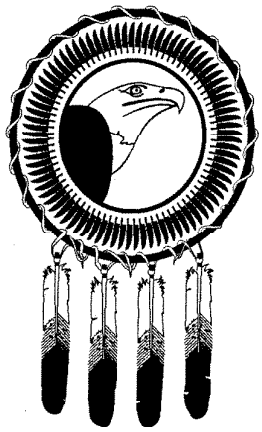
Malcolm Wiener Center for Social Policy

Are Indians Getting a Good Deal?
A Study of Bureau of Indian Affairs Forest Management

by

Gordon S. Smith

PRS89-3



Harvard Project on
American Indian Economic Development

John F. Kennedy School of Government
Harvard University

CONTENTS

EXECUTIVE SUMMARY

ARE INDIANS GETTING A GOOD DEAL?
A STUDY OF BUREAU OF INDIAN AFFAIRS FOREST MANAGEMENT

BY
GORDON SMITH
KENNEDY SCHOOL OF GOVERNMENT
HARVARD UNIVERSITY

April, 1989

Federal law designates the Bureau of Indian Affairs (BIA) as trustee for Indian tribal lands. The BIA's Division of Forestry is charged with managing Indian forest lands to maintain them in a perpetually productive state. Historically, BIA and Congress have interpreted forest management to mean selling and growing timber. This paper shows that Indians receive benefits from their forests which are far greater than timber revenues. Some of these benefits are revenues from products other than timber; most of these benefits accrue directly to Indians (such as firewood cut for personal use). Excluding spiritual, cultural, and esthetic values, benefits Indians received from their forests in 1986 are estimated to have been worth $395 million; timber revenues in 1986 were only $56.6 million.

This paper asserts that the mission of the BIA Division of Forestry should be to maximize the net benefits received by Indians, rather than to maximize the volume of timber cut or the revenues from timber sales. BIA's strong focus on timber cut causes tribes to forgo some non-timber forest benefits, and frequently causes unnecessary damage to remaining benefits. Further, this paper proposes that economic criteria be used to choose forest management actions.

The paper assumes that Indians are best able to ascertain their own preferences. This means that over the long term, Indian control of Indian resources will produce a mix of outputs that serves Indian preferences better than a mix chosen by a non-Indian body. Additionally, responsibility for resources will give Indians strong incentives to improve Indian capacity for managing resources.

It is not possible to get the ruling body of a tribe to agree on a single equation which weights all benefits and costs relating to its forest under all conditions. Instead of trying to develop this type of quantified objective statement, this paper proposes that the most practical means for weighing costs and benefits is a process where tribal members and staff with different interests and expertise contribute to resource management planning. To implement such a balancing process, this paper recommends that each tribe develop reservation resource management plans using a coordinated "interdisciplinary team," or ID team, composed of technical staff representing each branch of tribal and BIA resource administration. An ID team should include staff specializing in management of forests, wildlife, fisheries, range, roads, water, recreation, realty, enterprises, economic development, and cultural resources. Each team would apply the existing policies of its tribe when developing plans for all activities significantly affecting tribal forest lands.

The paper concludes with recommendations for action by the U.S. Congress, the BIA, the Intertribal Timber Council (ITC), and individual tribes. Major recommendations include:

- Congress should redefine the mission of the BIA Division of Forestry to maximize benefits tribes receive from their forests, subject to available funds.

- Congress should appropriate $630,000 per year to fund full-time interdisciplinary team coordinators hired by each tribe having more than 50,000 acres of commercial and noncommercial timberland or having timber sale revenues of more than $1 million per year.

- BIA should incorporate the economic criteria of marginal cost and marginal benefit into forest management plans.

- BIA should allocate funding for forest management by forest acreage or estimated value of benefits, not by volume of timber cut.

- BIA should incorporate locational data and stand diameter class stratification in all forest inventories, either by using the current geographic information system program or some other enhancement of the present inventory system.

- ITC should develop non-timber forest management performance criteria and invite congressional staff to reservations to learn the significance of these criteria.

- ITC should expand 1) informal opportunities for tribes to learn how other tribes are managing their forests and 2) opportunities for Indians seeking formal training in forest management.

- Tribes should expand their control over tribal forests by 1) hiring forest and other natural resource staff, 2) positioning themselves to exercise market power in the sale of their forest products, and 3) as each tribe's governing body considers appropriate, contract with BIA to perform natural resource management and planning.

ARE INDIANS GETTING A GOOD DEAL?
A STUDY OF BUREAU OF INDIAN AFFAIRS FOREST MANAGEMENT

BY
GORDON SMITH
KENNEDY SCHOOL OF GOVERNMENT
HARVARD UNIVERSITY

April, 1989

I. "GOOD" IS WHAT INDIANS PREFER

This paper attempts to answer the question "From the perspective of tribes, is the Bureau of Indian Affairs (BIA) doing a good job of managing tribal forests?" Using the perspective of tribes means good should be measured using the valuations held by tribal members, as expressed by tribal decision-making bodies. In the language of economists, good means maximizing net benefit obtained by tribal members from their forest.

The purpose of the paper is to identify how the BIA is and is not meeting tribal forest needs and to propose actions Congress, the BIA, the Intertribal Timber Council (ITC), and tribes may take to improve unsatisfactory aspects of the forestry program. Evidence shows that the BIA has significantly improved its forestry program in the past dozen years. However, research reveals that BIA forestry still focuses almost exclusively on timber production, while tribes desire and utilize a broad range of forest outputs.

This paper focuses on the relationship between the BIA and tribes because the doctrine of federal trust responsibility requires that the federal government manage tribal lands for the benefit of tribal members. Federal law designates the Bureau of

Indian Affairs as the trustee of Indian tribal lands. Title 25 of the Code of Federal Regulations, Section 163 (25 CFR 163) requires the Bureau to maximize benefits received by members of tribes for whom forests are held in trust.

There are two ways the BIA can do a "good" job of fulfilling its forest trust responsibilities. First, the BIA can focus its energies on doing what each tribe wants done with its forests, rather than doing something the tribe values less than optimally but which may be highly valued by Congress or the BIA itself. Second, whatever the BIA does, doing it well means accomplishing its goals as inexpensively as possible.

Although some analysts conclude that the economic problems of Indians stem from market failures, individuals working with tribal forests report few problems with market failures, other than imperfect information caused by poorly functioning institutional structures. As a result, the main focus of this paper is on how institutions do and do not serve Indian needs. However, as Indian populations and the demand for non-timber forest outputs grow, problems caused by unregulated access will also increase. Tribes also have suffered from timber purchasers controlling enough of the market for a tribe's timber to be able to depress the prices Indians receive. Enhancing the organizational capacity of tribes, and information available to tribal decision-makers, should help them mitigate problems of open access and price manipulation.

II. BIA'S ROLE IN TRIBAL FOREST MANAGEMENT

II.A. BIA's Forestry Program

Established within the War Department in 1824, the BIA was moved to the Department of Interior when that department was created in 1849. A forestry section was created in 1910, for the purpose of preserving growing trees and selling them for timber (Newell, Clow and Ellis, 1986). BIA's Division of Forestry has grown to over 1400 authorized positions in 1987, with 615 full-time permanent employees. Over 200 of these employees are foresters. The forestry program structure parallels that of the

Bureau, with the national chief providing coordination, direction, and oversight of the 11 of the 12 BIA area offices which have forestry programs. The bulk of the BIA's forestry work is carried out by local agency offices. Agency offices develop management plans for individual forests, administer timber sales, and carry out forest management actions on the 115 forested reservations in the United States. The Interagency Fire Center in Boise, ID., directs fire management, in coordination with the BIA Division of Forestry's Branch of Forest Resources Planning (BOFRP) of Portland, OR.

II.B. BIA Forestry's Mission

As recently as late 1986, the BIA unabashedly described its forestry operations, stating: "The primary service provided by the BIA forestry program is the harvest of the full allowable annual cut [AAC] from reservations with commercial forestlands, consistent with tribal objectives" (Sassaman and Miller, 1986).

However, in August 1987 the chief of the BIA, the U.S. Department of Interior's Assistant Secretary for Indian Affairs, issued a memo instructing BIA area directors to adjust their forestry programs to:

> ...insure that all future resource management plans and plan revisions include the addition of woodland management responsibilities to the Forestry Program. Arrangements should be made to provide assistance and oversight on these wooded reservations to meet the needs of the Indian owners (BOFRP, 1988a, pg. APP-39).

