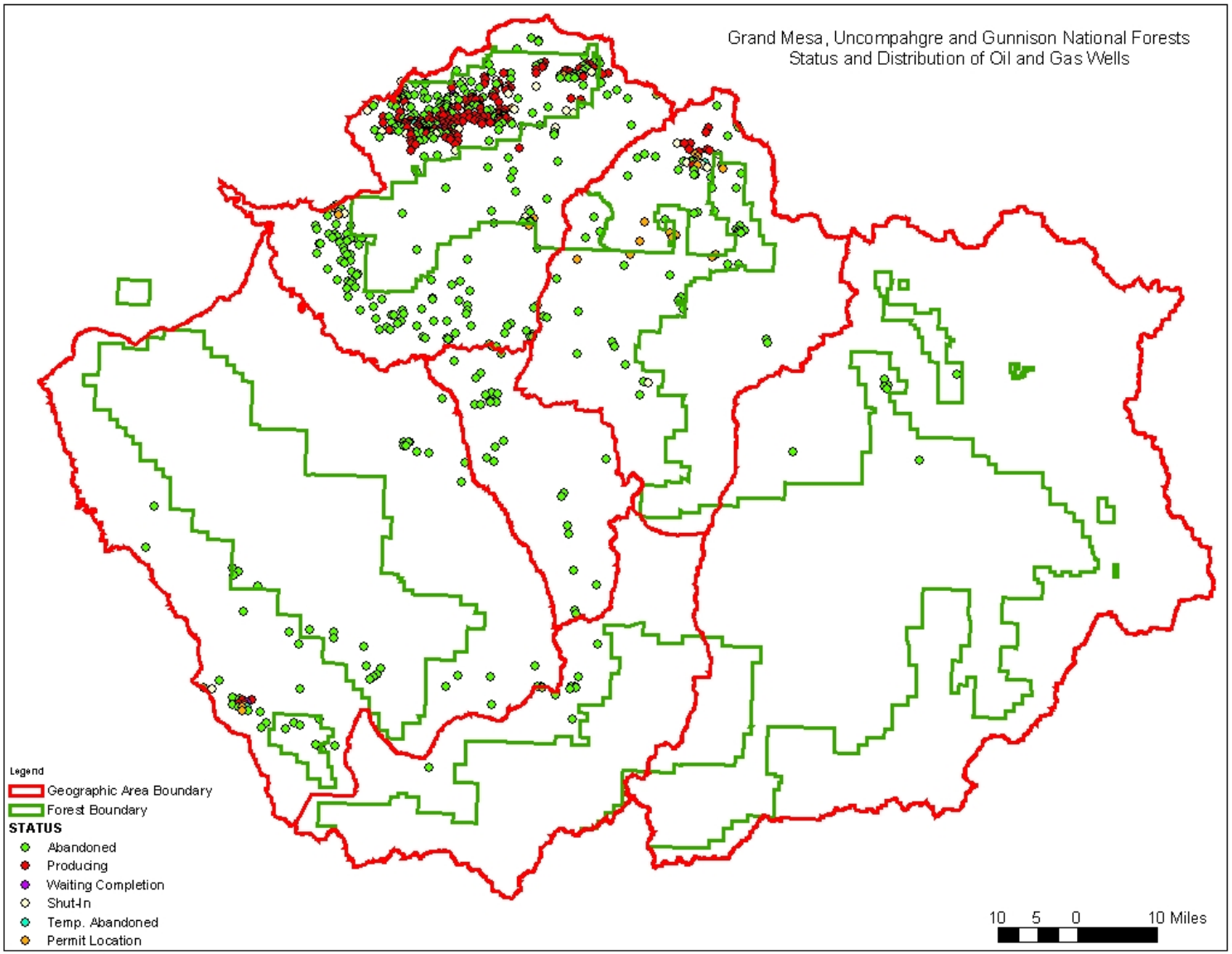


Table 8. Acres by Cover Type within ½ mile Buffer around Oil and Gas Wells, Grand Mesa, Uncompahgre and Gunnison National Forests

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	6,321	12	1
Sagebrush	2,515	5	3
Gambel Oak	10,910	20	4
Mixed Mountain Shrub	1,035	2	2
Snowberry	1,349	3	7
Willow	955	2	1
Cottonwood	182	0	5
Aspen	17,128	32	2
Pinyon/Juniper	3,498	7	3
Ponderosa Pine	3,003	6	3
Lodgepole Pine		0	0
Limber Pine		0	0
Douglas-fir	119	0	0
Blue Spruce	12	0	0
Spruce/Fir	5,275	10	1
Bristlecone Pine		0	0
Bare/Rock	986	2	0
Water	223	0	2
Total	53,511		2

Approximately two percent of the total forest cover has been influenced by past oil and gas wells. Forest-wide most of the area affected by past oil and gas wells is in the aspen cover type (32 percent of the area affected by drilling), but only two percent of the total aspen cover type on the GMUG has been affected by mining activities.

Currently 136,800 acres of the GMUG are leased. Additional lease parcel request have been received (152,500 acres as of 12/2004), with more expected. Leases and leasing interest has been limited to the North Fork Valley, Grand Mesa and Uncompahgre Plateau Geographic Areas.

Grand Mesa Geographic Area

Mining Activities

Mining site activity included in the USGS MAS/MILS database (Causey 1998) that occur within the Grand Mesa Geographic Area are listed in Table 9. Figure 7 displays where these mineral sites are located. No recently active sites are located on NFS lands.

Table 9. Status of Mining Sites in Grand Mesa Geographic Area.

Status	Off NFSL	On NFSL	Total
Historic	30	5	35
Prospect			0
Recent	6		6
Unknown	23	4	27
Grand Total	59	9	68

Table 10 lists the mineral types that were mined at these sites. Sand and gravel was the most common mineral extracted, followed by coal. Figure 8 shows coal was mined along the southern flank of the Grand Mesa. Sand and gravel sites are located off mostly along larger creeks and rivers, below the Forest. Two uranium mine sites were located in the lower elevations of Lands End.

Table 10. Mining Sites by Mineral Type for GMUG Area

Mineral Type	Off NFSL	On NFSL	Total
Base Metals:			
Aluminum	2		2
Tin	1		1
Common Variety:			
Clay	1	1	2
Sand & Gravel	27	3	30
Coal	21	1	22
Gold		1	1
Non-Metal:			
Gypsum		1	1
Uranium	4	2	6
Unknown	3		3
Total	59	9	68

While the USGS MAS/MILS data does not identify any current mining activity on the NFS portion of the Grand Mesa Geographic Area, there are nine small gravel pits utilized by Forest Service and County crews as rock sources for project work. The combined area affected by these gravel pits is less than 100 acres.

Figure 7. Status of Mining Sites Located on Grand Mesa Geographic Area

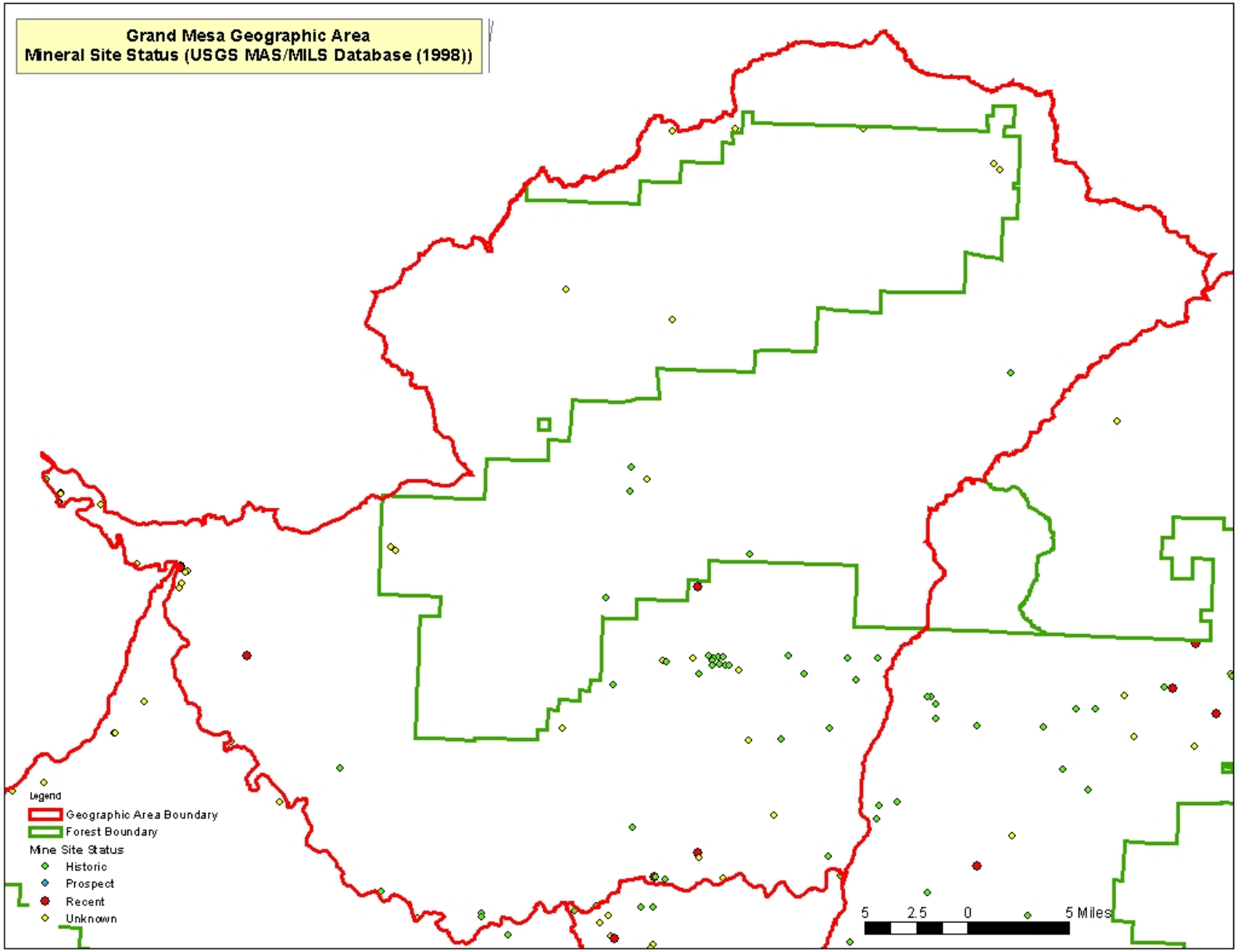


Figure 8. Mining Sites by Mineral Type on Grand Mesa Geographic Area.

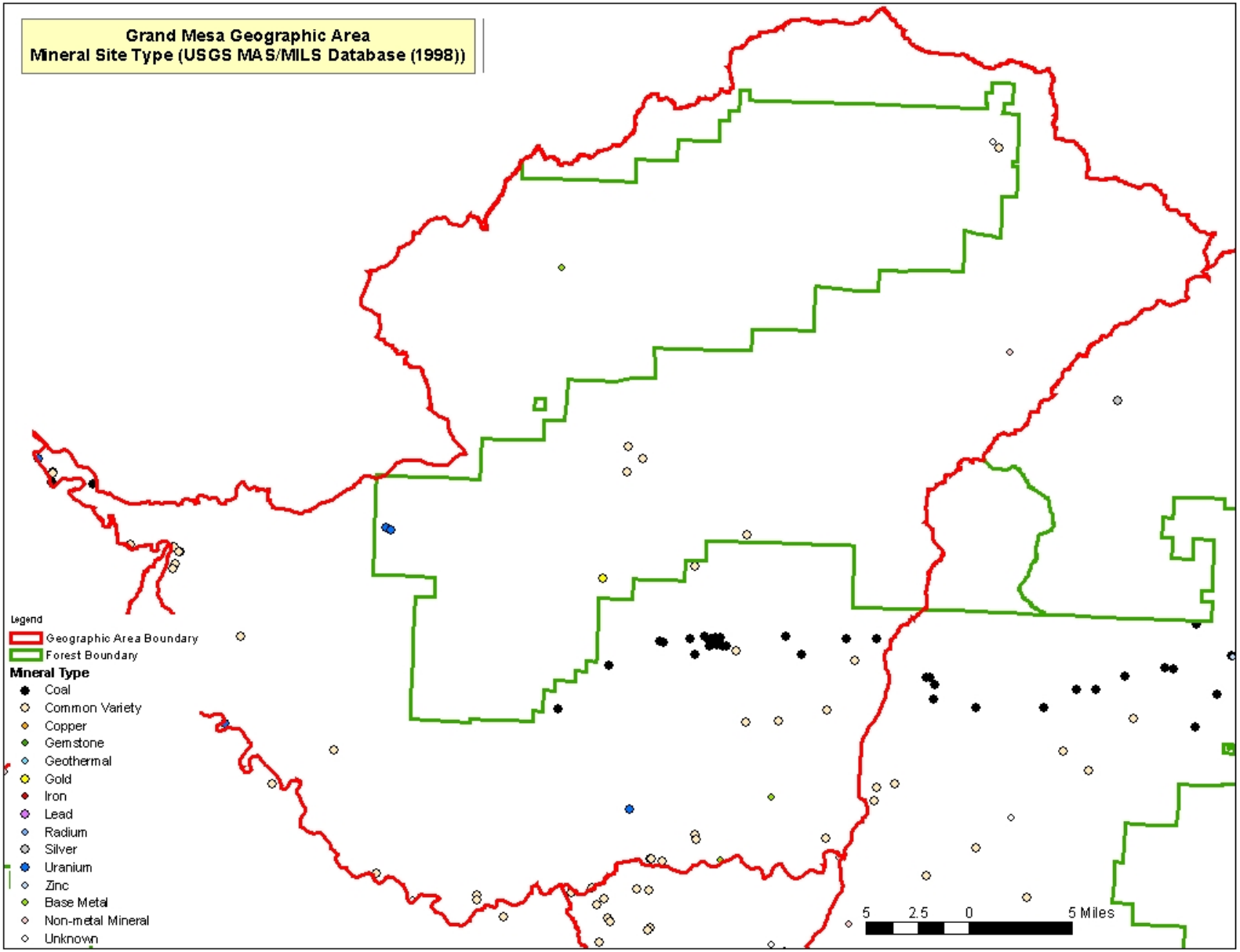
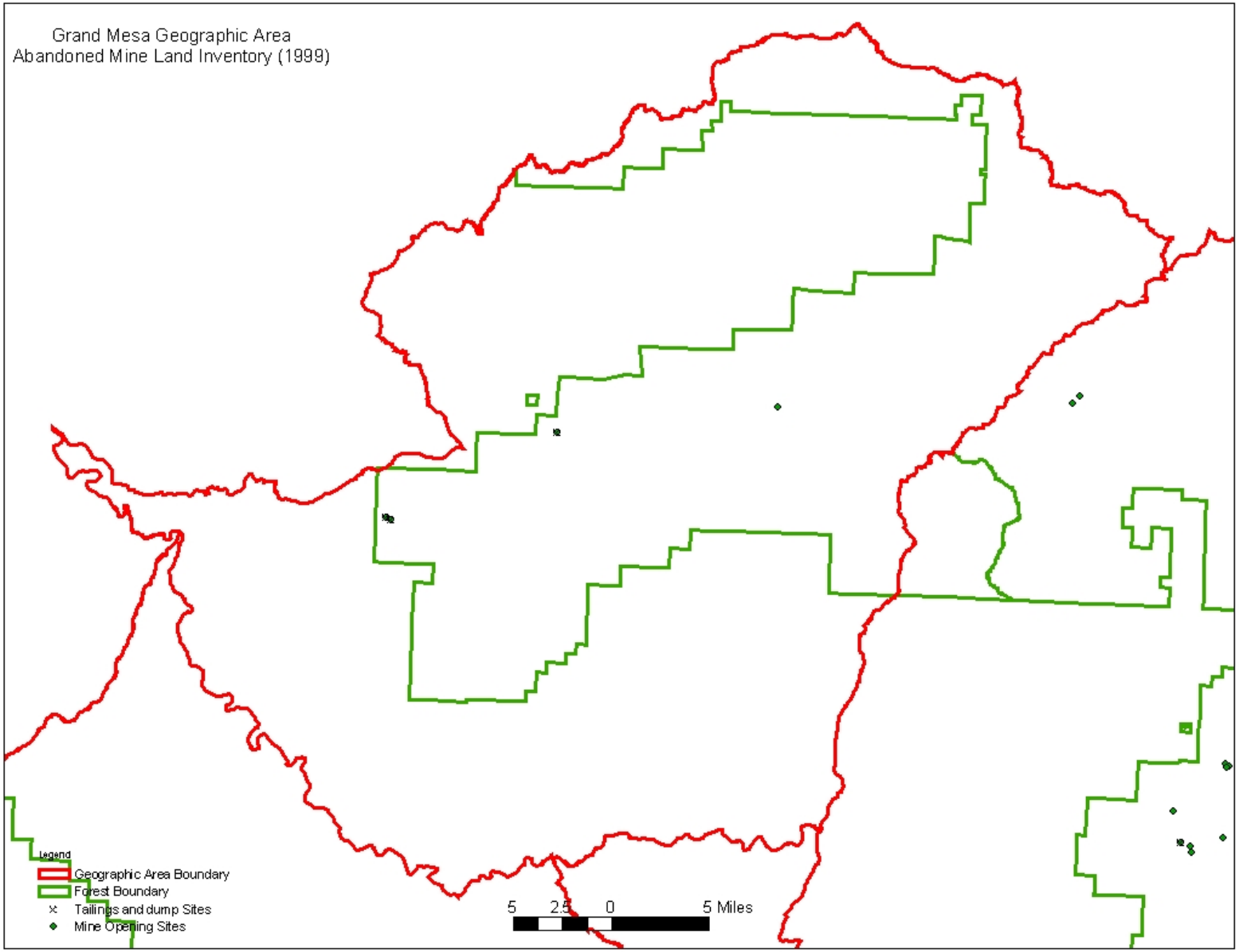


Figure 9. Abandoned Mine Land Inventory, Grand Mesa Geographic Area



Information from the abandoned mine land inventory indicates there are two adits with associated mine dumps (from the uranium mines), two open pits, and one highwall site located on the Grand Mesa Geographic Area (Neubert 1998). The highwall site has a hazard rating of potential danger. There are no other environmental degradation or physical hazard concerns for the other mining sites. These sites are shown on Figure 9, and the acres of cover type within ½ mile of these sites are summarized in Table 11. Less than one percent of the Grand Mesa Geographic Area has been influenced by past mining activities. There are currently no open claims on the Grand Mesa.

