The Economic Importance of Healthy Alaska Ecosystems

prepared by

Steve Colt
steve_colt@uaa.alaska.edu

Institute of Social and Economic Research
University of Alaska Anchorage
3211 Providence Drive
Anchorage, AK 99508
907-786-7710
http://www.iser.uaa.alaska.edu/

prepared for
Alaska Conservation Foundation

January 2, 2001

The Economic Importance of Healthy Alaska Ecosystems

Table of Contents

The author is grateful to Eric Larson, Stephanie Martin, and Amy Wiita of ISER for expert research assistance. Kirsten Shelton, a graduate student at Duke University, prepared Appendix A

Table of Tables and Figures

1. Introduction

Alaska's healthy ecosystems are scarce and valuable economic resources. As population, income, education and development pressures increase worldwide, the relative scarcity -- and hence the value -- of these ecosystems is almost certain to increase significantly. However, because most ecosystem services are provided as public goods rather than through private markets, the value of these services must be registered and acted on within the public policy arena. In fact, economic theory assures us that without careful public stewardship, critical ecosystem services will be underproduced by a private market economy.[1]

This report presents an initial assessment of the economic importance of Alaska's ecosystems in their unimpaired state. It considers the links between healthy ecosystems and a healthy Alaska economy, broadly defined to include a sustainable, healthful, and satisfying quality of life. It consists largely of synthesis and application of existing data and research. For example, Goldsmith et al. (1998) have produced detailed analyses of the economic significance of the Bristol Bay wildlife refuges and the Kenai National Wildlife Refuge (Goldsmith 2000b), while Larson (1998) has quantified Alaska's natural assets without monetizing them.

1.1. Natural Assets, Ecosystem Services and Economic Benefits

Functioning ecosystems are the foundation of human life and hence of all economic activity. As a recent international assessment put it,

> Ecosystems are the productive engines of the planet—communities of species that interact with each other and with the physical setting they live in. They surround us as forests, grasslands, rivers, coastal and deep-sea waters, islands, mountains—even cities. Each ecosystem represents a solution to a particular challenge to life, worked out over the millennia; each encodes the lessons of survival and efficiency as countless species scramble for sunlight, water, nutrients, and space. (World Resources Institute 2000)

Alaska's ecosystems and natural resources are valuable natural assets. Like other economic assets, healthy ecosystems provide a flow over time of benefits known as ecosystem

[1] See textbook treatments of this "market failure" problem in, e.g., Tietenberg (2000) or Lesser, Dodds, and Zerbe (1997). (Full listing of references is provided in the References section of this report)

services. Table 1 lists some major categories of ecosystem services and their benefits to humans.[2]

Table 1
A Taxonomy of Ecosystem Services and Their Benefits to Humans

Ecological Processes	• Fixing and cycling of nutrients • Soil formation • Circulation and cleansing of air and water • Regulation of atmospheric chemical composition • Pollination • Climate regulation • Disturbance regulation • Waste treatment
Watershed Benefits	• Erosion control and sediment retention • Local flood reduction • River and streamflow regulation • Water supply storage and retention
Habitat	• Habitat for resident and transient populations of animals and people
Biodiversity	• Genetic resources • Species protection and biological control of other species • Ecosystem diversity • Evolutionary processes
Consumptive Use	• Timber, fish, and other marketable commodities[3] • Subsistence harvests and associated activities • Sport hunting and fishing • Agricultural crop and livestock products
Non-Consumptive Use	• Outdoor recreation • Wildlife viewing • Scientific research, education
Future Use	• Option value (ability to use resource in the future) • Bequest value (ability to allow descendants to receive all types of benefits)
Passive Use	• Aesthetic Values • Spiritual Values • Preservation of Historical & Cultural Heritage • Existence (Satisfaction from knowledge that ecosystem remains intact)

Source: adapted from Costanza et al. (1997) and Dixon & Sherman (1998).

[2] For more information about the full range and variety of benefits from nature, see Costanza et al. 1997.
[3] Some authors also include subsurface commodities in this category

Some of these services, such as the Bristol Bay salmon runs, provide immediate economic benefits that can be appropriated by individuals for commercial gain. Others provide long-term life support benefits to society as a whole. These essential ecosystem services include water storage, regulation of the chemical composition of the atmosphere, and the cycling of nutrients. We also rely on nature for raw materials such as timber, and for the fish, crops, livestock, and wild animals and plants that we consume as food. All of these benefits from nature can be thought of as *economic* benefits and all can be quantified, at least in principle.[4]

In Alaska, the nonconsumptive use of nature is particularly important. For example, many people enjoy camping, hiking, picnicking, viewing wildlife, and other forms of outdoor recreation. These activities enrich our lives and are the basis for much of the tourism industry. More broadly, some people may value Alaska's natural assets even though they have never seen them and have no current plans to visit in the future. These values include the value of preserving the resource for their own possible future use (option value) or that of their children (bequest value), and the "existence value" of simply knowing that natural systems are intact and alive.[5]

Clearly, some natural resources – such timber and commercial fish -- are produced and traded in the private enterprise market economy. However, many other natural resources and ecosystem services -- such as scenic views, clean air, and recreational opportunities -- are *not* traded in markets. Often, this is because it is not physically possible to exclude people from using them. For some other resources, such as public lands, society has made the political choice to maintain public ownership and more or less free public access.

To economists, it is the fact that so many natural assets and ecosystem services are not traded in the market economy that makes them an important subject for study and informed public debate. Access to and enjoyment of Alaska's clean air, fish, scenic views, watchable wildlife, and wildland terrain is typically allocated through political and administrative processes. Because people do not pay money out of their pockets for these services, we cannot easily measure their economic value by observing market prices. But this does not mean that the economic value of the nonmarketed ecosystem services is zero. Healthy ecosystems clearly

[4] See Sagoff (1988) for a forceful critique of putting this proposition into practice when making public policy.

[5] The concept of existence value was first articulated by economist John Krutilla in a far-reaching 1967 paper entitled "Conservation Reconsidered" (Krutilla 1967). In addition to existence value, Krutilla stressed the fixed quantity of natural wonders and the irreversible nature of most major economic development projects.

provide huge economic benefits in the form of life support services, inputs to commercial activities, and direct satisfaction to people. A recent attempt to quantify these benefits pegged them at more than $33 trillion per year for the entire planet, more than twice the value of all goods and services traded in markets (Costanza et al. 1997).

1.2. Economic Significance and Economic Value

There are two broad ways to quantify the economic importance of an ecosystem. First, we can consider the economic activity associated with maintaining, managing, or using the ecosystem. This activity can be measured in the form of actual expenditures, jobs, or income associated with the ecosystem and is known as the *economic significance* of the ecosystem.

Second, we can consider the additional value or benefits that people derive from an activity or ecosystem service, over and above what they actually pay for these benefits. This is known as the *net economic value* of the activity or service. In order to compare these values to other economic values, it is necessary to express them in monetary terms.[6] Economists therefore measure net economic value by determining people's *willingness to pay* additional money for an activity or service, over and above what they actually do pay.

An example may help to clarify these concepts. In 1993, people spent $600 million within Alaska on goods and services directly attributable to sport fishing (Haley et al. 1999). This expenditure directly supported 6,635 Alaska jobs, with a payroll of $158 million. Through economic multiplier effects, an additional 2,601 Alaska jobs were supported with a payroll of $75 million. All of these numbers are measures of the economic significance of sport fishing in Alaska.

The same study found that in addition to making these actual expenditures, anglers would have been willing to pay an *additional* $215 million for physical or legal access to the fishing streams. This additional amount is the net economic value of all sport fishing in Alaska in 1993. Theoretically, government could capture a portion of this amount through higher fishing license fees, sales taxes on fishing gear, or other mechanisms. The number tells us that government could definitely *not* capture more than $215 million – if it tried, at least some people would find that the total costs of fishing exceeded the total benefits, and they would not fish.

[6] Many observers (e.g., Sagoff 1988) question the use of monetary measures and some have suggested alternative units of measure, such as the amount of embodied energy. However, attempts to use these nonmonetary units of measure have not proven successful.

In this report I consider both economic significance and net economic value. Both concepts are useful when evaluating the links between ecosystems and economies.

Economic Significance vs. Economic Impact

Economic significance is not the same as economic impact. Economic impact measures the extent to which economic activity would disappear in a region if there were no sport fishing. Without fishing, anglers – especially residents -- would still spend (in other ways) at least some of what they previously spent for sport fishing, continuing to generate jobs and income. Of course, the location of that spending might shift significantly.

1.3. Summary of Findings

Table 2 summarizes our findings. For each economic activity with commercial components, economic significance is measured by direct jobs, total jobs (after economic multiplier effects), and the total income associated with total jobs. Commercial fishing and tourism are the largest sources of jobs and income that depend in large measure on healthy ecosystems.[7] Together, these two industries support almost 60,000 total Alaska jobs and more than $1.6 billion of total income to Alaskan workers. Sport fishing and government resource management are next in importance, each supporting about 10,000 total Alaska jobs. Sport hunting, wildlife viewing, and other resident recreation together support another 13,000 jobs. Subsistence activities require substantial commercial inputs; the provision of these inputs supports almost 2,000 jobs in the cash economy.

It is possible to add all of these categories together after some adjustments for double counting. Almost 55,000 direct jobs (full time equivalent basis) and 84,000 total FTE jobs are closely linked to the health of Alaska's ecosystems. These jobs produce almost $2.6 billion of income for Alaska workers. When compared to total 1998 Alaska employment of about 317,000 FTE jobs, the 84,000 total jobs makeup more than 26 percent of all Alaska jobs (Figure 1). The 55,000 direct jobs amount to six times the number of direct petroleum jobs and more than twice the employment of the petroleum, mining, and construction industries combined.[8]

[7] Analysts disagree somewhat about which consumptive uses to include in an assessment of benefits from healthy ecosystems. In this paper I include uses that (1) depend on healthy ecosystems and (2) are sustainable over many years. I include commercial, sport, and subsistence uses of fish and wildlife. I exclude logging because logging to date in Alaska consists of clearcutting old growth forests.This practice significantly reduces other ecosystem services (habitat, water quality, scenery), so logging is not sustainable in the same way that fishing is.

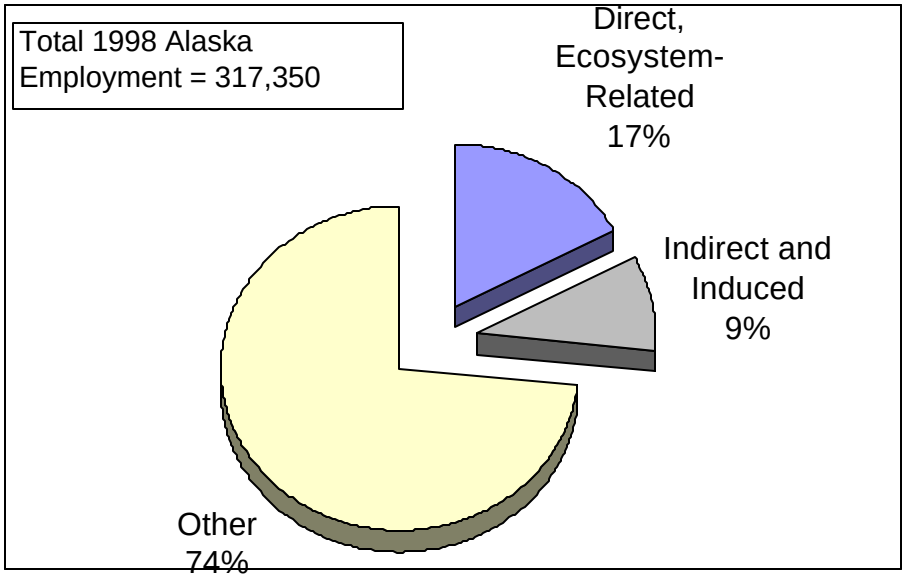
[8] This calculation based on 1998 direct employment of 8,870 petroleum, 1,580 mining, and 13,430 construction as reported in Goldsmith 2000a.

Table 2
Summary of the Economic Importance of Alaska Ecosystems

Economic Activity or Ecosystem Service	Economic Significance			Net Economic Value	
	Direct Alaska Jobs (avg annual)	Total Alaska Jobs (avg annual)	Total Income ($ million)	Low Estimate ($ million)	High Estimate ($ million)
Management and Stewardship Effort	4,534	10,475	527	Not Applicable	
Commercial Fishing & Processing	19,928	33,669	1,011	192	360
Sport Fishing	6,635	9,236	233	215	215
Sport Hunting (note 1)	2,160	2,987	75	23	23
AK Resident Wildlife Viewing (note 1,2)	3,615	4,896	123	17	37
Tourism (notes 1,3)	16,871	25,512	643	not yet fully quantified	
AK Resident Other Nonconsumptive Recreation (notes 1,4)	3,615	4,896	123	not yet fully quantified	
Subsistence Harvests (note 5)	1,978	1,978	61	0	1,700
Existence Value	Not Applicable			309	29,652
Life Support Benefits	Not Applicable			1,200	1,628
Adjustments for Double-counting	(4,356)	(9,450)	(238)		
Adjusted Total	**54,980**	**84,200**	**2,559**	**1,957**	**33,615**

notes:
(1) Total income for sport hunting, resident wildlife viewing, and tourism is estimated using the income to jobs ratio for sport fishing
(2) Wildlife viewing jobs and income based on primary purpose trips and secondary purpose trips. Net economic value low estimate based on primary purpose trips; high estimate includes secondary purpose trips
(3) Tourism industry includes nonresident sportfishing and sport hunting and hence double-counts some of the jobs and income reported for those activities.
(4) Lower bound estimate
(5) Subsistence-related jobs are cash jobs related to providing commercial inputs to subsistence

Figure 1
Ecosystem-Related Employment and Total Alaska Employment



The net economic value of commercial fisheries, sport fishing, sport hunting, and wildlife viewing appears to be fairly low, totaling between $450 million and $640 million per year. Subsistence activities generate potentially large amounts of net value to participants, ranging up to $1.7 billion. Planetary life support services from basic ecosystem processes like nutrient cycling generate more than $1 billion in net value. By far the largest single source of net economic value is the existence value that U.S. households and others derive from the continuing existence of Alaska's pristine and functioning ecosystems. As a partial measure of this value, I estimate that U.S. households receive up to $30 billion worth of economic value per year from the continued preservation of Alaska's federal conservation units in their undeveloped state.

