The Food We Eat

Have you ever thought about the how much energy and carbon is required to produce and transport the food you eat every day? Most of us go to the store and buy and eat our food without ever thinking about the energy and carbon required to feed us. If you take a little time to learn about what goes in to producing and transporting what you eat, you may be surprised how your food choices impact the amount of CO_2 that goes into the air.

Tracing Energy and Carbon in Our Food

The average person requires about 2000 calories worth of food every day. While you might think it doesn't make much difference if you eat 2000 calories of mostly vegetables and grains versus 2000 calories of mostly meat, it actually makes a huge difference in terms of associated energy use and carbon dioxide emissions.

A primarily meat-based diet requires about 10 times as much energy and land area to produce and creates about 10 times more carbon emissions than a primarily vegetable-based diet. This means an area of farmland that could feed about 10 mostly vegetarians could only feed about one person who eats mostly meat. This difference can be explained based on the way that food chains work.

During photosynthesis plants transform solar energy into chemical energy in the form of high-energy C-C and C-H bonds in organic carbon containing molecules (such as sugars, starches and proteins) in plant material. When animals eat plants, much of that chemical energy is transformed into heat energy and motion energy; only a small amount (about 10% of the chemical energy available in the organic biomass of the plant) is transformed into chemical energy in the biomass of the animal.

Similarly, when animals eat plants, about 90% of the organic carbon in the plant is released into the atmosphere through cellular respiration and only about 10% is incorporated into the body of the animal as organic carbon. Figure 1 below illustrates what this means in terms of land use required for vegetarian versus meat-based diets.

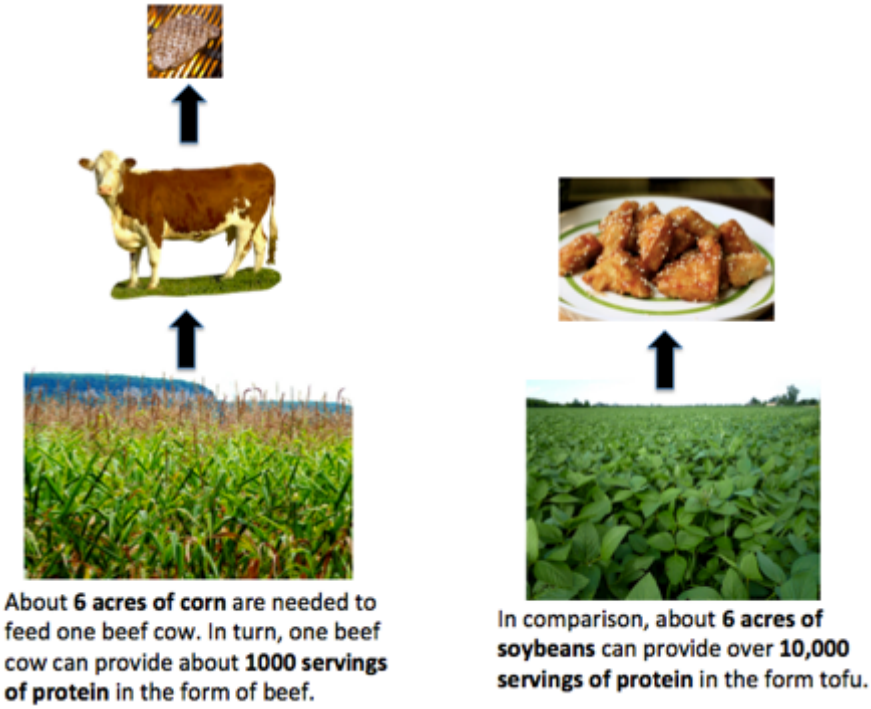

Figure 1. Comparison of acres of farmland required for meat-based versus vegetarian diets.

This story can be illustrated in terms of carbon emissions as well (see Figure 2). Note that most of the organic carbon in the biomass of the herbivore is released into the atmosphere as carbon dioxide through the process of cellular respiration. Only about 10% of the organic carbon in the cow is passed on to the person that eats the cow. Food chains in human food systems work very much the same way as food chains in natural systems. So, for example, in a meadow ecosystem, there will be lots and lots of plant biomass, less rabbit biomass, and even less fox biomass.

