To: Oregon policymakers
From: Doug Pollock, Founder - Friends of OSU Old Growth
Re: Amendments to SB 1546 - Establishing an Elliott State Research Forest (ESRF)

February 3rd, 2022

Dear Policymakers,

I'm sure we all share a common desire to resolve the long-standing Elliott issue for the greater public good. Despite the overwhelming chorus of support, I'm compelled to point out some *glaring* problems with this bill - and the foundational document it embraces (**OSU's Research Proposal for the ESRF**). I urge you to consider these changes so that this *research forest* might truly become "world-class".

But first, I ask you to consider what it means to establish a "**world-class research forest**". A leading proponent of this bill wrote me an email saying: "*The details [of the Elliott plan] include the strongest forest protections in any forest management plan (federal or state) in Oregon by a long shot.*" I ask why we should compare the creation of a "world-class research forest" to *managed federal and state forest lands*?! Why not compare it to other "world-class research forests"? After all, an exemplary research forest is located only a few hours' drive east of the Elliott.

When considering an Elliott State Research Forest, there's no better model than the **HJ Andrews Experimental Forest**, near Blue River. This ~16,000-acre research forest was established in 1948. Here, OSU researchers work in collaboration with the US Forest Service and the Willamette National Forest conducting ground-breaking, long-term research. The resulting partnerships advance science in unique and synergistic ways. In the Andrews, old-growth forests and a diverse array of ecologically-based research are the norm. Practically speaking, it is the *opposite* of what OSU's "working forest" concept for the Elliott entails. Large clear-cuts and industrial forestry practices were abandoned decades ago, as ecological forestry principles took root. The Andrews now supports a robust and productive research program without substantial logging. Wildlife habitat, forest ecology and carbon research are clearly prized and prioritized. Why not strive for the same high standards in the creation of an Elliott State Research Forest?

With this bill poised to release the Elliott from its financial obligations to the **Common School Fund** (CSF), we should ask why it fails to account for the potential value of the forest's enormous carbon reserves (estimated at roughly 10,000,000 tons). With the price of carbon on the European futures market trading at over $100/ton, the Elliott's carbon could be worth over $1 billion (far more than the timber). By severing the Elliott from the CSF, this bill would deprive the school fund of any future carbon revenue. We should also ask why OSU's renowned forest carbon experts were not part of the OSU Elliott team. We should ask why ecological forestry and carbon experts were also absent from DSL's Advisory Committee (while timber interests were well represented). We should ask why the Elliott must still be saddled with a substantial amount of clear-cutting (over 14,000 acres).

A big part of the answer was revealed in a comment made by the lead architect of OSU's Elliott plan. When asked why they used an unusually low estimate for log prices in their model, she replied, "*It's not about the price of logs, but supplying logs to the local mills*". Her answer reflects the deep bias of both the OSU approach and the Elliott Advisory Committee (a group with substantial ties to the timber industry and regional governments). Why were folks with financial conflicts of interest even allowed to serve on this important committee?! Further, the salary of the College of Forestry dean comes from a

$5M fund established by the former CEO of a company that logged the Elliott and tried to buy it. Is it any wonder that the resulting Research Proposal would continue clear-cutting and extensive thinning on vast stretches of the Elliott? I ask, "*Is this really the model of a "world-class research forest" - or industrial forestry disguised as research?*"

Sadly, OSU's proposal for the ESRF is neither relevant nor compelling. Their "working forest" concept mistakenly equates *intrinsic value* with *economic profit.* This approach says the land must be logged in perpetuity to support the research and forest management activities - and the local mills. While the mission described in Section 2 of this bill is largely positive, it is NOT reflected in OSU's timber-centric Research Proposal. The proposal is based on a ~30 year-old research concept (called "Triad") that has little scientific relevance and fails to meet the needs of both society and the timber industry. It prioritizes timber production over enormously important ecological services, like carbon sequestration, air and water filtration, wildlife habitat, and buffering against wildfire and climate change. It offers no visionary ideas for increasing carbon sequestration or monetizing the enormous carbon reserves. By continuing clear-cut forestry and extensive thinning on substantial areas of the forest, OSU's plan for the Elliott will only perpetuate the historic pattern of fragmentation. It also targets over 3,000 acres of older forest in the name of wildlife research. This is research focused on industrial forestry and supplying logs to local mills. It is anything but "world-class".

