CHARACTERIZATION OF FOREST SITES

by

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Introduction. Intensive forest management and silvicultural planning need reliable method of estimating the productive capacity of land for timber. The productivity of a particular site depends on the quality of the land and the environmental factors prevailing there. For better growth and development plants require *water*, *air*, *temperature*, *light* and *nutrients* which are met through atmosphere and soil. The factors influencing the atmospheric and soil conditions are responsible to govern the production capacity of forests.

Study of correlations between site factors and forest growth is a widely accepted reliable method of forest site assessment. This involves isolating the site components and studying their effects on tree growth. Site is a complex of physical and biological factors of an area that determines what vegetation it may carry. It is a sum of *pedosphere*, *biosphere* and *atmosphere*. The chief components of site are climatic, biotic and edaphic factors. To some extent these factors are altered through topographic variations. Therefore all such factors should be considered in *forest—site* studies.

As it is not always easy to decide beforehand which informaton on environmental conditions will be most important, it is advisable to base the site studies on the widest possible variety of site observations: to collect a large material of site and stand data from sample plots carrying the desired tree species, then to study stand properties as functions of the various site properties. In practice there is a great advantage in using the characteristics which can be distinguished in the field instead of tedious laboratory investigations. This is possible only through the detailed characterization of the site features in situ. Thus the forest sites characterization is the first step in site appraisal and requires great skill while recording the observations. The success in site appraisal depends on the ability of the surveyor as how thoroughly he has mapped the site features and collected the necessary informations.

The present paper describes the salient features and method of forest site characterization.

Site Characterization. Geographical limits of tree species and their development are influenced by climatic, physiographic, biotic and edaphic factors of site. Distribution of

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species varies as these factors vary and their significance singly or collectively tend to fluctuate accordingly. Therefore all the factors should be included in site descriptions.

Climatic Factors. The physiological background of the growth of trees has a very complex nature because of the interaction of a great many accompanying factors. The most important of them are *soil* and *climate*. The soil is in its turn to a high degree determined by the prevailing climatic conditions. Climate therefore stands out as the most regulator of growth. The climate is above all associated with the geographical position. The significant environmental changes are associated horizontally with differences in latitude and vertically with altitude. These effects become conspicuous over relatively short distances at latitudinal and altitudinal extremes as evidenced by rapid procession from boreal forests to stunted "taiga" in northern hemisphere and from sub-alpine forests to prostrate trees forms near the timberline in high Himalayan ranges of middle latitudes. Amount and distribution of precipitation is related to the longitude and proximity to sea and ocean. Therefore for the characterization of the general climate, the geographical position of the site i.e. *longitude* and *latitude* should be recorded in site survey sheet (Appendix-1).

The climatic factors most important for the growth of the trees are *precipitation*, *warmth* and *light*.

Precipitation in its various forms determines the moisture content of the soil and thereby also the access to soluble nutritive salts. The effect of precipitation has a maximum as well minimum value. Abundant precipitation results in heavy leaching of the nutritive salts and causes the retardation of growth. The same result will also be produced by a precipitation that is insufficient in relation to evapotranspiration. *Precipitation* can best be expressed as mean annual rainfall in mm and the rainfall during the growth period. Its importance for vegetation increases with amount of rainfall and number of rainy days during the year and the growth period.

Warmth: The most vital functions of plants—transpiration, assimilation and respiration depend upon the *supply of heat*. According to MITSCHERLICH (1933) an average temperature of at least +5 °C during the growing season is necessary for the growth of plants. The upper temperature limit, where the heat damages the living cells of the phanerogams, is stated to be +52 °C by DIELS (RUBNER, 1934).

The need of plants for *warmth* may be represented by means of temperature figures, which are of different kinds viz. annual averages, averages for the period of growth, extreme values and ranges.

Growth period: With the help of temperature and precipitation figures, the length of growing season can be determined. This is necessary because of regional variations in growing season. There are different opinions as to the lower temperature limit for the functions of life in plants. In high altitudes, temperate and alpine regions *temperature* is the minimum factor, but in other parts the minimum factor is water. Investigations carried out in Sweden have shown that the *growing season* in a wide sense coincides with that time during which the average temperature exceeds +3°C (ANGSTROEM, 1940, from PATERSON, 1956). MITSCHERLICH has suggested +5°C as lower temperature limit for the period of vegetation whereas RUBNER +10°C and MERRIAM +6°C (PATERSON, 1956).

