

## The future of food

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### The Future of Growing

Will we one day grow meat in **labs** and salad in **skyscrapers**? Who knows—but something has to change. By 2050, there will likely be nine billion people to feed, and our planet is already under **stress**. **Agriculture** is a leading **threat** to rivers, lakes, and coastal environments, and up to 40 percent of all **cropland** worldwide is experiencing soil **erosion**, reduced **fertility**, or **overgrazing**. As our **climate** changes, so will the ways we grow our food. Fortunately, many people are working on ways to produce more healthy and delicious food while **protecting** the environment.

### More Efficient Farms

All over the tropics, forests are being **converted** to **pastures** and **farmland**: 80 percent of all new tropical **farmland** is created by replacing forests, with huge environmental costs. But we could produce 50 percent more food without new farmland by increasing **yields**, shifting **diets**, and using water and **fertilizer** more efficiently.

### Test-Tube Beef

The livestock industry uses 75 percent of all agricultural land for **grazing** and growing animal feed and produces at least 18 percent of all **greenhouse gas emissions**. Some argue that safer, healthier meat could be grown using animal **cells**, instead of living animals—thereby reducing animal suffering, **waste** and **pollution**.

### Next Generation Fish Farms

Promising new methods of farming fish rely on giant **tanks**. Water, nutrients, and waste are **recycled**—sometimes to grow plants—and fish can't escape. Such methods could relieve pressure on wild stocks, drastically **depleted** by overfishing. And closed-system fish farms don't have the same environmental downsides as certain cage or pen fish farms, which use more wild fish for feed and can cause **pollution** and **disease**.

### Staying Power

Most farm **crops**, including wheat, rice, and maize, must be planted again each and every year. The roots of these “annual” plants are shallow, and farmers often use **resource-intensive** cultivation practices to grow them. But many wild plants, such as wheatgrass, are “**perennials**”—they live several years and produce food over many seasons. Their roots are **extensive**—and they help **stabilize** and build healthy soils. So what if we bred **crops** with deep, **perennial** roots?

### Castles in the Sky?

By 2050, there will likely be two billion more people. Feeding them the way we do now would require **immense** amounts of agricultural land we don't have. But 70 percent of people will live in cities—so why not grow food there, where they live? **Urban** farms can be found today in yards, roofs, and balconies. Some have even proposed farming in **skyscrapers**!

### The Future of Eating

Our population is **expanding**, while standards of living are also changing and our environment is increasingly **strained**. How will future food production meet the growing **demand**? Will our **diets** have to change? Can **technology** provide the answers? New trends in **biotechnology**, health science, processing, and cooking technologies, as well as issues like **climate** change, will all affect what we eat.

Exactly which foods will become fashionable in the future is impossible to **predict**. Most likely, some exist now, but are **underutilized**; some have yet to be found or invented; and some will be so radically different we would hardly recognize them today as food.

### Underused and Overlooked

About 2,500 plant species have been domesticated for food. But today, almost half our food **calories** come from just three grains: wheat, maize, and rice. What about the thousands of overlooked plant species—and an untapped diversity of animals? These resources could provide solutions to problems like the need for resilience in our food production systems and the need to meet growing demands without depleting natural resources. Here are a few promising examples:

- **Algae:** Seaweed and other algae, already popular in Japan, are highly nutritious and can be grown in both fresh water and salt water.
- **Insects:** Over 2,000 species of insects are already eaten worldwide, including mopane worms (*Gonimbrasia belina*) in South Africa. Insects are high in protein and require much less land, water, and food than animals raised for meat
- **Quinoa:** This grain (*Chenopodium quinoa*) from the Andes contains all the essential amino acids the human body needs for protein and has no gluten.
- **Emmer wheat:** While millions are spent on high-tech hybrids, neglected crops like the grain emmer (*Triticum dicoccum*), which requires less fertilizer and fewer pesticides than currently used breeds, are already being grown in places like Turkey.
- **Minor millets:** These cereals have been grown in Asia for 6,500 years. Many farmers in India and Nepal are now switching from growing crops like maize and rice back to traditional varieties bred to grow on local mountainsides.
- **Peach palm:** The peach palm (*Bactris gasipaes*) grows well in Central and South America and produces a large, nutritious fruit. The tree's spiny trunk makes the fruit hard to harvest—but breeders are now developing spineless varieties.
- **Giant swamp taro:** The giant swamp taro (*Cyrtosperma chamissonis*), which grows well in the salty, sandy soil of many Pacific islands, is rich in vitamins and minerals. Yellow varieties are high in beta carotene, which can help prevent blindness.
- **Sea buckthorn:** Sea buckthorn (*Hippophae rhamnoides*) uses nitrogen from the air as fertilizer, thanks to specialized bacteria in its roots. These dense roots are also used to prevent soil erosion in China. The berries are hard to pick, but new machines should help with the harvest.

