MEDIA REPORTS AND WEBSITES

The following articles represent a small proportion of the media reports available on topics for the new Geography 11–12 Syllabus (2022).

- Population:
 The world's most populous countries
- **Population:** The twenty countries with the fastest declining populations
- **Resources:** Gold mining is one of the world's most destructive and unnecessary industries – Here's how to end it
- Hazards: 200 Experts Dissected the Black Summer Bushfires in Unprecedented Detail. Here Are Six Lessons to Heed.
- Hazards:

Floods Play a Vital Role in Ecosystems – It's Time to Get Out of Their Way What Australia learned from recent devastating floods Floods can be a disaster from humans – but for nature it's a boom

- Hazards:
 Indigenous Expertise Is Reducing Bushfires in Northern Australia. It's Time to Consider Similar
 Approaches for Other Disasters
- Climate Change Adaptation. ADAPT NSW
- Sustainability: Three Core Principles of the Circular Economy
- Biodiversity Conservation:
 Royal Botanic Gardens and The Australian Institute of Botanical Science

EDITOR BOOK RECOMMENDATION

The Climate Book Greta Thunberg (E-Book and printed books available)



POPULATION

CHARTED: THE WORLD'S MOST POPULOUS COUNTRIES (1973–2023)

Visual Capitalist



Source: https://www.visualcapitalist.com/most-populous-countries-over-50-years/

The World's Most Populous Countries (1973–2023)

Humankind is now double the size it was in 1973

Of course, that growth has been far from uniform, and the ranking of the world's most populous countries continues to evolve.

Using the **latest data** available from the United Nations, we've looked at which countries have the largest share of the planet's **eight billion people**.

Country	•	Population (1973)	٠	Population (2023)	٠	Change (1973-2023)	
China		881,652,084		1,425,671,353		544,019,269	
India 🗠		596,107,487		1,428,627,666		832,520,179	
United States		207,314,772		339,996,567		132,681,795	
Russia		132,191,636		144,444,360		12,252,724	
- Indonesia		124,709,060		277,534,118		152,825,058	
• Japan		109,679,473		123,294,516		13,615,043	
Brazil		103,666,906		216,422,450		112,755,544	
Germany		78,667,473		83,294,634		4,627,161	
Bangladesh		71,144,816		172,954,325		101,809,509	
Pakistan		64,285,630		240,485,666		176,200,036	
II Nigeria		59,605,450		223,804,636		164,199,186	
Mexico		55,228,202		128,455,563		73,227,361	

The Top 10 Most Populous Countries

Here are the countries shown above, including how much they've grown over the past 50 years:

The numbers above highlight the extreme variance in growth for these world's most populous countries. While Germany has grown by just 6% over the past 50 years, Pakistan and Nigeria have nearly quadrupled their populations.

Half a century ago, there were only six countries with populations of over 100 million. Today, there are 15 countries past that mark, with Vietnam positioned to hit that milestone next.

The Top 20 Most Populous Countries

Things get even more interesting when we examine the top 20 most populous countries over the same time period.

Looking back 50 years ago, **Nigeria** was the lone African nation in the top 20. Today, it is joined by **Ethiopia**, **Egypt**, and the **Democratic Republic of the Congo** – all of which have experienced staggering population growth.

African nations are expected to lead population growth over the next few decades. By 2100, one quarter of the world's people are expected to be African. Europe is the flip side of this equation. Back in 1973, there were six European countries in this top list. Today, only **Russia** and **Germany** remain, with the latter country soon to fall out of the top 20 ranking.

Ukraine, which was shrinking, is expected to fall to at least 41st place due to the turmoil surrounding the Russian invasion of the country. Since the invasion began in February 2022, nearly 14 million border crossings have been recorded from Ukraine to other countries.

Country	Population (1973)	+	Rank (1973)	Population (2023)	+	Rank (2023)	
China	881,652,084		1	1,425,671,353		2	
India	596,107,487		2	1,428,627,656		1	
United States	207.314,772		3	339,995.567		3	
Russia	132,191,636		4	144,444,360		9	
- Indonesia	124,709,060		5	277,534,118		4	
• Japan	109.679,473		6	123,294.516		12	
Brazil	103.666,906		7	216,422,450		7	
Germany	78,667,473		8	83,294,634		19	
Bangladesh	71.144,816		9	172,954.325		8	
B Pakistan	64,285,630		10	240,485.666		5	

Nigeria	59,605,450	11	223,804,636	6
# United Kingdom	56,166,630	12	67,736,798	21
Mexico	55,228,202	13	128,455,563	10
Italy	54,379,587	14	58,870,763	25
France	51,814,077	15	64,756,586	23
- Ukraine	48,301,548	15	36,744,635	41
Vietnam	44,891,286	17	98,858,947	16
Philippines	40,406,232	18	117,337,366	13
Thailand	38,873,065	19	71,801,281	20
C Turkey	38,028,236	20	85,816,192	18
= Egypt	37,120,778	21	112,716,599	14
= Iran	30,981,903	25	89,172,768	17
🕿 Ethiopia	30,694,321	26	126,527,064	11
Z DRC	21,853,908	32	102,262,812	15

How Big Will Populations Get?

Once **India** becomes the world's largest country, it will likely remain so for many decades in the future, peaking in the 2060s (unless there are substantial changes in projected growth rates). India's peak population will stand at around 1.7 billion people.

The world's population is expected to peak later, around the 2080s. Humanity's peak population is expected to be about 10.5 billion.

POPULATION

RANKED: THE 20 COUNTRIES WITH THE FASTEST DECLINING POPULATIONS

Visual capitalist



Visualising Population Decline by Country

Since the mid-1900s, the global population has followed a steep upwards trajectory.

While much of this growth has been concentrated in China and India, researchers expect the next wave of growth to occur in Africa. As of 2019, for example, the average woman in Niger is having over six children in her lifetime.

At the opposite end of this spectrum are a number of countries that appear to be **shrinking** from a population perspective. To shed some light on this somewhat surprising trend, we've visualised the top 20 countries by population decline.

The Top 20

The following table ranks countries by their rate of population decline, based on projected rate of change between 2020 and 2050 and using data from the **United Nations**.

Rank	÷	Country	+	Decline 2020-2050
1		💳 Bulgaria		22.5%
2		Eithuania		22.1%
3		= Latvia		21.6%
4		Ukraine		19.5%
5		🚥 Serbia		18.9%
6		Bosnia and Herzegovina		18.2%
7		I Croatia		18.0%
8		Moldova		16.7%
9		 Japan 		16.3%
10		Albania		15.8%

Many of these countries are located in or near Eastern Europe, for reasons we'll discuss below.

