ISSUES OF CONCERN TO THE NATIVE YEW CONSERVATION COUNCIL

PUBLIC INPUT FOR THE ENVIRONMENTAL IMPACT STATEMENT
BEING PREPARED BY THE U.S.D.A. FOREST SERVICE,
BUREAU OF LAND MANAGEMENT, AND FOOD AND DRUG ADMINISTRATION
FOR HARVESTING NATIVE PACIFIC YEW TO PRODUCE TAXOL

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Author :

David Pilz, Head of the committee on public input into the EIS process and board member/NYCC, Owner of Special Trees, P.O. Box 2238, Corvallis, Oregon 973392238. (503) 7587131.

Committee Members/Contributors:

Dr. Stanley Scher, Board member/NYCC, Adjunct Professor with Sonoma State University, 970 Contra Costa Dr., El Cerrito, California 94530. (510) 5263520.

Jerry Rust, Secretary/NYCC, Lane County Commissioner, Public Services Building, 125 E. 8th Avenue, Eugene, Oregon 97401. (503) 6874203.

Richard Fairbanks, Board member/NYCC, Forester, 37290 Wheeler Road, Pleasant Hill, Oregon 97455. (503) 7472336.

Hal Hartzell, Jr., Vice President/NYCC, Author of "The Yew Tree", 62 N. Lawrence, Eugene, Oregon 97401. (503) 4858670.

Shimon Schwarzschild, President/NYCC, Consulting editor and writer, 1721 Berkeley Way #3, Berkeley, California 94703. (510) 8499466.

Please address official agency response to this document to the author.

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I. Introduction

In December of 1991, the USDA Forest Service (USFS), Bureau of Land Management (BLM), and the Food and Drug Administration (FDA) announced plans to develop an Environmental Impact Statement (EIS) for harvesting Pacific yews from federal lands to produce the promising new anticancer drug taxol. In its role as the lead agency, the USFS (Region 6) has distributed a pamphlet soliciting public input for developing the issues and concerns that should be addressed by this EIS.

Substantial harvests of bark from Pacific yews on federal lands of the Pacific Northwest have already been conducted for the last four years. Two years ago a group of interested citizens organized the Native Yew Conservation Council (NYCC) to address numerous concerns about this harvesting. The NYCC has held seven public meetings to date at various locations in Oregon, California, and Washington. In April of 1991, the NYCC incorporated as a nonprofit organization dedicated to the conservation of yew resources, and to the development of renewable and sustainable means of taxol production.

This document is the product of a committee of the board of directors of the NYCC which was convened to submit the concerns of our group to the EIS team for use in developing their alternatives. The members of the NYCC have very diverse interests, and this document cannot purport to represent them all. Every effort was made however, to include all of the items which were brought to the author's attention by the members of the EIS committee.

II. Public Input and the EIS Process

The harvesting of yews to produce taxol is an immense topic. It can not be adequately addressed without a thorough discussion of how the resource will be used after harvest, what taxol production alternatives exist, how these alternatives might be encouraged, and how government agency actions affect these considerations. The decisions reached in this EIS may have far reaching ramifications for yew harvests internationally, as well as the market for developing alternative modes of taxol production.

Most taxol production in the near future may be derived from scarce public resources. Soliciting informed public input for development of this EIS is critically important for making the best possible choices, and the agencies involved should be making extensive efforts to obtain such input.

Other than the original announcement pamphlet, what other efforts are being planned by the EIS team to solicit public comments and review?

What criteria will the EIS team use to rank the importance of various issues and concerns and to decide which ones should be considered in detail. How will these criteria relate to the goal of conserving yew resources? To the goal of producing taxol?

How will the EIS team evaluate the economic, political, or special interests of contributors to this EIS? Will this influence which issues are addressed, how they are addressed, which alternatives are developed, and which alternative is eventually selected?

What is the timetable for developing this EIS, and how does it relate to the time necessary for properly addressing the issues and concerns which are identified?

For what period of time and which activities will this EIS be applicable? When, and under what conditions will further public input and planning be required? Why?

What is the scope of this EIS? Which lands will it affect? Which agencies?
Which forests or districts? Will the decisions be applied uniformly over all these areas? If not, how will they differ?

How and when will this EIS be incorporated into existing federal agency plans, guidelines, and directives? Who will be the responsible officials for overseeing its implementation and monitoring compliance?

III. The Role of Pacific Yew in Forest Ecosystems

Only in the last several decades has the complexity and importance of native forest ecosystems become appreciated. The genetic diversity and interrelatedness of these naturally coevolved communities are being recognized as essential elements for maintaining the longterm productivity and health of our managed forests. What remains undiscovered far exceeds what is known, therefore it is essential that fully functional native ecosystems are preserved to insure the true sustainability of our public forest resources. The role of Pacific yew in both native and managed forests is a very recent topic of interest, since these trees were formerly considered an unimportant nuisance species by industrial foresters. Even so, enough is now known to indicate that yews play an important ecological role in the forest.

III. A. Native Ecosystems

Only by understanding the Pacific yew's natural distribution, its means of reproduction, its relationship to its native environment, and its evolutionary history, can wise and effective choices be made about its utilization and conservation.

III. A. 1. Native Range of Pacific Yew

Taxus brevifolia ranges from California to Alaska and, in places, inland as far as Idaho. This large range includes a great many habitats, plant associations, and climates. Genetically, the species may have uniquely adapted populations or races. In spite of the broad range of Pacific yew, populations and individual yews are often widely scattered, or located in specific microhabitats (e.g. riparian zones). To properly manage Pacific yew, the factors influencing this distribution need to be understood.

What is the most accurate range map available for the Pacific yew?

How does this range overlap the federal lands affected by this EIS?

How do yew population densities vary throughout this range?

Which climatic, physiographic, elevational, or vegetational factors determine the natural distribution of yews and their population densities? Which random or catastrophic events?

Within its range, which forest types, forest ages, plant associations, or successional stages are most likely to contain yew populations? What proportion of these habitats have been altered or lost due to commercial timber harvests?

What differences in response to harvesting activities might exist within the range of Pacific yew, especially at the limits of its distribution?

What constitutes appropriate portions of the range for units of conservation or preservation? For which values or adaptions?

What effect will yew harvest have on the distribution of native Pacific yews across plant habitat types, life zones, and geographical regions?

III. A. 2. Natural Reproduction

What are all the means by which yew regenerates naturally? How common is each? Under which conditions?

What combination of environmental and ecosystem conditions over time are necessary for successful sexual and asexual reproduction?

What is the relative frequency and importance of sexual versus asexual reproduction under natural conditions? In different environments?

What environmental conditions increase the likelihood of reproduction through clonal mechanisms such as layering or sprouting?

