The Study of Shifting Cultivation

by Harold C. Conklin

This paper consists of a brief discussion of problems involved in the study of shifting cultivation, a topical outline for further research, and an extensive but selected and geographically-indexed bibliography of world literature.

Since the Neolithic, extensive areas of forest land have been farmed every year under conditions of shifting cultivation (which can be defined minimally as any continuing agricultural system in which permanent clearings are cropped for shorter periods in years than they are fallowed). Today, the total area of such swidden farming has been estimated at 14 million square miles (36 million square kilometers), inhabited by 200 million people (FAO staff 1957: 9). In vast tropical and subtropical regions of Africa, Asia, and the New World, shifting-field cultivation is coextensive with agriculture. In Southeast Asia, for example, Dobby estimates that it accounts for one third of the total land area used for agricultural purposes (1954: 349). And in some regions, it has been estimated that the practice of this form of agriculture is more common at present than it was a century ago (Leach 1959: 64).

Despite the apparently widespread character of this type of land use, the associated critical limits and significant relations of time, space, technique, and local ecology have rarely been stated explicitly; the varying methods and consequences of shifting cultivation—for man, plants, and soils—are only beginning to be understood. The specific form that a system of swidden agriculture may exhibit within a given geographical or cultural province depends on the extent of available land, labor, and capital; the local settlement pattern; the degree of social and political integration with other segments of the larger society; and on a large number of more specifically agronomic variables, such as the kinds of principal crops raised (grains, root crops, etc.), types of crop associations and successions, crop-fallow time ratios, the dispersal of swiddens, the presence of live stock, the use of specified tools and techniques including special methods of soil treatment, the vegetational cover of land cleared, climate, soil conditions, and toponomy (Conklin 1957b: 2).

Apart from our minimal characterization of shifting-field agriculture, it is difficult to give a list of elements universally associated with this type of economy. Swidden soil may or may not be worked with hoes and other bladed implements; swiddens may or may not be fenced; swidden farmers may live in isolated and very temporary dwellings or in sedentary villages; etc. In areas where light scrub and grassland are cleared, exclusively hoe-and-burn (de Schlippe 1955c: 119), rather than slash-and-burn, clearing techniques may be observed. Unwanted vegetation is usually burned off after it has been cut, but in the continually-drenched jungle of the Colombian Chocó, the slash-and-mulch cultivation of a special variety of maize excludes the use of fire (West 1957). And on Mentawai, in another tropical area of

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well-distributed, heavy rainfall, a similar practice associated with taro cultivation has been reported (Maass 1902: 150). In general, the range of variation, even in such matters as the minimum duration of fallows, is expanded in those parts of the tropics where unusual conditions of precipitation and moisture prevail. In the low-rainfall, grass-fallow swidden and grazing area of upland Uganda, for example, there is often little difference in the length of the cropping periods and of the time intervals between them (Tothill 1940: 42–46). The fact of great variability from one system of shifting cultivation to another is well documented, although its significance has not yet been fully established.

With these factors in mind, it is evident that the study and analysis of the complex relations in shifting cultivation can profit greatly from a combined ethnographic and ecological approach. In recently published surveys, cultural geographers have strongly emphasized this view (Pelzer 1958a; Simoons 1958; Watters 1960a); and, with respect to a number of specific problems, the same point has been underscored anthropologically (e.g., Conklin 1959a; Leach 1959; Scott 1958). The special complexities of agriculture in tropical environments and the pitfalls of temperate zone ethnocentrism have been pointed out by Anderson (1952: 84), Bates (1952: 271–72), Temppany and Grist (1958), and others. An important introduction to the general potentialities and limitations of swidden farming has been outlined and revised by Pelzer (1945, 1958a), and these factors have been delineated more specifically for particular regions by such writers as van Beukering (1947) for Indonesia, Kolb (1942: 105–40) for northern Malaysia, and de Schlippe (1955c) for central Africa. In assessing these systems, Leach (1949; 1959) has stressed the importance of estimating total yield per unit of labor, and of expressing economic advantage in terms of available capital and other resources. General problems of demography, burning, soils, and crops have been discussed by Gourou (1956: 336–49), Bartlett (1956: 692–720), Pendleton (1954), and Masefield (1951) respectively. The frequently ignored but widespread practice of extensive intercropping has been documented by Anderson (1953: 84), Conklin (1957b: 79–86), Merrill (1909: 179–80), Segawa (1953), Skutch (1959), and R. C. Wood (1934). Major requirements for the study of ecological changes related to shifting cultivation have been discussed with respect to climax forest and second-growth vegetation (Richards 1952; Symington 1933), specific crops and crop successions (Burkill 1955; Grist 1955), tropical soils (Popono 1959; Trappnell 1958), and critical carrying capacities (Allan 1949; Carneiro 1960; Conklin 1959b; van Klaveren 1958).

