MA99 EDUCATION

Global Sustainability: Summary 01

NSW GEOGRAPHY 11-12 SYLLABUS 2022 FOR HSC 2027 AND LATER

1. Key ideas

- **Sustainable development** means meeting present needs "without compromising the ability of future generations" to meet their own (Brundtland, 1987). Four pillars: social, economic, environmental, cultural.
- **ESD in NSW law** "requires the effective integration of economic and environmental considerations in decision-making processes" (Protection of the Environment Administration Act 1991 (NSW) s 6(2)). Principles: precautionary; inter-generational equity; conservation of biodiversity and ecological integrity; improved valuation, pricing and incentive mechanisms. The EPBC Act (s 3A) adds social and equitable considerations.
- **Agreements set targets but rarely enforce them.** Paris has 194 Parties, yet current policies point to about 2.8°C (UNEP, 2025).
- **Progress is uneven.** 36 per cent of 139 SDG targets are on track or moving moderately; 15 per cent have gone backwards (UN, 2026).
- **Action happens at every level** and the levels interact: Mars and Nestlé fund Fonterra's farm Emissions Incentive.
- **Indigenous knowledge and benefit sharing** are both a right and a practical tool: Nagoya (2010), the San and Hoodia (2003), 87 IPAs, 320 ranger groups.
- **The dairy industry** is large, mostly local and growing: 1,005 Mt in 2025, less than 7 per cent traded, India the largest producer.
- **Dairy is improving per litre and worsening in total.** Intensity fell almost 11 per cent from 2005 to 2015; total dairy cattle emissions rose 18 per cent.
- **Feed additives work where cattle are housed** and struggle where they graze. That is the centre of the critical analysis.

> If you remember one pair of numbers, make it 11 per cent down and 18 per cent up.

2. Numbers to know

FIGURE	VALUE	SOURCE
Agenda 2030	193 states, 17 SDGs, 169 targets, 25 September 2015	UN
Paris Agreement	194 Parties; "well below 2°C", pursue 1.5°C	UN, 2015
Warming on current policies	About 2.8°C; 1.5°C needs a 55% cut by 2035 on 2019	UNEP, November 2025
SDG targets, 2026	36% on track or moderate, 49% too slow, 15% regressed	UN DESA, 7 July 2026
SDG Index, Australia	29th of 169, score 79.02 (Finland 87.40)	SDSN, June 2026
Earth Overshoot Day	30 July 2026, 1.73 Earths; Australia 16 March	Global Footprint Network
HDI, Australia	7th, 0.958	UNDP HDR 2025
Nagoya Protocol	In force 12 October 2014, 143 Parties; Australia not a Party	CBD
Indigenous Protected Areas	87; 90 million ha land, 6 million ha sea	NIAA, 2026
Indigenous rangers	320 groups; more than 3,800 jobs by 2030	NIAA, 2026
Australian targets	43% below 2005 by 2030; 62 to 70% by 2035; net zero 2050	Climate Change Act 2022; 2025 NDC



Figure 1 · Share of SDG targets by progress, 2026 report, 139 targets with trend data. Source: UN DESA, The Sustainable Development Goals Report 2026, 7 July 2026.

DAIRY FIGURE	VALUE	SOURCE
World milk	1,005 Mt in 2025, up 2.1%; 1,223 Mt projected by 2035	OECD FAO, 2026
By species	81% cow, 16% buffalo, 3% other	OECD FAO, 2026
India	247.87 Mt (2024 to 25); over 80 million farmers	PIB, 2025
Cow milk leaders	EU 148.5 Mt, US 105.1, India 103.2 (cow only)	USDA FAS, 2025
Trade	Less than 7% traded; EU, NZ, US projected nearly 70% of exports	OECD FAO, 2026
New Zealand	2% of world milk; about 56% of WMP exports by 2035	OECD FAO, 2026
Yield per cow, 2015	North America 9,867 kg; Sub-Saharan Africa 457 kg	FAO and Global Dairy Platform
Dairy cattle emissions	1,711.8 Mt CO_2-eq (2015), up 18% on 2005	FAO and Global Dairy Platform
Intensity gap	1.3 to 1.4 kg CO_2-eq per kg FPCM, against 4.1 to 6.7	FAO and Global Dairy Platform
Australian farms	21,989 (1979 to 80) to 3,772 (2024 to 25), down about 83%	Dairy Australia
Australian output	8,315 ML; A$5.966 billion farmgate; Victoria 63.3%	Dairy Australia, 2024 to 25
Australian exports	54% of output (2000) to 36% (2025)	Dairy Australia
NZ rivers	About 45% of length unsuitable for swimming	MfE, 2023



Figure 2 · Global dairy cattle emissions by source, 2015. “Other” is the remainder of the three named shares. Source: FAO and Global Dairy Platform, 2019.

3. Strategies at a range of scales

STRATEGY	SCALE	EVIDENCE	LIMIT
Dairy Sustainability Framework (2013)	Global industry	11 criteria; members make 29% of cow and buffalo milk	Voluntary
Pathways to Dairy Net Zero (2021)	Global industry	40 organisations; about 30% of world milk	Efficiency based
ADSF Goal 11	National industry	30% intensity cut by 2030 on 2015	On-farm index 0.96 against 0.72
Arla FarmAhead	Corporate	30.3% absolute Scope 3 FLAG cut by 2030; up to EUR 550 million a year	Cost sits in the milk price
Fonterra	Corporate	30% per tonne FPCM by FY2030; customer funded incentive	Intensity, not absolute
New Zealand	National	Agriculture out of ETS (June 2024); target cut to 14 to 24% (October 2025)	Pricing ruled out