Why are yew seedlings abundant in a few areas, but almost totally absent under most conditions?

What role do birds and small mammals play in sexual reproduction by eating the berries (arils) and seeds? Do their digestive enzymes improve seed germination? Do they distribute the seed through defecation? Through gathering and stockpiling for winter months? How far?

Given that most yews are prolific and regular seed producers, why are seedlings so scarce?

Were yews more prolific seed producers before habitat fragmentation by commercial forestry practices, and if so, what implications does that have for future reproduction of yews?

Will further reduction of yew populations in managed stands reduce pollen availability in remaining natural stands, and thereby reduce natural reproductive success?

Since yew is a dioecious species, what male/female ratios are optimum for reproduction? How does spacing affect gene flow and sexual reproductive success?

Are any monitoring activities planned to track changes in natural reproduction?

What effect will yew harvests have on ability of native yews to reproduce in a manner which preserves genetic diversity, population distributions and ecosystem functions?

What is the effect of proceeding with the harvest of yew in old growth sites when knowledge of how to regenerate yew in managed forests is sparse?

III. A. 3. Wildlife

The yew is a premiere wildlife tree. The foliage, berry, bark, and structure of the yew tree are used extensively by a variety of birds and animals. Birds such as the sapsucker and pileated woodpecker use the yew as a source of berry, sap, and insects. Raptors, such as the spotted owl use the structure of the yew as a medium or lowlevel roost within the forest canopy. Birds and rodents collect the seeds. Deer, elk, and moose browse the yew heavily, especially in winter. Bear and cougar utilize tough yew boles to sharpen their claws.

Unlike most other subcanopy trees, the yew is not soft and weepy. Rather, its limbs are rigid and horizontal, providing excellent roosting sites in owl habitat and, unlike cedar or hemlock, will hold a large bird. This is especially important in riparian zones in the southern range of the yew where they provide a low canopy perch for spotted owls to escape lethal summertime temperatures while avoiding predators on the ground. In areas such as the Klamath, the yew is the favorite roosting spot because it grows in cooler riparian sites. In addition, it is likely that the yew also provides shade and insects for fish in the streams and rivers.

There seems to be several important aspects to yew as winter browse. The food is available and is high in nutrition, especially nitrogen, but it may also play a role in reducing parasites in the intestines of browsing animals (See section III. A. 5.).

III. A. 3. a. Spotted Owl

What is the effect of removing the yew tree from the perch, food, roost and nesting habitat of the spotted owl and other birds?

Will harvest of yews diminish the ability of Spotted Owls to use preferred oldgrowth forest habitat?

Will the harvest of yews affect critical or secondary habitat for the Spotted Owl as defined in the Thomas Report, and in the EIS being developed by the Forest Service for Management of the Spotted Owl?

Will harvest of yews diminish the ability of the Spotted Owl to use commercial forest lands for some of its habitat requirements?

III. A. 3. b. Other Birds and Small Mammals

Which other birds and animals interact with yews and how?

Are any of these other wildlife species threatened or endangered, or likely to become so?

How would yew harvests affect populations of sapsuckers or pileated woodpeckers which are known to feed on the bark or insects therein?

How would harvest of mature trees affect populations of birds and small mammals which feed on yew berries, and how would any such effect alter future yew reproduction?

More generally, what effect will yew harvest have on other wildlife which uses the yew, and if they are diminished by harvest removal, what effect will that have on future yew populations?

III. A. 3. c. Browsing Animals

What is the effect of yew harvest on the thermal cover for big game animals?

What is the effect of yew harvest on forage supplies, quality, and availability throughout the year for big game animals?

If forage supplies are enhanced under any scenario, does this enhancement come at a cost to other wildlife species? If so, what relative priorities will these wildlife values be given, and why?

III. A. 4. Ecosystem Functions

Does the harvest of yew remove stands from classification as "Significant Old Growth" as defined by Pacific Northwest Research Note 447?

What ecological roles do both mature and immature yews play in oldgrowth forest ecosystems?

Are the differences between shrub and tree forms of Pacific yew genetic or environmental? What implications do these differences have for harvests, for future yew populations, for wildlife interactions, for roosting habitat, and for the ecological role of yews in forest ecosystems?

What is the effect of yew harvest on the quantity and quality of lower canopy layers that are sturdy enough for birds of prey to use for hunting or thermal shelter in oldgrowth forests?

What roles and functions does Pacific yew have in riparian zones?

Do fishing birds use it as a perch, and how would its removal effect them?

Given its resistance to decay, what role does yew play in stream stability and hydrology? Are yew roots effective stream bank stabilizers? Are fallen yew trees? Do yews provide significant shade to streams? Nutrient or food input? How would harvests alter these relationships?

What effect does removal of yew have on insects, fungi, or other microflora and fauna?

Are there unique insects, fungi, or other microflora and fauna which have coevolved with and are especially adapted to yews? If so, are their populations endangered by yew harvest? (See next section III. A. 5.)

Are there unique coevolutionary adaptations between yews and any of the other organisms in its environment? If so, are these organisms or their relationship to yews endangered by harvesting? (See next section)

III. A. 5. Role of Taxanes in Chemical Ecology and Evolution

The unique mode of action whereby taxol works as an anticancer agent in humans, namely suppressing cell division by stabilizing microtubules, also poses interesting questions about its role in ecosystems and why yew trees evolved the ability to produce and tolerate taxanes. For instance, one hypothesis formulated by Dr. Stanley Scher of the BioResources Research Center, Forest Products Laboratory, University of California, Berkeley holds that these taxanes are responsible for the wood's resistance to fungal decay, thereby allowing the slowgrowing tree time to root adventitiously and produce new shoots when it is knocked to the ground by overstory trees falling on it. When chemicals with this mode of action are introduced into the environment over long periods of time, other organisms will perforce either adapt, or learn to use the compounds themselves. For instance, browse animals may prefer yew foliage because the taxanes therein may inhibit the growth of intestinal parasites. Soil microorganisms, especially mycorrhizae, may be specifically, uniquely, or obligatorily adapted to yews, in order to grow in the presence of taxane compounds. These potential adaptations are especially important because taxanes may be useful for a variety of medical purposes and understanding how coevolved organisms have adapted may lead to greater understanding and use of taxane chemistry in medical science.

If special evolutionary adaptations by other organisms to taxane compounds in yew trees do exist, are these unique organisms threatened by yew harvests?

Will harvest of yew (legal and illegal) affect the ability of researchers to study adaptations of other organisms to the presence of taxanes in yews?

Are there differences between populations of yews in their relationships with associated organisms, and if so, how much yew can be harvested without irrevocably or unacceptably diminishing opportunities to study these differences?

