

A global perspective on wetland salinization: ecological consequences of a growin...

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Our natural wetlands on Earth provide many benefits, that without them, would leave us with severe problems. Just a few of the services that wetlands provide us, and all the life on earth are improving our freshwater quality, being a habitat for wildlife and supporting biodiversity, including aquatic animals, and acting as a sponge, storing flood waters and keeping a flow of water during dry spells. Without these wetlands the quality of our freshwater would be significantly worse and unregulated. We would see the death of much of the aquatic wildlife in wetlands, and either death or movement of other wild life inhabiting these wetlands.

Also, without that natural sponge there, floodwaters would just flow freely instead of being trapped, meaning that when we hit dry spells, we no longer have wetlands there as a source of flowing water. This would obviously increase the severity of droughts and with further climate change and global warming, could seriously harm our source of drinking water. Also, all the benefits that wetlands give us, most importantly the sequestering of carbon, are severely impacted by the ions that saline water carries with it. These ions have the power to change biogeochemical reactions and alter elemental cycles.

Unfortunately, salinization, or collection of salts, is harming these natural wetlands, degrading them, decreasing the quality of our ecosystem, and putting them on a course to eventually be diminished, either several decades from now, or much, much sooner. Throughout time, wetlands have

experience what is known as primary salinization, or the natural collection of salts, through global change in temperature, glacial cycles, and rising sea levels. These factors have also contributed to the salinization of coastal and inland bodies of water as well. However, this primary salinization wasn't enough to cause a real problem that severely degrades our wetlands.

The real problem is caused by what is known as secondary salinization, or the anthropogenic manipulation of the hydrologic cycle. Over the past few centuries this human manipulation has rapidly salinized wetlands, due to the agriculture and then the industrial revolution. These wetlands sit at low elevation levels, lower than most bodies of water, allowing surface and ground water to easily flow into them. This along with very few governments doing anything about the problem puts our wetlands in sever danger. The rate of salinization continues to go up, reaching unprecedented levels, due to climate change, and many human manipulations. These manipulations include vegetation clearance, intensive irrigation, river regulation, mining and extraction, and de-icing salts, along with several events that cause intusion of seawater into coastal wetlands.

Evapotranspiration, a process in which waters are transferred from plants and soil into the atmosphere causes an increase in salt concentrations at the surface of the soil. When vegetation is cleared out to allow for crops to be planted, that increased salt concentration then gets carried by irrigation waters and is then transferred into groundwater. This groundwater is then carried into main water sources and ends up in our wetlands. This, in-turn is a major contributor to wetland degradation. In the times since the

agricultural revolution, millions of acres of natural vegetation have been cleared to make room for crops, and in-turn has led to a massive increase in salinization of groundwaters, and eventually salinization of wetlands.

Intensive irrigation goes hand in hand with rapidly increasing population that we are experiencing today. As the population continues to rise faster and faster, we will find the need for an increase in agriculture across the world, and as we know agriculture comes with the need for irrigation, especially in areas where natural precipitation isn't enough. So, with that increase in irrigation, is going to come an increase in the transport of salts, and this will continue to make our wetlands more and more salinized. Another issue with the clearance of vegetation is the transportation of salts through natural weather events. Rain and other precipitation lead to the transportation of salts in the same manner that irrigation does. The lack of vegetation to keep those salts in the soil aids in salt transportation.

Another mechanism in the salinization of wetlands is river regulation. We see river regulation across the world in the building of dams and reservoirs to hold freshwater for our use. In most cases river regulation is a good thing, because without it, we could have issues with having enough freshwater in certain areas. However, in this case, it is detrimental due to the frequent wetting and drying of rivers, and also the frequency in the duration of dry-down periods. When riverbeds are dry, that causes concentrations of salt in the soil to rise, then when those same riverbeds are then hit with an influx of water due to river regulation, those salts are then carried. This is the same process by which salts are carried through precipitation and intensive

irrigation. Salts rise, then are hit with a large amount of water, then are carried with that water, and eventually those waters find their way into our wetlands.

