ENVIRONMENTAL MONITORING METHOD:

Koala Scat Searches

About This Method

This document helps you to monitor Koalas by searching for and identifying their scat. This method has been adapted from: The development of an improved scat survey method for koalas, A. Jiang, A. Tribe & P. Murray. You can find more information on the Monitoring Country website: monitoringcountry.org.au or scan the QR code.

This method has three parts: **1. Get Ready**, **2. Out on Country** and **3. Back in the Office.** Each part can be undertaken separately but you must complete all three parts to finish the method. At the end of the document, you will find guidance for all the gear you need - **Gather Your Gear – Complete List**.

We recommend you read the whole document before you start.

Part 1: Get Ready

GATHER YOUR GEAR

Equipment required for this part:

- ☐ Tablets/phones with:
  - ability to take photos
  - data collection and navigation apps
- ☐ Laptop/computer with software for:
  - mapping
- ☐ GPS device (recommended)
- ☐ Reference documents or field guides: Koala scat guide

KEEP IN MIND

Why?

Make sure there is a clear monitoring question and that the method you have selected will answer the monitoring question.

If this is the first time you are monitoring, you will need to design the survey: what are you monitoring, where will you survey, and when and how often you will survey?

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We acknowledge Aboriginal and Torres Strait Islanders as the Traditional Owners and Custodians of Country and recognise their continuing connection to and stewardship of land, water, and sea. We honour their culture, customs, and community. We pay our respects to their Ancestors, Elders, and future leaders.

ENVIRONMENTAL MONITORING METHOD:

Koala Scat Searches

When?

Prepare well before heading out on Country so that you have time to gather gear or train staff, if needed.

Who?

1 ranger/staff to plan and prepare

Training and skills

Staff involved in planning are trained and competent in:

- ☐ Mapping software (like QGIS or Google Earth) and/or monitoring point generator
- ☐ Navigation systems (like Avenza app or GPS device)
- ☐ Data collection systems (like Fulcrum app or paper datasheets)

Check permissions

Consult with Traditional Owners, landholders and relevant government agencies and authorities, to determine appropriate access and approvals for environmental monitoring:

1. Where you can go – consult with the owners/managers of the land.
2. What you can do – check if you need scientific licences or ethics permits
3. What or who can you take photos of
4. What can be done with data and photos – who owns them, where will they be stored and how will data be interpreted and communicated.

ACTIONS

Make a plan and prepare

If you have done this monitoring before, it is best to do the surveys at the same time and same sites so that you can compare the data to previous surveys and see if there have been changes.

1. Plan which dates you will do the scat search surveys
   - If you are also collecting scat for DNA analysis, you need to collect scat that is fresh and hasn't been degraded by the sun (high UV in summer) or heavy rain
2. Gather Koala records in your area and identify where potential Koala habitat is
   - Such as from Traditional Owners, Atlas of Living Australia (ALA) or government databases.

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3. Use the monitoring point generator or mapping software to select your sites
   - Choose an area where you know Koalas are or there is suitable habitat (Eucalypt Forest and woodland)
   - The number of sites will depend on how large an area you want to survey, how much time and how many people are available, and what analysis you want to do (e.g. index of activity, occupancy or population size)
   - It is best practice to randomly select site locations and then stratify (define/categorise) by major habitat type
   - Sites should be at least 500 m apart
4. Give each site a unique name, and export and save the location data in your data management system
5. Prepare maps of sites and load sites onto navigation devices
6. Plan how you will record information on Country (electronic data forms or paper datasheets)
7. Plan your data management system (how you will store scat data)
8. Check **GATHER YOUR GEAR** lists for **Get Ready, Out on Country** and **Back in the Office** (complete list on last page) and get any equipment you don't have.
   - See buying guide(s) for advice
9. Charge electronic devices (tablets/phones, power banks, GPS) and batteries

