Forest Plan Monitoring Report
For fiscal year 2009
Shoshone National Forest

Prepared by the Shoshone National Forest planning staff

February 2011

Forest Supervisor certification

I certify that the Shoshone National Forest Land and Resource Management Plan (Forest Plan) is sufficient to guide management of the Shoshone over the next year. The Shoshone is currently revising the Forest Plan to address changes in ecological conditions, regulatory changes, and public input that has occurred since the publication of the Forest Plan in 1986.

X

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Introduction

This monitoring report for fiscal year 2009 includes information for the various resource areas of the Shoshone National Forest. Each resource area includes a summary of trend data that relate to direction in the Shoshone National Forest Land and Resource Management Plan (Forest Plan) and monitoring, including the latest information for fiscal year 2009. Trend information provides context for what has happened to the resource during implementation of the Forest Plan.

Forest Plan budget

Actual costs of applying management direction from the Forest Plan

This monitoring item is intended to help verify assumptions made in the Forest Plan relative to funding implementation of the projected mix of goods and services. It was designed to track the actual cost of implementing the Forest Plan and allows us to keep track of trends in expenditures in any given resource area.

The Forest Plan estimated the budget level necessary for implementation between 2001 and 2010 at an average annual expenditure of approximately $12 million (2002 dollars). Actual expenditures are reviewed annually and compared to Forest Plan projections. This has become a challenge given the many changes that have occurred in the budgeting process since the Forest Plan was published. Changes include combining or splitting of fund codes used to track dollars allocated to a particular resource program and modifications to the way expenditures are tracked. For example, the General Administration fund (NFGA), which represents the overhead cost of running a national forest, is no longer a separate fund code. It is now distributed throughout the other funds.

Table 1 compares projections made in the Forest Plan to actual costs for 2009 using the most current fund codes.

Table 1. Comparison of fiscal year 2009 expenditures to Forest Plan full implementation budget (thousands of 2009 dollars)

Cost center and cost center components	Fund code	Fiscal year 2009 expenditures	Forest Plan	Percent of Forest Plan
Planning, inventory, and monitoring				
Inventory and monitoring	NFIM	835	1,057	79
Land management planning	NFPN	290	111	261
Recreation management				
Heritage, recreation, and wilderness	NFRW	1,449	1,570	92
Wildlife and fish management				
Wildlife habitat management, anadromous fish, inland fisheries, and threatened/endangered species administration	NFWF	842	1,103	76
Rangeland management				
Range NFS	NFRG	380	585	65
Range betterment	RBRB	18	91	20
Forest products				
Timber sales management	NFTM	803	550	146
Salvage timber sales	SSSS	6	124	5
Timber cooperative work	BDBD	41	26	150
Vegetation and watershed management				
Vegetation management, range management, soil and water improvements, soil, water, and air ops	NFVW	956	891	107
Physical resources				
Minerals management	NFMG	67	248	27
Land ownership management	NFLM	195	208	94
Land and water acquisition	LALW	0	35	0
Infrastructure management				
Facilities maintenance and improvements	CMFC	685	496	138
Road maintenance and improvements	CMRD	1,207	1,051	115
Trails maintenance and improvements	CMTL	461	838	55
Law enforcement				
Law enforcement	NFLE		29	
Wildland fire management				

Cost center and cost center components	Fund code	Fiscal year 2009 expenditures	Forest Plan	Percent of Forest Plan
Hazardous fuels reduction	WFHF	1,418	389	365
Preparedness and fire use	WFPR	1,273	1,045	122
Cooperative work	CWFS	20	91	22
General administration				
General administration	NFGA	No longer a separate fund	1,492	
Total		10,946	12,030	91

Evaluation

The total 2009 expenditures for the Shoshone National Forest represent approximately 91 percent of Forest Plan projections in actual dollars; adjusted for inflation, the 2009 expenditures represent just 77 percent of Forest Plan projections. Although fluctuations in funding occur on an annual basis within particular resource areas, the overall trend in the last decade has been downward. Our ability to implement Forest Plan management direction depends on the budget allocated by Congress. The mix of goods and services projected in the Forest Plan will be revisited and adjusted as the Forest Plan is revised. The Notice of Intent to revise the Shoshone National Forest Land and Resource Management Plan was published on September 24, 2010.

Soil resources

Condition and trend

The Forest Plan states that soil monitoring will occur to 1) establish baseline data soil resource values, and 2) measure the effects of management on these baseline values. The purpose of this monitoring is to maintain soil productivity, minimize human-caused soil erosion, and maintain the integrity of associated ecosystems. Key indicators of soil productivity include erosion, fertility and nutrient removal, soil heating, soil compaction, and rutting.

One of the long-term objectives of the soils program was the Soil Resource Inventory (SRI). This was correlated by the National Resources Conservation Service (NRCS) soil survey program in 2008 after almost 30 years of effort. This baseline inventory provides technical descriptions of soils and management interpretations that meet National Soil Survey standards. These data are being used in appropriate National Environmental Policy Act (NEPA) analyses.

Soil loss and resulting productivity declines due to erosion caused by management activities are one of the primary concerns of the soil program. The Forest Plan states, “Soil losses shall not exceed tolerance levels as determined by SRI interpretations and monitoring.” The Forest Service erosion modeling changed from the universal soil loss equation model to using the Rocky Mountain Research Station’s water erosion prediction project model (WEPP) in the late 1990s. The NRCS still uses tolerance levels for erosion, but use is focused on agricultural lands. WEPP has more direct application to erosion estimates relating to forest management activities. This modeling has been used in NEPA analyses for projects

involving land disturbance for the last eight years. WEPP model runs and qualitative monitoring substantiates on various NEPA projects show that management-induced upland erosion is not a significant factor. This is primarily due to projects' applying best management practices. The greatest sediment movement is from road systems and even this is relatively minor. The major cause of sediment entry into stream systems on the Shoshone is from naturally occurring debris flow and channel erosion processes that dominate in the Absaroka volcanic substrates.

Soil management handbook direction to protect soil productivity is not to detrimentally disturb greater than 15 percent of a designated land area. In the past, measuring had been completed by various techniques that were inconsistent. In 2009, the Rocky Mountain Research Station developed soil disturbance monitoring protocols. A soils graduate student used the protocol in the analyses of eight recent timber sales between June 2008 and August 2009.

The results of this study indicate that current harvesting methods on the Shoshone are meeting current guidelines for soil disturbance. No single cutting unit contained greater than 15 percent of its area in a detrimentally disturbed condition. The timber sale that contained the highest level of disturbance was Carter Mountain salvage on the Wapiti Ranger District. Two cutting units contained over 5 percent of the unit area in a state of high soil disturbance. Soil rutting caused by machine traffic was by far the most common disturbance type, followed by soil compaction. The Bald Ridge salvage (Clarks Fork Ranger District) and Deadman Bench (Clarks Fork Ranger District) sales showed similar results, with rutting being the most common disturbance type, but high disturbance covered an area of less than 5 percent in all units sampled. The Purdy salvage had the highest disturbance level, but again, all units sampled contained less than 5 percent aerial extent of high soil disturbance. No other monitored site on the Washakie and Wind River Ranger Districts contained any high level disturbance. Rutting was the most common disturbance type, and the Purdy site, which is a post-wildfire salvage, had the highest levels of erosion detected, between 5 percent to 17 percent aerial extent.

Monitoring of fens resulted in the most direct loss of soil productivity. The Sawtooth Peatbeds, located on the Beartooth Plateau, are the only known fen-palsa in the continental United States. Unintentional cattle use during the summer of 2004 led to irreplaceable damage to the surface peat layer.

Monitoring of the 2000 Sinks Canyon prescribed burns and subsequent invasion by cheatgrass shows that these fires have altered site long-term productivity. Management options to improve the situation are limited.

Monitoring of roadside revegetation efforts in conjunction with the North Fork of the Shoshone, Togwotee Pass, Beartooth Highway, and Sinks Canyon projects continues. The North Fork highway corridor has considerable cheatgrass and noxious weed issues. Revegetation has failed in some key areas such as Horse Creek Flats. Togwotee Pass and Sinks Canyon plantings have had greater success than expected. Beartooth Highway work is too recent to make an evaluation.

Several watershed improvement projects were completed in 2009 (Table 2). These projects were designed to disconnect open roads and trails from streams and wetlands or return unneeded or unauthorized roads to production.

Table 2. Watershed improvement projects completed in 2009

General area	Project	Acres
Gooseberry Creek drainage	Trail 650 relocation	3.2
	Road 213.3B disconnection	1.5
Grass Creek drainage	Road 218.1A decommissioning	0.3
	Unclassified road decommissioning	0.3
Gwynn Fork drainage	Road 202.2C disconnection	3.6
East Fork Wind River drainage	Road 277 disconnection	2.1
	Total acres	11.0

Evaluation

Forest Plan and current soil management direction are being met. WEPP modeling, soil disturbance monitoring protocols, and best management practice reviews show that erosion caused from management-induced perturbations are within acceptable limits. Timber harvesting operations on the Shoshone appear to be meeting requirements for soil disturbance levels. Season of harvest and soil moisture are strongly related to the level of disturbance occurring on a site. Cutting units that are harvested when the soil is wet, as occurred on Carter Mountain, increase the amount of moderate and high-level soil disturbance, especially rutting and compaction. Harvests conducted on very dry soils, or especially over frozen and snow-covered ground, as on the Deadman Bench and Bald Ridge sales, show very little soil disturbance, and almost no severe soil disturbance as a result of harvesting.

Watersheds

Condition and trend and evaluation

Watershed condition is integral to all aspects of resource management and use. Good watershed management maintains the productive capacity of soils, protects water quality and quantity, sustains native species, provides beneficial uses, and reduces the threat of flood damage to Forest Service infrastructure and downstream values. Lands within the Shoshone National Forest supply water to support a variety of uses both within and downstream of the Shoshone.

The science of wildland watershed management has evolved considerably since the Forest Plan was developed. The evolution of the science and the results of Forest Plan monitoring are reflected in annual monitoring reports and certain amendments to the Plan, specifically the oil and gas leasing and allowable sale quantity amendments.

The oil and gas leasing and allowable sale quantity efforts incorporated a first generation watershed cumulative effects analysis screening process using best available information at that time. Model assumptions and weaknesses were identified as part of the process. Modeling results were presented in tabular form because spatial presentation opportunities were limited.

This first generation modeling identified watersheds of concern. Watersheds of concern are those where impacts have reached a level of disturbance at which watershed condition and stream health are degraded beyond their abilities to recover in the short term. On the Clarks Fork and Wapiti Ranger

Districts, the large Yellowstone fires of 1988 were a major impact leading to identification of watersheds as areas of concern. On the Wind River Ranger District, two potential watersheds of concern were identified, mainly due to logging in the 1960s through early 1980s. These identifications led to monitoring and inventory of watershed condition across the Shoshone and to implementation of watershed improvement projects in targeted areas. Examples include inventory of stream reaches, obliteration of roads, fencing to control livestock use, and interdisciplinary best management practice reviews on timber sales, commercial livestock grazing allotments, special use permit livestock pastures, and prescribed burns.

Best management practice reviews (Table 3) provide valuable information on whether implementation of best management practices is occurring and if so, its effectiveness. If implementation is not occurring, or is found to be ineffective, the review identifies the reasons and corrective actions are taken. Overall, implementation of best management practices is occurring and is effective in protecting soil and water resources. Concerns with proper wetland and riparian area management and proper road drainage have been identified, resulting in changes in grazing management and road design. Specific information about fiscal year 2009 reviews is provided.

Physical stream health surveys have been occurring since 1994. A new set of survey protocols was implemented in 2003 and under this set of protocols, 111 stream reaches have been surveyed. Hydrologists collected data in 2003. Seasonal crews, under supervision of a hydrologist, collected data between 2004 and 2008. In 2009, data were collected by a contractor. Reaches surveyed in 2008 were analyzed and assessed in 2009 (Table 4). Fifteen reaches were surveyed in 2009. These data are presently being analyzed and assessed.

Information from these surveys is allowing for two things. One is development of a strong and valuable reference reach database, i.e., reaches that are of the expected stream type for their setting. These reference reach data are important for comparative purposes with reaches that are or may be of concern due to past and present management activities. The collected information is also allowing for identification of reaches that are at less than desired health. This information is being used by managers to make adjustments in land management activities to allow for stream health improvement.

A comprehensive evaluation of the monitoring requirements in the Forest Plan occurred as part of the fiscal year 1996 monitoring and evaluation report. The evaluation recommended the water resources monitoring section be updated and revised to make it current with either the science of watershed management or regional direction. Specific recommendations were made. Some of these recommendations were incorporated into Forest Plan Amendment No. 97-001. Others were not. All of this information should be reconsidered and reevaluated as part of any upcoming revision efforts.

An updated Watershed Condition Assessment was completed in preparation for recent attempts at forest plan revision. This update supersedes previous assessments. The updated assessment indicates time and management have improved watershed conditions on the Shoshone and, generally, watershed conditions have improved in the last 10 to 15 years.

There are 147 6th level hydrologic unit boundary[1] watersheds on the Shoshone. Currently, most of these (99 percent) are in good to excellent condition. Those in excellent condition (20 percent) are generally in wilderness and provide good reference conditions for the attributes of healthy watersheds. Those in good condition (79 percent) reflect, to varying degrees, past and present activities.

Most of the concern in the good condition watersheds is related to historical uses such as heavy grazing or roading associated with motorized recreation and timber harvest. These watersheds are generally on an improving trend due to ongoing management actions.

There are two watersheds (1 percent) of extraordinary concern. One is Upper Soda Butte Creek, which includes drainage areas in Wyoming and Montana. The concern is entirely within Montana and is related to historic mining activity in the Cooke City area. This concern is being mitigated through watershed improvement plans, including a $22.5 million restoration project in the New World Mining District, managed by the Gallatin National Forest. This restoration project began in the late 1990s and is nearing completion. Once completed, the condition rating for the Upper Soda Butte Creek watershed will likely be recategorized to good. The second watershed is the Lower Crandall Creek composite and in particular, one of its sub-watersheds, Lodgepole Creek. This sub-watershed was severely burned during the 1988 Clover Mist Fire and then experienced a damaging thunderstorm and flood event in 1989. These two disturbances resulted in significant changes in upland and stream channel stability, which can best recover with time. Eventually, after stabilization occurs, this watershed will be recategorized to good condition.

All projects incorporate guidance from Forest Service Handbook 2509.25, Watershed Conservation Practices, as appropriate, and supplemental direction if other needs are addressed that are not covered in the handbook. This handbook meets the requirements of the best management practices in the Wyoming Nonpoint Source Management Plan per a 2006 memorandum of understanding between the Forest Service and Wyoming Department of Environmental Quality.

There is mounting evidence the earth is experiencing a warming trend. This trend or change in climate may affect the weather and stream systems across the Shoshone. If realized, effects could include altered precipitation patterns and changes to the quantity, quality, and timing of snowmelt and river flows from the Shoshone. Total annual streamflow volume could decrease and the annual snowmelt period could begin weeks sooner. There could also be increased summer thunderstorm activity with greater rainfall amounts at higher intensity. Five anticipated impacts that may directly threaten water quality include increased water pollution-associated problems from rising stream temperatures, an increase in extreme water-related events, reductions in available drinking water, water boundary movement and displacement, and the displacement of aquatic communities as water temperatures change.

[1] A hydrologic unit boundary is a geographic area representing all or part of a surface drainage basin or distinct hydrologic feature. A 6th level hydrologic unit boundary ranges in size from 10,000 to 40,000 acres and is named and coded with 12 digits.

There is a growing demand for water within and downstream of the Shoshone. Municipalities, agriculture, industry, and recreation demands continue to grow. Water availability is likely to decrease with the combination of climate change and increasing development. Water users within and downstream of the Shoshone could be affected.

We are working cooperatively with the Rocky Mountain Research Station to model the impact of climate change on hydrologic regimes across the Shoshone. Results of the project will allow us to better understand changes in water availability and ecological processes that may result from climate change. The Greater Yellowstone Coordinating Committee is funding a project titled Climate Change and Watershed Sensitivity Analysis, expected to be completed in late 2011. The project includes the Shoshone National Forest.

Table 3. Best management practice reviews, 1999 through 2009

Year	Activity
1999	Bear Creek allotment
1999	Burroughs Creek Salvage Sale
2001	Lodgepole II Timber Sale
2001	Dick Creek allotment
2002	Rock Creek allotment
2002	Wood River/Kirwin allotments
2002	East Fork allotment
2002	Enos Creek allotment
2003	West Goose Timber Sale
2003	Union Pass allotment
2003	Wolf Creek I & II Timber Sales/Unit 40 Fire Salvage Sale
2004	Atlantic Creek Salvage Sale
2004	Rattlesnake II Timber Sale
2004	Maxon Basin allotment
2004	Belknap allotment
2005	Fish Lake Creek allotment
2005	Spring Mountain Timber Sale
2005	Carter and Marquette Timber Sales
2006	Rainbow Lake Timber Sale
2006	Wiggins Fork allotment
2007	Middle North Fork Timber Sale
2007	Pearson allotment
2007	Warm Springs allotment
2007	Bachelor Creek Timber Sale
2008	Bald Ridge allotment
2008	Pine/Willow allotment
2008	Pilot Creek Salvage Sale
2009	Purdy Fire Salvage Sale
2009	Trout Creek Fuels Reduction
2009	Upper Clarks Fork Small Permitted Pastures
2009	Canfield Timber Sale

Summary of fiscal year 2009 best management practice reviews

Purdy Fire Salvage Sale

This sale was implemented after the 2006 Purdy Fire. At the time of the review, the sale was mostly completed. Planning and implementation occurred in a very short time due to concerns with loss of value in the timber product. The review indicated all applicable best management practices were implemented and effective. The team was particularly pleased with the quality of temporary road and skid trail obliteration and protection of wetland areas. The review team determined this sale is an excellent example of how soil and water best management practices can be carried through from the planning stages to on-the-ground actions.

Trout Creek Fuels Reduction

This project was implemented in 2007 to treat existing vegetation through prescribed fire to reduce mountain big sagebrush and conifer encroachment, improve wildlife habitat and range condition, and reduce fuels and potential for crown fire initiation in surrounding forested areas. The review indicated all applicable best management practices were implemented and effective, and that, in general, rangeland burns are not an over-arching concern relative to soil and water resources. The review team did note the need to plan for and manage the incursion or spread of invasive plants.

Upper Clarks Fork Small Pastures

This grazing review focused on small, special use permitted horse pastures, as well as a Wyoming Game and Fish Department horse pasture and a Forest Service horse pasture, in the Upper Clarks Fork area. Areas reviewed were B-4 Ranch units 2A, 2B, 6A, and 6B; K-Z Guest Ranch pastures 1, 2, and 3; the Wyoming Game and Fish Department horse pasture; and the Crandall Ranger Station horse pasture.

The review indicated all applicable best management practices for the Game and Fish Department and Forest Service pastures were implemented and effective. The review team did recommend that a formal grazing strategy be developed for the Game and Fish Department pasture and that the pasture be permitted or managed through an agreement. Presently, the pasture is provided to the Department at no cost.

Overall, the review indicated best management practices on the B-4 Ranch and K-Z Guest Ranch areas were implemented and effective. However, there were areas of excessive utilization and stream bank trampling along small, unnamed streams in some B-4 Ranch areas and along Corral Creek at the K-Z Guest Ranch. Relative to the B-4 Ranch concern, the review team recommended an evaluation of the need for utilizing Forest Service lands as pasture, given apparent availability of forage on deeded lands. If the evaluation had determined a need for pasture, the team recommended implementation of a grazing strategy where the entities within the Ranch Corporation would utilize the same deferred rotation schedule for all four pastures. Relative to the K-Z concern, the team recommended relocation of the corrals to an upland area and rehabilitation of the existing corral area, which is directly adjacent to Corral Creek. The team also recommended implementation of a new grazing strategy that involves rest rotation and addition of new pasture. Both the B-4 Ranch and K-Z recommendations are being pursued or implemented.

Canfield Timber Sale

This sale was implemented to sanitize and salvage log areas heavily affected by beetle kill to provide defensible space in the wildland urban interface.[2] The sale was situated in an area with multiple complexities due to the nature of the soils, alluvial fans and associated stream channel migration, and wet areas. Considerable interdisciplinary effort went into eliminating wet areas from the bounds of units and identifying and rehabilitating designated stream crossings.

[2] Wildland urban interface is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.

The review indicated all applicable best management practices were implemented and effective. A concern was identified with the lack of post-use drainage built into an old hauling road that is also used as a permanent Nordic ski trail. Minimal drainage was constructed due to a concern with affecting use by skiers. Upon review, the team recommended additional drainage construction on the trail. This recommendation was implemented.

Table 4. Stream reaches surveyed in 2008, with notes on health and management need

Stream name	Field survey date	Channel type	Most probable form	Notes
North Fork Paint Creek	7/7/2008	C5	E5	Bank building flows. Needs continued protection from grazing to continue bank development.
Russell Creek	7/15/2008	C5	E4b	Recovering based on adaptive grazing management. Developing more stable banks.
Russell Creek	7/22/2008	C5	E4	In exclosure. Recovering from past grazing. Should have more stable banks.
Muddy Creek	7/31/2008	E4	E4	Recovering from past grazing. Should have more stable banks. Will likely re-establish at a down cut elevation.
Little Bear Creek	7/29/2008	C3		Reference.
Ghost Creek	8/4/2008	E4b		Possible reference. Grazing in meadows above likely increased fine sediments in this reach.
Spring Creek	8/12/2008	C4b		Reference.
Ghost Creek	8/14/2008	C4b	E4	Recovering from past grazing. Should have more stable banks and be narrower.
Ghost Creek	8/14/2008	B4c	E4	Recovering based on adaptive grazing management. Channel should be narrower.
Ghost Creek	8/14/2008	C4b	E4b	Recovering based on adaptive grazing management. Should have more stable banks and be narrower.
Dry Fork Paint Creek	8/19/2008	B5a	A4	Intermittent channel. Current and past grazing. Should have more stable banks.

Water uses and rights

Condition and trend and evaluation

Water is a limiting resource on the Shoshone and to lands and communities surrounding the Shoshone. Protection and management of existing water rights and uses are crucial to sustainable management of the Shoshone and sustaining local communities.

Forest Plan goals have been met and management direction has been implemented.

Many new water right applications were reviewed to ensure the requested uses would not conflict with existing uses and rights, including instream flows quantified by the Big Horn adjudication. Potential conflicts were resolved as the applications were processed through the State Engineer's Office or through special use permit clauses, once a right was granted.

Work relative to the filing of water right claims with the State Engineer's Office, per agreement under the Big Horn adjudication interlocutory decree, has been completed. The Shoshone provided detailed surveys of non stock-related discrete water uses listed in the decree. Stock-related discrete water uses will be validated over time as staffing and funding permit. Final location and volume information on instream flow quantification points were provided as well.

Water is a highly valued resource on the Shoshone National Forest. There is continuing discussion by state and local governments, particularly in light of potential changes in climate, on developing water storage throughout Wyoming.[3] The discussion includes potential locations on the Shoshone. In the last few years, the only potential location that has been seriously considered is a flood control/storage reservoir in the Popo Agie watershed. No formal storage proposals on the Shoshone have been submitted to the Forest Service. The resource and socioeconomic effects of water storage projects could include issues ranging from Yellowstone cutthroat trout, wild and scenic rivers, recreation, water rights, and downstream interests, among others. The issues and impacts would be dependent on the proposed project and its location. To determine whether water storage is the best use for a particular area, a full environmental analysis would be conducted.

Air quality

Condition and trend and evaluation

Federal land managers manage air quality as directed by the Clean Air Act and the Wilderness Act. On the Shoshone, the Fitzpatrick, Washakie, and North Absaroka Wilderness areas are Clean Air Act designated Class I airsheds. Class I designation provides protection to pristine lands by severely limiting the amount of additional human-caused air pollution that can be added to these landscapes. All other areas on the Shoshone, including the Popo Agie and Absaroka-Beartooth Wilderness areas, are Class II airsheds, where air quality cannot fall below standards set by the Wyoming Department of Environmental Quality.

Program management and monitoring activities have evolved significantly since the Forest Plan was developed. Management and monitoring activities include:

[3] River basin plans at http://waterplan.state.wy.us/ provide details.

- Coordination with other Shoshone programs, such as fire, to ensure protection of air quality and air quality related values[4]
- Intra- and interagency coordination, particularly with the Bridger-Teton National Forest and Wyoming Department of Environmental Quality, Air Quality Division
- Membership with the Greater Yellowstone Area Clean Air Partnership and the Greater Yellowstone-Teton Clean Cities Coalition
- Reviews of air quality permit applications and industrial mining and energy development environmental documents being prepared by other agencies
- Weekly monitoring of the South Pass National Atmospheric Deposition Program site
- Thrice-yearly monitoring of Ross and Saddlebag Lakes, which are part of a national long-term lake monitoring program that resulted from the 1983 western lakes survey
- Support to State of Wyoming monitoring of the Dead Indian Pass Interagency Monitoring for Protected Visual Environments site
- Support to State of Wyoming monitoring of air quality in the South Pass area of the Washakie Ranger District

The Shoshone is represented at annual Greater Yellowstone Area Clean Air Partnership meetings. The partnership allows for exchange of information and dialogue between numerous state and federal agencies responsible for air quality in the Greater Yellowstone Area. The partnership produced an assessment in 1999, with an update in 2005, which identifies air quality issues, conditions, pollution sources, and monitoring sites. Four primary air quality issues within the Greater Yellowstone Area were identified: urban and industrial emissions, oil and gas development in southwest Wyoming, prescribed and wildfire smoke, and snowmobile emissions. This document is available at the Supervisor's Office in Cody.

