Sustainable Development in the USA

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Introduction

Since its very beginning, the United States has been a land of growth and expansion – a growth that was both territorial and economic and that made the nation the world’s largest consumer of land, merchandise, and energy. Following the Second World War, this growth and drive to expand was introduced to the world as a model for development and was known as the American Way of Life. This model is reaching its limits today, since the Earth’s ability to support such development on a worldwide scale is no longer taken for granted. The world’s leading superpower is now dealing with the challenge of sustainable development.

The United States is a young nation, born out of the Industrial Revolution. The Far West was “conquered” using the railroad and the electric telegraph as tools. Oil exploration began in Pennsylvania in 1859. The US saw the birth of the phone, airplanes, and Internet; automobiles were manufactured in series for the first time in the US. The concentration of these inventions in one single country was no accident; they all responded to a need – the need to overcome the challenge of the immensity of the territory while dealing with the chronic shortage of manpower. These inventions accelerated communications in an unprecedented way across all activities. Thus, despite relatively limited human resources, the expansion of American territory in a short period of time made the country the leading global industrial power, without compromising the nation’s cohesion. This cohesion is sustained at the steep cost of high energy and natural resource consumption. This is why the geography of settlement in the US is a strong indicator of the exceptional nature and paradoxes of this country.

Despite the economic crisis in which it is immersed today, the United States is still one of the richest countries in the world. It produced 22% of the adjusted gross world product in purchasing power parity (PPP) in 2003. With $37,750 PPP per capita, the US is therefore the world’s most prosperous nation among countries with more than 20 million inhabitants. This global economic leadership was already
established in the late 19th century, and fed a tenacious Promethean myth. With attitudes shaped by seventeenth-century Anglo-Saxon Protestantism, Americans saw themselves as a “chosen people” and first viewed their wide open space as a type of Biblical “New Canaan”, a territory with unlimited resources, overflowing with milk and honey. Their Manifest Destiny was to make the best use of this gift from God. When for the first time an American set foot on the Moon in July 1969, public opinion was that the United States had reached a stage of development that would permanently preserve it from the tyranny of nature. This belief in the steady progress of living conditions and in the control of our environment no longer exists today.

American supremacy has recently been handicapped by the emergence of new global enemies, symbolized by the September 11, 2001, terrorist attacks in New York City. The limits of military power were put under the spotlight and the international influence of the United States was blighted by the military adventurism of the Bush administration in Iraq. Its economic leadership trembled at the onset of the subprime crisis in 2006 which eventually led to the collapse of financial markets in September 2008. Although on a much more local scale, Hurricane Katrina and the flooding of New Orleans (August 29, 2005) changed the way that Americans view the environment. The popularity of former Vice President Al Gore, who was recently awarded a Nobel Peace Prize, has increased. The unilateral policy of the Bush administration in environmental matters is openly questioned. While Americans consume more than 22% of the world’s energy for less than 5% of its population, they have come to a turning point in their relationship with environmental protection and development. The aim of this book is to address this issue by exposing the situation of the US settlement and population during this current transitional period which is a period that is bound to see the very foundations of the US territory challenged, as well as the end of past development models and ideals.

