

Unit Fourteen

Drought, Heat Stress/ Animal Welfare

Overview

In this unit you will learn about droughts and extreme heat conditions and what you can do to mitigate these conditions. You will also learn about how to assess animal welfare in disasters.

Objectives

Upon completion of this unit, you should be able to:

- List the effects and conditions leading to drought and heat stress
- Describe measures you can take to mitigate drought and heat stress
- Define animal welfare
- Determine your vulnerability to drought and heat stress
- Determine your level of awareness about animal welfare issues in disasters

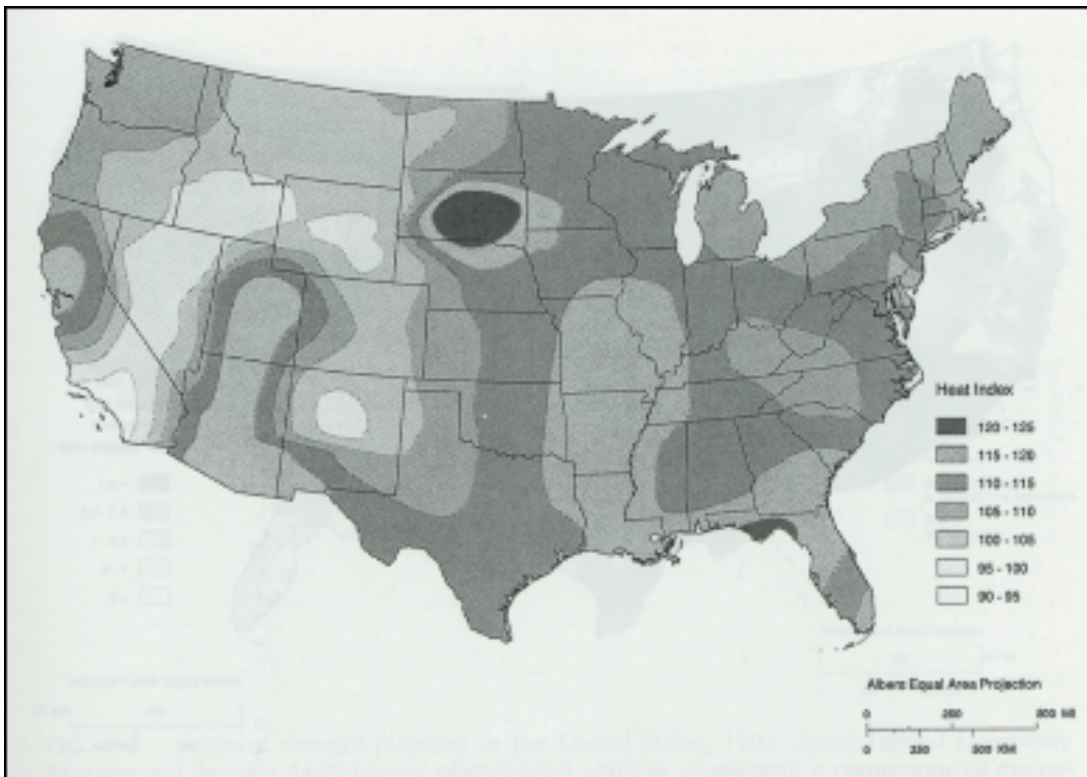
Drought

Droughts are probably the single most expensive disaster that affects the animal care industry in the U.S. This is because vast areas of the country's livestock industry can be affected by droughts. Droughts bring reduced availability of forage and decreased growth rates in animals, and make livestock and poultry production less efficient. Droughts are often associated with conditions that lead to extreme heat.

A practical definition of drought is when precipitation and other water resources fall below expectations but the demand for water is not diminished.

Low water resources can also be caused by increased demand, such as that resulting from increasing population or industry. Droughts can affect any part of the U.S. Droughts usually develop gradually and may go undetected for months or years until a crisis exists. Much of the world is currently affected by progressive drought conditions. For more information on droughts see: <http://drought.unl.edu/ndmc/>.

The map below illustrates the severity and regional extent of extreme summer heat in the U.S.



From FEMA: Multi-hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, Washington, DC, 1997.

Mitigation of droughts

Personal water conservation measures avoid depletion of water supplies both before and during periods of extended drought. Examples including reducing the number of times that cars are washed, lawns are watered, and preferring to take showers over baths.

