

Grazing Riparian Ecosystems: Water Developments

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Livestock often are attracted to riparian systems for the availability of forage and water, shade and smooth terrain.

Riparian ecosystems are extremely productive, with some providing 81 percent of the summer forage utilized by livestock (Roath and Krueger 1982). Livestock grazing of riparian vegetation can result in a decline in soil health, loss of biotic diversity, degradation of wildlife habitat, reduced water quality and alterations in stream hydrology.

However, grazing has been found to be important for the proper functioning of many riparian zones. Implementation of proper grazing management practices is essential to prevent livestock from congregating in riparian ecosystems, which results in a decline in water quality.

The development of off-stream water sources has been shown to reduce livestock use of riparian ecosystems (Miner et al. 1992), reducing the fecal contamination in the stream. Off-stream water developments have been linked to improvements in riparian health and livestock production. Livestock that have access to an off-stream water source have been reported to have greater weight gains (Stillings et al. 2003).

Type of Water Developments

Limited Access

Livestock access to the riparian ecosystem can be limited through the use of fencing to manipulate animals to go to designated watering areas with hardened crossings or exclude them from the stream channel (Figure 1). These fencing strategies can result in a reduction in sedimentation and erosion, and increase water quality.

Hardened Crossings

A hardened crossing is a designated crossing area that has a hardened bottom, usually rock or gravel, that provides livestock with firm footing and discourages congregating in the stream (Figure 2, page 2). When creating hardened crossings, placing them in areas that livestock currently use to access the stream is important.



Figure 1.
Example of a limited access watering area.

(Photo courtesy of Don Poggensee, USDA NRCS.)



Figure 2. Example of a hardened crossing access watering area.

(Photo courtesy of Don Poggensee, USDA NRCS.)

Figure 3. Photo of a submersible pump.

Off-stream Water Developments

Submersible pumps

Submersible pumps are used to divert water from the stream into a tank outside of the riparian corridor (Figure 3). One disadvantage of this system is water quality is not as high as water from a well; however, submersible pumps are not as costly as well development.

Well development

Solar

Solar-powered water developments consist of a power supply and pump (Figure 4). The power supply consists of photovoltaic (solar) panels, which are made up of solar cells that produce direct-current (DC) electricity when exposed to light. The power created by the solar panels either directly powers the pump or is stored in batteries. The pumps used in solar water systems are designed to use direct current.

Solar-powered water developments have two primary designs: battery-coupled and direct-coupled. Battery-coupled water pumping systems consist of solar panels, a charge control regulator, batteries, pump controller, pressure switch and tank, and DC water pump (Figure 5).

The electric current produced by photovoltaic (PV) panels during daylight hours charges the batteries. The batteries in turn supply power to the pump anytime water is needed.

The use of batteries spreads the pumping over a longer period of time by providing a steady operating voltage to the DC motor of the pump, enabling the system to provide a constant source of water for livestock.

In direct-coupled pumping systems, electricity from the solar panels is sent directly to the pump, which in turn pumps water through a pipe to where

it is needed (Figure 6). This system is designed to pump water only during the day. The amount of water pumped is dependent on the amount of sunlight hitting the PV panels and the type of pump. To compensate for variations in flow, proper pairing of pump and solar panels is required to achieve efficient operation of the system.

Due to the irregular flow associated with solar systems, either a storage tank or a large tank needs to be used because these systems need to be able to store three to seven days of water to ensure livestock have a constant source of water.



Figure 4. Example of a solar-powered watering system.

