

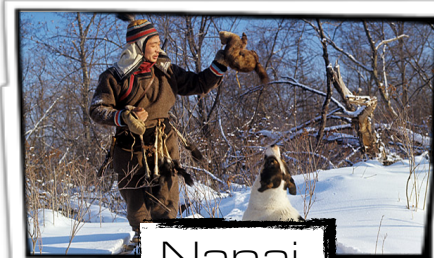
## E. Agriculture in the Periphery

Despite the massive technological advances over the past 200 years, the average human on the planet is an intensive subsistent farmer, living in the periphery (or in the peripheral region of their State). This section will explore the various agricultural traditions and the people who have kept the traditions alive since the dawn of humanity.

Transhumance. Throughout history, the agricultural communities expanded in size and density; conquering, claiming and cultivating all available arable land. Due to their smaller population size and obsolete technology, transhumance groups were relegated to the lands that agriculturalists could not use for agriculture: mainly highlands, desert regions, rain forests and the arctic. Transhumanance tribes survive through hunting and gathering. They circulate through their routine areas, eating the plants and animals native to the region. They can identify thousands of types of plants by their leaves and their bark. They can track animals by their sounds, footprints and urine/feces smells. Their life is environmentally determined; living and surviving along with nature. The most well known of these transhumance groups are:

- Aborigines of the desert regions of the Australian Outback
- Inuits and Nunavut's in the arctic region of Alaska-Northern Canada
- San in the Namib and Kalahari Deserts of Southern Africa
- Pygmies in the Congo Jungles of Central Africa
- Nanai in the arctic regions of Siberia-Far East Russia.

Many of these regions have been protected as indigenous preserves or reservations, protected by their State from being developed by other businesses.



