

THE ATMOSPHERIC RESERVOIR

Examining the Atmosphere and Atmospheric Resource Management

"North Dakota's Water Cycle"

By Mark D. Schneider

Known as the *water*, *hydrologic*, or *H₂O* cycle, this intricate circulation of water around our planet is essential to all life. Rivers and lakes make up a visible part of the water cycle here in North Dakota, but there is a tremendous amount of "invisible" water in the form of water vapor flowing through the atmosphere. During the summer when warm, moist air from the Gulf of Mexico makes its continental trek northward through the plains, there are roughly five and a half million acre-feet or nearly two trillion gallons of water floating above our state every day! In addition, more than three-quarters of ND's annual precipitation occurs between April and September when moisture from this low level flow condenses into rain producing clouds.

There are many dynamic processes involved in transporting water through our atmosphere. We often focus on the *evaporation* process because of the enormous quantities of water that are moved by it. During evaporation, liquid water molecules escape the outer layer or surface of a water source and enter the vapor stage. The rate that water evaporates is increased when: the surrounding air is less saturated, there is greater airflow around the water source, water

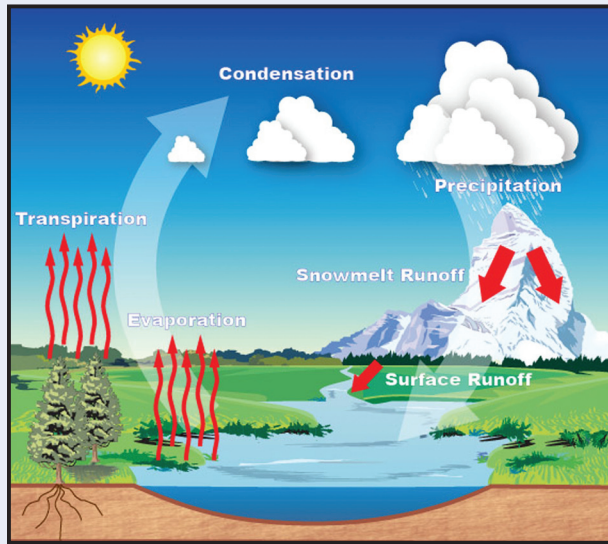


Image Courtesy of the National Weather Service.

temperatures are higher, the air pressure and density are less, and when surface area is greater. The opposites of these factors are true in regards to decreased evaporation rates. The average amount of water evaporated from Lake Sakakawea per day is 2,472 acre-feet or nearly 800 million gallons. This is enough water to grow approximately 73,000 bushels of wheat.

As wheat, crops and vegetation grow, water is evaporated off of their surfaces through the process of *transpiration*. Transpiration is made possible by tiny pores on each plant's outer skin called *stomata*. *Stomata* means *mouth* in Greek and appropriately so because each stomata communicates between the inner and outer parts of plants, allowing water to be released and then evaporated into the surrounding air. Amazingly,

only one percent of the water transpired through a plant is used for growth; the remaining ninety-nine percent returns to the air through a combined evapotranspiration process.

As evaporated water rises and cools, *condensation* occurs and clouds develop. Clouds are made up of small water droplets and ice crystals that can combine to make larger particles by "bumping" into each other or by grouping together around a common nucleus or central

particle and growing in size. This results in *precipitation* processes and water is once again brought back to the earth. As soils reach saturation from this precipitation, excess water becomes *runoff* and flows into rivers and lakes. A trip through the water cycle has now been completed.

This is a very basic description of the incredibly dynamic water cycle that is continually working around us. It is difficult to comprehend the sheer amount of water in our atmosphere that we're unable to see and what a vital role it plays in sustaining life here.

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