

A 250 year drought catalogue for the Island of Ireland

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1. Introduction & Aims

Recent decades have witnessed severe drought events across Europe with serious impacts including reductions or loss of water supply, decreased agricultural production and power generation, environmental degradation and even loss of life (e.g. Hannaford et al., 2011). Appropriate drought planning, particularly in the context of future climate change begins with understanding the magnitude and socio-economic impacts of past events. In Ireland, few studies detailed have been conducted on historical droughts.

The aims of this work are twofold:

1. This research seeks to develop a detailed drought catalogue for the island of Ireland (Iol) to provide a fuller understanding of historical drought climatology.
2. Documentary sources, particularly newspaper archives are employed extensively to (a) support the quantitative findings and (b) explore the socio-economic impacts of notable droughts.

2. Data & Methods

DATA: OBSERVED AND RECONSTRUCTED

The Standardized Precipitation Index (SPI) (McKee et al., 1993) is applied to the recently established IIP network (Noone et al., 2015; Figure 1) to identify drought events across Iol for the period 1850–2015. To extend the analysis further, precipitation reconstructions (Casty et al. 2007) were extracted for the island for the period 1765–1849 are combined with an Iol composite (mean of the 25 IIP stations).

DROUGHT IDENTIFICATION

Drought start is defined as the month in which SPI-12 falls below -1.00, with the return to positive values indicating the month of drought termination (Lennard et al., 2016). Additional statistics were derived for each drought event, including: Duration, Accumulated deficit, Mean deficit and Maximum intensity for each event.

Figure 1: Names and locations of 25 stations comprising the IIP network (1850-2015)

DOCUMENTARY SOURCES

Documentary evidence in the form of newspaper archives is used to confirm the occurrence of drought events and to examine their socio-economic impacts. Of particular note are the *Belfast Newsletter* and the *Freeman's Journal* which began reporting in the early and mid-eighteenth century, respectively.

Acknowledgements

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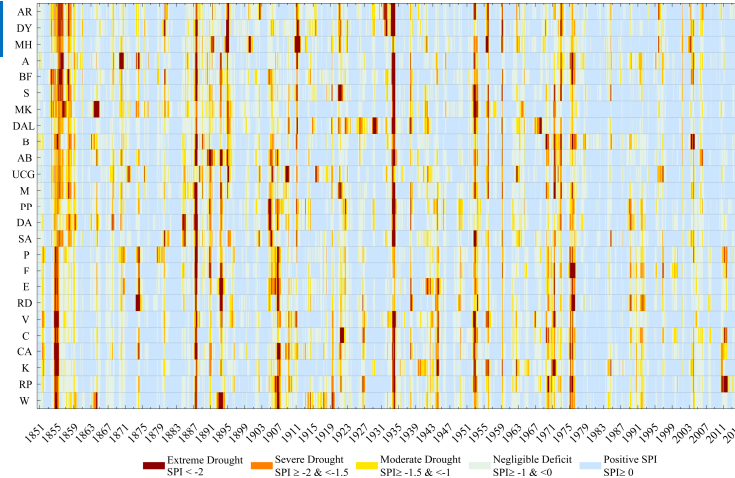


Figure 2: SPI-12 values for all 25 IIP networks stations (Figure 1). Negative SPI-12 values are colour coded according to severity threshold to highlight periods of moderate to extreme drought conditions.

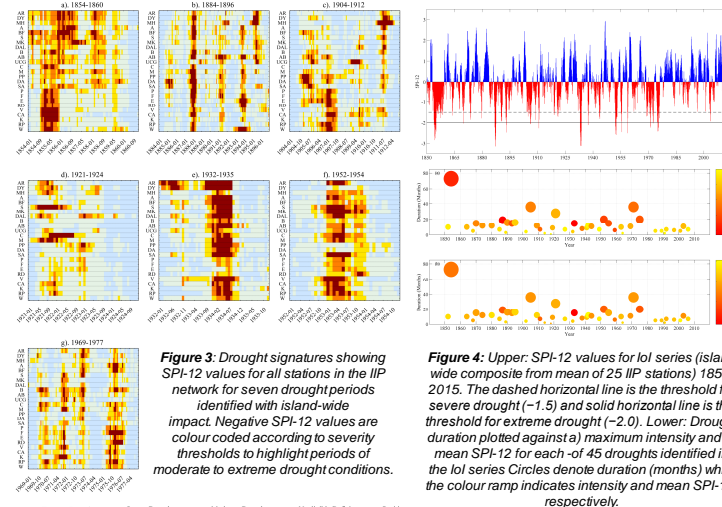


Figure 3: Drought signatures showing SPI-12 values for all stations in the IIP network for seven drought periods identified with island-wide impact. Negative SPI-12 values are colour coded according to severity thresholds to highlight periods of moderate to extreme drought conditions.

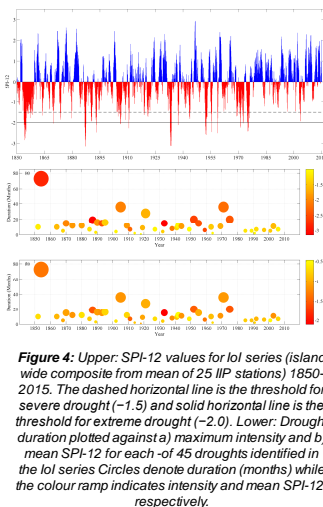


Figure 4: Upper: SPI-12 values for Iol series (island wide composite from mean of 25 IIP stations) 1850-2015. The dashed horizontal line is the threshold for severe drought (-1.5) and solid horizontal line is the threshold for extreme drought (-2.0). Lower: Drought duration plotted against a) maximum intensity and b) mean SPI-12 for each of 45 droughts identified in the Iol series. Circles denote duration (months) while the colour ramp indicates intensity and mean SPI-12, respectively.