The scientific shortcomings of OSU's "research" plan for the Elliott were exposed in a scathing 5-page critique written by Dr's. Jerry Franklin and K. Norman Johnson in November of 2020 (and included at the end of this letter). These renowned experts on ecological forestry have strong ties to OSU. Dr. Franklin graduated from OSU, worked as a professor in the College of Forestry, and played an instrumental role in developing the HJ Andrews Experimental Forest. Dr. Johnson also graduated from OSU, is a Professor Emeritus and served on OSU's Elliott exploratory committee until 2019. In their letter to OSU, they wrote:

> "*The current document "puts the cart before the horse" by proposing a major experiment before conducting such an analysis and without developing on-the-ground familiarity with the property. In addition, the experiment OSU has proposed is badly flawed, compromises development of the long-term research potential of the forest, and lacks significant relevance to management of Oregon's forests. The proposed experiment violates basic principles essential to production of statistically valid and socially convincing outcomes. Furthermore, the focus on Triad, an academic concept related to land allocations at regional scales, has no relevance to pressing forestry issues facing Oregonians."*

When the Land Board adopted OSU's Research Proposal at their December 8th, 2020 meeting, they acted contrary to good science, overwhelming public sentiment, and the opinion of these eminent experts. Where the proposal lacks integrity, fails to follow sound scientific principles, and does not meet the needs of Oregonians, it undermines the very concept of a *research forest* - and erodes public trust. If the Legislature adopts OSU's deeply-flawed Research Proposal, it will undermine the very foundation of the Elliott State Research Forest.

Privately, most conservation advocates (including those on the Elliott Advisory Committee) concede that "no one trusts OSU" - yet they ask us to embrace OSU's timber-centric Research Proposal! They recognize the long history of undue influence of the College's timber industry sponsors, yet are willing to allow OSU to manage this research forest and determine the governance structure! They concede this bill has some serious shortcomings, yet they've embraced it because they think it's the best deal they're

going to get. Publicly, they frame it as a conservation victory, while admitting privately it's all about compromise. I guess this is their standard approach. Unfortunately, compromise and a scientifically-flawed research plan are inconsistent with creating a "world-class research forest".

I've summarized specific sections of the bill that ought to be changed below. I urge you to either address these deficiencies - or reject SB 1546 entirely. When it comes to establishing a "world-class research forest", Oregonians deserve and expect much better than this!

Sincerely,

Doug Pollock, Friends of OSU Old Growth (www.friendsofosuoldgrowth.org)

Here are specific problems in Senate Bill 1546-1 that ought to be amended:

Limitations on Judicial Review are overly restrictive: Section 13. (4) (a) through (d) in the amended bill are designed to limit judicial review to "Approval of a forest management plan or amendments to a forest management plan that are materially inconsistent with:.." the foundational documents controlling the ESRF. Among other things, this includes the mission and management policies, the Research Forest Proposal, and the Habitat Conservation Plan. The bill seems to say, "*You can only take us to court if we don't follow our own plans.*" The problem with this is that some of these plans (e.g. OSU's Research Forest Proposal) are fundamentally flawed and biased - as I've described above. If one contests the scientific validity and societal relevance of the Research Proposal (as Dr's. Franklin and Johnson - and the vast majority of the public did), then limiting judicial review to violations of the flawed proposal doesn't do much good!

Problematic Research Proposal will be very difficult to modify and update: Section 4 positions the Research Proposal that OSU submitted to the Land Board at their December 2020 meeting (and amended in April 2021) as the foundational document controlling all research in the ESRF. It is especially noteworthy that the part (2) (a) states:

> "The university.. **May**, after receiving input and approval from the State Land Board and approval from the board of directors of the Elliott State Research Forest Authority, further amend the proposal..."