Table 11. Acres by Cover Type within ½ mile Buffer around Abandoned Mine Land Inventory Sites (Openings and Tailings), Grand Mesa Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	179	10	0
Sagebrush	43	2	2
Gambel Oak	52	3	0
Aspen	443	26	0
Pinyon/Juniper	628	37	2
Spruce/Fir	326	19	0
Bare/Rock	1	0	0
Water	39	2	1
Total	1,711		0

Oil and Gas Exploration and Development

A very different scenario is seen for oil and gas exploration and development on the Grand Mesa Geographic Area. The entire Geographic Area has high potential for oil and gas. This area is on the southern edge of the Piceance Basin and drilling activity has been high. Table 12 identifies the current status of these wells and whether they occur on NFSL, or not (COGCC 2005).

The total number of all wells in the Grand Mesa Geographic Area account for 70 percent of the wells in the area surround the GMUG. Sixty-four percent of the abandoned wells in the GMUG area are in the Grand Mesa GA. Ninety-one percent of the producing wells in the GMUG area are in the Grand Mesa GA. Forty-three percent of the abandoned wells on NFS lands in the GMUG occur on the Grand Mesa; while 25 percent of the producing wells on the Forest are on the Grand Mesa Geographic Area. Figure 10 displays oil and gas well locations and their status for the Grand Mesa.

Figure 10. Status and Distribution of Oil and Gas Wells, Grand Mesa Geographic Area

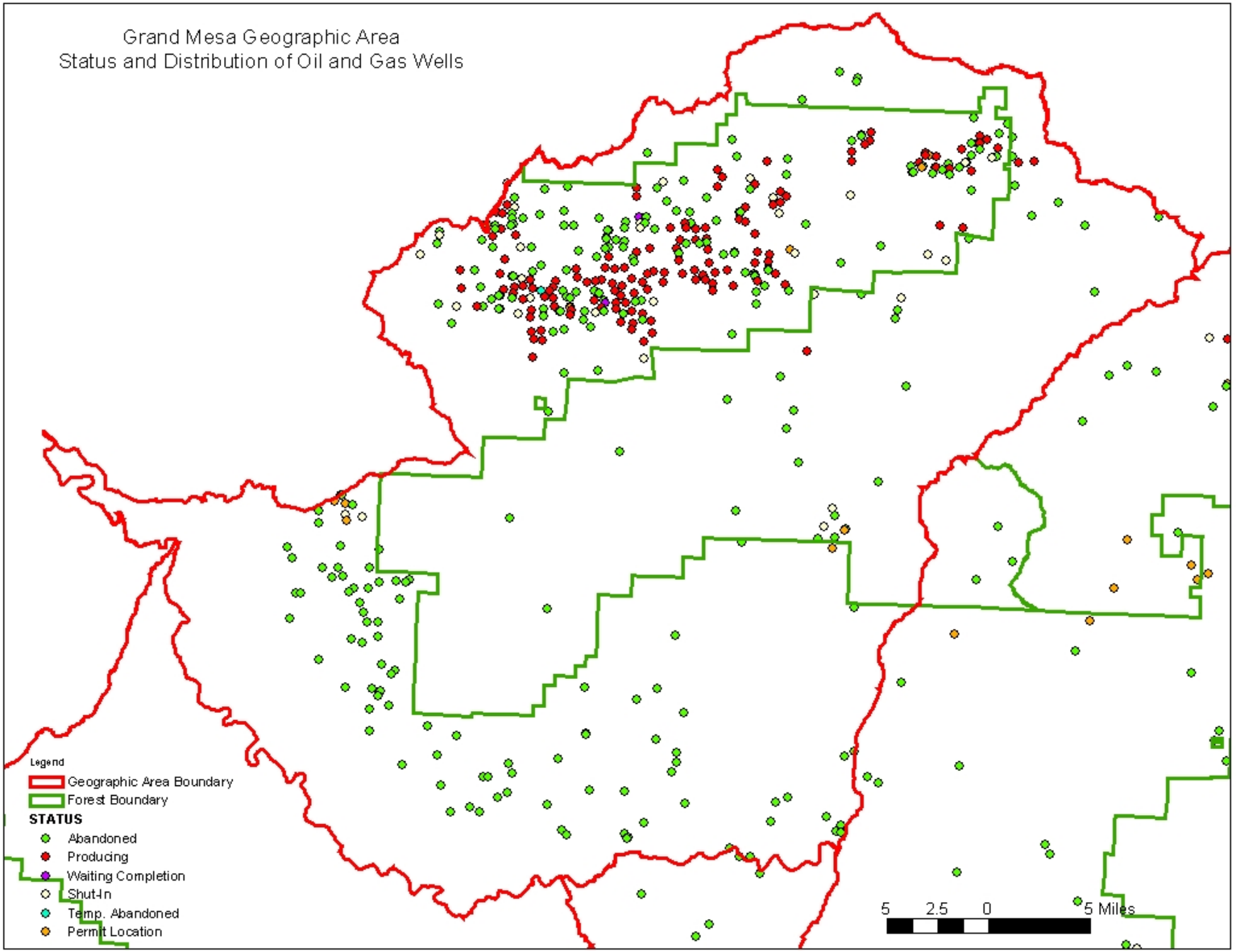


Table 12. Status of Oil and Gas Wells, Grand Mesa Geographic Area

Status	Off NFSL	On NFSL	Total
Abandoned	234	33	267
Producing	144	3	147
Waiting Completion	2		2
Shut-in	29	4	33
Temporarily Abandoned	1		1
Permit Location	18	2	20
Total	428	42	470

The acres of habitat affected by oil and gas well locations on the Grand Mesa Geographic Area are summarized in Table 13. Approximately six percent of the NFS lands on the Grand Mesa Geographic Area have been influenced by oil and gas wells. Most of the area affected is within aspen (33 percent); however, 22 percent of the blue spruce, 21 percent of the sagebrush, and 19 percent of the cottonwood cover types on the Grand Mesa have been influenced by oil and gas wells.

Table 13. Acres by Cover Type within ½ mile Buffer around Oil and Gas Wells, Grand Mesa Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type on GMGA
Grass/Forb	3,164	15	8
Sagebrush	485	2	21
Gambel Oak	3,923	18	8
Mixed Mountain Shrub	632	3	4
Snowberry	981	5	9
Willow	431	2	12
Cottonwood	89	0	19
Aspen	7,174	33	8
Pinyon/Juniper	1,366	6	5
Douglas-fir	111	1	3
Blue Spruce	12	0	22
Spruce/Fir	2,825	13	3
Bare/Rock	224	1	2
Water	201	1	5
Total	21,619		6

Oil and gas development and exploration is expected to continue on this Geographic Area. Currently 24,000 acres are leased. Requests that additional parcels be made available for leasing have dramatically increased (72,000 acres as of January 2005). The presence of a lease does not insure that exploration and development will occur; however, increases in drilling activity are occurring.

Gunnison Basin Geographic Area

Mining Activities

Mining site activity included in the USGS MAS/MILS database (Causey 1998) that occur within the Gunnison Basin Geographic Area are listed in Table 14. Figure 11 displays where these mineral sites are located. Concentration areas occur north and west of

Crested Butte and near Pitkin, Tincup and Whitepine. Thirty-five percent of all USGS MAS/MILS sites in the GMUG area occur in the Gunnison Basin Geographic Area. Six recently active sites are located on NFS lands (43 percent of all recently active sites on NFSL in the GMUG area).

Table 14. Status of Mining Sites in Gunnison Basin Geographic Area.

Status	Off NFSL	On NFSL	Total
Historic	87	123	210
Prospect	31	19	50
Recent	19	6	25
Unknown	343	146	489
Grand Total	480	294	774

Table 15 lists the mineral types that were mined at these sites. One hundred percent of the titanium, cobalt, diatomite, kyanite, lithium, perlite, rare earth, silicon, tantalum, thorium, vermiculite, and zeolites mined off the GMUG area, came from the Gunnison Basin Geographic Area. Figure 13 displays the mineral types for this Geographic Area.

Table 15. Mining Sites by Mineral Type for Gunnison Basin Geographic Area

Mineral Type	Off NFSL	On NFSL	Total
Base Metals:			
Aluminum	1		1
Manganese	13	8	21
Mercury	3		3
Molybdenum		1	1
Titanium	2		2
Tungsten	1	1	2
Common Variety:			
Clay		1	1
Sand & Gravel	23	6	29
Stone	1	1	2
Coal	2	6	8
Copper	11	6	17
Geothermal	1	2	3
Gold	48	42	90
Iron	3	8	11
Lead	26	24	50
Non-Metal:			
Barite		3	3
Beryllium	2	6	8
Calcium	2	2	4
Cobalt		1	1
Diatomite	1		1
Feldspar	2	1	3
Fluorine	3	2	5
Graphite	1	1	2
Kyanite Group	2	1	3
Lithium		1	1
Mica		3	3
Perlite	4	3	7
Pumice	3		3
Quartz Crystal	1	1	2
Rare Earth	1	3	4
Silicon	1		1
Sulfur	1		1
Tantalum	2		2
Thorium	2		2
Vermiculite	3		3
Zeolites	1	1	2
Silver	26	40	66
Uranium	20	18	38
Zinc	21	31	52
Unknown	246	70	316
Total	480	294	774

Figure 14 displays the recently active sites, by mineral type. There are also nine small gravel pits located on NFS lands utilized by Forest Service and County crews as rock sources for project work in this Geographic Area. These sites are also shown on Figure 14.

Figure 11. Status of Mining Sites Located on Gunnison Basin Geographic Area

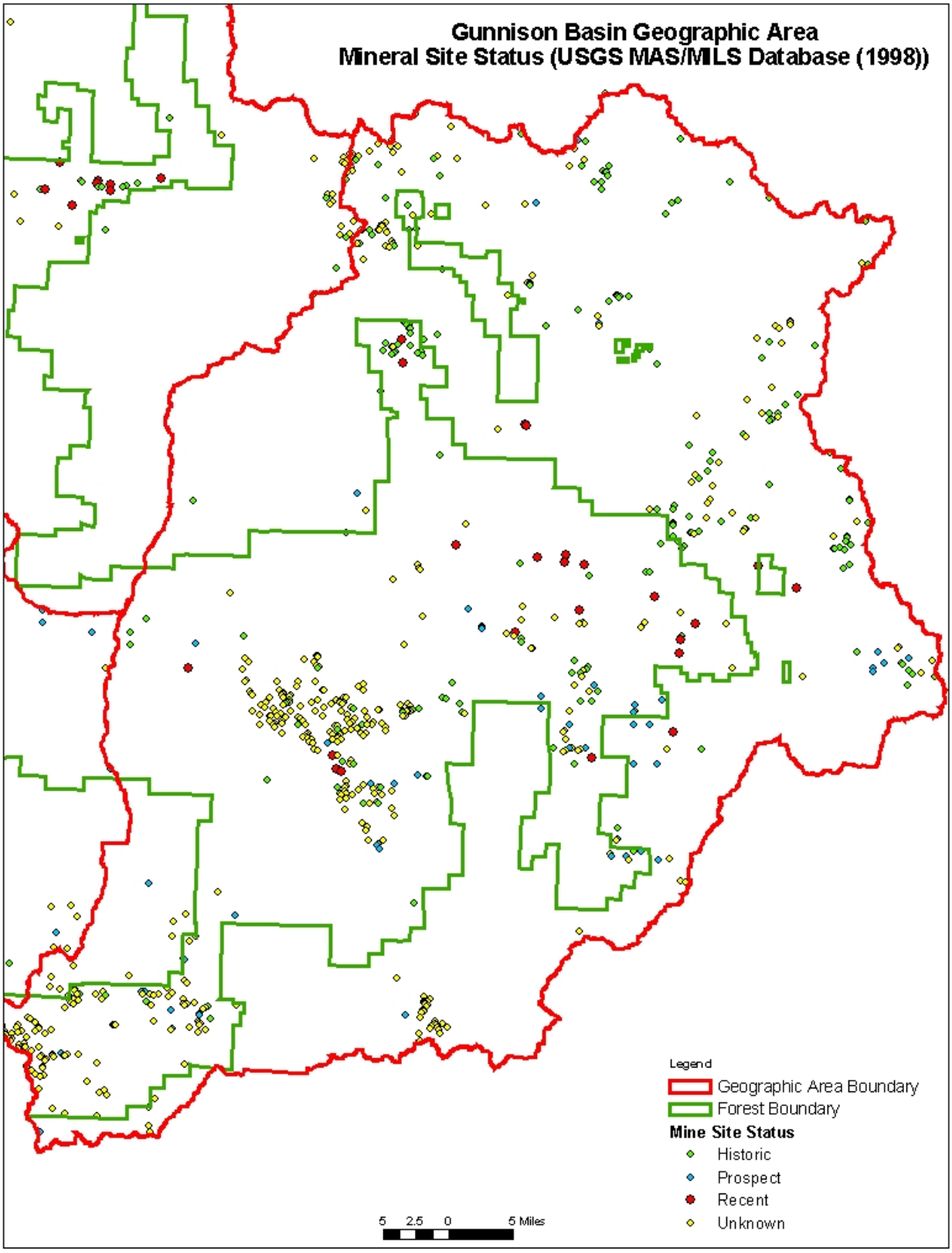


Figure 12. Mining Sites by Mineral Type on Gunnison Basin Geographic Area.

