Full Length Research Paper

Land suitability classification of choice of trees species in District Rahim Yar Khan, Punjab, Pakistan

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Pakistan especially in Province Punjab has a narrow forest resource. More than 90% of the fuel wood and almost 50% of timber requirements are being met from trees being growing on the private farm lands, based on agroforestry as compared with the state forests. It is obvious that trees have to be grown in conjunction with agricultural crops on private farm lands. The main objectives of the study pertain to prepare the land suitability classification in Punjab especially the District of Rahim Yar Khan along with the identification of the agroecological zones of province. The area was surveyed according to its total extent, component soils series and their proportion, spotting characteristics of each soil series, their major limitations/hazards for tree plantation and suitability for specific tree species were identified and tree species were recommended according to soil characteristic, then land suitability map of choice of trees species was prepared by using Geographic Information Systems (GIS) software and marked the area according to the soil types and species. This classification would help the agroforester and all those interested in planting on their farm lands in matching suitable species of trees for different soils in the Punjab. The resources available to the agroforester would be used properly and diligently without wastage of the time and money. It would help him in identifying the land management alternatives and he shall evaluate the land uses for a meaningful assessment.

Key words: Agroforestry, land suitability classification, agroecological zones, soil profile.

INTRODUCTION

The country has a narrow forest resource base extending over only about 4.8% (4.59% excluding farmland plantations) of its area, which is insufficient to provide the material needs of the growing population and expanding industry, and to retard and arrest the ongoing environmental and ecological degradation process. The situation is further aggravated by the natural, but uneven distribution of the forest resources. Almost 80% of the productive forests are located in the north (Hazara, Malakand, Azad Kashmir and Northern areas, whereas 80% of the population and wood based industry is located in the southern and central parts of Pakistan (Rahim et al., 2010; Baig et al., 2008). Pakistan's fast growing population of about 152.53 million is dependent for its wood and wood products requirement on a meager

forest resource base of 4.2 million hectares (Ahmed et al., 2010; Hussain et al., 2003). The per capita forest area thus is only 0.0265 ha (Rahim et al., 2010), compared to the world average of one hectare. Only 1/3rd of the total forest area is productive, while the rest is of environmental and protective value only (Ahmad, 1998; Anon, 2000; Naz et al., 2010). It is becoming increasingly difficult to meet the demands of the growing population for fuel wood, fodder, agriculture implements and raw material required for wood based industries (Caviglia and Kahn, 2001). There is no doubt that scanty tree cover is the result of the gross mismanagement of forests in the past (Kalinganire et al., 2008). The constantly growing population and the changing human needs is a great challenge for the agricultural / forest land use planners (Ahmad, 1993). It results in the competition of different land uses for the same tract of land and has led to an increasing need for systematic national agricultural land use planning. Land evaluation is a comprehensive approach and a best possible tool for

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systematic land use planning on sustained basis (Borden and Giese, 2001; Botha, 2006). The aim of these classifications is to guide the land users/planners in such a way to put the land resources to the most beneficial use on sustained basis without deteriorating the resources and the environment as well (Brady and Weils, 2002 ; Gebrehiwot, 2004: Craig E, Wilkinson K, 2004). The term _land evaluation' refers to assess the suitability for forest trees of different tracts of land mapping units for specific kind of use and to find out the land management alternatives that would be physically and financially practicable and economically viable (Dawes and Goonetilleke, 2003). Soils and land suitability maps of various agroecological zones represent land resource information for different users including the Punjab Forest Department for execution of it Farm Forestry Extension Programme.

These maps are based on the soil sample collected and it comparison with data generated by _soil survey' of Pakistan, published in its _reconnaissance soil survey reports' of various districts. These maps give a brief account of the various kinds of soils identified and mapped various agroecological zones of the Punjab and their classification for land suitability to grow specific forest trees in combination with the farm crops. The tree species considered for the purpose are those listed by the Forest Department as the popular ones among the farmers of different forest zones in the province (Sheikh et al., 2000). The land suitability classification is intended to guide the farm forestry extension staff and the farmers in selection of most adopted and promising tree species for each kind of soil occurring in the farmlands as well as to assist them in adoption of appropriate soil and water management technology that will encourage tree growth and improve quality of the wood for maximum returns as envisaged under the project (Isbell, 2002).