This sampling of the literature indicates a cumulative awareness of some of the more interesting problems, but relatively few of these have yet been dealt with thoroughly by ecologically-oriented field investigators working in an ethnographic context. Among the more complete published reports on specific systems of shifting cultivation are monographs by Lizkowitz (1951) for the Lamet of Laos, de Schlippe (1953c) for the Azande in Africa (cf. Tonder and Bergeroo-Campagne 1956), Freeman (1955) for the Iban of Sarawak, Conduminas (1957) for the Mpong Gar of Vietnam, and Conklin (1957b) for the Hanunóo of the Philippines. No detailed study, however, has yet been based on more than one or two consecutive years of actual observation despite the fact that, with field-forest rotation, the agricultural cycle for any given swidden site is rarely completed in less than eight to ten years.

In tallying the numerous issues discussed and written about by students of shifting cultivation, I find that almost all the questions that have been raised eventually converge on the same problem area, within which two principal topics—population and productivity—are of primary interest. This is well illustrated by the extensive literature on pre-Columbian and contemporary Mayan agriculture. In almost every report or interpretive discussion, there are lengthy sections devoted to one or both of these central topics (e.g., Altschuler 1958; Bullard 1960; Bushnell 1958; M. D. Coe 1957; W. R. Coe 1957; Cowgill 1960; Emerson 1953; Hester 1954; Kempton 1953; Lundell 1953; Meggers 1954; Palerm and Wolf 1957; Perez Toro 1946; Popono 1960; Sanders 1957; and Stadelman 1940). Considerable controversy often accompanies the discussion of these issues, partly because accurate estimates of the desired quanta are neither easily made nor readily verified.

Some of the specific difficulties encountered in field research designed to investigate swidden productivity in terms of crop yields and labor efficiency include: (1) extensive intercropping; (2) the usual lack of cadastral surveys and census or agronomic data in swidden regions; (3) the common necessity of checking all sites on foot, making even simple periodic checks extremely time-consuming and sometimes impossible; (4) the widespread disinclination of swidden farmers to divulge precise or even approximate figures as to the extent of their own recent plantings or harvests; and (5) the prevalence of ritual taboos which prevent the charting or measurement of plots containing sacred crops.

On the other hand, where intimate contact with swidden cultivators has already been established, valuable field investigation of factors determining costs and yields is possible, and adequate techniques of indirect as well as direct checking can be devised. The opportunity to carry out this type of continuous, first-hand study of swidden farming economy frequently falls to the anthropologist.

Under such conditions, field research is facilitated by an awareness of the ecological and cultural matrix within which swidden activities take place, and by the recognition of as wide a range as possible of problems faced by swidden cultivators at each stage in the agricultural cycle.

The three-dimensional diagram in Fig. 1 provides an ecologically-oriented frame of reference which I have found helpful in discussing such problems. The placement and relative width of the labeled bands subdividing each of the three visible faces of the diagrammatic cube are significant. A few words of explanation may

ECOLOGICAL DIMENSIONS OF SHIFTING CULTIVATING

Along the environmental axis, climatic factors refer to such conditions as moisture in its many aspects, temperature, air movement, and sunlight. Edaphic factors relate to general soil conditions including parent material, fertility, porosity, texture, relief, and drainage. Biotic factors pertain to floral and faunal components of the environment. Of these three general environmental categories, and under conditions of shifting cultivation, climatic factors are least amenable to cultural control or change, in contrast to biotic factors, which are most highly correlated with cultural activity and which also contain the greatest number of discrete subdistinctions (e.g., particular plant types) which are important to swidden agriculturists. This explains the sequence and relative width of the general environmental divisions noted in the diagram.

