

CLIMATE AND CROP SERVICE.

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

The following summaries relating to the general weather and crop conditions during July are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

Alabama.—The drought, which began about the middle of April, was effectually broken over the greater portion of the State by fairly general rains during the early and latter parts of the last decade, though at the close of the month it continued dry in many central and west central and a few northern counties. Early corn a failure; early cotton considerably damaged by drought; late corn and late cotton held up fairly well, and were improving at close of month.—*F. P. Chaffee.*

Arizona.—The season, as regards aridity and deficient supply of water for irrigation, exceeds all previous years of drought. Vegetation has languished for water and the ranges have become almost barren.—*Wm. G. Burns.*

Arkansas.—Hot, dry weather prevailed during the greater portion of the month, with light and widely scattered showers during the second decade, and ample rains from the 28th to the 31st, inclusive, except in some northern counties. Early corn was practically made by the 15th, but late corn suffered badly from lack of moisture during the third decade, and cotton began to wilt, turn yellow, and shed its forms and squares. Wheat and oat thrashing was practically completed by the 15th, the yield in some localities being better than expected, but generally below the average. Apples continued to drop, but peaches and grapes were ripening and fairly promising. Where sufficient rainfall occurred, the crop outlook at the close of the month was very promising.—*Edward B. Richards.*

California.—The yield of wheat and barley has been fully up to expectations in the central and northern portions of the State. Near the end of the month very high temperatures prevailed north of the Tehachapi. At many points in the great valley maximum temperatures exceeding 114° were reported. South of the Tehachapi the month was cooler. Pears, peaches, prunes, and plums yielded excellent crops in most sections. Fruit drying and canning have been carried on extensively.—*Alexander G. McAdie.*

Colorado.—The notable feature of the month was the general lack of rainfall. Such extreme dryness was particularly unfortunate at this time owing to the fact that practically no water was to be had for irrigation. Vegetation suffered even under ditches heretofore generally well supplied with water. Corn and potatoes withstood the drought remarkably well; the second crop of alfalfa was light, and the same was true of the grain crops except where irrigated or favored by showers. The ranges in the northeastern counties, though brown, afforded very satisfactory pasturage; elsewhere they remained short, especially in the southern counties, where it was necessary to remove live stock from localities on account of lack of grass and stock water.—*F. H. Brandenburg.*

Florida.—Crops suffered from the lack of rain until the third decade of the month. Cotton suffered from rust and the loss of foliage, and the crop will be very short. Owing to the dry weather the acreage of sweet potatoes will be less than usual. The bulk of pineapple shipments was made during the month. Shipments of vegetables and melons were much curtailed. Rain during the last decade of the month benefited citrus trees and checked the loss of fruit.—*A. J. Mitchell.*

Georgia.—The mean temperature was the highest on record for July in the past eleven years. The heat was intense throughout the first ten to twelve days of the month, day temperatures ranging from 100° to 108° in the majority of sections. The rainfall was very unevenly distributed. Drought continued in the northwestern and portions of the western and southwestern sections. Heavy rains occurred in the southeast. The general crop situation was critical in the dry districts; in other sections crops made satisfactory progress and were promising, cotton being heavily fruited and opening in many fields in the southern counties. Late peaches were practically a failure, except in a few central districts.—*J. B. Marbury.*

Idaho.—While the precipitation was unusually excessive in the extreme northern counties and excessive in the central, southwestern, and southeastern counties, there was a large area along the Snake River basin with only a trace. Fortunately the rains extended to most agricultural sections and resulted in improving the condition of all crops. Although the month was exceptionally cool and some frost occurred, no great damage to crops resulted. On the night of the 14-15th a windstorm of unusual severity visited northern counties, blowing down barns and working destruction to much timber and standing grain. During the night of the 2d and 3d snow to the depth of 3 to 5 feet fell in the Boise, Owyhee, and Cœur d'Alene Mountains.—*S. M. Blandford.*

Illinois.—The weather has generally been moderately warm during the month, though there have been periods of quite low temperature for midsummer. Showery conditions were frequent throughout the greater part of the State, and in the northern district the rain was at times very heavy. In the southern district the rains were light,

and though of quite frequent occurrence were not sufficient in some localities to meet the needs of vegetation. In general the month was very favorable for the growth of crops, though there was some injury in the southern part of the State by dry weather and in the northern part by excessive rains. There has been a good yield of wheat, oats, and hay, though there was some damage to each of these by rain during harvest. In some localities the wheat yield was very large. Corn is in exceptionally fine condition generally, but there is some injury by drought in the southern part of the State. Apples promise a light crop.—*M. E. Blystone.*

