AMERICAN WOOD COUNCIL

June 6, 2011

Doug Hensel
Assistant Deputy Director
California Department of Housing and Community Development
Division of Codes and Standards
1800 Third Street
Sacramento, CA 95833

Re: Proposed Express Terms 2010 CALGreen – 2010 Annual Code Adoption Cycle.

Dear Mr. Hensel:

The American Wood Council (AWC) would like to thank you for this opportunity to comment on changes to the California Green Building Code as proposed by the Department of Housing and Community Development on April 21, 2011. We encourage all departments that use these provisions to support identical language, whenever possible.

Section A4.405.3 – Use of recycled content and renewable materials

While we support, in principle, the addition of renewable resources as an option to recycled content, a further refinement to the language is suggested. Ideally, the user should have an option that allows for selecting either renewable or recycled products, based on equal material value thresholds. As currently proposed, the section still contains a bias for structural steel, which can easily achieve the recycled content value established in A4.405.3.1. Since the intent of this section is to reduce material waste by encouraging the development of new recycled products, please consider limiting qualifying products to only those that serve a non-structural function. Without such a limitation, and given the value thresholds, it is likely that structural steel will be the only recycled product needed in the project to comply with the threshold value. By instead focusing the subsection on recycled non-structural products, there is a greater likelihood that items such as carpeting, shingles, drywall, and many other innovative recycled products will be developed and selected.

For your consideration, the intent of these suggestions can be accomplished in two ways. First, and most preferable, would be to change A4.405.3.1 to non-structural products and change A4.405.3.2 to equal values of 10% and 15% for Tier 1 and Tier 2, respectively. As a second, but less preferred alternative, the proposed language in A4.405.3.2 could be retained, but add “non-structural” to qualify the types of recycled products that can be used.

Section A4.405.4 – Use of building materials from rapidly renewable sources

As previously stated in our testimony, the recognition of “rapidly” renewable resources has been found to be inconsistent with the goals of sustainability and green building rating systems. Most rating systems are moving away from provisions that encourage the use of

"rapidly" renewable resources or products manufactured from agricultural practices. Scientific analysis has demonstrated that constant tilling, seeding, fertilizing, and harvesting of the land, year after year, is far more detrimental to the environmental then prolonged life-cycles associated with natural or managed forest resources. Following is an excerpt from a paper prepared by Alex Wilson and presented to the USGBC Board. A copy of the complete report is attached.

> *Problems with the Existing Credit MRc6*
>
> *The limitation of LEED credit MRc6 to rapidly renewable materials may not be justified from an LCA standpoint. The intent is to reward renewable materials that use solar energy (photosynthesis) to grow and are regenerated on a fairly rapid cycle (less than ten years). While there are some materials that satisfy this criteria quite well (e.g., cork, bamboo, and sisal), some other biobased materials carry fairly heavy environmental and health burdens.*
>
> *Products derived from corn, soybeans, cotton often carry significant environmental burdens from fertilizers, pesticides, energy use in farming and processing, and soil runoff. Such materials may still be very good alternatives to conventional materials, particularly those derived from fossil fuels and mined minerals or metals, but the investigations carried out by Sylvatica suggest that the environmental and health burdens associated with agriculture may not be adequately addressed. Sylvatica's preliminary research comparing agriculture and forestry land uses suggests that the justification for rewarding rapidly renewable products over wood-derived products may not be justified. In short, there may be little scientific justification for continuing to preferentially reward rapidly renewable biobased products over forest-derived biobased products in LEED.* [1]

California agencies should not be promoting a practice which has a marginal or negative environmental impact. There is clearly enough uncertainty that neither rapidly renewable nor agricultural derived products should be given preference over wood products.

We appreciate the opportunity to comment on these proposed changes to the CALGreen code. Please let me know if you have any questions.

Sincerely,

Kenneth E. Bland

Kenneth E. Bland, P.E.
Vice President Codes and Regulations

attachment

[1] **Dealing with Wood and Biobased Materials in the LEED® Rating System.** ***A White Paper to the USGBC Board. Submitted by Alex Wilson. BuildingGreen, Inc.***

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INFORMATION

Dealing with Wood and Biobased Materials in the LEED® Rating System

A White Paper to the USGBC Board

Submitted by Alex Wilson
BuildingGreen, Inc.

Background and Purpose

At the U.S. Green Building Council (USGBC) Board Meeting on January 27, 2006, the Board addressed the issue of certified wood in relation to the LEED® Rating System. Following a discussion of these issues, the Board created a Wood Task Force to examine wood and biobased credits in the LEED Rating System and consider whether there might be an opportunity for changes to LEED credits that would maintain LEED's integrity and environmental leadership while addressing critiques that the rating system is biased against wood as a generic material and respond to the debate raging between the environmental community and the timber industry.. Alex Wilson, of BuildingGreen, Inc., in Brattleboro, Vermont, was asked to chair this effort, and Bettina van Hagen of EcoTrust in Portland, Oregon, and Gail Vittori of the Center for Maximum Potential Building Systems in Austin, Texas, agreed to participate.

Alex Wilson was commissioned to develop this white paper, which was submitted to the USGBC Board of Directors at their New Orleans board meeting on May 4, 2005.

The purpose of this white paper is to review findings of the Wood Certification Meeting held in September, 2005, to examine comments that were received on proposed changes to wood and rapidly renewable credits in the LEED Rating System, and to formulate a proposal for altering the relevant credits in LEED in a manner that is reasonably acceptable to all parties involved. Any proposed changes to LEED would still have to be processed through the comment and balloting steps described in the LEED Foundation Document.

Key Findings from September 2005 Wood Certification Meeting

A special Wood Certification Meeting (previously referred to as the "Wood Certification Summit") was organized by the U.S. Green Building Council and held in Washington, DC on September 29, 2005. The meeting was facilitated by staff from the Keystone Center and included approximately 30 participants representing five forest certification systems (up to three representatives from each), along with members of the LEED Materials and Resources Technical Advisory Group (MR TAG), the Wood Sub-TAG of the MR TAG, and various staff and leadership from the USGBC.

A report on this meeting was distributed to participants and others on 29 March 2006 and is provided as Appendix A of this white paper. A very brief summary follows:

The meeting focused on the following question: "How should USGBC evaluate and utilize different certification systems that will continue to evolve over time?" Following broad-ranging discussion, the facilitators focused the discussion on four possible resolutions or scenarios: 1) maintaining the status quo with the Forest Stewardship Council (FSC) standards as the only certification option; 2) developing a new, unified certification approach; 3) establishing criteria for assessing and qualifying certification programs; and 4) maintaining the full LEED credit for FSC certification and awarding partial credit for other qualifying certification systems. Participants generally viewed the third scenario as a reasonable approach as long as it involves stakeholders in the decision-making process and builds on what has been done to date, where appropriate and relevant. It was pointed out that scenario 4 is a possible outcome of pursuing scenario 3, rather than a strategy itself.

The participants broke into small groups to discuss Scenario 3 in greater detail. These discussions focused extensively on the criteria that could be used to evaluate certification systems—how criteria differ from standards, how to fairly involve stakeholders that are often advocacy groups, how to maintain an open and transparent process, and how to tie this process into a broader discussion of USGBC values.

Various next steps were identified by participants, many of them focused around a matrix of criteria that could be used in evaluating forest certification systems.

The efforts of the Wood Task Force and this report are envisioned as being part of the follow-up process identified through the September 2005 Wood Certification Meeting.

Examining the Environmental Basis for Materials & Resources Credit 6 in LEED

An underlying premise in the LEED MR credits is that rapidly renewable materials are beneficial and should be preferentially used in green buildings. Rapidly renewable materials are defined in LEED as agricultural and other natural materials that grow on a ten-year cycle or faster. One of the tasks of this investigation is to examine how reasonable that premise is.

BuildingGreen, Inc. subcontracted to Sylvatica, a life-cycle assessment (LCA) consulting firm based in North Berwick, Maine, to examine the LCA basis for the rapidly renewable credit in the LEED Rating System. The intent of this examination was to determine whether there is environmental justification for a LEED credit (Materials & Resources Credit 6—MRc6) that rewards the use of rapidly renewable

materials over longer-rotation biobased materials (wood), and by extension, whether there is environmental justification for changing MRc6 into a credit that rewards use of longer-rotation biobased materials, including wood.

The findings of this investigation are included in Appendix B of this white paper; a brief summary is provided as follows:

The LCA methodology that Greg Norris of Sylvatica used examines three areas of concern: impacts on human health, depletion of resources, and impacts on ecosystem health. Of these three categories, the most significant for many biobased products, but the one for which there has been the least data gathered to date, is the impact of land use and land cover change on biodiversity within the category of impacts on ecosystem health. Only one of the leading life cycle impact assessment methods in use internationally explicitly addresses this: EcoIndicator 99.[1] This impact assessment method incorporates empirical data that robustly and clearly shows that agricultural land uses have a far greater negative impact on species diversity than does conversion to a managed mixed-broadleaf forest. These results are summarized in the table below (note results highlighted in red):

Land use category	Potentially Disappeared Fraction (PDF)
Continuous urban	**96%**
Discontinuous urban	**80%**
Industrial area	**70%**
Rail area	**70%**
Green urban	**70%**
Conventional agriculture	91%
Integrated agriculture	91%
Organic agriculture	82%
Intensive meadow	**89%**
Less intensive meadow	**70%**
Organic meadow	**70%**
Mixed broad-leafed forest	10%

Source: EcoIndicator 99 methodology report, version 17 April 2000, Table 5.6, page 67.

In Norris's words: "conventional and integrated agricultural land uses tend to reduce species diversity by 91% relative to natural levels, while organic agriculture reduces species diversity by 82%. By comparison, mixed-broadleaf forest reduces species diversity by 10% relative to the natural state."

However, as Norris explains in his report, the factors in the table above are on a per-acre-year basis, while an LCA comparison of different materials needs to normalize

[1] Earlier versions of the US EPA's TRACI methodology for life cycle impact assessment did include a basic approach to this issue, but it was removed from more recent versions of TRACI.

the impacts by equivalent units of product function provided to the product user, so that we are comparing apples to apples. One challenge Sylvatica faced was coming up with pre-existing data, in the only database containing inventory data for land-use impacts on species diversity that is consistent with the EcoIndicator99 method (the European EcoInvent database), for a building application in which the functional needs could be met either with an agricultural product or with a wood product. We chose to compare natural linoleum flooring (produced with linseed oil from the agriculturally produced flax plant) with hardwood flooring, derived from a managed, mixed-hardwood forest. More specifically, a 2.5 mm thickness of linoleum was compared with 3/4-inch-thick hardwood flooring. Because the hardwood flooring has roughly twice the expected life as the linoleum, the impacts were scaled accordingly.

The findings of the wood and linoleum LCA comparisons, based on the EcoIndicator99 impact assessment method, are shown in a number of graphs in the Sylvatica report, with one chart reproduced here. Hardwood flooring is shown in the left bar, softwood flooring on the right, and linoleum flooring in the center (using rapeseed production as a proxy for flax production). Segments of the bars below the zero line are supposed to indicate "negative" impacts—or benefits. The blue segments below the zero-line, for example, indicate climate change impacts, which are negative due to carbon sequestration. The sizeable red segment for carcinogens below the zero-line in the linoleum bar are due to the fact that the EcoInvent database for crop growth shows phytoremediation (the uptake of heavy metals by rapeseed). Thus, these benefits to the agricultural soil environment need to be evaluated along-side modeling of the eventual fate of the product (in this case linoleum made with linseed oil possibly containing traces of heavy metals) and the possibility for human exposures to the metals.

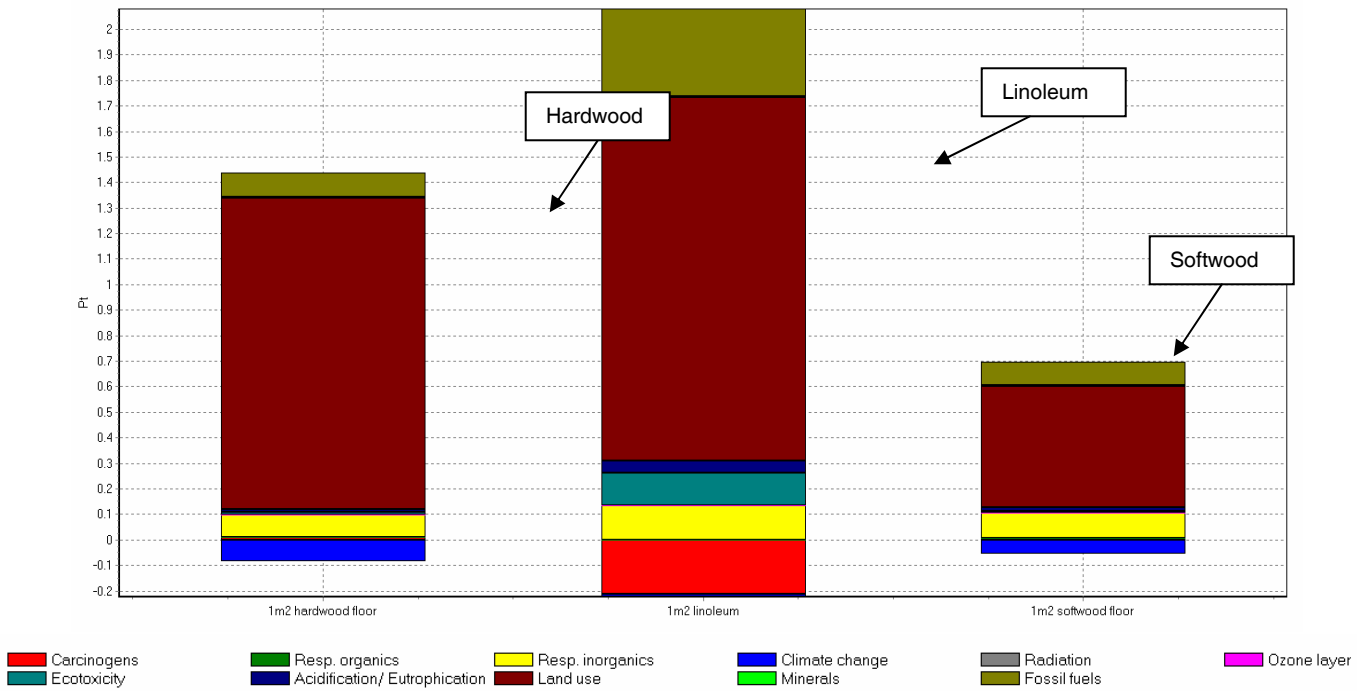


Figure 6: Comparison of hardwood flooring and linoleum production (with rapeseed production used as a proxy for linseed production) based on BEES 3.0 data for production of "generic linoleum," using EcoInvent data and the EcoIndicator 99 method: ***Total Weighted Scores***

The first general conclusion to be drawn from these results is the relative significance of land-use impacts (the large dark brown segments of the graphs) compared with other impact categories. The overall heights of the bars shows the comparative total LCA impacts of these different materials per functional unit of material. A much smaller volume of linoleum is needed to provide the flooring function, compared with wood, yet the total impacts of the linoleum are larger.

