WWF

REPORT

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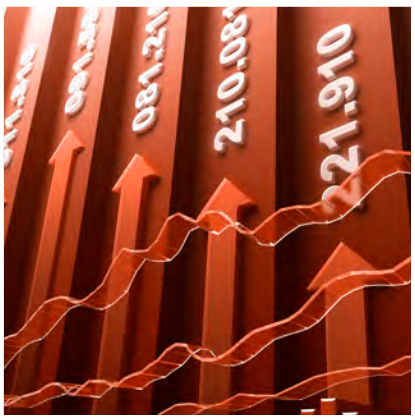
2012

The 2050 Criteria

Guide to Responsible Investment in Agricultural, Forest, and Seafood Commodities



WWF
WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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Green soy leaves, Rondonópolis, Brazil

FOREWORD

John Tobin
Managing Director, Global Head of Sustainability Affairs, Credit Suisse

Natural capital—together with human and financial capital—is a fundamental input to the global economy. Nowhere is the value of natural capital more evident than in agricultural, marine, and forest production—the so-called soft commodities. In addition to supplying the calories that sustain the lives of 7 billion people, soft commodities are also in high demand as vital sources of fiber and animal feed. More recently, soft commodities have become important inputs to transportation biofuels and emerging bioproducts industries. The evidence of increasing demand is everywhere, from sharp increases in commodity prices to food production becoming one of the fastest-growing sectors by revenue.

While the importance of soft commodities is clear, we also know that agribusiness, seafood production, and forestry have profound impacts on the natural environment and surrounding communities. From habitat conversion to water consumption, and from soil erosion to the accumulation of carbon pollution in the atmosphere, the global soft commodities business poses an enormous sustainability challenge. If business and society are to make the shift from the 20th-century model of unsustainable production and consumption to a 21st-century model of sustainability, the front lines are to be found in agricultural fields, at the edge of the forests, and in fishing grounds around the world

Investors are keenly aware of the boom in soft commodities, but not everyone fully understands its complex environmental implications. Thanks to WWF and its unique expertise and understanding of the interaction between markets and conservation, *The 2050 Criteria* sheds much light on the subject. The financial community will benefit from this timely, science-based overview of high-impact global commodity sectors. Further, by identifying Key Performance Criteria for responsible practice, we now have a tangible framework to evaluate companies on the ground and to support the data-driven assessments of business value that sustainability creates.

At Credit Suisse, we believe that financial institutions should systematically evaluate environmental and social risk in transactions, which in fact is becoming standard practice in the banking industry. We also believe that this process should be part of a broader commitment to long-term sustainability, including support for organizations such as the United Nations Global Compact and the United Nations Environment Program Finance Initiative and membership in industry sustainability initiatives such as the Roundtable on Sustainable Palm Oil.

While Credit Suisse understands that soft commodities pose unique sustainability risks to investors, we also understand that responsible agriculture, seafood production, and forestry offer compelling opportunities for mainstream investment. Responsible producers may have a competitive advantage through increased efficiencies, lower costs, better technologies, and improved market access, while responsible buyers and retailers benefit from reliable, high-quality supply chains and sound reputations. For food, agriculture, and consumer goods companies operating in the 21st century, sustainability builds value and provides a key distinction for a company's business performance and strategy.

FOREWORD

On a planet of finite natural resources, the sustainable management of those resources, on which all our livelihoods depend, is a shared responsibility. Scientific analysis by World Wildlife Fund (WWF), however, demonstrates a troubling trend: we are currently consuming natural resources at a rate faster than Earth is replenishing them, or the equivalent of one and a half planets. At the current pace of growth, we will need three planets in the coming decades to meet humanity's needs. For bankers, this is the equivalent of living on the principal; for farmers, it is like eating your seed.

This trend is already having a profound impact on the global economy, and if we continue with business as usual we can expect bleak scenarios of poverty, hunger, political unrest, and stunted economic development. As global per capita consumption continues to rise, buoyed by unprecedented growth in emerging markets, it is the responsibility of all sectors of society to develop solutions to scale up food production while preserving biodiversity.

Financial products are ultimately derivatives of the natural economy. The owners and managers of global financial assets are those most exposed to the systemic risks resulting from degradation of our planet's natural resource base. They also hold influence over the actions of firms and markets. In our age of transparency and systems-based thinking, it is incumbent upon the financial sector to move from a reactive stance to a leadership role. Indeed, financial institutions must play an essential part in ensuring the long-term sustainability of our most basic markets—food, fuel, and fiber—for the billions who depend on them. By establishing thoughtful and scientific sustainability criteria for lending and investment conditions, and driving this across portfolios and down to the deal teams, financial institutions can manage risk and help ensure assets are protected in the long term.

Jason Clay
Senior Vice President,
Market Transformation,
World Wildlife Fund

The 2050 Criteria is a vital tool for informing these processes and developing solutions to the resource challenges the economy is facing. This guide is grounded in science and draws on intelligence gleaned from over 100 commodity experts working across more than 50 countries. It outlines the impacts of producing many of the world's most important food and fiber products, while providing criteria to identify best practices and reduce these impacts on the environment and society.

I hope this publication creates a new baseline and catalyzes finance and private sector alignment to confront the challenges of sustainability on a planet of finite resources. We look to the leaders of the global financial system who capitalize key industries to go further to raise standards in critical commodity markets. Those who move with urgency today to protect resources and manage risk will be tomorrow's leaders.

WWF is proud of its work in developing *The 2050 Criteria*, and we look forward to working collaboratively across all industries to protect the planet, its resources, its people, and its species.

ABSTRACT

Soft commodities represent fundamental building blocks of the global economy and play a vital role in human development. Agriculture, forest products, and seafood supply chains are responsible for feeding, clothing, and helping to fuel the world. In the past decade, soft commodity markets have experienced unprecedented volatility and scarcity, generating a range of supply chain shocks, social outcries, and policy responses. In many cases, Earth's natural resources are proving insufficient to meet accelerating global demand. Such trends pose a threat to businesses and investors, key ecosystems, and society at large. *The 2050 Criteria* provides a summary framework for mainstream financial actors to promote the global sustainability of these resources and the markets that depend on them.

The 2050 Criteria addresses 10 major global commodity sectors. These sectors are identified as high priority by the World Wildlife Fund due to the depth and significance of their current and potential aggregate impacts on global biodiversity, greenhouse gas emissions, and water use. These sectors include: aquaculture; beef; cotton; dairy; palm oil; soy; sugar; timber, pulp, and paper; wild-caught seafood; and bioenergy. Overall guidance is also provided for "other terrestrial commodities."

Each chapter contains both a summary of the industry and a guide to responsible investment. Primary environmental and social risks associated with the sector are clearly outlined. Leading standards and certifications are identified which can function as robust systems of verification and traceability, typically representing current best practices for mainstream financiers, producers, and procurers. For markets where credible standards do not yet exist, or for firms just commencing the path to sustainability, the capstone of this document is the Key Performance Criteria (KPC) for identifying environmentally and socially responsible companies and projects. *The 2050 Criteria*'s environmental and social risks and mitigation criteria are organized according to 10 cross-cutting themes: Biodiversity Loss & Conversion; Climate Change & Air Quality; Soil Erosion & Degradation; Water Use; Pesticides & Toxicity; Nutrient Loading & Eutrophication; Disease & Animal Care; Labor; Local & Indigenous Communities; and Society & Consumers. In addition, each chapter provides an overview of major trends, emerging investment opportunities, and links to external tools and resources.

The 2050 Criteria are designed for use by a variety of stakeholders, in particular banks, investors, and financial analysts. Insights are drawn from WWF's more than 100 commodity experts working across more than 50 country offices, partnerships and engagements with over 40 leading food and agriculture companies and 12 global banks, and input and reviews from leading social and human rights nongovernment organizations. *The 2050 Criteria* therefore connects environmental science with current practices and policies of leading firms in each sector, resulting in both credible and practical recommendations. Recent trends in corporate action suggest that sustainable supply chains for soft commodities provide a business advantage that is increasingly important to

Abstract

maintaining both reputation and cost structures and therefore competitiveness and profitability. Consequently, WWF believes that a concise, practical guide to responsible financing will benefit mainstream audiences and accelerate the integration of environmental and social factors into private sector behavior and investment.

The development of Key Performance Criteria is an evolving process designed to improve over time, reflecting the performance curve of the respective industries and current scientific understanding of the respective systems. In that respect, WWF expects future editions of *The 2050 Criteria* to reflect increasing societal expectations of responsible performance and continuous improvement in the framework and indicators.

Flooded forest, Rio Negro
Amazonas, Brazil

2050 CRITERIA OVERVIEW

Price volatility and scarcity in soft commodity supply chains pose significant challenges for businesses and financiers. Navigating these risks and uncertainties in agricultural, forest, and fisheries sectors grows increasingly complex as environmental and social impacts are brought to light. WWF's 2050 Criteria unravels this complexity, identifying the primary environmental and social risks for each commodity and pinpointing the Key Performance Criteria needed to smartly manage these issues and identify good practice. Throughout the publication, the Key Performance Criteria of utmost priority are identified by boldface type.

CATEGORIES OF IMPACT

- Biodiversity Loss & Conversion
- Climate Change & Air Quality
- Soil Erosion / Degradation
- Water Use
- Pesticides & Toxicity
- Nutrient Loading & Eutrophication
- Disease & Animal Care
- Labor
- Local & Indigenous Communities
- Society & Consumers

ENVIRONMENTAL & SOCIAL RISKS

- Escaped Fish
- Fish/Shrimp Feed
- Wild Brood and Seed
- Habitat Loss
- Overgrazing and Loss of Pasture Biodiversity
- Cattle Feed
- Land Conversion
- Loss of Pasture Biodiversity
- Irresponsible Forestry Practices & Habitat Conversion
- Encroachment on MPAs
- Fishery Collapse
- Benthic Impacts
- Bycatch
- Indirect Land Use Change
- Air Quality
- Greenhouse Gas Emissions
- Soil Health, Compaction, & Erosion
- Water Use
- Excessive Chemical & Antibiotic Use
- Agrochemical Use
- Genetic Modification
- Agrochemical Use Impacting Reefs
- Water Discharge from Mills
- Nutrient and Waste Loading in Water
- Nutrient Loading in Runoff
- Riparian Areas
- POME Discharge
- Disease
- Animal Health & Welfare
- Poor Working Conditions
- Health & Safety Risks
- Smallholders
- Child Labor and Debt Bondage
- Credit and Debt
- Importing Labor
- Respiratory Risks to Laborers & Communities
- Conflicts Over Shared Commons
- Ecosystem Services
- Community Displacement
- Food Displacement
- Timber Rights
- Food Insecurity
- Global Food Security
- Food Safety
- Illegal and Untraceable Products
- Illegal, Unregulated and Unreported (IUU)

COMMODITIES

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT: Biodiversity Loss & Conversion; Climate Change & Air Quality; Soil Erosion / Degradation; Water Use; Pesticides & Toxicity; Nutrient Loading & Eutrophication; Disease & Animal Care; Labor; Local & Indigenous Communities; Society & Consumers

- Animal Health and Welfare
- Area Based Management
- Chemical Use
- Ecosystem Functions
- Food Security
- Greenhouse Gas Emissions
- Indirect Land Use
- Labor Rights
- Land Management System
- Legal Production
- Life Cycle GHG
- Local & Indigenous Communities
- Manure Management
- Non-Target Species Impacts
- Nutrient Management
- Operational Health & Safety
- Pest Management
- Priority Areas Protection
- Soil Management
- Sustainable Feed
- Transparency and Traceability
- Water Management

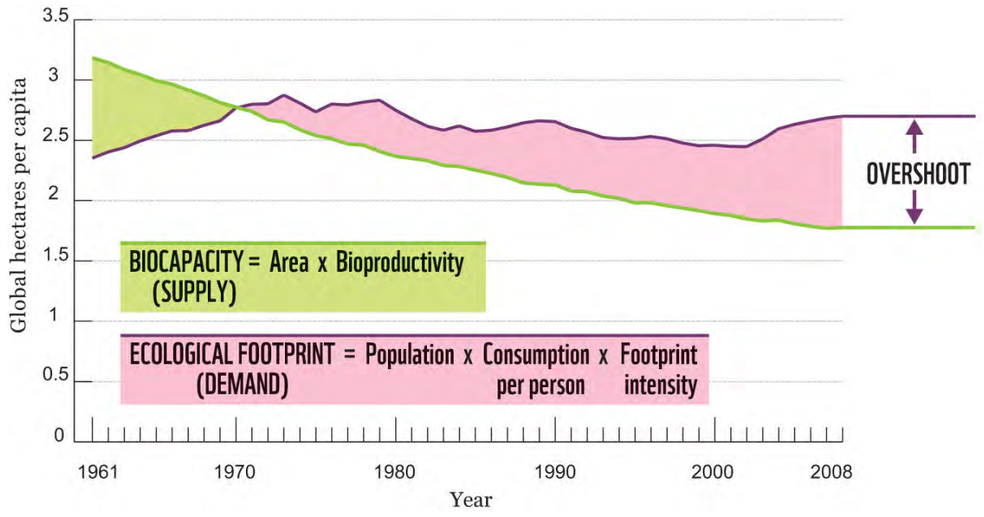
Intensive cultivation of soybeans, Goias State, Brazil

INTRODUCTION

IMPORTANCE

The 2012 WWF Living Planet Report, the world's most extensive science-based evaluation of the state of the planet, contains disturbing findings. In 2008, the Earth's total biocapacity was 12.0 billion gha, or 1.8 gha per person, while humanity's Ecological Footprint was 18.2 billion gha, or 2.7 gha per person (both the Earth's Ecological Footprint and its biocapacity are expressed in a common unit called a global hectare, where 1 gha represents a biologically productive hectare assuming world average productivity). This discrepancy means it would take 1.5 years for the Earth to fully regenerate the renewable resources that humans use in one year. In short, we need 1.5 Earths in order to regenerate humanity's annual demand on nature in a sustained fashion. If everyone lived like the average American, we would need four Earths.[1]

Figure 1: Trends in Ecological Footprint and biocapacity per person between 1961 and 2008
The decline in biocapacity per capita is due to an increase in global population and consumption. The increase in the Earth's productivity is not enough to compensate for this demand (Global Footprint Network, 2011).



As shared by Jason Clay in the Foreword, the predicament might be compared to a farmer living off of his or her seed. For bankers, it is the equivalent of living off the principal. Society is rapidly depleting the natural capital and services base upon which the economy and human development depend.

Agriculture, forest products, and seafood—known as "soft commodities"—are the segments of human activity that typically pose the greatest threat to critical ecosystems and resources. For example, the world's forests contain 80 percent of remaining terrestrial biodiversity,[2] sequester and store much of the world's carbon, and maintain regional watershed and weather functions upon which industry and billions of people rely. Yet deforestation is occurring at a rate of approximately 13 million hectares per year[3]—an annual loss the size of the state of Massachusetts—releasing 20 percent of global greenhouse gas emissions.[4]

Agriculture and forestry are the single largest drivers of forest loss, responsible for 85 percent and 10 percent of deforestation respectively,[5] with 40 percent of this forest loss occurring in Brazil and Indonesia alone primarily due to the production of beef and palm oil.[6] In addition, the agriculture sector is the largest user of water (more than twice that of all other sectors combined),[7] the largest user of chemicals, and the greatest source of water pollution.[8] In our seas, wild-caught fish provide over 1.5 billion people with one-fifth of their intake of animal protein, and 3 billion people with at least 15 percent of their animal protein.[9] In 2008, the industry employed 44.9 million people directly and its growth rate is outpacing global population trends.[10] Yet approximately 87 percent of the world's fisheries are fully exploited or overfished.[1112] Many fish stocks have already experienced severe declines from overfishing, and it is predicted that others are at risk of collapse in coming years if current exploitation rates continue,[13] threatening the food supply, employment, and the viability of many marine ecosystems.

If the current situation is unsustainable, then the coming decades appear ominous. By 2050, the human population, as well as the middle class, is predicted to increase by more than 3 billion.[14] To place this in perspective, Chinese and Indian per capita real income is doubling at a rate 10x that of England's growth during the Industrial Revolution, at approximately 200x the scale.[15] 70 percent of the new humanity will live congregated in cities.[16] Their incomes having more than tripled, the new middle class will consume more animal protein (total demand will more than double by 2050,[17] resulting in a 5-10x caloric efficiency loss in cereals), vegetable oils, and packaged foods, outstripping agricultural resources. As available land, water, and other ecosystem services dwindle, climate change will continue to inflict weather shifts and major crop failures, while biofuels increasingly compete for inputs. The effects are already upon us, helping drive commodity prices to all-time highs in 2007-2008 and 2010-2011. According to the World Bank, these spikes pushed an additional 44 million people into extreme poverty and generated widespread civil unrest.[18]

In summary, over the next 40 years, land, energy, water, and weather constraints will place unprecedented pressure on mankind's ability to access its most basic goods—food, fuel, and fiber. Humanity must now produce more food in the next four decades than we have in the last 8,000 years of agriculture combined. And we must do so sustainably.

Yet typical production practices are insufficient to meet this need. Furthermore, the food system has become so interconnected that the escalating frequency of droughts, crop failures, and other weather events impart rapid economic and food security consequences around the globe. Unchecked, producers will respond to the resulting price mechanisms unilaterally and often with inefficient agronomic practices, resulting in further acceleration of deforestation, resource depletion, and compounding climate change impacts. By 2050, the supply chains that feed, clothe, and help fuel the world may be severely degraded and/or require untenable trade-offs—with severe social and economic consequences.

Fortunately, there are alternative scenarios. Mainstream models for sustainable production of agricultural, forest, and seafood products exist and are often well vetted—such approaches preserve critical environmental resources while improving relations with labor, local communities, and customers. Furthermore, they often enhance yields, cost structures, and profitability. As a result, good practices have already been adopted by portions of industry and are increasingly expected by major buyers and financiers. Yet more must be done, and the uptake of best practices must accelerate, before the window of opportunity has passed. *The 2050 Criteria* aggregate and distill these better practices, merging them with environmental science and market research, to provide a credible framework for responsible investing in key soft commodity sectors. It is our hope that this guidance can facilitate alignment, enhance the financial sector's ability to operate effectively in these sectors, and enable investors to help drive the sustainability of key global markets.

INDUSTRY TRENDS

The environmental and social risks associated with soft commodities supply chains are both systemic and acute, threatening cost structures, availability of key resources, reputational standing, and the overall viability of important markets and economies.

WWF works with dozens of multinational companies in the food, agriculture, and consumer goods sectors, and we have witnessed and assisted in major steps undertaken to confront global resource challenges. These trends include major brands engaging their supply chains to establish long-term agreements and improve yields; large traders buying smaller players to secure access to raw materials; retailers purchasing processing plants to secure direct access to materials and control quality; upstream capacity building and training; and more sophisticated, multidimensional vendor scorecards. As one of WWF's partners in the financial industry explained: "In our conversations with major food and agribusiness clients, the dialogue has gone from downstream market positioning to 'commodity control.' The industry is moving from an 'open supply' market to dedicated supply chains. Failure to act is not an option."

> "In our conversations with major food and agribusiness clients, the dialogue has gone from downstream market positioning to 'commodity control.' The industry is moving from an 'open supply' market to dedicated supply chains. Failure to act is not an option."
>
> **– Harry Smit**
> Associate Director,
> Food & Agriculture
> Research and Advisory,
> Rabobank International

In addition, soft commodity players are increasingly engaging at the industry level to ensure "pre-competitive" sustainability of key input markets. Such efforts have included industry roundtables on palm oil, soy, sugarcane, cotton, and forest products; cooperation between firms such as Unilever, Tesco, McDonald's, and others on whitefish stock sustainability; commitments within the Consumer Goods Forum, an industry association of more than 400 leading companies, to eliminate deforestation from supply chains[19]; cross-industry research and collaboration at the Sustainable Food Lab; the Sustainable Agriculture Initiative's 30-member industry platform to conduct research and help implement sustainable food processes in shared supply chains[20]; and The Sustainability Consortium, led by Walmart, working to establish an industry-wide sustainability labeling system for consumer goods.

Large producers have also been adjusting strategy. Consolidation, precision input application systems, and land acquisition are all common tactics to secure scarce resources. Producers are also increasingly engaging and training outgrowers and smallholders, where yield gaps are greatest. After 20 to 30 years of decline, there has been a renewal of private and public spending on rural logistics, infrastructure, genetic research, and other technologies. Finally, capital investments are increasing in large projects that produce both environmental and business benefits, such as manure biodigesters, methane capture systems for mill effluents, and the generation of biodiesel from previously discarded agricultural byproducts.

Sheila Bonini, a Senior Expert in McKinsey & Co's Sustainability and Resource Productivity Practice, summarizes the overall trend: "For the food and agriculture industry, a primary challenge—and opportunity—of our time is sustainable supply chains. Resource scarcity and volatility, as well as global transparency, are the new normal. Indeed, ensuring sustainability requires some new thinking and investment. Yet major initiatives are underway which will reshape the competitive playing field in favor of supply chain actors who have made those efforts."

Governments have responded to these challenges in part through actions such as Russia's 2010 export ban on wheat[21]; Brazil's zoning of palm oil expansion[22]; the US Lacey Act and the EU Timber Regulation; the Chinese government's push to consolidate the dairy industry[23]; bills in the EU and US proposing position limits on commodities speculation; and Australia's recently passed carbon tax.[24] Yet recent experience—e.g., Rio +20 and the UN climate meetings in Copenhagen and Cancun—reflect that the public sector finds it difficult to move effectively on these issues in the international arena. Due to its geographic reach, extended supply chains, and direct interests, the private sector and its financiers have begun to take the lead.

Examples of Corporate Actions in Soft Commodity Supply Chains

- Cargill has committed to only trading RSPO-certified palm oil in North America and the EU by 2015 and globally by 2020. The Cargill Sustainable Cocoa Program is teaching better agricultural practices to 60,000 cocoa farmers through 1,100 field schools in West Africa, delivering an average 30 percent increase in farmers' incomes through improved yields and quality.[25] Cargill is also purchasing palm oil production in Brazil to gain secure access to rainfall.
- Nestlé, through its farmer programs, has made its 1,014 agronomists and 17,273 support staff available to train over 140,000 farmers globally in better practices.[26]
- Mars has produced an open-source mapping of the cocoa genome to help transform an aging and threatened supply base and deliver long-term livelihoods to West Africa's cocoa farmers.[27]
- Kimberly-Clark has set a 100 percent certified sustainable sourcing goal (currently achieving 99.9 percent) with a preference for the Forest Stewardship Council (FSC).[28]
- Unilever has committed to 100% sustainable sourcing of all agricultural raw materials by 2020. Unilever also is making good progress and leading sustainable sourcing of palm oil. Also the company runs a significant in-house Commodity Risk Management Operation.[29]

Despite these significant efforts, certified sustainable soft commodities to-date typically represent 0-3 percent of the market per sector. In the best cases they have not surpassed 15 percent penetration. Thus, overall, the performance of most industries is far from adequate. Broad adoption of the Key Performance Criteria herein would represent a major step in making relevant actors more responsible and driving change on the ground.

For the food and agriculture industry, a primary challenge—and opportunity—of our time is sustainable supply chains. Resource scarcity and volatility, as well as global transparency, are the new normal. Indeed, ensuring sustainability requires some new thinking and investment. Yet major initiatives are underway which will reshape the competitive playing field in favor of supply chain actors who have made those efforts.

- Sheila Bonini
Senior Expert, Sustainability and Resource Productivity Practice, McKinsey & Co

Figure 2: Market Uptake of Standards and Certifications
This table provides an overview of the production of certified soft commodities to date.