Along the cultural axis, three distinctions are noted: technological, social, and ethnological. Technological factors refer to the ways in which the environment is artificially modified, including the treatment of crops, soils, pests, etc. In systems of shifting cultivation, these relationships are of primary importance and often exhibit great complexity; hence, the relatively greater width of this sector. Social factors involve the sociopolitical organization of the farming population in terms of residential, kin, and economic groups; etc. These factors are usually well within the domain of anthropological interest. Ethnological factors refer to the ways in which environmental components and their interrelations are categorized and interpreted locally. Failure to cope with this aspect of cultural ecology, to distinguish clearly between native environmental categories (and associated beliefs) and those used by the ethnologist, can lead to confusion, misinformation, and the repetition of useless clichés in discussing unfamiliar systems of land use.

The numerically labeled temporal distinctions refer to the five successive phases of swidden farming: selecting, cutting, burning, cropping, and fallowing. The first three phases involve the removal of old vegetation; the last two, the control of new vegetation. The wavy line separating phases 4 and 5 indicates that in any given environmental setting the relative duration of the cropping period may vary more than that of the preceding clearance phases. The proportionately greater width of the phase-5 band, the broken lines at one side of the cube, and the dotted extensions in the same direction, represent the longer, yet variable, periods of fallowing.

The special importance attaching to the temporal dimensions of the diagram stems from the fact that the study of swidden farming—more than that of permanent-field agriculture—must include the investigation of farming practices over extended periods of continuous cultural and environmental change. The dotted cube represents repetition of the cycle.

Once the range of locally significant variations along each of these dimensions has been worked out, one can frame questions more systematically—and at varying levels of generalization—about the interrelation be-
tween different ecological components of a given system. This approach can be illustrated by a very simple example. If one were to examine carefully the factors operative within that sector for which the diagram would suggest the designation "biotechnological relations during the burning phase," he might be led to ask such questions as: Are all forms of vegetation killed by cutting and by the intense heat of subsequent burning? If not, what are the assumed reasons? Natural coppicing, resprouting? Artificial protective covering? Firebreaks? Techniques of slashing and felling? Others? The answers to such questions are rarely found in the literature, but they may be of crucial importance in terms of the choice of a new swidden site and the nature of the succession of regrowth during the following period, which in turn may partly determine the length of the swidden cycle.

One cannot anticipate all significant avenues of field inquiry merely by being aware of these broad ecological dimensions. Even in the brief illustration just cited, considerable knowledge of the actual range of problems in swidden agriculture is presupposed. The extent of such problems, and of their varied solutions among different groups of swidden cultivators, is suggested in the following topical outline. This inventory of swidden activities, arranged largely according to the sequence of phases mentioned above and indicated along the temporal axis of the diagram, is designed primarily as an aid to future field research. The original content of this outline reflected primarily the patterns of Malaysian integral swidden farming (Conklin 1957b: 2–3) among those groups with which I am most familiar. It has been further augmented, however, by suggestions from the literature and from students of similar systems in other areas. For coverage of factors especially important in regard to partial systems of swidden agriculture, I have been less successful, though some published and manuscript questionnaires prepared by government agencies and by FAO have been helpful (e.g., Wind, et al. 1980–31: 1022–33; de Haan 1959: 1953–54).

**Topical Outline**

This composite outline of topics to be investigated in the study of shifting cultivation stems from diverse sources. It is not exhaustive or complete for any particular system. Nor does it provide a set of fixed rules for field research. It does comprise, however, an ordered listing of suggestive topics intended to draw the investigator’s attention to factors which have proven significant in some areas and which might otherwise be neglected. The first section of the outline deals with cross-cutting, general considerations which are not restricted to a particular stage in the swidden cycle. The succeeding sections are sequentially organized. Considerations implied throughout the outline, but not usually specified, include: (a) native categorization of relevant natural and cultural phenomena, (b) correlates, (c) incentives, (d) available alternatives, and (e) differential results.

