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Fire-weather warnings for the national forest areas of Oklahoma and Arkansas were issued on the 19th and conditions occurred mostly as forecast.—*R. A. Dyke.*

*Denver forecast district.*—North Pacific Lows predominated, as in the preceding month, and unusually warm and dry weather prevailed in the greater part of the district. The winter, so far, has been notable for the absence of severe storms and low temperature.

Live-stock warnings were issued for eastern Colorado on the morning of the 10th, a south Pacific Low of moderate intensity being central in Arizona and an area of high pressure in the north Pacific States and northern Rocky Mountain region. Temperatures near zero were reported in parts of Wyoming. Temperatures near zero occurred in localities in eastern Colorado on the 12th, preceded by snowfall. The live-stock warnings were extended to eastern New Mexico on the morning of the 11th. Snow, with temperatures well below the freezing point, occurred in eastern New Mexico on the 12th and 13th.

Moderate to heavy snowfall occurred in eastern Colorado on the 24th, following the unusual movement of an area of low pressure from the Gulf of California. The center of the disturbance was over northeast Arizona at 6 a. m. on the 23d. It moved southeastward to Roswell, N. Mex., by 6 p. m. of that date. During the following night the center moved almost directly northward to eastern Colorado, after which it again moved southeastward, being over Alabama, at 6 a. m. on the 25th. The temperatures following the snowfall were low in extreme eastern Colorado but moderate elsewhere.—*Frederick W. Brist.*

*San Francisco forecast district.*—January was an unusually stormy month in this district. The whole north

Pacific Ocean was in a turmoil nearly all the while. The storms traveling inland passed farther south than customary, due largely to the fact that the pressure over northern Alaska was frequently above normal. On this account rain and heavy snow occurred in the Pacific States farther south than usual.

No less than 20 storm, four small-craft warnings, and one advisory warning were issued during the month. Practically all were verified in part, if not wholly. Casualties on sea and land were incommensurate with the violence of the storms; there being no bad disasters as yet reported at sea and no great interruption to traffic on land.

The worst storm was experienced along the north Pacific coast during the afternoon and evening of the 29th, when a maximum wind velocity of 110 miles from the southwest occurred at Tatoosh Island and an estimated velocity of 150 miles from the southeast at North Head was reported. The North Head station reported the anemometer there was destroyed by a falling wireless tower when it was recording 132 miles an hour, and that a conservative estimate of the maximum velocity for the storm was 150 miles. This is a record breaker, so far as that station is concerned.

The rains caused moderate freshets in the Sacramento River, but the stages reached by the water were not high enough to cause serious damage.

Frost warnings were issued on 18 days for parts of California. The heaviest frosts occurred on the mornings of the 9th, 10th, and 11th, and they did considerable damage to truck crops and citrus fruit. The citrus crop, however, as a whole was not seriously affected by the cold weather and at the close of the month it was in a promising condition.—*E. A. Beals.*

## RIVERS AND FLOODS.

### FLOODS DURING JANUARY, 1921.

By H. C. FRANKENFIELD, Meteorologist.

[Weather Bureau, Washington, Feb. 28, 1921.]

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*Atlantic drainage.*—There were no floods north of North Carolina except a purely local one in the James River at Columbia, Va., on January 15. The flood came from the Rivanna River, and the flood stage was barely reached. No damage was done.

Heavy rains reported on January 10 caused moderate floods in the lower Roanoke River with a crest of 34.6 feet, 4.6 feet above the flood stage, at Weldon, N. C., on January 12. There was also a moderate flood at the same time in the Peedee River at Cheraw, S. C., with a crest of 27.2 feet, 0.2 foot above the flood stage. More heavy rains reported on January 14 resulted in a second flood in both of the above-mentioned rivers and also in the Neuse and Cape Fear Rivers, but the stages were not excessive. A third rise was forecast for the Peedee River from the melting of the heavy snows that fell over headwaters from January 25 to January 27, inclusive, and a crest stage of 25.2 feet was reached at Cheraw on the morning of February 2.

All of these floods were properly forecast and little or no damage occurred. Live stock, to the value of \$5,000, was saved by the warnings for the Cape Fear River.

