Drought, water quality, and livestock health

Summary

Drought and high temperatures can _cause water quality problems in livestock water sources, increasing risk of some livestock health problems. Overall, in terms of drought-related water quality issues, livestock owners should be aware of:

- High mineral concentrations, particularly high concentrations of sodium, sulfates, and nitrates, which can lead to acute and chronic health problems.
- Blue-green algae outbreaks occur sporadically and are hard to predict, but can cause rapid death and other illness.
- Risk related to microbial contamination is highly variable.
- Organic chemical contamination is the lowest risk unless there is a pre-existing suspicion of a chemical contaminant.

Poor Water Quality

Background

Water quality has assumed a greater profile in recent years. As water quality declines, livestock production is often adversely impacted. Water quality can be negatively impacted in the summer months when drought increases the concentration of minerals, and drought combined with warm temperatures increase microbes in the water. Guidelines have been developed for many situations including aquatic life (fish), domestic use, recreational, industrial, livestock, etc. Within the livestock guidelines, there is considerable species variation.

Water quality guidelines provide an assessment of water quality, however if the concentration of the substance exceeds the guideline, it does not mean that toxicity is an immediate consequence. Some of the guideline values are based on palatability and not specifically on toxicity.

There are a variety of local laboratories throughout BC that can assess water quality: https://directory.cala.ca/. Producers can also purchase conductivity meters to do their own testing for total solids in water. Note that testing for total dissolved solids is a good overall indicator of water quality but doesn't tell which substances are the problem. If conductivity tests are out of normal range, the water can then

be tested at a laboratory for specific ions.

Indications of Water Quality

Microbiology

Microbial contamination can be a major concern in standing water. Routine water testing at laboratories often involves biological measurements such as bacterial counts. Coliform bacteria counts or more specifically *E.coli* counts are conducted.

Salinity

This is a common measurement to assess water quality. It is a measure of the total dissolved solids (TDS) in the water and typically, Ca, Mg, Na, HCO_3^-, CL and SO_4 ions are included. Different laboratories and hand held meters measure salinity slightly differently, but in general Total Dissolved Solids is classified into four categories; fresh water, brackish water, salt water or brine.

Subjective Description of Salinity (TDS)	
Fresh Water	< 1000 mg/L
Brackish Water	1000 - 10,000 mg/L
Salt Water	10,000 - 100,000 mg/L
Brine	> 100,000 mg/L

Species Variation for Salinity

Some animal species are more likely to have health problems due to high water salinity. Generally, poultry are most susceptible followed by dairy cattle. Most other livestock species can tolerate 4000 - 5000 mg/L in the water. The following is a more comprehensive description of the salinity guidelines.

Guidelines for Saline Water in Livestock	
Concentration (mg/L)	Comment
< 1000	No impact on livestock
1000 - 3000	Considered acceptable for most livestock No effect on performance Transient diarrhea until adaptation

3000 - 5000	Generally acceptable for most livestock except poultry (diarrhea, poor growth)
5000 - 7000	Acceptable in most livestock except poultry, lactating or pregnant animals
7000 - 10,000	Unfit for poultry and swine Unfit for young, pregnant lactating animals Reduced productivity Unfit during periods of heat stress
> 10,000	Not recommended

Specific Ions

In some instances, highly toxic minerals or chemicals may be present in the water. General testing for TDS or salinity will not detect these specific toxic substances. A more in-depth water analysis for metals, anions, nitrates pesticides, ammonia, etc. may be necessary. Careful inspection of the water sample may provide useful insight. For example, high sulfide concentrations may be detected by smell. Anaerobic decomposition will produce hydrogen sulfide and a rotten egg smell. Elevated iron concentrations will produce a bitter taste in the water. Invertebrate organisms may die if insecticides are present in the water.

Careful examination of the livestock can also provide valuable information. Initially, elevated sulphate concentrations will produce diarrhea. With long term exposure, sulphate will interact with essential metals such as selenium or copper and produce mineral deficiencies and clinical disease in cattle. With gradually increasing exposure to moderate sulphate levels in water or feed, cattle can adapt without illness. Veterinarians can conduct examination of animals if producers have concerns.

Water Quality Guidelines for Specific Agents

There are many documents providing information concerning a variety of agents and the impact on livestock. The following table provides a general overview of information. These values can be used for a quick reference, but do not include unique situations or species differences.

Typical Water Quality Guidelines for Common Agents Encountered in the Livestock Industry.

Agent	**(mg/L)**
Arsenic	0.025
Calcium	1000
Chromium	0.05
Cobalt	1.0
Fluorine	1
Iron	0.3
Lead	0.1
Magnesium	400
Manganese	0.5
Mercury	0.003
Molybdenum	0.5
Nickel	1.0
Sodium	1000
Selenium	0.05
Uranium	0.2
Zinc	50
Nitrate (N)	100
Nitrite (N)	10
Sulphate	1000
Total Dissolved Solids	3000
Chlorine	250
Coliform Count	< 100 organisms /100mL

Resources:

https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/livestock/livestock-and-water-quality/livestock-water-quality

Other Water-Related Hazards

In addition to water quality issues, there are other issues associated with standing water in hot, dry conditions.

