TEEBAgriFood

Interim Results – Connecting the Dots

The Economics of Ecosystems & Biodiversity

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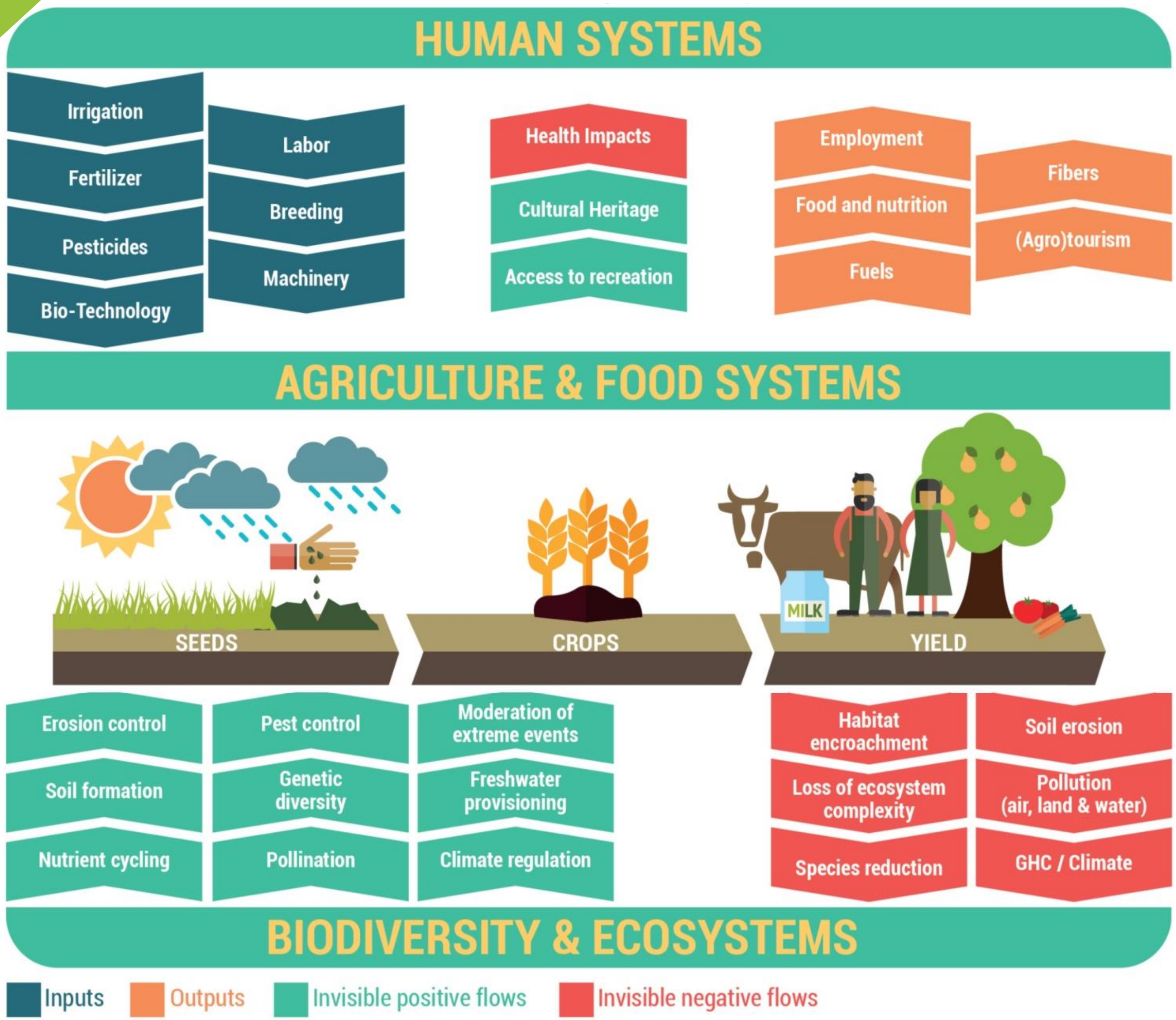
The visible and invisible flows of agricultural production



Production and Consumption of MAIZE

Maize feeder study - developed by CONABIO – connected with research on human health

1. Production: Global and Regional
2. Maize = Food?
3. Maize and Health
4. The Environment
5. Policies

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TEEBAgriFood – Production of Maize Global and Regional

Agricultural ecosystems have expanded worldwide and now cover half of the non-frozen land on Earth.

