RURAL SOCIOLOGY

**Rural sociology** is a field of sociology associated with the study of social life in non-metropolitan areas. It is the scientific study of social arrangements and behaviour amongst people distanced from points of concentrated population or economic activity. Like any sociological discipline, rural sociology involves the examination of statistical data, interviews, social theory, observation, survey research, and many other techniques.

In contrast to rural sociology, urban sociology is the study of urban social life.

Agribusiness is one focus of rural sociology and much of the field is dedicated to the economics of farm production. Other areas of study include rural migration and other demographic patterns, environmental sociology, amenity-led development, public lands policies, so-called "boomtown" development, social disruption, rural health care and education polices, and etc.

**Definition of "rural"**

Sociologists define "rural" as those areas which are not urban in nature. The line between urban and rural is quite arbitrary, although rural sociologists in America often use the U.S. Census Bureau's definition of rural as being an area of fewer than 1000 people per square mile.[1] The 2000 Census reported that rural America was home to nearly 21% of the U.S. population (59,274,000 people).

**History of rural sociology**

Rural sociology became prominent during the late industrial revolution in France, Ireland, Prussia, Scandinavia, and the US. As urban incomes and quality of life rose, a social gap appeared between urban and rural dwellers.

Early works of Max Weber in the late 19th century has been concerned with rural sociology. In the 1920s, Edmund deS. Brunner studied some 140 villages as director of the Institute for Social and Religious Research, he reported that as agriculture mechanized, farms were growing larger.

After World War II, modern rural sociology began to appear in France, Germany, Italy, the Netherlands, and the UK.

**Issues in rural America**

Rural economic trends in the United States are complex, as many regions are facing economic decline and rural exodus, while other regions -- in particular, coastal and mountainous areas -- are facing increased economic stimulus and an influx of new residents. Many traditionally rural industries such as mining, ranching, and agriculture are no longer economically viable, although in some regions these industries are being replaced by new, non-traditional industries such as information technology, resort towns, tourism, and art. These industries are providing economic growth and social diversity to areas that were otherwise declining. The Rural Rebound: Recent Nonmetropolitan Demographic Trends in the United States American Center for the West

Currently, rural capital is flowing into either urban areas or a cluster of some 33-40% of rural counties, namely the intermountain West, the Ozarks, coastal regions, counties along I-80 in Nebraska, and the Kansas City Metropolitan Area. This growth of wealth is concentrated near urban areas, transportation corridors, and scenic amenities (Drabenstott, 1999).

Many parts of rural America are experiencing an economic slump, especially those economically dependent on agribusiness. For instance in 1999 the prices for corn, wheat, and soybeans were all down approx. 33% from the 1995-1998 average. Food production is being subsidized by off-farm income. Some farmers are working second and third jobs to support their farms. In 1974 80% of farm operators were primarily farmers. By 1997 that had dropped to 60% (McDaniel, 2000), (Lee, 2000).

Some natural resource-based industries within rural areas are experiencing resource depletion, whereas other rural areas in states such as Wyoming, Colorado, and New Mexico are seeing huge economic growth due to the extraction of natural gas and other minerals.
Rural society is faced with various problems including the environmental degradation and overuse of water resources, the establishment and inadequate regulation of toxic waste dumps, and poverty. The loss of rural population to urban areas is also an area of concern, especially in northern states, such as North Dakota.

Key topics in rural sociology

- agribusiness
- Diffusion of innovations
- role homogeneity
- rural exodus
- types of rural communities
- Rural community development

A metropolitan area is a large population center consisting of a large metropolis and its adjacent zone of influence, or of more than one closely adjoining neighboring central cities and their zone of influence. One or more large cities may serve as its hub or hubs, and the metropolitan area is normally named after either the largest or most important central city within it.

General definition

There has been no significant change in the basic metropolitan area "concept" since its adoption in 1950, though significant changes in geographic distributions have occurred since, and is expected to further evolve through time. Because of the fluidity and evolution of the "term" metropolitan statistical areas, the colloquial reference by the general population and media to define an MSA is with a more familiar reference to "metro service area, metro area, metro, or MSA" and widely intimated to mean the aggregate geographic area inclusive of not only a well known city population, but also its inner city, suburban, exurban and sometimes rural surrounding populations, all of which are influenced by employment, transportation, and commerce of the more largely well known urban city.

A metropolitan area usually combines an agglomeration (the contiguous built-up area) with peripheral zones not themselves necessarily urban in character, but closely bound to the center by employment or commerce. These zones are also sometimes known as a commuter belt, and may extend well beyond the urban periphery depending on the definition used. It is mainly the area that is not part of the city but is connected to the city. For example, Pasadena, California would be added to Los Angeles' metro area. While it isn't the same city, it is connected, and Pasadena is also located in Los Angeles County.

The core cities in a polycentric metropolitan area need not be physically connected by continuous built-up development, distinguishing the concept from conurbation, which requires urban contiguity. In a metropolitan area, it is sufficient that central cities together constitute a large population nucleus with which other constituent parts have a high degree of integration.

In practice the parameters of metropolitan areas, in both official and unofficial usage, are not consistent. Sometimes they are little different from an urban area, and in other cases they cover broad regions that have little relation to the traditional concept of a city as a single urban settlement. Thus all metropolitan area figures should be treated as interpretations rather than as hard facts. Metro area population figures given by different sources for the same place can vary by millions, and there is a tendency for people to promote the highest figure available for their own "city". However the most ambitious metropolitan area population figures are often better seen as the population of a "metropolitan region" than of a "city". [citation needed]

Differences in terminology by country

The term metropolitan area is sometimes abbreviated to 'metro', for example in Metro Manila and Washington, DC Metro Area, which in the latter case should not be mistaken to mean the metro rail system of the city. Although it can be compared in composition to many of the world's metropolitan areas, in France the term for the region around an urban core linked by commuting ties is an aire urbaine (officially translated as "urban area"). In Japan that would be toshiken (都市圏, lit. bloc of cities).

Country official unique definitions
Australia areas under the unifying influence of one or more major towns or cities. Each capital city forms its own Statistical Division, and the population of the SD is the most-often quoted figure for that city's population. Statistical Districts are defined as non-capital but predominantly urban areas. The statistical divisions that encompass the capital cities are commonly though unofficially called 'metropolitan areas'.

**European Union**

The European Union's statistical agency, Eurostat, has created a concept named Larger Urban Zone (LUZ). The LUZ represents an attempt at a harmonised definition of the metropolitan area, and the goal was to have an area from a significant share of the resident commute into the city, a concept known as the “functional urban region”.

**Republic of India**

In India, the Census Commission defines a metropolitan city as one having a population of over 40 lakh (4 million). Mumbai, Delhi, Chennai, Kolkata, Bengaluru, Hyderabad, are the six cities that qualify. Residents of these cities are also entitled to a higher House rent allowance. The figure only applies to the city region and not the conurbation.

**United States**

The Office of Management and Budget defines "Core Based Statistical Areas" used for statistics purposes among federal agencies. Each CBSA is based on a core urban area and is composed of the counties which comprise that core as well as any surrounding counties that are tightly socially or economically integrated with it. These areas are designated as either metropolitan or micropolitan statistical areas, based on population size; a "metro" area has an urban core of at least 50,000 residents, while a "micro" area has less than 50,000 but at least 10,000.

**Additional terms**

At the turn of the 19th century only 3 percent of the world's population was urbanized. During the 20th and into the 21st century the presence of humans in urban areas has increased dramatically. Within the first quarter of the 21st century it is expected that more than half of the world's population will live in urban areas, if this is not already the case.

By 2025, according to the *Far Eastern Economic Review*, Asia alone will have at least 10 hypercities, those with 20 million or more, including Delhi (~20 million), Jakarta (24.9 million people), Dhaka (25 million), Karachi (26.5 million), Shanghai (27 million) and Mumbai (33 million). Lagos has grown from 300,000 in 1950 to an estimated 15 million today, and the Nigerian government estimates that city will have expanded to 25 million residents by 2015.

If several metropolitan areas are located in succession, metropolitan areas are sometimes grouped together as a megalopolis (plural megalopoleis, also megalopolises). A megalopolis consists of several interconnected cities (and their suburbs), between which people commute, and which are so close together that suburbs can claim to be suburbs of more than one city. Another name for a megalopolis is a metroplex (short for metropolitan complex) or conurbation.

This concept was first proposed by the French geographer Jean Gottmann in his book *Megalopolis*, a study of the northeastern United States. One famous example is the BosWash megalopolis consisting of Boston, Providence, Hartford, New York City, Newark, Philadelphia, Wilmington, Baltimore, Washington, and vicinity.

The biggest one is the Taiheiyo Belt (the Pacific Megalopolis) in Japan consisting of Tokyo, Shizuoka, Nagoya, Osaka, Okayama, Hiroshima, Fukuoka and vicinity. The main transportation such as Shinkansen and expressways is constructed along these cities. The population of this megalopolis is around 82.9 million.

Guangdong Province's Pearl River Delta is a huge megalopolis with a population of 48 million that extends from Hong Kong and Shenzhen to Guangzhou. Some projections assume that by 2030 up to 1 billion people will live in China's urban areas. Even rather conservative projections predict an urban population of up to 800
million people. In its most recent assessment, the UN Population Division estimated an urban population of 1 billion in 2050.\[^{[10]}\]

The megalopolises in Europe are the Milan metropolitan area (pop. 7.4 million) in Italy, Ruhr Area (pop. 5.3 million) in Germany, the Randstad (Knooppunt Arnhem-Nijmegen and Brabantse Stedenrij are counted with the Randstad) in the Netherlands (pop. 7.4 million), the Flemish Diamond in Belgium (pop. 5.5 million), Ile de France in France and the metropolitan area of London and Moscow, as well as several 'smaller' agglomerations, such as the Meuse-Rhine Euregion, the Ems-Dollart Euregion, the Lille-Kortrijk-Tournai Euregion and Metropoly of Upper Silesia in Poland (17 cities around Katowice with a total population of over 2 million). Together this megalopolis has an estimated population of around 50 million.

Africa's first megalopolis is situated in the urban portion of Gauteng Province in South Africa, comprising the conurbation of Johannesburg, and the metropolitan areas of Pretoria and the Vaal Triangle, otherwise known as the PWV.

It has been suggested that the whole of south-eastern, Midland and parts of northern England will evolve into a megalopolis dominated by London. Clearly when usage is stretched this far, it is remote from the traditional conception of a city.

Megacity is a general term for agglomerations or metropolitan areas which usually have a total population in excess of 10 million people. In Canada, "megacity" can also refer informally to the results of merging a central city with its suburbs to form one large municipality. A Canadian "megacity", however, is not necessarily an entirely urbanized area, as many cities so named have both rural and urban portions. It also doesn't need 10 million inhabitants to bear the designation. Moreover, Canadian "megacities" do not constitute large metropolitan areas in a global sense. For example, Toronto has a metropolitan population of 5.5 million but is part of a much larger metropolitan area home to over 8.1 million people.

Census population of a metro area is not the city population. However, it better demonstrates the population of the city. Los Angeles may only have a city population of near 4,000,000, but has two metropolitan area populations, depending on definition, 13 million in the core area and 18 million in the Combined statistical area.

**Social theory**

Social theory is the use of theoretical frameworks to study and interpret social structures and phenomena within a particular school of thought.

An essential tool used by scholars in the analysis of society, social theories are interdisciplinary, drawing ideas from and contributing to such disciplines as anthropology, economics, history, human geography, literary theory, mass communications, philosophy, sociology, and theology.

The origins of social theory are difficult to pinpoint, but many arguments return to Ancient Greece. Berch Berberoglu cites Plato, Socrates and Aristotle as influencing social theory throughout the enlightenment up to the late nineteenth and early twentieth century (Berberoglu 2005, p. xi). "Critical" social theories, such as neomarxist theories and feminist theories, argue that because theories are generally based on premises that entail normative positions, it is necessary to critique the ideological aspects of theories and related oppressive social relations.

Social theory as a discipline

Harrington discusses the etymology of social theory, stating that while the term did not exist in any language before the twentieth century, its origins are ancient and lie in two words; ‘social’ from the Latin *socius* and ‘theory’ from the Greek *theoria* (Harrington 2005). Social theorising aided the Greeks in making sense of their lives, and in questioning the value and meaning of things around them.

Social theory as a distinct discipline emerged in the 20th century and was largely equated with an attitude of critical thinking, based on rationality, logic and objectivity, and the desire for knowledge through a posteriori methods of discovery, rather than apriori methods of tradition. With this in mind it is easy to link social theory to deeper seated philosophical discussions.
Social theory in relation to the natural sciences

Compared to disciplines within the objective natural sciences -- such as physics or chemistry -- social theorists may make less use of the scientific method, and their conclusions and data can be interpreted more subjectively. While standards of rigor do exist within quantitative social science methodologies, their precision is bounded by a degree of uncertainty inherent in human behavior. However, because experiments in the natural sciences are necessarily social artifacts, and social theory treats social artifacts as being constructed, social theorists posit that even experiments in the natural sciences and their concomitant results are social constructions. Social theories can complement research in the natural sciences and vice-versa.

The concept that social theory may supersede certain aspects of the natural sciences is called the social construction of reality. Social theory takes knowledge, the manner in which we acquire knowledge, and the institutions by which knowledge is reified and disseminated among a human collectivity to be socially constructed. In effect, the laws of nature can only be derived using social tools within a social context. According to social theory, the understanding of natural phenomena is predicated on the understanding of social phenomena, as the interpretation of natural phenomena is a social activity.

This interpretation of the natural sciences leads to some deeper epistemological questions. By questioning the methods by which we deem knowledge to be "objective," we necessarily put into question any scientific knowledge whatsoever. Social theory does not exist in mutual exclusion to the natural sciences; one is often complementary to the other. Rather, social theory calls for natural scientists to examine their methodologies with a critical eye by situating said methodologies within a social context.

History

Pre-classical social theorists

Prior to 19th century, social theory took largely narrative and normative traits. Expressed in story form, it both assumed ethical principles and recommended moral acts. Thus one can regard religious figures as the earliest social theorists.

Saint Augustine (354 - 430) and St. Thomas Aquinas (circa 1225 - 1274) concerned themselves exclusively with a just society. St. Augustine describes late Ancient Roman society but through a lens of hatred and contempt for what he saw as false Gods, and in reaction theorized The City of God. Similarly, in China, Master Kong (otherwise known as Confucius) (551 - 479 BCE) envisaged a just society that went beyond his contemporary society of the Warring States. Later on, also in China, Mozi (circa 470 - circa 390 BCE) recommended a more pragmatic sociology, but ethical at base.

In the 18th century, after Montesquieu's The Spirit of Law established that social elements influences human nature, pre-classical period of social theories have changed to a new form that provide the basic ideas for social theory. Such as: evolution, philosophy of history, social life and social contract, public and general will, competition in social space, organicist pattern for social description and ... Jean-Jacques Rousseau in this time played a significant role in social theory. He revealed the origin of inequality, analyzed the social contract(and social compact) that forms social integration and defined the social sphere or civil society. He also emphasized that man has the liberty to change his world, a revolutionary assertion that made it possible to program and change society.

Classical social theory

The first “modern” social theories (known as classical theories) that begin to resemble the analytic social theory of today developed almost simultaneously with the birth of the science of sociology. Auguste Comte (1798 - 1857), known as the 'father of sociology', laid the groundwork for one of the first social theories - social evolutionism. In the 19th century three great classical theories of social and historical change emerged: the social evolutionism theory (of which Social Darwinism forms a part), the social cycle theory and the Marxist historical materialism theory.

Another early modern theorist, Herbert Spencer (1820 - 1903), coined the term "survival of the fittest" (and incidentally recommended avoidance of governmental action on behalf of the poor). Some Post-Modern social
theorists like Shepard Humphries, draw heavily upon Spencer's work and argue that many of his observations are timeless (just as relevant in 2008 as 1898). Vílfredo Pareto (1848 - 1923) and Pitirim A. Sorokin argued that "history goes in cycles", and presented the social cycle theory to illustrate their point. Ferdinand Tönnies (1855 - 1936) made community and society (Gemeinschaft and Gesellschaft, 1887) the special topics of the new science of "sociology", both of them based on different modes of will of social actors. Emile Durkheim postulated a number of major theories regarding anomie and functionalism. Max Weber theorized on bureaucracy, religion, and authority. Karl Marx theorized on the class struggle and social progress towards communism and laid the groundwork for the theory that became known as Marxism. Marxism became more than a theory, of course, carrying deep implications over the course of 20th century history (including the Russian Revolution of 1917).

Most of the 19th century pioneers of social theory and sociology, like Saint-Simon, Comte, Marx, John Stuart Mill or Spencer, never held university posts. Most people regarded them as philosophers, because much of the their thinking was interdisciplinary and "outside the box" of the existing disciplines of their time (eg., philology, law, and history).

Many of the classical theories had one common factor: they all agreed that the history of humanity is pursuing a certain fixed path. They differed on where that path would lead: social progress, technological progress, decline or even fall, etc. Social cycle theorists were much more skeptical of the Western achievements and technological progress, however, arguing that progress is but an illusion in of the ups and downs of the historical cycles. The classical approach has been criticized by many modern sociologists and theorists, among them Karl Popper, Robert Nisbet, Charles Tilly and Immanuel Wallerstein.

Modern social theory

Much of 19th-century classical social theory has been expanded upon to create newer, more contemporary social theories such as Multilineal theories of evolution (neoevolutionism, sociobiology, theory of modernization, theory of post-industrial society) and various strains of Neo-Marxism.

In the late 19th and early 20th centuries, social theory became most closely related to academic sociology while other related studies such as anthropology, philosophy, and social work branched out into their own disciplines. Such subjects as "philosophy of history" and other such multi-disciplinary subject matter became part of social theory as taught under sociology.

Attempts to recapture a space for discussion free of disciplines began in earnest in the late 1920s and early 1930s. The Frankfurt Institute for Social Research provides the most successful historical example. The Committee on Social Thought at the University of Chicago followed in the 1940s. In the 1970s, programs in Social and Political Thought were established at Sussex and York. Others followed, with various different emphases and structures, such as Social Theory and History (University of California, Davis). Cultural Studies programs, notably that of Birmingham University, extended the concerns of social theory into the domain of culture and thus anthropology. A chair and undergraduate program in social theory was established at the University of Melbourne and a number of universities now specialize in social theory (UC-Santa Cruz is one example). Social theory at present seems to be gaining more acceptance as a classical academic discipline.

