R. Dentan
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ROBERT KNOX DENTAN

POTENTIAL FOOD SOURCES FOR FORAGERS IN MALAYSIAN RAINFOREST: SAGO, YAMS AND LOTS OF LITTLE THINGS

It may be that enough starchy food simply does not exist in most rain forests to supply even small human groups on a reliable, long-term basis. In that case, prehistoric hunter-gatherers could not have lived in the deep forest but must have been oriented toward its edges, where they could collect food from several different habitats. The archaeological evidence is too fragmentary at present to prove this notion, but the fact that the Hoabinhnians so consistently combined terrestrial sources with aquatic foods supports it. (Hutterer 1988:69.)

No wonder then, if agriculture be neglected in a country, where the labour of five men, in felling sago trees, beating the flour, and instantly baking the bread, will maintain a hundred. (Thomas Forrest, quoted in Ellen 1988:119.)

Simple uni-directional causal processes seldom occur in human environmental relations. (Ellen 1982:20, cf. also 180-181.)

INTRODUCTION

The Problem

This paper addresses the question, raised in several recent papers (e.g., Bailey et al. 1989; Hart and Hart 1986; Headland 1987 and 1990b; 1 Except where indicated, information on Semai comes from research I conducted in 1961-63 on a Ford Foundation grant, and in 1975 on sabbatical; on Btsisi', from my research in 1976 and from talking with Barbara Nowak. Extensive documentation of the technology and ethnoscience of these two peoples is available in the American Museum of Natural History (Semai), the Cambridge Museum of Archaeology and Ethnology (Btsisi'), and the Botany Department, Universiti Malaya (both peoples). George Appell, Peter Brosius, Celia Ehrlich, Peter Gardner, Rosemary Gianno, Thomas Headland, Kirk Endicott, Peter Laird, Shuichi Nagata, Rodney Needham, Barbara Nowak and Patricia Townsend commented helpfully on earlier versions of this paper or otherwise helped erode my ignorance. Its obduracy is my fault.

1 ROBERT KNOX DENTAN is Professor of American Studies and Anthropology at the State University of New York at Buffalo. His main fields of academic interest include: peace, societies without power hierarchies, and cultural ecology, and his major publications are The Semai: A nonviolent people of Malaya, New York: Holt, Rinehart and Winston, 1979, and ‘The rise, maintenance and destruction of peaceable polity’, in: J. Silverberg and P. Gray (eds), To fight or not to fight: Violence and peacefulness in humans and other primates, New York: Oxford University Press, 1991. Professor Dentan’s address is 318 Beard Ave., Buffalo, NY 14214, USA.
Headland and Reid 1989), whether foragers could survive in tropical rainforest without access to agricultural goods through trade. The focus is on Malaysian peoples in particular, with some reference to other Southeast Asians; and on sago, with some reference to other sources of starch. The Malaysian peoples are the Austroasiatic-speaking ‘Semang’, a catch-all term for west Malaysian foragers like Batek, Kintaq, Kensiui and perhaps Temoq; their horticulturalist kin, Semai and Btsisiq, with both of whom I have resided; and Penan, Austronesian foragers of east Malaysia.

In the last decade, some scholars have argued that most, or probably all, modern foraging peoples live in contact with agriculturalists or pastoralists and trade for agricultural products; most even know how to do agriculture (Dentan 1988a; Headland 1990b; Headland and Reid 1989). Even the Andamanese, in traditional ethnography the ideal type of isolated foragers, were eating rice and milk as early as the middle of the twelfth century (Polo 1934:377). This dependence of foragers on their agricultural and pastoral neighbours is consonant with the idea that rainforests are ‘green deserts’, without the resources to support a purely foraging way of life.

The ‘green desert’ argument runs like this. In tropical rainforest most of the energy stored in plants is in trunks or leaves too high in the canopy to be worth gathering, even if edible (Bailey, Jenicke and Rechtman 1991:161; McElroy and Townsend 1985:185). Moreover, the subtler seasonality of the tropics makes storage of energy and moisture in tubers, rhizomes, etc., less adaptive than in zones with marked winters or dry seasons. Therefore, wild yams and other tubers do not produce and store enough starch reliably enough to support foragers without agricultural connections. The upshot, green desert theorists suggest, is that foragers could not live in the Malaysian rainforest without some sort of symbiotic relationship with horticulturalists, because tubers and pigs could not provide sufficient carbohydrates.

The question is not, of course, whether nowadays west Malaysian foragers, generically Semang, trade to survive. Since no foragers anywhere survive without trade, this modern dependence, although consistent with the ‘green desert’ thesis, in no way proves it (Colinvaux and Bush 1991). Many Malaysian and Indonesian foragers seem to be ‘professional primitives’, people specialized in collecting forest products for use and for trade (Fox 1969; e.g., Peterson 1978a, 1978b). This trade has been extensive for many centuries (Dentan 1988a; Dunn 1975; Forbes 1885:235-236; Kress 1977:46; Needham 1972:178; Rambo 1985:31; cf. Eder 1988:38; Gardner 1982:463 and 1985:413). But, by the same token, modern Semang reliance on wild yams may also be a ‘recent’ adaptation to cultural contact, as may the reliance of east Malaysian foragers, Penan, on sago as their primary starch staple (Hutterer 1988:67; Langub 1988:207-208; Sastrapradja 1988:205). Cross-culturally, such shifts in foraging strategy are not rare (e.g., Headland 1988 and 1990b; P. Townsend 1990:146).
ERISTIC CONSIDERATIONS

Introduction
Every academic debate has its own rules, which rhetoricians call its 'eristics'. Since the rules governing the continuing debate about the possible inability of foragers to get enough starch to live in tropical rainforest (a) are sometimes inexplicit and (b) sometimes favour one or the other side in the debate, it is important at the outset to specify the degree to which this paper conforms to the rules and to note how eristics limit evidence.

The 'green desert' argument harks back to the work of the nineteenth-century botanist Justus Liebig (e.g., Headland 1990b:7). The Liebig effect or law of the minimum is that, since the success of an organism in a given habitat requires specifiable amounts (a 'critical minimum') of certain materials essential for growth and reproduction, those materials in shortest supply (i.e., nearest the critical minimum) limit that success. Ellen (1982:21-51) gives a typically nuanced and sensible survey of anthropological attempts to determine limiting factors for people with particular survival strategies in particular habitats.

Most of the 'green desert' argument is indirect, referring to the availability of relevant sources of starch rather than to direct observation or archaeological inference. This paper confines itself to such indirection, arguing that such resources are commoner, at least in Malaysia, than the current debate indicates. Since the debaters have framed the question as whether foragers could live in tropical rainforest without 'outside' inputs rather than whether they did, this paper suggests resources people could have used without addressing the imponderable question of whether they did in any detail. This limitation is consistent with the inadequacy of the archaeological evidence (e.g., Rambo 1984:237, n1) and the rejection, by at least some of the disputants, of some foragers' claims that they or their ancestors could live solely off the rainforest, and enjoyed doing so.