Indiana.—In the south and central sections hay making and the thrashing of wheat, rye, oats, and barley were completed or well advanced, with generally satisfactory results, although in some localities grain was damaged in shock and in others the yield of wheat and hay was below average. In the north section wheat, oats, and hay were saved with difficulty, on account of frequent showers. Corn made excellent progress and the crop was in most encouraging condition at the end of the month, except in some localities of the south section where rain was not sufficient, and in parts of the northern counties where it had suffered from excessive moisture. The potato crop is promising, but it also suffered in localities of the northern section from too much rain, and in portions of the southern section on account of lack of moisture. Apples continued to fall and the indications are generally for a light crop.—*W. T. Blythe.*

Iowa.—The month was about normal as to temperature, but the precipitation exceeded all records for July in respect to average amount, frequency of showers, and distribution of moisture. The records show rainfall at one or more stations in the State every day during the month. The conditions were unfavorable for harvesting hay and grain, and for cultivation of late corn, resulting in considerable damage to crops, and total loss of acreage in low places and river bottoms. At close of the month fair progress had been made in securing the bulk of the hay and small grain, and the condition of all farm staples was rated higher than was deemed possible during the prevalence of the heavy storms.—*John R. Sage.*

Kansas.—Corn grew rapidly, eared well, and at close of month was in very good condition, except in a few northwestern counties, much of the early in the central and southern counties being hard enough to feed. Wheat and oat harvest concluded and thrashing begun. A good crop of tame hay* was secured and the cutting of a fine crop of prairie hay has begun. Apples, though falling in a few counties, promise a good crop. The potato crop is large and of fine quality.—*T. B. Jennings.*

Kentucky.—The month was fairly favorable for growing crops, although more rain would have been beneficial in many sections. Corn was generally in good condition at the close of the month. Tobacco was very uneven, the Burley districts making the best showing, while the crop was quite indifferent in many localities in the western portion of the State. The weather was generally favorable for harvesting and thrashing wheat. Other crops did fairly well during the month.—*H. B. Hersey.*

Louisiana.—Dry weather during the first ten days of the month retarded the growth of crops. Cotton retained a healthy color and was materially improved by showers during the latter half of the month. While cane stopped growing in most sections, it also retained a healthy color, and, having been exceptionally well cultivated, with favorable rains a good yield is still possible. Rice suffered seriously, but late rice was much improved by showery weather toward the close of the month. Late corn made good growth. The pea crop suffered for rain early in the month, but at the close was doing well.—*I. M. Cline.*

Maryland and Delaware.—The rains have been well distributed, except for a dry period from the 11th to 17th and for a dry area from Allegany County southeastward to St. Marys and eastward to the ocean; this latter belt obtained relief, however, during the general rains at the close of the month. Corn is a very promising crop; hay has given light yields and pastures have been short at times; wheat has given a good grain, with satisfactory return for the amount of straw, but light considering the acreage; oats are a good yield generally; fall plowing has made average advance; tobacco was hurt by drought, but greatly improved by late rains; all fruit is scarce; vegetables of all kinds have been plentiful and of superior quality.—*Oliver L. Fassig.*

Michigan.—Excessive rainfall in the lower peninsula was detrimental to corn, beans, and late potatoes. At the beginning of the month the soil was thoroughly soaked and much lowland was flooded. July was wet with generally cool nights, preventing rapid growth of corn and beans, but favoring heavy growth of hay, wheat, rye, barley, and oats. Hay and grain harvests were much later than usual. Much cut hay and wheat in shock were injured, but generally the yield of the latter was large and of fair grade. Corn made slow growth during the entire month and, like other crops, was much in need of cultivation. Sugar beets made good progress and were in promising condition at close of month. On the whole the outlook for apples was promising, although scab and considerable dropping were reported.—*C. F. Schneider.*

* That is, wild hay that has been cultivated.