0. General considerations
1. Site selection
2. Cutting
3. Burning
4. Cropping
5. Fallowing

0. GENERAL CONSIDERATIONS

0.1. Group
0.1.1. Identification (political, social, linguistic)
0.1.2. Larger group identification
0.1.3. Subgroups
0.2. Population
0.2.1. Size and distribution
0.2.2. Lowest density (population/total area)
0.2.3. Economic density (population/cultivable area)
0.2.4. Other demographic considerations (e.g., growth, depopulation)
0.3. Location
0.3.1. Spatial location
0.3.1.1. Of the area studied (geographic co-ordinates, including altitude)
0.3.1.2. Within the area studied (micro-geographical co-ordinates, including distances, elevation, etc.)

0.3.2. Temporal location
0.3.2.1. Time period(s) covered by study
0.3.2.2. Timing of specific events (date, duration)
0.3.3. Quantification
0.3.3.1. Measurement (including local measures of time and space [linear, area, weight, volume])
0.3.3.2. Enumeration (including local techniques)
0.3.3.3. Incidence (abundance in time and space)
0.3.3.4. Distribution (frequency in time and space)
0.3.3.5. Variation (range, reliability of estimates)
0.4. Environmental conditions (regional and local)
0.4.1. Climatic factors
0.4.1.1. Precipitation and humidity (moisture, available water resources)
0.4.1.2. Temperature
0.4.1.3. Wind (direction, velocities, seasonality)
0.4.1.4. Storms
0.4.1.5. Sunlight
0.4.2. Edaphic factors (soil and terrain conditions)
0.4.2.1. Relief (topography)
Elevation
Slope
Drainage
0.4.2.2. Soils (zones, types, etc.)
Parent material and age
Fertility (in terms of physical properties and nutrients)
Texture and porosity
Aggregation and compactness
Soil moisture
Subsurface macro- and micro-biology
0.4.2.3. Other terrain features
Outcropping of rock
Results of wind and water erosion
0.4.3. Biotic factors
0.4.3.1. Flora (local plant associations and successions in terms of their botanical and ethnobotanical composition)
Climax vegetation (e.g., rain forest, grassland)
Second growth vegetation
Swidden vegetation (including weeds)
0.4.3.2. Fauna (local forms of animal life in terms of their zoological and ethnozoological classification and importance)
   Wild fauna (especially swidden pests—insects, birds, other vertebrates, and mammals)
   Domesticated fauna (see 0.5.1.3)

0.4.3.3. Disease (types, prevalence, etc.)
   Plant and animal diseases (especially of domesticates)
   Human health and disease

0.5 Cultural setting
0.5.1. Technological factors
0.5.1.1. Crops (classification and handling of domesticated plants [and useful nondomesticates])
   Crop list (including nonswidden domesticates)
   Crop associations and successions
   Crop uses (seasonal pattern, preferences)
   Food (diet, meal pattern, relative proportions of various foods, etc.)
      Drink
      Technology
      Ritual
      Cash
      Other purposes

0.5.1.2. Tools (implements and techniques of use)
   Cutting implements (e.g., axes, adzes, knives, machetes, hoes; and sharpening devices)
   Digging implements (e.g., dibbles, planting and digging sticks, digging bars, picks, hoes)
   Carrying equipment and containers (e.g., nets, baskets, bags, lines, tubes, boxes, bins)
   Food crop preparation equipment (e.g., scrapers, strainers, sieves, slicers, pounders, grinders, mortars and pestles, presses, sifters, flails, winnowing devices, chopping blocks, and mats)
   Special harvesting equipment (e.g., reaping knives, cutting rings, climbing devices)
   Other movable equipment

0.5.1.3. Domesticated animals (classification and treatment)
   Kinds of domesticated animals
   Significance for swidden agriculture
      Traction and transport
      Feed requirements
      Crop damage
      Manure

