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CODES 120

1 November 2024

Lack of Biodiversity in the Lower Mississippi River

According to the United Nations, biodiversity is defined as "the variety of life on Earth, in all its forms". In the Lower Mississippi River, however, there isn't much variety due to the decline in biodiversity and in the native species that live there, such as paddlefish. Interactions between human affairs, oil companies, and invasive animal species put the biological variability of the Lower Mississippi River at an increasing risk if no work is done against them.

When it comes to focusing on defining systems and trying to figure out what the specific classifying drivers are, there are many different perspectives available. This is because human activities can affect biodiversity in the lower range of the Mississippi River through various means. For example, pollution from industrial activities can contaminate water sources, which can then impact the animals that rely on these sources. Invasive species can be introduced through travel and agricultural activities as well, disturbing the local ecosystem. Other human activities that contribute to habitat loss include urban development, infrastructure and agriculture experiments.

Example of agricultural runoff that is carrying potential pollutants from the farm to the Mississippi River (Newcomer)

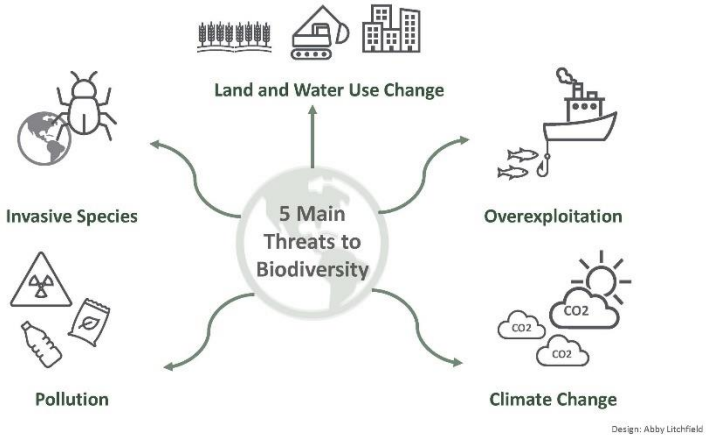
For example, wetland damage drainage from farming or construction can lead to the reduction of natural habitats for wildlife. Additionally, in the context of rivers, the alteration between dams and water flow to dams and levees can change the natural dynamics, affecting different species that rely on the specific habitat. Even among those trying to make things better, operational outcomes in biodiversity management are compromised by inconsistent logic and lack of clarity in key terms such as sustainability, environmental quality and resilience. The interaction between animals and human activities, especially those from specific companies, can create a complex challenge for maintaining biodiversity and the river. Importantly, the companies that operate in this specific area can often contribute to more habitat destruction and pollution for the river, which can lead to a decline in the animal population.

Agricultural fields can also add fertilizer in waterways, which can then lead to harming aquatic life. These, among other industrial charges and changes, can contaminate the river, making it harder for fish and wildlife to effectively find clean water or rely on certain water. For example, Asian Carp tend to consume large amounts of plankton,which can be a very vital food source for many native fish species. The appearance of Asian Carp can change the food dynamics in the Mississippi River. Their feeding habits can reduce the wave of plankton, which affects not only the fish in the water, but also other aquatic organisms that rely on that specific plankton for survival. As Asian Carp populations can tend to grow, they can take the place of native fish strain—especially because Asian Carp are known for their extremely high reproductive rates. With females being capable of laying millions of eggs at a time each season, the swift reproduction process allows the females to completely takeover and dominate the ecosystem. The invasion of of Asian carp can also have economic issue for communities within the Mississippi River. Fishing industries that are local depend on native fish species and can

suffer due to declining population. This can then build up to economic losses for those who rely on fishing for upkeep.