The greatest potential for effects to air quality on the Shoshone is from wildland fire smoke and upwind sources, such as industrial/energy development and urban emissions. Air quality issues and concerns on the Shoshone are expected to increase as oil and gas developments in southwest Wyoming progress and the population increases in Utah, Arizona, and California, which are upwind sources of urban air pollution. Short-term impacts to air quality also result from wildland fire on and off the Shoshone.

The Shoshone, through technical support from the Bridger-Teton National Forest, continues to be involved in environmental review of energy development projects being analyzed by the Bureau of Land Management in southwest Wyoming. This support also provides monitoring of active industrial and oil and gas development in the area.

Data have been collected at the South Pass National Atmospheric Deposition Program site since 1986.[5] This site is presently funded via an agreement between the Forest Service and State of Wyoming.

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[4] Air quality related values are resources that may be affected by a change in air quality and generally relate to visibility, odor, flora, fauna, soil, water, climate, geological features, and cultural resources. Values are specific for each wilderness area.

[5] Data are available at http://nadp.sws.uiuc.edu.

Data have been collected at Ross Lake in the Class I Fitzpatrick Wilderness and at Lower Saddlebag Lake in the Class II Popo Agie Wilderness since 1986. Monitoring at these two lakes is being conducted to assess the effects of air pollutant deposition on air quality related values.

Data have been collected at the Dead Indian Pass Interagency Monitoring for Protected Visual Environments site since 2000 to monitor air quality and visibility in the Class I North Absaroka Wilderness.[6] This site is also useful for monitoring visibility in the Absaroka-Beartooth Class II Wilderness.

Air quality monitoring trend analysis

South Pass National Atmospheric Deposition Program site

Analysis of data collected between 1986 and 2006 (2007 data are not yet available) was completed in early 2008. Both wet deposition and precipitation-weighted deposition data sets were analyzed. The analysis indicates change over time, with statistically significant upward or downward trend depending upon the parameter (Table 5 and

[6] Data are available at http://vista.cira.colostate.edu/improve/.

Table 6, Figure 1 and

Precipitation-weighted (mg/l)								
Parameter	**Seasonality**	**Season**	**1986**	**2006**	**Difference**	**Change**	**Trend**	**Significant**
NH_4	Yes	Winter	0.033	0.061	0.028	85%	Up	0.05
		Spring	0.076	0.147	0.071	93%		
		Summer	0.147	0.280	0.133	90%		
		Fall	0.056	0.133	0.077	138%		
NO_3	Yes	Winter	0.565	0.623	0.058	10%	Up	0.05
		Spring	0.596	0.816	0.220	37%		
		Summer	1.000	1.340	0.340	34%		
		Fall	0.534	0.806	0.272	51%		
SO_4	Yes	Winter	0.584	0.318	-0.266	-46%	Down	0.01
		Spring	0.719	0.417	-0.302	-42%		
		Summer	1.020	0.782	-0.238	-23%		
		Fall	0.547	0.447	-0.095	-18%		

Figure 2).

Ammonia (NH_4) is on an upward trend and has basically doubled, but there are seasonal differences. The greatest deposition occurs during fall and winter. Potential sources of ammonia are upwind feedlots and machinery, e.g., drilling rigs that do not use catalytic converters.

Precipitation-weighted nitrate (NO_3) deposition is on an upward trend for all four seasons. There is no statistically significant trend with wet deposition nitrate levels, but values have increased substantially for the winter, spring, and fall seasons. The differences between wet and precipitation-weighted deposition are explained by units of measure, i.e., volume by weight by period versus concentration by precipitation volume, respectively. The statistically insignificant trend in wet deposition is due to differences between seasons and variability within and across seasons. A potential source of nitrate is upwind emissions from oil and gas developments.

Sulfate (SO_4) is on a downward trend through all seasons. Values have decreased by 25 to 50 percent. The trend could be related to 1990s-era reductions in the use of high sulfur diesel fuel. Controls on emissions at refineries and coal-fired power plants, on a western United States regional basis, could also be a cause.

There is no trend with inorganic-nitrogen (Inorg-N) at the 95 percent confidence level but there is an upward trend at the 90 percent level. A potential source of inorganic nitrogen is upwind agricultural activities.

Table 5. South Pass National Atmospheric Deposition site wet deposition trend analysis

Wet deposition (kg/ha)								
Parameter	**Seasonality**	**Season**	**1986**	**2006**	**Difference**	**Change**	**Trend**	**Significant**
NH_4	Yes	Winter	0.041	0.077	0.036	88%	Up	0.05
		Spring	0.122	0.206	0.084	69%		
		Summer	0.141	0.194	0.053	38%		
		Fall	0.060	0.139	0.079	132%		
NO_3	Yes	Winter	0.621	0.755	0.134	22%	None	--
		Spring	0.823	1.170	0.347	42%		
		Summer	0.910	0.892	-0.018	-2%		
		Fall	0.415	0.863	0.448	108%		
SO_4	Yes	Winter	0.638	0.377	-0.261	-41%	Down	0.01
		Spring	0.900	0.643	-0.257	-29%		
		Summer	0.950	0.508	-0.442	-47%		
		Fall	0.599	0.410	-0.189	-32%		
Inorg-N	Yes	Winter	0.160	0.247	0.087	54%	Up	0.10
		Spring	0.282	0.406	0.124	44%		
		Summer	0.353	0.377	0.024	7%		
		Fall	0.148	0.316	0.168	114%		

Figure 1. South Pass National Atmospheric Deposition Program site wet deposition trend analysis

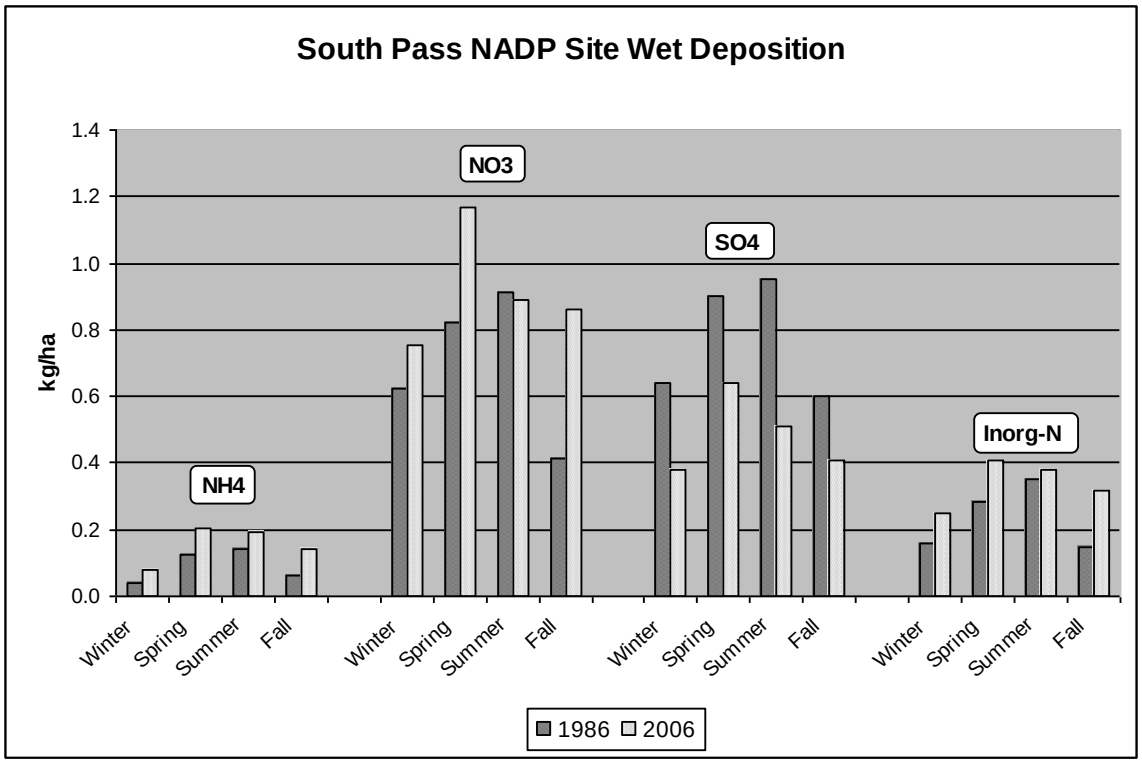
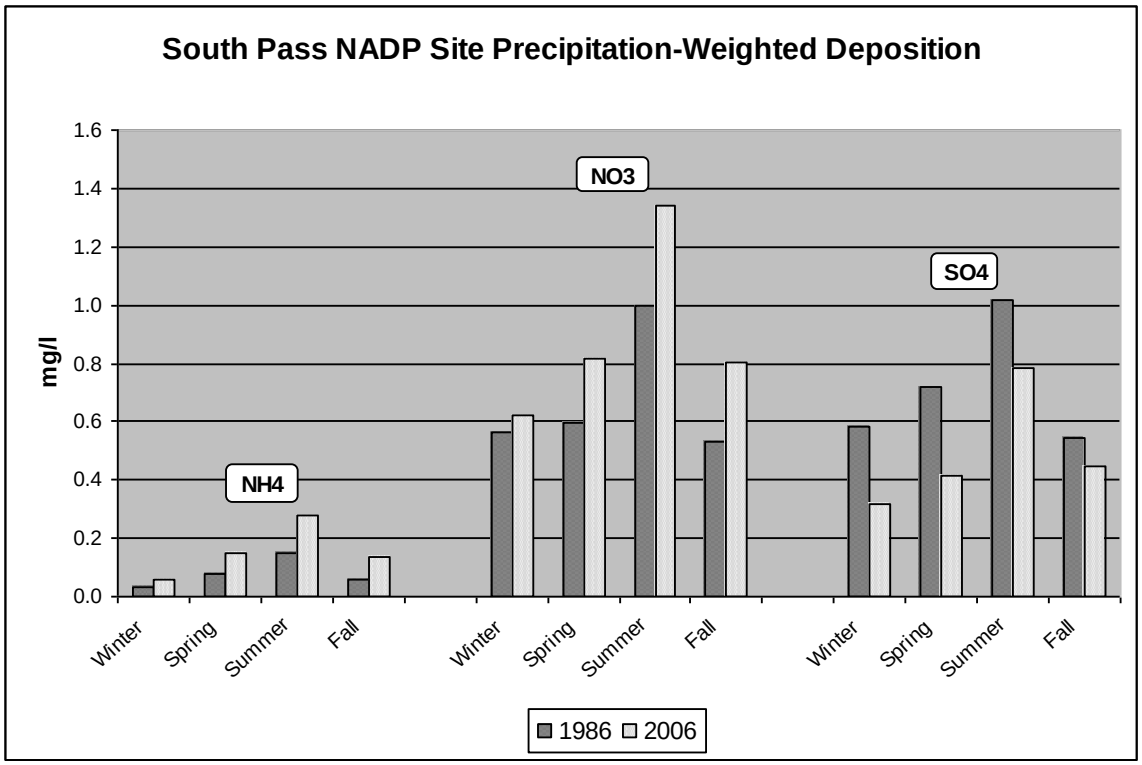


Table 6. South Pass National Atmospheric Deposition Program site precipitation-weighted deposition trend analysis

Precipitation-weighted (mg/l)								
Parameter	Seasonality	Season	1986	2006	Difference	Change	Trend	Significant
NH_4	Yes	Winter	0.033	0.061	0.028	85%	Up	0.05
		Spring	0.076	0.147	0.071	93%		
		Summer	0.147	0.280	0.133	90%		
		Fall	0.056	0.133	0.077	138%		
NO_3	Yes	Winter	0.565	0.623	0.058	10%	Up	0.05
		Spring	0.596	0.816	0.220	37%		
		Summer	1.000	1.340	0.340	34%		
		Fall	0.534	0.806	0.272	51%		
SO_4	Yes	Winter	0.584	0.318	-0.266	-46%	Down	0.01
		Spring	0.719	0.417	-0.302	-42%		
		Summer	1.020	0.782	-0.238	-23%		
		Fall	0.547	0.447	-0.095	-18%		

Figure 2. South Pass National Atmospheric Deposition Program site precipitation-weighted deposition trend analysis



In addition to Forest Service uses, the Wyoming Department of Environmental Quality and other agencies continually utilize data collected from this site. These data, along with data from other National Atmospheric Deposition Program sites in Wyoming, are used to model and track emissions and acid

deposition across southwest Wyoming, which includes the Class I Fitzpatrick and Class II Popo Agie Wilderness areas on the Shoshone. Because of industrial development in southwest Wyoming and growth of several major cities upwind of the Shoshone, continued monitoring of this site is important relative to managers being able to demonstrate compliance with the Clean Air and Wilderness Acts.

Lower Saddlebag and Ross Lakes

Analysis of data collected between 1986 and 2007 was completed in early 2008. The analysis indicates change over time, change over time, with statistically significant upward or downward trend depending upon the parameter, season, and lake parameter, season, and lake sampling location (Table 7 and

Table 8).

Acid neutralizing capacity is on a downward trend at both lakes. There is a greater change at Ross Lake. The change is occurring at all sampling locations, i.e., inlet, outlet, epilimnion, and hypolimnion.[7] The inlet at both lakes exhibits seasonality, but the outlets do not. The change at Lower Saddlebag, at the outlet and hypolimnion, is statistically non-significant, while at Ross it is significant.

The commonly accepted threshold for acid neutralizing capacity, when acid neutralizing capacity values are greater than 25, is no more than a 10 percent change. Thus, the downward trend at Ross Lake is a significant concern. The downward trend at Lower Saddlebag is approaching the threshold level, so it is a concern as well. The downward trend in acid neutralizing capacity at each lake may be due to the upward trend in nitrate (NO_3) at both lakes.

Nitrate (NO_3) is on an upward trend at the inlet of both lakes. Lower Saddlebag Lake exhibits seasonality, while Ross Lake does not. There is no trend at either lake at the outlet or epilimnion. The hypolimnion at Lower Saddlebag is on an upward trend while at Ross there is no trend.

The upward trend at the inlet of both lakes is a significant concern and could explain the downward trend in acid neutralizing capacity. Since there is no trend at the lake outlets, it is possible the influx of nitrogen (N) is being used by aquatic biota (both plant and animal) living in the lakes. Increases at each lake in the hypolimnion are also a significant concern because this zone is typically void of nitrogen. Thus, this increasing trend could be the enrichment phase of eutrophication,[8] meaning these once stable lakes (in terms of N) are becoming acidified. NO_3 sources could be emissions from upwind locations, such as oil and gas developments, or from what was stored in glaciers and large snow fields that have been rapidly melting over the last decade.

Sulfate (SO_4) at Lower Saddlebag Lake does not exhibit a statistically significant change, but there has been a 20 percent decrease (approximately). SO_4 is on a downward trend at Ross Lake at the inlet, outlet, and hypolimnion, but not the epilimnion. This trend at the Ross Lake inlet is not statistically significant, but it is statistically significant at the outlet and hypolimnion. Lower Saddlebag does not exhibit seasonality, but Ross does.

The downward trend could be related to 1990s-era reductions in the use of high sulfur diesel fuel. Controls on emissions at refineries and coal-fired power plants, on a western United States regional basis, could also be a cause.

In addition to Forest Service uses, Wyoming Department of Environmental Quality and other agencies continually utilize data collected from these lakes. These data, along with data from other lakes in the Wind River Mountains, are used to model and track emissions and acid deposition across southwest Wyoming, which includes the Class I Fitzpatrick and Class II Popo Agie Wilderness areas on the

[7] Epilimnion is the upper layer of water in a stratified lake. Hypolimnion is the lower layer of water in a stratified lake, typically cooler than the water above and relatively stagnant.

[8] Eutrophication refers to excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen.

Shoshone. Because of industrial development in southwest Wyoming and growth of several major cities upwind of the Shoshone, continued monitoring of these lakes is important relative to managers being able to demonstrate compliance with the Clean Air and Wilderness Acts.

Table 7. Lower Saddlebag Lake trend analysis

Lower Saddlebag Lake									
Parameter	Location	Seasonality	Season	1986	2007	Difference	Change	Trend	Significant
ANC (ueq/l)	Inlet	Yes	Spring	66	62	-4	-6%	Down	Yes
			Summer	77	67	-10	-13%		
			Fall	71	75	4	6%		
	Outlet	No		68	67	-1	-1%	Down	No
	Epilimnion	N/A		73	69	-4	-5%	Down	Yes
	Hypolimnion	N/A		76	68	-8	-10%	Down	No
NO_3 (mg/l)	Inlet	Yes	Spring	0.126	0.784	0.658	522%	Up	Yes
			Summer	0.079	0.434	0.355	449%		
			Fall	0.024	0.662	0.638	2,658%		
	Outlet	Yes	Spring	0.233	0.326	0.093	40%	None	--
			Summer	0.051	0.046	-0.005	-10%		
			Fall	0.034	0.037	0.003	9%		

Lower Saddlebag Lake									
Parameter	Location	Seasonality	Season	1986	2007	Difference	Change	Trend	Significant
	Epilimnion	N/A		0.011	0.014	0.003	27%	None	--
	Hypolimnion	N/A		0.001	0.201	0.200	20,000%	Up	Yes
SO_4 (mg/l)	Inlet	No		1.030	0.838	-0.192	-19%	None	--
	Outlet	No		1.030	0.824	-0.206	-20%	None	--
	Epilimnion	N/A		0.969	0.816	-0.153	-16%	None	--
	Hypolimnion	N/A		0.975	0.971	-0.004	0%	None	--

Table 8. Ross Lake trend analysis

Ross Lake									
Parameter	Location	Seasonality	Season	1986	2007	Difference	Change	Trend	Significant
ANC (ueq/l)	Inlet	Yes	Spring	74	59	-15	-20%	Down	Yes
			Summer	66	50	-16	-25%		
			Fall	66	60	-6	-9%		
	Outlet	No		69	61	-8	-11%	Down	Yes
	Epilimnion	N/A	Summer	76	55	-21	-28%	Down	Yes
	Hypolimnion	N/A	Summer	74	65	-9	-12%	Down	Yes
NO_3 (mg/l)	Inlet	No		0.033	0.395	0.362	1097%	Up	Yes
	Outlet	No		0.022	0.049	0.027	123%	None	--

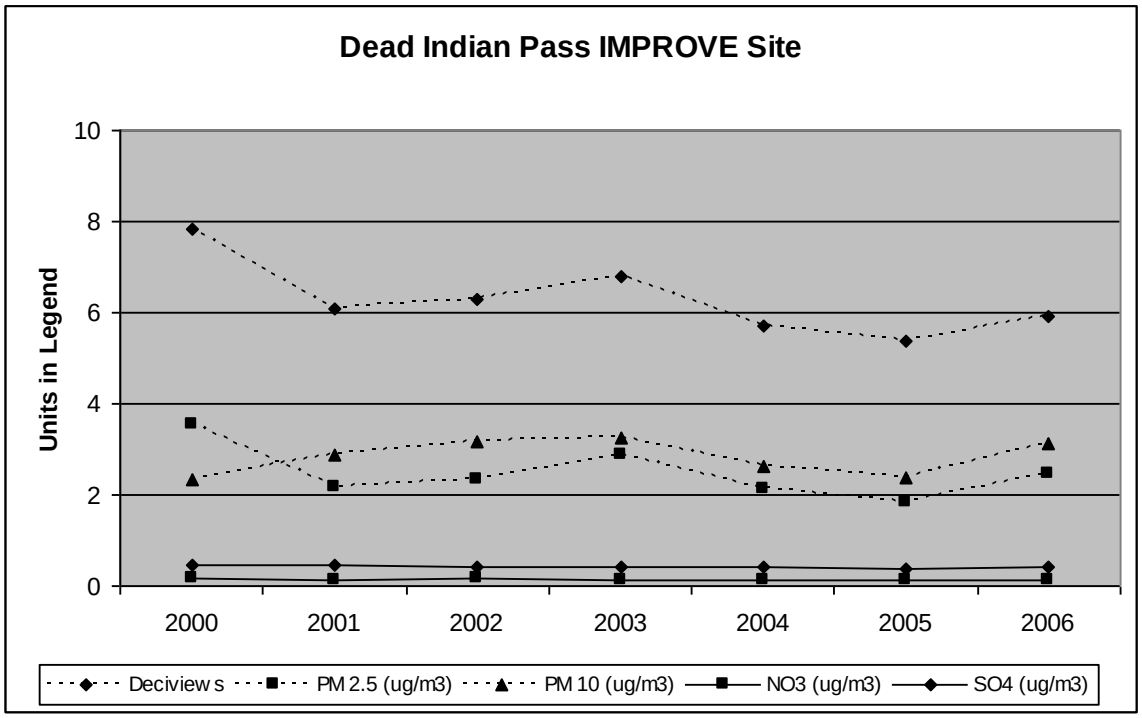
Ross Lake									
Parameter	Location	Seasonality	Season	1986	2007	Difference	Change	Trend	Significant
	Epilimnion	N/A	Summer	0.014	0.079	0.065	464%	None	--
	Hypolimnion	N/A	Summer	0.027	0.034	0.007	26%	None	--
SO_4 (mg/l)	Inlet	Yes	Spring	1.020	0.881	-0.139	-14%	Down	No
			Summer	0.890	0.808	-0.082	-9%		
			Fall	1.020	0.698	-0.322	-32%		
	Outlet	Yes	Spring	1.060	0.894	-0.166	-16%	Down	Yes
			Summer	0.914	0.826	-0.088	-10%		
			Fall	0.963	0.872	-0.091	-9%		
	Epilimnion	N/A	Summer	0.884	0.837	-0.047	-5%	None	--
	Hypolimnion	N/A	Summer	1.050	0.926	-0.124	-12%	Down	Yes

Dead Indian Pass Interagency Monitoring for Protected Visual Environment site

Available data, collected since 2000, can serve only as informational at this point because there is insufficient record to conduct statistical analysis (Figure 3**Error! Reference source not found.**). Over time, as more data are collected, the record will be analyzed to determine if a baseline can be established and if there are trends in visibility. Several more years of data collection are necessary before meaningful analysis can occur. Relative to Figure 3, readers must recognize data for the year 2000 are very suspect because the data do not meet quality control/quality assurance criteria and data for the year 2006 are provisional.[9] Data collected after 2006 are not presented at this time, but will be presented when the next comprehensive analysis of all air quality data for the Forest is assessed. The next comprehensive analysis will likely occur in 2012 (see below).

In addition to Forest Service uses, Wyoming Department of Environmental Quality and other agencies continually utilize data collected from this site. These data, along with data from other Interagency Monitoring for Protected Visual Environment sites in the Greater Yellowstone Area, are used to model and track air quality in the region. This includes the Class I North Absaroka and Class II Absaroka-Beartooth Wilderness areas on the Shoshone. Because of upwind sources of air pollution, continued monitoring of this site is important relative to managers being able to demonstrate compliance with the Clean Air and Wilderness Acts.

Figure 3. Dead Indian Pass IMPROVE site record



[9] Data collected to date are available on the Interagency Monitoring of Protected Visual Environment Web site at http://vista.cira.colostate.edu/improve/.

Scenery

Condition and trend

Scenery on the Shoshone is primarily in a very high visual quality condition. The majority of the Shoshone's scenery has little or no evidence of human-caused alteration (1.38 million acres of designated wilderness out of 2.4 million acres total land area of the Shoshone). A small portion has a mix of low to high alteration evidence.

The majority of the Shoshone's scenery is unaltered or appears unaltered. A minority portion is a mix of slightly altered and moderately altered. Recent (last 10 years approximately) alterations by prescribed burning and mechanical activities have been carefully planned with effective project design features and mitigation measures to maintain the intrinsic, natural landscape character. Most of the human manipulations go unnoticed by casual observation.

Evaluation

In the recent past, the Shoshone has implemented limited landscape-altering activities. Over the last few years, wildland fire use has been the primary landscape-altering agent. Generally, fire use has a positive effect for long-term scenic enhancement by removing dead and dying trees and creating early seral stage areas that increase scenic diversity. Visual quality objectives and how they may be altered are assessed during project analyses for all vegetation management projects proposed on the Shoshone. These assessments were completed for every project analyzed in 2009.

The Shoshone is anticipated to sustain a very high visual quality condition.

