Dissolved Oxygen (DO) **What is It? Management Opportunities to Mitigate Negative Impacts**

Dissolved oxygen (DO) refers to the amount of oxygen within stream water. It is measured as milligrams (ml) of oxygen per liter (L) of water (mg/L). DO is critical for the survival of fish and other aquatic life. Most trout species function normally at 7.8 mg/L and above. Trout begin to suffer at about 6 mg/L, and are severely affected at about 4.3 mg/L and below.

Dissolved oxygen in streams is increased by mixing and turbulence, such as when streams flow over riffles and waterfalls. In streams, dissolved oxygen decreases as water temperature increases. Thus, management practices which increase water temperature can reduce dissolved oxygen levels (e.g., hot irrigation return flows, reduced stream flow rates due to diversions, and removal of plants along streams which provide shading).

Aquatic plants can increase and decrease DO levels. During the day, aquatic plants conduct photosynthesis which creates oxygen in the water. During the night, aquatic plants respire and consume oxygen from the water. Thus, DO levels will naturally be lowest at or just before dawn and highest mid to late afternoon. Aquatic plants are an important part of a healthy stream. However, excessive levels of nitrogen and phosphorus added to a stream can cause a fertilizer response and excessive aquatic plant growth. At night these plants can reduce oxygen to low levels. When plants die, significant oxygen can be used as microbes decompose the dead plant material.

In the UFRW, irrigation and grazing could be contributing to low DO observed at several sample sites. This could be due to elevated nitrogen and phosphorus levels, but the data collected thus far in the project show relatively low levels of nitrogen and phosphorus. Irrigation could be decreasing in-stream DO by reducing streamflows which will increase temperature and reduce mixing and turbulence in the stream. Tailwater entering streams could have reduced DO levels, and elevated temperature compared to the stream. In a recent study, we found that tailwater can be warmer or colder than the stream it returns to depending upon factors such as tailwater flow rates and amount of time spent on the pasture. In general, water is warmed as it flows across pastures during daylight hours. We also found that DO in tailwater ranged from as low as 1.5 to almost 8 mg/L. This indicates that tailwater can be managed to increase DO. For example, mixing of tailwater over rocks or a weir can oxygenate tailwater before it enters a stream. (November 2007)

For more information on fish and dissolved oxygen see: Thompson and Larsen. Fish Habitat in Freshwater Streams. UC Publication 8112. (type in “8112” in the search box at the following web site: http://anrcatalog.ucdavis.edu/InOrder/Shop/Shop.asp)

For more information on irrigated pasture management and dissolved oxygen see: Tate et al. 2005. Monitoring Helps Reduce Water Quality Impacts in Flood-Irrigated Pasture. California Agriculture. 59:168-175. (http://repositories.cdlib.org/anrcs/californiaagriculture/v59/n3/p168/)

Reduced flows, increased temperature, nutrients & algae can lead to low DO measurements. Investigate opportunities for aerating water by having it tumble over rocks, weirs, etc. Minimize ‘dirty’ tailwater returning to the system.