Minnesota.—Rains were beneficial in central and northern central portions and in excess in the south. There were very heavy rains locally, and on the 4th and 5th and on the evening of the 15th and the morning of the 16th these were accompanied by hail and destructive winds, which laid the grains flat to the ground and tore down buildings, windmills, etc. Toward the end of the month the soil in south-central and southeastern counties became so soft from the rains that in some fields binders could hardly be used for cutting grain. Except in the relatively small areas affected by the hail and windstorms, all the small grains were in splendid condition. Rye and barley were ripening early in southern portion, and spring wheat and oats were heading. Rye, winter wheat, and barley harvest began in the south before the middle of the month, and spring wheat and oat harvest before the end of the month. Flax is generally a good crop. Corn made rapid growth. A splendid hay crop has been secured, though a great deal was spoiled by the rains. The potato crop is a large one.—*T. S. Outram.*

Mississippi.—Over the northern and western portions of the State and in some of the southern counties cotton made satisfactory growth during the month and was generally of fair size and well fruited, while in the central and extreme eastern counties the continued dry weather was very detrimental to the staple, which grew but little and was much damaged by blooming to the top and shedding, especially on hill lands, where the plants were small and unpromising. Much early corn was cut for fodder, although in a few northern counties some fields of early corn that escaped the June drought matured in good condition. Late corn generally continued promising. Cane, rice, and sorghum did fairly well. Peas were still being sown for hay and many sweet-potato slips were being set out. Pastures were poor. Peaches were only a fair crop and generally of inferior quality.—*W. S. Belden.*

Missouri.—The rainfall was very unevenly distributed, being excessive in many of the northern and western counties, while some of the southeastern counties received less than half an inch. The heavy rains in the northern and western sections retarded thrashing, oat harvest, and haying during the fore part of the month and in some districts wheat in shock sprouted considerably, and a part of the oat crop was lost, but in most sections grain that was well shocked suffered but little damage. Some hay was also damaged, but in general an excellent crop was secured in good condition. In a few of the extreme southeastern counties corn was seriously injured by drought, and in the northern sections some loss was caused by floods, but as a rule the crop made excellent progress and gave promise of being the largest in the history of the State. Cotton also suffered from drought in the extreme southeast, but elsewhere all crops, except flax, continued in excellent condition.—*A. E. Hackett.*

Nebraska.—A month of heavy rains which caused rivers and creeks in the southeast portion to overflow and seriously damage all crops in the valleys along their banks. The harvesting of wheat and oats was retarded by rain, and in the eastern section the quality of the grain was injured, while some wheat was ruined. Considerable hay and alfalfa was damaged by the rain. Corn made a vigorous growth, eared heavily, and at the end of the month promised an exceptionally heavy crop.—*G. A. Loveland.*

Nevada.—Remarkably cold weather for July prevailed over the State the first week of the month. Freezing temperatures occurred on the mornings of the 2d and 3d, and from 2 to 5 inches of snow fell on the high mountains in the north half of the State on the night of the 2d. The first and second decades were quite cool, but the last decade was unusually warm. The weather was very favorable for harvest work and the growth of irrigated crops. The water supply was quite plentiful throughout the month. A good crop of hay was cut and saved without damage. Grain ripened rapidly and some was cut and stacked. Range grass was fairly good and live stock did well.—*J. H. Smith.*

New England.—The weather was fairly favorable to crop growth, although there was a deficiency of sunshine and an excess of rain. The weather was unfavorable to harvesting and securing hay and much of the crop was secured in a damaged condition. All crops were in fairly good condition, except corn, which was much retarded by the unfavorable weather and will doubtless be a short crop.—*J. W. Smith.*

New Jersey.—The month was chiefly characterized by frequent thunderstorms, very destructive in places, being accompanied by high wind and hail. Hay and oat harvest greatly retarded; some grain still in the fields and sprouting. Growing crops at close of month were generally in good condition.—*Edward W. McGunn.*

New Mexico.—Drought was quite severe in all sections excepting the southeastern portion, where the rainfall was far in excess of the normal. Irrigation water failed in many localities, and crops on temporal lands¹ were a failure.—*R. M. Hardinge.*

¹ Referring to this term "temporal lands," Mr. Hardinge adds the following note:

"Temporal lands are unirrigated lands. I can find no authority in the dictionaries for this use excepting that 'temporal' has a meaning of 'seasonal.' In this section the word is in common use as applied to such planted lands as depend on rainfall only for the raising of the crop. This use of the word is derived from the classification of lands under the old Mexican law into *irrigated*, *temporals*, and *pastoral*. I believe we have no English word of the same significance; 'unirrigated' does not express it."

