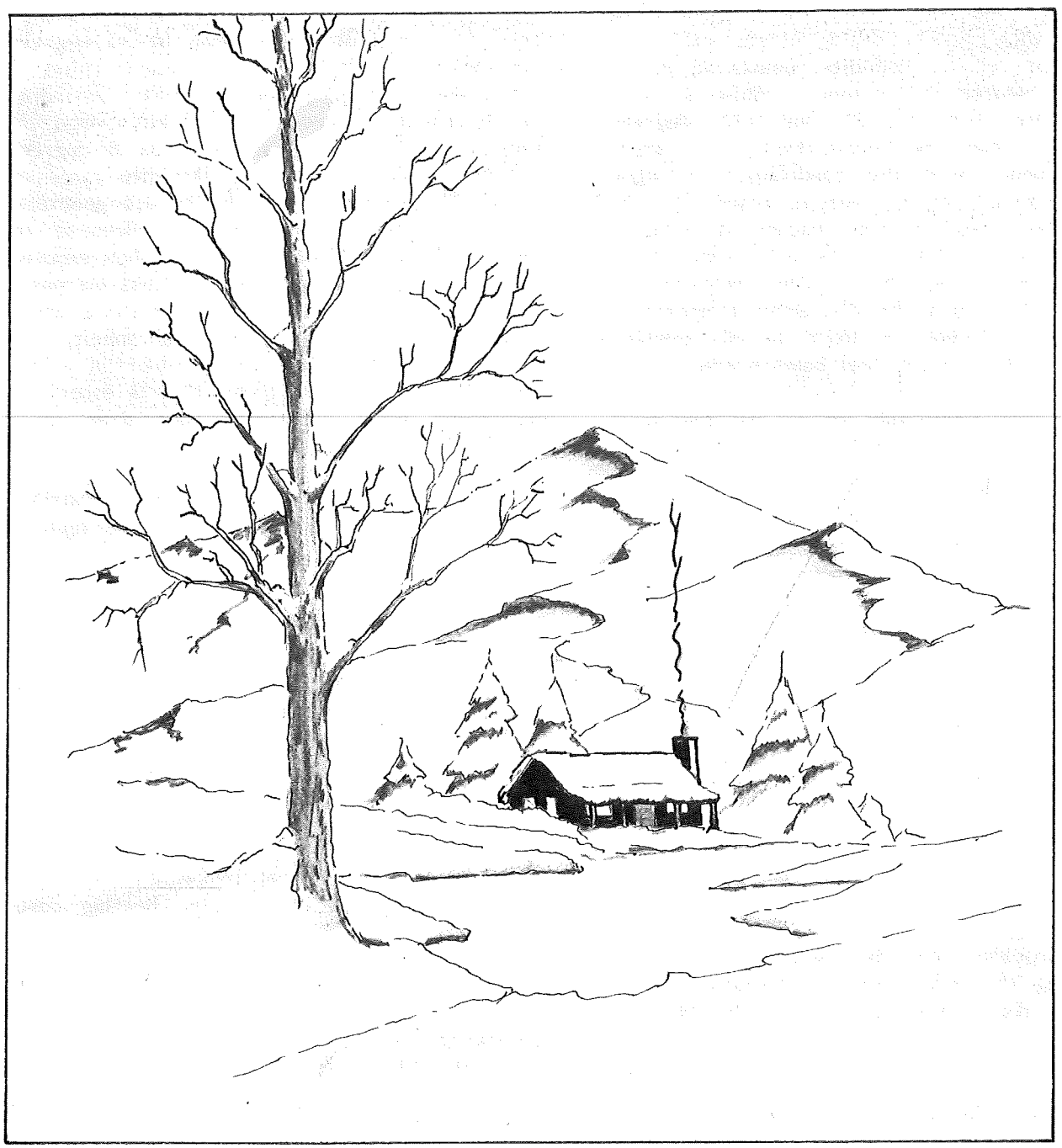
ENVIRONMENTAL INFORMATION SUMMARIES C-20

WINTER INDOOR COMFORT



noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL DATA AND INFORMATION SERVICE / NATIONAL CLIMATIC CENTER ASHEVILLE, N.C. NOVEMBER 1981

Compared to summer when the moisture content of the air (relative humidity) is an important factor of body discomfort, air moisture has a lesser effect on the human body during outdoor winter activities. But it is a big factor for winter indoor comfort because it has a direct bearing on health and energy consumption.

