Reinvestment in Jobs, Communities and Forests:
The Benefits and Costs of a National Program for Road Removal on U.S. Forest Service Lands, A Preliminary Analysis

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FORWARD

While this report focuses on the benefits and costs of a national program of road removal on U. S. Forest Service lands, we recognize that such a program exists within a much larger and more complex historical, political, and environmental context.

The accumulation of wealth in the United States in the form of "constructed capital"-- buildings and infrastructure systems such as energy, water and transportation systems-- has been immense. In contrast, wealth in the form of natural-capital stocks and the associated ability of these stocks to provide a sustainable flow of environmental services, such as the purification of water and air, has diminished from pre-industrial conditions. To the extent that we defer reinvestment in diminished natural-capital stocks that lack satisfactory constructed substitutes, these trends bring into question our society's sustainability.

Forests and watersheds are important functional elements of our natural-capital stock, and the capacity of these forests and watersheds to provide essential habitat, water purification, flood control, and other ecosystem services has been impaired due to road building and resource extraction. The movement advocating for forest-road decommissioning and watershed restoration indicates a growing recognition that the costs of deferring reinvestment in these forms of natural capital are unacceptably high. What is called for is the displacement of the most destructive elements of the extraction economy, which draws down stocks of natural capital, with a restoration economy that reinvests in natural-capital stocks. The ultimate objective could be characterized as a sustainable society in which all critical capital stocks -- constructed, natural, social, human, and cultural -- are maintained at levels sufficient to assure (to the degree possible) that the benefits of economic security, just and democratic societies, and ecological integrity can be enjoyed by all present and future generations.

A useful framework involves consideration of five forms of capital: constructed capital, natural capital, human capital, social capital, and cultural capital . Constructed capital includes the stock of buildings, tools and equipment, inventories of goods, and "infrastructure" facilities of all sorts, including energy, water, and transportation. Natural capital includes stocks of natural resources and functional components of ecosystems and their interaction from which flow goods (natural resource harvests) and services (climate regulation, gas exchange, purification of water and air, and so forth). Human capital includes the accumulation of individual abilities, skills and experience that serve as the basis for human productivity in all its forms, both within labor markets and in households and volunteer activities. Social capital represents the stock of "civic virtues" and networks of civic engagement, community involvement, reciprocity norms, and trust essential to the function of democratic societies, and essential to vibrant economies as well (see Putnam, R. 2000. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon and Schuster). Finally, cultural capital refers to the body of stories, visions, and myths shared by people and providing the framework for how people view the world and their proper role in it.

We have organized our study along the basic lines of the above listed forms of capital. Chapter 1 deals with constructed capital, the basics of the U. S. Forest Service system of roads, alternative road decommissioning and road-removal programs, and the monetary flows, jobs, and other market benefits associated with the constructed-capital aspects of forest roads. Chapter 2 discusses natural capital. Chapter 3 deals with human capital. Chapter 4 is concerned with social and cultural capital. Chapter 5 discusses cost-benefit analysis of road decommissioning. Chapter 6 addresses the implementation issues of financial investment, allocation and reallocation of Forest Service budgets, and timeline considerations. The concluding chapter discusses recommendations and suggestions for further research. Following the Afterword and References are appendices where more detailed or technical material is addressed.

We wish to point out that the focus of this report is on road decommissioning and road removal rather than on the broader questions of "What is the best overall National Forest road-management strategy?" and "How best to apply a science-based forest-road analysis to achieve an optimum National Forest road system?" We also wish to make it clear that the larger historical, political and environmental context is beyond the scope of this study.

Finally, we wish to stress that this is necessarily a preliminary analysis. While forest-road decommissioning is a term that covers a broad range of efforts-- from "benign neglect," or gating, to full road obliteration or road removal-- our focus is on more "active" decommissioning efforts and largely ignores the more passive forms of decommissioning common across the country. Active forest-road decommissioning efforts tend to be concentrated in a few rather mountainous areas of the country where erosion, water quality, and fish habitat benefits are prominent, and existing data are highly decentralized. Due to the fragmented and incomplete nature of road-decommissioning activity and data, our analysis necessarily utilizes a case study approach that seeks out secondary data sources where they are available, and in their absence employs a key-informant interview methodology to produce primary data. We then draw out general inferences and conjectural scenarios from these case studies where possible, and we identify information gaps that should serve as priority areas for future research.

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Arcata California, Spring 2003

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Finally we wish to thank Wildlands CPR for providing the resources to conduct this preliminary analysis.

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Definitions:

Road - a motor vehicle travelway over 50 inches wide, unless designated and managed as a trail.

Decommissioning – activity that results in the stabilization and restoration of unneeded roads to a more natural state.

Classified Roads - "Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including state roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service" (36 CFR 212.1).

Temporary Roads - "Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be part of the forest transportation system and not necessary for long-term resource management." The Forest Service will still be required to remove and revegetate these roads within 10 years of the end of their use (FSM 7701.2).

Unclassified Roads - "Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization" (36 CFR 212.1).

New Road Construction -- activity that results in the addition of forest-classified or temporary road miles.

Road Reconstruction - activity that results in improvement or realignment of existing classified roads.

Road Improvement - activity that results in an increase of an existing road's traffic-service level, that expands its capacity, or that changes its original design function.

Road Obliteration – one of the five road-decommissioning treatments (establishing drainageways and removing unstable road shoulders; and full obliteration by recontouring and restoring natural slopes). In this study "road obliteration" is used synonymously with "road removal."

Unroaded areas – areas that do not contain classified roads.

EXECUTIVE SUMMARY

The U. S. Forest Service (USFS) manages National Forests and grasslands, which contain a total of 191 million acres, an area equal to the size of Texas. These lands contain over 523,000 miles of roads. This study considers the 446,000 miles of roads that fall under Forest Service jurisdiction.

Road decommissioning involves taking roads out of service. This can be done by merely blocking entrances or by some combination of other road-decommissioning treatments, such as removing culverts and unstable road shoulders, up to full obliteration of roads through recontouring, restoring natural slopes and revegetating. This study investigates decommissioning of USFS roads at the national, regional, and local levels as it relates to constructed capital, human capital, natural capital, and social and cultural capital.

Chapter One defines three alternatives for national road-decommissioning programs:

Program Name	Total Miles*	Annual Miles	$ per mile	Annual Cost (in millions)
1. Status Quo	50,000	2,500	$7,500	$18.75
2. Critical Funding	140,000	7,000	$7,500	$52.50
3. Complete Unneeded Road Removal	186,000	9,300**	$10,000	$93.00

* Over twenty years
** With a greater proportion of road obliteration and more thorough road-decommissioning treatments.

Chapter One explains the basis for the total miles decommissioned in each of these three programs. It also discusses the road-decommissioning costs involved with each program in relation to national, regional and individual National Forest data. In addition, specific road-decommissioning work done by Redwood National Park and the Bureau of Land Management is discussed. An economy-wide estimate of over 3,000 jobs associated with Complete Unneeded Road Removal is discussed. The high percentage of these jobs associated with the operation and manufacturing of heavy equipment is examined, as well a range of additional jobs associated with road decommissioning.

Chapter Two discusses the extensive and varied impact of USFS roads on natural capital. These impacts include sedimentation and landslides, hydrologic and water quality effects, biological invasions, habitat fragmentation, forest disease, and recreational, non-market, and passive-use values. Recognizing the complexity of ecosystem valuation, the chapter reviews costs associated with the various impacts listed above. While not being able to determine a single cost per mile of road decommissioned, this review examines the significant magnitude of adverse environmental costs associated with each of the above impacts.

Chapter Three discusses human capital in relation to road-removal jobs and training. The contribution of such jobs and training to increasing human capital is also discussed. For purposes of illustration, a $5-million road-decommissioning training amount is proposed and described.

Chapter Four discusses social capital and road decommissioning. Social capital refers to the stock of "civic virtues" and networks of civic engagement, involvement, reciprocity norms, and trust essential to democratic communities. An illustration is given for a $5-million program to build social capital in local communities near National Forests. Cultural capital refers to the body of stories, visions, and beliefs shared by people and providing the framework for how people view the world and their role in it. Cultural capital for Indian as well as non-Indian communities is also noted in relation to road decommissioning. For example, an EPA report regarding the Karuk Tribe in northern California says that “Over the long term, more than 2,000 miles of road throughout the Karuk's ancestral territory will need decommissioning or significant upgrading and remediation of mining impacts,” and “Building the tribe's capability to play an appropriate role in ecosystem management is the only means by which ecosystem restoration, cultural survival, and community prosperity will be achieved.”

Chapter Five analyzes the benefits and costs of road decommissioning in terms of the present value of maintenance, environmental impacts, human capital (training) impacts, and social impacts. Also we describe and discuss the analytical framework used by Clearwater National Forest in its Roads Analysis for assessing road-use value and environmental risk.

Chapter Six makes suggestions and recommendations regarding implementation of the "Full Unneeded Road Removal" Program. These include:

- Consider a national road-decommissioning program and its funding in relation to the large amount proposed for FY 2004 funding for fuel reduction, fire fighting, and fire suppression. In particular, would more net benefits result from more spending on road decommissioning and less spending on fire-related programs?

- Road-decommissioning training should be integrated with other ecosystem-restoration training. The suggestions of the Western Council of Industrial Workers regarding implementation should be considered.

- Individuals and organizations in communities near National Forests should be encouraged to investigate their National Forests' Roads Analyses, which were completed January 13, 2003. Several individual National Forests have made their Roads Analyses available on their Web sites.

- Individuals and organizations should identify critical roads at high risk of becoming impassable and associated with significant environmental impacts. Participatory research by the various stakeholders in communities near National Forests should be encouraged and organized.

- After FY 2004, we suggest that funding committed for five-year blocks of time to individual National Forests may be an effective way to encourage individual National Forests to develop and implement road-decommissioning components as part of their overall road -management plans.

Chapter Seven lists suggestions for further research regarding constructed, natural, human, social, and cultural capital aspects of road removal on National Forest lands.

Appendices follow which give detailed information regarding road-decommissioning costs, calculations of present value of road maintenance, individual National Forest Schedule of Proposed Activity and Road Analyses reports, a sample Road Decommissioning Contract, and other documents.

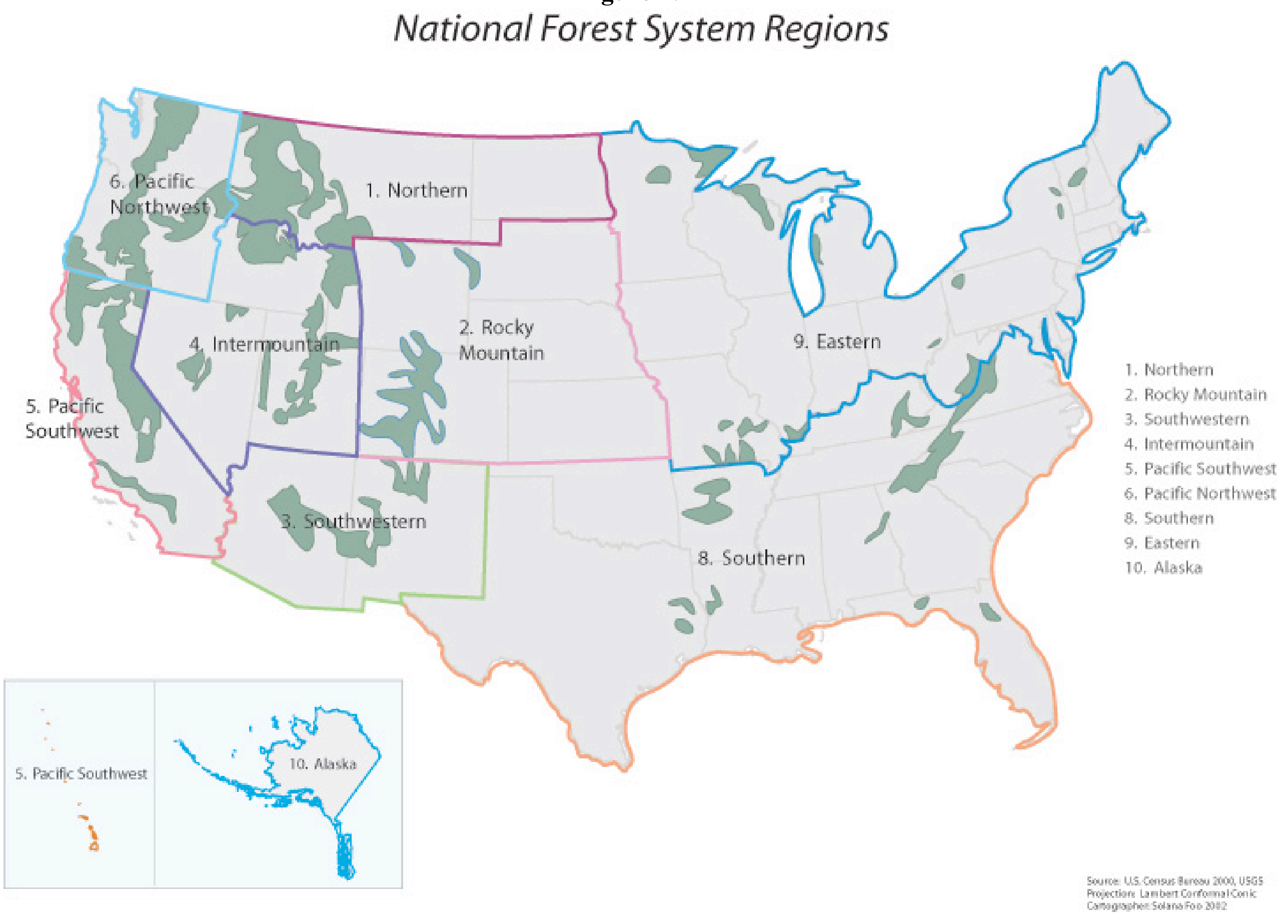
1. Constructed Capital

A. U. S. Forest Service Roads System

i. Overview

The U.S. Forest Service (USFS) manages 155 individual National Forests and 20 grasslands containing a total of 191 million acres, an area equal to the size of Texas (ww.fs.fed.us/aboutus/meetfs.shtml). These National Forests are spread over 9 diverse Forest Service Regions (see Figure 1).

Figure 1:



National Forest Regions Map

In addition to temporary roads, there are a total of 523,000 miles of classified and unclassified roads on National Forest System lands (see Table 1).

Table 1: Forest Service Road Classification Definitions	
Classified	Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access, such as state roads, county roads, privately owned roads, National Forest System roads, and roads authorized by the Forest Service that are intended for long-term use
Unclassified	Roads on National Forest System lands that are not managed as part of the forest transportation system (such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as trails) and those roads no longer under permit or authorization

(from USDA (2001) *National Forest System Road-Management Strategy: Environmental Assessment and Civil Rights Impact Analysis* p. 20)

Classified roads are divided into public, private, and NFS roads. The *Draft National Forest Road System and Use* (USDA 1998b) defines public roads as county, state, interstate, and federal land-management agency roads that "provide primary access into and through USFS lands. Privately owned roads [provide access to] private lands within and adjacent to USFS lands" (USDA2000, FEIS p. 10). The remainder of the classified roads are National Forest System roads, which the Forest Service maintains and administers.

This study considers a total of 446,000 miles of roads, including the 386,000 miles of classified NFS roads and the 60,000 miles of unclassified roads that the Forest Service acknowledges exist on NFS lands.

<u>**Categories of Roads**</u>

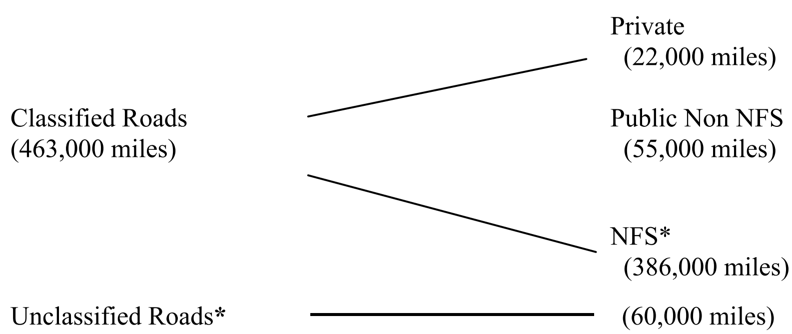


Figure 2: Categories of Roads (USDA 2001)
*NFS and unclassified roads are the focus of this study.

ii. National Forest System Road Management

The Forest Service has produced several comprehensive documents relevant to National Forest System road management. Some of these include

- *Forest Roads Analysis: Informing Decisions About Managing the National Forest Transportation System* (1998), which describes "an integrated ecological, social and economic approach to transportation planning addressing both existing and future roads -- including those planned in unroaded areas;"
- *Forest Roads: A Synthesis of Scientific Information* (2000), which is a comprehensive report that identifies "known and hypothesized road-related issues [in order] to summarize the scientific information available about them;"
- *Forest Service Roadless Area Conservation: Final Environmental Impact Statement* [FEIS] (2000), which, relevant to this study, gives statistics describing two budget scenarios regarding road decommissioning; and
- *National Forest System Road Management Strategy: Environmental Assessment* (2001), which, among other things, contains a description of alternative NFS road-management strategies.

In particular, the *NFS Strategy* (2001) describes a No-Action Road Management Strategy Alternative and a Proposed Road Management Strategy Alternative. The No-Action Alternative is described as focused on "road development." The No-Action Alternative section of *NFS Strategy* gives statistics on 1996-1999 road decommissioning (p. 23-25) and "Planned Number of Miles and Types of Forest Management Roads Constructed and Reconstructed Annually". The No-Action Alternative can be used as "a baseline against which the impacts of alternatives can be measured."

In the process of assessing the impacts of a prohibition on road construction and reconstruction on the management and operation of the [National Forest Transportation] system, the *Forest Service Roadless Area Conservation: FEIS* describes a Current Budget Levels scenario and a Critical Funding Needs Are Met scenario. Each of these scenarios gives specific figures for miles of road to be decommissioned.

iii. Distinctions Between Road Decommissioning and Road Removal

Officially, the USFS does not have a road removal program. However, the USFS *does* have an overall road-management strategy that calls for making "decisions regarding proposed road construction, reconstruction and decommissioning at the local level using a science-based roads analysis process that considers environmental and transportation needs and effects at multiple scales." It does "give priority to decommissioning unneeded roads and reconstructing and maintaining the most heavily used roads."

Within this overall management strategy, funding levels associated with different scenarios imply specific levels of road decommissioning.

In the Current Budget Levels scenario, if the current appropriated road construction and maintenance budget level of $200 million a year is continued and keeps pace with inflation, which reflects a 5-10 % increase each year,

> …the rate of decommissioning would continue at 2,500 miles per year with an additional 2,500 miles per year likely being closed because lack of maintenance will make them impassable even to high clearance vehicles (FEIS, p. 15).

Over a forty-year period, the Status Quo scenario characterizes 186,000 miles of road as “unneeded.”

In the Critical Funding Needs Are Met scenario, if

> Congress and other Federal agencies …establish sustained funding for NFS roads at a $900 million annual level, [an] estimated 146,000 miles of unneeded roads (including unclassified roads) would be decommissioned at the rate of 7,000 miles per year (USDA 2000 FEIS p. 17).

These scenarios have different patterns over time. The Current Budget Levels scenario envisions 5,000 miles of roads decommissioned annually (half of which merely become impassable due to lack of maintenance, as described above) over forty years. For a total reduction of NFS roads of approximately 100,000 by 2020, 150,000 by 2030 and continuing reductions beyond 2030 due to additional roads becoming impassable due to lack of maintenance. The Critical Funding scenario has a total reduction of NFS roads of approximately 140,000 miles by 2020 and no net change in total NFS roads thereafter (See Figure 3). From the above one can define two different USFS Road *Decommissioning* Programs.

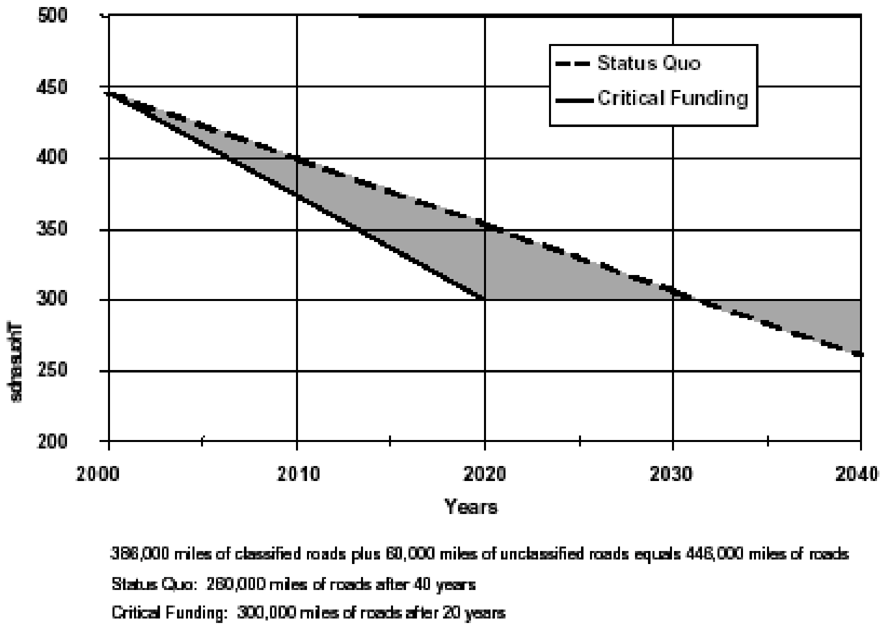


Figure 3: Range of possible National Forest System road miles based on funding (from Forest Service Roadless Area Conservation, 2000, p. 14).

