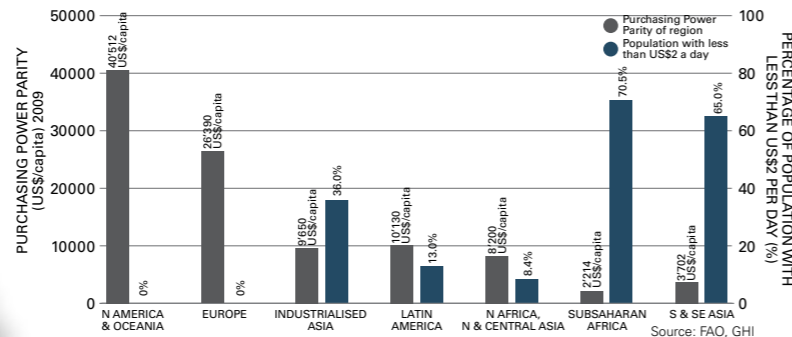
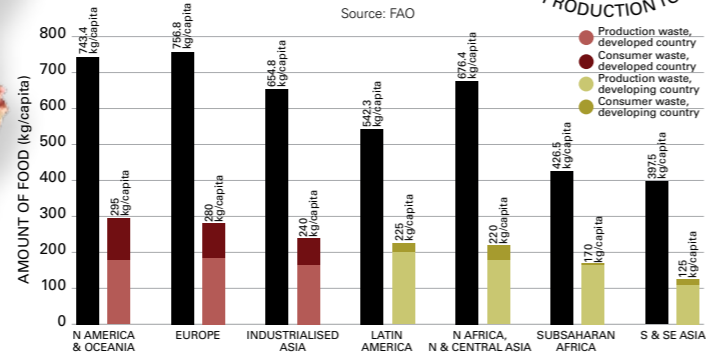
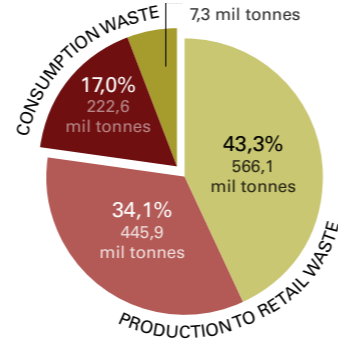


EXCESS

1/3 or **1.3 billion tonnes** of food produced for human consumption is lost or wasted.

Developed and developing worlds generate **about the same amount** of food waste.

However **per capita food waste** is **fast 50% more** in developed countries than developing countries.

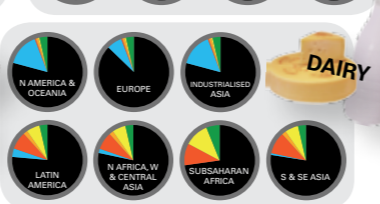
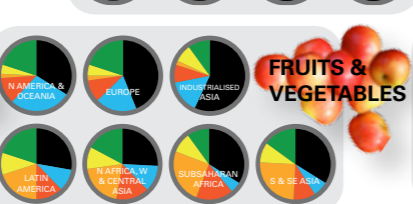
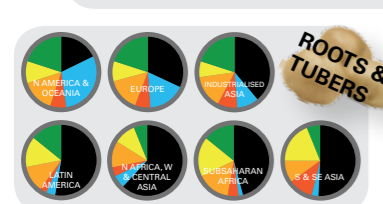
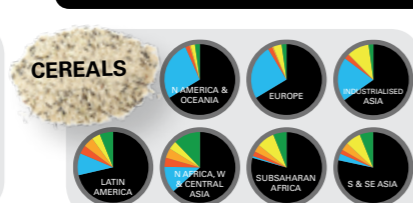
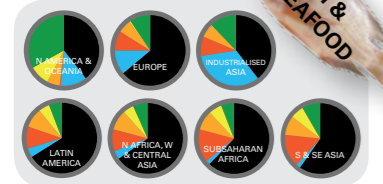


Developed countries waste **1/2 to 1/3 of their food**. Developing countries waste about **1/3**. The regions that waste the least food have the **lowest income** in Purchasing Power Parity and the **highest poverty levels**.

