



UNDERSTANDING
HUMAN IMPACTS
ON BIODIVERSITY

BLACK
COCKATOO
CRISIS



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Year 11 ATAR Biology Learning Objectives

- understand that ecosystem diversity and dynamics can be described and compared with reference to biotic and abiotic components and their interactions
- use science inquiry skills to design, conduct, evaluate and communicate investigations into biodiversity and flows of matter and energy in a range of ecosystems
- evaluate, with reference to empirical evidence, claims about relationships between and within species, diversity of and within ecosystems, and energy and matter flows
- communicate biological understanding using qualitative and quantitative representations in appropriate modes and genres.

[\(Year 11 ATAR Biology, Unit 1, Ecosystem & Biodiversity\)](#)



Year 11 ATAR Biology Content

Science Inquiry Skills

- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments

Science as a Human Endeavour

- contemporary technologies, including satellite sensing and remote monitoring enable improved monitoring of habitat and species population change over time

Science Understanding: Describing Biodiversity

- ecosystems are diverse, composed of varied habitats, consisting of a range of biotic and abiotic factors, and can be described in terms of their component species, species interactions and the abiotic factors that make up the environment
- in addition to biotic factors, abiotic factors, including climate and substrate, can be used to describe and classify environments

Science Understanding: Ecosystem Dynamics

- ecosystems have carrying capacities that limit the number of organisms (within populations) they support, and can be impacted by changes to abiotic and biotic factors, including climatic events
- human activities that can affect biodiversity and can impact on the magnitude, duration and speed of ecosystem change. One example of this is habitat destruction, fragmentation or degradation.
- conservation strategies used to maintain biodiversity are:
 - genetic strategies, including gene/seed banks and captive breeding programs
 - environmental strategies, including revegetation and control of introduced species
 - management strategies, including protected areas and restricted commercial and recreational access

Understanding Human Impacts on Biodiversity

Lesson Objective:

Students will be able to interpret a range of scientific and media texts related to human activities that can affect biodiversity, evaluate processes, claims, and conclusions by considering the quality of available evidence, and use reasoning to construct scientific arguments.

Task:

Students will examine a film documentary and a Government Policy focused on the impact of habitat destruction on biodiversity. They will evaluate the evidence presented, identify key claims, and construct a scientific argument outlining the consequences of habitat destruction on ecosystem health.

Key Points:

- Explanation of human activities affecting biodiversity
- Examples of habitat destruction, fragmentation, and degradation
- Importance of considering evidence quality in scientific arguments

Previous class time or as 'homework':

Watch the *Black Cockatoo Crisis* Documentary film.



Preparation

Watch the *Black Cockatoo Crisis* film (at school or as homework).

Access Options:

Vimeo:

<https://vimeo.com/ondemand/blackcockatocrisis>

SBS On Demand:

<https://www.sbs.com.au/ondemand/movie/black-cockatoo-crisis/2295518787622>

Clickview:

<https://launch.clickview.net/open?AppLink=video:79607552>



Think-Pair-Share

Consider the statement:

“Habitat removal on a small scale does not significantly impact biodiversity.”

Do you think this statement is true or false?

Why? What is your reasoning?



The belief that small-scale habitat destruction does not significantly impact biodiversity, is a

common misconception!

Lets have a more detailed look at the impacts of human activity on biodiversity.



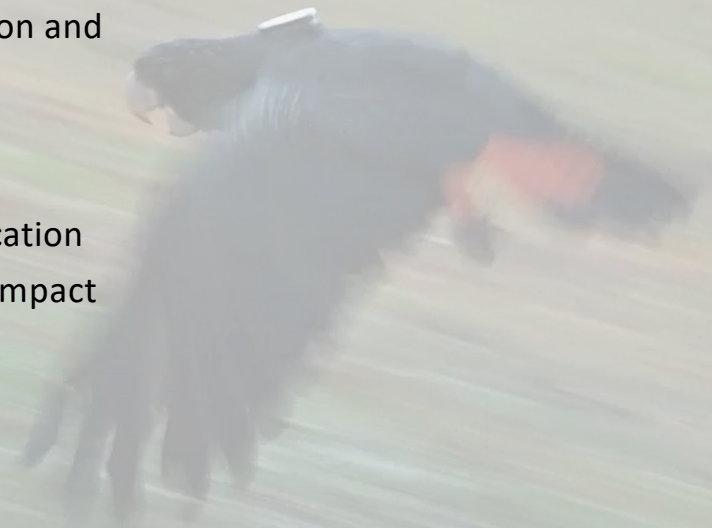
Human Activities

Human activities can affect biodiversity

Human activities can impact on the magnitude, duration and speed of ecosystem change in a number of ways.

- habitat destruction, fragmentation or degradation, including erosion and dryland salinity
- the introduction of invasive species
- unsustainable use of natural resources
- the impact of pollutants, including biomagnification and eutrophication
- emissions contributing to the enhanced greenhouse effect which impact climate change

This lesson we are going to focus on habitat destruction, fragmentation and degradation.



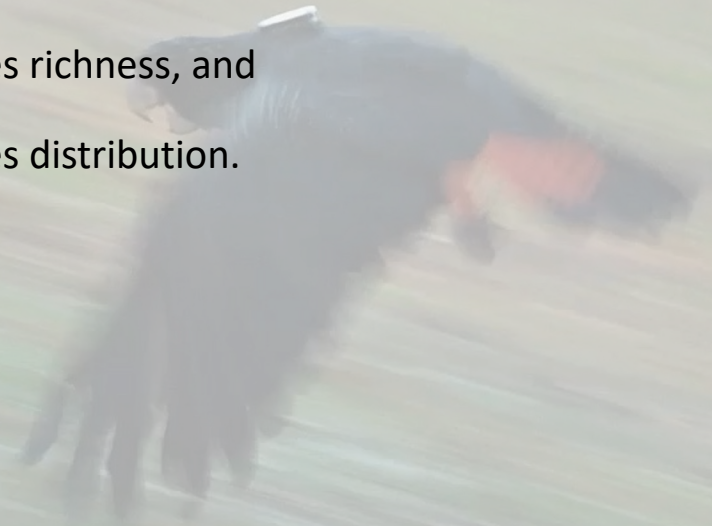
How does habitat change effect biodiversity?

