TEEBAgriFood Foundations Report
Full set of figures

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The SDG ‘wedding cake’

Figure 1.1
Source: EAT 2016
**TEEB timeline and connected global events**

- **2008**: March 2007 decision on study on the economic significance of nature and biodiversity by G8+5 Environment Ministers
- **2009**: Climate Issues update for UN Climate Change Conference in Copenhagen
- **2011**: TEEB Synthesis Report released at UN Biodiversity conference in Nagoya
- **2012**: Rio+20 Conference on Sustainable Development delivers "The Future We Want" — outcome document includes references to sustainable agriculture and including the need to maintain natural ecological processes that support food production systems
- **2013**: 7th Trondheim Biodiversity Conference on Ecology and Economy for a Sustainable Society
- **2014**: UN General Assembly’s Open Working Group proposal on Sustainable Development Goals forwarded to the Assembly
- **2015**: CBD COP-13 (Cancun) Theme: mainstreaming the conservation and sustainable use of biodiversity for well-being, Focus: agriculture, forestry, fisheries & tourism
- **2016**: 8th Trondheim Biodiversity Conference on Food systems for a sustainable future

**Selected meetings and events that have reflected and driven international interest in systems thinking and focus on the agrifood sector from a biodiversity perspective**

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**Source:** authors
The food and beverage value chain

Figure 1.3
Source: adapted from Trucost 2016
Capital stocks and value flows in eco-agri-food systems

Figure 1.4
Source: authors
Mapping evidence of policy impact

Figure 2.1
Source: authors
The safe and just space for humanity

Figure 2.2
Source: adapted from Raworth 2012
Photo showing industrial monoculture alongside smallholder agriculture in Tanzania

Figure 2.3
Source: Bourne 2009
Food systems map that shows how multiple subsystems interact

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Source: adapted from the Nourish initiative n.d.
Modified high-level ‘systems’ diagram of an archetypal eco-agri-food system

Figure 2.5
Source: adapted from Figure 1.4
Illustrative Causal Loop Diagram of a generic eco-agri-food system

Figure 2.6
Source: authors
Production of key food groups by farm size

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Source: adapted from Herrero et al. 2017
World fish production, 1950-2016

Figure 3.2
Source: adapted from HLPE 2014
Relationship between participation in agricultural sector and GDP per capita, 2015

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Source: adapted from Roser 2018
The status of the nine planetary boundaries overlaid with an estimate of agriculture’s role in that status
Trade in biomass by main sub-category, 1980-2010

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Source: adapted from Dittrich 2012
Biomass-based commodity trade between countries

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Source: adapted from Dittrich 2012
Regions of greatest nitrogen use in the world

Source: adapted from Townsend and Howarth 2010
Generalized representation of Nitrogen transfers through the world agro-food system, 1961 and 2009

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Nutrients exported in soybean products from Argentina, 2007-2017

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Economic growth and prevalence of undernourishment, 1992, 2000 and 2010

Figure 3.12

Source: adapted from FAO 2015a
Mapping of value generation in smallholder Asian rice production systems to the Sustainable Development Goals

Figure 3.13
Source: authors
Image source: Wikimedia
Per capita consumption of meat in selected countries or regions

Figure 3.14
Source: adapted from Wirsenius et al. 2010
Effect of diets on GHG emissions and cropland

Figure 3.15

Source: adapted from Tilman and Clark 2014
Sustainable local food system in Chicago

Figure 3.16
Source: adapted from CMAP n.d.
Global urban population growth is propelled by the growth of cities of all sizes

![Bar chart showing population growth in cities of different sizes from 1990 to 2030.]