During periods of heat and drought, people use a lot of power for air conditioning. This creates an excessive drain on the community's energy supply that could lead to other problems, such as a power outage. Insulating homes reduces the demand for air conditioning and helps conserve electricity. Keeping household thermostats set to 78 degrees F will also reduce energy use.

Industry and agriculture can also reduce water consumption and water loss through a number of methods, including appropriate land use, advanced irrigation technology and methods to reduce evaporative losses.

Landowners can contribute substantially to local drought mitigation through proper watershed, forest, and rangeland management.

To avoid economic losses from the impact of local weather-related losses, large livestock producers should try to spread their operations (i.e., where they feed cattle) over several states, so that extreme conditions in one location only affect a small part of their total operation.

Extreme Heat

Extreme heat is defined as temperatures that are 10 degrees or more above the normal average high temperature. However, heat stress can also occur at lower temperatures, e.g., when ambient temperatures are hot (>105° F), humidity is high (>90 percent), and there is little or no air movement or cloud cover. (see figure below). Although these combinations of conditions occur less frequently than simple above-average high temperatures, they can be associated with massive mortality in animals (and humans).

		Relative humidity, %																				
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Dry bulb temperature, °F	60	59	59	59	59	59	59	59	59	59	60	60	60	60	60	60	60	60	60	60	60	
	62	60	60	60	60	60	60	61	61	61	61	61	61	61	61	61	62	62	62	62	62	
	64	61	61	61	61	62	62	62	62	62	62	63	63	63	63	63	63	64	64	64	64	64
	66	62	62	62	62	63	63	63	63	64	64	64	64	64	64	65	65	65	65	66	66	66
	68	63	63	63	64	64	64	64	65	65	65	66	66	66	66	67	67	67	67	67	68	68
	70	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68	69	69	69	69	70	70
	72	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71	71	72	72
	74	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73	74	74	74
	76	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76	76
	78	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76	77	77	78	78
	80	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78	79	79	80	80
	82	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81	81	82	82
	84	70	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84	84
	86	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	85	86
	88	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86	86	87	87	88
	90	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	89	90
	92	74	75	76	77	78	79	80	81	82	83	84	85	85	86	87	88	89	90	91	91	92
	94	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	93	94
	96	76	77	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93	94	95	95	96
98	77	78	79	80	82	83	84	85	86	87	88	89	90	91	93	94	95	96	97	97	98	
100	78	79	80	82	83	84	85	86	87	88	90	91	92	93	94	95	97	98	99	99	100	
102	79	80	81	83	84	85	86	87	89	90	91	92	94	95	96	97	98	100	101	101	102	
104	80	81	82	84	85	86	88	89	90	91	93	94	95	96	98	99	100	101	103	103	104	
106	81	82	84	85	86	88	89	90	91	93	94	95	97	98	99	101	102	103	105	105	106	
108	82	83	85	86	87	89	90	92	93	94	96	97	98	100	101	103	104	106	107	107	108	
110	83	84	86	87	89	90	91	93	94	96	97	99	100	101	103	104	106	107	109	109	110	
112	84	85	87	88	90	91	93	94	96	97	99	100	102	103	105	106	108	109	111	111	112	
114	85	86	88	89	91	92	94	96	97	99	100	102	103	105	106	108	109	111	112	112	114	

Temperature-humidity index values (From Thom EC: Temperature-humidity index values, Weatherwise 12:57-59, 1959)

Conditions that can precipitate heat stress can last for a few days or for as many as several weeks. Because of differences in the average temperature in different areas of the country and at different times of the year, the absolute temperature that defines extreme heat varies throughout the U.S. When drought and extreme heat occur at the same time, the conditions can be very dangerous.

Extreme heat usually occurs in the summer. However, susceptibility to extreme heat can occur at other times if animals are not adapted to ambient temperatures. For example, heat stress occurs most commonly in the late spring, early summer when a sudden increase in temperature affects cattle and other outdoor animals that have not had time to adjust to these higher temperatures.

Examples of Heat Stress

Examples of heat stress occurred in August 1977 in California and in July 1995 in Iowa and Nebraska.