Standard body (with launch date)	Indicator	Market Uptake			Data Source
		2009 Baseline	February 2012	July 2012	
Forest Stewardship Council (1994) www.fsc.org	% FSC certified roundwood	8.4%	12%	10.05%	www.fsc.org **and** http://faostat.fao.org
	% FSC labelled pulp & paper	5.6% FSC (virgin fiber or recycled)	5.64% FSC (virgin fibre) 53% recycled	5.6% FSC (virgin fibre) 53% recycled	
Roundtable on Responsible Soy (2004) www.responsiblesoy.org	% global soy production that meets RTRS criteria	0%	16%	16%	www.responsiblesoy.org **and** http://www.fas.usda.gov/
Roundtable on Sustainable Palm Oil (2003) www.rspo.org	% of global palm oil production that meets RSPO criteria	1%	11.6%	13.86%	www.rspo.eu
Better Cotton Initiative (2005) www.bettercotton.org	% of Better Cotton produced globally	0%	.3%	1.8%	www.bettercotton.org
Bonsucro (2004) www.bonsucro.com	% sugar production that meets Bonsucro standard	0%	1.13%	1.53%	www.bonsucro.com **and** http://faostat.fao.org
Roundtable on Sustainable Biofuels (2007) www.rsb.org	% of global biofuels traded that meets credible standards	0%	1%	2%	http://faostat.fao.org
Global Roundtable on Sustainable Beef www.sustainablelivestock.org	% of beef production certified globally	0%	0%	0%	http://faostat.fao.org
Marine Stewardship Council (1997) www.msc.org	% of tuna that is MSC certified	0%	.7%	10.83%	www.msc.org **and** http://faostat.fao.org
	% of whitefish that is MSC certified	19%	26.7%	+/- 53%	
Aquaculture Stewardship Council (2009) www.ascworldwide.org	% of farmed salmon purchases from ASC certified producers	0%	0%	0%	http://faostat.fao.org
	% of farmed shrimp purchases from ASC certified producers	0%	0%	0%	
Alliance for Water Stewardship (AWS) (2009) www.allianceforwaterstewardship.org	% of water withdrawals under AWS certification in WWF Priority Basins	0%	0%	0%	http://allianceforwaterstewardship.org/

FINANCIAL SECTOR TRENDS

As overall investment in soft commodities sectors expands, the financial sector is deepening its awareness of and commitment to sustainability. Thus far, the most notable area of overall leadership has been through the broad trend toward pre-competitive environmental and social commitments. Examples include:

- The Banking Environment Initiative (BEI),[30] with membership including many of the world's leading international banks, aims to announce a major new compact in late 2012 to eliminate net deforestation and degradation from the majority of portfolios and business activities. The compact will center on the primary drivers of deforestation: palm oil, beef, soy, timber, and pulp and paper.
- The United Nations Principles for Responsible Investment (UNPRI)[31] has received over 1,000 signatories representing $1.4 trillion assets under management. The UNPRI contains subgroups such as the Farmland Working Group[32] and the Palm Oil Working Group.[33]
- The Equator Principles Financial Institutions (EPFI)[34] is comprised of 73 leading financial institutions worldwide that have collectively committed to incorporating the International Finance Corporation Performance Standards (IFC PS) into project finance, and potentially to other forms of corporate lending as the EPFI expands its mandate.
- The United Nations Environmental Program Financial Institutions (UNEP FI)'s[35] more than 200 members include leading banks, insurance companies, and investment funds that have committed to integrating environmental, social, and governance factors into all aspects of their banking practices.
- The Natural Capital Declaration's[36] signatories announced a commitment to integrate natural capital impact calculations into their financial products and services at Rio+ 20.
- A widely expressed concern among institutional investors regarding systemic and reputational risk exposure in commodities and land acquisitions resulted in the Principles for Responsible Investment in Farmland[37] and other initiatives.

In particular, the updated and revised IFC PS, which underpin the Equator Principles, may produce a far-reaching effect. They require IFC clients in soft commodity sectors to commit to credible voluntary standards as a consequence of financing, and EPFI members seem likely to make the same demand for their project finance lending as they adopt the new Performance Standards in late 2012. The IFC PS specifically require:

> *"The client will implement sustainable management practices to one or more relevant and credible standards as demonstrated by independent verification or certification . . . Where relevant and credible standard(s) exist, but the client has not yet obtained independent verification or certification to such standard(s), the client will . . . take actions to achieve such verification or certification over an appropriate period of time."* [38]

There is international consensus emerging around enhanced ESG risk monitoring, the unacceptability of financing deforestation, irresponsible fishing, and human or food displacement, and the use of credible standards as a key threshold in investing and lending. However praiseworthy, commitments by the financial sector have thus far been insufficient to reshape the playing field. For example, public compacts have not always translated into action, many sector policies lack sufficient strength or scope, and existing policies do not always translate into implementation, leaving signatories open to persistent risks and reputational attacks. Credible execution should effectively address gaps in 1) **policy strength**; 2) **policy scope** across portfolios; and 3) **implementation** on the ground.[52] If it executes properly, a financial institution can effectively position for enhanced and responsible performance in these sectors of growing importance. Indeed, as price volatility, resource scarcity, public criticism, regulation, and shifts toward transparency all escalate, financial institutions that move in lockstep with industry leaders will likely stand to benefit.

WWF Commodities Finance

WWF works extensively via its global partnerships and engagements with over 10 leading banks, and with the financial sectors as a whole, to help drive improvement in important industries. In response to their interests and concerns in these high-impact sectors, WWF has helped partners benchmark their lending and investing policies, train staff in implementation, and develop major new financial products in sustainable soft commodities. Furthermore, WWF works with financial institutions to generate tools for the global banking sector, including a global water risk mapping tool developed with DEG, a global commodity risk mapping tool for short- and long-term finance under development with the IFC (currently entering its pilot phase with approximately 30 banks), and others. WWF also engages with ESG Data Providers, such as the market leader Morgan Stanley Capital International (MSCI), asset managers, and analysts, to help deepen the understanding of supply chains risks in the food, agribusiness, and packaged goods sectors.

Examples of Potential Financial Opportunities Emerging from the Shift to Sustainable Soft Commodities

Fixed income for large-scale capital projects related to reutilization of waste products, enhanced efficiency, and power generation

- Palm Oil: Methane capture systems for palm oil mill effluent (POME) at mill sites represent roughly 3.5 percent market penetration in Indonesia and 8 percent market penetration in Malaysia.[39] They significantly reduce or eliminate methane emissions from POME—which represent 70 percent of GHG emissions from palm oil (not including potential deforestation)—while fully powering mill operations and providing excess energy back to the grid.[40]
- Dairy: US$4-20 million[41] industrial-scale biodigesters on American dairy farms convert would-be methane emissions from manure into energy. Biodigesters can also consume organic waste from population centers. The technology feeds power back into the grid and generates salable byproducts including liquid fertilizer and fibers that serve as a natural replacement for peat moss.[42]
- Sugar: Agricultural byproducts produced during sugarcane cultivation can be collected and burned to create biogas. US$6-20 million high-pressure boilers or internal combustion engines convert the resulting gas into energy with a typical three-year payback period. In addition to reducing waste, these systems can provide energy for processing operations and for a portion of the local grid.

Reduced due diligence costs and enhanced client performance

- A growing body of research is demonstrating correlations between credible certification and business performance. For example, in 2012, WWF, FMO, and CDC published Profitability and Sustainability in Palm Oil Production, a report that analyzes the incremental financial costs and benefits of RSPO certification on palm oil operations.[43] The study demonstrates causal relationships between sustainable practices and enhanced profitability, paving the way for new financial products and enhanced due diligence through use of credible certification as a performance proxy. In July 2012, KPMG published the study Responsible Soy: Cost/Benefit Analysis of RTRS Certification in Argentina and Brazil,[44] which shows the positive business case, specific business advantages, and potential three-year payback for credible certification in soy cultivation. The report was published by IDH, in collaboration with WWF, IFC, and FMO, and will be available in full narrative form in late 2012. Similar trends have been identified in cotton and forestry.[45,46]

Supply chain and smallholder finance facilities

- Supply chain finance vehicles tied to credible sustainability standards allow good-performing small and midsize vendors to rapidly ramp up production into dedicated supply chains. These facilities—including trade finance, "factoring," inputs finance, and inventory finance—are well established in coffee, cocoa, and other sectors. These financial products are also believed to smooth input availability risks for global buyers and to improve product quality. Innovations are expanding into new crops and regions, often in partnership with civil society organizations that help organize farmers into bankable cooperatives.

Rehabilitation and resale of degraded lands

- Much of the growth in demand for soy, palm oil, and other row crops can be met through the rehabilitation of previously degraded, or "idle," lands in tropical countries. Use of degraded lands is a low-cost strategy that produces financial returns in the form of high yields[47] while minimizing the political, reputational, environmental, and social risks associated with conversion of important ecosystems. For example, degraded lands in Indonesia are estimated to range from 12 to 74 million hectares,[48] more than sufficient to meet projected increases in global palm oil demand through 2050. Many organizations, including WWF and partners, are working toward understanding the financial, institutional, and political barriers to using degraded land and developing (buy->enhance->sell) financial mechanisms.

Rural infrastructure and outgrower training

- Closing yield gaps provides the lowest-hanging fruit for agricultural production gains. American cotton, for example, yields on average 900 kg per hectare, whereas sub-Saharan Africa averages 300 kg per hectare. These gaps are juxtaposed with rich consumer demand, which currently often relies on imports. Africa contains more middle class households than India, 6 of the world's 10 fastest-growing economies, and an emerging consumer class poised to outsize China's.[49,50] Regional and international players can reduce costs and secure access to key resources through mill placement and achieving full utilization through farmer training, waste reduction, and improved infrastructure.
- Nurseries and seed retail: Lack of access to good genetic quality is a major driver for yield gaps among producers, particularly smallholder farmers, globally.[51] In palm oil, for example, most smallholders do not know that the seedlings they buy locally are of poor quality, or they do not have access to higher-yield alternatives. Nurseries for high-yield seeds can centralize the reputable distribution of seeds for a community of approximately 25 smallholder families averaging 2,000 hectares of land each.

Public and private equity portfolios

- New financial products can leverage the business benefits from good performance, credible certification, and sustainable supply chain strategies to create 21st-century responsible mainstream food, forestry, and fisheries equity portfolios. WWF has helped to catalyze such products with partner financial institutions, and many additional market opportunities will emerge as reporting, market penetration, regulation, and other factors progress.

ASSET CLASSES

Environmental, Social and Governance (ESG) management in soft commodities is relevant across the activities of a financial institution, including asset management in both public and private equities, underwriting, credit and corporate lending, project finance, and for holders of real physical assets. Financial institutions are also exposed to these high-impact sectors through commodity derivatives, index trading strategies, and trade finance.

Following the world food price shocks in 2007-2008 and again in 2010-2011, a public debate has emerged around the role of index traders and speculators in influencing the spot price of food. The commodity price spikes over the past five years were unprecedented in US history.[53] To what degree speculation may have played a role in these price movements is a contentious and ongoing debate, with studies emerging on both sides and the need for further research. Notably, institutional investment in commodities index strategies increased from US$13 billion at the end of 2003 to $260 billion in March of 2008.[54] This colossal movement of capital into commodities over the last 10 years (due to bearish returns in traditional equity markets, decline of the dollar, and desire for diversification) and the emergence of commodities as an "asset class" may be contributing raises to increased co-movements of prices, short term volatility and other potential market distortions. Yet regardless of actual impacts on spot prices and longer-term volatility, concerns over index speculation should not be quickly written off, as financiers will remain targets for criticism. Indeed, the Dodd-Frank Wall Street Reform and Consumer Protection Act ("Dodd-Frank Act") in the US has introduced mandatory position limits on hard and soft commodities, and similar regulations may follow in Europe.[55,56] The OnValues report Responsible Investment in Commodities outlines a series of practical steps to improve ESG risk management for investors heavily exposed to index trading strategies.[57]

In the current environment, two primary points emerge:

- Contention regarding the role of futures markets and speculation in food price increases should not distract from the impact of long-term secular trends. Population growth, rapid increases in emerging market consumption, dietary shifts, and climate change are fundamentally altering supply and demand characteristics and show no signs of abating in the foreseeable future.
- The world needs more investment in agriculture, not less. The decline of funding and research for agriculture over the past 30 years has been disastrous for the world's poor,[58] and bad practices and low yields have helped draw additional lands into cultivation unnecessarily. Yet 21st-century investment in agriculture must be "smart" capital that recognizes the value of natural resources, distinguishes responsible practices, and requires that credible performance thresholds be met.

Combined with appropriate ESG policies, criteria, management, training, and incentives, financiers can be both a part of the solution and beneficiaries of global price movements in commodities. In particular, investment in real equities—i.e., actual businesses—in agricultural value chains can play a key role in order to help meet global challenges. Such strategies improve liquidity and add value to productive resources. Yet investors across the agriculture, forestry, and seafood sectors must be aware of environmental, social, and reputational risks; actively manage those risks; and work collaboratively with peers, partners, and their investees to improve performance.

IDENTIFYING LEADING STANDARDS

Credible certifications must demonstrate good practice in terms of both operational effectiveness and underlying environmental and social criteria.[59] The forthcoming chapters of *The 2050 Criteria* identify leading standards that best meet WWF's KPCs outlined herein and that are operationally robust as demonstrated by compliance with the ISEAL Code of Good Practice for Setting Environmental and Social Standards.[60] For non-experts, the best way to evaluate compliance with the ISEAL codes is to assess whether a standard-setting organization is an ISEAL member or associate member. ISEAL does not, however, place specific environmental and social content requirements within its Code or upon their members. WWF therefore deploys an internal mechanism, the Certification Assessment Tool (CAT), which is aligned with the KPCs herein, to evaluate the robustness and credibility and environmental and social standards. Outputs of the CAT are expected to become available for public use in 2013. The standards and certifications identified herein are not infallible.

The ISEAL Alliance, founded in 2002, is now the global umbrella association for social and environmental standards. It ensures that a certification has sufficiently robust operational systems, such as third-party auditing, independent accreditation of certification bodies (auditors), supply chain verification systems, and grievance mechanisms. Through its membership policies, ISEAL serves to avoid a "race to the bottom" in the standards and certification arena. ISEAL has also developed "Codes of Good Practice,"[61] including the Standard-Setting Code, the Impacts Code, and the Assurance Code, which establish system requirements for credible practices in the social and environmental standards space. These codes can be referenced by all stakeholders and serve as an excellent resource.

However, they stand out as the strongest multi-stakeholder platforms for guiding the continuous improvement of soft commodity supply chains towards sustainability. WWF supports and challenges these initiatives towards this end.

DEPLOYING KEY PERFORMANCE CRITERIA AND STEPWISE IMPROVEMENT PLANS

Financial institutions investing in regions with poor governance may achieve more for the environment and society by allowing "full compliance over time" rather than declining potential deals with companies on the grounds that their production units are not all certified or because their processing facilities are not yet completely free of inputs from unsustainable sources. A company's progress toward better performance will often depend upon its ability to make the investments needed to transform its operating practices. Financial institutions can support such transformation by financing a company while its operations (or those of its suppliers) progress toward credible performance standards and certification, provided there is agreement on a time-bound action plan that can be leveraged to ensure progress is maintained and achieved. Such is the value of stepwise systems—for example the Global Forest & Trade Network[62] in forestry

and the Major Buyer Initiative in seafood. In sectors or regions where such formal structures are not available, the Key Performance Criteria are designed to provide guidance to identify the highest-priority mitigation practices for investees and projects. The potential reputational risks during the transition phase can be managed by strict and transparent loan conditions and shareholder resolutions where appropriate, requiring the company to meet stepwise targets.

Further prioritization is offered within the criteria themselves. While WWF would prefer to see financial institutions and companies embrace all the Key Performance Criteria described in this guide as critical to maintaining long-term performance and healthy ecosystems, we understand that firms generally seek to comprehend the most critical issues to address first and with the highest priority, and to emphasize these in their filters and time-bound plans with investees. Thus, the environmental or social risk mitigation practice(s) of utmost importance for each sector are placed in bold within each KPC table. These top priority requirements for responsible production are based on those impacts that are A) potentially irreversible and B) high-leverage drivers for a number of other critical impacts, such as greenhouse gas emissions, erosion and soil health, and loss of biodiversity.

SUPPLY CHAIN SEGMENTS

The KPCs outlined in *The 2050 Criteria* pertain primarily to production processes and to a limited extent primary processing. The soft commodities production and harvesting stage is typically where the greatest environmental impact occurs on land, water, carbon, and other key impact categories. Other stages of the life cycle, including further processing, transportation, consumer use, and end of life, can also create significant environmental and social impacts that should be actively addressed and managed. Many companies have already made early efforts to improve performance at downstream processing centers or to reduce transportation costs, including reducing wastage. Yet recognition and mitigation of risks at the production/harvesting stages in soft commodity supply chains is still rudimentary relative to the full scale of the impacts.

The 2050 Criteria should also be used as a tool for evaluating the procurement policies of downstream players. In many cases, the traders, processors, and leading consumer brands—often highly concentrated in commodity supply chains—hold the greatest influence and opportunity to drive broader change throughout the more fragmented production base. These large players are often dependent on debt and equity markets. Thus, financiers can play an important role in determining the "rules of the game," helping to drive uptake of more responsible practices while simultaneously mitigating their own risks and identifying better performers.

TRANSPARENCY: THE META-INDICATOR

The evaluation of environmental and social performance requires data and information from operating companies, and this information has historically been difficult to obtain, inconsistent, or of poor quality. Regardless of best intentions or commitments, it is impossible to ensure that efforts to improve production and/or supply chains have been successful without a robust and consistent system for the collection, reporting and verification of data, including independent auditing. For most commodities and firms, this is best achieved through the use of credible third-party environmental and social certifications where available.

ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEMS

An Environmental and Social Management System (ESMS) is a critical aspect of a firm's performance on environmental and social issues. An ESMS may form a piece of a broader Environment, Health, and Safety (EHS) system that addresses important social and occupational matters. An ESMS has multiple parts, including corporate policies, performance goals, systems for collecting and managing data, operational and emergency plans, and a governance mechanism, including internal reporting and the assignment of staff responsibilities. For greenfield and expansion projects, the ESMS is often built upon an Environmental and Social Impact Assessment (ESIA), which may include procedures for identification and categorization of impacts, community consultation, and the long-term management and mitigation of impacts. For pre-existing operations, the ESMS is often constructed based on environmental (and social) audits that a company may have undertaken in the past.

The overall quality of an investee's ESMS can be gauged by experienced experts. However, the mere existence of a producer ESMS is not a replacement for responsible practice. The quality of an ESMS should be evaluated alongside the actual performance data that the ESMS generates. An ESMS is not only for producers, but is also appropriate for food processors, logistics companies, and retailers. In the case of these downstream companies, however, the existence and quality of a responsible sourcing policy stands out as the critical component of the company's approach to responsible supply chains.

DEVELOPMENT

The WWF Markets Transformation Initiative, Commodities Finance, Agriculture, Forestry, and Seafood teams have, over time, gained extensive experience working with corporate leaders in the food, agriculture, and commodities sectors. WWF has helped launch six industry roundtables in key commodities, with more forthcoming, and is engaged with companies such as Coca-Cola, Unilever, Sodexo, Carrefour, Walmart, Kraft, McDonald's, Mars, and many others to reduce key impacts and risks in global supply chains. WWF also works intensively with private sector financial institutions to develop investment and lending guidance, research, and new products for soft commodity sectors. The guidance herein synthesizes this experience with the latest analyses by WWF's more than 100 commodity experts, who draw on conservation science from programs and scientists in more than 50 country offices. *The 2050 Criteria* represents the intersection of current environmental science and business reality and can therefore serve as a framework to assess and separate the leaders from the laggards in the current competitive landscape of sustainable supply chains.

WWF expects that *The 2050 Criteria* will be updated periodically to reflect changes in the industry, increased information, and improving standards of performance, thus "raising the bar" for responsible policies and practices over time. WWF believes strongly in the principle of continuous improvement both as a commitment within firms and as a trajectory across sectors. *The 2050 Criteria* refers to "responsible" performance, not "sustainable," as true sustainability is a systems-based concept that will involve going beyond the criteria laid out herein. "Responsible" players are considered to be those who are leading their peers in sustainability efforts and who have thus prioritized succeeding in the elimination of the most damaging, risky, and irreversible impacts from their value chains.

INTRODUCTION TO THE COMMODITY CHAPTERS

The following chapters arguably represent the most important agricultural, forest, and fisheries commodity sectors in terms of global ecological impact. Each chapter commences with a general introduction to the commodity and the industry associated with it, including the major producing countries and an overview of a typical value chain. The foremost environmental and social risks for business are then presented in a detailed chart. The capstone of this document is the presentation of a set of Key Performance Criteria that help mitigate these environmental and social risks. The risks and criteria are linked through a set of icons reflecting major categories of environmental and social impact. Leading mainstream standards and certifications are then identified and should be adopted by investees where available to ensure good performance. Each chapter concludes with the identification of major sustainability-related trends and investment opportunities. A companion website for *The 2050 Criteria* is available, offering further data, information, tools, and resources for each soft commodity sector.

The guidance herein should not discourage the active investigation of and engagement with specific supply chains, as key risks and mitigations vary not only by species, but also by geographies and practices.

CHAPTER 1: AQUACULTURE

Aquaculture, or "fish farming", is the fastest growing food production system in the world. The following chapter focuses on global salmon and shrimp production, of which aquaculture represents 70 and 55 percent respectively. Primary environmental risks in aquaculture production can include conversion of sensitive areas such as mangroves, nutrient loading of local waterways, unsustainable feed inputs, and changes to the local gene pool with resulting biodiversity loss.

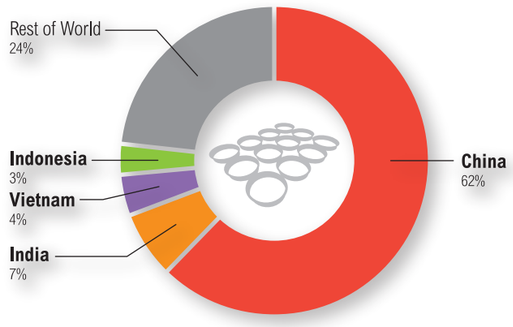
Atlantic salmon in a fish farm, Ryfylke, Norway

AQUACULTURE

Aquaculture, or "fish farming," has established itself as a staple protein source for global markets and will likely play a major role in the 21st-century diet. Aquaculture is the world's fastest-growing food production system, averaging 8.3 percent annual growth between 1970 and 2008.[63] 70 percent of the world's salmon and 55 percent of the world's shrimp is now produced via aquaculture. Farmed salmon is a more than US$5 billion industry that generates nearly 2.4 million metric tons of product each year.[64] According to the FAO, as of 2010 global farmed shrimp production totaled 3.8 million metric tons, or more than US$10 billion in trade, a 46 percent increase over the prior five years. Farmed shrimp is now the most valuable traded marine product in the world.[65]

Global Aquaculture Production

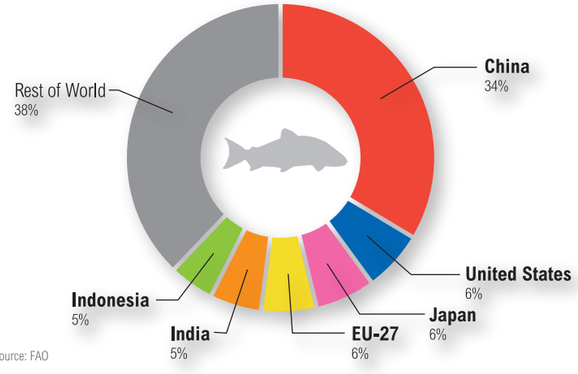
Excluding Aquatic Plants, Five year average by weight, 2006-2010



Source: FAO

Global Fish Consumption

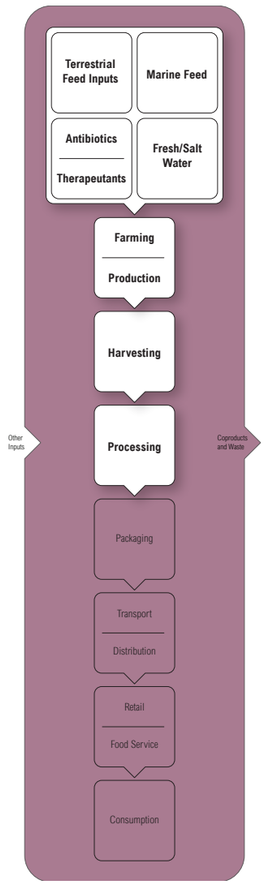
for Aquaculture and Wild Caught Fish, Excluding Aquatic Plants
Five year average by weight, 2006-2010



Source: FAO

Figure 3: Countries of High Production and Consumption
(a) China is the leading producer of aquaculture followed by India, Vietnam, and Indonesia; (b) Globally, China leads the world in fish consumption, followed by the US, Japan, and the EU.