New York.—The month was unusually rainy, and disastrous floods occurred in the western plateau, and parts of central and eastern sections, either washing away crops on lowlands or causing their abandonment. Corn and beans were backward and some rot in potatoes and grapes appeared. The harvest of hay and grain was much delayed and great quantities were ruined by rains, and only a light crop of apples, peaches, pears, and hops was indicated. The acreage of buckwheat was reduced, while some improvement in the condition of crops was reported near the close of the month. July was generally very unfavorable for farm operations and for the growth of crops.—*R. G. Allen.*

North Carolina.—The month of July was characterized by a considerable excess in monthly mean temperature, very high maximum temperature, and a marked deficiency in rainfall. Conditions not favorable for the best development of crops. In fact the month was the driest July in North Carolina since 1872. During the early part of July corn continued to grow rapidly, many correspondents reporting it "best for years," but during the middle of the month upland and early planted corn suffered much from drought. Cotton and tobacco also deteriorated somewhat. Cotton generally was well balled, and fields were kept clean and thoroughly cultivated. Cutting and curing tobacco made rapid progress during the month, and the crop cured well. Sweet potatoes and vegetables were injured by the drought. Peanuts and rice did well. Fruit was generally inferior in quality, and there was much dropping of late varieties. Grapes promised a large yield, and melons were abundant.—*C. F. von Herrmann.*

North Dakota.—The weather was generally favorable for the growth of all vegetation, and prospects for small grain were never better. Corn was backward, being retarded by cool, wet weather, but at the close of the month was growing rapidly. Some slight damage was done grain by scattered hailstorms and high winds.—*B. H. Bronson.*

Ohio.—The temperature departures were slight; precipitation excessive in northeastern counties, deficient in some southwestern. Vegetation made good growth. Corn is excellent, except in a few northern counties; a large crop of oats being secured; tobacco made good growth; second crop of clover is quite promising; apples continue dropping, though a few correspondents report a fair crop; grapes continue promising, though rotting in a number of counties.—*B. L. Waldron.*

Oklahoma and Indian Territories.—Some slight damage was caused by hot winds during the first week, but the scattered, daily showers after the 9th benefited crops in general and placed the ground in fine condition for fall wheat plowing, which was well advanced by the close of the month; wheat and oats were harvested and being thrashed; early corn was made and being cut with good yields; late corn and kaffir corn made good growths; cotton was laid by during the third week in good condition, and was squaring, blooming, and bolting by the close of the month; millet, broom corn, castor beans, and flax were being secured with good yields; hay making continued throughout the month; early fruit was being marketed and was abundant, while late fruit was greatly benefited by the showers.—*C. M. Strong.*

Oregon.—The first week was cool and wet; the remainder of the month was dry and warm, except a short cool spell at the end. Good crop of hay secured. Peach crop fair and apples good. Wheat harvest progressed finely; average crop. Italian prunes almost a failure. Good crop of vegetables.—*Edward A. Beals.*

Pennsylvania.—Like the preceding month, July was both cool and wet. Haying, harvesting, the seeding of buckwheat, and the advancement of corn were seriously retarded during the first half of the month, and there was much complaint of wheat sprouting in shock, hay being damaged, slow germination of late plantings and seedlings, bottom lands being flooded, hillsides washed, and fruit "dropping." The last decade brought more favorable conditions. Oats developed rapidly and gave promise of favorable returns; the wheat crop, where thrashed, proved to be of good quality and much heavier than anticipated; corn was making satisfactory progress; tobacco plants were backward, but apparently thrifty. The early potato crop was light, and, while late plantings were making fair growth, both rot and blight were developing in many fields.—*T. F. Townsend.*

Porto Rico.—The weather conditions were generally favorable throughout the month for the growth of all crops, but the land was too dry and hard for cultivation in many localities. Sugar making was carried on and practically completed. The degree of sweetness was very low and the yield of sugar poor and unsatisfactory. Young canes have improved, but many ratoons will probably be abandoned, which will materially affect the next crop. The coffee crop rallied somewhat and the first grains were being gathered. The preparation of land for tobacco seed beds was active and the indications are that a large crop will be sown. The rice crop was in all stages from the newly sown seed to the matured grain. Some corn was harvested. Such fruits as mangoes, pineapples, and alligator pears were abundant and of good quality. The markets were generally well supplied with other fruits and vegetables during the month.—*E. C. Thompson.*

