



# Resilient Madison County: A 2020 Report for Planning, Preparedness, Education, and Action



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# ABOUT THIS REPORT

This report was prepared by the Model Forest Policy Program (MFPP) from the collaborative process led by Madison County, Idaho along with the City of Rexburg and Sugar City. The project was guided and informed by the members of the Resilient Madison project advisory team, including representatives from the school districts, University of Idaho Extension Service, Idaho Public Health Service, Fremont-Madison Irrigation District, Madison Emergency Management Department, Brigham Young University-Idaho (BYU-I) and a number of other leading Madison citizens. The report provides a review of the results of the Madison County risk assessment and resilience planning process. It also serves to inform and support recommendations in a separate report on the integration of resilience strategies into the Madison County Comprehensive Plan 2020 update process. The project was made possible through funding to MFPP from the Federal Emergency Management Agency (FEMA) Region X Cooperating Technical Partners (CTP) grant program (FEMA Grant # EMS-2018-CA-00002).

The Model Forest Policy Program (MFPP) is a national nonprofit organization that builds the capacity of communities to be resilient to extreme weather and other rapidly changing conditions with strategies that sustain healthy natural resources, citizen well-being, and thriving economies. The MFPP team facilitated a process to engage local stakeholders, assess risks and potential solutions, identify resilience goals, and outline action strategies to protect people, infrastructure, and natural resources.

The MFPP Team gratefully acknowledges the leadership and support of Madison County through the multi-faceted planning initiatives, with special thanks going to Bradley Petersen, Madison County Administrator and Annalisa Wiggins, volunteer project co-leader.

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Left: Madison County Farmland                      Right: South Teton River, Rexburg, ID

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# EXECUTIVE SUMMARY

## INTRODUCTION

Communities of the American West are a vital force in the life of our country. The people of Madison County, Rexburg, and Sugar City, Idaho are prime examples of the hard working, faith-based, rural culture that is the backbone of the country. The farmers, ranchers, business owners, educators, and local government officials and staff collectively manage critical landscapes and watersheds that we all depend upon for the air, water, food, and fiber that drive the local and regional economy. The three local jurisdictions are jointly responsible for managing community assets and serving the needs of the local residents. That shared role requires thoughtful planning and execution of those plans in the best interest of the communities to meet today's goals and challenges while protecting the resources for sustainable and thriving communities of the future.

## PURPOSE AND PROCESS

In recent years Madison County is experiencing a number of impacts and stressors that call for solutions through their local planning processes. Their rapid rate of growth and development coupled with the condition and capacity of aging infrastructure raises issues with land use patterns, infrastructure needs, and strains on natural resources of the area. In recent years a pattern of more extreme weather events has become a threat multiplier to the existing stressors of growth and infrastructure needs. The changing weather patterns include more severe wind and hail storms, more intense rainfall events, hotter and drier summers, warmer winters, and more frequent and prolonged drought conditions. These factors of growth and severe weather are leading to more storm damage, flooding, drought, and wildfire risks with harmful effects to farms, livestock, public health, and property damage.

Madison County and municipal leaders decided to address these stressors as part of their multi-jurisdictional planning with updates to four planning processes occurring in the 2019-2020 timeframe, including updates to their economic development plan, hazard mitigation plan, FEMA Risk MAP process, and county-wide comprehensive plan.

The Model Forest Policy Program ([www.mfpp.org](http://www.mfpp.org) - MFPP) was identified as a collaborative partner to facilitate a risk assessment and resilience planning process with Madison County. The findings and recommendations of the resilience planning are intended to guide and inform the updates and implementation of these four planning processes, with an emphasis on the comprehensive plan being updated in 2020. MFPP facilitated a planning process with a local planning team, offering a series of webinars and working sessions, a one-day local resilience planning workshop, and a collaborative planning process to identify resilience goals and strategies. From those activities and local input MFPP produced two reports. This **Resilient Madison Report** provides the risk findings and recommendations for resilience strategies to guide and inform other planning and policy processes. The companion report, **Madison Comprehensive Plan Update Report**, provides a gap analysis for the existing 2008 comprehensive plan and specific recommendations for policy updates for the new comprehensive plan taking place in 2020. The desired outcomes of the project are to increase Madison County resilience to extreme weather; raise the level of awareness, health, and safety of Madison County residents; and build local support for taking action on hazard mitigation and resilience policies and practices. A variety

of educational products were also produced to support outreach activities during the 2020 comprehensive plan update period.

## **EMERGING CHALLENGES AND FUTURE RISKS**

**Land Use Change and Aging Infrastructure:** Rapid population growth and development in Madison County has led to a significant shift in land use patterns. Residential land use increased by 44% between 2000 and 2010, with most of that spreading outside the municipal boundaries of Rexburg and Sugar City. The increase since 2010 is likely even larger than that. This low density pattern of growth is a strain on aging infrastructure, raises government costs for services, and impacts the natural resources of available farmland and residential water supply from the Snake River Plain aquifer. The sprawling nature of the growth also significantly increases the amount of impervious cover from roofs, roads, and parking lots, leading to increasing impacts from stormwater runoff and secondary municipal flooding, such as the unprecedented rain, hail, and flood event of 2014 on the BYU-Idaho campus in Rexburg.

**Extreme Weather Patterns:** Extreme weather patterns of the region have become a threat multiplier to the region with shifts to more extreme conditions of all kinds. Seasonal temperatures are shifting to hotter, drier summers with increased heat stress on people, farms, and natural resources, especially in the last 50 years. 2015 was the second hottest year on record since 1895 and resulted in early spring runoff, followed by severe summer drought conditions. This led to a record breaking severe and prolonged wildfire season with significant public health impacts from prolonged air quality problems. The warmer temperatures also cause more rain, less snow, more rapid spring runoff and flooding, followed by drier summer conditions. Temperatures have also shifted to warmer nights year round and warmer winters, raising issues with heat stress to crops and more problems with insect pests and invasive species. The combination of warmer temperatures and less precipitation creates “flash drought” conditions, where severe drought damage happens in a shorter period of time. These conditions impact crops and livestock, degrade cold water streams and recreational fishing, and put strain on utility costs, water supply, and health effects for local residents.

**Economic Impacts:** The combination of meeting the demands of rapid growth, maintaining and upgrading aging infrastructure, and adapting to the increasingly severe weather puts significant strain on already limited county and city budgets. Low density development has higher economic costs, with less revenue and fewer benefits than more compact growth patterns. Local governments, businesses, and residents are asked to absorb more impacts and costs. Farms and ranches can see losses from floods, drought, insects, and health effects. The \$30-50 million recreational fishing economy is at risk as world class fisheries decline. Storm and flood damage can severely impact home and business owners. The county residents look to local planning and agency services to assist with reducing these risks and costs, and adapting to changing conditions for people, farms, ranches, businesses, and the natural resources of landscapes and watersheds.

## **RESILIENCE STRATEGIES AND GOALS**

The Resilient Madison project team reviewed the findings of the risks assessment and considered the potential solutions and resilience strategies to address their priority risks. Following the resilience planning curriculum and the resilience planning workshop, the team developed four major resilience strategies to address the priority Madison County risks and develop action steps to mitigation hazards

and build county-wide resilience. The following briefly summarize the strategies and goals identified by the Resilient Madison Team:

### **STRATEGY 1: RESPONSIBLE DEVELOPMENT**

**Goal 1: County-Wide Land Use.** Coordinate land use planning across all jurisdictions to preserve quality of life, existing rural character, food and water security, and resilience to extreme weather impacts.

**Goal 2: Low Impact Development.** Manage growth and development to maximize natural solutions that address adverse impacts and minimize the need for new infrastructure.

**Goal 3: Resilient Infrastructure.** Manage infrastructure placement, design, construction, and maintenance to conserve water, energy, and resource materials and maximize resilience to impacts of extreme weather conditions.

**Strategy 1: Responsible Development** is the first resilience strategy, as a necessary step to address the impacts of rapid growth and sprawl, reduce strain on aging infrastructure, and mitigate the risks of extreme weather patterns. Three major objectives are needed: 1) Enhanced **county-wide land use** management is a key factor in resilience, sustainability, and protection of people, infrastructure, and natural resources. 2) Consistent use of **low impact development** and green building practices are vital to mitigate the risks of development, reduce maintenance costs, and increase property values; and 3) Building with **resilient infrastructure** that is designed and constructed for current and future extreme weather conditions is vital to building for safety, sustainability, and resilience to future impacts. Together these three factors can provide long term resilience with healthy populations and a thriving economy. These goals can be achieved through a variety of policies and practices, including zoning choices, farmland conservation, low impact development and green building codes, ordinances, and incentives, use of green infrastructure, enhanced stormwater management, hazard mitigation practices, resilient infrastructure design specifications, and use of strong energy and water conservation practices.

### **STRATEGY 2: WATER MANAGEMENT AND GREEN INFRASTRUCTURE**

**Goal 4: Water Management.** Optimize water resource management to meet current and future needs of municipal water supply, agricultural irrigation, and aquatic and terrestrial wildlife habitat.

**Goal 5: Green Infrastructure.** Develop a county-wide nature-based green infrastructure plan to mitigate flood damage, maximize groundwater recharge, enhance stormwater control measures that protect water quality, and increase benefits of natural landscaping.

**Strategy 2: Water Management and Green Infrastructure** go hand-in-hand when it comes to wise use of water resources. The high, desert climate of Madison County makes water management a top priority. Five resilience objectives for water management are identified to protect and optimize water supply for human uses and water availability for healthy natural systems. The first three water management objectives involve finding a sustainable balance between the available water supply (surface streams and aquifer) and meeting the demands for municipal, agricultural, and natural system needs. To meet those demands without depleting water supplies, two additional water objectives call



for maximizing water conservation through education and technology (residential and agricultural) and having an adequate response to mitigate drought conditions when needed.

The use of nature-based Green Infrastructure practices are a vital and highly cost-effective method to help protect water resources and achieve the water management objectives described above. First, a county-wide green infrastructure plan will enable use of natural features across the watershed to manage stormwater runoff, protect water quality, prevent flooding, maximize groundwater recharge, and help maintain stream baseflow during drought. Second, installing urban green infrastructure practices in Rexburg and Sugar City will manage stormwater and reduce flooding, plus a range of co-benefits, including cooling effects, cleaner air, green amenities that draw development and raise property values, increase natural habitat for pollinators and wildlife. Third, subdivision regulations can be used to bring green infrastructure practices to new development that will save developers money while increasing the low impact nature of future development footprints, thereby reducing the cost of maintenance for local jurisdictions and landowners.

### **STRATEGY 3: SUSTAINABLE AGRICULTURE**

**Goal 6: Sustaining Agriculture with Planning and Policy.** Maintain and support the agricultural industry as a key component of Madison County’s economy, quality of life, rural character, and food & water security.

**Goal 7: Sustainable Agriculture with Resilient Farming Practices.** Increase the use of sustainable agricultural practices to preserve the health and integrity of agroecosystems, optimize production, and increase resilience to extreme weather conditions.

**Strategy 3: Sustainable Agriculture** is a high priority resilience strategy for Madison County, where the farming and ranching economy and the rural quality of life are a vital part of the local culture. Achieving agricultural systems that are sustainable over the long term in the face of extreme weather impacts calls for both supportive planning and policy along with on-the-ground farming practices. The first set of resilience objectives for sustaining the agricultural economy focus on planning and policies in collaboration with the Fremont-Madison Irrigation District and other agricultural agencies and partners. The plans and policies needed include land use zoning and policies that conserve high value farmland for agricultural uses, management of irrigation resources for maximum efficiency, preparation for drought response management, and collaborations for fundraising to enable project development. The second set of objectives focus on practical, on-the-ground farming and ranching practices that sustain a healthy agroecosystem, reduce inputs, and raise profits for the farmers and landowners. These include several high priority practices, such as cutting edge soil conservation and soil health practices; water efficiency systems, exploring adaptive alternative crops; use of integrated pest, weed, and disease management; and other mitigation measures for heat, flood, hail and other extreme weather impacts.

## **STRATEGY 4: EMERGENCY PREPAREDNESS AND COMMUNITY ENGAGEMENT**

**Goal 8: Emergency Preparedness.** Develop a multi-jurisdictional coordinated emergency preparedness and response program for extreme weather events, including heat waves, storms, floods, wildfire, and power outages.

**Goal 9: Community Engagement and Resilience.** Develop a collaborative, multi-jurisdiction educational campaign on sustainability and resilience to extreme weather and secondary impacts to public health and safety.

**Strategy 4: Emergency Preparedness and Community Engagement** are vital aspects of all resilience planning and implementation. All the objectives from the first three strategies have a role in community preparedness, response, and post-incident resilience. The first set of resilience objectives focus on multi-jurisdictional coordination for preparedness and emergency response systems and resources. The objectives include mapping flood and other risk zones, collaborating emergency response with first responder, agricultural agents, and public health officers; and integrating extreme weather responses into hazard mitigation plan, comprehensive plan, Risk MAP, and other related planning processes. The second set of preparedness objectives focus on coordination and synergy with education and outreach activities, including shared resources for presentations, public forum events, PSAs, social media, and targeted outreach campaigns for specific audiences, such as business owners, homeowners, developers, landscape designers and builders, medical professionals, farmers, etc. Educational efforts should also be integrated into the implementation activities of all existing planning processes.

### **TAKING ACTION**

The resilience strategies identified in this report are not meant to be a stand-alone plan for implementation. The action steps for this report are to analyze the findings and determine the best points of integration into existing planning processes so that extreme weather is addressed as a threat multiplier adding to the existing risks and stressors already known across Madison County. A special focus has been put on relevance to the Comprehensive Plan as that update process is still underway with significant opportunity to insert relevant information, goals, and policy recommendations. A separate but related report has been produced with more specific gap analysis and recommendations for the Comprehensive Plan update process. These two reports are meant to complement each other without undue duplication and should be considered together during the update process in 2020.

In addition, the FEMA Risk MAP process is currently underway and will be ongoing for the foreseeable future. These reports are also relevant to provide context and bigger picture thinking to the focused floodplain work of the Risk MAP process.

Finally, although the authors have not had the opportunity to review the newly updated Hazard Mitigation Plan or Economic Development Plan, it is highly likely that consideration of extreme weather resilience should be considered as they move forward with implementation activities for both of those plans.

# INTRODUCTION

The Resilient Madison County 2020 Report is the product of a collaborative process led by Madison County along with Rexburg and Sugar City. The report seeks to concisely review the relevant changes and impacts to Madison communities and provide an overview of the resilience strategies that can be integrated into the existing plans, policies, and practices of the county and its municipalities. This report is accompanied by a second report that analyzes the resilience gaps and opportunities in the 2008 Madison County Comprehensive Plan and provides recommendations to integrate resilience into the update process in 2020. This may include updating their comprehensive plan policies, revising codes and ordinances, and implementing aspects of their recently updated hazard mitigation plan and economic development plan. It also relates to the FEMA Risk MAP process currently underway with Madison County.

The goal of the Resilient Madison project is to increase the resilience of Madison County to extreme weather and other rapidly changing conditions with strategies to protect the people, infrastructure, and natural resources of the county. The project is motivated by the rapid and troubling changes from extreme weather and rapid growth being experienced by residents of the county. The project is designed to assess and understand the changing conditions, impacts, and increasing risks for Madison County and develop practical resilience strategies that can be put into action through existing plans and processes.

The desired outcomes of the project include: 1) a resilience report that identifies priority strategies for increased resilience in Madison County; 2) a Comprehensive Plan analysis with resilience recommendations for the update process; 3) increased awareness, health, and safety for the people of the county; 4) long term resilience benefits from integration of resilience into the multi-jurisdictional comprehensive plan update of 2020; and 5) opportunities to use resilience strategies when implementing the updated hazard mitigation plan and economic development measures.

## Background on Madison County

Madison County is a remarkable place. The lay of the land is a study in contrasts across this small, rural county in southeastern Idaho. The landscape varies greatly from east to west with an amazing variety of ecosystems. In the southeast corner lies the Targhee National Forest, with forested mountains that provide source water for the Snake River, provides water to downstream communities, and draws outdoor enthusiasts from around the world. Across the middle stretches vast agricultural lands growing crops and cattle on the rich soil and rolling hills of the Rexburg Bench. Three major rivers flow from east to west across the valley floor and converge into the Snake River. The Teton, Henry's Fork, and Snake Rivers turn this high desert land, averaging only 10-12 inches of rain per year, into highly productive farm lands. An extensive canal system fed by river water and managed by experts with the Fremont-Madison Irrigation Districts make that possible. The rivers also provide world class cold-water trout fisheries to local residents and tourists alike. In the northwest corner the landscape changes again to lava plains with desert sand dunes managed by the Bureau of Land Management.

The county seat of Rexburg has an elevation of 4865 feet. It receives an average of just 14 inches of rain per year falling mostly in the spring months. Stream flow in dry, summer months depends significantly on melting snowpack in the upstream forest mountains of the Targhee National Forest. In winter, Rexburg receives an average of 42 inches of snow per year in winter months. These high desert-like conditions call for careful water management in summer for both farms and towns. The water supply for the residents of Rexburg and Sugar City comes from groundwater drawn from the Eastern Snake Plain Aquifer. The farm irrigation water is largely drawn from the surface rivers and distributed through the elaborate canal system. The Madison-Fremont Irrigation District serves to meet agricultural needs and works to maximize groundwater recharge of the aquifers following irrigation uses.

The roughly 40,000 people of the growing Madison County have a rich history since settlements were established in 1913 by the people of the Church of Jesus Christ of Latter Day Saints (LDS). The county population today remains above 95% LDS, with a deep tradition of LDS religious values and principles. There are two municipalities, Rexburg and Sugar City, plus several more historic town sites. Rexburg is the county seat and home to Brigham Young University – Idaho (BYU-I) with about 27,000 students most of the year. The local community economy is primarily driven by a combination of agricultural economy and the university-related goods and services economy for students and faculty.



Irrigation Canals in the Fremont-Madison Irrigation District, Rexburg, ID

## Resilience Planning Process

The planning steps and development of this report are a collaborative process led by Madison County, Idaho in cooperation with the City of Rexburg and Sugar City. Bradley Petersen, Madison County Administrator, provided critical leadership in the development and ongoing support of the project. His vision, hard work, and commitment to creating resilience for the people of Madison County is the foundation of the project process. Annalisa Wiggins provided essential support as project co-leader and local project organizer. Her many hours of volunteer effort and dedication to the process kept the project moving forward.

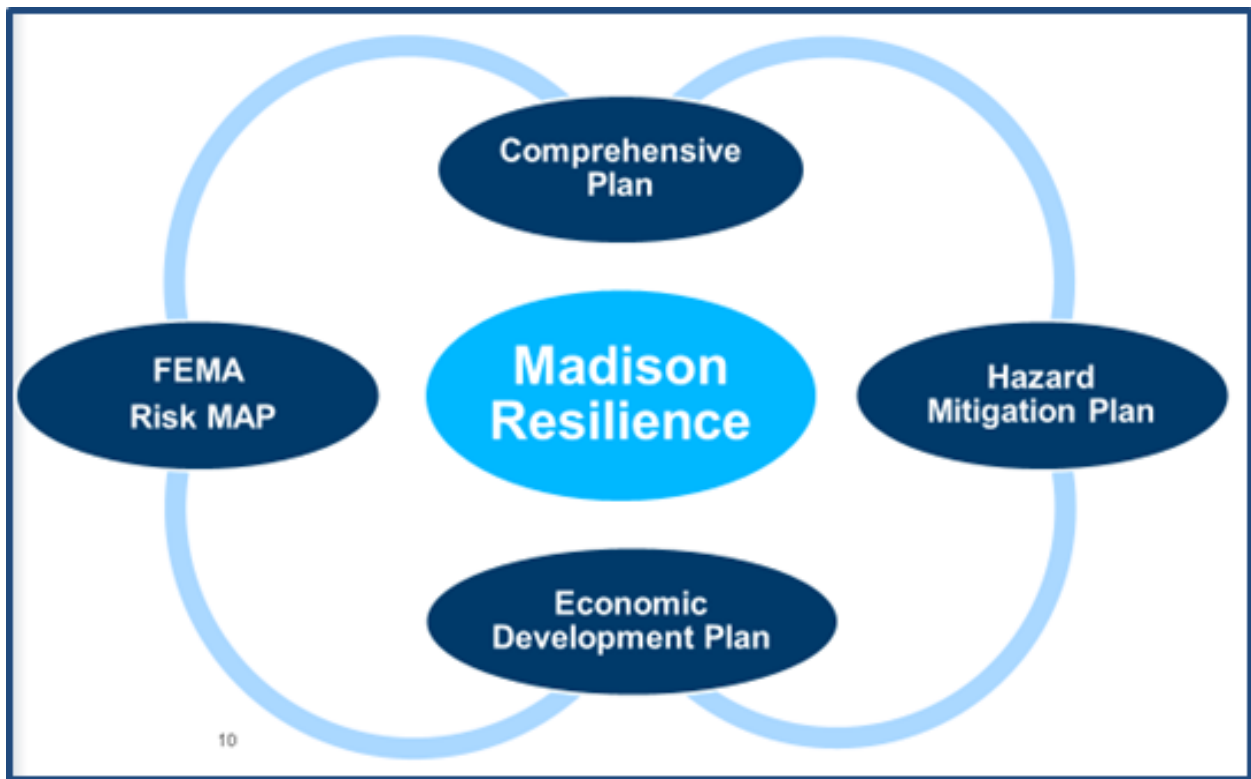
The planning process was facilitated by the Model Forest Policy Program (MFPP) team, made possible with funding support from FEMA Regional 10. The MFPP staff and consultants provided a virtual learning curriculum with bi-weekly webinars and working sessions. The curriculum provided guidance and educational content through the four major steps: 1) form a local planning team and community engagement; 2) assessment of local risks and opportunities; 3) identify and develop local resilience strategies; and 4) create an action plan for implementation. (See Resilient Madison Syllabus in the Appendix.)

The gathering and analysis of relevant information included research into available national and state references, study of relevant authoritative websites and online planning tools, numerous individual interviews with local leaders of the county, and a series of live interactive working sessions with the Madison planning team. The planning process and analysis also included holding a one-day in-person strategic planning workshop in Rexburg, ID on September 4, 2019. The well attended workshop provided good participation from a broad cross section of local leadership. A summary was shared with the participants followed by lively discussions to analyze the risks to the County and potential strategies and opportunities to increase the resilience for people, infrastructure, and natural resources. (See Workshop Summary and Participant List in the Appendix.)

Following the workshop, the team identified the priority risks to be addressed and developed four groups of resilience strategies to address the major risks from rapid growth and the exacerbating conditions of extreme weather events. The team then focused on the priority resilience concepts and recommendations as outlined below. The report was reviewed by key county leaders before being finalized for public review and comment.

# OVERVIEW OF TRENDS, RISKS, AND RESILIENCE OPPORTUNITIES

Madison County, Rexburg, and Sugar City are growing and changing rapidly. The community faces challenges and opportunities from rapid growth, aging infrastructure, and increasing frequency and intensity of extreme weather events and shifting seasonal patterns. It is important for multi-jurisdictional planning to factor in these trends, address these challenges, and take advantage of growth opportunities with sound multi-jurisdictional planning. The Resilient Madison project supports this objective by integrating resilience strategies into long term thinking that informs four Madison County planning processes. The goal is to identify and implement practical and effective stewardship strategies to prepare for extreme weather conditions and protect people, infrastructure, and natural resources now and into the future. This report speaks most directly to the comprehensive plan update process. However, it is also directly relevant to planning and implementation steps for the FEMA Risk MAP process, the hazard mitigation plan, and economic development initiatives county-wide.

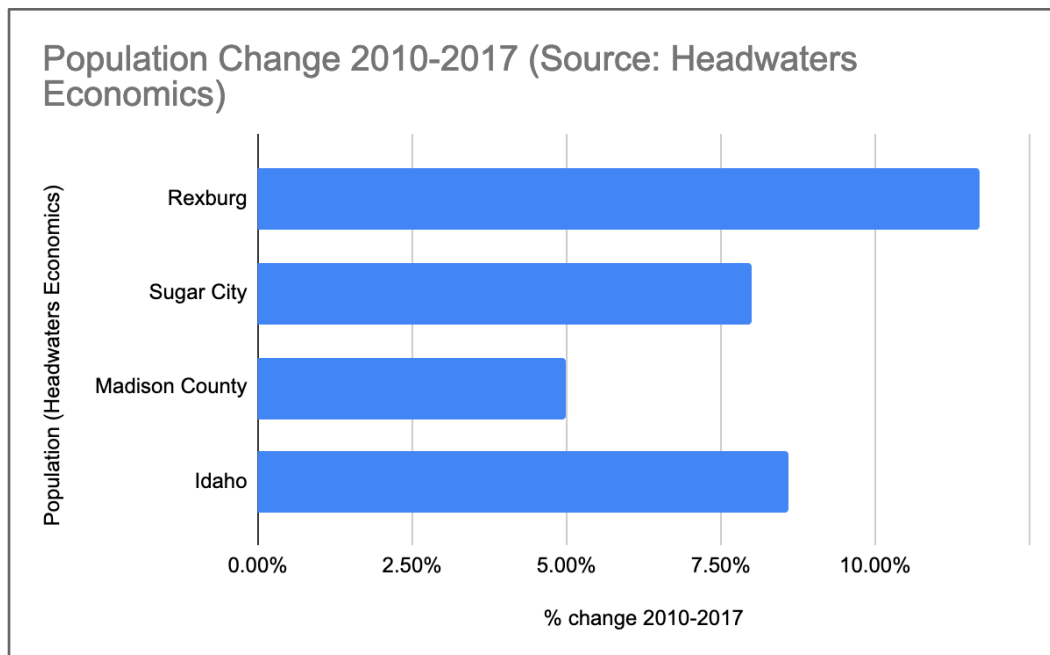


*Source: Madison County Presentation, MFPP 2019*

# Trends in Population Growth, Development, and Land Use

Madison County has been experiencing relatively rapid growth since 2010, with the bulk of the growth taking place within Rexburg City limits (see chart). Much of this growth relates to the expansion of Brigham-Young University’s Idaho Campus in Rexburg. This growth is leading to increased pressure on county and city governments and its infrastructure, as well as on available housing stock.