Habitat loss ***indirectly*** influences biodiversity by:

- decreasing population growth,
- reducing ecosystem carrying capacity,
- disrupting species interactions,
- reducing trophic chain length,
- diminishing dispersal ability & breeding success,
- altering predation rate, and
- increasing incidence and impact of disease.

Habitat loss ***directly*** influences biodiversity by its negative impact on:

- species abundance,
- genetic diversity,
- species richness, and
- species distribution.



Effects of habitat changes

Effects of habitat changes due to:

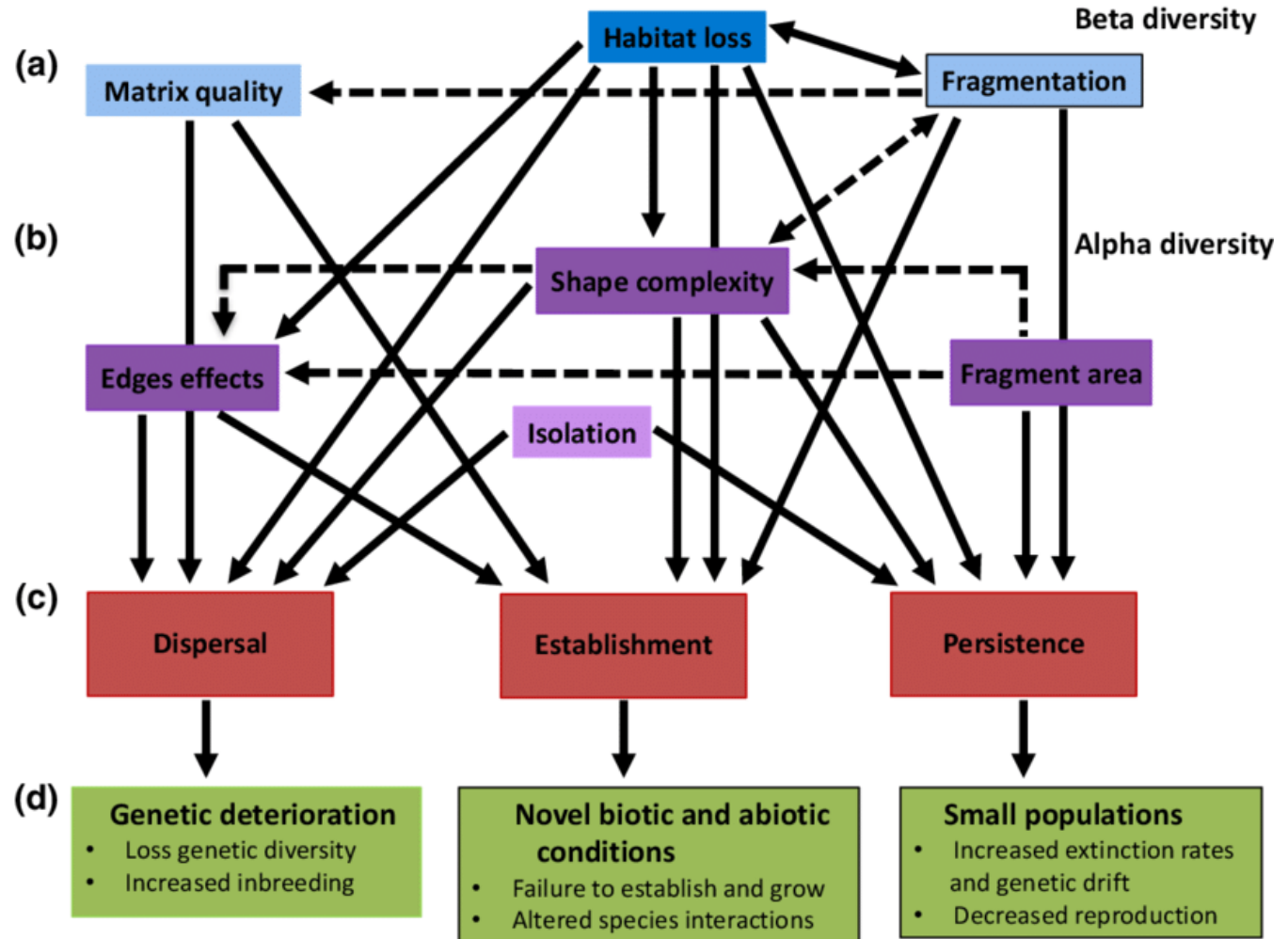
a) habitat loss and fragmentation occurring at the landscape (blue boxes) and

b) fragment levels (purple boxes) affecting functional diversity within communities (alpha diversity) and between communities (beta diversity) that ultimately depend on

d) species responses (green boxes) to disturbance. These responses are mediated by

c) species' functional traits associated with fundamental processes of species life (red boxes).

Arrows indicate the indirect (dashed lines) and direct (solid lines) effects of habitat loss and multiple fragmentation processes on natural communities.



[\(Zambrano et. Al, 2019\)](#)

What is the difference between:

- Habitat Destruction
- Habitat Loss
- Habitat Fragmentation





Habitat destruction,

in ecology, is defined as the elimination or alteration of the conditions necessary for animals and plants to survive.




Habitat destruction not only impacts individual species but the health of the global ecosystem. It is primarily, though not always, human-caused.



Habitat loss,

in ecology, is defined as the reduction or elimination of the space in which a species or community of organisms lives and reproduces.

Habitat loss, which may be caused by natural disturbances (*such as volcanic eruptions, floods, and landslides*), is largely the product of human development of natural areas for profit (*such as deforestation, strip mining, agriculture, and residential and commercial development*) and resultant pollution.

The image shows a wide landscape under a blue sky with scattered white clouds. In the background, a dense line of tall, thin trees, likely pines, stretches across the horizon. The middle ground is a cleared area with sparse, low-lying green and brown vegetation, interspersed with numerous fallen logs and branches. The foreground is dominated by dry, tangled twigs and sparse green plants, suggesting a recently cleared or degraded area. A white text box is overlaid on the right side of the image, containing text about habitat loss and biodiversity.

After a critical point of lost habitat, ecosystems may no longer be able to provide the environmental resources needed to ensure the survival of the plants, animals, and other forms of life that live there, increasing their chances of becoming extinct. Habitat loss is the leading cause of the global decline in biodiversity



Habitat fragmentation

Habitat fragmentation is defined as the division of habitat into a number of smaller and more isolated patches of habitat.

Habitat fragmentation can be caused by natural events as well, but is more often caused by human activities.



Causes of habitat fragmentation include development and construction, mining, logging, agriculture, and urban sprawl.

