THE AUSTRALIA WE LOVE

PLACES YOU LOVE

A report on key issues affecting nature and society in Australia

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The Places You Love Alliance acknowledges the Traditional Owners of country throughout Australia. We pay our respects to them and to their elders both past and present.

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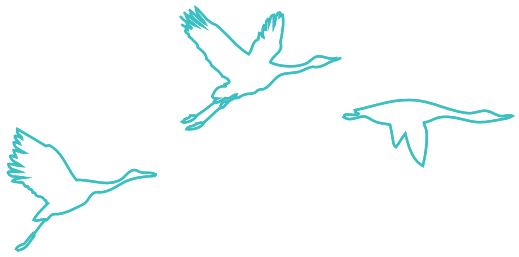

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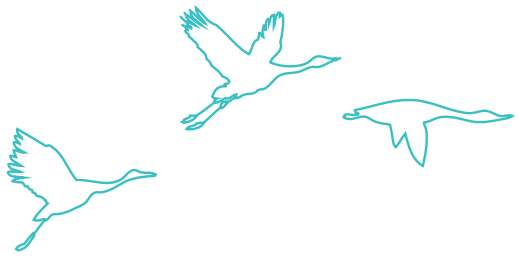


contents

What kind of Australia do you want to live in?

What issues matter and what changes do you want to see? What are the values of your community that make it a place you love to live?

What are the positive initiatives that are really making a difference to how we care for the natural resources of Australia like food, water, energy, air, forests, oceans and all of our unique and incredible native animals and plants?

How is your community taking action to make a real difference through collaboration and innovation?

Join the National Nature Conversation and help build a vision for a healthy, happy and sustainable Australia.

#OzNatureConvo

Find out more at www.placesyoulove.org

Photo © Tourism Australia, Chris Kapa

Imagine what our nation would be like in 10 years' time if we fixed the challenges facing nature.

Photo © Tourism Australia, Greg Snell

foreword

Do you remember your happiest childhood memories?

When I ask friends and family about what makes them feel Australian, they talk of happy times spent outdoors - camping, walking, swimming and picnicking.

As Australians we place a high value on our nation's unique and unspoiled environment. We are proud of the clean air and water that surround us. We love our spectacular Great Barrier Reef, our Alpine ranges and our rainforests.

Imagine a future where our precious natural heritage is safe from destructive threats. That is the vision that unites the Places You Love Alliance.

Places You Love is Australia's largest alliance of environment organizations, bringing together 1.5 million supporters and 42 conservation groups. We are unified by one ambition – to see nature in Australia adequately valued and protected. We recognize that a healthy natural world is the foundation for a strong and healthy society.

The Australia We Love Report consolidates best available information about the state of nature in Australia. We draw on the latest science and economic data, as well as social and cultural analysis.

We will introduce you to everyday Australians taking action to look after the places they love. Their stories represent thousands of Australians who act to improve our health and the health of nature.

Each of these people recognizes the challenges that lie ahead.

As you read through the data you will see our natural world is struggling to sustain itself. Nature is in decline and the natural beauty of Australia is under threat.

The Alliance formed because we know that if we all work together, we can have both a vibrant economy and a healthy, thriving environment.

We also came together because we recognize conservation organizations have not always got it right. Too often we have directed rather than worked together with you. We have not spent enough time listening, sharing and learning together.

It is up to all of us to make the changes that need to be made, and to teach the next generation of Australians to value the natural world that sustains us.

When we stand up for nature together, decision makers will follow.

We want to hear your story. What are your ideas and concerns? What are you willing to do? Who are you willing to recruit to the effort?

Join us for the National Nature Conversation in 2015.

Glen Klatovsky
Director
Places You Love Alliance

introduction

"Progress towards a global sustainable future is just too slow. A sense of urgency is lacking. Internationally and nationally, the funds and political will are insufficient to halt further global environmental degradation and to address the most pressing environmental issues – even though technology and knowledge are available to do so."

– UN Global Environment Outlook, 1997[1]

This sobering assessment of humanity's efforts towards a truly sustainable society is now nearly 20 years old. Since then, humanity's drive to improve our own wellbeing and prosperity has surged ahead, making the most of the resources available to us to do so. Modern society relies so heavily on these resources and creates such immense pressures in their extraction and harvest that the ability of nature to sustain itself and our society is being compromised beyond critical limits.

It is a truism to say that without nature our civilization would not exist. Yet the idea that a fundamentally compromised nature might not support our society as it has for millennia is not yet part of mainstream understanding.

Humanity cannot 'create' water, but only harvest, purify and consume it. We rely on animals, insects and wind to pollinate our food crops, borne of soils that are the product of trillions of microorganisms, most of which are yet to be named. The very air we breathe is regulated in composition and quality by oceans, forests, grasslands and a complex atmospheric cycle.

The sum total of humanity's economic growth rides on the back of the natural resources of this Earth. Even intellectual property that can be bought and sold without ever having a physical footprint is developed by humans, who themselves would perish without the material resources and vital processes of nature.

"Nature is the very foundation of Australia's wealth and wellbeing"

Nature is the very foundation of our wealth and wellbeing, yet to the best of our knowledge, almost every indicator and trend in nature's health, and in humanity's impacts on nature, continue to worsen. It is far more difficult to find positive trends than it is to find continuing or worsening problems.

In part, humanity's inability to curb its ever-growing impacts on nature stem from our concept of nature as 'other', as a near-infinite resource to be exploited for our benefit, as something to be tamed and conquered. Yet subtle shifts in this attitude shed new light on humanity's intricate relationship with and reliance upon nature.

Before the 1960s, conservation thinking focused on "nature for itself", prioritizing wilderness and intact natural areas, generally without people[2].

In the 1970s and 1980s, rapid increases in the impacts of human activity and awareness of its consequences led to a focus on strategies to reverse or reduce threats to species and habitats from humans.

By the late 1990s, there was ample evidence that human pressures on nature were ubiquitous and persistent, and that the best endeavours of nature conservation were failing[1].

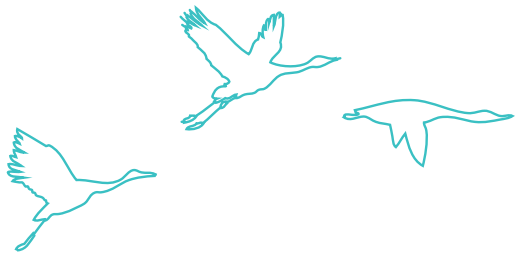
By 2005, conservation turned towards the protection and management of ecosystems as the source of irreplaceable goods and services provided by nature to humanity.

More recently, this utilitarian approach of providing sustainable benefits for people has shifted again, recognizing not only the fundamental links between humanity's wellbeing and prosperity and the health of nature, but once again the intrinsic values of nature in their own right[3].

The inevitable conclusion is that humans are a part of nature itself. Nature's health is our health, and nature's wealth is our own.

With this evolving perspective comes the recognition of some fundamental limitations to our understanding of nature and our place in it:

First, humanity's ability to measure and monitor all of



nature's systems and processes is limited, conceptually, technically and financially[4]. As a result, we have neither a comprehensive picture of the health of nature, nor a complete understanding of the impacts of any decline in nature on our own wellbeing.

Second, our institutions, globally and in Australia, are not optimized to address the increasingly complex and integrated challenges arising at the interface of social, economic, technological and environmental concerns[5].

Third, our understanding and definition of human wellbeing may be far too narrow[6].

Finally, the term 'sustainability' is used far too loosely in regard to humanity's impact on nature. Depending on the context, it is often not measured, is poorly defined, defies objective interpretation, or all three[7].

When the rate of some degrading practice (say, harvesting a wild fish population) is reduced, that practice is often labelled as being 'more sustainable'. However, if that practice simply depletes the finite resource more slowly yet still beyond its ability to replenish itself, then any claim of sustainability is false. This is like driving a car towards a wall at 100 kilometres an hour, then slowing to 80 kilometres an hour and assuming that this is 'sustainable'. At some point you still hit the wall at an unsafe speed.

This report identifies the need to establish a clear and credible baseline of key trends and issues affecting nature and society in Australia and around the world, on the assumption that a healthy Australian society relies on healthy nature for our prosperity and our wellbeing. This credible baseline is one necessary element for galvanizing and growing a people's movement for nature in Australia. Such a movement will be critical if Australians are to adopt and implement the systemic changes required of our society to achieve our true potential this century.

The report is divided into 7 sections.

Section 1 highlights the importance of healthy nature as the foundation for a healthy and prosperous society.

Section 2 is a brief note of the long history of human influence on nature in Australia, and the complexity involved in decisions regarding land, water and sea.

Section 3 provides a synthesis of some of the key indicators of the pressures on nature in Australia and the impact of these pressures on Australian nature and society. Many of the measures reported here are simply snapshots in time and space, highlighting the difficulty of measuring the complexity of nature and our interactions with it in any comprehensive way.

Section 4 is a synthesis of similar indicators at a global scale.

Section 5 looks at how progress is measured in Australia, and the importance of adopting broader definitions of sustainable wellbeing as a frame for effectively valuing and protecting nature.

Section 6 tells the stories of ordinary Australians doing extraordinary things for nature, inspiring us all to better value and protect what we have.

Section 7 is a call to action that looks ahead to an innovative and solutions-focused future in which Australia is effectively valuing and protecting nature as the foundation for the sustainable wellbeing of our society.

SECTION 1

Nature, Society and Economy

This report is based on the idea that the material economy is embedded in society, which is embedded in nature, and that we cannot understand or manage society or the economy without understanding the whole interconnected system.

All economic activity occurs in the natural, physical world. It requires resources such as energy, materials and land. In addition, economic activity invariably generates material residuals, which enter the environment as waste or polluting emissions. The Earth, being a finite planet, has a limited capability to supply resources and to absorb pollution.

The emerging perspective of humanity's intimate links with and reliance upon nature over the last 50 years begins to reframe how we see ourselves and our society. This is no news to some, a subtle psychological shift for many of us, and possibly quite a leap for others. It pushes us to reconsider our existing concept of society as a function of the economy, with nature as one element of that system. This human-centred view of modern society can be crudely represented as a set of interlinking systems in which economic and social systems are dominant, and nature is a subset of resources for use (Figure 1).

A revised framework views human society as just one element, albeit complex and very influential, of 'nature' which also includes the land, freshwater, oceans, atmosphere and all other living things. Again from a human-centred view, this can be crudely represented as a nested arrangement of various types of 'capital' (Figure 2). In this framework, natural capital is any stock or flow of energy and material that produces goods and services. Human capital consists of people's health, knowledge, skills and motivation. Social and cultural capital concerns webs of interpersonal connections, social networks, cultural heritage, traditional knowledge, trust, and the institutional arrangements, rules, norms, and values that facilitate human interactions and cooperation between people. Manufactured capital comprises buildings, machinery, transportation infrastructure, and all other human artefacts and services that fulfil basic human needs such as shelter, subsistence, mobility, and communications. Financial capital has no real value itself but is representative of natural, human, social or manufactured capital, enabling each to be owned and traded[8,9].

In simplistic terms, this utilitarian view of economy, society and nature may be useful to calculate how much of our stocks or resources we can exploit before significant thresholds or tipping points are reached, but it falls short in at least two critical aspects. It doesn't account for values, and it only partly accounts for sustainable wellbeing.

Values represent a strong guiding force in modern society, shaping attitudes and behaviours. Values have been shown to influence political persuasions; willingness to participate in political action; career choices; ecological footprints; financial decisions; and feelings of personal wellbeing[10].

Yet the full suite of values in Australian society, such as cooperation, caring, honesty, love, respect, faith, beauty, trust, integrity and wisdom, may not be adequately reflected or accounted for in the function of our society. They are certainly lacking in the model of five 'capitals' (Figure 2).

Explicit consideration of values may be a necessary precursor to a future Australian society in which all of our needs are met, in which nature as the foundation for our prosperity and wellbeing is effectively valued and protected, and in which our civilization's true potential to thrive within natural limits can be fulfilled. A new framework for Australian society's relationship with nature will be required to achieve this.

Development that addresses our sustainable wellbeing will certainly need to adequately account for various forms of 'capital' which overlap and interact in complex ways to produce all human benefits.

This report recognizes that human, social and produced assets depend on the natural world.

In other words, healthy nature is the necessary foundation for a healthy and prosperous society.

Sustainability thus requires that we live off the interest (sustainable yields) generated by natural capital without depleting the capital itself.

Balancing and investing in all the dimensions of our wealth to achieve sustainable wellbeing requires that:

- Our society operates within the capacity of our finite planet to provide the resources needed for this and future generations;
- These resources are distributed fairly within this generation, between generations, and between humans and other species; and
- Our society uses these finite resources as efficiently as possible to produce sustainable wellbeing, recognizing its dependence on the wellbeing of the rest of nature.

Australian society has never had greater capacity,

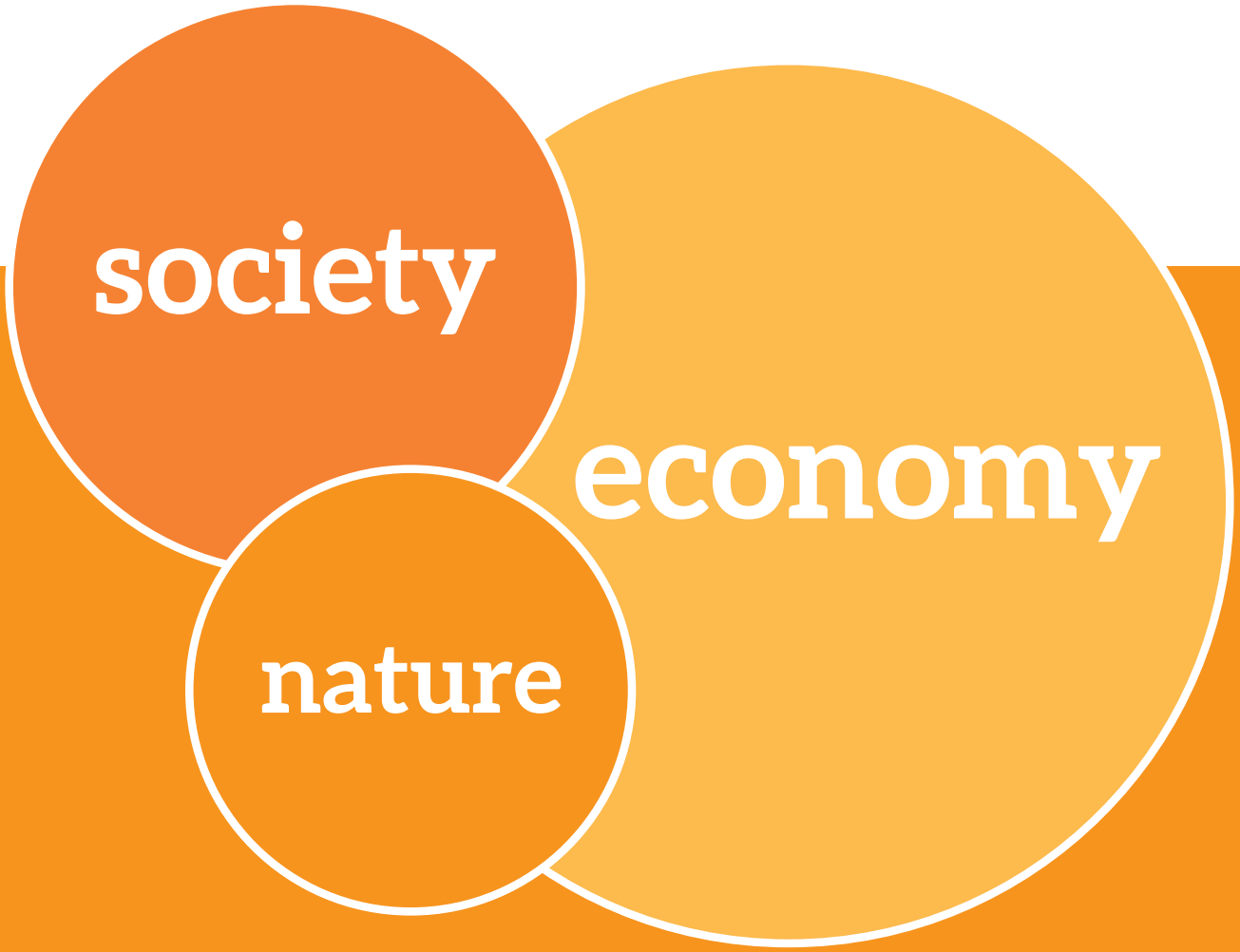


Figure 1: Simplistic model of a commonly perceived relationship between economy, society and nature.

understanding, material abundance, and opportunities to achieve these objectives. This includes scientific knowledge, communications, technology, resources, and productive potential.

Australia has achieved continued economic growth despite many negative global events including the Asian financial crisis in 1997 and the global financial crisis of 2008. Australia has not had a formal recession since 1992[11]. However, Australia is not delivering growth within the bounds of our natural environment.

"Almost every measurable trend for nature continues to worsen."

Despite improvements in per capita resource and waste production, increased efficiencies in material and energy consumption, stronger legal protections for nature and a growing realization of the importance of sustainable

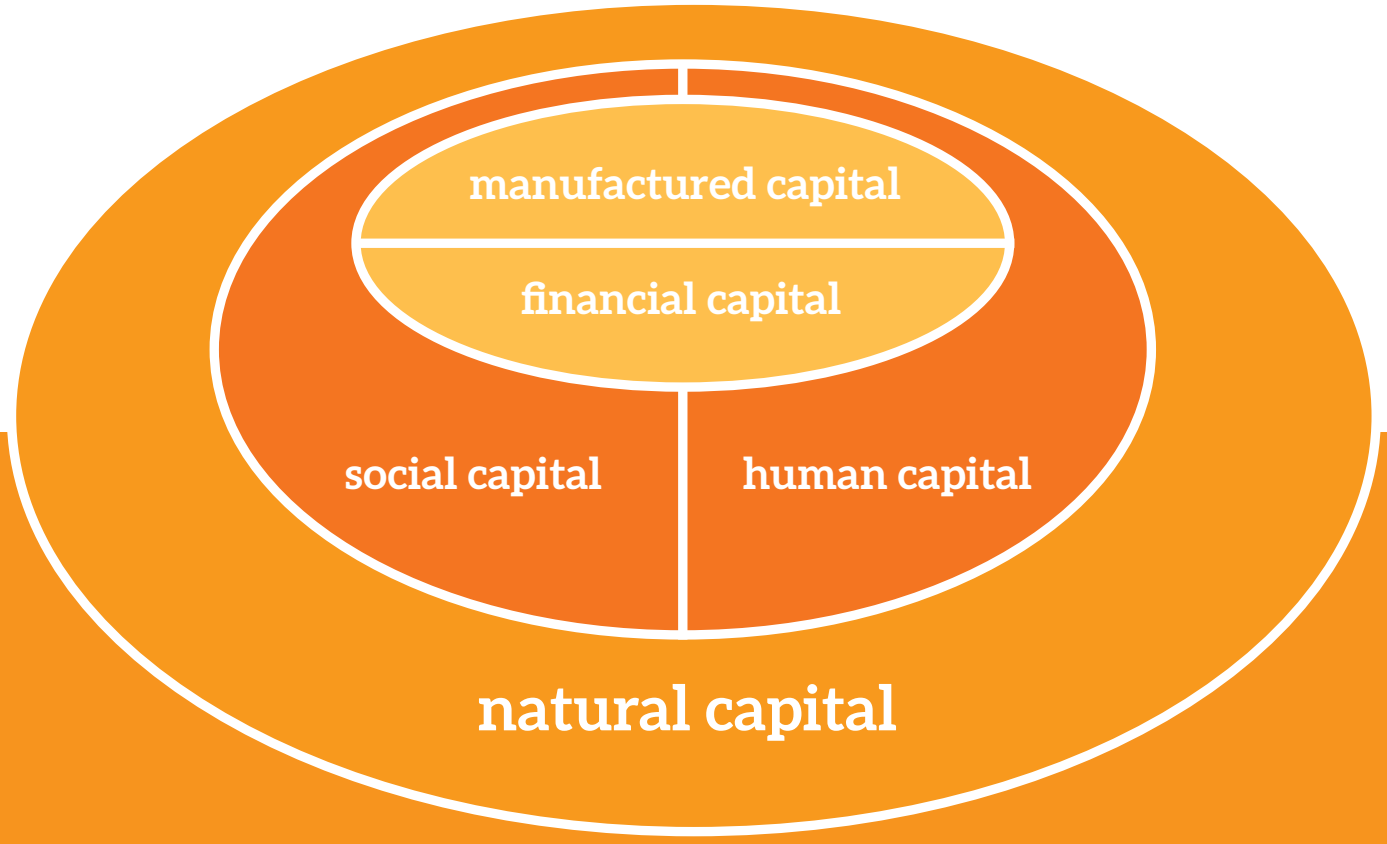


Figure 2: A nested model of the relationships between five forms of 'capital'[8]

development in all sectors of society, almost every measurable trend for nature continues to worsen.

To make matters worse, the aspects of nature, society and the economy that we currently measure are only part of the story. We can measure gross domestic product and average life expectancy and the amount of land either cleared or protected, but measures of progress that capture community values and sustainable wellbeing are noticeably lacking.

Our Health and Wellbeing

Studies spanning across different cultures, ages and socio-economic conditions have consistently shown that natural settings are associated with strong developmental and wellbeing benefits when compared with urban built settings. A growing body of research is finding that exposure to the non-human natural world positively enhances perceptions of physiological, emotional, psychological and spiritual health in ways that cannot be satisfied by alternate means.

"Exposure to nature has benefits on physical and mental wellbeing. Nature deficit has significant negative implications for wellbeing."

For example, physical activity in natural settings greatly improves positive emotions, self-esteem and behaviours. In one study, people who perceived their neighbourhoods as very green had up to 1.6 times greater likelihood of better physical and mental health compared with those who perceived their neighbourhoods as lower in greenness[12]. Visits to the forest (compared with urban trips) can have a long-lasting influence on immune system markers, increasing the activity of antiviral cells and anti-cancer proteins, and these changes can remain significant for a full week after the visit[13,14]. A long-term study of elderly people found that greater access to green spaces in which they could readily walk was an accurate predictor of longevity, and those who walked in the green spaces lived longer[15]. Children also see improvements in motor fitness, balance, and coordination when provided with a natural landscape for play[16]. Several studies show that children's ADHD symptoms decrease after they spend time outside. Children who played regularly in outdoor settings with "lots of green" had milder ADHD symptoms than those who played indoors or in a built environment[17].

The human benefits of time spent in nature are not accounted for in Australia's national accounts or State of the Environment reports.

A growing body of research is finding that exposure to the non-human natural world positively enhances perceptions of physiological, emotional, psychological and spiritual health in ways that cannot be satisfied by alternate means.

Photo © Tourism Australia, Anson Smart

SECTION 2

Indigenous Australia

In any discussion about nature and the natural environment in Australia, it is important to recognize that the land and its flora and fauna have been subject to the sustained and active influence of Indigenous people for more than 50,000 years[18,19]. Over this extended time, the management and use of the environment by Aboriginal and Torres Strait Islander peoples helped shape natural habitats and species distribution and abundance, especially through the use of fire[20]. Many of Australia's native habitats now rely on fire regimes of particular timing, frequency and intensity of burning, or other active management, to continue to function as they have for many thousands of years.

Aboriginal land and sea management practices have long been part of a complex set of societies, with laws and customs, traditional systems of land ownership, land use patterns and religious and economic practices. This is part of the oldest living culture on Earth[21] that gave rise to a vast web of 'cultural landscapes' across the continent. These landscapes encompass the homelands of hundreds of Indigenous language groups, and lie at the basis of today's native title claims.

However, these cultural landscapes, and the natural connections of which they are a part, have been subject to vast structural and functional changes and destructive impacts from modern industrialized society. Upon British colonization in the late 18th century, Australia was considered ***terra nullius***, or 'nobody's land'. Under colonial and later law, Aboriginal Australians were forcibly removed from their homelands and denied their property rights in the land, while colonization vested sovereignty over the entire continent in the British Crown[22].

Lands were taken by the Government and held as 'crown land' or granted to the new settlers in the form of leases or freehold. This brought about the rapid and intense process of land use change and environmental impacts we are familiar with today from mining, broad-scale land clearing, dams and water extraction, urbanization, fragmentation and habitat loss, and endangered species.

This dispossession had far-reaching consequences for Indigenous peoples, whose customary tenure was extinguished in the context of British law and whose ways of life and self-government were severely disrupted.

Thereafter, the history of engagement between governments, the wider settler society and Aboriginal and Torres Strait Islander people involved periods of violent conflict, forced dispossession and displacement, assimilationist policies that denied Aboriginal people basic rights, separated families and entrenched discrimination and inequalities within the settler society. The effects of these historical policies, some of which ended only in the 1990s, reverberate through Aboriginal society today in unresolved trauma and claims for justice[23].

In an historically significant decision in 1992 the High Court of Australia in Eddie Mabo and Others v. The State of Queensland confirmed the existence of native title to lands originally owned and occupied by the Aboriginal peoples of Australia and rejected the doctrine of ***terra nullius***[24].

However, Native Title is a property right that reflects but doesn't fully encompass a relationship to land that is the very foundation of Indigenous religion, economy, culture and wellbeing[25]. While Australian law is now able to recognize and even to protect Indigenous peoples' rights and interests in land and water, Australian governments retain legal power to extinguish those rights and interests[26].

The long history of active Indigenous management on nature in Australia, and the recognition of native title are just two elements among the many layers of social, historical, economic, ecological and cultural complexity regarding any decisions today about the protection, management or development of land and sea in Australia.

Over the last couple of decades, Australia has seen the convergence of several key pressures in remote Australia, largely centred around Indigenous lands, formally recognized or otherwise. These areas are also commonly high in ecological and cultural values because of their unique characteristics, their remoteness from industrial attention, and their historical custodianship.

However, mining and extractive industries have become increasingly focused on such areas just as the need to address significant Indigenous economic and social disadvantage in remote areas was widely acknowledged. Securing sustainable economic opportunities in ways that protect rather than damage nature and culture, while

Over the last couple of decades, Australia has seen the convergence of several key pressures in remote Australia, largely centred around Indigenous lands.

Photo © Tourism Australia, James Fisher

respecting Indigenous rights and interests, presents a major challenge in modern Australia.

Importantly, formalized Indigenous land and sea management programs are increasingly significant in Australia. For example, the Indigenous Protected Areas (IPA) Program is a network of Aboriginal owned and managed lands, registered under the National Reserve System (NRS) of protected areas[27]. The success of the IPA Program is widely acknowledged, including some of the most biodiverse and highly valued of all NRS properties. There are 60 declared Indigenous Protected Areas covering just over 48 million hectares across Australia, representing more than one third of the NRS[28].

SECTION 3

Key Indicators – Taking Australia's Pulse

Over the last few decades, despite increased public focus and investment, Australia's significant environmental problems have mostly worsened or remained the same.

This report presents data that more than 1,600 plant and animal species are listed as threatened or extinct by the Australian Government. One million hectares of native vegetation was cleared per year between 2000 and 2010. Since 1985 half the coral cover of the Great Barrier Reef has been lost. Invasive plants and animals cost Australia's agricultural sector $7 billion per year. And 3,000 Australians die from urban air pollution per year.

Yet there is also a real lack of good quality, consistent information about the health of nature in Australia. Confidently identifying trends in the health of nature is often not possible using existing information[29]. There is an urgent need to improve our understanding of the state of nature if we are to improve the health of our natural environment.

This section uses an established framework of indicators that describes the interactions between society and the natural environment, referring to Drivers, Pressures, Condition, Impacts, and Responses (See framework below and on page 19)[30].

DRIVERS

The driving forces that create pressures on nature that result in changes in its condition or health are social, demographic and economic in nature, many of which are related to socio-economic sectors that fulfil human needs for food, water, shelter, health, security and culture. The most influential driving forces on nature are population growth and developments in the needs and activities of individuals, as expressed through material extraction and consumption.

"Population is projected to grow up to 42-70 million by 2100."

Human Population Growth

The growth of human population in Australia is a significant driver of pressure on nature. It is strongly linked to growing material resource consumption, another significant driver of pressure on nature.

In the year 1900, the Australian population was estimated at about 3.7 million. We hit the 10 million mark some time in 1959, and the 20 million mark in 2003 (Figure 3)[31].

Framework of indicators used in this report

Drivers describe the social, demographic and economic developments in societies and the corresponding changes in life styles, overall levels of consumption and production patterns.

These drivers function through human activities which may intentionally or unintentionally exert **Pressures** on nature.

The pressures exerted by society may lead to unintentional or intentional changes in the **Condition**, state or health of nature.

Changes in the condition or state of nature have an **Impact** on the welfare or wellbeing of humans through the provision of natural services.

Humans make decisions in **Response** to these impacts to influence the drivers and pressures, improve condition and mitigate impacts.

Today, the resident population of Australia is over 23,600,000[32].