CRITERIA FOR DIVISION INTO AGRO ECOLOGICAL ZONE

Some criteria are quantitative such as percentage of vegetation cover in a particular ecological zone, that is, land available for timber production, total growing stock, its level of productivity, density of woody vegetation that can safeguard soil from erosion and provide refuge to the natural fauna etc. There are other criteria which are qualitative or descriptive only, such as those relating to the role of the trees in the optimal land use of the tract, supply of wide range of products and services critical for the welfare of local population, social needs of the surrounding communities that influence the existence of the trees and utilization of the forest produce, the level and quality of people's participation, etc (Kitalyi et al., 2004). Based on the above considerations, the following criteria have been used for the selection of the representative zones: Climatic and edaphic considerations physiography and ecology; extent of forest and

agricultural resources in each zone; site specificity: Water logging, salinity, commanded and un-commanded area and other landforms; the level of biological diversity; socio-economic needs of the communities living in the zone; their agricultural practices and soil fertility. The socio-cultural status of the communities (that is, the adequacy or otherwise of irrigation water) include sub soil water and the degree of similarity and comparability (Figure 1). This follows the five broad based agro-ecological zones of Punjab where the study has been conducted (Rahim et al., 2010).

Agro ecological zone iii-A – Sandy deserts

This zone covers a part from certain districts of Sindh; and from the province of Punjab, this region covers the Districts of Rahim Yar Khan, Bahawalpur, Bahawalnagar and the Cholistan desert, characterized by elongated NESW oriented sand ridges formed by eolian (pertaining to wind) agencies. However, the vegetation is sparse and lopped heavily for fuel, fodder and hutments (Rahim et al., 2010).

Agro ecological zone III- A and B – Sandy deserts

This region (Thal) covers the Districts of Muzaffargarh, Mianwali, Bhakkar, Khushab and Layyah with various forms of sand ridges and dunes including, longitudinal, transverse sand sheets with silty and clayey deposits that occur in narrow strips. The sand ridges are 5 to 15 m high. Between the sand ridges, there are hollows where runoff water is collected after the rain (Rahim et al., 2010).

Agro ecological zone IV-A – Northern irrigated plains

The Districts of Sahiwal, Lahore, Kasur, Okara Faisalabad, Jhang and part of Multan, Gujrat, Sheikhupura and Gujranwala are covered by this region. The land is lying between Sutlej and Jhelum Rivers, having a relatively flat surface although, there are some remnants of old river channels. This region is canal irrigated. Its climate has been changed from arid to humid through the world's largest canal system (Rahim et al., 2010).

Agro ecological zone V - Barani (rain fed)

The salt range, Pothwar plateau and Himalayan piedmont plains form this region. Climatically, a small narrow belt lying along the mountains is nearly humid, whereas in the southern part, it is semi-arid and hot. The narrow belt has the summer mean maximum daily temperature of about 38°C with frequent cold spells. The mean monthly rainfall
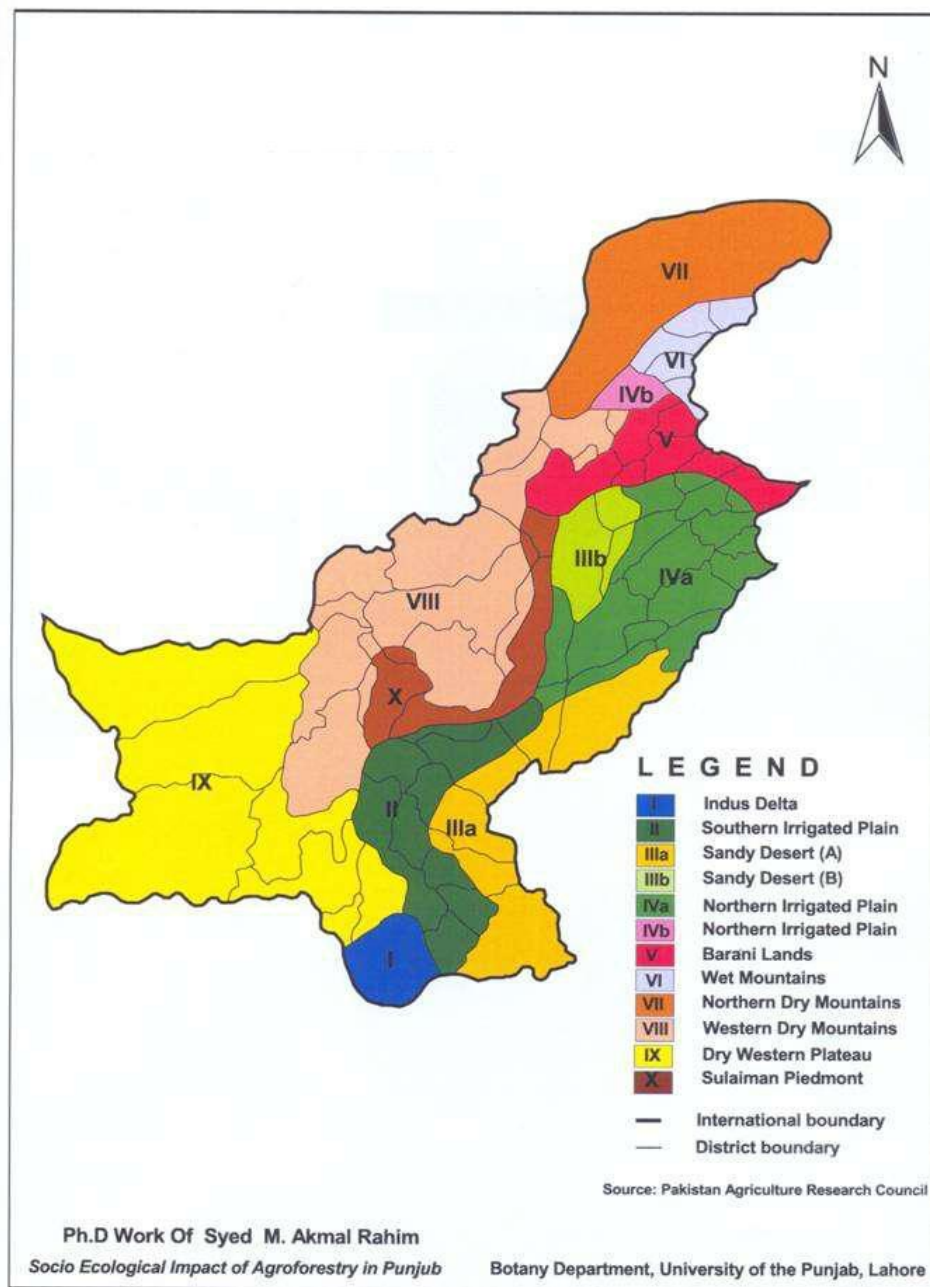
Figure 1. Agroecological zones of Pakistan.

