

A SIMPLIFIED LAND SUITABILITY CLASSIFICATION FOR TEA

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ABSTRACT:

A simplified method of classifying lands according to their suitability for the growth of tea is required for making decisions on diversification, replanting, management and conservation needs on existing tea lands. Previous attempts at land suitability/capability classifications for tea are discussed. The principles of a suitability classification in accord with current international thinking on the subject are presented. Four suitability classes are recognized according to the degree of limitation or hazard for the growth of tea. Subclasses are separated on the basis of the kind(s) of limitations present. A yield potential is assigned to each class. On the basis of these yield potentials, the expected yield under standard management are predicted for different fields of St.Coombs and St.Joachims Estates and compared with actual available data. The applications of this simplified system of land suitability classification to tea estates and the evaluations that can be made are discussed.

1. Introduction:

Classification of lands according to their suitability for the growth of tea will serve many purposes. Thus, when applied to uneconomic tea lands, it can be decided whether a particular tract of land is producing poorly on account of inherent unsuitability of the land for the growth of tea on the one hand or poor management, defective genetic material or some other reason on the other. Lands can be earmarked for diversification into other crops on the basis of such evaluations.

Decisions regarding the desirability of replanting lands with *abonal* tea and the order in which lands should be taken up for replanting can also be made from the suitability classification. Naturally, the lands which show the greatest return on the investment of replanting would be taken up first.

Programmes of infilling could be worked out in a similar manner.

A third area in which the land suitability classification for tea can be used is to measure management performance. Once the yield potentials for each land class under standard management has been assessed, the yield goals towards which the management should aim could be fixed for any tract of land or estate. The extent to which management is meeting these goals can then be easily determined.

The suitability classification of lands proposed here indicates not only the degree but also the kind of limitation or hazard for the growth of tea that exists on a given tract of land. A further use of the classification would therefore be to work out the conservation measures required to keep the lands at their present levels of suitability or improve them. The use of tea lands as a renewable resource which could be managed for sustained production indefinitely thus becomes easier to plan as the conservation needs can be predicted.

The first attempt to identify and classify regions according to their suitability for tea based on selected land characteristics was made by Panabokke (1970) who identified the main agro-ecological regions of the tea and rubber growing areas. While this gave a general assessment of the suitability of these regions for tea, no criteria by which a specific tract of land could be assessed according to its suitability for the growth of tea was given.

Smith (1971), working under the aegis of the FAO supported Agricultural Diversification Project, formulated specifications for a "land capability" classification of the Wet Zone as a basis for diversifying uneconomic tea and rubber lands into other crops.

Smith (*ibid.*) worked out a set of criteria based on limitations of climate, topography, soils and drainage according to which lands were classified according to their general capability for agriculture, including available <sup>annual</sup> ~~annual~~ crops, pasture, plantation crops and forestry. Unfortunately, as with all capability classification

this classification was too general and failed to take into account the unique requirements and characteristics of tea as a crop. It therefore did not lend itself to very precise or useful interpretations.

Desaunettes et al. (1974) proposed a methodology for land evaluation in the Wet Zone of Sri Lanka. This was based on division of the Wet Zone into pragmatically defined "major land systems" i.e. major physiographic regions. These regions were subdivided into physiographic units corresponding more or less to the classification of Smith (1971) mentioned above. The actual method of mapping was to study the distribution of land classes each physiographic unit and to extrapolate this distribution to cover each physiographic region. Unfortunately, this method was too complex to be applied by those not directly involved in the mapping itself, and also the sample areas needed to represent the physiographic regions kept increasing as the mapping progressed and new physiographic regions kept on being discovered.

De Silva (1978) outlined "a system of classification of land within tea plantations designed to suit development needs". This was based on a simple division of the well-drained land according to topography and quality of the soil (good soil and poor soil) and ill-drained land according to topography, ~~availability of land~~ availability of land and location. Recommendations regarding the diversification of units not suited to tea <sup>into</sup> with other crops and uses were also made.

The principles of a system of land suitability classification for Sri Lanka were proposed by De Alwis (1976) and have been adopted <sup>as</sup> on the basis of land suitability classifications for different uses by the Land Use Division. This system is in accord with the FAO Framework for Land Evaluation (1978) <sup>it</sup> the emphasizes the two-step approach in which the physical suitability classification precedes the final (economic) land evaluations.

