Methodology for the Assessment of Bioplastic Feedstocks

February 2022

Bioplastic Feedstock Alliance

Authors

Erin Simon, Plastic and Material Science, World Wildlife Fund

Alix Grabowski, Plastic and Material Science, World Wildlife Fund

Kori Goldberg, Plastic and Material Science, World Wildlife Fund

David Kuhn, Corporate Resilience, World Wildlife Fund

Jessica LaMay Zeuner, Plastic and Material Science, World Wildlife Fund

Acknowledgments

The Bioplastic Feedstock Alliance (BFA) thanks those who provided expertise and review of the methodology during the 2021 update, including:

External reviewers:

Michael Carus (Founder and Managing Director, Nova-Institute)

Hazel Culley (Sector Lead and Head of Consulting, FMCG & Retail, twentyfifty)

Jessica Fanzo, PhD (Bloomberg Distinguished Professor of Global Food Policy & Ethics, Johns Hopkins University)

Christopher Lamoureux (Manager, Policy and Stakeholder Engagement, Social Accountability International)

Jason Locklin, PhD (Professor and Director, New Materials Institute, University of Georgia)

Helen Mant (Sector Lead, Food and Agriculture, twentyfifty)

Nicola Noponen (Sector Lead, Chemicals and Polymers, Roundtable on Sustainable Biomaterials)

WWF reviewers:

Cecelia Alcoreza Lora (Manager, Forest Sector Transformation, World Wildlife Fund)

Tjasa Bole-Rentel (Bioenergy Program Manager, World Wildlife Fund)

Gyan de Silva (Program Officer, Freshwater, World Wildlife Fund)

Adam Dixon (Senior Science Specialist, Northern Great Plains, World Wildlife Fund)

John Holler (Senior Program Officer, Climate, World Wildlife Fund)

Martha Kauffman (Vice President, Northern Great Plains, World Wildlife Fund)

Monica McBride (Director, Food and Freshwater, World Wildlife Fund)

Amelia Meadows (Manager, Forests, World Wildlife Fund)

Corey Norton (Vice President, Supply Chain Legality, World Wildlife Fund)

Anis Ragland (Senior Program Officer, Freshwater, World Wildlife Fund)

Catherine Rothacker (Program Officer, International Cooperation, World Wildlife Fund)

Brad Schallert (Director, Carbon Market Governance, World Wildlife Fund)

Morgan Schneider (Program Officer, Corporate Water Stewardship, World Wildlife Fund)

Nathalie Simoneau (Director, Gender and Social Inclusion, World Wildlife Fund)

Althea Skinner (Lead Specialist, Socially Inclusive Conservation, World Wildlife Fund)

Martha Stevenson (Senior Director, Research and Strategic Initiatives, Forests, World Wildlife Fund)

Nicole Tanner (Corporate Stewardship Manager, Food and Freshwater, World Wildlife Fund)

Contents

Background

No Plastic in Nature

The Bioplastic Feedstock Alliance (BFA) aligns with World Wildlife Fund's (WWF) vision of *No Plastic in Nature by 2030*. *No Plastic in Nature* prioritizes the reduction of unnecessary plastic as a principal area of action, followed by strategies to source the plastic that is considered necessary with sustainable inputs, and ensure that this plastic is being reused or recycled. Decreasing production of new plastic must be a priority, and today 99% of new plastic is made from fossil fuels—contributing to climate change, degrading habitats, and threatening communities around the world.

However, while we are working to reduce our use of plastic and improve our ability to recycle and reuse it, we will still require some new plastic to meet critical health and safety needs. But this smaller amount of new plastic doesn't have to come from fossil fuels—responsibly sourced biobased plastic can result in better environmental outcomes and decouple plastic from the impacts of fossil fuels.

Responsibly sourced biobased plastic, plastic derived wholly or partially from biomass, can play a vital role in infusing new material into a circular plastic system to address unavoidable material loss and degradation during recycling operations. Shifting to responsibly sourced biobased plastic alone will not fix our broken material system; as with fossil-based plastic, biobased plastic must be collected in order to be a successful part of a circular system.

As we transition to a future economy no longer dependent on fossil-derived energy and materials, we can reduce the carbon intensity of materials used in packaging, textiles, the automotive industry, and a wide range of other industrial and consumer goods applications. However, the bioeconomy (where renewable carbon from plants replaces fossil carbon in the production of new materials) relies on agriculture and forestry industries, both of which can have serious social and environmental impacts. This is why careful decision-making and responsible sourcing are necessary for the production and management of biomaterials, considering the increasingly important issues related to food security, land competition, water, climate change, biodiversity loss, safe labor practices, and overall environmental and social performance. For WWF's full position on biobased plastic, see [WWF Position: Biobased and Biodegradable Plastic.]

About the Bioplastic Feedstock Alliance

Convened by WWF, the Bioplastic Feedstock Alliance (BFA) was formed in 2013 as a multistakeholder initiative dedicated to a sustainable vision for biobased plastics. WWF organizes thought leadership in the biobased and biodegradable plastic space to support the shift away from fossil-based plastic and toward the increased conservation of the world's most precious places and species.

The BFA provides a community for scientists, companies, policy-makers, nongovernmental organizations (NGOs), and others to explore the risks and opportunities of biobased and biodegradable plastic. Through research, collaboration, and education, the group strives to guide the sourcing of feedstocks for biobased plastic in order to establish a sustainable flow of materials, creating lasting value for present and future generations.

For an up-to-date list of BFA members, and for more information, visit the [BFA website].

BFA Methodology

A foundational objective of the BFA is to develop and maintain a methodology for assessing feedstocks at the regional level in order to secure a common understanding of responsible sourcing considerations based on best-known science.

This methodology provides guidance on how to assess risks associated with different types of feedstocks and make more transparent sourcing decisions on biobased plastic feedstocks to have a more positive impact on the environment, society, and the economy. This tool allows brands and producers to analyze potential biobased plastic feedstock solutions based on clear criteria. The methodology allows users to (1) compare different biobased plastic feedstock and region combinations across key criteria in terms of environmental and social performance; (2) understand what kinds of changes to production systems would result in better environmental and social outcomes; and (3) identify opportunities for management programs that would track progress and improve sustainability outcomes over time.

Due to the overall complexity of the choice of feedstocks and the potential for trade-offs, there is no list of "sustainable" or "not sustainable" feedstocks. Any such list would fail to account for variation in production practices and regional variation, and therefore would not be a useful asset. There is no simple or single formula that can be applied globally to biobased plastic feedstocks, but there are some common indicators of performance. Using the best available data, each feedstock needs to be evaluated at the most specific regional level possible, taking into consideration the energy required for production; impacts from climate change on the feedstock and landscape; agricultural chemical inputs; impacts on biodiversity, soil, air, and water; and social dynamics and issues regarding land use, labor, and food availability. The same feedstock grown in different regions or different feedstocks grown in the same region will provide different results due to regional agronomic and climatic variations—soil type, rainfall, input use, and cultivation techniques. Focusing on a standard set of key performance indicators will facilitate understanding of the trade-offs and risks that each feedstock may present within a given region. What is important is that feedstocks are assessed in a consistent way (for example, using this method) and production impacts are monitored for continuous improvement.

Connecting to Traditional Risk Management Framing

In accordance with common terminology used in due diligence, the BFA Methodology supports users through *risk identification*, *risk assessment*, and *risk mitigation*. Through the methodology users *identify* potential social and environmental risks at the regional level, *assess* specific risks at the local level, and explore and further develop *risk mitigation* plans for any significant identified risks. Specifically, the Executive Level Screening serves as a way for users to identify potential risks; the Survey Level Screening allows users to assess whether and to what extent these identified risks exist in the specific supply chain. The Survey Level Screening also allows users to explore and confirm existing and planned risk mitigation activities. Additional assessment (for example, applying third-party standards and audits) provides additional scrutiny.

Scope

The scope of this methodology is *land use change to initial processing*, where initial processing includes activities that directly affect the landscape where the feedstock is grown. The decisions about what material to use for a product, how it is made, and the assessment of its environmental and social performance can be informed by a number of tools. This methodology is a tool for one piece of the system and should be considered as one tool in the toolbox. The BFA chose to address this piece of the system due to the need for consensus and tools for decision-making, not because it was deemed more important or more valuable in the overall impact of a product.

This methodology does not take into consideration logistics beyond the initial production and processing levels. Manufacturing process, use, and end of life are out of scope. Although biobased plastics should be carefully evaluated for their end-of-life impacts in addition to their sourcing implications, **this methodology focuses exclusively on sourcing impacts**.

Biobased plastics must be used in appropriate applications and paired with infrastructure capable of effectively reusing, recycling, or composting it to achieve *No Plastic in Nature* and a more circular plastic system.

2021 Update

The BFA Methodology was originally developed with the intention that it would be updated regularly as more science, tools, and guidance became available. All indicators in the methodology were updated in 2021 to reflect the latest science and provide new resources developed since the publication of the original methodology. The 2021 update also included a major focus on adopting resilience factors across the methodology. In order to successfully integrate biobased plastics into the circular economy at scale, their production must support climate resilience at the landscape level. This methodology is intended to drive users toward sourcing decisions and practices that do more good, rather than only doing less bad as compared to fossil-based plastic.

Finally, a major undertaking of the 2021 update was to ensure the methodology is applicable to novel feedstocks. When the methodology was first published in 2013, the questions and guidance were tailored to traditional agricultural feedstocks, as they were the most frequently used and explored biobased plastic feedstocks. As novel feedstocks such as algae, residues from crop harvesting, tall oil (byproduct from the pulp and paper industry), CO_2 capture and utilization, used cooking oil, and more become realistic feedstocks at scale, it is crucial that these feedstocks are held to the same standards as traditional feedstocks. This updated version of the methodology is comprehensive; it can assess both traditional agricultural feedstocks and novel feedstocks.

BFA Guiding Principles

For BFA Governance

1. Actively engage a diverse set of stakeholders who are affected by biobased plastic production.
2. Maintain a methodology that is globally adaptable and can address local conditions.
3. Commitment to be credible and transparent.
4. Be responsive, flexible, and continuously improve in the face of climate change.
5. Provide opportunity for innovation.

6. Remain technology- and feedstock-neutral.

For the Content of the Methodology

7. Maintain conservation of natural resources and biodiversity.

8. Protect or enhance the health and welfare of farmers and their communities.

9. Protect and use nature-based solutions to address the impacts of climate change and other threats.

10. Use a science-based systems approach to drive appropriate best practices in feedstock risk mitigation.

Goals

The below definition of "optimal biobased plastic feedstock" provides the biobased plastic industry with an ideal for which to strive. The BFA Methodology uses this multipronged definition to provide goals for companies and producers to assess feedstocks.

Goals and Indicators

In order to explore how a feedstock in a specific region measures up to the definition of an optimal biobased plastic feedstock (defined by five components, explored in the box below), the BFA has identified the following 13 indicators (see Table 1). Each indicator is explored in detail in the Survey Level Screening portion of the methodology.

An optimal biobased plastic feedstock is one that:

1. Is legally sourced, conforms to the Universal Declaration of Human Rights (UDHR), and is produced in a safe and healthy way for workers and surrounding communities.

2. Is one that is derived from renewable biomass whose production is sustainably managed.

3. Does not adversely impact food security and affordability and maintains or improves social and economic conditions along with ecosystem services in producing communities.

4. Does not directly or indirectly result in destruction of critical ecosystems or loss of high conservation value (HCV) habitats.

5. Contributes to landscape resilience and is resilient to the impacts of climate change.

Table 1: Aggregated Indicator List—13 Indicators	
Environmental: Ecosystem Services Biodiversity Chemical Use and Impact Residues and Waste Management GHG Emissions Land Use Change Impacts Soil Management Water Management	***Social:*** Food Security Legal Production Local and/or Indigenous Communities Occupational Health and Safety Labor Rights

Each of the indicators in itself is complex and requires different assessment methods in order to consider the potential environmental, social, and economic impacts that each feedstock could have on them. The depth to which any interested party can assess a feedstock depends on the amount of data they have for each of these indicators.

The Methods and Tiers

To accommodate the variability in data availability, the assessment tool has two tiers: Executive Level Screening and Survey Level Screening. The methodology is intended to be directional and also includes guidance for further assessment past Survey Level Screening. The first tier requires the least amount of information and may be used to screen out feedstocks that are not viable at a high level, while the second tier requires more in-depth analysis.

Each tier of the methodology requires a certain amount of information to be available, and in some cases expert input may be useful. The BFA has identified the risk level for a final decision based exclusively on assessment at each tier. See Table 2, which explains the differences between each tier of the methodology.

Executive Level Screening (ELS)

When an organization begins to investigate the many options for biobased plastic feedstocks, there is a need for an initial assessment to narrow that list to the most viable options for more in-depth assessment and decision-making. To allow for a high-level assessment of many feedstocks, the BFA developed the Executive Level Screening (ELS). At this tier, the user follows the screening at a highly qualitative level in order to identify major risks. The primary utility of this tier is for identifying potential risks to explore further in the Survey Level Screening. The second purpose of this tier is to provide a GO (move onto Survey Level Screening) or NO GO (feedstock is less viable) screening to help users understand whether the feedstock/region combination should be prioritized for further investigation. There may be other scenarios where the Executive Level Screening is a good fit for initial assessment; for example, a user may not be deciding between different feedstocks to make a particular material but instead may be exploring a single feedstock option sourced in two or more different geographies.

Table 2: Screening Comparison			
	Executive Level Screening	Survey Level Screening	Additional Assessment
Format:	Yes/no survey	13 indicator data sheets	Provided in indicator data sheets
Who:	Brands and producers	Brands and producers	Third parties to be determined
Required:	High-level understanding of impacts of feedstocks	In-depth data on 13 indicators	Indicators that expose high potential risk should be explored more carefully with higher-quality data and external expertise.
Gate:	All Yes's = GO Any No's = more analysis needed before decision	Aggregate data into scorecard and use result to guide decision-making and need for further assessment	Survey + Additional Assessment = Best possible information for decision
Risk Level:	If final decision is based on just the Executive Level Screening, the risk is **high** that not all information is being considered.	If final decision is based on Survey Level Screening results, the risk is **moderate to low** that not all information is being considered.	If final decision is based on Survey + Additional Assessment, the risk is **low** that not all information is being considered.

Executive Level Screening Instructions

The Executive Level Screening (ELS) was designed to act as a GO/NO GO tool to help users decide which feedstocks should be screened further and pursued. In this tool, use the feedstocks currently under consideration and run each one through the ELS. For best results, the use of local-level information and scientifically based responses will guide the user more accurately. In the Survey Level Screening, some questions have a follow-up question if the first response is a "No"; if the answer to the follow-up question is a "Yes," the tool considers that overall question a "Yes." The ELS provides users with a short research guide to understand the high-level benefits and issues with the feedstocks being considered and is an important first step to building knowledge for decision-making. The questions that were answered "No" in the ELS should be explored more in depth. A user may choose to complete the Survey Level Screening for the indicators related to the "No" answers for a deeper understanding of these issues before moving on.

Finally, if a question cannot be answered confidently at the time of the Survey Level Screening, the answer is considered "Unknown."

For the purpose of this methodology, if an answer is “Unknown,” mark “No.” “No” responses flag the need either to obtain more information during the Survey Level Screening or to prioritize a mitigation strategy for that issue. Either way, an “Unknown” must be flagged for further exploration. If a response is considered “Unknown,” provide further detail in the “Identified Risks” section.