III. A. 6. Preserved Natural Areas

Which habitats, plant associations, or forest ecosystems need to be surveyed in order to identify distinctive genetic populations of Pacific yew which are in need of preservation? What criteria will be used to select appropriate means of preserving genetic diversity?

Do any Research Natural Areas currently specify Pacific yew as a target element? If so, how are they distributed? Should more be added? What criteria will be used to decide this?

Will any Research Natural Areas be designated specifically for yew populations?

Will there be an effort to preserve specific exceptional stands of yew?

What areas will be totally off limits to yew harvests, and why?

Will any yew groves be preserved as interpretive areas for visits by future tourists interested in "The Great Yew Bark Harvest Controversy" of the late twentieth century?

III. B. Managed Forests

Any area in which yew harvests are contemplated will be considered a "managed forest" for the sake of this discussion, whether or not there is a planned harvest of softwood fiber or other commodities.

III. B. 1. Artificial Regeneration of Yews

To what extent will artificial regeneration of Pacific yew be used to replace harvested yews? How many more yews will be harvested than if their "allowable cut" were to rely solely on natural regeneration?

Do USFS and BLM districts intend to develop comprehensive Pacific yew regeneration plans with specific prescriptions for different plant associations, environmental conditions, or soil types? Will there be region or statewide regeneration plans and funding?

What means of regenerating yew is most likely to result in healthy established plants that will eventually grow above browse height?

How will Pacific yew regeneration activities be funded? Are KV funds appropriate?

If natural sexual reproduction is to be encouraged in managed forests, what male/female ratios should be selected and what spacing is required for effective pollen transfer between trees and gene flow within and among populations?

If stumps left from harvesting can sprout successfully, under what conditions will this occur? Stump height? Amount of bark left? Presence or absence of fire or browsing? Light or canopy conditions? Aspect or exposure? Moisture regimes? Temperature extremes? Soil conditions? Seasonal time of harvest?

Will sprouting stumps really succeed in eventually growing into new mature trees, or are they merely dying out slowly? Under what conditions? Would new trees from this source be more likely to fall over or have decayed bases?

What is the most effective means of propagating yew for artificial regeneration of harvested populations?

What site conditions are most likely to contribute to successful yewestablishment? Where would nurseryproduced yews best be planted?

How do nursery yew plants produced from seeds compare with those produced from cuttings? Cost? Time? Size? Vigor? Growth rates? Likelihood of establishment success? Genetic variability?

Will yews for planting be produced in federal nurseries, contracted to private nurseries, or both?

Will USFS and BLM districts conduct administrative surveys or monitoring plots of regeneration success?

Do yews require specifically adapted mycorrhizal fungi to survive and grow vigorously in the field (See section III. A. 5.)? Can they be readily introduced into habitats previously uncolonized by yews if they do not have artificial fungal inoculation in nurseries?

How will the yew tree sampling program now being conducted by the USFS contribute to propagation of trees which may produce greater quantities of taxol in the future?

III. B. 2. Commercial Reforestation Practices

What are the effects of clearcut harvesting practices on the survival, health, growth, and reproduction of both naturally and artificially regenerated Pacific yew? Will silviculturalists or timber sale planners write specific prescriptions for protecting yews?

What are the effects of a clearcut environment on the survival, health, growth and reproduction of both naturally and artificially regenerated Pacific yew?

What are the effects of various types and intensities of both natural and controlled burns on the survival, health, growth, and reproduction of both naturally and artificially regenerated Pacific yew? Will fuel specialists be involved in writing specific prescriptions for protecting yews?

What are the effects of soil disturbances and erosion on the survival, health, growth, and reproduction of both naturally and artificially regenerated Pacific yew?

How will negative effects from softwood reforestation practices be mitigated, and how successful is that mitigation likely to be?

How will the timing and methodology of harvesting yews for taxol affect its regeneration?

III. B. 3. Forest Management Regimes

How does the use of different silvicultural harvest systems (clearcutting, seed tree, shelter wood, selective cutting, patch cutting, uneven age management, etc.) effect the survival, growth, health, and reproduction of natural and artificially regenerated yew over its entire potential life span?

How much importance will be placed on management for yew populations, what priority will it be given in silvicultural decisionmaking, and how will these guidelines be implemented in forest plans and district activities? How will the relative value of the taxol resource and the softwood timber resource be evaluated?

Will timber sale contracts include specific prescriptions for management of the yew resource? Will this be required of all sales with any yew in them, or will there be a minimum yew population size before it is specifically addressed in a timber sale contract? Will marking guides for partialcut timber harvests incorporate provisions for preserving yews?

What standards will there be for yew "leave" trees in yew harvest areas? Will only certain diameter classes of yews be designated for harvest? Will yews be left unharvested in certain areas (e.g. riparian zones)?

How do different management regimes affect taxol concentrations in various parts of the tree (bark, limbs, needles, heartwood, etc.)?

What are the effects of short rotation management for softwood fiber on yew populations, yew abundance, yew growth, and yew form over its potential life span? How will high densities of the overstory canopy affect yew tree survival and viability?

What implications do harvest activities have for the spread of Phytophthora lateralis root rot to which Pacific yew is susceptible? Can the spread of this disease be controlled in the context of clearcut harvest and artificial regeneration practices? How will it be controlled? How widespread is the disease now? How much yew mortality can be expected? Will the disease remain restricted to commercial timber lands, or will harvest activities also spread it to areas which are offlimits to timber cutting?

What is the relationship between fire frequency and yew population age structure in natural stands, and what implications does this have for managed stands?

What effects do fragmentation of forest stands and patch size have on the viability of yew populations over time?

How will negative effects from each management regime be mitigated, and how successful is that mitigation likely to be?

Will there be a population viability analysis which indicates the minimum stocking levels of yew trees required to insure longterm health and survival of the species? What are the minimum number of yew trees in various age classes that should remain in each stand? In each drainage? In eachdistrict? In each forest?

Will silvicultural activities take into account the likelihood of global warming and subsequent shifts in climatic regimes over the life span of a yew, especially at the extremes of its range?

III. B. 4. Genetic and Biological Diversity

How genetically variable is Pacific yew, and how much of that variation should be conserved in managed forests? Why?

What percentage of the original yew gene pool has already been lost through intensive commercial forestry practices? How has that loss been distributed? How much more can be sacrificed while still maintaining significant and sufficient genetic variability?

What method of yew propagation is most likely to conserve genetic variability within and among populations of native yews?

How does the current U.S. Forest Service program of sampling yews throughout their range in the Pacific Northwest contribute to understanding of the genetic and phenotypic variability of native Pacific yew?

III. B. 5. Research

How will the genetic, ecological, and silvicultural unknowns related to managing yews be addressed? What specific questions and research goals will be addressed?

