

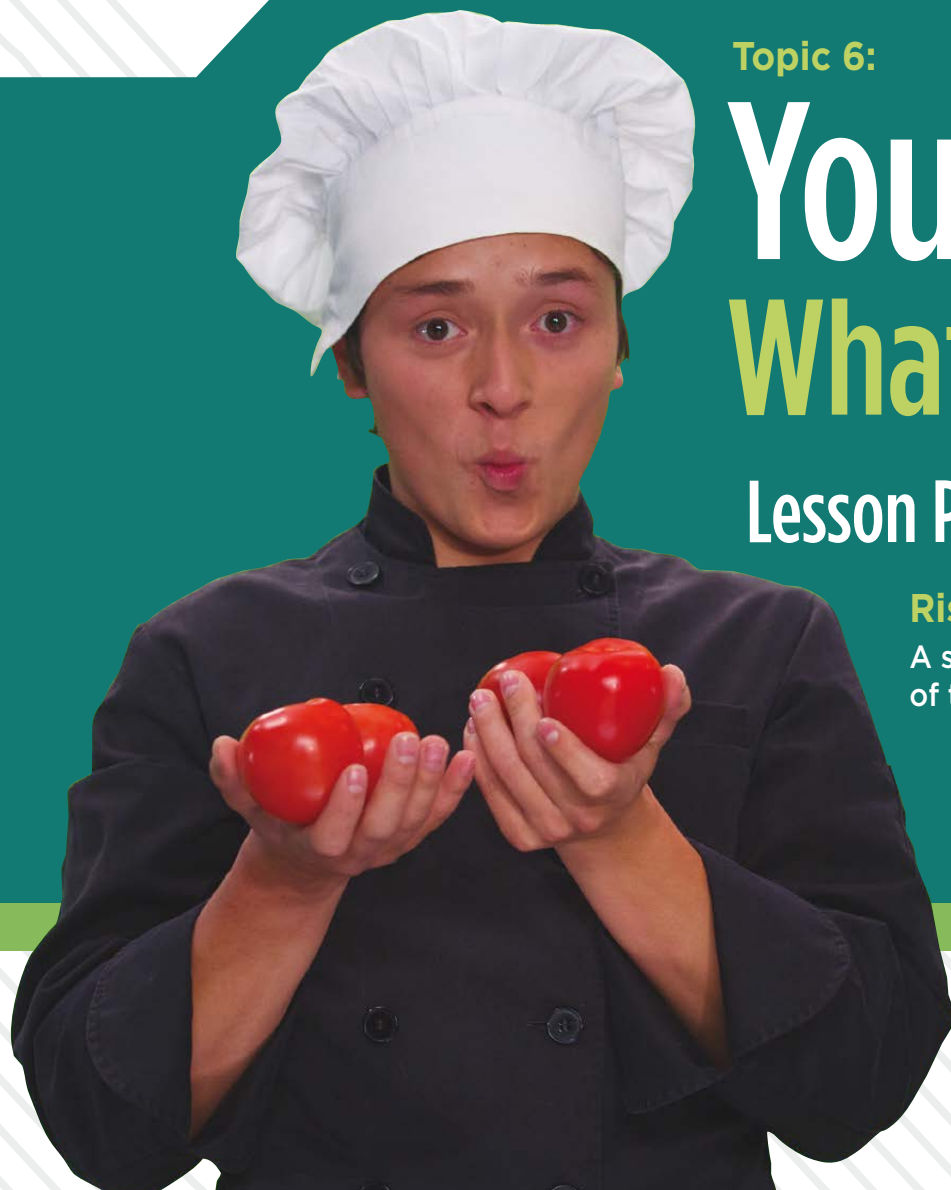
Topic 6:

# You Are What You Eat

## Lesson Plans for Children and Youth

**Rise Up Against Climate Change!**

A school-centered educational initiative  
of the Inter-American Development Bank



# Rise Up

Against Climate Change

A school-centered  
educational initiative  
of the Inter-American  
Development Bank

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## Rise Up Lesson Plans

Our Climate Is Changing

Energize!

Water to Treasure

Intelligent Consumption

Sustainable Cities for Smart Urban  
Growth

You Are What You Eat

Ensuring Healthy Environments

Protecting the Land

People Committed to Fight Climate  
Change



# Rise Up

## Against Climate Change

Rise Up is a climate change education initiative of the Inter-American Development Bank that seeks to encourage children and youth to use their creativity and energy to come up with feasible, sustainable, long-term strategies to mitigate and adapt to climate change. This set of lesson plans is one of nine on different climate change topics that can be used independently or together with the

other lesson plans and materials of the Rise Up initiative, including instructional videos, learning games and a Green School Toolkit. Each set of lesson plans includes an introductory text about the topic that can serve as a background material for the teacher or as a text for older students. The lesson plans can be used at the primary and secondary levels of education; they are divided into basic, intermediate, and advanced plans to help each teacher determine what activities are appropriate for his or her students. To find all the Rise Up materials please go to **[www.iadb.org/riseup](http://www.iadb.org/riseup)**

*Emiliana Vegas, Chief, Education Division,  
Inter-American Development Bank*



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# General Introduction to the Lesson Plans

**“Y**ou are what you eat.” It’s a familiar expression, but do you have any idea how true it is?

Food does a lot more than simply nourish our bodies; it’s an essential part of who we are. When we gather together to produce, prepare, and consume food, we are part of a community. The passing down of food traditions from generation to generation helps form our very identity.

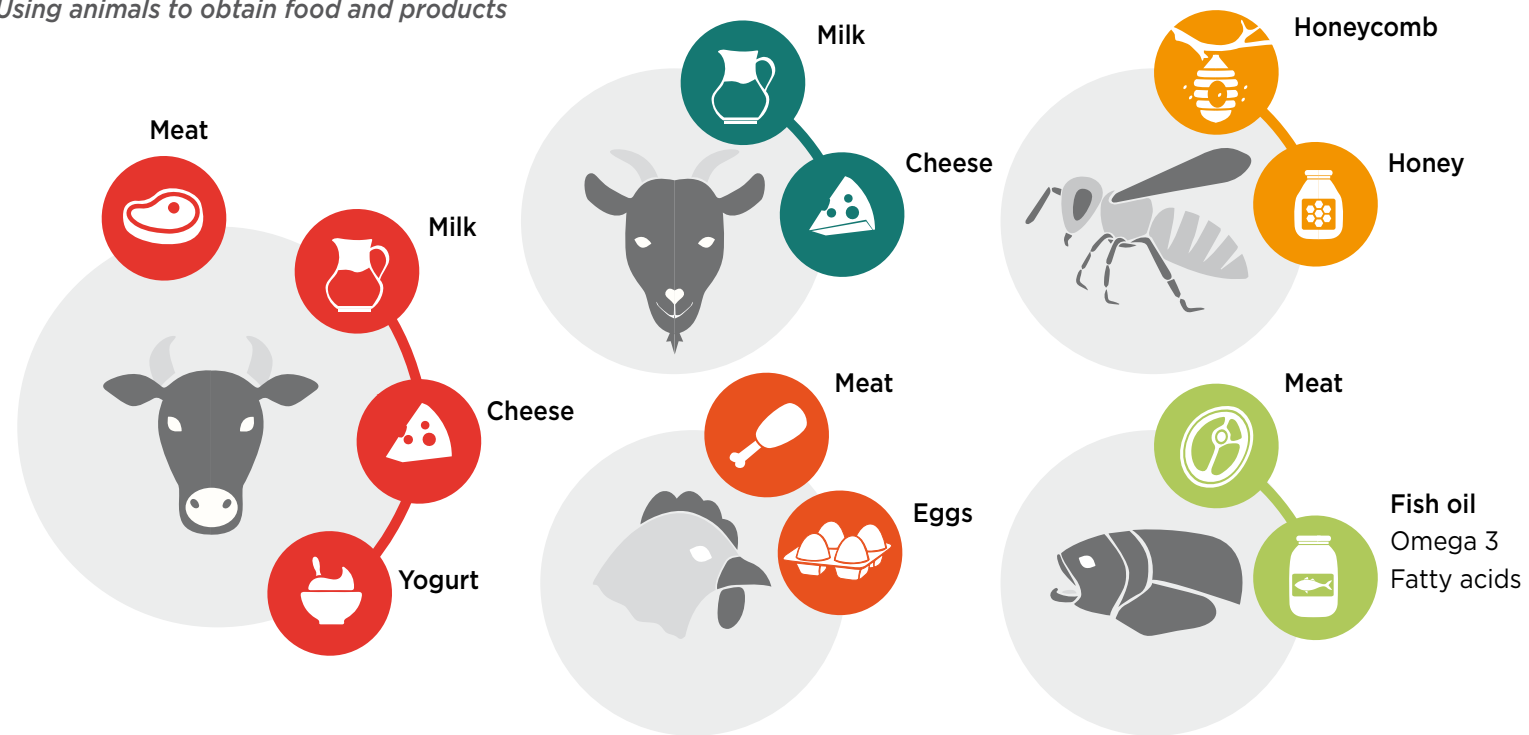
One of the best ways to learn about the history of different places and cultures is to eat the local food. How people eat shows us how they’ve adapted to the geographical and climatic conditions in their region. The same food may have different names, uses, and methods of preparation in different places, depending on local traditions and needs as well as local geography and agricultural practices. Over the centuries, these differences have given rise to a wide range of traditional regional dishes, recipes, and cooking styles, some of which remain favorites.

Many of the world’s traditional dishes contain a balance of plant and animal-derived foods. The variety and complexity of modern cooking provide clues about how food shaped humans’ development and historical evolution.

The earliest humans were expert hunters who traveled great distances in search of herds of animals to hunt. They also ate other animal products, such as eggs, honey, milk, cheese, and yogurt (figure 1). Although they gathered wild plants and herbs for food, medicines, and teas, animal foods were the mainstays of the human diet for thousands of years.

One of the earliest economic activities undertaken by ancient peoples was fishing in natural environments. Later, people began to practice aquaculture, or fish farming, reproducing in ponds the species they caught in the wild, either trading them or keeping them for their own subsistence.

*Figure 1. Using animals to obtain food and products*



Gradually, around 12,000 years ago, societies of hunters and gatherers in what is now considered the Middle East began to domesticate animals and plants, thus ensuring more stable food sources for themselves and a more stationary lifestyle for their families. Learning to grow plants was particularly important, both for providing food for people as well as for their domesticated animals. Over many years, people evolved from hunters and gatherers into farmers, and agriculture was born.

## Earth: The living provider

With the growth of agriculture the world over, people began to understand how important the Earth and its soil are to human survival. In addition to providing raw materials for shelter and everyday necessities, soil is essential for producing food for most living beings. Bacteria, fungi, plants, animals, and people all depend on soil for food.

Soil is much more than just dirt and rocks—it is a complex entity consisting of millions of living organisms and microorganisms that interact with its nonliving elements to provide the basic conditions for all life. The Amazonian Yanomami indigenous people believe that all the world's knowledge is found in the soil.

### Soil: The basics

Soil may be the warrior goddess of recycling! With her faithful army of helpers, she wastes nothing and repurposes everything. When leaves fall to the ground, the soil's microorganisms—mainly bacteria and fungi—start breaking them down, while ants, worms, and other larger soil-dwelling organisms (macrofauna) tear the leaves apart and ingest them, making light work for their micro-sized friends. Medium-sized organisms such as woodlice (mesofauna) also play a role on this decomposition team, feeding on small pieces of leaf litter and breaking down its organic materials. Spiders and other soil predators regulate the populations of soil dwellers. The end products of this process—humus (fertilizer) and newly released plant nutrients—are now ready to nourish the next generation of seeds that land in the soil.

Recycling is complicated work; the soil must also use her army to dig through and oxygenate the earth and to transform so-called waste into raw material for life. For instance, earthworms and ants

are the engineers and architects that excavate, build air channels, and prevent compression. Dung beetles are the tough combat officers that eat manure and transform it into organic soil. Fungi are the sergeants, team leaders, and medics; they support plants by increasing the roots' capacity to absorb nutrients, secreting compounds to dissolve minerals, and in some cases even curing plant diseases.

As long as this army is allowed to work together in its recycling quest, the soil will continue providing substantial resources for humankind. However, unsustainable human activities such as resource overexploitation, improper waste management, and deforestation change the physical properties of the soil, directly affecting the survival of soil-dwelling organisms. In fact, some soil dwellers such as small arthropods (beetles, mites, arachnids, etc.) are so sensitive to change that they serve as biological indicators of soil quality—and a measure of humans' intervention. They remind us that we need to look below our feet and appreciate this army that provides us with the food and other resources we need to survive.

For more proof that humans can't survive without the life forms that dwell in the soil, consider how things work from the standpoint of energy transmission. Have you heard of interconnected food chains, which get their energy from decomposing organic material? Just as fallen leaves are converted back into soil, organic debris sooner or later returns back to the earth, adding to the initial stockpile when organisms die (figure 2). This provides energy for the next generation of life.

We will explore soil in more detail a bit further on.

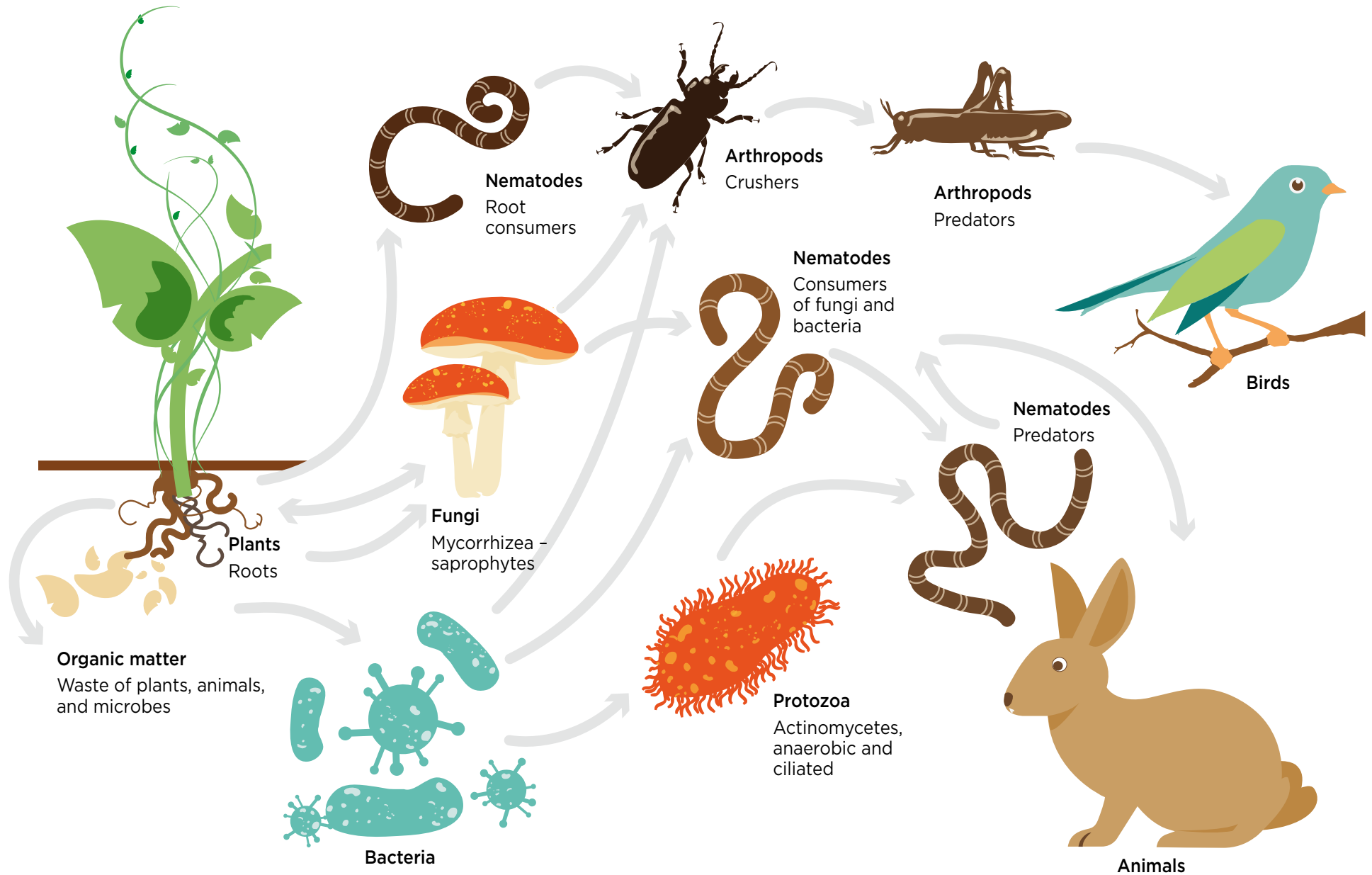
### Energy flow and the movement of matter

Energy allows living things to carry out their functions and to meet their internal and external physiological needs. Organisms obtain energy in a variety of ways, depending on their position in the food chain (figure 3).

Some organisms known as *autotrophs* make their own food and can transform solar energy into chemical energy. These are often called **primary producers**. Examples include some plants, algae, and bacteria.



Figure 2. The soil's food web

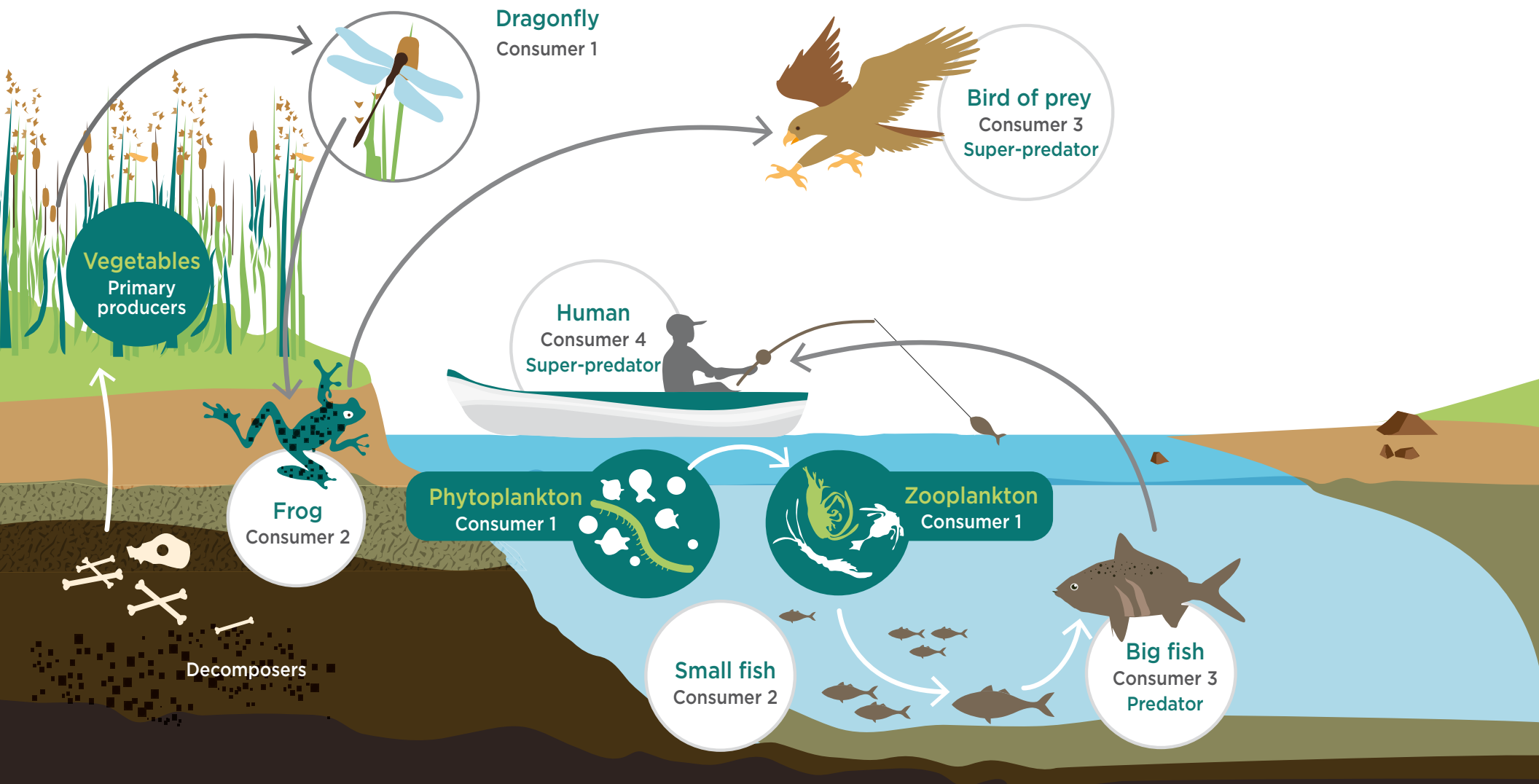


Organisms that feed off of others and do not produce their own food are called *heterotrophs*. Among heterotrophs, the **primary consumers** are *herbivores*, which eat only plants and other primary producers. Examples are rabbits, squirrels, giraffes, and many insects. **Secondary consumers** are *carnivores* that eat herbivorous animals. Examples are frogs, hawks, and some snakes. **Tertiary consumers**, such as eagles and pumas, eat the secondary consumers. Humans are considered **quaternary consumers**,

meaning that we get energy from plants and animals from various levels of the food chain.

