

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 (IoI) 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 socioeconomic 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 lol 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 Figure 1: Names and locations of 25 stations for each drought event, including: Duration, Accumulated deficit, Mean deficit and Maximum intensity for each event.

DOCUMENTARY SOURCES

comprising the IIP network (1850-2015

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.

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Severe Drought Moderate Drought Negligible Deficit Positive SPI Extreme Drought SPI < -2
SPI ≥ -2 & <-1.5 SPI> 15 & <-1 SPI> -1 & <0 SPI> 0

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 4: Upper: SPI-12 values for IoI 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 IoI series Circles denote duration (months) while

the colour ramp indicates intensity and mean SPI-12

respectively.





moderate to extreme drought conditions



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

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.

Belfast Newsletter, July 8th 1806, page 4	The Irish Times Sept. 16, 1893, page 6	The Irish Times, July 2, 1887, page 5
DROUGHT	The Protracted Drought	
Dittooni		The Drought
SEE ! the demon Drought appears,	TO THE EDITOR OF THE IRISH TIMES,	
Wide he waves his fiery wing.	Sir, Adverting to the protracted drought,	The following circular has been issued by
Drinking up night's dewy tears,	which is at present causing so much anxiety. I beg to offer a suggestion which I	the Bishop of Meath:
Preving on the bloom of spring.	think would be worth trying. We all can	Ballymacoll House, Dunboyne,
Aroying on the bloom of spring.	perceive every evening the thick black	July 1st 1887
Bending o'er their wasted urns,	masses of rain-cloud gathering over the	
Hark ! the sedge-crown'd sisters weep;	city and suburbs, threatening to fall every	"Rev. And Dear Brother, - The long drought
Banna sighs, and Lagan mourns,	instant, but still failing to come down.	threatens to become a national calamity. Agreeably to the apostolic precept, that 'in
As they travel to the deep,	Now, I think this condition of the atmosphere would furnish a splendid	all things, by prayer and supplication, with
	opportunity for testing the power of	thanksgiving, our requests should be
Agriculture droops his head,	dynamite as a rain producer, A few	declared to God, our Church sanctions
As the with'ring pow'r he eves :	cartridges carried up by some paper	public prayers for such changes of weather as may be most conducive to human
Flora's heart is fill'd with dread,	balloons and exploded at a considerable altitude would, I think, be sufficient for	comfort and prosperity.
While with thirst her offspring dies.	the purpose. The experiment would prove	T therefore authorise you, under the
	novel and interesting, inexpensive, and	present circumstances, to use the prayer for
Idle sad Linlea views	would be a great treat to the citizens. Of	rain, nothing doubting that our Heavenly
All her stream-turn'd engines stand,	course an open space, such as the Phoenix	Father will graciously accept the humble petitions of His people, and will dispose of
Where the bleachfields bright diffuse	Park, would be the most suitable place for	all things for the real welfare of those who
Wealth and beauty o'er the land.	trying the experiment. Tours etc.,	approach Him in the spirit of trustful resignation to His will, - I am always your
	A. Citizen	resignation to His will, - I am always your
Rise, ye Pleiads pity take -	A. Chizen	loving friend and bishop,
Bid the kindly rain descend -		"C.P. Meath"
Joyful the Naiads make -		
Drooping Nature's tribes befriend.		
Thou, Orion, too arise !	Figure 6: Evidence from newspaper archite	ves of the social and cultural impact of
Wide thy glittering faulchoin wield -	historical droughts. Left: Poem entitled 'D	rought' which appeared in the Belfast
Soon the tyrant of the skies		
To thy magic pow'r shall yield	Newsletter at the end of a long drought in	
to my magic pow r shan yield	suggestion during the 1893 drought which	n affected water supply in Dublin City.
Ine 28, 1806 HAFIZ	Right: Call to pray for rain during the intens	
	right out to play for faill during the intens	cisiana mac aroagintor 1007 (inurphy

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 IoI 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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