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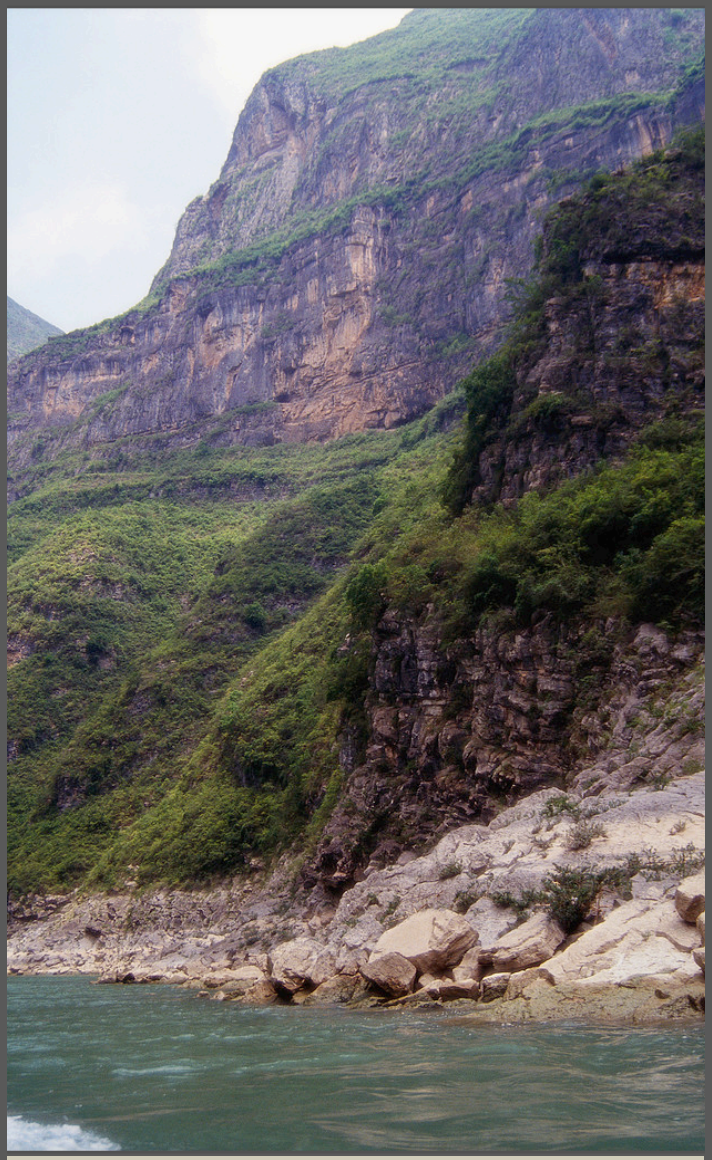


REGIONAL REPORT:

GREAT PLAINS

EXECUTIVE SUMMARY

*The **Great Plains Region** consists of Montana, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas.*

The Great Plains is a broad expanse of relatively flat grassland, bordered on the northwest by the Rocky Mountains. The region has a distinct north to south temperature gradient, resulting in disparate extreme weather events across the region. In the north, Montana, Wyoming, and the Dakotas have experienced record rainfalls and snowmelt since 2011, causing rivers to overflow, ultimately costing $2 billion in North Dakota alone. Conversely, the south has experienced severe droughts and heat waves, with Texas and Oklahoma facing sweltering temperatures with more than 100 days over 100ºF. These high temperatures further stress water resources in the south, endangering access to clean water for the rapidly growing urban populations in Texas and costing $10 billion in agricultural losses.

Demographic shifts in population size, diversity, and density are complex in the Great Plains, and interact with energy extraction industries to shape land use in the region. Northern populations have shrunk as a result of movement of younger generations from rural to urban areas in search of economic opportunities, leaving aging rural populations with few people of working age. On the other hand, the boom in oil and gas production with the advent of extensive hydraulic fracturing or “fracking” in the Eagle Ford, Barnett and Bakken shales has drawn young workers from across the country. Such rapid growth in a semiarid region that is becoming drier is not a good combination—some towns have had to truck water in from regional reservoirs and rivers.

The Great Plains are being altered by changes in demography, intensive energy extraction activities, and use of public lands for grazing and ranching. Manmade boundaries threaten to trap wildlife in islands of habitat, preventing them from migrating in concert with changing temperatures. For example, bison populations that have survived for thousands of years migrated in response to climate change in the past, but are now constrained by highways, buildings, and degraded habitat, forcing them to adapt in place to new environmental conditions. The biodiversity of this region provides an important source of economic opportunity for rural communities, particularly through tourism in Yellowstone, Grand Teton, and Glacier National Parks. For example, tourism contributed $773.3 million to Wyoming in 2014 alone.

Regional Overview

GEOLOGY & GEOGRAPHY

The geologic history of the Great Plains, in its essence, is a story of seas. Starting in the Cretaceous Period, from 145 million years ago to 65 million years ago, the Western Interior Seaway covered the entire midwest region of the present-day United States (Trimble, 1980). This shallow, inland sea slowly receded during the Late Cretaceous and the Paleocene (approximately 65-55 million years ago), leaving behind thick marine deposits on the relatively flat seafloor (Fig. 1). As the sea receded, the rivers and streams that were formed eventually carved out the regions of the land and distributed this deposition, funneling the water into what we now know as the Gulf of Mexico.

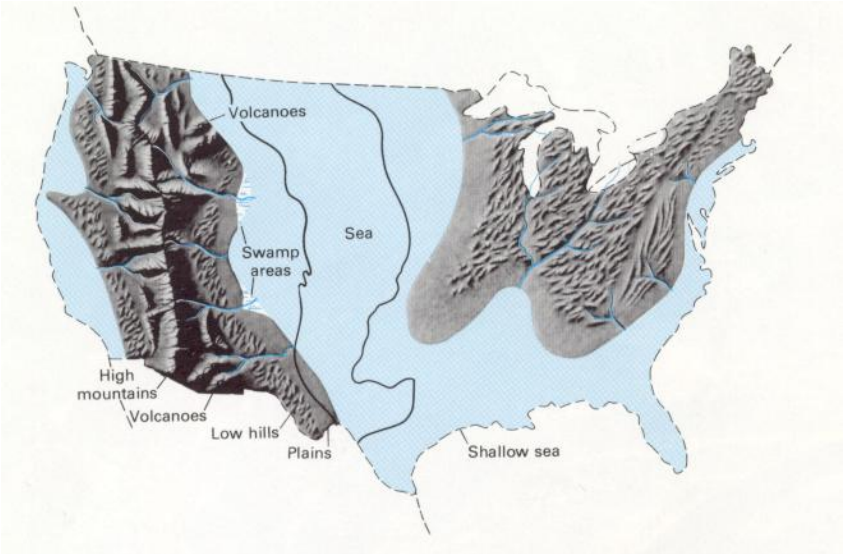


Figure 1: Depiction of Geologic Formations in the Cretaceous Period (~145-65 mya) (Trimble, 1980)

The movement of the earth and as well as the injection of hot molten rock at the surface caused a slow uplift in the land that displaced the Western Interior Seaway. Organic-rich mud settled to the bottom of the seafloor during this process, creating the foundation for the hydrocarbon source rocks located beneath the Great Plains region (Trimble, 1980). The deep burial of mud within the crust of the earth helped to transform the mud into shales with potent oil- and gas-generating potential. Oil was released from these source rocks at just the right temperature and pressure. The Southern Great Plains, now the oil-rich states of Oklahoma and Texas, were especially conducive to the accretion of hydrocarbons

because the settling of the Seaway toward the present-day Gulf of Mexico left much of mud deposits on this land (Wishart).

