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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, it can be all types of ways. Animals and companies can affect biodiversity in the lower range of the mississippi river throughout various means. When it comes to animals, like fish and birds, it is easy to affect the mississippi and influence changes. Such as pollution from industrial activities can contaminate water sources.

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

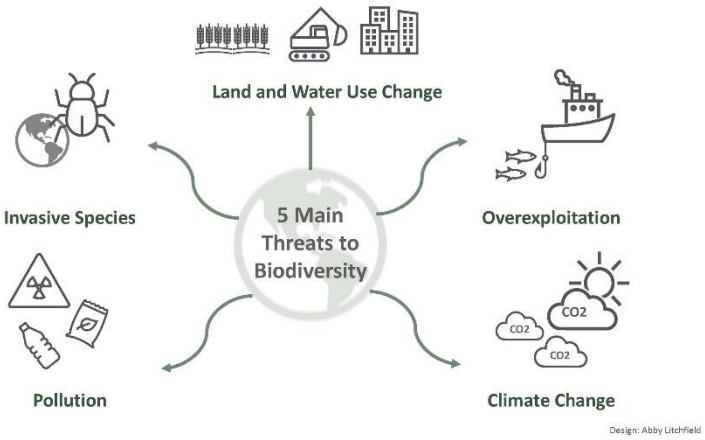
More so invasive species can be introduced by human activities as well, disturbing the local ecosystem. Companies that contribute to habitat loss through urban development, infrastructure and agriculture experiments. For example; wetland damage

drainage from farming or construction can be a possibility to reduce natural habitats like wildlife. Operational outcomes in biodiversity management are compromised by inconsistent logic and lack of clarity in key terms such as sustainability, environmental quality and resilience. Additionally,the alteration between dams and water flow to dams and levees can change the natural dynamics of the river, affecting different species that rely on the specific habitat. The interaction with animal and human activities, especially from specific companies can create a complex challenge for maintaining biodiversity and the river. Both animals and companies have impacts on the biodiversity of the lower mississippi river through pollution, and invasive species. Biodiversity issues in the East St.Louis and the lower mississippi river and super tied together to health issues of the ecosystem and well-being of animal species. The region is specifically home to wildlife with river systems and wetland forest, these ecosystems can face significant conflict from industrial pollution, agricultural practices and etc. Furthermore 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 approach fertilizer in waterways, which can also lead to harming aquatic life. 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; Asian carp can 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. The way 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. Asian carp can also be 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

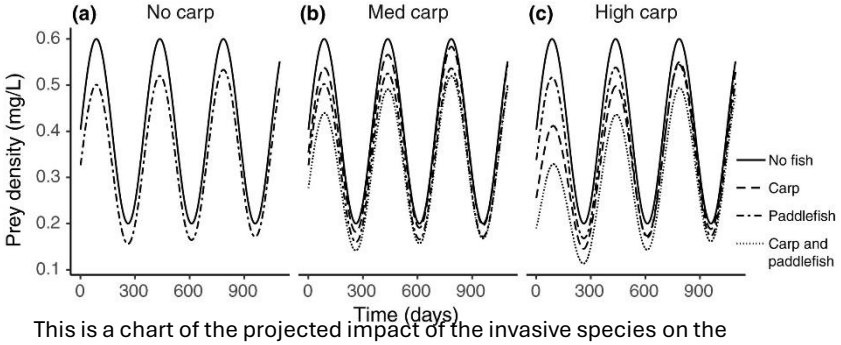
allows the females to completely takeover and dominate the ecosystem. The invasion of of Asian Carp can also have economic issue for communities within the Mississippi River. Fishing industries that are local depends on native fish species can suffer due to declining population, that can build up to economic losses for those who rely on fishing for upkeep. The Lower Mississippi river is a vital sourceful ecosystem for the United States. Transformation efforts in the Lower mississippi river focus on balancing the necessities of industries with the recognition Another factor to remember is the role in biodiversity; seasonal flooding can be a critical process in the lower mississippi river area. Distribution of nutrients, floodplain habitats, etc. and creating temporary wetlands that can serve as breeding for fish, amphibians and etc. 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,focusing on the pollution reduction, sustainable practice, habitat restoration that tend to balance economic practices with the must have at protecting biodiversity. Acknowledging these issues is beneficial for being able to maintain the ecological concept of the lower mississippi river and guaranteeing it supports animal populations.