In the present paper, a simplified version of this land suitability classification used by the Land Use Division is presented. The simplifications that have been introduced are reductions in the <sup>no.</sup> members of classes and sub-classes and dropping of the suitability unit. They are intended to facilitate rapid mapping by quickly trained personnel. This information is required very early to enable plantation managers and planners to make quick decisions on matters such as diversification and clonal replanting programmes.

## 2. Principles of the Classification:

The general principles underlying the land suitability classification as used here have been outlined by de Alwis (1976). "Land" includes the attributes of climate, landform (topography), soil, geology, hydrology, vegetation, microbial and <sup>and</sup> faunal population and past and present human activity. "Land classification" is the interpretive grouping of lands into units for a specific purpose. "Land suitability classification" is a special kind of land classification. It is a grouping of land into units whose behaviour can be predicted under a particular use and defined management. The particular use that was considered in this study was the growth of tea.

The assumption on which this simplified land suitability classification for tea are based <sup>are</sup> as follows:-

- (a) The classification is an interpretive grouping of land with respect to its potentialities and limitations for the growth of tea. It is not applicable to assessing land for other uses - for which separate suitability classifications are required.
- (b) The land suitability classification for tea is only a prediction regarding the behaviour of land under tea with defined levels of management. It will not necessarily reflect the present performance of tea on any tract of land.
- (c) A sustained high level of management but one that a majority of users are capable of attaining, is assumed. In this case, the implementation of the official recommendations of the Tea Research Institute is the management level assumed.

- (d) The land is classified according to its current physical features, not taking into account future improvements involving expensive investments (eg. major land levelling and stone terracing). The classification of a tract of land may change after such major improvements have been effected but will not alter as a result of improvements that are within reach of the average user.
- (e) Only physical factors contributing to or limiting productivity, or use of the land as a renewable resource are considered in this classification. Size of holding, location, transportation facilities, present management level, utilities and infrastructure, labour, prevailing market conditions etc. are not taken into account. While these factors are important in the economic evaluation, they do not contribute to the physical productivity of the land.
- (f) The same suitability groupings (suitability classes and suitability subclasses) apply throughout the country. But the criteria adopted in the major tea growing regions (up-<sup>country</sup> working, mid-country and low-country) differ slightly in some cases.
- (g) The suitability groupings<sup>s</sup> are based on our current knowledge and understanding of the factors that influence the growth of tea. As new information becomes available from research and actual use of the land and as technologies change, the groupings will alter. Ultimately, the yield levels provide the best measure of the effectiveness of the groupings.

The simplified land suitability classification for tea has four suitability classes. Lands <sup>in</sup> each class have the same degree of limitation or hazard for the growth of tea, the limitation or

hazard increasing progressively from class I to Class 4 as follows:-

<u>Suitability Class</u>	<u>Degree of limitation or Hazard</u>	<u>Suitability</u>
1	No significant limitation or hazard.	very suitable
2	Moderate single limitation or hazard.	Suitable
3	Moderate, non-interacting or mildly interacting, dual limitations.	Suitable
4	One or more severe limitations or strongly interacting, dual limitations <u>or</u> multiple, moderate limitations.	Unsuitable.

Classes 1, 2 and 3 are considered suitable for the growth of tea, in decreasing degrees. Class 4 is unsuitable.

Six suitability subclasses are recognized within each class. These subclasses indicate the kind of limitation or hazard for the growth of tea. The subclasses and their coding symbols are as follows:-

<u>Subclass</u>	<u>Symbol</u>
Climate	c
Slope	t
Rockiness	r
Soil depth	d
Soil group	g <sup>s</sup>
Gravel	g

All lands within the same subclass have roughly the same management and conservation needs. <sup>Lands</sup> ~~Lands~~ in Class I have no limitations or hazard for the growth of tea and therefore no subclasses. A tract of land in Class 2 can have only one subclass and would be designated 2d for instance if the limitations present is the depth of soil.

Lands in Class 3 can have two non-interacting or mildly interacting moderate limitations. A typical designation of a tract of land in Class 3 would be 3rs where moderate limitations of rockiness and soil group are both present.