Moderate floods in the Broad and Wateree Rivers of South Carolina at about the same time were forecast as a whole, although with indifferent success for the Wateree River on account of lack of information as to the amount of water released at the Wateree Power Co. dam, about 9 miles above Camden. The same trouble apparently

operated to cause the failure on January 28 of the forecast of 27 feet at Camden by January 29. This forecast was based upon the melting of the heavy snow and ice that accumulated over headwaters from January 25 to 27, inclusive.

The Santee River remained above flood stage throughout the entire month with no material damage. This river has been in flood for so long a period and the swamps are so full of water that little if any grazing could be carried on.

*Gulf drainage.*—The Tombigbee River was above flood stage of 39 feet at Demopolis, Ala., for about six days, beginning with January 14 and a crest stage of 43.8 feet was reached at 3 p. m. January 16. Warnings had been issued on January 12. Damage amounted to about \$22,000, \$20,000 of which covered the sinking of a tow-boat. Value of property saved through warnings, about \$2,200.

High water prevailed in the Pearl River of Mississippi at the beginning and continued until well after the middle of the month.

A middle of the month flood in the upper Trinity River of Texas was well forecast. The flood was a moderate one and live stock was removed from the lowlands before its arrival.

Following heavy rains on January 12 and 13, floods were forecast for the Sulphur River of Texas, and stages from 2 to 3 feet above the flood stages were reached at the time specified in the warnings.

*Pacific drainage.*—Heavy rains on January 17 caused flood stages on the following day in the mountain tributaries of the Sacramento and Lower San Joaquin Rivers, and warnings were issued on the following day for the drainage canal interests at Stockton, and for the lower Mokelumne River; also for the Sacramento River between Monroeville and the mouth of the American River. Warnings for the upper valley were issued on January 17.

On the morning of January 29 heavy rains were in progress over the upper Sacramento Valley and advisory warnings of a substantial rise were issued in the early evening. More detailed and specific warnings were issued on the following morning, and also carried southward throughout the valley. These warnings were verified in the main, and no damage was done except in a few localities.

The Willamette River was in flood at the close of the year 1920 and did not fall below the flood stage at Portland, near the mouth of the river, until January 9, 1921. The crests varied from 3 to 4 feet above the flood stages. Warnings for the flood were issued at the proper time and the losses amounted to only about \$21,000, of which about \$20,000 occurred at Oregon City.

*Flood stages during month of January, 1921.*

River and station.	Flood stage.	Above flood stages—dates.		Crest.	
		From—	To—	Stage	Date.
<b>ATLANTIC DRAINAGE.</b>					
James:	<i>Feet.</i>			<i>Feet.</i>	
Columbia, Va.....	18	15	15	18.0	15
Roanoke:					
Weldon, N. C.....	30	12	13	34.6	12
Neuse:					
Neuse, N. C.....	14	12	13	14.5	13
Do.....	14	16	17	15.3	17
Smithfield, N. C.....	14	15	18	14.7	16
Cape Fear:					
Elizabethtown, N. C.....	22	12	14	25.4	13
Do.....	22	16	18	26.5	17
Peedee:					
Cheraw, S. C.....	27	12	12	27.2	12
Do.....	27	16	16	32.5	16
Santee:					
Rimini, S. C.....	12	(1)	7	13.5	1
Do.....	12	12	(2)	16.2	20
Ferguson, S. C.....	12	(1)	8	13.2	3
Do.....	12	13	(2)	14.0	21
Wateree:					
Camden, S. C.....	24	16	17	26.0	16
Broad:					
Blairs, S. C.....	15	15	15	16.2	15 D. N
<b>EAST GULF DRAINAGE.</b>					
Apalachicola:					
River Junction, Fla.....	12	(1)	1	12.3	1
Tombigbee:					
Demopolis, Ala.....	39	(1)	3	44.5	1
Do.....	39	15	19	43.8	16
Pearl:					
Jackson, Miss.....	20	(1)	20	26.6	2
Columbia, Miss.....	18	(1)	2	19.9	1
<b>MISSISSIPPI DRAINAGE.</b>					
Ouachita:					
Camden, Ark.....	30	(1)	1	30.8	1
Sulphur:					
Finley, Tex.....	21	17	23	26.3	17
Ringo Crossing, Tex.....	20	14	19	23.5	15
<b>WEST GULF DRAINAGE.</b>					
Trinity:					
Dallas, Tex.....	25	13	17	33.1	15
Trinidad, Tex.....	23	15	25	34.4	22
<b>PACIFIC DRAINAGE.</b>					
Sacramento:					
Red Bluff, Calif.....	23	30	30	24.4	30
Tuolumne:					
La Grange, Calif.....	8	18	18	9.9	18
Mormon Slough:					
Bellota, Calif.....	20	18	18	20.8	18
Calaveras:					
Jenny Lind, Calif.....	14	18	18	15.0	18
Mokelumne:					
Bensons Ferry, Calif.....	12	19	19	12.0	19