The first issue is **birth rates**, which according to the Peterson Institute for International Economics (PIIE), have fallen since the **collapse of the Soviet Union**. Across the region, the average number of children per woman fell from 2.1 in 1988 to 1.2 by 1998.

Birth rates have recovered slightly since then, but are not enough to offset deaths and **emigration**, which refers to citizens leaving their country to live elsewhere.

Eastern Europe saw several waves of emigration following the European Union's (EU) border expansions in 2004 and 2007. The PIIE reports that by 2016, **6.3 million** Eastern Europeans resided in other EU states.

The Outliers

There are two geographical outliers in this dataset which sit on either side of Europe.

Japan

The first is Japan, where birth rates have fallen continuously since 1970. It wasn't until 2010, however, that the country's overall population began to shrink.

By the numbers, the situation appears dire. In 2021, **811,604** babies were born in Japan, while **1.44 million** people died. As a result of its low birth rates, the island nation also has the world's highest average age at 49 years old.

The Japanese government has introduced various social programs to make having kids more appealing, but these don't appear to be getting to the root of the problem. For deeper insight into Japan's low birthrates, it's worth reading **this article** by *The Atlantic*.

Cuba

The second country is Cuba, and it's the only one not located within the Eastern Hemisphere. Cuba's fertility rate of 1.7 children per woman is the lowest in the Latin American region. It can be compared to countries like Mexico (2.2), Paraguay (2.5), and Guatemala (3.0).

Cuba's immigration is also incredibly low compared to its neighboring countries. According to the International Organization for Migration, immigrants account for just **0.1%** of its total population.

Visual capitalist– https://www.visualcapitalist.com/ ranked-the-20-countries-with-the-fastest-decliningpopulations/

EDITOR WEBSITE RECOMMENDATION

Our World in Data https://ourworldindata.org

Population growth @

IN THIS SECTION

- ψ Population growth by world region
- Population growth by country
- \downarrow The distribution of the world population over the last 5000 years
- ψ Population growth rate by country and region

NATURAL RESOURCES

GOLD MINING IS ONE OF THE WORLD'S MOST DESTRUCTIVE AND UNNECESSARY INDUSTRIES – HERE'S HOW TO END IT

The Conversation

Stephen Lezak, University of Oxford

The 16th-century King Ferdinand of Spain sent his subjects abroad with the command: "Get gold, humanely if possible, but at all hazards, get gold." His statement rings true today. Gold remains one of the world's most expensive substances, but mining it is one of the most environmentally and socially destructive processes on the planet.

Around 7% of the gold purchased globally each year is used for industry, technology or medicine. The rest winds up in bank vaults and jewellery shops.

Beautiful objects and stable investments are worthwhile things to create and own, and often have significant cultural value. But neither can justify gold mining's staggering human and ecological toll. In a **recent study**, my colleagues and I showed how it might be possible to end mining and instead rely entirely on recycled gold.

Despite improvements in gold mining practices over the past century and new regulations designed to limit mining's impacts, this industry continues to wreak havoc upon landscapes across every continent except Antarctica.

In a given year, gold mines **emit more greenhouse gases** than all passenger flights between European nations combined. **Gold mining** also accounts for 38% of annual global mercury emissions, which cause millions of small-scale miners to suffer from chronic mercury poisoning, which can cause **debilitating illness**, especially in children.

Our research involved modelling hypothetical scenarios in which gold consumption could decline to more sustainable levels. Using current recycling rates, we examined a fully circular gold economy in which the world's entire supply of gold came from recycled sources.

Even today, nearly one-quarter of annual gold demand is supplied through recycling, making it one of the world's most recycled materials. The recycling process uses no mercury and has **less than 1%** of the water and carbon footprint of mined gold.

We found that a global decline in gold mining would not necessarily derail any of gold's three central functions in jewellery, technology or as an investment.



Two trucks transport gold ore from Barrick Cowal Gold Mine in New South Wales, Australia. Image: Jason Benz Bennee/Shutterstock

Towards circularity



Gold stocks and three scenarios of gold flows. Lezak et al. (2022), CC BY-NC-ND

Our model showed that the gold used for industrial purposes (mainly in dentistry and smartphones) could be supplied for centuries even if all gold mining stopped tomorrow.

We also found that jewellery could still be produced with recycled gold in a fully circular gold industry. There would just be about 55% less to go around, which would still leave more than enough for essential uses.

NATURAL RESOURCES

In order to make this future a reality, investors would have to limit their trading to existing reserves, without adding newly mined gold to their coffers.

A world with a shrinking supply of gold would likely mean that consumers would pay more for the same 24-karat pure gold ring. But more likely, jewellery purchases would shift to cheaper (and more durable) alloys of gold that are already popular. And in the future, demand for gold may decline as consumers become more concerned with making sustainable choices.

The role that invested gold plays in the global economy would likely continue to function regardless of extraction. Like Renaissance art, gold is valuable precisely because it is scarce. Ending gold mining would not put an end to the buying and selling of gold for bank vaults. Instead, it would make existing stocks of gold more valuable.

Irrespective of whether the world needs gold, our research suggests that the world does not need gold mining.

Private investors and central banks may balk at this idea. The US government, for example, is the world's single largest owner of gold, holding **US\$11 (9.1) billion in reserves**. But transitions to sustainability are always hardwon and the gold industry is no exception.

Inspired by other transitions

Like gold, the extraction of fossil fuels is also environmentally damaging. But unlike gold, fossil fuels provide warmth and electricity to homes and businesses, power to vehicles and fertiliser to farms. Transitioning away from this resource required decades of research and investment into clean energy technologies.

By contrast, finding substitutes for gold does not require any research. Jewellery can be made more sustainable by blending gold with other metals. Investors can rely on existing gold stocks and diversify to other stable assets. And technology can continue to use recycled gold when appropriate.

Closing gold mines is the first step. But many regions have grown dependent on gold mining, and artisanal mining alone supports as many as **19 million** miners and their families worldwide, mostly in developing economies.

These miners deserve a just transition that ensures they do not become collateral damage in the shift to sustainability. Governments must provide a robust safety net for former gold miners and their families. That includes offering lowcost training and reskilling to ensure that miners can find employment in more sustainable industries.