It is important to note that "decommissioning" includes several types of "treatments":

- Blocking Entrances
- Revegetation and Waterbarring
- Removing Fills and Culverts
- Establishing Drainages and Removing Unstable Road Shoulders
- Full Obliteration by Recontouring and Restoring Natural Slopes

Only the last treatment qualifies as "full road removal." Merely blocking an entrance or letting a road become impassable is very different from more active forms of decommissioning.

B. Three Road Decommissioning Program Alternatives

This study defines *three* basic road decommissioning program alternatives. The first two are based on the two scenarios set described in USDA (2000) FEIS. The third is an alternative developed especially for this report.

1. The Status Quo Road-Decommissioning Program for NFS roads (Status Quo Program Alternative)
2 The Critical Funding Road-Decommissioning Program for NFS roads (Critical Funding Program Alternative)
3. Complete Unneeded Road Removal Program (Complete Unneeded Road Removal Alternative)

We define

- the Status Quo Program as decommissioning 2,500 miles of road a year over the next forty years (with an additional 2,500 miles of road becoming impassable per year due to lack of maintenance);

- the Critical Funding Program as decommissioning 7,000 miles of road a year over the next twenty years; and

- the Complete Unneeded Road Removal Program completely removing 186,000 miles of unneeded roads associated with the Status Quo Program over a twenty-year period.

In order to better understand the total of miles considered "unneeded," we need to consider the maintenance and deferred maintenance of USFS roads. "The total fiscal year 2000 road maintenance budget of $111 million…[met] less than 20% of the Agency's annual need…" ((USDA 2000 p. 3). "A 20 year sustained program of $500 million/year would be necessary just to mitigate this critical backlog, much less resolve the rest of the system needs which continue to accumulate" (USDA 1998b, p 18). Given current budget levels and the amounts of maintenance allowed in the Status Quo scenario, 186,000 miles are categorized as "unneeded" (USDA 2000b, p. 16 Figure 9).

Box 1: An Example of Maintenance Issues: Siuslaw National Forest

One of the most significant road issues facing Siuslaw National Forest is the lack of adequate funding for the maintenance of its existing road system. The forest currently has approximately 2,280 miles of roads, including 290 miles of key low-clearance primary and secondary roads, and 400 miles of key high-clearance secondary roads. As of 2002, 770 miles (includes 80 miles of non-key roads) were subject to maintenance. Needed annual maintenance costs were estimated at $3,762,000, with an additional $17,917,000 in deferred maintenance costs. The remaining 1,510 miles of unmaintained roads would require estimated annual maintenance costs of $2,494,000, with an additional $6,917,000 in deferred costs. The 2002 budget allotment for road maintenance was $767,000, or just 22% of what is needed to maintain the key system (source: Siuslaw National Forest Road Analysis Report, January 2003).

	Status Quo Alternative (after 40 years)	Critical Funding Alternative (after 20 years)	Complete Unneeded Road Removal Alternative (after 20 years)
Maintenance Level	Miles	Miles	Miles
Passenger Cars Maintenance Level (3,4,5)	60,000	80,000	
High Clearance Vehicles Maintenance Level (2)	40,000	160,000	Level 1 - 5 Total 260,000
Single Purpose Roads Maintenance Level (1)	160,000	80,000	
Unneeded Roads	186,000	146,000	186,000
Sum	446,000	446,000	446,000

Table 2: Comparison of Three Alternatives

Under the Critical Funding Alternative, 40,000 fewer miles of road are decommissioned than under the Status Quo Alternative, and the roads not decommissioned are maintained at higher maintenance levels. The Complete Unneeded Road Removal Alternative involves actively decommissioning (culvert removal, waterbarring, ripping, recontouring, etc.) the same total of unneeded roads as the Status Quo Alternative, with the remaining 260,000 miles of roads maintained at maintenance levels 1-5.

Ultimately, though, the total miles of road decommissioned depends on determinations regarding how many miles of roads should be maintained at each maintenance level on each forest. This determination is largely made at the level of the individual National Forest. Put another way, the number of miles of roads actually decommissioned under any of the above three programs would be the aggregate of decisions made at the level of the individual National Forest. It should also be noted that the above focuses on the total miles of road decommissioned, rather than the types of treatment involved in that decommissioning. While lesser levels of treatment after former roadways are grown over may appear at first to be adequate, subsequent storm events may prove otherwise.

C. Discussion of Costs of Road Decommissioning

The average cost of decommissioning a mile of road for each alternative is determined by the combination of treatments employed. According to the Forest Service, roads may be decommissioned simply by having a road entrance blocked. In contrast, roads may be decommissioned through complete obliteration. Also roads may be decommissioned by some combination of the other three treatments:

- Revegetation and Waterbarring
- Removing Fills and Culverts
- Establishing Drainages and Removing Unstable Road Shoulders.

Blocking road entrances can be accomplished by any of several different devices: steel gates, earth berms, ranch gates, no devices, boulders, posts and signs, slashes, guardrails, posts or chains. These examples may cost as little as $500. The cost per mile of road would depend on the number of miles of road closed by a single device. For example, if a 10-mile section of road were blocked for $500, the cost per mile would be only $50, but all of the failure potentials would remain.

For road obliteration, outsloping costs have been estimated at $10,000 per mile, and ripping to a minimum depth of 2 feet is estimated to cost an average of $800 per mile. Road obliteration for small roads with gentle terrain and few stream crossings was estimated to range from $10,000 to $20,000 per mile. Estimates for road obliteration of medium-sized and major roads ranged from $40,000-$70,000 and $100,000-$250,000 per mile, respectively (Bagley 1998, p. 16).

Nationally, costs for road decommissioning vary from “a few hundred dollars up to $50,000 per mile” with “the average range…typically $5,000 to $10,000 per mile” (USDA 2000, p. 8). The average of the typical range is $7500 per mile.

The only data we have found for actual road-decommissioning costs by National Forest region shows great variation. This data for 1997 ranges from $611 per mile in the Rocky Mountain Region to $8,600 per mile for the Alaska region, with an overall average of $3,967 per mile of road decommissioned (see Table 3). It should be noted that this table is for miles of road and costs of road *decommissioning* and includes miles of roads that were merely gated. Costs per mile would be higher if more complete road treatments were employed.

	Northern	Rocky M	SE	Inter M	Pacific SW	Pac NW	Southern	Eastern	Alaska	Total
Region #	1	2	3	4	5	6	8	9	10	
$ ‘000	892.7	70.3	96.5	92	709.7	1542	183.3	25.3	25.8	3638
miles	233.4	115	137	32	85	190	92.1	29.1	3	917
$/mile ‘000	3.825	0.611	0.704	2.875	8.349	8.116	1.990	0.869	8.600	3.967

Table 3:
Road Decommissioning by National Forest Regions 1997 (USDA 1998b, p. 18)
(dollars and miles are in thousands)

For this study we have surveyed road-decommissioning costs from several sources.

The Jackson State Forest Road Decommissioning Project in Mendocino County, in northwestern California, had an average cost of $10,832 per mile of road decommissioned. The Jackson State Forest project involved waterbarring (and revegetation), stream-crossing removal, cross ditching, outsloping, but was not full road obliteration (see Table 4).

Table 4: Caspar Road 600 Decommissioning Project, Jackson State Forest
August 6, 1998 to September 9, 1998

	Estimated Costs									
	Total		Stream Crossing Removal		Cross Ditching Road 600		Out-Slopping Road 600		Waterbarring Road 603	
	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost
Excavator ($95/hr)	214	$20,330	120	$11,400	14	$1,330	35	$3,325	--	--
D-8 Tractor ($95/hr)	75	7,125	41	3,895	--	--	12	1,140		
D-6 Tractor ($60/hr)	6	360	--	--	--	--	--	--	6	$360
Laborers ($21/hr)	80	1,680	--	--	--	--	--	--	--	--
Material (jute netting)	--	3,000	--	--	--	--	--	--	--	--
Total Cost	$32,495		$15,295		$1,330		$4,465		$360	
Total Units	3 mi		23,400 cu yd		2,600 linear ft		6,800 linear ft		2,600 linear ft	
Cost per Unit	$10,832/mi		$0.65/cu yd		$0.51/linear ft[1]		$0.66/ linear ft[1]		$0.14/ linear ft[2]	

[1] Average width of 22 feet [2] Average width of 15 feet

Bill Baxter, Division Chief Research, Education & Demonstration Program, Jackson Demonstration State Forest California Department of Forestry and Fire Protection, 802 North Main Street, Fort Bragg, CA 95437

We also obtained data for the cost of road decommissioning in the Six River National Forest from 1991-2002 (see Table 3), and we analyzed the costs and calculated the cost per mile decommissioned. Cost per mile decommissioned by Ranger District ranged from $7,189 to $30,777. The average for the Lower Trinity Ranger District, which treated over half of the roads decommissioned during this period, was $9,378 per mile. The overall average cost was $12,375 per mile of road decommissioned.

Ranger District	Miles of Treated Road	Cost	Average Cost/Mile
Lower Trinity	93.16	$873,642	$9,378
Mad River	34.08	$245,006	$7,189
National Recreation Area	25.3	$320,500	$12,668
Orleans	24.37	$750,028	$30,777
Total	**176.91**	**$2,189,176**	**$12,375**

Table 5: Road Decommissioning in Six Rivers National Forest, 1991-2002

Source: Forest_wide_restoration.xls, provided by Six Rivers National Forest.

A survey of road treatment costs in the northcoast area of California by the BLM found costs ranging from $22,000 to $272,000 per mile (see Appendix B).

Other cost estimates we have obtained from the BLM for several government agencies range from $22,000 to $272,000 per mile of road removed. The range of costs per cubic yard removed for crossings is much smaller, ranging from $3.00 to $7.88 per cubic yard. This suggests the costs for road removal are more dependent on the number and size of stream crossings and the amount of material involved (see Appendix B for full summary and table).

D. Illustrations of the Three National Road Removal Alternatives

For purposes of illustration, we will assume that the mix of treatments for the Status Quo and Critical Funding Alternatives are the same to the extent that they result in the same average cost per mile of road decommissioned ($7,500 per mile--the average of the "typical" range of road decommissioning costs). The Complete Unneeded Road Removal Alternative is defined as having a higher proportion of roads decommissioned by road obliteration and more intensive road decommissioning treatments. Because of the higher level of road-decommissioning treatments involved in this alternative, we will assume the average cost per mile of road decommissioned will be higher for this alternative. For purposes of illustration we will assume that in the Complete Unneeded Road Removal Alterative the average cost per mile of road decommissioned is $10,000 per mile, which is the upper end of the $5,000-$10,000 per mile range given in USDA 2000, and close to the $10,832 per mile cost for the Caspar Road Decommissioning in Jackson State Park, though lower than the $12,375 average cost per mile for Six Rivers National Forest decommissioning.

Based on the above assumptions, the Status Quo Alternative would have an annual cost of $18,750,000 per year for the 2,500 miles of road decommissioned annually at a cost of $7,500 per mile. Also based on the above assumptions, the Critical Funding Alternative would have an annual cost of $52,500,000 for the 7,000 miles of road decommissioned at an average cost of $7,500 per mile. Finally, based on the above assumptions, the Complete Unneeded Road Removal Alternative would have an annual cost of $93,000,000.

Table 6:
Summary of Alternatives

Alternative	Total Miles	Annual Miles	$ per mile	Annual Cost (in $millions)
1. Status Quo	50,000	2,500	$7,500	$18.75
2. Critical Funding	140,000	7,000	$7,500	$52.50
3. Complete Unneeded Road Removal	186,000	9,300*	$10,000	$93.00

*This is based on decommissioning roads at a constant rate over 20 years.

E. Road Decommissioning Jobs

i. Number of jobs, income, and taxes

A very rough, first approximation of the employment impact of a national road removal program can be derived from the observation that "analyses of the 1995 Resource Planning Act Program showed that about 33 jobs economy wide are supported per $1 million expenditure on building and maintaining roads [and that the] case can be made that removing existing roads and restoring the land underlying them would support roughly the same rate of employment" (Clearwater NF, Roads Analysis). At 33 jobs per $1 million expenditure, the three alternatives would generate:

1. The Status Quo Alternative – 619 jobs
2. The Critical Funding Alternative – 1,733 jobs
3. The Economically Optimal Road Removal Alternative – 3,069 jobs

It should be noted that the above is a national, "economy wide" estimate. For example, road-decommissioning expenditures include significant payments for heavy equipment work. Although some of these payments are not direct payments for labor, they are indirectly tied to the labor costs and jobs of manufacturing heavy equipment. For example, suppose a heavy equipment private contractor, because of the prospect for long-term road decommissioning work, obtained a loan for a new piece of heavy equipment. Part of the contracted amount the contractor is paid would go toward the loan and would be an interest payment rather than a labor payment. However, because the loan would pay for a new piece of equipment, a new piece of equipment would have been manufactured and the labor and jobs associated by the equipment would have been generated.

In order to estimate direct and indirect employment on a "micro" or local level, the overall cost must be separated into the amounts spent on different road-decommissioning treatments. Each treatment involves a different labor/non-labor combination, i.e. the proportion of total costs that are labor and non-labor. Once this combination is estimated, the different types of jobs involved must be identified, and hourly wage rates for the different types of jobs involved need to be estimated. Using these wage rates and the amount spent for each type of job, we can calculate the number of full-time jobs involved for each job type and the total number of full-time jobs involved. (For a listing and description of the types of job tasks involved with road decommissioning see the following Boxed sections.)

As noted above, heavy equipment use is a significant part of the overall cost of road-decommissioning work. The Jackson State Project published data relevant to the labor and non-labor costs of decommissioning. In this project, 86% of the total costs was related to heavy equipment, 5% came from labor, and 9% was material related (jute netting). Excavator and D-8 tractor charges were both $95 per hour, and D-6 tractor charges were $60 per hour (for a very small number of D-6 tractor hours). The weighted average heavy-equipment charge for the project was $94 per hour. These figures are close to the heavy-equipment costs incurred in the Prairie Creek State Park Miner's Ridge project, where heavy equipment charges were $90 per hour. Using actual compensation for heavy-equipment operators and laborer costs.

Not all of the heavy equipment cost goes into wage income. For example, if a piece of heavy equipment were rented, much of the cost would go to cover the cost of the equipment, operation of the equipment and the overhead and insurance of the rental agency. Appendix C shows how, based on Jackson Demonstration Forest road decommissioning, the direct employment portion of the heavy equipment cost could be calculated. In particular Appendix C shows how only 20% of each $1,000,000 expended on road decommissioning may go directly to wage income. If so each $1,000,000 spent on road decommissioning would directly generate 4.3 full time equipment jobs. An additional 5% of each $1,000,000 would go directly to laborer wages. Given the lower laborer wage this would generate an additional two jobs per million dollar expended. For a total of 6.3 jobs directly generated per million dollars expended on road decommissioning.

Another way to look at this information is to say that 12.6 full-time jobs for the 6-month construction season are created for each million dollars of road-decommissioning expenditure. Using these figures the Status Quo alternative generates 118 direct full-time annual jobs, the Critical Funding alternative 331 direct full-time annual jobs and Optimal Road Removal Alternatives 586 direct full time annual jobs. In terms of full-time 6 months jobs, Status Quo alternative generates 236 direct full-time 6 month jobs, the Critical Funding alternative 662 direct full-time 6-month jobs and Optimal Road Removal Alternatives 1,172 direct full time 6 month jobs.

Garrity (1995) states that 40% of road-obliteration costs for the proposed Northern Rockies Ecosystem Protection Act (NREPA) is labor. This is significantly higher than the 25.2% estimate of labor cost to total expenditure in the Jackson State Project. The NREPA case involves 6,455 miles of roads obliterated with an estimate of 324 excavator jobs and 78 road-reclamation jobs, for a total of 402 jobs. Heavy-equipment jobs are 81% of total jobs in the Garrity study and only 68% of total jobs in the Jackson State case. The relationship of miles of road decommissioned to jobs, though, are very close, as shown in Table 7 below.

	Miles Decommissioned	% Labor Cost	Total Jobs	Miles Decommissioned per job
Garrity	6,455	40%	402	16.6
Complete Unneeded	9,300	25%	586	15.9

Table 7: Comparison Miles Decommissioned per Job

The jobs multipliers in rural counties are relatively low. For example, in Humboldt County, CA, the jobs multipliers average about 1.3, i.e. every new job ultimately generates approximately .3 of an additional job. The total of direct and indirect local jobs generated by the Complete Unneeded Road Removal Program then would be 762 (586 x 1.3).

The magnitude of heavy-equipment employment related to road decommissioning is large. The extent of heavy-equipment use in road decommissioning in one lightly populated rural county that has a high level of restoration work was investigated in "Heavy Equipment Work in Ecosystem Restoration: Estimated Worker Days in Humboldt County and Surrounding Areas" (Davis, 2003). This study noted, "from … August 2002 through September 2002, 102 heavy equipment operators were simultaneously employed by the sum total of restoration projects tallied in this preliminary report in Humboldt County and surrounding areas and 6,223 worker days were tallied. The majority of the heavy equipment was used in road decommissioning and culvert replacement projects."

Direct income associated with each alternative would not necessarily be identical to total wages generated by each alternative. The amount paid per hour to a private heavy-equipment contractor covers payment for operating the heavy equipment and the costs of fuel, repair, replacement, and insurance and office costs. In addition the hourly heavy-equipment rate would include compensation for the owner of the equipment in terms of time spent administering and coordinating the use of the equipment. Furthermore, the investment in purchasing the equipment would need to be compensated. For example, out of a $94 per hour heavy-equipment rate and a mean $19.29 gross hourly wage for the equipment operator (BLM 2000), $74.81 would remain to pay all other costs. For purposes of illustration assume that half of this amount, $37.40, went to pay for payroll taxes, fringe benefits, fuel, repair, insurance, office costs. The remaining $37.41 would go for heavy-equipment replacement costs, which is 40% of the hourly heavy-equipment rate. Since 86 % of total costs are heavy-equipment costs, 40% of 86% is 34.4%, so 34.4% of decommissioning cost could be related to purchasing and producing heavy equipment, such as raw materials extraction and processing, manufacturing, assembling, transporting, and selling heavy equipment, as well as associated services such as bookkeeping, management, etc. Indirectly over the twenty years, a significant portion of the amount expended could become income to a variety of other sectors and regions of the economy. For example, this heavy-equipment component would total $6.4 million, $18.1 million, and $32.0 million annually, or $128 million, $362 million, and $640 million cumulatively over the twenty years for the Status Quo, Critical Funding, and Complete Unneeded Road Removal alternatives.

Tax revenues would be a percentage of the total income, wages plus return on investment income. This can be estimated using the IMPLAN input-output software or approximated using coefficients contained in that software, but is outside the scope of this preliminary analysis.

ii. Types of Jobs

The previous section discussed two basic categories of jobs: heavy-equipment jobs and laborer jobs. Heavy equipment is needed for stream-crossing removal and numerous and varied other tasks (see Box 2).

Box 2: Types of jobs Created from a Road Removal and Restoration Program

Stream-crossing removal involves excavator and dozer combinations to:
--remove trees and brush (with excavator-mounted masticator) and stockpile them near sites for use or removal
--accumulate and pile ground mulch (dozer may be used)
--construct a small road bench on uphill sides of streams

Bulldozers with rippers are also needed to:
--decompact inboard ditches and road benches to 12" deep and strip organic matter and incorporate it into fill
--recontour the cutbench (except at springs or seeps)
--push fill into cutbanks and compact them
--cut berms on downslope sides
--push extra fill to "storage" areas or truck it to stable areas.

Non-heavy-equipment operator labor is needed to:
--divert water around excavation sites, with berms or pipes
--install sediment filters (silt fence, bio-logs)
--evenly distribute mulch coverage

Best Management Practices Road-Stream Crossing Removal, by Brian R. Merrill and Ethan California State Parks, December, 2001

Non-heavy-equipment operator labor is needed to divert water around excavation sites with berms or pipes, install sediment filters, evenly distribute mulch, perform revegetation, including tree planting, seed application, etc. (see Box 3). In addition various technical jobs are also involved, such as GIS specialists, soil-bioengineers, and others involved in monitoring. Finally, secondary jobs are created by road-decommissiong projects (e.g. nursery growers, performance inspectors, biological monitors, fabricators and machinists) (ASJE, p. 7).