Perhaps related to the expansion of BYU-Idaho, Madison County’s population is on the young side. In 2017, the average age in Madison County was 23.5 years old, compared to 37.8 years old nationally (Headwaters Economics). The very young and the elderly are often more vulnerable to risks discussed in this report. In 2017, 23% of Madison County residents were under the age of 15, and only 8% were over the age of 65.



## LAND USE CHANGE FROM FARM LAND TO URBAN SPRAWL

Population growth in Madison County and in the region has led to a relatively rapid increase in the amount of land used for residential development. Between 2000 and 2010, the percentage of land under residential development increased by 44% in Madison County. Much of this development is happening outside the limits of both Rexburg and Sugar City and is sprawling in nature, meaning that it is low density and happening outside the urban core. It is driving the conversion of agricultural land to developed land, threatening the rural nature and agricultural identity of Madison County.

Along with development and sprawl comes an increase in impervious (typically paved) surfaces. The low density nature of much of the development in the county means that it is a challenge to provide necessary infrastructure, in particular stormwater systems.

## **AGING INSTRUCTURE NEEDS TO ACCOMMODATE GROWTH AND CHANGING WEATHER**

As the region experiences more intense spring runoff and precipitation events, the development patterns and inadequate infrastructure will lead to an increased risk of flooding. Clustered or higher density development, effective neighborhood and broader scale green infrastructure, and other strategies to address this combined risk of development, population growth, and aging/inadequate infrastructure.

## **Trends in Extreme Weather and Seasonal Changes**

Madison County is used to extreme weather and experienced in managing a wide range of conditions. However, the weather disruptions in recent years are outside the “normal” for Idaho with more frequent and intense weather impacts. Patterns of temperature and precipitation are changing in ways that require adjustments beyond what has been done in the past. The evidence for these changes comes from both the weather data and from the first hand lived experience of the people of Madison County. Below is a summary of the most important changes and trends being observed now and expectations into future decades. These are the changing conditions with impacts important to address now and to plan for in the future.

**Temperature:** Weather records show that temperatures across Idaho and Madison County are shifting toward hotter summers and warmer winters. University of Idaho professors indicate the average annual temperatures in Idaho have warmed by 2 to 2.5 degrees Fahrenheit since 1900, mostly in the past 50 years. This fits with global patterns and aligns with the observable shifts in nature, such as lilacs blooming a week or two earlier, earlier spring snow melt, and changes in the timing of fish migrations. The year of 2015 demonstrated the trend in more extreme years in the region. It was the second hottest year on record since 1895. There was normal total precipitation but had more rain and less snow. Early spring runoff was followed by a wicked hot and dry summer, including a longer than normal fire season. The region experienced serious impacts from drought and secondary wildfire that year. University of Idaho projections indicate those trends in severe years will become more common in future decades, perhaps even as frequently as 1 out of every 2 years.

**Precipitation:** Changes in precipitation are frequently part of the changing weather patterns. In Idaho, precipitation varies greatly by region. Madison County is a high, cold desert with an average of only 10-12 inches of rainfall per year, which has not changed significantly. However, there are important shifts in the hydrologic patterns. First, the shift to more rain and less snow is a significant change. The total snowpack depth is on a downward trend and the snow line is moving up to higher elevations. Projections indicate that winter and spring precipitation may increase some over the next century as warmer air holds more moisture. However, droughts are also expected to be more frequent and more intense due to the warmer conditions. The swing between these two extremes is expected to become more extreme over time. In addition to reduced snowpack, the earlier, warmer spring weather also causes early and rapid spring runoff. There is more frequent spring flooding followed by hotter and lower summer stream flows. Another significant shift is an increase in the number of more extreme precipitation events. The number of days with heavy rainfall greater than 1 inch has been above the



long-term average for the last 10 years. These events are often accompanied by high wind and storm conditions with significant risk to people, infrastructure, and natural systems.

These shifts in temperature and precipitation can lead to a wide variety of impacts and challenges to the communities of Madison County.

**Heat Stress:** While people don't generally notice changes in average annual temperatures, people, plants, and animals do take notice when there are longer heat waves with more high heat days in a row. While three to four consecutive days above 100 degrees Fahrenheit are not all that unusual, Idaho is starting to see longer heat waves in recent years. Boise, Idaho has recorded 9 consecutive days above 100 degrees Fahrenheit only three times since records started being kept. Those heat waves occurred in the years of 2003, 2006, and 2015. Boise temperatures hit a high of 110 on June 28, 2015 during that nine-day streak. This definite trend toward hotter, drier summers, including elevated night time temperatures, can significantly impact public health, built infrastructure, agriculture, and natural systems. It can be especially difficult for vulnerable populations where air conditioning has not been commonly available because it was not needed in the past. The warmer nights especially have an increased negative impact on crops, livestock, and people when they do not get a chance to cool down during the night. Shifts in the timing of temperature changes can also affect the length and timing of the growing season, longer allergy seasons, and mismatches in the timing of species life cycles disrupt reproduction.

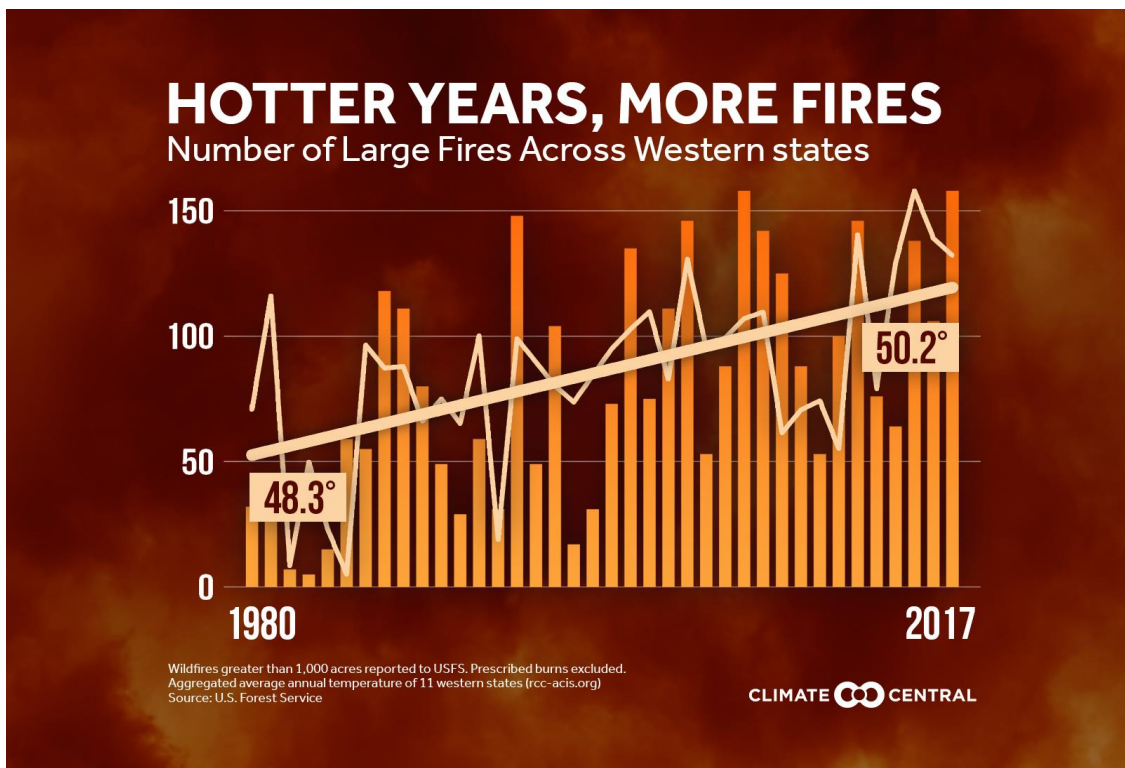
The warmer, drier summers were frequently mentioned during one-on-one interviews with Madison County residents. Also mentioned were late freezes affecting gardens and crops, kids not getting out of school for cold weather anymore, and winters are getting milder. However, extreme cold can also occur. The shifts in the flow of the jet stream can weaken and push the Arctic polar vortex down into the lower 48 states, creating intense cold, snow and ice events periodically. The most recent polar vortex was January 2019 with recording breaking cold across the Midwest and a number of weather related fatalities.

**Storms, Wind, Hail and Floods:** The increased intensity of rainfall events is one of the most frequently cited shifts toward more extreme weather events. This is driven in part by the warmer air temperatures, which puts more moisture and energy into the atmosphere. For each 1 degree warmer the air is, the atmosphere can hold 4% more moisture. When this is combined with more wind energy in the atmosphere, intense rain and storm events can occur. For inland areas this shows up as intense thunderstorms with wind and lightning, increased tornadoes, and very heavy rainfall that leads to serious flooding. In some cases this warm, moist air develops a pattern of "training" where storms track along a stationary line over several hours to days and dump large volumes of water in a concentrated area. This occurred all across the Midwest in 2019, causing massive flood damage to a wide swath of the agricultural lands in the heartland of America. Farmers were unable to get in their fields to plant for months and in some cases were wiped out by the flood damage. Residents of Rexburg spoke about an increase in these storm and flood events. The BYU-I campus experienced a strong hail storm and flooding event on campus in 2014 that was an unprecedented event at the time. When heavy rainfall is combined with a lot of impervious surfaces from developed lands, then flooding can be even more severe and damaging to the community.

**Drought and Wildfire:** The coupling of hotter temperatures and less precipitation can also lead to “flash drought” conditions where the soil and vegetation dries out very quickly. Serious drought impact occurs much sooner than would be expected in the normal temperature range. These flash drought conditions often precede wildfire events in the northwest. It also impacts cities with higher water and power bills, public health stressors, and the need for more irrigation of lawns and crops. At the same time the underground aquifer is more depleted while stream flows are already low. This affects the cold water fisheries and the important tourism and recreation economics of southern Idaho in the summer. The world class trout fisheries of Henry’s Fork and Snake River bring \$30-50 million in tourism and recreation dollars to the region and make up a very important quality of life element to local residents. Drought and wildfire pose very significant risks to these important rivers.

Wildfire brings with it significant risk from air quality degradation, which can be chronic, lingering impacts for months as the fire seasons continue to expand in time. Vulnerable individuals and outdoor workers are at risk from chronic exposure to thick smoke in the air. In the aftermath of fire the erosion of bare landscapes causes sediment runoff from heavy rainfall events. This can lead to landslides and sediment damage to sensitive freshwater streams.

The length of fire seasons across the region is steadily increasing each year, estimated to be about 32 days longer now than in 1984.



Source: [www.climatecentral.org](http://www.climatecentral.org).

**Public Health:** The health of the people of Madison County can be impacted by all of the risks and stressors discussed so far. Vulnerable segments are at risk from heat stress and numerous secondary effects, including injury from storms and floods, respiratory effects from poor air quality during wildfire events, and increased risk of disease from both water-borne and vector borne diseases. The severe wildfires of 2015 demonstrated the effects of poor air quality problems in the region. Chronic flooding conditions can also lead to exposure to toxic mold and bad indoor air quality. Conditions also favor more pollen and other allergens, which can exacerbate allergies and asthma for a significant percentage of the population. Changing weather patterns can increase mosquito, tick, and fly populations and the vector-borne diseases that they carry, such as West Nile Virus and Zika. The warmer temperatures favor more “disease transmission days” when temperatures fall between 61 and 93 degrees Fahrenheit. Finally, mental health and social cohesion is also a concern in the face of serious and ongoing challenges from the impacts of extreme weather and related stressors.

**Rapid Growth:** Rapid growth and development is important to take into account when building resilience to extreme weather. Development is both a risk and an opportunity to the community. Good land use management is the first principle to managing growth well. Where and how to develop is an essential factor in minimizing the risk from the natural elements of sun, wind, and water. Madison County is experiencing significant growth and has a great opportunity with the updated planning processes to move toward more sustainable development patterns that will benefit people and the natural systems around them.

**Economics:** Impacts from extreme weather carry with them inherent risk to the local economy in a variety of ways, ranging from public health to infrastructure to the ecosystems the community depends upon. Rural communities are extremely connected to the natural resources of their landscapes and watersheds. Their rural economy and way of life is intertwined with the natural and agricultural systems.

## Resilience Opportunities

In view of the potential impacts and stressors of current and future extreme weather events, Madison County came together to analyze their risks and identify practical resilience strategies that can be woven into their existing planning processes and implemented over time to achieve their desired resilience outcomes. The opportunities range widely from land use and development, to water management and flood prevention, sustainable agriculture, and emergency preparedness for all its citizens.

Following a one-day workshop with the Resilient Madison project team and much review and discussion, the following resilience goals and objectives were drafted to guide the next steps of weaving these objectives into other plan updates. The objectives are organized below under four major resilience strategies. Following the list, the report outlines how these strategies can be utilized in plan updates and ultimately implemented as policies, practices, and projects that bring tangible increases in health, safety, and resilience to Madison County.

# Resilience Goals and Objectives

The resilience goals are organized according to four top priority resilience strategies identified by Madison County during the September 4, 2019 Resilience Planning Workshop in Rexburg, ID.

**Strategy 1: Responsible Development**

**Strategy 2: Water Management and Green Infrastructure**

**Strategy 3: Sustainable Agriculture**

**Strategy 4: Emergency Preparedness and Community Engagement**

The following goals and objectives were developed from local information gathering, review, and comment by local participants in the Resilient Madison project. They represent a compilation of priority resilience concepts to integrate into other planning processes so that mainstream resilience into the standard operating policies and procedures for Madison County and other relevant jurisdictions, businesses, and organizations where ever possible.

## ***STRATEGY 1: RESPONSIBLE DEVELOPMENT***

**Goal 1: County-Wide Land Use.** Coordinate land use planning across all jurisdictions to preserve quality of life, existing rural character, food and water security, and resilience to extreme weather impacts.

**Objective 1.1** Coordinate and align updates for county-wide zoning, municipal growth boundaries, townsite footprints, and impact areas to maximize conservation of high-value agricultural land and minimize the footprint of residential, commercial, and industrial development beyond city or existing townsite boundaries.

**Objective 1.2** Establish zoning categories to meet resilience goals with green infrastructure and conservation zoning in unincorporated county lands, preservation of high value agricultural lands, and protection of natural resources, including streams and riparian zones, irrigation systems, forests, wetlands, and wildlife habitat.

**Objective 1.3** Update land use zoning, codes and ordinances to align with the updated comprehensive plan and achieve resilient land use goals that address extreme weather impacts.

**Objective 1.4** Assess and develop land use management practices to be consistent with and promote the resilience objectives of the current Hazard Mitigation Plan.

**Objective 1.5** Assess and develop land use management that is consistent with FEMA's latest floodplain mapping and minimizes development in floodways.

**Goal 2: Low Impact Development.** Manage growth and development to maximize natural solutions that address adverse impacts and minimize the need for new infrastructure.

**Objective 2.1** Adopt and implement conservation subdivision regulations according to zone categories to minimize the footprint of residential, commercial, and industrial

development with low impact development practices, including minimal impervious cover, optimal stormwater control measures, energy and water conservation, and use of natural plantings for urban forestry and native landscape plantings.

**Objective 2.2** Develop and maintain interconnected systems of green infrastructure and multi-modal transportation within urban boundaries and townsites to provide natural stormwater solutions, pollinator and wildlife habitat, improved air and water quality, and economic development amenities.

**Objective 2.3** Promote, incentivize, and/or require design and construction that meets third-party certified low-impact development and/or green building standards for conservation and minimal environmental impacts, especially in all high value, high risk, or sensitive areas.

**Goal 3: Resilient Infrastructure.** Manage infrastructure placement, design, construction, and maintenance to conserve water, energy, and resource materials and maximize resilience to impacts of extreme weather conditions.

**Objective 3.1** Design all stormwater infrastructure to manage projected extreme rainfall in storm events and maximize groundwater recharge in drought events (regenerative stormwater design).

**Objective 3.2** Emphasize the use of green infrastructure and natural solutions for all structures to reduce costs and maintenance, while maximizing effectiveness, longevity, and co-benefits of green space.

**Objective 3.3** Locate, design, and construct all infrastructure to avoid hazard zones and meet high standards of construction to withstand weather extremes of heat, cold, wind, flood, and drought.

**Objective 3.4** Design and construct buildings to meet green building standards for water, energy, and resource materials conservation.

## ***STRATEGY 2: WATER MANAGEMENT AND GREEN INFRASTRUCTURE***

**Goal 4: Water Management.** Optimize water resource management to meet current and future needs of municipal water supply, agricultural irrigation, and aquatic and terrestrial wildlife habitat.

**Objective 4.1** Assess aquifer status and groundwater supply for current and future projected residential and commercial uses and develop water efficiency and reservoir strategy to maintain adequate aquifer levels.

**Objective 4.2** Assess current surface and groundwater sustainability for agricultural use and develop long range conservation strategy to conserve water use and maximize groundwater recharge

**Objective 4.3** Assess surface instream flow for current and projected conditions and develop measures to protect cold water fish habitat during warm, dry periods

**Objective 4.4** Develop county-wide drought preparedness and response plan as contingency for severe and prolonged drought events, with responses for municipal supply, irrigation, and natural instream flow.

**Objective 4.5** Produce outreach campaign for homes and businesses on the benefits and methods of water conservation, low impact lawns and gardens, enhanced stormwater management, and pollution prevention for air and water quality.

**Goal 5: Green Infrastructure.** Develop a county-wide nature-based green infrastructure plan to mitigate flood damage, maximize groundwater recharge, enhance stormwater control measures that protect water quality, and increase benefits of natural landscaping, including stormwater management with bioswales, bioretention zones, rain gardens, etc.

**Objective 5.1** Create county-wide land use plan for large landscape green infrastructure that incorporates watershed stewardship, riparian and floodplain protection, riverine flood mitigation, farmland conservation, and wildlife corridors.

**Objective 5.2** Create municipal green infrastructure plans for Rexburg and Sugar City that maximize nature-based methods to address stormwater flooding, protect water quality, and create urban green space habitat and economic amenities.

**Objective 5.3** Update county subdivision regulations, codes, and ordinances to encourage and enable conservation cluster development and conservation of contiguous farmland in all areas outside of municipal city limits or townsite impact areas.

### **STRATEGY 3: SUSTAINABLE AGRICULTURE**

**Goal 6: Sustaining Agriculture with Planning and Policy.** Maintain and support the agricultural industry as a key component of Madison County's economy, quality of life, rural character, and food & water security.

**Objective 6.1** Identify key agricultural areas for protection in Future Land Use Plans and Policies with farmland preservation zoning and other supportive tools.

**Objective 6.2** Collaborate with Fremont-Madison Irrigation District to understand current and future water needs, and to maximize water resource efficiency for resilience to changing extreme weather conditions

**Objective 6.3** Contribute to collaborative development of a drought management plan to include water efficiency and drought contingency response measures for severe or prolonged drought conditions.

**Objective 6.4** Support agricultural agencies, nonprofits, and landowners in seeking funding (grants, cost-share, etc.) to evaluate, demonstrate, or adopt sustainable and resilient farming practices.<sup>1</sup>

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<sup>1</sup> Additional objectives that Madison County may want to consider in framing this goal include:

- Integrate local and/or regional food security policy into the Comp Plan or a standalone food security policy.
- Create a strategic plan for agriculture in the county/region.

**Goal 7: Sustainable Agriculture with Resilient Farming Practices.** Increase the use of sustainable agricultural practices to preserve the health and integrity of agroecosystems, optimize production, and increase resilience to extreme weather conditions.

**Objective 7.1** Form a collaborative working group to explore and demonstrate advances and applications of on-the-ground sustainable agricultural practices to maximize soil health, protect watersheds, and optimize crop, livestock, and forest production in the face of more extreme weather conditions.

**Objective 7.2** Promote soil conservation and soil health practices, such as no-till, cover crops, rotational grazing, composting, and perennial crops.

**Objective 7.3** Explore alternative crops and livestock more adaptive to changing weather conditions.

**Objective 7.4** Collaborate with agricultural support agencies, and local farmers to develop resilience measures that address extreme weather impacts to local crops and livestock, including heat stress, invasive species, disease, parasites, storms, floods, and wildfire.

**Objective 7.5** Promote and support the use of Integrated Pest, Weed, and Disease Management for current and future pest and health challenges.

**Objective 7.6** Promote and support the use of best practices for efficient on-farm water management.

## **STRATEGY 4: EMERGENCY PREPAREDNESS AND COMMUNITY ENGAGEMENT**

**Goal 8: Emergency Preparedness.** Develop a multi-jurisdictional coordinated emergency preparedness and response program for extreme weather events, including heat waves, storms, floods, wildfire, and power outages.

**Objective 8.1** Analyze landscape conditions and develop maps of risk zones for riverine floodplains and stormwater flood risks zones and identify focus areas for flood mitigation and targeted public education.

**Objective 8.2** Collaborate with First Responders of Madison County, Rexburg and Sugar City, plus School Districts and BYU-I to coordinate preparedness measures for homes, businesses, schools, churches, and hospitals.

**Objective 8.3** Collaborate with NRCS, University extension services, Irrigation District, and State of Idaho to coordinate preparedness measures for farms, ranches, agricultural services, and transportation systems.

**Objective 8.4** Collaborate with Idaho Public Health to educate all sectors about emergency preparedness and response measures.

**Objective 8.5** Identify points of integration of emergency preparedness into existing plans and practices, including hazard mitigation plan, comprehensive plan, and emergency response systems.

**Goal 9: Community Engagement and Resilience.** Develop a collaborative, multi-jurisdiction educational campaign on sustainability and resilience to extreme weather and secondary impacts to public health and safety, including floodplain protection, flood mitigation practices, wildfire response and air quality impacts, and other extreme weather impacts to people, infrastructure, and natural resources.

**Objective 9.1** Coordinate efforts by Madison County, Rexburg, and Sugar City to host a series of presentations and public forums to share sustainability and resilience strategies and gather ideas, input and support from public audiences.

**Objective 9.2** Collaborate with Idaho Department of Health to coordinate an outreach program of presentations, PSAs, and social media on extreme weather safety, public health, and community resilience.

**Objective 9.3** Develop outreach campaign for homeowners and businesses on the methods and benefits of green infrastructure and low impact landscaping, including protected riparian zones, water conservation for homes and lawns, enhanced stormwater management, and rain gardens for urban wildlife habitat and groundwater recharge.

**Objective 9.4** Identify points of integration for community engagement in the implementation steps of the updated comprehensive plan, hazard mitigation plan, and economic development plan.

#### South Teton River, Rexburg, Idaho 2019



*Photo Credit: Gwen Griffith, 2019.*



# RESILIENCE STRATEGIES FOR MADISON COUNTY

## OVERVIEW

The resilience goals and objectives listed above for Madison County revolve around four major themes or strategies to achieve the desired resilience outcomes:

- Responsible Development
- Water Management and Green Infrastructure
- Sustainable Agriculture, and
- Emergency Preparedness and Community Engagement

These strategies are inter-related with overlap between the goals, objectives, and methods of implementation. This section addresses resilience options for each of the four major strategies by briefly summarizing a range of approaches that can be used to build resilience in Madison County through planning, policies, practices, and education. It is organized by the four resilience strategies, while recognizing the holistic, synergistic approach they represent for the community. The leaders of Madison County can then consider, select, and integrate the most appropriate resilience strategies into existing plans, policies, project decisions, and public education efforts. Rather than providing information on each goal and sub-objective in a lengthy format, this section consolidates resilience recommendations under these four overarching strategies.