In modern times, generally speaking, social theory began to stress free will, individual choice, subjective reasoning, and the importance of unpredictable events in place of the classic determinism – thus social theory become much more complex. Rational Choice Theory and Symbolic Interactionism furnish two examples. Most modern sociologists deem there are no great unifying 'laws of history', but rather smaller, more specific, and more complex laws that govern society.

Post-modern social theory

Scholars and historians most commonly hold postmodernism to be a movement of ideas arising from, but also critical of elements of modernism[citation needed]. Because of the wide range of uses of the term, different elements of modernity are chosen as being continuous, and different elements of modernity are held to be critiqued. Each of the different uses also is rooted in some argument about the nature of knowledge, known in philosophy as epistemology. Individuals who use the term are arguing that either there is something fundamentally different about the transmission of meaning, or that modernism has fundamental flaws in its system of knowledge1.
The argument for the necessity of the term states that economic and technological conditions of our age have given rise to a decentralized, media-dominated society in which ideas are simulacra and only inter-referential representations and copies of each other, with no real original, stable or objective source for communication and meaning. Globalization, brought on by innovations in communication, manufacturing and transportation, is often[citation needed] cited as one force which has driven the decentralized modern life, creating a culturally pluralistic and interconnected global society lacking any single dominant center of political power, communication, or intellectual production. The postmodern view is that inter-subjective knowledge, and not objective knowledge is the dominant form of discourse under such conditions, and the ubiquity of copies and dissemination fundamentally alters the relationship between reader and what is read, between observer and the observed, between those who consume and those who produce. Not all people who use the term postmodern or postmodernism see these developments as positive. Users of the term often argue[citation needed] that their ideals have arisen as the result of particular economic and social conditions, including what is described as "late capitalism" and the growth of broadcast media, and that such conditions have pushed society into a new historical period.

The term "postmodernism" was brought into social theory in 1971 by the Arab American Theorist Ihab Hassan in his book: The Dismemberment of Orpheus: Toward a Postmodern Literature. In 1979 Jean-François Lyotard wrote a short but influential work The Postmodern Condition: A report on knowledge. Jean Baudrillard, Michel Foucault, and Roland Barthes were influential in 1970s in developing postmodern theory.

**Theory construction**

Almost all good research is guided by theory. Selecting or creating appropriate theory for use in examining an issue is thus an important skill for any researcher. Important distinctions: a theoretical orientation (or paradigm) is a worldview, the lens through which one organizes experience (i.e. thinking of human interaction in terms of power or exchange); a theory is an attempt to explain and predict behavior in particular contexts. A theoretical orientation cannot be proven or disproven; a theory can. Having a theoretical orientation that sees the world in terms of power and control, I could create a theory about violent human behavior which includes specific causal statements (e.g. being the victim of physical abuse leads to psychological problems). This could lead to an hypothesis (prediction) about what I expect to see in a particular sample, e.g. “a battered child will grow up to be shy or violent.” I can then test my hypothesis by looking to see if it is consistent with data in the real world. I might, for instance, review hospital records to find children who were abused, then track them down and administer a personality test to see if they show signs of being violent or shy. The selection of an appropriate (i.e. useful) theoretical orientation within which to develop a potentially helpful theory is the bedrock of social science.

In agriculture, agribusiness is a generic term for the various businesses involved in food production, including farming and contract farming, seed supply, agrichemicals, farm machinery, wholesale and distribution, processing, marketing, and retail sales. The term has two distinctly different connotations depending on context.

Within the agriculture industry, agribusiness is widely used simply as a convenient portmanteau of agriculture and business, referring to the range of activities and disciplines encompassed by modern food production. There are academic degrees in and departments of agribusiness, agribusiness trade associations, agribusiness publications, and so forth, worldwide. Here, the term is only descriptive, and is synonymous in the broadest sense with food industry.

Among critics of large-scale, industrialized, vertically integrated food production, the term agribusiness is used negatively, synonymous with corporate farming. As such, it is often contrasted with smaller family-owned farms. Negative connotations are also derived from the negative associations of "business" and "corporation" by critics of capitalism or corporate excess. As concern over global warming intensifies, biofuels derived from food crops quickly emerged as a practical answer to the energy crisis. Adding corn ethanol to gasoline or using palm oil for biodiesel makes the fuel burn more cleanly, stretches oil supplies, and perhaps most attractive to some politicians, provides a nice boost to big agribusiness. In Europe and in the US, increasing biofuels was mandated by law.[1]

An example of an agribusiness was the Old North State Winegrowers Cooperative in North Carolina. Wine grape farmers came together to not only sell their grapes but to share a winery, winemaker and marketing brand together. The cooperative failed in 2006, three years after opening its winery.  [2] [3]
Many progressive agribusinesses are now operating online businesses. Rising fuel costs are increasingly adding financial burdens on the day to day running of agricultural companies. An example of an online agribusiness is FarmingPages.com[1].

**Agriculture** is the production of food and goods through farming and forestry. Agriculture was the key development that led to the rise of human civilization, with the husbandry of domesticated animals and plants (i.e. crops) creating food surpluses that enabled the development of more densely populated and stratified societies. The study of agriculture is known as agricultural science.

Agriculture encompasses a wide variety of specialties and techniques, including ways to expand the lands suitable for plant raising, by digging water-channels and other forms of irrigation. Cultivation of crops on arable land and the pastoral herding of livestock on rangeland remain at the foundation of agriculture. In the past century there has been increasing concern to identify and quantify various forms of agriculture. In the developed world the range usually extends between sustainable agriculture (e.g. permaculture or organic agriculture) and intensive farming (e.g. industrial agriculture).

Modern agronomy, plant breeding, pesticides and fertilizers, and technological improvements have sharply increased yields from cultivation, and at the same time have caused widespread ecological damage and negative human health effects.[citation needed] Selective breeding and modern practices in animal husbandry such as intensive pig farming (and similar practices applied to the chicken) have similarly increased the output of meat, but have raised concerns about animal cruelty and the health effects of the antibiotics, growth hormones, and other chemicals commonly used in industrial meat production.[citation needed]

The major agricultural products can be broadly grouped into foods, fibers, fuels, raw materials, pharmaceuticals and stimulants, and an assortment of ornamental or exotic panget products. In the 2000s, plants have been used to grow biofuels, biopharmaceuticals, bioplastics,[1] and pharmaceuticals.[2] Specific foods include cereals, vegetables, fruits, and meat. Fibers include cotton, wool, hemp, silk and flax. Raw materials include lumber and bamboo. Stimulants include tobacco, alcohol, opium, cocaine, and digitalis. Other useful materials are produced by plants, such as resins. Biofuels include methane from biomass, ethanol, and biodiesel. Cut flowers, nursery plants, tropical fish and birds for the pet trade are some of the ornamental products.

In 2007, about one third of the world's workers were employed in agriculture. Though in 2003 agricultural employees were fewer but due to the agricultural awareness it increased rapidly in 2008– the services sector overtook agriculture as the economic sector employing the most people worldwide.[3] Despite the fact that agriculture employs over one-third of the world's population, agricultural production accounts for less than five percent of the gross world product (an aggregate of all gross domestic products).

**Etymology**

The word *agriculture* is the English adaptation of Latin *agricultṛa*, from *ager*, "a field",[4] and *cultūra*, "cultivation" in the strict sense of "tillage of the soil".[5] Thus, a literal reading of the word yields "tillage of a field / of fields"...

**Overview**

Agriculture has played a key role in the development of human civilization. Until the Industrial Revolution, the vast majority of the human population labored in agriculture. Development of agricultural techniques has steadily increased agricultural productivity, and the widespread diffusion of these techniques during a time period is often called an agricultural revolution. A remarkable shift in agricultural practices has occurred over the past century in response to new technologies. In particular, the Haber-Bosch method for synthesizing ammonium nitrate made the traditional practice of recycling nutrients with crop rotation and animal manure less necessary.
Synthetic nitrogen, along with mined rock phosphate, pesticides and mechanization, have greatly increased crop yields in the early 20th century. Increased supply of grains has led to cheaper livestock as well. Further, global yield increases were experienced later in the 20th century when high-yield varieties of common staple grains such as rice, wheat, and corn (maize) were introduced as a part of the Green Revolution. The Green Revolution exported the technologies (including pesticides and synthetic nitrogen) of the developed world to the developing world. Thomas Malthus famously predicted that the Earth would not be able to support its growing population, but technologies such as the Green Revolution have allowed the world to produce a surplus of food.\textsuperscript{[6]}

Many governments have subsidized agriculture to ensure an adequate food supply. These agricultural subsidies are often linked to the production of certain commodities such as wheat, corn (maize), rice, soybeans, and milk. These subsidies, especially when instituted by developed countries have been noted as protectionist, inefficient, and environmentally damaging.\textsuperscript{[7]} In the past century agriculture has been characterized by enhanced productivity, the use of synthetic fertilizers and pesticides, selective breeding, mechanization, water contamination, and farm subsidies. Proponents of organic farming such as Sir Albert Howard argued in the early 1900s that the overuse of pesticides and synthetic fertilizers damages the long-term fertility of the soil. While this feeling lay dormant for decades, as environmental awareness has increased in the 2000s there has been a movement towards sustainable agriculture by some farmers, consumers, and policymakers. In recent years there has been a backlash against perceived external environmental effects of mainstream agriculture, particularly regarding water pollution,\textsuperscript{[8]} resulting in the organic movement. One of the major forces behind this movement has been the European Union, which first certified organic food in 1991 and began reform of its Common Agricultural Policy (CAP) in 2005 to phase out commodity-linked farm subsidies,\textsuperscript{[9]} also known as decoupling. The growth of organic farming has renewed research in alternative technologies such as integrated pest management and selective breeding. Recent mainstream technological developments include genetically modified food.

As of late 2007, several factors have pushed up the price of grain used to feed poultry and dairy cows and other cattle, causing higher prices of wheat (up 58%), soybean (up 32%), and maize (up 11%) over the year.\textsuperscript{[10][11]} Food riots have recently taken place in many countries across the world.\textsuperscript{[12][13][14]} An epidemic of stem rust on wheat caused by race Ug99 is currently spreading across Africa and into Asia and is causing major concern.\textsuperscript{[15][16][17]} Approximately 40% of the world's agricultural land is seriously degraded.\textsuperscript{[18]} In Africa, if current trends of soil degradation continue, the continent might be able to feed just 25% of its population by 2025, according to UNU's Ghana-based Institute for Natural Resources in Africa.\textsuperscript{[19]}

History

Since its development roughly 10,000 years ago,\textsuperscript{[20]} agriculture has expanded vastly in geographical coverage and yields. Throughout this expansion, new technologies and new crops were integrated. Agricultural practices such as irrigation, crop rotation, fertilizers, and pesticides were developed long ago, but have made great strides in the past century. The history of agriculture has played a major role in human history, as agricultural progress has been a crucial factor in worldwide socio-economic change. Wealth-concentration and militaristic specializations rarely seen in hunter-gatherer cultures are commonplace in societies which practice agriculture. So, too, are arts such as epic literature and monumental architecture, as well as codified legal systems. When farmers became capable of producing food beyond the needs of their own families, others in their society were freed to devote themselves to projects other than food acquisition. Historians and anthropologists have long argued that the development of agriculture made civilization possible.

Ancient origins

The Fertile Crescent of Western Asia, Egypt, and India were sites of the earliest planned sowing and harvesting of plants that had previously been gathered in the wild. Independent development of agriculture occurred in
northern and southern China, Africa's Sahel, New Guinea and several regions of the Americas. The eight so-called Neolithic founder crops of agriculture appear: first emmer wheat and einkorn wheat, then hulled barley, peas, lentils, bitter vetch, chick peas and flax.

By 7000 BC, small-scale agriculture reached Egypt. From at least 7000 BC the Indian subcontinent saw farming of wheat and barley, as attested by archaeological excavation at Mehrgarh in Balochistan. By 6000 BC, mid-scale farming was entrenched on the banks of the Nile. About this time, agriculture was developed independently in the Far East, with rice, rather than wheat, as the primary crop. Chinese and Indonesian farmers went on to domesticate taro and beans including mung, soy and azuki. To complement these new sources of carbohydrates, highly organized net fishing of rivers, lakes and ocean shores in these areas brought in great volumes of essential protein. Collectively, these new methods of farming and fishing inaugurated a human population boom that dwarfed all previous expansions and continues today.

By 5000 BC, the Sumerians had developed core agricultural techniques including large-scale intensive cultivation of land, mono-cropping, organized irrigation, and the use of a specialized labor force, particularly along the waterway now known as the Shatt al-Arab, from its Persian Gulf delta to the confluence of the Tigris and Euphrates. Domestication of wild aurochs and mouflon into cattle and sheep, respectively, ushered in the large-scale use of animals for food/fiber and as beasts of burden. The shepherd joined the farmer as an essential provider for sedentary and semi-nomadic societies. Maize, manioc, and arrowroot were first domesticated in the Americas as far back as 5200 BC. The potato, tomato, pepper, squash, several varieties of bean, tobacco, and several other plants were also developed in the New World, as was extensive terracing of steep hillsides in much of Andean South America. The Greeks and Romans built on techniques pioneered by the Sumerians but made few fundamentally new advances. Southern Greeks struggled with very poor soils, yet managed to become a dominant society for years. The Romans were noted for an emphasis on the cultivation of crops for trade.

Middle Ages

During the Middle Ages, farmers in North Africa, the Near East, and Europe began making use of agricultural technologies including irrigation systems based on hydraulic and hydrostatic principles, machines such as norias, water-raising machines, dams, and reservoirs. This combined with the invention of a three-field system of crop rotation and the moldboard plow greatly improved agricultural efficiency.

Modern era

After 1492, a global exchange of previously local crops and livestock breeds occurred. Key crops involved in this exchange included the tomato, maize, potato, manioc, cocoa and tobacco going from the New World to the Old, and several varieties of wheat, spices, coffee, and sugar cane going from the Old World to the New. The most important animal exportation from the Old World to the New were those of the horse and dog (dogs were already present in the pre-Columbian Americas but not in the numbers and breeds suited to farm work). Although not usually food animals, the horse (including donkeys and ponies) and dog quickly filled essential production roles on western-hemisphere farms.

The potato became an important staple crop in northern Europe. Since being introduced by Portuguese in the 16th century, maize and manioc have replaced traditional African crops as the continent's most important staple food crops.

By the early 1800s, agricultural techniques, implements, seed stocks and cultivated plants selected and given a unique name because of its decorative or useful characteristics had so improved that yield per land unit was many times that seen in the Middle Ages. With the rapid rise of mechanization in the late 19th and 20th centuries, particularly in the form of the tractor, farming tasks could be done with a speed and on a scale previously impossible. These advances have led to efficiencies enabling certain modern farms in the United States, Argentina, Israel, Germany, and a few other nations to output volumes of high-quality produce per land unit at what may be the practical limit. The Haber-Bosch method for synthesizing ammonium nitrate represented a major breakthrough and allowed crop yields to overcome previous constraints. In the past century agriculture has been characterized by enhanced productivity, the substitution of labor for synthetic fertilizers and pesticides, water pollution, and farm subsidies. In recent years there has been a backlash against the external environmental effects of conventional agriculture, resulting in the organic movement.
The cereals rice, corn, and wheat provide 60% of human food supply. Between 1700 and 1980, "the total area of cultivated land worldwide increased 466%" and yields increased dramatically, particularly because of selectively-bred high-yielding varieties, fertilizers, pesticides, irrigation, and machinery. For example, irrigation increased corn yields in eastern Colorado by 400 to 500% from 1940 to 1997.

However, concerns have been raised over the sustainability of intensive agriculture. Intensive agriculture has become associated with decreased soil quality in India and Asia, and there has been increased concern over the effects of fertilizers and pesticides on the environment, particularly as population increases and food demand expands. The monocultures typically used in intensive agriculture increase the number of pests, which are controlled through pesticides. Integrated pest management (IPM), which "has been promoted for decades and has had some notable successes" has not significantly affected the use of pesticides because policies encourage the use of pesticides and IPM is knowledge-intensive. Although the "Green Revolution" significantly increased rice yields in Asia, yield increases have not occurred in the past 15–20 years. The genetic "yield potential" has increased for wheat, but the yield potential for rice has not increased since 1966, and the yield potential for maize has "barely increased in 35 years". It takes a decade or two for herbicide-resistant weeds to emerge, and insects become resistant to insecticides within about a decade. Crop rotation helps to prevent resistances.

Agricultural exploration expeditions, since the late nineteenth century, have been mounted to find new species and new agricultural practices in different areas of the world. Two early examples of expeditions include Frank N. Meyer's fruit- and nut-collecting trip to China and Japan from 1916-1918 and the Dorsett-Morse Oriental Agricultural Exploration Expedition to China, Japan, and Korea from 1929-1931 to collect soybean germplasm to support the rise in soybean agriculture in the United States.

In 2005, the agricultural output of China was the largest in the world, accounting for almost one-sixth of world share, followed by the EU, India and the USA, according to the International Monetary Fund. Economists measure the total factor productivity of agriculture and by this measure agriculture in the United States is roughly 2.6 times more productive than it was in 1948.

Six countries - the US, Canada, France, Australia, Argentina and Thailand - supply 90% of grain exports. Water deficits, which are already spurring heavy grain imports in numerous middle-sized countries, including Algeria, Iran, Egypt, and Mexico, may soon do the same in larger countries, such as China or India.

Crop production systems

Crop production systems vary among farms depending on the available resources and constraints: geography and climate of the farm; government policy; economic, social and political pressures; and the philosophy and culture of the farmer. Shifting cultivation (or slash and burn) is a system in which forests are burnt, releasing nutrients to support cultivation of annual and then perennial crops for a period of several years. Then the plot is left fallow to regrow forest, and the farmer moves to a new plot, returning after many more years (10-20). This fallow period is shortened if population density grows, requiring the input of nutrients (fertilizer or manure) and some manual pest control. Annual cultivation is the next phase of intensity in which there is no fallow period. This requires even greater nutrient and pest control inputs. Further industrialization lead to the use of monocultures, when one cultivar is planted on a large acreage. Due to the low biodiversity, nutrient use is uniform, and pests tend to build up, necessitating the greater use of pesticides and fertilizers. Multiple cropping, in which several crops are grown sequentially in one year, and intercropping, when several crops are grown at the same time are other kinds of annual cropping systems known as polycultures.

