Fluctuation in Colocasia Cultivation and Landesque Capital in Navosa, Viti Levu, Fiji

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Irrigated Taro (Colocasia esculenta) *in the Indo-Pacific*
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Navosa is a seasonally-dry leeward climate region of interior Viti Levu, the largest island of Fiji. Taro (*doko*, *dalo*, *doxo*, *Colocasia esculenta*) has been grown there with the aid of landesque capital (terracing, creekfields, aqueducts) as a principal crop for centuries, but most of this capital now lies disused. The reasons for decline will be evaluated, with a focus on two previously overlooked processes: damage associated with the intrusion of ungulates and the accumulated effects of soil erosion in gully environments. It is argued that current cultivators tend to report (sudden) proximate rather than (gradual) distal causes but it is the latter which ultimately have the greater effect in reducing the use of landesque capital in the agricultural landscape. Some of the degradation can be ameliorated and some renewal of landesque capital has occurred, stimulated by increased demand for *dalo* and the emergence of a community-based project (*Vitokoni ni Vuci*) that aids the development of indigenous irrigated agriculture. These changes suggest a developmental turning-point in the local region towards reintensification.

1. Introduction and Background

For most of the period since initial settlement 3000+ years ago indigenous Fijians of the seasonally-dry leeward climate zones have relied upon yams (*uvi, Dioscorea* spp.) and taro (*dalo*, *doko*, *doxo*[1)], *Colocasia esculenta*), as *kakana dina* or 'true foods' (Pollock 1992).

Before cassava became popular for human consumption (about mid 20th century), *uvi* and *dalo* were predominant among cultivated foods (Thaman 1990; Thaman and Thomas 1985), but at an unknown date (perhaps during an arid climate period about 700–1250 years ago; Nunn and Britton 2001), irrigated terracing was developed (esp. in hill regions near reliable sources of fresh water) for growing *Colocasia*. This innovation has created landesque capital (Blaikie and Brookfield 1987: 9) that enhances livelihood resilience through anthropogenic structural modifications to the landscape. In Fiji, these techniques can also be described as part of a process of indigenous development (Maiava and King 2007).

The recent shift to cassava coincides with the introduction of alternative crops, a dramatic population decline (nadir about 1920; McArthur 1967), and other changes associated with the arrival of European peoples, the diffusion of modernity and the replacement of local cultural economies with world system economies. Nevertheless, against this backdrop of change, *uvi* and *dalo* have retained their cultural value as prestige foods (Pollock 1992;

Thaman 1990: 28), at least partly because of their climatic and ecological suitability.

The remnants of many medium to large-scale irrigated *Colocasia* production systems (called *vuci*), visible on aerial photographs, have been studied by Parry (1987) and Kuhlken (1994a). Smaller extant systems have been studied by Sahlins (1962), Watling (1984) and Hashimoto (1990). The last big creekfield system on alluvial terraces (the Nakula complex shared by Namoli and Korolevu villages of Noikoro district), ceased in 1993 (King 2004: 62). A medium to large-size hillside *vuci* at Waibasaga village (Nasikawa district) was still in use until 2000, a fact unknown to this author before his visit there in 2010.

Many of the early historical accounts from Fiji (mainly in the late 19th century) mention or allude to irrigated dalo gardens. None of these mention the retirement or decline of irrigation systems. There are two conflicting reports (Williams 1982/1858; Milne 1859) which can be interpreted to suggest that wetland (includes irrigated) and dryland dalo were about equally prevalent circa 1858–1859. The best descriptions are in the following works: Boyd (1986/1878: 44), Horne (1881: 75–78), Milne (1859: 152), Thomson (1889: 646, 650), and Williams (1982/1858: 61–62). Parham (1937) has considerable detail, and later works of relevance for Fiji include: Brookfield (1979), Kuhlken (1994b, 1999, 2002), Parry (1994, 1997), and Spriggs (1981, 1985: 418–420, 1990).