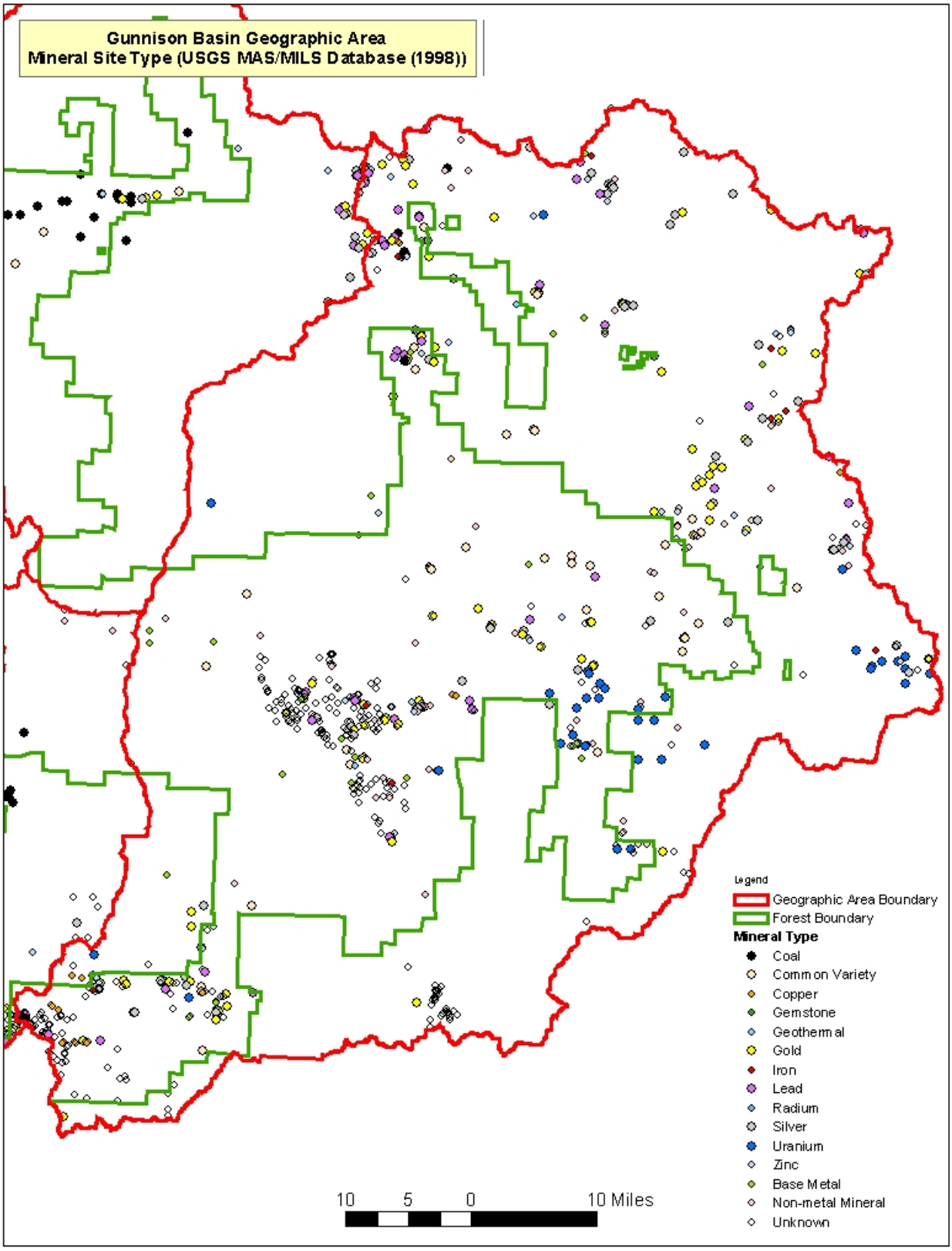


Figure 13. Recently Active Mining Sites by Mineral Type for Gunnison Basin Geographic Area

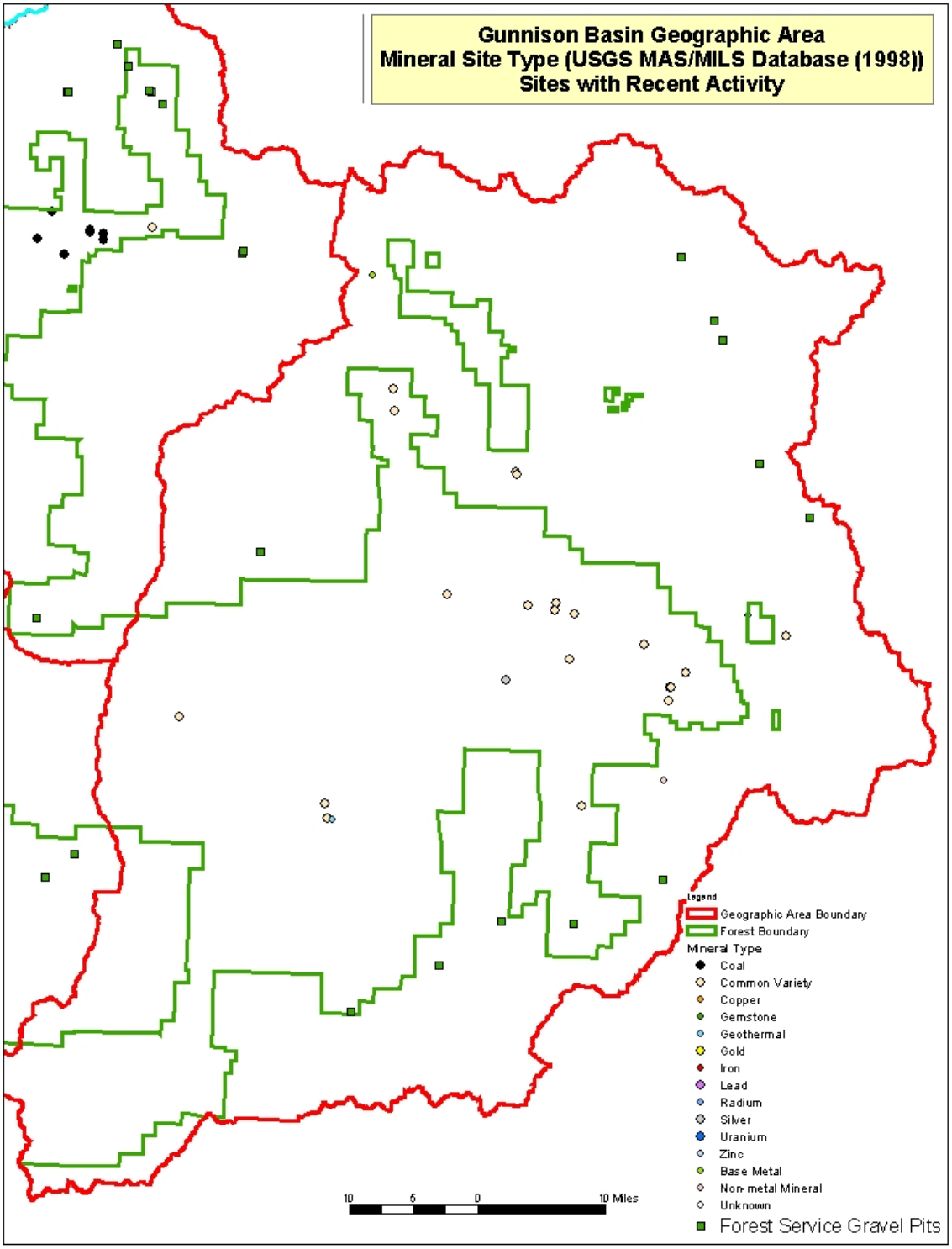
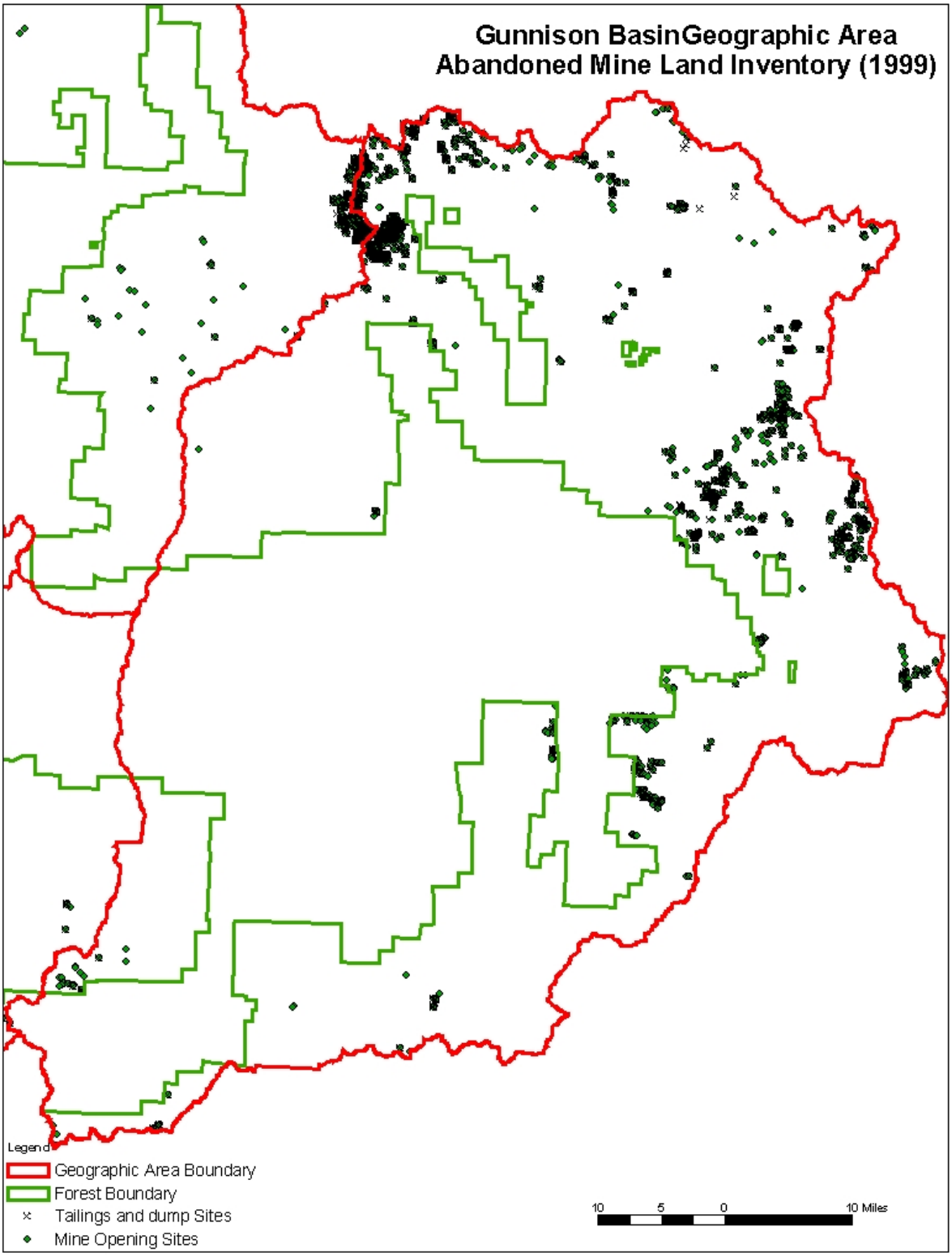


Figure 14. Abandoned Mine Land Inventory, Gunnison Basin Geographic Area



Information from the abandoned mine land inventory (Lawson et al. 1996, Fehlmann et al. 1998) indicates there are 956 mine dumps, six highwalls, four processing sites, two mill tailings and four dumps sites that have not been classified by type. In addition there are 616 adits, nine incline shafts, 590 prospect holes, 24 open pits, 185 vertical shafts, one stope, two subsidence features and 75 other types of mine openings. The environmental degradation and physical hazard ratings for these mining sites are listed in Tables 16 and 17 below.

Table 16. Environmental Degradation Ratings for Abandoned Mine Land Inventory on the Gunnison Basin GA (counts of tailings, dumps and openings combined)

Rating	Extreme	Significant	Potentially Significant	Slight	None
Number of Sites	1	14	72	204	2115

Table 17. Physical Hazard Ratings for Abandoned Mine Land Inventory on the Gunnison Basin GA (counts of tailings, dumps and openings combined)

Rating	Extreme Danger	Dangerous	Potential Danger	No Significant Danger
Number of Sites	9	96	283	2028

To determine the influence these 2,474 features had on surrounding vegetation and habitat, sites were buffered by ½ mile. Table 18 below summarizes the acres affected by these mining sites, by cover type. Mining activities have impacted more lodgepole pine (26 percent) and spruce/fir (21 percent) than any other cover types in the Gunnison Basin Geographic Area. Approximately 10 percent of the NFS lands in the Gunnison Basin are within ½ mile of mining activity.

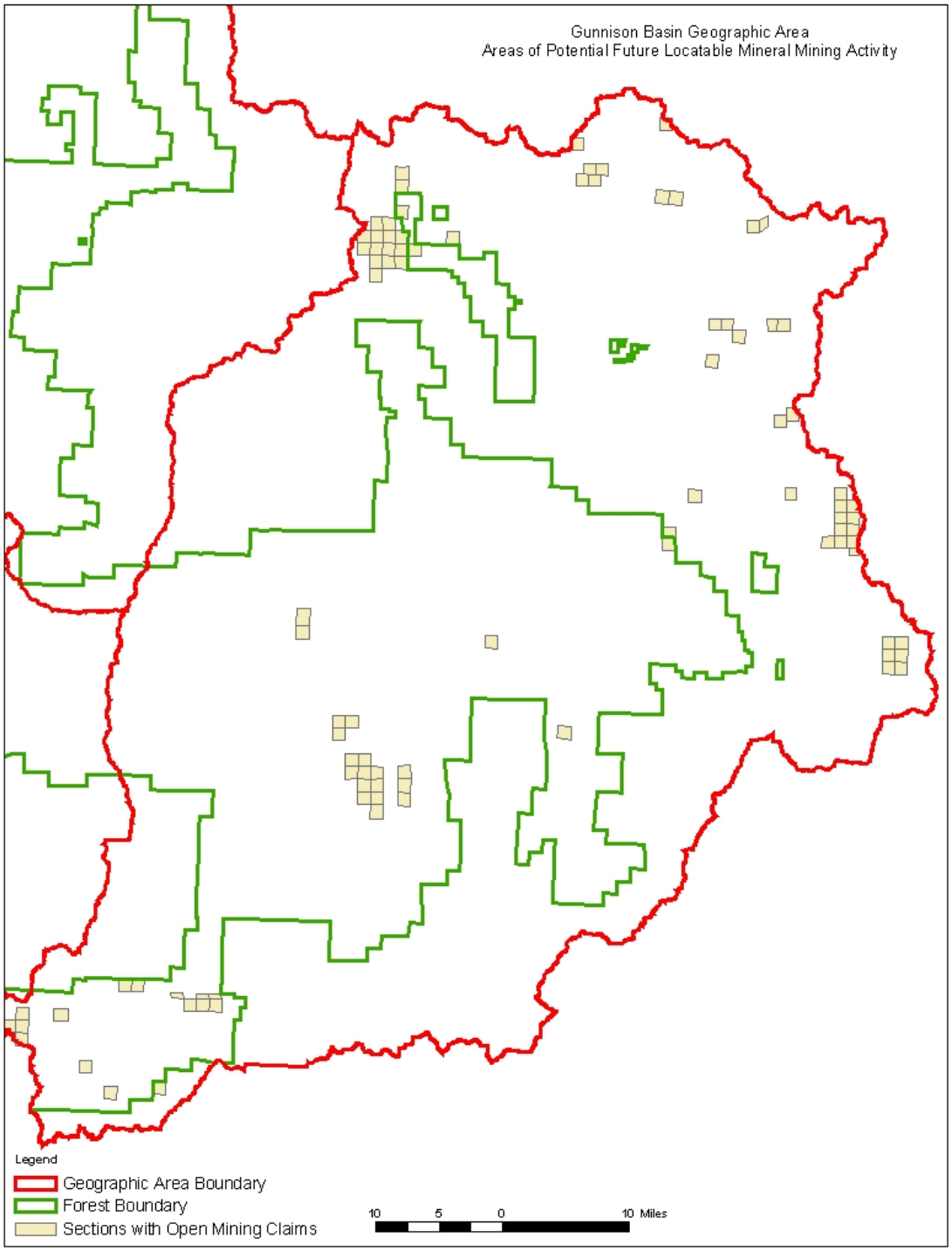
Table 18. Acres by Cover Type within ½ mile Buffer around Abandoned Mine Land Inventory Sites (Openings and Tailings), Gunnison Basin Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	26,104	19	10
Sagebrush	8,708	6	13
Mixed Mountain Shrub	1,001	1	9
Willow	8,941	6	14
Cottonwood	1	0	0
Aspen	12,357	9	6
Ponderosa Pine	1,253	1	11
Lodgepole Pine	35,212	26	13
Limber Pine	53	0	9
Douglas-fir	1,038	1	3
Blue Spruce	19	0	1
Spruce/Fir	29,450	21	8
Bristlecone Pine	710	1	10
Bare/Rock	12,976	9	13
Water	84	0	3
Total	137,905		10

An indication of potential future areas of mining activity or development can be gained by reviewing where active mining claims occur. Figure 15 displays sections with one or

more open mining claim (Hyndman and Campbell 1999). Areas with active claims also correspond to areas of past activity.

Figure 15. Areas of Potential Future Mining Activity, Gunnison Basin Geographic Area



Oil and Gas Exploration and Development

Oil and gas exploration and development on the Gunnison Basin Geographic Area has had a very small influence. Only seven wells have ever been drilled in this geographic area and all have been abandoned (COGCC 2005) (see Figure 6). Of these, only one well was located on NFS land, in East Red Creek. The geologic formations underlying this Geographic Area have low and mostly no potential for oil and gas reserves. There are no existing leases or lease requests for this Geographic Area. Approximately 500 acres of mostly spruce/fir, aspen and some grass/forb cover type occur within ½ mile of the one well on NFS lands.

North Fork Valley Geographic Area

Mining Activities

Mining site activity included in the USGS MAS/MILS database (Causey 1998) that occur within the North Fork Valley Geographic Area are listed in Table 19. Figure 16 displays where these mineral sites are located. Most of the past mining activity in this Geographic Area has occurred off NFSL. The exception is along the Ruby Range on the east side of the Geographic Area, north of Kebler Pass. Table 20 lists the mineral types that were mined at these sites. Figure 17 displays the mineral types for this Geographic Area.

