Watershed Management and Maintenance for Agroecosystem Resilience

Abstract

Due to rising average temperatures and changing weather patterns, there are increasingly frequent episodes of extreme rainfall, extreme wind, flooding, and other storm events in the great state of Missouri. If not properly maintained, compromises to watersheds and dams can result in flooding of agricultural areas -- decimating crops, destroying land structures, and even threatening human life. The danger of these events and the economic impact can be devastating ... but it is preventable!

In 1954, 1,182 federally funded flood-prevention structures were built throughout the state of Missouri – due to its flood-prone geography. These structures were given a design-life of 50-100 years. Now, some 66 years later, the increase in severe weather patterns is testing not only the initial build and design of these aging structures but has escalated the importance of their maintenance and upkeep to a top priority -- in an immediate sense.

There are currently no services, minus ours, that maintain the watershed and dams in Johnson County, Missouri. Our aim is not only to continue to maintain these flood-prevention structures in our immediate area -- with the possibility of expansion -- protecting people and property, but to do so with a more concentrated effort. With your investment of $300,000 we intend to procure the proper equipment needed as well as implement a more coordinated maintenance effort which will aid us in combating this issue for many years to come.

Our experience in this line of work (14 plus years) gives us insight, know-how, and expertise that will drive the project's success. Our innovative methods come from this experience and solutions to a wide variety of issues which call for unique and creative approaches. The plethora of issues are as varied as the land itself –- issues can range from working with excessive rates of sediment deposition due to stream bank erosion, sheet erosion from agricultural lands, and loss of channel heterogeneity to the loss of tree cover or reduction in woody debris (a critical habitat component in prairie streams), maintaining good vegetative growth, or filling burrows with compacted soil

in order to discourage burrowing animals that can cause seepage. All of these issues would require not only expertise but an ability to be innovative on the approach and ultimately the solution. Having the proper equipment to address the variety of obstacles Mother Nature throws at us is key to our success.

The importance of this issue has been noted by state officials, and in a *WallaceFarmer* article from March 5, 2020, Missouri Senator Roy Blunt stated: "After the historic flooding we saw over last spring and in previous years, it is clear that we need to fundamentally change the way the Missouri River is managed. Farmers, families, and local officials I've talked to are rightly concerned with the lack of progress that has been made in repairing damaged infrastructure and putting stronger protections in place for the future. We can't just sit by and wait for the next major flood event." (*WallacesFarmer*, 2020)

While bills have been signed for the Army Corps of Engineers to begin to study this problem and play defense, we believe, it is one that requires a more immediate response. We want to play offense. Currently, as it stands, 2019 set a record for flooding in Missouri. Residents received more than $93 million in federal funding. (Rouse, 2019)

Statistics show that this issue is only on the rise in communities like ours and the need for our project is great. A lot of eyes are on the northern portion of the state with a concentrated effort on flooding regarding land associated with the Missouri River, and while that too is a great concern, our farmers and communities in Johnson County have just as much to lose. We would like to ensure -- or give them as good a chance as we can – that they do not face such devastation.

With Extreem LLC's experience, and funding for proper equipment, we could assist in agroecosystem resilience, prevent structural damage, avert disaster, and stymie negative economic impact due to the neglect of these critical flood-prevention structures -- an annual estimated benefit of $179,727 ($2.25 per acre) in Johnson County alone and an inestimable increase in quality of life for a community which we have been invested in for the entirety of our lives, and regardless of outcome will continue to work to improve and to protect it.

Project Goal (150)

Our aim, with this grant, is to invest in the equipment which will give us the ability to maintain the critical watersheds and dams in our immediate area -- with the possibility of expansion -- protecting people and property.

Project Objectives (400)

Routine assessment of 37 dams in Johnson County, and maintenance of the Southfork Black Water Watershed. This includes but is not limited to structure maintenance (to a depth of 150mm minimum) which is essential to keep a contiguous vegetative cover; spillway maintenance, ensuring it is capable of safely carrying flood flows of water from the full supply level of the dam back to the drainage line; Maintaining the body of water – laying stone or establishing runner grasses on the sides of the storage where damage can occur; Catchment maintenance – erosion in the catchment can readily fill the dam with sediment rather than water, so controlling it is essential.

Statement of Innovation (100)

Each issue we will approach as creatively and innovatively as we possibly can in order to maintain the harmony of nature with the man-made structure. This may call for use of materials that we have never used before or an approach that is unique to the situation.