As the roads/developments branch out they cut off and isolate pieces of habitat from each other, creating more “edges” and eroding the core of the habitat.

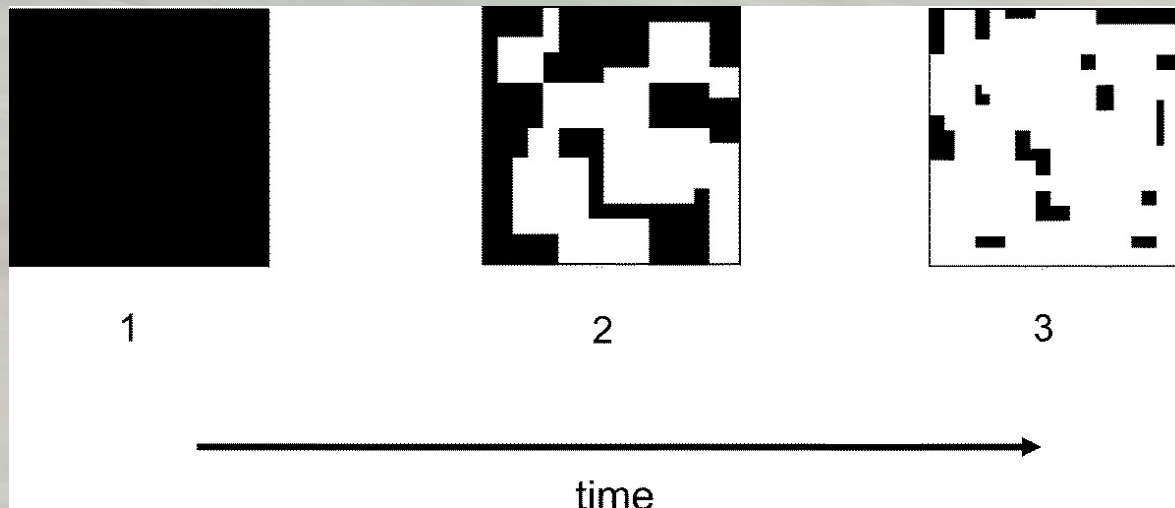
When habitats are fragmented, species are prevented from crossing into other fragmented sections.

Habitat Fragmentation

This figure illustrates the process of habitat fragmentation, where “a large expanse of habitat is transformed into a number of smaller patches of smaller total area, isolated from each other by a matrix of habitats unlike the original” (Wilcove et al. 1986).

Black areas represent habitat. White areas represent the matrix.

[Fahrig \(2003\)](#)



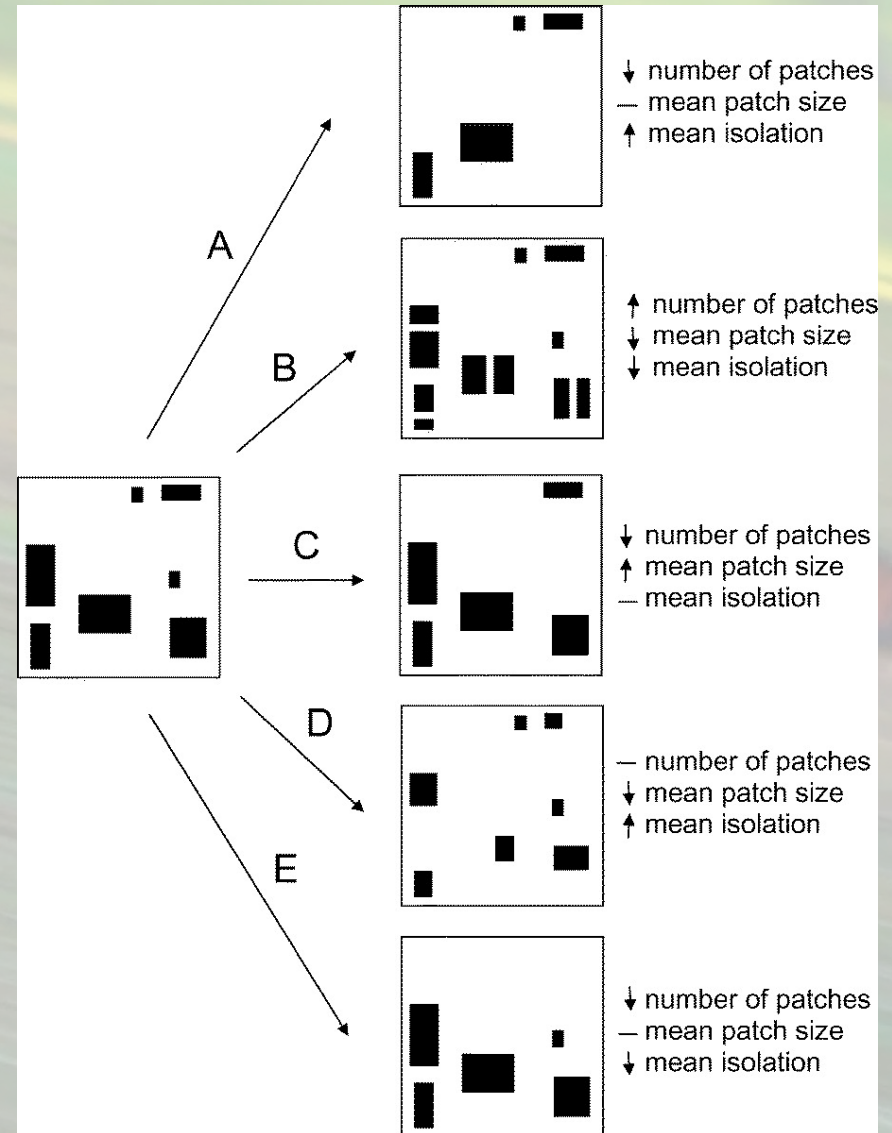
Habitat Loss leading to Habitat Fragmentation

Habitat loss causing habitat fragmentation in landscapes can result in these effects:

- an increase in the number of patches,
- a decrease in mean patch size, and
- an increase in mean patch isolation (nearest neighbor distance).

Actual changes are indicated by arrows.