Source: adapted from UNDESA 2015
Development of meat supply over time

Figure 4.2
Source: adapted from Stoll-Kleemann and O’Riordan 2015
Understanding health impacts in a food systems context

Figure 4.3
Source: adapted from IPES-Food 2017
Annual costs resulting from endocrine-disrupting chemical (EDC) exposure

- **EU**: $217 BILLION (1.28% of GDP)
- **USA**: $340 BILLION (2.33% of GDP)
- **USA**: $42 BILLION (Pesticides alone)

Source: adapted from Attina *et al.* 2016; Trasande *et al.* 2016
Time changes in the dietary share of ultra-processed products in the average household food basket in Canada and Brazil

Figure 4.5

Source: adapted from Monteiro et al. 2013
Global prevalence of anaemia in children of preschool age 0-5 years

Figure 4.6

Source: adapted from Monteiro et al. 2013
Estimated country-specific prevalence of inadequate zinc intake

Figure 4.7
Source: adapted from Wessels and Brown 2012
Main types of food losses and wastage

- Field losses (e.g. pests, diseases, rodents)
- Pre-Processing (e.g. inefficient harvesting, drying, milling)
- Transport (e.g. spillage, leakage)
- Storage (e.g. technical deficiencies)
- Processing & Packaging (e.g. excessive peeling, washing)
- Marketing (e.g. spoilage, rotting in stores)
- Wastage by Consumer (e.g. overeating, food wastage)

High Income Countries
- Moderate at first stages of food chain depending on type of food

Low Income Countries
- Relatively high at first stages of food chain especially for perishable food items
- Losses and wastage relatively low in latter part of food chain; food not consumed in households and other consumption units is often used for feed and/or distributed in society

Source: adapted from Lundqvist 2008
Fresh fruit and vegetable market share of modern and traditional market retail sales

Source: adapted from Gomez and Ricketts 2013
Structure of food marketing system, East and Southern Africa, 2010

![Diagram showing the structure of the food marketing system in East and Southern Africa. The diagram illustrates the breakdown of Domestic/Regional Production not Exported (82%) and Imports (18%). The components include Agricultural Production, Manufacturing and Processing, Distribution, Marketing and Retail, and Household Consumption. The diagram details the consumption of own production (40%), unprocessed (17%), informal (7%), formal low (30%), and formal high (6%). The sources of consumption are traditional sector (open air markets, kiosks, street vending, small shops) (51 - 57%) (85 - 95% of market demand) and modern sector (3-10%).][1]

Source: adapted from Tschirley et al. 2014
Projected structure of food marketing system, East and Southern Africa, 2040

Figure 4.11
Source: adapted from Tschirley et al. 2014
A food systems thinking lens

Figure 4.12
Source: adapted from IPES-Food 2017
The food system and related social equity, justice and ethics issues

Figure 5.1
Source: authors
Climate change is projected to reduce crop yields in regions where food demand is projected to increase most.
Trends in rural and urban extreme poverty by region

Figure 5.3
Source: adapted from IFAD 2016
Stunting prevalence by subnational region

Figure 5.4
Source: adapted from IFPRI 2016
Food Price Index

Figure 5.5
Source: FAO 2018a
Food Commodity Price Indices

Figure 5.6
Source: FAO 2018a
Cost of living in Asian cities

Figure 5.7
Source: Numbeo 2018
Basic Food Basket and minimum wage in a sample of countries in Latin America

Source: personal communication, FAO Regional Office for Latin America and the Caribbean, based on country data and ILOSTAT
Undernourishment and obesity rates vary significantly by region

Figure 5.9
Source: adapted from World Bank 2015
Rates of disease burden of diabetes, all ages

Figure 5.10
Source: adapted from IHME 2015
Rates of disease burden of cardiovascular disease (CVD), all ages

Source: adapted from IHME 2015
Food losses and waste at consumption and pre-consumption stages by region

Figure 5.12
Source: adapted from Gustavsson et al. 2011
Food losses and waste at consumption and pre-consumption stages by region

Figure 6.1
Source: authors
Palm oil value chain

Figure 6.2
Source: authors
**Elements of the TEEBAgriFood Evaluation Framework**

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<th>CONTRIBUTIONS TO HUMAN WELL-BEING</th>
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<td><strong>Social Capital</strong></td>
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<td>• Increased access to food</td>
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<td>• Increased employment opportunities</td>
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<td>• Land displacement</td>
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**AGRI-FOOD VALUE CHAIN**

- Agricultural production
- Manufacturing & Processing
- Distribution, Marketing & Retail
- Household consumption