Train

1. Check the **Training and skills** requirements for **Get Ready, Out on Country** and **Back in the Office** steps and arrange any training or expertise that you need.
2. Run everyone involved in the survey through the plan.
   - Be clear on how many people will be involved, what everyone will be doing, and what they will need to do the survey.
3. Prepare guides for identifying Koala scat, including fresh vs. old scats
   - Guides can be loaded onto tablets/phones or printed and laminated
4. Run a training session for all rangers involved in the survey to learn or refresh:
   a. How to use the devices (like tablets/phones and GPS)
   b. How to use data collections apps and record data
   c. How to identify Koala scats including how old the scat is
   d. How to find and measure trees (that may be used by Koalas)

Next Section – Part 2: Out on Country

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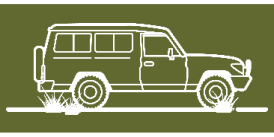
Part 2: Out on Country



GATHER YOUR GEAR

<u>One set</u> of this equipment for <u>each team</u>:

- ☐ Tablets/phones
- ☐ Power bank (optional)
- ☐ GPS device and spare batteries (recommended)
- ☐ Reference documents or field guides: Koala scat guide
- ☐ Sample tubes (if collecting scats)
- ☐ Permanent marker
- ☐ Measuring tape
- ☐ Flagging tape

KEEP IN MIND

When?

If you are planning to collect scat for DNA, make sure there hasn't been any heavy rain in the last 2 weeks.

Avoid windy conditions or extreme heat when tree branches are more likely to fall.

Who?

2 rangers per team

Training and skills

Make sure everyone knows the plan.

Field staff are trained and competent in:

- ☐ Navigation systems (like Avenza app or GPS device)
- ☐ Data collection systems (like Fulcrum app or paper datasheets)
- ☐ Identifying Koala scats including the age of scats
- ☐ Identifying Koala habitat, and trees that Koala may use
- ☐ How to collect scat samples without contaminating

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ACTIONS

Check that your electronic devices (tablets/phones, power banks, GPS, batteries) are charged before you head out.

Find the central tree

1. Once you arrive at your site, find the tree closest to the waypoint
   - A tree is a live, woody stem of any plant. Do not include palms, cycads, tree ferns and grass trees
2. Check that the Diameter at Breast Height (DBH) is at least 1 m by wrapping the measuring tape around the tree trunk at 1.3 m above the ground
   - If the tree is on a slope, measure at 1.3 m above the ground on the uphill side.
   - Try not to disturb the ground or vegetation
3. Mark the location of the central tree on the navigation device (e.g. GPS)
4. Record **survey effort data**

Search for Koala scat

1. Set up the search area around the tree by measuring 1 m out from the tree base in several directions to form a circle
   - Try not to disturb the ground or vegetation
2. Start the timer
   - You will stop the timer when you find the first scat OR when you finish searching if no scat is found
3. Do a quick search for obvious scat that you can see on top of the ground
   - Try not to disturb the ground or vegetation
4. Do a careful search for hidden scat by lifting up and looking under leaf litter and vegetation
5. Stop the timer when you find the first scat
6. Collect the scat
   - If collecting scat for DNA, follow the steps in **Collect Koala scat for DNA**
   - If not collecting scat for DNA, pick up each scat as you find it so that you don't count it twice
7. Count all of the scat
   - Both team members should look at the scat to confirm it is from a Koala
   - Compare to the Koala scat guide and/or take photos with the measuring tape for scale if you are unsure

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8. If no scat was found, stop the timer now
9. Record **scat search data**
10. Tie flagging tape on a branch to show this tree has been searched

Move to the next tree

11. Find the next closest tree that is at least 2 m away
    - This prevents overlapping search areas (which could mean counting the same scat twice)
    - A tree is a live, woody stem of any plant, except palms, cycads, tree ferns and grass trees
12. Mark the location of the tree on the navigation device (e.g. GPS)
13. Repeat the steps in **Search for Koala Scat**
14. Continue until you have searched a total of 30 trees: the central tree and the 29 trees closest to the central tree
15. Collect the flagging tape from all of the trees before leaving the site