Figure 4: Aquaculture Value Chain
The processes highlighted in white are the areas of the aquaculture value chain where the risks and key performance indicators on the following pages are most relevant.



The primary environmental and social risks associated with the expanding aquaculture industry include conversion of sensitive areas such as mangroves for shrimp farms, unsustainable feed input sources, eutrophication of local waterways due to nutrient overload from farm waste, and changes in the gene pool and biodiversity loss due to interactions between farm and wild species. The prioritization of environmental and social impacts varies by species and geography. For instance, in some instances, proper farm siting to preserve ecosystem functionality is of paramount importance (e.g., conversion of biodiverse mangroves), while water management is a more pressing concern in others (e.g., drainage into waterways upon which local communities depend). Environmental externalities in aquaculture can also generate systemic risks for regional industries. For example, in 2007-2009, the Chilean salmon aquaculture industry's yields collapsed due to diseases spread because of poor biosecurity practices. Chile's output dropped more than 75 percent, creating severe consequences for major investors and insurers, while global salmon prices increased approximately 33 percent.[66,67]

THIRD-PARTY CERTIFICATIONS

In recent years, producer groups, nonprofits, and industry associations have generated more than two dozen aquaculture standards. However, these commercial standards have failed to meet the criteria outlined in the ISEAL Code of Good Practice for Setting Environmental and Social Standards. As a result, a diverse multi-stakeholder initiative was formed, including over 2,200 individuals from a wide range of NGOs, industry, and academia, to conduct the Aquaculture Dialogues and to ultimately create the standards adopted by the Aquaculture Stewardship Council (ASC). ASC standards are complete for tilapia, pangasius, bivalves, abalone, and salmon, and standards for shrimp and freshwater trout will be completed in 2012. The ASC Certification will soon be an ISEAL[68] associate member, reflecting the standard's robust multi-stakeholder development process. The ASC is also exemplary of a new generation of certifications in that it is "outcome based"—criteria focus on quantitative performance measurements as opposed to purely mandating better management practices.

AQUACULTURE

ENVIRONMENTAL & SOCIAL RISKS

SHRIMP

SALMON

Nutrient & Waste Loading in Water

Excess food and waste can increase levels of nutrients in the surrounding water, leading to the growth of excess algae, which consumes oxygen needed by other plant and animal life.

Excess food and waste can increase levels of nutrients in the surrounding water, leading to destruction of the flora and fauna on the ocean bottom, and the growth of excess algae, which consumes oxygen needed by other plant and animal life.

Fish/Shrimp Feed

If derived from unsustainable sources, fish feed (e.g., fishmeal, fish oil, and soy protein) can contribute to overfishing, the depletion of wild fish populations, and/or to land conversion in terrestrial ecosystems.

If derived from unsustainable sources, fish feed (e.g. fishmeal, fish oil, and soy protein) can contribute to overfishing, the depletion of wild fish populations, and/or to land conversion in terrestrial ecosystems.

Habitat Loss

Coastal wetlands and mangroves can be destroyed for placement of new aquaculture sites, impacting critical breeding and nesting grounds for other species.

Not applicable

Excessive Chemical & Antibiotic Use

Excessive use of antibiotics, antifoulants, and pesticides, or the use of banned and toxic chemicals, can cause negative consequences for marine organisms and human health, including human pathogen evolution and antibody immunity.

Excessive use of antibiotics, antifoulants, and pesticides, or the use of banned and toxic chemicals, can cause negative consequences for marine organisms and human health, including human pathogen evolution and antibody immunity.

Water Use

Poor management of water resources, including lack of coordination between operators in a common area, can lead to depletion of aquifers and salinization and contamination of ground water and farmland, impacting local communities and livelihoods.

Not applicable

Escaped Fish

Not applicable

Escaped farmed salmon can compete with wild fish and interbreed with local wild stocks of the same species, altering the local genetic pool.

Disease Introduction & Transfer

Viruses and pathogens can transfer between farmed and wild shrimp, as well as between farms, and can lead to major outbreaks. Pathogens can be introduced via aquaculture if bio-security is not well managed.

Viruses and parasites can transfer between farmed and wild fish, as well as between farms, and can lead to major outbreaks. Pathogens can be introduced via aquaculture if bio-security is not well managed.

Poor Working Conditions

There can be poor living and working conditions for employees, particularly in processing plants, including lack of fair wages, gender discrimination, child labor, limited access to health care and education, and insufficient or absent health and safety procedures.

There can be poor living and working conditions for employees, particularly in processing plants, including lack of fair wages, gender discrimination, limited access to health care and education, and insufficient or absent health and safety procedures.

Conflicts Over Shared Commons

Conflicts can arise among users of the shared coastal environment.

Conflicts can arise among users of the shared coastal environment.

Wild Brood & Seed

Collection of wild brood and seed (post larvae) can cause biodiversity loss.

Not applicable

Ecosystem Services

Loss of water availability and other ecosystem services can occur for surrounding communities.

Not applicable

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion
Climate Change & Air Quality
Soil Erosion / Degradation
Water Use
Pesticides & Toxicity
Nutrient Loading & Eutrophication
Disease & Animal Care
Labor
Local & Indigenous Communities
Society & Consumers

KEY PERFORMANCE CRITERIA

Ecosystem Functions

The farms have been sited in environmentally suitable locations while conserving local biodiversity, natural habitat and ecosystem function. The producer has protocols in place to ensure limited escapes.

Water Management

A complete assessment of fresh water resource requirements and discharge impacts should be conducted, taking into consideration production needs, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies. (Appropriate systems for management may vary across aquaculture species and techniques.)

Sustainable Feed

The producer ensures the traceability and sustainability of the ingredients used for fish feed; in particular that fishmeal and fish oil is coming from responsible fisheries, but also that the production of soy and other vegetable ingredients did not result in land conversion.

Legal Production

The product is produced/harvested and traded in compliance with all applicable local, national and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land, water, or coastal environment.

Chemical Use

Antibiotics and other therapeutants, pesticides, and parasitcides are used properly on site, judiciously and in a targeted fashion, using available expertise. Where possible, antibiotics should be used under protocols established in consultation with a trained and accredited professional. There is no use of antibiotics that are critical for human health according to the list contained in the World Health Organization's 'Critically Important Antimicrobials for Human Medicine.' Treatments are 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 of chemical run-off on local communities are assessed and managed. In shrimp production, no antibiotics use is permitted. The storage, handling and disposal of hazardous materials and waste must be done responsibly, according to the law and minimizing their respective potential impacts on the environment and human health.

Pest Management

An integrated/alternative disease management approach is developed and implemented. (Equivalent to Integrated Pest Management - see Annexure)

Area Based Management

The producer participates in area based management schemes to increase transparency and coordination among entities operating in a common area for certain activities (e.g., stocking, harvesting, medical treatments, number of escapes, etc.).

Labor Rights

Management is aware of and complies with local labor legislation and the ILO core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Operational Health & Safety

Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable, personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities

The rights of local people are respected, which can be assessed by: demonstrated and non-contested rights to utilize the land/coastal environment and recognition of and respect for other legal or customary rights; negotiations with indigenous people based on FPIC (free, prior, and informed consent); 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.

NOTE: Salmon and shrimp aquaculture are highlighted in this chapter. Yet the indicators presented have applications, to varying degrees, across all forms of aquaculture. However, a species-specific, regional, and local perspective is required to properly manage risks and mitigate associated impacts. See Tools and Resources for links to information and specific criteria for responsible aquaculture production of other species beyond salmon and shrimp.

TRENDS AND OPPORTUNITIES

Aquaculture is the fastest-growing food production system in the world, providing opportunities for investment in capital infrastructure and improved technologies. However, the industry's growth is paired with a legacy of negative consumer perceptions in the West and increasing global consumer concerns around sanitation, chemicals, and water. These issues can have negative repercussions not only on surrounding environments, communities, and consumers, but on the long-term viability of the production sites themselves. Thus, it is critical to pair investment opportunities with strong industry know-how and good practices in environmental and social risk management.

Opportunities for responsible investment are now becoming more widespread and identifiable. Certification and field testing according to the Aquaculture Stewardship Council (ASC) (see below) is now under way on pangasius, tilapia, and salmon fish farms (and soon shrimp) around the world. Uptake is projected to be significant; for example, the Vietnamese government has pledged that 100 percent of exported pangasius from Vietnam will be independently certified to a credible environmental/social farmed seafood standard by 2016.
50 percent of that 2016 target will be certified to the ASC. This represents 90 percent of pangasius product on the global market. These shifts will generate new investment opportunities in vertical integration (consolidation is already under way, most notably in shrimp and salmon, where operators are racing to ramp up supply and distribution channels), infrastructure, water treatment, traceability systems, and other dimensions of the industry. Financing certification costs in and of themselves can serve as an asset class, as companies face cash requirements of approximately US$50,000 for audits and on-site improvements. In return, ASC sustainability labeling will grant producers access to new markets and the ability to charge a premium for their products.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the aquaculture industry, including good practice guides and performance criteria for tilapia, pangasius, oysters, bivalves, and abalone, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 2: BEEF

Beef is produced in nearly every country around the world, under a wide array of production systems. Consumption is primarily domestic, and beef represents humanity's third most consumed source of protein. Primary environmental risks in cattle reering can include conversion of tropical forests (most notably in the Amazon Rainforest), greenhouse gas emissions, and waste management.

Cattle in pasture and forest, Alta Floresta, Brazil

BEEF

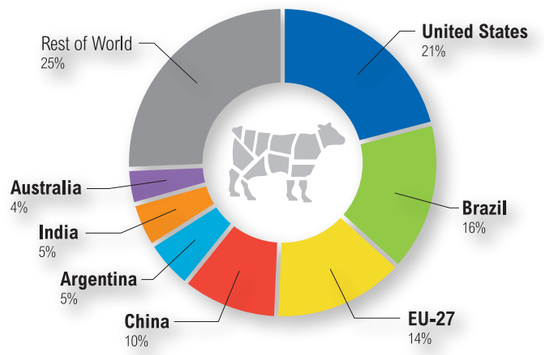
Beef is the world's third most consumed protein source.[69] It is produced in nearly every country, and production systems vary greatly depending on geography, breed of cattle, infrastructure development, access to capital, public policy, and other factors. Globally, beef is a $500 billion industry[70], and it is a particularly fast-growing sector in Brazil and other South American countries. Due to spoilage, weight, trade policies, and potential cold chain failures, 98.5 percent of beef is consumed within the countries of production, while the remainder is exported.[71]

The beef industry faces important challenges around land and water use, waste management, animal welfare, and greenhouse gas emissions. In particular, beef production drives the foremost conversion frontier in the Brazilian Amazon, helping make beef responsible for 25 percent of global LULUCF (Land Use, Land-Use Change, and Forestry) emissions[72] and affecting more eco-regions of significant biodiversity than any other single commodity. It is estimated that cattle pastures make up 70 percent of global agricultural land but provide only 6-11 percent of humanity's food.[73] Cattle also contribute directly to greenhouse gas emissions, emitting methane through digestion and manure, as well as carbon and nitrous oxide through feed intake.

Because beef production systems vary greatly across regions and even within countries, the impacts also vary in terms of severity and scope, and local cultural values and systems should be considered. In some developing countries, many families rely on a small herd as an important source of nutritional security and income. They face important challenges to productivity, security, and improved livelihoods (see Trends and Opportunities), which should be both respected and addressed.

Global Beef Production

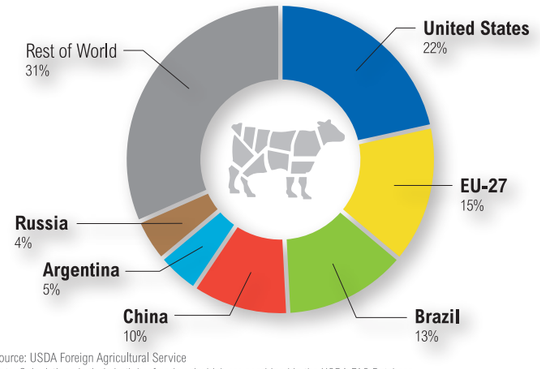
Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service
Note: Calculations include both beef and veal which are combined in the USDA FAS Database.

Global Beef Consumption

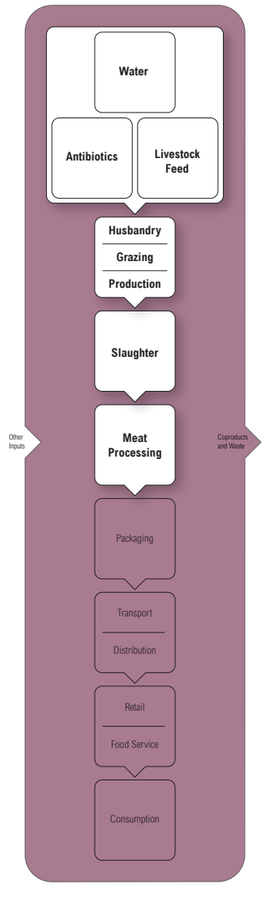
Domestic, Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service
Note: Calculations include both beef and veal which are combined in the USDA FAS Database.

Figure 5: Countries of High Production and Consumption
(a) The United States is the leading producer of beef followed by Brazil, the European Union, and China; (b) Globally, the United States, the European Union, and Brazil lead beef consumption.

Figure 6: Beef Value Chain
The processes highlighted in white are the areas of the beef value chain where the risks and key performance indicators on the following pages are most relevant.



THIRD-PARTY CERTIFICATIONS

The Rainforest Alliance/Sustainable Agriculture Network developed a Standard for Sustainable Cattle Production Systems in 2010 and certified the first ranches in Mato Grosso, Brazil, in May 2012.[74] This standard focuses on beef production systems in the tropics. The Global Roundtable on Sustainable Beef (GRSB), of which Rainforest Alliance is also a member, has begun to assess the possibility of standards development for beef production globally. In addition, in Argentina, the National Grasslands Certification program provides standards for beef production.

BEEF

ENVIRONMENTAL & SOCIAL RISKS

Land Conversion
Land conversion of forests or other native habitat can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss through conversion of High Conservation Value areas and forest fragmentation. This is particularly relevant in the Brazilian Amazon and other tropical areas of Latin and South America.

Community Displacement
Land acquisition and forest conversion in regions with unclear or unenforced property rights can result in displacement and loss of ecosystem services for local communities and indigenous peoples.

Greenhouse Gas Emissions
Apart from GHG emissions through land conversion, beef cattle can contribute to greenhouse gas emissions through methane (CH_4) emissions from enteric fermentation and manure, carbon dioxide (CO_2) from land conversion for ranching and/or feed production, and nitrous oxide (N_2O) from manure.

Air Quality
Aerial emissions of ammonia can cause nitrogen enrichment of downstream habitats with consequent loss of species diversity. On farm and production-related activities can negatively impact air quality through particulate matter and odor, affecting local communities.

Overgrazing and Loss of Pasture Biodiversity
Overgrazing on the ranch can cause soil degradation, compaction, and biodiversity loss. High frequencies of defoliation, overuse of fertilizer and established stands of only 1-2 plant species, can lead to a loss of diversity of native plant species and of feed sources for insects and birds.

Cattle Feed
Significant feed requirements of beef cattle can have indirect impacts on land conversion and ecosystems when produced unsustainably and require significant agrochemical, water, and fossil fuel inputs.

Global Food Security
The use of grains for cattle feed can result in a caloric inefficiency, an issue under increased scrutiny due to global food security concerns.

Food Safety
Food safety system failures can occur. Incidents of e-coli contamination are of particular concern for ground beef. Food safety measures and inspection are important at the processing and packaging stages.

Nutrient Loading in Runoff
Downstream impacts due to sediment run-off from overgrazing and manure-rich run-off from the feedlot can increase levels of nutrients in local waterways, leading to the growth of excess algae, which consumes oxygen needed by other plant and animal life.

Riparian Areas
Inadequate riparian area management can allow cattle to wade directly into streams, contributing to nutrient-loaded runoff and soil erosion.

Water Use
Beef cattle require significant amounts of water to produce feed, for processing, and for manure management.

Disease
Cattle disease is a significant factor that can limit access to export markets, pose significant supply risks, decrease efficiency, and contribute to cases of cattle-wildlife conflict.

Animal Health & Welfare
Cattle that do not receive proper care and handling are typically stressed, less productive, and make less efficient use of resources. Improper handling and slaughtering are often of public concern.

Health & Safety Risks
On-farm health and safety risks can occur, particularly at the processing stage in the abattoir due to inadequate training, inadequate oversight, and faulty equipment.

Poor Working Conditions
There can be poor living and working conditions for employees, including violations of International Labour Organization (ILO) core labor principles, lack of fair wages, limited access to health care and education, gender discrimination, and insufficient health and safety procedures.

Smallholders
Traditional grazing rights and control over productive resources are important issues both for smallholders and those displaced by new enterprises in countries with tenuous or absent land tenure, particularly in the Horn of Africa and West Africa. Access to credit, extension, artificial insemination, quality and affordable inputs (feed and medicine), fair pricing, and cold chain infrastructure remain key challenges for efficient smallholder production and improved livelihoods.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion · Climate Change & Air Quality · Soil Erosion / Degradation · Water Use · Pesticides & Toxicity · Nutrient Loading & Eutrophication · Disease & Animal Care · Labor · Local & Indigenous Communities · Society & Consumers

Priority Areas Protection
The area of land to be utilized does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. The land area has not been converted from native forest or HCV since May 2009.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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.

Sustainable Feed
There has been no deforestation in order to create pasture for cattle or cropland to produce animal feed. Good agricultural practices are used in feed production.

Water Management
A complete assessment of water resource requirements (including abstraction and discharge impacts) should be conducted, taking into consideration production needs, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Chemical Use
Antibiotics are used properly on site, judiciously and in a targeted fashion using available expertise. Where possible, antibiotics should be used under protocols established in consultation with a trained and accredited professional. There is no use of treatments that are critical for human health according to the list contained in the World Health Organization's 'Critically Important Antimicrobials for Human Medicine.' Agrochemicals are 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.

Animal Health & Welfare
Proper equipment, facilities, and training are provided to ensure humane care and handling of livestock. Proper nutrition is provided to ensure healthy animals and minimize stress. Access to veterinary and/or equivalent services is ensured in order to care for sick animals.

Land Management System
A land management system is developed which implements grazing practices that manage for biodiversity, retain soil biomass levels, protect riparian areas, and sequester carbon.

Manure Management
A Manure Management Plan is developed and implemented at the feedlot and processing plant focused on reducing greenhouse gas emissions, acidifying emissions, and eutrophying emissions.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable personal protective equipment provision and hazardous substance monitoring and testing.

Labor Rights
Management is aware of and complies with local labor legislation and the ILO core labor standards. Management actively manages its labor issues (e.g. child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety) and actively monitors compliance in its operations.

TRENDS AND OPPORTUNITIES

Well-managed range and grasslands can help preserve biodiversity through invasive species management and averting soil compaction, resulting in healthy levels of soil biomass and grasses that can sequester carbon and support healthy ecosystems. Beef production also serves as a source of rural employment and local nutrition. In some countries, it is often the method by which smallholders can claim title to land (often in regions with unclear or traditional property rights). There is also significant opportunity to bring so-called degraded lands back into production as pasture and thus avoid potential deforestation for grazing.

For smallholders, many of whom rely on a small herd as their primary source of protein and income (e.g., in sub-Saharan Africa), key challenges to improved productivity and livelihoods include access to credit, extension services, artificial insemination, quality and affordable inputs (feed and medicine), fair pricing, and cold chain infrastructure. Establishment and respect for grazing and resource rights can also improve security and help open opportunities for finance.

Even in the United States, the average rancher maintains a herd of 30-50 cattle and struggles against thin margins, and there has been an overall industry trend toward consolidation due to economies of scale. Sustainability solutions need to be developed for operators of all types and sizes.[75]

In certain beef production systems, the generation of biogas from methane capture systems or biodigesters on feedlots can offer renewable energy investment opportunities. There are also significant opportunities to close yield gaps and improve efficiency in beef production, thus utilizing less land and potentially generating fewer impacts per calorie.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the beef industry, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 3: COTTON

Cotton is the largest, and one of the oldest, sources of textile fibers in the world. While six countries dominate cotton production, 90 percent of cotton farms average less than one hectare in size, serving as a valuable cash crop for small farmers. Primary environmental risks in cotton production can include immense water and chemical use, while social risks can include health hazards, child labor and debt bondage.

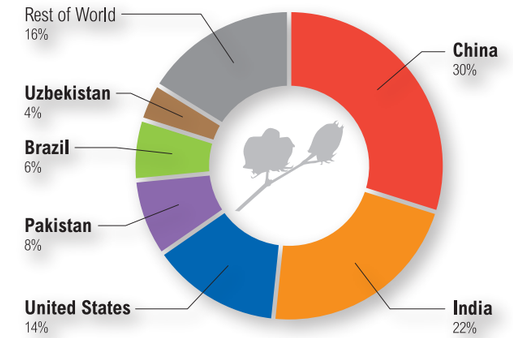
Cotton bolls in field

COTTON

Cotton—in use for at least 5,000 years and one of mankind's oldest fibers[76]—is an essential global commodity. Cotton occupies 35 million hectares of land worldwide and is the largest single source of fiber for global apparel.[77] 80 percent of the world's annual production of 25 million tons of lint is produced in just six countries: China, India, US, Pakistan, Brazil, and Uzbekistan.[78,79] 90 percent of the world's cotton farms are located in China and Africa, where they average less than one hectare in size.[80] Cotton is both an important cash crop for many small farmers and a valuable source of foreign exchange for many economies. Cotton products are utilized by nearly every consumer on the planet.

Global Cotton Production

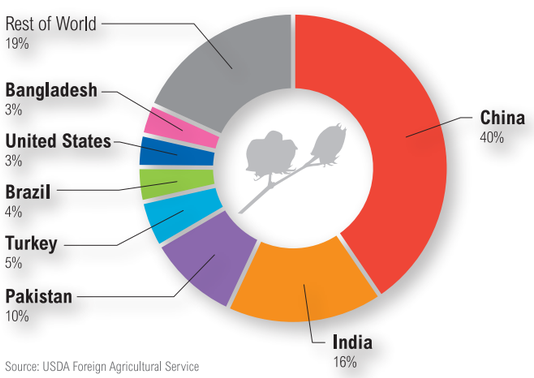
Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service

Global Cotton Consumption

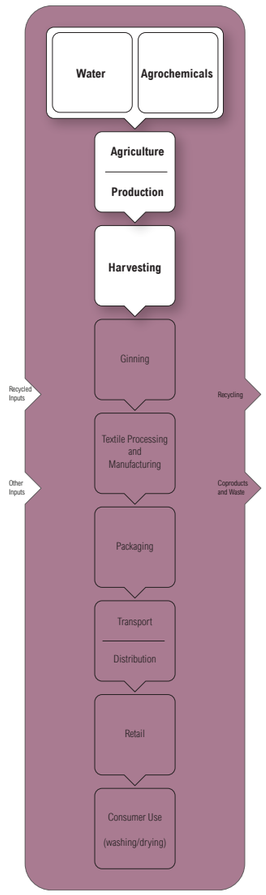
Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service

Figure 7: Countries of High Production and Consumption
(a) China is the leading producer of cotton followed by India and the United States; (b) Globally, China, India, and Pakistan lead cotton consumption.

Figure 8: Cotton Value Chain
The processes highlighted in white are the areas of the cotton value chain where the risks and key performance indicators on the following pages are most relevant.



The primary environmental risks in cotton production are its immense water and chemical usage. Over 53 percent of cotton fields in the world require irrigation, as the majority are in regions where water is scarce.[81] The impacts on the Aral Sea in Central Asia are a notorious example: in the period 1960-2000, the Aral Sea lost approximately 70 percent of its volume as a result of diverting water in order to grow cotton in the desert.[82] During harvesting, herbicides—often carcinogenic compounds—are used extensively to defoliate cotton plants to help facilitate picking. Cotton uses approximately 25 percent of the world's insecticides and more than 11 percent of the world's pesticides, while occupying only 2.4 percent of its arable land.[83] The environmental footprint of cotton continues through the processing and dyeing phases of the production cycle. The World Bank estimates that 17-20 percent of industrial water pollution worldwide comes from textile coloration and treatment alone.[84] The extensive use of chemicals in cotton production can pose serious health hazards for workers. These risks combine with other potential and severe social problems documented in cotton production such as child labor and debt bondage.