2. Reported Reasons for *Vuci* (Wet Dalo Garden) Decline and Cessation in Fiji

Vuci systems usually declined gradually[2)] (Hashimoto 1990; Kuhlken and Crosby 1999; Sahlins 1962; Watling 1984) which suggests that the main causes of *vuci* decline are subtle and stress-related rather than associated with particular events or shocks. Several reasons for *vuci* decline have been reported in the literature (see King 2004: 62–64). These reasons have been categorised by the author into either: (a) physical constraints; (b) political and sociocultural influences; or (c) technological changes associated with modernization, as in Table 1.

3. Proximate versus distal causes

The cause of decline can be attributed to either proximate (near, tangible, and sudden) or distal (remote, indistinct and slowly-changing) factors. The category prototype theories of Rosch (1977) and Lakoff (1987) provide the foundation to this approach (summarized in *ibid*, pp. 39–57), partly supported by recent theories about how the process of abstraction, mediated by psychological distance, guides the evaluation of near and distant situations (Liberman and Trope 2008). It is expected that proximate construals connected to basic categories can be remembered better and in more detail, probably aided by the rehearsal effect (Neisser and Libby 2000: 318), compared to the relatively-abstract superordinate categorization associated with distal construals.

The author has conducted informal interviews between 2005 and 2009 with local cultivators, who reported a variety of reasons for the decline and cessation of *vuci.* Some common reasons were: (a) cyclone damage, for example, from Cyclone Bebe (1972) or Cyclone Kina (1992–1993); (b) laziness of cultivators (interpreted here as a reaction to drudgery-aversity;

Table 1 Reported reasons for *vuci* (wet *dalo* garden) decline and cessation in Fiji

1 *Physical constraints*
1.1 The drudgery of terrace-construction.
1.2 Continual monitoring and maintenance of the *vuci* system is necessary.
1.3 The risks to structural integrity caused by droughts, floods and the collapse of retaining walls.
1.4 Depopulation caused by disease epidemics after European contact.
1.5 Gully and sheet erosion and the decline of water tables.
2 *Political and sociocultural influences*
2.1 The influence of European and Indo-Fijian cultural and economic values and practices.
2.11 The introduction of market cropping.
2.111 The development of plantation agriculture (e.g., bananas, copra).
2.12 The process of labour displacement (e.g., to sandalwood, *yaqona*, gold).
2.2 The replacement of chiefly authority by colonial authority.
2.21 The weakening of traditional social solidarity and leadership.
2.3 The cessation of war and internecine conflict.
2.31 Increased internal migration.
2.4 The colonial imposition of 'tax gardens' and tenurial fixation.
2.5 The relocation of settlements downstream and away from their *vuci.*
3 *Technological changes associated with modernisation.*
3.1 The introduction of new species of ungulates (i.e., cattle, horses, goats), and the encouragement of extensive grazing, leading to the displacement of cultivated gardens.
3.11 Animal damage to gardens and waterworks.
3.2 Agricultural innovations (e.g., the plough and other implements or tools that aid dryland cultivation).
3.3 New cultigens (e.g., *Xanthosoma*, but esp. *Manihot esculenta* (cassava)).
3.4 New cultivars (e.g., dryland-tolerant *Colocasia*).

see Chayanov 1991; Thorner *et al.* 1986); (c) long (esp. decadal) periods of drought; or (d) colonial demands for agricultural modernization.

Regarding the first reason, cyclones are frequent in Fiji (Kostaschuk *et al.* 2001; Thompson 1981) and therefore it is assumed that *vuci* were previously damaged by cyclones and subsequently repaired. The question is unavoidable: why was the decision taken to retire *vuci* rather than repair them? Answers to this question were usually vague, or cause was attributed to the laziness of the cultivators. There may have been other reasons no longer remembered.

Laziness was the response of elder stakeholders (all former cultivators) where the target was their junior (often current) cultivators at the time of decline. However, sociocultural and economic change was pronounced during the period of initial modernization associated with *vuci* decline, and the answer may have more to do with interviewees' inability to comprehend the enormity of these changes and their impact on the behaviour of their heirs. Chayanov (1991) uses a rational explanation based around a smallholder's aversion to drudgery as the motivating factor behind apparent laziness. The question remains whether drudgery was, in fact, experienced.

