LANDSCAPE ASSESSMENT FRAMEWORK
CONCEPT AND GUIDELINES
An accessible framework for holistically measuring, monitoring and communicating the sustainability of a landscape
February 2018

These guidelines for application of the Landscape Assessment Framework were developed in consultation with Conservation International’s field offices and departments in the U.S. offices.

To learn more, please visit www.conservation.org/LAF

LEAD WRITER
Danielle King | Sustainable Landscapes Fellow, Conservation Finance Division | dking@conservation.org

CONTRIBUTING AUTHORS
Joanna Durbin, Percy Summers, Simon Badcock, Anurag Ramachandra and Fabiano Godoy

MORE INFORMATION
Fabiano Godoy | Technical Director, Conservation Finance Division | fgodoy@conservation.org

Front cover, back cover and page 10: © Conservation International/Photo by Tory Read
SUMMARY

Current pressures on ecosystem services and precious natural capital to meet the planet’s resource needs will only increase with population growth and climate change. As a result, the landscape scale has emerged as a unit for holistically managing various land uses and stakeholder needs within a region. The landscape or integrated approach simultaneously addresses multiple objectives by seeking synergies and minimizing tradeoffs. To support this approach, there is a need to systematize analysis and communication of performance on and progress towards those multiple sustainability objectives. Such a framework could guide local activities, inform policy decisions and advise investment priorities.

This document introduces the Landscape Assessment Framework (LAF) as Conservation International’s (CI) contribution to filling this gap. The LAF is a structure for measuring, monitoring and communicating the sustainability of a landscape based on existing metrics and datasets. It supports CI’s Sustainable Landscape Approach (SLA) in monitoring the implementation of sustainable landscape management projects and is applicable in a variety of contexts. The framework can also be used independently from the full SLA for a rapid assessment and characterization of a landscape before any activities have begun.

The LAF is not a system for the monitoring and evaluation (M&E) of projects, but rather of indicators that together characterize the sustainability of a landscape against broader management objectives.

Application of the LAF enables stakeholders to answer questions such as: What is the state of the natural capital, and what is driving ecosystem degradation? How sustainable is the level of agricultural production? Are people benefitting from interventions?

SUSTAINABLE LANDSCAPES

The landscape is interpreted as a geographical space that results from the interaction between social, ecological, economic and governability processes. Landscape delineation may be complex and should aim to identify a coherent integrated unit of analysis. A landscape should be delineated such that the area is large enough to understand the connections and tradeoffs between conservation and production, yet small enough to feasibly support and manage in a holistic manner. It might be beneficial to delineate landscape boundaries in relation to administrative or jurisdictional boundaries to best integrate government actors and enable use of pre-existing datasets.

CI believes that in a sustainable landscape:

- Natural ecosystems are conserved or restored;
- Agricultural systems are productive, economically viable, sustainable and resilient to climate change;
- Livelihoods and well-being of all social groups are enhanced;
- Decision-making processes at all levels are inclusive, equitable and participatory.

CI’s SLA brings together governments, businesses, community members and non-governmental organizations to identify, develop and test new solutions aimed at sustaining natural capital and avoiding ecosystem degradation through the development of environmentally friendly, low-emission policies, practices and business models.

LANDSCAPE ASSESSMENT FRAMEWORK

CI’s LAF evaluates and monitors the status and trends in key indicators that collectively characterize landscape sustainability, and then communicates the results through a series of graphs, charts and maps that are easy for all stakeholders to understand and use. After providing a status assessment of the sustainability of a landscape early in a landscape initiative, LAF application can be repeated to assess the changes in a landscape over time.

The LAF is highly adaptable and enables stakeholders to select and track the most pertinent indicators for sustainability in the context of their landscape across the four dimensions of landscape sustainability: natural capital, sustainable production, human well-being and governance.

Key features of the LAF include:

- Use of relevant indicators reflecting the status of all four dimensions to ensure a holistic assessment;
- Reliance on existing sources of credible, low-cost data to promote ease of development;
- Regular updates to monitor trends in the landscape, based on time series and spatial data from credible datasets;
- High level of adaptability for various landscape features and contexts (e.g., size, location, scope);
• Production of accessible graphics and user-friendly summaries to maximize accessibility and easy communication, including:
  • Development and conservation organizations
  • Commodity sourcing and producing companies
  • Investors and financial institutions
  • Local and national governments

APPLYING THE FRAMEWORK
As a foundation, it is critical to start by delineating boundaries and defining sustainable landscape goals and targets across all four dimensions of landscape sustainability. Once that is complete, the steps to apply the LAF cycle are:

1. Select relevant landscape indicators
2. Compile and analyze specific data for selected indicators
3. Communicate current status and change through summary card and interactive dashboard
4. Guide investments and adaptive management
5. Monitor changes over time
6. Review indicators and available datasets

These steps are designed to enable and promote the adaptive management of landscape initiatives.

OUTPUT
The LAF provides three unique outputs to support transparency and effective decision-making: a framework summary card to capture overlying trends at the landscape level, an interactive online dashboard for monitoring and communication, and an interactive online web map allowing stakeholders to perform additional simple analysis and interpret different visualizations. Use of the LAF can help provide stakeholders with a holistic view of landscape sustainability, credible data to inform decision-makers and consistent information to support adaptive management.

This guidance enables CI teams to begin the process of applying the LAF for their landscape and to identify areas where collaboration with other experts may be required.