0.5.2. Social factors
0.5.2.1. Property ownership and economic transactions
   Kinds of agricultural property (including land, crops, animals)
   Social significance of agricultural property
   Types of ownership and usage rights
   Establishment of new property rights
   Transfer of established property rights
      Inheritance
      Gift exchange
      Purchase/sale
      Lease
      Rental
   Settlement of disputes over property rights
   Loss of agricultural property by
      Theft
      Litigation
      Destruction
      Safeguards against losses
      Transactions involving agricultural products
      Within the local community
      Beyond the local community (including participation in external market economy)
   Other economic considerations

0.5.2.2. Labor arrangements
   Division of labor
   Overall swidden work pattern
   Seasonal distribution of labor
   Labor requirements (per task, per area)
      Man-hour input
      Energy input
   Labor arrangements within smallest economic unit
   Recruitment of additional labor (types, combination), by
      Obligation
      Request
      Exchange, of
      Equivalent labor
      Other services
      Feasts
      Payment (in crops, cash, other media)
      Task basis
      Time basis
      Other arrangements
   Loss of productive agricultural labor within the smallest economic unit
   Agricultural work outside the unit
   Nonagricultural activities
   Illness
   Other reasons

0.5.2.3. Local group organization
   General settlement pattern (including seasonal variation)
   Kinds of local groups (including social composition)
      Domestic units
      Settlements
      Larger units
   Internal relations of local groups
   Interrelations between local groups
   Settlement location with respect to cultivated swidden
   Permanency of settlement location

0.5.2.4. Social structure
   General pattern of kinship and social relations (including principles of affiliation and descent)
      Family organization
      Larger social groups within the society
      Marriage and residence rules
      Patterns of authority
      Social stratification
      Local
      Within wider contexts
      Political organization
      Local
      Regional
      National

0.5.2.5. Contact
   General pattern of relationships with members of other societies
   Contact with other swidden farming groups
   Local contact with representatives of nonswidden-farming groups, including
      Hunters
      Traders
      Miners
      Foresters
      Lumbermen
      Cattlemen (herders)
      Homesteaders (settlers, land buyers)
0.5.2.5. Contact (Continued)

Surveyors
Swidden laborers (from other societies)
Missionaries
School teachers
Government officials (including the military)
Agricultural extension personnel
Anthropologists
Others

Contact, in other regions, with non-swidden-farming groups
By performing labor in areas of permanent-field agriculture
By using, visiting, attending
Markets, stores
Schools
Government offices
Religious centers
Medical centers
By other means

0.5.3. Conceptual factors
0.5.3.1. Local interpretation of general agricultural activities, with regard to
Environmental relations
Group relations
Individual involvement
Motivation
Ideology

0.5.3.2. Local interpretation of ritual aspects of agriculture
Seasonal pattern of agricultural rites
Magical principles employed
Relations with supernaturals

0.5.3.3. Local interpretation of unanticipated swidden crises.

0.6. Change
0.6.1. Processual changes within the swidden cycle (see 1. through 5. below)

0.6.2. Environmental changes during the last decade (and during the last century) which have affected the availability and distribution of natural resources

0.6.3. Sociocultural changes of agricultural significance which have occurred during the last decade (and during the last century) and which involve:

0.6.3.1. New cultivated plants (annuals; perennials)
Food crops
Cash crops
Cover crops

0.6.3.2. New agricultural techniques
0.6.3.3. New domesticated animals
0.6.3.4. New markets
0.6.3.5. New roads
0.6.3.6. Immigration, emigration
0.6.3.7. Change in social structure
0.6.3.8. Combination of swidden farming with other systems of land use (e.g., grazing, plantation agriculture)

0.6.4. Correlation of local environmental and cultural changes with modification of external

0.6.4.1. Commercial interests
0.6.4.2. Administrative policy
0.6.5. Present trends and future possibilities

1. SITE SELECTION

1.1. Preliminary considerations
1.1.1. Land considered uncultivable, because of
1.1.1.1. Poor drainage
1.1.1.2. Limiting surface conditions (e.g., rocky, sandy, or eroded terrain)

1.1.1.3. Limiting vegetation (e.g., some grassland associations)
1.1.1.4. Religious taboos (e.g., sacred groves, cemeteries)
1.1.1.5. Other systems of land usage
1.1.2. Variables considered within cultivable area (including preferences)