1.4. Organization of this Report

Section 2 considers the economic significance of activities related to the management and current uses of healthy Alaska ecosystems. In section 3 I consider the net economic value of these activities as well as other noncommercial values such as life support and existence values. Section 4 concludes with a brief discussion of how the economic importance of Alaska ecosystems may change in the future. An appendix provides additional discussion about the role of quality of life in promoting regional economic growth.

2. Economic Significance of Ecosystem-Related Activities

2.1. Management and Stewardship Effort

This section considers the economic activity associated with the management and stewardship of public lands and natural resources. The direct effects of management and stewardship consist of government agency employment and procurement expenditures. The procurement expenditures reflect the goods and services that land managers purchase in order to carry out their missions. These include travel, commodities, and a substantial amount of "contractual services" which can range from printing to consulting to heavy construction. Much of these procurement expenditures therefore support the jobs of private sector workers.

Spending by resource management agencies has direct, indirect, and induced effects on jobs and payroll. The *direct* effect is the payroll paid to government agency employees and the payroll paid out by businesses selling goods and services directly to an agency. These businesses might include air taxis, for example. The *indirect* effect is the jobs created and payroll paid out by those businesses that sell to businesses providing goods and services directly to the agency. These might include parts suppliers serving charter air service providers. The *induced* effect is the jobs created and payroll paid in businesses that provide goods and services to the employees holding the direct and indirect jobs. Many of these induced jobs are in retail trade.

The federal agencies I consider are the Forest Service (within the federal Department of Agriculture), the National Park Service, Fish and Wildlife Service, and Bureau of Land Management (all within the Department of Interior), and the National Marine Fisheries Service (within the Department of Commerce). The State of Alaska agencies I consider are the departments of Fish and Game, Natural Resources, Environmental Conservation, and Public Safety (Fish and Wildlife Protection Division). To confine the estimates to stewardship activities, I exclude one half of the employment and expenditures of the Bureau of Land Management, the Alaska Department of Natural Resources, and the Alaska Department of Environmental Conservation. Finally. I also include the activities of 49 Alaska-based nonprofit conservation groups.

Direct Employment and Expenditures

In 1999 more than 4,400 people (full-time equivalent) were employed in Alaska in stewardship activities by the major federal and state land management agencies. Peak employment, which includes summer seasonal park, refuge, and firefighting personnel, was slightly more than 6,200 people. The nonprofit conservation groups employed an additional 112 people. Table 3 summarizes these employment numbers. The two largest employers are the federal Department of the Interior and the Alaska Department of Fish and Game. The major land management agencies spent about $285 million in fiscal year 1999 to support these jobs. The agencies spent an additional $276 million to purchase travel, contractual, and other goods and services. The nonprofit groups spent about $4 million on payroll and benefits and about $5 million on procurement.

Multiplier Effects

An additional 5,941 average annual jobs were generated from procurement expenditures and from the respending of employee paychecks. Total employment related to stewardship in fiscal 1999 was therefore 10,475 jobs. Total labor income (payroll plus benefits) was more than $525 million. Given the nature of the land management mission, it is likely that almost all of the expenditures – both payroll and nonpayroll -- are incurred within Alaska. In addition, many of the direct jobs are high paying. Both of these factors contribute to a large economic multiplier from stewardship activities.

Federal Expenditures

The federal government spends about $366 million on the direct operations of its own major land management agencies and also pays for more than 25 percent of the State of Alaska expenditures reported in Table 3. Overall, the federal government spends about $418 million or about 75 percent of the management and stewardship dollars reported here. Because these dollars come from outside Alaska, the activities they support are a “basic industry.” Just as the military provides national defense services to the nation as a whole, land managers in Alaska provide environmental stewardship services to the nation as a whole.

Table 3
1999 Employment, Payroll, and Expenditures Directly Associated with Environmental Stewardship in Alaska

	Average Annual Employment	Peak Employ-ment	Payroll & Benefits ($ million)	Other Expend. ($ million)	Total Expenditures ($ million)
Federal Agencies (FY2000)					
Interior Department	1,518	1,965	109.2	79.9	189.1
Park Service	647	902	33.9	38.9	72.8
Fish and Wildlife Service	525	613	55.3	21.6	76.9
Bureau of Land Management (1)	347	450	20.0	19.4	39.4
Agriculture Dept. - Forest Service	792	1,059	50.5	52.9	103.4
Commerce Department - NMFS (2)	102	106	7.2	66.5	73.7
Total Federal	**2,412**	**3,130**	**166.9**	**199.4**	**366.2**
State Agencies (FY99)					
Department of Fish and Game	1,245	1,752	68.7	40.1	108.8
Department of Natural Resources (1)	340	810	21.1	10.7	31.8
Dept.Environmental Conservation (1)	245	249	15.1	8.3	23.4
Fish & Wildlife Protection	154	167	11.7	4.1	15.8
Other land-related (1,3)	27	28	1.7	12.9	14.6
Total State	**2,010**	**3,005**	**118.2**	**76.1**	**194.3**
Nongovernmental Environmental Organizations					
(49 Alaska-based groups)	**112**	**112**	**4.2**	**5.1**	**9.3**
Total Direct Employment	**4,534**	**6,247**			
Total Expenditures			**289.3**	**280.6**	**560.6**
Indirect and Induced Jobs & Payroll	**5,941**		**237.5**		
Total Employment & Income	**10,475**		**526.8**		

Notes to table:

(1) BLM, State DNR, State DEC, and State Other land-related categories assume that one half of total activity by these agencies is stewardship related.

(2) National Marine Fisheries Service

(3) Other land related includes seafood marketing and Division of Tourism

(4) Average annual employment estimated as permanent full time plus 1/2 of permanent part time plus 1/4 of temporary.

Sources: National Park Service, Dept. of the Interior Office of the Secretary, Bureau of Land Mgmt, Fish and Wildlife Service, USDA Forest Service, State of Alaska FY99 Executive Budget, Alaska Conservation Foundation

2.2. Fishing, Hunting, and Wildlife Viewing

Commercial Fishing

More than 5.6 billion pounds of fish and shellfish were harvested in waters off Alaska in 1999. The catch accounted for 55% of U.S. seafood production, almost four times more than the next largest U.S. producing state. These fish had an "ex-vessel" market value (before any processing) of $1.2 billion.

Table 4 presents several indicators of fishing and seafood industry activity. According to figures compiled by the Alaska Commercial Fisheries Entry Commission, about 75,000 people receive all or part of their income from the commercial fishing and seafood processing industry. Average annual seafood industry employment was about 20,000 in 1995, the last year for which reasonably good data are available (Goldsmith 1997).[9] Total participation is much higher than average annual employment because of the seasonal and/or part-time nature of the industry. Participation and employment has grown in the last decade, despite volatile prices and the rise of the worldwide salmon farming industry.

The fishing industry is particularly important to rural Alaska. More than 50% of limited entry permit holders reside in rural areas of the state. For many small coastal and river communities, commercial fishing is a major source of income, both to individuals and to local governments.

[9] Most fish harvesters work as self-employed proprietors. No systematic data is collected on the number of proprietors living or working in Alaska.

Table 4
Alaska Commercial Fisheries Indicators

Number of Participants (average of 1997-1998)

Permit Holders	15,000
At Sea Employees	4,500
Shore Based Processing	24,000
Crew Members	31,500
Total	**75,000**

Number of Licenses and Permits

	1998	**1999**
Limited Entry Permits	26,178	24,704
Vessel Licenses	15,959	15,849
Crewmember Licenses	24,916	25,060
Number of Processors and Buyers	651	657

Ex-vessel Value(1) of Commercial Harvest ($ million)

	1998	**1999**
Salmon	261	363
Herring	12	15
Halibut	68	137
Groundfish	368	415
Shellfish	215	271
Total Ex-vessel Value	**924**	**1,201**

notes: (1) Ex-vessel value is the amount of money received by fish harvesters selling their catch to processors
Source: Alaska Department of Fish and Game, Division of Commercial Fisheries

The commercial fishing and fish processing industry is Alaska's largest direct employer among private sector basic industries. It directly supported about 20,000 full time equivalent[10] jobs in 1995. About 9,000 of these jobs were in fish harvesting and 11,000 in fish processing. Total direct labor income from the industry was about $600 million (in 1998 dollars). The industry generated an additional 14,000 jobs and $420 million of income through indirect and induced effects. In total, more than 33,000 average annual jobs and $1 billion of income is attributable to commercial fishing and fish processing in Alaska in recent years. Table 5 summarizes these results.

[10] This term means the same thing as "average annual"

Table 5
Summary of Economic Significance of Commercial Fishing

	Jobs (average annual employment)	Income (millions of 1998 dollars)
Direct Jobs and Income		
Fish Harvesting	9,019	240
Fish Processing	10,909	344
Total Direct Jobs and Income	**19,928**	**584**
Indirect and Induced Jobs & Income	13,741	427
Total Jobs and Income attributable to Fishing and Seafood Industries	**33,669**	**1,011**

Source: Author calculations based on data in Goldsmith (1997)

Sport Fishing

The Alaska Department of Fish and Game estimates that in 1997, nearly half a million anglers fished in Alaska. About half were residents and about half were Visitors. Together they spent more than 2.6 million person-days fishing (ADF&G 1998a). In 1993, 70% of all Alaska households contained at least one person who had been sport fishing within the past three years.

In 1993, ISER conducted household surveys of residents and nonresidents and used them to produce a major study that estimates the economic effects of sport fishing in Alaska (Haley et. al. 1999). This section summarizes some of the key results of that study, and compares them to several previous studies.

Spending for sport fishing has direct, indirect, and induced effects on jobs and payroll. The *direct* effect is the jobs created and payroll paid in businesses selling directly to the anglers, such as food stores and guide services. The *indirect* effect is the jobs created and payroll paid by those businesses that sell to businesses providing goods and services directly to anglers. These include, for example, truck drivers delivering stock to the food stores and advertising agents providing services to the guides. The *induced* effect is the jobs created and payroll paid by businesses that provide goods and services to the direct employees as they spend their paychecks.

In 1993, residents and nonresidents spent $600 million (in 1998 dollars) in Alaska on goods and services attributable to sport fishing. Of this total, residents spent $379 million, or 63

percent, and nonresidents spent $221 million. It is interesting to note that almost half of the total expenditures ($280 million) were for boats, vehicles, and cabins used by Alaska residents. These expenditures are often neglected in studies of this type, and these data provide one of the few direct estimates of the amount of money that Alaskans actually pay in order to live and recreate in a place with such plentiful outdoor opportunities.

Table 6
Direct Expenditures on Alaska Sport fishing

(millions of 1998 dollars)

	Spending on Goods and Services used in Sportfishing	Total Spending Attributable to Fishing Activity		In-State Spending Attributable to Fishing Activity	
Residents	**991**	**411**	**#**	**379**	**63.2%**
Trip-specific	112	99	#	99	16.4%
Fishing & camping gear	77	60	#	56	9.4%
Vehicles and boats	718	209	#	181	30.1%
Cabins	83	43	#	43	7.2%
Nonresidents	**492**	**221**	**#**	**221**	**36.8%**
Trip-specific	89	89	#	89	14.9%
Package Tours	69	32	#	32	5.3%
Nonfishing Instate	185	83	#	83	13.9%
Travel to/from Alaska	149	16	#	16	2.7%
Total	**1,483**	**632**		**600**	**100.0%**

source: Haley et al. 1999

These direct expenditures directly accounted for 6,635 jobs (annual average equivalent basis), with a payroll of $158 million. The indirect and induced effects of this activity accounted for an additional 2,601 jobs and $75 million in payroll which, when added to the direct jobs and payroll, resulted in 9,236 total jobs and $233 million in payroll.

Table 7
Summary of Economic Significance of Sport fishing

(1993 data converted to 1998 dollars)

	Angler Expenditures $ million	Alaska Payroll $ million	Avg Annual Alaska Employment
Direct	600	158	6,635
Indirect & Induced	N/A	75	2,601
Total	600	233	9,236

source: Haley et al. 1999

Comparison to Previous Studies and Years

Two other major studies of the economic significance of sport fishing corroborate the basic ISER results and indicate substantial growth in nonresident spending on sport fishing:

In 1991 the U.S. Fish and Wildlife Service conducted a national survey of fishing, hunting, and wildlife-associated recreation. The survey found that Alaska residents spent $283 million on sport fishing, while nonresidents spent $198 million (in 1998 dollars). The total expenditures of $481 million are roughly comparable to the $600 million dollar figure from the ISER study. Because of major differences in how expenses were categorized, it is difficult to push the comparison further.

In 1986, Jones and Stokes Consultants studied sport fishing in Southcentral Alaska. They found that residents spent $98 million while nonresidents spent $29 million. They estimated that these expenditures supported 2,840 jobs in 1986. The Jones and Stokes study did not count vehicle-related expenses or travel to and from Alaska. When these categories are removed from the ISER numbers, the adjusted numbers (shown in Table 8) still show significant growth in sport fishing spending and related employment. Most of this growth has come from increased nonresident fishing activity, for which expenditures grew at an average rate of 18.4% per year. Alaska resident activity has increased more or less at the rate of population growth, while nonresident spending on sport fishing more than tripled.

Table 8
Growth in Sport fishing Significance from 1986 to 1993 in Southcentral Alaska

	Jones & Stokes 1986	ISER 1998	ISER 1998 Adjusted	Average Annual Growth 86-93
Expenditures (million 1998$)				
Resident	98	233	114	2.2%
Nonresident	29	105	94	18.4%
Total	127	338	207	7.3%
Jobs (average annual)	2,840	6,100	3,744	4.0%

Source: Author calculations using data in Haley et al 1999

Sport Hunting

More than 82,000 Alaskans and 12,800 nonresidents purchased hunting licenses in 1999. These numbers reflect a slight decline in resident hunting effort during the past decade coupled with an 80% increase in nonresident effort. In 1991, the Alaska Department of Fish and Game sponsored a major survey of resident and nonresident hunters and a study of the economic importance of sport hunting (McCollum and Miller 1994a,b,c). In the presentation that follows, I have adjusted their results to account for inflation and for changes in participation between 1991 and 1999.