MORE INFORMATION
Fabiano Godoy, Technical Director, Conservation Finance Division, fgodoy@conservation.org
INTRODUCTION

Populations around the world are competing for increasingly scarce natural resources, in many cases depleting their stock of natural capital and suite of ecosystem services in the process. In the future, these issues will only become more acute with climate change and population growth. To holistically address varying land uses and stakeholder needs, the landscape scale has emerged as a relevant unit for integrated management toward sustainability.

The landscape or integrated approach was conceived to address multiple objectives simultaneously by seeking synergies and minimizing tradeoffs. While many organizations are working toward fostering sustainable landscapes with a general consensus on concepts, there remain few demonstrations of integrated landscape management toward diverse goals. In the absence of clear objectives and measurable indicators, there remains a lack of robust guidance frameworks to enable sound planning decisions, guide sustainable investments and inform the development of more complex monitoring frameworks.

This document introduces the Landscape Assessment Framework (LAF) as Conservation International’s (CI) contribution to filling this gap by providing a means to measure, monitor and communicate the sustainability of a landscape. Rather than being overly prescriptive, this framework provides an open structure and guidelines for monitoring the implementation of sustainable landscape management projects.

The LAF supports CI’s Sustainable Landscape Approach (SLA) but can also be used with other initiatives independent of the SLA, such as for a rapid assessment and characterization of an integrated sustainable landscape initiative before implementation has begun.

SUSTAINABLE LANDSCAPES

A landscape is interpreted as geographical space that results from the interaction between social, ecological, economic and governability processes.

The delineation of landscapes might be complex due to the interrelation of these processes and the dynamics among and within them; however, delineation is important and the landscape area should act as a coherent integrated unit.

LANDSCAPE ASSESSMENT FRAMEWORK

Tracking landscape-scale initiatives that increase production while sustaining natural capital is a critical step to ensure accountability and effective management of limited investments. The adoption of a standardized yet flexible systematic framework for measuring and monitoring the status of and change in key indicators that characterize landscape sustainability is essential to communicate advancements in this field.

CI has developed the LAF to provide an all-inclusive framework for the M&E of landscape initiatives toward overall landscape goals to secure financing, enable...
replication and scale, and help stakeholders to identify and track the most relevant targets for their landscape goals. While developed for terrestrial ecosystems, the LAF can also be applied in freshwater-dominated landscapes. Please see Appendix A for a list of LAF applications completed to date.

The LAF differs from other methodologies in that it monitors progress toward broad dimensions of landscape sustainability – natural capital, sustainable production, human well-being and governance – with quantifiable indicators to enable decision-makers and program managers to prioritize their activities and investments in sustainable landscape initiatives. It is also worth noting that the LAF is not a system for project M&E, but rather for the M&E of indicators that together characterize the overall sustainability of a landscape against the broader integrated landscape management objectives.

**LANDSCAPE ASSESSMENT FRAMEWORK**

- Natural Capital
- Sustainable Production
- Human Well-being
- Good Governance

*Figure 1: Dimensions of LAF analysis*

LAF analysis is structured around four dimensions:

1. **Natural capital** refers to the stock of resources – including soil, air, water, species, ecosystems and other natural assets – that provide the wide range of ecosystem services upon which life depends. Areas of natural capital are not defined solely as geographies inclusive of biodiversity, natural resources and ecological processes, but must also consider the human beneficiaries within the landscape. The LAF helps the user to identify and monitor key indicators of the status of natural capital using spatial and temporal data.

2. **Sustainable production** systems are vital to livelihoods, economic development and food security, and may include activities such as: expanding agricultural production to degraded lands; reducing the footprint of mining activities; increasing aquaculture to reduce pressure on fisheries; or minimizing industrial waste and runoff. The LAF enables the user to track output by production sector and the extent of the impact of the sector on natural capital to provide a sound basis for prioritizing investments.

3. **Human well-being** is composed of five dimensions: health, good social relations, security, freedom/choice and the material necessary for a good life. The LAF helps the user incorporate metrics for human well-being to enable improved targeting of the components necessary for sustainable livelihoods and broader human welfare systems.

4. **Governance** refers to the norms, practices and rules by which a group of people direct and organize their activities and interests. This includes landscape management, resource tenure, stakeholder participation, and many other critical aspects. Good governance ensures that social and environmental safeguards of all groups are respected. In support of good environmental governance, the LAF is operationalized through a multi-stakeholder platform and in compliance with CI’s Rights-based Approach (RBA). The LAF monitors factors relating to governance not only for alignment with policies and regulations, but also to help strengthen such mechanisms.

Key features of the LAF include:

- Use of relevant indicators reflecting the status of all four dimensions of landscape sustainability to ensure a holistic assessment;
- Reliance on existing sources of credible, low-cost data to promote ease of development;
- High level of adaptability for various terrestrial landscape features and contexts (size, location, scope);
- Regular updates to monitor trends in the landscape, based on time series and spatial data;
- Production of user-friendly graphics and summaries to maximize accessibility and communicability across a range of audiences.

It is also important to note the limitations of the framework, or contexts in which other tools may be more appropriate. For example:

- Data is aggregated at the landscape level, generally from jurisdictionally based datasets, thus LAF analysis might not provide detailed enough information over small geographies for some initiatives (e.g., per farm);
- Analysis is conducted based on changes in the same landscape and the set of indicators for each landscape could be different, thus the LAF does not compare the sustainability of different landscapes against one another;
- To maintain low implementation costs, the LAF relies heavily on existing data sources, which may: be not easily accessible; be poorly organized for interpretation and analysis; be based on boundaries that do not coincide well with landscape boundaries; and/or not meet desired accuracy in terms of data collection and/or management, thus a field data collection might be necessary.