South Carolina.—The excessive heat from the 1st to the 8th when maximum temperatures of over 100° occurred in nearly all portions of the State, together with general absence of precipitation, the rapid evaporation of the little rain that fell, and low relative humidity, caused rapid deterioration of all crops, particularly of corn just approaching maturity,

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the mean temperature, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, July, 1902.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	82.8	+2.7	Lock No. 4	109	7	Valleyhead	53	22	2.50	-2.48	Bermuda	8.52	Letohachee	0.20
Arizona	81.4	-2.4	Aztec	119	18	Duncan	33	19	0.48	-1.35	Pinal Ranch	1.83	Many stations	0.00
Arkansas	79.4	-0.7	Rison	105	16	Pond	50	21	4.49	+0.26	Texarkana	13.94	Fayetteville	0.37
California	72.8	-1.8	Volcano	122	13	Bodie	17	4	0.07	+0.01	Laguna Valley	2.32	Many stations	0.00
Colorado	64.8	-3.2	Blaine	109	14	Russell	19	6	1.27	-1.08	Blaine	4.25	Wallet	T.
Florida	82.3	+0.8	Molino, Wausau	105	7	Holt	56	6	5.20	-1.47	Manatee	11.66	Key West	1.57
Georgia	82.0	+2.1	Douglas	108	2	Clayton	54	28	4.55	-1.47	Stillmore	12.29	Adairsville	1.18
Idaho	63.0	-3.8	Hepzibah	105	20	Chesterfield	26	20	1.50	-0.84	Priest River	5.61	3 stations	T.
Illinois	76.1	-0.4	Garnet	104	17	Equality	5	21	5.04	+1.53	Cambridge	11.55	Cairo	0.40
Indiana	75.7	-0.3	Equality	104	17	5 stations	44	1	3.89	+0.09	Kokomo	6.96	Cannelton	0.21
Iowa	73.1	-0.6	Mount Vernon	104	17	Winamac	41	1	8.67	+4.99	Odebolt	13.57	Keokuk	4.87
Kansas	76.8	-1.8	St. Charles	99	17	Clinton	41	1	4.32	+0.90	Lebanon	9.80	Lakin	0.45
Kentucky	78.1	+0.3	Colby, Hoxie	105	15	Colby	45	20	1.91	-2.14	Catlettsburg	4.85	Hopkinsville	0.26
Louisiana	82.2	+1.0	Ulysses	107	17	Loretto	48	22	3.72	-0.65	Plain Dealing	15.42	Prevost	0.70
Maryland and Delaware	75.8	-0.1	Bowling Green, Cadiz	102	8	Collinston	60	21	4.56	-0.67	Takoma Park, Md.	7.53	Milford, Del.	1.77
Michigan	69.4	+0.3	Libertyhill	102	8	Grantsville, Md.	43	11	3.24	-0.67	Deerpark, Md.	11, 24	Detour	1.04
Minnesota	69.7	-1.0	Rayne	104	18, 19	Deerpark, Md.	23	16	5.24	+2.48	Wetmore	23	Owosso	11.06
Mississippi	82.4	+1.3	3 stations	104	18, 19	Tower	95	9	4.76	+1.00	New Richland	11.98	Pipestone	1.34
Missouri	77.0	0.0	East Tawas	98	7	Duckhill, University	55	22	3.68	-1.22	Aberdeen	6.76	Corinth	1.11
Montana	62.8	-3.6	Traverse City	24	24	Potosi	50	21	4.55	+0.87	Oregon	10.77	Caruthersville	0.15
