THE BIOLOGY AND MANAGEMENT OF WILD RUMINANTS

CHAPTER FOURTEEN

METEOROLOGY AND THERMAL CHARACTERISTICS OF THE RANGE

by

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Evaluation of the meteorological characteristics of the earth-atmosphere interface is really a study of atmospheric and soil physics. Systematic recording of these characteristics results in the recognition of cycles, or rhythmic recurrences of certain physical relationships over time. For example, the earth revolves around the sun, and rotates on its axis in very precise periods. This results in very precise cyclic patterns of solar radiation over the earth's surface. Liquid water on the earth's surface absorbs solar energy and evaporates, changing from a liquid at the surface to a gas in the atmosphere, which eventually condenses and falls as precipatation. Since this sequence of events, called the hydrologic cycle, is driven by solar radiation, which varies rhythmically from season to season as the angle of the earth's axis in relation to the sun varies, the amounts of evaporation and precipitation vary rhythmically too; the hydrologic cycle is somewhat predictable. The timing is not as precise as the timing of the daily and seasonal solar radiation cycles, however, but wet and dry periods are recognized in many areas of the earth's surface.

The rhythmic nature of solar energy flux also results in temperature and wind rhythms, both daily and seasonally. Local patterns are influenced by large-scale atmospheric movements, of course, but under stable, high pressure conditions, 24-hour patterns are often quite predictable; the atmosphere is calm at sunrise, wind velocities increase to maximum in the afternoon, and decline to zero at sunset.

Patterns are recognized as a result of repeated measurements over time and space. Several standard measurements of weather conditions are made daily by professional weather observers and volunteers at hundreds of locations all across the United States and Canada. Other countries have similar measurement networks. The data are compiled into summaries that are available from government agencies and in libraries.

What meteorological characteristics are measured at weather stations? Temperature, which is an indicator of the energy balance of the atmosphere, is often represented as the high and low for a 24-hour period. Stations with recording equipment may report hourly temperature readings. Wind velocities and directions are measured and reported from many stations at specified times, often hourly when recording equipment is used. Atmospheric pressure is recorded, and sky conditions, with cloud types and heights, are observed and measured. Precipitation is reported for 24-hour periods from most stations, and hourly from the more automated stations. The amount of snow on the ground is also reported from many stations.

Weather measurements are made with some standardization of equipment and equipment location. Standard instrument shelters house temperature- and humidity-measuring equipment. Instruments in these shelters are located about 1 1/2 to 2 meters (5 to 6.5 feet) above the ground. The shelters are painted white and have slatted, louvered walls that permit air to circulate through the shelter while protecting the instruments from the sun's rays. They should be oriented so the door opens on the side away from the sun.

Cup anemometers are usually used to measure wind velocities. They should be located away from trees and other obstructions, but the distances from the instruments to influencing objects varies greatly from station to station since some stations are in heavily wooded areas and others are in open fields. Rain gauges should also be located away from obstructions, but again the distances vary at different stations. The weather recording stations operated by professional meteorologists are usually much more standardized than the temperature and precipitation stations manned by volunteers.

The term weather implies short-term atmospheric characteristics, and the term climate long-term characteristics. The accumulation of weather data over a period of several years results in general descriptions of the climate for a given area, and after a few years of measurement, norms are established. The term microclimate is often used by ecologists to describe the conditions surrounding a plant or an animal, but the term is very much a misnomer. The first part of the term (micro) is inappropriate because the thermal energy that influences an organism may well be coming from a long distance away. The sun, for example, is about 93,000,000 miles away (not very micro-), yet solar energy definitely influences the organism-atmosphere interface. The second part of the term (climate) is also inappropriate because organisms, especially short-lived plants and mobile animals, do not stay in one location long enough for a "climate" to develop around them. While it is generally known what is meant by the term microclimate, there is a better term available to identify the thermal conditions surrounding an organism. That term, thermal boundary region, is used throughout this book.

The thermal boundary region is defined as the layer of air around a plant or animal with temperatures and densities that are influenced by the surface characteristics of the plant or animal. Surface temperature, for example, may be different from that of the surrounding atmosphere or fluid of the animal. It is dependent on both biological and physical factors. The absorption of a large amount of solar radiation by the animal's surface results in a thermal boundary region of greater depth, while a wind over the surface reduces its depth. The thermal boundary region is discussed in detail in CHAPTER 15, UNIT 3.3.

Meteorological characteristics that affect thermal boundary region characteristics are discussed in the next 5 TOPICS, in this CHAPTER, followed by discussions of THERMAL CHARACTERISTICS AND BASIC HEAT TRANSFER in CHAPTER 15.

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