

ings were ordered on the 24th, and on the 28th northwest warnings were displayed on Lake Superior and northeast warnings on Lakes Michigan and Huron. The warnings were continued for forty-eight hours. This storm was not as severe as those which occurred earlier in the month. No wrecks of any kind were reported and it is thought that advantage was taken of the warnings in every case.

Unseasonably cold weather overspread the district during the latter part of the month and forecasts of freezing temperature were made on April 30 for the eastern and southern portions of the forecast district. The conditions were sufficiently severe to cause a flurry in the grain market, the prices rising decidedly as the result of the cold weather, as it was thought that considerable damage would be done.—*H. J. Cor, Professor of Meteorology.*

**DENVER FORECAST DISTRICT.**

Special warnings were issued well in advance of the cold snap that visited western Wyoming and Utah on the 2d and of the killing frost that occurred in western Colorado on the morning of the 5th. Warnings were also issued on the morning of the 10th for the killing frost that occurred in Utah on the 11th, and on the 29th for the severe freeze in southeastern Colorado and northern New Mexico. Vegetation was far advanced in the last-named districts and great damage resulted to fruit, gardens, etc.

Notices of light frosts were frequently included in the forecasts for such localities as the progress of vegetation warranted.—*F. H. Brandenburg, Forecast Official.*

**SAN FRANCISCO FORECAST DISTRICT.**

The month opened with a marked depression over Utah, accompanied by heavy rains over southern and central California, with snow in the mountains. The precipitation was also heavy in northern Arizona, the twenty-four hour rainfalls at Flagstaff on April 1 and 2 being 2.78 inches and 1.50 inches, respectively. In California, especially in the southern portion, rainfalls from 1 to 2 inches were recorded.

A persistent high off the coast of northern California and Oregon prevailed from April 2 to 9. A moderate depression over Nevada and Utah appears to have extended westward, overlying the Sierras and causing unsettled weather with showers generally in California on April 10.

The first reports from Southeast Farallon, 27 statute miles west of San Francisco, were received on April 17, a submarine cable having been successfully laid April 10 to 14.

Unsettled weather prevailed on April 16 and 17. At Los Angeles a twenty-four hour rainfall of 2.94 inches was reported on April 17. The remainder of the month was free from any marked disturbance.—*A. G. McAdie, Professor of Meteorology.*

**PORTLAND, OREG., FORECAST DISTRICT.**

In this district the month was dry and slightly cooler than usual, with no damaging storms. High winds occurred along the coast on the 6th and 7th for which warnings were issued in time to be of benefit to outgoing vessels.

During the latter part of the month frosts, which were accurately forecast, seriously damaged the peach crop of southern Oregon. Preventive measures, such as smudging, spraying, direct heating, etc., are not generally employed by horticulturists in this district and but few availed themselves of the opportunity presented by the warnings to protect their crops.—*Edward A. Beals, Forecast Official.*

**AREAS OF HIGH AND LOW PRESSURE.**

*Movements of centers of areas of high and low pressure.*

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
<b>High areas.</b>										
I.	3, p. m.	47	97	7, a. m.	47	60	Miles.	Days.	Miles.	Miles.
II.	11, a. m.	45	124	14, a. m.	41	101	2,450	3.5	700	29.2
III.	13, p. m.	47	101	18, a. m.	37	83	1,225	3.0	408	17.0
IV.	17, p. m.	38	123	20, p. m.	49	87	1,775	4.5	394	16.4
V.	21, p. m.	41	105	24, p. m.	30	82	2,400	3.0	800	33.3
VI.	21, p. m.	38	123	29, p. m.	27	80	1,700	3.0	567	23.6
VII.	25, a. m.	38	123	28, a. m.	48	123	4,250	8.0	531	22.1
VIII.	28, a. m.	53	108	29, a. m.	49	100	850	3.0	283	11.8
IX.	29, a. m.	38	123	*2, a. m.	48	122	450	1.0	450	18.8
X.	29, p. m.	41	105	*3, p. m.	47	60	750	3.0	250	10.4
Sums.							2,600	3.0	867	36.1
Mean of 10 paths.							18,450	35.0	5,250	218.7
Mean of 35.0 days.							1,845		525	21.9
<b>Low areas.</b>										
I.	1, a. m.	43	109	3, a. m.	49	69	2,000	2.0	1,000	41.7
II.	2, a. m.	37	105	4, p. m.	45	66	2,250	2.5	900	37.5
III.	3, a. m.	53	117	7, a. m.	49	89	1,950	4.0	488	20.3
IV.	6, p. m.	32	106	9, a. m.	44	67	2,450	2.5	980	40.8
V.	8, p. m.	42	118	15, a. m.	39	75	2,875	6.5	442	18.4
VI.	16, p. m.	39	120	21, p. m.	32	65	3,300	5.0	660	27.5
VII.	21, p. m.	51	120	28, a. m.	32	65	3,450	6.5	531	22.1
VIII.	25, p. m.	51	120	27, a. m.	50	97	1,100	1.5	733	30.6
IX.	29, a. m.	42	93	*1, a. m.	48	68	1,400	2.0	700	29.2
X.	30, a. m.	51	120	*4, a. m.	47	71	3,000	4.0	750	31.2
Sums.							23,775	36.5	7,184	299.3
Mean of 10 paths.							2,378		718	29.9
Mean of 36.5 days.										27.1