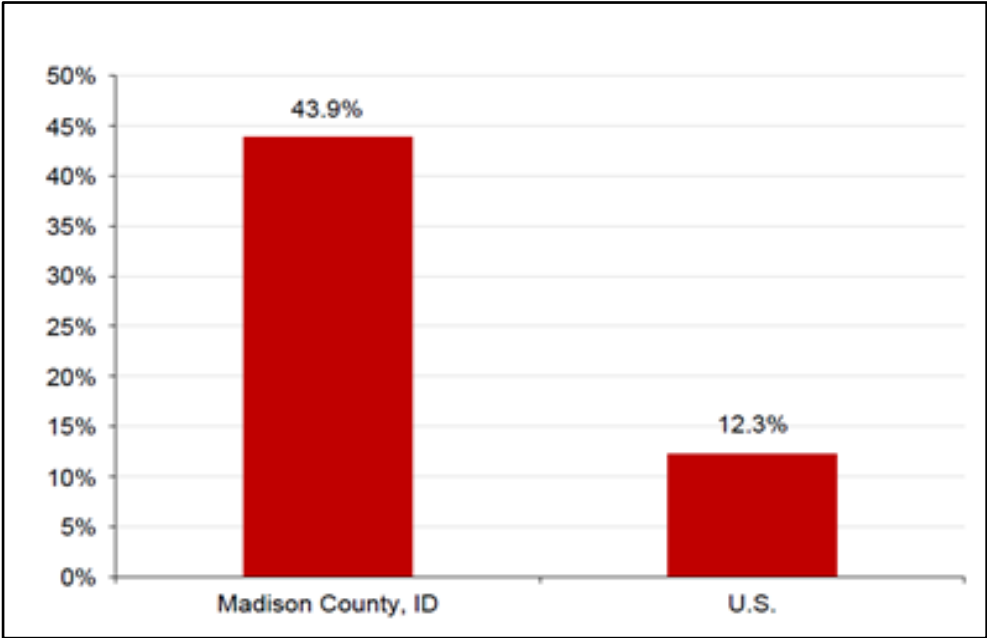
# RESILIENCE STRATEGY 1: RESPONSIBLE DEVELOPMENT

The first group of strategies coalesces around the theme of “responsible development.” This term can mean different things to different people. In the context of Madison County, we understand it to mean development that provides the county with an economic base while preserving open space and agrarian values. It also means avoiding development that will put residents at harm’s way due to hazards such as flash flooding. Development should be efficient and sustainable over the long term.

## 1.1. Growth Management and Farmland Conservation

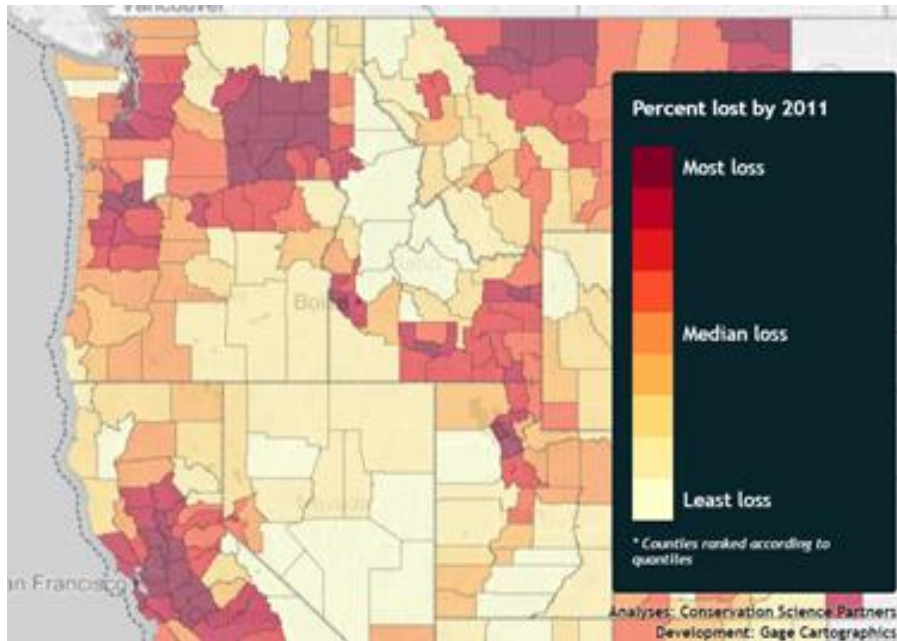
The county has experienced rapid residential development in recent years. From 2000-2010 the land area in residential development increased by 43.9%. From 2010-2017 the county continued to experience rapid development, and Idaho experienced the fourth highest increase in housing stock in the nation. As of 2011, Madison County ranked among the top counties in the Northwest in terms of the cumulative percent of land lost to development. According to the 2017 Census of Agriculture, 64% of the county’s land is in farms--82% of that area is managed as cropland, 15% as pasture, and 3% as woodland and other uses. Wheat and barley for grain occupy 49% of all cropland.

**Percent Change in Area, Total Residential Development, 2000-2010**



*Data Sources: Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University.*

## Cumulative Loss of Land to Development in 2011



*Source: DisappearingWest.com.*

The availability of land for farming is crucial to maintaining Madison County’s farming culture and economy. Farmland also provides important green infrastructure and wildlife habitat, and crop production is important to local and global food security. There are many strategies for preserving open space and agricultural lands while concentrating industrial and commercial development in areas that avoid public health hazards but are still accessible to the public.

Idaho is a “Dillon’s Rule” state, meaning that the powers of counties to regulate land use are limited to those powers delegated to counties by the state. That said, Idaho law (Chapter 67) provides substantial powers to counties to provide for land use and delegates local planning commissions with certain duties, including keeping comprehensive plans up to date. Under Idaho Statute 67-6508, the comprehensive plan “shall consider previous and existing conditions, trends, compatibility of land uses, desirable goals and objectives, or desirable future situations for each planning component.”

The zoning code is an opportunity to put smart growth principles from the comprehensive plan into action. While plans and ordinances must respect private property rights (see Idaho Statute 67-8003), local planning commissions do have ample powers under Idaho law to regulate land use for responsible development. Idaho Statute 67-6508 authorizes planning commissions to establish zoning ordinances that set standards for how buildings are constructed, how/where they are positioned on a lot, and what amount of open space is required.

Much of Madison County’s zoning code is already focused on preserving low-density development to maintain open space in agricultural and recreation areas. To maintain low-density rural development in the long term, it may be desirable to promote high-density development in certain areas so as to discourage sprawl and preserve open space around the development. In the current zoning code, Sec.

117-58. (Residential (R) Zone) limits density to two units per dwelling, while Sec. 117-59. (Town Site (TS) Zone) does not have clear density requirements. Particularly in the TS Zone, it may be desirable to encourage higher density development to avoid sprawl and reduce the need for expensive extensions of utility lines. Higher density development can make use of utilities such as water more efficiently. With higher density comes greater fire risk; hence fire-resistant materials and techniques are important in compactly developed neighborhoods.

### **THE ECONOMIC IMPLICATIONS OF SPRAWL**

The American Farmland Trust reports that developed land increased by 57% between 1982 and 2007. At the same time, the U.S. population only grew by 30% percent. In Idaho, between 1980 and 2000, population grew by 32% and developed land increased by 46.2% (Idaho Parks & Recreation).

Sprawl patterns of development result in higher economic costs, with less revenue and fewer benefits than compact – or smart – growth strategies. Economic burdens include loss of productive farm and timber lands, increased travel costs, decreased economic resiliency of urban centers, loss of natural lands that support tourism and hunting, increased tax burdens, utility and school construction and maintenance, and loss of rural character.

In 2002, the Federal Transit Administration published the results of a 5-year study led by Rutgers University on nationwide growth patterns, projected out 25 years and starting in 2000. In the “Costs of Sprawl – 2000”, the researchers reported:

- Sprawl will consume 4.7 million more acres than compact land development would have. Nearly 25% of this land conversion could have been avoided through growth control measures, without compromising growth or altering housing markets.
- The average residential housing cost would decrease by 7.8% under a smart growth scenario. Under a controlled growth strategy, lower infrastructure tap-in fees and 4.6 million fewer water and sewer laterals would result in national infrastructure savings of \$2.6 billion.
- Controlled growth would save 9.2% in local lane-miles and 11.8% in local road costs.
- Controlled growth would save the country \$4 billion annually in local public-service costs.

At a state level, Rutgers examined two possible growth patterns for the state of New Jersey: one in which growth continues according to historical trends (uncontrolled), the other – based on a new state plan – where development is directed into existing and new centers, and away from rural and environmentally-sensitive areas. In their report “The Costs & Benefits of Alternative Growth Patterns”, the researchers concluded the new -- smart growth -- state plan would:

- Reduce fiscal deficits due to growth by \$160 million per year
- Lead to more people being able to afford housing
- Require 870 fewer miles of centerline roads
- Save significant amounts of developable lands
- Attract income to and expand the tax base of communities with existing and new centers

The Costs of Sprawl-2000: [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_rpt\\_74-a.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_74-a.pdf).

The Costs and Benefits of Alternative Growth Patterns:

<https://nj.gov/state/planning/assets/docs/publications/143-impact-assessment-nj-state-plan-090100.pdf>.

There are various zoning tools available to limit the development of agricultural land. Some communities have used mitigation policies to require developers to offset the impacts of developing farmland. These ordinances require developers to purchase easements to permanently protect an equivalent or greater amount of farmland than they develop.

Agricultural Land Mitigation Ordinance:

<https://fic.briteweb.com/law/davis-ca-agricultural-land-mitigation-ordinance/>.

Agricultural Mitigation Case Studies:

<https://fic.briteweb.com/publications/agricultural-mitigation-case-studies-program-summaries-and-stakeholder-perspectives-from-seven-western-communities/>.

Agricultural Mitigation Guidebook:

<https://fic.briteweb.com/publications/conserving-californias-harvest-a-model-mitigation-program-and-ordinance-for-local-governments/>.

Some communities have templates for developer agreements, e.g., [McCall, ID](#); and [Boise, ID](#). The contents of an agreement for Madison County would depend on what kind of mitigation measures or actions the developer is expected to take, and these might not be decided on or negotiated until the actual rezoning process. Agreements could be accompanied by a bond to ensure performance of the agreement.

The following subsections provide more detailed information on specific types of development mitigation policies.

### **1.1.1. Conservation Easements**

A conservation easement is a deed restriction landowners voluntarily place on their property to protect resources such as productive agricultural land, ground and surface water, wildlife habitat, historic sites or scenic views. They are used by landowners (“grantors”) to authorize a qualified conservation organization or public agency (“grantee”) to monitor and enforce the restrictions set forth in the agreement. Conservation easements are flexible documents tailored to each property and the needs of individual landowners. The landowner usually works with the prospective grantee to decide which activities should be limited to protect specific resources. Agricultural conservation easements (ACEs) are drafted to keep land available for agriculture. In general, ACEs limit subdivision, nonfarm development and other uses of the land that are incompatible with farming. The following are additional references:

ACE Fact Sheet: <https://www.farmlandinfo.org/agricultural-conservation-easements>.

Drafting Conservation Easements for Agriculture: <https://www.farmlandinfo.org/drafting-conservation-easements-agriculture>.

Sample Agricultural Conservation Easement Language: <https://www.farmlandinfo.org/agricultural-conservation-easement-language-selected-farmland-protection-programs>.

ACE Sample Documents: [https://fic.briteweb.com/resources/sample-documents/?document\\_type=383](https://fic.briteweb.com/resources/sample-documents/?document_type=383).

### **1.1.2. Urban Growth Boundaries**

Urban growth boundaries (UGBs) define areas intended to accommodate anticipated growth for a given planning horizon. UGBs are often used to guide decisions about infrastructure development including the construction of roads and extension of water and sewer services. In the context of farmland protection, they separate areas appropriate for future growth from areas intended for agricultural use.

Madison County may consider more consciously using UGB designations to help guide the location of new development to desired areas and discourage development of prime agricultural lands. UGB zones can receive more favorable consideration for planning approvals and development of infrastructure, such as central water and sewer lines.

For examples of UGB ordinances, see [Local UGB Laws](https://fic.briteweb.com/laws/?keywords=163&law_type=208); [https://fic.briteweb.com/laws/?keywords=163&law\\_type=208](https://fic.briteweb.com/laws/?keywords=163&law_type=208).

### **1.1.3. Cluster Zoning**

Cluster zoning allows or requires houses to be grouped together at densities that exceed the usual requirements. Clustering houses on a small portion of a larger parcel can protect open space. This technique is also called cluster or conservation development. In the context of farmland protection, cluster zoning can allow or require new houses to be sited in wooded areas or on less productive soils while keeping more productive land available for agriculture. However, some question the effectiveness of cluster zoning as a farmland protection tool because the use of remaining open space may be limited. Some communities use this form of zoning between urban and rural areas rather than relying on cluster zoning to keep land available for agriculture. For more information, see [Local Conservation Subdivision Laws](https://fic.briteweb.com/laws/?law_type=208&keywords=120); [https://fic.briteweb.com/laws/?law\\_type=208&keywords=120](https://fic.briteweb.com/laws/?law_type=208&keywords=120).

### **1.1.4. Transferable Development Rights**

Transferable Development Rights (TDRs) have emerged in recent years as a way to shift development from areas where a community desires open space/conservation toward areas more appropriate to concentrate development. TDR programs enable the transfer of development potential from one parcel of land to another. TDR programs are typically established by local zoning ordinances. In the context of farmland protection, TDR is often used to shift development from agricultural land to designated growth zones located closer to municipal services. TDR is also known as transfer of development credits (TDC) and transferable development units (TDU).

If Madison County would like to implement TDRs, an ordinance providing for TDRs will need to adhere to the requirements under Idaho Statute 67-6515A:

- They must be voluntary (landowners have the right not to accept them) and cannot be a condition of a conditional use permit.
- The County must designate “sending” and “receiving” areas and ensure that receiving areas (where rights are transferred to) have enough space to accommodate all the rights sent there.
- The County can set a time limit to exercise the right to develop elsewhere—after that time the right to develop can revert to the owner of property from which it was transferred.
- The transfer of development rights cannot change rights to water.
- The right must be filed with the recorder’s office in a document that specifically describes the property and is signed by anyone with a property interest in or lien to the land.

For more information, see:

TDR Fact Sheet: <https://www.farmlandinfo.org/transfer-development-rights>.

Selected TDR ordinances: [https://fic.briteweb.com/laws/?law\\_type=208&keywords=160](https://fic.briteweb.com/laws/?law_type=208&keywords=160).

### **1.1.5. Purchasing Agricultural Conservation Easement (PACE)**

Purchasing agricultural conservation easement (PACE) programs are similar to TDRs. They pay property owners to keep productive land available for agriculture. PACE is known as purchase of development rights in many locations. Landowners voluntarily sell agricultural conservation easements to public entities to prevent it from being converted to other uses. After selling an easement, the landowner retains other rights of ownership, including the right to farm the land, prevent trespass, sell bequeath or otherwise transfer the land. For more information see

- PACE Fact Sheet: <https://fic.briteweb.com/publications/purchase-of-agricultural-conservation-easements>.
- Status of Local PACE Programs Fact Sheet: <https://fic.briteweb.com/publications/2016-status-of-local-purchase-of-agricultural-conservation-easement-programs/>.
- Local PACE Enabling Statutes: [https://fic.briteweb.com/laws/?keywords=153&law\\_type=208](https://fic.briteweb.com/laws/?keywords=153&law_type=208).
- Find a PACE Program: <https://fic.briteweb.com/farmland-protection-directory/>.

## **1.2. Rezoning**

Zoning is one of the most effective methods to achieve desired land use goals for a community. Land use designations of all types can be established with zoning guidelines to encourage conservation and open space in one area and more dense development in another.

The County can consider thresholds for when to rezone areas of the county for industrial and commercial development (i.e., when population reaches a certain amount in a township). Processes for

“rezoning” an area for more intense development can require “mitigation measures” to preserve open space in areas where there is a desire to conserve farmland and recreational space. As allowed by Idaho Statute 67-6511A (Development Agreements), the County may provide in the zoning code as a condition of rezoning that an owner or developer must enter into a development agreement that provides for certain hazard mitigation measures, creates a certain amount of open space through an easement, or whatever other tool the County would like to use to facilitate its goals of low-impact development and more resilience infrastructure.

The process for rezoning could be better laid out in the form of an ordinance in Madison County Code Chapter 117. A proposal to rezone might be “scored” according to whether it fulfills goals in the comprehensive plan, including maintaining the present balance of open space, avoiding the creation of flood hazards, ensuring that the development is adequately served by utilities; etc. Projects that fall short of a certain score could be required to implement certain mitigation measures; whereby the proponent could exercise some choice in which mitigation measures they prefer to bring up the score to the passing level.

There are many examples of rezoning ordinances. Such ordinances can set both the process of applying for rezoning and lay out the criteria that the decision-maker must consider in making the decision. A relatively simple example comes from the North Slope Borough, AK, [Section 19.60.060](https://library.municode.com/ak/north_slope_borough/codes/code_of_ordinances?nodeId=TIT19ZO_CH19.60PLZOCOAP_S19.60.060RE). ([https://library.municode.com/ak/north\\_slope\\_borough/codes/code\\_of\\_ordinances?nodeId=TIT19ZO\\_CH19.60PLZOCOAP\\_S19.60.060RE](https://library.municode.com/ak/north_slope_borough/codes/code_of_ordinances?nodeId=TIT19ZO_CH19.60PLZOCOAP_S19.60.060RE))

A more complex process might require collaboration with the County’s emergency management director to ensure consistency with the Hazard Mitigation Plan, or with Public Health (for example, a Health Impact Analysis could be conducted).

One challenge to rezoning is that conditions change overtime, while comprehensive planning processes and zoning ordinances may lag behind these changes. Some communities strive to plan for growth in advance by having “adaptive management” measures that are triggered when certain thresholds are reached.

- One such measure is a “dynamic zone” that is triggered by a particular threshold or event, the code changes automatically. For example, if the South Teton River overflowed and caused a certain level of damage in terms of dollars to buildings located near the river, the area alongside of the river could become part of a dynamic zone where new buildings must meet higher flooding standards.
- Another flexible zoning measure is a “floating zone.” The County would create standards for the zone (perhaps a unique zone for open space) but the zone would not be implemented or placed on the zoning map at this time. The zone might later be implemented based on the request of landowners or as a mitigation measure for rezoning nearby lands for more intense development.



## 1.3. Incorporating Hazard Mitigation into Land Use Planning

The strategies in this subsection are designed to integrate hazard management into land use planning.<sup>2</sup> The integration of the Comprehensive Plan and the Hazard Management Plan should be a priority in order to ensure that all hazardous and special areas are identified, and that land use planning is in sync with hazard mitigation goals. The County can incorporate recent information from the 2019 Hazard Mitigation Plan on drought, flooding, fires, and extreme weather events into the comprehensive plan and zoning map to avoid building in areas that are vulnerable to these hazards. It will be important to identify these areas on Land Use maps and planning permits to avoid inappropriate activities on those sites. Madison County Homeland Security, with its knowledge of hazards, is an important partner in shaping future land use planning.

*“The nation will always be vulnerable to natural hazards; therefore it is only prudent to invest in mitigation. In this context, mitigation should be considered in the broadest possible sense to encompass mitigation projects and processes that relate to enforcing strong business codes and land use and zoning measures as well as developing comprehensive plans that will limit disaster-caused damage and promote reduced losses from such things as disruption of utilities and transportation lines.”*

*Multihazard Mitigation Council Board of Direction, 2005*

### 1.3.1. General Hazard Mitigation Strategies

When allowing for rezoning or permits for new development, the County can consider “mitigation measures” if development is allowed in vulnerable areas. The floodplain overlay zone in the current zoning code (Section 117-63) already carries out such a function. The County may want to consider if it is up to date with current flooding hazards and whether there is a need to limit development in areas that might be vulnerable for other reasons (i.e., fire-prone areas close to a forest that might need additional fireproofing). The sensitive lands overlay zone (Section 116-61) may also serve to provide mitigation measures for development in vulnerable areas. The sensitive lands overlay zone may need to be updated to ensure that it is covering all vulnerable areas.

Currently the zoning code does not discuss on-site renewable energy on individual properties and in communal installations (i.e. solar, wind, and geothermal energy production). Such generation could provide backup power in case of a power outage and reduce reliance and strain on County-wide utilities. The County may want to encourage use of this generation in the code, perhaps by considering it to be a mitigation measure for high-density development that would otherwise strain County services.

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<sup>2</sup> Some additional strategies specific to water management (stormwater control and conserving water to mitigate droughts) are discussed in connection with Resilience Strategy 2.

### **1.3.2. Floodplain Management**

Flooding is the most common and costly natural disaster in the U.S. Despite billions in investments for attempts at flood control there is still over \$6 billion in flood losses every year along with tragic loss of life. Unfortunately the rapid rate of urban growth coupled with increasing intense rainfall patterns means floods are expected to increase into the future.

#### **LIMITING FLOODPLAIN DEVELOPMENT**

It is impossible to prevent all flooding since a significant percentage occurs beyond the predictable flood plain and can be caused by factors beyond our control. However, the first and most obvious line of defense to prevent flood losses is to manage the floodplain to be free of all structures and available to function as intended with overflow areas, wetlands, and riparian buffers during flood conditions.

When a community is willing to enact an ordinance to limit development in the floodplain and maintains a Floodplain Insurance Rate Map in conformance with the National Flood Insurance Program (NFIP), then community residents can obtain subsidized flood insurance rates. Madison County as well as Rexburg and Sugar City have been NFIP participants since 1991, but the floodplain maps date back to 1991 and no longer reflect an accurate floodplain profile. Madison County is currently participating in the FEMA Risk MAP updating process. Updated floodplain maps are expected to indicate a significant increase in the floodplain zones for all jurisdictions, particularly for flood zones around the Snake and the Teton Rivers.

To build more resilience to the risk of floods, communities can go one step beyond flood insurance through the NFIP to participate in the FEMA Community Rating System program (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that reduce risk through various methods, including public education, updated policies, enhanced floodplain and stormwater management, and higher design and construction standards. Communities can participate in CRS at different levels that fit their budget and capacity. Communities in CRS that complete proactive flood mitigation and stormwater management policies and practices have lower flood insurance premiums for local residents, businesses, and government facilities. Currently Madison County participates in NFIP but not in the CRS program. The expanded floodplain areas from the updated maps may create more need and more opportunities for proactive floodplain management to help offset the possible increase in flood insurance requirements for existing structures in the newly defined floodplain.

As discussed above, Madison County already has zoning ordinances providing for a floodplain overlay in Section 117-63 (as well as a sensitive lands overlay in Section 117-61.) These ordinances may need to be updated. A major update of floodplain ordinances is anticipated to be a major outcome of the comprehensive plan update and the updating of the floodplain maps. This should also complement the recommendations for flood mitigation from the updated Hazard Mitigation Plan too. If there is a need for a significant change, Madison County may want to consider drawing from ordinances that other counties have implemented:

- Bay County, FL: <https://www.baycountyfl.gov/DocumentCenter/View/1765/Bay-County-Floodplain-Management-Ordinance-PDF?bidId=>.

- Scott, LA: [https://library.municode.com/la/scott/codes/code\\_of\\_ordinances?nodeId=MUCO\\_CH18FLPR](https://library.municode.com/la/scott/codes/code_of_ordinances?nodeId=MUCO_CH18FLPR).
- New Braunfels, TX: <https://www.nbtexas.org/DocumentCenter/View/1848/Chapter-58-Ord-no-2011-53?bidId=>.

If updating the floodplain overlay zone, the County may want to consider adopting the 500-year (rather than 100-year) flood plain boundary as the “locally regulated floodplain” for purposes of the National Flood Program Insurance (NFIP). This can earn additional Community Rating System credits that help reduce the cost of insurance.

## **DESIGN STANDARDS**

Short of limiting construction in floodplains, Madison County can use its zoning code to prescribe some standards for how buildings are to be placed on lots, including elevation. The current zoning code already does this to some degree, for example, Section 117-59 (c) (15) prescribes an elevation of 12 inches from street level for developments in the Town Site (TS) Zone. The County can consider whether these standards need to be updated.

The Idaho Department of Water Resources has provided a Model Idaho Flood Damage Prevention Ordinance that should be considered when updating Madison codes and ordinances for floodplain development and construction standards. This model ordinance authorizes local governments to adopt floodplain management ordinances that identify floodplains and minimum floodplain development standards to minimize flood hazards and protect human life, health, and property. An effective floodplain protection program yields many co-benefits to the community. In addition to protection of life, health, and property, it also minimizes damage to public utilities and infrastructure; avoids business interruptions; supports a more stable tax base; reduces costs of public money for flood control and post flood recovery; avoids the high cost of emergency rescue services from flooding; notifies property buyers or owners about flood risk levels; and ensures those who occupy areas of flood hazard take responsibility for their actions.

Flood Damage Prevention Ordinance – Idaho Model Ordinance

<https://idwr.idaho.gov/files/forms/Idaho-Model-Flood-Damage-Prevention-Ordinance.pdf>

Additional standards for buildings to ensure flood safety may be implemented through a local building code, provided that such code is consistent with Idaho Statute 39-4116. Madison County adopted the Unified Development Code in 2010; however this code is not available online due to its size.

Finally, there is a need for standards to manage large volumes of stormwater discharge that could contribute to flooding. Resilience Strategy 2 contains information on stormwater management.