Our population is projected to increase to between 36.8 million and 48.3 million in 2061, and reach between 42.4 million and 70.1 million in 2101 (Figure 3)[33]. The projected development of infrastructure (e.g. housing, transport, water supply, energy, communications) strongly correlates with anticipated population growth, reflecting the longstanding pattern of association among these variables[34].

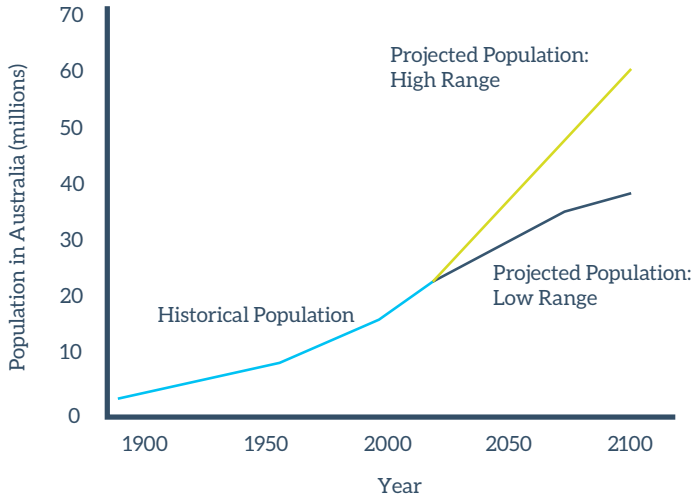


Figure 3: Past, present and future population in Australia, 1900-2100[31,32,33]

Growth in Material Consumption

One of the main drivers of human-caused change to nature has been the growth of consumption, defined as the flow of materials and energy through society. Materials or energy are extracted from the environment, transformed into products and then eventually returned to the environment as waste.

Humanity is consuming raw materials at a level never seen before with far-reaching impacts on nature including biodiversity, land use, climate and water.

Australia consumes more resources per person than most other nations on Earth[35]. We consume about 35 tonnes per person per year. By contrast, an emerging nation like India consumes about 5 tonnes per person, while the US and Japan consume about 28 tonnes[35].

"Consumption of natural resources is projected to increase by up to 27% by 2030."

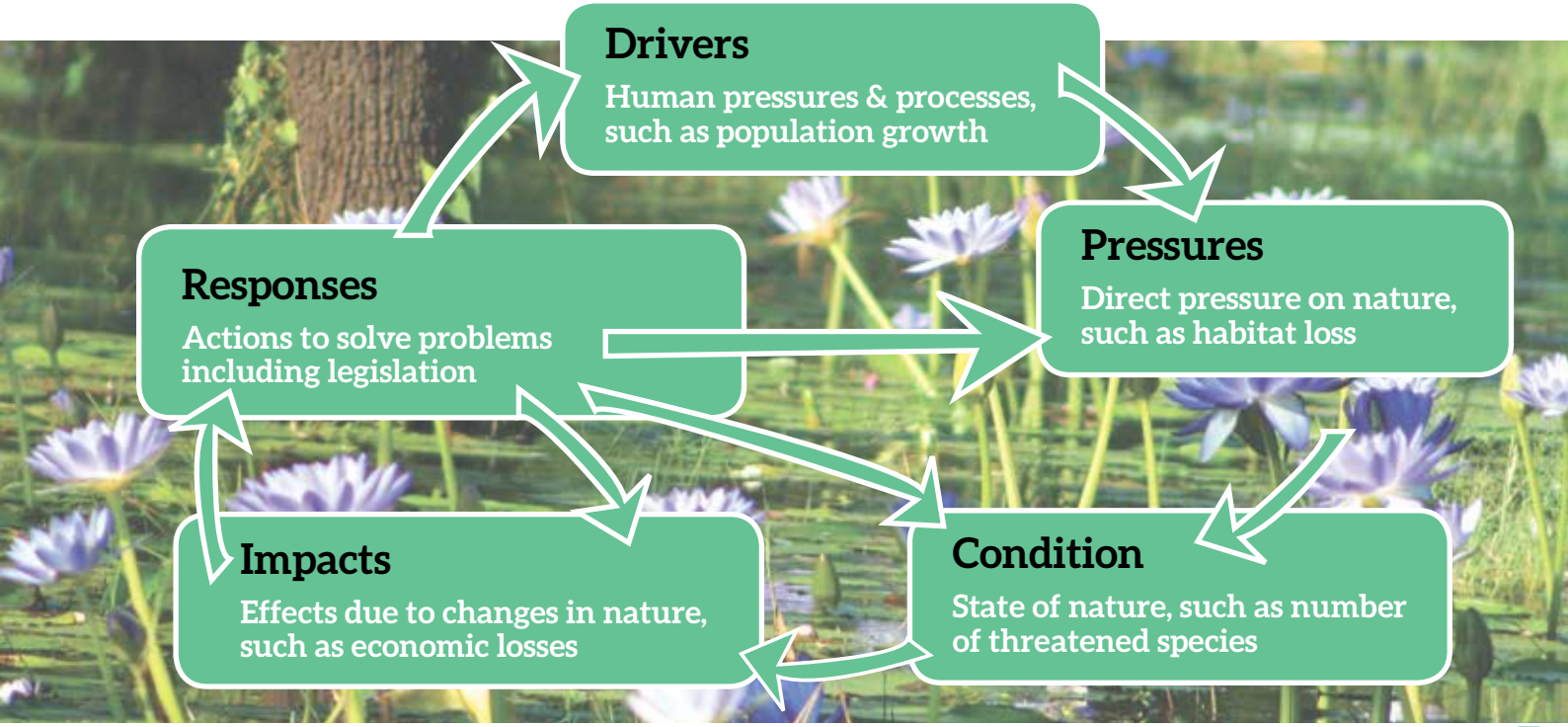


Photo Stuart Blanch

RINGNECKED PARROT | Destruction and fragmentation of habitats are major factors in the global decline of species.

Photo © Tourism Australia, Maxime Coquard

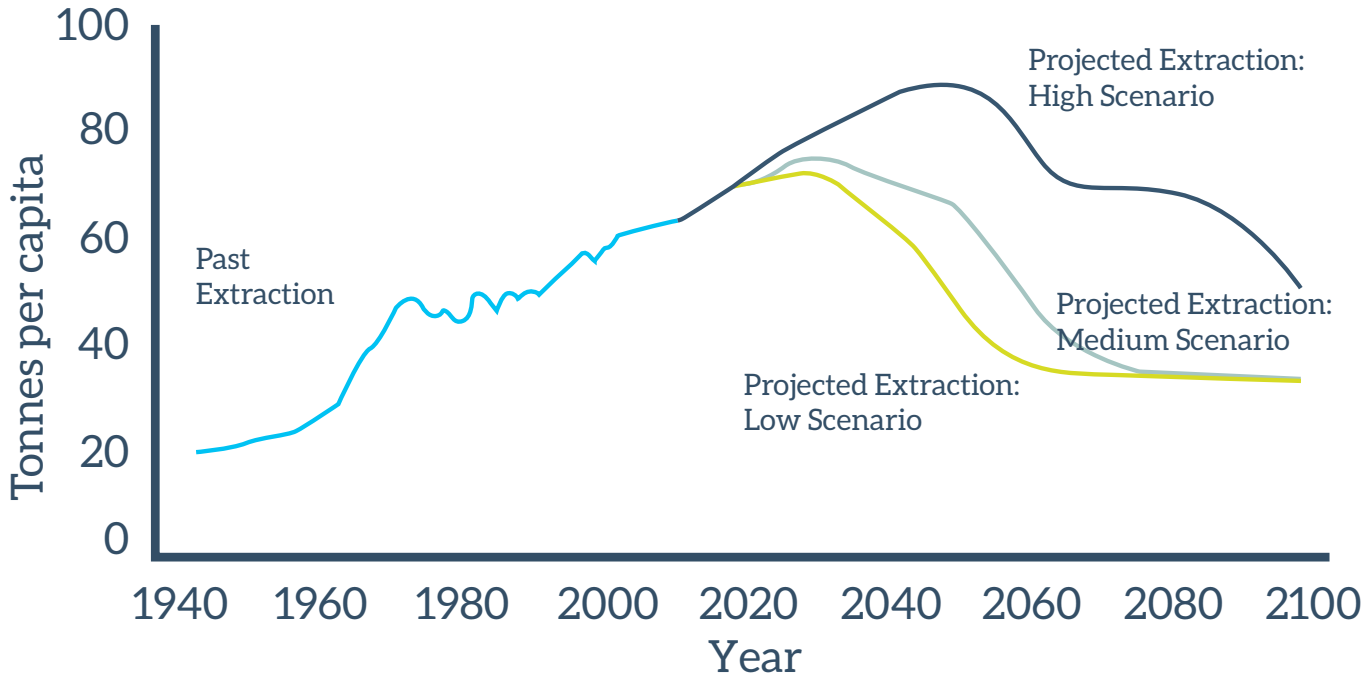


Figure 4: Domestic extraction of natural resources in Australia, past, present and projected, 1946-2101, tonnes per capita[36]

This is largely thanks to our resource-intensive lifestyle of large houses with poor energy efficiency, large travel distances, significant amounts of food waste, and a diet heavy in meat and dairy products[35].

However, Australia is also a net exporter of many resources, almost doubling our impact on nature[36]. This is expressed in figures of domestic extraction of natural resources in Australia (Figure 4).

The Australian economy is projected to grow by 2.7-3.0% per year until 2050. As Australia's economy expands, it is likely that our resource consumption and waste production will also increase[34]. Forecast scenarios in Australia based on varying levels of resource availability and growth rates could see primary materials extraction rise to 90 tonnes per capita by 2050 (Figure 4)[36].

Australia's long-term energy projections show total energy production nearly doubling due to strong export demand and electricity demand increasing by nearly 50 per cent by 2030[37].

Australia relies on a very high percentage of fossil fuel resources for its energy supplies. More than 95% of energy consumption in Australia in 2011 (Figure 5a) was derived from fossil fuel sources (coal, oil, petroleum and natural gas products), up from 93.8% in 2001[38]. The percentage of renewable energy used in Australia is very small, accounting for around 5% of total energy consumed.

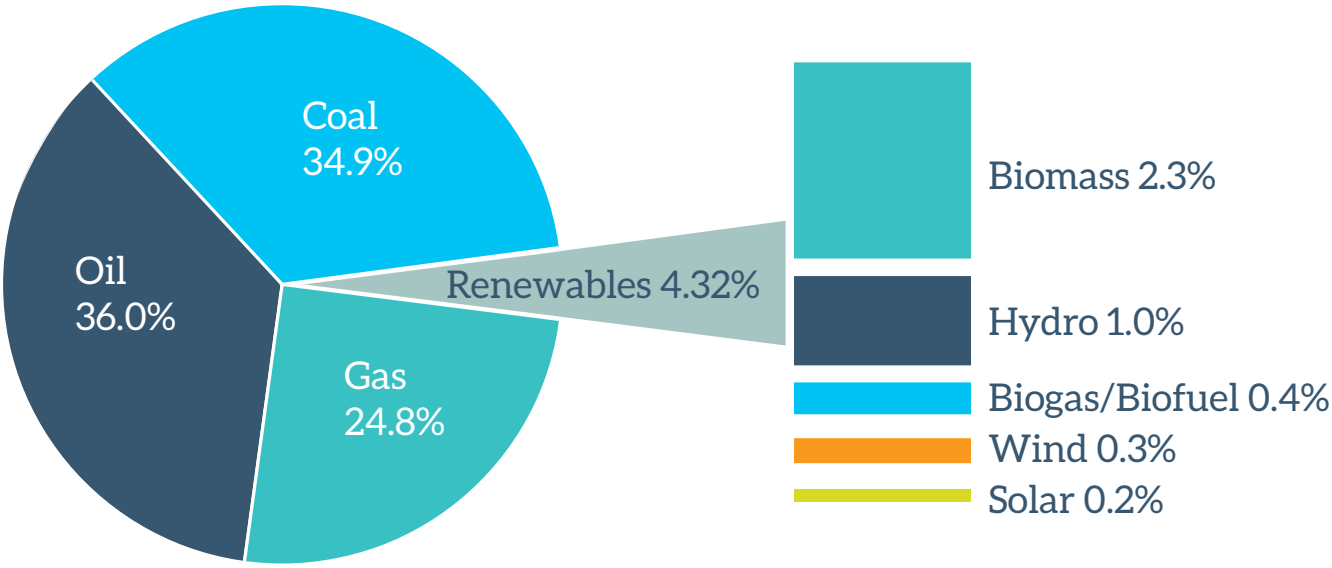


Figure 5: Energy consumption in Australia by energy type, 2010-11[39]

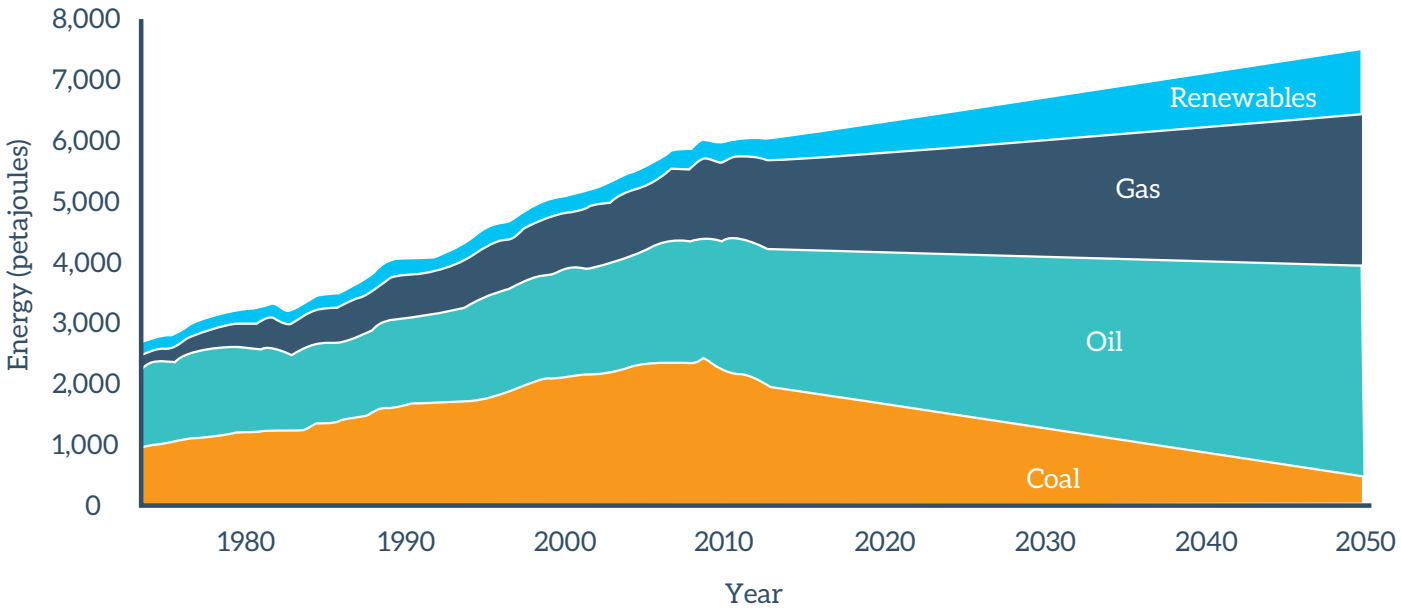


Figure 6: Australia's total energy consumption by energy type (petajoules), 1974-2013[39], and forecast energy consumption (petajoules), 2013-2050[34]

Total primary energy consumption is projected to grow by around 21 per cent (0.5 per cent per year) over the period 2012-13 to 2049-50, to reach 7369 petajoules (Figure 6)[40]. Non-renewable energy is projected to fall from 95 per cent of the primary energy consumed in Australia in 2012–13 to 86 per cent by 2049-50, with renewables accounting for 14% of consumption (Figure 6)[40].

"Renewable energy sources will only account for 14% of energy consumed in 2050"

PRESSURES

Australia has a unique natural environment suffering from a range of pressures including habitat loss and fragmentation, climate change, invasive plants and animals, pollution, altered fire regimes, freshwater extraction, mining and large-scale grazing by stock animals[34].

The impacts related to these activities are predicted to increase in the coming decade[41].

Twenty-six indicators to establish baseline measures for a range of pressures affecting our natural environment

Australia has a unique natural environment suffering from a range of pressures including habitat loss and fragmentation, climate change, invasive plants and animals, pollution, altered fire regimes, freshwater extraction, mining and large-scale grazing by stock animals.

Photo Julian Murphy

Impacts **While many of the impacts of extensive habitat change on nature are well documented, impacts on human wellbeing are rarely quantified, although links between human environmental change and the emergence of disease in humans and wildlife have been documented[48].**

were proposed in 2000[42]. Today meaningful national trends for 21 of these indicators cannot be established[29,34]. Of the remaining 5 indicators, 3 show improving trends (ozone depleting substances in the atmosphere, fuel consumption per transport output and pollution discharges from point sources), and 2 show worsening trends (energy use and human population)[29]. Similar data gaps are evident in each of the state and territory jurisdictions. Across eight jurisdictions and 26 indicators (208 in total), 9 are improving (4.3%), 8 are stable (3.8%), 16 (7.7%) are worsening, and 7 coastal and marine indicators are not applicable (ACT, 3.4%). Meaningful trends for the remainder (168, or 80.8%) cannot be established[29].

Some key statistics and trends in the pressures affecting nature are presented below, drawing on a range of scientific and government sources.

Habitat Change

Habitat can be defined as the natural environment of an animal or plant or other organism.

Habitat or landscape change includes three distinct processes: a reduction in the total amount of the original vegetation (habitat loss); subdivision of the remaining vegetation into fragments, remnants or patches (habitat fragmentation); and introduction of new forms of land-use to replace vegetation that is lost (conversion)[43].

Destruction and fragmentation of habitats are major factors in the global decline of species, the modification of native plant and animal communities and the alteration of ecosystem functions[43].

The natural habitats that existed in Australia before European settlement in 1788 across terrestrial, fresh water and marine areas have been changed substantially through a range of human and natural pressures.

For example, agricultural production since European settlement of Australia has resulted in widespread clearance of native vegetation in the intensive land use zone of southwest, southeast and eastern regions of the continent[34]. The resulting landscape change now threatens biodiversity, ecosystem functioning and agricultural productivity[44].

Such changes have been driven by relatively unrestricted access to land, technological change and growth in productivity and population.

Now land is under increasing pressure, with new demands for multiple objective land use producing combinations of food, fibre, minerals, energy, landscape amenity, water, carbon and biodiversity.

A range of indicators provide information about habitat change across Australia, including native vegetation clearing, aquatic habitat destruction, altered fire regimes, introduced species, erosion, surface water extraction, changes in coastal use, disturbance of marine habitat, disturbance of potential acid sulphate soils, algal blooms, and changes in land use, among others.

Estimates of changes in the extent and condition of many habitats across Australia, including grasslands, rangelands, deserts, algal beds, wetlands, lakes, rivers and estuaries are not routinely measured[34,45]. Furthermore, this lack of data is complicated by problems of under-sampling, variation in measurement techniques, problems with definitions, and issues with combining datasets with varying coverage over time and space[29,45].

However, some measurable information demonstrates that landclearing and habitat loss have been significant in the past, and continue in the present.

Of an original 235 million hectares of Australia's forests and woodlands, 44% or about 104 million hectares have been cleared since European settlement. 36% was cleared before 1972 and 5% after 1972 – representing 85.7 million and 11.5 million hectares respectively (Figure 7)[46]. The clearing has been offset by the regrowth of 2.9% of the original cleared area.

In the absence of clearing, forest and woodland losses are presumed to be due to causes such as fire, drought or disease like die-back. Non-clearing losses have accounted for 5% of the area changed in the last 20 years.

Of the 50.5% of forests and woodlands that have not been cleared or lost due to non-clearing events, 20.5% were converted to non-forest at some point after 1972 and are therefore in disturbed condition (Figure 7)[46].

"On average about 1 million hectares of native vegetation was cleared per year between 2000 and 2010, and at least 50% of Australia's wetlands have been filled or destroyed."

Of naturally non-wooded areas – areas that were neither

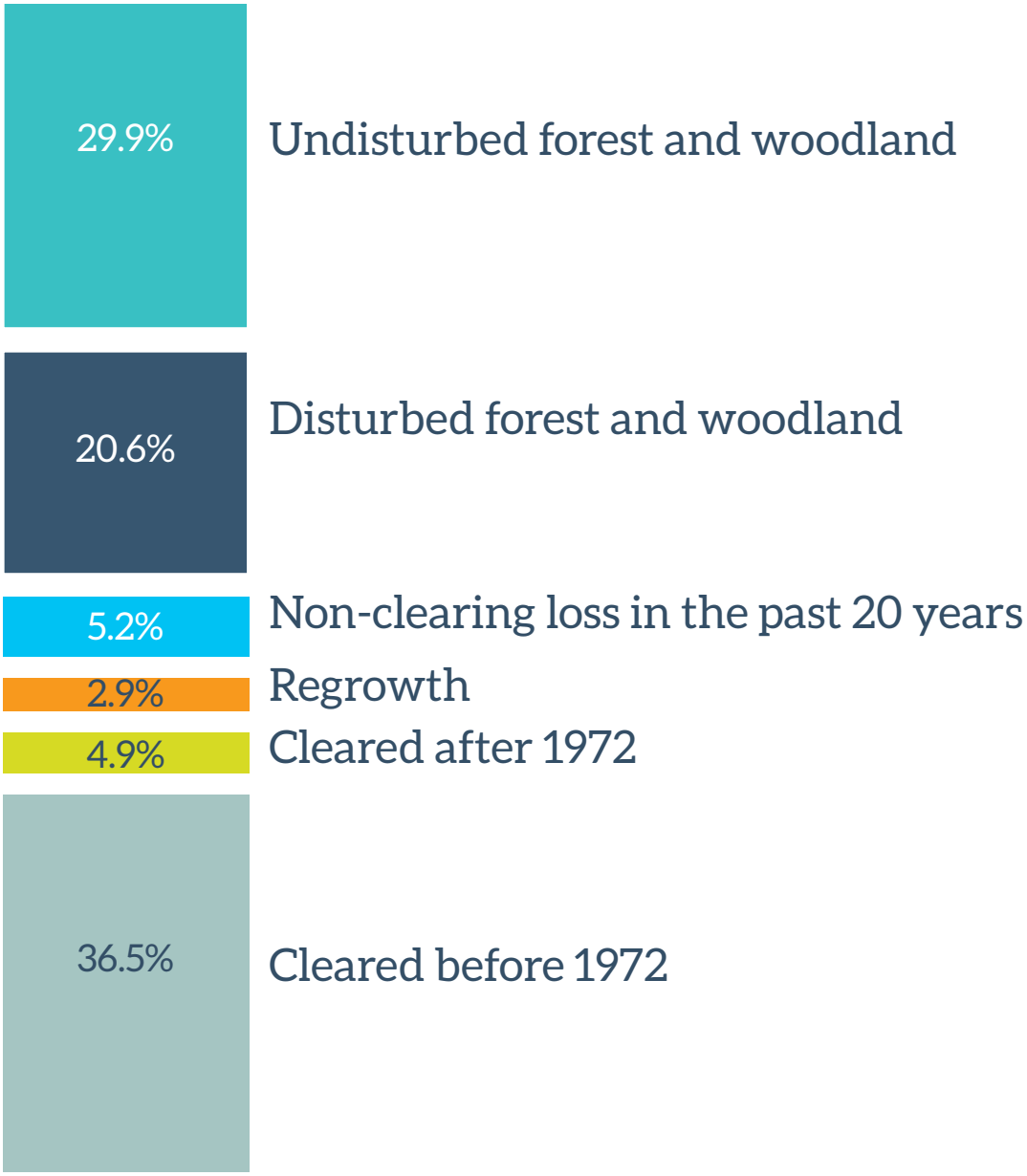


Figure 7: Changes in forest and woodland area across Australia[46]

forest nor woodland at the time of European settlement – 65% retain good ground cover, with the remainder having poor (or "low") ground cover[46].

Undisturbed forests are restricted to mountainous areas of the west or eastern coasts. Long cleared areas are primarily in the western and eastern inland zones of extensive agriculture. More recently cleared areas are primarily in Queensland, in the formerly extensive brigalow and mulga forests. Low ground cover dominates the centre of the country, while transformed ground cover dominates the central Queensland savannahs and grasslands (Figure 8)[46].

Land clearing has significantly diminished over the past decade due to the expansion of protected areas and native vegetation laws[46], but still averaged around 1 million

Impacts Other physical changes as a result of climate change are likely to include:

- Increases in the extent of saline soils (which may grow to cover as much as 17 million hectares by 2050) ;
- Declines in stream flow and stream water quality in southern Australia (water yields in the Murrumbidgee, Goulburn and Border river catchments down by 43–54% by 2070, and end-of-valley stream salinity concentrations up by 8–11%[57]).

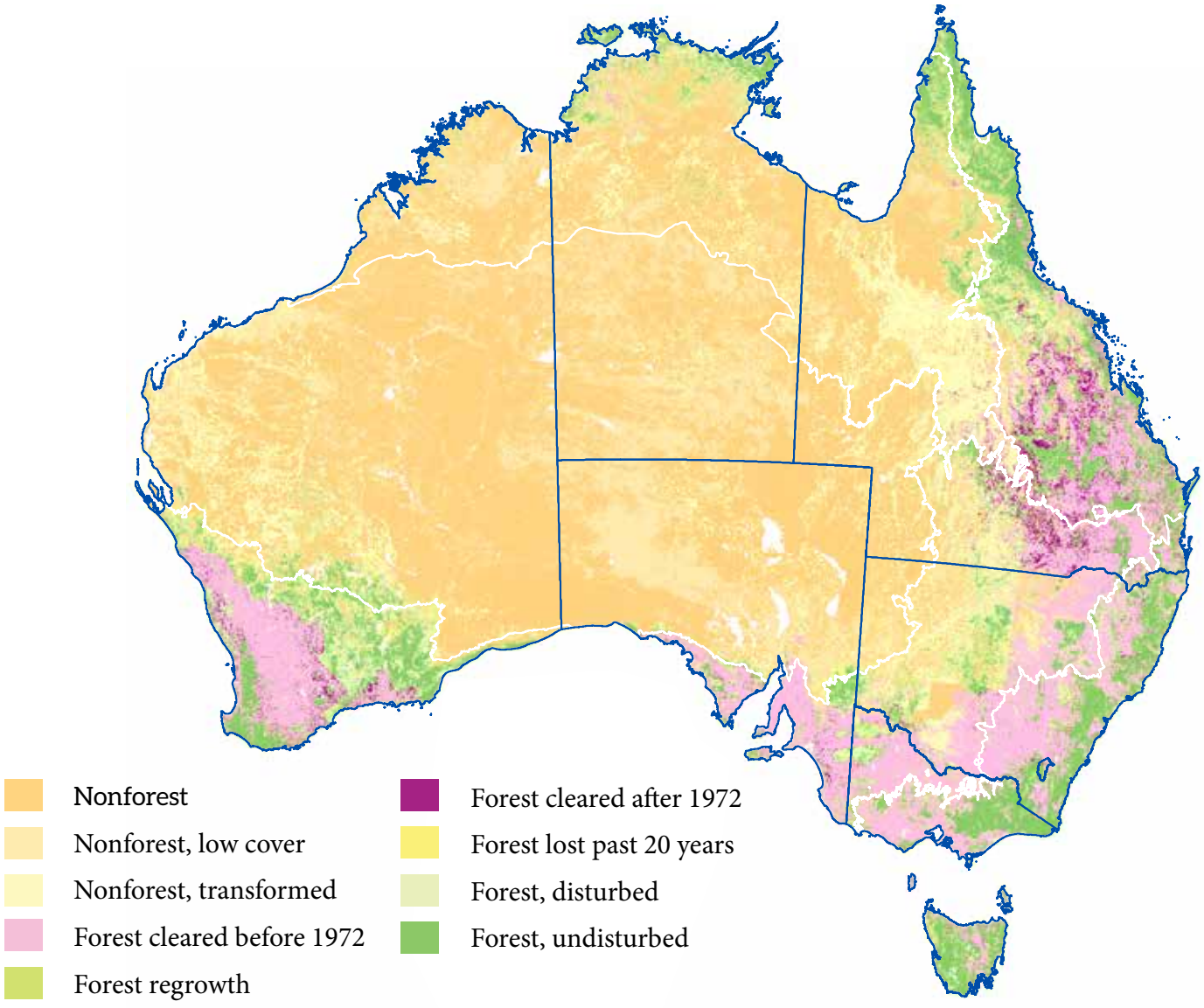


Figure 8: Land cover change in Australia[46]

Impacts In Australia, an increase in mean global temperature of 2°C would likely mean, amongst many impacts, the loss of the Great Barrier Reef[53], 80% of Kakadu National Park's freshwater wetlands[54,55], and north Queensland's tropical rainforests[56].