Collect Koala scat for DNA

1. Look for fresh scat
    - Fresh scat has a strong smell of Eucalyptus and is moist OR dry and shiny
    - Do not touch scat with your bare hands
2. Collect each fresh scat using the lid of an empty sample tube to pick up the scat and it into the tube
    - Do not touch scat with your bare hands
    - You can also use tweezers or wear gloves, but you must disinfect tweezers or use fresh gloves for each scat
    - If multiple scats are very fresh AND in a small pile, they can be put in the same sample tube if you think they are from the same animal
3. Label each tube with the date, site, tree coordinates and sample number
    - Sample tubes will be pre-labelled with the sample number OR you will have a list of sample numbers to use
4. Record **scat collection data** for each fresh scat collected

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RECORD DATA

Data to record about survey effort

What to record	Required?	Notes
Information to record about each site surveyed		
Project name	Yes	Make it clear which project this data belongs to and its purpose
Date	Yes	Record the date the site was searched
Personnel	Yes	Record the name of the people who did the scat search - this is helpful if any questions come up about the data
Site name/number	Yes	Record the name or number of the site
Central tree coordinates	Yes	Record an accurate location of the central tree (using a handheld GPS if possible) (latitude and longitude or eastings and northings)
Koala sighting	Optional	Was a Koala seen at the site
Habitat description and/or photo	Optional	Describe or take a photo of the habitat type and landscape features at the site. This could be a category of major habitat types on Country and/or about Koala preferences (e.g. habitat trees, canopy heath). Make note of which camera/tablet/phone any photos were taken on, and the filename of the photo (usually end in .JPG)
Signs of disturbance	Optional	Types and causes of disturbance you can see at the site
Stories and notes	Optional	Record information or stories from Elders, and anything else worth noting about the area or animals.
Video	Optional	Record videos of information or stories from Elders, and rangers performing or describing the work they are doing.

Data to record when searching and collecting Koala scat

What to record	Required?	Notes
Information to record about each tree searched		
Site name/number	Yes	Record the name or number of the site
Tree coordinates	Yes	Record an accurate location of the tree (using a handheld GPS if possible) (latitude and longitude or eastings and northings)
Tree species and/or photo(s)	Optional	Identify the species of the tree and/or take a photo. Photos of the tree, bark, leaves and flowers can help with identification. Make note of which camera/tablet/phone the photos were taken on, and the filename of the photo (usually end in .JPG)

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Tree Diameter at Breast Height (m)	Optional	Use the measuring tape to get the trees diameter (measured at 1.3m above the ground)
Tree health	Optional	Describe the health of the tree in the context of Koala preferences (e.g. canopy cover).
Scat search time	Yes	Record how long you searched, either: • Start of search to finding the first scat OR • If no scat found, start to end of search
Number of scats found	Yes	Record how many scats were found
Scat ages	Optional	Record the number of fresh scats and number fo old scats.
Photo(s) of scat	Optional	Take photos with the measuring tape for scale if you are unsure if the scat belongs to Koala. Make note of which camera/tablet/phone the photos were taken on, and the filename of the photo (usually end in .JPG)
Ground cover	Optional	Record the type of ground cover. This could be from pre-selected categories based on types of vegetation/ground cover in the area, such as: • Bare: more than 50% of search area is covered by bare ground • Leaf: more than 50% of search area is covered by leaf litter • Bark: more than 50% of search area is covered by fallen tree bark • Low grass: more than 50% of search area is covered by low grass (<20cm high) • High grass: more than 50% of search area is covered by high grass or shrubs (>20cm high)
Koala sighting	Optional	Record whether a koala was seen in the tree or not.
Photo of koala	Optional	Take a photo of the koala if there is one in the tree and make a note of which camera/tablet/phone the photo was taken on, and the filename of the photo (usually ends in .JPG).
Information to record about each scat collected for DNA		
Date	Yes	Record the date the site was searched
Site name/number	Yes	Record the name or number of the site
Tree coordinates	Yes	Record an accurate location of the tree (using a handheld GPS if possible) (latitude and longitude or eastings and northings)
Sample number	Yes	This is the unique number of each sample. The sample number must be written on the sample tube.
Scat age	Optional	Describe how fresh the scat looks.