STAGES OF WASTE

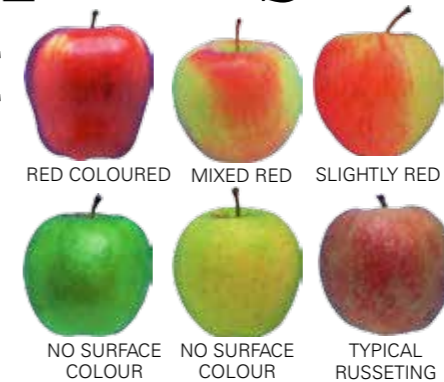
- AGRICULTURE
- POSTHARVEST
- PROCESSING
- RETAIL
- CONSUMER

Source: FAO



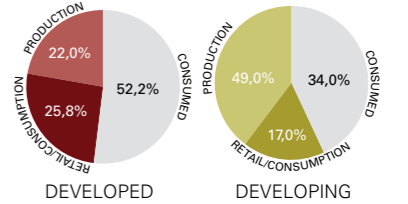
THE PERFECT SUPERMARKET APPLE

- POSTHARVEST: 0.93% WASTED
- POSTHARVEST: 0.93% WASTED
- PROCESSING: 32.44% WASTED
- RETAIL: 6.56% WASTED
- CONSUMER: 13.95% WASTED



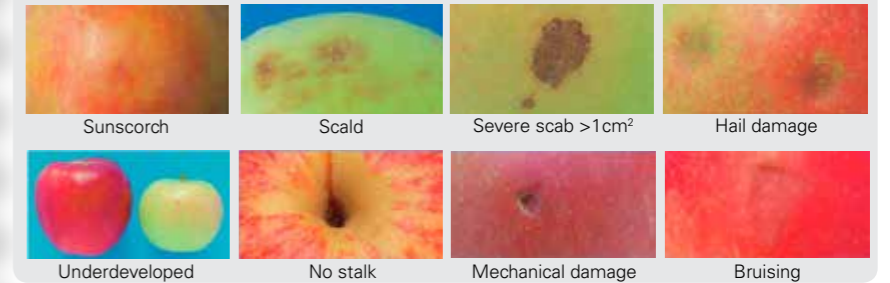
Source: OECD International Standards for Fruits and Vegetables: Apples

Fruits and vegetables generate the highest proportion of waste. Globally **56.7%** of fruits and vegetables are wasted.



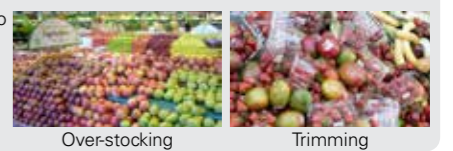
PRODUCTION LOSSES/WASTE

Stringent regulations by regulatory bodies like OECD requiring high "appearance quality standards" and food safety. Apples damaged by improper handling are also forbidden.



SUPERMARKET PRACTICES

Supermarkets routinely overstock fresh produce to give consumers the impression of abundance. Trimming is also performed to remove produce or parts of produce that do not conform to the supermarket's cosmetic standards, which are hence unlikely to be bought by consumers.