### **1.3.3. Fire Hazard Management**

For buildings near forested areas, requirements in the zoning code to reduce fire vulnerability are important. The requirements for fire avoidance in the fire-proofing in sections 117-52 (Agricultural

Zone) and 117-53 (Agriculture/Recreation (A/R) Zone) are an excellent start. The County may want to consider whether these requirements should also apply to other zones or whether other requirements should apply.

The County may also consider requiring new developments to submit a fire protection plan during site plan review. A plan would indicate where water can be obtained, how “defensible space” (open space to reduce fire spreading) will be maintained, and how residents and firefighters can quickly and safely get in and out of the buildings.

Finally, the County may consider strengthening requirements for building and roof materials to be both fire-resistant and “green” (i.e., able to channel or conserve water or conserve energy or promote public health). Keep in mind that some fire-resistant building materials may not meet green building standards if they are treated with flame-retardant chemicals that can potentially harm people’s health, and fire fighters may be concerned about green building techniques and materials that might make fires more hazardous. It is important to involve fire protection experts and green building experts in setting standards.

## **1.4. Capital Improvements**

When preparing a capital improvements plan, the County can consider siting new municipal buildings in locations that are close to the people they serve and in less-vulnerable areas (i.e., out of a floodplain or an area at high risk for a wildfire), unless they absolutely must be located in more vulnerable areas. The need to avoid vulnerable areas must be balanced with the need for people to easily access these areas. Likewise, when developing transportation policy, make sure that new roads that lead to new developments go towards less vulnerable areas (not in a floodplain). As discussed further in connection with Resilience Strategy 2, capital improvements are an opportunity to implement infrastructure that is more energy efficient or better manages water (i.e., green infrastructure).

## **1.5. Pre-Disaster Planning**

The County can plan for post-disaster redevelopment before a disaster strikes by creating a post-disaster redevelopment plan that specifies which areas would not be rebuilt or would be rebuilt only with specific mitigation measures to make buildings more resilient. The plan would also have strategies for managing disaster debris. Great sensitivity is required in this kind of planning. In New Orleans, for example, efforts to limit residents’ return to impoverished neighborhoods were perceived as racist and contributing to gentrification that pushed out residents who had lived there for decades. A post-disaster redevelopment plan needs to consider the needs of vulnerable populations. FEMA provides grant assistance to encourage planning for post-disaster response. Eligibility for post-disaster FEMA funding also requires that planning for the response be included in the existing Hazard Mitigation Plan.

## 1.6. Transportation Management

One aspect of responsible development that may be overlooked is the need to plan for transportation to and from areas of desired development while avoiding congestion. Alternative transportation refers to methods of moving around that do not involve individual cars or trucks. It can include carpooling, public and private transit (busses, shuttles, etc.), bicycling, and walking. Planning for alternative transportation and public transit is important in the context of resilience and comprehensive planning, and has multiple co-benefits for air quality, human health, and quality of life. Regardless of the specific form of transportation, planning and coordination is required to ensure that the infrastructure is in place to encourage use.

It is also important to note that transportation planning is closely linked to the use of green infrastructure and stormwater management for design standards (discussed as part of Resilience Strategy 2). Requiring the use of “Green Street” or multi-modal “Complete Streets” design goes hand in hand with where the streets are located in land use planning.

### 1.6.1. Public Transportation

Public transportation in rural communities can be a challenge, but various communities have identified creative approaches to making it viable. It can be an essential service for the elderly, people with physical disabilities, low-income residents, and others. It allows these and other residents to get to and from work, school, places of worship, medical appointments, grocery stores, and recreational centers.

Providing traditional route-service public transportation in rural communities is really challenging. There often are not enough riders to make it financially viable, distances are long, and funding is challenging. There has been a recent multi-county effort to provide public transportation between communities in eastern Idaho and across the state line in Teton County. However, to date, little progress has been made and that idea remains just that. Brigham Young University Idaho provides a free shuttle from campus to Walmart.

While a traditional route-service approach where busses or trains serve residents on a fixed schedule is one approach, there are other approaches that may often be more appropriate to rural communities. This can include demand-response public transportation (dial-a-ride), vanpools, or reimbursement programs.

TRIP Everywhere is one such creative model in Riverside, CA. This volunteer driver program is funded by the Independent Living Partnership, the Riverside County Transportation Commission, the Riverside County Office on Aging, foundations, and participating communities. TRIP reimburses family and friends who transport the elderly and people with disabilities to approved trips such as medical appointments. See <http://ilpconnect.org/trip-riverside/> for more information.

## 1.6.2. Pedestrian Friendly Communities

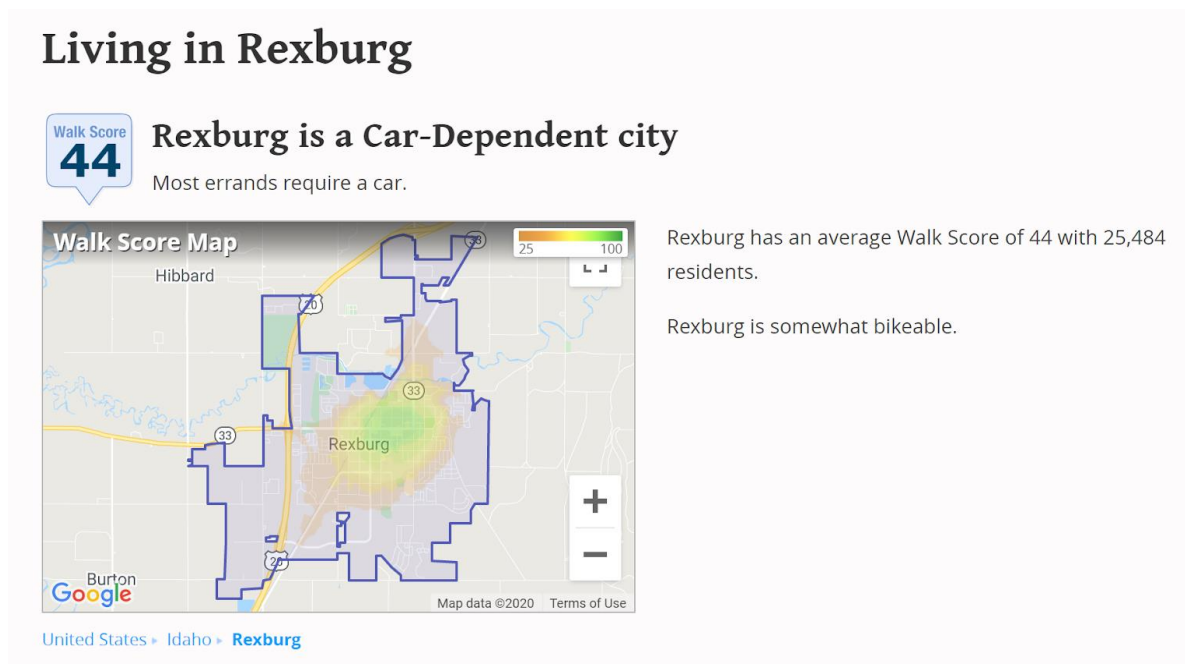
Walkable or pedestrian friendly communities have a number of benefits. In addition to reducing carbon emissions and increasing the resiliency of a community, walkable communities have obvious benefits to human health, increase home values, and are associated with higher levels of civic engagement.

Walkscore, a company that rates neighborhoods based on a number of walkability factors, and also produces transit and bicycling scores for neighborhoods, towns, and cities (see [walkscore.com](https://walkscore.com)).

According to their research, communities with a high Walkscore rating have:

- A neighborhood center (e.g. a main street or a public space)
- Enough people to support both business and transit
- Affordable housing located near businesses
- Parks and open space
- Pedestrian design, where buildings are close to streets and parking lots are in the back
- Schools and workplaces close by
- Complete streets that are designed for bicyclists, pedestrians and transit

According to Walkscore.com, Rexburg is a car-dependent city. The system was unable to produce a separate score for Sugar City.



**Source:** Walkscore.com, created on 3/8/20.

This means that there is room for improvement. The organization Walk Friendly Communities has developed an assessment tool and rating system to guide communities seeking to become more pedestrian friendly (see <http://walkfriendly.org>). Two Idaho communities have successfully been certified as Walk Friendly Communities, Coeur D'Alene at the Bronze level, and Sandpoint at the Silver

level (as of March 2020). This means that both of those Idaho towns have made “a commitment to improving and sustaining walkability and pedestrian safety through comprehensive programs, plans, and policies.”

Walk Friendly Communities identifies five overarching strategies that support this commitment, with 2-3 concrete examples in each category. See their website for a number of resources, toolkits, and case studies.

Some ideas for creating a more pedestrian-friendly community follow:

- Information Gathering:
  - Hire dedicated staff to focus on coordination of pedestrian related programs
  - Produce an annual safety report
  - Conduct and publish a regular infrastructure inventory report
  - Develop, implement and regularly update an active transportation plan that covers both walking and bicycling
  
- Planning:
  - Involve the public and key stakeholders in all stages of developing those plans
  - Adopt a Complete Streets Policy, beginning with the Comprehensive Plan update (see <https://smartgrowthamerica.org/program/national-complete-streets-coalition/publications/policy-development/>)
  - Design a variety of policies so that they encourage walking. For example, connectivity policies that ensure pedestrian safety and access; land use policies that encourage denser development. For one regional example of a parking policy that encourages pedestrians, see Sandpoint Idaho’s Downtown Streets Plan & Design Guide ([www.sandpointidaho.gaov/home/showdocument?id=414](http://www.sandpointidaho.gaov/home/showdocument?id=414))
  
- Design:
  - Design and build sidewalks and trails to decrease walking distance, reduce accidents, and encourage physical activity
  - Make sure that bridges include well designed accommodations for both cyclists and pedestrians
  - Establish crosswalks where you can reasonably expect people to want to cross a road
  
- Motivate:
  - Create a program that can educate, inspire, motivate and reward people for walking and biking as a mode of transportation. For example, Safe Routes to Schools is a national initiative that focuses on infrastructure improvements, enforcement, tools, safety education, and incentives to encourage walking and bicycling to and from school. See <http://www.saferoutesinfo.org/> for a number of tools, model programs and policies, and more. Another example is the “Everyone is a Pedestrian Campaign” designed by the National Highway Traffic Safety Administration, and is available to communities seeking to support public education around pedestrian and bicyclist safety. See <https://one.nhtsa.gov/nhtsa/everyoneisapedestrian/index.html>.

- Wayfinding and maps provide information pedestrians need about moving around a city on foot or on bike. These can be for example print or printable maps, signs, apps.
- **Enforce:**
  - Have an adequate number of traffic safety officers for the size and scale of your community, consider having them on bicycles or on foot
  - Targeted enforcement operations focused on high volume areas, areas with documented safety concerns, or unaddressed infrastructure problems
  - Ensure that law enforcement participants and collaborates with other departments

### **1.6.3. Bicycle Friendly Communities**

A good deal of what makes a community pedestrian friendly also contributes to supporting bicycling. There can be distinct needs, problems, and stakeholders however. According to the League for American Bicyclists, a Bicycle Friendly Community (BFC) “welcomes bicyclists by providing safe accommodations for bicycling and encouraging people to bike for transportation and recreation.” The League has been collecting data on the building blocks of a bicycle friendly community since 1995, and has translated this work into ten building blocks, any or all of which could be addressed in comprehensive, transportation, school and other plans:

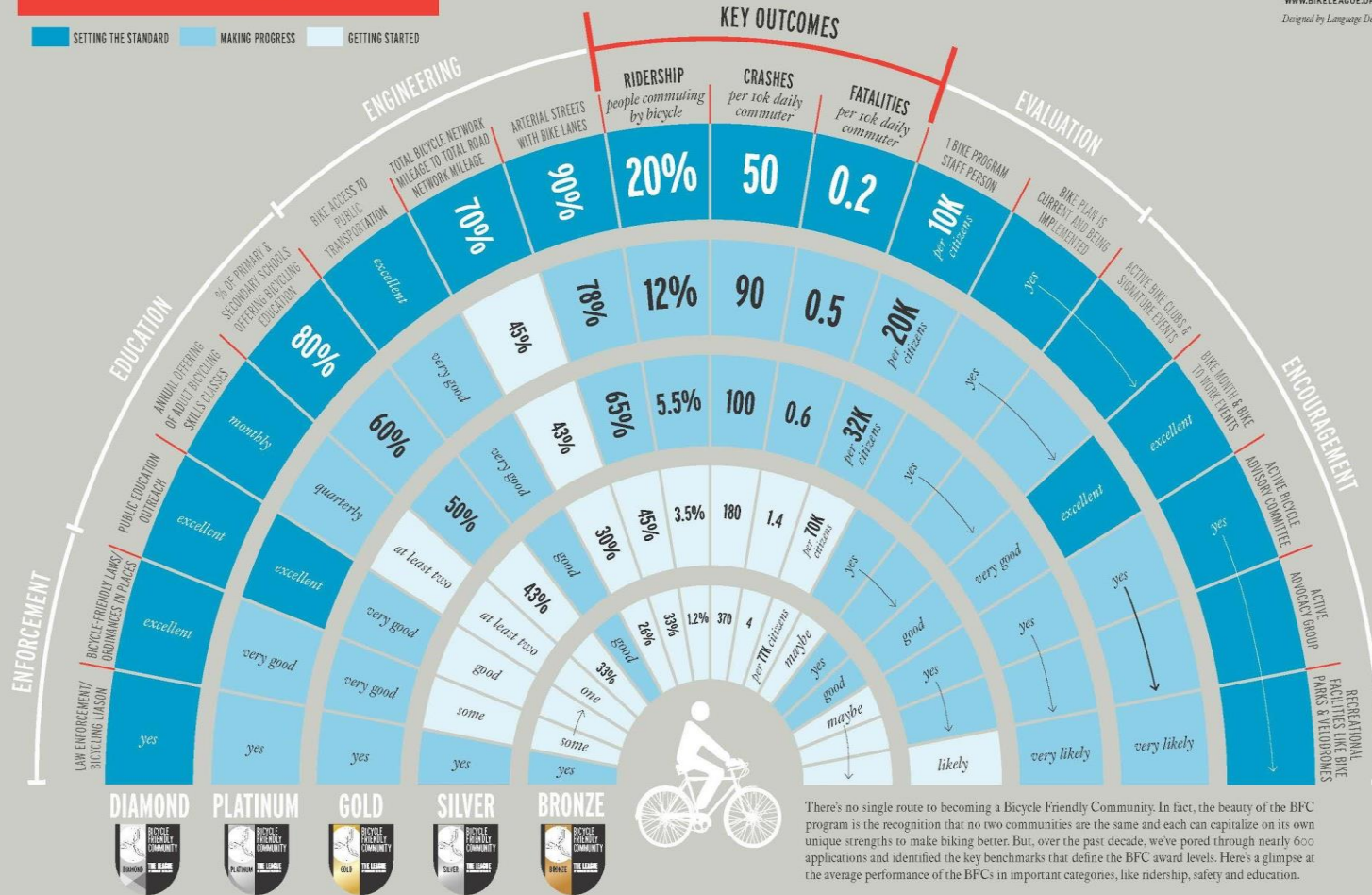
- **High Speed Roads with Bicycle Facilities:** The percentage of roads with posted speed limits of over 35mph have bicycle facilities on or off road.
- **Total Bicycle Network Mileage to Total Road Network Mileage:** The total miles of on and off road bicycle facilities divided by the total center miles of the road network.
- **Bicycle Education:** The percentage of K-12 schools that offer bicycle education to its students.
- **Share of Transportation Budget Spent on Bicycling:** The percentage of the total transportation budget spent on bicycling averaged over a 5-year period.
- **Bike Month & Bike to Work Events:** The number of events promoted as part of bike month.
- **Active Bicycle Advocacy Group:** The number of bicycle, active transportation and transportation advocacy groups in a community.
- **Active Bicycle Advisory Committee:** whether one exists and how often it meets.
- **Bicycle Friendly Laws & Ordinances:** Local ordinances or state laws that either restrict or protect bicyclists in a given community.
- **Bike Plan is Current and Being Implemented:** The existence and age of a bike plan with goals, whether it is being implemented, and whether progress is being made towards its goals.
- **Bike Program Staff to Population:** the number of full-time employees (FTEs) in a community that are dedicated to bike programs compared to total population, reported as the thousands of residents per 1 FTE.



# THE BUILDING BLOCKS OF A BICYCLE FRIENDLY COMMUNITY

produced by  
**THE LEAGUE**  
 OF AMERICAN BICYCLISTS  
 WWW.BIKELEAGUE.ORG  
 Designed by Language Dept.

SETTING THE STANDARD    MAKING PROGRESS    GETTING STARTED



There's no single route to becoming a Bicycle Friendly Community. In fact, the beauty of the BFC program is the recognition that no two communities are the same and each can capitalize on its own unique strengths to make biking better. But, over the past decade, we pored through nearly 600 applications and identified the key benchmarks that define the BFC award levels. Here's a glimpse at the average performance of the BFCs in important categories, like ridership, safety and education.

See <https://bikeleague.org/content/building-blocks-bicycle-friendly-communities> for more information.

# RESILIENCE STRATEGY 2: WATER MANAGEMENT AND GREEN INFRASTRUCTURE

The second group of strategies discussed in this report relate to water management that makes the most efficient use of a relatively limited water supply while conserving water and avoiding the impacts of occasional flooding through green infrastructure. This section covers water management, including water supply, stormwater management, and related energy management and the water-energy nexus.

## WATER SUPPLY AND DEMAND

Madison County and the Fremont-Madison Irrigation District are charged with being excellent stewards of a limited water supply. With precipitation levels averaging 10-12 inches of rainfall per year, a careful balance between water supply and water use has to be maintained. Making the most of water supply for human uses involves two main approaches: 1) water conservation behaviors and practices by water users; and 2) construction or purchase and maintenance of high efficiency water systems, equipment, and appliances by people, utilities, landowners, farmers, business, governments, and organizations. Water stewardship also extends to water management for the entire hydrologic cycle to meet the needs of people and nature. Using natural solutions to water management, such as green infrastructure practices, helps make the most of water resources throughout the hydrologic cycle and creates numerous co-benefits for the community.

## GREEN INFRASTRUCTURE

“Green infrastructure” (sometimes referred to as “GI”) is an approach to water management that uses natural solutions and cost-effective materials and practices that mimic the natural water cycle, help avoid flooding, and create healthier urban environments. GI uses natural vegetation, healthy soils, and landscape features to slow down, soak in, and filter stormwater runoff as it recharges the groundwater and maintains baseflow to the streams. It involves protecting floodplains, planting trees, restoring natural plants and wetlands, and designing sites with these natural functions in mind. Green infrastructure practices can be used instead of building a new water treatment plant to clean the water or instead of building a flood wall to prevent flood damage. The practices can be wholly natural or they can be partially engineered with green roofs, pervious pavement, bioretention cells, and rainwater harvesting. These landscaping practices add to the amenities and values of property and encourage economic development in the area. Green infrastructure planning and concepts can be applied at multiple scales from the individual home site, to the site design of a commercial building, to neighborhood streets and parks, on up to the large landscape scale of an entire watershed, including forest cover and biological wildlife corridors.

Madison County can consider developing a county-wide green infrastructure plan as part of its capital improvements and comprehensive planning process. This plan could include both the large landscape conservation of county lands and the urban landscape features of Rexburg and Sugar City in an

integrated fashion. The GI plan would offer a long-term vision for the desired use of natural solutions that could be realized gradually over time with each land use or development permit decision as they are made.

Incorporating strong requirements for green infrastructure can increase the value of the property and can cost less to build. Installing more trees, bioswales, and roadside infiltration trenches alongside roads can save considerably over the cost of curb and gutter and stormwater underground pipes. GI can also be much less expensive to maintain over time. As Madison County updates the subdivision codes and ordinances, special attention can be paid to require certain elements of green infrastructure and incentivize others to demonstrate the cost effective nature of this approach to stormwater management.

Perhaps best of all these GI stormwater practices tend to bring numerous other resilience co-benefits to any scale, from large landscape to urban or suburban settings. In our cities, the trees and vegetated surfaces help reduce the heat island effect, clean the air quality, provide pollinator habitat, and reduce nuisance flooding. Certain practices can naturally irrigate areas without needing artificial watering. Natural shading can increase the lifespan of infrastructure, such as parking lot paving and rooftop covers. Wildlife habitat and water quality of streams will be improved adding to the green amenities that draw economic development to the city. Green amenities also encourage more outdoor activities, improve mental health, and enhance the health of the community.

#### **CAPITAL COST SAVINGS AND MULTIPLE ECONOMIC BENEFITS OF LID/ GREEN INFRASTRUCTURE PRACTICES**

*“In the vast majority of cases, the US. Environmental Protection Agency (EPA) has found that implementing well-chosen LID practices saves money for developers, property owners, and communities while also protecting and restoring water quality.”*

Source: EPA (2007): Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices; [https://www.epa.gov/sites/production/files/2015-10/documents/2008\\_01\\_02\\_nps\\_lid\\_costs07uments\\_reducingstormwatercosts-2.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/2008_01_02_nps_lid_costs07uments_reducingstormwatercosts-2.pdf).

There is a growing body of evidence that green infrastructure and low-impact development (LID) practices can result in cost savings, while simultaneously generating multiple economic, social and environmental benefits. The experiences of 30 public utilities and state and municipal agencies are described in EPA case study reviews published in [2007](#) and [2013](#).

2007 Case Study: [https://www.epa.gov/sites/production/files/2015-10/documents/2008\\_01\\_02\\_nps\\_lid\\_costs07uments\\_reducingstormwatercosts-2.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/2008_01_02_nps_lid_costs07uments_reducingstormwatercosts-2.pdf).

2013 Case Study: [https://www.epa.gov/sites/production/files/2015-10/documents/lid-gi-programs\\_report\\_8-6-13\\_combined.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/lid-gi-programs_report_8-6-13_combined.pdf).

Comparing conventional stormwater management versus LID, nearly all of the cases of developments -- mainly residential subdivisions -- realized savings ranging from 15% to 80% and \$3,400 to \$785,000; only one project had higher costs of \$737,200 (EPA, 2007).

Findings from these reviews and other economic valuation studies indicate that LID and green infrastructure:

1. Can cost less than traditional pipe and pond grey infrastructure alone;
2. Result in multiple non-market benefits; for the public these include: reduced system management costs, habitat creations, improved air quality, and reduced carbon emissions; and for developers and business owners: stormwater volume reduction, reduced energy demand for heating and cooling, avoided stormwater facility costs, and increased roof longevity; and
3. Can be successfully integrated into Capital Improvement programs.

**Case Example:**

Accounting for capital cost savings and non-market benefits, the Philadelphia Water Department found LID/green infrastructure approaches provide 20 times the benefits of traditional stormwater infrastructure such as large tunnels and pumping stations. The benefits quantified and monetized as part of this analysis included increased recreational opportunities, air quality improvements, water quality and ecosystem enhancement, creation of LID/GI-based jobs, increased property values, and reduced urban heat stress.

Report: A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds (2009);  
[https://www.epa.gov/sites/production/files/2015-10/documents/gi\\_philadelphia\\_bottomline.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/gi_philadelphia_bottomline.pdf).

## 2.1. Controlling Water

Particularly in times of severe weather with heavy rainfall, it is important that Madison County has the land use ordinances, infrastructure, and outreach to control stormwater and avoid flooding. Managing stormwater runoff is a complex and very important task wherever people have disturbed or altered the landscape. This is true for a wide range of settings from very urban areas to low density housing to wide open farms and forests and even in wilderness areas where roads and trails provide human access. How well rainfall runoff is managed makes a major difference in water quality protection, the health of wildlife and aquatic habitat, flood prevention, protection of built infrastructure, and human health and safety. Stormwater management is guided by the use of the most up to date best management practices by design engineers and by a complex set of environmental regulations for the wide range of watershed conditions where it is required to be used.

There are three critical factors that have converged in recent decades to make stormwater management a critical issue for Madison County and many other rural districts in the region. The first is rapid population growth and transformation of the landscape from forests, rangelands, and farms into human developments. This growth results in a lot more rooftops, roads, and parking lots that greatly increase the percentage of impervious surface cover across the watershed and take away the safe places for heavy rainfall to flow and soak into the ground. The second is the deteriorating condition of 50 to 100

year old aging infrastructure that has become a liability with leaky pipes, degraded culverts, failing stormwater pipes, and crumbling bridges and roads that are vulnerable to the damage of heavy rainfall runoff. The third is the increasing intensity of storms and rainfall events that can far exceed the design storm the stormwater system was designed to manage. The combination of these three factors raises the threat of flooding in every setting and requires a multi-prong approach to address these pressures and create stormwater control systems that match current as well as future conditions in which these factors continue to escalate.