What will be the extent, purpose, and funding of research by each organization into answering these questions?

How will research activities and funds be distributed among basic ecological research, applied silvicultural research, and longterm studies? Who will conduct and administer each type of research?

Which research funds will be from public sources? Which from private sources? Will funds from private sources bias the research to the detriment of either the resource or the public? What are the most appropriate funding sources for serving the public's interests?

IV. Harvesting of Pacific Yew

It is the stated intent of this EIS to "focus on the short and longterm effects of a fiveyear (emphasis added) harvest program." Yew resources are already so diminished from commercial forestry operations that almost any selected alternative is likely to have a substantial impact on remaining populations over the next five years. Even with the selection of a "low level of bark harvest" alternative, a continuing market for bark would probably encourage poaching to the detriment of the species. As in few other environmental choices, the time frame for making decisions that will dramatically effect a crucial resource is incredibly short.

Information gathered for addressing many of the concerns in this section may be derived from sources which are biased, have vested interests, or which have concerns about proprietary rights. Where this situation exists, it needs to be recognized and discussed.

Who or what is the source for each estimate in this section? How accurate is it? Is it likely to be biased? If so, why, and in which direction?

How do the agencies involved intend to develop more reliable and less biased estimates?

IV. A. Inventory

It is impossible for any kind of reasonable discussion of alternatives or impacts to occur without an accurate and comprehensive inventory of native yews on public lands. It is imperative that the inventory be a completely open and well publicized process, so that all parties involved can independently judge its accuracy, meaning, and implications. Insofar as the agencies involved have to date made a significant impact on the yew resources without previously preparing an EIS based on accurate inventory data, those agencies are in direct violation of the National Environmental Policy Act (NEPA) and the National Forest Management Act (NFMA) and will continue to be so (if significant harvesting continues) until such an inventory and EIS is complete.

IV. A. 1. Inventory Methods

Is there an inventory plan, and if so, when and how will detailed printed copies be made public?

What assumptions are being used?

How have the sample locations been identified? What were the results?

How has the sampling scheme been stratified?
How intensive is the sampling within a stratum? A geographic location? A district? A forest? A region?

How extensive is the sampling throughout the range of the Pacific yew?

What data are being collected, and to what degree of precision?

How are the data being collected, by whom, and how will they be analyzed?

IV. A. 2. Inventory Timetable

When will inventory results be made public?

How will the timing of inventory results fit in with the harvest level decision making process?

IV. A. 3. Public and Scientific Involvement and Review

How will the results be made public and in what format?

What opportunities will the public, foresters, or scientists have to review the assumptions, procedures, analyses, or conclusions of the inventory?

Will site specific maps be made available to the public for ontheground verification?

IV. B. Harvest Plans

IV. B. 1. How Much Proportionately

Of the native yew resource which originally existed in the forests of <u>all ownerships</u> in the Pacific Northwest (Washington, Oregon, California, and Idaho), how much had already been lost through commercial forestry practices when bark harvesting began?

Of the native yew resource which originally existed on <u>USFS</u> <u>lands</u> in the Pacific Northwest, how much had already been lost through commercial forestry practices when bark harvesting began? On <u>BLM</u> <u>lands</u>?

Of the native yew resource which remained intact when bark collection began, how much has now been harvested, and how much remains?

Of the native yew resource which remains at this date, how much is located in each of the following: sold timber sales, planned timber sales, areas identified as Spotted Owl Habitat, areas identified as "Significant Old Growth" as defined by PNW Research Note 447, and in areas with permanent congressional protection from harvest activities?

What are the implications for yew harvests when the amounts and proportions described in all of the aforementioned questions are displayed in the context of a pie diagram?

What is the source for historical estimates? How were they derived?

IV. B. 2. How Much Total

Should any more yew trees be harvested for bark? For other parts?

What percentage and total amount of the remaining yew resource (trees, bark, needles, etc.) will be harvested for taxol production?

How much (natural) native yew will be reserved unharvested? By district? By forest? By Region? By physiographic provence? Overall?

What if there is still a demand for yew harvests when the designated yew resource has been depleted?

IV. B. 3. Where

Where will further harvesting occur? How will these areas be prioritized?

How will more harvesting be distributed between agencies, forests, and districts?

How will harvests be distributed among forest land use categories? Among land type categories? Among forest ecosystem types or sizes? Among forest stand condition types or sizes?

Will there be allowances for exceptional, isolated, or rare stands of yew?

Where will unharvested yews be located?

IV. B. 4. How Fast

How rapidly will yew designated for harvest actually be harvested (over what period of time)?

How does the rate of harvest correspond to anticipated demand for taxol?

How does the rate of harvest correspond to anticipated development and approval of technologies for alternative extraction procedures which would significantly improve yields?

How does the rate of harvest correspond to balancing the need for clinical trial supplies with the need for intermediate and longterm therapeutical supplies?

What is a "sustainable harvest" of yew resources? Is this possible? How many trees per year? How much foliage per year? If the harvest is not intended to be sustainable, how is that decision justified in light of applicable laws?

IV. B. 5. Yield Assumptions

Cited figures of taxol yield from various parts of a tree (bark, limbs, needles, etc.), as well as the weight of these parts from different sized trees, vary widely. It is imperative that accurate figures be developed, and that the methods and assumptions used to calculate them be made public knowledge in a readily accessible and widely distributed format. Therefore we feel the EIS must clearly address the following issues.

For a range of given sizes of yew trees (diameter and height combinations) how much total wet and dry weight is there of bark, small limbs, needles, heartwood, etc? Statistically, what are the averages and variation? What does the variation depend upon (e.g. tree form or canopy conditions)? How were the estimates derived?

What is the statistical distribution (average, range, variation) of taxol content in various parts (bark, small limbs, needles, heartwood, etc.) of Taxus brevifolia in different portions of its range?

How do environmental conditions (temperatures, light/canopy conditions, moisture regimes, soil/nutrition, etc.), time of year, and tree age or health affect taxol concentrations in the various tree parts? How was this information derived?

Commercially, under different harvesting scenarios (peeling bark in the woods at different times of year, peeling bark mechanically in a processing plant, high water pressure bark peeling, needle harvest, whole tree harvest, etc.), what percentage of targeted materials are recoverable?

To date, what has been the percentage of bark recovered from harvested trees?
What has been the actual percent yield of taxol from bark that has been achieved to date? What is theoretically possible in a commercial setting?

Given the yield estimates derived above and the total harvest plans addressed in section IV. B. 2., how many cancer patients could potentially be treated under different harvesting scenarios?

IV. B. 6. Public Access to Information about Harvest Activities

Will federal land management agencies make information about harvesting plans, contracts, activities and timing available to the public?