In warm temperate and tropical regions, where the average temperature of winter months never falls below +3°C, the growing season has to be calculated by an other method. Here the relationship between temperature and rainfall will decide the resting period of vegetation which occur at a certain degree of aridity. For the calculation of this aridity limit several formulae are available. DE MARTONNE'S "aridity index" calculated from the formula

$$i = \frac{P}{T+10}$$

(i=index; P=annual precipitation in mm; T=annual mean temperature in °C) claims world-wide applicability. Investigations of aridity carried out in the field shows that DE MARTONNE'S aridity of 20 corresponds to dry limit of vegetation (PATERSON, 1956). Thus aridity occurs at an index value of 20 or under it. This calculation shows the annual average of the climate and does not give an idea of the variation of seasons. LAUER (1952) has developed DE MARTONNE'S formula to be used for calculation of indices for the separate months. The connection with the annual formula has been preserved by multiplying the quotient by 12. DE MARTONNE'S formula for the calculation of the number of arid and humid months respectively during the year thus has the followng form:

$$20 = \frac{12\,p}{t+10}$$

(p=average monthly precipitation; t=average monthly temperature in °C). The number of arid months constitute the amount by which the year should be reduced in order to establish the growing season in months. The simple inverse functional relationship between p and t in the above formula facilitates the drawing of a nomogram in order to establish the boundary between aridity and humidity (Fig. 1). By means of this nomogram and with the knowledge of monthly averages of precipitation (p) and temperature (t) the number of arid months can easily be settled for any place on the earth.

Light is of the greatest importance for the photosynthesis of plants. The effect of carbon dioxide is directly dependent on the intensity of light. A certain quantity of carbon dioxide gives greater power of growth with increased intensity of light (MITSHERLICH, 1933).

Light is more difficult to put on a numerical basis. One can use number of hours when the sun is above the horizon during the year as well as during the growing season both calculated as a percentage of total number of hours of the years. Solar radiation—the source of energy can also be used to represent the factor *light*. MILANKOVITCH'S calculation (1930) of annual radiation at the earth's surface in g.-cal./cm^2 may prove helpful in expressing the *light*. These values of light seems difficult to obtain and bring into practical utility in forestry. The fact is that the effect of light changes with seasons and will thereby be related to temperature conditions. The later can therefore be supposed to express the effect of light conditions on vegetation (PATERSON, 1956).

Topographic Factors. Topography exerts an indirect effect on growth through local modification of climate and edaphic influences particularly moisture and temperature regimes. Association between site quality and physiography may be evaluated either in terms of continuous variates or as descrete topographic position categories or by a combination of the two approaches. The former treatment is most appropriate in areas of rugged, mountainous terrain; the later generally is to be preferred in regions of moderate relief. Judging from the past works on site appraisal, the following topographic variables are recommended to be recorded:

Descrete Topographic Positions. The sites can be calssified into following categories:

Plains: very slight in relief, extensive and wide spread upper surface of the land with less than 2° slope.

Plateau: the mild in relief, projecting upper land surface above the surroundings.

Valleys: formed from rivers or streams and as a rule still flowing through, extended concave shape areas with slopes in the direction of river or stream flow.

Valley bottom: deeper, more or less flat portion of a valley.

Valley meadow: portion of valley bottoms which are over flooded by high water level.

Upper valley: upper end of the valley from where the stream/rivers originate.

Lower valleys: the lower ends of the valleys where it almost ends to form a plain.

Slopes: the sides of an elevated ground, peaks, hills or hillocks.

Terraces: flat, extended and moderately wide areas which interrupt the gradient of a slope.

Ridges: long extended, in all sides sloping rising grounds (peaks).

Hill tops/summit: rounded peaks sloping in all the directions.

Depressions: oblong, concave shaped areas encircled with ascending embankments.

Springs: a shallow deepening, depression shaped in cross section and the source of a water flow.

Continuous Topographic Variates: *Altitude:* It has got an important influence on tree growth indirectly by changing the temperature and rainfall etc.

Marked changes in evapo-transpiration, moisture and growth period are associated with the changes in elevation. The altitudes can be recorded as the height above mean sea level in meter.