Prolonged droughts, related to *El Niño* events, can occur more frequently than the long-

run average of every eight years (Sturman and McGowan 1999: 14–15) and thus initiate decline among those *vuci* in vulnerable situations. This reason was given occasionally, but in at least one case there was evidence that indicated an interaction with a declining water table where the cause was gully erosion rather than prolonged aridity.

The Fiji colonial administration from the late 19th century to the mid 20th century created rather draconian mechanisms of social control (Ravuvu 1991: 17–41) and enforced a doctrine of agricultural production and modernization. One interviewee gave the actions of that administration as a reason for *vuci* decline, also alluded to by others but seldom made explicit.

The reasons above are typically based on proximate events (i.e., cyclone damage, labour relations, droughts or the threats of colonial 'masters'), but not distal changes such as increasing system dysfunction from eroding water supply channels, increasing numbers of ungulates, or incremental changes in the economic system. It is perhaps unsurprising that this should be the case; the author is surprised, however, to find that there seems to be a lack of specific theory addressing this failing of oral history.

4. The Unreported Gradual Distal Cause: Gully Erosion and Irrigation Disturbance

Parry (1987: 132) concluded that the Sigatoka River catchment water table had declined markedly in prehistoric times due to eroding river and stream channels. This process continues today. The author has observed several creeks during 1998–2009 where the *vuci* water supply canal intake points stand above the extant water level, suggesting historical gully erosion since the last use of the canal, in many cases about early-mid 20th century.

The canal offtake on the Rogorua Creek in the Solikana Valley, Navatusila District is an example. An easy repair would require the extension of the canal further upstream (necessitating a slightly smaller catchment, perhaps critical in droughts) and a new dam, but the repair was not undertaken (cessation about 1950). Downstream from the intake the creek has eroded to bedrock, and then infiltrates underground; potentially eliminating the construction of a new canal or other water transport system downstream.

These degradation processes limit the possibilities for irrigation and can cause decline and cessation of *vuci* systems, but have rarely been documented, partly because, I argue, the effects are local within catchments and often accumulate gradually, suggesting that they are perceived distally.

5. Another Distal Gradual Cause: Infrastructural Damage by Ungulates

In 1998, the two remaining Navosa *vuci* recorded by the author were of a small size with non-canal (spring) supply systems that were physically protected from animal damage either by natural features (the steep sides of a small basin), or by fencing and robust polythene pipe. This led the author to consider damage from ungulates (hoofed animals) as a prime cause for *vuci* decline, and as a significant disincentive to their renewal.

The historical evidence indicates that the establishment of cattle, horses and goats in

Navosa did not occur until about the turn of the 19th century (Colony of Fiji 1901), and there is no record of protective fences enclosing main cultivated areas in Navosa (except about the confines of fortified settlements, Parry 1987).

There is evidence that pigs (*vore*, *vuaka*, *Sus scrofa*) existed in Fiji prior to 1000 BP (Worthy and Clark 2009), but specific evidence for the presence and size of feral populations is lacking. There is more uncertainty because the general prehistory of commensal species in Fiji is now regarded as questionable (Worthy and Clark 2009: 252–254). Consequently, few inferences can be made about changes in the impact of pigs on Fijian ecology and society over the long-term. Pigs can cause serious damage by uprooting and eating corms, and villagers took action to repel feral pigs during 1998 in forest margin areas by burning grassland, and pigs were continually hunted (King 2004: 283–284). In Nasauvakarua, pig hunting was organised nearly every Saturday (esp. in the dry season), and at that time the *Bose ni rara* (village council) had banned the keeping of domestic sows (because they attracted boars from the forest). These control techniques were successful, but are conditional upon sufficient human population. It would be very helpful to have a timeline of pig populations, but demographic data on wild pigs is unavailable.

Agricultural census data for Nadroga-Navosa show a strong and positive trend throughout the 20th century in the number of ungulates. For example, cattle numbers increased from only 292 during 1901 at the start of the 20th century (Colony of Fiji 1901) to 55,286 in 1991 (an exponential increase and 189 times the baseline) (Ministry of Primary Industries and Co-operatives 1992). See Fig. 1.