In 1999 sport hunters spent $165 million that supported a total of almost 3,000 Alaska jobs. Residents spent about $41 million on general hunting gear plus about $72 million on trip-related expenses. The total resident expenditure of $113 million supported 1,470 direct jobs and more than 2,000 total jobs, counting multiplier effects. Nonresidents spent almost $4,000 per trip on trips for which sport hunting was their "primary purpose." That's about 5 times as much per trip as residents. However, visitors from out of state don't make big miscellaneous equipment expenditures in Alaska. Overall, nonresidents spent about $52 million, which supported 690 direct and almost 1,000 total Alaska jobs.

Table 9
Economic Significance of Alaska Sport Hunting in 1999

	Resident	Nonresident	Total
Misc. expenses per participant per yr ($)	498	50	
Number of Participants	82,360	12,782	95,142
Total misc expenditures ($ million)	41.0	0.6	41.7
Expenditures per trip ($)	825	3,996	
Number of trips	87,424	12,782	100,205
Total trip-related expenditures ($ million)	72.1	51.1	123.2
Total Direct Expenditures ($ million)	113.1	51.7	164.9
Direct Alaska jobs	1,470	690	2,160
Indirect & Induced Jobs	562	266	828
Total Alaska jobs	2,032	955	2,987

source: Author calculations based on McCollum and Miller (1994a, 1994c)

Wildlife Viewing by Alaska Residents

McCollum and Miller (1994c) conducted a major mail survey of Alaska voters in 1991. Their data showed that 14 percent of Alaskans took at least one overnight trip with the primary purpose of viewing wildlife. Together these people took about 84,000 primary purpose trips in 1991. The same group also went on 143,000 additional trips for which wildlife viewing was a secondary purpose. I have adjusted these results to account for price changes and population growth.

Based on the 1991 survey data, I estimate that Alaskans took more than 107,000 "person-trips" in 1999 with the primary purpose of wildlife viewing. They spent a total of $82.3 million on miscellaneous equipment and an additional $63.4 million on trip-related expenditures. This spending directly supported 2,657 Alaska jobs. After economic multiplier effects are accounted for, primary purpose wildlife viewing supported 3,567 total jobs.

Table 10
Economic Significance of Wildlife Viewing Trips by Alaska Residents

	Primary Purpose Trips	Secondary Purpose Trips	Total
Misc. expenses per person per yr ($)	226	NA	226
Number of People (1)	364,023		364,023
Total misc expenditures ($ million)	82.3		82.3
Expenditures per trip ($)	591	410	477
Number of Trips	107,203	182,011	289,215
Total trip-related expenditures ($ million)	63.4	74.6	138.0
Total Direct Expenditures ($ million)	145.7	74.6	220.3
Direct Alaska jobs	2,657	959	3,615
Indirect and Induced Jobs	910	371	1,281
Total Alaska jobs	3,567	1,329	4,896

notes: (1) number of people estimated as all registered voters plus one half of other Alaskans age 18+. All other expenditure data from McCollum and Miller (1994c) mail survey of registered voters, 1991.
source: Author calculations based on McCollum and Miller (1994a, 1994c)

Secondary purpose trips supported much less economic activity, largely because these trips are assigned no credit for the miscellaneous expenses on gear. Alaskans took more than 182,000 person-trips with wildlife viewing a secondary purpose, and spent almost $75 million on those trips. This activity supported 959 direct jobs and 1,329 total jobs. Altogether, if secondary purpose trips are included in the total, wildlife viewing activity supported almost 5,000 total Alaska jobs.

Outdoor Photography and Filming Activity

There appears to be no systematic data on the level of commercial wildlife photography or filmmaking. Anecdotal evidence[11] suggests that there are between 200 and 300 professional photographers shooting Alaska scenery. The photographers are only a small part of the media industry, which also includes web site designers, magazine producers and writers, and video production specialists. Most of these people work full time but much of their work does not involve scenery or wildlife.

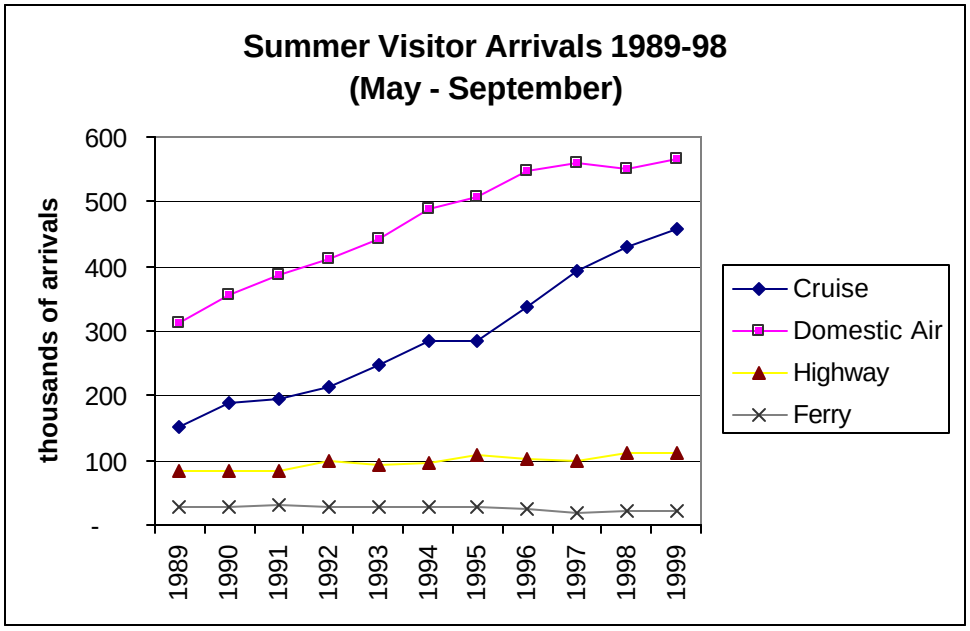
[11] Personal communications with Clark Mischler (photographer), Hal Gage (Alaska Photographic Center),Gerryann Lowther (American Society of Media Photographers). October 2000.

In addition, our anecdotal evidence suggests that a significant amount of commercial photography is purchased by other industries, notably the tourism and recreation industries. These purchases are already accounted for in our analysis of these other industries. The photographers' jobs are part of the "indirect" employment generated by these industries. Based on this very limited information, it is probably reasonable to attribute about 200 full time Alaska jobs to ecosystem-dependent photography and media activity that is not already accounted for in this analysis as a purchase by another industry.

2.3. Tourism and Commercial Recreation

As Figure 2 indicates, the Alaska Visitor industry is the only private sector basic industry that has grown continuously since statehood and continues to grow. That's because it is fundamentally tied to United States and worldwide population and income growth. More than 1.4 million Visitors came to Alaska in 1999, and more than 1.1 million of them came primarily to see the state's mountains, glaciers, and wildlife. These tourist Visitors spent more than $800 million in Alaska, and supported almost 17,000 Alaska jobs on an average annual basis. Clearly tourism is a mainstay of Alaska's private sector economy, and outdoor recreation is very important to both visitors and residents alike.

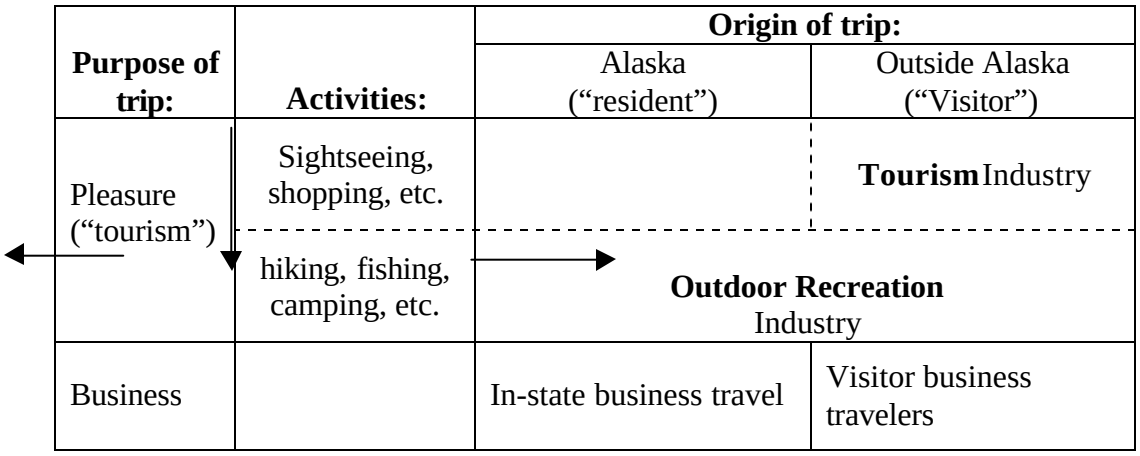
Figure 2
Alaska Summer Visitor Arrivals 1989-1999, by Entry Mode



Tourists, Visitors, Recreation, and the Alaska Economy

Before considering the economic importance of tourism and recreation, it is useful to clarify some definitions. A common definition of "tourism" is traveling for pleasure. The term "recreation" generally connotes specific outdoor activities such as hiking, fishing, or skiing. A *Visitor* (with a capital "V") is usually defined as someone who comes to Alaska from outside the state. These definitions, however, can lead to some overlap and confusion. For example, Alaska residents could be tourists when they travel from one Alaska region to another for pleasure. But Visitors are not "tourists" when they come to Alaska primarily for business.

To minimize such confusion and to conform to conventions used by many other analysts, I will define *tourists* to be *Visitors* traveling through Alaska for pleasure We will define the *Alaska tourism industry* to be the production within Alaska[12] of goods and services for sale to tourists. I will define the *Alaska recreation industry* as the production within Alaska of goods and services used by both tourists and Alaska residents who are pursuing outdoor recreation activities. Although these definitions still overlap, they are the best possible matches to the available economic data. In particular, these definitions agree with the common use of the term "tourism industry" to refer to one of Alaska's basic industries – an industry that sells its products and services to nonresidents.



The State of Alaska collects good data on Visitors that allows us to estimate the economic significance of the tourism industry quite accurately. However, it is far more difficult

to estimate the economic importance of the recreation industry using the definitions above. That's because there is almost no data on the recreational travel patterns and spending habits of Alaska residents, other than the information already reported for fishing, hunting, and wildlife viewing.

To someone interested in the health of the overall Alaska economy, it might seem that only Visitors matter, because they bring money into the state, while resident recreation does not. According to this reasoning, it does not help the overall Alaska economy for the Mat-Su Borough to promote itself as a birdwatching destination for Anchorage residents because the Mat-Su's success would probably come at the expense of Kenai Peninsula destinations.

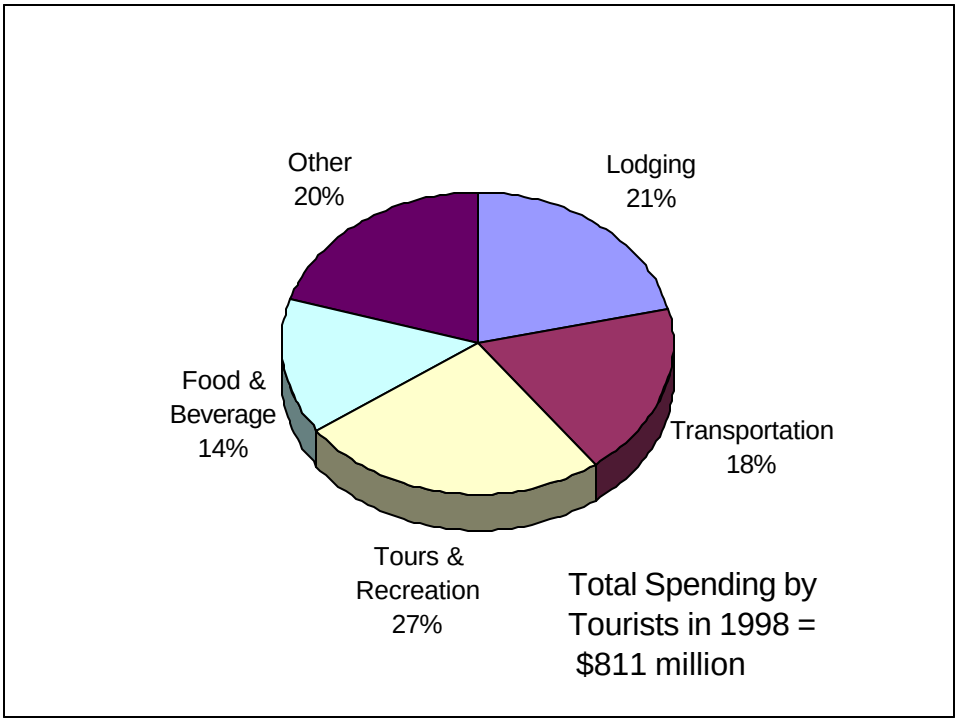
This way of thinking is correct when thinking about marketing – it really doesn't help the Alaska economy as a whole for two regions to wage tourism-marketing campaigns that compete for the same group of Alaska residents. But it is not so easy to say that "only Visitors matter" when summing up the economic importance and the economic value of tourism and recreation. That's because many Alaskan residents are "permanent visitors" who have brought themselves, their money, and their talents to the state in large part because of the quality of life benefits available here. It is also important to remember that Alaska residents can choose to go out of state for recreation. High quality opportunities keep residents' recreation dollars from leaking out of the Alaska economy. Finally, many Alaskans are "self-producers" of recreational experiences that Visitors buy with cash. We buy rafts, kayaks, skis, planes, and cabins because of the special opportunities we have to use them.

Economic Significance of the Tourism Industry

Several studies have developed estimates of overall expenditures by tourists. The most detailed is the McDowell Group's analysis based on extensive primary data collection (McDowell Group 1999). According to this analysis, the average tourist spent about $730 in Alaska in 1998, leading to total tourist spending of $811 million. Tourists spend roughly equal amounts of money on lodging, transportation, tour products, food & beverages, and everything else, as shown in Figure 3.

[12] This definition excludes, for example, the employee compensation of the crew of large cruise ships. It also excludes air travel to and from Alaska.

