Queensland's extended wet and dry periods Australian Rainfall Periods (April to March) Relative to Historical Records 1889-2023 1889 – 1896 (7 Year) 1916 – 1922 (6 Year) 1933 - 19411896 - 19031903 – 1911 1911 - 19161922 - 1933(7 Year) (8 Year) (5 Year) (II Year) (8 Year) Rainfall for this dry period was 46% below the 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 previous wet period.* • Federation drought: heatwaves, bushfires and dust storms associated with >40% livestock losses in Queensland. Rainfall for this wet period was 13% above the previous dry Above-average seasons - rainfall was 41% above the Rainfall for this dry period was 27% Livestock numbers in Queensland reduced from 6.5M to 2.5M cattle and from 19M to 7M sheep. long term average. below the previous wet period.* • Queensland cattle accounted for 45% of the national herd in 1930s/40s, but wool was A period of recovery with average to above average rainfall; Rainfall 26% below the previous wet period.* Livestock increased with property expansion into the Queensland interior. Sheep numbers in Queensland exceeded 20M head. the dominant industry. • Rural production increased due to the outbreak of World War II. • Two periods of severe drought occurred (from 46% above the previous dry period.* 1911 & from 1914) with comparisons made with the severity of the Federation drought. Drought closed down pastoral stations, with heavy • Severe drought resulted in large-scale wheat feeding of the state sheep flock, which reduced government revenue Western New South Wales impacted by soil erosion and woody weed few years due to many settlers' lack of farm management skills, 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. British government purchased the entire Australian wool clip. Wool prices increased, prices were fixed to control inflation. Widespread flooding in most of rural Queensland Major Brisbane floods (1889, 1890 and 1893). 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, Sheep numbers returned to 20M head following the Federation drought. Properties in western New South Wales were abandoned with collapse in carrying capacity, resulting in the Royal Commission investigating financial Annual widespread flooding in most of rural Queensland. Prickly pear declared a noxious weed (1910); estimates of spreading was at 930 ha per • In the Gascoyne region of Western Australia there was severe drought (1935/36 – Nation-wide depression with low wool and beef prices with stock unable stock losses and interruptions to services. 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. 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 "In August (1915) not a blade of grass was to be inadequate farm sizes, heavy capital debt and interest burdens 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). Rabbits, kangaroos, flystrike, cattle ticks and prickly pear followed settlers. Tick fever reduced cattle numbers by 50-90%. The "rabbit fence" was 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 4th March • Northern Queensland abattoirs purchased cattle stations to guarantee kill numbers and and unsatisfactory common Wheat harvests were low in 1918 & 1919. By 1919 prickly pear had covered 25Mha in Queensland and northern New South Wales. finished in 1891; free netting wire was offered to kangaroo infestation area • Landmark shipment of Brahman cattle (31 head) from USA to north Queensland took 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 Artesian bores sunk and bore drains developed from 1887. • Cattle numbers peaked post-Federation drought (6.5M head in • Peak artesian bore discharge occurred from flowing bores. ripped from the ground on the islands offshore and that fish and dolphins 1891 1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1941 - 1948 1948 - 19571957 - 19701970 - 19771977 - 19831983 - 19911991 - 1996(7 Year) (9 Year) (7 Year) (6 Year) (13 Year) (8 Year) (5 Year) Rainfall was 29% below the Rainfall for this wet period was 42% above the previous dry period.* previous wet period.* • The War Service Land Settlement Scheme provided farms in every state for over 12,000 returned • The 1990s drought was characterised by back-to-back El Niño events over four years (1991, ldiers – a significant reduction from post-World War I. In general, efforts to avoid the mistakes Rainfall was 27% below the previous wet Rainfall was 38% above the previous dry period, with major flooding of Brisbane.* 1992, 1993, 1994). Thousands of stock died; a 70% reduction of livestock in the western Darling 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 Average to good years; 21% above the previous dry period.