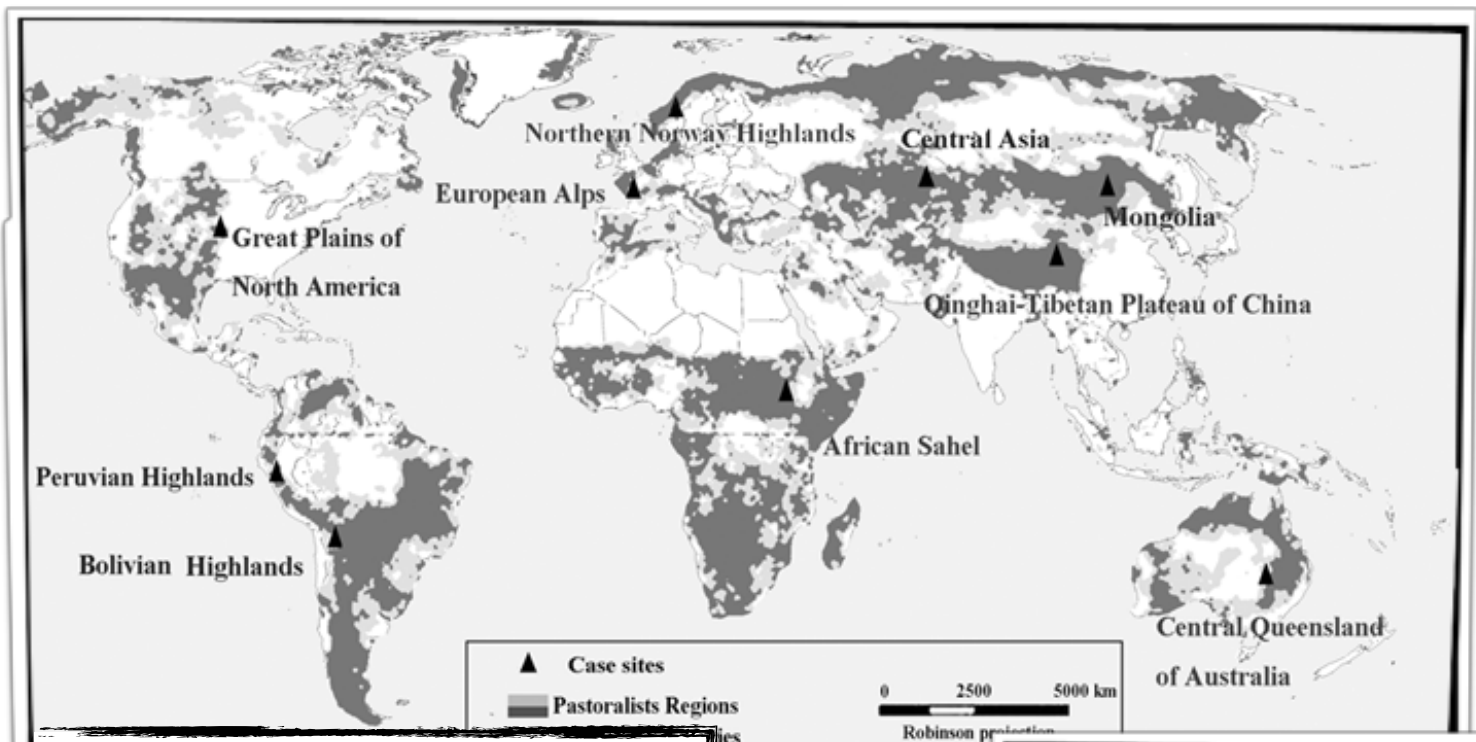
Nanai



Pygmies



Aborigines



Map of Pastoral Regions

Pastoralism. In regions with limited vegetation, mountainous terrain and higher altitudes, pastoralism is still the prevalent source of food. There are ~500 million pastoralists in the world. 75% of states have at least one pastoral community in their borders. Pastoralists coexist with their animal herds, most commonly: sheep, goats, yak, cattle, camels, yaks, llamas, reindeer, and horses. They guide the herds to new pastures and water sources, while providing protection for wild animals. They guide the breeding practices of the animals, encouraging the mating between animals that have the most desired qualities. In exchange, the people use the animals for their resources. The milk and meat become food. The wool, bones and skin become material for tools. It is a stable, low energy system of living that is sustainable in otherwise harsh living conditions. Important pastoral societies include:

- Maasai in the Sahel of Kenya
- Qashqa'i in Iran and Central Asia
- Saami in Norway's Northern Highlands
- Zulus in the highlands of Southern Africa.
- Mongols of Central Asia
- Berbers of North Africa/Sahara Desert
- Tibetans in China-Nepal

Similarly to modern hunter gatherers, pastoralists now exist within the borders of larger states. While the pastoralists live a transhumance lifestyle, they are still dependent on urban areas. Selling animals is the pastoralists source of profit. Urban centers also provide the tools, clothing, or other items that pastoralists need, but cannot easily make on their own; thus the need for selling their animals for currency to buy other material needs. To assist them, pastoral groups have begun to use cell phones. This allows the tribe's leaders to call into town, check on the price of animals, meat, or wool in order to bring their herds/flocks in when the price is the highest; in order to make more money.



Maasi



Qashqa'i



Saami



My Great-Grandfather never mentioned the border crossing here...



