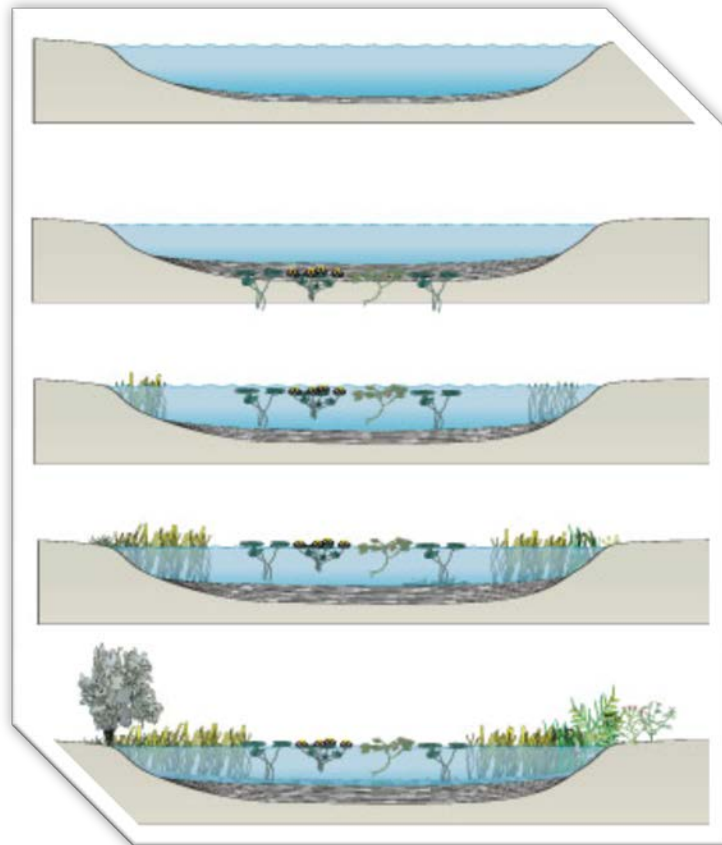


# The Ecological Succession of Microorganisms in the Hudson River Estuary



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New York, 2015

**Introduction:** When people look around in a forest, they think back to the ways it used to be hundreds of years ago. Some forests or other land biomes have come out of the water bodies that used to be present which is described as the process of Aquatic succession, a type of ecological succession. Aquatic succession occurs when water bodies experience several changes within the ecosystem until it reaches a point called the climax community. The climax community stage at the end of succession is the same as the telluric climax community stage where a new different type of ecosystem becomes out of an old one. In the case of aquatic ecological succession, deciduous temperate forests will come out of different water bodies such as lakes, rivers, ponds, etc. Ecological Succession in water bodies are affecting the world in great ways because the biodiversity is changing, which in turn changes our ways of living since we depend on most organisms that come from the water through the energy and the food cycle. What is being studied is the ecological succession in the Hudson River, specifically the microorganisms and their abundances in the different depths of the estuary is investigated through the installation of glass slides in the Hudson River. It is hypothesized that 80% cover of biofilm or Periphyton on the slides in higher abundance compared to other microorganisms.

**Background:** Ecological succession is the study of changes in the community structure of an area for a period of time ("The Virtual Nature Trail at Penn State Kensington Ecological Succession", 2009). There are two different types of succession which are primary and secondary succession. Primary succession is when new organisms colonize new land. The type of primary succession that takes place in a freshwater environment is called the Hydrosere. The pioneering community is being studied in the Hudson River Estuary. The composition of the climax community is usually controlled by the climate, acute disturbances (i.e. annual storms)

and chronic disturbances (i.e. daily tidal movements), (Tewfik, Guichard, McCann, 2007) – also biotic and abiotic factors, (Nydam, Stachowicz, 2007) community metabolism, species composition, (Hirata, 1987, pp. 25-35) sedimentation grazing, herbivory, predation, and shading. (Hirata, 1986)

In aquatic succession, the primary organisms that colonize a certain area in the water are always the microorganisms. Microorganisms are spread throughout the plant, protozoa, bacteria, and fungi kingdoms. They are organisms so small that they can't be seen by the naked eye but through a microscope. (ScienceDaily, "Microorganism", 2014) Protozoa are single celled organisms that can be autotrophic, heterotrophic, freely swimming or a part of biofilm. (Knott, "Water Resource Characterization DSS - Protozoans") Algae are a group of autotrophic protists and different sized bacteria using photosynthesis eventually become macrophytes. Phytoplanktons are microscopic plants that can be single celled and travel in colonies. They are at the bottom of the food chain along with the algae. (Lindsey, Scott, 2010) On surfaces at the bottom of many water bodies are Periphyton, a layer of mainly algae and other organisms which are also known as biofilm.