Impacts **By 2050 rainfall is predicted to increase in northern Australia, and decline by 5–20% further south and inland. There is a greater than 60% risk of a drop in mean annual precipitation across the bulk of the continent by 2050. These changes, in combination with anticipated changes in relative humidity, evapotranspiration and wind are likely to significantly increase drought and fire in some parts of Australia, particularly in southern regions[57]. This includes increases in:**

- **The number of months of drought (40% more by 2070 in eastern Australia and up to 80% more in south-western Australia);**
- **The number of very high and extreme fire days (up from 23 to 38 per year in Canberra by 2050);**
- **Area of land burned by bushfires annually[57];**
- **Costs of bushfire damage (an additional $1.5 billion in south-eastern Australian ecosystems, over and above the costs if no climate change took place[58]).**

hectares per year during the period 2000–10[34].

Some estimates place the loss of Australian wetlands at more than 50% of those that existed some 200 years ago[47], including:

- Swan Coastal Plain, Western Australia – 70% loss;
- Coastal region, New South Wales – 75% loss;
- South-east, South Australia – 89% loss;
- State of Victoria – 33% loss;
- River Murray, south eastern Australia – 35% loss;
- Floodplain wetlands of the Murray-Darling Basin – 90% loss.

Climate Change

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of atmospheric greenhouse gases have increased[49].

Australia's climate has warmed by 0.9°C since 1910, and the frequency of extreme weather has changed, with more extreme heat and fewer cool extremes[50].

Rainfall across Australia has increased in the north and declined in the southwest since about 1970. Autumn and early winter rainfall has mostly been below average in the southeast since 1990[50]. Extreme fire weather has increased and the fire season has lengthened across large parts of Australia since the 1970s[50].

The duration, frequency and intensity of heatwaves have increased across large parts of Australia since 1950[50].

Global mean sea level has risen by 225 mm from 1880 to 2012[50].

These patterns are predicted to continue.

"Four degrees warming is expected by 2100. Two degrees warming will see the loss of the Great Barrier Reef."

The latest assessment report from the Intergovernmental Panel on Climate Change (IPCC) sets out four carbon budgets that correspond to different degrees of warming by the end of the 21st century. The current consensus target by governments is to limit global average temperature increase to 2°C[49].

The IPCC considers that the risks to unique and threatened natural systems, and of extreme weather events, is high at 2°C of warming[49].

Globally we have only a certain 'carbon budget' to spend, or a certain amount of greenhouse gas emissions we can afford to emit, before we reach that level of warming. On our current burn rate it is forecast that globally we are set to blow our carbon budget by 2034, 66 years ahead of schedule[51].

It is now likely that the Earth will experience 4 degrees of warming by the end of the century[51].

In a 4°C world, the limits for human adaptation are likely to be exceeded in many parts of the world, while the limits for adaptation for natural systems would largely be exceeded throughout the world[52].

Impacts **It is estimated that invertebrate and vertebrate pests and weeds cost Australian agriculture at least $7 billion a year and costs on the environment are unquantified but substantial and thought to be at least of this order[69,70]. Globally, the costs of invasive alien species are around US$350 billion[71]. Twenty five percent of costs to consumers associated with food products are due to invasive weeds, pests and diseases[71].**

Invasive Species

An invasive species is an organism that causes ecological or economic harm in a new environment where it is not native. This includes alien species (not native to Australia), as well as native species that have spread into new areas[34]. Invasive species (including plants, animals and pathogens) have altered ecosystem composition and functioning and caused extinctions in most bioregions of Australia[34].

Examples of Australia's most damaging invasive species include:

- Cats and foxes, which have caused many mammal extinctions;
- Chytrid fungus, which has caused at least 4 frog extinctions;
- Phytophthora and myrtle rust, two devastating plant diseases;
- Black rats, a major threat to island birds;
- Carp, which dominate and have transformed waterways in the Murray-Darling system;
- Gamba grass and other high biomass exotic pasture grasses which fuel damaging fire regimes;
- Rabbits, goats, camels and other exotic herbivores that cause widespread degradation;
- Yellow crazy ants and other tramp ants that dominate large areas.

Australia ranks globally as one of the worst affected countries in terms of numbers of invasive species and for the ecological damage sustained[59]. Australia has the highest number of mammal extinctions (34% of global extinctions since 1500), mostly due to exotic predators[60]; the highest number of invasive trees and shrubs (29% of the global total)[61]; and one of the highest densities of exotic plant species[62] and extent of widespread weeds[63].

Numbers of introduced species in Australia have been estimated at about 30,000 plants, 650 vertebrates, 1200 freshwater fish, with invertebrates, marine organisms

Impacts **Invasive species have:**

- **permanently altered Australia's native terrestrial and aquatic ecosystems and the diverse services they provide, (e.g. salvinia, gamba grass, myrtle rust, tramp ants);**
- **driven native endemic species to extinction (e.g. cats, foxes, chytrid fungus);**
- **transmitted infectious diseases from wildlife to humans (e.g. mosquitoes);**
- **directly reduced the quality of life of affected Australians (e.g. tramp ants); and**
- **decimated fisheries (e.g. pilchard herpes virus)[69].**

and pathogens and diseases unknown[59]. More than 3000 plants, about 100 invertebrates and 250-500 marine organisms have naturalized (established in the wild), and many are invasive, resulting in significant ecological and economic costs. Most have yet to spread to the full extent of their potential range, so invasive species impacts will grow.

Australia's most recent State of the Environment report gave the worst possible ratings for invasive species impacts on biodiversity: 'very high' and 'deteriorating', and found that management outcomes are 'ineffective'[34].

Invasive species have already caused or contributed to the extinction of more than 40 Australian mammals, birds and frogs, and are second only to habitat loss in the numbers of Australian species and ecological communities they threaten[64,65].

In the past five years, two more Australian animals have likely become extinct – the Christmas Island pipistrelle (a microbat)[66] and the Christmas Island forest skink[67]. The causes almost certainly include invasive species, including yellow crazy ants that have transformed the Christmas Island ecosystem[68].

"Invasive pests and weeds cost Australian agriculture at least $7 billion a year and costs on nature are at least that much again."

Australia continues to experience regular incursions of high impact invasive species, with recent incursions including myrtle rust, yellow crazy ants and smooth newts. Best estimates for new incursions are approximately as follows:

- Plant naturalizations 10-20 per annum;
- Invertebrate pests 2-4 per annum;
- Plant pathogens 10-14 per annum;
- Animal diseases no data but new strains likely to arrive in wildlife and pet trade;
- Vertebrate pests <1 per annum (most recently as pet fish)[69].

The success of strategies for individual invasive species varies but overall invasive species are expected to become more threatening for environmental values[34].

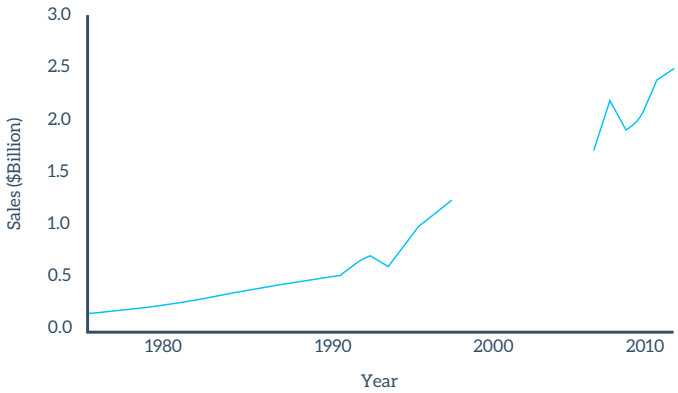


Figure 9: Sales of crop protection products in Australia including insecticides, herbicides and fungicides, 1975-2012[73,74]

Invasive species will increase in number and their impacts will grow due to inadequate investment in biosecurity and threat mitigation. Impacts will be further exacerbated by climate change[1].

Pollution

Pollutants influence nature directly through mortality and reduced reproductive success, and also indirectly through habitat degradation[72]. Pollutants include pesticide and fertilizer effluents from agriculture and forestry, industrial wastes from mining and oil and gas extraction, sewage, airborne particulate matter, contaminated run-off from urban and suburban areas and oil spills.

Pesticides

Substantial amounts of pesticides are used on Australian farms annually: in 2002, over 18,000 tonnes of herbicides, 8,000 tonnes of insecticides, 3,000 tonnes of fungicides and 500 tonnes of plant growth regulators[34]. Sales in agricultural chemicals for crop protection have been steadily increasing since the mid-1970s[73]. Recent estimates put annual sales for crop protection products at more than $2.5 billion (Figure 9)[74].

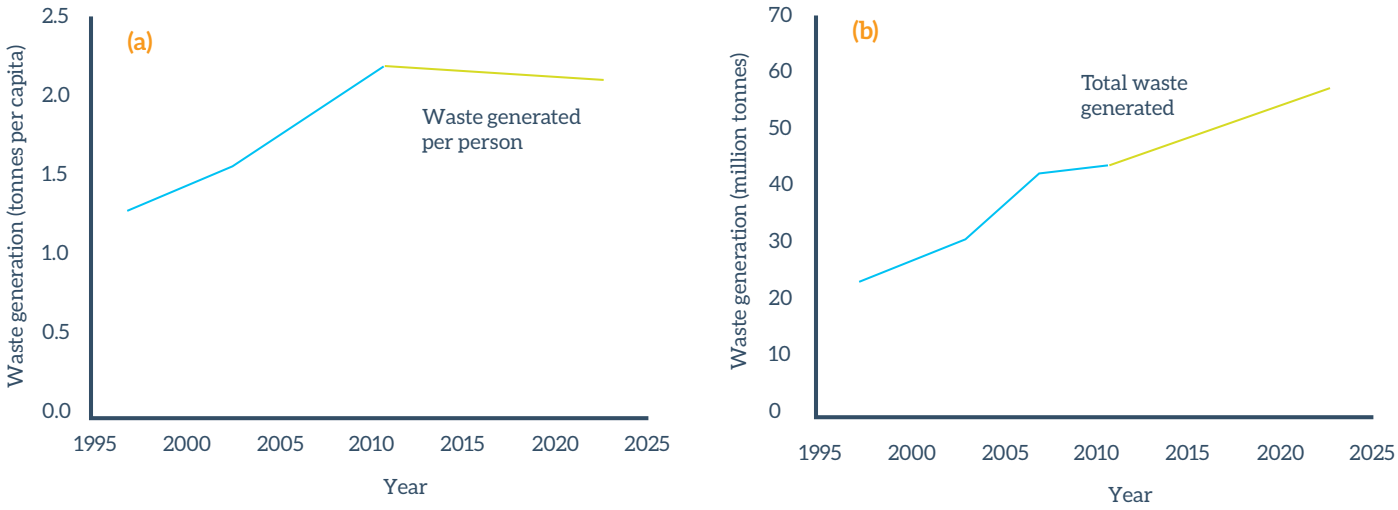


Figure 10: Annual waste generation, (a) tonnes per capita and (b) tonnes in total, 1997-2023. Green lines are projected figures[75,77]

Waste

The total volume of waste generated in Australia nearly doubled from 22.7 million tonnes in 1996-97 to 43.8 million tonnes in 2006-07[75] (Figure 10b). Each Australian family contributes enough rubbish each year to fill a three-bedroom house from floor to ceiling[76].

Annual waste generation in Australia has recently been estimated at 2,140 kg per person[75]. This includes waste disposal plus recycling plus waste energy recovery.

Despite a predicted decrease in per capita waste generation by 2023 (Figure 10a)[77], total waste generated is still predicted to increase overall (Figure 10b)[77].

"Each Australian family contributes enough rubbish each year to fill a three-bedroom house from floor to ceiling."

In 2004, the average Australian household wasted $1,226 on items purchased but unused in that year[78]. Wasteful consumption amounts to over $10.5 billion dollars annually spent on goods and services that are never or hardly ever used. This is equivalent to two-thirds of Australian government expenditure on hospital services in 2012-13[79].

Impacts **For particles smaller than 2.5 micrometres, there is sufficient evidence to conclude that long-term and short-term exposure causes illness and death from cardiovascular conditions, and is likely to cause respiratory conditions. There are additional health effects from exposure to particles of 10 micrometres that are independent of those caused by smaller particles. This includes evidence of causal relationships between short-term exposure and cardiovascular and respiratory effects and mortality[80].**

Air Pollution

Ambient air quality and air pollution management in Australia's urban centres is generally good, but the pressures of air pollution on nature and human health are still a matter of serious concern.

Airborne particulate matter, made up of tiny pieces of solids and liquids, is a complex mixture of substances that are derived from a range of sources and processes. Natural sources of these particles include wind erosion, bush fires and the production of marine aerosol. Human-made sources involve fuel combustion (e.g. power generation, domestic wood heaters, vehicles), mechanical suspension (e.g. lifting of dust from roads at coal mines), or abrasion and fragmentation (e.g. tyre wear). Industrial activities may involve combustion processes, mechanical processes or chemical processes[80].

In NSW the most important source of particulate matter is coal mining. Domestic/commercial sources (notably wood heaters) are the most important in Tasmania. In Victoria, the largest sources are wood heaters, industry and diesel vehicles. In all jurisdictions emissions of airborne particulate matter smaller than 10 micrometres are projected to increase by up to 65% between 2011 and 2036[80].

"Air pollution causes 3,000 deaths a year, more than twice the national road toll."

Altered Fire Regimes

Bushfires have been part of the Australian environment since before human settlement of the continent. Some Australian flora and fauna have evolved to coexist with bushfires, and in the case of eucalypt forest, fire forms an integral part of its regeneration cycle. Aboriginal arrival to Australia resulted in changes in the incidence of bushfires[82].

Australia's fire regimes—the frequency, intensity and timing of bushfires—have major consequences for vegetation distribution, composition and condition, and soil bareness and erosion[34].

With European settlement, major changes to patterns of fire occurred in Australia. Burning has changed in frequency, timing, location, and intensity, resulting in a range of ecological responses including changes in populations and habitats of fire-sensitive species, structural and diversity changes in some habitats, and invasion of fire-promoting alien species such as grasses[82].

Impacts **Airborne particulate matter has adverse impacts on ecosystems, agriculture, visibility, cultural heritage and climate. For example, large accumulations of particles on leaves may affect the drought tolerance of trees, potentially leading to regional tree dieback. The largest effects of human-made aerosols on ecosystems are likely to be indirect, such as increases in sulphur and nitrogen deposition, leading to the acidification and eutrophication of natural ecosystems[80].**

Impacts **The health costs of air pollution in Australia are estimated to be in the order of $11.1 billion to $24.3 billion annually, solely as a result of mortality[80]. It is estimated that urban air pollution accounts for up to 1% of deaths and illness in Australia, with some 3000 deaths attributable to this cause annually[34], more than twice the national road toll[81].**

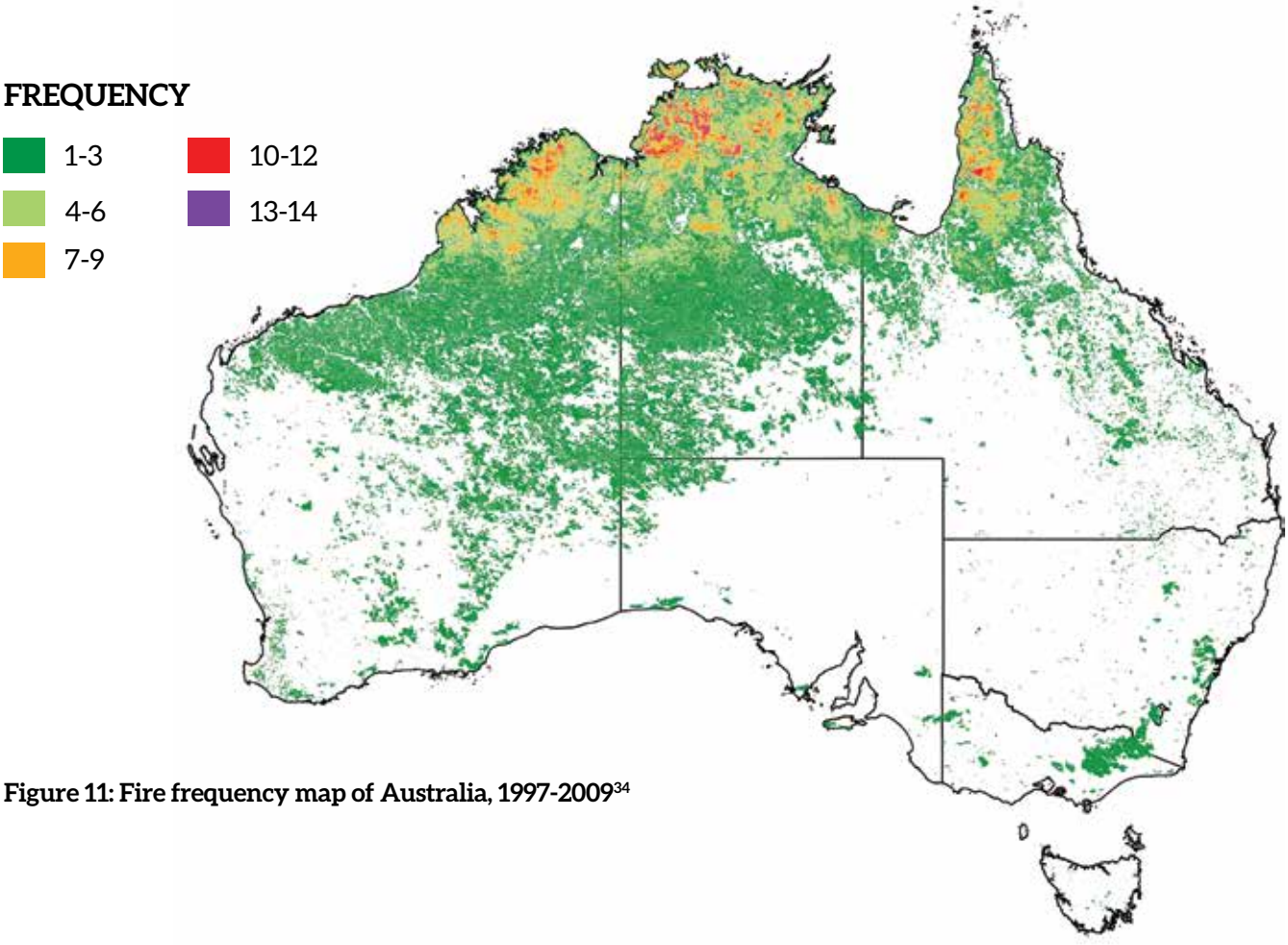


Figure 11: Fire frequency map of Australia, 1997-2009[34]

"Uncontrolled fires continue to pose a serious threat to human life, property, community assets and forest values including water, wood and biodiversity. This risk will likely grow as Australia warms."

Fire is critical to the maintenance of biodiversity and ecological processes and contributes to the distinctive nature of Australian forests and woodlands. At the same time, uncontrolled fires pose a serious threat to human life, property, community assets and forest values including water, wood and biodiversity. Large-scale high intensity fires, often referred to as firestorms, have periodically inflicted major losses on the community since European settlers arrived in Australia. Inappropriate fire regimes also threaten ecological values[83].

Estimates of the extent of fires in Australia suggest that an average of 387,867 km^2 of savanna and temperate grassland was burnt annually between 1990-1999[84]. This is approximately 5% of the total land area of Australia. About 300,000 km^2 per year was burnt or fire affected in northern Australia (Figure 11)[82].

Current fire management incorporates a very diverse range of objectives (e.g. protection of human life and wellbeing, conservation of biodiversity, water and catchment management, carbon dynamics) that do not always harmonize[85].

A key approach to protecting people and their assets is fire suppression and fuel management. Biodiversity conservation emphasizes differing aspects of fire regimes (fire intensity and fire frequency). Fire management in coming decades will also be increasingly used to optimize carbon benefits, through reduced emissions of greenhouse gases (GHG) and enhanced carbon sequestration[85].

Climate change has the capacity to fundamentally alter global fire regimes. Fire activity may increase due to rising temperatures and decreasing humidity. Alternatively, fire activity may decrease if ecosystem productivity decreases due to declining rainfall. Climate change will also interact with other drivers, such as the spread of alien species, to alter fire regimes. Such changes in fire regimes may lead to gradual changes in ecosystem composition and structure, or the changes may be rapid and transformational[85,86], putting people, forest resources and ecosystems at risk[87].

While increases in the frequency of severe fire weather across much of Australia are very likely, the responses of vegetation and the dynamics of biomass accumulation and fuel availability are much harder to predict with current knowledge, so predictions about changes in fire frequencies and intensities are uncertain[88,89].

Impacts **Bushfires in 1983, 2003, 2006 and 2009 burned significant areas of forest and farmland in southern Australia, resulting in loss of human lives, farm infrastructure and livestock[90].**

Impacts **By 2050, it is estimated that increases in bushfire damage in south-eastern Australian ecosystems due to climate change will have cost an additional $1.5 billion per year, over and above the costs if no climate change took place[58].**

Water Use

Australia is a dry continent. As a nation, we could not exist without taking water out of the natural environment and using it for domestic and productive purposes.

Water resources are fully allocated or over allocated in the populated south-east and south-west, even in years of average rainfall[91]. This over allocation causes severe stress on nature, particularly in drought years such as the 'big dry' in southern Australia from 1997 to 2009.

Total water extracted from the environment in Australia was almost 70,000 GL in 1997, declining to just under 60,000 GL in 2009 as a result of severe drought and water restrictions, rising again to almost 75,000 GL in 2012 (Figure 12)[92–97].

"Total water extraction from the environment in Australia between 1997 and 2012 has remained relatively constant, at about 150 times the volume of Sydney Harbour each year."

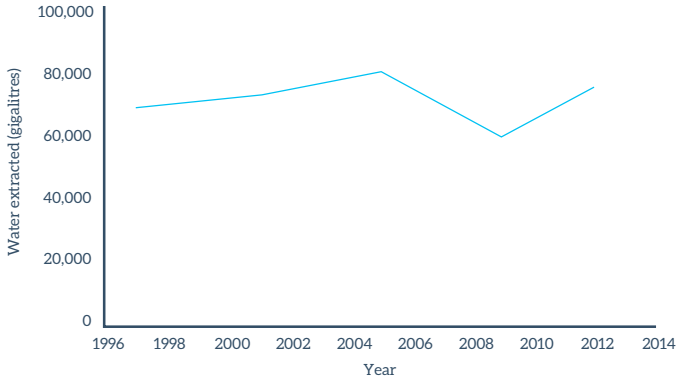


Figure 12: Total water extracted from the environment in Australia (gigalitres), 1997-2012[92-97]

In 2011-12, 74,925 GL of water was extracted from the environment and used within the Australian economy, 4% higher than in 2010-11. Increase in agricultural water use by more than 2,000 GL contributed most strongly to this increase (Figure 13)[97].

Impacts **Current bushfire damage costs associated with the Victorian agricultural and timber industries have been used in models exploring future economic impacts of climate change on those industries. Resulting total losses are projected to be as much as $71 billion in agricultural losses by the end of the century, and $142 billion in timber losses in the same period as a result of increased fire under climate change scenarios[87].**

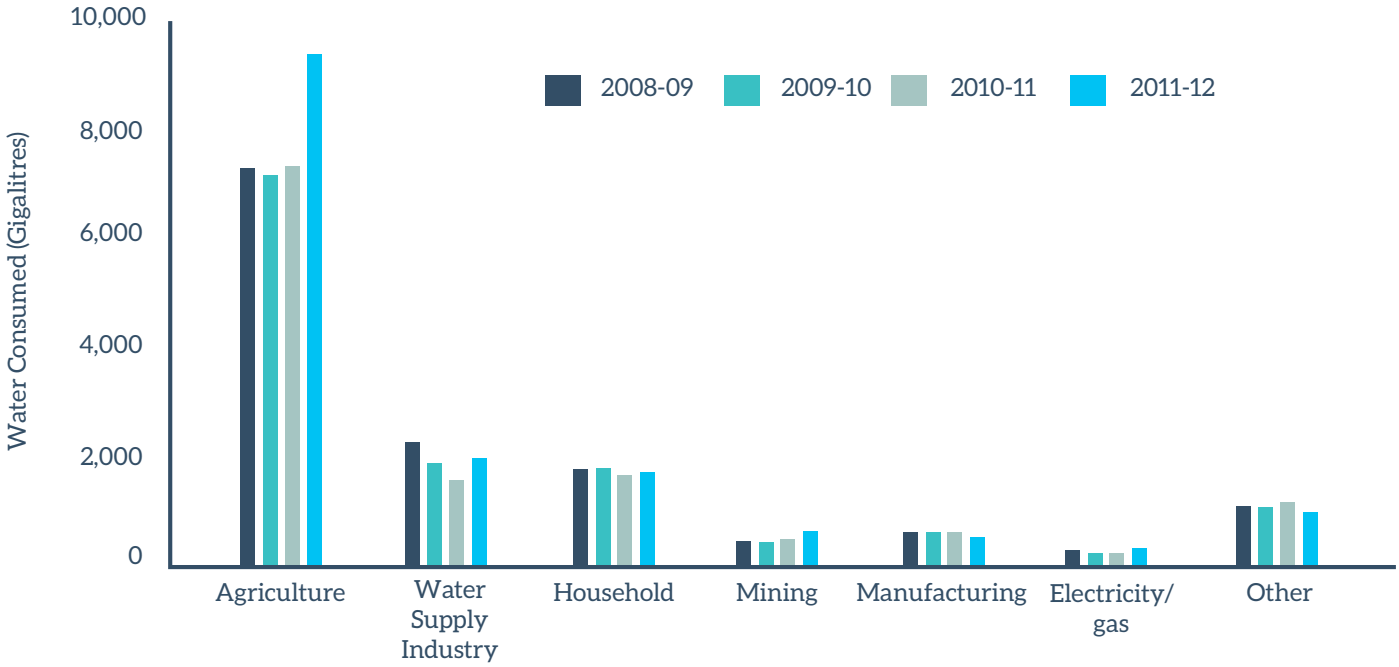


Figure 13: Water consumption by industry and household (gigalitres), 2008-2012[97]

The long term trend in irrigated agriculture shows a relatively steady increase in area irrigated across Australia since the 1920s, despite some gaps in the data. Irrigated area declined around the period of intense drought around 2006-07, but is increasing again (Figure 14), covering more than two million hectares in 2012[97].

Most of the ongoing impacts on Australia's inland water environments are legacies of our historical land use, pest and weed introductions, and water resource development.

In northern and remote Australia, human impacts have not significantly affected ecosystem function; in most southern regions, inland water ecological processes have changed substantially since European settlement and ecosystem function is significantly affected. The populations of many native freshwater species have declined[34].

Reported groundwater use in Australia increased by approximately 60% between 1983–84 and 1996–97, from 2,600 GL/year to 4,200 GL/year[99]. This was caused not only by an increase in population, but by people switching to groundwater from surface-water sources that had become more limited and more tightly regulated.

In addition, almost one-third of the 851 nationally important wetlands in Australia in 2001 had threatened water regimes[100].