Box 3 Other Road-Decommissioning Job Tasks

--remove Humboldt crossings (logs crisscrossed in stream, covered with fill)
--stabilize old fills and crossings
--bank material against unstable cutslopes
--outslope road surface
--pull culverts
--install no-maintenance drainage structures
--block access (or add bridges) when removing culverts and fill
--revegetate with native plants
--minimize erosion, rilling, rutting, gullying
--rock roads
--convert roads to trails
--recontour slopes
--restore riparian areas

Performing revegetation includes:

-- planting riparian trees
-- planting other native plants
-- planting willows (sprigs)
-- installing erosion prevention materials such as jute netting
-- fertilizing and seeding
-- recontouring slopes
-- restoring riparian areas

Specific professional needs:
--GIS specialists
--engineers
--low-impact loggers and thinners
--soil bio-engineers
--tree planters

Box 4: Secondary Job Creation

Further, there is secondary job creation in related industries (e.g. nursery growers and composters, performance inspectors, biological monitors, fabricators and machinists) *(ASJE, 7)*.

When considering all the National Forest regions and districts, attention must be given to ecosystem-specific road removal, which requires a variety of job related tasks and job types. For example, deserts have tender and diverse vegetation, with great genetic variation, which must be protected from further travel. Desert road removal programs include:
1) restricting access by camouflaging it; 2) decompacting road surfaces to a 3-foot depth;
3) excavating pits of various sizes for water collection and increased surface roughness and variability (a crew of four can dig several hundred per day using hand tools and power augers); 4) horizontal mulching (branches on slope contours) *(*Wildlands CPR 1999 *Desert Road Removal, Road RIPorter)*.

F. Current Reported Levels of Road Decommissioning and Road Removal

Each National Forest prepares a Schedule of Proposed Actions, or a SOPA. In order to provide insight into the quality and time lines of the road-decommissioning information that is currently and easily accessible through the Web, we surveyed a sample of individual National Forests. In particular we chose two forests (or groups of smaller, jointly managed forests) from each of the Forest Service's nine regions. Generally, the choices represent a small forest and a large forest relative to other forests in the region. For some regions, we chose more than two forests. Wherever possible, a brief tally of road-decommissioning activity listed in the most recently available SOPA is provided in the Comments column. Where SOPA information was not available, other easily accessed information is provided, when possible.

Overall, twenty-nine National Forests were surveyed (see Appendix A for details). Twenty-two had SOPA reports online and seven did not. Of the twenty-two with SOPAs online, eight reported some road decommissioning and nine did not. The amount of road decommissioning reported ranged from a few miles to 85 miles, plus an additional nine roads closed to prevent the spread of noxious weeds in the Wenatchee-Okanagon National Forest in Washington. Of the five that did not have SOPAs posted online, two mentioned road-decommissioning work or road closures and three did not. Humboldt-Toiyabe National Forest noted that they had 12.5 miles of road scheduled for obliteration. A few National Forests noted that decommissioning involved road closures in the form of gates or earthen berms, and other National Forests did not specify the type of decommissioning treatments to be used. The detailed results of our survey are reported in Appendix B.

SOPAs refer only generically to "decommissioning," without using more specific terms such as "closure," "ripping," "cross-ditching," "water-barring," "obliteration," etc., which would be useful. A clearly presented link to SOPA information on the homepage of a Web site would also be helpful, as would a more uniform format for quarterly NEPA /SOPA reporting.

Box 5: Road Analysis

In August 1999 the USDA Forest Service published Miscellaneous Report FS-643, *Roads Analysis: Informing Decisions about Managing the National Forest Transportation System*. The objective of the roads analysis was "to provide decision-makers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions….In October 1999, the agency published Interim Directive 7710-99-1 authorizing units to use, as appropriate, the road analysis procedure embodied in FS-643 to assist land managers making major road management decisions."

In March 2000 the Forest Service proposed revisions of regulations to shift "the focus of National Forest System road management from development and construction of new roads to maintaining and restoring needed roads and decommissioning unneeded roads within the context of maintaining, managing, and restoring healthy ecosystems." This culminated in the final National Forest System Road Management Rule that removed the emphasis on transportation development and added "a requirement for science-based transportation analysis. The final rule is intended to help ensure that additions to the National Forest System road network are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated."

"Roads analysis is a six-step process. The steps are designed to be sequential with the understanding the process may require feedback and iteration among steps over time as new information becomes available. The amount of time and effort spent on each step differs by project based on specific situations and available information. The process provides a set of possible issues and analysis questions for which the answers can help managers make choices about road system management. Decision-makers and the analysis team determine the relevance of each question, incorporating public participation as deemed necessary. The following six steps from Report FS-643 guided the process:

Step 1. Setting up the analysis
Step 2. Describing the situation
Step 3. Identifying the issues
Step 4. Assessing benefits, problems and risks
Step 5. Describing opportunities and setting priorities
Step 6. Reporting (Key Findings)

The product of this analysis is a report for decision-makers and the public that documents the information and analyses used to identify opportunities and set priorities for future national Forest road systems" (excerpted and adapted from the Introduction to the Clearwater National Forest Roads Analysis accessible at http://www.fs.fed.us/r1/clearwater/rap/index.htm)

G. Road Analysis Reports

Individual National Forests were required to apply the Road Analysis methodology to their particular forests by January 13, 2003. The results of this analysis are becoming readily available through postings on individual National Forest Web sites. These road analyses provide valuable information for science-based, systematic and comprehensive road management and road decommissioning in each National Forest.

Though quite comprehensive, the available roads analyses tend to be more descriptive than quantitative. Even so they are useful in identifying situations where there is high risk regarding adverse impacts. The Roads Analysis approach used by the Clearwater National Forest is particularly useful and is presented in Chapter 5.

Roads Analysis addresses directly and comprehensively all the subjects relevant to this report. In regard to this chapter on constructed capital, Step 2 of the Roads Analysis, Describing the Situation, considers questions such as:

What are the locations of all roads?
What are the underlying geographic and geologic templates?
What are the ages and development histories of the roads?
What are the road-use patterns over time, now and in the future?

Step 4 considers the benefits access roads provide for commodity production, such as timber and minerals.

Step 5 includes the question:

Can the maintenance requirements of the existing system be met with current and projected budgets?

Roads Analysis at the individual National Forest level, clearly, is essential and useful for characterizing National Forests as "constructed capital." Chapter 7 includes some suggestions and recommendations regarding using and improving SOPAs and road analyses.

H. Summary

There are 523,000 miles of classified and unclassified roads on National Forest System lands. 486,000 miles of those are under Forest Service jurisdiction. The Roadless Area Conservation Rule and the Road Management Strategy call for decommissioning between 100,000-186,000 miles of unneeded roads over the next 20-40 years.

Road decommissioning includes (1) reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation; (2) blocking road entrances, installing water bars, removing culverts, re-establishing drainages, and removing unstable fills; (3) pulling back road shoulders; (4) scattering slash on roadbeds; (5) eliminating roadbeds by restoring natural contours and slopes; and (6) using other methods designed to meet the specific conditions associated with the land around unneeded roads.

Road obliteration for small roads with gentle terrain and few stream crossings was estimated to range from $10,000-$20,000 per mile. Estimates for road obliteration of medium-sized and major roads ranged from $40,000-$70,000 and $100,000-$250,000 per mile respectively.

This study uses the small road category to define *three* basic road-decommissioning program alternatives. The first two are based on the two scenarios described in USDA(2000) FEIS and have an estimated cost of $7,500 per mile. The third is an alternative developed especially for this report and has an estimated cost of $10,000 per mile. A summary of the three alternatives looks like this:

Program Name	Total Miles*	Miles/Yr	$/mile	Annual Cost (in millions)	Jobs/year
1. "Status Quo"	50,000	2,500	$7,500	$18.75	619
2. "Critical Funding"	140,000	7,000	$7,500	$52.50	1733
3. "Complete URR"	186,000	9,300**	$10,000	$93.00	3069

A National Program of Road Removal can be conceptualized as decommissioning 186,000 miles of unneeded roads over a twenty year period at an average of 9,300 miles of road per year at an average of $10,000 per mile or an expenditure of $93 million annually. Thirty-three jobs generated per million-dollar expenditure economy-wide would create more than 3,069 jobs annually. The vast majority of jobs created locally would involve heavy-equipment operators. Many other types of labor-intensive jobs would also be created, such as engineers, GIS techs, road obliteration inspectors, and riparian restoration and revegetation workers. Indirectly, over a twenty-year period, more than $600 million would be generated related to the manufacture of heavy equipment; this would benefit industrial states such as Michigan.

Finally, information contained in the roads analyses, which individual National Forests were required to complete by January 13, 2003, is extremely useful for refining and estimating benefits and costs of road decommissioning and road removal.

2: Natural Capital - Natural Resources and Environmental Services

"Nature's capital generates the flow of natural resources and other environmental benefits such as the rate at which human wastes can be assimilated" (Hackett, 2001).

"…natural capital is not just an inventory of resources; it includes all those components of the ecosphere, and the structural relationships among them whose organizational integrity is essential for the continuous self-production of the system itself" (Wackernagel and Rees, 1997).

"Costanza et al (1997) argue the various forms of ecosystem services such as climate regulation, soil formation, nutrient cycling, habitat, erosion control, and recreation are the benefits that flow from natural capital stocks" (Hackett, 2001).

Ecosystem valuation is "particularly complex" (EPA 2000). The Environmental Protection Agency has recently issued guidelines for economic analyses of resources such as air under EPA jurisdiction *(Guidelines for Preparing Economic Analysi*s, September 2000). The key complication arises (potentially) from the many ecosystem attributes whose values are not directly connected to use by humans, also known as "non-use values."

In addition to the difficulty arising from non-use values are the difficulties that arise from the great number, variety, and complexity of particular impacts to ecosystems. Following is an overview of particular effects on ecosystems, which notes their relation to roads and includes some description and discussion related to gauging these effects.

Geomorphic effects, including sedimentation and landslides

"Road-related mass wasting results from (1) improper placement and construction of road fills and stream crossings, (2) inadequate culvert sizes to accommodate peak flows, sediment loads and woody debris, (3) roads located on soils prone to mass wasting and (4) water diversion onto hill slopes and other unstable parts of the landscape" (The Humboldt-Toyiabe National Forest Roads Analysis p. 81).

*"Surface erosion occurs on most wildland roads because their surfaces, cutslopes, fillslopes and associated drainage structure are usually composed of erodible material and are exposed to rainfall and concentrated surface runoff" (*USDA*, Road Analysis, p 49).*

Redwood National Park technicians are undisputed experts in road restoration. They have developed, tested, and applied road-restoration techniques at a level virtually unprecedented anywhere in the world. Since the park was expanded in 1978, nearly half of its 300 miles of roads have been restored or removed. This work has cleared about 1,300,000 cubic yards of material from stream crossings, landings, and unstable road benches at a cost of about $10,000,000 (Ziemer 1998). Sediment removal costs, after failures, in this case $7.70 per cubic yard, are a direct result of forest roads. Comparing such costs with the cost of road and stream-crossing removal can provide managers with an effective means of measuring the relative impact of roads.

Removal of stream crossings in Redwood National Park and on private lands in northern California averages between $1.00 and $3.50 per cubic yard (Bagley 1998; Spreiter 1992; Weaver and Hagens 1996). Comparing this one-time expense with the ongoing sediment mitigation cost of $7.70 per cubic yard reveals an important economic insight to road removal: *the cost of removing sediment from waterways can be significantly higher than the cost of preventing it from eroding in the first place.* Removing roads, which stops soil-erosion and sedimentation, is more cost-efficient than repairing damaged waterways, restoring habitat, and recovering threatened and endangered species.

As a road ages, it generates a progressively increasing rate of erosion (Ziemer 1998). According to the Forest Service, "erosion prevention and control measures can effectively reduce the chance of future habitat damage" (Ziemer 1998). In-stream engineering projects to recover fisheries habitat may be successful as a temporary short-term strategy, but they are not a substitute for protecting the physical and biological processes that produce watershed habitat (Reeves and Sedell 1992). The Forest Service has invested millions of dollars in erosion control and monitoring over the past several decades. Despite these investments and restrictive land-use practices, in recent years sediment loads in streams have not shown a decreasing trend (Payette and Boise National Forests 1990). In 1999 the Forest Service expected to pay over $80 million to restore fish habitat (USDA Forest Service 1998 (a), cited in Talberth and Moskowitz, 1999). As these and other studies clearly illustrate, it makes not only ecological but also economic sense to address the root cause of the problem (roads) rather than the result of the problem (sedimentation).

Unpaved roads in the Little Tennessee River basin in northwestern North Carolina were estimated to contribute between 520,080 and 681,200 tons of sediment runoff per year. At an estimated cost of $1.94 per ton (1995 dollars), unpaved roads in this area impose a yearly cost on municipalities and private citizens of between $1,009,000 and $1,321,500 (Niemi and Whitelaw 1997). Although costs of sediment vary from region to region, the above estimate suggests that such costs can be significant. It is worth noting that these are yearly costs. If such costs recurred each year, the present value of such costs at a 5% rate of return would be $20–26 million. In other words it would require $20–26 million at 5% to return between $1-$1.3 million annually (see Box 6: Examples of Present Value).

Box 6: Examples of Present Value

Alternatives can have different patterns of expenditures over time and we can not assume that an expenditure in the future has the same value as an expenditure today. Calculating the net present value of different alternatives enables us to compare a one-time expenditure such as road removal with ongoing costs such as road maintenance. Net present value allows us to determine the amount of money needed now to finance a pattern of expenditures in a given alternative. If the present value of one alternative is higher than another, that alternative could be considered more expensive.

The following examples assume that all amounts have been adjusted to take inflation into account. To make calculations easier a discount rate of 10% is used, so for this example $1 now would be considered equivalent to $1.10 one year from now.

Example 1: Suppose maintenance costs for one maintenance treatment are $100 a year forever. In this case, we could say that the present value of the cost of maintenance is $1,000. In other words $1,000 invested at 10% would return $100 a year forever.

Example 2: Suppose maintenance costs for another maintenance approach are $1,100 for the first year only with zero costs thereafter. This approach would also have a present value of cost of $1,000.

Example 3: Suppose maintenance costs for a third maintenance treatment were $550 for the first year and $605 for the second year with zero costs thereafter. The present value of the first year of costs is $500 and the present value of the second year of costs is also $500. It would take $500 to yield $550 at the end of one year at 10%, and the resulting $550 would be spent by the end of the first year. An additional $500 compounded annually for two years would result in $50 the first year and an additional $55 yield the second year for a total of $105 increase in the principal, i.e. $105 by the end of the second year for a total of $605. Therefore, starting with $1,000 at 10% interest, a person could just cover a maintenance cost of $550 the first year and $605 the second year.

Discounting means that, with a discount rate of d, dollar costs or benefits expected to occur Y years in the future must be divided by a factor of $(1+d)^Y$ before they are added together to obtain net present value of cost.

	Treatment One		Treatment Two		Treatment Three	
		PV		PV		PV
Year	Annual Cost	Annual Cost	Annual Cost	Annual Cost	Annual Cost	Annual Cost
1	$100	$9.09	$1,100	$1,000	$550	$500
2	$100	$8.26	0	0	$605	$500
3	$100	$7.51	0	0	0	0
4	$100	$6.83	0	0	0	0
5	$100	$6.21	0	0	0	0
50	$100	$0.85	0	0	0	0
.						
.						
.						
Total		$1,000		$1,000		$1,000

Hydrologic and water quality effects

Water and water bodies have a great many potential uses and benefits including…habitat for fish and other aquatic organisms other than fish, domestic and municipal water supplies, irrigation water supplies and recreational use to name just a few (adapted from USDA Road Analysis p. 63).

It has been estimated that 10 to 25 percent of new water storage capacity is built solely to store sediment each year (Clark 1985). In addition reservoir and lake capacity is reduced by sediment each year. The quantitative analysis of the benefits to municipal water districts from road decommissioning and road removal is a very promising area for research.

New York water supply

The following provides some statistics related to municipal water supply and roads.

> It has been pointed out that some of the very best water quality in the United States is found in unroaded and unlogged areas. Furthermore watershed protection may be the best and cheapest way to guarantee the quality and quantity of drinking water. The city of New York, by spending $1.5 billion to safeguard its vast upstate reservoir system, is avoiding the expense of constructing filtration facilities estimated to cost $6-$8 billion, and $200 million a year in operating expenses (Swanson and Loomis, 1996, p. 44).

However, in the Catskills region, from which the city of New York draws its water, watershed protection takes the form of regulating pollution sources rather than road decommissioning.

Seattle–Cedar River watershed

The Seattle Public Utilities Department has one of the largest unfiltered surface drinking-water systems in the country (the following information is based on personal communication with Marti Spenser, Seattle Public Utilities Department Watershed Management Engineer,). The Cedar River and the Tolt River watersheds are the primary sources of water for Seattle. Virtually all of the 90,000 acres in the Cedar River watershed lie within the Mt. Baker-Snoqualmie National Forest. Of the approximately 30,000 to 50,000 acres of the Tolt River watershed, one-third is managed by the Forest Service. No further commercial harvesting is allowed under the city's Habitat Conservation Plan. Periodic thinning of small-to-medium diameter trees is done with the goal of returning the land to old-growth habitat (with large trees, snags, fallen trees left in place, etc.). There is no public access.

Of the approximately 620 miles of dirt and gravel roads in the Cedar River watershed, approximately 60 miles have been decommissioned (or in their terms, "deconstructed") over the last several years. The Cedar River watershed deconstruction included pulling "sidecast back to a stable position, installing large water bars and cross drains, and restoring stream crossings" (removing culverts and fill). No roads were fully obliterated because the types of soils involved made returning the roads to their natural contours infeasible. However, upwards of 90 % of the decommissioned roads get extensive treatment that renders them undrivable (the most important consideration was soil stability, i.e. keeping sediment out of streams, rather than appearance). The estimate for the Cedar River watershed decommissioning is approximately $30,000 per mile of road decommissioned. They have mapped the watershed extensively and have designated roughly one-third of the total mileage (approximately 200 miles) for decommissioning. The current plan is to decommission approximately10 miles per year through 2020.

By far, in the case of this watershed, the most important criterion for decommissioning roads is the likelihood of a road contributing sediment to streams. A secondary consideration is savings due to reduced road maintenance. Although no previous decisions to decommission roads were made, the prospect of a filtration facility costing several million dollars is always present. The public utilities department believes that road decommissioning contributes to making a filtration plant unnecessary and is more cost-effective over time. They hope to get funding in the near future to do the science to support this assertion. Generally, the public utilities department is moving towards doing more cost-benefit analysis in their asset-management planning process. Estimates for the savings in road maintenance could not be obtained in time for inclusion in this report.

Biological invasions

> *To what degree do the presence, type, and location of roads increase the introduction and spread of exotic plant and animal species, insects, diseases, and parasites? What are the potential effects of such introductions to plant and animal species and ecosystem function in the area? (from Humboldt-Toiyabe Road Analysis, p. 70).*

Roads are the primary vectors in the spread of invasive species…When looking at the noxious weed populations on the districts that compose the northeast central portion of the Forest and the Carson Ranger District, 84% of the weed populations are associated with roads. Typically invasive plants will follow a road system and *then once established start expanding into surrounding areas…It is not uncommon to experience an 80% to 90% reduction in native species due to invasive plants (Humboldt-Toiyabe National Forest Roads Analysis, Ch. 4 p. 70).*

The Bureau of Land Management employs the California Conservation Corps crews to remove invasive pampas grass from roadsides and clearings in the Headwaters Reserve in Humboldt County. First, existing plants must be thoroughly removed. A single missed plant produces enough seeds to regenerate large areas. Although sites do not need to be revisited annually, revisiting every other year is desirable. It would take decades for a canopy to grow sufficiently to shade out pampas grass, during which time seeds would have had the opportunity to invade other areas. Road obliteration with proper landscaping accelerates the re-growth of natural forest canopies and reduces unvegetated areas that attract invasive species due to unnatural increases in areas exposed to direct sunlight. (personal communication BLM staff).

Habitat fragmentation

When roads slice through formerly unbroken habitat areas, the resulting openings affect species' abilities to hunt, find cover, or den. The degree of habitat fragmentation generally correlates with road density. Road densities greater than 1 mile per square mile have been shown to reduce habitat security and increase mortality for a range of predators, including grizzly and black bears, and lynx (Britell et al. 1989; Naney 1991; Noss 1996 citing Brody and Pelton 1989). A 1996 study of Montana grizzly bears found that animals avoided areas of high road density even though roads were closed to public use (Mace et al. 1996). Studies in southern Utah and the northern Great Lakes have shown that mountain lions and wolves, respectively, fail to survive when road density exceeds 0.9 miles per square mile (Thiel 1985; Van Dyke et al. 1986; Jensen et al. 1986; Mech et al. 1988). In 1989 Mech determined that wolves could survive in areas with higher road density only if they existed adjacent to roadless lands populated by wolves.

These results suggest how road-decommissioning treatments differ in terms of environmental benefits, i.e. ineffective road closures do not have the beneficial impact on wildlife that more intensive treatments such as road obliteration have. The more a road-decommissioning alternative reduces overall road density in an area, the more wildlife benefits increase. Given that estimates exist for the public's willingness to pay for environmental services including wildlife habitat, this aspect of road decommissioning might be quantifiable.

For each alternative, the set of roads to be decommissioned imply acreages of land that will become unroaded. The Status Quo alternative involves the smallest acreage and the Complete Unneeded Road Removal alternative the largest. In so far as the value of unroaded areas can be estimated through willingness-to-pay and travel-cost methods, the total value of the acreage of unroaded land in each alternative can be quantified.

