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Food is essential to human survival.

Prior to 11,000 years ago, all evidence implies that human groups were limited to a hunter-gatherer lifestyle where seasonal variations would greatly influence their success. The Malthusian-Darwinian dynamic—where environmental constraints are modified through the use of technological and cultural adaptations—led to millennia during which humans have learned to reshape their environment and themselves, leading to increases in population and economic output.

Starting with the assumptions that 1) thermodynamics results in a zero sum game in human and natural systems, 2) that smaller systems are interconnected with larger ones, and 3) that there are hard global limits on the resources available on the planet, the Malthusian-Darwinian dynamic forces human societies to create complex support systems. From hunter-gather societies and progressing through early agricultural settlements, city states, nations, and empires, basic scaling rules about how human systems are organized emerge. These patterns are of particular interest when considering the vulnerability of the global food system in relation to projected decreases in petroleum supply. (Received February 12, 2014)