[Fahrig \(2003\)](#)

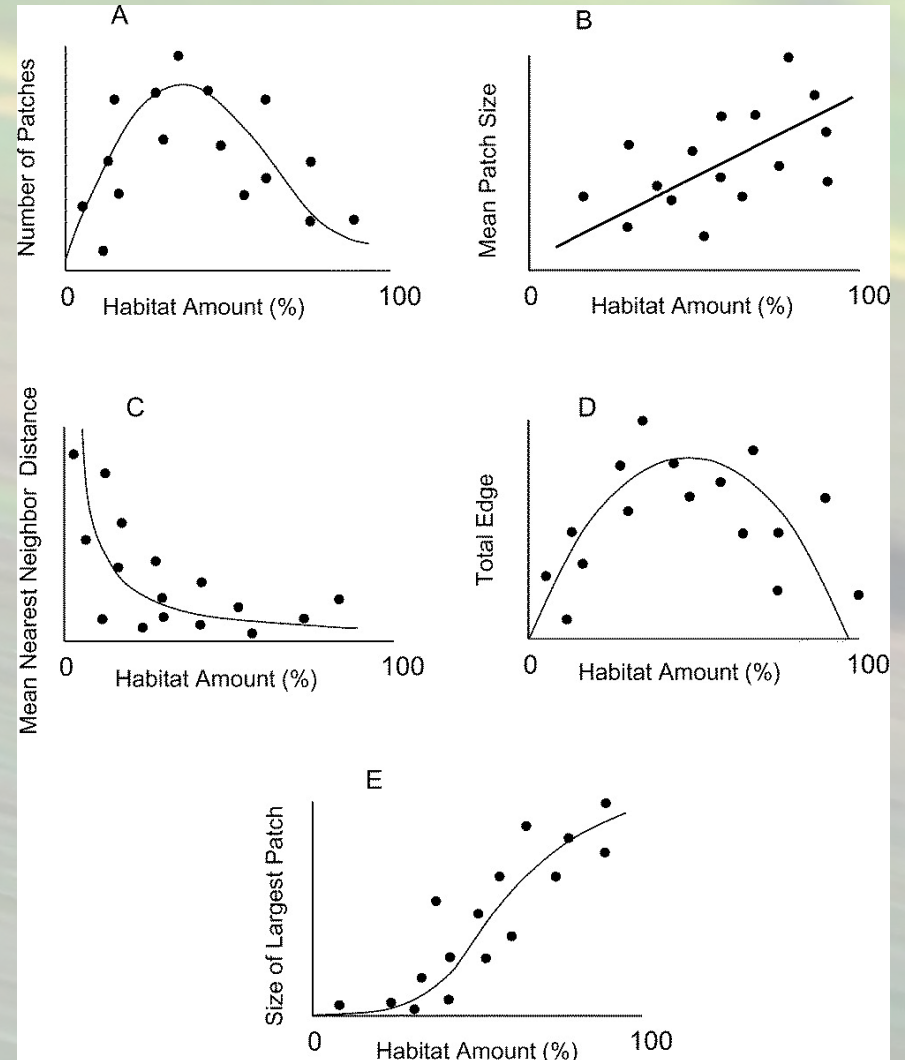


Patterns in Habitat Fragmentation: 'Patch' sizes

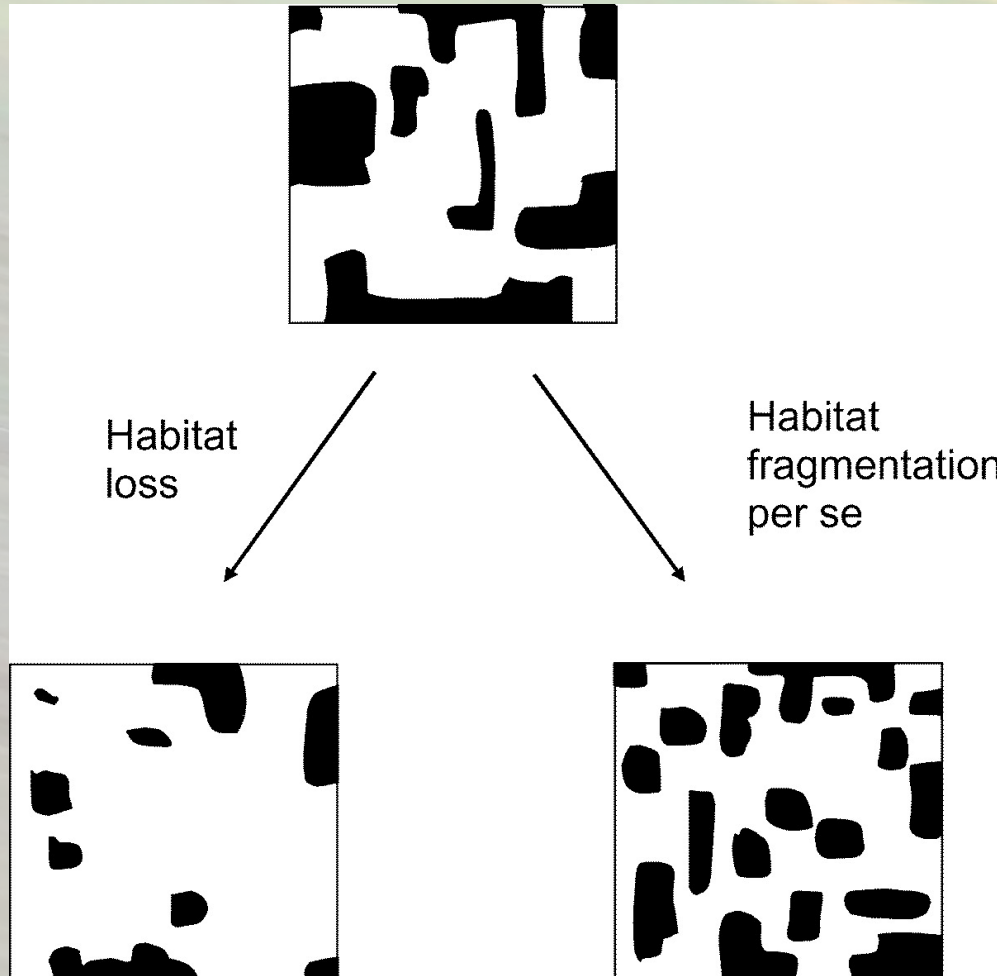
There are some interesting relationships between habitat *amount* and the different ways fragmentation can be measured.