When plants, animals, and people die, **decomposer** organisms such as fungi and bacteria go to work, transforming the remains (i.e., matter and energy) into a form that can be reused by autotroph organisms, often returning it to the soil. Thus the energy flow is constant, passing through all living things through the medium of food (see figure 3).

Figure 3. The food chain



## What is this stuff we call soil?

### Soil composition

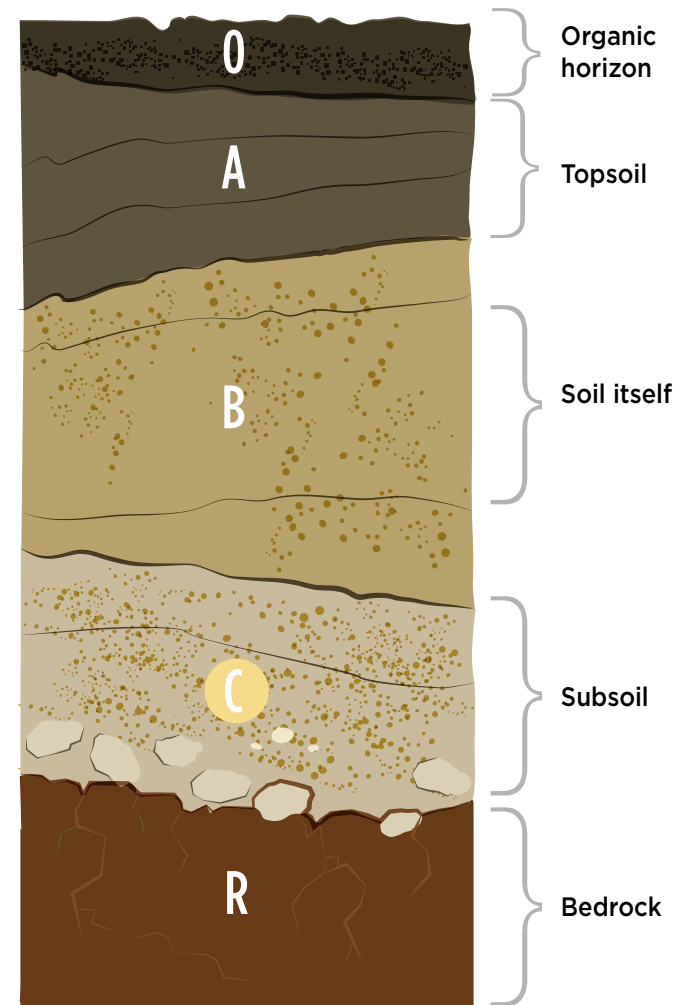
Soil is a complex mixture of eroded rocks, dissolved minerals, organic matter, tiny plant and animal organisms, air, and water. Many chemical, physical, and biological processes take place in soil—for example, as wind and water deposit sediments, and rocks are broken down and dissolved to form new minerals—and animals excrete organic material into it. These processes produce mineral nutrients, silt, clay, humus (fertilizer), and many other soil elements.

*Figure 4. Soil horizons*

- O** Consists of at least 35% partially decomposed organic material.
- A** Made up of very small particles of minerals. Rich in humus and dark in color, this layer is suitable for farming.
- B** Consists of mineral particles (separate or mixed with humus), concentrating gradually over time.
- C** Situated beneath the soil, consisting mostly of medium-to small-sized stones. Contains small quantities of organic material from the decomposition of deep roots.
- R** The deepest of the layers, consisting of huge rocks that form the subsoil and soil when they break down. Importantly, no life exists in this layer.

Soil is composed of several layers or “horizons. As soil formation progresses, horizontal layers varying in color, composition, and structure called “horizons” appear. The entire set of horizons is termed the soil profile.

Scientists who study soil (pedologists) have devised complex classification systems for the various soil horizons. The simplest system outlines the five most important (figure 4).



## Soil types

The type of soil, its chemical composition, and its organic origins greatly affect agriculture and thus all of our lives. Categorized according to texture and composition, the main soil types are:

- » **Sandy soil:** This soil is light, loose, easy to till, and not very fertile. It filters water quickly and contains few nutrient reserves. Sandy soil will not form a ball when you roll it in your fingers.
- » **Silty soil:** Although this soil also filters water quickly and is easy to till, its medium-sized granules make it fertile. Silty soil forms a tiny but breakable ball when you roll it in your fingers.
- » **Clay:** This soil's extremely fine particles do not easily filter water and air; instead, it forms a heavy, nutrient-dense, fertile clay when saturated with water and is difficult to till when dry. You can easily form a ball (similar in texture to chewing gum) when you roll it in your hand.

In addition to these three main types, there are soil combinations such as silty clay, sandy clay, sandy silt, and clay loam (a combination of all three types).

Regardless of type, all soils play five vital roles that benefit humans and the planet:

- » Sustaining biological activity, diversity, and productivity
- » Regulating and distributing water and the minerals dissolved in it
- » Filtering, draining, immobilizing, and detoxifying organic and inorganic materials, including municipal and industrial waste
- » Storing and facilitating the cycle of nutrients and other biogeochemical elements
- » Supporting socioeconomic activities and protecting archeological treasures

Knowing the soil types is important to farmers because each type must be managed differently. For example, crops planted in sandy soil may need to be watered more often than crops planted in clay, while farms with more clay in the soil need better drainage systems than those with sandier soil.

## Agriculture: Cultivating the soil

Although we depend on agriculture for most of our food and raw materials, farmers and agricultural workers are often underappreciated by city dwellers.

Yet keeping up with cities' growing demand for food and resources takes a great deal of knowledge and skill! As in any other profession, farmers have had to evolve with the times, developing increasingly more sophisticated and productive growing techniques that fit the needs and characteristics of their region, taking maximum advantage of local "assets" or conditions, and making the best use of available technology. Below are some of the soil cultivation methods in use today.

*Manual or industrial monoculture.* Farmers using this agricultural method specialize in growing a single crop, such as coffee or corn. While this can produce high yields (which is why some producers use it), it is also the most harmful to local ecosystems. The land must be completely cleared and the soil tilled before planting the chosen crop, and this leads to erosion. In addition, this method requires the use of fertilizers, pesticides, and other chemicals, which disrupts the soil's natural balance and depletes its nutrients and leads to other serious consequences. Thus, the benefit this method affords to farmers comes at a high cost, since large expanses of land are used and then quickly depleted.

*Polyculture or traditional agriculture.* This type of farming has been carried out in Latin America for many years on small properties known as *chagras* or *chacras*, which are farmed for subsistence, barter, or less often, for production and trade. In this system, farmers grow a combination of plant species close together, such as corn, beans, and squash. They may or may not clear the land of other species before planting. Depending on which species is being sowed, the land might have to be prepared with fertilizers prior to planting. Crops are planted in various locations and rotated each season to minimize stress on the soil. Whether or not this system damages the local ecosystem depends on the amount of clearing and the chemicals used.

*Organic or ecological agriculture.* This agricultural method makes optimal use of resources, favors soil fertility and biological action, minimizes the use of nonrenewable resources, and

requires no synthetic fertilizers and pesticides. In this system farmers use organic fertilizers or compost, sow crops alongside “protector” plant species, and use pesticides made from natural plant compounds. The land may or may not be cleared. This type of agriculture aims to protect the soil; hence, it does not use any manmade chemicals (such as conventional pesticides or agrochemicals) to fertilize the soil or to eliminate pests. Most organic farming is polyculture farming as well.

*Natural agriculture.* Also known as “do-nothing” farming, this approach aims to reap maximum benefit from the land without disturbing its natural ecological niche. To protect nutrients, microorganisms, small organisms, and earthworms, the land is

*Figure 5. Urban agriculture*



not tilled. No fertilizers are used; instead, the soil is nourished by decaying plants and animals. Farmers also do not weed; “weeds” are controlled by spreading straw, planting white clover, or briefly flooding the land. No agrochemicals are used, so plants do not become vulnerable to diseases and pests.

## Urban agriculture

As food prices rise, people are beginning to “farm” in small city areas, such as on rooftops, patios, and terraces. This is known as urban agriculture.<sup>1</sup>

Urban agriculture (and periurban agriculture on the outskirts of cities) may help mitigate food insecurity in Latin America and the Caribbean. Currently 78 percent of the population lives in urban areas, and the United Nations (UN) projects the figure will increase to 88 percent by 2050. As the number of rural farmers has declined amid the growth of cities, concern over food security has prompted several international organizations—including the World Bank, the UN’s Food and Agriculture Organization (FAO), and the Inter-American Development Bank (IDB)—to support projects addressing the situation.

<sup>1</sup> To learn more about planting crops, see the School Green Areas module in Rise Up’s Green School Kit at [www.iadb.org/riseup](http://www.iadb.org/riseup).





Urban agriculture uses home gardens, terraces, and roofs to produce food. According to the FAO ([www.fao.org](http://www.fao.org)), this practice offers the following benefits:

- » Improves family nutrition
- » Generates additional resources from the sale of surplus production
- » Generates bonds between communities by working together
- » Generates community networks by promoting knowledge sharing among farmers
- » Allows participatory territorial planning
- » Increases the city's green areas
- » Promotes the efficient use of natural resources
- » Recovers knowledge and traditions
- » Promotes gender equality through the inclusion of women
- » Reduces the use of fossil fuels for transporting produce, mitigating climate change

### For each crop, a region and a season

All farmers, whether they reside in urban or rural areas, have to learn about plants, local geographical features, and weather patterns, and then use this knowledge to meet their crops' needs during planting, sowing, and harvesting. Rice plants, for example, need lots of water to grow, so they must be planted in the rainy season. Citrus trees should be planted at the height of the winter **so the fruit can ripen** during the spring. Melons should be planted in the spring following the frosts. And bananas require high temperatures and lots of moisture, so they should be planted in the tropics.

As we saw in the **module 1 of this series “Our climate is changing”** countries in the boreal and austral regions (located above the Tropic of Cancer or below the Tropic of Capricorn) have seasons with pronounced temperature changes, while those in the intertropical region (close to the Equator) have consistent temperatures year-round with seasons determined by the quantity of rainfall. Food availability in each region and season depends on these climatic and geographical conditions.

To grow food, farmers must understand their crops' requirements for light, heat, and moisture, along with their germination and growth periods. Farmers rely on **planting calendars**, which tell them which crops can be grown in each region of the world.

### What are planting calendars?

Planting calendars are diagrams or tables that identify which seasons of the year are the most conducive for producing crops in a given region. Planting calendars harness ancestral information and modern technical knowledge to help growers determine when they should cultivate certain crops. Some calendars list individual foods, while others group similar foods in categories, such as garden vegetables, fruit trees, grains, and so on.

While these calendars are useful for determining when to plant or harvest a crop, farmers also need to know which regions are best suited for which crops, since planting and growing seasons vary by region and climate. Below we'll examine some of the climate variations that must be considered when planting crops in Latin America and the Caribbean.

Since the Earth is tilted on its axis, the sun's rays strike its surface at different angles as it revolves around the sun. These differences in the angles at which each hemisphere receives sunlight cause seasonal changes, or climatic seasons, in both hemispheres throughout the year.

*Planting in the Southern Hemisphere.* The Southern Hemisphere has four climatic seasons: winter, spring, summer, and fall. In Latin America, these seasons occur in countries below the Tropic of Capricorn, such as Argentina, Chile, Uruguay, and Paraguay.

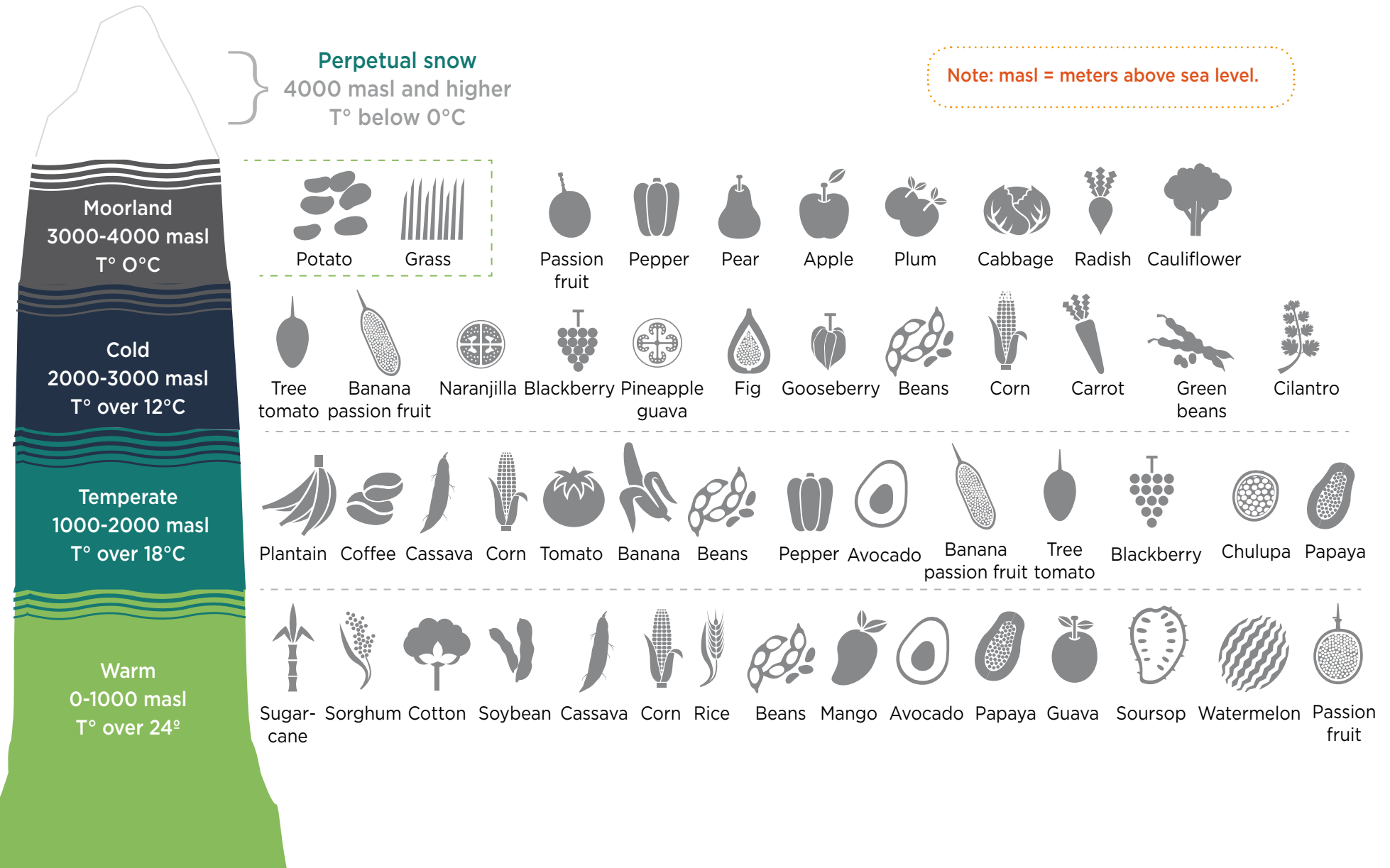
Climatic seasons influence the types of crops that can be grown as well as their planting and harvesting times. As a result, the availability of many foods depends on the time of year. Some crops, however, are able to adapt to seasonal climate conditions. For example, certain plant species have adapted to survive conditions of extreme heat and cold, or strong winds.

*Planting in the tropics.* In the tropics, weather conditions are generally stable year-round, without dramatic variations, and a region's climate depends on its topography and elevation. Variations in **elevation** and **temperature range** enable farmers to

grow different plants simultaneously, producing a variety of foods throughout the year (see figure 6). For instance, farmers can grow rice—which requires a warm, rainy climate—in a tropical valley, while also growing beans and tomatoes in cooler, drier, areas at higher elevations.

The Latin American and Caribbean countries (such as Mexico, Guatemala, the Antilles, Venezuela, Colombia, Ecuador, and Peru), which are located near the Equator (between the tropics of Cancer and Capricorn) have tropical climates, allowing for this type of farming.

Figure 6. Agriculture at various elevations and temperature ranges



## Our food

Having access to a variety of foods is important because our bodies need energy and nutrients to function properly and stay healthy. The quality, quantity, and combinations of the foods we include in our diet determine the quality of our physical and mental health and our energy levels. We need to eat a variety of nutritious foods every day in order to be, feel, and look our best.

### Food groups

Foods are classified according to their nutritional value in terms of vitamins, minerals, proteins, fats, and carbohydrates, which include sugars, starches, and fiber. Our bodies need all of these nutrients, which is why eating a balanced diet is so important. It is ideal to consume a variety of foods from food groups 1-4 (listed below); eating too much or too little of any of them can lead to metabolic imbalances, or even disease. Group 5 is the exception; it is a catch-all category for foods that we should eat infrequently, or even eliminate altogether.

- » *Group 1: Meat, fish, eggs, seeds, nuts, and legumes.* These foods are rich in high-quality **protein**. They are also good sources of **minerals**, such as iron and zinc, and **vitamins** A, D, and B. Nuts also provide healthy **fats** and **vitamin** E, while legumes contribute **carbohydrates** and **fiber**. However, when eating meat it's important to choose lean cuts to avoid eating too much saturated fat, which is less healthy than the type of fat found in nuts and seeds.
- » *Group 2: Milk and dairy products.* Like Group 1 foods, these foods are rich in high-quality **protein**. They also provide some **carbohydrates**, **minerals** such as calcium and phosphorus, and **vitamins** A, D, and B. Dairy products are often also rich sources of **fat**, and while eating a serving or two every day is OK, it's a good idea to watch your portion sizes (e.g., drink one cup of milk for breakfast, not three!).