Though human activity is arguably the primary cause, 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 to why the 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 native paddlefish would rapidly decrease if the non-native silver and bighead carp were introduced into their environment. This experiment helped to



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

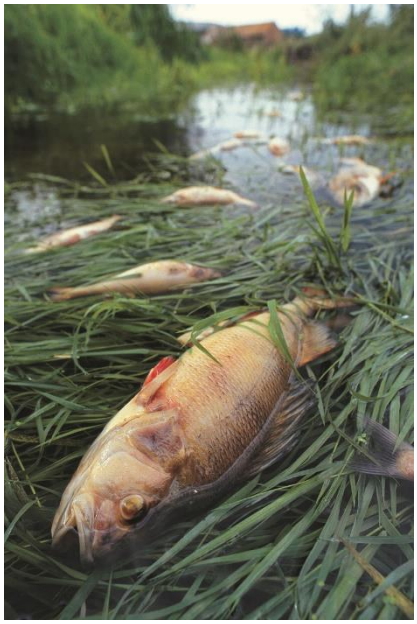
figure out a way to “access the risks posed by other invasive species” as well (Kinlock et al. 1086). They also observed the effects that the silver and bigheaded carp had on the health of the newborn paddlefish. Originally, the juvenile and adult paddlefish had similar stages of growth and it was on par for most of the juveniles to grow to be around the same size in adulthood, also known as somatic growth. During the experiment however, the researchers observed that “bigheaded carps could substantially reduce both the somatic growth and population trajectory of both juvenile and adult paddlefish” (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

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

However, this experiment will not work in all areas since different areas suffer from different issues. This is especially true in the areas of the Lower Mississippi River where there

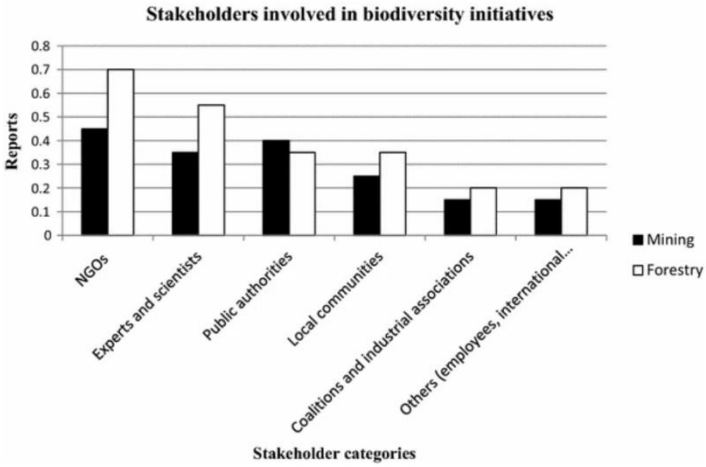
are companies that continuously dump into the river and complicate the causal chain. This mainly happens near big cities such as Saint Louis where the development of the riverfront has been largely aided by industrialization. By adding in an additional step, the environment surrounding the Mississippi River is at an even higher risk of losing its biodiversity to invasive species. 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, which 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.



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 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.



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

For us to learn more about the lack of biodiversity during the spring of 2025, there are 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. 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 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 more involved on the main platforms. By participating and showing awareness on the main platforms, it puts this topic at the forefront of everybody's mind or at least keeps it as a thought. By doing this the public can be educated that this 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 helps invite them in to help find ways to solve this problem. Also in the future, getting the local schools, elementary schools and high schools to teach more through education. 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 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.

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.

WORKS CITED

Berrisford, Kate. “5 Main Threats to Biodiversity.” *Network for Business Sustainability (NBS)*, 21 July 2021, nbs.net/5-main-threats-to-biodiversity/. Accessed 12 Nov. 2024.