Nebraska	72.4	-2.5	Bearisley	102	29	Ovando	30	29	1.87	+0.52	Troy	5.44	Glasgow	0.03
Nevada	67.9	-4.5	Okolona	106	4	Kennedy	38	17	5.98	-2.46	Ashland	13.86	Cody	0.88
New England	66.3	-2.5	Leakesville	103	15	Palmetto	25	3	0.44	+0.32	Halleck	2.00	Several stations	0.00
New Jersey	73.0	-1.0	Poplarbluff	103	15	Fort Fairfield, Me.	30	3	3.90	-0.77	Cream Hill, Conn.	9.40	Bemis, Me.	1.02
New Mexico	71.3	-1.5	Bridgerton	100	18	Charlottesville	43	17	4.78	-0.18	Chester	9.92	Cape May, C. H.	1.83
New York	68.3	-0.6	Ohio	110	25	Winsors	27	6	1.51	-0.65	Carlsbad	10.50	Bluewater, Ohio	T.
North Carolina	78.6	+0.9	Lyons	99	8	Axton	34	11	6.77	+3.01	Angelia	12.46	Ogdensburg	1.58
North Dakota	67.6	-0.4	Chapelhill	107	19	Linville	44	23	2.74	-2.76	Highlands	5.71	Graham	0.98
Ohio	74.0	+0.2	Napoleon	106	24	Gallatin	34	9	2.15	-0.48	Amenia	5.20	New England City	0.08
Oklahoma and Indian Territories	79.7	-1.6	Bethany	100	8	New England City	20	20	4.69	+0.78	Hillhouse	8.75	Frankfort	0.70
Oregon	64.0	-2.4	Heraldton, Ind. T.	105	9	Hillhouse, North	43	11	2.22	-1.16	Goodwater, Ind. T.	8.90	Umatilla, Ind. T.	0.10
Pennsylvania	71.8	+0.6	Healdton	105	9	Lewisburg	49	6	1.46	+1.01	Bay City	4.00	Umatilla	0.00
Porto Rico	79.9	0.0	Blalock, Umatilla	106	20	Kenton, Okla.	28	4	5.8	5.8	Emporium	12.95	Kennett Square	2.11
South Carolina	80.8	+1.0	York	99	17	Bend	41	11	6.04	+1.67	Las Marias	17.42	Santa Isabel	0.50
South Dakota	71.4	-0.6	Cayey	99	8	Dushore	41	11	4.96	-2.29	Yemassee	9.62	Winsboro	0.71
Tennessee	79.0	+1.1	3 stations	107	4, 6	Adjuntas	53	7	3.79	-1.86	Elk Point	8.02	Cherry Creek	0.05
Texas	82.4	-1.0	Cherry Creek	110	15	Alken	58	15	2.47	-0.29	Tellico Plains	4.68	Kenton	T.
Utah	68.4	-4.2	Springfield	106	17	Howard	40	10	1.97	-2.21	Temple	19.79	Laureles Ranch	0.00
Virginia	76.5	-1.0	Beaumont	108	14	St. Lawrence	44	22	5.84	+3.54	St. George	1.82	5 stations	0.00
Washington	63.8	-1.8	Fort McIntosh	108	19	Erasmus	44	22	0.32	-0.17	Fredericksburg	6.84	Woodstock	0.94
West Virginia	74.2	-0.1	Cotulla	112	21	Burnett	55	20	3.12	-1.44	Ashford	4.11	Connell	0.00
Wisconsin	70.6	+0.2	Green River	112	21	Marion	23	23	1.60	+0.87	Morgantown	8.42	Lewisburg	0.96
Wyoming	62.7	-3.8	Columbia	108	10	Wilbur	30	27	3.54	-0.91	Delevan	12.19	Antigo	0.97
			Pasco	108	20	Oceana	45	1	6.25	+2.85	Lagrange	3.46	Hyattville	0.10
			Rippon	104	17	Oscola	35	10	0.80	-0.19				
			Valley Junction	95	27	Daniel	26	7						
			Basin	107	28									