Survey Level Screening

Once the user has identified a short list of feedstock/region combinations from the results of the ELS, they should move on to the Survey Level Screening. At this level the user runs each feedstock/region through the 13 indicator data sheets. These data sheets have been developed to identify risks for further exploration. The data sheets act as scorecards and provide the user with the opportunity to identify potential opportunities and impacts for each feedstock. Each indicator provides a list of mitigation activities recommended by the BFA. As this methodology is designed for early information gathering as a decision-making tool, it does not provide the opportunity for measuring progress over time. It does, however, identify existing management systems, standards, and certification programs, connecting the results with existing responsible sourcing resources.

Survey Level Screening Instructions

The Survey Level Screening has been set up as explained above in the form of 13 data sheets that allow the user to score each feedstock/regional pairing against the 13 indicators and then aggregate the results in a scorecard to measure against the five goals of the methodology for an ideal biobased plastic feedstock. If a user completes the Executive Level Screening and is confident there is low risk across some of the indicators, the user may choose to complete only the Survey Level Screening sections that the results from the Executive Level Screening indicate need more research.

Metrics in each indicator ask users questions that elicit yes/no responses. “Yes” indicates a positive response—i.e., there is low risk identified for this specific metric. “No” indicates a potential risk. Follow-up questions will determine whether this identified risk has an identified mitigation strategy. Multiple “No” responses correlate with increasingly high risk that this feedstock/region combination has unmitigated social and/or environmental impacts and requires a strong mitigation plan to proceed. All “No” responses require further research to explore the probability and severity of identified risks, and mitigation plans should be in place before production is pursued. In the “Justification” column, users should explain why they answered “Yes” or “No” and include the sources of information used to reach this answer. The “Mitigation Strategy” column should be filled out to document plans to reduce identified risks. Each indicator includes recommended next steps and resources that may be useful when exploring potential mitigation strategies. The BFA advises that the user begin with the Ecosystem Services data sheet, as it will help identify key services impacted by the new feedstock for further assessment in other indicators.

As above with the Executive Level Screening, if a question cannot be answered confidently at the time of assessment, the answer is considered “Unknown.” For the purpose of this methodology, if an answer is “Unknown,” mark “No.” “No” responses flag the need either to obtain more information or to prioritize a mitigation strategy for that issue. Either way, an “Unknown” must be flagged for further exploration. If a response is considered “Unknown,” provide further detail in the “Identified Risks” section.

At the end of each indicator, the question “***How many identified issues remain without clear mitigation strategies or improvement plans?***” is posed. This total number is indicative of the feedstock/region combination’s risk. Once all 13 indicators are complete, the user should pull this number from each indicator into the Summary Scorecard. It is at this point that the user should compare the differing risks and opportunities of the options.

Table 3: Categories of Feedstocks		
Category	Description	Examples
A	Biobased feedstocks from agricultural or forestry operations	Sugarcane, sugar beet, corn, woodchips
B	Biobased feedstocks from marine or aquatic operations	Cultivated macroalgae (seaweed), industrial microalgae production
C	Biobased feedstocks from biobased end-of-life products	Used cooking oil
D	Biobased feedstocks from agriculture or forestry residues	
D1	Field residues (materials traditionally left on the field after harvesting)	Corn stover, pineapple leaves
D2	Processing residues (materials left over after crop has been processed)	Tall oil, sawdust

Feedstock Categorization

Different types of feedstocks have different impacts and considerations. Provided at the top of each indicator in the Survey Level Screening is guidance on the relevance of the indicator for different types of feedstocks. Users of this methodology should focus on the indicators that are relevant to the specific feedstock being assessed. To determine which category your feedstock falls into, see Table 3, above.

Note: Any feedstock being assessed as C: "end-of-life product" or D (including D1 and D2): "residue" should meet the Roundtable for Sustainable Biomaterials (RSB) definitions provided by the RSB Standard for Advanced Fuels and the RSB Standard for Advanced Products, respectively.

RSB Definitions

"*End-of-life product*": Material with low economic value that the holder discards or intends or is required to discard and that was not primarily produced or intended for the production of advanced fuels or advanced products and has reached the end of its intended supply chain, as it has been consumed, used, spoiled, etc.

"*Production residue*": Material that is a secondary product of a process that is inelastic in supply and that has an economic value ratio of ≤5% with respect to the sum of primary product(s), coproducts and other byproducts generated from the same production process.

Assessment Level Review

In assessing some feedstock/region combinations, some indicators may be particularly complex and important, requiring additional assessment. Recommendations for additional assessment and resources to explore in further detail for each of the 13 indicators are provided in the individual data sheets. Indicators that expose high potential risk should be explored with higher-quality data and/or local expertise before a decision as to whether to pursue the specific feedstock/region combination is made. By completing this additional level of review for indicators that have exposed high risk, the user should have all the best science and information available when proceeding forward with a biobased plastic feedstock solution.

Production Management and Risk Mitigation

The BFA recommends that this methodology be used in conjunction with credible responsible sourcing systems such as sustainable agriculture standards.

This tool is a decision-making methodology for assessing risk and understanding the trade-offs across various feedstock opportunities. It is not a certification, standard, or method for production management, measurement, or improvement over time. There are, however, many of these management programs in the forms of certifications, roundtables, standards, and best management practices (BMPs) for a number of commonly used feedstocks. For more information on this topic, see the 2019 WWF and ISEAL (the global membership association for credible sustainability standards) discussion paper *Credible Assurances at a Landscape Scale*, intended to stimulate conversation about what credible assurance and claims around sustainable production processes look like at a landscape scale.

The BFA recommends pursuing sustainability certifications that are ISEAL code compliant. ISEAL is a global organization that supports ambitious and transparent sustainability systems. ISEAL code compliance demonstrates successful adherence to ISEAL's Standards-Setting, Impacts and Assurance Codes of Good Practice.

See below for additional resources and tools recommended to be used in conjunction with this methodology.

List of Certifications and Management Systems

Standard for global sugarcane production	Bonsucro	Bonsucro is a multistakeholder standard-setting organization for global sugarcane production. Bonsucro's metric-based standard does not prescribe practices to producers; however, it sets the bar for outcomes at the farm and milling level. Bonsucro's production standard is recognized by the European Union's Renewable Energy Directive. The production standard addresses social, economic, and environmental aspects of sugarcane farming and milling. The BFA recommends that the Bonsucro production standard and associated carbon metric tools be used when sourcing sugarcane derivatives for biobased plastic feedstocks.
Standard for soy sourcing	The Round Table for Responsible Soy (RTRS)	The Round Table for Responsible Soy (RTRS) is a nonprofit, global platform for dialogue on responsible soy that maintains the RTRS certification Standard for Responsible Soy Production. WWF helped establish the RTRS in 2005. For more information on soy production impacts, visit https://www.worldwildlife.org/industries/soy.
Standard for tree-based products	Forest Stewardship Council (FSC)	The Forest Stewardship Council (FSC) is an independent nonprofit membership organization cofounded by WWF in 1993 to advance forest stewardship through the certification of forest management practices and labeling of certified forest products. It is built on best practices for sustainable forest management—production operations for forest-based products should meet FSC standards to ensure forest ecosystems, water quality, wildlife habitats, and local communities are protected.
Standard for palm oil	RSPO Next	For palm oil, RSPO Next goes above and beyond the Roundtable on Sustainable Palm Oil's (RSPO) requirements and through voluntary effort exceeds the RSPO principles and criteria. Third-party verification can ensure RSPO Next companies achieve additional goals categorized into the following categories: reduction of greenhouse gases (GHGs), no deforestation, no fire, no planting on peat, respect for human rights, and transparency. RSPO Next requires achievement in each of these categories across the entire organization including the company's supply base, joint ventures, and investments.
Standard for other feedstocks	Roundtable on Sustainable Biomaterials (RSB) and RSB's GHG Calculator	Roundtable on Sustainable Biomaterials (RSB) also certifies the above-mentioned feedstocks. RSB certifies biomaterials made from primary biomass as well as wastes/residues through all stages of the supply chain up to the manufacture of the end product, enabling plastics to carry impact-based claims on their fossil displacement, climate mitigation, and sustainability. Finally, RSB's GHG Calculator allows users to calculate the supply chain GHG emissions of a material and understand whether a biomaterial achieves a GHG reduction compared with the fossil-based alternative.

Climate resiliency	Stockholm Resilience Center	Climate change is already directly impacting agriculture, and its impact is only expected to be more dramatic in the future. It is increasingly important to manage for change, not just persistence. Building resiliency into the system and adapting strategy to account for changing climate and increasing numbers of climate events will be key to maintaining a stable supply and mitigating the effects of shocks caused by extreme weather events. Diversification of feedstocks and growing locations are adaptation strategies that may effectively build resiliency into the production system. Visit the Stockholm Resilience Center online for more information about climate change resilience.
Climate change impacts	Scenario planning	Scenario planning is an effective method that is increasingly important to plan for climate change impacts when the future is both unknown and likely to be very different from the present. Scenarios are plausible characterizations of the future. They differ from forecasts and predictions because they are not associated with probabilities, but they are based on scientific evidence and must be plausible. Scenarios should be used in three stages: (1) to identify the range of future conditions to be considered by vulnerability assessments for feedstock production systems, natural resources, landscapes, and/or relevant indicators; (2) to identify potential adaptation actions to address vulnerabilities; and (3) to evaluate the vulnerability and value of potential adaptation actions themselves. Scenario planning is often conducted for 30-year time periods, but time frames and methods for scenario development should be compatible with the feedstock and natural environment. The main inputs from scenarios will likely be climate variables, although other factors included in the scenarios (e.g., fire, floods) can certainly contribute to evaluating vulnerability.
Water management	WWF's Water Risk Filter and the Alliance for Water Stewardship Standard (AWS)	Excellent water management is important for all feedstocks and regions and can be seen in each of the five goals of the methodology. The BFA recommends the following options for assessing water risk: • First, WWF's Water Risk Filter can be used to understand the level and type of risk in the basin where the crop production is being considered. Then, this area should be explored under future conditions (scenarios). If current/future projections show medium to high water risk—i.e., medium-high overall risk, or high risk in any one category (scarcity, quality, etc.)—further investigation and information is needed. The Water Risk Filter will allow companies to build water risk assessments and explore various scenarios over 10-year and 30-year time frames. The BFA recommends this as a first step followed by full water stewardship activities to mitigate more substantial water risk later in the process. The Water Risk Filter also has an "operational risk" survey section that looks specifically at what risks are incurred and perpetuated by on-site actions. After the survey is completed, mitigation responses are generated by the Water Risk Filter. • BFA recommends implementation of the Alliance for Water Stewardship Standard for medium-high-risk and high-risk locations. The AWS Standard is a stepwise approach to mitigating water risk and is designed to work in any industry or geography. The AWS Standard overlaps with governmental regulations, crop production standards, ISO standards, etc. It is designed to address current and future risk for water management. See further information on AWS in Appendix B. Water risk assessment and climate risk assessment should be assessed in tandem.

Indirect Land Use Change	Low Indirect Impact Biofuel (LIIB) Methodology RSB Low iLUC Risk Biomass Module	Indirect land use change (iLUC) as a part of overall land use change (LUC) is reviewed at a very high level in this methodology. WWF, Ecofys, and École polytechnique fédérale de Lausanne (EPFL) have developed a methodology to reduce iLUC, called the Low Indirect Impact Biofuel (LIIB) Methodology. The LIIB methodology was designed to distinguish biofuels that have a low risk of causing indirect impacts but can be used for biomass production as well. It develops concepts proposed for mitigation of iLUC and other indirect impacts into a practical and cost-effective methodology that can be used by policy-makers and voluntary certification schemes that wish to stimulate production with low risk of unwanted indirect impacts. RSB also has an add-on module for RSB certifications to explore a crop's risk of causing iLUC. The RSB Low iLUC Risk Biomass Module provides operators with the opportunity to voluntarily explore additional criteria and compliance indicators to demonstrate a low risk that their operations will displace biomass production elsewhere.

Assessment of Biobased Plastic Feedstock

Exercise Information

Feedstock Evaluated	
Geographical Boundary*	
Level of Data/Information** (Circle one)	Local/Production Site(s) Regional National
State of Project (Circle one)	Feedstock in Production Feedstock Being Considered
Method Version	2021
Name of Reviewer	
Date	

*The geographical boundary is defined as the area where the feedstock is sourced. Ideally, local data and information from an actual production site are used for this exercise, but that is not always available. For this exercise, indicate in this field where, to the best of your knowledge, the feedstock is or will be sourced—be as precise as possible given available information. Attach a map with boundaries if possible. Users exploring nonagricultural feedstocks (e.g., feedstocks from seascapes or industrial processes) should also report geographical information, as all biobased plastic feedstock production has the potential for local impacts.

Local data is more representative than regional data, which is more representative than national data. Therefore, the most specific data available should be used when answering the screening questions and completing the worksheets. In this field, indicate which level of data was used when making this evaluation. Generalize to the level of data used ***most often* if necessary.

Comments:

Executive Level Screening

Applicable feedstock categories: A–D

Step 1: Identify feedstock and sourcing region.

Step 2: Review each feedstock/region combination for the following questions. Resources provided can serve as a starting point to help answer each question. *Note: Biobased plastic feedstocks may not be land-based crops. Some questions below may not be relevant for novel feedstocks (nonagricultural biobased plastic feedstocks, wastes and residues, etc.). New questions added to this updated version of the methodology (2021) attempt to capture additional impacts from novel feedstocks.*	Response: Yes or No Please also add relevant notes from your research in this column. A "Yes" for each of the questions indicates a higher likelihood of the particular feedstock as a viable solution.
1. If this feedstock is land-based, is it already cultivated in this region? If "No": Is the new feedstock known to be noninvasive? *Resources* • *Crop production metadata is available through FAOSTAT.* • *For the US: The US Department of Agriculture (USDA) National Agricultural Statistics Service's tool CropScape is a geospatial data set that shows which crops are grown where through a mapping interface with many data layers.* • *Country-level ministries or departments of agriculture may publish crop production briefs (e.g., the Brazilian Institute of Geography and Statistics, a government agency that publishes the national* Census of Agriculture). • *Group on Earth Observations Global Agricultural Monitoring's (GEOGLAM) initiative Crop Monitor provides information related to crop cultivation area and up-to-date crop conditions.* • *International Union for Conservation of Nature (IUCN) Global Invasive Species Database is a global database with information on invasive alien species that threaten native biodiversity and natural areas.* • *Global Forest Resources Assessment, provided by the Food and Agriculture Organization of the United Nations, provides country-level data on planted trees and plantations, as well as native vs. non-native species under production in country. Follow-up research on invasiveness of species is required.* • *Nature Map Explorer is a global map indicating natural forest, planted forest, and woody plantations (see "Human impact on forests" section).*	Yes or No Yes or No

• *Check local government information/media coverage to ensure the feedstock is not considered an invasive species in the region.*	
2. Can this feedstock be legally sourced in this region? *Check for legal issues related to sourcing this feedstock in this region. For example: Legal challenges may include existing quotas for production of crops in the region under consideration, issues of land rights, or the risk that minimum wage cannot be guaranteed.* *Resources* • *Check local and national policy/regulations.* • *Explore negative media attention for the crop/region combination.* • *Refer to US Department of Labor reports (*The Department of Labor's Findings on the Worst Forms of Child Labor*, the* List of Goods Produced by Child Labor or Forced Labor*, and the* List of Products Produced by Forced or Indentured Child Labor). • *Refer to* Nature Economy and People Connected, Sourcing Hub: Preferred by Nature*, a sourcing hub for timber with timber legality risk maps (country level) and accompanying risk assessments/reports per country*.	Yes or No
3. In the sourcing region, can you obtain this feedstock from sources that adhere to labor and operational health and safety (OHS) regulations? *Resources* • *national and local OHS laws* • *country-level labor department reports*	Yes or No
4. Identify key environmental problems with the feedstock. Key problems are those that have clear evidence of occurrence and cause a severe or major and lasting impact on the environment. List them here or on an attached sheet. List mitigation systems/plans for each issue. *Potential Environmental Issues* • *threatens/impacts endemic species and protected areas (rare, threatened, or endangered species and ecosystems) either directly or indirectly (e.g., land use change)* • *impacts threatened/endangered species (species may be listed at the federal, regional, or local level)* • *requires direct land use change to grow feedstock (natural habitat conversion)* • *soil erosion, compaction, and degradation* • *pollutes the local water resources* • *utilizes water from already or projected water-stressed area* • *threatens/impacts intactness and connectedness of ecosystems*	List here:

