Ecological Footprint:

Steps Towards Sustainability

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Sustainability, Human Welfare, and Ecosystem Heal
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School of Public Policy
Georgia Institute of Technol
Atlanta, GA 33032,
Annu. Rev. Ecol. Syst. 1995. 26:1–24
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THE CONCEPT OF ENVIRONMENTAL SUSTAINABILITY[1]
Robert Goodland
S-5043, Environment Depart
orld Bank, Washington, DC 20433
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Commentary
Defining and predicting sustainab
Robert Costanza
Abstract
11
ustainability:
An Economist's Perspecti
ROBERT M. SOLOW
Robert M. Solow is Institute Professor of Economics
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Living Sustainability …

- *If everyone lived the way Australians do, we would require 4.5 planets to support the world's population*
- *To understand sustainability, we need to understand our impact on the natural world*

Global Sustainability Overview

- Sustainability means meeting today's needs without compromising future generations, by balancing environmental, social, and economic wellbeing.
- The ecological footprint measures how much nature we use compared to how much Earth can regenerate.
- Humanity is currently consuming resources at a rate equivalent to 1.7 Earths, placing us in ecological overshoot.
- The global average ecological footprint is 2.7 global hectares (gha) per person, exceeding Earth's biocapacity.
- In 2024, Earth Overshoot Day fell on 1 August, indicating how early we exhaust the planet's annual ecological budget.

Australia has one of the world's largest Ecological Footprints at 7.3 global hectares (gha) per person

Location	Population (millions)	Ecological Footprint (gHa/person)
Australia	26.6	7.3
Queensland	5.5	7.9
Victoria	6.8	6.9
South Australia	1.8	6.6
New South Wales	8.3	7.0
Western Australia	2.9	8.5

Global average Ecological Footprint is currently estimated at 2.7 gha per person

Why do ecological footprints vary by state?

- Industry structure: Mining and energy-intensive industries increase per-capita footprint (e.g. WA, QLD)
- Population density: More people sharing infrastructure lowers per-person impact (e.g. VIC, NSW)
- Transport & energy use: Car dependence, long distances and climate affect energy demand

Australia’s Ecological Footprint

Key factors driving Australia’s high footprint include:

- Heavy reliance on fossil-fuel energy
- Long travel distances and car-dependent cities
- High meat and dairy consumption
- Large, energy-intensive homes and widespread air-conditioning
- High levels of material use, waste generation, and consumer goods turnover

Environmental Pressures Overview

- Land clearing and habitat fragmentation
- Increasing water stress and altered river systems
- Soil degradation, salinity, and declining soil health
- Growing waste volumes and rising pollution levels
- Accelerating loss of biodiversity and native species
- Rapid urbanisation and expanding urban footprints

Land Cover Change…

- *Some 70% of Australia's native vegetation has been cleared or modified over last 200 years*
- *An estimated 7.7m ha of native forest cover was lost between 2000 and 2017, making Australia a global deforestation hotspot*
- *Effects include land degradation, greenhouse gas emissions, biodiversity loss*

Land Cover Change (2025)

- Land clearing and fragmentation still increasing in 2025
- Native vegetation loss weakening ecosystem resilience
- Wildlife corridors becoming highly disrupted and isolated
- Land-use expansion driving long-term ecological decline
- Restoration efforts critical for climate and biodiversity goals