The fourth mechanism of secondary salinization of wetlands has to do with the mining and extraction that goes on globally. When oil is extracted from the ground, sometimes naturally saline ground water is also extracted. In most parts of the United states and around the world, there are regulations put in place to avoid the discharge of this wastewater. However, there are instances of leaks, spills, and illegal discharge. Due to this, there have been increases of soil and surface water salinity. Until recently, this has been ignored as a cause for increase in salinization. Since then regulations have tightened and improvements were made, but there are still instances of this happening.

Also, with the increasing need for fossil fuels, there will be more extraction, leading to more of this wastewater ending up in the soil and in surface water. Mining also has an influence on the salinity of wetlands. When mining for resources, saline wastewater is found in a similar way it is found when extracting fossil fuels. Some of this wastewater along with minerals that hold a high salt concentration can dissolve and end up in ground water and surface water. This poses a large threat to inland wetlands, where surface and ground water both flows. Again, there are regulations to prevent such a thing from happening, and in most cases, regulations have solved the problem. However, these regulations aren't aimed toward preventing these

waters from harming wetlands, leaving them at an increased risk for salinization.

Another harmful form of secondary salinization is de-icing salts commonly used on roadways and airport runways. Currently, de-icing salts are the cheapest and most efficient way for airports and cities to de-ice their streets. While this may be very effective in keeping people safe, it is not very effective in helping the environment. These salts are seldom flushed away after use, resulting in a high concentration of salt build-up. Then when this salt build-up is washed away by precipitation, they end up in surface runoff, and eventually in inland wetlands.

There are also many coastal wetlands across the globe that are subject to secondary salinization. One of the most important of these is the intrusion of sea waters into freshwater wetlands. Over time, sea levels have continued to rise at a fast rate, and due to climate change and global warming, these sea levels continue to rise at an unprecedented rate. As these sea levels rise, it causes an intrusion of sea waters to flow into coastal wetlands, as well as ground and surface water that also flows into wetlands. Another cause of coastal wetland salinization is the reduction of freshwater flows into bays and estuaries. This allows for sea water to flow into surface and groundwater and eventually end up in coastal wetlands. This can be caused naturally but is mostly done by man through the construction of dams, which reduces freshwater flow.

Coastal wetlands are also affected by mining and extraction near coastal aquifers which allows sea waters to intrude into groundwater and end up in coastal wetlands, as well as the creation and deepening of channels, which allows sea water to move further upstream into coastal wetlands. Hurricanes and tropical storms, which are predicted to increase in frequency in the near future, cause storm surges which allows sea water to flow freely into coastal wetlands. The standard that most relates to the salinization of inland and coastal wetlands is Standard number 3 in the Gress “ Looking at Landscapes and Places” landscape packet. Standard 3 states “ how have we (human actions) changed or modified the physical environment?”. This relates to the salinization of inland and coastal water bodies because of secondary salinization. As we recall, secondary salinization is the anthropogenic, or human, modification that causes increased salinity in bodies of water, specifically in wetlands.

The actions we have taken to change the physical environment of both inland and coastal wetlands. Yes, there are many natural causes to the salinization of wetlands, such as storm surges, but even with those, human actions increase the severity of a natural event. Without human modification of the environment, we would have such an increase in sea levels. We also wouldn't have such a large increase in the amount of tropical storm and hurricanes that lead to storm surges flushing sea water into coastal wetlands. In our inland wetlands the human modification of our environment is even more evident. We consistently clear vegetation to plant crops, and then intensively irrigate those crops when there are solutions to use less

land and less water while getting the same output. We build dams and channels and alter the path of naturally flowing water to give easier access to the over usage of that water. We extract massive amounts of fossil fuels with an evident disregard for whatever else comes with those fossil fuels and how to properly dispose of it.

