Journal of Anthropological Archaeology 39 (2015) 51–62

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa

Diesel and damper: Changes in seed use and mobility patterns following contact amongst the Martu of Western Australia

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ARTICLE INFO

Article history:
Received 5 June 2014
Revision received 23 February 2015

Keywords:
Broad spectrum revolution
Foraging theory
Marginal Value Theorem
Seed use
Martu
Western Australia
Last Glacial Maximum
Sexual division of labor
Ground stone

ABSTRACT

Seed-reliant, hunting and gathering economies persisted in arid Australia until the mid-twentieth century when Aboriginal foragers dropped seeds from their diets. Explanations posed to account for this "de-intensification" of seed use mix functional rationales (such as dietary breadth contraction as predicted by the prey choice model) with proximate causes (substitution with milled flour). Martu people of the Western Desert used small seeds until relatively recently (ca. 1990) with a subsequent shift to a less "intensive" foraging economy. Here we examine contemporary Martu foraging practices to evaluate different explanations for the dietary shift and find evidence that it resulted from a more subtle interaction of technology, travel, burning practices, and handling costs than captured solely by the prey choice model. These results have implications for understanding the roles of mobility, aggregation behavior, sexual division of labor, and seed use in the broad-spectrum revolutions of arid Australia and the Western United States.

1. Introduction

A hallmark of the "broad-spectrum revolution" (BSR) was the systematic adoption of wild seeds into forager diets, marking initial steps toward domestication of many cereals (Flannery, 1969). Investigating causes of this change (Bettinger et al., 2010; Fuller et al., 2011; Geib and Jolie, 2008; Piperno et al., in press; Rhode et al., 2006; Savard et al., 2006) is an ongoing subject of archaeological investigations worldwide, but proponents of human behavioral ecology (HBE) often see it as a broadening of diet to include resources requiring higher handling, but lower search costs, triggered by depression of higher ranked prey (Edwards and O'Connell, 1995; Simms, 1987; Stiner, 2001; but see Zeder, 2012 for an alternative view). Australia represents an important case because hunter–gatherers there relied on Acacia and grass seeds without domesticating them (Allen, 1974; Bliege Bird et al., 2008; Gould, 1969; Tindale, 1977; Walsh, 1990). Although prehistorians disagree when Aboriginal foragers first used seeds, most agree that use of seeds as staple foods was a consequence of intensification among broad-spectrum foragers.

The BSR in arid Australia appeared to reverse its course in the twentieth century when Aboriginal foragers ceased harvesting seeds, while still foraging for other foods. The proximate cause seemed obvious: foragers simply substituted commercial flour for seeds – why harvest and grind seeds when milled flour is free (Altman, 1987; Balme, 1983)? O'Connell and Hawkes (1981, 1984), posed an HBE explanation grounded in principles of the prey choice model (PCM) in their study of the foraging ecology of the Alyawara. They argued that availability of commercial foods discouraged foraging, easing depression of highly ranked foraged foods. Consequently whenever Alyawara women chose to forage their overall returns (E/T – kcal/search + handling-h) were sufficiently high that lower-ranked seeds fell out of the optimal diet. O'Connell and Hawkes speculated that had potatoes rather than wheat flour been the introduced staple, Alyawara would nonetheless have bypassed seeds while continuing to harvest native tubers because of the higher post-encounter return rates (e/h – kcal/handling-h) of the latter.

Like other Aboriginal groups, contemporary Martu of Western Australia rarely harvest seeds despite the facts that seeds were staples until relatively recently, foraged foods account for about half

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http://dx.doi.org/10.1016/j.jaa.2015.02.002
0278-4165/

of all calories currently consumed, and Martu foragers frequently encounter seeds. Foraging returns in seed-bearing habitats are often low enough that the PCM predicts Martu would do better by taking seeds. Although Martu have substituted commercial flour for seeds, we argue that it is their use of 4-WD vehicles and diesel fuel that has made seed harvesting uneconomical by imposing an opportunity cost between time spent processing seeds and traveling to new patches.

2. Background on the issue

Alyawara foragers voluntarily harvested seeds of only one species of Acacia (*Acacia coriacae*) during O'Connell's year of observations in the mid-seventies. Taken while still green, their pods required no grinding so provided a much higher caloric return than feasible for milled seeds. Alyawara ground ripe acacia pods (*A. aneura*, *A. coriacae*, and *A. cowleana*) only at O'Connell's request, despite evidence that they had regularly collected these resources recently.