Maize has become one of the most important crops in agriculture, mostly because of its great environmental adaptability and high productivity.

Maize production has increased twice as much as its harvested area since the year 1990.

Area of maize grain cultivation increased by 41% between 1990 and 2013.
Production increased by 111% in this same period.

The average current maize yield is 5.5 tons/ha, expected to reach 6.5 ton/ha by the year 2025 and 8.6 ton/ha by 2050.
Yields per hectare increased from 1.5 to 2 ton/ha in Africa; and from 7.4 to 9.95 ton/ha in North America from 1990 to 2013

Three Types of Maize Production Systems

Maize production systems have a high heterogeneity of producers and overlapping of management practices. Three systems with two subsystems (differential dependency and impact on ecosystem services:

a. intensive (irrigated and rainfed),
Profit-oriented enterprises that rely on expert knowledge, hired workforce, full mechanization and high agricultural inputs

b. smallholders (shifting and stable), and
Predominantly rainfed, formed by a highly heterogeneous group of farmers with a wide variety of aims and management practices. Mainly subsistence or semi-subsistence farmers who depend on traditional ecological knowledge to manage ecosystem services underlying farm productivity

c. organic (small and large-scale)
Organic systems are small and large-scale production units, essentially market oriented following a wel defined set of rules.
Large and small-scale organic systems vary in their degree of mechanization and market integration

Small-Scale Maize Production

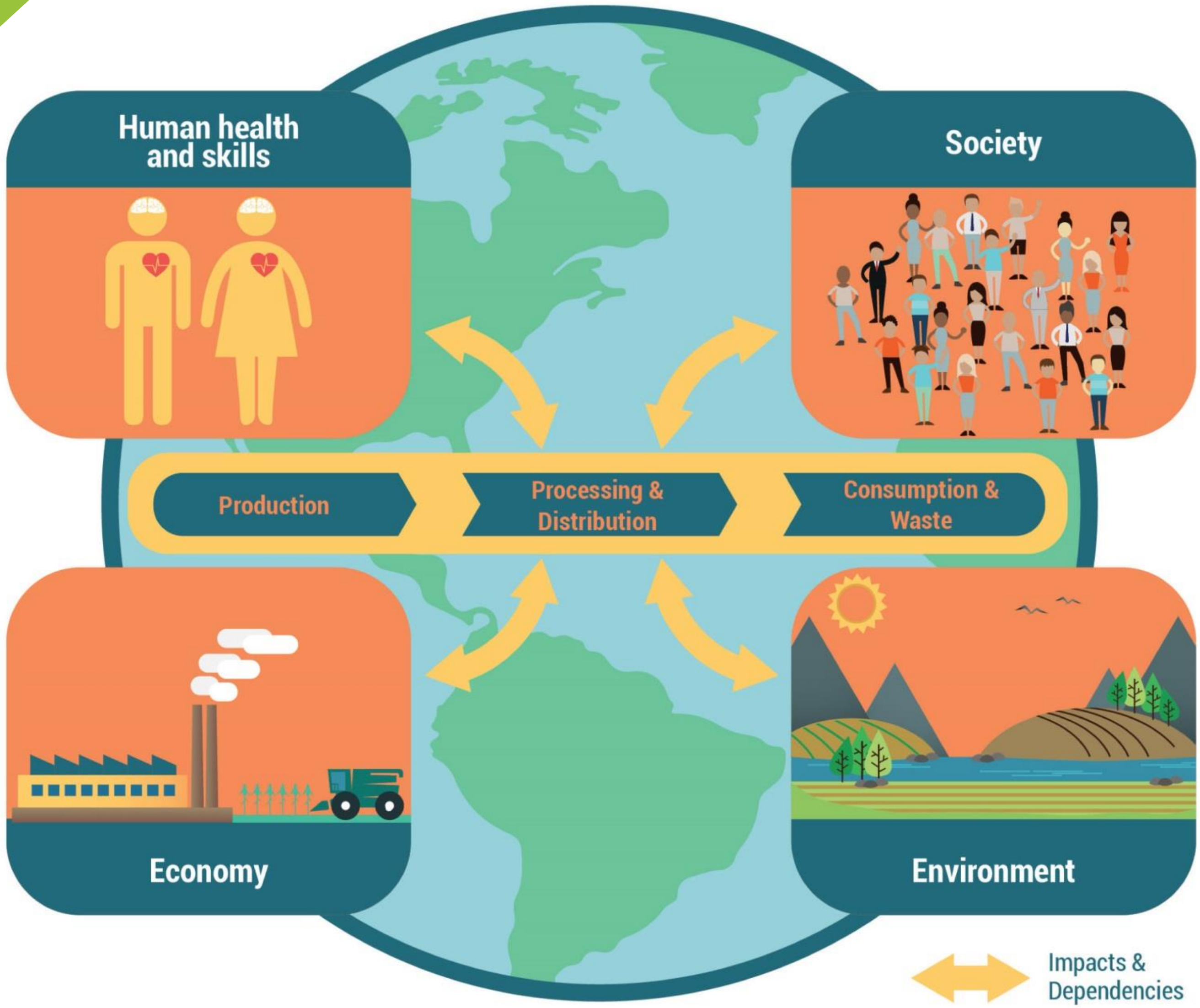
Agrobiodiversity that is managed in small-scale maize production systems has a strategic value for feeding both the societies that produce and those that consume this cereal.
Its evolving (on-farm) conservation represents an irreplaceable natural insurance. It offers farmers a wide array of adaptation options for unpredictable future conditions.