• *specifically threatens refugia* • *cultivated on land that would otherwise be more beneficial for nature-based climate solutions (e.g., for nonagricultural climate adaptation strategies)* *As there are many resources available to help answer this question, these are listed in Appendix A.* Are the identified environmental risks addressable? Do actionable mitigation systems exist in the region? Is there a plan for continuous improvement? **If "No" to any of these three questions, answer "No."**	Yes or No
5. List known social issues associated with this feedstock. *Potential Social Issues (List for Reference)* • *low wages and unfair prices for farmers and laborers* • *abuses of workers' rights including unhealthy working conditions, forced labor, child labor, discrimination* • *restrictions on workers' collective bargaining power or freedom of association* • *impacts on land ownership and control* • *impacts on Indigenous communities* • *impacts on water access and withdrawal rights, stable and equitable access to water, and water quality including impairment to water used for drinking water, sanitation, and hygiene* • *livelihood activities displaced* • *commodity pricing, price volatility* • *impacts on health and well-being* • *impacts on availability of natural resources* • *impacts on natural capital or ecosystem services* *See Appendix A for guidance and resources to answer this question.* Are there mitigation systems in place that can address these social issues? Is a continuous improvement plan in place? **If even one risk is missing a mitigation plan or system, "No" must be marked.**	List here: Yes or No
6. Are vulnerability assessments available, or have you done a vulnerability assessment for climate change for this feedstock in this landscape? Is there a mitigation plan in place to address risks identified by the vulnerability assessment for climate change? *Vulnerability assessment should be based on climate projections and identify key climate change impacts on (1) the feedstock itself, (2) required resources for production, and (3) the surrounding landscape including communities and ecosystems. If there are identified impacts in all three climate categories, the*	Yes or No Yes or No

feedstock and area might not be suitable for production and "No" should be marked. *Vulnerability assessments should include the following:* • *key [climate risks](), which may include but are not limited to temperature changes, flood or drought risk, higher likelihood and severity of storms, and sea level change* • *evaluation of exposure, sensitivity, and adaptive capacity of the species, ecosystem, or ecological process. Sensitivity and adaptive capacity are sometimes evaluated together* • *analyses of observed (historical) and projected (future) climate, land use, demography, and other important climate and non-climate factors* • *evaluation of changes that have already occurred in the species, ecosystem, or ecological process of interest (where possible, identifying changes that are determined to be caused by either climate or non-climate drivers)* • *an objective scoring method to evaluate the relative vulnerabilities of species, areas, or processes of interest* • *estimation of uncertainties (which can be estimated using expert knowledge or statistical variation) of projected changes in both climate and non-climate drivers of change as well as the species or ecosystem response* • *an analysis of spatial information available for the potentially vulnerable areas, including an evaluation of potential climate refugia (i.e., areas of low exposure to climate change)* • *narratives that describe key information sources, relevant ecological and geographical contexts, and justifications for rankings* *Global tools and existing literature can be used to answer the above questions at a regional level. For further assessment, methodology users could explore working with an expert on the feedstock/region under review, for example, an academic institution with research activity in this space.* *For more information on global tools and existing literature, see the Task Force on Climate-Related Financial Disclosures' [technical supplement](), a comprehensive toolkit that provides a thorough explanation of climate projections and scenario planning and provides links to many additional sources.* *Additional information on resilience can be found in Appendix A.*	
7. Are there credible feedstock management systems in these regions? If "Yes": Will you pursue the adoption of the relevant management system?	Yes or No Yes or No

If "No": Is there a plan to ensure production meets or exceeds the recognized standard? *Recommended Certifications* • *Roundtable on Sustainable Biomaterials* • *Bonsucro* • *Forest Stewardship Council* • *Roundtable on Sustainable Palm Oil* • *Round Table on Responsible Soy* • *Alliance for Water Stewardship* • *Rainforest Alliance/Sustainable Agriculture Certification* (WWF only endorses this certification when an alternative WWF-endorsed standard does not exist for a specific commodity.) • *AFi Land Management and Long-Term Protection Principle*	Yes or No
8. Can you verify that this region is not identified on the FAO Low-Income Food-Deficit Countries list? *Low-Income Food-Deficit Countries (LIFDCs)—List* If "No": Will you take specific effort to ensure the feedstock would not create food supply disruption or affect other ecosystem services?	Yes or No Yes or No
9. Can you confirm that the introduction or increased production of this feedstock has not been shown to increase food prices in the region? *Resources:* *Although there is no single source to answer this question, it is helpful to explore media attention and research focused on the specific geographic area and specifically on issues raised by local agricultural production in this geography. Search for past instances of food price increases due to new or increased agricultural activity.*	Yes or No
10. Does or will the cultivation of this feedstock contribute to the ability of ecosystems and communities to respond to, recover from, and adapt to climate shocks and stresses? *A production system meets this qualification if it is produced in an agroforestry system or if it promotes nature-based solutions to help vulnerable people adapt to climate change and reduce disaster risk in the surrounding landscape (i.e., ecosystem-based adaptation and ecosystem-based disaster risk reduction). Nature-based solutions and the design of agroforestry systems must explicitly include the role of biodiversity and address the need to help nature adapt to climate change through climate-informed and flexible management. Refer to vulnerability assessments collected or conducted in screening question 6 to*	Yes or No

better understand the impacts of climate change on nature-based solutions and agroforestry systems. *For more information and resources on nature-based solutions, see **Resilience Resources** in Appendix A. For more information on specific qualities of resilience for an ecosystem, see **Factors of Resilience** in Appendix A.*	
11. Is it clear that no critical ecosystems, high conservation value (HCV) habitats, High Carbon Stocks, or intact forest landscapes exist in the regions of feedstock cultivation? If "No": Is this feedstock produced or will it be produced in a way that does not put any priority places at risk (directly and indirectly)? *Resources* • *World Database of Protected Areas: This is the most comprehensive global database of marine and terrestrial protected areas. It is updated on a monthly basis.* • *Alliance for Zero Extinction: This resource monitors the geospatially defined last remaining habitat of threatened species.* • *Important Bird Areas (IBA): A global map of IBAs is provided by BirdLife, and a US map is provided by Audubon.* • *UN Biosphere Reserves: These are areas of learning for sustainable development. Reserves aim to reconcile biodiversity conservation and the sustainable use of natural resources.* • *IUCN Protected Area Categories: Protected areas are categorized into specific types (strict nature reserve, wilderness area, etc.) that are recognized by the UN and used as a global standard for defining protected areas.* • *RAMSAR Sites: These wetland sites are designated to be of international importance under the Ramsar Convention on Wetlands.* • *Global Forest Watch: This online tool to monitor global forest data in near-real time includes an intact forest landscapes layer.* • *Intact Forest Landscapes (IFLs): Mosaic of forest and naturally treeless ecosystems within the zone of current forest extent, which exhibit no remotely detected signs of human activity or habitat fragmentation and are large enough to maintain all native biological diversity, including viable populations of wide-ranging species. The maps are produced by Greenpeace, The University of Maryland, Wildlife Conservation Society, Transparent World, World Resources Institute, and WWF.*	Yes or No Yes or No
12. Is this feedstock of low risk to cause habitat conversion? *The following factors may be indicative of lower risk for habitat conversion:* • *The feedstock is grown on degraded land.* • *The feedstock is grown on land already under agricultural production.*	Yes or No

The feedstock is a waste or residue (RSB criteria for determining a waste or residue comes from the [RSB Standard for Advanced Fuels]). *The feedstock is produced on nonarable land (e.g., microalgae facility located on nonarable land).* *The feedstock is grown in open water without negative impact to the local ecosystem (e.g., open water seaweed farming).* *Resources* *[Accountability Framework initiative (AFi)]* *WWF publications by country/priority commodities* *other commodity-specific reports covering the region, with information about the specific land type this feedstock is being cultivated on*		
SCORE	The ELS is designed to allow a user to identify high-level risks at a qualitative level, to aid in decision-making, and to provide guidance on where additional due diligence is needed for projects that move forward. A "Yes" for each of the 12 questions indicates a higher likelihood of the particular feedstock/region as a viable solution and indicates that the feedstock/region should move on to review at the BFA Survey Level Screening. A single "No" in itself may not mean the combination of feedstock/region should not move forward, but "Yes" answers provide higher confidence in the solution moving forward. **Total number of "No" responses: ______**	

Survey Level Screening

BFA Survey Level Screening		
ECOSYSTEM SERVICES *Applicable feedstock categories: A, B, D1*		**GOALS: 3**

Context

Human beings benefit from multidimensional resources that are supplied by nature. Nature provides society with ecosystem services such as water and air purification, pest and disease control, primary food production, and cultural and spiritual inspiration. Producing biomass for the purpose of biobased plastics may interrupt these self-regulatory processes. Community well-being is intricately linked to the functioning of ecosystem services, and any negative impacts to ecosystem services from biomass production systems or from climate change may have serious issues for the community. Producing biobased plastic feedstocks should not impair the ecosystem services of that region.

The capacity of ecosystems to continue providing ecosystem services should be evaluated based on future climate scenarios. If only historical data is used in an assessment, the capacity of an ecosystem to provide services may be miscalculated. Using only historical data may compromise the effectiveness of management decisions made to conserve or provide ecosystem services.

Implementation of best practices in feedstock production to protect ecosystems can lead to improved outcomes for the provision of ecosystem services and producers. Two examples are given below.

The USDA Conservation Reserve Program (CRP) was created in an effort to improve soil, water, and wildlife resources by encouraging and paying farmers to plant long-term resource-conserving cover plants on some lands. Farmers can receive annual rental payments for planting permanent vegetation on their idle, highly erodible farmland. Contract duration is between 10 and 15 years.

The Farmable Wetlands Program (run by the CRP with the assistance of local conservation groups) works to restore previously farmed wetlands and wetland buffers in the United States to improve the hydrology and vegetation of the land. Farmers and ranchers in any state are eligible to participate in the Farmable Wetlands Program, although there are restrictions for enrollment in terms of past land use practices and amount of acreage. Healthy wetlands provide numerous ecosystem and biodiversity benefits, including reduction in downstream flood damage potential, improved surface and groundwater quality, recharge of groundwater supplies, and reduced nutrient (nitrogen and phosphorus) discharge to surface water.

See Appendix A for additional resources to answer these questions.

Preliminary Research

Before users explore the potential impacts of the proposed production system or feedstock on the ecosystem services of the area, they should find out what ecosystem services (ecological processes beneficial to people) the area currently provides and who benefits from these services, via a scientific literature search and/or by consulting local experts. Examples of ecosystem services are water provisioning; water quality protection; soil formation; soil retention; soil carbon storage; greenhouse gas (GHG) mitigation; air quality protection; food, fuel, and fiber production; erosion control; pollination; pest regulation; disease regulation; recreation (e.g., hunting and fishing, wildlife viewing); biodiversity conservation; and cultural and aesthetic services. Methodologies for identifying ecosystem services are numerous, and some initial guidance and resources can be found in Appendix A.

Users of this methodology should be careful to acknowledge and manage for all relevant ecosystem services provided by this landscape; but in order to focus research, we recommend users **identify the top three to five ecosystem services provided by the landscape, as identified by local stakeholders.**			
Metric	**Result**	**Justification**	**Mitigation Strategy**
1A. Can it be proven that the production of this feedstock **does not or will not** disrupt access for communities and other beneficiaries to ecosystem services identified above?	Yes No		
1B. Have the beneficiaries of these ecosystem services been identified and engaged in order to identify their concerns?	Yes No		
2. Is demand for the ecosystem services listed expected to remain stable (rather than increase) based on future climate and demographic projections?	Yes No		
3. Can it be proven that the feedstock **is not displacing or will not displace** natural perennial vegetation or disrupt the ability of an ecosystem to be resilient (based on migration, minimum size to provide services, refugia, functional redundancy, and other resilience measures)? Note: In general, any shift of native perennial vegetation to an exotic monoculture results in substantial loss in ecosystem services.	Yes No		
4. Is or will the feedstock be a perennial or an annual variety, or is the feedstock produced in an agroforestry system? Note: In general, perennial crops may have a less negative impact on ecosystem services than annual monocultures.	If perennial or agroforestry, answer “Yes.” If annual, answer “No.”		

5. Are there existing payment for ecosystem services (PES) schemes either in the region or for the feedstock that are relevant, and will they be implemented or replicated?	Yes No		
6. Does the project include a rigorous plan and committed funding for the monitoring and evaluation of the effects of the proposed feedstock production strategy on key target ecosystem services? Provide details on adaptive management and cost-effectiveness of management decisions.	Yes No		
7. Does the production of this feedstock contribute net positive benefits to the region and its inhabitants? More specifically, does production of the feedstock contribute to the resilience of the landscape in one or more of the following ways: • **Improved climate change impact resilience:** Specific qualities of a resilient ecosystem that should be explicitly considered in the process of evaluating resilience include the size of the area, refugia characteristics, genetic diversity, functional diversity, and functional redundancy. Also, if an area supports the migration of certain species, it should be considered of particular resilience value for biodiversity. For additional resources, see Appendix A. • **Physical and biological means:** These means include habitat and crop diversification, location-based conservation of local/indigenous seed and germplasm diversity, maintenance of natural enemies' species diversity, and improved water capture and retention. • **Sociocultural and political means:** These include diversification of farming systems and local economies, as well as technical, legal and social support	Yes No		

networks for small-scale farmers, rural communities, and Indigenous peoples that reduce socioeconomic and political vulnerability and strengthen adaptive knowledge processes.			

Calculations based on scenario modeling could be used for further assessment for this Ecosystem Services indicator. Scenario modeling is an exercise that can be done at many levels and is important in the resilience-building process. If this further assessment is pursued, please add results in the "Comments" box below. For guidance on scenario modeling, see the Task Force on Climate-Related Financial Disclosures' technical supplement, a comprehensive toolkit that provides a thorough explanation of climate projections and scenario planning and provides links to many additional sources.

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	BFA recommends the use of the InVEST tool, Earth Genome Project tools, and/or similar tools to map and quantify the biophysical and economic value of changes in ecosystem services provision to get a more detailed understanding of the impacts from land use change and the resultant trade-offs to society. Identify baseline services and known interactions with the feedstock.

BFA Survey Level Screening		
BIODIVERSITY *Applicable feedstock categories: A, B, D1*		**GOALS: 2, 4, 5**

Context

Under no circumstances should feedstock production result in deforestation or conversion of existing natural areas of high conservation value.