Figure 7. The five food groups





- » *Group 3: Fruits and vegetables.* These are foods you should eat at each meal and in relatively large amounts. Low in calories and highly nutritious, they provide **carbohydrates**, many **vitamins** (especially A and C) and **minerals**, and even some **protein**. They are also high in **fiber** and are generally low in fat (except for avocados, olives, and coconuts, which are good sources of healthy fats).
- » *Group 4: Grains, cereals, and tubers.* These foods are rich in **carbohydrates**, vegetable-based **proteins**, and **fiber**. They are also good sources of **vitamins** B and E, and many **minerals**, such as magnesium and manganese. It's important to choose 100-percent whole grains (i.e., brown rice, whole wheat, whole oats, whole corn, whole quinoa, etc.) whenever possible, and to limit white rice and breads and other foods made with refined flours (i.e., labeled in food ingredient lists as "wheat flour," "corn starch," etc.), since the refining process removes many valuable nutrients. Eating too many refined grains and flours has been associated with obesity as well as the development of diseases such as diabetes, heart disease, and certain cancers.
- » *Group 5: Sweets, soft drinks, and fried foods.* These foods are high in **sugars**, **fats**, and **salt**, and should be eaten only occasionally and in moderation (or even eliminated entirely). Frequent consumption of these foods is linked to obesity and many diseases.

## Food for all

Proper nutrition includes both the quality and quantity of the foods required for good physical and mental health. Improper nutrition may lead to undernourishment, which generally affects the poor, who lack the economic means to obtain sufficient food. Despite global efforts to eradicate undernourishment and hunger, some 870 million people were still undernourished between 2010 and 2012, according to the FAO.

Millions of people have little or no access to protein-rich foods such as meat, fish, and eggs. In addition to economic factors such

as rising food and fuel costs, food shortages are also caused by weather events and factors related to climate change.

One of the most serious environmental and food security issues we currently face is the depletion of the world's fisheries. The number of depleted fish reserves increased by 13 percent between 1992 and 2012; these reserves simply have no more fish. Today, 85% of the fish reserves are overexploited, depleted, or in recovery, and only 15 percent of the world's reserves are currently underexploited.<sup>2</sup>

Yet as fishing reserves decline, the UN Environmental Programme (UNEP) warns that more than 500 million people worldwide depend on fishing and aquaculture to live, and the availability of fish helps feed 3 billion people. Public policies and international agreements are therefore urgently needed to regulate the world's fishing operations, care for the marine environment, and ultimately help prevent the undernourishment of vast numbers of people.

Extreme weather events (such as droughts, floods, melting glaciers, and other global changes) have also affected crops in recent years, influencing food availability and prices and threatening food security.

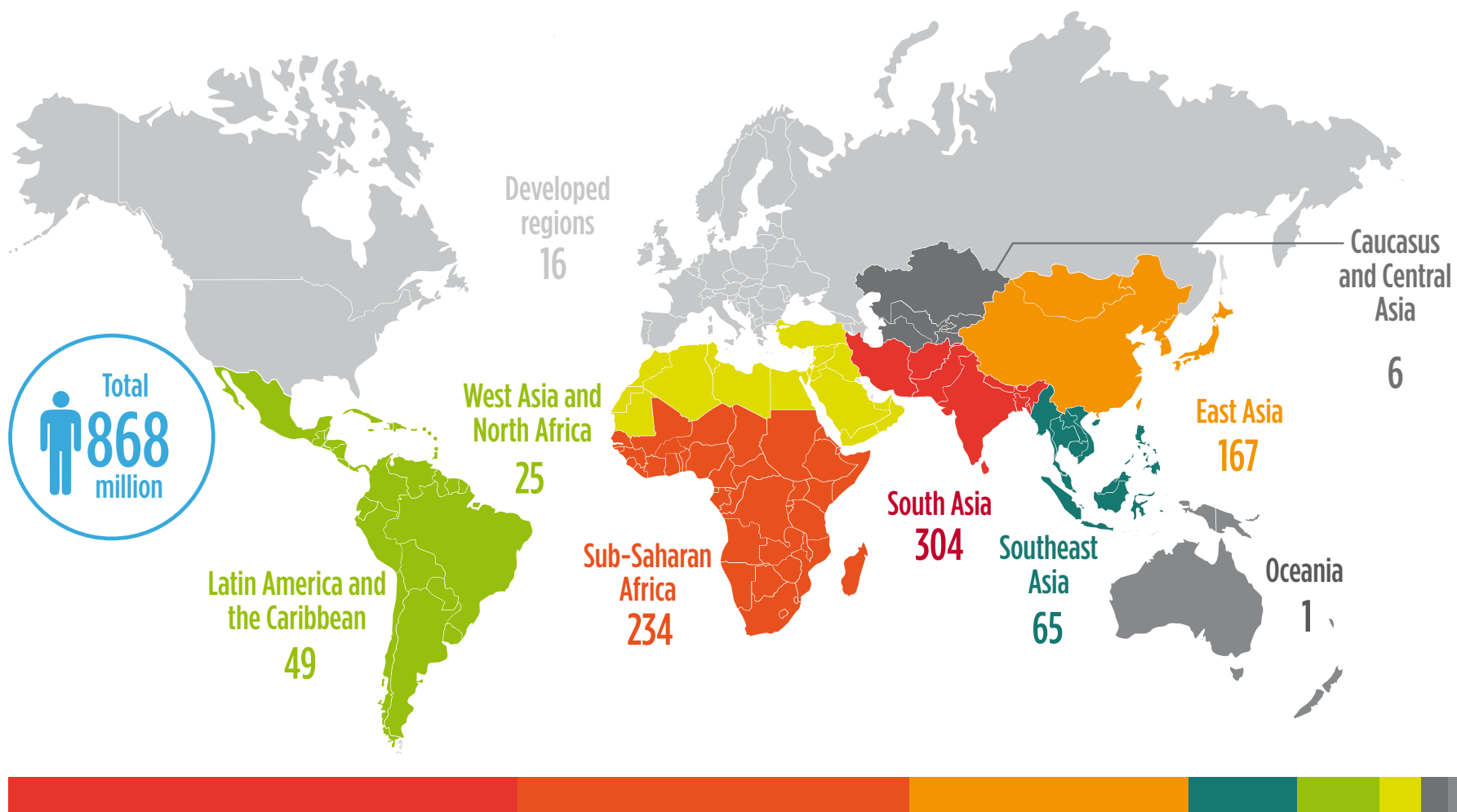
## What's water got to do with it?

We can't grow food without water. Yet climate change is dramatically changing the distribution of rainwater on the planet. Rising temperatures alter weather patterns, leading to droughts in some regions and floods in others. This has a drastic impact on crop and livestock production.

Many coastal areas throughout the world are seeing much more rain than in the past. Crops are more prone to damage from heavy rains, hail, and flooding; greater numbers of pests; and frost and other effects of sudden temperature changes. Likewise, fishing production declines due to the climate changes that affect the temperature of the oceans.

<sup>2</sup> UNEP (United Nations Environment Programme), "Keeping Track of Our Changing Environment: From Río to Río+20 (1992-2012)," 2011, [http://www.unep.org/geo/pdfs/keeping\\_track.pdf](http://www.unep.org/geo/pdfs/keeping_track.pdf).

Figure 8. Undernourishment in developing countries, by region (in millions of people, 2010–12)



Source: [www.fao.org](http://www.fao.org).

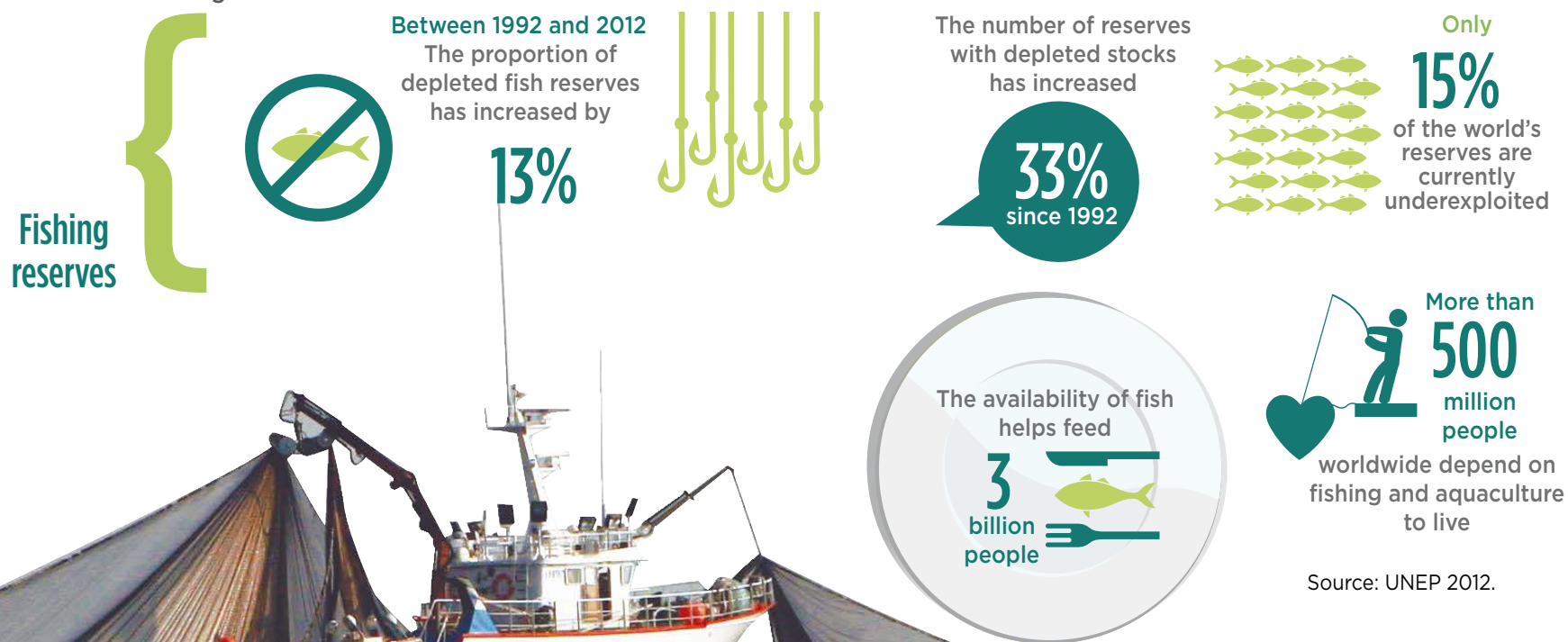
Conversely, many inland areas are experiencing longer droughts that dry the land and weaken or kill crops that need ample water to survive. These extreme droughts increase the demand for irrigation; however, many South American and Caribbean farming operations use obsolete technologies that actually exacerbate the damage.

The changes in rainfall distribution also deplete the Earth's fertile topsoil—the nutrient layer covering the planet—further damaging food crops, which leads to economic losses. This is especially alarming since topsoil is a nonrenewable resource. It takes anywhere from 100 to 500 years for just 25 millimeters of topsoil to form naturally; yet this outermost layer of soil is being eroded at ever-higher rates due to increased rainfall combined with overexploitation of the land and urban development.

Unfortunately, many South American and Caribbean farmers have responded to these drastic changes in rainwater distribution and other climate- and weather-related challenges by turning to shortsighted agricultural techniques such as heavy chemical use. While these methods may support crop production in the short term, they ultimately cause further damage to local ecosystems, threatening the sustainability of the agricultural system and creating greater food insecurity.<sup>3</sup> Local food producers must learn new technologies to combat climate change while they draw on the traditional agricultural knowledge of indigenous and other peoples—which, according to the UN's Food and Agriculture Organization, are among the best practices for sustainable agriculture. Only then will these regions be able to achieve food security and food sovereignty.

3 Ibid.

Figure 9. World's fishing reserves



## Food security and food sovereignty

According to the FAO, “Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious foods to meet their dietary needs and food preferences, in order to lead an active and healthy life.” The four pillars of food security are availability, access, use, and stability.<sup>4</sup>

Food sovereignty is understood as “the right of all people to define their own food and agricultural policies in order to obtain sustainable development and food security objectives. . . This involves protecting domestic markets against the surplus of products that are sold cheaper in the international market and against the not-so-legitimate practice of selling at prices below production costs.”<sup>5</sup>

Food sovereignty favors local food production on farms, fisheries, and pastures, as well as methods of distribution and consumption that are environmentally, socially, and economically sustainable. It guarantees local farmers the right to use the land, water, seeds, livestock, and local biodiversity to produce food for the local population. Moreover, it tends to favor transparent trade, and it prevents large international food producers from sabotaging local farmers and agricultural markets.

Food security and food sovereignty have the same goal: guaranteeing access to sufficient, safe, and nutritious foods. However, advocates of each fiercely disagree on how to achieve this.

Advocates of food sovereignty argue that an emphasis on food security undermines local production and violates the right of the people to define their own agricultural and food policies. They also claim that it exposes people to foods contaminated by genetically modified organisms and promotes “unsustainable and unfair international trade.” Food sovereignty proponents argue that food access problems cannot be solved without local sustainable development. Ensuring equal access to land, seeds, and water and favoring local and ancestral technologies are the prerequisites for that development. They also claim that evidence shows these

4 FAO (Food and Agriculture Organization), “The State of Food Security in the World,” <http://www.fao.org/docrep/016/i3027e/i3027e00.htm>.

5 FAO, “Soberanía alimentaria—Agronoticias América Latina y el Caribe,” <http://www.fao.org>.

methods produce better results than high-tech agricultural methods.

Proponents of food security, however, argue that countries can also meet their food needs with imported products, even when those same products are produced locally. They believe that improving people’s access to food is more important than shoring up local production to meet the demand, especially if imported foods are less expensive.

Although the debate continues, more and more countries are embracing food sovereignty as part of their agricultural policy. Ecuador was the first Latin American country to include the concept in its constitution, while Nicaragua, Mexico, and Costa Rica, among others, have laws or bills addressing it. In addition, the UN General Assembly approved the Optional Protocol to the International Covenant on Economic, Social, and Cultural Rights, which allows violations of the right to food to be reported to the international judicial system.

As the concepts of food security and food sovereignty gain acceptance, policies that promote sustainable agricultural technologies and practices will be adopted and agricultural producers will make greater efforts to protect biodiversity and use sustainable technologies. Such measures will be essential to minimize the strong impact of climate change on food production.

### Genetic engineering of foods

As scientists and biotechnologists search for solutions to protect agriculture and the food supply from the effects of climate change, they’ve developed sophisticated genetic engineering techniques to manipulate the genes of food crops for specific purposes. Genetically modified organisms (GMOs) are one such development. These are seeds that have been genetically altered to improve their resistance to pests, their adaptation to insecticides and temperature extremes, as well as poor growing conditions such as eroded, nutrient-poor soil, water scarcity, and mineral contamination. Scientists have also created crops that grow and mature faster, and that have added nutrients.

While genetic engineering of foods may increase food security in the short term, we must beware of potential negative impacts that may threaten food security, food sovereignty, or even human health in the long run.

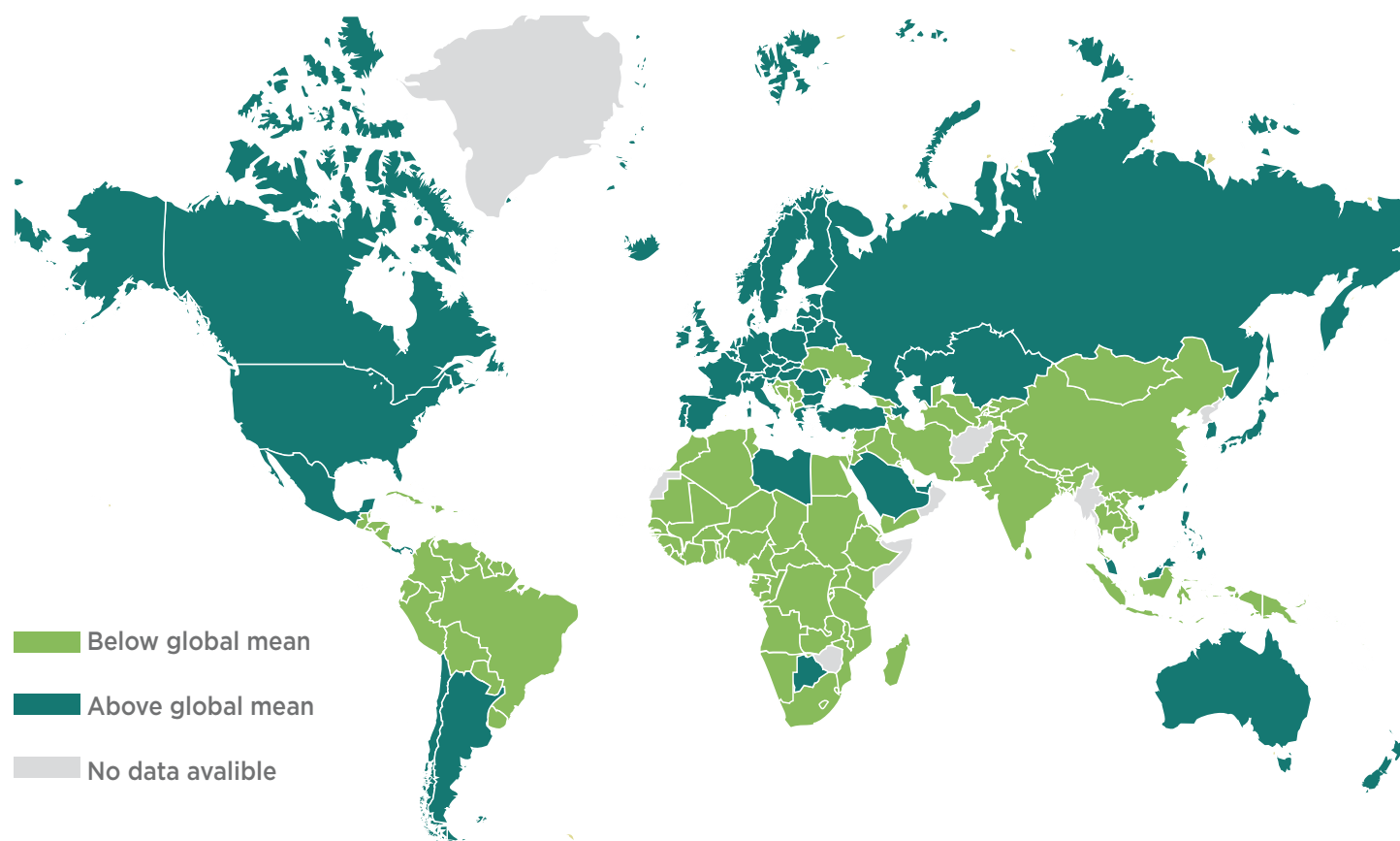
A variety of concerns have so far been raised:

- » Although no definitive conclusions have been reached, some claim that GMO foods may influence the development of cancer and other human diseases.
- » The transnational or multinational companies that have developed GMO technologies have the capacity to monopolize worldwide food production, affecting local

economies, limiting local production, and eliminating small farmers.

- » Biodiversity may suffer as many species may become extinct and only a few survive.
- » Using more and stronger herbicides may damage human health and ecosystems.

*Figure 10. Economic development around the world (as measured in GDP per capita), 2010*



Source: UNEP GEO Data Portal, as compiled from the World Bank, UNPD.

Note: GDP = gross domestic product. All data are for year 2010 except the 2009 data used for Australia Brunei Darussalam, Iran, Libya, Qatar, Saudi Arabia, the United Arab Emirates, and Yemen.

The crops and foods that have been subject to the most genetic engineering thus far are corn, soybeans, canola, rice, wheat, and cotton. Argentina, the United States, and Canada are the main producers of GMO crops.

### Organic or ecological agriculture

At the other end of the spectrum from genetic engineering is organic or ecological agriculture. While not as high-tech as genetic engineering, organic agriculture may be a highly effective solution to climate change in that it “maximizes the use of farm resources, emphasizing soil fertility and biological activity, while at the same time minimizing the use of non-renewable resources and completely eliminating the use of synthetic fertilizers and pesticides in order to protect the environment and human health.”<sup>6</sup>

Organic agriculture is concerned with avoiding synthetic fertilizers and pesticides and excessive energy use as well as maintaining ecosystems and biodiversity.<sup>7</sup> Organic production contributes to food security since it allows inhabitants of the world’s poorest rural areas to become self-sufficient, freeing them from having to pay rising food prices.