**APPLYING THE FRAMEWORK**

Although the overall objective of the LAF is to measure, monitor and communicate the status of and trends in key indicators that collectively characterize landscape sustainability, the framework is adaptable and can be tailored to different needs (see Box 1) by selecting and completing certain processes (see Figure 2).

Application of the LAF provides an initial characterization and status assessment of the sustainability of a landscape that can be repeated over time to monitor the...
changes in a landscape. More specifically, a landscape characterization refers to the delineation of boundaries, definition of goals and analysis of indicators, which provides a useful snapshot of the status of a landscape. Adding targets to the initial characterization enables an assessment of criteria relating to sustainability across the landscape. Monitoring the sustainability of the landscape is possible when this assessment is repeated and updated as better or newer data becomes available.

Application of the LAF is a cyclical six-step process based on select steps of the overall framework for application of the Open Standards for the Practice of Conservation guidelines (see Figure 3). Please see Appendix C for a fully worked-through example of LAF application.

**Step 0 – Establishing a common ground**
Prior to application of the LAF, it is critical to define boundaries, identify goals and set targets for achieving a sustainable landscape in the local context. This is necessary not only to integrate the needs of all stakeholders and foster support, but also to ensure the project is designed to best meet the integrated management needs of the particular landscape. Many landscape initiatives have already defined these elements when the LAF is applied; however, if this is not the case, some guidance is presented below.

The definition of targets across all four dimensions also provides for the opportunity to align with private sector goals (e.g., the Consumer Goods Forum’s pledge to help achieve zero net deforestation by 2020) and international and/or national commitments [e.g., the Sustainable Development Goals (SDGs) or Nationally Determined Contributions (NDCs)].

Stakeholder input and participation is particularly critical during these preliminary activities. While an initiative may have predetermined elements that are important from the perspective of one catalyzing stakeholder, these are likely to be adjusted to reach consensus by all stakeholders. The full suite of stakeholders should include all relevant actors who may impact the landscape, which might include government bodies, civil society organizations, producer cooperatives, large landowners, corporate actors and others.

In some landscapes, an additional component of analysis may be necessary to identify and map the critical natural capital if pre-existing information and data are not available (see Appendix B).

**BOUNDARIES**
The landscape is delineated such that the area is large enough to understand the connections and tradeoffs between conservation and production activities, yet small enough to feasibly support and manage holistically. The delineation of a landscape can be complex given the potential range of ecological, social, economic and governability variables and the interdependencies between these factors. Nonetheless, a meaningful delineation of boundaries is necessary for implementation of the landscape approach and to monitor the sustainability of the area.

The stakeholders involved in the management of the landscape should delineate the landscape boundary, as the purpose of the landscape management interventions will provide much of the direction for delineation. In some cases, the process is iterative and might start with an area around farms, indigenous lands, a watershed, political boundaries or other features, depending on the catalyzing stakeholder, and be expanded or reduced based on the homogeneity of the surrounding land.

---

**Box 1. Uses of LAF analysis**
Given the variety of actors involved in the design and implementation of integrated sustainable landscape initiatives, the LAF is useful for many stakeholders, including but not limited to:

- Development and conservation organizations-designing strategies, implementing projects, and managing resources that seek to track and communicate the status of progress towards sustainable landscape goals.
- Commodity sourcing and producing companies looking to determine which landscapes and activities can best position them to meet sustainability commitments.
- Investors and financial institutions determining where to invest, the risks involved and the potential for growth.
- Governments interested in creating enabling conditions for green growth and sustainable development to meet development and conservation goals.

---

10The Open Standards for the Practice of Conservation are available at: http://cmp-openstandards.org/
Spatial analysis can facilitate and provide rationality to the adjustment of the landscape boundaries. Some criteria that could be used include: biophysical aspects, governance, sourcing and supply chain actors or other activities. It is also important to be aware of those landscape features that have high ecological, social, cultural and/or economic value.

In practice, it can be rather pragmatic to define landscapes in relation to administrative or jurisdictional boundaries to best integrate government actors, optimize investments, and enable use and aggregation of pre-existing datasets (e.g., most censuses are conducted along state, department or provincial boundaries). Jurisdictional boundaries also help to recognize and engage governments as key actors in establishing policy and governance enabling conditions. Ideally, ecological units would roughly correspond with administrative boundaries; however, this is not always the case, and some iterative process delineating the boundary might be necessary to understand the interchanges.

**Box 2. Delineating the landscape**

An appropriate scale for landscape delineation is large enough to capture and evaluate tradeoffs between both production and conservation actions, yet small enough to feasibly implement. This could range from a small community to a large national protected area to a region that crosses into multiple countries.

For example, in Nicaragua’s Jinotega landscape, the objective was to assess and monitor the landscape with a focus on coffee production, so the landscape was defined by areas with a concentration of coffee farmers and processing facilities with biophysical and social similarities. See Appendix A for additional examples.

While the initial process is iterative, boundaries should not change once delineated. It is important that landscape boundaries are clear and recognized by all stakeholders, so that the subsequent analyses of landscape sustainability and management plans are easy to implement.

**GOALS**

Goals relate to the overall vision for the landscape and may be qualitative and/or subjective, but should be broadly based on pursuing sustainability (e.g., conservation of natural capital or delivery of essential ecosystem services; improvement of livelihoods for indigenous groups; identification of new markets for sustainable products). An adaptation of the sustainable landscape description presented earlier in this document may be a good starting point.

Setting goals provides the opportunity to align interests and adjust activities and definitions for the local context. During this step, stakeholders should make explicit the ecosystem services to consider and provide general guidance regarding the desired status for each of the four dimensions of landscape sustainability. As stated earlier, some goals may be predetermined by the stakeholder initiating the LAF; however, bringing together landscape actors within a multi-stakeholder platform enables definition of and consensus on goals and priorities.