Cultural resources

Condition and trend

Cultural resources are non-renewable resources that include traditional use areas, prehistoric and historic artifacts, features, structures, sites, districts, photographs, and other archival materials. The Shoshone National Forest has a rich cultural history. Archaeological and ethnographic investigations indicate that people have lived in the area known as the Shoshone National Forest for at least 10,000 years. Indigenous Americans such as the Shoshone, Arapaho, Blackfeet, Comanche, Crow, Nez Perce, Northern Cheyenne, and Sioux used the landscape encompassed by the Shoshone National Forest for traditional cultural practices and subsistence living. Mountain men hunted, trapped, and traded in these lands, using Union Pass to travel through the mountains. Evidence of past uses remains, for example, in abundant and widely scattered prehistoric sites and historic structures, in the Nez Perce National Historic Trail, in tie hack flumes and camps near Dubois, and at Kirwin, a ghost town that was once a thriving mining community in the 1800s.

The Forest Service identifies, evaluates National Register of Historic Places (NRHP) eligibility, and protects cultural resources by following regulations, standards, and guidelines outlined in the National Historic Preservation Act and the Programmatic Agreement Among the USDA Forest Service, Wyoming

Forests, Wyoming State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding Compliance with the National Historic Preservation Act on the National Forests and Grasslands of Wyoming (Programmatic Agreement).

Compliance with Sections 106 and 110 of the NHPA has resulted in the identification of approximately 1,100 cultural resources across the Shoshone. Shoshone National Forest cultural resources include one National Historic Landmark, six NRHP listed properties, and one National Historic Trail. Specialists have also identified eight Priority Heritage Assets (PHA), some of which include National Register-listed properties.

In fiscal year 2009, Section 106 compliance was completed for 28 federal undertakings and the Section 106 process was started for 14 undertakings. Review for these projects carried over to fiscal year 2010. In fiscal year 2009, 25 new cultural resources were identified and evaluated for the NRHP during the course of Section 106 cultural resource inventories.

The cultural resources of the Shoshone National Forest attract external partners. Several Section 110-related projects occurred during fiscal year 2009, including research-oriented survey, archaeological field schools/excavation, and historic photograph archiving. Many of these were partially funded by partnership agreements, i.e., challenge cost shares. Researchers, professors, and students from Indiana University, the Office of the Wyoming State Archaeologist, the Greybull River Sustainable Landscape Ecology (GRSLE) organization, the University of Colorado, and Northwest College participated in research-related projects on the Shoshone National Forest in fiscal year 2009. Thirty-one new cultural resources were identified by forest partners in fiscal year 2009.

Many previously known or recorded cultural resources were relocated during Section 106 and Section 110-related field surveys during fiscal year 2009. GRSLE partners relocated, provided updated data, and condition assessments for 16 prehistoric archaeological sites. These data indicate that prehistoric sites are threatened by illegal artifact collection activity, i.e., looting. Condition assessments were conducted at two PHA in fiscal year 2009. Results of the condition assessments revealed evidence of potential looting at one site. Incidents were reported to Forest Service law enforcement personnel.

Two historic properties monitored during Section 106 inventories were identified as needing mitigation to prevent potential adverse effects from livestock grazing and dispersed recreation. Mitigations were recommended and concurred upon by the State Historic Preservation Office.

Monitoring and condition assessment data indicate that prehistoric archaeological sites are most threatened by illegal artifact collection and recreation.

Evaluation

Direction for cultural resources is lacking in the Forest Plan. The Forest Plan states and suggests the following:

- Eligible sites must be nominated to the NRHP
- A cultural history overview was completed in 1980 and updated in 1984

- 25,000 acres had been surveyed and 130 cultural resources recorded, including six historic properties listed on the NRHP

Demand trends in the Forest Plan suggest cultural resource inventories were required to be completed by 1990, inventories were to be undertaken prior to ground disturbing activities, and a predictive site location model should be generated.

Some aspects of the Forest Plan are being met, specifically those related to Section 106 compliance. Field inventories continue to be carried out prior to ground disturbing activities and other federal undertakings. The Forest Plan equates Section 106 inventory with ground disturbing activity; however, Section 106 analysis is required for federal undertakings that have the potential to affect historic properties, regardless of the level of ground disturbing activity taking place (e.g., renovation of historic structures, land exchanges, etc.).

A predictive model has not been generated for the Shoshone, and it is recommended that a Forest-wide model not be created. Rather, individual models for specific locations (e.g., watersheds), cultural resource types (e.g., high elevation villages) and/or project areas (e.g., fire areas) be generated and tested. Currently, the Shoshone National Forest generates high archaeological site probability zones using variables in the Programmatic Agreement; variables include such things as proximity to water and slope. High site probability zones are used to identify areas for cultural resource surveys for range, timber, and prescribed burn undertakings.

The Forest Plan suggests that a cultural resource inventory be completed by 1990. This goal and timeframe are unrealistic. It is likely the entire Shoshone National Forest will never receive a 100 percent cultural resource inventory. More realistically, specific areas will continue to be inventoried when analyzed for Section 106 review, or identified for research field survey. Also, it is important to note that as survey methods improve, past cultural resource inventories may become inadequate. For example, the current intensive inventory standard requires a pedestrian survey be conducted with 30 meter-wide transects. Past field inventories where wider transects were employed are not considered adequate by today's standards.

Little progress has been made toward nominating historic properties to the NRHP. The Forest Plan lists six properties on the NRHP. Fiscal year 2009 records indicate that six historic properties are on the register, one property is listed as a National Historic Landmark, and one property has been designated a National Historic Trail. Additionally, the Shoshone National Forest culture history overview created between 1980 and 1984 is outdated and in need of revision. Cultural history overviews are necessary to provide adequate contexts for the evaluation of cultural resources for the NRHP.

Minerals

Condition and trend

Locatable materials are generally hardrock materials mined or processed for the recovery of metals and nonmetallic minerals, and uncommon varieties such as distinctive deposits of limestone and silica.

Locatable mineral[10] extraction is a process that starts with notices of intent to operate, plans of operations, and bonding. Since 2002, the Shoshone has averaged less than one notice of intent per year. Panning and dredging for gold have increased in the past several years. The Wyoming Department of Environmental Quality manages these activities. For example, Department of Environmental Quality guidelines do not permit dredging in class 1 waters, which include all wilderness streams and the main stem of the Clarks Fork of the Yellowstone River from the Montana state line to the Shoshone boundary (Guideline No. 19). On National Forest System lands, locatable mineral activities that reach a level of significant surface resource disturbance require a plan of operation that is used to determine adverse impacts to the environment and surface resources (36 CFR 228.4).

Leasable materials include coal, oil, gas, oil shale, sodium, phosphate, potassium, and geothermal resources as examples. At this time, only oil and gas resources are being leased on the Shoshone. Shoshone National Forest lands available for oil and gas leasing were determined in the 1995 Oil and Gas Leasing Record of Decision, which also identified appropriate stipulations for protecting surface resources. Most oil and gas wells near the Shoshone are considered mature wells (over 40 years old). Often these wells are involved in tertiary recovery (the last phase of recovery). These wells have an additional recovery expectancy of over 20 years. To enhance recovery of petroleum products, companies are now directional drilling from the original drilling pad. Directional drilling requires less infrastructure, such as pads, roads, and pipelines. Recently, due to high oil and gas prices and more advanced technologies, drilling has increased on lands adjacent to the Shoshone. Less than 10 percent of exploratory wells result in production of oil and gas. Some success in the Clark, Wyoming, area has initiated interest in seismic exploration on and adjacent to the Shoshone. Since there are no active wells on the Shoshone at this time, no monitoring of oil and gas operations have occurred. Of the 34 wells drilled in the past, 31 have not produced and three have been capped due to low production.

Table 9. Acres of oil and gas leased per year, 1970, 1973 through 2003, 2005, and 2007

Year	Acres leased	Year	Acres leased	Year	Acres leased
1970	6,719	1981	111,424	1990	2,119
1973	33,883	1982	129,628	1998	2,775
1974	6,375	1983	94,086	1999	0
1975	5,168	1984	37,032	2000	1,950
1976	16,609	1985	6,329	2001 - 2003	0
1977	11,289	1986	27,694	2005	8,800
1978	6,858	1987	28,000	2006	8,600
1979	3,093	1988	70,934	2007	8,570
1980	34,903	1989	56,520		

Mineral materials[11] (saleable/common variety materials) are the other resources managed under the minerals/geology program. In the last decade, mineral material permits averaged less than 30 per year and resulted in the removal of several hundred tons of rock, sand, and gravel. Sand and gravel removal

[10] Locatable minerals include gold, silver, copper, tin, lead, and other valued deposits/metals.

[11] Mineral materials (or saleable minerals) are common and often widespread materials such as stone, sand, gravel, clay, cinders, plain clays, and decorative rock.

is occurring in existing material pits. Most rock material removal is incidental in amount and disturbance and is provided to the public under free use permits. The Shoshone does manage a single commercial rock permit. The material for this permit is removed from a specific rock source site that was analyzed through the NEPA process. Management of mineral materials is expected to continue at a low level of activity for the Shoshone, with interest in decorative/landscape rock increasing somewhat.

Evaluation

There is no evaluation based on monitoring oil and gas operations versus plan direction, since there are no ongoing operations on the Shoshone.

In other areas, Forest Plan direction could use some updating. Because of changing situations with roadless and grizzly bear habitat management, some Forest Plan direction could be adjusted to ensure that oil and gas leasing direction is consistent with direction for these other resources. Currently, since there are no operations, there are no problems, but there is the potential for inconsistencies in the future.

Invasive plants

Condition and trend

Invasive species infestations negatively affect forest and rangeland environments and wildlife habitat, can prevent managers from meeting objectives, may reduce native genetic diversity, disrupt recreation use, reduce resource production, degrade water quality, and cause economic loss. The threat to ecological systems from invasive species is acute and expanding. If invasive species are present, natural processes and the survival of native species and their plant communities are at risk. Invasive plants are a threat to forage capacity for big game, especially on winter ranges, and can reduce winter range carrying capacity. Invasive species pose an economic threat to downstream and adjacent landowners and livestock operations. Forage reductions both on and off the Shoshone can threaten the viability of livestock operations with reduced grazing capacity. Large-scale treatments can be cost prohibitive to adjacent private landowners. Under climate change, more rapid expansion of invasive species, especially cheatgrass, may impact native species and natural ecosystem processes.

Prior to the Forest Plan, Canada thistle was the most common invasive plant found on the Shoshone. This plant is now considered a lower threat across the Greater Yellowstone Ecosystem and control efforts have been shifted to the more invasive and greater environmental damaging plants such as leafy spurge, knapweeds, Dalmatian toadflax, musk thistle, and oxeye daisy.

In 2009, there were an estimated 5,000 to 6,000 acres of invasive plant species on the Shoshone. We treat approximately 2,000 acres annually in cooperation with local and state agencies. An increase in available funds in fiscal year 2009 allowed treatments on approximately 2,500 acres. The actual areas surveyed for invasive plants during early detection rapid response (EDRR) activities are much greater.

Several large infestations occur on the Shoshone. These include Dalmatian toadflax in the South Fork of the Shoshone River drainage; leafy spurge, cheatgrass, and musk thistle in the Sinks Canyon area; oxeye

daisy along U.S. Highway 212 and along the Wiggins Fork; and cheatgrass and musk thistle increases in the Sinks Canyon area. Annual treatment plans are made and executed during the field season. Knapweed (spotted, diffuse, and Russian), yellow toadflax, common tansy, and whitetop occur as scattered populations mostly along trails, trailheads, and road corridors.

Current control efforts focus on EDRR programs for eliminating small infestations and containing the spread of larger populations of invasive plants. Small populations of invasive plant species have the potential to spread over thousands of acres and alter native plant community composition and land productivity. The lands that are the most threatened include most of the Shoshone's big game winter ranges.

New small infestations continue to be found and treated by EDRR teams. New yellow toadflax populations on Highway 212 and Eagle Creek were treated. Sulfur cinquefoil was found and treated by horse pack crews along the Elk Fork drainage. New populations of this species were also treated in the Sinks Canyon area. Houndstongue continues to be the fastest spreading invasive plant on the Shoshone, with numerous new locations. Spotted knapweed was found in numerous new locations, with the most significant being in the Wayne's Hole drainage, along the North Fork of the Shoshone River, and at the Crandall work center. The Sinks Canyon, Togwotee Pass, and the Beartooth Highway all had new invasive plant locations associated with road right-of-way construction. New populations of spotted knapweed and other invasive plant species were found in Newton, Three Mile, Horse Creek, Fox Creek, and Crazy Creek campgrounds. Areas around recreation residences and lodges also had new invasive plant populations documented, including Crossed Sabres, Goff Creek, and Blackwater lodges. Fuel reduction project areas around Eagle Creek, Pagoda, and Green Creek summer homes groups also had new infestations. Timber sales, such as Spring Mountain, had new infestations and the continued spread of Canada thistle on most past sale units continues to be a problem. Trailhead monitoring also resulted in new locations of several invasive plant species.

Bio-control efforts are less intensive than EDRR activities. The primary focus is on Dalmatian toadflax in the South Fork of the Shoshone River drainage and Canada thistle populations scattered across the Shoshone.

Mechanical control efforts are used to prevent seed dispersal. Musk and bull thistle can be chopped down prior to seed maturity. After flowering occurs, spotted knapweed can be pulled, bagged, and burned to limit seed spread. Before flowering, herbicide application is the major treatment option.

Education efforts are focused through weed management area (WMA) participation. Weed tours occurred in the Dubois-Crowheart and Popo Agie WMAs. A volunteer early detection group was formed by the Park County WMA to hike trails in search of new infestations. The Grass Creek WMA held an annual spray day and planted willows along stream courses. The Park County WMA, in cooperation with the Wapiti Irrigation District, held a ditch spray day. Forest Service employee education efforts include interdisciplinary team involvement, seasonal work force orientation, annual updates and maintenance of the invasive species maps, and one-on-one contacts.

Another education effort is through the certified weed-free feed program. In the last 10 years, signs, brochures, hunter contacts, and law enforcement involvement in the program have dramatically increased. County weed and pest organizations are partners in this program, providing the inspection programs that lead to the certification of weed-free hay. Enforcement of regulations is an important part of our partnership with the counties.

Funding from State and Private Forestry grants is an important part of the Shoshone's weed program. Grant funds are used to treat lands adjacent to the Shoshone. Grant proposals are jointly applied with the Wyoming Department of Agriculture and the Regional Office. Approximately $80,000 in grants were received for Park County, Dubois-Crowheart, and Popo Agie WMAs. Matching funds were in excess of $200,000. The value of this program to keeping National Forest System lands weed free cannot be overestimated.

Evaluation

The large treatment areas of the South Fork of the Shoshone River drainage, the Sinks Canyon area, U.S. Highway 212 (Beartooth Highway), and along the Wiggins Fork are gradually being contained and reduced in size. Control of Dalmatian toadflax, oxeye daisy, and leafy spurge will take several decades at current budget levels to accomplish. Extensive cheatgrass coverage in Sinks Canyon, a result of a prescribed fire in 2000, cannot be controlled due to difficulties in the application of herbicides on rough terrain. Further prescribed fire in similar habitats should be curtailed because of the potential of type conversion to cheatgrass.

EDRR efforts have been successful and should remain a primary emphasis of the invasive plants program. Environmentally, this is the best option due to the importance of maintaining healthy native plant communities and reducing introduction of chemicals into watersheds. Costs for EDRR activities are far less than what can be spent if a large infestation were allowed to become established.

Bio-control efforts have had mixed results. *Mecinus janthinus* densities are increasing and are beginning to reduce Dalmatian toadflax populations. Elevation may be the reason for the slow increase in populations compared to other known release sites in the western United States. *Rhinocyllus conicus* populations have helped reduce Canada thistle in some release sites and not on others. Bio-control efforts are a long-term part of the solution that will take another decade to show effects on population levels of these invasive plants.

Cheatgrass continues to spread in lower elevations habitats dominated by Wyoming big sage, basin big sage, and blue bunch wheatgrass. This spread is occurring due to warming climates and disturbances created by wildland and prescribed fire. The Sinks Canyon, North and South Forks of the Shoshone River, Wood River, Greybull River, Sunlight Basin, and Face of the Mountain areas are most susceptible to cheatgrass invasion. These areas also coincide with important big game winter range.

Public education efforts have been successful in relation to WMA tours, information publications, and spray days. Citizen participation has been well received and knowledge about invasive species has increased. This is apparent by the increase in herbicide sales and noxious weed questions posed to county weed and pest organizations and the Forest Service in the last five years. Forest Service

personnel awareness has increased in the last five years, but improvement still needs to be made in identification and knowledge of invasive plant issues. Problems have occurred in fuels reduction projects, site preparation, horse pastures, administration sites, and in special use permitting.

The certified weed-free feed program is critical to reducing the spread of invasive plants in remote areas of the Shoshone. A lapse occurred with special use authorizations on the North Fork of the Shoshone River, where hay was purchased that was not certified. Delay in enforcing our regulations led to Park County Weed and Pest and several producers of certified weed-free products expressing their displeasure and questioning our sincerity in the program. Consistency is needed in enforcement of certified weed-free feed policies.

The State and Private Forestry program has resulted in numerous partnerships with adjacent landowners, providing critical support to the WMAs. Continued participation in this program is critical to keeping areas of the Shoshone free of invasive plant species.

Aquatic habitats and fisheries

Condition and trend

Stream and lake aquatic habitat

The Shoshone has about 4,063 miles of perennial streams, with about 1,660 miles of stream that support some type of fishery. Overall, stream habitat conditions are improving or remaining stable and meeting or moving toward desired conditions. Improved livestock grazing practices, improved road drainage, removing stream crossing barriers to fish passage, and implementing stream habitat enhancement projects have improved riparian and stream habitat conditions and the aquatic populations associated with them.

On the Shoshone, 308 lakes currently support some type of fishery. The majority of the fish-bearing lakes are located on the Beartooth Plateau and in the Fitzpatrick and Popo Agie Wilderness areas. Most of these lakes are found in the granitic geologic type. Granitics are not as erosive as volcanics, tend to form rolling bench lands, and are less steep than volcanics. The soil type is less porous and stores more surface water, creating numerous lakes and ponds. The Absaroka volcanics have very few lakes and ponds because of steep slopes, high erosiveness, and soil types with poor water-absorbing characteristics resulting in lesser ability to store surface water.

Overall, the condition of the lake habitats is good to excellent and meeting desired conditions. Most are located in the high country or wilderness. There are a few, localized issues with livestock (cattle) grazing and commercial livestock in isolated, high use areas that are being addressed through adaptive management. Over the years, we have developed various lake and pond enhancements that have created or improved fish habitat.

Riparian habitat

Riparian habitat has been mapped on the Shoshone. In 1999, all riparian polygons that were greater than 160 feet wide on the ground were rated in an integrated fashion using the proper functioning condition methodology with best available information. Since that time, riparian habitat condition has been periodically updated on a project level basis. Overall, riparian condition has improved due to improved livestock grazing practices, improved road drainage, removing stream crossing barriers to fish passage that have also caused stream bank erosion and excessive sedimentation, and implementing stream enhancement projects. In 2009, riparian condition was updated for the range allotments addressed in that Environmental Assessment. Almost all riparian polygons had improved or remained stable.

Game trout

Game trout are the management indicator species for aquatic habitat. Forest-wide, game trout populations and their habitats have been maintained or enhanced since 1986. The reasons for overall improved population and habitat conditions include improved livestock grazing administration and compliance and reductions in animal unit months.[12] This has led to improved riparian and fish habitat conditions by reducing bank trampling and erosion and increasing stream bank stability. Improved road drainage has reduced fine sediment input to streams. Correcting numerous fish passage barriers at road crossings has increased access to available habitat. We have constructed various stream habitat improvement structures and created or enhanced various lakes and ponds.

Yellowstone cutthroat trout

Yellowstone cutthroat trout are a game trout and a Region 2 sensitive fish species. Rangewide, Yellowstone cutthroat trout (YCT) have been reduced to a fraction of their historic range, primarily from stocking of non-native trout and habitat degradation. On the Shoshone, YCT populations have now stabilized and are improving due to improved land management practices, stream habitat restoration projects, and population restoration projects. The Shoshone is part of the rangewide YCT working group. A YCT status assessment and management plan has been developed; a revised version is currently being finalized. Region 2 has also developed a Conservation Management Strategy for YCT. The Wyoming Game and Fish Department is currently developing a statewide management strategy for YCT, which will be reviewed by the Forest Service. We have used current fish population information to develop various GIS management layers. Some of these include current and historic YCT range, current stream and lake fish species, natural and human-caused barriers to fish passage, barriers at stream crossings, and potential management opportunities. In cooperation with the Wyoming Game and Fish Department, we have developed and prioritized restoration and enhancement opportunities from this information. As part of this effort, we initiated the first of two phases of the Dead Indian Creek YCT restoration project in 2009. Non-native trout will be removed with rotenone between two natural barrier falls. Genetically pure YCT will be planted and managed as a naturally reproducing population. This is a complex project since a portion of the restoration effort is within designated wilderness.

[12] An animal unit month is the equivalent to the amount of dry forage consumed by an 800-pound non-lactating cow in one month (approximately 840 lbs, or 28 lbs per day).

Since 2005, we have been monitoring YCT in cooperation with the Wyoming Game and Fish Department. We have selected representative stream reaches. We monitor the populations and habitat every other year to determine long-term trends. YCT populations and habitat have remained stable or improved since monitoring began.

Rangeland management

Commercial livestock grazing

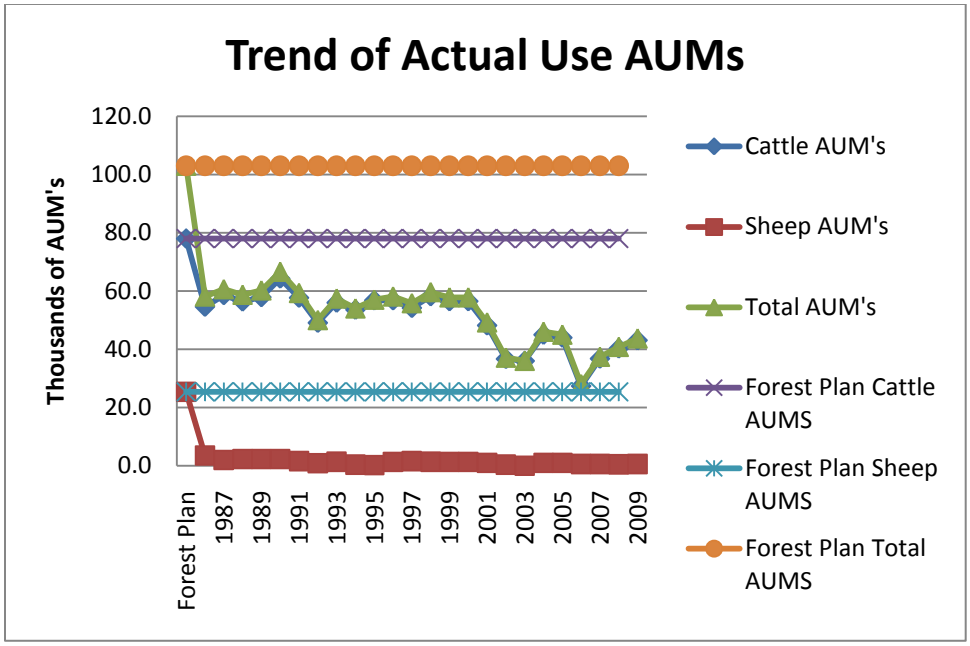
An animal unit month (AUM) is the unit of measure used to report and compare the amount of commercial livestock grazing that takes place on the national forest. An AUM is the equivalent to the amount of dry forage consumed by an 800-pound non-lactating cow in one month (approximately 840 lbs, or 28 lbs per day). Recreation visitor livestock and permitted outfitter/guide pack and saddle stock are not included in this category.

Table III-1 in the Forest Plan contains a list of management practices and the proposed outputs for those practices (see Chapter III, pages III-13 to III-14 for range projections). For commercial livestock grazing, the Forest Plan predicted an average annual output of 78 thousand cattle and horse AUMs and 25.4 thousand sheep AUMs for a total of 103.4 thousand AUMs per year. Since 1985, several allotments have been closed to commercial livestock grazing and as sheep allotments became vacant they were not re-stocked, resulting in the current permitted grazing of 64.8 thousand cattle and horse AUMs and 600 sheep AUMs for a total of 65.4 thousand AUMs.