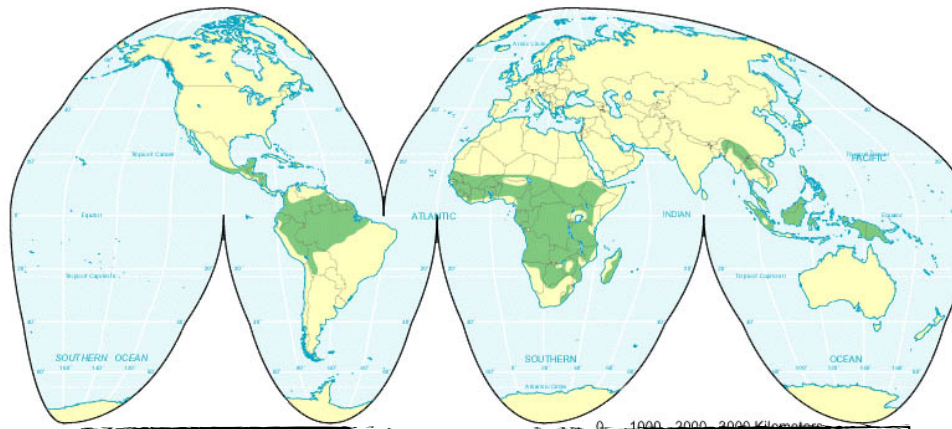
The states' important city centers and population hubs are in the economic heartland where agricultural and industry dominate. While pastoralists are citizens of their state, they typically do not have the normalized citizen-government relationship like agriculturalists and industrialists. States have developed policies that “control” the pastoralists and their movement. Political borders now run through the frontiers the pastoralists used to historically roam; now limiting where the pastoralists can or cannot go with their herds. States are founded by governing officials that promote the ownership and private control of land for economic gain. Thus, large land parcels of land are sold to individuals and corporations. To protect their investment, farmers and businesses have constructed fences and walls, using security forces to protect the private property boundaries. This has threatened the pastoral way of life. The restrictions keep the animals away from lands where the animals can graze in different seasons. It has forced them find ways to adapt their lifestyle and the movement patterns.

### Subsistence Agriculture.

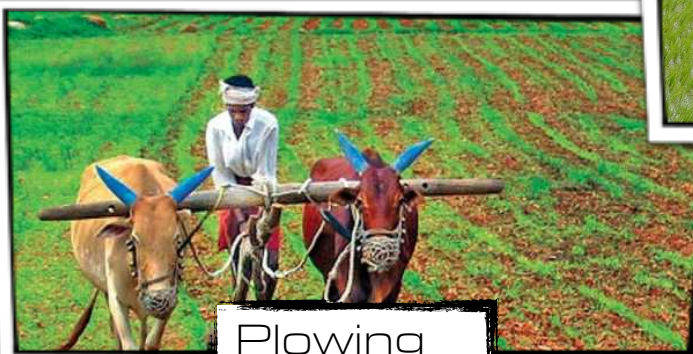
In the periphery, the most common form of agriculture is intensive subsistence. This is food that is grown with a great amount of human and animal effort, primarily for family or local community consumption. All aspects of the process are completed by hand, or primitive hand-made tools. It is common to find market gardens, mixed crop-livestock, and cash-crop plantations.

This type of agriculture is found primarily in:

- Amazon Basin in South America
- Sahel, Congo Basin, Great Rift Valley in Sub-Saharan Africa
- Indochina Peninsula, Malay Archipelago, and Sumatra in Southeast Asia
- Guangdong region in Southern China



### Modern Subsistence Farming







Intertillage



Irrigation

#### • Technology Use.

Subsistent agriculture uses handmade or basic tools and techniques. These regions are tightly bound by environmental determinism, as little can be done to effect the land or the crops to drastically improve the chance of a greater harvest. The work requires a large amount of effort to produce what limited food they can harvest, requiring many people to work. As a result, the labor on the family farms comes from the family themselves, especially women. Most tools that are used are made from local woods, stones, metals, or animal products like bone and leather. In a Stage 2 society, farmers begin to have access to industrially produced tools. Wealthier families have large domesticated mammals that can assist with the heavy labor, like plowing and intertillage - the tilling/plowing of the soil in-between the rows of crops to improve nutrition and harvest. Most fertilizer that is used is the manure from the people and animals when it is available.

Green technologies have begun to diffuse into the periphery. As societies progress into Stage 2, they become interconnected with multinational organizations and NGOs that assist with funding and technological resources. Thus, industrial tools, GMOs, fertilizers and herbicides have been increasingly used on subsistent farms. On the positive the improved tools, hybrid seeds, and chemicals have shown improvements in the yields at harvest time. On the down side, most farmers can only afford the chemicals - not the technology to safely distribute it onto their fields. Instead of airplane crop dusters, they spread and spray the chemicals by hand. This direct exposure has been linked to lung, immune system, and brain diseases. Another problem is financing. Once farmers go down the path of green technology, it is hard to turn back. This puts tremendous financial strain on farmers, as they have to purchase new seeds and new chemicals each year. The tractors need to regularly purchase refined gasoline, have oil changes, and have access to replacement parts. This financial burden keeps the technology from being regularly used in impoverished regions. Finally, the chemicals cause pollution in the air and water. This causes health problems to local animals and to the people who rely on the water for survival. Thus, while green technologies have increased the yields in difficult climates, but there is still a long way to go before food stability is reached.