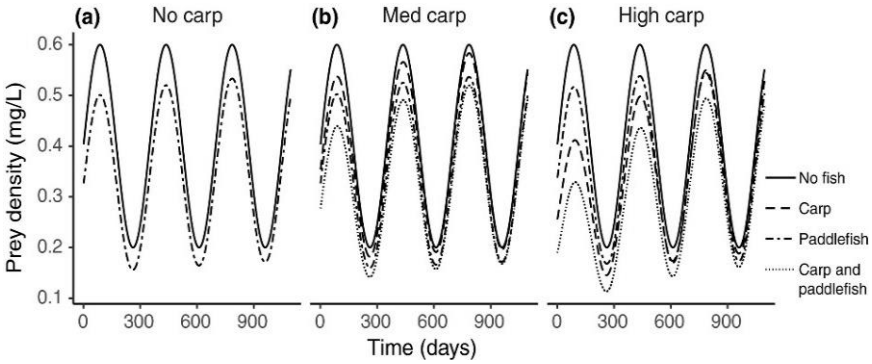
The lower Mississippi River is a vital ecosystem for the United States. Transformation efforts in the lower Mississippi River focus on balancing the necessities of industries with the recognition of the harm they cause. Another factor to remember is that seasonal flooding can be a critical process in the lower Mississippi River area. Distribution of nutrients, floodplain habitats, and creating temporary wetlands that can serve as breeding for fish, amphibians and more are all related to these season floods. Flooding can also help provide and maintain vegetation diversity by depositing more seeds and can reduce competition against plant species. However, the initiation of invasive species by human activities can make a mess of the local ecosystems: it can lead to outcompeting native species, as stated before, and altering food webs. Budgeting efforts are crucial to be able to mitigate these specific impacts, specfically those focusing on pollution reduction, sustainable practice, and habitat restoration that seeks to balance economic practices with the must have of protecting biodiversity. Acknowledging these issues and potential solutions is beneficial for being able to maintain the ecological balance of the lower Mississippi River while guaranteeing that it can support its animal populations.

As is clear from the paragraphs above, there are many different drivers for a lack of biodiversity. Whether that be because of toxic chemicals, animal waste, human waste, or something else, native species are continuing to die out, which causes the biodiversity of bodies of water, such as the Mississippi River, to decrease. This then becomes a cycle of events that continuously repeats itself in a declining fashion in which the rivers will soon become fully inhabitable, even for the invasive species. This chain of events is known as a causal chain, meaning that each of the topics leads a trail of influence that illustrates why biodiversity continues to decrease.



All of the above are drivers for biodiversity and can cause the native species in the Mississippi to die out

Studies have demonstrated many of these causes in action. For example, in "Modeling bioenergetic and population-level impacts of invasive bigheaded carps (Hypophthalmichthys spp.) on native paddlefish (Polyodon spathula) in backwaters of the lower Mississippi River" by Nicole Kinlock, Adam Laybourn, Catherine Murphy, Jan Hoover and Nicholas Friedenberg, researchers explored how invasive species affect the native species living in an area. They used bioenergetic models of silver and bighead carp and observed that the population of



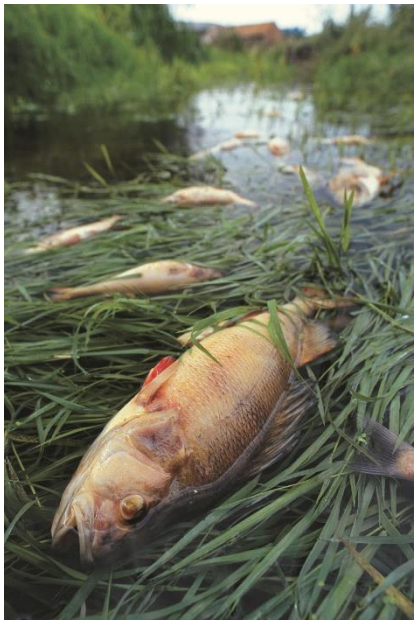
This is a chart of the projected impact of the invasive species on the native species that the researchers found in their studies

native paddlefish would rapidly decrease if the non-native silver and bighead carp were introduced into their environment. This experiment helped to figure out a way to "access the risks posed by other invasive species" as well (Kinlock et al. 1095). Once the bigheaded carps were introduced into the environment, the paddlefish began to die out and biologically change. If this simulation were to happen in real life, the biodiversity of the Lower Mississippi River would drastically decrease. Native paddlefish are a major part of the Mississippi. Without them, other native species would also start to die out, making the environment better for more invasive species to come in and start the cycle all over again. In addition, outside of the river, many animals on land such as black bears depend on the river for their main source of food. If the species in the river are gone, the bears and any other species that were dependent on them will eventually disappear as well. Thankfully, due to this experiment, researchers can begin to search for ways to prevent this from happening, both in the Mississippi and other bodies of water.