and of cotton that was then in full bloom. The former wilted and many of the ears failed to kernel, and the latter turned yellow and began to shed its leaves, squares, and young bolls. Subsequent weather conditions were more favorable, but crops recovered slowly from the set back, especially in localities where there was a large deficiency in precipitation, and these were numerous throughout the State, except in the southeastern portions where the precipitation was slightly in excess. Many points had sufficient rain during the latter half of the month and at such places all crops were in a flourishing condition.—J. W. Bauer.

South Dakota.—The weather was generally favorable for spring wheat, oats, barley, rye, and grass until the latter part of the month, when high temperature and much sunshine matured late spring wheat and oats somewhat too rapidly in the middle and northern counties, and insufficient moisture over large areas retarded the progress of corn, late potatoes, late flax, millet, and pastures. Corn was backward over most of the State during the entire month, but on the whole did very well until the latter part. The month closed with the rye crop and the bulk of the barley crop in shock or stack, oat harvest far advanced, spring wheat harvest begun in the extreme northern and nearing completion in the extreme southern portions, and all harvested small grains secured in shock or stack under unusually favorable weather conditions for such work and generally promising very good returns; corn mostly silking or

earing. Early potatoes and flax very good, the late promising only fairly. A large proportion of the hay crop well secured in stack, and range live stock in unusually good condition.—S. W. Glenn.

Tennessee.—The month began with corn and cotton in fine condition, and tobacco, peas, peanuts, millet, and gardens doing well; a severe drought followed, shortening the corn crop very materially and damaging all other growing crops seriously. Wheat thrashing progressed under favorable conditions, also oat harvesting and haymaking. The prospects for apples and peaches continued poor. Good rains came during the last three days of the month and greatly revived growing crops, but a large part of the early corn in the central portions of the State was too badly damaged to be much benefited.—H. C. Bate.

Texas.—The weather during the month was generally favorable for the growth of crops, but owing to frequent and heavy rains farm work and cotton picking were considerably retarded. The growth and development of cotton continued rapid over all portions of the State until the last decade of the month, when many fields in the valleys of the Brazos, Colorado, and Trinity rivers were flooded; many crops were either destroyed or badly damaged. Cotton was damaged to some extent by weevil and boll-worms, and rust and shedding were reported from some localities after the heavy rains. At the close of the month cotton picking was general, and in central and southern sections many bales had been marketed. An

improvement was noticed in the condition of June corn, although this crop suffered along river bottom lands. Rice, sugar cane, and all minor crops made satisfactory advancement.—*Edward H. Bowie.*

Utah.—A remarkably cool spell prevailed during the first decade. Freezing temperatures and heavy frosts occurred in the elevated valleys of the State on several mornings between the 2d and 9th, badly damaging potatoes and other tender vines, and slightly damaged corn, wheat, and alfalfa in places. Irrigation water became very short before the close of the month, but on the whole growing crops did fairly well.—*L. H. Murdock.*

Virginia.—During the first half of the month fairly favorable weather prevailed over the State and crop growth was, in the main, satisfactory, but the latter half was quite droughty and vegetation suffered considerably, especially early corn, pastures, and tobacco. Opportunities for field work were almost uninterrupted, and at the close of the month all crops were clean. Hay making, thrashing and housing of wheat, and cutting and stacking of oats were vigorously prosecuted.—*Edward A. Evans.*

Washington.—Long drought broken by heavy rains beginning on 1st, and lasting three to six days, averting danger to and causing great improvement in crops. In parts of the eastern section it was the heaviest July rainfall known. With the exception of the first week it was a splendid month for haying. Fall wheat harvest progressed during the last week; the yield was fair to good. Oats were in need of rain. The potato crop promises to be excellent.—*S. N. Salisbury.*

West Virginia.—The weather conditions during the month were generally favorable for crop growth and also for harvesting. By the end of the first week wheat was mostly in shock and some was being thrashed, with light yield. Meadows continued to thicken and improve, so that

haying was not in full progress until the last week, when hay was secured in good condition, with about half a crop. Oat harvest was in progress during the last week, with a good yield, and early potatoes were made, with a good crop. Corn made excellent growth during the month, and the prospects were for a fairly good crop. Some fall plowing was being done during the latter part of the month. Apples continued to fall during the month, and the prospects were for about half a crop; peaches and plums were scarce, but grapes were quite promising.—*E. C. Voe.*

Wisconsin.—Crops generally in a very promising condition, although frequent and heavy rains damaged grains and hay in most sections and delayed the harvest. Killing frosts occurred the first of the month in the extreme northern counties and considerable damage resulted; light frost occurred in the middle section, but no damage resulted. The first of the month was exceptionally cool and retarded the advancement of corn, but later it showed a gradual and thrifty growth. Rain was materially deficient the greater portion of the month in the northeast counties. Hail did material damage in some localities, especially in St. Croix County on the 22d.—*J. W. Schaeffer.*

Wyoming.—The weather was unseasonably cool during the first half of the month and retarded crop growth some, but was warm and favorable for good crop growth during the latter half. Precipitation was sufficient in most sections of the State, except parts of Big Horn County, where some crop failures resulted. At the end of the month haying was in general progress, and the second crop of alfalfa was being secured in several sections. Gardens and grain were backward, but doing well. Ranges had become generally dry, but stock was in good condition. Prospects for winter feed were poor in sections. As a whole the month was favorable for agricultural interests.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

STUDIES ON THE STATICS AND KINEMATICS OF THE ATMOSPHERE IN THE UNITED STATES.