Paradoxically, agrobiodiversity stewards are the most vulnerable to biotic and abiotic stress, being the poorest and having the highest levels of food insecurity.
This paradox will persist as long as the local and global value of agrobiodiversity stewardship remains invisible to the markets and to society overall, and therefore is not duly compensated

Despite the global expansion of modern maize varieties, landraces are still grown in several regions of the world. This is partly due to economic drivers such as a lower market value of modern varieties and high technological transaction costs, but also to the close relationship between cultural and crop diversity, particularly in Latin America.

The same holds for certain spiritual ceremonies that include maize

Eco-agri-food systems complex – impacts and dependencies



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Eco-agri-food systems complex – impacts and dependencies

The vast majority of maize in the world is produced as raw material for the livestock, sweetener and oil industries, as well as for the production of ethanol and other non-edible products.

- **Globally 14% of Maize directly used as food** (US only 1 % as direct-food)
- Production of maize grain for animal feed is **55%**
- Maize produced for **industrial purposes** is **21% (**incl. ethanol, sweetener and oil industries,...)
- Seeds, waste and other uses
- Maize's supply chain is heterogeneous and defined by its ultimate use

Historically maize has had multiple uses, some of them closely linked to the cultural development of both the producers and the consumers of this cereal, for thousands of years and up to the beginning of the 20th century its was mainly used for food.

The Use of Maize

Direct food-maize is geographically restricted in terms of its consumption, production and commerce, in contrast with maize that has industrial purposes.

With exceptions (Mexico and Central America) production and consumption of **direct food-maize** is concentrated in societies with high poverty rates that depend on this cereal as a staple food, that is, as a main nutrient source.