Table 19. Status of Mining Sites in North Fork Valley Geographic Area.

Status	Off NFSL	On NFSL	Total
Historic	28	4	32
Prospect			
Recent	10	0	10
Unknown	6	15	21
Grand Total	44	19	63

Table 20. Mining Sites by Mineral Type for North Fork Valley Geographic Area

Mineral Type	Off NFSL	On NFSL	Total
Common Variety: Sand & Gravel	11		11
Coal	23	1	24
Copper		1	1
Gold	3	5	8
Lead		3	3
Non-Metal: Gypsum	2		2
Sulfur	1		1
Silver	1	7	8
Uranium	1		1
Zinc	1	2	3
Unknown	1		1
Total	44	19	63

Table 19 above indicates there are no recently active mining sites located on the North Fork Valley Geographic Area. However; coal leases extend onto NFS land and

underground mining activities extend under NFS lands. Facilities related to exploration and development of coal reserves (roads to access coal exploration wells drilled to define the extent of coal reserves, methane exhaust vents) do exist on NFS land, primarily in the Flatirons area. Figure 18 displays the coal mine and coal lease locations for the North Fork Valley Geographic Area.

There are also five small gravel pits located on NFS lands utilized by Forest Service and County crews as rock sources for project work in this Geographic Area. These sites are also shown on Figure 18.

Figure 16. Status of Mining Sites Located on North Fork Valley Geographic Area

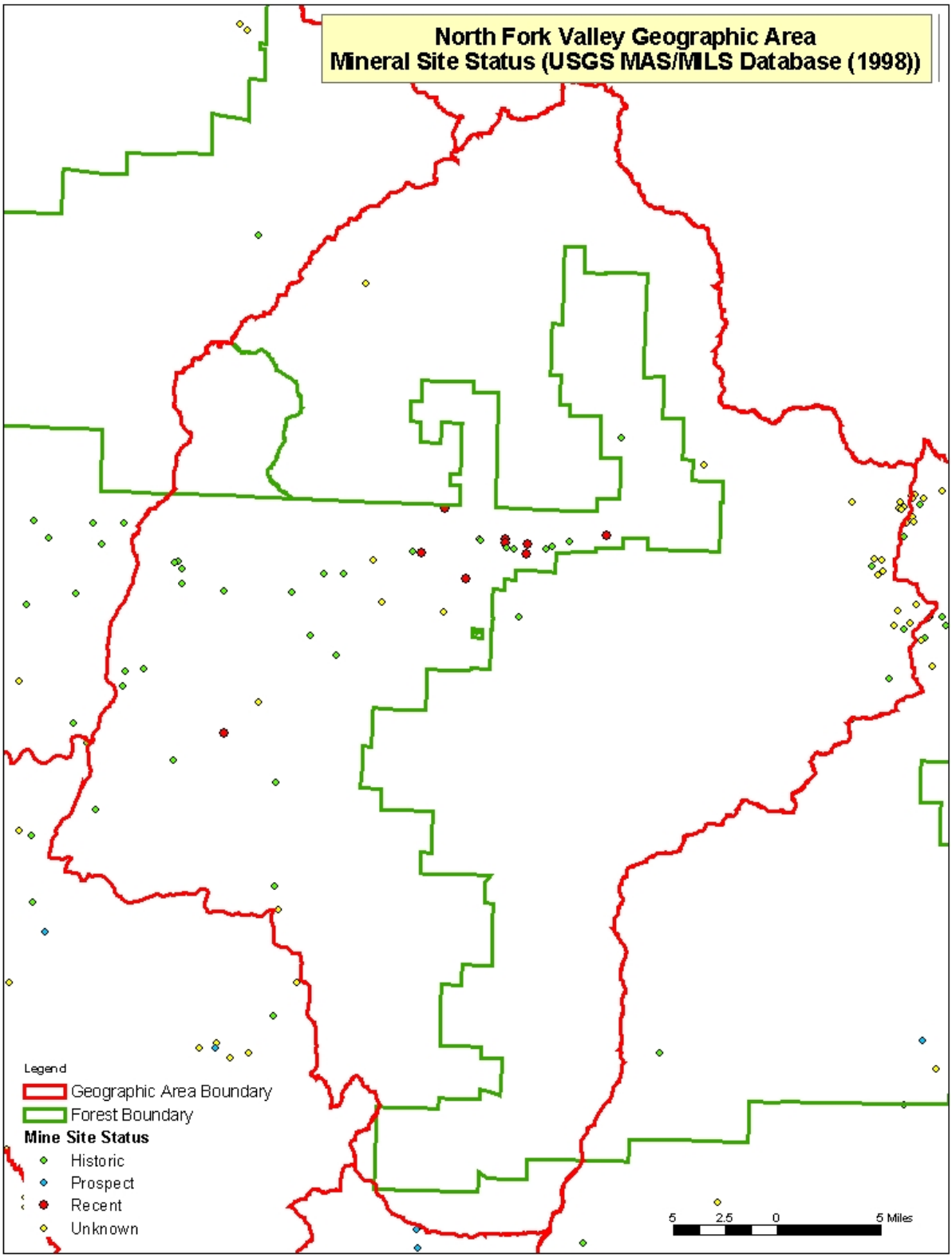


Figure 17. Mining Sites by Mineral Type on North Fork Valley Geographic Area.

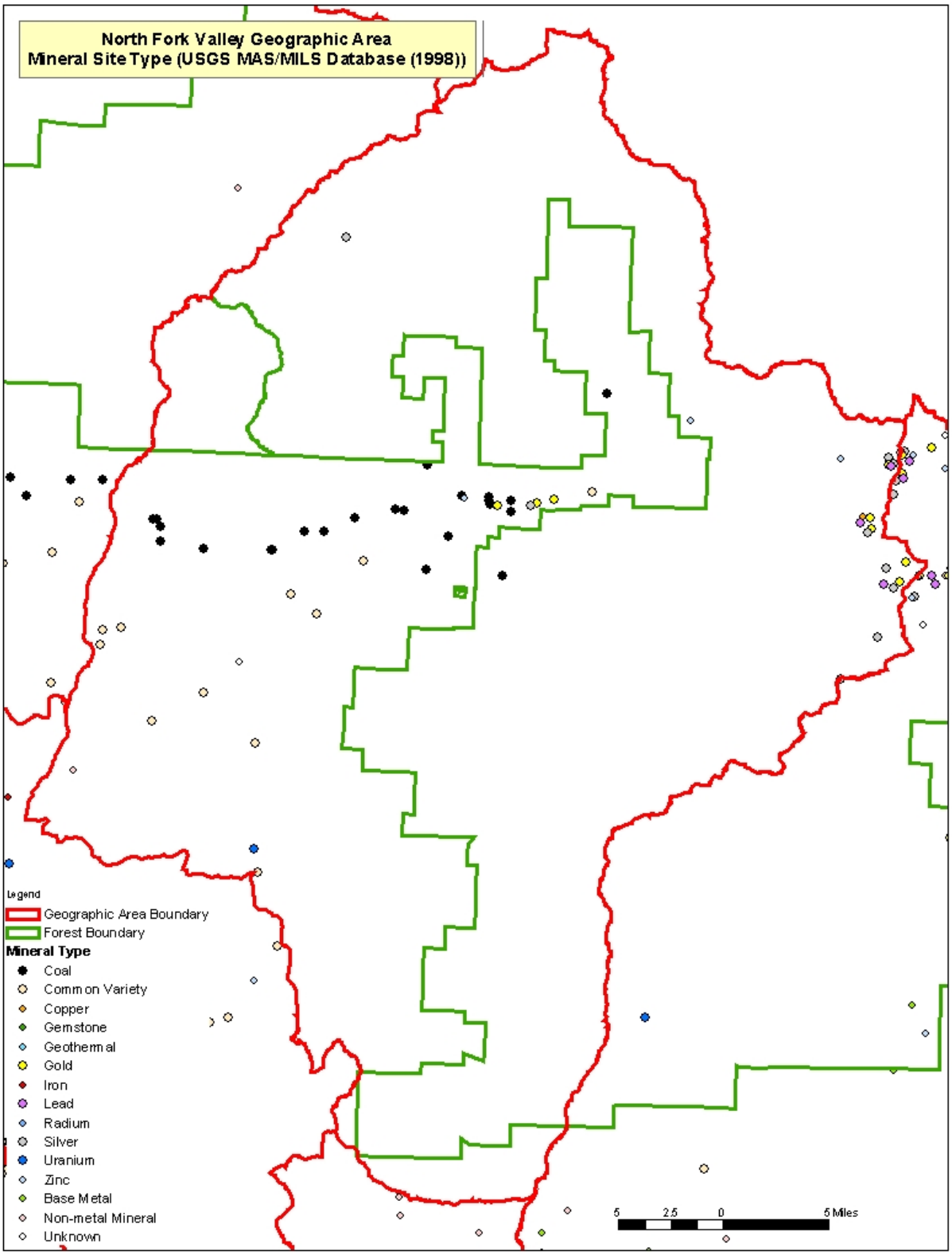


Figure 18. Active Coal Mines, Coal Leases, Gravel Pits on North Fork Valley Geographic Area

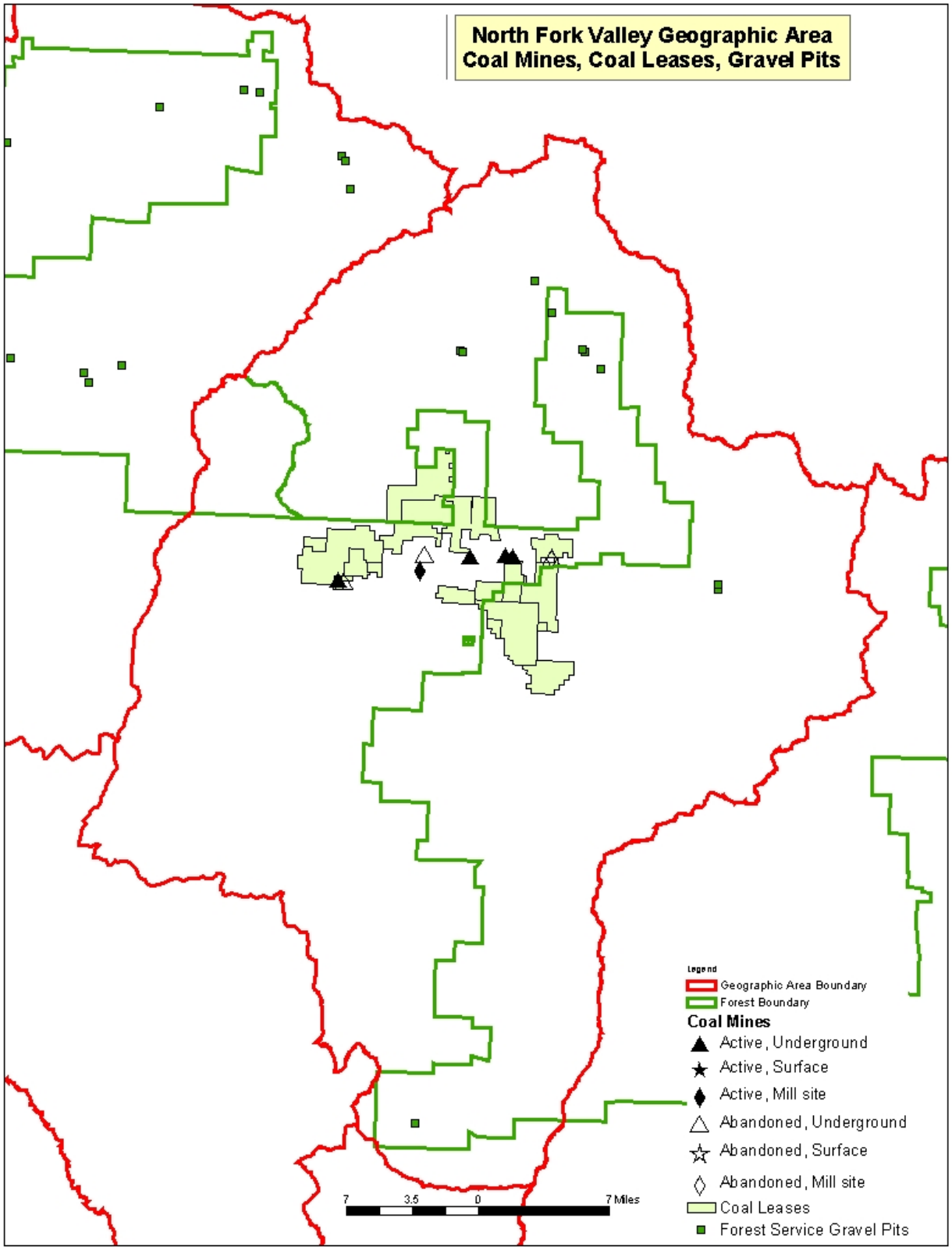
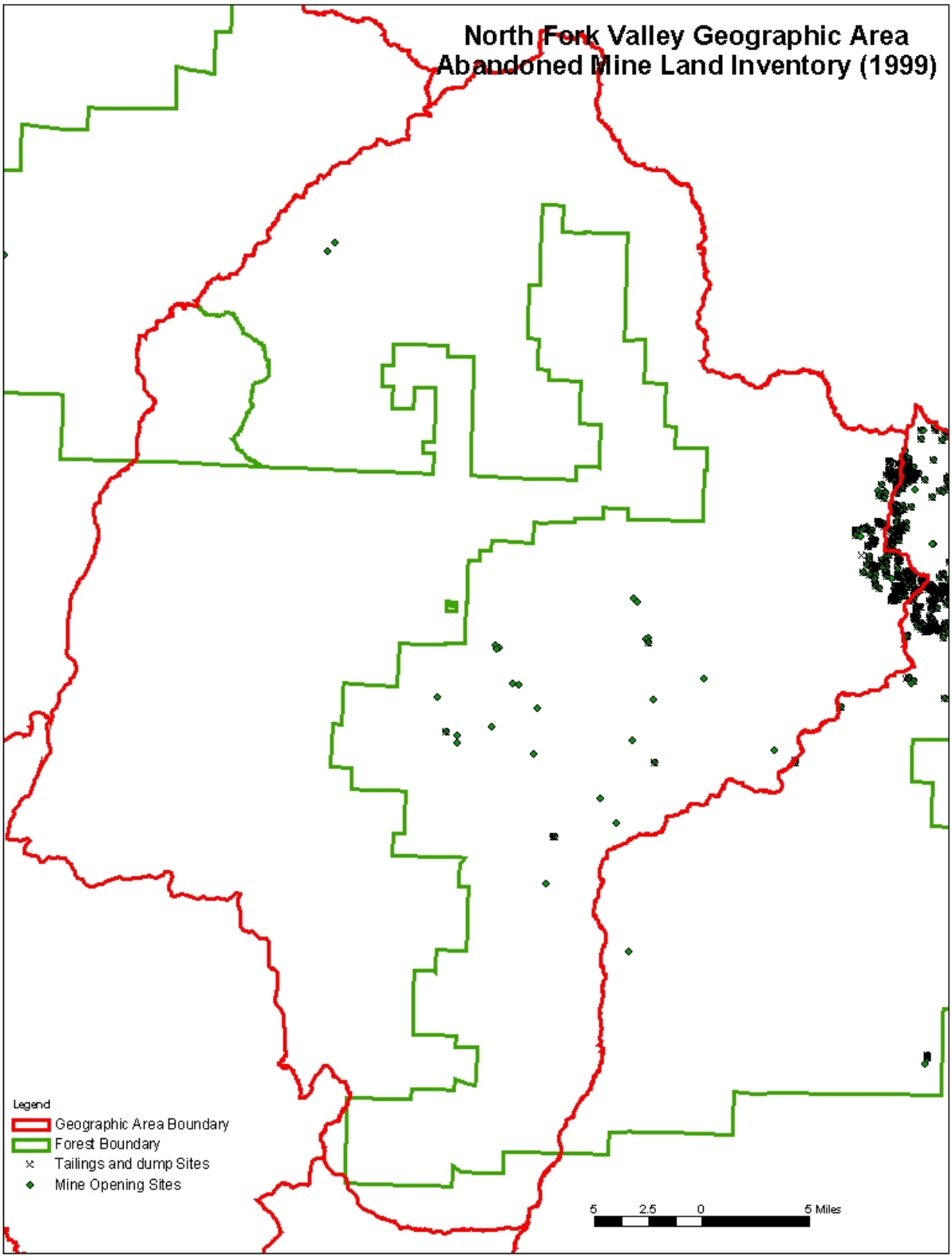


Figure 19. Abandoned Mine Land Inventory, North Fork Valley Geographic Area



Information from the abandoned mine land inventory (Fahlmann 1998) indicates mining activity in and around the West Elk Wilderness that was not included in the USGS MAS/MILS database. The concentration of mining activity in the Ruby Range is included in the abandoned mine land inventory. This inventory indicates there are 160 mine dumps. In addition there are 47 adits, one incline shaft, 92 prospect holes, 65 vertical shafts, and 11 other types of mine openings. Environmental degradation and physical hazard ratings for these mining sites are listed in Tables 21 and 22 below.