The organic-rich mud that settled to the seafloor additionally created an expansive and relatively flat region. The immense agricultural production of the Great Plains in the present is reflective of this sediment deposition as well as the easy-growing geographic conditions that represent an ancient seafloor. Furthermore, the Great Plains region generates more than half the world's wheat exports, suggesting the historical contingency between the fertile soil that was left behind millions of years ago and the productive agricultural region of today (Wishart).

Though the Great Plains are commonly known to be a stretch of flat land, the region contains a considerable amount of geographic diversity. Starting in the western United States bordering the Rocky Mountain range, the Great Plains region gently slopes downward from an average elevation of 6,000 feet to an average elevation of 1,500 feet, and eventually to 0 feet at the edge of the Gulf of Mexico (Fig. 2). Forested mountains cover western Montana, Wyoming, and South Dakota, extensive rangelands occur across the Plains, marshes persist along Texas' Gulf Coast, and desert landscapes provide another distinct setting in western Texas (Shafer et al., 2014). Overall, the Great Plains are dominated by short grass prairie in the west from the high elevation and dry climate and long grass prairie in the east from the lower elevation, wetter climate.

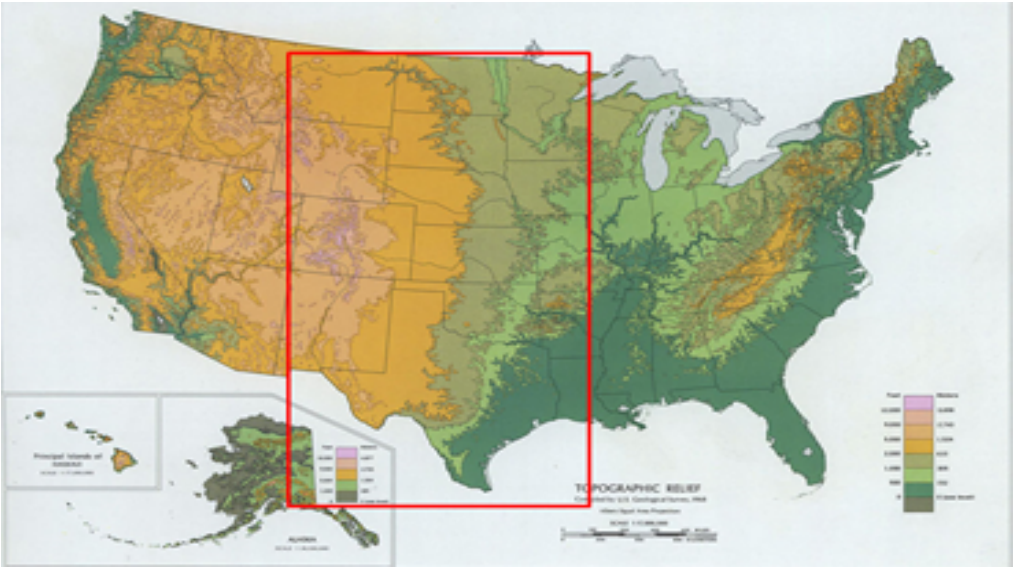


Figure 2: Topography of the Great Plains
High elevation (yellow) compared to low elevation (green)
(U.S. Geological Survey, 1968)

CLIMATE

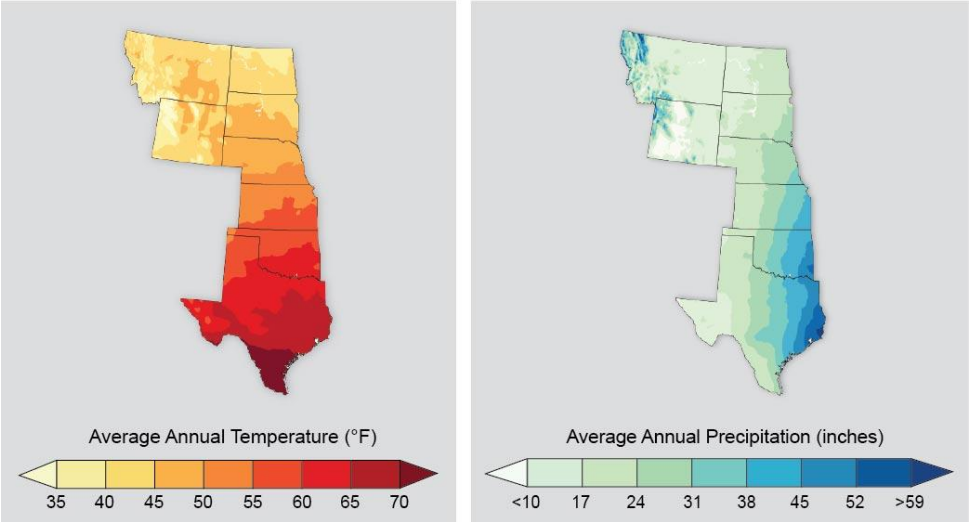


Figure 3: Temperature and Precipitation Distribution in the Great Plains (Shafer et al., 2014)

The Great Plains cover much of mid-America, and because of this, a variety of climates persist in the region. Much of the rainfall occurs in heavy precipitation through the summer months, and the average rainfall across the Great Plains is less than 30 inches. As you move from west to east, the climate gets progressively wetter (Fig. 3). This stems from the Rocky Mountain range on the western portion of the region, which becomes heavily precipitated and contributes to a rain shadow effect on the states that border the Rocky Mountains (Wishart). Certain parts of eastern Colorado, for example, are just outside of the mountain range and present extremely arid, desert-like conditions.

The region has a distinct north to south gradient in terms of temperature, with colder temperatures in the north and hotter temperatures in the south (Fig. 3). Wind speeds are often very high, as grasslands are the least protective biome from the wind (Wishart). This leads to terrible dust storms, especially in times of drought, and wind from thunderstorms occurring in the late spring and summer can lead to intense tornadoes. Significant weather challenges include anything from winter storms, extreme heat and cold, severe thunderstorms and tornadoes, drought, and floods.