**TARGETS**

Targets should be specific, measurable, realistic and ideally time-bound\(^\text{11}\) (e.g., 50% of farmers implement best practices and achieve productivity above the department's average yield by 2040; 1 million metric tons avoided emissions CO2e from a protected area between 2020 and 2030). These are the specific quantitative objectives the landscape initiative is working toward in pursuit of its goals.

**STEP 1 – Select relevant indicators for each of the four dimensions**

Once stakeholders agree upon landscape goals and targets, the next step is selecting relevant indicators that will provide information to describe the current status – and potentially historical trend and/or future projections (e.g., climate-related variables or crop suitability) – regarding each of the goals.

Project teams should not focus on process or activity input indicators (e.g., the number of people trained or workshops held), but rather on output indicators (e.g., the number of farmers with improved practices or companies adopting sustainability policies); and mostly on outcome indicators (e.g., decreased deforestation or improved status of biodiversity). Outcome indicators are based on the overall change you are trying to influence at a bigger level and are explicitly tied to your landscape’s goals and targets.

The minimal number of indicators that are necessary and sufficient to demonstrate a landscape’s progress towards sustainability should be selected, though there is not an
ideal number. These indicators are not exhaustive, but rather like the dashboard on a car: They are meant to provide enough information to highlight what is and is not going well, and bring attention to what might need further investigation or investment. It is important to select indicators that are relevant at the landscape level and would provide direct or proxy information related to the goals and targets defined in the previous step.

Another important point to consider is the balance between data availability and cost for data collection: if the collection of additional data yields diminishing returns on conservation actions, then resources are better allocated elsewhere within the initiative. When this is the case, it is suggested that project teams refer to established indices (e.g., Human Development Index, Geographic Difficulty Index) and/or collaborations that CI has supported (e.g., Country Metrics, Freshwater Health Index). As a starting point for brainstorming context-specific landscape indicators, Appendix D has an initial list of potential indicators used to date in LAF analysis with a description of each indicator and a link to data sources. In addition, the indicators should not be selected based only on the specific activities and strategies that an organization is implementing. Although some of the


project-specific indicators can feed the LAF, for initiative-level impact it is suggested to develop an M&E system based on the strategy’s overarching theory of change.

While it can take considerable time to identify and measure changes in all indicators, changes in landscape governance are on particularly long timescales and might not require updates as frequently. Moreover, while it is generally possible to find relevant and appropriate datasets for quantitative indicators relating to natural capital, sustainable production and human well-being, indicators relating to governance may not have a suitable pre-existing source of data for analysis, therefore requiring some level of data collection, including interviews, within the landscape.

The Climate, Community and Biodiversity Alliance’s (CCBA) Sustainable Landscapes Rating Tool (SLRT) provides an excellent basis to rapidly assess the jurisdictional policy and governance enabling conditions for sustainable landscapes. Criteria for assessing key enabling conditions are structured under the themes of: land use planning and management; land and resource tenure; biodiversity and other ecosystem services; stakeholder coordination and participation; and commodity production systems. Each criterion is rated with an aggregate letter grade (e.g., A-, B, C+) based on

---

### Figure 4: Example excerpt of draft LAF dashboard for Rupununi, Guyana

---

13 The CCBA’s SLRT is available at http://www.climate-standards.org/sustainable-landscapes-rating-tool
The web map has the ability to display datasets in a geographic context that may help inform conclusions on trends or identify new indicators for analysis. For example, while an administrative unit’s rate of land-use change may be decreasing overall, geographic analysis may show a high level of very concentrated deforestation, natural resource exploitation or other degradation (Figure 6). More detail on the production of these outputs is described in the following “Outputs” section of this document.

It is also important in this step to have stakeholder feedback to ensure that the indicators analyzed are relevant and appropriate and that the intended analyses are important to the overall landscape goals.

**STEP 4 – Guide investments and adaptive management**

After sharing the LAF findings, it is critical that landscape managers, decision-makers, practitioners and other stakeholders integrate these findings into their landscape management plans to enable adaptive management. Integrated landscape management initiatives require a degree of strategic planning in securing and managing complementary investments, which LAF analysis supports. Using outputs from LAF analysis to identify and communicate successful areas in addition to areas requiring additional investment enables informed landscape stakeholders to optimize their investments.

**STEP 5 – Monitor changes over time**

Repeat assessment promotes analysis of changes in biophysical and social indicators and the impact of management and policy decisions. The frequency of updates depends on the needs of the users and availability of datasets, but should be included as part of the initiative’s regular monitoring plan. For example, while fire risk and fire occurrence can be updated daily, the poverty index would not change drastically within a year and the data could be collected less frequently.

**STEP 6 – Review indicators and available datasets**

Periodic review of indicators and available datasets promotes adaptive use of the LAF and ensures use of the most current data for relevant indicators. Landscapes are dynamic units and changes in governance, policies, regulations, or even extreme events (e.g., intense migration due to extreme weather events) would affect the sustainability of the landscape. This step enables revision of the LAF to incorporate such changes.

**OUTPUTS**

Three highly accessible visuals are produced for analysis and communication of the status of the landscape’s sustainability: a summary card, an interactive dashboard and a web map. The LAF does not prescribe a specific software solution; however, these outputs have historically been produced using the data visualization software solution; however, these outputs have historically been produced using the data visualization software solution;

---

14 Ideally, whoever originally developed the LAF for a particular landscape would update it to enable monitoring. CI’s Conservation Finance Division is developing guides and can help to build capacity amongst field programs so that anyone can use the framework independently.
software Tableau Public\textsuperscript{15} complemented by ArcGIS Online\textsuperscript{16} to enable production and dissemination of accessible visual interpretation and analysis.