THIRD-PARTY CERTIFICATIONS

There are currently no certifications that comply with the ISEAL Code of Good Practice for Setting Environmental and Social Standards and fulfill the Key Performance Criteria herein. Furthermore, cotton maintains one of the most complex commodity supply chains in the world; thus, the cost of complete segregation and tracking of certified cotton is high. Organic is the oldest sustainable cotton certification and focuses on chemical use, while Fair Trade certification focuses primarily on social issues. The market share of organic cotton has increased in recent years, but is still less than 1 percent. To move from a niche market to a position of having a more mainstream impact on world cotton production, WWF initiated the Better Cotton Initiative in 2004 and is now an active player in this multi-stakeholder body. The BCI is a mainstream agricultural and production standard that operates in key geographic regions to improve cotton production practices and sustainability. It has opted not to produce a certification, and thus Better Cotton can be produced by any farmer, anywhere. Companies such as Ikea, Marks & Spencer, Levi Strauss & Co., H&M, Adidas, Nike, Walmart, Sainsbury's, Tesco, and many others support the scaling up of BCI and communicate that support to their customers.

COTTON

ENVIRONMENTAL & SOCIAL RISKS

Agrochemical Use
Cotton production can involve intensive use of chemicals which can have severe impacts on soil, water, laborers, and local communities. During harvesting, herbicides—sometimes carcinogenic—are often used to defoliate cotton plants to help facilitate picking.[85]

Water Use
Cotton production can require heavy use of water for irrigation, impacting farm economics and the livelihoods of surrounding communities. Over 53 percent of cotton fields in the world require irrigation, and the majority of these crops are in regions where water is scarce.[86]

Child Labor & Debt Bondage
Child labor and debt bondage can be associated with cotton production and are often masked by the complexity of supply chains. Depending on age, activity, and access to health and education, child labor in cotton can violate International Labour Organization (ILO) core labor standards and deprive families of the opportunity to exit multi-generational cycles of poverty. The issue of child labor is particularly relevant in West Africa, Central Asia, and South Asia. The issue of debt bondage is particularly relevant in agrarian economies of South Asia and Latin America.

Health & Safety Risks
Laborers—family or hired—can be exposed to harmful toxins, primarily due to excessive application and inadequate personal protective equipment (PPE) while spraying chemical pesticides and herbicides. In particular, pregnant women and child laborers risk harmful exposure to hazardous pesticides. Even when not participatng in spraying, children are often the first victims of pesticide poisonings due to the proximity of their homes to cotton fields or the re-use of empty pesticide containers.[87] In India and Uzbekistan, children are often directly involved in cotton pesticide application. In Pakistan, Egypt, and Central Asia, child labourers often work in cotton fields either during or following the spraying season.

Habitat Loss
Much of the land used to cultivate cotton has been in production for generations. Yet land conversion of forests or other ecologically sensitive areas can cause acute biodiversity loss through pollution, conversion of High Conservation Value areas, and forest fragmentation.

Greenhouse Gas Emissions
Cotton production's heavy reliance on fertilizers, especially when poor application practices are used, can generate nitrous oxide (N_2O) and carbon dioxide (CO_2) greenhouse gas emissions.

Smallholders
Independent smallholder producers are often "price-takers" and have little power in relation to the buyers. Unfair practices can occur.

Credit & Debt
Farmers can become unable to repay debts due to high input prices, crop failure, delayed or absent payment from buyer, high interest, and/or excessive inputs use and pest resistance. Women—important and often unpaid laborers—can lack access to credit principally due to men's collateral ownership.

Ecosystem Services
Loss of water availability and other ecosystem services for local and surrounding communities can occur.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion
Climate Change & Air Quality
Soil Erosion / Degradation
Water Use
Pesticides & Toxicity
Nutrient Loading & Eutrophication
Disease & Animal Care
Labor
Local & Indigenous Communities
Society & Consumers

Chemical Use
Agrochemicals are properly used on site, judiciously and in a targeted fashion using available expertise. There is no use of hazardous chemicals listed in the Stockholm Convention. There is a plan to phase out hazardous agrochemicals listed in the Rotterdam Convention or listed as Classification I in the World Health Organization's Recommended Classification of Pesticides by Hazard. Agrochemicals are prepared and applied by trained personnel—and not by children or pregnant women. Information and training is provided on appropriate, moderate, and efficient use of chemical inputs, and provision of personal protective equipment (PPE) is provided in appropriate climates. Potential impacts on local communities of chemical run-off and spraying are assessed and managed.

Water Management
A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration crop needs, soil field capacity, hydrological conditions, precipitation distribution, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Pest Management
An Integrated Pest Management (IPM) plan is developed and implemented, ideally incorporating biological controls. An Integrated Weed Management plan is developed and implemented, ideally including cultural and biological controls, appropriate rates of pre-emergent and post-emergent applications, and appropriate altering of active ingredients.

Nutrient Management
A Nutrient Management Plan focused on optimal uptake and minimal loss of nutrients has been developed and is implemented. The plan can include: soil and foliage testing (regularly and especially prior to fertilizer applications), use of variable rate technologies for fertilizer application, application based on up-take, application informed by weather conditions, crop rotation, and use of cover crops and filter strips. Appropriate, science-based riparian zones are established and maintained to prevent fertilizer run-off into freshwater and marine habitats.

Soil Management
A Soil Management Plan is developed and implemented with a focus on soil productivity, including retention of soil biomass levels, soil structure, salinity, pH, and carbon sequestration. The plan can outline crop and geographically appropriate practices such as no-till, only planting on suitable slopes, use of cover crops, crop rotation, tree hedges, contour planting, etc. The plan should also include adequate protection of riparian areas.

Priority Areas Protection
The area of land to be utilized does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. The land area is not being converted from native forest to a plantation or other land use.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable, personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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.

NOTE: Because cotton production systems vary greatly across regions and even within countries, the impacts also vary in terms of severity and scope. The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

TRENDS AND OPPORTUNITIES

Rising global incomes, populations, and standards of living are driving increased demand for cotton. India has transitioned from a net importer to the second-largest exporter after the introduction of Bt cotton in the mid-1990s; and Brazil, while currently representing only 7 percent of global production, is moving up the ranks as it allocates new lands.[88] In 2010-2011, cotton prices surged 145 percent to a 140-year high, shocking brands and retailers and impacting margins.[89,90] In turn, when cotton prices came off their peak, many spinners defaulted on their debts. Bangladesh alone defaulted on 150,000 tons of cotton in 2011, resulting in US$150 million in losses, demonstrating that volatility can be just as costly to an industry's supply chain players as high prices.[91]

Development of producer organizations can aid in addressing social risks and achieving gains—for instance, by establishing producer credit unions. In the West African and South Asian contexts, the challenge is less a lack of freedom to organize and more an absence of resources. In Brazil, a key social challenge is that many workers are irregular (i.e., unregistered) and therefore fall outside union structures; thus, they do not benefit from statutory or collectively agreed protections and benefits.

There is enormous opportunity for improving cotton yields, quality, and profitability for farmers globally while reducing environmental impacts. For example, American cotton yields average 900 kg per hectare, whereas sub-Saharan Africa yields average 300 kg per hectare. Yet Africa contains more middle-class households than India, 6 of the world's 10 fastest-growing economies, and an emerging class of consumers poised to overtake that of China in number.[92,93] A field study in India has shown that application of best management practices implemented under the Better Cotton Initiative (BCI) resulted in pesticide reductions of 81 percent, water use reduction of 49 percent, chemical fertilizer reduction of 18 percent, and an average 15 percent increase in farmer profitability.[94] Resulting improvements in soil quality and water use efficiency are also immensely valuable for the viability of food crops grown alongside or in rotation with cotton.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the cotton industry, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria

CHAPTER 4: DAIRY COWS

Dairy production represents an approximately $300 billion industry worldwide, with 93 percent of dairy products consumed in the country of origin. 65 percent of the world's 250 million dairy cows are located in India, the EU, and Brazil. Primary environmental risks in dairy production can include land conversion, greenhouse gas emissions, and water pollution, as well as unsustainable feed.

Dairy cows feeding

DAIRY

The dairy industry produces fluid milk, powdered milk, cheese, spreadable fats, yogurt, and other items. The sector generated total global revenues of $299.7 billion in 2009.[95] There are approximately 250 million dairy cows in the world, with approximately 65 percent located in India, the EU, and Brazil.[96] In the US, milk has a farm value of production second only to beef among livestock industries, and equal to corn.[97] Due to the imperative for freshness, the majority of milk and dairy products are consumed within the countries of production, while only 7 percent are traded globally, with a significant portion of that international trade taking place between the EU-27.[98]

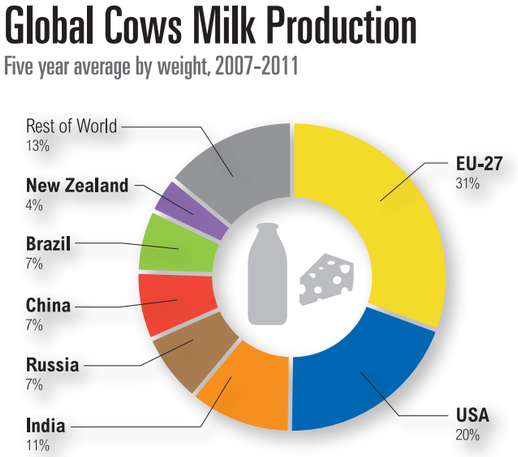
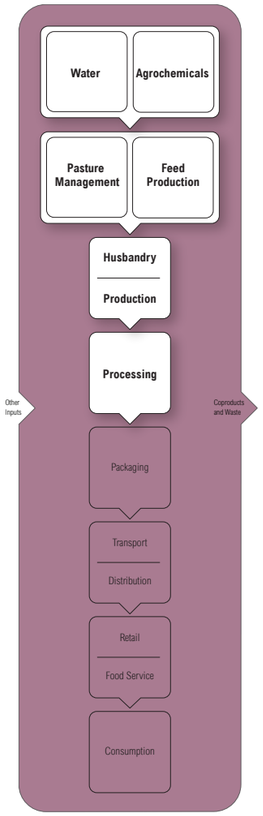


Figure 9: Countries of High Production and Consumption
(a) The European Union is the leading producer of cows' milk followed by the United States and India; (b) Globally, the European Union, India, and the United States lead consumption of cows' milk.

Figure 10: Dairy Value Chain
The processes highlighted in white are the areas of the dairy value chain where the risks and key performance indicators on the following pages are most relevant.



The most critical environmental impact of dairy production is greenhouse gas emissions from enteric fermentation and manure. A life cycle assessment (LCA) completed by FAO in 2010 suggests that the global dairy sector contributes 4 percent to global anthropogenic GHG emissions.[99] Water pollution is the second most significant concern due to potential runoff of manure and nutrients into waterways. Land conversion presents another risk, particularly in the tropics, due to the large amounts of feed (e.g., soy and corn) typically required for dairy herds.[100] In regions where water supplies are constrained, the large water footprint of dairy (average of 1,000 liters per liter of milk[101]), particularly for irrigated fodder production, may lead to water scarcity and competition with other users. Conversely, well-managed dairy farms present ecosystem service opportunities by providing food and cover for wildlife, helping to control flooding, protecting wetlands, conserving open spaces, and sequestering carbon.

Dairy's domestic consumption and limited trade make it primarily a local issue. There is often heavy government involvement and sometimes subsidies in milk production, and dairy farms are often family owned and seen as essential for rural employment. Thus, local cultural values are central to the design of production systems and animal welfare concerns. In developing countries, many families rely on a single dairy cow or small herd as their primary source of protein and income. They face important challenges to productivity, security, and improved livelihoods (see *Trends and Opportunities*) that should be both respected and addressed.

THIRD-PARTY CERTIFICATIONS

The Rainforest Alliance/Sustainable Agriculture Network has developed a Standard for Sustainable Cattle Production Systems, released in 2010. This standard focuses on beef and dairy production systems in the tropics and is not wholly applicable for other ecoregions.

DAIRY

ENVIRONMENTAL & SOCIAL RISKS

Land Conversion
Land conversion of forests or other native habitat can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss through conversion of High Conservation Value areas and forest fragmentation.

Nutrient Loading in Runoff
Manure rich run-off from the dairy operation can increase levels of nutrients in local waterways, leading to the growth of excess algae, which consumes oxygen that is needed by other plant and animal life.

Riparian Areas
Inadequate riparian area management can allow cattle to wade directly into streams, contributing to nutrient-loaded runoff and soil erosion.

Cattle Feed
Significant feed requirements for dairy cattle can have indirect impacts on land conversion and ecosystems when produced unsustainably and require significant agrochemical, water, and fossil fuel inputs. (Note: Many dairy farmers produce their own feed on site. See 'Other Terrestrial Commodities' for relevant considerations.)

Loss of Pasture Biodiversity
High frequencies of defoliation from the overuse of fertilizer and only 1-2 plant species can lead to a loss of diversity of native plant species and of feed sources for insects and birds.

Air Quality
Aerial emissions of ammonia can cause nitrogen enrichment of downstream habitats with consequent loss of species diversity. On farm and production-related activities can negatively impact air quality through particulate matter and odor, affecting local communities.

Greenhouse Gas Emissions
Apart from GHG emissions through land conversion, dairy cattle can generate greenhouse gas emissions through methane (CH_4) emissions from enteric fermentation and manure, carbon dioxide (CO_2) from land conversion for ranching and/or feed production, and nitrous oxide (N_2O) from manure.

Disease
Cattle disease is a significant factor that can limit access to export markets, pose significant supply risks, and decrease efficiency.

Animal Health & Welfare
Cattle that do not receive proper care and handling are typically stressed, less productive, and make less efficient use of resources. Improper handling is often of public concern.

Water Use
Dairy cattle require significant amounts of water to produce feed for processing and for manure management. On average, 1,000 liters of water is required to produce 1 liter of milk.

Food Safety
Food safety system failures can occur. Food safety measures and inspection are important at the production and processing stages.

Smallholders
Traditional grazing rights and control over productive resources are important issues both for smallholders, and those displaced by new enterprises, in countries with tenuous or absent land tenure. This is particularly relevant in the Horn of Africa and West Africa. Access to credit, extension, artificial insemination, quality and affordable inputs (feed and medicine), fair pricing, and cold chain infrastructure remain key challenges for efficient smallholder production and improved livelihoods.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion · Climate Change & Air Quality · Soil Erosion / Degradation · Water Use · Pesticides & Toxicity · Nutrient Loading & Eutrophication · Disease & Animal Care · Labor · Local & Indigenous Communities · Society & Consumers

Priority Areas Protection
The area of land to be utilized does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. The land area is not being converted from primary forest to grazing land or other land use.

Manure Management
A Manure Management Plan is developed and implemented at the farm and processing plant focused on reducing greenhouse gas emissions, acidifying emissions, and nutrient loading.

Sustainable Feed
There has been no deforestation in order to create pasture for cows or cropland to produce animal feed. Good agricultural practices are used in feed production.

Water Management
A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration production needs, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Chemical Use
Antibiotics are used properly on site, judiciously and in a targeted fashion using available expertise. Where possible, antibiotics should be used under protocols established in consultation with a trained and accredited professional. There is no use of treatments that are critical for human health according to the list contained in the World Health Organization's 'Critically Important Antimicrobials for Human Medicine.' Agrochemicals are 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.

Land Management System
A land management system is developed which implements grazing practices that manage for biodiversity, retain soil biomass levels, protect riparian areas, and sequester carbon.

Animal Health & Welfare
Proper equipment, facilities, and training are provided to ensure humane care and handling of cows. Proper nutrition is provided to ensure healthy animals and minimize stress. Access to veterinary and/or equivalent services is ensured in order to care for sick animals.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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.

TRENDS AND OPPORTUNITIES

Countries with the largest herd sizes are not necessarily the largest producers of milk—e.g., India contains a dairy herd four times the size of the US; however, the US produces nearly twice as much milk. There is immense room to improve productivity and efficiencies per cow internationally.[102,103] For smallholders in emerging economies, many of whom rely on a single cow or small herd as their primary source of protein and income, key challenges to improved productivity and livelihoods include access to credit, extension services, artificial insemination, quality and affordable inputs (feed and medicine), fair pricing, and cold chain infrastructure. In addition, establishment and respect for grazing and resource rights can improve security and help open opportunities for finance. Within developed countries, yield variability is still significant, as demonstrated in the recent US Dairy Life Cycle Assessment. There are substantial opportunities for the dairy sector to improve productivity and reduce GHG emissions by adopting improved management practices aligned with local cultural values and regulations.

US and European markets present investment opportunities for US$4-20 million[104] industrial-scale biodigester installations on American dairy farms. These projects can significantly reduce greenhouse gas emissions and nutrient loading, consume organic waste from population centers, feed power back into the grid, earn carbon credits, and generate salable byproducts including liquid fertilizer and fibers that serve as a natural replacement for peat moss.[105] Dairy Management Inc., the US dairy industry association, in partnership with the US Environmental Protection Agency and supplemented by various government incentives, is striving to spur the construction of 1,300 industrial-scale biodigesters on US dairy farms by 2020.[106] Achieving this ambitious goal could have a significant impact on US greenhouse gas emissions and landfill use.

The dairy industry is growing overall, with global milk production expected to increase by more than 2 percent annually throughout the coming decade.[107] Chinese purchases account for most of the increase in international trade growth, and the Chinese government has announced its intentions to ensure a glass of milk per day for every child.[108] There is significant opportunity to bring “degraded lands” back into production as pasture to help meet this growing demand.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the dairy industry, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 5: PALM OIL

Palm oil is the world’s most consumed vegetable oil. 90 percent of oil palm fruits are produced in plantations in Malaysia and Indonesia, while India, Indonesia, and China are the largest consumers. Primary environmental risks in palm oil production can include conversion of biodiverse tropical forests, and greenhouse gas emissions from the conversion and drying of peatlands, for plantation development.

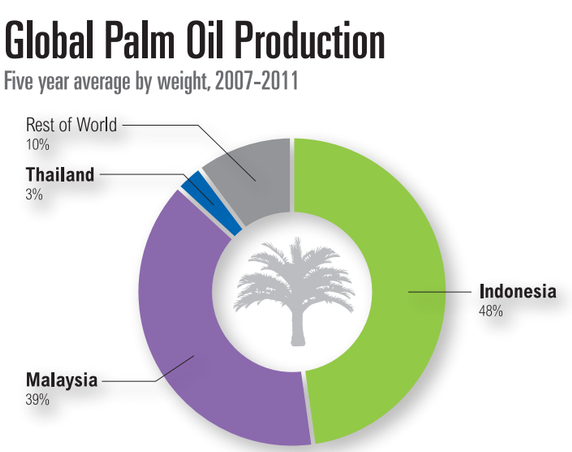
Close-up of palm fruit, Musim Mas palm oil plantation, Sumatra, Indonesia

PALM OIL

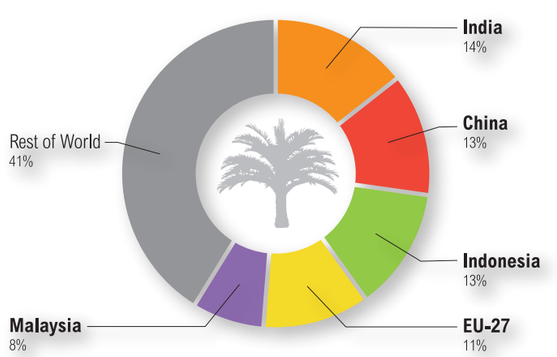
Palm oil is the world's most consumed vegetable oil and is used in the manufacture of food products, detergents, cosmetics, and, increasingly, biofuels.[109] When compared to production of other oilseed crops, palm oil plantations typically generate significantly greater per hectare vegetable oil yields—10x that of soybeans and 6x that of rapeseed.[110,111] 90 percent of current global palm oil production occurs in Malaysia and Indonesia,[112] where the industry employs millions. Growing populations and changing diets, as well as new growth from biofuels mandates and the oleochemical industries, are driving accelerating demand for palm oil. Production increased by a factor of 20 over the last 40 years,[113] and some analysts estimate demand will increase more than 36 percent from 2010 to 2015[114] and more than 65 percent by 2020.[115] The industry, while still growing in Indonesia and East Malaysia, is also embarking on rapid expansion into West and Central Africa, Latin America, Papua New Guinea, and elsewhere.[116]

Much of the world's palm oil is produced on land that was, until recently, tropical forest containing some of the planet's most important forest biodiversity. Between 2005 and 2010, 30-40 percent of oil palm expansion in Malaysia and Indonesia occurred at the expense of natural forests.[117] While the direct cause of deforestation is difficult to identify (e.g., direct palm oil expansions vs. logging vs. wild fires), it is estimated that between 2005 and 2010, 28 percent of forest loss in Indonesia and Malaysia was due to conversion for large-scale palm oil production.[118] The continued development of palm oil under poor or corrupt governance systems not only impacts important animal species but also displaces indigenous populations from their land, causes tropical forest fires, and leads to severe social conflicts. As of 2010, approximately 22 percent of all oil palm plantations in Indonesia are located on peat soils, while in Malaysia the number is estimated at approximately 11 percent, causing a long-term source of carbon emissions.[119]

Palm oil can potentially play a crucial role in meeting the global demand for edible oils, sequestering carbon, and improving livelihoods. Yet current practices in the industry and a lack of governance pose a threat to global biodiversity and climate. As expansion moves to other areas of the tropics, the financial sector can play an important role in conducting due diligence, supporting proper land use planning, and requiring improved industry practices to ensure responsible practice.



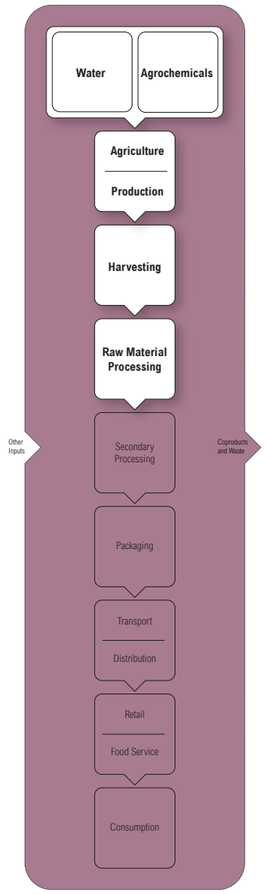
Source: USDA Foreign Agricultural Service



Source: USDA Foreign Agricultural Service

Figure 11: Countries of High Production and Consumption
(a) Indonesia and Malaysia are the leading producers of palm oil; (b) Globally, India, China and Indonesia lead palm oil consumption.

Figure 12: Palm Oil Value Chain
The processes highlighted in white are the areas of the palm oil value chain where the risks and key performance indicators on the following pages are most relevant.



THIRD-PARTY CERTIFICATIONS

The Roundtable on Sustainable Palm Oil (RSPO) has emerged as the leading mainstream palm oil production and milling standard, currently commanding 12 percent of the global market in palm oil production and 5 percent of global sales. The RSPO standards and certification system ensures the preservation of HCV as palm oil expands, while raising the bar on productivity. General Mills, McDonald's, Johnson & Johnson, Procter & Gamble, Walmart, Marks & Spencer, Unilever, Nestle, and many others have made commitments to source only Certified Sustainable Palm Oil (CSPO).[120] The Rainforest Alliance has also created a standard for palm oil currently operating in the marketplace with a strong emphasis on environmental sustainability. The Roundtable on Sustainable Biofuels (RSB) ensures sustainable use of palm oil for energy production.

In response to the growth of these standards, the Indonesian palm oil industry has also launched the Indonesian Sustainable Palm Oil (ISPO) certification, which is intended to communicate that palm oil production has obeyed Indonesian law. ISPO standards were not designed through a multi-stakeholder process and do not fulfill the operational criteria in the ISEAL Standard Setting Code, and the ISPO's environmental and social content does not fulfill the WWF KPCs outlined above.

PALM OIL

ENVIRONMENTAL & SOCIAL RISKS

Land Conversion
Land conversion of forests or other native habitat can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss through conversion of High Conservation Value areas and forest fragmentation.

Greenhouse Gas Emissions
The practice of clearing forests or draining peatlands for palm oil plantations generates significant carbon dioxide (CO_2), and the decay of palm oil mill effluent can produce methane (CH_4) emissions.

Community Displacement
Land acquisition and forest conversion in regions with unclear or unenforced property rights can result in displacement and loss of ecosystem services for local communities and indigenous peoples.