Steps toward sustainability

Responsibly drawing down gold extraction will take time. But several measures are available to begin the transition today. On the demand side of the industry, major jewellery brands, including **Pandora**, have already committed to using only recycled gold by 2025. Global technology firm **Apple** has also recently set a goal to use exclusively recycled materials by 2030.

On the supply side, mining companies should begin retiring mines that extract only gold. Many copper mines produce gold as a byproduct, which will likely continue into the future.

Meanwhile, institutional investors should stop investing in new gold mines. That includes groups like the **World Bank**, which has invested US\$800 (£660) million in gold mines in Africa, Asia, South America and the Pacific Islands since 2010.

Justice-minded fund managers, such as those overseeing endowments, should add gold mining firms alongside coal producers to their divestment lists. And central banks should redirect their future investments toward other stable stores of value, or at least source exclusively recycled gold.

The world is filled with difficult sustainability trade-offs. Gold mining is not one of them. Drawing down this industry stands out as a relatively easy way to reduce humanity's footprint on a fragile planet.



Artisanal gold mining near Kouremale, northern Guinea. Image: Tommy E Trenchard/Alamy Stock Photo

Related articles

Artisanal gold mining in South Africa is out of control. Mistakes that got it here. Published: August 3, 2022 9.25pm AEST https://theconversation.com/artisanalgold-mining-in-south-africa-is-out-of-control-mistakesthat-got-it-here-188038

Gold mining leaves deforested Amazon land barren for years, find scientists https://theconversation.com/ gold-mining-leaves-deforested-amazon-land-barrenfor-years-find-scientists-141639

Pictures from outer space reveal the extent of illegal gold mining in Peru https://theconversation.com/ pictures-from-outer-space-reveal-the-extent-of-illegalgold-mining-in-peru-159416

200 EXPERTS DISSECTED THE BLACK SUMMER BUSHFIRES IN UNPRECEDENTED DETAIL. HERE ARE SIX LESSONS TO HEED

The Conversation 2023

The Black Summer bushfires of 2019–20 were cataclysmic: a landmark in Australia's environmental history. They burnt more than 10 million hectares, mostly forests in southeast Australia. Many of our most distinctive, ancient and vulnerable species were worst affected.

A new book released today, titled **Australia's Megafires**, synthesises the extent of the losses. The work involved contributions from more than 200 scientists and experts. It provides the most comprehensive assessment yet of how the fires affected biodiversity and Indigenous cultural values, and how nature has recovered.

The work reveals a picture of almost unfathomable destruction. More than 1,600 native species had at least half their range burnt. And hundreds of species and ecosystems became nationally threatened for the first time, or were pushed closer to extinction.

We must use Black Summer as an opportunity to learn – and make fundamental changes. Here, we outline six lessons to heed.

1. Natural systems are already stressed

Problem: Even before Black Summer, most Australian ecosystems were already struggling due to multiple threats.

The threatened alpine bog communities in the Australian Capital Territory, for example, were already being damaged by climate change, weeds and feral animals. Then the Black Summer fires came through and burnt 86% of known sites.

Put all these threats together, and recovery for these ecosystems – which are slow to develop – will not be easy. They may be lost altogether, along with threatened animals that call the bogs home, such as the **broadtoothed rat**.

Solution: Managing crises such as fires is not enough on its own. Our natural systems must be made more resilient. More effective legislation and management is needed to control all threats that degrade nature. And in some cases, threatened species may need to be relocated to put them out of harm's way.

RIGHT: Loss of alpine bogs threatens the survival of the native broad-toothed rat. AAP Image/Supplied by Museums Victoria, Heath Warwick

2. We don't know what, or where, all species are

Problem: Thousands of Australian species are not (or barely) known to science. It's very hard to protect a species if we don't know it exists, where it lives or how it responds to fire.

For example, it's likely that the Black Summer fires sent many invertebrate species – such as insects and spiders – to extinction. But we'll never know because they were never described by Western science, and their distributions were never traced.

Only about 30% of Australia's estimated 320,000 invertebrate species have been **described** by taxonomists. Of those that are described, most are known from only one or two records, which provides only limited insight. Information is similarly poor for fungi.

Solution: We need to gather more information about how species and environments respond to fires, and to what extent conservation efforts after fires are working. This is especially true for poorly known species groups. And the data should be made accessible to all who seek it.



3. Emergency responders don't have enough information

Problem: Emergency responders told us that during the fires, they didn't have the information to prioritise the most important areas for conservation.

We found across 13 agencies, just two threatened species were covered by a specific and accessible emergency plan: the Wollemi pine and the eastern bristlebird. These plans told emergency responders what rescue action was needed.

For example, a plan was in place to protect the only known natural stand of Wollemi pines, in New South Wales. This prompted an **extraordinary firefighting effort** during the Black Summer fires. The effort was successful.

Solution: More than 1,800 of Australia's plant and animal species are at risk of extinction. We must identify which are a priority, where they are, and how to protect them from bushfires. This information must be communicated to emergency responders and incorporated into regional fire management plans.

4. Biodiversity usually comes last

Problem: Traditionally, the hierarchy of what to protect in disasters goes like **this**: first human life, then infrastructure, and finally biodiversity. If this hierarchy continues, some of our most significant species and natural environments will be lost.

In **one example** recounted to the book's researchers, fire authorities decided to prioritise saving a few farm sheds over 5,000 hectares of national park.

Solution: There are cases, such as avoiding extinctions, where protecting nature is more important than saving infrastructure. Community priorities should be surveyed, and the information used to inform planning and policy.

Legal obligations to protect biodiversity in fires are few. The **current re-working** of federal environment laws provides an opportunity to change this.

5. Conservation funding is grossly insufficient

Problem: Decades of sustained management effort is needed to recover many species and environments affected by fire. Unfortunately, funding for the task is short-term and inadequate.

For example, both state and federal governments invested heavily in controlling feral herbivores, **such as deer**, in the months after the fires. This was done to protect unburnt and regenerating vegetation. Yet, eventually the funding dries up and feral **populations rebound**. Extra funding for some short-term recovery projects flowed in the wake of the Black Summer fires – from governments, the private sector and the community. But for many species, recovery will be a long-term proposition – if it happens at all.

Solution: Governments must stop seeing spending on the environment as optional. It's as fundamental to our society and well-being as health and education – and funding levels should reflect this.