- A Number of patches
- B Mean (average) patch size
- C Mean (average) distance to the nearest patch
- D Total Edge
- E Size of largest patch

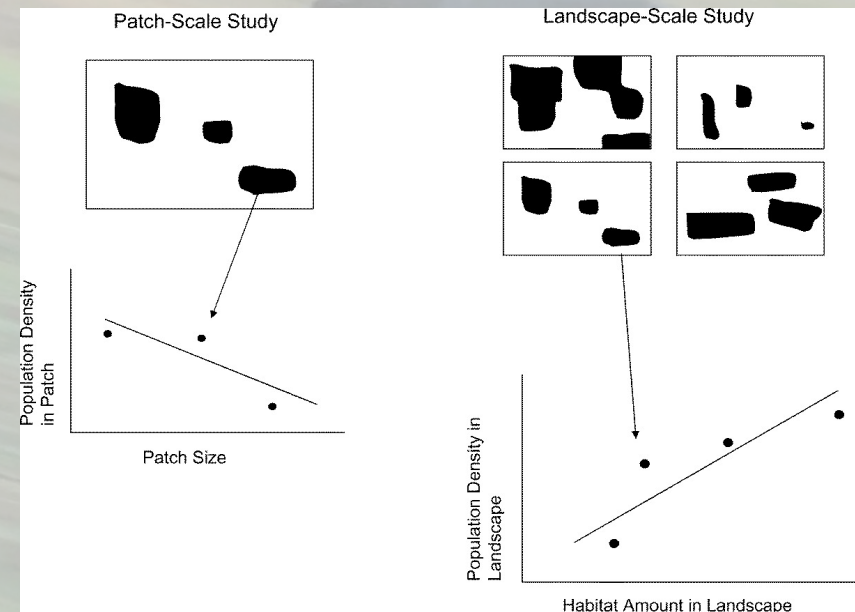
[Fahrig \(2003\)](#)



Habitat Loss vs Fragmentation



Both habitat loss and habitat fragmentation per se (independent of habitat loss) result in smaller patches. Note also that habitat fragmentation per se leads to reduced patch isolation. [Fahrig \(2003\)](#)



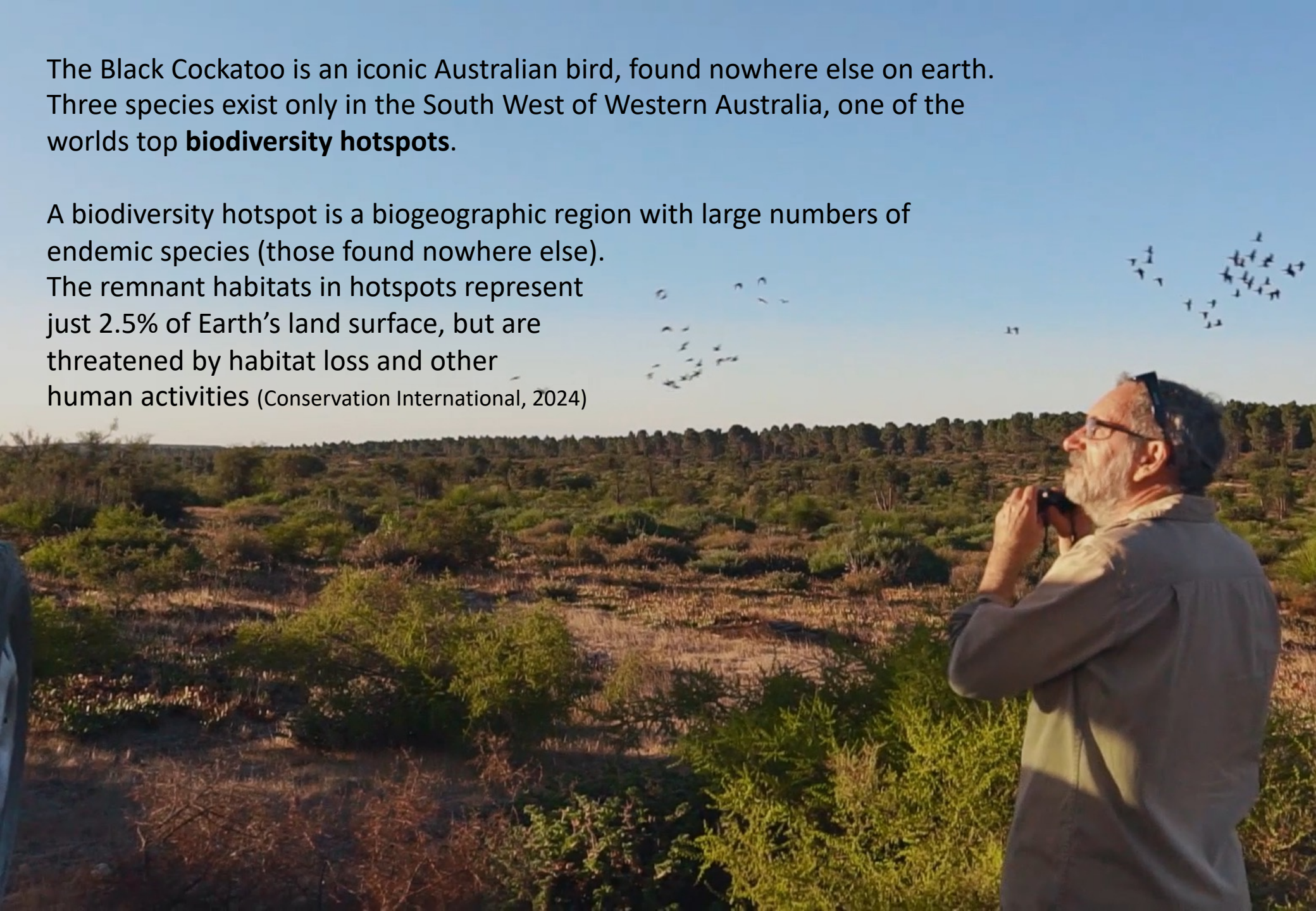


CASE STUDY:

BLACK
COCKATOO
CRISIS

The Black Cockatoo is an iconic Australian bird, found nowhere else on earth. Three species exist only in the South West of Western Australia, one of the worlds top **biodiversity hotspots**.