Keywords (50)

Dam, watershed, flood prevention, watershed maintenance, dam maintenance, agroecosystem resilience, disaster aversion, Missouri watersheds, Missouri dams.

Project Background (1,200)

In 1954, observing the unique geographical make-up of the state of Missouri -- which left it vulnerable to disasters such as flooding -- the Watershed Protection and Flood Prevention Act (Public Law 566) passed Congress. At that time 1,182 flood prevention structures were built in Missouri. However, Congress halted funding for the program in 2010, without total completion of the project. Congress restored some funding in 2017, allowing for at least two more structures to be created for flood reduction measures.

However according to KTTN.com, in a Jan. 11, 2019, article: “Most of Missouri’s watershed structures constructed during the program’s peak years are strategically placed ‘ponds’ with dams designed to capture runoff and hold it back until it is released slowly through a principal spillway pipe in the dam.” (KTTN, 2019)

Despite the project’s short comings, communities saw great benefits from the structures – mainly in crop production. Prior to this, crops were being destroyed by flash flooding. A farmer was lucky to go even one or two years without crops being destroyed. Other benefits were seen in the prevention of structural damage. Prior to the watershed project things like bridges were being destroyed from floodwaters around the abutments and were having to be replaced every three to four years. In short, the watershed project has saved many communities a whole lot of money over the past sixty years.

However, these flood-damage-reduction structures were not made to last forever. A normal lifespan of one is 50 to 100 years. In order to ensure these structures last as long as possible, and to avert dam failure, proper maintenance and upkeep is key – the importance of this can not be understated.

Clif Baumer, an NRCS environmental engineer in Columbia, noted that some of the oldest structures are nearing the end of their design life – and though they will continue to provide flood benefits for some time to come their design life is dependent on how long it takes for sediment to fill the reservoir. (KTTN, 2019)

While some landowners maintain structures, they are limited in their abilities. Maintenance sometimes requires removing trees from dams or clearing drainpipes. When landowners do not maintain the structures themselves, the watershed districts attempt to do so with the aid of property taxes levied for that purpose. However, this funding is limited. And as the structures continue to age, the maintenance need increases.

Extreem LLC, was hired 14 years ago by Southfork Black Water Watershed to maintain these structures in Johnson County. Extreem's maintenance abilities have been limited by funding, and for each unique situation we have had to struggle to acquire the proper tools to get the job done at the standard and level for optimal results. And as we have seen the increase in flooding and have witnessed an increase in crop loss and structural damage, it became apparent that a more coordinated effort with greater support was imperative.

As the environment and weather patterns change, flood risks will increase. For an overall look at the impact of the extreme weather in this region, approximately 2,242 properties are at flood risk in Johnson County and annual flood damages in Johnson County were $1.1 million this year. (Flood Factor)

If we cannot implement this project and acquire the tools to meet the ever-growing risk factors that we face with both increased extreme weather and aging flood structures, then it is guaranteed that the community is at risk of reverting back to the financial hardships and agricultural setbacks that once devasted Missouri agriculture production.

Our expertise and background in watershed and dam preventative measures and maintenance, as well as our local partnerships with Southfork Black Water Watershed, place the Extreme LLC in a unique position to make a major difference. We want to continue to combat this issue and seek the support to help us continue this effort.

Outcomes and Benefits (1,200)

With the anticipated effects of climate change come the expectation of more resilient, healthy watersheds and structurally sound flood-prevention structures. This project would work to meet

these expectations, protecting from monetary loss and benefiting the communities in which we work in ways that are simply unquantifiable.

Increased resilience of flood-prevention structures, provided by proper maintenance and upkeep, has a direct economic impact. The quality-of-life contribution to the community at large has not been monetized and therefore the economic contributions of the overall impact of this type of project is often under-valued.

What has been monetized is the annual benefit to protecting crop production and preventing structural damage within this project's current geographic range – this is valued at $179,727/per year ($2.25/acre).

Extreem LLC, has been approached to extend our reach to communities outside Johnson County, but limited resources have left us unable to do so. With your help, expansion could be possible, and thus these benefits would flow over to surrounding communities as well.

Way back in 1974, there was an environmental impact statement created, regarding the Southfork Blackwater River Watershed (which we are solely responsible to maintain), and they found that without the project the monetary loss would be $112,849. With the project the monetary loss would reduce by 47 percent to $59,590. (US Soil Conservation Service, 1974) And this was almost 50 years ago! In that study 4,439 acres benefited from the watershed.

