McGILL UNIVERSITY SAVANNA RESEARCH PROJECT
SAVANNA RESEARCH SERIES No. 8

CURRENT AGRICULTURAL PRACTICES AMONG THE WAIWAI

by

Ronald R. Dagon

McGILL UNIVERSITY SAVANNA RESEARCH PROJECT
ST. IGNATIUS, RUPUNUNI DISTRICT, GUYANA

DEPARTMENT OF GEOGRAPHY
McGILL UNIVERSITY
MONTREAL, P.Q., CANADA

July 1967

Technical Report No. 9

Project NR 387-020-Contract No. Nonr-3855 (00)
OFFICE OF NAVAL RESEARCH, GEOGRAPHY BRANCH

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ABSTRACT

In order to increase the knowledge of the effect of shifting cultivation upon the movement of the forest/savanna boundary, the author examined the shifting cultivation practices of a tribe well within the forest, south of the Rupununi savannas.

This preliminary examination of the Waiwai Tribe describes the settlement around Kanashen mission, and concentrates especially upon their methods of cultivation and the effect upon the surrounding natural forest vegetation. A list is given of the food crops grown as well as the livestock kept, and the importance of hunting and fishing is shown. Future developments in the Waiwai economy are suggested, and the problems of population pressure in an unfavorable ecosystem noted. A great need is seen for further investigation in this area.

FIGURES AND TABLES

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FOREWORD

The field research that led to this paper 'Current Agricultural Practices Among the Waiwai', was conducted as a contribution to the Savanna-Bush Environments Research project which has operated within the McGill University Savanna Research Project since May, 1962. The Savanna-Bush project is supported by the Geography Branch of the Office of Naval Research.

The M.U.S.R.P. is concerned with the nature of shifting cultivation in the Rupununi District of Guyana primarily because of its impact upon the vegetation and especially the position of the forest/savanna boundary of the region. In addition to the study of the shifting cultivation around the forest periphery of the Rupununi Savannas, it appeared essential to gain an understanding of those shifting cultivators located well on the forest side of the forest/savanna boundary: namely the Waiwai and associated tribes.

To that end the Project was fortunate in obtaining the services of Mr. Ronald R. Dagon, the co-operation of the field personnel of the Unevangelized Fields Mission at Kanashen, and the Missionary Aviation Fellowship in Guyana.

Kanashen is a particularly valuable study area in that the Waiwai are shifting cultivators living on the forest side of the forest/savanna boundary and are only now beginning to feel the impact of a developing Guyana. Such investigations will balance the detailed investigations of the savanna ecosystem currently underway in the Rupununi. The material gathered to date is presented in this preliminary form because of the current interest being shown in the Rupununi District by a variety of workers in many disciplines.

Theo L. Hills
Director
McGill University Savanna
Research Project

Fig. 1

Principal place names mentioned in the text.
--------- Indicates the south forest/savanna boundary.

PREFACE

On Friday, 18 November 1966, with the permission of M. L. Persaud, District Commissioner of the Rupununi, I flew south from Lethem, Guyana, on the Rio Takutu in a chartered Cessna 180 aircraft of the Missionary Aviation Fellowship (M.A.F.), to the landing strip of the Unevangelized Fields Mission (U.F.M.), at Kanashen on the upper reaches of the Essequibo River. An approximate course of 157° (magnetic) from the junction of the Takutu and Sawariwau Rivers provided ample opportunity to observe and photograph, from approximately 500 feet, the extent and nature of the south savannas of the Rupununi District, as well as the forest-savanna boundary. The return flight to Lethem was made via Gunn's Strip, an isolated savanna downstream from Kanashen and adjacent to the Essequibo. (See place names in Figure 1).

On Tuesday, 9 May 1967, a return visit was made to the mission and on Thursday, 25 May 1967, the trip was repeated for the third time. The return flight on this third trip gave an opportunity to observe and photograph the landscape and vegetation in the general vicinity of the headwaters of the Essequibo and New Rivers, as well as the landscape between the Essequibo and Rupununi Rivers on the northern and eastern slopes of the Kanuku Mountains. Observations from these flights, as well as detailed ground investigations, will form the basis of an extensive separate report on the vegetation of the Rupununi District.

The gathering of the information reported here was only made possible through the continued courtesy and cooperation of director Bob Hawkins (U.F.M.), and the interest and skill of pilot Herb Morgan (M.A.F.).

Ronald R. Dagon.

TABLE I. A breakdown of the current population of the five-village complex at Kanashen by sex and age-class (all figures as of 8 May, 1967 - the seven members of U.F.M. and their families are not included in the table).