- ☛ In California, death rates increased 18-fold in dairy cows during 4 days of intense heat and humidity resulting in the loss of 725 milking cows. Nearly 75 percent of the deaths were in high-producing cows.
- ☛ In 1995, nearly 10,000 cattle died in Iowa and Nebraska feedlots. A death rate of up to 10 percent of cattle on feed was reported in some lots. Most feedlots suffered 2 to 50 cattle deaths.
- ☛ In central Iowa alone (in 1995), livestock producers lost approximately \$28 million because of the heat. Losses to the poultry industry in Iowa and Nebraska were estimated to be \$25 million. In the same summer, almost one million chickens died in East Coast states.

Mitigation of heat stress

Provide shade

The best type of shade reflects the heat, and, therefore, reduces the exposure to heat. Shade also reduces the exposure to direct sunlight and the likelihood of sunburn. Examples are galvanized metal or aluminum roofs. Shade should be provided at a rate of 20 to 24 square feet per head of cattle. In addition, the roofs should be about 10 to 14 feet above the ground to allow for adequate airflow.

Other buildings and structures that may impede airflow should not be within 50 feet of where shade is provided.

Install sprinkler systems

Another method to reduce heat stress is to install sprinkler systems. These should produce large droplets and run for 2 to 3 minutes every 20 - 30 minutes. Because dairy cattle may suffer heat stress while being herded for milking, some farmers also install fans that run alternately with the sprinklers. The goal is to wet the cow with only as much water as can evaporate and reduce the surface heat through conduction.

Special care must be taken so that sprinkler systems do not create excessively muddy environments, as muddy coats reduce an animal's ability to dissipate heat.

Feed and Water

Adequate amounts of water should be made available at a rate of at least 25 percent body weight per day.

Animals need 3 to 4 days to acclimate to hot temperatures. During this time they adjust their feed intake and metabolism to dissipate heat. Livestock should be encouraged to maintain feed intake, which involves offering high quality and tasty and aromatic feeds, and cleaning the feed bunk out completely at least once a day. Fermenting and rancid feed leftovers, which can be distasteful and odorous, discourage eating.

Cattle in feedlots should be fed lower fiber diets during periods of extreme heat, because dense feeds generate less internal heat during digestion.

All animals should have constant access to clean water.

Avoid transportation

Death rates in livestock in transit can be expected to double on hot days, unless appropriate precautions are taken. Many of these deaths can be prevented by avoiding transportation and processing on hot days or during the hottest parts of the day.

Some recommend moving livestock without interruption for up to 32 hours. This avoids lengthy stopovers that can rapidly lead to heat building up inside a trailer and stressing the animals being transported. Alternatively, if animals are being transported they should be given many rest stops with opportunity to move about freely and given access to clean water.

Avoid exercise

Excessive exercise in horses should be avoided. Also, persons working with animals should rest regularly. A few minutes of sweat-free rest every hour will help restore physical and mental energy.

Assess wind breaks

Wind breaks that are useful in the winter months against blowing snow may be detrimental in the summer, when air movement can help to reduce heat stress. Determine the location of wind dead spots with a smoke gun. Areas with wind dead spots can be fenced off in the summer, and opened as a snow break in the winter.

Fish

The greatest problem that arises for fish in ponds when ambient temperatures are high is the development of low oxygen conditions. To reduce heat and low oxygen tension related deaths, remove the largest fish, as they are most susceptible to low oxygen tension in the water.

Decrease the feed rate to less than 1 percent body weight per day. The oxygen tension of the water can be increased by adding fresh, aerated well water or by sprinkling the pond surface. Pond water should always be kept at least 2 feet deep.

Early slaughter

In some cases the best option to ensure the well being of animals will be to slaughter them.

Impact & Consequences

Droughts and extreme heat have many adverse impacts and consequences. The following table presents some commonly reported problems that arise in droughts and from heat stress and the unit where you can learn more about the consequences.