Table 21. Environmental Degradation Ratings for Abandoned Mine Land Inventory on the North Fork Valley GA (counts of tailings, dumps and openings combined)

Rating	Extreme	Significant	Potentially Significant	Slight	None
Number of Sites	0	3	12	38	323

Table 22. Physical Hazard Ratings for Abandoned Mine Land Inventory on the North Fork Valley GA (counts of tailings, dumps and openings combined)

Rating	Extreme Danger	Dangerous	Potential Danger	No Significant Danger
Number of Sites	2	13	58	303

Table 23 below summarizes the acres affected by these 376 mining sites, by cover type. Mining activities have impacted more aspen (29 percent) and spruce/fir (26 percent) than any other cover types in the North Fork Valley Geographic Area. Approximately three percent of the NFS lands in the North Fork Valley are within ½ mile of mining activity. There are currently no active mining claims within the North Fork Valley Geographic Area.

Table 23. Acres by Cover Type within ½ mile Buffer around Abandoned Mine Land Inventory Sites (Openings and Tailings), North Fork Valley Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	2,735	16	7
Gambel Oak	1,062	6	1
Mixed Mountain Shrub	1,252	7	5
Willow	883	5	9
Aspen	5,070	29	2
Pinyon/Juniper	19	0	1
Spruce/Fir	4,643	26	4
Bare/Rock	1,788	10	6
Water	79	0	7
Total	17,532		3

Oil and Gas Exploration and Development

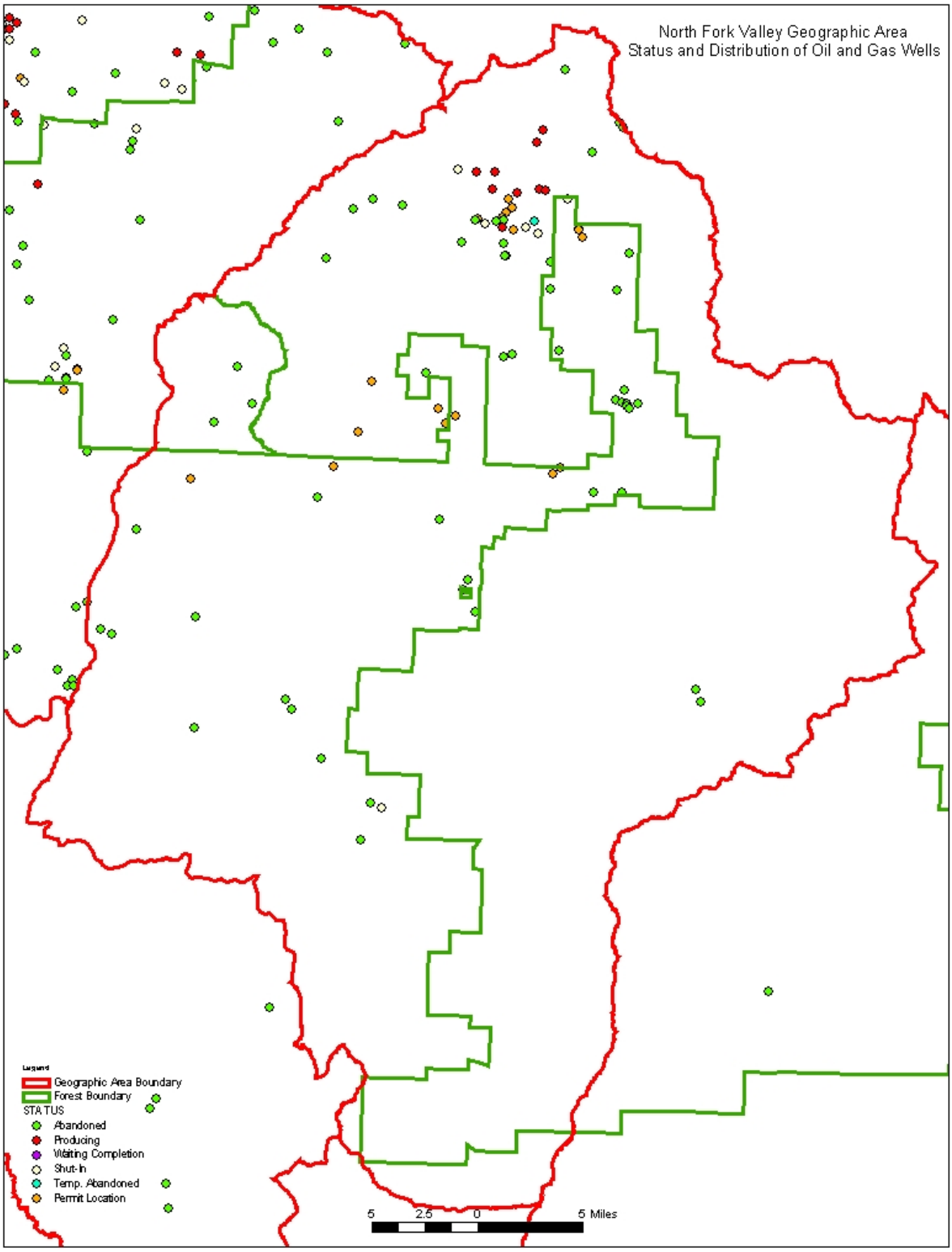
The northern half of the North Fork Valley Geographic Area has high potential for oil and gas. This area is also on the southern edge of the Piceance Basin. Table 24 identifies the current status of oil and gas wells and whether they occur on NFSL in this Geographic Area (COGCC 2005).

Table 24. Status of Oil and Gas Wells, North Fork Valley Geographic Area

Status	Off NFSL	On NFSL	Total
Abandoned	28	24	52
Producing	0	9	9
Waiting Completion	0	0	0
Shut-in	2	5	7
Temporarily Abandoned		1	1
Permit Location	9	10	19
Total	39	49	88

The total number of all wells in the North Fork Valley Geographic Area account for 13 percent of the wells in the area surrounding the GMUG. Twelve percent of the abandoned wells in the GMUG area are in the North Fork Valley Geographic Area. Six percent of the producing wells in the GMUG area are in the North Fork Valley GA. Thirty-two percent of all abandoned wells on NFS lands in the GMUG occur on the North Fork Valley GA, while 75 percent of all producing wells on the GMUG are found here. Figure 20 displays oil and gas well locations and their status for this Geographic Area. The majority of activity has been in the Clear Fork area.

Figure 20. Status and Distribution of Oil and Gas Wells, North Fork Valley Geographic Area



The acres of habitat affected by oil and gas well locations on the North Fork Valley Geographic Area are summarized in Table 25. Approximately four percent of the NFS lands on the North Fork Valley Geographic Area have been influenced by oil and gas wells. Most of the area affected is within aspen (44 percent) and Gambel oak (25 percent); however, 29 percent of the snowberry, and 21 percent of the sagebrush cover types on the North Fork Valley GA have been influenced by oil and gas wells.

Table 25. Acres by Cover Type within ½ mile Buffer around Oil and Gas Wells, North Fork Valley Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type on GMGA
Grass/Forb	1,728	8	4
Sagebrush	1,835	8	21
Gambel Oak	5,456	25	8
Mixed Mountain Shrub	391	2	2
Snowberry	368	2	29
Willow	515	2	5
Cottonwood	93	0	9
Aspen	9,796	44	5
Pinyon/Juniper	18	0	1
Spruce/Fir	1,983	9	2
Bare/Rock	60	0	0
Water	19	0	2
Total	22,262		4

Oil and gas development and exploration is expected to continue on this Geographic Area. Currently 60,900 acres are leased – the largest amount on any Geographic Area. Requests that additional parcels be made available for leasing have dramatically increased (65,700 acres as of January 2005). The presence of a lease does not insure that exploration and development will occur; however, increases in drilling activity are occurring.

San Juans Geographic Area

Mining Activities

Mining site activity included in the USGS MAS/MILS database (Causey 1998) that occur within the San Juans Geographic Area are listed in Table 26. Figure 21 displays where these mineral sites are located. Concentration areas occur near Ouray and Telluride. Thirty-two percent of all USGS MAS/MILS sites in the GMUG area occur in the San Juans Geographic Area. Seven recently active sites are located on NFS lands (50 percent of all recently active sites on NFSL in the GMUG area).

Table 26. Status of Mining Sites in San Juans Geographic Area.

Status	Off NFSL	On NFSL	Total
Historic	77	464	541
Prospect	18	17	35
Recent	4	7	11
Unknown	36	93	129
Grand Total	135	581	716

Table 27 lists the mineral types that were mined at these sites. Approximately 61 percent of the silver mines, 60 percent of the lead mines, 59 percent of the gold mines and 57 percent of the zinc mines occurred on the San Juans Geographic Area. Figure 22 displays the mineral types for this Geographic Area.

Table 27. Mining Sites by Mineral Type for San Juans Geographic Area

Mineral Type	Off NFSL	On NFSL	Total
Base Metals:			
Manganese	1	3	4
Mercury		1	1
Molybdenum		3	3
Tungsten	1	3	4
Vanadium	10	4	14
Common Variety:			
Sand & Gravel	7	8	15
Stone	3		3
Coal	2	7	9
Copper	2	20	22
Geothermal	2	1	3
Gold	24	179	203
Iron		5	5
Lead	13	68	81
Non-Metal:			
Barite		2	2
Calcium	1	1	2
Feldspar	1		1
Fluorine		5	5
Graphite		1	1
Mica	4		4
Silver	6	112	118
Uranium	18	8	26
Zinc	12	64	76
Unknown	28	86	114
Total	135	581	716

Figure 23 displays the recently active sites, by mineral type. There are also six small gravel pits located on NFS lands utilized by Forest Service and County crews as rock sources for project work in this Geographic Area. These sites are also shown on Figure 23.

Figure 21. Status of Mining Sites Located on San Juans Geographic Area

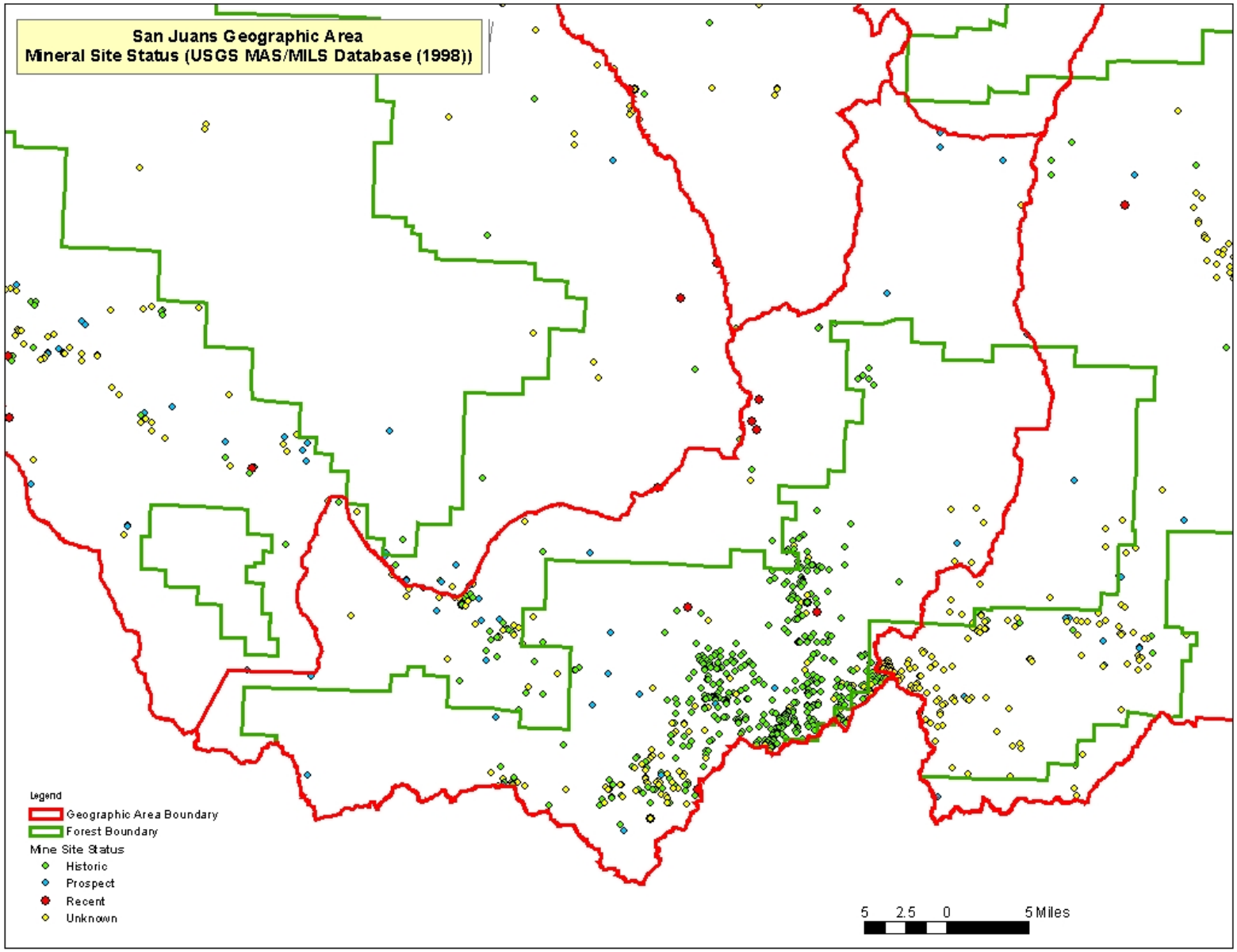


Figure 22. Mining Sites by Mineral Type on San Juans Geographic Area.

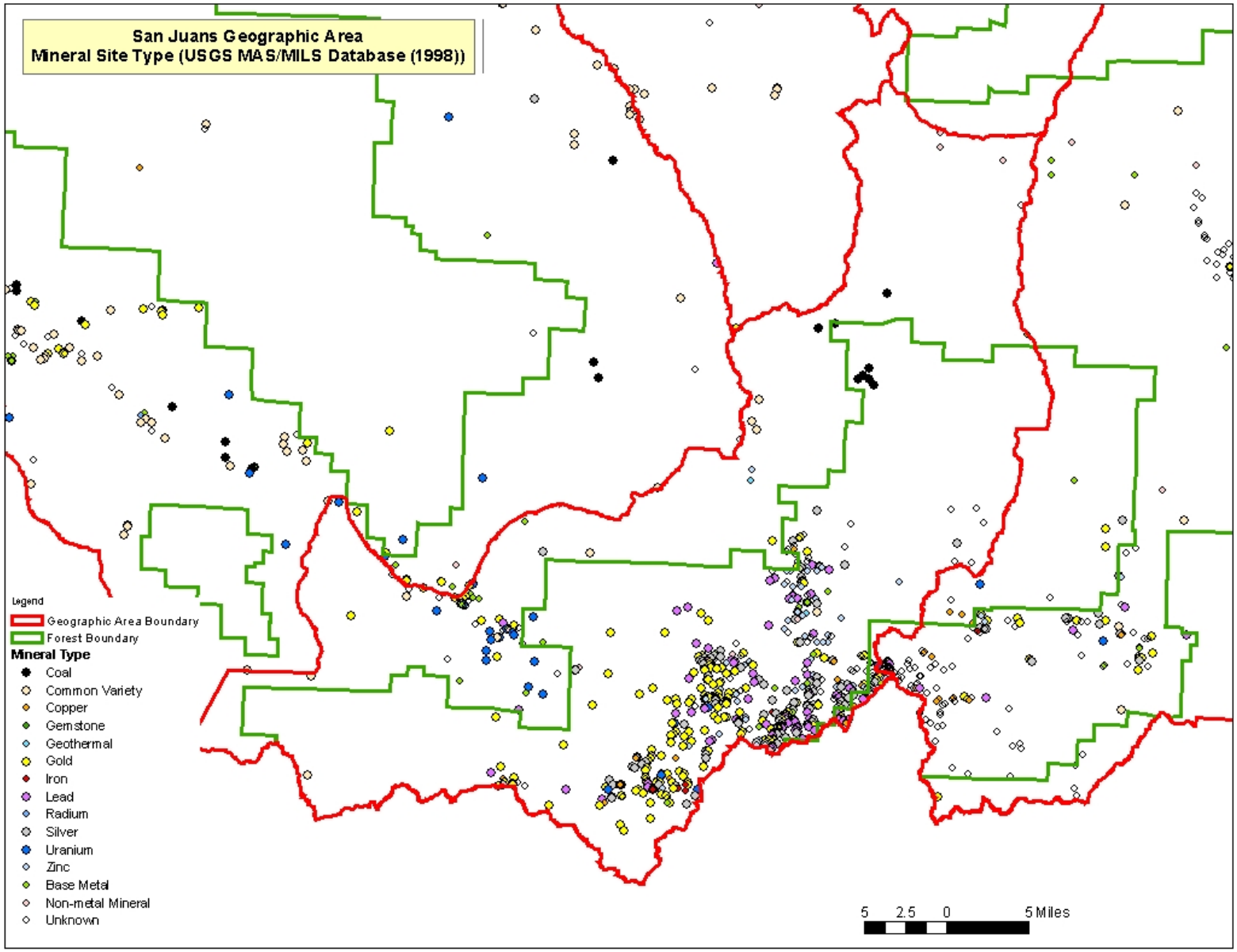


Figure 23. Recently Active Mining Sites by Mineral Type for San Juans Geographic Area