Impacts **Available water resources in Australia's populated areas are likely to decline further as a result of climate change[101], with relative declines in stream flow about three times those in rainfall[102]. Declines in water availability per person will be much larger because of increasing population.**

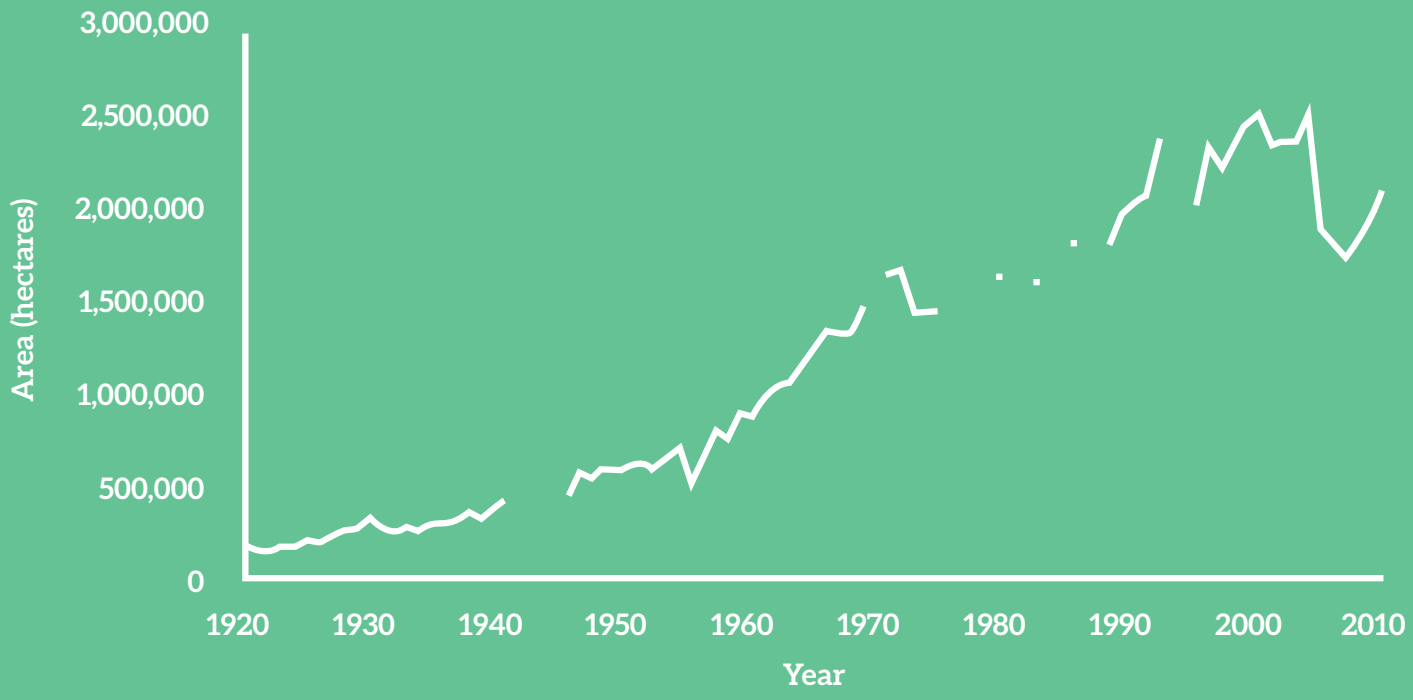


Figure 14: Area of Australia irrigated (hectares), 1920-2012[97]

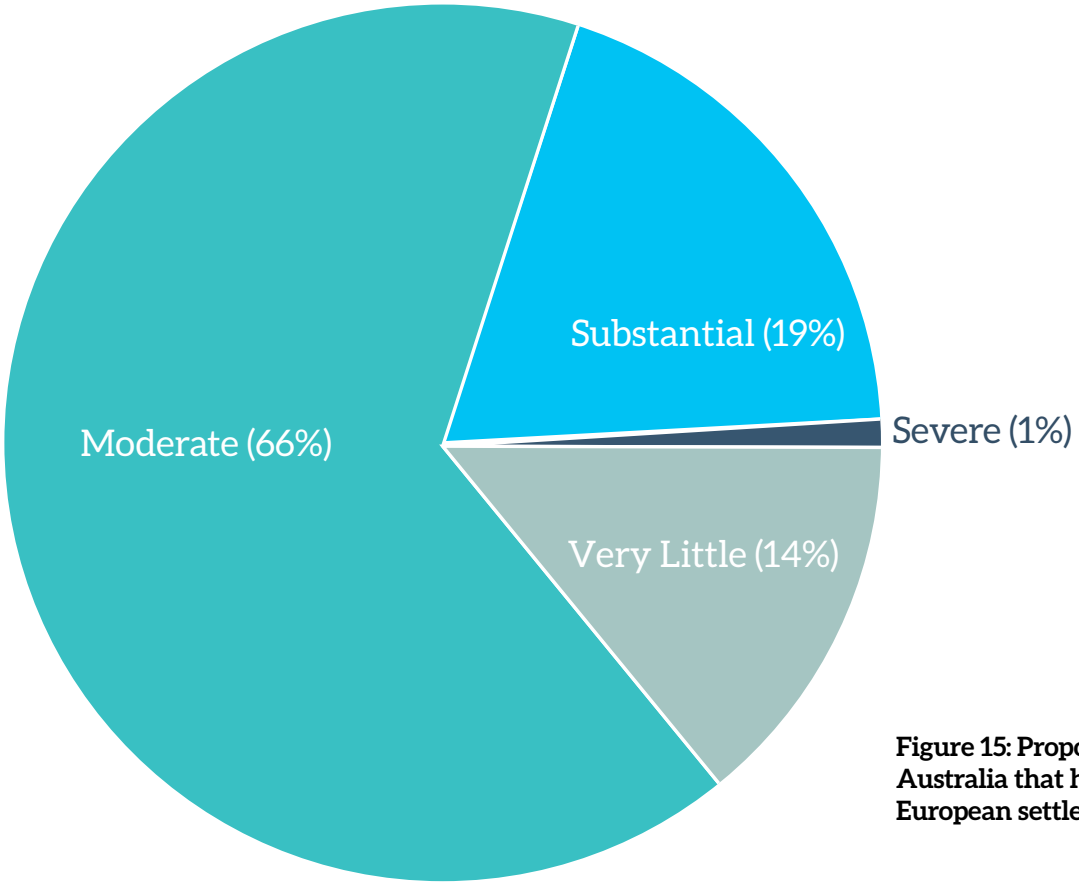


Figure 15: Proportion of river length in Australia that has been modified since European settlement[98]

Stock Animals

Livestock grazing is the most extensive of Australia's land uses, practised across 55% of the continent[34,44].

Pressures of grazing stock animals on nature include direct and indirect influences on soil erosion, soil carbon rundown, soil acidification processes, greenhouse gas emissions, water quality, habitat degradation and destruction.

The number of grazing livestock in Australia has remained relatively constant since 1973, as measured by slaughtered cattle and sheep.

The quarterly trend for livestock slaughter in Australia between June 1973 and June 2014 shows the number of cattle (including calves) slaughtered in Australia hovered just above two million, with a spike in the late 70s of close to four million (Figure 16)[103]. The number of sheep (including lambs) slaughtered in the same period has fluctuated more widely between about six million and nine and a half million, with the average sitting around 7.5 million (Figure 16)[103].

"About 8 million cattle and 30 million sheep are slaughtered every year."

When records for live exports are added from March 1988, cattle numbers increase by an average of about 50%, and sheep numbers increase by an average of about 2%. For example in 2013, approximately 1.97 million live cattle

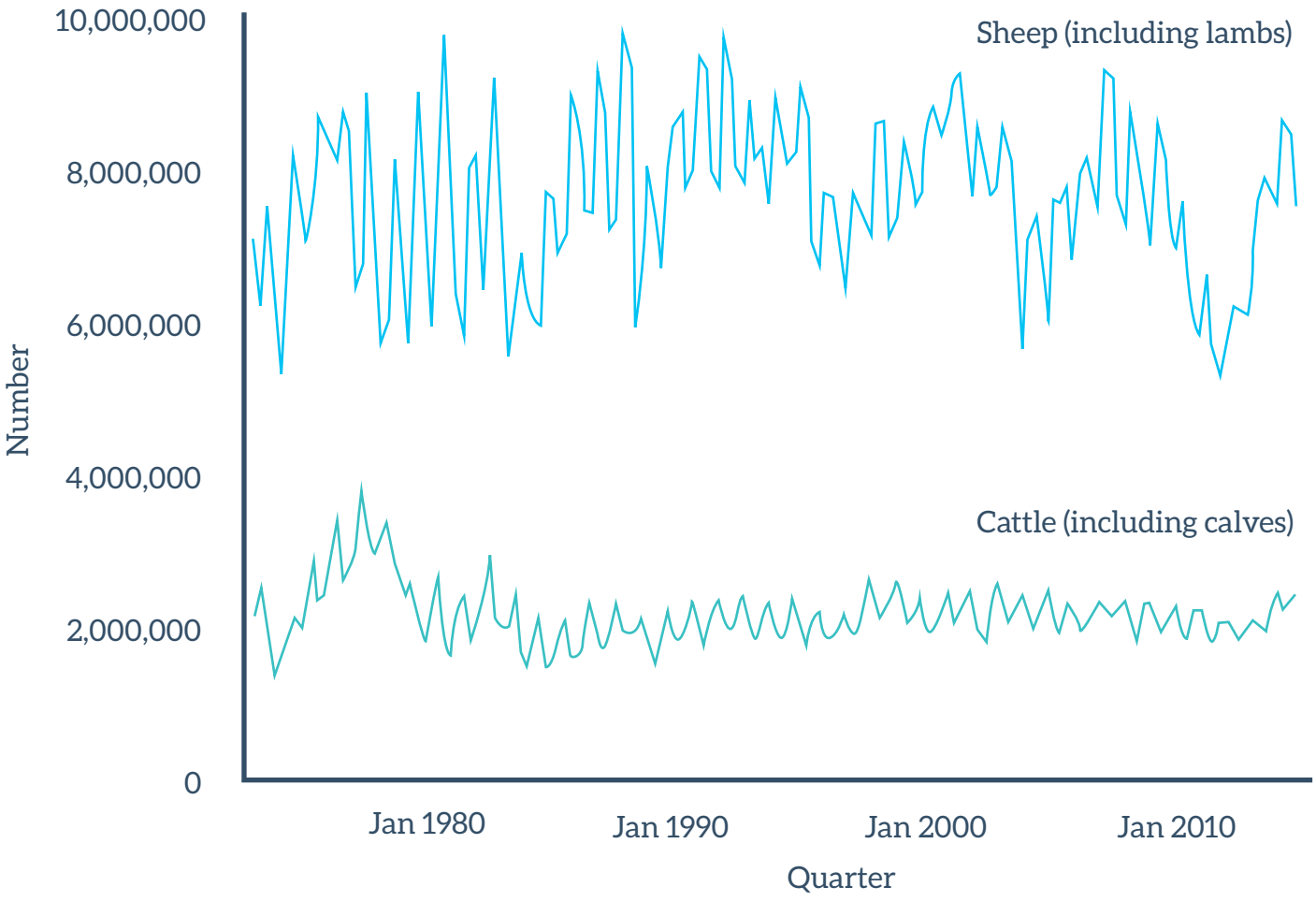


Figure 16: The number of cattle and sheep slaughtered in Australia, quarterly for 1973-2014[103]

and 727,000 live sheep were exported from Australia[103]. These figures are in addition to the 9 million cattle and 31.5 million sheep slaughtered in the same year.

The numbers of chickens produced in Australia has grown substantially since 1973, as measured by slaughtered animals (Figure 17). Pig production in the same period has fluctuated significantly with numbers in 2014 similar to peak numbers produced in the 1970s (Figure 17)[103].

In 2011, the number of chickens slaughtered in Australia per year exceeded half a billion for the first time, and numbers have continued to climb. About 3.5 million pigs were slaughtered in 2013[103].

Prior to European settlement, Australian ecosystems had not experienced heavy grazing by ungulate herbivores, and the introduction of large herds of cattle and sheep had a catastrophic impact on soils, landscape processes, vegetation and fauna, especially in the mid- to late 1800s[104].

In many places, this degradation has stabilized over the past century, after the initial depletion in natural capital. Original soils have been transformed, and grazing-sensitive species depleted, to create degraded but potentially stable ecological states under ongoing grazing[104].

Furthermore, stocking levels in native vegetation are now lower than those that occurred in the late 1800s in many regions. Nevertheless, grazing by domestic livestock is still a major degrading activity in many Australian ecosystems[104].

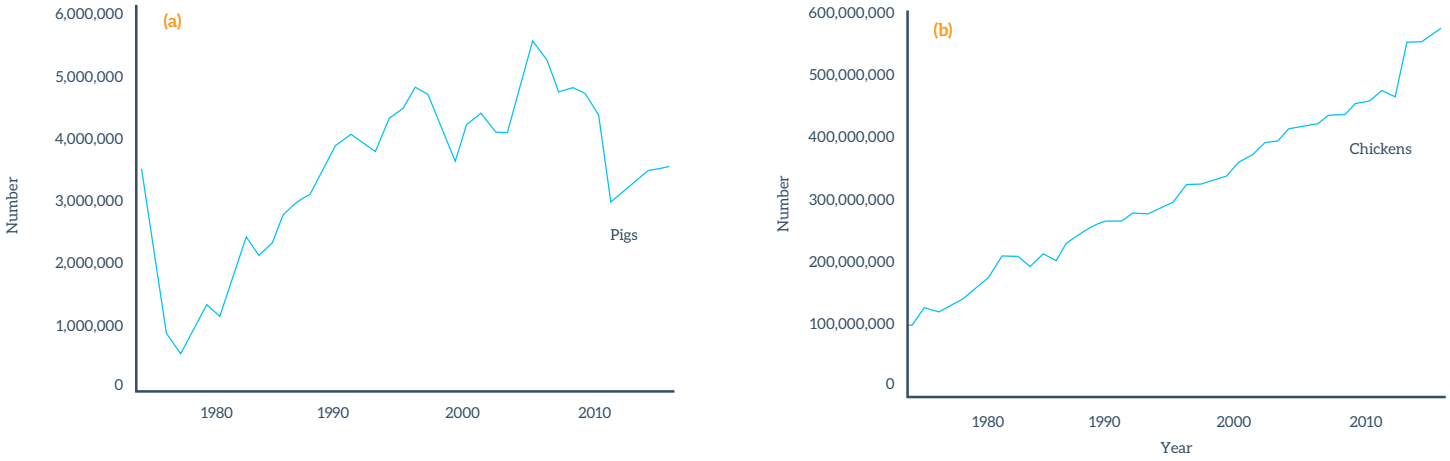
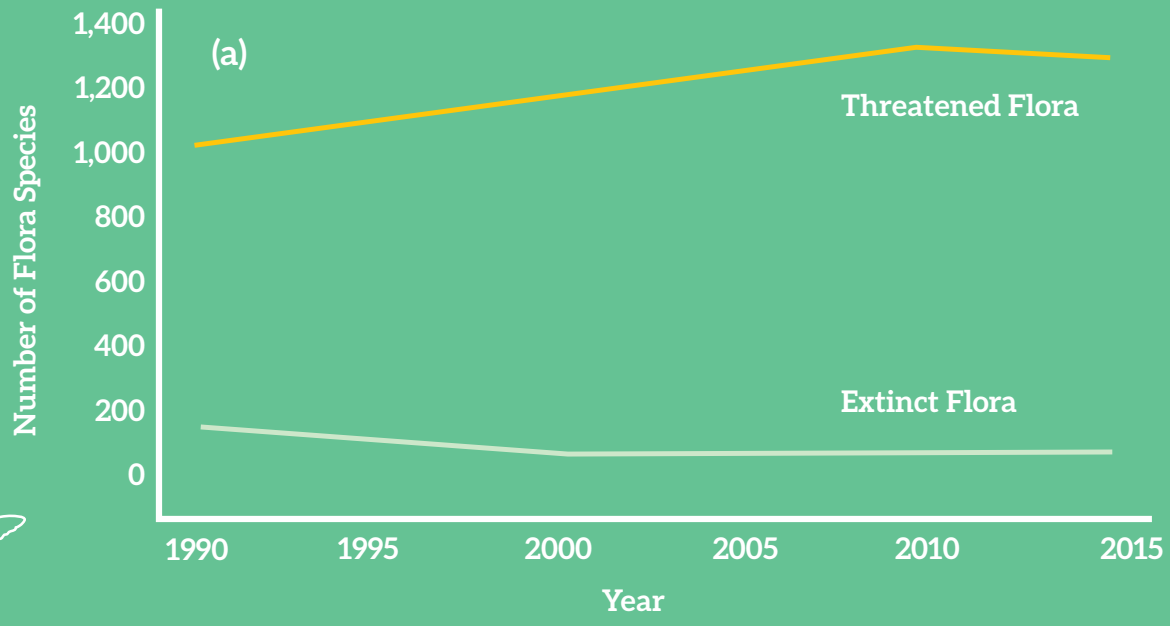
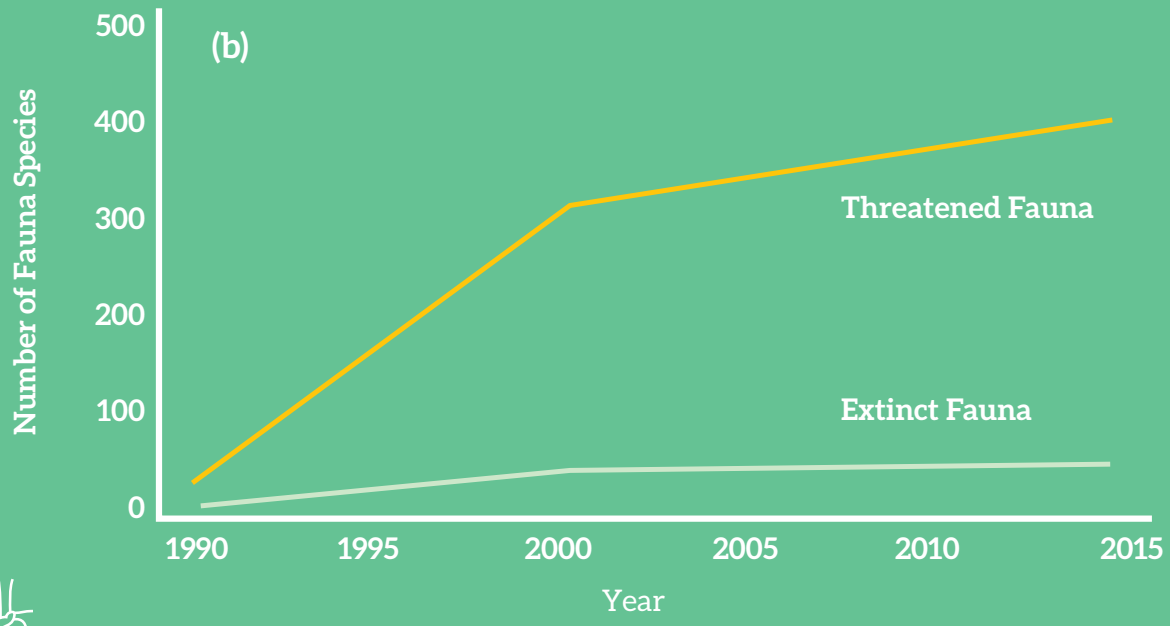
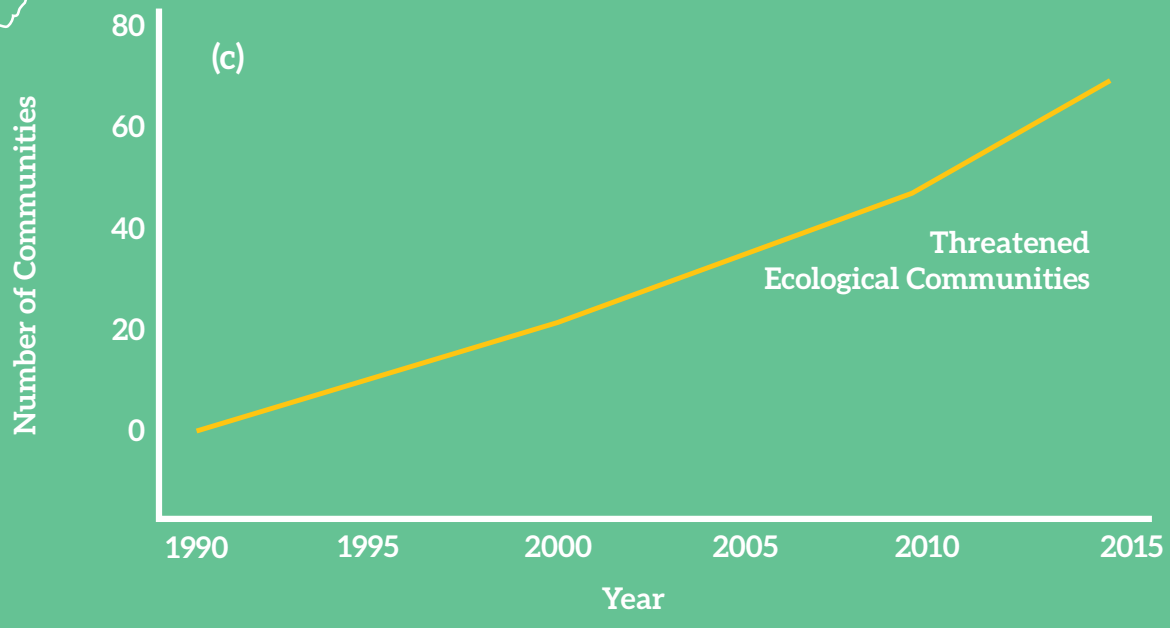


Figure 17: The number of (a) pigs and (b) chickens slaughtered in Australia, yearly for 1973-2014[103]

Impacts **Grazing by domestic livestock and associated land management activities have greatly degraded many Australian ecosystems[104]. The livestock sector increasingly competes for scarce resources, such as land, water, and energy, and has a severe impact on air, water and soil quality[105].**


(a)
Number of Flora Species
1,400
1,200
1,000
800
600
400
200
0
Threatened Flora
Extinct Flora
1990
1995
2000
2005
2010
2015
Year


(b)
Number of Fauna Species
500
400
300
200
100
0
Threatened Fauna
Extinct Fauna
1990
1995
2000
2005
2010
2015
Year


(c)
Number of Communities
80
60
40
20
0
Threatened
Ecological Communities
1990
1995
2000
2005
2010
2015
Year

CONDITION

The pressures exerted by society may lead to unintentional or intentional changes in the condition or state of nature.

Forty indicators to establish baseline measures on the condition (health) of nature were proposed in 2000[42]. Today meaningful national trends for 28 of these indicators cannot be established[29,34]. Of the remaining 12 indicators, 5 show improving trends (ultraviolet radiation levels at the surface and 4 air quality indicators), 4 are stable (stratospheric ozone concentration, river health and two air quality indicators) and 3 show worsening trends (greenhouse gas atmospheric concentrations, threatened species and ecological communities, and sea level)[29]. Similar data gaps are evident in each of the state and territory jurisdictions. Across eight jurisdictions and 40 indicators (320 in total), 16 are improving (5.0%), 28 are stable (8.8%), 18 (5.6%) are worsening, and 6 coastal and marine indicators are not applicable (ACT, 1.9%). Meaningful trends for the remainder (252, or 78.8%) cannot be established[29].

Some key trends in the condition of nature are presented below, drawing on a range of scientific reports.

Biodiversity

Biodiversity is the term used to encompass the variety of all living organisms on Earth, including their genetic diversity, species diversity and the diversity of marine, terrestrial and aquatic ecosystems, together with their associated evolutionary and ecological processes.

Australia is known as a 'megadiverse' country for biodiversity, amongst a list of 17 countries that harbour the majority of the Earth's species. Between 500,000 and 600,000 species of animals and plants currently inhabit the Australian landmass, but only around 25% have been formally named. The remaining unnamed 75% are mainly small insects, nematodes, fungi and micro-organisms[106].

Australia's biodiversity has been modified since European settlement by land clearing, habitat fragmentation, biological invasions, burning, harvesting of species from land and sea, and climate change[106].

"At least 39 plants and 55 animals are thought to have become extinct since European settlement."

There are surprisingly few scientific data sets on how Australian biodiversity is faring; however, direct measures, such as numbers of extinct and endangered species, and indirect measures, such as extent of vegetation cover, show that biodiversity in both terrestrial and aquatic environments is declining. Australia's marine environments are in relatively good condition, except near cities[106].

Evidence from monitoring suggests that pressures on Australian biodiversity are increasing, despite the investments in management[106].

Numbers of plants, animals and ecosystems that are threatened with extinction or destruction have increased since national records began in 1990. At least 39 plants and 55 animals are thought to have become extinct since European settlement in Australia. A further 1,259 plants, 396 animals and 67 ecological communities are listed as threatened by the Australian Government (Figure 18)[68].

Nearly half of Australia's 5,815 terrestrial ecosystems, covering an area of approximately 257 million hectares, meet international criteria for threatened ecosystems as a result of land clearing and degradation. This contrasts with just 67 ecological communities recognized as threatened under national legislation[46].

Ecosystems near large population centres and on prime agricultural land have experienced the greatest declines; hence, most endangered species occur along the eastern coastline and in south-eastern and south-western Australia[106].

Of the 1,600 Australian species of plants and animals classified as rare or endangered, most are concentrated along the eastern seaboard and in southern and south-western Australia (Figure 19)[106].

Figure 18: Numbers of threatened and extinct Australian flora (a), fauna (b) and ecological communities (c), 1990-2014[68,107,108]

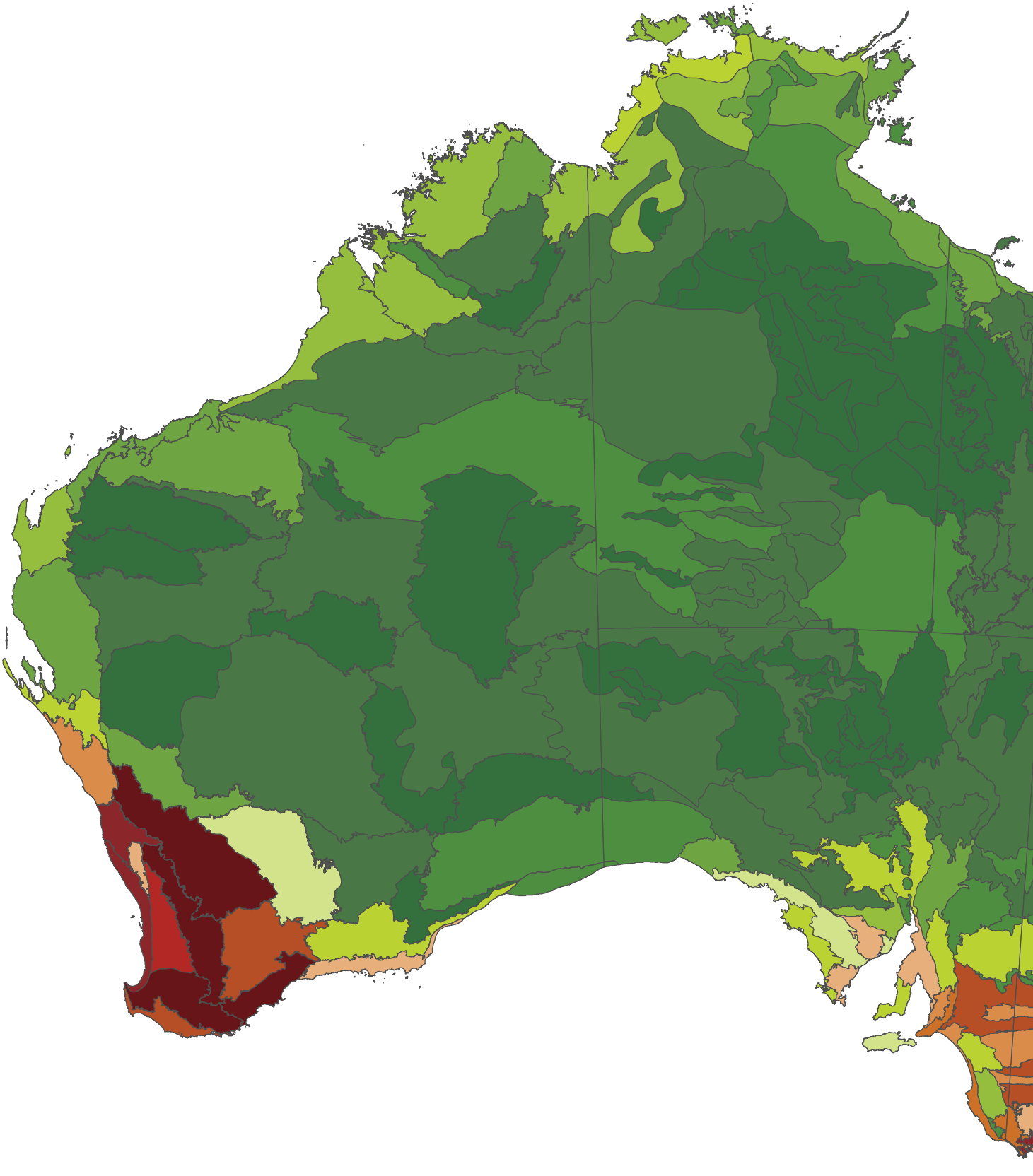
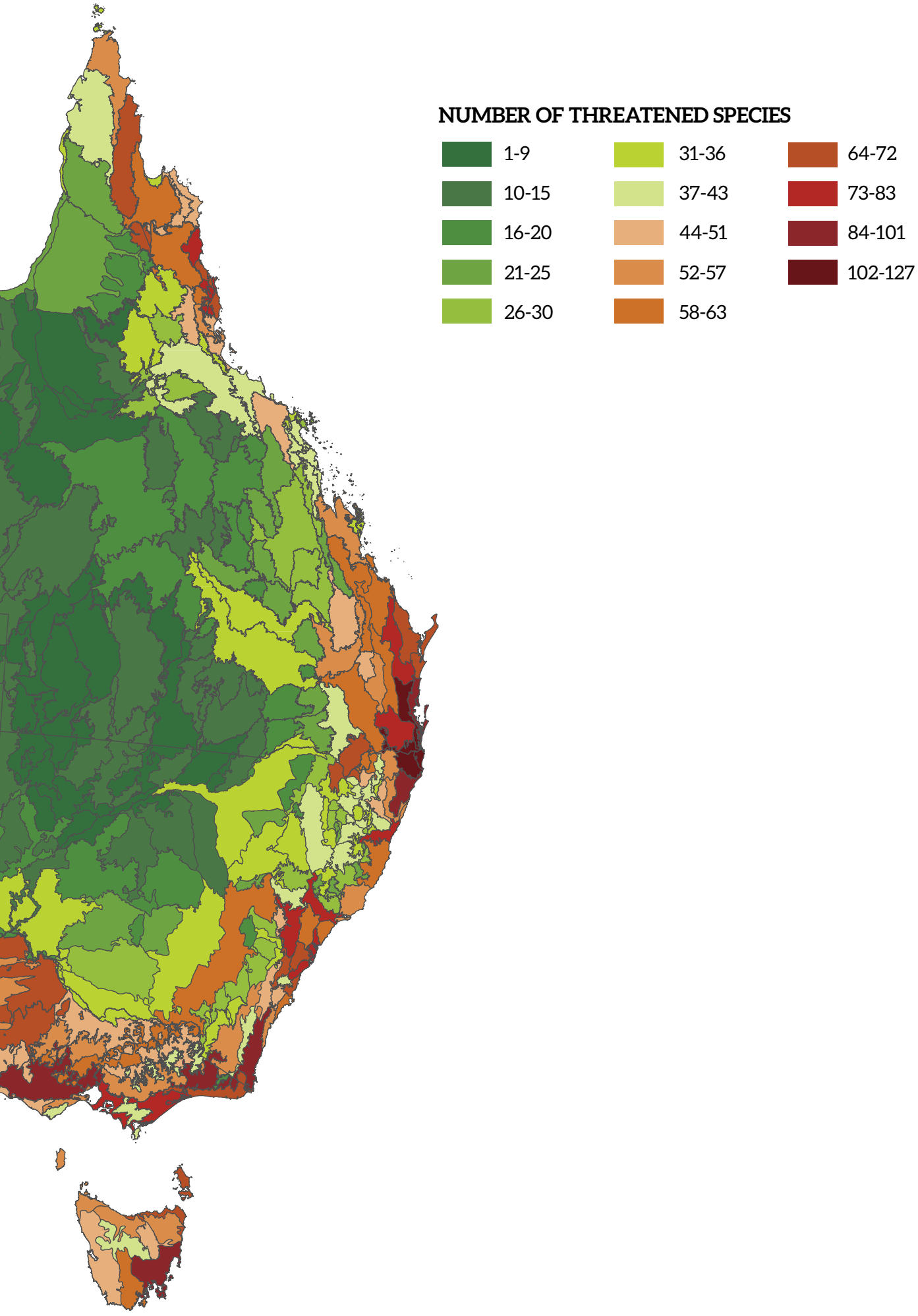


Figure 19: The number of species by bioregion across Australia currently listed as threatened by the Australian Government[106]


NUMBER OF THREATENED SPECIES
1-9
10-15
16-20
21-25
26-30
31-36
37-43
44-51
52-57
58-63
64-72
73-83
84-101
102-127

Impacts **There is now unequivocal evidence that biodiversity loss reduces the efficiency by which nature captures biologically essential resources, produces biomass, decomposes and recycles biologically essential nutrients[109]. For example, loss of genetic diversity within crop species impacts the yield of commercial crops, loss of tree species diversity impacts production of wood in plantations, loss of plant diversity in grasslands impacts the production of fodder for grazing animals, loss of diversity of fish impacts stability of fisheries yields, plant pathogens such as viral and fungal infections are more prevalent in plant communities with lower diversity[109].**

Air Quality

Ambient air quality and air pollution management in Australia's urban centres is generally good, but the impact of urban air quality on health is still a matter of serious concern.