Lands in Class 4 have either one or more severe single limitations, eg. 4t for a land which is too steep for the successful cultivation of tea, or strongly interacting dual or multiple limitations eg. 4td for a land in which both slope and soil depth are limiting.

### 3. Criteria for grouping land into subclasses and classes:

The criteria for grouping lands into subclasses are qualitative and consist merely of a recognition of the kinds of limitations or hazards present. As previously stated, lands with no limitations or hazards go into Class I ie. this class has no subclasses.

Criteria for grouping subclasses into classes on the other hand, should be defined clearly and as far as possible quantitatively in order to arrive a meaningful land suitability classification or land evaluation.

Tables 1a and 1b give the criteria for placing lands in classes and subclasses.

Tables 1a and 1b are only first approximations of the criteria based on presently available data and the <sup>pooled</sup> ~~proved~~ experience of many people active in tea planting or research. As more data become available these criteria may have to be refined.

TABLE 1(a)

Criteria for placing lands in Classes according to their suitability for Tea - single limitations.

Sub-Class (kind of Class (degree) of limitation)	Climate (agro-ecological region).	Slope (%).	Soil Depth (cm).	Soil type (great soil group).	Rockiness (%).	Gravel (Vol.% in top 90 cm).
		<u>Up-country</u>				
1 (none)	wu <sub>2-3</sub> , Iu <sub>2-3</sub>	0-25	> 90	ryp	0-10	0-10
2 (moderate)	Iu <sub>1</sub>	25-70	50-90	Earthworm infested ryp	10-20	10-50
4 (Severe)	All other up- country regions.	> 70	< 50	Hydromorphic clayey and eroded soils.	> 20	> 50
		<u>Mid-country</u>				
1 (none)	wm <sub>3</sub>	0-25	> 90	ryp	0-10	0-10
2 (moderate)	wm <sub>2</sub> & im <sub>2</sub>	25-55	60-90	rbl & ibl	10-20	10-50
4 (severe)	All other mid- country regions.	> 55	< 50	Hydromorphic clayey & eroded soils	> 20	> 50
		<u>Low-country</u>				
1 (none)	wl <sub>1</sub>	0-25	> 90	ryp	0-10	0-10
2 (moderate)	wl <sub>2</sub>	25-70	50-90	rbl	10-20	10-50
4 (severe)	All other low- country regions.	> 70	< 50	Hydromorphic clayey & eroded soils	> 20	> 50

TABLE 1 (b)

CRITERIA FOR PLACING LANDS IN CLASSES ACCORDING TO THEIR  
SUITABILITY FOR TEA-DUAL MODERATE LIMITATIONS (INTERACTIONS).

MODERATE LIMITATIONS.	CLIMATE	SLOPE	SOIL DEPTH	SOIL TYPE	ROCKINESS	GRAVEL
Climate	class 2	class 3	class 4	class 3	class 3	class 3
Slope	class 3	class 2	class 4	class 3	class 3	class 3
Soil depth	class 4	class 4	class 2	class 3	class 3	class 4
Soil type	class 3	class 3	class 3	class 2	class 3	class 3
Rockiness	class 3	class 3	class 3	class 3	class 2	class 3
Gravel	class 3	class 3	class 4	class 3	class 3	class 2

4. Yield potentials of different classes:

Ultimately, the best evaluation of the physical suitability of land for tea under given management is done by the tea crop itself. The suitability is then reflected in the yield. This makes it possible to assign a yield potential of tea for any class of land, under defined management. Table 2 gives the yield potentials assigned to each suitability class on the basis of data available and estimates of performance where no data are available.

Table 2. Yield potentials of tea in different suitability classes.

Suitability Class.	Yield potential(kg/ha)		
	Up-country	Mid-country	Low-country
1	> 2750	> 2500	> 3750
2	2250-2750	2000-2500	2250 -2750
3	1750-2250	1500-2000	1750- 2250
4	< 1750	< 1500	< 1750

\* Management according to T.R.I.recommendations.