Starches vs. Carbohydrates
The green desert argument focuses on starch. Since the human body cannot use starch without first digesting it into sugar, concentrating on sources of starch without attending to sources of sugar may be misleading. Take fruits, for example. Semang and Malaysian indigenes generally (a) tended wild trees, (b) were aware that defecating seeds around campsites eventually produced saplings, which they weeded in a desultory and opportunistic manner, and (c), except for Batek, assigned particular trees to particular individuals in a way that contravened the pervasive stress on sharing but kept people from simply felling trees to get the fruit (Carey 1976:45, 55, 76, 87; K.M. Endicott 1989; Hawkins 1958; Nagata 1989; Rambo 1985:40, 69-71; Schebesta 1927:83; Skeat and Blagden 1906,
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1:338). This pattern Ellen (1988) calls 'husbanded collecting'. Moreover, at least in east Malaysia, foragers planted wild fruit seeds to provide future fruit and bait for wild boars (Rousseau 1990:246).

Among Batek, fruits and honey, also found in trees, are the preferred foods. Nowadays, the next preference is for agricultural and other foods produced elsewhere and obtained by trade. Foraging for wild tubers has third preference, and actually growing starches comes in last. This order of preference seems to correlate positively with the number of calories per hour of work (Endicott 1984). The horticultural Semai and Jah Hut would rank growing their own food higher and treat wild tubers as emergency foods. In all cases, however, tree fruits are at the top of the list.

Indeed, ownership of fruit trees seems basic to indigenous Malaysian notions of land tenure (Rousseau 1990:142-143). The only sort of privileged relationship to natural resources which Batek Semang assert concerns orchards abandoned by Malays (K.M. Endicott 1989), and other groups tend to express their relationship to land in terms of their relationship to trees (Gianno 1983, 1986, 1989, in press; Nowak 1989; Carole Robarchek 1989; Schebesta 1926:86). Indeed, Kensiu Semang divide all history into before or after they began tapping upas trees (Antiaris toxicaria), which individuals can 'own' (Nagata 1989). When transportation is easy, fruits become a major trade item (Carole Robarchek 1989; cf. Dentan 1971). This ubiquitous arboricentricity suggests two inferences: first, that fruits have traditionally been important in Semang diet, and second, that Semang foraging either is 'pre-adapted' for exploiting other tree resources or retains traces of an earlier adaptation to the exploitation of trees as food sources. Fruits, of course, are rich in sugar and other nutrients (cf. McElroy and Townsend 1985:185).

Now, in tropical rainforests the subtlety of seasonality that results in a lack of selective pressure on plants to develop underground storage organs accounts for the paucity of such plants in the rainforest. But it also means that fruits are less affected by seasonality. Although west Malaysia has two main fruit seasons, some trees bear fruit the year round (Holttum 1954:5-6; Williams-Hunt 1952:48). Moreover, palm inflorescence sap is another rich source of sugars; several Malaysian species are good sources (Corner 1966:125-126, 288, 321-322; Lake 1894:285). The green desert argument dismisses the three or four months a year that wild fruits are abundant in west Malaysia by asserting, correctly, that it needs to account only for the limiting condition, the month or two when sources of carbohydrate are minimal. This dismissal begs the question of how long people could survive without a source of starch, depending solely on protein and sugars, a

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2 The recent severe disruption of Batek life, which drove people from their native territories, may account for their tenuous notions of ownership (K.M. Endicott 1989), although relocated Kintaq and Kensiu retain property rights in trees far away (Nagata 1989). Btsisi' say that once they realized the potential of defecatory proto-arboriculture, they began to shift their residential sites accordingly.
question I also, for reasons of space, ignore. It also elides a salient feature of rainforest, its heterogeneity (see below, and cf. Ellen 1982:189).

Adaptive Specialization

A second eristic limitation is that the people need to depend entirely on climax rainforest, without exploiting any other environment (e.g., Hutterer 1988:69). Thus the relatively isolated Andamanese peoples are not a legitimate exception to the rule that no one can live off tropical rainforest, because they also exploit riparian, mangrove and littoral environments. But few known foragers in whatever environment confine themselves to a single ecological niche. Inuit exploit the ocean as well as the tundra, northern Athapaskans lakes as well as subarctic forest (e.g., Nelson 1969, 1973:55-70, 73-80, 269-272). Agta exploit littoral and riverine environments (Headland 1988:126). Rather than specializing, foragers tend to maximize the diversity of their food sources by exploiting ecotones (Rambo 1984:241). Moreover, most tropical rainforests are seral patchworks rather than climax forest (Bailey, Jenicke and Rechtman 1991:160-162; Colinvaux and Bush 1991:153-154; see below). Finally, travelling through west Malaysian forest except by stream or path is difficult, although such open spaces have biota somewhat distinct from those of the interior (Williams-Hunt 1952:7-9). Avoiding ecotones would be almost impossible.

Moreover, for most peoples not integrated into the world economy, minimizing the risk of starvation by maximizing the sources of subsistence is a fundamental strategy, so that, for example, Semai plant all the cultivars of all their crops, including some of no current economic significance, just in case their main cultivars fail (see also next paragraph). Exploiting two or more ecological niches serves the same function. Thus, however useful ‘for the sake of argument’, the requirement that people must confine themselves entirely to the deep forest means that, to qualify as a true exception, a people must behave in ways uncharacteristic of both their species and their economic adaptation. This paper dismisses this unrealistic requirement.

‘Pursuing’ Yams vs. Opportunistic Foraging

The third eristic limitation is that the main starch sources considered are underground storage organs, notably wild yams. This limitation is consistent with the assertion that ‘Contemporary tropical forest foraging peoples subsist on very few species, because the costs of finding, pursuing, and processing additional forest foods are relatively high’ (Bailey, Jenicke and Rechtman 1991:161). This statement may reflect the foraging strategies of the Efe and Ache cases the authors cite (cf. Hart and Hart 1986); although I am unaware of conditions in the Efe area, species diversity in adjacent forests is low. By definition, however, opportunistic ecological strategies avoid the costs of locating and ‘pursuing’ particular resources.
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by taking advantage of whatever resources chance provides (e.g., Colinvaux 1979:125).

Traditionally, Malaysian indigenes do not confine themselves to particular food sources. Unlike the African forests just mentioned, Malaysian rainforest holds a great many species but relatively few members of any given species. To exploit it, the optimal foraging strategy is 'diffuse', rather than being focused on particular species. It involves opportunistic 'searching' for food sources rather than pursuit of particular kinds (for diffuse vs. focused strategies, see Cleland 1966; Dawson 1983:56-57; for search vs. pursuit, Winterhalder 1983:203-205). This strategy entails being willing to eat a wide variety of foods (Winterhalder 1983:204).