A young country of exceptional growth

Just like Canada and Australia, the United States is a “new country,” as they were so called at the beginning of the last century. Unlike China, India, and most European countries, the US does not have thousands of years of experience in rural territorial development. The country was mainly populated during its colonization. Native Americans left only subtle traces of their ancient presence. Decimated by epidemics, which preceded the Conquistadors, before the Native Americans even met the first “pale face”, these Native peoples primarily lived on a crop-based economy and adopted a kind of semi-nomadic life as a result of the introduction of the horse on the Great Plains. The story of westward expansion and the development of the US territory has often been portrayed as an epic story [CLA 92]. Considering that the country was born with the Declaration of Independence on July 4, 1776, it is
remarkable to think that a territory of such size was conquered and developed so quickly with such limited human resources. The first census, held in 1790, counted no more than 4 million inhabitants, of which 20% were black slaves, which meant that the average population density was only four people per sq. km in the area covering the 13 founding colonies, between the Appalachian Mountains and the shores of the Atlantic; the census excluded the Native Americans who were at that time considered as foreigners and deported towards the West. The United States experienced exceptional growth in the 19th century. Today’s borders were established in 1853 for the 48 conterminous states. In 1850, there were already 23.2 million inhabitants – once again excluding Native Americans. Expansion resumed at the end of the Civil War. Alaska was purchased in 1867; Hawaii became a protectorate in 1898. There were nearly 76 million inhabitants at the turn of the century, including Native Americans who had been included in censuses since 1880.\(^1\) After the final internal “frontier” closed, Arizona and New Mexico became states in 1912. The 100 million population mark was reached in 1915. Population growth exceeded an average annual rate of 2.2% per year between the end of the Civil War and the beginning of the First World War, which was a growth rate four times higher than the average rate in the world at that time. This population explosion was fueled by the arrival of more than 40 million people from Europe between 1845 and 1915, by a high birth rate and by a life expectancy that was already higher than in the rest of the world. The US territory still bears the marks of this period of development. Port cities served as gateways to the continent. During the steel industry boom, industrial growth was concentrated in the cities of the Northeast, while the mountains to the West were barely populated. It was during this period that the main regional patterns of the US territory were formed and with the same proportions which continue to characterize the country today.

The First World War marked a turning point. In particular, it marked the abrupt and voluntary end of the great wave of European immigration, which in turn resulted in the relative slowdown of population growth. The lowest growth rate of the US population (0.7% per annum) was observed in the decade from 1930 to 1940. The United States had reached its territorial limits. Its economic and military power now directed at outside countries, particularly to Latin America and the Pacific Ocean. In return, these regions have provided the US with the majority of its immigrants since the 1960s. The 1930s were also the transition from the “paleotechnical” era symbolized by coal-powered railways to a “neotechnical” era dominated by fuel-powered automobiles and airplanes [MEI 04]. In terms of geography, the 20th century was a time for urbanization. The majority of the population lived in cities by the time of the 1920 census and the newly settled Great Plains were already

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1. According to the US Census Bureau official figures, the 1880 census counted 66,000 survivors of more than 500 American-Indian nations living in miserable conditions on Indian “reservations”.\(^1\)
beginning to depopulate. In 1960, metropolitan areas were drawn statistically in an effort to understand the new realities of suburban sprawl. Population growth remained strong. The United States went from a population of 100 million to 200 million between 1915 and 1968. It then went from 200 to 300 million between 1968 and 2007. But over such a long period it could not grow seamlessly. Recent decades – since about 1969 – marked by the unprecedented growth of the information technology (IT) and telecommunications industries, differ significantly from the post-war period.

While the United States may be living proof of the power of technology, which enabled modern mankind to disproportionately increase its control over nature, it is impossible to entirely ignore the environment in which mankind lives. This is why human geography, which studies the territory, is useful for defining the foundations that allow humans to organize their lives and build their societies, economies, and governments. To understand the settlement of the United States is to understand the representations of those people who, for over a century, have projected their hegemonic power onto countries the world over – an act which now carries heavy responsibilities given the increasing dangers linked to global warming. Faced today with the threat of a “man-made” apocalypse, all humans are forced to alter their relationship with territory and environment, and rebuild their societies with respect for sustainable development. Even more so than everyone else, Americans must now radically transform their relationship with the land on which they live. This book explores the fundamental elements of the relationship Americans have today with their territory in an effort to understand the nature of changes necessary at the dawn of the third millennium.

How this book is organized

This book deals with human geography, but not without consideration for the study of American society and the environment in which Americans live. Scales are therefore treated in a flexible way, switching rapidly from overall views to local or regional views in an attempt to understand the complex interactions between society and the environment. Based on a tradition founded by French geographer Vidal de la Blache, we begin with a map showing population densities which we explore asking ourselves, “Why are there so many people in this area?” Each chapter takes a step towards finding a logical answer to this important question.