	Sex		
Age-class	Male	Female	Sub-total
- 1	13	21	34
1 - 5	76	60	136
6 - 12	45	49	94
13 - 18	13	35	48
19 - 29	52	37	89
30 - 45	56	44	100
46 -	15	12	27
		TOTAL	528

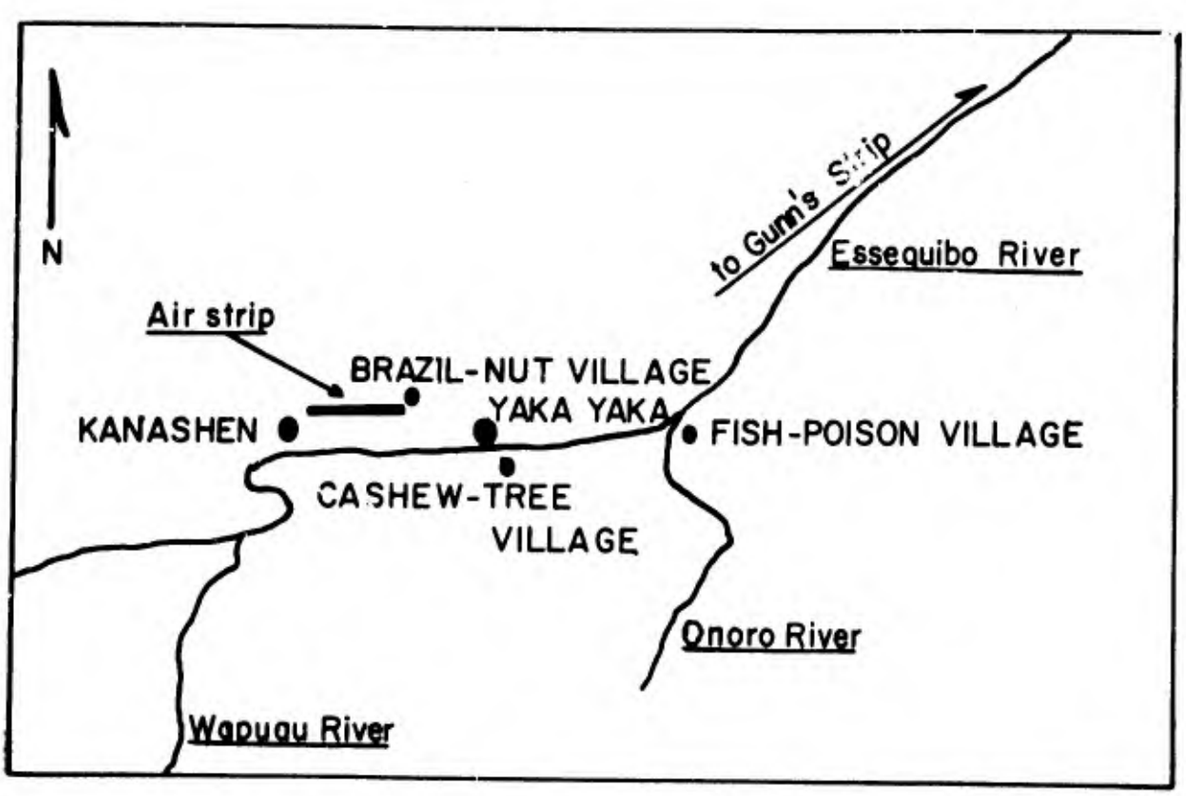


Fig. 2

The five-village complex at the Kanashen mission on the upper Essequibo River.

SETTLEMENT AND POPULATION

Kanashen is but one of five villages forming a close complex along the Essequibo River in the general vicinity of its junction with the Wapuau and Onoro Rivers at approximately 1°30' North, and 58°40' West, (see Figure 2). The proximity of Kanashen to the river bank and the village's relationship to its principal areas of cultivation is clearly indicated in Figures 3, 4, and 5. The population has grown from some 46 to 528 Amerindians since 1949 when the director of the Unevangelized Fields Mission first entered the area. This count of 528 as of 8 May 1967, represents an increase from about 430 since my initial visit in November 1966. In November 1966, the population of Kanashen and Yakayaka was some 150 each with the remainder split between the smaller Brazil-Nut, Cashew-Tree, and Fish-Poison villages. Many of these Amerindians had come into the mission from Brazil, (exact numbers unknown), and this has happened again quite recently. In addition to a rising birthrate, the numbers were increased by the arrival in January and February 1967 of 75 Katawina and 7 Cikiyana Indians from deep in Brazil, and if the anticipated arrival, at the end of the rainy season, of an additional 100 Indians from Brazil does materialize, the population could exceed 700 by the end of 1967.

Because of this tremendous increase in population and the desire of many of the Waiwai to move their houses off the silt and clay banks to better-drained areas of sandy soils, it is expected that the focal points of the village locations, shown in Figure 2, might well shift during the coming year. Furthermore, it is also anticipated that the mission staff will somewhat decentralize rather than continue to concentrate in Kanashen proper. After the end of the current rainy season, the Katawinas will establish a village and cultivation sites downstream from the existing complex in the area between Gunn's Strip and the junction of the Kassikaityu and Essequibo Rivers. Some of these potential fields had already been selected and clearing begun at the time of my most recent visit. A breakdown of the present population of this five village complex by sex and age-class is presented in Table I, (the table does not include the mission staff and their families). The effect of continually improving medical care and an adequate programme of sanitary measures is clearly reflected in these figures. Note that 50% of the total population is now less than 12 years old.