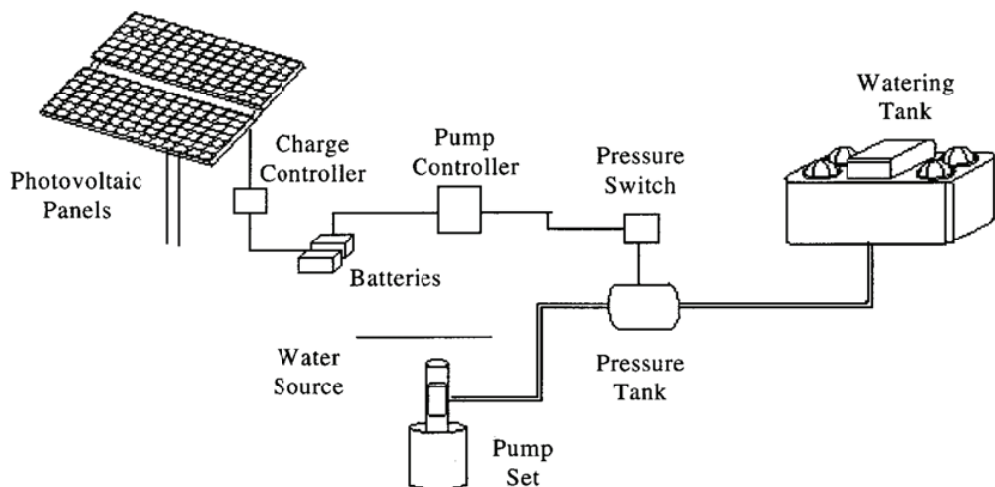


Figure 5. Design depicting battery-coupled water pumping system (Buschermohle and Burns).

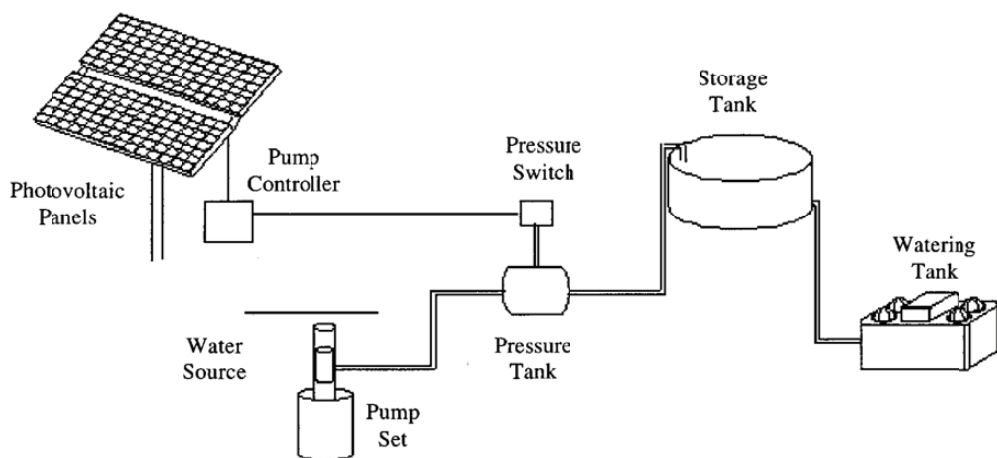


Figure 6. Design depicting direct-coupled water pumping system (Buschermohle and Burns).

Wind (Windmill, Turbines)

Windmills and wind turbines are an economical power source for pumping water in places where electric power is not available (Figure 7). Wind-powered systems use the energy of the wind to power the pump, or wind energy can be used to generate electricity, powering DC pumps. While windmills and turbines are less costly to install than other systems, they require considerable maintenance. Similar to solar systems, wind-powered systems do not provide a continuous flow of water, thus tanks with a capacity of three to seven days for livestock are required as part of wind-powered systems.

Electric

In areas where alternating-current (AC) electrical power is readily available, an AC-powered pump is the best choice for pumping water. Electric-powered systems are the most cost effective for powering a pump. Pumps powered by electricity require very little maintenance and provide a more dependable flow of water to the tank, thus tanks are only required to hold a two- to three-day supply of water.



Figure 7. Example of a windmill water system.

(Photo courtesy of Gary Kramer, USDA NRCS).