Soil Health, Compaction, & Erosion
Planting on unsuitable slopes can lead to erosion and soil loss.

Palm Oil Mill Effluent Discharge
Palm Oil Mill Effluent (POME) can contain significant quantities of biological materials, nitrogen, and phosphorus. If this effluent is not treated prior to discharge, it can negatively impact the local soils and waterways through de-oxygenation via eutrophication.[121]

Agrochemical Use
Poor or excessive pesticide and herbicide application practices can result in increased worker exposure and emissions to the surrounding ecosystem and local communities.

Poor Working Conditions
There can be poor living and working conditions for employees, including violations of International Labour Organization (ILO) core labor principles, lack of fair wages, gender discrimination, and limited access to health care and education.

Importing Labor
Importing labor is a common practice in the palm oil industry and can include bonded labor and contract issues, including a lack of political rights or access to education for imported laborers. This practice can cause social conflicts with local communities and local discrimination.

Smallholders
Independent smallholder producers largely sell via middlemen and have no direct relationship with the mills buying their fruit. As such, they are often "price-takers" and have little power in relation to the buyers. Unfair practices can occur.

NOTE:The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts..

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion
Climate Change & Air Quality
Soil Erosion / Degradation
Water Use
Pesticides & Toxicity
Nutrient Loading & Eutrophication
Disease & Animal Care
Labor
Local & Indigenous Communities
Society & Consumers

Priority Areas Protection
The area of land to be utilized does not contain, is not suspected of containing, and is not needed to maintain, primary forest or High Conservation Value (HCV) areas. The area of land to be utilized has not been converted from primary forest or HCV since November 2005.

Greenhouse Gas Emissions
The area of land to be utilized does not contain high carbon stocks—e.g., peatlands or forests. Efforts are made to increase carbon sequestration in the management unit. Techniques can include soil carbon management, restoration of native vegetation, and eliminating burning practices. Existing plantations on peat are managed to maintain the water table at approximately 40cm below ground level to minimize oxidization and emissions. The producer plans to remove oil palm from peat areas and restore them to natural vegetation and hydrology. A reliable methodology is used to measure and manage life-cycle GHG emissions from the use of agricultural inputs, fossil energy and waste management in the plantation and mill operations. Particular attention is paid to minimizing the use of fertilizers, capturing methane from Palm Oil Mill Effluent (POME), and increasing the use of renewable energy in mill operations.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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.

Chemical Use
Agrochemicals are properly used on site, judiciously and in a targeted fashion using available expertise. There is no use of hazardous agrochemicals listed as Classification I or II in the World Health Organization's Recommended Classification of Pesticides by Hazard. Agrochemicals are 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. Training in proper usage is available to contracted labour and smallholders supplying the mill. Potential impacts on local communities of chemical run-off and spraying are assessed and managed.

Pest Management
An Integrated Pest Management (IPM) plan is developed and implemented, ideally incorporating biological controls. An Integrated Weed Management plan is developed and implemented, ideally including cultural and biological controls, appropriate rates of pre-emergent and post-emergent applications, and appropriate altering of active ingredients.

Nutrient Management
A Nutrient Management Plan focused on optimal uptake and minimal loss of nutrients has been developed and is implemented. The plan can include: soil and foliage testing (regularly and especially prior to fertilizer applications), use of variable rate technologies for fertilizer application, crop rotation, and use of cover crops and filter strips.

Soil Management
A Soil Management Plan is developed and implemented with a focus on soil productivity, including retention of soil biomass levels, soil structure, salinity, pH, and carbon sequestration. The plan can outline crop and geographically appropriate practices such as no-till, only planting on suitable slopes, use of cover crops, crop rotation, tree hedges, and contour planting, etc. The plan should also include adequate protection of riparian areas.

Water Management
A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration crop needs, soil water holding capacity, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g. child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations. Training, research and development, and other resources are provided to smallholders to enhance outputs and increase income. Company ensures transparent market pricing information for independent smallholders.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable, personal protective equipment provision and hazardous substance monitoring and testing.

TRENDS AND OPPORTUNITIES

Rather than clearing new lands, projected increases in global palm oil demand through 2050 can be met by utilizing existing degraded lands, estimated to range from 12 to 74 million hectares in Indonesia,[122] or simply through realizing yield potentials for the crop. Many organizations, including WWF and partners, are working toward understanding the financial, institutional, and political barriers to using degraded land and developing institutions and financial mechanisms to make this option more attractive to developers.

Palm oil production also represents a major social opportunity for smallholders and for broad-based economic growth in developing nations. The industry is inherently labor intensive, requiring a global average of one worker per five hectares (competing oil crops often require approximately one worker for every 200 hectares). Booming commodity prices in recent years have helped lift millions out of poverty in Indonesia and Malaysia.[123]

Financiers play a key role in the palm oil supply chain. RSPO can and should stand as both a reputational and business risk management tool (and already does for many banks and funds). Current current practices as such are surveyed in WWF's: *Palm Oil Investor Review: Investor Guidance on Palm Oil*.[124] CSPO (Certified Sustainable Palm Oil) production (and use further down the supply chain) may also serve as a proxy to offset certain due diligence costs, indicating early on that there is strong documentation, full legal compliance, better agricultural practice, and forward-looking market positioning. WWF's recent report *Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance*[125] demonstrates the links between certification and enhanced financial performance. In these evaluations, investors should not only note RSPO "membership," but also observe whether companies are applying RSPO New Planting Procedures to new developments and are honoring their RSPO time-bound plans to all holdings. Reputational risks for end users and traders who are major purchasers of palm are also high, and investors can guide them toward appropriate procurement policies.

A sustainable palm oil sector can also provide upside opportunities for investments in capital expenditures, such as palm oil mill effluent (POME) methane capture systems to fuel mill operations and POME composting for fertilizer substitution (see Examples of Potential Financial Opportunities Emerging from the Shift to Sustainable Soft Commodities, page 22). Such systems significantly reduce or eliminate methane emissions from POME while fully powering mill operations and surrounding communities.[126]

Investment channels also include the direct financing of certification costs. Average global yields for RSPO-certified producers are 5.1 metric tons per hectare, whereas the global average is 3.5 metric tons per hectare. Smallholders often produce less than 1 metric ton per hectare, and thus opportunities for yield and other improvements are greatest for small-scale as well as midsize producers.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the palm oil industry, including reports on and for investors, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 6: SOY

Soy is a globally traded commodity, and soybean meal is the largest source of animal feed in the world. The US, Brazil, and Argentina produce 90 percent of the world's soy exports. China is soy's top importer, fueling its rapidly expanding pork industry. Primary environmental risks associated with soy production can include deforestation and land conversion, most notably of the Brazilian Cerrado, a biodiversity hotspot larger than the entirety of Mexico.

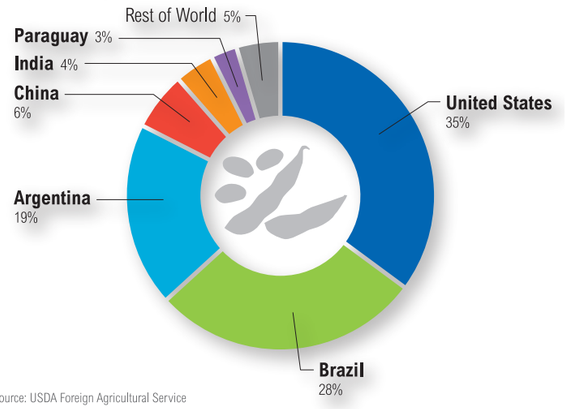
Green soy leaves, Rondonópolis, Brazil

SOY

Soy is a globally internationally traded commodity, produced in both temperate and tropical regions, that serves as a key global source of protein and vegetable oils. Total world production reached 245,065,000 metric tons in 2011.[127] Soy is available in three forms: the whole soybean and its two derivative products, soybean oil and soybean meal. Soybean meal is currently the largest source of animal feed in the world. Thus most of the world's soybeans are consumed indirectly by humans through products like meat (chicken, pork, and beef), dairy, eggs, and farmed fish.[128] Soybean oil is primarily used for cooking oil; however, its use in biodiesel production is rapidly growing.[129] Other nonfood uses are increasing and include paints, inks, waxes, and soy-based foam and plastic products.

Global Soybean Production

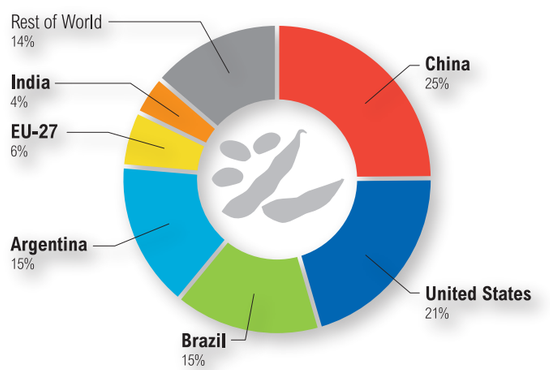
Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service

Global Soybean Consumption

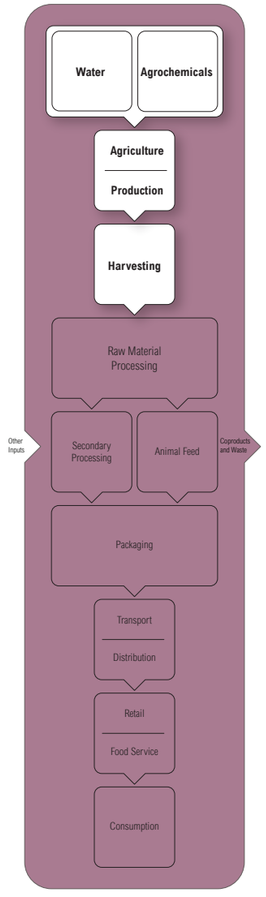
Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Servicea

Figure 13: Countries of High Production and Consumption
(a) The Unitest States, Brazil, and Argentina are the leading producers of soy; (b) Globally, China, the United States, Brazil, and Argentina lead soy consumption.

Figure 14: Soy Value Chain
The processes highlighted in white are the areas of the soy value chain where the risks and key performance indicators on the following pages are most relevant.



In 2011, Brazil, the US, and Argentina alone accounted for nearly 90 percent of global soybean exports.[130] China is currently the world's top importer of soy and is expected to expand purchases an additional 59 percent by 2020.[131,132] The majority of the increase in soy production in the last decade has been in Brazil, an expansion that has contributed to deforestation in the Amazon, Atlantic Forests, and most significantly the Cerrado region. A savannah woodland, the Cerrado is a biodiversity hotspot larger than the entirety of Mexico.[133] The Brazilian government estimates that CO2 emissions associated with conversion of the Cerrado are equivalent to more than half the total emissions from the UK for 2009.[134] Many Cerrado species, a significant proportion of which are found nowhere else in the world, are at high risk of extinction.[135] The Cerrado is nicknamed "Brazil's water tank" because it safeguards a large percentage of the water resources of Brazil and neighboring countries, and the further loss of remaining areas in the Cerrado poses a major risk to water supplies. Similar negative impacts from expansion are present in Argentina in the Gran Chaco, Pampas grasslands, and Yungas forests.[136] Paraguay is facing significant pressure on its Chacos and Atlantic forests.[137] And in Bolivia there is conversion pressure on its Cerrado, Pantanal, and Amazon forests.[138]

Lucrative soybean production is also associated with negative social impacts in Brazil, Argentina, and Paraguay, as the concentration of farmland in the hands of a few has pushed small farmers and communities off the land, encouraging exploitation of workers.[139] The rapid penetration of genetically modified seeds has also sparked controversy, and concerns are now escalating around potential increases in pest resistance among genetically modified species.[140]

THIRD-PARTY CERTIFICATIONS

There are a range of soy production standards that drive significant improvements above conventional production. WWF actively works with multiple standards, and supports the Roundtable on Responsible Soy in particular, as it is the mainstream industry standard that best meets the KPCs herein. RTRS commenced its first certifications of production sites in summer 2011 and has certified 399,033 metric tons in Brazil, Paraguay, and Argentina. India is in the process of certifying approximately 15,000 metric tons. Bolivia, Uruguay, and China are in the process of developing an RTRS National Interpretation. The Roundtable on Sustainable Biofuels (RSB), ProTerra, and the Sustainable Agriculture Network (SAN) standards also strongly fulfill the KPCs herein and comply with the ISEAL Code of Good Practice for Setting Environmental and Social Standards. In addition, Organic and Fair Trade are long-standing certifications in soy that are particularly strong in the area of chemical usage and labor rights respectively. However, HCV and habitat conversion are not fully protected in these certifications. Thus, responsible financiers should conduct additional due diligence on this essential issue when evaluating Organic or Fair Trade clients or projects.

SOY

ENVIRONMENTAL & SOCIAL RISKS

Land Conversion
Land conversion of forests or other native habitat can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss through conversion of High Conservation Value areas and forest fragmentation. This is particularly relevant in the Cerrado region of Brazil.[141]

Agrochemical Use
Poor or excessive pesticide and herbicide application practices can result in increased worker exposure and emissions to the surrounding ecosystems, waterways, and local communities.[142]

Soil Health, Compaction, & Erosion
Based on soil type and practices, soil erosion, compaction, salinity, pH, organic matter, soil structure, and nutrient balance can each become critical and difficult to reverse issues. Soil health can be negatively impacted through unsustainable application of agrochemicals and heavy equipment use. Salinization and water logging can occur from poor irrigation. Compaction reduces water infiltration and can lead to run-off of nutrients in flood events.

Food Displacement
Conversion of traditional food farms to major soy operations for export can result in food displacement for local communities.[143,144,145] This risk is under increased scrutiny due to global food security concerns.

Water Use
Unsustainable water use in irrigated systems can cause issues of over withdrawal from aquifers, impacting farm economics and the livelihoods of surrounding communities (e.g., Ogallala Aquifer in North America and Guarani Aquifer in South America).[146]

Greenhouse Gas Emissions
Apart from greenhouse gas (GHG) emissions through land conversion, soy production can generate greenhouse gas emissions through carbon dioxide (CO_2) from fossil fuel inputs, CO_2 from deforestation, and CO_2 and nitrous oxide (N_2O) from soil management and tillage practices, as well as mill operations.[147]

Genetic Modification
A controversial issue for many consumers and regulators, the widespread use of genetically modified soy varieties may risk increased resistance among pests and weeds in the long term.

Poor Working Conditions
There can be poor living and working conditions for employees, including violations of International Labour Organization (ILO) core labor principles, lack of fair wages, gender discrimination, and limited access to health care and education.[148]

Community Displacement
Land acquisition and forest conversion in regions with unclear or unenforced property rights can result in displacement and loss of ecosystem services for local communities and indigenous peoples. This is particularly relevant in Brazil, Argentina, and Paraguay.[149]

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion · Climate Change & Air Quality · Soil Erosion / Degradation · Water Use · Pesticides & Toxicity · Nutrient Loading & Eutrophication · Disease & Animal Care · Labor · Local & Indigenous Communities · Society & Consumers

Priority Areas Protection
The area of land to be utilized does not contain, and is not suspected of containing, native forest or High Conservation Value (HCV) areas. The area of land to be utilized has not been converted from native forest or HCV since May 2009.

Pest Management
An Integrated Pest Management (IPM) plan is developed and implemented, ideally incorporating biological controls. An Integrated Weed Management plan is developed and implemented, ideally including cultural and biological controls, appropriate rates of pre-emergent and post-emergent applications, and appropriate altering of active ingredients.

Soil Management
A Soil Management Plan is developed and implemented with a focus on soil productivity, including retention of soil biomass levels, soil structure, salinity, pH, and carbon sequestration. The plan can outline crop and geographically appropriate practices such as no-till, only planting on suitable slopes, use of cover crops, crop rotation, tree hedges, and contour planting, etc. The plan should also include adequate protection of riparian areas.

Chemical Use
Agrochemicals are properly used on site, judiciously and in a targeted fashion using available expertise. There is no use of hazardous agrochemicals listed as Classification I or II in the World Health Organization's Recommended Classification of Pesticides by Hazard. Agrochemicals are prepared and applied by trained personnel—and not by children or pregnant women. Potential impacts on local communities of chemical run-off and spraying are assessed and managed.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Nutrient Management
A Nutrient Management Plan focused on optimal uptake and minimal loss of nutrients has been developed and is implemented. The plan can include: soil and foliage testing (regularly and especially prior to fertilizer applications), use of variable rate technologies for fertilizer application, crop rotation, and use of cover crops and filter strips.

Water Management
A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration crop needs, soil water holding capacity, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Greenhouse Gas Emissions
Efforts are made to reduce fossil fuel emissions on farm and increase GHG sequestration. Techniques can include soil carbon management and restoration of native vegetation.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g. child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable, personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

TRENDS AND OPPORTUNITIES

As China expects to dramatically increase its soybean imports more than 50 percent by 2020, there is a limited window of time to coordinate global efforts to protect what remains of the native savannas and forests such as the Cerrado, Pantanal, Atlantic Forests, Amazon, Gran Chaco, and Pampas of Latin America. Given the structure of China's demand, focus can be brought on major soy crushers and traders, such as Cargill, Bunge, and Wilmar, who must screen vendors so as to not irresponsibly source soy from valuable ecoregions. An example of good policy is the Brazilian Soy Moratorium, an industry-led effort, representing approximately 90 percent of Brazil's production, to ensure soy is not produced on recently deforested land.[150] However, the Moratorium encompasses only the Brazilian Amazon–where soy is a relatively small driver of deforestation–and does not protect the Cerrado and other key regions. With possible changes in the Brazilian Forest Code, market tools such as the Roundtable for Responsible Soy (RTRS) become even more critical. Another potential driver of improvements in soy production is corporate buyers. Unilever, Waitrose, ARLA Foods, Royal Ahold, Friesland-Campina, and Lantmannen have already made commitments to source credibly certified soy.

Responsible soy production, including better management practices and deforestation reduction, is increasingly an investment focus and a lending hurdle for financial institutions. Recent research has shown that improvements in market access and premiums, as well as operational improvements, can generate an expected payback period of three years for average Brazilian and Argentinean soy producers.[151] Additionally, initiatives such as the IDH Soy Fast Track Fund[152] match investments in producers, processors, and/or buyers to increase volumes of responsible soy.

As soy production centers transition toward sustainability, the most significant investment opportunities include:

- Soil analysis and appropriate nutrient application technologies for on-farm input optimization
- Irrigation application efficiency management technologies, including Variable Rate Irrigation (VRI) systems and drip irrigation
- Investments in new agriculture areas (e.g., degraded lands), making sure they are in accordance with strict and credible expansion criteria. The financing of land rehabilitation (typically a two-to-five-year process) can be aggregated with initial equipment financing—most notably a combine tractor.
- Improved agricultural extension services for producers. These services are often provided through the private sector. Additional support for existing state, federal, and private institutions will help provide access to science-based and resource-efficient practices.
- Financing of certification costs to access new markets, defend existing markets, and improve company performance.[153]

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the soy industry, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 7: SUGARCANE

Sugar is a globally traded commodity with a fragmented production base consisting of over 100 countries. Traditionally used for sweetener, sugarcane is now also processed into ethanol, diesel, bioplastics, and a range of other products. Primary environmental risks in sugarcane production can include conversion of important ecosystems, impacts on freshwater quality and greenhouse gas emissions. Primary social risks can include forced or bonded labor, and the displacement of, or loss of ecosystem services for, local communities.

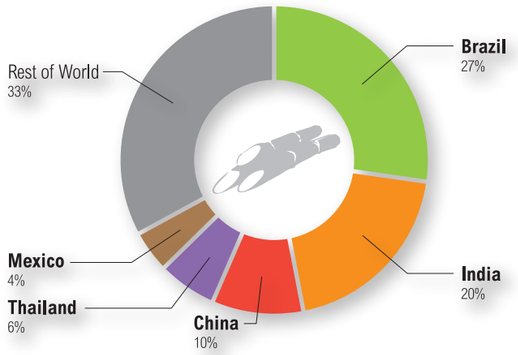
Sugarcane field, Zambia

SUGARCANE

Sugarcane—cultivated up to 5,000 years ago in South Asia—is now a global commodity produced throughout the tropics and used for sweeteners, biofuels, and a growing range of bioproducts (including bioplastics). Production is extremely fragmented, with sugarcane grown in over 100[154] countries. Sugarcane occupies 23.8 million hectares of land worldwide,[155] yielding a total of approximately 1.68 billion tons of sugar cane per annum.[156] From this cane, approximately 131.2 million tons of sugar and over 27.5 billion liters of ethanol are produced (though exact ratios depend on a range of additional factors, including specifically the price of oil). Roughly 35 percent of sugar production is traded internationally.

Global Sugar Production

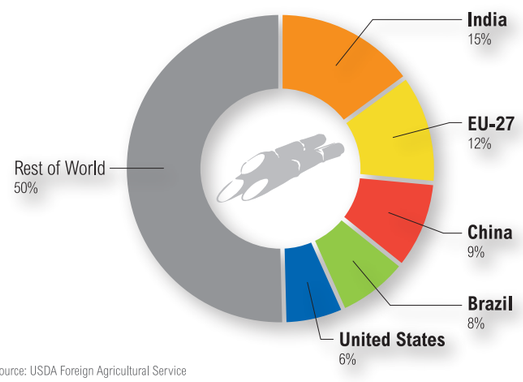
Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service

Global Sugar Consumption

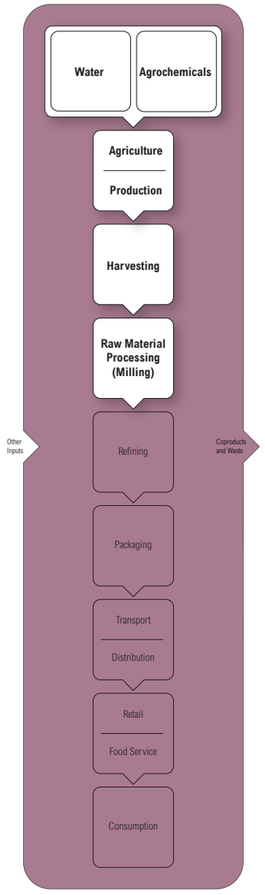
Including Sugarcane and Sugarbeet, Five year average by weight, 2007-2011



Source: USDA Foreign Agricultural Service

Figure 15: Countries of High Production and Consumption
(a) Brazil, India, and China are the leading producers of sugar; (b) Globally, India, the European Union, and China lead sugar consumption.

Figure 16: Sugar Value Chain
The processes highlighted in white are the areas of the sugar value chain where the risks and key performance indicators on the following pages are most relevant.



Leading producer countries include Brazil, India, China, Thailand, Pakistan, Australia, Colombia, and Mexico, which account for nearly 80 percent of total cane production.[157] Brazil, Thailand, and Australia alone represent approximately 65 percent of international exports.[158] Historically, demand for sugar has been the primary driver of sugarcane production. In addition to this consumption, additional demand now includes ethanol, diesel, bioplastics, jet fuel, and other products. Numerous countries, including the US, Brazil, Colombia, China, Australia, the EU-27, and others have created renewable energy mandates that will continue to drive demand for cane-derived energy products.[159] Sugarcane's potential as a biofuels feedstock will be fully realized through the development of cellulosic technology, as over 15 percent of the plant is fiber.

Sugarcane's potential to help satisfy global energy demand will be limited in part by poor production practices that generate severe impacts on freshwater quality and availability in key eco-regions, indirectly convert land, and emit greenhouse gases. An estimated 49 percent increase in land area under sugarcane cultivation by 2050 is required to meet projected global demand,[160] and biofuel mandates may drive even further growth. WWF has already witnessed expansions in key eco-regions in Coastal East Africa and the Mekong. Future expansion is expected to impact more key areas of global biodiversity, including West Papua in Indonesia (over 50,000 hectares zoned for sugar alone, though as of writing forestalled by the government);[161] the Brazilian Cerrado and Atlantic Forest (through an investment to double the size of the local industry);[162] Mexico (potentially up to 1 million hectares for biofuels);[163] and the Miombo Woodlands and Kafue Flats in Zambia. Malawi, Uganda, Mozambique, and Kenya likely also face upcoming expansion of sugar production. In addition, the current sugar supply chain can generate serious negative impacts on local communities and labor. Land acquisition in regions with unclear or traditional property rights can result in displacement of, or loss of ecosystem services for, local communities and indigenous peoples. Furthermore, there is incidence of severe human rights violations in production, such as forced or bonded labor.[164]

THIRD-PARTY CERTIFICATIONS

Bonsucro (www.bonsucro.com) is a multi-stakeholder certification launched in summer 2011 that addresses the Key Performance Criteria herein and has already certified nearly 2 percent of the global sugarcane production area, representing as much as 25-30 percent of the global market. Bonsucro's 59 members include producers, end users, and traders such as The Coca-Cola Company, PepsiCo, Kraft, Unilever, Raizen, Copersucar, Cargill, Bunge, and Louis Dreyfus. In its development, Bonsucro benefited from the long-lived successes and challenges of other agricultural commodity standards and is one of the first "outcome based" standards. For example, sugarcane producers must rigorously measure the entire carbon footprint of their production via a standardized tool.