The first chapter is devoted to the physiography of the United States. Determinism remains an important factor in the geography of existing settlements, especially when we consider the impact of natural hazards. Based on a map of population distribution, we will explore in turn the influence of the environment
through the study of topography, geology, and the climates and ecosystems in the US.

The second chapter studies how Americans have developed and used their territory and its natural resources, and offers an explanation of how their awareness of the value of this natural heritage grew, as well as how they envisage its preservation. In this context, we will explore, in particular, agriculture, forestry, mining, and fossil fuel resources, such as coal, oil and natural gas, the use of which we now know is responsible for global warming. Finally, the last section of this chapter is devoted to federal land and protected areas in the United States.

In Chapter 3 we consider the environment in which Americans live, and focus on population growth, fertility, life expectancy, aging and immigration in the United States.

An important part of the work of the US Census is the classification of the population by race and community. The fourth chapter is devoted to the study of these issues, which have divided American society since its inception. We give special attention to the study of the most delicate issues, starting with the “Native American question” followed by the “Black question”, which is today the most heated political debate in the country. This enables us to better understand the contribution of recent immigration to the diversity of this “multicultural” nation; we will study two population groups of uncertain definitions, “Hispanics” and “Asians”.

The fifth chapter focuses on regional settlement of the American territory. It is put into perspective using three carefully selected observation points: 1930, 1970, and 2005. Each is analyzed according to geography and population dynamics. This chapter looks at the beginning of the urbanization of the United States and presents the territory’s urban framework.

Chapter 6 explores the dynamics of regional settlements highlighted in the previous chapter. We begin with economic factors, analyzed through data on employment, and with special attention given to industrial evolution. We then look at internal migration, since the American population is very mobile and internal migration is constantly changing population maps. Special attention is given to the migration of retirees.

Chapter 7 moves to a different scale to further complete the study of the way in which population dynamics affect the territory. We take the opportunity to look at the specific way urbanization occurs in this country. American cities tend to be diluted by the widespread urbanization of metropolitan areas. This phenomenon is not reserved strictly to big cities, as is demonstrated through a brief case study.
Case studies also form the backbone of Chapter 8, which seeks to explain urbanization in the United States through two main factors: segregation and the fragmented governance of metropolitan areas. This chapter focuses on specific examples in four selected metropolitan areas: Atlanta, Detroit, Houston and Portland.

The ninth chapter is devoted to the study of New Orleans and the natural disaster, Hurricane Katrina, which struck in 2005. In order to understand what is happening in southeastern Louisiana, one must understand the factors presented in all other chapters. The case of New Orleans is also an opportunity to measure the extent of environmental challenges in the United States. This natural disaster may mark a turning point in the history of the relationship which this country has with the environment, and we hope to present the reader with an approach by which geography can contribute to the debate on the concept of sustainable development, which is too often clichéd.

Methods, tools, and acknowledgements

This book primarily addresses population, and census data is its primary source of information. Such a work would not have been possible without the input of key data on the environment and economy of the US. The following major federal agencies have, over several years, provided a wealth of valuable information, reference maps, and downloadable databases free of charge via the Internet: the US Census Bureau, the United States Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the Bureau of Labor Statistics, and the United States Department of Agriculture (USDA). The author warmly acknowledges these initiatives, since without the visionary policy launched by President Clinton, geographic information systems (GIS), the basis for this book, would never have come into existence.

The author is also especially grateful to the NOAA and the US Department of Commerce project study managers who joined efforts for the STICS (Spatial Trends in Coastal Socioeconomics) program to compile, harmonize, and document databases, which categorized neighborhoods during the period 1970 to 2000. This work enabled us to provide the necessary chronological depth, too often absent from GIS, to understand the evolution of territories over the long term.