Blue-Green Algae

Blue-green algae, also known as cyanobacteria blooms, can look like blue-green scum, pea soup or grass clippings suspended in the water. Producers watering livestock from dugouts or ponds should start monitoring when temperatures rise above 25°C. Blue-green algae are caused by excess levels of nitrogen and phosphorus. These nutrients are commonly introduced from runoff or soil erosion from fertilizer and manure. The combinations of these excess nutrients with hot, sunny days can result in toxic algal blooms. These blooms commonly occur in late summer and early autumn but can occur earlier depending on the weather. When conditions are favorable, the bacteria can multiple rapidly with populations doubling in a day or less and persist for several weeks. However, even with rapid bacteria growth the formation of toxic blooms is not predictable. Signs of cyanotoxin consumption usually appear within 20 minutes of ingestion. Symptoms include weakness, staggering, difficulty breathing, paddling, convulsions, bloody diarrhea, and rapid death.

Environmental factors such as rain, heavy winds or cooler temperatures will slow bacterial growth or break up the bloom. Winds are very helpful in mixing the bacteria throughout the water body which reduces population growth.

The main preventive measures are those that help reduce nutrients getting into the dugout, such as buffer strips and good manure management. Some farmers may consider some kind of water aeration. If there is a history of previous blooms, there's a good chance they will occur again especially during drought conditions. Monitoring nitrogen, phosphorus, and dissolved oxygen can give some indication of when the water body is at risk of blooming. Copper sulfate (0.2-0.4 ppm) may be added to the pond or dugout to control blue-green algae growth.

Regular visual inspection for signs of colour change, algal growth, etc. is probably a minimum precaution. Knowing the difference between cyanobacteria and green algae or duck weed can be useful.

How to recognize an algae bloom - Province of British Columbia (gov.bc.ca)

https://www.alberta.ca/agri-news-dangers-of-blue-green-algae.aspx

https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/livestock/livestock-and-water-quality/duckweed.

Stick/jar tests can be helpful to identify cyanobacteria if the landowner is unsure and prairie Diagnostic Services offers an ELISA test for blue-green algae.

That being said, testing water before an outbreak is seldom useful. The toxins appear and disappear rapidly. Once you have an outbreak, the water is likely back to normal in about 10 days or less.

Organic Chemical Contamination

Contamination of water with pesticides including a variety of herbicides or insecticides can be a concern in intensive agricultural regions. Soil run off, spray drift, contaminated rain fall, spills, poor disposal or direct application are typical exposure scenarios.

Drought can increase the concentration of pre-existing chemical contaminants in water. With past flooding in BC, the organic contamination may have increased. Analysis for agricultural chemicals/organic chemicals can be very expensive and time consuming but can be conducted at A&L Laboratories in Ontario (https://www.alcanada.com/).

Other Drought related indirect risks to livestock health

Toxic plants

As forage species become depleted on pastures, livestock may graze plant species they would not usually consume. This increases the risk of ingestion of highly toxic plants, as well as ingestion of moderately toxic plants in amounts high enough to cause illness. Producers should ensure cattle have sufficient forage, and exclude cattle from areas with toxic plants.
https://www.beefresearch.ca/topics/weed-brush-control-in-pastures/

High nitrates in feed

During drought, stressed crops accumulate nitrates increasing risk of nitrate poisoning in cattle and other ruminants. Acute poisoning through exposure to high nitrate feeds can result in rapid death. Chronic poisoning results in failure to thrive, decreased production and abortion. If introduced gradually, ruminants can adapt to feed with moderate nitrate levels. Nitrate levels can be determined through forage testing.
https://www.gov.mb.ca/agriculture/crops/crop-management/forages/utilizing-high-nitrate-feeds-safely.html

https://open.alberta.ca/dataset/2389916

Anthrax

Anthrax is caused by the spore forming bacteria *Bacillus anthracis,* which is found in soil. Virtually all animals are susceptible to anthrax, but herbivores including cattle, sheep, goats and horses are especially susceptible, and infection generally results in rapid death. Cases in BC are very rare, however, disruption of soil, including through flooding or drought, increases the risk of animals being exposed though exposure to contaminated soil. Anthrax is reportable to the Canadian Food Inspection Agency and the BC Office of the Chief Veterinarian.
https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/anthrax/eng/1330045348336/1330045807153

https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/animal-health/reportable-notifiable-diseases

https://open.alberta.ca/publications/5495101

Lungworms

Lungworms (*Dictyocaulus viviparous*) can cause sporadic disease outbreaks in cattle, with severity of illness related to parasite load and general health of the animal. The risk of lungworms can be increased during drought where pastures are sparse and cattle are forced to graze low-lying, damp areas. When cattle are close together, environmental contamination increases, and the lungworms larvae mature quickly in warm, moist environments. Cattle grazing vegetation in these areas are at risk of ingestion of high numbers of lungworm larvae.

For animal health concerns specific to their herd, producers are encouraged to reach out to their herd veterinarian.