Additional livestock census data are available, but, unfortunately, different district and provincial groupings are used across different census years making direct comparison difficult. Nevertheless, inferences can be made, and in Navosa the trend for cattle is also generally apparent for horses but less so for goats. In sum, there has been a strong (and potentially environmentally destructive) trend of population increase in ungulates in Navosa since the early to mid 20th century. In the drought year of 1998–1999, cattle and the damage they caused were frequently mentioned by cultivators as a significant aggravation in Navosa (King 2004: 265–266).

Because ungulates can also damage cassava gardens, reasons are needed to account for the special vulnerability of *vuci*. Compared to cassava gardens, damage from ungulates is greater for traditional *vuci* because: (a) *vuci* have fragile infrastructures including terrace walls, canals or aqueducts (made of tree fern trunks or bamboo), and (b) *vuci* have greater system areas and thus require much longer perimeter fences to enclose and protect them, often over undulating topography, demanding a higher infrastructure cost which is a major disincentive for cultivators. By comparison, cassava gardens are rainfed with fencing that encloses only the cultivated area and not catchments or water transport systems, and minimal soil cultivation or preparation is practised on sloping land.

The author's argument is that because the increase in ungulate population has occurred gradually over many decades, it goes unnoticed as a background distal cause that gradually increases stress in *vuci* systems, ultimately leading to decisions that cause *vuci* decline and cessation. Because this cause is not proximal for interviewees it is reported only rarely[3]. In response to direct questioning, this interpretation has been supported by at least one local

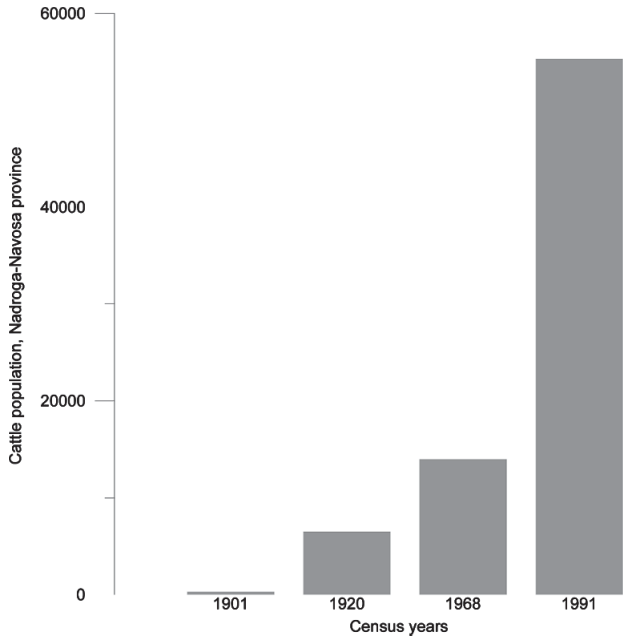

Figure 1 Graph showing changes in cattle population in Nadroga-Navosa during the 20th century

participant when raised in discussion, but has not otherwise been the subject of research.

6. Recategorization: proximate versus distal causes of decline and cessation

In an attempt to clarify the distinction between reported and unreported causes, I have recategorized the different reasons for decline as either proximate or distal (Table 2). The common reasons that were reported are listed as proximate, together with some reasons that would have been proximate when they occurred, but are now forgotten and must be inferred. Distal reasons are all inferred.

7. Demo-Agroecological Transition, Disintensification, and Signs of Reintensification In Navosa?

In Fiji, indigenous swidden cultivation and agroarboricultural systems (Clarke and Thaman 1993) remain important because of their inherent labour and energy efficiencies (and local resilience) (Bayliss-Smith 1982; King 2004: 64–79), aided by the adoption of new food species. Plough agriculture and other technological changes were adopted in many places in the early-mid 20th century as part of a colonial policy towards agricultural modernization, and about the time that *vuci* systems were in serious decline.

