Comparing Energy Use and Efficiency in Central Iowa Agroecosystems

Rachael Cox and Mary Wiedenhoeft*

Energy is relevant to all areas of human life; energy sustains us through food, drives our transportation, warms and cools our buildings, and powers our electrical gadgets. In nature, ecosystems function by capturing and transforming energy. Agroecosystems are formed when humans manipulate the capture and flow of energy for food, fiber, and fuel production. Comparing the energy use and efficiency in different agroecosystems throughout central Iowa allows producers and consumers alike to make more informed decisions about energy and sustainability in the food system.

Achieving sustainability in an agricultural system can be done by ensuring economic viability, conserving the environment, and supporting socio-cultural growth and maintenance. Energy relates to each of the three requirements of sustainability. First, energy is connected to economic viability because most of our sources of energy—fossil fuels, wind power, electricity, solar power, and more—are associated with a cost and knowing this cost as a part of an agroecosystem is essential to determine economic viability. Next, energy is related to environmental conservation because some energy sources, particularly fossil fuels, are finite resources harvested from the earth at a cost to the ecosystem. Also, the consequences of using non-renewable energy sources have been closely linked to the environmental problems of climate change.

Lastly, energy is connected to sustainability because it is strongly rooted in societal values and lifestyles around the world. Energy availability and use has been central to our industrial cultural development. Not only this, but it is highly politicized. The small groups of people who have control over the energy resources have a great deal of wealth and political power, globally and in the United States.

Many of the energy sources discussed above are industrial cultural energy. According to Stephen R. Gliessman (2007), energy sources can be divided into two categories—ecological energy and cultural energy. Ecological energy consists primarily of the energy from the sun. Cultural energy is energy which comes from human or human-manipulated sources. This category is divided into two categories—industrial cultural energy and biological cultural energy. Industrial cultural energy describes energy sourced from fossil fuels, radioactive fission, and geothermal and hydrological sources (Gliessman, 2007). Biological cultural energy consists of human labor, animal labor, and renewable sources.

In Iowa, the majority of agricultural systems are dependent on industrial cultural energy, specifically fossil fuels. They are used to fuel the tractors, cultivators, dry grain, and transport the products. As the global political situation is constantly changing, the costs of energy changes, and the pressure of house gases increases, understanding the different sources and the flow of energy in farming systems becomes important. As farming changes with these changes, the use of energy may also shift or change, and energy may become unavailable.

Though Iowa's landscape is dominated by crop production, a wide variety of agricultural systems are present throughout the state. An agroecosystem is a production system, which has defined boundaries and is evaluated according to inputs, outputs, and cycling within the system. Exploring and discovering the efficiency of varied systems will provide valuable information as our farming systems continue to change and adapt to environmental, social, and political pressures.

Materials and Methods: Defining the Agroecosystems

Three agroecosystems were selected from one geographical region of Iowa. They are all located in central Iowa that has soils with a common parent material—glacial till. Another factor linking the systems is their location and reliance on the same urban area, Ames, Iowa. Each farm was selected to fit into three categories: industrial row crop production, integrated crop and livestock production, and small-scale mixed vegetable production.

The first system selected was a corn and soybean production system on 1850 acres, which represents the industrial row crop production category. Central Iowa allows producers and consumers alike to make more informed decisions about energy and sustainability in the food system.