Table 10. Authorized commercial livestock grazing use (1,000 AUMs)

Reporting year	Cattle/horse AUMs	Percent of Forest Plan	Sheep AUMs	Percent of Forest Plan	Total AUMs	Percent of Forest Plan
Forest Plan	78.0	100	25.4	100	103.0	100
1986	54.6	70	3.5	14	58.1	56
1987	58.6	75	2.0	8	60.6	59
1988	56.4	72	2.3	9	58.7	57
1989	57.9	74	2.3	9	60.2	58
1990	64.3	82	2.3	9	66.6	65
1991	57.7	74	1.6	6	59.3	58
1992	49.1	63	0.9	4	50.0	49
1993	56.0	72	1.4	6	57.4	56
1994	53.6	69	0.4	2	54.0	52
1995	56.8	73	0.2	1	57.0	55
1996	56.8	73	1.3	5	58.1	56
1997	54.2	69	1.6	6	55.8	54
1998	58.2	75	1.4	6	59.6	58
1999	56.5	72	1.3	5	57.8	56
2000	56.5	72	1.3	5	57.8	56
2001	48.2	62	1.0	4	49.2	48
2002	36.7	47	0.4	2	37.1	36
2003	36.0	46	0.0	0	36.0	35
2004	45.0	58	1.0	4	46.0	45
2005	44.0	56	1.0	4	45.0	44
2006	27.4	35	0.6	2	28.0	27
2007	36.8	47	0.6	2	37.4	36
2008	40.3	52	0.5	2	40.8	40
2009	43.1	55	0.6	2	43.7	42

Figure 4. Trend of authorized commercial livestock grazing use



Evaluation

The difference between the authorized use figures and the permitted use figures is accounted for as non-use. Non-use, or partial non-use, of an allotment may occur for one of two reasons: non-use for personal convenience and non-use for resource protection. Non-use for personal convenience indicates that grazing use was offered but the permittee declined to use it. Non-use for resource protection is normally associated with non-use due to a prescribed fire or wildfire, during a period of severe drought, or implementation as a forage reserve. A forage reserve allotment is held through a term grazing permit but is not typically stocked by the permit holder; it is stocked as needed when another allotment is unavailable due to resource conditions, predator conflicts, or rest following a vegetation treatment.

Permitted grazing use by commercial livestock has never reached the levels the Forest Plan projected to be available. Presently, cattle grazing use is approximately 55 percent and sheep grazing use is approximately 2 percent of Forest Plan projected levels. In response to localized drought conditions and predation, some allotments were in non-use or partial non-use status resulting in actual grazing use being considerably lower than permitted use. In addition to the reduced numbers of livestock grazing, some grazing seasons were also shortened.

While demand for cattle grazing allotments has remained high, sheep allotments have been vacant due to a lack of interest resulting from a depressed market, predation problems, and conflicts with wildlife. Because of this lack of need, a decision notice from an environmental analysis determined that due to the potential for disease transmission between bighorn sheep and domestic sheep, no permits would be issued for domestic sheep grazing on the vacant sheep allotments located on the Clarks Fork and Greybull Ranger Districts.

Vegetation utilization

Vegetation utilization and resource impacts from both livestock and wildlife are measured by various methods, including landscape appearance for both upland and browse species, height/weight measurements, stubble height, herbage left ungrazed, streambank stability, streambank impact transects, and clipping and weighing. A combination of these methods was used in the 2009 field season to monitor livestock and wildlife utilization on 32 allotments. This represents 44 percent of the 72 allotments upon which commercial livestock were actually grazed. The most common grazing management systems on the Shoshone are multiple pasture deferred rotation or rest rotation. Under this system, grazing is delayed or not used at all on a given area or unit of the allotment to allow plant reproduction, recovery, and establishment of new plants.

Rangeland utilization and condition and trend monitoring data are collected by employees, contractors, and permittees. The Cooperative Permittee Monitoring program was established in 1998 with assistance from the University of Wyoming and the Wyoming Agricultural Extension Service. Currently there are 28 permittees collecting some level of monitoring data on 33 allotments.

Table 11 shows the allotments and the acres monitored, the reason for monitoring, and the monitoring protocol and summarized results. Monitoring target codes and protocol codes are shown in Table 12 and Table 13.

Table 11. Allotments and acres monitored, reason for monitoring, and the monitoring protocol and summary of results

Allotment	Acres monitored	Monitoring target[13]	Monitoring protocol	Monitoring results
Bald Ridge	24,882	RC/T	P3S, CF, SP	Maintained or improved conditions
Basin	73,122	UU, RU, SB, WR, RC/T	LAH, LAB, SH, GS, CBL, PP	Annual utilization within allowable use standards
Crandall	11,449	RC/T	P3S, CF, SP	Maintained or improved conditions
Reef Creek	11,449	RC/T	P3S, CF, SP	Maintained or improved conditions
K-Z Horse Pasture	532	RC/T	BMP	Overall good conditions, riparian & H20 issues
Crandall Game and Fish Department Horse Pasture	35	RC/T	BMP	Good condition
Crandall Ranger Station Pasture	42	RC/T	BMP	Good condition
Wood River (and Kirwin)	7,768	RC/T	P3S, CF, SP	Maintained or improved conditions
Timber Creek (and Francs Peak)	10,009	RC/T	P3S, CF, SP	Maintained or improved conditions
Meeteetse (and Carter)	6,088	RC/T	P3S, CF, SP	Maintained or improved conditions
Piney	14,292	RC/T	P3S, CF, SP	Maintained or improved conditions
Sugarloaf-East-Twin	21,943	RC/T	P3S, CF, SP	Maintained or improved conditions
Squaw Creek	6,307	RC/T	PP	Maintained or improved conditions
Atlantic City	1,008	RC/T	PP, CBL	Maintained or improved conditions
Middle Fork	26,472	UU	LAH	Annual utilization within allowable use standards
Maxon Basin	3,791	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
South Pass	6,599	RC/T, UU	PP, LAH	Annual utilization within allowable use standards

[13] Monitoring target and protocol codes are defined in Table 12 and Table 13.

.

Allotment	Acres monitored	Monitoring target[13]	Monitoring protocol	Monitoring results
Bear Creek	33,672	RC/T, UU	PP, LA, CBL, GRI	Maintained or improved conditions
Wiggins Fork	37,660	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Warm Springs	16,873	RC/T	PP, LAH, SP	Annual utilization within allowable use standards
Wind River	44,177	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Ed Young Basin	11,548	RC/T, UU	PP, LAH, SP	Annual utilization within allowable use standards
Horse Creek	29,980	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Parque Creek	13,523	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Ramshorn	16,007	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Dickinson Park	22,139	RC/T	PP	Maintained or improved conditions
Hays Park	8,670	RU, UU	PP, LAH	Annual utilization within allowable use standards
Union Pass	39,491	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Whiskey Mountain	12,105	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Pine/Willow	18,351	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Slate Creek	8,296	RC/T, UU	PP, LAH	Annual utilization within allowable use standards
Sawmill Creek	9,391	RC/T	PP	Maintained or improved conditions

Table 12. Monitoring target codes

Monitoring target	Code
Upland utilization	UU
Riparian utilization	RU
Streambank	SB
Winter range	WR
Resource condition/trend	RC/T

Table 13. Monitoring protocol codes

Monitoring protocol	Code
Landscape appearance – herbaceous	LAH
Landscape appearance – browse	LAB
Stubble height	SH
Herbage left ungrazed	HLU
Grazing response index	GRI
Greenline stability	GS
Streambank impact	SI
Height/weight	HW
Paired plot clipping	PPC
Cover by life form	CBL
Parker 3-step	P3S
Photo Point	PP
Photo Point transect	PPT
Sample point	SP
Cover frequency	CF
Best management practice review	BMP

Evaluation

Annual utilization data collected in 2009 showed few sites that exceed allowable use standards. This is primarily the result of intensive administrative activity that resulted in livestock being removed when allowable utilization levels had been reached, and/or lower livestock numbers on many allotments.

Range condition and trend

Range analysis field exams are conducted according to processes described in the Region 2 Rangeland Analysis and Management Training Guide. The primary method utilized was re-reading Parker 3-Step permanent transects and overlaying them with cover frequency plots. Additionally, photo points, photo transects, and cover by life form transects were established or re-evaluated. General observations made during allotment inspections were also used to evaluate rangeland conditions.

Evaluation

Analysis of the data, reports, and photographs indicates that the rangeland resource is generally meeting or moving toward objectives. Where plant composition was determined, data displayed a static or positive trend toward the desired condition. Rangeland that was currently in desired condition showed the least change and those changes were due to natural succession. Forest-wide, with a few exceptions, range vegetation conditions

are either at or moving toward the desired conditions as outlined in the Forest Plan and/or associated allotment management plan.

Rangeland management NEPA analysis, allotment management plans, and annual operating instructions

The rangeland management interdisciplinary team has completed analysis for 10 livestock grazing allotments. The final environmental assessment and decision document were issued for nine of the livestock grazing allotments. As soon as concurrence is received from the Wyoming State Historic Preservation Office for the tenth, a decision notice will be issued for the final allotment. After the appeal period, allotment management plans will be developed to implement management practices to achieve the desired conditions outlined in the selected alternative.

Annual operating instructions are developed by rangeland management specialists and reviewed with each permittee. These instructions are used to outline numerous details specific to that year's management of the allotment. In cases where an up-to-date allotment management plan is not in place, the annual instructions will cover those directions as well. Typically, these instructions include the annual livestock management strategy, range improvement constructions plans (if any), treatment of invasive plant species, designation of monitoring sites, the level of desired utilization, or any other pertinent management needs to implement Forest Plan standards and guides.

Evaluation

Upon completion of the NEPA requirements for the allotments listed above, we will be on track to meet the schedule outlined in the Rescissions Act (Public Law 104-19). In 2010, rangeland analysis, condition and trend data, and cultural surveys will begin on the final two allotments that remain on the Rescissions Act schedule. In addition to the allotments remaining on the Rescissions Act Schedule, we will begin a schedule of analyzing previous allotment management NEPA documents for adequacy and updating them as necessary.

Special uses

Condition and trend

The Forest Service issues special use authorizations (permits, easements, and leases) to allow private or government entities to occupy, traverse, or use National Forest System lands. Special use authorizations are granted for specified periods, generally not exceeding 20 years, but often with provisions for renewal, e.g., for facilities with substantial financial investment such as resorts. Shorter-term and one-time authorizations are also issued, e.g., for scientific studies and recreation events that are anticipated to occur within a limited and clearly defined timeframe.

Special use authorizations fall into two broad categories – recreation special uses and non-recreation special uses.

Recreation special uses

Recreation special uses include both commercial and non-commercial activities. Commercial activities are those that provide a service to the public for a fee. These include developed campgrounds, ski areas, lodges, organization camps, and outfitting and guiding. Non-commercial activities are essentially private in nature and are principally represented by the recreation residence program. Certain group events, competitive events, and recreation events can be either commercial or non-commercial, depending on how they are conducted. Excepting outfitting and guiding, recreation special uses are conducted outside designated wilderness. Outfitting and guiding occur both inside and outside designated wilderness and include trail rides, rafting, fishing, big game hunting, pack trips, snowmobiling, and sled dog tours.

Certain categories of recreation special use authorizations have remained relatively constant, for example, recreation residences, resorts, organization camps, skiing, whereas others have increased over time, e.g., outfitting and guiding (Figure 5 and Figure 6). Of those that have remained constant, some are limited as a matter of public policy, e.g., recreation residence authorizations have remained at pre-1986 levels because Forest Service policy precludes issuance of authorizations for new residences. Others remain constant for a variety of reasons, e.g., resorts, organization camps, and skiing tend to remain constant due to limited capacity and/or public need for additional facilities. Where such constraints do not occur, authorization numbers have generally increased.

Non-recreation special uses

Non-recreation special uses include such uses as roads, ditches, pipelines, communication sites, and utility lines.

Non-recreation authorizations have generally increased over time. Authorizations for new proposed uses are generally granted if the proposed use is found to be consistent with Forest Service policy, the Forest Plan, and if potential environmental impacts can be mitigated successfully.

The overall trend in special uses for the last five years has been toward a gradual increase in authorizations.

Table 14. Categorization of special use authorizations by year for 1982, 1984, and 1995 through 2001

Special use type	1982	1984	1995	1996	1997	1998	1999	2000	2001
Organization camp	3	3	3	3	3	3	3	3	3
Resort	17	17	17	19	19	18	18	18	19
Skiing	3	3	4	4	4	4	4	4	4
Recreation residence	100	100	100	100	100	100	100	100	100
Outfitter/guide	110	118	118	132	135	100	147	134	127
Roads	–14	12	34	34	33	38	37	35	35
Research	–	1	–	–	15	17	16	13	19
Utilities/communications	–	67	38	37	46	46	48	42	47
Water use	–	78	79	82	79	74	75	74	93
Other	–	65	–	76	70	8	21	35	48
Total	448	461	460	507	523	443	491	483	510

Table 15. Categorization of special use authorizations by year for 2002 through 2009

Special use type	2002	2003	2004	2005	2006	2007	2008	2009
Organization camp	3	3	3	3	3	3	3	3
Resort	18	18	18	18	18	18	17	17
Skiing	4	4	4	4	4	4	4	5
Recreation residence	100	100	100	100	100	100	100	100
Outfitter/guide	121	91	126	97	114	108	112	130
Roads	18	18	–	–	41	41	43	45
Research	5	6	8	7	15	12	20	26
Utilities/communications	42	47	47	47	45	48	44	45
Water use	84	89	90	90	88	92	91	93
Other	30	16	45	54	68	71	74	79
Total	460	432	481	458	496	497	508	543

[14] Data gaps are represented in the table as "–." The corresponding chart addresses data gaps by straight-line bridges between the years preceding and following a data gap.

Figure 5. Categorized chart of special use authorizations by year for 1982, 1984, and 1995 through 2009

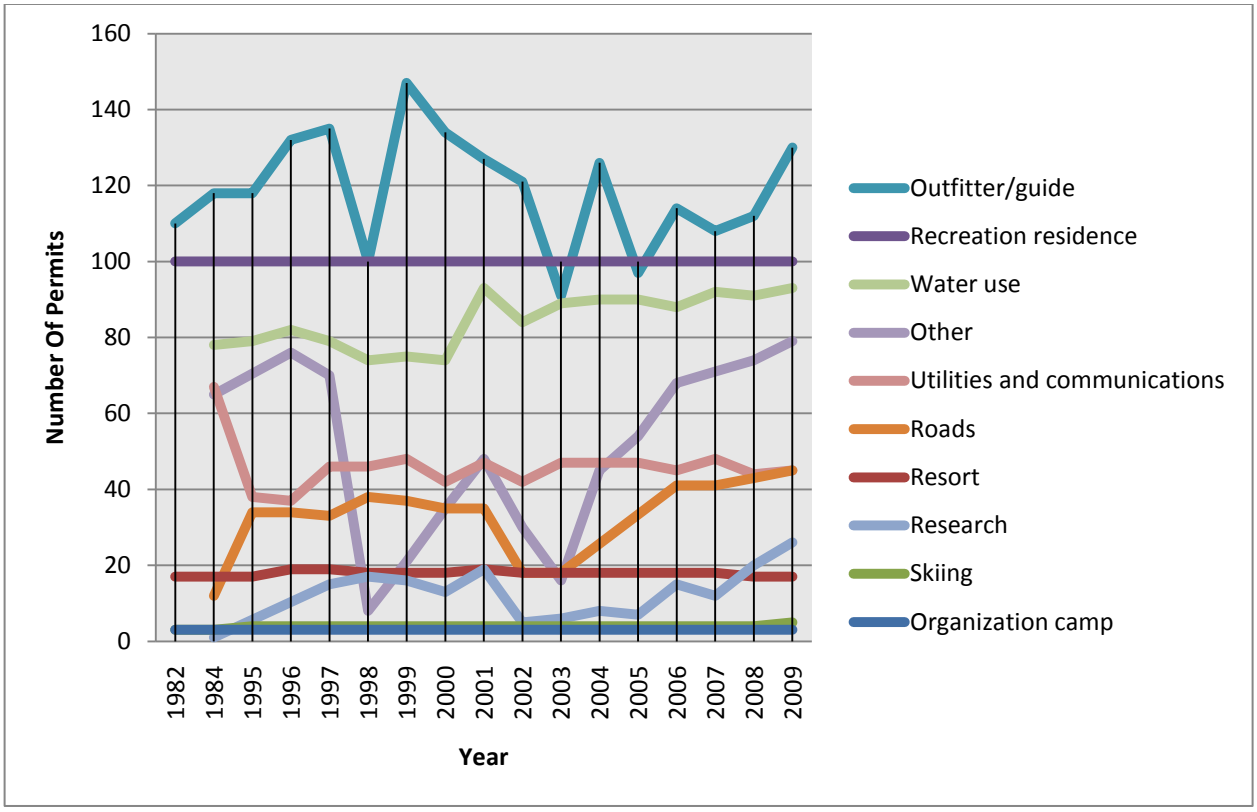
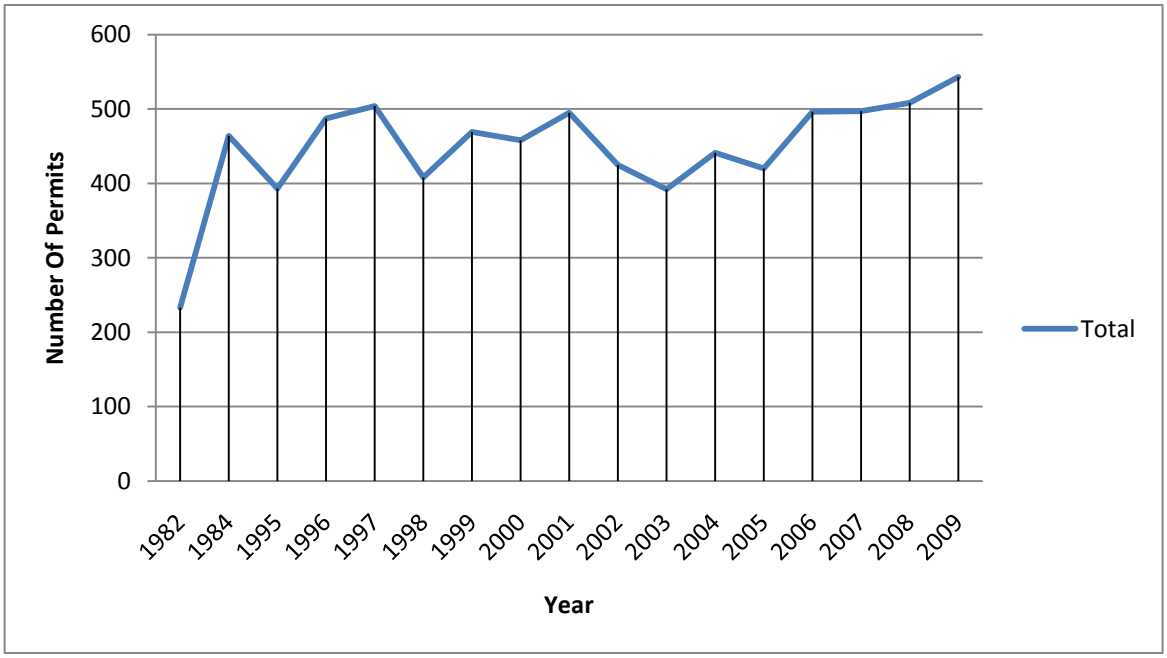


Figure 6. Chart showing total special use authorizations by year for 1982, 1984, and 1995 through 2009



Compliance with the Forest Plan is a condition for issuance of special use authorizations. Additionally, a number of special use facilities and activities are monitored each year for compliance with the terms of their

authorizations. Where monitoring reveals noncompliance, the authorization holder is contacted and the use brought back into compliance (or the authorization is revoked and the use ceases). Each year, the Regional Office establishes a target number of uses to be monitored and, if warranted, subject to corrective action. Additional monitoring may be conducted based on available staffing, available funding, and on-the-ground priorities.

Table 16. Special use monitoring, 2006 through 2009

Special use monitoring	2006	2007	2008	2009
Target	128	146	85	187
Number monitored	175	235	134	219

Land ownership

Condition and trend

Land ownership adjustment

Approximately 99.8 percent of all lands within the boundary of the Shoshone National Forest are federally owned and managed by the Forest Service. Where these lands occur, private inholdings tend to be relatively consolidated. For these reasons, land ownership adjustments are not as common as on other units of the National Forest System, where land ownership is more fractured. Nevertheless, land ownership adjustment through purchase, exchange, and sale is a useful tool for improving land management efficiency and meeting resource management objectives.

Within the last 20 years, the most significant acquisition has been of a large number of mineral-entry inholdings on the Greybull Ranger District. This acquisition has returned virtually the entire historic Kirwin mining district to federal ownership and serves to simplify achievement of resource management objectives. Acquisition of other inholdings is desired, but limited by other priorities, the willingness of sellers, and the ability to obtain funding for acquisition of high priority parcels.

Exchanges and sales are pursued to consolidate ownership patterns (simplifying management), to resolve encroachments on National Forest System lands, and to eliminate unneeded administrative facilities.

Table 17. Shoshone National Forest acreage for 1986, 1991, 2005, and 2009

Year	Acres
1986	2,433,125
1991	2,432,990
2005	2,437,218
2009	2,437,217

Table 18. Acres of land acquired, 1986 through 2009

Year	Transaction	Acres
1986	Wyoming Game and Fish	160
1991	Deer Creek Trailhead	1
1992	Kirwin	3,843
1996	South Fork Exchange	103
1998	TE Ranch Exchange	365
2002	Dunrud	589
	Total	5,061

Table 19. Acres of land disposed, 1986 through 2009

Year	Transaction	Acres
1986	Wyoming Game and Fish	161
1988	Goodyear	3
1989	Julien	1
1991	Stuart	3
1996	B4 Ranch	1
1996	South Fork Exchange	157
1997	Les Terry	< 1
1998	TE Ranch Exchange	55
2008	Meeteetse	< 1
2009	Cody Dwelling	< 1
	Total	382

Of the land ownership adjustment cases, the Small Tracts Act identified in Table 19 (except only the Goodyear sale) were pursued to resolve occupancy trespasses. Similarly, of the exchanges, the South Fork Exchange was pursued for reasons that included occupancy trespass. From 2006 through 2009, the single significant occupancy trespass that was not resolved through a land ownership adjustment was associated with a property commonly known as the Wright Place (Homestead Entry Survey 49). It involved a trespassory cabin entirely on National Forest System lands and within the Clarks Fork Wild and Scenic River corridor. It was resolved by the removal of the cabin in 2009. Minor trespasses, for example, encroachment by fences or other minor structures, are resolved by removing the structures as they are discovered, and as available staffing and funding allow. In certain instances, a temporary special use authorization may be put in place pending removal.

In addition to the adjustment of fee simple absolute land ownership interests, i.e., the exchange, sale, and purchase of entire properties, partial interests and, in particular, rights-of-way are also pursued. Two

administrative use road rights-of-way were acquired in 2009: one from JCK, LLC (Forest Road 366.1E) and one from Mooncrest Ranch (Forest Roads 402 and 402.2A).

Surveying

Cadastral surveying is an integral part of the Shoshone's lands program. Each year, the Regional Office establishes a target number of miles to be surveyed.

Table 20. Land line surveying, 2006 through 2009

Land line surveying	2006	2007	2008	2009
Target (miles)	8	15	10	10
Number monitored	16	19.5	6.15	3.5

In 2008, difficult field conditions resulted in not achieving the target. In 2009, underachievement was caused by 1) focusing of substantial surveying funding on identification of the Wright Place occupancy trespass, and 2) an inability to contract in a timely manner for surveying services. Regarding the second cause, surveying is accomplished almost exclusively by contract. The contract for these services terminated at the end of 2008; a new contract was not issued until mid-summer 2009. Only a limited number of miles were posted and/or maintained to standard during 2009.

Wildlife

Grizzly bears

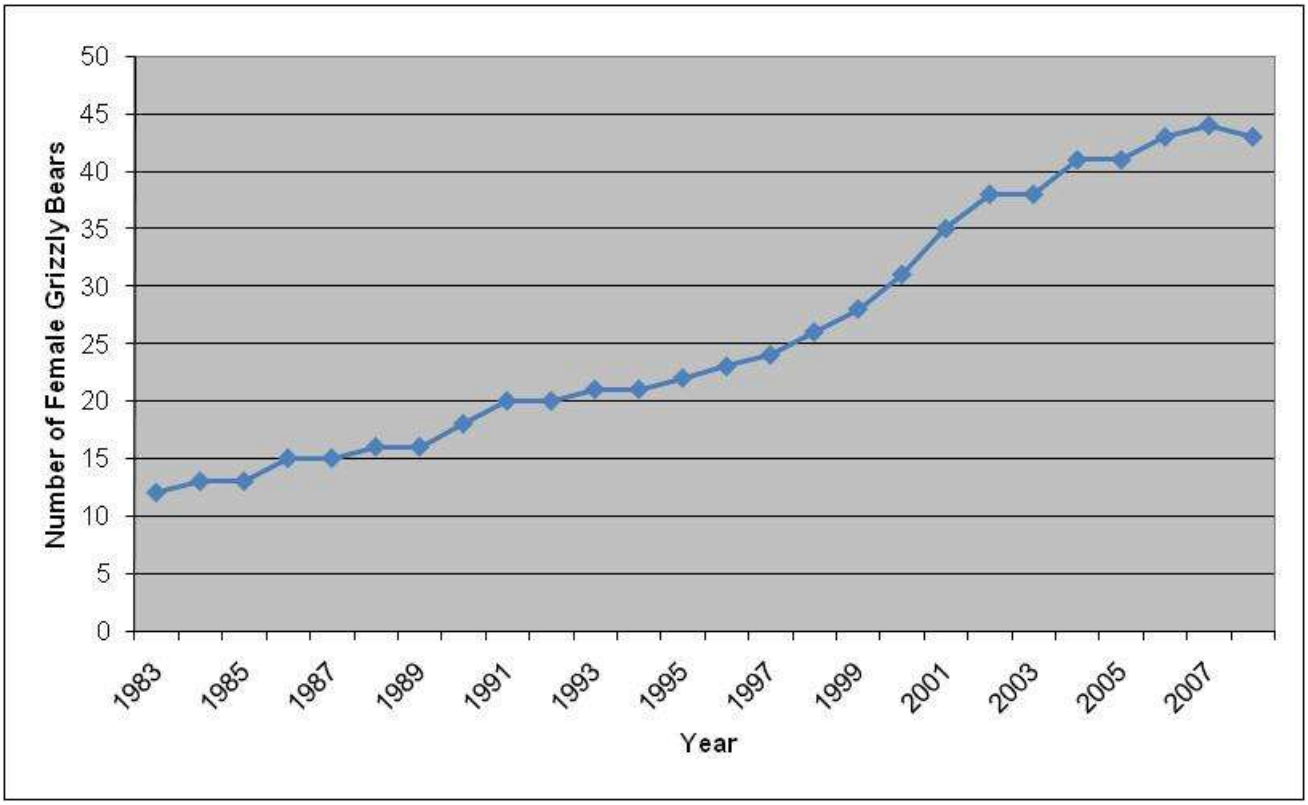
Condition and trend

The general trend in the grizzly bear population within the Greater Yellowstone Ecosystem has been steadily upward since the species came under the protection of the Endangered Species Act in 1975. Figure 7 shows the trend in the count of unduplicated females, which represents an estimate of population trend. Current population estimates are over four times greater than when grizzly bears were listed. Grizzly bears have continued to expand into new areas both within and outside the original recovery zone, with the greatest expansion south on the Bridger-Teton National Forest and east on the Shoshone National Forest. All recovery targets, except female mortality, have been met since 1998. All 18 bear management units in the Greater Yellowstone Ecosystem have been occupied at least five times in the last six years by females with young.