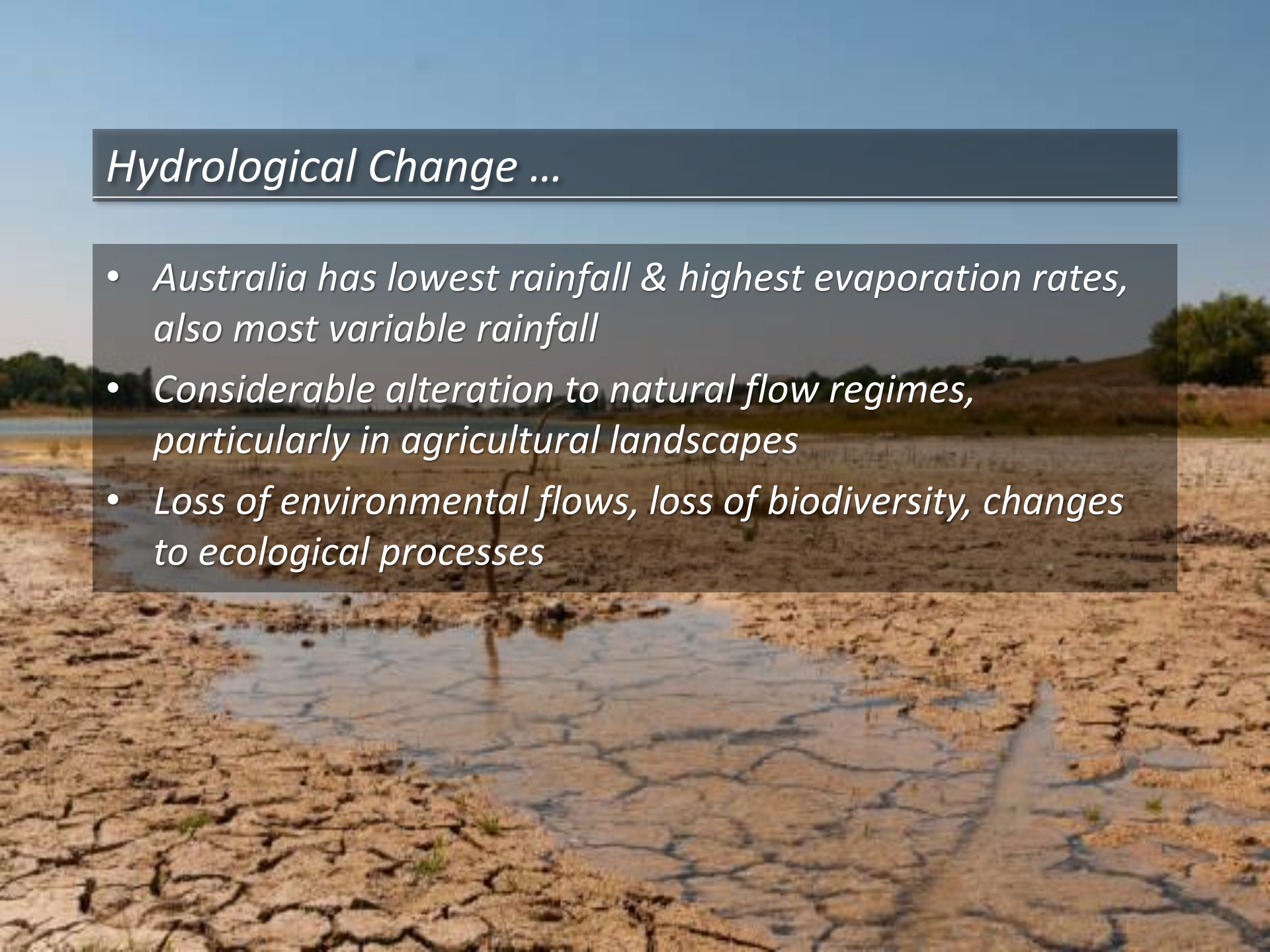
Land Degradation …

- *Salinity affects 2.5 million ha of agricultural land (5.7 million ha at risk in MDB alone)*
- *Soil acidity affects 50 million ha*