No. VII. A CONTRIBUTION TO COSMICAL METEOROLOGY.

By Prof. FRANK H. BIGELOW, dated August 12, 1902.

GENERAL REMARKS.

I have already published the results of certain computations and discussions on the subject of the direct connections between the variations of the solar output of energy, and the corresponding synchronisms in the meteorological elements of the earth's atmosphere. These are in particular, Solar and Terrestrial Magnetism, Weather Bureau Bulletin No. 21, 1898, and Eclipse Meteorology and Allied Problems, Weather Bureau Bulletin I, 1902, which include the substance of other minor papers related to this subject. The purpose of these studies has been, (1) to establish the fact that a synchronous connection does exist between the solar and the terrestrial forces, and (2) to derive the operation of these periodic movements so as to ultimately lead meteorology to a scientific understanding of the terrestrial seasonal climatic changes, and to a true basis for forecasts of weather conditions, at least one year in advance.

The difficulty of reaching a correct solution of this problem is well understood by those who have worked upon it, to reside in the unsteadiness of the solar output itself, and the numerous subordinate transformations of the energy, through the radiation, the general and local cyclonic circulations, till it culminates in a season having certain characteristics. The material for the study consists in the variations of the pressures, temperatures, and vapor tensions at many stations in different portions of the earth, in the fluctuations of the terrestrial magnetic field, in the changes of the spectrum energy of the solar and the aqueous vapor curves, and in the variations of the sun spots, the prominences, and the solar faculae. The magnitude of the task involved in handling this material is such as to limit the attempt to deal with it to a few institutions having these subjects specially in charge. Among them the United States Weather Bureau has been able to make some contributions from time to time.

SUMMARY OF THE DISCUSSION OF 1898.

On pages 121-130, Bulletin No. 21, is given a brief account

of an extensive discussion of the data then at hand, and the result was such as to show that there is a marked synchronism between the solar and terrestrial variations of energy. Fig. 24 serves to recall this fact and it shows that in the sun-spot period, 1878-1893, there was a true synchronism in the variation of the sun-spot areas, the European magnetic force, which is the resultant of the two components measured on a horizontal plane, and the American meteorological system. The latter includes a variation of temperature at 25 stations in the north-western portions of the United States, the pressure at 10 stations, the variable mean movements of the storms in latitude and longitude, and the movement of the tracks of the cold waves in latitude. Each of the two latter elements was derived from an exhaustive compilation of the coordinate positions of the cyclonic centers for the interval of fifteen years ending with 1893. It led me to the following summary:

The increase of solar magnetic intensity is synchronous with a diminution of temperature but with an increase of pressure, and this function persists throughout every phase of the research.

In spite of some irregularity, there is a distinct conformity in the general sweep of these curves, and also in the tendency to describe crests during the same years. Indeed, the occurrence of four subordinate crests in the 11-year period suggests strongly that a 2 $\frac{3}{4}$ -year period is superposed upon the long sweep of that periodic curve. Apparently this minor period is the basis of these seasonal variations of the weather conditions of the United States more than anything else, so that in long-range forecasting this period must be very carefully considered.

It was for the purpose of carrying this subject one step further forward that the discussion of the data summarized in this present paper was undertaken. There has been considerable delay in completing the work on account of many other important duties.

It is evident that the terrestrial magnetic field affords the data which is most available for studying the fundamental periods in this solar-terrestrial synchronism. An exact quantitative computation for the several elements involves a very large amount of labor, and therefore it is important as an alternative to derive the periods by *methods which shall give reliable proportional variations* of the elements. The ideal treatment is to compute the total deflecting force of the magnetic field, by using the means of 24-hourly observations of the horizontal force, the declination, and the vertical force, taking out their daily component variations in rectangular coordinates