Similarly, each alternative implies different acreages of land that will become less densely roaded. Land that has road densities of 0.9 miles per square mile or lower benefits wildlife such as wolves and bears. Again, in so far as these wildlife values can be estimated, the value of creating different amounts of less densely roaded land can be quantified.

Forest diseases

One example of a forest disease that roads help spread is the Port-Orford cedar root fungus. Port-Orford cedar is an ecologically and commercially valuable species endemic only to southwest Oregon and northwest California. Port-Orford cedar is an extremely valuable commercial species, both for its landscaping use and as a finished wood product. Individual mature Port-Orford cedar trees can bring up to $50,000 on the open market. The Japanese prize the wood for use in their homes because it closely resembles their native hinoki cedar. Port-Orford cedar is also an important species to Native Americans, who used it in ceremonial houses and sweat lodges.

There have been serious losses of the tree due to the exotic root fungus disease *Phytophthora lateralis*. The water-borne spores of *P. lateralis* are spread through moving water and carried in mud on the tire treads (University of California Weed Research and Information Center, 1999).

Roads that access disease-free areas are being closed during the rainy season or year-round with gates or tank traps to lessen the risk of disease introduction (Siskiyou National Forest Roads Analysis 2003). A study of road closures in the northern Rockies showed that "many [road] closure devises were not effective at preventing motorized use on roads designated "closed" or restricted…Only 27% of all the inventoried closure points fully closed the roads that they were intended to block and showed no signs of motorized activity beyond the closure points. With apparent administrative use factored out, road closures still allowed unplanned motorized use on 51% of all roads inventoried during this two year study" (Havlick). Considering that a single Port-Orford cedar can bring $50,000, decommissioning unneeded roads in areas where the disease is present could be cost effective in protecting disease-free areas.

Recreation effects

Recreation, hunting, and fishing in National Forests are estimated to contribute $111 billion to the gross domestic product and to generate 2.9 million jobs each year. These uses contribute 31.4 times more value to GDP and generate 38.1 times more jobs than the timber sale program (Talberth and Moskowitz (1999).

A variety of measurement techniques to estimate the value of outdoor recreation and other non-market goods and services have been developed by economists in recent decades. Non-market valuation techniques can be subdivided into two categories: indirect and direct. Indirect valuation approaches rely on observed behavior to infer values, and economists refer to these valuation modeling approaches as "revealed preference models." The travel-cost method (TCM) is a prominent revealed preference model that uses the relationship between visits and travel expenditures to infer the value of a recreational site. In contrast, direct valuation approaches rely on people stating their valuation, and include various survey-based techniques such as contingent valuation, conjoint analysis, and choice modeling to directly elicit preferences.

For example, the zonal travel-cost method has been used to measure the recreational economic benefits from wilderness visitation in the eastern Trinity Alps of California (Hackett, 2000). The zonal TCM involves aggregating visitation data by county zones of origin, and computing travel cost from the zone to the study area. Visitors are estimated to have spent a total of $566,058 in travel expenditures to access wilderness in the eastern Trinity Alps. These visitors are estimated to have received a total of $219,028 in net benefits from their wilderness experience, over and above the cost of traveling to the wilderness area, or $29.28 per individual visit. Based on the net benefits from recreation and the discount rate recommended by the Forest Service, the wilderness resource is estimated to have a capital value of $5.48 million.

The value of restoring and maintaining healthy salmon populations has also been estimated using a contingent value survey approach (Niemi *et al* 1999). This study found that the residents of Washington and Oregon placed a substantial value on restoring and maintaining healthy salmon populations, saying that, on average, they are willing to pay about $30–97 per household, per year to protect salmon. Although some percentage of this expression of value reflects a desire to secure salmon for the commercial and recreational fisheries, a considerable portion is linked to a desire to protect salmon for their intrinsic characteristics. Similarly, the value of increased populations of bear, deer and other species could, in principle, be estimated using the contingent value approach.

"Mapping" the overall benefit to the portion attributable to road-decommissioning alternatives is difficult but not impossible. Decommissioning roads decreases road densities and increases the acres of roadless areas. Roadless areas and areas with lower road densities both increase wilderness values and populations of various species. These increases in value could be estimated using methods such as the travel-cost method and contingent valuation, though this is not possible given the funding available for the current study. Decommissioning roads would reduce vehicular access to some areas and would have to be weighed against opportunities created by increasing fish and game populations. For example, not being able to drive to some fishing spots would have to be weighed against increased fish populations available to be caught. Judgments regarding such tradeoffs between access and opportunities can be made regarding specific roads in specific areas. For example, as will be discussed in Chapter 5, forest roads can be categorized as "low road value" and "high environmental risk." Clearly those roads that provide minimal resource or recreation access, combined with environmental risks such as erosion, would be likely candidates for road decommissioning.

Roads and wildfires

The relationship between roads and wildfires is problematic. "Humans are suspected to cause at least 90% of wildfire in the US, over half of which begin along roads. In 1941, Shaw and co-workers reported 78% of all anthropogenic fires occurred within 265 feet of a road. In New Jersey, the origins of 75% of all forest fires were traced to roadsides" (Noss, 1999). Thus a road provides access for humans to start and to respond to fires once they are started. Again, perhaps the positive or negative contribution of roads to wildfires can best be addressed in particular cases: where a road provides little resource or recreation access value, and where forests are close to their natural condition and distant from human settlements, decommissioning roads may reduce the risk of human-caused fire without increasing the loss of life or property due to fire. Perhaps Fire Safe Councils in conjunction with watershed-based groups can help determine where road decommissioning is appropriate and necessary.

Benefit transfer technique of ecosystem valuation

One approach to ecosystem valuation is called "benefit transfer." In some cases it may be feasible to use value estimates generated for a similar site to infer values at an unstudied site that is of public policy interest. Boyle and Bergstrom (1992) define benefit transfer as "...the transfer of existing non-market values to a new study which is different from the study for which the values were originally estimated." Thus benefit transfer allows the researcher to use information, models, or values generated from one study and apply them to analysis of a site or situation with similar attributes. The transfer could involve information on primary physical effects such as roadway erosion, secondary physical effects such as increased turbidity (or sediment loading) due to erosion, and the economic implications (reduced recreational or commercial fish landings). The advantage of benefit transfer is that it can be done at a much lower cost. Unfortunately in many cases there have been no relevant studies from which to transfer benefit information. This is especially the case with ecosystem services such as erosion control.

"The Economic Impact of the Wildland Recovery System of the Northern Rockies Ecosystem Protection Act" (Garrity 1995) estimates the total benefits from the proposed Northern Rockies Ecosystem Protection Act at $904,332,357 and the total cost at $110,820,852. The act proposes obliterating a total of 6,455 miles of roads. The cost of road-related work is 40 % of the total of road-related and "forest reclamation" work. Assuming that 40 % of the total benefit is attributable to road decommissioning, then road decommissioning results in $364 million of benefit, or $56,427 per mile of road decommissioned, several times more than the cost per mile of road decommissioned. The accuracy of the benefit transfer approach depends on the validity of the initial study and the degree of similarity to the unstudied situation.

Summary

The capacity of forests and watersheds to provide essential habitat, water purification, flood control, and other ecosystem services has been impaired due to road-building. These impacts include sedimentation and landslides, hydrologic and water quality effects, biological invasions, habitat fragmentation, and forest disease.

Environmental benefits of road decommissioning include reduction of landslides and erosion, which impose millions of dollars of costs annually. One example given is the removal of stream crossings in Redwood National Park and on private lands in northern California, which average between $1.00 and $3.50 per cubic yard. Comparing this one-time expense with the ongoing post-failure sediment mitigation cost of $7.70 per cubic yard reveals an important economic insight to road removal: *the cost of removing sediment from waterways can be significantly higher than the cost of preventing it from eroding in the first place.* Removing roads, which stops soil-erosion and sedimentation, is more cost-efficient than repairing damaged waterways, restoring habitat, and recovering threatened and endangered species.

Road removal reduces costs to municipal water districts by reducing the need for costly filtration facilities. Road removal also drastically reduces the costs of trying to control invasive plant species, whose spread is promoted by roads. Road removal improves habitat and enhances a host of recreational as well as non-use values.

3. Human Capital

Human capital is another term for the knowledge, skills, and capabilities of people that can be deployed to create a flow of useful work for community and economy (Hackett, 2001, p. 208).

A. Conceptual Basis

As with the other forms of capital, one should consider both the “stock,” or level of capital at a point in time, and the “flow” of benefits over a period of time, such as a year. One measure of the level of an individual’s human capital is the level of her or his education. One’s annual income is one measure of the flow of benefits from their stock of human capital. Years of experience is another measure of the level of one’s human capital. One’s income tends to be higher as the number of years of experience increases. The value of the stock can be estimated from the value of the flow of benefits. For example, a net revenue of $5,000 per year from a rental unit, at a 5% rate of return, implies that the capitalized value of the apartment is $100,000, the amount that would generate $5,000 per year at a 5% rate of return. Improvements of $20,000, if they generated an additional $1,000 net revenue per year, would also be consistent with a 5% rate of return (see Box 6:Present Value Examples p. 22).

This section presumes that increasing an individual’s stock or level of human capital through increased road-decommissioning-related training and experience will increase that individual’s annual income. Two questions examined are 1) what is the nature of the training that would be provided, and 2) how could that training result in a greater likelihood of cumulative useful employment experience?

B. Proposed Characteristics of Ecologically-Based Road-Removal Jobs

<u>“High Road” Approach</u>

One study by the Alliance for Sustainable Jobs and the Environment (Van Daalen 2001) described five criteria for “quality” jobs in restoration:

1. family wage, fully trained, journeyman level (careers)
2. certified training and apprentice with skills standards and curricula
3. a safe, healthy workplace
4. year-round jobs (duration, stability, tenure, mixed contracting)
5. trained pools of contractors to bid on stewardship style

(Oregon study, Van Daalen 2001, p. 7)

Another ASJE document entitled “The High Road to Restoration Jobs” describes restoration job training tied to ecological concepts and development of a local workforce for “stewardship contracting for continual monitoring and maintenance.”

Other ASJE suggestions regarding community implementation include bringing in additional worker constituencies besides organized labor, including non-industrial private forest owners, tribes, and fishermen. They also encourage incentive programs for restoration on private lands, such as easements, cost-share programs, reinvestment and social investment (van Daalen 2001, p. 9 citing Kattleman, 2000 and Willer, 2000). In contrast to the “high road” approach, this study defines a "low road" approach that involves focusing contract competition exclusively on low bids, exploitation and abuse of immigrants and undocumented workers, and minimum-wage jobs. This approach is termed a "race to the bottom" (van Daalen 2001, p. 5). The report notes that any such "gypo" contractors operate without commitment to the workforce or the land. The ASJE report asserts that the Forest Service will save money in the long run with reduced supervision, implementation, and maintenance, by choosing the "high road" approach.

The "high-road" approach to forest restoration is based on further training and apprenticeship, leading to "complex ecosystem management," where each worker must "demonstrate a mix of skills and proficiencies." The "skills mix" is important in training programs and in on-the-ground applications (van Daalen, 2001, p. 6).

A study by Brodsky and Hallock in 1998 concluded that using this new “high road”’model for watershed restoration work was at least as cost effective as the traditional method (i.e. low bid, narrow task, unskilled workforce). This is primarily due to the fact that trained and skilled workers perform more efficiently and make fewer errors. The failure rates and repair work required under Jobs in the Woods contracts were lower (Western Council of Industrial Workers, 2001).

As an example, the study cites the Washington State Jobs for the Environment program. This program created 800 restoration jobs of 1-24 month duration, with wages at $12.44 per hour plus health benefits. It resulted in 167 miles of salmon habitat re-opened, 725 acres re-vegetated, and 138 miles of road abandoned. Another example is the federal Jobs in the Woods (JITW) program. In 1995 JITW spent $27.8 million, of which 99% went to contractors, creating 2,200 jobs with average wages of $17.10 per hour, but for a duration of only 5.3 weeks. About half the jobs went to displaced workers (van Daalen 2001, p. 4).

Contracts

The ASJE study also identifies a need to move from short-term jobs to "bundled contracts" –i.e. multi-task, across public/private, ecosystem-wide (van Daalen 2001, p. 5).

> "These contracts give ecosystem contractors the opportunity to utilize the varied skills of this new emerging workforce. These contracts also sometimes involve partnerships between agencies or between private/public land owners. Importantly, the multiple tasks incorporated in these contracts allow for longer employment durations. The U.S. Forest Service has made genuine progress building support for reformatting contracts so they meet forest management needs while also promoting high quality employment for local residents" (WCIW, p.3).

The key ingredient of stewardship contracting "is the 'best value' selection of contractors, choosing the contractors based on quality of work, rather than cheapest contract," according to Carol Daly of the Flathead Forestry Project, Montana, testifying at a Congressional hearing on Stewardship Contracting (US House of Representatives, 2002). Also, WICW suggests that preference be given to contractors who include in their bids ecosystem training and high quality employment goals and that this preference could be standardized and institutionalized through legislation (WCIW, p. 3). For a copy of a draft of the Jackson State road-decommissioning contract see Appendix F.

Worker Rights Criteria – Restoration Principles

Certification of ecological forest products sometimes includes "worker rights" criteria:
"Timber operations are conducted with respect for workers' rights and their role in the community," and includes a checklist which contains, among others, "wage and benefits packages are representative of prevailing local standards," "mechanisms exist for resolution of employee grievances", etc. (Institute for Sustainable Forestry, 1994).

In addition, restoration program coordinators suggest that worker selection criteria should include level of career interest and commitment to restoration work (RCAA).

Restoration Principles and Criteria were developed by a diverse group of forest activists and forest ecologists from around the U.S., with input from representatives of forest practitioners. They included the Communities and Workforce Core Principle – *make use of or train a highly-skilled, well-compensated workforce to conduct restoration*-- and stated that:

> A highly-skilled, well-compensated workforce is essential for restoration to meet high ecological standards. Building the restoration economy requires a commitment to regional training capacity (multi-jurisdiction and interdisciplinary), skill certification, consistent funding over decades and assuring workers' rights to organize and bargain collectively. The process of advancing ecological restoration must be open, inclusive and transparent, and should contribute to breaking down class, culture, gender, language and religious barriers.

The principles propose job criteria very similar to those listed above that were proposed by ASJE.

Quality Jobs Criteria:

a) Restoration contracts should recognize and foster a multi-disciplinary, high-skilled workforce of trained, certified restoration technicians and applied ecologists, and provide stable, full-season employment.

b) Restoration workers should be compensated with a family living wage at levels commensurate with their knowledge and skills, set as a functional minimum.
c) Restoration must be supported by regional training and skill certification systems (e.g. apprenticeship programs), with stable funding, that provide for multidisciplinary skill development to broaden career opportunities.
d) Employment and training systems must be equally accessible to the existing diverse workforce. Restoration contracts and regional training systems must be linked by recognized skill standards and associated wage and benefit standards.
e) Contracting, employment, and training systems must promote the efficient and fair utilization of local, regional, and mobile workers in a way that most effectively meets ecological integrity as well as social goals.
f) Restoration workers at all wage and skill levels must be guaranteed the right to organize and bargain collectively.

The principles also state:

> …Contracts for restoration work on public lands must be awarded on "best value" rather than "lowest bid" criteria. Best value should be based on desired ecological, community and workforce objectives, which ensure contractors possess the necessary skills and capacities to carry out high quality work, have successfully performed such work in the past, and provide social and economic benefits to communities….

Preference for "best value" contracts on public lands should not exclude any business or group of persons, but should be given to local crews and small businesses, underserved communities, and mobile workers, who can demonstrate direct knowledge and experience of the ecosystem in which the work will be done. Procurement mechanisms should encourage contractors to include a training and employment component that will increase the capacity of existing displaced timber workers and mobile workers to access and perform high-skill, long-duration work. The mobile workforce consists of economically disadvantaged, under-represented, and culturally diverse crews of migrant and community-based forest workers who perform services such as tree-planting, thinning, brush disposal, prescribed burning, trail construction, etc.

"In general, restoration involves a mix of road removal and decommissioning, silvicultural treatments, riparian and in-stream habitat restoration, and monitoring." Overall, "the high-road to restoration offers an industry led by 'applied ecologists': contractors and restoration technicians thinking and doing on the ground, working as a team with scientists and managers to apply local experiential knowledge in combination with the best available science" (van Daalen, 2001, p. 6).

These features would tend to encourage individuals to obtain greater levels of knowledge and skills in regard to restoration work and to choose restoration employment as a career.

C. Training

Training related to road decommissioning and road removal can be an important part of comprehensive training in restoration work. The following are examples of ecosystem restoration training programs.

Sweet Home Pilot training program: The Ecosystem Workforce Project model began in 1994 with the Sweet Home Pilot, which "combined training in forest and stream ecology, restoration, and legal and entrepreneurial basics with practical field experience" (EWP, 1997, p.2). There were seven projects in 1995 using the model. Detailed accounting is available for these. (NOTE: These programs are not specific to road removal and decommissioning, but rather train for a wide range of restoration skills. However, training costs may be extrapolated. The best training program will be cross-disciplinary, thus training workers in skills that will lead to flexibility in the field and sensitivity to ecological concerns.

Jobs in the Woods program: According to the Western Council of Industrial Workers, a comprehensive ecosystem training curriculum was key to success of the federal Jobs in the Woods program. This was developed through Oregon State University, with a consortium of institutions led by professor Flaxen Conway (Western Council of Industrial Workers and Pacific Northwest Carpenters Regional Council, 2001).

Redwood Community Action Agency: Redwood Community Action Agency's "Ecosystem Management Training Programs in Humboldt County" lists projects and skills (RCAA, p.34, and p.10). Relevant projects included landslide stabilization, road decommissioning, culvert brushing, culvert and ditch maintenance, water bar creation, and erosion inventories. Relevant skills sets included experience in the construction of drainage structures, culvert and drop inlet maintenance, concepts of pulling stream crossings and regrading prism, outsloping, inboarding, and storm proofing roads.

Redwood Community Action Agency and the Mattole Restoration Council conducted a one day Heavy Equipment Supervisor's Training Workshop, which focused on successful project management covering

-- budget/financial management
-- principles of supervision
-- reporting and invoicing tips
-- common problems that develop at implementation worksites
-- safety
-- guidance on field supervision
-- photo documentation
-- in-project monitoring

The complete workshop outline is included in Appendix F.

The California Fish and Game, the U.S. Forest Service, and the non-profit Collaborative Learning Circle funded the training. The cash funding of the workshop totaled $3,780 for approximately twenty participants.

Road-decommissioning training programs cover contracting, implementation, supervision, monitoring, and onsite training. Five-day programs have been conducted at an approximate cost of $600 per participant (not including meals and lodging). At this rate, a twenty-participant weeklong program could be conducted at a cost of $12,000. It is important to note that "training programs have an obligation to limit enrollment to a realistic projection of jobs that will exist" (van Daalen 2001, p. 5, citing Rux, 1996). As demonstrated in the Humboldt Restoration Jobs study, a significant number of people are currently employed as heavy-equipment operators working in restoration in Humboldt County, with more than a majority working in road decommissioning. Training programs directed at these people could increase their job skills, productivity, and income.

Summary

There is a need for an adequate national restoration investment (van Daalen 2001, p. 5). Currently restoration job training is an "unfunded mandate." Although the level of funding needed nationally is difficult to determine, if each of the 155 national forests were allocated on average $32,000 annually, this would total approximately $5,000,000. If this additional amount were earmarked specifically for road-decommissioning training, this would be 5.3% of the $93 million physical cost of road decommissioning and removal in the Complete Unneeded Road Removal alternative.

4. Social and Cultural Capital

> *Social capital, as the concept is used by sociologist James Coleman and political scientist Robert Putnam, refers to the stock of "civic virtues" and networks of civic engagement, involvement, reciprocity norms, and trust essential to democratic communities… Cultural capital refers to the body of stories, visions, and myths shared by people and providing the framework for how people view the world and their proper role in it (Hackett, 2001).*

Putnam's comprehensive study of diverse regions of Italy identified "civic virtues" or social capital as perhaps the most important factor of economic prosperity, more important than natural resources, education, or political or economic organizational structures or forms. Rather than social capital developing as a consequence of economic development, a highly developed level of social capital may be a primary basis of economic development. As applied to road removal, recognition of the primacy of social capital suggests that rather than a road-removal program healing the divisiveness that currently exists regarding forest management, particularly on federal lands, healing that divisiveness may be a precondition for developing a socially beneficial road-removal program.

Forest Community Research Study

The non-profit Forest Community Research (FCR) organization recently published a major, Ford Foundation-funded assessment of the Northwest Economic Adjustment Initiative (NEAI) of the 1993 Northwest Forest Plan. This assessment examined NEAI programs in terms of "five dimensions of community capacity--(1) physical capital, (2) financial capital (3) human capital, (4) cultural capital, and (5) social capital," (FCR 2003)--which correspond closely to the categories used as a framework for our study. One of the lessons identified in the FCR study was that "Social and human capacity building, what it terms as 'soft infrastructure,' are key elements in reaching affected communities and improving well-being." The FCR report recommends that "Support is needed at local levels (such as that through the Forest Service's Rural Community Assistance Program), as well as at agency and state institutional levels to encourage, support, and facilitate collaboration."

