Chapter 13
Ecosystem Services, Climate Change, and Food Security

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ABSTRACT

Food security is a rising concern around the world, especially in developing countries within arid and semi-arid regions. Ecosystem provides different services to support living and human survival, which includes some major food sources around the world like agriculture, fisheries, and livestock. With advancing times, humans improved these services and produced enough food to support the rising population. However, with increasing greenhouse gases, a new problem came into existence, commonly known as climate change (CC), which accelerated issues like food security and safety. Under such issues, people don't have access to basic facilities and food supply to survive, and with future population growth estimates, it is becoming even more difficult. Some major food sources together with alternate sources are discussed in this chapter. Upcoming CC impacts are discussed in detail in relation to major food sources and supported by world maps to provide a better picture. Major actions, government initiatives, and some suggestions are also provided to overcome this global crisis.

INTRODUCTION

Ecosystem Services (ES) are the benefits people obtain from the ecosystem itself. These include food and water (provisioning services); floods, droughts, degradation (regulating services); soil formation, nutrient cycles (supporting services) as well as recreational, spiritual and religious benefits (cultural services) (Fig.1). These services are regulated by overall biosphere, lithosphere, atmosphere and anthrosphere cycles. At present, anthrosphere causing a huge influence on atmosphere and environmental processes by increasing pollution, like ocean acidification and global warming, commonly, known as climate change. These effects causing impacts on ecosystem services at various levels. The major point of concern with increasing global population is food security, supported as provision services under a broad range of ecosystem services.

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ES are under major threat in Arid and semi-arid (ASA) regions due to limited water and agriculture resources. ASA regions are characterised by low average rainfall (300-600mm), average high temperatures, resulting in fundamental limits on animal and plant population together with agriculture production (CSIRO 2011; Ludwig & Asseng, 2006; Ribot, Magalhães, & Panagides, 2005; John, Pannell, & Kingwell, 2005; Vörösmarty, Green, Salisbury, & Lammers, 2000). It covers major areas in the United States, Argentina, Southern Africa, North Africa, the Sahel, West, and Central Asia and Australia (Fig.1). ASA regions represent 15.7% and 22.6% global land area, respectively and together support 18.5% of the global population (UN, 2010).

The natural variability of climate together with anthropogenic impacts induced changes influencing the climate. Temperature and precipitation demonstrated a strong change in last decades as shown in Fig. 2. Natural climate variability includes the changes introduced by the short term external forces (Volcanic activity, short-term changes in solar radiation) as well as long-term external forces (tectonic movement, solar radiation, changes in the Earth's orbit and asteroid bombardment) of nature. Whereas anthropogenic climate change can include the human-influenced changes causes the emission of greenhouse gases by burning fossil fuels, deforestation and land use changes ultimately lead to warming of earth's surface (IPCC, 2007; 2013). Both types of climate variation when interacting with each other causes climate change (CC), which ultimately affect the global system.

Figure 1. Pie chart explaining a) Percentage share of different types of Arid regions globally; b) Arid regions globally by continental share; c) Semi- Arid region globally by continental share
(Data Source: UNSO/UNDP, 1997)