6 FAO, “Is Certification Right for Me?” Economic and Social Department, FAO. [www.fao.org](http://www.fao.org).

7 FAO, Organic Agriculture and the Law, FAO Legislative Study 107, 2012, <http://www.fao.org>.

Among their many advantages, organic agriculture processes:

- » Reduce erosion, pollution, and variations in the water cycle, since they do not rely on synthetic fertilizers and pest control.
- » Are 25–81 percent more energy efficient than traditional farms, depending on the soil and climate.
- » Generate 48–66 percent fewer carbon emissions than conventional farms, as organic matter absorbs and transforms carbon.
- » Reduce nitrous oxide emissions, since organic crops use less nitrogen than conventional crops.
- » Promote biodiversity by taking advantage of a variety of plant and animal species to protect crops, which are perfect habitats for various species of birds, insects, and soil microorganisms.
- » Promote the health and welfare of animals; organic farmers typically reject the overuse of veterinary drugs, and supply animals with organic feed and adequate space, air, and protection.
- » Promote employment and local economic development by providing jobs for the local workforce throughout the year. The focus on diverse crops and maintaining local biodiversity and soil health reduces the need for farmers to migrate to urban areas.

Figure 11. Select international organic seals





- » Strengthen ties and networks in rural communities as organic farmers research new techniques and make joint decisions to address problems such as climate change and farm productivity.
- » Facilitate the creation of cooperatives and organizations to promote environmental stewardship, efficient production, product quality, and domestic and overseas trade.
- » Improve trading conditions, access to markets, and farm labor rights for small producers; many organic farms have adopted the principles of fair trade, promoting better economic conditions, improved health care, and access to social services.

Organic production is one of the fastest-growing sectors in the world's food economy. As consumers become aware of its benefits, many are willing to pay the higher price tag. Many prefer organic products because they have not been subject to pesticides or synthetic fertilizers and are better for the environment and human health. These consumer preferences strengthen the market for such products. National and international institutions can give organic labels to some products letting buyers choose th

### Vermicomposting: Another way to maintain and restore soil health

Like organic farming, vermicomposting is a way to restore soil quality, even in extreme cases where the land has been devastated by erosion and the excessive use of chemical fertilizers. The castings excreted by worms become nutrient-rich compost that serves as a natural fertilizer.

Many organic farmers who have manure, coffee pulp, or other waste products on hand use vermicomposting, as these so-called waste materials are actually ideal foods for earthworms. The Californian red worm is the most commonly used earthworm for vermicomposting.

Vermicomposting has only a few basic requirements. The farmer has to ensure that there is sufficient moisture, remain alert for some pests, and regulate the temperature of the waste piles.

Earthworms are also being used as raw material for the production of protein-rich animal feed, and even as a supplement in foods for humans.

*Figure 12. An example of vermicomposting*





Lesson Plans at the

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# Basic Level

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## Basic lesson plan 1: Where does our food come from?

### General objectives

- » Explain the relationships among plants, soil, and food.
- » Understand the importance of household organic waste as a raw material for fertilizer.

### Class activity 1: Experiment on competition among substrates

Objective	Time	Place
Observe the growth of a seed in different types of substrates	40 minutes (plus 1 month of monitoring)	Outdoors

#### Materials

- » One- or two-liter recycled plastic bottles, substrates (soil, sand, and small stones; soil with plastic, paper, and cardboard waste; soil with fruit peels; and animal bones), seeds of rapidly growing local plants, water, X-Acto knife, awl, absorbent torch wick, tables 1 and 2 for this experiment.

#### Preparation

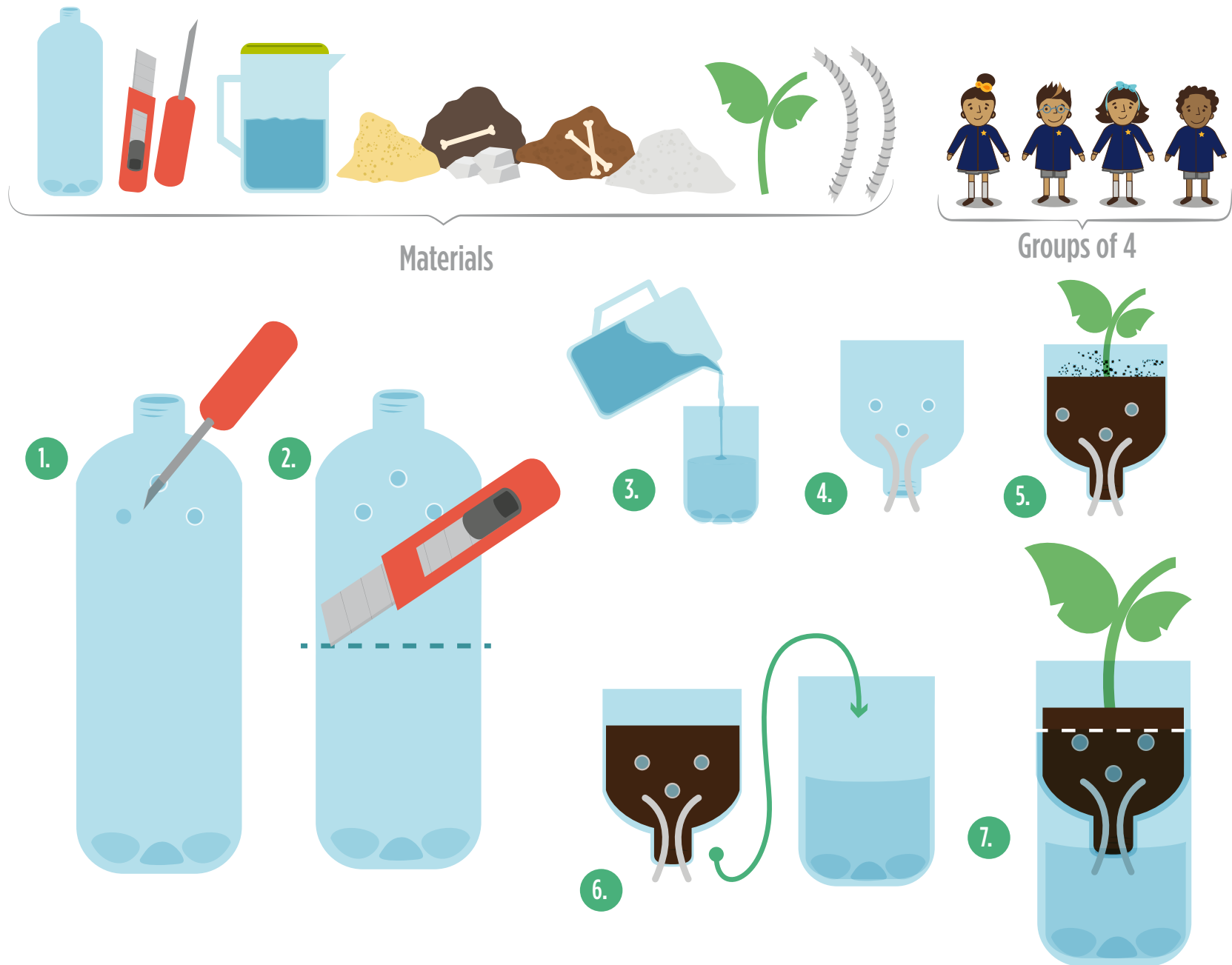
- » Ask about the availability of fast-growing seeds in your region, and instruct your students to bring some to class (or bring them yourself).
- » Prepare the materials and the substrates beforehand with help from your students.

- » Cut and prepare the bottles as illustrated in figure 13.
- » There are two parts to this experiment: The first is to germinate seeds in different substrates. The second is to work with the plants that are produced.

#### Step by step (figure 13)

- » Divide the class into groups of four.
- » Explain the term “substrate” (the substrate is like a home or foundation that supports a living being and meets certain basic needs, providing mooring, nutrition, protection, and water reserves) and give each group a different type of substrate, as well as a cut plastic bottle, water, and seeds. Ask: Can seeds grow in any type of substrate?
- » Have students cut a strip of absorbent wick and put it into the mouth of the bottle, leaving roughly 6 centimeters (cm) (2.36 inches, in.) hanging out.
- » Tell students to fill the bottle with the substrate they were assigned, with the wick facing downward.
- » Have them insert the part of the bottle with the substrate into the other half.
- » Ask them to plant the seeds 3 cm (1.18 in.) deep and cover them with the substrate.
- » Finally, tell them to dampen the substrate with a little water and put it outdoors.

Figure 13. Experiment: Competition among substrates



*Table 1. Observation log for the experiment with substrates*

	Conditions of the substrate	Condition of the seed
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		

- » Students should observe what happens to the seeds during the next 2 weeks, ensuring that the substrate stays damp but is not soaked. Ask students to record the conditions of the plant and the substrate in table 1.
- » After 2 weeks, ask the students to observe all of the substrates and the condition of the seeds in each one. Ask:
  - Did the seeds germinate?
  - Did you notice any changes in the substrates?
  - Which species of seeds germinated the fastest and best? Does this have anything to do with the substrate? Why?
  - Which substrates were least suitable for seed

germination?

- Can seeds grow in any kind of substrate?
  - What happens when seeds are planted in an unsuitable substrate?
- » Discuss how soil type affects germination time and plant quality. What would happen if a plant grew in nutrient-poor soil or if some type of pollutant were present? How would this influence the quality of the plant and the fruit it might bear?

- » Finally, tell them that it's up to us to monitor the Earth's soil, treat it as a resource, and oversee its continual renewal, since the soil is where we derive most of our resources to sustain life.
- » After the plants have germinated, have students observe their growth over the next 2 weeks.
- » Ask them to select the strongest-looking plants from the substrates experiment.

Table 2. Log for recording plant condition

	Outdoors in the sun	In the dark
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		

» After 1 week, ask:

- What differences did you observe between the plants outdoors and those kept in the dark?
- Which plants are stronger and have continued to grow?
- Ask: Did sunlight influence the plants' growth? How?
- Place a few plants outdoors in the sun and a few others in the dark. Ensure that they are well hydrated over the next few days.

- Have students observe the growth of the plants for 2 weeks and note changes in the plants (vitality, height, color, etc.) in each location. Have them record any changes in table 2. How does sunlight affect the plants?
- What other environmental changes may influence a plant's growth?
- Are we affected by changes in the environment in the same way as plants? Why?

### **Box 1. The effect of sunlight on plants**

Plants require light to feed themselves. They transform solar energy captured by chlorophyll into biochemical energy that feeds the whole plant. Both a shortage and an excess of light can be fatal to a plant. When a plant experiences too little or too much light, signs appear on its leaves, fruit, and stems in the form of blemishes, dryness, discoloration, and a loss of lushness.

**Shortage of light:** When plants receive too little light, they can't carry out photosynthesis properly, and as a result they get weaker and grow more slowly. Leaves turn yellow and flowers may fall off before fully opening or may not blossom at all.

**Excess of light:** When plants are exposed to too much sunlight, they can also be severely damaged. In this case, white spots may appear and the plant may become brown and dry. The plant will look wilted during the hottest hours of the day and the edges of the leaves may look burned and brown. The plant will lean away from the sunlight and the leaves will lose color.

Some plants, however, can withstand intense light or survive in low light. Different species have different needs.

Before growing any plant, it's important to know what type of plant it is and what conditions it needs to survive. Some vegetables, fruits, and flowers, for example, need to receive at least 6 hours of direct sunlight a day. Some plants benefit from exposure to the afternoon sun, which helps protect them from frost. Certain garden plants can survive in the shade and do fine with less than 6 hours of direct sunlight a day. Plants that grow underneath trees in the forest receive sunlight indirectly.

At the end of this month-long experiment, remind students that soil, plants, and food are interrelated and depend on many factors, including substrates and sunlight. Emphasize the products we receive from plants, such as food, the raw materials for medicines and for building furniture and houses—and even the oxygen we breathe.

## Class activity 2: How does soil get “fed”? (Composting)

Objective	Time	Place
Create compost and recycle nutrients into the soil.	40 minutes (plus 6 weeks of monitoring)	Outdoors

### Materials

- » Pickaxe, shovel, fruit peels, food scraps, water, dirt, sawdust, table 3 for this experiment.

### Preparation

- » Request permission to create a compost pile at school.
- » Prepare the material for each group beforehand, especially the organic solid waste and dirt.
- » If you are unable to secure a place to dig, groups may also produce compost in 50 cm (20 in.) square wooden boxes.

### Step by step

- » Talk to your students about what they do with food waste and shells at home. Do they throw them in the trash? Do they separate them? If so, what do they use them for?
- » Ask: Can organic waste be reused? Have you heard of “composting”? Tell students they will make compost from their food waste.
- » Have students dig a 1-meter or 1-yard square hole, 30–50 cm (12–20 in.) deep.

**Table 3. Log for recording observations of composting**

	Soil conditions	Presence of animals (you may include an illustration)	Presence of plants (you may include an illustration)
Week 1			
Week 2			
Week 3			
Week 4			
Week 5			
Week 6			

- » Put down a layer of sawdust on the bottom.
- » Have students add a layer of organic material, such as chunks of fruit, food scraps, eggshells, beans, rice, and other vegetable matter. Moisten this layer with water if it is dry.
- » Cover the waste with a layer of sawdust, followed by a layer of dirt.
- » Students should rotate the compost every 8 days for 6 weeks and water the material if it gets too dry. Have them record the changes they observe each week in table 3.
- » At the end of 6 weeks, ask students:
  - What changes did you observe over the past 6 weeks?
  - What happened to the organic materials over that time?
  - What factors affected the compost during these weeks?
  - Why is it important to compost using organic solid waste?
- » Explain that composting is a great way to reuse organic materials that would otherwise end up in landfills. It is a natural process that helps make soil fertile by incorporating nutrients from fruits, vegetables, eggshells, and seeds back into the ground.

## Class activity 3:

### Online game—Rise Up Food!

#### Objective

Understand what a plant needs to survive.

#### Preparation

Invite your students to play the video game entitled “Rise Up Food,” which they can find at [www.iadb.org/riseup](http://www.iadb.org/riseup).

## Formative assessment

Before proceeding to the next topic, ensure that students:

- » Understand soil characteristics and can differentiate between organic and inorganic components.
- » Understand the relationship between soil, plants, and food.
- » Can name the types of substrates.

## Integration with other subjects

- » **Science:** Research organisms that live in the soil (earthworms, beetle larvae, ants, etc.) and their potential benefits or harmful effects to agriculture.
- » **Language:** Create a comic strip about the life of an earthworm.

## Remember

- » Plants anchor themselves in the soil and are vital to our food supply. Soil does more than provide a home for plants; many life processes that support plants and animals occur in it. Just as there is no life without water, there is also no life without soil.
- » Although many plants can adapt to different types of soil, a weathering process must take place to prepare soil for future use.
- » Light is vital for plant development since it allows plants to produce their own food.

## Tip for the teacher

Let students experiment with soil and seeds to observe growth processes and learn about the relationship between soil and food.

#### Suggested reading and viewing

- » The website of the United Nations Food and Agriculture Organization provides a wealth of information on food and organic agriculture. [www.fao.org](http://www.fao.org).

## Basic lesson plan 2: Food for all!

### General objectives

- » Promote urban agriculture as a farming practice that contributes to reduced greenhouse gas (GHG) emissions and promotes food security.
- » Learn which foods grow locally and how to prepare them, as well as some traditional recipes.

### Class activity 1: Portable garden

Objective	Time	Place
Plant a school garden using two different substrates.	1 class (monitoring for 20 minutes per week while the plant grows)	Outdoors

#### Materials

- » **For “live” bottles:** 1- to 2-liter recycled plastic bottles, dirt, quick-growing seeds (e.g., garden vegetables), water, scalpel or X-Acto knife, awl, strong twine or string, table 4 for this experiment.
- » **For artificial substrates:** Recycled expanded polystyrene (styrofoam), plastic cups (recycled) or eggshells, deep rectangular plastic container (e.g., food storage container), sand, black plastic bag (recycled), quick-growing seeds (such as garden vegetables), water, X-Acto knife, awl, tape, water, material for composting, rice hulls, or sawdust.

#### Preparation

- » Aim to create two types of gardens, one using soil as a substrate and the other using artificial materials. You may choose to garden with one or both substrates.

- » If you choose to use the artificial substrate, have students prepare it as described in box 2.
- » Prepare an area in the school to place the crops. For “live” bottles, we suggest using a wall.
- » Do the experiment yourself first to see if any additional precautions are necessary and to learn which seeds are best suited for the experiment.
- » Prepare materials ahead of time and cut the bottles, or ask other teachers or volunteers to supervise and help students do it.
- » Use the compost from lesson plan 1 to supplement the substrate.

#### Step by step

- » Divide the students into groups of four, and give each group materials to make “live” bottles. Be sure each group have soil or an artificial substrate to work with.
- » Hold the bottle horizontally and mark the area that you will cut).
- » Using an X-Acto knife, cut along the line at the top of the bottle.
- » Heat the awl and use it to punch two holes roughly 2.54 cm (1 in.) from each side of the cut portion, and two more holes directly opposite the first two on the other side of the bottle. Make sure the holes line up.
- » Cut two 20 cm (8 in.) pieces of string or twine and insert these into each set of holes, passing all the way through the bottle. Tie knots at the bottom.



- » Fill the bottle halfway with soil or artificial substrate and plant and cover the seed. Water lightly and leave the bottle in a well-lit area that is protected from rainfall and animals. Use the string to hang the bottles on the wall as shown in figure 15.
- » Ensure that **“live” bottles** and containers with an **artificial substrate** are left in areas that get 6 hours of sunlight per day. Students should look at the plants every 3 days to observe their condition and to water them when needed.

Each group should enter its observations in the log in table 4 and compare the advantages of each substrate during the monitoring period.

- » Tell students that growing our own food is easy and healthy; it is less costly, both economically and environmentally, than buying food.

