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The Impacts of Flooding on the Depletion and Dispersal of Plants

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ABSTRACT

Flooding has both positive and negative impacts not just on humans and the environment but also on the dispersal and depletion of plants species depending on the specific condition and types of plants involved. On one hand flooding can transport seeds e.g., coconuts, Avocado, palms, water lily etc. and plant parts over a long distance allowing them to disperse more widely than they would have been more able to. This can be beneficial for certain plants species that rely on water-based dispersal mechanism such as Hydrochory. Flooding also has a significant effect on terrestrial plants that cannot withstand inundation for a long period of time. When flood water rise, the submerged vegetation is deprived of oxygen which is necessary for photosynthesis and respiration which mechanically damage the plants and creating unfavorable soil conditions for plants. Flooding can mechanically uproot plants, break stems and branches of trees leading to decline in plant density and diversity at affected areas. Flooding is unavoidable but can be managed if appropriate measures are instituted, such as construction of Dams and reservoirs to hold excess water, riverbank protection, construction of levees and spillways, appropriate drainage systems and storm water management, canalisation and dredging of major rivers.

INTRODUCTION

Flooding is a natural occurrence where areas or land that is normally dry abruptly becomes submerged in water (Magami *et al.,* 2014). Flooding has many extreme negative social, economic and environmental impacts (Kolawole *et al.,* 2011). Some of the negative impacts of flooding include; damage to properties, crops and livestock, loss of human life, health problems, damage to roads, bridges, and power plants (Adetuji and Oyeleye, 2018). Despite these negative impacts of flooding, it still has some important role to play in the environment. It recharges groundwater systems, fills wet lands, moves viable nutrients and contribute to the dispersal of seeds of plants e.g., such as coconut, water lily, lotus etc. around the ecosystem, increases fishing activities and triggers dispersal, migration and breeding (Jeffrey *et al.,* 2020).

Flooding occurs in three forms; coastal flooding, river flooding and urban flooding also called flash floods. Coastal flooding occurs in the low-lying belt of mangrove and fresh water swamps along the coast. River flooding

occurs in the flood plains of the larger rivers while urban flooding is linked with rivers in the inland areas. It is often short-lived and the sudden heavy rains in the inland areas can change them into a destructive torrent (Oruonye *et al.,* 2017). Many factors are responsible for flooding which include; dumping of refuse in water bodies (Magami *et al.,* 2014), constructing buildings on flood plains and poor maintenance of drainage facilities and breakage of dams (Adetuji and Oyeleye, 2018). Removal of vegetation, increase in the size of water channel and increase in erosion also contribute to flooding. Flooding can also be caused by excess rainfall when the absorption capacity of the soil is exceeded. Other causes of flooding include; climate change, excessive precipitation, rise in sea level and development of unplanned cities.

Types of Flooding and Causes

Many conditions result in flooding (Magami *et al.,* 2014). Hurricanes, clogged drainages, and rainfall are some of the conditions that have led to flooding in various regions across the globe. Here are the leading types of floods:

- Flash Flood: This is the type of flooding caused by heavy rainfall. The flood conditions develop rapidly because the rainfall is so heavy the ground is incapable of absorbing the water quickly enough, resulting in a very high runoff rate. The events are generally locally intense and damage is usually restricted to a limited area.

- River Floods: Rivers or streams can overflow their banks. This happens when the river or stream holds more water upstream than usual, and it flows downstream to the neighboring low-lying areas, typically referred to as the floodplains. As a consequence, this creates a sudden discharge of water into the adjacent lands leading to flooding.
  Dams in rivers may also at times overwhelm rivers when the carriage capacity is exceeded, causing the water to burst and get into the floodplains. Flood caused by river overflow has the potential of sweeping everything in its path downstream.

- Lakes and Coastal Flooding: Lake and Coastal flooding occurs when large storms or tsunamis causes the water body to surge inland. These overflows have destructive power since they can destroy ill-equipped structures to withstand waters strength such as bridges, houses, and cars. In the coastal areas, strong and massive winds and hurricanes drive water onto the dry coastal lands and give rise to flooding. The situation is even worsened when the winds blowing from the ocean carry rains in them. Sea waters from the tsunami or hurricane can cause widespread damage.

- Urban floods occur when the drainage system in a city or town fails to absorb the water from heavy rain. The lack of natural drainage in an urban area can also contribute to flooding. Water flows out into the street, making driving very dangerous. Although water levels can be just a few inches deep, urban floods can cause significant structural damage.

- Pluvial floods form in flat areas where the terrain can't absorb the rainwater, causing puddles and ponds to appear. Pluvial flooding is similar to urban flooding, mainly in rural areas. The agricultural activities and properties in areas where pluvial floods have occurred can be seriously affected.