The colder the outdoor temperature, the more heat must be added indoors for body comfort. However, the heat that is added (from a coal, gas, oil, electric, solar, or woodburning system) will cause a drying effect and lower the indoor relative humidity, unless an indoor moisture source is present. While a room temperature between 71 and 77 degrees Fahrenheit may be comfortable for short periods under very dry conditions, prolonged exposure to dry air has varying effects on the human body and usually causes discomfort. The moisture content of the air is important, and by increasing the relative humidity to above 50 percent within the above temperature range, 80 percent or more of all average dressed persons would feel comfortable.

Studies[1] have shown that dry air has four main effects on the human body:

1. Breathing dry air is a potential health hazard which can cause such respiratory ailments as asthma, bronchitis, sinusitis, and nosebleeds, or general dehydration since body fluids are depleted during respiration.

2. Skin moisture evaporation can cause skin irritations and eye itching.

3. Irritative effects, such as static electricity which causes mild shocks when metal is touched, are common when the air moisture is low.

4. The "apparent temperature" of the air is lower than what the thermometer indicates, and the body "feels" colder.

These problems can be reduced by simply increasing the indoor relative humidity. This can be done through use of humidifiers, vaporizers, steam generators, sources such as large pans, or water containers made of porous ceramics. Even wet towels or water in a bathtub will be of some help. The lower the room temperature the easier the relative humidity can be brought to its desired level. A relative humidity indicator (hygrometer) may be of assistance in determining the humidity in the house.

Referring to item 4, a more detailed discussion is necessary. While the indoor temperature as read from a thermometer may be 75 degrees Fahrenheit, the apprent temperature (what it feels like) may be warmer or colder depending on the moisture content of the air. Apparent temperature can vary as much as 8 degrees Fahrenheit within a relative humidity range of 10 to 80 percent (these limits are generally possible in a closed room). Because of evaporation the human body cools when exposed to dry air, and the sense of coldness increases as the humidity decreases. With a room temperature of 70 degrees Fahrenheit, for example, a person will feel colder in a dry room than in a moist room; this is especially noticeable when entering a dry room after bathing.

Table 1 gives apparent temperatures for various combinations of room temperature and relative humidity. As an example of how to read Table 1, a room temperature of 70 degrees Fahrenheit combined with a relative humidity of 10 percent feels like 64 degrees Fahrenheit, but at 80 percent it feels like 71 degrees Fahrenheit. Although degrees of comfort vary with age, health, activity, clothing and body characteristics, the table can be used as a general guideline when raising the apparent temperature and the level of comfort through an increase in room moisture, rather than by an addition of heat to the room. This method of changing the apparent temperature can give the direct benefit of reducing heating costs because comfort can be maintained with a lower thermostat setting if moisture is added. For example, an apparent comfortable temperature can be maintained with a thermostat setting of 75 degrees Fahrenheit with 20% relative humidity or with a 70 degree Fahrenheit setting with 80 percent humidity. A relative humidity of 20 percent is common for homes without a humidifier during winter in the northern United States.

---

[1] For some representative studies refer to Human biometeorology: A selected bibliography, NOAA Technical Memo EDIS NCC-4, September 1980.

Fig. 1 is a map of average mid-winter (January) indoor relative humidity for the contiguous United States, ignoring all indoor moisture sources, and keeping the room temperature (thermostat setting) at 70 degrees Fahrenheit.[2] During periods of cold waves, the indoor relative humidity may be lower than values shown on the map. However, some indoor moisture sources are always present and may vary from home to home and room to room. Not considering humidifiers, vaporizers, etc., some sources may be from cooking, washing, indoor plants, or from evaporation and transpiration (breathing) of the body itself; these sources can increase the relative humidity by about 5 to 15 percent.

[2]The map in Fig. 1 was derived from mean outdoor dew-point temperature as an approximation of indoor dew point, and an assumed indoor temperature of 70 degrees Fahrenheit.

Fig. 2 is a map of mean monthly outdoor relative humidity for January.

References

American Society of Heating, Refrigerating and Air Conditioning Engineers, 1972: ASHRAE Handbook of Fundamentals, New York, N.Y., 688 pp.

Steadman, R.G., 1979: The assessment of sultriness, Part 1, A temperature-humidity index based on human physiology and clothing science. Journal of Applied Meteorology, 18, 861-885.

U.S. Department of Commerce, ESSA, 1968: Climatic Atlas of the United States, 80 pp.

U.S. Department of Commerce, ESSA, 1966: Selected Climatic Maps of the United States, 32 pp.