Since the 1980s, there has been a steady decline in some of the key air pollutants such as ammonia, carbon monoxide, lead and sulphur dioxide as well as the oxides of nitrogen and volatile organic compounds[34].

"The health costs of air pollution in Australia are estimated to be in the order of $11.1 billion to $24.3 billion annually."

In most jurisdictions there has also been a reduction in overall annual particulate matter concentrations between 2003 and 2012, although in some jurisdictions the concentrations have not decreased significantly[80]. However, projections show that particulate matter emissions are likely to increase under a business-as-usual scenario, in spite of controls on emissions from several sectors[80].

Land

Two centuries of European land use has left a legacy of widespread transformation and disturbance of Australia's native ecosystems[44]. This transformation has occurred through land clearing and modification for agriculture and other developments, and the associated changes of soil acidification, salinity and erosion. Approximately 15% of the continent has been cleared or severely modified, with this modification concentrated in the intensive land use zone of southeast and southwest Australia. Extensive grazing now covers approximately 55% of the continent and intensive cropping and improved pastures approximately 10%[44].

The areas targeted for agriculture and urbanization tend to be the most productive, and often the most biodiverse. Much of the remaining native vegetation cover is severely fragmented into small patches, especially in south eastern Australia, with roads, urban development, agriculture and plantations isolating existing fragments to the point that much of their biodiversity potential is severely compromised[110].

Approximately 30% of Australia's land mass was covered by 'forest' at the time of first European colonization in the late 18th century. Australia's native forests now cover 15% of total land area—this represents a total loss of 41.4%

Impacts **Every year, urban air pollution accounts for up to 3,000 deaths in Australia, 1% of all deaths annually[34] and more than twice the national road toll[81].**

Impacts **In 2001, the National Land and Water Resources Audit estimated that soil acidity affected 50 million hectares of surface layers and 23 million hectares of subsoil layers of Australia's agricultural zone. The estimated annual value of lost agricultural production due to soil acidity was $1.585 billion, about eight times the estimated cost of soil salinity at that time[34].**

of original forest cover since European settlement due to land clearing, 2.9% regrowth and 5.2% lost to non-clearing events such as bushfire and disease[46]. It is anticipated that cover of virgin forests will continue to decline.

Of the 2.93 million km^2 of wilderness in Australia (38% of total land area, mostly in the north and west), only 14% was protected in 2000. This value increased marginally to 19% by 2006 as the size of the Reserve System itself increased by 37%[111].

"The condition of terrestrial habitats continues to degrade faster than restoration efforts can respond."

The significance of these figures is illustrated through an assessment of 'human influence' across Australia, a measure of direct human influence on terrestrial ecosystems using available data sets on human settlement, access, landscape transformation and electric power infrastructure (Figure 20)[112]. Human influence values range from 0 to 64, where zero represents no human influence and 64 represents maximum human influence possible.

Oceans

More than half of the coral cover of the Great Barrier Reef has been lost since 1985. Two-thirds of that decline has occurred since 1998. The rate of decline from 2006-2012 was consistently above 1.4% per year[114]. Tropical cyclones, coral predation by crown-of-thorns starfish (COTS), and coral bleaching accounted for 48%, 42% and 10% of the respective estimated losses. However, in the relatively pristine northern region of the reef, there was no overall decline. In the absence of COTS, coral cover would increase at 0.9% per year, despite ongoing losses due to cyclones and bleaching. Thus reducing COTS populations by improving water quality and developing alternative control measures could prevent further coral decline and improve the outlook for the Great Barrier Reef. Such strategies can, however, only be successful if climatic conditions are stabilized, as losses due to bleaching and cyclones will otherwise increase[114].

"More than half of the coral cover of the Great Barrier Reef has been lost since 1985. Remaining coral cover is predicted to be lost with two degrees warming through climate change."

The Great Barrier Reef is generally seen as the best example of Ecosystem Based Management, Marine Protected Area design and implementation, Integrated Marine Planning and to some extent Integrated Coastal

Impacts **16% of Australian cropping area is likely to be affected by water table-induced salinity, 67% of the area is subject to transient salinity and other root-zone constraints, costing the farming economy about A$1330 million per annum, in lost opportunity[113].**

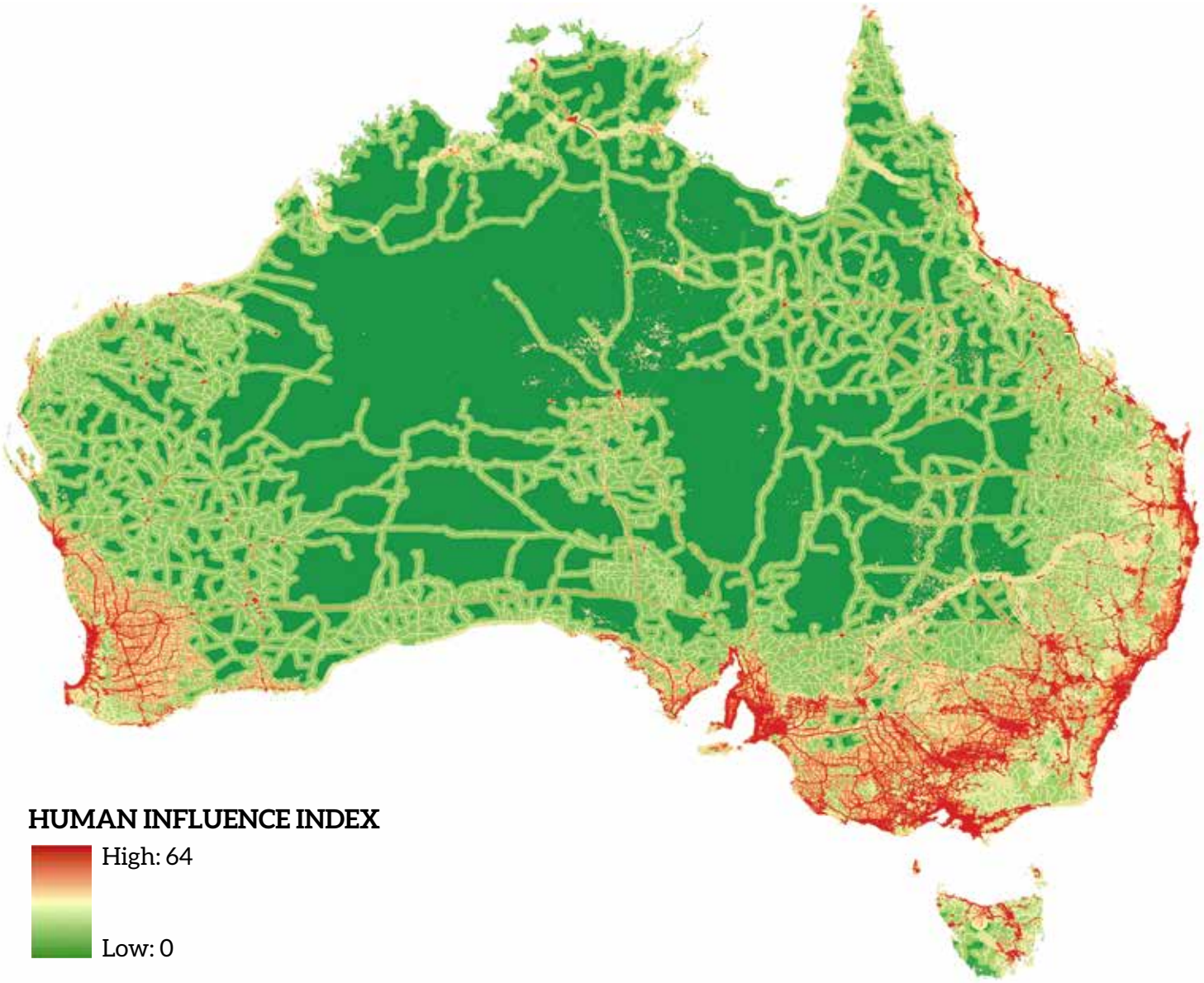


Figure 20: Map of human influence on Australia's land area[112]

Zone Management. Despite this degree of management, coral cover is declining rapidly and the system is seen to have many other declining values[115].

Even with the recent management initiatives to reduce threats and improve resilience, the overall outlook for the GBR is poor, has worsened since 2009 and is expected to further deteriorate in the future[115].

Freshwater

Australia has no national-level program for monitoring and reporting on aquatic ecosystem condition[34].

Regulation of rivers in Australia, including extraction of water and the installation of structures such as dams and weirs, has dramatically altered seasonal flow patterns and reduced connectivity between rivers and their floodplains. The impacts of catchment land uses include both changes

Impacts **The economic contribution of tourism, recreation, commercial fishing and scientific research and management related to the Great Barrier Reef is estimated at more than $7 billion in direct expenditure and more than $5.6 billion in value-added contributions. There are nearly 70,000 jobs associated with these industries[116]. With total coral cover loss on the reef, these economic contributions could also be lost.**

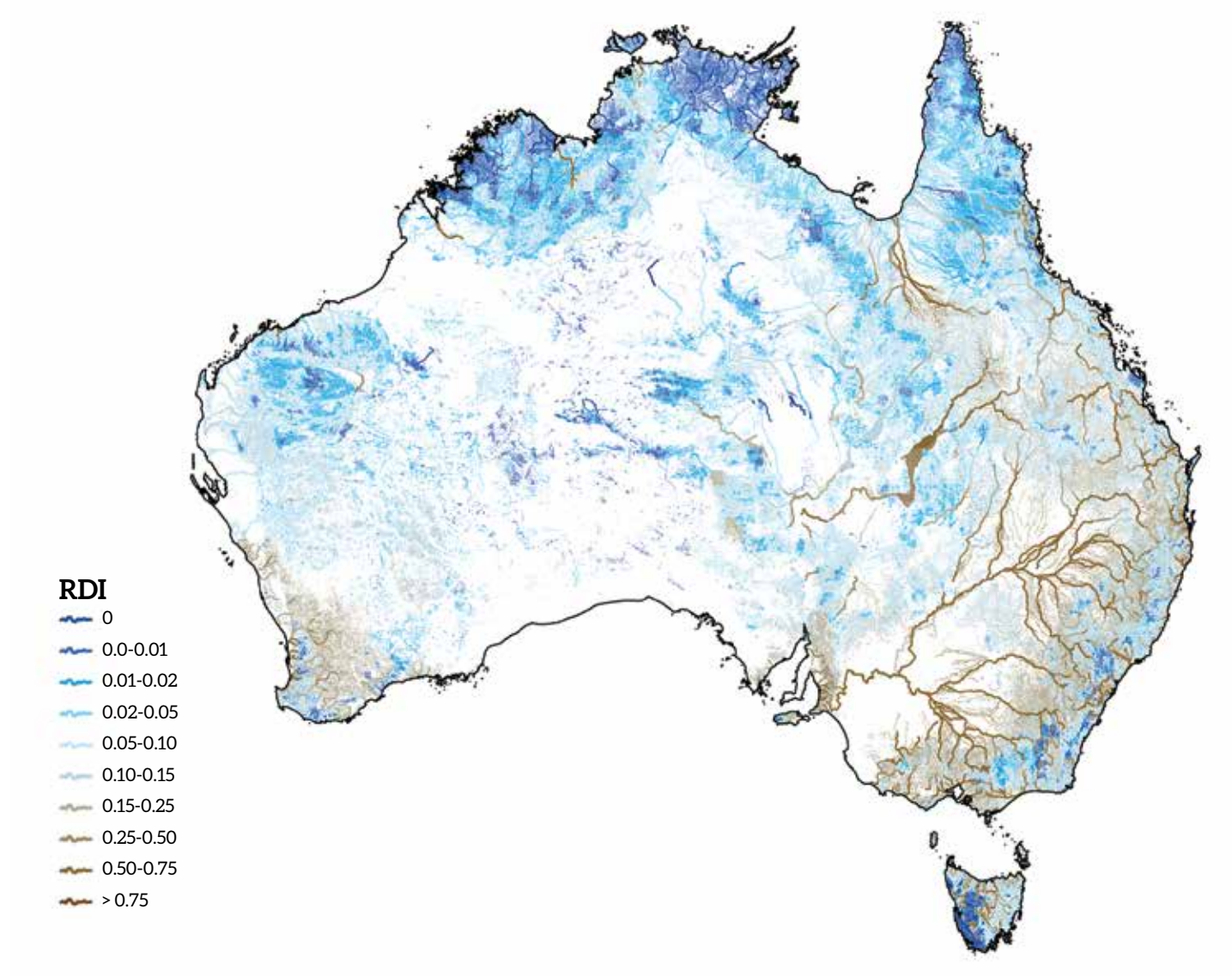


Figure 21: National river disturbance index (RDI)[118,119]

to water quality from pollutants and alteration to flow regimes, for example as a result of increased run-off following the clearing of native vegetation. These impacts are cumulative and often synergistic and have serious consequences for aquatic fauna, including the loss of habitat, fragmentation and isolation of populations and direct mortality[117].

"More than 85% of rivers in Australia have been modified due to land clearing, irrigation, dams and weirs and other development pressures."

The national river disturbance index (RDI) (Figure 21)[118,119] provides a picture of human impacts on rivers and streams along a continuum from near-pristine (RDI values close to 0) to severely disturbed (RDI values close to 1). Index values close to the undisturbed end of the continuum are rare, especially among large rivers. Most of the least disturbed streams are predicted to lie within the monsoonal tropical north or the arid/semi-arid centre of the continent[117].

In a subsequent assessment of 210,000 km of rivers across Australia, less than 15% of assessed river length remains largely free of modification due to changes in catchment disturbance, habitat, hydrological disturbance, nutrients and suspended sediment. Even in national parks, rivers are affected by dams and flow modification, grazing, mining and resort development[98].

Approximately one quarter of the river length assessed has lost at least 20 percent of the different kinds of aquatic invertebrates that would be expected to occur under natural conditions[98].

Imagine what our nation would be like in 10 years' time if we fixed the challenges facing nature.

Photo © Kerry Trapnell

Australia's Food Bowl

River disturbance in the Murray-Darling Basin, Australia's most significant agricultural region, is worse than most other areas of the country (Figure 21).

With a catchment of more than a million square kilometres, the Murray–Darling Basin is one of the world's largest drainage systems, accounting for 70% of irrigated agriculture and more than 40% of the gross value of agricultural production nationally[101].

In a comprehensive assessment of the health of river ecosystems in the 68 zones of Murray–Darling Basin, only one zone was rated in Good health. Eight zones were rated in Moderate health. Most zones were rated as Poor (38 zones) or Very Poor (21 zones) (Figure 22). In some cases, drought is likely to have compounded human-induced pressures within the Basin[101].

Impacts The Murray-Darling Basin produces a significant proportion of Australia's agricultural products, including 49% of Australia's irrigated produce, nearly 100% of Australia's rice, 94% of Australia's cotton, 74% of Australia's grapes, 60% of Australia's hay and 59% of Australia's production from sheep and livestock[122]. The gross value of agricultural production exceeds $18.6 billion annually. The condition of freshwater ecosystems in the region is critical to ongoing agricultural productivity[109].

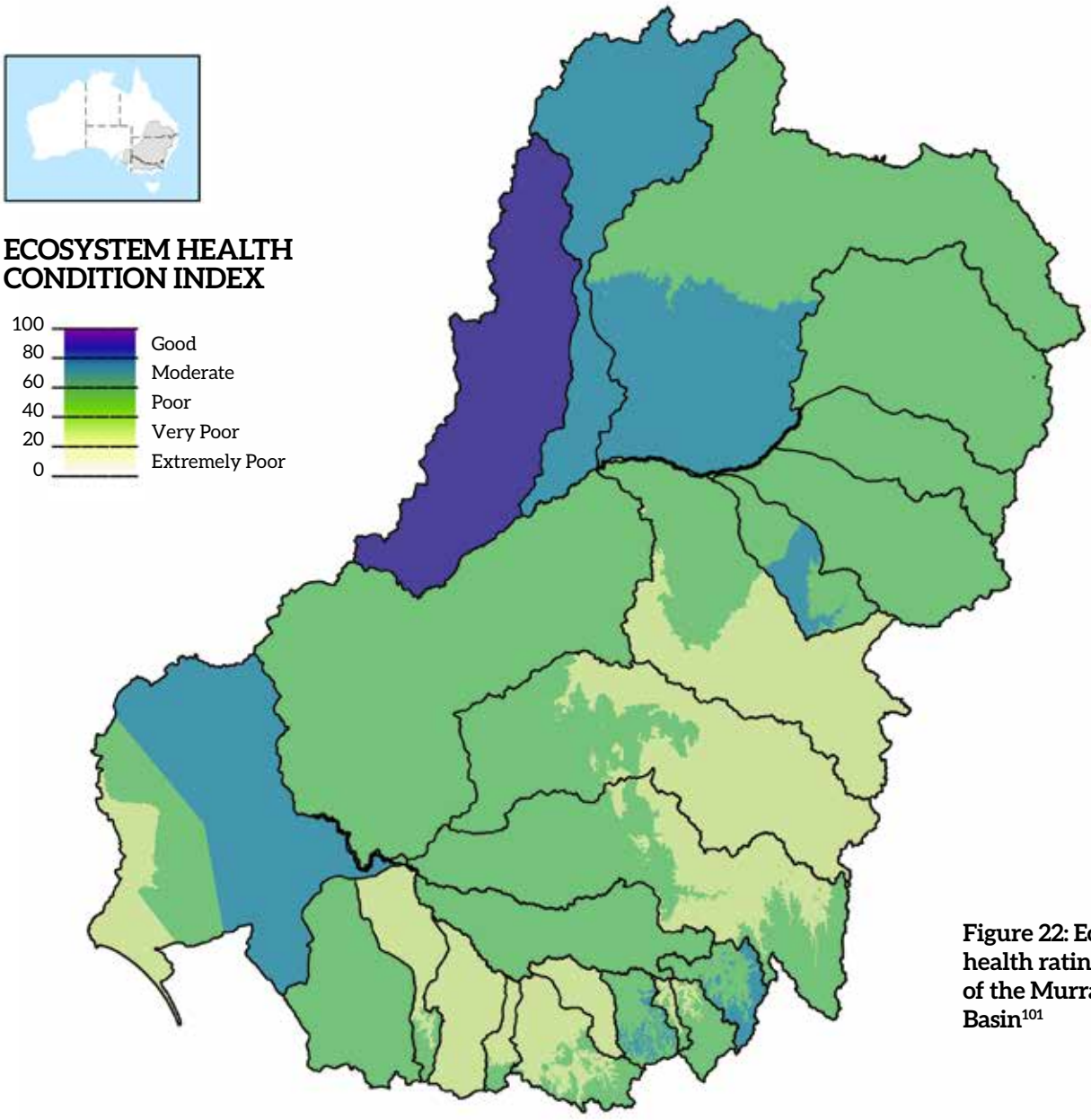


Figure 22: Ecosystem health rating for 68 zones of the Murray-Darling Basin[101]

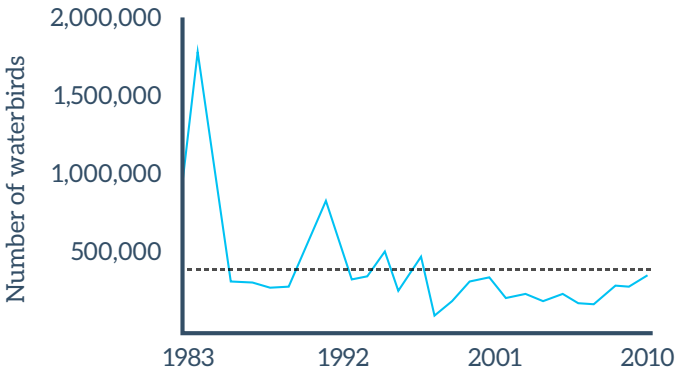


Figure 23: Waterbird abundance during annual aerial surveys of waterbirds across eastern Australia, 1983-2010. The dashed line is the long-term average abundance[121].

Wetlands

The condition of many of the remaining wetlands across Australia has deteriorated due to changes in water flows from rivers and surrounding catchments and the expansion and intensification of agriculture and increased urban and industrial expansion. However, a comprehensive overview of the distribution and condition of wetlands across Australia is not available[120].

Perhaps a useful surrogate for wetland condition is a long-term survey of waterbirds across eastern Australia that found waterbird abundance declined significantly between 1983 and 2010, with numbers dropping below the long-term mean in 1998 and remaining there[121] (Figure 23).

Groundwater

Many major aquifers throughout Australia have been developed to the point where use is equivalent to or even exceeds the sustainable yield (Figure 24).

IMPACTS

Changes in the quality and functioning of nature have an impact on the welfare or wellbeing of humans through the degradation or loss of ecosystem services or direct health and economic impacts.

A major reason for seeking to effectively protect and value nature is to maintain the benefits that it provides to humans, otherwise known as ecosystem services. Ecosystem services can be defined as the direct and indirect contributions of ecosystems to human wellbeing.

Ecosystem services include provision of clean air and water, natural fertilization and nutrient cycling in soils, mitigation of climate extremes, pollination of plants including crops, control of pests, provision of genetic resources, production of goods like food, fuel and fibre, maintenance of cultural and social values, and others.

Most ecosystem services are not adequately considered in decision-making and policy development because there is insufficient knowledge about the processes that deliver the services and because there are not adequate methods for assessing impacts on them in terms that can be compared with other policy or decision options.

Some services are measured in isolation, such as fire regimes, some species interactions including invasive species, and impacts of climate variability and change. Yet critical services for human wellbeing such as pollination and biological control of pests are not measured in any way that can inform management or avert future crises.

An important concept in sustainability is the precautionary principle, where a cautious approach to development and exploitation is required, especially where there is insufficient evidence about the likely impacts. Australia fails to apply this mechanism[123].

Impacts addressed in this report are distributed throughout. More detailed impacts on Australia's food systems are detailed here.

Australia's Food System

The natural environment comprises the entire basis for food production through water, nutrients, soils, climate, weather and insects and other animals for pollination and controlling infestations.

Australia is one of the world's most food secure nations: self-sufficient in key food commodities including meat, dairy and grains. Domestic production currently supplies 90 per cent of domestic food demand[124].

The world will need to produce 70–100% more food to feed a global population of 9 billion by 2050 given climate change and energy security scenarios[125]. As a food exporter,

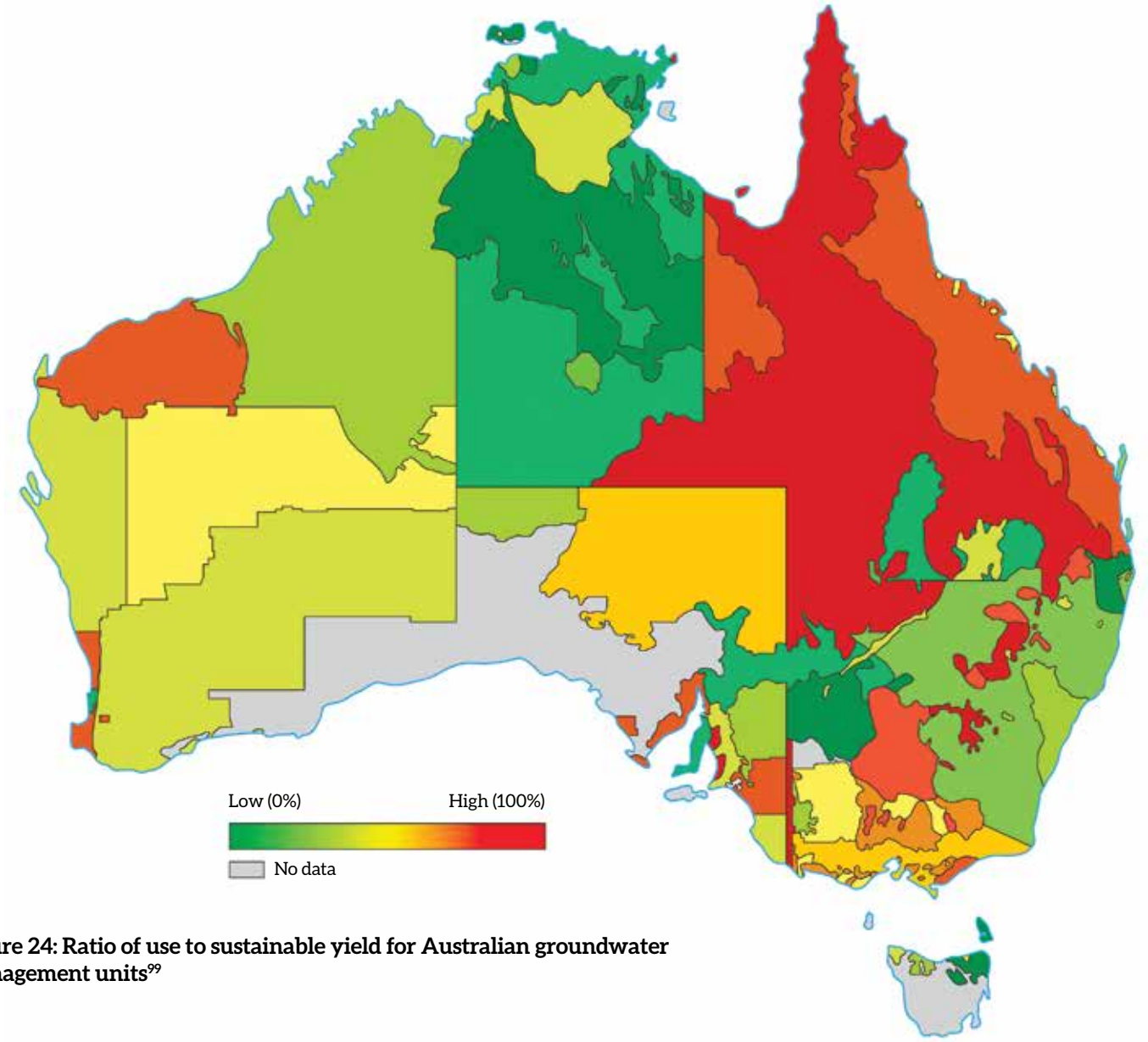


Figure 24: Ratio of use to sustainable yield for Australian groundwater management units[99]

Australia may be called upon to produce more food in the future. Australia will also have to meet increasing domestic food demand as the population expands. If our population grows to 35–40 million and climate change constrains food production, we can expect to see years where we will import more food than we export[126].

Agriculture consumes three quarters of Australia's available water, and covers almost two thirds of the total land area, making the agricultural sector extremely vulnerable to changes that have been predicted to occur as a result of climate change.