An endangered Rosenberg's monitor at Kangaroo Island, after the Black Summer fires. For many species, recovery is a long road. Image: David Mariuz

6. First Nations knowledge has been sidelined

Problem: First Nations people have **used fire** to manage forested landscapes for millenia. Yet their knowledge and perspectives have not been incorporated into forest fire management and recovery.

So how has this come about? Barriers identified in the book include inadequate employment and training opportunities for First Nations people to undertake cultural burning activities. Also, First Nations people are frequently denied access to Country to rekindle and develop their land management skills, and lack the legal authority to undertake cultural burning.

And as the book shows, cross-cultural challenges mean non-Indigenous fire officers can have limited appreciation or knowledge of Indigenous cultural burning protocols.

Solution: Indigenous people should be supported to **rekindle**cultural fire practices in forests. And non-Indigenous fire managers should, with consent from First Nations people, incorporate these practices into policies governing fire management and recovery.

What's more, species and sites that are culturally important to First Nations people should be prioritised for protection and recovery.

NATURAL HAZARDS – BUSHFIRES

Harnessing our grief

The Black Summer fires showed people care. The disaster triggered an outpouring of grief from Australia and around the world. We understood one thing clearly: we were losing what enriches our lives.

But protecting our precious natural assets requires a fundamental reset of Australia's fire management.

More broadly, the Black Summer fires kickstarted a huge collaborative recovery effort from governments, conservation and research organisations, and First Nations groups. If we're to be better prepared for future megafires, this impetus must continue.

Libby Rumpff ,University of Melbourne Brendan Wintle, University of Melbourne John Woinarski, Charles Darwin University Sarah Legge, Australian National University Stephen van Leeuwen, Curtin University



First Nations fire knowledge has been sidelined. Pictured: a workshop on Indigenous fire practices in Bungendore, NSW, in 2020. Image: Kydpl Kyodo

https://theconversation.com/200-experts-dissected-theblack-summer-bushfires-in-unprecedented-detail-here-are-6-lessons-to-heed-198989

EDITOR BOOK RECOMMENDATION

Australia's Megafires. Biodiversity Impacts and Lessons from 2019 – 2020. CSIRO PUBLISHING https://www.publish.csiro.au/book/8085/



WHAT AUSTRALIA LEARNED FROM RECENT DEVASTATING FLOODS

The Conversation 2023

Iftekhar Ahmed Associate Professor, University of Newcastle

Australia and New Zealand have both faced a series of devastating floods triggered by climate change and the return of the La Niña weather pattern. So it makes sense that Australia has now sent disaster crews to help with the aftermath of Cyclone Gabrielle.

With **five serious floods** in the space of 19 months in 2021–2022, Australia's experiences – and how people responded – offer New Zealand a guide for recovering and rebuilding after an extreme weather event.

The flooding events in both countries share two key common elements. First, the floods broke previous records and were the largest in recent history. Second, there were also repeat flood events.

In Auckland, there were **two massive floods within five days**, while Cyclone Gabrielle became the Coromandel's **fifth severe weather even**<u>t</u> for 2023 and devastated other parts of the North Island.

The other common factor is urbanisation. Auckland's population has been growing, resulting in the increasing development of the built environment. Intensifying urban development places pressure on existing drainage systems – parts of which are no longer fit for purpose.

Extensive built-up and paved areas with hard, impermeable surfaces can also cause rapid run-off during heavy rain, with the water unable to be absorbed into the ground as it would be in **soft**, **vegetated areas**.



Working with the community

Our **recent research** in the Hunter Valley in Australia – one of the areas affected by those five successive floods – identified similar factors contributing to the flooding events, including a **rapidly growing regional population**.

Two of our research sites – the Cessnock and Singleton local government areas – had growing urban centres that reflected a similar development trajectory to Auckland, albeit in a smaller scale.

Our research in the Hunter Valley established the importance of identifying existing community resilience and gaps. We also observed the need to involve the community at all levels. This included having early warning systems and evacuation protocols in place to improve community access to information and warnings.

The State Emergency Services (SES) is the main agency in New South Wales responsible for flood response and management. Supported by community volunteers, the SES has a clear focus at the local level.

This community focus is evident with its "door-knocking kit", which is based on a community-level vulnerability assessment. The SES has a list of those in the community who are most at risk, such as the elderly and people with disabilities. When a flood risk becomes evident, SES volunteers go knocking on doors to check their preparedness and provide evacuation support.

The equivalent of SES in New Zealand, Auckland Emergency Management, could learn from this community-based approach and include it within its **Community Group Support** initiative, so that future disaster responses can be more closely tailored to the community.

In the recent floods in Auckland, communication was an issue. Relaying directives and information through multiple institutional layers **led to confusion**, which could have been avoided through a closer community-based approach.

LEFT: Disruption by floods to the road connection to Aberdeen, Hunter Valley. Image: NSW Surf Lifesaving, author provided

Building a volunteer army

Another key factor in Australia is the large cadre of SES volunteers – around **9,000 in New South Wales**, a state with a population of just over eight million. This is a significant form of social capital, without which the current approach to flood response and management would not be possible.

While there are initiatives in New Zealand to attract and engage volunteers, more needs to be done. Civil defence needs to conduct a structural review of the existing volunteer organisations that work in the disaster and emergency response field to identify ways to improve the recruitment and retention.

We also found evidence of volunteer "burn-out", meaning there's a need to support volunteers emotionally and financially during extended periods of disaster response and recovery.

While there is a large number of SES volunteers in Australia, more are needed as climate change drives more frequent, extensive and intense disasters. Given the similar nature of repeat climate-related disaster events in New Zealand, provisions for a large cadre of well-supported and well-trained volunteers is necessary.

A review of existing volunteer agencies and community organisations should be undertaken to identify ways they can be harmonised to avoid competing pressures for resources. As well, there's a need to nurture collaboration between agencies to help with sharing skills, training, data and resource management.

The need for resilience

Perhaps the key lesson for New Zealand, and also Australia, is the need to think beyond emergency management to building long-term resilience within agencies and communities.

As climate-related disasters become more common, we need to think about how our cities grow and how we can incorporate flood resilience by retaining green areas and vegetation, improved drainage and transportation links.

But both countries also need to focus on being ready for a disaster, instead of managing it after it happens. In doing so, the pressures of managing the disaster when it arrives would be less – and so would the long-term impacts on people and the economy.