Still, this directive did not substantially change BIA forestry. The Bureau is requesting an additional $3.05 million per year to manage woodlands (BOFRP, 1988a); it is not, however, focusing significant resources on non-market and non-timber outputs from timberlands. If a tribe reduces its AAC, the Bureau will reduce forestry staffing proportionally (Miller, 3/30/89).

II.C. BIA Trust Responsibilities

The relationship between tribes and the BIA is further complicated by the ambiguity of the trust relationship and vacillation in federal policy toward Indians.

What trust responsibility entails has never been fully defined. However, courts have defined the trust relationship to extend:

> ...from the protection and enhancement of Indian trust resources and tribal self-government to the provision of economic and social programs necessary to raise the standard of living and social well-being of the Indian people to a level comparable to the non-Indian society (Jozwiak, 1987, p. 474).

Courts hold the United States, as trustee of Indian property, to the standard of a private "prudent manager."

However, federal control of Indian resources is not absolute. The Indian Self-Determination and Education Assistance Act (P.L. 93-638) of 1975 gives tribes leverage in legal disputes with the BIA. Also, regarding fish and game, the courts have ruled that tribal regulations prevail over state regulations (Kalt, 1987). But whether the tribe or BIA prevails in a conflict over Indian forest management seems to be a matter of historical circumstance. Not surprisingly, tribes seem to prevail more frequently when they have staff expertise available and when they are not dependent on BIA actions for short-term operating revenues (Trosper 3/27/89).

Problems stemming from the lack of clarity of Federal trust responsibility are exacerbated by Indians not trusting the federal government. U.S. policy toward Indians has changed in succession from war, to wardship, to allotting land to individuals and selling "surplus" reservation land, to imposing new forms of government, to termination of tribal status, to self-determination. In the 1980's federal attempts to cut the funding and scope of programs serving Indians heightened Indian distrust of Federal intentions. Recognizing the limited resources tribes now command, many Indians fear federal abdication of trust responsibility.

III. IMPORTANCE OF TRIBAL FORESTS

III.A. Timber Benefits

Forests are a major resource for tribes. Timber revenues from stumpage peaked in 1979 at nearly $120 million and have been in the range of $43-67 million per year from 1982-87. Stumpage is the price someone pays a forest owner for the privilege of cutting trees. Stumpage does not include wages or other costs of removing trees, or any value added by manufacturing. On 25 reservations, stumpage provides more than half of all revenues generated by tribal programs (Sassaman and Miller, 1986).

TABLE 1
RESERVATIONS WITH TIMBER REVENUES OVER $1,000,00 IN 1987

Reservation	Forest Area (acres)	Commercial Timber(MMBF)	Harvested Vol(MMBF)	Value ($1000)
Yakima	492,619	5,924	112.8	20,702
Warm Springs	394,576	4,706	107.6	12,177
Colville	701,980	6,000	95.7	11,620
Fort Apache	1,331,169	3,876	87.6	6,262
Hoopa	88,850	2,009	49.3	3,331
Navajo	4,884,201	1,950	30.6	2,101
Menominee	220,050	2,784	49.7	1,769
Quinault	129,221	610	22.5	1,455
Flathead	456,614	2,584	17.1	1,435
Spokane	107,237	435	11.2	1,091

Sources: Branch of Forest Resources Planning, Status of Forest Management Inventories & Planning; Division of Forestry, Forestry Program Funding & Position Analysis.

Tribal forests cover 15 million acres, of which 5.6 million are classified as commercial forest (BOFRP, 1988b) capable of producing merchantable timber. Forests cover more than 25 percent of Indian lands, and constitute two percent of the 740 million acres of forest in the United States. Surveys indicate that Indian lands contain more than 44.7 billion board feet of timber. In 1987, AACs totalled 994 million board feet (DOF, 1988). From 1982 to 1987, cuts have ranged from 646 to 747 million board feet (MMBF) per year (Newell, Clow and Ellis, 1986; BOFRP, 1988b; BIA, 1987).

Tribes and the BIA invest substantial resources in managing forests, mostly through tree planting and thinning, and road construction and maintenance. In 1987 total investments in Indian forests are estimated to have been approximately $95 million. The BIA forestry budget was approximately $33 million, with an additional $15 million for fire protection operations. Forest management deductions from timber sale revenues and other tribal and allottee forestry spending totalled more than $18.5 million (DOF, 1988; Miller, 3/30/89).

III.B. Non-Timber Benefits

No comprehensive tallies exist by which to measure the value of non-timber forest outputs received by tribes. However, estimates indicate that benefits other than timber revenues are very great. The most easily identifiable non-timber benefits are forest products which are sold, including firewood, posts, poles, Christmas trees, berries, nuts, mushrooms, smokewood, ornamental plants, and recreation, hunting and fishing permits. (See Appendix for a partial list of non-timber forest products.)

It is possible to estimate the value of many un-marketed forest products consumed by Indians by estimating the cost of purchasing such a good on the market. For example, house logs can be valued at the price someone would have to pay to purchase equivalent logs. Similarly, wood used for heating can be valued at the price of producing the same amount of heat from the cheapest readily available alternative source of heat, such as heating oil or electricity.

Aesthetic, cultural and spiritual values, on the other hand, are extremely difficult to measure. Research for this paper unearthed no estimates of the value of cultural and spiritual benefits; indeed, most people probably would be offended by an attempt to put a price tag on their culture and religion. Even without counting esthetic, cultural and religious benefits, non-timber forest benefits are substantial.

Woodlands are another source of non-timber benefits. Woodlands are a type of forest defined as areas of which at least 10 percent is covered by trees, but where

those trees are of a species which is not marketable for timber. Timberland, alternatively, is forested with trees of a species for which a market exists for the wood. Timberland is considered commercial if the land is capable of producing at least 20 cubic feet per year of merchantable wood. If the land is covered by a commercial species, but will not produce at least 20 cuft/yr, it is classified as non-commercial timberland.

A recent BIA study of benefits derived from woodlands concluded that Indians realize benefits of $38.8 million per year from tribal woodlands. Though some of these benefits are cash revenues, the bulk of these benefits derive from personal use. The BIA calculated the value of woodland outputs by multiplying the quantities consumed of these outputs by their current market prices. BIA estimated benefits received in 1987 to be worth (in millions): fuelwood, $29.8; posts and poles, $0.8; Pinyon nuts, $3.8; range, $2.5; wildlife, $1.9; and other, $0.2 (values do not sum because of rounding error) (BOFRP, 1988a). These benefits accrue with virtually no BIA management other than fire control.

TABLE 2
UTILIZATION VALUE OF INDIAN WOODLAND OUTPUTS, 1987

Benefit	Market Value
Fuelwood	$29,776,625
Posts & Poles	$813,247
Pinyon Nuts	$3,756,313
Range	$2,454,607
Wildlife	$1,878,102
Other	$185,882
Total	$38,864,415

Source: BOFRP, BIA, Native American Woodland Resources, p. iv.

While it is roughly two thirds of annual timber revenues, the BIA's estimation of woodland benefits includes only a fraction of the non-timber benefits tribes receive from their forests. The study does not count non-timber benefits from timber land.

Also, the study does not count wages tribal members receive for working on timber lands. For example, on the San Carlos Apache reservation, the BIA estimates potential tribal income from stumpage revenue to be $80,000 to $150,000 per year and forest employment to be 28 full-time person years per year, with more than 760 tribal members working in the forest for part of each year. Indian forestry wages are estimated to be $1,750,000 per year, with self-employment earnings of $138,000. The estimated market value of alternative services sufficient to replace personal use values is $350,000 to $660,000 per year. Non-market amenities such as esthetics and cultural values were not priced (Meneeley, 1987).

TABLE 3
SAN CARLOS APACHE RESERVATION ANNUAL FOREST BENETITS

Item	Benefit
Tribal Stumpage Income	$80-150,000
Indian Empolyment	28 person years, full time
	262+ person years, part time
Indian Wages	$1,754,304 (forestry)
	$138,230 (self-employment)
Person Use Values	$353,500-666,000
Nonmarket Amenities	not measurable in dollars

Source: Meneeley, p. IV-11.