The summary card\textsuperscript{17} is an important step in communicating the results of the landscape analysis and provides an overview of the performance of each indicator in the context of the landscape (see Appendix E). Condensing key information into two pages, the summary captures overarching trends observed at the landscape level and includes narrative describing the biophysical components of the landscape and other relevant contextual information. One key element of the summary card is the Sustainable Landscape Index (see Figure 5), which links analysis back to the targets established in Step 0. Measuring progress of an indicator against quantifiable targets and displaying its current status as an axis of a radar or spider graph enables assessment against broader landscape sustainability goals (e.g., NDCs, SDGs).

Similarly, the interactive online dashboard\textsuperscript{18} presents all the indicators and trends over time for the whole landscape; however, unlike the summary card, the dashboard also contains other indicators that are supplementary to the holistic overview. In addition, the dashboard provides an interactive tool that can disaggregate the data into sub-regions, or time series.

\textbf{WHAT’S NEXT?}

As CI institutionally moves toward the implementation of more landscape and seascape scale initiatives as opposed to site-based projects, the LAF provides initial guidance to evaluate the impact of these higher-level efforts and institutional strategies. More pragmatically for field offices, LAF application can help to both inform the development and support the implementation of country strategies.

To this end, CI plans to further operationalize the LAF to equip stakeholders, expand reach, share results and foster adaptability.

\textbf{For more information}
Visit: www.conservation.org/LAF
Contact: Fabiano Godoy, Technical Director, Conservation Finance Division, fgodoy@conservation.org
APPENDICES

APPENDIX A: LAF applications completed to date (p. 12)
APPENDIX B: Resources for identifying and mapping natural capital (p. 13)
APPENDIX C: Example LAF Application (p. 14)
APPENDIX D: Examples of indicators used in LAF analysis (p. 16)
APPENDIX E: Sample summary card (p. 18)
**APPENDIX A**

**LAF applications completed to date**

As of September 2017, CI’s Carbon Fund has worked with field offices on six LAF applications. Interactive dashboards for these LAF applications can be found at https://public.tableau.com/profile/carbon.fund

<table>
<thead>
<tr>
<th>Location</th>
<th>Focus &amp; Overall Description</th>
<th>Size &amp; Boundary</th>
<th>Population</th>
<th>Drivers of Deforestation</th>
<th>Commodities</th>
<th># Indicators Measured in Dashboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia: North Sumatra</td>
<td>Supporting local government efforts to reduce deforestation and associated carbon emissions along with long-term sustainable economic development</td>
<td>7,015,830 ha – delineated along the administrative boundaries of Indonesia’s North Sumatra province</td>
<td>13,500,000</td>
<td>Agricultural expansion – palm oil</td>
<td>Palm oil, rubber, coffee, cocoa</td>
<td>18</td>
</tr>
<tr>
<td>Indonesia: Mandailing Natal*</td>
<td>To better understand environmental and socio-economic changes in the region, develop an approach to assess and address key issues in coffee landscapes to ensure that the tools being used for guiding investment, research and sourcing of coffee are practical.</td>
<td>644,000 ha – delineated based on the highest concentration of high-quality coffee cultivation, considering processing facilities and municipal boundaries</td>
<td>378,000</td>
<td>Agricultural expansion</td>
<td>Coffee, livestock, corn, beans</td>
<td>9</td>
</tr>
<tr>
<td>Peru: Alto Mayo</td>
<td>Working with partners in the region to determine whether coffee is the primary driver of deforestation, given its suitability for coffee cultivation.</td>
<td>780,000 ha – delineated along the Alto Mayo river basin of San Martin</td>
<td>232,000</td>
<td>Agricultural expansion – coffee</td>
<td>Coffee, cocoa, maize, rice</td>
<td>9</td>
</tr>
<tr>
<td>Indonesia: North Sumatra</td>
<td>Developing an approach to assess and address key issues in coffee landscapes to ensure practicality of the tools being used for guiding investment, research and sourcing of coffee</td>
<td>600,000 ha – delineated along the administrative boundaries of North Sumatra’s Mandailing Natal regency</td>
<td>411,000</td>
<td>Agricultural expansion – palm oil</td>
<td>Palm oil, rubber, coffee, cocoa</td>
<td>13</td>
</tr>
<tr>
<td>Indonesia: Mandailing Natal*</td>
<td>To better understand environmental and socio-economic changes in the region, develop an approach to assess and address key issues in coffee landscapes to ensure practicality of the tools being used for guiding investment, research and sourcing of coffee</td>
<td>163,535 ha – delineated along the administrative boundaries of the department</td>
<td>25,000</td>
<td>Agricultural expansion</td>
<td>Coffee, sugar cane, bananas, livestock, beans</td>
<td>13</td>
</tr>
<tr>
<td>Indonesia: Mandailing Natal*</td>
<td>To better understand environmental and socio-economic changes in the region, develop an approach to assess and address key issues in coffee landscapes to ensure practicality of the tools being used for guiding investment, research and sourcing of coffee</td>
<td>5,497,534 ha – delineated along the administrative boundaries of Guyana’s Upper Takutu-Upper Essequibo Region #9</td>
<td>150,000</td>
<td>Agricultural expansion</td>
<td>Coffee, livestock, corn, beans</td>
<td>18</td>
</tr>
</tbody>
</table>

*The Mandailing Natal landscape is nested within the larger North Sumatra landscape.*
APPENDIX B

Resources for identifying and mapping natural capital

There are numerous tools and resources available for identifying, measuring, modeling and valuing natural capital, including tool selection guides. Some potential resources for consideration are listed below; however, we acknowledge that this list was not produced through extensive review; these resources vary in terms of levels of expertise and time required; and not all listed resources are free. More guidance on vetted and recommended tools and resources will be provided in the forthcoming revised Sustainable Landscape Approach guidance document.