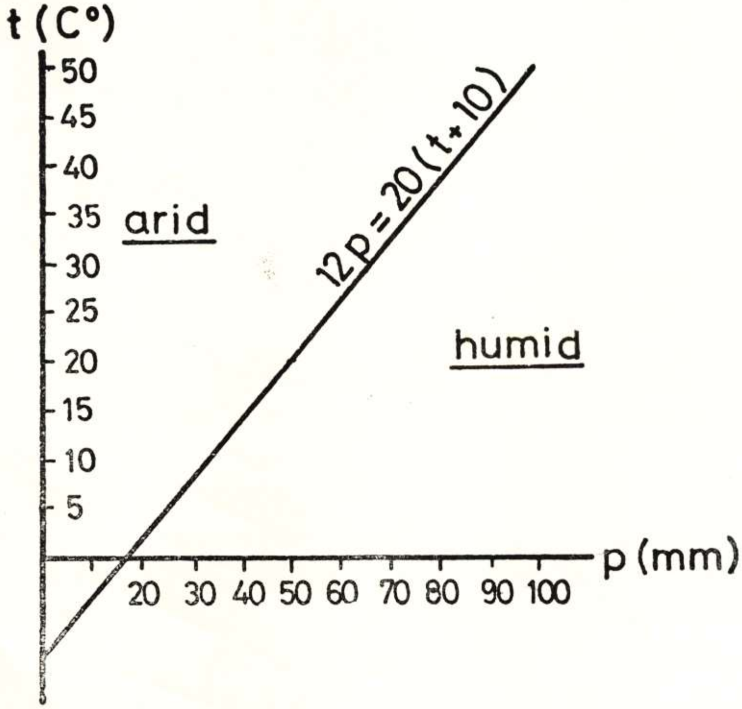

Fig. 1. Limit between humid and arid climates as presented by Lauer in his development of de Martonne's formula for index of aridity.

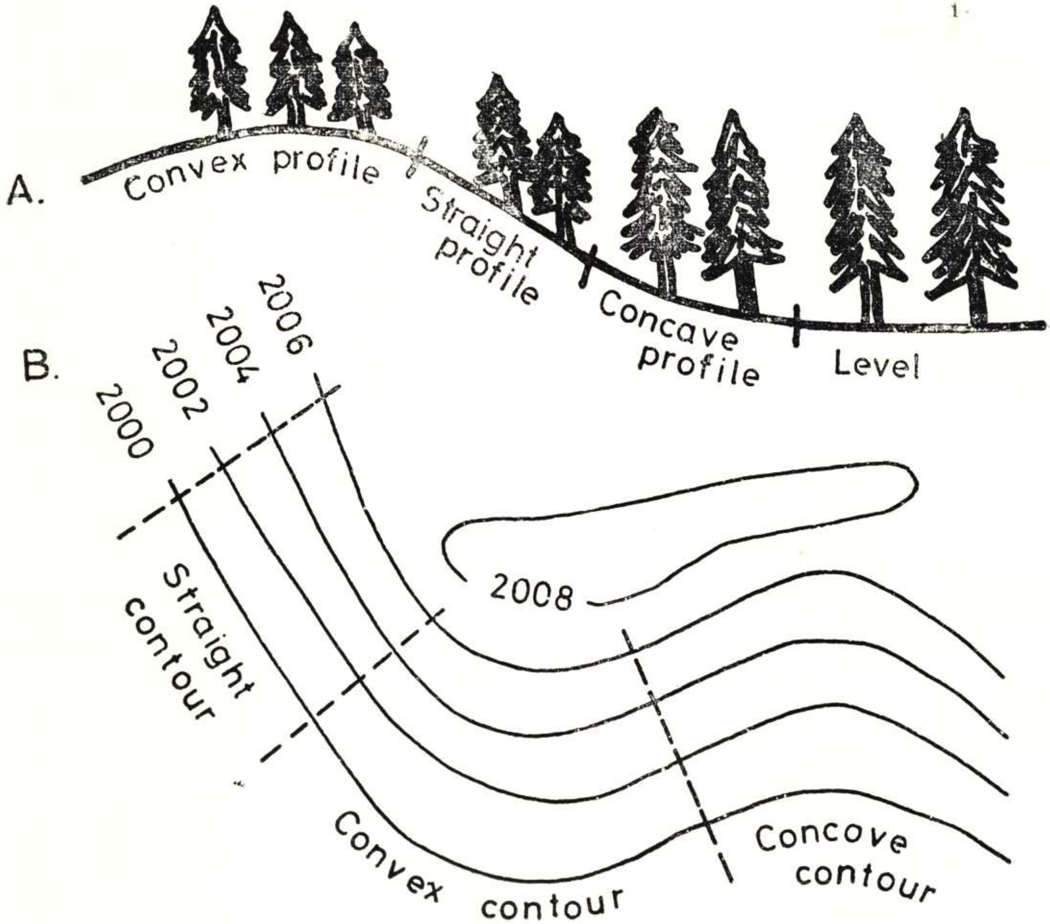

Fig. 2. Topographic classification of an area for site index prediction.