The only thing that has changed since then, is that the monetary value the watershed protects has increased. And will continue to increase. But so do the threats. And the combat strategy is a preventative strategy. Preventing impairments in these flood-prevention structures and watersheds via healthy upkeep and maintenance not only protects valuable ecosystem services that provide economic benefits to society but also prevents expensive replacement and restoration costs.

These cost avoidance scenarios are difficult to assign an economic value to due to the issue of scale and complexity of the unknown. However, Marty Comstock, NRCS state conservation engineer, estimated the annual benefit of all flood-prevention structures in the state of Missouri to be $27 million. (KTTN, 2019) Investing in upkeep of these structures maintains this benefit.

As the expenses associated with recovery from extreme weather impacts continue to increase, so too will the annual benefit of these structures. And the rising trend is expected to continue – a trend which saw an increase by a factor of 6 between 1997 and 2007 (EPA, 2015).

Floods now cause an average of $8 billion in damage every year in the U.S. What we want to provide, is the most efficient way to avoid excessive future costs by increasing preventative measures now so that flood-prevention structures continue to function and retain resiliency under a wider range of climatic conditions.

While cost avoidance plays a big part in this project, so does protecting people's well-being. The impact and benefit that this provides is hard to quantify.

After the devasting floods of 2019 in Missouri, an article in *Successful Farming*, by Terri Queck-Matzie, helped shed some light on the realities of what farmers face in this scenario. One corn farmer, Nic Shearer, discussed the aftermath, explaining that when farmland floods the headaches come for months, even years after. Sand and debris removal can wreak havoc. When fields flood, the clock starts. Every day crops are not in the ground is a lost day. Flooding deprives the soil of oxygen and smothers all life on it. With no plants to feed on, symbiotic fungi, which pass nutrients to plants while absorbing carbohydrates, are lost. The entire soil life system must be re-established. This can take years.

After the flood in 2019, Shearer lost 100 percent of his grain. The grain could not be fed or sold, not even for ethanol. But it wasn't just the grains that needed to be assessed after the flood – numerous dangers await on a flooded farm. Farms come with inherent hazards – machinery and equipment, electrical components, chemicals, rodents. When co-mingled by contaminated floodwaters, unsound physical structures and animal carcasses are only part of the problem.

During this flood event as many as 50 levee breaches were reported in the U.S. Army Corps of Engineers Omaha District alone. "Is anyone fixing the underlying problem?" asks Queck-Matzie.

Shearer says that even if they were to put things back like they were before the flooding, is not what he would like to see. His concerns go to the river management that may have contributed to the flooding. He wants to see flood control made a top priority. While Shearer ultimately made it through the 2019 flood and lived to farm another year – not everyone is so lucky.

Our watershed and flood-prevention structure maintenance project not only protects from this type of unnecessary and devastating hardship for farmers but aids in agroecosystem resilience of the land, which ultimately will lead to a prosperous future.

Project Design and Methods (1,200)

Extreme LLC will procure 3 to 5 assistants to help facilitate any needed maintenance of watershed and dam structures to prevent flooding and erosion – and ensure all precautions are taken to achieve this work safely. These measures will include, but are not limited to mowing, cleaning brush, maintaining inlets (such as trash racks and ensuring anti-swirl baffles are firmly attached), repairing broken-down or worn-out fences, sodding, rock riprap or waterlines, cut and remove large, woody vegetation, remove debris in pipe spillways, filling burrows, and mulching to ensure proper water flow to reduce flooding, sedimentation, erosion damage, and to ultimately improve the conservation, development, and proper utilization of the land.

The ultimate goal of all methods is to maintain the structure's functionality and aim to make them more adaptable to change and better equipped to handle large storm events. However, regular operation and maintenance as well as thorough and consistent inspection must be practiced throughout the lifetime of a dam.

Regular Maintenance Methods (not exhaustive):

- Dam bank maintenance. A layer of topsoil over the bank (to a depth of 150mm minimum) is essential to keep a contiguous vegetative cover.
- Spillway maintenance. The spillway has to be capable of safely carrying flood flows of water from the full supply level of the dam back to the drainage line.

- Maintaining the body of water. Lay stone or establish runner grasses on the sides of the storage where damage is occurring. ...
- Catchment maintenance. Erosion in the catchment can readily fill the dam with sediment rather than water — control it.

Project Deliverables/Products (400)

Safe, clean, and maintained watersheds and dams in Johnson County, Missouri.