Malaysian indigenes maximize the number of species they use as food, including in their diet a large number of insects and species sold in American tropical fish stores (Dentan 1965, 1968). The breadth of the indigenous people's diet scandalizes other Malaysians who eschew monkeys, mantises, grubs, reptiles, bats, etc. (e.g., Lat 1975). Travelling through the forest, even the relatively settled (and forest-ignorant) east Semai snack on a bewildering variety of foods, particularly berries and small fruits, almost all of which are too small, too few or not tasty enough to be worth taking home. As the importance of adapting to the variability and unreliability of forest resources declines, the diet becomes more restricted, so that in west Malaysia the relatively settled west Semai horticulturalists eschew many foods the swiddening east Semai enjoy (Dentan 1965; cf. Headland 1988). This flexible exploitative strategy requires many skills and techniques designed to exploit habitat heterogeneity, since no one resource or combination of resources is abundant enough to rely on, and failure of one set leads to reliance on others (Dawson 1983:57; Ellen 1982:189). It would therefore be unlikely in principle that Malaysian foragers would rely exclusively on a few starch sources.

In assessing the productivity of rainforest, it is important to remember that any measure which refers to the amount of time spent locating or getting to a resource is misleading, insofar as foragers do not orient their quest towards any particular food, but pick up morsels more or less continuously as they travel. To describe people as 'searching' for wild yams (or hunting pigs) is grossly to overstate the energy output necessary to produce a culturally acceptable return (Ellen 1982:44-46). In this sense, rare foods or small food organisms can in the aggregate be important in the diet although individual species are too infrequently encountered or too tiny to count. One entomologist estimates that there are about 400 pounds of insect protein per acre of tropical forest (Burgett, quoted in McCall 1990). Indeed, the sense that Mexico before the Conquest was a protein-starved area may rest on ignoring the importance of insects in diets there (Sokolov 1989).

In traditional east Semai protein diets, pigs, monkeys and deer are in the aggregate less salient than the aggregate of tiny fish, rats, mice, bats,
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insects, frogs, lizards, little birds, snakes and so on (Dentan 1965, 1968a, 1968b). The abundant little freshwater snail *Melanoides variabilis*, for instance, was a common food resource among east Semai in 1962 (Dentan 1968b:137-139); related species were important to the Philippine foragers who occupied the Bungiao rock shelter (Fellows 1973:281, 284; Spoehr 1973:73) and the Borneans of Niah Cave (Medway 1960:370, 377). The fact that Agta foragers in the Philippines nowadays eat only two species of insects seems a matter of taste rather than of environmental limitation (Headland 1988:129). A reliance on charismatic megafauna would be ill adapted to tropical rainforest, but indigenous Malaysian peoples are not so specialized.

*Other Starch Sources*

Similarly, it would be uncharacteristically maladaptive for opportunistic foragers to rely solely on any single starch staple as long as others were available for emergencies, although under normal circumstances wild yams of several species are the main Semang starch dish (e.g., Headland 1990a:26; K.M. Endicott 1979:17, 54-55, 103, and in press; Skeat and Blagden 1906, i:112-117; cf. Gardner 1985:413). Alternative sources of starch or sugar occur in Malaysian rainforest. Fruits and honey, as noted above, are favourite Semang foods. Although *ti* (*Cordyline terminalis*), now extensively planted as ornamentals or magical plants by, for example, Btsisi' and Malays (Skeat 1900:79-80), may not be indigenous to west Malaysia, nevertheless cycads and true crotons, the other two members of the Melanesian 'croton complex' (Chowning 1963:41), grow wild there; some Melanesian scholars think these plants are ancient multipurpose cultigens which by themselves could support a population (Ehrlich 1989; for other references, see Leenhardt 1946; Panoff 1972:383n). Certainly cycad seed flour is easy to store against periods in which carbohydrates might be in short supply (Thieret 1958).

Similarly, the grains of Job’s tears (*Coix lachrymae jobi, Semai kareel*) are about 60% ‘soluble carbohydrates, mostly starch’; the plant was still ‘of some importance to the hill folk and non-Malayan people of Malaysia’ as late as the twentieth century (Burkill 1966:638-639). Semang still know the plant, which was the subject of ‘husbanded collection’. West Malaysian horticulturists like hill Semai say it is the ancestor of the earliest crops (Hutterer 1988:69; Dentan 1979:47), and Semai from around Geruntom said in 1976 it was both ‘planted and grows by itself’. The latter used it for necklaces but not food, and, ‘in olden times’, would chew it and spit it (-prooh) into the wind as part of their extensive thundersquall ritual. The appearance in this ancient ritual (for which see, e.g., Clayton Robarchek 1987) suggests the plant was known in ancient times. As a cereal, *Coix* is probably richer in nutrients than most wild yams (Platt 1962; McElroy and Townsend 1985:185). Since this cereal thrives best in secondary forest, however, its importance in ancient times would depend on the frequency...
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with which natural events like floods, windfalls and landslips disturbed climax forest.

The most intriguing aspect of the eristic limitation to underground starch storage organs is that 'the biggest [starch] storage organs in the plant kingdom' are not underground but in the trunks of hapaxanthic palms, notably the genus Corypha (Corner 1966:124-125). Hapaxanthic palms produce huge terminal inflorescences. To do so, they must store starch for several years in advance, so that seasonality has relatively little effect and the starch is available all year round (Strickland 1986:126). Naturally sterile trees, which do not form inflorescences, continue to store starch, so that a single sterile Metroxylon palm may contain 900-1200 pounds (Corner 1966:318). In ten days, comments an early observer, a man could produce enough food for a year from palm-trees, so that it is possible to assert 'the almost complete dependence of early humanity on the palm' (Corner 1966:33). Once dried, the starch extracted is light, and easy to store and to carry (Strickland 1986:126).

Indeed, sago is more productive calorically than dry rice (Strickland 1986:131). The switch from sago to rice production in central Borneo, for example, seems to have been due to prestige and taste factors rather than narrowly economic ones (Rousseau 1990:125). Starch, generically 'sago', is the main staple throughout eastern Indonesia, and in parts of New Guinea and Oceania.

This paper now turns to these potential sources of starch.

ACCESSIBILITY OF SAGO PALMS

The centrality of trees in the thinking of foragers in both parts of Malaysia may constitute a pre-adaptation to husbanded collecting of fruits, and ultimately sago, as discussed above. Moreover, wild pigs push over sago palms and rip them up with their tusks, so that hunters pursuing pigs as in the 'green desert' model would be likely to encounter starch even if the protein got away (George N. Appell, letter to the author 19/12/89). Looking for palm beetle grubs would also introduce foragers to sago.