- Artificial Intelligence for Ecosystem Services (ARIES): a specialized software for modeling ecosystem services and complementary web-based database (http://aries.integratedmodelling.org/)

- CI’s natural capital mapping initiative: an institutional effort to spatially identify areas of important – or “essential” – natural capital within a certain geography (http://www.conservation.org/projects/Pages/Mapping-natural-capital.aspx)

- Co$ting Nature: a web-based tool using global data for the rapid mapping of terrestrial ecosystem services and conservation priority areas along with current pressures and future threats (http://www.policysupport.org/costingnature)

- High Carbon Stock (HCS) Toolkit: methodology for identifying both high carbon forested areas for protection and low carbon degraded areas that may be developed (http://highcarbonstock.org/)

- High Conservation Value (HCV) approach: an approach to identifying and managing biologically, ecologically or socially valuable components within a landscape (https://www.hcvnetwork.org/)

- Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST): a software package comprised of models for assessing different land use and policy scenarios in terms of impacts to the provision of ecosystem services (https://www.naturalcapitalproject.org/invest/)

- Key Biodiversity Areas (KBA): a collection of sites identified as contributing to the “global persistence of biodiversity” (http://www.keybiodiversityareas.org/)

- Multiscale Integrated Model of Ecosystem Services (MIMES): a framework for analyzing the interactions between ecosystem service function and human livelihoods under varying scenarios (http://www.afordablefutures.com/)

- Social Values for Ecosystem Services (SoLVES): software developed by the US Geological Survey that is linked to ArcGIS to assess, map and quantify the perceived social values of ecosystem services (https://solves.cr.usgs.gov/)

- Toolkit for Ecosystem Services Site-based Assessment (TESSA): practical guidance for assessing the ecosystem service benefits received by people in specific geographies (http://tessa.tools/)

- WaterWorld: an online model for testing the implications of different land and water related policies (http://www.policysupport.org/waterworld)
## APPENDIX C
### Example LAF application

The following is an overview of applying the LAF for Peru’s Alto Mayo landscape.

### STEP 0 – Establishing a common ground

The project envisions the Alto Mayo watershed becoming a landscape model at the regional level that integrates natural capital, governance, sustainable production and promotion of sustainable investments to improve the quality of life for people in the region.

**Boundaries:** the geography of the Alto Mayo catchment area maps closely to the administrative boundaries of two provinces – Rioja and Moyobamba – within Peru’s department of San Martin. The landscape is home to highly biodiverse tropical forests, but characterized by some of the highest rates of deforestation and poverty in the Peruvian Amazon. Rioja and Moyobamba share a common history and have similar livelihood activities, with coffee and rice as the main economic agents of land-use change.

**Goals:** while broad and sometimes subjective, goals relate to the overall vision of a sustainable landscape.

- Agricultural production with best practices
- Provision of essential ecosystem services
- Measurable improvements in human well-being
- Sustainable markets and investments
- Reduction of greenhouse emissions

In addition, the project has a specific goal to understand the contribution of the Alto Mayo Protected Forest to the development of local livelihoods at the landscape level.

**Targets:** aspirations for goals are assigned numbers and values to make goals objective and identifiable. Examples include:

- Reduction in CO2 emissions of 3.5 million tons secured by standing tropical forests
- ≥10 additional private sector enterprises investing in low emissions development strategies
- Increase National Protected Area budget to 10x current funding level

### STEP 1 – Select relevant indicators for each of the four dimensions

| Natural Capital | Fires – number of fires that occur daily  
|                 | Forest cover – area of landscape covered by forest (50% threshold)  
|                 | Fragmentation – the breaking apart of habitat independent of habitat loss  
|                 | Deforestation rate – annual rate of how fast the landscape is being deforested as a percentage of the whole landscape  
| Production      | Agricultural production – yields per hectare of major crops (coffee, maize, cocoa and rice)  
|                 | Emissions – level of greenhouse gas emissions from agricultural production and land-use change  
|                 | Land use – post-deforestation land uses  
| Human well-being | Income – average monthly income  
|                 | Poverty index – percentage of population in poverty  
| Governance      | Governance conditions were assessed using the CCBA’s SLRT<sup>19</sup> |

STEP 2 – Compile and analyze specific data for selected indicators
After indicators were identified and datasets collected, the Conservation Finance Division at CI’s headquarters compiled the data to perform geographic and statistical analysis using ArcGIS.