### Foods of Tomorrow?

Many foods we'll eat in the future don't yet exist. Researchers constantly tinker with plant and animal ingredients, processed foods and even packaging, to improve flavor and nutrition. A few samples are below—but the biggest changes may come from ideas we cannot yet imagine.

- **Breathable Chocolate:** Want the flavor of real chocolate, without the calories? You can now inhale tiny particles of chocolate, as a mist.
- **Patch in a Pinch:** Some essential nutrients could soon be given to soldiers and astronauts through a patch on the skin, for quick absorption in emergencies.
- **"Smart Packaging":** In the near future, food packaging could monitor foods to detect ripeness or spoiling—or even actively prevent foods from spoiling.
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**Vocabulary:**

**lab** - *noun* a workplace for the conduct of scientific research

**skyscraper** - *noun* a very tall building with many stories

**stress** - *noun* the relative prominence of a syllable or musical note (especially with regard to stress or pitch); (physics) force that produces strain on a physical body; difficulty that causes worry or emotional tension; special emphasis attached to something; (psychology) a state of mental or emotional strain or suspense; *verb* put stress on; utter with an accent; to stress, single out as important; test the limits of

**Agriculture** - *noun* the class of people engaged in growing food; the practice of cultivating the land or raising stock; a large-scale farming enterprise; the federal department that administers programs that provide services to farmers (including research and soil conservation and efforts to stabilize the farming economy); created in 1862

**threat** - *noun* declaration of an intention or a determination to inflict harm on another; a warning that something unpleasant is imminent; a person who inspires fear or dread; something that is a source of danger

**erosion** - *noun* (geology) the mechanical process of wearing or grinding something down (as by particles washing over it); a gradual decline of something; condition in which the earth's surface is worn away by the action of water and wind; erosion by chemical action

**fertility** - *noun* the state of being fertile; capable of producing offspring; the property of producing abundantly and sustaining vigorous and luxuriant growth; the ratio of live births in an area to the population of that area; expressed per 1000 population per year

**grazing** - *noun* the act of brushing against while passing; the act of grazing

**climate** - *noun* the weather in some location averaged over some long period of time; the prevailing psychological state

**protect** - *verb* shield from danger, injury, destruction, or damage; use tariffs to favor domestic industry

**Efficient** - *adj.* being effective without wasting time or effort or expense; able to accomplish a purpose; functioning effectively

**convert** - *noun* a person who has been converted to another religious or political belief; *verb* change in nature, purpose, or function; undergo a chemical change; change the nature, purpose, or function of something; change from one system to another or to a new plan or policy; change religious beliefs, or adopt a religious belief; cause to adopt a new or different faith; make (someone) agree, understand, or realize the truth or validity of something; score (a spare); complete successfully; score an extra point or points after touchdown by kicking the ball through the uprights or advancing the ball into the end zone; exchange or replace with another, usually of the same kind or category; exchange a penalty for a less severe one

**pasture** - *noun* a field covered with grass or herbage and suitable for grazing by livestock; animal food for browsing or grazing; *verb* feed as in a meadow or pasture; let feed in a field or pasture or meadow

**farmland** - *noun* a rural area where farming is practiced; arable land that is worked by plowing and sowing and raising crops

**yield** - *noun* an amount of a product; production of a certain amount; the income or profit arising from such transactions as the sale of land or other property; the quantity of something (as a commodity) that is created (usually within a given period of time); *verb* consent reluctantly; cease opposition; stop fighting; bring in; be the cause or source of; give in, as to influence or pressure; end resistance, as under pressure or force; be willing to concede; be flexible under stress of physical force; give or supply; cause to happen or be responsible for; move in order to

make room for someone for something; give over; surrender or relinquish to the physical control of another; be fatally overwhelmed

**diet** - *noun* the act of restricting your food intake (or your intake of particular foods); the usual food and drink consumed by an organism (person or animal); a prescribed selection of foods; a legislative assembly in certain countries (e.g., Japan); *verb* eat sparingly, for health reasons or to lose weight; follow a regimen or a diet, as for health reasons

**fertilizer** - *noun* any substance such as manure or a mixture of nitrates used to make soil more fertile

**grazing** - *noun* the act of brushing against while passing; the act of grazing

**cell** - *noun* (biology) the basic structural and functional unit of all organisms; they may exist as independent units of life (as in monads) or may form colonies or tissues as in higher plants and animals; a device that delivers an electric current as the result of a chemical reaction; a room where a prisoner is kept; small room in which a monk or nun lives; any small compartment; a small unit serving as part of or as the nucleus of a larger political movement; a hand-held mobile radiotelephone for use in an area divided into small sections, each with its own short-range transmitter/receiver