Figure 14. How to make a “live” bottle

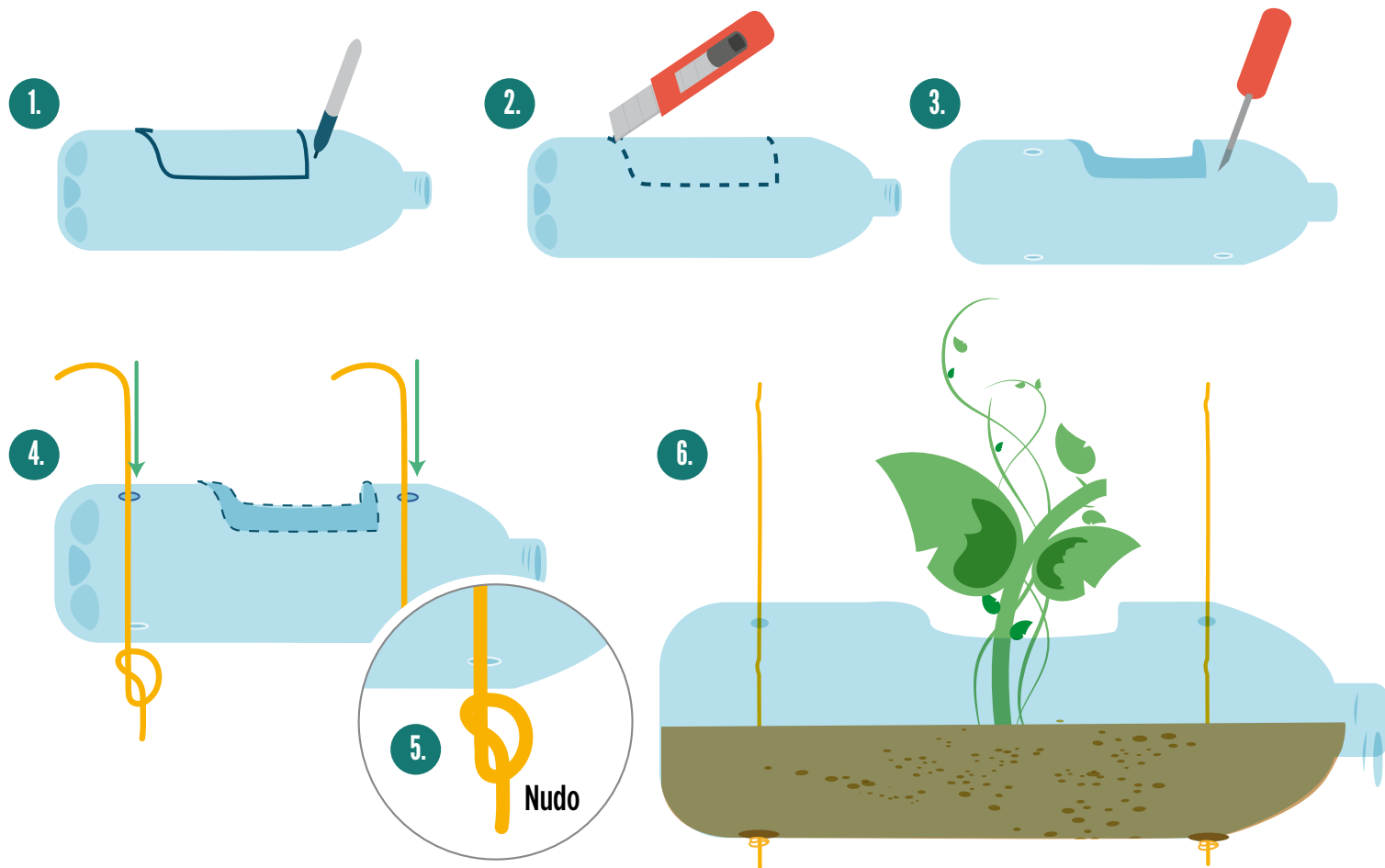


Figure 15. Arranging a group of live bottles

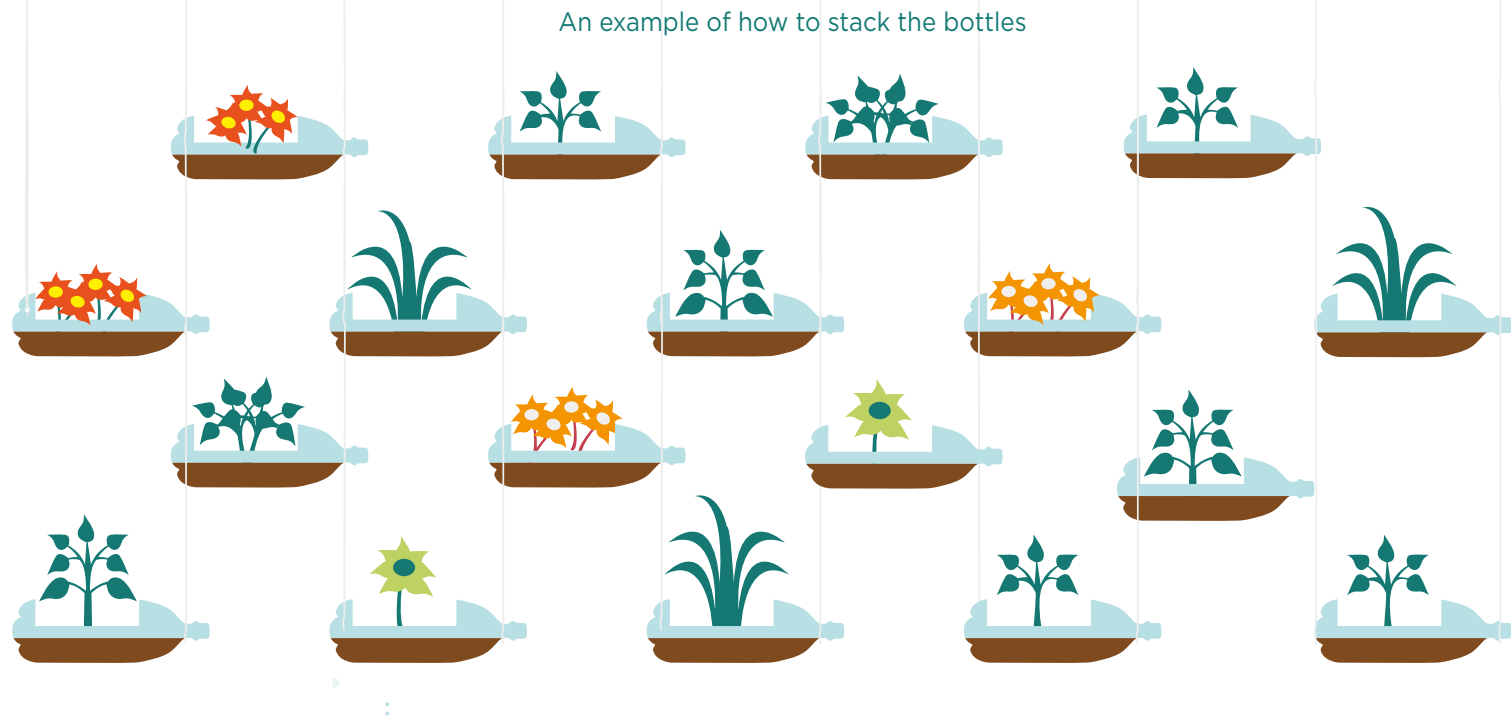


Table 4. Log for recording observations of plant growth in live bottles with soil and with artificial substrate

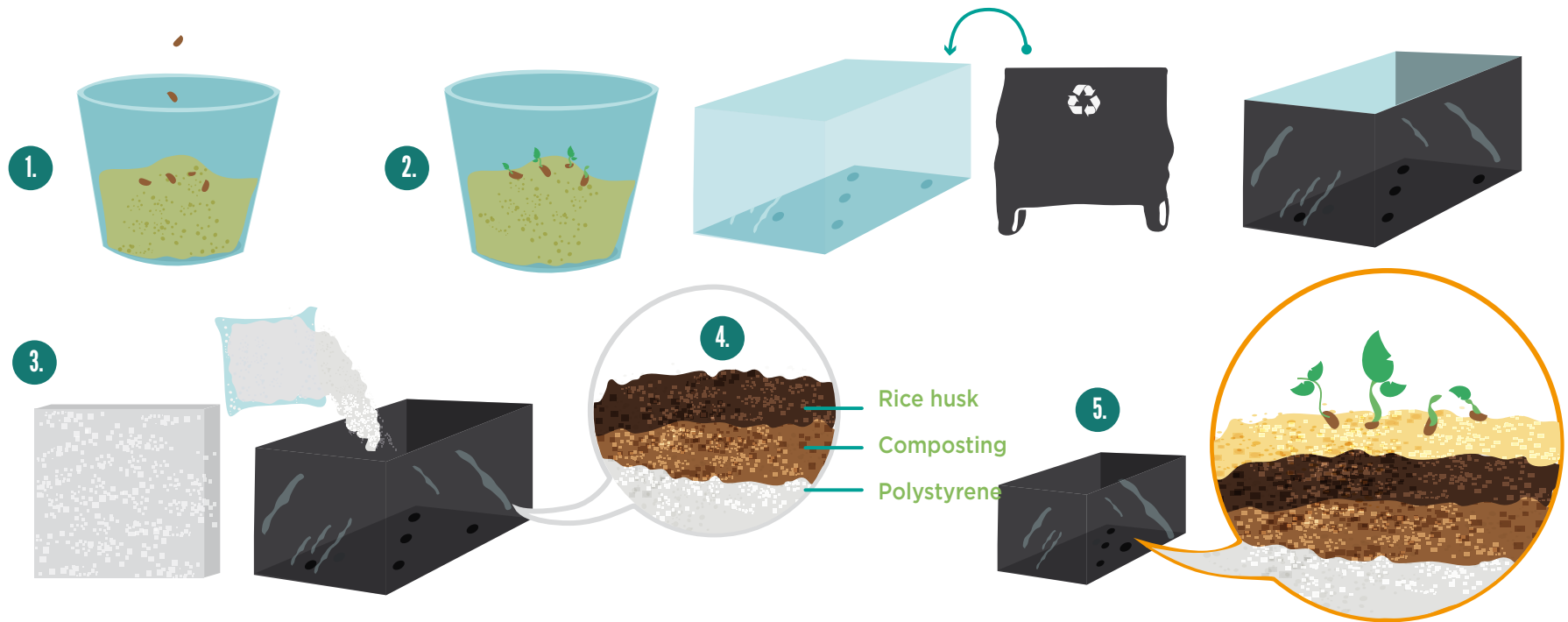
	Description of the “live” bottles substrate	Description of artificial substrate
Day 1		
Day 2		
Day 3		
Day 4		

## Box 2. Making artificial substrate

- » **Step 1.** This experiment requires getting seeds to germinate. Ask each group to sow seeds in plastic cups or open eggshells filled with wet sand. Leave the seeds in an area sheltered from the elements until the plants emerge.
- » **Step 2.** Once the plants have emerged, have students prepare the artificial substrate in which they will grow. Have them punch five holes in the bottom of the container and cover it tightly with black plastic.
- » **Step 3.** Ask students to crumble the artificial substrate (styrofoam) into fine granules and place these in the container.

- » **Step 4.** Have them add to the styrofoam a 50-50 mixture of compost and rice hulls/sawdust, and combine well.
- » **Step 5.** Ask your students to make a small hole in the artificial substrate, remove their plant from the cup, transplant it in the substrate (taking care not to damage the roots), and moisten it with water.

Both “live” bottles and container with artificial substrate should be left in a place where they receive 6 hours of daily sunshine and should be reviewed by the groups every three days to observe the state of the plant. They should spray it with water if necessary. Each group should complete the table below and compare the advantages of the two methods of cultivation on plant growth during ensuing days



## Class activity 2: Grandma's cookbook

Objective	Time	Place
<ul style="list-style-type: none"> <li>» Create a cookbook using the region's traditional foods, and prepare native recipes.</li> <li>» Promote consumption of local foods as a way to mitigate climate change.</li> </ul>	Five classes over two months	Classroom and neighborhood

### Materials

- » Small notebook, colored pencils, items needed to cook or prepare a recipe.

### Preparation

- » Ask permission to use the school kitchen or find another suitable place where students can prepare recipes from their cookbook once every 2 weeks.
- » Have students bring ingredients and supplies for each cooking session (four cooking sessions). Ask parent volunteers to supervise students and help prepare the food.

### Step by step

- » On the first class, ask students to research local foods and regional dishes with their parents, grandparents, and/or neighbors.
- » For each recipe, they should ask the person:
  - What is the recipe called?
  - Who taught you the recipe?
  - What ingredients are needed to prepare it?
  - How much time is required to prepare it?

- How much time is needed for cooking?
  - What variations exist for this recipe?
  - Why do people continue to make traditional foods such as this one?
- » Each student should research at least one dish of each group (an appetizer, soup, main dish, dessert, or beverage).
  - » In the subsequent class, organize students in groups of four and assign each group a cookbook category: appetizers, soups, main dishes, desserts, or beverages
  - » Ask your students to use table 5 to add their recipes to the respective category in their cookbook.

**Table 5. Sample form for recording recipes**

The [enter category] of my region	
Name of recipe and illustration:	
Ingredients:	
Total preparation time:	
Cooking time:	
Preparation:	
Variations:	

- » Have each group choose a recipe from the section of the cookbook assigned to them and divide the task of bringing the ingredients and materials. Every 2 weeks, the groups should prepare different recipes, rotating cookbook section assignments each time.
- » Once every group has prepared a recipe from each section of the cookbook, ask:
  - Which recipes were you already familiar with? Which ones had you tried before?
  - What is your favorite traditional recipe or food from our region?
  - How often do you eat this dish at home?
  - Why is it important to be acquainted with and eat traditional foods from our region?
  - What traditional foods have you tried from other regions or countries? What do you like about this food?
- » Tell students that we get more than nutrition from food; it also plays a role in a region's culture. Discuss the economic and environmental importance of consuming local foods in terms of transportation costs and GHG emissions.

### Formative assessment

Before proceeding to the next topic, ensure your students:

- » Are familiar with and know how to grow plants in two ways at home or at school
- » Are acquainted with and can prepare their region's traditional recipes, and understand the importance of food to regions and cultures

### Integration with other subjects

- » **Science:** Research agricultural and stockbreeding practices in your region and their effect on soil fertility.
- » **Language:** Write a composition on the origins of your favorite food.
- » **Social studies:** What is the relationship between people and food in your region? Where is the food made? What influence has food production had on the region's economy?

### Remember

- » Urban farming is a low-cost, practical solution to the food crisis for families.
- » Salvaging regional culinary traditions strengthens cultural identity.
- » Choosing to consume local foods helps to slow climate change.

### Tip for the teacher

Use these lesson plans to set up a regional native food fair involving the entire student body as a way to preserve cultural traditions and traditional knowledge.

### Suggested reading and viewing

- » Find recommendations for making the school environmentally friendly in module 7 of the Green School Toolkit. [www.iadb.org/riseup](http://www.iadb.org/riseup).



Lesson Plans at the

# Intermediate Level

## Intermediate lesson plan 1: We are links in a chain

### General objectives

- » Become acquainted with soil biodiversity and its importance as a mainstay of life.
- » Understand the flow of nature's energy through the food chain.

### Class activity 1:

#### Experiment: The soil is alive

Objective	Time	Place
Observe the physical and biological characteristics of different soil types.	2 hours	Outdoors

#### Materials (per group)

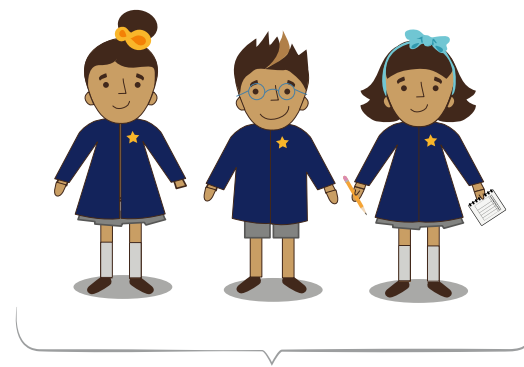
- » Plastic cups (recycled), 1 meter (or 1 yard) of string or twine, four stakes or sticks, measuring tape or yardstick, soil biodiversity sheet (box 3).

#### Preparation

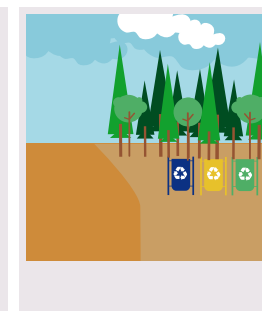
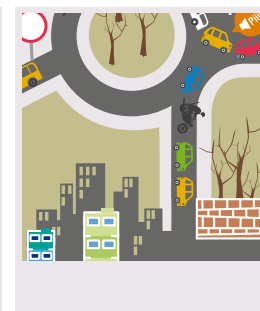
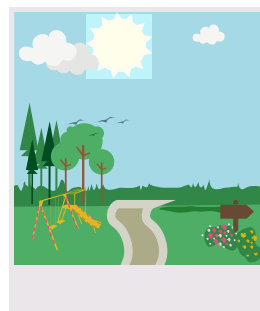
Find a park or green area where students can conduct the experiment.

### Step by step

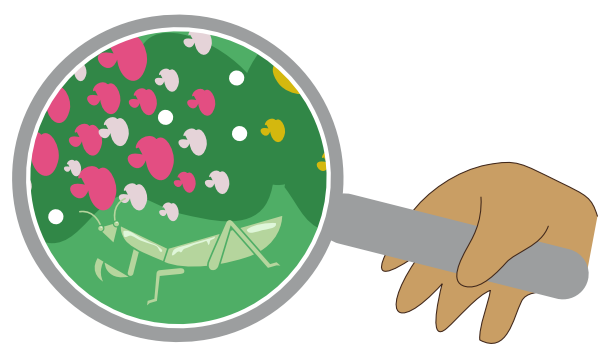
Organize students into groups of three or four. Each group must have its own materials.



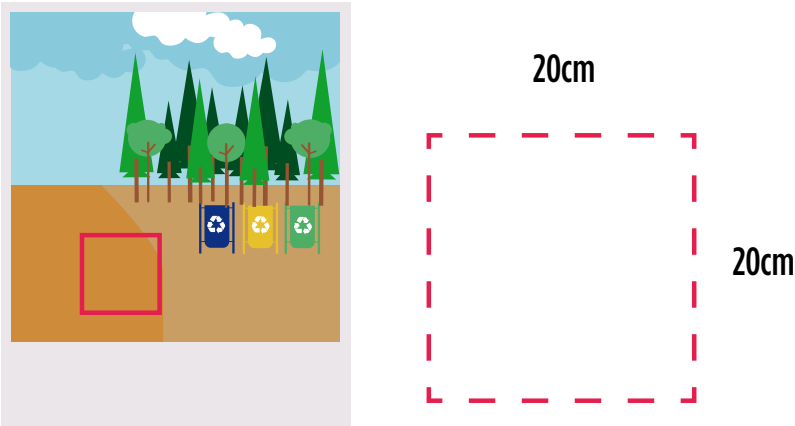
Tell students that each group must select three different outdoor spaces: a green area, a paved area, and an area with dirt.



Ask students if they believe there is life in the soil and if they believe there is life in the outdoor places they selected.



Ask them to mark off with string or twine an area 20 centimeters square (cm²) (8 x 8 in.) in each of these places.



Ask them to observe the quadrant and to record in table 6 what they see.

*Table 6. Log for recording observations of life in the soil*

	Soil	Weather conditions	Animals	Plants
	Moist or dry/ hard or soft/ color	Rainy/sunny/ snowy	Invertebrates/vertebrates	Shrubs/creeper plants/ trees/mosses
Green area				
Paved area				
Area with exposed dirt				



### Box 3. Soil biodiversity sheet

The name in parentheses corresponds to the taxonomic class to which the animal belongs:

*Earthworms (Oligochaeta)*. They eat dirt, decompose matter, produce humus, dig through the soil, improve soil infiltration and aeration, and reduce soil acidity.

*Ants (Insecta)*. They cut leaves and use them to cultivate a fungus that they feed on. They decompose matter, produce humus, dig through the soil, and improve infiltration and aeration.

*Centipedes (Diplopoda)*. Most centipedes are carnivores; they eat soft-bodied insects, spiders, worms, and other arthropods, including other centipedes. Some eat leaves. They decompose organic matter and produce humus.

*Millipedes (Chilopoda)*. They are carnivorous predators that feed on insects and other animals that live in the soil. They contribute to the production of humus.

*Beetles (Coleoptera)*. There are several species of beetles and their food sources vary. They may feed on flowers, fruits, leaves, manure, roots, seeds, and even wood. They decompose organic matter, produce humus, and disperse seeds.

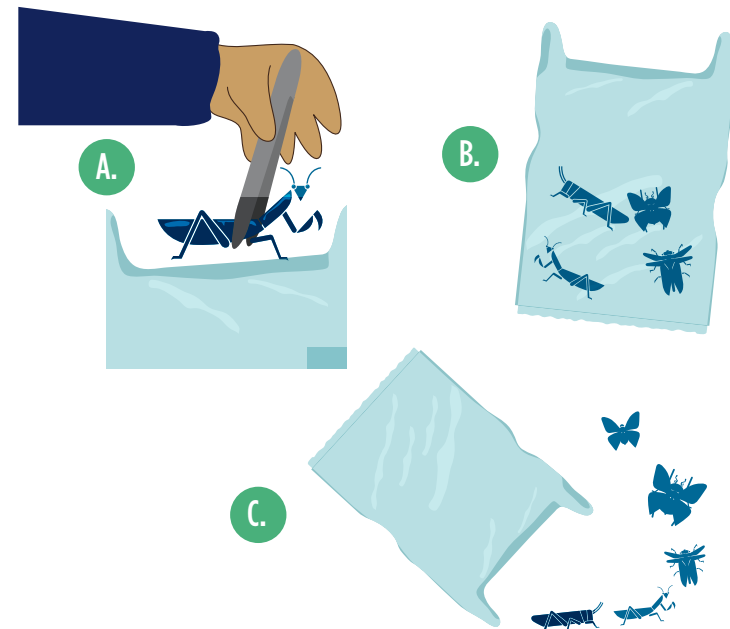
*Spiders (Arachnida)*. They eat insects and help control their numbers.