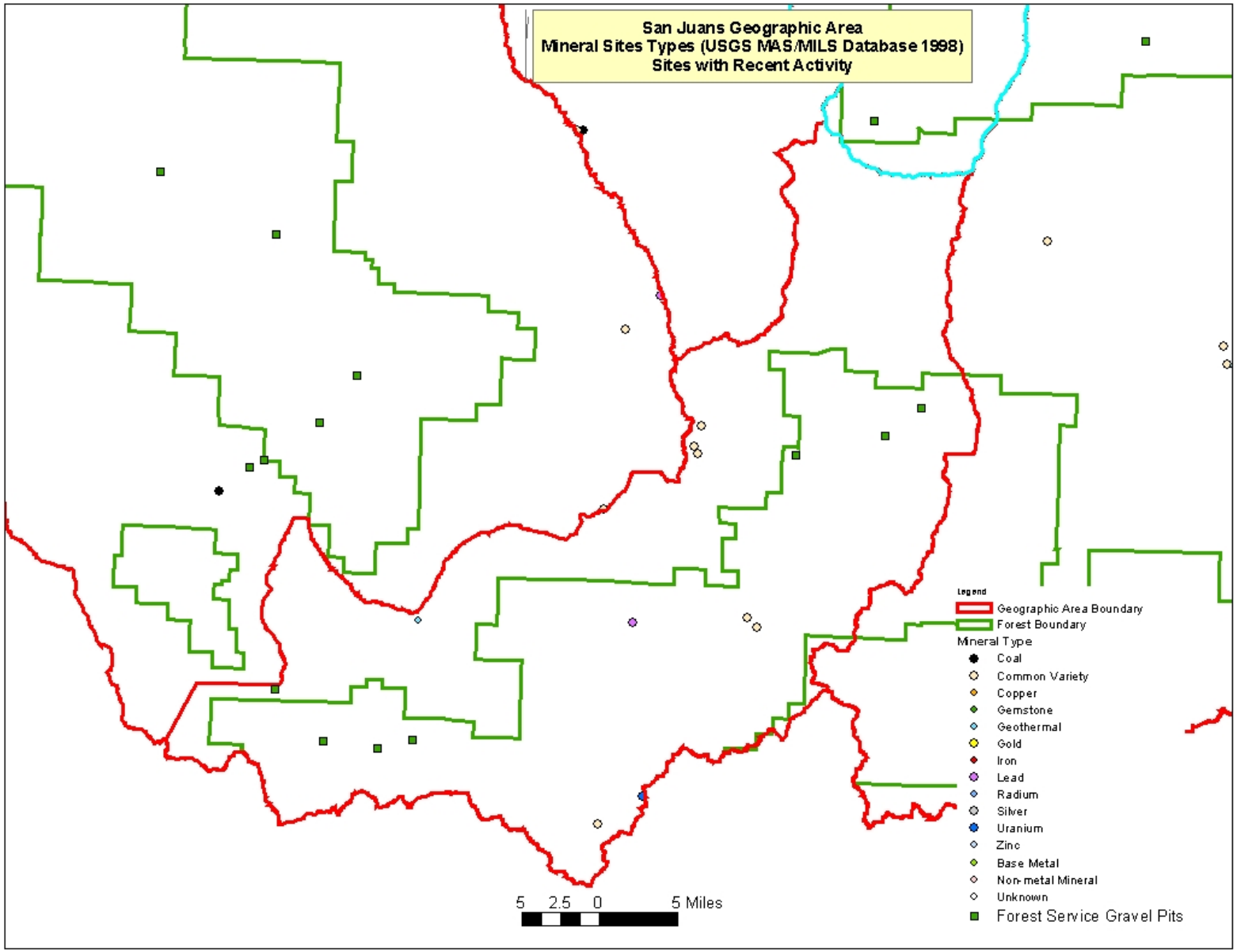
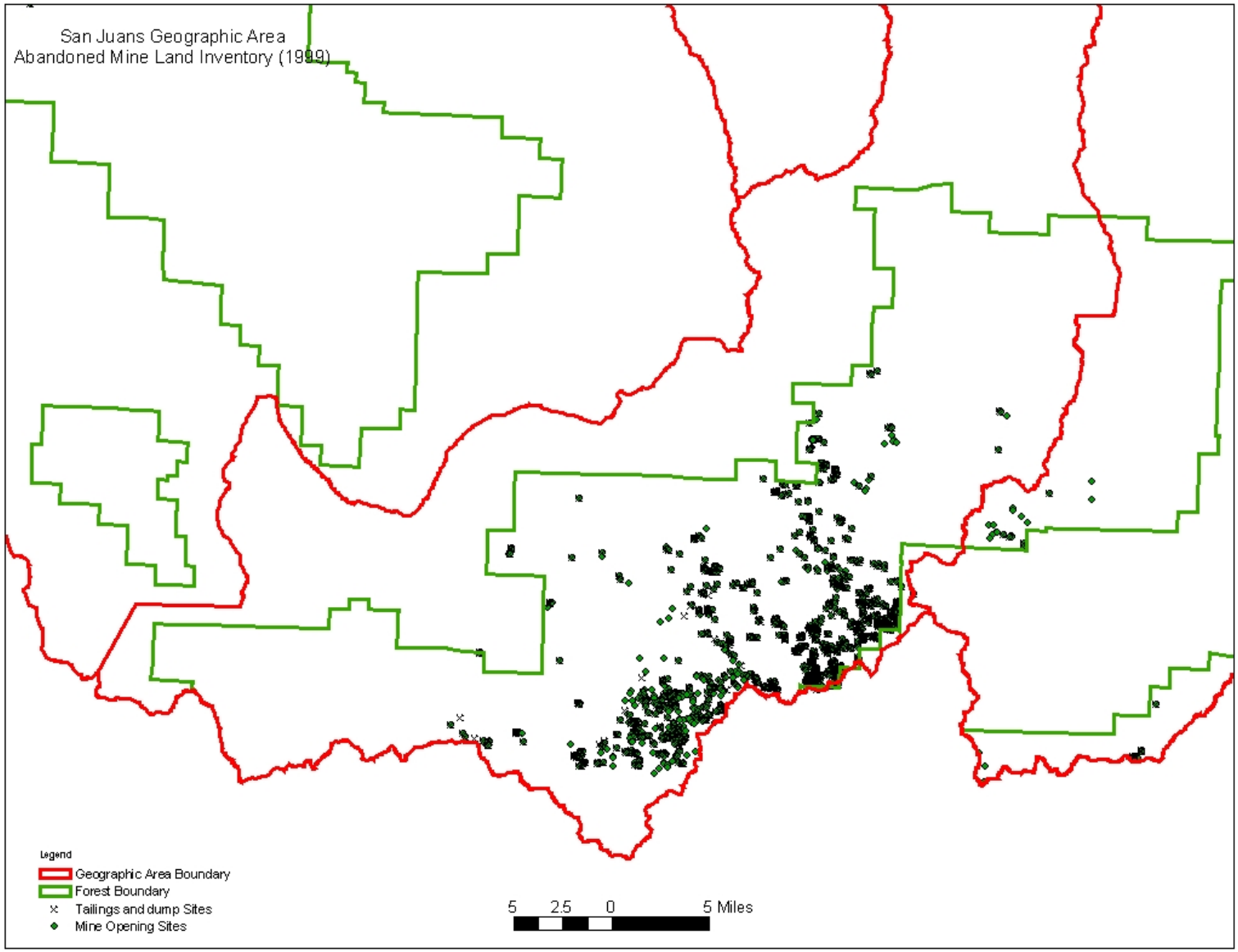


Figure 24. Abandoned Mine Land Inventory, San Juans Geographic Area



Information from the abandoned mine land inventory (Neubert and Harris 1996, Fehlmann 1997) (Figure 24) indicates there are 797 mine dumps, three highwalls, five processing sites, three mill tailings and two spoil sites. In addition there are 716 adits, 351 prospect holes, four open pits, 69 vertical shafts, two stopes, one subsidence feature and six other types of mine openings. Environmental degradation and physical hazard ratings for these mining sites are listed in Tables 28 and 29 below.

Table 28. Environmental Degradation Ratings for Abandoned Mine Land Inventory on the San Juans GA (counts of tailings, dumps and openings combined)

Rating	Extreme	Significant	Potentially Significant	Slight	None
Number of Sites	3	72	167	179	1510

Table 29. Physical Hazard Ratings for Abandoned Mine Land Inventory on the San Juans GA (counts of tailings, dumps and openings combined)

Rating	Extreme Danger	Dangerous	Potential Danger	No Significant Danger
Number of Sites	3	58	328	1545

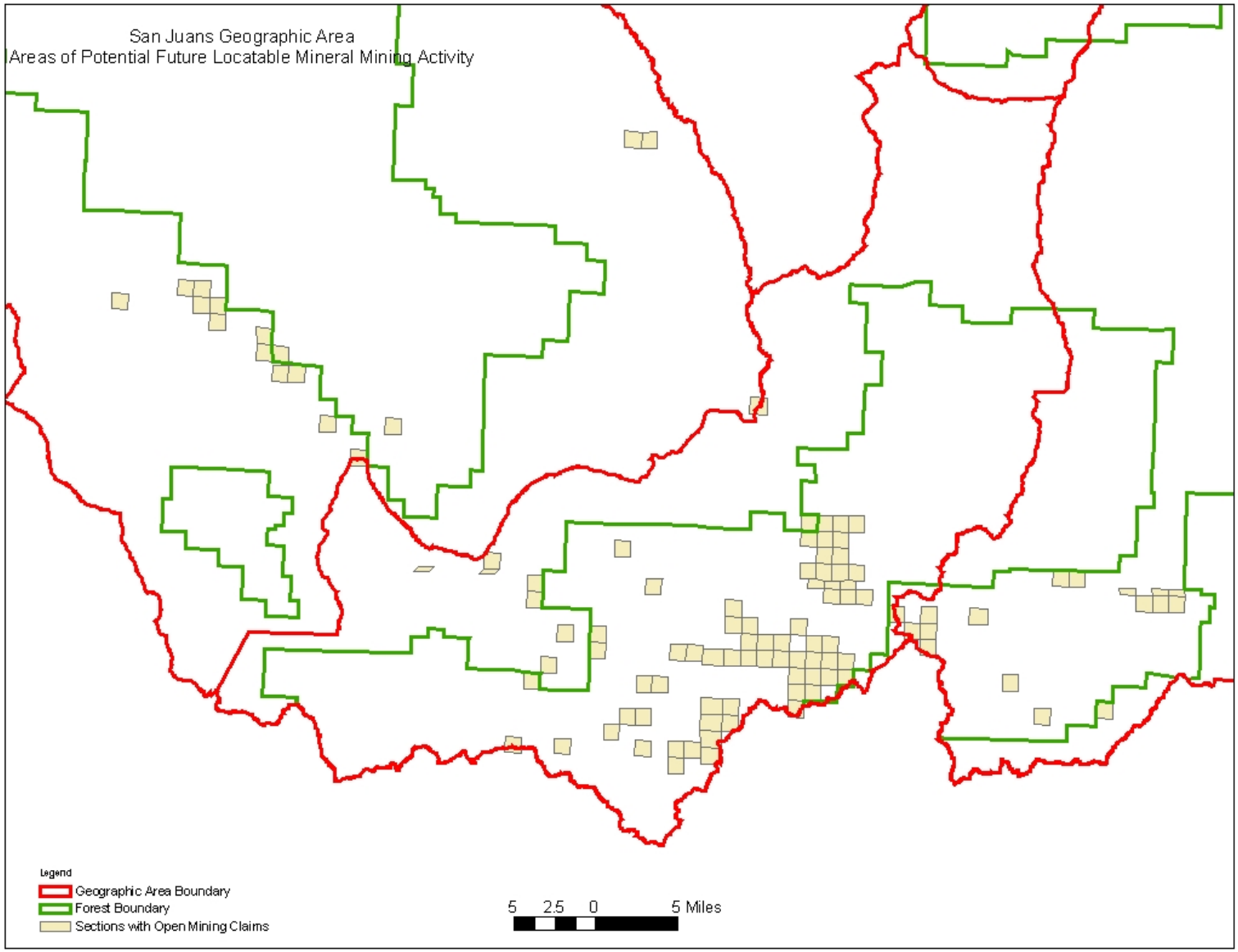
To determine the influence these 1,959 features had on surrounding vegetation and habitat, sites were buffered by ½ mile. Table 30 below summarizes the acres affected by these mining sites, by cover type. Mining activities have impacted more spruce/fir (34 percent), bare/rock (24 percent) and grass/forb (22 percent) than any other cover types in the San Juans Geographic Area. Approximately 20 percent of the NFS lands in the San Juans are within ½ mile of mining activity. This is the largest percentage of all geographic areas.

Table 30. Acres by Cover Type within ½ mile Buffer around Abandoned Mine Land Inventory Sites (Openings and Tailings), San Juans Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	16,427	22	23
Gambel Oak	1,942	3	18
Mixed Mountain Shrub	108	0	12
Willow	1,871	2	26
Cottonwood	113	0	18
Aspen	10,401	14	14
Pinyon/Juniper	492	1	55
Ponderosa Pine	22	0	3
Douglas-fir	412	1	14
Spruce/Fir	25,530	34	19
Bare/Rock	18,067	24	25
Water	193	0	22
Total	75,579		20

An indication of potential future areas of mining activity or development can be gained by reviewing where active mining claims occur. Figure 25 displays sections with one or more open mining claim (Hyndman and Campbell 1999). Areas with active claims also correspond to areas of past activity.

Figure 25. Areas of Potential Future Mining Activity, San Juans Geographic Area



Oil and Gas Exploration and Development

Oil and gas exploration and development on the San Juans Geographic Area has had a very small influence. Only eleven wells have ever been drilled in this geographic area, all have been abandoned, and none occurred on NFS land (see Figure 6). The geologic formations underlying this Geographic Area have moderate potential in the Lone Cone/Beaver Park area, and low and mostly no potential for oil and gas reserves elsewhere. There are no existing leases or lease requests for this Geographic Area.

Uncompahgre Plateau Geographic Area

Mining Activities

Mining site activity included in the USGS MAS/MILS database (Causey 1998) that occur within the Uncompahgre Plateau Geographic Area are listed in Table 31. Figure 26 displays where these mineral sites are located. Most of the past mining activity in this Geographic Area has occurred off NFSL. Mining activities, primarily for uranium were located along the western edge of the Geographic Area, along the San Miguel and Dolores River drainages. Twenty-five percent of all mining sites in the GMUG area occur in the Uncompahgre Plateau Geographic Area.

Table 31. Status of Mining Sites in Uncompahgre Plateau Geographic Area.

Status	Off NFSL	On NFSL	Total
Historic	243	7	250
Prospect	55	2	57
Recent	39	1	40
Unknown	204	10	214
Grand Total	541	20	561

Table 31 above indicates one recently active mining site located on NFS lands within the Uncompahgre Plateau Geographic Area – a vanadium mine. Table 32 lists the mineral types that were mined at all sites. Approximately 25 percent of all mine sites in the USGS MAS/MILS database occur on the Uncompahgre Plateau Geographic Area. This includes the only mines for sodium, gemstone, zirconium and radium. It also includes 92 percent of the vanadium and 74 percent of the uranium mine sites in the GMUG area. Figure 27 displays the mineral types for this Geographic Area.