This gives OSU enormous and unreasonable control over their problematic proposal. OSU may (but is not *required to ever)* change their original Research Proposal. The Land Board can recommend changes, but the university can choose to ignore them. Also, any changes to the Research Proposal must be approved by the Land Board AND the board of directors of the ESRF. The language does not specify how many members of the Board must approve amendments to the proposal. Thus it is unclear whether a simple majority or all members' approval is needed. The same uncertainty applies to the Land Board's approval. Finally, one must assume "university" applies to the OSU Board of Trustees (BoT). Given the relatively conservative nature of the OSU BoT, one would expect them to have little interest in understanding or changing the Research Proposal. **The bottom line is these restrictions will likely make it very difficult to update and improve the Research Proposal over time.**

Monetization of Carbon will shortchange Common School Fund: The bill apparently fails to provide any mechanism to compensate the CSF for future carbon credits. A knowledgeable source told me that the European carbon market is currently trading at over $100/ton. With the Elliott's carbon reserves estimated to be up to 10,000,000 tons, this equates to over $1 billion! This far exceeds the assessed value of the timber and land. Even if this estimate is off by an order of magnitude, the carbon value is clearly substantial and will likely increase over time. **By severing the Elliott from the CSF, this bill would deprive the school fund of any future revenue derived from carbon credits.** This, in itself, may be valid grounds for a lawsuit.

Section 11 of the bill dictates how the money from forest carbon sales could be used. It lists a number of broadly-defined uses:

- Support financial obligations of the authority.
- Conduct research or undertake other program activities located in the forest.
- Create financial reserves to ensure the long-term financial integrity and stability of the authority as a self-supporting entity.
- Hold and ensure compliance with permits, certifications and permissions from federal, state and local entities, including a habitat conservation plan and related incidental take permit.
- Work and partner with federal, state, tribal, local or private owners of lands surrounding the forest concerning land management, research and consolidation.
- Raise funds and advance cross-sector partnerships that further the mission and management policies for the forest described in section 2 of this 2022 Act and support programs related to the forest.

One can imagine great potential for conflicts of interest and ethically questionable decisions related to the revenue from carbon credits (and timber sales). Who would decide how the funds would be allocated - the board of directors, OSU, or the Executive Director? **This bill fails to ensure that any of the oversight entities would be truly independent.** It has no safeguards to prevent the kind of blatant financial conflicts of interest that have plagued other state entities (such as the Oregon Forest Resources Institute). Would researchers, program activities and partnerships favored by special interests receive funding? If so, how would the board of directors, executive director and university leaders avoid even the appearance of a conflict of interest? With carbon credits expected to grow over time, this could be a significant problem. The bill ought to provide much more clarity and direction on how funds will be allocated, so as to minimize the inevitable conflicts of interest. This is another reason why the oversight body needs to be completely independent of OSU, DSL, and the current Advisory Committee.

Selection of board candidates is exceptionally biased and exclusive: Sections 5 and 6 deal with the selection of the board of directors of the ESRF.

Section 5 (3) (c) says the Land Board shall:

> "Consult with, and consider input from, the university and the existing board of directors when determining whom to appoint to the board of directors."

Section 6 (1) describes how the pool of potential board candidates would be selected:

> "...the Director of the Department of State Lands, the Elliott State Research Forest Advisory Committee formed by the Department of State Lands and Oregon State University shall develop a list of candidates for appointment as the first voting members of the board of directors of the Elliott State Research Forest Authority".

Section 6 (2) states that the Land Board *shall* appoint the first board of directors from the candidates specified in 6 (1). **In short, the DSL Director, current Elliott Advisory Committee, and OSU are the *only* ones allowed to nominate candidates - and the Land Board *must* choose from this group!** The Land Board could not, for example, choose their own, independent candidates.

This provision is clearly designed to restrict who can serve on the board of directors. During the multi-year Elliott process, OSU, the Advisory Committee, and the DSL Director have often shown substantial bias in favor of the timber industry. Putting them in charge of selecting candidates for the primary oversight entity for the ESRF is akin to having the "foxes chose who can guard the henhouse". A "world-class research forest" must have a truly independent governance structure, free of any financial conflicts of interest.

Section 5 (3) (d) provides an additional mechanism to ensure allegiance to the mission, management policies, and operations of the forest. It allows the Land Board to filter out prospective candidates based on what they judge to be the candidates' willingness to comply with the relatively conservative Research Proposal and Forest Management Plan. This is yet another sign of autocratic control that has no business being in the bill. Conservative forestry professionals (who are disproportionately white males) are more likely to support OSU's antiquated approach to forest management. **This is likely to promote an insular governing body and lead to implicit discrimination.** The Land Board should be able to select candidates with a diverse set of perspectives and backgrounds (regardless of whether the candidates fit the agenda of OSU, DSL, and the Advisory Committee). This section of the bill is inconsistent with our basic governing principles.