While land conversion for feedstock production has clear and obvious risks to biodiversity, feedstock production may threaten species and habitats through additional direct and indirect pathways. For example, species of special concern may inhabit the project site, even if it has already been modified from its natural condition, or species may use the site as a migration or dispersal corridor. Development of the area for feedstocks may threaten populations of such species. Species and habitats occurring outside the project site may also be placed at risk from a number of threats emanating from it: Construction and operation of the project may result in the exploitation of off-site natural resources (including species) by project laborers; activities currently in the project area may be displaced elsewhere, including to nearby protected areas; invasive species may be introduced intentionally or accidentally and spread beyond the project site; new infrastructure (e.g., roads, canals) may open up previously inaccessible areas to settlement or exploitation; and downstream aquatic systems may be affected if a project alters hydrology or water quality (through erosion and sediment load), including through the introduction of agrochemical pollution.

Indirect impacts to protected areas in proximity to the project site or in a shared watershed may also occur. For example, the demand for water from the production of biomass may pose threats both upstream and downstream of the project site. All potential impacts must be assessed as part of a detailed biodiversity assessment. Project design (e.g., the retention/establishment of buffer and riparian protection zones) and management (e.g., use of integrated pest management) may be able to prevent or minimize direct and indirect impacts to biodiversity and nearby protected areas.

Biodiversity is also at risk from climate change. It is important to assess the state of an ecosystem and the biodiversity therein using climate information to understand vulnerability, exposure, and adaptive capacity of ecosystems and biodiversity to climate change.

Metric	Result	Justification	Mitigation Strategy
1. Is there evidence that feedstock cultivation will **<u>not</u>** directly affect or be in proximity to (follow local legislation for guidance, or if that is lacking, consider upstream and downstream or adjacent areas) any protected areas or areas designated as environmentally important by national legislation or international conventions (e.g., Ramsar, World Heritage Sites)? An overview of relevant international biodiversity conventions is available here.	Yes No		

2. Is there evidence that biodiversity in the area will **<u>not</u>** be severely impacted by climate change? See Appendix A for resources.	Yes No		
3. Is there evidence that feedstock cultivation does not or will not affect any areas identified as priorities for biodiversity conservation (e.g., protected areas or natural environment, like forests, natural grasslands, savannas, coastal mangroves, etc.) or areas of cultural importance to local community members (e.g., burial sites, sacred forests)?	Yes No		
4. Is there evidence that the project does not or will not increase access to and/or activity in areas that were previously inaccessible or lacking infrastructure (e.g., by building roads, bringing trains, or facilitating movement on river networks)?	Yes No		
5. Will a change in the cultivating practices in the proposed project site improve the ability of the land to provide habitat? Answer “Yes” if the land in question is currently degraded and remediation and cultivation could improve habitat provision for native fauna (pollinators, birds, aquatic species, etc.). Additionally, aquaculture operations may also provide new habitat—for example, a seaweed farm that provides new nursery habitat for fish and crustaceans.	Yes No		

6. Is there assurance the feedstock cultivation or processing will **not** affect any terrestrial species of concern (critically endangered, endangered, or vulnerable species per IUCN Red List); rare or threatened habitat types; or nationally or internationally recognized biological priorities? Consider the impacts of habitat conversion, disturbance, or fragmentation, including disruption, fragmentation, or dispersal of migratory pathways, and introduction of species that are non-native (invasive or genetically modified organism (GMO)) to the larger region. Global threatened species are listed at www.redlist.org; national/regional threatened species can be found in the country's ministry of environment or equivalent. For threatened habitats, users should refer to country-level guidance. See Appendix A: Environmental Resources for more information.	Yes No		
7. Is there evidence that feedstock cultivation or processing will **not** affect any aquatic species of special concern (critically endangered, endangered, or vulnerable species per IUCN Red List)? Aquatic covers both saltwater and freshwater species. Consider the impacts of downstream habitat conversion, disturbance, fragmentation, water abstraction or water pollution, and introduction of species that are non-native (invasive or GMO) to the larger region (e.g., coral reef ecosystems).	Yes No		
8. Is there a plan to minimize unintended negative consequences on natural resources (including animal species) in surrounding areas during project development or operation (e.g., night production effect on nocturnal species; introduction of humans as predators)?	Yes No		

9. Does or will feedstock cultivation or processing **not** require the draining of wetlands or altering of hydrological regimes (e.g., peat bogs, brackish water)?	Yes No		
10. Are aquatic systems within the feedstock cultivation site adequately buffered and protected from agricultural activities (or will they be)? Provide details on buffer plans.	Yes No		
11. Did or will you create and implement a management plan for biodiversity management (species and habitat) to assure that those of special concern and existing ecosystems are not adversely affected?	Yes No		

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy and its impacts on biodiversity. The following sources are credible sources for more information on biodiversity and agriculture/forestry: Farming with Biodiversity, WWF Sustainable Agriculture Overview, WWF Responsible Forestry Overview, WWF Biodiversity and Agriculture, FoodPrint

BFA Survey Level Screening		
CHEMICAL USE AND IMPACT *Applicable feedstock categories: A, B, D1*		**GOALS: 1, 2, 4, 5**

Context

Agrochemical use is a factor that may have multiple impacts on the environment and the health and well-being of the workers, as well as the local community. Agrochemicals can be properly used on site, judiciously and in a targeted fashion using existing best practices. Agrochemicals must be prepared and applied by trained personnel with appropriate protective gear and in accordance with the law and producer guidelines—and not by children or pregnant women. Potential impacts on local communities of chemical runoff and spraying must be assessed and managed. There should be no use of hazardous agrochemicals listed as Classification I or II in the World Health Organization's Recommended Classification of Pesticides by Hazard, nor should there be use of chemicals listed in the Rotterdam Convention Annex III due to their highly hazardous nature and particular risk in developing countries where low awareness and lack of proper labeling of chemicals put people and the environment at greater risk. FAO's International Code of Conduct on Pesticide Management should be followed in the use and disposal of chemicals as a safeguard for human health and the environment. Finally, agrochemical use should not violate The Stockholm Convention on Persistent Organic Pollutants.

In the case of plant nutrition, products, soil, and foliar analyses should be performed prior to any application, and a plant nutrition expert should make the application recommendation. Excess nutrient use—in particular, excess nitrogen and phosphorous use—is harmful to the natural environment, as an overabundance of nutrients in water results in eutrophication, a process whereby algae rapidly accumulate in water bodies, creating toxic algal blooms. Cyanobacteria, a group of photosynthetic bacteria, decompose the algae through an oxygen-intensive process, which results in decreased oxygen levels and hypoxic conditions known as "dead zones." These eutrophic conditions and dead zones detrimentally affect aquatic ecosystems and drinking water quality.

In the case of pest control, a scouting program should exist to identify and monitor pest pressure, and physical, mechanical, or biological means should be part of the strategy to reduce pest pressure and/or habitat that is host to pests prior to any pesticide application. Pesticides should be reviewed for their relevant legal registrations and for their toxicity and environmental persistence. Criteria for selecting products should include reducing overall toxicity for both aquatic and terrestrial organisms as well as overall efficacy. Records of all applications should be maintained. Application technology should be appropriate and strive for accurate application, reduced drift, and increased safeguards against worker exposure. Strict adherence to worker safety practices and re-entry intervals is a must.

Given the technical nature of pest control and nutrient management and the potential impacts these agrochemicals may have on workers and the environment, it is important that there be adequate technical support in terms of reviewing feedstock condition and making control recommendations. Appropriate selection of feedstock protection products, precise application methodologies, and timely field monitoring can greatly reduce chemical applications.

Chemical use for the production of feedstocks will be affected in the coming years by climate change, which alters the distribution and severity of pest outbreaks.

Metric	Result	Justification	Mitigation Strategy
1A. Is this feedstock produced without synthetic nutrients in this region? **Answer questions 1B and 1C only if you answered “No” to 1A.**	Yes No		
1B. Are or will nutrient management systems be used for the production of this feedstock that allow for quantitative monitoring? Explain nutrient management approach and monitoring.	Yes No		
1C. Are or will there be activities (crop rotation, buffer zones, no-till, replacing chemicals with compost, etc.) to reduce the amount of synthetic nutrients used? If “Yes,” list activities in comment column.	Yes No		
2A. Is there low future risk of increased need for synthetic nutrients or impact from nutrient use for this area? Consider major climate events, soil organic carbon content, soil structure related to compaction, depth of the top layer of soil related to erosion, etc. **Answer question 2B only if you answered “No” to 2A.**	Yes No		
2B. Will mitigation activities be put in place to reduce future risk of increased nutrient use?	Yes No		

3A. Are there **no** regulated chemicals used for pest management on this feedstock in this region? “Regulated” may signify strict requirements for training, handling, and equipment, or it may imply full restrictions against the production and use of such chemicals. Use WHO Recommended Classification of Pesticides by Hazard, and Guidelines to Classification, 2019 for guidance on chemicals. This guidance document includes restrictions on chemicals made by the Stockholm Convention and the Rotterdam Convention. **Answer questions 3B, 3C, and 3D only if you answered “No” to 3A.**	Yes No		
3B. Are pest management systems used, or will they be, for this feedstock in this region that allow for quantitative monitoring? Include historical use of pest management chemicals—amount, timing, and method of application per hectare. Note: Verify that chemical quantities are not double-counted for both nutrient and pest management.	Yes No		
3C. Are there or will there be activities (pest confirmation before application, parasitic insects, or other examples of integrated pest management (IPM)) to reduce the amount of regulated pesticides used? If “Yes,” list activities.	Yes No		
3D. Can you verify that none of the pesticides being used are classified as either 1A or 1B on the World Health Organization pesticide classification system in use for this feedstock and that the production of this feedstock is compliant with World Bank Operational Policy OP 4.09? See Appendix B for World Bank Operational Policy OP 4.09.	Yes No		

4A. Is there low future risk for this area that would increase the need for or impact from regulated **pesticide** use? Consider pesticide resistance and mutation, new pests, the possibility for pests to be carriers for other destructive factors, etc. **Answer question 4B only if you answered "No" to 4A.**	Yes No		
4B. Will mitigation activities be put in place to reduce future risk of increased **pesticide** use? If "Yes," explain the activities. Refer to NEXT STEPS for tools to plan mitigation activities.	Yes No		

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production chemical use strategy and its impacts. BFA recommends that the user verify that the site abides by EPA (EPCRA) Hazardous Chemical Storage Reporting Requirements. See Appendix B for EPCRA explanation.

BFA Survey Level Screening		
RESIDUES AND WASTE MANAGEMENT *Applicable feedstock categories: A–D*		**GOALS: 1, 2, 5**

Context
Feedstock processing sites generate many different types of residues, byproducts, and waste. The International Civil Aviation Organization defines byproducts, residues, and waste (for the purposes of biofuel feedstock production but relevant nonetheless to biobased plastic feedstock production) as follows: • byproducts: secondary products with inelastic supply and economic value • residues: secondary products with inelastic supply and little economic value; can include agricultural or processing residues • waste: products with inelastic supply and no economic value; any substance or object which the holder discards or intends or is required to discard Utilizing byproducts, residues, and waste can provide many environmental and economic benefits. For example, these products can be used to generate electricity (from bagasse in sugarcane, fiber and nutshell in palm oil), as animal feed (from waste products with high nutritional value), for further processing into chemicals and fuels, or on-farm as soil amendments to improve structure and quality of the soil. The production of electricity from byproducts can reduce the demand for fossil-sourced energy to generate electricity. Likewise, utilizing processing wastes as a feedstock to produce biobased materials can displace the use of fossil resources for materials (e.g., plastic) production.

Metric	Result	Justification	Mitigation Strategy
1A. If the feedstock is a waste or residue, does it meet RSB criteria? (RSB criteria for determining a waste or residue comes from the RSB Standard for Advanced Fuels.) If the feedstock does not meet RSB's criteria as a waste or residue, the feedstock should be categorized in this methodology as A or B.	Yes No N/A (feedstock is not a waste or residue)		
1B. If the feedstock is a waste, can you confirm there is no evidence of negative displacement impacts? (Negative displacement impacts may include reallocation of waste from another use, such as animal feed or soil amendment.)	Yes No N/A (feedstock is not a waste)		

1C. *Only answer if feedstock is in category D1 (field residue).*
 	
Is there evidence that the current or proposed rate of feedstock waste/residue removal from the field or forest does not have a negative impact on soil quality or stability?
 	
• Certifications (such as RSB) often have requirements to ensure waste/residue removal does not have a negative impact.
• Look for evidence relevant to the specific feedstock/region under assessment.
• For more information on residue removal rates and impacts, see the following:
  ○ Crop Residue Removal Impacts on Soil Productivity and Environmental Quality
  ○ Review of the Impact of Crop Residue Management on sSoil Organic Carbon in Europe
  ○ Crop Residue Removal: Impacts on Yield
  ○ Residue Removal and Potential Environmental Consequences
  ○ Crop Residue Removal for Biomass Energy Production: Effects on Soils and Recommendations
	Yes
	
	No		

2. Processing chemicals: If chemicals are used to process this feedstock, are adequate protocols in place to ensure chemicals used are managed properly and not discharged into the local area?	Yes No N/A		
3. Is there **no risk** of impact on local air quality from open burning during production of this feedstock?	Yes No N/A		

SCORING SUMMARY	How many questions above were answered with “No”? ______ “No” responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? ________**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered “No.”

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy and its impacts on residues and waste management. More information on wastes and residues can be found in the RSB Standard for Advanced Fuels (waste and residues).

BFA Survey Level Screening		
GHG EMISSIONS *Applicable feedstock categories: A–D*		**GOALS: 2, 5**

Context

One of the major advantages biobased plastic feedstocks may offer over traditional fossil feedstocks is the potential for a reduced greenhouse gas (GHG) footprint. Traditional agriculture and forestry (and the production of some novel feedstocks) can serve as both a source and a sink of carbon dioxide. As plants grow, they sequester atmospheric carbon dioxide, which is then stored throughout the life of the product (and possibly longer if the product is recycled). This carbon dioxide is then released during decomposition of the product at end of life. However, there must be credible and consistent GHG accounting to ensure biobased plastic feedstocks do in fact achieve GHG savings as compared to the fossil alternative. A consistent GHG accounting strategy is also necessary for comparing different biobased plastic feedstock production systems against each other. A rigorous and credible assessment determining the net GHG balance should be an essential aspect of all feedstock proposals.

Potential contributors to GHG emissions from biobased plastic feedstock production vary depending on the feedstock, land use change, and specific production process. General sources of emissions may include CO_2 emitted by farm management processes, pre-harvest burning, soil tillage, irrigation (soil moisture impacts GHG emission rates), and nitrous oxide emissions from the application of chemical pesticides and herbicides.

A methodology for GHG accounting needs to be identified and used consistently to ensure a dependable assessment of GHG emissions, allowing for meaningful comparisons across feedstock production systems. GHG accounting elements such as emission factors must be selected carefully to ensure that they are representative of the specific process(es) being examined, as emissions associated with feedstock production vary significantly across geographies and production processes, among other factors.

Overall product decisions need to be based on all life-cycle emissions, not just cradle to gate. Although this methodology focuses only on sourcing impacts (cradle to gate), users should base final decisions on analysis of full life-cycle emissions, including implications for the disposal of the material at end of life. Ideally a cradle-to-grave GHG life-cycle assessment should be conducted by qualified assessors to fully document and evaluate the GHG balance from both the production of the biomass and the downstream processing, taking into account factors such as direct and indirect land conversion (to best scientific knowledge), agricultural inputs, energy requirements, transportation, end use, byproduct use, and waste streams. Per guidance from the RSB, feedstocks that meet the criteriafor waste or residue should exclude GHG impacts from cultivation.