State Emergency Services played an important role in working with the community during and after the Hunter Valley floods. Image: NSW Surf Lifesaving, author provided

FLOODS CAN BE A DISASTER FOR HUMANS – BUT FOR NATURE, IT'S BOOM TIME

The Conversation 2022

Paul Humphries Associate professor in ecology, Charles Sturt University Keller Kopf Lecturer, Charles Darwin University

Humans, as a rule, do not like floods. And three years of La Niña rains have meant Australians have had more than enough of floods.

But Australia's plants and animals have evolved alongside periodic floods, as they have for fire. For them, floods are a boon. These pulses of water are vital to the health of most river floodplain ecosystems. For some native fish, floods create new habitat as the waters fill floodplains, wetlands and creeks. Many trees like river red gums need periodic flooding too.

Floods trigger a huge spike in growth. Nutrientrich sediment is washed downstream and out on to floodplains. This is a boon to algae and aquatic plants at first, and, once the water evaporates, to grasses, shrubs and trees. Herbivores such as wallabies and wombats feast on the new growth.

Most of the time, rivers stay in their main channels and floodplains are dry. But in years like this one, so much rain falls that water spills over the banks and fills floodplains. This is a life-giving process which nourishes and replenishes. Without floods, rivers would not be rivers – they'd just be drains, unfit for all but the very hardiest of animals and plants.



Herbivores like wallabies flock to the new growth after floods. Image: Shutterstock

Why does nature need floods?

It's not all good news for nature. Flooding is a disturbance for wildlife and plants, moving things around and shaking things up. Some animals may drown, high flows may rip out plants and even undermine and topple trees. Low-oxygen **blackwater** events_and fish kills – heartbreaking for many – often follow floods, as they have recently on the Murray. But after the damage comes the boom.

Once the initial pulse of water subsides, it often takes much longer for the water to evaporate or drain from the floodplains. Plants killed by the water will add to the organic matter load, which may later be used by other plants.

The pulse of nutrients that goes with flooding is wonderful for freshwater phytoplankton (miniscule aquatic plants), as well as zooplankton which feed on them, such as tiny rotifers, known as wheel animals, and crustaceans. Some fish leave the main channel of the river and swim onto their new temporary habitat, feeding on the zooplankton. Waterbirds follow them.

Should the timing be right, native fish like golden and silver perch may breed in floodplain wetlands. Their larvae are poor swimmers, and these still, food-rich water bodies are ideal nurseries.

South Australia's Kati Thanda-Lake Eyre has only filled a handful of times over the last century. But the unprecedented rains this year have partly filled the lake. When water covers the arid land, brine shrimp eggs hatch in their millions and start feeding and breeding. It's a brief boom for fish, but as the water evaporates, the lake gets saltier and eventually kills the fish. Pelicans, cormorants, terns and gulls head inland to feast on shrimp and dying or dead fish.

In northern Australia, many rivers are not dammed, and widespread natural flooding occurs most years. Indigenous people here are accustomed to living alongside flooding and have been making use of the riches of floodplain productivity for more than 50,000 years. Tropical floodplains offer food and habitat

NATURAL HAZARDS – FLOODS

to everything from aquatic plants and barramundi to saltwater crocodiles and magpie geese.

In Australia's south-east, floodwaters generally don't linger quite as long as they do in the tropical north. But they do rise rapidly – sometimes several metres over only a couple of days. Much of the water will never return to the main channel of the river but will evaporate slowly. Deeper remnants like billabongs, lagoons or oxbow lakes – actually old river channels – linger longest.

The giant of Australia's rivers, the Murray, takes longer to flood because Australia is mostly flat. Pulses of water move slowly down its tributaries to the main channel. It can take weeks to months for rain that falls on the Great Dividing Range to make it to the Murray's mouth at Goolwa in South Australia.

These lingering floodwaters are perfect for freshwater mussels, as well as frogs, lizards, platypus and snakes. Bottlebrushes, wattles, reeds, rushes and aquatic plants do well out of floods too.

Of course, introduced species often thrive too. Common carp populations typically boom after floods. And willow trees and other invasive aquatic plants that spread through pieces breaking off, do well on the back of floods.

Our uneasy relationship with rivers

Nature needs floods. But while you might not believe it, we need them too. Most of the world's major cities were founded next to rivers, which gave their inhabitants water, fish, transport, and fertile farmland. But for all river cities, there are times when the river surges and can destroy houses and livelihoods.

Many cities have tried to tame floods with levees and dams. But as we're finding now, you can reduce the impact of smaller floods – but the big ones are all but unstoppable.



Floodplain fertility can be seen with the naked eye, as in this image of the Murray River flowing through the Riverina in New South Wales. Image: Shutterstock

Because we have farmed and settled so many floodplains, farmers are particularly vulnerable to floods. Floodwaters hitting bush will be slowed by trees and plants. But farms are often cleared, which can see more erosion take place. Whole farms can be devastated by flooding, leading to **food prices spiking**.

With climate change, Australia is expected to experience bigger and more frequent floods. This may be a good thing for nature but means people will no longer be able to live safely in some places. It will also mean iconic ecosystems like Kakadu **will be at risk**, with sea level rise predicted to push saltwater into almost half of its famous wetlands by 2070.

While floods bring pain in the short term, over the longer term both humans and nature need the benefits they bring.

The Conversation 2022 – https://theconversation.com/ floods-can-be-a-disaster-for-humans-but-for-nature-itsboom-time-192837



Birds like red-necked avocets flock to ephemeral lakes like Kati Thanda–Lake Eyre. Graham Winterflood/Flickr, CC BY

FLOODS PLAY A VITAL ROLE IN ECOSYSTEMS – IT'S TIME TO GET OUT OF THEIR WAY

The Conversation 2016

Floods are often seen as a force of destruction. From photographs of crops under water and houses being swamped by swollen rivers, to stories of road, business and public amenity closures, the news during flooding understandably emphasises human loss.

But as river ecologists, we find it hard not to see the positive side of flooding. Why? Because although floods cause destruction, they are also creators, of which we are all beneficiaries.

Floods as destroyers

Rivers have played pivotal roles in most civilisations throughout human history due to the universal need for drinking water and other resources like food. Rivers feature in the mythology, religion, philosophy and culture of so many societies and also play political roles, acting as borders between tribes, states and nations.

Virtually all of the world's major cities were founded on soils made fertile by flooding. In fact, floods – and the fertility that they bring - have been one of the most important reasons why human societies exist where they do today.

But despite their benefits to humans, rivers also bring death and destruction. In terms of lives lost, the top two worst natural disasters on record are floods.