And lastly, we continue to use de-icing salts on our roads with the knowledge that it continues to harm our environment. Why do we do all of this? Because in today's modern times we, as humans, look for the easiest and most cost effective ways of doing something. We fail to look at the consequences of our actions, with only the cost benefits of what we are doing in mind. There are so many easier ways to go about these things. Yes, they may cost more, but what cost are we going to pay in the long run due to the harmful effects we have on our own world? The answer is that eventually we will be paying a far greater price than any price we would have to pay to change just a few human effects we have on our environment.

The textbook "Living in the Environment" by G. Tyler Miller and Scott E. Spoolman discusses the benefits that wetlands provide us. When discussing coastal wetlands, they discuss what those wetlands are made up of. They include coastal marshes, salt marshes, and mangrove forests. They explain the important services that these coastal wetlands provide by saying "They help to maintain water quality in tropical coastal zones by filtering toxic pollutants, excess plant nutrients, and sediments, and by absorbing other pollutants". They go into detail about how these coastal wetlands are a productive ecosystem and provide a habitat for a variety of life, aquatic and

non-aquatic. They also provide a habitat for “ as many as 60 species of grasses and other plants”.

They also provide information on how expansion is harming mangrove forests, an important piece to coastal wetlands. They said, “ more than 35% of the world’s original mangrove forest had been lost to agricultural and urban expansion”. These are even more ways that humans are modifying the physical landscape as we discussed about standard 3. This puts into perspective how detrimental it is to continue to harm coastal wetlands by enabling so much secondary salinization. The book also discusses how important inland bodies of water, including wetlands, are to our planet. They said, “ although freshwater systems provide less than 2. 2% of the Earth’s surface, they provide a number of ecosystem and economic services”. (page 179) They discuss what makes up an inland wetland including “ marshes, swamps, and prairie potholes”. (page 183) The book also discusses how productive inland wetlands are, and the variety of species that they are home to. (page 184) And finally, the book discusses how we are continuously degrading our freshwater ecosystems, including wetlands, by dams, flood control, expansion, and agriculture. (page 185). The book covers all the reasons why inland and coastal wetlands are so important to wildlife, and our environment, as well as covering why human impacts are so detrimental, and the consequences of our impacts.

The main points or issues of my article is secondary salinization, or the human impacts and manipulations that cause severely increased salt levels in our inland and coastal wetlands across the world. The numerous ways that

we strip away important pieces of our wetlands and leave them vulnerable to complete destruction over time. I realized that there are so many services that these wetlands provide, that without them we will continue to inch closer and closer to our own peril. The services they provide are unique, and without them, not only will those ecosystems be impacted but the world around them will be impacted. I'm surprised that there were so many ways that we are impacting these ecosystems through salinization. I never really thought about how detrimental these simple things such as putting salt on our roadways could be. When I'm out on the lake, I never think about the effects that the dam allowing that lake to be there could be making on an ecosystem thousands of miles away. I never thought about how agriculture, a very vital part of our lives, and thought about as a positive in this world, could be making such a negative impact.

When thinking about irrigation, we always think about water usage and how that is affecting us, but we really don't think about the other effects irrigation makes. And just recently we are learning how the extraction of fossil fuels is affecting tectonic plates, so we are learning about the negative effects of that, but we never really thought about what else comes up with those fossil fuels, and the effects that the discharge of those substances can have. We think we have a good understanding of the things that are going on around us and our impacts on the environment. However, this just goes to show that even the simplest things that we don't think about can have such a negative effect, especially when it's happening thousands of miles away from us. I think that we can do such a better job at paying attention to the way we

treat our water sources. There have been so many rules and regulations put in to protect our ground and surface water, but we continue to find more and more ways that we are harming it.

This article shows that governments around the world continue to ignore the serious problems we are facing with our wetlands. I'd like to know more ways that we are harming our water sources. Even past water usage and salinization. How many things do we do every day that severely effect our water? We should make it a worldwide effort to educate the people of this world the effects they put on this environment, not just our waters. We should continue to get governments around the world, including our own, to tighten up on regulations on agriculture, fossil fuel extraction, mining and so much more to slow down the process that is happening so fast. At the rate we are going, our world can only last so long and it's up to us to save it.

References:

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