Little research has been done on the total value of non-stumpage benefits generated by Indian forests. One economist estimated that total direct and indirect benefits received by Indians and non-Indians from Indian forest lands to be $395 million in 1986. Like other values cited in this paper, this estimate does not include aesthetic, cultural and spiritual values. The estimate does include Indian and non-Indian wages earned by workers producing timber and non-timber products from Indian forests. One can derive an estimate of all wage and non-timber benefits (other than aesthetic and cultural benefits) by subtracting stumpage revenues from the total. By

this method, non-stumpage benefits would be estimated to have been $338 million in 1986.

IV. TRIBES WANT A MIX OF FOREST OUTPUTS

The actions of tribal governments provide an indication that tribes prefer that their forests generate a mix of outputs. Tribes usually seek to maximize some combination of timber revenue, other revenue, employment, personal use values (including aesthetic amenities), and stability of output levels over time.

Tribal preferences for forest outputs are never expressed in the form of a statement weighting each output against all others. Instead, tribal councils express tribal preferences through diverse resolutions and laws relating to forests, appropriations of resource management funds, and approval of formal forest plans. This paper did not include an exhaustive review of actions taken by the councils of forest-owning tribes; instead, tribal preferences were ascertained through interviews of tribal council members and BIA and tribal forest and natural resource staff, as well as through examination of ITC documents, and objective statements in forest management plans.

While timber revenues and employment are very important to tribes, research into tribal preferences revealed a consistent concern for a variety of forest outputs. The ITC articulates widely held tribal views:

> Forest resources are vital to the economic and social welfare of many Indian Nation and Native Alaskan Corporations. The management of these valuable and renewable resources not only provides income and employment opportunities for our people, but also affects our lives in many other ways.
>
> The harmony of man, trees and other vegetation, soil, water and wildlife which collectively comprise the forest community, influence our very emotional and spiritual well being...(ITC Planning Committee, 1989).

Because preferences for the mixture of outputs a tribe may receive from its forest vary from tribe to tribe, evaluation of how well the BIA serves tribal preferences depends on qualitative reports from each reservation. For example, on the Flathead reservation of Montana, a tribal priority for use of the forest is to provide employment for tribal members. BIA forestry staff work closely with the tribe, offering small timber sale contracts which tribal members can log with a minimum of specialized equipment and taking other measures to make it easy for tribal members to work in the forest. Tribal staff report substantial satisfaction with the work of local BIA forestry staff (Trosper, 3/28/89).

In contrast, the White Mountain Apache tribe has sued the BIA for mismanagement of its forest, arguing that the BIA has acted from 1903 or earlier through 1987 to destroy the tribe's forests (White Mountain Apache Tribe, 1985; Hawkins, 1987). Despite professional opinions that the BIA was carrying out accepted silvicultural practices (Dykstra, 1989; Acting Assistant Chief, 6 June 1986), the mix of outputs was not satisfactory to the tribe. The tribe desired a forest with a higher volume of standing timber, and more larger and older trees. In order to maintain timber volume in its forest, the tribe has reduced its AAC by roughly one third, trading timber revenues for cultural, water, tourist and game values.

Revealing yet another set of preferences, Quinault Indians have sued the BIA for failing to obtain fair market value for their timber, failing to adequately reforest, failing to obtain payment for some merchantable timber, and charging Indians too much for administering timber sales (Newell, 1986; McQuillan, 1986). The Quinaults bringing suit against the BIA wanted maximum cash return from their forests. These Indian suits against the BIA demonstrate -- in the Quinault's case -- a preference for timber revenue and -- in the White Mountain case -- a preference for non-timber benefits.

V. EVALUATION OF BIA FOREST MANAGEMENT

Evaluation of whether the BIA is serving tribal preferences is not exact. Tribal satisfaction is the best measure of this goal. Also, timber management can be evaluated to determine how much it minimizes damage to or enhances the production of non-timber benefits.

The BIA's success in maximizing cash returns can be evaluated by comparing BIA performance to that of other forest managers. Because timber is the largest revenue producer in tribal forests and because more data exist on timber than on any other output, the efficiency analysis in this paper focuses on timber. The sections below show that the BIA falls short by both failing to serve tribal preferences and to conduct it work in a cost effective fashion.

V.A. BIA Maximizes Timber Harvest Volume

In contrast to tribal preferences for a variety of outputs, BIA management focuses on maximizing the volume of timber cut. The BIA seems to see maximizing the volume cut as the way to maximize stumpage revenue.

The Bureau's focus on cutting trees follows from the authorizing environment of the Bureau and from its historical development. Accountability measures established by Congress, training of the Bureau's forestry program staff, historical funding levels, types of data gathered, issues addressed in planning documents, and outputs enhanced by management actions all encourage the BIA to maximize timber harvest and staff levels.

Federal law requires that the BIA use sustained yield forest management and review timber sale activities in accordance with the National Environmental Policy Act (NEPA) of 1969 and applicable Council on Environmental Quality regulations (25 CFR 163.4 and 163.27). However, forest management plans show that the Bureau interprets these requirements as placing constraints on specified actions, such as logging near streams, rather than as establishing values to be enhanced forest wide.

BIA Forestry does virtually no management of non-timber forest outputs desired by tribes. It was not until 1987 that the BIA formally acknowledged that it should manage Indian forest lands which are not commercial timber lands (Branch of Forest Resources Planning, 1988a). BIA recognizes the need to manage non-timber resources, evidenced by its statement that it needs an additional staff of 20.8 and $1.3 million to manage cultural resources, and 42 staff and $2.5 million to manage woodlands (Division of Forestry, 1989).

But change is slow to come. The BIA's allocation of natural resource staff still reflects the Bureau's longstanding focus on timber. The Bureau's Budget Justification's, F.Y. 1990 shows the full time equivalent of 575 staff in general natural resources, forestry, water, wildlife and parks. Of these staff, 552 -- or 96 percent -- are in forestry.

It is revealing to contrast BIA staffing allocations with those of tribes. For example, the Colville reservation has more standing commercial timber than any other reservation. Yet of the approximately 59 tribal staff managing different natural resources, only about 25 are forestry employees.

The Bureau's focus on timber production and harvesting is reflected in forest management plans reviewed for this paper. Planning documents of six of the 15 largest timber producing reservations were reviewed (Colville, Flathead, Fort Apache, Makah, Quinault and Yakima; however, plans for Colville, Makah and Quinault are out of date or were never approved by BIA). The plan for the San Carlos Apache tribe was also reviewed, because the tribe has taken a strong role in managing its forest resources. These plans vary in quality from comprehensive and sophisticated to little more than lists of goals. Even among the ten largest timber producing tribes, as of September 30, 1988, three did not have current forest plans (Branch of Forest Resources Planning, 1988b).

While forest plan objectives state that each plan is to maintain the forest in a perpetually productive state and call for protection of non-timber values, most plans give relatively little attention to non-timber resources. For example, the BIA's current Fort Apache Indian Reservation Forest Management Plan is a plan which the BIA considers to be thorough and well documented. However, in the Fort Apache plan BIA staff devoted 172 pages to a discussion of cutting and growing timber before addressing all non-timber resources in a 37 page subsection.

Unlike other plans reviewed for this report, the San Carlos Apache and Flathead Indian Reservation forest management plans integrate timber and non-timber management. Though more than half of the San Carlos plan is devoted to specifications for the cutting and growing of trees, the plan presents options for preserving or enhancing non-timber outputs. Silvacultural prescriptions in the plan explicitly specify treatments to protect or enhance non-timber outputs or present policymakers with a range of options for treatments. Unlike other forest plans this author is aware of, the economic analysis in the San Carlos plan consists of more than just a list of total stumpage revenues for the prior ten years. The economic analysis also includes brief summaries of forestry-related Indian employment and wages, costs of forest management activities, consideration of present and potential markets, and estimates of personal use and non-market values.

The Flathead Reservation forest management plan designates the primary resource value to be enhanced in each part of the forest, and management prescriptions protect or enhance values other than the primary value.