Practically all maize ethanol in the world is produced in the US, which accounts for 67% of worldwide ethanol –the rest is mainly produced in Brazil with sugarcane

The Use of Maize

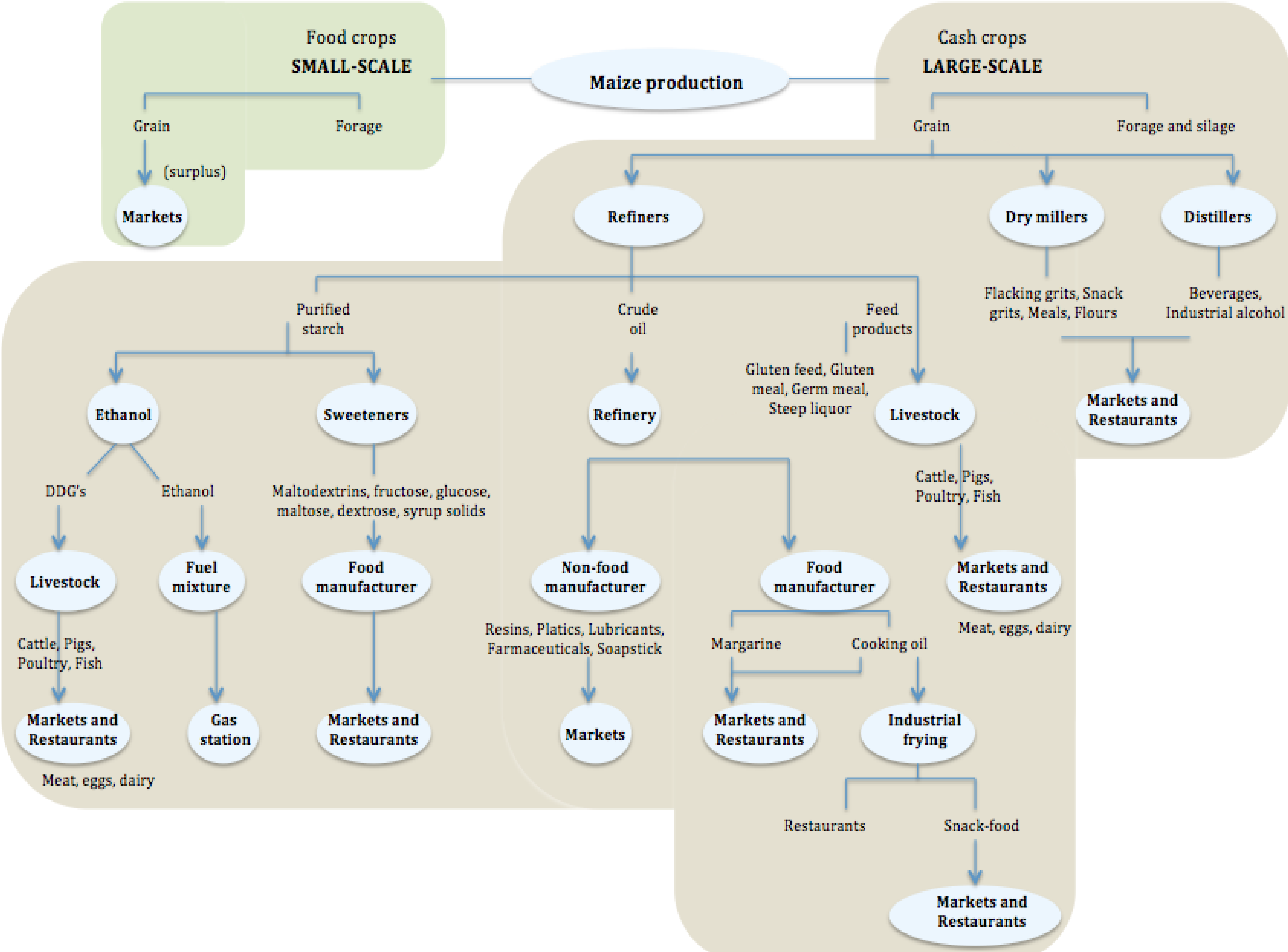
Smallholders provide most of the world direct food-maize and are the stewards of the genetic, agricultural and landscape diversity of this crop.

