

Climate change and adaptation

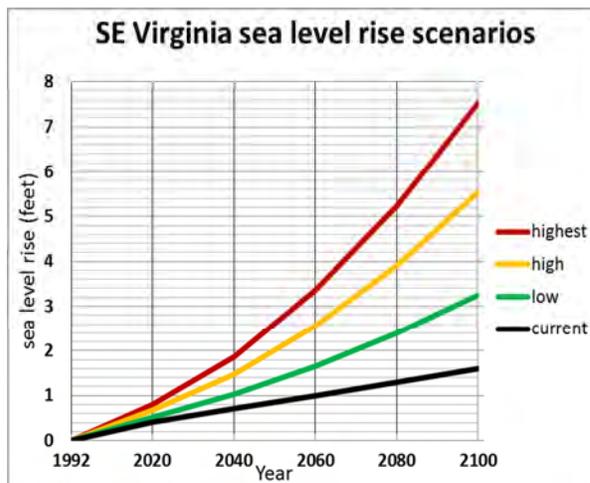
Sea level in Chesapeake Bay is affected by changes in three general factors. The result for coastal Chesapeake Bay has been a long-term, and recently accelerating, rise in the level of tidal waters.

1. **Volume of water in the ocean increasing due to 2 factors:** Glaciers, ice caps, and ice sheets in Greenland and Antarctica are melting, adding water that was stored on land surfaces to the ocean basins. At the same time, the water in the oceans is warming causing it to expand.
2. **Elevation of Chesapeake Bay's coast is sinking:** The primary cause is the continuing adjustment of the earth's crust to the melting of glaciers from the last ice age. Secondly, groundwater withdrawal contributes to local subsidence.
3. **Changes in ocean circulation:** Changes in the location and rate of the Gulf current off the coast of Virginia affects water levels.



In Virginia, sea level is rising at the fastest rate of any of the Atlantic states, second only to the Gulf states. Analysis of historic data puts measured sea level rise rates on approximately the high (yellow) scenario below. We anticipate ~0.6m rise in sea level by 2050.

This will significantly affect natural resources and increase human risk in the Chesapeake Bay.



Sea level rise will increase the vulnerability of human infrastructure and natural resources to flooding.

Human infrastructure at risk includes: houses, businesses, roads, tunnels, airports, stormwater and sewer systems, and utilities.

Sea level rise is also predicted to increase coastal erosion. Many of our coastal resources are critical components of a natural system to reduce coastal flooding. Sea level rise and coastal erosion eat away at the extent of marshes, beaches and shallow water areas, reducing both their extent and their capacity to reduce flood impacts.

Climate change and adaptation, cont'd

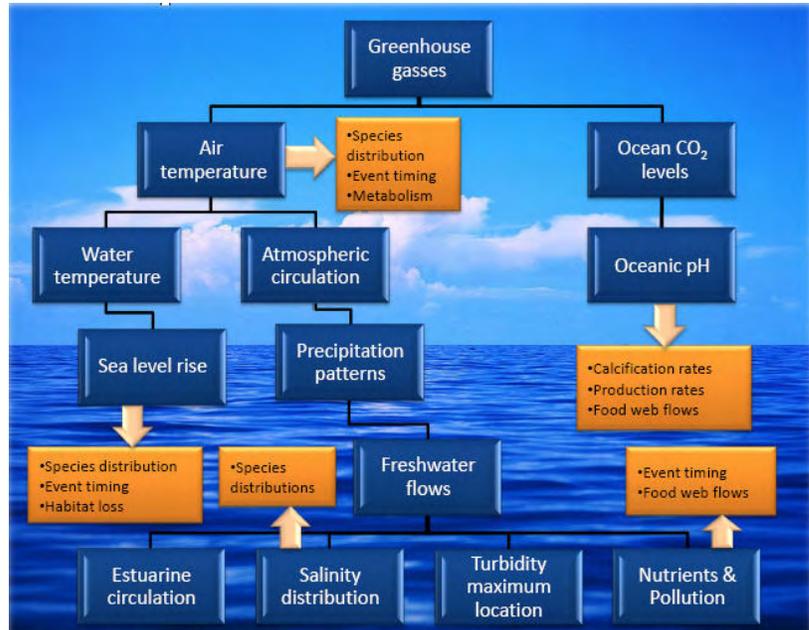
Climate change cascades: A cascade is defined as a process that occurs in successive stages, each of which is dependent on the preceding one, and often producing a cumulative effect.

Climate change cascades occur when a species or process not directly affected by changes in temperature or precipitation responds to climate change due to a change in a related species or process that is strongly affected by changes in temperature or precipitation.

A cascade may be a linear relationship or a complex interconnected network. The diagram on the right illustrates some ways that a changing weather system can reverberate through natural systems and impact health and human safety as well as economic activities.

For example:

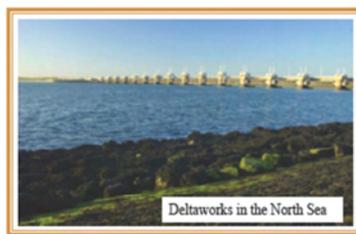
- Sea level rise
 - change in salinity distribution
 - change in Estuarine turbidity maximum location
 - location of phytoplankton bloom
 - availability of food for zooplankton population
 - availability of food for jellyfish and ctenophore populations



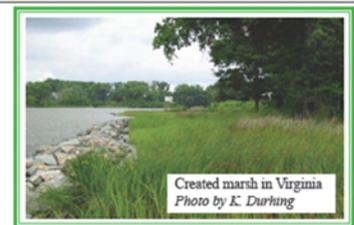
Adapting to climate change:

Shifting climatic conditions, such as sea level rise and changes in the frequency or intensity of storms, are predicted to increase flood damage. Predicting the impact of these changes allows localities to target adaptation strategies which will mitigate both current and future flooding. Practically, only sea level rise changes can be predicted with any level of confidence. Although some research has been done on changes in storm patterns, Chesapeake Bay receives heavy precipitation from both tropical systems (tropical storms and hurricanes) and Nor'easters, which respond to different climatic forces. This makes changes in precipitation patterns difficult to predict.

Most sea level rise adaptations are aimed at reducing flood losses and are particularly focused on reducing storm surge impacts, since storm surge impacts will increase with sea level rise, causing damage in currently unaffected areas.



Floodgates or Tidal Barriers
Advantages: Protects a huge area of land from flooding with one project, protects everyone, no social equity issues.
Disadvantages: Expensive, ecologically transformative and damaging.



Wetland Creation
Advantages: Reduction of intensity and frequency of flooding; preserves or increases valuable habitat; provides recreation and open space areas, reduces water pollution and enhances groundwater recharge.
Disadvantages: Extensive land required to provide benefit, continued maintenance required.