Effects of Flooding on the Environment

- In the agricultural sector, flooding can ruin crops, delay harvests, spoil produce, remove or contaminate valuable topsoil and cause death of livestock (Olajuyigbe *et al.,* 2012). These effects can cause great emotional stress and financial loss to farmers.
- For the general public, food shortages and higher costs of produce can result.
- Flooding also destroys wildlife habitats, depletes fishery stock and alters biodiversity and ecosystem functions critical to socio-economic development.
- Flooding Disrupt economic and social activities.
- It set back the nation's security and development by damaging or destroying roads, buildings and other infrastructure.
- A secondary effect of floods is the contamination of floodwaters with chemicals and sewage. This can pose a threat to the health of people and animals and can increase the risk of contracting waterborne diseases.
- It also causes death by drowning.

Ways to Manage Flooding

- Design A Good Drainage System: The design and layout of a town's drainage system can build a great foundation for preventing floods and cause less headache overtime (Emeribeole, 2015). A drainage system should be well-mapped and properly covered to prevent leaves, debris and large items from clogging the system. Water should be able to drain freely and quickly to avoid pooling in streets and low-lying areas.

- Plant Vegetation: While trees, shrubs and even different varieties of grass can be decorative and scenic, they serve an even greater purpose when it comes to flood prevention (Hansson *et al.,* 2008) Extra vegetation can absorb excess water into the soil and can prevent land erosion by slowing down heavy water flow.

- Create Retention Basins: Also known as retarding basins, detention basins provide a pathway for water runoff and a temporary holding place for floodwaters. Vegetation and large rocks are often used to line the edges of the basin for additional absorption and to slow the rapid flow of water and prevent erosion. (Nkwunonwo *et al.,* 2016).

- Building of well planned environmentally sustainable dams.

- Desilting and canalization of rivers and natural drainage channels

- Provide Education: It is important to educate people that live in the town and ensure they understand the importance of keeping drainage systems clear. This can help reduce the amount of litter and debris that clogs culverts and water ways. (Evans *et al.,* 2017). In addition to prevention, it is important to educate people on what to do if a flood occurs to stay safe and minimize damage. Providing contact information for a flood cleaning service can be helpful to businesses that are impacted by storms.

Effects of Flooding on the Depletion of Plants

Flooding can have a significant impact on terrestrial plants that cannot withstand inundation for extended periods of time (Nkwunonwo *et al.,* 2005), although Some plants are perfectly okay growing in wet places e.g., rice, bulrushes or water lilies, water hyacinth, etc. However, when flood water rise, the submerged vegetation is deprived of oxygen which is necessary for photosynthesis and respiration in the roots leading to the build-up of carbon dioxide, methane and nitrogen gases (Najeeb *et al.,* 2010). Ultimately, the roots can suffocate and die. Toxic compounds such as ethanol and hydrogen sulphide can also build up in the soil and damage plants. If leaves and stems are submerged, photosynthesis (absorption of energy from the sun to produce sugars) can be inhibited and plant growth can slow or even stop. Plants that are suffering from excessive-water stress are more prone to infection by disease-causing organisms such as fungi or insects. (Sperber, 2014). Also, excessively wet soil tends to favour the growth of soil-microbes such as *Fusarium* spp., *Phytophora* spp. and *Rhizoctonia solani*, which can infect plant roots leading to diseases such as root and crown rot. The damage caused to plants by flooding differs depending on the time of the year and the age of the plants. Here are some of the ways flooding enhances the reduction or destruction of plants;

- **Suffocating Soil**: When soil is saturated by excessive flooding, soil pores are completely filled with water and have little to no oxygen present. Much like humans, plants need oxygen to survive, with the gas taken into plants via leaves and roots. Also identical to humans, plants such as farm crops can't breathe underwater (Najeeb. *et al.,* 2010). Essentially, excess and prolonged flooding kills plant roots because they can't breathe. Dead plant roots in turn lead to death of aboveground plant, or crop, growth.

- **Nutrient depletion:** Flooding can wash away nutrients from the soil which can lead to nutrient depletion, beneficial microbes in the soils die and anaerobic organisms take over and produce toxic byproducts that may further kill the plants. Plants require nutrients to grow, and if the soil is depleted of nutrients, the plants will not be able to grow.

- **Salinization:** Floodwaters can bring in saltwater from the ocean, which can lead to salinization of the soil. This can make it difficult for plants to absorb water and nutrients, leading to their depletion.

- **Soil compaction:** Flooding can cause soil compaction, which can make it difficult for plants to grow. Compact soil can prevent water and air from reaching the roots of plants, leading to their depletion.

- **Causes Plant diseases:** Flooding can create conditions that are conducive to the growth of plant diseases. Plant diseases can weaken plants, leading to their depletion.