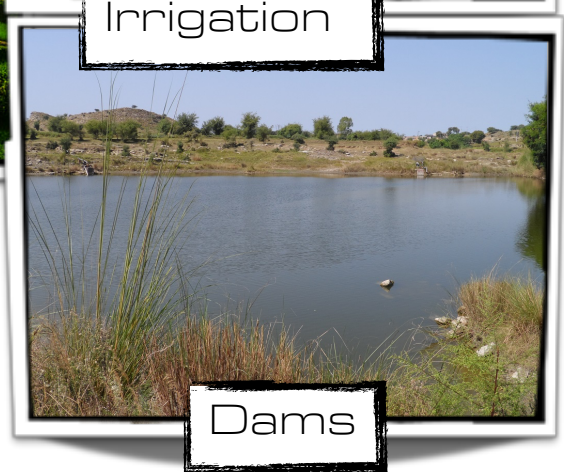
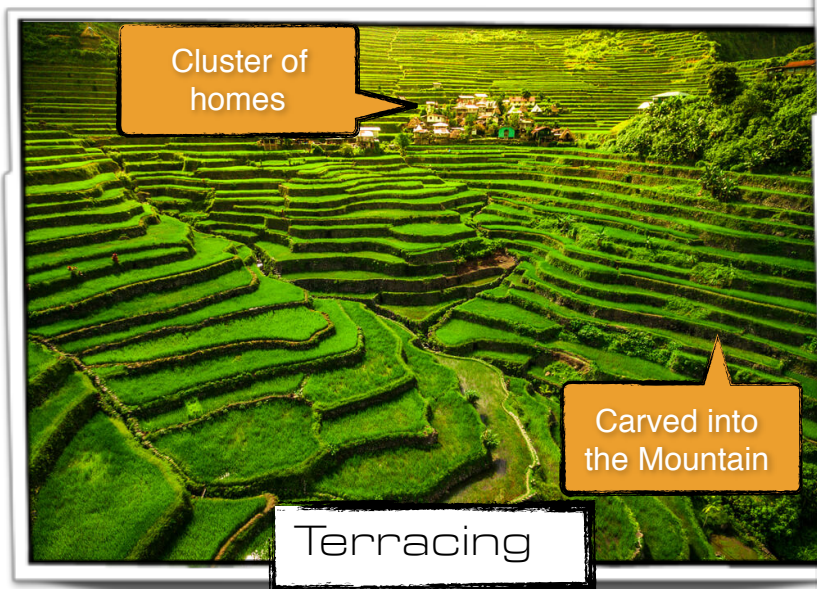


Harvesting



Chemicals by Hand

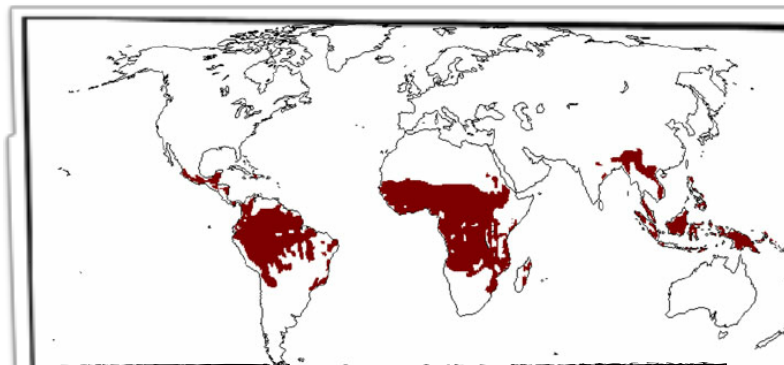




- **Landscape.** Intensive subsistent farms are smaller family farms, on small plots of land. Traditionally, the homes of multiple families are clustered together. Some African societies form their buildings in a circular shape around their animal pens to protect them. In accordance with Von Thunen, the intensive gardening takes place close to the homes, with extensive farming techniques being used further away from the settlement.

