Swidden Farming as an Agent of Environmental Change: Ecological Myth and Historical Reality in Indonesia

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ABSTRACT

Swidden farming, once condemned as a major cause of deforestation, has increasingly come to be seen as a form of forest management and even conservation. Under traditional conditions, it is now assumed, swiddening was a sustainable practice and cultivation cycles were long enough to allow forest to regenerate during the fallow interval. This article tests these assumptions against historical evidence from Sulawesi (Indonesia) in the period 1820–1950. The data show that intensive bush-fallow swidden systems, with fallow periods of just five to six years, were already the norm in the early nineteenth century, when average population densities were still low and production for commerce limited. In most cases these traditional short-fallow systems were sustainable, in the sense of not entailing progressive deforestation beyond an established swidden-fallow complex. But within that complex the natural forest was permanently replaced by a much less rich and diverse anthropogenic vegetation. In some areas, moreover, swidden farming took an unsustainable, itinerant form involving the creation of fire-climax grassland. This too appears to have been a traditional pattern; there is no evidence that it resulted from population growth, or from external influences such as migration or commerce. The view of traditional swidden farming as an environmentally benign practice is an idealised one, and should not be allowed to obscure the fundamental incompatibility of agriculture with nature conservation.

KEYWORDS

Swidden farming; deforestation; sustainability; Indonesia; Sulawesi

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This article uses historical evidence from northern Sulawesi (Indonesia) to question the currently popular view of swidden farming as a form of forest management or even conservation. The argument is structured as follows. The first section traces the emergence, in the late twentieth century, of the modern view of swidden farming as an environmentally benign practice. The second introduces the regional setting and the related literature. The third examines historical evidence regarding the duration of the swidden cycle and its impact on the natural vegetation in those cases where the rotation appears to have been sustainable. The fourth highlights evidence for wholly unsustainable swidden practices and for their role in the creation and progressive extension of fire-climax grasslands. The fifth briefly examines why recent writers have tended to forget facts that were once well known about the historical prevalence of short fallow cycles and unsustainable swidden variants. The sixth and concluding section outlines some implications for environmental historiography and conservation policy.

1. A REVOLUTION IN ATTITUDES TO SWIDDEN FARMING: FROM PROBLEM TO SOLUTION

The second half of the twentieth century saw a dramatic reassessment, in academic and policy-making circles, of the environmental impact of swidden farming. In 1966, J.E. Spencer, in his landmark survey *Shifting Cultivation in Southeastern Asia*, could still portray the dominant attitude to this type of agriculture as one of condemnation: swidden farming was held responsible for the 'destruction and waste' of timber, soils, flora, fauna, and 'wild landscapes'.[1] Yet less than thirty years later, an official World Bank country study on environment and development in Indonesia concluded that because swidden agriculture in its traditional form involves 'long term rotation cycles that allow for forest regeneration and soil rebuilding', its environmental impact 'should probably not be considered deforestation at all'.[2]

It was Harold Conklin's *Hanunóo Agriculture: A Report on an Integral System of Shifting Cultivation in the Philippines*, published in 1957, which led the reaction against the colonial and early postcolonial stereotype of swidden cultivation as something 'axiomatically destructive of plant growth, soil, and other resources'.[3] In this meticulous field study Conklin revealed, essentially for the first time in detail, the ecological sustainability, as well as the complexity, productivity and labour-efficiency, of a traditional bush-fallow foodcrop farming system operating at an appropriate population density. Although Conklin's study was commissioned by the Food and Agriculture Organization of the UN in the context of an international investigation into shifting cultivation as a problematic

1. Spencer 1966, p. 3.
2. World Bank 1994, p. 52.
3. Spencer 1966, p. 3.

type of land use, his conclusion, as the FAO noted in its preface, was that in the Hanunóo case there was in fact no problem to be addressed.

> It will perhaps come as a surprise to some readers that Dr. Conklin has not concluded his work by suggesting possible ways of improving the standards of living of the group he has studied. It is felt, however, that in this particular case there was no urgent need for such suggestions. It is a case of almost perfect equilibrium between man and his environment, and if there is any deterioration on either side it is an extremely slow process.[4]

Not all forms of shifting cultivation, Conklin acknowledged, were this benign. Some involved progressive expansion of the deforested area, rather than continuous *in situ* rotation. These unstable forms, however, were characterised in his study as 'incipient', 'pioneer', or 'partial' variants, practised by recent and/or unskilled migrants from more densely populated areas. As such they fell outside the category of 'integral' (established and traditional) swidden systems exemplified by that of the Hanunóo.[5]

Conklin's work was a key source of inspiration and data for Clifford Geertz's equally influential 1963 book *Agricultural Involution: The Processes of Ecological Change in Indonesia*. Geertz took Conklin's ecological approach one step further by characterising swidden farming as 'the imitation of a tropical forest'.[6] The variety of cultivars planted in the swidden echoed the natural biodiversity of the rainforest, while the fallow stage resembled the process of regrowth following the death of a single tree under natural conditions. Geertz, however, did also emphasise the instability of the system under conditions of population growth, which beyond a critical threshold would lead either to an unproductive grassland climax or to to the adoption of an area-intensive farming system such as wet rice cultivation. This kind of demographically-driven intensification was explicitly modelled by Ester Boserup in *The Conditions of Agricultural Growth: The Economics of Agrarian Change Under Population Pressure* (1965). Boserup proposed a universal transition from forest-fallow cultivation, via bush-fallow and short-fallow, to annual and multi-cropping systems such as irrigated rice farming. In this scheme each transition led to higher areal productivity but at the same time to lower labour-efficiency; hence the preference of sparse populations for swidden farming, which yielded more food for less work than any of its alternatives. What for centuries had been thought of as the most primitive form of agriculture now came increasingly to be seen as the most efficient, and also as 'the ideal way to exploit the tropical environment while conserving it'.[7]

During the 1960s and 70s the idea of swidden farming as a close, and under appropriate conditions benevolent, adaptation to forest nature percolated stead-

4. Conklin 1957, p. v.
5. Conklin 1957, pp. 2–4, 154–5.
6. Geertz 1963, p. 31.
7. Russell 1988: 92.

ily into conventional wisdom among scholars of Southeast Asia, particularly Indonesia. At the same time there was a tendency toward liberal estimation of the customary fallow period: 'an interval that varies from 15 to 20 years'; 'a fallow period of anything from a few years to more than twenty years, during which the vegetation regenerates'.[8] Conklin, by comparison, had reported an average fallow interval of just 8–10 years among the Hanunóo.[9] Geertz, for his part, refrained – prudently, it is tempting to add, in view of his argument that a fallowed swidden was a kind of simulated rainforest – from citing this (or any other) specific figure.

