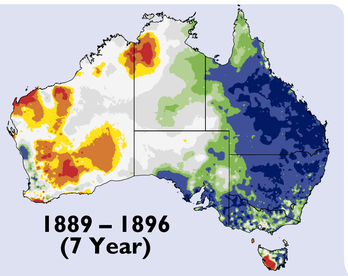
Queensland's extended wet and dry periods

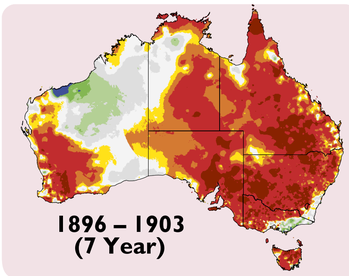
Australian Rainfall Periods (April to March) Relative to Historical Records 1889–2019



1889 – 1896 (7 Year)

Above-average seasons – rainfall was 41% above the long term average.*

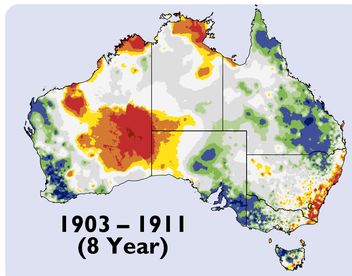
- Livestock increased with property expansion into the Queensland interior.
- Sheep numbers in Queensland exceeded 20M head.
- Widespread flooding in most of rural Queensland.
- Major Brisbane floods (1889, 1890 and 1893).
- Nation-wide depression with low wool and beef prices with stock unable to be sold.
- Rabbits, kangaroos, flystrike, cattle ticks and prickly pear followed settlers. Tick fever reduced cattle numbers by 50-90%. The " rabbit fence" was finished in 1891; free netting wire was offered to kangaroo infestation areas.
- Artesian bores sunk and bore drains developed from 1887.



1896 – 1903 (7 Year)

Rainfall for this dry period was 46% below the previous wet period.*

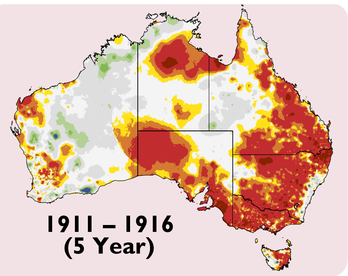
- Federation drought: heatwaves, bushfires and dust storms associated with >40% livestock losses in Queensland.
- Livestock numbers in Queensland reduced from 6.5M to 2.5M cattle and from 19M to 7M sheep.
- Western New South Wales impacted by soil erosion and woody weed infestation (1898/99).
- Properties in western New South Wales were abandoned with collapse in carrying capacity, resulting in the Royal Commission investigating financial stress in the Western Division.
- Sir Sidney Kidman acquired properties and nearly lost all by 1901 due to the severity and widespread nature of this drought.
- Tropical Cyclone Mahina struck Bathurst Bay (Cape York) on 4 March 1899. The surrounding region sufferred a massive storm surge from the category 5 system, killing over 400 people – the largest death toll of any natural disaster in Australian history. Reports recorded that grass was ripped from the ground on the islands offshore and that fish and dolphins were left in trees 15m above sea level.



1903 – 1911 (8 Year)

A period of recovery with average to above average rainfall; 46% above the previous dry period.*

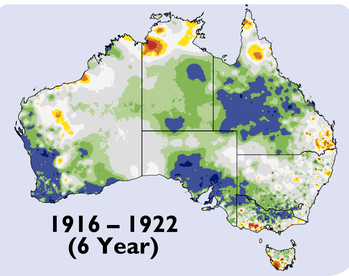
- Sheep numbers returned to 20M head following the Federation drought.
- Annual widespread flooding in most of rural Queensland.
- Prickly pear declared a noxious weed (1910); estimates of spreading was at 930 ha per day.
- Northern Queensland abattoirs purchased cattle stations to guarantee kill numbers and industry viability.