Next section – Part 3: Back in the Office

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Part 3: Back in the Office

GATHER YOUR GEAR

Equipment required for this part:

- ☐ Tablets/phones (or paper datasheets) that you used to record data
- ☐ Data management system
- ☐ Laptop or computer with software for:
  - Spreadsheets
  - Mapping
- ☐ Sample tubes with scat (for DNA analysis only)
- ☐ -20˚C freezer (for DNA analysis only)

KEEP IN MIND

When?

Always try to complete this work as soon as you can after returning from your time on Country so that what you did and what you saw is fresh in your memory.

Scat samples need to be put in the freezer as soon as possible to stop the DNA from breaking down. Once you have sent the samples for DNA analysis, it can take several months to get the results back.

Who?

1 person to manage the data

Training and skills

Staff managing data are trained and competent in:

- ☐ Mapping software (like QGIS or Google Earth)
- ☐ Spreadsheet software (like Microsoft Excel)
- ☐ Data collection systems (like Fulcrum app or paper datasheets)
- ☐ Data management systems (like databases, cloud storage and external hard drives)

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ACTIONS

Storing and sending sampling

As soon as you return from the field:

1. Check that the sample tubes are labelled correctly with the date, site, tree coordinates and sample number
2. Store the sample tubes in the freezer until they are sent for analysis
3. Contact the lab to let them know you have samples ready for analysis
4. Send the samples to the lab
    - The lab will give you specific instruction on where and how to send the samples
    - You will need to make sure the samples stay frozen/cold – this may mean you need to send them express or drive them to the lab
    - You usually need to send the lab the data that goes with the samples – they will probably ask for an electronic version (spreadsheet) and a printed version to be sent with the samples
5. Wait for the results

Data entry, analysis and reporting

1. Record a summary of what you did and why, any observations (like weather conditions, fire history and site condition), anything that went wrong or didn't work and things that worked well.
2. Upload the **survey effort, scat search and scat collection data** to your data management system
    - Recommended: get someone else to proof the data to check for mistakes
3. Upload any photos or videos taken during the survey to your data management system
4. Import the data into a spreadsheet. The data can be analysed to estimate Koala Activity Level (KAL), occupancy, or population size:
    a. Koala Activity Level is the percentage of trees with Koala scat. Calculate this for each site using this formula: (number of trees with scat/30 trees)*100
        - Low KAL = 0-33%
        - High KAL = 33-100%
        - KAL can give you an idea of whether you have low or high numbers of Koala on Country
    b. Occupancy is the percentage of sites with Koala scat. Modelled occupancy can be estimated using modelling software, OR naïve (raw) occupancy can be calculated using this formula: (number of sites with scat/number of sites)*100

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- If you do the survey regularly (every year), occupancy can give you an idea of whether there are changes in how many Koalas are on Country over time

c. Population size can be estimated using scat DNA data and mark-recapture or spatially-explicit capture-recapture analysis

5. Use the mapping software to create a map of
    a. All sites that were surveyed
    b. The sites at which Koala were found (from all surveyed sites)
6. Discuss with the ranger team or community the results of the monitoring, and any reasons for changes in activity, occupancy, or population size to previous years
    - Consider whether trends might be related to your management (like protecting habitat trees) to check how well management is working, or if you need to make adjustments
7. Share the data according to any data sharing or funding agreements you have made

Next section – Full Equipment List

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Gather Your Gear – Complete List

The complete **GATHER YOUR GEAR** list for **Get Ready**, **Out on Country** and **Back in the Office**.

Gear List	Required?	Get Ready	On Country	In Office
Tablets/phones: • Ability to take photos • Apps for data collection (like Fulcrum) and navigation (like Avenza)	✓	✓	✓	✓
Laptop or computer with software for: • Mapping (like QGIS or Google Earth) • Spreadsheets (like Microsoft Excel)	✓	✓		✓
GPS device & spare batteries	**Recommended**	✓	✓	
Power bank	**Recommended**		✓	
Reference documents and/or field guides: • Koala scat guide	✓		✓	
Measuring tape	✓		✓	
Flagging tape	✓		✓	
Sample tubes	**DNA sampling only**		✓	✓
-20˚C Freezer	**DNA sampling only**			✓
Data management system (like databases, cloud storage and external hard drives)	✓			✓

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