ECOLOGY/BIOMES

The Great Plains are dominated by grassland and prairie. Most of the animals and vegetation reflect this habitat, but the variety of geographic differences in the region allow for additional species (Wishart). In higher elevation areas like Yellowstone National Park, for example, large predatory mammals such as bears and wolves are apparent. Across the vast plains, immense grazers such as bison and pronghorn occupy the territory. The plains also see their fair share of small animals like prairie dogs, coyotes, and rattlesnakes, and the insect population is dominated by locusts and chiggers.

Agriculture is extremely prevalent in the region because of the fertile soil from historical sedimentation. However, clearing the land for new crops allows for certain species to invade the area and thrive in the rich soil. Farmers are noticing the influence of invasive cactus species taking over farmland and inhibiting the growth of crops (Wishart).

ECONOMY

Economy in the Great Plains is driven by three main industries - agriculture, energy, and tourism. Home to America's Wheat Belt, the region is often illustrated as "amber waves of grain." Wheat has been grown in the Great Plains since 1874 and is now the dominant and quintessential crop of the region. Most of the wheat cultivated in the Great Plains is consumed domestically and used for bread and pasta products. Due to the climate gradient in the region, wheat is grown at different times in different portions of the Great Plains with winter wheat grown in the south and spring wheat in the north. Wheat requires little water to produce and is thus an economical crop for a region susceptible to drought.

In addition to wheat, other key crops include cattle, cotton, soy, and corn. Texas is the largest producer of cotton and cattle in the nation (Texas Department of Agriculture 2015). Soy is a relatively recent crop to the region, but has rapidly grown in acreage and yield in the last sixty years (Wishart) and is now the second most planted field crop in the United States (EPA 2013). A portion of the Corn Belt extends into the Great Plains and the majority of the corn cultivated is used for feed grain for cattle and poultry production.

Energy production in the Great Plains rank among the top in the nation. According to the Energy Information Administration, Texas is the top crude oil producer in the nation, contributing 37% of national production, and ranks among the top producers in the world. North Dakota ranks second in the nation and Oklahoma ranks fifth, contributing 13% and 4%

to national production. Wyoming is the nation's top coal producer, contributing 39% of national coal production (Energy Information Administration). The Great Plains are also among the top contributors to national wind energy production - with Texas, Kansas, and Oklahoma ranking first, third, and fourth in the nation (Energy Information Administration). Hydraulic fracturing of shale for natural gas is also growing in the region. With shale plays found in Texas, Oklahoma, Kansas, Montana, Wyoming, and North Dakota (Energy Information Administration), hydraulic fracturing is becoming an industry game-changer for the region.

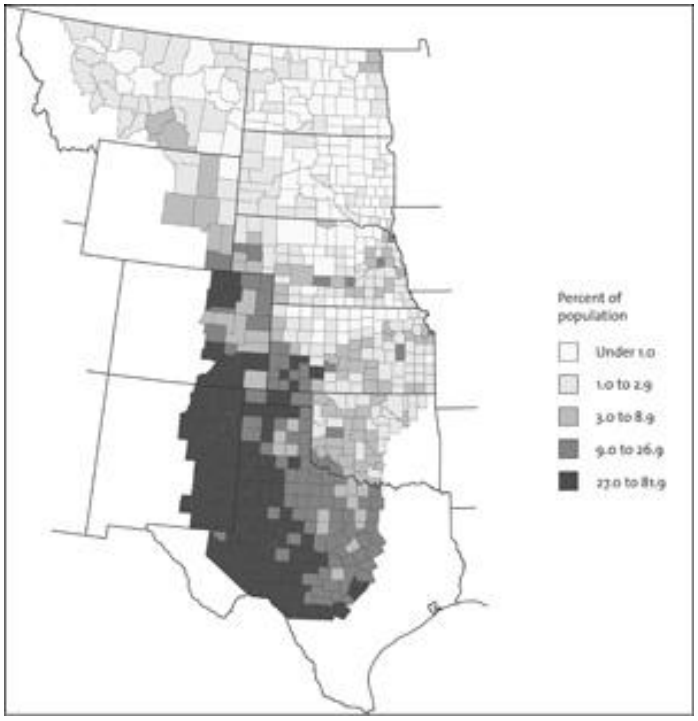
Tourism is the fastest growing industry in Wyoming and Montana. Yellowstone, Grand Teton, and Glacier National Parks attract many interested in outdoor recreation and scenic landscapes to the region. Yellowstone, for example, is home to abundant wildlife, over 300 active geysers, and more than 10,000 hydrothermal features - hosting more than 3 million visits annually (National Park Service). These visits stimulate the local economy. In 2014 alone, visitors spent $421 million in communities near Yellowstone (Missoulian). In 2014 overall, national park visitors spent $432.1 million in Montana and $773.3 million in Wyoming (Missoulian).

DEMOGRAPHICS

Demography of the Great Plains is vast and varied. Population diversity, for example, increases with decreasing latitude. The Northern Great Plains is predominantly Caucasian, with 81-87% of state populations in Montana, Wyoming, North Dakota, South Dakota, and Nebraska identifying as White alone (not Hispanic or Latino) in the U.S. Census Bureau 2013 statistics. The Southern Great Plains is much less homogenous and more racially diverse than its northern counterpart. Kansas reports a population of 77% White alone (not Hispanic or Latino) with large Hispanic and Black/African American populations (U.S. Census Bureau). Oklahoma reports a population of 67.5% White alone (not Hispanic or Latino) with large American Indian, Hispanic, and Black/African American populations (U.S. Census Bureau). In Texas, those identifying as White alone (not Hispanic or Latino) account for 44.0% of the population while those identifying as Hispanic/Latino and Black/African American represent 38.4% and 12.4% of the population, respectively (U.S. Census Bureau).

Population size and density also increase with decreasing latitude. In the Northern Great Plains, populations range from 580,000 people in Wyoming to approximately 1 million in Montana (U.S. Census Bureau). According to estimates from the 2010 U.S. Census Bureau Report, population density is also low in the region. Wyoming has the lowest population density in the nation, ranking 50th with 5.8 individuals / sq. mile. South Dakota has the highest population density in the Northern Great Plains with 10.7 individuals/sq. mile. In the southern portion of the Great Plains, populations range from 2-4 million in Nebraska, Oklahoma, and Kansas (U.S. Census Bureau). Texas has the largest population in the Great Plains and is the second most populous state in the nation with an estimated 27 million people in 2014 (U.S. Census Bureau).