⇨ *That's half of Australia's agriculturally productive soils!*

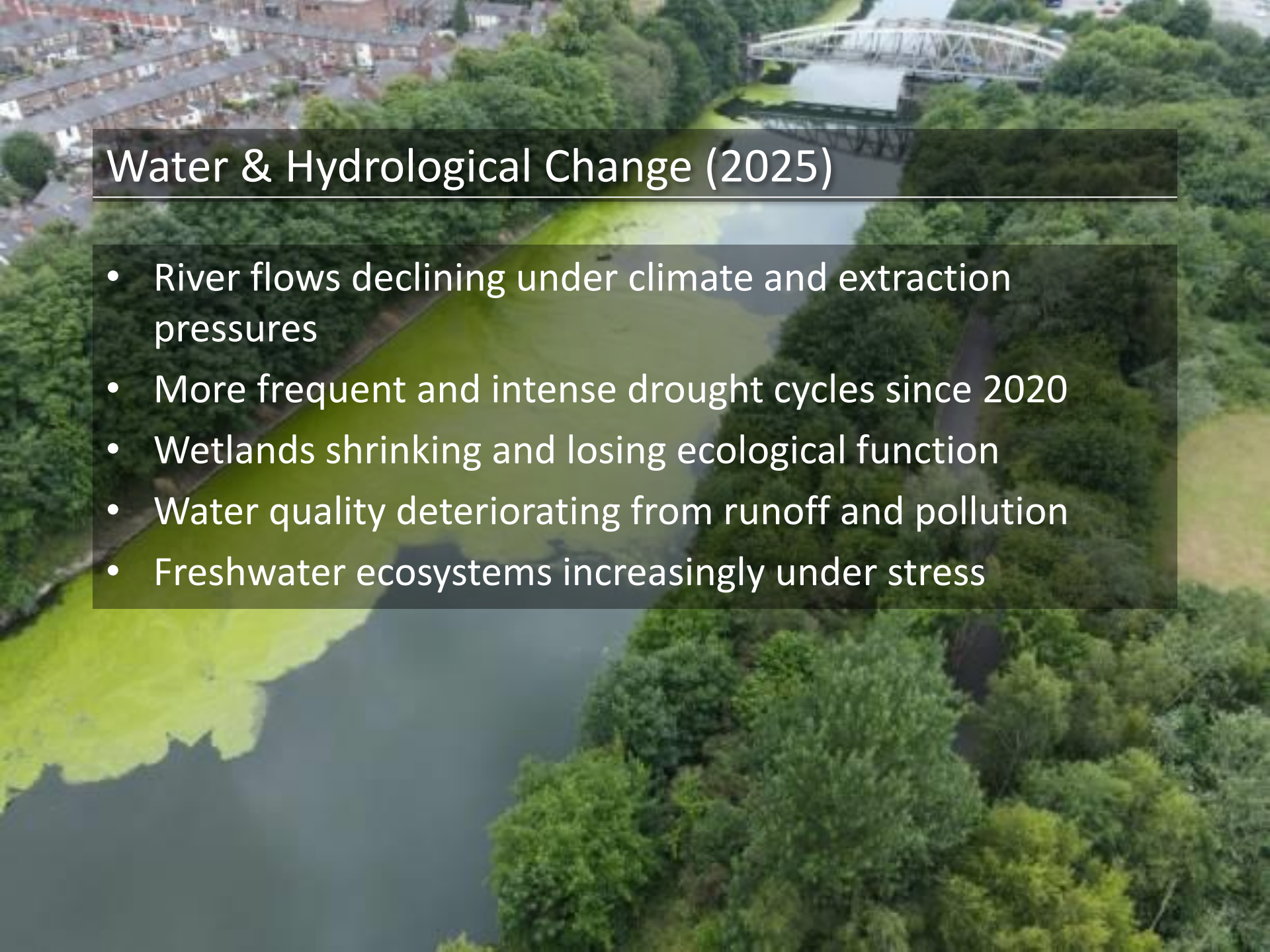
Land Degradation (2025)

- Soil acidity expanding across major agricultural regions
- Salinity affecting productivity and ecosystem health
- Soil carbon declining under intensive land use
- Erosion increasing after drought and land clearing
- Healthy soils essential for long-term resilience



Hydrological Change …

- *Australia has lowest rainfall & highest evaporation rates, also most variable rainfall*
- *Considerable alteration to natural flow regimes, particularly in agricultural landscapes*
- *Loss of environmental flows, loss of biodiversity, changes to ecological processes*



Water & Hydrological Change (2025)

- River flows declining under climate and extraction pressures
- More frequent and intense drought cycles since 2020
- Wetlands shrinking and losing ecological function
- Water quality deteriorating from runoff and pollution
- Freshwater ecosystems increasingly under stress

Waste in Australia: Where does it come from?

Key facts

- *Australians generate ~43.8 million tonnes of waste per year (2,080 kg of waste per person)*
- *Households account for ~12.7 million tonnes (~29%)*
- *Average household produces ~400 kg of waste per year*

Major sources of waste (beyond households)

- *Construction & demolition (largest stream)*
- *Manufacturing & industry (packaging and processing waste)*
- *Mining & resource extraction (very large volumes, often regionally concentrated)*
- *Commercial & institutional (offices, retail, hospitality and health services)*

Pollution: Why are Australia's emissions so high?