1911 – 1916 (5 Year)

Rainfall for this dry period was 27% below the previous wet period.*

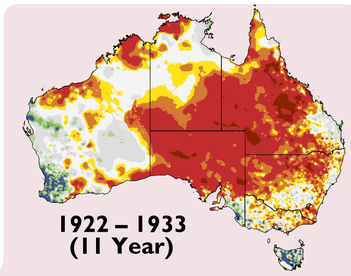
- Two periods of severe drought occurred (from 1911 & from 1914) with comparisons made with the severity of the Federation drought.
- Drought closed down pastoral stations, with heavy stock losses and interruptions to services.
- " In August (1915) not a blade of grass was to be seen between Rockhampton and Longreach."
- Crops on the Darling Downs failed and little sugar cane was harvested on the coast (e.g. 1916); wheat crop failed (e.g. 1911 & 1915).



1916 – 1922 (6 Year)

Rainfall 43% above the previous dry period.*

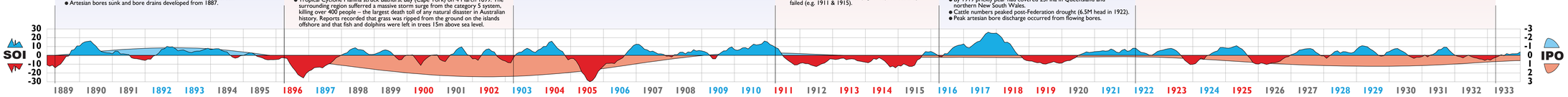
- Soldier settler blocks (>23,000; 9.3Mha) were provided Australia-wide post World War I – expectations of success were over-optimistic due to this wet period, along with world-wide food shortages and a wool boom. About a third of the settlers (nearly 12,000) had abandoned their farms within a few years due to many settlers' lack of farm management skills, inadequate advisory services, excessive prices for stock and equipment, the fall in commodity prices in 1920-24, poor quality of Crown lands, over-valuation of properties, inadequate farm sizes, heavy capital debt and interest burdens, and unsatisfactory commonwealth state relations.
- Wheat harvests were low in 1918 & 1919.
- By 1919 prickly pear had covered 25Mha in Queensland and northern New South Wales.
- Cattle numbers peaked post-Federation drought (6.5M head in 1922).
- Peak artesian bore discharge occurred from flowing bores.

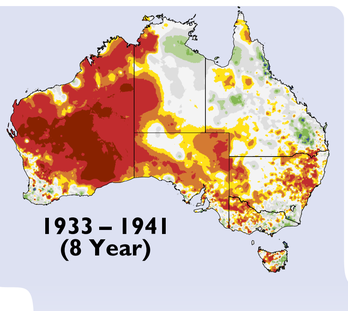


1922 – 1933 (11 Year)

Rainfall 26% below the previous wet period.*

- Severe drought resulted in large-scale wheat feeding of the state sheep flock, which reduced government revenue.
- World-wide depression occurred, with declining agricultural prices.
- *Cactoblastis cactorum* moth introduced in 1926 to combat prickly pear – eradicated by 1929.
- During 1930s cattle lost in drought equalled the number of cattle sold off properties.
- The first contour banks for erosion control were surveyed and constructed in the Darling Downs.
- South Australia had substantial loss of perennial vegetation and soil erosion (1925/6 – 1929/30), resulting in eventual government legislation (Soil Conservation Act 1939) for regulation of carrying capacity.

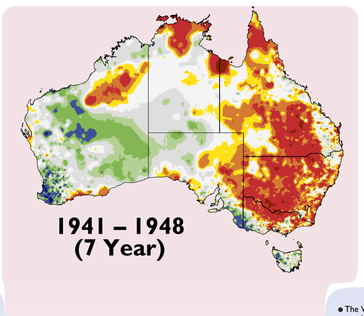




1933 – 1941 (8 Year)