"Agricultural production costs, including insurance, are likely to rise while yields diminish. Livestock will be stressed, crops will be damaged, and fire risks will increase."

Global temperatures are predicted to rise by as much as 4.8°C by 2100[49]. Across much of Australia, this is likely to translate to higher temperatures, stronger storms, longer droughts and faster evaporation of stored water.

Production costs, including insurance, are likely to rise while yields diminish[50].

Changes to rainfall, temperature, storm intensity and drought frequency will increase evaporative water loss, increase soil erosion, stress livestock, damage crops, exacerbate fire risks and threaten fish stocks[34,49].

As Cyclone Larry's destruction of North Queensland banana crops demonstrated in 2006 and Cyclone Yasi in 2011, extreme weather events and adverse climatic conditions can directly affect the availability and cost of fresh food[126].

Pollination provides vital ecosystem services to crops and wild plants. Insect pollination, mostly by bees, is necessary for 75% of all crops that are used directly for human food worldwide[127].

There is clear evidence for severe regional declines in domestic honey bee stocks in the USA (59% loss of colonies between 1947 and 2005) and Europe (25% loss of colonies in central Europe between 1985 and 2005)[127].

Among the most significant pressures leading to pollinator decline are land-use change with the consequent loss and fragmentation of habitats; increasing pesticide application and environmental pollution; decreased pollen source diversity; alien species; the spread of pathogens; and climate change[127]. Increases in these pressures in Australia could result in similar pollinator losses in Australia. It is important to note that honey bees are an introduced species in Australia with significant impacts on native animals including hollow-nesting species and native bees.

Some sectors vulnerable to the effects of climate change on agriculture are[128]:

- **Fruit:** Temperature increases exceeding 1.5°C could lower yields and reduce fruit quality.
- **Cotton:** Production may be affected by intensified competition for diminishing water supplies.
- **Viticulture:** Later ripening could lead to the risk of reduced grape quality, and most if not all regions will experience decreased water availability.
- **High rainfall pastures:** Expected decreases in winter and spring rainfall in southern Australia would greatly reduce plant production, significantly constraining animal production.
- **Rangelands:** A 20% reduction in rainfall is likely to reduce pasture productivity by about 15% and live-weight gain in cattle by 12%. For the Macquarie River region of NSW as much as a 43% reduction in pasture growth in the Trangie and Carinda areas could occur by 2030 with an average annual revenue loss of $186 million.
- **Dairy cattle:** Rising temperatures are likely to lower milk yield from cows. By 2030, annual milk losses are likely to be between 250 and 310 litres per cow, depending on the rate of warming.
- **Beef cattle:** Increased heat stress-related livestock deaths are expected. Heat stress in Australian beef cattle already increased 40% in frequency between 1957 to 1996, and is estimated to increase by a further 138% by the year 2050 due to climate change.
- **Pests and Weeds:** Projected warming will increase the ability of pests to survive winters, and accelerate the development of most summer-active species. A warmer climate would enable tropical species, such as the Queensland fruit fly and the cattle tick, to spread southwards into NSW and threaten exclusion zones established to protect interstate and international trade.

RESPONSES

Humans make decisions and interventions in response to the impacts of pressures and drivers on nature, and in response to changing conditions.

Twelve response indicators to measure management and policy interventions to address a range of impacts on nature were proposed in 2000[42]. Today meaningful national trends for eleven of these indicators cannot be established[29,34]. The one for which we have a measurable trend is waste water treatment for inland waters which shows an improving trend[29]. Similar data gaps are evident in each of the state and territory jurisdictions. Across eight jurisdictions and 12 indicators (96 in total), 6 are improving (6.3%), 5 are stable (5.2%), 1 is worsening (1.0%), and 2 coastal and marine indicators are not applicable (ACT, 2.1%). Meaningful trends for the remainder (82, or 85.4%) cannot be established[29].

Four trends in responses are explored in greater detail here.

Australia is ranked amongst 40 countries that have been assessed as not adequately funding biodiversity protection and conservation.

Photo © Tourism Australia, Hugh Stewart

Environmental Expenditure by Government

Regular environmental expenditure accounts have not been produced in Australia. Recent estimates put total national expenditure on environmental protection at $34.1 billion for 2009-10, and $35.7 billion in 2010-11[129].

"Australian governments and businesses have substantially increased expenditure on the protection and management of nature over the last few decades."

These figures include environmental protection and natural resource management activities such as waste and wastewater management, protection of biodiversity and landscapes, protection of air and climate, and management of mineral and energy resources. Solid waste management ($10.4 billion, almost 33% of total) and waste water management ($6.1 billion, or 19% of total) are the largest environmental services supplied to the economy[129].

While earlier estimates of government spending on the environment exist, they measure different activities. Comparison is therefore not possible. However, estimates of whole-of-government environmental expenditure between 2001 and 2005 increased to record levels, from $1.7 billion to $2.4 billion[130].

Australia is ranked amongst 40 countries that have been

assessed as not adequately funding biodiversity protection and conservation[131].

Protected Areas

Since the establishment of Australia's first national park, Royal National Park, in 1879, the network of land and ocean that comes under some form of government protection has grown substantially.

The National Reserve System (NRS) of protected lands has increased from 6.5% of the country in 1991 to 16.5% in 2014, covering more than 127 million hectares.

There are now 60 Indigenous Protected Areas covering just over 48 million hectares across Australia, representing more than one third of the NRS[28].

"The National Reserve System of protected lands and waters has increased to cover 127 million hectares, 16.5% of Australia."

The strategy for the National Reserve System to 2030 sets out to improve and expand the NRS through addition of new areas, better representation of regional ecosystems, and protection of critical areas for climate change resilience such as refugia[132].

Australia now has the world's largest network of marine reserves, protecting over 3.1 million square kilometres of the marine environment[133]. However, at the time of writing the current Australian government is reviewing the zoning and the management of the latest 2.3 million square kilometre addition to the network, leaving the status of those areas uncertain.

Legal Protection for Nature

While Australia does have a system of environmental laws and regulations across federal, state and local government, these laws are manifestly inadequate in protecting the natural environment and its resources.

It is important to understand the context that has led to existing laws relating to the protection and management of nature and identify outstanding issues of concern.

Australia's existing legal framework for nature

State environmental legislation was largely the sole regulator of environmentally damaging activities for most of the twentieth century. Between the 1960s and the 1990s the States adopted a range of different, often innovative and even world-leading legislation to address environmental harms.

The Australian Government made some inroads into legislating on environment matters in the 1970s and 1980s, relying on areas in which it had constitutional authority to act such as in external affairs, power over corporations or over territories, power over Commonwealth lands, and taxation and financing powers.

A watershed moment in environment law in Australia came in 1983 with Commonwealth Government intervention to protect the Gordon River in Tasmania from State Government dam-building plans. Validity of the Commonwealth action was upheld in the High Court[134]. This confirmed the wide scope of the Federal government to legislate in relation to external affairs and represented a decisive shift in focus and expectation on the national government to engage in environmental protection.

It took until the 1992 Intergovernmental Agreement on the Environment[135] for the division of Commonwealth and State authority in environmental matters to be resolved. The agreement was intended to 'integrate environmental considerations into government decision-making at all levels' of the government. This agreement effectively laid the groundwork for the enactment of the Environment Protection and Biodiversity Conservation Act 1999 ('EPBC Act').

"Australia's legal framework for the protection and management of nature is inadequate, complex, piecemeal, subject to ongoing weakening and poor enforcement."

The limits and fate of the EPBC Act

The EPBC Act established protection for a range of 'matters of national environmental significance' ('MNES') and extensive administrative and institutional machinery

to go with that framework. MNES include matters relating to biodiversity conservation, nuclear actions, the Commonwealth marine environment, freshwater protection from large-scale coal mine and coal seam gas developments, National Heritage and World Heritage.

The EPBC Act is meant to allow Australia to meet its international obligations on the environment. The Act also incorporates principles of ecologically sustainable development[136].

Enactment of the EPBC Act was the first attempt at national environmental regulation bringing together a single national standard for environmental protection that operates concurrently with the various state and territory environment and planning schemes. There have been benefits in this change as well as challenges.

The EPBC Act prevents people from taking actions (e.g. mining and substantial residential developments) likely to have a significant impact on a MNES unless they have an approval from the federal Environment Minister.

The Act allows for a range of supporting processes to take place such as the listing process for threatened species, requirements for conservation statements and recovery plans to assist decision making under the Act. There are also a range of exclusion mechanisms that mean that in certain circumstances proponents don't need EPBC Act approval.

Decisions made under the Act are not subject to merits review however there is increased capacity for members of the community to challenge the legality of the decisions made under the Act. There have been many attempts and a number of successful challenges to decisions made under the Act.

The EPBC Act system has its weaknesses, with its results described as 'fragmentary and ambiguous'[137]. It has also been susceptible to politicization of decision-making.

Whatever the shortcomings of the EPBC Act and its administration to date, recent moves to degrade the Act represent retrograde steps for environmental protection and environmental law in Australia[138].

In particular, the present Australian Government, supported by the states and territories, is looking to hand approval powers for projects that would trigger MNES to the states.

Analysis recently commissioned by the Places You Love alliance demonstrates that not one of the states or territories has the capacity or the legal framework to meet the basic requirements of protecting MNES[139].

It is important to note that many criticisms of the EPBC Act and the role of the federal government in environmental regulation are based on falsehoods.

The reality of the impact of federal environment oversight of major projects affecting MNES is that the process is relatively quick and streamlined compared to state processes. The major causes of delays rest with poor quality environmental assessments from the proponents and under-resourced state and territory bureaucracies undertaking assessments based on state regulatory requirements[140].

The Places You Love alliance has prioritized the protection of the existing laws despite their flaws. We cannot go backwards on environmental protection. We need more effective laws not weaker ones.

The rise and fall of climate law

Environmental law and policy has been the subject of concerted attack on other fronts also. Most notably, major national legislative efforts to tackle climate change have been a point of keen political controversy. A comprehensive package of 'clean energy' laws was enacted in 2011[141] which included a form of emissions trading scheme with an initial fixed price, specialist low carbon energy financing mechanisms, and laws to support carbon offsetting activity.

The current Australian Government repealed the Clean Energy Act in mid-2014.

Limits and attacks on environmental law at the State level

Australia has failed to adequately balance the tension between the protection of the environment and the community against development pressures.

This is exacerbated by the fact that the states and territories, having the greatest role in environmental protection in Australia, rely on royalties and other income from large developments - residential, mining and energy in particular. The state is often the proponent for such developments.

Imagine what our nation would be like in 10 years' time if we fixed the challenges facing nature.

Some jurisdictions have enacted good environmental laws but they have been poorly enforced or hardly used at all. One example is Victoria's Flora and Fauna Guarantee Act 1988, Victoria's key threatened species law[142].

In some cases, environmental laws have not been reviewed or overhauled for many years despite significant changes in social, economic, legal and environmental contexts. For instance, Victoria's Environment Effects Act 1978, which provides for environmental impacts assessments, has not been updated since it was enacted.

Enforcement of environmental laws in Australia is difficult and complex, and is a major reason for the lack of effectiveness of these laws. Lack of state agency willingness or capacity to undertake enforcement activity contributes to the failure of enforcement.

In addition to attempts to weaken the EPBC Act some State Governments have pursued retrograde policies on environmental law in recent years. Some examples of backward steps in environmental protection include:

Photo © Glenn Walker

- The Victorian Government's loosening of controls on the clearing of native vegetation through so-called Permitted Clearing of Native Vegetation regulations[143].
- The Tasmanian Government (with Federal support) re-opening of large tracts of native forest to logging and abandonment of the 'Forest Peace Deal'[144].
- Amendment of statutory controls over mining decisions in New South Wales to ensure that economic considerations take priority over any other considerations including environmental ones[145].
- Weakening of environmental impact assessment processes in Queensland have been weakened for major projects[146] and objection rights have been removed in relation to most mining projects[147].

Public Attitudes to Nature

To see how Australians view the current state of nature and their connection to nature it is worth looking at recent polling.

"Public concern in Australia about the state of nature has decreased substantially since 2007."

Public concern in Australia about the state of the environment has decreased substantially since 2007. In 2011-12, 62% of people aged 18 years and over were concerned about environmental problems in general in Australia compared with 82% in 2007-08. There were similar declines in concern about water shortages and climate change (Figure 25)[148].

In the same period, the proportion of Australians who thought the condition of the natural environment was good increased to 50% in 2011-12, up from 29% in 2007-08.

About three quarters of Australians (73%) took part in some activity that involved contact with nature in 2011-12. The most popular was visiting a national park or botanic garden (52%), followed by a nature walk or bush walk (42%) (Figure 26)[149].

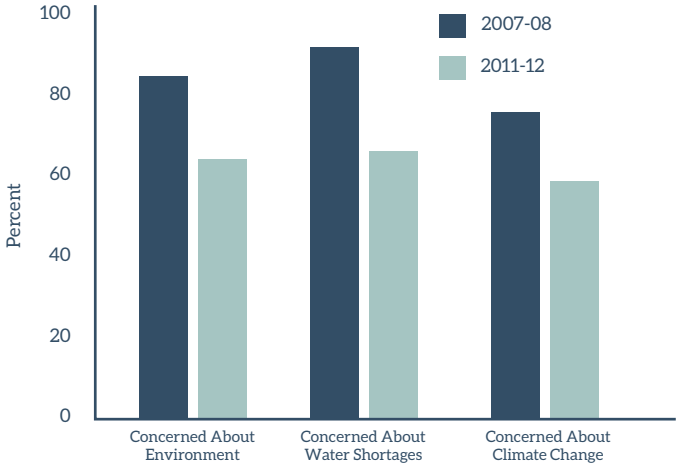


Figure 25: Percentage of Australians concerned with environmental issues, 2007-8 and 2011-12[148]

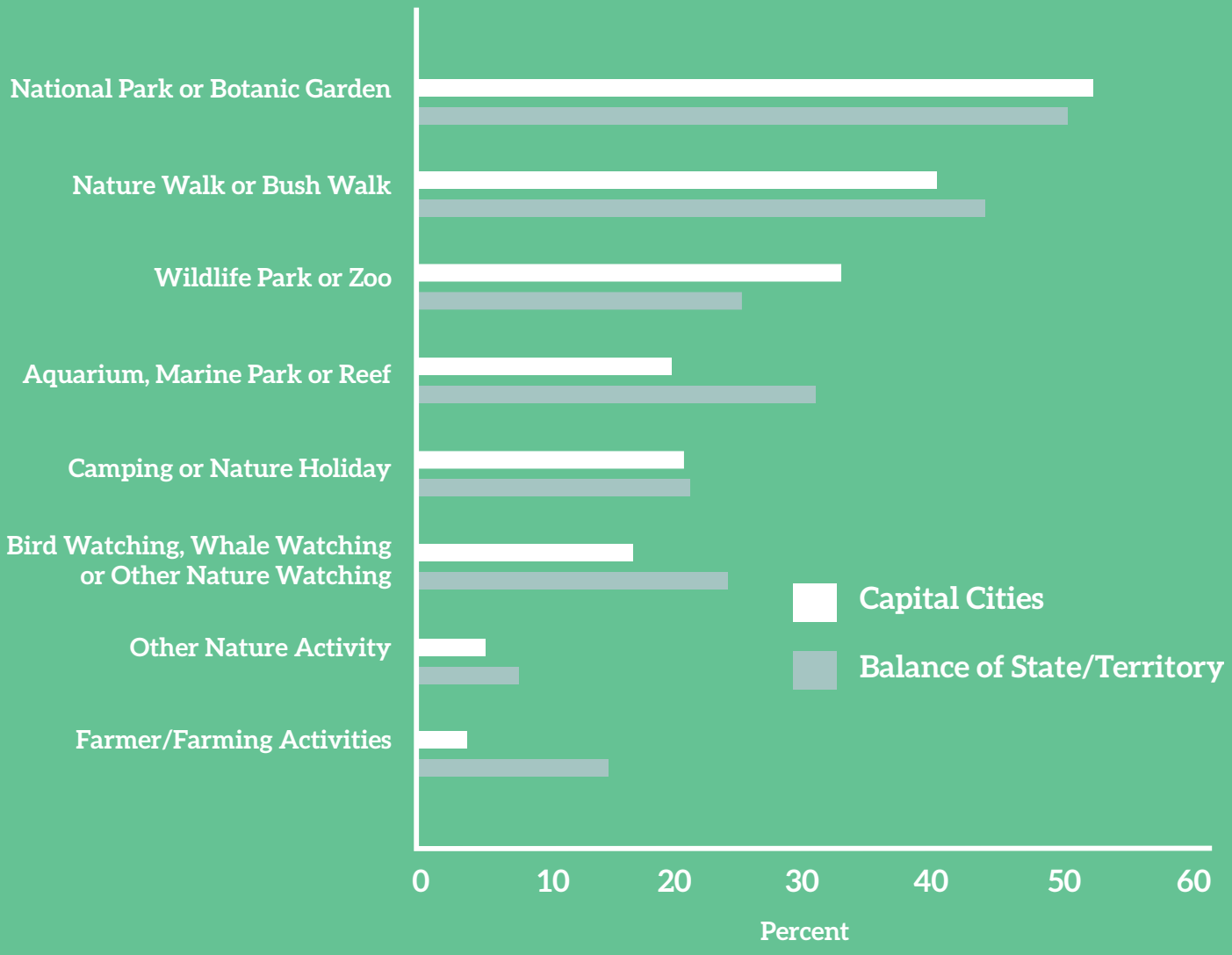


Figure 26: Type of participation in natural environment related activities[149]

SECTION 4

Key Indicators – Taking the Global Pulse

The patterns of decline in nature and the growing pressures affecting nature in Australia are a reflection of many global trends. This section outlines some of the more troubling trends at the scale of the Earth, perhaps as early warnings of the possible future Australia may face without addressing the key drivers and pressures on nature.

Humans are impacting nature more than at any time in our history. In fact, it is now well established that humans are affecting the structure and function of nature at a global scale[150].

Numbers of people on the planet have skyrocketed over the last hundred years, and there will be 9 billion of us by mid-century.

People have also grown wealthier on average, exploiting more and more of nature and its resources as per capita consumption grows.

Urgent and escalating problems at the global scale are now all too familiar: climate change, ozone depletion, biodiversity loss, decline in fisheries, increasing air pollution, water and food scarcity and land-use change.

"Humans are impacting nature more than any time in our history."

There is a high and growing risk to global economic and political systems through the degradation, failure or transformation of key elements of nature.

Compared to the last 12,000 years of relatively stable conditions, the Earth is now experiencing a new period of rapid and systemic changes and instability, with growing risks of thresholds and tipping points.

All of this brings into stark relief the fact that human civilization relies on healthy nature for our own wellbeing and prosperity.

DRIVERS

Human Population Growth

By 1804, the human population had reached 1 billion[151]. From that point forward, population growth accelerated very quickly[151].

Through the early 2000s, most researchers thought that the world population—which today hovers around 7 billion—would reach 9 billion by mid-century and then stop growing. Through revised modelling and statistical approaches, the latest estimates from the United Nations say there is a 95% chance the world population will be between 9 billion and 13.2 billion by the year 2100 (Figure 27)[152].

"World population could be 13.2 billion by the end of the century."

Much of that growth will likely take place in Africa, where population is estimated to rise from 1 billion to 4 billion by the end of the century. Unlike projections from last decade, the new projections show a steady increase through 2100 rather than a mid-century levelling off[152].

Growth in Material Consumption

A measure called 'material footprint' is used to describe the impact of development on nature and its resources. This footprint is calculated as the total amount of primary resources required to service consumption in a country, whether those resources are found within the borders of that country or are imported from elsewhere.

Humanity now uses eleven times as much energy (Figure 28)[153], and eight times the weight of material resources every year as it did only a century ago[154].

Global consumption has grown astonishingly over the last century. The extraction from nature of construction materials grew by a factor of 34, ores and minerals by a factor of 27, fossil fuels by a factor of 12, and biomass by a factor of 3.6[155].

At a global scale, the total amount of 70 billion tonnes of raw material extraction per year is unprecedented, and per-capita levels of resource consumption are at their highest level in history, at an average of 10.5 tonnes per person in 2008[35].

By 2050, a global population of 9 billion people could require an estimated 270 billion tonnes of natural resources to fuel the level of consumption we are used to in OECD countries[35]. Global consumption of primary resources (minerals, ores, fossil fuels and biomass) would be four times as large compared to today, leading to much larger environmental impacts as well.

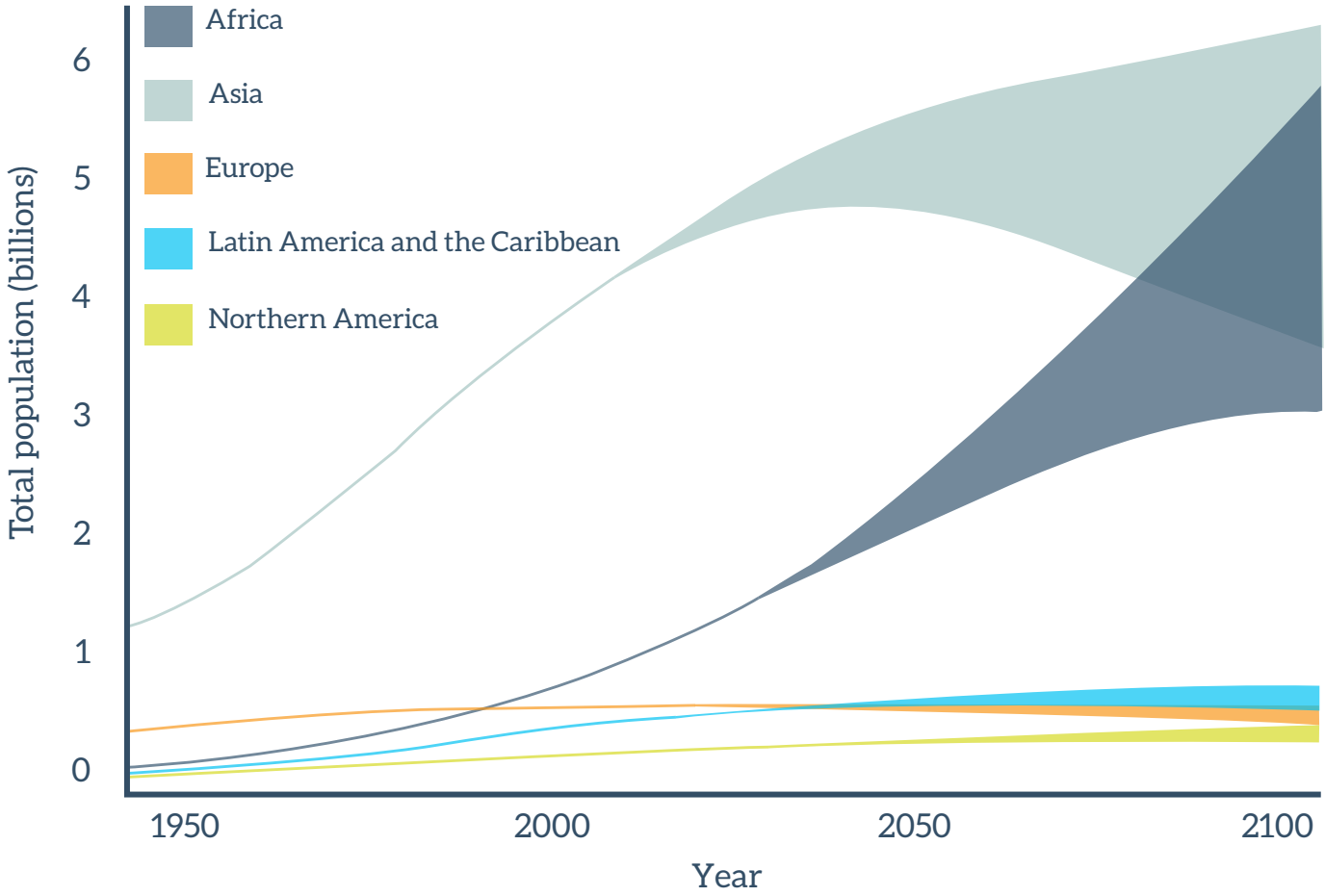


Figure 27: The United Nations' population projections for each continent now include a range of numbers, rather than a single line[152].

"Global consumption could be four times larger than today by 2050."

By 2050, global primary energy consumption is projected to increase to 696-879 exajoules per year, up from 2010 levels by 27-61%[156]. The energy mix in 2050 will continue to be dominated by fossil fuels, 59-77%, compared to 79% in 2010[156].

It is estimated that food production worldwide will need to increase by 70% by 2050 due to anticipated population growth[125]. For example, global meat production is predicted to increase to 455 million tonnes by 2050, almost double the 2007 figure of 258 million tonnes, and cereal production in the same period is projected to increase by about 50% to 3,009 million tonnes[125].

By 2050, global water withdrawals are projected to increase by some 55% due to growing demands from manufacturing (400%), thermal electricity generation (140%) and domestic use (130%) (Figure 29)[158].

By 2040 water demand is projected to exceed supply. This is irrespective of climate change, which will likely exacerbate the situation[159]. Without improved efficiencies, agricultural water consumption is expected to increase by about 20% globally by 2050[160].

Environmental water flows will be further contested, putting ecosystems at risk. Groundwater depletion may become the greatest threat to agriculture and urban water supplies in several regions. Nutrient pollution from urban wastewater and agriculture is projected to worsen in most regions, intensifying eutrophication and damaging aquatic biodiversity[158].

Impacts World price of food is estimated to become 30–50% higher in coming decades and have greater volatility[157].

Impacts The combined effects of climate change, land degradation, cropland losses, water scarcity and species infestations may cause projected agricultural yields to be 5–25% short of demand by 2050. Increased oil prices may raise the cost of fertilizer and lower yields further[157].

Impacts Freshwater availability will be further strained in many regions, with 2.3 billion more people than today projected to be living in river basins experiencing severe water stress[158].