Figure 3
Composition of 1998 Tourist Spending in Alaska



source: McDowell Group 1999

These expenditures directly supported 16,400 average annual jobs in 1998. After accounting for indirect and induced effects, tourism supported about 25,000 total Alaska jobs in 1998 and 1999. Table 11 summarizes these findings.

Table 11
Economic Significance of the Alaska Tourism Industry

	1998			1999	
Number of Visitors	Summer	Fall-Winter-Spring	Entire Year	Summer (actual)	Entire Year (estimate)
Vacation / Pleasure	885,600	31,500	917,100	914,500	946,000
Visiting Friends & Relatives	103,200	49,200	152,400	105,500	154,700
Business / Pleasure	66,000	22,700	88,700	67,600	90,300
Business	94,900	107,700	202,600	97,400	205,100
Seasonal Workers	14,000	5,200	19,200	14,000	19,200
Total Visitors	1,163,700	216,300	1,380,000	1,199,000	1,415,300
Tourists (1)	**1,021,800**	**92,050**	**1,113,850**	**1,053,800**	**1,145,850**
Tourist percent	88%	43%	81%	88%	81%
Expenditures per Visitor per Trip					
Vacation / Pleasure			782		
Visiting Friends & Relatives			381		
Business / Pleasure			812		
Average for all Tourists			728		
Total Tourist Expenditures ($ million)			811		832
Direct Employment from Visitor Tourism			16,400		16,871
Indirect and Induced Employment			8,400		8,641
Total Employment from Visitor Tourism			24,800		25,512
Estimated Total Income from Tourism ($ million)					643

Notes:
(1) Tourists are Vacation / Pleasure + Visiting Friends & Relatives + one half of Business / Pleasure
Source: McDowell 2000, McDowell 1999. Total 1999 expenditures and employment estimated by author.

Economic Significance of Other Nonconsumptive Outdoor Recreation

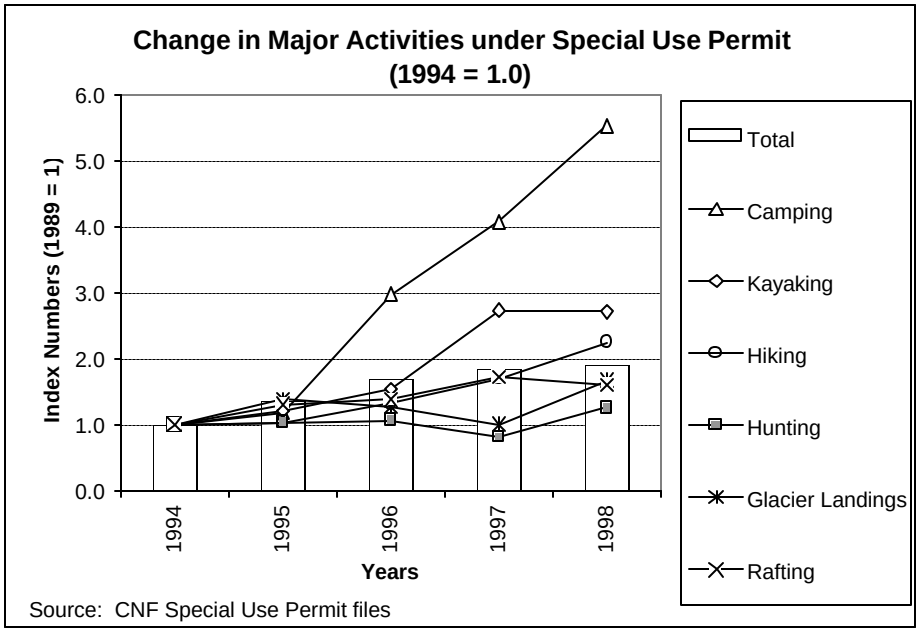
I have already estimated the economic significance of *all* nonresident recreation activities (included within tourism) and of resident sport fishing, sport hunting, and trips for which wildlife viewing is either the primary or secondary purpose. To round out the picture of the economic significance of ecosystem-dependent outdoor recreation we need some measure of other nonconsumptive recreation by Alaska residents – hiking, camping, rafting, kayaking, skiing, etc.—that was not included when residents reported their sport fishing, hunting, or wildlife viewing-related trips. Since there is no systematic data collected that isolates these activities, only informed speculation is possible based on two recent studies of specific places and

activities. I first summarize the results of these studies, and then construct a crude estimate for other nonconsumptive resident recreation.

Colt et al. (forthcoming) considered recreation and tourism in Southcentral Alaska, with a focus on the Chugach National Forest. Their calculations showed that while Visitors generated about 4.2 million person-days[13] in Southcentral Alaska in 1998, the resident population of southcentral could potentially generate almost four times this level of person-days of recreation activity on summer weekend days alone. These calculations are broadly supported by proprietary survey data from the Matanuska-Susitna Convention and Visitors' Bureau. Their data show that a significant share of Anchorage residents reported making numerous trips to the Mat-Su Borough during recent years, during both summer and winter seasons.[14]

Special use permit data from the Chugach National Forest show that commercial recreation is increasing rapidly, but we can't say whether the growth outpaces that of dispersed, independent recreation. Figure 4 shows that while overall numbers of clients in permitted (hence, commercial) activities almost doubled between 1994 and 1998, the categories of camping, kayaking, and hiking grew far faster than this overall average.

Figure 4
Changes in Major Permitted Activities on the Chugach National Forest



[13] We use the term person-days here instead of the more common term "visitor-days" to avoid confusion, since we have previously defined the term visitor to mean a nonresident.

[14] The specific data remain confidential by agreement with the MatSu CVB.

Active sports such as mountain biking and whitewater rafting seem to be growing fastest among summer activities on the Chugach Forest. For example, special use permitted whitewater rafting client days on Six Mile Creek grew at an average rate of 40% *per year* from 1994 to 1998, although the data shows an apparent leveling off in this trend in 1998.

Interviews with more than 130 people associated with the recreation and tourism industry strongly suggest that "soft adventure" is the fastest growing segment of the commercial recreation industry. In response to this surge in demand it seems that many new small businesses are being created close to recreation lands. As shown in Table 12, the number of recreation-related businesses[15] grew by almost 6% per year in the Chugach Forest region,[16] compared to zero growth in Southcentral Alaska and only 2.5% growth for all of Alaska. Significantly, the same type of vigorous growth also occurred in the Denali National Park region.

Table 12
Growth in Numbers of Recreation-Related Business Licenses

Region	Annual Rate of Change 1993-1998			
	Corp.	Partnersh	Sole Prop	Total
Forest	11.4%	4.1%	5.0%	5.7%
Kenai	9.1%	3.4%	0.8%	2.4%
Anchorage	2.6%	-3.1%	-3.4%	-2.0%
Matsu	8.2%	1.1%	0.3%	1.4%
Other Southcentral	3.5%	0.6%	-1.6%	-0.2%
SOUTHCENTRAL	**4.1%**	**-0.1%**	**-1.3%**	**0.0%**
Denali	15.7%	2.6%	4.9%	6.2%
Fairbanks	5.1%	-3.3%	-5.4%	-2.9%
Other Alaska	4.2%	5.7%	0.7%	2.5%
Outside Alaska	3.8%	12.5%	5.1%	5.2%
TOTAL	**4.3%**	**1.6%**	**-1.0%**	**0.6%**

source: Colt et al. (forthcoming), Chapter 4

Some of the growth has been particularly strong. For example, the number of "Hotels and other Lodging Establishments" has grown from 88 to 222 within the Chugach Forest region during the past 10 years. "Recreation and Amusement Establishments" grew at an annual rate of

[15] Eating and Drinking Places (SIC 58), Hotels and Other Lodging Places (SIC 70), and Amusement and Recreation (SIC 79).

[16] The Colt et al. study divided Alaska into regions based on zip code. The regions begin with the Forest (all towns and cities located within or adjacent to the Chugach National Forest) and extend outward to the rest of the state. The forest region comprises: Cooper Landing, Cordova, Girdwood, Hope, Moose Pass, Seward, Tatitlek, Valdez, and Whittier.

7% in the Chugach Forest region compared to a decline in Anchorage and very little change overall in Southcentral.

Goldsmith (2000b) was able to allocate recreational visits to the Kenai Wildlife Refuge in 1997 by activity and by residency of the participant. Table 13 summarizes his analysis. There were 112,000 on-site recreational visits, with 80% made by Alaska residents.[17] The right-most column of the table shows that sport fishing was the dominant activity, generating almost 77% of the visits. The visits generated a total of about $20 million in direct expenditures that supported 373 average annual total jobs (after taking into account the indirect and induced effects). Alaska resident spending supported 67% of these jobs, and sport fishing accounted for about half of the jobs.

While this study only considers one place, the results confirm Colt's suggestion (mentioned above) that Alaska residents could easily account for four times as much recreation demand as nonresidents. They also suggest that residents spend about the same amount of money per person per trip ($90-160) on nonconsumptive use as they do on sport fishing. This amount is in rough agreement with the spending per trip for wildlife viewing-related trips reported above.

With this background for guidance it is possible to estimate a reasonable range for the level of other nonconsumptive recreation not already accounted for. A reasonable lower bound on this number would be the same activity level reported for resident wildlife viewing (about 1.7 million person-days spent and 5,000 total jobs supported). The rationale for this estimate is a review of survey data showing that camping, hiking, and other nonconsumptive uses accounted for about 1.0 million person days in the Chugach Forest alone. Many of these person-days may have been spent by nonresidents, and many of them could have been reported to survey researchers as part of trips with wildlife viewing as a secondary purpose. Nonetheless, a number this large for only one National Forest supports the estimate of an additional 1.7 million person-days spent statewide in other nonconsumptive recreation.

A reasonable upper bound on other resident nonconsumptive recreation would be three times the level of reported wildlife viewing, or about 5.2 million person-days. This works out to

[17] The analysis also considered activities occurring off-refuge but dependent on refuge resources, such as sport fishing on the Kenai River outside refuge boundaries. For clarity, we only consider on-site activity here. Considering off-site "dependent activities" roughly doubles the expenditures and jobs associated with recreation and with the refuge.

almost 9 days per Alaskan per year and would also be about three times the level of person-days spent sport fishing by all Alaskans. Without hard data, it is hard to imagine the level of ecosystem-dependent other recreation exceeding this level.

Table 13
Economic Significance of Visits to Kenai Wildlife Refuge

	Source of Demand					
	Local Residents	Non-local AK Residents	Visitors (non-AK)	Total visits	AK Resident Share	Activity Share of Total
Visits						
Sport Fishing	20,614	48,957	16,319	85,890	81%	77%
Sport Hunting big game	2,665	488	98	3,251	97%	3%
Sport Hunting other	3,000	3,000	-	6,000	100%	5%
Nonconsumptive use	1,867	7,638	7,469	16,974	56%	15%
Total	**28,146**	**60,083**	**23,886**	**112,115**	**79%**	100%
Expenditures per visit ($)						
Sport Fishing	87	87	264			
Sport Hunting big game	1,002	1,004	4,694			
Sport Hunting other	503	503				
Nonconsumptive use	86	157	157			
Total Expenditures ($ million)						
Sport Fishing	1.8	4.3	4.3	10.4	58%	53%
Sport Hunting big game	2.7	0.5	0.5	3.6	87%	19%
Sport Hunting other	1.5	1.5	-	3.0	100%	15%
Nonconsumptive use	0.2	1.2	1.2	2.5	54%	13%
Total	**6.1**	**7.5**	**5.9**	**19.5**	70%	100%
Total avg annual Employment (includes indirect and induced effects)						
due to:	Local Residents	Non-local AK Residents	Visitors (non-AK)	Total	AK Resident Share	Activity Share of Total
Sport Fishing	33	79	88	200	56%	54%
Sport Hunting big game	48	9	9	66	86%	18%
Sport Hunting other	27	29	-	56	100%	15%
Nonconsumptive use	3	23	26	52	50%	14%
Total	**110**	**140**	**124**	**373**	67%	100%

notes: excludes incidental visits (driving through refuge)
source: Goldsmith (2000)

Table 14 summarizes the economic significance of these estimates. Other nonconsumptive resident recreation supports between 3,615 and 10,846 direct jobs and between 4,896 and 14,688 total jobs.

Table 14
Economic Significance of Other Nonconsumptive Resident Recreation

	Low Estimate	High Estimate
Alaska Jobs from Wildlife Viewing Trips		
Direct	3,615	
Total	4,896	
Assumed Ratio of Other Recreation to Wildlife-related Recreation	1.0	3.0
Direct Alaska jobs from Other Recreation	3,615	10,846
Indirect and Induced Jobs	1,281	3,842
Total Alaska jobs	4,896	14,688

notes: Wildlife viewing-related jobs based on McCollum & Miller (1994c)
Indirect and induced jobs for other recreation assume same economic multiplier as wildlife viewing trips.

2.4. Subsistence[18]

Subsistence harvests are vitally important to thousands of Alaskans for economic, cultural, and spiritual reasons. More than 54 million pounds per year of fish, wildlife, and plants were harvested statewide for subsistence during the 1990s. This represents about 2% of the total harvested biomass. The 2 billion pounds per year of commercial fish account for 97%, and sport hunting and fishing take about 1% (18 million pounds per year). As Table 15 shows, rural residents consumed an average of 375 pounds of subsistence foods per person per year and obtained 35% of their calories and more than 100% of their protein from this source.

[18] This section relies principally on ADF&G Division of Subsistence, *Subsistence in Alaska: 1998 Update*, a concise overview of subsistence activities and economics.