\* May.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*H. C. Frankenfield, Forecast Official.*

**RIVERS AND FLOODS.**

The stages of water in the Mississippi River were decidedly higher than during April, 1902, the excess ranging from 6 to 10 feet. Above the mouth of the Ohio the highest stages were due to the substantial and well distributed rainfall, while farther south the last of the flood waters of the preceding month of March passed slowly to the Gulf of Mexico, augmented by a moderate tide from the Ohio about the middle of the month. In fact, the crest of the flood of March, 1903, did not pass New Orleans until the 6th and 7th of April when a stage of 20.4 feet was reached, 4.4 feet above the danger line, and 0.9 foot higher than any previously recorded stage.

The arrival at St. Paul on the 14th of the steamer *Cyclone* marked the opening of through navigation on the Mississippi River for the season; it was seven days later than in 1902, when the same steamer was the first to pass through Lake Pepin.

Ice was last observed in the Missouri River on the 9th. Navigation at Pierre, S. Dak., was resumed for the season on the 6th, although the river was not entirely clear of ice until three days later. From the 5th to the 6th there was a rise at Bismarck, N. Dak., of 7 feet, of which the greater portion evidently came from the Yellowstone and Little Missouri rivers. The crest of this rise traveled steadily down the river, diminishing to about four feet by the time it reached Sioux City, Iowa, and to about two feet after leaving Kansas City, Mo. It reached St. Louis, 1330 miles from Bismarck, on the 18th.

The Illinois River continued above the nominal danger line throughout the month, the steady rains preventing any falls of consequence. No damage was reported.

Nothing of special interest occurred along the Ohio River, although the steady rains from the 7th to the 17th occasioned a sharp rise which was felt over the entire tributary district.

The crest of this rise passed Cairo, Ill., during the 22d to the 24th, but danger-line stages were not reached, except at Evansville, Ind., where the maximum stage was 36.1 feet on the 21st, 1.1 feet above the danger line. The necessary warnings were issued on the 18th, and the actual damage was limited to the overflowing of some lowlands that had been planted in corn. Farming operations, however, were greatly delayed, owing to the wet soil.

The Tennessee River fell during the first week of the month, immediately after which heavy rains set in, resulting in a general rise. Stages of from 2 to 3 feet above the danger lines were experienced from Florence, Ala., to the mouth of the river. Above Florence the rise, while very marked, was not at all dangerous. General warnings which were issued on the 8th proved to be of great value. Near Riverton, Ala., 40,000 railroad ties were saved, while at Chattanooga, Tenn., tannery supplies to the value of \$40,000 were moved to a place of safety, upon the advice of the forecast official.

The western tributaries of the Mississippi River, except the Missouri, fell steadily throughout the month. Those in the

State of Louisiana, except the Atchafalaya, going below the danger lines for the first time in several weeks.

The condition of the rivers of New England and the Middle Atlantic States was very satisfactory, nothing of special interest was noted. There was a gradual fall throughout the month.

In the South Atlantic and east Gulf States the rivers were high during the early days of the month as a result of the heavy rains of the closing days of March. The necessary warnings had been issued and no harm was done, except that occasioned by the enforced delay in lumbering and lowland farming operations.

The highest and lowest water, mean stage, and monthly range at 175 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

## CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions during April are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

**Alabama.**—Quite cool, unfavorable for germination and growth. Temperatures as low as 30° in northern and north-central counties on 4th and 5th, slightly damaging frosts as late as 24th. Destructive local windstorms, hail, and excessive rains; generally deficient rainfall, favorable for work, except on lowlands, which crusted badly. Bulk of cotton and upland corn planted, but stands seriously injured by cold; minor crops did fairly well, fruit unpromising.—*F. P. Chaffee.*

**Arkansas.**—First decade was favorable for all farm work, and considerable progress was made in planting. During second decade cool, wet weather interfered with planting and prevented proper germination of seed. During third decade cool and dry, cotton planting was nearing completion, except in southern tier of counties, and early planted was coming up to a medium stand, poor color. Some corn was up, stand poor; considerable replanting of cotton and corn was necessary. Wheat and oats made slow progress. Considerable damage by frost on the 30th.—*Edward B. Richards.*

