

Proceedings Report

Land Use Change Analysis and Assessment Workshop

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INTRODUCTION

Broad consensus on how to best quantify direct land use change (LUC) and land use classification for United States row crops is lacking. Different data sources and methods of calculation are used, resulting in a considerable range of LUC estimates. These estimates are instrumental to resource management decision-making and policy development, directly impacting farmer and rancher livelihoods, biodiversity, water security, food security, energy security, and other critical ecosystem services. Therefore, developing a consistent LUC quantification evaluation framework that meets broad stakeholder needs is critical to reduce risk of impairment of natural and managed ecosystems and support resiliency moving forward.

Key barriers to developing consensus on LUC assessment methodologies include fluid and inconsistent definitions of foundational terms, varying accuracy of data sets over time and location, variation in analytical timeframes, methods for reporting results (e.g., net vs gross LUC) and previous land use baselines (managed vs unmanaged), lack of access to protected information, models that are expensive and under continual revisions, difficulties with remote sensing in differentiating between lightly managed lands, minimal independent validation of reported accuracies, and a failure to consider the social dynamics of rural communities.

There is a lot at stake when it comes to LUC assessment.

Several critical economic, ecological and cultural outcomes impacted by LUC assessment:

- Access to global markets for soybeans and other commodities
- Farm and ranch economic viability
- Agriculture policy and regulations related to the sodbuster provisions, swampbuster provisions and topics connected to the Endangered Species Act
- Conservation and biodiversity protection programs
- Carbon markets and farm-gate financing (for example, risks associated with operational loans to farmers)

A two-part workshop was held to convene a multi-stakeholder group focused on the state of the science and key gaps in LUC assessment, data, and methodologies. It included stakeholders from academia, industry, non-profit organizations, conservation groups, the public sector and producer groups. This workshop series was one of the leading contemporary efforts to gain consensus among diverse stakeholders. Each workshop participant came with their own individual and/or organizational interpretation of land use change definitions, classifications, and needs which impacts their work. Despite those differences, the workshop invited all participants to come together and work towards common goals, outlined in the [Objectives](#) section of this Proceedings Paper.

The first session of the workshop focused on introductions, reflecting upon the workshop Primer Report, understanding the details of LUC definition variation, and breakouts discussing the interests of participants in LUC and what expertise they bring to the group, along with setting a framework for assessing quantification methods. The second session began with summarizing Workshop Session 1 and discussing feedback given by participants. Then, breakout groups were formed to discuss four use cases for LUC quantification and forming working groups,

ending with action plans and reflections on the workshop overall. This Proceedings Paper - Land Use Change Analysis and Assessment Workshop provides a summary of the [Objectives](#) of this project, a high-level overview of [Workshop Session 1](#) and [Workshop Session 2](#), key findings of [Workshop Session 1](#) and [Workshop Session 2](#), an overview of [Working Group Use Cases](#), and [Action and Next Steps](#) of the project.

OBJECTIVES

The purpose of the Land Use Change Analysis and Assessment Workshop was to convene a multi-stakeholder group focused on the state of the science and key gaps in LUC assessment, data, and methodologies. The intent was to (1) establish shared definitions of key terminology and criteria for ideal LUC frameworks, (2) create a shared vision for a LUC quantification framework that meets the needs of diverse stakeholders, and (3) develop an action plan for achieving the shared vision and form working groups to begin implementation based on those proposed working group use cases.

These workshops were the initial steps of a broader initiative to provide the scientific, social, and peer-reviewed publications to build common ground and improve accuracy in assessment, access to consensus-derived methodologies, and needed dialogue that will enhance understanding in LUC quantification.

WORKSHOP SESSION 1 OVERVIEW

Workshop Session 1 set the stage for participants to introduce themselves, become oriented with the current state of the science in LUC, and participate in breakout sessions to discuss current gaps and needs for more accurately assessing LUC.

The first session of the [workshop agenda](#) began with introductions of the project's coordinators, moderators and speakers, and an overview of which organizations/groups were represented among participants. Next, an overview of findings from the Primer Report was presented, followed by breakout sessions with seven groups to introduce participants to one another in smaller groups with open-ended reflections on the Primer Report and discussion about what each person brought to the table and what their stake is in ensuring LUC is accurately quantified. Comments and ideas were captured on Miro, a whiteboard platform which allows for real-time and asynchronous note-taking and strategy mapping (<https://miro.com>), for preparation in sharing with the full group. After the breakout session ended, each group reported their key takeaways from the Primer Report and highlights of their discussion regarding their individual roles and investment in LUC.