In general, states have been experiencing out migration from rural areas to urban areas as residents move towards growing economies. As a result, rural populations in the Great Plains are aging and have dwindling populations of youth. This excludes the Bakken, a region of the Great Plains predominantly centered in North Dakota, where hydraulic fracturing is increasing rural populations at notable rates and is the fastest growing region in the nation ("The Bismarck Tribune" 2015). Given the economic prosperity of the region, job growth continues to increase and as a result, the Great Plains boasts the lowest unemployment rates in the nation (Kotkin 2012). However, rural towns and Native American reservations continue to suffer from poverty and low wages - problems that are only exacerbated with out-migration to urban areas.



Hispanic population in the Great Plains, by county, in 2000 (Wishart)

The Great Plains region is home to 5 out of the top 10 most populous reservations in the United States. The Osage Reservation in Oklahoma, the Flathead Reservation in Montana, and the Pine Ridge Indian Reservation located in South Dakota and Nebraska rank second, third, and fourth in population size respectively (U.S. Census Bureau). Additionally, Oklahoma has the highest concentration of individuals identifying as American Indian / Alaska Native in the nation (U.S. Census Bureau).

Unfortunately, the reservations on which these populations live have subpar living conditions many have described as comparable to that of the developing world. Reservations are plagued with high rates of poverty, substance abuse, and unemployment as well as low rates of literacy and life expectancy. The Pine Ridge Indian Reservation, home to the Oglala Sioux Tribe in South Dakota, is one of the poorest regions in the United States. With a population of 35,000, 20% are unemployed and almost half live below the poverty line (U.S. Department of Housing and Urban Development). President Obama has recently designated the Pine Ridge Indian Reservation as a Promise Zone community, aiming to address and improve systemic poverty, economic and educational opportunity, and housing and infrastructure for the tribal community.

Jay Mallin / Grist

Indian reservations in the Great Plains are also marginalized by the growing hydraulic fracturing industry in the region, generating many environmental justice issues. The Keystone XL Pipeline extension proposal, for example, is being actively protested by American Indians throughout the Great Plains. With concerns for water contamination due to brine and oil spills, loss of historical lands to pipeline development, and public safety given rapid population growth, American Indians in the region are strongly opposed to the plan.

Impacts of Global Change: The Science

CLIMATE DISRUPTION

Climate disruption manifests in a variety of forms throughout the region, ranging from the overt impacts of increasing global temperatures and greater frequency of heat waves to more subtle effects such as the increased risk and frequency of severe weather events like droughts, severe storms, heat waves, etc.—the occurrence of the manic rainfall that inundated Texas and Oklahoma a very real implication of this increased risk. In general, the likelihood of extreme weather events (e.g. Texas summer of 2011) has increased due to global warming while some extreme cold weather events (e.g. in the UK) have become less likely.

On a smaller scale, based on global climate models and a high-resolution regional climate model, there will be a net increase in the number of days in which severe thunderstorm environmental conditions (NDSEV) occur during the late 21st century. Attributed primarily to increases in atmospheric water vapor within the planetary boundary layer, the largest increases in NDSEV are shown during the summer season proximate to the Gulf of Mexico and Atlantic coastal regions (Trapp, et al., 2007). These changes create tangible risk, materializing as the unprecedented 2011 drought in Texas, for example. This severe event lead to widespread hardship for ranchers and farmers, tree mortality in central and eastern Texas, and record-setting wildfires that destroyed tens of thousands of buildings (Nielsen-Gammon, 2012).

(Source: National Climate Assessment)

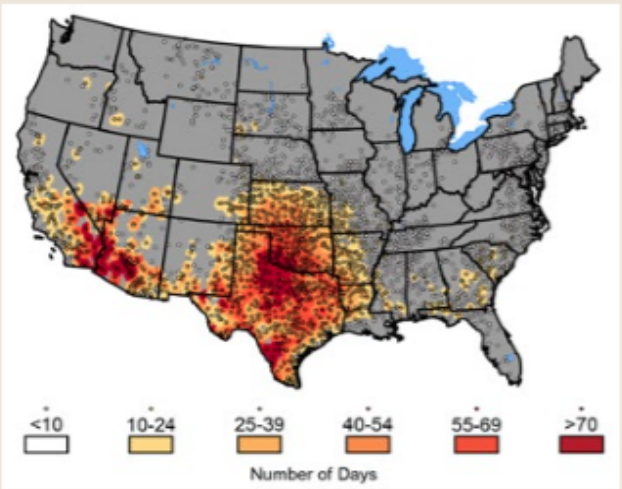


Figure 19.10. In 2011, cities including Houston, Dallas, Austin, Oklahoma City, and Wichita, among others, all set records for the highest number of days recording temperatures of 100°F or higher in those cities' recorded history. The black circles denote the location of observing stations recording 100°F days. (Figure source: NOAA NCDC 2012[3]).

Another facet of global change through climate disruption is its impact on ecosystems. Ecosystem harm may seem like a local issue, disparate from systemic climate change, but in reality, these harms not only are brought about by climate disruption but also impel much systemic changes. For example, ecosystem processes of the Great Plains' wetlands are at risk of having nutrient cycling and productivity disrupted by Climate Change (Covich, et al., 1997). Another example of climate change's impact on ecosystems is the loss of waterfowl due to loss of habitat by heating up

(Source: National Climate Assessment)