Slope steepness: Degree and extent of slope influence both surface and sub-surface movements of water. This is especially significant in rocky mountainous regions where most of the annual precipitation occurs as snow. Following the snow melt, water in excess of the water holding capacity of the soil and substratum tends to move the slopes and causes the loss of soil and water both.

The steepness of the slope can be recorded either in degree or in %. For forest site characterization the following classes are recommended:

Slope steepness classes (notation)	Slope in °	Slope in %
Plains	0—2	0—3
Undulating	2—5	3—9
Mod. slopy	5—10	9—17
Strongly slopy	10—20	17—36
Steep	20—30	36—58
Very steep	30—45	58—100
Precipitous	over 45	over 100

Aspect: It influences precipitation, temperature and evaporation and thus the supply of water and nutrients to plants. In hilly regions sun radiation, soil and air temperatures and relative humidity of a site are intimately bound to the aspects.

A convenient way to express *aspect* is with azimuth scale of 360° from north. The expressions can further be used in forms of Sin Q, Cos Q and so on. The following: N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW and NNW sixteen classes are proposed for expressing the aspect where N denotes north, E denotes east, S denotes south and W denotes west.

Slope position: Lower slopes generally afford better growth conditions than upper slopes or ridges because of better moisture relations with the same precipitation (LUNT, 1939). Lower slopes are generally associated with deeper top soil. The slope position refers to the location of the site on the slope i.e. the distance from the main ridge and is expressed in terms of the % of total length of the slope. The following 5 classes are being recognized for field descriptions:

Slope position classes (notation)	% distance from the main ridge
Ridges	0
Upper slopes	0—33
Middle slopes	33—66
Lower slopes	66—100
Hill bottoms	beyond 100

Slope length: This corresponds to the distance of site from ridge and is expressed in meter or chain. The length of the slope decides the time required for surface and subsurface movement of the water and thereby extent of loss or gain in water storage. According to CARMEAN (1967) the better sites are associated with shorter slope length. Broadly the slope length can be recognized as follows:

(*i*) Short .. less than 100 meter or 5 chains.
(*ii*) Long .. more than 100 meter or 5 chains.

Shape of the slope and profile curvature: The shape of a slope can affect the movement and storage of water from the site. Any site situated on a slope has a topographic profile which is either concave, convex or straight as illustrated in fig. 2(A). Also the contours of the site as illustrated in fig. 2(B) can be described by concave, convex and straight lines. Therefore the topographical shape of an area can be described by three classes of profile and contour curvatures giving a total of nine combinations. Convex and linear slopes tend to loose water more rapidly than concave slopes. Concave positions also benefit from thicker A-horizons and somewhat greater soil depths are associated with this type of slope. For practical purpose the concavity or convexity is simply determined by occular inspection and the sites can be classified accordingly into three classes viz. *convex*, *concave* and *linear* slope shapes.

Biotic Factors. The forest production on a given site is determined by the (i) plant association and (ii) the history of the natural disturbances. The influence of plant association enters into site predictions in atleast two ways. First, and most obviously, weeds may prevent growing space. This effect is most evident when undesirable species are intermingled in the dominant canopy. Lesser inhibition on growth occurs if weeds are restricted to ground level. Secondly, the rooting behaviour, nutrient uptakes and mineral cycling in forest eco-systems differ from species to species. The grades of litter decomposition and the release of nutrients available for plants are more associated with the comp osition of the crop.

Therefore it is necessary to record the composition and conditions of the main crop along with the understorey and ground flora as shown in the site survey sheet (Appendix-I). The disturbances in upper soil layers due to grazing, burning, trampling, grass cutting or litter removal may be recorded as follows:

(*i*) no disturbances
(*ii*) slight disturbances
(*iii*) moderate disturbances
(*iv*) strong disturbances.