Table 15
Alaska Subsistence Harvest and Nutritional Value

	1990 Population	Total Annual Subsistence Harvest (Pounds)	Harvest per Person (Pounds)	Percentage of Daily: Protein Reqt. (49 g/day)	Percentage of Daily: Calorie Reqt. (2400/day)	Replacement Value @ $4/lb ($ million)
Rural Participants						
Southcentral	11,014	1,688,467	153	100%	14%	6.8
Kodiak Island	13,309	2,061,607	155	101%	14%	8.2
Southeast	28,410	5,064,509	178	116%	17%	20.3
Southwest-Aleutian	13,710	5,114,522	373	242%	35%	20.5
Interior	10,383	6,359,597	613	398%	57%	25.4
Arctic	20,380	10,507,255	516	335%	48%	42.0
Western	19,447	12,918,649	664	431%	62%	51.7
Total Rural	116,653	43,714,606	375	243%	35%	174.9
Urban Participants						
Ketchikan Area	13,828	461855	33	22%	3%	1.8
Juneau Area	26,751	922,910	35	22%	3%	3.7
Matsu Area	39,415	1,056,322	27	17%	2%	4.2
Fairbanks-Delta	81,728	1,307,648	16	10%	1%	5.2
Kenai Peninsula	40,008	1,600,320	40	26%	4%	6.4
Anchorage	226,338	4,390,957	19	13%	2%	17.6
Total Urban	433,390	9,740,012	22	15%	2%	39.0
Alaska Total	550,043	53,454,618	97	63%	9%	213.8

Source: ADF&G Subsistence Division 1998.

Economic Significance of Subsistence

Although subsistence is often thought of as a noncommercial activity, it requires substantial economic inputs of time, skill, and purchased equipment and supplies. The purchased inputs and supplies support jobs and income in the cash economy. Goldsmith (1998) estimated that the typical Alaska Native household spends about $2,300 per year on subsistence-related equipment, fuel, and other supplies, while the average Non-Native household spends about $600. He used these estimates in his Alaska input-output economic model to estimate that the subsistence harvest of 1.7 million pounds in three Bristol Bay wildlife refuges supports a cash economy payroll of $2 million and 65 jobs. Almost half of the jobs are in Alaska's commercial centers.

In Table 16 I extend these results to the entire state of Alaska – both rural and urban areas. To control for the differences in the intensity of subsistence activity, the extension is based on the amount of cash economy inputs per pound harvested. The Bristol Bay case study

suggests that it takes about $1.81 in cash expenses to generate each pound of subsistence harvest. About $1.15 of this expenditure ultimately ends up as payroll income received by Alaskans, and every $31,000 in payroll supports a job.[19]

When these parameters are applied to the statewide level of subsistence harvest, I estimate that Alaskans spend about $100 million per year on cash inputs to subsistence activity. This expenditure generates almost 2,000 Alaska jobs and more than $61 million in resident income. Almost half the jobs are in the urban areas where most commercial activity takes place. Subsistence therefore generates about as much associated commercial activity and Alaska cash jobs as sport hunting.

Table 16
Jobs and Income from Commercial Inputs to Subsistence

	Location of Jobs and Income		
	Rural Areas	Urban Areas	Total
Case Study: Bristol Bay Refuges			
Harvest (pounds)			1,762,261
Expenditures ($)			3,182,531
Payroll ($ million)	1.2	0.8	2.0
Jobs (average annual)	35	30	65
cash expenditures per pound harvested			1.81
payroll per pound harvested	0.70	0.44	1.15
payroll per job supported	35,227	26,000	30,982
Extension to all Alaska			
Harvest (pounds)			53,454,618
Expenditures			96,535,632
Expenditures per rural resident			677
Payroll ($ million) received in:	37.6	23.7	61.3
Jobs (average annual)	1,068	910	1,978

source: Case study based on Goldsmith 1998. Extension to all Alaska is author calculations based on case study and state wide subsistence harvest data in ADF&G Subsistence Division 1998.

The estimates above do not consider the direct human effort expended in subsistence activities. There is almost no comprehensive, recent data on time spent on subsistence. In addition, it is difficult even in principle to allocate time to subsistence as a form of "employment." For example, should time spent cleaning, dressing, or cooking subsistence foods be counted as "labor"? Because of these difficulties, only the roughest estimates are possible of

[19] Most of the employment is in the trade sector, which pays low wages.

the amount of direct labor devoted to subsistence. Goldsmith (1998) uses census data to estimate that the average rural Alaska Native adult spends about 3 months per year on subsistence. Based on this assumption, and assuming that rural non-Natives spend 1 month per year, the total labor input to subsistence is about 13,000 person-years of labor per year.

Table 17
Estimated Labor Input to Subsistence

	Alaska Native	non-Native	Total
Total 1995 Rural Population	61,320	63,047	124,367
Adult fraction	58%	72%	
Adult Population	35,638	45,415	81,053
Months per year spent on subsistence	3.0	1.0	
Person-months of labor effort	106,914	45,415	152,329
Person-years (= "jobs")	**8,910**	**3,785**	**12,694**

source: Author calculations based on Alaska 1995 population and assumptions about number of months per adult spent in subsistence

3. Net Economic Value

In this chapter I present estimates of the net economic value generated by several of the activities discussed above. I also consider passive use or existence values associated with healthy ecosystems.

As discussed in the introduction, net economic value represents the additional benefit or satisfaction that people receive from an activity, over and above what they must expend to carry out the activity. For many activities dependent on healthy ecosystems the natural resource itself is not traded in a market or is priced at well below market value. In these cases, estimates of net economic value from a resource-using activity are (admittedly imperfect) estimates of the total value that people place directly on the natural resource itself.

3.1. Commercial Activities

Net Economic Value of Commercial Fish

Section 2.2 reported that the "ex-vessel" value of the commercial fish catch has been about $1.2 billion in recent years. This value reflects, in large part, the labor and capital that go into catching the fish. We can get some idea of the monetary value to commercial fishers of the fish themselves, in their natural state, by considering data on how much fishers are willing to pay for limited entry permits. The value of the permit reflects the value of the right to fish.

A 1993 analysis by the Alaska Office of Management and Budget (Pierce 1993) estimated that the market value of all Alaska limited entry permits averaged $783 million during the period 1984 through 1992. This is about 1.6 times the average ex-vessel value of the fish caught each year with those permits. We also examined recent data for one of Alaska's most important fisheries – the Bristol Bay drift gillnet fishery. These data show that over the five years 1995 through 1999, the average price of a limited entry permit was about 3 times the average annual ex-vessel value of fish caught by permit holders. There are good economic reasons why this estimate of the ratio could be too low[20] as well as too high,[21] but it is a reasonable number to use for this analysis.

[20] The estimate could be too low because the market value of permits actually traded reflects what the incremental seller is willing to accept for their permit. Most permit holders do NOT sell their permits in a given year because the value of the permits to them exceeds what they could earn by selling.

Applying these two estimates to the ex-vessel fish value for all of Alaska's commercially caught fish yields the following results. First, the up-front market value of the perpetual right to catch the commercial fish ranges from about $2 billion to about $3.6 billion. This can be thought of as the amount that the commercial fishing industry would be willing to pay to permanently buy the ecosystem services provided by spawning grounds, rearing habitat, and open ocean living habitat. Second, the net economic value embodied in the commercially-caught fish in 1999 ranges from about $200 to about $360 million. This value represents one estimate of what the entire industry could pay resource managers each year to assure viable fish stocks, while still making money.

Table 18
Net Economic Value of Alaska Commercial Fish, based on 1999 Catch

	Low estimate	High estimate
1999 Total Ex-vessel commercial fish value ($ million)	1,201	1,201
Ratio of limited entry permit value to ex-vessel value of the annual catch	1.6	3.0
Estimated market value of the perpetual right to catch the entire commercial fish catch ($ million)	1,922	3,603
Estimated Net Economic Value of Alaska Commercial fish caught in 1999 ($ million) (annualized value of catching rights for 1999 using a 10% rate of return on the perpetual rights)	192	360

source: Author calculations based on Commercial Fisheries Entry Commission (2000) and Pierce (1993).

In thinking about these numbers, several caveats are in order. First, they represent the value of the fish resource in its wild or "raw" state. The retail, or "final" market value of Alaska's commercial fish harvest is many times higher than the raw resource value. Second, the commercial value of wild fish fluctuates greatly with changes in world market prices. These, in turn, are influenced by changes in technology, such as the recent growth of fish farming. Finally, this estimate of the net economic value of commercially caught fish is conservatively low because it excludes the vital ecosystem services that salmon provide when they transport key nutrients such as carbon, nitrogen, and phosphorus upstream, returning them to nutrient-poor

[21] The estimate could be too high because fish prices have been declining, and permit holders have recently been

terrestrial ecosystems. These nutrients play a key role in sustaining other species such as eagles and bears (National Research Council 1996). The value of these nutrient cycling services is only partially captured in the net economic value of other activities considered in this paper.

Net Economic Value of Sport Fishing

Using 1993 data, Haley et al. (1999) estimated the overall net economic value of sport fishing in Alaska at about $215 million (expressed in 1998 dollars). Close to $140 million is the resident share of that net value and $74 million the nonresident share. These estimates represent a lower bound on the actual overall net economic value of sport fishing. That's because the study estimated the net economic value of many different sites by considering how much people would have to be compensated if they were denied access to that *particular* site only -- while access to other sites was still available. It should be clear that the sum of these individual values is probably far less than the loss people would suffer if *all* sport fishing were no longer available.

Table 19
Net Economic Value of Alaska Sport Fish
(millions of 1998 dollars)

Region	Resident	Nonresident	Total
Southeast	11.7	11.5	23.3
Southcentral	126.4	62.0	188.5
Southwest	3.0	0.1	3.1
State Total	141.1	73.6	214.8

source: Haley et al. 1999

Net Economic Value of Sport Hunting

Alaska residents reported a willingness to pay about $200 more than they actually did pay per overnight hunting trip. Nonresidents were willing to pay more than $500 on average, with trips targeting Brown Bears generating more than $700 per trip. These values yield a total estimated net economic value to sport hunters of about $24 million in 1999. For comparison, the hunters actually spent $165 million. This is the value from overnight hunting trips only – no good data on day trips exists. By comparison, sport fishers spent about $600 million and

"caught" after paying high prices for permits based on their expectations that prices would remain high.

received additional net economic value of about $214 million. The sport fishing data includes many day trips.

Table 20
Net Economic Value of Overnight Hunting Trips in Alaska

	Net Economic Value per Trip		Number of Trips		Net Economic Value ($ million)		
Species	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident	Total
Black Bear	$181	$434	2,807	1,187	0.5	0.5	1.0
Brown Bear	$246	$718	1,238	1,679	0.3	1.2	1.5
Caribou	$200	$512	15,685	4,045	3.1	2.1	5.2
Moose	$214	$465	44,579	3,079	9.6	1.4	11.0
Wolf	NA	$416	248	486		0.2	0.2
Sheep	$316	$583	-	1,419	0.0	0.8	0.8
Goat	$149	$497	1,073	179	0.2	0.1	0.2
Deer	$169	$263	13,456	377	2.3	0.1	2.4
Elk	$117	$104	908	141	0.1	0.0	0.1
Waterfowl	$118	$560	7,430	192	0.9	0.1	1.0
All Species	$194	$513	87,424	12,782	16.9	6.6	23.5

source: author calculations based on McCollum & Miller (1994a, 1994c), and Alaska Department of Fish & Game (2000)

Net Economic Value of Wildlife Viewing Trips by Alaska Residents

Respondents to McCollum and Miller's 1991 survey were willing to pay between $100 and $160 more than they actually did pay to go on wildlife viewing trips. The total net economic value of primary purpose wildlife viewing is about $17 million -- the same as the total net value of sport hunting to residents. Secondary purpose trips generated an additional $20 million in net value.

Table 21
Net Economic Value of Wildlife Viewing Trips by Alaska Residents

	Primary Purpose Trips	Secondary Purpose Trips	Total
Net Economic Value per Trip (1998$)			
Bears	324	143	
Caribou	149	122	
Moose	119	103	
Wolf	169	52	
Sheep	213	130	
Mountain Goat	361	146	
Whales	190	174	
Sea Birds	200	111	
Eagles	193	126	
Average Value per Trip ($)	159	110	-
Number of Trips	107,203	182,011	289,215
Total Net Economic Value ($ million)	**17.0**	**20.1**	**37.1**

source: author calculations based on McCollum & Miller (1994c)

3.2. Subsistence

Three methods have been used to generate estimates of the economic benefits of subsistence. The first is the nutritional value method. As Table 15 showed, subsistence provides substantial shares of Alaskans' protein and calorie requirements. However, it is difficult to move beyond this observation to generate an estimate of net economic value using this method.

The second way of valuing subsistence is to calculate the potential replacement cost of subsistence foods. Table 15 uses a value of $4.00 per pound and shows that the total replacement cost of the subsistence harvest is more than $200 million. Obviously a higher assumption for the replacement cost per pound will yield a higher estimate of total value. The main thing to keep in mind about the replacement cost method, beyond its clumsiness, is that it provides a *lower bound* on the *total* economic value. It is a lower bound because it does not include the cultural and social value of the experience independent of the products obtained. It is an estimate of total value because it makes no allowance for the cost of the inputs used in the activity. For example, Table 16 (above) shows that subsistence requires an estimated cash expenditure of $1.80 per pound harvested. This cash expenditure, plus the value of the labor input, must be deducted from the replacement value to determine the net economic value using

this method. If labor used for subsistence is valued at more than about $5.00 per hour, then the net economic value of subsistence is close to zero using the replacement cost method.

The third way to estimate net economic value is to apply the same valuation methods that economists have used for sport fishing, hunting, and wildlife viewing. Due to practical difficulties, no one has ever attempted to apply the "travel cost" or the "contingent valuation" methods to Alaska subsistence. However, a major attempt was made after the Exxon Valdez oil spill to estimate participants' net willingness to pay for the opportunity to engage in subsistence. These studies looked at tradeoffs between time spent on subsistence and cash employment opportunities. They estimated that people were willing to pay between $32 and $118 per pound harvested (Duffield 1997). Applying this estimate to the total Alaska harvest of 53.4 million pounds yields an estimate of $1.7 billion for the net economic value of the total subsistence harvest.

In summary, it remains quite difficult to measure the net economic value of subsistence in economic terms. Using standard techniques, one can come up with estimates that range from zero (using a $4.00/lb replacement value less the cost of cash and labor input) to more than $1.7 billion (upper bound on net willingness to accept compensation for lost subsistence opportunities).