**Arizona.**—Cool weather prevailed during the greater portion of April, but there was some quite warm weather during the third decade. The greater part of the month was dry, and over a large area no rain whatever fell. There was considerable rain in the northern and central portions of the territory early in the month and about the middle of the month. The condition of crops was somewhat backward on account of cold weather, but the prospects at the end of the month were generally the best in years, due to rains earlier in the season and to the ample supply of irrigation water. This latter, however, was diminishing.—*M. E. Blystone.*

**California.**—The temperature was considerably below normal, and the rainfall less than average. Heavy frosts on the 10th and 11th caused slight injury to early deciduous fruits, but grapes and citrus fruits were not injured. The heavy rainfall in southern California caused very little damage to grain and new hay, and greatly benefited all crops. Grain and grass in the central and northern sections were beginning to suffer from scanty rainfall toward the close of the month.—*G. H. Willson.*

**Colorado.**—Temperature averaged nearly normal; the nights were so cool that germination and growth were slow; sharp frosts were frequent, culminating east of the mountains in a severe freeze at the close of the month, when gardens, early beets, alfalfa, and fruit suffered badly. Plowing and seeding made favorable progress and good stands of small grain were general. With the warm weather of the third decade, many varieties of fruit began to bloom in eastern and southern counties, and much damage resulted from the freezing weather that prevailed at its close. The snow remained unusually late in the mountains; considerable melting occurred on southern slopes and in unprotected places, but on the whole the amount of moisture stored in the form of snow or in the ground was greater than at the close of March. The ground was comparatively dry, and the run off had been small at the close of the month.—*F. H. Brandenburg.*

**Florida.**—The month was abnormally dry and cool. The general conditions were favorable for farm work, which was well advanced. The

drought retarded germination, and low temperatures had an ill effect on cotton and corn. Cotton chopping was pushed and early corn worked several times; much replanting of both staples was necessary. Citrus trees suffered for want of rain, there being numerous reports of fruit dropping. Pineapples did very well. Oats suffered very much. The crop promises to be light.—*A. J. Mitchell.*

**Georgia.**—Frosts were quite general on the 5th, 23d, and 24th. The rainfall was slightly above normal in the middle section and deficient elsewhere. The weather was not favorable for crops. Cotton planting was very late and germination and growth were slow; cool weather during the latter portion of the month caused many young plants to die and stands were generally poor. Wheat and oats were attacked by rust and the hessian fly and deteriorated steadily. A short peach crop is anticipated. The season is very backward throughout the entire State.—*J. B. Marbury.*

**Idaho.**—Severe frost occurred on the 29th; most of the fruit was thought to be uninjured. Precipitation averaged nearly normal and was well distributed throughout the month, occurring at some stations on every day except the 13th. Vegetation backward, but otherwise in good condition.—*S. M. Blandford.*

**Illinois.**—During the first decade the temperature was above the seasonal average, the soil had dried out, and plowing was being actively prosecuted. Wheat was in a promising condition; considerable progress had been made in the seeding of oats and meadows and pastures were making vigorous growth. Conditions during the latter part of the month were generally unfavorable. Rains made the soil heavy and plowing was retarded; unseasonably cold weather arrested the growth of wheat and affected the germination of oats.—*William G. Burns.*

**Indiana.**—At beginning of April wheat, rye, clover, timothy, and pastures were showing growth in advance of season and some oats had been sown; but excessive moisture in ground and low temperature with frequent frosts during the month delayed farm work and retarded growth of vegetation, so that at its close oats had not all been sown, but little plowing for corn had been done, the grasses and fall sown cereals were in only average condition, and fruit had been greatly injured.—*W. T. Blythe.*

**Iowa.**—Conditions were favorable for an early start of grasses and winter grains; but at the outset the soil was saturated and was kept excessively moist by seasonal rains and the prevalence of cloudy and misty weather. This retarded seeding and plowing for corn to an unusual extent, and the usual acreage of oats and spring wheat was somewhat reduced by excessive moisture in fields intended for these crops.—*John R. Sage.*

**Kansas.**—Wheat in good condition, growing well, and the third week began jointing in several counties; but little damage from hessian fly. Oat sowing finished. Much corn planted. Frost cut off early apples and injured all fruit.—*T. B. Jennings.*

**Kentucky.**—The temperature averaged considerably above the normal during the first twelve days of April and all vegetation got an excellent start. The remainder of the month was cool. Light frost occurred in many localities on the 18th, 22d, and 23d, but no serious damage resulted. Cool nights retarded the growth of vegetation to quite an extent during the latter part of the month. Farm work was delayed by frequent rains, and at the close of the month was quite backward.—*H. B. Hersey.*

**Louisiana.**—The weather during the month was not favorable for agricultural interests. Preparations for cotton planting and planting were pushed vigorously during the early part of the month, but by the close of the second decade a general drought was interfering materially with farm work. The cotton crop is from two to three weeks late. As a