*Termites (Insecta)*. They eat wood, decompose organic matter, produce humus, dig through soil, and improve soil aeration and infiltration.

*Isopods (Malacostraca)*. They eat leaves, decompose organic matter, and produce humus.

*Earwigs (Insecta)*. They are omnivorous and eat various organisms that live in the soil.

- » Tell them to place the animal life they find in each quadrant into the plastic cups for identification and then to return them to where they found them. Use the Soil Biodiversity Sheet (box 3) as a guide to identifying the organisms students find in the experiment.



- » After students have recorded their comments about the three sites, ask them:
- What differences did you observe in the three areas?
  - Which areas had live organisms? What common characteristics in the areas favor life?
  - Which areas had both animal and plant life?
  - What characteristics did the animal life forms have in common? Did they have antennae, limbs, hair? Were they slimy, etc.?

- What happens when a sheet of concrete replaces a green area?
  - In which of these areas could a plant sprout or an animal live?
- » Ask them whether the findings in the green areas were representative of all green areas? What would conditions be like for these life forms in large expanses of soil in a forest, in the mountains, or close to the sea?
- » Discuss other animals that students may have observed at other sites and have them describe their characteristics—that is, whether the animals have legs, wings, and/or antennae; what they would eat; and what roles they would play in the soil.

## Class activity 2:

### Hunting for your own food

Objectives	Time	Place
Identify the dynamics of nutrients across the food chains.	1 hour	Outdoors

#### Materials

- » Five different colored bandanas to distinguish the people in each group. The number of bandanas is the same as the number of students, Five different colored ribbons or cards for each student and five additional cards for students in the group of plants (about 150 in total for a group of 22); whistle

#### Preparation

Find a large area where students can run safely. Mark off the area and set up five safe areas.

#### Step by step

- » Talk about relationships among the organisms of an ecosystem. For example, can one organism be food for another?
- » Have students heard the term “food chain”? Why is the word “chain” used in this context? Is it related to connections? What does “food” mean? *[Teacher note: Review the chapter text for this lesson plan.]*
- » Have students play a game that demonstrates how the food chain works. Groups will each represent a member of the food chain and the play area will represent the ecosystem.
- » Identify safe zones for each group. Explain that some animals must catch others, depending on their respective roles.

- » Organize students into five groups. The size of each group should reflect its position in the food chain; top levels should have fewer students than lower levels. For instance, in a class of 22 students, group sizes may be as follows:
  - Larger predators: 2 students
  - Omnivores: 3 students
  - Carnivores: 4 students
  - Herbivores: 5 students
  - Plants: 8 students
- » Begin by explaining the ecosystem's characteristics and assign an appropriate animal or plant to each group. For example: tell them you are in the jungle where a lion and wolf (large predators); a coyote, a fox, and a bear (omnivores); a bison, a gorilla, a hippo, a koala, and an ant (herbivores); a cheetah, a mongoose, a tiger, and a hyena (carnivores); a mangrove swamp, a bromeliad, an epiphytic, a giant bird of paradise, a fern, a bush, an orchid, and a palm (plants) live.
- » Give each group a different colored bandana; all group members will have the same color.
- » Give members of each team (except plants) five ribbons or cards of the same color—these represent “lives.” One of the cards or ribbons should be marked with an “X,” which represents “disease.” Give each member of the plant group 10 cards or ribbons, since they cannot eat any of the other groups.
- » The characteristics of the groups are as follows:
  - Large predators: Eat plants, herbivores, carnivores, and omnivores (including humans)
  - Omnivores: Eat plants and animals (herbivores and carnivores)
  - Carnivores: Eat flesh (herbivores and omnivores)
  - Herbivores: Eat plants
  - Plants: Must defend themselves from all predators

- » Each group starts the game in its “safe zone.” When you blow the whistle, students move out into the open in search of food and to defend themselves from predators. Plants pop out first, followed by herbivores, then carnivores, and so on—all the way up to the large predators. Each group must pop out in search of food and to dodge predators on the hunt. Any individual who is caught must give one life to its predator. After a few minutes, blow the whistle three times, signaling everyone to return to the safe zones to rest.
- » Rules:
  - All group members must stay within the ecosystem.
  - Once the whistle blows, no one can stay in the safe zone.
  - Players may only catch organisms upon which they naturally feed.
  - Any organism that's caught must hand over one life to its predator.
  - When a student runs out of lives, s/he must return to the safe zone.
  - Large predators must return to the safe zone if they accumulate five index cards with an “X” indicating disease.
- » Play several rounds. When you are finished, have each group add up the number of lives it has accumulated. Ask them how they felt when trapping and being trapped, and how they think wild animals feel in this situation. Ask what would happen if any of the groups lost all their lives? How would this affect the other groups?<sup>8</sup>

### Formative assessment

Before proceeding to the next topic, ensure that students understand:

- » The importance of living organisms to the soil
- » How food chains work

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<sup>8</sup> Game adapted from OPEPA, a Colombian environmental education organization. [www.opepa.org](http://www.opepa.org).

## Integration with other subjects

- » **Science:** Research the effects of detergents, oils, and other contaminants on the soil.
- » **Language:** Write a fable about an organism that lives in the soil and a pollutant that affects it.
- » **Mathematics:** Using the data from the earlier activity, “The soil is alive,” ask students to tabulate the total number of animals and plants found in each area and the number of different types. Have them plot a comparative graph of the three areas and discuss the findings, stressing the diversity and richness of each area.

## Tips for the teacher

- » Games and dynamic role-play help students understand topics in the curriculum by recreating the dynamics that occur in nature.
- » Hold a soil biodiversity costume contest. Have students create costumes using recyclable materials that represent organisms that live in the soil.

## Remember

- » Twenty-five percent of the world's species live in the soil. There is more biodiversity in the soil than on it. There are thousands of species in a cup of garden soil, and millions of individual organisms.
- » Soil biodiversity provides nourishment for plants; plants not only provide food for animals (including humans) but also fibers, timber, and raw materials for pharmaceuticals.
- » The biodiversity of the soil stores and releases carbon, helping to regulate the GHG cycle and the global climate. This directly affects human health, crop productivity, water resources, and food security.
- » Balance in the food chain ensures stable resource availability in ecosystems; if this equilibrium is altered, some populations may increase and others may completely disappear.

## Suggested reading and viewing

- » A class activity on organic matter and biological activity can be built around a presentation on “Conservation of Natural Resources for Sustainable Agriculture” available from the website of the FAO (the United Nations Food and Agriculture Organization). Students learn the processes of microorganisms in the soil as well as the role of bacteria, protozoa, and earthworms in circulating nutrients. In the search box at [www.fao.org](http://www.fao.org) enter “organic matter and biological activity” and scroll down to the link for the document.

## Intermediate lesson plan 2: I am what I eat

### General objectives

- » Understand how planting seasons work and the influence of climate on crops.
- » Become acquainted with the attributes of a healthy balanced diet.
- » Understand that good farming and food marketing practices help protect the Earth.

### Class activity 1: An agricultural calendar

Objectives	Time	Place
Create an agricultural calendar for a tropical, boreal, or austral region of Latin America.	1 hour	Classroom

#### Materials

- » Pasteboard, tempera paints, paintbrushes, markers.

#### Preparation

Research five crops grown in tropical and austral (in the Southern Hemisphere) regions of Latin America, including their planting and harvesting times, proper care and conditions, and the countries that grow and consume them.

Share this information with the class (write it on the board or print it out) and have students use it to create a planting calendar for these crops.

### Step by step

- » Organize students in groups of four.
- » Assign each group one food grown in the tropics and one grown in the austral region (see examples in box 4).
- » Have each group draw two foods on pasteboard and cut them out.
- » Use the information you have brought in to class to discuss:
  - What time of year are the crops planted?
  - What time of year are they harvested?
  - What specific care do they need to grow?
  - What countries grow these crops?
  - Where are they consumed? How often?
- » Hand out or show students the planting calendar form and ask them to fill in:
  - The months of the year
  - Rainy and dry seasons (tropical region)
  - Seasons (austral region)

Figure 16. Seasons in the austral region

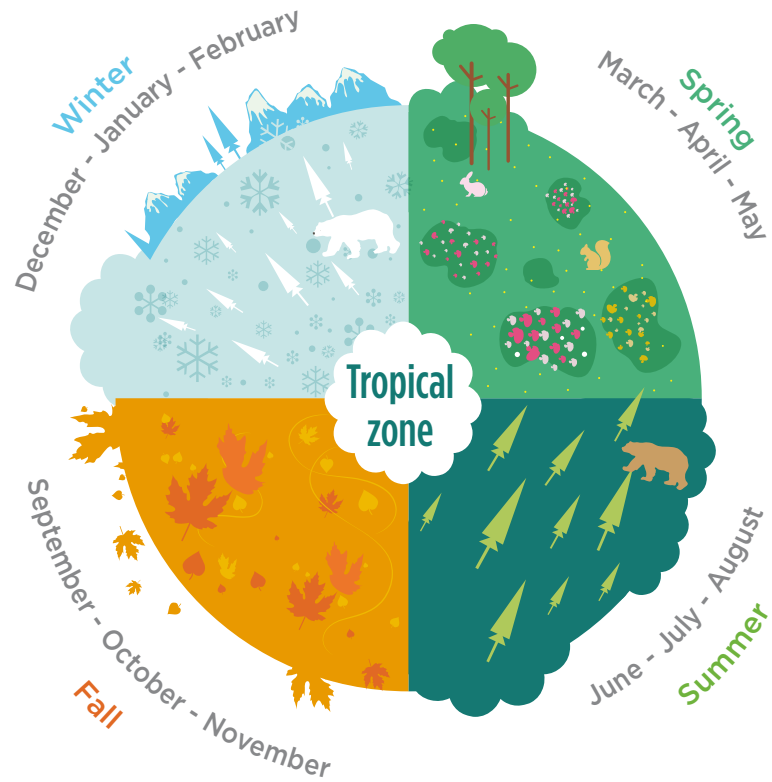
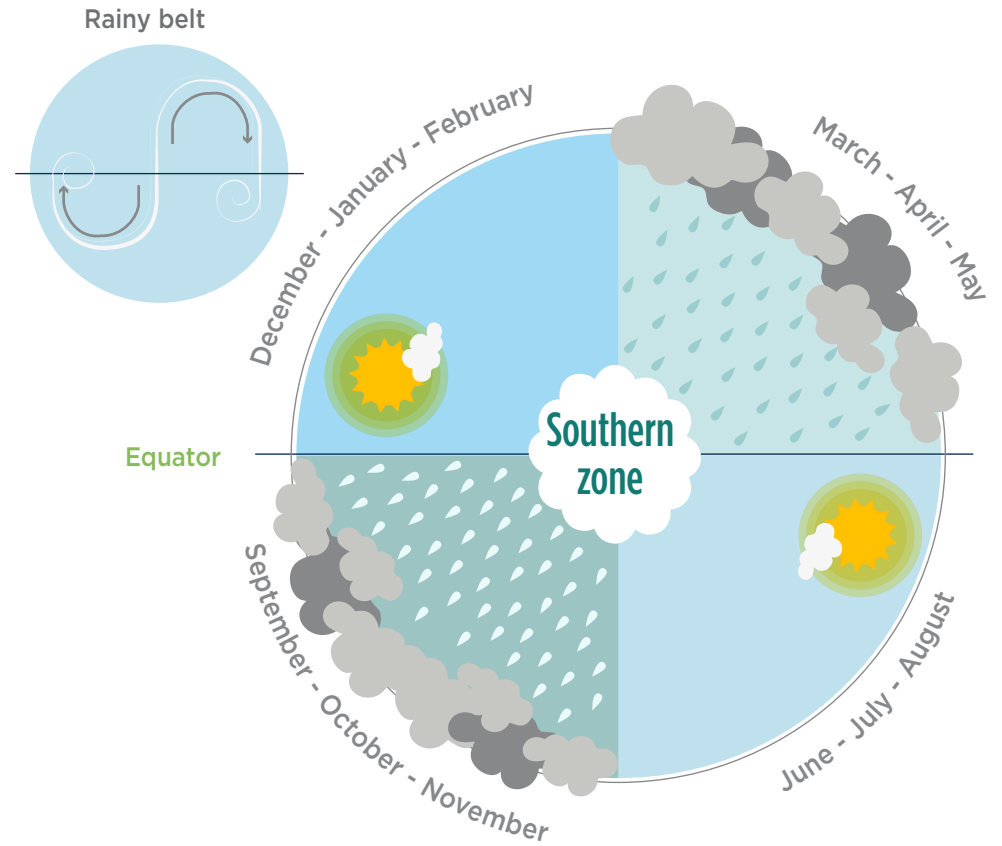


Figure 17. Rainy and dry seasons in the tropics



**Box 4. Food crops grown in the tropics and the austral region**

**Foods from the tropics**

» **Corn**

» **Coffee**

» **Cacao**

» **Cassava**

» **Plantain**

» **Rice**

» **Wheat**



**Foods from the austral region**

» **Squash**

» **Chicory**

» **Beans**

» **Leeks**

» **Strawberries**

» **Sweet potatoes**

» **Scallions**



- » Have students use the appropriate calendar for their food crop to pinpoint the months that correspond to its planting and harvesting seasons.
- » Compare and observe differences between the two regional calendars and discuss:
  - Why is it important to know the planting and harvesting periods for crops?
  - Why aren't all foods produced in the same area?

- Does climate change affect planting and harvesting periods? How else does it affect the crops?
- » Explain to students that farmers need to know what conditions each crop requires. This means knowing what soil type and water volume it requires, the geography of the areas where it grows, and the climate associated with these places.



## Class activity 2: Food diary: Our food

Objectives	Time	Place
Become acquainted with the characteristics of a healthy, balanced diet for humans and the best agricultural practices for the future of the planet.	1 class (plus monitoring for 1 week)	Classroom

### Preparation

Before class, look over the characteristics of a balanced diet and its importance to health and development in both children and adults.

### Step by step

- » Ask your students to write down the foods they eat at breakfast, lunch, and dinner each day for a week.
- » After 1 week, write some of their lists on the board and categorize the foods into the appropriate food groups (see the introduction to this unit).
- » Compare your students' diets with the ideal children's menu (box 5) and ask them to point out foods that appear too often or too little in their diets.
- » Ask your students the following questions and discuss their answers as a group:
  - Where does the food we consume daily come from? Do you buy it? Do you grow it?
  - Does the food that you eat at home come from our region? What other places does it come from?
  - How many processes do you think have the foods you eat every day undergo? Which ones undergo the most manufacturing processes?
  - What benefits are there to buying foods produced locally or growing them yourself?

- » Explain that eating a balanced diet provides the nutrients necessary for optimal physical, intellectual, and emotional growth. Stress the importance of home or school gardens to ensuring good nutrition as well as eating foods harvested locally and foods with minimal processing and packaging. Help them understand that choosing such foods contributes to the area's economic, environmental, and social development since these foods have fewer preservatives, are transported shorter distances, have lower production costs, and help the economy of local communities as well as the planet.

#### Box 5. *The ideal children's diet*

**Dairy:** Three servings per day.

**Eggs:** Three whole eggs per week.

**Meat:** Two servings per day (fish, chicken, beef).

**Vegetables:** Three to five servings per day (either raw or cooked).

**Fruit:** Three servings per day, one of which should be a citrus fruit.

**Grains:** One serving, which may replace one serving of meat or eggs.

**Fats:** Corn, grape-seed, sunflower, or olive oil as dressing; butter or margarine on occasion; avoid fried foods.

**Sugars:** Only to sweeten tea or milk.

**Sweets:** Occasionally.

**Beverages:** Water, juice; shakes or soft drinks on occasion.

## Formative assessment

Before proceeding to the next topic, ensure that students:

- » Understand the links between climate, planting, and food production
- » Are familiar with the products grown in their region
- » Can describe and identify a balanced diet

## Integration with other subjects

- » **Science:** Ask your students: “What is your favorite food?” Then have them research the following questions:
  - Where does it come from?
  - What processes does it undergo before it goes to market? How much packaging does it come in?
  - Where do the waste products from this food end up?
  - How are these waste products used?
- » **Mathematics:** Research how many and which food products are consumed most in your home. How much do they cost per month? Could you grow some of them yourself?
- » **Civics:** Create a local market with food products grown in home gardens.

## Remember

- » Balanced nutrition depends on eating foods from the four basic food groups: proteins, fruits and vegetables, grains and cereals, and dairy.
- » A healthy diet must be accompanied by proper hydration and frequent physical exercise.
- » Planting calendars are useful to knowing what we can plant in the region where we live at any given time of year.

## Tips for the teacher

As part of this lesson plan, we recommend talking about eating disorders such as obesity, bulimia, and anorexia, which are increasing among adolescents. Stress the importance of exercise, playing outdoors, and spending more time playing sports, rather than watching television or playing video games to supplement the topic.



Lesson Plans at the

**Advanced Level**

## Advanced lesson plan 1: Food security and climate change

### General objectives

- » Learn about the current state of the world for agricultural production.
- » Learn about the relationship between climate change and food.
- » Learn about the impact of farming systems on the soil.
- » Learn about the concept of food security and its relationship to climate change, land use, and other political and social factors.

### Class activity 1: What climate change looks like in our region

Objectives	Time	Place
<ul style="list-style-type: none"> <li>» Understand how climate change affects food security in the world.</li> <li>» Understand how farming techniques contribute to climate change.</li> </ul>	1 hour	Classroom

#### Materials

- » Printouts (preferably) or projection of figures 18-20; computer and projector.