Given the evidence presented earlier that land-use impacts of agriculture are eight or nine times as great as forest impacts on a per-acre-year basis, the differences in the environmental performance of wood and linoleum flooring might seem less significant than expected. The reasons for the less than eight-fold difference in total impacts per functional unit (e.g., per square meter-year of flooring) are the facts that the linoleum is thinner than the flooring so that it requires fewer acre-years of production per square meter-year of flooring. Follow-up LCA comparisons of other applications that could be served by either agricultural or wood resources would be very useful, if the data could be found. For example, a comparison of cotton fabrics with rayon fabrics (derived from wood cellulose) used for upholstery might provide a better apples-to-apples comparison. Another possibility might be a concrete form-release agent derived from soybean oil with a such a material derived from pine rosin (if there were such a product).

The bottom-line conclusion drawn from this (fairly limited) investigation is that there may not be a scientifically valid justification for rewarding rapidly renewable materials in LEED over conventional wood products. Clearly, further investigations would be beneficial.

Recommendations for Changes to the LEED Rating System

Based on input from participants of the USGBC's Wood Certification Meeting and input from the LCA investigation conducted by Greg Norris of Sylvatica, the following recommendations are offered to the USGBC Board:

1. Change MRc6 from a Rapidly Renewable Credit to a Biobased Credit

Background

The current LEED credit, MRc6, rewards building materials derived from rapidly renewable materials. The intent with this credit is to encourage the use of resources that are regenerated in less than ten years and are thus highly renewable. The following products can be used to attain this credit: cork flooring (derived from bark of the cork oak, *Quercus suber*, which grows in the Mediterranean and can be sustainably harvested on a nine- or ten-year cycle); bamboo flooring (derived from a species of bamboo, *Phyllostachys pubescens*, that reaches maturity in 4-6 years and regenerates from the root system), sisal wallcoverings, wool carpeting, cotton insulation, and a wide range of building materials that are derived from agricultural products, including cotton insulation, soy-based polyurethane foam insulation, plant-oil-based concrete form-release agents, natural linoleum (made from linseed oil and other natural ingredients), and fabrics made from corn-derived polylactic acid (PLA).

Compared with products derived from *non-renewable* resources, such as petrochemical feedstocks and mined minerals, there is probably good justification to have a credit that rewards renewable materials.

Problems with the Existing Credit MRc6

The limitation of LEED credit MRc6 to *rapidly* renewable materials may not be justified from an LCA standpoint. The intent is to reward renewable materials that use solar energy (photosynthesis) to grow and are regenerated on a fairly rapid cycle (less than ten years). While there are some materials that satisfy this criteria quite well (e.g., cork, bamboo, and sisal), some other biobased materials carry fairly heavy environmental and health burdens.

Products derived from corn, soybeans, cotton often carry significant environmental burdens from fertilizers, pesticides, energy use in farming and processing, and soil runoff. Such materials may still be very good alternatives to conventional materials, particularly those derived from fossil fuels and mined minerals or metals, but the investigations carried out by Sylvatica suggest that the environmental and health burdens associated with agriculture may not be adequately addressed. Sylvatica's preliminary research comparing agriculture and forestry land uses suggests that the justification for rewarding rapidly renewable products over wood-derived products may not be justified. In short, there may be little scientific justification for continuing to preferentially reward rapidly renewable biobased products over forest-derived biobased products in LEED.

Recommendation for Modifying MRc6

It is recommended that MRc6 be expanded to include all biobased materials—including wood—as long as those materials meet certain minimum levels of environmental certification or are grandfathered in as acceptable rapidly renewable materials. We suggest that wood and rapidly renewable (short-rotation) biobased products should be addressed differently in MRc6, as follows:

Until LEED v.3 is released, all rapidly renewable biobased materials (materials that currently comply with MRc6 in LEED 2.2) will be grandfathered into this credit and automatically approved. This includes bamboo, cork, sisal, coir, and all agricultural products.

With wood products, it is proposed that MRc6 will designate two levels of forest certification: Tier 1 and Tier 2 certification. To achieve the MRc6 credit, wood products may carry either Tier 1 or Tier 2 certification. Tier 1 certification systems are considered to be less rigorous than Tier 2 certification systems. Tier 1 certifications will eventually need to be approved for MRc6 based on criteria that will be developed and maintained by USGBC based on stakeholder input, as per the Wood Certification Meeting report summarized at the beginning of this report. It is proposed that certain Tier 1 certification systems would be grandfathered into this approval until the release of LEED v.3, by which time the USGBC will have completed the process of designating acceptable Tier 1 and Tier 2 wood certification systems. The intent of MRc6 would be to approve all wood products that have undergone some level of certification that ensures that they are not derived from illegal logging. Likely certification systems would be the Sustainable Forestry Initiative (SFI) certification with third-party verification, the Canadian Standards Association (CSA) wood certification, and the American Tree Farm System (ATFS).

Tier 2 wood certification systems also satisfy requirements for MRc6; these are more rigorous than Tier 1 systems. Initially, only one such (Tier 2) wood certification system would be recognized by the USGBC and LEED: that of the Forest Stewardship Council

(FSC). For more discussion of Tier 2 wood products certification, see discussion below relating to MRc7.

The threshold levels of these biobased materials needed to satisfy MRc6 are not addressed in this report; there is no current recommendation to change these levels.

2. Modify MRc7 to Establish a Basis for Adoption of Certification Systems but Maintain the FSC Certification Requirement for Wood Products at this Time

Background

The current LEED credit, MRc7, rewards wood-based building materials and products that carry third-party Forest Stewardship Council (FSC) certification. FSC, an international, nonprofit organization, does not actually certify products; rather, FSC accredits independent bodies that carry out such certifications. Currently there are two FSC certification organizations in North America that carry out the vast majority of FSC certifications in the U.S. and Canada: the SmartWood Program of The Rainforest Alliance, a nonprofit organization based in New York City; and Scientific Certification Systems, Inc. (SCS), a for-profit company based in Oakland, California.

The framers of the LEED Rating System recognized that FSC offered the most robust system for ensuring that wood products came from well-managed forests. A highly sophisticated chain-of-custody certification process was created by FSC to make sure that wood specified for a particular project actually came from the well-managed FSC-certified timberlands.

In the ensuing years since FSC was launched (1992) and the LEED Rating System was launched (2000), there has been a great deal of attention paid to the issue of forest certification. FSC has streamlined its certification process to make compliance easier and to permit FSC certification of products containing less than 100% FSC-certified wood fiber. And other forest management certification systems, such as the Sustainable Forestry Initiative (SFI) have been improved to make them more rigorous. The North American forest products industry has been seeking to broaden MRc7 to allow non-FSC certification system to meet the credit.

Recommendation for Modifying MRc7

It is recommended that MRc7 be modified to establish criteria for “Tier 2” certification systems that satisfy the intent of LEED MRc7, while not changing the actual requirements of MRc7 at this time. The argument is that other certification systems could be developed that are equivalent to FSC, or that are even more rigorous. The expectation is that participants of the Wood Certification Meeting held in September 2005 will continue to assist USGBC in its effort to define a set of minimum criteria that any certification system would need to meet before being approved as a MRc7 referenced standard. Until that process is complete, there would be no change in the FSC certification requirement for wood products in meeting MRc7.

In addition, it is recommended that waste agricultural materials, such a particleboard made from wheat straw (stems left after harvesting the grain), be approved *by definition* for MRc7. Such materials currently satisfy both the recycled-content credit

(MRc4) and the rapidly renewable credit (MRc6); if also approved by definition for MRc7, they could satisfy three different credits—thus providing a strong incentive for their use in LEED projects.

The threshold levels of these biobased materials needed to satisfy MRc7 are not addressed in this report; there is no current recommendation to change these levels.

Possible Future Direction for Wood and Biobased Credits in LEED and for Other Materials

In the future, MRc7 could be expanded to include other biobased materials that meet robust certification standards, such as certification of bamboo flooring and USDA Certified Organic standards.. The requirement for rigorous Tier 2 environmental certification programs for biobased materials in order to satisfy MRc7 could be a strong incentive for respective producers to develop certification programs for such materials as bamboo and cork—which would provide a way for specifiers and users to distinguish among different products in the marketplace.

The recommended changes to MRc6 and MRc7 proposed herein represent the first step of what could be an eventual merging of these two credits. Under such a scenario, there might be a single credit for biobased materials with one or two points available depending on the level of certification of those materials. The first point would be earned for biobased materials earning Tier 1 certification or that meet certain prescriptive criteria (cork and bamboo, for example, might be accepted with no certification). The second point could be earned only for products that achieve Tier 2 certification, including FSC-certified wood, other non-FSC wood certification systems that meet USGBC requirements, agricultural products carrying organic certification, and so forth.

Beyond wood and biobased materials, this approach for awarding points in LEED based on certification that is built on a platform of life-cycle assessment could be extended to other raw materials. While very challenging, it is conceivable that a multi-tiered approach, such as suggested here, could be used in awarding LEED points for mined and quarried materials, such as metals and minerals. A certification system for aluminum, for example, could address environmental issues and the welfare of indigenous cultures relative to the mining of bauxite and production of aluminum—thus rewarding environmentally and socially responsible operations.

Making the Changes to MRc6 and MRc7 Outlined Herein

The following process is proposed for vetting and approving this proposal (several of these steps are envisioned as occurring concurrently):

1. Endorsement by the USGBC Board or Executive Committee of the Board of this general approach to modify LEED MRc6 and MRc7.

2. Presentations to USGBC Chapters and members to explain the proposed changes and seek buy-in.

3. Communication about the proposed changes to the green building community and mainstream building industry seeking understanding and consensus.

4. Review and modifications of the proposal by the MR TAG, with input into that process by the Wood Sub-TAG.

5. Review and modifications of the MR TAG-approved proposal by the LEED Steering Committee.

6. Review and modifications of the LEEC SC-approved proposal by the USGBC Board of Directors.

7. Solicitation of public comments and balloting by USGBC membership of the changes to LEED MRc6 and MRc7.

Advantages and Disadvantages of the Proposed Changes to MRc6 and MRc7

Advantages:

1. The proposed MRc6 change would more accurately reward environmentally responsible practices—meaning it will make LEED more environmentally robust. The findings suggest that there is not an environmental justification for rewarding conventional agriculture over relatively standard forestry. MRc6 currently makes the value judgment that rapidly renewable materials are better, from an environmental standpoint, than longer-rotation biobased materials (wood), and this does not appear to be justified by the science.

2. The recommendations find opportunity for improving the environmental performance of the LEED rating system in the intense conflict that has existed over MRc6 and MRc7, and thereby address the chief concern of the timber industry (that LEED is “biased against wood”). This advancement in the rating system may therefore redirect the significant resources that have been aimed against LEED and green building — hostility that is having a negative impact on the advancement of green building practices.

3. The recognition of SFI and other wood certification systems in LEED *might* lessen timber industry opposition to FSC. It could do this by opening up dialog between the environmental community and the timber industry and reducing the adversarial relationship that currently exists. If SFI, CSA, and other certification schemes were allowed to be part of LEED—to participate with the environmental community in this

rating system—the companies in the timber industry and the trade associations serving that industry might feel less of a need to actively fight FSC. Members of the American Forest & Paper Association (AF&PA), for example, might become freer to dual-certify their timber holdings.

4. The change would ramp up the recognition of wood in LEED overall—from one potential point that can be earned to two points. This would improve the competitive position of wood compared with other building materials.

5. FSC-certified wood (clearly the most robust certification system) would be eligible for two points, compared with only one point that is achievable in the present LEED rating system.

6. The change in MRc6 and MRc7 may open the door to other much-needed certification systems for other biobased materials, such as bamboo.

7. For the timber industry, removing the opposition to LEED from their policy agenda might be seen as a significant cost-saving opportunity.

Disadvantages or risks of these changes:

1. This change would open the door to recognition of SFI in LEED—giving significant recognition to a certification system that is less robust than FSC. FSC has played a tremendously important role in transforming the timber industry, both internationally and in the U.S. The fact that FSC certification is the *only* way to get a point in LEED for using wood has given a great deal of attention to FSC. Without FSC, it is clear that SFI and other industry certification systems would not be nearly as strong as they are today. By opening the door to other wood certification systems in LEED, such as SFI, there is risk that FSC will lose some of the market transformation value that it has provided.

2. Some could spin these modifications to LEED as caving in to timber industry demands. This could result in hostility or conflict within the USGBC membership.

Final Thoughts

It is my opinion that the changes outlined in this report make sense and are the right thing to do on many levels. From an environmental standpoint, the changes would correct a problem in the existing LEED Rating System that rewards short-rotation agricultural products more than standard wood, while increasing the overall recognition of wood compared with non-renewable materials. Wood is a building material whose primary input in production is sunlight, whose production sequesters carbon dioxide from the atmosphere, whose production can support biodiversity as well as the biophilia benefits of natural areas, and that can be salvaged for reuse at the end of its intended life and is ultimately biodegradable.

From a political standpoint, the proposed changes have the potential to build bridges to an important segment of the building products community and, in the process, gain wider buy-in to the USGBC's vision of green building. With greater recognition of wood and with a mechanism for other-than-FSC-certified wood to be recognized in LEED, the timber industry's support of less-robust alternatives to LEED might be reduced. As

an ally, the wood products industry could help to further *robust* green building initiatives.

From a fiduciary standpoint, the proposed changes have the potential to reduce expenditures that are needed to counter efforts by the timber industry to block the use of LEED by federal and state agencies. These changes could also improve LEED's competitive advantage in the green-building-program marketplace. Wider adoption of LEED would increase revenues to the Council and further its mission to advance green building.