- **Loss of biodiversity:** Flooding can lead to the loss of biodiversity, which can have a negative impact on the ecosystem. The depletion of plants can lead to the loss of habitats for animals, which can lead to a decline in biodiversity.

- **Reduced crop yields:** Flooding can lead to reduced crop yields, which can have a negative impact on food security. The depletion of plants can lead to a reduction in the amount of food that can be produced.

- **Economic losses:** Flooding can lead to economic losses, particularly for farmers who rely on crops for their livelihoods. The depletion of plants can lead to a reduction in income for farmers, which can have a negative impact on their livelihoods.

- **Environmental degradation:** Flooding can lead to environmental degradation, which can have long-term consequences for the environment.

The depletion of plants can lead to soil erosion, loss of biodiversity, and other environmental problems.

- Additionally, Flooding can mechanically uproot plants, break stems and branches and wash away seeds and seedlings, leading to a decline in plant density and plant diversity.

Role of Flooding in the Dispersal of Plants

The transfer of seeds from a parent or mother plant to a different location is called seed dispersal. Seed dispersal through water is called hydrocolloid. The seeds of plants that grow in or near running water are usually dispersed by water (Wenny and Levey, 2000). Common examples are coconut, palms, water lily seeds of mango, oranges and lotus etc. These fruits and seeds have several adaptations for floating in water. Coconut fruits have a light and fibrous fruit wall and are carried over long distances by water. Lotus has flat, spongy thalamus containing seeds. Kohai and mangrove trees are located on the banks of rivers and estuaries. Therefore, the seeds float on the surface of the water and the stream carries the seeds away. Plant seeds growing in water are spread to water, but there are many other ways to play a part of water when dispersing seeds. Plants growing by water often relied on water and transport their seeds. You can produce floating seeds, or it may be a thread that helps buoyant. Flooding is likely to have several benefits for different plant species. Seed survival is often higher away from the parent plant. This higher survival may result from the actions of density-dependent seed and seedling predators and pathogens, which often target the high concentrations of seeds beneath adults (Manzaneda *et al.,* 2005). Competition with adult plants may also be lower when seeds are transported away from their parent.

Flooding helps in the dispersal of plants through the following ways:

- **Facilitates seed distribution:** Flood waters can carry seed pods and grains far away from their source. This helps to disperse plants so that they can grow in areas that they might not have been able to reach otherwise.
- **Increases habitat diversity:** Flooding can create new habitats for plant species by depositing sediments, nutrients, and organic matter in areas that were previously inaccessible.
- **Increases genetic diversity:** As plants are carried away by flood waters, they mix with other specimens, leading to increased genetic diversity.
- **Provides nutrients:** Flood waters often bring nutrient-rich soil and other organic matter to areas that are in desperate need of it. This helps to jump-start the growth of plant species.
- **Reduce competition:** Flood waters can wash away invasive species or competing vegetation, clearing the path for native plants to establish themselves.
- **Improves soil quality:** Flood waters can carry sediment and organic matter from upstream areas, which can then be deposited on soil. This helps to enrich the soil and improve its overall quality for plant growth.
- **Promotes germination:** A sudden surge of water can trigger the germination of seeds that have been lying dormant for extended periods of time.
- **Supports wetland ecosystems:** Flooding can help to preserve the integrity of wetland ecosystems by providing the moisture and nutrients necessary for plant species to thrive.
- **Promotes biodiversity:** Floods can lead to the creation of new habitats and environments, leading to the growth of a more diverse range of plant species (Green *et al.,* 2021)
- Flood waters allows plants to reach specific habitats that are favorable for survival, a hypothesis known as directed dispersal. It may also allow plants to colonize vacant habitats and even new geographic regions.

FEATURES THAT ENABLE SEEDS DISPERSAL THROUGH WATER

There are several features that enable seeds and plants to disperse a long distance and still survive. (Manzano and Malo, 2006):

1. Buoyancy: Seeds that can float on water are more likely to be carried away by water currents.
2. Water-resistant coatings: Seeds that have a waterproof or water-resistant coating around them are less likely to absorb water and sink to the bottom.
3. Air pockets: Some seeds have air pockets that help them float on water.
4. Hooks or barbs: Seeds with hooks or barbs can attach to fur or feathers of animals that come in contact with water, which can then transport them to new locations.
5. Slimy or mucilaginous coatings: Seeds with slimy or mucilaginous coatings can stick to water-dwelling organisms such as fish and amphibians that move between water bodies.
6. Long dispersal periods: Some seeds can remain viable for extended periods, which allows them to travel long distances through water currents.