1.1.2.1. Distances from one’s own previous swidden and settlement sites
1.1.2.2. Distances from present swidden and settlement sites (including those other than one’s own)

1.1.2.3. Topography (including slope)
1.1.2.4. Exposure to sun and wind
1.1.2.5. Soil conditions
1.1.2.6. Type of vegetation
1.1.2.7. Ownership and previous use of land
1.1.2.8. Anticipated labor requirements
1.1.2.9. External considerations (e.g., government restrictions, crop quotas)

1.1.3. Timing
1.2. Procedures
1.2.1. Preliminary surveying (visits to potential sites)
1.2.2. Planning (including personnel and timing)
1.2.2.1. Informal discussions
1.2.2.2. Formal discussions
1.2.2.3. Resolution of conflicting interests
1.2.3. Ritual testing of site (e.g., by location augury)
1.2.4. Definitive surveying and marking of swidden site

1.3. Results

1.3.1. Selected sites (number, area)
1.3.2. Characteristics of swidden sites
1.3.2.1. Topographic orientation
1.3.2.2. Size (dimensions)
1.3.2.3. Shape
1.3.2.4. Divisions
1.3.2.5. Borders
1.3.2.6. Degree of separation from other swidden sites

1.4. Related Activities
1.4.1. Traveling, visiting, feasting
1.4.2. Shifting of residence or settlement site
1.4.3. Ritual observances

2. CUTTING

2.1. Preliminary considerations
2.1.1. Kind of vegetation at the site
2.1.1.1. Virgin growth (initial clearance)
2.1.1.2. Previously cleared

Climax growth
Second growth

2.1.2. Provision of necessary tools
2.1.3. Labor arrangements
2.1.4. Timing
2.2. Procedures
2.2.1. Rituals
2.2.2. Cutting low forest growth
2.2.2.1. Slashing of low undergrowth and small trees
2.2.2.2. Lopping of saplings
2.2.2.3. Removal of wood for construction (e.g., fences, dwellings)

Fuel

2.2.2.4. Spreading of cut debris
2.2.3. Cutting of high forest growth
2.2.3.1. Notching techniques
2.2.3.2. Felling of large trees

Scaffolding construction
Mishaps
Kickbacks
Snaps
Entanglements
3. BURNING

3.1. Preliminary considerations

3.1.1. Necessity of burning

3.1.2. Parts of site not to be burned (because of fruit trees, etc.)

3.1.3. Surrounding vegetation

3.1.4. Timing, in relation to

3.1.4.1. Kind of vegetation to be burned

3.1.4.2. Dryness of cut vegetation

3.1.4.3. Rains

3.1.4.4. Other signs

3.2. Procedures

3.2.1. Preparatory

3.2.1.1. Protective clearing
   Around productive plants
   Around swidden site

3.2.1.2. Protective covering of young plants and tree crops

3.2.1.3. Protective burning to prevent later escapes

3.2.1.4. Arrangements with cultivators of adjacent or neighboring swiddens

3.2.2. Main burning

3.2.2.1. Actual firing

3.2.2.2. Controlled burning

3.2.2.3. Uncontrolled burning

3.2.3. Reburning

3.2.3.1. Piling of incompletely burned debris

3.2.3.2. Secondary firing

3.2.3.3. Tertiary firing

3.2.4. Treatment of unburned logs and stumps

3.3. Results

3.3.1. Swidden sites completely cleared by fire

3.3.1.1. Ash cover

3.3.1.2. Modified soil conditions

3.3.1.3. Modified biotic conditions

3.3.2. Swidden sites not completely cleared by fire

4. CROPPEING

4.1. Preliminary considerations

4.1.1. Cropping pattern in terms of

4.1.1.1. Main crop focus:
   - Annual grains
   - Root crops
   - Tree crops

4.1.1.2. Main crop associations and successions

4.1.1.3. Environmental requirements of principle crop types

4.1.2. Labor requirements

4.1.3. Timing of initial planting, in relation to

4.1.3.1. Date of completed clearance (burn)

4.1.3.2. Seasonal climatic changes

4.1.3.3. Calendric agricultural rites

4.2. Procedures

4.2.1. Main planting

4.2.1.1. Rituals
   - Magical techniques
   - First planting rites

4.2.1.2. Preparation of soil
   - None, other than burning
   - Turning, digging, hoeing
   - Mounding
   - Ditching
   - Ridging
   - Terracing
   - Other techniques