Indeed, this book is, first, the result of the creation of geographic information systems. A GIS is an organized set of geo-referenced, graphic, and appointed databases, which constitutes a model of geographical reality. A GIS is a powerful tool which allows managers to reconcile a variety of data using spatial factors as
common denominators. It can work at different levels. A GIS consists of five essential components:

- hardware;
- specialized software\(^2\);
- databases;
- classification and documentation of this data;
- an expert capable of handling and analyzing the data.

The power of GIS is such that it enabled us to work on the scale of a continent, based on data pertaining to levels as detailed as block groups which constitute the smallest unit of census data freely distributed. It enabled us to work at different levels and to move from an analysis of the entire continent to a study of the neighborhoods of a single city.

The power of GIS can only be successfully utilized, however, using methods that allow the manipulation of massive tables of locally geo-referenced data as well as their statistical analysis and mapping within all of the studied territory, particularly in the case of a territory as large as the United States. This is where spatial statistics, the subject of our previous work [ZAN 05], comes in. This branch of mathematics applied to spatial data is used here for the purpose of mapping with “smoothing” methods which use qualitative data. “Smoothing” makes it possible to provide a cartographic generalization and a reliable map despite the multitude and variety of statistical units used by databases. We therefore have readable maps for the entire US territory, based on significant data collected for each county, which reduce the loss of detail caused by the aggregation of data broken down by state (51, including the District of Columbia). The implementation of this map “smoothing” is done using free software CrimeStat v.3.1, whose existence we owe to Ned Levine\(^3\) and which was published with the support of the US National Department of Justice. For this we are most sincerely grateful.

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2. We worked with licensed software MapInfo v.8.0\(^\circ\) and Vertical Mapper v.3.1\(^\circ\) acquired by the Geography Laboratory of the University of Orléans, the CEDETE.

Figure 1. The US territory
Chapter 1

The American Territory

1.1. A continent-nation with a dispersed population

The United States of America consists of a federation of 50 states located on the North American continent and in the Pacific Ocean. The country’s surface area spans 9,161,924 km², and represents 6.1% of the total of Œkoumene.¹ It is the fourth largest country in the world after Russia, Canada, and China (see Figure 0.1).

Although it has the third largest population in the world after India and China, its population only represents 4.5% of the world’s total population.

With nearly 32.4 inhabitants/km², the US has a lower population density than the world average of 50 inhabitants/km² according to the latest population estimates of the United Nations. The US territory is composed of three distinct geographical areas. The vast boreal region located in the northwest became the 49th state of the Union in 1959. The state of Alaska spans 1,481,347 km², but its estimated population of 663,661 in 2005 gives it an average density of only 0.45 inhabitants/km².

After long benefiting from the status of “colony”, the Pacific archipelago of the Hawaiian Islands had a population of 1,275,194 inhabitants in 2005, a surface area of 16,635 km², and an average population density of about 76.7 inhabitants/km². Hawaii became the 50th state of the Union in 1959.

¹ Literally, the “inhabited world”, referring to all emerged land except for Antarctica.
Most geographical studies of the United States focus on the territory of the 48 conterminous states, including the District of Columbia, and the two remaining states are treated separately. The surface area of the conterminous states is 7,663,942 km². With an estimated population of 294,471,549 inhabitants in 2005, the average density (38.4 inhabitants/km²) remains below the world average.

The population is very unevenly distributed (see Figure 1.1). The permanent imbalance between East and West can first be explained by the history of the country, but many other elements are explained as a matter of location and environment.

Geographical determinism is particularly important for the two peripheral states in the Pacific region.

Alaska is largely unoccupied, due both to its location and to its environment. It is a remote, peripheral territory, located in the extreme northwest of the continent on the opposite side of the territory from the area first settled by Europeans. It is also a boreal region with a very hostile climate; it is mostly barren, very mountainous (Mount McKinley, 6,194 m), volcanic, and highly prone to seismic activity. Access is very difficult; only the southern coast is free of ice all year round. As the “last frontier” for American pioneers, Alaska is nonetheless a highly coveted territory due to its wealth of natural resources, particularly hydrocarbons.