Geographic Location and Size of Project Area (300)

The scope of this project is currently approximately 80,000 acres, with the possibility of expansion to the greater state of Missouri. Within this boundary we currently oversee maintenance of 37 structures. There are 1,114 within Missouri, which we could also potentially use our resources on any of these structures in the future and are qualified to do so.
Johnson County's population is 54,062 (2019) and contains 829.28 square miles. Warrensburg is the largest city with a population of 20,418. Other cities include Knob Noster (2,785), Holden (2,236), Leeton (556), and Elm (547). (Wikipedia)

As of 2017, there was approximately 27.7 million acres of agricultural land in Missouri. Johnson County contributes a significant amount of agricultural assets relative to its size. Johnson County is in a predominantly a rural area with 60% crop land; pasture 21%; forest 8%; and other 11%. In 2021, Johnson County's head count on beef cattle was 35,000; milk cows 400; acres of corn stood at 48,900 in 2020; soy acreage at 82,200; and wheat at 3,800. (USDA, 2021)

Project Action Plan (600)

With your contribution of $300,000, Extreem LLC would purchase an excavator, an ax grinder attachment for the excavator, a skid steer, a work truck to pull trailers loaded with larger equipment such as mowers, a gooseneck trailer with dual axel and dual tires in order to carry a

significant amount of weight, and a post driver for the skid steer which is used to replace fence structures.

Currently, we can not appropriately address the issues of these water structures with the equipment we are limited to. Neglecting these larger issues is unwise and could lead to much greater costs in the long run.

In conjunction with equipment acquisition, closer inspection on structures and a comprehensive report on immediate maintenance needs as well as continual maintenance plan will be laid out and presented to Southfork Blackwater Watershed. A comprehensive strategy will be developed.

Technology Transfer (300)

Training team members on any and all equipment used.

Project Management (400)

Ron Wheeler will be onsite as project lead, while Dianna Wheeler will manage all administrative duties.

Team Qualifications (1,200)

Ron Wheeler has over 14 years' experience in the field. Dianna Wheeler has been in administrative positions for over 10 years. Throughout the span of this time, the Wheeler's have used personal equipment and have taken up the responsibility of maintenance and upkeep for the Southfork Blackwater Watershed and flood-prevention structures within Johnson County. The scope of the work has been vast, and Extreem LLC has been able to procure a partnership with the Watershed for over a decade and has worked with the community to navigate the maintenance and upkeep of a variety of structures. Wheeler has taken personal care of individual's dams and waterway structures for the better part od a decade. Extreem LLC's mission will be and always has been to protect the community from flooding and to aid in the

argoecosystem resilience – a fragile aspect of this work that Extreem LLC is incorporates into their solutions.

Project Evaluation (1,200)

Regular operation and maintenance as well as thorough and consistent inspection will be practiced on each structure. In addition to maintaining proper function, and compliance with safety regulation, these habits can lead to the early detection of deficiencies and prevention failure. Continuing these management activities will extend the useful life of these structures. We will also provide Southfork Black Water Watershed with detailed reports of the project including routine inspections and any developments. Using a strategic methodology we will evaluate the design-life of each structure and any perceived weaknesses. This evaluation is done by visiting each site and through careful observation and inspection pinpoint any issues that need to be addressed. Logging any on-going or performed maintenance and repairs and observing how structures handle extreme weather will also be a part of our ongoing project.

Assessment of Environmental Impact (800)

The importance of maintaining a healthy watershed cannot be understated. The benefits of healthy watersheds are numerous. Healthy watersheds provide sufficient amounts of clean water required for safe drinking water, aquatic organisms and wildlife, and recreation.

One of the major components of this project is ensuring sediment buildup and erosion is curbed. Sediment build-up and erosion can negatively affect the water structure's ability to perform its duty. Another huge component is maintaining the natural land structures and vegetation on and around the structure. All of this, if not properly addressed, can have a negative impact on the agroecosystems resilience -- for land to be able to return to its natural state as quickly as possible is essential for the crop lands that are prevalent in Johnson County.

Not only is agroecosystem resilience beneficially for the soil that farmers sometimes refer to as "black gold" due to its importance, but this is also important for the natural ecosystem as a

whole. When floods occur, indigenous species can face competition from invasive species. The natural function of the ecosystem is disrupted. A more resilient ecosystem aids indigenous species in out-competing invasive ones.

Believe it or not, maintaining healthy watersheds can also help global warming! By working to maintain proper land cover provides the soil with resources that are capable of sequestering carbon, thereby offsetting greenhouse gas emissions. Overall, floodplains and structurally sound flood-prevention structures enable healthy watersheds to be better adapted to more extreme weather patterns and changes in precipitation associated with climate change.