A wide variety of data sources were used in the application of the Alto Mayo LAF, including:
- The Peruvian Ministry of Environment’s (MINAM – Ministerio del Ambiente) National Program of Forest Conservation for Climate Change Mitigation (PNCBMCC – Programa Nacional de Conservación de Bosques para la Mitigación del Cambio Climático)
- NASA’s Moderate Resolution Imaging Spectroradiometer (MODIS) Active Fire Detections
- The Peruvian National Institute of Statistics’ (INEI) Agricultural Census

Some data also required field collection, including:
- Poverty – for which the Grameen Foundation’s Progress out of Poverty Index\(^\text{20}\) was used
- Forest cover – for which manual methods of field collection by a consultant were more cost-effective than purchasing satellite images
- Governance – conditions of governance were assessed using the CCBA’s SLRT, which were then revised and approved by the government
- Emissions – a consultant completed the calculation of greenhouse gas emissions per sector

STEP 3 – Communicate current status and changes through summary card and interactive dashboard
Results of analysis are visualized using Tableau and ArcGIS Online to produce the summary card, interactive dashboard and web map. Please view at: https://public.tableau.com/profile/carbon.fund

STEP 4 – Guide investments and adaptive management
Results of LAF analysis were used to adaptively manage the initiative and adequately distribute both activities and resources. For example, at the beginning of the project, it was anticipated that the region’s brick factory would have the largest impact in terms of greenhouse gas emissions; however, through LAF application it was determined that rice production was actually a more significant source of emissions. Given this insight, the project focus was shifted to address emissions from (1) the production of rice and (2) deforestation for the expansion of coffee production. Application of the LAF also informed project management by enabling a comparison of how trends in natural capital, sustainable production and human well-being among project beneficiaries compared to trends at the departmental or national scale (e.g., looking at whether conservation agreements with coffee producers within the landscape initiative impacted their productivity relative to producers outside of the initiative’s activities). It was also apparent from LAF application that indigenous communities in the region needed more financial backing in support of their lifestyle habits as environmental stewards and not agents of deforestation.

STEP 5 – Monitoring changes over time
The LAF was originally applied in 2013 and repeated in 2014. The status of the landscape’s sustainability improved in several areas as visualized in the spider graph (see Figure 5).

STEP 6 – Review indicators and available datasets
We are currently in the process of determining whether a revised set of indicators or new datasets are needed.

\(^\text{20}\) More information available at http://www.progressoutofpoverty.org/
APPENDIX D

Examples of indicators used in LAF analysis

The following list was compiled based on indicators used in LAF analyses as of December 2017. To reiterate, this is not a fixed list – the indicators used vary between LAF applications, and it is important that initiatives develop a unique set of indicators based on their specific objectives.

While ideally all indicators would be directly linked to sustainable landscape goals, the identification of some proxy indicators has been necessary. Although most of this data is freely available, some require a subscription or fee.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
<th>Publication/Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected areas</td>
<td>Area of the landscape under legal protection</td>
<td>IUCN and UNEP-WCMC (2016), The World Database on Protected Areas (WDPA) [Online], [09/2016], Cambridge, UK: UNEP-WCMC. Available online at: <a href="https://www.protectedplanet.net/">https://www.protectedplanet.net/</a></td>
</tr>
<tr>
<td>Fires</td>
<td>Number of fires that occur in the landscape in total or per land zoning</td>
<td>NASA Near Real-Time and MCD44D MODIS Active Fire Detections (SHP format). Available online at: <a href="https://firms.modaps.eosdis.nasa.gov/download/">https://firms.modaps.eosdis.nasa.gov/download/</a></td>
</tr>
<tr>
<td>Rainfall and temperature</td>
<td>Average annual or monthly rainfall and temperature for an analysis of temperature and rainfall trends over a period and quantification of frequency of extreme events</td>
<td>Funk, Chris, Pete Peterson, Martin Landsfeld, Diego Pedreros, James Verdin, Shradhannan Shukla, Gregory Husak, James Rowland, Laura Harrison, Andrew Hoell &amp; Joel Michaelsen. &quot;The climate hazards infrared precipitation with stations—a new environmental record for monitoring extremes&quot;. Scientific Data 2, 150066. doi:10.1038/sdata.2015.66. 2015. Available online at: <a href="http://chg.geog.ucsb.edu/data/chirps/">http://chg.geog.ucsb.edu/data/chirps/</a></td>
</tr>
<tr>
<td>Water quality/quantity</td>
<td>Rate of water flow in nearby rivers or streams and average depth of wells throughout the landscape</td>
<td>[Field survey]</td>
</tr>
<tr>
<td>Habitat loss or gain for endemic and endangered species</td>
<td>The area of forest cover that has been lost or regrown in a habitat range for endemic or endangered species</td>
<td>IUCN Red List of Threatened Species. Version 2014.2. Available online at: <a href="http://www.iucnredlist.org/">www.iucnredlist.org/</a></td>
</tr>
<tr>
<td>Indicator</td>
<td>Description</td>
<td>Publication/Citation</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-deforestation land use</td>
<td>Quantification of the land use after deforestation occurs</td>
<td>[Visual interpretation of random sampling points over a high-resolution image and/or government data]</td>
</tr>
<tr>
<td>Agricultural productivity</td>
<td>The average annual yield of the major agricultural products per unit of area (e.g., kg/ha)</td>
<td>[Field survey and/or government census]</td>
</tr>
<tr>
<td>Agricultural production</td>
<td>The average annual production of the major agricultural products (e.g., kg)</td>
<td>[Field survey]</td>
</tr>
<tr>
<td>Market price of agricultural commodities</td>
<td>The market price paid per unit (e.g., kg) of agriculture commodity</td>
<td>[Field survey and/or government census]</td>
</tr>
<tr>
<td>Farm size</td>
<td>The average size of the farms in the landscape, or the percentage of farms per size category (e.g., small, medium and large)</td>
<td>[Field survey]</td>
</tr>
<tr>
<td>Area under cultivation</td>
<td>Average area of a farm under different agricultural cultivation</td>
<td>[Field survey]</td>
</tr>
<tr>
<td>Sources of income</td>
<td>Income from different sources on the farm (e.g., crops produced or sold, services provided, off farm labor)</td>
<td>[Field survey]</td>
</tr>
<tr>
<td>Agricultural costs</td>
<td>Average annual cost to produce agricultural products (e.g., inputs, labor, machinery)</td>
<td>[Field survey]</td>
</tr>
<tr>
<td>Use of best practices</td>
<td>Percentage of farmers that use best practices (e.g., organic fertilizers, climate smart agriculture) in comparison with the total numbers of farmers in the landscape</td>
<td>[Field survey]</td>
</tr>
<tr>
<td><strong>Human well-being</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poverty or human development index</td>
<td>Percentage of population in poverty. (It can also be measured using proxies.)</td>
<td>[Government census] or Progress out of Poverty Index from <a href="http://www.progressoutofpoverty.org">www.progressoutofpoverty.org</a>; USAID’s Poverty Assessment Tools from <a href="http://www.povertytools.org">http://www.povertytools.org</a>; UNDP’s Human Development Index from <a href="http://hdr.undp.org/">http://hdr.undp.org/</a></td>
</tr>
<tr>
<td>Rate of employment</td>
<td>Number of employed people vs number of people living in a community</td>
<td>[Government census]</td>
</tr>
<tr>
<td>Education/literacy</td>
<td>Level of education completed</td>
<td>[Government census]</td>
</tr>
<tr>
<td>School enrollment</td>
<td>Percentage or number of children that are enrolled in school</td>
<td>[Government census]</td>
</tr>
<tr>
<td>Water supply</td>
<td>Source of drinking water (e.g., well, indoor plumbing, river/stream, rainwater)</td>
<td>[Government census]</td>
</tr>
<tr>
<td>Cooking fuels</td>
<td>Measure of household cooking fuel (e.g., wood, electricity, gas, charcoal)</td>
<td>[Government census]</td>
</tr>
<tr>
<td>Population malnourished</td>
<td>How many people are undernourished in the landscape</td>
<td>[Government census]</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The CCBA’s Sustainable Landscapes Rating Tool should be consulted to identify and select indicators to characterize, assess, and monitor governance conditions relating to: land use planning and management; land and resource tenure; biodiversity &amp; other ecosystem services; stakeholder coordination &amp; participation; and commodity production systems.</td>
<td><a href="http://www.climate-standards.org/sustainable-landscapes-rating-tool">http://www.climate-standards.org/sustainable-landscapes-rating-tool</a></td>
</tr>
</tbody>
</table>
The following is an overview of applying the LAF for Peru’s Alto Mayo landscape.