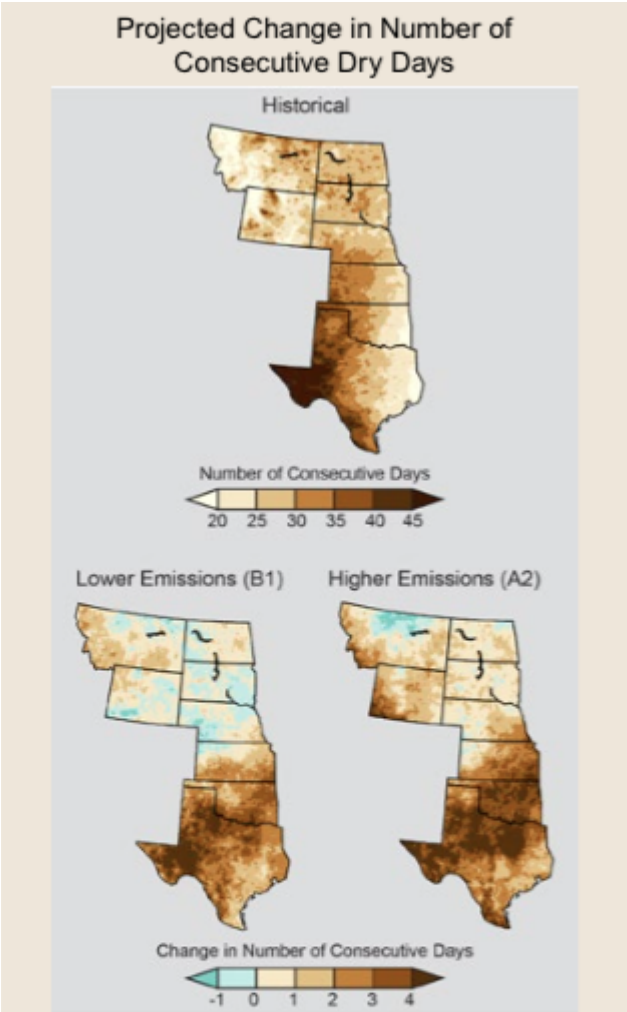


Figure 19.5. Current regional trends of a drier south and a wetter north are projected to become more pronounced by mid-century (2041-2070 as compared to 1971-2000 averages). Maps show the maximum annual number of consecutive days in which limited (less than 0.01 inches) precipitation was recorded on average from 1971 to 2000 (top), projected changes in the number of consecutive dry days assuming substantial reductions in emissions (B1), and projected changes if emissions continue to rise (A2). The southeastern Great Plains, which is the wettest portion of the region, is projected to experience large increases in the number of consecutive dry days. (Figure source: NOAA NCDC / CICS-NC).

and drying of the Prairie Pothole Region of the northern great plains compounded by the drainage of these wetlands for conversion to other land uses (Johnson, et al., 2005). Agriculture will also be negatively impacted as precipitation is projected to decrease and increased temperatures may lead to increased loss of soil without proper management—the employment of no-till or conservation tillage is essential to addressing soil loss (Zhang and Nearing). On top of this, climate change is projected to decrease the yield and/or quality of wheat grown in Nebraska due to climate change—nitrogen management and the utilization of new cultivars are need to adapt to climate change (Weiss, Hays, Won, 2003). This example could potentially serve as a harbinger of the detrimental impacts of climate change on agricultural productivity.

POLLUTION

Anthropogenic pollution remains ubiquitous, persistently threatening the world and resulting in unique ecological, abiotic, and human impacts in the Great Plains. A large portion of the scientific research covering pollution in the Great Plains focuses on the impact on air quality in the region. Much of the development for coal production in the US occurs in Wyoming's Powder River Basin, as stated in the Human Features section, impacting air quality in the whole region due to sulfur dioxide (SO_2) and sulfate (SO_4^{2-}) emission (Durran, et al., 1967). The long range dispersion of SO_2 was found to be slightly higher in winter and summers and concentrations were highest near point sources during stagnant conditions in the spring (Durran, et al., 1967). On the other hand, geogenic substances—namely dust—result in substantial air quality degradation as well. Dust air pollution poses a particular threat to the Great Plains because the region is more windy

than most other places in the US. Speeds of generally 20-30 miles per hour help drive the transportation of dust during, and exacerbate such pollution during periods of low precipitation. This leads to the Great Plains having a high number of hours in which there are elevated concentrations of dust in the air (Deane and Gutmann, 2003).

In addition to air quality degradation, water pollution constitutes a major threat to the natural features of the great plains and its human populations. Agriculture is a substantial source of this harmful pollution both due to the scale of the industry in tandem with the over-application of agricultural chemicals. A key example of this pollution is the extensive application of urea (CH_4N_2O), the most prevalent nitrogen (N)-based fertilizer used on agricultural soil, leading to an enormous amount of chemical runoff. This pollution results in increased ratios of N:P (phosphorus), which may cause subsequent increase of algal mass and affect the occurrence of toxic cyanobacteria in already P-rich lakes, the abundance of phytoplankton, and gross community composition (Finlay, et al., 2010). This may become an increasing problem as more fertilizer is needed to grow more food for a more highly populated world in 2050 (Finlay, et al., 2010)

BIODIVERSITY LOSS

An inherent implication of global change is the loss of flora and fauna biodiversity throughout the world as human processes decimate the natural habitat essential to many species and even whole ecosystems. Indeed, the world is said to be on the edge of a sixth mass extinction, largely due to human-induced global change—potentially adversely impacting as much as 40% of the world's economy and leading to the loss of basic services in most rural/indigenous communities and invaluable ecosystem services around the world (Barnosky, et. al.). The Great Plains will face its own unique conservation challenges due to its inhomogeneous landscape with many hotspots of biodiversity. Endangered/threatened species are spread throughout the whole landscape, though much higher incidence of these species are endemic to parts of the landscape with "special features," e.g. wetlands, rivers, sand hills, caves, and prairie dog town. However, land conversion in the Great Plains (unsurprisingly) followed the precipitation gradient of the landscape, failing to account for the biodiversity of locales, and leading to the loss of many organisms where this conversion overlaps with biodiversity hotspots.

Climate change and land conversion will lead to extensive loss of waterfowl in the PPR, as previously stated in the Climate Change subsection above, as the land dries out due to warming or is drained for development. The Great Plains' fowl have been found to be more impacted than those in western mountains as drastic habitat reduction occurs and

their range shifts with the changing climate. On the other hand, some types of neotropical migratory species benefitted from the encroachment of some invasive species, though negative impacts far outweigh such benefits in the broader system. Additionally, hardwood trees declined over the last century in areas where rising populations of ungulates occurred due to decrease in large predator populations, while hardwood recruitment was observed in areas that retained their large predator populations.

(Source: National Climate Assessment)

POPULATION CHANGE

Human population change is a dynamic issue intertwined with the other issues of global change, amplifying many of them. The population of the great plains region has changed drastically, both demographically and in overall size, over the course of the past several decades. From 1950 to 1990, county level population in the Great Plains declined for every decade except the 1970s, and the greatest losses were in completely rural nonadjacent counties. The civilian labor force declined for all but the 1970 decade, when there was a substantial increase due to increased nonmetro manufacturing and the baby boom cohorts reaching labor force age (Adamchak, et al., 1999). During the 1980s, 84 percent of these nonmetropolitan counties had total population declines, a proportion greater than any other decade studied (Albrecht, 1993). Communities which flourished as trade centers for agriculture during this period depopulated as generations of young families move to the larger cities while metropolitan centers enjoyed continuous growth and rural-to-urban migration has created high proportions of elderly and dwindling numbers of youth (Rathge, 2001). Overlaying climate change on top of these demographic trends leads to a path of severely taxed water supplies in a region already constrained by limited resources and, particularly in the south, hugely increasing demand for air condition, and thus energy and water to cool power points, during the hot summer months (National Climate Assessment, 2014)