In tropical environments, all of these cropping systems are practiced. In subtropical and arid environments, the timing and extent of agriculture may be limited by rainfall, either not allowing multiple annual crops in a year, or requiring irrigation. In all of these environments perennial crops are grown (coffee, chocolate) and systems are practiced such as agroforestry. In temperate environments, where ecosystems were predominantly grassland or prairie, highly productive annual cropping is the dominant farming system.

The last century has seen the intensification, concentration and specialization of agriculture, relying upon new technologies of agricultural chemicals (fertilizers and pesticides), mechanization, and plant breeding (hybrids and GMO's). In the past few decades, a move towards sustainability in agriculture has also developed, integrating ideas of socio-economic justice and conservation of resources and the environment within a farming system. This has led to the development of many responses to the conventional agriculture approach,
including organic agriculture, urban agriculture, community supported agriculture, ecological or biological agriculture, integrated farming, and holistic management.

**Crop statistics**

Important categories of crops include grains and pseudograins, pulses (legumes), forage, and fruits and vegetables. Specific crops are cultivated in distinct growing regions throughout the world. In millions of metric tons, based on FAO estimate.

**Livestock production systems**

Animals, including horses, mules, oxen, camels, llamas, alpacas, and dogs, are often used to help cultivate fields, harvest crops, wrangle other animals, and transport farm products to buyers. Animal husbandry not only refers to the breeding and raising of animals for meat or to harvest animal products (like milk, eggs, or wool) on a continual basis, but also to the breeding and care of species for work and companionship. Livestock production systems can be defined based on feed source, as grassland-based, mixed, and landless. Grassland-based livestock production relies upon plant material such as shrubland, rangeland, and pastures for feeding ruminant animals. Outside nutrient inputs may be used, however manure is returned directly to the grassland as a major nutrient source. This system is particularly important in areas where crop production is not feasible due to climate or soil, representing 30-40 million pastoralists. Mixed production systems use grassland, fodder crops and grain feed crops as feed for ruminant and monogastic (one stomach; mainly chickens and pigs) livestock. Manure is typically recycled in mixed systems as a fertilizer for crops. Approximately 68% of all agricultural land is permanent pastures used in the production of livestock. Landless systems rely upon feed from outside the farm, representing the de-linking of crop and livestock production found more prevalently in OECD member countries. In the U.S., 70% of the grain grown is fed to animals on feedlots. Synthetic fertilizers are more heavily relied upon for crop production and manure utilization becomes a challenge as well as a source for pollution.

**Production practices**

**Tillage** is the practice of plowing soil to prepare for planting or for nutrient incorporation or for pest control. Tillage varies in intensity from conventional to no-till. It may improve productivity by warming the soil, incorporating fertilizer and controlling weeds, but also renders soil more prone to erosion, triggers the decomposition of organic matter releasing CO$_2$, and reduces the abundance and diversity of soil organisms.

**Pest control** includes the management of weeds, insects/mites, and diseases. Chemical (pesticides), biological (biocontrol), mechanical (tillage), and cultural practices are used. Cultural practices include crop rotation, culling, cover crops, intercropping, composting, avoidance, and resistance. Integrated pest management attempts to use all of these methods to keep pest populations below the number which would cause economic loss, and recommends pesticides as a last resort.

**Nutrient management** includes both the source of nutrient inputs for crop and livestock production, and the method of utilization of manure produced by livestock. Nutrient inputs can be chemical inorganic fertilizers, manure, green manure, compost and mined minerals. Crop nutrient use may also be managed using cultural techniques such as crop rotation or a fallow period. Manure is used either by holding livestock where the feed crop is growing, such as in managed intensive rotational grazing, or by spreading either dry or liquid formulations of manure on cropland or pastures.

**Water management** is where rainfall is insufficient or variable, which occurs to some degree in most regions of the world. Some farmers use irrigation to supplement rainfall. In other areas such as the Great Plains in the U.S. and Canada, farmers use a fallow year to conserve soil moisture to use for growing a crop in the following year. Agriculture represents 70% of freshwater use worldwide.

**Processing, distribution, and marketing**

In the United States, food costs attributed to processing, distribution, and marketing have risen while the costs attributed to farming have declined. From 1960 to 1980 the farm share was around 40%, but by 1990 it had declined to 30% and by 1998, 22.2%. Market concentration has increased in the sector as well, with the top 20
food manufacturers accounting for half the food-processing value in 1995, over double that produced in 1954. As of 2000 the top six US supermarket groups had 50% of sales compared to 32% in 1992. Although the total effect of the increased market concentration is likely increased efficiency, the changes redistribute economic surplus from producers (farmers) and consumers, and may have negative implications for rural communities.

Crop alteration and biotechnology

Crop alteration has been practiced by humankind for thousands of years, since the beginning of civilization. Altering crops through breeding practices changes the genetic make-up of a plant to develop crops with more beneficial characteristics for humans, for example, larger fruits or seeds, drought-tolerance, or resistance to pests. Significant advances in plant breeding ensued after the work of geneticist Gregor Mendel. His work on dominant and recessive alleles gave plant breeders a better understanding of genetics and brought great insights to the techniques utilized by plant breeders. Crop breeding includes techniques such as plant selection with desirable traits, self-pollination and cross-pollination, and molecular techniques that genetically modify the organism. Domestication of plants has, over the centuries increased yield, improved disease resistance and drought tolerance, eased harvest and improved the taste and nutritional value of crop plants. Careful selection and breeding have had enormous effects on the characteristics of crop plants. Plant selection and breeding in the 1920s and 1930s improved pasture (grasses and clover) in New Zealand. Extensive X-ray and ultraviolet induced mutagenesis efforts (i.e. primitive genetic engineering) during the 1950s produced the modern commercial varieties of grains such as wheat, corn (maize) and barley.

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The green revolution popularized the use of conventional hybridization to increase yield many folds by creating "high-yielding varieties". For example, average yields of corn (maize) in the USA have increased from around 2.5 tons per hectare (t/ha) (40 bushels per acre) in 1900 to about 9.4 t/ha (150 bushels per acre) in 2001. Similarly, worldwide average wheat yields have increased from less than 1 t/ha in 1900 to more than 2.5 t/ha in 1990. South American average wheat yields are around 2 t/ha, African under 1 t/ha, Egypt and Arabia up to 3.5 to 4 t/ha with irrigation. In contrast, the average wheat yield in countries such as France is over 8 t/ha. Variations in yields are due mainly to variation in climate, genetics, and the level of intensive farming techniques (use of fertilizers, chemical pest control, growth control to avoid lodging

Genetic Engineering

Genetically Modified Organisms (GMO) are organisms whose genetic material has been altered by genetic engineering techniques generally known as recombinant DNA technology. Genetic engineering has expanded the genes available to breeders to utilize in creating desired germlines for new crops. After mechanical tomato-harvesters were developed in the early 1960s, agricultural scientists genetically modified tomatoes to be more resistant to mechanical handling. More recently, genetic engineering is being employed in various parts of the world, to create crops with other beneficial traits.

Herbicide-tolerant GMO Crops

Roundup-Ready seed has a herbicide resistant gene implanted into its genome that allows the plants to tolerate exposure to glyphosate. Roundup is a trade name for a glyphosate based product, which is a systemic, non-selective herbicide used to kill weeds. Roundup-Ready seeds allow the farmer to grow a crop that can be sprayed with glyphosate to control weeds without harming the resistant crop. Herbicide-tolerant crops are used by farmers worldwide. Today, 92% of soybean acreage in the US is planted with genetically-modified herbicide-tolerant plants. With the increasing use of herbicide-tolerant crops, comes an increase in the use of glyphosate based herbicide sprays. In some areas glyphosate resistant weeds have developed, causing farmers to switch to other herbicides. Some studies also link widespread glyphosate usage to iron deficiencies in some crops, which is both a crop production and a nutritional quality concern, with potential economic and health implications.

Insect-Resistant GMO Crops

Other GMO crops utilized by growers include insect-resistant crops, which have a gene from the soil bacterium Bacillus thuringiensis (Bt) which produces a toxin specific to insects; insect-resistant crops protect plants from damage by insects, one such crop is Starlink. Another is cotton, which accounts for 63% of US cotton acreage.
Some believe that similar or better pest-resistance traits can be acquired through traditional breeding practices, and resistance to various pests can be gained through hybridization or cross-pollination with wild species. In some cases, wild species are the primary source of resistance traits; some tomato cultivars that have gained resistance to at least nineteen diseases did so through crossing with wild populations of tomatoes. Costs and Benefits of GMOs

Genetic engineers may someday develop transgenic plants which would allow for irrigation, drainage, conservation, sanitary engineering, and maintaining or increasing yields while requiring fewer fossil fuel derived inputs than conventional crops. Such developments would be particularly important in areas which are normally arid and rely upon constant irrigation, and on large scale farms. However, genetic engineering of plants has proven to be controversial. Many issues surrounding food security and environmental impacts have risen regarding GMO practices. For example, GMOs are questioned by some ecologists and economists concerned with GMO practices such as terminator seeds, which is a genetic modification that creates sterile seeds. Terminator seeds are currently under strong international opposition and face continual efforts of global bans. Another controversial issue is the patent protection given to companies that develop new types of seed using genetic engineering. Since companies have intellectual ownership of their seeds, they have the power to dictate terms and conditions of their patented product. Currently, ten seed companies control over two-thirds of the global seed sales. Vandana Shiva argues that these companies are guilty of biopiracy by patenting life and exploiting organisms for profit. Farmers using patented seed are restricted from saving seed for subsequent plantings, which forces farmers to buy new seed every year. Since seed saving is a traditional practice for many farmers in both developing and developed countries, GMO seeds legally bind farmers to change their seed saving practices to buying new seed every year.

Locally adapted seeds are an essential heritage that has the potential to be lost with current hybridized crops and GMOs. Locally adapted seeds, also called land races or crop eco-types, are important because they have adapted over time to the specific microclimates, soils, other environmental conditions, field designs, and ethnic preference indigenous to the exact area of cultivation. Introducing GMOs and hybridized commercial seed to an area brings the risk of cross-pollination with local land races. Therefore, GMOs pose a threat to the sustainability of land races and the ethnic heritage of cultures. Once seed contains transgenic material, it becomes subject to the conditions of the seed company that owns the patent of the transgenic material.

There is also concern that GMOs will cross-pollinate with wild species and permanently alter native populations’ genetic integrity; there are already identified populations of wild plants with transgenic genes. GMO gene flow to related weed species is a concern, as well as cross-pollination with non-transgenic crops. Since many GMO crops are harvested for their seed, such as rapeseed, seed spillage in is problematic for volunteer plants in rotated fields, as well as seed-spillage during transportation.

Food safety and labeling

Food security issues also coincide with food safety and food labeling concerns. Currently a global treaty, the BioSafety Protocol, regulates the trade of GMOs. The EU currently requires all GMO foods to be labeled, whereas the US does not require transparent labeling of GMO foods. Since there are still questions regarding the safety and risks associated with GMO foods, some believe the public should have the freedom to choose and know what they are eating and require all GMO products to be labeled.

Environmental impact

Agriculture imposes external costs upon society through pesticides, nutrient runoff, excessive water usage, and assorted other problems. A 2000 assessment of agriculture in the UK determined total external costs for 1996 of £2,343 million, or £208 per hectare. A 2005 analysis of these costs in the USA concluded that cropland imposes approximately $5 to 16 billion ($30 to $96 per hectare), while livestock production imposes $714 million. Both studies concluded that more should be done to internalize external costs, and neither included subsidies in their analysis, but noted that subsidies also influence the cost of agriculture to society. Both focused on purely fiscal impacts. The 2000 review included reported pesticide poisonings but did not include speculative chronic effects of pesticides, and the 2004 review relied on a 1992 estimate of the total impact of pesticides.

Livestock issues
A senior UN official and co-author of a UN report detailing this problem, Henning Steinfeld, said "Livestock are one of the most significant contributors to today's most serious environmental problems". Livestock production occupies 70% of all land used for agriculture, or 30% of the land surface of the planet. It is one of the largest sources of greenhouse gases, responsible for 18% of the world's greenhouse gas emissions as measured in CO$_2$ equivalents. By comparison, all transportation emits 13.5% of the CO$_2$. It produces 65% of human-related nitrous oxide (which has 296 times the global warming potential of CO$_2$) and 37% of all human-induced methane (which is 23 times as warming as CO$_2$). It also generates 64% of the ammonia, which contributes to acid rain and acidification of ecosystems. Livestock expansion is cited as a key factor driving deforestation, in the Amazon basin 70% of previously forested area is now occupied by pastures and the remainder used for feedcrops. Through deforestation and land degradation, livestock is also driving reductions in biodiversity.

**Land transformation and degradation**

Land transformation, the use of land to yield goods and services, is the most substantial way humans alter the Earth's ecosystems, and is considered the driving force in the loss of biodiversity. Estimates of the amount of land transformed by humans vary from 39–50%. Land degradation, the long-term decline in ecosystem function and productivity, is estimated to be occurring on 24% of land worldwide, with cropland overrepresented. The UN-FAO report cites land management as the driving factor behind degradation and reports that 1.5 billion people rely upon the degrading land. Degradation can be deforestation, desertification, soil erosion, mineral depletion, or chemical degradation (acidification and salinization).

**Eutrophication**

Eutrophication, excessive nutrients in aquatic ecosystems resulting in algal blooms and anoxia, leads to fish kills, loss of biodiversity, and renders water unfit for drinking and other industrial uses. Excessive fertilization and manure application to cropland, as well as high livestock stocking densities cause nutrient (mainly nitrogen and phosphorus) runoff and leaching from agricultural land. These nutrients are major nonpoint pollutants contributing to eutrophication of aquatic ecosystems.

**Pesticides**

Pesticide use has increased since 1950 to 2.5 million tons annually worldwide, yet crop loss due to pests has remained relatively constant. The World Health Organization estimated in 1992 that 3 million pesticide poisonings occur annually, causing 220,000 deaths. Pesticides select for pesticide resistance in the pest population, leading to a condition termed the 'pesticide treadmill' in which pest resistance warrants the development of a new pesticide. An alternative argument is that the way to 'save the environment' and prevent famine is by using pesticides and intensive high yield farming, a view exemplified by a quote heading the Center for Global Food Issues website: 'Growing more per acre leaves more land for nature'. However, critics argue that a trade-off between the environment and a need for food is not inevitable, and that pesticides simply replace good agronomic practices such as crop rotation.

**Climate Change**

Climate change has the potential to affect agriculture through changes in temperature, rainfall (timing and quantity), CO$_2$, solar radiation and the interaction of these elements. Agriculture can both mitigate or worsen global warming. Some of the increase in CO$_2$ in the atmosphere comes from the decomposition of organic matter in the soil, and much of the methane emitted into the atmosphere is due to the decomposition of organic matter in wet soils such as rice paddies. Further, wet or anaerobic soils also lose nitrogen through denitrification, releasing the greenhouse gas nitric oxide. Changes in management can reduce the release of these greenhouse gases, and soil can further be used to sequester some of the CO$_2$ in the atmosphere.

**Distortions in modern global agriculture**

Differences in economic development, population density and culture mean that the farmers of the world operate under very different conditions.
A US cotton farmer may receive US$230 in government subsidies per acre planted (in 2003), while farmers in Mali and other third-world countries do without. When prices decline, the heavily subsidised US farmer is not forced to reduce his output, making it difficult for cotton prices to rebound, but his Mali counterpart may go broke in the meantime.

A livestock farmer in South Korea can calculate with a (highly subsidized) sales price of US$1300 for a calf produced. A South American Mercosur country rancher calculates with a calf's sales price of US$120–200 (both 2008 figures). With the former, scarcity and high cost of land is compensated with public subsidies, the latter compensates absence of subsidies with economics of scale and low cost of land.

In the Peoples Republic of China, a rural household's productive asset may be one hectare of farmland. In Brazil, Paraguay and other countries where local legislature allows such purchases, international investors buy thousands of hectares of farmland or raw land at prices of a few hundred US$ per hectare.

Agriculture and petroleum

Since the 1940s, agriculture has dramatically increased its productivity, due largely to the use of petrochemical derived pesticides, fertilizers, and increased mechanization (the so-called Green Revolution). Between 1950 and 1984, as the Green Revolution transformed agriculture around the globe, world grain production increased by 250%. This has allowed world population to grow more than double over the last 50 years. However, every energy unit delivered in food grown using modern techniques requires over ten energy units to produce and deliver, although this statistic is contested by proponents of petroleum-based agriculture. The vast majority of this energy input comes from fossil fuel sources. Because of modern agriculture's current heavy reliance on petrochemicals and mechanization, there are warnings that the ever decreasing supply of oil (the dramatic nature of which is known as peak oil) will inflict major damage on the modern industrial agriculture system, and could cause large food shortages.

Modern or industrialized agriculture is dependent on petroleum in two fundamental ways: 1) cultivation—to get the crop from seed to harvest and 2) transport—to get the harvest from the farm to the consumer's refrigerator. It takes approximately 400 gallons of oil a year per citizen to fuel the tractors, combines and other equipment used on farms for cultivation or 17 percent of the nation's total energy use. Oil and natural gas are also the building blocks of the fertilizers, pesticides and herbicides used on farms. Petroleum is also providing the energy required to process food before it reaches the market. It takes the energy equivalent of a half-gallon of gasoline to produce a two-pound bag of breakfast cereal. And that still does not count the energy needed to transport that cereal to market; it is the transport of processed foods and crops that consumes the most oil. The kiwi from New Zealand, the asparagus from Argentina, the melons and broccoli from Guatemala, the organic lettuce from California—most food items on the consumer's plate travel an average of 1,500 miles just to get there.

Oil shortages could interrupt this food supply. The consumer's growing awareness of this vulnerability is one of several factors fueling current interest in organic agriculture and other sustainable farming methods. Some farmers using modern organic-farming methods have reported yields as high as those available from conventional farming (but without the use of fossil-fuel-intensive artificial fertilizers or pesticides. However, the reconditioning of soil to restore nutrients lost during the use of monoculture agriculture techniques made possible by petroleum-based technology will take time.