CONCLUSION

Flooding being a disaster is unavoidable but can be managed if appropriate measures are instituted. Notably, flooding is caused by excessive rainfall, poor environmental planning and management and weak

policy implementation by institutions concerned with flood management. Flooding is also caused by increasing deforestation and inability of developers to adhere to physical development plans and scheme. Flooding has negative implication on the environment, economy and social lives of peoples living at flood prone areas. Flooding affects physical and natural developments such as houses, plants, trees, roads, bridges and other structures. In the cases of serious flooding, lives can be lost in the process. Flooding destroys and alter the ecosystem and a wide variety of terrestrial plants. More so, it enhances the spread and survival of most aquatic plant and some terrestrial plants that their seeds freely float on water.

Combination of hard infrastructural solutions and ecosystem-based adaptation should be employed. Examples include the construction of Dams and reservoirs to hold excess water, riverbank protection, construction of levees and spillways, appropriate drainage systems and storms water management, and dredging of major rivers. Appropriate measures should be put on ground to stem the level of flooding occurrence. Specifically, governments should ensure that environmental management policies are properly enforced in the country. Development control activities should be taken seriously to avoid the erection of developments on flood plains and flood prone areas. Awareness raising, education on flood risk, communication and messaging need to be strengthened to minimize flooding effects. Ecosystem-based solutions such as reforestation in important river catchments, planting native vegetation on flood plains that have been claimed for cropping, and creating buffers through vegetation should be serious considered.

REFERENCES

Adetunji, M. A and Oyeleye, O. I. (2018). Assessment and control measures of flood risk in Ajibode Area of Ibadan, Oyo State, Nigeria.

Emeribeole, A. C (2015). Managing flood disasters in Nigerian cities: Issues and strategies towards meeting the challenges in the modern world (A Case Study of Owerri Metropolis Imo State Nigeria). From the Wisdom of the Ages to the Challenges of the Modern World Sofia, Bulgaria.

Evans, U. F., Dominic, K. O., Evans, G. U and Utting, C (2017). Analysis of the relative contributions of climatic elements and environmental variables to flood disaster in Bayelsa State, Nigeria

Green, Andy J., Baltzinger, C., and Lovas-Kiss, Á. (2021). Plant dispersal syndromes are unreliable, especially for predicting zoochory and long-distance dispersal.

Hansson, K., Danielson, M and Ekenberg, L. (2008). A framework for evaluation of flood management strategies. *Journal of Environmental Management*.

Jeffrey, O, Noku, C. J., Effiong, J., and Ayara, N. (2020). A geospatial expose of flood-risk and vulnerable areas in Nigeria. *International Journal of Applied Geospatial Research*.

Kolawole O.M., Olayemi A.B and Ajayi K.T (2011). Managing flood in Nigerian cities: Risk analysis and adaptation options Ilorin city as a case study. *Archives of Applied Science Research*.

Magami, I. M., Yahaya, S and Mohammed, K. (2014). Causes and consequences of flooding in Nigeria. *Biological and Environmental Sciences Journal for the Tropics*.

Manzaneda, Antonio J.; Fedriani, Jose M. and Rey, Pedro J. (2005). Adaptive advantages of myrmecochory: the predator-avoidance hypothesis tested over a wide geographic range, *Ecography*.

Manzano, P., and Malo, J. E. (2006). Extreme long-distance seed dispersal via sheep. *Frontiers in Ecology and the Environment*.

Najeeb, U., Bange, M.P., Tan, D.K.Y., and Atwell, B. J (2010). Consequences of Water logging on plants and Opportunities for Mitigation of Yield Losses.

Nkwunonwo, U. C, Whitworth, M. and Baily, B. (2016). Flooding and flood risk reduction on the reduction of plants species in Nigeria: Cardinal gaps. *Journal of Geography and Natural Disasters*.

Nkwunonwo, C. U (2005). Meeting the challenges of flood risk assessment in data poor developing countries, with particular reference to flood risk management in Lagos, Nigeria. Ph.D Thesis. University of Portsmouth.

Olajuyigbe, A.E., Rotowa, O.O. and Durojaye, E. (2012). An Assessment of Flood Hazard in Nigeria: The Case of Mile 12, Lagos May 2012 Mediterranean *Journal of Social Sciences* 3(2):367-375 DOI: 10.5901/mjss.2012.v3n2.367

Oruonye, E.D., Ahmed, M.Y., Yakubu, D., Wui, V. C and Ejati T.D.H (2017) Effects of flood disaster on rural livelihood and coping mechanism in Lau Local Government Area, Taraba State, Nigeria. *Agricultural Science Research Journal*.

Sperber J.I. (2014). University of Wiscobsin-Extension: The Effects OF Flooding on Woody Plants, Shrubs and flowers.

Wenny, D.G. and Levey, D.J. (2000). Directed seed dispersal by water in a tropical rain forest. Proceedings of the National Academy of Sciences of the United States of America.

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