3.3. Existence Values[22]

So far, this paper has considered sources of economic value that involve some sort of direct resource use. However, people may value natural resources for reasons that are independent of any direct use values. These values are referred to as non-use or *existence values*, concepts first articulated by Weisbrod (1964) and Krutilla (1967). Krutilla suggested that "when the existence of a grand scenic wonder or a unique and fragile ecosystem is involved, its preservation and continued availability are a significant part of the real income of many individuals" (Krutilla 1967, p.779). For example, Freeman (1993) explains that people may gain utility from the knowledge that a natural area is preserved despite the fact that they do not expect to visit that area. Similarly, people may be willing to pay to protect an endangered species even though they do not expect to ever see the species. These values may be motivated by desires to

[22] This section draws heavily on Goldsmith et al. 1998, pp. 6-43 through 6-49

provide for future generations or by the desire to preserve the option of one's own future resource use, as well as other factors (Freeman 1993).

In this section I use existing studies of values for wildlife habitat and wilderness areas in Alaska and other places to estimate the possible magnitude of existence values for Alaska's protected terrestrial ecosystems. While the estimates are highly uncertain, the available evidence supports the conclusion that Alaska's protected public lands produce billions of dollars of existence value every year for United States citizens. Global values could be significantly higher.

Concepts and Measurement of Existence Value

Since Weisbrod and Krutilla's introductions of the concept that individuals may value a resource independent of their use of that resource, a variety of classification schemes have explored the components of non-use value. The literature discusses these values as being related to the "intrinsic value" of resource existence; to the uncertainty of future demand, including altruistic motives and prospects for future use by oneself, one's peers, or future generations; and to ethical motivations.

Little agreement has been reached among economists regarding "terminology, definitions, what motivates people to hold non-use values, and how to measure them empirically" (Freeman 1993, p.142). However, this lack of agreement has not stopped economists from attempting to measure these non-use values, and there is now widespread agreement that they are far from zero, and are often large enough to be the predominant component of the total value of a protected ecosystem. There are three reasons for this phenomenon. First, existence values can be held by the entire population, while use values can only accrue to those who actually visit a natural area. For wildlife habitat, in particular, the number of actual visitors is likely to be very small compared to the national or global population. Second, stated existence values may reflect deeply held convictions about the preservation of cultural heritage – both the survival of intact indigenous cultures and the direct association of healthy lands with one's own culture. Third, it is plausible that people implicitly equate the existence of protected areas and animal species with the maintenance of the planet's overall life support services.

Existence value is usually measured by asking people what they would be willing to pay to preserve, acquire, or protect a given area. These studies are called *contingent valuation* studies because the respondents (generally) do not actually have to pay the amounts. The CV method has some well-known drawbacks. These include (1) distortions that arise because of the hypothetical nature of CV questions; that is, the absence of real financial consequences, and (2) biases introduced by "strategic responses" (i.e., individuals may adjust their stated amounts in an attempt to achieve certain outcomes).[23] To gauge these problems, some authors have compared CV estimates with the results from simulated market experiments, and found reasonable agreement between the two approaches. Many economists are comfortable with the CV method in spite of its hypothetical nature because it has proven to be reasonably accurate when applied to situations where people actually do end up paying.[24]

Estimates of Existence Values

Hundreds of contingent valuation studies have been performed for specific natural areas around the world.[25] However, there appears to be only one CV study focused specifically on existence values in Alaska. In 1992, a team of preeminent economists performed a nationwide CV study of the willingness of the American public to pay to prevent future oil spills similar to the Exxon Valdez spill (Carson et al. 1992). They found that U.S. households were willing to make a one-time payment averaging $31 per household to prevent future spills in Prince William Sound. At the time of the study there were 90.3 million U.S. households and hence the total one-time valuation of oil spill damages suffered by the American public was $2.8 billion. Since this figure is a one-time payment, we must convert it to an annualized value – about $3 per household per year. Since there are now about 103 million households, the annualized willingness of U.S. households to pay to avoid future oil spills in the Exxon Valdez spill area is now about $309 million per year.

---

[23] Recently, the concept of "calibration" has been examined as means to adjust for potential biases in CV estimates. For example, in 1994 NOAA proposed a correction factor of 50 percent (i.e., estimates should be divided by two) for use in natural resource damage assessment. (This adjustment was later rescinded). These issues are discussed in detail in a variety of sources, including the US Fish and Wildlife Service's manual discussing the role of economics in natural resource damage assessment (Industrial Economics 1995).

[24] There are now many studies that use both the travel cost method and the contingent valuation method to measure use values for ecosystem services. The travel cost method is based on actual behavior, and the two methods often yield essentially the same estimates of value as measured by willingness to pay.

[25] Most of these studies can now be accessed through the *Environmental Valuation Reference Inventory*, a web-based database maintained by Environment Canada and other sponsors. http://www.evri.ec.gc.ca/evri/

Goldsmith et al. (1998) considered the existing literature on existence values in relation to the ecological values of three wildlife refuges in the Bristol Bay area. These refuges comprise 13.2 million acres with 5.5 million acres of designated wilderness. They concluded that the existence value to U.S. households of these refuges ranged between $25 and $50 per household per year.

Other studies reach broadly similar conclusions. Table 22 provides a summary of some of the most relevant examples. The main message seems to be that U.S. residents are willing to pay between $5 and $50 per year to preserve specific natural areas.

Application to Alaska

Given the fact that no actual studies have been done and the uncertainties associated with the technique, we can only speculate about the magnitude of the existence value for all of Alaska's ecosystems. To form a lower bound estimate, we could use an existence value of $3 per household per year, or $300 million per year to U.S. residents. This figure is *roughly* equivalent to direct federal agency expenditures for agencies that manage public lands. To form a high estimate, we could take the figure of $25 per household per year for the 13.2 million acres of Bristol Bay wildlife refuges and extrapolate it to cover all of Alaska's 152 million acres of federal conservation units. This leads to a total existence value estimate of about $30 billion per year considering only the value to U.S. households. Table 23 summarizes these estimates. Moving beyond the United States, it is easy to see that the global existence value of Alaska's unimpaired ecosystems is very uncertain but very large – probably somewhere between $1 billion and $50 billion per year.

Table 22
Summary of Willingness-to-Pay Estimates of Existence Values

Author (Date)	Study Location	Description of Resource	Description of Commodity	Annual Willingness to Pay (1997$)
Carson et al. 1992	Alaska: Prince William Sound	Prince William Sound coast and waters	WTP for spill prevention plan	$3 per U.S. household per year ($31 one-time)
Goldsmith and Hill 1998	Alaska: Bristol Bay Wildlife Refuges	13.2 million acre wildlife refuges made up of three separate refuges	WTP for preserving wildlife habitat	$25 to $50 per household U.S.
Walsh, et al. 1984	Colorado	1.2 million acre designated wilderness area (2% of total state acreage) made up of 13 separate areas.	WTP to preserve current wilderness areas	$25.90 per Colorado household
Reid, R., M. Stone and T. Whiteley 1993	British Columbia	Current Wilderness in B.C.	WTP for doubling wilderness	$11 per B.C. household ($110 one-time)
			WTP for tripling wilderness	$14 per B.C. household ($140 one-time)
Bishop and Boyle 1985	Illinois	Illinois Beach State Nature Preserve; 830 acres of dune habitat; only record of geologic history of Lake Michigan	WTP to ensure maintenance and/or protection of the nature preserve	$33 per Illinois resident who had not visited the preserve
Gilbert, A., et al. 1991	Vermont	Lye Brook Wilderness Area, Green Mountain National Forest	WTP for protection, continued management of the area	$10.38 per person within 75 miles
Gilbert, L. 1994	Massachusetts	Parker River National Wildlife Refuge; 4,662 acres, six miles of barrier beach	WTP to ensure maintenance and/or protection of the Refuge	$27 per visitor

Table 23
Hypothetical Existence Value of Healthy Alaska Ecosystems

	Valuation per U.S. household per million acres	Million Acres	Total Valuation per household	Number of Households	Annual Existence Value $ million
Prince William Sound (WTP to avoid oil spill)	n/a	n/a	3.00	103,000,000	309
Bristol Bay Wildlife Refuges	1.89	13.2	25.00	103,000,000	2,575
Alaska conservation units (based on Bristol Bay refuges)	1.89	152	287.88	103,000,000	29,652

3.4. Life Support Services

By virtue of their size and productivity, Alaska's ecosystems provide significant life support services to the entire planet. Scientists are just beginning to provide credible estimates of the economic value of these services provided on large scales. In this section I consider one set of initial estimates for the entire planet, and apply it to Alaska. This exercise must be considered quite speculative given the data and methods available.

Global Value of Ecosystem Services

A group led by economist Robert Costanza (Costanza et al. 1997) divided the Earth into 16 types of ecosystems, or biomes, and considered 17 types of ecosystem services potentially provided by each biome. They used a combination of methods[26] to estimate a dollar value per acre for each biome and then multiplied the value per acre by the number of acres of each biome type. Although these estimates are extremely primitive, they provide an important first step toward understanding the economic importance of basic ecosystem processes.

[26] The chief valuation methods were replacement cost, market prices, statistical studies of human behavior (hedonic pricing and travel cost), and contingent valuation. For more information about these methods, see textbooks such as Tietenberg (2000) or Lesser, Dodds, and Zerbe (1997). An informal powerpoint presentation covering these methods can be found at the author's web site: http://local.uaa.alaska.edu/~afsgc/

The Costanza team estimated that the world's ecosystems currently provide between $16 trillion and $54 trillion of services per year, expressed in dollars of 1994 purchasing power. The average or "best" estimate is $33 trillion per year, which is about twice the amount of conventionally measured annual world economic output. About two thirds of this value comes from coastal ($10.6 trillion/yr) and open ocean ($10.3 trillion/yr) marine systems and the remaining one third from terrestrial systems, mostly forests ($4.7 trillion/yr) and wetlands ($4.9 trillion/yr). The three most valuable services provided are nutrient cycling ($17 trillion/yr), waste treatment ($2.3 trillion/yr), and regulation of floods, storms, and other disturbances ($1.8 trillion/yr). The authors note that "the majority of the value we could identify is currently outside the market system."

Application to Alaska

It is straightforward to apply the Costanza et al. values per acre to the number of acres of each biome in Alaska to estimate the economic value of major ecosystem services provided by Alaska lands and waters. My estimates are in 1998 dollars and exclude several categories of services that do not relate directly to life support services.[27] Table 24 shows the results. The calculations suggest that Alaska lands and waters provide about $1.6 billion per year of basic life support services through ecosystem processes. Wetlands, lakes, and rivers provide the bulk of these services in the form of water regulation, water supply, and waste treatment.

There are two major sources of bias in these estimates that are worth noting. First, the estimates are likely to be on the high side of reality because the services estimated to be most valuable relate to water regulation, filtration, and supply. For these services the average values *per acre* estimated by Costanza et al. are relatively high because they were derived from studies of populated places. For example, it is unlikely that Alaska wetlands are now generating $300 million worth of annual waste treatment services with a population of only 600,000 people, because that would mean that every person in the state is avoiding $500 per year in waste treatment costs by making use of wetlands for filtration. In reality, sewage treatment in large cities is provided by mostly human-made systems and costs about $100 per person per year. To

[27] The excluded categories are raw materials, food production, genetic resources, recreation, and cultural values. These categories are excluded either because they reflect industrial production that is arguably independent of long-term ecosystem health, or because they have been treated more thoroughly in other sections of this paper.

put the matter another way, there is very little wastewater being filtered by the vast majority of Alaska wetlands because there are relatively few people living near them.

The second obvious source of bias is the exclusion by the Costanza team of entire categories of ecosystem services. These include, most noticeably, wildlife habitat provided by forests, lakes, and rivers, and all services provided by tundra. Most likely, these categories were assigned a zero value because the Costanza team could not locate enough rigorous analysis to produce a credible estimate. Obviously terrestrial and aquatic wildlife habitat is a major service provided by Alaska's ecosystems, so the exclusion of these categories leads to an underestimate of reality.

Given these countervailing biases, a realistic estimate of the value of basic life support services provided by Alaska ecosystems using the Costanza approach probably ranges from about $1.2 billion to about $1.6 billion per year. This result is reassuring because it falls within the range of estimates for existence value. As discussed above, some scholars have suggested that reported existence values are proxies for people's valuation of basic life support services, so the two types of valuations should not be wildly different.

The results of this exercise also interesting because they underscore the relatively *high* values of other specific benefits already discussed above – benefits from fishing, tourism, subsistence, recreation, and existence. One important implication of this relationship is that there need be no great conflict between managing for values important to Alaskans and other U.S. citizens and managing for values important to global well-being. If land managers continue to protect the ecosystem services that currently provide high economic value to U.S. citizens, then they are likely to serve the global interest in long-term life support at the same time.

Table 24
Costanza Methodology for Economic Value of Major Ecosystem Services Applied to Alaska Lands and Waters

(millions of 1998 dollars per year)

Biome	Millions of Acres in Alaska	Economic Value by Ecosystem Service (milions of 1998$ per Year)												
		Gas regulation	Climate regulation	Disturbance regulation	Water regulation	Water supply	Erosion control and sediment retention	Soil formation	Nutrient cycling	Waste treatment	Polination	Biological control	Habitat/ Refugia	Total
Marine														
Open Ocean	128.0	21.4	-	-	-	-	-	-	66.5	-	-	2.8	-	**90.7**
Coastal	19.2	-	-	7.4	-	-	-	-	310.9	-	-	3.2	0.7	**322.2**
Terrestrial														
Temperate / Boreal Forest	140.2	-	54.3	1.2	-	-	-	6.2	-	53.7	-	2.5	-	**117.9**
Grass and rangeland	17.6	0.5	-	-	0.2	-	2.2	0.1	-	6.7	1.9	1.8	-	**13.6**
Wetlands	10.4	6.1	-	207.9	0.7	174.0	-	-	-	191.3	-	-	13.9	**593.9**
Lakes & Rivers	13.5	-	-	-	323.7	125.9	-	-	-	39.5	-	-	-	**489.1**
Tundra	98.1	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Ice/rock	84.9	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Cropland	1.0	-	-	-	-	-	-	-	-	-	0.1	0.1	-	**0.2**
Total	**512.8**	**28.1**	**54.3**	**216.5**	**324.6**	**299.9**	**2.2**	**6.3**	**377.4**	**291.3**	**2.0**	**10.4**	**14.6**	**1,627.6**
Marine	147.2	21.4	0.0	7.4	0.0	0.0	0.0	0.0	377.4	0.0	0.0	6.0	0.7	413.0
Terrestrial	365.7	6.6	54.3	209.1	324.6	299.9	2.2	6.3	0.0	291.3	2.0	4.4	13.9	1,214.6

4. The Future

4.1. The Emerging Importance of Quality of Life

A relatively new school of economic thought holds that rural economies within advanced industrial societies grow when people move to communities where they want to live, rather than simply going to places where jobs are available. Simply put, this view holds that jobs follow people rather than people following jobs. Perhaps the best-known proponent of this school is Thomas Power (1996), who holds that the traditional view of the rural western U.S. as dependent on natural resource extraction and processing is dangerously obsolete.

