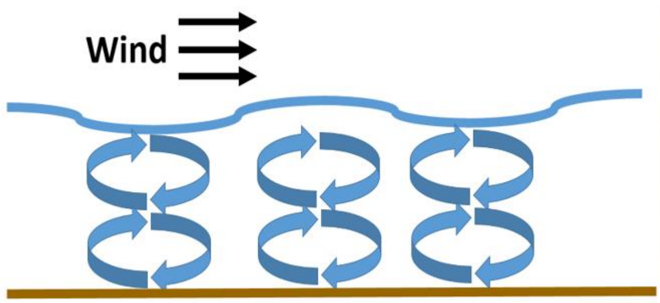
What Is Causing Malheur Lake Turbidity?

Developing A Malheur Lake System Model

Thanks to funding from Oregon Watershed Enhancement Board's Focused Investment Partnership, Dr. Tamara Wood (United States Geological Survey) and doctoral student James Pearson (Oregon State University/United States Fish and Wildlife Service) are conducting research to determine the drivers of turbidity in Malheur Lake. Turbidity is a measure of water clarity in the lake, and high levels of turbidity decrease light availability, which in turn inhibit growth of aquatic plants (muddy looking water rather than clear water). Thus, the negative impact of turbidity in Malheur Lake have made this Pacific Flyway rest stop much less enticing for migratory birds due to a lack of food.

To find solutions to restore Malheur Lake, Dr. Wood and James are conducting important tests to learn what makes the water in Malheur Lake turbid. One theory is that carp are responsible for a portion of the turbidity in Malheur Lake via their activity and mode of feeding, which uproots aquatic plants and suspends sediment into the water column. While the carp's feeding technique creates turbidity and degrades the aquatic habitat, researchers are beginning to try to understand how wind is also contributing to the turbid environment and acting to further degrade the aquatic ecosystem of Malheur Lake. For instance, as wind travels across the lake's water surface, it creates energy that generates circular waves that extend to the sediment, resulting in a shearing action that can suspend fine sediment into the water column and create a turbid environment (figures below). These turbid conditions can be further exacerbated by long wind fetches (distance wind travels across an exposed water surface). Large shallow lakes such as Malheur Lake are especially susceptible to wind re-suspension due to the large surface area (≈ 45,000 acres), shallow depths (≈ 2 feet), and long wind fetches (≈ 8 miles across). Thus it is proposed that these factors (carp and wind stress) combine to create a turbid environment with reductions in aquatic plants, invertebrates, and fish.



Dr. Wood, James, and other researchers from the United States Geological Survey spent a week this August conducting experiments at Malheur Lake designed to determine how strong the wind's energy must be to transport fine sediments up into the water column. First, cores were collected from the lake by pushing 4-inch plastic sleeves into the bottom sediments. These cores were carefully carried back to the lake shore, to keep the layering of the sediments exactly as it was in the lake. Then, clear (low turbidity) water from the Blitzen River was carefully placed on top of the cores, and a spinning cap was placed on the top of the sleeve to simulate the action of wind blowing across the surface of the water. The speed of the spinning cap was carefully controlled and was slowly ramped up over time. The turbidity of the water on top of the core was measured continuously through the experiment. In this way, the spinning velocity at which the sediment was first released from the bottom in large quantities could be precisely identified. Because the equipment is carefully calibrated ahead of time, this spinning velocity can be translated into the amount of shearing force, and equivalent wind speed, that is required to lift sediments in Malheur Lake.

During this experiment the researchers were also able to visually identify the layers of sediments in the cores which contributed to a better understanding of the turbidity in the lake. A layer of very fine, silty sediment overlays a thick base of organic peat, a relic of times when the lake was a vast wetland. The top layer of fine silts varied from about 1 cm at a southerly site in the lake near Cole Island Dike to 4 cm at a site located farther north in slightly deeper water. Knowing some basic constraints on the amount of fine silts available provides a useful means of determining the maximum possible concentration in the water column, and the resulting turbidity.

Incorporation into the Systems Model

This experiment enabled us to quantify a major parameter (‘*Shear Stress for Erosion’* or the force necessary to suspend sediment) in Malheur Lake. Quantifying this was a crucial step in the construction of the Systems Model and will now enable us to simulate how turbidity throughout Malheur Lake will respond to changes in physical and environmental conditions such as fluctuations in lake area, wind speed, and wind direction. Once these additional tests are done and the construction of the Systems Model is complete we will be able to test alternative restoration scenarios targeted at reducing turbidity and promoting the growth of aquatic vegetation.

Project Collaborators:
Dr. Tammy Wood (USGS)
David Schoellhamer (USGS)
Liam Schenk (USGS)
Joe Barnett (USFWS)
James Pearson (USFWS)