The fate of subsistent agriculture is tied tightly to the landscape. Any effort to change the landscape comes at a great cost. Mountainous regions must be terraced - carving in to the mountain side to create flat farm land. Communities gather the resources to construct dams, to pool water to create a more consistent source for farming and daily life. To get water to the farm land, irrigation channels must be dug by hand to bring water to the fields. Because these are done by hand, constant maintenance has to be performed to keep them usable.

Shifting agriculture/cultivation is the most common technique used in intensive subsistence agricultural. Shifting agricultural is primarily utilized in the tropical regions (20°N-20°S). Tropical regions have a climate is warm enough to support agriculture - being home to a unique collection of edible plants - but the soil is nutrient poor because of the rain forests. Because the rain forests are ever-green, they rarely shed their leaves nor have periods of decomposition like the northern regions. In comparison with all the other forms of cultivation, shifting agriculture uses the largest percentage of dry land in the world. Different regions have unique names for the process. In Mexico, shifting agriculture is referred to as Milpa. In Zambia, it is called Chinemene. In Asia, it is called ladang.



Shifting Agriculture Map





Shifting agriculture follows a three step process.

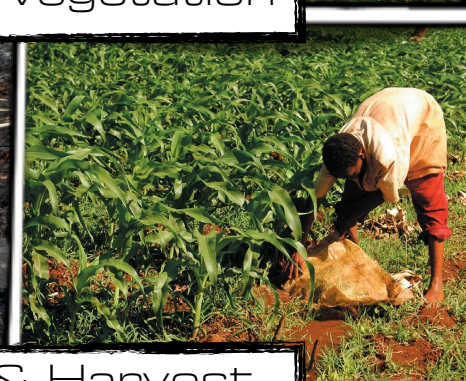
- **Step 1: Clear the land.** A common technique is for clearing the slash and burn method (also known as swidden). All trees and vegetation are cut down in a small area, preparing the land to be farmed. The branches, timber, vines and leaves are left on the ground. Then, the cut-vegetation is burned. The ashes of the burnt vegetation create a thick layer of humus over the ground that returns nutrients to the soil, similar to an organic fertilizer. Now the once-nutrient poor soil is ready to support plant life.
- **Step 2: Plant.** A variety of crops are planted, depending on the region. This is a comparatively extensive process, compared to intertillage. The farmers walk along in a row with a stick, they make a hole in the new layer of humus to put the seed in, and then covers it back up. Common crops for shifting agriculture are maize, beans, squash, millet, sorghum, and cassava. Crops are planted in a rotation on the cleared fields for two to five years, until the yields diminishes due to nutrient depletion in the soil.
- **Step 3: Shift.** At the appropriate time, a new patch of land is begins to be cleared. Once the new segment of land is ready, and when the old area of land is starting to have reduced fertility, the process of burning and farming repeats. The previous lands are left fallow - or to rest - allowing vegetation to regrow. The tribe has multiple sections of land it rotates through. By the time they return back to the first segment of land, all the vegetation has returned and the process starts over. This way, it sustains the local ecology, never over farming or removing from the land more than what is needed.