Will individuals or organizations requesting information be notified?

Will this information be made available a reasonable period of time before activities occur? What constitutes procedural accountability in this regard?

How will these procedures compare with information about timber sale activities? Other forest activities?

IV. C. Waste

The scarcity of remaining yew trees and the immense demand for the lifesaving drug taxol combine to make native Taxus brevifolia on federal lands a resource of **strategic national significance** in the fight against cancer. Current harvest and processing arrangements are wasting large portions of this resource to the immense detriment of cancer patients, while simultaneously depleting the resource far faster than necessary. Waste is resulting from harvesting arrangements, harvesting methods, monitoring of the harvests, and extraction procedures. It should be incumbent upon the agencies and private companies involved to demonstrate that their arrangements, methods, and procedures are efficient, state of the art, closely monitored, and nonwasteful. If the organization in question is not capable of carefully and fully utilizing this precious resource, then it should defer to organizations which can, or wait and preserve the resource until it is able to handle the task. (Also see Policy, Section V.)

IV. C. 1. Harvesting Arrangements

What is considered "economical" depends a great deal on how much peopleare willing to pay. It is hard to imagine a cancer patient or member of their family who would not be willing to walk to the bottom of a steep brushy hill to collect a few pounds of yew bark that a commercial picker would bypass because the price was kept artificially low through exclusive harvesting and processing arrangements.

What effects do the exclusive arrangements that the USFS and BLM currently use for yew bark harvesting have on the price paid by contractors to pickers for that bark, and ultimately on the percentage of available bark recovered from a given area?

What would be the effect of competitive harvesting and processing arrangements on the efficiency of bark harvests, the bark recovery rate from harvested trees, and the price of yew bark?

What would be the effect of competitive harvesting and processing arrangements on the efficiency of extraction, yields, and ultimately the price of taxol.

Do the current exclusive arrangements encourage or discourage efforts to develop alternative sources of taxol, and why?

Will the current exclusive arrangements provide more or less taxol to cancer patients between now and the development of an adequate sustainable supply? When? At what cost? With how much profit for the companies involved?

What other arrangements could the USFS or BLM make to reduce wastes (e.g. purchase orders for gleaners, force account pickers, etc.)?

What consideration will be given to the availability of yew trees and taxol for future cancer patients? To the availability of yew trees for the development of other useful drugs?

IV. C. 2. Harvesting Methods

What will be the harvesting methods of choice, and why?

Will these methods yield the greatest amount of taxol for cancer patients, and if not, why not?

If the methods selected do not yield the most taxol, what are the justifications, and would these justifications remain valid if harvesting arrangements were to be altered?

What legal, economic, technological, bureaucratic, or procedural challenges must be meet to arrange for harvesting other parts of a yew tree for taxol production?

IV. C. 2. a. Bole Bark

What are all of the methods of harvesting bark? How do these methods compare in potential and actual yields of bark? How do these methods compare in potential and actual yields of taxol from a given tree? Does this differ from bark yield and, if so, why?

How does the size and form of the tree affect these methods?

What is the smallest yew tree from which it is practical and economical to remove bark? Under what circumstances? Under what arrangements?

How do season and location of the trees affect these methods?

Is partial stripping of trees a useful approach to conserving the resource, or will this method cause them to decay and die, thus wasting the bark which was left?

How rapidly does taxol degrade in unharvested bark in the field, and how is the degradation process influenced by environmental factors?

How long after yew has been felled is it still practical and economical to return for gleaning more bark? Under what conditions and arrangements?

How do other silvicultural and commercial forestry practices effect these methods and their yields?

How thoroughly should a harvest unit be cleaned of bark before it is acceptable to burn the slash (given that yew stumps are protected for sprouting)?

How much employment do the various harvest methods provide to local communities?

IV. C. 2. b. Limb Bark

What is the smallest limb from which it is practical and economic to remove bark? Under what circumstances and arrangements?

What is the largest limb size that could be processed with needle extraction procedures?

IV. C. 2. c. Needles

Not utilizing the needles of the Pacific yew is undoubtedly the largestand most important type of waste occurring with current harvest methods. The taxol and other taxane compounds in needles are wasted in at least two ways:

1) During the onetime harvest of yew trees for their bark, the needles and small limbs are left to rot on the ground. It is technically feasible with current methods to do a primary extraction of the various taxane compounds from the needles and limbs of harvested trees. The compounds are thus stabilized in a "mother liquor" or "initial extraction" solution. They can then be concentrated for storage until approval is given for commercial procedures which will isolate taxol approved for human use or convert associated taxanes into taxol.

2) By cutting down yew trees, they are not being managed for maximum production of more needles, which would provide a continuous and sustainable supply of taxol for future cancer patients.

What legal, economic, technical, bureaucratic, or procedural reasons are there that prevent needles from becoming an immediate source of taxol for human use?

How are these obstacles to the use of needles being addressed by each organization involved in taxol production? How soon can FDA approval of needleproduced taxol for human use be expected?

Will taxol which is derived from needles and approved for human use be limited to a specific source such as a single species of Taxus? Needle type, cultivar, or clone? If so, why?

Are impurities in the drug taxol more closely related to raw source materials or to extraction procedures? Why?

What level or types of impurities make a significant difference in clinical efficacy or toxicity for human use? How is this determined? Can the process be hastened?

What reasons are there why needles are not being put through an initial extraction process to preserve their taxane compounds for future use?

Do the USFS and BLM have trials or studies started to determine the optimum means of cropping yew trees for a sustainable harvest of needles? If not, why not?

What can public agencies or the federal government do to expedite the process of obtaining taxol from needles?

IV. C. 2. d. Wood

Can taxol be extracted from the wood of yew trees? In what yield? How do the yield and extraction procedures from wood compare to other parts of the tree?

How will planned harvests affect the availability of yew wood for other uses (high value musical instruments, furniture, veneer, bows, native American artifact replicates, etc.) over the next 500 years?

What can the USFS and BLM do to capture the highest quality and greatest quantity of wood from trees cut down for bark? How much emphasis will these efforts be given, and how could they be implemented?

What can the agencies preparing this EIS do to help develop new markets for yew wood products? How would development of new yew wood markets affect employment in forest dependant communities?

IV. C. 3. Harvest Monitoring and Control

As with inventory, it is impossible to make intelligent or responsible decisions about managing yew resources without keeping track of what is being utilized.

IV. C. 3. a. Regulation of Legal Harvests

For perspective (See section IV. B. 1.): How many yew trees were there originally? How many were eliminated in commercial forestry practices to date? How much bark does that represent? How much taxol does that represent? How many trees were left, and how much bark remained, (totally and proportionately) when bark harvests for taxol began?