Table 32. Mining Sites by Mineral Type for Uncompahgre Plateau Geographic Area

Mineral Type	Off NFSL	On NFSL	Total
Base Metals:			
Manganese	2		2
Molybdenum	2		2
Sodium	1		1
Vanadium	149	4	153
Common Variety:			
Clay	4		4
Sand & Gravel	64	3	67
Stone	1		1
Coal	15		15
Copper	3	1	4
Gemstone	1		1
Gold	36	2	38
Lead	1		1
Non-Metal:			
Beryllium		2	2
Fluorine	3		3
Gypsum	1		1
Mica	1		1
Pumice	1		1
Quartz Crystal	1		1
Zirconium	1		1
Radium	3		3
Silver	1		1
Uranium	204	5	209
Unknown	46	3	49
Total	541	20	561

There are also five small gravel pits located on NFS lands utilized by Forest Service and County crews as rock sources for project work in this Geographic Area. These sites are also shown on Figure 26.

Figure 26. Status of Mining Sites Located on Uncompahgre Plateau Geographic Area

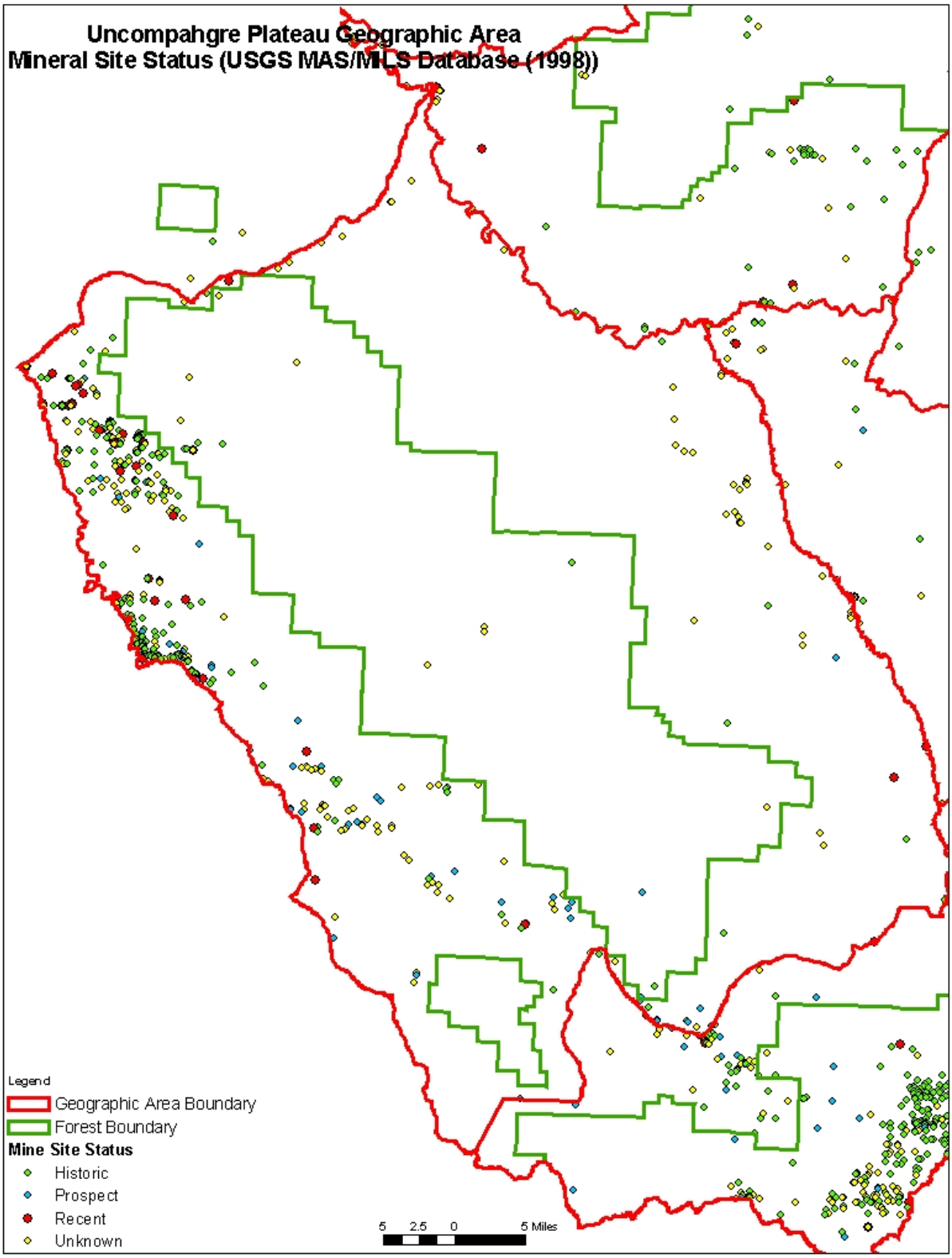


Figure 27. Mining Sites by Mineral Type on Uncompahgre Plateau Geographic Area.

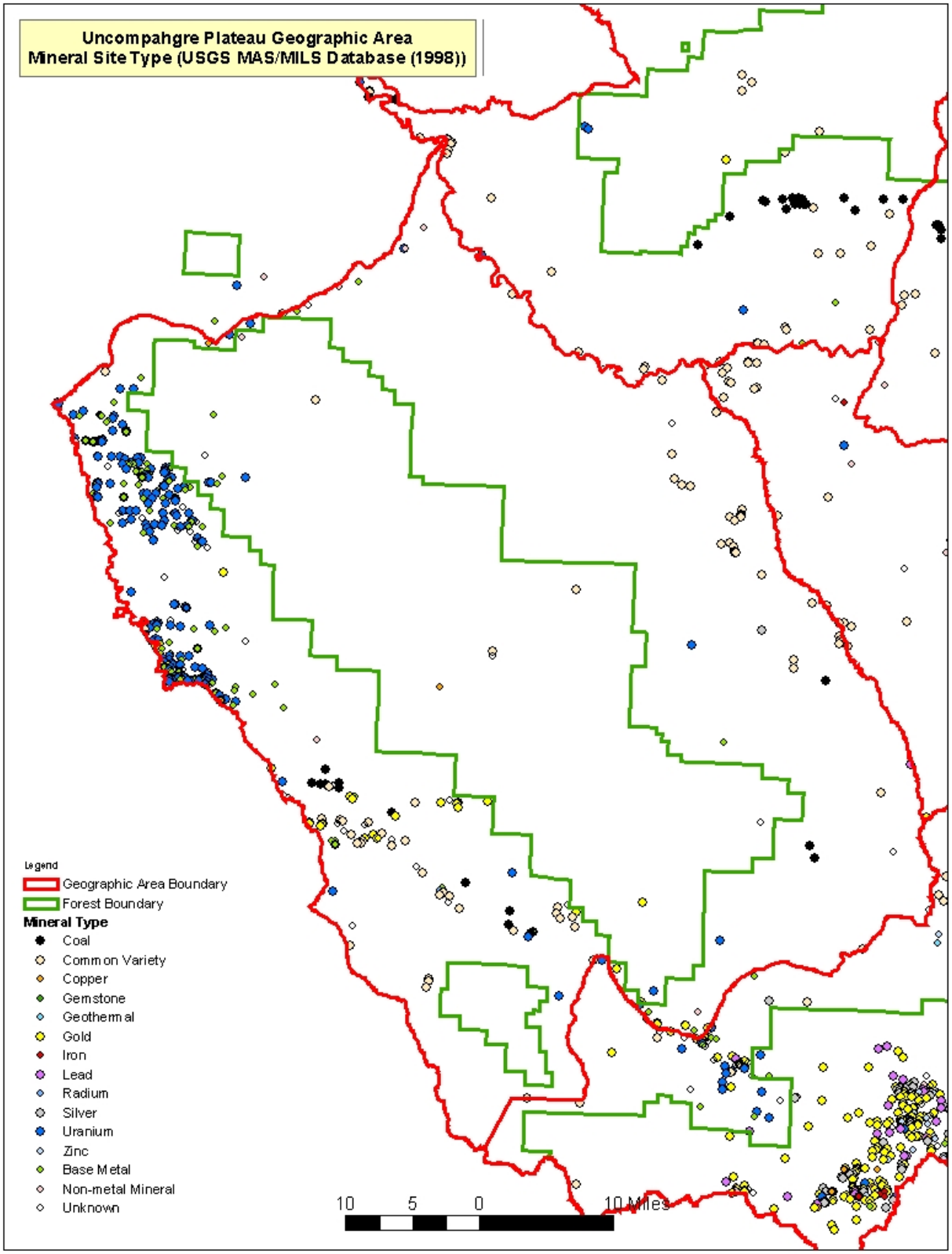


Figure 28. Recently Active Mining Sites by Mineral Type for Uncompahgre Plateau Geographic Area

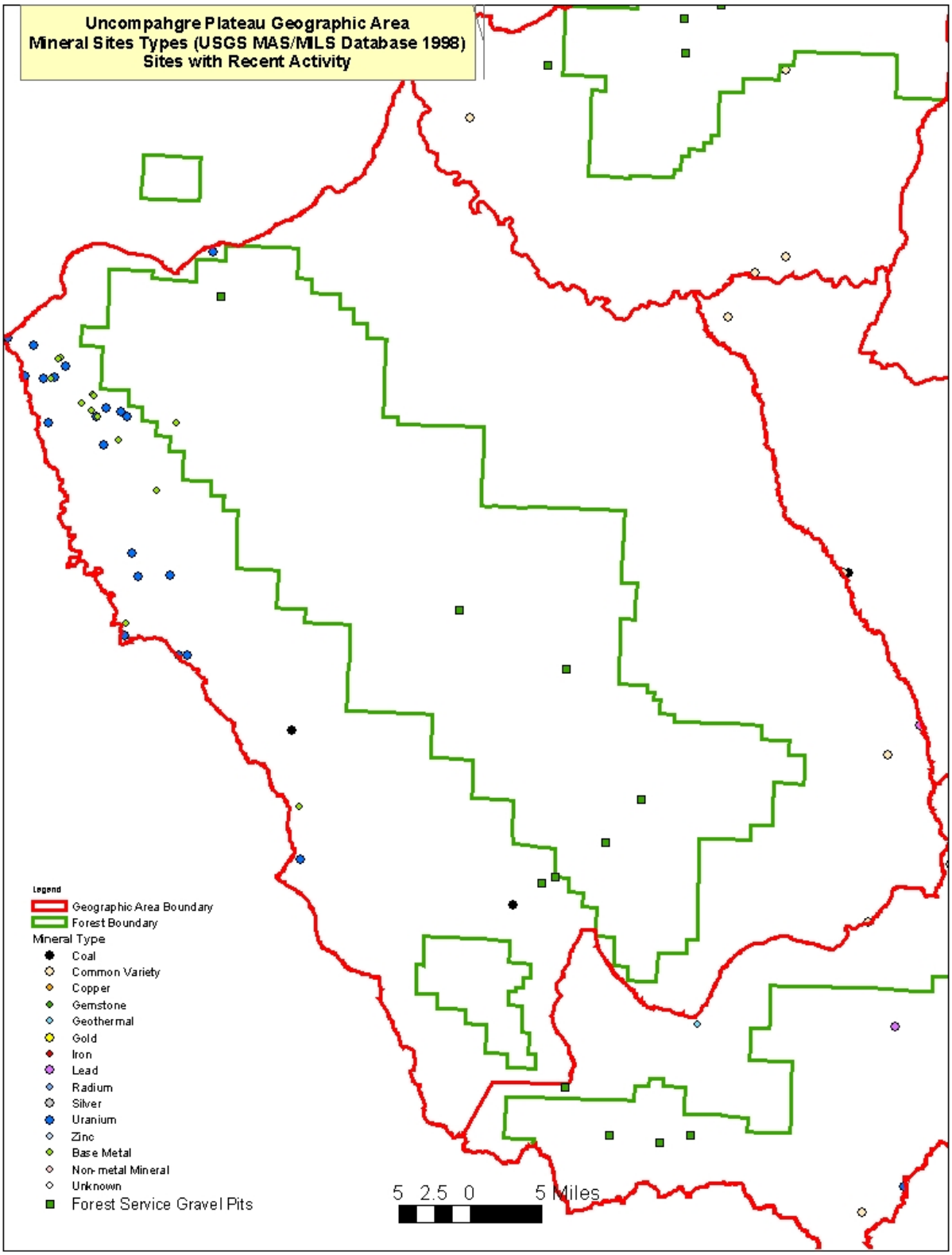
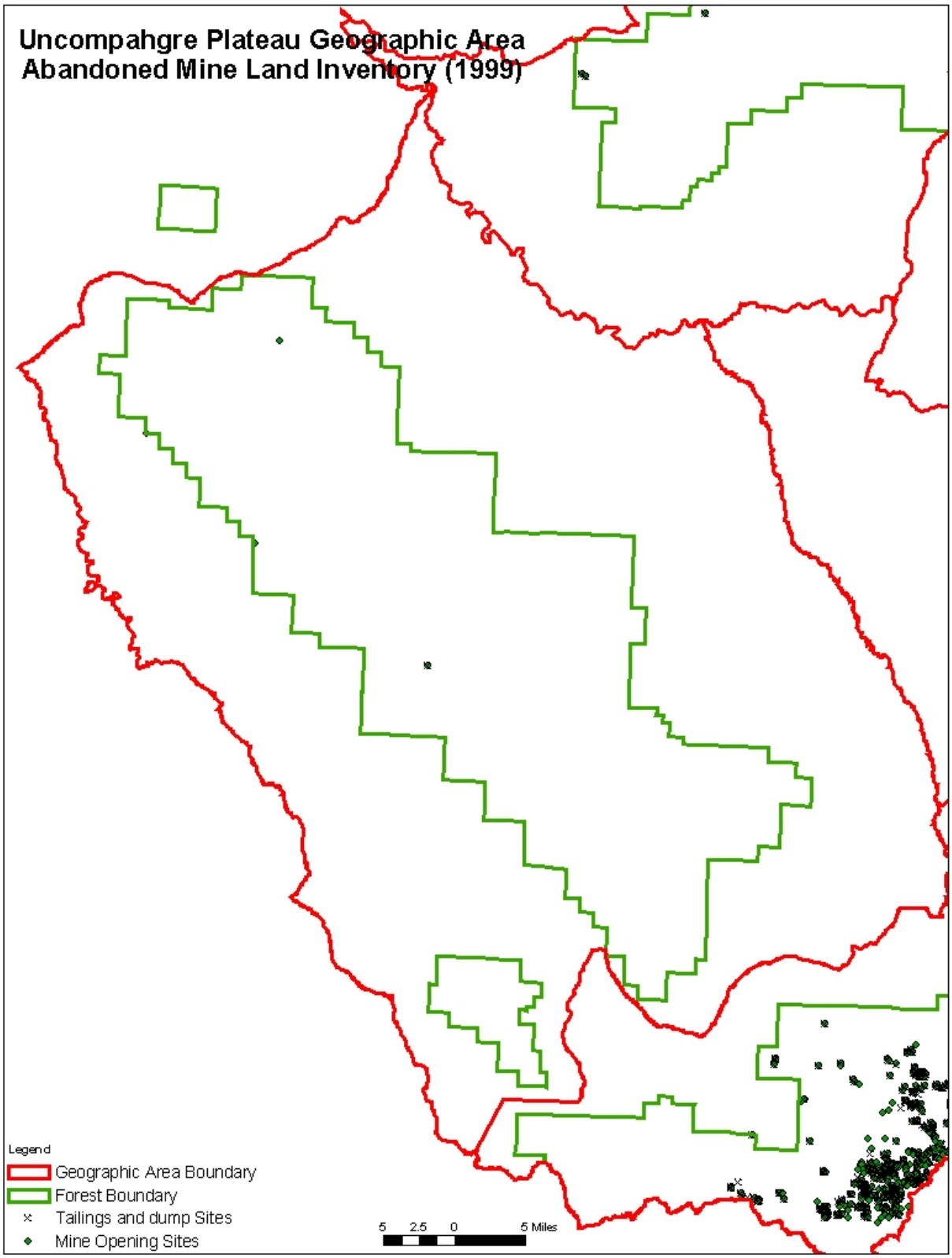


Figure 29. Abandoned Mine Land Inventory, Uncompahgre Plateau Geographic Area



Information from the abandoned mine land inventory (Neubert and Harris 1996) (Figure 29) indicates there is one mine dump, two prospect holes, one open pit and one vertical shaft. Only the vertical shaft has a physical hazard rating of potential danger. There are no other concerns with these mining sites.