is approximately 200 mm in summer and 36 to 50 mm in winter (December - February) (Rahim et al., 2010).

METHODOLOGY

The area was completely surveyed with the technical help of ‗soil survey' of Pakistan and soil samples were collected from various areas (0 to 180 cm depth) which were analysed and compared with the old data of soil analysis done by the Department. Then area was again surveyed with local old staff of Forest Department and selected the tree species more suited according to the Characteristics of component soils (proportion of the component soil). The information has been prepared for use by the personnel having no technical background but only a limited knowledge about the soils who may consult only the information given on ‗land suitability mapping units'(grouped map delineations given specific colors and represented by larger, italicized, Arabic numbers and described by using GIS software (Perveen et al., 2004). These mapping units are much fewer in number and are described in a rather generalized form for easy comprehension. What the user of this information ought to do first is to find out in which mapping unit this area or site of interest (farmland) falls on the ‗soils and land suitability' map. For that purpose, the map has been prepared in paper color prints along with the related topographic map sheet. The transparent film of the ‗soils and land suitability' map should then be placed on the relevant part of the topographic sheet so that the geographical features drawn on the former get exactly superimposed on the latter (NRCS, 1999). The soil mapping units

are described briefly with respect to their total extent in the area, component soils series and their proportion, spotting characteristics of each soil series, their major limitations/hazards for tree plantation and suitability for specific tree species. For the sake of simplicity, some generalization has been done so that a maximum of three important soil series that occupy more than 90% of the area under any unit have been described with respect to only a few main distinguishing characteristics (Shahid et al., 1998 to1999). The spotting soil characteristics considered and the terms used for their description are as defined below.