In April 2007, the U.S. Fish and Wildlife Service delisted the Yellowstone population of grizzly bears. The Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area was completed in 2003 and is the document that is to guide management and monitoring of the Yellowstone grizzly population after delisting. This document describes a Primary Conservation Area where stipulations to protect grizzlies are applied. The Primary Conservation Area is the same as the original recovery zone and much of this occurs on the Shoshone (1,230,000 acres). Forest plans for the six Greater Yellowstone Area national forests were amended to include direction in the Forest Plan Amendment for Grizzly Bear Habitat Conservation in the Greater Yellowstone Area National Forests Record of Decision.

In September 2009, the courts enjoined the delisting decision. As the grizzly bear is currently listed, the associated Forest Plan amendment is invalid. The fact remains, however, that the Conservation Strategy is the best available science and the monitoring required by the Strategy is indeed more applicable than the original monitoring items in the Forest Plan. Therefore, the Shoshone National Forest will continue to monitor these items in the future.

Figure 7. Number of unduplicated female grizzly bears 1983 through 2009



Evaluation

The 2009 monitoring report reports the Shoshone's responses to the following monitoring requirements as listed in the Conservation Strategy:

- Change in number of livestock allotments
- Allotments with recurring conflicts
- Change in the number of developed recreation sites
- Change in secure habitat and motorized access (inside and outside the Primary Conservation Area)

These items are monitored against the 1998 baseline data. The 2009 data for the Shoshone show:

- No change in the number of livestock allotments on the Shoshone
- One allotment is having recurring livestock conflicts
- A reduction of two in developed sites

- Two bear management subunits had very slight decreases in secure habitat: Lamar 1 and Shoshone 3 decreased 0.1 percent and 0.2 percent, respectively

Black-footed ferrets

Black-footed ferrets have not occurred on the Shoshone since the late 1980s and therefore monitoring is not possible.

This monitoring item needs to be dropped.

Wintering bald eagles

As of 2007, bald eagles are no longer a federally listed species. Although the species is still on the Region 2 sensitive species list, the Shoshone has extremely limited habitat for this species and all nests in the last several years have been on adjacent Bureau of Land Management land. The Bureau of Land Management monitors the wintering eagle populations, so data are available should the Shoshone ever need it. This monitoring item is not needed.

Gray wolves

Condition and trend

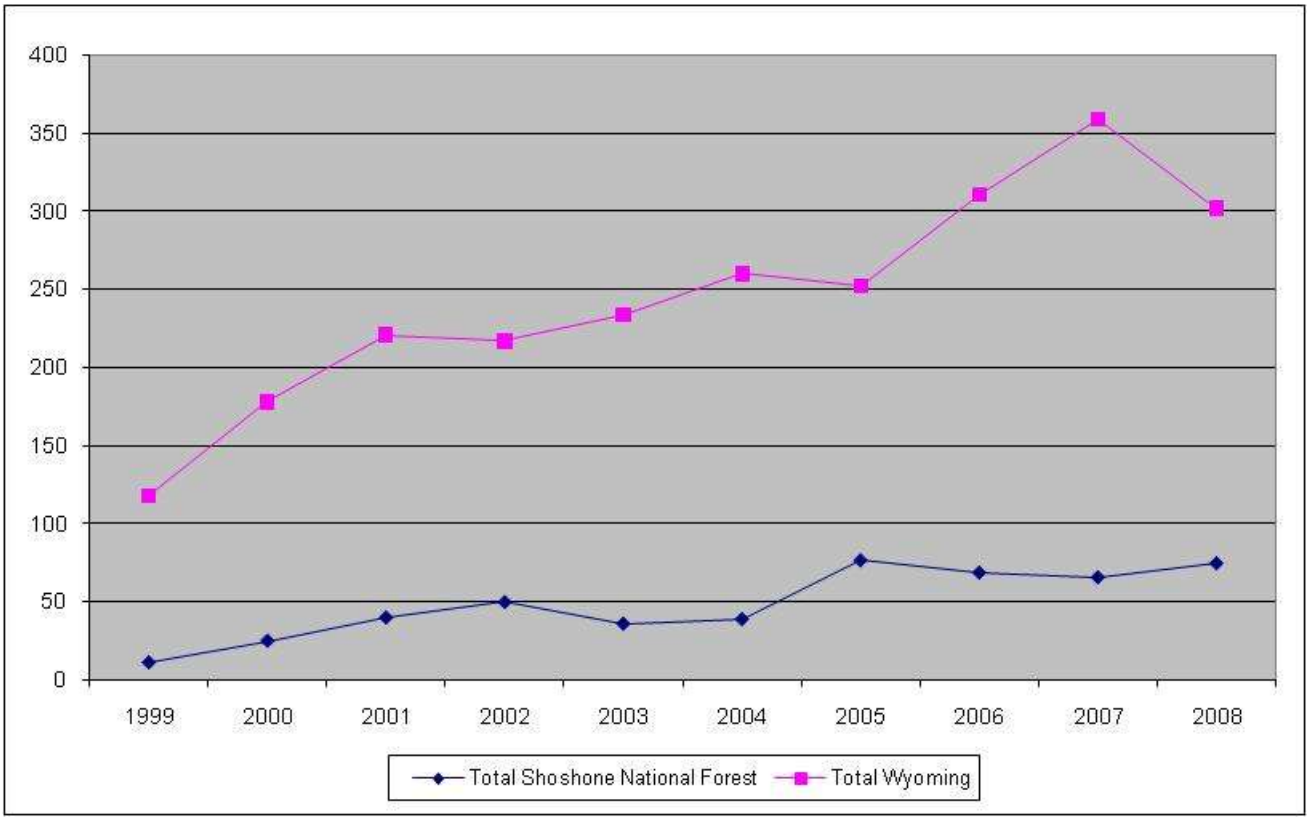
Gray wolves started moving onto the Shoshone National Forest from Yellowstone Park in 1995 after initial reintroduction efforts there. Thirty-one gray wolves from Canada were reintroduced into Yellowstone National Park in January 1995-96. Wolves have continued to increase in number and distribution on the Shoshone, as shown in Figure 8. These animals and any other native wolves that might have remained in the Greater Yellowstone Area were classified as a non-essential experimental population, as per provisions of the Endangered Species Act. In March 2008, the gray wolf was delisted. In July 2008, this delisting was overturned by the courts.

The U.S. Fish and Wildlife Service monitors wolf packs closely by keeping collars on wolves in each pack.

Evaluation

Each year more wolf packs have been established on the Shoshone, although the last few years the total numbers of wolves has stabilized somewhat, mostly because of management removal when wolves depredate livestock. The number of wolves in Wyoming is starting to stabilize for the same reason. When wolves disperse into areas without a large prey base and with livestock, removal is frequent. If wolves were delisted, the Wyoming Game and Fish Department would be in the lead for monitoring. Monitoring efforts for this species are likely to continue.

Figure 8. Gray wolf numbers in Wyoming and on the Shoshone National Forest



Cavity dependent species

Given the ongoing insect and disease epidemic and the resulting large number of dead trees occurring on the Shoshone, snag habitats are very abundant and will be for several decades. This item does not need to be monitored in the future.

Winter range carrying capacity

Winter forage use for the Whiskey Mountain bighorn sheep herd on the Wind River Ranger District was monitored by Wyoming Game and Fish Department, Bureau of Land Management, and Forest Service personnel. This has been an ongoing monitoring effort for around 40 years. Forage condition was measured using vegetation clipping and by calculating pounds of forage produced per acre on several sampling transects both on and off the Shoshone.

Winter range forage production fluctuates from year to year, due in large part to drought conditions. Figure 9 and Figure 10 show the two transects on the Shoshone that are part of the Whiskey Mountain bighorn sheep herd range. Fall clippings show that spring production on these two sites was among the highest herbaceous production since monitoring began in 1974.

Figure 9. Herbaceous production for Whiskey Basin sheep west

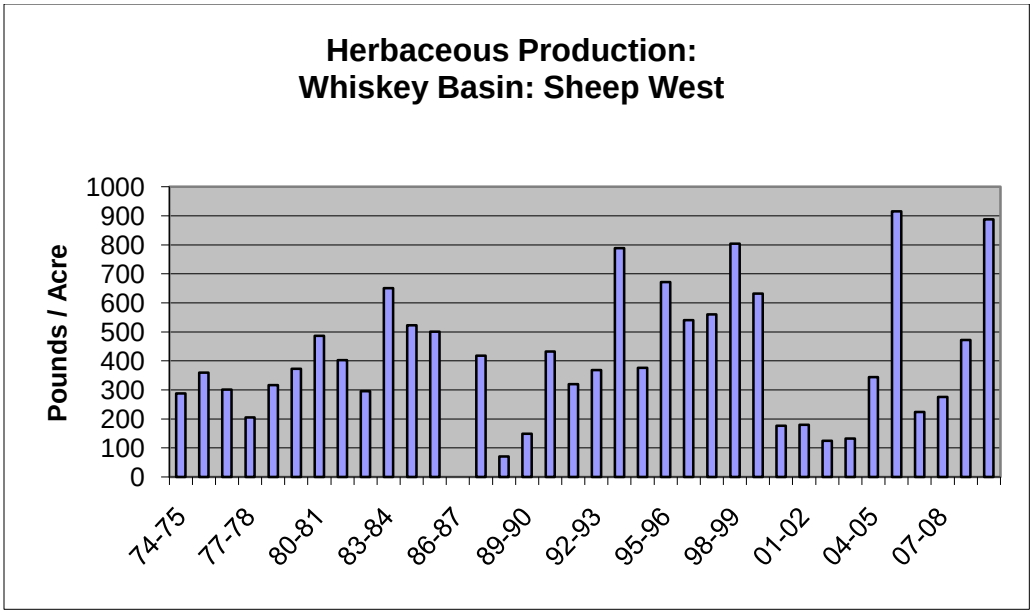
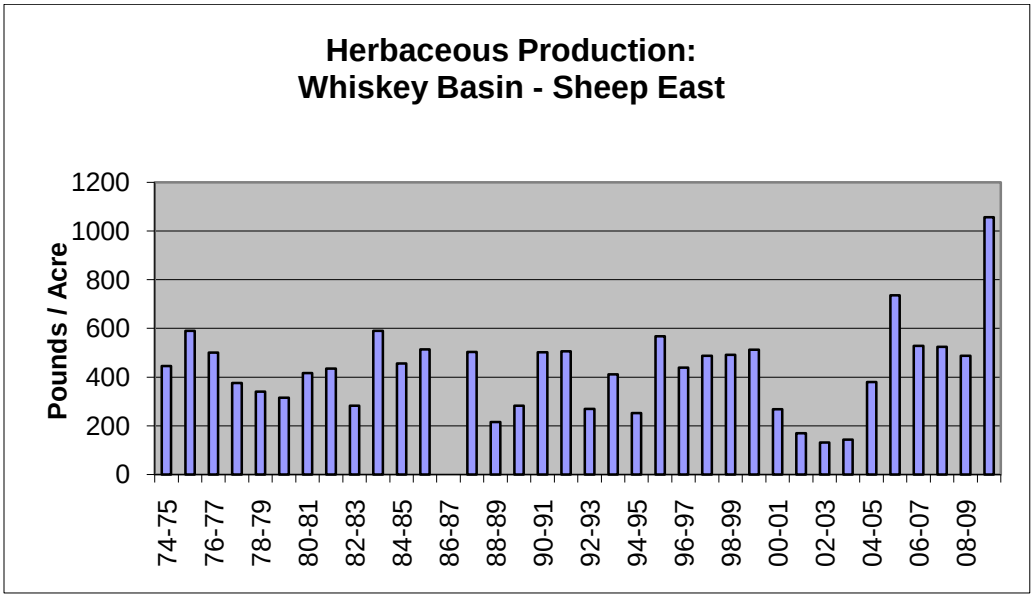


Figure 10. Herbaceous production for Whiskey Basin sheep east



The Elk Fork and Sweetwater Creek areas in the North Fork winter range were surveyed during April 2009 prior to green-up. Utilization of herbaceous vegetation appeared rather light. Small, scattered groups of elk were observed but the amount of sign did not indicate large concentrations of animals had been present. A survey was conducted on Little Bald Ridge in the Sunlight winter range during May 2009. Green-up had already begun but winter grazing patterns were still obvious. Areas that had not been protected by snow had obvious utilization with relatively little residual herbaceous vegetation. Aspen is limited in this area, but browsing of suckers around the few small clones in the area was obvious. Large groups of elk plus a few bighorn sheep and

deer were still present on the winter range, as they had not yet migrated to summer ranges in Yellowstone National Park.

Evaluation

This and other monitoring over recent years indicate that range conditions are generally stable to improving. Winter range is an important resource that can be a limiting factor for wildlife. As mentioned earlier, drought conditions lead to fluctuations in winter range conditions. The decline in livestock numbers on the Shoshone over the last decade has reduced some of the concern about overuse of winter range areas by livestock.

Wildlife and fish habitat improvements

In fiscal year 2009, the following wildlife habitat improvements were accomplished:

- 500 acres of weed treatment in winter range
- 90 acres of aspen restoration
- 3,200 acres of grizzly bear habitat improvement
- Additional vegetation treatments on 2,681 acres

Evaluation

This is typical accomplishments (in number of acres and type) plus an increase in accomplishment over previous years mainly due to additional grizzly bear money that was provided in a financial earmark to the Shoshone.

Management indicator species

Peregrine falcons

Condition and trend

Figure 11. Number of peregrine nests over time

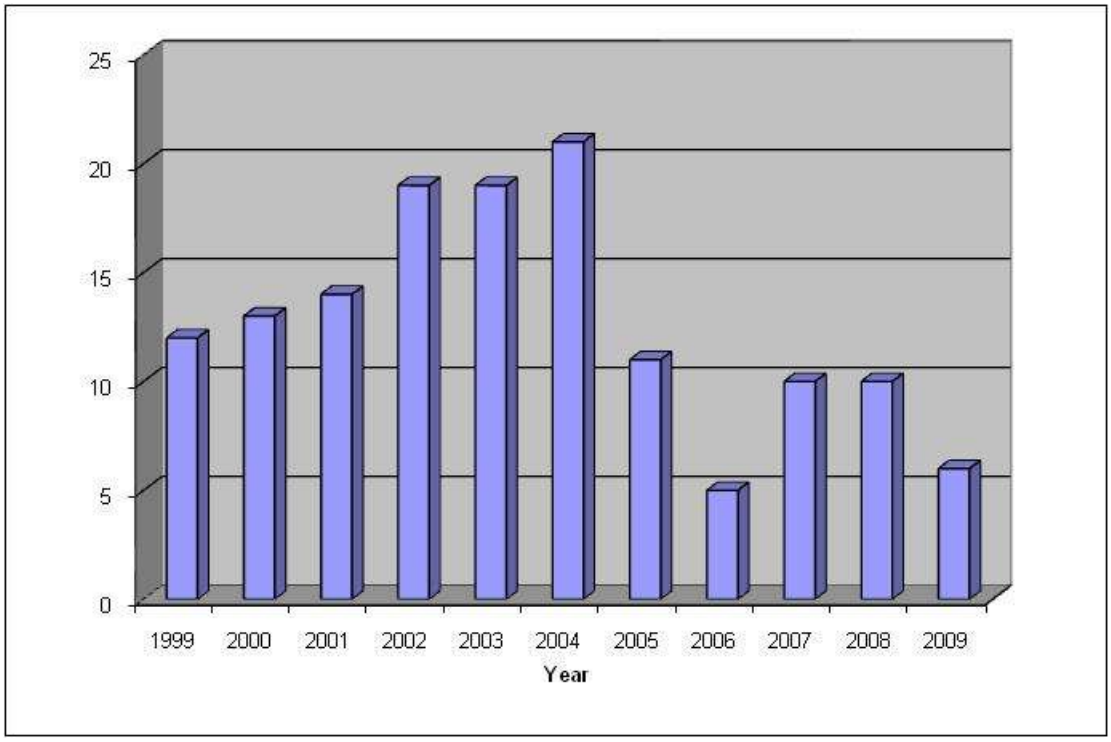
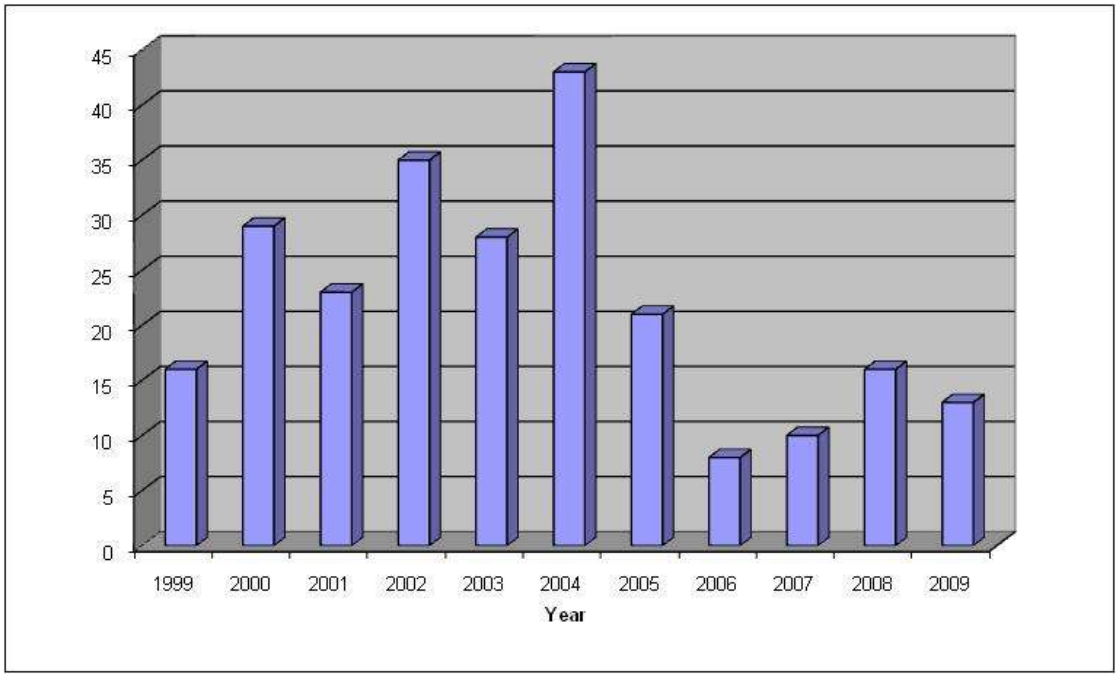


Figure 12. Number of peregrine fledglings over time



Evaluation

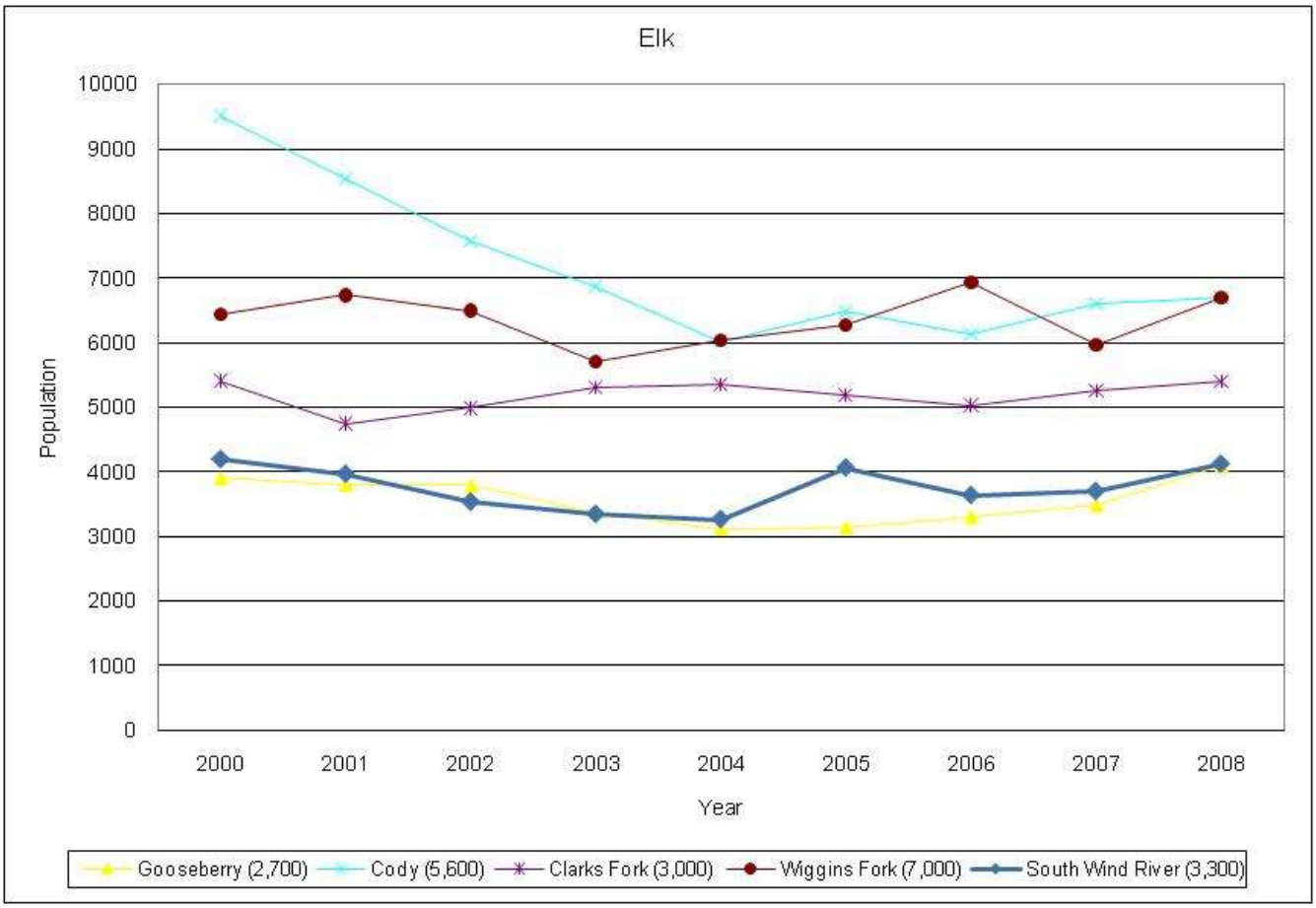
Since its delisting, the peregrine population has continued to expand its distribution, but due to financial constraints, monitoring efforts have decreased. Figure 11 and Figure 12 show downward trends for both nest sites and number of fledglings in the last several years. However, these apparent trends are more indicative of a downward trend in monitoring over the last several years than of an actual downward population trend. Now that peregrines have been delisted for several years, and nesting distribution has expanded sufficiently, the Wyoming Game and Fish Deaprtment reprioritized their monitoring efforts toward more imperiled species.

Elk

Condition and trend

Figure 13 shows the population trend for herds on the Shoshone.

Figure 13. Population trends for elk herds on the Shoshone National Forest



Evaluation

Elk herds across the Shoshone are fairly stable. There was a slight decline in 2003 due to low calf ratios and the Wyoming Game and Fish Department overcorrected for this by restricting hunting opportunities and then populations grew too much. The population of the Cody herd increased after the 1988 fires and then decreased through Wyoming Game and Fish Department efforts to move the population toward the herd objective.