Dr. Keith Kline, distinguished scientist of Oak Ridge National Laboratory, presented on current definitions and inconsistencies in LUC, followed by a panel on the State of the Science featuring Dr. Doug McCorkle (Sustainable Environmental Consultants), Sarah Olimb (World Wildlife Fund), Dr. Nathan Torbick (Hummingbird Technologies), and Dr. Alyssa Whitcraft (NASA

Harvest/University of Maryland). Panelists described their professional experiences with LUC quantification and described challenges they see to more accurately describing LUC.

A second breakout session consisting of the same seven groups as the first breakout session focused on setting a framework for assessing quantification methods. The following questions led the conversation:

1. From the “State of the Science” panel, what did you agree or disagree with?
2. What is your personal criteria for what makes an ideal LUC quantification approach?

Participants shared answers within their breakout group and worked to find shared criteria that everyone could agree on. Comments were recorded by each group in Miro.

After the breakout session rooms closed, the breakout groups reported back on their findings and reflections with the greater group. A follow-up email was sent to all participants to provide feedback for the second workshop session.

KEY FINDINGS FROM WORKSHOP 1

Takeaways and call-outs from Breakout 1 and “State of the Science” panel

Definitions are lacking consensus.

The core definitions surrounding land use change, land cover and land management classification and assessment are not widely agreed upon across several sectors. The questions being addressed by several sectors in assessing land use change, land cover, and land management classification are not clear and consistent. Organizations assessing land use change should clearly define the goal of the assessment, key questions to address in assessment, core definitions being used and assumptions in the terminology used.

There are opportunities to improve the process of defining LUC terms, but the methods are not yet clear.

Suggestions for a better definition-setting process included (a) “asking the right questions”, (b) enhanced and clearly-identified focus on the desired outcome of a LUC assessment, and (c) recognizing that there are gaps in the databases regarding LUC. Consensus-driven processes to address the inconsistency in LUC terms are not present across sectors.

Data gaps are not easily filled.

Data gaps and data accessibility limitations remain a concern for LUC assessment. For example, most grower data or other corporate data are not publicly available. While it was agreed that more transparency would be good for LUC definitions, there must also then be steps taken to protect data privacy. Similarly, data quality should also be assessed to ensure

accuracy and compatibility. Participants suggested third party data quality checks may be desirable and in some cases, even critical. Political influence on LUC definitions to suit the needs of organizations was identified as a potential issue and participants agreed there should be more scientific consensus.

The National Resources Inventory (NRI), managed by the U.S. Department of Agriculture's Natural Resources Conservation Service, is an appraisal of natural resource conditions and trends on non-federal land. The NRI was considered by the participants and several presenters to be a potential standard for LUC assessment, while recognizing that it too has limitations in field-level evaluations and timeframes for updates. Participants recognized other datasets, geographic information service (GIS) tools, improvements and linkages are needed.

There is a lot at stake when it comes to LUC assessment.

Workshop participants identified several critical economic, ecological and cultural outcomes impacted by LUC assessment:

- Access to global markets for soybeans and other commodities
- Farm and ranch economic viability
- Agriculture policy and regulations related to the sodbuster provisions, swampbuster provisions and topics connected to the Endangered Species Act
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- Carbon markets and farm-gate financing (for example, risks associated with operational loans to farmers)

The identification of these topics lead to the development of working group focuses for Workshop Session 2. Participants affirmed that there is a need to be proactive rather than reactive in LUC assessment or risk incorrect definitions negatively impacting their respective sectors.

Perspectives are missing from discussions about land use change and collaboration is currently lacking.

Land use change (LUC) assessment impacts many agricultural, conservation, sustainability, and industrial sectors and yet cross-sector collaborative efforts to address issues are few. Workshop participants widely agreed that common ground can and should be established between these groups. It was affirmed among the group that all organizations and stakeholders who are actively impacted by or are working with LUC data should be involved in future discussions.

Shared criteria of “ideal” LUC quantification

Participants developed the following set of shared criteria for an ideal LUC quantification.