Rainfall for this wet period was 13% above the previous dry period.*

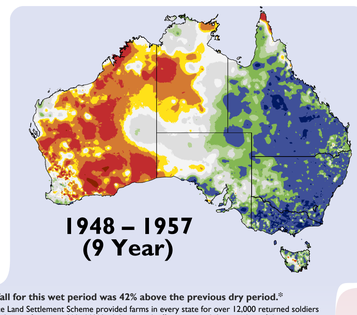
- Queensland cattle accounted for 45% of the national herd in 1930s/40s, but wool was the dominant industry.
- Rural production increased due to the outbreak of World War II.
- British government purchased the entire Australian wool clip. Wool prices increased, prices were fixed to control inflation.
- In the Gascoyne region of Western Australia there was severe drought (1935/36 – 1940/41). It resulted in a substantial loss of perennial shrubs, soil erosion and sheep and cattle losses which were documented in the West Australian Royal Commission into the Financial and Economic Position of the Pastoral Industry in the Leasehold Areas (1940).
- Landmark shipment of Brahman cattle (31 head) from USA to north Queensland took place (1933).



1941 – 1948 (7 Year)

Rainfall was 10% below the previous wet period.*

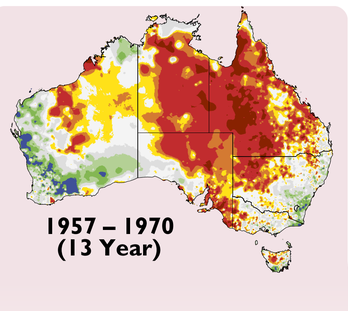
- Agricultural prices were fixed to control inflation during the war period.
- Pasture shortages resulted in reduced wool production with large stock losses; sheep numbers in Queensland fell from 24M head (1941) to 16M head in 1948.
- In western New South Wales, substantial dust storms and animal losses during 1941/42 – 1944/45 were graphically portrayed in Sir Russell Drysdale's paintings and Keith Newman's Sydney Morning Herald reports, supporting the need for government action.



1948 – 1957 (9 Year)

Rainfall for this wet period was 42% above the previous dry period.*

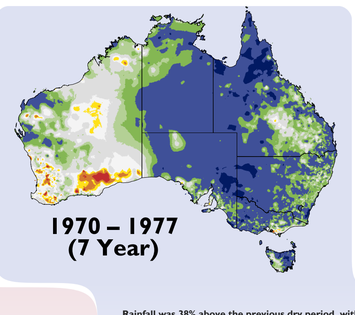
- The War Service Land Settlement Scheme provided farms in every state for over 12,000 returned soldiers – a significant reduction from post-World War I. In general, efforts to avoid the mistakes of the past were successful; comprehensive training, greater care in selection and subdivision of land, with much larger scale funding, ensured most soldier settlers remained on the land to achieve a reasonable standard of living.
- High export prices in the post-war years benefited many landholders. Sheep properties were in high production and good prices as a result of the " wool boom", where wool was selling "" a pound (weight) for a pound (pair)" in association with demand for uniforms (Korean war).
- Despite the overall favourable period, in 1951 there were 9 months of record low rainfall associated with substantial stock losses – captured as a series of photographs and paintings by the artist Sir Sidney Nolan who travelled throughout Queensland and the Northern Territory in 1952 under commission for the Brisbane Courier Mail.
- The " Dog/Dingo fence" was initiated to contain 55Mha of sheep country in South Australia, New South Wales and Queensland.
- Rabbits were estimated to have eaten the equivalent of 70M sheep. Rabbit numbers drop when Myxomatosis was released (1950) bringing large resource recovery.
- The Queensland-British Food Corporation - Peak Downs farming scheme (Central Highlands, Queensland) was initiated in 1948 encompassing 200,000 ha; although the scheme was dissolved in 1953, it demonstrated the farming potential of Central Highlands.
- Consecutive floods during this period occurred throughout Queensland, from the coast to western regions.