A biodiversity hotspot is a biogeographic region with large numbers of endemic species (those found nowhere else). The remnant habitats in hotspots represent just 2.5% of Earth's land surface, but are threatened by habitat loss and other human activities (Conservation International, 2024)



Population Decline

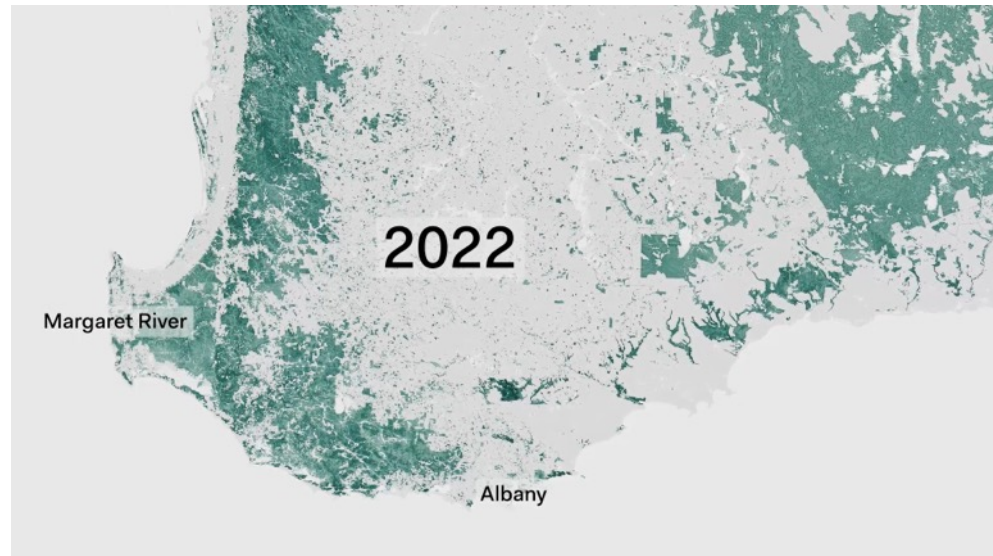
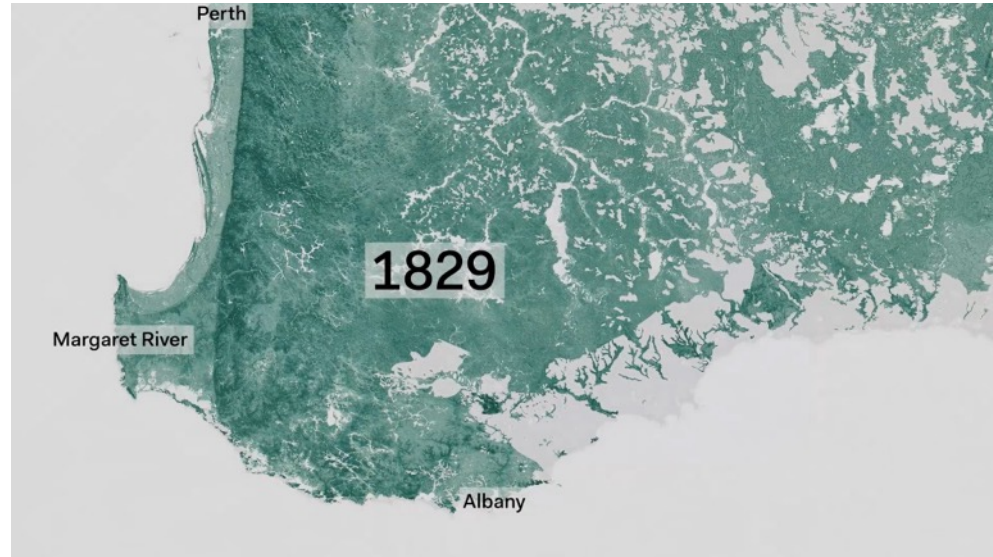
Once seen in flocks of thousands that blackened the sky like rain clouds, WA species of Black Cockatoos are now listed as **'Endangered'** by the International Union for the Conservation of Nature (IUCN).



Why are Carnaby's Cockatoos disappearing?

The decline has been mainly caused by a loss of habitat and breeding sites.

Approximately 87% of Carnaby's cockatoo habitat in the Wheatbelt has been cleared of native vegetation since the 1950s.



Impacts of Human Activities

Estimates show the population of Carnaby's Cockatoo has decreased by over 50% since European settlement.

There are a number of reasons for this - all related to human activity.



Habitat Fragmentation

Clearing of bushland and habitat fragmentation is the greatest threat to Carnaby's cockatoos.

It means they need to travel further to find enough to eat and may not find enough food for themselves and their young.



Images: Google Earth





Vehicle Strike

Death or injury from motor vehicle strikes is unfortunately a major cause of death and injury in Western Australia.

Carnaby's cockatoos feed in native bushland along the side of roads and drink water from potholes.

Due to their size, they need time to take off.... More time than it takes for a car to hit them!

Disease

Black cockatoos can become ill from drinking water that is not fresh and clean, or being exposed to pesticides and herbicides. One disease has been discovered recently in Carnaby's Cockatoo, which paralyses their hind legs so they cannot stand or walk. It is called 'Cockatoo Hindlimb Paralysis Syndrome' (CHiPS). Wildlife vets are continuing to investigate its cause and what can be done to protect the birds.



[DBCA Library](#)



Illegal Shooting

It is against the law to deliberately kill any threatened wildlife.

When there is not enough natural food left, hungry black cockatoos may be attracted to apple and pear seeds or nuts in orchards. Instead of putting nets over their crops to stop the birds, orchardists may get out their gun.



Work in small groups to answer the following questions

1. What evidence was presented in the documentary relating to the current threats facing Black Cockatoos in Western Australia?
 - List the sources of evidence reported, and group them according to quality.
 - What criteria did you use to judge quality of evidence.
 - Which evidence would you be confident to use to form a scientific argument and draw a conclusion.
 - Does relative quality of evidence influence it's value or strength?
2. In the film what solutions were suggested to prevent extinction of Black Cockatoo species?
 - What evidence was used to argue that those solutions would be effective?
 - What evidence will be required to indicate the solutions are having a positive impact?
3. How does [The Australian Government's Threatened Species Strategy 2021–2031](#) relate to the content of the film?
 - How does the strategy propose to address the Biodiversity Crisis?
 - What evidence will be required to assess if the strategy is effective?

What can be done to save them?