Following are other policy recommendations relevant to development of social capital that are contained in the assessment:

a. Soft infrastructure development needs to be closely integrated with hard infrastructure development, rather than being treated as a separate strategy.

b. Support for soft infrastructure development needs to be long-term and ongoing in nature, aimed at continuous capacity-building and enhancement.

c. Soft infrastructure support through programs like the Economic Action Program/Rural Community Assistance Program of the Forest Service and through the Economic Development Administration are unique and need to be maintained and funded.

d. Development planning and implementation needs to be structured in ways that facilitate broad and ongoing community involvement. For example, planners might consider replicating the Skamania model of participatory community development and/or implementing other participatory models.

Box 7 Skamania Model: Skamania County, Washington

Skamania County, located in southwestern Washington, is one of thirty-one case studies in the three-state NEAI area. Skamania County's economy has always been tied closely to the river, forest, and mountains. In the late 1970s and early 1980s, the timber-dependent community experienced an economic decline that resulted in the highest unemployment rates in the state of Washington. The Skamania County Economic Development Council, which was founded in 1985, is a private non-profit that coordinates many of the county's economic development activities. It seeks to assist local businesses in retention and expansion efforts. It also helps prospective businesses locate to the county. "The southern Skamania County case study provides an interesting story of communities and a county trying to reconstruct their identity from being primarily a logging region to a destination tourism and recreation region, mixed with technology and scientific research" (Forest Community Research 2003).

Participatory Principle

The Restoration Principles (DellaSalla *et al*, 2003) include the following "participatory principle":

Participatory Principle – *encourage involvement of a diversity of communities, interest groups, agencies and other stakeholders at all levels.*

Meaningful involvement of a diversity of communities, interest groups, agencies, and other stakeholders (at local, regional, and national levels) should be achieved through open, inclusive, and transparent decision-making processes with recognition of and respect for differences**.**

The Restoration Principles also includes the following "participatory criteria":

a) Adaptive processes for carrying out assessments, planning, monitoring, and evaluation of restoration efforts on public lands should be "all-party" processes to the extent feasible; that is, open to and proactively inclusive of all stakeholders at local, regional, and national levels.
b) No one interest or community should be afforded control of or undue influence on public-land management decision-making.
c) Adaptive all-party processes should strive to build consensus around ecological, social, and economic principles and practices by focusing on common values, mutual goals, and the resolution of conflicts based on class, culture, language, and religion.

One particularly interesting suggestion from the Forest Community Research Assessment was to engage local participants in the evaluation process through participatory research. Funding for such local participatory research could contribute to building capacity for community collaborations regarding road management, road decommissioning, and road removal.

Cultural Component

Successful tribal restoration projects may illustrate the value of cultural aspects of restoration programs. An EPA summary, "Restoring Watersheds by Decommissioning Forest Roads: Karuk Tribe and Forest Service Form Successful Partnership," goes so far as to state, "Building the tribe's capability to play an appropriate role in ecosystem management is the only means by which ecosystem restoration, cultural survival, and community prosperity can be achieved" (EPA) (see Box). Forest Community Research's NEIA Assessment suggests that "the elements that contributed to the success of tribal worker retraining and ecosystem workforce development programs have applicability in non-tribal contexts."

Community Forestry

Many organizations have discussed community goals and considerations related to forests.:

Box 8: Restoring Watersheds by Decommissioning Forest Roads:
Karuk Tribe and Forest Service Form Successful Partnership

For years the tribal lands of the Karuk Tribe of California, located in northern California near the Oregon state line, have been honeycombed with roads for mining (gold, gravel, and quartz) and timber harvesting. Today, however, the watersheds are in imminent danger of environmental crisis because of sedimentation resulting from those past activities, threatening the habitat of coho and chinook salmon, as well as steelhead trout. A 72% decline in timber harvesting between 1989 and 1997 has also devastated the region's economy. Many tribal members who once worked for logging or mining operations are now unemployed.

Today, 95% of tribal ancestral lands are located in the Klamath and Six Rivers National Forests. In 1994 a government-to-government protocol agreement emerged from this overlap to help protect and restore the region. The Steinacher Road, once serving as the region's main corridor, was soon identified as the largest contributor of sediment to Steinacher and Wooley Creeks, which eventually lead to the Lower Salmon River. It is estimated that since the road's construction in 1971, more than 10,600 cubic yards of sediment have entered stream channels from cutbanks and the road surface; and annual delivery is more than three times background levels.

Securing funding

In 1998 the Karuk Tribe entered into a memorandum of understanding (MOU) with the Klamath National Forest calling for the sharing of resources, funding, and staff to help with decommissioning Steinacher Road. The Karuk Tribe secured 319 funding to help provide "storm-proofing" and prescription planning until significant restoration funds could be secured for the remainder of the decommissioning. Over the next two years, the Karuk Tribe and the northern California Indian Development Council secured more than $1 million of funding from seven different funding sources to help with the project. In January 2000 an MOU was signed between the Karuk Tribe and the Six Rivers National Forest to continue completion of the Steinacher Road project as funding becomes available. Organizers of the project estimate that it will cost $1.9 million and take one project team three years to complete. (continued next page)

The Northwest Forest Plan "identified reduced revenues to…counties, fewer jobs, and social disruption as the main economic effects in resource dependent communities due to significant declines in timber harvesting levels” (Klamath NF, 1998).

The Ford Foundation-supported National Demonstration Project “aims to find out if community-based forestry can [, among other things, reduce] forest fragmentation and [maintain] wildlife habitat and water quality…produce economically viable local jobs with good wages or otherwise augment local income and reduce poverty…heal the divisiveness that currently exists…regarding forest management issues, particularly on federal lands…help communities weather uncertain ecological and economic future” (www. nwf.org/…community-based forestry).

The American Forests organization, in discussing community-based forestry issues and strategies, discussed a goal to :

> Clarify and expand Forest Service authorities to provide technical assistance to communities. The agency needs to have clear authorities to work with and assist communities directly. Authorities are needed to facilitate the process by which the Forest Service collaborates with community groups on planning and decision-making, enters cooperative agreements, cost-share grants and contracts with local non-profit groups, small businesses, and youth conservation programs” (www.americanforests.org/…).

(continued from previous page) Building tribal capability

With assistance from the Northern California Indian Development Council, the Karuk Tribe initiated a Comprehensive Watershed Restoration Training and Implementation Program for tribal members and staff. The goal is to prepare the members of a Tribal Restoration Division for careers as watershed restoration specialists while supplying on-the-job apprenticeships completing critical restoration work on projects available throughout the tribe's ancestral territory.

Since the Tribal Restoration Division was established, at least sixteen tribal members have undergone training in heavy equipment application, prescription planning and surveying, and supervision of project sites. The new watershed restoration specialists have also removed about 94,800 cubic yards of sediment to stable locations and reestablished the natural drainage for five major streams that cross the abandoned Steinacher Road.

Improved water quality and fisheries are seen as a significant component of rebuilding the economy of the region. Watershed restoration represents an opportunity for long-term, stable employment based on non-resource-extraction ecosystem management and a stable, fully functioning ecosystem. Building the tribe's capability to play an appropriate role in ecosystem management is the only means by which ecosystem restoration, cultural survival, and community prosperity will be achieved.

Looking ahead

Over the long term, more than 2,000 miles of road throughout the Karuk's ancestral territory will need decommissioning, significant upgrading, and/or remediation of mining impacts. These projects will take twelve project teams 25-30 years to complete. At a minimum, continuing this program requires $3 million per year above the current forest watershed budget for planning, inspection, administration, andlogistical support. If funding can be secured, the partnership created between the Karuk Tribe and the Forest Service will continue to serve as a model for a systematic approach to long-term salmon recovery efforts on the Klamath River.

US EPA

Community goals and considerations related to forests identified above can be grouped in the following four categories:

1. <u>Promotion of the community-wide economy and social stability:</u>
   - increase revenue to counties
   - reduce social disruption
   - improve economic stability
   - help communities weather an uncertain ecological and economic future
   - heal the divisiveness that currently exists…regarding forest management issues, particularly on federal lands…
   - develop non-traditional forest-based resources that could contribute to economic diversity

2. Promotion of jobs:
   - more jobs
   - produce economically viable local jobs or otherwise augment local income and reduce poverty

3. Improved community participation in planning and decisions related to forests.

4. Expand Forest Service technical assistance to communities

Conclusion

As suggested earlier in this chapter, healing the divisiveness that currently exists regarding forest-management issues, particularly on federal land, improving community participation in planning and decisions related to forests, and expanding Forest Service technical assistance to communities, may be the means to achieve the other identified goals such as improving economic stability through producing economically viable local jobs, etc. FCR's assessment of the NEIA notes that

> Serious economic challenges remain for a number of communities in the Northwest, particularly for many of the smaller and isolated communities. Further development efforts, whether they are focused on soft infrastructure development or hard infrastructure development, need to continue to address the challenge of building community capacity and improving well-being over the long term. Continued state and federal support will be needed for many communities to continue building and transforming their economies for future prosperity (FCR 2003).

What magnitude of expenditures might be appropriate for a social capital–community capacity component of a Complete Unneeded Road Removal program? For purposes of illustration consider an additional $5 million annual allocation for a social capital–community capacity component. This would be only 5.3% of the $93 million cost of the Complete Unneeded Road Removal alternative. This additional $5 million allocation would provide an average of $32,000 for each of the 155 National Forests. Such a $5 million allocation appears modest considering that

1) the NEAI allocated $200 million a year for portions of Washington, Oregon, and California;
2) the Critical Funding Road Decommissioning alternatives recognizes a $900 million annual road-management budget; and
3) according to the Associated Press, the administration proposes for the fiscal year 2004 federal budget $1.57 billion for forest-fuel reduction, fire fighting, and fire suppression, an increase of $173 million over 2003.

5. Benefits and Costs

There are many benefits and costs related to road decommissioning. Following a discussion of the present value of annual maintenance costs and deferred maintenance, two analytical frameworks are presented. The first is a table addressing the present value of maintenance costs, environmental impacts, human capital/training, and social impacts. The second is the analytical framework used by Clearwater National Forest using a 2 x 2 matrix of Road-Use Values and Resource Risk.

A. Present Value of Annual Maintenance Costs and Deferred Maintenance

Nationally, "Roughly, appropriated annual maintenance ranges from… $60-$100/mile for maintenance level 2 roads, and $20-$40 for maintenance level 1 roads" (USDA 1998, p. 13). Using the midpoint in both of these ranges--i.e. $80 and $30 as weighted averages based on the proportion of level 1 and level 2 roads--results in an appropriated annual maintenance for level 1 and 2 roads of $67 per mile. At a 5% discount rate, the present value of maintenance at the current appropriated level is $1,340. In other words $1,340 returning 5% a year would generate a stream of revenue equal to $67 per year, and in that sense $1,340 in the present can be considered equivalent to continued annual expenditures of $67 per year (see earlier Box: Present Value Examples).

Recognizing that appropriated funding nationally is approximately one-fifth of the maintenance needed (USDA 2000, p. 3), the implied needed maintenance expenditure per mile of level 1 and 2 road is $335 [note: a case could be made that this amount would cover deferred maintenance needs]. At a 5% discount rate, the present value of this annual maintenance cost would be $6,700 per mile.

At the individual National Forest level, the Clearwater National Forest, for example, has published data on its annual road-maintenance need (USDA, Clearwater NF 2003 Chapter 5 p. 6). The data implies that the average annual road-maintenance need is $185 per mile. At a 5% discount rate, the present value of this annual maintenance would be $3,700. Clearwater National Forest condition surveys indicate a total of $46,650,000 of deferred maintenance for all of Clearwater National Forest roads. Annual maintenance costs of level 1 and 2 roads are 14% of total road-maintenance costs. If this percentage is the same for deferred maintenance, then deferred maintenance on level 1 and 2 roads is $2,248 per mile. Based on this the total, deferred maintenance and present value of future maintenance for level 1 and 2 roads in Clearwater National Forest is $5,955 per mile.

B. An Illustration of Four Road-Management Options

Four different options may be considered for road management for any given road segment:

Option One:	Current level of (inadequate) maintenance
Option Two:	Full maintenance of a road
Option Three:	Abandonment of a road with no maintenance
Option Four:	Complete removal of an unneeded-road.

Each of these options has different costs and benefits regarding constructed capital, natural capital, human capital, and social capital. We will consider "average" maintenance level 1 and 2 roads. For purposes of illustration consider the following:

In Option One, Current Level of (inadequate) Maintenance, the present value of maintenance is $1,340 (the present value of appropriated maintenance for level 1 and 2 roads calculated in the previous section). But, in so far as this is an inadequate level of maintenance, there are adverse effects such as sedimentation in waterways, provision of habitat for invasive species, adverse impacts on wildlife, increase in spread of disease, diminished intrinsic or non-market values, etc.

In Option Two, Full Maintenance, the present value of maintenance can be approximated by the $6,700 per mile based on national data, or the $5,955 per mile based on the Clearwater National Forest. Adverse effects would be fewer than in Alternative One, but equal to or greater than the adverse effects in Option Four, the optimal decommissioning alternative.

In Option Three, Abandonment with No Maintenance, the present value of maintenance is zero; however, the adverse effects noted above would tend to be even greater than in Option One.

In Option Four, the Complete Unneeded Road Removal Option, the present value of decommissioning is $7,500 under the Critical Funding Scenario and $10,000 under the Complete Unneeded Road Removal Scenario. The adverse impacts would be the lowest of the four alternatives.

In terms of employment, for a given amount of road Option One involves the status quo. If the total labor costs of full maintenance over time exceeded the labor costs of optimal decommissioning, Option Two, over time, could generate a high level of employment in the long term but not in the near term. Option Three would see a reduction in employment below even that of Option One. Option Four, for the same level expended on labor would generate employment equivalent to Option Two in the long term, and higher levels in the near term. In terms of training and long-term employment benefits, Option Two and Four would have superior results. The exact nature and extent of these results would depend on the particular types of jobs, training, and contracts associated with the options.

It should be noted that decisions on specific road segments taken as a whole constitute a road-management program for a National Forest. Such a program would be a combination of Option Four (Road decommissioning) of some road segments and Option Two (Full Maintenance) of other road segments. Options One (Current level of (inadequate) maintenance) and Option Three (Abandonment of a road segment with no maintenance) would not be preferable options.

The above discusses the four options in terms of different maintenance costs and employment. The impact on social and cultural capital would vary from option to option. The relevant question is: Would a community be more cooperative and develop better given the mix of employment, environmental, and training impacts of Option One, Two, Three or Four?

Option	Present Value Maintenance/	Environmental Impacts	Human Capital (Training)	Social Impacts
1. Current Inadequate Maintenance	$1,340	next to worst	neutral	*
2. Full Maintenance	$5,955 - $6,700	2nd best	1st or 2nd	*
3. Abandonment	0	worst	worst	*
4. Complete Unneeded Road Removal	$10,000	best	1st or 2nd	*

*depends on impact of mix of maintenance/decommissioning, environmental, and training impacts for each option.

Table 8: Comparison of Road-Management Options

For purposes of illustration, consider a completely unneeded road, i.e. one in which there is zero use, and suppose the present value of maintenance is $6,000 per year per mile. Suppose that the total adverse environmental impacts that could be avoided by full maintenance, rather than abandonment, exceed $6,000. In this case it would be socially preferable to fully maintain the road rather than abandon it.

Furthermore, suppose Complete Unneeded Road Removal reduces environmental damage an additional $4,000 per mile for this road, beyond that achieved by full maintenance. Then society would be even better off decommissioning the road, rather than fully maintaining it in terms of present value of maintenance and environmental impacts.

In addition, if the human capital benefits of job training under the Complete Unneeded Road Removal Option are superior to the other options, this would be an additional reason for preferring this option. Finally, the case could be made that opportunities for affected communities to improve cooperation and community development would be enhanced by a sustained level of increased employment, increased environmental benefits, and an improved base of employment skills from training provided by the Optimal Decommissioning Option. With this in mind, as long as the net benefit in terms of natural, human, social, and cultural capital between full maintenance and optimal decommissioning exceeded $4,000 per mile, the optimal decommissioning is preferable to full maintenance. In this case, $4,000 in environmental damage avoided per mile could be considered the "tipping point" at which road removal becomes preferable to full maintenance.

This tipping point could be determined at the point that Net Present Value of Environmental Damage exceeds the Net Present Value of Road Use. Or in other words, if the Net Present Value of Road Use is less than the Net Present Value of Environmental Damage, then Option Four (Road Decommissioning) would be preferred over Option Two (Full Road Maintenance).

Because of the difficulties of conducting a quantitative analysis such as that described above, qualitative approaches may well be more practical. Road-management options have been evaluated qualitatively through a grid approach, evaluating road value and environmental risk, as in Clearwater National Forest's Roads Analysis (http://www.fs.fed.us/r1/clearwater/rap/index.htm).

The ranking of these options for any particular road will vary depending on the particular circumstances for a road. In some cases, the benefits provided by a particular road will far outweigh the environmental benefits of decommissioning. Each particular case must be considered in light of its particular circumstances. This leads us to the subject of road analysis in individual National Forests.

C. Clearwater National Forest – Road-Use Value – Resource Risk Analytic Framework

The somewhat quantitative approach presented in the previous section can be conceptualized in more qualitative terms using the grid approach applied in the Clearwater National Forest Roads Analysis. Two sets of criteria are considered:

Road-use value criteria:

1. Annual maintenance cost values
2. Recreation-use value
3. Access value
4. Resource-management value

Resource risk criteria:

1. Mass-wasting risk
2. Surface-erosion risk
3. Aquatic risk
4. Wildlife risk

A detailed discussion of each criteria is included in the Clearwater Roads Analysis (see Appendix F). After each of the criteria are evaluated for a particular portion of road, the overall road-use value and the resource risk are separately characterized as high or low.

Four combinations are possible:

High Value – Low Risk
High Value – High Risk
Low Value – Low Risk
Low Value – High Risk

The combination of low road value and high resource risk characterizes a road as a priority for risk analysis, for reduced maintenance, for possible decommissioning, or for focused resource study. Clearwater National Forest's draft Road Management Category Graph estimates that 228 miles of road are in this category (see Figure 4). The graph is explained in more detail in Box 7.

Figure 4 Road Risk/Value Graph - Clearwater National Forest

Draft Road Management Category Graph

	LOW POTENTIAL FOR INVESTMENT	**HIGH POTENTIAL FOR INVESTMENT**
↑ **Risk** **12** **9**	Category 3 Low Value/High Risk <u>228 miles</u> • Priority for risk analysis • Consider reducing maintenance level • Consider decommissioning • Focus on resource concerns	Category 2 High Value/High Risk <u>568 miles</u> • Priority for investment • (CIP, PFSR, etc.) • Focus on resource concerns
8 ↓ **5** **Risk**	Category 4 Low Value/Low Risk <u>167 miles</u> • Consider reducing maintenance level • Consider decommissioning • Review for potential resource concerns	Category 1 High Value/Low Risk <u>386 miles</u> • Preferred condition • Maintain to standard • Review for potential resource concerns
Value	← **4** **7**	**8** **12** → **Value**

<u>Vertical Axis</u>: 5 to 8 = low risk
9 to 12 = high risk

<u>Horizontal Axis</u>: 4 to 7 = low potential for investment (low value)
8 to 12 = high potential for investment (high value)

Box 9: Road-Management Categories and Graph
(from Clearwater National Forest Road Analysis, Ch. 5, p. 2 – 3)

The four road-management categories in the graph are based on value and risk. Within each category, there are possible management options for the roads.

Category 1: High Value/Low Risk
- Maintain to standard by focusing road-maintenance funds on these roads
- Review for potential resource concerns
- These roads form part of the potential minimum road system for the forest

Category 2: High Value/High Risk

- These roads are a high priority for sub-forest scale roads analysis to identify high-risk reduction needs
- High priority for capital-improvement funding
- Increase maintenance funding to these roads to keep resource risks from increasing

Category 3: Low Value/High Risk

- High priority for sub-forest roads analysis to identify high-risk reduction needs and to confirm road-use value
- Potential for reducing maintenance level
- Consider decommissioning

Category 4: Low Value/Low Risk

- Lowest priority for expending annual road-maintenance funds
- Moderate potential for decommissioning or reducing maintenance level
-

A few factors need to be noted to correctly interpret Figure 4, which places roads in the four categories.

The results are applicable to only the 1,349 miles of roads that underwent detailed analysis. It is important to understand that road values are relative only to other roads analyzed in detail. This means that a low value road in the graph may still have a relatively high value overall on the forest compared to a road in the remaining 2,730 miles of local roads that were not analyzed in detail, and vice versa.

Those roads with a value of 7 or less potentially could have their current maintenance level reduced. Those roads with a risk rating of 9 or more represent roads that may be causing unacceptable resource impacts, while those rated less than 9 are not as much of a resource concern.

Category 2 roads would have the highest priority for potential increases in maintenance funding, and Category 4 roads would be considered first for decreases in maintenance funding.

