Terrestrial Ecosystems

3.1 Vegetation

Area of Analysis

Vegetation was evaluated at several different scales. As part of the Terrestrial Ecological Assessment, completed as part of the Regional Species Conservation Project, vegetation was evaluated at the subregional scale using GAP Analysis data; at the Forest and geographic area scales using R2Veg data. Only information from the Forest and geographic area scales is summarized in this document.

Condition and Trend

Vegetation in the R2Veg database is classified by cover type, which is determined by the dominant cover or species present at the time of classification. The resulting classification is much more simplified than actual conditions on the ground. (For example: spruce/fir cover type includes areas where Englemann spruce and/or subalpine fir is the dominant vegetation. In much of this cover type, aspen is also present as a subdominant species.) Figure 3.1.A. displays the current distribution of cover types on the GMUG. Table 3.1.A. displays the distribution of cover types by geographic area. Each geographic area has a very different composition of cover types.

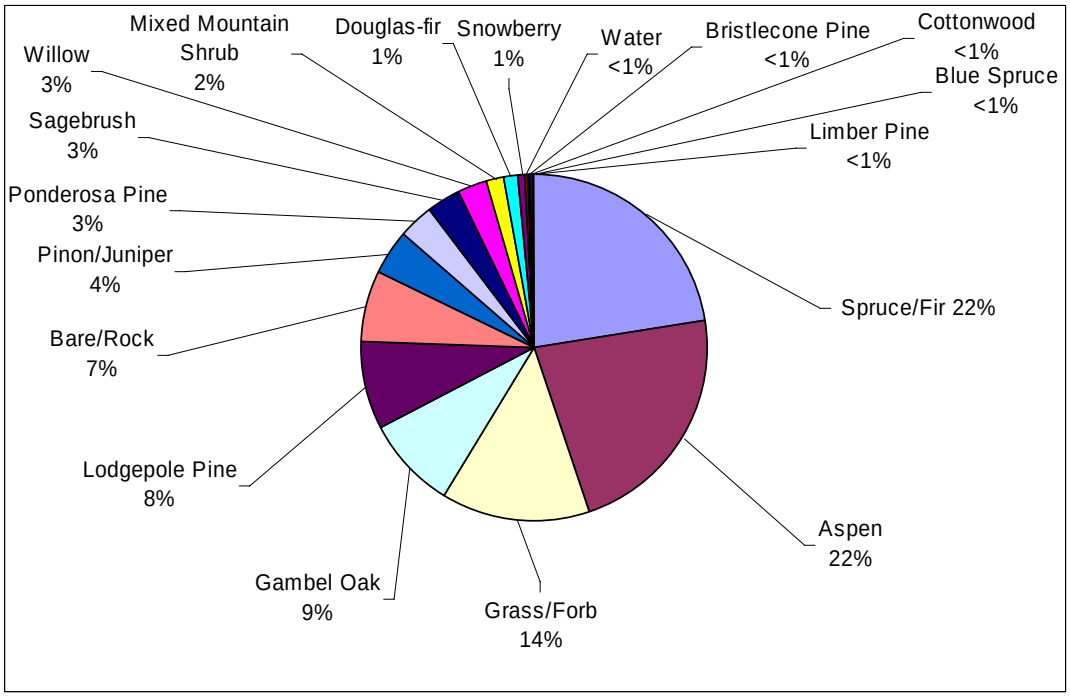

Figure 3.1.A. Current distribution of cover types on GMUG NF.

Table 3.1.A. Current distribution of cover types (as percentages*) by Geographic Area

Cover Type	Grand Mesa	Gunnison Basin	North Fork Valley	San Juans	Uncompahgre Plateau
Grass/Forb	11	19	8	19	6
Sagebrush	1	5	2	0	3
Gambel Oak	14	<1	14	3	24
Mixed Mountain Shrub	5	1	4	0	1
Snowberry	3	0	0	0	1
Willow	1	5	2	2	0
Cottonwood	0	0	0	0	0
Aspen	27	14	40	20	24
Pinyon/Juniper	7	-	1	0	16
Ponderosa Pine	-	1	0	0	15
Lodgepole Pine	-	20	-	0	-
Limber Pine	-	<1	-	-	-
Douglas-fir	1	3	0	1	0
Blue Spruce	0	<1	-	0	0
Spruce/Fir	26	25	23	36	7
Bristlecone Pine	-	1	-	-	-
Bare/Rock	4	7	6	19	1
Water	1	<1	0	0	0

* Percentages shown as 0 indicate a trace of the cover type occurs in that area.
Percentages shown as – indicate the cover type is not present in that area.

Vegetation is also characterized by structure. Structure is described by habitat structural stages, which are defined by size class, tree diameter, and canopy closure (measured as crown cover percent). Table 3.1.B. displays habitat structural stage definitions.

Table 3.1.B. Habitat structural stage definitions (Hoover and Wills, 1987).

Habitat Structural Stage	Size Class	Diameter	Crown Cover Percent
1T[1]/1M[2]	Grass-Forb	Not applicable	0 – 10%
2T[1]/2S[3]	Shrub-Seedling	< 1 inch	0 - 10%
3A	Sapling-Pole	1 – 9 inches	11 – 40%
3B	Sapling-Pole	1 – 9 inches	41 - 70%
3C	Sapling-Pole	1 – 9 inches	71 - 100%
4A	Mature	9+ inches	11 – 40%
4B	Mature	9+ inches	41 - 70%
4C	Mature	9+ inches	71 - 100%

[1] Opening in forest cover type created by some type of disturbance
[2] Natural meadow
[3] Shrub cover type

Current habitat structural stages for forest and woodland cover types on the GMUG and each geographic area are presented in Table 3.1.C. Natural meadows (1M) and shrub cover types (2S) are not included in Table 3.1.C., but openings in forest cover types that were created by some management action or natural disturbance (1T and 2T) are included in the table.

Table 3.1.C. Distribution of habitat structural stage (as percentages) by GA and on the GMUG NF.

Habitat Structural Stage	Grand Mesa	Gunnison Basin	North Fork Valley	San Juans	Uncompahgre Plateau	GMUG
1T	0	<1	0	0	<1	<1
2T	1	<1	<1	<1	1	<1
3A	4	6	6	7	11	7
3B	9	31	31	7	21	24
3C	2	9	5	<1	3	5
4A	5	7	7	9	17	9
4B	36	29	25	57	39	34
4C	44	17	26	21	10	21

Overall, the GMUG is dominated by mature and dense stand conditions (4B and 4C) in all forest and woodland cover types. The distribution varies considerable by geographic area. Both the Grand Mesa and San Juans have approximately 80 percent of the forest/woodland types in mature, dense stand conditions. The higher level of timber harvest on the Uncompahgre Plateau is reflected in the distribution of habitat structural stages. (See Vegetation sections for each Geographic Area in the Comprehensive Assessment for more detail.)

Habitat structural stages are used to indicate availability of different types of wildlife habitat, potential risk for future fire, insect and/or pathogen activity, and time since some disturbance last affected an area. (Also see discussions in Timber Industry, Wildland Fire Management, and Forest Health in the CA.)

Table 3.1.D. includes additional information for each of the major cover types summarized at the Forest level. Similar tables occur in the Vegetation sections for each geographic area in the Comprehensive Assessment. Comparison of Table 3.1.D. to the geographic area tables will expose the different conditions on each Geographic Area. (Note: Age distribution is not included in Table 3.1.D. because age data availability is limited to a few geographic areas.)

Environmental factors such as soils, slope, aspect, climate, and elevation determine the plant communities that can potentially grow on a given area. The stable plant community that establishes in the absence of disturbances is called the potential natural vegetation (PNV) type. For the GMUG, areas where a given PNV type can occur have been mapped using the criteria listed above, as well as existing vegetation information. Figure 3.1.B. displays the distribution of PNV types on the GMUG. (Note: PNV types with less than 0.5 percent are not shown in this figure.) Distribution of PNV types on each geographic areas is different (see Vegetation Sections in Comprehensive Assessment).

Table 3.1.D. Current vegetation characterization for NFS lands on GMUG NF.

Cover Type[1]	Composition of GMUG[1]	Habitat Structural Stages[1]	Canopy Conditions[1]	Past Vegetation Treatments (1955 – 2003) [3]	Effects of Roads/Trails[4]
Spruce-fir (Englemann spruce – subalpine fir)	748,400 acres 22%.	<1% 1T <1% 2% 5%-3A 13%-3B 2%-3C 10%-4A **43%-4B** 27%-4C	37% - single-storied 63% - multi-storied	11% of type has been affected by timber harvest <1% has been treated by fire/mechanical to reduce fuels	78% of type is within ½ mile of an existing road or trail.
Aspen	740,900 acres 22%.	<1% 1T 1%-2T 6%-3A 24%-3B 4%-3C 2%-4A **33%-4B** 29%-4C	38% - single-storied 62% - multi-storied	3% of type has been affected by timber harvest <1% of this type has been treated with prescribed fire	85% of type is within ½ mile of an existing road or trail.
Lodgepole Pine	280,300 acres 8%.	<1%-2T 2%-3A **44%-3B** 20%-3C 2%-4A 18%-4B 14%-4C Note: 3A/3B/3C is over represented and 4A/4B/4C is under represented due to photo interpretation errors.	7% - single-storied 93% - multi-storied	11% of type has been affected by timber harvest 4% of this type has been treated with prescribed fire. Note: large areas tiehacked in the late 1800s on the Gunnison Basin GA are not included.	78% of type is within ½ mile of an existing road or trail.

Cover Type[1]	Composition of GMUG[1]	Habitat Structural Stages[1]	Canopy Conditions[1]	Past Vegetation Treatments (1955 – 2003) [3]	Effects of Roads/Trails[4]
Douglas-fir	45,700 acres 1%	7%-3A 18%-3B 5%-3C 19%-4A **35%-4B** 14%-4C	14% - single-storied 86% - multi-storied	9% of type has been affected by timber harvest 7% of this type has been treated with prescribed fire Note: Large areas cutover between the late 1800s and 1950s on Gunnison Basin not included.	74% of type is within ½ mile of an existing road or trail.
Ponderosa Pine	114,900 acres 3%	<1 2T 9%-3A 12%-3B <1% 3C 38%-4A **40%-4B** 1%-4C	38% - single-storied 62% - multi-storied	37% of type has been affected by timber harvest. 15% of type has been treated with prescribed fire. Note: Large areas cutover between the late 1800s and 1950s on Uncompahgre Plateau and Gunnison Basin not included.	94% of type is within ½ mile of an existing road or trail.
Bristlecone Pine	7,400 acres <1%	**32%-3A** 21%-3B 1%-3C 28%-4A 18%-4B	16% - single-storied 84% - multi-storied	<1% of type has been affected by timber harvest. 5% of this type has been treated with prescribed fire.	90% of type is within ½ mile of an existing road or trail.

Cover Type[1]	Composition of GMUG[1]	Habitat Structural Stages[1]	Canopy Conditions[1]	Past Vegetation Treatments (1955 – 2003) [3]	Effects of Roads/Trails[4]
Limber Pine	600 acres <1%	4%-4A **91%-4B** 6%-4C	14% - single-storied 86% - multi-storied	5% of this type has been affected by timber harvest. 7% treated with prescribed fire.	83% of type is within ½ mile of an existing road or trail.
Blue Spruce	2,600 acres <1%	4%-3A 9%-3B 22%-3C 9%-4A 23%-4B **33%-4C**	3% - single-storied 97% - multi-storied	41% of type has been affected by timber harvest. 1% of this type has been treated with prescribed fire.	92% of type is within ½ mile of an existing road or trail.
Pinyon-Juniper	135,800 acres 4%	21%-3A 28%-3B <1%-3C 21%-4A **29%-4B** <1%-4C	66% - single storied 34% - multi-storied	11% of type has been treated by prescribed fire or mechanical treatments.	73% of these types are within ½ mile of an existing road or trail.
Cottonwood	4,500 acres <1%	6%-3A 2%-3B <1%-3C **57%-4A** 34%-4B 1%-4C	65% - single-storied 35% - multi-storied	None recorded.	81% of these types are within ½ mile of an existing road or trail.
Gamble Oak – Mixed Mountain Shrub	351,300 acres 11%	100% 2S 49% large (>6.5’) 44% med. (2.5-6.4’) 6% small (<2.5’)	28% - single-storied 72% - multi-storied	18% of these types have been treated with prescribed fire or some mechanical treatment.	85% of these types are within ½ mile of an existing road or trail.
Sagebrush	101,700 acres 3%.	100% 2S 1% large 44% med. (2.5-6.4’) 56% small (<2.5’)	25% - single-storied 75% - multi-storied	14% of this type has been treated with prescribed fire or some mechanical treatment.	94% of type is within ½ mile of an existing road or trail.