CLIMATE

There is at present little climatic data available for the area, but daily rainfall is now being recorded, as well as 24-hour maximum and minimum temperatures, (only a lack of equipment, not interest, prevents the keeping of more extensive records). There is in general a rainy season from April through August and a somewhat dryer season (lower precipitation but high relative humidity), from October through to late March. Records available to date show an average rainfall of some 115" per year with most of this, (75-80%), falling within the rainy season. Brief local showers can be expected throughout the year. Average yearly maximum temperatures are in the neighbourhood of 90° and minimum temperatures approach 70°. It has been suggested that there are many days during the rainy season when the sun

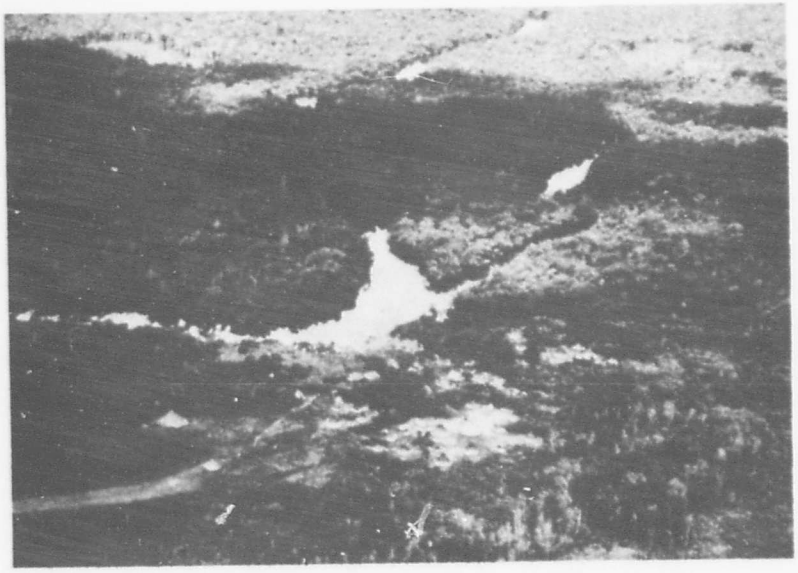


Fig. 3
The village of Kanashen on the north bank of the upper Essequibo River. The west end of the airstrip is visible on the left side of the photo; cultivated fields begin the right and lower edges of the photo.

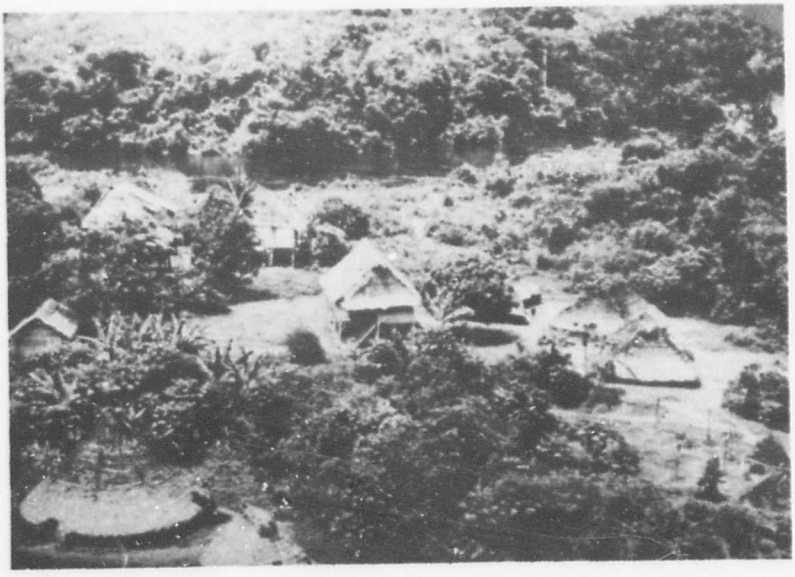


Fig. 4
A closer view of a portion of the village of Kanashen with the Essequibo River in the background. Mango, plantain, and a variety of citrus trees can be seen adjacent to the houses. The mission staff homes are easily identified from their rectangular shape and their construction upon stilts - an innovation that has only recently been accepted by the Wai-Wai with the construction of one Amerindian home on stilts in November 1966 and one currently under construction.

is rarely seen, but in spite of the very heavy lower cloud cover during the rainy season and the normally scattered cloud cover throughout the year, the sun is seen, if only for short durations, on nearly every day of the year. A river level gauge on the Essequibo, belonging to the Department of Works and Hydraulics, is also read daily and reported to Georgetown.