While Power and his disciples have presented some convincing evidence to support their claims, one must be cautious in applying the conclusions to Alaska. There are two main reasons for this caution. First, about one third of all jobs in Alaska currently depend on the extraction and sale of crude oil. Most of this dependence stems from our reliance on oil revenues to fund government rather than a direct connection with the oil production industry. Goldsmith (1997) estimates that petroleum production accounts for only 10% of total Alaska jobs, while state spending of royalties and severance taxes accounts for 26% of these jobs. Thus, while Alaska's timber and mining industries play minor roles in the Alaska economy consistent with Power's view of the "new" American West, the petroleum industry remains a major force in Alaska.

The second reason we must be cautious in applying evidence from the American West to Alaska is that, to a great extent, the lower 48 states are now highly integrated into a more or less single set of economic markets. This recent integration, due in part to the rise of telecommunications and knowledge-intensive jobs, is a critical part of the reason why people are moving in large numbers into rural western communities with good quality of life.

Alaska is currently going through a broadly similar process of integration into the national and world economy. Our wages, incomes, and cost of doing business are no longer twice as high as those of other states. The trade and service sectors of Alaska's urban centers are just as diversified as those of major metropolitan areas in the lower 48 western states. However, we still face significant economic and social barriers due to our distance from the rest of the United States market. And Alaska is still "cold and dark" in the winter. Therefore, it remains to be seen whether quality of life will be as important to future Alaska economic growth as it arguably was for the American West during the past decade.

Empirical Evidence on Quality of Life from Alaska Studies

Erickson (1999) provides evidence from Sitka that the traditional "economic base model" of the Alaska economy may be increasingly irrelevant in the future, consistent with Power's views. When the closure of the Sitka pulp mill was imminent, several economists predicted losses to Sitka of about 900 jobs and 1,900 people. In fact, the community lost only about 231 jobs and about 450 people between the 1993 closure and 1996. Average annual employment actually increased from 1997 to 1998. Meanwhile, the Sitka real estate market was described as undergoing "wild increases"[28] during the early 1990s just before and during the pulp mill closure. Ketchikan has suffered similarly mild effects from the closure of its mill.

Berman (1987) has presented solid empirical evidence that property values in the Matanuska-Susitna Borough increase when parcels are closer to surrounding publicly owned open space and farther away from built-up neighboring lots. His data shows that this factor explains a significant percentage of the overall variation in Mat-Su property values.

While all of this evidence is consistent with an increasing importance of quality of life in determining place of residence and economic growth, it is too early to tell whether this factor will prove to be decisive in launching a new "lifestyle industry" in Alaska. It is also possible that Southeast Alaska will surge on the strength of its milder weather and proximity to the rest of the U.S. economy, while the rest of the state does not. Further discussion of the role of quality of life in economic growth is presented in Appendix A.

4.2. The Short Run

Over the next ten to twenty years, commercial fishing will continue at its present rate, but the industry will likely generate less total market value as fish farming drives prices down. Only the most efficient fishers will remain competitive, and consolidation of the fleet is likely with some loss of employment. Jobs and income may fall slightly due to these pressures. They could fall substantially if federal regulators determine that the Bering Sea is being severely overfished.

Tourism and recreation will continue to grow, with sport fishing growth determined to a great extent by allocation decisions. International Visitors will make up a nontrivial and increasing fraction of total Visitors. The fastest growing arrival mode in 1999 was international charters (Mc Dowell 2000). Because per capita incomes will also continue to increase, more and

[28] Charles Horan, real estate appraiser, quoted in Erickson 1999 p. 12.

more Visitors will be willing to pay for direct access to "soft adventure" experiences (Colt, et al. forthcoming). Increasing conflicts over access to public lands are likely. Alaskans will need to think through and discuss what forms of tourism access are most compatible with resource protection, a healthy economy, and their own quality of life. Tourism growth will likely be constrained in some areas and for some activities by natural and social carrying capacities rather than by the level of demand.

The level of sport hunting will probably remain flat, due to a combination of declining resident demand and continuing modest increases in nonresident demand. Nonconsumptive wildlife viewing should continue to increase, as Americans grow older and richer. According to a recent national marketing study, bird watching is far and away the fastest growing form of outdoor recreation in America today (New Strategist Publications 1997).

Quality of life could contribute to significant short run economic growth in parts of Alaska. In particular, the ability of our state to attract or retain retiring baby boomers will play a key role in short run future growth. Retired persons bring their income and purchasing power with them without displacing other basic sector workers. They are economically equivalent to permanent tourists. The average tourist stays in Alaska about six days and spends about $700. The average retiree probably stays in Alaska between 200 and 300 days per year and probably spends between $30,000 and $60,000 per year. Every new or retained retiree has about 30 to 50 times the annual economic impact of a new tourist. Thus one immediate challenge for those who support growth led by a high quality of life is to demonstrate or apply the link between quality of life and more retirees.

4.3. The Long Run

During the next century, Alaska's economy is unlikely to benefit from petroleum and natural gas extraction to the extent it did during the past half century. The direct extraction of other natural resources is also constrained by physical and economic limits. Tourism is the only basic Alaska industry that has grown continuously since statehood, but even tourism is likely to be limited by capacity constraints after a further doubling in size during the next twenty or thirty years.

Looking ahead between 50 and 100 years, it is clear that Alaska's functioning, protected ecosystems will become increasingly valuable global assets in a crowded industrialized world. Direct use values are likely to decline in relative importance while existence values are likely to

increase significantly. It is likely that world population, average per capita income, and average education levels will all double within the next 25 to 50 years, leading to an eight-fold increase in the key factors that drive up existence value. In addition, the continuing degradation of other ecosystems in other places will further increase the relative scarcity and hence the value of Alaska's ecosystems. And the increasing pressure to manage global environmental change will put an increasing premium on scientific knowledge gained from large-scale ecosystems that are not human-dominated. Alaska is one of the few places likely to retain such large areas of undisturbed lands and waters.

The great challenge for those who value both a healthy Alaska economy and the long-run preservation of healthy Alaska ecosystems is to figure out new ways to capture even a small fraction of the existence values that people throughout the world already perceive. Strategic investments in quality of life improvements may provide one lever for attracting more retirees and new-economy small businesses to the state. Other, more mundane steps toward economic and social integration could also prove important. Increasing telecommunications bandwidth may be more economically valuable than building new physical transportation links. Even simple actions such as specifically marketing Alaska as a retirement destination could have significant effects over the long run.

With proper management and continued protection, Alaska's healthy ecosystems can continue indefinitely to support the healthy fishing, tourism, recreation, and subsistence activities that currently support more than 84,000 Alaska jobs. Innovative strategies that tap into the billions of dollars of existence value already expressed by people around the globe could strengthen these links between healthy Alaska ecosystems and a healthy Alaska economy.

References

Alaska Commercial Fisheries Entry Commission, 2000. *Basic Information Table S 03T* for Bristol Bay Salmon Drift Gillnet. http://www.cfec.state.ak.us/bit/X_S03T.htm

Alaska Department of Fish and Game, 1998a. *Harvest, Catch, and Participation in Alaska Sport Fisheries During 1997*. Fishery Data Series No. 98-25. Prepared by Allen Howe, et al. Anchorage: the division, 333 Raspberry Rd., 99518.

Alaska Department of Fish and Game, 1998b. *Subsistence in Alaska: 1998 Update.* Available at http://www.state.ak.us/local/akpages/FISH.GAME/subsist/download/subupd98.pdf

Alaska Department of Fish and Game, 2000. *Licenses Sold 10 Year Recap.* http://www.state.ak.us/adfg/admin/license/general/10yrsold.htm

Berman, Matthew, 1987. *Private Values and Public Lands* Presented to 1987 Western Regional Science Association Annual Meetings. On file at ISER.

Brown, Greg. 1999. *Alaska Community Quality of Life Study.* Anchorage: Alaska Pacific University. Available at: http://polar.alaskapacific.edu/gregb/

Environment Canada, et al. 1998. Environmental Valuation Reference Inventory. http://www.evri.ec.gc.ca/evri/

Carson, Richard, R.C. Mitchell, W.M. Hanemann, R.J. Kopp, S. Presser, and P. Ruud, 1992. A Contingent Valuation Study of Lost Passive Use Values Resulting from the Exxon Valdez Oil Spill. Prepared for the Attorney General of the State of Alaska. On file at ISER.

Colt, Steve. 1995. The Eco-nomic Impacts of Eco-tourism: Some Preliminary Thoughts.

Colt, Steve, Stephanie Martin, Martha Tomeo, and Jenna Mieren, forthcoming. *Recreation and Tourism in Southcentral Alaska: Patterns and Prospects.* ISER, under review by USDA Forest Service, Pacific Northwest Labs.

Costanza, R. et al. 1997. *The Value of the World's Ecosystem Services and Natural Capital, Nature* 387(15) (May 1997): p. 254.

Dixon, J.A. and P.B. Sherman, 1991. "Economics of Protected Areas," *Ambio*, 20(2) pp. 68-74

Duffield, J., 1997. "Nonmarket Valuation and the Courts: the Case of the Exxon Valdez," *Contemporary Economic Policy* 15 (October), pp. 98-110.

Erickson & Associates, 1999. *Beyond Tongass Timber: The Changing Role of the Tongass Timber Industry in the Economics of Southeast Alaska: A Local Perspective.* Prepared for Southeast Alaska Conservation Council. Juneau: Erickson & Associates.

Freeman, Myrick, 1993. *The Measurement of Environmental and Resource Values: Theory and Methods.* Washington D.C.: Resources for the Future.

Goldsmith, Scott, et al. 2000a. *The Alaska Economic Database: Charting Four Decades of Change.* ISER Working Paper 00.1, February.

Goldsmith, Scott, et. al. 2000b. *The Kenai National Wildlife Refuge: Economic Importance.* ISER, May.

Goldsmith, Scott, et al. 1998. *Economic Assessment of Bristol Bay Area National Wildlife Refuges: Alaska Peninsula/Becharof, Izembek, Togiak*. ISER, December.

Goldsmith, Scott, 1997. *Structural Analysis of the Alaska Economy.* Prepared for Alaska Science and Technology Foundation. ISER: August.

Haley, Sharman, Matthew Berman, Scott Goldsmith, Alexandra Hill, and Hongjin Kim, 1999. *Economics of Sport Fishing in Alaska.* ISER, December.

Industrial Economics, 1995. *A Manual for Conducting Natural Resource Damage Assessment: The Role of Economics.* Prepared for U.S. Fish and Wildlife Service.

Krutilla, J., 1967. "Conservation Reconsidered," *American Economic Review* 57: 777-786.

Larson, Eric. 1999. An Overview of Alaska's Natural Assets. ISER. http://www.iser.uaa.alaska.edu/projects/sustainabledevelopment/index.htm

Lesser, Jonathan, Daniel Dodds, and Richard Zerbe, 1997. *Environmental Economics and Policy*. Addison-Wesley.

McCollum, D.W. and SuzAnne Miller. 1994a *Alaska Hunters: Their Hunting Trip Characteristics and Economics.* Alaska Department of Fish and Game, Anchorage, August.

McCollum, D.W. and SuzAnne Miller, 1994b. *Alaska Voters: Their Wildlife Related Trip Characteristics and Economics.* Alaska Department of Fish and Game, Anchorage, August.

McCollum, D.W. and S.M. Miller, 1994c. *Nonresident Hunters: Their Hunting Trip Characteristics and Economics*. Alaska Department of Fish and Game, Anchorage, August.

McDowell Group, 2000. *Alaska Visitor Arrivals Summer 1999.* Prepared under Alaska Visitor Statistics Program for State of Alaska Division of Tourism. Available at http://www.dced.state.ak.us/tourism/summer99.pdf

McDowell Group, 1999. *Alaska Visitor Industry Economic Impact Study 1999 Update.* Prepared under Alaska Visitor Statistics Program for State of Alaska Division of Tourism. Available at http://www.dced.state.ak.us/tourism/impact99.pdf

Miller, Suzanne, and Daniel McCollum, 1999. "Less May Mean More: Maximizing the Economic, Environmental, and Social Benefits from Alaska's Visitors Industry." Available at http://www.dced.state.ak.us/tourism/lessmay.htm

National Research Council, 1996. *Upstream: Salmon and Society in the Pacific Northwest*. Washington D.C.: National Academy Press.

New Strategist Publications, 1997. *Americans at Play: Demographics of Outdoor Recreation and Travel.* Ithaca NY: New Strategist Publications.

Pierce, Brad, 1993. "Commercial Fishing Revenues and Expenditures from Carlson v. State." Memorandum to OMB Director Shelby Stasny. On file at ISER.

Power, Thomas, 1996. Lost Landscapes and Failed Economies: The Search for a Value of Place. Island Press.

Reid, R., M. Stone and T. Whiteley, 1995 "Economic Value of Wilderness Protection and Recreation in British Columbia" British Columbia Ministries of Forests, and Environment, Land and Parks, WP-6-012.1995, December

Sagoff, Mark, 1988. *The Economy of the Earth: Philosophy, Law and the Environment* (Cambridge Studies in Philosophy and Public Policy). Cambridge University Press.

Tietenberg, Tom, 2000. *Environmental and Natural Resource Economics* (5th ed.) Addison-Wesley.

Twardock, Paul, and Chris Monz, 2000. "Recreational Kayak Visitor Use, Distribution, and Financial Value of Beaches in Western Prince William Sound, Alaska between 1987 and 1998." Forthcoming in Cole, David N.; McCool, Stephen F. 2000. *Proceedings: Wilderness Science in a Time of Change*. Proc. RMRS-P-000. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Weisbrod, B., 1964. "Collective-Consumption Services of Individual-Consumption Goods," *Quarterly Journal of Economics* 78(1): 471-477.

