Australian Capital Territory

Nature Conservation (Buru – Eastern Grey Kangaroo) Conservation Culling Calculator Determination 2026

Notifiable instrument NI2026–510

made under the

Nature Conservation (Buru – Eastern Grey Kangaroo) Controlled Native Species Management Plan 2026, s 3.4 (Implementation of the management plan)

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1 Name of instrument

This instrument is the *Nature Conservation (Buru – Eastern Grey Kangaroo) Conservation Culling Calculator Determination 2026*.

2 Commencement

This instrument commences on the day after its notification day.

3 Conservation culling calculator

I determine the *Nature Conservation (Buru – Eastern Grey Kangaroo) Conservation Culling Calculator 2026* in schedule 1.

4 Revocation

This instrument revokes the *Nature Conservation (Eastern Grey Kangaroo) Conservation Culling Calculator Determination 2018* (NI2018-141).

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Conservator of Flora and Fauna

19 November 2026

Schedule 1

(see s 3)

Nature Conservation (Buru – Eastern Grey Kangaroo) Conservation Culling Calculator 2026

Summary

The purpose of conservation culling in protected areas in the ACT is to maintain densities of Buru at levels that retain conservation values of grassy ecosystems. In particular the aim is to moderate kangaroo grazing effects to achieve a grazing regime favourable for the conservation of plants and small animals that frequent the ground-layer vegetation.

The culling calculator takes into account that the heterogeneous pasture structure desired for biodiversity conservation does not develop at either extreme of high or low grazing and is designed to achieve the 'Optimal Grass Height Range' for each reserve to support biodiversity (see Section 4.2.2 of the *Buru (Eastern Grey Kangaroo): Controlled Native Species Management Plan 2026*). The calculator uses the formula below and the outcome can then be subject to expert ecological judgment to consider site-specific factors such as other management activities or species of interest (e.g. threatened species) in each reserve.

Conservation culling formula

The (A) **target number of Buru to remain** after culling is subtracted from (B) the **current population**, making allowance for (C) **population growth** in the interim to the next cull. The three components of this formula are explained in the following points (A to C).

A: The target number of Buru to remain after culling

The target number of Buru to remain after culling is calculated to achieve the grassy ecosystem 'Optimal Grass Height Range' of average native grass heights between 5 and 12cm.

The target number of Buru is the number required to eat excess grass above the Optimal Grass Height Range and therefore relies on how much grass will be available as food in the landscape. This instrument outlines two ways to calculate the target number of Buru: Method 1 uses annually collected field data about grass structure and composition with mathematical models to estimate above ground pasture vegetation, predict how much fresh grass will grow and be available as food for Buru and predict how much individual Buru will eat. Method 1 accounts for annual variation in grassy structure and sets a target

number of Buru that is expected to eat excess grass given current conditions. Method 2 uses the area of broad vegetation classes in the landscape and the associated standard Buru number per hectare (density) expected to achieve the optimum grass height range in average climate years.

Method 1: Using annual grassy layer field data to calculate the target number of Buru

The site of interest is first divided into large areas (management polygons) with similar grass structure, species composition and productivity that are therefore likely to have similar management requirements. For example, management polygons could be classified according to plant community type (PCT) boundaries, or whether exotic grasses or native grasses are more common and whether or not Kangaroo Grass is the dominant native grass species. Detailed information about the grass condition in small areas (survey plots) is measured within the management polygons in Spring or early Summer.

Each management polygon should contain at least two survey plots which are positioned to be representative of variation in grass structure within the polygon. Survey plots that are a 400m^2 circle with an 11.3 m radius from a central point are commonly used.

The field data required to represent each survey plot include:

- average grass height,
- dominant grass species,
- proportion of the grass that is green and
- proportion of the ground covered in grass.

For grass height and proportion green grass, measurements can be recorded in each of a series of quadrats (normally 10) randomly located throughout the survey plot, plot averages can then be calculated from the series of quadrat data. The dominant grass species can also be recorded in each quadrat as that with the most leafy biomass (ignoring culms). The most frequently dominant grass among quadrats can then represent the survey plot. The proportion of the ground covered in grass can be measured by taking a standard number (e.g. 75 or 100) of random steps within each survey plot and recording the dominant ground cover category at each step (e.g. native C4 grass, native C3 grass, native forb, cryptogram, rock, leaf litter, thatch, dead forb, bare ground, exotic forb, annual grass, or exotic perennial grass).

Buru target densities within survey plots can then be calculated using the above data with the herbage mass productivity and Buru offtake models for different grass species that were developed according to the method described by Snape et al (2021). To provide a precise target Buru density (rather than a range), a precise target grass height from within the Optimal Grass Height Range is used in the calculations. In general, 7cm is used as the precise target grass height but this may be varied to meet the management requirements of specific sites or species.