Boiral, Olivier, and Iñaki Heras-Saizarbitoria. “Managing Biodiversity through Stakeholder Involvement: Why, Who, and for What Initiatives?” *Journal of Business Ethics*, vol. 140, no. 3, 30 Apr. 2015, pp. 403–421, link.springer.com/article/10.1007/s10551-015-2668-3, https://doi.org/10.1007/s10551-015-2668-3. Accessed 12 Nov. 2024.

DeLong, Don C. “Defining Biodiversity.” *Wildlife Society Bulletin (1973-2006)*, vol. 24, no. 4, 1996, pp. 738–749, www.jstor.org/stable/3783168. Accessed 1 Nov. 2024.

Joedredge. “New Invasive Carp Species Makes Home in Mississippi River Basin.” *WROK 1440 AM / 96.1 FM*, 13 Dec. 2022, 1440wrok.com/new-invasive-carp-species-makes-home-in-mississippi-river-basin/. Accessed 12 Nov. 2024.

Kinlock, Nicole L., et al. “Modelling Bioenergetic and Population-Level Impacts of Invasive Bigheaded Carps (Hypophthalmichthys Spp.) on Native Paddlefish (Polyodon Spathula) in Backwaters of the Lower Mississippi River.” *Freshwater Biology*, vol. 65, no. 6, 27 Feb. 2020, pp. 1086–1100, onlinelibrary.wiley.com/doi/full/10.1111/fwb.13494, https://doi.org/10.1111/fwb.13494. Accessed 12 Nov. 2024.

Newcomer, Eileen. “Pollution on the Mississippi River.” *Www.lakeforest.edu*, 2013, www.lakeforest.edu/academics/majors-and-minors/environmental-studies/pollution-on-the-mississippi-river. Accessed 12 Nov. 2024.

Oil Care Campaign. “Oil Care Company.” *Oil Care Company*, 2015, oilcare.org.uk/what-we-do/impacts-of-oil/.

Reed, Tamsen, et al. “Adapting to Climate Change in the Upper Mississippi River Basin: Exploring Stakeholder Perspectives on River System Management and Flood Risk Reduction.” *Proquest.com*, Jan. 2020, www.proquest.com/docview/2473714608?pq-origsite=primo&sourcetype=Scholarly%20Journals. Accessed 12 Nov. 2024.

Reuter, Michael, et al. “The Nature Conservancy’s Approach to Conserving and Rehabilitating Biological Diversity in the Upper Mississippi River System. Tab”: *Large Rivers*, vol. 15, no. 1-4, 19 Dec. 2003, pp. 549–560, www.umesc.usgs.gov/documents/publications/2005/reuter_a_nature_conservancy.pdf, https://doi.org/10.1127/lr/15/2003/549. Accessed 1 Nov. 2024.

Schneider, Brandon. *Changes in Fish Use and Habitat Diversity Associated with Placement of Three Chevron Dikes in the Middle Mississippi River*. 2012. Southern Illinois University Edwardsville, 2012.

Semer, Claire. “Exploring the Academic Success of Student Veterans in Higher Education.” *ProQuest*, vol. 140, no. 3, Feb. 2017, www.proquest.com/docview/1868535627?pq-origsite=primo&sourcetype=Scholarly%20Journals. Accessed 12 Nov. 2024.

Wallace, Ken J. “Values: Drivers for Planning Biodiversity Management.” *Environmental Science & Policy*, vol. 17, Mar. 2012, pp. 1–11, www.sciencedirect.com/science/article/pii/S1462901111001912, https://doi.org/10.1016/j.envsci.2011.12.001. Accessed 1 Nov. 2024.

Winger, P. V., and P. J. Lasier. “Toxicity of Sediment Collected Upriver and Downriver of Major Cities along the Lower Mississippi River.” *Archives of Environmental Contamination and Toxicology*, vol. 35, no. 2, 1 Aug. 1998, pp. 213–217, https://doi.org/10.1007/s002449900369. Accessed 1 Nov. 2024.

Zinni, Yasmin. “Pollution’s Effects on Animals.” *Sciencing*, 30 Sept. 2021, www.sciencing.com/pollutions-effects-animals-5292091/. Accessed 12 Nov. 2024.