Invasive species like carp are one of the wildlife stakeholders that can flourish in the river due to human activities

However, this experiment won't work in all areas, especially in the areas of the Lower Mississippi River where there are companies that continuously dump into the river and complicate the causal chain. In "Toxicity of Sediment Collected Upriver and Downriver of Major Cities Along the Lower Mississippi River" by P. V. Winger and P. J. Lasier, the authors explain how companies have been exposing contaminants to the river and said contaminants have been

seeping into the sediment of the river. The waste mainly consists of oil, which “spreads over the surface in a thin layer that stops oxygen getting to the plants and animals that live in the water” (OilCare) and greenhouse gases, which heat up the Earth and therefore raise the temperatures of rivers and other bodies of water. All of this subsequently makes the environment unlivable for the preexisting native species. Similar to how the native paddlefish dying out affects the surrounding species, this waste is highly toxic to the animals that live off the Mississippi River. The resulting death of the native animals allows for invasive species to make their home somewhere that is dangerous for the remaining animal and plant life. Since “the Lower Mississippi River is one of the highest priority ecosystems” (Winger and Lasier 213), these companies are starting what may become a catastrophic decline in biological variability not only in the Lower Mississippi, but around the world. To remedy this, more experiments similar to the one done by Kinlocke and their team in different places where the amount and intensity of pollution differs. By doing this, more native species and their environments can be saved and any species that may have had to be relocated can return to their rightful homes.

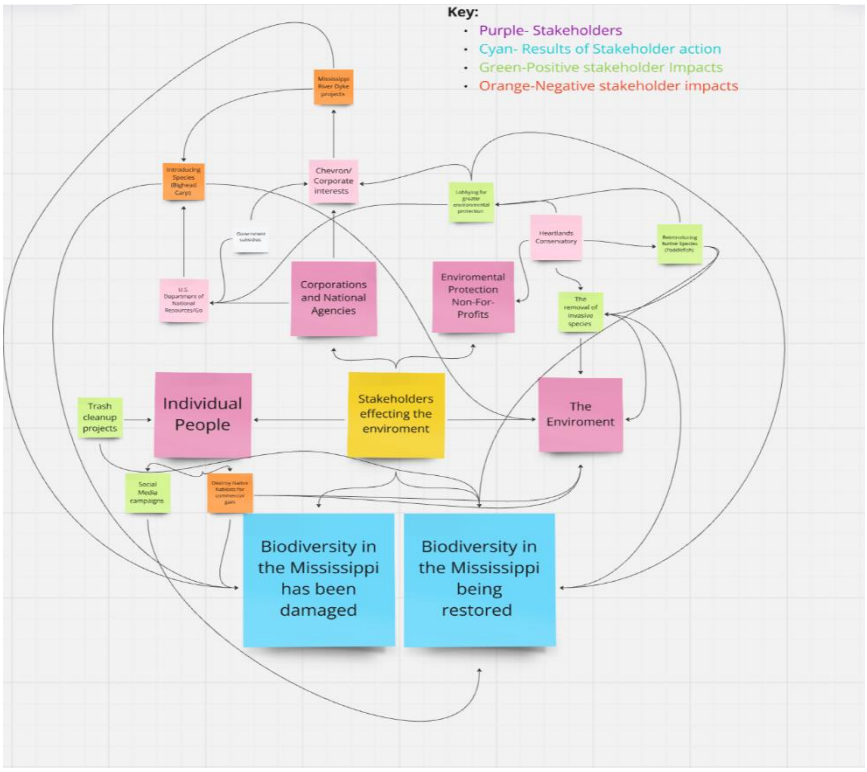


Death is one of the major effects that water pollution from industrialization have on animals in the Mississippi River

On a broader scale, the current fate of the Mississippi River is a prime example of the concept of the Tragedy of the Commons. This term, coined by Garrett Harden, describes the exploitation and inevitable degradation of a shared natural resource that occurs when numerous entities seek to exploit such a resource. In the case of the Mississippi river, stakeholders (those who are invested in a resource), such as the Chevron corporation, are in a constant battle with

organizations such as the Missouri Department of Natural Resources over the use of the river. However, stakeholders are not exclusively limited to human entities, as the wildlife which inhabits the river are also stakeholders, and perhaps are the most at risk of exploitation. This is apparent by how invasive species tend to arrive and/or flourish in the river either directly or indirectly due to human activities.