Edaphic Factors: Until the morphology and genesis of a soil are known, no knowledge can be gained and no research can be planned most effectively to forecast the productivity of the land. Soil morphology gives a firm basis to develop principles of predicting the total space for tree roots to develop in search of available air, water and nutrients for their growth. The morphology of the soil is expressed in its profile and associated features.

Associated Features: *Surface drainage:* It is directly related to the permeability and infiltration of the soil. In extreme cases it influences adversely the air and water balance of the soil and thus affects root growth markedly. The surface drainage can be characterized as: (i) good (ii) imperfect and (iii) poor.

Profile Features: Surface accumulation of organic matter alongwith the mineral soil constitute the profile of a forest soil. The nature and properties of humus and mineral layers reflect the general biological condition and storage capacity of site for air, water and nutrient supplies. Therefore both the layers must be considered in profile descriptions.

Organic matter deposits: Organic matter in the form of either incorporated or unincorporated humus influences the moisture regime of soils as well as their structure and porosity to air. It serves as a direct source of energy for soil orgnisms and a reservoir of nitrogen and other essential plant nutrients. In excessive amounts, organic matter may reflect poor drainage and be associated with low productivity.

On the basis of the grade of decomposition, the organic matter lying on the top of mineral soil is divided into L(litter), F(fermentation) and H(humus) layers. The nitrogen supplies of forest trees are met mostly in organic forms which depend upon the thickness, composition, structure and root penetration of each layer. These characteristics may be used to characterize the organic layers as given in site survey sheets. The organic matter accumulation is not uniform throughout. The recordings should therefore be based on a number of observations taken at several places to avoid the errors.

The C/N ratio (HOUBA, 1949; HANDLEY, 1954), availability of nitrogen (WITTICH, 1952), carbon dioxide production (SMIRNOV, 1955) and the microbial and faunal activities (NEF, 1957) are directly related with the kind of humus forms. The humus forms must therefore be included in profile descriptions. For the recognition of humus forms in the field, the following types are suggested, the details of which are given in *KARTIERANLEITUNG* (ARBEITSGEMEINSCHAFT BODENKUNDE, 1971).

(i) Typ. Mull (ii) Cryptomull (iii) Wormmull (iv) Sandmull (v) Mull like moder (vi) Typ. Moder (vii) Raw humus like moder (viii) Raw humus poor in fine humus (ix) Typ. Raw humus (x) Raw humus rich in fine humus (xi) Moory (xii) Moist mull (xiii) Moist moder (xiv) Moist raw humus (xv) Brown mud (xvi) Grey mud (xvii) Putrified mud (xviii) Low moor peat (xix) High moor peat (xx) Transitional moor peat.

Mineral Soil: The characteristics of the soils produced by soil forming processes are genetical in nature and differ from layers to layers. Recognition of different horizons including geological substratum is the first step in profile characterization. The usefulness of profile descriptions is greatly increased by the proper use of genetic horizon designations which are described in detail in KARTIERANLEITUNG (1971) and Soil Survey Manual (1951).

The characteristics such as soil texture, stoniness, color, depth, humus content, structure, compactness, root penetration, calcareousness, soil reaction, permeability etc.

are used to describe each horizons separately. Special features like concretion, mottlings, water stagnation, bleachings, etc. need also mention. The datails of such features are given in site survey sheet. The numerical values like aeration vol. %, bulk density and available water capacity in mm are not recorded in the field. Their determination follows later on based on the data derived from the lab. analysed samples. On the basis of the entire site observations the total evaluation is made in respect of the followings:

Parent material: The effect of parent material is expressed more subtly in derivative properties of soil profiles. Soil texture and amount and rate of release of minerals depend on texture and chemical composition of parent material and that soil drainage and root penetration below the solumn are affected by size and orientation of structural cracks. Parent material is expressed in terms of geology and rock i.e. the source of soil origin such as alluvial, colluvial, loess, sandstone, granite etc.