While a full life-cycle emissions assessment is an important part of due diligence before final decision-making, project approval, and any public claims, it is out of scope for this methodology—the focus of this methodology is limited to cradle to gate in order to be consistent with the goal of providing a relatively simple assessment that identifies areas that need further investigation. When the full life-cycle emissions assessment is conducted, the end-of-life considerations of the product or packaging must be carefully considered. (E.g., will this design change or the switch to this material compared to the status quo result in an item that was commonly recycled now going to landfill, compost, etc.? Consider not just what is technically possible, but also the prevalence of availability of collection and processing for each possible outcome in the relevant geography. This will affect the item's GHG performance across its full life cycle.)

Direct and Indirect Land Use Change

Both LUC and iLUC are typically significant determinants of the GHG impact associated with biobased plastic feedstock production and must be accounted for to ensure comprehensive assessment of emissions associated with feedstock production. While tools to measure the GHG impacts of land use change are still emerging (see references in "Metric" below), these impacts can be significant and should be accounted for in assessing the GHG impacts associated with feedstocks. GHGs emitted during cradle to gate fall under two general categories: land occupation and land transformation (LUC) and indirect land use change (iLUC). Land occupation includes all land use activities such as soil management, tillage, fertilizer, and other impacts. For LUC and iLUC, WWF and World Resources Institute (WRI) are developing new guidance on corporate GHG accounting for LUC and identifying mitigation pathways for the agriculture, forestry, and other land use (AFOLU) sector. This new guidance from the Greenhouse Gas Protocol—to be published in 2022—on corporate land use and removals accounting for land-based emissions will provide support in consistent and credible measurement approaches in this area, and once released should be used to estimate these emissions.

Metric

Note: BFA recommends the use of existing GHG accounting tools for this indicator. Examples of credible tools are listed below. After assessing the feedstock under consideration with a recommended tool, answer the two questions posed below and the "Scoring Summary" question.

Scope: For the rest of the Methodology, the scope for assessment is land use change to initial processing, where initial processing includes activities that directly affect the landscape where the feedstock is grown. However, for this metric, the scope must be expanded slightly to compare the GHG emissions of the biobased plastic feedstock to the fossil alternative. For this indicator, we recommend that the system boundary be cradle to factory gate (i.e., the system boundary extends past the farm boundary to include the chemical and mechanical transformation of the feedstock into the final form of the plastic product). Expanding the system boundary for this one indicator allows for a more accurate comparison of the full production GHG impacts of the material being assessed with the full production GHG impacts of the fossil alternative.

Biogenic CO_2 uptake and emissions should be accounted for and reported separately from non-biogenic uptake and emissions as per the GHG Protocol and ISO 14067 standard in a transparent and well-documented manner. Whether using the GHG Protocol or the ISO 14067 standard, consistency in the choice of methodology across feedstocks is a must for comparability. The user should identify the method of choice and transparently report assumptions used. In certain cases, this will lead to "negative" biogenic GHG values in a cradle-to-gate assessment, reflecting environmental reality at that point in the life cycle. Users of cradle-to-gate data generated with this approach will subsequently be able to model true end-of-life fate and associated release of biogenic as well as non-biogenic carbon in the context of the intended application as well as with respect to regional specificities in terms of available infrastructure and technology for recovery and disposal.

At this tier of the methodology, for emission factors, it is acceptable to use industry average data—for fertilizers, fuels, etc. For electricity emission factors, data should be country specific. For input data, it is important to strive for production location (or at least feedstock and region) specificity—i.e., fertilizer input amounts should ideally be based on actual farm usage, or, at minimum, an average for the specific feedstock in the region should be used. When possible, use site-specific data as opposed to general proxy data to improve the accuracy of the assessment.

Tools that can aid in estimating the GHG impacts of feedstock production include the RSB's GHG Calculator to calculate the supply chain GHG emissions of a material; WWF's Biogenic Carbon Footprint Calculator to calculate biogenic emissions for a variety of forest-based products; the Cool Farm Alliance's Cool Farm Tool to support estimating greenhouse gas metrics for feedstock production; IPCC's 2019 Land Use, Land-Use Change, and Forestry(LULUCF) guidance; and reference values to the IPCC Guidelines for National Greenhouse Gas Inventories.

In accounting for GHG emissions associated with feedstock production, the Greenhouse Gas Protocol's guidance for land emissions and removals—to be published in 2022—should be used. While this guidance for land sector emissions is under development, we recommend the following guidance documents in the interim: from the GHG Protocol: GHG Protocol Corporate Standard, Scope 3 Standard, Product Standard, Agriculture Guidance, LULUCF project guidelines, Brazil forestry tool; from IPCC: Guidelines for National GHG Inventories, Good Practice Guidance for LULUCF; from ISO: ISO 14064–1:2018; from Quantis: Accounting for Natural Climate Solutions Guidance; and

from Gold Standard: Value Change Initiative, Value Chain (Scope 3) Interventions Guidance, and Soil Organic Carbon Guidance.

Metric	Result	**Justification** Document tools and data used for evaluating GHG performance	Mitigation Strategy
1. After evaluating, are the biogenic GHG emissions for this feedstock negative, neutral, or positive at the farm gate?	Negative Neutral Positive		
2. After evaluating, are the non-biogenic GHG emissions for this material greater than, equal to (within margin of error), or less than the fossil alternative at the factory gate? Consider fossil emissions from cultivation equipment, agricultural chemicals, processing, etc. Use existing emission factors or previously conducted life-cycle assessments (LCAs) for comparison to fossil alternatives. Refer to ISO 14067:2018.	Less Equal to Greater		

SCORING SUMMARY	After evaluation, is there evidence that this feedstock results in less GHG emissions than the fossil alternative? YES NO
Note: In order to be in line with a limit of 1.5°C global warming above preindustrial levels, biomaterials will need to offer reduced GHG emissions as compared to the fossil alternative. The RSB Advanced Products Standard offers the following guidance for GHG reductions: "*Whenever certified final products are intended to replace fossil derived products, these certified final products shall achieve at least 10% lower lifecycle greenhouse gas emissions calculated on a cradle-to-grave basis relative to the lifecycle*." Due to the scope of the BFA Methodology, GHG impacts for this assessment are only explored from cradle to factory gate. Additional assessment should be used to explore the GHG impacts of the product past the factory gate.	

IDENTIFIED RISKS	If any of the metrics above highlight a risk, it should be identified here.

NEXT STEPS	If the GHG assessment was completed using industry average data or broad assumptions, there is an inherent risk in moving forward with the chosen feedstock. Due to the limited scope of this methodology, the information produced by this GHG cradle-to-gate assessment should be included and refined to contribute to the overall life-cycle assessment of the biobased plastic product in consideration. For further assessment of a product's (not just feedstock's) carbon footprint, see ISO 14067: 2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification.

BFA Survey Level Screening		
LAND USE CHANGE IMPACTS *Applicable feedstock categories: A, B, D1*		**GOALS: 1, 2, 4, 5**

Context

According to the IPCC, "Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover." Land use can be either beneficial or harmful to nature. At the nexus between agriculture and conservation, land use change may refer to the conversion of natural ecosystems into agricultural land, including pastureland. Direct land use change (DLUC) occurs when existing ecosystems are replaced by a new land use. Indirect land use change (iLUC) occurs when existing feedstocks are used for a new purpose (for example, biofuel or biobased plastic) that triggers ecosystem destruction elsewhere to make new room for agriculture (Beard and Grillo, 2015)[1]. Land use change can lead to habitat loss and fragmentation, biodiversity loss, and the disruption of ecosystem services such as climate regulation, pollination, water cycling, and soil formation.

Globally, biobased plastics are not currently a significant user of land and are not predicted to become so in the near future. In 2019, 0.79 million hectares, accounting for only .016% of total global agricultural area, was estimated to be used for biobased plastic production (European Bioplastics, 2020)[2]. Still, any industry that uses land as an input must be held accountable for its impact on global land use change. Analyzing the land use of biobased plastics will remain important as new technologies, applications, and biocomposites are developed and as total biobased plastic production increases.

Land use can have a significant impact on the ability of biobased plastic production to meet climate goals as well as on the minimization of environmental and biodiversity impacts. Given the expansion of agricultural land use to meet biofuel, food, and fiber production, enormous pressure has been placed on areas rich in biodiversity and of conservation value. The project site must not include the conversion of any natural ecosystems such as forests, grasslands, peatlands, or other wetlands as part of the production area.

Wastes and residues may also have significantly lower land use impacts compared to other feedstocks, as they are, by definition, byproducts of existing production. In using waste and residues there must be strong assurance that these materials are truly waste and not being displaced from other uses, for example, residues that were intended to be left on the field to prevent erosion and reduce nutrient loss.

Often, feedstock productivity (measured by feedstock yield in a given area) can be increased by combining food, feed, and/or fiber production with biobased plastic feedstock production through intercropping, rotational cropping, or integrated agroforestry systems.

Tools and certifying bodies exist to evaluate and minimize the impacts of biobased plastic feedstocks and their impacts on land use. Sustainable biomass certifications can ensure environmental and social damage are avoided and detrimental land use change (for example, deforestation or grassland conversion) does not occur.

Note on iLUC: While there are many methods for measuring and assessing iLUC, there is no globally agreed-upon method. Because the risk of iLUC should not be ignored, a qualitative assessment of iLUC is included under the Land Use Change Impacts indicator.

[1] Beard, James and Rafael A Grillo Avila. "Airlines' Biofuel Ambitions Must Not Increase Emissions." WWF, World Wildlife Fund, Environmental Defense Fund, May 1, 2015, https://www.worldwildlife.org/blogs/sustainability-works/posts/airlines-biofuel-ambitions-must-not-increase-emissions.

[2] "Bioplastics Market Data." *European Bioplastics E.V.*, Jan. 5, 2022, https://www.european-bioplastics.org/market/.

For more information from BFA on land use, see [BFA's Fact Sheet on Land Use (2020)].

Metric	Result	Justification	Mitigation Strategy
1. Is there evidence that the establishment of this feedstock will **not** require the conversion of natural ecosystems or carbon sinks (e.g., forests, peatlands, wetlands, grasslands) to cropland?	Yes No		
2. Does or will the production of this feedstock maintain the current use of the land? Does the production of this feedstock represent an improved use of that land (e.g., using marginal or degraded lands, cover cropping, inter/rotation cropping, integrated agroforestry systems, etc.)? The use of degraded land may be more favorable (and may contribute to landscape resilience) because it is less likely to result in indirect land use change (as the use of productive agricultural land will create demand for productive agricultural land, which must be satisfied elsewhere). This RSB module speaks to this in detail: RSB Low iLUC Risk Biomass Criteria and Compliance Indicators	Yes No		
3. If demand increases for this feedstock in the future (or supply decreases due to climate change impacts), is there a low likelihood additional land will be converted to production?	Yes No		
4. Does or will the post-change land use add net long-term social or environmental value to the community that was not available previously? Identify added value.	Yes No		

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy and its impacts on land use change. The Roundtable on Sustainable Biomaterials has developed an add-on certification to other RSB certifications, the RSB Low iLUC Risk Biomass Criteria and Compliance Indicators (which may not be used as a stand-alone certification), to enable producers to demonstrate low indirect land use change risk. While intended for alternative fuel producers, this addition to a certification can be pursued by nonfuel producers using the Advanced Products Standard as well. In addition, the EU has just released a draft implementing act to give requirements on how a crop can be certified as low iLUC risk (to be published).

BFA Survey Level Screening		
SOIL MANAGEMENT *Applicable feedstock categories: A, D1*		**GOALS: 2, 3, 4, 5**

Context
Loss of topsoil is a key threat to sustainable agriculture. Globally, soils are being lost at an alarming rate, and the loss of soil organic matter is currently one of the greatest sources of carbon emission. Methods to reduce and mitigate soil erosion include practices such as conservation and no-till sowing, cover crops or groundcover, buffer zones, and sediment traps. Another key practice to mitigate soil erosion is the reincorporation of organic matter, crop stubble, or organic process waste. These practices increase soil carbon, providing a positive benefit in net carbon balance. An overall management plan should be developed around the maintenance and improvement of soil organic content. There is extensive research highlighting the productivity benefits of implementing these practices and the importance of soil organic matter.

Metric	Result	Justification	Mitigation Strategy
1. Explore the current soil condition for the region in question. Are there net benefits to the soil from the project under evaluation? Answer "Yes" if soil, whether underutilized, degraded, or healthy, will be maintained or improved by this project. Answer "No" if the soil quality/quantity is at risk as a result of this project. Resources: FAO Soils Portal ISRIC Soil Geographic Database	Yes No		
2A. Will soil management practices be utilized in this region for production of this feedstock (e.g., no till, soil amendments, frequency of soil tests, use of compost)? Detail the practices. **Answer question 2B only if you answered Yes to 2A.**	Yes No		

2B. Is there a certification or standard in place that incentivizes adherence to these soil management practices?	Yes No		
3A. Do the local producers have access to soil best management practices and expertise for that region? **Answer question 3B only if you answered "No" to 3A.**	Yes No		
3B. If local practices or expertise is not available, can and will you take steps to increase access to best practice information and engage producers on good soil management practices?	Yes No		
4. Is there evidence that this feedstock/region combination could increase carbon stored, soil health, or soil retention?	Yes No		

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy for soil management. Find more information on soil management here: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/

BFA Survey Level Screening		
WATER MANAGEMENT *Applicable feedstock categories: A, B, D1*		**GOALS: 1, 2, 3, 4, 5**

Context

Agriculture is responsible for about 70% of the global freshwater withdrawn (rivers, lakes, groundwater) and used by human populations. Expansion of the agricultural landscape will add pressure to this finite resource. Nonagricultural commodities such as forest products from tree plantations or algae production facilities also have their own water demands. Novel feedstocks may also bring new water considerations; for example, seaweed may improve water quality by extracting excess nutrients and pollution from seawater. The questions in this indicator should be answered with respect to water used for cultivation as well as processing *if such initial processing occurs in the landscape under consideration* (e.g., for seaweed or microalgae, the user should consider freshwater used to process seaweed into biochemicals at the local site).

Impacts of climate change are particularly felt through water; increasing frequency of drought, extreme weather events, and variability in weather patterns will be felt through water in agriculture, in communities, and by ecosystems. The efficiency of water use in agriculture is highly variable and subject to waste due to inadequate or nonexistent management systems and inefficient irrigation systems. A complete assessment of water resource requirements should be conducted, taking into consideration feedstock needs, soil field capacity, hydrological conditions, precipitation distribution, downstream human and environmental needs and uses, impacts of climate change on water availability, and impacts water use will have on the watershed and regional ecology. Impacts of climate change on surface and seasonal water availability as well as groundwater recharge need to be expressly taken into account. This assessment needs to be conducted regardless of water source: groundwater (blue), surface water (blue), or rainwater (green). Aquifers and natural bodies of water should be monitored to ensure that they are adequately being recharged and that their use for agricultural purposes is not altering the natural hydrologic regime. This evaluation is critical in water-scarce regions, and water extraction should not deprive downstream users of this scarce resource nor impact biodiversity.

Agriculture is also a major source of water pollution in the form of sedimentation, nutrients, and pesticides. Water quality should be evaluated in order to make sure the water is not contaminated and is of sufficient quality for crop needs and continued human consumption. Water sources should be protected with buffer zones to avoid contamination risks and soil erosion impacts and to ensure the viability of the aquatic ecosystem. Water should be monitored routinely in order to assess water quality and identify any issues in a timely fashion.

Discharge water from processing facilities should also be monitored in order to evaluate impacts the cultivation may have on downstream water quality. Discharge water quality should meet, at a minimum, local legal standards and be consistent with the World Bank Pollution Prevention and Abatement Handbook, which establishes wastewater management guidelines. A monitoring program should be in place, and discharge water treatment facilities should be in place if discharge water does not meet guidelines.