Supporting rural economies through active forest management should NOT be an explicit management policy of a "world-class research forest": Section 2. (3) states,

> "The management policies of the forest are to:...(e) **Support rural economies through active forest management, timber harvest**, recreation and research..."

The Dean of OSU's College of Forestry has repeatedly stated that research will NOT be used as a justification for cutting trees. Timber will be an outcome of many research activities, but it won't be the driver. It is therefore inconsistent to have "active forest management and timber harvest" as explicit management policies in what is desired to be a "world-class research forest". Rural economies will be supported by a broad spectrum of activities and ecological services associated with the ESRF, but listing these as "management policies" shows clear and unreasonable bias. This is not how scientific research works and is inconsistent with a "world-class research forest".

(Critique of OSU's draft Research Proposal for the Elliott State Research Forest)

November 28, 2020

Creating a Scientifically Credible and Socially Relevant Research Agenda for the Elliott State Research Forest

By Jerry F. Franklin with assistance of K. Norman Johnson

SUMMARY: The Oregon State University College of Forestry (OSU COF) has an extraordinary opportunity to serve the citizens and forest resources of Oregon at the Elliott State Research Forest (ESRF). It can do that by creating new knowledge about forest ecosystems and demonstrating the application of that science in managing forests for the multiple environmental, economic, and cultural benefits desired by Oregon's citizens. However, the current OSU COF proposal for management and research on the Elliott Forest needs significant revision if it is to succeed in achieving those benefits.

Activities on the ESRF should begin with development of a problem analysis to identify what research and experiments are needed to address problems of importance to Oregonians. The current document "puts the cart before the horse" by proposing a major experiment before conducting such an analysis and without developing on-the-ground familiarity with the property. In addition, the experiment OSU has proposed is badly flawed, compromises development of the long-term research potential of the forest, and lacks significant relevance to management of Oregon's forests. The proposed experiment violates basic principles essential to production of statistically valid and socially convincing outcomes. Furthermore, the focus on Triad, an academic concept related to land allocations at regional scales, has no relevance to pressing forestry issues facing Oregonians.

The citizens of Oregon are effectively giving OSU COF a $121 million gift in creating the ESRF – arguably the largest single investment that the State of Oregon has ever made in forest research. The state deserves a research program that will contribute to creation of forest ecosystems that can better meet current challenges, such as wildfire, climate change, and recovery of threatened salmon populations. The program also needs to have great flexibility to meet the ever-changing needs and preferences of society.

The State Land Board should direct OSU COF to make a fresh start at designing a research program that includes scientifically rigorous experiments directed at sustaining the productivity and other functions of managed forest landscapes. This process of selecting the research foci and initial experiments for OSU's program should be undertaken systematically and transparently. It is important that stakeholders understand how the topics for research were selected and how they relate to proposed experiments. Independent outside peer review would be appropriate for both the problem analysis and for all major research projects and experiments.

The State Land Board should also insure that there is a process by which OSU COF's program of research and management at the ESRF will undergo periodic outside review by an independent panel of scientists and citizens, who will report to the State Land Board on its findings.

I appreciate this opportunity to comment on Oregon State University College of Forestry's (OSU COF) proposal to undertake management of the Elliott State Forest for research and education. My credentials for commenting on this proposal include my involvement in forest research in the Pacific Northwest for over 60 years, much at Oregon State University and most recently as a professor in the University of Washington's School of Environmental and Forest Science. My entire career has been involved with development and management of experimental forests and long-term research projects. I helped lead the development of the globally recognized H. J. Andrews Experimental Forest and managed Andrews, Cascade Head Experimental Forest, and the Wind River Canopy Crane facility for significant periods. I also participated in conceptualization and implementation of the National Science Foundation's Long Term Ecological Research Program (LTER), successfully competed for one of the initial grants (at Andrews), and coordinated activities of the LTER network for the National Science Foundation. I was involved in obtaining congressional funding for and the design of the only statistically designed regeneration harvest experiment in the Douglas-fir region (DEMO). I am coauthor with Norm and Debora Johnson, of the foundational textbook for ecological forestry, "Ecological Forest Management".