Depth is effective thickness of the soil material above an inert or non-soil material (sand, bedrock etc.); three depth classes are considered, that is deep (>100 cm), moderately deep (50 to100 cm) and shallow (<50 cm) (Sheikh and Soomro, 2006). Drainage is the condition of the soil with respect to wetness or natural removal of excess water, affecting aeration of the plant root zone; five terms are used, that is excessively drained (generally dry, water removed very rapidly, water table below 150 cm depth), somewhat excessively drained (water removed rapidly, water table below 150 cm depth), well drained (water removed readily, water table below 150 cm depth), moderately well drained (water removed somewhat slowly or water table at 150 to 200 cm depth), imperfectly drained (water removed very slowly, water table at 100 to 150 cm depth) and poorly drained (water not removed naturally, water table at 50 to 100 cm depth). Calcareousness indicates the amount of carbonates/lime present in the soil material (Rodrigo et al., 2005). Structure describes the status of soil with respect to its development; three terms are used, that is stratified (thin layers of different material clearly identified; no structural development), weakly structured (the material homogenized to at least 50 cm depth, with no clear stratification) and moderately structured (the material homogenized and showing well formed peds) (Hamid et al., 2006). Salinity/sodicity presence of excess salts (salinity) and/or pH more than 8.5 which generally reflects >15% exchangeable sodium (sodicity); four terms are used, that is —non-saline, non-sodic‖ (no salinity, pH <8.5), —slightly saline-sodic‖ (slight salinity, pH 8.6 to 8.8), —saline-sodic‖ (moderate to strong salinity, pH >8.8) and —saline/sodic surface‖ (slight salinity and/or pH >8.5 in the surface soil only) (Herbst, 2001), while soil texture describes the proportion of sand, silt and clay in the soil material; seven classes are used, that is sandy (sand, loamy sand or loamy fine sand), coarse loamy (sandy loam, fine sandy loam or loamy very fine sand), loamy (loam), silty (silt, silt loam or very fine sandy loam), fine loamy (clay loam or sandy clay loam), fine silty (silty clay loam), and clayey (silty clay, sandy clay or clay) (Harper, 2000). With respect to topography/slope, all soils should be regarded as level, with a slope of <1%, unless described otherwise. The symbols used for land suitability (S1, S2, S3 and N).

Land suitability for forest trees

The soil mapping units mentioned above were further grouped on the basis of similarity in suitability and management requirements of their component soils for planting forest trees. Such groups, called as _land suitability mapping units‘, are described in table with respect to their component soil mapping units, spotting characteristics and proportion of important soil components, suitability of each soil component for selected tree species and specific soil management requirements/improvement suggestions. The proportion of the component soil series is described in terms of _dominant‘, _major‘, _considerable‘ and _minor‘ which represent >80%, 51 to 80%, 20 to 50% and <20% of the total area under the unit respectively (Paul, 2007). The terms used for describing the soils and their proportions are the same. The land suitability is described in terms of classes as defined (Carroll, 2004; Eduardo et al., 2006):

S1: Highly suitable for planting the relevant tree species; no or a minor limitation; highly responsive to improved management and inputs; good for nurseries.
S2: Moderately suitable for planting the relevant tree species; moderate limitation(s) of inadequate rooting depth, low water availability, salinity/sodicity or impeded drainage etc; fairly responsive to improved management and inputs.
S3: Marginally (or poorly) suitable for planting the relevant tree species; severe limitations of too shallow rooting depth, low water/nutrients availability, salinity/sodicity or impeded drainage etc; not much responsive to improved management/inputs or requires too high inputs to be economical for improvement.
N: Not suitable for planting the relevant tree species; may support the plants with special techniques involving high inputs but not economic to do so (Herbst, 2001).

It is important to point out that the land suitability mapping units have been somewhat more generalized than the soil mapping units in the sense that some minor soil components described for the former, though significantly different from the major or dominant ones, have been ignored in the latter because of their small extent and for the simplification needed to make differentiation of the units relatively palatable for the non-technical farmer and forest staff. The land suitability for various forest species has been assessed with the assumption that the species would be planted and grown for wood production on commercial basis, rather than as a common practice. The species rated as 'N' (not suitable) or as _S3‖ (marginally suitable) simply imply that their planting is not economically feasible or is going to give very low return because of slow growth rate and/or low quality of wood obtained, or special care/high investment is needed in terms of water, fertilization, amendments etc for its planting which may not be practical.

Study area

(Rahim Yar Khan Tehsil District Rahim Yar Khan): Agroecological zone III- A (Sandy Desert) physical environment.

Location and extent

The area under report is located in Rahim Yar Khan District of the Punjab province. It lies between 27° 56$^{/}$ to 28° 52$^{/}$ N latitudes and 70° 00$^{/}$ to 70° 32$^{/}$.

Climate

The climate of the area is classified as arid subtropical continental. The mean annual rainfall is 97.2 mm, most of which falls during late summer (monsoon) season. The mean daily summer and winter temperatures are 33.6 and 14.5°C respectively with the mean daily maximum summer and mean daily minimum winter temperatures being 40.3 and 5.7°C respectively. The monthly variations of rainfall, temperatures, evaporation and relative humidity.

Physiography and general nature of soils

The following major landforms with specific nature of soils and hydrological conditions are distinguished as active floodplains, recent floodplains, subrecent floodplains and rolling sand plains.