6. Implementation

A. Magnitude of Road-Decommissioning Funding in Relation to Total Road-Management Budget and Federal Fire-Related Appropriations

In the Status Quo alternative, road decommissioning accounts for 9.375% of the $200 million total Forest Service road-management budget contained in that alternative. Road decommissioning is a smaller percentage of overall road-management expenditures in the Critical Funding alternative, at 5.83%. If road decommissioning under the Complete Unneeded Road Removal alternative were the same proportion of the total road-management budget as in the Status Quo alternative, the total road-management budget would be $992 million.

Summary of Alternatives

Alternative	Annual Cost (in $millions)	Total Road-Management Budget	Decommissioning as a Percentage of total Road-Management Budget
1. Status Quo	$18.75	$200	9.375 %
2. Critical Funding	$52.50	$900	5.83 %
3. Complete Unneeded Road Removal	$93.00	$992	9.375 %

The aforementioned figures come from consideration of road decommissioning from a national, or macro, level. Determination of the "best" size for the overall Forest Service road budget and the percentage of that overall budget that should go to the Road Removal alternative could be an aggregation of the roads analysis at the micro, or individual national forest, level. In other words, each individual National Forest, based on their individual roads analysis, would prioritize road-management projects. The sum of priority projects that individual National Forests propose for each year would determine a national roads-management budget. Similarly the sum of proposed road decommissioning would determine the national road-decommissioning budget. Dividing this road-decommissioning budget by the national road-management budget would determine road decommissioning as a percentage of the national road-maintenance budget.

Until such priority projects from individual National Forests are identified and the cost of these projects totaled, the Complete Unneeded Road Removal Program could be used as an approximation of the financial investment needed annually for road removal. As noted earlier, an additional amount would be needed for training: an average of $32,000 allocated per National Forest for training annually would equal approximately $5 million annually for training. Similarly, an additional $5 million annually could be allocated as an investment in social capital to improve community capacity for collaboration and intergovernmental partnerships. The total constructed-, human-, and social-capital investment would then be $103 million annually. This $103 million expenditure avoids future maintenance costs for unneeded roads, increases human capital through training and long-term employment promotion, builds communities' capacities to collaborate, and builds natural capital through improvements in water quality, habitat, recreation, and other environmental benefits.

Current levels of road decommissioning and road removal are markedly below the levels suggested in both the Critical Funding alternative and the Economically Optimal Road Removal alternative. Our survey of National Forests Scope of Projects Assessments (SOPA) revealed very little reporting of road decommissioning and little information regarding types of road removal, such as the amount of full road obliteration. The Forest Service Roads Atlas also will not be completed for several years.

In contrast, the proposed fiscal year 2004 federal expenditures for fire-related programs exceeds $2 billion. It would seem appropriate to seek to include in the discussion of forest-fuel reduction, fire fighting and fire suppression, the marginal benefits of increased funding for roads analysis relative to the marginal benefits of fire-related programs. In particular it would be useful to consider the benefits of increasing funding to identify which unneeded roads are at high risk of becoming impassable, and which roads will add large amounts of sediment to waterways if they are abandoned without proper road-decommissioning treatments.

Box 10: A Numerical Example of the Concept of Optimization and Economic Efficiency

If $100 million total are available and $70 million are spent on Activity A and $30 million on Activity B, this allocation is economically optimal if the last million dollars spent on activity A yields basically the same additional benefits as the last million dollars spent on Activity B. Technically the last dollar or small amount spent on each activity should yield the same amount of additional benefit; this is what is meant by the benefits being equal "at the margin," or that the "marginal benefits" are equal.

The reason marginal benefits equalize at the optimum can be seen by considering the following: For most things marginal benefits decline; that is, the benefit from the first million dollars spent on Activity A is greater than the benefit from the second million spent on Activity A, which is greater than the third million and so on. At some point the benefit from an additional million expended on Activity A is less than spending the first million on Activity B. Additional millions can then be thought of as spent on the activity that has the highest remaining marginal benefit, until the total amount available is expended. If one allocates in small increments, then, ideally, the marginal benefits are exactly equal when the total amount available is expended.

B. Specific Recommendations for Implementation of Training Programs

The Western Council of Industrial Workers offers some strategies for implementing restoration programs that incorporate "high road" concepts with restoration and ecosystem health concerns. These strategies include the following:

1. Establish government support and funding for "certified forest ecosystem worker training....A joint training/apprenticeship committee, ecosystem and educational delivery institutions would be involved."

2. Establish contracting criteria to encourage "full integration of quality employment goals with watershed-quality goals. This translates to more long-term 'stewardship' contracts covering multiple, year-round tasks, bundling of contracts, combining with a variety of landowners...and giving preference to bidders that hire trained, certified ecosystem forest workers.

3. Require (funders) to award a given percentage of their contracts that encompass year-round stewardship activities and bundling of contracts with private, corporate, tribal and federal entities. This percentage could be raised over a multi-year period.

3. Establish broad policy statements to require resource-management decisions "to be integrated with quality employment goals and goals that promote community stability/sustainability." This would include criteria to measure quality job outcomes and resource-management outcomes, ecological checklists, and methodology to favor longer-term employment.

4. Link these policies to small-business assistance programs.

5. Create a core group of certified ecosystem workers to act in emergency situations
(WCIW, pp.7-10).

C. Identify a Reasonable Timeline Horizon for Development and Implementation of Program.

An immediate crucial task is identification of roads at high risk of becoming impassable and roads that are in danger of causing adverse environmental effects. At a national level increased funding for roads analysis and preparation of the Forest Service Roads Atlas could assist carrying out this crucial task. Increased funding for road decommissioning as part of an overall increase in Forest Service road-management funding would help address critical situations. It would be especially appropriate to consider these levels of funding in light of the huge increases in fuel-reduction funding being contemplated for FY 2004. Locally, during the upcoming year, individual National Forests, which are more advanced in the roads analysis, could, with their adjacent communities, define multi-funding sources for demonstration road-management programs that include significant road decommissioning and road-removal components.

After FY 2004 it would be helpful if five-year blocks of funds were allocated so that individual National Forests could submit five-year road-decommissioning packages as part of overall road-management plans. Subsequent year funding could be based on the magnitude of packages approved. Based on the response to the initial years of such a program, the total funding available for the period could be adjusted upwards, if necessary. Under this arrangement, initial road decommissioning might be higher or lower than that implied by a constant rate; the rate would, in part, be a function of the time National Forests need to develop road-decommissioning packages and the backlog of roads that need to be decommissioned. Five-year blocks of funding at the individual National Forest level would provide a more reliable basis for local heavy-equipment operators to obtain financing for additional heavy equipment. It would also provide greater security for other road-decommissioning workers.

There is no reason why decommissioning all the unneeded roads at a constant annual rate over the next twenty-year period would be the optimal time path for road decommissioning. The National Forest Road System did not grow evenly over time. The total number of National Forest System roads increased from approximately 100,000 miles in 1944 to the current 386,000, an increase of 286,000 miles over the approximately fifty-year period. The biggest increase occurred between 1980 and 1985, when total Forest Service roads went from approximately 225,000 to 350,000 miles, an increase of 125,000 miles, or 50% in this five -year period alone (see Figure 5).

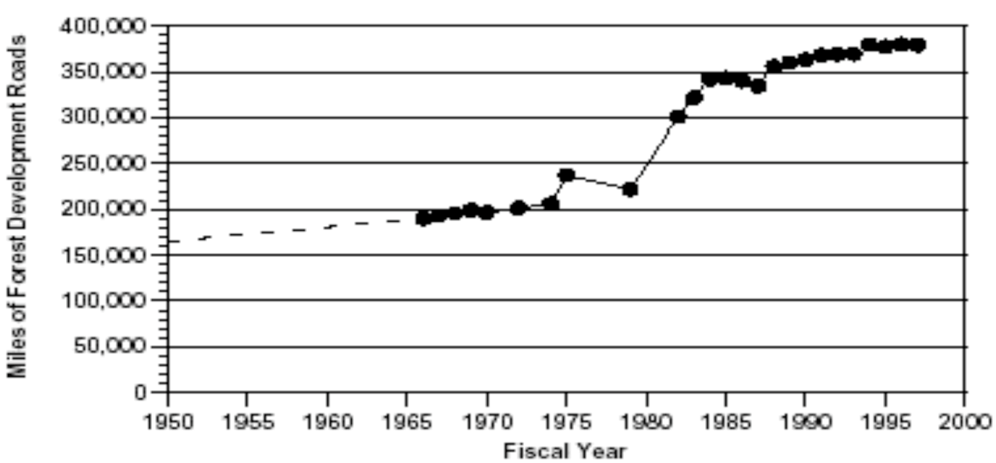


Figure 5: Mileage History of Forest Development Roads (USDA 1998)

With such an uneven pattern for road construction, it is not surprising that the appropriate annual level of decommissioning will vary. Communities associated with National Forests could expect substantial amounts of funding and higher levels of employment for a sustained period of time. There will also be increases in income and employment in states associated with heavy-equipment manufacturing.

7. Summary, Recommendations, and Suggestions for Further Research:

A. Overall Conclusions and Recommendations

- A National Program of Road Removal can be conceptualized as decommissioning 186,000 miles of unneeded roads over a twenty-year period at an average of 9,300 miles of road per year at an average of $10,000 per mile, or an expenditure of $93 million annually. If 33 jobs were generated per million dollar expenditure economy-wide, this would create more than 3,069 jobs annually. The vast majority of jobs created locally would involve heavy-equipment operators. Many other types of labor-intensive jobs would also be created. Indirectly over a twenty-year period more than $600 million would be generated related to the manufacture of heavy equipment, benefitting industrial states such as Michigan.

- Environmental benefits of road decommissioning include reduction of landslides and erosion, which impose millions of dollars of costs annually. Road removal reduces costs to municipal water districts by reducing the need for costly filtration facilities. Road removal also drastically reduces the costs associated with invasive species, whose spread is promoted by roads. Road removal improves habitat and enhances a host of recreational as well as non-use values.

- Road removal-related training programs that emphasize interdisciplinary training and skill certification, and that promote a highly skilled, well-compensated workforce, can increase human and social capital.

- A $5 million road-decommissioning national-training component would represent only $32,000 per National Forest for the 115 National Forests.

- The present cost of annual maintenance of Class 1 and 2 roads is approximately $6,000.

- Information contained in the Roads Analyses, which individual National Forests were required to complete by January 13, 2003, is extremely useful for refining and estimating benefits and costs of road decommissioning and road removal.

- Reporting of information on National Forest Web sites needs to be improved. Use of more descriptive terms such as "closure", "ripping," "cross-ditching," "water-barring," "obliteration," etc., rather than simply "decommissioning" would be helpful. In some cases researchers must dig to unearth road-decommissioning information. A clearly presented link to SOPA information on the home page of a Web site would also be helpful, as would a more uniform format for quarterly NEPA/SOPA reporting.

- Healing the divisiveness that exists regarding forest-management issues, particularly on federal land, improving community participation in planning and decisions related to forests, and expanding Forest Service technical assistance to communities may be the means to achieve the other goals communities have identified, such as improved economic stability through economically viable local jobs.

- Indian tribes' experiences with restoration may be relevant in non-tribal contexts. The EPA notes that "Building the tribe's capability to play an appropriate role in ecosystem management is the only means by which ecosystem restoration, cultural survival, and community prosperity can be achieved" (US EPA (2002). Forest Community Research's NEIA Assessment suggests that "the elements that contributed to the success of tribal worker retraining and ecosystem workforce development programs have applicability in non-tribal contexts."

- Funding for engaging local participants in the evaluation process through participatory research could contribute to building capacity for community collaborations regarding road management, road decommissioning, and road removal.

- $5 million annually for social-capital building and community-capacity building programs would represent only $32,000 per National Forest for the 115 National Forests.

- Annually, road-management options can be evaluated quantitatively by comparing the benefits from the access that roads provide minus the present value of road-management costs, to the benefits from reducing landslides and erosion and other adverse environmental impacts minus the costs of decommissioning.

- Road-management options can be evaluated qualitatively through the grid approach, evaluating road value and environmental risk as was done in Clearwater National Forest's Roads Analysis (http://www.fs.fed.us/r1/clearwater/rap/index.htm).

- Roads that are likely to soon become impassable, especially in a way that prevents future decommissioning of the road beyond the impassable area, and roads that have significant adverse environmental impacts, need to be quickly identified and steps taken toward proper road decommissioning before the road becomes impassable.

- A total of $103 million annual allocation for road removal and training appears small in comparison to the $1.2 billion appropriated for the NEIA and the $1.57 billion proposed for FY 2004 for forest-fuel reduction, fire fighting, and fire suppression, which is $173 million more than the 2003 allocation.

- Analysis of the marginal benefits of increased fire-related funding compared to road-removal funding is suggested.

- Prior to implementation of a national road-decommissioning program, immediate increases in funding for roads analysis, road atlas, and identification of roads at high risk of becoming impassable and harmful to the environment may be in order.

- After FY 2004, allocation based on five-year road-decommissioning funding packages may be desirable. Individual National Forests could be encouraged to submit road-decommissioning packages as part of their overall road-management plans, which in turn are based on their roads analyses. Such five-year funding could help heavy-equipment private contractors and others working on road decommissioning with their own planning over this period. Also, if future appropriations are based on the magnitude of individual National Forests that have successfully developed five-year road-decommissioning plans, then national funding levels can encourage individual National Forests to develop plans, and the overall level of such funding would be based on how prepared individual National Forests and their adjacent communities are to develop and carry out road-decommissioning programs.

- There is no reason why decommissioning all the unneeded roads should proceed at a constant annual rate or be limited to a twenty-year period.

B. Suggestions for Further Research

1. Constructed Capital and Associated Job Types

- Further research is needed in the Pacific Northwest regarding forest road decommissioning, including obtaining more information at the National Forest level and from Redwood National Park and other state parks. In addition, further information from private contractors and consultants involved with road decommissioning in the Pacific Northwest, such as Pacific Watershed Associates, could be obtained.

- Further research is needed on job creation and job costing data and analysis (including additional information on prevailing wage rates for specific job categories in different regions).

- Further research into differences in road-decommissioning jobs in different ecosystems is needed.

- More information on deferred maintenance and annual cost of maintenance for each National Forest is needed.

2. Natural Capital Valuation of Environmental and Non-market Effects

- More information on the extent of landslide risk and the amount of road-related erosion is needed in each National Forest.

- Estimates of the cost of sedimentation to aquatic life and municipal and private water supplies is also needed. National Forest watersheds that are part of municipal water supplies need to be identified, and the cost in terms of lost reservoir capacity and treatment cost need to be investigated.

- More information is needed on the cost of dealing with invasive species and plant diseases that are spread by means of roads.

3. Human Capital -- Training

- Further research is needed on training budgets for field instruction, tuition, materials, space, and travel. Also the Yurok, Hoopa and Karuk Tribes have restoration training programs that might provide useful data regarding curriculum and training costs.

- Restoration activists and practitioners in each National Forest could be surveyed for current and projected status of the road-decommissioning-related workforce. Finally, information on labor union apprenticeship programs, family-scale wage proposals, and analyses relevant to road decommissioning could be obtained.

- The Ecosystem Workforce Program’s studies of best value restoration contracting need to be examined as to their usefulness in designing road-decommissioning contracts and training programs.

4. Social and Cultural Capital – Community Capacity Building

- Another source of information on community goals and considerations related to road decommissioning is the public input into the Forest Service Roadless Area policy. From this input additional goals and considerations, and values and concerns related specifically to roadless areas and decommissioning of roads could be obtained, such as those related to recreation and wildlife. This public input could be studied in order to determine community concerns regarding the relationships between roads and fire.

- Perhaps the most direct source of information regarding community perceptions can be obtained from the “community visioning” component of the Northwest Forest Plan. Extensive primary-source material exists on specific community goals, which were expressed in a series of community meetings. This information could be utilized in future efforts to build community capacity.

- The many individual Forest Community Research NEIA Assessment case studies need to be examined more closely for new approaches and problem-solving techniques relevant to building community capacity.

- Overall, the Complete Unneeded Road Removal program and timeline suggested by this preliminary study needs to be refined into a proposal on which relevant stakeholders can comment. These comments can then be incorporated into a revised document that policy makers could use to rapidly bring about much needed road removal on National Forests.

AFTERWORD

As we noted initially, this report addresses the benefits and costs of road decommissioning on National Forests, but it exists within a larger historical, political, and environmental context. We believe it more beneficial to suggest approaches and different ways of conceptualizing and understanding the complex issues involved, rather than staking out a position. We believe that a better understanding of the benefits and costs of road removal can result in different but mutually beneficial gains for all parties involved. We see such win-win outcomes as much preferable to situations structured to produce "winners" and "losers," in which one person's gain is another's loss.

We do not wish to ignore the access that roads provide. We do wish to point out the employment, environmental, training and community benefits that road decommissioning and road removal generate. Especially when access benefits are low or non-existent, road decommissioning and road removal are the option likely to produce the greatest net benefits to society.

Finally, we wish to make the following points. Initially it may appear that a nationally led program supported by quantitative national data is most desirable. Upon examination some advantages of growing more "organically," based on individual National Forests and communities, become clearer. Conditions vary greatly over the National Forest System, and the development of consensus among each community's stakeholders is important in order to mobilize financial resources and implement policies. Ultimately, we may be able to have both: the advantages of a nationally funded and nationally directed program, and landscape-specific, place-based, experience-based, and community-based management of individual National Forests.

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APPENDIX A: A Brief Survey of Road Decommissioning Activity Information Available on USDA Forest Service Websites

This brief survey of online information is by no means comprehensive or exhaustive. The purpose of the survey is to provide insight into the quality and timeliness of the road decommissioning information that is currently and easily accessible through the worldwide web.

Two forests (or groups of smaller jointly managed forests) were chosen from each of the Forest Service's nine regions. Generally, the choices represent a small forest and a large forest relative to other forests in the region. The state in which most of the forest lies is included. For some regions, more than two forests were chosen. Wherever possible, a brief tally of road decommissioning activity listed in the most recent available Schedule(s) of Proposed Actions (SOPA) is provided in the Comments column. Where SOPA information was not available, other easily accessed information is provided, when possible.

All of the links listed as sources were active as of January 5, 2003.

Northern Region (Region 1)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Clearwater (ID)	1,722,132	43,168	There is a Roads Analysis Report available at http://www.fs.fed.us/r1/clearwater/rap/index.htm. No road decommissioning projects listed in 1st Qtr. SOPA 2003 in any of the four Ranger Districts.
Flathead (MT)	2,628,719	273,344	The only information found was in the Moose Post-Fire Project FEIS, released 10/28/02. The preferred alternative (of the five offered) includes 56 miles of road decommissioning.
Gallatin (MT)	2,151,171	343,694	4th Qtr. 2002 SOPA includes no listings for road decommissioning work. There is a listing for a project decommissioning 10 miles of road to be completed between July 1 and October 1, 2003.
Idaho Panhandle (ID): Kaniksu St. Joe Coeur D'Lene	3,496,107	489,387	4th Qtr. 2002 SOPA includes one listing of "Ecosystem Restoration….

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r1.htm.

Sources: http://www.fs.fed.us/r1/clearwater/Projects/Projects.htm. Click on links to reports for individual Ranger Districts.
http://www.fs.fed.us/r1/flathead/news_releases/nrs.htm. Click: "Moose FEIS Released" link.
http://www.fs.fed.us/r1/gallatin/projects/nepa/index.shtml. Click on link to either HTML or PDF files.
http://www.fs.fed.us/r1/gallatin/contracting/index.shtml. Click on 2003 Advanced Acquisition Projects link.
http://www.fs.fed.us/ipnf/eco/manage/quarterlynepa/index.html. Click on link for appropriate quarter.

Rocky Mountain Region (Region 2)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Samuel R McKelvie (NB)	116,885	806	Only information found was in the FEIS for Nebraska National Forest, released 7/31/02: "As site Specific road and trail analyses are

			conducted and decisions are made, . . . some of the other routes, both user-created (unclassified) and classified, may be decommissioned and the areas restored." p14.
White River (CO)	2,477,332	199,606	Only information found was in a travel management document: "One of the objective strategies in the Forest Plan is to decommission 22 miles of unneeded road per year." p4.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r2.htm.

Sources: http://www.fs.fed.us/ngp/plan/feis.htm. Click on the "Nebraska National Forest Link" link (650kb pdf file).
http://www.fs.fed.us/r2/whiteriver/planning.html. Link to http://www.fs.fed.us/r2/whiteriver/Plan/NOI_travelmgt.pdf.

Southwestern Region (Region 3)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Apache-Sitgreaves (AZ)	2,761,387	129,460	4th Qtr. 2002 SOPA includes listings for: --6 miles of road decommissioning and a "sediment reduction project including road work" (Alpine RD). --2 road closures (Black Mesa RD). Other 3 ranger districts had no listings.
Tonto (AZ)	2,969,543	96,384	4th qtr. SOPA includes no road decommissioning activity. Only information found was in a cover letter, dated 8/2/02, advising the public that a forest-wide analysis of the road system was getting underway. Calls for public input to identify potential projects including road decommissioning.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r3.htm.