How many yew trees have been cut and how many pounds of bark have been collected since harvest for taxol has begun?

How precise are these estimates? How will more precise estimates be obtained in future harvests?

What will future harvest monitoring activities entail? Will they include: Where material is collected? What is collected? How it is collected? Who collects it? Efficiency of collection? How it is handled? Who collects or purchases it? Price?

How comprehensive will monitoring activities be? How many personnel will be assigned to a given size collection program? How and to what extent will monitoring be funded?
How will results from these program be used? How and in what format will gathered information be made available to the public?

How will information derived from monitoring programs be used to regulate future harvest activities?

IV. C. 3. b. Illegal Harvests

Every concern in this document about harvest or management activities is directly affected by the existence of a black market for yew bark and poaching activities. Yew trees will continue to be destroyed and yew resources wasted illegally as long as a market exists for the bark. If that market were eliminated, that is, if the only legal source of taxol was from needles, it is unlikely that nearly as many trees would be destroyed. There might still be a black market for needles, but these could be easily obtained from shrubby yews or older sprouted stumps, rather than cutting trees to collect the foliage. Most poachers probably have a cancer victim in their families too, and would prefer not to cut down old yew trees if they could make money some other way.

What is the extent of illegal harvest activities? How will this be determined?

How does the amount of illegally collected bark compare to legally collected bark? Does it vary by ownership or area?

Where is the illegally collected bark being sold? To legal processors? To speculators? To overseas buyers? How will this be determined and controlled?

Can the US Fish and Wildlife Service provide expertise in monitoring and controlling bark poaching? Would their forensic laboratory in Ashland be able to identify the source of illegally collected bark?

What types and intensities of law enforcement activities are planned to control illegal harvesting? What are the penalties for collectors? For buyers?

What will the agencies involved do to insure that these enforcement activities address the sources of the poaching incentives?

How will illegal poaching affect areas set aside for preservation of yew trees in their natural state (e.g. Research Natural Areas, genetic conservation areas, parks or wilderness areas)?

How will illegal poaching affect areas where some or all yew trees are left for silvicultural, wildlife, or recreational purposes?

What can the agencies involved do to increase public awareness of the need to discourage poaching activities (advertising, public announcements, flyers,news spots, etc.)? How might this be coordinated with public notices of legitimate harvest activities?

Is it possible to securely protect <u>any</u> yew trees from illegal harvests?

IV. C. 4. Bark Processing

Harvesting only the bark from old yew trees is, by itself, incredibly wasteful. Not extracting every last gram of taxol from that bark is a direct insult to cancer patients. Under current arrangements, extraction of taxol from the bark is being handled by private companies and is not subject to public scrutiny. Insofar as wasted taxol in this process contributes directly to greater demand for harvesting more yew trees from federal lands, we feel extraction activities should be subject to public oversight. Specifically, an annual flow chart should be developed which details how much bark was collected, when it was processed, how much taxol was extracted, and how much was delivered to NCI for clinical trials and compassionate use in cancer patients. The burden of proof should be upon the companies which have contracts with the federal government for taxol production. They should demonstrate that their methods are producing the largest and most timely yields possible from a given amount of raw material. Considering the importance of this drug and the scarcity of the resource, if they are not able to meet reasonable performance standards, the contracts for extraction should be granted to companies which demonstrate the ability to do so.

IV. C. 4. a. Handling, Storage and Degradation

How is yew bark being handled and processed when it is collected?

Does this handling lead to loss or degradation of taxol, and if so, how could that be prevented?

Is collected yew bark currently being stored for later processing, and if so, why?

If so, under what conditions is it being stored, and how rapidly will the taxol degrade? What are the best conditions for storage?

If yew bark is being warehoused, for how long is it being stored, and what percentage of its taxol is being lost during this period of time?

What regulations, contractual stipulations, or incentives would minimize loss of taxol from yew bark pending extraction?

IV. C. 4. b. Extraction efficiency

Does the extraction method currently being used give the highest yield of taxol among those available? If not, which method would, and why is it not being used?

Are supercritical fluid extraction technologies being evaluated as alternatives to present extraction procedures using organic solvents? What are the relative advantages and disadvantages of each technique?

What are the technological capabilities of the chemical companies with contracts for extraction? Could other companies extract higher yields from harvested materials? Can contractual arrangements be altered to improve yields of taxol?

Are other taxanes present in the yew bark being extracted and saved for future use, and if not, why not?

IV. C. 4. c. Accountability and Public Oversight

What can the federal agencies involved do to maximize the yield of taxol from a given harvest of yew trees from public lands?

What can and should the federal agencies involved do to oversee extraction and taxol production activities by private companies? How should these activities be incorporated into contracts? What performance standards would be appropriate in these contracts?

Since it is a public resource and a national fight against cancer, how will the public be kept informed of performance by private companies?

How will determinations of performance levels by private companies be used to alter or assign future contracts?

V. Public Agency Decisions

Past, present, and future decisions made by public agencies (NCI, FDA, USFS, and BLM) are critical for defining the context in which yews are harvested for taxol production. These decisions can mean the difference between wise use of public yew resources for the maximum benefit of cancer patients, or a wasteful program which devastates the resource, deprives cancer patients, and caters to corporate avarice. Serving the public they represent should be the primary goal of these agencies.
Is there a need for an oversight committee, such as a "Taxol Regulatory Commission", to review and coordinate the activities of federal agencies? To insure accountability?

V. A. Federal Policy

The National Cancer Institute (NCI) has been the lead agency in the development of taxol, they have much to say about needed supplies and actual amounts of taxol being produced and delivered, and their decisions can easily be construed as having a significant impact on the environment. Why are they not participating in this EIS?

What are the priorities which the NCI assigns to providing taxol for clinical trials, compassionate use, and longterm therapeutic supply? Why? Under what conditions would these priorities change?

What are the relative priorities assigned by each agency to the goals of
1) conserving yew resources, 2) maximizing taxol yields, 3) maximizing taxol production, 4) minimizing public financial outlays, and 5) providing for the security of private profits? How will these priorities change over time?

What is the rationale for these priorities? To what extent are they a matter of public debate? What events or conditions would alter them?

What value are federal agencies and the federal government willing to assign to the last remaining old native Pacific yew trees in order to expedite greater efficiencies and a rapid switch to alternative taxol sources?

What role should competition and free markets play in developing and producing taxol for cancer patients? Why have these principles not been a part of federal policy to date, and when or under what conditions will they be encouraged?

Why is yew bark from public lands being provided virtually free of charge or at a trivial price? How long will this continue? Under what conditions?
How would a price be determined for harvested yew materials?