ROOM TEMPERATURE (°F)	RELATIVE HUMIDITY (%)										
	0	10	20	30	40	50	60	70	80	90	100
75	68	69	71	72	74	75	76	76	77	78	79
74	66	68	69	71	72	73	74	75	76	77	78
73	65	67	68	70	71	72	73	74	75	76	77
72	64	65	67	68	70	71	72	73	74	75	76
71	63	64	66	67	68	70	71	72	73	74	75
70	63	64	65	66	67	68	69	70	71	72	73
69	62	63	64	65	66	67	68	69	70	71	72
68	61	62	63	64	65	66	67	68	69	70	71
67	60	61	62	63	64	65	66	67	68	68	69
66	59	60	61	62	63	64	65	66	67	67	68
65	59	60	61	61	62	63	64	65	65	66	67
64	58	59	60	60	61	62	63	64	64	65	66
63	57	58	59	59	60	61	62	62	63	64	64
62	56	57	58	58	59	60	61	61	62	63	63
61	56	57	57	58	59	59	60	60	61	61	62
60	55	56	56	57	58	58	59	59	60	60	61

TABLE 1. Apparent Temperature for Values of Room Temperature and Relative Humidity

(1) Apparent temperature rounded to nearest whole degree
(2) Adapted from data supplied by Prof. R.G. Steadman, Colorado State University

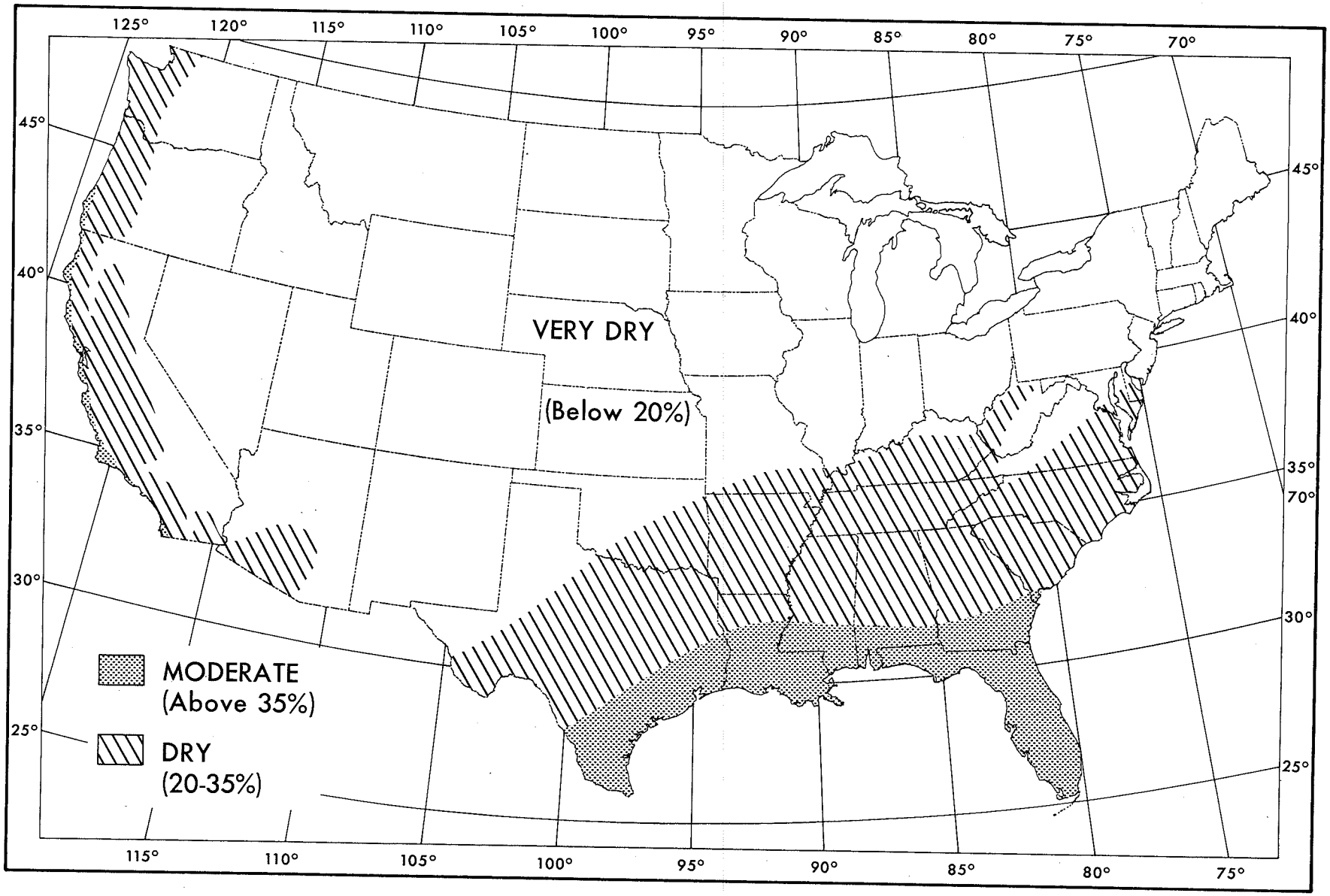


Fig. 1 Average indoor relative humidity (%) for January.