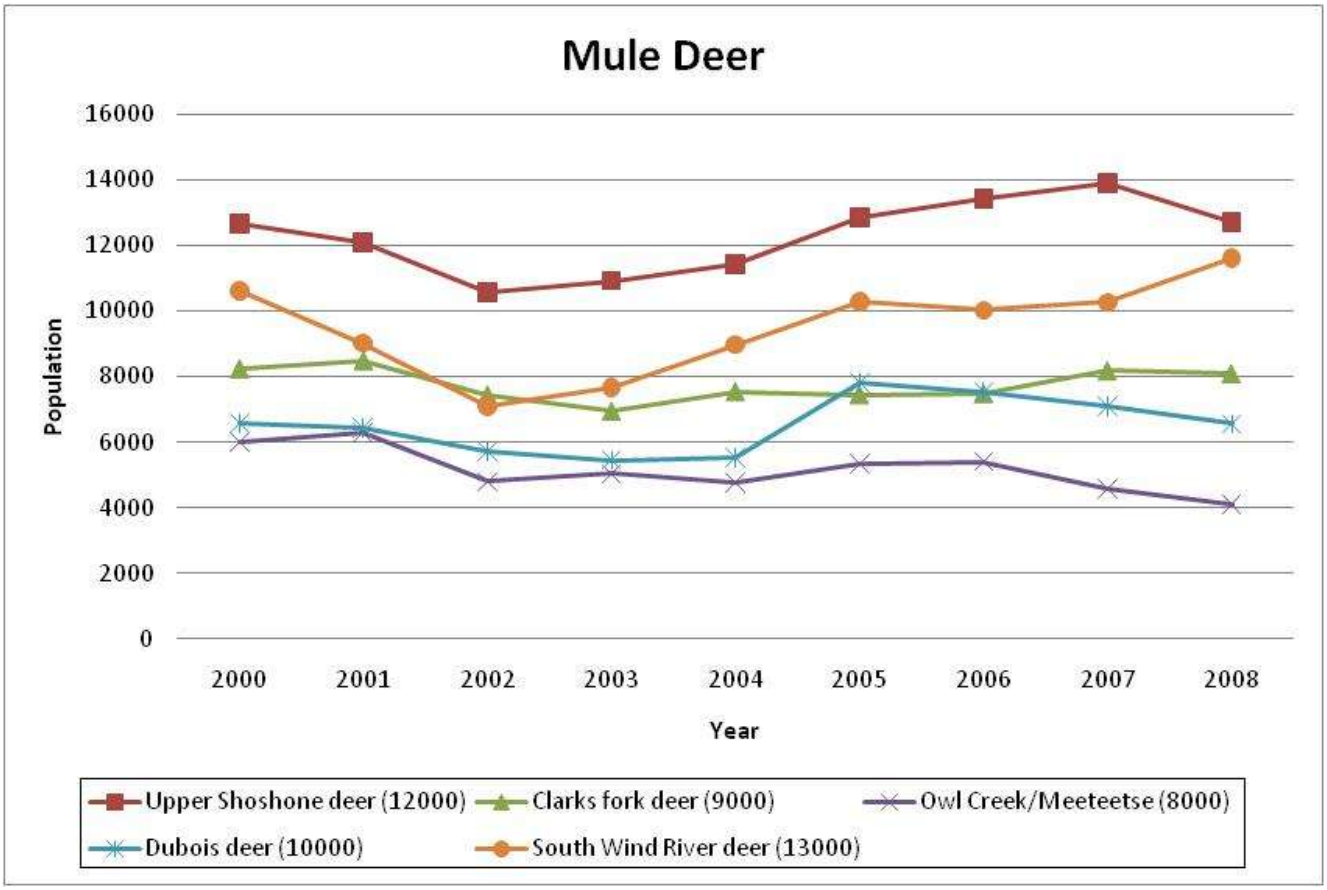
In general, the portions of the elk herds closer to Yellowstone Park have lower calf recruitment, probably because of more predators and lower nutritional resources, and the more front country herds have normal or above normal recruitment, even with liberal hunting seasons.

Mule deer

Condition and trend

Figure 14 shows the population trends for the mule deer herds on the Shoshone over the last several years.

Figure 14. Population trends for mule deer herds on the Shoshone National Forest 2000 through 2008



Evaluation

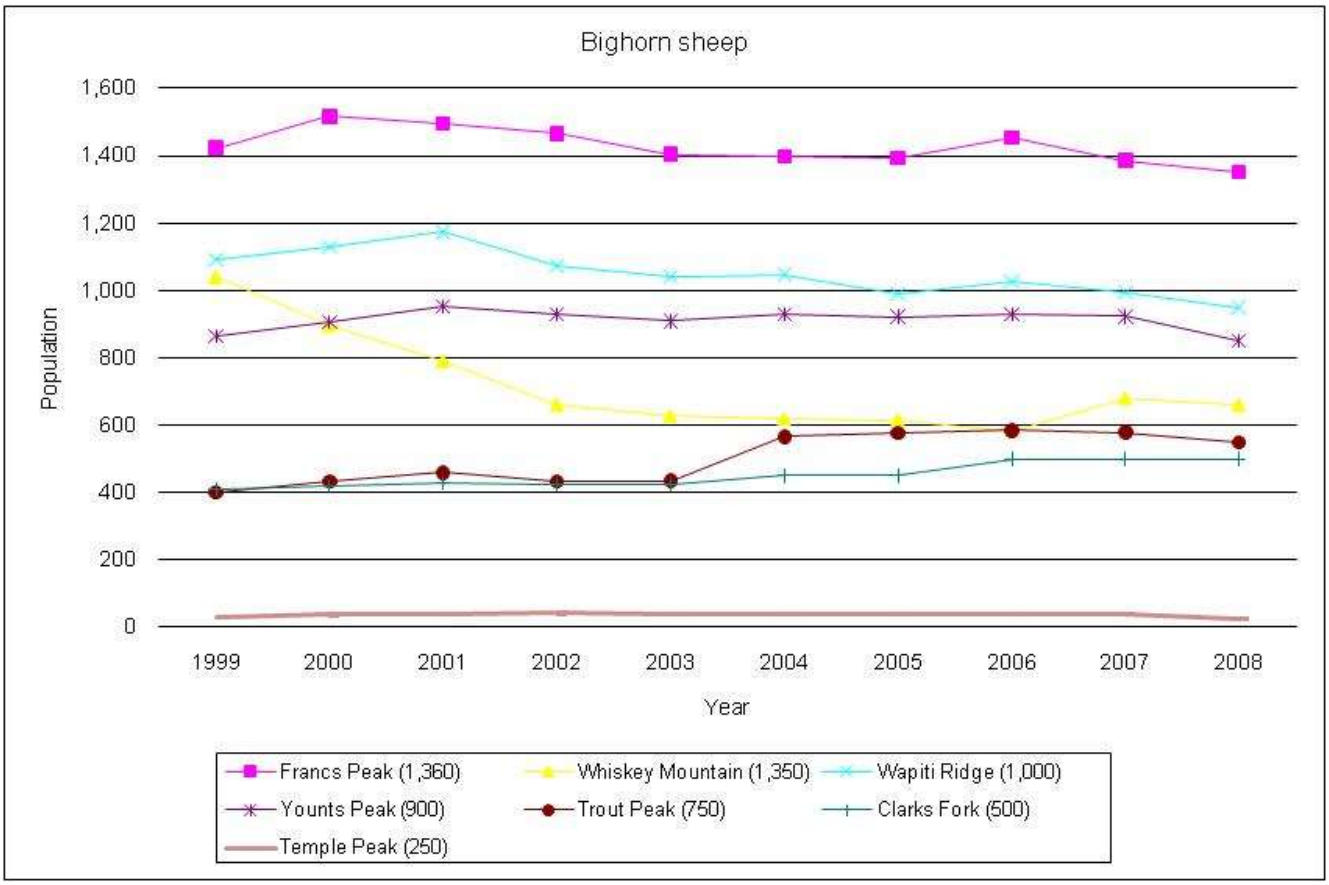
Many deer herds are below objective because the habitat in many of these areas is not able to meet the needs of the objective-sized herds. Owl Creek is the most notable. The Wyoming Game and Fish Department has been working on the habitat issue for a number of years. In particular, the South Wind River herd has been a success story as better fawn recruitment and the success of protecting yearlings from hunters have resulted in getting closer to objective numbers.

Bighorn sheep

Condition and trend

Figure 15 shows the population trends for the bighorn sheep herds on the Shoshone over the last several years.

Figure 15. Population trends for bighorn sheep on the Shoshone National Forest



Evaluation

Most populations are below objective, but only slightly. Populations are relatively stable with the exception of the Whiskey Mountain herd, which is still re-stabilizing from the pneumonia die-offs in the early 1990s. Hunting seasons have remained relatively stable over these years.

Many bighorn sheep herds throughout the west have been struggling with diseases that are influencing population trends. Much of this problem is likely from contact with domestic livestock that can carry pathogens that bighorn sheep immune systems cannot battle. The Shoshone has no domestic sheep grazing allotments within core bighorn sheep range (defined by the Wyoming Game and Fish Department) but there is some recreational domestic goat use.

Moose

Condition and trend and evaluation

Moose generally occur in such low densities on the Shoshone that population estimates are unreliable. The Wyoming Game and Fish Department feels that the populations have declined somewhat in recent years, probably in response to increased levels of predation and lower quality habitat conditions due to drought. Both the Shoshone and the Wyoming Game and Fish Department are actively working on enhancing moose habitat in various locations.

Brewer's sparrows

Condition and trend

Since it began in 2002, the Monitoring Wyoming Birds project has produced data on this species. Although the species appears to be in decline regionally, local monitoring has shown it appears to be common where high quality habitat exists in Wyoming and on the Shoshone (Table 21).

Data from 2002 to 2009 from the Monitoring Wyoming's Birds project for the Shoshone indicate the species is at high densities in grassland, shrub, and juniper habitat types and at lower densities in mid-elevation conifer and montane riparian habitat. Grassland and shrub habitats are plentiful on the Shoshone, although the recent drought has reduced quality somewhat.

Table 21. Densities of Brewer's sparrows (birds/kilometer) in various habitats

Year	Shoshone National Forest montane grasslands
2002	15
2003	16
2004	2
2005	6
2006	31
2007	31
2008	35
2009	23

Evaluation

Brewer's sparrows are doing well on the Shoshone, even with the less than great sagebrush conditions.

Northern goshawks

Condition and trend

Breeding Bird Survey data for goshawk suggest a markedly increasing trend (4.4) in the central Rockies for the last seven to eight years (1986 through 2007). Data for the same region from 1980 through 2003 indicate a stable to slightly positive trend of 0.4 percent per year. Data collected on the Shoshone National Forest indicate the species is present but uncommon. Surveys of old nesting areas and surrounding habitat were conducted in 2002 and 2003 and no nests were discovered. In 2004, in partnership with the Wyoming Natural Diversity Database, surveys were performed again in areas where earlier nests had been found. Two nests

were discovered. Monitoring efforts later in the summer of 2004 failed to confirm whether these nests produced young. Surveys in 2005 confirmed three active nests. No fledgling counts were conducted in 2005. In 2006, Region 2 implemented the first phase of the National Goshawk Protocol and surveyed five blocks of primary habitat on the Shoshone, out of which two blocks were occupied by goshawks. In 2009, this protocol was run again and three habitat blocks, out of 10 surveyed, were occupied.

Evaluation

Goshawks are probably doing pretty well on the Shoshone. They are seen with some regularity even in less than ideal habitat.

American marten

Activity and condition trends

Forest Service personnel commonly see marten in suitable habitats. Some monitoring was completed in the winter of 1995-1996 by snow tracking along snowmobile routes on the northern and southern ends of the Shoshone. Marten tracks were encountered at a frequency of 0.7 tracks per mile. Many of these same routes were again surveyed in the winters of 2002-2003 and 2003-2004. Surveys in 2002-2003 had good snow conditions and recorded over 50 marten tracks. Snow conditions in 2003-2004 were much poorer and resulted in less snow tracking. Marten tracks were still seen frequently. Additionally, a crew surveying for lynx tracks in the Beartooth Mountain area of the Clarks Fork Ranger District in the winter of 2001-2002 gathered information on marten occurrences. This crew recorded marten tracks while looking for lynx tracks, and they found over 40 marten tracks.

Evaluation

Marten are common on the Shoshone and probably have a stable trend. Local trappers are still successful in trapping marten with similar effort over the past decades. During the winters of 2005-2006 and 2006-2007, marten were commonly accidental captures in wolverine live traps on the northern end of the Shoshone

Blue and ruffed grouse

Condition and trend

The Wyoming Game and Fish Department collected harvest data for this species for some years, but the agency no longer collects these data. For both species, the trends were fairly stable. Blue grouse habitat is plentiful on the Shoshone and individuals are often seen by Forest Service personnel. Ruffed grouse habitat is declining with conifer encroachment in many aspen areas, especially on the northern portion of the Shoshone. Ruffed grouse data from the Breeding Bird Survey taken from 1986 through 2007 for the central Rockies indicate a slight downward trend (-0.9) (summarized as a percent change per year).

Data for the blue grouse for the same years and region indicate a negative trend (0.8).

Evaluation

These species are probably somewhat stable in their population trends as we know from the trends in their habitats and the lack of other factors affecting them.

Beavers

Condition and trend

Bank dwelling beavers are scattered through most major drainages on the Shoshone where suitable habitat occurs. In 1996, observations of lodges, dams, or colonies were made by Mark McKinistry and Carter Kruse in the following locations: Sweetwater drainage (Rock and Beaver Creeks), Little Popo Agie (Pass, Snow, and Cherry Creeks), Middle Fork Popo Agie (Sawmill, Townsend, and Roaring Fork Creeks), North Fork Popo Agie (Sanford Park), Wind River (Torrey, Jakey's Fork, Horse, Sixmile, Trout, South Fork Fish, and Sheridan Creeks, and Upper Wind River), Clarks Fork (Sunlight, Gilbert, and Lake Creeks, and Libby Lake area), and Greybull River (West Timber Creek).

In 2004, surveys on the southern part of the Shoshone revealed signs of beavers in Brooks Lake Creek, Warm Spring Creek, Coyote Creek, Sheridan Creek, Wind River, Horse Creek, Willow Creek, and Beaver Creek.

In the fall of 2007, almost 900 miles of streams were surveyed for beavers and 149 locations of beaver activity were observed, with the majority observed on the Washakie Ranger District. Beaver activity appears to be linked strongly with willow communities. Beavers have declined over time due to drought, lack of dominant deciduous vegetation in riparian areas, and perhaps trapping.

Evaluation

Beavers appear to be associated with large communities of willows, which are not very prevalent on the Shoshone other than on the Washakie Ranger District. It is unlikely that beavers will ever be common in the Absaroka volcanics of the northern portion of the Shoshone. The lack of beavers in the other areas may indeed signify a lack of the quality riparian habitat.

Hairy woodpeckers

Condition and trend

The hairy woodpecker was not recorded on any Monitoring Wyoming's Birds transects, which is not surprising as woodpeckers are not as vocal as songbirds. Breeding Bird Survey data for the central Rockies from 1986 to 2007 show a slight downward trend (-3.6) (summarized as a percent change per year). Forest Service personnel report seeing hairy woodpeckers while in the field, indicating that hairy woodpeckers do occur, though they are uncommon on the Shoshone. In the last five years, habitat conditions for hairy woodpeckers have improved as densities of snags have increased due to the insect and disease epidemic in forest vegetation.

Evaluation

Although hairy woodpeckers may be uncommon on the Shoshone, habitat suitability is high. With the insect and disease factors at work creating a continuous supply of snags, all woodpecker species are benefitting. Hairy woodpeckers particularly prefer aspen snags and aspens have not been affected by the current pathogens, but the loss of conifers may be opening up more suitable conditions for aspens than we have seen in decades.

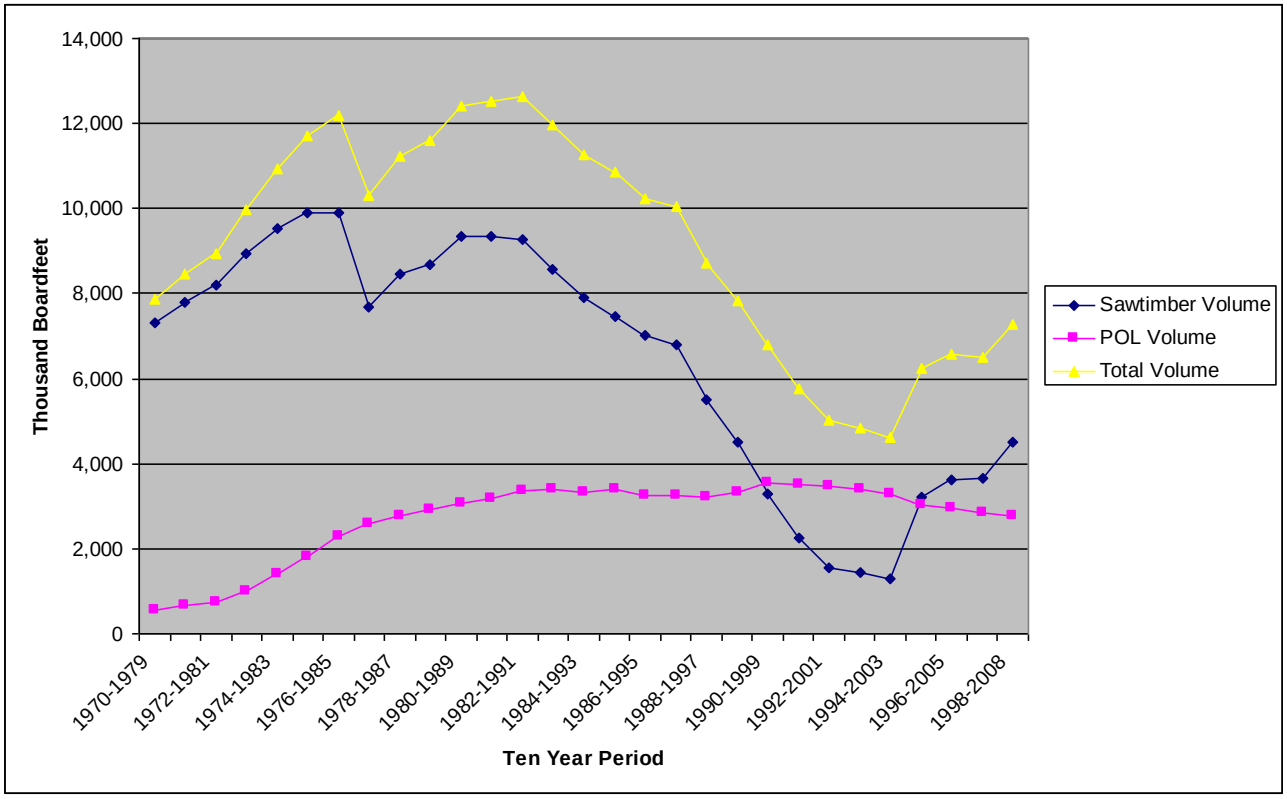
Timber

Allowable sale quantity

Condition and trend

The Forest Plan set an average annual allowable sale quantity volume of 11.2 million board feet. The Forest Plan set this amount as the maximum allowable harvest of timber from the suitable timber land base of approximately 86,000 acres. In the early 1990s, monitoring indicated that timber data and assumptions used in the Forest Plan analysis had overestimated the amount of timber the Shoshone could produce. This, combined with the 1988 fires that burned over 9,000 acres of suitable timber land, resulted in the need to amend the Forest Plan. The Forest Plan was amended in August 1994 with a recalculated allowable sale quantity. The amendment changed the annual average volume to 4.5 million board feet of sawtimber and products other than logs. The 4.5 million board feet includes 1 million board feet of standing dead trees that are cut for personal use firewood from suitable lands. Volume in addition to the allowable sale quantity is obtained from the unsuited base. One million board feet of personal use firewood and 1 million board feet of volume are cut for other vegetation management purposes. Other reasons include wildlife habitat improvement, enhancement of scenic views, hazard tree removal, or other ecosystem management reasons. The amendment directed that all salvage volumes offered for sale would count toward allowable sale quantity.

Figure 16. Average annual harvest for rolling ten-year periods



Data from Table 22 are displayed in Figure 16 using a rolling 10-year average to smooth out the year-to-year fluctuations that make it difficult to discern trends.

Total average annual volume harvested fell steadily through the1990s, until an increase in 2004. The volume of products other than logs sold since 1986 has averaged slightly over 3 million board feet per year. Volume for products other than logs remained relatively stable during that period. Sawtimber volume sold has fluctuated greatly since 1986. Sawtimber volume sold has averaged 5.5 million board feet since 1986. Since 1997, sawtimber volume sold has averaged 4.2 million board feet. During the late 1990s and early 2000s, sawtimber volume sold was as low as 0.1 million board feet.

The large fluctuations in total saw timber volumes were driven by salvage sales in response to large disturbance events such as the 1988 wildfires and the recent insect epidemic.

Limited quantities of other forest products, such as Christmas trees, mushrooms, pine cones, etc. are collected on the Shoshone and contribute to the social and economic environments.

Table 22. Volume sold and harvested, by product, in thousand board feet[15]

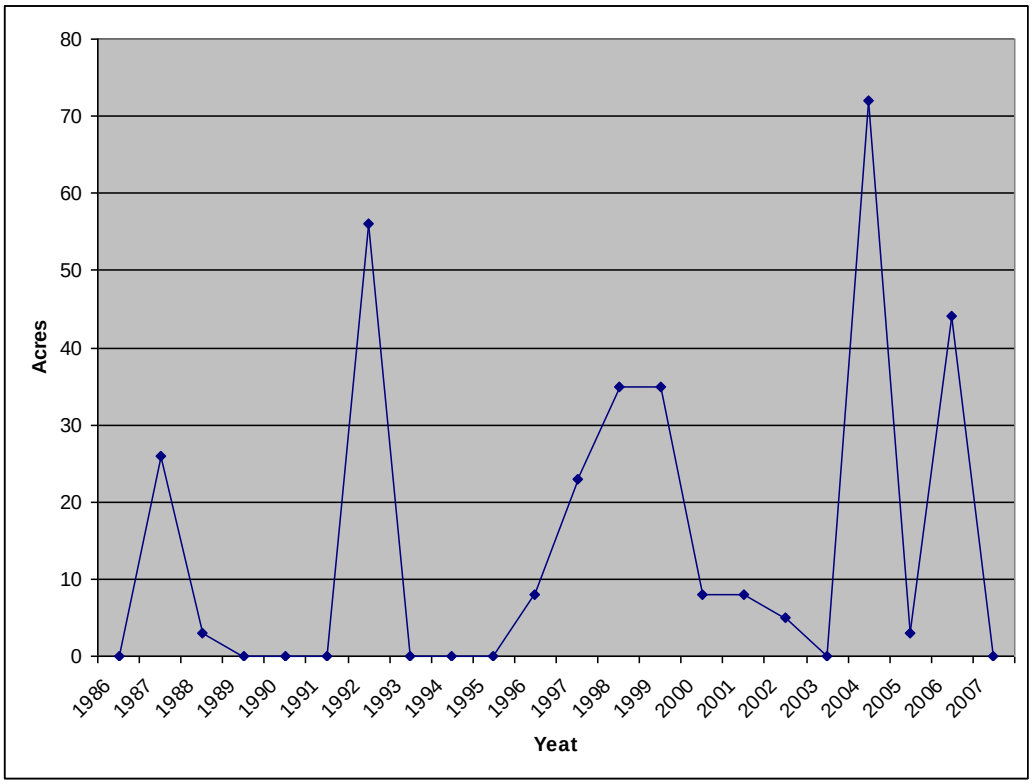
Fiscal year	Sawtimber sold	Products other than logs sold	Total		Sawtimber harvested	Products other than logs harvested	Total
1970	5,777	427	6,203		11,519	501	12,020
1971	3,735	348	4,083		11,569	388	11,957
1972[16]	--	--	1,177		--	--	3,678
1973	--	--	3,777		--	--	7,798
1974	--	--	3,335		--	--	6,121
1975	--	--	5,200		--	--	2,852
197617	26,731	796	27,527		3,996	341	4,337
1977	7,723	1,370	9,093		5,557	998	6,555
1978	9,999	969	10,968		5,108	1,107	6,216
1979	6,784	635	7,419		17,187	351	17,538
1980	10,479	1,404	11,883		7,682	842	8,525
1981	7,911	1,213	9,123		10,653	1,574	12,227
1982	8,466	2,884	11,350		3,625	2,415	6,040
1983	9,107	4,174	13,281		5,366	1,749	7,115
1984	6,978	4,421	11,398		6,490	4,052	10,542
1985	4,720	5,103	9,823		11,575	4,345	15,920
1986	4,743	3,806	8,549		8,799	4,360	13,159
1987	15,410	3,262	18,672		14,639	4,824	19,463
1988	12,054	2,270	14,324		12,351	3,509	15,860
1989	13,620	2,106	15,726		5,982	2,109	8,091
1990	10,516	2,437	12,953		14,709	2,360	17,069
1991	7,104	3,292	10,395		10,055	2,489	12,544
1992	1,327	3,170	4,497		6,926	3,300	10,226
1993	2,730	3,441	6,172		4,222	2,975	7,197
1994	2,254	5,176	7,430		3,965	3,790	7,755
1995	284	3,420	3,705		1,141	3,796	4,936
1996	2,850	3,784	6,634		2,234	3,627	5,861
1997	2,241	2,970	5,211		1,732	3,975	5,707
1998	2,315	3,359	5,674		385	5,230	5,615
1999	1,158	4,250	5,408		1,289	4,092	5,380
2000	400	2,202	2,602		2,020	1,611	3,631
2001	112	2,923	3,035		1,068	2,895	3,962
2002	4	2,466	2,471		630	2,619	3,250
2003	1,410	2,458	3,868		1,044	2,591	3,635
2004	21,373	2,538	23,911		5,762	2,465	8,226
2005	4,369	2,596	6,965		11,939	2,731	14,670

[15] Data from Eilers 2009. Numbers in this table were rounded up to the next whole number.
[16] Cut and sold data by product are not available for fiscal years 1972 through 1975 (totals only).
[17] Fiscal year 1976 data include the transition quarter.