Population Change in the Great Plains

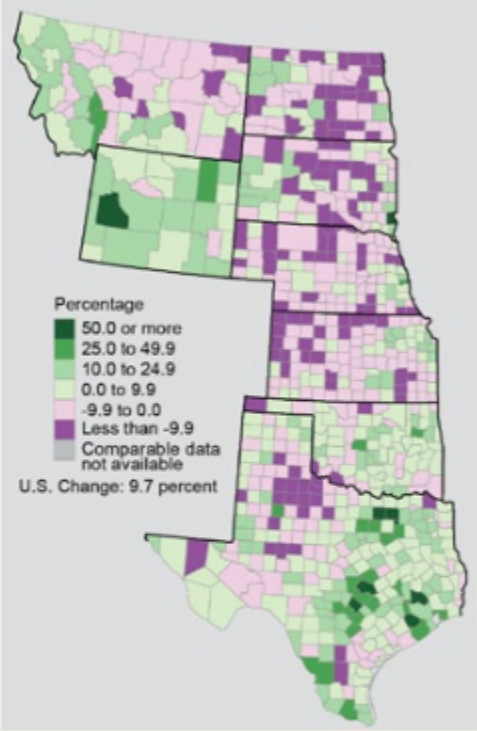


Figure 19.8. Demographic shifts continue to reshape communities in the Great Plains, with many central Great Plains communities losing residents. Rural and tribal communities will face additional challenges in dealing with climate change impacts due to demographic changes in the region (Ch. 14: Rural Communities; Ch. 12: Indigenous Peoples). Figure shows population change from 2000 to 2010. (Figure source: U.S. Census Bureau 2010[57]).

INVASIVES & DISEASES

Along with changing human population, invasive species and diseases have dispersed throughout the world, and their populations have subsequently flourished in new places away from predators. This is a global problem often unseen beyond its local impacts. The Great Plains' wide range of habitats allows it to sustain a myriad of different species brought in. Some human practices or types of land use have promoted the invasion of nonnative species without directly introducing them. Coal mining and later development of coalbed methane extraction in Wyoming could lead to greater intrusion by invasives (Bergquist, et al., 2007). In some cases, the removal of one invasive grass species led to a new invasive taking up much of the land rather than natives, preventing that land from returning to a pristine state. (Larson and Larson, 2010). Broader systemic impacts of invasives have come to light over time: Some non-native plants affect nutrient cycling, e.g. A. cristatum was found to decrease soil C and N in addition to displacing native species and decreasing biodiversity—altering pools and flows of energy and nutrients in the prairie ecosystem (Christian and Wilson, 1999). Another example is that, over the past sixty years, changes in flow management and agricultural practices, coupled with climate variability and drought have altered stream flow and caused a dramatic decline in stream water yields and levels of groundwater leading to the expansion Juniperus virginiana (eastern redcedar), and the invasion of the non-native Elaeagnus angustifolia (Russian olive) into riparian ecosystems. This proliferation has further altered the water balance in this system and exasperated the problem of water scarcity with negative feedback on ecosystem services and growth of native woody species impacting the ability of the native Populus deltoides to re-establish itself, which is of concern for resource managers (Skolaut, et al., 2012)

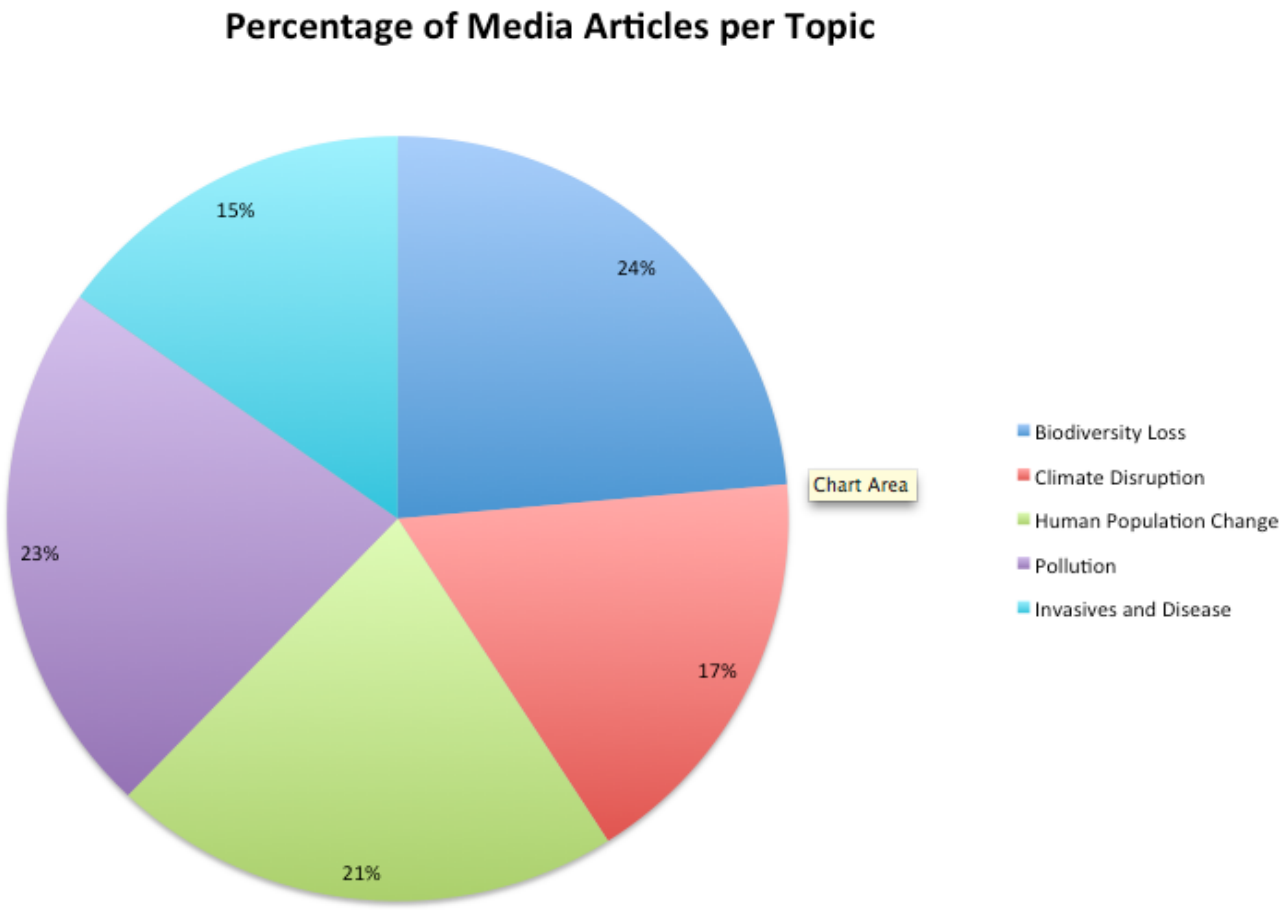
Disease spread is an insidious byproduct of globalization and interconnected with global change. Disease affecting agriculture readily spreads with the transportation of crops between discrete land areas. This is of particular worry to the Great Plains region as one of the agricultural hubs of the US and thus the world. At the southern end of the region, Potato psyllids have been infected with Candidatus Liberibacter (Ca. L.) solanacearum, with the highest incidence occurring in the Lower Rio Grande Valley of Texas (LRGV)—the reported overwintering location for this pest. The numbers of Ca. L. solanacearum-infected psyllids were positively correlated with the final percentage of Zebra Chip disease (ZCD) in tubers. However, with proper management and proactive action to prevent and control the spread of pests such as Ca. L. solanacearum, management can effectively contain the spread of diseases. This was demonstrated through results showing that population levels of immature life stages of the psyllid and percentage of ZCD differed greatly between commercial and untreated fields (Goolsby, et al., 2012). Another invasive pest in the great plains exemplifies the issues of invasives spreading disease to agricultural field. The wheat curl mite (WCM),