"Slash"/Clear the Land



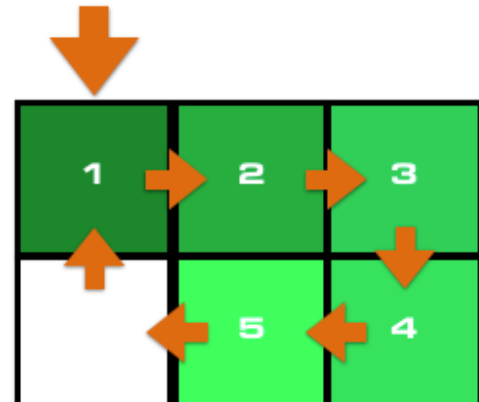
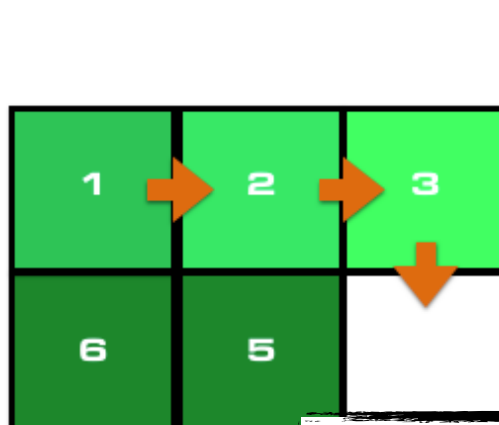
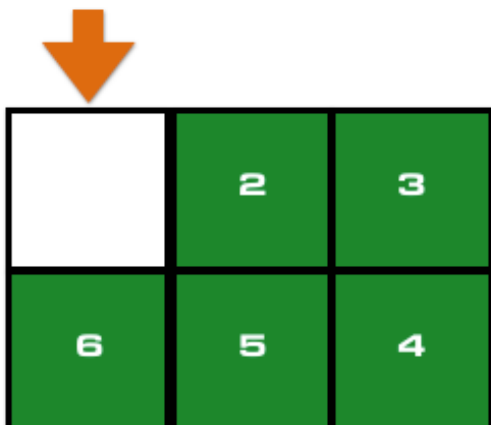
Burn the Vegetation



Farming: Plant & Harvest

Cleared

Regenerated



Shifting Cultivation Plan

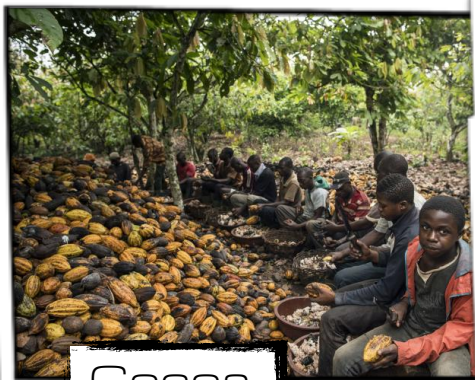


- Economy.** Societies that rely on subsistence agriculture have a high percentage of their society employed in the primary sector. With limited technology, many human hands are needed to produce as much food as possible. This is reflected in the high agricultural density, because such a large number of people are invested into farming each acre of land. Unfortunately, the seasonal yields are extremely limited, with barely enough to feed the family. In a successful year, the farms yield enough food may be grown to meet all the family's needs AND have surplus to sell or barter with the local markets to pay for new tools, clothing or schooling for some of the boy children. However, in years of poor harvest, they can only grow 9 months worth of food per harvest. This means the family will be faced with a three month "hunger season" with little-to-no money to purchase food. The GDP per capita in these regions is less than \$2 per day to meet all their family's needs.



Little development can be made within the society because every effort of every person must be placed to providing the next meal. Even less financial investment is available, because the residents do not have extra money and no banking institutions exist. Some states have coastlines, natural harbors, or natural resources that can attract Foreign Direct Investment (FDI). However, landlocked states or semi-desert regions do not have any comparative advantages to attract foreign companies to their territory. With the UN's Sustainable Development initiatives, NGOs have stepped in with microloans using the Grameen bank system. With these microloans, communities can purchase for new tools or equipment that increase productivity, improve the yield, improve yield, or quality of life - like solar powered electricity.