In the 1980s and 90s, concern over rapid deforestation as a result of commercial logging, settler migration and the spread of oil palm and pulpwood plantations gave additional reason to appreciate the ecological virtues of swidden cultivators, whose own practices were indisputably less destructive and who in many cases were being dispossessed and marginalised as the forest frontier retreated. At the same time, and partly for the same reason, there was also rising interest in the smallholder arboriculture or 'agroforestry' systems, based on commercial tree products (including rubber, copra, resins and in some cases also fruits, timber and firewood for local markets), which had emerged in many places as developments of traditional swidden farming via the planting of economically useful trees on abandoned swiddens. Typically far more biodiverse than any estate arboriculture, these systems were hailed as 'recreating the forest' in the form of 'forest gardens'.[10] Some authors even began to describe rotational swidden cultivation itself as a form of agroforestry.[11]

Those who have studied the development of smallholder agroforestry on former swidden land have understood that unlike swidden farming, it is entirely predicated on commerce.[12] They have also understood that the longevity of the tree crops involved means that these cannot generally be integrated into a closed fallow cycle and so must either replace swidden farming proper or, if they continue to coexist with it, lead to additional clearance of natural forest.[13] Nevertheless the reinterpretation of swidden-derived commercial arboriculture as 'ethnoconservation', and of swidden farmers as 'managers of the forest', has helped to inspire an idealistic conviction among anthropologists, ecologists and forest scientists that deforestation in Southeast Asia has always been the result of external pressures or interference, in the absence of which local populations would have continued to live in harmony with the forest.[14]

8. Hardjono 1971, p. 133; Missen 1972, p. 34.
9. Conklin 1957, p. 145.
10. De Jong 1995; Salafsky 1994.
11. Colfer, Peluso and Chin 1997, p.156; Sinclair 1999: 175.
12. Gourou 1940, p. 348; Michon and de Foresta 1995: 94.
13. Dove 1993: 145; Tammes 1949, p. 7.
14. De Jong 1995; Colfer and Dudley 1993.

> While forests were utilized and managed by local communities, no irreversible changes occurred. Tropical forests began to deteriorate as modern state formations introduced centralized management regimes, which triggered the loss of local autonomy and control over self-support systems ...[15]

The same kind of idealism is also evident in the work of historians of the region. Anthony Reid, writing in this journal, has portrayed the relationship between farmers and forests in pre-colonial Southeast Asia as one of idyllic symbiosis.

> Until about fifteen centuries ago the interaction of humans with the Southeast Asian rainforest was primarily one of interdependence. Trees were felled for food and aromatic woods, and in dryer zones to burn in a process of shifting cultivation, but population pressures were low enough for routine regeneration.[16]

Before the modern era of plantation agriculture and mechanised logging, in this view, the only important agents of permanent environmental change were wet rice farming and the cultivation of smallholder cash crops, particularly pepper.[17] Swidden food-crop farming was more a part of the natural landscape than an intrusion into it. Robert Cribb's generally authoritative *Historical Atlas of Indonesia* presents a similar picture: under traditional swidden cultivation, abandoned plots were allowed to 'revert to jungle over a period of perhaps twenty to thirty years'. While this 'certainly affected the structure of tropical forests', Cribb doubts whether it was 'any more significant than natural destructive forces such as landslides or lightning strikes'.[18] Peter Boomgaard, in his standard work *Southeast Asia: An Environmental History*, is more circumspect on this point but nevertheless reports that in traditional swidden farming the fallow phase 'may take as long as thirty years' and that if it falls below eight years, the system tends to become unsustainable.[19]

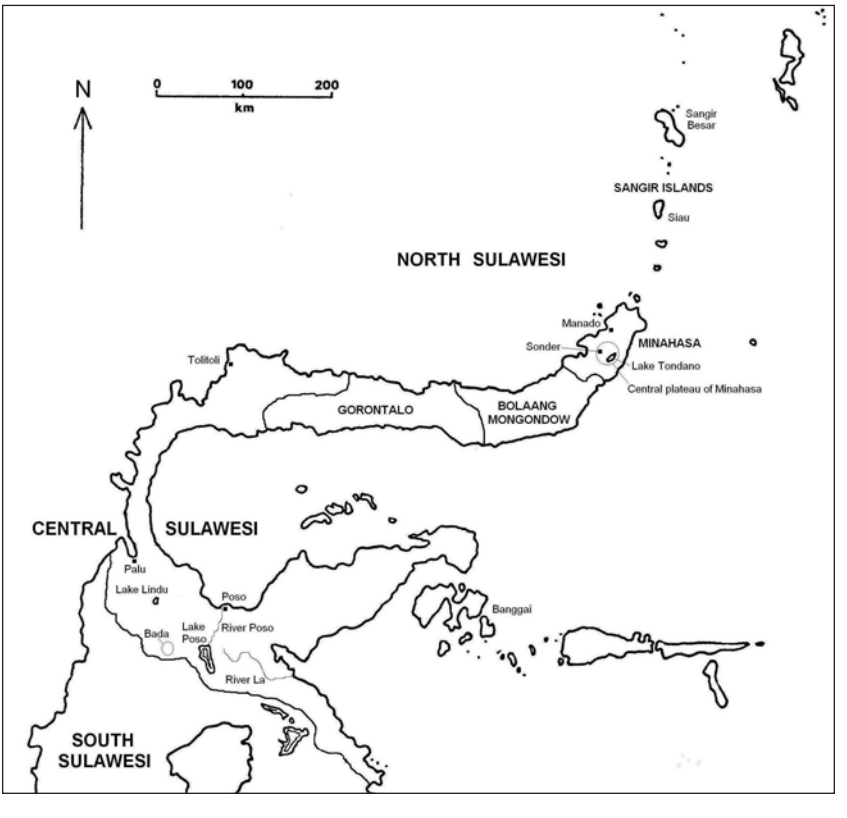
Given the magnitude of the assumptions that have become entrenched over the past half century, it is high time to reassess the environmental impact of swidden cultivation in a systematic way on the basis of concrete historical evidence. In the remainder of the present article, I attempt to do this in relation to an Indonesian region on which I have made a detailed study encompassing environmental and demographic history.[20]

15. De Jong, Lye and Abe 2003, p. 19.
16. Reid 1995: 93.
17. Reid 1995: 93, 101–103.
18. Cribb 2000, p. 23.
19. Boomgaard 2007, pp. 220, 222.
20. Henley 2005b.

2. SWIDDEN FARMING IN NORTHERN SULAWESI

'Northern Sulawesi' refers here to the northern half of that island (and its smaller outliers), equivalent to the late-colonial 'residency of Manado' or the combined present-day provinces of North Sulawesi, Gorontalo and Central Sulawesi (Map 1). It covers a land area of some 90,000 square kilometres (roughly the size of Scotland). At the time of the first reasonably comprehensive census in 1930, its population was a little over 1.1 million; a century earlier, in 1830, probably about 700,000. In the nineteenth century its inhabitants were mostly farmers growing subsistence crops on swidden fields and obtaining the limited quantity of trade goods which they consumed (principally textiles and iron) by selling coconut oil, cacao, coffee, surplus rice, or gold dust and forest products collected during the agricultural off-season.