Cover Type[1]	Composition of GMUG[1]	Habitat Structural Stages[1]	Canopy Conditions[1]	Past Vegetation Treatments (1955 – 2003) [3]	Effects of Roads/Trails[4]
Willow	86,100 acres 3%	100% 2S 22% large (>6.5') 63% med. (2.5-6.4') 15% small (<2.5')	27% - single-storied 73% - multi-storied	None recorded.	81% of these types are within ½ mile of an existing road or trail.
Snowberry	20,500 acres 1%	100% 2S 93% med. (2.5-6.4') 7% small (<2.5')	28% - single-storied 72% - multi-storied	1% has been treated with prescribed fire.	91% of these types are within ½ mile of an existing road or trail.
Grass/Forb	460,900 acres 14%	100% 1M	Not applicable	2% of these types have been treated with prescribed fire.	80% of these types are within ½ mile of an existing road or trail.

[1] R2VEG database
[2] Stand exam data for GMUG.
[3] RMACT database. NOTE: Rangeland treatments prior to 1980s are not included in RMACT database and are underrepresented in the shrub and grass/forb cover types.
[4] INFRA transportation data related to R2VEG data. Includes all inventoried roads and trail, not just routes open to public use.

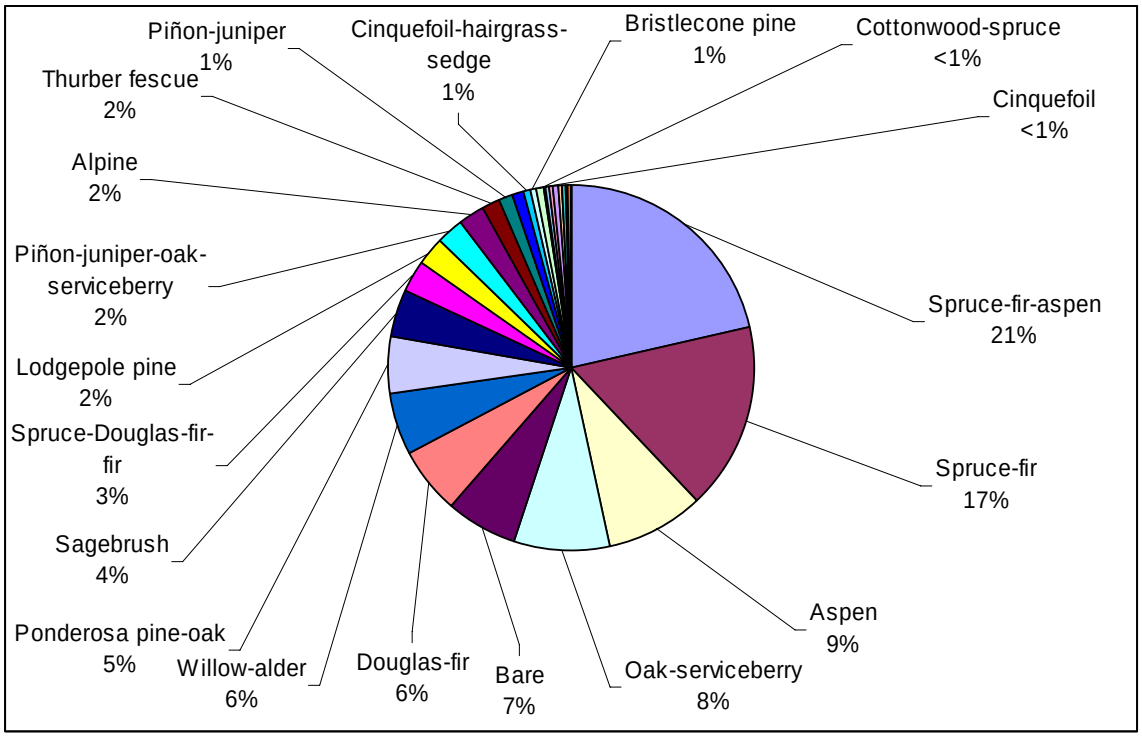

Figure 3.1.B. Distribution of PNV types on GMUG NF.

Historically, for any given PNV type, natural disturbances occurred at characteristic intervals and intensities, called regimes. When disturbances were intense enough to kill portions of the existing plant community, the remaining vegetation recovered through a certain progression or succession of plant communities over time. The interaction between disturbance regimes and succession cycles resulted in shifting mixtures (or ranges) of different plant communities (seral stages) within any given PNV type over time. The ranges in seral stages vary depending on the landscape scale. Where management actions (e.g., fire suppression, grazing, timber harvests, seeding) have interrupted the natural disturbance regimes and/or succession pathways for PNV types, the current distribution of seral stages may be altered from what would have historically existed at some point for a given PNV type.

To evaluate how current conditions compare to historic ranges, the Vegetation Dynamics Development Tool (VDDT) was used. Current knowledge on disturbance intervals and succession pathways were used to build models for the timber, woodland, and some shrub PNV types on the GMUG. Current conditions were then compared to model results to see where departures exist. Results for the PNV types that have had the most management activities are summarized in Tables 3.1.E., 3.1.F., and 3.1.G. (Note: The VDDT model was run at the geographic area level and not all modeled PNV types occur on all geographic areas.)

Table 3.1.E. Forest types modeled.

Spruce-Fir PNV	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late Seral**
VDDT Model	*27-32%*	*20-24%*	*12-13%*	*31-40%*
Grand Mesa	8%	40%	52%*	
Gunnison Basin	5%	49%	45%*	
North Fork Valley	14%	32%	53%*	
San Juans	1%	43%	56%*	
Spruce-Fir-Aspen PNV	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late**
VDDT Model	*13-19%*	*22-29%*	*13-16%*	*35-49%*
Grand Mesa	5%	63%	32%*	
Gunnison Basin	4%	63%	33%*	
North Fork Valley	6%	69%	25%*	
San Juans	1%	24%	75%*	
Unc. Plateau	3%	45%	52%*	
Aspen PNV	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late**
VDDT Model	*8-14%*	*23-26%*	*17-24%*	*23-43%*
Grand Mesa	3%	15%	82%*	
Gunnison Basin	6%	43%	50%*	
North Fork Valley	5%	58%	36%*	
San Juans	4%	25%	72%*	
Unc. Plateau	13%	41%	46%*	
Lodgepole Pine PNV	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late**
VDDT Model	*8-14%*	*23-26%*	*17-24%*	*23-43%*
Gunnison Basin	6%	43%	50%*	

Ponderosa Pine-Oak PNV	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late**	**Fire Maintained Open**
VDDT Model	*14-16%*	*11-14%*	*2-10%*	*7-12%*	*48-65%*
Unc. Plateau	<1%	25%	55%	1%	19%**

*Lack of age data makes it difficult to differentiate between these two stages.
**Much of current fire maintained open was created through thinning, not fire.

Table 3.1.F. Woodland types modeled.

Pinyon-Juniper PNV Type	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late Seral**
VDDT Model	*1-3%*	*5-11%*	*56-59%*	*30-34%*
Grand Mesa	<1%	5%	2%	93%

Pinyon-Juniper-Oak-Serviceberry PNV	**Early**	**Mid**	**Late**
VDDT Model	*28-51%*	*39-43%*	*9-29%*
Unc. Plateau	3%	2%	95%

Pinyon-Juniper PNV Type	**Early Seral**	**Early-Mid Seral**	**Late-Mid-Seral**	**Late Seral**
VDDT Model	*1-3%*	*5-11%*	*56-59%*	*30-34%*
Grand Mesa	<1%	5%	2%	93%

Pinyon-Juniper-Oak-Serviceberry PNV	**Early**	**Mid**	**Late**
VDDT Model	*28-51%*	*39-43%*	*9-29%*
Unc. Plateau	3%	2%	95%

Table 3.1.G. Shrub types modeled.

Oak-Serviceberry PNV Type	**Early**	**Mid**	**Late**
VDDT Model	*30-70%*	*28-34%*	*0-36%*
Grand Mesa	8%	34%	58%
North Fork Valley	6%	50%	44%
San Juans	9%	27%	64%
Uncompahgre Plateau	4%	48%	48%

Oak-Serviceberry PNV Type	**Early**	**Mid**	**Late**
VDDT Model	*30-70%*	*28-34%*	*0-36%*
Grand Mesa	8%	34%	58%
North Fork Valley	6%	50%	44%
San Juans	9%	27%	64%
Uncompahgre Plateau	4%	48%	48%

The natural and human disturbance histories for the different geographic areas are reflected in the current conditions displayed in the tables above. Areas with more recent activities/disturbances have higher percentages in the earlier seral stages. Areas where disturbance regimes have been interrupted (i.e., fire suppression) tend to have higher percentages in the later seral stages, typically much higher than would have occurred

historically when disturbances were not suppressed. (See Vegetation Sections in Comprehensive Assessment for specific details.)

The VDDT results displayed above correlate to the Fire Regime Condition Class rankings displayed in the Wildland Fire Management section in the CA.

Existing data in the R2VEG database for grass, forb, and shrub types is currently lacking, so the VDDT model was not used to determine departure between current or historic conditions. Rangeland condition and trend information has been collected and is displayed in the Rangeland Health section in the CA.

Desired Conditions

Vegetation is managed to sustain all Potential Natural Vegetation (PNV) types that should exist on the GMUG. Conditions within each PNV type include all the structural features, species compositions (plant and animal), and seral stage distributions that are appropriate for each type across different landscape scales. Habitat is provided for the full compliment of wildlife species on a sustained basis. Natural disturbance processes occur and function within the historic regimes for each type, where compatible with other management objectives.

Condition Gap

Fire regimes have been interrupted in areas classified as fire regime condition class 2 and 3 (see discussion in Wildland Fire and Fuels Management in the CA). The risk of losing key ecosystem components is moderate to high in these areas (i.e., Douglas-fir) and recent disturbances have been uncharacteristic in size and intensity (i.e., Burn Canyon fire).

The majority of all forest, woodland, and shrub cover types are relatively uniform in condition; most are dominated by mature, dense stand conditions with very little early seral conditions. These conditions are very susceptible to fire and/or insect/pathogen attacks which could affect very large areas.

Current Forest Plan direction does not recognize the benefits of allowing natural disturbance processes to operate. Current direction is that fires are to be suppressed, and insect and disease infestations are to be prevented and controlled.

Current distributions of some cover types are very different from the distribution of PNV types that contain those cover types (e.g., Douglas-fir, willow).

Past management activities have altered species composition in some PNV types (e.g., seeding non-native species in grass-forb and sagebrush).

Past management activities (i.e., timber harvests, fuelwood collection, fire suppression) have altered structural components of some PNV types to the point some are extremely limited (e.g., very large diameter ponderosa pine, large diameter down woody material, large diameter snags).

Invasive plant species have increased across the GMUG and the potential for future spread and invasion is high. (See Invasive Plant Species section in the CA.)

Management Implications

If the results of natural disturbance processes are incompatible with other management objectives, vegetation conditions are managed to be resilient or resistant to undesirable disturbances.

If species components are currently limited or completely lacking, management actions may be needed to restore/reintroduce native species.

If structural components are currently limited or lacking, management actions may be needed to promote development of these structural components over time.

Spruce-fir

- The spruce-fir cover type occurs in both the spruce-fir and the spruce-fir-aspen PNV types.
- A large percentage of this cover type is in mature, dense stand conditions, susceptible to stand replacing fires and/or epidemic insect/pathogen outbreaks. Because so much of the area is in relatively uniform conditions, natural disturbances have the potential to impact large areas at one time.
- If a large scale disturbance happens, there will be a shift from mature spruce/fir. Disturbances (human or natural) in the spruce-fir-aspen PNV type will regenerate in aspen within a few years. Disturbances in the spruce-fir PNV type do not have aspen as an early seral species and may take 50 to 200 years to regenerate to spruce. Several centuries may pass before mature spruce-fir habitats would be present again on the disturbed sites.
- Management activities (i.e., timber harvests) could be used to increase stand diversity and reduce susceptibility for high intensity large-scale disturbances.
- Much of this cover type is within designated Wilderness areas and currently unroaded areas. Management direction (i.e., theme designations) limits or restricts management activities to respond to or potentially reduce disturbances. Only natural processes will alter vegetation conditions in these protected areas.

Aspen

- Aspen currently dominates almost a quarter of the GMUG land area. On over half of this area, aspen is a seral species to conifer dominated PNV types. If succession continues without some kind of disturbance (natural or human-caused) that regenerates aspen, most of what is now aspen will gradually convert into conifer dominated habitats.
- Aspen becomes very susceptible to cankers and root rots between the ages of 80-120 years old. The majority of the aspen on the GMUG is in or approaching this age range.
- Loss of aspen is a concern primarily on the Gunnison Basin Geographic Area at the lower elevation range. Aspen stands are dieing out as a result of lack of fire disturbance to regenerate suckering, and heavy wild ungulate browsing that removes the aspen regeneration that does occur.

Lodgepole Pine

- Lodgepole pine occurs naturally only on the Gunnison Basin GA. (It was planted off-site in small areas on other Geographic Areas in the 1960s.) Lodgepole pine is a seral species in spruce-fir, spruce-Douglas-fir-subalpine-fir and Douglas-fir PNV types, and is the only tree species in the Lodgepole Pine PNV type. Lodgepole pine is currently the most common tree species on the Gunnison Basin Geographic Area.
- Lodgepole pine regeneration naturally occurs in very dense stands which can have suppressed growth rates (Johnston et al. 2001) and become very susceptible to dwarf mistletoe and mountain pine beetle. The majority of this cover type is currently in these stand conditions, which are experiencing and will continue to be susceptible to dwarf mistletoe and mountain pine beetle.
- Large scale stand replacing disturbances are the more common regimes in this type. Management activities that increase stand diversity could potentially reduce the intensity and size of future disturbances.