The dependence on oil and vulnerability of the U.S. food supply has also led to the creation of a conscious consumption movement in which consumers count the "food miles" a food product has traveled. The Leopold Center for Sustainable Agriculture defines a food mile as: "...the distance food travels from where it is grown or raised to where it is ultimately purchased by the consumer or end-user." In a comparison of locally-grown food and long-distance food, researchers at the Leopold Center found that local food traveled an average of 44.6 miles to reach its destination compared with 1,546 miles for conventionally-grown and shipped food.

Consumers in the new local food movement who count food miles call themselves "locavores": they advocate a return to a locally-based food system where food comes from as close as possible, whether or not it is organic. Locavores argue that an organically-grown lettuce from California that is shipped to New York is still an unsustainable food source because of dependence on fossil fuels to ship it. In addition to the "locavore" movement, concern over dependence on oil-based agriculture has also dramatically increased interest in home and community gardening.
Farmers have also begun raising crops such as corn (maize) for non-food use in an effort to help mitigate peak oil. This has contributed to a 60% rise in wheat prices recently, and has been indicated as a possible precursor to "serious social unrest in developing countries."[113] Such situations would be exacerbated in the event of future rises in food and fuel costs, factors which have already impacted the ability of charitable donors to send food aid to starving populations.[113]

One example of the chain reactions which could be caused by peak oil issues involves the problems caused by farmers raising crops such as corn (maize) for non-food use in an effort to help mitigate peak oil. This has already lowered food production.[112] This food vs fuel issue will be exacerbated as demand for ethanol fuel rises. Rising food and fuel costs has already limited the abilities of some charitable donors to send food aid to starving populations.[113] In the UN, some warn that the recent 60% rise in wheat prices could cause "serious social unrest in developing countries."[112] In 2007, higher incentives for farmers to grow non-food biofuel crops[115] combined with other factors (such as over-development of former farm lands, rising transportation costs, climate change, growing consumer demand in China and India, and population growth)[116] to cause food shortages in Asia, the Middle East, Africa, and Mexico, as well as rising food prices around the globe.[117][118] As of December 2007, 37 countries faced food crises, and 20 had imposed some sort of food-price controls. Some of these shortages resulted in food riots and even deadly stampedes.[12][13][14]

Another major petroleum issue in agriculture is the effect of petroleum supplies will have on fertilizer production. By far the biggest fossil fuel input to agriculture is the use of natural gas as a hydrogen source for the Haber-Bosch fertilizer-creation process.[119] Natural gas is used because it is the cheapest currently available source of hydrogen.[120][121] When oil production becomes so scarce that natural gas is used as a partial stopgap replacement, and hydrogen use in transportation increases, natural gas will become much more expensive. If the Haber Process is unable to be commercialized using renewable energy (such as by electrolysis) or if other sources of hydrogen are not available to replace the Haber Process, in amounts sufficient to supply transportation and agricultural needs, this major source of fertilizer would either become extremely expensive or unavailable. This would either cause food shortages or dramatic rises in food prices.

Mitigation of effects of petroleum shortages

One effect oil shortages could have on agriculture is a full return to organic agriculture. In light of peak oil concerns, organic methods are much more sustainable than contemporary practices because they use no petroleum-based pesticides, herbicides, or fertilizers. Some farmers using modern organic-farming methods have reported yields as high as those available from conventional farming.[108][109][110][111] Organic farming may however be more labor-intensive and would require a shift of work force from urban to rural areas.[122]

It has been suggested that rural communities might obtain fuel from the biochar and synfuel process, which uses agricultural waste to provide charcoal fertilizer, some fuel and food, instead of the normal food vs fuel debate. As the synfuel would be used on site, the process would be more efficient and may just provide enough fuel for a new organic-agriculture fusion.[123][124]

It has been suggested that some transgenic plants may some day be developed which would allow for maintaining or increasing yields while requiring fewer fossil fuel derived inputs than conventional crops.[125] The possibility of success of these programs is questioned by ecologists and economists concerned with unsustainable GMO practices such as terminator seeds,[126][127] and a January 2008 report shows that GMO practices "fail to deliver environmental, social and economic benefits."[128] While there has been some research on sustainability using GMO crops, at least one hyped and prominent multi-year attempt by Monsanto Company has been unsuccessful, though during the same period traditional breeding techniques yielded a more sustainable variety of the same crop.[129] Additionally, a survey by the bio-tech industry of subsistence farmers in Africa to discover what GMO research would most benefit sustainable agriculture only identified non-transgenic issues as areas needing to be addressed.[130] Nonetheless, some governments in Africa continue to view investments in new transgenic technologies as an essential component of efforts to improve sustainability.[131]

Policy

Agricultural policy focuses on the goals and methods of agricultural production. At the policy level, common goals of agriculture include:
• Conservation
• Economic stability
• Environmental impact
• Food quality: Ensuring that the food supply is of a consistent and known quality.
• Food safety: Ensuring that the food supply is free of contamination.
• Food security: Ensuring that the food supply meets the population's needs.[112][113]
• Poverty Reduction

Demography

is the statistical study of all populations. It can be a very general science that can be applied to any kind of dynamic population, that is, one that changes over time or space (see population dynamics). It encompasses the study of the size, structure and distribution of populations, and spatial and/or temporal changes in them in response to birth, migration, aging and death.

Demographic analysis can be applied to whole societies or to groups defined by criteria such as education, nationality, religion and ethnicity. In academia, demography is often regarded as a branch of either anthropology, economics, or sociology. Formal demography limits its object of study to the measurement of populations processes, while the more broad field of social demography population studies also analyze the relationships between economic, social, cultural and biological processes influencing a population.[1]

The term demographics is often used erroneously for demography, but refers rather to selected population characteristics as used in government, marketing or opinion research, or the demographic profiles used in such research.

Data and methods

There are two methods of data collection: direct and indirect. Direct data come from vital statistics registries that track all births and deaths as well as certain changes in legal status such as marriage, divorce, and migration (registration of place of residence). In developed countries with good registration systems (such as the United States and much of Europe), registry statistics are the best method for estimating the number of births and deaths.

The census is the other common direct method of collecting demographic data. A census is usually conducted by a national government and attempts to enumerate every person in a country. However, in contrast to vital statistics data, which are typically collected continuously and summarized on an annual basis, censuses typically occur only every 10 years or so, and thus are not usually the best source of data on births and deaths. Analyses are conducted after a census to estimate how much over or undercounting took place. Censuses do more than just count people. They typically collect information about families or households, as well as about such individual characteristics as age, sex, marital status, literacy/education, employment status and occupation, and geographical location. They may also collect data on migration (or place of birth or of previous residence), language, religion, nationality (or ethnicity or race), and citizenship. In countries in which the vital registration system may be incomplete, the censuses are also used as a direct source of information about fertility and mortality; for example the censuses of the People's Republic of China gather information on births and deaths that occurred in the 18 months immediately preceding the census.

Indirect methods of collecting data are required in countries where full data are not available, such as is the case in much of the developing world. One of these techniques is the sister method, where survey researchers ask women how many of their sisters have died or had children and at what age. With these surveys, researchers can then indirectly estimate birth or death rates for the entire population. Other indirect methods include asking people about siblings, parents, and children.

There are a variety of demographic methods for modeling population processes. They include models of mortality (including the life table, Gompertz models, hazards models, Cox proportional hazards models, multiple decrement life tables, Brass relational logits), fertility (Hernes model, Coale-Trussell models, parity progression ratios), marriage (Singulate Mean at Marriage, Page model), disability (Sullivan's method, multistate life tables), population projections (Lee Carter, the Leslie Matrix), and population momentum (Keyfitz).
Important concepts

A population pyramid is an age/sex distribution diagram.

Important concepts in demography include:

- The **crude birth rate**, the annual number of live births per 1000 people.
- The **general fertility rate**, the annual number of live births per 1000 women of childbearing age (often taken to be from 15 to 49 years old, but sometimes from 15 to 44).
- **age-specific fertility** rates, the annual number of live births per 1000 women in particular age groups (usually age 15-19, 20-24 etc.)
- The **crude death rate**, the annual number of deaths per 1000 people.
- The **infant mortality rate**, the annual number of deaths of children less than 1 year old per 1000 live births.
- The **expectation of life** (or life expectancy), the number of years which an individual at a given age could expect to live at present mortality levels.
- The **total fertility rate**, the number of live births per woman completing her reproductive life, if her childbearing at each age reflected current age-specific fertility rates.
- The **gross reproduction rate**, the number of daughters who would be born to a woman completing her reproductive life at current age-specific fertility rates.
- The **net reproduction ratio** is the expected number of daughters, per newborn prospective mother, who may or may not survive to and through the ages of childbearing.

Note that the crude death rate as defined above and applied to a whole population can give a misleading impression. For example, the number of deaths per 1000 people can be higher for developed nations than in less-developed countries, despite standards of health being better in developed countries. This is because developed countries have relatively more older people, who are more likely to die in a given year, so that the overall mortality rate can be higher even if the mortality rate at any given age is lower. A more complete picture of mortality is given by a life table which summarises mortality separately at each age. A life table is necessary to give a good estimate of life expectancy.

The fertility rates can also give a misleading impression that a population is growing faster than it in fact is, because measurement of fertility rates only involves the reproductive rate of women, and does not adjust for the sex ratio. For example, if a population has a total fertility rate of 4.0 but the sex ratio is 66/34 (twice as many men as women), this population is actually growing at a slower natural increase rate than would a population having a fertility rate of 3.0 and a sex ratio of 50/50. This distortion is greatest in India and Myanmar, and is present in China as well.

**Basic demographic equation**

Suppose that a country (or other entity) contains \( Population_t \) persons at time \( t \). What is the size of the population at time \( t + 1 \)?

\[
Population_{t+1} = Population_t + \text{Natural increase}_t + \text{Net migration}_t
\]

Natural increase from time \( t \) to \( t + 1 \):
Natural increases, \( t \)

\[ \text{Births}_t - \text{Deaths}_t \]

Net migration from time \( t \) to \( t + 1 \):

\[ \text{Netmigration}_t = \text{Immigration}_t - \text{Emigration}_t \]

This basic equation can also be applied to subpopulations. For example, the population size of ethnic groups or nationalities within a given society or country is subject to the same sources of change. However, when dealing with ethnic groups, "net migration" might have to be subdivided into physical migration and ethnic reidentification (assimilation). Individuals who change their ethnic self-labels or whose ethnic classification in government statistics changes over time may be thought of as migrating or moving from one population subcategory to another.\(^2\)

More generally, while the basic demographic equation holds true by definition, in practice the recording and counting of events (births, deaths, immigration, emigration) and the enumeration of the total population size are subject to error. So allowance needs to be made for error in the underlying statistics when any accounting of population size or change is made.

**History**

Ibn Khaldun (1332-1406) is regarded as the "father of demography" for his economic analysis of social organization which produced the first scientific and theoretical work on population, development, and group dynamics. His *Muqaddimah* also laid the groundwork for his observation of the role of state, communication and propaganda in history.\(^3\)

The *Natural and Political Observations ... upon the Bills of Mortality* (1662) of John Graunt contains a primitive form of life table. Mathematicians, such as Edmond Halley, developed the life table as the basis for life insurance mathematics. Richard Price was credited with the first textbook on life contingencies published in 1771,\(^4\) followed later by Augustus de Morgan, ‘On the Application of Probabilities to Life Contingencies’, (1838).\(^5\)

At the end of the 18th century, Thomas Malthus concluded that, if unchecked, populations would be subject to exponential growth. He feared that population growth would tend to outstrip growth in food production, leading to ever increasing famine and poverty (see Malthusian catastrophe); he is seen as the intellectual father of ideas of overpopulation and the limits to growth. Later more sophisticated and realistic models were presented by e.g. Benjamin Gompertz and Verhulst.

The period 1860-1910 can be characterized as a period of transition wherein demography emerged from statistics as a separate field of interest. This period included a panoply of international ‘great demographers’ like Adolphe Quételet (1796-1874), William Farr (1807-1883), Louis-Adolphe Bertillon (1821-1883) and his son Jacques (1851-1922), Joseph Körösi (1844-1906), Anders Nicolas Kaier (1838-1919), Richard Böckh (1824-1907), Wilhelm Lexis (1837-1914) and Luigi Bodio (1840-1920) contributed to the development of demography and to the toolkit of methods and techniques of demographic analysis.\(^6\)

**The demographic transition**
Contrary to Malthus' predictions and in line with his thoughts on moral restraint, natural population growth in most developed countries has diminished to close to zero, without being held in check by famine or lack of resources, as people in developed nations have shown a tendency to have fewer children. The fall in population growth has occurred despite large rises in life expectancy in these countries. This pattern of population growth, with slow (or no) growth in pre-industrial societies, followed by fast growth as the society develops and industrializes, followed by slow growth again as it becomes more affluent, is known as the demographic transition.

Similar trends are now becoming visible in ever more developing countries, so that far from spiraling out of control, world population growth is expected to slow markedly in the next century, coming to an eventual standstill or even declining. The change is likely to be accompanied by major shifts in the proportion of world population in particular regions. The United Nations Population Division expects the absolute number of infants and toddlers in the world to begin to fall by 2015, and the number of children under 15 by 2025. The figure in this section shows the latest (2004) UN projections of world population out to the year 2150 (red = high, orange = medium, green = low). The UN "medium" projection shows world population reaching an approximate equilibrium at 9 billion by 2075. Working independently, demographers at the International Institute for Applied Systems Analysis in Austria expect world population to peak at 9 billion by 2070. Throughout the 21st century, the average age of the population is likely to continue to rise.

The science of population

Populations can change through three processes: fertility, mortality, and migration. Fertility involves the number of children that women have and is to be contrasted with fecundity (a woman's childbearing potential). Mortality is the study of the causes, consequences, and measurement of processes affecting death to members of the population. Demographers most commonly study mortality using the Life Table, a statistical device which provides information about the mortality conditions (most notably the life expectancy) in the population. Migration refers to the movement of persons from an origin place to a destination place across some pre-defined, political boundary. Migration researchers do not designate movements 'migrations' unless they are somewhat permanent. Thus demographers do not consider tourists and travelers to be migrating. While demographers who study migration typically do so through census data on place of residence, indirect sources of data including tax forms and labor force surveys are also important.

Demography is today widely taught in many universities across the world, attracting students with initial training in social sciences, statistics or health studies. Being at the crossroads of several disciplines such as
geography, economics, sociology or epidemiology, demography offers tools to approach a large range of population issues by combining a more technical quantitative approach that represents the core of the discipline with many other methods borrowed from social or other sciences. Demographic research is conducted in universities, in research institutes as well as in statistical departments and in several international agencies. Population institutions are part of the Cicred (International Committee for Coordination of Demographic Research) network while most individual scientists engaged in demographic research are members of the International Union for the Scientific Study of Population – IUSSP or, in the United States, in the Population Association of America.

Environmental sociology

Environmental sociology is typically defined as the sociological study of societal-environmental interactions, although this definition immediately presents the perhaps insolvable problem of separating human cultures from the rest of the environment. Although the focus of the field is the relationship between society and environment in general, environmental sociologists typically place special emphasis on studying the social factors that cause environmental problems, the societal impacts of those problems, and efforts to solve the problems. In addition, considerable attention is paid to the social processes by which certain environmental conditions become socially defined as problems.

Although there was sometimes acrimonious debate between the constructivist and realist "camps" within environmental sociology in the 1990s, the two sides have found considerable common ground as both increasingly accept that while most environmental problems have a material reality they nonetheless become known only via human processes such as scientific knowledge, activists’ efforts, and media attention. In other words, most environmental problems have a real ontological status despite our knowledge/awareness of them stemming from social processes, processes by which various conditions are constructed as problems by scientists, activists, media and other social actors. Correspondingly, environmental problems must all be understood via social processes, despite any material basis they may have external to humans. This interactiveness is now broadly accepted, but many aspects of the debate continue in contemporary research in the field.

History

Modern thought surrounding human-environment relations is traced back to Charles Darwin. Darwin’s concept of natural selection suggested that certain social characteristics played a key role in the survivability of groups in the natural environment. Although typically taken at the micro level, evolutionary principles, particularly adaptability, serve as a microcosm of human ecology. Work by Humphrey and Buttel (2002) traces the linkages between Darwin’s work on natural selection, human ecological sociology, and environmental sociology.

Academic

It became recognized in the latter half of the 20th century that biological determinism failed to fully explain the relationship between humans and the environment. As the application of social determinism became more useful, the role of sociology became more pervasive in analyzing environmental conditions. At first, classical sociology saw social and cultural factors as the only cause of other social and cultural conditions. This lens ignored the concept of environmental determinism or the environmental factors that cause social phenomena.

The works of William R. Catton, Jr. and Riley Dunlap challenged the constricted anthropocentrism of classical sociology. In the late 1970s, they called for a new holistic, or systems perspective. Since the 1970s, sociology has noticeably transformed to include environmental forces in social explanations. Environmental sociology emerged as a coherent subfield of inquiry after the environmental movement of the 1960s and early 1970s. It has now solidified as a respected, interdisciplinary subject in academia.

Concepts

Existential dualism

The duality of the human condition rests with cultural uniqueness and evolutionary traits. From one perspective, humans are embedded in the ecosphere and coevolved alongside other species. Humans share the same basic
ecological dependencies as other inhabitants of nature. From the other perspective, humans are distinguished from other species because of their innovative capacities, distinct cultures and varied institutions. Human creations have the power to independently manipulate, destroy, and transcend the limits of the natural environment.

Support for each perspective varies among different communities. Biologists and ecologists typically put more weight on the first perspective. Social scientists, on the other hand, emphasize the second perspective. This division has shaped the foundation for the primary paradigms of environmental sociology.

Societal-environmental dialectic

In 1975, the highly influential work of Allan Schnaiberg transfigured environmental sociology, proposing a societal-environmental dialectic. This conflictual concept has overwhelming political salience. First, the economic synthesis states that the desire for economic expansion will prevail over ecological concerns. Policy will decide to maximize immediate economic growth at the expense of environmental disruption. Secondly, the managed scarcity synthesis concludes that governments will attempt to control only the most dire of environmental problems to prevent health and economic disasters. This will give the appearance that governments act more environmentally conscious than they really do. Tertiary, the ecological synthesis generates a hypothetical case where environmental degradation is so severe that political forces would respond with sustainable policies. The driving factor would be economic damage caused by environmental degradation. The economic engine would be based on renewable resources at this point. Production and consumption methods would adhere to sustainability regulations.