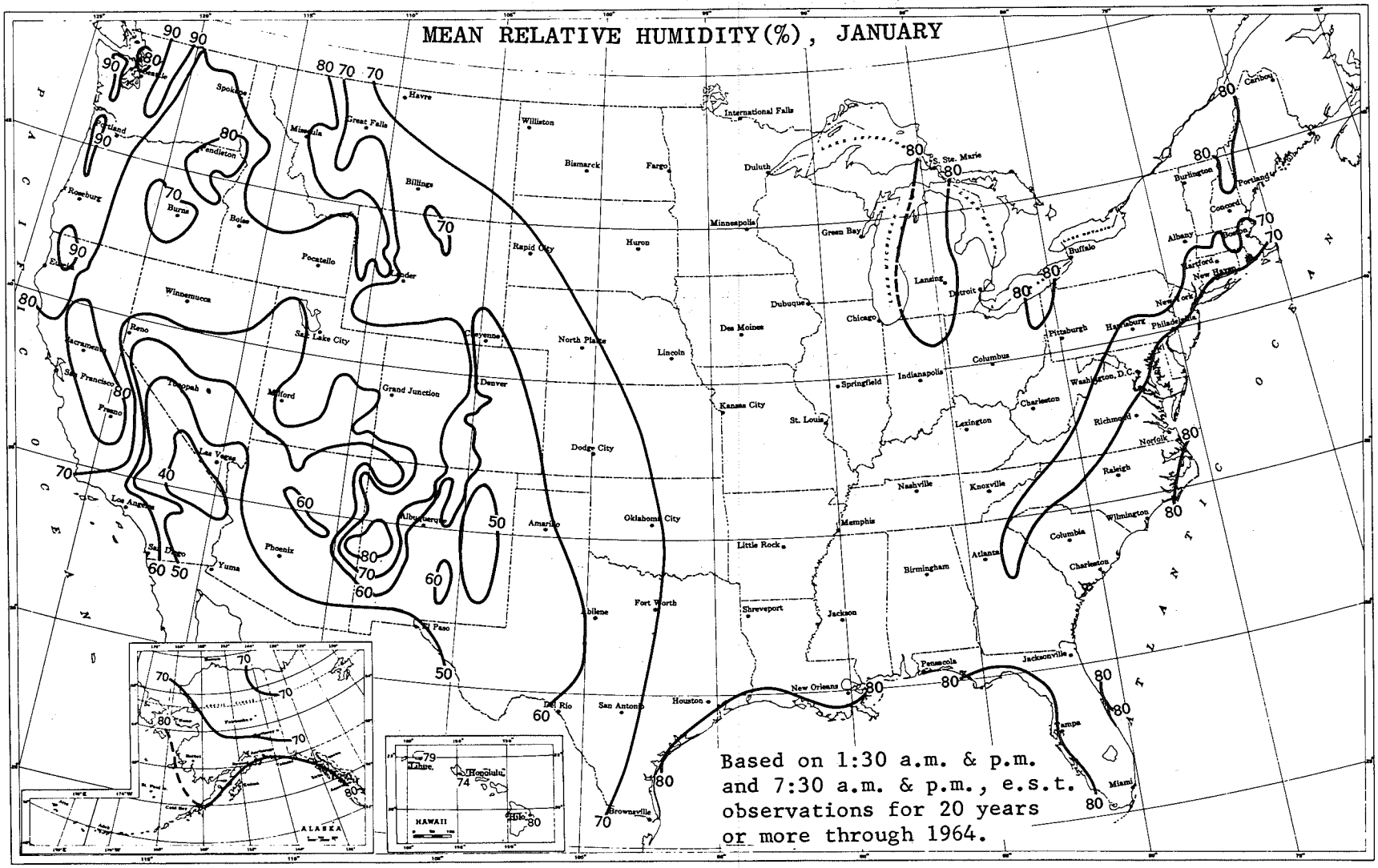


Fig. 2 Mean monthly outdoor relative humidity (%) for January.

USCOMM-NOAA-ASHEVILLE, N.C./11/81/2000