Northern Sulawesi is a region for which extensive data relating to swidden farming practices are available in Dutch sources covering the period from the



MAP 1. Northern (North and Central) Sulawesi, showing the areas and places mentioned in the text.

beginning of the nineteenth century up to 1950. Recent literature, by contrast, is of little help on this topic, at least from a historical perspective. The standard reference work *The Ecology of Sulawesi*, by Whitten, Mustafa and Henderson, provides a good illustration of how recent writing on the ecology of swidden cultivation tends to reflect assumptions and extrapolations rather than empirical research. Both in its original (1987) and its second (2002) editions, this book describes swidden agriculture as a sustainable system 'characterised by long fallow periods between short periods of intensive production'. Following temporary cultivation, fields are said to be 'abandoned for 15–30 years during which time the soil recovers'.[21]

Only two references are cited by the authors in support this statement. Of these, one is a general source and the other refers to a forest reserve in West Java. Neither includes evidence from Sulawesi itself, whether contemporary or historical. Ironically, Whitten and his co-authors do note that in parts of Central Sulawesi there are 'vast areas of grassland caused by shifting cultivation on poor soils'. What 'went wrong' here, they speculate – along the same lines as Conklin, but again without citing any local evidence to support their theory – was that the farmers responsible were immigrants who 'originally worked land in the richer lowlands but were forced by various pressures to move to the poorer soils of the hills where their techniques were inappropriate'. As a result they were forced to abandon their original sustainable swidden rotation in favour of an unsustainable, itinerant practice of continuously shifting cultivation, leading to progressive deforestation and grassland creation.[22]

How do these retrospective speculations compare with the contemporary data on swidden farming practices found in historical sources? The discussion below is divided into two parts. Section 3 looks at what contemporary reports say about length of the swidden cycle and its implications in terms of how much primary forest is permanently replaced by what kind of secondary vegetation, assuming that the rotation is indefinitely sustainable. Section 4 highlights some evidence for wholly unsustainable swidden practices, and for their role in the creation and progressive extension of fire-climax grasslands.

3. THE SWIDDEN CYCLE: DURATION AND IMPACT UNDER SUSTAINABLE CONDITIONS

Table 1 shows all the quantitative information on cultivation periods and fallow intervals that I have been able to find in Dutch sources from the colonial period. The earliest figures date from the 1820s, the latest from the 1940s. The majority refer to one of two areas: Minahasa, the mountainous, volcanic, agriculturally productive area at the tip of the northern peninsula of Sulawesi where Dutch

21. Whitten, Mustafa and Henderson 1987, pp. 575, 577; 2002, 570.
22. Whitten, Mustafa and Henderson 2002, p. 571.

involvement was longest and most intensive; and the almost equally fertile and populous Sangir islands to the north of Minahasa. However there are also some data from less densely populated areas, with more typical, infertile tropical soils, further south in Bolaang Mongondow, Gorontalo, and Central Sulawesi.

TABLE 1: Swidden cycle data in Dutch sources on northern Sulawesi, 1821–1949

Year	Locality	Fallow interval (years)	Main crop cultivation period (years)	Source
1821	Minahasa	5–6	1	Reinwardt 1858, 585
1824	Minahasa	5	1	Olivier 1834–37, II, 35
1825	Minahasa	at least 3, often 5 or more	not specified	Riedel 1872, 539, 540
1825	Sangir islands	4–5	not specified	Van Delden 1844, 18
1833	Minahasa	2–4	not specified	AV Manado 1833 (ANRI Manado 48)
1840	Minahasa	3–5	not specified	Van Doren 1857–60, II, 362
1846a	Minahasa	at least 3	1–2	Francis 1860, 349, 350
1846b	Minahasa (central uplands)	3–5	2	Grudelbach 1849, 406
1846c	Minahasa (northwest coast)	6–15	not specified	E. Francis, Aantekeningen, 12 juni 1846 (ANRI Manado 50)
1855	Minahasa (west coast)	5	not specified	Fragment 1856, 150
1857	Bolaang Mongondow (north coast)	3–5	not specified	Riedel 1864, 272
1860	Minahasa (west coast)	7–10	1–2	Teysmann 1861, 344
1861	Minahasa (central uplands)	4–6	not specified	CV Manado 1861 (ANRI Manado 95)
1863	Minahasa	3–10	not specified	CV Manado 1863 (ANRI Manado 52)
1864a	Minahasa	3–10	not specified	CV Manado 1864 (ANRI Manado 39)
1864b	Minahasa	2–5	1	Graafland 1864, 8
1866	Minahasa	4–7	not specified	CV Manado 1866 (ANRI Manado 52)
1869	Minahasa (southwest coast)	5–8	2	De Clercq 1870, 526–7
1870	Minahasa	2–4 or more	1	N.P. Wilken 1870, 374
1872a	Minahasa	2–4 or more	1	G.A. Wilken 1873, 134
1872b	Minahasa (southeast coast)	9–10 or more	not specified	G.A. Wilken 1873, 134
1875	Minahasa	2–10 or more	2–4	Edeling 1919, 48

Year	Locality	Fallow interval (years)	Main crop cultivation period (years)	Source
1879	Minahasa	3–10	not specified	CV Manado 1879 (ANRI Manado 86)
1881	Minahasa	at least 3, 'usually much longer'	not specified	Matthes 1881
1888	Central Sulawesi (Palu Bay)	2–3	not specified	Landschap Donggala 1905, 522
1895a	Minahasa	up to 25	not specified	Koorders 1898 (vegetation map)
1895b	Minahasa (central uplands)	6–8	2–3	Koorders 1898, 26
1895c	Central Sulawesi (Poso area)	6–8	not specified	A.C. Kruyt 1895–97, II, 117
1895d	Central Sulawesi (Poso area)	3–4	not specified	A.C. Kruyt 1895–97, III, 131
1900	Central Sulawesi (western highlands)	5–6	not specified	A.C. Kruyt 1938, IV, 35
1912a	Minahasa	2–6	1	Dirkzwager 1912, 1165
1912b	Gorontalo (south coast)	5 or more	1–2	Regeeringsrapport Boalemo 1914, 169
1917	Gorontalo (north coast)	4–10	1–3	Van Andel and Monsjou 1919, 118–19
1927	Central Sulawesi (Tolitoli, west coast)	2–3	2–3	Kortleven 1927, 88
1931a	Central Sulawesi (Palu Bay)	3–6	1	Dutrieux 1931, 3
1931b	Central Sulawesi (western highlands)	5–8	1	Dutrieux 1931, 3
1932	Central Sulawesi (Banggai, east coast)	about 5	not specified	A.C. Kruyt 1932, 477
1938	Minahasa	3–5	1–2	Weg 1938, 147
1939	Central Sulawesi (Lindu, western highlands)	6	1	Bloembergen 1940, 390
1941	Sangir (Siau)	5–8	3–5	M. van Rhijn 1941, 42
1949	Sangir (Sangir Besar)	5–7	1	Blankhart 1951, 86

What immediately stands out here is the general shortness of the recorded swidden cycles. Of the 41 entries in this table, only nine (22 per cent) mention a fallow period of more than eight years. Unexpectedly, the fallow intervals from the less fertile areas outside Minahasa and Sangir (1857, 1888, 1912b, 1917, 1927, 1931a, 1931b, 1932, 1939) are no longer than the rest. Only two (5 per cent) of the entries – both of them, ironically, from Minahasa – seem to refer to what might be described as long fallow cycles: respectively up to fifteen years

(1846c), and up to 25 years (1895a). Unlike the majority of the data, both of these high figures are of doubtful reliability since they are actually estimates by visitors of the age of briefly observed secondary vegetation, rather than descriptions by resident officials of farming practices observed over long periods.