Douglas-fir

- There is currently much less Douglas-fir on the GMUG, particularly the Gunnison Basin Geographic Area, than occurred historically. Much of the Douglas-fir PNV is currently in lodgepole pine cover. This shift is likely due to historic fires and past insect outbreaks eliminating much of the Douglas-fir seed source (Johnston et al. 2001).
- Fire suppression over the past 100 years interrupted the more frequent fire regime in Douglas-fir, allowing lodgepole pine, blue spruce, and other vegetation to become established, increasing overall stand densities. This has increased the potential for future fires to be more intense in this PNV type. If such fires do occur, there is concern that the remaining Douglas-fir will be eliminated.
- Current dense, multi-storied stands are also susceptible to insect/pathogen attack, which has been occurring throughout the Douglas-fir on the GMUG (See Forest Health section in the CA). This increased mortality also has the potential to eliminate Douglas-fir in areas where it currently exists.

Ponderosa Pine

- Ponderosa pine is the climax species in both the Ponderosa pine-oak (on the Uncompahgre Plateau GA) and the ponderosa pine (on the Gunnison Basin GA) PNV types.
- Ponderosa pine is the most common conifer tree species on the Uncompahgre Plateau. Current vegetation mapping for the Gunnison Basin GA under-represents the amount of ponderosa pine that currently exists on the ground.
- Both ponderosa pine PNV types occur at the lower elevations of the Forest and have been dramatically influenced with historic harvest activities (much prior to the establishment of the GMUG National Forests) which removed the accessible old, large diameter trees. Many ponderosa pine obligate species require this type of habitat, which is extremely limited across the landscape.

- Fire suppression in ponderosa pine interrupted the frequent fire regimes (see Wildland Fire Management section in the CA), resulting in increases in understory vegetation and fuel accumulations.
- More recent timber harvest activities focused on reducing stand susceptibility to insect attack (see Wood Products Industry and Forest Health sections in the CA) and have resulted in more even-aged stands occurring on the landscape than would have occurred under unaltered disturbance regimes.

Pinyon-juniper

- Three pinyon-juniper PNV types have been identified on the GMUG; each with different understory compositions and each considered to have a different fire regime.
- Current conditions in all pinyon-juniper PNV types are dominated by late seral conditions of continuous dense stands. Manier et al. (2003) compared conditions between 1937 and 1994 and noted increases in stand density as well as expansion of areas inhabited by pinyon-juniper.
- Current stand conditions lack patchiness or diversity in structure, making them susceptible to large scale stand-replacing crown fires that may burn with higher intensities than occurred historically (i.e., Burn Canyon in 2002).
- Ongoing pinyon pine mortality has eliminated much of the pinyon in areas below the GMUG, potentially increasing the importance of the remaining pinyon on the GMUG as future seed sources and wildlife habitat for pinyon obligate species.
- The proximity of wildland urban interface areas to the pinyon-juniper cover types increases the potential for future activities within this cover type.

Cottonwood

- The existing extent of cottonwood is roughly the same as the potential extent of the cottonwood-spruce PNV type. However, the structural stage distribution indicates the majority of this type is in mature conditions with no areas or early regeneration. As mentioned in the Riparian-Wetlands section in the CA, information on riparian habitats is very limited.
- Cottonwood habitats on the GMUG are important to maintain because of the limited amount of this habitat remaining off the Forest.

Gambel oak and Mixed Mountain Shrubs

- Current conditions in Gambel oak and mixed mountain shrub cover types have less patchiness and structural/seral stage diversity than would have occurred historically. As a result, this cover type is more susceptible to higher intensity fires than may affect larger areas of land than would have occurred in the past (as seen in recent fires on the Grand Valley and Paonia districts).

Willow

- Current mapping of willow cover type indicates it occurs on less than half the area that could potentially support willow (the Willow-Alder PNV type). This is due to a combination of reduction in beaver populations (due to historic trapping), heavy historic livestock grazing, and changes in water tables.

- Errors in cover type mapping have been identified on the Grand Mesa and may also occur elsewhere on the GMUG. As with cottonwood, information on riparian habitats, including willow, is very limited.

Sagebrush

- Past livestock grazing, rangeland treatments to convert sagebrush to grasslands, and fire suppression efforts have altered understory species composition and structural stage diversity in this cover type.
- The sagebrush cover type mostly occurs at the lower elevations of the Forest, with the majority of this type occurring on private and other federally managed lands (BLM, NPS). Potential for loss of sagebrush habitat on private land increases the importance of maintaining healthy conditions on federal land.

Grass-forb

- A wide variety of grass-forb habitat types occurring at many elevation ranges are combined into the grass-forb cover type. Data needs to be improved to differentiate between the different habitat types.
- Species composition in grass-forb cover types have been altered from historic conditions through livestock grazing and introduction of non-native species through reseeding projects and unintended actions.

Risks to Achieving Desired Conditions

It will take time to achieve desired conditions in vegetation. The amount of time needed is related to the current level of departure between current conditions and desired conditions. Early seral conditions in any cover type/PNV type can be created quickly through management activities. Developing very large diameter ponderosa pine distributed across the ponderosa pine PNV types will take centuries.

As mentioned above, current vegetation conditions are very susceptible to fire and insect/disease disturbances. The potential for extensive and/or intensive disturbances is increasing. High levels of insect/disease-caused mortality are occurring in some host species (i.e., Douglas-fir, pinyon pine, subalpine fir) reducing and potentially removing these species from the ecosystem. Recent fires have been uncharacteristically intensive and extensive, resetting large areas to early seral conditions instead of creating mosaics of seral stages (i.e., Burn Canyon fire). Soil loss following intense fires reduces the potential to reestablish the vegetation that was present before the fire.

Changes in climate may further alter disturbance regimes.

Risks identified in all other sections related to vegetation conditions (Wood Products Industry, Livestock Industry, Wildland Fire Management, Invasive Plant Species, Rangeland Health, Forest Health in the CA) are risks to achieving desired vegetation conditions.

Need for Change

Need to develop desired condition statements for each PNV/cover type to include desired structural stage and/or seral stage distributions and desired disturbance behavior.

Consistent protocols need to be used to inventory old growth at the project level and the old growth data/inventory needs to be consolidated. An old growth inventory needs to be completed. (Also see the Species Diversity section in the CA.)

Data deficiencies identified through assessment work need to be corrected:

- Habitat structural stage determinations in the R2Veg database for lodgepole pine and aspen reflect a larger amount of 3B than actually exists on the ground. Errors in photo interpretation classified these species with narrow diameters as smaller size classes. Much of the areas classified as 3B should be 4B.
- Ponderosa pine is underrepresented in the R2VEG database for the Gunnison Basin GA due to errors in photo interpretation.
- Information on sagebrush across the GMUG is limited. The extent of current sagebrush cover type is mapped; however, identification of sagebrush to the species level is incomplete. This information is very important to adequately evaluate habitat for many wildlife species (i.e., Gunnison sage-grouse).
- Available data on grassland and forbland species composition across the GMUG needs to be consolidated. Information collected during range analysis is stored in the TERRA database. Cover type data stored in R2VEG only includes a few dominant species, usually not grass or forb species.

Performance Measures

- By cover type and PNV type: acres habitat structural stage
- Performance measures under timber, range, fire, noxious weeds, and species diversity; also evaluate changes in vegetation

3.2 Ecosystem Health (Insect and Disease Activity)

Area of Analysis

Several different scales were considered in the evaluation of insect and disease activity in and around the GMUG National Forest. Aerial survey information, gathered by the Rocky Mountain Region Forest Health Management unit, covers the entire area within the geographic area boundaries surrounding and including the Forest. Only GMUG National Forest System land where vegetation data (R2Veg) is available was evaluated to determine vulnerability (risk) to seven different insect or pathogen organisms.

Condition and Trend

The existing Forest Plan recognized the high susceptibility of many areas of the Forest to insects and diseases. It also identified the most prevalent organisms and areas of highest activity. At that time an epidemic of mountain pine beetle, western pine beetle, and round-headed beetle was causing mortality in ponderosa pine on the Uncompahgre Plateau. Dwarf mistletoe was also identified as a problem, predominantly in lodgepole pine on the Gunnison Basin GA. The Forest's timber management program was specifically adjusted under the existing Plan to treat ponderosa pine to reduce stand densities to prevent further mortality by creating a mosaic of tree age and size class and to increase species diversity. Similarly, timber management actions were focused on lodgepole pine to reduce dwarf mistletoe by removing infested trees. (See Timber Management and Wood Products Industry discussion in the CA.) The pine beetle epidemic on the Uncompahgre Plateau returned to endemic levels by the early 1990s due to a combination of silvicultural treatments and natural beetle population decreases. Dwarf mistletoe continues to be a problem (see below).

Insect and disease activity is monitored in several ways. Aerial surveys are conducted annually to observe insect and pathogen activity. Surveys are scheduled to cover all areas at least once every three years, with emphasis being given to locations with known activity. Consequently, not all areas of the GMUG have been surveyed each year; however, recent surveys do cover the entire GMUG. Figure 3.2.A. displays a compilation of aerial survey inventory data from 1995 through 2004 for the GMUG. On-the-ground surveys have also been conducted during project-level analyses to identify insect and disease activity. Generally, insect and disease activity and associated mortality have been increasing on the GMUG over the past ten years. Notable activity includes:

- Subalpine fir mortality is occurring throughout the spruce/fir cover type across the entire GMUG. Mortality is due to various causes (balsam fir bark beetle, Armillaria root rot, western spruce budworm). Areas most affected include the Grand Mesa, the Fruita Division, the Telluride area, and the Alpine Plateau.
- A western spruce budworm outbreak has been ongoing for several years on the Uncompahgre Plateau. Repeated defoliations are now resulting in mortality of subalpine fir, Douglas-fir, and Engelmann spruce in the understory of the spruce/fir cover type. Western spruce budworm activity is also occurring on the San Juans Geographic Area in the Dallas Divide, Ouray, and Big Cimarron areas, and in the Lake Fork of the Gunnison portion of the Gunnison Basin Geographic Area.

- Spruce beetle populations have been increasing in the past several years, much in response to an extensive blowdown event that occurred in 1997. Spruce beetle activity is scattered throughout the spruce/fir cover type. Areas with the highest amount of activity include the Grand Mesa and northern end of the San Juans Geographic Area. Note: not all spruce beetle activity is visible from the air. Ground surveys have been used to locate pockets of activity, particularly on the Grand Mesa.
- Pinyon mortality started to occur in 1995 on the west side of the Uncompahgre Plateau. By 2002 it had spread to both sides of the Uncompahgre Plateau, and in 2003 and 2004 it greatly increased, moving north to the Kannah Creek and Plateau Valley areas of the Grand Mesa. The majority of the mortality has occurred below the National Forest boundary.
- Mountain pine beetle activity has been increasing in ponderosa pine on the Uncompahgre Plateau and in lodgepole pine on the Gunnison Basin Geographic Area. Western pine beetle activity has also been increasing in ponderosa pine on the Uncompahgre Plateau.
- Douglas-fir beetle activity is occurring wherever Douglas-fir is found on the GMUG. Areas most affected include the upper North Fork Valley, Lake Fork of the Gunnison, and the San Miguel and Naturita canyon areas.
- Dwarf mistletoe is very prominent in lodgepole pine in the Taylor Park and Pitkin areas of the Gunnison Basin GA. Mortality due to dwarf mistletoe has increased significantly in lodgepole pine. Note: Dwarf mistletoe activity is also not easily visible during aerial surveys.
- Aspen mortality in mature stands has been increasing across the GMUG due to various fungi. Aspen become more susceptible to heart rot and root rot causing fungi as they age (> 80 years of age). Note: not shown on Figure 3.2.A.
- Armillaria root disease in also prevalent in mature conifer stands throughout the GMUG, also due to natural aging. Note: not shown on Figure 3.2.A.

To evaluate future potential vulnerability to insect and disease outbreaks, modeling using existing vegetation conditions was done. Conditions susceptible to five insects and two pathogens were evaluated. Table 3.2.A. displays the vulnerability ranking in acres, as percentages of host species cover, and as percentages of the GMUG for each of these organisms. The host species for each organism are also displayed.

The acreages shown as being vulnerable to insects/pathogens correspond to the acreages of the various host species (see Vegetation section in the CA). The percentages of host species indicate that the majority of all forested cover types are moderately to highly vulnerable to the modeled insects and diseases. This vulnerability does not ensure that future insect and disease activity will occur; however, the probability that this activity and associated mortality will continue into the future is high.