Achieving the changes outlined in this report will not be easy, however. The arguments will have to be clearly and honestly articulated to the USGBC membership, to the environmental community (which the USGBC cannot afford to alienate), and to the timber industry. The delivery of this message will have to be carefully planned and implemented.

Respectfully submitted,

March 29, 2006

Dear participant:

I'd like to begin by reiterating USGBC's appreciation of your engagement in our dialogue about how we address wood and wood certification in the context of our LEED green building rating system, and for your feedback on the draft report from our September 29 meeting. The conversation has been lengthy and complex, and we appreciate your commitment and dedication.

We learned a tremendous amount about both the general and specific issues by listening to you during the summit last fall and through subsequent communications, and are tremendously appreciative of the role Keystone has played in the effort. From USGBC's perspective, among the overall themes we took away from the meeting was the importance of explicitly connecting our values and mission of market transformation to how LEED addresses wood and wood certification, and to do so in a way that responds to the diversity of the forestry industry and its environmental, economic, and social impacts.

The conclusion of the meeting underscored the need for a transparent methodology for assessing certification programs that are achieving USGBC's aim of market transformation, and finding an appropriate way to include all such programs that support our mission.

Recognizing the importance of this topic, USGBC has created a Board Task Force chaired by Alex Wilson, president of BuildingGreen, Inc., to lead the effort. Our commitment, as affirmed by USGBC's Board of Directors, is to address the outstanding issues related to wood and to reach resolution in 2006.

As a first step, a matrix that identifies assessment criteria was proposed. A draft of that matrix is attached together with the final meeting report which reflects your comments. Per the report, our next steps were defined as follows:

1. USGBC modifies the list of issues in the matrix to reflect the group discussion, as appropriate. (Completed, as attached.)
2. USGBC circulates the revised matrix back to the group for comment. (Current action.)
3. The comments are incorporated as appropriate and a revision is circulated to the group.
4. Additional comments are incorporated as appropriate and a revised version is taken to an independent expert to research and further develop criteria and metrics.
5. These criteria are circulated back to the group and then to the LEED Steering Committee.

Tom Dietsche, LEED Program Manager, is the primary point of contact on USGBC's staff. Please review the attached matrix and share your comments and feedback with Tom by the close of April 25, via wood@usgbc.org. You can also reach him directly at (202) 828-1136 and tdietsche@usgbc.org.

Thank you once again for your support and assistance in this process. We look forward to moving this process forward quickly.

Best regards,

S. Richard Fedrizzi
President, CEO, and Founding Chair

USGBC Wood Certification Criteria Matrix
March 29, 2006

> Average	Governance			Operational						Environmental Issues										Social Issues							Other
				Labeling			Other			Field level (on-the-ground) performance										Fairness			Other				
	Stakeholder balance	Independent of foresters with vested interests	Independent Funding	Labelling	Honest labelling	Chain of custody	Knowledge and Learning Systems	Accreditation: third party, etc.	Recertification	Maintain "natural" forest; biodiversity; invasives mgt	Protect old growth	Retain biological legacies	Genetic Modification	Conversions		Clearcutting limits	Sustainable yields		Avoid chemical use	Prohibit toxic chemicals	To workers	To indigenous people	To contractors	Conservation zones; exceptional value	Public consultation	legal compliance; illegal logging	Civil rights violations	Economic practicality
										Ecological issues						Renewability			Toxicants								
FSC																											
SFI																											
CSA																											
ATFS																											
PEFC																											

The U.S. Green Building Council's WOOD CERTIFICATION MEETING [1]

September 27, 2005

(Note: this report was finalized and distributed in March 2006)

Synopsis and Key Outcomes

On September 27, 2005 the U.S. Green Building Council (USGBC) convened a meeting to discuss issues related to certification of environmentally preferable and socially responsible forestry. The Keystone Center (TKC), an independent and neutral party, facilitated the meeting. Approximately thirty participants attended the meeting with up to three representatives from each of five certifications systems present, USGBC staff and leadership, and members of the Materials and Resources technical advisory group (MR TAG) and Wood Sub-TAG).

The meeting began with a welcome and overview by USGBC leadership followed by a review of the day's agenda and objectives by the Keystone Center. TKC then presented a summary report of its observations based upon its interviews and conversations with a number of stakeholders prior to the meeting. The USGBC presented a draft matrix of wood certification criteria followed by an open conversation among those present. The participants also engaged in both plenary and small group discussions about various scenarios under which the USGBC might move forward with the wood certification issue. The group considered four possible scenarios or trajectories to resolve the issues raised by competing word certification programs: (1) a "status quo" scenario moving forward with FSC only; (2) a "harmonization" scenario involving the development of a new, unified certification approach combining existing efforts; (3) a "recreate" scenario involving the establishment of USGBC criteria to be used to assess existing programs accordingly; and (4) a "stratification" scenario in which the full LEED credit for FSC would be maintained and partial credit to others that qualify would be designated.

At the conclusion of the meeting and after considerable discussion, the most logical next steps were for USGBC to (1) further develop, refine, and improve the matrix presented by Nigel Howard and (2) work on above scenario #3 by:

a. Developing criteria consistent with USGBC's core values and the best current forestry science, possibly with the assistance of a widely credible third party knowledgeable in forest certification issues;

b. Considering stakeholder feedback; and

c. Building on what has been done to date where it is appropriate and relevant.

[1] This meeting summary was prepared by TKC to reflect the range of views and concerns expressed during the discussion; it is not intended to be a verbatim transcript of the meeting. TKC, as a neutral facilitator, has taken no position on the issues raised but rather seeks to elicit and convey accurately the views and comments of the participants that attended the meeting.

I. Introduction *Rick Fedrizzi, U.S. Green Building Council*

Rick welcomed the group (see *Attachment A* for a list of participants and observers) and provided a brief overview of USGBC, LEED, and the impetus for the forest certification meeting. Please see *Attachment B* for a copy of his presentation.

Speaking to his own hopes for the meeting's process and outcome, Rick encouraged a free and open dialogue and expressed USGBC's keen interest in hearing participants' concerns and benefiting from their input and expertise regarding critical questions facing USGBC. He noted that the meeting may need to be the first of several on this topic. He concluded that he hoped the meeting would serve as a first step towards generating a meaningful report to help inform the LEED Steering Committee.

II. Overview of the Day *Peter Adler, The Keystone Center*

Peter introduced The Keystone Center and explained the day's objectives which were to:

(1) Report on Keystone's interviews and observations and develop a set of mutual assumptions going forward;
(2) Achieve the fullest clarity about the dimensions, distinctions, and similarities among the five certification systems; and
(3) To examine alternative resolution scenarios and design a pathway forward.

He said that the foremost goal of the day was to seek to achieve the highest level of clarity possible, with any degree of consensus serving as a secondary benefit that may or may not be realized. The major challenge, he noted, was to consider the question posed at the top of the agenda: "How should USGBC evaluate and utilize different certification systems that will continue to evolve over time?"

He then reviewed the agenda which would include an overview of the day, a presentation by Rick Fedrizzi, a report on Keystone's interviews, a presentation by Nigel Howard on ways that certification schemes might be compared "apples-to-apples, oranges-to-oranges," and a discussion aimed at exploring possible pathways to resolution.

Peter then outlined the following ground rules for the day:

- An expectation of civility and respectful dialogue, which means not interrupting others, not monopolizing speaking time, and not huffing out of the room when you inevitably hear things you disagree with.

- Participants speak first. Invited observers will be given time to contribute later.

- The possible use of a polling tool that can calibrate levels of consensus.

With that, each person introduced him or herself, named their affiliation, and pointed to one thing they either felt especially proud of or especially misunderstood about.

III. Report on Keystone Interviews *Doug Thompson, The Keystone Center*

Doug reviewed the results of the interviews conducted by Keystone leading up to the meeting. They were presented in the following categories:

- Views largely held in common
- Divergent perspectives
- Observations and emerging questions

Please see *Attachment C* for a copy of the presentation.

Discussion

A conversation ensued around the central goal of the meeting. One or more participants expressed the following thoughts:

- Questions about USGBC's decision-making process, what decisions, if any, would be made during or as a result of the meeting, and whether the right decision-makers were present at the meeting.
    - USGBC offered that, based on widespread dissatisfaction with what had resulted from the TAG process, the meeting was intended to identify what USGBC needs to explore and consider in order to help chart a path forward; therefore, the conversation should focus on generating timely, solid information to inform the LEED Steering Committee.
    - Some concern was expressed that a disconnect might result from the lack of Steering Committee presence at the meeting.

- A suggestion that the goal of the meeting should be to consider how USGBC ought to approach certification standards: How should it evaluate existing standards? Should it develop its own proprietary standards, and if so, how would that relate to the certification of existing standards?

- Questions were raised about the role of ANSI requirements in USGBC's decision-making processes. USGBC clarified that the impetus for this meeting was completely independent of ANSI compliance. At the behest of its members and customers and to facilitate their interactions, USGBC recently applied for certification; however, achieving compliance was not considered an issue because USGBC believes that it has always operated beyond ANSI requirements.

- A perspective that an in-depth exploration of USGBC's organizational processes may not be the most valuable and productive use of the group's time, particularly given that other more appropriate venues exist for such discussion.

- A concern that should USGBC move toward maintaining multiple standards, it could result in a prohibitively complex LEED submittal process; it was suggested that, in order to encourage participation in LEED, it is necessary to streamline the process.

- One participant noted that, while the focus of this meeting may be to negotiate between competing certification systems, it is important to clarify that the sub-TAG had a broader mandate--namely, to improve the certified wood credit.

- USGBC underscored that the central question of the meeting was not how LEED should evolve, but rather how USGBC should evaluate forest certification systems.

IV. Wood Certification Criteria: A Draft *Nigel Howard, USGBC*

Nigel presented a draft matrix of certification criteria, distilled down from an exhaustive list of 108 issues generated by the Wood sub-TAG. Please see *Attachment D_Matrix* for a copy of the criteria matrix.

Doug Thompson of Keystone led the group in a discussion of the matrix, focusing on the following general questions:

- Are these the right criteria?
  - Are there any that should not be used?
  - What criteria, if any, are missing?
- What criteria need to be probed further?
- What else would help USGBC toward its objectives?
- What else is important to put on the table?

Discussion

What follows is a summary list of comments offered by one or more participants as individuals and does not imply full group consensus. Key comments included:

- In terms of governance, an appropriate certification team should include conservation biologists, wildlife specialists, etc. Foresters would also be an important stakeholder group to participate. Rather than discussing what parties to exclude, it would be more useful to focus on identifying the various components and exploring the appropriate roles for each.

- A suggestion that reference to independent accredited certification bodies be included.

- That one central challenge is in balancing the need for prescription - to ensure that forests are being managed appropriately - with the flexibility necessary to deal with issues that arise on the ground. For example, it was recommended that, rather than prohibiting genetically modified trees and materials, certification should focus on ensuring that, where such materials emerge, they adhere to defined protocols. Similarly, it was suggested that setting acreage limits for clear-cutting insufficiently responds to best ecological practice on the ground and could produce undesirable results, such as forest fragmentation.

- Consideration of certification criteria must be grounded in USGBC's underlying mission of driving the built environment towards sustainability.

- In light of the apparent confusion regarding differences between the process of various certification systems versus how they actually operate on the ground, an idea would be to include field-level audits within the criteria for assessment.
    - Nigel Howard clarified that on-the-ground performance assessment is intended to cut across all of the issues listed on the criteria matrix, including social components.

- Criteria are more valuable when related to one another rather than viewed in isolation. For example, it could be useful to look at how governance relates to a labeling program's administration.

- The need to consider temporal issues when assessing what is occurring on the ground was underscored by the recommendation that assessments be based on adopted practice versus that which may currently exist only in written policy.

- That "availability" of product should be characterized instead as "accessibility," assessing whether or not there are well-developed tools in place to enable everyone throughout the product's decision chain to access needed resources.

- Rather than speaking to governance that is independent from foresters, the criteria should focus on ensuring that decision-making is independent from funding.

- That chain of custody should refer to tracking the flow and movement of wood through third-party auditing, with labeling as the next step.

- A caution related to labeling, that understanding the percent content behind the label is what enables accurate assessment.

- In addition to third-party auditors, there must also be a system for monitoring those third parties.

- A concern that the characterization of the environmental issues, as written, could exclude every current certification system. The recommendation was offered that the criteria be written in a way that is responsive to regional barriers and focuses

- on over-arching goals such as maintaining biodiversity, supporting key forest values, etc.

- Important to assess the social elements of certification systems in light of the context within which they were developed. For example, social-laden values were suggested to be more present in the FSC standard because it was created to respond to international needs. The CSA standard, on the other hand, may not incorporate these factors as specifically, because it arose within a context in which such values were addressed through other means.

- Single questions should be merged into more global themes.

- Economic considerations, one of the three pillars of sustainability, are not adequately addressed by the matrix.
    - Nigel Howard offered that economic considerations were intended to be internalized under the "Market" heading.

- Although the broad categories were right on, the actual criteria were too international in focus, given that the majority of forest lands in the US are owned by small land owners. Therefore, it is important to focus on considerations relevant to that scale.

- A concern expressed regarding the exclusion of foresters from governance, since foresters bring the most direct information about on-the-ground operations.

- Some wood product companies do not label because their product is not solid/constant.

- Regarding genetically modified trees, rather than banning them altogether, the standards ought to acknowledge that they exist already and create guidelines accordingly. Additionally, it is important to consider that, if landowners cannot harvest GM trees, they will be unwilling to replant them.

- Noted that clear-cutting limits are irrelevant to small landowners. USGBC is encouraged to adhere to a national focus that seeks to create incentives for small landowners to hold on to their land.

- Suggested that, since the question of how best to assess certification systems will continue to arise, it would be most useful to focus on structures and processes, as opposed to individual on-the-ground performance criteria.

- A caution not to assume that a direct line can be drawn between the uptake of the LEED system and overall forest performance in the U.S. An assessment of the real relationship between forests and LEED would be very useful. Such a study would need to consider how much of the anticipated LEED uptake would come from U.S. forests as opposed to international sources.