The Hawaiian Islands benefit from a tropical climate with relatively favorable trade winds since they are outside the path of major hurricanes in the Pacific. They are, however, a mountainous region of volcanic origin with highly active, though not eruptive, volcanoes. Populated areas are therefore concentrated along the coast. Freshwater resources in volcanic regions are typically scarce, particularly on the leeward coast.

It is also an ultra-peripheral region which lived in total isolation until the 19th century. Its intermediary position between America and Asia earned strategic interest during the imperial period of 1895–1945, which led to a mixed population of indigenous Polynesians, American settlers of European origin, and immigrants from Asia, particularly Japan.

With the arrival of long-distance aviation, its strategic importance declined, but the archipelago developed a solid tourism-based economy to the point where the Oahu island coast is, in fact, densely urbanized today. Today, over 72% of the archipelago’s population resides in the metropolitan area of Honolulu.
Geographical determinism also influences the 48 conterminous states. It is easier to understand the geography of the population through a map of counties as opposed to a map of states, but not without first adjusting values to smooth the effects of variability, improve the map’s general readability, and compensate for the fact that the very large counties of the West are much more visible than those of the East.

As with most maps that show detailed socioeconomic data, the following map was realized using this smoothing process [ZAN 05].

*Figure 1.1. Population density 2005*

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2. The county is the basic territorial division of the American territory. There were 3,141 counties in 2005 (see Chapter 8).
From the Atlantic to the Pacific, the country has very simple, yet strikingly vast, structural areas. The territory forms a rectangular block of 7.7 million km² which lies between 67°W and 125°W longitude and spans 4 time zones. New York is barely closer to San Francisco than it is to Ireland. From east to west, the 45th parallel crosses the country over nearly 4,500 km. In latitude, the country stretches from the 24th parallel North at the tip of Florida, to just a stone’s throw from the 49th parallel North, which was adopted under a treaty with England in 1846 as the official border between the United States and Canada, west of the Mississippi all the way to the Pacific coast. From north to south the 100th meridian crosses the country for more than 2,500 km between Mexico and Canada. With its continental mass and its position in latitude, the United States territory is quite similar to the territory of China, with one major difference: it shares borders with the ocean on three sides along nearly 40,000 km of its coastline. This long coastal played a considerable role in the settlement of the United States.

The Atlantic Ocean coast is the longest, with nearly 23,500 km, and follows a very jagged coastline from the tip of Florida to Maine, and 2,600 km in a straight line from Key West to the Canadian border. The Atlantic Ocean extends south and merges with the vast Gulf of Mexico. Less uneven than the Atlantic coast, the Gulf Coast is more than 8,300 km in length. Over 18,100 km long, the Pacific coastline stretches over 1,900 km in a straight line between San Diego and Vancouver. In addition to these three ocean fronts, the five freshwater Great Lakes at the Canadian border form a veritable inland sea stretching over nearly 250,000 km², and greatly influencing the climate of the Northeast. The majority of the US population now resides in a “coastal region”, defined by the National Oceanic and Atmospheric Administration (NOAA) as a place usually located within 100 km of one of the three ocean fronts or the Great Lakes (see Figure 1.2). In 2005, the average population density of these coastal regions reached 118 inhabitants/km², compared to only 22 inhabitants/km² for the “inland” regions in the conterminous 48 states. Although

![Figure 1.2. Population share living within 100 km of an ocean or the Great Lakes](image-url)
not a new phenomenon, the importance of “coastal” regions has increased since 1930. While total population grew by 140% between 1930 and 2005, that of coastal regions increased by 176%, and that of inland areas by 114%. If we exclude the Great Lakes and only consider counties located along the coasts of the Atlantic, Gulf of Mexico or Pacific, the coastal population, as defined in its most traditional sense, increased from 24 million in 1930 to nearly 84.5 million in 2005, representing an increase of 250%, and a density of 165 inhabitants/km².

The first seven chapters of this book are devoted to identifying the factors which explain today’s map of the population, and to exploring the diversity of these factors.