The survey plot level data is used with the mathematical models to:

- calculate existing above ground pasture vegetation (herbage mass),
- predict Spring and Autumn grass growth, and
- predict Spring and Autumn per capita Buru offtake.

Target Buru densities for survey plots can then be calculated and averaged within shared management polygons. The average target Buru density is then scaled up to the relevant management polygon area to provide a target Buru number for each management polygon. The target Buru numbers for each management polygon are then added together to give the target Buru number for the entire area of interest.

Method 2 Using broad vegetation classes

In the absence of detailed grassy layer monitoring, target Buru densities can be calculated using a simple formula based on vegetation structure. In average climatic conditions, it is estimated that a density of approximately one Buru per hectare in grassland is likely to maintain the desired conservation environment under varying pasture growth conditions for small animals. The corresponding figures for other vegetation types are inversely proportional to the percentage canopy cover:

- open woodland = 90% of grassland target (0.9 Buru/ha);
- woodland = 50% of grassland target (0.5 Buru/ha); and
- forest/open forest = 10% of grassland target (0.1 Buru/ha).

Thus, it would be calculated that a reserve comprising 100 hectares of forest, 100 hectares of open woodland and 100 hectares of grassland could sustain 10+90+100=200 Buru whilst maintaining grass structure to provide suitable habitat conditions for grassland plant and animal species.

While this formula does not account for site specific or seasonal variation in vegetation condition, it can provide a useful starting point for decisions about Buru management that can be refined using expert ecological judgement if required.

Site specific target densities that do not result from either of the above methods may be applied to support ecological research, when supported by a defined research project that has been approved by the Conservator of Flora and Fauna and which has gained ethics approval, if required.

B: The current population

Population abundance is determined within a Buru Management Unit (BMU). Each BMU represents a single shared Buru population, as determined by landscape features that influence Buru movement, such as roads or an urban interface. A BMU typically consists of multiple land tenures and Buru counts are conducted across all land components, not just the Nature Reserve. Counts are obtained using several survey methods. Refer to Appendix 6.5 of the *Buru (Eastern Grey Kangaroo): Controlled Native Species Management Plan 2026* and Coulson *et al.* (2021) for methods of estimating Buru population abundance.

C: Population growth in the interim to the next cull

The annual population growth of Buru (r) varies with food availability, weather, current Buru population density and mortality factors such as predation and vehicle collisions and is calculated using the formula $r = \log_e(N_{t+1}/N_t)$ where N_t is the population size in one year and N_{t+1} is the population size in the following year.

The target Buru density (A) is an average for the year, so the population starts the year below the target and ends the year above it. For example, if the target was 1 Buru per ha, the cull should reduce the density to 0.91 Buru per ha to allow for a predicted annual population growth rate of r = 0.18 (or 20% annual increase) and the population will end the year at 1.09 Buru per hectare.

Based on population estimates from multiple ACT Buru populations, Hone and Snape (2024) developed the following formulas for predicting population growth that take population density into account. These formulas are used to calculate the site specific predicted annual population growth rate for each BMU:

- Predicted annual population growth rate $r_p = 0.317 - 0.151 \times N_t$
- Forecast population density $N_{t+1} = N_t \times e^{rp}$.

The above formulas result in larger populations having lower annual population growth rate predictions compared to smaller populations due to density dependent factors. For example, the predicted annual growth for a population starting at 1.0 Buru per hectare is r = 0.17 (or 19% annual increase), whereas the predicted annual growth for a population of 0.1 Buru per hectare is r = 0.3 (or 35% annual increase). In some instances, such as fenced populations or those subject to fertility control treatments, birth or mortality rates may be much higher or lower than normal so annual population growth varies from what is calculated using these formulas. In these cases it is necessary to apply a special growth rate based on observations or predictions relevant to the specific circumstance.

Expert Ecological Judgment

Expert ecological judgment is sometimes used to adjust culling figures to account for site-specific management requirements and/or activities, or to manage habitat for specific threatened species. Expert opinion provides critical flexibility and adaptability to the culling program. In particular, site variations in complementary management actions can be considered as part of overall Buru management and culling targets. Management actions that may influence culling figures include ecological burning, livestock grazing, exclusion fencing and slashing or mowing. Likewise, the target Buru density may be adjusted in a reserve to meet the specific habitat requirements of a threatened species.

References

Coulson, G, Snape, MA, Cripps, JK (2021) How many macropods? A manager's guide to small-scale population surveys of kangaroos and wallabies. *Ecological Management & Restoration* **22**, 75-89.

Hone, J, Snape, M (2024) Bias and precision of predicted densities of overabundant kangaroo populations. *Ecological Management & Restoration* **25**, 182-188.

Snape, MA, Fletcher, D, Caley, P (2021) Species composition, herbage mass and grass productivity influence pasture responses to kangaroo grazing in a temperate environment. *Ecological Management & Restoration* **22**, 16-23.