Livestock Water Demands

The expected water consumption per head per day is dependent on temperature, and livestock class and age. Careful consideration needs to occur in extreme weather conditions such as high temperatures or freezing conditions to assure adequate water. Water consumption can reach more than 20 gallons per day for beef cattle when temperatures exceed 90 degrees. Providing an adequate supply of water through proper storage or tank size is necessary.

(Daily water requirements table appears on following page.)

Calculating Tank Size

The minimum livestock storage tank capacity should be enough to meet the minimum water requirements for the number of animals being grazed per day. The water tank should supply adequate water for two to three days

Table 1. Daily water requirements for different livestock classes at 50 F and 90 F.

| Livestock Class | Water Requirements (50 F) | Water Requirements (90 F) |
|-------------------------|---------------------------|---------------------------|
| Beef Cattle (lactating) | 12-14 gallons/head/day | 16-20 gallons/head/day |
| Dairy Cattle | 20-30 gallons/head/day | 26-38 gallons/head/day |
| Sheep and Goats | 1-4 gallons/head/day | 1.5-5.5 gallons/head/day |
| Horses | 8-12 gallons/head/day | 10.5-16 gallons/head/day |

using an electric pump or three to seven days using solar or wind pumps. The following formula can be used to calculate storage requirements: number of livestock x days of storage required x requirements in gallons/head/day = total gallons needed (Sedivec and Printz 2005).

Use the following formula when calculating tank storage capacity:

$$23.5 \times \text{the radius (half the diameter) of the tank squared} \times \text{the depth of the tank} = \text{tank capacity.}$$

Example:

Tank Diameter = 15 feet

Tank Depth = 2 feet

$$23.5 \times (15/2)^2 \times 2 = 2,644 \text{ gallons}$$

Tank size is important for storage, but accessibility by livestock also should be considered when selecting a tank. Cattle prefer to drink out of tanks that have a height of at least 2 feet. A higher tank height also prevents livestock from entering the tank, maintaining water quality. Sheep and goats, on the other hand, prefer to drink out of a 1-foot tank because they have difficulty drinking out of higher

tanks. However, modifications can be made to enable sheep and goats to drink from a 2-foot tank, such as placing cinder blocks around the tank.

To maintain the integrity of the watering site, the ground surrounding the tank needs to be reinforced to prevent soil erosion and keep the area dry. The two primary means to reinforce watering sites are placing the tank on 6 inches of gravel or placing the tank on a 5-inch-thick concrete pad overlaying 6 inches of gravel.

Cost-sharing Opportunities

A number of agencies provide cost sharing for livestock water developments. Federal governmental agencies that provide cost sharing include the Natural Resources Conservation Service (NRCS) and U.S. Fish and Wildlife Service. State agencies that may provide cost-sharing include the Game and Fish Departments and Department of Natural Resources. Conservation groups such as Ducks Unlimited are also a source of cost-sharing. Contact your local offices for more information.

Literature Cited

Buschermohle, M.J., and R.T. Burns. Solar-powered livestock watering systems. Agricultural Extension Service. The University of Tennessee.

Miner, J.R., J.C. Buckhouse and J.A. Moore. 1992. Will a water trough reduce the amount of time hay-fed livestock spend in the stream (and therefore improve water quality?). *Rangelands*. 14: 35-38.

Roath, L.R., and W.C. Kruegar. 1982. Cattle grazing influence on a mountain riparian zone. *J. Range Manage.* 35(1): 100-103.

Sedivec, K.K., and J.L. Printz. 2005. Rancher's guide to grassland management iii. NDSU Ext. Ser. North Dakota State University. Fargo, N.D.

Stillings, A.M., J.A. Tanaka, N.R. Rimbey, T. Delcurto, P.A. Momont and M.L. Porath. 2003. Economic implications of off-stream water developments to improve riparian grazing. *J. Range Manage.* 56(5): 418-424.

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