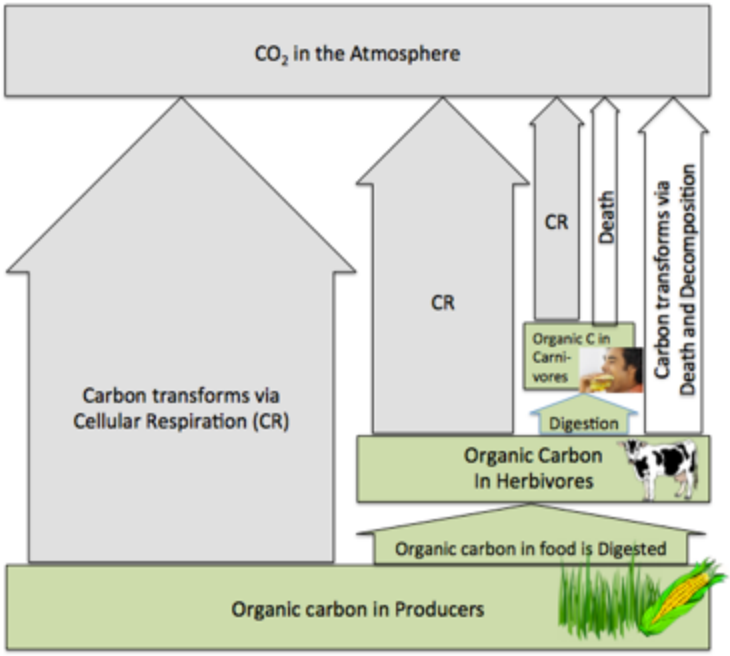

Figure 2. Tracing carbon in a human food chain

Learning about food chains can help us understand why meat-based diets lead to 10 times as much carbon emissions as vegetarian diets. A study done by the United Nations Food and Agricultural Organization found that livestock, like cows and pigs, create more greenhouse gases than transportation—18% of the world's entire greenhouse gas emissions! The rise in human population since the 1800s has led to more cows being raised for dairy and meat purposes, leading to an overall increase in greenhouse gas emissions. Some of these greenhouse gas emissions are in the form of carbon dioxide. Livestock are often fed grains, which take a substantial amount of land to grow-- feed for livestock accounts for 40% of the world's agricultural output.

Carbon dioxide is also emitted when fossil fuels are burned to produce fertilizer to grow feed. Grazing livestock is a major driver of deforestation worldwide; overgrazing is turning a fifth of all pastures and ranges into desert. Feed production and grazing both displace forests and prairies that might normally serve as sinks for carbon dioxide. Additionally, cow flatulence and manure production emit more than one-third of the global emissions of methane, another greenhouse gas, which warms the planet 20-times faster than carbon dioxide. What all this adds up to is that by eating less meat, you can reduce your personal carbon emissions and help slow human impacts on climate change!

Tracing Energy and Carbon in the Transportation of Our Food

Carbon and energy in food chains do not make up all the carbon and energy that we use when we eat our food. The average American meal travels 1500 miles before it gets to a diner's plate! Most grocery stores use large trucks to import food items from around the country. These trucks emit a lot of carbon. The first reason is that the trucks are usually air conditioned or refrigerated to keep the food fresh. This refrigeration produces a lot of greenhouse gas emissions. The second reason trucks produce carbon is that trucks emit carbon when they burn gasoline. The chemical energy in the gasoline is transformed into motion energy of the vehicle and waste heat energy. The hydrocarbon molecules with high-energy C-C and C-H bonds in the gasoline are transformed into carbon dioxide and water and emitted into the atmosphere through combustion. Remember that millions and millions of years ago the carbon atoms in the gasoline were part of the biomass of ancient plants which, over geological time, were converted into fossil fuels.

According to the Environmental Protection Agency, the burning of fossil fuels such as gasoline account for approximately 47 percent of all carbon dioxide emissions. By buying locally grown food or by growing your own food, you can reduce the amount of carbon dioxide emissions associated with transporting your food over long distances.