OSU COF has made significant progress in developing a vision statement, but some further changes are required, most profoundly a problem analysis to identify priorities for research and experiments on the Elliott State Research Forest (ESRF). A critical missing element in the existing document is provision for independent oversight of OSU COF's research and management of the property. It is fair to say that OSU COF's record in management of its own lands and in support of long-term research is checkered. Providing independent oversight is necessary to establish and sustain the trust necessary if OSU COF is to manage this important property. This group should include both scientists and distinguished citizens that represent the spectrum of stakeholder interests. They would be charged with reporting regularly and publicly to the State Land Board. Funding to sustain and make credible their oversight activities would be needed. Conservation easements could also provide some additional legal teeth in the oversight function.

The problem analysis is critical to identify the important issues relevant to managing Oregon's forest that OSU COF can address on the Elliott Forest. Such a document would provide a systematic approach to identification, review, and prioritization of potential research topics for the OSU program. It would be the basis for identifying the research, including experiments, necessary to address those issues. Examples of the scientific issues that need consideration are development and demonstration of approaches to creating managed forests that are more resilient in the face of disturbances, such as wildfire, and climate change, and techniques to better integrate forest management with restoration of salmon populations.

Development of a problem analysis will have several important benefits. First, it can make the process of identifying OSU COF's research priorities a much more transparent process. It would put on record the various topics/issues that were considered and the processes used by OSU COF in making its selection. While some stakeholders have relatively little interest in what research is done on the Elliott, many stakeholders do want to know more about OSU COF's research plans as well as to have input into these plans. It could allow for much broader participation by individuals both within and outside of the institution. The problem analysis should also undergo a scientific peer review process before it is finalized.

The State Land Board needs to provide OSU COF with time to develop such a problem analysis and to familiarize themselves with the property, so that the proposed activities are based on on-the-ground familiarity and not simply on maps and remote imaging. Detailed information on stand ages and structural and compositional characteristics is necessary to identify comparable areas for research. Attention to the geomorphic and hydrologic features of drainages is also needed, so that credible experiments examining the interactions of forest management on aquatic systems and fish, can be developed. ***The development of specific studies and experiments needs to follow, not precede, development of such familiarity. Initiating activities on a property that is intended to be managed in perpetuity for research, demonstration, and education should never began with by committing essentially all of it to a single experiment.*** OSU COF's current proposal for a major experiment is very much "putting the cart before the horse"!

The deficiencies in the massive experiment currently proposed by OSU COF further emphasizes the need for a systematic assessment of research priorities and the potential of the ESRF before activities are undertaken. The experiment lacks a relevant focus (a supposed test of TRIAD) and has multiple significant flaws in its design and proposed implementation. The potentials for statistically credible scientific or socially convincing outcomes from the current design are near zero. Some of my concerns with this specific proposal are as follows.

The purported purpose of the experiment is to test the TRIAD concept. TRIAD is a concept that envisions forests in a region being managed using three general approaches (Hunter and Calhoun 1996): (1) Areas for intensive commodity production, (2) Areas with little or no resource use by people; and (3) Areas in which resource use is integrated with protection of ecological values. Here in Oregon, such a partitioning

of forest lands has already occurred – an approximation of the Triad approach. The industrial forest lands are currently managed intensively for commodity production (Triad category 1); and the national parks, wilderness areas, and Late Successional Reserves represent Triad category 2. The remaining managed forestlands (e.g., federal, state, tribal, most non-industrial private lands, conservation trust lands, etc.) represent Triad category 3. All owners and managers of lands in this latter category (Triad category 3) seek to integrate economic and environmental goals in the management of their properties by choice and/or law. A further important aspect of Triad is the geographic scale to which the Triad model applies and at which it needs to be tested. This scale is where the "Issues of economic distribution and balance can usually be evaluated [and is] at the scale of an individual state or county" (Hunter and Calhoun 1996). ***Triad is not intended to be applied to nor can it be tested at the scale of a single property***.

Hence, Triad is inappropriate as either an intellectual or experimental focus for OSU COF's research program on the ESRF. A Triad-like division has already occurred in Oregon by policy decisions made regarding management of the various forest ownerships. Practically speaking, the proposed experiment can provide no meaningful insights into the merit of the concept. Indeed, what Oregonians need most is research that will assist managers of the Triad category 3 lands in achieving their goals of managing forests simultaneously for economic, environmental and cultural values.