Effective soil depth: It signifies the total volume of soil available for roots distribution and the supply of nutrients and moisture required by the plant roots. Stone and gravel contents when present in higher amounts play an important role in reducing the available space for the spreading up of roots, and simultaneously limit the supply of water and nutrients. It is less detrimental in fine textured soils than in sandy soils. Under some circumstances moderate amounts of coarse fragments may benefit growth by favouring deeper penetration of lighter rains and thus reducing evaporation losses. In profile the soil depth and stone content decide jointly the *effective depth* and are recognized as follows:

Soil depth

Classes	*depth (cm)*
(*i*) very shallow	up to 15
(*ii*) shallow	15—30
(*iii*) moderate	30—60
(*iv*) deep	60—100
(*v*) very deep	over 100

Stoniness

Classes	Vol.-%	Stones	Notion	Gravels
very poor	below 1	x″		g″
poor	1—10	x′		g′
medium	10—30	x		g
high	30—75	$\bar{x}$		$\bar{g}$
very high (Skeleton)	over 75	X		G

Soil texture: Soil texture plays important role in moisture and nutrient supplies. aeration, drainage, absorption and release of cations. Clay and silt particles are the stores of nutritional elements and the retention and availability of moisture in soil depends to a large extent upon clay and silt contents. With the help of finger test, the following textural classes are important to be recognized in the field, the details of which can be had from KARTIERANLEITUNG (1971).

Textural classes	*Notion*	*Textural classes*	*Notion*
Sand	S	Sandy Loam	sL
Silty Sand	uS	Silty Loam	uL
Loamy Sand	lS	Clayey Loam	tL
Clayey Sand	tS	Sandy Clay	sT
Silt	U	Loamy Clay	lT
Sandy Silt	sU	Clay	T
Loamy Silt	lU		

Water supply: The soil aeration and water supply to plants are directly related to pore size distribution. Texture, structure, humus content and compactness of the soil govern the pore size distribution. Stoniness and effective depth determine the storage capacity of the soil for moisture. Topographic factors affecting surface run off, seepage and approximity of ground water table have considerable bearing on soil moisture supply. The consideration of all the factors lead to classify the *water supply status* of sites as:

dry, moderately fresh, fresh, very fresh, ground fresh, reserve fresh, summer fresh, slope fresh, moist, slope moist, ground moist and *wet*.

Nutrient supply: N, P, K, Ca and Mg are the major nutrients required by the plants. The evaluation of the status of N supply depends on humus content, its form and C/N ratio whereas parent material, topographic position, erosion or sedimentation decide the P supply. The supply of K is the function of the amount and type of clay minerals whereas the Ca and Mg supplies are determined by pH values and parent material. Thus the variables used to express moisture supply usually contain effects of nutrients and water. Total depth and stone contents decide the nutrients storage capacity of soil. The fertility of a site with respect to the individual nutrients can be characterized as *very poor, poor, moderate, good and rich.*

Considering the fertility status of individual nutrient elements and the effective soil volume, the sites can be ranked into following nutrient supply classes:

Ranks	*Nutrient supply classes*
I	very poor
II	poor
III	moderate
IV	fairly rich
V	rich
VI	very rich

Aeration: Since limitation in movement and supply of air occur when soil voids are occupied primarily by water, the soil water regime is intimately related to soil aeration. Clay and silt pans, compacted or cemented "hardpan" layers and compacted medium to heavy textured surface horizons are related to aeration. Poor aeration and impeded drainage are interdependent. The amount of fluctuation in water table during the growing season is a critical factor in poorly drained and badly aerated soils, In wet land areas, fluctuations in air and water supplies are produced by ground water movements within the root zone and are associated with conspicuous differences in site quality. Therefore the ground water level and water stagnation status should also be recorded while characterizing the sites.

Summary: Locality factors determining the site complex have been discussed. To characterize the site in the field, easily ascertainable features have been proposed. To record the site features and morphological characteristics in the field, a universally applicable, "*Site Survey Sheet*" has been developed and appended.

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Institute of Soil Science and Forest Nutrition University of Goettingen (West Germany)	Site Survey Sheet	Top. Map No.	Geographical Position:
	Forest Division/Range: Comptt. No.		Longitude: Latitude:
Name of Surveyor:	Date:	Serial No.	

Climate	Total-Precipitation		Average Temperature		Major Climatic Growth Zones	Sub-Climatic Growth Zones	Growth Period / Period of Vegetation	
	Yearly (mm)	Growth Period (mm)	Yearly (°C)	Growth Period (°C)			days.	months

Relief / Topography	Elevation in meter above mean sea level	Plains	Plateau	Valleys	Valleybottoms	Valleyslopes	Upper Valleys	Slope in °	0 – 2	2 – 5	5 – 10	10 – 20	20 – 30	30 – 45	> 45
								in %	0 – 3	3 – 9	9 – 17	17 – 36	36 – 58	58 – 100	> 100
		Lower Valleys	Slopes	Terraces	Ridges	Hill-Top / Summit	Depressions / Springs	Notation	Plains	Undulating	Mod. slopy	Str. slopy	Steep	Very steep	Precipitous