Hydrology

Indus River, abandoned channel of Hakra River and Panjnad Canal

system influence the hydrology of the area. The abandoned channel of Hakra River provides natural drainage to the area. More than 60% of the tehsil area is irrigated by the network of Panjnad Canal system. Rest of the area is either out of the reach of canal command or sandy ridges. A negligible area (about 2.5%) is under annual flooding by the Indus River. Almost entire area has brackish ground water except a narrow strip along the river Indus where it is of good quality

Present land use /natural vegetation

Irrigated cropping of wheat, gram, oilseed, and pulses in Rabi and cotton, sugar-cane rice and millets in Kharif with perennial/seasonal canal supplies supplemented by tube wells is the main land use in major part of the area. Remaining area is lying uncultivated and is mostly used as poor grazing land. Natural vegetation includes *Prosopis spicigera* (jand), *Acacia jacquemontii* (jandi), *Salvadora oleoides* (wan), *Capparis aphylla (*karir*), *Tamarix articulata* (frash), *Tamarix* sp. (lai), *Calotropis procera* (ak), *Desmostachya bipinnata* (dab), *Alhagi camelorum* (jawan), *Acacia arabica* (kikar), *Zizyphus jujuba* (ber) and *Tamarix diocia.* (pilchi). (Reconnaissance Soil Survey Reports of Rahim Yar Khan, 1972; Cholistan, 1974 and Dera Ghazi Khan, 1974).

RESULTS

Land suitability for forest trees

The soil mapping units mentioned above were further grouped on the basis of similarity in suitability and management requirements of their component soils for planting forest trees. Such groups, called as ‗land suitability mapping units', are described in Table 1 with respect to their component soil mapping units, spotting characteristics and proportion of the important component soils, suitability of each soil for selected tree species and specific soil management requirements/improvement suggestions. The proportion of the component soil series is described in terms of ‗dominant', ‗major', ‗considerable' and ‗minor' which represent >80%, 51 to 80%, 20 to 50% and <20% of the total area under the unit respectively. The terms used for describing the soils and their proportions are the same as done for Table 1. The land suitability is described in terms of classes as defined:

S1: Highly suitable for planting the relevant tree species; no or a minor limitation; highly responsive to improved management and inputs; good for nurseries.
S2: Moderately suitable for planting the relevant tree species; moderate limitation(s) of inadequate rooting depth, low water availability, salinity/sodicity or impeded drainage etc; fairly responsive to improved management and inputs.
S3: Marginally (or poorly) suitable for planting the relevant tree species; severe limitations of too shallow rooting depth, low water/nutrients availability, salinity/ sodicity or impeded drainage etc; not much responsive to improved management/ inputs or requires too high inputs to be economical for improvement.

N: Not suitable for planting the relevant tree species; may support the plants with special techniques involving high inputs but not economic to do so.

It may also be clarified that the land suitability for various forest species has been assessed with the assumption that the species would be planted and grown for wood production on commercial basis, rather than as a common practice. The species rated as ‗N' (not suitable) or as ‗S3‖ (marginally suitable) simply imply that their planting is not economically feasible or is going to give very low return because of slow growth rate and/or low quality of wood obtained, or special care/high investment is needed in terms of water, fertilization, amendments etc. for its planting which may not be practical (Table 1). Following species are proposed for this area according to the site quality and soil characterization; *Dalbergia sissoo* (Shisham)*, Bombax ceiba* (Simal)*, Populus deltoid s*(Shisham)*, Acacia nilotica*(Babul)*,, Eucalyptus camaldulensis* (Sufeda)*, Melia azedarach* (Dhrek)*, Salix spp* (Willow)*, Albizzia lebbeck* (Kala siris)*, Mangifera indica*(Mango)*, Zizyphus jujuba* (Ber)*, and Azadirachta indica* (Neem)*.* (Figure 2 and Table 1)

DISCUSSION

A suitable site is a prerequisite for successful agroforestry as did Brady and Weils (2002). Forest trees have traditionally been grown in the Punjab province without adopting any scientific and systematic inputs. As such, maps of land suitability are very important in order to build up an efficient tree production network. In the present study, land evaluation has been performed through suitability classification by using the data of soil characteristic in relation to land inundation type, soil toxicity and ground water level under a Geographic Information System (GIS) environment by Hossain et al. (2007). A suitability map has been produced that shows the suitable area for forest trees species in various district of the Punjab province. An efficient Agro forestry system requires proper planning and timely management of available agricultural land areas under appropriate requirements of the trees of those areas. Obviously such a practice includes an evaluation of land capability and determination of suitability of each of these areas for forestry species suited to that soil. The role of land characteristics is extremely important in tree / wood production activities. Such characteristics are determined by a number of issues namely site quality, water table, water source and marketing etc. All these factors collectively determine the suitability of a given area for a particular type of afforestation as mentioned by Dawes and Goonetilleke (2003).