The worst was in 1931, when at least 4 million people died and almost 30 million people were affected by **floods in China**.

In the United States, the Great Mississippi Flood of 1927 affected about 630,000 people and covered an area of almost 70,000 square kilometres. That flood's destructive power was exacerbated by the failure of levees, as has commonly happened elsewhere.

By contrast, death tolls from Australian floods have been comparatively light. Purportedly the most lethal flood in Australia's history was the **1852 Gundagai flood**, which claimed almost 90 lives. Many drowned because the town was previously built on the lowland flood plain of the Murrumbidgee River.

Deaths and destruction occur to the extent they do because of our desire to live in the very areas that are most prone to flooding. But with living on flood plains comes risk, and sooner or later, a big flood will come.

> Levees have been constructed to separate rivers from their flood plains. Bidgee/Wikimedia, CC BY-SA

Floods as creators

Generally, **rivers flood every one to two years**. It is just what they do. The reason is because of the interaction of geology, geomorphology and climate.

When rivers flood, water moves out onto the flood plain. But so does sediment and a lot of organic matter, nitrogen and phosphorus – the energy and materials that fuel river ecosystems and productive farm land. There is in fact mutual exchange of these rich materials between rivers and flood plains, which is why river flats are valued so much by farmers, and often why these areas became permanent settlements.

Some fish and other animals move backwards and forwards between the main channel and flood plain too, but all benefit from the rich materials transported by flooding.

Nature over nurture

In our ambition, we think that we can live on and exploit flood plains through controlling flooding. But this has been shown time and time again to be deluded.

Since the industrial revolution, vastly ambitious and expensive engineering projects around the world have sought to separate rivers from their flood plains, to reclaim land on which to build houses or to farm, and to prevent flooding. In most cases, levees have been built to effectively raise the level of riverbanks.



NATURAL HAZARDS – FLOODS

While these reduce the incidence of minor floods in some areas, they mostly fail to stop the major ones, and generally make flooding much worse in areas downstream.

Flood damage in the European Union from 2000-12, for example, cost an average **US\$6.8 billion a year**, despite the extensive networks of levees designed to prevent flooding. Similar networks of dams and levees are ineffective at preventing large-scale flooding in Australia. **Climate change is set to make the costs even higher**.

Going with the flow

If we've learned anything from floods, it is that trying to prevent flooding, especially the big ones, **is enormously expensive, rarely works and causes ecological and socio-economic damage**. There are, however, ways in which people can live and enjoy the benefits of rivers without causing damage.

For example, the **Yolo Bypass in Sacramento**, **California** is a clever way of harnessing the floodplain's capacity to buffer the effects of flooding, rather than trying to prevent flooding in the first place. The bypass, built in the 1930s, transports a large percentage of high flows away from the city, and into a reconnected flood plain. The flood plain is, during non-flood periods, used for agriculture and other activities.

Researchers argue that there are many human uses consistent with periodic flooding, such as the growing of pasture and timber, but building infrastructure on flood plains is not one of them.

Solutions such as these are far less costly than trying to prevent flooding and mopping up after inevitable failure. But of course, this requires a transformation in thinking when planning the design of towns and in developing flexible agricultural practices. Floods are reminders that nature can be both creator and destroyer. Herodotus referred to Egypt as "the gift of the Nile". It would be wise of us to view our own flood plains in the same way: that they are the gift of our rivers.

We should learn to accept that there will be times when the landscape on which we live, farm or play is reclaimed by the river that created it. On the flipside, we can rejoice when the river spends its time confined to its banks, and make hay while the sun shines.

Paul Humphries Senior lecturer in Ecology, Charles Sturt University

Nicole McCasker Postdoctoral researcher, Charles Sturt University

R. Keller Kopf Postdoctoral research fellow, Charles Sturt University

The Conversation 2016 – https://theconversation.com/ floods-play-a-vital-role-in-ecosystems-its-time-to-getout-of-their-way-66676



The Yolo Bypass is CalifoRrnia is one way of harnessing floodwater for good. Source: Mwehman/Wikimedia, CC BY-SA

HAZARDS – USING INDIGENOUS KNOWLEDGE

INDIGENOUS EXPERTISE IS REDUCING BUSHFIRES IN NORTHERN AUSTRALIA. IT'S TIME TO CONSIDER SIMILAR APPROACHES FOR OTHER DISASTERS

The Conversation

Northern Australia is by far the most fire-prone region of Australia, with enormous bushfires occurring annually across thousands of square kilometres. Many of these vast, flammable landscapes have precious few barriers to slow down a fire. Infrastructure and resources are limited, and people are widely dispersed across the region.

Fire risk reduction in the recent past included very local prescribed burning operations. The overall effect was small, with huge greenhouse gas emissions from out-of-control savanna wildfires.

So, what might a better approach look like?

Our team at the Charles Darwin University's Darwin Centre for Bushfire Research has been working with Indigenous land managers, conservation, research and government organisations in northern Australia for the last 25 years to find more effective ways to manage wildfires.

These collaborations have led to a new approach, blending modern scientific knowledge with traditional Indigenous land management practices to reduce bushfire risk.

How? By reducing fuel load through a patchy mosaic of small, low intensity, burns early in the fire season that cut the risk of late dry season fires when greenhouse gas emissions are much greater.



By collaborating with Indigenous ranger groups, this experience shows Australia can develop economically sustainable long-term solutions to manage bushfire risks — and shows what might be possible for other natural hazards such as cyclones and floods.

Such collaborations deliver benefits such as:

- reducing the risk of wildfires and other natural hazards
- engaging widely with dispersed remote communities
- building community resilience to bushfires and other natural hazards
- reducing greenhouse gas emissions (which soar when savanna fires get out of control)
- saving government costs
- protecting biodiversity and
- conserving water.

When done well, a collaborative approach to emergency management can create opportunities on country, enhance cultural and learning opportunities for Indigenous peoples and deliver environmental benefits for everyone.

Making fire management economically sustainable: a case study

Indigenous fire management skills and traditions have long been practised in Australia but part of the challenge, as one study put it, is "finding the economic means to reinstate this type of prescribed strategic management." In other words, how do we pay for it?

