

A Century of Drought in Hawai‘i: Geospatial Analysis and Synthesis across Hydrological, Ecological, and Socioeconomic Scales

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SUPPLEMENTAL INFORMATION

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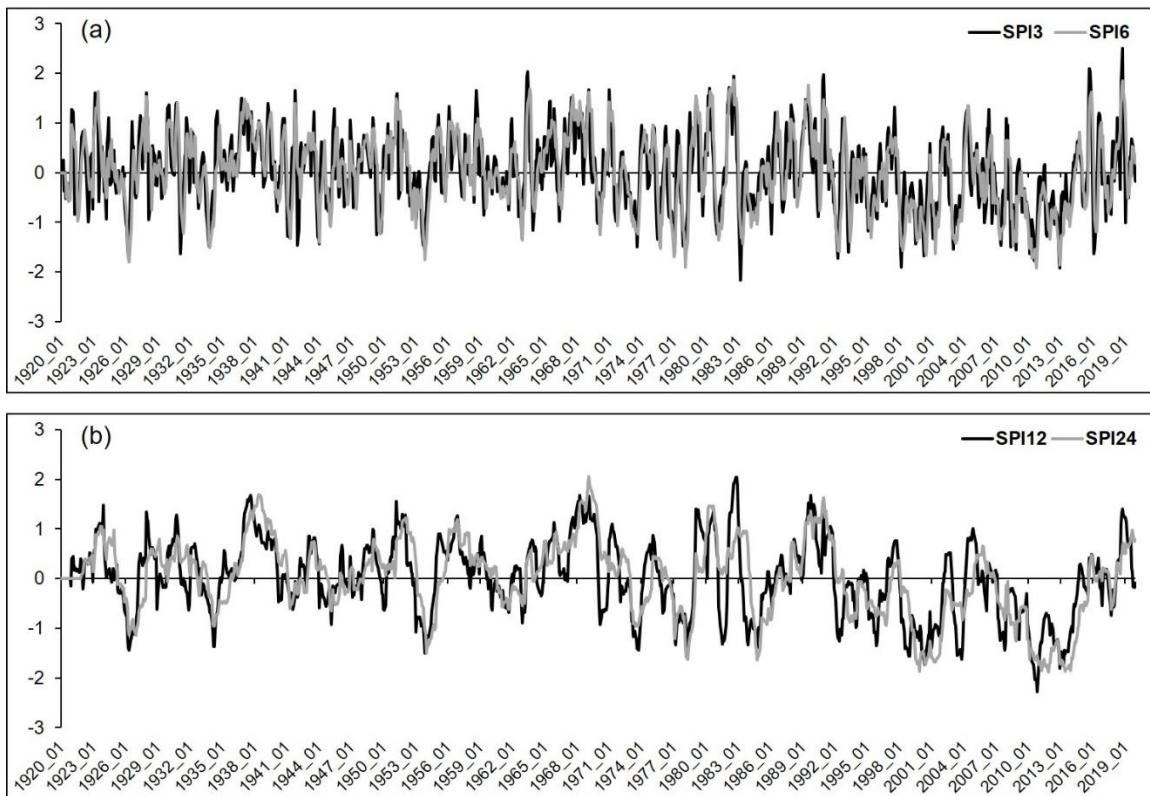


Figure S1. Standardized Precipitation Index (SPI) time series for the State of Hawai‘i from 1920-2019. (a) 3-month (SPI-3) and 6-month (SPI-6); (b) 12-month (SPI-12) and 24-month (SPI-24).

Table S1. Statewide droughts (1920-2019) identified by average SPI-6, sorted by overall rank. Overall rank is the average of the ranks of the metrics shown here: average intensity (absolute value of SPI values), peak intensity, duration, magnitude, and maximum percent area. Maximum percent area is the maximum percentage of land area with SPI-6 < -1 during the event (moderate drought or worse).