Should the public receive compensation for taxanes derived from national resources, especially in the event of large profits by private companies (e.g. resource extraction fees or windfall profit taxes)?

Will there be performance standards in future yew harvest and taxol production contracts? If not, why not?

Will the selected alternative in this EIS include recommendations to Congress concerning appropriate national policy on taxol production in order to conserve yew resources? What role do the federal agencies involved with this EIS have in recommending national policies or plans for the sustainableproduction of taxol?

V. B. Taxol Production Plans

Will federal agencies require private companies to develop detailed public plans for taxol production, especially from alternative sources? If not, why not?

Will this EIS address a national plan for the production of taxol, or will it address only yew harvests?

How can the public judge how reasonable the selected alternative in this EIS is, unless it can be examined in the context of a national plan for the production of taxol?

Have the agencies involved with this EIS considered contracting out the development of yew harvest plans or alternatives under this EIS? What would be the advantages and disadvantages of this approach? What would be the criteria for awarding such a contract?

V. C. Funding

How will the USFS and BLM fund the actions selected in the preferred alternative?

How much money will be allocated to implement yew harvesting and monitoring decisions? Yew research? What will be the nature of this funding? Who would be able to control or alter the levels of funding? Under what conditions?

Will the agencies involved with this EIS allocate funds to stimulate research and development of taxol production alternatives? How would the funding for alternatives be related to diminishing supplies of yews for harvest?

VI. Taxol Production Alternatives

How can public agencies or the federal government promote development of alternative sources of taxol?

How will progress towards these alternatives be measured and evaluated?

How will funding for various alternatives be reallocated as some become morefeasible than others?

What criteria will the USFS and BLM use to reduce or eliminate bark harvesting permits as alternative sources of production are developed?

VI. A. Total Synthesis

Which laboratories nationally and worldwide have the most extensive and innovative taxol synthesis research programs? Which are most likely to succeed?

Why has the molecule not been synthesized after twenty years of effort to do so?

VI. A. 1. Timetable

How much work is being done worldwide on total synthesis of taxol or related taxanes, and how soon are these efforts likely to succeed?

Once taxol is synthesized, what would be involved with scaling up to commercial production? How long is this likely to take?

Once total synthesis of taxol was begun on a commercial scale, what would be involved with approving that source for human use, and how long would that take?

VI. A. 2. Expense

How much further funding will be required to produce taxol from total synthesis? How much will have been spent worldwide on this research?

Once the procedures for total synthesis of taxol have been worked out, how much will it cost to scale up to commercial production of taxol?

Once commercial production of taxol is achieved, how much will taxol produced by this method cost?

How much employment would this process provide to local communities?

VI. A. 3. Commercial Feasibility

How do the development and production challenges of commercial production of taxol by total synthesis compare with other alternatives?

How can the agencies involved in this EIS contribute to successful synthesis efforts?

What chemical byproducts or wastes would be produced by commercial synthesis of taxol? How many could be recycled, and at what cost?

VI. B. Cell Culture

Which laboratories nationally and worldwide have the most advanced cell culture research programs for producing taxol from Taxus cell lines?

Which of these organizations are most likely to develop a commercially viable process and why?

VI. B. 1. Timetable

How long will it take for taxol to be available in commercial quantities from this source, and in what quantities?

VI. B. 2. Expense

How much will it cost to produce taxol from cell culture? How much investment will be required to scale up to production of commercial quantities?

How much employment would this method provide to local communities?

VI. B. 3. Commercial Feasibility

What economic, technological, logistical or procedural hurdles exist toproduction of taxol from cell culture?

Taxol inhibits cell division; is this a problem for growing Taxus cells in artificial media?

How can the agencies involved contribute to development of superior Taxus cells cultures for taxol production? To the general success of these programs?

VI. C. Taxane Extraction and Semisynthesis

What current progress and future possibilities exist for improving taxol yields through alteration of other taxane molecules derived from yews?

Which yew species or cultivars, and which parts of those plants, hold the most promise for large yields of taxol from semisynthesis with other taxanes?

What research is being done nationally and internationally on the anticancer potential of related taxane molecules (e.g. French research with taxotere)?

What FDA requirements or procedures would need to be met in order to approve clinical trials or therapeutic use of taxol derived from semisynthesis procedures which modify related taxane compounds? How long would this take? Can the process be shortened or accelerated?

How can the agencies involved with this EIS contribute to making semisynthesis techniques a viable and economical process? To research which examines other taxanes as cancer fighting drugs?

VI. D. Taxol from Needles

There are private companies which have claimed they have been able, for the last year or more, to produce purified taxol from needle extractions and are currently pursuing FDA approval of this taxol for human use. Extraction of taxol from needles represents a very large, sustainable, and readily available source of taxol, because both ornamental and native yews sprout new foliage prolifically when pruned. If semisynthesis methods can be used to convert other taxanes and improve yields, this supply becomes orders of magnitude greater.

What technological or procedural obstacles remain to approving taxol extracted from needles for human use?

What can public agencies or the federal government do to accelerate,encourage, or streamline the process of obtaining taxol from needles?

VI. D. 1. From Native Yew Harvest

How might native yews trees or shrubs be pruned to enhance the sprouting of new foliage, while still retaining various wildlife values?

How might sprouting stumps or stripped trees be managed to produce the greatest quantity and best quality of new foliage for needle harvests?

What can the USFS and the BLM do to find answers to these questions and formulate plans for sustainable needle harvests as soon as possible?

How much employment would this approach generate for forest dependant communities?

VI. D. 2. From Ornamental Yews

There is an immense resource of mature ornamental yews planted throughout our urban and suburban landscape. These yews are easily accessible and pruned on a regular basis anyway. Although many of these varieties do not contain very high concentrations of taxol, they do contain high concentrations of similar taxanes which could be converted to taxol or other anticancer drugs. Why discard these valuable compounds by burning, composting, or dumping them?

What economic, technological, logistical, or procedural challenges exist to developing a program for producing taxol from ornamental yew clippings? Is it feasible to produce taxol from mixed clippings of a variety of yew cultivars?

How can these challenges be meet? Could a volunteer program be developed for collection of clippings from ornamental yews?

How can the agencies involved contribute to making ornamental yews a viable source of taxol?

VI. E. Taxus Biomass Plantations

Plantations of yews grown under agricultural conditions and managed for optimum growth and quality of foliage for taxol extraction have both advantages and disadvantages. The major disadvantage is the time and investment required to establish and grow such plantations to the point where they can provide significant production. Of course, the sooner one starts, the less this is a disadvantage. Advantages include: 1) Proven, existing propagation techniques 2) Biosynthesis already arranged by evolution, sunlight, soil and water 3) Control over production 4) Numerous opportunities to maximize taxol yields 5) Centralized production economies and 6) local employment.