Environmental regulations for stormwater management are authorized under the Clean Water Act and are administered by the US EPA. Most states administer these regulations directly. Idaho is one of only four states where the EPA administers the program directly with local jurisdictions. There are two major regulatory statutes related to stormwater management. There is the National Pollution Discharge Elimination System (NPDES) which is a permitting system to prevent pollution to waters of states. NPDES permits address all sources of pollutants, including both end of pipe point discharges and non-point source pollution that comes with stormwater runoff. Municipalities above a certain size are required to have an NPDES permit for stormwater management referred to as the Municipal Separate Storm Sewer System, or MS4 permit system. This regulates how cities manage their stormwater runoff in order to prevent pollution from rainfall runoff, such as sediment from construction sites, oils and heavy metals from parking lots, toxins from landfills, sewage overflows, and many other types of stormwater pollution. Although Madison County and Rexburg do not currently fall under MS4 requirements, the guidelines and methods from those programs are an excellent model to improve the stormwater management practices with voluntary measures. Better stormwater management will build Madison resilience by helping to prevent damage and pollution, provide amenities that draw economic development, save money, protect health and safety, and get ahead of the curve for future regulations.

The NPDES and MS4 permit programs of Boise, Idaho are a useful model to review. The links below provide models from the City of Boise for a stormwater management plan and city ordinance, a stormwater design manual to ensure new developments meet current design standards, and partnerships for education and innovative projects using green infrastructure practices.

- City of Boise Stormwater Management Program:  
<https://www.partnersforcleanwater.org/media/1153/2019-city-of-boise-swmp-final.pdf>.
- City of Boise Stormwater Ordinance:  
[http://cityclerk.cityofboise.org/media/223712/13588\\_0815.pdf](http://cityclerk.cityofboise.org/media/223712/13588_0815.pdf).
- City of Boise Stormwater Management Design Manual:  
<https://www.cityofboise.org/media/4271/stormwaterdesignmanualrev2018.pdf>.
- Partnership Efforts for Boise Stormwater and Drainage Control:  
<https://www.partnersforcleanwater.org/>.
- Lower Boise River: Green Stormwater Infrastructure Online Tour:  
<https://boise.maps.arcgis.com/apps/MapJournal/index.html?appid=051136d2476a42b88db86d683cde5ecd>.

### **2.1.1. Stormwater Management Plan and/or Program**

Since heavy rain can contribute to flash floods, it is important for a community to be able to handle the potential volume of stormwater (i.e., have a system for conducting it to an infiltration, retention, or storage area). Madison County's ordinance governing the Sensitive Overlay Zone (117-61) recognizes the importance of stormwater management and requires the construction of stormwater collection and management facilities as the first step of site development. These facilities are supposed to be designed to manage the maximum expected stormwater runoff for a 10-year storm. In view of more extreme weather trends and growth patterns, the County may want to update calculations of what volume of stormwater a 10-year storm might produce based on projected rainfall and increased impervious cover. Future rainfall projections should be included at least out to the design life of new buildings and infrastructure under construction. The County may consider extending similar requirements to other zones.

Since stormwater management is so critical to flood management, it would be helpful to have a stormwater management program with a dedicated budget for Madison County, Rexburg, and Sugar City. Part of the budget could go toward raising community awareness about the importance of stormwater systems and upgrading the stormwater practices for new growth and development projects. These programs are appreciated when they are seen to be solving community problems with chronic flooding, damage to existing infrastructure, such as roads and bridges, or causing harm to nearby streams. There are models for setting up a Stormwater Program or Authority, some of which charge a modest stormwater fee on the water bill that generates funding for on-the-ground projects to solve runoff problems.

The County can help ensure that water infrastructure is prepared for flooding and extreme weather events using a tool such as EPA's Climate Resilience Evaluation and Awareness Tool (CREAT) (<https://www.epa.gov/crwu/build-climate-resilience-your-utility>), which helps users.

- Find out which extreme weather events pose significant challenges to the utility and build scenarios to identify potential impacts.
- Identify critical assets and the actions the utility can take to protect them from the consequences of a changing weather on utility operations.
- Generate reports describing the costs and benefits of risk-reduction strategies for decision-makers and shareholders.

### **2.1.2. Integrated Water Resource Management Plans**

Integrated Water Resource Management Plans (IWRM) are designed to integrate water management for all its major uses, including water supply, wastewater treatment, stormwater management, without interfering with water's ecological functions. Sometimes referred to as One Water, this more holistic approach requires more time and stakeholder engagement to accomplish. However, the end result does a much better job of meeting multiple needs and taking advantage of synergies and shared resources. There is also a strong link between water management and land use planning. Managing growth through land use planning has significant impacts on water resources. Land use decisions can affect

water quality, water demand, and water supply and relates back to other factors of resilience from land use choices. The benefits of IWRM include greater water security, sustainability, resilience, flood prevention, and conservation of water resources for healthy natural systems. IWRM approach also draws in multiple stakeholders that are sometimes left out of more limited water management approaches. Establishing a One Water team that regularly coordinates an integrated approach to water management will yield benefits in many ways across the planning spectrum.

### **2.1.3. Permeable Surfaces**

Permeable pavement is a special type of pavement with pores that allows rainwater to pass through it into the ground below, replenishing underground aquifers. There are many options for permeable surfaces to substitute for standard asphalt or concrete, such as pervious concrete, permeable pavers, and a variety of plastic grids that hold rock or soil substrates. Benefits include

- Reducing the need for water retention infrastructure
- Filtering pollutants with the stormwater system
- Reducing ground surface temperatures
- In winter conditions, reducing the amount of de-icing products needed
- Lower installation costs (no underground piping, storm drains, or sloping/grading)
- Potential for a longer life than regular concrete or asphalt when correctly install

When the County is considering capital improvements, it may want to consider permeable pavement for sidewalks, parking lots, and low-water bridges. Different types of permeable pavement are available for different types of structures.

- Highways--porous asphalt
- Very low speed areas (driveways and parking lots)--single-sized aggregate (loose gravel) with plastic grid enforcement
- Areas with occasional parking (stadiums)--porous turfs or permeable interlocking concrete pavers (units connect in a grid pattern, with in-between spaces filled with grass or gravel)

Permeable pavement does have some drawbacks, including

- Lower strength due to high void content (not recommended for highways and high-volume streets)
- Higher cost (although there are cost reductions from saving on stormwater installations)
- Frequent “vacuuming” or flushing maintenance to particles getting clogged (without this maintenance the pavement becomes like impervious concrete).
- The need to avoid installing on a ground surface exceeding a 20% slope (or else stormwater will run downhill over the permeable pavement).

### **2.1.4. Rainwater Harvesting**

Rainwater harvesting systems capture rainwater from roofs, parking lots, and other hard surfaces and redirect it to an underground or above-ground holding tank. Harvested rainwater can have a variety of secondary uses. It is most often lightly filtered for outdoor uses, such as gardens, lawns, washing cars, and other outdoor uses. With a more sophisticated system it can be filtered to a higher degree to some indoor uses, such as flushing toilets or showers, or sent to a second tank for later use. In some systems it can be filtered to a very high degree and serve as reuse for drinking water when necessary. At the household level, the holding tank can be as simple as a barrel positioned to catch water from a gutter, with the harvested water used for the lawn. Often there are 1000 to 5000 gallon cisterns above or below ground to capture the runoff with a pump to send to its second uses.

Rain harvesting can help reduce flooding in times of high intensity rainfall, provided the systems are used regularly and sufficient storage capacity is available before rain events. In some cases, very large scale rainwater harvesting is used on commercial sites to meet stormwater requirements by storing large volumes of stormwater for slow release or reuse for irrigation systems.

### **2.1.5. Urban Forests**

Urban trees are an efficient and affordable means of reducing stormwater impacts. As part of green infrastructure practices, they also improve public health, reduce energy costs, combat the heat island effect, and increase the visual quality of a community.

PennState Extension determined that one acre of pavement releases 36 times more runoff than a forest. During a rainfall event of one inch, one acre of forest will release 750 gallons of runoff, while a parking lot will release 27,000 gallons.

Studies indicate that land conserved for stormwater retention and flood prevention “show an eight-to-one dollar savings ratio versus man-made flood-control structures” (McDonald, Robert I. 2015. Conservation for Cities: How to Plan & Build Natural Infrastructure. Washington, D.C.: Island Press.)

#### **Additional Benefits of Urban Forests include**

- Lower heating and cooling energy costs: Lawrence Berkeley National Laboratory and Sacramento Municipal Utility District found that trees placed around houses to shade windows yielded between 7 and 47 percent energy savings. Trees planted in the west and southwest of buildings yielded the highest savings. Furthermore, a 20 percent tree canopy could result in cooling savings of 8-18 percent and heating savings of 2 to 8 percent. (1)
- Urban trees resulted in energy savings of 11+ kWh/tree (yard) and 1.4+ kWh/tree (street) in a study quantifying ecosystem services resulting from Portland, Oregon’s green infrastructure practices in 2009. (2)



## Urban Heat Island

- Through their leaves, trees also provide evaporative cooling, which increases air humidity. Shaded surfaces may be 20-45 degrees cooler, and evapo-transpiration can reduce peak summer temperatures by 2-9 degrees. (3)
- Peak air temperatures in tree groves are 9 degrees cooler than open areas without trees. Furthermore, suburban areas with mature trees are 4 to 6°F (2 to 3°C) cooler than new suburbs without trees. (1)
- Evergreens and conifers in Sacramento were found to intercept over 35 percent of the rainfall that hit them. (1)
- Green infrastructure approaches implemented in Chicago diverted over 70 million gallons of stormwater in 2009 from the combined sewer overflow (CSO) system. (4)

## Air Pollution

- Urban trees reduced particulate matter less than 10 micrometers in diameter (PM-10) by 0.2 lbs. per tree per year. Additional modeling found that 547 ha. of mixed greenspace within a 10 x 10 km square of East London could significantly reduce pollution with an estimated effect of two deaths and two hospital emissions avoided per year. (2,5)
- In urban areas with 100 percent tree canopy cover, trees can reduce hourly ozone by up to 15 percent, sulfur dioxide by 14 percent, and particulate matter by 13 percent. (3)
- Modeling of removal of pollution by trees across the urban areas of the United States estimated that they remove 711,000 tons of pollution from the air per year with an economic value of \$3.8 billion. This could be increased through increasing the density of tree cover. (3)

## Carbon Pollution

- The net rate of carbon sequestered by urban trees in the continental United States in 2005 is estimated to have been around 24 million tons per year (88.5 million tons CO<sub>2</sub>), while current total carbon storage in urban trees in the continental United States is approximately 700 million tons of carbon. (1)
- A single large healthy tree can remove greater than 300 pounds of carbon dioxide from the atmosphere every year. New York City's urban forest alone removes 154,000 tons of CO<sub>2</sub> annually. (3)
- The value of residential properties with the trees and vegetation are 3 to 10 percent higher than properties without. (1)
- Portland found an approximate increase of \$14,500 per tree for home value, including surrounding homes. (2) The increased home values can translate to increased property tax revenue for the local jurisdiction as well.
- Philadelphia is expecting an increase of up to \$390 million in property values near parks and green areas over the next 45 years. (6)

## Sources:

1. "Reducing Urban Heat Islands: Compendium of Strategies: Trees and Vegetation," U.S. Environmental Protection Agency <https://www.epa.gov/sites/production/files/2014-06/documents/treesandvegcompendium.pdf>
2. "Portland's Green Infrastructure: Quantifying the Health, Energy, and Community Livability Benefits," Environmental Services, City of Portland. <https://www.portlandoregon.gov/bes/article/298042>
3. "Sustaining America's Trees and Forests," U.S. Forest Service. [http://www.fs.fed.us/openspace/fote/reports/nrs-62\\_sustaining\\_americas\\_urban.pdf](http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf)
4. "Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide." ASLA. [https://www.asla.org/uploadedFiles/CMS/Government\\_Affairs/Federal\\_Government\\_Affairs/Banking%20on%20Green%20HighRes.pdf](https://www.asla.org/uploadedFiles/CMS/Government_Affairs/Federal_Government_Affairs/Banking%20on%20Green%20HighRes.pdf)
5. "Microeconomic Evidence for the Benefits of Investment in the Environment – review." Natural England. <http://publications.naturalengland.org.uk/publication/32031?category=49002>
6. "Green City, Clean Waters: Green Infrastructure – The Philadelphia Story." Philadelphia Parks & Recreation, The Dirt / ASLA. [http://aslathedirt.files.wordpress.com/2013/12/dupontsummit-asla-120613\\_final.pdf](http://aslathedirt.files.wordpress.com/2013/12/dupontsummit-asla-120613_final.pdf)

## 2.2. Urban Water Efficiency<sup>3</sup>

Managing water efficiently can significantly help to address the potential impacts of intense or prolonged drought conditions. One of the best approaches to a more sustainable water system is to manage water demand using best available water efficiency and conservation practices. Water efficiency involves using maximum efficiency of system design, construction, and equipment efficiency for both water and energy usage. Efficiency gains are applicable to all water systems including agricultural irrigation, municipal and industrial water supply, and protecting instream flow for natural habitat and hydropower production. Efficiency gains can be made through numerous policies and practices ranging from large scale land use policies to individual site scale policies for use of water efficient construction materials and water fixtures. This subsection discusses strategies for water efficiency that could be based in the zoning code, incorporated into capital improvements and utilities, or used in a consumer education strategy.

### 2.2.1. Zoning for Water Efficiency

Land use zoning can be used to encourage development close to existing infrastructure and clustering homes to minimize the length of water supply lines. This makes homes more affordable, reduces the costs of system maintenance, and decreases the water loss to system leaks, which can be a major factor

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<sup>3</sup> Agricultural water efficiency is addressed in Strategy 3, Strategies for Sustainable Agriculture.

for water utility operators. Other zoning strategies could incentivize (or use as a mitigation measure) actions that conserve water, such as

- Upgrading the construction requirements to “green plumbing” standards and calling for use of water efficient fixtures and appliances to reduce the per capita water use.
- Using drought-tolerant plants that do not require regular watering;
- Using compost or organic mulch as a ground cover to increase permeability and water holding capacity, reduce evaporation, and reduce the need for regular watering; and
- Including rain-harvesting barrels that can be used where potable water is not required.

### ***2.2.2. Municipal and Utility Efficiency***

The County can apply water conservation and efficiency strategies to its own properties:

- When the County is investing in capital improvements, it should consider installing infrastructure that uses less water (i.e., toilets in municipal buildings can have two buttons to allow more or less water to flush).
- A system to capture greywater can be installed to divert water from basins into surge tank for reuse for flushing toilets or watering lawns.
- Repair existing leaks in building pipes.
- Water utilities should strive for universal metering (i.e., make sure that all water use is accounted for and billed).

Water utilities can improve the water efficiency of their systems, including leak detection and repair and use of high efficiency water treatment and wastewater treatment systems. A resource for analysis and upgrades by utility companies is Creating Resilient Water Utilities (CRWU) (<https://www.epa.gov/crwu>), an EPA resource that provides water sector utilities with the practical tools, training, and technical assistance needed to increase resilience to extreme weather events.

### ***2.2.3. Consumer Outreach***

Strategies for water conservation practices generally focus on public outreach to convince households and businesses (water utility customers) to use less water. The following are some of the methods that can be used to encourage water conservation:

For residences, business, and organizations:

- Ensure the utility rate structure encourages water efficiency, or at least does not encourage water waste. If rates are raised, consider offering a rebate if a customer uses less than a certain amount of water in a given billing period.
- Provide information in utility bills, schools, community events, and other media regarding household strategies for water conservation, including installing devices that reduce faucet flow

and the amount of water flushed, fixing leaky faucets, using drought-tolerant landscaping (i.e., shifting from residential lawn turf to a xeriscape approach more attuned to a desert environment).

- Make available water conservation kits for residences and businesses available at cost. Kits could include low flow faucet aerators, high efficiency showerheads, leak detection for toilets, and replacement valves.
- Include information in utility bills showing how much a customer has conserved since the previous billing period, and how much more they would need to conserve to keep up with a neighbor that is conserving.

## **2.3. Energy - Water Nexus**

Saving water also means saving energy. A great deal of energy goes into collecting, cleaning, and pumping potable drinking water out to water users. Green infrastructure such as rain harvesting equipment can reduce the use of potable drinking water for uses like lawn irrigation, thereby reducing the amount of energy needed to produce and pump potable water and in turn reducing the emissions associated with energy production. It is in the interest of water utilities to know their customers' water uses and encourage water conservation, especially in an arid climate where water resources are scarce and need to be used wisely.

## **2.4. Energy Efficiency**

There are a number of policy approaches that support making progress on energy and water efficiency, materials conservation, and more (see for example <https://www.aceee.org/topic/building-policies>). Two are addressed here: building codes and building rating systems. Resilient land use and land management policies and ordinances also save energy and are addressed elsewhere in this report.

### **2.4.1. Building Codes**

Building codes are the foundation of any local effort to raise a community's collective energy and water efficiency and other resilience strategies. Building codes can address energy and water efficiency in both existing and new buildings. They set minimum standards aligned with local values, goals, and concerns. Building codes can be prescriptive (assigning minimum specific criteria that must be met in new construction and at times of major renovations); or performance based (sets minimum performance targets that allow designers and builders flexibility in how they will meet those targets). There are a number of model codes that can be resources for Madison County:

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 (commercial and high rise residential buildings)

- International Energy Conservation Code (IECC) (primary residential one- and two- family dwellings and small multi-family dwellings)
- The International Green Construction Code (IGCC) is a more sustainable and energy efficient version of ASHRAE 90.1 (see <https://www.ashrae.org/technical-resources/bookstore/standard-189-1>)

### **2.4.2. Building Rating and Transparency**

The most widely recognized and used independent green building certification system is LEED (Leadership in Energy and Environmental Design), which comes out of the US Green Building Council (see <https://www.usgbc.org> for extensive information on LEED and USGBC). LEED provides a measurable framework to ensure buildings and communities of all types are healthy, sustainable, and water- and energy- efficient. Projects under LEED are designed, built, operated and maintained to achieve performance metrics in the following categories:

- Location & transportation
- Sustainable sites
- Water efficiency
- Energy & atmosphere
- Materials & resources
- Indoor environmental quality

Additional credit is given for innovative strategies and strategies that address regional priorities (per USGBC).

There are a variety of ways that Madison County can use the LEED certification system to achieve its Objective 3.4 on green building standards, as well as a number of other objectives. The most successful local green building programs combine incentives with regulations and mandates to achieve rapid transformation in the resilience of their built environment.

Many of the goals and objectives laid out in Madison County’s plans are addressed by the LEED certification system, and LEED offers some additional strategies that can be considered in the planning process. Here are a few examples organized by category:

- Location and transportation: sensitive land protection, access to quality transit, reduced parking footprint
- Sustainable sites: protect or restore habitat, open space, rainwater management
- Water efficiency: outdoor and indoor water use reduction, building-level water metering
- Energy and atmosphere: achieve minimum energy performance, optimized energy performance, renewable energy production, green power and carbon offsets

- Materials & resources: storage and collection of recyclables, sourcing of raw materials, construction and demolition waste management
- Indoor environmental quality: indoor air quality; non-toxic materials, thermal comfort, daylight, and quality views

As of March, 2020 there are two LEED certified projects in Madison County, and a third in the pipeline (all in Rexburg). These are:

- The Grove: Certified at Platinum level under LEED BD+C Homes v3 LEED 2008 in December 2015
- Carlow Senior Apartments: Certified at Platinum level under LEED BD+C Homes v2 LEED 2008 in March 2017
- Hemming Mixed Used Office Retail is registered but not certified under LEED BD+C Core & Shell v2 LEED 2.0

These certifications can be highlighted as success stories and reported to the public for their benefits to occupants, landowners, and the community over time.

## 2.5. Renewable Energy Sources

Renewable energy sources provide a source of resilience by reducing reliance on imported fossil fuels that may be subject to fluctuating markets. Having alternate sources of power can be particularly important with the increasing frequency of severe weather events that knock out power. Renewable energy sources may also promote healthy air, reducing health risk for the elderly, children, and other vulnerable populations.

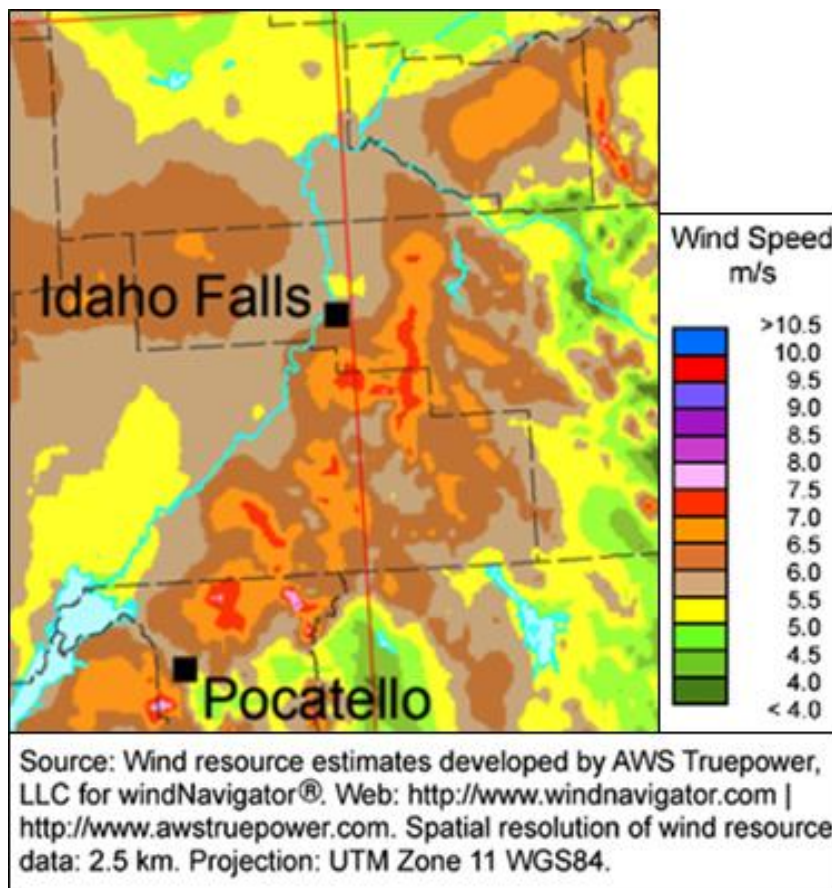
Idaho's utility scale in-state power generation was dominated by renewable sources (82%) in 2017 and that hasn't changed. Renewable energy is dominated by hydroelectric power. Idaho Power owns and operates 17 hydroelectric power plants along the Snake River and its tributaries. As Idaho's snowpack declines and the demand for decreasing water supplies increases, this source of energy will become less reliable. Coal fired power plants in Wyoming, Oregon and Nebraska provided significant power to Idaho, however due to market forces many of those plants will be retired in the coming years. (Idaho Governor's Office on Energy and Mineral Resources (<https://oemr.idaho.gov/>), US Energy Information Administration (<https://www.eia.gov/>)). Both hydropower and coal fired power are vulnerable to shifts in weather conditions and related market forces moving forward.

Madison County should invest time and resources in feasibility studies of various renewable energy sources, and identify those that have the most potential for public and private applications, and at what scale. Given the value placed on independence, the county should look into various methods of supporting distributed generation--approaches that produce energy close to where it will be consumed. Distributed generation can happen at multiple scales. It can be limited to a single residence or commercial building, or it can be part of a microgrid that provides power to larger scale projects such as a university campus or residential neighborhood.

Various policies are needed to support distributed generation, while others greatly facilitate its adoption. For an in-depth discussion about policy options, see <https://www.energy.gov/eere/slsc/renewable-energy-distributed-generation-policies-and-programs>.