Significantly, both the San Carlos and Flathead plans were developed by coordinated groups drawing on BIA and tribal staff responsible for a wide variety of resource and development specialties. Other plans had little sign of hands-on tribal input in the drafting of the document. The Flathead plan lists 47 people as contributors, including people from the U.S. Forest Service, the University of Montana,

and two BIA area offices. Tribal and BIA agency staff include specialists on wildlife, range, conservation, fire prevention, hydrology, fisheries, and recreation, in addition to foresters and reforestation and timber sales staff. Interestingly, although total listed Bureau staff outnumber tribal staff nearly six to one, in the professions relating to water and wildlife and fisheries, tribal staff outnumber outnumber Bureau staff.

Development of non-timber forest resources is a sign of Indian control of tribal forests. For example, the White Mountain Apache Tribe reduced it timber cut by roughly one third, to stop reducing the volume of timber in tribal forests (Washco, 3/29/89). The Tribe also adjusts silvicultural treatments to benefit its trophy elk herd. Several tribes have created tribal wilderness or primitive areas, including those on the Flathead, Fort Apache and Yakima reservations.

Non-timber development does not necessarily signal hostility between tribal and BIA staff. For example, on the Colville reservation, tribal and BIA staff have developed an interdisciplinary team to manage resources and have taken actions such as altering timber sales so as not to damage tourism (Stires, 3/29/89). Similarly, at the Flathead reservation, tribal and Bureau staff work together collegially and incorporate wildlife, employment, water quality, tourism, aesthetic, and cultural resource considerations into forest management activities.

V.B. Tribal Losses from BIA's Timber Focus

When timber dominates forest management, tribes obtain fewer benefits than they would if forest management staff treated each part of the forest separately and enhanced the most valuable output of each section of the forest. For example, consider the creation of tribal wilderness areas by the tribes on the Flathead, Fort Apache and Yakima reservations. Without attributing a particular cash price to the wilderness benefits they receive, these tribes implicitly value the new wilderness more than foregone stumpage revenues. Similarly, when the White Mountain Apache tribe reduced its AAC from about 97 million board feet (MMBF) per year to about 66 MMBF

per year, the tribe indicated that it values having trees larger than 24 inches in diameter, maintaining the present volume of timber per acre, and limiting water runoff more than it values foregone stumpage revenues. When timber production is the sole management goal, these additional values are lost.

Enhancing non-timber values does not necessarily decrease timber revenues. For example, plans for the recent Three Mile Creek timber sale on the Colville reservation were altered in order to protect big game winter range, minimize the impact on food plants used by tribal members, and avoid cutting in areas where tribal income from recreation would be affected. Adjustments did not decrease the timber cut. Changes did result in a decrease in grazing, but tribal policy makers considered added benefits to far outweigh that loss (Erickson, 1989).

Substantial gains are possible when the most valuable output of each section of forest is enhanced. There are some attempts to price these gains. After extensive study of National Forests, economist Marion Clawson (1976) concluded that assigning a dominant use to each section of forest yields two to four times the benefits that can be obtained when different outputs are uniformly emphasized across the forest.

Using sophisticated modeling techniques to optimize the mix of management treatments applied to a forest should provide a dramatic increase in benefits. When students from the Northern Arizona University School of Forestry applied the Terrestrial Ecosystem Analysis and Modeling System (TEAMS) to approximately four percent of the Navajo tribe's commercial forest, the students developed a management plan predicted to provide a net present value of benefits of $1.9 million greater than the Navajo staff had been able to devise. These extra benefits are in addition to the benefits expected to be derived from the Navajo's multiple resource management plan. Even if sophisticated modeling systems are not applied to all Indian forests, this exercise demonstrates that tremendous gains are possible from coordination managment of timber and non-timber benefits (Covington, 1989).

V.C. BIA Inefficiency

Separate from the issue of whether the BIA is working to provide the mix of outputs tribes prefer is the question of whether the BIA accomplishes it objectives for the lowest possible cost. Several studies document failures of the BIA to effectively and inexpensively carry out its work.

One influential critique of the BIA's resource management is a 1976 evaluation by the Comptroller General of the United States. This report showed failure in basic inventory, planning, reforestation, thinning, timber sale and financial control (U.S. Senate, 1976). The major emphasis of this report was that cutting was substantially less than allowed. While the total Indian AAC was about 1093 MMBF in 1976 (Division of Forestry, 1988), actual contract sales were about 818 MMBF. As a result of this report, Congress appropriated additional funds to BIA forestry, especially for eliminating the 912,00 acre backlog of lands needing reforestation or thinning (17 percent of Indian commercial forest).

In the same year, the American Indian Policy Review Commission reported its findings regarding Bureau forest management (U.S. Congress, 1976). Separate from problems stemming from insufficient tree growth data, the report criticized the BIA for adjusting timber sale prices using log scale measurements, which undercount revenue increases which mills gain when lumber prices rise. The report hypothesized that AACs were too high. It criticized the Bureau for using the Austrian and Hanzlik formulas for calculating allowable annual cuts, because these formulas make no use of economic concepts relating to the value of timber. The report also pointed out that AAC calculations hinge on three professional judgements which can be biased: anticipated growth per acre, optimum timber volume per acre, and whether land is considered commercial.

Bureau inefficiency still exists. Tribal staff on the Yakima reservation report that logging procedures protecting soils and riparian areas are not rigorously enforced and

that plantings in higher elevation reforestation efforts are damaged or killed by winter conditions (Palmer, February 2, 1989). A study comparing BIA operating costs to state and U.S. Forest Service costs in Arizona and New Mexico showed that, on average, Bureau planting costs per acre were 57 percent higher than costs incurred by the Forest Service or states (Wells, 1985). The study attributed the high planting costs to transportation and associated support costs, high wages, and excessively large numbers of trees planted per acre.

Other reports of Bureau ineffectiveness focus on work not being completed, rather than costing too much to complete. In their lawsuit against the BIA, Quinault Indians argue that BIA's failure to manage their lands according to local industry standards has cost Indians an average of more than $800 per acre, as of 1988 (McQuillan, 1988).

TABLE 4
STATUS OF FOREST PLANS OF CLASS I AND II RESERVATION
AS OF SEPTEMBER 30, 1988

Area	#ClassI	Current	%Current	#ClassII	Current	%Current
Aberdeen	-	-	-	5	5	100
Albuquerque	3	3	100	7	0	0
Anadarko	-	-	-	1	0	0
Billings	3	3	100	3	3	100
Eastern	4	3	75	3	1	33
Juneau	-	-	-	21	0	0
Minneapolis	10	3	30	5	3	60
Muskogee	-	-	-	3	0	0
Navajo	1	1	100	-	-	-
Phoenix	4	1	25	-	-	-
Portland	14	9	64	14	4	29
Sacramento	2	1	50	5	0	0
Total	41	24	59	67	16	24

Source: Branch of Forest Resources Planning, Status of Forest Management Inventories and Planning.

Some BIA documents also reveal inability to complete management activities. As of September 30, 1988, of the 108 reservations which local BIA agency offices consider to have major (class I) or moderate (class II) commercial timber value and where forest plans are required, 100 had current field inventories of timber lands, 74 had inventory

analyses, 38 had calculated annual allowable cuts, 40 had current management plans, 32 had required forest histories, and 29 had environmental assessments of the forest (Branch of Forest Resources Planning, 1988b). In timber management, the inventory analysis and forest managment plan are the two most crucial documents, yet only 69 percent had current inventory analyses, and only 37 percent had current management plans. With respect to these two documents, moderately timbered reservations fare worse than major reservations. Eighty percent of major timber reservations have current inventory analyses, while only 61 percent of the moderate reservations have these analyses. Of the major reservations, 59 percent have current forest plans; only 24 percent of the moderate reservations have them.

The single fact which most clearly demonstrates the Bureau's inability to complete forest management activities is the backlog of acres needing reforestation or timber stand improvement. A 1975 General Accounting Office report documented a 912,000 acre backlog of timberland needing management (U.S. Congress, 1976). In response, in 1977 Congress passed P.L. 94-373, appropriating an extra $5.5 million per year, from 1978 through 1987, to eliminate the backlog. Due to increasing costs the appropriation was increased to approximately $8 million per year in the early 1980's. Despite this funding, the annual rate of decrease of the backlog has slowed. As of 1987, 572,000 acres remained in the backlog and an additional 260,000 acres on new backlog had been added since 1977, resulting in a total backlog of 832,000 acres (Division of Forestry, 1988). Appallingly, after ten years and millions of dollars, the BIA appears only to have reduced the total backlog by nine percent.