* ● Severe drought – a survey reported that 60% of Australian • OPEC oil crisis resulted in overseas market closures; collapse in beet Downs and Maranoa were estimated, with • High export prices in the post-war years benefited many landholders. Sheep properties were in primary producers were affected – mostly in the eastern half of This dry period had rainfall 29% below the previous wet period.* Rainfall was 10% below the previous wet period. reductions of 40% reported elsewhere high production and good prices as a result of the "wool boom", where wool was selling " a pound summer seasons (e.g. 1984/5 and 1987/88). Livestock numbers in some Queensland cattle numbers increased from 6.8 to 11M head (in 1978 – a productive areas were also affected with reduced Agricultural prices were fixed to control inflation during the war period. Pasture shortages resulted in reduced wool production with large stock 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 retained beyond sustainable property carrying capacities, contributing to degradation of land condition. Assessments followed to define land capacity, sustainability and • Economy of Australia suffered its worst recession since the weight) for a pound (paid)" in association with demand for uniforms (Korean war). 60% increase). Great Depression (1929 – 1939). 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 Japan closed beef imports from the USA in late 1973, subsequently the • The National Drought Policy (1992) was initiated, losses; sheep numbers in Queensland fell from 24M head (1941) to 16M Graziers Association submission (1988) that eventually led to the government-supported South-West Strategy (1994) involving property • Producers in financial difficulty pre-drought due to high interest egradation levels for vegetation zones of northern Australia pasture lands (e.g. Tothill USA stopped beef imports from Australia, due to its own cattle to encourage primary producers to adopt self-reliant approaches to managing for climate reconstruction and assessment of 'safe' livestock carrying capacity. • Queensland wool production peaked (1963). Sheep properties diversified into beef and grain with commodity market shifts. rates and high debt within the wool industry. artist Sir Sidney Nolan who travelled throughout Queensland and the Northern Territory in 1952 oversupply. A backlog of cattle were held on Australian properties because 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. • In western New South Wales, substantial dust storms and animal losses under commission for the Brisbane Courier Mail. • The "Dog/Dingo fence" was initiated to contain 55Mha of sheep country in South Australia, New Mulga feeding and molasses/urea supplementary feeding there was no export slaughter market; the price of cattle was not sufficient variability. For the first time, support payments for during 1941/42 – 1944/45 were graphically portrayed in Sir Russell Drysdale's paintings and Keith Newman's Sydney Morning Herald reports, 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. allowed livestock to remain on-property to consume dry to meet transport costs to sale. This situation continued until markets to farm families, interest rate subsidies and tax 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 pastures and litter with resulting land degradation. the USA re-opened after 1978. incentives through the Farm Management Bond The south-west Queensland pastoral region came under pressure with the retention of livestock; in north-east supporting the need for government action. 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, scheme were created. • Southern Oscillation Index (SOI) extension • Australian Wool Corporation set a reserve price for wool in 1970 to Burdekin River following rainfalls of 200mm, which peaked at Selheim (19.6m), the regulate the wool supply. • Campaign launched in 1970 for the successful eradication of brucellosis and second highest flood on record. Queensland soil erosion and loss of 'desirable' perennial communication was developed (1991). In January grasses, resulted in extensive government-sponsored surveys and well-documented case studies reported from graziers. Queensland) was initiated in 1948 encompassing 200,000 ha; although the scheme was dissolved in 1953, it demonstrated the farming potential of Central Highlands. 1994, tropical cyclone Sarah delivered up to 500mm in 12-18 hours at some locations. Western culosis in cattle (ended 1997). • Consecutive floods during this period occurred throughout Queensland, from the coast to 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. 