Frequency
The fact that many of the palms in question (see Table I) grow in lowland forest or the fringes of the mangrove may connect with the fact that, in west Malaysia, the Semang foraging way of life seems best adapted to the lowlands, a fact which their current demography may obscure (Benjamin 1976:87; Rambo 1984:241; cf. Eder 1988:42; Headland 1988:122-123; Peterson 1978a:338). The coastal Wila or Bila, Semang of Penang and Province Wellesley, seem to have become extinct around the turn of the century. The Semang Paya, 'swamp Semang', may also be a lowland
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TABLE I

TENTATIVE IDENTIFICATION OF SOME WEST MALAYSIAN SAGO PALMS

<table>
<thead>
<tr>
<th>LINNEAN NAMES</th>
<th>MALAY NAMES</th>
<th>SEMAI NAMES(^{(a)})</th>
<th>SEMANG NAMES(^{(b)})</th>
<th>SAGO PER TREE</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>+Arenga(^{(c)}) pinnata (= saccharifera)</td>
<td>kabung, enau [gomuti, sugar palm]</td>
<td>paley, kab(&gt;)k</td>
<td>bakeh*</td>
<td>—</td>
<td>rel. little</td>
</tr>
<tr>
<td>Arenga westerhoutii (= obtusifolia?)</td>
<td>palas, langkap</td>
<td>tqook, tq(&gt;q)</td>
<td>taqaq*</td>
<td>taqaq</td>
<td>—</td>
</tr>
<tr>
<td>Caryota mitis(^{(d)})</td>
<td>tukas, (en)duduk [fishtail palm]</td>
<td>gaseq</td>
<td>riq*</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Caryota obtusa var. aequatoralis</td>
<td>rabuk gunung [giant mt. fishtail palm]</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>+Corypha umbraculifera</td>
<td>(cabbage palm)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>C. utan(^{(e)}) (= C. elata)</td>
<td>ibus, lontar, gebang</td>
<td>baay, booy</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cycas(^{(f)}) circinalis</td>
<td>bogak</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Eugeissona tristis(^{(g)})</td>
<td>bertam [attap palm]</td>
<td>bl(t)p</td>
<td>btam</td>
<td>cmbak, chnbek(+)</td>
<td>not much</td>
</tr>
<tr>
<td>Metroxylon rumphii(^{(h)})</td>
<td>rumia [sago]</td>
<td>rumiaq, rumuq</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Metroxylon sagu</td>
<td>rumia [sago]</td>
<td>rumiaq, rumuq</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Code: + = probably not native to West Malaysia
* = see note \(^{(b)}\).

\(^{(a)}\) Semai are 'Senoi', central Asian horticulturalists.

\(^{(b)}\) Very tentative identification, based on word lists collected by Skeat and Blagden (1906, vol. ii) and concordance in Benjamin (1976:125). Names followed by an asterisk are those Burkil 1966 lists as 'Semang' without specifying the particular language. The Kintaq subgroup would be Kintaq Bong; the Batek, Batek Dek.

\(^{(c)}\) The genus 'plays a considerable part in the lower stories of the rainforest' (Corner 1966:288). The smaller species propagate in part by suckers, forming clusters (cf. Brosius 1989).

Although gomuti may not be native to west Malaysia, 'hybrid swarms' of gomuti-langkap occur on forest fringes. Moreover, besides langkap, which is a 'common rain forest palm', Malaysian indigenes name another species of wild palm, krib, which they say is closely related and which may be either indigenous gomuti or a third species of Arenga.
Jakun and Sabimba, indigenous peoples in the south of the peninsula, ate *Arenga* pith (Logan 1847:255, s.v. 'anaw' [= enau]; cf. Wilkinson 1956:142; Wojowasito et al. 1959:166). Jakun also 'gorged' on sugar from *Arenga* sap ('cabong' [= kabung], Lake 1894:285). Yet other species of this genus produce sago in Borneo (*A. undulatifolia*) and the Philippines (*A. ambong*).

*A. pinnata* is a tall palm occurring wild everywhere in west Malaysia, especially in the lower mountains around clearings. It is rare in primary forest, however, and produces relatively little sago, eating too much of which may cause 'bowel complaints'. Nevertheless, Jakun ate *langkap* pith (Logan 1847:255), and the sago was a staple among some hill peoples of Mindoro in the Philippines. *A. westerhoutii*, about 30' tall, which spreads by suckers, grows in clusters on the mountain slopes.

K.M. Endicott (personal communication 1989) reports that Batek *taqaq* is generic for 'palm pith' rather than for a particular species of palm. Some sort of synecdochic usage, common in Aslian languages, may be involved (cf. Dentan 1970, 1988).

(d) Malay *tukas* or *tukus* applies to several palms, including also *Didymosperma hastata* (Burkill and Haniff 1930:273, 327). *Didymosperma* is now classed as *Arenga*, which lumpers would telescope into *Caryota* (Corner 1966:80-81, 286-287). Burkill (1966:476) gives *rabo* as Temiar Senoi and *rabak* as Btsisi' for the very common but relatively small *C. miitis*, which is especially common in disturbed areas, for example along river banks (Wee and Cortlett 1986:25, 56, 99). *C. aequatorialis*, 60' tall, is solitary and found generally throughout the hills. Peoples elsewhere get sago from other species of this genus, e.g. *C. cumingii* in the Philippines, the giant *C. rumphiana* in east Malaysia and Indonesia, and *C. urens*, the kutil or toddy palm in India (e.g., Gardner 1985:414; Ruddle et al. 1978:4). Cameron (1865:401, 407) identifies 'neepong' as *C. urens*, although Malay *nibung* usually refers to *Oncosperma* spp. A similar use of the Malay word would explain my odd fieldnote that Btsisi' ate *Oncosperma* pith.

(e) The huge cabbage palm, 3' in diameter and 70' tall, has never been found wild and is therefore not a likely pre-arboricultural source of food (Corner 1966:92, 123, 300). *C. revoluta* produces sago in China, *C. pectinata* in the east Himalayas. *Ibus* is littoral in some areas but elsewhere is found inland. It is found only in northernmost west Malaysia and produces 200 pounds of starch per palm. Burkill (1966:731) gives *baid* as the Temiar equivalent of the term I recorded for Semai as *baay*, a tree 6-20' tall, 'by no means uncommon near the sea, while inland, in forests, a similar plant grows' (Burkill 1966:731). Four feet of trunk produce about 5 pounds of sago; but the seeds, produced annually, provide about the same amount of starch.

(f) I include this cycad among sago palms only because it has an edible pith. On the other hand, it fruits so copiously that cutting it down for sago would be silly.

(g) An almost stemless, slender undergrowth palm, so common as to be a pest, with 'a little sago in the stalk and inflorescence, which the jungle tribes use' (Burkill 1966:973). Corner (1966:245) calls it a 'tiresome weed'. Semai use a special word for the fruit, *kleed*, a unique usage which suggests the importance of the plant. The Btsisi' call the tree *btam*, following local Malay usage.

The Penan staple is sago from *E. insigne* and *E. utilis* (Corner 1966:40, 124).