A second striking feature of the swidden cycle data is that the stated fallow periods show no discernible downward trend over time: in the early nineteenth century they are already just as short as in the early twentieth. Figure 1 illustrates graphically the average reported fallow intervals listed in Table 1. Here the trend line lies virtually flat, over the whole period from 1820 to 1950, at an average fallow period of between five and six years. This line takes no account of locality or of changes in the cultivation (as opposed to fallow) period, and does not include those fallow interval data which specify no upper limit. However, the data from the two localities (Minahasa and Sangir) for which a considerable series of fallow period indications is available do not suggest local shortening either; the limited information on cultivation periods likewise implies no systematic change; and the open-ended fallow period indications (1825, 1846a, 1870, 1872a, 1872b, 1875, 1879, 1881, 1912b) mostly date from the middle rather than the beginning of the documented period, which again does not imply a consistent chronological trend.

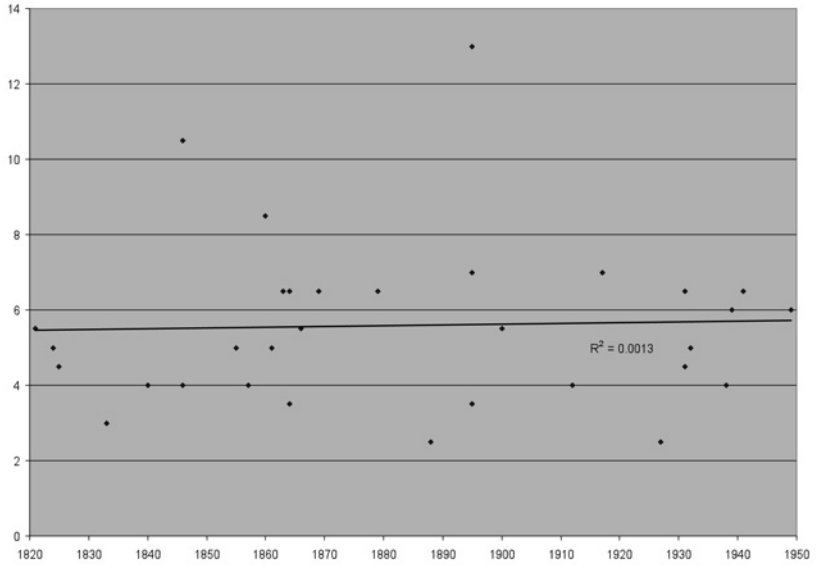


FIGURE 1. Average reported fallow interval (years) for swidden cultivation systems in northern Sulawesi, 1821–1949. Sources: see Table 1.

The absence of any observable tendency for swidden cycles to become shorter between 1820 and 1950 is remarkable, given that this was a long period of strong population growth. In Minahasa, the area to which most of the swidden data refer, the population more than tripled from about 100,000 in 1850 to over 300,000 in 1930, raising the average population density from about twenty persons per square kilometre to more than sixty. The additional inhabitants were supported not by means of an intensification of swidden agriculture, but by a direct transition in many places from rotational to permanent-field farming (and to some extent by food imports). The proportion of the Minahasan rice crop grown on irrigated rather than dry (mostly swidden) fields grew from less than a quarter in 1850 to over sixty per cent in 1930.[23]

FIGURE 2. Wet ricefields in Central Sulawesi (Kulawi, near Lake Lindu), with swidden fallow vegetation on adjacent slopes, circa 1913. Source: Abendanon 1915–18, II, Plate CLVIII.

The paradoxical combination, at the beginning of our period, of a relatively low population density with a short average swidden cycle is clarified by the fact that the distribution of the population was highly uneven. In the early nineteenth century the population of Minahasa was concentrated on the fertile central plateau around Lake Tondano, where its density was at least seventy persons per square kilometre.[24] The rest of the country was largely uninhabited except for

23. Henley 2005b, pp. 405, 408, 526.
24. Henley 2005a: 160.

a few small coastal harbour settlements, so that the average population density for Minahasa as a whole was only around twenty persons per square kilometre. Elsewhere in the region too, small, populous enclaves of intensive short-fallow swidden farming, often located in high mountain valleys where they were supplemented by even smaller areas of wet rice cultivation on bunded or terraced fields (Figure 2), alternated with wide expanses of uninhabited wilderness (Map 2). Almost nowhere was the population sparsely and evenly enough distributed to permit long-fallow swidden rotations.

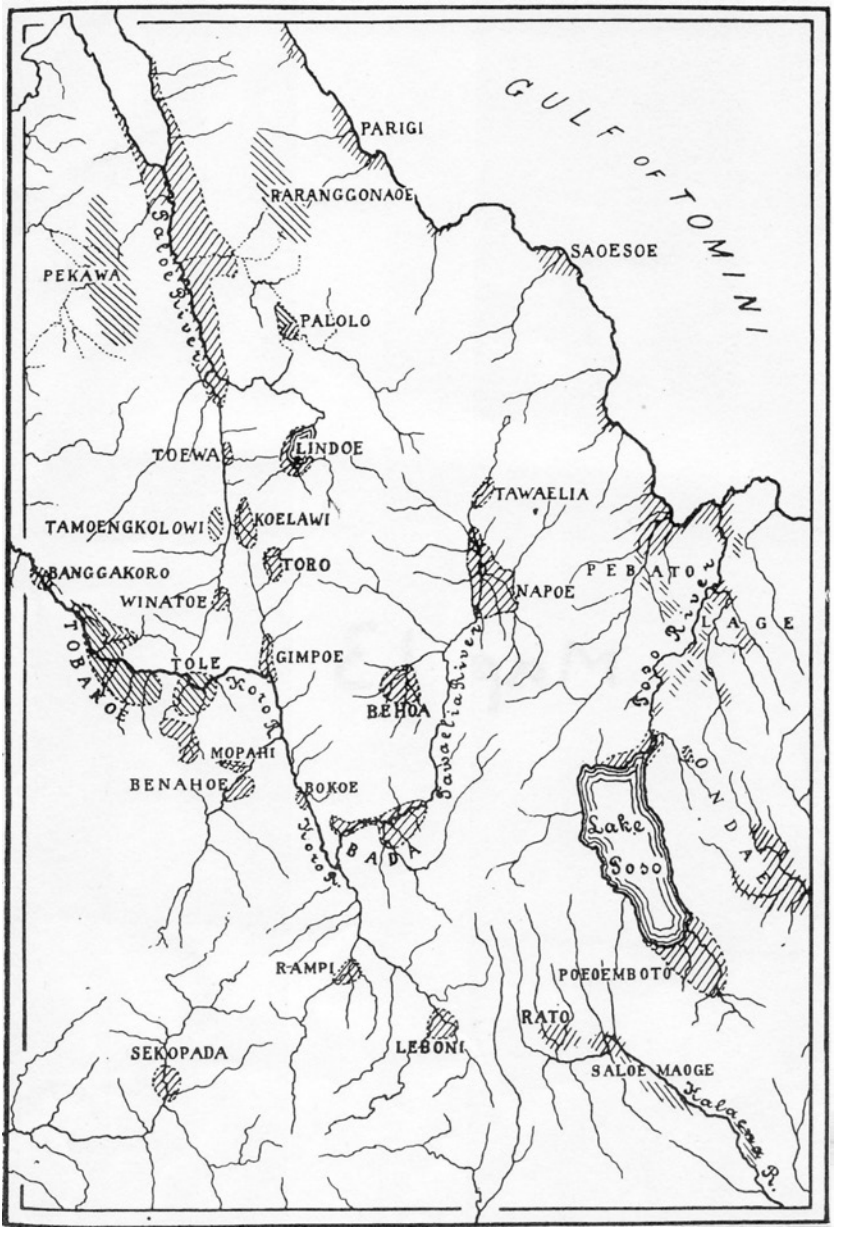
The prevalence of very short swidden cycles, even at the beginning of our documented period, was partly a direct result of the geographical concentration of the population, which in turn reflected the limited availability of high-quality farmland and the need for defensive security in the form of relatively large nuclear settlements. However, there was also a positive preference among farmers for opening their swiddens in secondary vegetation that was still young, and therefore relatively easy to cut and clear.[25] Fallow vegetation more than eight years old, as Seavoy has noted, can no longer be felled with a bush knife, only with an axe.[26] Besides being much more laborious to fell, older forest is also much more difficult to burn, entailing a risk that the cleared plot will have to be abandoned until the large trunks have rotted.[27] The fact that the productivity of short-fallowed swiddens was evidently not so poor as to outweigh these disadvantages of long fallowing is consistent with recent empirical evidence that fallow length is a weak predictor of crop yields in swidden cultivation.[28]