- **Change ‘net loss’ of habitat to ‘net gain’, by planting more food trees and protecting what’s left**
- Plant black cockatoo food trees in your garden (e.g. banksia, hakea, macadamia)
- Put out a water source, even a small bird bath – and keep it full of clean water
- Get involved in council-run planting days to plant more food for black cockatoos
- Become a Citizen Scientist! - join the BirdLife Australia annual “[Great Cocky Count](#)”
- Report injured black cockatoos to the rescue service at Kaarakin Black Cockatoo Conservation Centre or DBCA’s wildlife helpline
- Learn more about black cockatoos
- Write to councillors and Ministers and ask them to save Carnaby’s Cockatoo by protecting their habitat



Restoration & Mitigation Strategies



The Threatened Species strategy 2021-2031 identifies 8 key action areas that are fundamental to the recovery of threatened species, divided into 2 groups:

- DIRECT ACTION
- SUPPORTING ACTION

Plus:

- MONITORING AND REPORTING

(Commonwealth of Australia, 2021)

DIRECT Action

- Mitigating new & established threats
- Conserving restoring and improving habitat
- Emergency preparedness & response
- Climate change adaptation & resilience

INDIRECT Action

- Effective planning for conservation
- Knowledge & tools
- Forging stronger partnerships
- Community leadership & engagement





Australian Government

Department of Climate Change, Energy,
the Environment and Water

Climate change

Energy

Environment

[Home](#) / [Environment](#) / [Biodiversity](#) / [Threatened species & ecological c](#)

← **The Threatened Species
Action Plan 2022-2032**

Saving Native Species

Priority Species >

Priority Places

Development and consultation

Threatened Species Strategy
2015-2020

Carnaby's Cockatoo

Common name

Carnaby's Cockatoo

Scientific name

Zanda latirostris

EPBC status

Endangered

Government Policy:

- Priority Protection and maintenance of existing habitat for both nesting and foraging
- Reduce competition for hollows and provide supplementary hollows, including the ongoing maintenance of supplementary hollows where required.
- Planting feeding habitat, including working with land managers to create additional food sources for the birds.
- Provide safe drinking areas near urban roost areas, to encourage cockatoos away from watered roadside verges.



Photo: Claire Greenwell

Carnaby's Black Cockatoo feeding in a Pincushion Hakea (*Hakea laurina*).
Photo: Sallyanne Cousins

black cockatoos



Encourage life into your garden: plant for black cockatoos

Heather Waugh and Douglas Betts Volunteer Master Gardeners

Help save an entire species and get free help in the garden in exchange? That's a deal that's hard to refuse!

We're talking about the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*).

Of the three black cockatoo species in the South-West of Western Australia, Carnaby's is the most threatened, listed as endangered under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

These cheeky birds, punctuating Perth skies with their raucous 'wee-lar' calls during the first half of each year, are up against tough odds. They breed in the Wheatbelt, using hollows in mature trees as nests to raise their chicks. In some areas more than 90% of the native vegetation has been cleared. After breeding they

return to the coastal plain, where widespread clearing for urban areas and agriculture has caused a dramatic loss of feed habitat.

Numbers of this iconic species have halved since the 1960s. They have vanished from one-third of their former range and it is thought that most of the birds we see today are too old to breed. Will our children or grandchildren farewell the last of these beautiful birds?

Thankfully, our gardens are opportunities for vital urban habitat. Carnaby's eat seeds, flowers and insect larvae. They feed on some of our beautiful native plants, such as banksias, hakeas and grevilleas, as well as the fabulous Marri (*Corymbia calophylla*). Of course, not everyone can fit a Marri tree in their garden, but here are some striking and adaptable options that Carnaby's will love.



Marri fruits, or 'honky nuts', are a favourite food of black cockatoos
Photo: Sallyanne Cousins