<sup>1</sup> Continued from December.

<sup>2</sup> Continued into February.

*Flood stages during month of January, 1921—Continued.*

River and station.	Flood stage.	Above flood stages—dates.		Crest.	
		From—	To—	Stage.	Date.
<b>PACIFIC DRAINAGE—continued.</b>					
Columbia:	<i>Feet.</i>			<i>Feet.</i>	
Vancouver, Wash.....	15	5	6	15.5	6
Willamette:					
Eugene, Wash.....	10	1	6	12.9	3
Albany, Ore.....	20	(1)	6	23.5	1
Oregon City, Ore.....	12	(1)	9	14.3	6, 7
Portland, Ore.....	15	2	9	18.9	6
Santiam:					
Jefferson, Ore.....	10	2	5	13.0	3
Yamhill:					
McMinnville, Ore.....	35	6	6	37.9	6

<sup>1</sup> Continued from December.

**MEAN LAKE LEVELS DURING JANUARY, 1921.**

By UNITED STATES LAKE SURVEY.

[Detroit, Mich., Feb. 3, 1921.]

The following data are reported in the "Notice to Mariners" of the above date:

Data.	Lakes. <sup>1</sup>			
	Superior.	Michigan and Huron.	Erie.	Ontario.
Mean level during January, 1921:	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Above mean sea level at New York.....	602.08	579.92	571.99	245.54
Above or below—				
Mean stage of December, 1920.....	-0.17	-0.18	+0.10	+0.14
Mean stage of January, 1920.....	+0.04	-0.12	+0.69	+0.23
Average stage for January, last 10 years.....	+0.03	-0.03	+0.36	+0.13
Highest recorded January stage.....	-0.70	-2.75	-1.56	-2.06
Lowest recorded January stage.....	+1.20	+0.84	+1.03	+1.74
Average relation of the January level to—				
December level.....		-0.20	-0.10	0.00
February level.....		0.00	+0.10	-0.10

<sup>1</sup> Lake St. Clair's level: In January, 571.98 feet.

**EFFECT OF WEATHER ON CROPS AND FARMING OPERATIONS, JANUARY, 1921.**

By J. WARREN SMITH.

January was characterized by persistent mild weather for the season in all sections of the country and no unusually low temperatures occurred. Precipitation was light, except in the central and north Pacific coast districts; considerable areas in the Southern States received less than 2 inches during the month. These conditions were unusually favorable for winter farm work and much plowing was done in the Southern States, particularly during the latter part, while the planting of early truck crops was under way in that section. There was considerable delay in farm work in the Pacific Coast States, however, due to persistent rains.

There was comparatively little snow protection to winter grains in the principal wheat growing sections, but, owing to the mild temperatures, no extensive damage occurred, although there was some complaint of alternate thawing and freezing in a few districts, principally in the upper Mississippi Valley. The month was generally favorable for winter truck, except for some frost damage in California and in portions of the South about the middle of the month. Western winter ranges were open for grazing during much of the month and ranges and stock continued mostly in good condition. Under the influence of the mild weather, fruit buds developed prematurely in the Southern States. Citrus fruits continued in satisfactory condition in both California and Florida.