STRATEGY	SCALE	EVIDENCE	LIMIT
Denmark	National	Livestock tax from 2030, DKK 300 to 750 per t	Not yet in force
Feed additives	Farm	3-NOP cuts methane about 32.7%	Grazing, fading, trust

4. The critical analysis in one table

QUESTION	METHANE REDUCING FEED ADDITIVES
What is it?	3-NOP (Bovaer) and Asparagopsis (bromoform) block methane formation in the rumen. Enteric methane is 58.5% of dairy cattle emissions.
Does it work?	3-NOP: methane down 32.7% (meta-analysis, 2023). Asparagopsis: 9 to 98% in a feedlot (2020), 39 to 44% in Victorian dairy cows (2023).
Where does it fail?	Grazing: 3-NOP must be in the rumen at all times; unsuitable for NZ pasture herds (Fonterra). Fading: a 30% cut gone by weeks 9 to 12 (2025).
What are the risks?	Milk bromine 5 times and iodine 9 times higher in one trial; FAO safety concerns. Denmark: 434 of 644 herds reported lower yield.
Who benefits?	dsm-firmenich, processors with Scope 3 targets, retailers, future generations.
Who pays?	Farmers (breakeven US$0.10 to 0.14 per head per day), Danish farmers under a mandate, grazing farmers left out.
Social licence?	Arla UK trial, November 2024: boycott calls from thousands of people online. The additive is metabolised by the cow and does not pass into milk (The Grocer).
Judgement	An effective technology and a limited strategy: worth using in housed herds, especially when paid for, but not a global solution. If 3-NOP cut enteric methane 30% in every herd, total dairy cattle emissions would fall only about 17.6% (0.585 multiplied by 0.30).

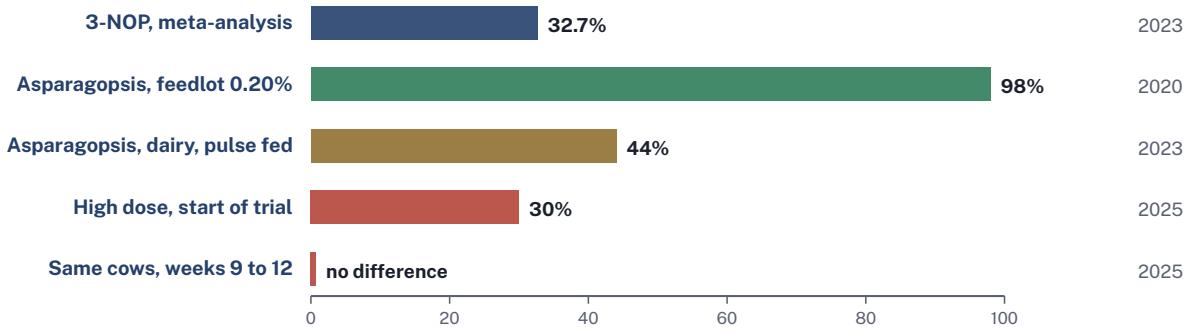


Figure 3 · Methane cuts reported for the two additives. The last two bars are the same 30 cows at the start and end of a 12 week trial. Source: FAO (2023); MLA (2020); Alvarez-Hess et al. (2023); Angellotti et al. (2025).

5. Key terms

TERM	MEANING
Benefit sharing	Fair return to the holders of genetic resources or traditional knowledge when others profit from them.
Biocapacity	The capacity of ecosystems to supply resources and absorb waste, in global hectares.
Emissions intensity	Emissions per unit of output, such as kg CO_2-eq per kg FPCM.
Enteric fermentation	Microbial digestion in the rumen that releases methane.
FPCM	Fat and protein corrected milk, a standard unit that lets different milks be compared.
Absolute and relative decoupling	Output rising while total emissions fall (absolute), or only emissions per unit falling (relative).
NDC	Nationally Determined Contribution: a country's own Paris target, renewed every five years.

TERM	MEANING
Scope 3 FLAG	A company's supply chain emissions from forest, land and agriculture, which for a dairy processor means its farmers.
Social licence	Public acceptance an activity needs in order to continue.
Methanogens	Microbes in the rumen that make methane from hydrogen and carbon dioxide.

6. If the question says … use …

IF THE QUESTION SAYS	USE
"principles of ESD"	The four NSW s 6(2) principles, each applied to dairy (a Danish tax is polluter pays).
"global forums and agreements"	Paris and the UNEP gap; the ICJ opinion (unanimous, not binding); BBNJ in force January 2026.
"levels of action"	UN to individual, with the Mars and Nestlé to Fonterra to farm chain.
"Indigenous Peoples' practices"	Nagoya, the San and Hoodia, IPAs and rangers.
"criteria" or "evaluate"	Name the criterion first: absolute emissions, intensity, farm numbers, livelihoods.
"spatial patterns"	Producers against exporters; India against New Zealand; yields 9,867 against 457 kg.
"influences"	Perishability and a thin traded share; drought and water; deregulation; plant-based demand.
"a range of strategies"	DSF, ADSF, Arla, Fonterra, New Zealand, Denmark: one line and one limit each.
"critically analyse ONE strategy"	Section 4 of this summary, in order, ending on the judgement.
"future directions"	1,223 Mt by 2035; more than half of growth from India; intensity in South Asia decides emissions.

About this resource

MA99 EDUCATION

Scope

NSW Geography, Year 12. Written to the NSW Geography 11-12 Syllabus 2022, Global Sustainability, for students sitting the HSC in 2027 and later years. Every worked context uses real, sourced case studies: the global dairy industry, with each figure dated and its source named where it is used, and every number was recomputed from its inputs before printing.

Permitted use

Print it, annotate it and keep it on any device you own, for your own study.

Not permitted

Sharing, posting, selling or redistributing it, in whole or in part. Each copy is licensed to one student.

Copyright MA99 Education.
ma99education.com.au