These conflict-based syntheses have several potential outcomes. One is that the most powerful economic and political forces will preserve the status quo and bolster their dominance. Historically, this is the most common occurrence. Another potential outcome is for contending powerful parties to fall into a stalemate. Lastly, tumultuous social events may result that redistribute economic and political resources.

Treadmill of production

In 1980, Schnaiberg developed a conflict theory on human-environment interaction. The theory is that capitalism is driven by higher profitability and thereby must continue to grow and attract investments to survive in a competitive market. This identifies the imperative for continued economic growth levels that, once achieved, accelerate the need for future growth. This growth in production requires a corresponding growth in consumption. The process contains a chief paradox; economic growth is socially desired but environmental degradation is a common consequence that in turn disrupts long-run economic expansion (Schnaiberg 1980).

Paradigms

Human Exemptionalism Paradigm (HEP)

The HEP theory claims that humans are such a uniquely superior species that they are exempt from environmental forces. Shaped by the leading Western worldview of the time, this was the popular societal paradigm from the industrial revolution until the second half of the 20th century. Human dominance was justified by the uniqueness of culture, which is far more adaptable than biological traits. Culture also has the capacity to accumulate and innovate, making it an unbounded resource capable of solving all natural problems. As humans are not governed by natural conditions, they have complete control of their own destiny. Any potential limitation posed by the natural world is surpassable using human ingenuity.

New Ecological Paradigm (NEP)

In the 1970s, scholars began recognizing the limits of what would be termed the Human Exemptionalism Paradigm. Catton and Dunlap suggested a new perspective that took environmental variables into full account. They coined a new theory, the New Ecological Paradigm, with assumptions contrary to the HEP. The NEP recognizes the innovative capacity of humans, but that says humans are still ecologically interdependent as with other species. The NEP notes the power of social and cultural forces but does not profess social determinism. Instead, humans are impacted by the cause, effect, and feedback loops of ecosystems. The earth has a finite
level of natural resources and waste repositories. Thus, the biophysical environment can impose restraints on human activity.

Events

Modern environmentalism

The 1960s built strong cultural momentum for environmental causes, giving birth to the modern environmental movement. Widespread green consciousness moved vertically within society, resulting in a series of federal policy changes in the 1970s. This period was known as the ‘Environmental Decade’ with the creation of the United States Environmental Protection Agency and passing of the Endangered Species Act, Clean Water Act, and amendments to the Clean Air Act. Earth Day of 1970, celebrated by millions of participants, represented the modern age of environmental thought. The environmental movement continued with incidences such as Love Canal.

Historical studies

While the current mode of thought expressed in environmental sociology was not prevalent until the age of modernity, its application is now used in analysis of ancient peoples. Societies including Easter Island, the Anasazi, and the Mayans ended abruptly, largely due to poor environmental management. The collapse of the Mayans sent a historic message that even advanced cultures are vulnerable to ecological suicide. At the same time, societal successes include New Guinea, Tikopia island, and Japan, whose inhabitants have lived sustainably for 46,000 years.

A resort town, sometimes called a resort city or resort destination, is a town or area where tourism or vacationing is a primary component of the local culture and economy. Most resort towns have one or more actual resorts in or nearby, although some places are considered resort towns merely because of their popularity among tourists.

Typically, the economy of a resort town is geared almost entirely towards catering to tourists, with most residents of the area working in the tourism or resort industry. Shops and luxury boutiques selling locally-themed souvenirs, motels, and unique restaurants often proliferate the downtown areas of a resort town.

Resort town economy

If the resorts or tourist attractions are seasonal in nature (such as a ski resort), resort towns typically experience a on-season where the town is bustling with tourists and workers, and an off-season where the town is populated only by a small amount of local year-round residents.

In addition, resort towns are often popular with wealthy retirees and people wishing to purchase vacation homes, which typically drives up property values and the cost of living in the region. Sometimes resort towns can become boomtowns due to the quick development of retirement and vacation-based residences.

However, most of the employment available in resort towns are typically low paying and it can be difficult for workers to afford to live the area in which they are employed. Many resort towns have spawned nearby bedroom communities where the majority of the resort workforce lives.

Resorts towns sometimes struggle with problems regarding sustainable growth, due to the seasonal nature of the economy, the dependence on a single industry, and the difficulties in retaining a stable workforce.

Social disruption

Social disruption is a term used in sociology to describe the alteration or breakdown of social life, often in a community setting. For example, the closing of a community grocery store might cause social disruption in a community by removing a “meeting ground” for community members to develop interpersonal relationships and community solidarity. The term is often associated with the effects of rapid population growth.
In punishment, **social disruption** occurs when the deliverer of punishment and the setting in which the punishment is delivered become conditioned aversive stimuli. More simply put, a person who delivers punishment can become something that is avoided by the subject of the punishment. For example, a lab rat may come to avoid an experimenter delivering shocks as punishment. The experimenter himself is not a *punishing stimulus*, but the rat learns to associate the actual punishment (the shocks) with the person delivering the shocks.

**Rural health**

In medicine, **rural health** is the interdisciplinary study of health and health care delivery in the context of a rural environment or location.

Some of the fields of study comprising rural health include: health, geography, midwifery (remote locations often do not have an OB/GYN), nursing, sociology, economics, telehealth/telemedicine, etc.

**The problem in defining rural**

Rural can be defined in many ways, such as by population density, by geographic location or other. Due to the large number of choices in the definition parties may often disagree with one another on which definition to use.

Rural Health definitions can be different for establishing undeserved areas or health care accessibility in rural areas of the United States. According to the handbook, *Definitions of Rural: A Handbook for Health Policy Makers and Researchers*, “Residents of metropolitan counties are generally thought to have easy access to the relatively concentrated health services of the county’s central areas. However, some metropolitan counties are so large that they contain small towns and rural, sparsely populated areas that are isolated from these central clusters and their corresponding health services by physical barriers.” To address this type of rural area, “Harold Goldsmith, Dena Puskin, and Dianne Stiles (1992) described a methodology to identify small towns and rural areas within large metropolitan counties (LMCs) that were isolated from central areas by distance or other physical features.” This became the Goldsmith Modification definition of rural. “The Goldsmith Modification has been useful for expanding the eligibility for federal programs that assist rural populations—to include the isolated rural populations of large metropolitan counties.”

**The 5W’s and 1H of Rural Health**

The impact of “place” on health has gained increased attention. Does where people live, work, and play make a difference in terms of access and utilization of health services? According to [1] place does matter, in some cases. When discussing the role of place in health as a concept, health status and health behaviors, including health services utilization, are shaped by an aggregate of interacting factors encapsulated in specific geographic locations. Researchers have attempted to compare the health of rural and urban dwellers. In doing so, several questions have been brought to the forefront of this discussion including: (1) Where is rural? (2) Who lives there? (3) What is their health status? (4) Why can we expect these health outcomes? (5) When can we expect real changes? and (6) How can we help? The following sub-sections will provide insight into how these questions have been answered. More specifically, they will discuss variations in rural definitions, socio-demographic characteristics of rural dwellers, health outcomes and determinants of health across rural areas, as well as highlight the impact of policy and research on the improvement of the health of this population subgroup.

Before reviewing these sub-sections lets first consider the reasons for reviewing rural health and exactly why it deserves our attention. The rural communities found in various parts of the world, whether it be Canada, the United States, Australia, the United Kingdom, Africa, or China to name a few, have diverse social, geographic, and economic characteristics [2]. Most rural communities have a larger proportion of elderly and children, with relatively small populations of people of working age (20 -50 yrs) which is resulting in a higher dependency ratio. Rural communities show a health disadvantage for many health measures. Compared to their rural counterparts, rural individuals have poorer socio-economic conditions, have lower educational attainment, exhibit less-healthy behaviors (smoking, alcohol consumption) and have overall higher mortality rates. Simply put, in general, rural individuals are characterized as being less healthy overall in comparison to their urban counterparts [3]. We must try to reduce the health disparities between rural and urban populations and to do this we must conduct specialized research and then implement various policies and programs with the rural population being part of the equation (rural proofing policies or rural lens considerations).
When considering rural health a few key terms must firstly be defined. Geographically, equality suggests that there should be an even distribution of services per head of population. In equity, the equality in relation to need is the most important factor. For example, as a general rule there is a conflict between efficiency and equity in all planning and resource allocation. Where efficiency, is to provide services that maximize health benefit while minimizing cost. For example, when a province or territory is sparsely populated, more health care dollars may be put towards transportation costs. For example, almost 13% of health care spending in the Northwest Territories goes toward medical transportation which is significantly higher than the national average of less than 2%.

Where is rural?

Rural definitions are numerous, to the point where some have said “there are almost as many definitions of rural as there are researchers”. Despite increasing attempts to delineate rural from urban, no internationally recognized efforts have emerged. It would appear that several countries, including Canada, the United-States, the United Kingdom, Australia, and New Zealand have developed their own formulas to defining ‘rural’. Variations of this definition, even within the same country, have been somewhat problematic. Different formulas provide different numbers. For instance, depending on which definition is applied, Canada’s rural population varies from 22 to 38 percent. While in the United-States, it varies from 17 to 63 percent.

Most rural definitions have been based on geographical concepts, also referred to as “technical definitions”. These have included measures such as population size, population density, and distance from an urban centre, settlement patterns, labor market influences, and postal codes. Based on these concepts, there would appear to be six definitions of rural in Canada, nine in the United-States, two in the United-Kingdom, three in Australia and one in New Zealand. Further adding to the complexity of studying rural health is that certain areas share a common denomination by definition, but are very different places to live in.

Who lives there?

Rural population trends are particularly subject to change due to their migration patterns. reported a 64% drop in Canada’s rural population between 1851 and 1986. As of 2001, despite the steady decline, 30.4% of Canada’s population still lived in predominantly rural regions. Similarly, in Australia, urban areas experienced the largest growth rates between 1991 and 1996, while its remote locations experienced the lowest. Despite this pattern, 29% of Australia’s population still lived in rural or remote areas. In the UK, out-migration amongst the younger age group seeking education and employment is prevalent, although their rural areas also experience high rates of in-migration, particularly amongst the elderly and retired. Therefore, rural populations appear to be very dynamic in nature. Generally, socio-demographic statistics confirm that the rural population is primarily composed of persons under the age of 14 and over the age of 60, while urban areas are in large part composed of the working age group (30–59 years of age).

In addition to differing age groups, racial and ethnic populations in rural areas also appear to be quite diverse. For example, Non-Hispanic whites are the most widespread population sub-group (82%) in non-metropolitan areas of the United-States (66% in metropolitan areas), while African Americans constitute the largest minority group (8.4%) Interestingly, Hispanics comprise 5.4% of the rural population in America, a contrast from metropolitan areas where Hispanics have surpassed African Americans in becoming the largest minority population. The remaining 4% is largely represented by Native Americans. A noted characteristic of Canada’s rural dwellers is that nearly 50% of its Aboriginal population lives in rural and remote areas, while immigrants and other visible minorities live primarily in urban regions (88%)

In Australia, nearly 40% of its Indigenous population lives in the remote hinterland. It is therefore apparent that persons who live in rural areas are not a homogenous group.

According to Xie Fuzhan, director of the National Bureau of Statistics (NBS) China’s rural population stood at 737 million, 56 percent of the total population of more than 1.3 billion at the end of 2006, and has seen its rural population shrink in recent years as the country’s urbanization has gathered momentum. This may also be due to the fact that 90% of rural residents do not have any type of health insurance and are experiencing very limited access to health care and are seeking better paying jobs in urban areas to be able to get coverage and also where they can have better access to care. The rural population in China was recorded at 64 percent of the total 1.3 billion in 2001 and 74 percent in 1990.

What is their health status?
Health status comparisons are typically assessed through rates of life expectancy, morbidity, and mortality. \[20\] found life expectancy rates to be significantly higher in urban areas when compared to rural areas. Life expectancy in men ranged from 74 years in the most remote (No MIZ) areas of Canada to 76.8 years its urban centers. As for women, life expectancy was again lowest in rural (Weak MIZ) areas with an average of 81.3 years. Interestingly, those living in rural areas adjacent to urban centers experience slightly higher rates of life expectancy (men-77.4 years; women- 81.5 years). Likewise, Australian life expectancy ranged from 78 years to 72 years in major cities to very remote locations \[21\]. In light of these life expectancy rates, it is not surprising that all-cause mortality rates of both Canadian and Australian persons increased as per the level of remoteness. In China, the life expectancy of the female population at birth is 73.59 years in urban areas and 72.46 in rural areas. Male life expectancy is 69.73 years in urban areas and 58.99 in rural areas. Most rural men are hard workers in the agricultural sector and for the most part may not be able to afford health care and the appropriate services may not be available \[22\].

The common leading causes of death in rural areas include higher risks of cardiovascular and respiratory diseases, as well as injury (i.e., poisonings, motor vehicle accidents). Again, further adding to the complexities of rural health, there are exceptions to the abovementioned statistics. For instance, opposite trends were found in New Zealand where urban dwellers were more likely to have been diagnosed with heart disease, asthma, arthritis, and osteoporosis than their rural counterparts \[23\]. These conflicting results confirm that much still needs to be learned regarding the impact of ‘place’ on health.

**Why can we expect these health outcomes?**

‘Determinants of health’ are a combination of elements that influence health status. While the Public Health Agency of Canada has outlined 12 key determinants of health ((1) Income and Social Status; (2) Social Support Networks; (3) Education and Literacy; (4) Employment/Working Conditions; (5) Social Environments; (6) Physical Environments; (7) Personal Health Practices and Coping Skills; (8) Healthy Child Development; (9) Biology and Genetic Endowment; (10) Health Services; (11) Gender; (12) Culture), these generally represent complex interactions between, social and economic factors, individual behavior and physical environment. Although ‘determinants of health’ are generic elements set out to interpret health outcomes in any population, these may greatly differ across geographical locations.

**Health Determinants**

**Education and Literacy**

According to the “How Healthy are Rural Canadians?” \[13\] report, persons living in rural locations had lower rates of secondary school graduation. In Australia, similar results were reported with only about 30% of adults in rural areas having completed secondary school in comparison to about 48% in major cities \[21\]. Not surprisingly, young people from rural locations were also less likely to pursue post-secondary education.

**B. Income and Social status**

Rural persons also reported higher percentages of low income status \[13\], likely a result of their lower education levels. \[24\] confirmed income gaps ranging from $4,821 to $3,725 between 1980 and 2000, all in favor of Canada’s urban regions. In the United-States, the rural-urban income gap has been calculated at 23% ($27,776 vs. $36,079) \[25\]. China’s focus on growth along the coasts has led to a large urban-rural income gap. There is also a wide gap in provision of social and health services between the regions. In 1993, only 10% of the rural population had medical insurance compared with 50% of urban residents \[26\].

**C. Employment and working conditions**

Those living in rural areas also experience higher rates of unemployment. Bollman’s data pertaining to Canada (1992) demonstrates unemployment rates to be consistently higher in rural and small towns from 1976 through 1989, fluctuating between 7% and 12%. The ‘service’ industry is currently the dominant occupation in rural and small towns, although the forestry, farming and fishing, manufacturing, and mining labor forces are still very much prevalent \[27\]. These latter occupations are often accompanied with greater health and safety hazards due to the use of complex machinery, exposure to chemicals, working hours, noise pollution, harsher climates, and task related physicality. Such health and safety hazards can explain the higher rates of life threatening injuries that are reported from the rural workforce \[28\].
D. Personal health practices and coping skills

There also appears to be strong urban-rural differences in several health behaviors. According to the “How Healthy are Rural Canadians?”[13] report, persons from rural areas report higher rates of smoking, higher exposures to second-hand smoke, higher overweight/obesity rates and lower rates of fruits and vegetable consumption. Suicide rates, injury and poisoning were also important contributors to the higher mortality rates found in rural areas. In addition, the[29] reported substantially higher rates of interpersonal violence (ie. homicide) in rural areas when compared to major cities. It should also be noted that lower levels of stress and a higher sense of community belonging were found as levels of rurality increased[13].

E. Physical environment

[30] identified additional evidence of environmental variations in determinants of health. This particular project reported lower water quality and crowding of households as factors affecting disease control in rural and remote locations. As well, insufficient wastewater treatment, lack of paved roads and exposure to agricultural chemicals has been identified as additional environmental concerns for those living in rural locations[31].

F. Health Care Services

“Some would say that there is an “inverse care law” in operation. People in rural communities have poorer health status and greater needs for primary health care, yet they are not as well served and have more difficulty accessing health care services than people in urban centres”. During the 1990’s, only 20% of the government’s public health spending went to the rural health system that served 70% of the Chinese population.

A reoccurring theme in relation ‘rural and remote’ demography is that its population density is low and dispersed. In relation to the current discussion are the impacts of these characteristics on health care services, more so the inability of rural and remote locations to sustain health care services at accessible locations. For example, between 1990 and 2000, 228 rural hospitals closed in the United-States (7.8%), which lead to a reduction of 8, 228 hospital beds. Canadian rural and small town dwellers have half as many physicians (1 per 1000) as their urban counterparts, and on average, have to travel five times the distance to access these services (10 km).

While an increase in local hospital closures within rural and remote locations have resulted in a reduction of primary care and an increase in travel, these have not been the sole rural health care issues. Confirmed that “good rural health care does not depend on the presence of a very small hospital that cannot, in today’s environment, provide genuinely acute care” (p. 1803). Additional health care concerns have included quality of care, specialization of services, ambulatory care and emergency treatment, all factors that have inadvertently impacted the health of rural persons. Found reductions in specialized health care services such as dentists, dental surgeons and social workers, between 1998 and 2005 in selected rural areas of Canada. In addition, ambulatory services were only available in 40% of the selected sites, blood and urine testing services in one third of the sites, and only one of the 19 sites had neo-natal services. As well, and particularly of concern for the aging rural population, nursing services had reduced from 26.3% in 1998 to 21.1% in 2005.