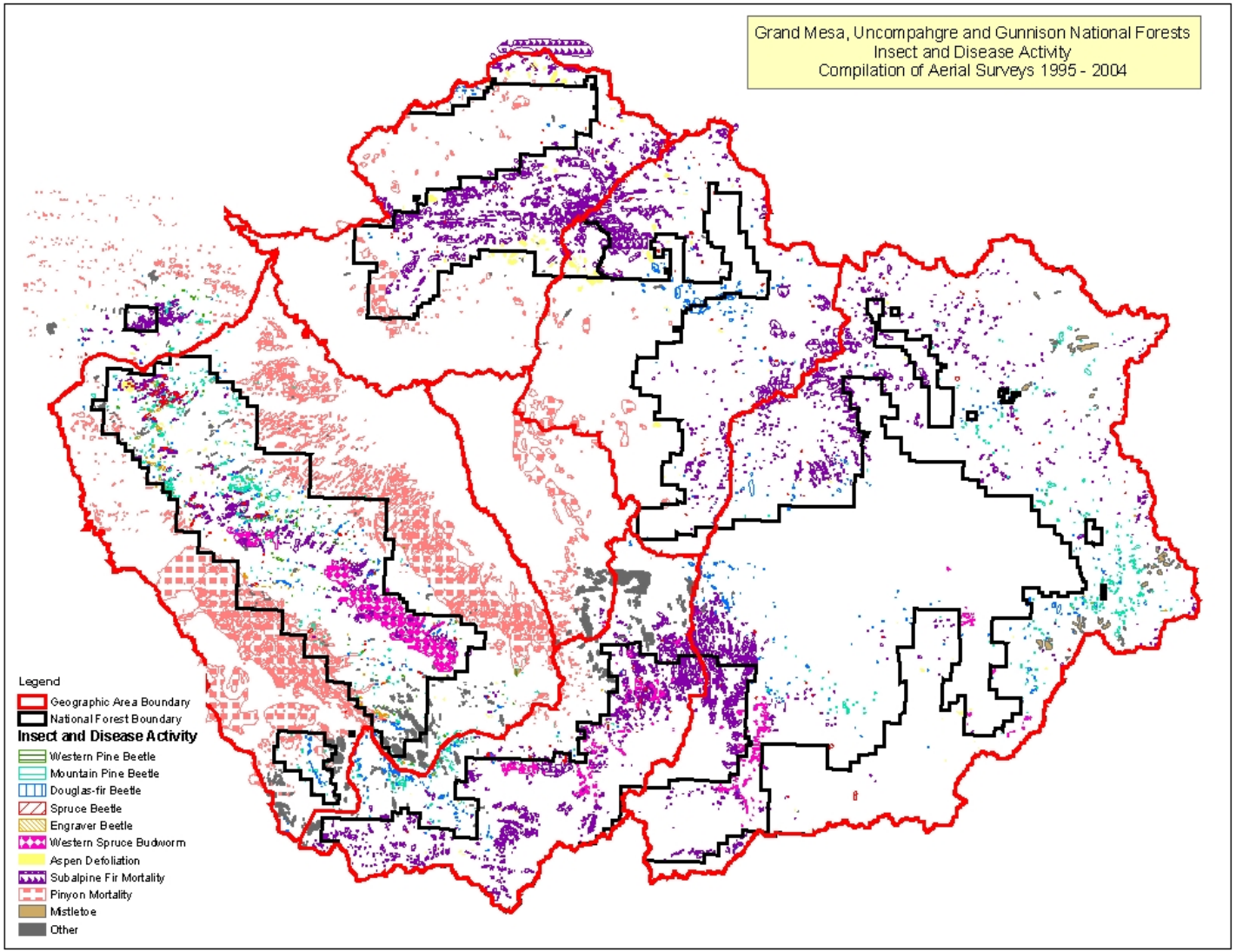

Figure 3.2.A. Insect and disease activity observed during aerial surveys 1995 – 2004, GMUG NF.

Table 3.2.A. Vulnerability ranking for future insect/pathogen infestations , GMUG NF.

Organism	Units	Vulnerability Ranking				Host Species
		High	Moderate	Low	None	
Western Spruce Budworm	Acres	1,020,600	272,300	1,000	1,892,700	Subalpine fir, Douglas-fir, Engelmann spruce
	% of Host	79	21	<1	0	
	% of GMUG	32	9	<1	59	
Spruce Beetle	Acres	701,100	353,000	113,000	2,019,600	Engelmann Spruce
	% of Host	61	29	10	0	
	% of GMUG	22	11	4	63	
Douglas-fir Beetle	Acres	38,000	115,200	8,300	3,025,100	Douglas-fir
	% of Host	23	71	5	1	
	% of GMUG	1	4	<1	95	
Mountain Pine Beetle 1	Acres	87,700	89,200	23,900	2,985,800	Ponderosa Pine
	% of Host	43	45	12	<1	
	% of GMUG	3	3	1	94	
Mountain Pine Beetle 2	Acres	318,100	84,500	5,100	2,778,900	Lodgepole Pine
	% of Host	78	21	1	0	
	% of GMUG	10	3	<1	87	
Lodgepole Pine Dwarf Mistletoe	Acres	378,200	29,500	100	2,778,900	Lodgepole Pine
	% of Host	93	7	0	0	
	% of GMUG	12	1	<1	87	
Armillaria	Acres	355,600	351,400	131,500	2,348,100	Blue spruce, Douglas-fir, Engelmann spruce, Subalpine fir
	% of Host	30	29	9	32	
	% of GMUG	11	11	4	74	

Desired Conditions

Insect and disease disturbances contribute to functioning ecosystems. Native insect and disease organisms play a natural role where appropriate and desirable, but are prevented or suppressed to endemic levels of damage where necessary to protect other resource values. The scale of damage associated with large scale insect and disease disturbances is within the historic range of variability.

Condition Gap

The mix of tree species, stand structure (density, multiple layers, extent of contiguous area in susceptible condition, etc.), and weather conditions, especially drought, will determine the level of tree mortality that may occur at the landscape level. Relatively uniform stand conditions inherently vulnerable to insect/disease attack dominate the majority of the forested landscape of the GMUG. These conditions make the GMUG susceptible to large-scale insect and disease disturbances. For forests to be less susceptible to insect and disease infestations, they need to be diverse in age, size, density, and species composition.

Management Implications

Increasing levels of insect and/or disease caused mortality are occurring across the GMUG. This is increasing fuel accumulations in forested stands, increasing the risk for high intensity stand replacing fires that could affect very large areas under certain weather conditions. Large areas of dead/dying and/or burned trees would result in loss of scenery values, habitat for wildlife species, and negatively impact watershed resources.

The current conditions in the majority of all forest cover types are moderately to highly vulnerable to one or more insect/disease. These relatively uniform habitat conditions could allow epidemic insect populations to develop. Once outbreaks occur, they often continue until no more suitable habitat (host tree species) is left.

Large-scale disturbances (insects/disease mortality, fire) that remove/kill mature forest overstory vegetation will take many years (100-200+ years) to return to mature forest conditions.

Drought conditions stress vegetation making even less vulnerable stand conditions potentially subject to insect and disease mortality. Once a tree is attacked by one organism, it often becomes more susceptible to attacks by other organisms.

Susceptibility to various fungal pathogens is an endemic process, slow moving and directly associated with tree age.. The majority of all forest cover types on the GMUG are mature, with average ages between 80 – 120 years. This is the age at which species such as aspen and subalpine fir become most susceptible to root rot and heart rot causing pathogens. In aspen/conifer mixed stands currently dominated by aspen, an increasing shift to more conifer dominance will occur as mature aspen succumb to fungal agents.

Subalpine fir mortality from the various causes is resulting in a species composition shift with subalpine fir decreasing and, in some areas, dropping out of the species mix.

Pinyon pine mortality is resulting in a shift from pinyon-juniper stands to juniper dominated stands. Because most pinyon mortality has occurred below the Forest boundary, the remaining live trees on the Forest may serve as seed sources and reserve habitat areas for species dependant on pinyon pine.

Insect and disease caused mortality and decadence creates important habitat features (snags, broken tops, down woody material) required by many wildlife species.

Insect and disease caused mortality and decadence reduced the merchantability of affected commercial tree species, lessening the opportunity to use timber harvest as a means to treat vegetation.

Insect and disease caused mortality and decadence in and near recreation sites increase hazard trees and public safety concerns. Tree removal results in loss of screening between camping sites.

Risks to Achieving Desired Conditions

Timber management strategies designed to respond to forest health concerns are often delayer or unimplemented due to budget/personnel constraints, analysis and decision appeals, lack of markets, and decreasing mill capacities.

Proactive timber management activities designed to reduce risk/susceptibility to insects and disease will be limited to areas designated as Theme 5, and portions of areas designated as Themes 3, 4, 7, and 8 where road access currently exists or temporary and/or new road construction is determined to be a suitable use. Timber management activities will not be allowed in Themes 1 or 2 and Theme 3 areas where temporary road construction is not a suitable use. In these areas, natural processes such as insect and disease mortality would be allowed to proceed without human influence.

There are potential risks of insects moving out of Theme 1, 2, or 3 areas and affecting other themes. Control of insect epidemics is extremely difficult once populations have built up.

Lack of structural diversity, species diversity, and high densities (or stocking levels) make current vegetation conditions very susceptible. Timber management activities can alter these conditions by increasing structural/species diversity and reducing stand densities. Opportunities for proactive timber management will be limited to Theme 5 areas and limited areas of Themes 3, 4, 7, and 8.

Weather conditions are beyond agency control, but are a dominant factor in intensity and spread of many forest health organisms. Subsequent years of drought conditions have resulted in increased levels of insect and disease activity. Long-term changes in weather could allow insect and disease activity in areas previously less susceptible (higher elevations), or invasive species may be able to spread into new areas (white pine blister rust, sudden oak death).

Need for Change

Strategies to reduce risk to insect/disease-causing organisms need to be incorporated in all projects that treat forest vegetation (timber harvest, prescribed fires, chaining).

There needs to be recognition of threats and strategies developed to prevent or reduce the risk of potential introduction and spread of non-native insects and disease.

Recognition that large scale disturbances are natural processes in certain cover types of the GMUG and are likely to occur in areas where natural processes are desired.

Integrated pest management options (i.e., biological control) should be considered in management of insect and disease organisms identified as forest health concerns.

Performance Measures

- Acres affected by insect and disease, by cover type, type of organism, and intensity of effects
- Acres treated to reduce insect and disease mortality, by cover type, type of organism, and treatment method

3.3 Rangeland Health

Area of Analysis

Rangeland health was evaluated for areas of rangeland vegetation (grass, forb, shrubland, woodlands, and open timber forests types with herbaceous understories) that exists primarily within grazing allotments on the GMUG. Riparian areas and wetlands, although considered to be a part of rangelands, are evaluated in Section 2.3 Riparian/Wetland Resources. Information on areas outside of grazing allotments is limited. Information for the Naturita Division and portions of the San Juans Geographic Area within grazing allotments is currently not available.

Condition and Trend

Rangeland health is a function of upland soil conditions, riparian systems, plant and animal communities, and water quality. Rangeland health is not just a measure for lands grazed by livestock, however, information described in this section is currently limited to areas of rangeland suitable for livestock grazing. (See Livestock Industry section in the CA.)

For rangeland vegetation, rangeland condition is based on the ecological condition of a site, by comparing existing vegetative composition and cover to potential composition and cover that would be appropriate for a given location. The 1991 Amended Forest Plan does not describe the rangeland vegetation condition that existed at that time. A range report (RAMIS) from 1987 did list acres of range condition by allotment. Table 3.3.A displays this information as percentage of each condition class summarized for the GMUG.

Table 3.3.A. 1987 Rangeland Condition for GMUG (RAMIS report).

Condition Class	Acres	% of Total Acres
Poor	641,696	38
Fair	766,287	45
Good	235,158	14
Very Good & Excellent	463,67	3
Total Suitable	1,689,508	

Current rangeland vegetation condition was determined by local rangeland management specialists based on their knowledge of the ground combined with results of years of rangeland vegetation studies. Rangeland vegetation conditions are displayed in Table 3.3.B. and in Figure 3.3.A. Areas displayed with no condition are not considered to be suitable rangeland.

Table 3.3.B. Current rangeland condition for suitable rangeland for the GMUG and each Geographic Area.