BIA administrators and Bureau critics sometimes assert that that the BIA is not ineffective, but underfunded. One study compared 1981 BIA forest development expenditures to those of the Bureau of Land Management (BLM), U.S. Forest Service (USFS) and Industrial Forestry Association. The study concluded that, on a per acre

basis, the BLM spent 443 percent, USFS spent 140 percent, and the private association spent 328 percent as much as the BIA (Jozwiak, 1987).

BIA administrators assert that trust responsibility requires the government to devote as many resources to Indian lands as it does to other private lands. However, if the data is disaggregated, BIA may be devoting as many resources to land management as other public bodies. A study of public forests on the Olympic Peninsula of Washington showed the BIA agency office as having 2200 acres per employee, while an adjacent Forest Service unit had 2769 acres per employee and nearby state forest management area had 2724 acres per employee (US Dept. of Interior, 1985a).

However, gross spending is not a sufficient measure of BIA performance. One should examine cost per acre of activity, elimination of backlogs, increases in tribal management skills, completion of IRMPs, and incorporation of non-timber resource data into inventories.

V.D. Improvement in BIA Accomplishments

Despite such management failures, BIA work has improved significantly since 1976. In the last few years the BIA has devoted increased resources to completing and updating forest management documents. New planning documents, such as the draft San Carlos Apache Forest Management Plan and the Yakima reservation Forest Inventory Interim Analysis Summary provide important management information not included in earlier planning documents. As discussed above, the San Carlos plan adjusts silvicultural prescriptions to minimize damage to non-timber benefits. The Yakima inventory analysis documents the distribution of species within each timber type, and catalogs the volume and distribution of different diameter classes within each specie. Forest managers must have this information to develop good silvicultural prescriptions for individual timber sales.

While newer forest plans include maps specifying special treatment areas, more locational data is needed. Several plans distinguish wildlife winter habitat, major

watersheds, alpine areas, as well as visually sensitive and primitive areas. However, timber data is still aggregated within each type of area. Coordinating economic factors, various non-timber products, and timber is difficult. It requires dividing the forest into relatively small plots, identifying the state of each factor or product on each plat, and having some means to sort plots by factors and outputs. Systems for accomplishing this kind of coordination of numerous variables across a land area are called geographic information systems (GIS). The TEAMS system described above incorporates such a system.

The BIA recognizes the need for unaggregated locational data and is starting to apply geographic information technology to tribal forests. The Division of Forestry has designated a GIS coordinator for each area and a national GIS coordinator. The Bureau says it needs an additional 33.2 staff and $1.48 million per year to implement GIS (Division of Forestry, 1989).

Much of this increase in planning sophistication can be attributed to the Branch of Forest Resources and Planning (BOFRP), in Portland, OR. Created in the early 1980's, from the Forestry Field Staff Assistance Office, BOFRP provides centralized expertise and technical support for forest inventory analysis and forest management planning.

Recently, the Bureau has undertaken the first steps in a national effort to incorporate non-timber values into forest management plans, by designating a person in each area office to be responsibile for integrated resource management planning (IRMP). The Bureau also has established guidelines for integrated resource management plans, contained in Section 30 of the Bureau of Indian Affairs Manual, Supplement 10. IRMP coordinators have other responsibilities and do not necessarily have facilitation skills. Thus, they may not be effective at getting areas which are not now working on IRMPs to develop such plans. However, designation if these coordinators is a positive first step toward implementing IRMPs.

VI. SOLUTIONS TO INDIAN FOREST MANAGEMENT PROBLEMS

VI.A. Implement Interdisciplinary Forest Management Planning

This paper has shown that Indians prefer a mix of outputs from their forests and that Indians receive a sub-optimal level of benefits when forest management focuses predominantly on timber production. Further, it is clear that tribal decision-making bodies will not choose a mathematical function which weighs the value of each output against all others. Thus, some alternative means is needed for incorporating non-timber values into management plans. Increasing each BIA forestry expenditure by some percentage will not maximize benefits to tribes. A change in the decision-making process is required.

In lieu of some explicit standard to apply to all forest management judgements, this paper recommends instituting a resource planning process involving management professionals who work with each resource affected by a management decision. When staff responsible for different resources do not communicate, the plans they develop fail to utilize the expertise of staff from areas other than their own. Development of forest management plans should be the responsibility of an official interdisciplinary team (ID team) of staff, not solely the responsibility of staff responsible for growing and cutting timber. These ID teams should be led by tribally selected coordinators, trained by the ITC and ID coordinators from other tribes with successful ID teams, and should not be dependent on the BIA's existing IRMP resources.

For an ID team to operate successfully, several conditions must hold:

Recognition. The ID team must be responsible for developing management plans. ID team membership must be clearly specified. Usually designation of membership and investing of responsibility requires action by the tribal governing body and acceptance by the BIA.

Trust and Respect. Members of the ID team must trust individuals from other specialties and respect the role of other specialties in the planning process. Recognize that trust is built, not mandated.

Coordination. A single person must be responsible for guiding the work of the ID team. This coordinator should have communication, negotiation, and administrative

skills. Because timber now dominates the planning process, the coordinator should not be a forester.

Inclusion of Existing Staff. The ID team should include people from all decision and planning branches involving the forest, including tribal government, physical resource departments, human resources, tribal enterprises, administration and planning.

Flexibility. The process must be flexible. The ID team should not consider all resource plans, but only plans where multiple resources are significantly affected. The ID team should not work as a whole; to work on individual projects, the coordinator should designate task groups of up to six people from affected fields.

Follow Through. The ID team must not end its involvement with the completion of a plan, but must track the implementation of the plan and ensure that the plan is fully carried out.

In addition to maximizing the level of benefits tribes receive from their forest, ID teams help forest managers comply with federal and tribal laws requiring compliance with a wide range of environmental standards.

VI.B. Theory of Optimal Timber Management

In addition to changing the process for devising forest management plans, the BIA should also change its method for calculating allowable annual cuts. Current formulas for making this calculation only incorporate biological growth and volume factors. Formulas should consider economic factors, such as interest rates, and effects on other forest benefits.

Currently, the BIA calculates AACs by assuming that its goal is to cut all trees at the "culmination of mean annual increment" (CMAI). CMAI is the age at which the growth (in volume terms) of a tree (or stand of trees of equal age) is greatest, averaged over the life of the tree (or stand). A forester estimates CMAI, and then inserts that number into a standard formula for calculating an AAC. Other numbers included in AAC formulas include the current volume of wood in the forest, expected future growth, and the length of time allowed for transforming the forest from its current state to a state where no trees are older than the age at which they attain CMAI and that there are roughly equal numbers of trees of different ages.

Cutting trees at CMAI maximizes the benefit obtained from those trees only when some stringent conditions apply:

- o logs cut are the only benefit derived from the forest;
- o there is no time preference for benefits (0% interest rate);
- o there are no costs of harvesting the timber.

When these conditions do not apply, the optimal time to cut is not at CMAI.

If a forest provides benefits other than stumpage revenues, these benefits usually make it worth delaying timber harvest past CMAI. To create a hypothetical example, a stand of trees may protect the spawning beds of a valuable tribal fishery, provide winter cover for the tribe's trophy elk herd, and be the destination for tourists who provide the tribe with more income than provided by that tribe's entire timber industry. In this extreme case, the tribe could gain the most benefits by never cutting the trees.

Alternatively, if a tribe has a positive time preference for receipt of benefits, this preference will push the optimal harvest age to an earlier time. A positive time preference means that for some particular benefit the tribe would rather have it now than later. Interest rates are a monetary expression of time preference.

Further, harvest costs (per board foot of timber harvested) normally decrease as timber stock density increases. Also, small trees tend to produce knotty lumber which sells for low prices. Large, old growth trees produce clear grade lumber, which retails for two to eight times the price of knotty lumber, depending on the species. When these factors apply, the optimum harvest point is after CMAI, because waiting allows the stock density to increase, which reduces per unit harvest costs and increases the amount of high-value timber, thus providing a greater net benefit than would be obtained if trees were cut at CMAI.