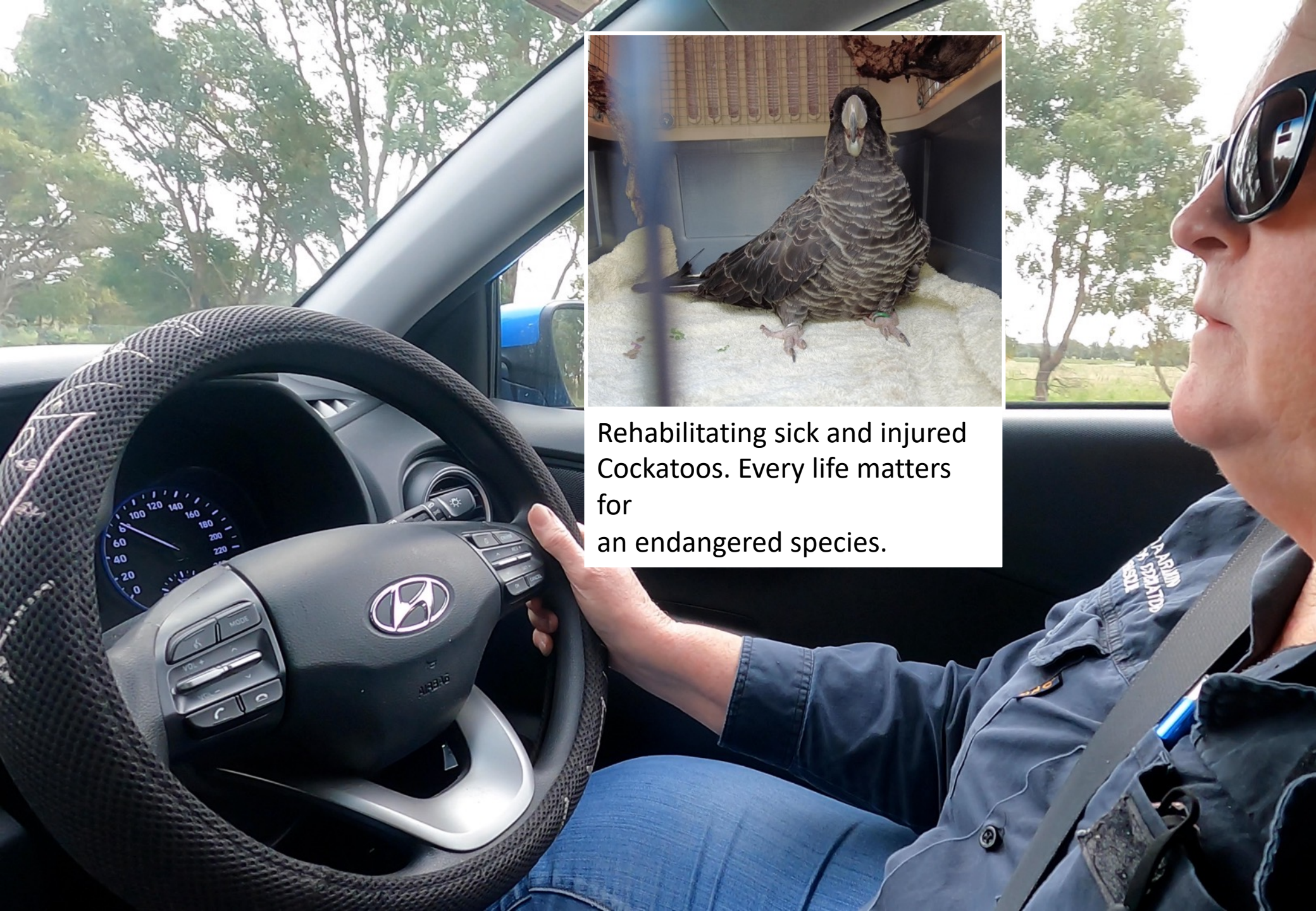
Plant Cockatoo Food & Shelter

- Choose the right plant for your situation: look for the '*Choose for Black-Cockatoos*' label in nurseries, or refer to information on ["How to Plant Black-Cockatoo Friendly Gardens"](#)
- Use prickly hedges to provide shelter. If planting low plants, make sure Carnaby's will feel safe enough to come to the ground.
- Don't place food plants next to roads. Birds can get hit by traffic.
- Supply clean fresh water in your garden.

Installing artificial nesting hollows in breeding areas.

**Trees need to be at least 300 years old to form suitable nesting hollows and due to clearing insufficient old trees exist.*





Rehabilitating sick and injured Cockatoos. Every life matters for an endangered species.

Tag and release of rehabilitated Cockatoos allows scientists to track where they go and what areas of habitat they use.



Forging partnerships with community.

Engaging in 2-way dialogue with
community

Understanding effects of climate change on
available habitat & applying good policy &
strategy to foster resilient ecosystems.



MONITORING & REPORTING



Collecting monitoring data and reporting that data is critical to any recovery effort for scientific, economic and sociopolitical reasons.



Monitoring

Regular and effective measurement:

- Helps identify if conservation strategies are working
- Allows for adaptive management (learning from what has been done and doing it better)


Monitoring

Both longitudinal data (collected regularly over a long period of time) as well as large scale data is needed



Monitoring by Citizen Scientists

The [Great Cocky Count](#) (GCC) is a citizen-science survey, and the biggest single survey for black-cockatoos in Western Australia.

A group of citizen scientists are participating in a survey in a natural, scrubby landscape. One person is sitting on the ground in the foreground, looking through binoculars. Another person stands in the middle ground, also using binoculars. To the right, a woman in a pink shirt and hat stands near a table with a water bottle and other supplies, while a man behind her uses binoculars. The background shows a vast, flat landscape under a clear sky.

First, volunteers register observed roost sites to help plan the survey, then one evening in April registered volunteers monitor the known roost sites, counting black-cockatoos as they arrive in the evening. Records submitted from across south-western WA provide a snapshot of black-cockatoo populations, helping to quantify changes in their numbers.

2019 Great Cocky Count Report

Summary of Key Findings

Carnaby's population stable in the Perth region

Carnaby's Black-Cockatoo

Carnaby's Black-Cockatoo is a threatened species endemic to southwest Western Australia. In the months between January to July, most Carnaby's move from the wheatbelt region where they breed, to coastal areas, including the Perth Metropolitan Area and other parts of the Swan Coastal Plain. Carnaby's are particularly vulnerable to increasing levels of clearing for forestry, urban and industrial development across the southwest. It is therefore important we understand the population size and distribution of Carnaby's Black-Cockatoo across their species range.

The Great Cocky Count

The Great Cocky Count (GCC) is an annual, citizen science survey for black-cockatoos in Western Australia. The survey occurs throughout the southwest on a single evening in April. Volunteers are allocated to known roost sites and count the number of black-cockatoos that arrive at the site to roost for the night. The tenth GCC was held on Sunday 7 April 2019.



birds are in our nature

The 2019 Count: key findings

In 2019 750 volunteers surveying 397 roost sites across the southwest.

2019 recorded 22,647 white-tailed black-cockatoos across the species range, which is the highest number recorded in GCC history. A similar number recorded east of Yankeep in the pine plantation east of Carnaby's Black-Cockatoos.

6,104 Forest Red-tailed Black-Cockatoos recorded at 119 occupied roosts.

Greater Perth-Peel Region

The Greater Perth-Peel Region covers the Peel Coastal Plain and the No. 1 Plateau. The minimum population of Black-Cockatoo in the Greater Perth-Peel Region is 13,984.

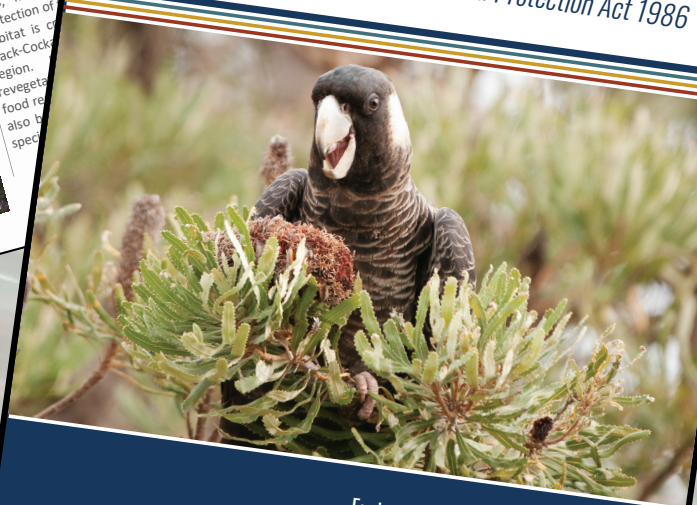
Trend analysis of roost counts for Black-Cockatoo in the Perth-Peel Region over recent years (2013-2018) has stabilised. However, a decline of 35% (approx.) was recorded in 2019.

On the Perth-Peel Region, many of Carnaby's Black-Cockatoo roost sites, many of which are protected under the Protection of the Environment Act 1986, are in areas where habitat is cleared for agriculture, forestry, revegetation, and other land use. Food resources are also being affected by these activities.



EPA Advice: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region

In accordance with section 16(j) of the Environmental Protection Act 1986



Environmental Protection Authority

May 2019

Reporting

helps to:

- validate efforts,
- maintain momentum for action, and
- ensure transparency, accountability efficient investment.

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