Participation

Participants agreed that broad participation is necessary to create an accurate and evolving LUC assessment process. Harmonization and discussion between organizations could be helpful to encourage connectivity to emission factors and other ecosystem service end uses for LUC. For example, participants would like to see the U.S. Department of Agriculture (USDA) and National Aeronautics and Space Administration (NASA) sharing satellite data, survey data, and other sources of information that relates to LUC. Participants emphasized the importance of engaging farmers, ranchers and First Nations communities.

Governance and progress

There is agreement that a consensus-building process for LUC definitions is important and should follow science-based approaches. Three steps are important in the governance and methodology evaluation process: 1) third-party evaluation of the datasets utilized (based on clear and transparent goals for the assessment), 2) third-party, neutral evaluation of the LUC methodology, and 3) third-party, neutral evaluation of the interpretation and synthesis of assessment results. Participants shared the idea that a utilizing a third-party verifier with contextual understanding to allow for independent validation of results would be ideal, but questions remain around how groups will come together to clearly identify guidelines, who will own data, and how data can be used to create standards (for example, with the International Organization for Standardization).

Resolution and scale

Participants identified that data scale can and should be tailored to needs of the LUC assessment based on stated outcomes. Tiers, like those used by the Intergovernmental Panel on Climate Change and other organizations in classifying rigor in methods and certainty in results, could be utilized to enable approaches at different levels. The ability to use different sources of data, like that previously mentioned from the USDA and NASA, would allow different degrees of granularity and suit specific LUC assessment needs. Another consideration is a need for a system that enables tracking collectively across whole landscapes as well as finer scales such as by county or farm. These data should also be locally relevant to account for soil orders and types and other impactful background information.

Data quality, privacy and transparency

Ideal conditions for data quality were established relatively quickly by participants. Main attributes to achieving high quality data for LUC assessment purposes included:

- Consistency in the collection of the data, including methodology and use of units, that furthers the “state of the science” in LUC
- Ensuring data are consistent with an integrated model incorporating economic realities of LUC
- Quality checks that confirm meta-data information layers and data layers generate similar answers
- Improved clarification on differences types of current land cover, for example, identifying and clearly establishing differences between native prairie and grassland

To improve transparency of data used in LUC assessment and maintain grower data privacy, participants believe data providers (farmers and corporations) need regulatory safe-harbor and to realize value from data sharing. Financial incentives for voluntary data sharing could aid in better operational practices. These data should be managed and curated in a common reference library and more public data could be leveraged to narrow the knowledge gap in LUC assessment.

Definitions

Following the “State of the Science” panel and breakout sessions, participants expressed their increased awareness in finding how terms can be interpreted differently across other workshop participants. For example, the term “grassland” could be broken down into several different categories including “native”, “pasture”, “hay”, and more. Defining the scope would also be helpful, for example, “row crops planted in new areas”. Questions arose whether these further assessments should be self-proclaimed by the grower, identified by tools such as satellite as previously mentioned, verified by a third party, or a combination of these methods.

Regardless of what methods are used, the consensus of participants is that very clear definitions must be drafted and a form of verification should be standardized. Several participants shared first hand experiences in seeing land incorrectly classified.

Lookback timing

Participants agree the ideal LUC assessment process should consider standardizing “lookback timing”. Lookback timing refers to the historical time frame between present-day and a historical point over which a LUC assessment is completed. This could be in the form of a base year or a set number of years in the past to determine when changes took place and the impacts of those changes. For example, LUC assessments may need to incorporate longer time horizons to address impacts of changes to native ecosystems. LUC assessment may need short time horizons to determine changes to crop types or establishment of pasture fields. Many participants felt that typical crop rotation schemes should span at least 3 years of lookback data.

LUC assessment should include agreed-upon starting points and time frames for different categories of assessment such as for government, or industry. Workshop participants stated that current lookback periods vary by LUC assessment methods.

Outcomes

Desired outcomes of an ideal LUC assessment process meets the needs of multiple audiences. Outcomes stated by participants included consideration of economic incentives, assurances for regulatory safe harbor for participants and stakeholders, equitable value sharing for data, and analytical linkages to emission factors and other ecosystem services.

Shared criteria word cloud



Figure 1: Word cloud based on word frequency within notes from the shared criteria segment of workshop session 1.

WORKSHOP SESSION 2 OVERVIEW

Workshop Session 2 focused on establishing a shared vision for evaluation of LUC quantification methods. The workshop included breakout sessions and identifying participants who want to become more involved in working groups.

