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Subject: Some Examples of Limiting Factors Affecting Field Work Productivity In East Africa

To: Robert E. Perdue, Jr., Chief
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To make judgements on how much time is required to conduct field work in Tanzania involves many variables that are difficult to sort out. Although we both see the usual same kinds of problems, I feel that it is necessary to review some of the limitations.

Collecting

I will assume that:

One VW bus will be the field vehicle.

A maximum of 20 laborers can squeeze into the field vehicle.

Twenty laborers will collect, as an average, 100 pounds per day.

Stephen Muchai will be the botanist assistant

Two species have been selected from plants that I collected in Tanzania, 1973, to exemplify limiting factors affecting productivity.

1.) Garcinia smeathmannii (Clusiaceae), sb: Found locally within a small isolated ravine forest surrounded by extensive grassland. Trees scattered, slender, 15-20 feet tall, 2-4 inches in diameter. One-half hour to drive 3 miles of dirt road and one mile on rough grassland (off road). About one hour to locate plant and verify its identification. About five hours for 12-15 laborers to cut and haul stems up to one-half mile from forest patch to vehicle. About two hours to debark stems at collecting site. About one hour to load bark, return to drying area and unload bark. The total weight was 85 pounds for 9 1/2 hours time.

An estimated 400-500 pounds of Garcinia bark may have been available in this small ravine forest. The natives, who recognized Garcinia, said G. smeathmannii was only available in this one ravine, which was within the area described by Perdue on his voucher specimen. It was not on Paget-Wilkes' list of plant collections from Mufindi, but Perdue had obtained one other general collection from another district (Rungwe District).

To collect 300 pounds of bark from the one forest patch using the vehicle and labor crew just described, it might require six days. The yield for each successive day might be as follows:

Day 1 - 85 pounds
Day 2 - 60 pounds
Day 3 - 50 pounds
Day 4 - 40 pounds
Day 5 - 35 pounds
Day 6 - 30 pounds

Total: 6 days - 300 pounds

Twenty laborers might obtain 300 pounds of Garcinia bark in five days.

A decreasing yield in quantity per unit of time is true with most plant collections. As more of a particular plant is eliminated, more time is devoted to walking and searching either because laborers have to go further away from the vehicle or the plant just becomes more scarce.

2.) Gnidia kraussiana (Thymelaeaceae) st-lf-fl-fr. Stems several to many, mostly herbaceous, arising from a swollen fleshy root, from one-two feet high. Common to abundant over extensive areas of some grasslands that have been recently burned. About 45 minutes to one hour to haul 20 men to collection site. Twenty men collected for three hours, then eight of the men loaded the vehicle and returned with me to the drying area. Later returned to pick up plant material and remaining 12 men who had continued collecting for four more hours. A total of 170 pounds was obtained in nine hours, of which nearly four of my hours were used in just driving the vehicle.

There was probably at least 2000 pounds of Gnidia kraussiana available at the one particular site. In contrast with Garcinia, a major limiting factor with Gnidia is not the plant (for a 500 pound sample) but the size of the vehicle used to haul laborers and plant material. With our kind of vehicle, it would take three days (170x3=510) to obtain the required 500 sample. Another difference is that it is easier to collect common plants of grasslands than common plants of forests.

Combining the collections of Gnidia and Garcinia with employment of 20 laborers, a total of 800 pounds might be obtained in eight days (100 pounds per day).

Excluding Acacia mearnsii and Tabernaemontana holstii (not needed), there are 22 other species listed in my memorandum dated September 14. The total weight of all needed samples is 6800 pounds, thus it might be assumed that it will take 68 days for African labor to collect this amount.

Plants that are likely to be problems because of abundance or identification are listed later.

Reconnaissance

In addition to possibly 68 days needed for collecting time for reconnaissance has to be considered. Initially a week or more could be spent looking over a select area. Some active species are likely to be readily identified while others may later be recognized during the collecting of large samples.

Also, it would help to have a driver, especially if only one botanist will be working in the field. The eyes of the botanist should be able to focus on plants rather than on the road. There is even a greater need for a driver at a time when samples are being collected in the field. When two or more trips are possible between the drying and collection sites, the botanist should remain at the collecting site in order to monitor the plants collected as well as to be able to observe other plants. In 1973 at Mufindi, I spent a great deal of my time as a truck driver, not as a botanist.

Drying

As far as I know, we presently do not have any field equipment in Tanzania. Plastic needed for drying samples has been a limiting factor during my previous trip to Kenya and Tanzania, especially along the coast where drying is slow. At Jilore in 1972 and 1973, I have had to stop collecting until other samples became dried and packed. However, with the kinds of samples now required from Tanzania, this may be less of a problem because:

> It often requires more time to obtain a 300 pound sample of one species than three - 100 pound samples of three species.
>
> With one exception, only one part of the plant is needed. On previous trips, two to three parts of a species were collected in bulk.
>
> Many of the samples are roots, bark, or twigs and not stems (ws-sb).

The distance in travel time (in your field vehicle) between your current drying area and future collection sites has to be evaluated along with

the weight of the sample needed. For example, it would be convenient to stay at Tanga to collect about six or more species available in the coastal bush and thickets within 30 miles north, west, and south (of Tanga). Many of the remaining forest species that occur at various intervals from 25-60 miles west of Tanga could also be collected. At the far extreme is Warburgia (300 pounds, sb). It primarily occurs in dry sclerophyllous forest in the northwest Usambaras about two or more hours drive (80 miles) from Tanga. Subtracting travel time between Magamba, West Usambara, and Tanga leaves about four hours for collecting Warburgia, which may give us about 50 pounds of bark per day.

On two to four or more occasions it may be necessary to set up drying areas. Each time you have to move drying beds means a four to nine day lag period in collecting. Drying conditions are optimum in September.

Shipping

Arrangements may have to be secured for two separate shipments, one for the Coast and the other for Mufindi. Tanzanians are very slow; thus, it may require a lot of our time in Dar-es-Salaam to insure that samples are properly packed and that other arrangements are finalized.

Species likely to be a limiting factor because of abundance.

These are plants rated in the 50 percent probable category. The yield rate in quantity is expected to follow that exemplified by Garcinia. Assuming that more than 300 pounds of the required plant part is available, it might take us an average of 4.5 days to collect 300 pounds.

Acalypha stuhlmannii (Euphorbiaceae)
Commiphora boiviniana (Burseraceae)
Millettia oblata (Fabaceae)
Monanthotaxis buchananii (Annonaceae)
Tabernaemontana ventricosa - Usambara Mountains but not Lake Manyara National Park (Apocynaceae)
Tacazzea galactogoga (Asclepiadaceae)

Species likely to be a limiting factor because of identification or depend on the presence of leaves, flowers, and/or fruits.

Acalypha stuhlmannii
Commiphora boiviniana
Gardenia jovis-tonantis (Rubiaceae)
Parinari curatellifolia (Chrysobalanaceae)
Tacazzea galactogoga
Monanthotaxis buchananii

Plants rated 67-90 percent probable.

Plants rated in the 90-99 percent category are, of course, not regarded as a problem for identification or abundance. Those in 67-90 percent category for 300 or 500 pounds are considered as possibility of being limited in abundance or problematical in identification. For example, Ximenia. When I later arrived at Jilore, many plants were leafless because of a long dry spell. Rains occurred at Jilore just after my arrival and within two weeks numerous species came into flower, Ximenia was one of these. The chances of finding Ximenia with either leaves or flowers appears to be better at the coast than in the highlands.

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cc: Arthur S. Barclay, Botanist