1957 – 1970 (13 Year)

This dry period had rainfall 29% below the previous wet period.*

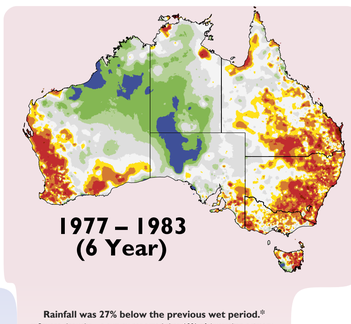
- The widespread drought of 1964-1966 severely affected New South Wales and Queensland.
- In south-west Queensland the drought contributed to the economic and resource degradation of the mulga lands reported in the Warrego Graziers Association submission (1988) that eventually led to the government-supported South-West Strategy (1994) involving property reconstruction and assessment of 'safe' livestock carrying capacity.
- Queensland wool production peaked (1963). Sheep properties diversified into beef and grain with commodity market shifts.
- Fitzroy Basin Development Scheme launched (1962) to clear 4.5Mha of brigalow country.
- Government established drought scheme for western Queensland (1964); Fairbairn dam (Emerald) development initiated.
- In Central Australia wind and water erosion resulted in extensive surveys and re-assessment of carrying capacity.



1970 – 1977 (7 Year)

Rainfall was 38% above the previous dry period, with major flooding of Brisbane.*

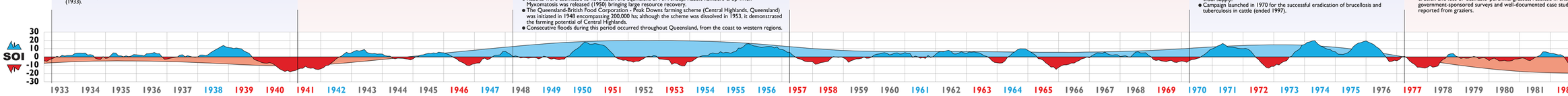
- OPEC oil crisis resulted in overseas market closures; collapse in beef market mid-1970s.
- Queensland cattle numbers increased from 6.8 to 11M head (in 1978 – a 60% increase).
- Japan closed beef imports from the USA in late 1973, subsequently the USA stopped beef imports from Australia, due to its own cattle oversupply. A backlog of cattle were held on Australian properties because there was no export slaughter market; the price of cattle was not sufficient to meet transport costs to sale. This situation continued until markets to the USA re-opened after 1978.
- Australian Wool Corporation set a reserve price for wool in 1970 to regulate the wool supply.
- Campaign launched in 1970 for the successful eradication of brucellosis and tuberculosis in cattle (ended 1997).

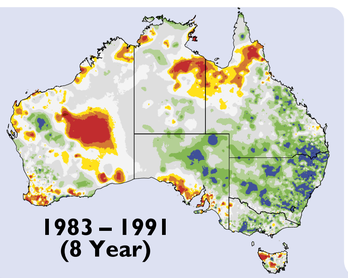


1977 – 1983 (6 Year)

Rainfall was 27% below the previous wet period.*

- Severe drought – a survey reported that 60% of Australian primary producers were affected – mostly in the eastern half of the continent.
- Economy of Australia suffered its worst recession since the Great Depression (1929 – 1939).
- Producers in financial difficulty pre-drought due to high interest rates and high debt within the wool industry.
- Mulga feeding and molasses/urea supplementary feeding allowed livestock to remain on-property to consume dry pastures and litter with resulting land degradation.
- The south-west Queensland pastoral region came under pressure with the retention of livestock; in north-east Queensland soil erosion and loss of 'desirable' perennial grasses, resulted in extensive government-sponsored surveys and well-documented case studies reported from graziers.

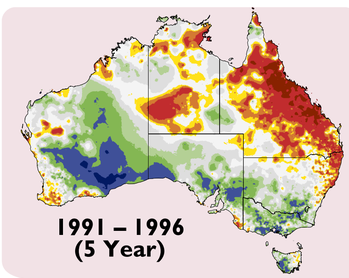




1983 – 1991 (8 Year)

Rainfall for this dry period was 29% below the previous wet period.*

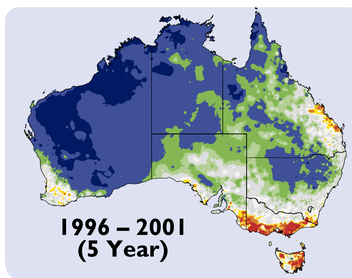
- The 1990s drought was characterised by back-to-back El Niño events over four years (1991, 1992, 1993, 1994). Thousands of stock died; a 70% reduction of livestock in the western Darling Downs and Maranoa were estimated, with reductions of 40% reported elsewhere – productive areas were also affected with reduced crop yields.
- The National Drought Policy (1992) was initiated, to encourage primary producers to adopt self-reliant approaches to managing for climate variability. For the first time, support payments for farm families, interest rate subsidies and tax incentives through the Farm Management Bond scheme were created.
- Southern Oscillation Index (SOI) extension communication was developed (1991). In January 1994, tropical cyclone Sarah delivered up to 500mm in 12-18 hours at some locations. Western Queensland had high flood inundation in the following February/March.
- In 1995 the rabbit calicivirus escaped quarantine and killed 10M rabbits within 8 weeks of its release.