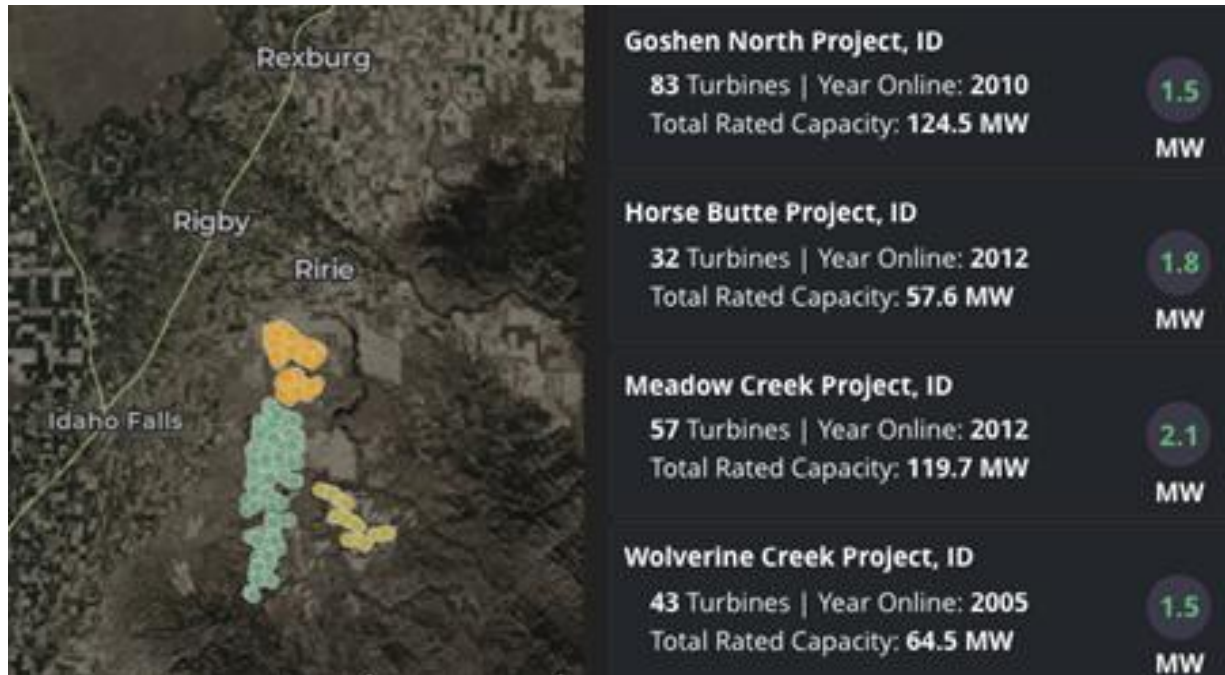
### 2.5.1. Wind Potential

There is substantial potential for wind generation in and around Madison County. The existing Madison County Code includes an ordinance (Article V, Wind Turbines) supporting wind turbines, providing a policy foundation for expanding wind energy production locally. As stated in Sec. 109-120, “Proper location and construction of small and commercial wind turbine facilities must be consistent with sound land use planning while allowing private and commercial providers to meet their generating objectives.” It is important to include wind energy and other renewable energy sources in a larger conversation about land use and comprehensive planning. That said, there is a need for planning to minimize any potential negative effects of wind turbines on residents. In October 2019, the Madison County Board of Supervisors voted for a moratorium on future wind and solar energy projects through October 2020, until an ordinance for wind and solar energy can be passed. This will be an opportunity to develop wind energy responsibly.



Source: <https://windexchange.energy.gov/maps-data/34>.

Four projects just south of Madison County in Bonneville County may serve as models for future wind development locally.



Source: <https://eerscmap.usgs.gov/uswtdb/viewer/#8/43.965/-112.971>.

## 2.5.2. Geothermal Energy

In an active volcanic area such as the Snake River Plain Volcanic Province, there is potential for geothermal energy. The Boise Geothermal Heating Utility, the largest in the country, delivers naturally heated 177° water through a network of pipes that (as of 2019) warmed more than 6 million square feet of building space. (<https://www.cityofboise.org/departments/public-works/geothermal/>)

Geothermal Energy, Inc. is studying decades of data from previous subsurface explorations within the Idaho Snake River Plain (SRP) volcanic province. Their Play-Fairway Analysis aims to identify targets within the SRP that show the greatest potential for geothermal energy production. The geothermal potential in this province has been estimated at over 800 MW of potential power production. For perspective, this is nearly a quarter of current geothermal production in the United States. ([https://openei.org/wiki/Snake\\_River\\_Plain\\_Geothermal\\_Region](https://openei.org/wiki/Snake_River_Plain_Geothermal_Region); <https://www.geothermalenergyinc.com/snake-river-plain-idaho>)

In addition to the value of centralized geothermal energy production, Madison County has the potential to link the construction and operation of geothermal plants to a new “green collar” vocational training program to help meet the growing need for trained renewable energy technicians and the demand for more use of renewable energy sources across the region. This pairing of geothermal energy with training programs would bring benefits to economic development, reduced cost of energy, and multiple environmental benefits from clean air and reduced carbon emissions. This concept could figure into implementation of the county’s economic development plan in future years.



# RESILIENCE STRATEGY 3:

## SUSTAINABLE AGRICULTURE

The third group of strategies relates to sustainable agriculture from a policy and planning perspective, as well as from sustainable and resilient on-the-ground farming practices. Planning for sustainable agriculture means planning for both ecological and economic sustainability, including farmland conservation (in land use discussion above), food and water security, drought preparedness, extreme weather resilience, and agricultural economic development.

### 3.1. Planning for Agriculture

Planning for agriculture means supporting food production and agricultural economic development and to protect and conserve farmland for current and future generations. It involves steering urban growth away from active agricultural communities, reducing regulatory barriers, encouraging appropriate infrastructure development and new opportunities, and addressing the sustainable use of agricultural resources. The [Farmland Information Center](#), a partnership between the USDA NRCS and American Farmland Trust, offers more information on planning for agriculture. See [How to Plan for Agriculture and Toolbox](#).

Farmland Information Center: <https://www.farmlandinfo.org/>

How to Plan for Agriculture: <https://farmlandinfo.org/how-to-plan-for-agriculture/>

Farmland Toolbox: <http://farmlandinfo.org/toolbox/>

### 3.2. Water Availability

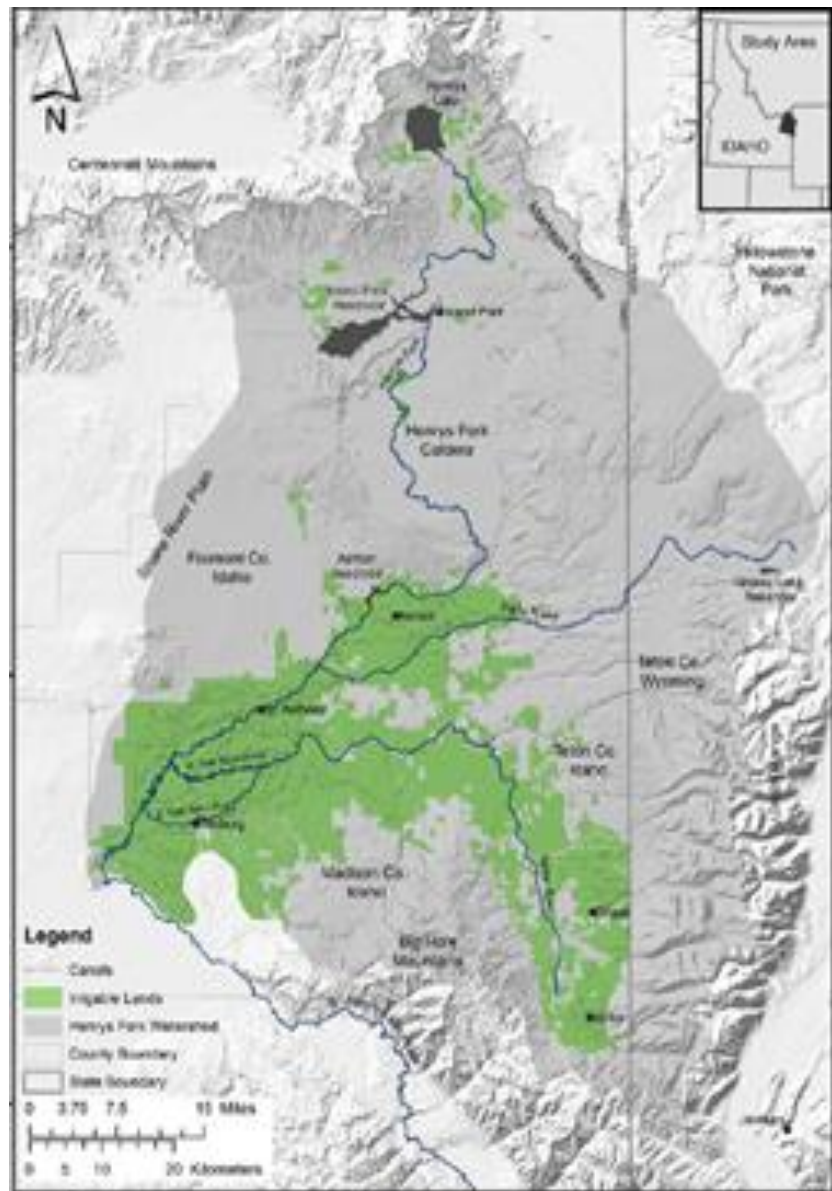
The availability and timing of water is the greatest single limiting factor for agricultural production in the region. Most of the water available for agricultural use comes from melting snowpack and surface waters, with little precipitation during the growing season. Water is supplied to farms via a system of irrigation canals, managed by the Fremont-Madison Irrigation District. The irrigation canals provide water to an estimated 125,913 acres in Madison County. In addition, some farms utilize groundwater via wells.

People depend on the Eastern Snake Plain Aquifer for municipal and residential water supplies and some limited agricultural irrigation. In recent years there has been a great deal of concern about falling groundwater levels in the Eastern Snake Plain Aquifer due to diversion of water supplies for human uses. The region already experiences frequent water scarcity and drought conditions. Madison County had seven declarations of drought from 2001-2014. In 2009 the Idaho Department of Water Resources began an extensive aquifer recharge project designed to eliminate a 600,000 acre-feet annual deficit of water recharging the aquifer.

The Henry's Fork Watershed Basin Study Water Needs Assessment (2012) determined that:

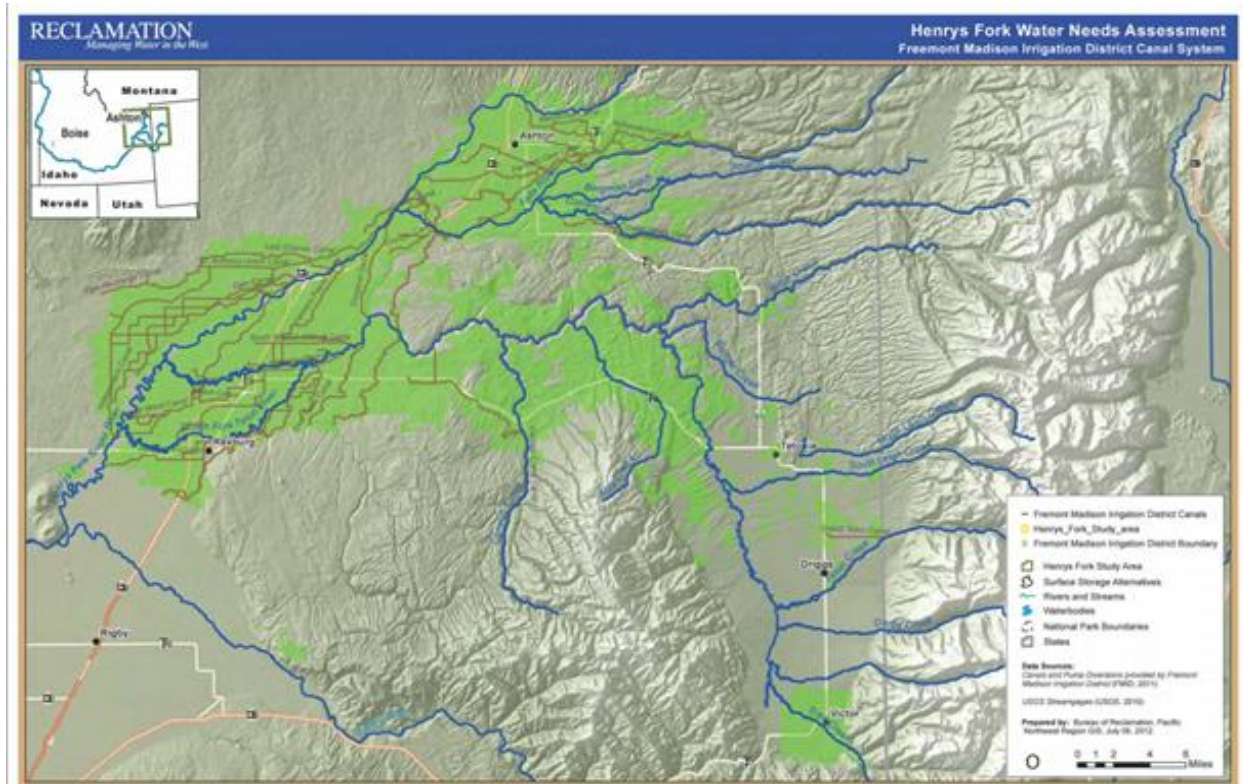
- During years with drought conditions, many of the irrigators in the Freemont Madison Irrigation District (FMID) have inadequate water supplies. A statistical analysis of all water years since 1972 showed that drought conditions occurred in one-third of those years.
- During an average water year and without regard to water right priorities, the current unmet needs for all of the irrigated lands are estimated at more than 80,000 acre-feet or 23 percent of the total water needs. A drought year exacerbates the water needs in the basin, with more than 36 percent of the total water needs unmet.
- An analysis of actual irrigation diversions in recent years indicates that even with the more efficient irrigation methods, FMID does not have a sufficient water supply during average and less-than-average water years.

### Henry's Fork Watershed Basin



*Source: From Henry's Fork Drought Response Plan.*

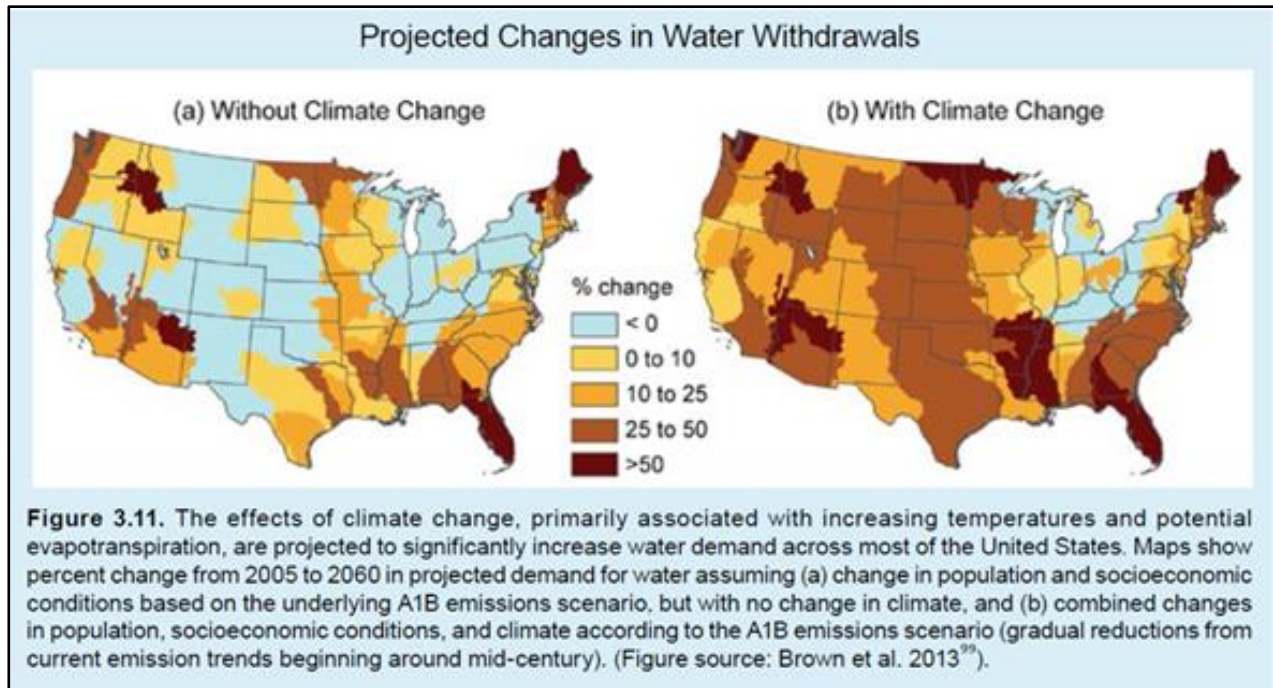
## Henry's Fork Water Needs Assessment



Source: <https://www.usbr.gov/pn/studies/henrysfork/techrept/interim/appa.pdf>.

### Henry's Fork Watershed

Projections show that changes in weather extremes will increase water demands in the region by as much as 25-50% by 2060. Temperature increases are already resulting in a hotter and longer growing season. These trends are expected to increase the frequency of temperature-induced drought conditions, and increase agricultural water demand in general.



*Source: Brown, T. C., R. Foti, and J. A. Ramirez (2013), Projected freshwater withdrawals in the United States under a changing climate, Water Resource. Res., 49, 1259–1276, doi:10.1002/wrcr.20076. [https://www.fs.fed.us/rm/pubs\\_other/rmrs\\_2013\\_brown\\_t001.pdf](https://www.fs.fed.us/rm/pubs_other/rmrs_2013_brown_t001.pdf) (March 2013).*

### 3.3. Water Timing

The most significant change in water availability that will affect agriculture will likely be changes in the timing of water flows. Snowpack is declining due to increased temperatures and more precipitation falling as rain rather than snow. The loss of slowly melting snowpack, which the region has relied on to store water over the winter and gradually release that water during the summer dry season, is a serious risk to summer stream flows and aquatic habitat. In addition, precipitation is expected to increase in spring and decrease in summer. As a result, there is more water flowing during the winter and spring, and less flowing during the warmer months of the growing season.

In addition to increasing water scarcity in the summer, these trends are increasing the potential for spring flooding, which is already a concern. Since 1958, the amount of rain falling during heavy precipitation events has increased by 12% in the Northwest. Heavy precipitation events are more likely to result in flooding and damage to crops. Methods are needed to help offset the disruptions in water flow timing, such as increasing upstream storage capacity for summer release as needed and adjusting the downstream water management practices to help blunt the rise in agricultural water demand during the hot summer months. Riparian restoration with vegetative cover along streams and canals can also help to cool surface waters and reduce water loss from evaporation in summer months.

## 3.4. Agricultural Water Management & Efficiency

Increasing the efficiency of on-farm water use is an important strategy for reducing the impacts of water scarcity. Opportunities to improve water management include:

- Increase the use of high-efficiency irrigation techniques, such as Low Elevation Spray Application (LESA), or drip irrigation in some instances.
- Improve soil health with increased organic matter and reduced erosion to reduce water needs
- Explore alternative crops and varieties that require less water
- Investigate upstream water capture & storage without disrupting stream channels
- Use of precision irrigation practices including soil moisture content monitoring
- Increase use of cover crops to support soil health programs

## 3.5. Soil Health

Intensive agricultural systems within the inland PNW have depleted more than 50% of native soil organic matter (SOM), deteriorated soil microbial community, faunal diversity, and soil structure, and increased soil erosion. Both wind and water soil erosion rates are high in the region and are expected to increase due to many factors including storm intensity and less precipitation falling as snow.

Improving soil health in the region may be the most beneficial strategy for adapting to changing weather trends in the region, and especially for adjusting to warmer temperatures and water scarcity. Benefits of improving soil health include:

- Increased soil water holding capacity and reduced water needs
- Increased fertility and productivity
- Reduced soil erosion
- Increased resistance to pests and disease
- Reduced input costs
- Reduced flooding
- Increased carbon sequestration.

Farmers have additional opportunities to increase profitability through the use of precision farming techniques such as integrated pest, weed, and disease management, precision nitrogen management, and alternative crops that are adapted to new climate conditions.

Recommended practices that show significant promise for farmers in Madison County include

- Rotational Diversification and Intensification

- Cover Crops in various configurations
- Crop residue management
- Conservation tillage
- Fertility management
- Alternative crops

According to the 2017 Census of Agriculture, the use of conservation practices is very limited in Madison County. However, local research by the Madison Soil and Water Conservation District indicates that conservation practices have significant soil health benefits in the region. The Madison Soil and Water Conservation District located in Rexburg, Madison County, Idaho conducted a study as part of the Madison County Soil Health Initiative to provide data that shows sound Soil Health Practices such as Cover Crops, No-Tillage/Minimum Tillage, Variable Rate Fertilizing and diverse crop rotations will improve soil productivity, conserve irrigation water, increase resource savings, reduce erosion, and be economically viable to agricultural producers. The following briefly summarizes several high priority conservation practices for Madison County to encourage with education and demonstration projects.

See Madison County Healthy Soil Initiative <https://projects.sare.org/project-reports/ow15-032/> Madison Soil and Water Conservation District, 2015-2017.

### ***3.5.1. Conservation Tillage & Crop Residue Management***

Conservation tillage systems have been increasingly adopted by growers in the inland PNW to:

- Conserve soil fertility and soil organic matter
- Increase soil water holding capacity
- Reduce soil erosion
- Improve sustainability of dryland cropping systems in the region
- Reduce fuel and labor costs
- Facilitate improved crop residue management
- Contribute to low carbon farming outcomes.

In the inland PNW, under conventional tillage systems such as plowing, disking, or chiseling, residues are recycled by incorporating them into the soil. Alternatively, under conservation tillage systems, residues are recycled by leaving them to decay on the field surface.

### ***3.5.2. Rotational Diversification and Cover Crops***

Rotational diversification and intensification have been shown to increase soil health, reduce fertilizer use/cost, increase farm productivity, and increase farmers' ability to adapt to changes in growing

conditions and markets. The use of rotational diversification can significantly impact the production of primary crops while producing an additional crop. For instance:

- Arable cropping systems with legumes reduced N fertilizer use 24%
- Wheat yields following pea or lentil cover crops can be 10–20% greater than in a wheat-fallow rotation
- Wheat yields following canola can be 10–30% greater
- Diversification with cover crops is a highly recommended soil health practice that has many benefits, including improving soil health, reducing water needs, suppressing pests and disease, and increasing general productivity.

As growing conditions change, farmers should explore potential alternative crops that may not have been practical to grow in the past. Shifting growing zones and a longer growing season may present opportunities to introduce new crops, and may make some traditional crops less productive.

### **3.5.3. Fertility Management**

Precision Farming and Soil Fertility Management are systems that use science, data collection and technology to precisely match farming practices to local conditions and crop needs. The goal of fertility management is to avoid the harmful and expensive overuse of fertilizers. Careful fertility management helps farmers maximize productivity and minimize costs, while also reducing damage to soils and water resources.

### **3.5.4. Carbon Sequestration**

A number of new technical advances and sustainable agricultural practices are undergoing research and early applications on innovative farms in the region. Studies indicate that soil health practices have significant potential for increasing carbon sequestration on agricultural lands and generating additional income for farmers with carbon offsets. These practices include a range of soil health innovations in low carbon farming that can increase carbon storage in the soil, reversing the typical carbon loss from traditional agriculture. The end result for the farmer is lower costs, higher productivity, and healthier agroecosystem.

The practices found in the table below represent those that could be applied within the state without affecting local crop markets and the best practices or activities.

### Potential Statewide Carbon Sequestration

Practice	CO2-e Million Metric Tons/year
Cropland related	6.9
Forest land related	2.6
Livestock related	2.1
Grazing land related	1.5
Ethanol and biodiesel production	1.1
Riparian and wetland area related	0.4
<b>Total</b>	<b>14.6</b>

If there were about 14.6 million metric tons of CO2e offsets (credits) produced in the state, and these offsets were purchased at \$10 per metric ton, then the state could see \$146 million dollars come into the state.

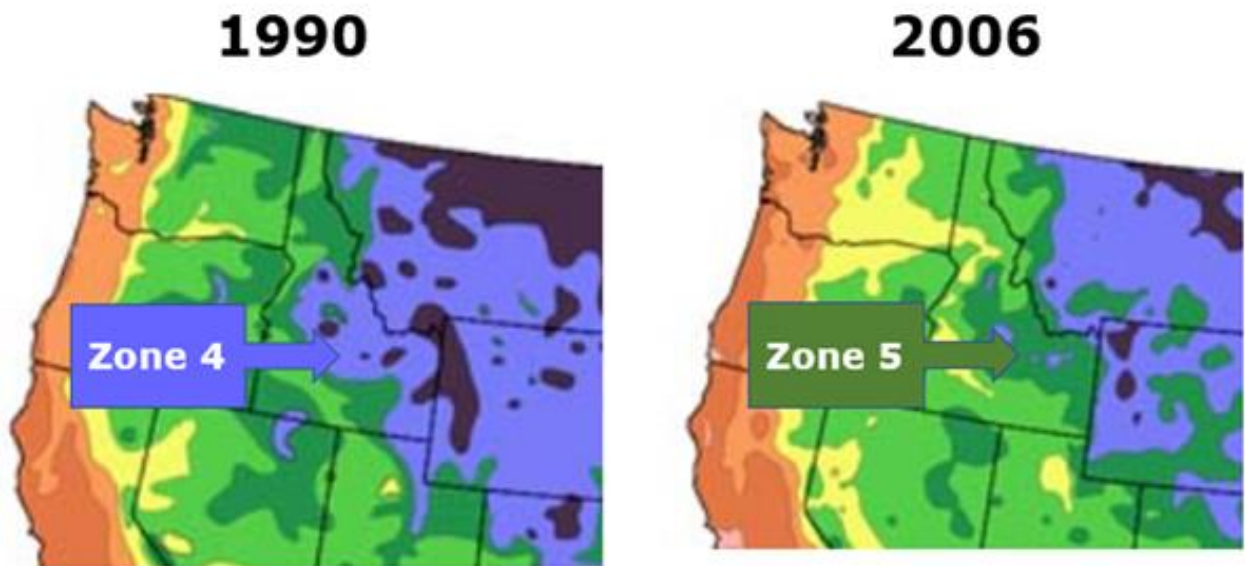
### **3.5.5. *Alternative Crops***

As growing conditions change, farmers should explore potential alternative crops that may not have been practical to grow in the past. Shifting growing zones and a longer growing season may present opportunities to introduce new crops, and may make some traditional crops less productive.