Furthermore, it would facilitate the achievement of acceptable land use suitability and/or capability through the use of appropriate land resource assessment techniques on agriculture land for afforestation and it will ensure that adequate land resource data is collected to

Table 1. Suitability mapping units – Rahim yar khan tehsil, component soils, land suitability for forest trees and specific management requirements.

Land suitability unit	Component soil mapping units	Spotting characteristics of component soils**(proportion of the component soil)	Land suitability for forest trees												Specific management requirements/ improvement suggestions
			Shishum Dalb. sissoo	*Simal* Bomb. celba	*Poplar* Popu. delt.	*Kikar* Acac. niloti.	*Eucalyp* Eucal. camal	*Bakain* Melia azadi	*Toot* Morus alba	*Willow* Salix babil	*Siris* Albiz. lebek	*Mango* Mang. indica	*Jaman* Selzig jumb	*Neem* Azadi indica	
1	4, 5, 10, 11	Deep, well drained silty/loamy soils (dominant)	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	No specific management required; prefer use for nurseries
2	1	Deep, well drained, stratified silty/ loamy soils (major)	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	Make larger pits and add organic matter for planting; avoid over irrigation / long ponding on clayey soils
		Deep, moderately well drained, stratified clayey soils (considerable)	S3	S2	S2	S2	S2	S3	S3	S2	S3	S3	S3	S3	
3	15, 17	Deep, moderately well drained clayey/fine silty soils (dominant)	S2	S2	S1	S1	S2	S2	S2	S2	S2	S2	S2	S2	Make larger pits, add organic matter for planting; and avoid over irrigation/long ponding; in addition add gypsum on saline-sodic soils
		Deep, moderately well drained, porous saline-sodic (minor) clayey/fine silty soils	N	N	S3	S2	N	N	N	N	N	N	N	N	
4	1F*	Deep, well drained, stratified silty/loamy soils (major)	S2	S2	S1	S1	S2	S1	S1	S2	S2	S3	S2	N	Make larger pits, add organic matter for planting; avoid long ponding on clayey soils; avoid planting on sandy soils
		Deep, moderately well drained, stratified clayey soils (minor)	N	N	S3	S3	N	N	S3	N	N	N	N	N	
		Deep, excessively drained sandy soils (minor)	N	N	N	N	N	N	N	N	N	N	N	N	

Table 1. Contd.

5	3	Undulating, excessively drained, stratified sandy soil (major)	N	N	N	N	N	N	N	N	N	N	N	N	Avoid planting on sandy soils; make larger pits, add organic matter for planting on silty soils
		Deep, well drained, stratified silty soils (considerable)	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	
6	3F*	Deep, excessively drained, stratified sandy soil (major)	N	N	N	N	N	N	N	N	N	N	N	N	Avoid planting on sandy soils; make larger pits, add organic matter and N fertilizer for planting on silty soils
		Deep, well drained, stratified silty soils (considerable)	S2	S2	S1	S1	S2	S1	S1	S2	S2	S3	S2	N	
7	2F*	Deep, moderately well drained, stratified clayey soils (major)	N	N	S3	S3	N	N	S3	N	N	N	N	N	Make larger pits and add organic matter for planting; avoid long ponding on clayey soils; avoid planting on sandy soils
		Deep, well drained, stratified silty/loamy soils minor)	S2	S2	S1	S1	S2	S1	S1	S2	S2	S3	S2	N	
		Deep, excessively drained sandy soils (minor)	N	N	N	N	N	N	N	N	N	N	N	N	
8	9, 12, 16, 18	Deep, moderately well drained, porous saline-sodic/ (dominant gypsiferous clayey/ silty soils	N	N	S3	S2	N	N	N	N	N	N	N	N	Make larger pits, add organic matter for planting; and avoid over irrigation/long ponding; in addition add gypsum on saline-sodic soils
		Deep, moderately well drained clayey soils (minor)	S2	S2	S1	S1	S2	S2	S2	S2	S2	S2	S2	S2	

Table 1. Contd.