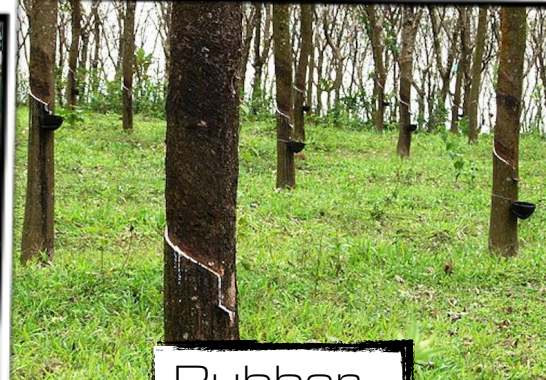
Success in the subsistent communities is further undercut through global trade. Industrialized agricultural states take advantage of their economies of scale, mass producing cheap grains and selling them on the global market. The price the grains are sold at is so cheap, the subsistent farmers cannot compete; leaving no one to buy what little food they are able to put onto the market. States are able to protect their farmers through tariffs and quotas, unless they are a part of free trade agreements. However, many states have low GDPs and need the low cost agricultural imports to support their struggling populations. The farmers become trapped. Some farmers choice to leave their farms, emigrating to an urban area in search of secondary or tertiary sector opportunities. Other farmers abandon producing food crops for human consumption, and begin to focus on producing commercial cash crop planation farms that can only be grown in their region. For example: the USA or Europe cannot grow coffee, palm oil, rubber, tea, cocoa, or sugarcane. Farmers work their comparative advantage in hopes that they can sell their cash crops and purchase the imported, lower cost food crops.