CONSUMER BEHAVIOUR

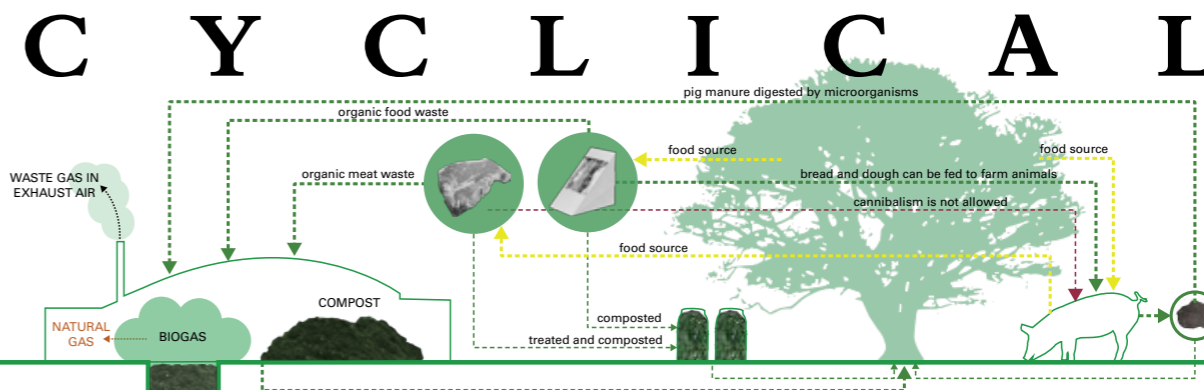
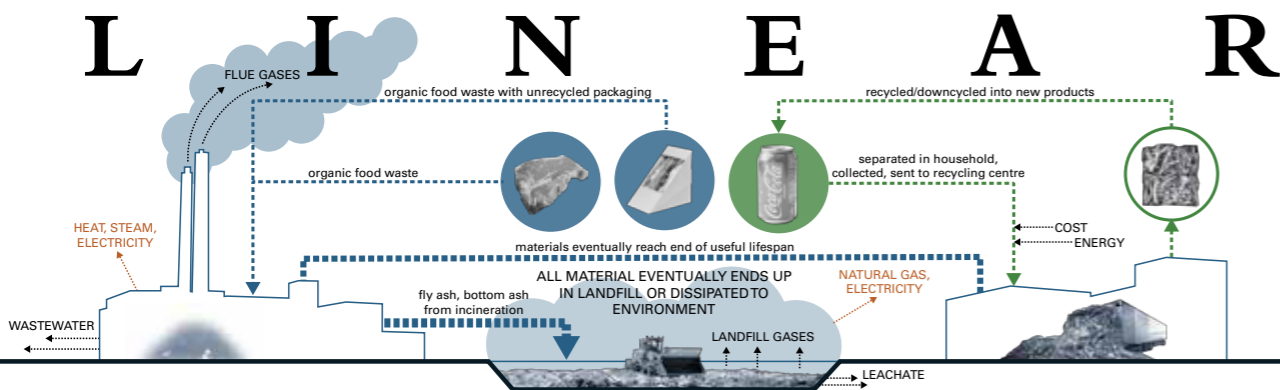
Bad planning by consumers in buying and cooking often leads to overstocking, resulting in spoilage of produce.

Most consumers also cannot tell if produce is still edible, choosing to throw it away rather than take a risk.



REFERENCES:

- International Food Policy Research Institute 2011, Global Hunger Index.
- Food and Agriculture Organisation 2011, Food Balance Sheets.
- Food and Agriculture Organisation 2011, Production.
- Population Reference Bureau 2005, 2005 World Population Data Sheet
- United States Department of Agriculture 2010, U.S. Apple Statistics
- Food and Agriculture Organisation (2011), Global Food Losses and Food Waste: Extent, Causes and Prevention. Food and Agriculture Organisation, Rome.
- United States Department of Agriculture (2009), Supermarket Loss Estimates for Fresh Fruit, Vegetables, Meat, Poultry, and Seafood and Their Use in ERS Loss-Adjusted Food Availability Data, United States Department of Agriculture, Washington DC.
- United States Department of Agriculture (2009), Supermarket Loss Estimates for Fresh Fruit, Vegetables, Meat, Poultry, and Seafood and Their Use in ERS Loss-Adjusted Food Availability Data, United States Department of Agriculture, Washington DC.
- Organisation for Economic Co-operation and Development (2010), International Standards for Fruits and Vegetables: Apples
- Fadavi, R. / Keyhani, A. / Mohasebi, S.S. (2011), An analysis of energy use, input costs and relation between energy inputs and yield of apple orchard
- Steel, Carolyn (2009), Hungry City, How Food Shapes Our Lives, Vintage Books, London.
- <http://www.fao.org/docrep/009/AC911E/ac911e06.htm> / Global and Regional Food Consumption Patterns and Trends, download: 16. October 2011



INCINERATION

Waste is disposed of by burning, which reduces up to 90% of waste volume. Waste was first burnt in "destructors" from 1874. The first municipal incineration plant operated from 1975.

Operation cost: 131-180 CHF / tonne

1. Storage and handling
2. Waste fed into furnace
3. Combustion in furnace
4. Recovery of heat, steam and electricity
5. Air pollution control (flue gas)
6. Residue handling (ash, water)

- HARMFUL BYPRODUCTS

Flue gas: Contains particulate matter, hydrochloric acid, heavy metals, sulphur dioxide and nitrogen oxides. Toxic and pollutive.