Aceria tosichella, and the plant viruses it transmits represent an invasive mite-virus complex that has affected cereal crops worldwide, leading to significant economic impact in North America (Navia, et al.). The main damage caused by WCM comes from its ability to transmit and spread multiple damaging viruses to cereal crops—wheat streak mosaic virus (WSMV) and wheat mosaic virus (WMoV) being the most important. Difficulties encountered in making progress towards managing WCM and its transmitted viruses stem from the complexity of the pathosystem (Navia, et al.)

An example of human impacts can be exemplified by the spatial patterns of human West Nile Virus (WNV) (Chuang, et al., 2012). WNV risk correlates to landscape-level features that likely reflect variability in mosquito ecology, avian host communities, and human activity: land cover, hydrology, soils, and elevation all influenced WNV risk, although the main drivers were different in each study area. Risk for WNV was generally higher in areas with rural land cover than in developed areas and higher close to wetlands or soils with a high ponding frequency. In western South Dakota, WNV risk also decreased with increasing elevation and was higher in forested areas (Chuang, et al., 2012).

Impacts of Global Change: Popular Media

Overview



POLLUTION

Overall, the largest cause of publicized Pollution in the Great Plains is the result of industry in the energy sector. Fracking, one of the major players in the energy industry, is the cause of many of these pollution issues. One example of this comes from Nebraska, where local residents raised concern about a fracking wastewater injection site. Although fracking pollutes, it also has some benefits that the state highly publicised. An example of this is a tax of 20 cents per barrel of wastewater, [with] the money [being] used to maintain roads and monitor water quality (Schaneman, 2015). This bill is a great example of how the media can publicize certain aspects of a dilemma in order to incite certain feelings in a

public and is important because it could set a precedent for how issues like fracking may be handled in our region.

On the other hand, the negative sides of pollution related to fracking is also highly visible in Great Plains media. One of these negative news stories came from Oklahoma, when residents discovered that scientists had been kept silent about the link between earthquakes and fracking since 2010. Finally, it was exposed that "'this rise in seismic activity, especially in the central United States, is not the result of natural processes," and that deep injection of wastewater is the primary cause of the dramatic rise in detected earthquakes and the corresponding increase in seismic hazard in the central U.S." (Schlanger, 2015). Having issues like fracking earthquakes reach the public is a big step for exposure. Although it is horrible that this was swept under the rug for 5 years, the fact that scientific information is a major step for informing citizens. In this way, media can help empower citizens in the Great Plains to take steps in having a healthy environment.

Yet, fracking pollution is not the only source of pollution in the Great Plains. In Kansas City, Kansas, diesel fuels were shown to be at such high unhealthy levels that they sent some to the hospital and raised death rates (Bavley, 2014). This story exemplifies the difficult balance between pollution and industry in the Great Plains. Yet, it is a large step towards fighting pollution because a story about a rising human death rate is likely to spur action from citizens.

David McNew/Getty

CLIMATE DISRUPTION

Kansas Ag Network

Major climate issues in the Great Plains are caused by drought and increasing number of hot days per year. Both of these climate issues affect agriculture, and since this is one of the major industries in the area, states in this region are suffering tremendously because of these changes. Kansas, a major corn producing state, is one of the notable examples of this. Kansas farmers have realized that as temperature increases, wheat production decreases, and this information is covered extensively in local media. One major news article that showed up in many places around the region was that for every 1 degree increase in average world temperatures, the globe… will lose 6 percent of its wheat production (Lawrence Journal-World, 2015). The Kansas population knows that farmers losing production would affect their entire economy, and since wheat production drives the economy, this warning is quite widespread in local media.

Other states are also feeling the economic pressure that comes with increasing temperature. Recently, an article about NASA study of a basin in northwestern Wyoming was published, revealing that snowmelt in the area is on average sixteen days earlier than it did

from the 1970s through the 1990s. (Vinas, 2015). Some states in the Great Plains, like Montana and Wyoming, depend on the outdoor industry as a large part of their economy. Since winter recreation is a large part of this industry, issues like increased snowmelt will have as dire economic consequences for these states as the decrease of wheat in Kansas. While media that addresses the connection between climate disruption and consumer wallets is not as readily available, it is easy to see such linkage through the headline articles in news sources.

Media does not shy away from the potential for changes in climate to impact civilians in other ways. Fire warnings are widely publicized throughout the Great Plains and while media won't identify one factor, they admit that "a combination of strong winds, low relative humidity and warm temperatures can contribute to 'extreme fire behavior'"(The Bismark Tribune, 2015). Since much of the Great Plains is grassland, fire would have devastating effects on the landscape.