**NORTH TAPANULI, NORTH SUMATRA, INDONESIA**

**State of Natural Capital, Production & Human Well-Being**

### State of Natural Capital

- **NORTH TAPANULI**
  - The district of North Tapanuli covers approximately 380,000 ha and is home to approximately 287,170 inhabitants.

### Production

- **Agricultural Commodities**
  - The agricultural sector of Taput is primarily composed of cocoa, sugar palm, and benzoin (e.g., benzoin and rubber).

### Human Well-Being

- **Human Development Index (HDI)**
  - The HDI is a comprehensive, global indicator of development equity and people's welfare, and it is measured using three main components: longevity, educational attainment, and standard of living.

**APPENDIX E**

Sample summary card (page 1)

The following is an overview of applying the LAF for Peru's Alto Mayo landscape.
The Sustainable Landscapes Partnership (SLP) is a unique, innovative public-private partnership that addresses increasing food, water, and energy security risks to economic development and human welfare, and the related challenges of climate change and ecosystem fragmentation.

With support from the U.S. Agency for International Development (USAID) and the Walton Family Foundation, the SLP has established a $20 million grant facility that will invest in replicable low carbon business models that reduce pressure on forests, support balanced economic growth, improve livelihoods and expand community income-earning opportunities. Significantly, the SLP will identify and help to reduce existing investment barriers to private sector participation in low carbon development, thereby catalyzing additional investment into established green growth commodity production and supporting market mechanisms.

The Government of Indonesia, USAID, and Conservation International are the initial implementing partners and sit on the SLP Management Council (MC). With practical input from public and private sector partners, the SLP will mobilize its investment facility to identify, develop, and test new private sector investment opportunities needed to transform increasing demand for sustainably produced commodities and avoided loss of ecosystem services into tangible incentives and sufficient returns to investment. To ensure the quality of its investments, the SLP will also provide technical support needed to generate feasibility studies, establish baselines, and monitor results in ways that can generate proof of concept and increasingly larger-scale investments.

The SLP is launching investments in two regencies in Indonesia and expects to expand to other areas in the future. Lessons learned through initial SLP operations there will inform plans to expand the program globally.

### North Tapanuli | North Sumatra

The North Tapanuli District covers 379,971 hectares—roughly 3,800 square kilometers—and hosts rich biodiversity including orangutans, tigers and tapirs, which are part of the Bukit Barisan ecosystem. Just over 287,166 people live in the district, with an average density of 73 people per square kilometer. Agriculture is the strongest economic driver for the district, where more than 27,000 hectares of land are dedicated to rice and food crop production. The main commodities are incense and Arabica coffee, which farmers grow in the districts’ extensive highlands. Incense-producing trees grow naturally as part of complex agro-forestry systems.

### Landscape Accounting

In order to track on-the-ground implementation, the SLP is developing a low-cost holistic Landscape Accounting Framework to monitor the status and change of key indicators that collectively characterize a sustainable landscape.

By tracking not only ecosystem health and loss, but also key human development and agricultural production indicators, the SLP is able to measure impact, understand the interlinked relationships between ecosystem health and human well-being, target project investments, and support local decision makers.

In addition, this type of monitoring will enable the end-users/buyers of commodities originating from these areas to confidently meet their “zero-net deforestation” buying pledges and motivate governments and farmers to invest in cost-effective and sustainable production methods.