Photo © Tourism Australia, Jonathon Marks

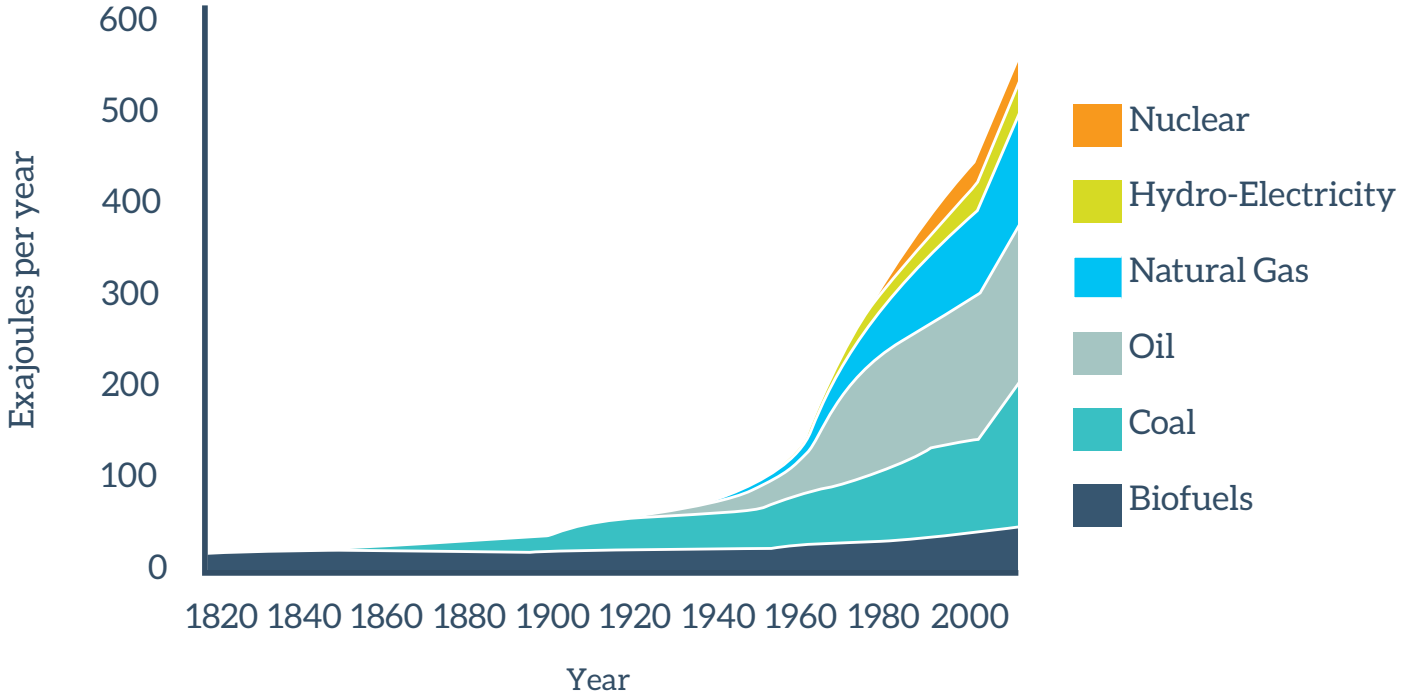


Figure 28: World energy consumption, 1820-2000, by fuel type[153]

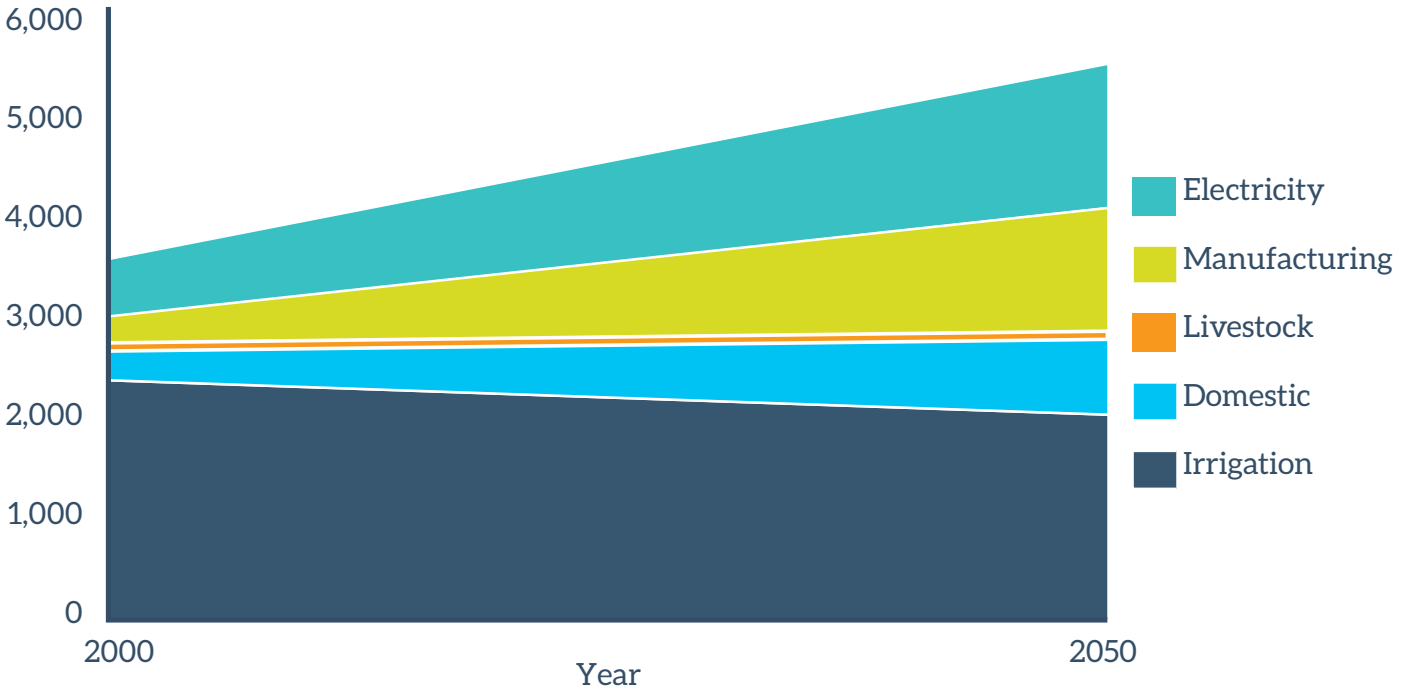


Figure 29: Global water demand (freshwater withdrawals) 2000 and 2050 (km^3 per year). Does not include rain-fed agriculture[158]

PRESSURES

The majority of pressures on nature at a global scale show increasing trends over recent decades.

Habitat Change

Globally, 21.8% of land area has been converted to human-dominated uses[161], not including non-converting habitat degradation such as grazing or selective logging. Habitat loss has been most extensive in tropical dry forests (69% converted in SE Asia), temperate broadleaf and mixed forests, temperate grasslands and savannahs (> 50% lost in North America), and Mediterranean forests, woodlands and scrub. Meanwhile, tundra and boreal forest biomes remain almost entirely intact[161]. These are minimum estimates of habitat loss.

Habitat conversion exceeds habitat protection by a ratio of 8:1 in temperate grasslands and Mediterranean biomes, and 10:1 in more than 140 ecoregions[161].

Habitat loss in the terrestrial domain has been caused largely by the expansion of agriculture: more than 30 per cent of land has been converted for agricultural production[159]. In 2009, there were approximately 3.3 billion hectares of pasture and 1.5 billion hectares of cropland globally[159].

Direct habitat loss is a major threat to coastal ecosystems through aquaculture. Wetlands in particular have faced a 50 per cent loss in the 20th century[72]. Freshwater ecosystems are severely affected by fragmentation and floodplain ecosystems are also threatened[159]. Marine floor habitats have been degraded as a consequence of bottom trawling and other destructive fishing methods[159].

Forest plantations, generally cultivated for industrial purposes, increased by 50 million hectares globally between 2000 and 2010, reaching 264 million hectares or 7% of the total forest area[159].

The net expansion of cropland is projected to increase from around 120 to 500 million hectares between 2005 and 2050 (an increase equivalent to about 50% of Australia's land area)[125].

Climate Change

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased[49].

Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850[49].

The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years (Figure 30). Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions. The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification[49].

In 2011, estimated worldwide emissions from human activities totalled nearly 46 billion metric tons of greenhouse gases, expressed as carbon dioxide equivalents. This represents a 37 percent increase from 1990[163].

Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions[49].

However, more disruptive climate change is likely to be locked in, with global greenhouse gas (GHG) emissions projected to increase by 50% over the next four decades, primarily due to a 70% growth in energy-related CO_2 emissions. The atmospheric concentration of GHGs could reach 685 parts per million (ppm) by 2050[158].

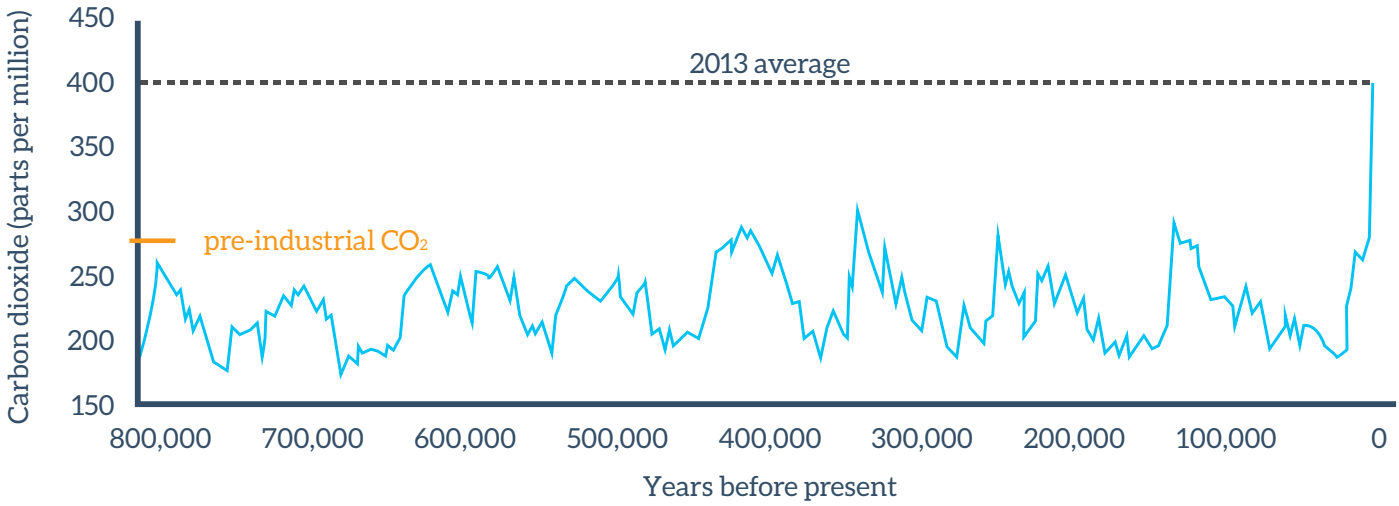


Figure 30: Atmospheric carbon dioxide concentrations in parts per million for the past 800,000 years, with the 2013 annual average concentration as a dashed line[162]

"Global greenhouse gas emissions are projected to increase by 50% over the next four decades."

As a result, the global average temperature increase is projected to be 3° C to 6° C above pre-industrial levels by the end of the century, exceeding the internationally agreed goal of limiting it to 2° C[158]. Such a rise has not been seen on the planet for around 3 million years[164].

Invasive Species

Invasive species are increasing in number, extent, and influence worldwide as a result of increasing globalization[165]. The extent of biological invasions has increased rapidly over the past half century[165]. Very few ecosystems anywhere in the world are free of introduced species, and an increasing proportion of biomes, ecosystems, and habitats are becoming dominated by introduced species[165].

Increases in the number and spread of alien species appear to be strongly associated with substantial increases in the extent and volume of trade and transport, particularly over the last 25 years[166].

Negative effects on biodiversity are generally the main concern associated with biological invasions, but invasions also have serious implications for human wellbeing[165].

Global data on invasive species are scarce, representing a major gap in understanding the pressures on nature worldwide[59].

Pollution

Pollution takes many forms. Pesticides and plastics in particular are prevalent in modern society and represent ongoing pressures on nature and human wellbeing.

Pesticides

Without pesticide application the loss of fruits, vegetables and cereals from pest injury would reach 78%, 54% and 32% respectively[167]. However, most of them are highly toxic. Pesticides and their degraded products flow into the atmosphere, soils and rivers, resulting in the accumulation of toxic substances and thus threatening human health and the environment[168].

Impacts **During the next 10 years, many countries will experience water problems such as shortages, poor water quality, or floods that will risk instability and state failure and increased regional tensions[178].**

Links between pesticide exposure and increased incidence of cancer has been demonstrated in a range of studies[169].

Globally 4.6 million tons of chemical pesticides, many containing mercury, arsenic and lead, are annually sprayed into the environment[170]. Only 1% of the sprayed pesticides are effective, while 99% are released to non-target soils, water bodies and atmosphere, and finally absorbed by almost every organism[170].

Worldwide consumption of pesticides has undergone significant growth since the 1960s, with global sales increasing 37-fold between 1960 and 2005[170].

Plastics

In the second half of the 20th century, plastics became one of the most universally-used and multipurpose materials in the global economy, and became an essential part of modern lifestyles.

With continuous growth in plastics production worldwide for more than 50 years, global production in 2012 rose to 288 million tonnes (Figure 31)[171]. More than a third of production is for disposable items of packaging, most of which are discarded within a year or so of manufacture[172].

The durability and increasing usage of plastics create a major waste management problem with plastic accounting for about 10 per cent of the waste generated by humans[172].

Plastic debris has accumulated in natural habitats from the poles to the equator; it is a very conspicuous component of the debris that is present in marine habitats[172].

Over 260 species, including invertebrates, turtles, fish, seabirds and mammals, have been reported to ingest or become entangled in plastic debris, resulting in impaired movement and feeding, reduced reproductive output, lacerations, ulcers and death[174].

The vast majority of work describing environmental consequences of plastic debris is from marine settings and more work on terrestrial and freshwater habitats is needed[174].

In addition to the physical problems associated with plastic debris, there has been much speculation that, if ingested, plastic has the potential to transfer toxic substances to the food chain. Despite the environmental concerns about some of the chemicals used in plastic manufacture, it is important to emphasize that evidence for negative effects in humans is still limited[174].

Water Use

Data on water use (withdrawals and consumption) and quality are very often outdated, limited or unavailable. Global withdrawals have tripled over the last 50 years to meet the demands of a growing population with increasing wealth and consumption levels[159]. Projected water demands may reach planetary limits in the coming decades[175].

Impacts **Between now and 2040, fresh water availability will not keep up with demand without more effective management of water resources. Water problems will hinder the ability of key countries to produce food and generate energy, posing a risk to global food markets and hobbling economic growth. As a result of demographic and economic development pressures, North Africa, the Middle East, and South Asia will face major challenges coping with water problems[178].**

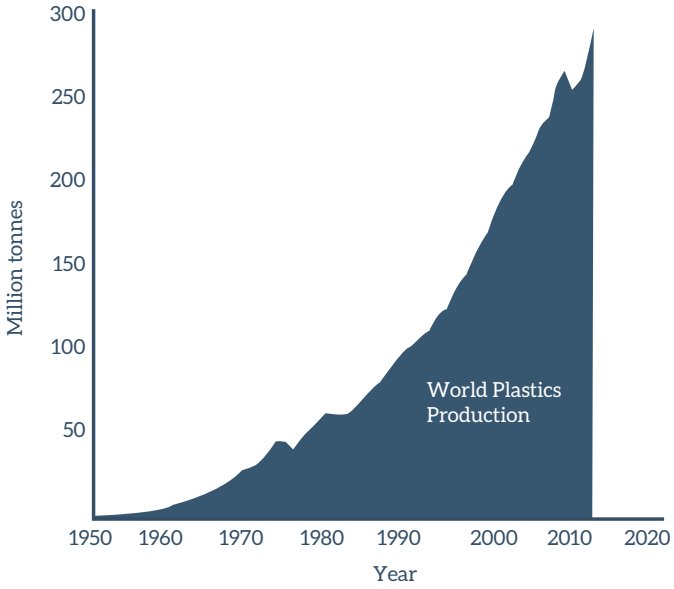


Figure 31: World plastics production 1950-2012 (million tonnes)[171]

Agriculture accounts for roughly 70% of total freshwater withdrawals globally, with the industrial and domestic sectors accounting for the remaining 20% and 10%, respectively, although these figures vary considerably across countries[160].

The global demand for water is expected to grow significantly for all major water use sectors, with the largest proportion of this growth occurring in countries with developing or emerging economies. Without improved efficiencies, agricultural water consumption is expected to increase by about 20% globally by 2050[159].

There is over 5,000 km^3 of water stored in constructed reservoirs. These storages increased by a factor of 7 between 1950 and 2005[176], resulting in high dam density across many countries (Figure 32)[177].

There is clear evidence that groundwater supplies are diminishing, with an estimated 20% of the world's aquifers being over-exploited, some massively so[160]. Globally, the rate of groundwater abstraction is increasing by 1% to 2% per year[160].

Stock Animals

The use of land for biomass production is among the most significant pressures on nature. Biomass is the mass of biological organisms in any given area, including natural vegetation, wildlife, crops and livestock.

Of the plant biomass used directly by humans in 2000, only 12% directly served as human food, while 58% was used as feed for livestock[179].

Livestock such as cattle, sheep, pigs and chickens contribute a significant proportion to human-appropriated biomass in global food systems, both as sources of meat and consumers of plant biomass[125,179].

Livestock production is thus a key pressure on nature. Substantial projected growth in this sector from 2000–2050 due to increasing population and per capita demand will effectively double production volumes[125].

As of 2000, the livestock sector is estimated to have contributed 18% of anthropogenic greenhouse gas emissions, and 63% of reactive nitrogen mobilization[180].

By 2050, it is estimated that the livestock sector alone may significantly overshoot recently published estimates of

Impacts **Exposures to plastics, plasticizers, and other additives to polymers are ubiquitous in modern society. Exceedances in certain susceptible populations, such as pregnant women and children, are known to occur in some instances[173]. Of principal concern from a human health perspective are endocrine-disrupting properties of plastic components such as Bisphenol A and di- (2-ethylhexyl) phthalate (DEHP). Because many of today's plastics are not biodegradable, continued use at accelerating rates is unsustainable and will cause a significant burden for future generations[173].**

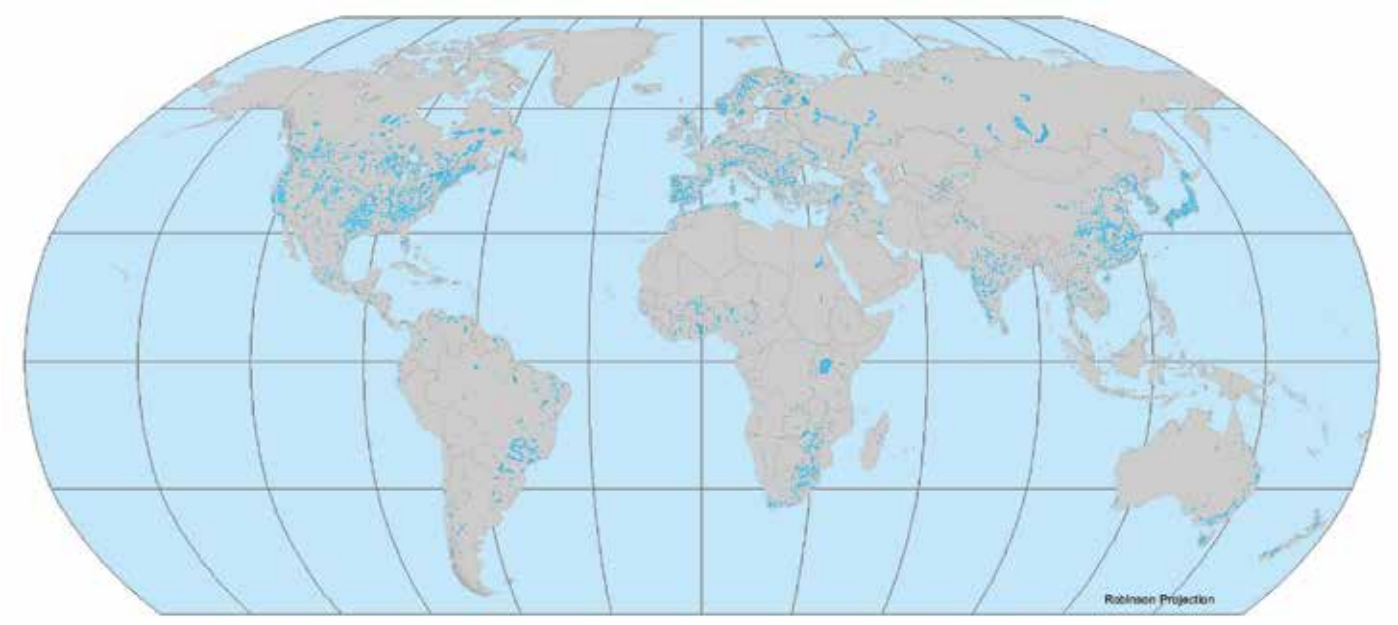


Figure 32: Global distribution of large dams and reservoirs [177]

humanity's "safe operating space" in the domains of climate change, reactive nitrogen mobilization, and appropriation of plant biomass at planetary scales[180].

Alteration of the nitrogen cycle results in increased radiative forcing (change in the energy in the atmosphere due to GHG emissions), photochemical smog and acid deposition, and productivity increases leading to ecosystem simplification and biodiversity loss.

CONDITION

The pressures exerted by society may lead to unintentional or intentional changes in the condition or state of nature.

Biodiversity

The variety of all living organisms on Earth, including their genetic diversity, species diversity and the diversity of marine, terrestrial and aquatic ecosystems, together with their associated evolutionary and ecological processes is in decline.

Biodiversity has continued to decline over the past four decades, with most indicators showing negative trends[181]: declines in population trends of vertebrates, habitat specialist birds and shorebird populations worldwide; declines in extent of forest, mangroves and seagrass beds; decline in the condition of coral reefs. None of these trends show significant recent reductions in the rate of decline[181].

Of an estimated 75,000 species assessed for their status, more than 20,000 are considered threatened[182].

Twenty-five percent (n = 1,139) of all mammals for which adequate data are available are threatened with extinction. The conservation status of marine species is of particular concern, with an estimated 36% of species threatened. Moreover, 52% of all species for which population trends are known are declining. These trends indicate that the overall conservation status of mammals will likely deteriorate further in the near future, unless appropriate conservation actions are put in place[183].

Trends from more than 10,000 different wildlife monitoring schemes around the world are combined in single measure called the Living Planet Index[184]. This index shows a decline of 52% from 1970 to 2010, based on 10,380 representative populations of 3,038 species of birds, mammals, amphibians, reptiles and fish. This suggests that, on average, vertebrate species populations are about half the size they were 40 years ago. Even those populations inside protected areas have declined on average by 18% between 1970 and 2010[184].

Biodiversity loss is projected to continue. Climate change is projected to become the fastest growing driver of biodiversity loss by 2050, followed by commercial forestry and, to a lesser extent, bioenergy croplands. Mature forests are projected to shrink in area by a further 13% by 2050[158].

Impacts The aggregate economic loss of biodiversity and ecosystem service benefits associated with forest loss worldwide is estimated to be between US$2 and 5 trillion per year. By way of comparison, the world's oil, gas and coal companies have a combined stock market valuation of $5 trillion[186].

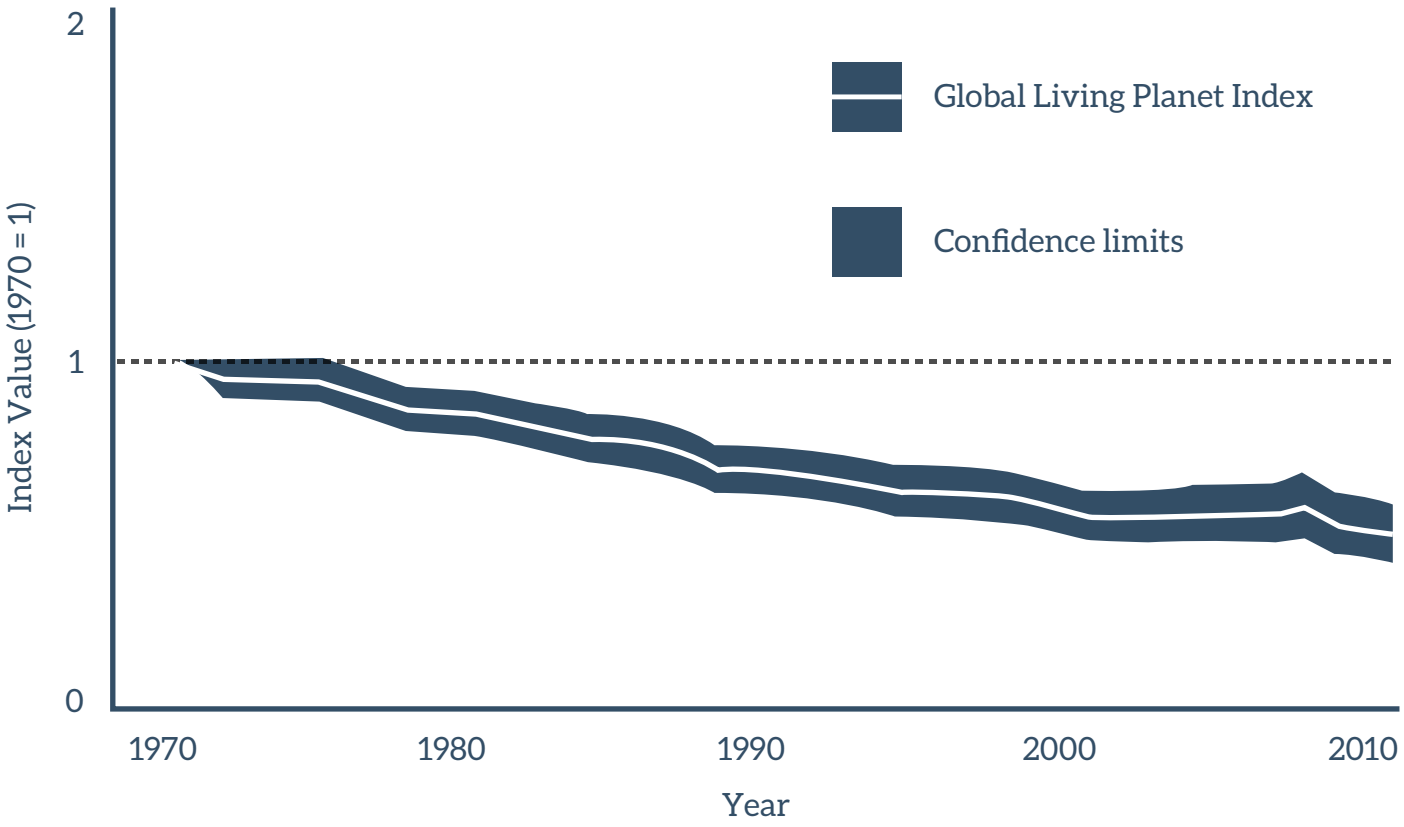


Figure 33: The Global Living Planet Index showing global declines in biodiversity, 1970-2010[185]

Impacts Air pollution is among the main causes of premature deaths and health problems, especially in children. Air pollution is set to become the world's top environmental cause of premature mortality. By 2050, the number of premature deaths from exposure to airborne particulate matter is projected to more than double to reach 3.6 million a year globally[158].

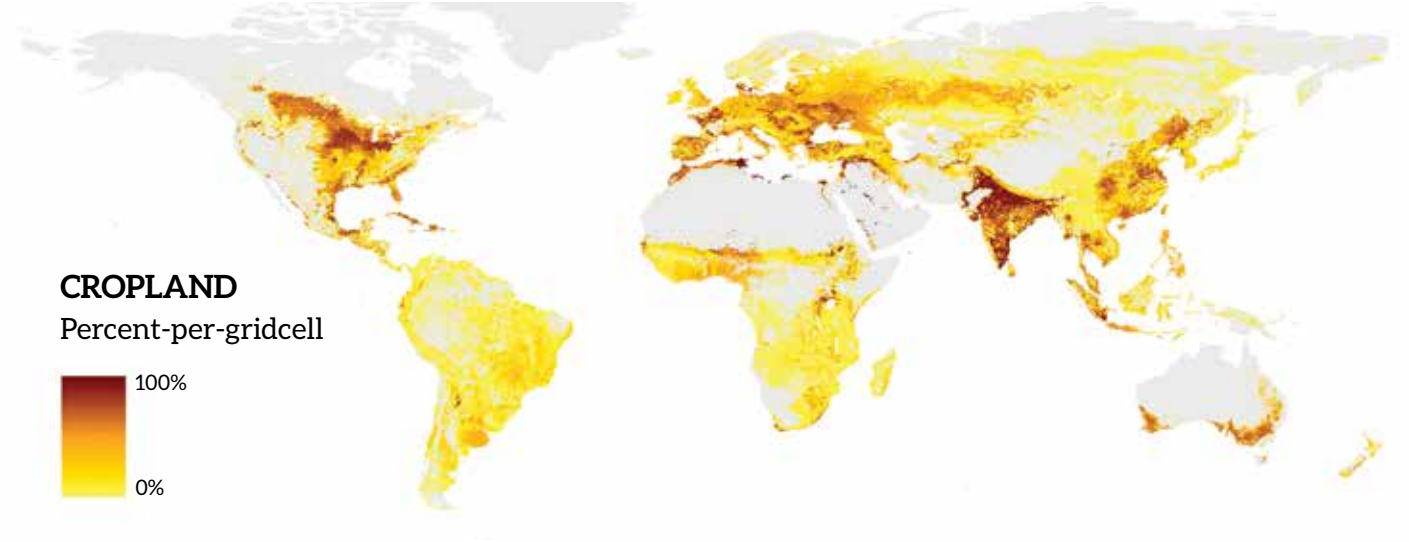


Figure 34: Fraction of global cropland cover at 10km² resolution[188]

Air Quality

Some key air pollutants have increased globally in the last two decades[187], including sulphur dioxide from coal- and oil-based power generation, nitrogen oxides primarily from motor vehicles, black and organic carbon from cooking with coal and biomass, and ammonia from fertilizer and livestock[187].

Land

Habitat loss through conversion to agriculture is one of the most significant pressures on nature[188]. During the 1980–2000 period, more than half of the new agricultural land across the tropics came at the expense of intact forests, and another 28% came from disturbed forests, raising concerns about environmental services and biodiversity globally[189].

A measure of land converted to cropland at a resolution of 10 km² provides a stark picture of the extent of intensive agriculture across the world (Figure 34).

Forests, woodlands, savannahs and grasslands have been the most extensively cleared vegetation types for the establishment of cropland across the world. There has been an estimated net loss of 11.4 million km² of forests/woodlands (6 million since 1850) and 6.7 million km² of savannahs/grasslands/steppes (4.7 million since 1850)[188].

Impacts **At a global scale, land is becoming a scarce resource, highlighting the need for more efficient land use allocation and innovation in agriculture. Between 2000 and 2030, the total land demand for additional cropland, biofuel crops, grazing land, urban expansion, industrial forest expansion, and growth of protected areas is estimated to be 285 – 792 million hectares, roughly equivalent to the land areas of Argentina and Australia respectively[189].**

Impacts **Available land that is suitable for cropping is predicted to be exhausted as early as in the late 2020s and at the latest by 2050[189].**

The range in availability by 2030 might be a deficit of 44 million hectares (the size of Iraq) to a surplus of 223 million hectares (the size of Greenland).

Oceans

Every square kilometre of the world's oceans is affected by human pressures (Figure 35)[190]. Over a third (41%) of the world's oceans have medium high to very high human impact, with a small fraction (~2.2 million km^2, 0.5%) experiencing very high impact.

Most of the highest predicted cumulative impact is in areas of continental shelf and slope, which are subject to both land- and ocean-based human pressures. The majority of very low impact areas (3.7% of the oceans) occurs in the high-latitude Arctic and Antarctic poles, in areas with seasonal or permanent ice that limits human access[190].