Reducing fuel load through a patchy mosaic of small, low intensity, burns early in the fire season cuts the risk of late dry season fires when greenhouse gas emissions are much greater. Waanyi Garawa Rangers (Jimmy Morrison), Author provided

NATURAL HAZARDS – INDIGENOUS



Northern Australia is by far the most fire-prone region of Australia, with enormous bushfires occurring annually in some places. AAP Image/Dave Hunt

After Australia ratified the Kyoto Protocol in 2007, there was renewed focus on reducing wildfires in Australia's tropical savannas due to their significant role in creating greenhouse gas emissions.

In collaboration with Indigenous land managers and others, our collective efforts helped to develop what's known as the savanna burning methodology. This system incentivises management of fire in the north.

Under this method, Indigenous land managers in tropical savannas can earn income for managing fire on their land to reduce greenhouse gas emissions. This is done through a tightly controlled system in which their emissions savings are measured in terms of carbon credit units.

Global and local benefits

This approach has allowed a new carbon economy to bloom in remote northern Australia. As one **study** put it:

Since the development of the first savanna-burning methodology determination in 2012, 25% of the entire 1.2 million km2 eligible northern savannas region is now under formally registered savannaburning projects, currently **generating** [more than] A\$30m per year.



These self-acquired funds go far to support Indigenous rangers to develop and improve skills so they can continue improving fire management across the north.

As Dean Yibarbuk, fire ecologist and senior traditional owner in West Arnhem Land has **said**:

This fire management program has been successful on so many levels: culturally, economically and environmentally. Through reinstating traditional burning practices, new generations of landowners have been trained in traditional and western fire management, hundreds of thousands of tonnes of greenhouse gas have been abated, and the landscape is being managed in the right way.

A consistent and reliable flow of funds from carbon contracts, as well as other government and philanthropic sources, further offers many other socio-economic benefits. It has been instrumental in allowing art centres, weed and feral animal control businesses, rock art conservation projects, and bi-cultural schools to flourish.

Investing money to save money

This system shows what's possible with the right engagement and policy levers. Perhaps one day a similar approach could help reduce risk from other kinds of natural disasters, all while building community resilience.

In the future, could we have similar systems where flood mitigation projects or cyclone risk reduction projects are made economically viable for local communities?

This would reduce reliance on emergency services. It also makes it less likely cultural protocols are breached when non-local emergency personnel are sent in. For example, tree removal is a common cyclone risk reduction practice but it's important to know which trees are culturally significant in a community, and why you need to leave them alone.

For these approaches to work, **genuine and ongoing engagement**with Indigenous peoples and dispersed remote communities is **essential**.

As a start to this engagement, we brought together Indigenous leaders, government representatives, and emergency management agency personnel from across the north for a meeting at Charles Darwin University late last year, supported by the Bushfire and Natural Hazards Cooperative Research Centre.

Many of the key personnel in these groups were meeting for the very first time, despite having worked for years on trying to address the same problems.

Self-acquired funds from the system go far to support Indigenous rangers to develop and improve skills so they can continue improving fire management across the north. Waanyi Garawa Rangers (Jimmy Morrison), Author provided

NATURAL HAZARDS – INDIGENOUS

With appropriate funding, we could make such gatherings regular events so it's easier for these stakeholders to work together. Long term collaborations can reduce disaster risk for northern Australian communities who live there permanently, build their resilience, and cut significant costs for Australian governments.

Resources to cover training, transport, and logistics are crucial to implement such an integrated approach.

Long term solutions cost money. But by drawing on local Indigenous knowledge and expertise on disaster risk reduction, we can make huge savings in the long term.

Kamaljit K Sangha, Senior Ecological Economist, Charles Darwin University

Andrew Edwards, Research Fellow Bushfires, Charles Darwin University

Willie Rioli, Sr Fire Coordinator for the Tiwi Islands, Indigenous Knowledge

The Conversation 2021 – https://theconversation.com/ indigenous-expertise-is-reducing-bushfires-in-northernaustralia-its-time-to-consider-similar-approaches-forother-disasters-155361

Indigenous land managers in certain areas can earn income for managing fire on their land to reduce greenhouse gas emissions. AAP Image/Dave Hunt



EDITOR BOOK RECOMMENDATION

FIRE COUNTRY Victor Steffensen



WHY ADAPT TO CLIMATE CHANGE?

Source: Adapt NSW https://www.climatechange.environment.nsw.gov.au/why-adapt

What is adaptation?

Adaptation means making adjustments to decisions and activities, in consideration of climate change, in order to manage risks and harness potential opportunities.

The goal of climate change adaptation for NSW is to increase the ability of our environmental, social and economic systems to not only cope with a changing climate but thrive. It involves becoming climate-resilient, which is about reducing greenhouse gas emissions, and learning how to live with the impacts we can't avoid.

Why is NSW adapting to climate change?

The climate of NSW is changing. Average temperatures have been steadily rising since the 1960s. The decade from 2010 to 2019 was the hottest on record, while 2019 was the hottest year in NSW.

Climate change is already affecting the natural, social and economic welfare of NSW and will increasingly affect the environment and our quality of life in every part of the state.

Responding to climate change involves two key actions:

- 1. **Mitigation**: reducing emissions and stabilising the levels of heat-trapping greenhouse gases in the atmosphere; and
- **2. Adaptation**: adapting to the changes we have already caused due to climate change, and the changes we anticipate in the future.

Mitigation vs Adaptation

Mitigation is about taking action to limit further changes in climate. These actions involve both reducing the greenhouse gases emitted into the atmosphere and enhancing the natural systems that store greenhouse gases such as oceans, forests, and soil (the sinks).

This is an ongoing mission that the NSW Government is committed to - but as our climate continues to change, we need to be able to adapt.

The goal of adaptation is to reduce our vulnerability to the harmful effects of climate change – such as sealevel rise or more intense extreme weather patterns. It is fundamental that the people of NSW are empowered to adapt, so we can, together, make a difference now and for future generations.

Who should adapt to climate change?

The NSW Government's objective is for the NSW community to work together to be more resilient to a changing climate.

The most effective climate change adaptation occurs at a local level through the actions of individuals, businesses and communities in response to locationspecific climate change impacts.

The NSW Government will help NSW adjust to a changing climate by:

• Supporting local adaptation actions.



CLIMATE CHANGE ADAPTION

- Managing climate change risks to its own assets and services.
- Removing market, regulatory and governance barriers to the private sector and local government adapting effectively.
- Reducing climate change impacts on health and wellbeing.
- Managing impacts on natural resources, ecosystems and communities.
- Through our collective actions we can make NSW more resilient to a changing climate.