1.2. Major geographical areas

![Topography of the United States of America](image)

Figure 1.3. *Topography of the United States of America*

Land topography has as much influence on settlement as do climate and the presence of waterways. Topography influenced settlement patterns from the very beginnings of westward expansion, as well as the development of regions by
populations of European origin. Site characteristics defined the location of major cities founded in the eighteenth and nineteenth centuries, less because of obstacles brought about by nature, and more because of the natural influence that the environment had on transportation conditions at a time when horse-drawn carts and inland waterways still represented the main means of transportation, and the first railways were struggling to climb steep slopes. The urban framework developed naturally, starting on the Atlantic coast and gradually expanding westward, based on opportunities determined in part by topography. Rural populations were more influenced by the obstacles of nature, mostly climate-based, but they were also strongly influenced by topography and altitude.

A land relief map shows three main regions running north to south (see Figure 1.3). To the east, the medium-size Appalachian Mountains reach 2,060 meters. They separate the coastal plains of the Atlantic, which are narrow in the north and wider in the south and end with the very flat peninsula of Florida, from the central Great Plains. Even though the Appalachians hardly represent a real obstacle to settlement, they played a role in the layout of transportation routes which prevailed before 1850. The development of some transportation and urbanization networks was influenced by the ease of movement offered by valleys. The development of New York, and its dominance over its rivals, Boston, Philadelphia and Baltimore, at a time when coastal cities (gateways to Europe) were supplying westbound settlers and therefore driving the country’s expansion was greatly assisted by its easy access to the Hudson-Mohawk passage. These same transportation factors facilitated to a lesser extent the development of the city of Pittsburgh, Pennsylvania, situated at the head of the Ohio River Valley.

The Great Plains form the largest geographical natural region on the continent, and extending into Canada. In the US portion they form a flat basin which is drained by the third largest river basin in the world, that of the Mississippi River and its major tributaries. From the source of the Missouri River all the way to the Mississippi River delta, the Missouri-Mississippi river system extends to 5,934 km. The drainage basin covers 3.22 million km². The deep gutter that follows along the 2,000 km of the Mississippi’s lower course corresponds with a tectonic trench of high seismic risk (New Madrid fault). Towards the south, the Lowlands cover the entire coast of the Gulf of Mexico, with its uneven shores, especially in the vast delta of the Mississippi. In the north, the dividing line between the Mississippi and St Lawrence River basins does not show any significant land relief, but it represents the limits of the terminal moraine from the last Quaternary glaciation.
It was only in the vast plains of the Middle West that the US was really able to put into practice the geometric survey of the territory based on the parallels and meridians of Thomas Jefferson’s concept of *Township.* The geometric grid, which characterizes urban and rural areas, and was initiated in Philadelphia in the eighteenth century, is a hallmark of the American landscape. In these immense flat areas, it is the hydrographic system that determines the points of contact between land and river transport, or the crossing points of major rivers where main cities were built. The success of Chicago is therefore linked to its location at the southern tip of Lake Michigan.

The eastern part of the territory is populated in a continuous and relatively dense manner. This is first explained by the precedence of its colonization, but also by the absence of any major natural obstacles.

West of the Mississippi, the environment becomes less friendly, especially starting at the 100th meridian. The Great Plains rise gradually until they form the foothills of the Rocky Mountains. The city of Denver is more than 1,600 meters above sea level. These high plains differ from the lower plains of the Middle West mostly by their semi-arid climate. The plains end abruptly at the barrier of the Rocky Mountains. The Rocky Mountains are actually a series of separate mountain ranges whose altitude do not exceed 4,400 meters. They mark the beginning of the Pacific West region, whose topography is particularly rugged all the way to the coast.

The irregular geology of fault blocks explains the juxtaposition of mountain chains and basins, some of which form high plateaus and others very deep troughs. This is why, for instance, the Great Salt Lake of Utah is situated at an altitude of 1,280 meters.

The highest point of the conterminous United States is Mount Whitney (4,417 m) located in the Sierra Nevada in southern California, just 150 km away from the lowest point located in Death Valley at 86m below sea level.