In addition to its focus, the failures of the proposed experiment are numerous. The whole idea of committing most of what is intended to become a long-term research property to one massive experiment at the outset, is an outstandingly bad idea, since it greatly limits the potential for future research projects, notwithstanding arguments by proponents that you could nest other experiments within its design. We know from experience that our current ideas about the most pressing research questions, scientifically and socially, are going to undergo dramatic change with time. If most of the unreserved portions of a property have already been compromised by an experiment, the opportunities will be limited for other major research programs to be undertaken as new knowledge emerges and societal goals change.

The proposed experiment would be immensely expensive and take many years to implement; hence, it would take decades before any useful knowledge could emerge. It bases its treatments on watersheds and yet has no credible plan or intellectual engagement in measuring impacts of management on hydrology and aquatic ecosystems. Such research must be an important part of the Elliott Forest research program. However, the cost and institutional commitment for such research generally allows for relatively few gaged watersheds and the calibration of such watersheds requires 10 to 20 years before any treatments can begin. So, why are whole watersheds being proposed as the treatment units in the proposed experiment?

The experiment lacks a rigorous statistical design. The first and most basic principle in designing field experiments is random assignment of treatments to the experimental units – the specific land areas that are going to be part of the experiment. Treatments are not randomly assigned to the experimental units in OSU COF's proposed experiment – rather the characteristics of the experimental units (such as how much older forest is present) are the basis for assigning the treatment that they will receive! A second

principle is that the treatments must include controls, which would be experimental areas that do not receive any treatment. The experiment does not include control treatments. The presence of a large semi-reserved area elsewhere on the Elliott does not fulfill the requirement for experimental controls. A third principle is that, if you want clear tests of variables – for example, how ecological responses are affected by the number of trees retained or the spatial pattern of the retention or the effects of different retention patch sizes – you must avoid confounding your treatments. Treatments are confounded when you change more than one variable at a time. Confounding of treatment variables is implicit in the current design.

There are many potential research topics highly relevant to the management of Oregon's forestlands, which could be addressed in OSU COF's research program. This summer has made obvious the importance of developing management regimes that would reduce the vulnerability

of managed forests in western Oregon to wildfire and other large-scale disturbances. A related and critical research need is to conceive and test multiple approaches to adapting managed westside forests to climate change. Experiments of this type are underway in many forest regions of North America – but notably not in the Douglas-fir region! Silvicultural approaches to integrating ecological and economic goals is a major challenge in management of a broad array of forest ownerships in Oregon, from small, non-industrial private forest lands to tribal and federal forests. Extensive experimentation is needed to better quantify the tradeoffs between various forest values, such as the economic costs and ecological benefits associated with various levels of live tree and dead wood retention during harvests. Similarly, research, including experimentation, is needed to compare economic returns and ecological benefits of mixed-age forests compared with even-aged forests. Any and all of these could be the foci of rigorous, statistically credible experiments that would directly benefit the citizens and forest ecosystems of Oregon.

OSU COF's research at the Elliott Research Forest needs to include significant, credible attention to the relationships between forests and streams. The streams and rivers are the very best and most sensitive indicators of the health (or, I would substitute the word, functionality) of our forest landscapes. We need much better knowledge of the impacts of management on water quality and quantity and on health of the biota. The salmon are arguably the most significant of the endangered biota of the Elliott. There has been no meaningful consideration of streams and stream biota in the current research plan – for example, no consideration of how geophysical processes line up with the expected treatment units. There are multiple ways to configure riparian networks to achieve desired outcomes but this is not a part of the current experimental design. Credible experiments are needed but these will be expensive and significant time will elapse before treatments can begin. The potential for stream-based experiments should not be compromised as they will be by the current research design. These concerns with the research related to aquatic systems and salmon need to be dealt with "up front", not some time after other experimental manipulations have already been planned, let alone implemented.

In conclusion, the OSU COF should drop the current proposed experiment and undertake a comprehensive and transparent problem analysis to identify the research priorities and experiments that will provide the greatest benefit for Oregon citizens and forest ecosystems. Any research projects,

including experiments, should be developed after the COF has an opportunity to become more familiar with the property and reassess how research can benefit the citizens and forests of Oregon in the short- and long-term.

Hunter, Malcolm L., Jr. and Aram Calhoun. 1996. A triad approach to land-use allocation. Pages 477-491 in "*Biodiversity in Managed Landscapes*", edited by R. C. Szaro and D. W. Johnston. Oxford University Press: New York.