Sources: http://www.fs.fed.us/r3/asnf/bboard/new_nepa_calendar/0701-0602_alpine.htm and
http://www.fs.fed.us/r3/asnf/bboard/new_nepa_calendar/0701-0602_blackmesa.htm.
http://www.fs.fed.us/r3/tonto/planning/planning.htm. Click on the "Latest Schedule of Proposed Actions for Tonto NF" link.
http://www.fs.fed.us/r3/tonto/planning/planning.htm. Click on the "Cover letter for Forest Roads Analysis" link.

Intermountain Region (Region 4)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Uinta (UT)	958,650	78,329	According to the SOPA for the 2nd, 3rd and 4th quarters of 2002, no road decommissioning is planned.
Humboldt-Toiyabe (NV)	5,983,797	269,067	Latest SOPA posted is for winter quarter of 2001: no road decommissioning planned. A document dated 7/2/02 tells of roads analysis getting underway. Analysis will not include 4-wheel drive roads, which will be considered in a later separate analysis of watershed projects. Found an untitled table that lists 987 miles of road in Toiyabe NF and

			485 miles in Humboldt NF.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r4.htm.

Sources: http://www.fs.fed.us/r4/uinta/nepa/10-2002_nepa_quarterly.htm, http://www.fs.fed.us/r4/uinta/nepa/07-2002_nepa_quarterly.htm and http://www.fs.fed.us/r4/uinta/nepa/04-2002_nepa_quarterly.htm.
http://www.fs.fed.us/htnf/nepa.htm.
http://www.fs.fed.us/htnf/news/index.html. For the numbers of miles of road, click on "Statistics for the Roads Analysis Process July 2002" link.

Pacific Southwest Region (Region 5)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Cleveland (CA)	566,850	132,892	SOPA for Nov. 2002 – Jan. 2003 includes two different projects decommissioning and rehabilitating 0.1 mile of level II road.
Six Rivers (CA)	1,118,247	129,259	1st qtr 2003 SOPA includes no road decommissioning activity. 4th qtr. SOPA includes the decommissioning of 7 spur roads.
Inyo (CA)	2,003,110	101,909	No road decommissioning projects listed under 2002 SOPA/Decisions.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r5.htm.

Sources: http://www.r5.fs.fed.us/cleveland/sopa2.html. http://www.r5.fs.fed.us/sixrivers/projects/environmental/sopa/.
http://www.r5.fs.fed.us/inyo. Click on link to "Schedule of Planned Activities" link, then click on individual links to the various ranger districts.

Pacific Northwest Region (Region 6)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Rogue River (OR)	688,649	60,503	3rd qtr. 2002 SOPA include 1 road decommissioning project.
Siskiyou (CA)	1,163,224	69,337	SOPA for 3rd and 4th qtrs. 2002 include listings for various road decommissioning projects in the Chetco RD, Gold Beach RD and in the Two Rivers Zone.
Wenatchee-Okanogan (WA)	3,454,053	237,617	1st qtr. 2003 SOPA for Wenatchee include: --2 projects with "potential for road closures and road decommissioning." --1 requested road closure 1st qtr. 2003 SOPA for Okanogan include: --decommissioning of 58 miles of closed and/or non-drivable roads. --one-quarter mile of road . . . would be obliterated. --about 15 miles of road would be closed or decommissioned. --2 projects with consideration of closures and obliterations. --closure of 9 roads to decrease potential for noxious weed spread. --12.5 miles of road obliteration.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r6.htm.
Sources: www.fs.fed.us/r6/rogue/planning_3rd_sopa.htm.
http://www.fs.fed.us/r6/siskiyou/planning/sopa/. Chose file for appropriate quarter from directory index.
http://www.fs.fed.us/r6/wenatchee/planning/planmain.htm.

Southern Region (Region 8)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Alabama (AL): William. B. Bankhead, Conecuh, Talladega, Tuskeegee	1,276,336	610,395	No SOPA information was found. A Monitoring and Evaluation report for 1999 mentions the long-term closure of 165 miles of road in FY 1998 (the Forest Plan had called for 230 miles to be closed), and the seeding of 28 acres of closed roads and landings in FY 1998 (95 acres had been called for).
Ouachita (AR)	2,728,260	953,309	4th qtr 2002 SOPA include several projects where roads analysis would be conducted. A document dated 5/23/2000 mentions the "reduction of density," the re-seeding of closed roads and the decommissioning of 8 unclassified roads with gates or earthen berms.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r8.htm.
Sources: http://www.southernregion.fs.fed.us/alabama/planning/planning-reports.htm.
http://www.fs.fed.us/oonf/plan/sopa/sopa.htm.

Eastern Region (Region 9)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Finger Lakes (NY)-Green Mountain (VT)	831,174	431,338	No SOPA information was found. "Roads Policy" link connects to the Forest Service's national roads policy webpage.
Superior (MN)	3,260,630	1,167,586	1st qtr. 2003 SOPA lists no projects with road decommissioning 4th qtr. 2002 SOPA include one project mentioning road closure.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r9.htm.
Sources: http://www.fs.fed.us/r9/gmfl/.
http://www.superiornationalforest.org/resources/2003/janmar.html.
http://www.superiornationalforest.org/resources/2002/octdec.html.

Alaska Region (Region 10)

Forest(s)	Total Acres*	Acreage Privately Held	Comments
Chugach	6,908,540	858,168	According to the SOPA for the 2nd, 3rd and 4th quarters of 2002, no road decommissioning is planned.
Tongass	17,446,595	2,368,111	According to the SOPA for Oct. 2002-Oct. 2003, no road decommissioning activity is

			planned.

* Sum of acreage owned by the Forest Service and privately owned acreage within the forest's boundary as of 2001. Source: http://www.fs.fed.us/land/staff/lar/LAR01/table3_r10.htm.

Sources: http://www.fs.fed.us/r10/chugach/chugach_pages/nepa.html.
http://www.fs.fed.us/r10/tongass/. Click on the "Management News" link in the lefthand frame. Then click on the "Schedule of Proposed Activities" link from list at the top of the page. Then click on the links for the individual ranger districts.

The quantity and quality of road decommissioning information available on USDA Forest Service websites varies greatly from region to region, and from forest to forest within a region. One suspects this variety is due to differing priorities and resources. For example, road decommissioning seems to be a higher priority in forests where damage due to erosion and sediment transport is more likely. Not surprisingly, the Pacific Northwest Region (Region 6), with its steep terrain and high annual rainfall, has the most, and generally the best, information available. Similarly, individual forests (or groups of jointly managed forests) appear to devote differing amounts of human and financial resources to the construction and maintenance of their websites. Sites range from the technologically sophisticated with comparatively large amounts of regularly updated information to the relatively rudimentary with limited information and infrequent updates.

The majority of the available information concerns proposed projects and can be found in the quarterly Schedules of Proposed Actions (SOPA). The quality of this information ranges from fairly comprehensive, detailed and timely to vague and/or out-of-date. In several cases, SOPA information is non-existent on the forest's website. In cases where SOPA information is unavailable, other road decommissioning information can sometimes be found by following links to NEPA (National Environmental Policy Act) Actions or Activities, Forest Management or Roads Policy. In every case, relatively few details of road decommissioning work already completed are easily accessible.

APPENDIX B: Road Treatment Costs

California Department of Parks and Recreation completed road removal work on narrow roads with small stream crossings in the Dark Gulch Area of Sinkyone Wilderness State Park in 1992. No information was available on volumes excavated. Overall project heavy equipment cost was $56,615 for 1.6 miles of road, or $50,050 per mile (2001 dollars). Work was accomplished by Invitation For Bid-style contract (CDPR 1994).

The Bureau of Land Management completed road removal work on narrow roads in extremely steep terrain in the King Range National Conservation Area in 1995-96. Surveyed stream crossing excavations averaged $4.26 per cubic yard (2001 dollars). Overall project heavy equipment cost was $614,410 for 3.5 miles of road, or $175,198 per mile (2001 dollars). Work was accomplished by experienced contractors through an assistance agreement (BLM 1998).

California Department of Parks and Recreation completed road treatment work on 2.9 miles of very narrow roads (16-22 feet) with very small stream crossings (average 100 cubic yards each) in Humboldt Redwoods State Park in 1997. About half of the project was complete road removal and half was partial road removal. Surveyed stream crossings averaged $7.88 per cubic yard (2001 dollars). Work was accomplished by park staff using leased or state owned equipment for a cost of $21,993 per mile (2001 dollars) (CDPR 1997).

The National Park Service completed road removal work on an extremely narrow road (average 13 feet) in Whiskeytown National Recreation Area in 1998. No data are available on stream crossings. Total cost for removal of 4,500 feet of road was $134,984, or $158,3810 per mile (2001 dollars). The work was accomplished by an 8A contractor (negotiated contract) (Dave Kruse, pers. comm.).

The Forest Service has undertaken road decommissioning work on narrow roads with small stream crossings (average 100-600 cubic yards each) in Six Rivers National Forest over the last several years. Stream crossings (unsurveyed) typically cost $3.00 to $5.00 per cubic yard (no escalation factor applied, since no specific year or yardage was available). Many of the forest roads are simply waterbarred; thus costs per mile are not comparable (Carolyn Cook and Corrine Black, pers. comm.).

Bureau of Land Management removed roads in the Headwaters Forest in 2000-2001. For two road reaches that were completed as of this report, stream crossing excavations ranged from 200 to 10,000 cubic yards and averaged about 2500 cubic. Total cost for the roads was about $304,000 and averaged about $189,350 per mile (David Fuller, pers. comm.)

Pacific Coast Fish Wildlife and Wetlands Restoration Association (PCFWWRA) will decommission 4.5 miles of abandoned logging roads in Redwood Creek, upstream of the parks in summer 2001. The project proposes a budget of about $57,337 per mile. Work will include complete excavation of 29 stream crossings (average volume of 556 cubic yard), fillslope excavations and construction of waterbars (Mitch Farro, pers. comm).

Table: Summary of road treatment costs in northcoast region of California.

Project	Year (s)	Length of Road	Ave. Stream Crossing Size	Ave. Cost per Yard for Crossings	Cost per Mile1
CDPR Sinkyone 2	1992	1.6 mi	na		$50,000
BLM King Range 2	1995-96	3.5 mi	na	$ 4.26	$175,000
CDPR Bull Creek 2	1997	2.9 mi	100 cu. yds	$ 7.88	$22,000
NPS Whiskeytown 2	1998	0.9 mi	na	na	$158,000
USFS Six Rivers 3	1990s	na	100-300 cu. yds	$ 3.00-5.00	na
Redwood National Park 3	1997-2000	21.6 mi	6,332 cu. yds	$ 4.14	$272,000
BLM Headwaters Forest 4	2000-2001	1.6	2500	na	$189,352
PCFWWRA4	2001	4.5 mi	556 cu. yds	na	$57,000

1 Costs are rounded to thousands.
2 Costs have been adjusted to 2001 dollars.
3 Costs are as reported during project year.
4 Draft data.

References:

California Department of Park and Recreation, 1994. Dark Gulch Rehabilitation Unit Summary, 1994. California Department of Parks and Recreation, Eureka, CA.

California Department of Park and Recreation, 1997. Preacher Gulch Landform Rehabilitation Report, 1997. California Department of Parks and Recreation, Eureka, CA.

Bureau of Land Management, 1998. King Range Road Removal Final Report, April 1998, U.S. Bureau of Land Management, Arcata, CA.

APPENDIX C: Further Discussion of Jobs, Income, Taxes

The mean hourly wage for the standard occupation category that includes construction equipment operators for highway and street construction is $19.29/hr. For construction laborers the mean wage ranged from $10.05 to $14.98/hr. For Forest and Conservation Worker the mean wage ranged from $8.72 to $10.45/hr.

For purposes of illustration consider an equipment operator hourly rate as being 25 percent of the $94/hr total heavy equipment cost, or $23.50. Then for the Jackson State Project, 20.2 percent of the total cost would be equipment operator costs. Adding the 5 percent of total costs that are laborer costs in the project, results in a total labor cost of 25.2 percent of the total decommissioning costs. For 1 million dollars there would be $202,000 of equipment operator labor costs and $50,000 of other labor costs. Using a $23.50/hr heavy equipment operator wage and a $12.50/hr. total laborer cost and 2,000 hours per job per year, we calculate that 4.3 full time annual equipment operator jobs, and 2 other annual jobs (for a total of 6.3 full time annual jobs) per million dollars of road decommissioning. Another way to look at this information is to say that 12.6 full time jobs for the 6-month construction season are created for each million dollars of road decommissioning expenditure. Using these figures for the Status Quo, Critical Funding and Optimal Road Removal Alternatives yield, 118, 331 and 586 full time annual jobs or 236, 662, and 1,172 full-time 6-month jobs.

[Note: The heavy equipment operator jobs are based on gross wages. Employer payroll taxes and fringe benefits for equipment operators would be paid out of the total heavy equipment hourly rate. Very specific prevailing wage (Davis-Bacon) labor rates including Social Security, Workers Comp, Unemployment, a 10% overhead and 6% profit are available by state. For example Tractor Operator (D6 or larger) range from, $31.81 to $40.24 in Idaho and Montana. Precise rates are given for loader, backhoe operators and types of dump truck. Consequently as long as employer payroll taxes and fringe benefits were at the level that was the case with the Jackson State Forest project, the estimate for heavy equipment operator jobs would not be affected].

For the laborer jobs, assuming that the laborer costs reported in the Jackson State Project included employer payroll taxes and fringe benefits, then the $12.50 would be total cost per hour. Such a total cost per hour would be consistent with various combinations of gross wages and employer payroll tax and fringe benefit combinations. For example, one could have a $10.00 per hour gross wage and a 25 percent employer payroll tax and fringe benefit package, or a $10.63 per hour gross wage and a 15 percent employer payroll tax and fringe benefit package. Further research will refine the labor costs and number of jobs involved in each alternative.

APPENDIX D: Complete Listing of National Forest Websites Surveyed 4/18/03 (including those found not to have Road Analysis Reports posted)

Region 1 – Northern		
Forest	State	Road Analysis Report Available at:
Beaverhead-Deerlodge NF	MT	Not Listed
Bitterroot NF	MT/ID	Not Listed
Clearwater NF	ID	http://www.fs.fed.us/r1/clearwater/rap/index.htm
Idaho Panhandle NF	ID	Not Listed
Custer NF	MT / SD	http://www.fs.fed.us/r1/custer/projects/index.shtml
Dakota Prairie NG	ND / SD	Not Listed
Flathead NF	MT	Not Listed
Gallatin NF	MT	Not Listed
Helena NF	MT	Not Listed
Kootenai NF	MT / ID	Not Listed

Region 2 – Rocky Mountain		
Forest	State	Road Analysis Report Available at:
Arapaho-Roosevelt NF	CO	Not Listed
Bighorn NF	WY	Not Listed
Black Hills NF	SD/WY	Not Listed
Buffalo Gap NG	SD	Not Listed
Fort Pierre NG	SD	Not Listed
Grand Mesa NF	CO	Not Listed
Gunnison NF	CO	Not Listed
Uncompahgre NF	CO	Road Summary: http://www.fs.fed.us/r2/gmug/policy/uncrds.html

Region 3 – Southwestern		
Forest	State	Road Analysis Report Available at:
Apache-Sitgreaves NF	AZ	Not Listed
Black Kettle NG	OK / TX	Not Listed
Carson NF	NM	http://www.fs.fed.us/r3/carson/engineering/road_analysis_report.pdf
Cibola NF	TX / NM / OK	Not Listed
Coconino NF	AZ	Not Listed
Coronado NF	AZ / NM	Not Listed
Gila NF	NM	Not Listed
Kaibab NF	AZ	Not Listed
Kiowa and Rita Blanca NG	TX / NM / OK	Not Listed

Region 4 – Intermountain		
Forest	State	Road Analysis Report Available at:
Ashley NF	UT/WY	Not Listed
Boise NF	ID	Not Listed
Bridger-Teton NF	WY	Not Listed
Caribou-Targhee NF	ID/WY	Not Listed
Dixie NF	UT	Cedar City Ranger District only: http://www.fs.fed.us/dxnf/d2/ra/exec_sum/index.html

Fishlake NF	UT	Not Listed
Humboldt-Toiyabe NF	NV / CA	http://www.fs.fed.us/htnf/RAReport/index.html
Manti-La Sal NF	UT / CO	Not Listed
Salmon-Challis NF	ID	http://www.fs.fed.us/r4/sc/currentprojects/projects.htm - roads
Region 5 – Pacific Southwest		
Forest	State	Road Analysis Report Available at:
Angeles NF	CA	Not Listed
Eldorado NF	CA	Not Listed
Inyo NF	CA	No Report Listed http://www.fs.fed.us/r5/inyo/projects/roads.html
Klamath NF	CA / OR	http://www.fs.fed.us/r5/klamath/projects/analyses/forestroads/index.shtml
Six Rivers NF	CA	Not Listed

Region 6 – Pacific Northwest		
Forest	State	Road Analysis Report Available at:
Colville NF	WA	Not Listed
Columbia River Gorge NSA	OR/WA	http://www.fs.fed.us/r6/columbia/roads_analysis/roads_analysis.htm
Crooked River NG	OR	http://www.fs.fed.us/r6/centraloregon/projects/planning/roadsanalysis/index.shtml
Deschutes NF	OR	http://www.fs.fed.us/r6/centraloregon/projects/planning/roadsanalysis/index.shtml
Fremont NF	OR	Not Listed
Gifford Pinchot NF	WA	http://www.fs.fed.us/gpnf/forest-administration/roads-analysis/
Hells Canyon NRA	OR / ID	Not Listed
Ochoco NF	OR	http://www.fs.fed.us/r6/centraloregon/projects/planning/roadsanalysis/index.shtml
Siuslaw NF	OR	http://www.fs.fed.us/r6/siuslaw/rap/index.htm

Region 8 – Southern		
Forest	State	Road Analysis Report Available at:
Angelina NF	TX	Not Listed
Apalachicola NF	FL	Not Listed
Bankhead NF	AL	Not Listed
Bienville NF	MS	Not Listed
Cadd-LBJ NG	TX	Not Listed
Caribbean NF	Puerto Rico	Not Listed
Chattahoochie-Oconee NF	GA	Not Listed
Cherokee NF	TN	Not Listed
Conecuh NF	AL	Not Listed
Croatan NF	NC	Not Listed
Daniel Boone NF	KY	Not Listed
Davy Crockett NF	TX	Not Listed
Delta NF	MS	Not Listed
De Soto NF	MS	Not Listed
Frances Marion-Sumter NF	SC	Not Listed

George Washington and Jefferson NF	VA	Not Listed
Holly Springs NF	MS	Not Listed
Homochitto NF	MS	Not Listed
Kisatchie NF	LA	Not Listed
Land Between the Lakes NRA	KY / TN	Not Listed
Nantahala NF	NC	http://www.cs.unca.edu/nfsnc/roads/roads_report.htm
Pisgah NF	NC	http://www.cs.unca.edu/nfsnc/roads/roads_report.htm
Tombigbee NF	MS	Not Listed

Region 9 – Eastern		
Forest	State	Road Analysis Report Available at:
Allegheny NF	PA	http://www.fs.fed.us/r9/allegheny/forest_management/projects/analyses/roads/index.htm
Chequamegon-Nicolet NF	WI	http://www.fs.fed.us/r9/cnnf/roads/index.html
Chippewa NF	MN	Not Listed
Finger Lakes NF	NY	Not Listed
Green Mountain NF	VT	Not Listed
Hiawatha NF	MI	Not Listed
Hoosier NF	IN	Not Listed
Huron-Manistee	MI	Not Listed

Region 10 – Alaska		
Forest	State	Road Analysis Report Available at:
Chugach NF	AK	Not Listed
Tongass NF	AK	http://www.fs.fed.us/r10/tongass/management news/tra/tongassroadanalysis.pdf

APPENDIX E: Valuation of Nonmarket Benefits

A variety of measurement techniques to estimate the value of outdoor recreation and other non-market goods and services have been developed by economists in recent decades. Non-market valuation techniques can be subdivided into two categories: indirect and direct. Indirect valuation approaches rely on observed behavior to infer values, and economists refer to these valuation modeling approaches as revealed preference models. The travel cost method (TCM) is a prominent revealed preference modeling approach that uses the relationship between visits and travel expenditures to infer the value of a recreational site. In contrast, direct valuation approaches rely on people stating their valuation, and include various survey-based techniques such as contingent valuation, conjoint analysis, and choice modeling to directly elicit preferences. Both types of models provide results that are used frequently in public policy decisions, though the stated preference approach is more controversial. Revealed and stated preference studies typically require extensive primary data collection that makes their use problematic for small-scale projects and for agencies with limited budgets. Measurement of nonuse values such as existence values for preserving natural landscapes, environmental assets, or ecosystems remains controversial because these values usually require a stated preference measurement approach. In contrast the measurement of use values (for non-market goods such as sport fishing, backpacking, hiking, and hunting) is generally accepted by economists and policy makers because the "actual" behavior is used to reveal value.

In some cases it may be feasible to use value estimates generated for a similar site to infer values at an unstudied site that is of public policy interest. The economic method involves using a technique called benefit transfer. Boyle and Bergstrom (1992) define benefit transfer as "...the transfer of existing non-market values to a new study which is different from the study for which the values were originally estimated." Thus benefit transfer allows the researcher to use information, models, or values generated from one study and apply them to analysis of a site or situation with similar attributes. The transfer could involve information on primary physical effects, such as roadway erosion, secondary physical effects, such as increased turbidity (or sediment loading) due to erosion, and the economic implications (reduced recreational or commercial fish landings). The advantage of benefit transfer is that it can be done at much lower cost. Unfortunately in many cases there have been no relevant studies from which to transfer benefit information. This is especially the case with ecosystem services such as erosion.