SOILS AND VEGETATION

The immediate area of interest which lies adjacent to both the north and south banks of the Essequibo River, is relatively unknown in terms of its geology, geomorphology, and most critically, the nature of its soil and soil development. The topography of this area, bounded generally by the Essequibo River and Amuku Mountains to the south, (cultivation occurs on both sides of the river) and the Kamoa Mountains to the northwest, is greatly dissected with very steep slopes. Many of the areas between ridges remain flooded throughout the year and support dense stands of palms (primarily Euterpe and Mauritia sp.). Granitic outcrops on hills of considerable size, 1500 or more feet above sea level, are in evidence adjacent to the mission area and further north in the Kamoas. Local hilltops are dominated by lateritic sands and gravels (bright red-yellow in colour), while adjacent to the village proper nearer the river's edge, the soils are heavy grey clays underlain by red and white mottled clays. With the exception of Gunn's Strip, an isolated "natural" savanna, some eight miles northeast of Kanashen and just south of the junction of the Kassikaityu and Essequibo Rivers, the entire area surrounding this village complex is covered by high bush (rain forest), or a rain forest/swamp forest matrix. Fanshawe indicates on his vegetation map of British Guiana (1952)* that the entire area falls under the montane rain forest classification, but the area has been little studied. It is within this general area south of the Essequibo that a subtle transition begins towards what must be regarded (at least on a physiognomic basis) as true tropical or Amazonian rain forest. Regardless of terminology applied, this forest has a dominant canopy of primarily evergreen trees at a height of some 30 meters with emergent trees, often clumped, reaching to 35-40 meters. It is generally three-layered, considering only woody erect species, with a lowerstorey at some 15-20 meters and an understorey at 3-5 meters. There are conspicuous numbers of deciduous and/or semi-deciduous trees in the canopy and among the emergents. Epiphytes and lianas are present in varying degrees, palms often form a major part of the lower- and understories and the larger trees are often buttressed. A generalized profile of this forest is shown in abstract form in Figure 6. Among the genera recognized as part of the canopy layer in the immediate vicinity of the mission were Protium, Macoubea, and Eschweilera.

The general relationship of a typical field under cultivation, to the topography at Kanashen, is shown in Figure 7. Soil samples were collected at the sites indicated in the figure, and a detailed analysis of these samples should be available in the very near future through the courtesy of the Minister of Agriculture, Guyana; Ken Rutherford, Queen's University, Kingston; and Barbara Metzger, Rutgers, The State University of New Jersey. It is now anticipated that these soil samples will be repeated over a two-year period at three to four-month intervals in order to follow changes in structure and nutrient levels associated with the cultivation of these particular fields. In appearance, colour, and structure, these soils bear a marked resemblance to those of the savannas further north in the vicinity of Aishalton.

* See Bibliography

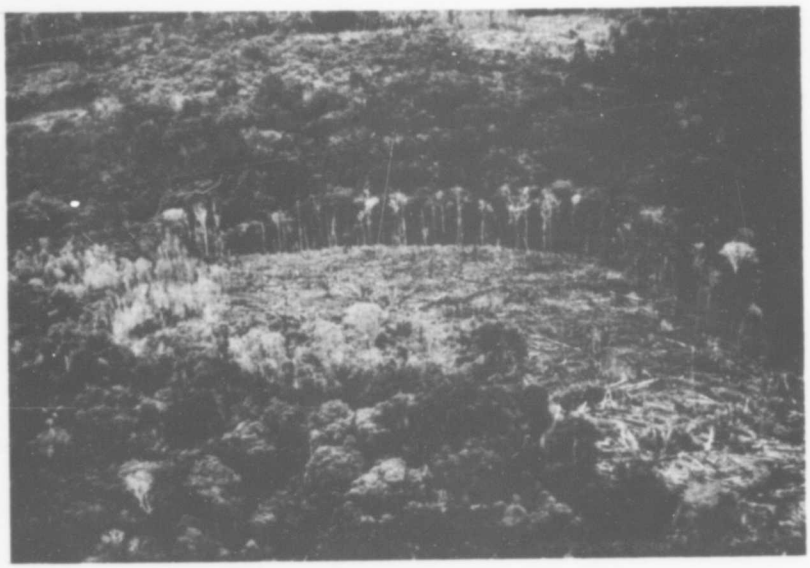
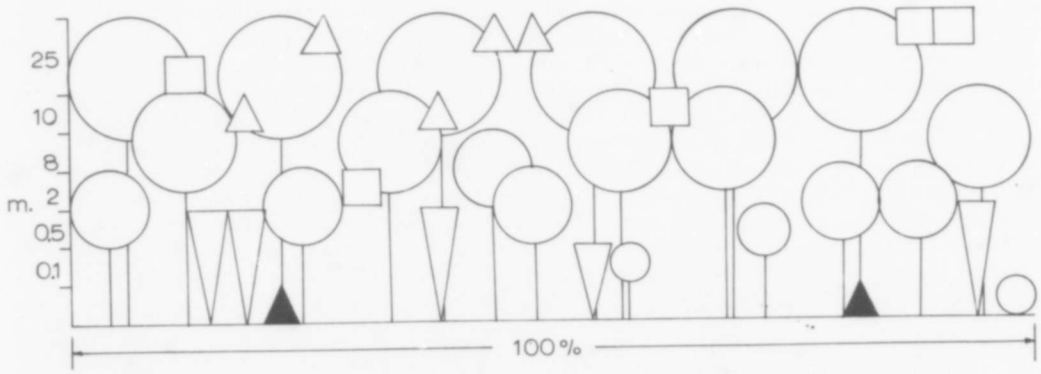


Fig. 5
A new field in the vicinity of Kanashen surrounded by montane rain forest (some 85-100 feet in height). The field is approximately 2-3 acres in size and was cut, burned, and will be cultivated by several families.



LEGEND

O Erect woody plants

□ Climbing or decumbent woody plants (lianas)

△ Epiphytes

▽ Herbs

Fig. 6
A generalized profile of the forest (high bush) in the immediate vicinity of the village of Kanashen - the profile shown in an abstract form. The symbol (▲) indicates a buttressed stem.