9	7, 8, 13	Deep, moderately well drained, porous saline-sodic (dominant) silty soils	N	N	S3	S2	N	N	N	N	N	N	N	N	Make larger pits, add organic matter and gypsum for planting on porous saline- sodic soils; avoid planting on dense saline-sodic soils
		Deep, moderately well drained, dense saline-sodic (minor) clayey/silty soils	N	N	N	S3	N	N	N	N	N	N	N	N	
10	14	Deep, moderately well drained, dense saline-sodic (dominant) clayey/fine silty soils	N	N	N	S3	N	N	N	N	N	N	N	N	Avoid planting
		Deep, moderately well drained, porous saline-sodic (minor) clayey soils	N	N	S3	S2	N	N	N	N	N	N	N	N	
11	19, 20, 21, 4, 7, 9, 12, 13' 15'	Undulating and rolling, excessively drained, sandy soils (dominant)	N	N	N	N	N	N	N	N	N	N	N	N	Avoid planting

 * Subject to river flooding almost every year during monsoon season. ** The characteristics are generalized for important soil components of eac h land suitability unit. The proportion of each component is described (within parentheses) in terms of: (>80%), major (50 to 80%), considerable (20 to 50%) and minor (≤20%). All the soils are level to nearly level, structured/homogenized, non-saline, non-sodic, porous/permeable, with water table beyond 150 cm depth and contain negligible to moderate (0-14%) amount of lime, unless described otherwise. The depth is defined in terms of thickness of the rooting zone as: Deep (> 100 cm) and moderately deep (50 -   100 cm, underlain by sand).

enable proper assessment of land suitability and/or capability in various districts of the Punjab province. Land suitability classification maps are more refined and apply to the capacity of land resources to sustain particular forms of land use for the selection of species for forestry. For this reason, land suitability techniques have generally superseded land capability assessments and are recommended for use in the field of the Agriculture and Forestry especially in Agroforestry as described by Brady and Weil (2002).

Hossain (2001) also mentioned such ‗land suitability' maps have equal potential for two or more uses (e.g. Agriculture and Forestry), the preferred land use option should be the one that is the most viable in the area that is one, which represents the ―highest and best‖ use of that land. The information in this chapter would help him to pin point the well drained, particularly drained, waterlogged, sloping or gently sloping lands and guide him to choose of appropriate tree species. This particular information has been summarized for several Districts of the Punjab and would provide a wealth of useful information to enable
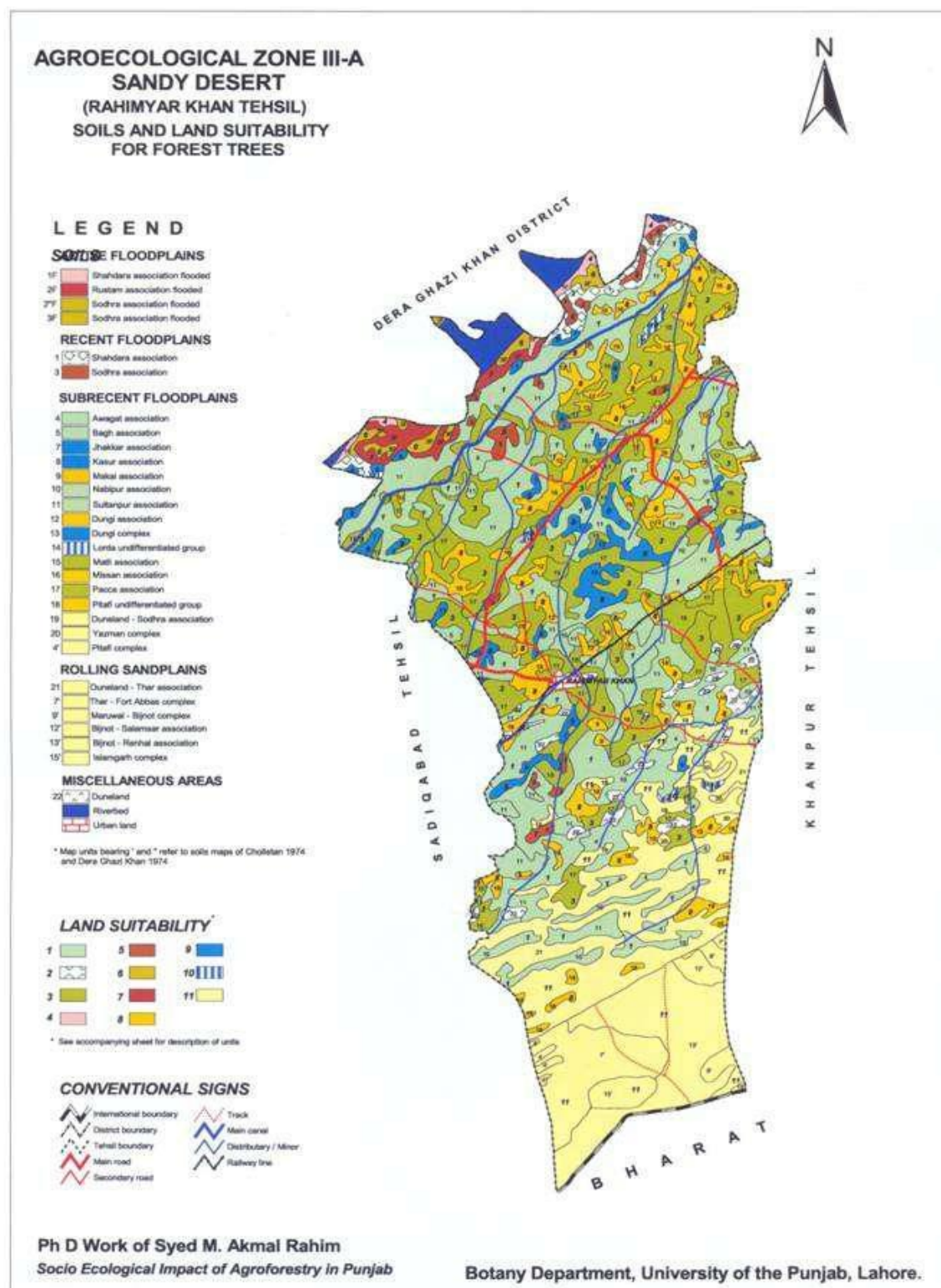
Figure 2. Land suitability map for forest trees in Rahim Yar Khan District of Punjab Province.

