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Estimating doses from Aboriginal bush foods post-remediation of a uranium mine

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ABSTRACT

This paper presents a calculator to facilitate assessments of ingestion doses from Aboriginal bush foods. The calculator combines information on traditional diet and land use with radionuclide concentration ratios and ingestion dose coefficients to estimate doses. The calculator was applied to the planned remediation of Ranger uranium mine to derive a set of scaling factors between radionuclide activity concentrations in environmental media and ingestion dose from bush foods. The scaling factors can be used to estimate doses from bush foods once the post-remediation radiological conditions of the mine and surrounding environment are known.

1. Introduction

Most uranium mining projects in Australia occur in remote areas inhabited by Aboriginal people whose diet includes bush foods.[1] This intersection of mining and culture can raise concerns about radionuclide contamination of bush foods and associated elevated radiation doses to people consuming them. Ranger uranium mine in the Alligator Rivers Region (ARR) stands as an example. The mine is located on Aboriginal land and is surrounded by biologically diverse freshwater and terrestrial ecosystems that function as sources of bush food of local indigenous communities. Measurements of radionuclides in bush foods from these ecosystems have occurred over the life of the mine (see, e.g., Doering and Bollhöfer (2016a) and references therein) to provide assurance that they remain radiologically 'safe' for consumption. The mine is now proceeding towards decommissioning and remediation. There is concern that the remediated site could be a future source of radionuclide contamination to bush foods and consequently a source of above-baseline radiation dose to Aboriginal people. The aim of this paper is to develop a methodology to estimate doses from radionuclides in bush foods after remediation of the mine. The study forms part of a broader assessment of radiological exposure pathways for the remediated site and helps address the question 'What is the above-baseline radiation dose to Aboriginal people after remediation of Ranger uranium mine and is this dose above or below the public dose limit of 1 mSv in a year'?

2. Setting and remediation context

The ARR covers an area of approximately 28,000 km^2 in northern Australia (Fig. 1). The climate is tropical with distinct wet (November–April) and dry (May–October) seasons. Most of the ARR is Aboriginal land and around two-thirds is World Heritage listed as Kakadu National Park. Aboriginal people have inhabited the ARR for tens of thousands of years, hunting and gathering bush foods from the environment. This tradition of hunting and gathering is recorded in many of the archeological rock art sites found in the ARR and in Kakadu National Park in particular (Chaloupka, 1993).

Ranger uranium mine is located in the ARR (Fig. 1) and is surrounded by Kakadu National Park and its Ramsar listed wetlands. Mining began in 1980 and has included the extraction of uranium mineralised material through open-cut methods and on-site ore

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[1] Bush foods are the edible tissues of wild plants and animals traditionally hunted and gathered from the environment.

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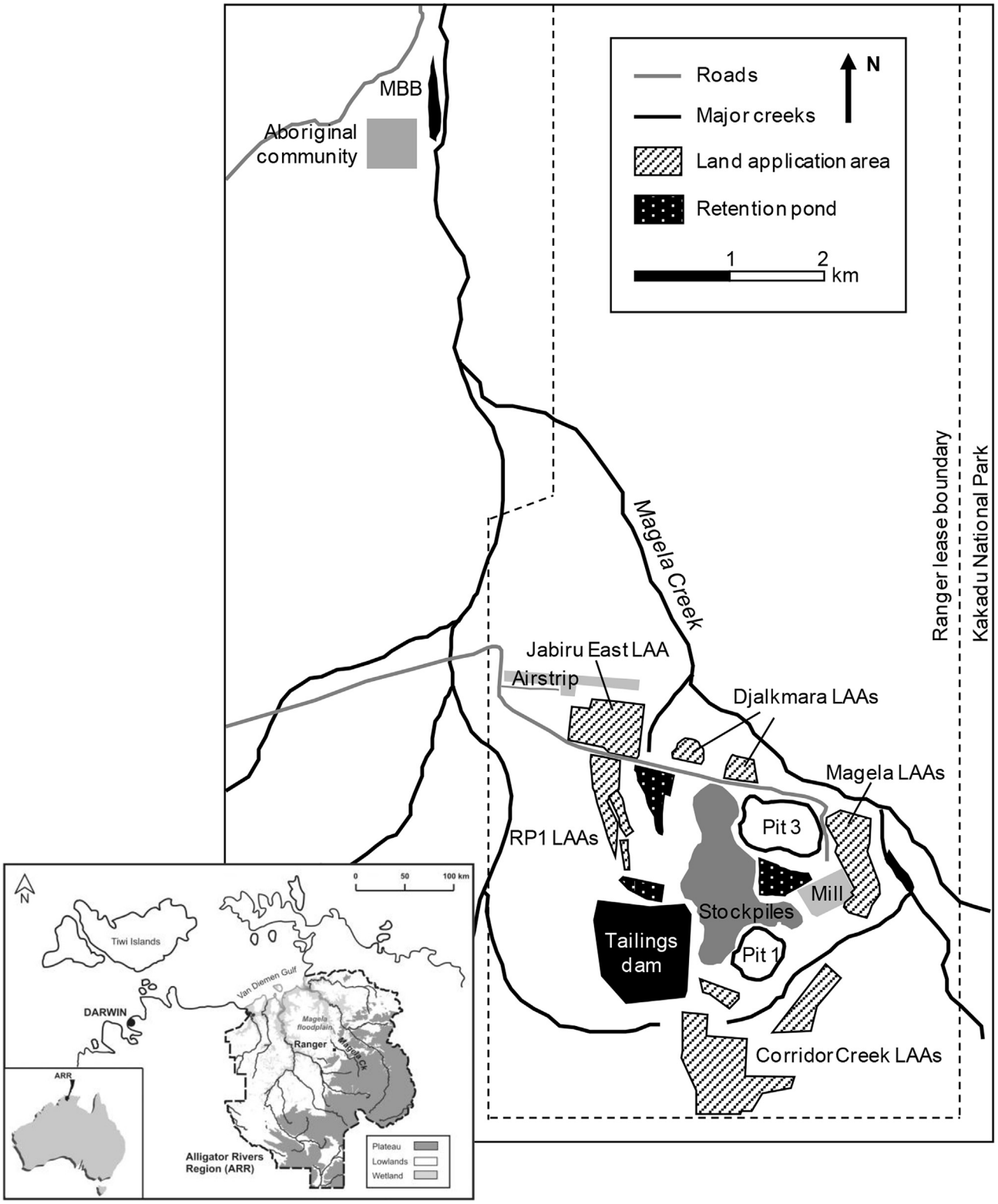

Fig. 1. Position of Ranger uranium mine and Mudginberri Billabong (MBB) along Magela Creek. The inset at the bottom left shows the location of the Alligator Rivers Region in the broader geographical context of northern Australia.

processing. The Ranger Authorisation requires that all mining and processing activities must cease by 2021 and that the site must be remediated by 2026. The Environmental Requirements for the mine (Commonwealth of Australia, 1999) set out the environmental protection conditions for remediation and are a condition of the Ranger Authorisation. The Environmental Requirements require that the site must be remediated to *"an environment similar to the adjacent areas of Kakadu National Park such that … the rehabilitated*