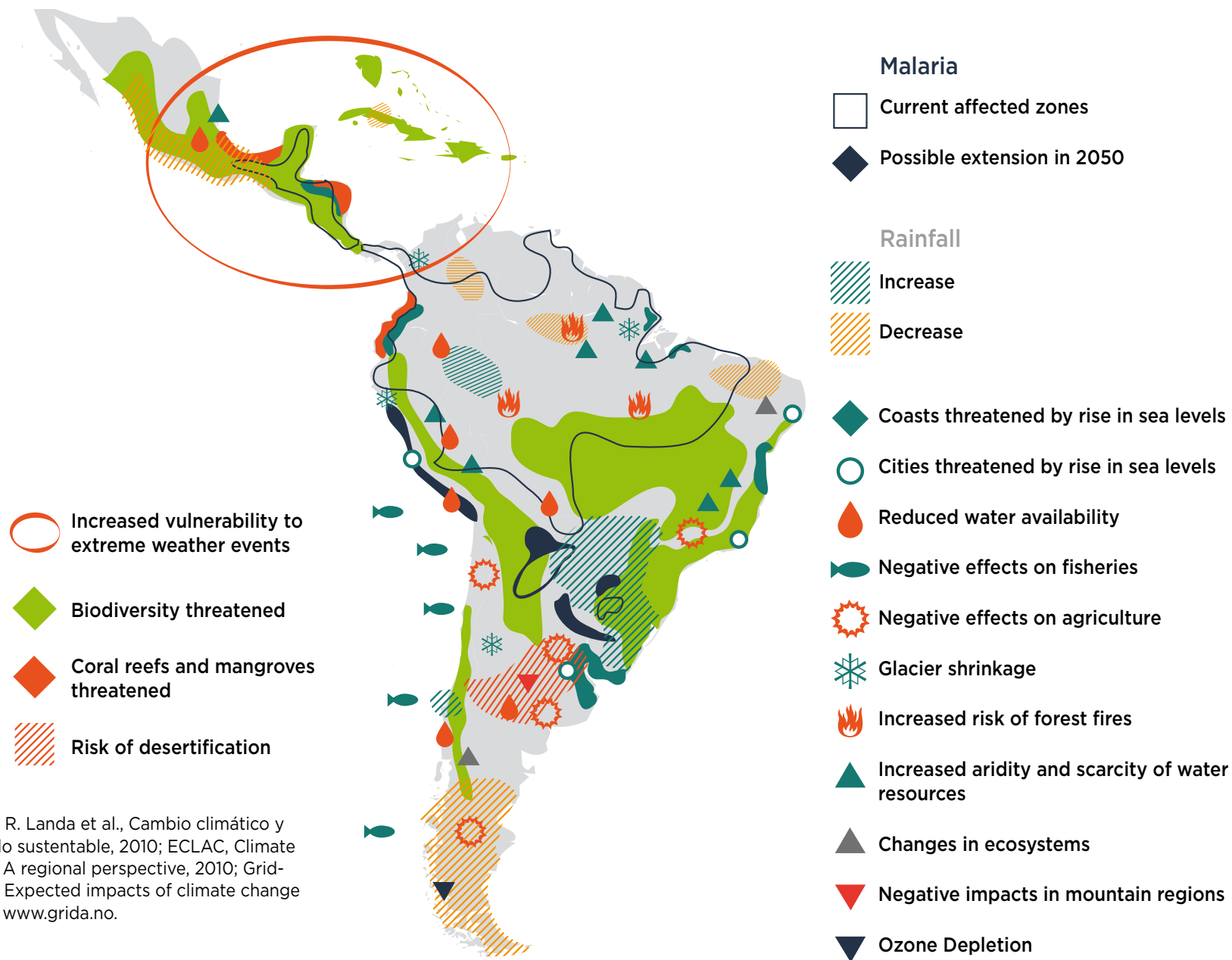
#### Preparation

Carefully study the three maps. Review the unit introduction.

#### Step by step

- » Divide students into groups of five or six.
- » Ask students what they know about farming techniques around the world.
- » If they do not know how large-scale conventional farming works, talk about it and compare it with traditional farming. Do not refer to natural and organic crops at this point. They will be discussed later.
- » Encourage them to come up with a hypothesis as to how these techniques might influence climate change, considering the soil, forests, water, fish, and wildlife.
- » Present the three maps to the class, giving them time to study each one.
- » Distribute copies of the maps to each group, if possible.
- » The activity consists of determining the impact of climate change on food security by region, and learning about predictions for the future.
- » Discuss the impacts on farming, fishing (if applicable), water availability, and production structures in each region of the world, with an emphasis on Latin America and the Caribbean.
- » Ask and discuss: Which signs of impact have you seen on resources in our area?

Figure 18. Expected impacts of climate change in 2050



Sources: R. Landa et al., Cambio climático y desarrollo sustentable, 2010; ECLAC, Climate Change: A regional perspective, 2010; Grid-Arendal, Expected impacts of climate change in 2050, [www.grida.no](http://www.grida.no).

Figure 19. Summary of climate change patterns projected for 2100

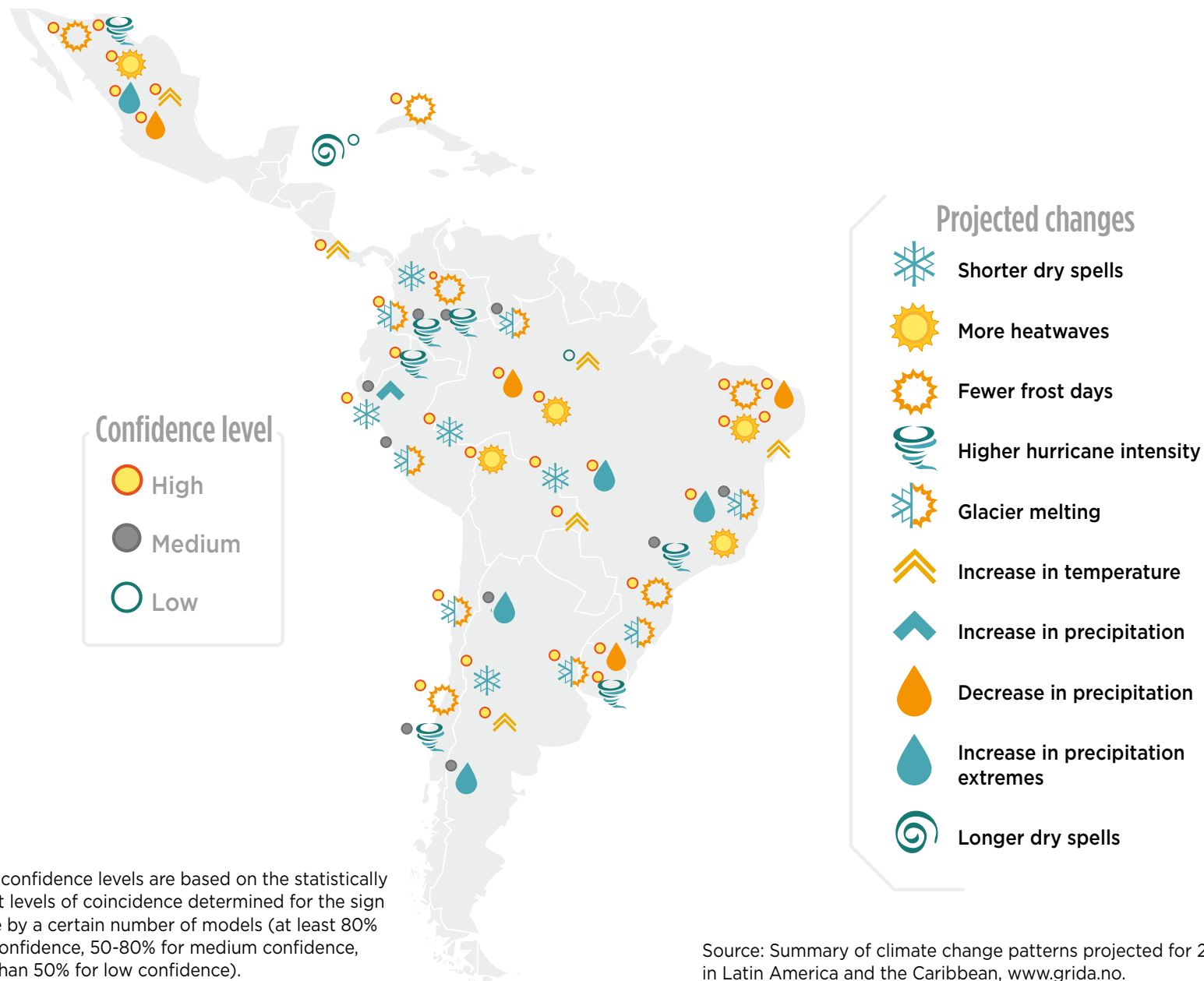
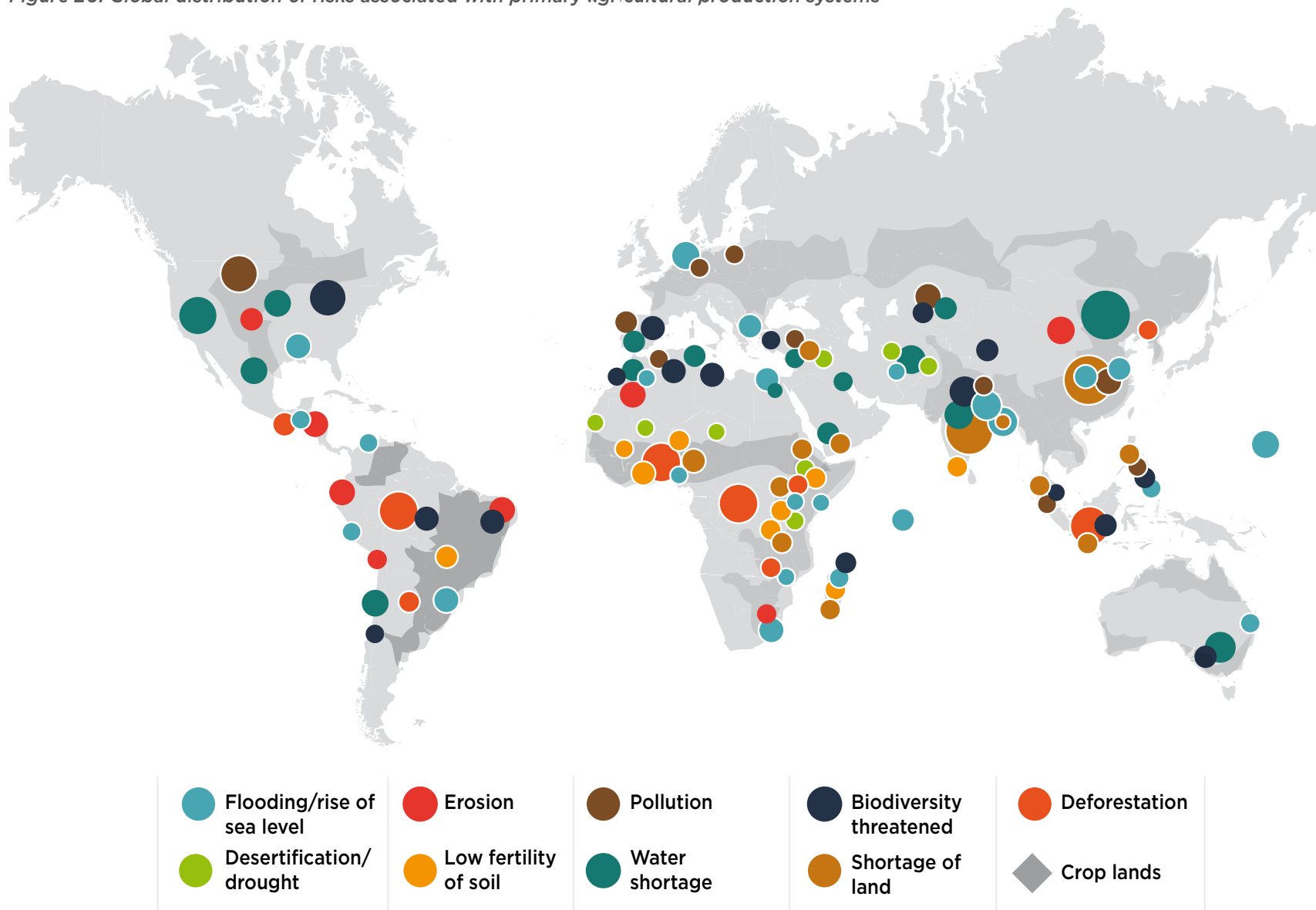


Figure 20. Global distribution of risks associated with primary agricultural production systems



Source: Food and Agriculture Organization of the United Nations (FAO) and Earthscan. The State of the World's Land and Water Resources for Food and Agriculture: Managing Systems at Risk. [www.fao.org](http://www.fao.org).



## Class activity 2: Has the market already felt the effects?

Objectives	Time	Place
Identify the relationships between food products, fossil fuels, and climate change.	4 hours	In the city or town's largest marketplace (this activity involves a field trip)

### Materials

- » Notebooks, pens, camera, and questionnaire to interview vendors.

### Preparation

- » Get authorization from the school's administration to take students on a field trip and organize the logistics.
- » Ask parents or other adults to volunteer to help chaperone your students during the trip.
- » Arrange for a field trip to a nearby marketplace and tell your students they will be journalists for a day. Advise them to take a camera along, if possible.
- » Send parents a letter informing them of the field trip, explaining any costs, and asking for their permission.
- » For homework before the field trip, have students prepare a series of questions to ask marketplace vendors about products that are grown and sold in the region as well as their preparation, variations in prices from one week to another, how weather variations affect products and prices, how the climate affects products, whether they experience product shortages, and so on.

### Step by step

- » At the market, have each group choose a stall that sells food products. Some can go to meat stalls, some to fish stalls, and others to vegetable or fruit stalls. Groups should explain to the merchants that they are doing a project on food and ask them if they mind being interviewed.
- » Each group should ask and write down:
  - The origin of the food sold at the stall
  - Climate and environmental phenomena that affect the food (rainfall, drought, pests, etc.)
  - Seasonality
  - Perceived impact of climate change on the availability and quality of the food (Is the impact already visible?)
  - Variations in prices and their causes
- » They should also research how climate and price changes affect producers, vendors, and consumers.
- » Ask groups to take photographs of the stalls, the vendors, and the marketplace. They must get permission from the vendors first.
- » Back at school, ask students to share their experiences and the lessons they learned with the whole class. Have them create a newsletter on food and climate change.
- » Help students develop the newsletter; have them write stories, features, and editorials and choose the best photographs. Post the newsletter in a central place at the school or on the school's bulletin board. If you have a school radio station or a community radio, have students share their experiences through that medium.

## Class activity 3: Who eats what?

Time	Place
2 hours	Classroom or a room with Internet access and a projector

### Materials

- » Images to display from the book *Hungry Planet: What the World Eats* by Peter Menzel, which are available on *Time* magazine's website (<http://time.com/8515/hungry-planet-what-the-world-eats/>).

### Preparation

- » Read the pertinent parts of the unit introduction. On *Time* magazine's website, visit Peter Menzel's photo gallery in "Hungry Planet: What the World Eats." The site describes the diets of 30 families in 24 different countries, with images of the food they purchase and information on what they spend per week on food and their favorite dishes.<sup>9</sup>
- » Note which countries have the greatest contrasts and where they are located, so you can display them in class.
- » Note the exchange rate for the dollar on the day of the activity, so your students can compare their own family's household spending to that of the families in the images.
- » The day before the activity, have students ask their parents how much they spend weekly on food for the family and have them check their pantries to see what food is on their shelves.

### Step by step

- » Ask students: What do the terms "food security" and "food sovereignty" mean? Discuss students' ideas and share with them information from the chapter text, including the FAO definitions:

- "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious foods to meet their dietary needs and food preferences, in order to lead an active and healthy life. The four pillars of food security are availability, access, use and stability."

- "Food sovereignty is understood as the right of all people to define their own food and agricultural policies in order to obtain sustainable development and food security objectives. . . This involves protecting domestic markets against the surplus of products that are sold cheaper in the international market and against the not so legitimate practices of selling at prices below production costs."

- » Discuss the components of the definitions and the pillars identified. Ask students to define the terms in their own words to ensure that they understand each concept fully.
- » Have them make a list of the foods their families eat most often in a given week and how much they spend on food.
- » Discuss the ideal combination of food groups for good nutrition.
- » Divide students into groups of four or five for the remainder of the activity, and show them the online images from Menzel's "Hungry Planet: What the World Eats."
- » Have students fill in the table based on the information in Menzel's piece, assigning each item a number from 0 to 5 (5 for items consumed most often and 0 for items that are not consumed at all), along with how much the families spend weekly on food in dollars.
- » In many Latin American and Caribbean countries, a large income gap exists between rich and the poor. Explain that the images show the foods consumed by representative populations; they do not reflect the diets of all the inhabitants in a country.
- » After each image is shown, allow the groups time to discuss which numbers to assign.

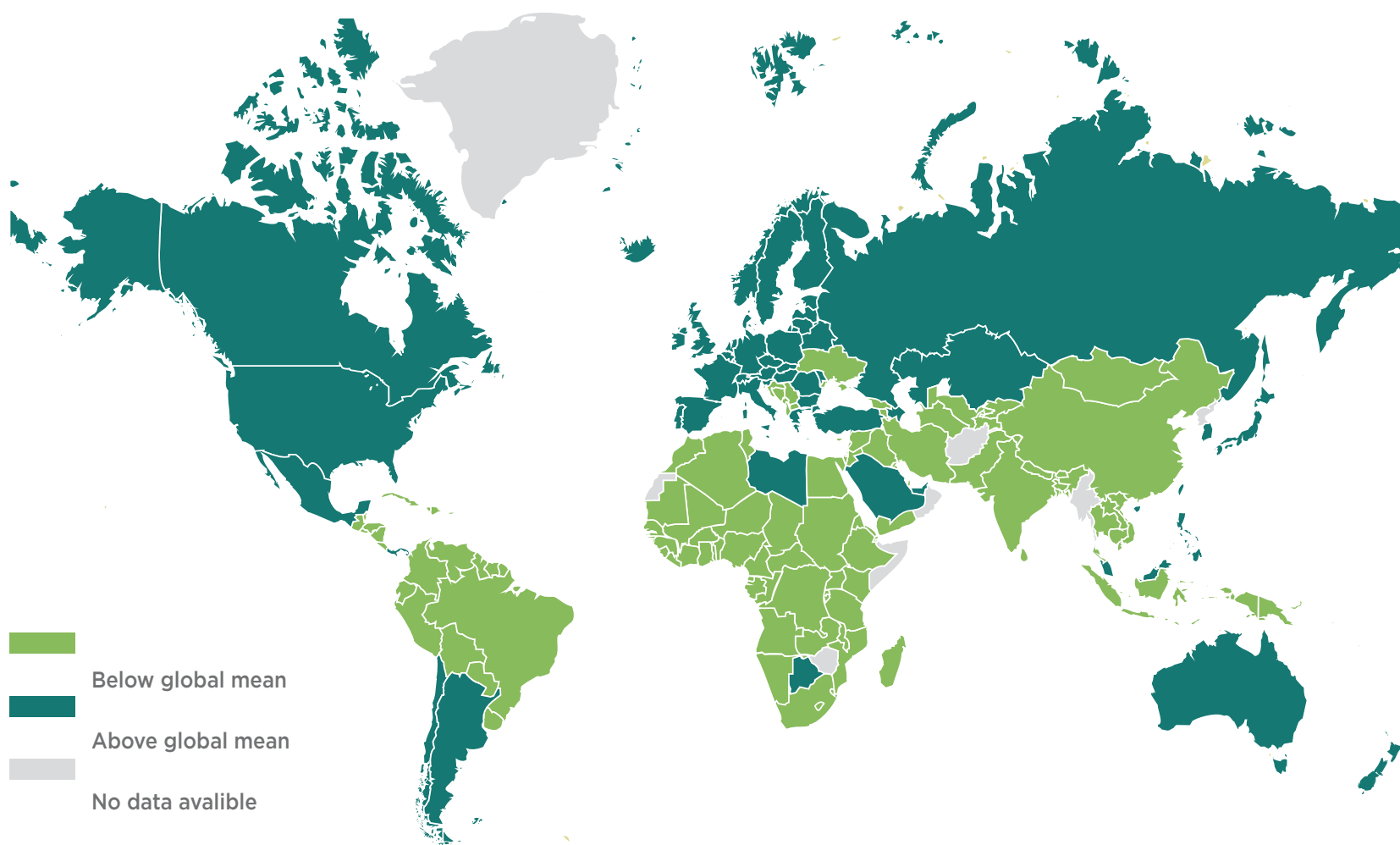
<sup>9</sup> Pater Menzel. 2005. *Hungry Planet: What the World Eats*. [www.time.com](http://www.time.com)

*Table 7. Weekly spending on food in various countries:*

	Fruits and vegetables	Grains, cereals, and tubers	Milk and dairy	Meat, fish, and eggs	Sweets and candies	Canned or packaged goods	Fast foods	Weekly spending in U.S. dollars
Germany								325.81
United States								341.98
Italy								260.11
Mexico								189.09
Poland								151.27
Egypt								68.53
Ecuador								31.55
Bhutan								5.03
Chad								1.23
Families in your región								

Source: Pater Menzel. 2005. Hungry Planet: What the World Eats. [www.time.com](http://www.time.com)