The second session of the workshop began with a recap of Workshop Session 1 and sharing of feedback from the post-workshop survey. Following this summary, four use cases for LUC quantification were introduced as breakout session topics: (1) Assess to Markets, (2) Economic Modeling, (3) Conservation, and (4) Carbon Accounting (referred environmental accounting in post-workshop efforts). The shared criteria portion of Workshop Session 1 influenced the development of the breakout structure in Workshop Session 2. Each participant chose a breakout topic (use case) and was prompted with the following questions:

- What are the ideal outcomes of using a clear framework?
- What stakeholders are involved in creation?
- What terms need to be more clearly defined?
- What resolution of data is necessary?
- What is the lookback period?
- Who owns the data? How is it verified? How are transparency and privacy balanced?

Breakout participants worked within their respective groups to answer the questions with respect to the four use cases. Participants recorded answers, comments, and ideas on Miro. Breakout leaders reported back findings to the larger group.

After the report back, a second breakout session was held to determine the focus of future working groups. Three use cases were chosen (1, 3, and 4 from above). The breakout groups collaborated to discuss elements of potential post-workshop working groups.

- What are the goals of this working group?
- What key actions should it be focused on taking?
- What other stakeholders should be invited to participate?
- What questions need to be answered in order to feel confident in launching this working group?

The workshop concluded with reflections from participants and facilitators and what follow-ups could be expected from the project team.

KEY FINDINGS FROM WORKSHOP 2

Establishing a shared vision for LUC quantification

Ideal outcomes from a clear framework would include consistency, standardization, and transparency of definitions, data, methodology and third-party validation of LUC assessment.

Data would be peer-reviewed and scientifically-validated by a neutral third party organization. Methods for LUC assessment would be assessed by a neutral third party organization. Synthesis and interpretation of results would be assessed by a neutral, third-party organization. Assessment of data, methods and synthesis might be completed by different organizations.

A diverse group of stakeholders need to be involved in the LUC assessment process. If an organization or stakeholder is affected by terminology or LUC assessment, they should be at the table to provide input in the process.. Farmers should also be involved as their data and direct land use are impacted by LUC assessment. There was general consensus that there is a need for involved parties to consider other sector and organizational needs rather than only defending their own opinions, views, and needs; multiple groups will be drawing from the same set of data.

There are many terms that need to be clearly defined. The most simple terms are lacking consensus across use cases for LUC assessment. Several key terms were mentioned repeatedly across breakout sessions. These include high conservation value areas, grasslands, native grasslands, or prairies.

How the data will be used should be clearly defined and understood to determine appropriate assessment methods. The intended purpose of data is crucial to this decision. Alignment with USDA and international guidelines, as well as market requirements, should be considered.

Lookback periods are typically about 20 years. It was generally agreed upon that longer-term, historical data are necessary for building an accurate baseline for assessment. The lookback period is important to consider from ecosystem, policy, regulatory, marketplace and land steward cultural practice perspectives.

Farmer data privacy was prioritized by group discussion as an important concern. Participants recognized that farmer data comes in many different formats and levels of detail. Third-party agricultural data platforms were discussed as being sources of security in data protection.

Working Group use cases

The following table captures information on three use cases for land use change assessment discussed during Workshop 2.

<p>Conservation</p>	<p>Goals</p> <ul style="list-style-type: none"> • Clearly defined land use change definitions • Integration with other entities working on LUC assessment (e.g. other conservation groups, industry groups) • Identify known interactions between agricultural and environmental impacts <p>Stakeholders</p> <ul style="list-style-type: none"> • Producers, non-governmental organizations, agencies, industry inclusive of land interests such as developers of commercial, residential, and renewables , representation from First nations, multi-generational interests, life cycle analysis practitioners/experts. <p>Key Actions</p> <ul style="list-style-type: none"> • Program work to support regeneration of disturbed or unproductive lands • Specifically define native prairie and high value conservation areas
<p>Environmental Accounting</p>	<p>Goals</p> <ul style="list-style-type: none"> • Work to include soil organic carbon in assessments and set temporal assessment standards in carbon • Identify short-term goals for environmental accounting and charge of this effort • Articulate practice change in context of LUC and understand key differences in LUC methods or services • Understand the intersection between GHG and LUC pending guidance • Ensure working groups complement and not duplicate others' work • Correctly identify challenges/issues of concern <p>Stakeholders</p> <ul style="list-style-type: none"> • Producers, industry actors • Carbon registries / carbon crediting entities • Data platforms • Economic modelers (for indirect land use change) • Soil scientist and soil organic carbon modelers • Environmental Protection Agency, U.S. Department of Agriculture, and World Resources Institute with other agencies developing and assessing protocols <p>Key Actions</p> <ul style="list-style-type: none"> • Identify stakeholders • Clarify rules and articulate timeframes - practical guiding actions