Tables 3 and 4 show a comparison between yields expected on the basis of these yield potentials and some yields actually obtained at St.Coombs and St.Joachim's Estates. The discrepancies between expected and actual yields are reasonably small in most cases at St.Coombs. The larger differences are explainable on the basis of the fact that parts of these fields are under experimental plots, and also only average yields for each class rather than the range are considered. Where larger values are obtained(as in field No.16)than the predicted values, this could be due to levels of management at the upper end of the range in each class.

TABLE(3)

ST. COOMBS ESTATE DISTRIBUTION OF SUITABILITY CLASS AND  
COMPARISON OF EXPECTED AND ACTUAL YIELDS.

FIELD NO.	AREA (UNDER CULTIVATION) (Ha)				TOTAL	EXPECTED AV YIELD KG/Ha.	ACTUAL AV YIELD KG/Ha.
	CLASS 1	CLASS 2	CLASS 3	CLASS 4			
1	5.53	1.37	-	2.54	9.44	2375	2020
2	2.00	0.72	-	0.64	3.42	2450	1820
3	9.83	4.66	0.28	3.61	16.38	2550	2255
4	5.40	4.64	0.13	4.28	14.45	2200	1440
5	4.69	3.08	-	0.42	8.19	2600	2200
6	1.76	1.38	-	0.48	3.62	2475	1170
7	1.47	3.00	0.28	0.18	4.93	3500	2010
8	3.58	2.15	-	1.14	6.87	2450	2130
9	5.37	5.03	1.45	-	11.85	2550	1445
10	3.64	2.90	-	1.10	7.64	2475	2485
11	2.35	3.40	-	1.99	7.74	2300	1895
12	4.24	4.70	-	3.38	12.32	2300	1860
13	2.59	3.77	0.06	1.58	8.00	2375	2170
14	1.29	3.50	-	1.59	6.38	2300	2000
15 + 17	0.87	1.12	-	1.20	3.19	2200	2335
16	1.24	0.94	-	0.04	2.22	2625	3385

TABLE (4)

ST. JOACHIM ESTATE DISTRIBUTION OF SUITABILITY CLASS  
AND COMPARISON OF EXPECTED AND ACTUAL YIELD.

FIELD NO.	AREA UNDER CULTIVATION (Ha.)					EXPECTED AV YIELD KG/Ha	ACTUAL AV YIELD KG/Ha
	CLASS 1	CLASS 2	CLASS 3	CLASS 4	TOTAL		
1	-	8.28	-	9.06	17.34	1975	1000
2	-	7.59	0.57	2.78	10.94	2225	810
3	-	5.86	0.92	14.22	21.00	1800	1360
4	-	1.82	0.44	6.25	8.51	1725	665
5	-	9.27	-	4.57	13.84	2175	520
6	-	6.90	-	5.61	12.51	2050	890
7	-	2.26	0.32	15.98	18.56	1625	538
8	4.03	14.0	-	0.51	18.54	2525	3135
9	-	3.85	0.35	2.22	6.42	2125	1645
10	-	3.47	-	2.78	6.25	2050	1892

In the case of St. Joachim's Estate, no definite conclusions can be drawn as only a single years' yield data is used. Extensive areas of replanting and pruning account for the large differences. The higher actual yield in field No.8 is probably the result of better than average management. Also, this field is downgraded in the classification by a slope limitation which may be reflected ~~in~~ more in terms of extra conservation measures, added costs of routine operations like plucking, etc. rather than reduced yields.

Further testing and refinement will be required for the criteria and yield potentials used, but the values given here seem to provide a fair assessment of the yields possible with good management and has predictive value.

##### 5. Application of this classification

The knowledge and training required to implement this land suitability classification on the existing tea lands can be <sup>imparted</sup> ~~imparted~~ in a very short time, especially to individuals already familiar with the tea industry. Estate Managers for example could easily apply this classification to obtain a suitability classification of the lands on their estates.

The simplified land suitability classification for tea when applied <sup>e</sup> lands itself to interpretations concerning management decision making in regard to diversification, replanting, infilling and conservation needs. It tells the Manager how well he is performing and on the other <sup>h</sup> ~~hand~~ allows on evaluation of management by higher level authorities and planners. It allows benefit-cost evaluations of any new capital investments to be made on an estate. It gives an indication of long-term production trends which allows gearing <sup>of</sup> investments in increased production to market demands.

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