Condition	Total GMUG Acres	% of GMUG Suitable	% of GM GA Suitable	% of GB GA Suitable	% of NFV GA Suitable	% of SJ GA Suitable	% of UP GA Suitable
Poor	42,152	3	1	4	1	3	5
Fair	585,145	44	34	39	48	18	52
Good	709,227	53	65	57	51	79	43
Subtotal Suitable	1,336,524	100					

Note: Condition information is currently not available for all of the San Juan Geographic Area

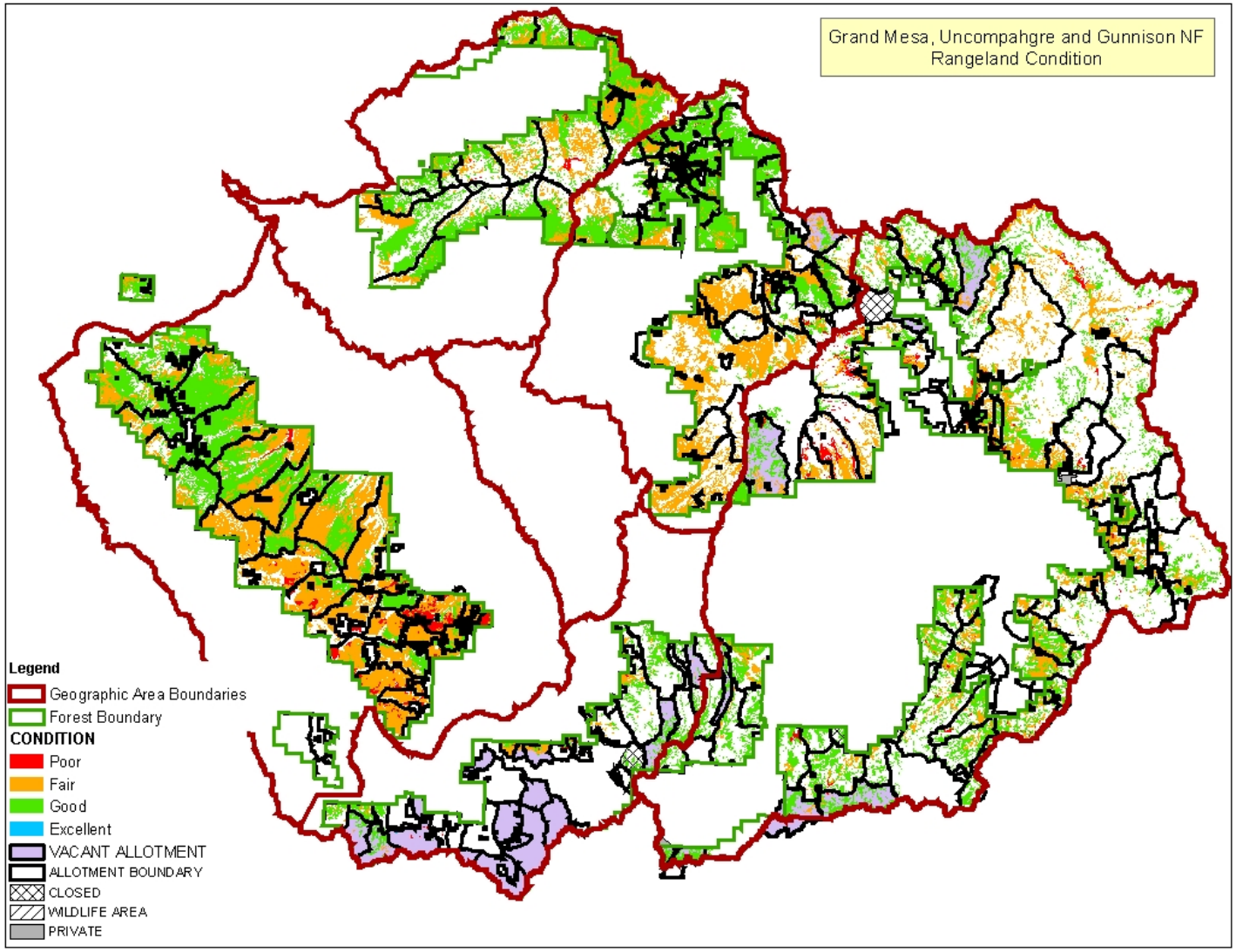

Figure 3.3.A. Rangeland condition on suitable rangeland for the GMUG NF.

There appears to be a difference of 353,000 acres in suitable rangeland between 1987 and 2005, likely due to differences in mapping technology, more accurate data, and changes in areas determined to be suitable for livestock grazing. By comparing the percentage of suitable rangeland in each condition class between 1987 to 2005, it appears that rangeland conditions have improved across the GMUG.

Trend in rangeland vegetation is an evaluation of whether current conditions are moving towards desired conditions (upward), are remaining static (no change), or moving away from desired conditions (downward). Current trend was also determined by local rangeland management specialists based on measured trend transects and knowledge of on-the-ground conditions. Trend in rangeland conditions is displayed in Table 3.3.C. and in Figure 3.3.B. Areas displayed with no trend are not suitable rangeland.

Table 3.3.C. Current Trend in Rangeland Condition for Suitable Rangeland on the GMUG and each Geographic Area.

Trend	Total GMUG Acres	% of GMUG Suitable	% of GM GA Suitable	% of GB GA Suitable	% of NFV GA Suitable	% of SJ GA Suitable	% of UP GA Suitable
Upward	351,340	26		28	61	18	17
Static	960,443	72	100	70	39	82	82
Downward	15,897	1		3			1
Unclassified	8,844	<1					
Subtotal Suitable	1,336,524	100					

Note: Trend information is currently not available for all of the San Juan Geographic Area.

In the poor condition range, approximately 74 percent has static trend and 12 percent has downward trend. In the fair condition ranges, approximately 64 percent has static trend and one percent has downward trend.

As mentioned above, riparian systems are another element of rangeland health. As described under Section 2.3 Riparian/Wetland Resources in the Aquatic Resources section, the current inventory of riparian systems is not complete. Information on condition (or health) and trend in these riparian systems is limited to relatively few sites (proper functioning condition surveys, green line surveys, and riparian transects have been conducted and established during range analysis for allotment management planning). Available information cannot be summarized Forest-wide.

Healthy, productive animal communities are another element of rangeland health. Several issues have been identified related to this element. Rangelands provide forage for both domestic livestock and wildlife populations and rangeland management needs to consider use levels by both permitted livestock and wildlife.

As discussed in the Livestock Industry section in the CA, domestic livestock use has been reduced overall and management in terms of timing, intensity, duration, frequency, and distribution has been adjusted in many areas of the Forest to maintain or enhance rangeland conditions as appropriate. Improvement needs are still recognized in portions of the Forest.

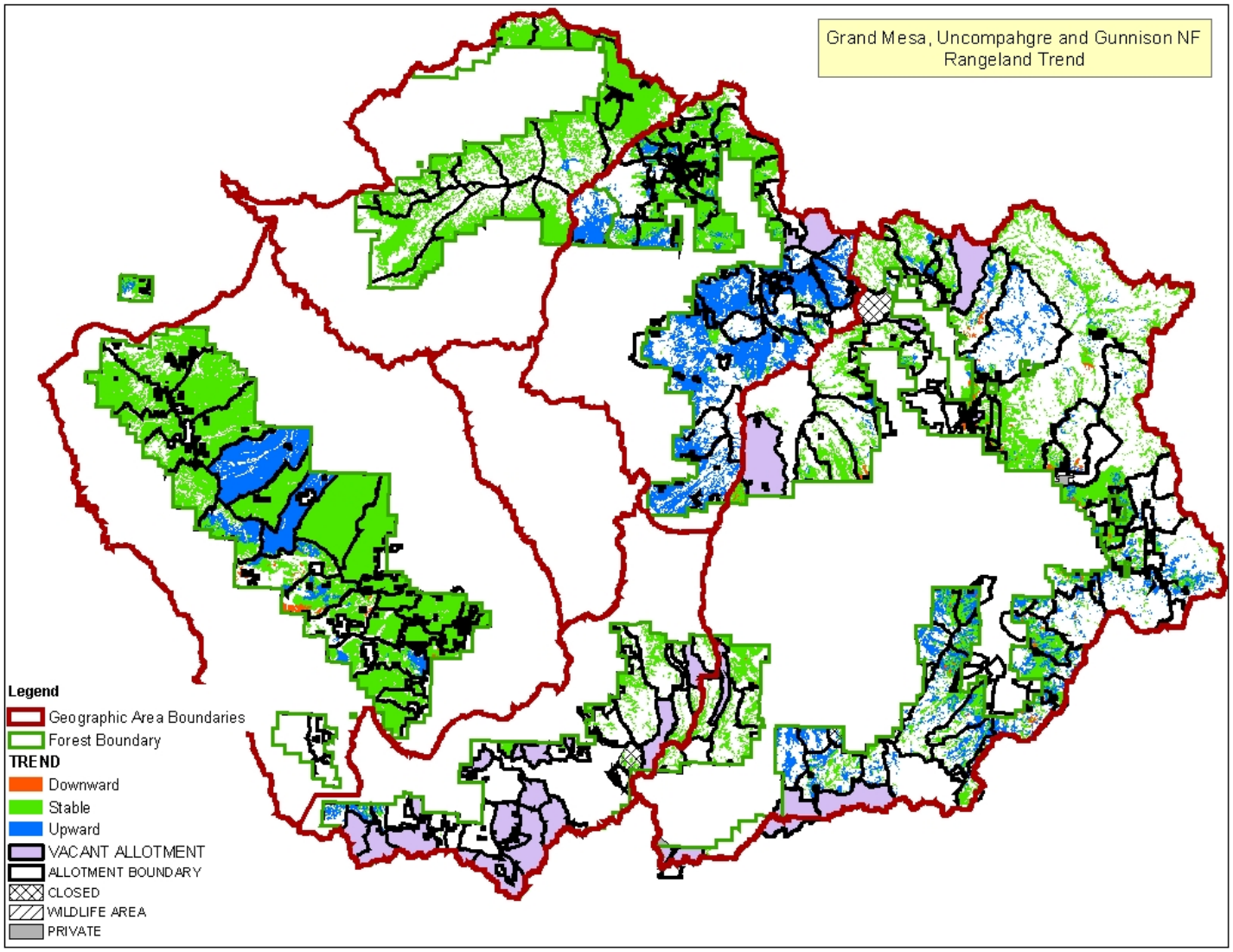

Figure 3.3.B. Trend in rangeland conditions for suitable rangeland, GMUG NF.

Wildlife populations are not as easily managed. Elk populations on the Forest are above population objectives established by the CDOW for many herd units. Competition between livestock and elk is occurring in some areas and use on rangeland vegetation is exceeding objectives. Elk use and distribution is influenced by management activities, recreational and hunting pressure, livestock distribution, and forage availability as well as management practices on adjacent private lands. Moose have been reintroduced to the GMUG and potential impacts of browsing, particularly on woody species, is not yet known. These influences need to be considered in designing future management actions so that rangeland resources management objectives can be achieved.

Another animal community related issue deals with overlap of domestic sheep and bighorn sheep. Domestic sheep are known to transmit diseases to wild sheep. Significant population declines in bighorn sheep occurred in the past. Efforts to maintain and/or reestablish bighorn herds through transplants, trapping and inoculation, and habitat improvement projects have been undertaken on the GMUG. There are currently 27 domestic sheep allotments (eight are currently vacant) in or within five miles of bighorn sheep range. Domestic sheep use in these areas needs to be evaluated to determine if there is a concern and whether corrective actions can or need to be taken.

The final element of rangeland health is water quality, which is addressed in the Aquatic Resources section in the CA. Water quality was evaluated at the watershed scale.

Desired Conditions

Healthy rangelands include:

- Upland soils which exhibit infiltration and permeability rates appropriate to soil type, climate, land form, and geologic processes.
- Riparian systems (associated with both running and standing water) which function properly, have the ability to recover from major disturbances (fire, grazing, 100-year flood) and include vegetation composition and cover that provides forage, habitat, and biodiversity.
- Plant and animal communities of native and other desirable species at population levels that are productive, resilient, diverse, vigorous, and able to sustain natural fluctuations and ecological processes.
- Special status, threatened and endangered species and their habitats are maintained or enhanced.
- Water quality which meets or exceeds State standards.

Condition Gap

Areas in poor and fair condition and/or in downward or static trend could potentially be improved.

A complete inventory of riparian areas is not available for the GMUG. Riparian condition and trend information is lacking for most of the Forest.

Past livestock grazing pressure, combined with fire suppression efforts over the past 100 years, has resulted in a predominance of later seral conditions in most vegetation types on the GMUG, which has an influence on the amount of available forage for both permitted livestock and grazing/browsing wildlife species.

Invasive plant species are present on the GMUG and have increased in number and in extent. (See Invasive Plant Species section in the CA.)

Competition between domestic livestock and wild ungulates (elk) is resulting in improper utilization of rangeland vegetation in some areas.

Information to determine the amount and impacts of domestic sheep overlap with bighorn sheep is lacking.

Management Implications

Current rangeland condition and trend is the legacy of past management activities and disturbances. Past heavy livestock grazing and vegetation conversion projects altered plant species composition and site productivity on many areas. Fire suppression efforts have allowed shrubby and woody species to increase over time, reducing available forage in understories. Invasive plant species have become established, replacing native species. Future activities and livestock management needs to be implemented to move the existing condition towards desired conditions identified to achieve multiple use objectives or to maintain desired conditions where they currently exist.

Areas preferred by livestock tend to coincide with areas that have higher susceptibility to invasive plant species (deeper soils, better soil moisture conditions, more solar radiation reaching the ground). Livestock management needs to be implemented so that suitable habitat for invasive plant species is not created. (Also see Invasive Plant Species discussion in the CA.)

Future management activities need to identify and implement methods to reduce competition for forage between cattle and elk in localized areas through improvement in rangeland conditions and/or improved animal distribution.

Livestock grazing can be used as a tool to achieve desired vegetation conditions (i.e., control invasive plant species, reduce flashy fuel accumulations).