Fly ash, bottom ash: Heavy metals. Toxic.

Wastewater: Water pollution.

+ USEFUL BYPRODUCTS

Heat, steam and electricity: Recovered as energy to power incineration plant, and provide district power and heating.

EVALUATION

+ Reduces volume, avoids problems of landfills, possible energy recovery.
- Can lead to health problems. Increasing cost due to more stringent regulations.



WASTE INCINERATION FACILITY BASEL (KVA BASEL) - Basel

- 210'000 tonnes household waste / year
- Generates 19% slag, 2.8% fly ash
- Provides 50% district heating requirements
- 80% useful energy obtained

LANDFILLING

Waste is disposed of by burying. Open dumping and burial are the oldest ways to dispose waste. Layered landfills were first used in USA in the 1920's. Sanitary landfills were used in 1937.

Operation cost: 4,50-20 CHF / tonne

1. Weighing and load inspection
2. Waste is compacted
3. Layers of waste are alternated with a daily cover made of soil, foam products, blankets, chipped wood or biosolids
4. Land continuously filled until it runs out

- HARMFUL BYPRODUCTS

Leachate (Sickerwasser): Precipitation contaminated by moving through landfill which can contaminate groundwater when in contact. Use of impermeable liners with drainage system, and water treatment

+ USEFUL BYPRODUCTS

Landfill gas: 120 kg of methane per tonne of Municipal Solid Waste. Potentially pollutive and dangerous. Can be directly used for heating, leachate evaporation and as pipeline quality gas. Generate electricity.

EVALUATION

+ Cheapest method of disposal. Can be used as reclaimed land. Landfill gas can be captured for energy.
- >10% global methane. Odours, pollution.



ELBISGRABEN LANDFILL - Füllinsdorf

- Residue landfill: Rock-like material including incineration slag. Moderate level of pollution
- 40'000 tonnes non-combustible waste/year
- Landfill gas for District of Liestal

RECYCLING

Processing of used materials to reduce waste of useful material. Recycling has always been practised. Municipal recycling began in New York in 1897.

Collection cost: 18-83 CHF / tonne

Sorting cost: 5,40-83 CHF / tonne

1. Sorting on consumer end
2. Collection and transportation to sorting at municipal facility
3. Sorting
4. Cleaning of materials
5. Reprocessing into new materials

+ PLASTIC

PET bottles > PET fabrics
PVC > Recycled or upcycled
High Density Polyethylene > Plastic lumber

+ GLASS

> Concrete aggregates
> Used in secondary markets
Green glass > Usually only wine bottles

+ PAPER

> Recycled newsprint saves 1 ton wood
> Recycled printing paper save 2 tons wood

EVALUATION

+ Reduce waste, use of virgin materials, energy use, pollution
- Most products can only be downcycled. Cost and energy in transport negate benefits.



LOTTNER AG - Basel

- 130'500 tons of raw paper
- 18'000 tonnes of post-plastics, metals and scrap, cable scrap, wood waste, alternative fuel, bulk goods, electronics, garbage
- Collection, valuation, removal of biomass

BIOGAS/BIOMASS

Organic waste is broken down through anaerobic digestion of microorganisms to produce biogas and compost. China experimented with biogas and biomass from 1958 as a source of energy.

Operation cost: 13,60-45 CHF / tonne

1. Weighing
2. Shredding and sifting.
3. Food, fruit, vegetable waste, waste oil and grease offal are ground and boiled at 133°C
4. Mixing and adding to fermentation tank
5. 15-day fermentation using anaerobic bacteria. Biomass converted to biogas.
6. Solid and coarse material is divided into piles and composted for 8 weeks with fungi, microorganisms and microbes, under intense ventilation
7. Material is stored, sifted and mixed according to use

- HARMFUL BYPRODUCTS

Waste gas in exhaust air: Decomposed by microorganisms in filter

+ USEFUL PRODUCTS

Biogas: Added to natural gas system
Compost: Used in horticulture, construction, sports fields, agriculture, civil engineering

CHALLENGES

- Costs in linking to existing energy sources



BIOPOWER PRATTELN - Liestal

- Capacity to process up to 15'000 tons organic waste annually
- 8000 tonnes compost per year
- 1,8 mio m³ biogas > ~10 mio kWh energy
- CO₂ substitution with biogas

COMPOSTING

Organic waste is decomposed and recycled as fertiliser and soil nutrient. Practised since Pliny the Elder. Used by EU in 1920's as farming tool.