4.2.1.3. Marking of swidden subdivisions

4.2.1.4. Handling of special features
   - Termitaria
   - Depressions
   - Stumps
   - Rocks
   - Others

4.2.1.5. Preparation of seed (of nonvegetatively-propagated crops)
   - Seed selection
   - Ritual seed
   - Nonritual seed
   - Mixing of seed (types combined)

4.2.1.6. Seed planting
   - Spacing and timing
   - Dibbling (or other) equipment and techniques
   - Seeding equipment and techniques
   - Individual placement
   - Dropping
   - Sowing (broadcast)
   - Ritual plot treatment
   - Protection of planted seed (from insects, birds, etc.)
   - Use of leftover seed
   - Replanting or transplanting

4.2.1.7. Preparation for planting of vegetatively-reproduced crops (e.g., root crops)
   - Selection of source plants
   - Storage and transport of parts removed

4.2.1.8. Planting of vegetatively-reproduced crops

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4.2.8. Planting vegetatively-reproduced crops (Cont.)
   Spacing and timing
   Use of planting sticks and other equipment
   Preplanting in moist area: later transplanting
   (e.g., taro)
   Ritual treatment

4.2.9. Interplanting of other annuals and perennials
   Spacing and timing
   Filling in a sparsely planted crop

4.2.10. Planting difficulties
   Seed shortage
   Labor shortage
   Delayed planting
   Failure to plant a burned site

4.2.2. Fencing
4.2.2.1. Need for fencing
   Domesticated and wild mammals
   Other reasons
4.2.2.2. Types of functional fencing
4.2.2.3. Types of token fencing
4.2.3. Guarding
4.2.3.1. Guarding maturing crops against
   Birds
   Monkeys
   Other animals not stopped by fences
   Theft
4.2.3.2. Watching techniques
   Tree lookouts
   Swidden shelters
4.2.3.3. Scaring techniques
   Scarecrows
   Manually-operated noise-making devices
   Wind-blow noise-making devices

4.2.4. Weeding
4.2.4.1. Weeding of swiddens to
   Prevent crowding; allow tillering, etc.
   Control rodent population
   Allow for continued intercropping
4.2.4.2. Types and techniques of weeding
   Pulling up weed sprouts and seedlings
   Cutting back herbaceous growth
   Digging out herbaceous growth
   Cutting down coppice shoots from live stumps, etc.
4.2.4.3. Weeding stages
4.2.5. Ritual and other techniques for crop protection from:
4.2.5.1. Wild animals
   Hunting techniques
   Trapping techniques
4.2.5.2. Insects
   Use of fumigants
   Use of smudges
4.2.5.3. Lodging due to wind
   Shielding
   Bending
4.2.6. Care of maturing crops
4.2.6.1. Thinning, pruning
4.2.6.2. Mulching
4.2.6.3. Manuring
4.2.6.4. Digging or hoeing
4.2.6.5. Irrigating
4.2.7. Main harvesting
4.2.7.1. Rituals
   Magical techniques
   First handling of mature crops
   Special harvesting taboos
4.2.7.2. Preparation of harvesting equipment
   Cutting or digging implements
   Gathering containers
   Carrying containers
4.2.7.3. Harvesting procedures
   Spacing and timing
   Cutting, picking, or digging techniques
4.2.7.4. Carrying in of harvest
4.2.7.5. Yields
4.2.7.6. Preliminary treatment of harvested crops
   Distribution of shares
   Threshing
   Drying
   Other
4.2.7.7. Main harvest-ending celebration
4.2.8. Storing of crops
4.2.8.1. Rituals
4.2.8.2. Division of crops for storage
   Seed for planting
   Crops for local consumption
   Crops for sale or trade
   Crops for ritual use
4.2.8.3. Techniques of storage
   House storage (in rafters, tubes, baskets, etc.)
   Storage in special structures
   Granaries
   Caches
   Racks
4.2.8.4. Storage difficulties
   Spoilage
   Damage by animal pests
   Theft
4.2.8.5. Handling of unusually abundant crops
4.2.9. Cleaning of swidden site
4.2.9.1. Secondary harvesting (rereaping, gleaning)
4.2.9.2. Cleaning and weeding of swiddens
4.2.9.3. Cultivation of remaining intercropped plants
4.2.10. Secondary cropping
4.2.10.1. General pattern
   Incentives
   Spacing and timing (especially of planting and harvesting activities)
   Crop associations
   Specific crops
   Relative yields
4.2.10.2. Dry season cropping of annuals (e.g., maize) and ratooning perennials (e.g., sugar cane)
4.2.10.3. Continued and extended cropping of perennials
   (e.g., root crops, bananas)
4.2.10.4. Wet season recultivation of annuals
4.3. Results
4.3.1. Cultivated swiddens
4.3.2. Fallow swidden sites (see 5.)
4.3.2.1. Unfinished swiddens (i.e., cleared but unplanted sites)
4.3.2.2. Sites from which most cultivates have been removed
   Beginning of succession to cultivable (desired) form of second growth vegetation
   Beginning of succession to uncultivable type of vegetation (often grassland)
   Factors fostering this succession
   Local deterrent factors
4.3.3. Harvested crops
4.4. Related activities
4.4.1. Planting and cropping activities outside the main swiddens
4.4.1.1. In old swiddens
4.4.1.2. In houseyards
   Plots for medicinal, ritual, ornamental, spice, or supplementary food plants
   Experimental plots
   Children’s play swiddens
4.4.2. Processing of harvested crops
4.4.2.1. Food products
5. FALLING