Risks to Achieving Desired Conditions

Invasive plant species are increasing across the GMUG. Poor and fair condition ranges are more susceptible to invasive plant species. Any future disturbances (human or natural) in these areas can exacerbate the risk to invasive plants. Areas disturbed by recent fires have seen an increase in invasive plant species. Once invasive plant species become established, they can out compete or replace native or desirable plant species.

Later seral conditions in timber and woodland vegetation types have less herbaceous vegetation than earlier seral conditions. Later seral conditions predominate in these vegetation types across the GMUG. Management opportunities to alter vegetation conditions will be limited by budget and personnel constraints. Emphasis on wildland urban interface protection from wildfire disturbances will focus future efforts in localized areas.

Elk (and potentially moose) populations will continue to affect rangeland vegetation condition and trend.

Need for Change

Desired conditions for healthy rangelands need to be defined generally for the entire Forest and specifically for each allotment.

Consistent monitoring methods to track rangeland vegetation (including riparian vegetation) condition and trend need to be implemented. Because rangeland condition and trend has implications on many different resources, monitoring needs to be designed and implemented in an interdisciplinary environment.

The Forest Service needs to continue and expand coordination efforts with the CDOW to maintain elk herds at population objectives, implement rangeland improvement projects to improve elk and livestock distribution, and monitor wild ungulate use to determine effectiveness of projects.

Performance Measures

- Rangeland condition (acres in each condition class)
- Rangeland trend (acres in each trend class)
- Riparian area condition and trend
- Acres meeting, moving towards, or not meeting/moving towards desired condition

3.4 Ecosystem and Species Diversity

Area of Analysis

Ecosystem and species diversity have been evaluated by considering information at a variety of scales. The subregional scale (landscape scale) was used to evaluate existing vegetation, historic range of variation, and some large-scale anthropogenic effects to vegetation types. Evaluations of existing vegetation conditions, comparison of existing to modeled historic conditions, and effects of past management activities at the Forest and geographic area scales are included in the Comprehensive Assessment and have been summarized in previous sections of this Comprehensive Evaluation Report. Species-specific information from a variety of sources covering diverse scales was also considered to determine species occurrence on the GMUG and the relative importance of habitat provided on the Forest to different species. Forest and Geographic Area level information was evaluated to determine plan level effects to species diversity and whether plan components needed to be developed to provide for species diversity.

Condition and Trend

Not all plant and animal species that occur on the GMUG were considered in the evaluation of ecosystem and species diversity. Under the 2005 Planning Rule, the Forest Service is directed to "Focus evaluation and development of plan components for species diversity on those species for which the Responsible Official determines that provision in plan components [in addition to those developed for ecosystem diversity] are needed." (FSH 1909.12, section 43.21)

Beginning with a large list of plant and animal species, that included: federal threatened or endangered species; proposed and candidate species; species with biodiversity rankings of G1-G3, T1-T3, or S1-S2; State species of special concern, State game species, Region 2 sensitive species identified because of the same conservation concern (see Species Diversity Section in the CA); USFWS birds of conservation concern, birds covered by the Migratory Bird Treaty Act, and plants tracked by the Colorado Natural Heritage Program (CNHP); further evaluation determined which species were known to occur on the GMUG. After species were identified, an iterative process was used to determine which species met the screening criteria for species-of-concern or species-of-interest (in FSH 19091.12, section 43.22d), and to determine where there may be needs for Plan components to provide for ecological conditions for these specific species. Species were eliminated from further consideration if there was no known occurrence or suitable habitat for that species on the Forest.

Some of the remaining species were grouped based on: 1) preferred or required habitat type(s) (e.g., ponderosa pine, sagebrush); 2) special habitat features used (e.g., cave, cliff, fen, soil types, geological formation, micro-climates, elevation ranges) which could occur in different habitat types; and 3) similar life histories (e.g., raptors). Some animal species are generalists and use a wide variety of habitats. These species were included in habitat groupings based on the habitat type used during some critical season (e.g., black bear in oak due to importance of mast production as fall food source). (Species groupings for plants are discussed in the Plant Technical Report in the CA. Species groupings for animals are identified in Appendix B to the Species Diversity section of the CA).

Evaluations of both species groupings and some individual species (mostly plants) were completed to:

- identify the extent of the habitat type on the GMUG,
- summarize current conditions of habitat,
- compare current conditions to potential habitat (based on Potential Natural Vegetation (PNV) mapping),
- briefly describe habitat requirements for each species in the group,
- described known information on species occurrence on the GMUG,
- discuss areas of potentially suitable and/or occupied habitat for each species,
- summarize past management activities that have affected habitat type,
- discuss potential future threats to habitat and the species that could be affected, and
- identify management considerations for habitat and species that may be needed.

Evaluations are available in the Species Diversity section of the CA. This section of the CER summarizes the results of these evaluations.

Federally Listed Species

The 1991 Amended Forest Plan included a list of federally threatened and endangered plant and animal species that occurred on the GMUG or should be considered as potentially being affected by activities on the GMUG. This list is no longer correct. One species has been extirpated from this portion of its range (whooping crane), one species has been de-listed (American peregrine falcon), and several species which were then candidate or proposed species have been listed. Table 3.4.A. includes the current federally threatened or endangered species that the USFWS identifies as occurring or needing to be evaluated on the GMUG.

The Endangered Species Act of 1973 requires all federal departments and agencies (including the Forest Service) to conserve threatened or endangered species and the habitats they depend upon, and to consult with the U.S. Fish and Wildlife Service on all actions authorized, funded, or carried out by such agency to ensure that the action will not likely jeopardize the continued existence of any threatened or endangered species or adversely modify critical habitat (FSM 2670). For every project the Forest Service must determine the effects of the proposed action on federally listed threatened or endangered species and their habitats to conform to Section 7 of the Endangered Species Act. These determinations are documented in Biological Assessments (BA). Since 1991, Forest Service biologists have been completing BAs and consulting with the USFWS as needed. The species addressed in past projects has changed as the listed species changed. This process will continue.

Table 3.4.A. Federally Listed Species on the GMUG NF.

Species	Status	Available Management Direction
Uinta Basin Hookless Cactus *(Sclerocactus glaucus)*	Threatened	Recovery Plan (1990)
Uncompahgre Fritillary Butterfly *(Boloria acrocnema)*	Endangered	Recovery Plan (1994)
Bald Eagle (*Haliaeetus leucocephalus*)	Threatened	Northern Region Bald Eagle Recovery Plan (1983)
Canada Lynx (*Lynx canadensis*)	Threatened	Canada Lynx Conservation Assessment and Strategy (2000, as amended 2003)
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened	Recovery Plan (1995)
Humpback Chub *(Gila cypha)*	Endangered	Recovery Plan (2002) and Recovery Goals (2002)
Bonytail chub *(Gila elegans)*	Endangered	Recovery Plan (2002) and Recovery Goals (2002)
Colorado Pikeminnow (*Ptychocheilus lucius*)	Endangered	Recovery Plan (2002) and Recovery Goals (2002)
Razorback Sucker (*Xyrauchen texanus*)	Endangered	Recovery Plan (2002) and Recovery Goals (2002)

Species-of-Concern

Species-of-concern are species for which the Responsible Official determines that management actions may be necessary to prevent listing under the Endangered Species Act. Criteria identified in FSH 1909.12, section 43.22b, states species-of-concern may include:

- species identified as proposed and candidate species under the ESA, (Note: there are currently no proposed species under the ESA that occur on the GMUG.)
- species with ranks of G-1 through G-3 on the NatureServe ranking system,
- infraspecific (subspecific) taxa with ranks of T-1 through T-3 on the NatureServe ranking system,
- species that have been petitioned for federal listing and for which a positive "90-day finding" has been made (a 90-day finding is a preliminary finding that substantive information was provided indicating that the petition listing may be warranted and a full status review ill be conducted) (Note: there are currently no species for which a positive 90-day finding has been made that occur on the GMUG), and
- species that have been recently delisted (these include species delisted within the past five years and other delisted species for which regulatory agency monitoring is still considered necessary).

Using these criteria, 12 animals and 81 plants were initially identified as species-of-concern. Screening criteria in FSH 1909.12, section 43.22d was used to determine which species may not require further consideration in the planning process. Species were not carried forward if:

- there are no known occurrences or suitable habitat of the species on the Forest.
- they are secure within the plan area.
- they are not affected by management or potential plan components.

Evaluations were further used to determine whether provisions for ecosystem diversity were adequate to support self-sustaining populations or whether plan components for species diversity were needed. Based on these evaluations the following species-of-concern were carried forward as requiring further consideration in the Plan (Table 3.4.B.):

Table 3.4.B. Species-of-Concern Requiring Further Consideration for the GMUG NF.

Plant Species	Ranking[1]	Habitat Group
Rocky Mountain thistle *(Cirsium perplexans)*	G2 / S2	Pinyon-juniper, sagebrush, mixed shrub
Colorado desert parsley *(Lomatium concinnum)*	G2 / S2	Pinyon-juniper
DeBeque phacelia *(Phacelia submutica, P. scopulina var. submutica)*	G4 / T2 / S2	Pinyon-juniper (Wasatch formation)
Oil Shale Fescue *(Argillochloa dasyclada, Festuca dasyclada)*	G3 / S3	Oil Shale, Green River Formation
Piceance bladderpod *(Lesquerella parviflora)*	G2G3 / S2S3	Oil Shale, Green River Formation
Terrestrial Wildlife Species	**Ranking**	**Habitat Group**
Gunnison sage-grouse *(Centrocercus minimus)*	G1 / S1	Sagebrush
Aquatic Wildlife Species	**Ranking**	**Habitat Group**
Boreal toad *(Bufo boreas boreas)*	G4 / T1Q / S1	Riparian, high elevation conifer
Colorado river cutthroat trout (*Oncorhynchus clarki pleuriticus*)	G4 / T3 / S3	Aquatic

[1] Ranking and Status categories are defined in *Appendix A, Acronyms and* Glossary of the Plan.

Management considerations for these species-of-concern have been identified in the species and habitat evaluations (included in the Species Diversity section of the CA) and need to be incorporated into the proposed Forest Plan components. Emphasis will be placed on protection of existing occupied and suitable unoccupied habitats, habitat restoration, and expansion of existing populations.

Species-of-Interest

Species-of-interest are species for which the Responsible Official determines that management actions may be necessary or desirable to achieve ecological or other multiple use objectives. Criteria identified in FSH 1909.12, section 43.22c, states species-of-interest may include:

- species with ranks of S-1, S-2, N1, or N2 on the NatureServe ranking system,

- State listed threatened and endangered species that do not meet the criteria as species-of-concern,
- species identified as species of conservation concern in State Comprehensive Wildlife Strategies,
- bird species on the U.S. Fish and Wildlife Service Birds of Conservation Concern National Priority list,
- additional species that valid existing information indicates are of regional or local conservation concern due to factors that may include: significant threats to populations or habitats, declining trends in populations or habitat, rarity, and restricted ranges,
- species that are hunted or fished and other species of public interest, and
- invasive species. (Note: Invasive species were not considered as species-of-interest on the GMUG but are addressed in a separate section of the proposed Plan.)

Using these criteria, 122 animals and 68 plants were identified as potential species-of-interest. The same screening criteria used for species-of-concern (FSH 1909.12, section 43.22d, listed above) were used to determine which species should be considered further in planning as species-of-interest. Information from the species/habitat evaluations was also considered to screen species. As a result, 23 animals and no plants have been selected as species-of-interest. They included (Table 3.4.C.):

Table 3.4.C. Species-of-Interest on the GMUG NF.

Terrestrial Wildlife Species	Ranking[1]	Habitat/Species Group
Boreal Owl (*Aegolius funereus*)	G5 / S2	High Elevation Conifer
American Marten (*Martes americana*)	G5 / S4	High Elevation Conifer
Northern Goshawk *(Accipiter gentilis)*	G5 / S3B	Aspen, High Elevation Conifer
Purple Martin (*Progne subis*)	G5 / S3B	Aspen
Red-naped sapsucker (*Sphyrapicus nuchalis*)	G5 / S4B	Aspen
Abert's Squirrel (*Sciurus aberti*)	G5 / S5	Ponderosa Pine
Brewer's Sparrow (*Spizella breweri)*	G5 / S4B	Sagebrush
White-tailed Ptarmigan (*Lagopus leucurus*)	G5 / S4	Alpine
Black Swift (*Cypseloides niger*)	G4 / S3B	Cliffs (Waterfalls)
Golden Eagle (*Aquila chrysaetos*)	G5 / S3S4B	Grasslands / Shrublands, Cliffs Raptor Group
Ferruginous Hawk (*Buteo regalis*)	G4 / S3B	Grasslands / Shrublands Raptor Group

Terrestrial Wildlife Species	Ranking[1]	Habitat/Species Group
Swainson's Hawk (*Buteo swainsoni*)	G5 / S5B	Grassland / Shrublands Raptor Group
Northern Harrier (*Circus cyanus*)	G5 / S3B	Grasslands, Wetlands Raptor Group
Prairie Falcon (*Falco mexicanus*)	G5 / S4B / S4N	Grasslands, Cliffs Raptor Group
American Peregrine Falcon (*Falco peregrinus anatum*)	G4 / T3 / S2B	Cliffs Raptor Group
Pallid Bat *(Antrozous pallidus)*	G5 / S4	Pinyon-juniper Bat Group
Spotted Bat (*Euderma maculatum*)	G4 / S2	Ponderosa Pine Bat Group
Townsend's Big-eared Bat (*Corynorhinus townsendii pallescens*)	G4 / T4 / S2	Ponderosa pine, cliffs, caves Bat Group
Fringed Myotis (*Myotis thysanodes*)	G4G5 / S3	Caves, Cliffs Bat Group
Rocky Mountain Elk (*Cervus elaphus nelsoni*)	G5 / T5 / S5	Generalist (Aspen – calving)
Mule Deer (*Odocoileus hemionus*)	G5 / S4	Generalist (Pinyon-juniper, oak, mountain shrub, sagebrush – winter)
Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*)	G4 / T4 / S4	Alpine, Cliffs
Desert Bighorn Sheep (*Ovis canadensis nelsoni)*	G4 / T4 / S3	Pinyon-juniper, sagebrush, cliffs

[1] Ranking and Status categories are defined in *Appendix A, Acronyms and Glossary of the Plan*.