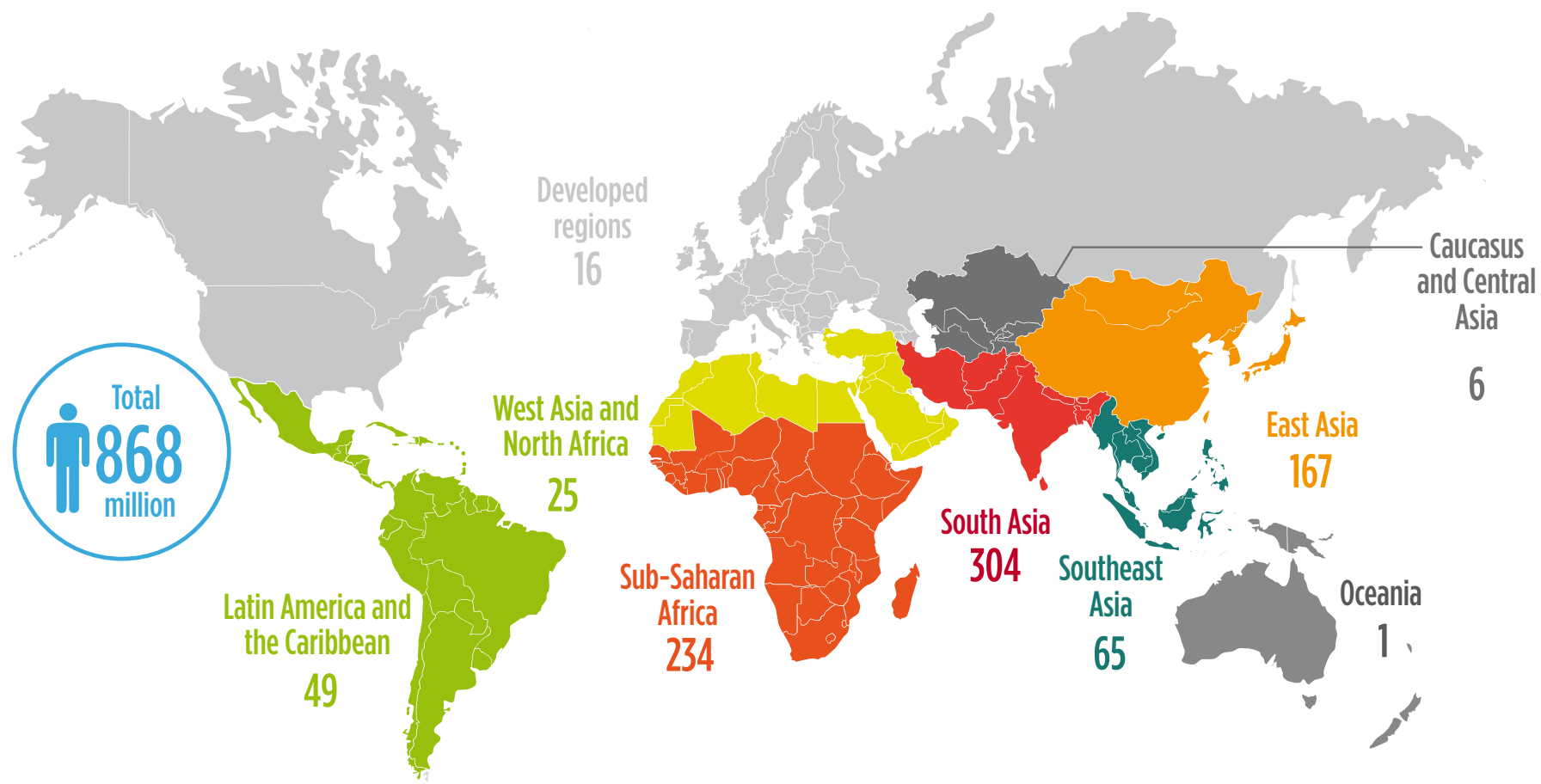
Figure 21. GDP per capita, 2010



Source: UNEP GEO Data Portal, as compiled from the World Bank, UNPD.

Note: GDP = gross domestic product. All data are for year 2010 except the 2009 data used for Australia Brunei Darussalam, Iran, Libya, Qatar, Saudi Arabia, the United Arab Emirates, and Yemen.

Figure 22. Undernourishment in developing countries by region, in millions of people, 2010-12



Source: FAO.

- » Ask students to work together to fill in the last row, taking an average based on their own families' food consumption habits and weekly food costs. Give them the current exchange rate and have them calculate the expenditure in dollars.
- » Ask: Why does undernourishment persist in the world?
- » Share figure 21 with your students. Ask: Does a country's GDP influence the way its population eats?
- » Ask: Is human activity generating undernourishment in the world today? What will happen in this regard in the future? Is climate change causing undernourishment?
- » Supplement your students' comments with the information in the unit introduction and share figure 22. Ask and discuss: What is the difference between undernourishment and malnutrition?
- » Returning to the exercise students did with the images, ask:
  - Which countries seem to be less nourished or undernourished? Why?
  - Does this coincide with the undernourishment index we saw in the image?
  - Which countries appear to be malnourished? Why?
  - Is malnutrition related to education or culture? Does our region suffer from undernourishment or malnutrition?
  - What does the last row in our table say about the families in our region?
  - Do you have anything more to add to the information you wrote in the table?
  - Do your conclusions coincide with the information in figure 22?

## Class activity 4: Debate on the relative merits of food security and food sovereignty

Objectives	Time	Place
Consider food security and food sovereignty as they affect the populations of Latin America and the Caribbean.	4.5 hours (2 for preparation and 2.5 for the debate)	Computer room or library for preparation, auditorium for the debate

### Materials

- » Notebooks, pens.

### Preparation

- » Divide students into four groups:
  - The first group will be advocates of food security (representatives of transnational industrial food producers, international institutions concerned with food coverage for the most vulnerable populations, and a government representative).
  - The second group will be proponents of food sovereignty (representatives of small local food producers, indigenous communities, environmentalists, and international institutions concerned with food quality, health, and sustainability).
  - The third group will be consumers in favor of food security.
  - The fourth group will be consumers in favor of food sovereignty.

- » Ask the groups to review the concepts of food security, food sovereignty, and genetic engineering, and to prepare to debate these concepts from their assigned role and viewpoint.
- » Give them 2 class hours to review the material, do research, and prepare their presentations. Have each group select a speaker, two debaters, and a representative to present conclusions.
- » Invite other classes and teachers to attend the debate and ask questions.
- » Prepare the auditorium as follows: In front, arrange four tables with four chairs at each. Set up a table for the moderator (yourself or a student from another class). Arrange chairs for the audience, including the students from teams who will not be debating.
- » Name three judges: the principal, a teacher, and a student representative.

### Step by step

- » Have the student representatives from each group sit at the tables and the audience take their seats.
- » Thank everyone for their participation and explain that the objective of the debate is to understand the concepts of food security and food sovereignty and the controversies around these topics in today's world.
- » Explain the following time limitations and start the debate:
  - 7 minutes for each speaker to present his or her team's position
  - 30 minutes for each team's debaters to ask questions of the opposing groups and for counter-arguments. This phase will be developed by the debaters.
  - 20 minutes for questions from the audience
  - 16 minutes to present conclusions (4 minutes per team)
  - 10 minutes for the judges to deliberate, select a winner, and present the reasons they selected that team

- » Moderator conclusions should:

- Reiterate the definitions of food security and food sovereignty.
- Mention the reasons it's difficult for nations to make decisions on genetically modified foods.
- Mention that consumers have a role and a voice on the topic. The market is driven by consumption and consumers have the power to influence the political decisions, and thus the future of our health, our farms, our people, and our economy.
- Mention that some people think that food security can be achieved through food sovereignty and that with their good soil, water, and climate, Latin American countries can achieve it.

### Formative assessment

Upon completion of this lesson plan, students should comprehend the following concepts:

- » Soil is fundamental for the development of all life; it is the source of the basic materials for survival for most living things.
- » The aspects of climate change that affect agricultural production are: melting glaciers, rising temperatures, increased or reduced rainfall, increased torrential downpours, longer or shorter dry periods, more heat waves, fewer cooler days, and increased intensity of hurricanes.
- » The risks to agricultural production include: floods and rising sea levels, erosion, pollution, loss of biodiversity, deforestation, desertification, loss of fertility, and water or land shortage.
- » Today there are approximately 870,000,000 undernourished people in the world.
- » Undernourishment is related to the economy, extreme weather events, mismanagement of natural resources, and a lack of education.
- » Undernourishment is different from malnutrition.
- » Food security and food sovereignty.
- » Genetically modified foods: advantages and disadvantages.

## Integration with other subjects

- » **Behavior and health:** Ask students to evaluate their eating habits and note areas for improvement. Have them share what they've learned through this lesson plan with their families.
- » **Geography:** Have your students locate on a map the countries analyzed in this lesson plan.

## Remember

- » Although current production systems facilitate the ability to process and obtain food, the continued use and abuse of the land has generated rapid soil transformation, threatening its usefulness and its ability to supply food for humanity.
- » Human activities influence climate change, causing:
  - Lost biodiversity—due to deforestation and the destruction of ecosystems
  - Rising GHG emissions—from burning petroleum derivatives and agricultural waste, and including gases such as methane, generated by animals and garbage
  - Coastal flooding, changes at sea that affect fishing, and sudden temperature changes
  - Longer droughts or rainy seasons that favor the proliferation of pests and contribute to more flooding, hail, frost, and heavy rains
  - Combined, these effects lead to loss of nutrients in the topsoil, loss of soil fertility, and damaged crops, as well as changes to fishing reserves that also lead to economic losses.
- » Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious foods that meet their dietary needs and food preferences, allowing them to lead active, healthy lives. The four pillars of food security are availability, access, use, and stability.

- » Food sovereignty exists when nations decide what, how, and where to produce the food its citizens eat, incorporating their ideals on sustainability and food security.
- » There are ways to obtain food security while establishing food sovereignty as a priority.
- » Undernourishment is related to the economy, extreme weather events, mismanagement of natural resources, and a lack of education.
- » Proper nutrition includes both the quality and quantity of foods required for good physical and mental health. There is a difference between undernourishment and malnutrition; the latter includes both a lack and an excess of food.

## Suggested reading and viewing

- » OXFAM International offered a series of recommendations about extreme weather events and food security, with examples, in advance of the for the 2011 UN Climate Change Conference in Durban, South Africa. "Extreme Weather Endangers Global Food Security" can be found at [www.oxfam.org](http://www.oxfam.org).
- » Articles on the advantages and disadvantages of genetically modified food crops, as well as experiences from countries that permit them or have banned them, are available from the website of the FAO (the United Nations Food and Agriculture Organization). [www.fao.org](http://www.fao.org). Just enter the phrase "GM food" (or any variant) in the search box.



## Advanced lesson plan 2: Alternative foods: Adapting to climate change

### General objective

- » Understand possible food alternatives and solutions for Latin America and the Caribbean.

### Class activity 1: Organic agriculture at the dinner table

Objectives	Time	Place
Understand the importance of organic agriculture in mitigating and adapting to climate change and as a measure against food insecurity.	2 hours	Classroom

#### Materials

- » Texts, videos, and magazine articles on organic agriculture in the world, your region, and your country.

#### Preparation

- » Use the unit introduction to learn about the advantages of organic versus conventional agriculture. Research any disadvantages.
- » Before starting this activity, have students research the advantages and disadvantages of organic agriculture.

#### Step by step

- » Divide your class into six groups to represent organic farmers, consumers, farm workers, the ecosystem, large-scale farmers using chemical fertilizers, and the rural community.
- » Ask students about different types of farming in the world and discuss them together. Use the pertinent part of the unit introduction named *Agriculture: Cultivating the soil*.
- » Tell students that each group will prepare a presentation on the advantages and disadvantages of organic agriculture from their assigned approach.
- » Give them 20 minutes to prepare.
- » As each group does its presentation, make a table showing the environmental, economic, cultural, and social benefits and disadvantages of organic agriculture.
- » Show the table to your students and ask if it's missing any advantages or disadvantages.
- » Use the chapter text and your own research to complete the table, if necessary.
- » Optional: For homework, ask students to write an essay comparing and contrasting conventional and organic agriculture, describing their advantages and disadvantages.

#### Tip for the teacher

Invite a local organic farmer to talk to the class about his or her work.

## Class activity 2: Field trip—A day in the vermicompost business

Objective	Estimated time	Place
Understand how the vermicompost business works and its advantages for clean agricultural production.	1-day field trip, plus 1 hour for classroom activity	Worm farm and classroom

### Materials

- » None required.

### Preparation

- » Have students research vermiculture and composting. Have them look for videos or articles that explain both, and introduce and discuss the concept and benefits of the vermicomposting business.
- » Research worm farm composting sites near the school or in your city that you can visit.
- » Contact farmers and explain that you'd like to show your students how vermiculture works to encourage them to construct a vermicomposting system at school. Remember to include the costs of the field trip in the budget.
- » Get authorization from the school's administration to take students on a field trip and organize the logistics.
- » Ask parents or other adults to volunteer to help chaperone your students during the trip.
- » Send parents a letter informing them of the field trip, explaining any costs, and asking for their permission.

### Step by step

- » As a farm employee shows students the vermicomposting process, encourage students to ask questions about the services the worm farm provides to the farm and the business of vermicomposting. How and to whom is vericompost sold? What advantages does this fertilizer have over chemical fertilizers?
- » Ask students to take notes on the composting process, the materials used, humidity and temperature control, the frequency of irrigation, reuse of materials, etc.
- » Before the end of the day, have students evaluate the activity and reflect on what they learned during the day.
- » Ask students if they would like to create a worm farm at the school for the school's green areas.
- » Plan a step-by-step process to help them create the farm, with help from their families.
- » Divide students into groups and in the following class have them determine step-by-step instructions for creating a worm farm. Explain that they will share these with people who will come to help. At the end of the class, make copies of the most accurate instructions.

### Tip for the teacher

Family activities focused on caring for the environment promote cohesion, reflection, and knowledge about the program. Use the Green Areas module in this program's Green School Kit to plan your worm farm. You can find it at [www.iadb.org/riseup](http://www.iadb.org/riseup).

## Class activity 3: Urban agriculture

Objectives	Time	Place
See how urban agriculture helps counteract food insecurity and climate change.	2 hours	Classroom

### Materials

- » *What to do: Recommendations to make the school an environmentally friendly space*, in module 7 of the Green School Kit at [www.iadb.org/riseup](http://www.iadb.org/riseup).
- » Documents on your city or region's public policy on urban and periurban agriculture; examples of urban communities in Latin America and the Caribbean with experience in urban agriculture.

### Preparation

- » Ask students to bring the above materials to class. Have them read at least one article or document in advance.

### Step by step

- » Ask your students what they learned about urban agriculture from their readings.
- » Do they believe urban farming could be a solution to food insecurity? Why?
- » Is it also an alternative for mitigating climate change?
- » Have them exchange the article or document they brought to class with a partner and give them 10 minutes to read each other's articles.
- » Ask six students to give the class a summary of one of the articles they read.

- » When the six students are finished, allow the other students to discuss the information presented and to contribute their ideas.
- » Ask: Based on our discussion, what other contributions does urban agriculture make? Have students explain their ideas to ensure they have a complete understanding. Make sure the 10 benefits mentioned in the chapter text are covered.
- » Talk about the Green Areas module of the Green School Kit and about horizontal gardens, in particular. Tell the class that this subsection is useful in developing the school's green areas, since it has planning and development activities for the entire school community.
- » Divide students into two groups and as homework have each member of the first group write a letter to its family telling them about the benefits of urban agriculture and encouraging its parents to try it at home. Have the members of the second group write a letter to the school principal, encouraging him or her to plant a garden at school and explaining its advantages. The next day pick the best letters, have the whole class sign them, and send them to parents and the school principal.

### Tip for the teacher

- » If some of the letters that were not selected make interesting points, have students draft a final version that includes those points.
- » You may request a space from the school administration on which to plant a horizontal or rooftop garden, if possible. Get parents involved and encourage them to maintain and care for the garden even after their children have moved on from your class, and to show other students how to do so. Get the school's administration and kitchen staff involved as well.
- » There are very specific technical requirements for growing a rooftop garden. Look for a manual or ask for help from someone knowledgeable on the subject.

## Class activity 4: Role-play on supporting local farmers and reducing GHG emissions

Objectives	Time	Place
Understand how protecting farmers and the land improves food security and sovereignty and helps combat climate change.	2 hours of preparation for the activity, 2 hours for the “fair” in the next class.	Classroom

### Materials

- » Documents, texts, and articles about products from different regions of the country; cardboard, markers, magazines, and paper bags or recycled packaging.
- » Products from each region of the country and snacks made with these products (will be taken by the students to the fair).

### Preparation

- » Divide students into groups of 4 or 5 and ask each to select one region of the country.
- » Have groups use the Internet to research the following:
  - Which crops are grown in the region?
  - Which are the most important—i.e., which have the largest-scale production and marketing?
  - Which do small farmers grow?
  - Which are the most nutritious?
  - What are the major difficulties that small farmers face?
  - What problems stem from large producers of these crops?

- How far do these products travel from the farm to your city or town?
- What weather events are these products exposed to in the region?
- What type of climate is ideal for these products?

- » Ask them to research snacks prepared with local products from each region and tell them they should bring them in on the day of the activity.

### Step by step

- » On the day of the game, ask: How does the consumption of local or regional products promote and food security, food sovereignty, and combat climate change?
- » Tell students that they will do a role-play activity with the objective of promoting the purchase of local or regional products. Each group will have a “shop,” and the shopkeeper will try to convince the rest of the group to buy local products from the regions they were assigned.
- » Give students an hour to design their store and prepare their campaigns, using billboards, packaging, and other materials.
- » After each group sets up its shop with their regional product and the snacks, the shopkeeper should talk about health, food security, and environmental protection benefits to market the products.
- » The other group members should act as buyers.
- » After all the groups have made their presentations, let students vote on which region would sell the most products if this were a real case, based on the following criteria:
  - Skill of the vendor
  - Customer service
  - Social considerations
  - Health and nutritional value
  - Environmental factors
  - Economic factors

## Formative assessment

At the end of this lesson, students should comprehend the following concepts:

- » Urban agriculture
- » Vermicomposting
- » Organic agriculture
- » Local consumption
- » The relationship between food security and the four concepts above.
- » The relationship between organic, urban, and local agriculture and climate change

## Integration with other subjects

- » **Language:** Write a script for a radio program on alternatives for creating greater food security.
- » **Physical education:** Research which foods produce the most energy for physical activity.

## Remember

- » We have seen that there is a strong relationship between the sustainability of rural and urban areas. (See the introduction to the unit on Sustainable Cities at [www.iadb.org/riseup](http://www.iadb.org/riseup).) We have also learned that the economy is important for food security and that food prices affect access to good nutrition. Consuming local or regional products helps eliminate certain costs that drive up food prices. When we choose products from our area, learn about them, and use them to prepare meals, we reduce transportation and fuel costs by reducing the distance foods travel from the farm to our city. We also reduce GHG emissions, mitigate climate change, and avoid additional migration of farmers into cities.
- » Intensive land use and speedy production processes have boosted agricultural yield, but they have also increased GHG emissions. Today, agriculture and livestock produce

10 to 12 percent of total GHG emissions, and 47 percent and 58 percent of methane and nitrous oxide emissions, respectively.

- » Vermicomposting helps reduce the use of artificial compost and chemical fertilizers.
- » Organic agriculture, urban agriculture, and local consumption can promote food security.

## Suggested reading and viewing

- » *The State of the World's Land and Water Resources for Food and Agriculture: Managing Systems at Risk* (2011) makes a series of projections and recommendations for addressing climate change. From [www.fao.org](http://www.fao.org) search for the "SOLAW report."
- » *Organic Agriculture and the Law* (2012) explains the environmental, social, and economic aspects of urban agriculture. From [www.FAO.org](http://www.FAO.org) search for FAO Legislative Study 107.

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