Agricultural water impacts should be examined in the context of the watershed's most pressing issues. Priority issues may include affordable and sustainable access to drinking water and to water used for sanitation and hygiene (water quantity and quality), flood risk, and reputational risk. For all water management data, users should consult the best available information, including climate information and peer-reviewed work (e.g., Water Footprint Network data or peer-reviewed sources at a more granular level for specific feedstocks in specific regions). To identify priority watershed issues, the Water Risk Filter should be used in tandem with local assessments such as Basin Health Report Cards.

Note on using the Water Footprint Network's (WFN) Water Footprint Assessment and World Wildlife Fund's Water Risk Filter: WWF recommends the use of both the Water Footprint Assessment and the Water Risk Filter to assess the water impacts of a particular feedstock in a particular region. The footprint gives an indication of how much water is used/impacted, and the risk filter adds to the geographic context. A footprint without context is not particularly useful because a large water footprint is not necessarily unsustainable—additional context informs whether a high/low footprint is particularly risky. Context without a footprint does not provide a user with the level of detail needed to understand the extent to which feedstock production impacts water risks in a region. For this reason, the metrics below require users to engage with both tools.

Metric	Result	Justification	Mitigation Strategy
Identify Watershed			
Quantity and Governance			
1. According to the Water Footprint Network, what is the freshwater footprint (m^3/ton) of this feedstock? See definitions at the end of this data sheet. Use regional-specific location, not country level.	Amount:	Informing on final overall—not scored	
2. According to the Water Risk Filter, is scarcity risk low in this region (e.g., water depletion, baseline water stress, blue water scarcity, drought risk, etc.)?	Yes No		
3. Does the feedstock's growing season **not** overlap with the region's blue water stressed months? Use Water Footprint Network Water Scarcity Maps (see Appendix A).	Yes No		
4. According to the Water Risk Filter scenario planning function, is this watershed at low risk for decreased availability in the future (e.g., risks such as decreased rainfall, increased consumption, increased chance of drought)?	Yes No		

5. Is the site **not** contributing to disruption of local water balance (e.g., increased floods and/or droughts), often perpetuated by land conversion and reduced soil health?	Yes No		
6. Are there regulatory agencies (e.g., a government's "inspection branch") that address and enforce water management in the area for quantity and quality on a holistic level (surface and groundwater)?	Yes No		
7. Are you participating collectively with other water users in the management of water at a watershed level and/or linking your water management into the watershed-level plan goals? An environmental flow or eFlow assessment would be ideally included in a catchment-level plan and could be used to ensure water use is within sustainable limits.	Yes No		
Water Quality and Access to Water, Sanitation, and Hygiene			
8. Does this watershed have low water stress due to pollution? Refer to Water Risk Filter "Water Quality Risk."	Yes No		
9. Is there evidence that the cultivation of this feedstock has **not** caused water pollution impacts in the past (eutrophication, acidification, ecotoxicity, salinity)?	Yes No		

10. Using the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation Tool to make a determination: Is there adequate access to both drinking water and sanitation in the country of production? See Appendix A for details.	Yes No		
11. Will or does the cultivation of this feedstock **maintain or improve** the local community's access to water?	Yes No		

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy for water management. General guidance for addressing water management and risk mitigation: First, employ mitigation responses suggested in WWF's Water Risk Filter by inputting data into the tool, which will identify mitigation responses that will correspond to the specific feedstock and basin risk. Second, engage with the AWS Standard. The AWS standard is a stepwise approach to mitigating water risk and is designed to work in any industry or geography. This framework helps water users understand their own use and impacts; it is intended to help improve water management across social, environmental, and economic dimensions. See Appendix A for more resources on water.

Blue water footprint—Volume of surface and groundwater consumed as a result of the production of a good or service. Consumption refers to the volume of freshwater used and then evaporated or incorporated into a product. It also includes water abstracted from surface water or groundwater in a catchment and returned to another catchment or the sea. It is the amount of water abstracted from groundwater or surface water that does not return to the catchment from which it was withdrawn.

Green water footprint—Volume of rainwater consumed during the production process. This is particularly relevant for agricultural and forestry products (products based on crops or wood), where it refers to the total rainwater evapotranspiration (from fields and plantations) plus the water incorporated into the harvested crop or wood.

Grey water footprint—The grey water footprint of a product is an indicator of freshwater pollution that can be associated with the production of a product over its full supply chain. It is defined as the volume of freshwater that is required to assimilate the load of pollutants based on natural background concentrations and existing ambient water quality standards. It is calculated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains above agreed-upon water quality standards.

BFA Survey Level Screening		
FOOD SECURITY *Applicable feedstock categories: A–D*		**GOALS: 3**

Context

The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life." Food security is often defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences. According to the World Health Organization, food security is built on three pillars:

- food availability: sufficient quantities of food available on a consistent basis
- food access: having sufficient resources to obtain appropriate foods for a nutritious diet
- food use: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation

Food security is a complex sustainable development issue that is linked to health through malnutrition but also to sustainable economic development, environment, and trade.

Today, the most widely used raw materials to produce biobased plastics are sugar and starch from crops such as sugarcane, corn, cassava, and sugar beet. These feedstocks are sometimes referred to as "first generation." "Second-generation" feedstocks are generally considered cellulosic residues, and "third-generation" references novel feedstocks such as wastes, CO_2 capture and utilization, algae, and more.

When biobased plastics are produced from crops traditionally used for food and feed, controversy can arise because there may be concern that the best application for these crops is as calories for human consumption. However, the bigger picture is not the specific issue of whether food or nonfood crops are being used to produce biomaterials but rather the integration of any feedstock for biomaterials production into a landscape and its social, environmental, and pricing effects there.

First-generation feedstocks have been optimized for maximum efficiency over decades of selective breeding. They consistently provide high yields with relatively lower inputs than other feedstocks. A feedstock that can be used for food should not be ruled out as a feedstock for biobased plastics simply because it has diverse applications; this is just an indication that this feedstock is an efficient user of land, nutrients, and water. For more on this topic, see the nova-Institute paper *Food or non-food: Which agricultural feedstocks are best for industrial uses?*.

There are many overlapping factors related to biobased plastic production and food security: global food prices, climate change, poverty, nutritional security, resilience of local farmers, land use change, and governmental policies for agriculture. The impact of biobased plastic production on each of these factors varies widely depending on the feedstock, the method of production, and regional circumstances. It is necessary to ensure that any biobased plastic production (regardless of the generation) avoids competition with food crops and avoids negative impacts to food security across all domains.

Food security of different geographies is and will be impacted by climatic changes, as climate change impacts human migration, resource availability, and feedstock suitability on local scales. And the places already most impacted by food insecurity are also those suffering from the most pervasive forms of poverty, environmental vulnerability, and impacts of climate change. Climate change has already been linked to changing patterns of agricultural pests and diseases, saltwater intrusion from sea level rise, and the decline of nutritional quality in plants. It is critically important to assess the impacts of climate change on food security at regional and local scales to identify impact hotspots—i.e., where social conflict may arise due to food or resource shortage as well as opportunities for biobased plastic feedstock production to potentially build the resilience of a particular population to food displacement due to climate change.

Users of the methodology should strive for a strong understanding of the food security dynamics in the region under consideration to ensure there are no negative impacts to people's livelihoods or to subsistence agriculture if there are to be changes to the existing land use practices for biobased plastic feedstock production.

Additional Reading

Colwill, J. A., et al. "Bio-Plastics in the Context of Competing Demands on Agricultural Land in 2050." *International Journal of Sustainable Engineering*, vol. 5, no. 1, July 25, 2011, pp. 3–16., https://doi.org/10.1080/19397038.2011.602439.

FAO, et al. "Transforming food systems for food security, improved nutrition and affordable healthy diets for all." *The State of Food Security and Nutrition in the World 2021.* FAO, Rome, Italy, 2021, pp. 1–240.

Holt-Giménez, Eric, et al. "We Already Grow Enough Food for 10 Billion People … and Still Can't End Hunger." *Journal of Sustainable Agriculture*, vol. 36, no. 6, July 24, 2012, pp. 595–598, https://doi.org/10.1080/10440046.2012.695331.

Smith, Matthew R., and Samuel S. Myers. "Impact of Anthropogenic CO2 Emissions on Global Human Nutrition." *Nature Climate Change*, vol. 8, no. 9, 2018, pp. 834–839., https://doi.org/10.1038/s41558-018-0253-3.

Research Steps

Exploring the food security situation in an area, and further, exploring the specific impacts of biobased plastic feedstock production on food security in a region require significant research and understanding of the local context. Many interconnected variables contribute to the overall food security of a place, and food security may differ significantly from one place to another within a region. Given the complex nature of food security, for this indicator the methodology avoids yes/no questions and instead guides users through three major research prompts that can help users understand the food security status of an area and the potential risks and benefits of feedstock production. Resources are provided for each question, and the intention of this indicator is for users to dig into important questions at the most specific level possible (e.g., farm-level data is preferred over local data, which is preferred over national data).

1. **Identify major food security issues in the area under consideration. This can include local, national, or regional data, with more specific data preferred.**

   a. **Context:** Exploring a country's food security status includes many unique dimensions including food availability, access, stability, and nutrition. Nutrition security considers more than caloric needs, taking into account essential nutrients to ensure good health. This considers not only access to nutritious food but also care and feeding practices, as well as issues of sanitation and health such as safe water and health care. A wide range of challenges such as poverty, climate change, food waste, rapid population growth, infrastructure, education, and degraded land and water resources contribute to food insecurity and nutritional insecurity. To start building an understanding of a place's food security and the existing challenges, the following sources can be used to explore national trends.

   b. **Resources**
      - The FAO Low-Income Food-Deficit Countries list should be checked to understand whether or not the country of production is classified as having both low income and food deficit; this classification means that based on the latest annual data this country lacks the necessary resources to import food and domestically produce sufficient food. If a country is included on the list, it is considered food insecure and especially susceptible to shocks in the food system.
      - FAO's IPC Acute Food Insecurity Reference Table for Area Classification helps users analyze food insecurity at the household level using international standards and thresholds. Both outcomes and contributing factors are integrated into this assessment.

- The Global Food Security Index developed by the Economist Intelligence Unit is an annually updated model that integrates issues across several categories: food quality and safety, food affordability, and food availability across 113 countries. The model incorporates 59 unique indicators, and the 2020 edition of the model includes a new "Natural Resources and Resilience" category, which integrates information such as a country's susceptibility to natural resource risks, the country's ability to adapt to these risks, and the country's potential exposure to climate change impacts. The data included in the Global Food Security Index is rich and comprehensive—exploring a country's profile carefully will provide a solid start to food security research. In addition, global rankings, trends, and findings are publicly published on the Global Food Security Index website and can help users understand underlying drivers of food insecurity around the world.

2. How does the production of this feedstock affect food security? Take into consideration land use change and specific methods of production.

a. **Context:** Feedstock production can affect food security in a number of ways (for example, impacts to food prices, local nutritional security, and land use impacts). Although there is potential for production of biobased plastic feedstocks to pose risks to food security, there is also an opportunity for production to improve food security. For example, growing food crops for biobased plastic production can allow for flexible allocation of crops in times of crisis. Food crops used for biobased plastic production can also improve global market stability by increasing the availability of food crops around the world, reducing the risk of shortages and speculation peaks.

b. **Considerations:** The following may be important considerations for your feedstock/region combination. Explore each.
- Does the feedstock contribute to diversification of food and income sources?
- Is the feedstock a dietary staple in the region, and/or is it a particularly nutritious food source?
- Are agricultural workers in the region experiencing food insecurity, and how does production of this feedstock affect that dynamic?
- Explore whether households in this region grow this feedstock for economic purposes versus for subsistence. If producers lose a source of income, they may not have the means to purchase more nutrient-dense foods, affecting their food and nutrition security.
- Finally, to better understand the food security status in the region and the effect of this feedstock on food security, consider regional social dynamics related to human rights, rights to land, Indigenous peoples' rights, and gender equity.

c. **Resources**
- Consult FAOSTAT, FAO Country Profiles, and resources available at the regional level.
- Engage with local research institutions (governmental or nongovernmental) to better understand conditions in the region and how this feedstock affects food security, including but not limited to health-related institutions (related to nutrition, hygiene, and safety), agricultural research institutions, economic institutions, and universities.

3. How can you mitigate the risks and increase the benefits?
- Given the wide range of impacts biobased plastic feedstock production can have on food security, the goal should be to mitigate risks and increase benefits as much as possible. Based on findings from the two research questions above, identify next steps to mitigate risk and increase benefits to promote food security, including experts or organizations to engage locally.

SCORING SUMMARY	**Record the identified issues that remain without clear mitigation strategies or improvement plans.**

NEXT STEPS	Although there is often data on how food systems perform at the national level, accessing quality subnational data on food security is significantly more challenging. To adequately understand the local context and potential implications of biobased plastic feedstock production on a local level, more sophisticated engagement with the producer (on the farm level) may be necessary. Partnering with a credible research institution may help users achieve better understanding of food security implications for a specific supply chain. Research institutions often undertake projects in which they map out supply chains and food environments to achieve higher-resolution data. These types of projects can produce useful geospatial maps as well as maps of stakeholder engagement to understand impacts across all involved groups regardless of power. Whether additional research with an outside organization or institution is pursued or the methodology user works closely and diligently with the stakeholders at the farm level, it is absolutely essential that elements of food security are explored before final project approval, not retroactively after impacts are being felt. Early identification of potential risks and benefits can ensure producers and purchasers of biobased plastic feedstocks implement a rigorous plan and committed funding to ensure the maximization of benefits and minimization of risks.

BFA Survey Level Screening		
LEGAL PRODUCTION *Applicable feedstock categories: A–D*		**GOALS: 1**

Context
Cultivating feedstocks for biobased plastic requires land and labor, which may potentially pose legal issues. In the case of agricultural feedstocks, the land being used may not be intended for agricultural production, and therefore may not be compliant with the local zoning law. In addition, because of the urbanization progress of many developing countries and regions, the intended agricultural land may not comply with the current and future land use plans for that given area. Utilizing land to cultivate feedstocks could also involve land acquisition. This process must have general consensus from all the stakeholders, like the local government, nearby farmers, and people from the local community. Business or agricultural practices should not continue with major disapproval from any of the stakeholders even if the practices per se comply with the local and national laws and plans. Potential legality issues in regard to labor practices also need to be taken into consideration. Issues in sourcing, minority rights, and appropriate resettlement and economic displacement policies exist in many countries, especially developing countries. This is a complicated issue. The variation in business and agricultural practices along with regionally specific legal concerns make it essential to research land and labor issues before undertaking a project. Additionally, further assurance that all the products are produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations is vital. A third-party assessment of legal production in consultation with local stakeholders will help ensure credibility and accuracy in understanding the local legal context.

Metric	Result	Justification	Mitigation Strategy
1. Is or will the feedstock production be compliant with international and local laws, regarding zoning and land use plans?	Yes No		
2. Is or will the feedstock production be compliant with international and local laws regarding water, air, and soil use, extraction, and/or emissions?	Yes No		
3. Is or will the feedstock production be compliant with the World Bank resettlement and economic displacement policies, including Operational Policy on Indigenous People 4.10 and Involuntary Resettlement 4.12? See Appendix B for regulatory definitions and further guidance.	Yes No		

4. Is local governance of feedstock production in accordance with Minority Rights in International Law? Note: Answering this question will require an understanding of the local context. It is recommended that users of this methodology conduct additional due diligence, including by consulting local stakeholders and partnering with institutions with a high level of local knowledge and experience. See Appendix B for regulatory definitions.	Yes No		
5. Do you have internal company processes in place to address future changes in the legal and regulatory landscape and a mechanism to audit the supplier to ensure continued compliance?	Yes No		

SCORING SUMMARY	How many questions above were answered with “No”? _____ “No” responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	If any of the metric scores highlight a risk, it should be identified here.