- A participant privy to a certification criteria matrix compiled through a partnership between World Wildlife Fund International and the World Business Council provided a comparison to the USGBC draft matrix, noting the following:

    - Issues present in WWF/WBC matrix and omitted in USGBC:
        - Transparency of process and results
        - Responsiveness to local issues, standards, and laws
        - Independence from auditors, and separation of the functions of standard-setting and crediting auditors
        - Freedom from conflicts of interest
        - Scientific basis
        - Economic affects (cost, technical feasibility, practicability)
    - Issues present in USGBC matrix and omitted in WWF/WBC:
        - Independence from foresters
        - Ecological issues in detail (as opposed to broad schemes geared towards driving improvement on the ground)
        - Clear-cutting limits (as opposed to a sustainable forestry standard)

- The participant sharing the information felt the comparison highlighted the unique focus of USGBC's matrix on specific ecological issues whereas, others have decided to look more at the process and goals.

- Noted that setting standards for genetically modified trees should be a moot point since they are illegal and would be more appropriately addressed in the general standard under short-rotation, where they would actually appear.

- Urged to consider that much of the nation's wood is grown in more of an agricultural/plantation setting, which does not promote the other arena of forest interests. It was suggested that there has been a lack of prescription around addressing "crop" wood and renewability and this calls into question what is meant by the term "forest."

- One participant felt that an inherent problem in the matrix lay in its implication that all of the certification programs would be scored according to the criteria. A more useful approach would be to focus on defining what matters to USGBC in terms of wood use, and then assessing how various programs measure up qualitatively in terms of those goals.

- Proposed that the matrix lacked a category relating to "Knowledge and Learning Systems;" something that would address the scientific underpinnings of adaptive management and establish the basis for forecasting and monitoring.

- Noting that LEED is a standard based on environmental performance, one participant posited that in order to reflect this goal, the criteria must focus on on-the-ground performance above all else.

- A reminder that the criteria are not intended to be yes or no questions, but rather would serve as a tool to assess how each program performs on a range of considerations.

- One participant mentioned the potential that SFI, CSA, and ATFS might all soon become one process under PEFC; thereby altering the certification landscape significantly.

- How to address SFI's non-certified wood procurement policy and other external wood procurement process integrity issues? (It was later noted that SFI non-certified wood remains part of a system that monitors on-the-ground performance. This aspect of the SFI program was likened to the FSC Controlled Wood Standard with additional monitoring protocols to ensure that general criteria are satisfied.)

- The lack of clarity surrounding what is meant by "clear-cutting limits" was highlighted: Some use the phrase in reference to standards that include a specific limit on acreage, while others use it to refer to qualifications or guidelines to be used when clear-cutting.

- A discussion ensued regarding the standard of 25% of the market that LEED uses to define "leadership"
    - USGBC has indicated to Keystone that further discussion of this issue is not be central to the wood certification issues and it need be addressed.

- Periodicity of auditing was cited as a category missing from the matrix.

- The importance of transparency was underscored.

- Suggested that field-level audits of on-the-ground performance must be applied to social issues as well.

- Recommended that USGBC's goal should be to develop a full list of criteria and then assess the performance of various programs according to that metric, thereby determining relative market leadership achieved by each.

- The following holes in the matrix were noted, with the caveat that a program need not encompass 100% of the criteria to the maximum in order to qualify for leadership:

    - Transparency and reporting
    - Accreditation process
    - Appeals
    - Legal compliance
    - Economics

- Suggested that "Independent of foresters" be altered to read "independent of vested interests" or "…of a dominant interest."

- The following specific considerations were suggested for inclusion under "Environmental Issues:"
    - Conversions
    - Biodiversity

  - Water and soil
  - Conservation zones
  - Exceptional-value forests
  - Invasives management
  - Clear-cutting limits that specify constraints (as opposed to forbidding it altogether)

- Criteria should be developed based on what would produce market transformation, according to USGBC's goals.

- The LEED Steering Committee should grapple with questions surrounding the international vs. national focus of assessment.

- The draft matrix may contain too many categories that are difficult—if not impossible—to measure or compare. One response might be to concentrate on key requirements for forest certification systems. [2]

- The following additional concerns were raised about the criteria:
  - The issue of appeals must be addressed.
  - There must be consistency in application of the standard.
  - "Market" should not be included as a category, because it is an outcome, not an assessment criterion.

- Keystone observed that there were some central tensions threading through the conversation, among them:
  1. Scale - International vs. National (or regional/local)
  2. Means – Prescriptive on-the-ground measures vs. Process (ISO type) measures
  3. Nature of Provider - Small Landowners vs. Large

Discussion

- Suggested that "Market - Push (recognition of achievement) vs. Pull (high standards with incentives to pull more of market into greater levels of achievement)" be added as a fourth dimension tension.

- There was some discussion about the wording of item #2, above; with participants discussing whether "Process" should be called something else, such as "performance-based" or "responsive."

[2] A suggested example of such key requirements provided subsequent to the meeting by a participant is the CEPI Comparative Matrix prepared by the independent consultant Rupert Oliver (Mr. Rupert Oliver, Director, Forest Industries Intelligence Limited, 19 Raikeswood Drive, Skipton, North Yorkshire BD23 1NA, United Kingdom, Tel/Fax: +44 (0)1756 796992, Email: editor@hardwoodmarkets.com). A summary overview of this matrix and its findings are available at www.cepi.org > Publications > Forest > Matrix: Finding your way through Forest Certification Schemes.

- Recommended that consideration of the nature of the provider should also encompass product type, not just forest size.

- One suggested construct: The goal of the criteria should be to distinguish between the bad actors, those in the middle of the road, and the over-achievers. One option would be to make reference to the existing accreditation as a prerequisite, and then layer FSC on top to recognize the over-achievers.
    - In response to this suggestion, one participant cautioned that it is not possible to determine whether extra-achievement is present based on the existing certificate, and therefore it would not be advisable to choose one certification system over another.
    - Another participant seconded the sentiment that the presumption that one standard is superior to another is not a valid starting place. Instead, the group should seek unbiased criteria by which to assess each certification system.

- Consider wood certification questions within a broader context, making sure that the same value set is referenced across all materials so as to avoid creating a bias against wood products.

- One participant felt that the matrix should appropriately reflect USGBC's principles and encouraged USGBC to continue to work to shape criteria that fit its core values.

- Do not lose sight of the differences within each certification system, which can vary widely by country and region.

- Suggest that the assessment vis-à-vis the criteria be based on a qualitative description as opposed to ranking scale of 1-10. The group could decide upon three or four descriptors under each parameter to inform the assessment.

- A quick update was offered regarding various certification systems' current methods of determining compliance, and to what extent the certification systems are pass/fail.
    - SFI - Uses a pass/fail assessment; if any indicator is not achieved, certification is prohibited unless it can be fixed quickly (within a month or so).
    - FSC – Uses criteria that are consistent world-wide; compliance is generally determined on pass/fail basis, however preconditions or mandatory actions are sometimes employed. Correction of nonconformance is allowed within a specified timeframe.
    - CSA – Allows for applicants to attempt to address major or minor non-conformist issues.
    - PEFC- Has pass/fail assessment using procedures that are used for certification internationally (ISO Guides 62,65,66).
    - ATFS – This standard was described as being most appropriate for the small, mom-and-pop scale land-holder. Corrective action requirements pertain to the ATFS group certification program.

  - Variance between systems is essentially in regards to what is considered a major vs. minor non-conformance.

- Suggested that, given that the consensus document submitted by the Wood Sub-TAG this past July is similar in content to the criteria currently in discussion, that document could still be useful in providing a general template.
  - Another participant offered the view that the Wood sub-TAG consensus document essentially constituted a "lowest common denominator" set of questions that each program found acceptable and thereby shows the similarities, not the differences, between programs.

- One participant expressed the perspective that social issues constitute the most important theme in the matrix, and therefore each system should be reviewed based on the details of those considerations. The following reflections were offered by representatives of each system:
  - CSA – It was indicated that this system focuses on bringing the public into the process, with special attention to protecting Aboriginal treaty rights and values. Results are added to 17 existing requirements.
  - FSC – Public consultation was said to run deep within fundamental basis of this system.
  - SFI – This system was said to involve working with local stakeholders, , labor organizations and experts in the social arena to strengthen and make more explicit its social standard
  - PEFC – It was noted that, under this system, public consultations take place for certification audits at Forest Management Unit (FMU) level, for standard development at national level and for PEFC endorsement at the international level.
  - ATFS – Based on Montreal Protocol standard. Appropriate for small landowners. Public comment period is part of certification process.

- The conversion issue, how to address turning natural forest into tree plantation, was cited as a key topic for the group to explore.

- This led to a discussion surrounding how useful or appropriate it would be for the group to undertake a point-by-point comparison between systems. Some felt that such an exercise would not be a productive use of the group's time, while others felt it was important to at least identify and catalog the key areas of difference.

- The facilitators requested the group to identify sticking points or areas of friction and the following aspects were noted for future consideration. There was not full agreement within the group that this was an agreed upon purpose of the meeting or a useful exercise. Some participants felt this was outside the scope and intent of the meeting and declined to participate in generating the list; others felt it was a useful exercise. Hence, the items noted below should not be construed as a list that is either complete or a consensus-based:

  1. Chain of custody
  2. Conversion of land from forests to plantations.
  3. Clear-cutting

4. Old growth
5. Confusion about tracking
6. Ecosystem maintenance
7. Process issues:
   a) Performance vs. systems-based approach – Using direct vs. indirect indicators affects the kinds of questions asked in arriving at a solution.
   b) Flexibility built into the language (i.e. "to the extent possible," "if consistent with your goals," etc.) and the resulting expectations for compliance.
   c) Variability – the degree to which the program is attempting to be consistent versus allows variability within a region or between regions.

- Once these issues had been identified, the discussion of their relevance continued. One participant felt it was not useful to cite these issues until the criteria had first been identified. Others felt that USGBC needed to be educated by those out in the field regarding how key issues play out at the ground level, and they saw value in identifying a list of critical issues and then moving to asses the relative performance of each system.

- One participant noted that the values of USGBC membership have changed over time, suggesting that the current matrix is more a reflection of the technical committees' composition than of the current membership.

- Some sentiment was expressed that the people generally tapped to weigh in on how various systems measure up vis-à-vis a list of criteria or issues are themselves advocates of one system or another; therefore, the outcomes can be very predictable. Instead, it might be more useful to commission an independent assessment. It was also suggested that USGBC go into the field to assess the processes first-hand.

- USGBC reminded the group that they acknowledged that some people felt the decision to solely reference the FSC standard might no longer reflect the current situation and this is one of the reasons for this meeting. The question at hand is: How should USGBC move forward?

V. Conflict Trajectories and Resolution Scenarios ***Peter Adler, The Keystone Center***

The balance of the day was then invested in illuminating conflict trajectories and evaluating resolution scenarios. The following four potential resolution scenarios were posed to provide a starting-point for discussion:

- *Status Quo* – moving forward with FSC only

- *Harmonize* – develop a new, unified certification approach

- *Recreate* – establish criteria and assess existing programs accordingly

- *Stratify* – maintain the full LEED credit for FSC and award partial credit to others that qualify

A. Resolution Scenarios

- The discussion began with an exploration of the option of USGBC developing its own proprietary rating system through which all existing systems would be assessed to determine compliance. The following comments were offered:
    - This is a good idea as long as stakeholders are involved in developing the system.
    - If USGBC were to take this on, the foundation would need to be laid in science, with a full exploration of all of the details behind each issues area. Given the scope and resource-intensiveness of such an undertaking, USGBC would be better served by focusing on developing an appropriate framework to compare existing systems, without developing its own proprietary system.
    - Because the certification system landscape will continue to be fluid, it is necessary to develop an assessment mechanism that can adapt to apply specific performance expectations to the ever-evolving programs.
    - USGBC needs to develop criteria that enable it to create a transparent and user-friendly level playing field for system assessment.

- Clarification was requested regarding USGBC's decision-making process for implementation of whatever criteria may be developed. The following explanation was provided:
    1. LEED Product Committees would submit proposals for MR credit 7, which might recognize different certification systems for approval against the USGBC's criteria.
    2. The Technical Advisory Group would assess and recommend back to the Committees their assessment of the degree to which the criteria were met.
    3. The Product Committees may choose to accept or not accept the TAG recommendations – the TAGs are advisory.
    4. This amended or new rating system incorporating this credit would then be submitted to the LEED Steering Committee, which would debate and approve the rating system or remand it back to the Product Committee for further consideration.
    5. It would then pass to the LEED Steering Committee for approval to go to Public Comment.
    6. A first round of public comment would follow.
    7. This could result in further revision.
    8. Any revised version would then go for a second round of public comment.
    9. The result after the second round of public comment would come back for approval to ballot.
    10. Finally, USGBC's 6,000+ members would have the opportunity to submit an up-down vote of approval of the ballot draft.

- One participant offered feedback on the four potential resolution scenarios offered above as follows:

  - Scenario #1, "Status Quo," is in fact not a starting point, but rather could be one potential outcome of #3, i.e. the end result could be that USGBC decides to move forward with something consistent with the current status quo.
  - Scenario #2 would be impossible to implement, and therefore is not a valid option.
  - Scenario #3 is where the group should focus its discussion.
  - Scenario #4 again would actually be an outcome of #3 as opposed to a strategy in itself.
- Suggested that the starting point should be developing criteria that are consistent both with USGBC's core values and with forestry science.

- Noted that a recent "Forest Dialogue" had hired consultants from both sides to develop an extensive report assessing many of the same questions. Additionally, the UK government has assessed various certification schemes. Both of these existing resources could be of value to USGBC's decision-making.

- In summary, participants generally seemed to view Scenario #3 as a reasonable resolution, as long as: 1) it involves stakeholders in decision-making, and 2) it builds on what has been done to date, where appropriate and relevant.

B. Small Group Discussion

Participants convened in small groups to discuss strengths, weaknesses, possible consequences, and probabilities of success of Scenario #3. The following comments were reported back to the larger group:

- Criteria vs. Standards –While the criteria can remain very general, developing them into actual standards would be a much more elaborate and detailed endeavor.

- If USGBC chooses an assessment consultant, it should do so in consultation with the involved stakeholders, particularly with the forest certification systems to be assessed.

- USGBC should take a leadership role through a fair and transparent process or risk having its reputation undermined.

- Because the major players are advocacy groups, any resolution developed is likely to be rejected by whoever may be perceived as the "loser." Therefore, a major challenge will be ensuring that people feel the process was just, even if it did not result in their desired outcome.

- This is an opportunity for USGBC to demonstrate its credibility by involving stakeholders in the process.

- At some point, USGBC will need to make the ultimate decision regarding the nature of the criteria.