It is apparent that rural and remote locations are plagued with problematic health care services. In large part, distance, isolation, and dispersed populations have been the leading causes of these problems. These common characteristics of ‘rural’ have led to difficulties in recruiting, as well as retaining, qualified and skilled professionals in the health care field. The urban and more prosperous areas are disproportionately home to the countries’ skilled health care work force in most if not all countries in Sub-Saharan Africa. For example, urban Zambia has 20 times more doctors and over five times more nurses and midwives than the rural areas. In Malawi, despite 87 percent of its population living in areas considered rural, 96.6 percent of doctors are found in urban health facilities. In Burkina Faso, there is one midwife for approximately 8,000 inhabitants in the richer zones, against one for nearly 430,000 inhabitants in the poorest zone. Many remote regions and districts do not have a single doctor, nurse or midwife to provide assistance to those that need it most . These abovementioned issues have resulted in innovative ways of delivering health care to rural dwellers, including over the phone medical consultations, travel grants, as well as mobile preventative and treatment programs. Further, there have been increased efforts to attract health professional to these isolated locations, for example increasing the number of medical students from rural areas and improving financial incentives for rural practice.

When can we expect real changes?
The many research centers (Center for Rural and Northern Health Research: Laurentian University, the Center for Rural Health at the University of North Dakota, RUPRI Center to name a few) and the many rural health advocacy groups (National Rural Health Association, National Organization of State offices of Rural Health, National Rural Health Alliance, to name a few) working hard on rural health issues have not been around for very long in comparison to other research centers. Health promotion initiatives are currently being undertaken in many rural areas with more and more emphasis placed on the participation of rural individuals to better improve specific programs. Only time will tell if any real changes shall occur, but for the time being we need to concentrate on implementing diverse programs and initiatives in order to reduce the gap between rural and urban populations. In Canada, many provinces have started to decentralize primary care and now have a more regional approach to health care. Recently, in Ontario, Canada, Local Health Integration Networks (LHIN) have been created in order to address regional issues used to decentralization planning and decision making. The Northeastern and Northwestern LHIN’s have been established with the hopes of being better able to suit the needs of the many Ontarians living in rural, northern and remote areas which have to face many different problems than their urban counterparts. An over (US) $ 50 million dollar pilot project has been approved in order to improve public health in rural areas in China. According to the Ministry of Health, the program is designed to seek ways for the improvement of rural health services and sustained improvement of health level of local people. This is a step in the right direction, and will hopefully present rural China with real changes. More importantly, China is also planning to introduce a national health care system. In Australia, much progress has been made in the past decade. The most important aspect is that recognition and acceptance of the need for a distinctive approach which addresses the diversity of rural and remote Australia has been achieved. Other achievements have been made in rural infrastructure, networking and collaboration, new models of service delivery and in research. The 1990’s have been the best of times and the worst of times in rural health delivery in the United States. They have been the best of times because the influence of rural health advocates on policy development has never been stronger. The community of analysts and advocates has more breadth and depth than ever before. They have been the worst of times because a certain emphasis has been placed on cost containment during the past 15 years which has resulted in actions that threaten the financial viability of rural providers.

How can we help?

In light of the above mentioned discussion, rural health issues have become increasingly interesting, and not to mention, complex. A few key points have arisen from this discussion that may be worth summarizing. First, there have been several attempts at delineating rural from urban. Variations of ‘rural definitions’ have left little hope for international comparisons. Second, the geographical diversity across countries, and within, mean that a generic geographical description of rural is unlikely. Third, rural dwellers are not a homogeneous group, different ‘types’ of people live under this label. Fourth, although health outcomes are generally poorer in rural areas, some discrepancies have left in doubt its direct causation. Finally, the possible determinants of health are numerous and to pin point specific factors that predicts health outcome in rural persons is nearly impossible. There is much more to ‘rural health’ than meets the eye. In studying rural health, one must look beyond geographical location and consider interactions among a multitude of influential factors. As stated by, “there is no one size fits all solution” (p. 160) to rural health. In other words, health issues in one area are not necessarily problematic in another.

Therefore, in an attempt to better understand and improve the health of rural persons, increased attention from academics and decision makers is needed. Continued research would contribute to our understanding of the impact of ‘place’ on health. Many countries have made it a priority to increase funds for rural health research and others have yet to act upon the specific recommendations made about this funding. For instance, several countries have developed research institutes with rural health mandates (ie. Centre for Rural and Northern Health Research- Canada; Countryside Agency- United Kingdom; Institute of Rural Health- Australia; New Zealand Institute of Rural Health- New Zealand). While research plays a fundamental role in speaking for rural dwellers, it also provides decision makers with evidence based information. With that said, ‘rural proofing’ practices have been implemented to ensure rural needs are not overlooked in policy making. Policy makers at all levels of governance play a critical role in ensuring the health of rural populations. Policies ensuring safe living conditions right through to accessible health care services will result in equal health outcomes across rural and urban locations.

Issues in rural health
• Underserviced delivery due to a lack or maldistribution of resources, both in terms of money and labour.
• Lack of specialty services. Medical specialists often do not have enough ‘critical mass’ of patients to allow them to economically serve a low population area. The hardship on patients can be particularly demanding in some illnesses, say cancer, in which treatment requires regular long distance travel.

**United States**

The 2010 United States federal budget includes $73 million to improve both access to and quality of health care in rural areas. This funding will strengthen regional and local partnerships among rural health care providers, expand community-based prevention interventions, and promote the modernization of the health care infrastructure in rural areas.

**Rural community development**

**Rural community development** encompasses a range of approaches and activities that aim to improve the welfare and livelihoods of people living in rural areas. As a branch of community development, these approaches pay attention to social issues particularly community organizing. This is in contrast to other forms of rural development that focus on public works (e.g. rural roads and electrification) and technology (e.g. tools and techniques for improving agricultural production).

Rural community development is important in developing countries where a large part of the population is engaged in farming. Consequently, a range of community development methods have been created and used by organisations involved in international development. Most of these efforts to promote rural community development are led by 'experts' from outside the community such as government officials, staff of Non-governmental organizations and foreign advisers. This has led to a long debate about the issue of participation, in which questions have been raised about the sustainability of these efforts and the extent to which rural people are - or are not – being empowered to make decisions for themselves.

**Rural Community Development in the United Kingdom**

In the UK rural community development is seen as very important. Rural areas are often some of the most deprived in the country. Rural Community Councils around the country support local rural communities in securing sustainable futures. The local rural communities are supported by experienced community development workers.

**Rural Community Development in the United States**

In the United States, rural community development is an essential tool in keeping rural areas economically viable in a very competitive global arena. Under the United States Department of Agriculture, this is addressed through the Rural Development mission area, comprising the Rural Housing Service, Rural Utilities Service, and Rural Business-Cooperative Service. Research and data sources for rural areas of the United States is also addressed by the United States Department of Agriculture through the Economic Research Service and the National Agricultural Library’s Rural Information Center.

Part of the United States Department of Commerce, the Economic Development Administration (EDA) is tasked within it’s mission “to generate jobs, help retain existing jobs, and stimulate industrial and commercial growth in economically distressed areas of the United States. EDA assistance is available to rural and urban areas of the Nation experiencing high unemployment, low income, or other severe economic distress.”

There are four Regional Rural Development Centers in the United States that coordinate “rural development research and extension (education) programs cooperatively with the land-grant institutions regionally and nationally. The Centers support and strengthen individual state efforts in rural areas by developing networks of university research and extension faculty from a variety of disciplines to address rural issues.”
**Sustainable development** is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations. The term was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity. As early as the 1970s "sustainability" was employed to describe an economy "in equilibrium with basic ecological support systems." Ecologists have pointed to The Limits to Growth, and presented the alternative of a “steady state economy” in order to address environmental concerns.

The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability.

**Scope and definitions**

The concept has included notions of weak sustainability, strong sustainability and deep ecology. Sustainable development does not focus solely on environmental issues.

In 1987, the United Nations released the Brundtland Report, which defines sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs.'

The United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection.

Indigenous people have argued, through various international forums such as the United Nations Permanent Forum on Indigenous Issues and the Convention on Biological Diversity, that there are four pillars of sustainable development, the fourth being cultural. *The Universal Declaration on Cultural Diversity* (UNESCO, 2001) further elaborates the concept by stating that "...cultural diversity is as necessary for humankind as biodiversity is for nature"; it becomes “one of the roots of development understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual, emotional, moral and spiritual existence”. In this vision, cultural diversity is the fourth policy area of sustainable development.

Economic Sustainability: Agenda 21 clearly identified information, integration, and participation as key building blocks to help countries achieve development that recognises these interdependent pillars. It emphasises that in sustainable development everyone is a user and provider of information. It stresses the need to change from old sector-centred ways of doing business to new approaches that involve cross-sectoral co-ordination and the integration of environmental and social concerns into all development processes. Furthermore, Agenda 21 emphasises that broad public participation in decision making is a fundamental prerequisite for achieving sustainable development.
According to Hasna, sustainability is a process which tells of a development of all aspects of human life affecting sustenance. It means resolving the conflict between the various competing goals, and involves the simultaneous pursuit of economic prosperity, environmental quality and social equity famously known as three dimensions (triple bottom line) with is the resultant vector being technology, hence it is a continually evolving process; the 'journey' (the process of achieving sustainability) is of course vitally important, but only as a means of getting to the destination (the desired future state). However, the ‘destination’ of sustainability is not a fixed place in the normal sense that we understand destination. Instead, it is a set of wishful characteristics of a future system.\[9\]

Green development is generally differentiated from sustainable development in that Green development prioritizes what its proponents consider to be environmental sustainability over economic and cultural considerations. Proponents of Sustainable Development argue that it provides a context in which to improve overall sustainability where cutting edge Green development is unattainable. For example, a cutting edge treatment plant with extremely high maintenance costs may not be sustainable in regions of the world with fewer financial resources. An environmentally ideal plant that is shut down due to bankruptcy is obviously less sustainable than one that is maintainable by the community, even if it is somewhat less effective from an environmental standpoint.

Some research activities start from this definition to argue that the environment is a combination of nature and culture. The Network of Excellence "Sustainable Development in a Diverse World",\[10\] sponsored by the European Union, integrates multidisciplinary capacities and interprets cultural diversity as a key element of a new strategy for sustainable development.

Still other researchers view environmental and social challenges as opportunities for development action. This is particularly true in the concept of sustainable enterprise that frames these global needs as opportunities for private enterprise to provide innovative and entrepreneurial solutions. This view is now being taught at many business schools including the Center for Sustainable Global Enterprise at Cornell University and the Erb Institute for Global Sustainable Enterprise at the University of Michigan.

The United Nations Division for Sustainable Development lists the following areas as coming within the scope of sustainable development:\[11\]

Sustainable development is an eclectic concept, as a wide array of views fall under its umbrella. The concept has included notions of weak sustainability, strong sustainability and deep ecology. Different conceptions also reveal a strong tension between ecocentrism and anthropocentrism. Many definitions and images (Visualizing Sustainability) of sustainable development coexist. Broadly defined, the sustainable development mantra enjoins current generations to take a systems approach to growth and development and to manage natural, produced, and social capital for the welfare of their own and future generations.

During the last ten years, different organizations have tried to measure and monitor the proximity to what they consider sustainability by implementing what has been called sustainability metrics and indices\[12\].

Sustainable development is said to set limits on the developing world. While current first world countries polluted significantly during their development, the same countries encourage third world countries to reduce pollution, which sometimes impedes growth. Some consider that the implementation of sustainable development would mean a reversion to pre-modern lifestyles.

Others have criticized the overuse of the term:

"[The] word sustainable has been used in too many situations today, and ecological sustainability is one of those terms that confuse a lot of people. You hear about sustainable development, sustainable growth, sustainable economies, sustainable societies, sustainable agriculture. Everything is sustainable (Temple, 1992)."\[13\]

Environmental sustainability
Environmental sustainability is the process of making sure current processes of interaction with the environment are pursued with the idea of keeping the environment as pristine as naturally possible based on ideal-seeking behavior.

An "unsustainable situation" occurs when natural capital (the sum total of nature's resources) is used up faster than it can be replenished. Sustainability requires that human activity only uses nature's resources at a rate at which they can be replenished naturally. Inherently the concept of sustainable development is intertwined with the concept of carrying capacity. Theoretically, the long-term result of environmental degradation is the inability to sustain human life. Such degradation on a global scale could imply extinction for humanity.

<table>
<thead>
<tr>
<th>Consumption of renewable resources</th>
<th>State of environment</th>
<th>Sustainability</th>
</tr>
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<tbody>
<tr>
<td>More than nature's ability to replenish</td>
<td>Environmental degradation</td>
<td>Not sustainable</td>
</tr>
<tr>
<td>Equal to nature's ability to replenish</td>
<td>Environmental equilibrium</td>
<td>Steady state economy</td>
</tr>
<tr>
<td>Less than nature's ability to replenish</td>
<td>Environmental renewal</td>
<td>Environmentally sustainable</td>
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</tbody>
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The notion of capital in sustainable development

The sustainable development debate is based on the assumption that societies need to manage three types of capital (economic, social, and natural), which may be non-substitutable and whose consumption might be irreversible. Daly (1991), for example, points to the fact that natural capital can not necessarily be substituted by economic capital. While it is possible that we can find ways to replace some natural resources, it is much more unlikely that they will ever be able to replace eco-system services, such as the protection provided by the ozone layer, or the climate stabilizing function of the Amazonian forest. In fact natural capital, social capital and economic capital are often complementarities. A further obstacle to substitutability lies also in the multifunctionality of many natural resources. Forests, for example, do not only provide the raw material for paper (which can be substituted quite easily), but they also maintain biodiversity, regulate water flow, and absorb CO2. Another problem of natural and social capital deterioration lies in their partial irreversibility. The loss in biodiversity, for example, is often definite. The same can be true for cultural diversity. For example with globalisation advancing quickly the number of indigenous languages is dropping at alarming rates. Moreover, the depletion of natural and social capital may have non-linear consequences. Consumption of natural and social capital may have no observable impact until a certain threshold is reached. A lake can, for example, absorb nutrients for a long time while actually increasing its productivity. However, once a certain level of algae is reached lack of oxygen causes the lake’s ecosystem to break down all of a sudden.

Market failure

If the degradation of natural and social capital has such important consequence the question arises why action is not taken more systematically to alleviate it. Cohen and Winn (2007)\textsuperscript{[16]} point to four types of market failure as possible explanations: First, while the benefits of natural or social capital depletion can usually be privatized the costs are often externalized (i.e. they are borne not by the party responsible but by society in general). Second, natural capital is often undervalued by society since we are not fully aware of the real cost of the depletion of natural capital. Information asymmetry is a third reason—often the link between cause and effect is obscured, making it difficult for actors to make informed choices. Cohen and Winn close with the realization that contrary to economic theory many firms are not perfect optimizers. They postulate that firms often do not optimize resource allocation because they are caught in a “business as usual” mentality.

The business case for sustainable development
The most broadly accepted criterion for corporate sustainability constitutes a firm’s efficient use of natural capital. This eco-efficiency is usually calculated as the economic value added by a firm in relation to its aggregated ecological impact. This idea has been popularised by the World Business Council for Sustainable Development (WBCSD) under the following definition: “Eco-efficiency is achieved by the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the earth’s carrying capacity.” (DeSimone and Popoff, 1997: 47)

Similar to the eco-efficiency concept but so far less explored is the second criterion for corporate sustainability. Socio-efficiency describes the relation between a firm’s value added and its social impact. Whereas, it can be assumed that most corporate impacts on the environment are negative (apart from rare exceptions such as the planting of trees) this is not true for social impacts. These can be either positive (e.g. corporate giving, creation of employment) or negative (e.g. work accidents, mobbing of employees, human rights abuses). Depending on the type of impact socio-efficiency thus either tries to minimize negative social impacts (i.e. accidents per value added) or maximise positive social impacts (i.e. donations per value added) in relation to the value added.

Both eco-efficiency and socio-efficiency are concerned primarily with increasing economic sustainability. In this process they instrumentalize both natural and social capital aiming to benefit from win-win situations. However, as Dyllick and Hockerts point out the business case alone will not be sufficient to realise sustainable development. They point towards eco-effectiveness, socio-effectiveness, sufficiency, and eco-equity as four criteria that need to be met if sustainable development is to be reached.

**Critique of the concept of sustainable development**

The concept of “Sustainable Development” raises several critiques at different levels.

**Purpose**

Various writers have commented on the population control agenda that seems to underlie the concept of sustainable development. Maria Sophia Aguirre writes:

"Sustainable development is a policy approach that has gained quite a lot of popularity in recent years, especially in international circles. By attaching a specific interpretation to sustainability, population control policies have become the overriding approach to development, thus becoming the primary tool used to "promote" economic development in developing countries and to protect the environment."

Mary Jo Anderson suggests that the real purpose of sustainable development is to contain and limit economic development in developing countries, and in so doing control population growth. It is suggested that this is the reason the main focus of most programs is still on low-income agriculture. Joan Veon, a businesswoman and international reporter, who covered 64 global meetings on sustainable development posits that:

"Sustainable development has continued to evolve as that of protecting the world's resources while its true agenda is to control the world's resources. It should be noted that Agenda 21 sets up the global infrastructure needed to manage, count, and control all of the world's assets."

**Consequences**

John Baden reckons that the notion of sustainable development is dangerous because the consequences are proceedings with unknown effects or potentially dangerous. He writes: "In economy like in ecology, the interdependence rules applies. Isolated actions are impossible. A policy which is not enough carefully thought will carry along various perverse and adverse effects for the ecology as much as for the economy. Many suggestions to save our environment and to promote a model of 'sustainable development' risk indeed leading to reverse effects." Moreover, he evokes the bounds of the public action which are underlined by the public choice theory: quest by the politics of their own interests, lobby pressure, partial disclosure etc. He develops his critique by noting the vagueness of the expression, which can cover anything: It is a gateway to interventionist proceedings which can be against the principle of freedom and without proven efficacy. Against this notion, he is a proponent of private property to impel the producers and the consumers to save the natural resources. According to Baden, "the improvement of environment quality depends on the market economy and the
existence of legitimate and protected property rights.” They enable the effective practice of personal responsibility and the development of mechanisms to protect the environment. The State can in this context “create conditions which encourage the people to save the environment.”