In summary, the fact that people prefer benefits now rather than later shifts the optimal harvest to an earlier time than it would otherwise be. Harvest costs shift the

optimal harvest age to a later time than it would otherwise be. Non-timber benefits may shift the optimal harvest time to an earlier or later time, but usually shift the optimal time to later than it would otherwise be.

It would be difficult to calculate CMAI in terms of market value of lumber, rather than volume. Making such a calculation requires a computerized optimization program such as TEAMS. Instead of making such a calculation, timber harvests can be calculated by an ID team. For any particular stand of trees growing on a particular reservation, an ID team can weigh the costs and benefits of accelerating or delaying timber harvest (in terms of the above three considerations). The ID team can then decide whether to accelerate, delay, forgo or modify timber harvest for the entire forest.

VII. RECOMMENDATIONS

Recommendations to Congress, the BIA, the ITC and to tribes propose specific changes to enhance net benefits received by tribes. Each recommendation is directed to the body with the most direct control over the matter affected by the recommendation.

VII.A. Recommendations to Congress

Recommendations to Congress focus on changing policy direction given to the BIA and changing appropriations to reflect the new policy goals:

- o Congress should redefine the mission of the BIA Division of Forestry to maximize net benefits tribes receive from their forests, subject to available funds.
- o Congress should appropriate $630,000 per year to fund full-time interdisciplinary team coordinators hired by each tribe having more than 50,000 acres of commercial and noncommercial timberland or timber sale revenues of more than $1 million per year.
- o Congress should direct appropriate agencies to act agressively to claim and protect Indian water rights, in order to protect Indian forest resources and to allow Indians to use flows originating on reservations for purposes desired by tribes.

VII.B. Recommendations to the BIA

Recommendations to the BIA focus on increasing planning and management to protect and enhance non-timber benefits tribes receive from their forest lands. These recommendations also concentrate on ways the BIA can help tribal organizations increase their capacity to manage tribal resources:

- o BIA should adopt the economic criterion of maximizing net benefits by undertaking management when the marginal benefit resulting from that management is greater than the marginal cost, and should incorporate this economic criterion into forest management plans, including the calculation of allowable annual cuts.

- o BIA should allocate funding for forest management by acreage or estimated value of benefits, not by volume of timber cut.

- o BIA Division of Forestry should recruit and hire individuals with professional skills relating to non-timber forest resources. When specific timber management skills are required, BIA should recruit and hire individuals with training and/or experience with non-timber resource management, in addition to required timber management skills.

- o BIA should increase the number of scholarships it offers to Native Americans who wish to undertake short courses, undergraduate or graduate training pertaining to the management of non-timber and timber forest resources.

- o BIA should support the development of an institute for Native American integrated forest resource management at Northern Arizona University.

- o BAI should move resources to the Branch of Forest Research and Planning, broaden the subject area expertise of BORFP staff, increase staff knowledge of state-of-the-art analytic practices used by other organizations, and increase the capacity for giving technical assistance to agency office and tribal staff.

- o BIA should develop forest inventory and data systems which run on IBM compatible personal computers and assist agency office and tribal staff in using these systems.

VII.C. Recommendations to Forest Managers

Several recommendations apply to the entity performing specific forest planning or management functions. These recommendations should be executed by the organization performing the affected function, whether the organization is the BIA or a tribe:

- o All reservations should develop and maintain current integrated resource management plans.

- o Forest management plans, timber sales, and other actions significantly affecting tribal forests should be developed and carried out by interdisciplinary teams of professionals representing all specialties affected by the particular plan. The

specialties should include wildlife, water, recreation, roads, realty, economics and forestry, where such staff exist.

- o BIA and tribes should cooperate to conduct annual reviews of the organization(s) managing each tribal forest.

- o Forest planning and management staff skills should be developed by using continuing education programs such as "Continuing Education in Forestry, Ecology, and Silvaculture" (CEFES) and "Tri-region Education in Ecology and Silvaculture" (TREES).

- o When calculating AACs, planners should not consider economically inaccessible areas as accessible for harvest, and should incorporate economic criteria into the AAC formula, including estimation of the culmination of mean annual increment of value, not volume.

- o Forest inventories should incorporate locational data and stand species and diameter class stratification, along with data on non-timber resources, in such a fashion that data can be quickly sorted by any variable.

- o Whenever feasible, timber sales should be small enough to be within the capacity of local Indian loggers.

VII.D. Recommendations to Tribes

Recommendations to tribes focus on ways for tribes to develop their capacity to manage tribal forests:

- o Tribes should develop staff expertise in various kinds of natural resource management, including timber management, with a special focus on integrated resource management.

- o Tribes should hire interdisciplinary team coordinators who have management skills and who are not foresters.

- o Tribes should position themselves to exercise market power in the sale of their forest products, by methods which may include developing knowledge of product markets and the needs of customers, establishing mechanisms (such as log yards) which control the flow of products, or by developing tribal enterprises which process tribal forest products.

- o Tribes should ensure that tribal organizational structures protect managers of tribal enterprises from interference in the day-to-day operations of enterprises, while ensuring that the tribal governing body retains authority to set basic policy.

- o Tribes should, as they become confident in their organizational capacity, use their authority under P.L. 93-638 to take over forest management and planning responsibilities.

VII.E. Recommendations to the ITC

Recommendations to the Intertribal Timber Council (ITC) focus on building the Council's capacity to inform and educate tribal forest managers, and to authoritatively communicate tribal interests to other bodies:

- o The ITC should expand its mechanisms of educating tribal forest managers, including use of newsletters, regional meetings, informal meetings requested by a tribe to address a specific need, and the distribution of a list of members who are willing to share their expertise with other members.

- o The ITC should develop forest management performance standards which measure management achievements enhancing net benefits received by tribes and should assist tribes in hosting visits by relevant Congressional staff in which tribes inform those staff about the performance measures and why they are important.

- o If necessary, ITC should seek funding for full time staff to carry out its expanded communication and education activities.

- o The ITC should encourage participants in the Indian forester intern program to attend a school which teaches total resource management, such as Northern Arizona University's School of Forestry.

SELECTED SOURCES

Acting Assistant Chief, 1986a. Division of Forestry, BIA, to Superintendent, Fort Apache Agency, internal memorandum, June 13, 1986.

---, 1986b. Division of Forestry, BIA, to Superintendent, Fort Apache Agency, internal memorandum, June 11, 1986.

---, 1986c. Division of Forestry, BIA, to Superintendent, Fort Apache Agency, internal memorandum, June 6, 1986.

August, Jack Jr., Art Gomez and Elmo Richardson, n.d. From Horseback to Helicopter: A Histroy of Forest Management on the San Carlos Apache Indian Reservation. American Indian Resource Organization, Inc.: no loc.

Bassett, Patricia M. and Daniel D. Oswald, 1983. Timber Resource Statistics for Eastern Washington. USDA Forest Service Resource Bulletin PNW-104: Portland, OR.

Bassett, Patricia M. and Daniel D. Oswald, 1981. Timber Resource Statistics for the Olympic Peninsula, Washington. USDA Forest Service Resource Bulletin PNW-93: Portland, OR.

Bell, Jack H., 1989. "Implementing G.I.S. on the Nex Perce Reservation." Unpublished paper, Nez Perce Tribe Wildlife Program: Lapwai, ID.

Berg, Warren and Scott Meneeley, eds., n.d. San Carlos Apache Indian Reservation Forest Inventory Analysis, 1980-1981, Draft. San Carlos Agency, BIA: San Carlos, AZ.

Beuter, John, 1985. Federal Timber Sales. Congressional Research Service: Washington, DC.

Branch of Forest Resources Planning, 1988a. BIA. Native American Woodland Resources: A National Overview. Division of Forestry, BIA, USDOI: Washington, DC.

---, 1988b. BIA. Status of Forest Management Inventories & Planning for FY 1988. BOFRP, BIA: Portland, OR.

Bureau of Indian Affairs, n.d. Indian Forest Management...1986.... BIA Forestry: Washington, DC.

Bureau of Indian Affairs, n.d. Indian Forest Management 1987. BIA Forestry: Washington, DC.

Clawson, Marion, 1979. The Economics of U.S. Nonindustrial Private Forests. Resources For the Future: Washington, DC.

---, 1977. Man, Land, and the Forest Environment. University of Washington Press: Seattle.

---, 1976. The Economics of National Forest Management. Resources For the Future: Washington, DC.