There is evidence that irrigated *vuci* agriculture was declining from the 19th century and

Table 2 Proximate versus distal causes of decline and cessation

Proximate	Distal
*Reported**	*Inferred*
Drudgery (reported as laziness)	Damage by increasing density of ungulates
Monitoring and maintenance requirements**	Slow gully and sheet erosion
Droughts, cyclones, floods, collapse of perimeter walls	Gradual depopulation
Imposition of 'tax gardens' and tenurial change	Exogenous economics and values including trends to market cropping and labour displacement
Inferred	Cessation of conflict and war
Disease epidemics and sudden depopulation	Colonial replacement of traditional leadership
Relocation of settlements downstream	Agricultural innovations such as dryland implements and tools
	New cultigens such as cassava and *Xanthosoma*
	New cultivars such as drought-tolerant *Colocasia*

* Reported causes suggest current constraints to renewal.
** May include associated distal causes such as animal damage.

throughout the early and mid 20th century[4], but has remained in a few places in particular niches. This decline coincided with and lagged (human) depopulation caused primarily by disease epidemics, environmental change, the increasing impact of introduced species, and with other (esp. political, technological and livelihood) changes associated with colonialism and the (slow) trend towards modernity.

Today, however, colonial prescriptions for the development of society are considered archaic and new ideals guide social action. The effects of postcolonial (Clammer 1973; Crosby 2002; Firth 1997) and postdevelopment critique (Curry 2003; Escobar 1995; King 2008; Sylvester 1999) have paralleled a wider questioning of colonial politics and norms. The field of development practice has also entered a new era, where institutional support for community-based ventures can now be found. One of these new ventures is *Vitokoni ni Vuci* (VNV, Friends of *Vuci*) which aims to revitalize (by progressing with the past, Clarke 1978) traditional irrigated *dalo* cultivation in Fiji. The venture began when the author was asked by a Navosa community in 1998 for help in rebuilding a canal that fed a *vuci* that had been badly damaged in the 1993 Cyclone Kina. Subsequently, VNV was established in 2006 with the goal of aiding communities to revitalize irrigated *vuci* agriculture[5].

Many Navosa communities have resurgent populations (with high youth components) that appreciate of the new cash value of *dalo*. These communities are very enthusiastic about preventing animal damage to land at risk, and strongly support the revitalization of *vuci* aided by VNV projects. Those most interested have: (a) limited areas of fertile land; or (b) are experiencing rapid demographic change resulting in high demand for cultivatable land; and (c) experience a pronounced dry-season which limits rainfed *dalo* production.

Without their own supply, villagers must purchase *dalo* (at a considerable cost) for weddings and other ceremonies. With these reasons in the background, there has been at least one case where *vuci* have been developed independently by a village farmer (thus creating landesque capital) influenced by VNV project activities. All of the VNV *vuci* projects include a focus on fencing to prevent ungulate damage, and it is believed that this factor was sig-

nificant in the farmer's decision to build his own *vuci*, which reinforces the argument that protection from ungulate damage is necessary to maintain landesque capital and sustain *vuci*, and lack of protection will lead to unsustainability and decline.

At a more distal level, this process suggests the beginning of a process of agricultural intensification, which raises questions about the direction of development. These questions are: does the demand for the renewal of landesque capital actually signify a reversal of disintensification, and if this is a turning point for intensification and development, what other factors (outside of *vuci* protection) are creating this demand and what is their relative importance?

Notes

1) These are Navosa dialect terms only and this list is not intended to be exhaustive; there are many other dialect variations in Fiji.
2) The field observations and verbal reports collected by the author from 1997 to 2009 are entirely consistent with other evidence for gradual decline.
3) One instance is reported in Kuhlken and Crosby (1999).
4) It is possible that this last phase of decline began earlier than the 19th century, and there may have been earlier cycles of decline and regrowth, but research on this aspect of prehistory has not yet been done.
5) A pilot project began in 2008 and was completed in 2010 under the auspices of UNDP-SG, GEF and UZAID. A 'Vuci Manual' is being prepared for publication, and further projects are planned.

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