- Whatever process is developed must make use of currently available information.
- USGBC should develop and distribute an overarching value statement.
- One component of this process should be providing a complete update on all of the certification systems.
- If this process is successful, it could gently raise the bar for other certification systems.
- The process will take time to reach completion and implementation, which is ultimately a benefit because it will allow the necessary system-restructuring to occur in the meantime.
- This effort could result in the creation of a broader model for USGBC selection processes.
- Based on the original formation of USGBC and LEED by some forward-thinking environmentalists, there is a residual reluctance to allow others into the system; therefore, an internal discussion within LEED is in order.
- The large number of stakeholders on this issue presents a central challenge for the process.
- Not everyone is fully informed about the current status of the various certification programs, nor is everyone is up-to-date about LEED itself. It is necessary to identify who should be responsible for providing that education. There is a need to explore the relationship between forest certification and the LEED market approach.
- At some point, USGBC leadership is going to have to identify its stance on value-related issues. Perhaps it would be beneficial to convene a smaller group with a few representatives from each certification system, as well as members of the LEED steering committee, to delve more into the details of the criteria.
- It is important for USGBC to understand that it will never please everyone and set its expectations accordingly.
- The outcome may be that different certification systems rise to the top on different issues, with the possibility of ultimately leading towards the harmonization of the best practices of each into one.
- In order to achieve success, USGBC must first set good criteria; however, the second and equally important challenge will be convincing the public that the criteria are good.
- Systems must be assessed on a region-by-region or country-by-country basis.

- In order to have an honest and productive conversation of the criteria, they must be separated from consideration of the actual standards. Many issues and elements should be included within the criteria as topics for consideration, with the standards questions following only after the criteria are determined.

  - A brief discussion ensued regarding this suggestion:
    - Some expressed agreement with the proposition of including a broad range of issues in the criteria and weighting them later.
    - It was cautioned that if there are many categories and each system is asked to submit reports for each category, external parties should be involved in review and assessment of those submissions.
    - A clarification was offered that there are two tiers of criteria: the super-set, which includes the laundry list of all issues that could be adopted and the subset, which would be used to actually evaluate each system. It was suggested that USGBC's mission is most reflected in the subset, of key issues for USGBC and therefore the focus should continue to be on identifying the 30 or 40 issues that comprise the subset.
    - USGBC was urged to incorporate the additional issues that had been raised throughout the day, as well as others that may have been overlooked.
    - A question was raised regarding the method that would be employed to eliminate potential criteria from the superset to establish the subset.
    - It was suggested that the group move forward as follows:
      a. Begin with the 30 issues already included in the matrix,
      b. Add the additional issues raised in the day's meting,
      c. Circulate for feedback,
      d. Revise as needed, and
      e. Move forward.

C. Round-Robin Assessment Concept

A brief discussion ensued regarding the proposal that one or more forests evaluated by each certification system be subjected to an on-site inspection by representatives from the other systems and from USGBC. The following comments were offered:

- If this were to take place, the site(s) would need to be selected by the other certification systems, not that system to be assessed.

- This proposal would be prohibitively expensive and logistically too challenging to implement. Additionally, many studies have already been done to compare systems, making the concept redundant. Furthermore, the utility of site-visit assessments is limited in any case by the fact that they rely on a very few data points that are easy to skew.

- The comments that the implementation cost of such a proposal would be too high to consider and that data already exists to inform decision-makers regarding what is taking place on the ground were reiterated by other participants.

D. Next Steps

Proposed actions:

1. USGBC modifies the list of issues in the matrix to reflect the day's discussion, as appropriate.
2. USGBC circulates the revised matrix back to the group for comment.
3. The comments are incorporated as appropriate and a revision is circulated to the group.
4. Additional comments are incorporated as appropriate and a revised version is taken to an independent expert to research and develop criteria and metrics, and to recommend prerequisites and minimum passing score.
5. These criteria are circulated back to the group for comments and then to the LEED Steering Committee

The group offered reactions to the above proposal. Comments included:

- It is important that participants have the opportunity to add additional concerns.
- It would not be useful for the group to engage in a repetition of the Wood Sub-TAG's process of word-smithing and tinkering.
- USGBC seems to be receiving somewhat contradictory messages: On one hand, they are being asked to step up and make decisions; but at the same time, they are expected not to make decisions that any stakeholders might not agree with.
- An expert independent party should be enlisted to take on the task of revising the criteria. Some believe this could be an essential element of moving forward productively.
- Some of the on-going conflict could be avoided with further clarification of the process.
- All participants should have the opportunity to comment on the overarching headings; however, only select individuals equipped to do so should be enlisted to evaluate how each system actually measures up on the details. Then that assessment should be opened for feedback and rebuttal. USGBC has the only ultimate right and responsibility to make a final decision.
- USGBC should focus on achieving consensus on the broader topic points. These should then be presented to the various systems for feedback regarding where and how they think the bar should be set. That gives the systems themselves the opportunity to explain their rationale and provide needed information and feedback to USGBC.
- Any body within USGBC that makes final decisions on qualifying standards for LEED must be balanced and transparent. A context paper on forest certification and credits would be an important part of any such decision-making.

- The request was made that USGBC respect the multiple time constraints faced by stakeholders.

VI. Closing Remarks *Rick Fedrizzi, U.S. Green Building Council*

Rick expressed his gratitude to all present for taking time out of from their numerous responsibilities to participate. He noted that forest certification, from his perspective, has been the single most contentious issue in USGBC's history, something all the more remarkable given that it deals with only one credit within a single program. Finally, he reiterated that USGBC as an organization is committed to market transformation and emphasized that the very fact that the forest certification landscape has changed so dramatically in the past five years is evidence of progress.

List of attachments sent with November 18 e-mail

A. List of Participants
B. Rick Fedrizzi's Power Points on USGBC
C. Doug Thompson's Power Points on Pre-Meeting Interviews
D. Nigel Howard's Initial Draft Matrix

Appendix B.
Life Cycle Perspectives on Wood and other Biobased Products
April 2006

Gregory A. Norris
Sylvatica / New Earth

This report provides a summary of approaches and findings from life-cycle assessment and related holistic evaluation methods as they characterize and compare agricultural and forestry land uses. The intended purpose is to support deliberations about the environmental justifications for LEED® credits related to the use of wood and other biobased materials in buildings.

The report consists of three sections, which address the following topics:

1. An overview of how Life Cycle Assessment (LCA) methods evaluate impacts on ecosystems and the depletion of resources
2. A summary of how LCA methods and databases account for land-use impacts; and a review of the information in existing life cycle inventory databases related to land use impacts of agriculture and forestry
3. An investigation and comparison of life cycle assessment results for representative agricultural products and forest products

1. Overview of how Life Cycle Assessment Addresses Ecosystems and Resources

Methods of life cycle impact assessment have tended to converge towards consistency in having three "endpoint categories" or areas of concern:[1]

- human health
- ecological/ ecosystem health, and
- depletion of resources

It appears that the purpose of the existing LEED credits related to wood and other biobased materials is to address a combination of resource-related and ecosystem-related impacts. As LEED takes an increasingly holistic approach to the impacts of building life cycles, these concerns about ecosystem and resource impacts are joined by concern about human health impacts. Thus, this section provides a brief discussion of each of the three endpoint categories within LCA, and how they are addressed by the databases and LCIA methods.

[1] For example, O Jolliet, R Müller-Wenk, J Bare, A Brent, M Goedkoop, R Heijungs, N Itsubo, C Peña, D Pennington, J Potting, G Rebitzer, M Stewart, H Udo de Haes, B P Weidema (2004) "The LCIA Midpoint-damage Framework of the UNEP/SETAC Life Cycle Initiative." *International Journal of Life Cycle Assessment* 9(6):394-404.

Human Health

Pollutant releases from processes throughout the life cycle have the potential to impact human health, both directly and indirectly. Direct impacts are those that stem from human exposure to the pollutants, through such exposure pathways as inhalation, ingestion,[2] and skin contact. Indirect impacts stem from exposures that result from environmental changes caused by pollution. Examples of the latter include climate change, which can increase the incidence of vector-borne diseases and famine; and depletion of the stratospheric ozone layer, which can increase the risk of skin cancer and cataracts.

Methods of life cycle impact assessment (LCIA) take into account a broad spectrum of direct and indirect human impact categories. For example, two recent and comprehensive LCIA methods are the US EPA's "TRACI" method, and the "EcoIndicator 99" method developed by a consortium of researchers in Europe. Both of these methods include modeling to take account of the following categories of human health impact:

- Cancer via pollutant releases to air, water, and soils
- Inhalation of primary and secondary particulates
- Inhalation of ozone ("smog")
- Climate change
- Stratospheric ozone depletion

In addition, each of the two methods includes another category for human exposure to non-carcinogenic substances.

A difference between TRACI and the EcoIndicator 99 method is that the latter includes modeling that relates all of the human health impacts to a final measure of human health damage, for which the units are "disability-adjusted life years lost", or DALYs. This is a measure widely used by the global health community for aggregating mortality and morbidity (health status impairment) impacts.

Resource Depletion

Resources can be categorized in various ways as renewable versus non-renewable, biotic versus abiotic, mineral versus non-mineral, etc. Renewable resources are sometimes referred to as "flow" resources, and sustainable use of these resources means using or harvesting these resources at a rate not exceeding their capacity to regenerate, and not otherwise degrading the capacity of the resource, so that it can provide an ongoing annual flow of resource services or output.

In contrast, non-renewable resources are referred to as "stock" resources. These resource stocks are natural endowments that are not naturally increased (at least not over time scales less than millennia). LCA modeling of stock resource depletion is poised to

[2] Ingestion can happen through a variety of pathways, including eating vegetables and fruits onto which the pollutant has deposited; eating fish whose flesh is contaminated with bio-accumulating substances such as mercury, drinking liquids that contain the pollutant, and – important for small children – hand-to-mouth contact.

change in the near future, as follows. Historically, depletion of stock resources has been assessed at the point of resource extraction. This approach makes sense for depletion of fossil fuel resources: when fuels are combusted, this is an irreversible conversion and loss of their energy availability. The consumption of fossil fuels is evaluated in LCA in one of two ways: either on an equal basis per energy unit of fuel combusted, or by taking into account the relative scarcity of the different fossil fuel resources.

By analogy, metal resource "depletion" has been modeled as occurring at the point of mining or extraction of the metal or ore. However, upon further reflection, we see that for metals, subsequent processing (refining, beneficiation) makes these material resources *more* available (more concentrated), not less; and we observe the potential for many rounds of recycling and reuse. For this reason, resource depletion analysis for metals is likely to shift to a focus on dissipative uses or discard of metals as the point at which depletion actually occurs.

Non-fuel abiotic resources include metals, as well as aggregate, sand, limestone, gravel, and gypsum; these non-metal minerals might be referred to as construction minerals. Since construction minerals are so abundant at least on a global scale (though local depletion of aggregate is becoming an issue of concern for regions of industrialized countries), most impact assessment methods in LCA focus on depletion of metals.

<u>Ecological/Ecosystem Health</u>

We can identify different ways in which life is lost when humans have adverse impacts on ecosystems:

1) Global biodiversity, species extinction
2) Local biodiversity, simplification of local food webs and ecosystems, local species loss
3) Premature deaths of individual animals or plants

It seems that at least to the present time, most people tend to care about the loss of non-human life primarily in terms of loss of species, globally or locally (levels 1 or 2 above), whereas it is only for human lives that premature mortality of individuals is an endpoint of explicit concern. Thus, one potential (and used) metric for assessing and comparing different levels of ecosystem damage is the number of species present at a local or regional or global level, before and after the disturbance of processes associated with product life cycles.

There are other metrics and viewpoints possible. One alternative is to interpret ecosystem impacts in terms of loss of ecosystem function, ecosystem services, or resource productivity. This more anthropocentric, "resource-oriented" view of ecosystems identifies functions or services valued by humans, which the ecosystems provide, such as carbon sequestration, water purification, etc.

The leading, recent methods of life cycle impact assessment each address ecosystem health in different ways. The table on the next page summarizes the sub-impact categories relating to ecosystem health that are included in each of the major methods.

Table 1: Ecosystem Health Impact Categories in Major LCIA Methods

Method	**Impacts included which relate to Ecosystem Health;** ("D" indicates that the method aggregates ecosystem damages for the indicated categories to an overall sum of ecosystem damages, measured in physical units)
EcoIndicator 99	Land Use (D) Ecotoxicity (D) Eutrophication (D) Acidification (D) Climate Change Ozone Depletion
CML 2000	Ecotoxicity Acidification Eutrophication Climate Change Ozone Depletion
TRACI 2006 (US EPA) (earlier versions of TRACI did take land use into account, in a simple way)	Ecotoxicity Acidification Eutrophication Climate Change Ozone Depletion

Note that only one of these three leading methods, EcoIndicator 99, includes a system for assessing the importance of land use. Further, only this method attempts to express the impacts of land use on the same quantitative, model-based, physical (not to say certain!) basis to support aggregation and inter-comparison of importance. The basis used for this damage aggregation is loss of species diversity, at a local and regional level. It is generally not considered feasible to attempt to estimate the impacts of specific product life cycles on a global extinction impact (Goedkoop and Spriensma 2000), since this would require information on the exact location of the last members of a species.

The Importance of Land Use / Land Cover Change

Habitat alteration is in many regions the most important way that human activity impacts ecological health, and the diversity of species at a local and regional level (Muller-Wenk 1998). Habitat degradation has also been frequently cited by biologists during the past 10 years as the single most important cause of the "Sixth mass extinction" currently underway at the global level; these same reports have often cited the global loss of biodiversity as the most serious environmental problem or issue by far.

Thus, we now turn to consider how LCA is increasingly dealing with this important pathway from product life cycles to ecosystem and species impacts.

2. How LCA methods and databases account for land-use impacts, and what these models and data show about agricultural and forest land uses

Life cycle assessments begin by constructing a model of the long chain of processes involved in making it possible to produce a product, use it, and dispose of it. For each process, the LCA makes use of models that estimate typical or average "environmental interventions" per unit of process output. These "environmental interventions" are most typically flows of pollution to the environment and flows of resources from the environment. They can also include impacts other than pollution and resource mass flows, such as noise, radiation, and the transformation and/or occupation of land. The computation of total "interventions" per unit of product service over the life cycle is called the life cycle inventory analysis.