(h) *Metroxylon* is almost certainly not native to west Malaysia and therefore is unlikely to have played any part in pre-arboricultural life there. It is also a suckering genus. The *rumut* reported for Johore indigenes (Logan 1847:255) may be *Metroxylon*.

people now extinct. The fate of 'Bru' (Austroasiatic 'forest?') and 'Pago' (Pangan?, i.e. Semang), both of Johore, is unclear (Dennys 1894:53; Logan 1847); they may have been lowland or littoral foragers. Although Semang elements are salient in the life of the Btsisi', a littoral Selangor people, ethnographers usually classify the latter as 'Senoi', Austroasiatic-speaking
horticulturalists of the Main Range. Lowland Semang, in short, used to be widespread.

Several of the palms are quite common or salient where they occur. *Langkap* is a 'common rainforest palm' (Whitmore 1973:38). *Tukas* is quite common in secondary rainforest of the sort created by floods and landslips, and thus occurs along river banks and in swamps near Temoq territory (Whitmore 1973:38, 45). Although the giant fishtail palm is less common, its huge size would make it conspicuous to foragers working the central mountain chain along the Pahang-Perak and Kedah-Thai borders, where it occurs at 3500-5000 feet (1000-1500 metres) above sea level (Whitmore 1973:45). Similarly, although *lontar* occurs only in the north along the coast and the adjacent alluvial plain, except for an enclave in Btsisi' territory in coastal Selangor, it and its related domesticate are among the world's most massive palms, producing up to 200 pounds of sago per tree (Corner 1966:92, 287; Whitmore 1973:51).

By contrast, *bertam* (*Eugeissona tristis*), endemic throughout West Malaysia, produces little sago per trunk but is so common that foresters regard it as a ' tiresome weed' (Corner 1966:245; cf. Ashton 1988:192; Gibson 1928:16).

'From about 1,000-1,500 ft. on hill ridges, it is most abundant, and here it commonly dominates the understory to the exclusion of nearly all tree species, including their seedlings. It is difficult to understand how the big trees in these ridge forests regenerate'. (Whitmore 1973:59.)

The fruit of this palm is so important to Semai as to be the only fruit with a name distinct from the name of the tree on which it grows. Close relatives, *Eugeissona utilis* and *E. insignis*, which grow at elevations up to 4000 feet (1200 metres) above sea level, are the staple of Penan foragers (Corner 1966:40, 124; Needham 1972:177).

Although true sago, *Metroxylon*, is not indigenous to the peninsula, *M. sagu* was commonly found in thick clusters west of the Main Range, *M. rumphii* to the east, where it grew half wild in swampy country (Ooi 1963:266). Moreover, a single mature *Metroxylon* tree about 9 metres tall will yield between 250 pounds and, rarely, over 1000 lbs. of sago (Cobley 1956:190; Corner 1966:318; Ooi 1963:266); about 88% of the pith is carbohydrate. Thus the resource is both concentrated and highly productive, and surely allowed foragers to live by husbanded collection in the rainforests on the islands east of Malaysia (P. Townsend 1990).

Most smaller species in Table I propagate by suckers, forming dense thickets and swards which, once found, would be easy for foragers to exploit (Holttum 1954:22-23), for instance in clumps like the common fishtail palm (Corner 1966:128, 287, 288; Whitmore 1973:45). Others,
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like bertam, dominate large patches of forest (Corner 1966:245). Yet others, like langkap, are 'gregarious' (Whitmore 1973:38).

Moreover, as plants many of which thrive on watersoaked soil or in disturbed areas, many of the species tend to have a riparian habitat, that is to say, grow by the seasonally flooding streams along which foragers travel and where they put up their camps (Rambo 1985:41). Streams have always provided Semang with the easiest way to travel through rainforest. Moreover, as ecotones, stream banks and mangrove edges seem to have been a focus of foraging efforts from ancient times (Benjamin 1974:6-7 and 1976:91; Gorman 1971:315; Hutterer 1988:69; Solheim 1970:162). Presumably the arrival of swidden horticulture on the peninsula increased the abundance of hapaxanthic palms like E. tristis and C. mitis, which flourish in disturbed surroundings. But natural disturbances like floods, landslips, lightning strikes and earthquakes, all salient terrors in the ideology of Malaysian indigenes, would probably suffice to assure areas of local abundance (Colinvaux and Bush 1991). Malaysia is at the edge of the volcanic ‘Ring of Fire’ which circles the Pacific, so that, although major eruptions have been atypically rare there for the last century or two, they have been significant in earlier times. Plagues of insects have the same effect (Colinvaux 1979:128-130). In the case of introduced species, the question might be whether they were introduced by arboriculturalists or by ‘husbanded collectors’, although linguistic evidence suggests the former.

Secondary Uses

Many of these palms have multiple potential uses which would attract people’s attention to their possible use as food (Ruddle et al. 1978:38-41). Since I am most familiar with Semai ecology, I will use their technology to illustrate this point. The Semai make string from the fibrous leaf sheathes of several of these palms, for example sugar and fishtail palms (cf. Corner 1966:63-65). Cotton for blowpipes comes from fishtail palms (Skeat and Blagden 1906, I:259-260). And the Semai use palm cotton from Caryota mitis for several other purposes. Palm beetles (Rhyncophorus ferrugineus, R. grandis, Semai ceq ngag) infest most species of Malaysian sago palms, for example langkap and true sago (Whitmore 1973:50, 58). In 1962 Semai along the Telom river roasted the adult beetles they encountered while clearing fields between February and April (Dentan 1968a:23); a Geruntom Semai in 1976 classified the beetles as cuuk, grasshopper or mantis, because people cooked and ate them the same way. The grubs belong to the class kmuur pqooh, ‘grubs cooked in bamboo tubes’, and taste fatty (Dentan 1968a:25). In other areas, sago grubs are a significant food resource for foragers (McElroy and Townsend 1985:189; Ruddle et al. 1978:39-41). Malaysian indigenes use the leaf petioles of Caryota mitis and of bertam to make blowpipe darts, fishtraps and winnowing baskets (Foo 1972:54). Bertam has many other uses (Whit-
more 1973:60). Semai say its nuts are tough, fatty, and sweet (ce’ed), like coconuts; they are or have been important enough to merit a special term, kleed. The tree is of ritual significance to Semang peoples of Kedah (Carey 1976:106-107; Skeat and Blagden 1906, II:3).