Tables in the Species Diversity section of the CA include the species considered and the rationale for selection as species-of-interest. Management considerations for species-of-interest are also identified in the species/habitat evaluations in the Species Diversity section of the CA and need to be included as plan components to support these species.

R2 Sensitive Species

The 1991 Amended Forest Plan recognized only four sensitive species. Sensitive species are *"those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by:*

> *significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution" (FSM 2670.5)*

The Rocky Mountain Region originally developed the Regional Forester's Sensitive Species list in 1993. This list had minor updates in 1994, was extensively revised in 2003 (process is described in USDA Forest Service 2003), and was revised again in 2005 (FSM 2670 (R2 supplement 2600-2005-1, 5/17/2005)). Currently, 38 animal and 17 plant sensitive species are known or likely to occur on the GMUG. These species were

considered in the evaluation process to determine species-of-concern and species-of-interest.

Currently, the Forest Service requires an evaluation of potential effects to Forest Service sensitive species and habitat during project-level analysis (FSM 2672.4) to ensure that Forest Service actions do not contribute to the loss of viability of any native or desired non-native plant or animal species, nor cause any species to move toward federal listing. A Biological Evaluation (BE) is prepared for each project in conformance with Manual direction to determine these effects. As with BAs for federally listed species, biologists have been completing BEs addressing sensitive species. The species addressed in past project analyses have changed as the sensitive species list changed.

Management Indicator Species

The 1991 Amended Forest Plan identified 17 management indicator species (MIS). These species were selected because changes in their populations were believed to indicate the effects of management activities. Selection criteria for species included:

- There were issues or concerns about the wildlife/fisheries species and/or their habitat.
- The species was endangered or threatened, either nationally or statewide.
- The species had special habitat needs that may be influenced significantly by management practices resulting from land use allocation.
- The species was economically important and was commonly hunted, fished, or trapped.
- The species represents the habitat requirements of other species or groups of species.

The 1982 Planning Rule required the use of MIS to measure and ensure species viability. The effects of plan and project alternatives on MIS needed to be evaluated and population trend monitoring was required. The 1991 Amended Forest Plan also included specific standards and guidelines for MIS habitat management.

The adequacy of effects to MIS analyses and required population monitoring became a focus of project-level NEPA analyses appeals. In 2001 the GMUG completed an assessment of 12 of the 17 MIS, which described suitability as MIS, habitat requirements, existing habitat conditions, and available population trend information to support future NEPA analyses. The MIS assessment also identified needed Forest Plan changes.

Between 2001 and 2004 Regional direction on the selection of MIS evolved. The 2005 Planning Rule also modified the MIS concept. These changes in direction resulted in a GMUG amendment to the current Forest Plan (May 2005) to change the MIS and the monitoring requirement. Individual species assessments for each MIS were completed which described habitat requirements, existing habitat, population trends, and management considerations. Table 3.4.D. lists the MIS that resulted from this 2005 Plan Amendment.

The 2005 Planning Rule no longer requires the use of MIS or population monitoring. Current MIS were considered in the evaluation to determine species-of-interest.

Species with Insufficient Information

For many species (especially plants) extensive research has concluded that there is insufficient information regarding habitat affiliations, population dynamics, and risks from management actions to determine if they should be a species-of-concern or species-of-interest. During the evaluation process it was determined that there are still 37 plants that have persistence questions. These plants can be grouped by habitat associations (e.g., alpine, fens, riparian/wetland, Green Mountain formation). Other agencies (e.g., CNHP) or organizations (e.g., Partners in Flight, Rocky Mountain Bird Observatory) continue to monitor and track these species. The Forest Service has been cooperating with these entities. Such cooperation should continue so that information on these species may gradually be acquired.

Table 3.4.D. Current Management Indicator Species for the GMUG NF.

Species	Habitat Association
Northern Goshawk (*Accipiter gentils*)	Mature aspen, lodgepole pine and mixed conifer/aspen
Elk (*Cervus elaphus nelsoni*)	Indicator for travel management objectives and high economic importance.
American Marten (*Martes americana*)	Mature to old mixed conifer, lodgepole pine and spruce-fir
Merriam's Wild Turkey *(Meleagris gallopavo)*	Gambel oak, pinyon-juniper and lower elevation ponderosa pine
Abert's Squirrel (*Sciurus aberti)*	Mature to late succession ponderosa pine
Red-naped Sapsucker (*Sphyrapicus nuchalis)*	Mature aspen
Brewers Sparrow (*Spizella breweri)*	Mature sagebrush
Common Trout (brook, brown, rainbow and cutthroat trout) (*Salvelinus fontinalis) (Salmo trutta) (Salmo gairdneri*) (*Oncorhynchus clarki)*	Streams, lakes and reservoirs

Desired Conditions

Ecological conditions provide for the diversity of native plant and animal species that occur within the plan area. For any habitat type, distribution of seral stages, habitat structure, and species composition is within expected ranges of variability. Natural processes are functioning at characteristic intensities and frequencies.

Within the limits of agency authorities, the capability of the plan area and overall multiple use objectives, ecological conditions will be provided to:

- Conserve federally listed species,
- Support self-sustaining populations of species-of-concern, and
- Support species-of-interest.

Condition Gap

The current Plan references dated direction concerning federally listed species, regionally sensitive species, and MIS. Existing management direction included in recovery plans and conservation assessments are not incorporated in the existing Forest Plan (see Table 3.4.A. above). The current Plan does not recognize existing agreements to manage, establish, and provide habitat for Gunnison sage-grouse, Colorado River cutthroat trout, or boreal toad. The Plan does not recognize that listed species and/or direction may change over time.

Condition gaps described in the Vegetation section in the CA relate to condition gaps in habitat for species that have been evaluated for the proposed plan. Specific examples include:

- Reduction in extent and altered species composition in riparian areas and wetlands have resulted in fewer habitats for species that rely on riparian areas and wetlands. Limited condition and trend data exists for riparian areas.
- Changes in plant species composition have eliminated forage for some wildlife species.
- Reduced numbers of very large diameter trees (living and dead) in most timber types limit available habitat for many species now and into the future. This is especially a problem in ponderosa pine habitats.
- Denser and more uniform structural conditions in many habitat types have resulted because of to interrupted fire cycles (e.g., Gambel oak and mixed mountain shrub). This shift has reduced habitat for species that require a variety of structural stages within close proximity of each other.
- Additional condition gaps in habitat for specific species or groups of species are described in each of the habitat/species evaluations (see Species Diversity section of the CA).
- The number of invasive, exotic species and the sizes of their populations have grown markedly, as has their influence on many ecosystems across the Forest. Effects on native species and populations are apparently increasing, yet exact effects are in many cases unknown. The resulting situation makes it difficult to predict or model the effects of future management.

Current Plan standards and guidelines for retention of snags and coarse woody debris are below minimum habitat requirements identified in scientific literature currently available for many species that rely on these habitat features in forest cover types.

The current Forest Plan requires habitat effectiveness be evaluated for elk by considering hiding and thermal cover, available forage, road density, and human activity on roads using the HABCAP model. Road use has been estimated based on the road maintenance level. Trail use is not included in Plan direction but has been evaluated by equating motorized trails to primitive roads in past analyses. Non-motorized trail use has not been considered in habitat effectiveness evaluations. Using coefficients defined in the current Plan (page III-77), adjusted open route densities have been calculated within a fourth order watershed. Higher densities of lower standard routes are equivalent to lower densities of higher standard routes in terms of habitat effectiveness. The species assessment completed for elk as part of the 2005 MIS Amendment (USDA Forest Service

2005b) suggested the need for road densities that are less than those allowed under the current habitat effectiveness guidelines.

There is an incomplete inventory of old growth stands. Old growth definitions have been developed but have not been consistently used to inventory and evaluate old growth during project analysis.

Current Forest Plan direction for riparian areas does not address fens, other wetlands or plants associated with these habitats.

The current Forest Plan does not include direction related to species-of-concern or species-of-interest.

The current Forest Plan does not include management direction for specialized habitats such as alpine, Green River formation, fens, acidic wetlands, dripping ledges, waterfalls, cliffs, and caves.

Management Implications

Management implications of vegetation conditions, described in the Vegetation section in the CA, relate to ecosystem diversity. There are direct implications to species diversity where conditions are described as limited, lacking, interrupted, and susceptible. These conditions relate directly to species habitat.

Because different species require different habitats, any change in habitat will have beneficial effects for some species and negative effects for others. Future management actions need to be designed to modify habitats in ways that are spatially and temporally more consistent with natural disturbance regimes for any given habitat type.

The current lack of diversity in habitat and structural stage conditions in forest, woodland, and shrub habitat types makes these habitat types less resistant or resilient to potential disturbances. Any deficiencies in habitats under current conditions would be exacerbated following large scale disturbances. If large areas are affected by disturbances (reset to early seral conditions), these areas would require a long time for habitats to return to pre-disturbance conditions. If areas are more diverse, disturbances may result in mosaics of different seral conditions. Recovery time will be shorter in those areas less severely impacted.

Use on existing roads and trails has influenced the largest amount of area in all habitat types on the GMUG (see Road and Trail Distribution section in Comprehensive Assessment and habitat/species evaluations located in the Species Diversity section of the Comprehensive Assessment). Human use on road and trails influences more species than just elk.

Management for federally listed species (current and potential) could constrain future forest management activities.

Even-aged management (i.e., shelterwood) in conifer forests does not allow for the retention or perpetuation of habitat features required by many species (multi-storied canopy, large diameter snags, coarse woody debris).

Risks to Achieving Desired Conditions

Risks described in the Vegetation section in the CA are risks to ecosystem diversity. Any disturbance (human or natural) that results in a change in vegetation beyond what would likely have occurred in the past (e.g., introduction of non-native species, eliminating native species, eliminating certain structural habitat components) are risks to species diversity. Loss of habitat can result in species loss.

Management emphasis for a single species can reduce or eliminate habitat for other species.

Loss of specialized habitats that are limited on the Forest may result in loss of species on the Forest and potentially cause that species to trend towards listing.

Where habitat conditions are most departed from conditions that would have been present in the past, corrective measures may be needed. Budget and personnel availability may limit opportunities to implement corrective measures.

Displacement of native species by invasive and non-native species has occurred in the past. The risk or susceptibility of areas to future increases in invasive species continues this threat to desired species into the future.

Biological control of invasive species can result in unintended and undesirable impacts to federally listed species, species-of-concern, or species-of-interest.

Need for Change

The Vegetation section in the CA contains identified needs for change that primarily relate to ecosystem diversity. The following items are more specific to species diversity needs:

- Within the limits of agency authorities, the capability of the Plan area and overall multiple-use objectives, Plan components in the Forest Plan need to be adequate to provide appropriate ecological conditions to contribute to conserving federally listed threatened or endangered species. This applies to currently listed species and to species that may be listed in the future. The Plan needs to incorporate management direction from existing recovery plans and other conservation assessments/plans that currently exist for listed species into Forest Plan management direction (e.g., Canada Lynx Conservation and Assessment Strategy, Uncompahgre Fritillary Butterfly Recovery Plan). Plan language needs to recognize that conservation measures for additional species may be needed in the future and will be incorporated into future project and Plan-level decisions as necessary.
- The Forest Plan needs to incorporate management direction included in conservation plans for species-of-concern (Gunnison sage-grouse Rangewide Conservation Plan, Boreal Toad Conservation Plan and Agreement) to contribute to efforts to prevent listing of these species.
- The Forest Plan needs to direct the development and implementation of conservation strategies for species-of-concern and species-of-interest that lack such strategies.