1991 – 1996 (5 Year)

Average to good years; 21% above the previous dry period.*

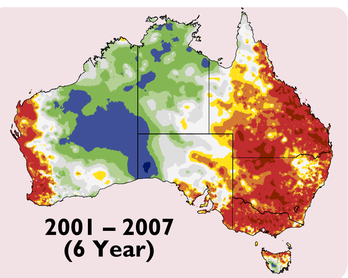
- In this wet period, winter rain occurred (notably 1983) along with a number of poor summer seasons (e.g. 1984/5 and 1987/88). Livestock numbers in some regions were retained beyond sustainable property carrying capacities, contributing to degradation of land condition. Assessments followed to define land capacity, sustainability and degradation levels for vegetation zones of northern Australia pasture lands (e.g. Tothill & Gillies 1992).
- Australian wool clip peaked and triggered the collapse of the reserve wool price scheme, which was dissolved in 1991 with 4.7M bales held in storage.
- Major flooding occurred in northern New South Wales and southern Queensland (e.g. Charleville, 1990). In February 1991 major flooding developed in the upper parts of the Burdekin River following rainfalls of 200mm, which peaked at Selheim (19.6m), the second highest flood on record.



1996 – 2001 (5 Year)

Recovery period with rainfall 49% above the previous dry period.*

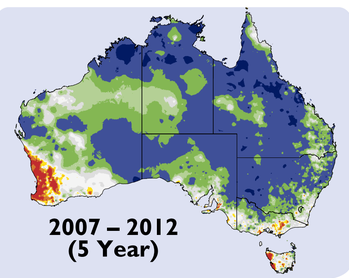
- Floods in many Queensland regions.
- Statewide assessment in November 2002 found that many regions had much better ground cover than expected.
- High macropod numbers (i.e. kangaroos) became a concern, along with domestic and feral livestock.
- Livestock statistics indicated that in June 2001 numbers were approximately equivalent to the high numbers that occurred in the late 1970s, increasing the potential risk of land degradation in drought and drier periods.



2001 – 2007 (6 Year)

Rainfall was 32% below the previous wet period.*

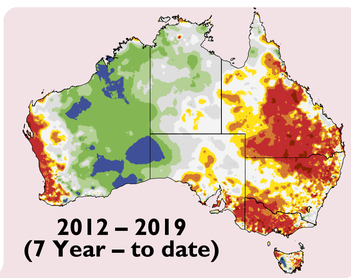
- The severity of rainfall deficit in the six-year Millennium drought in Queensland (2001 – 2006) was exacerbated by high temperatures and evaporative demand. This resulted in reduced pasture and resource condition in several regions.
- Simulated pasture growth (April 2001 – March 2007) averaged across Queensland was 29% below the long term mean.
- On a state-wide basis, retention of livestock numbers through the drought period (cattle 10.4 – 11.8M head; sheep 4M head on pasture) increased the risk of land and pasture degradation, however; high beef prices (2001) and reports on a regional basis indicated that livestock were reduced in order to decrease local grazing pressure.
- Tropical Cyclone Larry (March 2006) devastated the far north Queensland coast and adjacent tablelands.