Clements, Michael and Gary Morishima, Sept. 1, 1987. Testimony of the Intertribal Timber Council Before the Senate Select Committee on Indian Affairs, Nespelem, WA.

Cole, Leslie A., 1985. Forest Resource Planning: State of the States. National Council of State Governments: Lexington, KY.

Covington, W.W., et al., 1988. "Teams: A Decision Support System for Multiresource Management." Journal of Forestry 86(8) (August 1988): 25-33.

Deacon, Robert T., 1985 "The Simple Analytics of Forest Economics." Forestlands. Ed. Robert T. Deacon and Johnson.

Cutsforth, Marshall, Chief Forester, Division of Forestry, BIA, telephone interview by author, 26 January 1989.

Division of Forestry, 1989. BIA. Addendum to the FY 1987 Forestry Program Funding and Position Analysis : Update of the Needs Analysis. Division of Forestry, BIA: Washington, DC.

---, 1988. BIA. Forestry Program Funding and Position Analysis FY 1987. Division of Forestry, BIA: Washington, DC.

Dyksstra, D.P., Professor, School of Forestry, Northern Arizona University, Flagstaff, Az, interview by author, 27 March 1989.

Erickson, Jim, 1989. "Total Resource Management," presentationn at 13th Annual National Indian Timber Symposium, Phoenix, AZ, March 27-30.

---, 1986. "Findings and Recommendations, Forest Management Workshop," in A Decade of Indian Forest Management...10th Annual National Indian Timber Symposium, by Joann Reynolds: Intertribal Timber Council: Warm Springs, OR, 365.

Erickson, Jim and John Rydzik, 1989. "Total Resource Management: Colville Confederated Tribes." Unpublished paper, Colville Tribal Forestry, Nespelem, WA.

Flathead Indian Reservation Forest Management Plan 1982-1992, 1988. Compiled & ed. Arnold J. Browning. BIA Flathead Agency: Pablo, MT.

Gamman, John K., 1987. "Integrating Environmental Values into Development Planning: Lessons from the White Mountain Apache Tribe...." Unpublished paper, Dept. of Urban Studies, Massachusetts Institute of Technology, Draft, May.

Gregory, G. Robinson, 1987. Resource Economics for Foresters. John Wiley: New York.

Hanke, Steve H. and Barney Dowdle, 1987. "Privitizing the Public Domain." Prospects for Privitization. Ed. Steve H. Hanke. Academy of Political Science: New York.

Hawkins, Alvino, 1987. Vice Chairman, White Mountain Apache Tribe, Whiteriver, AZ. Testimony before the Senate Select Committee on Indian Affairs, Sept.1, Nespelem, WA.

Higgs, John M., 1986. "The Opportunities in Coordination Between Tribal Timber Resource Management and Tribal Timber Enterprise Management," in A Decade of Indian Forest Management...10th Annual National Indian Timber Symposium, by Joann Reynolds: Intertribal Timber Council: Warm Springs, OR, 149-165.

Intertribal Timber Council Planning Committee, 1989. Vision 2000: A Strategic Plan for the ITC to Year 2000. Intertribal Timber Council: Warm Springs, OR.

Investments in Forestry: Resources, Land Use, and Public Policy, 1985. Ed. Roger A. Sedjo. Westview Press: Boulder, CO.

Jozwiak, Frank R.,1987. "The Trust Responsibility and the Indian Forest," in Indian Forest Management: It's Not Just Trees: Eleventh Annual National Indian Timber Symposium, May 18-21, 1987, by Joann Reynolds: Intertribal Timber Council, Warm Springs, OR, 469-485.

Kalt, Joseph P., 1987. The Redefinition of Property Rights in American Indian Reservations: A Comparative Analysis of Native American Economic Development. Energy and Environmental Policy Center, John F. Kennedy School of Government, Harvard University: Cambridge, MA.

Lisle, Glen, ed., 1988. Yamima Indian Reservation Forest Management Plan, 1983-1992. Yakima Agency, BIA: Toppenish, WA.

Lloyd, J.D. Jr., 1987. 1976 Washington Timber Harvest. USDA Forest Service Resource Bulletin PNW-81, Portland, OR.

Lyon, L. Jack, et al., 1985. Coordinating Elk and Timber Management: Final Report of the Montana Cooperative Elk-Logging Study, 1970-1985. Montana Dept. of Fish, Wildlife & Parks.

Lyon, Richard E. A. Lyon and Maurice Williams, eds., 1986. Forest Management Plan, Fort Apache Indian Reservation, Whiteriver, Arizona...1981...1990. Fort Apache Agency, BIA: Whiteriver, AZ.

McCarty, Harry J.,1987. "The Indian Forest Data Base (IFDB)" in Indian Forest Management: It's Not Just Trees: Eleventh Annual National Indian Timber Symposium, May 18-21, 1987, by Joann Reynolds: Intertribal Timber Council, Warm Springs, OR, 98-99.

McQuillan, Alan G., 1987. A Report on Timber Regeneration Management by the U.S. Bureau of Indian Affairs on the Quinault Indian Reservation, 1965-1986, plaintiff's exhibit. Quinault Allottees Association.

Meeks, Gordon, 1982. A Legislator's Guide to Forest Resource Management. National Conference of State Legislatures: Denver.

Meneeley, Scott, ed., 1987. San Carlos Indian Reservation Forest Management Plan, 1982-1991, Draft. San Carlos Agency, BIA: San Carlos, AZ.

Miller, Robert W., Assistant Chief, Division of Forestry, BIA, interview by author, 30 March 1989.

Morishima, Gary, 1987. "Review of Findings and Recommendations of the 1977-1986 National Indian Timber Symposiums," in Indian Forest Management: It's Not Just Trees: Eleventh Annual National Indian Timber Symposium, May 18-21, 1987, by Joann Reynolds: Intertribal Timber Council, Warm Springs, OR, 10-28.

Newell, Alan S., Richmond L. Clow and Richard N Ellis, 1986. A Forest In Trust: Three-Quarters of a Centure of Indian Forestry, 1910-1986. Division of Forestry, BIA: Washington, DC.

Oswald, Daniel D., 1986. Analysis of Change in Timber Volume on Non-Federal Timberlands in Washington. USDA Forest Service Resource Bulletin PNW-128: Portland, OR.

Palmer, Carroll, Deputy Director of Department of Natural Resources of Yakima Indian Nation, telephone interview by author, 2 February 1989.

Phillips, Mark, 1987. "Legislative Update," in Indian Forest Management: It's Not Just Trees: Eleventh Annual National Indian Timber Symposium, May 18-21, 1987, by Joann Reynolds, Intertribal Timber Council: Warm Springs, OR, 128-133.

Phillips, Mark, Legislative Liaison for ITC, Edwards & Associates, Washington, DC, interview by author, 3 Feb. 1989.

Quinault Department of Natural Resources, 1980. Quinault Forest Management Plan. Unpublished draft, QDNR: Taholah, WA.

Research in Forest Economics and Forest Policy., 1977. Ed. Marion Clawson. Resources For the Future: Washington, DC.

Sassaman, Robert W. and Robert W. Miller, 1986. "Native American Forestry." Journal of Forestry. 84(10) (October 1986): 26-31.

Stires, James, Forester, Billings Area Office, BIA, interview by author, 30 March 1989.

Stoszek, Karl J., 1987. "Multiple Use Management is Nothing New But Action is Needed," in Indian Forest Management: It's Not Just Trees: Eleventh Annual National Indian Timber Symposium, May 18-21, 1987, by Joann Reynolds: Intertribal Timber Council, Warm Springs, OR, 144-148.

Stroup, Richard L. and John A. Baden, 1983. Natural Resources: Bureaucratic Myths and Environmental Management. Ballinger: Cambridge, MA.

Trosper, Ronald L., 1988a. "Multicriterion Decision-making in a Tribal Context," Draft, Dec. 1, 1987, forthcoming in Policy Studies Journal. (June 1988).

---, 1988b. "Why Forest Inventories are Important for Economic Development." Prepared for Twelfth Annual National Indian Timber Symposium, Fairbanks, AK, June.

Trosper, Ronald L., Tribal Economist, Confederated Salish and Kootenai Tribes, Flathead Indian Reservation, Montana, interviews by author, 27-29 March 1989.