**AGRICULTURAL AND FOOD OUTPUTS**

- Agricultural and food products, income (value added, operating surplus), and subsidies, taxes and interest

**ECOSYSTEM SERVICES**

- Provisioning (biomes, growth, freshwater), regulating (pollution, pest control, nutrient cycling), and cultural (landscape amenity)

**PURCHASED INPUTS**

- Labor inputs (incl. skills) and intermediate consumption (produced inputs such as water, energy, fertilizers, pesticides, animal health and veterinary inputs)

**RESIDUALS**

- Agricultural and food waste, GHG emissions, other emissions to air, soil and water, wastewater, and solid waste and other residuals

**NATURAL CAPITAL**

- Water, soil, air, vegetation, cover and habitat quality, biodiversity, etc.

**PRODUCED CAPITAL**

- Buildings, machinery and equipment, infrastructure, research and development, finance, etc.

**HUMAN CAPITAL**

- Education/skills, health, working conditions, etc.

**SOCIAL CAPITAL**

- Land access/tenure, food security, opportunities for empowerment, social cooperation, institutional strength, laws and regulations, etc.

*Source: authors*
Palm oil value chain revisited

Source: authors
Four types of capital

Figure 6.5
Source: adapted from Forum for the Future 2015
Applications of a universal evaluation framework

Figure 6.6
Source: authors
Steps in applying the TEEBAgriFood Evaluation Framework

1. Determine the purpose of evaluation
2. Determine the entry point and spatial scale
3. Determine the scope of the value chain
4. Determine stocks, flows, outcomes & impacts
5. Select evaluation technique
6. Collect data and undertake evaluation
7. Report and communicate findings

Figure 6.7
Source: authors
Drivers and constraints that affect farmers’ decisions

Figure 7.1
Source: adapted from Reganold 2011
The Boulder Sugar-Sweetened Beverage Tax is Here

Starting on July 1, 2017, a 2 cents-per-ounce tax was imposed on the distribution of drinks made with added sugar and other caloric sweeteners. Initiated by residents at the grassroots level, the Sugar Sweetened Beverage Product Distribution Tax was adopted by Boulder voters in November 2016.

Affected drinks include but are not limited to:
- Regular Sodas
- Sports Drinks
- Sweetened Waters
- Energy Drinks
- Presweetened Coffees and Teas

Where Will the Money Go?
- Health Promotion
- Physical Activity Programs
- Healthy Foods
- Wellness and Chronic Disease Prevention Programs that Improve Health Equity
- Nutrition and Food Education
- Other Health Programs Especially for Residents with Low Income

For more information, please visit BoulderSugarBevTax.com

Source: bouldercolorado.gov
Changes in expected revenues, costs and profits from adopting no-tillage

Figure 7.3
Source: adapted from Magnan et al. 2011
Life Cycle Assessment (LCA) boundaries

INPUTS: Energy, water and raw materials

Agricultural production → Manufacturing & Processing → Distribution, Marketing & Retail → Household consumption

OUTPUTS: Emissions to air, water & land

Figure 7.4
Source: adapted from Shonfield and Dumelin 2005
Causal Loop Diagram (CLD) of the study area, emphasizing the impacts of implementing the SAGCOT agriculture intensification plan

Figure 7.5
Source: authors
TEEBAgriFood Theory of Change functional domain

Figure 9.1
Source: authors
Eight key lock-ins of industrial agriculture

Figure 9.2
Source: authors
Time sequence of pesticide resistance in pest populations

Source: adapted from https://commons.wikimedia.org/w/index.php?curid=3965987
Transformational change through strengthening the connections in the value chain, indicating key pressure points (arrows)
Location of sugarcane processing units in Brazil (a) and agro-environmental zoning of sugarcane industry in São Paulo (b)

Source: SMA 2009; Walter et al. 2014
Agri-food actor group continuum

Figure 9.6
Source: authors
Schematic representation of the Inclusive Wealth Index and the Adjusted Wealth Index

Figure 10.1
Source: adapted from UNU-IHDP and UNEP 2014
SDG’s three-tiered structure and links to eco-agri-food systems

Figure 10.2
Source: authors, adapted from EAT 2016