Similarly Devitt (1988) observed nearby Anmatyere foragers harvest only the same green acacia, however they were willing to process seeds of woollybutt (*Eragrostis eriopoda*) grass and ripe *A. coriacae* pods to show what women's work had recently been like. Cane (1987) observed Pintupi foragers prepare dampers (a common term for wet-milled seed cakes and bread cooked on coals) from seeds of five different grasses and forbs to demonstrate their traditional lifeway, but found little evidence of ongoing seed usage in a survey of 35 outstation communities (Cane and Stanley, 1985). Nash (1993) found that Pintupi children learned of wild seeds as "olden time tucker," then used for cultural, rather than subsistence purposes. Altman (1987) found that Gunwinggu women in Arnhem Land no longer made seed damper except to prove they retained necessary skills. Brokensha (1975) found that Pitjantjatjara in South Australia no longer made damper from Native Millet (*Panicum decompositum*), but were willing to demonstrate traditional collecting and processing techniques. Palmer and Brady (1991) found that the Pitjantjatjara speaking Maralinga had stopped making damper from native seeds, even though they still occasionally ate the root of Pigweed (*Portulacca oleracea*), one of their traditionally important seed plants. Across arid Australia, Aboriginal foragers ceased harvesting seeds even though they retained the necessary expertise and technology. Anthropologists saw the availability of flour and the work required to make damper as being the reasons contemporary Aboriginal foragers largely forsook seeds.

The situation in the 1980s was somewhat different for Martu people. One of the authors (PMV) documented Martu use of 17 different species of grass and Acacia seed as staple foods. Yet by 1990, Walsh (2008) recorded Martu use of only six seed species. Recording nearly 1200 foraging bouts from 2000 to 2005, two of the authors (DWB and RBB) recorded only ten instances of Acacia and grass seed harvesting (Bliege Bird and Bird, 2008). We have since observed Martu collect seeds on only three occasions. Martu almost completely dropped seeds from their diets between 1988 and 2000 with a documented shift from a seed-reliant to a less intensive foraging economy.

3. Post-colonial context

To put this transition in historical context, we concentrate on the Martu community of Parnngurr, located within Karlamilyi (Rudall River) National Park and hosting a shifting population of about 80 people. Martu were among the last full-time hunter–gatherers in Western Australia. An autonomous band of Martu was first contacted near the modern location of Parnngurr in 1963 and relocated to join other Martu at Jigalong mission, 200 km away. While they continued to highly value bush foods, the Martu at Jigalong often found it difficult to forage and grew dependent on European food, especially flour. Tonkinson (1997: 162) records Martu as saying, "we were captured by flour" during the mission period.

During their stay at Jigalong, Martu were no longer able to burn-off grasslands for various traditional economic and social purposes, causing the vegetation of Martu estates in the Great and Little Sandy Deserts to revert to relatively homogenous, mature, Spinifex (*Triodia* spp.) grasslands. This likely had detrimental effects on the abundance and distribution of seed bearing grasses that grow best in areas burned one to four years previously (Bliege Bird et al., 2012a).

Many Martu returned to their homeland to establish the community of Parnngurr in 1984 in a successful attempt to block uranium mining at a nearby sacred place. This early outstation lacked a reliable supply of commercial foods; the nearest regularly supplied stores were at Jigalong and Punmu (the neighboring Martu outstation) both requiring up to a full day to reach by 4-WD. Support from the Department of Aboriginal Affairs involved periodic but unreliable truck deliveries and airdrops of supplies that included flour. A "shop" (initially a freezer in a shed with a generator) was installed by 1988. Regular deliveries to the store were running by 1990, but shortages due to inclement weather and mishap remain common even today (Newman et al., 1993; Walsh, 2008).

Martu at Parnngurr resumed foraging, both out of necessity, and because they saw foraging as key to renewing social and religious ties to their homeland. It was during the early period following resettlement that anthropologists observed Martu using seeds most intensively. Although Martu also resumed traditional burning practices, it took years to re-establish the anthropogenic mosaic of vegetation communities that had existed previously (Bliege Bird et al., 2012a).

Commercial goods, especially flour, increased in availability in the late 1980s at the same time that Martu dropped seeds from their diets; paradoxically, simultaneous with the re-emergence of an anthropogenic fire mosaic conducive to seed growth. We will argue that this transition also corresponds with greater access to motor vehicle transport and diesel fuel and that this change in mobility and transport has not previously been given adequate attention.

4. Purchased and foraged foods: trade-offs in utilizing seeds and flour

Today, although many Martu engage in some wage labor and some sell painted and basketry art, opportunities for employment at outstations are limited and foraging remains the most productive occupation (Codding, 2012; Codding et al., in press). Parnngurr residents spend 25–30% of their days hunting or gathering, and rely on foraged food for 35–50% of their daily diet, depending on season (Bliege Bird et al., 2015). While they continue to collect a wide array of plant and insect resources (especially fruit from *Solanum* spp., nectar from *Hakea suberea*, and *Endoxyla* spp. cossid larvae), today both men and women are primarily hunters, and their main prey, especially for women, are several species of monitor lizards (Bliege Bird and Bird, 2008; Bliege Bird et al., 2012a, 2012b). Bustards (*Ardeotis australis*) and hill kangaroo (*Macropus robustus*), mostly hunted by men, make up the bulk of the remainder (Bird et al., 2009, 2013).

Contemporary Martu foragers collect small-grained seeds only on rare occasions despite the retention of harvesting and processing skills. In 2002, two of the authors (DWB and RBB) observed