2007 – 2012 (5 Year)

The rainfall was 72% above the previous dry period.*

- Queensland experienced above-average wet years, that were generally beneficial for plant growth, groundcover and land condition. Simulated pasture growth (April 2007 – March 2011), was 65% above the long term mean.
- Livestock carrying capacity improved and trends in landscape condition were positive for many Queensland regions that were previously assessed at lower levels. Recovery in many regions appeared to have occurred, however, areas very low in condition failed to respond fully.
- Extreme storm events and some flooding events seriously impacted soils, flora and fauna in localised areas, as well as the social and economic circumstances of landholders. Extended water inundation caused the death of pasture grass and the loss of seed reserves over large areas (e.g. northern Gulf); where only partial recovery of the resource was observed.
- Widespread grass fire hazards developed due to the general abundance of pasture growth in most regions in Queensland.



2012 – 2019 (7 Year – to date)

Rainfall was 37% below the previous wet period.*

- Early in the period there was a surface and stock water drought, followed by a deficiency in pasture biomass.
- The live export hiatus resulted in livestock retention, excess domestic supply with severe market price failure; market recovery in the latter part of this period.
- Widespread floods and damage were associated with Tropical Cyclones Oswald (2013), Marcia (2015) and Debbie (2017).
- Above-average winter rainfall and unseasonal pasture growth (2016) created respite for Queensland and most of northern Australia.
- Late season rainfall (March 2018) in the Gulf and far north Queensland regions produced a beneficial pasture response. Rainfall intensity and amounts were lower for western Queensland – minor floods occurred in channel country areas.
- Severe bushfires occured late in 2018 in coastal and hinterland areas of central and northern Queensland.
- Extreme rainfall early in 2019 from monsoonal depressions (and cyclone activity) severely impacted Gulf, central-west and other north Queensland regions; catastrophic mass deaths of domestic and native animals ensued from flooding and exposure (cold, wet, windy conditions). While destructive waters flowed across broad areas of drought-affected pastoral lands, fringe areas to the flooding and channel country catchments benefited with invaluable pasture responses.
- Summer rainfall remained low for large areas of Australia. Queensland's drought-declared area was still 65% in April 2019; while 100% of NSW regions were still experiencing drought conditions.

***Rainfall percentage (%) change from the previous period (wet or dry) are for Queensland's main pastoral and dryland cropping zone (south of 19° latitude and east of a line approximately from Cloncurry to Hungerford - MLR); it represents approximately 60% (100Mha) of the state, but carries 80% of the state's livestock.**

Years on the graphs are classified, according to colour, based on whether they are either 'El Niño' years (red text year title), 'La Niña' years (blue text) or 'ENSO Neutral' years (dark grey text).

El Niño

Originally referred specifically to a warming of the sea surface off the coast of Peru, now more generally refers to the warming of the central and eastern equatorial Pacific Ocean, strongly associated with persistently negative values of the Southern Oscillation Index (SOI). Generally associated with extended drier periods.

La Niña

Now used to refer to the opposite of El Niño, or events associated with persistently positive values of the SOI. Generally associated with extended wetter periods.

ENSO Neutral

ENSO refers to the El Niño–Southern Oscillation which fluctuates between El Niño or La Niña (above). 'ENSO Neutral' refers to neither El Niño or La Niña. Often the equatorial Pacific Ocean temperatures are near the long-term average. It is possible to have wet or dry periods associated with 'ENSO Neutral' years.

Graph

The graph shows fluctuations in the six-month moving average of the **Southern Oscillation Index (SOI)**. The SOI compares the difference in atmospheric pressure anomalies between Tahiti and Darwin. The graph also shows fluctuations in the **Inter-decadal Pacific Oscillation (IPO)**, a slower moving fluctuation in Pacific Ocean sea surface temperatures which influences climate variability. The IPO values on the graph are the filtered time series using 11-year Chebychev filter provided by Andrew Coleman, UK Met Office (updated to May 2019).

Rainfall classification

Maps for each period show rainfall ranked against historical records from 1889 to 2019. The ranking is expressed as a percentile. For example, a percentile rank of 0–1 indicates that rainfall over the indicated period ranks within the lowest one per cent of rainfall values recorded for that period length, at that location.

Percentile	
99–100	Highest on record
90–99	Extremely high rainfall
80–90	Well above average
70–80	Above average
50–70	Higher than average
30–50	Lower than average
20–30	Below average
10–20	Well below average
1–10	Extremely low rainfall
0–1	Lowest on record

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