The fronds of almost all these palms make good roofing for the lean- tos Semang and other indigenes build on trips through the rainforest. Langkap ‘fronds make good thatch for temporary jungle shelters’ (Whitmore 1973:39). Bertam is the standard thatch among Semang like Jahai, Kensiu and Lanoh, as well as among Senoi horticulturalists (Carey 1976:107; Foo 1972:54; Ooi 1963:178; Polunin 1953:73-74, 77; Whitmore 1973:60). The leaves of true sago are so useful that even the Malays of southern Borneo, who reportedly did not extract sago from their palms, still cultivated them for their leaves (Broch 1985:179, 238). Malays who

### TABLE II

**PROCESSING SAGO (BTSISI*)**

<table>
<thead>
<tr>
<th>BTSISI TERM</th>
<th>COGNATES</th>
<th>PROCESS</th>
<th>PHOTOGRAPH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. STAGE 1: MEN’S WORK (-GUL, ‘COLLECT’)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>g&gt;q</em></td>
<td>S —gaqgiq</td>
<td>cut down, fell [before inflorescence appears]</td>
<td>Sastrapradja 1988:205</td>
</tr>
<tr>
<td><em>kunt&gt;q</em></td>
<td>M belah</td>
<td>cut into cross-sections</td>
<td></td>
</tr>
<tr>
<td><em>blah</em></td>
<td>M kerat</td>
<td>split</td>
<td>Ellen 1988:121</td>
</tr>
<tr>
<td><em>prah</em></td>
<td>S —wees teew</td>
<td>squeeze out, express [knead with water over a strainer**]</td>
<td></td>
</tr>
<tr>
<td><em>tos dow</em></td>
<td>S —qain ha dook</td>
<td>pour off the liquid</td>
<td></td>
</tr>
<tr>
<td><em>qain ha duk</em></td>
<td>S —qain ha dook</td>
<td>carry to house</td>
<td></td>
</tr>
<tr>
<td><strong>B. STAGE 2: WOMEN’S WORK (-CIT, ‘COOK’)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>jmuw</em></td>
<td>M jemur</td>
<td>sun-dry [on roof or fish-drying platform, 1 day]</td>
<td>Ruddle et al. 1978:30.</td>
</tr>
<tr>
<td><em>haruq lawan qisiq nyuw</em></td>
<td>M aru lawan isi nyiur</td>
<td>mix with meat of coconut</td>
<td></td>
</tr>
<tr>
<td><em>beh cit</em></td>
<td>S buh ceet</td>
<td>make cooked</td>
<td></td>
</tr>
<tr>
<td><em>congk&gt;h</em></td>
<td>S —qain ha M mangkok</td>
<td>ladle</td>
<td></td>
</tr>
<tr>
<td><em>qain hu</em></td>
<td>S —qain ha M mangkoq</td>
<td>carry to cup</td>
<td></td>
</tr>
</tbody>
</table>

* Btsisi’ is an Austroasiatic language containing many Austronesian loan-words, as is indicated by cognates in Austroasiatic Semai and Austronesian Malay.

** The liquid is in a cup men make from the leaf bracket of the palm. The Cambridge University Museum has a specimen of such a Btsisi’ timbaq mangkoq monk, ‘dipper cup [of] nibung-palm’.

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I only observed the second (women's) part of the process and so am unsure of what palm is involved. The Btsisi' said it was m>nq, a word probably cognate with Malay nibung. M>nq usually refers to Oncosperma tigillaria (= filamentosum), a much-used palm that is so abundant on the fringes of the mangrove that Btsisi' extend the word to denote the ecological zone between 'true' mangrove and land plants (for this zone, see Wee and Cortlett 1986:38-39, 42-46). Like Metroxylon, this palm forms groves by suckers. Besides having this primary meaning, m>nq is the unmarked synecdochic term for a number of palms, including also m>nq bayas (O. horrida; cf. Foo 1972:55), locally common in clumps in secondary forest. M>nq badiq, another Oncosperma, used for attap thatch (plook), is the smallest of the three, said to be common in the mangrove proper, with a tiny, inedible cabbage; the Botany Department at the Universiti Malaya has a specimen (catalog #106). Malays use the term nibung the same way, referring to n. bayas, n. padi, and also n. ibul (Orania sp.). Cameron (1865:401, 407) identifies 'niboong' [nibung] as Caryota urens, perhaps a misidentification of Metroxylon. At any rate, since Btsisi' were driven from west Johore through Malacca, where Metroxylon was an ancient staple (e.g., Wheatley 1964:133), I suspect that the palm involved is true sago. It is not now a staple and, indeed, was rarely used during the six months I spent in 1976 with Btsisi'.

The 'photograph' column lists pictures of non-Btsisi' performing similar sub-tasks in the preparation of sago.

live away from tidal waters (Hodder 1959:62-63; cf. Chowning 1963:4) use them instead of nibung palm (Oncosperma) leaves. Thus not only are sago palms common, they are also useful enough to attract people's attention for other purposes.

Technology

'Nomads... plant bananas (Simandjuntak 1967:41) [and] .... seeds of fruit trees to guarantee a continued supply of fruit; in addition, the fruit trees serve as bait for wild boars. Sago trees can also be planted and left to mature without supervision.' (Rousseau 1990:246.)

The skills and technology people in eastern Indonesia use to extract sago are well within the means of Malaysian foragers (for a survey of traditional methods of extraction see Ruddle et al. 1978:11-24; for local variants see, e.g., Brosius 1989; Ellen 1988:120-121; P. Townsend 1974:222-226; Table II above). One traditional New Guinea technology involved two stone tools: a cutting tool and a sago pounder. The former was used to cut down the palms and was about as efficient as a steel tool (W. Townsend 1969). Less specialized foragers might use a stone adze of the type Semang call 'thunder stones', which are found in Southeast Asian archaeological remains and are used in New Guinea to fell other sorts of trees (Tweedie 1957; Ruddle et al. 1978:16). It takes about an hour to haft such an adze (Ellen 1982:150). The sago pounder is a crude hammer with a wooden handle and a head of wood, bamboo or stone, used to flake out the pith (Ruddle et al. 1978:16-19; Ellen 1988:120). Bamboo or wood pounders would presumably not survive in archaeological deposits.

The next steps resemble those involved in leaching cyanic acid from tubers of the Dioscorea hispida, an important Semang food (K.M. Endicott
1979:55, and in press; Foo 1972:50). People knead or trample the pith in a trough by a stream. A palm spathe (as in Table II) suffices to transport water to the trough. To strain out the sago proper people use many sorts of filters: the fibrous leaf of the palm itself, bark cloth of the sort Semang wore, fibrovascular palm fibre from the base of the leaf, which Semang also use for string (a natural choice in the case of Arenga spp.; see Corner 1966:63–65). The water holding the suspended starch can be caught in a palm spathe or hollow log. The flour is easy to store and to prepare.

In short, palms with edible pith are common in many areas, particularly in the lowlands where Semang originally flourished. They are useful enough in other ways to attract people’s attention, and grow along routes which people normally travel. They occur in highly productive concentrated clumps in an ecotone which is also relatively rich in other kinds of food. None of the activities prerequisite to extracting sago require technology or skills unfamiliar to Semang or, save for adzes used to fell trees, likely to leave archaeological evidence. Headland’s dismissal of sago as a source of carbohydrate may rest on the fact that the Agta, among whom he has worked for many years, apparently have access only to Caryota cumingii, which, he says, is rare and contains far less sago than ‘true sago’ (Headland, 1987:466); he also reports that, unlike Semang, the Agta rarely dig wild yams (Headland, 1987:466–467).