The Roundtable on Sustainable Biofuels (RSB) serves as a strong standard in the context of sugarcane production for biofuels, and the Sustainable Agriculture Network (SAN) standard also provides a robust set of environmental and social criteria. Organic standards are also of notable significance in the sugar market. However, the sugarcane certified as organic in Florida, for example, would likely not fulfill the criteria of other standards, such as those of Sustainable Agriculture Network (SAN) or Bonsucro, as it is burned prior to harvest.

SUGAR

ENVIRONMENTAL & SOCIAL RISKS

Land Conversion
Land conversion of forests or other native habitat can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss through conversion of High Conservation Value areas and forest fragmentation. This is particularly relevant in Coastal East Africa, the Brazilian Cerrado, the Atlantic Forest, the Mekong region, and Indonesia.

Water Use
Unsustainable water use in irrigated systems can cause over withdrawal from aquifers and surface water, impacting farm economics and the livelihoods of surrounding communities. This is particularly relevant in South Asia (India and Pakistan) and a growing issue in Australia and Africa.

Child Labor & Debt Bondage
Child labor, forced/bonded labor, human trafficking, inadequate compensation, restricted rights to associate, and lack of contracts for laborers are violations of human rights that have been associated with sugarcane production.

Poor Working Conditions
There can be poor living and working conditions for employees, including violations of International Labour Organization (ILO) core labor principles, lack of fair wages, lack of protective equipment, lack of water and nutrition, lack of first aid equipment, exposure to agrochemicals, gender discrimination, and limited access to health care and education.

Agrochemical Use
Poor or excessive pesticide and herbicide application practices can result in increased worker exposure and emissions to the surrounding ecosystem and local communities. Chemical storage does not always follow company guidelines or local and national laws.

Agrochemical Use Impacting Reefs
Overuse of agrochemicals and poor soil management practices produce runoff that can have negative impacts on globally unique marine reef systems. This is particularly relevant in the Great Barrier Reef in Australia, the Mesoamerican Reef in Central America, and the Great Sea Reef in Fiji.

Soil Health, Compaction, & Erosion
Based on soil type and practices, soil erosion, compaction, salinity, pH, organic matter, soil structure, and nutrient balance can each become critical and difficult to reverse issues. Soil health can be negatively impacted through unsustainable application of agrochemicals, pre- and post-harvest burning, and heavy equipment use. Salinization and water logging can occur from poor irrigation. Compaction reduces water infiltration and can lead to run-off of nutrients in flood events.

Greenhouse Gas Emissions
Sugarcane production can generate greenhouse gas (GHG) emissions particularly through the practice of in-field burning and during processing at mills (sometimes offset by bioenergy co-generation). Other sources can include nitrous oxide (N_2O) from fertilizer applications, carbon dioxide (CO_2) from fossil fuel inputs, CO_2 from deforestation, and CO_2 and N_2O from soil management and tillage practices.

Respiratory Risks to Laborers & Communities
Pre- and post-harvest burning can result in respiratory issues for agricultural laborers and people living in neighboring communities.

Community Displacement & Loss of Ecosystem Services
Land acquisition in regions with unclear or unenforced property rights can result in displacement and loss of water and other ecosystem services for local communities and indigenous peoples. Cambodia, Laos, parts of Latin America, and parts of Southern Africa are the focus of potential land tenure conflicts. Conflicts with indigenous people in Brazil and Southeast Asia currently exist and/or face escalation.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion
Climate Change & Air Quality
Soil Erosion / Degradation
Water Use
Pesticides & Toxicity
Nutrient Loading & Eutrophication
Disease & Animal Care
Labor
Local & Indigenous Communities
Society & Consumers

Priority Areas Protection
The area of land to be utilized does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. The area of land to be utilized has not been converted from primary forest or HCV since January 2008. Where possible, regional conservation planning is implemented.

Water Management
A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration crop needs, soil water holding capacity, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Chemical Use
Agrochemicals are properly used on site, judiciously and in a targeted fashion using available expertise. There is no use of hazardous agrochemicals listed as Classification I or II in the World Health Organization's Recommended Classification of Pesticides by Hazard. Agrochemicals are 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 run-off and spraying are assessed and managed.

Nutrient Management
A Nutrient Management Plan focused on optimal uptake and minimal loss of nutrients has been developed and is implemented. The plan can include: soil and foliage testing (regularly and especially prior to fertilizer applications), use of variable rate technologies for fertilizer application, application based on up-take, application informed by weather conditions, crop rotation, and use of cover crops and filter strips. Appropriate, science-based riparian zones are established and maintained to prevent fertilizer run-off into freshwater and marine habitats. Broadcasting of fertilizer is avoided, with preference for direct deposition into the soil.

Soil Management
A Soil Management Plan is developed and implemented with a focus on soil productivity, including retention of soil biomass levels, soil structure, salinity, pH, and carbon sequestration. The plan can outline crop and geographically appropriate practices such as no-till, only planting on suitable slopes, use of cover crops, crop rotation, tree hedges, contour planting, elimination of in-field burning. etc. The plan should also include adequate protection of riparian areas.

Pest Management
An Integrated Pest Management (IPM) plan is developed and implemented, ideally incorporating biological controls. An Integrated Weed Management plan is developed and implemented, ideally including cultural and biological controls, appropriate rates of pre-emergent and post-emergent applications, and appropriate altering of active ingredients.The toxicity of annual applications of pesticides is continuously reduced or maintained.

Carbon Management
Efforts are made to reduce fossil fuel emissions and increase GHG sequestration. Techniques can include soil carbon management, restoration of native vegetation, eliminating in-field burning practices, improving in-mill co-generation technology, improving the sucrose recovery rate, and decreasing in-field fuel and agrochemical use.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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.

TRENDS AND OPPORTUNITIES

Global improvements in sugarcane sustainability and better practices have been driven by certification schemes that are increasingly required by biofuel mandates. Sugar sustainability has also been incentivized via demands from sugarcane derivative end users, including bioplastics, sugar, and molasses industry players. Well-managed sugar production sites offer the opportunity to increase soil health and thus improve carbon sequestration and water management. Bonsucro, a recently launched global mainstream standard for sugar certification, is experiencing rapid uptake, providing an opportunity for realizing the positive potentials of sugar. As a result of these shifts, the need to improve productivity and sustainability in the global sugarcane industry provides numerous opportunities for financiers. Currently, the most significant capital improvement opportunities in sugarcane sustainability include:

- Improved boiler technology for electricity co-generation. The biomass fuel produced during sugarcane cultivation can be collected and burned to create biogas. This not only reduces waste product but can also generate outputs for the local electrical grid.
- Methane capture from sugarcane milling effluents. The gas by-product of sugarcane production can be converted to fuel with the installation of a boiler or internal combustion engine.
- Soil and leaf testing for on-farm input optimization.
- Improved agricultural extension services. This capacity building is often provided at least partially by the private sector, and some regions provide extension services through a government-mandated levy.
- Improved harvesting efficiency and logistics. Sugarcane quality decreases significantly over time, as the cane dries out quickly following harvest, thus reducing price.
- Development of mechanization equipment appropriate for small-scale farmers and groups. For example, smallholders are currently forced to use can cutters if they cannot afford the $500,000 large harvester utilized by large capital-rich plantations. A smaller version of the harvester would produce a smaller ecological footprint than prevailing practices, while increasing yields.
- Application of and training in improved practices and technologies for smallholders and outgrowers. Yield gaps are typically greatest among small-scale growers, and actively engaging these producers can increase mill utilization and volumes in the supply chain. Private extension services will escalate significantly as large-scale producers fulfill near-term commitments under Bonsucro to certify their outgrowers, who often number in the thousands. Increased cooperation with the mills allows farmers to reclaim revenue from crops that otherwise would have spoiled, and implementation of best practices will increase the productivity of existing land, improving smallholder profitability.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the sugar industry, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

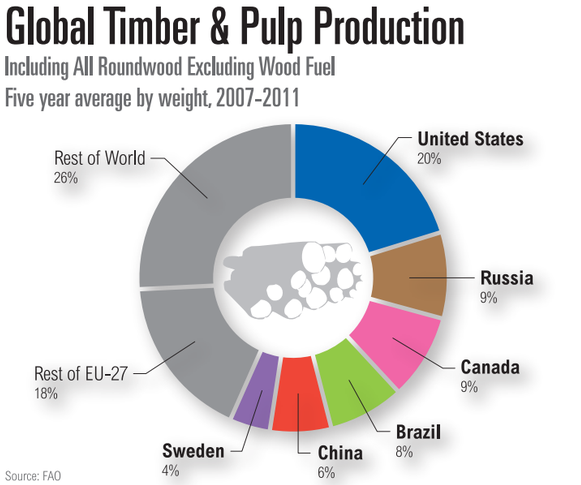
CHAPTER 8: TIMBER, PULP AND PAPER

More than half of the world's remaining 4 billion hectares of forest are designated as "production" or "multiple use", generating approximately $120 billion in revenues per annum. Activities can be broadly segmented into farmed production ("tree plantations") and harvesting within natural or semi-natural forests. Primary environmental and social risks associated with timber, pulp, and paper production include deforestation and forest degradation–resulting in severe biodiversity loss and greenhouse gas emissions–and the displacement of local and indigenous communities.

Timber transported via truck to paper and cellulose mill in Telemaco Barba, Brazil.

TIMBER, PULP, AND PAPER

The world's remaining forests occupy 4 billion hectares. More than one-third of these forests are primary,[165] over half—more than 2 billion hectares—are designated as "production" or "multiple use forests,"[166] and an estimated 7 percent represents planted forests and trees.[167] Each year, more than 3.4 billion cubic meters of wood is extracted from forests, approximately half of which is used for wood fuel (firewood or charcoal), and the remainder is used to make timber and paper products.[168] Primary timber products include sawn logs for further processing, as well as panel products from veneers, particles, or fiber. The world's



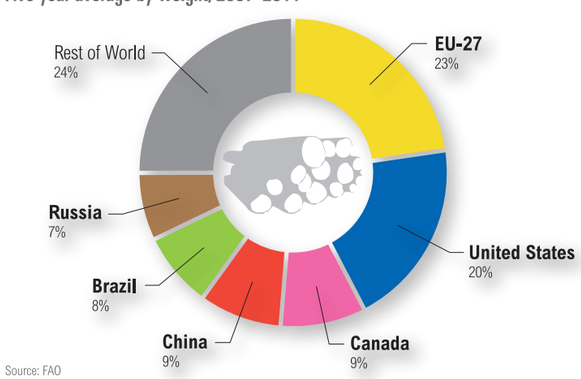
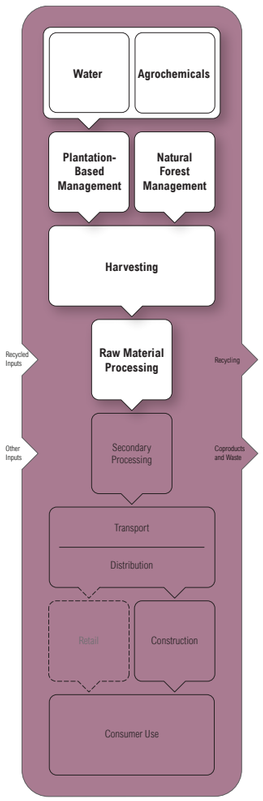


Figure 17: Countries of High Production and Consumption
(a) The United States, Russia, and Canada are the leading producers of timber and pulp; (b) Globally, the European Union and the United States lead timber and pulp consumption.

Figure 18: Timber and Pulp Value Chain
The processes highlighted in white are the areas of the timber and pulp value chain where the risks and key performance indicators on the following pages are most relevant.



managed forests—some of whom have been managed responsibly for centuries—generate approximately US$100 billion in wood removals and US$18.5 billion in other forest products per annum. This is fueled by over US$64 billion in annual investments.[169]

Forestry can broadly be divided into harvesting within natural or semi-natural forests, and farmed production on plantations. Many of the environmental challenges of tree plantations resemble those of row crops, with the greatest risks stemming from conversion or degradation of High Conservation Value (HCV) areas and natural forest, as well as displacement of local populations. Wild harvesting is more extractive and represents a spectrum of practices that can range from destructive clear-cuts to better practices such as the careful removal of selected trees via "reduced impact logging" ensuringthat the wider forest maintains diversity of genetics and age. Well-managed production in natural forests can potentially maintain many of the biodiversity values of a forest over time. Bad logging practices include overharvesting, "hit and run" logging in natural forests, or regeneration with single and/or exotic species. The key direct impact is usually degradation of habitat rather than outright loss. In temperate and boreal forests, this leads to greater homogeneity, causing biodiversity loss and greater vulnerability to diseases and climate change. In tropical and boreal forests, degradation is responsible for significant greenhouse gas emissions, the drying of forests, and loss of wildlife. In some countries, wood harvesting and infrastructure serves as a precursor to full forest conversion for agriculture.[170] As a result, land use, land use change, and forestry, also known as LULUCF, produces 17.5 percent—nearly one-fifth—of global greenhouse gas emissions, making the sector the world's third largest emitter.[171]

THIRD-PARTY CERTIFICATIONS

The Forest Stewardship Council (FSC) (www.fsc.org) is considered by independent NGOs to be the most credible mainstream timber, pulp, and paper standard.[172] For producers and traders/exporters who are not yet FSC certified, an option is participation inWWF's Global Forest & Trade Network (GFTN). GFTN requires development of a stepwise "Action Plan," with timelines and milestones to improve practices, leading to FSC certification. Other stepwise programs that move producers through a continuous improvement program include The Forest Trust (TFT), the Smartwood Smartstep Program, the Rainforest Alliance TREES Program, and the forthcoming FSC Modular Approach Program.

Financial institutions investing in regions with poor governance may achieve more for forest conservation by allowing "full compliance over time" rather than strictly declining potential deals with companies on the grounds that their production units are not all certified or because their mills are not yet completely free of wood from unsustainable sources. A company's progress toward better performance will often depend on its ability to make the investments needed to transform its operating practices. Financial institutions can support such transformation by financing a company while its forestry operations (or those of its suppliers) progress toward credible forest certification. The potential reputational risks during this transition can be managed by strict and transparent loan conditions or shareholder resolutions requiring fulfillment of stepwise targets.

TIMBER, PULP, & PAPER

ENVIRONMENTAL & SOCIAL RISKS

Irresponsible Forestry Practices & Habitat Conversion
Conversion, fragmentation, or degradation of forests can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss, including in habitats with high conservation values.

Community Displacement
Land acquisition, forest management, and forest conversion in regions with unclear or unenforced property rights can result in displacement and loss of ecosystem services for local communities and indigenous peoples.

Timber Rights
Conflicts with local communities can arise over rights to timber extraction or distribution of revenues from timber sales.

Ecosystem Services
Loss of forage fuel, food, and other ecosystem services can occur for local and surrounding communities.

Illegal & Untraceable Products
Trade of illegal and untraceable forest and paper products can occur. Chain of custody systems and emerging technologies (e.g., isotope and DNA analysis) are making it easier to track these infractions within supply chains.

Greenhouse Gas Emissions from Production
Forest loss and degradation represents up to 20% of global carbon dioxide (CO_2) emissions caused by human activity.[173] Good forestry practices, however, can ensure that forests store carbon and are resilient to climate change.

Health & Safety Risks
Operational health and safety risks are significant in the Timber, Pulp, and Paper sectors. There can be inadequate training, oversight, and Personal Protective Equipment (PPE).

Greenhouse Gas Emissions & Energy Consumption at Mills
Pulp and paper processing is one of the largest energy users in the manufacturing sector and contributes to greenhouse gas emissions.

Soil Health, Compaction, & Erosion
Soil erosion can occur from forest clearing or poor logging and road-building practices, leading to incidents of major regional and national flooding and water contamination.

Agrochemical Use
Poor or excessive pesticide application practices in plantation forestry can result in increased worker exposure and emissions to the surrounding ecosystem and local communities.

Water Discharge from Mills
Water effluent from pulping mills can result in pollution and eutrophication of local waterways.

Poor Working Conditions
There can be poor living and working conditions for employees, including violations of International Labour Organization (ILO) core labor principles, lack of fair wages, gender discrimination, sub-standard housing, and limited access to health care and education.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts. These risks represent only a portion of the larger set of life cycle impact and investment management concerns, such as downstream paper recovery systems and whether to use wood, cement, or concrete in building materials.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion · Climate Change & Air Quality · Soil Erosion / Degradation · Water Use · Pesticides & Toxicity · Nutrient Loading & Eutrophication · Disease & Animal Care · Labor · Local & Indigenous Communities · Society & Consumers

Priority Areas Protection
In cases of land conversion, the impacted area does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. In cases of natural forest management, the harvesting entity ensures that High Conservation Values (HCV) have been assessed and a suitable management plan has been adopted to manage or enhance the values identified. The source forest is not being converted from native forest to a plantation or other land use.

Local & Indigenous Communities
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 FPIC (free, prior, and informed consent); 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. Local communities are financially benefitting from the forest management.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The harvesting entity holds legal rights to conduct activities on the area of land. The timber was not traded in a way that drives violent armed conflict or threatens national or regional stability (commonly referred to as 'conflict timber'). The harvesting or processing entity, or a related political or military regime, is not legitimately suspected of violating human rights.

Ecosystem Functions
The source forest is managed in a way that maintains, enhances, or restores biodiversity values and ecosystem services. A Forest Management plan is in place that addresses biodiversity and soil conservation or restoration.

Area Based Management
The forestry company and/or processor are collaborating and operating within an effective spatial management system, including a protected areas network, and this network is well managed with regard to watersheds, High Conservation Value areas and biological corridors.

Greenhouse Gas Emissions
Greenhouse gas emissions at mill are reduced though little or no waste to landfill as well as through reduced energy use and little fossil fuel energy input.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable, personal protective equipment provision and hazardous substance monitoring and testing.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Water Management
In the forest or plantation, a Water Management Plan is in place that addresses relevant risks—such as silting of waterways due to logging and roads—and includes concrete measures to protect ground water or local water bodies. At the mill, bleaching technologies and water treatment should be in place to mitigate water pollution from chlorinated compounds, as well as oxygen deprivation. Water use during processing must be balanced with water availability in the river basin.

TRENDS AND OPPORTUNITIES

Production forests play a crucial role in maintaining the global climate, economic development, and biodiversity conservation. They provide vital links between and buffers for protected areas. Properly managed forestry operations can also generate sustainable poverty reduction for local communities. Over 350 million people live in or near forests, many of whom are among the world's poorest and are almost wholly dependent on forests for their survival.[174]

Tree plantations made up only 7 percent of total forest cover in 2006 but provided 50 percent of industrial roundwood.[175] A growing proportion of these can be described as intensively managed plantations, with a rotation of five to 25 years. Intensively managed plantations—which have expanded in recent years primarily in Asia, Oceania, and South America—yield far more wood per hectare than natural forests. Improvements in landscape planning and planting techniques could potentially boost productivity even more. If further expansion of tree plantations can be focused on a proportion of existing degraded land, while safeguarding the rights and livelihoods of indigenous peoples and local communities, the productivity benefits of plantations can be realized with minimal social or environmental costs. To help operators and investors meet this potential, the New Generation Plantation Project (NGPP) provides practical tools and case studies for tree plantation management best practices. These resources include reports on bioenergy and carbon, plantation biodiversity, and plantation forests in a green economy.[176]

Uptake of forest certification will increasingly be driven by regulation, such as the recently amended US Lacey Act and the European Union Timber Regulation, which comes into force in 2013. Over the next five years, similar legislation will close major markets to illegal trade in forest products.[177] Yet legal compliance, while crucial, is not sufficient to ensure that responsible production and processing practices are in place.

Emerging investment opportunities in sustainable forestry include innovation to enable more efficiency in pulp and paper mills, cleaner processing technologies, technologies allowing more cellulose fibers to be extracted from a given volume of wood, and technologies to increase the recycling rate of a fiber. The market for recycled post-consumer material is expanding and allows fibers a longer usage (five to seven applications in the paper sector). Supporting the further growth of this industry will reduce the need for more forest harvesting or plantation establishment. In timber production, there has been a trend over time, as forest concession tenures mature, toward decentralization and SME- (Small and Medium Enterprises) and community-owned forest management.[178] This new ownership base requires significant new investment in training, and technologies such as mobile sawmill facilities, to enhance livelihoods and sustainability and to ensure steady supply. REDD+ also opens potential new opportunities to gain funding, subsidies, carbon credits, and payments for ecosystem services through well-managed forests (see What is REDD+?, page 64).

TOOLS AND RESOURCES

For additional data, information, tools, and resources on the timber, paper, and pulp industries, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria

The market for carbon credits and other environmental benefits from forests (often characterized under the acronym of REDD+, reducing emissions from deforestation and forest degradation) continues to evolve. Any serious effort to address climate change will have to integrate forests. In addition, creating a value for standing and intact forests will help protect biodiversity and a range of other ecosystem services.

What is REDD+?

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a policy framework that compensates developing countries in the tropics and subtropics for reducing greenhouse gas emissions from deforestation and forest degradation. According to the IPCC 2007 assessment, deforestation and forest degradation account for up to 20% of global carbon dioxide (CO_2) emissions. The concept of compensating countries for "avoiding deforestation" was first introduced into the negotiations of the United Nation's Framework Convention on Climate Change (UNFCCC) in 2005 at Montreal. The approach was formally termed "REDD" in 2007 at the treaty negotiations in Bali, when it was expanded to include forest degradation. The "+" in REDD+ emerged in Copenhagen in 2009 and refers to the inclusion of measures to enhance carbon stocks in standing forests and promote reforestation in landscapes with limited areas of natural forest. Currently, REDD+ financing primarily consists of bi-lateral or multi-lateral agreements to support programs in individual countries with an emphasis on investments in institutional capacity to support future REDD+ initiatives.

REDD+ continues to evolve, and a number of challenges remain unresolved. These include:

- How to incorporate social and environmental safeguards into REDD+ initiatives?
- How to ensure benefits for local and indigenous communities?
- How to reduce the drivers of deforestation and forest degradation by promoting low carbon development strategies?
- How to establish baselines and measure emission reductions against those reference levels?
- How to structure financial flows to REDD+ recipients and link them to objective performance indicators?
- How can the private sector support REDD+, and what will be the role of markets in taking REDD+ to scale at the global level?

Private investors can potentially benefit from REDD+. Yet their involvement to-date has been minimal due to low risk-adjusted returns. The primary risks to private investment in REDD+ projects are regulatory, including demand concerns arising from the fact that no major industrialized economy has created a "cap and trade" system that would drive a market for REDD+ carbon credits, and supply concerns owing to the lack of clear ownership rights in developing countries over who can generate and sell REDD+ credits. Additional challenges relate to transactional costs—legal fees, technical consultants, and management time, which may not be recovered should a project not proceed—and the potential impermanence of forest-based offsets. These constraints have been managed in various ways, including a "multi-stakeholder" model where investors and civil society and/or the public sector cooperate to share costs in achieving shared goals. Another emerging opportunity, and perhaps more likely to scale, is the development of integrated business models where REDD+ is viewed as an additional source of revenue linked to sustainable land use, such as the certified sustainable production of forest or agricultural commodities.

CHAPTER 9: WILD-CAUGHT SEAFOOD

The seafood industry generates nearly $400 billion in revenue per annum and is a global source of protein and employment. However, as a result of growing consumer demand, modern practices, and poor regulation, approximately 87 percent of the world's fisheries are overfished or fully exploited. Primary environmental risks associated with seafood commodities can include fishery collapse, unsustainable bycatch, and encroachment on marine protected areas. The following chapter focuses on whitefish, tuna, tropical shrimp, and low trophic level (LTL) fisheries; yet the guidance is widely applicable.