Aspect	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW

Slope Position	Ridges	Upper Slopes	Middle Slopes	Lower Slopes	Hill-Bottom

Slope length	Short (< 100m)	Long (> 100m)	Slope-shape / Profile-Curvature	Convex	Linear	Concave	Level	Surface Drainage	Good	Imperfect	Poor

Forest-stocking	Tree Spp. and Proportion	Age-class	Yield-class	Site-class	Main timber Stock (Cubic meter)

Under-storey and ground flora	

Superficial O.M. / Humus / deposit.	Horizon	Thickness Cm	Material e.g leaf litter, grasses, roots etc.	Structure: Crumbly	Loose	Layery	Dense	Breakable	Sharp-breakable	Root-penetration: absent	very weak	weak	moderate	strong	rootblanket
	L														
	F														
	H														

Humus-Form					
Typ. Mull	Cryptomull	Wormmull	Sandmull		
Mull like moder	Typ. moder	Raw humus like moder	Fine humus poor rawhumus	Typ. rawhumus	Fine humus rich rawhumus
Moory	Moistmull	Moistmoder	Moist rawhumus		
Brown mud	Grey mud	Putrefied mud	Low moor peat	High moor peat	Transitional moor peat

Mineral soil	Geology (Parent-material)	Soil texture	Stoniness %	Colour (Munsell-chart)	Horizon symbols	Depth Cm	Boundary	Humus %	Structure	Compactness	Root-penetration fine root/dm²	Calcareousness % CaCO3	Special if any	pH	Aeration Vol-%	Water permeability Classes	Available water capacity (mm)	Bulk-density (g/Cm³)
	Shortform of geo.map	S/uS/lS/ts U/sU/lU/sL uL/tL/sT/lT T.	< 1 x,"g" 1 - 10 x', g' 10-30 x, g 30-75 x̄, ḡ > 75 X, G	F = flaked B = stripped A = veined/arteried	A (h,he,eh) B (v,t,s,h) C (n,v,c) P G (o,r) S (w,d,) R Z	0	— straight ~ wavy tongue-form --- inter-rupted transitional zone	<1 h" 1-2 h' 2-5 h 5-10 h̄ 10-15 h̄ 15-30 a > 30 H	Si Co Cr Bl Sp Pr Pl Gr	1 very loose 2 loose 3 mod. loose 4 compact 5 very compact	1 - 2 very poor 2 - 5 poor 5 -10 average 10-20 strong 20-50 very strong > 50 Rootblanket	0 + <0,3 k" 0,3-1,5 k' 1,5-1 0 k 1 0-2 0 k̄ > 20 k̄	Concretion Mottling Bleaching Waterstagnation Ground water					
Description																		

Total Evaluation

Parent material												
Humus form		Soil texture										
Podsolyness	weak	mod.	strong	Podsolization	weak	mod.	strong	Top-Soil 0- Cm	Intensive rooting Cm	Extensive rooting Cm		
Soil-forming Processes	Humus formation	Decalcification	Structure formation	Brown coloration	Clay accumulation	Podsolization	Gleying	Pseudogleying	Peat accumulation			
Soil type		Depth in Cm	< 15	15 – 30	30 – 60	60 – 100	> 100					
Depth of soil development	very shallow	shallow	mod.	deep	very deep	Grade of distinction	poor	mod.	strong			
Ground water level (dm)	≤0 / 0-2 / 2-4 / 4-8 / 8-13 / 13-20 / 20-30 / 30-40 / >40	pH	Water stagnation	deep sole dm.	Fluctuation zone dm.	periodicity	AVAILABLE WATER CAPACITY mm.					
Water storage	dry	mod. fresh	fresh	very fresh	ground fresh	reserve fresh	summer fresh	slope fresh	moist	slope moist	ground moist	wet
Fertility status	very poor	poor	mod.	good	rich	evaluation depends on						
N - Supply						humus content, its form and C/N ratio						Nutrient supply
P - Supply						parent material, topographic position, erosion or sedimentation						I = very poor II = poor III = moderate
K - Supply						clay content and clay minerals (Illite etc.)						IV = fairly rich V = rich
Ca - Supply						according to pH						VI = very rich

Special features if any:
e.g. Soil working, amelioration, grazing, burning, litter-removal, etc.

APPENDIX - I