United States, 1989. Budget of the United States Government, F.Y. 1990, Appendix. GPO: Washington, DC.

---, 1988. Title 25, Code of Federal Regulations. GPO: Washington, DC.

---, 1985. Department of Agriculture. Agricultural Statistics 1985. GPO: Washington, DC.

---, 1988a. Department of Agriculture Forest Service. Volume and Value of Sawtimber Stumpage...1987. Washington, DC.

---, 1988b. Department of Agriculture Forest Service. 1987 U.S. Forest Planting Report. Washington, DC.

---, 1984. Department of Agriculture Forest Service, Northern Region. Transaction Evidence Appraisal Process. Forest Service.

---, n.d. Department of Interior. Budget Justifications, F.Y. 1990, Bureau of Indian Affairs. Washington, DC.

---, 1986. Department of Interior. Report of the Taskforce on Indian Economic Development. GPO: Washington, DC, 1986.

---, 1985a. Department of Interior, Office of Inspector General. "Review of Selected Operations at the Olympic Peninsula Agency, Bureau of Indian Affairs." Office of Inspector General, USDI: Washington, DC.

---, 1985b. Department of Interior, Office of Inspector General. Memorandum: re audit reoprt "Forestry Management Program, Bureau of Indian Affairs." Office of Inspector General, USDI: Washington, DC.

United States Congress, 1976. American Indian Policy Review Commission. Report on Reservation and Resource Development and Protection...Final Report.... GPO: Washington, DC.

United States Senate, 1976. Committee on Interior and Insular Affairs. Management of Indian Natural Resources: Report by the Comptroller General of the United States. GPO: Washington, DC.

vanHouten, Rutger, 1987. "Conflicts in Management," in Indian Forest Management: It's Not Just Trees: Eleventh Annual National Indian Timber Symposium, May 18-21, 1987, by Joann Reynolds: Intertribal Timber Council, Warm Springs, OR, 134-143.

Walters, Anthony B., 1989. "Wild Botanical Commercial Commodities of the Pacific Northwest." Paper presented at Intertribal Timber Conference symposium: Phoenix, AZ.

Warren, Debra D., 1987. Production, Prices, Employment, and Trade in Northwest Forest Industries, Fourth Quarter 1986. USDA Forest Service Resource Bulletin PNW-144: Portland, OR.

---, 1986. Production, Prices, Employment, and Trade in Northwest Forest Industries, Fourth Quarter 1985. USDA Forest Service Resource Bulletin PNW-130: Portland, OR.

Wells, Arch H., 1985. "Cost Comparison Analysis for Forest Development Activities." Branch of Forestry, Phoenix Area Office, BIA: Phoenix, AZ.

White Mountain Apache Game & Fish Department, 1989. White Mountain Apache Tribe...1989 Nonmenber Regulations. WMAT: Whiteriver, AZ.

Williams, Gary D. and William A. Babcock, 1983. The Yakima Indian Nation Forest Heritage...(For the 1983-1992 Forest Management Plan). BIA Portland Area Office: Portland, OR.

Yakima Agency, 1988. Division of Forestry, BIA. Yakima Indian Reservation Forest Inventory Interim Analysis Summary...1983-1992. BIA: Toppenish, WA.

APPENDIX
NON-TIMBER FOREST SPECIALTY PRODUCTS

By David Schuman, USDA Forest Service Forest Products Laboratory

Major Categories of Non-timber Forest Products

Animal Bedding
Aromatics
Basketmaking
Berries
Charcoal
Cooking Greens
Cosmetics
Decorative Floral Greenery
Decorative Wood
Herbs & Spices
Honey
Maple Syrup
Medicinal
Mushrooms
Naval Stores
Nuts
Ornamental Plants
Pitchwood or Stumpwood
Recreation
Seeds, Seedlings & Cuttings
Smokewood
Soil Conditioners
Tannin Bark
Wildlife
Wood Products

Wood Products

Firewood
Posts
Poles
Christmas Trees
Shingles
Shakes
Fencing
Hop Poles
Bean Poles
Rustic Furniture
Fishing Poles (willow)
Plug Poles (alder)
Tomato stakes
Walking sticks
Bows (yew)
Slingshot Crotches
Arrows (Port-Orford cedar)
Bow staves (yew)
Almond knockers

Berries

Huckleberry
Blackberry
Oregon Grape
Plum
Blue Elderberry
Chokecherry
Currants
Blackcap
Salmonberry
Thimbleberry
Blueberry
Crabapple
Pawpaw
Raspberry
Serviceberry
Cranberry
Mulberry
Persimmon
Juneberry

Aromatics

Balsam gum & needles
Storax gum from Sweetgum
Birch oil
Pine oil
Hemlock oil
Sassafras oil
Cedar gum
Wintergreen oil
Witch Hazel
Spruce oil
Walnut oil

Nuts

Hazel nuts
Hickory
Walnut
Chestnut
Butternut
Golden Chinquapin
Pinyon Pine
Persimmon
Beechnut
Pecan

Mushrooms

Matsutake
Boletes
Morels
Hedgehog
Armilliria
Puffballs
Lions Mane
Polyporous
Fistulina
Craterellus
Lepista
Lyophyllum
Chantrelles
Oregon white truffle
Shiitake
Russula
Sparassis
Sweet Tooth
Agaricus
Polysilus
Clavaria
Pleurotus
Lepiota
Rowites

Cooking Greens

Nettle shoots
Dandelion shoots & leaves
Oxalis leaves
Salmonberry shoots
Fern shoots
Sheep Sorrel

Medicinal

Foxglove leaves (digitalis)
Quinine conks (Fomes laricis)
False hellibone roots
Wild mint
Black cherry bark
Ginseng root
Goldenseal
Sumac
Spruce gum
Black haw roots
May-apple or mandrake
Snakeroot
Cascara bark (laxative)
Witch Hazel bark & leaves
Bloodroot
Jinson leaves
Dill oil
Scotch broom
Oregon Grape roots
Princess pine
Balsum gum
Birch oil
Cohosh
Jerusalem oak
Sassafras oil & root
Wintergreen oil
Balm of Gilead buds
Boneset
Storax from Sweetgum
Western yew (taxol-cancer)
Wild ginger
Skunkcabbage roots
Calamus root
Lady slipper root
Yellow dock root

Smokewood

Hickory
Mesquite
Cherry
Alder
Apple
Maple
Oak

Soil Conditioners

Sawdust	Chips
Shavings	Bark
Pine straw	Peat
Moss	Leaves

Naval Stores gum or oleoresin

Longleaf pine	Slash pine

Pitchwood or Stumpwood

Longleaf pine	Slash pine
Douglas fir	Ponderosa pine

Decorative Wood - slabs, crossections, crotches, burls, roots & driftwood

Redwood	Oregon Myrtle
Walnut	Manzanita
Red Shank	Diamond Willow
Juniper	Cypress knees
Bigleaf Maple	Madrone

Decorative Greenery - boughs, greens, wreaths & sprays cones - ad infinitum

Sword and long fern	Club and Spanish moss
Wax myrtle	Evergreen huckleberry
Scotch broom	Salal - large, papoose & lemon leaf
Most true firs	Most cedars, esp Port-Orford & Incense
Douglas Fir	Galax
Rhododendren	Oregon Grape
Lucopodium	Silver Tip
Leucothoe	Bittersweet
Blueberry & Rocky Mtn Juniper	Dogwood
Pussey Willow	Mistletoe
Cattails	Magnolia
Gopherwood	Palmetto
Manzanita	Smilax
Princess pine	Teasel
Pachistima	Holly
Sumac	White Birch bark
Yew	Ocotillo stems
Ground pine	Brittlebush
Creosote stems	
Chapparal stems	
Agave stars	

Wildlife

Birdwatching & sightseeing	Photography
Hunting preserves	Fishing
Trapping	Guiding
Boat & dock rental	Blinds
Bait & equipment sale	Habitat improvement
Fish & game processing	Dog training, boarding & leasing
Raising fish & game	

Recreation

Sightseeing
Nature areas & trails
Horse rental
Dude ranches & farms
Cabin sites
Picnic sites
Camps
Target, trap & skeet shooting
Water skiing
Photography
Guiding
Outfitting
Boat & dock rental
Camping sites
Archery
Swimming
Skiing, sledding & tubing