**waste** - *adj.* located in a dismal or remote area; desolate; *noun* useless or profitless activity; using or expending or consuming thoughtlessly or carelessly; (law) reduction in the value of an estate caused by act or neglect; any materials unused and rejected as worthless or unwanted; the trait of wasting resources; an uninhabited wilderness that is worthless for cultivation; *verb* waste away; cause to grow thin or weak; use inefficiently or inappropriately; run off as waste; get rid of; spend thoughtlessly; throw away; devastate or ravage; lose vigor, health, or flesh, as through grief; spend extravagantly; get rid of (someone who may be a threat) by killing

**pollution** - *noun* undesirable state of the natural environment being contaminated with harmful substances as a consequence of human activities; the act of contaminating or polluting; including (either intentionally or accidentally) unwanted substances or factors; the state of being polluted

**tank** - *noun* a large (usually metallic) vessel for holding gases or liquids; an enclosed armored military vehicle; has a cannon and moves on caterpillar treads; as much as a tank will hold; a cell for violent prisoners; a freight car that transports liquids or gases in bulk; *verb* treat in a tank; store in a tank by causing (something) to flow into it

**recycle** - *verb* use again after processing; cause to repeat a cycle

**deplete** - *verb* use up (resources or materials)

**disease** - *noun* an impairment of health or a condition of abnormal functioning

**crop** - *noun* the stock or handle of a whip; the output of something in a season; a collection of people or things appearing together; a cultivated plant that is grown commercially on a large scale; the yield from plants in a single growing season; a pouch in many birds and some lower animals that resembles a stomach for storage and preliminary maceration of food; *verb* cut short; feed as in a meadow or pasture; let feed in a field or pasture or meadow; yield crops; cultivate, tend, and cut back the growth of; prepare for crops

**perennial** - *adj.* recurring again and again; lasting three seasons or more; lasting an indefinitely long time; suggesting self-renewal; *noun* a plant lasting for three seasons or more

**extensive** - *adj.* large in spatial extent or range or scope or quantity; of agriculture; increasing productivity by using large areas with minimal outlay and labor; broad in scope or content

**stabilize** - *verb* make stable and keep from fluctuating or put into an equilibrium; become stable or more stable; support or hold steady and make steadfast, with or as if with a brace

**immense** - *adj.* unusually great in size or amount or degree or especially extent or scope

**Urban** - *adj.* located in or characteristic of a city or city life; relating to or concerned with a city or densely populated area

**skyscraper** - *noun* a very tall building with many stories

**expand** - *verb* become larger in size or volume or quantity; make bigger or wider in size, volume, or quantity; extend in one or more directions; exaggerate or make bigger; grow stronger; expand the influence of; add details, as to an account or idea; clarify the meaning of and discourse in a learned way, usually in writing

**strain** - *noun* an intense or violent exertion; (physics) deformation of a physical body under the action of applied forces; injury to a muscle (often caused by overuse); results in swelling and pain; (psychology) nervousness resulting from mental stress; the act of singing; an effortful attempt to attain a goal; a lineage or race of people; the general meaning or substance of an utterance; a succession of notes forming a distinctive sequence; a special variety of domesticated animals within a species; (biology) a group of organisms within a species that differ in trivial ways from similar groups; difficulty that causes worry or emotional tension; *verb* use to the utmost; exert vigorously or to full capacity; become stretched or tense or taught; cause to be tense and uneasy or nervous or anxious; alter the shape of (something) by stress; to exert much effort or energy; rub through a strainer or process in an electric blender; remove by passing through a filter; separate by passing through a sieve or other straining device to separate out coarser elements; test the limits of

**demand** - *noun* the act of demanding; an urgent or peremptory request; the ability and desire to purchase goods and services; required activity; a condition requiring relief; *verb* request urgently and forcefully; claim as due or just; ask to be informed of; summon to court; lay legal claim to; require as useful, just, or proper

**technology** - *noun* the practical application of science to commerce or industry; the discipline dealing with the art or science of applying scientific knowledge to practical problems

**biotechnology** - *noun* the branch of engineering science in which biological science is used to study the relation between workers and their environments; the branch of molecular biology that studies the use of microorganisms to perform specific industrial processes

**predict** - *verb* make a prediction about; tell in advance; indicate by signs

**utilize** - *verb* convert (from an investment trust to a unit trust); put into service; make work or employ (something) for a particular purpose or for its inherent or natural purpose

**calorie** - *noun* unit of heat defined as the quantity of heat required to raise the temperature of 1 gram of water by 1 degree centigrade at atmospheric pressure; a unit of heat equal to the amount of heat required to raise the temperature of one kilogram of water by one degree at one atmosphere pressure; used by nutritionists to characterize the energy-producing potential in food