Source: https://www.climatechange.environment.nsw.gov.au/macksvilles-symbol-sustainability

AdaptNSV

ADAPT NSW WEBSITE – A COMPREHENSIVE TEACHING RESOURCE



NSW Office of

REGIONAL PROFILES and INTERACTIVE MAP



Learn more about Climate Adaptation in NSW – https://www.climatechange.environment.nsw.gov.au/nsw

BIODIVERSITY CONSERVATION

SYDNEY ROYAL BOTANIC GARDENS AND AUSTRALIAN INSTITUTE OF BOTANICAL SCIENCE

The Australian Institute of Botanical Science will advance fundamental knowledge of flora and drive effective conservation solutions to ensure the survival of plants and all life that depends on them.



Download the Australian Institute of Botanical Science prospectus for a detailed look at the vital science work we undertake. https://www.rbgsyd.nsw.gov.au/ science/australian-institute-of-botanical-science





Explore the Australian Institute of Botanical Science

Our world leading research and collections advance fundamental knowledge of plants and drive effective conservation. You can explore how we do this by taking a look at the elements that make up the Australian Institute of Botanical Science.



Did you know about the Royal Botanic Garden podcasts?

These interesting podcasts cover many topics in the Geography7–12 curriculum. Here are some to try. https://www.rbgsyd.nsw.gov.au/science/branch-out.



Discover the surprising world of plants in our award-winning Branch Out podcast.

EP. 1: NO PLANTS NO MEDICINE

EP. 2: NO PLANTS NO FOOD

EP. 3: NO PLANTS NO ANIMALS

EP. 4: NO PLANTS NO PAST

THREE CORE PRINCIPLES OF THE CIRCULAR ECONOMY

Liam Taylor, Australian Circular Economy Hub

The linear economy is poorly positioned to handle the challenges presented by a rapidly growing human population on a planet with finite resources. But moving towards a circular economy will require a firm understanding of its three core tenets.

The linear economy is failing us in a big way. The "take, make, dispose" model has resulted in inefficient use of our natural resources, a culture of consumerism and a predisposition towards waste. On a planet with finite resources, this has to change.

There is a growing global movement aimed at transforming this linear model to a circular economy, but what does this really mean? How do we take that linear model and turn it on its head?

Defining the Circular Economy

Looking beyond the linear take-make-dispose extractive industrial model, the primary aim of a circular economy is to redefine what is meant by growth, focusing on positive society-wide benefits rather than narrower and purely economic metrics.

Essentially, a circular economy requires us to completely rethink what we understand as progress and, in the process, redesign our economic model. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural and social capital.



Graphic by the Ellen MacArthur Foundation.

There are three primary principles associated with this transition to a circular economy according to the Ellen MacArthur Foundation:

- 1. Design out waste and pollution
- 2. Keep products and materials in use
- 3. Regenerate natural systems

Only by integrating all three in a concerted approach can a fully circular economy be achieved.

Designing out waste and pollution

For too long our linear economic model has caused our waste management approaches to focus on endof-life scenarios. A product reaches its use-by date or is replaced by a newer model and we are left asking how to dispose of the resultant "waste". But what if instead of building our products to reach obsolescence, we constructed them so the resources and materials used could be recovered and returned to the material cycle?

The first principle of the circular economy is about understanding that waste and pollution are largely a result of the way we design things and finding new and innovative ways to design out those negative impacts. Around 80 per cent of environmental impacts are determined at the design stage, meaning transitioning this area towards greater circularity can have amplified impacts throughout material cycles. By changing our mindset to view waste as a design flaw and harnessing new materials and technologies, we can ensure that waste and pollution are not created in the first place.

A prominent example of this kind of circular thinking can be seen in the turn towards reusable alternatives to single-use items such as coffee cups, water bottles and plastic straws and cutlery. By designing easily transportable, reusable alternatives we reduce our reliance on single-use products, a huge contributor to waste in a linear economy.

Keeping products and materials in use

The second principle of a circular economy is based on a simple premise: we can't keep wasting resources. On a planet with finite resources the products and materials we construct from those we extract must be kept in the economy for as long as possible. We can design some products and components so they can be reused, repaired, and remanufactured.

But making things last longer is only part of the solution, we also need to be able to get the resources used to create them back in the system so they don't end up in landfill. This is particularly pertinent for materials and resources with short lifespans such as food and packaging, which can cause huge amounts of waste without appropriate resource recovery processes.

Australia is no stranger to resource recovery, with recycling rates increasing from just 7 per cent of all waste in 1996 to 58 per cent in 2016/17. That still leaves around 40 per cent of all waste materials being disposed to landfill, that's equivalent to 21.7 megatonnes (millions of tonnes) of waste in 2016/17 according to the latest National Waste Report. To reduce this, we need to ensure we have appropriate collection systems for our various waste streams.

One example of this can be seen in container deposit schemes, an example of product stewardship legislation where the beverage industry is obliged to take greater responsibility for its packaging after it has been sold. Beverage suppliers must ensure that a system is in place for the recovery and recycling of their empty containers.

Regenerating natural systems

Perhaps the most transformative principle of a circular economy is in its emphasis on providing feedback loops that actively improve our natural environment. In the linear economy, environmentalism is predicated on trying to do *less harm.* Whilst this is an important guideline to follow in and of itself, the circular economy takes this to the logical next step by aiming to *do good* for the environment.

In nature, there is no concept of waste; everything is cyclical. All the great natural cycles – carbon, oxygen, nitrogen, water etc. – work in closed loops with little to no loss of resources through their cycle. The circular economy aims to mimic these natural cycles, creating an economic model that protects, supports and actively improves our environment.

This is particularly applicable to organic materials, which for too long in our linear economy have been treated as waste and disposed to landfill. This not only wastes the water and energy used to make the products in the first place but can also create negative environmental impacts as organic materials break down. When organic matter begins to rot in anaerobic environments like landfill, methane (a greenhouse gas with a warming effect around 25x stronger than carbon dioxide) is produced as a by-product. By returning valuable nutrients to the soil and other ecosystems instead of sending it to landfill, we can enhance our natural resources.

A rapidly growing movement exemplifying this principle is that of regenerative agriculture, which involves farming principles and practices that have positive impacts on the surrounding environment. This can involve projects such as increasing biodiversity levels, enriching soils, improving watersheds or enhancing ecosystem services, but ultimately, it's about doing good for the world around us.

- CIRCULAR ECONOMY
- AUSTRALIAN CIRCULAR ECONOMY HUB