Loomis, *et al.* (2000) estimate willingness to pay to restore ecosystem and environmental services including wastewater dilution, water purification, erosion control, fish and wildlife habitat and recreation along the South Platte in Colorado. The method of payment was in the form of increased water rates to purchase conservation easements along a 45-mile section of the South Platte and purchase water rights from willing farmers to provide increased instream flow. Using a dichotomous choice contingent valuation instrument, they find willingness to pay for the program to be $20.50-$21.65 per household per month (2000 dollars, 95% CI).

Woodward and Wui (2000) perform a meta-analysis of the economic value of wetland services using 39 existing studies. The authors use annual value per acre, which is not a surplus measure, and find that the value per acre of wetland is largely a function of the aesthetic properties of the wetland and ecosystem services that are strongly tied with economic factors such as flood control. Within a 90% confidence interval their estimated value calculations from the study are flood control = $393-$1,747 per acre and storm water assimilation = $237-$5,142 per acre. The calculated confidence intervals are of concern and the authors recognize this and suggest that it "…would be highly speculative to use of (sic) a single point from this distribution in a benefits transfer exercise" (p. 268).

Speyrer and Ragas (1991) estimated a hedonic model that examined the effect of recurring flooding on housing prices in the New Orleans area. In both urban and rural regions near New Orleans, housing prices are lower if the home is located in the 100-year flood zone relative to those outside the 100-year flood zone. All else equal, a suburban home with FEMA flood risk "A1" sold for $6,124 ($9,365, 2000 constant dollars) less than a home with similar characteristics but less flood risk. Similarly, an urban home with FEMA flood risk "A8" sold for $13,691 ($20,938, 2000) less than a similar home with less flood risk.

There is much less experience in the measurement of the economic value of ecological services. Ecological services are flows from environmental resources that are beneficial to ecosystems or social systems. Ecological services include flows such as biodiversity, nutrient cycling, maintenance of atmospheric chemistry, soil formation, habitat, maintenance of hydrological cycles, and so on. One of the problems of measuring ecological services is the sheer complexity of ecosystems and how one component relates to another.

Daily (1997) provides an excellent conceptual development of the importance of the ecosystem services, and their inherent value, this book does not provide the type of information needed to incorporate the value of ecological services into decision making. In fact, they provide evidence that such value estimates do not exist.

Costanza et al. (1997) provide estimates of ecosystem service values by type of ecosystem and type of service. These are average valuation numbers, and in some cases the range of values in the average is quite large, reducing the information content of the average number. For example, for forest ecosystems, Costanza et al. find an average value of $2 per hectare per year for the service "water regulation", $3 per hectare per year for "water supply", and $96 per hectare per year for "erosion control". For lake and river ecosystems, Costanza et al. find an average figure of $5,445 per hectare per year for "water regulation" and $2,117 for "water supply". One can see that the available numerical estimates for ecosystem service values are limited.

References:

Boyle, Kevin, and John Bergstrom. 1992. Benefit transfer studies: Myths, pragmatism, and idealism. *Water Resources Research* 28(3): 657-663.

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Environmental Protection Agency. 2000. "Guidelines for Preparing Economic Analyses." EPA 240-R-00-003. September.

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Results from a Contingent Valuation Survey." *Ecological Economics* 33: 102-117.

Speyrer, Janet Furman, and Wade R. Ragas. 1991. "Housing Prices and Flood Risk: An
Examination Using Spline Regression." *J. Real Estate Finance and Economic*s, 4:395-407.

Woodward, R.T. and Y.S. Wui. 2001. "The Economic Value of Wetland Services: A Meta-Analysis." *Ecological Economics* 37:257-270.

APPENDIX F: RISK AND VALUE CRITERIA (from Clearwater National Forest Roads Analysis: Appendix A).

Annual Maintenance Cost Values

This value was established to represent one value in the forest's calculation of the road management category. Maintenance costs for fiscal year 2001 were used for this calculation. Initially forest records produced a table showing the road maintenance cost for all the Arterial, Collector, and Major Local roads. Using these values, a table of High, Medium and Low Cost Values was established for each category of forest road. See the tables below.

ARTERIALS		
Total AM	Miles	AM/mile
1,851,395	415.90	4,452
High	more than $6700/mi	
Medium	$2200-6700/mi	
Low	less than $2200/mi	

COLLECTORS		
Total AM	Miles	AM/mile
1,482,315	641.09	2,312
High	more than $3500/mi	
Medium	$1200-3500/mi	
Low	less than $1200/mi	

LOCALS		
Total AM	Miles	AM/mile
639,345	664.38	962
High	more than $1400/mi	
Medium	$500-1400/mi	
Low	less than $500/mi	

Based on those values the following sets of values was given to each class of road:

Arterials High = 3, Medium = 2, Low = 1
Collectors High = 3, Medium = 2, Low = 1
Major Locals High = 3, Medium = 2, Low = 1

In order for these values to be compared it became necessary to provide a functioning factor to level out the values to one set of road costs that could be compared. An example would be the comparison of a High Value Arterial with a High Value Major Local Road. The value for each road did not provide for a true comparison unless a factor was applied. The functioning factor is an attempt to level the comparison between different classes of roads.

Arterial Roads 3
Collector Roads 2
Major Local Roads 1

Since the addition of the functioning factor to the original Annual Maintenance Cost Value for each road resulted in a new range of values, it became necessary to create a new High, Medium and Low. The following is the new adjusted Maintenance Cost Values:

6 or 5 equals a High Value = 3 shown on the road matrix
4 equals a Medium Value = 2 shown on the road matrix

3 or 2 equals a Low Value = 1 shown on the road matrix.

Recreation Use Value

- High = high use levels; major through roads; and roads to points of interest
- Medium = medium use levels; destination roads; numerous dispersed campsites
- Low = minor through road; no points of interest

Access Value

- High = primary access to private land or Forest Service administrative facility; includes Forest Highways that may provide access to multiple facilities, private land and management areas
- Medium = alternate access to private land or Forest Service administrative facility
- Low = does not access private land or Forest Service facilities.

Resource Management Value

- Step 1 is based on the following:
    - High = road segment in management area E1
    - Medium = road segment in management area C8S
    - Low = road segment in management areas A to C6.

- Step 2 – adjust the Step 1 ratings up or down based on the following:
    - Timber management needs
    - Reforestation management needs
    - Fire suppression or fire management needs

Adjusted values are shown in the Road Matrix for each road segment.

RESOURCE RISK CRITERIA:

Mass Wasting Risk

- The mass wasting and road surface erosion ratings (L, M, H) were based on the percentage of the road segment with high to very high erosion potentials. For mass wasting (MW), if the % of the road segment with H to VH mass wasting or debris avalanche or sediment delivery potentials is:

    - 0-33%, then the MW rating is LOW
    - 33-67%, then the MW rating is MODERATE
    - 67-100%, then the MW rating is HIGH

Surface Erosion Risk

- For road surface erosion (SE), if the % of the road segment with H to VH subsurface or parent material erosion potential is:

    - 0-33%, then the SE rating is LOW
    - 33-67%, then the SE rating is MODERATE
    - 67-100%, then the SE rating is HIGH

Aquatic Risk

- High = bull trout and/or steelhead trout present in the drainage and/or habitat is designated *focal* for bull trout and *critical* for steelhead trout.
- Moderate = habitat is designated adjunct for bull trout and/or westslope cutthroat trout is present in the drainage

- Low = bull trout, steelhead trout and/or westslope cutthroat trout are NOT present in the drainage.

Wildlife Risk

- High = high impact to elk
- Medium = moderate impact to elk
- Low = no impact to elk

APPENDIX G: Jackson State Park Road Decommissioning Contract Example

DRAFT

ROAD DECOMMISSIONING CONTRACT FOR FOREST ROAD 630

The CONTRACTOR shall perform all operations to the satisfaction of the STATE to decommission 3.5 miles of State Forest Road 630 designated on the project map. This work shall be conducted and completed between July 1 and October 15, 2002 and 2003. This operating period has been selected to coincide with low stream flow conditions. Required work shall include the following:

A. CONSTRUCTION OF ROAD SURFACE DRAINAGE STRUCTURES:

1. The CONTRACTOR shall use an excavator to install cross- road drains on all designated roads at an approximate spacing of 100 feet.

A cross-road drain is a deeply cut waterbar that drains the road surface and the inboard ditch. Each cross-road drain shall be free draining for its entire length and shall have a uniform grade of no less than 5 percent. The inlet of the drain shall be cut at least 12 inches into the original road surface. The bottom of the drain shall be at least 2 feet wide and its side bank steepness shall be less than 50 percent. The soil from this excavation shall be mounded as a berm on the downhill side of the drain to increase its overall height and to allow free, unobstructed drainage into the drain from the road surface. Care shall be exercised by the CONTRACTOR to locate cross-road drains away from identified unstable sites.

2. In addition to the installation of the cross drain structures, the CONTRACTOR shall use an excavator and a bulldozer (Caterpillar D-8 or equivalent with rippers) to reshape the road prism to create an outsloped road surface. The road surface shall be outs loped to a grade of 10 percent or greater. The PURCHASER shall roughly contour the road surface so that it freely drains and so that no berm exists. The entire road surface including inboard ditch shall be ripped prior to outsloping to improve water infiltration. The inboard ditch shall no longer exist when outsloping operations are completed.

3. The CONTRACTOR shall minimize earth material from being sidecasted off the road prism during out sloping operations. A berm on the outside of the road shall be maintained to keep earth material on the road surface until the outsloping operations can be completed. The final step with the excavator will be the removal of the berm and construction of the cross drains.

B. STREAM CROSSING EXCAVATIONS:

1. The CONTRACTOR shall excavate all watercourse crossings to re-establish a channel which is as close as feasible to the original natural watercourse grade and orientation. The excavation shall extend down to the level of the original channel bed through out the entire road prism, with the channel as wide or wider than the original channel. The stream bank steepness, in cross- section view, shall not be greater than 50 percent. The CONTRACTOR shall remove spoil material to a stable disposal site approved by the STATE. Material accumulated in the channel upstream of the road shall be excavated to form a stable stream channel. The finished excavation should, where possible, approximate the stream's original (pre-road) form. The CONTRACTOR shall excavate all watercourse crossings with the use of an excavator. All sites requiring excavation are flagged.

2. There are stream crossing excavations where substantial fill material exists. The CONTRACTOR shall use a bulldozer (Caterpillar D8 or equivalent) to distribute excavated material along road 630 to create an outsloped road profile. The intent is to move excavated fill material to the nearest appropriate disposal site. Disposal sites are to be located on flat stable areas where there is minimal risk of loose earth material impacting watercourses. The CONTRACTOR shall properly spread, and contour spoil material to meet the specification for outsloping described in A2 of this contract.

3. The PURCHASER shall properly dig up and remove all culverts from stream crossing removals within the project area. All culverts and non-native debris resulting from culvert removal shall be crushed and disposed of by the CONTRACTOR at a public disposal site. Ditch relief culverts shall have the inletCulvert debris on Roads 602 and 604 shall be crushed and buried on site. The PURCHASER shall treat all culvert sites the same as a stream crossing

excavation, with the exception that erosion control measures (straw mulch, erosion control netting and seedling planting) shall not be required at relief culvert sites.

4. In the event that the stream is flowing at any excavation site, all water quality requirements of the 1603 Agreement with the Department of Fish and Game shall apply, and efforts shall be made to minimize sedimentation to those streams. Accidental deposition of soil or debris into a stream shall be removed as soon as practical.

If the watercourse has running water at the time the watercourse crossing is being removed, the PURCHASER shall divert or pump stream flow such that equipment is not working in a live stream. A silt catchment basin shall be constructed across the stream immediately below the watercourse crossing site. The catchment basin shall be constructed of gravel which is free of mud or silt.

C. EROSION CONTROL AND REVEGETATION:

1. The excavated material and any cut bank resulting from the removal of any watercourse crossing shall be stabilized by the PURCHASER. Any excavated material, or cut bank resulting from stream crossing excavations, that is located within 100 feet of a watercourse shall be covered with at least two inches of straw mulch (compacted). Straw mulch on slopes over 30 percent shall be secured by the PURCHASER with erosion control netting (Jute Netting or equivalent). A watercourse means any well- defined channel found in the field with distinguishable bed and bank showing evidence of having contained flowing water (Class I, II or III watercourses as defined under Forest Practice Rules). The erosion control netting shall be installed by the PURCHASER within 5 working days of work completion in the area where the bare soil was created.

2. The PURCHASER shall plant XXXX coast redwood seedlings (styro-container #8 or equivalent) at a spacing of 10 by 10 foot spacing during the winter period immediately following road abandonment work in any place where erosion control netting has been installed. Planting specifications are found in Addendum xx. The STATE shall the supply coast redwood seedlings to be planted.

3. The PURCHASER shall plant XXX coast redwood seedlings (styro-container #8 or equivalent) at a zig-zag 12 foot spacing on the portion of State Forest Road 630 where outsloping operations have been completed. Seedlings shall be planted during the winter period immediately following road abandonment work. Planting specification are found in Addendum xx. The STATE shall supply the coast redwood seedlings to be planted.

D. ESTIMATE OF WORK TO BE COMPLETED:

The following are descriptions of site specific specifications for sites flagged on the ground:

(*List of site specific specifications*)

E. CONDUCT OF OPERATIONS:

1. The CONTRACTOR and the STATE shall walk and discuss each section of road decommissioning work prior to the initiation of operations to develop a site specific work plan which is acceptable to the STATE.

2. The CONTRACTOR shall maintain all State Forest roads used to access Road 630 during this project to the satisfaction of the STATE.

3. The CONTRACTOR shall furnish to the STATE production and cost data with respect to all road decommission operations. Production and cost data shall be provided within 60 days of completion of road decommission operation.

Appendix H: RCAA Workshop

September 12 - 13th 2002

King Range National Conservation Area BLM Whitethorn Office

Sponsored by: Mattole Restoration Council & the Collaborative Learning Circle

This course is limited to ten participants.

For information or to register, call Jessica DeKelver, Whitethorn MRC Office 707-986-1078 upriver@mattole.org

Heavy Equipment Supervisor's Training Workshop

Successful project management is key to:

~ Completing projects on time and within budget
~ Providing project quality assurance
~ Ensuring a safe, low-liability workplace
~ Successful communication with funding agencies
~ Working successfully with heavy equipment operators and laborers
~ Conducting on-site photo-documentation and monitoring
~ Completing reports and invoices
~ Successful contract negotiation throughout the project phases

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Learn:

Budget/financial management, principles of supervision, reporting and invoicing tips, common problems that develop at implementation worksites, safety, guidance on field supervision, photo-documentation & in-project monitoring

Heavy Equipment Supervisor's Training Workshop

Day 1 BLM office

12:00-12:30 — Introductions, organizational affiliation, watersheds worked in, interest in workshop (2 minutes each)

12:30-12:45 — Goals of workshop; Agenda review - both days
Goals: To learn from each other — Full Circle Training; To help project supervisors be effective in their work; To help assure that there is quality implementation

12:45-1:00 — Travel to Sanctuary Worksite

1:00-1:30 — Safety talk and demonstration; personal injury, fire, and prevention of environmental damage

1:30-2:00 — Guidance on field supervision
Discussion among participants about their experiences and what has worked, what has not

2:00-3:00 — Principles of Supervision
Who is in charge?
Power, authority, respect
How to get the best from each other, supervisor and operator
Focus on the end result-there are often several ways to get to the same place-let the operator offer their expertise to getting the job done
Know your contract requirements, deliverables, budgets, and timelines
Effective communication with your supervisor, the subcontractor, landowners, agencies and others
Negotiating cost/task changes with subcontractors
Subcontracts and Change Orders

3:00-3:15 — **Break**

3:15-4:15 — **Discussion with Operator,** Macky McCullough on worksite and project communication

4:15-5:00 — Open discussion/travel to campground

5:00-6:00 — **Free time**

6:00-7:30 — **Dinner**

7:30-8:30 Discussion on days sessions; anything missed?

Day 2 Nadelos Campground

8:00-9:30 **am** — **Budget and Financial Management**
Estimating costs; covering all costs —creative budgeting; using charge out rates
Budget forms;-RCAA example; ~MRC .example; others
Tracking costs; RCAA example; MRC example; others
Cost over-runs, budget amendments, cost under-runs and options

9:30-10:00 — **Break**

10:00-11:00 — **Reporting and Invoicing Tips**

Keep accurate and regular records of all costs and activity on your project; these are used for invoicing and reporting

Take photographs at all phases from established photo-points for reports
Know the contract guidelines and invoicing procedures-these vary by funding source; maintain records for three years

Submit invoices regularly, timely, accurately, and with adequate required documentation

Submit quality reports timely

Develop a trusting relationship with your contract officer or representative; be helpful and understanding of their issue

11:00-12:00— Common Problems that develop at work sites

The job is different than expected or budgeted
Breakdowns...who pays? Overtime?
Landowner or neighbor concerns
Emergencies: injuries, fire...
Weather

Timing, interfacing permits, construction, laborers, materials, and equipment with limited operating periods
12:00-1:00 — **Lunch** —

1:00-3:00 — **Project Monitoring**
Photo-documentation and monitoring
Objectives, procedures, use

3:00-5:00 pm — Wrap up discussion; review principles learned; evaluation of workshop forms; receive certificates for participation

Implementation/Contracting Supervisor's Training Workshop

Characteristics of successful project management include:

- Completing of projects on-time and in-budget
- Providing quality assurance for projects
- Ensuring a safe, low-liability workplace
- Successful communication with funding agencies
- Working successfully with heavy equipment operators and laborers
- Conducting on-site photo-documentation and monitoring
- Completing reporting and invoicing
- Successful contract negotiations throughout the project phases

The training will combine in-class work, discussions, and a three-quarter day field outing to an active restoration project. Training will begin at noon on Day 1 at the MRC office in Whitethorn with a safety demonstration, guidance on field supervision, and a move to the field for a discussion with the heavy equipment operators on worksite communication. At five pm, participants will break for dinner and evening discussion. Day 2 will begin at 8am at the campground with a short-course on budget/financial management, principles of supervision, reporting and invoicing tips, and common problems that develop at implementation worksites. Training on photo-documentation and in-project monitoring will also occur at work sites. At 3pm, participants will due a two-hour wrap-up and review of the principles discussed at the workshop.

Day 1	Meet at MRC's Whitethorn Office
12:00 - 12:30	Introductions, organizational affiliation, watersheds worked in, interest in workshop (2 minutes each)
12:30 -12:45	Goals of workshop; Agenda review — both days Goals: To learn from each other — Full Circle Training To help project supervisors be effective in their work To help assure that there is quality implementation
12:45 - 1:00	Travel to Sanctuary Worksite
1:00 - 1:30	Safety talk and demonstration; personal injury, fire, and prevention of environmental damage
1:30 - 2:00	**Guidance on field supervision** Discussion among participants about their experiences and what has worked, what has not
2:00 - 3:00	

Principles of Supervision

Who is in charge?

Power, authority, respect

How to get the best from each other, supervisor and operator

Focus on the end result-there are often several ways to get to the same place-let the operator offer their expertise to getting the job done

Know your contract requirements, deliverables, budgets, and timelines

3:00 -3:15 Effective communication with your supervisor, the subcontractor, landowners, agencies and others

3:15 - 4:15 Negotiating cost/task changes with subcontractors Subcontracts and Change Orders

4:15 - 5:00 Break

5:00 - 6:00 **Discussion with Operator,** Macky McCullough on worksite and project communication

6:00 - 7:30

Open discussion/travel to campground

7:30 - 8:30 pm

Free time

Day Two

8:00 - 9:30 am

Dinner

Discussion on days sessions; anything missed?

Campground

Budget and Financial Management

9:30— 10:00

Estimating costs; covering all costs —creative budgeting; using charge out rates

Budget Forms; RCAA example; MRC example; others

10:00—11:00

Tracking costs; RCAA example; MRC example; others

Break

Reporting and Invoicing Tips

Keep accurate and regular records of all costs and activity on your project; these are used for invoicing and reporting

Take photographs at all phases from established photo-points for reports

Know the contract guidelines and invoicing procedures-these vary by funding source; maintain records for three years
Submit invoices regularly, timely, accurately, and with adequate required documentation
Submit quality reports timely
Develop a trusting relationship with your contract officer or representative; be helpful and understanding of their issue

11:00- 12:00 **Common Problems that develop at work sites**
The job is different than expected or budgeted
Breakdowns.. .who pays? Overtime?
Landowner or neighbor concerns
Emergencies: injuries, fire...
Weather
Timing; interfacing permits, construction, laborers, materials, and equipment with limited operating periods

12:00 — 1:00 Lunch

1:00 — 3:00 **Project Monitoring**
Photo-documentation and monitoring
Objectives, procedures, use

3:00—5:00 pm Wrap up discussion; review principles learned; evaluation of workshop forms; receive certificates for participation