World Resources Institute, 2000. *World Resources 2000-2001: People and Ecosystems: The Fraying Web of Life*. Washington DC: United Nations Development Programme, United Nations Environment Programme, World Bank, and World Resources Institute.

Appendix A

Literature Review on the Economic Importance of Quality of Life

This Appendix was prepared by Kirsten Shelton, a graduate student in natural resource economics and policy at Duke University. It is organized around the discussion of several themes.

A.1. Theme 1: Jobs/Growth Follow High Quality of Life and Natural Amenities

Miller, J, "Values, Theory, Observation and Faith in Environmental Economics: An Examination of the Growth Follows Amenities Doctrine." *Electronic Green Journal,* Special Issue 9, December 1998.

Abstract: "GrowthFAD," the Growth Follows Amenities Doctrine, links regional economic prosperity with a pristine natural environment. According to GrowthFAD advocates, natural amenities provide "non-wage benefits" and by doing so attract a labor supply as well as non-labor income. Also, because extractive activities can degrade natural amenities and curtail the benefits that flow from them, such activities are discouraged, at least at traditional levels. Miller considers a model that maximizes well-being with respect to resource extraction. One result of the modeling shows environmental degradation as a form of regional population control. Miller provides a comparison of GrowthFAD, whose proponents view extractive industry decline as the engine of regional growth in the West, to the more traditional model of extractive industry as the "engine of regional economic growth" (people follow jobs). A table at the end of his article provides a visual representation of the competing doctrines of regional economic growth in the West.

Rudzitis, G, "Amenities Increasingly Draw People to the Rural West," *Rural Development Perspectives*, vol. 14, no.2 (9-13).

Abstract: Recent migrants to the rural West increasingly cite both physical and social environmental amenities as reasons why they moved. Job-related reasons are cited by only about 30 percent of the respondents in two surveys. People want to see greater environmental stewardship of the federal lands surrounding their communities, and these sentiments do not vary greatly by rural/urban location, length of residency, occupation, or other demographic characteristics. The survey results suggest a need to incorporate noneconomic factors more directly into regional development theories and their applications.

Discussion: Traditional migration theory states simply that people move to maximize their incomes. Rudzitis et al conducted two surveys to test this theory and reveal why people move to rural western areas rich in physical amenities or near protected federal lands. In the survey, Rudzitis et al asked what induced respondents to move to more rural western counties, primarily from urban locations. The results show the most important factors are overwhelmingly natural

amenity characteristics like environmental quality, scenery and outdoor recreation opportunities, not employment opportunities, less crime or other attractions traditional theory would suppose. Overall, social and physical amenity characteristics account for 77 percent of the reasons people moved. Some criteria used to judge differences in perceived quality of life were whether life in the new location was "less stressful, more enjoyable, happier, and healthier." The article concludes there is a correlation between environmental protection and a growing, stable economy and, thus, "maintaining a high-quality environment can become a development strategy."

Vias, A, "Jobs Follow People in the Rural Rocky Mountain West," *Rural Development Perspectives*, vol. 14, no.2 (14-23).

Abstract: Over the past 25 years, employment growth has followed population growth in the Rocky Mountain West. The allure of amenities to potential migrants and employers, especially for counties rich in pristine natural landscapes, has increased over time. As with other U.S. nonmetro counties, the service and trade sectors now dominate employment in the Rocky Mountains.

Discussion: Vias cites population and employment growth in the Rocky Mountain West from 1970-95 that outpaces most of the rest of the United States, with a simultaneous shift in type of employment from an extractive industry base towards the service and trade industries. Growth has occurred in this area despite lower wages and higher rents. Advancements in transportation and communications have lifted past constraints on industry location. Along with this change, residential preferences for environmental amenities and rising nonemployment income have increased in importance. Vias outlines two competing theories on the population and employment move from urban to nonmetro areas. The first, which he labels the "regional restructuring perspective," is the traditional people-follow-jobs theory where industries move to nonmetro areas primarily because of "lower input costs" such as labor, land and taxes. The second theory, the "deconcentration perspective," contends that newly footloose industries follow people's desire for high-amenity areas and, thus, jobs follow people. Vias cites recent research that supports the deconcentration perspective and adds the increasing role of retirees and their nonemployment income (through the multiplier effect, non-labor income can support a strong service and trade industry). He labels this theory that economic growth can be tied to high amenity areas the "quality-of-life model." In contrast to Rasker's opinion on trade and service jobs, Vias considers a decline in average wages in that industry as a sign those may not be the best jobs for local populations (see Rasker's articles below). Another interesting fact Vias cites Forest Service, BLM and rugged/scenic terrain lands as being positive predictors of population growth.

Nelson, P, "Quality of Life, Nontraditional Income, and Economic Growth: New Development Opportunities for the Rural West," *Rural Development Perspectives*, vol. 14, no.2 (32-37)

Abstract: Areas with high levels of natural amenities have enjoyed growing populations and income levels in the past decade. Much of this growth has come from the in-migration of people with income from self-employment or investments. These new migrants are usually well educated and often work as executives or professionals or in such industries as finance, insurance, and real estate or business services. Communities may find that policies that enhance

the quality of life (better schools, environmental protection, etc.) can attract more of these people who are in a financial position to act upon their residential preferences. This in turn can stimulate economic development.

Discussion: Growth in investment capital and small business startups is expanding in rural areas as technological innovations continue to improve communication and reduce the locational dependency of businesses. This trend has been largely overlooked in local economic development strategies. Nontraditional income like this is increasingly concentrated in areas with natural amenities, usually coastal and mountainous areas, which give areas with these amenities a competitive advantage for attracting nontraditional sources of income. Nelson advises communities enhance the qualities that attract these income sources,

"Instead of mortgaging a community's future by rolling back taxes and providing cheap land in an attempt to land a single large employer, communities may benefit by focusing on improved quality of life (investment in schools, environmental protection, "greenbelts," parks, and social infrastructure). Thus quality of life offers an alternative to traditional "smokestack chasing," and by pursuing such a development strategy, communities may be able to build a more solid foundation for years of growth and development." (pg. 37)

Salant, P, Dillman, D & Carley, L, *Who's Moving To Nonmetropolitan Counties? Evidence from Washington State*, February, 1997. Technical Report #97-07 of the Social & Economic Sciences Research Center.

Summary: The authors write that all of Washington State's nonmetropolitan counties gained population from 1990-1995 (80% of the growth from net in-migration). This report describes a mail survey done to analyze the social and economic characteristics of recent migrants from other states, where they came from and what motivated them to move. Seventy-two percent of respondents listed the quality of the natural environment as a major pull factor for moving to Washington State (both nonmetro and metro areas). Sixty-five cited outdoor recreational opportunities. The study did not find remarkable differences between nonmetro and metro areas.

A.2. Theme 2: Jobs vs. Environment a Myth; Environmental Amenities Good for Business.

Lorah, P, *Population Growth, Economic Security, and Cultural Change in Wilderness Counties*, Dept. of Geography University of St. Thomas.

Abstract: A familiar version of the "jobs versus the environment" argument asserts that wilderness areas limit economic growth by locking up potentially productive natural resources. Analysis of the development paths of rural Western counties shows that this is unlikely: the presence of Wilderness is correlated with income, employment and population growth. Similarly, Wilderness seems to be a catalyst promoting the transition from stagnating extractive economies to relatively competitive amenity economies. As the relationship between local economies and

the environment shifts from a reliance on extraction to a reliance on amenities, many local communities struggle to deal with the resulting cultural change.

Discussion: Lorah writes of environmental amenities as catalysts in western economic transitions from extractive industry based economies to diversified, service-oriented economies that rely more on tourists, retirees, and small business owners. The newcomers are attracted by "desirable lifestyles" and a "relatively high quality of life." Lorah shows that the presence of wilderness areas is associated with population, income and employment growth, thus dispelling the jobs vs. environment myth. He cites finding ways to deal with environmental consequence and with cultural changes that accompany the new growth as some of the greatest challenges in this transition. Lorah also sees a place for sustainable use of nonrenewable resources.

Quinn & Quinn, "Growth Opportunities from Environmental Improvement," Keynote Address, 1999 Forum on Sustainable Development, Australia.

Summary: Environmental protection is a market not a cost, responding to demand, creating jobs and business and investment opportunities and producing tax revenues and profits. The authors estimate the world market for environmental improvement at $497 billion ($179.3 in the U.S.) and growing. Much of the environmental protection industry value is not revealed in national accounts, including consumptive benefits, health benefits and ecosystem services. Market incentives to induce environmental improvement are crucial. The authors advocate "public markets" and discuss the strengths and weaknesses of both private and public markets, including a discussion of governmental environmental strategies. They cite Australia's competitive advantage in this field, which includes the ability to develop information and technical solutions to environmental problems and export such innovations.

Rasker, R, Alexander, B, *The New Challenge: People, Commerce and the Environment in the Yellowstone to Yukon Region***,** report for The Wilderness Society, October, 1997

Discussion: The authors identify environmental amenities as a significant factor in attracting and retaining businesses and residents in rural areas. An area's environmental amenities contribute to creation of a favorable business climate where economic diversity provides a stable, resilient economy and a high quality of life for community residents. The authors drew three major conclusions from their data about the region:

- Population growth was rapid in the 1990's, especially compared to 1980's
- Non-labor sources accounted for most of the personal income growth
- The service industry has posted the fastest employment and labor earnings growth

Population growth in rural counties of the Yellowstone to Yukon region in the 1990s occurred during a time of decreased locational constraints on business (due to communication and transportation innovations), lower relative real estate prices in the region, increased retirement and other sources of non-labor income, and more tourism and recreation travel to the region. Businesses, particularly in the service industry, and non-labor income sources are attracted to areas with high quality social and environmental amenities. The authors note the stabilizing force of non-labor earnings, which grew steadily every year of the study. This is noteworthy, particularly when compared to extractive industry economies whose earning vary over 35% from one year to another (they cite a figure from **Freudenberg and Gramling (1994)** that resource-

dependent communities are 5 – 10 times more unstable than the nation). Also, the service industry is outpacing traditional extractive industries in employment. The authors note that the definition of services and the benefits they provide to communities must be carefully considered to include, "the products of a research firm, a law office, a scientific and educational institution, a mail-order catalogue store, or advice given by a financial analyst over the phone to an overseas client." They continue, these services "may be difficult to recognize as exports, but they can and do bring outside dollars into the economy, and, therefore are by definition 'basic.'"

Rasker and Alexander cite a study by **Beyers (1995)** that surveyed business owners in rural locations in 44 states. The most frequently cited reasons for locating in a rural setting were "quality of life" and family ties. Less than two percent of respondents answered that traditional economic reasons (like lower taxes) were important considerations. Other surveys cited in this report show newly mobile entrepreneurs consider quality of life factors such as crime rate, quality of schools, friendliness of the community, proximity to recreation and scenery, and access to public lands in their decisions to locate. The authors conclude that environmental quality is an "economic asset and a comparative advantage of the Y2Y region."

Rasker, R. *A New Home on the Range: Economic Realities in the Columbia River Basin,* 1995, report for The Wilderness Society.

Discussion: Much like his other report, this report has a few other interesting considerations: Advantages rural communities can offer businesses: overall lower cost of doing business, including lower wages and sales taxes, lower real estate prices, lower crime rates, less commuting time. **Johnson and Rasker (1993)** found the most important reason for businesses to locate and retain operations in the northern part of the Greater Yellowstone region were: "scenic amenities, the rural character of the town, low crime rates, proximity to wildlife-based recreation, and other social, cultural, and environmental amenities." These factors also play a key role in in-migration to the area generally.

Rubio, S & Goetz, R, "Optimal Growth and Land Preservation," *Resource and Energy Economics* 20 (1998) 345-372.

Abstract: A model of optimal economic growth with a constant population subject to a constraint on the availability of land is presented. It takes account of the dual character of land as a production factor and as consumption good (environmental amenities). An extension of the analysis for the case of a growing population with endogenous growth based on human capital accumulation shows that if the rate of discount is not very low, then there exists a set of balanced growth paths compatible with a constant allocation of land.

Howe, J, McMahon, E, Propst L, 1996. *Balancing Nature and Commerce in Gateway Communities.* Island Press.

Discussion. Chapter 2 in this book, entitled "The Economic Value of Quality of Life" contains an approximate definition of quality of life as a "catchall term used to describe the noneconomic amenities a community has to offer, including clean air and water, safe streets, open space, cultural events, recreational opportunities, uncongested roads, good schools, and scenic views. " The authors point out this definition varies from person to person but that quality of life is a main

consideration in people's decisions on where they want to live and work. Further, the authors cite several studies that have shown environmental protection is good for business and economies in general. They maintain a high quality of life is important in attracting and maintaining businesses in a community. Studies cited include:

1992 MIT study: states with strong environmental policies consistently outperformed those with weak policies

1993 Bank of America study: states with strong environmental policies have enjoyed more economic growth than those with weak ones.

The book cites Sitka, Alaska, as one community in which quality of the environment is becoming a significant factor for a successful, resilient economy. It notes "the closure of the mill may have actually helped Sitka by improving local air and water quality and forcing the community to diversify its economy." (pg. 13)

A.3. Theme 3: Quantification of Quality of Life Benefits

Most of the studies looked at employment, population, income, new job and other statistics to analyze changes in employment over time by sector and to compare income earned in these different sectors. Overall, the trend seems to be from extractive industry sectors to service and trade sectors, along with government. Wages have gone down slightly in many cases in this transition. However, non-labor income has increased.

Data often used:

- Personal income and employment growth generated by natural-resource extraction and other historical industries compared to that generated from services and trade (Rasker)
- Distribution and changes in personal labor income between industries (Rasker)
- Non-labor income
- Population growth by place (several surveys of people and why they chose to move to high amenity areas)

Models:

- Miller, J provides a model for maximizing well-being with respect to resource extraction
- Rubio, S & Goetz, R provide a model of optimal economic growth that accounts for the dual character of land as a production factor and a consumption good
- Chattopadhyay, S applies the nested logit model to value environmental amenities. The model is compared to the two-step hedonic model.