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 Wet period start or continuation of Dry period? • At this stage, it is too early to tell. At present there is no forecast capability for multi-year rainfall variability. This poster present there is no forecast capability for multi-year rainfall variability. This poster presents historical Wet and Dry periods only, as described in McKeon et al. (2021) Queensland's multi-year Wet and Dry periods: implications for grazing enterprises and pasture resources in The Rangeland Journal 43(3) 121-142. ● The recent 24-month (April 2021 – March 2023) rainfall map (left) shows a wetter to • There has been a 48% increase in annual rainfall for the recent 24-month period (704mm) averaged across Queensland's major livestock region (see bottom LHS of poster), compared to the average of the previous 9-year Dry period (475mm). • The current drier forecast from June 2023 (BoM) is being influenced by several factors including an ENSO-neutral pattern (neither El Niño nor La Niña) tending towards El Niño in the latter part of the 2023, and the chance that a positive IOD event 1996 – 2001 (5 Year) 2001 - 20072007 - 20122021 - 20232012 - 2021(2 Year - uncertain) (6 Year) (5 Year) (9 Year) Rainfall was 48% above the previous Dry period.* The rainfall was 72% above the • For the previous 12-month period (April 2021 – March 2022), rainfall across Queensland was mostly well-received by most grazing enterprises, however, a large area stretching from the Lower Carpentaria district across to the eastern Central Coast district did not previous dry period.* Rainfall was 38% below the previous wet period.* Major Livestock Region Queensland experienced above-average wet years, • Surface and stock water drought (2012/13) was followed by low pasture biomass supply. that were generally beneficial for plant growth, groundcover and land condition. Simulated pasture Rainfall was 32% below the previous wet • In early 2022, exceptional rainfall caused flooding throughout the southeast of the state with much damage and disruption to families, • The live export hiatus resulted in livestock retention, excess domestic supply and market price households, properties, animals and natural resources. Recovery period with rainfall 49% failure; with some later market recovery. Most of the state's river systems had moderate to major flooding, with Channel Country waterways in the far west fed from both local rain and upstream contributions. There were three cyclone crossings into Queensland – Cyclone Seth (twice) and Tiffany (once). For the recent 12-month period (April 2022 – March 2023), there has been a much more even distribution of beneficial rainfall – growth (April 2007 – March 2011), was 65% above Widespread floods and damage were associated with Tropical Cyclones: Oswald (2013); Marcia 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 • The severity of rainfall deficit in the six-year Millennium above the previous dry period.* he long term mean. drought in Queensland (2001 – 2006) was exacerbated by high * Rainfall percentage (%) change from the previous period (wet or dry) are for Queensland's main pastoral and Floods in many Queensland regions.Statewide assessment in November 2002 found • Livestock carrying capacity improved and trends in landscape condition were positive for many shows fluctuations in the Inter-decadal Pacific Oscillation (IPO), a slower moving fluctuation in Pacific Above-average winter rainfall and unseasonal pasture growth (2016) created stock respite Late season rainfall (March 2018) in north Queensland yielded useful a pasture response. temperatures and evaporative demand. This resulted in relative to historical records. However, a drying pattern has formed for the last six months for the south-east of the state extending 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 2020). reduced pasture and resource condition in several regions that many regions had much better ground cover Queensland regions that were previously assessed to the Western Downs and Maranoa; and as far west as the south-west Queensland border for the recent three months (January dryland cropping zone (south of 19° latitude and east of a • Simulated pasture growth (April 2001 – March 2007) averaged • Bushfires (late 2018) affected coastal and hinterland areas (central, northern Queensland). at lower levels. Recovery in many regions appeared to have occurred, however, areas very low in line approximately from Cloncurry to Hungerford - Extreme rainfall (early 2019) impacted Gulf, central-west and other north Queensland regions; mass deaths (domestic, native animals) ensued from flooding and exposure. Areas adjacent to across Queensland was 29% below the long term mean. High macropod numbers (i.e. kangaroos) became a