AGRICULTURE

Food Crops. The principal food crop of the Waiwai remains cassava (Manihot esculenta) and the fields observed (Figure 8) give a general impression of reasonable production at least compared to fields observed along the forest-savanna boundary in the north. The pattern of agriculture is somewhat typical of shifting cultivation throughout the Rupununi District in that the high bush is cut, burned in situ, and then cassava is planted in irregular rows with other miscellaneous crops inter-planted, or planted, on the lower field fringes. As has been previously noted by other workers, only the bitter varieties of cassava are planted by the Waiwai and one must turn to the work of Jens Yde (1957)* for an explanation which is based primarily on the assumption that the Waiwai have been so isolated until quite recent times, that sweet varieties of cassava have not yet been introduced. Yde also attempts to distinguish the Waiwai from other Amazonian tribes on the basis of division of labour between sexes and considers that, due to the active role men play in this agriculture, the Waiwai are on the verge of a transition from semi-agriculture to full-agriculture. It is beyond the scope of this report to delve into this particular aspect of Waiwai agriculture, but any evaluation of such a transition must certainly take into account the stabilizing influence of the mission itself and the examples created by the mission staff. More difficult to assess, but nevertheless present, is the general spirit or pride which the Waiwai take in their individual achievements--again probably the result of the mission's influence.

One can state that there has been a definite shift from the principally hunting economy, described by Peberdy (1948)*, towards a more stable agriculturally oriented society, but hunting and fishing still have an important role among the Waiwai as will be noted further on. At the time of my initial visit, I was impressed by the size of some of the larger fields (12-15 acres), only to learn that these were village or community fields. On my last visit, I learned that many of the families have now decided to cut, burn, and cultivate individual fields--an apparent result of the desire to compete with their neighbours. It must also be considered that the agricultural success to date (measured by survival) is much more a matter of quantity produced, rather than quality, and this could easily establish a dangerous precedent in regards to long-range planning.

Unfortunately, one must suspect that the practice of agriculture in and around Kanashen is treading on a very thin line of success, and serious disaster might occur for a variety of reasons. One, the problem of low soil fertility in general cannot be escaped. Two, though it is most certainly advantageous to the role of the mission to continue to attract and concentrate people into villages, the population increase has been much more than expected while the general area of suitable cultivation remains roughly the same. Thirdly, because of the restriction imposed by the size of the area suitable for cultivation, the cycle between use and re-use of any given field is being considerably shortened to often 4-5 years of fallow. Erosion in sites of cultivation is, in general, quite severe. The concept that the natural ecosystem (rain forest) with its multi-stratified structure is a more efficient and more suited system than the widely-spaced single layered cultivated crop,

* See Bibliography

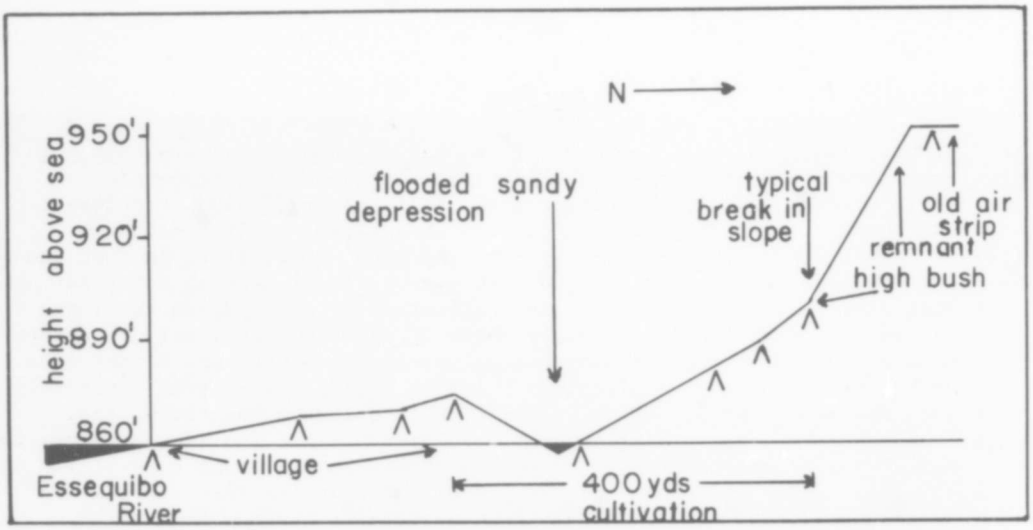


Fig. 7
General relationship of the cultivated fields to the topography and village location at Kanashen on the upper Essequibo River. The symbol (∧) indicates a soil-sampling site at which soil samples are to be collected at three or four month intervals over a two-year period.

Fig. 8
A typical field of bitter cassava (Manihot esculenta) at Kanashen. This stand is now ready to harvest after some 12-14 months of growth after which the field will be abandoned for a period of 4-5 years, recut, burned, and once again planted with cassava.

is most difficult to communicate. The idea that if land supports forest, it must surely support cultivation, is far from dead at Kanashen. The director and staff of the mission are not unaware of these problems and the addition of Rod Ketchem to the staff, to aid in development and agriculture, will most certainly be of some help, provided Ketchem can gain some support, technical guidance, and aid from outside sources. For example, the period from October 1966 to April 1967 was unusually wet and newly cut fields were not properly burned and therefore cannot be properly planted during this year. The effect of this cannot of course be evaluated until the following year when a possible shortage might well appear.