With swidden fallow intervals from the outset averaging only five to six years, it is obvious that within the populated areas the swidden landscape (Figures 3 and 4) never bore much resemblance to the natural rainforest it replaced, in which the canopy trees were typically centuries old and over thirty metres tall. The man-made character of the fallow vegetation was particularly evident where it consisted partly of deliberately planted fruit trees and palms.

> This fallow land ... has a monotonous appearance. Invariably it is characterized by a great number of ferns and copses of bamboo together with papaya and *tagalolo* [*Ficus septica*] trees, and by *lingkuwas* [*Alpinia galanga*] and *galoba* [*Costus* species] bushes, among which a coconut palm or a banana tree rises up here and there.[29]

Even in those places where the secondary woodland was denser and contained fewer cultivars, the stem diameter of its constituent trees was typically still only five to six centimetres, its canopy height five to six metres. And instead of the

25. Adriani and Kruyt 1912–14, II, p. 239; Graafland 1864, p. 20.
26. Seavoy 1973: 219.
27. Li 1991, pp. 37, 40.
28. Mertz *et al*. 2008.
29. De Clercq 1870: 527.



MAP 2. Western Central Sulawesi: inhabited (shaded) and uninhabited (unshaded) areas, circa 1920. Source: Kaudern 1925, 33.

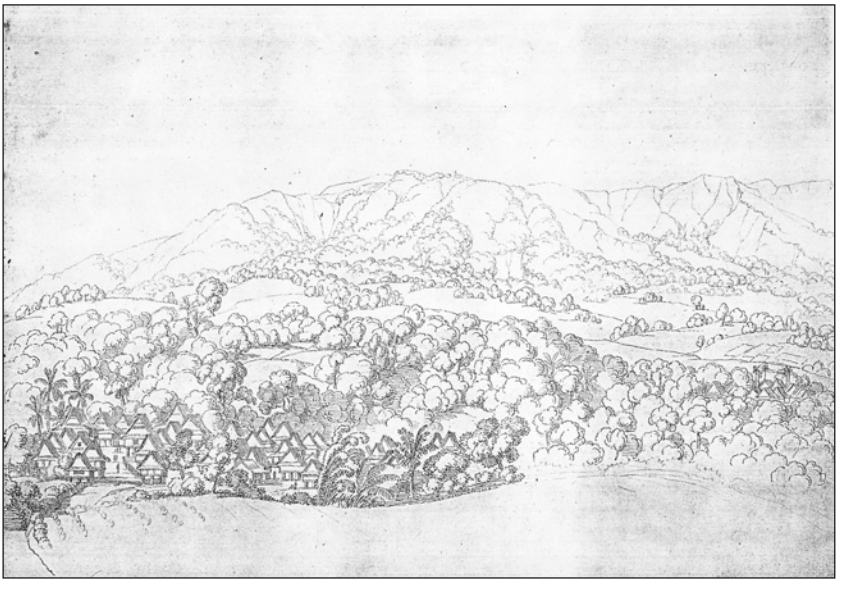


FIGURE 3. Swidden landscape, Minahasa (village of Sonder, central plateau), 1824. Source: RMV, Collectie A. Payen, Calpin A, Sketch 36.

thirty to fifty species of large tree typical of virgin hill forest, here there were just four or five.[30]

With a ratio of fallowed to cultivated land area often as low as 3:1, the swidden landscape was characterised not by occasional clearings scattered through high forest, but rather by a continuous patchwork of contiguous blocks of anthropogenic vegetation, some under current cultivation and others in various stages of more or less woody regrowth.

> The land in the neighbourhood of the village is usually divided into sections, the number of which depends on the number of years for which the land is left fallow, such that each farmer always returns to the same location after the cycle has elapsed. Usually there are five sections, sometimes more, sometimes fewer … The larger landowners have land of their own in each of these sections.[31]

These blocks of adjoining, simultaneously cultivated swiddens were sometimes very large, bearing during the burning and planting phase a striking resemblance (except for the absence of large-diameter tree stumps) to the landscapes created by modern logging operations (Figure 5).

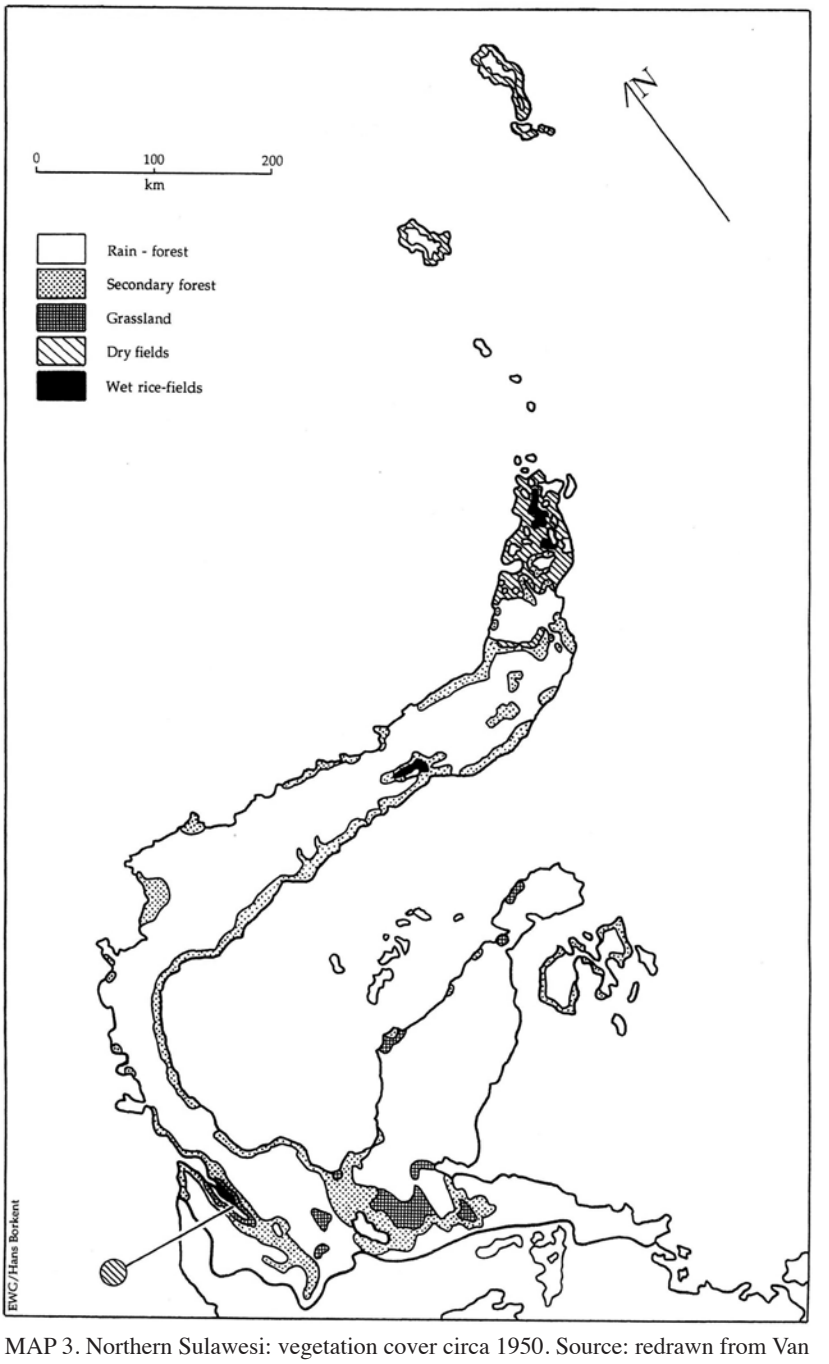
30. Koorders 1898, p. 26.
31. Edeling 1919: 51.