Fiscal year	Sawtimber sold	Products other than logs sold	Total		Sawtimber harvested	Products other than logs harvested	Total
2006	3,352	2,589	5,941		7,947	2,914	10,861
2007	10,713	2,145	12,857		3,724	2,271	5,995
2008	4,192	2,323	6,515		6,563	1,975	8,538
2009	6,003	3,753	9,756		7,498	2,864	10,362

As shown in Figure 17, 326 acres have been clearcut since the Forest Plan was approved in 1986. The majority of acres clearcut were along utility corridors for rights-of-way, along highways for construction projects and visual enhancements, and on the southern districts of the Shoshone for dwarf mistletoe removal.

Figure 17. Number of acres clearcut, 1986 through 2007



The following economic information is from "An Economic Profile of the Shoshone National Forest." Additional information on the timber industry in Wyoming is found in "The Dynamic Wyoming Timber Economy."

The lumber and wood products industry in the three-county area has declined. After peaking in 1978, labor earnings from lumber and wood products declined steadily from $14.3 million to $2.0 million in 2000. With the recent closure of the sawmill in Cody, labor earnings from lumber and wood products in the region may have declined further. Most of the decline in labor earnings for the lumber and wood products sector in the three-county region occurred in Fremont County when a major sawmill closed in Dubois. In Fremont County, labor

earnings from the lumber and wood products sector peaked at $13.4 million in 1978 and had declined to less than $1 million in 2000.

The Forest Plan as amended established an allowable sale quantity of 4.5 million board feet of timber. The volumes have fluctuated greatly since 1986 and have recently been increasing; the average for that period is near the Forest Plan allowable sale quantity amount. For purposes of an average economic projection, calculations were based on a sawtimber harvest of 4.5 million board feet and a products other than logs harvest of 2.5 million board feet. This is slightly above the amounts in the allowable sale quantity amendment, but in line with recent harvest levels.

Because there is no major timber processor in the three-county region, the majority of sawtimber harvest on the Shoshone is exported outside the area for processing. As a result, the major economic impact to the region's economy from the harvest of sawtimber on the Shoshone is logging. For the three-county region, the economic impact of the combined timber harvest is estimated at 90 jobs and $2 million in labor earnings, including direct logging jobs and additional jobs that are generated as a result of the direct jobs.

Evaluation

Due to the bark beetle insect epidemic, it is anticipated that harvest levels will be temporarily higher than average until the epidemic subsides, fuel levels are reduced, and the volume of damaged timber is salvaged. The increased harvest levels should continue until areas of wildland urban interface can be protected and there is some value in standing dead timber. It is anticipated the demand for products other than logs will continue at or above the current levels of 2.5 million board feet. Once the salvage effort is completed, it is anticipated the Shoshone will return to a harvest level near 4.5 million board feet of sawtimber and 2.5 million board feet of products other than logs. In the near term, the slightly higher volumes will result in proportionally higher economic benefits to the three-county region. In the long term, these levels of harvest may be difficult to maintain since 26 percent of the suitable base falls with inventoried roadless areas where timber cutting is restricted.

Reforestation

A specific discussion on restocking clearcuts is found below. This section focuses on reforestation of other types of regeneration harvest or from plantations resulting from natural disturbances.

Condition and trend

First, third, and fifth year regeneration surveys are performed on natural regeneration and on planted stock. Plantations are monitored through stake-row surveys. Monitoring protocols are outlined in chapter 2.7 of the Silvicultural Practices Handbook (Forest Service Handbook 2409.17). When stands meet or exceed minimum stocking standards, the stand is certified as fully stocked. If the stand is not regenerating naturally or plantation survival is poor, additional reforestation recommendations will be made by the fifth year survey.

In fiscal year 2008, we planted seedlings in areas devastated by the ongoing beetle epidemic after salvage operations on Carter Mountain (58 acres), Horse Creek (16 acres), and Moccasin Basin (10 acres), for a total of 84 acres of lodgepole pine and Englemann spruce. After the first summer, the survival rate was 55 percent at Carter Mountain, 18 percent at Cartridge Creek, and 92 percent at Moccasin Basin. In fiscal year 2009, seedlings were not planted. In fiscal years 2008 and 2009, we conducted natural regeneration surveys in

burned areas, mostly in areas burned in the 1988 fires on the Clarks Fork Ranger District. We have been certifying as naturally regenerated about 1,100 acres in each of those years. This is taking care of the backlog of areas that have burned.

Acres surveyed for regeneration of trees in the first, third, and fifth years after timber sales are conducted each year. In 2008, we surveyed 1,816 acres and were able to certify 493 acres. In 2009, we surveyed 2,803 acres and were able to certify 218 acres.

Evaluation

Survival percentages showed a wide range of variation, depending on species planted or evaluated, and microsite conditions at individual planting sites. Some of the third year plantation survival surveys, particularly for lodgepole pine, showed dramatic declines in survival from first year surveys due to the extended drought. However, while resurveyed stake rows showed lower survival rates, the presence of natural regeneration (of varying species) increased in most cases. Many of the planted stands that were certified in 2002 contained a high percentage of naturally regenerated seedlings that contributed to full stocking. Many other lodgepole plantings, however, have survived well and many were certified as fully stocked.

Whitebark pine survival on non-suited acres also varied greatly. Upland sites at higher elevations with low grass/forb competition survived better than lowland sites where ungulate grazing, browsing, or trampling diminished survival. This occurred in the Squaw Creek, Trail Creek, and East Fork Painter Gulch units on the northern part of the Shoshone.

The greatest factor in lowered survival on whitebark units planted in fiscal year 2002 was the late arrival of the seedlings, low soil moistures, and the competition with other national forests for the same planting contractor. The nursery releases whitebark pine stock for summer-fall planting, beginning around the middle of June. In normal or above average moisture years on whitebark pine sites, this timeframe would be soon after snow melt when available soil moisture is high and soil temperatures are appropriate. However, due to the extended drought and below normal snow pack, snowmelt occurred by the middle of May on most of the planting sites. This resulted in droughty soils with higher soil temperatures than what is optimum for whitebark pine seedlings. It is recommended that fall planting be used for whitebark pine.

Restocking of clearcuts

Condition and trend

The National Forest Management Act requires that where trees are harvested for timber production (suited timber lands) "the cuttings shall be made in such a way as to assure that the technology and knowledge exists to adequately restock the lands within five years after final harvest." For clearcuts, that means five years after the clearcut occurs (36 CFR 219.27 sec. (c)(3)). This monitoring item was intended to ensure that clearcuts are restocked by the fifth year.

Table 23. Status of clearcuts on the Shoshone National Forest, Wind River Ranger District

Year cut	Sale Name	Planted?	Year planted	Certified?	Year certified	Comments
2004	Horse Creek	No	--	Yes	2007	--
2005	New Sheridan Cr.	No	--	Yes	2006	
2005	Cartridge Cr. II	Yes	2009	No	--	Planted this year
2008	Bachelor Creek Roffer	No	--	No	--	1st year survey completed

Evaluation

The first, third, and fifth year surveys will continue for natural regeneration and on plantations and we will continue to plant or replant fill-in planting until we get certification of each stand.

Monitoring through on-the-ground surveys indicates that the majority of the clearcuts that were made before 1976 fully meet the criteria to be certified as fully stocked. The majority of clearcuts on the Shoshone occurred before the passage of the National Forest Management Act in 1976. Although regeneration surveys are not required for those acres clearcut before 1976, we have spent considerable time in past years visiting, evaluating, and surveying those acres in order to update records and evaluate past silvicultural treatments.

No clearcuts units were sold on the Shoshone in 2006, 2007, or 2008. In 2009, we did sell UW1 with 44 acres, UW2 with 43acres, UW3 with 27 acres, and Warm Springs with 72 acres of clearcuts totaling 186 acres. UW2 and UW3 were logged in 2009 and part of Warm Springs was logged in 2009, so the first year survey will be in 2010.

Timber stand improvements

Condition and trend

Timber stand improvement (TSI) is any vegetation management activity that improves the composition, condition, or growth of a stand of trees. This monitoring item requires that acres of TSI not vary more than 25 percent from what is planned annually. The Forest Plan projected 121 acres per year of TSI for the period between 1991 and 2001.

Table 24. Acres of TSI accomplished and acres projected by the Forest Plan, 1991 through 2009

Year	Acres Treated	Percent of Forest Plan
Forest Plan	121	100
1991	40	33
1992	407	336
1993	0	0
1994	140	115
1995	250	206
1996	117	97
1997	455	376
1998	937	774
1999	882	728
2000	0	0
2001	0	0
2002	239	198
2003	0	0
2004	0	0
2005	0	0
2006	0	0
2007	0	0
2008	550	455
2009	706	583
Average	248	205

During the past 12 years, emphasis for TSI activities has been placed in cutover areas to enhance new stand growth by reducing competition on desirable species and to promote individual tree growth. The majority of this work has been achieved using TSI contracts that are inspected by Forest Service personnel. Forest Service personnel have also completed TSI treatment under the guidance of a forester. Contract inspectors and foresters, using daily diaries and inspection reports, monitored accomplishments for the period shown above.

Areas were not contracted in fiscal years 2000 and 2001 due to the listing of the Canada lynx as a threatened species. Lynx analysis units (LAU) and potential lynx habitat were identified in fiscal year 2001. Pre-commercial thinning in LAUs is allowed when stands no longer provide snowshoe hare habitat[18] or when the thinning activity is in the wildland urban interface as identified in county wildfire protection plan and has fuels reduction objectives. Approximately 4,000 acres with TSI needs have been identified in LAUs.

Beginning in 2001, areas outside of LAUs were evaluated for TSI needs and requests submitted for TSI dollars and a TSI target in out years. In fiscal year 2002, approximately 153 acres of lodgepole pine stands were pre-commercially thinned in the South Pass area on the Washakie Ranger District outside of LAUs where previous stand improvement work (removal of mistletoe-infected overstory trees) had occurred. An additional 86 acres of lodgepole pine stands were also weeded to remove mistletoe-infected stems in the South Pass and

[18]Self-pruning processes have eliminated snowshoe hare cover and forage availability during winter conditions with average snow pack.

Limestone areas on the Washakie Ranger District and in the Lava Mountain area on the Wind River Ranger District. In 2008, we treated 550 acres on the Wapiti Ranger District that counted as TSI, all associated with fuels reduction from the North Fork environmental assessment in the wildland urban interface. These acres were outside the suitable timber base. In 2009, we treated 706 acres on the Wind River Ranger District, all associated with fuels reduction projects. Seventy-five acres on the Washakie Ranger District were pre-commercially thinned.

Evaluation

Between 1991 and 2009, we accomplished approximately 205 percent of what the Forest Plan projected for acres of TSI. Some of the TSI contracts span multiple years; therefore, acreage accomplishments will vary from year to year, with accomplishments exceeding planned acreage targets in some years.

One major reason the Forest Plan TSI estimates were exceeded on the Shoshone relates to the fact that clearcuts from the 1960s have grown in and are now overstocked. For example, on the southern part of the Shoshone, there are at least 4,000 acres of old cutover areas on suited base timber lands from the 1960s. Some of these stands are in need of thinning to reduce competition, promote growth, add to age class diversity, and protect these stands from insect and disease infestations.

TSI work on the Shoshone is anticipated to increase, at least temporarily, due to the need to reduce fuel loading in wildland urban interface areas. If timber stands in need of TSI are not treated, growth of these stands will be stagnated in the long run, will be more susceptible to disease infestations of dwarf mistletoe and commandra blister rust, and will provide habitat for epidemic outbreaks of insects such as the mountain beetle, ips, sawflys, etc.

Growth response

Condition and trend

Growth response to vegetation management is monitored through stand exam surveys. Data collected by stand surveys are used in growth and yield models to predict annual and long-term growth patterns and potential. Monitoring of growth response tells the manager whether vegetation responds to treatments and silvicultural prescriptions as predicted.

In 2008, we accomplished 1,277 acres of stand examination with force account crews on the Loop Road project area. In 2009, we advertised a service contract for stand exams; from that contract, we accomplished 21,051 acres of stand exams. The stand exams were in support of NEPA planning and Forest Plan validation. In the Carter and North Fork areas, surveys were conducted to assess the aftermath of the bark beetle and after major logging operations were completed.

Table 25. Acres and type of stand exam survey accomplished in each project area.

Survey type	Sunlight acres	Carter acres	North Fork acres	Loop Road acres
SE-CSR, Browns, FV				2,697
QS-CSR, Browns, Lynx, FV	231			
SE-CSR, Browns, Lynx, FV	4,108			
FV		5,607	8,404	

Evaluation

Data gathered in past years indicate that growth response in planted stands surveyed on the northern portion of the Shoshone is meeting the expected growth potential. Stands clearcut in the 1960s on the southern part of the Shoshone that were surveyed for growth response after treatment are at least meeting, if not exceeding, the expected growth potential. There is evidence that residual stands adjacent to those treated in the 1960s are heavily infected with dwarf mistletoe and commandra rust. Treatment of the adjacent stands and thinning of the new stands are critical to maintaining maximum growth potential and to reduce infection by mistletoe and commandra rust. Stands left untreated and densely stocked are more susceptible to infections from dwarf mistletoe, commandra rust, other diseases, and insect attacks. Potential for stand replacing fires is also a concern due to the age of the forest and the buildup of dead and down fuels (see forest health discussion below).

Size of clearcuts

Condition and trend

Clearcuts greater than 40 acres in size require the Regional Forester's approval. Clearcuts are rare on the Shoshone. Those that have occurred (see reforestation and reforestation monitoring) since 1989 have not exceeded the 40-acre limit.

Openings created by management activities

Condition and trend

Lands suited for timber production

We have not exceeded the created opening of 20 acres when adjacent to a natural opening, and we are maintaining sufficient spacing within continuously forested landscapes.

Within lands not suited for timber production

We have not had any created openings within lands not suited for timber production.

Lands not suited for timber production

Condition and trend

Lands not included in the suited timber base may not be managed for wood fiber as the primary product but may be managed for other resource objectives. In some situations, wood fiber is a byproduct of resource management activity, such as when openings are created for wildlife in a forested area. The Forest Plan contains standards and guidelines that specify what types of activities are permissible outside the suited

timber base. They are reviewed before activities occur. This monitoring item was intended to guarantee that lands outside the suited timber base are managed for the appropriate resource objectives.

In fiscal year 2002, a vegetation management project was completed on the Wapiti Ranger District along the North Fork of the Shoshone River corridor on non-suited timbered lands. The project was designed to remove timber from the Eagle Creek Campground, in preparation for its reconstruction. Removing trees before the campground project began reduced the reconstruction cost. Hazard trees were also removed from the site. Remaining woody material was made available to the public for fuel wood collection. Work was accomplished in support of the recreation program on the Forest through a timber sale contract. Three campground upgrades have occurred in the North Fork corridor using timber sale contracts to support other resource programs and objectives (Newton Creek, Three Mile, and most recently Eagle Creek). These projects saved an estimated $80,000 in campground reconstruction costs.

Planting of whitebark pine was completed in fiscal year 2002 on non-suited lands. Planting accomplishes two objectives: 1) providing a food source for grizzly bears, and 2) reestablishing whitebark pine that is blister rust resistant in areas where this species was destroyed by the wildfires of 1988, and in areas where white pine blister rust has caused heavy mortality on this tree species.

Evaluation

The vegetation management projects mentioned above involve removal of timber from non-suited lands for reasons other than commercial timber production. Individuals, communities, and businesses neighboring the Shoshone utilize material such as fuel wood (commercial and personal use), posts and poles, house logs, and sawtimber.

Removal of products such as fuel wood from the Shoshone is authorized by obtaining permits or through contracts.

Roads

Condition and trend

Much of the National Forest System Road inventory has been identified using either the global positioning system , aerial photography, or other location verification. These data will be used to produce the Motor Vehicle Use Map (MVUM), which will designate motorized use on roads and trails on the Shoshone, per the travel management regulation published in 2005. The MVUM will be available, implementing the travel management regulation on the Forest, by the beginning of 2010. Additionally, this inventory provides the base road system for the revised Forest Plan.

Inventory activity conducted in fiscal year 2009 resulted in an overall increase in National Forest System road mileage of approximately 15 miles, slightly more than 1 percent, from fiscal year 2008. This increase was due not to new road construction but to greater accuracy of the miles of National Forest System roads on the ground.

Road construction and reconstruction

There was no new construction and approximately 14 miles of reconstruction in fiscal year 2009. The increase in reconstruction from 2008 is associated with vegetation treatment activities and improvements to infrastructure resulting from increased use of the road system related to growing recreation use. This accomplishment is nearer the average of annual reconstruction since 1999. It is anticipated the trend will be toward higher levels of reconstruction and construction associated with greater emphasis being placed on vegetation treatments dealing with hazardous fuels.

Roads closed

The measure of roads closed is a change in maintenance level of a road to a maintenance level 1 road. There was no such change in 2009. In most years, there are very few, if any, changes to a maintenance level 1 or closed road. As we have direction from NEPA analysis prepared under Forest Plan direction, we close roads.

Roads obliterated (decommissioned)

The amount of road decommissioning in 2009 was up slightly from the past few years but low compared to the yearly average over the life of the Forest Plan. There were 1.4 miles of system road decommissioned as a result of watershed improvement project work.

Level 1 road maintenance

There was no level 1 road maintenance in 2009. Some years we do a little work, but most years these roads are not a high priority to maintain. While work is done each year to reduce the backlog of deferred maintenance, the need for maintenance grows at a higher rate than available funding. Efforts will continue on partnering with the Federal Highway Administration for improvements to forest highways. It is anticipated that travel management monitoring will receive greater emphasis upon publication of the MVUM.

Recreation

Condition and trend

The Shoshone National Forest provides recreation activities that range from high adventure in the back country to cruising paved highways. Expansive wilderness areas provide opportunities for people to experience solitude and adventure in a natural environment. Developed sites in highway corridors and in the front country complement the wilderness as part of the range of recreation opportunities.

Visitor data for 1970 through 1981 were used in development of the Forest Plan and showed a trend of increased recreation use (visitor days) on the Shoshone. That trend appears to have continued from 1981 through 2002 based on visitor data collected in 2003 during the National Visitor Use Monitoring project (NVUM). While a direct comparison of Forest Plan data and the more recent NVUM data cannot be made because of differences in the collection protocols, recreation use seems to be continuing to follow the upward trend. NVUM data were collected in 2009; these data are not yet available for analysis and comparison. This upward trend can be further verified once the 2009 NVUM data become available for comparison to the 2003 NVUM data. NVUM data for 2003 showed 651,000 visits occurring on the Shoshone.

Developed facilities include 32 campgrounds, 11 picnic grounds, 28 trailheads, and 18 permitted lodges. In addition, Sleeping Giant Ski area opened and was in operation in 2009 for the first time since the 2003/2004 season. The majority of developed facilities are on or adjacent to the Buffalo Bill Scenic Highway, the Chief Joseph Scenic Highway, the Beartooth All-American Road, and the Wyoming Centennial Scenic Byway, which traverse the Shoshone.

The number of developed campsites has remained steady and appears to be meeting the need, although the percentage of visitors using developed facilities increased from 34 percent of the total visitors in 1986 to 40 percent in 2003. The demand for updated recreation facilities will increase as the recreating public desires campsites that are more modern. In order to meet that need, reduce our deferred maintenance, and accommodate a trend of decreased tent camping and increased trailer and RV camping, some campgrounds have been reconstructed. Decisions on operation and maintenance and/or reconstruction of developed facilities are guided by the 2005 Recreation Facility Analysis.

Table 26. Recreation sites on the Shoshone National Forest, 1986 and 2004[19]

Type of site	1986	2004
Trailheads	20	28
Campgrounds	33	32
Picnic grounds	7	11

Table 27. Breakdown of developed recreation visitor days[20]

	1986	2003
Developed recreation	34 percent	40 percent

Dispersed recreation occurs throughout the Shoshone. Visitors enjoy the full range of recreation activities, including hiking, backpacking, hunting, fishing, horseback riding and packing, snowshoeing, off-highway vehicle riding, snowmobiling, camping and picnicking, viewing scenery and wildlife, dog sledding, downhill skiing, cross country skiing, mountaineering, whitewater rafting, and ice and rock climbing. The Forest Plan allows summer motorized activities on 25 percent of the Shoshone and winter motorized activities on 40 percent of the Shoshone.

Recreation use trends on the Shoshone have been affected by the increasing human population in adjacent communities, changes in technology related to recreation activities, and an expansion of lands occupied by the growing population of grizzly bears. New recreation pursuits, such as ice climbing and mountain biking, continue to attract new users. Grizzly bears attract people to viewing areas such as the North Fork of the Shoshone River; conversely, increasing and expanding bear populations have had the effect of displacing some recreation users to other locations on the Shoshone or to other areas.

The NVUM survey conducted in 2003 showed the top five activities recreationists participated in on the Shoshone were viewing natural features, viewing wildlife, general relaxing, scenic driving, and hiking and walking.

[19] Data for 1986 are from the Forest Plan FEIS. Data for 2004 are from the Shoshone National Forest Recreation Guide.
[20] Data for 1986 are from the Forest Plan FEIS. Data for 2003 are from the National Visitor Use Monitoring survey.

Uses that have increased in the last 20 years include mountain biking, off-road motorized travel, rafting, kayaking, rock and ice climbing, snowmobiling, day hiking, fly fishing, and scenic driving. Recreation use and demand for facilities will increase as the population of the country increases. While use is increasing for these activities, the percentage of visitors participating in dispersed recreation activities while visiting the Shoshone has risen slightly from 52 percent in 1986 to 55 percent in 2003.

Table 28. Dispersed recreation visitor days on the Shoshone National Forest in 1986 and 2003[21]

	1986	2003
Non-wilderness dispersed recreation	52 percent	55 percent

OHV (off-highway vehicle) use is one of the fastest growing forms of outdoor recreation. From 1982 to 2000, the number of people driving motor vehicles off road in the United States increased over 109 percent. OHV users now account for 5 percent of the total number of visitors to national forests; on the Shoshone, OHV use is following this national increase. Increases in OHV recreation in unauthorized areas are leading to increased wildlife disturbance, soil erosion, and sedimentation in streams.

Trails are the primary access routes to our back country settings. The Shoshone's trails system includes 1,389 miles of terra trails, 306 miles of snowmobile trails, and 48 miles of cross country ski trails. A wide range of recreation opportunities is available relative to the trail system, ranging from challenging foot travel to motorized uses. The priority pertaining to trails management is keeping mainline trails open and safe to support commercial and non-commercial access to wilderness. User and outfitter clearing of trails has been emphasized to allow us to focus on heavy maintenance and reconstruction. This trend is expected to continue as the backlog of maintenance increases due to reduced budgets and the increase of dead trees from fire and insect and disease infestations.

It has been difficult to meet expectations for acceptable levels of trail maintenance due to reduced funding and the extensive miles of trail in the system. An inventory of deferred maintenance needs was started in 1999. Approximately 85 percent of the Shoshone's 1,389 miles of system trail has been inventoried. The inventory is helping managers prioritize trail safety problems and plan repairs as funds become available.

The increase in popularity of OHVs has lead to resource damage on some primitive trail segments not designed for motorized use.

Winter use monitoring (trail counters and trailhead vehicle counts) indicates an increase in the use of non-system snow trails on the Shoshone.

In 2009, 703.92 miles of trail were maintained or improved to standard.

Wilderness accounts for approximately 55 percent of the Shoshone's acreage. The five (Absaroka-Beartooth, Fitzpatrick, Popo Aggie, North Absaroka, and Washakie) wilderness areas on the Shoshone contain 1.4 million acres. The number and duration of extended wilderness horse pack trips decreased, while the number of day rides and short, two- to three-day trips into wilderness have increased. From monitoring in the Popo Agie and

[21] Data for 1986 are from the Forest Plan FEIS. Data for 2003 are from the National Visitor Use Monitoring survey.

Fitzpatrick wilderness areas, it appears that use is increasing in these areas. These increases are not apparent in the other areas; comparing 1986 data and 2003 data, it appears that the percentage of total visitors recreating in wilderness decreased from 14 percent in 1986 to 5 percent in 2003.