Impact	Consequence	Refer to Unit #
Excessive heat can affect phones and other electronic equipment	Communications are challenged	5
During heat waves, excessive drain on power supplies can lead to power black outs	Infrastructure failure	6
Exposure to excessive heat may endanger animals and / or people	Threat to public and animal safety	7
Excessive heat may threaten lives	Need to evacuate people and animals	8
During droughts, watering holes can dry up	Displacement of animals	9
Exposure to excessive heat can cause canisters and vats to explode	Threat to public and animal health	10
Droughts may encourage the migration of ground burrowing animals closer to farms where they may burrow in lagoon walls and cause leakage	Adverse effects on the natural environment and wildlife	11
Excessive heat can kill large numbers of animals	Need for carcass disposal	12
During droughts, animals may become severely dehydrated and suffer from starvation	Need for euthanasia	13
Heat and droughts are stressful to animals	Threat to the well-being of animals	This unit
Animals suffering from heat stress, dehydration and starvation are of public concern	Public concern	15

Animal Welfare

The care of animals in disasters often raises questions about animal welfare. The American Veterinary Medical Association defines animal welfare as follows:

“Animal welfare is a human responsibility that encompasses all aspects of animal welfare, including proper housing, management, nutrition, disease prevention and treatment, responsible care, humane handling, and, when necessary, humane euthanasia.”

In practical terms animal welfare means that animals under human care have access to feed, water, bedding, are protected from the elements, and can enjoy expressions of normal behavior.

While the care of animals in disasters should never take precedence over the care of people, providing care for animals may facilitate the personal safety and welfare of a large segment of the human population. For example, some people will not evacuate without their animals. Helping these people evacuate their animals also improves public health by encouraging the owners to evacuate as well.

Case 1: Heat stress in the feedlots

In the summer in Kansas the heat is building up. Over a few days temperatures continue to climb and one day reach a heat index of 100. In feedlots, many of the cattle are showing signs of severe discomfort. More animals are due to arrive in some feedlots while others are preparing to send animals to market.

What should you be concerned about?

What are the immediate needs of these animals?

The primary association with death in cattle during the severe heat of 1995 was the availability of shade. In feedlots with little or no shade, mortality averaged 4.8 percent, while mortality in feedlots with shade averaged only 0.2 percent. Lots with a higher proportion of heifers were also at risk of higher than average mortality. Cattle in these high-risk groups should be given extra shade and space and special attention should be paid to ensure that they are not overheating on very hot days.

What would you do?

On which animals would you focus your efforts?

Dark hide and heavy cattle or those that have recently arrived at the feedlot are at greatest risk. These factors should be taken into consideration when extreme heat occurs. Dark (black) hide cattle should be allowed access to extra space and shade. If sprinkling animals with water is possible, sprinkle dark-skinned animals first.

Movement and processing of cattle and other livestock should be avoided when local weather reports indicate that extreme heat conditions may occur.

Review

Some of these cattle were severely stressed and, therefore, their welfare was potentially compromised.

By knowing the circumstances and which animals are at greatest risk of injury, illness, or death, owners can improve animal welfare.

Case 2: Ventilation failure

At a rabbit hatchery in Iowa the heat builds up in the summer. One very hot and humid day there is a blackout and the ventilators used to cool the rabbits fail.

What are your concerns?

What are some special considerations for these rabbits?

Animals in cages require special attention, because they often rely on extra ventilation for air circulation. During hot weather, provide caged animals with extra ventilation and plenty of fresh, cool water to drink. Offer water in shady places, as some animals may not venture into the sun if it is very hot. Provide salt licks for animals that require them regularly.

Fortunately, the owner has a generator and is able to run some ventilators. However, his generator is not sufficient to run all the fans. He has to choose which rabbits to cool.

What would you do?

What additional measures should be considered to ensure the well being of the rabbits?

Heat stress can be treated in the individual animals by spraying them with water. This is most effective if cold water is applied to the areas where blood flow is greatest. In many species (livestock, horses, and dogs) this includes the legs and feet, and can be accomplished by standing them in a stream of water or in cool mud. In the case of rabbits, the ears are the areas that dissipate heat most.

However, commercially grown rabbits are not used to being handled. Bucks and nursing does and their offspring can be resentful of being handled by humans.

What are your concerns?

How would you balance the need to handle rabbits and the need to cool them effectively?

The owner carefully checked each rabbit to see first if it is heat stressed. If a rabbit was showing signs of heat stress, he would slowly reach into its cage. If a rabbit did not object to being handled, he would give the rabbit and its offspring to one of his helpers to take inside his house and cool down.

Rabbits that objected to being handled he quickly moved with their offspring to the cages, where the ventilator fans were blowing. Here they were left under close supervision but undisturbed.