In Table II, I have listed the foods currently being cultivated by the Waiwai and given an indication of their present utilization. The fact that a listed food might be readily utilized by the Waiwai may be somewhat misleading since, as I indicated earlier, cassava is the mainstay in the diet. The classification of good or poor in the table, as regards production, was made by Rod Ketchem and certainly only reflects the current trend of crop production and is not indicative of any given field or particular year's growth. There has been a general lack of enthusiasm among the Waiwai for the citrus fruits which are plentiful and of excellent quality, but this attitude is slowly changing. One would think that, cabbage (Brassica oleracea), carrots (Daucus carota), cucumbers (Cucuumis sativus), and more importantly rice (Oryza sativa), could all be added to this current crop production with a fair measure of success. Seeds for the above, as well as for beets (Beta vulgaris), radishes (Raphanus sativus), borah or green snap beans (Phaseolus vulgaris), celery (Apium graveolens), several varieties of tomato (Lycopersicon esculentum), lettuce (Lactuca sativa). watermelon (Citrullus vulgaris), and okra (Hibiscus esculenta), were provided for Ketchem during my last visit at his request for experimental plantings. It is intended to continue to establish successful demonstration gardens in the hope that the Waiwai will then themselves start to cultivate and utilize a greater variety of food crops. Seed has also been provided through the Department of Agriculture for an experimental planting of ground-nuts or peanuts (Arachis hypogaea), a potential cash crop under government subsidy. This peanut crop might also well serve as a supplementary cattle feed and as "green manure" so urgently needed for other types of cultivation. Also utilized are Brazil Nuts (from Bertholletia excelsa), but these are either gathered from quite some distance into Brazil or north towards the Kamoa Mountains. The pulp surrounding the hard seeds of many of the local palms is also utilized and the seeds after soaking might well be considered as supplementary food for the livestock.

In addition to the plants cultivated for food, a variety of woody weed species are encouraged. These are utilized for everything from the manufacture of dyes and medicines to the production of a wide variety of fish poisons. In the time available, not all of the "protected weeds" listed by Yde (1957)* could be found; however several species of the genus Cecropia are prevelant around the village area and a few of the lianas utilized for fish poisons, Lonchocarpus sp. and Strychnos sp., were observed along several trails. Arrow-cane (Gynerium sagittatum) is encouraged along the stream and river banks where it rapidly forms

* See Bibliography

TABLE II. Cultivated food crops of the Waiwai at the village of Kanashen.

crop	plant growth - good (G) or poor (P)	used by Waiwai yes (Y) or no (N)
Cassava (Manihot esculenta)*	G	Y
Banana (Musa sp.)**	P	Y
Plantain (Musa paradisiaca)**	P	Y
Peas (Vigna sp.)	P	N
Beans (Vigna sp.)	P	N
Pumpkin (Cucurbita maxima)	P	N
Sweet potato (Ipomea batatas)	G	Y
Yam (Discorea sp.)**	P	Y
Corn (Zea mays)	P	Y
Sugar cane (Saccharum officinarium)	G***	Y
Cashew (Eugenia malaccensis)	G	Y
Rough Lemon (Citris medica)	G	N
Breadfruit (Artocarpus altilis)	G	Y
Lemon (Citrus lemon)	G	N
Lime (Citrus aurantifolia)	G	N
Mango (Mangifera indica)	P	Y
Pineapple (Ananas comosus)**	G	Y
Bell apple (Passiflora sp.)	G	Y
Squash (Lagenaria vulgaris)**	P	Y
Grapefruit (Citrus paradisi)	G	Y
Eddoe (Colocasia osculenta)	G	Y
Annatto (Bixa orellana)	G	Y
Pepper (Capsicum frutescens)**	G	Y
Arrowroot (Maranta arundinacea)	G	Y
Avocado (Persea americana)	G	Y
Pawpaw (Carica papaya)**	G	Y

* several varieties -- all bitter
** several varieties
*** often badly burned by local fire with resultant crop loss

dense stands often 3-4 meters tall. Auxiliary fields are cultivated both upstream from Kanashen in the vicinity of the Sipu River junction, and downstream in the vicinity of the Kassikaityu River junction, but the crops produced, primarily cassava and plantain, are used in situ during hunting trips and are not brought into Kanashen.

Livestock. At the time of my first visit, no cattle, sheep, or other domestic stock were being maintained by the Waiwai. Goats had once been introduced, but died after drinking cassava juice stored in the village houses. Then, in January 1967, three head of cattle were flown into Kanashen in three separate trips with a light aircraft (M.A.F.). These young cattle, brought from the St. Ignatius Livestock Farm on a purely experimental basis, are crosses between Jamaican Black and Zebu and should be well suited for the climate at Kanashen. This initial stocking included a young bull (310 lbs.), and two young heifers (275 lbs. each). The animals are being kept temporarily in a small corral at the east end of the airstrip until more suitable pasture can be provided. An additional shipment of three more heifers is anticipated at the end of the rainy season, but this cattle operation for some time to come will be purely on a trial and error basis.