The large majority of maize produced for non-industrially processed food is consumed within the national boundaries where it was produced.

White maize represents only 4% of the internationally traded maize; the other 96% is yellow maize, which is mainly destined for the livestock, ethanol, and edible oil industries.

The volume of white maize that is internationally traded is just a little over two million tons a year, which accounts for only 0.002% of the total production.

Consume of maize mainly for food is located almost entirely in the sub-Saharan Africa, Latin America and the south of Asia. For 900 million poor people this cereal constitutes their main food source.



Food crops
SMALL-SCALE
Maize production
Cash crops
LARGE-SCALE
Grain
Forage
(surplus)
Markets
Grain
Forage and silage
Refiners
Dry millers
Distillers
Purified starch
Crude oil
Feed products
Flacking grits, Snack grits, Meals, Flours
Beverages, Industrial alcohol
Ethanol
Sweeteners
Refinery
Gluten feed, Gluten meal, Germ meal, Steep liquor
Livestock
Markets and Restaurants
DDG's
Ethanol
Maltodextrins, fructose, glucose, maltose, dextrose, syrup solids
Cattle, Pigs, Poultry, Fish
Livestock
Fuel mixture
Food manufacturer
Non-food manufacturer
Food manufacturer
Markets and Restaurants
Meat, eggs, dairy
Resins, Platics, Lubricants, Farmaceuticals, Soapstick
Margarine
Cooking oil
Cattle, Pigs, Poultry, Fish
Markets and Restaurants
Gas station
Markets and Restaurants
Markets
Markets and Restaurants
Industrial frying
Meat, eggs, dairy
Restaurants
Snack-food
Markets and Restaurants

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High Fructose Corn Syrup (HFCS)

After ethanol, the most important industrial is **High Fructose Corn Syrup (HFCS).**

HFCS has gained ground over sucrose because of its easier storage and transportation handling; also because the price of HFCS is more stable, due to governmental subsidies for the production of maize (US); finally, because maize has a wider base production than sugarcane in the world.

HFCS has become the main sweetener of soft drinks and is used in fruit juices, breads, confectionery, marmalades, cereals, yoghurts and other dairy products, condiments, and canned and packed products.

Its consumption is still nine times smaller than sucrose, but in the US it already covers 40% of all sweeteners. Its nutritional value and its possible contribution to an increase of diabetes and hypertension in countries that use more HFCS than sucrose have been debated

HCFS producers have benefited from an implicit subsidy of approximately USD $243 million per year, and over USD $4 billion since 1986.

Diabetes

- The number of people living with diabetes and its prevalence are growing in all regions of the world**. In 2014, 422 million adults (or 8.5% of the population) had diabetes, compared with 108 million (4.7%) in 1980**.
- The epidemic of diabetes has major health and socioeconomic impacts, also in developing countries.
- In 2014, more than 1 in 3 adults aged over 18 years were overweight and more than one in 10 were obese.
- http://www.who.int/mediacentre/news/releases/2016/world-health-day/en/

- Diabetes caused 1.5 million deaths in 2012 (as many as HIV/AIDS). Higher-than-optimal blood glucose caused an additional 2.2 million deaths by increasing the risks of cardiovascular and other diseases.
- Direct annual costs of diabetes: more than 830 billion USD

Maize and Livestock

The increased production of cheap maize in the US has also benefited the **industry of concentrated animal feeding operations (CAFOs)** where animals are fed with subsidized maize instead of grass.

CAFOs have thousands of animals in small areas, creating large concentrations of excrement and antibiotics, which often spill in local rivers and are responsible for large methane emissions, contributing to climate change

Moreover, the widespread use of antibiotics in CAFOs has increased the risk for more virulent and resistant microorganisms, reducing the effectiveness of antibiotics to treat infections in livestock and humans.

Antibiotic Resistance

Antibiotic resistance refers specifically to the resistance to antibiotics that occurs in common bacteria that cause infections.