CASE HISTORIES

Penan

At least from the beginning of British colonization, sago has been important in Malaysia (e.g., Wells 1940:265–266, 268). The early history of Sarawak and Brunei revolves around the Metroxylon sago trade (e.g., Pringle 1970:15, 79, 110–111, 117–118, 121, 123, 125–126, 204n). Eugeissona sago is the main staple of the Penan, a nomadic people who live in the hills of northwest Borneo (Hutterer 1988:67). Their use of sago palms suggests how foragers in general may have used this concentrated and renewable resource.

There are two main groups of Penan, not to be confused with ‘Punan’, a term for an upriver people who are or have been nomadic (Rousseau 1990:20–21, 66, 216–252). The western and eastern Penan are foragers. By contrast, the Punan Ba or Bah, for instance, are a longhouse people, like the Kajang among whom they live. In the nineteenth century, the Iban drove them from their homes in east central Sarawak (Needham 1972: 177; Pringle 1970:xix, 47n., 113n., 130, 264, 275; Rousseau 1990:17, 22, 25, 63, 69–71, 88–89, 116, 169, 188, 254, 261, 283, 321, 325, 329, 332, 341); they may, however, have been nomads at one time, since their traditional history includes mentions of a time when they had no rice or canoes and subsisted solely on sago (Nicolaisen 1976:76, cited in Rousseau 1990: 59). Sellato (1989) and Hoffman (1986) are standard sources on Bornean nomads in general. In this paper, ‘Penan’ refers only to the east Malaysian foragers.
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'[S]ago palms grow in clumps of several trunks that rise from a mass of aerial roots. Penan always harvest sago by cutting only one or two of the trunks, leaving the palm to resprout; they never cut down the entire plant at the root clump, which would kill it ... “If there are many trunks we will get one or two. We thin it out so it will thrive. If there is a lot of sago, we will harvest some and leave some. We don’t like to kill it all off, in case one day there is nothing for us to eat. This is really our way of life.”' (Langub 1988:207-208; cf. Brosius 1989.)

Thus, although the Penan seem to be ‘professional primitives’ (Needham 1972:178; Fox 1969), and although foraging in tropical rainforest is a hard life for them, too (Needham 1954), nevertheless it seems that wild yams and sago together can provide enough starch to maintain an independent foraging way of life in Malaysian rainforest (K.M. Endicott, in press; Hong 1987:90, 98). Indeed, as Kenyah and Kayan swiddeners in east Malaysia become more marginalized, *Eugeissona utilis* sago and wild tubers are emergency foods of increasing importance for them, too (Hong 1987:30; Rousseau 1990:129).

Borneo nomads in general need not depend on trade for food. In fact, at least one group of swiddeners

‘would have dearly liked to see neighbouring nomads devote more time to gathering jungle produce and making rattan mats and baskets: they kept badgering them for these products and undertook arduous trips to visit them in their settlements, but usually came back with very little. The Penan claimed to be too occupied with their daily subsistence to spend time on collecting jungle produce ... [T]rade was not a high priority ... They engage in it at the request of sedentary groups, who are in fact the main beneficiaries of the exchange. Nomads also derive material benefits ... but trade may be more important to them in order to maintain friendly relationships with the neighboring agriculturalists than for economic gain.’ (Rousseau 1990:237-238.)

Hoffman (e.g., 1986) argues a version of the ‘green desert’ thesis for the Penan. Other Borneanists (e.g., Rousseau 1990) are unconvinced. Sellato and Brosius are preparing an extensive paper on the topic of Penan ability to thrive in the forests without depending on trade with agriculturists.

The question remains, however, of why, although no one can describe Penan life accurately without mentioning sago, most descriptions of Semang life do not mention it at all. To that question this paper now turns.

**Semang**

Yams, not sago, are salient in the recent diets of west Malaysian foragers
(K.M. Endicott 1979:17, 54-55, 103, and in press; Skeat and Blagden 1906, i:112-117; cf. Gardner 1982:464-465, 1985:413-414). Although absence of knowledge is hard to document, Batek and Temoq evince no knowledge of sago, while they name, use and can quickly locate half a dozen types of yam (Endicott, personal communication 1989; Laird, personal communication 1989). It seems possible that the differences in carbohydrate sources between Semang and Penan relate to two mutually connected phenomena, namely the spread of rice and the rising importance of particularly brutal slave raiding (for the latter, see Reid and Brewster 1983; Reid 1988). Horticulture apparently spread into west Malaysia about 7000 years ago, probably involving root crops and foxtail millet (Benjamin 1974:9-10; Reid 1988:18-19). As late as 1450 A.D. farming in the southern part of the peninsula, for example around Melaka, was poorly developed. Metroxylon sago, not rice, was still the staple (Wheatley 1964:132). Btsisi’ say they originated from that area, a fact which may account for their knowledge of how to prepare sago (see Table II above).

In general, the introduction of padi (wet rice) agriculture to west Malaysia seems to have had relatively little effect on indigenous agricultural systems (Benjamin 1974:23-24). The current importance of wet rice in west Malaysia results from British pressure (Spencer 1963:86). Rice did not spread to Irian Barat, the Moluccas or other parts of eastern Indonesia, where sago, usually from spontaneous stands but sometimes cultivated, remained the main source of carbohydrates (Ellen 1988; Pelzer 1963:120, 125; Reid 1988:5, 18-19).

On foragers, however, rice agriculture may have had two effects. First, under colonial pressure, wet rice came to be in direct competition with sago in west Malaysia, since the best padi land is along the coasts and in the lower parts of river valleys, where true sago flourishes (Hodder 1959:52; Spencer 1963:86). Moreover, sedentary padi farmers tend to exterminate sago groves in their vicinity. Second, rice is easy to carry and is a good commodity to exchange for forest goods. Even if early foraging life centred on rivers, the carbohydrates available to trade would have opened up the interior forests.

The arrival of Malays in west Malaysia about 2000 years ago seems to have coincided with a rise in the frequency of slave raids (Benjamin 1974:11; Dentan 1991; Reid 1988). Slaving would have made riparian life risky, since slavers, like everyone else, used rivers for transportation. Indeed, as late as 1962 many Pahang Semai would leave riverside settlements for the security of the forest when they heard the sound of a boat coming upstream, only to emerge when it was clear that they were safe. Raiding might tend to make people prefer camping away from rivers, and from the palms that grow best on river banks. Moreover, Bugis and presumably other raiding peoples recognized sago fibre in the river as a sign of human habitation upstream, even when the upstream people habitually concealed themselves (De Leeuw 1931:175). Thus a shift in
emphasis from a riparian orientation to dependence on deep forest produce might have grown over the years, with a concomitant shift from palm pith to tubers. Such a pattern would fit Gardner’s observation (1985:416) that ‘nomadism is a function of frontier events, and a bias toward living near the edge of the forest is evident’.