Vagueness of the term

The term of “sustainable development” is criticized because of its vagueness. For example, Jean-Marc Jancovic or the philosopher Luc Ferry express this view. The latter writes about sustainable development: "I know that this term is obligatory, but I find it also absurd, or rather so vague that it says nothing.” Luc Ferry adds that the term is trivial by a proof by contradiction: "who would like to be a proponent of an “untenable development! Of course no one! [...] The term is more charming than meaningful. [...] Everything must be done so that it does not turn into a Russian-type administrative planning with ill effects."

Basis

Sylvie Brunel, French geographer and specialist of the Third World, develops in A qui profite le développement durable (Who benefits from sustainable development?) (2008) a critique of the basis of sustainable development, with its binary vision of the world, can be compared to the Christian vision of Good and Evil, a idealized nature where the human being is an animal like the others or even an alien. Nature – as Rousseau thought – is better than the human being. It is a parasite, harmful for the nature. But the human is the one who protects the biodiversity, where normally only the strong survive.[28]

Moreover, she thinks that the ideas of sustainable development can hide a will to protectionism from the developed country to impede the development of the other countries. For Sylvie Brunel, the sustainable development serves as a pretext for the protectionism and “I have the feeling about sustainable development that it is perfectly helping out the capitalism”. [29]

“De-growth”

The proponents of the de-growth reckon that the term of sustainable development is an oxymoron. According to them, on a planet where 20% of the population consumes 80% of the natural resources, a sustainable development cannot be possible for this 20%: “According to the origin of the concept of sustainable development, a development which meets the needs of the present without compromising the ability of future generations to meet their own needs, the right term for the developed countries should be a sustainable de-growth”.[29]

Sustainable development in economics

The Venn diagram of sustainable development shown above has many versions, but was first used by economist Edward Barbier (1987). However, Pearce, Barbier and Markandya (1989) criticized the Venn approach due to the intractability of operationalizing separate indices of economic, environmental, and social sustainability and somehow combining them. They also noted that the Venn approach was inconsistent with the Brundtland Commission Report, which emphasized the interlinkages between economic development, environmental degradation, and population pressure instead of three objectives. Economists have since focused on viewing the economy and the environment as a single interlinked system with a unified valuation methodology (Hamilton 1999, Dasgupta 2007). Intergenerational equity can be incorporated into this approach, as has become common in economic valuations of climate change economics (Heal, 2009). Ruling out discrimination against future generations and allowing for the possibility of renewable alternatives to petro-chemicals and other non-renewable resources, efficient policies are compatible with increasing human welfare, eventually reaching a golden-rule steady state (Ayong le Kama, 2001 and Endress et al. 2005). Thus the three pillars of sustainable development are interlinkages, intergenerational equity, and dynamic efficiency (Stavins, et al 2003).

Arrow et al. (2004) and other economists (e.g. Asheim, 1999 and Pezzey, 1989 and 1997) have advocated a form of the weak criterion for sustainable development – the requirement that the wealth of a society, including human-capital, knowledge-capital and natural-capital (as well as produced capital) not decline over time. Others, including Barbier 2007, continue to contend that strong sustainability – non-depletion of essential forms of natural capital – may be appropriate.
Types of rural communities

Sociologists have identified a number of different types of rural communities, which have arisen as a result of changing economic trends within rural regions of industrial nations.

The basic trend seems to be one in which communities are required to become entrepreneurial. Those that lack the sort of characteristics mentioned below, are forced to either seek out their niche or accept eventual economic defeat. These towns focus on marketing and public relations whilst bidding for business and government operations; such as, off-site data processing or, perhaps, a factory.

For instance; International Falls, Minnesota markets itself as a site for sub-zero temperature experiments; Ottawa, Illinois managed to attract three Japanese firms; Freeport, Maine has become a center for mail-order companies such as L. L. Bean; and Mobile, Arizona has become the home of a number of solid-waste landfills.

Academic Communities

Academic communities are those in which the primary employers are boarding schools, colleges, universities, research laboratories, and corporate training facilities. These communities bring people away from other regions and thus bring new capital into the area.

Academic institutions, in rural areas, are very much like a factory in that the economic success of the community depends upon the success of the institution. Unlike factories, academic institutions tend to primarily offer jobs in the medium-skilled to professional range.

Area Trade-Centers

The automobile allows rural residents to travel farther, in less time, for goods and services. This reduces the importance of the rural store, along with decreasing rural population (see: rural exodus). As business relocate from impoverished communities, one town will become the trade center for its region, sometimes doing so by constructing a shopping mall.

Generally, business in a trade-center town, except for those in competition with the mall, will benefit from the mall's presence as shoppers spill over. These trade centers will knock out businesses in, and thus impoverish, nearby towns as shoppers converge on the town with the greatest variety of stores.

Exurbs

Government Centers

Rural regions are undergoing increasing government consolidation. This results in a small number of towns becoming centers of government activity, while the rest are devoid of government infrastructure. These centers include state and local capitals, and areas with prisons or military bases.

Centralized public administration focuses public-sector employment on a single community, assisting it over its neighbors. Benefits, for the government center, include improved public services, increased efficiency, and economic savings.

Recreation Communities

Recreation communities (tourist towns) define some local feature, usually a historic site or scenic vista, as a "natural resource" and market this to tourists. Travelers will then spend money on food, hotels, and the like, which brings capital into the town.

Retirement Communities
Retirement communities tend to house large numbers of elderly people. These retirees, bring pensions, Social Security, and savings which infuse the area with capital. Rural hospitals are increasingly unable to bring enough patients to support their operational budget, and retirement communities have developed, in some areas, as a means to solve this problem.

It should be noted that elderly residents, who migrate from the cities, tend to have above average wealth, thus creating an income disparity between the migrant retirees and the local elderly.

**Rural flight**

**Rural flight** (or rural exodus) is a term used to describe the migratory patterns of peoples from rural areas into urban areas. It often occurs in a region following the mechanization of agriculture when fewer people are needed to bring the same amount of agricultural output to market. Rural flight is exacerbated when the population decline leads to the loss of rural services such as stores and schools, when then leads to greater loss of population.

**In the United States and Canada**

The term is used in the United States and Canada to describe the flight of people from rural areas in the Great Plains and Midwest regions, and to a lesser extent rural areas of the northeast and southeast.

**Historical trends**

The shift from mixed subsistence farming to commoditized crop and livestock began in the late 19th century. New capital market systems and the railroad network began the trend towards larger farms that employed fewer people per acre. These larger farms used more efficient technologies such as Deere plows, automatic reapers, and higher-yield seed stock, which reduced human input per unit of production. During the Dust Bowl and Great Depression of the 1930s, large numbers of people fled rural areas of the Plains and Midwest because of depressed commodity prices, high debt load, and several years of drought and large dust storms. Rural flight from the Great Plains has been depicted in literature, such as John Steinbeck’s novel *The Grapes of Wrath* (1939), in which a family from the Great Plains migrates to California during the Dust Bowl period of the 1930s.

**Modern rural flight**

Post-World War II rural flight is caused by the growing industrialization of agriculture, in which small, labor-intensive family farms grow into, or are replaced by, heavily mechanized and specialized industrial farms. While a small family farm typically produced a wide range of crop, garden, and animal products, all requiring substantial labor, large industrial farms typically specialize in just a few crop or livestock varieties, using large machinery and high-density livestock containment systems that require a fraction of the labor per unit produced. The consolidation of the feed, seed, processed grain, and livestock industries meant that there are fewer small businesses in rural areas, which exacerbated the decreased demand for labor. Rural areas that used to be able to provide employment for all young adults willing to work in challenging conditions, increasingly provide fewer opportunities for young adults. The situation is made worse by the decrease in services such as schools, stores, and cultural opportunities that accompany the decline in population, and the increasing age of the remaining population further stresses the social service system of rural areas.

**Abandonment of small towns**

The loss of population in rural areas leads to the abandonment of small towns, turning their once thriving downtowns into empty or underutilized storefronts.

**German Landflucht**

In Germany *Landflucht* ("flight from the land") refers to the mass migration of peasants into the cities that occurred in Germany (and throughout most of Europe) in the late 19th century.
In 1870 the rural population of Germany constituted 64% of the population; by 1907 it had shrunk to 33%. In 1900 alone, the Prussian provinces of East Prussia, West Prussia, Posen, Silesia, and Pomerania lost about 1,600,000 people to the cities, where these former agricultural workers were absorbed into the rapidly growing factory labor class; One of the causes of this mass-migration was the decrease in rural income compared to the rates of pay in the cities. *Landflucht* resulted in a major transformation of the German countryside and agriculture. Mechanized agriculture and migrant workers, particularly Poles from the east (Sachsenganger), became more common. This was especially true in the province of Posen that was gained by Prussia when Poland was partitioned. The Polish population of eastern Germany was one of the justifications for the creation of the "Polish corridor" after World War I and the absorption of the land east of the Oder-Neisse line into Poland after World War II. Also, some labor-intensive enterprises were replaced by much less labor-intensive ones such as game preserves.

The word *landflucht* has negative connotations in German, as it was coined by agricultural employers, often of the German aristocracy, who were lamenting their labor shortages.

**Contemporary developing countries**

Today the phenomenon of rural flight is also well-known in developing countries, where many people in the countryside live below the poverty line. They migrate to cities to find employment or to get money by begging.

**Role homogeneity**

In sociology, *role homogeneity* is the degree of overlap amongst the different roles performed by different members of a community.

**Rural sociology**

Rural sociologists often note that amongst rural communities there exists a very high degree of role homogeneity, that is, one person may perform the duties of banker, coach, deacon, school board member, and neighbor.

**Controversy**

Sociologists have demonstrated that in areas of strong homogeneity, there is a general tendency to repress controversy. As a result, when disagreements arise, they can result into serious crises. Such communities tend to have local newspapers which are more oriented towards marketing, rather than news. What news is published, in a highly-homogeneous society, tends to focus on non-controversial topics and avoid "bad news".

**Diffusion of innovations**

![Diffusion of innovations](image)

The diffusion of innovations according to Rogers. With successive groups of consumers adopting the new technology (shown in blue), its market share (yellow) will eventually reach the saturation level.

**Diffusion of Innovations** is a theory of how, why, and at what rate new ideas and technology spread through cultures. The concept was first studied by the French sociologist Gabriel Tarde (1890) and by German and
Austrian anthropologists such as Friedrich Ratzel or Leo Frobenius. Its basic epidemiological or internal-influence form was described by H. Earl Pemberton, who provided examples of institutional diffusions such as postage stamps or compulsory school laws. The publication of a study of Ryan and Gross on the diffusion of hybrid corn in Iowa was the first sustainably visible contribution in a broader interest in innovations which was especially popularized by the textbook by Everett Rogers (1962), *Diffusion of Innovations* (Rogers 1964). He defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." [1]

**History**

The origins of the diffusion of innovations theory are varied and span across multiple disciplines. Rogers identifies six main traditions that impacted diffusion research: anthropology, early sociology, rural sociology, education, industrial, and medical sociology. The diffusion of innovation theory has been largely influenced by the work of rural sociologists. In the book *Diffusion of Innovations*, Rogers synthesizes research from over 508 diffusion studies and produces a theory for the adoption of innovations among individuals and organizations.

**Elements of diffusion of innovations**

The key elements in diffusion research are: the innovation, types of communication channels, time or rate of adoption, and the social system which frames the innovation decision process.

**Types of innovation-decisions**

There are three types of innovation-decisions within diffusion of innovations. An individual or an organization/social system bases the type of decision on whether an innovation is adopted/rejected. The three types of innovation-decisions are: Optional innovation-decisions, collective innovation-decisions, authority innovation-decisions.

Optional Innovation-Decision
This decision is made by an individual who is in some way distinguished from others in a social system.

Collective Innovation-Decision
This decision is made collectively by all individuals of a social system.

Authority Innovation-Decision
This decision is made for the entire social system by few individuals in positions of influence or power.

**The adoption process**

Diffusion of an innovation occurs through a five–step process. This process is a type of decision-making. It occurs through a series of communication channels over a period of time among the members of a similar social system. Ryan & Gross first indicated the identification of adoption as a process in 1943 (Rogers 1964, p. 79). Rogers categorizes the five stages (steps) as: awareness, interest, evaluation, trial, and adoption. It should be noted that an individual might reject an innovation at anytime during or after the adoption process. In later editions of the *Diffusion of Innovations* Rogers changes the terminology of the five stages to: knowledge, persuasion, decision, implementation, and confirmation. However the descriptions of the categories have remained similar throughout the editions.

**Five stages of the adoption process**
Knowledge

In this stage the individual is first exposed to an innovation but lacks information about the innovation. It should be noted that during this stage of the process the individual has not been inspired to find more information about the innovation.

Persuasion

In this stage the individual is interested in the innovation and actively seeks information/detail about the innovation.

Decision

In this stage the individual takes the concept of the innovation and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation. Due to the individualistic nature of this stage Rogers notes that it is the most difficult stage to acquire empirical evidence (Rogers 1964, p. 83).

Implementation

In this stage the individual employs the innovation to a varying degree depending on the situation. During this stage the individual determines the usefulness of the innovation and may search for further information about it.

Confirmation

Although the name of this stage may be misleading, in this stage the individual finalizes their decision to continue using the innovation and may use the innovation to its fullest potential.

Rates of adoption

The rate of adoption is defined as: the relative speed with which members of a social system adopt an innovation. It is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation (Rogers 1964, p. 134). The rates of adoption for innovations are determined by an individual’s adopter category. In general individuals who first adopt an innovation require a shorter adoption period (adoption process) than late adopters.

Within the rate of adoption there is a point at which an innovation reaches critical mass. This is a point in time within the adoption curve that enough individuals have adopted an innovation in order that the continued adoption of the innovation is self-sustaining. In describing how an innovation reaches critical mass, Rogers outlines several strategies in order to help a innovation reach this stage. These strategies are: have an innovation adopted by a highly respected individual within a social network, creating an instinctive desire for a specific innovation. Inject an innovation into a group of individuals who would readily use an innovation, and provide positive reactions and benefits for early adopters of an innovation.

Characteristics of innovations

Rogers defines several intrinsic characteristics of innovations that influence an individual’s decision to adopt or reject an innovation. The relative advantage is how improved an innovation is over the previous generation. Compatibility is the second characteristic, the level of compatibility that an innovation has to be assimilated into an individual’s life. The complexity of an innovation is a significant factor in whether it is adopted by an individual. If the innovation is too difficult to use an individual will not likely adopt it. The fourth characteristic, trialability, determines how easily an innovation may be experimented with as it is being adopted. If a user has a hard time using and trying an innovation this individual will be less likely to adopt it. The final characteristic, observability, is the extent that an innovation is visible to others. An innovation that is more visible will drive communication among the individual’s peers and personal networks and will in turn create more positive or negative reactions.

Adopter categories
Rogers defines an adopter category as a classification of individuals within a social system on the basis of innovativeness. In the book *Diffusion of Innovations*, Rogers suggests a total of five categories of adopters in order to standardize the usage of adopter categories in diffusion research. It should be noted that the adoption of an innovation follows an S curve when plotted over a length of time.\[citation needed\] The categories of adopters are: innovators, early adopters, early majority, late majority, and laggards (Rogers 1964, p. 150)

**Innovators**

Innovators are the first individuals to adopt an innovation. Innovators are willing to take risks, youngest in age, have the highest social class, have great financial lucidity, very social and have closest contact to scientific sources and interaction with other innovators.

**Early Adopters**

This is second fastest category of individuals who adopt an innovation. These individuals have the highest degree of opinion leadership among the other adopter categories. Early adopters are typically younger in age, have a higher social status, have more financial lucidity, advanced education, and are more socially forward than late adopters (Rogers 1964, p. 185).

**Early Majority**

Individuals in this category adopt an innovation after a varying degree of time. This time of adoption is significantly longer than the innovators and early adopters. Early Majority tend to be slower in the adoption process, have above average social status, contact with early adopters, and show some opinion leadership.

**Late Majority**

Individuals in this category will adopt an innovation after the average member of the society. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Late Majority are typically skeptical about an innovation, have below average social status, very little financial lucidity, in contact with others in late majority and early majority, very little opinion leadership.

**Laggards**

Individuals in this category are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents and tend to be advanced in age. Laggards typically tend to be focused on “traditions”, have lowest social status, lowest financial fluidity, oldest of all other adopters, in contact with only family and close friends, very little to no opinion leadership.

**Opinion leaders and communication channels**

Throughout the diffusion process there is evidence that not all individuals exert an equal amount of influence over all individuals. In this sense there are Opinion Leaders, leaders who are influential in spreading either positive or negative information about an innovation. Rogers relies on the ideas of Katz & Lazarsfeld and the two-step flow theory in developing his ideas on the influence of Opinion Leaders in the diffusion process.\[5\] Opinion Leaders have the most influence during the evaluation stage of the innovation-decision process and late adopters (Rogers 1964, p. 219). In addition opinion leaders have a set of characteristics that set them apart from their followers and other individuals. Opinion Leaders typically have greater exposure to the mass media, more cosmopolitan, greater contact with change agents, more social experience and exposure, higher socioeconomic status, and are more innovative.

**Diffusion in organizations**

Innovations are often adopted by organizations through two types of innovation-decisions: collective innovation decisions and authority innovation decisions. The collection-innovation decision occurs when the adoption of an innovation has been made by a consensus among the members of an organization. The authority-innovation decision occurs when the adoption of an innovation has been made by very few individuals with high positions.
of power within an organization (Rogers 2005, p. 403). Unlike the optional innovation decision process, these innovation-decision processes only occur within an organization or hierarchical group. Within the innovation decision process in an organization there are certain individuals termed "champions" who stand behind an innovation and break through any opposition that the innovation may have caused. The champion within the diffusion of innovation theory plays a very similar role as to the champion used within the efficiency business model Six Sigma. The innovation process within an organization contains five stages that are slightly similar to the innovation-decision process that individuals undertake. These stages are: agenda-setting, matching, redefining/restructuring, clarifying, routinizing.

Consequences of adoption

There are both positive and negative outcomes when an individual or organization chooses to adopt a particular innovation. Rogers states that this is an area that needs further research because of the biased positive attitude that is associated with the adoption of a new innovation (Rogers 2005, p. 470). In the Diffusion of Innovation, Rogers lists three categories for consequences, desirable vs. undesirable, direct vs. indirect, and anticipated vs. unanticipated.

Diffusion and management

Much of the evidence for the diffusion of innovations gathered by Rogers comes from agricultural methods and medical practice.