Overall Rank	Start	End	Avg. Intensity	Peak Intensity	Duration	Magnitude	Max. Pct. Area
1	Jun. 2009	Apr. 2014	0.96	-1.92	59	-56.68	91.36
2	Dec. 1997	Oct. 2000	0.96	-1.66	35	-33.72	92.4
3	Jul. 1952	Jun. 1954	0.75	-1.75	24	-18.06	94.89
4	Oct. 1977	Jun. 1978	1.13	-1.90	9	-10.15	96.12
5	Apr. 1925	Aug. 1926	0.70	-1.80	17	-11.82	88.01
6	Aug. 1976	Jun. 1977	0.90	-1.69	11	-9.89	91.74
7	Nov. 2002	Dec. 2003	1.04	-1.41	14	-14.59	69.94
8	Nov. 1991	Aug. 1992	0.97	-1.58	10	-9.72	89.31
9	Jul. 1933	May 1934	0.91	-1.52	11	-10.04	78.68
10	Dec. 2000	Oct. 2001	0.86	-1.63	11	-9.48	84.25
11	Jun. 2008	Mar. 2009	0.87	-1.46	10	-8.69	84.49
12	Jul. 1975	Feb. 1976	0.87	-1.52	8	-6.98	85.15
13	Nov. 2006	Nov. 2007	0.86	-1.34	13	-11.17	74.89
14	Feb. 1983	Aug. 1983	1.09	-1.44	7	-7.60	82
15	Nov. 1980	Nov. 1981	0.76	-1.36	13	-9.90	78.13
16	Aug. 1972	Nov. 1973	0.78	-1.23	16	-12.43	66.56
17	Dec. 1994	Feb. 1996	0.69	-1.31	15	-10.42	72.12
18	Nov. 1983	Feb. 1985	0.72	-1.10	16	-11.51	65.23
19	Feb. 1941	Aug. 1941	0.85	-1.33	7	-5.94	77.92
20	Mar. 1993	Sep. 1993	0.70	-1.40	7	-4.90	80.22
21	Jul. 1949	Jan. 1950	0.86	-1.24	7	-6.00	68.4
22	Nov. 1943	May 1944	0.68	-1.41	7	-4.73	74.92
23	Jun. 1962	Mar. 1963	0.57	-1.36	10	-5.69	66.05
24	Sep. 1969	Aug. 1970	0.50	-1.25	12	-6.00	62.54
25	Feb. 2016	Jul. 2016	0.73	-1.20	6	-4.38	68.31
26	Sep. 1944	Mar. 1945	0.71	-1.08	7	-4.95	47.48
27	Feb. 1931	Aug. 1931	0.66	-1.23	7	-4.61	65.43
28	Jul. 1971	Jan. 1972	0.54	-1.07	7	-3.76	55.98

Table S2. Droughts for Hawai‘i Island (1920-2019) identified by average SPI-12, sorted by overall rank. Overall rank is the average of the ranks of the metrics shown here: average intensity (absolute value of SPI values), peak intensity, duration, magnitude, and maximum percent area. Maximum percent area is the maximum percentage of land area with SPI-12 < -1 during the event (moderate drought or worse).

Overall Rank	Start	End	Avg. Intensity	Peak Intensity	Duration	Magnitude	Max. Pct. Area
1	Jan. 2007	Sep. 2014	1.20	-2.56	93	-111.44	92.43
2	Jan. 1998	Dec. 2001	1.00	-1.84	48	-48.14	85.93
3	Dec. 2002	Feb. 2004	1.27	-1.88	15	-19.06	89.45
4	Dec. 1991	Feb. 1994	0.65	-1.55	27	-17.65	91.84
5	Apr. 1925	Mar. 1927	0.74	-1.51	24	-17.86	78.23
6	Dec. 1975	Dec. 1978	0.59	-1.43	37	-21.95	89.64
7	Mar. 1983	Sep. 1985	0.73	-1.38	31	-22.52	76.18
8	Jan. 1972	Mar. 1974	0.63	-1.45	27	-16.94	90.15
9	Mar. 1981	Dec. 1981	1.15	-1.50	10	-11.51	78.03
10	Oct. 1952	Nov. 1954	0.68	-1.17	26	-17.55	59.98
11	Oct. 1932	Oct. 1934	0.55	-1.47	25	-13.75	77.31
12	Feb. 1995	Nov. 1996	0.56	-1.48	22	-12.32	76.10
13	Oct. 1962	Apr. 1963	0.81	-1.29	7	-5.64	51.09
14	Jan. 1970	Nov. 1970	0.67	-1.11	11	-7.40	62.55

Table S3. Droughts for Maui Nui (1920-2019) identified by average SPI-12, sorted by overall rank. Overall rank is the average of the ranks of the metrics shown here: average intensity (absolute value of SPI values), peak intensity, duration, magnitude, and maximum percent area. Maximum percent area is the maximum percentage of land area with SPI-12 < -1 during the event (moderate drought or worse).

Overall Rank	Start	End	Avg. Intensity	Peak Intensity	Duration	Magnitude	Max. Pct. Area
1	Jan. 1998	Apr. 2002	1.26	-1.94	52	-65.49	97.51
2	Mar. 2008	Mar. 2014	0.97	-1.85	73	-70.92	94.46
3	Mar. 1952	Nov. 1954	0.92	-2.00	33	-30.36	100.00
4	Mar. 1975	Nov. 1978	0.78	-1.76	45	-34.91	95.21
5	Jan. 1972	Mar. 1974	0.77	-1.44	27	-20.92	89.00
6	Jul. 1994	Nov. 1996	0.72	-1.47	29	-20.99	86.53
7	Dec. 1943	Dec. 1945	0.64	-1.77	25	-15.95	84.16
8	Apr. 1983	Sep. 1985	0.63	-1.39	30	-19.03	77.50
9	Dec. 2002	Feb. 2004	0.78	-1.53	15	-11.65	69.25
10	Dec. 1991	Feb. 1993	0.78	-1.42	15	-11.75	56.32
11	Feb. 1933	Sep. 1934	0.73	-1.25	20	-14.69	56.34
12	Mar. 1981	Dec. 1981	0.91	-1.27	10	-9.05	51.54
13	Nov. 1925	Mar. 1927	0.69	-1.22	17	-11.77	61.54
14	Mar. 2007	Dec. 2007	0.77	-1.22	10	-7.70	66.45
15	Oct. 1962	Mar. 1963	0.58	-1.04	6	-3.49	36.94