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy and its impacts on legality. It is recommended to look as close to production-site level as possible for compliance and to work with producers to include audits or third-party review.

BFA Survey Level Screening		
LOCAL AND/OR INDIGENOUS COMMUNITIES *Applicable feedstock categories: A–D*		**GOALS: 3, 4**

Context
Local and/or Indigenous communities describes the people who live in the areas where the feedstock is being produced. Sometimes when commercial production of a feedstock comes into a new area, it can displace available ecosystem resources or services that were historically used as part of the commons. For example, utilizing water to cultivate feedstocks may deprive the local community from using it as a drinking source. In addition, developing land for feedstocks may displace other traditional cultural uses or spiritual values to which Indigenous or traditional people have rights. As excerpted from WWF's *2050 Criteria*, a guide to responsible investment in agricultural, forest, and seafood commodities, "The rights of local people are respected, which can be assessed by: demonstrated and non-contested rights to utilize the land and recognition of and respect for other legal or customary rights; negotiations with Indigenous people based on Free, Prior and Informed Consent (FPIC); as well as other potential measures. Issues of gender representation, representation of traditionally marginalized groups, health and clean water, resource diversion and scarcity, ecosystem services, and potential impacts on livelihoods and smallholders, are considered and structured into consultations. Engagement and dispute resolution processes and instances are fully transparent." With the rapid expansion of many feedstocks, the rights of local communities and Indigenous peoples, landholders, and subsistence farmers are at greater risk of being violated. In order to ensure the well-being of Indigenous peoples and/or local communities, the land acquisition process must include free, prior, and informed consent with participation and support by all stakeholders involved, including those with customary rights or overlapping resource claims. Ongoing conflict or uncertainty over land and resource tenure can seriously undermine the viability and, therefore, the sustainability of the project, as well as its ability to contribute to poverty reduction. If there is no credible evidence that the land and/or resources were acquired in an open and transparent fashion or if there are unresolved disputes over the land or embedded resources, the project should not be approved. Additionally, local communities are also impacted by climate change, altering their livelihoods, resource use, and migration. For more guidance on respecting the rights of local and/or Indigenous communities, see Accountability Framework's overview on this topic and WWF's Standard on Indigenous Peoples.

Metric	Result	Justification	Mitigation Strategy
1. Does or could the production of this feedstock maintain or improve the access to material (e.g., physical resources) or immaterial (e.g., sense of community, innovation, intellectual capital) resources for local and/or Indigenous communities, explicitly considering climate change projections for resource availability?	Yes No		

2. Can you confirm the feedstock cultivation will not affect any areas identified as having cultural importance to local community members (e.g., burial sites, sacred forests)?	Yes No		
3. Can you confirm the production of this feedstock will not result in delocalization or migration for local and/or Indigenous communities? Delocalization: To remove from a native or usual locality. See IUCN Standard on Involuntary Resettlement and Access Restrictions.	Yes No		
4. Is there evidence that the production of this feedstock will **not** have negative impact on the cultural heritage or respect of Indigenous rights for local and/or Indigenous communities?	Yes No		
5. Does or could the production of this feedstock provide local employment or income-generating opportunities for local and/or Indigenous communities? FPIC would help determine whether this type of income-generating opportunity would be suitable for the community's needs and aspirations. It should not be assumed that the potential for employment with this project is necessarily satisfactory for the community's traditional and cultural norms. If the project negatively affects people's livelihoods, these negative impacts need to be mitigated or compensated for.	Yes No		
6. Does or could the production of this feedstock maintain or improve the living conditions for local women and men, including Indigenous communities? Consider the potential for the project to exacerbate or contribute to gender-based violence in the region.	Yes No		

7. Does or could the production of this feedstock maintain fair market prices for local crops? The project should protect, support, and restore the human rights and sustainable livelihoods of women and girls and of men and boys—a crucial step toward eliminating hunger and poverty and ensuring the safety and dignity of all people and communities.	Yes No		
8. Is there no evidence of production impacts that negatively affect the safe and healthy living conditions for local and/or Indigenous communities (e.g., effluent, air emissions and pollution, drinking water)? List potential impacts. See WWF's Standard on Community Health, Safety and Security for additional context on these risks and potential mitigation measures.	Yes No		
9. Was there or will there be FPIC in changing the use of this land? (Whether or not it is specifically called FPIC, this is the principle that a community has the right to give or withhold its consent to proposed projects through participation and influence on decisions that may affect the lands they customarily own, occupy, or otherwise use.) For more information on FPIC, see the WWF page Indigenous Peoples and Free, Prior, and Informed Consent.	Yes No		
10. Does or could the production site meet ILO Convention 169—Indigenous and Tribal Peoples Convention, Convention concerning Indigenous and tribal peoples in Independent Countries? Or is the production site in a country that is a	Yes No Unknown		

signatory to other conventions and/or declarations of importance to Indigenous communities and human, women's, and peasant rights, such as United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas, that supplement ILO 169? See Appendix B for ILO Convention 169.			

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	If any of the metric scores highlight a risk, it should be identified here.

NEXT STEPS	Verify that the project includes a rigorous plan and committed funding for the monitoring and evaluation of the proposed feedstock production strategy and its impacts on local and Indigenous communities.

BFA Survey Level Screening		
OCCUPATIONAL HEALTH AND SAFETY *Applicable feedstock categories: A–D*		**GOALS: 1**

Context

Agriculture ranks as one of the most hazardous industries. Workers can be exposed to toxic chemicals or have accidents with heavy machinery, and the work itself is not only physically demanding but also often located in regions hit hard by the impacts of climate change, such as increasing temperatures. These potential risks may increase when the business and agricultural practices occur in developing countries and regions where local laws may have relatively lower health and safety standards for such occupations.

The amount of agricultural chemicals used for cultivating feedstocks—and the precautions taken to train and protect workers from their negative impacts—are important factors to consider for occupational health and safety. See WWF's Standard on Pest Management for guidance for minimizing and mitigating the risks associated with chemical pest management.

Additionally, business entities should evaluate whether the agricultural labor practices, such as harvesting and processing of crops, will pose any additional physical threats to workers. Whether those processes will involve heavy machinery and whether workers have been through safety training for machinery work are all essential queries that businesses and agricultural entities should ask before any production begins. In areas where heavy machinery is not applicable and hand harvesting is common, the operation shall also assess the cumulative physical impact of these repetitive practices on the human body over time.

In situations where the instability of the local political environment threatens the health and safety of the workers, it is especially important that businesses and agricultural entities have a careful and thorough plan to ensure worker health and safety. It is possible that the cultivation of feedstock may have the potential to stabilize the local community through increased employment and local infrastructure; all social impacts, both positive and negative, should be considered.

Overall, it is critical that the operation have a comprehensive health and safety program that not only trains the workers on the health and safety aspects of their jobs, but also proactively seeks to reduce accident risk through conducting risk assessments, investigating causes of accidents, and seeking worker and labor representatives' input into process improvements that reduce worker risk. A third-party assessment of occupational health and safety in consultation with local stakeholders will help ensure credibility and accuracy in understanding the local context.

Metric	Result	Justification	Mitigation Strategy
1. Can you confirm the production of this feedstock does not pose any of the following potential worker safety issues? • high agrochemical use • inadequate storage of or training in the use of pesticides • manual or unregulated harvesting practices that pose health risks	Yes No		

• long working hours • long hours in areas with exposure to sunlight, ultraviolet radiation, and/or excessive heat • work at high elevations • work with complex or dangerous machinery • lack of training in emergency scenarios and evacuations • lack of availability of appropriate personal protective equipment (PPE) • lack of training in use of PPE or health and safety processes • other unsafe working conditions See both Appendix A: Resources—Social Resources and Appendix B: Regulation and Policy to help answer this question.			
2. Can you confirm the following are not of concern in this region? • active political unrest or political violence at the local, regional, or national level • lack of government oversight • exploitation by cartels or gangs See the World Bank's List of Fragile and Conflict-Affected Situations for evaluation of political unrest at the country level.	Yes No		
3. Is basic medical care equitable and accessible to the workforce in this region?	Yes No		
4. Will or does production comply with ILO Conventions (regarding Safety and Health in Agriculture, Safety and Health in Forestry Work, etc.)? ILO guidance on social impacts of aquaculture has not yet been established; for guidance on social impacts of aquaculture, see Principle 3 of the ASC. See Appendix B for regulatory definitions.	Yes No		

SCORING SUMMARY	How many questions above were answered with “No”? _____ “No” responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered “No.”

NEXT STEPS	It is recommended to require a site-level comprehensive health and safety program that not only trains workers on the health and safety aspects of their jobs but also proactively seeks to reduce accident risk through conducting risk assessments, investigating causes of accidents, and seeking worker and labor representatives’ input into process improvements that reduce worker risk.

BFA Survey Level Screening		
LABOR RIGHTS *Applicable feedstock categories: A–D*		**GOALS: 1**

Context

Feedstock production labor requirements, depending on the region and feedstock, may vary considerably, from having labor needs on a full-year basis to having intensive seasonal needs for a short period, such as during harvest. Human rights abuses related to child labor and forced and bonded labor can be more frequent in the case of agriculture work due to the vulnerability and informality of such sectors with relatively low requirements for workers' education and skill levels.

In the case of high seasonal needs and low local labor availability, feedstock operation managers will sometimes bring in migrant workers from other regions. This requires the provision of adequate housing, health facilities, training, etc. When these needs are not met, substandard living conditions may result for workers and their families. For more information on agriculture-related seasonal migration, see Seasonal Migration and Child Labour in Agriculture (FAO) and Migrant Workers in Commercial Agriculture (ILO).

At a minimum, the long-term sustainability of any agricultural venture must contemplate full compliance with local labor law, the Universal Declaration of Human Rights, the United Nations Guiding Principles on Business and Human Rights, and other ILO conventions noted below. Evaluating compliance with labor rights is not an easy task, even in the best of circumstances. Many of the issues are not necessarily specific to just one workplace or industry but may reflect larger social and economic trends at a national or regional level. Local, national, and regional labor and human rights NGOs should be consulted, as they can provide valuable input into this assessment; these experts can help highlight key labor rights concerns that need to be addressed in setting workplace practices in a particular region or industry.

Because many of these issues are complicated, seeking appropriate guidance is recommended. Additionally, a third-party assessment of labor conditions would help ensure credibility and accuracy in understanding the local context. Finally, labor rights coverage should extend through all supply chain operations; this methodology focuses exclusively on operations from cradle to gate, but users should be aware that processing and subsequent supply chain operations may require significant manual labor and expose workers to labor rights risks—users of this methodology are expected to perform due diligence across all supply chain operations.

Metric	Result	Justification	Mitigation Strategy
1. Explore the following labor risks for this feedstock/region combination. Sources for exploring these risks can be found in Appendix B: • use of migrant labor • level of FOA present/legal landscape • difference in manager nationality/race/religion • use of apprenticeship programs • female worker/male management • use of piece rate payment systems	Describe results of research here.		

• use of third-party labor providers • use of prison labor • seasonality of crop • company-provided accommodation • chance of children working with parents • government or company unions • culture of bribery			
2. Does or will the production of this feedstock meet the following labor rights standards? a. Child Labor: ILO Conventions 138 and 182, Recommendation 146 b. United Nations Convention on Rights of the Child c. Slave and Bonded Labor: ILO Conventions 29 and 105 d. Freedom of Association: ILO Conventions 87, 11, and 98 e. Equal Pay and Discrimination: ILO Conventions 100 and 111 f. Universal Declaration on Human Rights Note: If this is for new production, score for likelihood of new site to comply. See Appendix B for regulatory definitions.	Yes No		
3. Do or will all workers, including those employed by subcontractors, have contracts? Answer "Yes" if there is substantial evidence to ensure the quality, content, and rights secured by these contracts are lawfully adequate (under local and national laws) and are respected.	Yes No		
4. Will or does the cultivation of the feedstock accommodate worker composition by either supporting local labor when available or enabling a migrant workforce if necessary?	Yes No		

5. Is the local social infrastructure sufficient to address the needs of the labor force (health care, education, housing, etc.)? Additionally, consider how the producing company is contributing positively (or negatively) to building social infrastructure (e.g., facilities that support social services) for their employees and for the wider local community.	Yes No		

SCORING SUMMARY	How many questions above were answered with "No"? _____ "No" responses without identified mitigation strategies indicate moderate to high risk, and further research should be performed to explore the probability and severity of identified risks. Mitigation plans should be in place before production is pursued. **How many identified issues remain without clear mitigation strategies or improvement plans? _______**

IDENTIFIED RISKS	Identify and provide more detail for any questions answered "No."

NEXT STEPS	It is recommended to seek information specific to the production site and to work with producers to include audit or third-party review of relevant labor codes, such as through the SA8000 certification. Recognizing the need for customization based on the specific region and/or feedstock type, listed here are potential third-party organizations to partner with in verifying labor standard practices: Fair Labor Association, Human Rights Watch, International Labour Conference's Committee on the Application of Standards (part of United Nations' International Labour Organization), International Labor Rights Forum, Institute for Global Labour and Human Rights, Worldwide Responsible Accredited Production (WRAP), Student/Farmworker Alliance, Worker Rights Consortium.

SUMMARY SCORECARD

Indicator	Number of identified issues without clear mitigation strategies or improvement plans	Provide additional details and/or next steps for issues without clear mitigation strategies or improvement plans
Ecosystem Services		
Biodiversity		
Chemical Use and Impact		
Residues and Waste Management		
GHG Emissions		
Land Use Change Impacts		
Soil Management		
Water Management		
Food Security		
Legal Production		
Local and/or Indigenous Communities		
Occupational Health and Safety		
Labor Rights		

Note on Responsibly Sourced Biobased Plastic Claims

If the *Methodology for the Assessment of Bioplastic Feedstocks (2021)* is used, the scoring system is such that "No" responses from the Survey Level Screening indicate potential environmental or social risk. There should be clear mitigation strategies or improvement plans in place for any "No" response. If all "No" responses in the Survey Level Screening have mitigation or improvement plans established for the feedstock/region combination, this is a promising indication that strong sourcing safeguards are in place. **Use of this method does not imply endorsement or validation of sourcing practices from any organization.**

The information provided for this assessment is self-reported, and ultimately it is the user's decision how to proceed. Certification by credible standards remains the best approach to ensure responsible sourcing. See WWF Principles for Standards and Certification Schemes and the section "Production Management and Risk Mitigation" on page 7 of the methodology for more information.

Photo Credits

Cover photo credit: © Kari Schnellmann/WWF-Switzerland
"Contents" photo credit: © Yoon S. Byun/WWF-US
Page 1 photo credit: © Emily Vandenbosch/WWF-US
Page 2 photo credit: © Yoon S. Byun/WWF-US
Page 13 photo credit: © Andrew Parkinson/WWF-UK

Appendix A
Resources

The following high-level resources can help guide responses to Executive Level Screening and Survey Level Screening questions on environmental risks, social risks, and resilience.