Various computer models have been developed in order to simulate the diffusion of innovations. Veneris developed a systems dynamics computer model which takes into account various diffusion patterns modeled via differential equations.

There are a number of criticisms of the model which make it less than useful for managers. First, technologies are not static. There is continual innovation in order to attract new adopters all along the S-curve. The S-curve does not just 'happen'. Instead, the s-curve can be seen as being made up of a series of 'bell curves' of different sections of a population adopting different versions of a generic innovation.

The role of electronic communication social networks in assisting the diffusion of innovation

Prior to the introduction of the Internet, it was argued that social networks had a crucial role in the diffusion of innovation particularly Tacit knowledge in the book The IRG Solution - hierarchical incompetence and how to overcome it. The book argued that the widespread adoption of computer networks of individuals would lead to the much better diffusion of innovations, and with greater understanding of their possible shortcomings, and the identification of needed innovations that would not have otherwise occurred - the Relevance paradox.

Education

Education in its broadest sense is any act or experience that has a formative effect on the mind, character or physical ability of an individual. In its technical sense education is the process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to another.

Teachers in educational institutions direct the education of students and might draw on many subjects, including reading, writing, mathematics, science and history. This process is sometimes called schooling when referring to the education of teaching only a certain subject, usually as professors at institutions of higher learning. There is also education in fields for those who want specific vocational skills, such as those required to be a pilot. In addition there is an array of education possible at the informal level, e.g., at museums and libraries, with the Internet, and in life experience.

The right to education has been described as a basic human right: since 1952, Article 2 of the first Protocol to the European Convention on Human Rights obliges all signatory parties to guarantee the right to education. At world level, the United Nations' International Covenant on Economic, Social and Cultural Rights of 1966 guarantees this right under its Article 13.

Systems of formal education
**Education** is a concept, referring to the process in which students can learn something:

- **Instruction** refers to the facilitating of learning toward identified objectives, delivered either by an instructor or other forms.
- **Teaching** refers to the actions of a real live instructor designed to impart learning to the student.
- **Learning** refers to learning with a view toward preparing learners with specific knowledge, skills, or abilities that can be applied immediately upon completion.

**Primary education**

Primary (or elementary) education consists of the first 5-7 years of formal, structured education. In general, main education consists of six or eight years of schooling starting at the age of five or six, although this varies between, and sometimes within, countries. Globally, around 70% of primary-age children are enrolled in primary education, and this proportion is rising.[1] Under the Education for All programs driven by UNESCO, most countries have committed to achieving universal enrollment in primary education by 2015, and in many countries, it is compulsory for children to receive primary education. The division between primary and secondary education is somewhat arbitrary, but it generally occurs at about eleven or twelve years of age. Some education systems have separate middle schools, with the transition to the final stage of secondary education taking place at around the age of fourteen. Schools that provide primary education, are mostly referred to as primary schools. Primary schools in these countries are often subdivided into infant schools and junior schools.

**Secondary education**

In most contemporary educational systems of the world, secondary education consists of the second years of formal education that occur during adolescence.[citation needed] It is characterized by transition from the typically compulsory, comprehensive primary education for minors, to the optional, selective tertiary, "post-secondary", or "higher" education (e.g., university, vocational school) for adults.[citation needed] Depending on the system, schools for this period, or a part of it, may be called secondary or high schools, gymnasia, lyceums, middle schools, colleges, or vocational schools. The exact meaning of any of these terms varies from one system to another. The exact boundary between primary and secondary education also varies from country to country and even within them, but is generally around the seventh to the tenth year of schooling. Secondary education occurs mainly during the teenage years. In the United States and Canada primary and secondary education together are sometimes referred to as K-12 education, and in New Zealand Year 1-13 is used. The purpose of secondary education can be to give common knowledge, to prepare for higher education or to train directly in a profession.

The emergence of secondary education in the United States did not happen until 1910, caused by the rise in big businesses and technological advances in factories (i.e. emergence of electrification), that required skilled workers. In order to meet this new job demand, high schools were created and the curriculum focused on practical job skills that would better prepare students for white collar or skilled blue collar work. This proved to be beneficial for both the employer and the employee, because this improvement in human capital caused employees to become more efficient, which lowered costs for the employer, and skilled employees received a higher wage than employees with just primary educational attainment.

In Europe the grammar school or academy existed from as early as the 1500s, public schools or fee paying schools, or charitable educational foundations have an even longer history.

**Higher education**

Higher education, also called tertiary, third stage, or post secondary education, is the non-compulsory educational level that follows the completion of a school providing a secondary education, such as a high school, secondary school. Tertiary education is normally taken to include undergraduate and postgraduate education, as well as vocational education and training. Colleges and universities are the main institutions that provide tertiary education. Collectively, these are sometimes known as tertiary institutions. Tertiary education generally results in the receipt of certificates, diplomas, or academic degrees.

Higher education includes teaching, research and social services activities of universities, and within the realm of teaching, it includes both the *undergraduate* level (sometimes referred to as tertiary education) and the *graduate* (or *postgraduate*) level (sometimes referred to as graduate school). Higher education in that country
generally involves work towards a degree-level or foundation degree qualification. In most developed countries a high proportion of the population (up to 50%) now enter higher education at some time in their lives. Higher education is therefore very important to national economies, both as a significant industry in its own right, and as a source of trained and educated personnel for the rest of the economy.[citation needed]

**Adult education**

Adult education has become common in many countries. It takes on many forms, ranging from formal class-based learning to self-directed learning and e-learning. A number of career specific courses such as veterinary, medical billing and coding, real estate license, bookkeeping and many more are now available to students through the Internet.

**Alternative education**

Alternative education, also known as *non-traditional education* or *educational alternative*, is a broad term that may be used to refer to all forms of education outside of traditional education (for all age groups and levels of education). This may include not only forms of education designed for students with special needs (ranging from teenage pregnancy to intellectual disability), but also forms of education designed for a general audience and employing alternative educational philosophies and methods.

Alternatives of the latter type are often the result of education reform and are rooted in various philosophies that are commonly fundamentally different from those of traditional compulsory education. While some have strong political, scholarly, or philosophical orientations, others are more informal associations of teachers and students dissatisfied with certain aspects of traditional education.[citation needed] These alternatives, which include charter schools, alternative schools, independent schools, and home-based learning vary widely, but often emphasize the value of small class size, close relationships between students and teachers, and a sense of community.[citation needed].

**Indigenous education**

Increasingly, the inclusion of indigenous models of education (methods and content) as an alternative within the scope of formal and non-formal education systems, has come to represent a significant factor contributing to the success of those members of indigenous communities who choose to access these systems, both as students/learners and as teachers/instructors.

As an educational method, the inclusion of indigenous ways of knowing, learning, instructing, teaching and training, has been viewed by many critical and postmodern scholars as important for ensuring that students/learners and teachers/instructors (whether indigenous or non-indigenous) are able to benefit from education in a culturally sensitive manner that draws upon, utilizes, promotes and enhances awareness of indigenous traditions.[3]

For indigenous students or learners, and teachers or instructors, the inclusion of these methods often enhances educational effectiveness, success and learning outcomes by providing education that adheres to their own inherent perspectives, experiences and worldview. For non-indigenous students and teachers, education using such methods often has the effect of raising awareness of the individual traditions and collective experience of surrounding indigenous communities and peoples, thereby promoting greater respect for and appreciation of the cultural realities of these communities and peoples.

In terms of educational content, the inclusion of indigenous knowledge, traditions, perspectives, worldviews and conceptions within curricula, instructional materials and textbooks and coursebooks have largely the same effects as the inclusion of indigenous methods in education. Indigenous students and teachers benefit from enhanced academic effectiveness, success and learning outcomes, while non-indigenous students/learners and teachers often have greater awareness, respect, and appreciation for indigenous communities and peoples in consequence of the content that is shared during the course of educational pursuits.[3]

A prime example of how indigenous methods and content can be used to promote the above outcomes is demonstrated within higher education in Canada. Due to certain jurisdictions’ focus on enhancing academic success for Aboriginal learners and promoting the values of multiculturalism in society, the inclusion of
indigenous methods and content in education is often seen as an important obligation and duty of both governmental and educational authorities.\(^4\)

**Process**

**Curriculum**

An academic discipline is a branch of knowledge which is formally taught, either at the university, or via some other such method. Each discipline usually has several sub-disciplines or branches, and distinguishing lines are often both arbitrary and ambiguous. Examples of broad areas of academic disciplines include the natural sciences, mathematics, computer science, social sciences, humanities and applied sciences.\(^5\)

**Learning modalities**

There has been work on learning styles over the last two decades. Dunn and Dunn\(^6\) focused on identifying relevant stimuli that may influence learning and manipulating the school environment, at about the same time as Joseph Renzulli\(^7\) recommended varying teaching strategies. Howard Gardner\(^8\) identified individual talents or aptitudes in his Multiple Intelligences theories. Based on the works of Jung, the Myers-Briggs Type Indicator and Keirsey Temperament Sorter\(^9\) focused on understanding how people's personality affects the way they interact personally, and how this affects the way individuals respond to each other within the learning environment. The work of David Kolb and Anthony Gregorc's Type Delineator\(^10\) follows a similar but more simplified approach.

It is currently fashionable to divide education into different learning "modes". The learning modalities\(^11\) are probably the most common:\(^12\)

- **Visual**: learning based on observation and seeing what is being learned.
- **Auditory**: learning based on listening to instructions/information.
- **Kinesthetic**: learning based on hands-on work and engaging in activities.

It is claimed that, depending on their preferred learning modality, different teaching techniques have different levels of effectiveness.\(^13\) A consequence of this theory is that effective teaching should present a variety of teaching methods which cover all three learning modalities so that different students have equal opportunities to learn in a way that is effective for them.\(^14\) Guy Claxton has questioned the extent that learning styles such as VAK are helpful, particularly as they can have a tendency to label children and therefore restrict learning.\(^15\)

**Teaching**

Teachers need to understand a subject enough to convey its essence to students. The goal is to establish a sound knowledge base on which students will be able to build as they are exposed to different life experiences. Good teachers can translate information, good judgment, experience and wisdom into relevant knowledge that a student can understand, retain and pass to others. Studies from the US suggest that the quality of teachers is the single most important factor affecting student performance, and that countries which score highly on international tests have multiple policies in place to ensure that the teachers they employ are as effective as possible.\(^16\)

**Technology**

Technology is an increasingly influential factor in education. Computers and mobile phones are used in developed countries both to complement established education practices and develop new ways of learning such as online education (a type of distance education). This gives students the opportunity to choose what they are interested in learning. The proliferation of computers also means the increase of programming and blogging. Technology offers powerful learning tools that demand new skills and understandings of students, including Multimedia, and provides new ways to engage students, such as Virtual learning environments. Technology is being used more not only in administrative duties in education but also in the instruction of students. The use of technologies such as PowerPoint and interactive whiteboard is capturing the attention of students in the classroom. Technology is also being used in the assessment of students. One example is the Audience Response System (ARS), which allows immediate feedback tests and classroom discussions.
Information and communication technologies (ICTs) are a “diverse set of tools and resources used to communicate, create, disseminate, store, and manage information.”[17] These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony. There is increasing interest in how computers and the Internet can improve education at all levels, in both formal and non-formal settings.[18] Older ICT technologies, such as radio and television, have for over forty years been used for open and distance learning, although print remains the cheapest, most accessible and therefore most dominant delivery mechanism in both developed and developing countries. The use of computers and the Internet is in its infancy in developing countries, if these are used at all, due to limited infrastructure and the attendant high costs of access. Usually, various technologies are used in combination rather than as the sole delivery mechanism. For example, the Kothmale Community Radio Internet uses both radio broadcasts and computer and Internet technologies to facilitate the sharing of information and provide educational opportunities in a rural community in Sri Lanka. The Open University of the United Kingdom (UKOU), established in 1969 as the first educational institution in the world wholly dedicated to open and distance learning, still relies heavily on print-based materials supplemented by radio, television and, in recent years, online programming. Similarly, the Indira Gandhi National Open University in India combines the use of print, recorded audio and video, broadcast radio and television, and audio conferencing technologies. The term “computer-assisted learning” (CAL) has been increasingly used to describe the use of technology in teaching.

Educational theory

Education theory is the theory of the purpose, application and interpretation of education and learning. Its history begins with classical Greek educationalists and sophists and includes, since the 18th century, pedagogy and andragogy. In the 20th century, "theory" has become an umbrella term for a variety of scholarly approaches to teaching, assessment and education law, most of which are informed by various academic fields, which can be seen in the below sections.

Economics

It has been argued that high rates of education are essential for countries to be able to achieve high levels of economic growth.[23] Empirical analyses tend to support the theoretical prediction that poor countries should grow faster than rich countries because they can adopt cutting edge technologies already tried and tested by rich countries. However, technology transfer requires knowledgeable managers and engineers who are able to operate new machines or production practices borrowed from the leader in order to close the gap through imitation. Therefore, a country's ability to learn from the leader is a function of its stock of "human capital." Recent study of the determinants of aggregate economic growth have stressed the importance of fundamental economic institutions and the role of cognitive skills.

At the individual level, there is a large literature, generally related back to the work of Jacob Mincer, on how earnings are related to the schooling and other human capital of the individual. This work has motivated a large number of studies, but is also controversial. The chief controversies revolve around how to interpret the impact of schooling.

Economists Samuel Bowles and Herbert Ginitis famously argued in 1976 that there was a fundamental conflict in American schooling between the egalitarian goal of democratic participation and the inequalities implied by the continued profitability of capitalist production on the other.

Philosophy

Philosophy of education is the philosophical study of the purpose, process, nature and ideals of education. Philosophy of education can naturally be considered a branch of both philosophy and education. Philosophy of education is commonly housed in colleges and departments of education, yet it is applied philosophy, drawing from the traditional fields of philosophy (ontology, ethics, epistemology, etc.) and approaches (speculative, prescriptive, and/or analytic) to address questions regarding education policy, human development, education research methodology, and curriculum theory, to name a few.

Psychology

Educational psychology is the study of how humans learn in educational settings, the effectiveness of educational interventions, the psychology of teaching, and the social psychology of schools as organizations.
Although the terms "educational psychology" and "school psychology" are often used interchangeably, researchers and theorists are likely to be identified as educational psychologists, whereas practitioners in schools or school-related settings are identified as school psychologists. Educational psychology is concerned with the processes of educational attainment in the general population and in sub-populations such as gifted children and those with specific disabilities.

Educational psychology can in part be understood through its relationship with other disciplines. It is informed primarily by psychology, bearing a relationship to that discipline analogous to the relationship between medicine and biology. Educational psychology in turn informs a wide range of specialities within educational studies, including instructional design, educational technology, curriculum development, organizational learning, special education and classroom management. Educational psychology both draws from and contributes to cognitive science and the learning sciences. In universities, departments of educational psychology are usually housed within faculties of education, possibly accounting for the lack of representation of educational psychology content in introductory psychology textbooks (Lucas, Blazek, & Raley, 2006).

Sociology

The sociology of education is the study of how social institutions and forces affect educational processes and outcomes, and vice versa. By many, education is understood to be a means of overcoming handicaps, achieving greater equality and acquiring wealth and status for all (Sargent 1994). Learners may be motivated by aspirations for progress and betterment. Education is perceived as a place where children can develop according to their unique needs and potentialities. The purpose of education can be to develop every individual to their full potential. The understanding of the goals and means of educational socialization processes differs according to the sociological paradigm used.

Educational Development

In some developing countries, the number and seriousness of the problems faced are naturally greater. People in more remote or agrarian areas are sometimes unaware of the importance of education. However, many countries have an active Ministry of Education, and in many subjects, such as foreign language learning, the degree of education is actually much higher than in industrialized countries; for example, it is not at all uncommon for students in many developing countries to be reasonably fluent in multiple foreign languages, whereas this is much more of a rarity in the supposedly "more educated" countries where much of the population is in fact monolingual.

There is also economic pressure from those parents who prefer their children making money in the short term over any long-term benefits of education. Recent studies on child labor and poverty have suggested that when poor families reach a certain economic threshold where families are able to provide for their basic needs, parents return their children to school. This has been found to be true, once the threshold has been breached, even if the potential economic value of the children's work has increased since their return to school.

A lack of good universities, and a low acceptance rate for good universities, is evident in countries with a high population density. In some countries, there are uniform, over structured, inflexible centralized programs from a central agency that regulates all aspects of education.

- Due to globalization, increased pressure on students in curricular activities
- Removal of a certain percentage of students for improvisation of academics (usually practised in schools, after 10th grade)

India is now developing technologies that will skip land based phone and internet lines. Instead, India launched EDUSAT, an education satellite that can reach more of the country at a greatly reduced cost. There is also an initiative started by the OLPC foundation, a group out of MIT Media Lab and supported by several major corporations to develop a $100 laptop to deliver educational software. The laptops are widely available as of 2009. The laptops are sold at cost or given away based on donations. These will enable developing countries to give their children a digital education, and help close the digital divide across the world.

In Africa, NEPAD has launched an "e-school programme" to provide all 600,000 primary and high schools with computer equipment, learning materials and internet access within 10 years. Private groups, like The Church of Jesus Christ of Latter-day Saints, are working to give more individuals opportunities to receive education in
developing countries through such programs as the Perpetual Education Fund. An International Development Agency project called nabuur.com, started with the support of American President Bill Clinton, uses the Internet to allow co-operation by individuals on issues of social development.

**Internationalisation**

Education is becoming increasingly international. Not only are the materials becoming more influenced by the rich international environment, but exchanges among students at all levels are also playing an increasingly important role. In Europe, for example, the Socrates-Erasmus Programme stimulates exchanges across European universities. Also, the Soros Foundation provides many opportunities for students from central Asia and eastern Europe. Some scholars argue that, regardless of whether one system is considered better or worse than another, experiencing a different way of education can often be considered to be the most important, enriching element of an international learning experience.

**Religion and Education**

In Islam education is very important for both males and females, particularly young children. Contrary to common perception the seeking of all types of knowledge - be it academic, vocational, religious or secular - is encouraged at all ages. However, learning at an early age is thought to allow the mind to concentrate without the stresses and responsibilities of later adult life.

**References**


1. ^a,b see the article on Trans-cultural diffusion or Roland Burrage Dixon (1928): *The Building of Cultures*.
4. ^Ryan (1943), see above.