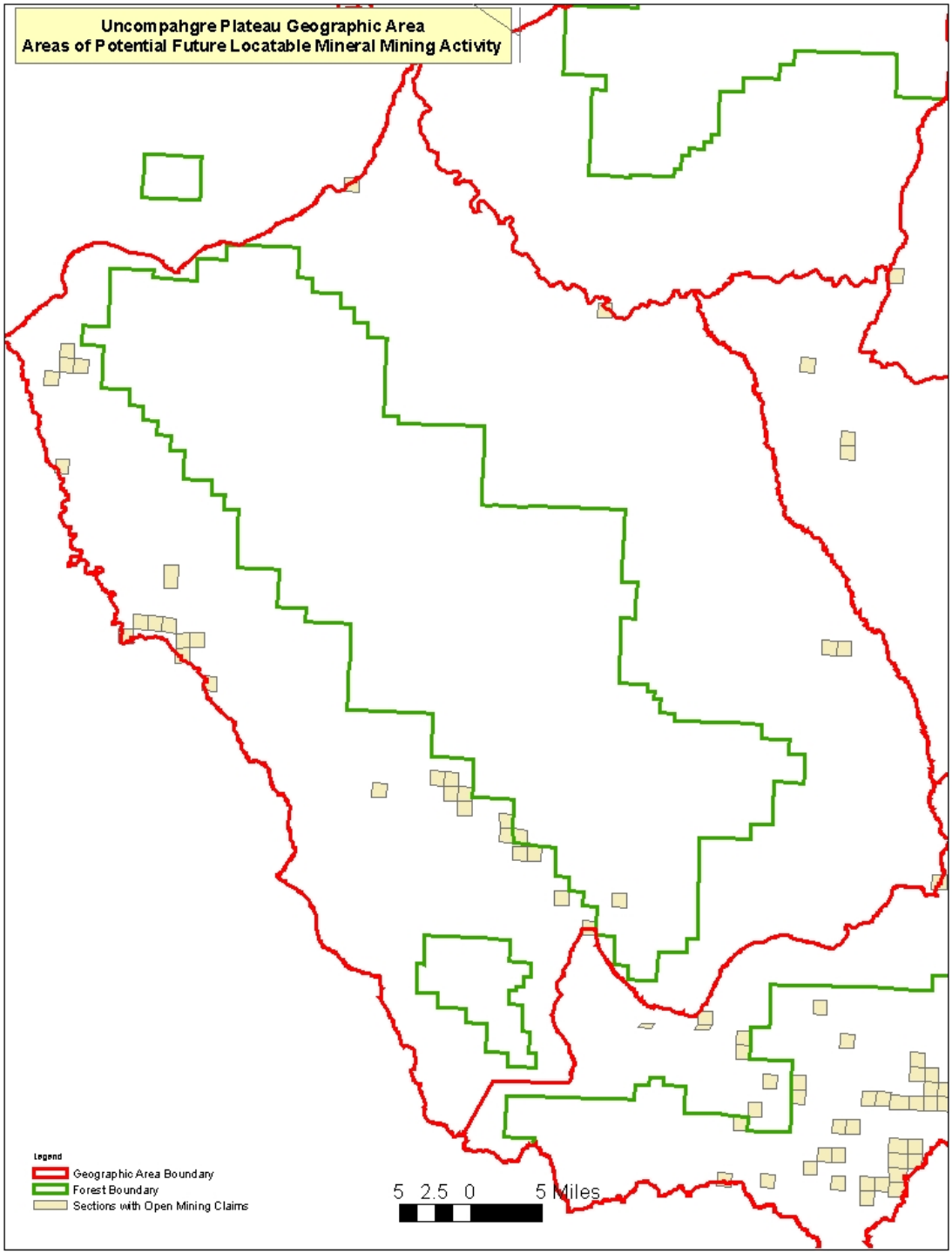
To determine the influence these five features had on surrounding vegetation and habitat, sites were buffered by ½ mile. Table 33 below summarizes the acres affected by these mining sites, by cover type. Mining activities have impacted more ponderosa pine (46 percent) than any other cover type in the Uncompahgre Plateau Geographic Area. Less than one percent of the NFS lands on the Uncompahgre Plateau are within ½ mile of mining activity.

Table 33. Acres by Cover Type within ½ mile Buffer around Abandoned Mine Land Inventory Sites (Openings and Tailings), Uncompahgre Plateau Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	86	5	0
Sagebrush	14	1	0
Gambel Oak	144	8	0
Cottonwood	21	1	1
Aspen	102	6	0
Pinyon/Juniper	458	25	0
Ponderosa Pine	836	46	1
Douglas-fir	136	7	5
Blue Spruce	10	0	
Bare/Rock	2	0	0
Total	1,809		0

An indication of potential future areas of mining activity or development can be gained by reviewing where active mining claims occur. Figure 30 displays sections with one or more open mining claim (Hyndman and Campbell 1999). Areas with active claims also correspond to areas of past activity.

Figure 30. Areas of Potential Future Mining Activity, Uncompahgre Plateau Geographic Area



Oil and Gas Exploration and Development

The south western portion of the Uncompahgre Plateau Geographic Area has high to moderate potential for oil and gas. This area is on the eastern edge of the Paradox Basin.

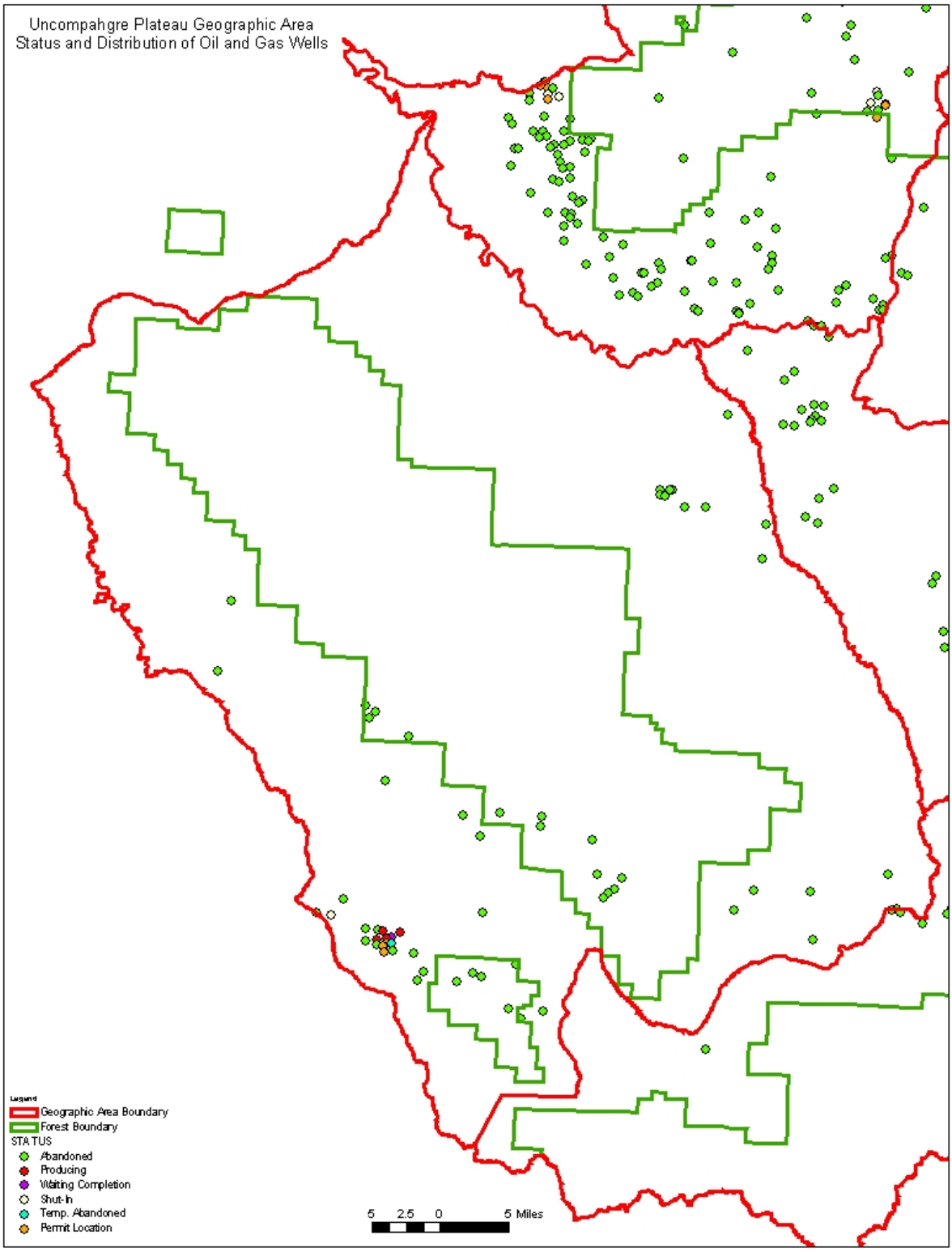
Table 34 identifies the current status of oil and gas wells and whether they occur on NFSL in this Geographic Area (COGCC 2005).

Table 34. Status of Oil and Gas Wells, Uncompahgre Plateau Geographic Area

Status	Off NFSL	On NFSL	Total
Abandoned	34	18	52
Producing	5		5
Waiting Completion	1		1
Shut-in	2		2
Temporarily Abandoned	1		1
Permit Location	3		3
Total	46	18	64

The total number of all wells in the Uncompahgre Plateau Geographic Area account for less than 10 percent of the wells in the area surrounding the GMUG. Twelve percent of the abandoned wells in the GMUG area are in the Uncompahgre Plateau Geographic Area. Three percent of the producing wells in the GMUG area are in the Uncompahgre Plateau GA. All wells drill to date on the Uncompahgre Plateau have been abandoned (24 percent of all abandoned wells on NFS lands in the GMUG occur on the Uncompahgre Plateau GA). Figure 31 displays oil and gas well locations and their status for this Geographic Area. The majority of activity has been northwest of the Naturita Division.

Figure 31. Status and Distribution of Oil and Gas Wells, Uncompahgre Plateau Geographic Area



The acres of habitat affected by oil and gas well locations on the Uncompahgre Plateau Geographic Area are summarized in Table 35. Approximately one percent of the NFS lands on the Uncompahgre Plateau Geographic Area have been influenced by oil and gas wells. Most of the area affected is within ponderosa pine (35 percent) and pinyon/juniper (25 percent).

Table 35. Acres by Cover Type within ½ mile Buffer around Oil and Gas Wells, Uncompahgre Plateau Geographic Area

Cover Type	Acres within ½ Mile Buffer	% of Total Buffer	% of Total Cover Type
Grass/Forb	886	10	2
Sagebrush	195	2	1
Gambel Oak	1,532	18	1
Mixed Mountain Shrub	12	0	0
Willow	8	0	1
Aspen	45	1	0
Pinyon/Juniper	2,114	25	2
Ponderosa Pine	3,003	35	3
Douglas-fir	7	0	0
Spruce/Fir	117	1	0
Bare/Rock	703	8	10
Water	3	0	0
Total	8,625		1

Oil and gas development and exploration is expected to continue on this Geographic Area. Currently 52,000 acres are leased this Geographic Area. Requests that additional parcels be made available for leasing have dramatically increased (15,100 acres as of January 2005). The presence of a lease does not insure that exploration and development will occur; however, increases in drilling activity are occurring.

Key Findings

- Past mining activity has been localized in several distinct areas of the GMUG. Different levels of activities occurred on the different GAs, associated with different mineral development.

Geographic Area	% of Total Mining in GMUG area	% of Mining on NFSL	Most Common Minerals Mined	Most Common Location of Mines
Grand Mesa	3	<1	Sand &Gravel	Major River Corridors, Skyway
Gunnison Basin	35	32	Gold, Silver	Crested Butte, Pitkin, Tincup and Whitepine
North Fork Valley	3	2	Coal	N. Fk. Gunnison River Valley
San Juans	32	63	Gold, Silver	Near Ouray and Telluride
Uncompahgre Plateau	25	2	Uranium, Vanadium	NW corner of GA

- Recent mining activity has occurred at less than five percent of the total mining sites identified in the GMUG area.

- An abandoned mine land inventory ranked mining sites concerning environmental degradation and physical hazards posed to human life. Three hundred fifty-five (355) sites have been identified as having environmental degradation of concern four extreme, 99 significant, 252 potentially significant) and need additional evaluations to determine corrective actions. One hundred eight-one (181) sites have pose physical hazard to humans (14 extreme danger, 167 dangerous) and should be closed or capped. An additional 672 sites pose potential danger to human life and should be evaluated for some access restriction.

- Mining activity (based on the abandoned mine land inventory) has influenced different amounts and cover types on the different Geographic Areas.

Area	Percent of Area Affected	Cover Types Most Affected
GMUG National Forest	8	Spruce/fir (24%), grass/forb (20%)
Grand Mesa	<1	Pinyon/juniper (37%) aspen (26%)
Gunnison Basin	10	Lodgepole pine (26%) spruce/fir (21%)
North Fork Valley	3	Aspen (29%) Spruce/fir (26%)
San Juans	20	Spruce/fir (34%) bare/rock (24%)
Uncompahgre Plateau	<1	Ponderosa pine (45%) pinyon/juniper (25%)

- Ongoing coal mining and exploration only occurs in the North Fork Valley Geographic Area. All active mines are located off-forest. Coal leases and coal mines underlie National Forest System lands. Facilities necessary for coal exploration and development (i.e., roads, exploration wells, methane vents) do occur on NFS lands.

- Areas of the GMUG have high and moderate potential for oil and gas resources. The Grand Mesa and North Fork Valley Geographic Areas overlie the southern portion of the Piceance Basin. Portions of the Uncompahgre Plateau and San Juans Geographic Areas overlie the eastern edge of the Paradox Basin.

- To date more oil and gas exploration and development activity has occurred off-Forest than on-Forest in the GMUG area (COGCC 2005).

Geographic Area	% of Total Drilling in GMUG Area	% of Drilling on NFSL
Grand Mesa	70	38
Gunnison Basin	1	1
North Fork Valley	13	44
San Juans	2	0
Uncompahgre Plateau	10	16

- Oil and gas well drilling has influenced different amounts and cover types on the different Geographic Areas.

Area	Percent of Area Affected	Cover Types Most Affected
GMUG National Forest	2	Aspen (32%) Gambel oak (20%)
Grand Mesa	6	Aspen (33%) Gambel oak (18%)
Gunnison Basin	0	Spruce/fir (0%)
North Fork Valley	4	Aspen (44%) Gambel oak (25%)
San Juans	0	None
Uncompahgre Plateau	<1	Ponderosa pine (35%) pinyon/juniper (25%)

Trends

- Activity related to locatable minerals has dropped during the past few years. This may be changing in several areas:

- There has been recent interest and minor activity in several uranium mines on the west side of the Uncompahgre Plateau GA.

- Mining for precious metals in the Silver Pick area of the San Juans is currently being proposed.

- A molybdenum mine located near Crested Butte on the Gunnison Basin Geographic Area is not currently active; however, changes in economic conditions could bring renewed interest in this mine.

- The coal resources underlying the North Fork Valley Geographic Area are low in sulfur, and are in high demand. Current mine operations plan to continue to define the extent of their coal resources through exploratory drilling. Areas determined to have developable resources will potentially be leased and mining operations will continue.

- Interest in acquisition of new leases and development of existing oil and gas leases has been increasing in the past year in response to rising prices for oil and gas, and the desire to become less dependent on foreign sources for these resources. There are currently 12 applications for permit to drill on the Forest, two on Grand Mesa and ten on North Fork Valley Geographic Areas. Drilling activity on NFS lands has never been as high as on surrounding private or public land (managed by Bureau of Land Management) and it is not anticipated that this trend will change in the future.

Management Implications

- Mining sites with environmental degradation concerns need to be evaluated and corrective measures implemented to reduce impacts to water quality and associated aquatic and terrestrial resources.

- Mining sites that pose physical hazard to human life need to be closed to human access. Where mine openings are determined to provide habitat for bats or other wildlife species, closures should be designed to allow continued animal use of these sites while preventing human access.

- Existing roads and trails (formerly roads) developed to access past mining sites are now recreational routes. As recreation use increases in the old mining districts around Telluride, Ouray, Crested Butte, Tin Cup, Pitkin, and other areas, the potential for human injury is a concern.

- Future development on private land inholdings (results of patented mining claims) has the potential to impact habitat and wildlife species particularly in the San Juans and Gunnison Basin Geographic Areas.

- The increased interest in oil and gas exploration and development has the highest probability of affecting terrestrial resources in the near future in areas of the Forest with moderate to high potential for oil and gas. Lease stipulations (described in the 1993 Oil and Gas Leasing Environmental Impact Statement and Record of Decision for the Grand Mesa, Uncompahgre and Gunnison National Forests) are designed to protect surface resources and reduce impacts to wildlife species from any future development. To date minimal area has been affected by oil and gas activities. If future development does occur, access on new roads should be limited to administrative traffic only, to lessen the effects of any additional roads. Implementation of the required mitigation and monitoring described in the leasing decision will also reduce the effects of any future oil and gas development that may occur on the Forest.

- While relatively little habitat Forest-wide has been affected by these mineral exploration and development activities, the ongoing ones – private land, powerlines, pipelines, and developed recreation sites are all within the defined WUI. These areas may need fuels management treatments.

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