Cocoa

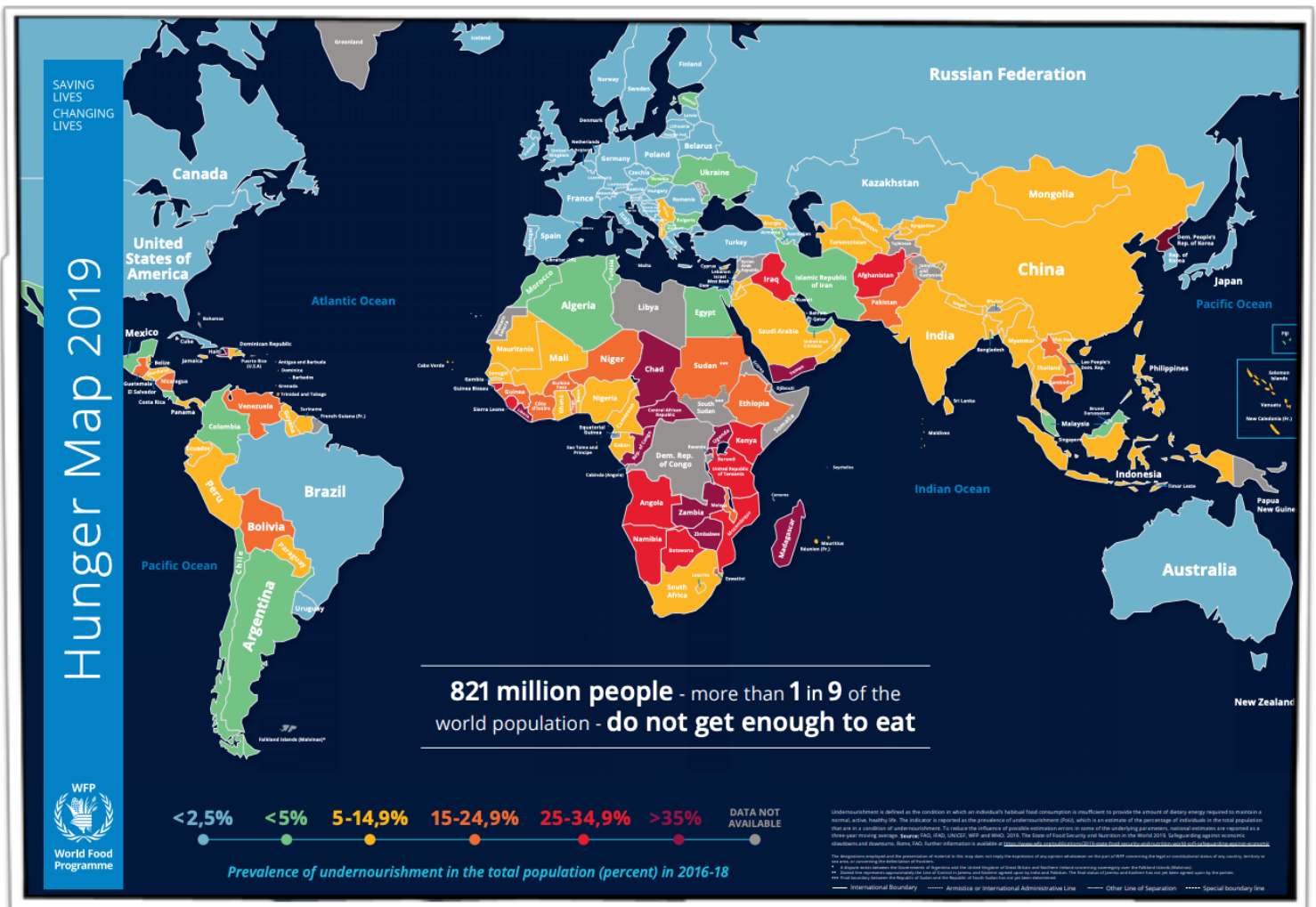


Coffee



Rubber

- Quality of Life.** Life is extremely difficult in subsistent communities. The life of a subsistent farmer is physically, mentally and emotionally tough. It takes a great deal of effort each day to do the tasks needed to survive. Women in particular are heavily invested, as women are responsible for more than 60% of the food produced in the world. This, along with having a high fertility rate, birthing the next generation to work the farms. For the extreme amount of effort invested into agriculture, food security is a major concern; as starvation is always “just around the corner.” Many communities can guarantee a 2-3 month hunger season, which they hope their infants and children will survive. Famines and droughts are common in harsh climates. In 2014-2016, Ethiopia and Somalia experienced a drought that has left 18 million people in danger of starvation. Those that do survive in these conditions suffer from malnutrition and development disorders, due to the lack of appropriate nutrients.





- Environmental Consequences.** Any form of agriculture has strong environmental impacts, due to the attempts to alter the landscape. For subsistence agriculture, the first environmental impact are the changes made to natural systems and habitats. The clearing of trees brings about concerns of deforestation, especially in shifting agriculture with the slash-and-burn technique. The loss of trees effects the air quality, as trees are essential to the production of oxygen in the air. When trees, or other plants, are burnt or allowed to decompose, the air quality is impacted as well. Decomposing organic matter releases CH<sub>4</sub>, which is a greenhouse gas that effects the environment. The loss of trees removes the habits for birds and animals in the region; causing the birds and animals to migrate or go extinct. In regions near the equator, Animal herds can overgraze the limited vegetation in a region, causing desertification - the expanding of deserts. When shifting agriculture is done on a small scale, the effects are minimal; with many considering it one of the most sustainable forms of agriculture on the planet. However, when industrial tools are used - like chain saws and tractors - the amount of forest cleared and the amount burned becomes unsustainable.



A second environmental impact is the change to the water. The desire for irrigation causes societies to either dam or divert rivers. The causes old wetlands to dry up, and new wetlands to form. When damming or wet rice farmer occurs, larger water ways are created. Old habitats become flooded while the new bodies of standing water become habitats for birds, reptiles, fish and insects. The insects can lead to an increase in diseases. Mosquitos are a key concern, as they are attracted to water and carry Malaria, Zeeka, Yellow Fever, amongst other diseases. When farmers begin to use fertilizers, pesticides and herbicides, the chemicals run off into the water; causing contamination to drinking water, as well as having harmful effects to the wildlife.

A third impact is to the soil. Due to the attempts to fertilize, through manure or chemicals, the arability of the soil improves. The decomposition of plants during the fallow periods further enriches the soil; restoring nutrients. However, farmers have to be careful when preparing the ground, because of wind and water erosion could wash away the soil needed for growing crops.