Table 29. Total wilderness visitor days, 1986 and 2003[22]

	1986	2003
Wilderness dispersed recreation	14 percent	5 percent

Campsite monitoring is occurring and appears to show some changes. In the Popo Agie and Fitzpatrick Wilderness areas, campsite numbers appear to be increasing slightly. Campsite conditions are stable in most locations with the exception of areas around high use lake basins where conditions are deteriorating. A large number of campsites are being observed within the restricted area close to trails and water and in some areas, campsites are too close together to provide solitude. Wilderness rangers are also seeing a drastic increase in the number of fire rings being constructed that are not naturalized when leaving the camp.

Fire and fuels

Condition and trend

Fire regimes

In ecosystems where periodic fire has historically played a role in maintaining structure and composition, past fire suppression policies have resulted in vegetation changes and allowed fuels to develop to unprecedented levels in many areas of the country, including some areas on the Shoshone. The departure of fire from its historic role contributes to ecosystem health and fire management problems. Symptoms of these problems include the development of unnaturally dense vegetation at broad scales and a heightened susceptibility to wildfires that are often uncharacteristically large, destructive, and costly to control.

By focusing on assessing resilience to fire disturbance, we will be able to adjust management actions to restore lands to a more healthy fire frequency and intensity.

We use fire regime condition class to measure ecological integrity and/or departure from reference conditions. A stand is within fire regime condition class 1 when vegetation characteristics, fuel composition, fire frequency, severity, and pattern are maintained within historical bounds for the fire regime. It is most relevant to measure long-term trends rather than annual changes.

Nearly 115,000 acres have burned in the last five years and 161,500 acres over the past 10 years on the Shoshone National Forest. In the past 10 years, an additional 48,900 acres have been burned by prescribed fire or received mechanical treatments that affected the fire regime condition class. Approximately 25,000 acres of these treatments have taken place in the last five years.

[22] Data for 1986 are from the Forest Plan FEIS. Data for 2003 are from the National Visitor Use Monitoring survey.

At broad scales, 63 percent of the Shoshone's acres are in fire regime condition class 1. Two vegetation conditions are in some jeopardy based on the time since the last disturbance, including approximately 578,000 acres of fire regimes II and III that are in condition class 2. This represents approximately 24 percent of the Shoshone. A summary of the number of acres by fire regime condition class is displayed in Table 30. At a smaller stand scale, other isolated areas on the Shoshone are fire regime condition classes 2 and 3. These areas have not been quantified.

Table 30. Fire regime condition class acres

Fire regime	Condition class	Fire return interval	Burn severity23	Acres	Percentage of Shoshone
II	1	35 – 70 years	Stand replacement	1,745	0.1
	2			26,662	1
III	1	35 -100 years	Mixed	26,376	1
	2			551,075	23
IV	1	70 - 150 years	Stand replacement	1,003,684	41
V	1	200 – 300 years	Stand replacement	499,800	21
Barren	None	None	None	328,298	13

Vegetation community types are associated with the various fire regime groups. Forest Plan direction and desired conditions for vegetation community types and other resources overlap with those for fire regime condition classes. Table 31displays the relationship of the vegetation communities to fire regimes.

[23] Burn severity in this instance refers to the first order fire effect on the vegetation and not a level of ecological damage. First order fire effects concern the direct or immediate consequences of fire, such as biomass consumption, crown scorch, damage to the trunks of trees, and smoke production.

Table 31. Fire regimes and associated vegetation communities

Fire regime	Elevations	Associated vegetation community types
II	Low	grasslands (fescue and bunchgrasses) sagebrush (mountain big)
	Middle	grasslands (fescue and bunchgrasses) sagebrush (mountain big)
III	Low	grasslands (fescue and bunchgrasses) sagebrush (mountain big)
	Middle	grasslands (fescue and bunchgrasses) sagebrush (mountain big) willow, Douglas fir, lodgepole pine, spruce/fir, aspen
IV	Low	willow/riparian areas, sagebrush (dwarf and black)
	Middle	willow/riparian areas, lodgepole pine, spruce/fir, aspen
V	Middle	lodgepole pine, spruce/fir, aspen
	High	willow, whitebark pine, spruce/fir, alpine grassland

Fire and hazardous fuels

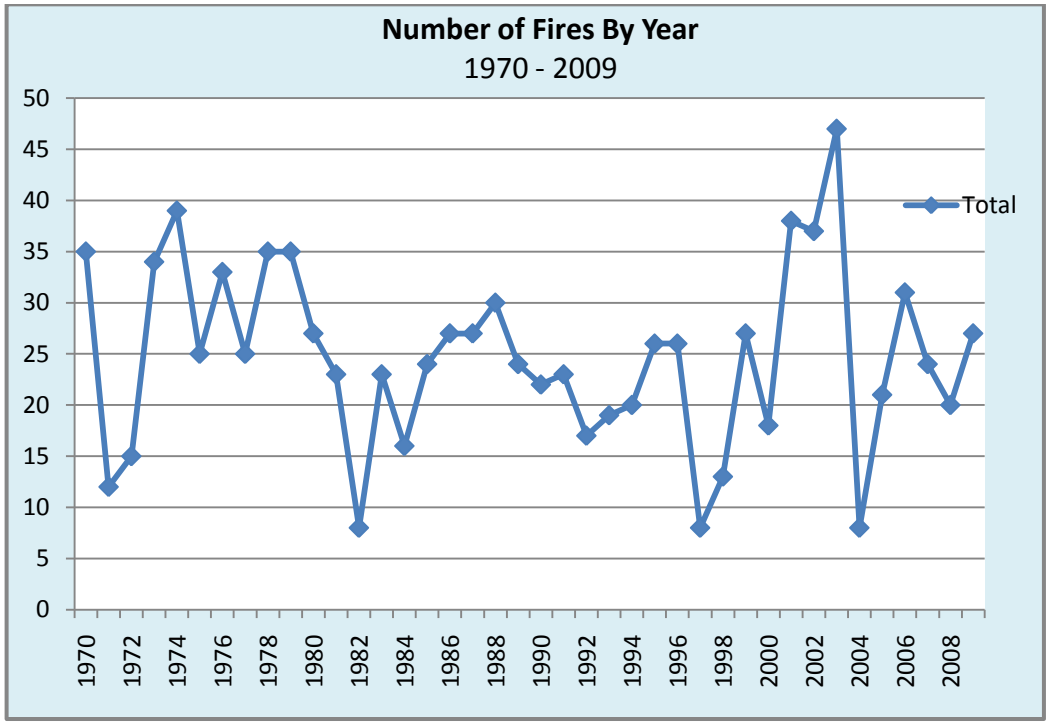
Since 1970, the Shoshone has averaged 25 wildfires annually, averaging 49 percent from natural ignition, 32 percent from escaped campfires, and 19 percent from other causes. Lightning-caused fires account for over 90 percent of the acres burned.

Over the last century, the Shoshone's fire management program has been focused on fire suppression, with efforts to keep fires as small as possible (Table 32 and Figure 18). Due to drier and hotter conditions, the trend in acreage burned since 1998 has been increasing (Table 33 and Figure 19).

Table 32. Number of fires by size, 1970 through 2009

Size in acres	Number of fires
0 to 0.25	744
0.25 to 9.9	175
10 to 99.9	36
100 to 299.9	9
300 to 999.9	5
1,000 to 4999.9	12
> 5,000	9

Figure 18. Number of fires per year, 1970 through 2009



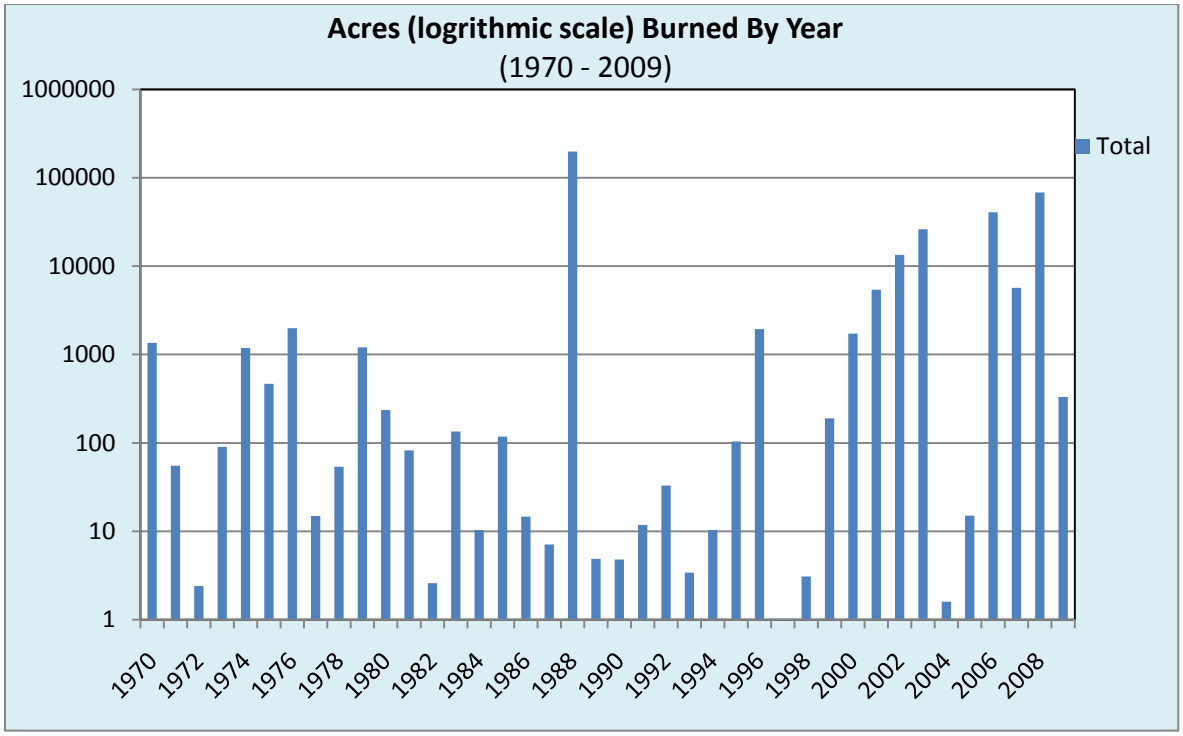
The use of unplanned wildland fire to accomplish resource benefit objectives is becoming a major component of the wildland fire acres burned. Resource objectives identified in the Forest Plan that can be accomplished through the use of wildland fire included hazardous fuels reduction, wildlife habitat improvement, natural processes in wilderness, and other vegetation management. In 2008, the Gunbarrel Fire was managed for a combination of resource benefit and protection objectives. Fire regime condition class was improved and hazardous fuels were reduced on over 68,000 acres. Since 2006, we have managed four fires that accomplished resource benefit objectives on over 80,000 acres. By increasing the opportunity for using fire as a natural process, a mosaic of burned and unburned areas will occur, producing a more natural patchwork of vegetation. In the last 10 years, about 179,000 acres of the Shoshone have burned as a result of wildfire and prescribed fire; most of these acres were in designated wilderness. Under the amended Forest Plan, a similar amount of fire is anticipated on the Shoshone, but the distribution of those fires could change. More acres outside wilderness areas are likely to burn. Several thousand acres associated with the Gunbarrel Fire burned

outside wilderness. Hazardous fuel conditions are present throughout much of the Shoshone. Some conditions are a result of fire exclusion and have resulted in changes in vegetation type and structure, such as sagebrush-grasslands being overgrown with juniper and other conifers, or aspen stands now dominated by conifers. Middle elevation conifer stands have become mature and are homogeneous on a broad scale. They lack diversity in age or size classes and are more prone to large-scale, high severity, stand replacement wildfires rather than mixed severity. The natural fuel conditions of the mature spruce/fir forest and high elevation subalpine forests are typically considered to be in a state of high hazard. Hazardous fuel conditions are also being augmented by an insect outbreak that has resulted in tree mortality on hundreds of thousands of acres.

Table 33. Annual acreage burned, 1970 through 2009

Year	Acres		Year	Acres		Year	Acres		Year	Acres
1970	1,358		1980	236		1990	5		2000	1,725
1971	55		1981	83		1991	12		2001	5,416
1972	2		1982	3		1992	33		2002	13,451
1973	90		1983	135		1993	3		2003	26,079
1974	189		1984	10		1994	10		2004	2
1975	467		1985	118		1995	104		2005	15
1976	1992		1986	15		1996	1,935		2006	40,489
1977	15		1987	7		1997	1		2007	5,700
1978	54		1988	197,228		1998	3		2008	68,274
1979	1,204		1989	5		1999	190		2009	332

Figure 19. Annual acres burned, 1970 through 2009



Currently, the Shoshone is experiencing a beetle epidemic composed primarily of Douglas fir and mountain pine beetles. Reconnaissance flights since 1999 have mapped approximately 823,000 acres of infestation. These beetles kill trees by girdling and introducing blue stain fungus. First, an increase in canopy fuels (dead needles) perpetuates crown fires, then as the needles drop the probability of crown fire decreases and ground fires increase as dead material accumulates.

High fuel levels (Table 34) result in uncharacteristically high fire intensities and sizes that can cause undesirable resource impacts, making it difficult to manage wildland fires and more difficult to use prescribed fire safely as a management tool.

Table 34. Hazardous fuels conditions on the Shoshone

Hazard rating[24]	Acres	Percentage of the Shoshone
None (barren and water)	367,031	15
Low	336,876	14
Moderate	941,075	38
High	792,616	33

As with other national forests, residential development is increasing on private lands adjacent to National Forest System lands. This increasing development increases the values to be protected from high fuel levels

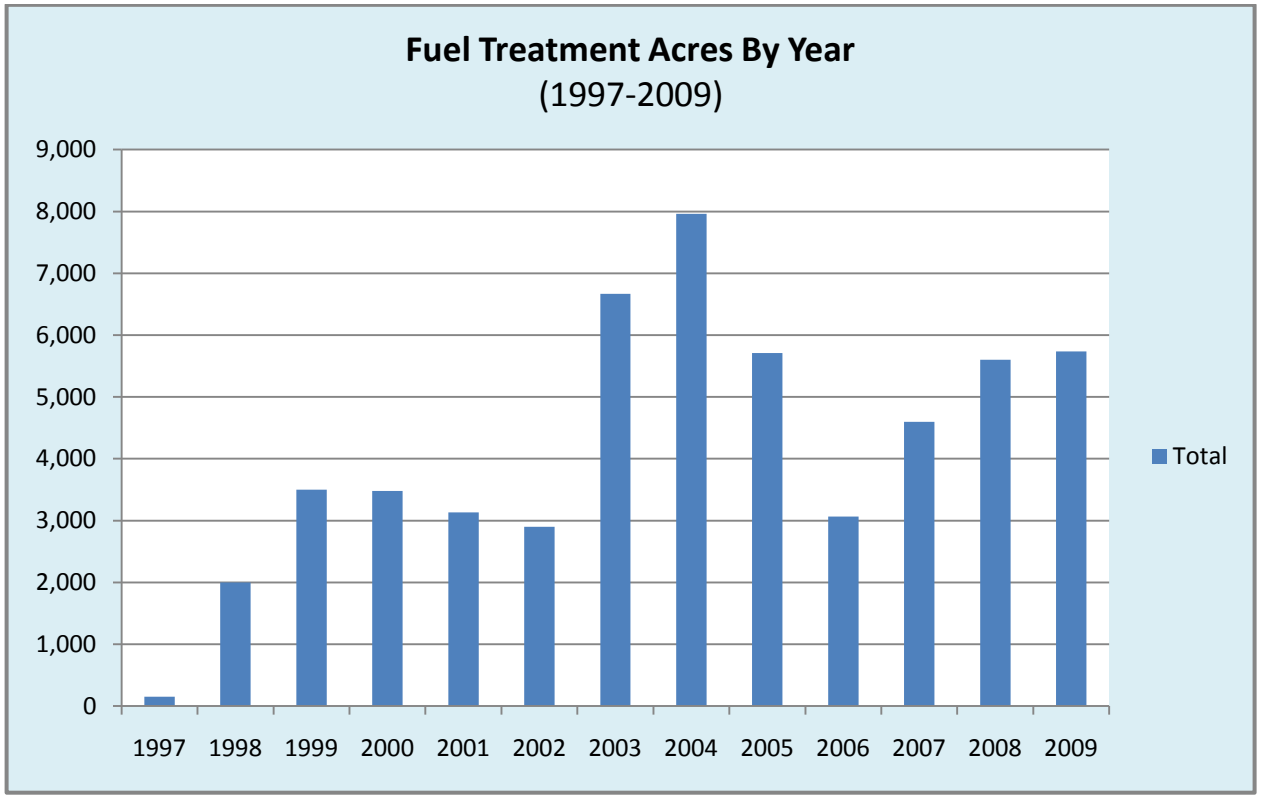
[24] Hazard fuel rating based on areas mapped using Standard Fire Behavior Models with consideration of the added influence to fire behavior due to insect killed trees: Low = Fuel Model 1; Moderate = Fuel Models 2, 4, 5, and 8; High = Fuel Models 6 and 10.

and wildland fire. Prescribed burns require extra planning and personnel during implementation to ensure infrastructure in adjacent developments are protected.

Another consequence of the increase in hazardous fuels conditions is the cost associated with fire suppression. While there have been only nominal increases in the average suppression costs per acre over the past several years, total fire suppression costs have increased substantially because of the increase in the number of acres burned each year. Protection of wildland urban interface areas is also contributing significantly to fire suppression costs. Impacts to communities are also increasing. Additional economic costs from larger and more intense fires are incurred by communities responsible for protection of private property. A reduction in visitors can lead to economic impacts to local communities.

In 1998, the Shoshone's prescribed fire program increased as part of the overall fire management program. With the 2000 National Fire Plan, funding increased to facilitate increases in staffing and equipment to further support the fire program. During the fall of 2002, the Shoshone engaged in a Shoshone-wide vegetation analysis, resulting in an integrated vegetation management program that included the use of prescribed fire and mechanical treatments to accomplish objectives. The 2003 Healthy Forests Initiative and Healthy Forests Restoration Act combined to provide the tools, funding, and expectation to begin treating hazardous fuels and improving fire regime condition class.

Figure 20. Acres of hazardous fuels treated, 1997 through 2009



Evaluation

The Forest Plan was amended in June 2008 (amendment 2008-01) to allow wildland fire from unplanned ignitions[25] to be managed to accomplish resource benefits anywhere on the Shoshone when and where conditions are appropriate. Previously, wildland fire use was allowed only in designated wilderness areas on the Shoshone. In addition, the application of appropriate management response to wildland fire was expanded Shoshone-wide to include the full range of options from monitoring to intensive suppression actions. Shoshone-wide and management area direction, standards, and guidelines that were redundant, process oriented, or no longer needed were removed or modified. Desired condition (goals) statement, general direction, standards, and guidelines regarding fire management activities and related resource protection measures were added as part of the amendment.

Forest Plan direction and desired conditions for vegetation are consistent with fire management actions that return fire to its natural role where appropriate. Forest Plan direction for fire and hazardous fuels management focuses on safety, then on managing fuel levels and managing fires to accomplish protection and resource benefit objectives. Direction for managing fire is retained from the 1986 Forest Plan as amended by Forest Plan Amendment for Wildland Fire Use Decision Notice (amendment 2008-01).

Future plan revision should include direction from amendment 2008-01, which includes options to use unplanned ignitions to accomplish resource benefits inside and outside wilderness and application of appropriate management response Shoshone-wide. Expectations for the future are for more acres being treated using wildland fire. The revised forest plan will likely include more specific desired conditions and objectives pertaining to hazardous fuels, fire regime condition class, ecosystem diversity, vegetation, and wilderness that provide more opportunities to allow fire to play its natural role as much as possible.

Projection of Forest Plan direction

The Forest Plan was amended in June 2008 to allow wildland fire from unplanned ignitions[26] to be managed to accomplish resource benefits anywhere on the Shoshone when and where conditions are appropriate. Previously, wildland fire use was allowed only in designated wilderness areas on the Shoshone. In addition, the application of appropriate management response to wildland fire was expanded Shoshone-wide to include the full range of options from monitoring to intensive suppression actions. Shoshone-wide and management area direction, standards, and guidelines that were redundant, process oriented, or no longer needed were removed or modified. Desired condition (goals) statement, general direction, standards, and guidelines regarding fire management activities and related resource protection measures were added as part of the amendment.

The use of wildland fire for resource benefit is expected to become a major component in the future. Under the amended Forest Plan, fires across the Shoshone will be managed for resource benefit when

[25] An unplanned ignition is the initiation of a wildland fire by lightning, volcanoes, or unauthorized and accidental human-caused fires. Wildland fire is a general term describing any non-structure fire that occurs in the wildland.
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and where conditions permit. As a result, the number of acres that receive a resource benefit from a wildland fire is expected to increase. Approximately 1.5 million acres of the Shoshone are in stand replacement burn severity. By increasing the opportunity for using fire as a natural process, a mosaic of burned and unburned areas would occur, producing a more natural patchwork of vegetation.

Fires across the Shoshone will be managed appropriate to the fire environment and location for any given year. The opportunity for fires to be managed for longer-term benefits is expected to reduce the size and number of large unwanted wildfires in the future. In the last 10 years, about 90,000 acres of the Shoshone have burned; most of these acres were in designated wilderness. Under the amended Forest Plan, a similar amount of fire is anticipated on the Shoshone, but the distribution of those fires could change. More acres outside wilderness areas are likely to burn. It is also possible the amount of acres burned in a 10-year period could increase with this additional flexibility with fire use. It is expected that some fires previously categorized as unwanted would be managed for resource benefit.

While there will be widespread additional opportunities for using fire for resource benefits, there are resources of significant value that are in need of protection, including wildland urban interface, high use recreation areas, timber and grazing, municipal watersheds, cultural resources, and critical wildlife and fish habitats.

All unplanned ignitions will receive an appropriate management response. The appropriate management response concept provides managers with increased flexibility to implement a response appropriate to an individual set of circumstances and conditions to utilize a full range of responses. The amended Forest Plan allows the application of the appropriate management response on a Shoshone-wide basis, giving fire managers the latitude to choose from the full spectrum of response options in order to implement the best actions given a set of circumstances.

Appropriate management response will be applied at all levels when managing a fire for resource benefits or as a wildfire, including initial attack.[27] In some situations appropriate management response is an action that managers may take and in others it is an action managers must take depending on the circumstances in which a fire occurs and the preplanned objectives for an area. Examples of options managers may choose include:

- Monitoring from a distance
- Monitoring on-site
- Confinement
- Monitoring with limited contingency actions
- Monitoring with mitigation actions
- Initial attack
- Suppression with multiple strategies

[27] Initial attack is a planned response to a wildfire given the wildfire's potential fire behavior. The objective of initial attack is to stop the spread of the fire and put it out at least cost. It is an aggressive suppression action consistent with firefighter and public safety and values to be protected.

- Control and extinguish
- Any combination of some or all of the above as well as other options

For all unwanted wildland fire (wildfire), the overarching goal of suppression will be applied in every case. The initial suppression action (initial attack) will usually focus on prompt and decisive control of the fire commensurate with public and firefighter safety and cost effectiveness. If initial or subsequent actions fail, control objectives may be modified and the tactical options that comprise the appropriate management response may change. As described above, the range of responses could include monitoring, or aggressive suppression actions, or some combination. Resource values to protect, expected fire behavior, availability of resources, probability of success, and firefighter and public safety are some of the factors that will be used to determine the appropriate management response.

Hazardous fuel reduction using prescribed fire and mechanical means will likely continue at the lower elevations near the wildland urban interface and other areas with high resource values that are accessible to crews and mechanized equipment. Some reduction may also occur in wilderness where wildland fire use is permitted. Large wildfires may result in some fuel reductions as well. Reductions in hazardous fuels from prescribed fire and mechanical treatments are expected to average about 6,000 acres per year. Reductions in hazardous fuels from unplanned ignitions are estimated at 90,000 acres or more for the next 10 years.

All smoke management decisions under current direction are made in accordance with State of Wyoming air quality regulations. The number of fires, location, elevation, extent, duration of smoke, atmospheric conditions, and public sentiment are some factors that influence decisions to use prescribed burns. These factors also influence decisions to allow wildland fire to achieve ecosystem management objectives within the parameters of social and economic concerns. Cumulative smoke emissions from prescribed fire and wildland fire are likely to increase in the short term, but are expected to decrease over the long term.

In the long term, the expansion of areas available for wildland fire use and the additional flexibility in the application of appropriate management response options are expected to reduce the amount of suppression-related expenditures and be more cost efficient than prescribed fire in some areas of the Shoshone. Although less frequent, high suppression costs may still occur in some areas, particularly on lands where homes are built next to the national forest or other resources and developments may be at risk. Additional costs may be incurred to reduce post-wildfire threats to life and property from floods, debris flows, and landslides.

Agency fire management policies have been through significant change. Some factors influencing these changes include the 1995 Federal Wildland Fire Management Policy Review, the Healthy Forests Initiative, the Healthy Forests Restoration Act, and the National Fire Plan. Amendment 2008-01 enables wildland fire management activities on the Shoshone to be consistent with the changes and is more adaptable to future policy changes.