The inappropriate use of antimicrobial drugs, including in animal husbandry, favours the emergence and selection of resistant strains, and poor infection prevention and control practices contribute to further emergence and spread of antimicrobial resistance.

Antibiotic resistance is one of the biggest threats to global health today. It can affect anyone, of any age, in any country

In the European Union alone, drug-resistant bacteria are estimated to cause 25,000 deaths and cost more than US$1.5 billion every year in healthcare expenses and productivity losses.

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Eco-agri-food systems complex – impacts and dependencies

The dead zone in the Gulf of Mexico is to a great extent the result of maize and soybean production in the so called Corn Belt, located in the states of Iowa, Illinois, Indiana, Nebraska, Kansas Minnesota and Missouri.
The United States cultivates 62% of GM maize in the world, and almost all maize that is produced within its territory is GM: 96% of its cultivated area.

Only 1% of US maize production is used as direct food, and 8% for industrially manufactured food (mostly high fructose corn syrup).
The rest is produced for the ethanol (49%) and livestock (42%) industries.

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Role of Sudsidies

Subsidies have played and still play an important role in maize production policy

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High fructose corn syrup (HFCS) became a cheaper sweetener than sugar cane.

Over the last half century, the average annual consumption per-capita of high-calorie sweeteners increased by 18 kilos approximately and HCFS accounts for over 80% of the additional calories consumed every day in the form of sweeteners.

In the US HCFS producers have benefited from an implicit subsidy of approximately USD $243 million per year, and over USD $4 billion since 1986. Soda producers, the main consumers of HFCS have saved nearly USD $100 million annually and about USD $1.7 billion since the mid 80s when the soda industry started to use HFCS in their products.

Between 1985 and 2000 “the real cost of (unsubsidized) fresh fruits and vegetables increased nearly 40% while the price of fats and sugars declined”.

Policies and Development

Policies that make improved seeds and subsidized chemical fertilizers available in countries like Rwanda and Zambia have resulted in increased yields, increased farmers´ income, and decreased poverty rates -as conventionally measured.

However, it was mainly the relatively wealthy minority who was able to benefit from this modernization process. For the poorest producers, these policies resulted in dispossession of land, inequality and even more poverty.
Most households were negatively impacted by the loss of subsistence practices. “Local systems of knowledge, trade and labour were impaired, and land tenure security was curtailed”.

Subsidized fertilizers have also encouraged small producers in Rwanda to abandon traditional polyculture systems for subsistence and local trade and to adapt to production systems with improved seed varieties, more intensive inputs, and credit.
In Zambia, subsidized maize to maintain low prices and subsidized fertilizers have also encouraged the promotion of monocrops and the expansion of maize production in areas with unsuitable biophysical conditions, causing soil acidification and degradation.

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Antibiotic Resistance

Drug-resistant infections currently kill an estimated 700,000 people worldwide each year. If efforts to curb antibiotic resistance fail, this number could increase to 10 million by 2050, surpassing the 8.2 million deaths a year caused by cancer,according to a global report commissioned by the UK government. The economic impact would also be devastating: the report estimates a cost of $100tn of global GDP over the next 35 years.

The food sector, primarily livestock production, is already grappling with a post-antibiotic reality. The meat industry is facing increased pressure, from both the public and the private sector, to phase out the routine use of these drugs.
www.theguardian.com/sustainable-business/2016/mar/14/antibiotic-resistance-nhs-fda-agriculture-health-pfizer

“Human resistance to antibiotics could bring ‘the end of modern medicine as we know it’,”
www.nhs.uk/news/2012/03march/Pages/antibiotic-resistance-who-strategy.aspx

HFCS and Diabetes?

Economic impact of diabetes

- Catastrophic medical expenditure significantly higher in people with diabetes.
- Direct annual cost of diabetes globally > US$ 827 billion.
- Losses in GDP worldwide estimated to be US$ 1.7 trillion from 2010 to 2030

WORLD HEALTH DAY 2016
GLOBAL REPORT ON DIABETES

World Health Organization