This irregular topography considerably impeded the progress of settlers in the 19th century. High altitudes combined with the land’s general aridity explain the very sparse population of the plateaus and basins of the inland regions of the West. Apart from a few urban oases, the population of the West is concentrated along the shores of the Pacific Ocean.

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3. Thomas Jefferson (1743–1826) is considered to be the father of the Declaration of Independence of 1776. He was president of the United States from 1801 to 1809 and pioneer of the country’s expansion (in particular, the Louisiana Purchase from France, in 1803).
Of all the natural hazards found in the West, frequent volcanic and seismic activity is among the most well known (see Figure 1.4). The city of San Francisco was destroyed by the great earthquake of 1906. California’s big cities are located along the San Andreas Fault line, a major transform fault whose massive strike will eventually result in The Big One, a major earthquake which is bound to happen in the future. Major earthquakes have recently shaken Los Angeles (Loma Prieta in 1989) and San Francisco (Northridge 1994).

The risk of volcanic activity is also high. There are numerous active volcanoes in coastal states, especially in the Northwest. A major eruption occurred in 1980 at Mount St Helens in Oregon, 120 km northwest of the city of Portland and 170 km...
south of Seattle. Mount St Helens experienced a Plinian eruption that liberated 1 km³ of ignimbrites and devastated a very large, although practically uninhabited area. The United States Geological Survey (USGS) lists 16 potentially active volcanoes and shows that certain Quaternary eruptions were more violent than that of Mount St Helens. While they may be less active than Indonesian volcanoes, the mountains of the Pacific Northwest are unstable. Certain geological studies indicate that the region of Yellowstone National Park is a potential “super-volcano” whose mega eruption once covered half of the United States in ash about 700 million years ago. This risk remains nonetheless hypothetical. Isolation and the harshness of winter in the highlands of Yellowstone Park, situated between 1,600 and 3,200 m of altitude, is a much more significant obstacle to settlement in the region. In the West, as in the rest of the country, climatic factors have more influence than topography and geology in explaining the settlement of the United States.

1.3. Unfavorable climatic factors

Despite the latitude of the country, the prevailing climates in the United States can hardly be characterized as “temperate” in the sense of being moderate or restrained. They are temperate since, for most of the territory, each year is marked by alternating cold and hot seasons. Most of the US experiences a continental climate, typified by extreme seasonal contrasts. The mountain barriers that follow the Pacific coast reduce the influence of the ocean to a narrow coastal area.

Meanwhile, the corridor of the Great Plains, stretching from the Gulf of Mexico to the Arctic Ocean, reinforces the continental climate in central and eastern regions, which is dominated by the clash of polar and tropical air masses, which results in frequent tornadoes.

The western part of the continent has an arid climate, while the Atlantic coast, and the shores of the Gulf of Mexico are very humid, and subject to an average of two hurricanes per year. Compared with Europe, winters are harsh despite the relatively low latitude. The North gets a great deal of snow and freezing temperatures, while the areas sheltered from frost are limited to a southern strip. Summers are very hot except in the Pacific Northwest and in some Northeastern counties located near Canada.

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4. Plinian eruptions are characterized by their explosive nature resulting in the formation of pyroclastic flows which sweep down the flanks of the volcano and cause the most loss of life. Another very dangerous phenomenon is “lahars”, violent mudflows caused by the sudden melting of snow which spread over valleys with great energy and speed.
Rainfall influences vegetation and agricultural potential (see Figure 1.5). Areas situated east of the 100th meridian receive just enough water to support dryland farming. The situation is different, however, west of the 100th meridian, with the exception of the Pacific Northwest region where ocean rains and rocky terrains bring above average precipitation rates.

Some mountains in the West are natural water towers as a result of heavy snows, but the aridity is generally such that irrigation is required practice south of the 40th parallel, and also in common used farther north.

The aridity increases moving south, where real deserts can be found. For example, average rainfall is less than 80 mm per year in Yuma, Arizona. The management of water resources is a major challenge for the American West.