FIGURE 4. Swidden landscape (with swidden houses), Poso area, circa 1905. Source: Adriani and Kruyt 1912–14, Plate 47.

FIGURE 5. Planting rice on a large swidden complex, Central Sulawesi, 1912. Source: ARZ photograph collection, Land- en Volkenkunde Celebes, 403.

During the pre-colonial and colonial periods, the fact that the population was still small by modern standards meant that the proportion of the total natural forest cover lost to swidden cultivation (and other human land uses) was still limited: just over a quarter in 1941.[32] Map 3 shows the approximate distribution of the deforested areas around that date. It is also true that even within the populated enclaves, small areas of permanent semi-natural forest were sometimes preserved for ritual purposes or as timber reserves.[33] Nevertheless, traditional swidden farming practices in northern Sulawesi clearly did not involve any kind of symbiosis with the natural forest. On the contrary, they involved the destruction of that forest and its replacement by completely different, man-made ecosystems that were much less rich and diverse.

32. Boomgaard 1996, p. 166.
33. Henley 2005b, pp. 578–9.



MAP 3. Northern Sulawesi: vegetation cover circa 1950. Source: redrawn from Van Steenis 1958.

4. UNSUSTAINABLE SWIDDEN PRACTICES AND PROGRESSIVE DEFORESTATION

So far it has been assumed that the swidden rotations documented in Table 1 were stable and sustainable, in the sense of not entailing progressive destruction of natural forest beyond the boundaries of an established complex of periodically fallowed and recultivated swidden plots. In most areas, as even sceptical Dutch colonial observers conceded, this was indeed the case.[34] There were, however, exceptions. Early descriptions of farming and settlement in the sparsely populated hinterland of Poso in Central Sulawesi, for instance, reveal a deviant pattern. Food-crop agriculture, here as in many other areas, was based on rice and maize, and took place exclusively on dry swidden fields. The fallow period, at three to eight years (Table 1, 1895c, 1895d), was also unexceptional. In Poso, however, this rotation was reportedly unsustainable, so that whole villages, and not just their outlying swidden houses, were periodically forced to shift to new locations.

> When the area of land that such a village needed to feed itself had become completely deforested and exhausted, the villagers chose a site for a new settlement within the territory of their tribe and founded a new village there. The old village was abandoned to its fate; the houses quickly became derelict, the protective pallisade decayed and only the coconut palms remained to mark the hill as the site of a former village. The traveller in this land saw at least as many such abandoned villages as inhabited ones.[35]

The existence of itinerant farming systems in Poso and adjacent areas had to do with the fact that farmers here combined swidden agriculture with extensive animal husbandry and hunting.[36] For this purpose they routinely set their abandoned swiddens on fire to promote the growth of young grass shoots for grazing by semi-domesticated water buffalo and wild deer. Because of the limited amount of fertile ash which the grass yielded after burning, and because of the heavy labour involved in extracting grass root mats from the soil or weeding their fast-growing shoots, grasslands created in this way were difficult to reincorporate into the swidden farming cycle.[37] As the grass spread, moreover, fires raging across it became increasingly difficult to control, accelerating the emergence of a permanent or semi-permanent fire-climax grassland (Figure 6).

It was this blocking and displacement of the swidden cycle by progressive grassland formation which caused farmers in eastern Central Sulawesi to become shifting rather than rotational cultivators, periodically moving their villages on to new forest lands and leaving open expanses of sword grass or savanna parkland in their wake. The approximate distribution of these grasslands in the

34. Henley 2005b, pp. 567–70.
35. Adriani 1919, pp. 9–10.
36. Henley 2005b, pp. 534–7.
37. Adriani and Kruyt 1912–14, II, p. 239.

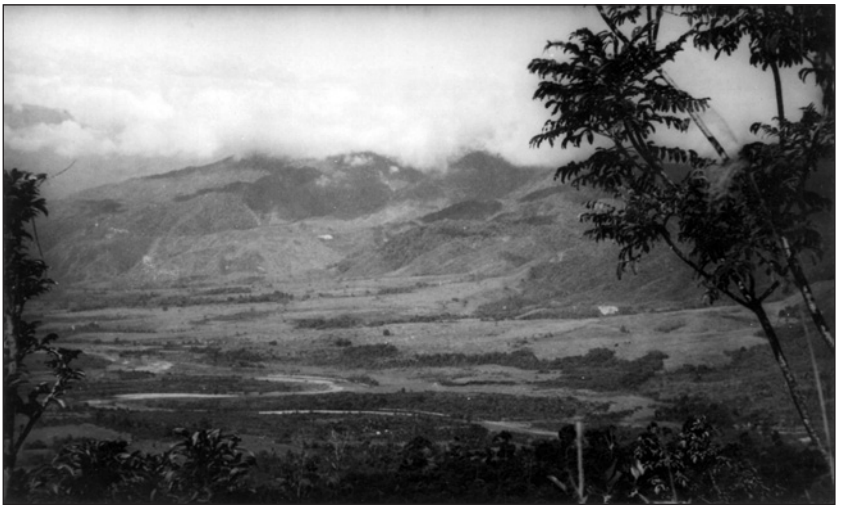


FIGURE 6. Grasslands in Central Sulawesi (Bada), circa 1912. Source: ARZ photograph collection, Land- en Volkenkunde Celebes, 39.

mid-twentieth century is shown in Map 3. The biggest of them, in the La river basin between Lake Poso and the east coast, stretched unbroken over an area of several hundred square kilometres, its treeless expanses almost uninhabited except for herds of deer and water buffalo, but still periodically set on fire in order to prevent vegetation succession and keep the livestock density high.[38] Contemporary observers noted that such landscapes could not be created by swidden agriculture alone, without the additional factor of repeated burning.