Material cost: 80-3'100 CHF depending on quality and scale

- BOKASHI COMPOSTING**
1. Kitchen waste is added in an airtight container
 2. Scraps are added with Bokashi EM mix
 3. Alternate layers of waste and Bokashi EM mix
 4. Compost tea is drained and diluted

HUMANURE

1. Human urine and faeces is added with paper and other carbon material
2. Compost is filtered through the ground
3. Compost enriches soil

VERMICOMPOST

Different types of worms are used to aid composting and create a heterogenous mixture of decomposing food or vegetable waste

+ USEFUL PRODUCTS

Compost: Organic farming, small-scale gardening. Adds nutrients to soil and can act as fertiliser.

CHALLENGES

- Perceived difficulty in adoption



COMPOSTING

- Compost Advice Basel-Stadt provides materials and instructions
- Supported by Basel Action Network and smaller groups

ANIMAL FEED

Scraps and leftovers are fed to livestock, e.g. pig swill. Ancient practice, now heavily regulated due to food safety concerns after outbreak of Mad Cow Disease in 1996.

EU REGULATION NO. 1774/2002

Products derived from animals declared unfit for human consumption must not enter the food chain. Animals must not be fed proteins from the carcasses of the same species - cannibalism is not allowed. Feeding of kitchen and food waste, including used edible oils to livestock was previously allowed under an exemption. This was terminated on 31. October 2006.

EU REGULATION NO. 142/2011

Milk and dairy products can be fed to farm animals.

SWILL ORDER (S.I. NO. 597/2001)

Feeding of "any broken or waste foodstuff" to farm animals is banned. Exceptions are made for the feeding of cereal grains, edible material of plant or vegetable origin, bread and dough (including biscuits) and chocolate that has not been in contact with an animal or animal by-product.

REFERENCES

Juhász, A.L./Magesan, G./Naidu, R. (2004): Waste Management. Science Publishers, Inc., New Hampshire, United States of America

Melosi, Martin V. (1981): Garbage in the Cities. Texas A&M University Press, United States of America

Strasser, Susan (1999): Waste and Want. A Social History of Trash. Metropolitan Books, New York

http://europa.eu/legislation_summaries/food_safety/animal_nutrition/f81001_en.htm / Animal by-products not intended for human consumption, download: 16. October 2011, Last update: 27. August 2008.

<http://www.agriculture.gov.ie/agri-food/industry/animalbyproducts/frequentlyaskedquestions/faqs/> / Department of Agriculture, Fisheries and Food. Frequently Asked Questions, download: 16. October 2011

http://www.vitalletrecycling.de/corolcms/front_content.php?idcat=24&lang=2&clients=1 / EU Regulation 1774/2002 Ban on Using Food Waste as Animal Feed in Germany, download: 16. October 2011

<http://www.attorneygeneral.ee/ssi/2009/B26680.pdf> / S.I. No. 12 of 2009, download: 16. October 2011, Last update: 20. January 2009

http://www.swissworld.org/en/environment/waste_management/landfills/Landfills, download: 16. October 2011

<http://www.lottner.ch/> / Lottner AG, download: 16. October 2011

<http://www.stadtgaertneri.bs.ch/kompost.htm> / Basel-Stadt: Stadtgärtneri - Kompost, download: 16. October 2011

http://www.kompost.ch/Kompost_Forum_Schweiz, download: 16. October 2011

<http://filesresources.worldbank.org/INT/WW/Resource/340232120896467407/Coitreau.pdf> / Landfill ER Revenues versus Landfill Costs, download: 16. October 2011, Last update: March 2008

<http://en.wikipedia.org/wiki/Landfill> / Landfill, download: 16. October 2011, Last update: 28. September 2011

<http://en.wikipedia.org/wiki/Incineration> / Incineration, download: 16. October 2011, Last update: 10. October 2011

<http://en.wikipedia.org/wiki/Recycling> / Recycling, download: 16. October 2011, Last update: 12. October 2011