him to choose the correct species in the particular zone. These results are comparable with estimates of soil attributes using the soil map. An important feature is the spatial distribution of the predicted soil attributes, which is provided in more detailed form than what the soil map provides (Paul, 2007). This classification would help the agroforester and all those interested in planting on their farm lands in matching suitable species of trees for

different soils in the Punjab. Selection of sites and the species suitable for a particular type of soils would go a long way to help the agroforester. Without this information it would not have possible for him to select a particular tree species for a particular site. The agroforester would not have to run around for assistance. He would get it right at the spot without lack of contradiction. The resources available to the agroforester would be used properly and diligently without wastage of the time and money. It would help him in identifying the land management alternatives and he shall be to evaluate the land its use for a meaningful assessment. The basic aim of the study was to prepare the maps for the agro farmers on the basis of land suitability classification to guide the land users/planners in such a way so as to put the land resources to the most beneficial use on sustained basis without deteriorating the resources as well as the environment. The term ＿land evaluation‘ refers to assess the suitability for forest trees of different tracts of land mapping units for specific kind of use and to find out the land management alternatives that would be physically and financially practicable and economically viable. The present study paralleled with the research conducted by Rodrigo et al. (2005) who assessed the suitability for forest trees of different tracts of land mapping units for specific kind of use and worked out the land management alternatives that would be physically and financially practicable and economically viable in terms of ＿land evaluation‘. Soils and land suitability Maps of various agroecological zones reveal land resource information that can be helpful for different users for the execution of certain projects for instance in Farm Forestry Extension Programme by the Punjab Forest Department. This suitability classification would help the agroforester and all those interested in planting on their farm lands in matching suitable species of trees for different soils in the Punjab. Selection of sites and the species suitable for a particular site would go a long way to help the agroforesters. The agroforester would not have to run around for assistance. He would get it right at the spot without any lack of contradiction. The resources available to the agroforester would be used properly and diligently without wastage of the time and money. It would also help him in identifying the land management alternatives and farmer shall be to evaluate the land its use for a meaningful assessment. It would specifically assist him to match the species for different soil all over the Punjab in a variety of agroecological zones, such as Barani, sandy deserts and irrigated plains in the North and South. All that would be required of him would be to understand the possible ways through which the available information could be rationally used to his maximum advantage. The information would also enable him to classify his land suitability in terms of highly suitable, moderately suitable or even as unsuitable for the planting. Additionally it would assist him to pin point the well drained, particularly waterlogged, sloping or

gently sloping   lands   and   provide guidelines to choose

appropriate tree species.

RECOMMENDATIONS

This study represents a pilot study with regards to the development of ＿soil and land suitability‘ maps, as the work was restricted to Districts Rahim Yar Khan of the Punjab. The undoubted utility of such maps based on the valuable land resource information being generated, makes it imperative that the same may be extended to the rest of the Districts of Punjab as the next step and later for other provinces too, for it not only assists the agrofarmers but also alleviates of poverty, consequently enhancing the gross economy at the national level.

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