## **3.6. Integrated Pest, Weed and Disease Management**

Changes in weather conditions are expected to result in increasing difficulty in the management of pests, weeds, and diseases. Significant temperature increases have been observed in the region. This is resulting in a hotter and longer growing season. In addition, the frost-free season length in the Northwest has increased by an average of 16 days since 1960, and the region has experienced a shift in USDA Hardiness Zones.





*Source: USDA Agricultural Research Service*

Impacts of these trends include:

- Higher temperatures will result in increased growth, reproduction, and distribution of pests, weeds, and diseases.
- Warmer winters and fewer frost-free days will reduce winter mortality of pests, weeds, and diseases.
- Longer growing seasons allow pests, weeds, and diseases to produce more generations per year which can lead to pests developing greater resistance to controls.
- Shifting hardiness zones will introduce new pests, weeds, and diseases.
- More intense storms will increase damages to crops, including hail and floods, resulting in greater susceptibility to pests, weeds, and diseases.

Integrated Pest, Weed, and Disease Management is a precise system for managing crop pests that relies heavily on prevention and control vs. pest eradication using chemicals. It can reduce costs and result in improved pest management, and relies on the following practices:

- Acceptable pest levels—control, not eradication.
- Preventive cultural practices—Crop variety selection, soil health, plant health.
- Monitoring—Regular observation is critically important.
- Mechanical controls—should a pest reach an unacceptable level, mechanical methods are the first options.
- Biological controls—Natural biological processes and materials can provide control, with acceptable environmental impact, and often at lower cost.

- Responsible use—Synthetic pesticides are used as a last resort. Matching the application technique to the crop, the pest, and the pesticide is critical.

### **The Economic Impact of Integrated Pest Management**

There is a growing body of literature from the U.S. on the relative costs and benefits of integrated pest management (IPM) programs. A [review \(1\)](#) of 61 of these studies, from across more than 25 states and varying crop types, was described by George Norton and Jeffrey Mullen at the Virginia Cooperative Extension. A large proportion of the cases saw a decrease in production cost, an increase in yield, and an increase in net returns per acre. In the northwest, alfalfa producers that utilized IPM used 2% less pesticides, increased yields by 13% and increased net returns per acre by 37%.

Across Europe and Latin America, IPM has been shown to be potentially profitable for potato production – notably in managing both molds and insects, including click beetle larvae (wireworms), leaf miner flies and budge midges. IPM practices utilized by potato farmers include seed treatment, insect pest, disease scouting using action thresholds for decision making to apply pesticides, and the use of trapping devices and selective insecticides versus chemical control. In the central coast of Peru, IPM strategies reduced pesticide use by 69.2%, while achieving 35% higher marketable potato yields and a higher net profit of US \$1,410/hectare. (2)

### **Case Example: Texas High Plains**

Integrated Pest Management practices were first introduced to the Texas High Plains in 1976. There, corn, cotton, sorghum and wheat produce an annual market value of \$1.83 billion and account for nearly 6 million acres harvested. Producers of these four crops have utilized a combination of relatively simple IPM techniques -- chemical, biological, cultural, physical and genetic -- that keep the pest populations at low, non-economic levels and utilize chemical applications only after economic thresholds have been reached. These practices have resulted in not only cost and/or labor saving, but have reduced the number and amount of pesticide applications. In 2000, IPM practices reduced production costs by more than \$173 million per year, and reduced environmental costs by more than \$99 million per year (as estimated by the public's 'willingness to pay' to reduce environmental risk). In 2001, the total economic value of IPM benefits to Texas producers of these four crops exceeded \$272 million per year ([Colette et al., 2001- \(3\)](#)).

(1) Economic Evaluation of Integrated Pest Management Programs

[https://vtechworks.lib.vt.edu/bitstream/handle/10919/24664/VCE448\\_120\\_1994.pdf?sequence=1&isAllowed=y](https://vtechworks.lib.vt.edu/bitstream/handle/10919/24664/VCE448_120_1994.pdf?sequence=1&isAllowed=y)

(2) Ecologic, economic, and environmental assessments of IPM in potato: Case study from Peru

<https://onlinelibrary.wiley.com/doi/full/10.1002/fes3.153>

(3) Colette et al, 2001

<https://ageconsearch.umn.edu/record/36136/files/sp01co01.pdf>

# RESILIENCE STRATEGY 4: EMERGENCY PREPAREDNESS AND COMMUNITY ENGAGEMENT

The fourth group of strategies are designed to broaden emergency preparedness for increasing risks from extreme weather, from flash floods to drought; from winter storms to summer heat stress. Emergency preparedness goes hand in hand with community awareness and engagement. This section also considers how community engagement can build resilience through social connections and a shared sense of preparedness and mutual support. The forthcoming updated Hazard Mitigation Plan is expected to include in depth discussion of emergency preparedness and community engagement. Once that plan is approved and disseminated, this section of the report should be reviewed in light of additional information, plans for engagement and outreach, and other related material.

## 4.1. Hazard Mitigation

### 4.1.1. *Wildfire Response*

The risk of wildfire has risen dramatically. This has happened not just in Idaho but across the entire Western US. Two critical areas for resilience from wildfire hazards and emergency preparedness are 1) Firewise and fire safety programs to prevent and respond to building fires in the wildlife urban interface (WUI) zone; and 2) staying safe during bad air quality days from regional wildfire smoke.

#### **Wildfire Mitigation**

The Madison County Emergency Management program can draw from extensive materials provided by FEMA and other sources to raise awareness regarding fire prevention and response, especially for those homes located in fire prone areas in the wildland urban interface zones. The EM can also institute a drought warning alert for the WUI zone so homeowners know of the increased risk of fire from drought conditions.

In addition to the fire prevention materials of FireWise programs, FEMA has extensive materials on Wildfire Safety to Prepare NOW, Survive DURING, and Be Safe AFTER a wildfire event:  
<https://www.ready.gov/wildfires>.

#### **Air Quality**

Depending on the atmospheric conditions, smoke from as far away as California or Alaska can have a significant impact on air quality in Madison County, ID. In fact, the likelihood of nonlocal wildfires causing poor air quality days is higher perhaps than a wildfire occurring within county boundaries.

Wildfire smoke, a mix of gas and fine particulate matter, has multiple negative health effects. It can irritate eyes, irritate respiratory systems, and worsen chronic heart and lung conditions. Prolonged smoke events can have mental health impacts as well.

### **Wildfires and Smoke in Idaho, August 2012.**



*Source: NASA Earth Observatory.*

You can't prevent a wildfire happening outside your county, or outside of your state. Strategies for reducing the negative impacts of these wildfire events include:

- Tracking and notification systems, with emergency notification systems sending out air quality alerts.
- Invest in high quality HEPA air filtration systems for buildings where vulnerable residents congregate (e.g. hospitals, schools, nursing homes).
- Identify air quality centers, conditioned spaces where people most vulnerable to smoke can stay.
- Schools should have alternative plans for outdoor activities such as sporting events, and a threshold beyond which such events will be cancelled or moved indoors.

AirNow has a wildfire smoke guide for public health officials with a great deal of information, as well as a number of accompanying fact sheets:

[https://airnow.gov/index.cfm?action=topics.smoke\\_wildfires\\_guide\\_factsheets](https://airnow.gov/index.cfm?action=topics.smoke_wildfires_guide_factsheets).

### **4.1.2. Extreme Heat Response**

Planning for extreme heat events in Madison County feels perhaps unnecessary and certainly unfamiliar. However, projections show an increase in the number of days over 90 degrees. Communities like those in the county are not designed to respond to prolonged hot days, literally. For example, homes often lack air conditioning.

Part of planning for extreme heat events are focused on cooling strategies at the community level. These can be encouraged through a variety of policies and programs. Common strategies include:

- Increasing trees and vegetation, which lowers surface and air temperatures through shading and evapotranspiration;
- Green roofs, or planting vegetation on top of commercial and residential buildings, reduces roof and surrounding air temperatures with the added benefit of helping with stormwater management;
- Cool roofs, light colored roofs that reflect sunlight and heat away from buildings, reduce roof temperatures and lower demand on cooling systems;
- Cool pavements, paving materials that remain cooler than traditional paving materials, cools pavement surfaces, surrounding air, and reduces heat in stormwater runoff to streams;
- Responsible growth strategies, those that protect the natural environment while making communities more livable, often have a cooling component.

See <https://www.epa.gov/heat-islands/heat-island-cooling-strategies> for more information.

The Excessive Heat Events Guidebook published by the EPA is a great resource to help communities plan and respond to these extreme weather events: [https://www.epa.gov/sites/production/files/2016-03/documents/eheguide\\_final.pdf](https://www.epa.gov/sites/production/files/2016-03/documents/eheguide_final.pdf).

### **4.1.3. Flood Response**

Flooding is the most common and most costly natural disaster experienced by most communities. Floods are expected to happen in floodplain areas along lakes and streams. However flood events can happen in unexpected locations any time that extremely heavy precipitation occurs or when rainfall is coupled with a blocked stormwater drain or other stormwater management problem that may occur.

The first flood response is to try to prevent flood damage in the first place. That starts with policies to prevent building in the floodplain or removing existing structures from floodplains with a history of chronic flooding.

If the County determines that some vulnerable areas are too dangerous for inhabitation (for flooding or other reasons), the County may participate in Federal Emergency Management Agency (FEMA)-sponsored buyout or relocation programs. Through both the Hazard Mitigation Grant Program and the Pre-Disaster Mitigation Program, FEMA provides funding to states (which in turn provide funding to

communities with Hazard Mitigation Plans) to carry out projects designed to reduce vulnerability to hazards, including flooding. Those who participate in NFIP (including Madison County) are eligible to get funding through FEMA's Flooding Mitigation Assistance. FEMA money can be used to relocate buildings out of the floodplain, or to purchase the property, in which case the owners would voluntarily accept the money and move elsewhere. The County would then own the land and would have to ensure that it is preserved in perpetuity as open space. Such programs must be voluntary—residents must believe that they can benefit from living elsewhere and be willing to accept the buyout amount (which reflects the market value and is often less than the amount needed to buy or build a new house).

Responding well to a flood event as it is happening and in the immediate days after requires advance education and preparation. The Madison County Emergency Management department can facilitate flood safety with a series of educational opportunities with residents, businesses, and organizations in the region. Potential flood victims need to participate in weather alert systems for advance flood warning and then know what to do if caught in a flooding situation in a building or a car. For greater resilience and education of local population, the Madison County Emergency Management Department can draw from the extensive materials available from FEMA and other sources to encourage all residents to have an emergency plan, prepare an emergency kit ready to use, and understand a few critical elements about flood safety, before, during and after the flood event, including remembering the important phrase: "Turn around, don't drown!" so they never drive through flood waters.

FEMA provides guidance on how to prepare for and respond during and after a flood event. This should be part of every emergency preparedness kit for all homes and the business continuity plan for organizations and businesses.

See FEMA - Flood Safety: Prepare NOW; Survive DURING, and Be Safe AFTER.

For the public: <https://www.ready.gov/floods>

For the EM Department: [Flood Safety Social Media Toolkit | Ready.gov](#)

#### **4.1.4. Emergency Planning for Vulnerable People**

Madison County already has strong values regarding protecting more vulnerable members of the community through the faith-based traditions of the Church of Latter Day Saints to look out for others in one's support network, with a system of LDS wards and stakes. These principles also apply to land use planning. It is important that plans assess and address the needs of people who might be particularly vulnerable and/or are likely to be most affected by hazards, especially if they live in areas that are at higher risk (like frequently flooded areas or areas that interface with wooded areas). Advance mapping by the emergency department of their locations, numbers, and constraints can help with effective response and rescue operations.

- Examples of potentially vulnerable people include the elderly or disabled, renters who cannot make changes to their homes, people who do not speak English well, low-income people, children and pregnant women, and people who do not have a vehicle for evacuations.

- Examples of strategies for protecting these populations include designating shelters for those whose buildings lack adequate heat or cooling (perhaps in collaboration with local churches) and organizing emergency transportation (i.e., a bus to bring people to shelters or somewhere out of the county in an extreme disaster).

#### **4.1.5. Power Outage Response Plan**

Power outages of any kind can pose serious risks to people in a variety of ways. People with health conditions or disabilities can be at risk any time their lights go out and medical equipment (oxygen machines or ventilators) are not working. The risk expands to everyone during prolonged power outages during extreme cold weather or extreme hot weather. It is important for homes and businesses to anticipate the possibility of a prolonged power outage and make preparations. FEMA provides guidance on how to prepare and manage power outages for homes and business. This should be part of every emergency preparedness kit for homes and the business continuity plan for organizations and businesses. See FEMA - How to Prepare and Protect Yourself During Power Outages, <https://www.ready.gov/power-outages>.

##### **Hazard Mitigation Saves**

“Carrying out a slate of coordinated mitigation activities over time is the best way to ensure that communities will be physically, socially, and economically resilient in coping with future hazard impacts.”

Source: Multihazard Mitigation Council, [Natural Hazard Mitigation Saves](#), 2005.

There is little question that disaster risk reduction mitigates negative economic, social and environmental impacts of natural hazards such as floods, hurricanes, tornadoes and earthquakes. In an independent review of FEMA investments in 4,000 domestic mitigation programs, the Multihazard Mitigation Council found, on average, a dollar spent on actions to reduce disaster losses provides the nation roughly \$4 in future benefits. Benefits included reductions in direct property damage, direct and indirect business interruption, nonmarket damage and cost of emergency response. Furthermore, FEMA grants to mitigate the impacts of natural hazards between 1993 and 2003 are expected to prevent 220 deaths and 4,700 injuries over 50 years. In total, the MMC study estimates the societal benefits of hazard mitigation grants during the ten-year time period yield a discounted present value of \$14 billion compared to \$3.5 billion in resources employed. FEMA-funded mitigation strategies brought about the most additional non-federally funded mitigation benefits if the FEMA grant helped to institutionalize mitigation in communities.

The Natural Hazard Mitigation Saves: 2017 Update Report further confirmed the beneficial payback of hazard mitigation:

“Mitigation represents a sound financial investment. This Interim Study examined two sets of mitigation strategies and found that **society saves \$6 for every \$1 spent through mitigation grants** funded through select federal agencies and a corresponding benefit-cost ratio (BCR) of 4:1 for investments to exceed select provisions of the 2015 model building codes”.






National Benefit-Cost Ratio Per Peril <small>*BCR numbers in this study have been rounded</small>		Federally Funded	Beyond Code Requirements
<b>Overall Hazard Benefit-Cost Ratio</b>		<b>6:1</b>	<b>4:1</b>
 <b>Riverine Flood</b>		7:1	5:1
 <b>Hurricane Surge</b>		Too few grants	7:1
 <b>Wind</b>		5:1	5:1
 <b>Earthquake</b>		3:1	4:1
 <b>Wildland-Urban Interface Fire</b>		3:1	4:1

Table 1. Benefit-Cost Ratio by Hazard and Mitigation Measure.

*Source: Natural Hazard Mitigation Saves, 2017 Interim Report: [https://www.fema.gov/media-library-data/1516812817859-9f866330bd6a1a93f54cdc61088f310a/MS2\\_2017InterimReport.pdf](https://www.fema.gov/media-library-data/1516812817859-9f866330bd6a1a93f54cdc61088f310a/MS2_2017InterimReport.pdf).*

## 4.2. Outreach

Madison County’s Strategic Goal 9 is to develop a collaborative, multi-jurisdiction educational campaign on sustainability and resilience to extreme weather and secondary impacts to public health and safety, including floodplain protection, flood mitigation practices, wildfire response and air quality impacts, and other extreme weather impacts to people, infrastructure, and natural resources. Strategic objective 9.1 suggests that the County, Rexburg and Sugar City conduct a series of presentations and forums focused on a variety of topics related to sustainability and resilience strategies.

It is crucial that the three jurisdictions partner with other departments, agencies, and stakeholders to ensure these dialogues are well attended and achieve their underlying mission. Madison County Homeland Security can play an important role in educating residents about hazards and the reasoning behind land use ordinances that strive to avoid hazards (such as the Floodplain Overlay). Residents, especially those who may have recently moved to more-vulnerable areas, can have unreasonable expectations that their property will be safe or Homeland Security will always be there to rescue them. It is important that residents are educated on risks and the limits of the County’s ability to help mitigate those risks.



An effective response plan integrates forecasting and warning systems, education and awareness campaigns, and coordinated response strategies, targeting those who are most vulnerable (e.g. children, elderly, people with chronic illness, outdoor workers, etc.). Common strategies that are appropriate to Madison County include:

- Mobilizing through social networks, utilizing LDS and other community gathering places;
- Establish neighborhood shelters and emergency centers such as schools or churches, with conditioned space that can be made available to vulnerable residents during an extreme weather event;
- Establishing a non-emergency helpline (perhaps in partnership with EIPH)
- Extreme Weather Alert systems are an important element to warn people of imminent weather impacts, such as storms and floods. Both FEMA and Madison County have weather alert systems available from their website and through Cell Phone Apps. Local TV weather stations often have weather alert apps as well. Weather alert radios are also available. It is good to cross reference and encourage the use of alert systems to increase safety during extreme weather events.
- Local and regional television weather media can also be a great partner for extreme weather education. It is good to encourage them to include weather related hazard information during their regular weather reports and refer people to where to learn more. Some TV stations have traveling outreach programs for schools to teach kids about weather safety.

There are two main channels for conducting education and outreach around emergency preparedness in Madison County--The Church of Latter Day Saints and the Eastern Idaho Public Health System. These are discussed in more detail below.

#### **4.2.1. Mobilizing the LDS Support System**

Emergency preparedness is a value embedded deeply in local congregations and the Church of Latter Day Saints (LDS) in general. Local church wards and stakes have a number of ways in which they help families be prepared for emergencies. They have emergency classes on food preparedness, emergency supply kits, and supplies for home power outages. Wards and stakes are organized hubs for dissemination of information through social gatherings, family and community networks, announcements at church, newsletter articles, and more. They also respond to emergencies with a social network to check on members and ensure everyone is safe and taken care of.

There are numerous opportunities to work with the LDS community to disseminate information on extreme weather preparedness and to integrate related curriculum into ongoing educational offerings through the church. Creating an extreme weather primer and emergency response insert for household emergency handbooks is one way that might quickly reach into homes and businesses with useful information on how to prevent, prepare, and response to storms, floods, drought, and other weather related events.

### **4.2.2. Public Health System**

Public health systems are set up to educate and engage the public, and to conduct outreach around prevention and preparedness. Idaho's public health system is divided into districts. Madison County is represented by the East Idaho Public Health District (EIPH), based in Idaho Falls. EIPH has public information officers on staff, who are the primary points of contact for disseminating information to the public on a range of topics, including emergency preparedness. Working through these public information officers will give resiliency staff access to TV and newspapers, newsletters, EIPH social media (including Facebook), and the EIPH website.

Public health education is vital to all levels of a community. In addition to the standard public health messages about diet and exercise, disease and wellness, there are significant opportunities for public health information to educate people about the hazards of severe weather and related environmental problems, such as bad air quality from forest fires and water pollution from flood water runoff. Some of the most important public health topics for reducing the impact of extreme weather include messages on extreme heat days, flood prevention, preparedness, and safety; air quality alerts; water quality alerts; storm and tornado safety; and avoiding hazardous areas, such as landslide areas and flood waters.

East Idaho Public Health offers robust public health resources. They have a website, newsletters, classes, reports, and public health topic papers. Recently they completed a Community Needs Assessment for several counties, including Madison County. They plan to use the information gathered to help target their educational programs to meet local needs. Counties and cities in the region would do well to review their assessment findings and be aware of local needs and priorities. Then look for opportunities where extreme weather health and safety could match up with local public health needs. For example, mental health is a high priority among the youth of the County. Organizing outdoor, hands-on-volunteer activities for environmental restoration and recreation might help get hazard mitigation work completed and bring mental health benefits to the young volunteers on the project. The EIPH will be updating their programs in coming years and now would be a good time to engage with ideas on educational content and program opportunities most helpful to Madison County.

During Fiscal Year 2019, EIPH partnered with Eastern Idaho Community Action Partnership, the United Way of Idaho Falls and Bonneville County, and VOICE Advocacy to conduct a community needs assessment in Eastern Idaho which covered Bonneville, Butte, Clark, Custer, Fremont, Jefferson, Lemhi, Madison, and Teton Counties. Information gathered through this process will be used by EIPH's Board of Health and Administration to better target education, resources, and service delivery as much as possible in an effort to improve health and quality of life of residents in our region. (Access the full Community Needs Assessment Report [here](#).) This will be an ongoing effort for the next three years. Each year, they will hold Community Conversations in each county as well as gather information through surveys.

### **4.2.3. Outreach Specific to Flooding**

Flooding in Madison County is one of the priority risks identified by the resilience planning team. Numerous agencies have produced education and outreach materials focused on flood safety which can

be tailored to the specific situation found in Madison County. Beginning with an already developed and tested public education and outreach campaign saves funds that can be used for other preparedness purposes. One campaign that focuses on flood awareness and safety is the NWS campaign “Turn Around Don’t Drown” (<https://www.weather.gov/safety/flood-turn-around-dont-drown>). This campaign includes a number of PSAs, videos, brochures, posters, and other print materials all of which can be tailored for use in local communities.

The Madison County Fire Department can continue to make sandbags available to the public and raise flooding awareness. It is also helpful to have a flood warning system in place. Information on potential severe weather (including flood warnings) is available from the National Weather Forecast Service out of Pocatello, ID at <https://www.weather.gov/pih/>.

# MAINSTREAMING AND IMPLEMENTATION

The resilience strategies identified and reviewed above need to be turned into action before they can benefit the communities of Madison County. There are a number of ways that the recommendations can be mainstreamed into existing plans, policies, and practices and transformed into tangible positive outcomes to protect people, infrastructure, and natural resources. These ideas are briefly reviewed below. Oversight of the Mainstreaming and Implementation process should be managed by a multi-jurisdictional team of leaders who meet regularly and work deliberately and methodically to take action on the priority recommendations from their updated plans. This will help ensure the plans are put into action and not just another plan on a shelf.

## **INTEGRATION INTO PLANNING PROCESSES**

Madison County has an excellent opportunity to integrate principles and strategies for resilience into the 2020 comprehensive plan update. A separate report outlines recommendations for each chapter to add relevant resilience considerations into the comprehensive planning elements. The recommendations align with the resilience strategies outlined in this report, including responsible development, water management, green infrastructure, sustainable agriculture, emergency preparedness, and community engagement.

It is also very important to integrate these resilience strategies and more long range planning into the next update of the hazard mitigation plan (HMPs). Even though HMPs are updated every 5 years, they are influencing land use and development decisions that will have 50-100 year life spans at a minimum and possibly much longer. It is vital that those decisions be based on the best available science looking ahead to the weather conditions expected 50 to 100 years from now. It is not too early to begin gathering information for the 2025 HMP update for Madison County and begin to use this resilient report to guide decisions made for implementing new mitigation projects now.

Implementation can also involve creating dedicated plans for high priority resilience outcomes, such as a county-wide walk-bike greenway and green infrastructure plan, or perhaps a dedicated county-wide drought response plan. Certainly there will need to be an updated floodplain management and flood mitigation plan to account for the updated floodplain maps upon completion of the Risk MAP process.

## **MAINSTREAMING FOR POLICIES, CODES, AND ORDINANCES**

The real on-the-ground difference from comprehensive and hazard mitigation planning is made when the resilience recommendations are translated into specific policies, codes and ordinances that can be enforced and monitored for compliance and results. It is critical to ensure that zoning policies are updated and matched with the new desired land use map for Madison County. Then a process to educate about and then adopt the new zoning laws must be set in motion. The next step requires updated subdivision regulations that incorporate the resilience recommendations for responsible growth, farmland conservation, updated building codes, enhanced water management (supply,

wastewater, and stormwater), use of green infrastructure, and encouraging sustainable agriculture. For public health and safety a multi-jurisdictional emergency preparedness and response plan can be updated based on the new HMP provisions along with the resilience recommendations, where appropriate.

### **MAINSTREAMING FOR BUDGET ALLOCATIONS**

Each of the mainstreaming and implementation steps toward greater resilience is likely to require funding to make happen through staffing, operational costs, and project costs. The most important aspect is to institutionalize resilience goals and objectives into the jurisdictional budget as a standard of practice for ongoing activities. Ideally, leadership should recognize resilience as a part of their scope of work and include that expectation for all agency staff and contractors who implement local government projects. When costs are an obstacle, a cost and benefit analysis can be used to demonstrate the savings and return on investment expected from conservation and hazard mitigation policies and projects. To the extent possible, such analyses should quantify “ecosystem benefits” (i.e., water capture, drainage, and filtering) provided by green infrastructure, which may not have a clear dollar value.