VI. E. 1. Scale

How many acres of yew hedges would be required to supply national or world wide demand for taxol?

How might the demand for taxol from plantations change relative to other sources over time? What are the most important factors to consider when addressing this question?

How might the agencies producing this EIS contribute to the development of this source of taxol?

VI. E. 2. Timetable

How long will it take to develop significant production of taxol from biomass plantations, and once production has begun, how rapidly will production increase with plantation age?

How would the time required to develop yew plantations correspond to yew harvests on public lands? How urgent is it to start plantations soon?

How would public and private investment in yew plantations correspond to various types of yew harvests on public lands over time?

VI. E. 3. Expense

How much annual investment (per acre, assuming various scales) will be required to establish, manage, and harvest plantations of yews for taxol production?

How much employment would these plantations provide to local communities?

VI. E. 4. Methods

By what means might the agencies involved in this EIS contribute to the rapid development of taxol produced from biomass plantations? Propagation contracts? Subsidies to the private sector?

What unique biological challenges exist in development of Taxus plantations (e.g. Phytophthora root rot)?

How can plantations best be managed for maximum, longterm taxol production?

How do biomass/needle plantations compare with other alternatives in timeliness, commercial feasibility and cost for producing taxol?

Could the USFS or BLM make land available through longterm leases for intensively managed yew plantations?

VI. E. 5. Superior Clones

The efficacy of biomass plantations for taxol production will probably depend on the taxol or taxane content of the individual clones of Taxus which are propagated. Given the variability among Taxus species and individuals, there exists a significant opportunity to select clones which are very superior in taxol or specific taxane production. Propagating these clones may shift taxol production estimates by several orders of magnitude. Superior clones which were massproduced through tissue culture techniques might be grafted onto established Taxus rootstock, so that selecting the clones need not necessarily delay plantation establishment.

How can the sampling program which the USFS has in progress contribute to the selection of superior clones for propagation in biomass plantations?

What arrangements will be made for making demonstrably superior propagation material available to private cultivators?

Will this superiority be ranked by ease of propagation (rooting, grafting, etc.) as well as taxol content?

VII. Human Significance of Native Yews

Wherever they grew, yew trees have served vital functions in the livesof people during all of human history. Its incredible utility has earned it a prominent role in the mythology, symbology, and spirituality of indigenous cultures throughout the northern hemisphere. The decisions addressed in this EIS will affect a very significant fraction of the last few unharvested native yew trees on the planet. These decisions will be implemented in a period of time that is infinitesimally brief compared to the evolutionary history of yews and human use thereof. No appropriate decisions regarding the harvest of these last old trees can be made without considering all the connections between yew trees and humanity. By far the most comprehensive text addressing these issues is the book, "The Yew Tree: A Thousand Whispers" by Hal Hartzell, published by Hulogosi, P.O. Box 1188, Eugene, OR 97440. This EIS will be woefully inadequate if it does not address the issues raised in this book, and place any selected action alternative into a larger philosophical context.

What are the implications for humanity if the last native oldgrowth yew trees on the planet are harvested for a few pounds of bark to prolong the lives of a few cancer patients?

What implications or symbolism does the harvest of the last old native yew trees have for the relationship of humans to their living environment, especially forests?

What reasons can humanity offer for nonsustainable use of a biological resource that has evolved over hundreds of millions of years?

VII. A. Historical

How does the use of yews contemplated in this EIS compare to historical use of yews throughout human history? Quantities? Rate of utilization? Conservation of natural populations? Purposes? Future supply?

What will be left ten, twenty, fifty or a hundred years from now? How does this compare with yew populations over the last hundred million years?

VII. B. Symbolic

For a tree which has such deep and complex symbolic significance for indigenous human cultures, what are the implications for all humanity if that past is eliminated with the harvest of the last old native yews?

As a premier representative of the natural/native oldgrowth forests which are becoming so rare on our planet; how many big, old yew trees should be preserved?

VII. C. Spiritual

Other than acting very conservatively, (that is, by preserving a significant number of old yew trees in their native habitat), how can a program based on economic priorities properly address the spiritual significance of yew trees to native cultures?

VII. D. Cancer Patients

Government policies routinely trade human lives to realize social purposes such as war goals, industrial policies, health policies, etc. These tradeoffs are often politically or economically motivated. Almost every family has been affected by cancer. Personal reactions to the promise of taxol and the current source of supply are highly individualistic. This EIS represents a unique opportunity for the public to comment on government policies which directly affect their lives, and the quality of their environment.

Given the opportunities to realize rapid and large increases in the production of taxol by minimizing waste and investing in production alternatives (especially the immediate utilization of needles), what justification is there for portrayal of the taxol supply as being dependant on cutting more old yew trees for their bark?

If, in the very short run, this really is the case, what is the U.S. public willing to sacrifice in order to prolong the lives of the cancer patients which might be treated until other supplies become available? What constitutes an informed choice in this matter?

How can this EIS be used to develop a win/win situation in which the demand for taxol in cancer treatment is more rapidly satisfied while simultaneously conserving native yew resources and preserving a representative sample of old yew trees?

VIII. Trash to Treasure: Conclusions

There are important lessons to be learned from the story of the yew tree. As recently as five years ago, the yew was considered a valueless weed or "trash" species in forest harvesting operations. Now it is the most valuable plant in the forest! Its value to cancer patients is obvious and immense, but its value goes far beyond that as well. This is a golden opportunity for society to recognize that no species on earth can be considered worthless. Our ignorance is simply too enormous for us to feeljustified in foreclosing options for future generations by eliminating a species for short term gain. This is the practical consideration, but we should also ask ourselves what <u>right</u> we have to deplete, in one short generation, the biological legacy we have inherited from eons of evolution? We are not harvesting yews we have planted and cultivated. We are mining a biological resource we have appropriated from our descendants!

Harvesting yew trees for taxol is intimately tied into the assumptions which have governed commercial timber harvesting practices on federal forests for the last several decades. The last small fraction of remaining native forests are now threatened with continued clearcut logging. It is time to change our assumptions and begin exercising true stewardship of all of our biological resources. The yew is not just another tree. Its unique chemistry, its slow growth, and its shade tolerance are all adaptations to living in the understory of oldgrowth forests. We must preserve these forest to preserve this tree.

This EIS process represents an historic opportunity for federal land management agencies in the United States. The decisions made here could lay the foundation for a long overdue transition to genuinely sustainable and multiple use of our public lands for the good of all citizens, present <u>and</u> future. These decisions will also be important internationally as an example of how to wisely utilize scarce and precious living resources.

We challenge the federal agencies preparing this EIS to seize this opportunity for significant and positive change in their management activities, and we hope to contribute to their success.