The next step in the LCA is a life cycle impact assessment (LCIA). This stage makes use of models that relate the quantities of interventions to different categories of impact. For example, all greenhouse gases are weighted and aggregated in terms of their total potential to trap heat in the atmosphere over a period of typically 100 years.

Thus, in order to assess land use impacts of product life cycles, we require two separate things: first, life cycle inventory data that provide quantitative estimates of land use per unit of process output, for large and diverse sets of processes; and second, life cycle impact assessment models that can interpret and aggregate these inventory data to provide summary assessments of total land use impacts over product life cycles. The requirement for both inventory data and an LCIA model that can make use of the data presents a sort of "chicken and egg" problem: what good is an LCIA method addressing land use if there are no life cycle inventory (LCI) data relating to land use, and why expend all the resources required to develop LCI data on land use until there is an accepted LCIA method? This problem contributed to the inability of LCA to address the important category of land use impacts, until recently.

In 1999, a group of researchers released a major new set of LCIA methods, called "EcoIndicator 99" which was updated in 2001.[3] During the same time period, the Swiss government made a major investment to consolidate and update a variety of LCI databases whose creation it had funded during the prior 20 years; this new database, named "EcoInvent 2000" is the single most important and comprehensive LCI database currently available in the world,[4] containing data for over 1500 different unit processes.

Fortunately, as part of the creation of the EcoInvent database, the project leaders decided to develop LCI data on land use that was consistent with the EcoIndicator 99 methodology for land use impact assessment. This combination of LCA resources makes it possible, for the first time, to include land use impacts in comprehensive LCA comparisons of products. We make use of the EcoInvent 2000 database and the EcoIndicator 99 method for the bulk of the remaining work presented in this report.

[3] Goedkoop and Spriensma 2001. Available, with companion reports, at http://www.pre.nl/eco-indicator99/ei99-reports.htm .
[4] See www.ecoinvent.ch

2.1 Agricultural and forest products in the EcoInvent 2000 Database

For agricultural processes, up to three different types of production are addressed, for a variety of crops:

- IP: Integrated production
- E: Integrated production with "Extensive plant protection"—as opposed to "intensive plant protection" (Extensive protection means no fungicides, insecticides or growth regulators.)
- O: Organic production

The LCI data generally relate to production in Switzerland during the late 1990s.
The inventories generally include the processes of soil cultivation, sowing, weed control, fertilization, pest and pathogen control, harvest and (where relevant) drying of the crop. Machine infrastructure and a shed for machine sheltering are included. Inputs of fertilizers, pesticides and seed as well as their transport to the farm are also considered, as are the direct emissions of chemicals onto the field.

The following agricultural plant products are included in the EcoInvent 2000 database:

- Barley grains (IP, E, O)
- Barley straw (IP, E, O)
- Fava beans (IP, O)
- Fodder beets (IP)
- Corn ("grain maize") (IP, O)
- Corn silage ("Silage maize") (IP, O)
- Corn starch
- Hay (IP, E, O)
- Potatoes (IP, O)
- Potato starch
- Peas (IP, O)
- Rape seed (IP, E)
- Rye grains (IP, E, O)
- Rye straw (IP, E, O)
- Soy beans (IP, O)
- Sugar beets (IP)
- Sunflower (IP)
- Wheat grains (IP, E, O)
- Wheat straw (IP, E, O)

The EcoInvent database also contains LCI data for a variety of forest products. For the growing and harvesting of trees, the data pertain to Germany and Scandinavia. Data are available for German hardwood (beech), German softwood (spruce), Scandinavian hardwood (mixed) and Scandinavian softwood (mixed). The forestry modeling includes the impacts associated with establishing the forest stand, tending it, and (for the German

forests) development of the forest roads. In addition there is data for cork harvesting from cork oak (Portugal).

Forest products in the database include:

- Sawn timber (hardwood vs. softwood; planed vs. not; air-dried vs. kiln-dried)
- Plywood (indoor use vs. outdoor use)
- Glued laminated timber (indoor vs. outdoor)
- Fiberboard (Hard vs. soft)
- Medium density fiberboard
- Oriented strand board
- Particleboard (indoor use vs. outdoor use vs. cement-bonded)
- Laminated timber element, transversally pre-stressed, for outdoor use
- Three-layered laminated board
- Wood pellets
- Wood wool

2.2 Summary of the EcoIndicator 99 methodology for land use impact assessment

The EcoIndicator 99 (EI99) methodology includes models for ecological impacts through the following pathways:

- Release of ecotoxic substances
- Release of acidifying and eutrophying substances to air and water
- Damage to ecosystem quality caused by land-use

The damage measure for all ecological impacts is expressed in units of area-years (m2*yr). These units come as the product of R*D*A, where R is the decrease in species richness, as a (unitless) fraction of the number naturally present, D is duration in time, and A is area.

The method in EI99 is based on work originally done by Muller-Wenk (1998) and Kollner (1999). The modeling takes account of both local and regional effects of changes in land use. Local effects occur within the land area for which the use is changed; regional effects occur outside the area that is used or converted, because the size of the untouched natural area is decreased. This latter effect is due to the species-area relationship, which is a non-linear positive correlation between the size of an area and the species diversity.

The EI99 method accounts for two ways that processes in product life cycles may impact land use: conversion of land use from one state to another; and occupation of land in one state, which prevents it from returning to its natural condition. Species diversity measures in EI99 focus on the impacts on diversity of vascular plant species, as these are essential providers of adequate food supply and other habitat characteristics.

2.3 Relative impacts of agricultural and forest land uses on biodiversity

As noted in the previous section, the EI99 method takes account of the impact of land conversion and land occupation in the diversity of vascular plant species in both the local (converted) area and the surrounding region. The results are expressed in units of potentially disappeared fraction (PDF) of species.

A summary of the PDF associated with different land use categories appears in the table below. Here the PDF is expressed relative to the species diversity on land in Switzerland which is not in the mountains ("lowlands") and is left in its natural state. As seen in the table, agricultural land use has a much greater (negative) impact on species diversity than does conversion to a mixed broadleaf forest. Conventional and integrated agricultural land uses tend to reduce species diversity by 91% relative to natural levels, while organic agriculture reduces species diversity by 82%. By comparison, mixed broadleaf forest reduces species diversity by 10% relative to the natural state.

Data on potentially disappeared fraction (PDF), relative to land in Switzerland not in the mountains ("lowlands") left in its natural state:[5]

Table 2: Land Use Impacts by Category

Land use category	**Potentially Disappeared Fraction (PDF)**
Continuous urban	96%
Discontinuous urban	80%
Industrial area	70%
Rail area	70%
Green urban	70%
Conventional agriculture	***91%***
Integrated agriculture	***91%***
Organic agriculture	***82%***
Intensive meadow	89%
Less intensive meadow	70%
Organic meadow	70%
Mixed broad-leafed forest	***10%***

[5] Source: EcoIndicator 99 methodology report, version 17 April 2000, Table 5.6, page 67.

3. Impacts of Biobased and Forest-based Products from a Life Cycle Perspective

In this final section we consider how life cycle assessment methods comparatively assess the impacts of biobased and forest-based products. This is done in two stages. First we describe how the *system scope* of LCA includes and then augments the assessment of impacts that are directly related to the site of resource production (e.g., the farm or forest). In this section we also consider how LCA *normalizes* impacts to attempt to compare alternative product systems that deliver an equivalent level of product-based (or service-based) function to the user. Next, we present the results of a simple comparison of processes involved in the life cycles of two alternative flooring materials: linoleum (which is made with linseed oil) and wood flooring.

System Scope and Impact Normalization in Life Cycle Assessment

Consider a hypothetical acre of land, which might by managed by humans in a variety of ways, including agriculture that leads to biobased materials, and forestry that leads to forest products. By putting this acre of land into either agricultural or forestry use, a number of inputs are required and a number of outputs and outcomes result. A logical way to express and quantify these changes in inputs and outputs is in terms of impacts per year per acre, and by comparison with a "no human activity" alternative that would leave the acre of land in its natural state over the long term.

Inputs to the agricultural and forestry processes include materials such as seeds, fertilizers, pesticides, and fuels used in harvesting equipment; they include the requirement for the equipment itself; and they also may include the direct use of natural resource inputs such as water used in irrigation. The outputs and outcomes from each of these land uses include:

- The product outputs
- Pollutant releases to air, water, and land from cultivation and harvesting processes
- Impacts on the habitat qualities of the land that lead to changes in the number and type of species present
- Impacts on other kinds of ecosystem services, such as water purification, carbon sequestration, etc.
- Accumulation or depletion of resource stocks, such as build-up or erosion/loss of topsoil

These inputs and outputs/outcomes of the alternative uses of the hypothetical acre of land are expressed graphically in a figure on the next page.

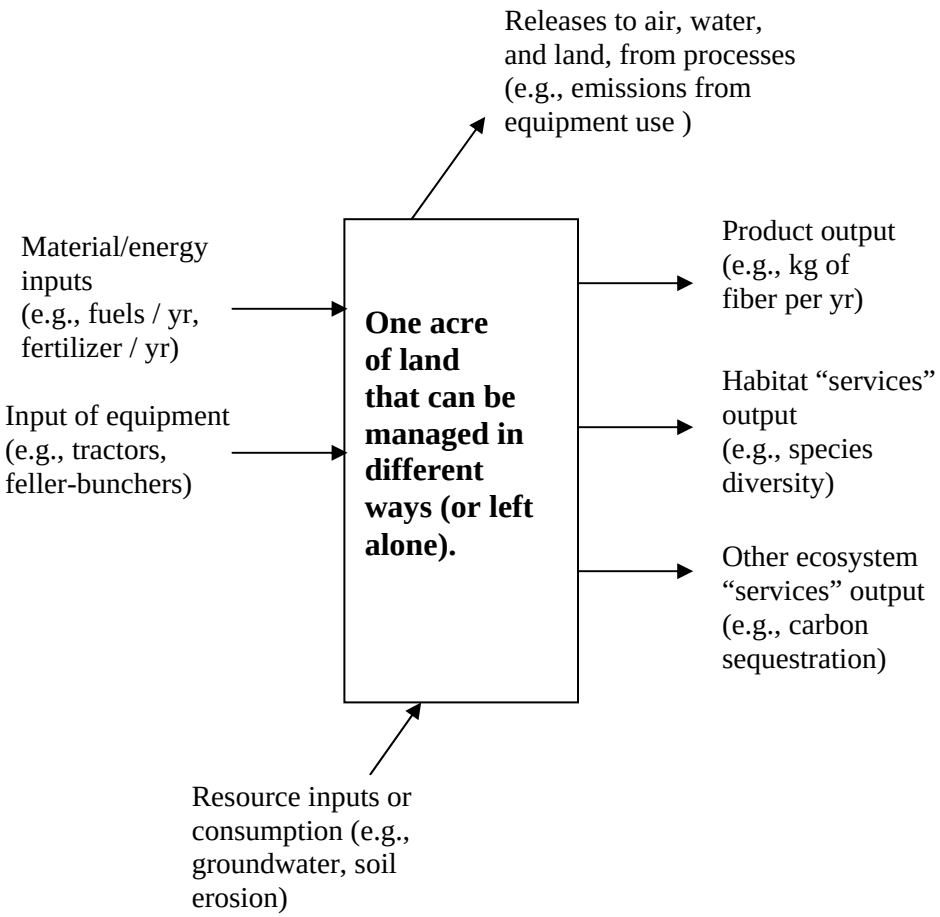
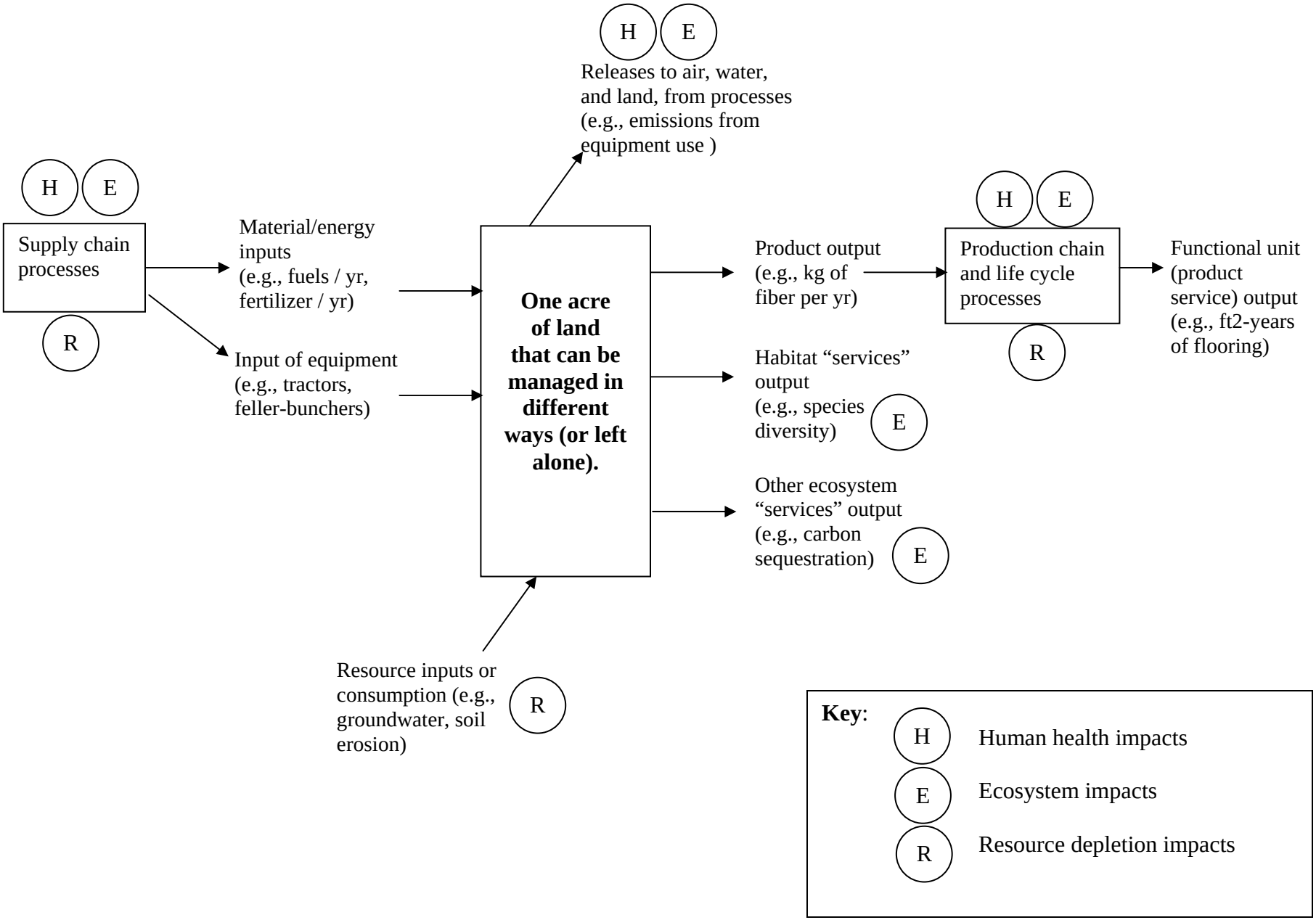


Figure 1: Schematic of impacts of 1 acre of agricultural or forest production

The life-cycle perspective starts with the scope of analyses described above, and then augments it in several ways. First, as we have seen, the life cycle impact assessment (LCIA) step models and aggregates the possible consequences of the input and output flows in terms of impacts on human health, ecosystem health, and resource depletion. Next we note that the material and equipment inputs to the production processes have extended supply chains of off-site processes. The fuels must be extracted, refined, and transported, for example – and each of the processes in these supply chains may have its own impacts on human health, ecosystem health, and resource use/depletion. Finally, we note that the product leaving the farm or forest is an input to a chain of "downstream" processes to produce the final product, and to support its use throughout a life cycle. For example, the wood must be sawn, planed, kiln-dried, shipped to a user, and installed in the building. Then during the use phase it may receive or require repeated surface treatments. Finally at the end of its useful life it may be disposed of in a landfill or incinerator, or recycled for other uses. And each of these production and life cycle processes may require inputs with supply chains, and may have their own impacts on human health, ecosystem health, and resource depletion or use. The fully-expanded system scope described above is illustrated in the figure on the next page.