The use of manure, other than on a very small scale for individual gardens, would appear to be beyond the capability of the currently planned livestock operation. Some six rolls of barbed wire have been purchased and the Department of Agriculture has provided some additional smooth wire, but clearing and fencing for pasture will be a considerable undertaking. These cattle, at the moment, seem to be doing quite well and are gaining weight. They appear to do best when permitted to graze freely throughout the village complex, but this procedure has brought complaints from Waiwai and mission staff alike. Care must also be taken to prevent these cattle from becoming pets, as many of the children are already thinking in these terms.

The poultry kept by the Waiwai are currently being used for eggs and a little meat, but to a very limited extent. The use of chickens for other than pets is relatively new and should most certainly be encouraged. Likewise, the number of chickens under production, currently 150-200, should be increased and eventually proper coop facilities provided and maintained.

Though hunting pressure is increasing in the general vicinity of the village due to the sheer increase of people hunting, predatory animals (jaguars, ocelots, pumas, and margay cats) are still present in sufficient numbers to be of serious concern to a fledgling livestock or poultry industry. The cattle, in particular, will have to be closely watched. Goats might well be considered for re-introduction, as long as they are kept away from cassava juice, since the previous introduction was a limited success, at least from a forage point of view. Apparently the goats subsisted entirely on young trees and woody shrubs -- all weeds. There are a multitude of ticks and flies that might cause some trouble for the cattle and similarly, close watch will be required to guard against problems with vampire bats (Desmodus rufus) which are quite plentiful around the station.

Use of fertilizers and improved grasses. The possibility of fertilization with normally available commercial products brought from Georgetown is extremely doubtful and in fact practically impossible at this time, due to transportation costs. Light aircraft with a payload of some 1000 lbs. are the only aircraft which can possibly land at Kanashen and the charter rate for such aircraft, added to the air-freight cost from Georgetown to Lethem, would raise the price of fertilizer by $0.25-0.30 (Guyana) per lb. -- most certainly a prohibitive cost. It is, of course, possible to reach Kanashen by foot, horse, or bullock from the south savannas in 10-14 days, or by a long and tortuous boat haul along the Essequibo, but these means are impractical for travelling or hauling bulk freight Larger aircraft, such as the DC-3 of Guyana Airways, can land at certain times of the year with some risk at Gunn's Strip (prior to 1957, this was the principal way of supplying the mission), but this is again economically unsound.

One possible solution to the low nutrient levels might be the use of a water soluble plant compound which would be rapidly taken up by the crop and not lost through leaching. In addition, these water soluble compounds would be much more economical to ship by air. Several experimental plots have been established in an attempt to evaluate NUTRO plant food crystals (analysis: total nitrogen 23%, available phosphoric acid 21%, and soluble potash 18%), a product of the Borden Chemical Company (USA), and if the results justify a greater expenditure, a larger experimental scheme to establish small pastures will be attempted in the fall of 1967. A very serious effort should be made to establish legumes, both in potential pasture sites and in a possible crop-rotation scheme, as "green manure". The variety of tropical grasses available from the Department of Agriculture should be fully exploited on an experimental basis. The excrement of the poultry kept by the Waiwai is another possible source of nitrogen.

The grasses which invade old sites of cultivation (some seven or eight species) are sour to the taste, some (Andropogon hirtiflorus and A. tener) are common on the fringes of south savanna bush islands, some are highly characteristic of poor or degraded soils, and most (I would suspect all) are low in nutritive value and, in general, are unpalatable to livestock. Supplemental feeding might be considered, but at present corn is one of the poorer crops cultivated by the Waiwai. The possibility of using fish as a fertilizer for corn was raised during my early visit, but in recent years fishing has been generally poor and the fish that are harvested are quickly utilized for food. Pangola grass (Digitonia decumbens) and tropical Kudzu (Pueraria phaseoloides) were both introduced in the early 1960's by the then resident Agricultural Officer at St. Ignatius, but both introductions have since died out. Another introduction, a tall rhizomous grass -- species unknown -- is producing very slowly and for the moment is of questionable value. Sweet potato (Ipomoea batatas) has escaped from sites of cultivation and makes up a considerable portion of the ground cover adjacent to the houses in the village proper.

HUNTING AND FISHING

Certainly supplementary to the cultivation, but still of considerable importance, are hunting and fishing which are somewhat seasonal in nature. One gathers that, not only are there serious seasonal variations in the availability of game, but that the continual increase in population makes game difficult to find in the general vicinity of the village complex. It is possible that the catch of fish could be vastly increased by a marked improvement in the methods of capture, e.g. the use of gill nets, fyke nets, improved design of fish traps, etc. The use of poisons results in the waste of large numbers of small fish which escape capture but die, and I would suspect that this often indiscriminate poisoning is having serious long-range effects on breeding. Among the more common larger species utilized for food are the lukanani (both Cichla ocellaris and C. temensis), the tigerfish (Pseudoplatystoma fasciatum), the paku (Metynnis sp.), and the haimara (Hoplian macrophthalmus). There are at least two species of caiman found in the upper Essequibo (Caiman crocodilus and Melanosuchus niger), but it is the spectacled caiman (C. crocodilus) that is commonly hunted and utilized for food. The much larger black caiman is seldom seen and is apparently well on its way to extinction. A large variety of both poisonous and non-poisonous snakes are common and often killed, including the anaconda or water camoodi (Eunectes murinus), but they are never utilized for food although on occasions they have been used for fish bait.