- Species-specific management considerations identified in the habitat/species evaluations need to be incorporated into Plan components for species-of-concern and species-of-interest.
- Desired conditions and management guidelines for wetlands and fens need to be developed.
- Desired conditions and management guidelines need to be developed for specialized habitats (i.e., alpine, Green Mountain formation, fens, acidic wetlands, dripping ledges, waterfalls, cliffs, caves, snags, coarse woody debris).
- Need to increase minimum guidelines for retention of large diameter snags, large diameter living trees to provide future snags, and coarse woody debris. Guidelines should vary by habitat type where necessary to reflect inherent differences between types. The selected silvicultural methods used in conifer forests need to insure retention of habitat features. There may need to be a shift from even-aged to uneven-aged harvest methods to maintain and develop these habitat features.
- The revised Plan needs to include guidelines for maximum road and trail (both motorized and non-motorized) densities within a specified scale that should be allowed to minimize impacts of road/trail use on species-of-concern and species-of-interest that could potentially be affected.
- Old growth guidelines need to be adjusted to recognize differences in historic disturbance regimes and resulting landscape patterns of seral conditions, as well as species habitat requirements (see evaluations of plan components on species by habitat type discussions in the Species Diversity section of the CA).
- Need to develop monitoring for rare plants.
- Need to complete and maintain electronic databases (Terrestrial, Aquatic, and Fauna) for national, regional, and Forest use.
- Need to collaboratively manage for rare species information with CNHP.

Performance Measures

- Each habitat type (e.g., high elevation conifer, aspen, and ponderosa pine) will be monitored to determine acres of each cover type and structural stage as conditions change over time as a result of management activities, natural disturbances, and succession.
- Acres treated for wildlife improvement
- Snags per acre retained following treatments
- Coarse woody debris retained following treatments
- Bird species will continue to be monitored through breeding bird surveys and Colorado Bird Observatory's Monitoring Colorado's Birds transects in the different habitat types. Monitoring information needs to be incorporated into FAUNA database.
- Projects areas will be evaluated for federally listed species, species-of-concern, and species-of-interest to determine species presence, project effects and any necessary design, mitigation, and/or monitoring needs associated with these species.

3.5 Invasive Plant Species

Area of Analysis

Invasive plant species have been evaluated at several different scales. Mapping efforts coordinated through the State of Colorado in 2000 collected inventory information by quarters of 2.7 minute quadrangle maps. Most of this information covered areas off the GMUG on private and BLM managed land. Site specific inventory information has been collected by Forest Service personnel, and county weed management personnel through cooperative efforts. The majority of this information is along roads and trails mostly on NFS lands. Modeling was done for the NFS lands using existing vegetation data (R2Veg), slope, elevation, aspect and precipitation data, to map invasiblity risk for NFS lands on the GMUG.

Condition and Trend Summary

Table 3.5.A. lists the current invasive plant species inventory for the GMUG. Information is from a combination of Forest Service and county inventories. The majority of inventoried infestations occur along roads. Roads are one of the major pathways upon which invasive plant species are transported; however, roads also serve as the primary survey routes. Not all parts of the GMUG have been inventoried for invasive plant species, and the inventory is not complete for the areas that have been surveyed.

Table 3.5.A. Invasive Plant Species Inventory (2004)

Species	Total Acres
Scentless Chamomile	2
Mayweed Chamomile	11
Common burdock	245
Cheat Grass (Downy Brome)	2,209
Plumeless thistle	11
Hoary cress (Whitetop)	448
Musk thistle	443
Diffuse knapweed	40
Spotted knapweed	121
Russian knapweed	828
Yellow starthistle	25
Oxeye daisy	1,111
Canada thistle	1,651

Species	Total Acres
Bull thistle	629
Houndstongue	13,104
Russian olive	88
Leafy spurge	418
Dame's rocket	11
Black henbane	31
Perennial pepperweed	78
Dalmation toadflax-broadleaf	57
Yellow toadflax	981
Scotch thistle	56
Tansy ragwort	1
Saltcedar (Tamarisk)	227
TOTAL	22,826

Quantitative trend information for invasive species spread on the GMUG is not available. Invasive species have been increasing over time. Knapweed and thistle species appear to be moving upward in elevation along Forest access roads. Invasive ornamental species (oxeye daisy, yellow toadflax) are expanding onto NFS land from private inholdings and communities within the Forest boundaries (Crested Butte, Telluride, Ophir, Ouray). The current cheat grass inventory grossly under represents the extent of this species. Cheat

grass has greatly expanded into areas disturbed by fires in the past few years on the Uncompahgre Plateau Geographic Area.

Data collection for facilities covered by ditch bill easements (i.e., canals, head gates, reservoirs) currently ongoing includes collection of invasive plant species information. This data will be incorporated into the existing forest inventory.

Areas where vegetative cover is disturbed and bare soil becomes exposed are most susceptible to invasive plant species. Physical factors of a site (available moisture, sunlight, temperature) influence the potential for invasive species to become established. A GIS based model was used to identify areas that have the highest risk for invasive plant species. Table 3.5.B. displays the percent of the GMUG and each Geographic Area that falls within each invisibility risk category. Figure 3.5.A. displays the invisibility risk rating for the GMUG. The Uncompahgre Plateau Geographic Area has the highest overall risk for future invasive plant species. The San Juans and Gunnison Basin Geographic Areas have the lowest overall risk.

Table 3.5.B. Invasibility Risk for GMUG and each Geographic Area, as percent of total area.

Risk Rating	% of GMUG	% of Grand Mesa	% of Gunnison Basin	% of North Fork Valley	% of San Juans	% of Uncompahgre Plateau
Very High	<1	1	0	0	0	<1
High	16	15	7	17	5	35
Moderate	22	24	14	23	11	37
Low	47	58	55	55	53	27
Very Low	16	4	24	5	31	0

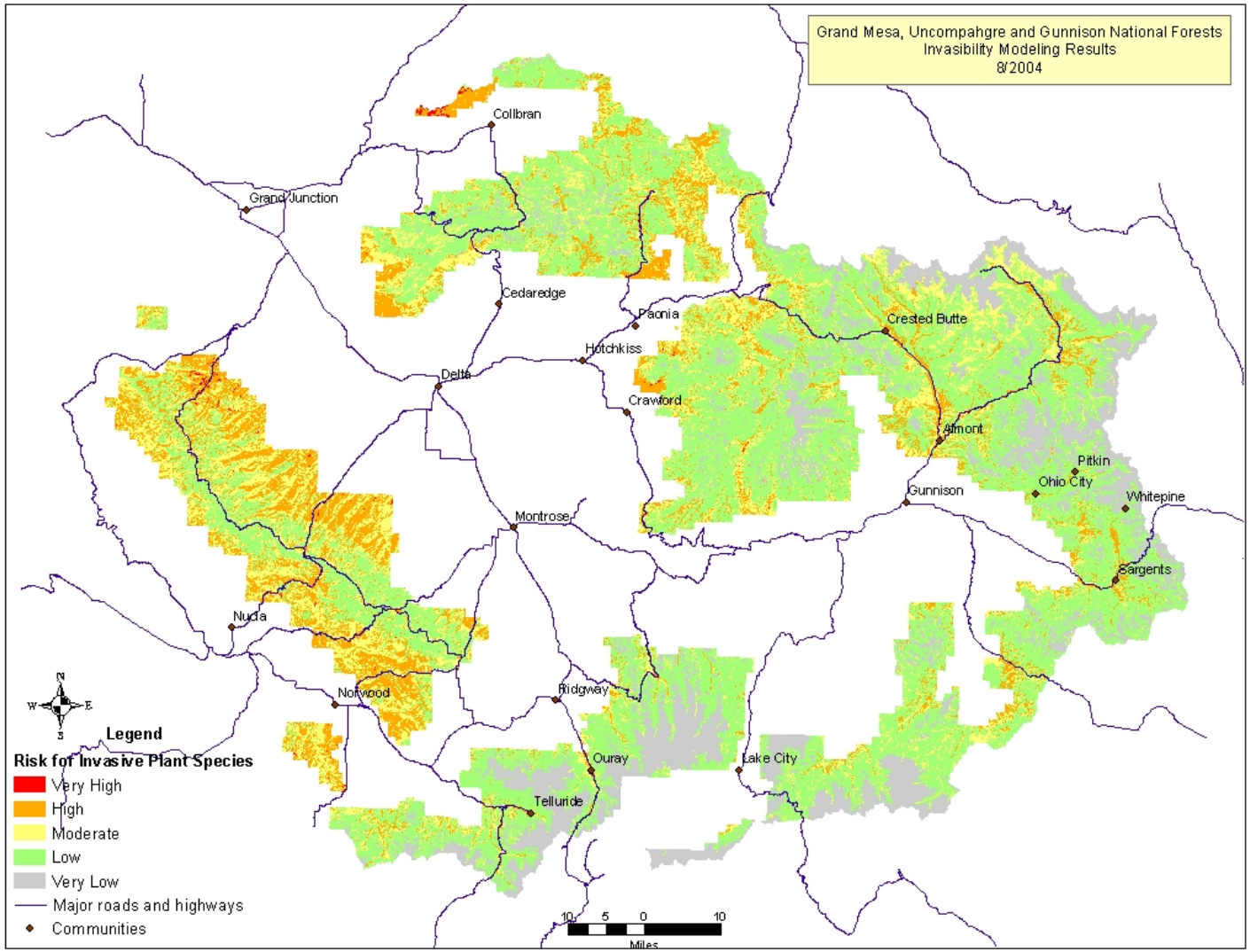

Figure 3.5.A. Invasibility Risk for Grand Mesa, Uncompahgre and Gunnison National Forests.

Management efforts for invasive plant species (education, inventory, treatment) are done in close coordination with other Federal, State and County weed management programs through cooperative agreements. Funds are combined to inventory and treat noxious weeds.

Desired Conditions

Through implementation of the National, Regional and Forest Invasive Species Strategies, Colorado Noxious Weed Act, County Weed Management plans, management actions are designed to prevent introduction of new invasive species, detect and suppress existing infestations, and restore healthy ecosystems through cooperative efforts with other federal, state and local agencies, and non-governmental partners.

Condition Gap

A complete inventory of invasive plant species infestations does not exist

Invasive plant species infestations are spreading onto and within NFS lands.

Education efforts on identification, prevention, and eradication of invasive plant species are limited.

Funding to implement education, prevention, inventory, treatments of invasive species is inadequate.

Management Implications

Any management activities that result in ground disturbance have the potential to create suitable substrate for the establishment of invasive plant species (i.e., timber harvest, wildland fire management, habitat improvement projects, road/trail construction, maintenance or use, livestock grazing).

Revegetation efforts need to be included as part of any ground disturbing activity to prevent the establishment of invasive plant species.

Risks to Achieving Desired Conditions

Existing and future levels of recreational use (vehicles, pack animals, hiking), livestock and wildlife have the potential to import and spread invasive species on the Forest.

Road construction, maintenance and use can spread invasive species seeds, new species can be introduced if gravel is brought in from sources where invasive plant species occur.

Timber management activities that disturb and expose mineral soil to facilitate tree regeneration are also creating seedbeds for invasive plant species.

Only timber operators are currently required to clean their equipment/vehicles before they enter the Forest. This is not a requirement for most vehicles that travel on the GMUG. Tires can easily transport invasive plant species seeds onto the Forest.

Livestock may introduce weed seeds ingested while in other areas. Livestock and wildlife species may also spread invasive plant seed.

Fire breaks/ fire lines constructed during fuels and wildland fire management activities have the potential to be infested by invasive plants. Seeds can be spread by firefighters on foot by vehicles into areas not normally traveled by the public.

Vegetation conditions have resulted in recent fires that have burned with high intensities over large areas (i.e., Burn Canyon). This trend is expected to continue. There is very high potential for invasive species to become established in these areas following disturbance.

Budget and available personnel will limit the amount of inventory, monitoring and treatment that can occur.

Need for Change

The current Forest Plan has very minimal direction concerning invasive species. There is a need to incorporate direction included in the National, Regional, state, and local Invasive Species strategies.

The proposed Plan needs to incorporate direction from the GMUG Invasive Species Action Plan.

All management activities need to incorporate best management practices for prevention of invasive species in project planning, design and implementation. This includes revegetation efforts following any ground disturbing activities. Direction included in the "Guidelines for Revegetation for the Arapaho-Roosevelt, Grand Mesa-Uncompahgre-Gunnison, and Medicine Bow-Routt National Forests, and Pawnee and Thunder Basin National Grasslands" need to be incorporated into the proposed Plan.

Cooperative efforts need to be expanded to manage invasive species.

Monitoring requirements need to be established to detect new infestations, evaluate treatment success to reduce infestations, evaluate effectiveness of best management practices to prevent introduction of invasive plants and to determine the acres affected by invasive species.

Education efforts need to be increased.

Invasive species management needs to occur in an interdisciplinary environment.

The focus for invasive species management on the GMUG has been primarily on invasive plants. Strategies need to be expanded to include invasive animal species (both terrestrial and aquatic) and other organisms (i.e., microbes, fungi, rusts).

Performance Measures

- Pursue new cooperative invasive species partnerships as opportunities arise. (This can include education, prevention, inventory and treatment partnerships.)
- Number of Coordinated Weed Management Areas established annually.
- Miles of roads, trails, ditches, and stream courses monitored for noxious weeds.
- Acres managed using some type of integrated pest management.
- Success of past treatments.
- Acres restored (eradication of invasive plant species)