East and West Malaysian foragers are strikingly non-violent, tending to flee from violence rather than to fight it (Endicott 1983; Forbes 1885:236-237; Needham 1954:230, 232; 1972:180; Pringle 1970:264, 292; cf. Dentan 1979, 1991; Gardner 1982:462-463; 1985:413, 423-424), but there seem to be differences in the ways they respond to, for example, destruction of their habitat. Penan recently caused a stir in the international environmentalist community by blockading logging roads (Sahabat ‘Alam Malaysia 1987, 1988; Walz 1988/89). By contrast, the Semang, and their Senoi cultural kin, quietly endure the destruction of their forests, which should be complete by the mid-1990s (Catmandu and Sivashanmugam 1987; K.M. Endicott 1982; Gomes 1988; Singh 1989). Both individuals and groups tend to flee from conflict as long as there is a refuge area where they can be relatively safe (e.g., Dentan 1991; Singh 1989). The greater tendency to flee among Semang might account for their orientation toward deep forest tubers as a primary source of starch, in contrast to the Penan, who retain some ties to the more dangerous riversides. The reliance on wild yams might then be sporadic for any particular group, which could shift from being ‘professional primitives’ to being refugees and back again in the pattern Peter Gardner (1985) calls ‘bicultural oscillation’.

Refugees, however, often have to abandon some of their luggage, both physical and mental. The loss of knowledge about resources and the skills to exploit them is perhaps commoner, at least in this area, than some students realize. Archaeological records indicate that Malaysian indigenes formerly made pottery and stone tools, all memory of which seems to have vanished long ago. Semang stopped using bows and arrows within living memory; by 1962, young people trying to make model bows made them with holes or notches through the bow itself in order to accommodate the arrow; the bows, of course, broke. Kensiu youngsters now say they wouldn’t know what to do with the commonest kind of wild yam, an enormous Dioscorea called takoop in most Aslian languages, although it remained an emergency food for the swiddening Semai and Jah Hut in the 1960s (Nagata 1989; cf. K.M. Endicott 1979:17-18, 54-55; the term refers basically to D. gibbiflora, but also apparently to D. glabra and D. orbiculata). In 1962, Semai on long trips through the rainforest noted takoop patches for possible exploitation in time of emergency, and in 1963 cash flow problems forced one settlement of Jah Hut, another Senoi people, then specializing in sculpture, to subsist on its enormous root. Similarly, the range of plant and animal resources foragers take advantage of is narrower now than even a few years ago, and certainly than millennia ago (Eder 1988:47; K.M. Endicott 1982, 1984; Headland 1988; P. Townsend 1990).
The processes of habitat destruction, specialization in forest products and permanent or oscillating geographical displacement may well be ancient. Malaysian indigenes sustain no authoritative repositories of knowledge; people transmit what they know in ad hoc ways, so that their ‘ethnoscience’ even in stable times is always in flux (Dentan 1988). Under the frontier circumstances the just described loss of folk knowledge seems inevitable.

An alternative explanation which has the attractiveness of simplicity is that, although Semang knew about sago, there are enough wild yams available for them not to need to use it. A similar situation may exist elsewhere. One piece in the evidence that ‘Tasaday’ foragers are a hoax is the allegation that, although they used only one species of *Dioscorea* yam, they did not know about the *Caryota* sago that is so abundant in their area (Berreman 1991:14; Headland 1990a:24, 25-26; Hyndman and Duhaylungsod 1990; Yen 1976:175). On the other hand, among the Paliyan foragers of southern India, a lowland people like the nineteenth-century Semang: ‘Yams are copious, even where Paliyan population density is highest, and there is little resort to a higher-altitude alternative, sago palm’ [*Caryota urens*] (Gardner 1985:414). The Semang staple *takoop* (K.M. Endicott 1979:17, 54-55) is a fallback food for west Malaysian horticulturalists. Perhaps sago served similarly as an emergency food for Semang who remembered how to get it.

Rambo (e.g., 1984) is a main proponent of a modified green desert thesis for Semang. Most people who have worked extensively with Malaysian indigenes agree with K.M. Endicott (in press) that Batek Semang, at least, can subsist, and have subsisted, as foragers, on wild yams without using sago.

**CONCLUSION**

Speculation about autochthonous life without extensive archaeological or ethnohistorical evidence is fun but cannot be conclusive. In considering environmental limitations, the green desert thesis discounts fruits, honey, small fauna and a multiplicity of individually rare resources which in the aggregate are common. It stresses only focused foraging strategies, not ‘diffuse’ opportunism or exploiting ecotones. These omissions detract from its usefulness as an account of Malaysian possibilities.

Apparently, moreover, Malaysian rainforest was rich enough in wild yams alone to support a purely foraging indigenous population, of the sort Philippine indigenes claim to have once had (Eder 1988:37-38, 44; K.M. Endicott, in press). This paper suggests that other potential sources of carbohydrate, notably but not exclusively sago, would provide adequate subsistence even if wild yams did not. Of course, the Semang or Penan may never have used those other potential sources of carbohydrate. In that case,
however, whatever difficulty they may have had in living in tropical rainforest without outside support is a matter of cultural ecology, which involves knowledge, rather than simply of a deficient physical environment. The deficiency would be cultural as well as environmental.

The question of whether foragers could live unaided in rainforest has political-philosophical undertones. Several 'green desert' theorists are, more or less overtly, anxious to dispel the idea that foragers lead leisurely lives in harmony with nature (e.g., Headland 1990b). I have myself criticized that notion (e.g., Dentan 1988a, 1988c). On the other hand, to insist that their lives as 'primitive polluters' are merely struggle and pain (Rambo 1985) risks polarizing the issue on precisely extraneous political-philosophical grounds. The outrage which greeted my earlier characterization of these two poles (NOT their proponents) as 'liberal' and 'conservative' (Robarchek and Dentan 1987) prompts obfuscating them as 'Rousseauvian' or culture-loving and 'Hobbesian' or biologizing (cf. Robarchek 1987, 1991). Personal politics are not at issue; the intellectual traditions into which theories fall are the question.

Using other people's lives implicitly to criticize our own, as Rousseauvians do, or to defend it, as Hobbesians do, are time-honoured anthropological enterprises (Marcus and Fischer 1986). Often in such cases, starkly simple characterizations of their lifestyle are appropriate. It is important, however, to recognize that those other lives are independent of our own, with a complexity that is staggeringly hard to capture in ethnography. Before using them in our internal quarrels, we need to capture that complexity. In a recent work, Headland (1990b) draws back from the polemical Hobbesianism of his early work to a more moderate position, according to which generic categorizations of forager affluence or poverty need intensive examination on the local level, distinguishing between individual and group adaptation. Sometimes, he concedes, foragers seem to live pretty well. If Rousseauvians would now concede that sometimes foragers live pretty badly, ethnographers and prehistorians could get on with the more basic work of documenting specific instances.

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