Finally there is the task of setting the basis for comparison. From the preceding discussion we might contemplate comparing the impacts of the "life cycles" of one acre of forestry with one acre of growing linseed oil. This is possible, but would not be conventional within LCA. The conventional intent of an LCA is to compare alternative product systems that deliver equivalent function to a user. Thus, rather than compare the two life cycles on a per-acre or per-acre-year basis, we would compare the amounts of activity from all life cycle processes in each of the cases that are required to deliver an equivalent product-related function or service, such as one square meter of flooring for a 20-year period. The functional-related basis of comparison, such as 20-square-meter-years of flooring, is called the "functional unit" in LCA parlance.

Example Comparisons of Linoleum and Wood Flooring

As a simple example to illustrate and investigate the relative order-of-magnitudes of the land-use and other life cycle impacts of a biobased product and a wood-based product, in the context of an equal functional unit, we consider hardwood flooring and linoleum.

LCA data for "Generic Linoleum" is found in BEES 3.0, based on 1995 study by Jonsson, Tillman, and Svensson of Chalmers University in Sweden. This study pertains to linoleum that has a thickness of 2.5mm, weighing 2.874 kg per m2 of flooring. Of this, 23% (670 g) is linseed oil. An additional 31% (877 g) is "wood flour" (sawdust). Other material inputs to linoleum production include limestone, jute backing, pine rosin, and cork flour.

The BEES manual reported the following input quantities for the cultivation of linseed (flaxseed) per acre:

- Nitrogen fertilizer: 31 lb/acre
- Phosphorous fertilizer: 15 lb/acre
- Potassium fertilizer: 12 lb/acre
- Pesticides: 0.4 lb active compounds/acre, with 20% lost to air
- Diesel tractor: 279 Btu per lb of linseed produced, which means 150 KBtu/acre

The output of linseed (flaxseed) for this process is reported as 536 lb/acre. Based on Canadian government data, Canada is the world's largest producer and exporter of flaxseed, representing almost 80% of world trade.[6] Flaxseed is grown in the western provinces of Manitoba and Saskatchewan.

The BEES manual further reports that energy inputs are required to press and process the linseeds to obtain the linseed oil, but the quantities of these energy inputs are not reported. The manual reports that these energy inputs were allocated on a mass basis between linseed oil (34%) and linseed cake (66%). The BEES manual cites a useful life for linoleum of 18 years.

The BEES manual also contains data on Marmoleum linoleum produced by Forbo Industries. This data cites a mass of 2.9 kg/m2 for the flooring material, with mass fractions of 25% linseed

[6] http://www.agr.gc.ca/mad-dam/e/bulletine/v15e/v15n17e.htm

oil and 39% sawdust. In the Forbo study, 15% of the burdens for wood processing were allocated to the production of sawdust, based on the economic value of the sawdust. No statement is made concerning data source or allocation assumptions for linseed oil production.

Recall that in order to assess the impacts of land use on habitat and species diversity, we need life cycle inventory data for this impact category as well as an impact assessment method that takes the inventory data into account. This combination is provided by using life cycle inventory data from the EcoInvent 2000 database, and assessing the results using the EcoIndicator 99 method for impact assessment. We do this in the present example.

The EcoInvent database contains data for rapeseed production, which we use as a proxy for flaxseed or linseed production. (We also compare the land-use impacts of other possible proxy crops on a per-kg basis later in the analysis.) The Chalmers study cites 670 grams of linseed oil per m2 of linoleum, which requires 3 x 670g = 2kg of linseed. Note that linseed oil production yields a co-product of linseed cake; searching in the web did not yield data on linseed cake prices; economic allocation is preferable to mass-based allocation of burdens based on the ISO standards. In the present example, we leave out allocation, assigning the full share of the land-use burdens to the production of the linseed for linseed oil.

BEES 3.0 does not contain information for wood flooring. Based on a quick search in the web, we use product characteristic data from Forest Insight for solid hardwood flooring[7] which reports 3/4-inch beech, oak, birch and ash flooring at 13 kg/m2.

From the EcoInvent database we use "sawn timber, hardwood, planed, kiln-dried, at plant." The data for planed, kiln-dried hardwood is on a volume basis in the EcoInvent database. Thus, since an inch is 0.0254 meters, then 1 square meter of 3/4-inch flooring is 0.019 m3 of hardwood. Hardwood flooring is sold with guarantees of 25 years or more; we assume a lifetime of 35 years in the present example.

As a sensitivity analysis, we also include an assessment of pine flooring using "sawn timber, softwood, planed, kiln-dried, at plant."

[7] http://www.forestinsight.ns.ca/index.htm

Comparison Results

First we conduct a very simple comparison of the land use impacts of the required quantities of wood and linseed oil, in order to gauge their relative importance in an order-of-magnitude way, normalized to the functional unit. Note that by comparing the hardwood product with just the linseed required to produce the linoleum, we are clearly not performing a true LCA comparison! Rather, we are making very conservative assumptions in favor of linoleum, just to get an initial sense of the orders of magnitude of land-use impacts for these two products when they are normalized on a functional unit basis. Later we will add the production of the other major material inputs to linoleum production, for a more comprehensive comparison.

Since the wood flooring is assumed to last roughly twice as long as the linoleum flooring, we compare the production of 0.019 m3 of planed, kiln-dried hardwood with the production of 2 x 2kg = 4kg of rapeseed (in place of linseed).

The comparison results are shown in the figure below. They lead to several conclusions. First, the hardwood production (based on processes for "intensive hardwood forestry" in the EcoInvent database) and agricultural production (based on processes for rapeseed production) turn out to be nearly identical in terms of the habitat-related impacts after they are normalized to the basis of an equivalent functional unit, using the EcoIndicator 99 method. The greater intensity of impact per year due to agricultural production is offset in this analysis by the fact that the forestry takes place over a longer time. We also see that the production of rapeseed leads to generally higher impacts on other impact categories such as carcinogens and ecotoxicity than does the production of the hardwood flooring. Finally, we observe that in the EcoIndicator 99 methodology, the impacts of the land use for these two processes (and their supply chains) are the dominant impact category within the total, weighted impacts.

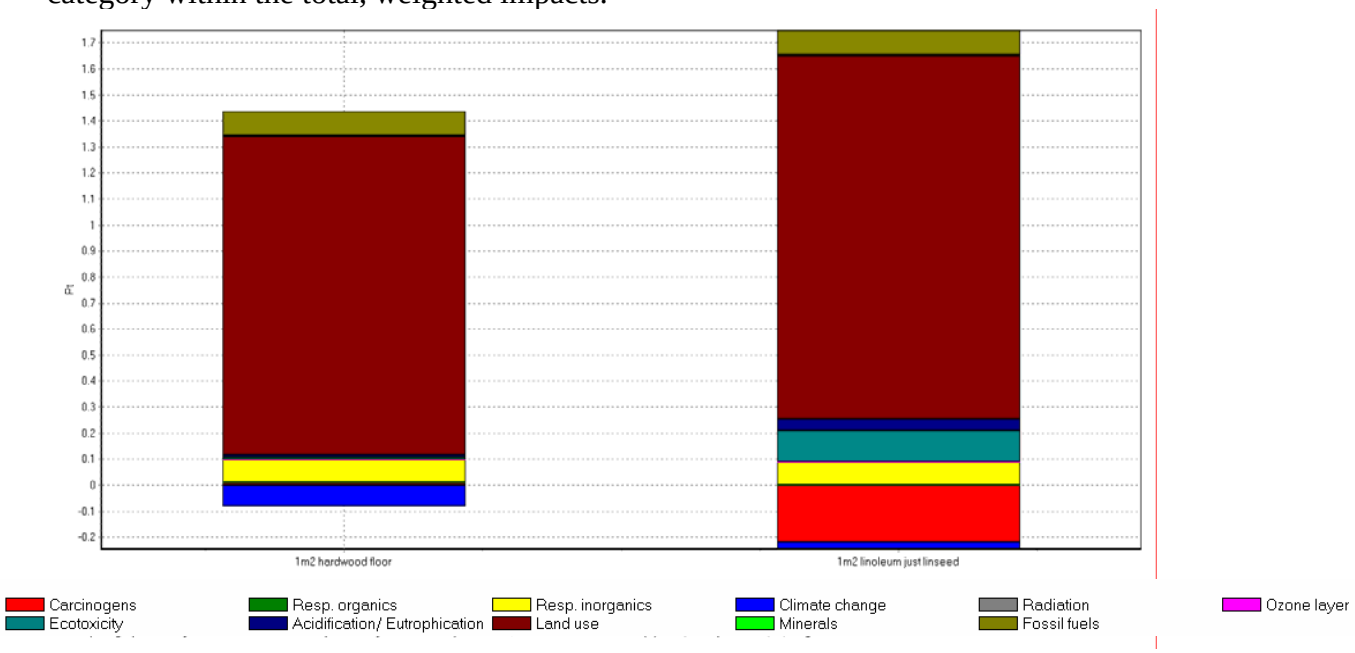


Figure 3: Comparison of hardwood flooring and the quantity of linseed (with rapeseed as a proxy) required to produce equivalent functional unit of linoleum flooring, using the EcoIndicator 99

As a sensitivity analysis, we add into the above comparison the production of an equivalent volume of planed, kiln-dried softwood. Those results appear below, and show the benefits of a shorter growing time for softwood lumber, on the land-use impacts that take into account both the intensity and the duration of the habitat-related impacts.

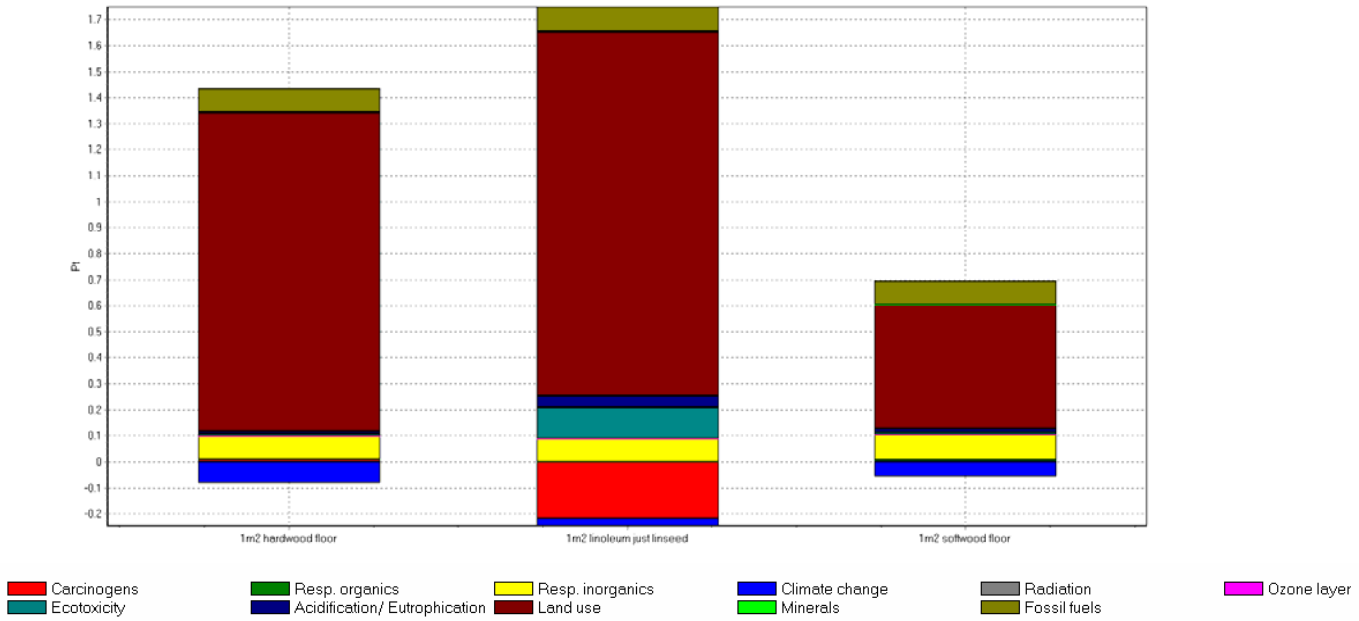


Figure 4: Comparison of hardwood flooring and softwood flooring and the quantity of linseed (with rapeseed as a proxy) required to produce equivalent functional unit of linoleum flooring, using the EcoIndicator 99 method

A second sensitivity analysis compares the impacts of five different crop types, on a per-kg output basis. These crop types are rape seed via extensive production, rape seed via integrated production, sunflower seed via integrated production, soy beans via integrated production, and soy beans via organic production. The results, displayed in the figure below, indicate that the land-use impacts of producing 1kg of these three crops were all within 15% of each other. They also show that land use related impacts dominate the total normalized results for all of the crops studies.