concern, along with domestic and feral livestock. • While there was significant cyclone and Tropical low activity across northern Australia, no 'official' cyclones crossed into Queensland for the latter 12-month period. However, on March 7th 2023, the slow moving Tropical low 16U brought heavy rainfall and flooding rains to the lower Gulf of Carpentaria region until March 10th. This deluge exacerbated the recent widespread rain delivered by MLR); it represents approximately 60% (100Mha) of the On a state-wide basis, retention of livestock numbers through the drought period (cattle 10.4 – 11.8M head; sheep 4M head Maps for each period show rainfall ranked against historical records from 1889 to 2023. The ranking is expressed as a percentile. For example, a percentile rank of 0–1 indicates that rainfall over the indicated period condition failed to respond fully. state, but carries 80% of the state's livestock. flooding and channel country benefited with invaluable pasture respo Livestock statistics indicated that in June 2001 • Extreme storm events and some flooding events on pasture) increased the risk of land and pasture degradation, • Summer rainfall was low for large areas of Australia in 2018/19 and 2019/20; extreme weather ex-Tropical Cyclone Ellie which had already saturated the Gulf's Nicholson, Gregory, Leichhardt and Flinders catchments. Evacuations and significant inundation of many rural properties and towns occurred. These flood waters caused extended isolation for a number of communities in northwest and western Queensland (Burketown, Urandangi and Camooweal) in the weeks following the rain event. seriously impacted soils, flora and fauna in localised ranks within the lowest one per cent of rainfall values recorded for that period length, at that location. numbers were approximately equivalent to the (heat, low humidity, wind) caused calamitous fire-sustaining conditions in coastal and inner-regional however; high beef prices (2001) and reports on a regional high numbers that occurred in the late 1970s, areas, as well as the social and economic basis indicated that livestock were reduced in order to areas in 2019/20; tragic losses ensued (human, native and domestic animals), with bushland, rural Highest on record increasing the potential risk of land degradation in circumstances of landholders. Extended water and urban property devastation. A short (late) wet period initiated pasture response in most decrease local grazing pressure. Major losses of livestock and the destruction of properties and roads were reported across the region. There is currently 28.7% of the state (1* March 2023) drought declared. Maps and Reports showing drought duration periods are available at www.longpaddock.qld.gov.au/drought/drought-declarations/. nundation caused the death of pasture grass and Extremely high rainfall drought and drier periods. regions (Jan-March 2020), particularly in the south-west channel country region. • Tropical Cyclone Larry (March 2006) devastated the far north Years on the graphs are classified, according to colour, based on whether they are the loss of seed reserves over large areas (e.g. northern Gulf); where only partial recovery of the Well above average Queensland's drought-declared area was still 67.4% as at February 2021. either 'El Niño' years (red text year title), 'La Niña' years (blue text) or 'ENSO Neutral' available at www.longpaddock.qld.gov.au/drought/drought-declarations/. • Rainfall and pasture growth sequences (multiple months) can be viewed by accessing the 'Drought Sequence Viewer' at • The 2020/21 La Niña resulted in below-average to average rainfall for much of Queensland years (dark grey text). Above average resource was observed. continuing Dry period status. Widespread grass fire hazards developed due to the general abundance of pasture growth in most k.qld.gov.au/drought/sequence/, or 'AussieGRASS' www.longpaddock.qld.go Higher than average 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 **Below** average Well below average Index (SOI). Generally associated with extended drier periods. Extremely low rainfall Now used to refer to the opposite of El Niño, or events associated with persistently Lowest on record Produced by **ENSO Neutral** ENSO refers to the El Niño-Southern Oscillation which fluctuates between El Niño or GPO Box 2454, Brisbane, Queensland 4001. La Niña (above). 'ENSO Neutral' refers to neither El Niño or La Niña. Often the

1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

equatorial Pacific Ocean temperatures are near the long-term average. It is possible to

have wet or dry periods associated with 'ENSO Neutral' years.

web: www.LongPaddock.qld.gov.au