POPULATION CHANGE

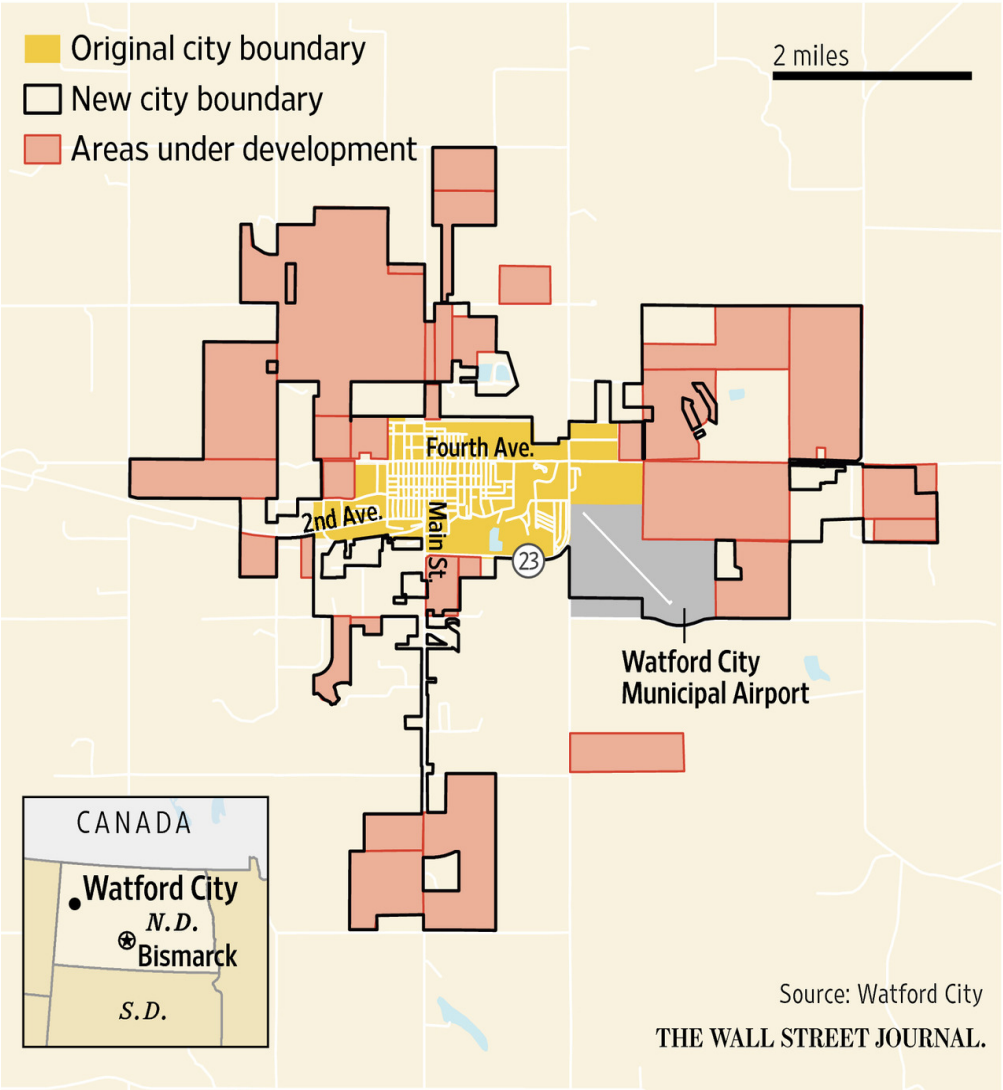
Even though the Great Plains has a low population, increasing population growth still causes changes in the area. Rapid population growth as a response to increases in the energy industry is an issues that is gaining media attention. One popular example of this comes from North Dakota where reporters said that "Shale oil turned this sleepy county seat surrounded by wheat fields into a boomtown, drawing developers to build housing for a population that has more than quadrupled in five years. But with crude prices less than half of what they were nine months ago, land-rush euphoria is giving way to concerns that projects will stall and Manhattan-level apartment rents could plunge as drillers cut production and jobs" (Brown, 2015). This nervous attitude towards the consequences of population growth seems to be shared by stakeholders across the region. Even professionals like the manager of the North Dakota census office Kevin Iverson are unsure about what will happen, saying "I expect growth will continue. We may see a slowdown for a while as a result of reduced oil prices and how long this lower oil prices will last. But in the long term, I think the Bakken is been a game changer for North Dakota." (Smith, 2015). Apart from leading to economic uncertainty, large population changes are mixing different ideas and traditions, which will change the face of the region.

Another major population issue in the Great Plains is the differing lack of opportunity between different socioeconomic groups. Newspapers are not shying away from this difference in opportunity, saying statements as bold as "A recent study by PolicyLink, a

California-based research and advocacy nonprofit, said the Austin-area economy would've been $21.7 billion larger in 2012 — a 22 percent increase — if its minority populations enjoyed the same employment and wage distributions as its Anglo majority" (Zehr, 2015). Given that populations are fluid, wage differences could cause certain towns to enjoy vastly different economies from each other, which may affect how they feel about certain environmental issues.

Homes on the Range

Developers are planning thousands of apartments in tiny Watford City, N.D. This is sparking concern as oil prices fall sharply.



Watford City, The Wall Street Journal

BIODIVERSITY LOSS

Mike Chaussee, Kx News

Although the Great Plains has a tremendous amount of land, species in this region are not safe. One of the species currently getting the most attention is the Sage Grouse. Since everyone from farmers to managers of wind farms are affected by conservation methods for it, the Sage Grouse is a highly controversial species. As one stakeholder put it "if we address fragmentation, disturbance and we put sage brush back on the landscape, the bird will handle itself. It will take care of itself. We deal with all those other stressors. It's a question about whether all of us can get together" (Chaussee, 2015). Yet, it is currently very difficult to get together. And, since there are so many legislative aspects to its protection, the decisions surrounding the Sage Grouse may color future species management plans in the region. For example, although things like wind farms are widely considered to be beneficial, they have been shown to be detrimental to the Sage Grouse. Issues like this are dividing even conservationists on issues surrounding the Sage Grouse.

Yet, the Great Plains have some excellent biodiversity success stories that the media also addresses. In this region, unconventional stakeholder groups, like hunters and fishermen, drive much of the knowledge and protection efforts for species in the area. One example of protection from an unconventional group is the Pallid Sturgeon. After being on the Endangered Species list for 20 years, it finally has a stable population (Gerlock, 2013). Having stories like this reach the public is important because they provide a model that others can learn from. In the future, hopefully citizens will take this as an example and continue to show the public is willing to make changes to help species in danger.

INVASIVES & DISEASES

Billings Gazette Staff

Since hunters and fisherman are prevalent in the Great Plains region, many media outlets have ample coverable of disease of invasives that could come affect their pursuits. When a wasting disease was discovered two hunt areas in Wyoming, hunters were quick to report their discoveries and work with the Wyoming Game Department (Billings Gazette, 2014). This story exemplifies how certain stakeholder groups can bring, and keep, issues in the media. Although hunters may not be thought of as a traditional conservation group, they are a large part in the spread of information to conserve species. Similarly, when dealing with water bodies "South Dakota is adding formal rules to require what many anglers already have been doing to protect against invasive foreign species. It will mean opening drain plugs and such with boats that are equipped with them, washing boats and trailers after a day on the lake or river, and never dumping live bait into a lake or river" (Dailey, 2015). Although this requires extra work, citizens are being very proactive in spreading information and following through with guidelines to support the recreation and environmental industry in the area.

Similarly, farmers keep close watch on disease in the area since it may

affect their livestock. In the case of Bird Flu, “the state's been in contact with every farm and backyard farm within six miles of the six farms where birds have tested positive. All of birds in that six mile radius are quarantined. That means no live birds can leave the farms until there are environmental tests and the quarantine is lifted” (Peters, 2015). In an area with such high agriculture, issues like this can cripple the economy of an area and are therefore well publicized in the media.

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