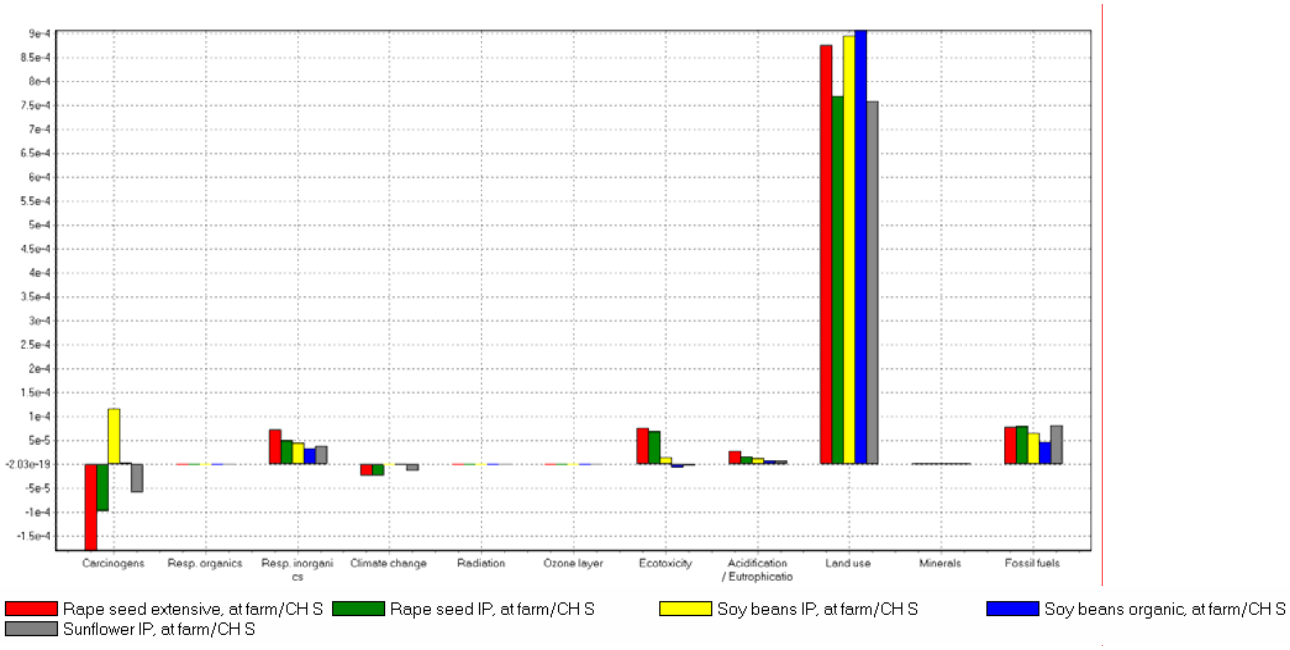


Figure 5: Comparison of production of 1 kg of oil crops, using the EcoIndicator 99 method

Finally, we use data from the BEES manual to add processes for the production of other major material and energy inputs to the production of linoleum. Specifically, we add modeling of the supply chains for the production of the following requirements to linoleum production, based on BEES data, on a per m^2 basis:

Limestone	509 g
Sawdust	877 g
Pine rosin	224 g
Acrylic lacquer	10 g
Electricity	2.3 MJ
Natural gas	5.2 MJ

We do not model the production of inputs of cork flour, pigment, and jute backing, due to lack of close proxy data in the EcoInvent database.

The results of the comparison indicate that the production of the linseed (modeled using rapeseed production as a proxy) was the process making the greatest contribution to the total impacts as characterized by the EcoIndicator 99 method. Adding the production of the other inputs did not dramatically change the results as compared with those shown in Figure x for just the production of the linseed (rapeseed) required to manufacture the linoleum. Thus, we also see, indirectly, that the results of the comparison of the hardwood flooring with the linoleum is sensitive to the assumptions made regarding allocation of the burdens of linseed production between linseed oil and linseed cake.

The results shown here need to be interpreted with caution because:

- We have used rapeseed production as a proxy in the absence of EcoInvent data for linseed (flaxseed) production
- We have allocated the full burden of the linseed production to the oil production, and
- We lack data from BEES to model the energy inputs required to produce oil from seed, so these burdens are missing

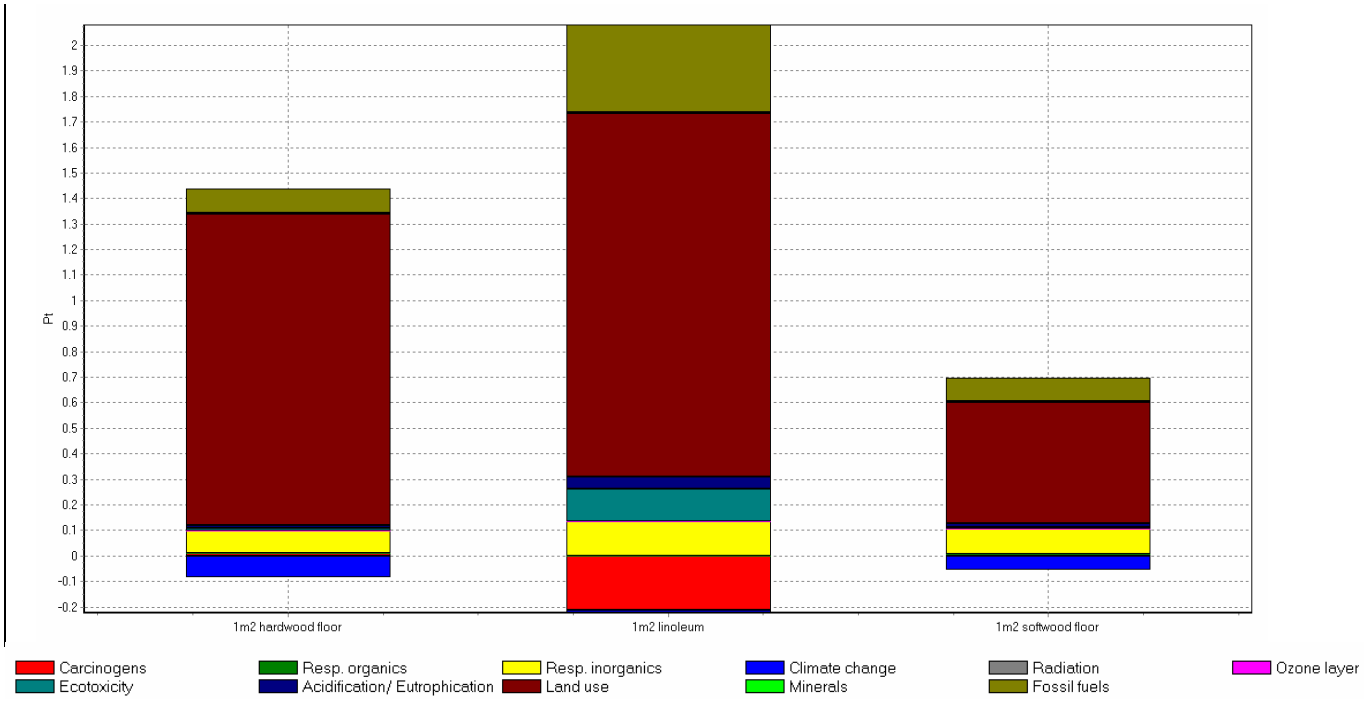


Figure 6: Comparison of hardwood flooring and linoleum production (with rapeseed production used as a proxy for linseed production) based on BEES 3.0 data for production of "generic linoleum," using EcoInvent data and the EcoIndicator 99 method: **Total Weighted Scores**

On the next page, we present the more detailed results behind the summary results of Figure 6. Figure 7 shows, for example, that for all but two impact categories – cancer on which the phytoremediation impacts are dominant, and releases of respiratory organics (VOCs)—the wood flooring options have a more environmentally positive profile (lower burdens). Recall that the climate change impacts are negative which indicates carbon sequestration.

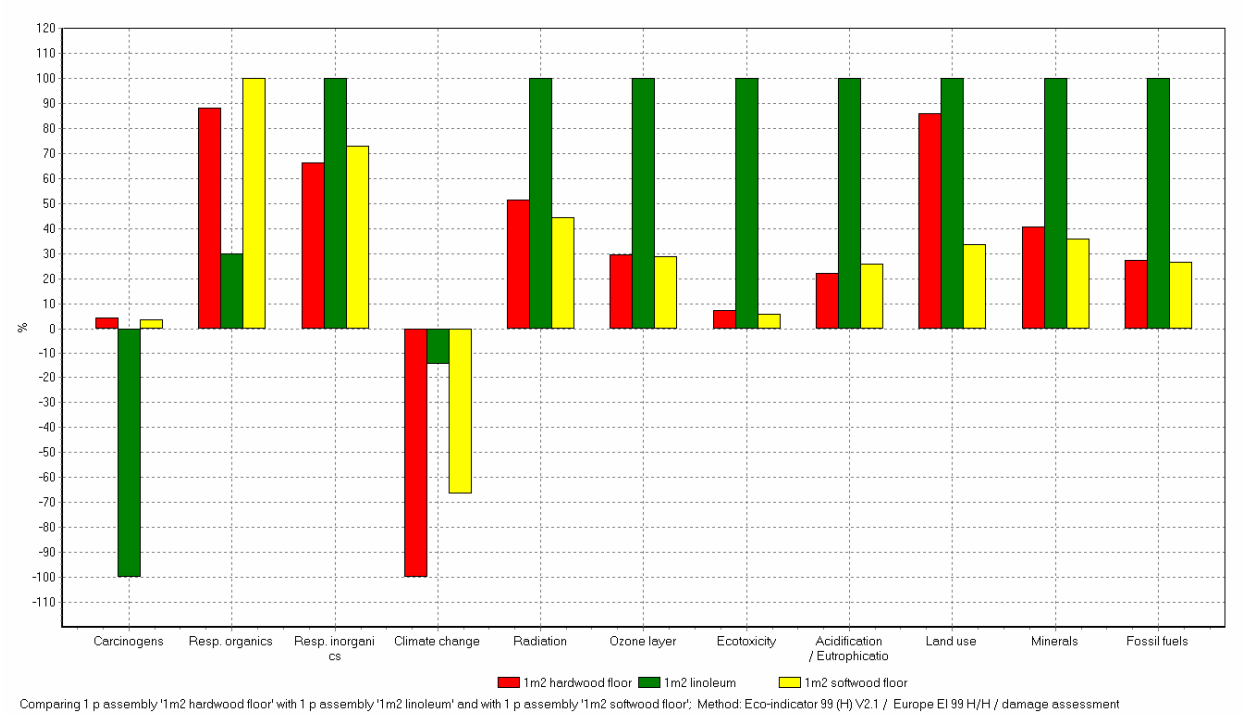


Figure 7: Comparison of hardwood flooring and linoleum production (with rapeseed production used as a proxy for linseed production) based on BEES 3.0 data for production of "generic linoleum," using EcoInvent data and the EcoIndicator 99 method: **Damages per Category**

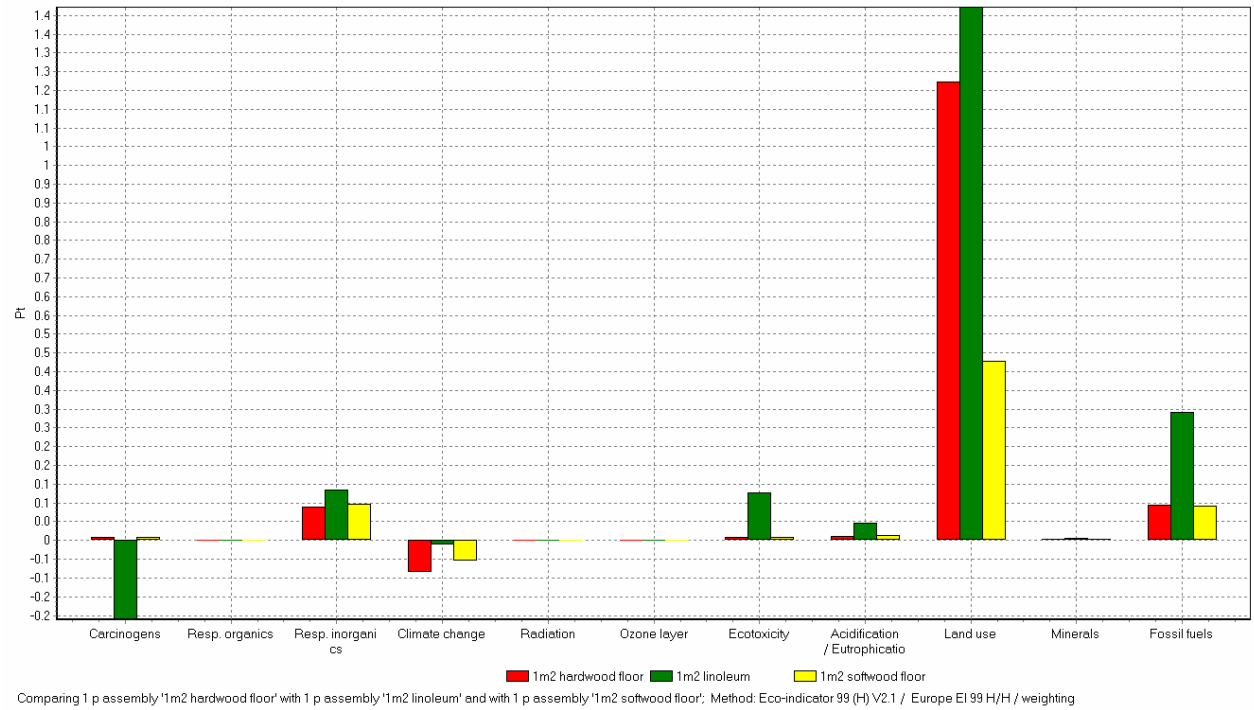


Figure 8: Comparison of hardwood flooring and linoleum production (with rapeseed production used as a proxy for linseed production) based on BEES 3.0 data for production of "generic linoleum," using EcoInvent data and the EcoIndicator 99 method:
Normalized and Weighted Scores per Category