Table S4. Droughts for the Island of O‘ahu (1920-2019) identified by average SPI-12, sorted by overall rank. Overall rank is the average of the ranks of the metrics shown here: average intensity (absolute value of SPI values), peak intensity, duration, magnitude, and maximum percent area. Maximum percent area is the maximum percentage of land area with SPI-12 < -1 during the event (moderate drought or worse).

Overall Rank	Start	End	Avg. Intensity	Peak Intensity	Duration	Magnitude	Max. Pct. Area
1	Jan. 1998	Dec. 2003	1.15	-2.09	72	-82.61	100.00
2	Sep. 1952	Oct. 1954	0.99	-2.02	26	-25.73	100.00
3	Apr. 1925	Mar. 1927	1.04	-1.82	24	-24.98	100.00
4	Jul. 1983	Aug. 1985	0.95	-1.91	26	-24.76	98.92
5	Nov. 1976	Sep. 1978	1.06	-1.88	23	-24.48	99.99
6	Mar. 2007	Jan. 2011	0.75	-1.60	47	-35.15	94.51
7	Dec. 1943	Jan. 1946	0.89	-2.06	26	-23.11	96.40
8	Jun. 1959	Feb. 1962	0.67	-1.49	33	-22.01	100.00
9	Jul. 1994	Oct. 1996	0.84	-1.46	28	-23.65	91.71
10	Jan. 1973	Feb. 1974	1.04	-1.53	14	-14.51	98.16
11	Jan. 2012	Jun. 2014	0.71	-1.47	30	-21.24	94.29
12	Oct. 1940	Nov. 1942	0.71	-1.37	26	-18.37	73.57
13	Oct. 1933	Oct. 1934	0.60	-1.42	13	-7.79	90.66
14	May 2017	Aug. 2018	0.53	-1.24	16	-8.44	65.30
15	Apr. 1946	Jan. 1948	0.60	-1.03	22	-13.30	58.30
16	Mar. 1981	Dec. 1981	0.72	-1.05	10	-7.21	62.32
17	Sep. 1993	Feb. 1994	0.59	-1.19	6	-3.54	69.58

Table S5. Droughts for the Island of Kaua‘i (1920-2019) identified by average SPI-12, sorted by overall rank. Overall rank is the average of the ranks of the metrics shown here: average intensity (absolute value of SPI values), peak intensity, duration, magnitude, and maximum percent area. Maximum percent area is the maximum percentage of land area with SPI-12 < -1 during the event (moderate drought or worse).

Overall Rank	Start	End	Avg. Intensity	Peak Intensity	Duration	Magnitude	Max. Pct. Area
1	Nov. 1997	Apr. 2002	1.18	-2.17	54	-63.71	100.00
2	Oct. 1983	Nov. 1987	0.86	-2.17	50	-43.22	100.00
3	Dec. 1952	Aug. 1954	1.15	-2.08	21	-24.23	100.00
4	Mar. 2007	Feb. 2009	0.86	-1.87	24	-20.69	99.78
5	Dec. 2009	Apr. 2011	0.93	-2.02	17	-15.81	99.95
6	Jan. 1924	Mar. 1927	0.84	-1.75	39	-32.73	87.98
7	Jul. 1975	Oct. 1978	0.75	-1.48	40	-29.80	95.32
8	Aug. 1944	Dec. 1945	0.73	-2.12	17	-12.49	100.00
9	Mar. 1992	Aug. 1994	0.49	-1.84	30	-14.58	100.00
10	Jan. 1973	Dec. 1973	1.00	-1.92	12	-12.05	97.24
11	Mar. 1941	Nov. 1942	0.73	-1.60	21	-15.33	83.10
12	Jun. 2012	Jan. 2014	0.68	-1.55	20	-13.53	91.46
13	Nov. 1933	Feb. 1935	0.79	-1.68	16	-12.64	87.51
14	Nov. 1994	Dec. 1995	0.72	-1.37	14	-10.10	92.95
15	Aug. 2016	Feb. 2018	0.70	-1.21	19	-13.35	72.68
16	Jun. 2002	Feb. 2004	0.59	-1.18	21	-12.42	77.48
17	Nov. 2005	Feb. 2006	0.79	-1.24	4	-3.18	82.99
18	Aug. 1979	Jun. 1980	0.49	-1.30	11	-5.42	73.96
19	Jan. 2015	May 2016	0.47	-1.02	17	-7.92	53.01
20	Jan. 1931	Jan. 1932	0.49	-1.01	13	-6.39	50.83