> When trees are felled to clear a swidden and the land is left to its fate once more after the harvest, young forest grows up again spontaneously, and there is no question of *alang-alang* fields being formed. This species of tough grass, which has a subterranean rhizome, does come up, but is subsequently overwhelmed by shrubs and trees. If people burn off the *alang-alang*, however, they destroy the young trees while actually promoting the growth of the grass, which burns only to ground level and then immediately puts up young shoots from its rhizomes, whereas the bushes and trees need a much longer recovery period.[39]

If human settlement became so sparse or distant that the burning stopped altogether, then the tree cover would slowly regenerate, eventually making the land suitable for settlement and cultivation once again.[40]

38. Henley 2005b, pp. 477–9.
39. J. Kruyt 1933: 38.
40. Adriani and Kruyt 1950–51, I, p. 167.

Large parts of eastern Central Sulawesi are naturally infertile, consisting either of limestone overlain by shallow calcareous soils, or ultrabasic rocks overlain by acid soils.[41] This helps to explain why farmers there were unusually willing to convert swiddens into permanent pasture, even when doing so would eventually make it necessary for them to relocate their villages. There is also some evidence in the historical record, and in oral tradition, for relocation as a direct result of declining soil fertility rather than exhaustion of forest and fallow woodland.[42] Nevertheless there is no evidence that itinerant cultivation and progressive grassland formation in Central Sulawesi were the results of 'incipient', 'pioneer' or 'partial' swiddening systems practised by inexperienced migrants from more densely populated areas, as suggested by Whitten, Mustafa and Henderson.[43] The areas concerned had a long history of settlement; the water buffalo herds central to the expansionary dynamic were not a recent or commercial innovation but a traditional element of the subsistence farming system, their importance underpinned by ritual and by competitive feasting practices involving animal slaughter (Figure 7).

FIGURE 7. Funeral feast in the Poso area with animals awaiting slaughter, circa 1918. Source: A.C. Kruyt 1919, 55.

41. RePPProT 1990, Map 8.
42. Henley 2005b, pp. 572–3.
43. Whitten, Mustafa and Henderson 2002, p. 571.

Progressive expansion of grassland and savannah at the expense of cultivated or cultivable land could not, of course, have continued indefinitely at a constant population density. The fact that the population of eastern Central Sulawesi underwent a secular decline during the late nineteenth century, together with reports of sustained emigration from one area due to 'overpopulation and the resulting lack of arable land', confirms that the demographic-ecological system was not in equilibrium.[44] But it would be wrong to conclude from this that the farming practices involved were novel, eccentric or unusual. Protracted episodes of ecological disequilibrium have been common throughout history, sometimes with fatal consequences for whole civilisations.[45]

Half a century ago, the antiquity and extent of grassland formation as a consequence of the combination of swidden farming with animal husbandry was well known to scholars of Indonesian agriculture.

> [T]his farm system and the corresponding extensive grassy plains are to be met with in the wet districts of Indonesia, e.g. the Gajo, Alas and Batak lands, in Upper Palembang (Pasumah) and the Toradja district and ... the north coast of Atjeh, the Padang Lawas south of the Batak district, in the lower districts of Palembang and the Lampongs, in southern Priangan, and in the whole of southern Celebes ... It is obvious that this farm system is very soon bound to create extensive grasslands in the drier districts, and this used to be seen in the north of Indramaju and is still found sporadically in eastern Java, although to a greater extent on Sumbawa, Sumba, Flores and Timor and the smaller islands where cattle are tended ...[46]

Likewise, the prevalence of short swidden cycles in Southeast Asia is also frequently noted in older literature.[47] R.D. Hill, in his historical geography of rice cultivation in Malaya, went so far as to regard all swidden systems involving fallow periods of more than eight years as recent deviations from a traditional short-fallow norm.[48] Why, then, have many recent writers lost sight of the fact that swidden farming was always an important agent of permanent deforestation?

5. LOSING SIGHT OF THE PAST: REASONS FOR FORGETTING

One reason for this scholarly amnesia is the disproportionate emphasis in recent literature on Borneo, the front line of current biodiversity destruction and the site of some of the best-known studies of indigenous agriculture. Although Borneo always had its share of short-fallow systems, its exceptionally infertile

44. A.C. Kruyt 1903: 203–4; 1899: 608.
45. Diamond 2005.
46. Terra 1958: 171.
47. Seavoy 1973: 219; Van Steenis 1937: 638.
48. Hill 1977, p. 183.

soils and low population densities also gave rise to some singularly unintensive agriculture – notably the itinerant shifting cultivation, influentially described by Freeman (1955), of the Iban, whose traditional preference for felling virgin rather than secondary forest was the more remarkable given that they were neither livestock farmers nor grassland burners. Genuinely rotational long-fallow systems also seem to have been more widespread in Borneo than elsewhere, and some are still in operation there today.[49]

A second explanation for the neglect of historical evidence for short-fallow and unsustainable swidden farming is that many of the relevant sources, especially for regions outside Kalimantan, have over the years become obscure and inaccessible. Certainly few of the Dutch publications cited in the present article, and none of the archive materials, were readily available to Whitten, Mustafa and Henderson when they were compiling their handbook on *The Ecology of Sulawesi*. Given that swidden farming was not a central concern of their study, under these circumstances it no doubt seemed expedient to deal with the subject by extrapolating from recent and general sources.

In addition, however, it is hard to avoid the impression that even authors who do possess good information on this topic sometimes prefer not to address the questions which that information poses. A table of 'features of swidden agriculture of various groups in Indonesia', presented by De Jong *et al*. in a special issue of the *Journal of Tropical Forest Science* devoted to 'Secondary Forests in Asia', includes three groups in Sulawesi which employ fallow periods of between two and four years – too short for the growth of anything that could be called 'secondary forest'.[50] In fact none of the fallow periods given in this table, the two from Kalimantan not excepted, exceed ten years, and only one (from Malay Sumatra) exceeds seven years – although several are accompanied by the suspiciously parenthetical note: '(previous 15–20)'. No comment on the shortness of the actually observed cycles appears in the accompanying text, which instead proceeds to focus on 'emerging tree crops', particularly rubber, that are increasingly replacing swidden systems 'in stands that may be considered secondary forest gardens'.[51] In other words it is to permanent agroforests, not to fallow vegetation, that the term 'secondary forest' refers here.