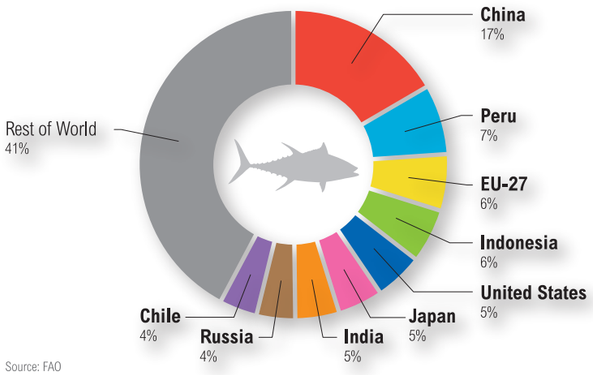
A school of tuna

WILD-CAUGHT SEAFOOD

The seafood industry—the world's last major hunter-gatherer food system—is a global source of protein and employment. Worldwide, fish provide over 1.5 billion people with one-fifth of their intake of animal protein and 3 billion people with at least 15 percent of their animal protein.[179] In 2010, the industry employed 54.6 million people directly, and its growth rate continues to outpace agriculture employment trends.[180] The total value of the wild-caught seafood industry was approximately US$388.9 billion globally in 2010.[181] The industry operates within national waters, but more often beyond national boundaries where regulation is often weak or absent.

Global Wild Caught Fish Production

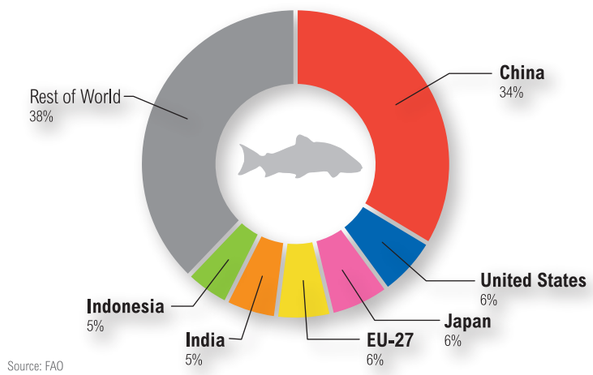
Excluding Aquatic Plants, Five year average by weight, 2006-2010



Source: FAO

Global Fish Consumption

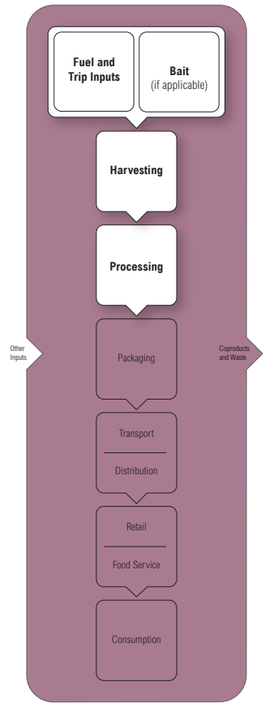
for Aquaculture and Wild Caught Fish, Excluding Aquatic Plants
Five year average by weight, 2006-2010



Source: FAO

Figure 19: Countries of High Production and Consumption
(a) China, Peru, the European Union, and Indonesia are the leading producers of wild caught fish; (b) Globally, China, the United States, Japan, and the European Union lead wild caught fish consumption.

Figure 20: Wild Caught Value Chain
The processes highlighted in white are the areas of the wild caught value chain where the risks and key performance indicators on the following pages are most relevant.



Modern fishing technology and improvements in gear design and fishing efficiency, as well as increasing consumer demand, have brought many fisheries into or near collapse. Approximately 87 percent of the world's fisheries are fully exploited or overfished.[182] Many fish stocks have already experienced severe declines from overfishing, and it is predicted that others are at risk of collapse in coming years if current exploitation rates continue.[183] Not only do these trends threaten key protein supplies for human consumption, but many fishing practices can have deleterious consequences for marine bottom habitat; bycatch species (including sea turtles, sharks, birds, and small cetaceans); juveniles of commercial species; and local fishing communities who rely on fish, shellfish, and other marine life for protein and livelihoods.

Whitefish fisheries:

Whitefish are white-fleshed, primarily bottom feeding fish species targeted by large commercial fisheries. They are typically processed into frozen fillets for global consumption.

Overfishing, driven by increasing demand, is the primary threat facing the global whitefish industry. Catch limits often fail to reflect that different whitefish species are often caught together. As a result, the actual catch for a particular species is often much higher than the allowed catch.

The second major threat is damage to marine ecosystems. In addition to significant ecosystem changes caused by overfishing, non-target species suffer injuries and fatalities as bycatch and through interactions with fishing gear. Fishing equipment, particularly bottom trawls, is also modifying and destroying benthic (sea floor) habitats. Without significant changes in policy and practice, unsustainable whitefish fisheries will continue to cause significant declines in marine ecosystem health and reductions in marine biodiversity.

Tuna fisheries:

The tuna industry consists primarily of two groups of fisheries: smaller tuna—mainly skipjack and albacore for canning—and high-value large tuna such as yellowfin, bigeye, or bluefin for the fresh and frozen seafood markets. Key tuna fishing regions include the Pacific and the Indian Oceans yet also include semi-enclosed seas such as the Mediterranean. Primary consumption markets include the US and Europe for canned tuna, and Japan, the US, and Europe for fresh and frozen tuna. However, new data from emerging economies suggest they will soon become strong consumers of both canned and fresh/frozen tuna products.

The key threat from the tuna industry is overfishing, including juvenile tuna bycatch, and bycatch of other marine and bird species. The primary driver of these threats is either inappropriate or zero management systems in place, due to the fact that tuna species are highly migratory and often also inhabit high seas beyond national jurisdiction.

Tropical shrimp fisheries:

Shrimp represents one of the most important fisheries in the tropics, forming a valuable export to global markets. The two greatest threats from the wild-caught tropical shrimp industry are bycatch rates, which can be eight to 20 times greater

(by weight) than the target landed catch,[184] and highly destructive trawling methods responsible for devastating bottom habitats. These excesses are often driven by absent, weak, or unenforced fisheries management systems.

Low trophic level (LTL) fisheries:
LTL fisheries, also called forage fisheries, are fished in large quantities by midwater trawls for Antarctic krill and purse seine vessels for anchoveta, sardines, and other pelagic fish. These fisheries serve industrial needs (fish oil and fish meal) for global animal feed, aquaculture, and pharmaceutical markets. Primary catch areas include the Arctic and Antarctic, as well as the nutrient rich north-south coastlines of South America, Africa, and Asia. Key consumption markets include China, Chile, and Northern Europe (for the aquaculture industry), as well the European and North American food and fish-oil industries.

Small pelagic species are an important part of the food web for much of marine life, and thus they are essential for marine ecosystems. In addition to overfishing, the bycatch of small and juvenile fish can accelerate population depletion. WWF is currently producing an overall position paper on low trophic level fisheries.

THIRD-PARTY CERTIFICATIONS

The Marine Stewardship Council (MSC) (www.msc.org) is the most robust global standard for sustainable fisheries in meeting the Key Performance Criteria herein and the only fishery-specific certification that is a full member of the ISEAL Alliance. In 2009, WWF commissioned Accenture Consulting to conduct a study that compared various marine eco-labels and identified their strengths and weaknesses, which can be accessed at the following URL: http://awsassets.panda.org/downloads/wwf_report_comparison_wild_capture_fisheries_schemes__2_.pdf. An updated review of fishery certification systems was commissioned by WWF and is available on the WWF Smart Fishing Initiative website (http://wwf.panda.org/what_we_do/footprint/smart_fishing/). In both reports, the Marine Stewardship Council was found to be the wild-capture seafood certification scheme most compliant with international sustainability criteria.

Three billion people now depend on fish as a primary protein source, and over four billion more rely on it to supplement other protein sources. Yet scientists are now reporting that the health of the oceans may be in even worse condition than originally thought. A recent study by the International Programme on the State of the Ocean cites a combination of factors threatening a new mass extinction event in the oceans similar to earlier extinctions recorded in prehistoric data.

WILD CAUGHT SEAFOOD

ENVIRONMENTAL & SOCIAL RISKS

Fishery Collapse
Uncontrolled fishing, inadequate management, surpassing quotas, and insufficient enforcement of compliance with management systems can result in overfishing, damage, and fishery collapse.

Bycatch
Bycatch associated with specific fisheries (e.g., dolphins, albatrosses, sea turtles, and juveniles of various fish species) can cause significant negative impacts for their populations. Poor management, such as overcapacity and allowing the use of inappropriate equipment and gear, can increase levels of bycatch.

Benthic Impacts
Use of certain equipment and gear (e.g., bottom trawlers) can cause significant impacts to the benthic (ocean floor) environment and the species which depend on it.

Encroachment on Marine Protected Areas
Encroachment into sensitive habitats and Marine Protected Areas (MPAs) can occur, destroying or damaging critical habitat for marine species.

Illegal, Unregulated & Unreported
Trade of illegal, unregulated and unreported (IUU) fish can occur within supply chains. Improved traceability through more robust chains of custody within supply chains, improved transparency, and DNA analysis are making it easier to track infractions within the supply chain.[185]

Health & Safety Risks
Operational Health & Safety (OHS) risks are significant in the Wild-Caught Seafood sector. There can be inadequate training, oversight, and equipment.

Poor Working Conditions
There can be poor living and working conditions for employees on vessels and in processing plants, including lack of fair wages, gender discrimination, limited access to health care and education, human rights abuses on vessels, and insufficient or absent health and safety procedures. Marine fishing is one of the most dangerous industries globally in terms of injuries and deaths.[186]

Smallholders
Independent smallholder producers are often "price-takers" and have little power in relation to the buyers. Unfair practices can occur.

Food Insecurity
Commercial fishing in regions with unclear or traditional fishing rights can result in displacement of the food supply for local communities and indigenous peoples.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion
Climate Change & Air Quality
Soil Erosion / Degradation
Water Use
Pesticides & Toxicity
Nutrient Loading & Eutrophication
Disease & Animal Care
Labor
Local & Indigenous Communities
Society & Consumers

Ecosystem Functions
The fishing company is operating within its fishing quota or a management system set according to scientific recommendations to meet at least Biomass and Maximum Sustainable Yield (BMSY). The entities are contributing to practices that will allow for sustainable management of fisheries.

Non-Target Species Impacts
A robust bycatch mitigation/management system is in place and technology is used that reduces bycatch to sustainable levels to reduce impacts on non-target species. In addition, potential impacts to trophic level relationships within a fishery have been assessed and fishing levels for target species have been adjusted accordingly.

Priority Areas Protection
There has been no encroachment on Marine Protected Areas (MPAs), and appropriate technology to prevent fishing gear damage to sensitive areas are used, including technologies to limit or eliminate negative impacts on the benthic environment.

Area Based Management
The fishing company is collaborating and operating within an effective spatial management system, including a protected areas network, and this network is well managed with regard to precautionary fisheries management.

Legal Production
The fishery is subject to an effective and transparent management system that respects local, national, and international laws and regulations and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable. There are no Illegal, Unregulated, or Unreported (IUU) fish.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable personal protective equipment provision and hazardous substance monitoring and testing.

Labor Rights
Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g. child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety) and actively monitors compliance in its operations.

Local & Indigenous Communities
The rights of local coastal communities are respected, which can be assessed by: demonstrated and non-contested rights to utilize the coastal environment and other legal or customary resources, assuming the existence and implementation of data collection and stock management measures; negotiations with indigenous people based on FPIC (free, prior, and informed consent); 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.

Transparency & Traceability
A robust traceability system is in place or there is a plan to establish such a system, providing transparent processes from boat to plate.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

TRENDS AND OPPORTUNITIES

Improved regional fisheries management and governance are critical to strengthening marine ecosystems and ensuring steady supply in the coming decades. Incentives for sustainable fishing can be created through the use of rights-based management systems and through designing, financing, and implementing international traceability systems that enhance the value of sustainable fishing practices. Opportunities exist to finance and implement fishery improvement projects that are designed to ensure that a fishery improves to a level that meets MSC certification standards. Such products include loans for improved gear and capital equipment; financing of catch-share programs; financing for vertical integration so that certified producers can access markets despite monopolistic practices in certain ports; preferential financing for companies that develop and implement robust seafood procurement strategies; and engagement with and support for multi-stakeholder groups such as the ISSF (International Seafood Sustainability Foundation) for tuna. These activities provide the benefits of a secure seafood supply in both the present and future, triple bottom-line financial returns, traceability and ensured legal compliance, reputational risk management, and enhanced food security and environmental performance.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on wild-caught seafood industries, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 10: BIOENERGY

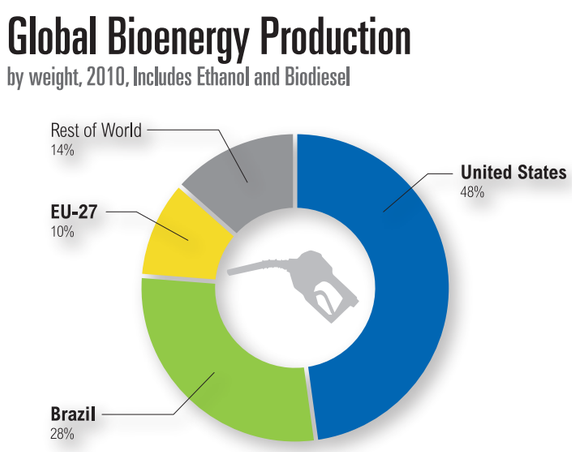
Bioenergy draws from a wide range of feedstocks such as wood, fruits, seeds, and row crops. The industry has expanded rapidly in recent years, driven in part of by government mandates, with liquid biofuels production increasing from 16 billion to 100 billion liters in the past decade. Though practices vary widely, primary environmental risks associated with bioenergy production can include conversion of important ecosystems, food insecurity, and greenhouse gas emissions.

Government-backed biofuel mandates continue to grow

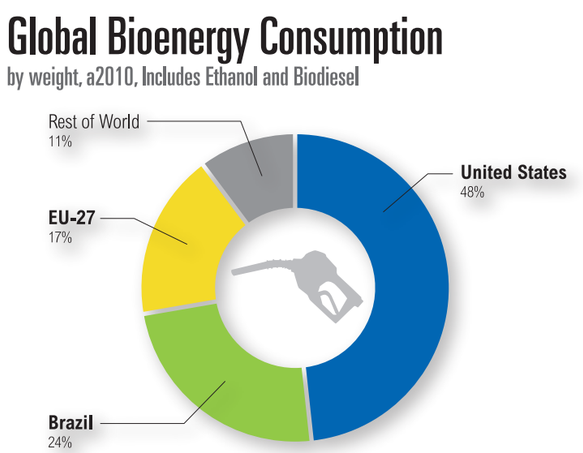
BIOENERGY

Bioenergy refers to manmade energy generated from plant feedstocks, which can range from wood to tree seeds to fruits to row crops. Bioenergy currently accounts for more than 10 percent of global energy consumption, most of which is traditional use of fuel wood and other biomass.[188] Modern applications of bioenergy (such as liquid biofuel production), upon which this chapter focuses, have increased in recent years driven by climate change mitigation policies, energy security, and rural development projects. Biofuel output has grown overall from 16 billion to 100 billion liters in the past decade. Today, approximately 3 percent of global road transport and 1.24 percent of the global electricity supply is provided by bioenergy.[189] The IEA estimates that 27 percent of global transport fuel consumption will be biofuels-based in 2050.[190] In order to achieve a 100 percent renewable energy supply by 2050, WWF's Energy Report estimates that nearly 40 percent of global energy is likely to come from one of the bioenergy technologies.[191]

The bioenergy industry is expanding geographically into regions such as Brazil, Mozambique, Tanzania, India, China, Russia, and Indonesia, bringing both opportunities and risks. Without strong sustainability safeguards at the national and management levels, bioenergy will add pressure to the conversion of forests, shrublands, and grasslands.[192] Key risks from bioenergy production also include impacts on local food security, potential indirect land use changes required to offset reductions in food production for local or global markets, and a net carbon benefit including all process inputs and land use changes.



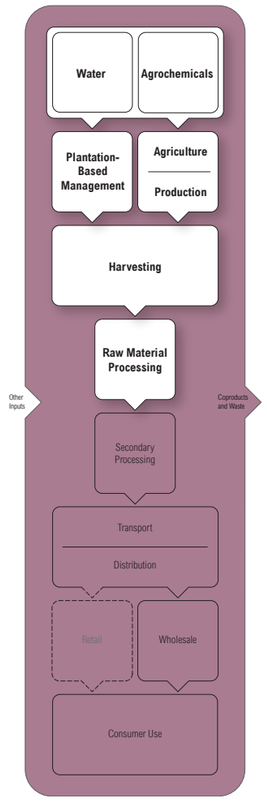
Source: US Energy Information Administration International Energy Statistics, 2010



Source: US Energy Information Administration International Energy Statistics, 2010

Figure 21: Countries of High Production and Consumption
(a) The United States and Brazil are the leading producers of bioenergy; (b) Globally, the United States, Brazil, and the European Union lead bioenergy consumption.

Figure 22: Bioenergy Value Chain
The processes highlighted in white are the areas of the bioenergy value chain where the risks and key performance indicators on the following pages are most relevant.



THIRD-PARTY CERTIFICATIONS

A range of environmental and social certifications meet WWF's Key Performance Criteria and comply with the ISEAL Code of Good Practice for Setting Environmental and Social Standards. The Roundtable on Sustainable Biofuels (RSB) is a recently launched system that serves as an umbrella standard across certifications and can be used by buyers making biofuel purchases. A number of RSB-certified operators are already producing biofuels compliant with the stringent RSB standard.

While the RSB provides standards for all types of liquid biofuels, there are standards that address the environmental and social risks of specific bioengergy feedstocks. For instance, the Roundtable on Sustainable Palm Oil (RSPO) provides standards for palm-oil based biodiesel; Bonsucro provides similar standards for sugarcane-based bioethanol; the Roundtable on Responsible Soy (RTRS) provides standards for soy-based biodiesel; and the Forest Stewardship Council (FSC) provides standards for wood pellets, chips, or wood-based second-generation liquid biofuels.

BIOENERGY

ENVIRONMENTAL & SOCIAL RISKS

Land Conversion
Land conversion of forests or other native habitat can contribute to climate change, loss of ecosystem services, and acute habitat degradation and biodiversity loss through conversion of High Conservation Value areas and forest fragmentation. This is particularly relevant in South-East Asia, Latin America, and Sub-Saharan Africa.

Food Displacement
Diverting a significant share of the agricultural output from food to fuel production can have an impact on food availability and prices. Opinions differ on the extent to which bioenergy developments contribute to rising food prices. Yet risks are highest in food insecure areas, where bioenergy investments can have a direct effect on access to food.

Greenhouse Gas Emissions
Bioenergy may or may not result in a net greenhouse gas emissions savings depending upon crop selection, location, and practices. The lifecycle emissions of bioenergy production includes: nitrous oxide (N2O) from fertilizer applications, carbon dioxide (CO_2) from fossil fuel inputs, CO_2 from deforestation, and CO_2 and N_2O from soil management and tillage practices. The bioenergy production lifecycle can generate net greenhouse gas emissions, or simply insufficient savings to justify development, if proper project planning procedures are not in place.

Agrochemical Use
Poor or excessive pesticide and herbicide application practices can result in increased worker exposure and emissions to the surrounding ecosystem and local communities.

Indirect Land Use Change
Indirect Land-Use Change (ILUC) refers to the displacement of various provisioning services by feedstock production. The redirection of land for bioenergy production can lead to additional land conversion in other communities due to local, regional, or global demand for food or other provisioning services. While these dynamics are not bioenergy specific, indirect impacts are a significant factor determining the GHG performance of bioenergy. Identifying ILUC impacts is complex and is an area currently subject to significant research.

Unsustainable Forestry Practices
Bioenergy production can result in conversion of biodiverse areas, including deforestation through land conversion for new plantations. Bioenergy production can also drive forest degradation through the intensification of forest management or unsustainable forestry practices to produce wood pellets or wood chips.

Water Use
Unsustainable water use in irrigated systems can over-withdraw from aquifers, impacting farm economics and the livelihoods of surrounding communities. Rain fed crops can also impact aquifer recharge and downstream water availability.

Soil Health, Compaction, & Erosion
Based on soil type and practices, soil erosion, compaction, salinity, pH, organic matter, soil structure, and nutrient balance can each become critical and difficult to reverse issues. Soil health can be negatively impacted through unsustainable application of agrochemicals, pre- and post- harvest burning, and heavy equipment use. Salinization and water logging can occur from poor irrigation. Compaction reduces water infiltration and can lead to run-off of nutrients in flood events.

Poor Working Conditions
There can be poor living and working conditions for employees, including violations of International Labour Organization (ILO) core labor principles, lack of fair wages, gender discrimination, and limited access to health care and education.

Community Displacement
Land acquisitions in regions with unclear or unenforced property rights can result in displacement and loss of ecosystem services for local communities and indigenous peoples.

NOTE: Because bioenergy production systems vary greatly across regions and even within countries, their impacts also vary in terms of severity and scope. The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional and local perspective is required to properly manage risks and mitigate associated impacts.

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion · Climate Change & Air Quality · Soil Erosion / Degradation · Water Use · Pesticides & Toxicity · Nutrient Loading & Eutrophication · Disease & Animal Care · Labor · Local & Indigenous Communities · Society & Consumers

Priority Areas Protection
The area of land to be utilized does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. The land area is not being converted from native ecosystems, such as forests to a plantation or other land use.

Food Security
If the bioenergy crop is being grown in food insecure areas, appropriate mitigation measures have been taken to ensure net increases in local food access.

Life Cycle GHG
The bioenergy crop has a significant life cycle greenhouse gas reduction benefit (50% reduction recommended), including impacts from direct and indirect land use change, when compared to fossil alternatives.

Greenhouse Gas Emissions
Efforts are made on the farm to reduce fossil fuel emissions and increase carbon sequestration. Techniques can include soil carbon management, restoration of native vegetation, and eliminating in-field burning practices.

Indirect Land Use
Possible unintended consequences of indirect land use change have been assessed and show that the crop generates low indirect land use change risks (e.g., produced from agricultural waste/byproducts, produced on degraded lands, or production is integrated with food production).

Chemical Use
Agrochemicals are properly used on site, judiciously and in a targeted fashion using available expertise. There is no use of hazardous agrochemicals listed as Classification I or II in the World Health Organization's Recommended Classification of Pesticides by Hazard. Agrochemicals are 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 run-off and spraying are assessed and managed.

Pest Management
An Integrated Pest Management (IPM) plan is developed and implemented, ideally incorporating biological controls. An Integrated Weed Management plan is developed and implemented, ideally including cultural and biological controls, appropriate rates of pre- and post-emergent applications, and appropriate altering of active ingredients.

Nutrient Management
A Nutrient Management Plan focused on optimal uptake and minimal loss of nutrients has been developed and is implemented. The plan can include: soil and foliage testing (regularly and especially prior to fertilizer applications), use of variable rate technologies for fertilizer application, crop rotation, and use of cover crops and filter strips.

Soil Management
A Soil Management Plan is developed and implemented with a focus on soil productivity, including retention of soil biomass levels, soil structure, salinity, pH, and carbon sequestration. The plan can outline crop and geographically appropriate practices such as no-till, only planting on suitable slopes, use of cover crops, crop rotation, tree hedges, and contour planting, etc. The plan should also include adequate protection of riparian areas.

Water Management
A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration crop needs, soil water holding capacity, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Legal Production
The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Labor Rights
Management is aware of and complies with local labor legislation and the ILO core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Operational Health & Safety
Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities
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 FPIC (Free, Prior, and Informed Consent); 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.

TRENDS AND OPPORTUNITIES

Current trends in bioenergy include research and development into second- and third-generation biofuels, which break down tougher components of non-edible crops or crop by-products, theoretically competing less with the food supply and operating more cost-competitively (see Tools and Resources). There is increasing private investment into these processing technologies, some of which include cellulosic energy products, algal digestion systems, and the genetic selection of both microorganisms and feedstock. Additional research efforts will have to focus on identifying bioenergy supply chains that can produce greater yields with less land, water, and fertilizers. Efficiency of feedstock use is equally important. Integrating bioenergy production with biomaterial, heat, and/or electricity production under the umbrella of the biorefinery model (e.g., power co-generation at agricultural processing centers using by-products from sugar, palm oil, and other crops) can lead to more efficient use of limited resources.