<p>Access to Markets</p>	<p>Goals</p> <ul style="list-style-type: none"> ● Raise awareness of issues to build trust in U.S. agricultural and LUC assessment systems and tools ● Build consensus on native grassland ● Map gray areas - CRP, marginal lands, native grasslands, intact grasslands. ● Support coalition efforts to support regionality in LUC issues, which will lead to definitions and methodologies to create a resource and/or framework for regulating bodies <p>Key Actions</p> <ul style="list-style-type: none"> ● First step in working group - definitions, methodologies to create a resource for regulating bodies ● Communications on market access issues related to LUC ● Gather buy-in from farmers and connect with other projects related to LUC like the Partnerships for Climate-Smart Commodities to leverage these connections and communicate on market access issues ● Work towards better utilization of existing NRI tools or refine other existing tools to move to finer geographic scales and map how to improve accuracy in the Food and Agriculture Organization as well as other data sources to be used in domestic and international markets ● Explore verification efforts to build trust
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ACTIONS AND NEXT STEPS

Several actions were discussed during the workshop. The primary action steps for this group are the following.

Continued facilitation support and building collaboration

The United Soybean Board and Carbon A List will continue efforts to facilitate collaborative and consensus building efforts on land use change quantification assessment through at least September 2023 with the potential for continued funding to extend this effort. There is an intent for collaboration across supporting and facilitating organizations. Facilitation and collaboration support will aid working groups, communications, publications, and collaborative developments for action. Collaborative support will include identification of organizing bodies to help coordinate and implement actions over the long term.

Working group establishment

Working groups will be established to develop strategy and implement actions identified through the workshop sessions. Working group 1 (WG1) was formed from workshop attendees volunteering to engage in strategy development for this topic. Technical working groups will be formed shortly after WG1 is fully established based upon use cases from this workshop. The focus for the working groups will be actions to address highlighted development needs for land use change quantification assessment.

Communications and publications

Carbon A List has been facilitating development of this proceedings report and a farmer-centered blog post on the workshop. Several workshop participants are taking steps to organize and develop a published peer-reviewed scientific journal issue(s) dedicated to the topic of land use change assessment. In the months following the workshop series, a public report or white paper and communications campaign will be developed to help build awareness and understanding of LUC quantification across both audiences already familiar with the topic and those on the periphery.

Development

There is a need to coordinate for development to support the action pathways identified during the workshop.

WORKSHOP AGENDAS

Workshop Session 1: April 13, 2023

Welcome
Primer Report Summary
Breakout: Introductions + Reflections on Primer Report
Why Talk About Land Use Change Quantification?
Break
Current Definitions and Inconsistencies
State of the Science Panel
Breakout: Setting a Framework for Assessing Land Use Change Quantification Methods
Next Steps and Closing

Workshop Session 2: April 27, 2023

Welcome
Recap Workshop 1
Breakout: Land Use Change Frameworks for Four Use Cases
Comparing and prioritizing use cases
Break
Looking ahead: Proceedings Paper and Workgroups
Breakout: Workgroups
Next Steps and Closing

WORKSHOP PARTICIPANTS

Total participants: 57

Ag Ventures Alliance | American Farmland Trust | American Soybean Association | Archer Daniels Midland | Carbon A List | Clear Frontier | Combyne | Context Network | Conservation Technology Information Center | CropGrower, LLC | Danone North America | Environmental Defense Fund | Environmental Protection Agency | General Mills | Habiterre | McDonald's | Michigan State University | National Aeronautics and Space Administration Harvest | National Sorghum Producers | The

Nature Conservancy | Oakridge National Lab | Perennial |
Smithbucklin | South Dakota State University | Sustainable
Environmental Consultants | TerraEconomics | University of
Illinois | University of Wisconsin | United Soybean Board | U.S.
Soybean Export Council | World Wildlife Fund | U.S. Department
of Agriculture

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