Healthy watersheds and dams provide many environmental benefits but can also simply make a place more desirable and increase tourism by providing desirable places to fish, swim, and boat, increasing property values.

The prosperity of our communities and individuals within the watershed truly depend on the work that we do, and the work that has already been done. Whether it is for crop irrigation, industrial manufacturing, or residential use, maintaining these structures is part of human existence and sustainability in this region.

Missouri is blessed with natural streams, lakes, and rivers like no other in the nation. They play an essential role in the health and well-being of each Missourian and the economy of our state. The quality of life for each Missourian can be closely tied to the health of our state's natural resources. Healthy watersheds and dams and levees provide many ecosystem services including, but not limited to: nutrient cycling, carbon storage, erosion/sedimentation control, increased biodiversity, soil formation, wildlife movement corridors, water storage, water filtration, flood control, food, timber and recreation, as well as reduced vulnerability to invasive species, the effects of climate change and other natural disasters. These goods and services are essential to our social, environmental, and economic well-being. (EPA, et al., 2018)

Declaration of Previous Conservation Innovation Grants (800)

None.

Producer Involvement (300)

None.

References (4,000)

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Executive Summary

Ron Wheeler is the executive of Extreem LLC and has 14 year's of experience working in Johnson County in this line of work. Extreem LLC is dedicated to its mission and understands how essential preventing flooding is in the community and works tirelessly to fulfill the mission of reinforcing these valuable structures by:

- Assessing each location thoroughly and addressing any damage to the structure itself or any obstruction that could be causing issues.
- Being responsive to any community member that reports an issue.
- Acquiring the right equipment and manpower to ensure the job is done correctly and safely.

Extreem LLC will meet regularly with Southfork Black Water Watershed to report on the project's development.

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The total cost of implementation for our Watershed Project is $170,000. Of this amount, ---------- has already been committed from [other funding sources, community partners, or major donors]. Your investment of $300,000 will complete the necessary funding needed to implement our project.

Statement of Need

The need for our project is great.

Our community has struggled with---------for several years, and its effects have been amplified by the rise of ----------, changes in ----------, and the loss of ---------. Statistics shoe that this issue is on the rise in communities like ours:

-Properly cited statistics from an authorative source.

Extreme LLC has confronted this issue in the past, and other local groups and governing bodies have addressed it, as well, but we believe a more coordinated effort with greater support will solve the issue.

Timeline of the issue in your community and any past initiatices, legislation, etc.

If our project is not implemented, the community is at risk of--------. Our expertise and background in ---------, as well as our local partnerships with---------, place the Extreme LLC in a unique position to make a major difference.

Goals and Objectives

Goal: Decrease the rate of - ------, which is a major component of the wider issue,----------, afflicting our community.

Objectives: IN the first year, provide ------consituents with----------, which will raise awareness, provide training, and connect individuals with crucial resources. This will cost approximately ----------and will incolve the following public outreach events.

Methods and Strategies

Objective: In the first year, provide ----constituents with------ which will raise awareness, provide training and connect individuals with crucial resources.

Methods:

Extreme LLC will hire a program assistant to faciliatat training, outreach, and development. The program assistant will coordinate with ---- and ------or other local partners to promote several public outreach events.

Event 1

Event 2

Staff and program assistant will hold weekly check in meetings to report jon progreww and developmetns.

Plan of Evaluation

Measuring the success of Extreme LLC Project:

Each outreach event will engage at least --- constituents and this engagement will grow by at least ---- % over the course of the program's first yeat.
[Chart of projected engagement increases]
-The rate of ------in our community will [increase/Decrease] by approximately -------% by the time of the progam's completion, as measured by an independent researcher.
Graph of anticipated changes in measurable trend

- -------% of consitutents will respong favorabley to the program and outreach events in monthy survey
- - Weekly meetings between program assistant, staff, and exexcutive director to share engagement data and any concerns.

Budget Information

Budget Item Amount Sub-Total

Personnel

Program assistant

Staff

Equipment

Rentals

Other tools and materials

Attach most recent statement of activities, etc

Organizational Background

Extreme LLC was founded by ------ to ---------. The founding executive director was inspired to address issues like ----------and better the community by ----------.

Our mission continues to be guided by our founding principles of --------, -0-------, and ------, as evidenced in our past projects;

-Examples of successful past projects

-Consider linking to digitcal material if your submitting electronically