The county and municipal procurement practices can be updated to reflect environmentally sustainable choices wherever possible to protect environmental conditions and to lead by example for businesses and organizations across the county. Most importantly, be sure that resilience outcomes are considered as core funding from regular revenue and not solely dependent upon soft funding year to year. Where possible look for revenue streams that can be dedicated to resilience programs, such as a small stormwater fee on water bills to pay flood mitigation and green infrastructure projects. Also look for cross over funding, such as use of economic development funds for green parks and recreational amenities that will treat stormwater and attract business to the region.

### **PUBLIC EDUCATION AND OUTREACH**

Public engagement is a very important objective in the planning process and in taking action on the planning provisions. Public outreach and gathering of public input should take place throughout the planning process as the plan is researched and drafted. Implementation of policies, codes, and ordinances requires education and outreach that builds public support for the upgrades to be made. Effective preparedness and resilience requires the public to learn about their extreme weather risks and know how to prepare, reduce those risks, and respond to impacts when they occur. Ideally a public education programs are developed in partnership with multiple jurisdictions, local nonprofits, schools, and churches with resources that are rolled out over time for specific audiences as needed. Madison County can work with NRCS, 4H, and Future Farmers of America to support demonstration projects and farm field days on sustainable practices. Local health departments can work with East Idaho Public Health for educational outreach on weather safety, air quality safety, heat stress response, and more. Madison Emergency Management can help educate families through their outreach programs and support for sharing an extreme weather guide to insert into household emergency plans through the LDS church network.

## **FUNDING RESILIENCE IMPLEMENTATION**

There is a wide array of funding sources for planning and implementing strategies for resilience to extreme weather. The sources include many long standing federal and state grants and low interest loans. There are also many foundation grants specifically for adaptation and resilience projects. FEMA provides several important grant programs for both pre-disaster mitigation planning and post-disaster recovery funds. It is important that Madison County stay informed about grants and use them when possible. However, as mentioned above, it is equally important to have standing revenue streams for sustainability and resilience programs for local jurisdictions to ensure continuity of programs across time. Revenue generating activities with a resilience focus are ideal, such as stormwater fees, recreational surcharges, or carbon markets are examples of potential funding streams.

In addition to grants and loans, there is a growing body of innovative financial mechanisms being developed specifically to meet the urgent challenge of extreme weather resilience. A national network of environmental finance centers exists specifically to support local and state governments with raising the capital they need for large mitigation projects. The methods can include use of various resilience bonds, revenue generating programs like stormwater authorities, and even insurance company funded mechanisms as a hazard reduction investment to reduce insurance losses over time. Please refer to the appendix for a list of potential funding sources for further investigation.

To support implementation, Madison County may consider engaging a contractor to assist with the comprehensive plan update process in 2020 in accordance with the recommendations of this report. The contractor may offer consultation in development of draft language for policies, codes, and ordinances to address Madison specific conditions for revised zoning and land use codes. They may also assist with integration of the HMP into the comprehensive plan update and building the business case for adoption of the revised zoning, land use map and codes, and other resilience provisions. The contractor may also provide assistance with educational materials and public outreach activities.

# APPENDIX A: ADDITIONAL RESOURCES

This section provides additional resources on the following topics:

- **Water Management**
  - Stormwater Management
  - Green Infrastructure
  - Urban Water Efficiency
  - Urban Forests
  
- **Sustainable Agriculture**
  - Agricultural Planning
  - Farmland Conservation
  - Agricultural Water Management
  - Agricultural Productivity
  - Pest Management
  
- **Rural Transportation**

## Water Management

### *General Water Management*

- APA Water and Planning: <https://www.planning.org/research/program/water/>.
- One Water: A Holistic Approach to Water Management article: <https://www.wateronline.com/doc/the-one-water-approach-0002>.
- Town of Hammonton NJ - 2018 One Water Award for holistic approach to water management and conservation including a popular residential rebate program for water-saving devices: <https://www.jerseywaterworks.org/conserving-and-managing-water-supplies-town-of-hammonton/>.
- Broward County FL - Water Supply Facilities Work plan (with county-wide IRWM): <https://www.broward.org/Planning/FormsPublications/Documents/Broward-County-WSFP.pdf>.
- Chester County, PA - County-wide IWRM: "[Watersheds, An Integrated Water Resources Management Plan for Chester County, PA and its Watersheds](#)" (54 MB, 244 pages, mostly color - Takes a long time to download!) – Good educational content – “what are impacts of land use on water resources?”
- Innovations in Storage for Resilience in the Columbia River Basin: <http://s3-us-west-2.amazonaws.com/wp2.cahnrs.wsu.edu/wp-content/uploads/sites/32/2019/12/2019-FINAL-Columbia-FEW-Progress-Report.pdf>. This describes management strategies used for the Columbia River Basin is one of the most highly managed, large river systems in the U.S., producing more hydroelectricity than any other river basin in the country.

## ***Stormwater Management***

- National Menu of Best Management Practices (BMPs) for Stormwater: EPA has found the practices listed in the menu of BMPs to be representative of the types of practices that can successfully achieve the minimum control measures; <https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater>.
- Chester County PA – Stormwater Management Plan: <https://www.chesco.org/2315/CW-Act-167-Stormwater-Plan>; Appendix D - County-wide Act 167 Stormwater Management Model Ordinance ([PDF version](#) (PDF, 2.9 MB, 176 pages, 10 color); [WORD version](#)).
- Chester County Board of Commissioners' [Resolution No. 08-13](#).

## ***Green Infrastructure***

- [What is Green Infrastructure: American Rivers](#)  
US EPA: <https://www.epa.gov/green-infrastructure/what-green-infrastructure>.
- EPA (2007): [Reducing Stormwater Costs through Low Impact Development \(LID\) Strategies and Practices](#): [https://www.epa.gov/sites/production/files/2015-10/documents/2008\\_01\\_02\\_nps\\_lid\\_costs07uments\\_reducingstormwatercosts-2.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/2008_01_02_nps_lid_costs07uments_reducingstormwatercosts-2.pdf)

This publication includes 17 cases of developments, primarily residential subdivisions – that include LID practices. In the 12 cases with sufficient economic data to compare conventional stormwater management and LID savings ranged from 15% to 80% and \$3,400 to \$785,000, and only one project had higher costs of \$737,200.

- EPA's [2013 report](#): was a compilation of 13 economic valuation studies of selected public utilities across the U.S. Report: [A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds](#) (2009):  
[https://www.epa.gov/sites/production/files/2015-10/documents/gi\\_philadelphia\\_bottomline.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/gi_philadelphia_bottomline.pdf)

Accounting for capital cost savings and non-market benefits, the Philadelphia Water Department found LID/green infrastructure approaches provide 20 times the benefits of traditional stormwater infrastructure such as large tunnels and pumping stations. The benefits quantified and monetized as part of this analysis included increased recreational opportunities, air quality improvements, water quality and ecosystem enhancement, creation of LID/GI-based jobs, increased property values, and reduced urban heat stress.

- Green Infrastructure: Professional Practices (American Society of Landscape Architects): <https://www.asla.org/greeninfrastructure.aspx>.
- Benefits of Green Infrastructure: <https://globaldesigningcities.org/publication/global-street-design-guide/utilities-and-infrastructure/green-infrastructure-stormwater-management/benefits-green-infrastructure/>.



## Urban Water Efficiency

- Alliance for Water Efficiency: <https://www.allianceforwaterefficiency.org/>.
- Ceres - Every Drop Counts (Business for Water Conservation): <https://www.ceres.org/initiatives/connect-the-drops>; <https://www.ceres.org/annual-report/2018/more-food-companies-value-every-drop>.
- Water-Energy Nexus - Department of Energy: <https://www.energy.gov/sites/prod/files/2014/07/f17/Water%20Energy%20Nexus%20Full%20Report%20July%202014.pdf>.
- Water-Energy Nexus - National Conference of State Legislatures: <https://www.ncsl.org/research/environment-and-natural-resources/overviewofthewaterenergynexusintheus.aspx>.

## Urban Forests

- The Vibrant Cities Lab Urban Forestry Toolkit: The U.S. Forest Service Step-by-Step Guide to Implementing Urban Forestry in Your Community Urban forests provide real, measurable benefits to neighborhoods. Many communities have developed plans to grow their urban forests, and harvest this suite of benefits.
- The Vibrant Cities Lab Career Pathways Action Guide Achieve Tree Equity through urban forestry jobs training. Cities like Detroit, Milwaukee, Atlanta, Pittsburgh, and more have faced their labor shortages through programs designed for residents who face barriers to employment, inclusively rebuilding tomorrow's urban forestry workforce.
- Urban Forestry Best Management Practices for Public Works Managers International City/County Management Association:
  1. Budgeting and Funding
  2. Staffing
  3. Ordinances, Regulations, & Public Policies
  4. Urban Forestry Management Plan
- Planning the Urban Forest: Ecology, Economy, and Community Development American Planning Association: This report addresses the need for planners to adopt a green infrastructure approach and presents the technical means to incorporate trees into planning. Find out how communities can develop urban forestry programs to capture the social and environmental benefits of trees.
- Trees and Stormwater Tools from the Green Infrastructure Center: [http://www.gicinc.org/trees\\_stormwater.htm](http://www.gicinc.org/trees_stormwater.htm): This contains tools to evaluate your city or county's tree protection and to determine how to make your city more pervious to reduce stormwater runoff and for managing your urban forest. A sample stormwater calculator tool is

provided for one city to practice using the tool. It also contains sample ordinances:  
[TSW Codes Ordinances Review Template](#)

- [Land Image Analyst](#): Land Image Analyst was developed by GDA Corp for the USDA Forest Service Chesapeake Bay Program as a land cover recognition tool to aid communities in developing land cover analysis and change detection. It has many applications, such as mapping tree canopy, identifying impervious surfaces, identifying stream buffers, and more.
- [Urban Forest Systems and Green Stormwater Infrastructure](#): A resource manual developed by the USDA Forest Service’s National Urban Forest Technology and Science delivery Team that focuses on the effects of trees on urban stormwater runoff. It provides a synthesis of the science around how urban trees help mitigate problems associated with stormwater runoff. This resource is designed to provide Urban Foresters and Natural Resource Managers some helpful urban forest management strategies to maximize stormwater benefits. Several tree crediting tools and case studies are also provided to help State and local governments better account for the stormwater benefits of urban forests as it relates to reducing stormwater volume and pollutant loading.

## Sustainable Agriculture

### *Farmland Conservation*

- [The Role of Local Governments in Protecting Farmland as a Vital Local Resource](#): This Planning and Policy Brief provides an overview of a range of regulatory and programmatic approaches that can be used to protect farmland from nonfarm development.
- [Farmland Information Center](#) is a partnership between the USDA NRCS and American Farmland Trust that provides tools for local governments to reduce the conversion of farmland to development or permanently protect agricultural land in the region: [Protect Farm & Ranch Land](#)
- [Preserving Large Farming Landscapes: The Case of Lancaster County, Pennsylvania](#): This article from the Journal of Agriculture, Food Systems, and Community Development stresses the importance of preserving large farming landscapes, highlighting three measures that best reflect the spatial effectiveness of farmland preservation efforts: the acreage and percentage of preserved farm parcels located in agricultural zones, the number and acreage of preserved farm parcels in large contiguous blocks, and the number and acreage of preserved farm parcels along growth boundaries. The article uses GIS analysis to examine farmland protection efforts in Lancaster County, Pennsylvania, one of the nation’s leading farmland preservation programs. The results demonstrate that three techniques—effective agricultural zoning, growth boundaries, and the acquisition of conservation easements—can work together in a farmland preservation package of approaches.
- [American Planning Association Knowledgebase Collection: Farmland Protection](#): From this page you can search for resources that provide background, policy guidance, and examples of local plan recommendations and regulatory standards for farmland protection from across the

country. And you can filter these search results by various geographic and demographic characteristics.

- Teton Regional Land Trust: Teton Regional Land Trust’s mission is to conserve working farms and ranches, fish and wildlife habitat, and scenic open spaces in Eastern Idaho for this and future generations. The land trust list a number of local Partners including Madison County and NRCS.
- Agricultural Conservation Easement Program: This NRCS program helps landowners, land trusts, and other entities protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements. Under the Agricultural Land Easements component, NRCS helps American Indian tribes, state and local governments and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.
- Farm Transitions Toolkit (Minnesota Institute for Sustainable Agriculture): The Toolkit offers resources, advice and help to plan for transitioning farmland to the next generation. Links to farmer success stories, farmer transitions programs, government programs, fact sheets, courses, planning tools, legal resources, and more. Also details ten common sustainable agriculture and conservation practices for farming your land.
- American Farmland Trust: Programs and policy for protecting agricultural land through publicly funded agricultural conservation easement programs, planned growth with agriculture in mind, and stewardship and conservation practices.

## ***Agricultural Planning***

- Model Plans and Policies: State-level Plans, Local and Regional Plans; Comprehensive and Master Plans.
- Blaine County, ID Comprehensive Plan: Agriculture: <https://www.co.blaine.id.us/DocumentCenter/View/3513/Chp-4-Agriculture.pdf>.
- Integrating Food Policy in Comprehensive Planning: Strategies and Resources for the City of Seattle: [https://www.seattle.gov/Documents/Departments/OSE/Seattle\\_food\\_comp\\_plan\\_FINAL\\_0820\\_12.pdf](https://www.seattle.gov/Documents/Departments/OSE/Seattle_food_comp_plan_FINAL_0820_12.pdf).
- Regional Food Policy <https://www.psrc.org/regional-food-policy>: The Regional Food Policy Council has developed a number of planning guides to assist communities interested in incorporating food policy in their comprehensive plans including Comprehensive Plan Policies-Planning for food <https://www.psrc.org/sites/default/files/blueprints-compplan.pdf>.
- A Guide for Local Land Use Planning for Agricultural Operations: The Indiana State Department of Agriculture and Indiana Land Resources Council believe the model agricultural zoning ordinances in this guide are valuable to counties across the state as they make proactive decisions about land use. There are many different strategies to accommodate the land use needs of a community, and the best approach for each county is to tailor solutions to its unique

characteristics. These models are intended to address land use issues that arise because of the variety of residential and agricultural uses found in rural Indiana today.

- Growing Local: A Community Guide to Planning for Agriculture and Food Systems: Growing Local was written to help communities remove barriers and advance solutions to sustain local agriculture and strengthen community food systems. It draws upon extensive research of local governments from across the country which have successfully improved farm viability and protected farmland, facilitated infrastructure development and increased access to healthy and affordable food. The Guide provides a history of food system planning, offers principles and practices and a comprehensive toolbox of programs and policies to advance planning, policy development and public investment. See also More Guides to Planning for Agriculture.
- Maine Farmland Trust - Municipal Action: Local Planning: <https://www.maineFarmlandtrust.org/building-farm-friendly-communities/local-planning/>. Because the comprehensive plan is the document to which town land use ordinances are referenced and legally tied, it should make strong, supportive statements about farms and farming.
- Planning for Agriculture in Wisconsin A Guide for Communities: [https://www.uwsp.edu/cnr-ap/clue/Documents/Comprehensive\\_Planning/Planning\\_for\\_Agriculture.pdf](https://www.uwsp.edu/cnr-ap/clue/Documents/Comprehensive_Planning/Planning_for_Agriculture.pdf).

## ***Agricultural Water Management***

- NRCS Irrigation Resources: NRCS Water Management Contacts, resources, and training materials.
- Water Quality, Conservation, Drought and Irrigation: National Center for Appropriate Technology. ATTRA - National Sustainable Agriculture Information Service. Publications, educational presentations, and other resources on water use, soil moisture management, water quality and water conservation. Specific topics include drought, water quality protection, riparian areas, aquaponics and aquaculture, livestock and drought, irrigation, rainwater harvesting and climate and weather information. Check out the Drought Resource Guide.
- Irrigating Efficiently USDA. NAL. Water and Agriculture Information Center. Offers a dynamic search of NAL catalog (AGRICOLA) article citations on efficient irrigation and water conservation methods for agriculture. Try a book citation search. Earlier versions cover 1994-2003 (articles), 1994-2003 (books), and 1988-1994.
- Strategies for Efficient Irrigation Water Use Oregon State University Extension: Suggestions for using irrigation resources efficiently, and stretching their effectiveness in times of drought.
- U. S. Arid Land Agricultural Research Center USDA. Agricultural Research Service.
- Agricultural Water Conservation Clearinghouse Colorado State University and partners. Information that "addresses agricultural water conservation globally, incorporating various climates with a focus on arid and semi-arid areas in the Western United States."
- USDA Drought Programs and Assistance: A list of available programs and resources

- National Drought Mitigation Center: The Drought Center helps people, organizations and institutions build resilience to drought through monitoring and planning, and we are the academic partner and web host of the U.S. Drought Monitor. Our capabilities include climatology, social science and public engagement, and we work at all scales, from individual ranches to local, state and tribal government, and countries around the world.
- Dry Farming Techniques in the Maritime Pacific Northwest From the USDA Northwest Climate Hub: Dry farming in western Oregon and Washington can help producers adapt and diversify in response to water availability and changes in climate. It is especially useful for producers who have little or no access to irrigation water. Dry farming techniques include management practices and crop varieties that make use of residual soil moisture during droughts and the dry summer season in the Northwest.
- USDA Northwest Climate Hub: Our goal is to provide information and technology to guide climate-informed decision making by farmers, ranchers, forest landowners, Native American tribes, natural resource managers and technology transfer specialists to generate sustainable and productive working landscapes in the Northwest.

## **CURRENT SUSTAINABLE AGRICULTURE RESEARCH & EDUCATION GRANT PROJECTS**

- Identifying Stacked Conservation Practices that Optimize Water Use in Agriculture  
This project located in Utah and Idaho will provide agricultural producers, students, and water managers with tools for optimizing agriculture water use. We will evaluate pivot irrigation water conservation practices consisting of mobile drip irrigation, low-elevation precision application, low-elevation spray application and mid-elevation spray application. The study will also consider drought tolerant crop genetics, tillage practices, and alternative crops to reduce irrigation water use.
- Water conservation practices for sustainable food production systems: developing an on-line, participatory training vehicle for ag-professional to enhance interaction with farmers  
University of Wisconsin - Madison Extension Specialists are developing a train-the-trainer online curriculum to enhance on-farm water stewardship and water conservation programs. The curriculum will include online instruction, participatory training and on-farm demonstrations.

## ***Soil Health and Agricultural Productivity***

- **Madison County Healthy Soil Initiative**  
<https://projects.sare.org/project-reports/ow15-032/>  
Madison Soil and Water Conservation District, 2015-2017.

The Madison Soil & Water Conservation District located in Rexburg, Madison County, Idaho conducted a study as part of the Madison County Soil Health Initiative to provide data that shows sound Soil Health Practices such as Cover Crops, No-Tillage/Minimum Tillage, Variable Rate Fertilizing and diverse crop rotations will improve soil productivity, conserve irrigation water, increase resource savings, reduce erosion and be economically viable to agricultural producers.

- **Farmer-to-Farmer Case Study Series**

[https://www.reacchpna.org/case\\_studies](https://www.reacchpna.org/case_studies)

Regional Approaches to Climate Change –Pacific Northwest Agriculture (REACCH).

By adopting farming practices such as tillage, residue management, crop rotations, soil organic amendments and resource-use efficiency farmers have been able to overcome barriers, often in unexpected ways. Innovative approaches used by Pacific Northwest farmers to improve on-farm sustainability and longevity are being featured in a series of case studies.

- **Producer Profiles**

<https://www.reacchpna.org/producer-profiles>

Regional Approaches to Climate Change –Pacific Northwest Agriculture (REACCH).

Producer Profiles tell the stories of Inland Northwest farmers who are adopting innovative practices that restore soils and reduce inputs, from no-till and precision agriculture to crop management using data from unmanned aerial vehicles. In the process, farmers are storing soil carbon and reducing greenhouse gas emissions.

- **Case studies to increase resilience among farmers and ranchers in the Pacific Northwest**

<http://csanr.wsu.edu/case-studies/>

Washington State University.

This case study series explores strategies that innovative farmers and ranchers in our region are already using, and which may be of interest to others. Each case study and its complementary video centers around the experience of a regional producer, and provide summaries of relevant biophysical, economic, and social science that help inform when and how these strategies might work in other places.

- **NRCS Soil Health Division**

<https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=nrcseprd1315420>.

The Soil Health Division (SHD) supports the NRCS mission by providing the best available soil health science, training, guidance, and technical re-sources to NRCS employees, customers, and partners in order to improve the health and function of our nation’s living and life-giving soil.

- **Regional Approaches to Climate Change (REACCH)**

<https://www.reacchpna.org/>.

The REACCH project was initiated in 2011 to ensure sustainable cereal production in the inland Pacific Northwest. The REACCH publication [Advances in Dryland Farming in the Inland Pacific Northwest](#) details recommended practices for climate resilient agriculture and soil health improvement.

- **Alternative Crops for the Columbia Basin**

<https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em8915.pdf>

Oregon State University, 2006.

This publication explores possibilities for new crops in the Columbia Basin. Crops discussed include, but are not limited to, oilseeds, food, forage, seeds and stems for revegetation, and crops that enrich the soil and/or reduce the threat of disease to primary crops.

- **Carbon Sequestration on Idaho Agriculture and Forest Lands**

<https://www.landcan.org/pdfs/72408.pdf>

Idaho Soil Conservation Commission - Boise, Idaho - February, 2003.

The practices found in Table 9 below represent those that could be applied within the state without effecting local crop markets and the best practices or activities.

If there were about 14.6 million metric tons of CO<sub>2</sub>e offsets (credits) produced in the state, and these offsets were purchased at \$10 per metric ton, then the state could see \$146 million dollars come into the state.

- **Carbon sequestration potential in cropland soils in the inland Pacific Northwest: Knowledge and gaps** <http://s3-us-west-2.amazonaws.com/wp2.cahnrs.wsu.edu/wp-content/uploads/sites/32/2019/11/C-sequestration-in-iPNW-croplands.pdf>

WSU Center for Sustaining Agriculture and Natural Resources, 2019.

We review regional research on the impacts of agricultural management strategies on carbon sequestration, including intensifying crop production, tillage, perennial crops, soil amendments, cover crops, crop rotation, reduced burning, and reduced erosion. Our summary suggests that a number of practices can provide real contributions to carbon sequestration, with the likelihood of substantial co-benefits in the form of soil conservation, improved water quality and soil water storage, increased microbial activity, and sustaining our soil's ability to grow food over future generations.

- **Northwest Biocarbon Initiative**

<https://www.climatesolutions.org/programs/nbi/soil-building-agriculture>.

The Northwest Biocarbon Initiative elevates the essential role that natural systems play in reducing carbon dioxide (CO<sub>2</sub>) in the atmosphere. By galvanizing the region's emerging biocarbon community to develop strategies that increase natural carbon capture and build a vibrant restoration economy, we are positioning the Northwest as the nation's leading incubator for biocarbon solutions.

- **Guide to Environmental Markets for Farmers & Ranchers**

<https://www.landcan.org/pdfs/GuidetoEnvironmentalMarketsforFarmersandRanchers.pdf>

American Farmland Trust, 2010.

This guide presents farmers and ranchers with a straight-up view of environmental markets: what they are, how they work and which ones can be most useful in helping to support agricultural operations. Most active farms and ranches preserve and generate environmental benefits. An environmental market makes it possible to buy and sell credits for environmental activities such as restoring wetlands, improving water quality or storing carbon. Markets for environmental benefits have been operating in the United States for many years, but recent developments have increased their potential as sources of on-farm income.

- **NRCS Environmental Markets Toolkit**  
<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/emkts/?cid=nrcseprd335028>.

NRCS develops online tools and data for estimating and quantifying the environmental benefits of land management actions. Below are links to these tools.

## ***Pest Management***

### **INTEGRATED PEST MANAGEMENT PROGRAMS**

- University of Idaho Integrated Pest Management (IPM) Center: Educational information and resources for the pest management needs of Idaho, aiming to reduce risks to human health, the environment and the economy caused by pests and pest management practices.
- Oregon State University & Oregon IPM Center Western IPM Center: Promotes smart, safe and sustainable pest management to protect the people, environment, and economy of the American West, focusing on the identification of pests and beneficial insects.
- Pest Management- Sustainable Agriculture Research & Education (SARE): Integrated pest management (IPM) uses a range of ecological strategies to prevent pest damage and resorts to the use of pesticides only when monitoring indicates such action is required to avoid economic loss. Whole farm pest management systems build upon the biological pest control approach of IPM systems by integrating ecological pest management practices into all aspects of crop production.
- Western IPM Center: Promotes smart, safe and sustainable pest management to protect the people, environment and economy of the American West.

## **Rural Transportation**

- National Rural Transit Assistance Program (National RTAP):  
<https://www.nationalrtap.org/Home>. RTAP's website has a resource center, training opportunities, toolkits, and more.
- Rural Transportation Assistance Program, Federal Transit Administration: The Rural Transit Assistance Program (49 U.S.C. 5311(b)(3)) provides a source of funding to assist in the design and implementation of training and technical assistance projects and other support services tailored to meet the needs of transit operators in non-urbanized areas.  
<https://www.transit.dot.gov/funding/grants/rural-transportation-assistance-program-5311b3>.