The tremendous bows and long arrows (7-8 feet long and made from the arrow-cane G. sagittatum),for which the Waiwai are so well known, remain the principal means of killing game even though there are now some 70-75 shotguns in the village complex. The availability of shells to each hunter is restricted to roughly one half-dozen per month, a restriction necessitated by the problems of aerial supply, but also a restriction which serves to maintain the basic hunting skills at a high level (a skill notably lost among the majority of Amerindians living in the savannas).

Among the birds hunted for food, the most common are the Powis (Crax nigra), macaws (Ara and Anodorhynchus sp.), the Marudis (Penelope sp.), and toucans (Ramphaston sp.). However, any bird from the size of a hummingbird (Trochilidae and Topoza sp. among many others), or parakeet (Psittacula sp.) upwards is considered to be fair game for the pot and is hunted by any boy large enough to pull a small (24-inch) bow. Because of the tremendous variety involved, many species were not identified in the time available to discuss hunting with the Waiwai or missionaries. Any monkey is hunted and eaten, from the howler and the woolly(Alouatta and Lagothrix sp.) to the spider monkey (Ateles sp.). The tail of the woolly monkey is used in the manufacture of a "duster" sold as a curio.

Other mammals hunted and eaten include both the grey and red brocket (Mazama nemorivaga and M. americana), llaba (Cuniculus paca), agouti (Dasyprocta sp.), tapir (Tapirus terrestris), peccary (both Tayassu tajacu and T. pecari), and several species of armadillo (Priodontes and Dasypus sp.). The sloth (Bradypus tridactylus) is seldom seen, but when the opportunity arises, it is

Fig. 9

A group of Wai-Wai children with one of the young Wai-Wai teachers. These children take a tremendous interest in any visitor and are eager to help in any way they can and like children everywhere expressed a great interest in photographs of the author's children taken in the United States.

hunted and eaten. Actually, the only mammals not utilized for food, other than the predatory cats, are the woolly opossum (Caluromys philander) and one animal described in such a manner that it most certainly is of the family Procyonidae and is most likely either the coatimundi (Nasua nasua) or kinkijou (Potos flavus).

FUTURE DEVELOPMENTS IN THE ECONOMY OF THE WAIWAI

The practice of selling a limited number of artifacts through outlets in Georgetown, as well as the hides of predatory cats, brings some money into the villages. It is not a great amount of money, in the order of $3,000, Guyana, per year, but is sufficient to purchase such items as cloth, knives, tools, shotguns, etc. The need to increase the amount of cash input without lowering the quality of the product is of major concern. The employment of some of the Waiwai by the Rupununi Development Company to help open a cattle trail from the south savannas across the Essequibo, New, and Corentyne Rivers into Surinam, temporarily bolstered the economy but, of course, this was a one-time operation and plans to use the trail for cattle have since been abandoned by the Company. An interesting sidelight is that the trail itself is being maintained over a good distance by hunting parties and as a result is in better condition today than when it was originally cut as a cattle trail. A small-scale balata operation is now under way -- the gum of the bulletwood tree (Manilkara bidentata) is to be gathered at Kanashen and then flown out by the light aircraft of M.A.F. A power-saw and a power-tiller are now in the village and some consideration is being given to the purchase of a small tractor and appropriate accessories.

Unfortunately such modern devices will not necessarily help with the fundamental problems of soil structure and nutrient manipulation. Indeed the effect may be just the opposite -- excessive tilling may hasten the leaching process, accelerate erosion, etc. These are very pressing problems for, although at present agricultural production is meeting local demands, the operation is certainly marginal and the birth rate is rising continuously.

Some immediate and relatively inexpensive steps can be taken in regard to agriculture, e.g. the use of fallen trees placed perpendicular to the slope to reduce erosion and to create terraces, the re-introduction of goats, the expansion of the poultry operation, the planting of rice and ground-nuts, the establishment of a suitable legume, etc. In addition and most importantly some imaginative thinking and long-range planning is imperative to insure survival of this rapidly growing village complex. Serious consideration should be given to the development of fish-rearing ponds, to a soil survey in the foothills of the Kamoa and Amuku Mountains, to the development of a cottage industry and possible decentralization of the village complex itself. Finally, it is to be hoped that outside interest in this area will continue in order to help solve many of the problems raised by the encroachment of a massive village complex on a generally unfavourable natural ecosystem.

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13 ABSTRACT

In order to increase the knowledge of the effect of shifting cultivation upon the movement of the forest/savanna boundary, the author examined the shifting cultivation practices of a tribe well within the forest, south of the Rupununi savannas.

This preliminary examination of the Waiwai Tribe describes the settlement around Kanashen mission, and concentrates especially upon their methods of cultivation and the effect upon the surrounding natural forest vegetation. A list is given of the food crops grown as well as the livestock kept, and the importance of hunting and fishing is shown. Future developments in the Waiwai economy are suggested, and the problems of population pressure in an unfavorable ecosystem noted. A great need is seen for further investigation in this area.

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