# Coastal Vulnerabilities and Hazards in OBR

“ The Intergovernmental Panel on Climate Change (IPCC) describes climate vulnerability as a function of: (1) the character, rate, and magnitude of the climate change stressor (e.g., 1°C increase in water temperature over the next decade), (2) the sensitivity of the system to the climate stressors, and (3) the ability of the system to adjust to climate change, moderate potential damages, take advantage of opportunities, or cope with the consequences (referred to as “adaptive capacity”)”

Coastal hazards refer to the risks of life and property on the coastline that are created by coastal flooding, high winds and waves, short- and long-term shoreline erosion, and storm surges. The risk that a natural hazard poses is considered by estimating the impact that it would have on the people, services, facilities, and structures in a coastal community. Risk is typically defined as “probability of an event x consequence” and the greater the frequency and/or impacts, the greater the risk.

**Threats and Hazards**

1. **Flooding**
    1. Sources: coastal storm, dam break, heavy rainfall
    2. Higher risk of damage because of increased development in flood prone areas
    3. Solution: protecting floodplains preserves ecosystem function and reduces loss of life and property damage from floods
    4. https://coast.noaa.gov/floodexposure/#-9456156,5591962,8z

5. Tool https://water.weather.gov/ahps/region_forecast.php?state=mi, https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=48dcf8ca136a49a298a60e31422d58f0

2. **Lake Levels**
    1. Sources: high lake levels from increased precipitation, which is linked to climate change. Unusually intense oscillations of lake levels observed recently
    2. Dangers  of chronic flood and erosion as well as property damage and shoreline erosion from storm surge and storm waves
    3. Lake level changes will impact shipping canals. Ports, shoreline development, and residential water supply and hydroelectric energy production
    4. https://coast.noaa.gov/llv/
3. **Storms**
    1. Storm surge, high winds, heavy rain and flooding, as well as tornadoes can cause intense property damage as well as power outages
    2. Winter storms can produce rough lake conditions, coastal flooding, and beach erosion.
    3. Strong winter storms are also responsible for significant land losses around the Great Lakes.
    4. https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=3805293158d54846a29f750d63c6890e

5. https://www.ncei.noaa.gov/access/monitoring/cei/graph
6. https://www.ncdc.noaa.gov/stormevents/

4. **Erosion**
    1. Coastal erosion is a process whereby large storms, flooding, strong wave action and human activities – such as inappropriate land use, alterations, and shore protection structures – wear away beaches and bluffs during a flood or storm or over a period of years. Erosion undermines and often destroys homes, businesses, and public infrastructure and can have long-term economic and social consequences.
    2. http://www.greatlakesshoreviewer.org/#/great-lakes

**Climate Change Phenomenon**

1. **Increasing Air Temperature**
    1. Potential impacts: heat waves, drought, wildfire, invasive species, shift in species range, changes in phenology, reduction of snowpack
    2. Consequences: illnesses, loss of life, loss/degradation of coastal ecosystem services, decline in quality and quantity of freshwater, destruction and damage to coastal property and infrastructure, economic losses
    3. Rain on snow → more nutrients in Lakes
    4. Tools: https://hprcc.unl.edu/maps.php?map=ACISClimateMaps#, https://water.weather.gov/ahps/region_forecast.php?state=mi

5. https://mrcc.purdue.edu/mw_climate/snowfallClimatology/snowfallClimatology.html
6. https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/time-series

2. **Declining Great Lake Levels**
    1. Potential impacts: water loss, blush erosion, hypoxia, harmful algal blooms, invasive species
    2. consequences : reduction in quality and quantity of fresh water, impairment of coastal infrastructure, reduction of coastal ecosystem services, coastal property damage,  economic losses
    3. http://www.greatlakesshoreviewer.org/#/great-lakes
    4. https://coast.noaa.gov/llv/
3. **Increasing Storm Frequency/ Intensity**
    1. Potential impacts: flooding, high wind, high waves, erosion, storm surge, salinity shifts, nonpoint source pollution, increased toxins
    2. Consequences: injuries and loss of life, destruction of coastal property, loss of ecosystem services, decline in water quality, economic losses,
4. **Increasing Precipitation**
    1. Flooding, erosion, nonpoint source pollution, increase toxins, salinity shifts, higher lake levels
    2. consequences: injuries and loss of life, destruction of coastal property, loss of ecosystem services, decline in water quality, economic losses,

3. http://www.climatedata.us/
4. https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html?bkmrk=mi

5. **Increasing water temperature**
    1. Impacts: hypoxia,, pathogens and disease, harmful algal blooms, invasive species, shifts in species range, changing in phenology
    2. Consequences: loss of ecosystem services, decreased water quality, economic losses

**Sensitive populations**

- https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities
- https://headwaterseconomics.org/tools/populations-at-risk/tool-about/
- https://response.restoration.noaa.gov/resources/environmental-sensitivity-index-esi-maps
- https://ejscreen.epa.gov/mapper/
- https://screeningtool.geoplatform.gov/en/#6.68/44.96/-84.01