Environmental Resources

- IUCN Red List of Threatened Species, for the most comprehensive list of conservation statuses for plant and animal species.
- Integrated Biodiversity Assessment Tool by UN Environment World Conservation Monitoring Centre, for geographic information about global biodiversity.
- Global Forest Watch Interactive Map provides geospatial forest information (tree cover gain/loss).
- The State of the World's Land and Water Resources for Food and Agriculture from FAO provides information on the status of land and water resources around the world as well as existing and predicted opportunities and challenges related to these resources.
- Land cover maps from NASA and the European Space Agency can be used to explore deforestation trends.
- Global Assessment of Human-induced Soil Degradation (GLASOD) provides a world map of human-induced soil degradation.
- Trends.Earth from Conservation International for monitoring land change including productivity, land cover, and soil organic carbon.
- World Database of Protected Areas provides the most comprehensive global database of marine and terrestrial protected areas, updated on a monthly basis.
- Alliance for Zero Extinction: Geospatially defined last remaining habitat of threatened species.
- Important Bird Areas: Global map of IBAs from BirdLife, Audubon map of IBAs in the US.
- UN Biosphere Reserves: Areas of learning for sustainable development. Reserves aim to reconcile biodiversity conservation and the sustainable use of natural resources.
- IUCN Protected Area Categories: Protected areas categorized into specific types (strict nature reserve, wilderness area, etc.), recognized by the UN and used as a global standard for defining protected areas.
- RAMSAR Sites: Wetland sites designated to be of international importance under the Ramsar Convention on Wetlands.
- Global Forest Watch: Online tool to monitor global forest data in near-real time, includes an intact forest landscapes layer.
- Country-level soil health maps.
- Media attention to explore individual, local environmental challenges and reputational risks to sourcing.

Ecosystem Services Tools

- Natural Capital Coalition's The ESII (Ecosystem Services Identification & Inventory) Tool: Free online tool that can be used in site planning, impact assessments, and cost/benefit analyses, or to compare alternatives.
- Guide to Selecting Ecosystem Services Models for Decision Making: Lessons from Sub-Saharan Africa: Guide to help advisors select an ecosystem services model(s) best suited to their needs.
- Ecosystem Services Assessment Support Tool: A tool to help break down the ecosystem services assessment process into a logical sequence of steps.
- Guidance for Key Biodiversity Areas, Natural World Heritage Sites, and Protected Areas provides guidance on existing ecosystem assessment tools that can be applied to measure or model ecosystem services provided by important sites for biodiversity and nature conservation.

Water Management Tools

- WWF Water Risk Filter is an online tool to explore, assess, respond to, and value water risk.
- Alliance for Water Stewardship standard guidance: Fully online, interactive version of AWS Standard 2.0 and related guidance. AWS provides a global framework to help water users understand their water use and the associated impacts. Use of the AWS framework can help identify water risks and opportunities at the catchment level. AWS offers a stepwise approach to mitigating water risk that is designed to work in any industry or geography.
- RAMSAR key biodiversity area sites: RAMSAR sites are wetland areas designated to be of international importance under the Ramsar Convention on Wetlands. Geographic information related to these as well as key biodiversity areas should be taken into account in analyzing the potential impacts of growing a biofeedstock in a specific geographic area.
- UN-Water has developed seven indicator reports that track progress toward the various targets set out by Sustainable Development Goal 6: *Ensure access to water and sanitation for all*. These reports highlight challenges and opportunities across six unique water indicators and identify best practices moving forward. Reports are based on country-level data.
- WFN Water Scarcity Maps.
- WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply: Water, Sanitation, and Hygiene tool.
- World Resource Institute's Aqueduct tools to identify and evaluate water risk.

Relevant Resources by Potential Risk	
Potential Risk	**Relevant resources from list above** *Media attention can be used for all risks to explore individual, local environmental challenges to a geography/feedstock combination and reputational risks to sourcing.*
Threatens/impacts protected areas either directly or indirectly (e.g., land use change)	• World Database of Protected Areas • Alliance for Zero Extinction • Global map of IBAs from BirdLife • Audubon map of IBAs in the US • UN Biosphere Reserves • IUCN Protected Area Categories • RAMSAR Sites • Global Forest Watch • Trends.Earth • Land cover maps from NASA and the European Space Agency • Global Forest Watch Interactive Map • State of the World's Land and Water Resources for Food and Agriculture
Impacts to threatened/endangered species in the area; impacts to endemic species	• IUCN Red List of Threatened Species • Integrated Biodiversity Assessment Tool • Alliance for Zero Extinction • Global map of IBAs from BirdLife • Audubon map of IBAs in the US

Requires direct land use change to grow feedstock (natural habitat conversion)	• Trends.Earth • Land cover maps from NASA and the European Space Agency • Global Forest Watch Interactive Map • State of the World's Land and Water Resources for Food and Agriculture
Soil erosion, compaction, and degradation	• Country-level soil health maps • Global Assessment of Human-induced Soil Degradation (GLASOD)
Pollutes the local water resources; utilizes water from already or projected water-stressed area	• All water management tools listed above
Threatens/impacts intactness and connectedness of ecosystems; specifically threatens refugia	• Assessing Resilience in Social-Ecological Systems: Workbook for Practitioners
Cultivated on land that would otherwise be more beneficial for nature-based solutions for adaptation	• Nature-based Solutions Initiative, University of Oxford • Nature-based Solutions, International Union for Conservation of Nature • IUCN Global Standard for Nature-based Solutions, International Union for Conservation of Nature • Nature-based Solutions for Climate Change, World Wildlife Fund

For Further Analysis—Comprehensive Environmental Tools for Decision-Making

The tools below can help map and quantify biological and physical changes and the economic impacts of such changes in ecosystem services provisioning to get a more detailed understanding of the impacts from land use change and the resulting trade-offs to society. They can also help identify potential deforestation hotspots. These tools are complex and may be better suited for detailed analysis after the ELS has been completed and further investigation into a feedstock/region combination is needed.

- InVEST tool: InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) is a suite of models used to map and value the goods and services from nature that sustain and fulfill human life. It helps explore how changes in ecosystems can lead to changes in the flows of many different benefits to people.

- Earth Genome Project offers a number of tools and services to help users translate big environmental data into insight for decision-making.

Social Resources

- Global Map of Environmental and Social Risks in Agro-Commodity (GMAP): Six of the 10 indicators specifically focus on social factors.
- US Department of State Country Reports on Human Rights Practices.
- Media attention, country profiles from departments of state, NGO white papers on social issues.
- Global Forest Watch, map layers on Indigenous and Community Lands.
- Roundtable for Product Social Metrics, 2020 Handbook for Product Social Impact Assessment: Guides assessment of the positive and negative social impacts of products and services on four stakeholder groups: workers, local communities, small-scale entrepreneurs, and users.
- Accountability Framework's Operational Guidance on Respecting the Rights of Indigenous Peoples and Local Communities.
- Social Accountability International is a global nongovernmental organization committed to advancing human rights at workplaces. The SAI website provides comprehensive information on the services provided by SAI and ongoing programs including industry collaborations and research.
- The SAI 8000 Standard and Certification System is an industry-leading social certification program.
- WWF-Specific Safeguard Standards (guidance and social policies): These standards may provide some additional information and guidance to methodology users that could be useful in ensuring decisions made around biobased plastic feedstock sourcing reflect sound social analysis and WWF's values (below).

Indigenous Peoples and Local Communities

- WWF's Standard on Community Stakeholder Engagement
- WWF's Standard on Disclosure
- WWF's Standard on Indigenous Peoples
- WWF's Standard on Cultural Resources
- WWF Policy Statement on Human Rights
- WWF Policy Statement on Gender Equality
- WWF Standard on Pest Management

Some social indicator responses will rely on similar information across a country. For example, issues such as freedom of association and collective bargaining, wages, and use of seasonal, casual, and migrant labor may all rely on information about the agriculture sector more generally in the region if feedstock-specific data is not available. However, data/research collected from as close to the production site as possible and with input from local stakeholders is preferred whenever possible.

Resilience Resources

- Local community vulnerability assessments (e.g., Climate Vulnerability and Capacity Analysis Handbook (CVCA) by the Care Climate Change and Resilience Information Center or the Participatory Capacity and Vulnerability Analysis (PCVA) by Oxfam)
- Local adaptation planning documents
- National Adaptation Plans (NAPs)
- National vulnerability assessments
- National hydrology and meteorology service
- Internet-based interactive IPCC scenario mapping tools
- Internal Geospatial Information Services (GIS) staff (or consultants, depending on organizational capacity)
- National government forestry, soil and watershed, or agriculture services
- District- or state-level government office annual reports

- National planning agency annual reports
- Peer-reviewed studies and gray literature on economic trends
- Local-level Climate Vulnerability and Capacity Analyses or other community-based assessments
- [The World Bank online data portal]

Factors of Resilience	
Connectivity or Fragmentation	The degree to which the landscape facilitates or impedes movement of resources or species. *Example: A river with multiple dams has low connectivity because water and species migration pathways are obstructed.*
Natural Variability	The degree to which a given system is accustomed to, or adapted to, variability in the frequency of occurrence of natural hazards (e.g., floods, droughts, and fires) and resource availability. *Example: A forest with naturally occurring fires will be more resilient to an increase in fires than a forest that never experiences them because it is composed of species that have evolved to be successful under fire regimes.*
Refugia	The existence and quality of places within a system that are less exposed to climate and environmental variability and thereby help in maintaining ecosystem services during broader regional environmental change. The greater the number and quality of these refugia, the less sensitive the ecosystem may be. *Example: Deep depressions in a stream or riverbed that provide refuge for some fish during the dry season also have the potential to protect species from rising temperatures and increasing drought-related reductions in stream flow.*
Functional Redundancy	The degree of duplication and/or overlap of key functions or services in a system where greater overlap translates to greater resilience. *Example: In the 1980s in the Caribbean, overfishing reduced abundances of herbivorous fish, which was followed by mass mortality of herbivorous sea urchins; this is commonly thought to have resulted in the change from coral-dominated reefs to algae-dominated reefs. If only one herbivorous species had been lost, the function of algae control would have been left intact. Instead the redundancy in the system was lost.*
Biodiversity	Biodiversity is defined as the variety and composition of living organisms. Greater variability in species composition helps ensure that the impact of a particular hazard is not felt uniformly throughout an entire ecosystem, and thus reduces overall sensitivity, as key functions are maintained. *Example (ecosystem): A forest primarily made up of one tree species will inherently be more sensitive to disease than one that is made up of multiple species (some of which may be resistant to the blight).*

Natural Productivity	The rate of generation of an ecosystem's biomass. Slower generation rates contribute to higher sensitivity, as a portion of a system would not be able to regenerate quickly after a shock, thus causing more long-term disruption, and lower resilience, in the ecosystem as a whole. *Example: Corals take years to grow to maturity. If a large portion of coral is lost, then that reef system could suffer for a prolonged period of time. If enough damage is done to the reef and it bleaches in its entirety, that could result in years of impact on the coastal systems and fisheries that rely on it.*

Appendix B:
Regulation and Policy Definitions

Biodiversity

IUCN Red List of Threatened Species List

Chemical Use

World Bank OP 4.09—Pest Management
World Bank policy on pest management, including supporting strategies to reduce reliance on synthetic chemical pesticides.

WHO Recommended Classification of Pesticides by Hazard
1A Defined as “Extremely Hazardous”
1B Defined as “Highly Hazardous”

EPA Emergency Planning and Community Right-to-Know Act (EPCRA) Hazardous Chemical Storage Reporting Requirements
US EPA regulation that establishes safety rules around hazardous chemicals used or stored in the workplace, including annual public reporting requirements.

Food Security

FAO Low-Income Food-Deficit Countries List

FAO Food and Agriculture Database

IPC Acute Food Insecurity Reference Table for Household Groups

GHG Emissions

ISO 14044:2006 Environment Management—Life-Cycle Assessment—Requirements and Guidelines
ISO 14044:2006 is a guideline that provides requirements and recommendations that an individual should utilize through each phase of developing a life-cycle assessment (LCA).

ISO/DIS 14067.2 Carbon Footprint of Products—Requirements and Guidelines for Quantification and Communication

Labor Rights

Child Labor: ILO Conventions 138 and 182, Recommendation 146
ILO Convention 182 Worst Forms of Child Labour Convention, 1999

A child is anyone under the age of 18. This recommendation summarizes what activities are deemed the worst forms of child labor, including (but not limited to) slavery, child trafficking and prostitution, and life endangering work.

ILO Convention 138 Minimum Age Convention, 1973
Convention concerning Minimum Age for Admission to Employment

ILO Recommendation 146 Minimum Age Recommendation, 1973
Recommendation of a minimum age of employment for children and measures to safeguard a child's mental and physical health during employment.

United Nations Convention on Rights of the Child
Declaration and articles that list the rights of every child and focus on protecting children from exploitation.

Slave and Bonded Labor: ILO Conventions 29 and 105
ILO Convention 105 Abolition of Forced Labor Convention, 1957
Basis of #105: Convention concerning the abolition of forced labor

ILO Convention 29 Forced Labor Convention, 1930
For the purposes of this Convention, the term ***forced or compulsory labor*** shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.

Freedom of Association: ILO Conventions 87, 11, and 98
ILO Convention 98 Right to Organise and Collective Bargaining Convention, 1949
Workers shall enjoy adequate protection against acts of anti-union discrimination in respect of their employment.

ILO Convention 87 Freedom of Association and Protection of the Right to Organize Convention, 1948
And/or
ILO Convention 11 Right of Association (Agriculture) Convention, 1921

Equal Pay and Discrimination: ILO Conventions 100 and 111
ILO Convention 100 Equal Remuneration Convention, 1951
Men and women will be paid equal value for equal work, without discrimination based on sex.

ILO Convention 111 Discrimination (Employment and Occupation) Convention, 1958
Defines discrimination in occupation and employment.

Universal Declaration on Human Rights
All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act toward one another in a spirit of brotherhood.

Additional Resources
International Labor Organization (ILO) Website

Social Accountability International SA8000 Standard
Standard that provides recommendations on workers rights and employment, including guidance on number of working hours, equitable payment and disciplinary practices, collective bargaining, health and safety, etc.

Legal Production

[Minority Rights: International Standards and Guidance for Implementation]
This United Nations' policy pays attention to issues such as the recognition of minorities' existence, their rights to nondiscrimination and equality, the promotion of multicultural and intercultural education, the promotion of their participation in all aspects of public life, etc.

[Operational Manual—Involuntary Resettlement 4.12]
To address involuntary resettlement caused by Bank-financed development projects. The main objective of the policy is to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts.

[Operational Manual—Indigenous People 4.10]
This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of Indigenous peoples.

Local and Indigenous Communities

[ILO Convention 169 Indigenous and Tribal Peoples Convention, 1989]
Convention concerning Indigenous and Tribal Peoples in Independent Countries

[Guidelines on Free, Prior, and Informed Consent (FPIC)]
Indigenous people's right to free, prior, and informed consent (FPIC) has been recognized by the United Nations. Based on these guidelines, Indigenous peoples should be guaranteed the collective right to give or withhold their free, prior, and informed consent to relevant activities that take place in or otherwise impact their lands, territories, and resources.

[The 2050 Criteria]
World Wildlife Fund (WWF) developed these criteria to address the widespread insufficiency of food, fiber, and bioenergy to meet the needs of human society. Providing distilled guidance based on leading industry practice, The 2050 Criteria should serve as a field guide for investors to access mainstream agricultural, forest, and seafood commodities in a responsible manner.

Occupational Health and Safety

[ILO Convention 184—Safety and Health in Agriculture Convention]
This series of manuals has been developed by the International Labor Organization to help unions representing agricultural workers tackle health, safety, and environmental (HS&E) problems.

WWF

Bioplastic
Feedstock
Alliance

bioplasticfeedstockalliance.org