Key facts

- *The average household emits ~14 tonnes of greenhouse gases each year*
- *Australia has highest annual emissions at ~27 tonnes per person (30% higher than US - 21.2 tonnes)*

Key drivers of high emissions

- *Energy mix: Heavy reliance on coal and gas for electricity*
- *Housing & cooling: Large homes and high air-conditioning use, especially in hot climates*
- *Transport: Car-dependent cities and long travel distances*
- *Industry: Energy-intensive mining and manufacturing sectors*

⇨ *Impacts: Poor air quality, climate change and health risks*

Pollution: Land-based impacts on waterways

- *We discharge ~9,200 tonnes of phosphorus and 32,000 tonnes of nitrogen to Australia's waterways per year*
- *Pollution from land contributes up to 80 % of all marine pollution*

⇨ *Nutrient enrichment & toxic algal blooms*

⇨ *Significant impacts on Great Barrier Reef and other coastal systems*

Waste & Pollution (2025)

- Australians generate one of the highest volumes of waste globally, with plastics, e-waste, packaging waste, and chemical pollutants increasing annually.
- Agricultural nutrient runoff (nitrogen & phosphorus) continues to drive toxic algal blooms, fish kills, and declining water quality, impacting systems such as the Great Barrier Reef.
- Up to 80% of marine pollution originates from land-based sources, including plastics, chemicals, sediment runoff, and micro-pollutants that enter rivers and coasts.
- Ocean currents concentrate floating waste into gyres, including the Great Pacific Garbage Patch, where plastics break down into microplastics that persist for centuries.
- Air pollution remains a major public health issue, with particulate matter linked to increased rates of head and neck cancer and chronic respiratory disease.
- ‘Forever chemicals’ (PFAS) persist in soil and water for decades, raising long-term concerns for human health and environmental quality.

Biodiversity Loss …

Aust extinctions (or extinct in the wild) since European colonization (2019):

- *38 plants*
- *34 mammal species*
- *11 invertebrates*
- *9 bird species*
- *4 amphibians*
- *3 reptiles*
- *1 fish*

Biodiversity Loss (2025)

- Extinction risks rising across many native species
- Habitat loss and fragmentation still widespread
- Invasive predators causing severe wildlife decline
- Climate change disrupting ecosystems and species ranges
- Urgent protection and recovery efforts needed

Population: Growth and net increase

- *Australia's population est. at 26.6 million*
  - 1 birth every 1 min. 44 sec. (16 March 2024)
- *World population est. at 8.1 billion (16 March 2024) - 4.3 births every second -*
- *Births (~132 million) exceed deaths (~62 million), resulting in a net increase of 70.2 million people per year*
- *Over 200,000 more people on Earth every day!*

⇨ *Net population growth increases demand for food, energy, land and resources*

Urbanisation …

- *86.4% of Australia's population live in urban areas*
- *66% of Australians live in a capital city (expected to increase to 67% by 2056)*
- *Australia's cities characterised by significant urban sprawl*

⇨ *major social and transport issues, land clearing, energy requirements, pollution, water supply*

Urbanisation Pressures (2025)

- Rapid urban growth increasing land and resource pressures
- Heat island effects intensifying in expanding cities
- Green space per capita continuing to decline
- Car-dependent transport driving emissions upward
- Sustainable planning vital for long-term liveability

HOPE Strategic Plan Links (2025)

- Climate Action → reducing greenhouse gas emissions, promoting renewable energy, advocating for stronger climate policies, and building community climate resilience
- Nature Protection → safeguarding biodiversity, restoring degraded ecosystems, preventing habitat loss, and supporting conservation programs for threatened species
- Circular Economy → driving waste reduction, resource recovery, repair and reuse initiatives, and encouraging government, businesses, and households to shift away from linear consumption
- Sustainable Communities → supporting healthier, low-impact lifestyles through improved urban planning, active and public transport, green spaces, energy-efficient design, and strong community engagement

Living More Sustainability …

- *Understand your individual impact on the natural environment*

⇨ *Calculate your 'ecological footprint'*

- *Learn how to reduce your impact and make informed choices (perhaps lifestyle changes)*
- *Educate those around you about living more sustainably*