**Materials:**

<b>Material</b>	<b>Quantity</b>	<b>Function</b>
Glass Slides	20	To use as hard substrate for colonization of organisms
White String	3 m 6.75 cm	Used to hang the glass slides in the estuary
Manila Rope	2 3/8" x 50', 9.53 mm x 15.24 m	To hang the quadrant from the pole. To connect the

		quadrant to the anchor
Carabiner	2	To clip the rope to the U-Bolt or Hose Clamp
U-Bolt	2	Use as a tool to hang the rope from the pole
Hose Clamp	2	Use as a tool to hang the rope from the pole
PVC Pipes	4	Use as support for the glass slides in the water
PVC Pipe Corner Connector	4	To connect the PVC pipes together
PVC Pipe Glue	1 can	Used as an adhesive to attach the connectors to the PVC pipes
Anchor	1	To weigh down the glass so that they won't move
OM116L Monocular Compound LED Microscope	1	To measure and observe abundances on slides
Diamond Drill Bits 1.5 mm	1	Used in the drill
Drill (DeWalt XRP)	1	Used to drill the holes in the glass slides, and PVC pipes
Personal Protection Equipment		To protect when drilling and using microscope
Meter Stick	1	To measure distance between glass
Alcohol	1 Bottle	To clean the microscope
Paper Towels	-----	To clean up the glass pieces
Kim Wipes, Cotton Balls	-----	To clean the microscope
Tape	1 roll	To cover the glass slide to prevent from cracking

Permanent Marker	1	To dot the glass slide and mark any distances.
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**Safety:**



Gloves are required



Protective clothing is required

**Procedure:**



Figure 1 shows the design of the quadrat with the glass slides with the use of string, a PVC Pipe and an anchor in the Hudson River Estuary.

1. Put on the *Personal Protective Equipment*, take out the *drill* with the *1.5 mm drill bit* and insert the drill bit inside the drill.
2. Take out a *glass slide* and lay cover the top of the slide with *tape*. Dot the middle of the tape with the *Permanent Marker* to indicate the place where the glass will be drilled.
3. Lay the glass slide on a flat surface that there wouldn't be any worry to drill on. Use the drill to drill a small hole in the glass where the dot was place (usually at the top in the middle).
4. After drilling the glass slides take off the tape and set them to the side.
5. Take the *PVC pipe* and use the *Meter Stick* and permanent marker to divide the PVC pipes into 3 sections evenly, about 30 centimeters. Dot the different sections with the permanent marker.
6. Replace the 1.5 mm drill bit with a bigger one and use the drill to drill holes in the PVC pipes.
7. Take the glass slides and divide them into four groups. Take the *White String* and insert them into each group of the glass slides, securing them with a knot on each side of the slide so that they wouldn't collide with each other. Also, leave some length of the line left over at each end.
8. Using white string with the glass slides attached, insert the ends that are left over in both pipes securing them tightly with a knot.
9. Attach the PVC pipes to the corner connectors with PVC glue and let dry.
10. Now that the design is complete, install the design in the estuary near a dock safely with adult supervision and wait a couple of months so that the organisms can colonize.

11. After a couple months pass, take out the slides and observe them through a *Microscope* that has been cleaned already with the *Kim wipes, Alcohol, and Cotton balls*.
12. Record observations by measuring percent coverage of microorganisms on slides
13. Insert the slides back into the water.

**Conclusion:** The installation of the slides in the Hudson River Estuary located at Pier 101 has yet to be completed. Once the installation has been completed, it is expected that microorganisms will be the dominant feature then, once the quadrat is installed, it is expected to find mainly microorganisms. It is also hoped to find sessile organisms as well as encrusting organisms such as different type of encrusting bryozoans, algae. There were also expectations to find larvae for mussels. With time, there was hope to find sponges as well. With installing in a very productive season, a lot is predicted to what will be found on the slides in the estuary.

**Suggestions for Improvement:** For further research, the design is going to be changed into a frame with PVC pipes to have a more secure structure for the impending colonies. When the design was changed to PVC pipes, the strings attached into the pipes were too loose to install, if the strings were too loose, the glass slides could break. There were also supposed to be two extra larger holes in the top side of the PVC pipes to connect the rope from the PVC pipes to the pier. There was also a struggle with finding location to install the quadrat so that it won't disturb other projects and get destroyed itself by boats. With all those problems, the quadrat couldn't be installed into the estuary. But the project is planned to be taken upon someone else in the future.

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