5.1. Preliminary considerations
5.1.1. Necessity of falling
5.1.1.1. Excessive weed growth (evidence)
5.1.1.2. Soil depletion (evidence)
5.1.1.3. Other reasons
5.1.2. Given factors influencing duration and quality of fallow
5.1.2.1. Original vegetation cleared
Selective cutting during clearance
Fire resistance of plant species
5.1.2.2. Kinds of second growth vegetation in region
Forest types
Scrub types
Grassland types
5.1.2.3. Dispersal of swiddens
5.1.2.4. Exposure of swidden site to wind-blowen seed
5.1.2.5. Previous burning of vegetation at the site
Time lapsed since initial burn
Repeated burning
5.1.2.6. Preferred vegetation for new swidden clearance

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The following bibliography comprises a selected list of more than 1200 references to books, articles, reviews, and some publicly-available but unpublished works which contain direct and significant statements regarding swidden agriculture. For purposes of this listing, an ethnographic report which states merely that such-and-such a tribe “practices slash-and-burn agriculture” or that the group raises “corn, beans, pumpkins, and chilies by the usual primitive farming techniques practiced in this region” does not constitute a significant reference, and therefore it is not included. On the other hand, I do include some borderline cases where information is provided regarding poorly documented areas. General works and textbooks containing only brief references to swidden cultivation are excluded, as are sources treating related problems (e.g., food, labor, crops, weeds, grazing, grass fires) but lacking any explicit statement regarding swidden activities. Though no other general restrictions—geographical or topological—are intended, many gaps undoubtedly exist. References to works in non-European languages are very few, and the literature on Southeast Asia and Malaysia is probably more adequately covered than that for other tropical areas. I would greatly appreciate having important omissions brought to my attention.

A number of specialized bibliographies, the coverage of which includes many of the specific interests of this paper, are listed below as regular entries (see especially Bartlett 1955, 1957a, 1961; Bergaw et al. 1940; E. E. Edwards 1942; Ford 1956b; MacLeish et al. 1940; and U.S. Department of Agriculture 1942—).

To save space, full entries are listed only once, and are arranged alphabetically by author. A terminal ‘x’ indicates a source particularly useful in preparing the Topical Outline above; a terminal ‘o’ indicates a source of probable importance but one unavailable at the time of this compilation. Inasmuch as many of the important general discussions of shifting cultivation and all of the actual field reports are regionally specific, the main listing is followed by a Geographical Index.


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