By not highlighting this distinction, these and many other authors give the impression that it is the traditional practice of the farmers in question, rather than their conversion to commercial arboriculture, which has led them to engage in 'recreating the forest'.[52] The characteristic conflation here of smallholder arboriculture, swidden farming and forest conservation is not, of course, intended to mislead. But it does reflect an ethically, politically and romantically inspired insistence on the ecological virtue of Indonesia's tribal and post-tribal 'indig-

49. Knapen 2001, p. 248; Mertz *et al*. 2008: 79.
50. De Jong *et al*. 2001: 710.
51. De Jong *et al*. 2001: 710, 715.
52. De Jong 1995.

enous peoples', most of whom live close to forested areas and were swidden farmers in the past.[53]

6. IMPLICATIONS FOR SCHOLARSHIP AND POLICY

The portrayal of swidden farmers as guardians of the forest is, in effect, a variant on the myth of the 'ecologically noble savage'.[54] Swidden farming is a vanishing way of life in Southeast Asia, and there is no doubt that the transformation of its practitioners into smallholder tree crop planters is a better ending to its story, both for the farmers and for their environment, than their displacement or proletarianisation by big business in the form of logging and plantation concerns.[55] De Jong is also right to point out that in the past, many swidden farming communities did preserve small areas of primary (or at least old secondary) forest within their territories for ritual reasons and as reserves of timber, rattan, medicinal plants and game.[56] But when considering the historical relationship between swidden farming and deforestation, it remains important not to miss – if the pun can be excused – the wood for the trees. Even if we accept that modern smallholder tree plantations are forests, they are still dependent on access to markets, without which tree crops could not be sold, imported foodstuffs could not be purchased, and more land would have to be cleared of trees for local food production. In the past, when commerce was less highly developed, 'integral' swidden farmers like those described by Conklin may have cultivated some fruit and other trees for their own use; but their primary focus was on subsistence field crops like rice, which could never be grown under a forest canopy. It follows that on balance, they had a much greater interest in felling trees than in planting them.

Swidden farmers did, of course, allow young uncultivated trees to grow on their fallowed fields. But this does not mean that they lived in a 'forest'. In *The Conditions of Agricultural Growth*, Ester Boserup distinguished between two types of shifting cultivation. The first was 'forest-fallow', with fallow intervals of at least twenty years, allowing the development of 'secondary forest'. The second was 'bush-fallow', with intervals 'usually between six and ten years'. 'No true forest', Boserup noted, 'can grow up in so short a period, but the land left fallow is gradually covered with brush and sometimes also with small trees'.[57] Most traditional Indonesian swidden farming practices fell into this second, bush-fallow category. The associated fallow vegetation – even at its maximum development, in which form it covered only a small part of the landscape – consisted precisely of 'small trees'. It was also far less complex in

53. Henley and Davidson 2007, pp. 34–5.
54. Redford 1991.
55. Padoch *et al*. 2007.
56. De Jong 1997: 193.
57. Boserup 1965, p. 15.

composition than the Southeast Asian rainforest that it replaced, the biodiversity of which is greater than that of any other ecosystem on earth.[58]

The impact of swidden farming on the natural vegetation, then, was neither slight nor temporary. The system's relatively profligate use of land meant that even when it took sustainable forms, compared to wet rice cultivation and other non-rotational systems it was still responsible for much more deforestation per head of the human population which it supported. Of all the sustainable options, the preferred bush-fallow swidden variant was in a sense the most destructive possible choice: neither intensive enough to spare the forest, nor extensive enough to incorporate and recreate it.

A final point to reiterate is that not all swidden farming was sustainable anyway, in the sense of involving a stable *in situ* fallow rotation. Some swidden farmers were always shifting rather than rotational cultivators, periodically moving their villages on to new forest lands and leaving uninhabited expanses of grassland or savanna in their wake. This practice was associated with the deliberate but poorly controlled use of fire to stimulate the growth of young pasture for livestock. The evidence from Sulawesi does not suggest that it resulted in any direct way from commerce, migration or other external influences. The unstable combination of shifting cultivation with animal husbandry and grassland burning which produced the most spectacular deforestation in pre-colonial Indonesia must be regarded as an indigenous system, no less 'traditional' in nature than its (relatively) less environmentally destructive counterparts.

These facts require scholars to dispense once and for all with the comforting modern myth that at one time, when swiddening was the dominant form of agriculture, 'the interaction of humans with the Southeast Asian rainforest was primarily one of interdependence', and that deforestation began with commerce, 'settled cultivation' and 'the loss of local autonomy' to 'modern state formations' and 'centralized management regimes'.[59] On a more purely practical note, taking a realistic view of swidden farmers as agents of forest destruction may also mean reconsidering calculations of recent deforestation rates which underestimate the early extent of bush-fallow and fire-climax vegetation.[60]

Does the revisionist view of swidden cultivation presented above also have policy implications for environmental protection and conservation? In a time when swidden farming as such has almost disappeared, any such implications are bound to be limited. In northern Sulawesi today, cocoa planting – largely by migrants from other regions who settle for that purpose on the forest frontier – has long eclipsed swidden farming as an agent of deforestation.[61] Nevertheless there have been instances in which indigenous farmers, caught between the migrant expansion and the boundaries of the few remaining protected nature reserves,

58. Whitmore 1995, p. 7.
59. Reid 1995: 93; Cribb 2000, p. 23; De Jong, Lye and Abe 2003, p. 19.
60. Henley 2005b, pp. 475, 484–9.
61. Ruf and Yoddang 2004.

have been permitted to occupy land within a national park on the grounds that their traditional land use practices, including swidden cultivation, enable them to 'manage park resources in a sustainable fashion'.[62]

While the human (as opposed to environmental) ethics of this decision are beyond the scope of the present discussion, its premise – that ecological sustainability is equivalent to, or at least compatible with, nature conservation – is flawed. Ultimately that premise proved irrelevant to the outcome of the experiment, which was that the beneficiaries of the dispensation planted cocoa trees just as migrant settlers would have done. But even if they had kept the promise given by their representatives that they would practice only traditional agriculture, their presence would have been inconsistent with any idea of preserving natural ecosystems. The conservation of tropical rainforests is incompatible with agriculture – traditional or otherwise, and notwithstanding insistent claims to the contrary.[63]

This is as true of swidden cultivation as it is of other farming methods: more true, in fact, since swiddening, even when it takes sustainable forms, is uniquely profligate in its use of land. With the age of mature trees in virgin Southeast Asian rainforests ranging between 200 and 700 years, it would still be true even if the twenty- and thirty-year cultivation cycles mentioned in the literature were common in reality.[64] But with the real norm, even in the distant past, lying between five and eight years and with unsustainable, expansionary systems being common at all documented periods, any idea of swidden farming as a form of rainforest conservation is clearly far-fetched. The support or consent of nearby swidden farming populations, if it can be obtained, may facilitate the protection of nature reserves. But what is certain is that in the area they actually farm, there will be no more rainforest.

LIST OF ABBREVIATIONS

ANRI Manado [...]	Arsip Nasional Republik Indonesia (Indonesian National Archive, Jakarta), Manado residency collection (1677–1914), [archive bundle number]
ARZ	Archief van de Raad voor de Zending der Nederlandse Hervormde Kerk (Archive of the Council for Missions of the Dutch Reformed Church), Het Utrechtse Archief, Utrecht.
AV	Algemeen Verslag (General Report)
CV	Cultuur Verslag (Cultivation Report)
NA MvO [...]	Nationaal Archief (Dutch National Archive, The Hague), Indonesian Memories van Overgave collection, [document number]
RMV	Rijksmuseum voor Volkenkunde (National Museum of Ethnology), Leiden

62. Li 2007, p. 147.
63. Colfer and Dudley 1993; Colfer, Peluso and Chin 1997.
64. Age range for virgin forest: Nicholson 1965, p. 82.

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