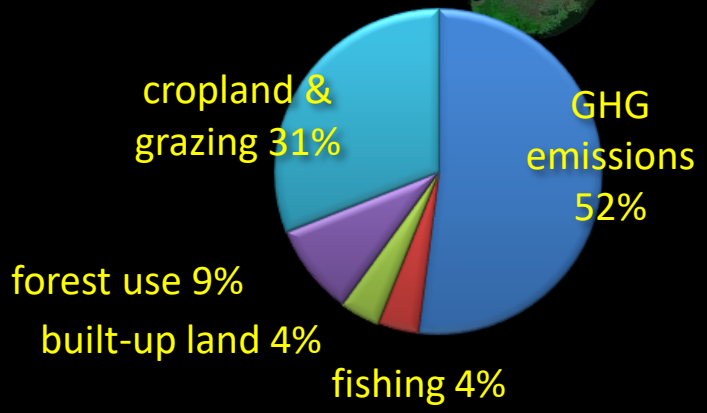
Ecological Footprint: Recap

- *Area of productive ecosystems required to produce resources used and assimilate wastes*
- *Represents a general measure of consumption*
- *Provide links between consumption & population patterns, environmental impacts & sustainability.*
- *Useful comparative concept*

Australia's Footprint …

- *One of the largest ecological footprints per capita (7.3 global hectares per person).*
- *> 50% of footprint due to GHG emissions (average household of 2.6 people emitting ~15-20 tonnes of GHG pa)*

Composition of Australia's Ecological Footprint[2]



2. World Wide Fund for Nature (2011) http://www.wwf.org.au/footprint/

WWF Ecological Footprint Calculator …

https://wwf.org.au/get-involved/ecological-footprint-calculator/

Ecological Footprint Calculators (2025)

- WWF Footprint Calculator → simple, user-friendly tool for individuals to assess their lifestyle impacts
- Global Footprint Network (GFN) Calculator → scientifically robust tool showing ecological footprint, biocapacity, and overshoot
- Household and business calculators → measure energy use, carbon emissions, water use, and waste generation at different scales
- These tools help identify high-impact lifestyle categories such as transport, food choices, home energy use, and consumption habits — guiding practical action to reduce overall ecological footprint

Visual Infographic Slide (Example)

What Can You Do …

- *Buy organic and locally grown food*
- *Choose products with minimal packaging*
- *Use public transport and consider walking or cycling*
- *Switch to clean & green energy sources*
- *Use energy saving devices - set your air conditioner to 25^{o}C*
- *Turn off your lights, computers and other devices*
- *Use recycled products and avoid single use products (e.g. plastic bottles, shopping bags, etc)*
- *Choose eco-friendly cleaning products*
- *Consider eating less meat – (production, packaging & consumption of meat accounts for 18% of all GHG emissions globally)*
- *Get informed and inform others – get your friends and family to calculate their footprints.*

Living More Sustainably (2025)

- **Reduce home energy use**
  – Improve insulation, switch to LED lighting, minimise heating and cooling use
- **Choose plant-rich, low-impact foods**
  – Eat more vegetables, legumes, whole foods; reduce red meat consumption
- **Minimise waste and single-use packaging**
  – Choose reusable options, repair items, buy less and buy better
- **Use active or public transport whenever possible**
  – Walk, cycle, carpool, or use buses and trains to cut emissions
- **Switch to renewable or cleaner energy sources**
  – Install solar, choose green energy providers, reduce fossil fuel dependence

Think Globally, Act Locally (2025)

Community workshops and education programs
– Building awareness, sharing solutions, empowering local action

Citizen science projects
– Water monitoring, wildlife surveys, biodiversity tracking

Local clean-ups, restoration, and tree-planting activities
– Improving local ecosystems and strengthening community stewardship

Advocacy, submissions, and policy engagement
– Influencing decisions that affect climate, nature, and sustainability

Volunteering with HOPE and partner organisations
– Supporting practical projects, campaigns, and community initiatives

Resources & References

- **WWF Living Planet Report**
  – Global trends in biodiversity, ecological footprints, and planetary health
- **IPCC Assessment Reports (AR6)**
  – Scientific consensus on climate change, impacts, and mitigation pathways
- **Australian State of the Environment Report**
  – Comprehensive assessment of Australia's environment, including land, water, biodiversity, and climate
- **Global Footprint Network (GFN)**
  – Ecological footprint data, biocapacity trends, and Earth Overshoot Day analysis
- **HOPE Strategic Plan 2024–2029**
  – HOPE's priorities for climate action, nature protection, circular economy, and sustainable communities

Thank You

Any Questions?

Questions will be addressed by the presentation team…