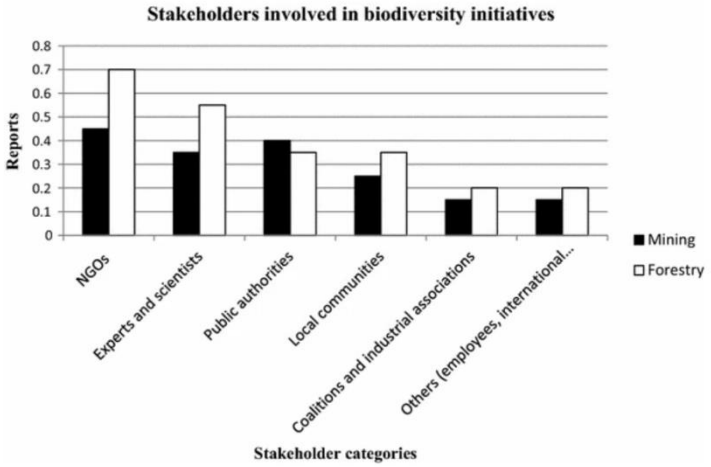
Unfortunately, as previously mentioned, efforts on behalf of stakeholders who'd like to improve the issue, such as the government, are not always effective. In the article, "Adapting to Climate Change in the Upper Mississippi River Basin: Exploring Stakeholder Perspectives on River System Management and Flood Risk Reduction", authors Tamsen Reed and Liesa Reys Mason describe the damage caused by flooding in the upper Mississippi, preforming an in-depth stakeholder analysis of the pressing issues facing those who live in the northern Mississippi river basin. Mason and Reed describe how competing levels of government fail to address the issue; preferring to defer the responsibility to other levels of government. This is an example of actors in power not utilizing their position to solve an issue, as many are more concerned with reelection and the holding of power over utilizing their position to assist with the issues they face. In "Managing



Miro Board with the direct and indirect stakeholders of the issues with biodiversity in the Lower Mississippi River

Biodiversity Through Stakeholder Involvement: Why, Who, and for What Initiatives?", Oliver Boreal discusses how stakeholders can successfully use their position to the benefit of a natural resource, and how private entities can both stay economically competitive while not exploiting the natural resources they use.

For us as a research team to learn more about the lack of biodiversity during the spring of 2025, there are multiple things that need to take place. During this next year we need to take on more site visits as well as talking and engaging with more community partners. This can cultivate and enrich collaboration to bring awareness towards biodiversity. This is because, if we are to undo the damage done to biodiversity within the Mississippi River, it starts with a move to increase communication and collaboration between stakeholders. When conversations are formed about shared interests, fears, and goals, stakeholders can find common ground amongst each other. For example, corporations such as Chevron can communicate with conservation officials. Although they may share different goals (in the case of Chevron to produce as much capital as possible), they may be able to work together to ensure the perseverance of the river itself. Since both stakeholders require the river to function, they are both incentivized to protect it; shared interests creating common ground and sparking conversations. To directly address the issue of biodiversity, however, education and direct action is necessary. Although not guaranteed to produce lasting results, direct action (river



These are types of stakeholders Boreal discusses and how much they are involved in improving biodiversity

clean ups, invasive species removal, etc.) can spread awareness on an issue and target ethos of the public, drawing attention to an issue that can be easily ignored or differed onto a different entity.

In order for this to be successful we need to get this conversation circulating in more mainstream dialogue such as social media and other public spaces By participating and showing awareness on various popular social media and getting information onto governmental platforms, it puts this topic at the forefront of everybody's mind, or at least plants the seed. By doing this, the public can be educated about how helping the environment is more than just the thing people think about the most, which is saving the trees. Social media is a platform that everybody uses daily and pays close attention to. Creating things that grab people's attention on it helps invite them in to help find ways to solve this problem, so this is one thing we seek to do. Also in the future, getting the local schools, such as elementary schools and high schools to teach more about biodiversity, is a primary goal of ours as schools are a place where children can learn about things happening in the world that have an impact or once had an impact. Teaching about invasive species can give students more knowledge on paddle fish and bigheaded carp. This not only gets students educated but also puts them in a position to learn more about biology.

Connecting the problem of biodiversity to Heartlands Conservancy can help us to collaborate and partner with their mission. Heartland's main mission is to work with other people in the Southern Illinois area to protect the health of our distinctive communities and nationally significant natural and cultural resources. Heartlands is a non-for-profit organization that seeks to maintain and restore biodiversity in the American bottom. Our work aligns with them due to our focus on biodiversity protection. JJK FAN, on the other hand, is more focused on youth

education and agriculture. Our work aligns with them as well due to our focus on youth education.

To conclude, the preservation of biodiversity within the Mississippi river is at constant risk. Human-based entities, such as companies and individuals, are in a unique position of responsibility, as they can both maintain or destroy the area in which they inhabit. Bighead Carp and other invasive species threaten native fish populations, as one rogue fish may eventually destroy an entire region. These reasons and more are why we must work collaboratively to protect the biodiversity of the Mississippi. If we wish to maintain all areas of the river, it is essential for stakeholders to collaborate; creating a healthy, beneficial ecosystem for all.

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