Extensive government biofuel mandates are a major driver for growth in the global bioenergy market. Government targets alone would require more than 60 billion gallons of global biofuels production capacity by 2022, most of which does not yet exist.[193] Such expansion risks publicly untenable food displacement and other environmental and social impacts. In response, government mandates are increasingly requiring that bioenergy be procured through credibly certified supply chains, as in the case of the EU's RED (Renewable Energy Directive).[194]

The overall trend toward standardization and certification in the bioenergy sector may represent a significant step toward reducing unwanted environmental and social impacts and achieving greater efficiency in the bioenergy industry. Sustainable and traceable supply chains should be combined with the opportunity provided by planting on degraded, or "idle," lands. Key growing regions have significant lands available from historic crop production or other uses, which can satisfy bioenergy demands without compromising food production. Well-managed production sites can also increase soil health and resulting rates of carbon sequestration.

TOOLS AND RESOURCES

For additional data, information, tools, and resources on bioenergy industries, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

CHAPTER 11: OTHER TERRESTRIAL COMMODITIES

The following chapter provides a summary framework for terrestrial food and agriculture industries beyond those discussed in the prior chapters. As global population and consumption expand, increasing prices and land development will pressure many environments and communities. Some risks are acute, such as water or chemical usage, and can impact key ecosystems, while other impacts are dispersed and aggregate, such as greenhouse gas emissions.

Freshly irrigated corn field

OTHER TERRESTRIAL COMMODITIES

The soft commodities addressed above represent many of the world's highest impact sectors in terms of critical ecosystems for biodiversity, carbon storage, and watershed management. However, the analysis is not comprehensive. Some additional commodities trade in smaller volumes, yet they can impart acute risks in key regions. For other commodities, production may be significant, but it is dominated by countries with stricter environmental regulations and/or which contain fewer High Conservation Value areas. Examples of other terrestrial commodities of importance range from cashews to rice to corn. Issues, impacts, and mitigation approaches vary by species and region. Nonetheless, the following framework provides a generic summary guide for use as a starting point in evaluating environmental and social risk mitigation for other terrestrial agricultural supply chains.

TRENDS AND OPPORTUNITIES

Trends and opportunities in sustainable terrestrial commodity supply chains vary considerably based on sector, geography, and practices. Cross-cutting trends include the adoption of credible certifications, vertical integration and coordination in the supply chain, transparency, precision application of inputs, conservation tillage, IPM, biological controls, crop rotation and other natural soil and pest management approaches, power co-generation from agricultural by-products, water management, and increasing management of biodiversity and water at a landscape and regional level.

Specific cross-cutting investment opportunities may include:

- Capital expenditure needs for: improved equipment; irrigation; higher-efficiency processing; safety equipment; storage and infrastructure; and methane capture, composting, and power co-generation facilities
- Carbon, water, and biodiversity credit-generating projects via sequestration, reduction, and set-asides
- Increased working capital needs to manage rising commodity and input prices
- Financing of certification costs to access new markets, defend existing markets, and improve company performance
- Supply chain finance for smallholders and SMEs (small and medium enterprises)
- Input financing, including, in addition to traditional inputs, improved genetics and water rights
- Local and regional infrastructure, logistics, R&D, and extension services

TOOLS AND RESOURCES

For additional data, information, tools, and resources on other terrestrial commodities, including cross-sector resources on sustainable agriculture, visit *The 2050 Criteria* Companion Website at www.panda.org/2050criteria.

OTHER TERRESTRIAL COMMODITIES

KEY PERFORMANCE CRITERIA

CATEGORIES OF IMPACT

Biodiversity Loss & Conversion | Climate Change & Air Quality | Soil Erosion / Degradation | Water Use | Pesticides & Toxicity | Nutrient Loading & Eutrophication | Disease & Animal Care | Labor | Local & Indigenous Communities | Society & Consumers

Priority Areas Protection

The area of land to be utilized does not contain, and is not suspected of containing, primary forest or High Conservation Value (HCV) areas. The land area is not being converted from primary forest to a plantation or other land use.

Legal Production

The product is produced/harvested and traded in compliance with all applicable local, national, and ratified international laws and regulations. The producer holds legal rights to conduct activities on the area of land.

Chemical Use

Agrochemicals are properly used on site, judiciously and in a targeted fashion using available expertise. There is no use of hazardous agrochemicals listed as Classification I or II in the World Health Organization's Recommended Classification of Pesticides by Hazard. Agrochemicals are 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 run-off and spraying are assessed and managed.

Pest Management

An Integrated Pest Management (IPM) plan is developed and implemented, ideally incorporating biological controls. An Integrated Weed Management plan is developed and implemented, ideally including cultural and biological controls, appropriate rates of pre-emergent and post-emergent applications, and appropriate altering of active ingredients.

Nutrient Management

A Nutrient Management Plan focused on optimal uptake and minimal loss of nutrients has been developed and is implemented. The plan can include: soil and foliage testing (regularly and especially prior to fertilizer applications), use of variable rate technologies for fertilizer application, application based on up-take, application informed by weather conditions, crop rotation, and use of cover crops and filter strips. Appropriate, science-based riparian zones are established and maintained to prevent fertilizer run-off into freshwater and marine habitats.

Soil Management

A Soil Management Plan is developed and implemented with a focus on soil productivity, including retention of soil biomass levels, soil structure, salinity, pH, and carbon sequestration. The plan can outline crop and geographically appropriate practices such as no-till, only planting on suitable slopes, use of cover crops, crop rotation, tree hedges, contour planting, etc. The plan should also include adequate protection of riparian areas.

Water Management

A complete assessment of water resource requirements and discharge impacts should be conducted, taking into consideration crop needs, soil water holding capacity, hydrological conditions, downstream human and environmental needs and uses, and impacts that the water use and discharge will have on the watershed, community health, and regional ecology. This is especially important in water stressed areas. A Water Management Plan is in place that addresses relevant risks and includes concrete measures to protect ground water or local water bodies.

Greenhouse Gas Emissions

Efforts are made to reduce fossil fuel emissions on farm and increase GHG sequestration. Techniques can include soil carbon management, restoration of native vegetation, and eliminating in-field burning practices.

Labor Rights

Management is aware of and complies with local labor legislation and the International Labour Organization (ILO) core labor standards. Management actively manages its labor issues (e.g., child labor, forced or bonded labor, freedom of association, discrimination and gender equity, living wage, use of contractors to avoid social benefits, health and safety, etc.) and actively monitors compliance in its operations.

Operational Health & Safety

Applicable Operational Health & Safety (OHS) protocols are followed, which can include: adequate training, accident reduction programs, formal documentation and grievance procedures, and if applicable personal protective equipment provision and hazardous substance monitoring and testing.

Local & Indigenous Communities

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 FPIC (Free, Prior, and Informed Consent); 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.

NOTE: The key environmental and social risks presented above represent a summary view from a global perspective and acknowledge that a regional, local, and species-specific perspective is required to properly manage risks and mitigate associated impacts.

CONCLUSION: MAINTAINING A LIVING PLANET

Across the planet, people are using natural resources faster than they can be renewed. This has devastating consequences for biodiversity in WWF's priority places, the people and species that depend on these ecosystems, and the wider economy. Forecasts suggest that, by 2050, human population will exceed 9 billion, income will almost triple, and per capita consumption (on average) will double, particularly in developing countries. Working together, we can shift global commodity production to feed, house, clothe, and transport a world of 9 billion people in a way that preserves our resources for future generations.

Farmer, picking corn on the steep slopes of her farm, Upper Catchment, Lake Naivasha, Kenya

CONCLUSION

The 21st century has presented humanity with the ominous reality that, by 2050, we may face widespread insufficiencies of food, fiber, and bioenergy to meet our needs. Population increases, changing purchasing power and dietary preferences in emerging economies, expanding biofuels markets, climate change, and other factors are creating profound shifts in global food production and demand. These forces are compounding pressures for products that are already often produced inefficiently, unsustainably, and with significant externality costs. If we continue to extract and produce soft commodities in the current modes, our access to these resources will inevitably falter —with attendant social and economic consequences.

The commodities presented in *The 2050 Criteria*—aquaculture; beef; cotton; dairy; palm oil; soy; sugar; timber, pulp, and paper; and wild-caught seafood; as well as bioenergy and other terrestrial commodities—play key roles in meeting humanity's growing demands while simultaneously generating some of the largest and most irreversible impacts on communities and key ecosystems around the world, including biodiversity loss, watershed disruption, climate change, and social conflict. We must rapidly improve performance, as the accelerating demand for these 10 soft commodities will not subside. A critical success factor for achieving sustainability on Earth involves aligning financiers, producers, and buyers around credible certification and performance criteria for major agricultural, forest, and seafood commodities, and rapidly ratcheting that performance toward sustainability. The financial sector, despite its key role, currently lags behind industry in this respect. Financial institutions must begin taking appropriate measures to act responsibly and credibly in this space and to align with industry and civil society.

Toward this end, *The 2050 Criteria* seeks to provide distilled guidance that represents the frontline combination of environmental science, mainstream industry trends, and financial realism. For a given commodity, each chapter provides: an overview of the basic market structures and dynamics; primary environmental and social risks; leading third-party certifications; current trends and investment opportunities; and Key Performance Criteria for mitigating environmental and social risks. A companion website provides additional tools and resources for each sector. Taken individually, we hope that these criteria can help create much-needed alignment by outlining credible, responsible practices that have been tested and are already in use by many industry leaders. Taken as a whole, *The 2050 Criteria* document provides a tool and an entry point for financial players to access mainstream agricultural, forest, and seafood commodities in a responsible manner.

Financial institutions facilitate the entire value chain of conversion from natural resources into food, fuel, and fiber. They play a unique role in helping to establish the rules of the game and making daily operations possible. The adoption of *The 2050 Criteria* by financiers will: help ensure that reputational risks are managed; contribute to improved investment performance; align financing criteria with the environmental and social criteria increasingly demanded within international value chains, reducing transaction costs and simplifying financing decision-making; and shape fundamental practices on the ground in these essential, high-impact sectors. If finance, industry, and civil society can increasingly—and in a determined manner—work together around science-based realities and shared interests, we can move mankind's essential agricultural, forest, and seafood markets toward sustainable production. We can ensure that Earth meets humanity's current demand without compromising the prospects for human development and functioning markets in the coming decades.

Key Action Points for Financiers

- Apply the Key Performance Criteria of *The 2050 Criteria*, and ideally credible standards to ensure full compliance, as a **due diligence tool to identify responsible practice in upstream players and projects**. For investees who are not yet fully compliant, financing is often a key hurtle. Engage through strict and transparent loan conditions or shareholder resolutions requiring the company to meet targets on a time-bound plan.
- **Monitor and evaluate performance**, ensuring that company practices are transparent and verified through an accredited third party specialist.
- Downstream entities can face reputational, supply, and in some cases legal risks due to unsustainable sourcing. Apply credible standards or the Key Performance Criteria of *The 2050 Criteria* to the **evaluation of the supply chain management/procurement policies of downstream players–processors, traders, and brands**.
- For investors who rely on **financial intermediaries**, request that asset managers use the Key Performance Criteria of *The 2050 Criteria*, and ideally credible standards to ensure compliance, in lending and investing policies for investments in soft commodity value chains. Inquire upon environmental and social risk management policies in asset manager questionnaires, and request that performance be included in annual reporting.
- **Develop clear sector policies** for your institution, including adoption of the Key Performance Criteria of *The 2050 Criteria*, and ideally credible standards to ensure full compliance, as lending/investing thresholds and as time-bound performance targets for clients or financial intermediaries. An effective sector policy:
  - Is strong in scope and strength
  - Describes how the policy will be implemented
  - Holds senior-level endorsement
  - Deploys staff who are trained and accountable for delivery
  - Specifies targets that allow for credible monitoring and reporting
  - Is publicly disclosed to stakeholders
  - Contains a commitment to regular review and updating

ANNEXURE A: INTERNATIONAL LABOUR ORGANIZATION AND THE DECLARATION ON FUNDAMENTAL PRINCIPLES AND RIGHTS AT WORK

The International Labour Organization (ILO) is a special UN body based in Geneva, Switzerland, and founded in 1919. The ILO has ratified 189 conventions as of July 2011.

In 1998, the International Labour Conference established the *Declaration on Fundamental Principles and Rights at Work*.[195] These four principles are seen as fundamental and apply to all societies, businesses, and actors, regardless of level of economic development. The four principles are as follows:

- Freedom of association and the effective recognition of the right to collective bargaining[196]
- Elimination of all forms of forced or compulsory labor[197]
- Effective abolition of child labor[198]
- Elimination of discrimination with respect to employment and occupation[199]

The ILO has 185 member states.[200] Yet the ILO conventions are not designed to be followed solely by nations. Companies and industry associations frequently voluntarily commit to the four "Fundamental Principles" and beyond.

The World Wildlife Fund uses the ILO "Fundamental Principles" as its baseline for establishing responsible labor practices and also refers to these as "ILO core labor standards." The ETI (Ethical Trading Initiative) Base Code also serves as a good reference, drawing from ILO labor standards to highlight top-priority labor criteria in supply chains.[201] WWF encourages firms to go beyond the four principles, adopting industry-specific and cross-industry conventions as relevant, such as ILO conventions on agriculture, maritime labor, and migrant workers. An easily navigable list of ILO conventions is located at http://www.ilo.org/dyn/normlex/en/f?p=1000:1:0::NO:::.

ANNEXURE B: INTEGRATED PEST MANAGEMENT

According to the US Environmental Protection Agency, Integrated Pest Management (IPM) is defined as:

> *An effective and environmentally sensitive approach to pest management that relies on a combination of commonsense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means and with the least possible hazard to people, property, and the environment.*[202]

IPM applies not only to agriculture sectors, but also to homes, gardens, and other industries. IPM evolved in parallel and in response to calendar-based and prophylactic applications of pesticides on commercial farms. IPM recognizes that these approaches to pest management not only pose health and safety hazards, but can also prompt harmful adaptations and mutations among pests, and can harm other species important for the proper functioning of the farm and surrounding ecosystems.

Integrated Pest Management became part of national policy in 1972 when President Richard Nixon ordered federal agencies to study and advance the concept in all relevant spheres. In 1979, President Jimmy Carter established the interagency IPM Coordinating Committee.[203]

Six major principles can be said to define American IPM:[204]

1. **Setting Action Thresholds**: The emphasis for IPM is pest control rather than eradication. Thresholds should be defined for pest populations up to which their presence is acceptable and will maintain healthy pest predator populations. Beyond this threshold, the costs of pest populations become an economic threat and warrant a response.
2. **Preventative Cultural Practices**: Proper selection and placement of crops due to local conditions, as well as quarantining of sick plants.
3. **Monitoring and Identifying Pests**
4. **Mechanical Controls**: Physically removing pests, erecting barriers, setting traps, tillage, and other commonsense methodologies should be the first line of action.
5. **Biological Controls**: Use of beneficial insects (e.g., ladybugs for aphid control) and beneficial insecticides (derived from naturally occurring microorganisms) is often low cost and low impact.
6. **Judicious Pesticide Use**: Synthetic pesticides should be used only as required and at specific times in the calendar life cycle of the pest.

IPM is not the same as Organic, which prohibits use of synthetic pesticides altogether, although there are many overlapping practices. IPM is also not a rigid and defined set of practices. There is a continuum of farming practices that range from adoption of certain IPM techniques in certain conditions to full implementation with robust evaluation and feedback systems. The Environmental Protection Agency recommends a constant movement along that continuum toward stronger implementation on all farms.

ANNEXURE C: AREA CONVERSION AND HIGH CONSERVATION VALUES (HCV)

Area Conversion refers to the transformation of landscapes in order to serve economic activities. Living ecosystems often do not have markets for many of the critical benefits they provide to humans, or they face a "tragedy of the commons," and thus the incentive is often for rapid conversion rather than ensuring maximum value over time. In certain ecosystems and/or when executed improperly, this conversion can have devastating and irreversible impacts on biodiversity and ecosystem services for surrounding communities.

For example, during the last 20 years of the 20th century, nearly one-fifth, or 300 million hectares, of tropical forests were converted to non-forest land uses worldwide. Tropical forests are home to an estimated 50 percent of the world's biodiversity, 1.6 billion people worldwide, and 60 million indigenous peoples. Tropical forest destruction can impose particularly severe environmental and social costs, including loss of biodiversity, water shortages, uncontrolled fires into surrounding areas, and displacement and disregard for the rights of local or indigenous communities.[205] Forest conversion also contributes to climate change due to the burning or decay of biomass from the converted vegetation and emissions resulting from soil disturbance and drying. Deforestation is the third-largest source of greenhouse gas (GHG) emissions globally.

In marine systems, area conversion is similarly impactful. The destruction or damage of the ocean bottom, reef systems, or mangroves not only destroys critical breeding grounds for commercial fisheries, but also imparts serious and potentially irreversible consequences for biodiversity and local livelihoods.

Due to the combination of irreversibility and simultaneous legion impacts on biodiversity, livelihoods, water, climate change, and other factors, area conversion is often the KPC of utmost importance for commodity sectors where such practices occur.

One important practice for which WWF advocates in certifications is the identification of High Conservation Value (HCV) areas. HCVs refer to landscapes with environmental and/or social values of outstanding significance or critical importance. These values matter for both people and nature, and were developed and are agreed upon by a wide range of stakeholders, including significant economic actors. The HCV concept serves as a generic, globally applicable standard for identifying and safeguarding these values in responsible land use and management. Identification of HCV is a practice in landscape planning that should be embedded into ESIAs in any new project or plantation. The definitions, research, and implementation around HCV are housed in the HCV Resource Network (http://www.hcvnetwork.org/).

HCV areas contain one or more of these six High Conservation Value elements:

- HCV1. Areas containing globally, regionally, or nationally significant concentrations of biodiversity values (e.g., endemism, endangered species, refugia).
- HCV2. Globally, regionally, or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.
- HCV3. Areas that are in or contain rare, threatened, or endangered ecosystems.
- HCV4. Areas that provide basic ecosystem services in critical situations (e.g., watershed protection, erosion control).
- HCV5. Areas fundamental to meeting basic needs of local communities (e.g., subsistence, health).
- HCV6. Areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic, or religious significance identified in cooperation with such local communities).

HCV assessments are typically conducted with the use of GIS and satellite mapping as well as stakeholder consultations. The resulting HCV assessment report identifies High Conservation Value areas and makes recommendations to management regarding how to ensure their maintenance and enhancement. Recommendations might include reforestation of buffer areas, or clear designation and signage for forests functioning as biological corridors. A monitoring plan is also developed to help the company manage their progress and plan for continuous improvements.

ANNEXURE D: FRESHWATER USE AND INVESTORS

Freshwater access is increasingly perceived as a material risk for soft commodity producers, processors, and their investors. Freshwater supplies are also essential for the viability of the overall economy, nature and society.

- 2.8 billion people (40% of the world's population) live in areas of severe water stress[206]
- 780 million people lack access to safe drinking water[207]
- 2.6 billion people lack adequate sanitation services[208]
- Of all species, freshwater species are declining the fastest, particularly in the tropics (70% decline in the Living Planet Index since 1970)[209]
- In developing countries, 70% of industrial wastes are dumped untreated into waters where they pollute the usable water supply.[210]
- Agriculture accounts for 92%—the largest contributor by far—to the global water footprint[211]

Three megatrends are accelerating humanity's water challenges:

1. The majority of the over three billion additional people who will join the population by 2050 will reside in the developing world, often in places where water resources are already stressed, and increasingly in cities that are poorly served by water and sanitation service infrastructure. Increased water scarcity leads to increased potential for conflicts. It is estimated that by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions.[212]
2. Global average temperatures are expected to increase 1-2 degrees Celsius by 2050.[213] Climate change results in higher weather variability, less freshwater stored in ice, more droughts and floods, and changes in the ecosystem due to higher water temperatures.
3. Income and consumption is rising, particularly in BRIIC economies. To feed the larger and richer population, a near doubling of freshwater supplies for irrigation is required.[214]

Insufficient water can disrupt or arrest business operations through physical unavailability, regulatory restrictions, or stakeholder conflict. These risks are interlinked: as water becomes scarce, the public becomes more apprehensive of private sector use, and the regulatory environment grows tighter. This concern is heightened in water stressed regions where communities do not have access to sufficient amounts of water to fulfill basic needs and expectations.

Water Risks[215]

Physical risk
Relates to water quantity (scarcity and flooding) and water quality that is unfit for use (pollution). Physical risk may mean that a company might not have sufficient amounts of good quality water for their business operations and supply chains.

Regulatory risk
Relates to the imposition of restrictions on water use by government. This may include the pricing of water supply and waste discharge, licenses to operate, water rights, quality standards etc.

Reputational risk
Relates to the impact on a company's brand and can influence customer purchasing decisions. Reputational risk manifests itself through tensions and conflict around access to water or the degradation of local water resources. In a highly globalised information economy, public perceptions can emerge rapidly around business decisions that are seen to impact on aquatic ecosystems or local communities' access to clean water.

Investors' awareness of water-related risk is increasing. This has manifested, for example, in demand for listed companies in water-intensive sectors to disclose more information on basin risks, operational risks, and responses. One such platform is Carbon Disclosure Project, whose membership includes over 190 companies. Continued poor management and under-valuation for water resources will likely result in the increasing relevance of these investor and corporate initiatives.

Water scarcity can also foster opportunities. Technologies such as drip irrigation emerged in some of the world's most water-stressed regions in the world. Accordingly, water-scarce locations are not necessarily deserving of divestment. Rather, a nuanced understanding of how a business is responding to stress, sometimes referred to as a "water stewardship response", is critical in determining investment risk and value vis a vis freshwater.

Acronyms Used

ASC	Aquaculture Stewardship Council
ATTRA	Appropriate Technology Transfer for Rural Areas
BCI	Better Cotton Initiative
BEI	Banking Environment Initiative
BMSY	Biomass and Maximum Sustainable Yield
BRIIC	Brazil, Russia, India, Indonesia, China
CH4	Methane
CO2	Carbon Dioxide
CSPO	Certified Sustainable Palm Oil
DNA	Deoxyribonucleic Acid
EPFI	Equator Principles Financial Institutions
ESMS	Environmental and Social Management System
EU RED	European Union Renewable Energy Directive
FAO	Food and Agriculture Organization of the United Nations
FPIC	Free, Prior, and Informed Consent
FSC	Forest Stewardship Council
GFTN	Global Forest & Trade Network
GHA	Global Hectare
GHG	Greenhouse Gas
GRSB	Global Roundtable for Sustainable Beef
HACCP	Hazard Analysis and Critical Control Points
HCV	High Conservation Value
IBAT	Integrated Biodiversity Assessment Tool
IDF	International Dairy Federation
IDH	Dutch Sustainable Trade Initiative
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
IISD	International Institute for Sustainable Development
ILO	International Labour Organization
ILUC	Indirect Land-Use Change
IPM	Integrated Pest Management
ISEAL	International Social and Environmental Accreditation and Labeling
IUU	Illegal, Unregulated, or Unreported
KPC	Key Performance Criteria
LCA	Life Cycle Assessment
LULUCF	Land Use, Land Use Change, and Forestry
MLA	Meat and Livestock Australia

Acronyms Used

MPA	Marine Protected Areas
MSC	Marine Stewardship Council
N2O	Nitrous Oxide
NGO	Nongovernmental Organization
NGPP	New Generation Plantation Project
NRCS	Natural Resources Conservation Service
OHS	Operational Health and Safety
POME	Palm Oil Mill Effluent
RSB	Roundtable on Sustainable Biofuels
RSPO	Roundtable on Sustainable Palm Oil
RTRS	Roundtable on Responsible Soy
SAI	Sustainable Agriculture Initiative
SAN	Sustainable Agriculture Network
SARE	Sustainable Agriculture Research and Education
SME	Small and Medium Enterprises
TFT	Tropical Forest Trust
TREES	Training, Extension, Enterprises, and Sourcing
UK	United Kingdom
UNEP FI	United Nations Environment Programme Finance Initiative
UNPRI	United Nations-backed Principles for Responsible Investment
USDA	United States Department of Agriculture
WHO	World Health Organization
WWF	World Wildlife Fund

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