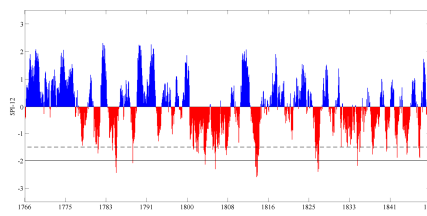


Figure 5: SPI-12 series for the island of Ireland reconstructed series 1765–1849 (Casty et al. 2007). The dashed horizontal line is the threshold for severe drought (-1.5) and solid horizontal line is the threshold for extreme drought (-2.0). Table 2: Details of drought events (1765–1849) from associated documentary evidence.

Year	Effective severity	Nature of socio-economic impacts	Source
1764-1766	23	Recent and future in England completely dried up. ...	Crozier et al. (2011), 15 June 2011
1766-1768	23	... ..	...
1768-1770	23	... ..	...
1770-1772	23	... ..	...
1772-1774	23	... ..	...
1774-1776	23	... ..	...
1776-1778	23	... ..	...
1778-1780	23	... ..	...
1780-1782	23	... ..	...
1782-1784	23	... ..	...
1784-1786	23	... ..	...
1786-1788	23	... ..	...
1788-1790	23	... ..	...
1790-1792	23	... ..	...
1792-1794	23	... ..	...
1794-1796	23	... ..	...
1796-1798	23	... ..	...
1798-1800	23	... ..	...
1800-1802	23	... ..	...
1802-1804	23	... ..	...
1804-1806	23	... ..	...
1806-1808	23	... ..	...
1808-1810	23	... ..	...
1810-1812	23	... ..	...
1812-1814	23	... ..	...
1814-1816	23	... ..	...
1816-1818	23	... ..	...
1818-1820	23	... ..	...
1820-1822	23	... ..	...
1822-1824	23	... ..	...
1824-1826	23	... ..	...
1826-1828	23	... ..	...
1828-1830	23	... ..	...
1830-1832	23	... ..	...
1832-1834	23	... ..	...
1834-1836	23	... ..	...
1836-1838	23	... ..	...
1838-1840	23	... ..	...
1840-1842	23	... ..	...
1842-1844	23	... ..	...
1844-1846	23	... ..	...
1846-1848	23	... ..	...
1848-1850	23	... ..	...

3. Key Results

Results show that Ireland is drought prone but recent decades are unrepresentative of the longer-term drought climatology. During the years 1850–2015 seven major drought rich periods were identified with an island-wide fingerprint in 1854–1860, 1884–1896, 1904–1912, 1921–1923, 1932–1935, 1952–1954 and 1969–1977. These events exhibit substantial diversity in terms of drought development, severity and spatial occurrence. Two exceptionally long events are found in the record: the continuous drought of 1854–1860 and the drought of 1800–1809 (in fact a series of three droughts with brief interludes).

Over the last 250 years, droughts have resulted in agricultural hardship, water resource crises and failures and preceded some of the major famines of the eighteenth and nineteenth centuries. Figure 6 shows a sample of three newspaper articles that signify the social/economic impact and cultural legacy of historic droughts.

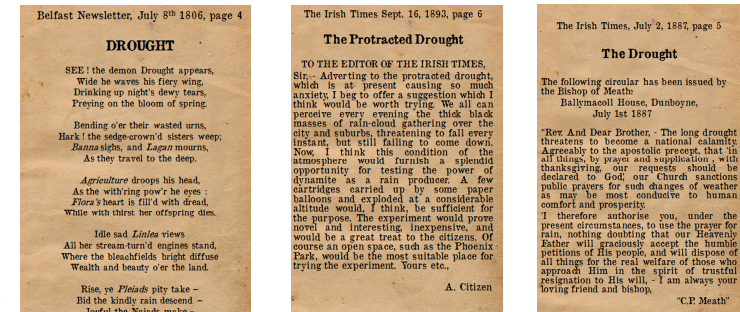


Figure 6: Evidence from newspaper archives of the social and cultural impact of historical droughts. Left: Poem entitled 'Drought' which appeared in the Belfast Newsletter at the end of a long drought in 1806. Middle: Weather modification suggestion during the 1893 drought which affected water supply in Dublin City. Right: Call to pray for rain during the intense island wide drought of 1887 (Murphy et al. 2017)

4. Conclusions

This research has developed a 250-year drought catalogue for Ireland. Employing the Standardized Precipitation Index (SPI) to identify droughts across 25 stations in the IIP network and an Iol series shows that the region is surprisingly drought prone. However, recent decades are not representative of the long-term drought climatology of Ireland. Newspaper archives can be used to trace the progression of drought events and impacts and we thus advocate their wider use in corroborating quantitative assessments. The resulting catalogue challenges prevailing perceptions about drought in Ireland while strengthening the evidence base for future drought and water resource planning across the island.

References

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