Review

Recognizing and acting to improve animal welfare involves judgment. Often the decision on how to improve an animal's welfare is best made on a case-by-case basis. In this case a balance had to be struck between handling the rabbits, which could stress them, and subjecting them to continued conditions of extreme heat, another source for stress.

Mitigation of threats to animal welfare in disasters

Emergency management officials, members of the livestock industry, and the public should work together to define appropriate standards for animal welfare in disasters. There are also many organizations that provide guidelines and standards that can be adapted to the care of animals in disasters.

Understanding the issues that ensure appropriate standards of animal welfare is important before a disaster strikes. In disasters, optimal conditions for animal care are sometimes difficult to achieve. Nevertheless, the public expects appropriate standards to be met.

Also, in disasters, some may use the way animals are cared for to judge the quality of human care provided by emergency management teams. Therefore, it is crucial to ensure that appropriate guidelines and standards for animal welfare are agreed upon ahead of time. Prior understanding and agreement on decision-making criteria for animal welfare helps allocate resources and can greatly improve the public's perception of the overall quality of disaster response.

Assess Your Vulnerability

Extreme Heat	
Item	Vulnerability Score
1. How often does your farm suffer conditions that can lead to heat stress in your animals? 1 (never)—5 (usually once a year)	
2. When your farm is affected by a high heat index, how much effort is it to prevent heat stress in your animals? 1 (no more effort than usual)—5 (caring for these animals disrupts all other activities)	
3. What is your vulnerability to extreme heat? Add 1 and 2	Enter this number on page 16-3
Animal Welfare	
Item	Vulnerability Score
1. How many of your livestock depend on utilities, such as electric power, to maintain appropriate standards of care? 1 (none)—5 (they all do)	
2. For the animals under your care, how often have these animals lost access to feed, water, bedding, protection from weather, and freedom to express normal behavior? 1 (never)—5 (it happens at least once a year)	
3. What is your vulnerability to compromised animal welfare? Add 1 and 2	Enter this number on page 16-5



Learning Check

Directions: Determine if the following statements are true or false based on the material in this unit. When you have finished, check your answers on page 14-17.

1. Droughts may be the most expensive of natural disasters in the U.S.
True or False?

2. Extreme heat is defined as conditions when temperatures are more than 25 degrees F above normal average highs.
True or False?

3. Heat stress in animals occurs only under conditions of extreme heat.
True or False?

4. To allow air to circulate, buildings should be at least 10 feet apart.
True or False?

5. Under extreme heat conditions, livestock require about 25 percent of their body weight in water per day.
True or False?

6. Livestock usually require about 3 to 4 days to acclimatize to temperature extremes.
True or False?



Learning Check

7. Postponing transportation of livestock until it is cooler is an effective method to reduce heat-related deaths in livestock.
True or False?

8. If an animal's fur is caked with dry mud, the animal is less susceptible to heat stress.
True or False?

9. Under conditions of extreme heat, the larger the fish, the more susceptible they are to heat stress.
True or False?

10. Windbreaks that are beneficial against snowdrifts in the winters may not provide ventilated areas with shade in the summer.
True or False?

11. The demand for water in droughts can be reduced by using water sparingly.
True or False?

12. Watershed, forest, and rangeland management can contribute to effective mitigation against droughts.
True or False?



Learning Check

13. Spreading livestock operations out among several states is an effective economic mitigation for farmers against local weather-related disasters.

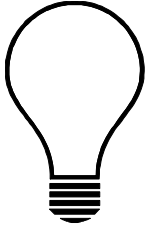
True or False?

14. Light-skinned cattle are at greater risk of heat stress than dark-skinned cattle.

True or False?

15. The decision on how to improve an animal's welfare is best made on a case-by-case basis

True or False?



Answers

For every question that you answered incorrectly, review the page listed next to the answer to find out why your answer was incorrect.

1. True.....14-1
2. False.....14-3
3. False.....14-3
4. False.....14-4
5. True.....14-4
6. True.....14-4
7. True.....14-4
8. False.....14-4
9. True.....14-5
10. True.....14-5
11. True.....14-4
12. True.....14-2
13. True.....14-2
14. False.....14-10
15. True.....14-9

Summary

This unit described the effects of drought and extreme heat and how you can mitigate some of their effects. This unit also discussed animal welfare and presented case studies that highlighted consideration for the welfare of animals in disasters.