Ocean acidification, a consequence of rising anthropogenic CO_2 emissions, is poised to change marine ecosystems profoundly by increasing dissolved CO_2 and decreasing ocean pH, carbonate ion concentration, and calcium carbonate mineral saturation state worldwide.

Freshwater

Given escalating trends in species extinction, human population, climate change, water use and development pressures, freshwater systems will remain under threat well into the future.

A study comparing human water security to biodiversity threats highlights regions where either human water security or biodiversity challenges, or their conjunction, predominate (Figure 36)[192].

The developing world, particularly in Africa and across Asia, shows tandem threats to human water security and biodiversity, posing significant challenges. Large, contiguous areas of low threat to biodiversity and human water security remain where dense population and agriculture are absent, such as parts of Canada, Russia, the Amazon basin and northern Australia.

Wetlands cover at least 6% of the Earth's surface. They play a key role in hydrological and biogeochemical cycles, harbour a large part of the world's biodiversity, and provide multiple services to humankind. However, pressure in the form of land reclamation, intense resource exploitation, changes in hydrology, and pollution threaten wetlands on all continents.

Depending on the region, 30–90% of the world's wetlands have already been destroyed or strongly modified in many countries with no sign of abatement. Climate change scenarios predict additional stresses on wetlands, mainly

Impacts **Humans depend heavily on goods and services from the oceans, and these needs will likely increase with a growing human population. Ongoing decline in populations of fish and other marine species used for food and loss of coral reef cover as a result of declining ocean condition will have significant impacts on marine goods and services. For example, substantial revenue declines, job losses, and indirect economic costs may occur if ocean acidification broadly damages marine habitats, alters marine resource availability, and disrupts other ecosystem services[191].**

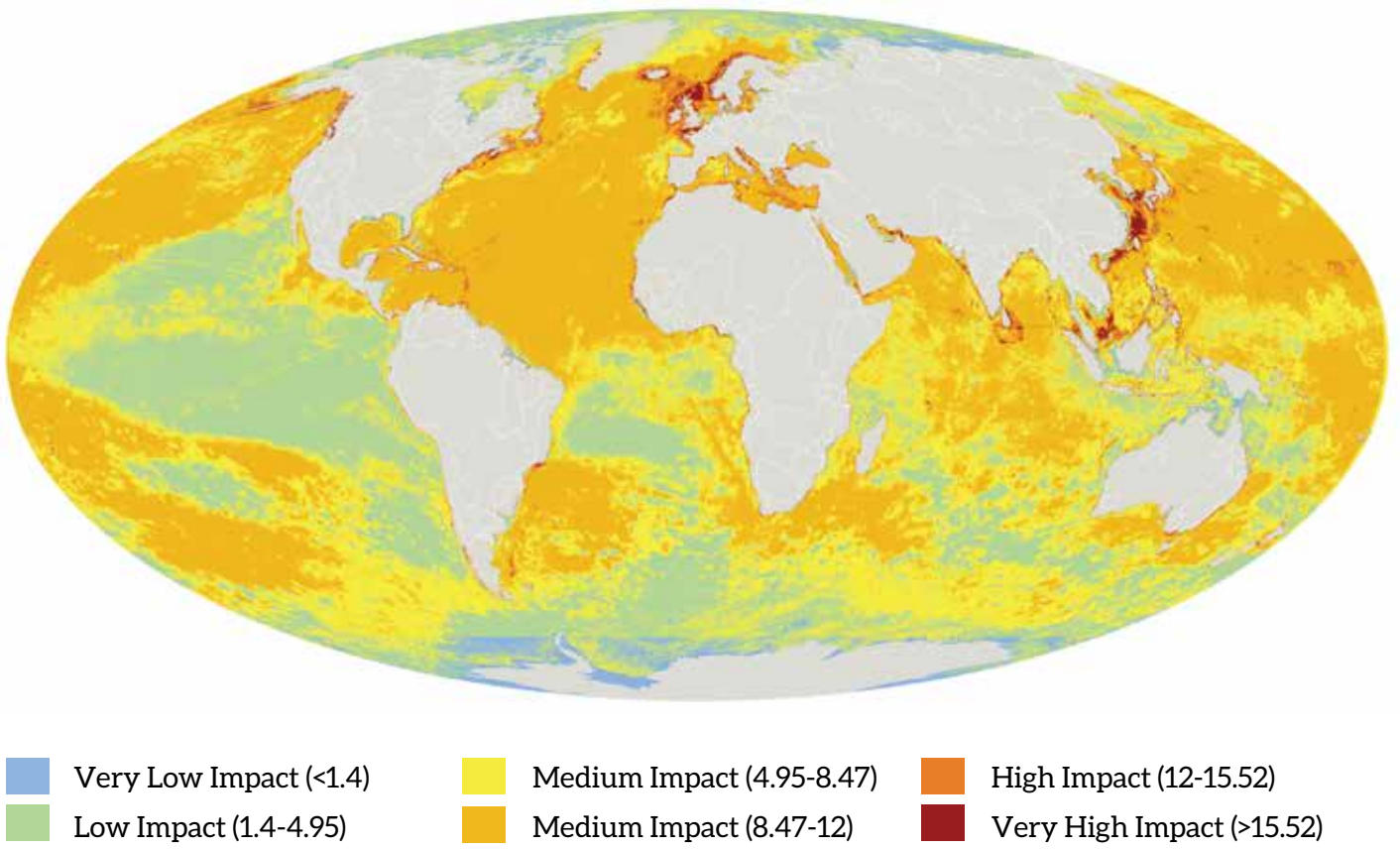


Figure 35: Global map of cumulative human impact across 20 ocean ecosystem types[190]

because of changes in hydrology, temperature increases, and a rise in sea level[193].

Fresh waters are experiencing declines in biodiversity far greater than those in the most affected terrestrial ecosystems[194]. For example, of the 6,260 known amphibian species, nearly one-third (2,030 species) are globally threatened or extinct[182].

IMPACTS

Ecosystem Function and Global Food Systems

The Millennium Ecosystem Assessment in 2005 was the first global effort to examine links between human wellbeing and biodiversity[72]. The assessment found benefits to societies from biodiversity in material welfare, security of communities, resilience of local economies, relations among groups in communities, and human health[72].

Modifying ecosystems to enhance a service generally comes at a cost to other services. Only 4 of 24 ecosystem services assessed at a global level have been enhanced (crops, livestock, aquaculture, and carbon sequestration). Fifteen of the remaining services have been degraded

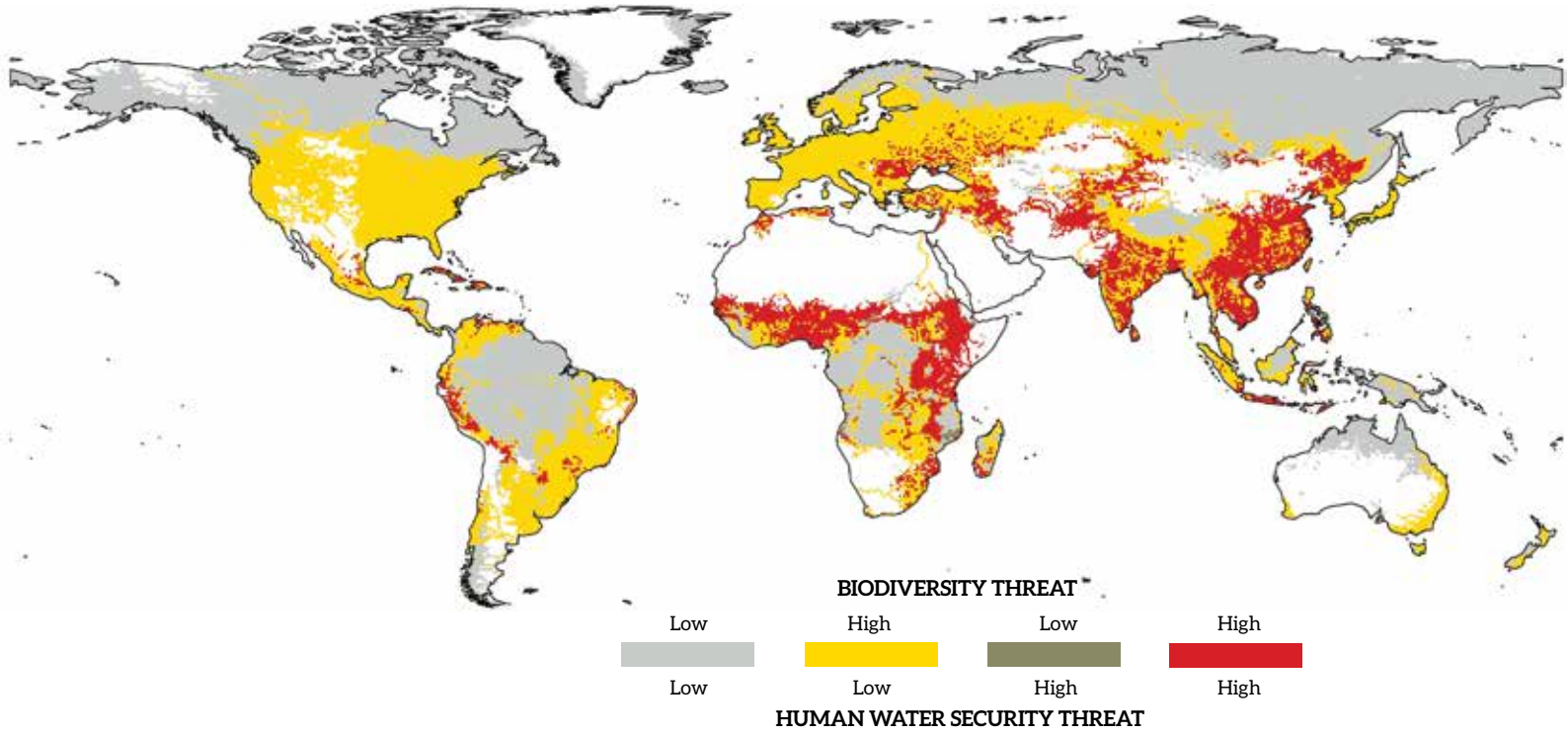


Figure 36: Prevailing patterns of threat to human water security and biodiversity[192]

(including water supply, timber production and many cultural benefits) (Figure 37)[72].

These changes, in combination with a range of other pressures including speculation in food stocks, extreme weather events, low cereal stocks, growth in biofuels competing for cropland and high oil prices, have significant impacts on global food security[157].

The recent food crisis of 2006-2008 resulted in a 50–200% increase in selected commodity prices, drove 110 million people into poverty and added 44 million more to the undernourished. Elevated food prices have had dramatic impacts on lives and livelihoods, including increased infant and child mortality, of those already undernourished or living in poverty and spending 70–80% of their daily income on food[157].

RESPONSES

The prospect for improving human wellbeing is dependent on the capacity of individuals, institutions, countries and the global community to respond to environmental change.

The rate of improvement of many responses to pressures on nature has slowed[181]. Overall, efforts to stem the decline of nature have clearly been inadequate, with a growing mismatch between increasing pressures and slowing responses[181].

International Agreements On The Environment

Over the last 60 years, global leaders have signed on to more than 1,200 international agreements on

SERVICE	SUB-CATEGORY	STATUS
Provisioning Services		
FOOD	Crops	↑
	Livestock	↑
	Capture fisheries	↓
	Aquaculture	↑
	Wild foods	↓
FIBRE	Timber	≈
	Cotton, hemp, silk	≈
	Wood fuel	↓
GENETIC RESOURCES		↓
BIOCHEMICALS, NATURAL MEDICINES, PHARMACEUTICALS		↓
WATER	Fresh water	↓
Regulating Services		
AIR QUALITY REGULATION		↓
CLIMATE REGULATION	Global	↑
	Regional and local	↓
WATER REGULATION		≈
EROSION REGULATION		↓
WATER PURIFICATION AND WASTE TREATMENT		↓
DISEASE REGULATION		≈
PEST REGULATION		↓
POLLINATION		↓
NATURAL HAZARD REGULATION		↓
Cultural Services		
SPIRITUAL AND RELIGIOUS VALUES		↓
AESTHETIC VALUES		↓
RECREATION AND ECOTOURISM		≈

Figure 37: Ecosystem services assessed at the global scale that have been enhanced (Up Arrow), degraded (Down Arrow) or remained relatively stable (≈)[72]

Impacts **Up to 65% of global river discharge, and the aquatic habitat supported by this water, is under moderate to high threat[192].**

Impacts **Water quality remains the largest cause of human health problems worldwide. More than 90% of water and fish samples from aquatic environments are contaminated by pesticides[159].**

the environment[195], including 124 ocean-related; 253 biodiversity-related; 90 on chemicals, hazardous substances and waste; 107 on freshwater resources; and 30 conventions broadly related to habitat. The number of states ratifying each agreement has also increased over time[159].

However, the failure of successive international climate negotiations to achieve carbon emission reduction commitments that match agreed targets highlights the complexity of multilateral approaches to addressing the drivers and pressures affecting nature[51].

Protected Areas

The area of land and ocean protected by national and regional legislation has continued to rise, now covering 14% of territorial land and waters globally[196].

Environmental Expenditure

Substantial investments have been made worldwide in land and water management, the reduction of waste, control of pollution, protection of species, and efficiencies in natural resource use. For example, biodiversity-related aid spending reached US$3.13 billion in 2007[181].

Environmental responses are attracting greater financial flows but these still fall short of the resources needed. The Organisation for Economic Cooperation and Development countries' aid commitments to the three UN conventions on biodiversity, climate and desertification grew from US$5.1 billion in 1999 to US$17.4 billion in 2009[159]. The same countries allocated US$22.9 billion to official development assistance for climate change mitigation and adaptation in 2010. Yet the cost for developing countries to adapt to climate change alone has been estimated at US$70–US$100 billion a year for 2010–2050[159].

SECTION 5

What We Measure

What we measure affects what we do; and if our measurements are flawed, decisions may be distorted.

In a world of increasing change and complexity, there is a critical need for sustainability indicators to capture not only raw measures of this pressure or that condition, but also the dynamics of changes and trends and the trajectories of important features of both the Earth system and social and economic pressures[197].

Unfortunately, in many cases, making the measurement appears to be the sum total of action on a particular issue.

For example, we measure material consumption and waste production in Australia, but this is not accompanied by any measure of what sustainable consumption and waste production might be, nor any accompanying set of policies and regulations to ensure that those limits are not breached.

We measure rate of land clearing, and put in place regulations to control it, but there is no measure of how much land clearing might be sustainable, nor any comprehensive measurements on whether any regrowth is equivalent in structure and function to the land previously cleared.

Thus decisions regarding these matters are not bounded by the ability of nature to support those decisions. Material consumption, waste production and land clearing, within the bounds of regulations, continue without regard for the range of issues and consequences that we don't measure.

Measuring Equitable and Sustainable Wellbeing

Recent reviews of ecological and sustainability indicators highlight the need for substantial development in how nature and society are measured[4,197].

If Australian society is to function 'sustainably' in the future, sustainable development must refer to a path of development that sustains or prevents the diminishing of something. Our first requirement is to state what that "something" should be.

Such a task may require some measure or statement of what the health of nature or the health of Australian society should be in the future.

This report assumes that human wellbeing, and the wellbeing and prosperity of Australian society, depend on healthy nature.

Thus a sustainable path in this context requires that 'development' results in improvements to the wellbeing not only of the current generation, but also of future generations and nature itself.

Gross domestic product (GDP)-based measures of progress largely ignore the value of natural and social capital and the distribution of wealth and income. The GDP makes no distinction between productive and destructive activities. GDP places a positive value on all transactions and adds them to the total. Illness, pollution, and natural disasters all cause the GDP to increase, as money is spent to treat the sick, clean up the mess, and repair the damage[9].

"A sustainable path requires that 'development' results in improvements to the wellbeing not only of the current generation, but also of future generations and nature itself."

The European Union, the Organization for Economic Cooperation and Development, the Stiglitz Commission, and many others have recognized the need to go beyond GDP as a measure of sustainable wellbeing[9].

The Human Development Index (HDI)[198] was developed in an attempt to broaden the perspective of wellbeing beyond economic growth and income by adding literacy and mortality rates to the equation of income.

However, neither GDP nor HDI reflect in any way the state of the natural environment, or give any indication of whether levels of wellbeing are sustainable.

Recent developments in measuring sustainability and wealth have focused on capturing not only manufactured and human capital but also natural capital, health improvements and technological change. One study found that these last three often-neglected contributors to wealth fundamentally affect the conclusions drawn about whether given nations are achieving sustainability[199].

Another measure known as the Inclusive Wealth Index(IWI)[200] measures the wealth of nations by carrying out a comprehensive analysis of a country's productive base. That is, it measures all of the assets from which human wellbeing is derived, including manufactured,

Figure 38: The Australian National Development Index conceptual framework[201]

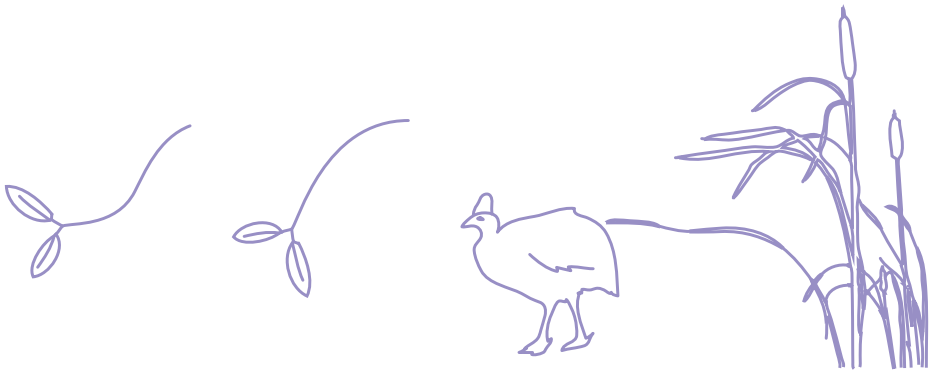
human and natural capital. In this, it measures a nation's capacity to create and maintain human wellbeing over time. This becomes the new measure of sustainability in which a country's inclusive wealth is the social value (not dollar price) of all its capital assets, including natural capital, human capital and produced capital.

Yet even this approach has its limitations. For example, the focus on natural capital is on stocks of material for consumption or conservation, and ignores more complex functions like ecological processes.

A more holistic approach to measuring national progress and wellbeing to reflect the values and priorities of Australians is under development. The Australian National Development Index (ANDI)[201] incorporates not only economic indices but also accounts for other critical domains that lead to enhanced wellbeing including:

1. Children and young people's wellbeing
2. Community and regional life
3. Culture, recreation and leisure
4. Governance and democracy
5. Economic life and prosperity
6. Education, knowledge and creativity
7. Environment and sustainability
8. Justice, fairness and human rights
9. Health
10. Indigenous wellbeing
11. Work and work-life balance
12. Subjective wellbeing and life satisfaction[201].

These twelve domains will each have twelve indicators, all of which will be combined into a single composite index, providing a more complete picture of national wellbeing (Figure 38)[201]. Such an index promises a much deeper and richer understanding of Australian society and its progress. It has the potential to influence decisions by governments, businesses and individuals in ways that advance Australia's development without drawing down our natural, social, human or manufactured capital.



Everyday Australians Looking After The Places They Love

President of the Ecological Agriculture Association of Australia

KERRY COCHRANE

We want farmers to think 'what is my connection to the land, what is my relationship to it?' On the basis of that, then make farming decisions. By understanding the ecology and how parts connect, we make better farming management decisions.

There is a different way of doing things.

The use of hydrocarbons has to be phased out. We cannot keep putting chemicals on the planet in the volume that we have. Our future farmers will need to be energetic, creative and motivated to challenge and to explore.

That's what it's all about.

SECTION 6

MATTHEW CHARLES JONES

We know we can do things differently. We are already doing things differently.

We are working toward making our town 100 percent renewable by the year 2022.

Other towns, states and countries are doing this around the world - we'd like to see whether it is possible in our town.

We're working with people locally to identify what a new energy supply could look like.

Founding member of Totally Renewable Yackandandah

Nyikina Traditional Owner, Managing Director Madjulla Inc

Photo: Mark Pearce

DR ANNE POELINA

Several years ago the Kimberley came under extensive threat from mining.

Over the past few years I have been working with very senior elders, with other Aboriginal leaders, to look at how we might protect the Kimberley and develop the diverse economies that we believe are sustainable and will bring mutual benefit.

This is about our country – the river, the sea, the hill country and the desert. We need to preserve the land if we want to preserve humanity.

THEA ORMEROD

I am not used to doing things to make other people feel uncomfortable or obstructed – but when all other avenues have been exhausted, there comes a point where the only thing left is civil disobedience.

Taking care of God's planet for future generations is part of what our faith calls us to do.

This is about a public voice. Joining of Hindu voices with Jewish voices, with Islamic voices and Christian voices to actually speak publicly about the importance of acting in relation to climate change. At the moment our lifestyles are not compatible with maintaining a world that can continue for future generations.

President of the Australian Religious Response to Climate Change

Photo: Sean McPhillips

Photo: Shaun Denaro

EMILY KATE SYMES

Eco-fashion entrepreneur

People want to know where their clothes come from, how they're made, how their purchase choices are impacting our environment.

The fashion and textile manufacturing industries are some of the most polluting industries in the world. We are creating options for Australians to shop sustainably.

Photo: Deanne Eccles

DEANNE ECCLES

Tourism operator and founding member of the 'Knitting Nannas of Toolangi'

It became clear that we needed to act. Tourism is the way forward. Clear-fell logging is keeping us in the past.

The Knitting Nannas want to draw attention to the clear-fell logging in Melbourne's water catchments – the Yarra Valley, where we live.

We set up with banners, our fold out chairs, our thermos, we enjoy the forest and we knit together. We are very loving, caring people.

We want to make a stand for these forests but we want to do it in a peaceful way.

SECTION 7

What's Next?

This report is a sobering reminder that nature, the very foundation of humanity's prosperity and wellbeing, is being diminished faster than we can restore it. But it is also a call to action, to embrace Australia's potential as an innovative and prosperous nation with the means and the will to achieve our fullest potential this century.

The focus of this section is on the future, and how Australia can achieve a truly sustainable society in which the values of the community are embedded and fulfilled.

Societies have a long history of mobilizing efforts, making sacrifices and changes, to defeat an enemy at the gates, or even just to compete more successfully with a rival. But there is not much evidence of societies mobilizing and making sacrifices to meet gradually worsening conditions that threaten real disaster for future generations[202]. This is the situation in which Australian society finds itself today. Australia is experiencing ever-worsening trends in the health of nature, but the changes are not sudden enough to precipitate the scale of response required to reverse those trends.

Yet rapid and massive mobilization is exactly what will be required to ensure nature is effectively valued and protected into the future, so that Australian society can achieve its full potential this century.

One critical factor necessary to inspire such change is a shared vision, developed and owned by the community, for what kind of society Australians want in the future. If we don't know where we want to go, it makes little difference that we make progress. Yet vision is not only missing almost entirely from policy discussions; it is missing from Australian culture as a whole.

"This is a call to action to embrace Australia's potential as an innovative and prosperous nation with the means and the will to achieve our fullest potential this century."

One of the most challenging tasks facing our society today is the creation of such a shared vision of a sustainable and desirable society, one that can provide permanent prosperity within the constraints of the real world; one that is fair and equitable to all of humanity, to other species, and to future generations[203].

This will inevitably require innovation, collaboration and action from the ground up, led by communities. It will rely on a collective understanding of Australian values, and how those values can be embodied in institutions, laws and behaviours.

Motivations and Values

There is mounting evidence that facts play only a partial role in shaping people's judgment. Emotion is often far more important, in particular, dominant cultural values, which are tied to emotion[204]. Thus simply conveying information about "bigger-than-self" problems like climate change and the decline of nature is likely to leave many people unmoved – or perhaps even more resistant to change[205].

However, there is good reason to believe that such bigger-than-self problems will only be systemically addressed through a combination of:

- An understanding of the effect of cultural values upon people's motivation to change their own behaviour or to demand change from political and business leaders;
- An understanding of the range of factors that activate and strengthen some values rather than others.
- Widespread public debate about the ways in which government, business and civil society organizations serve to strengthen particular values through their communications, campaigns and policies[204].

Values can defined through five features: A value is (1) a belief (2) pertaining to desirable end states or modes of conduct, that (3) transcends specific situations, (4) guides selection or evaluation of behaviour, people, and events, and (5) is ordered by importance relative to other values to form a system of value priorities. These are the formal features that distinguish values from such related concepts as needs and attitudes. They make it possible to conclude that security and independence are values, whereas thirst and a preference for blue ties are not[206].

There is also a long-held theory that humans have an innate tendency to focus on life and life-like processes, that there is a human need for deep and intimate association with the natural environment, particularly its living forms[207]. This reinforces the importance of a self-interested basis for a human-centred ethic of care and conservation of nature, most especially the diversity of life[208], an ethic that can be harnessed as the basis of inspiration and motivation.

There is a large body of evidence about the way in which people's values are organized across cultural contexts, that finds people's values tend to cluster in remarkably similar ways across cultures[204].

This research also makes the distinction between two broad classes of value: intrinsic or self-transcendent values, and extrinsic or self-enhancing values. Intrinsic values include the value placed on a sense of community, affiliation to friends and family, and self-development. Extrinsic values, on the other hand, are values that are contingent upon the perceptions of others – they relate to envy of 'higher' social strata, admiration of material wealth, or power[204].

These two classes of value act in opposition. For instance, to the extent that a person considers the intrinsic value of 'community feeling' (which includes the desire to improve the world through civic involvement) to be important, they are less likely to place importance on the extrinsic value of 'financial success' (which encompasses an individual's desire for money, possessions and his or her envy of those who have these things).

Many of the barriers to wellbeing are symptoms and results of an underlying system of values that operates both within individuals and societies, based strongly in extrinsic values[209].

However, in much the same way that measures of GDP cannot capture the breadth of information required to achieve sustainable wellbeing, the fulfilment of extrinsic values are only a part of the broader set of intrinsic values that communities express in a multitude of ways.

For example, when asked what kind of future society they want for themselves and their children, many people reply with personal happiness and health, enough money to live comfortably, better education, and a world that is more just and sustainable[210,211].

A better understanding of the shared values of Australians regarding the kind of future they see for themselves and Australian society could have a significant influence in developing a shared vision for Australia in which nature is effectively valued and protected, and the sustainable wellbeing of Australian society is ensured.

Champions for Nature

The preceding section highlighted stories of regular Australians who are not only taking significant personal actions to better value and protect nature, but also bringing along their communities with them. In the process, the communities' values are given expression in new and powerful ways.

While there is currently no long-term plan for the future sustainable development of Australian society, there is a growing movement of passionate and active communities across Australia, taking action to ensure their own futures. These actions are collaborative, innovative and proactive, and gathering momentum by the day.

"Communities around Australia are taking action to ensure their own futures."

There are business collectives developing innovative and sustainable business models, local groups restoring enormous tracts of land, whole communities banding together to produce their own energy and food, and community organizations forging new methods of governance and decision making to ensure Australian institutions are able to achieve their greatest potential in this ever more complex world.

It's time for us to listen

We want to know what kind of Australia you want to live in. What does your community look and feel like in 10 years' time where nature is effectively valued and protected, and where all of us can achieve our full potential?

What are the values of that community that make it a place you'd love to live?

What are the positive initiatives that are really making a difference to how we care for the natural resources of Australia like food, water, energy, air, forests, oceans and all of our unique and wonderful native animals and plants?

How might your community be taking action to make a real difference through collaboration and innovation?

Join the **National Nature Conversation** and help build a vision for a healthy, happy and sustainable Australia.

#OzNatureConvo

Find out more at www.placesyoulove.org

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Places You Love alliance members

- ACT Conservation Council
- Arid Lands Environment Centre
- Australasian Bat Society
- Australian Conservation Foundation
- Australian Marine Conservation Society
- Australian Rainforest Conservation Society
- Bat Conservation and Rescue Queensland
- BirdLife Australia
- Birds SA
- Cairns and Far North Environment Centre
- Climate and Health Alliance
- Colong Foundation for Wilderness
- Conservation Council of South Australia
- Conservation Council of Western Australia
- Environment Centre NT
- Environment Kimberley
- Environment Tasmania
- Environment Victoria
- Environmental Justice Australia
- Friends of the Earth Melbourne
- Greenpeace Australia

- Householders' Options to Protect the Environment Inc
- Humane Society International
- International Fund for Animal Welfare
- Invasive Species Council
- National Parks Association of NSW
- National Parks Association of the ACT
- National Parks Australia Council
- Nature Conservation Council of NSW
- Nature Conservation Society of South Australia
- Queensland Conservation Council
- Queensland National Parks Association
- Rainforest Rescue
- Sunshine Coast Environment Council
- Tasmanian Conservation Trust
- Tasmanian National Parks Association
- The Wilderness Society
- Total Environment Centre
- Victorian National Parks Association
- Wildlife Preservation Society of Queensland
- WWF-Australia

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