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LAND SUITABILITY FOR MAJOR CROPS IN CAUVERY BASIN, TAMIL NADU, INDIA USING REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT

Agriculture is a dominant sector in Tamil Nadu Cauvery basin. It contributes 45 percent to the Gross domestic production, employs nearly 60 percent of the total labor force and generates the bulk of market exchange. Giving the poor performance of the agricultural sector in relation to the fast growing population, intensification of agriculture is critical aim of the study is to find land suitability for major crops of Cauvery basin using remote sensing and GIS techniques objective to study the physical and socio economic characteristics of Cauvery river basin, Tamil Nadu. To assess the land suitability for major crops based on soil characteristics of river Cauvery basin. The Study area the entire Cauvery Basin covers three states and a union tertiary namely Karnataka, Tamil Nadu and Kerala and Pondicherry which lie between 10° 05′N and 13°30′N latitudes and 75°30′E and 79°45′E longitude. Whereas the present study is concerned with the Cauvery Basin of Tamil Nadu which lies between 10° 07′ 55″N and 12° 41′ 39″ N latitudes and 76° 15′ 43″ E and 79° 50′43″E longitudes. Interpretation of Land use/Land cover maps using Topographical sheets on 1:250,000 scales. The Geology, Geomorphology, and land use of Tamil Nadu in Cauvery basin have been mapped using land sat band 4 FCC and ETM data. The Soils drainage, soil erosion, soil depth, soil texture, soil gravelliness, soil calcareousness Soil irrigability and, water holding capacity of Tamil Nadu Cauvery basin has been prepared based on. Based soil erosion, soil drainage, soil texture, soil depth, soil gravelliness, soil calcareousness, water holding capacity, and land irrigability the land suitability for major crops of Tamil Nadu Cauvery basin has been evaluated. Lands at ETM 30 meter Resolution Technology used and analysis are Erdas imagine 9.1 and Arc GIS 9.2. The analysis is done taking different aspects. Therefore it is logical to analyze the ranking of crops, which is done in second part. In the third part of analysis, an attempt is made to identify the crop combinations. The last analysis is to identify the index of crop diversification to explain the relative agricultural potential of the districts.

KEYWORDS: Land Use Land Cover, Soil Calcareousness, Suitability for the Major Crops, Land Suitability for Sugarcane, Land Suitability for Groundnut, Land Suitability for Cotton, Remote Sensing and GIS

INTRODUCTION

Agriculture is a dominant sector in Tamil Nadu Cauvery basin. It contributes 45 percent to the Gross domestic production, employs nearly 60 percent of the total labour force and generates the bulk of market exchange. Giving the poor performance of the agricultural sector in relation to the fast growing population, intensification of agriculture is critical. This calls for judicious planning of land resources to sustain agricultural production to meet the ever increasing demand for

food, while achieving environmental protection. The concept of sustainable agriculture involves producing quality crops in an environmentally friendly, socially acceptable and economically feasible way (Addeo et.al. 2001). This implies optimum utilization of the available natural resource for efficient agricultural production. An efficient agricultural production system requires proper planning and timely management of available agricultural areas under an appropriate land allocating scheme. Obviously, such a scheme includes an evaluation of land capability and determination of suitability of each of these areas for different agricultural crops. Agricultural crop production is determined by land and soil characteristics namely elevation, slope, aspect, soil (pH, drainage and texture), land cover and climatic factors.

AIMS AND OBJECTIVES

The aim of the study is to find land suitability for major crops of Cauvery basin using remote sensing and GIS techniques with the following Objective.

- To study the physical and socio economic characteristics of Cauvery river basin, Tamil Nadu.
- To assess the land suitability for major crops based on soil characteristics of river Cauvery basin.

THE STUDY AREA

The entire Cauvery Basin covers three states and a union tertiary namely Karnataka, Tamil Nadu and Kerala and Pondicherry which lie between 10° 05′N and 13°30′N latitudes and 75°30′E and 79°45′E longitude. Whereas the present study is concerned with the Cauvery Basin of Tamil Nadu which lies between 10° 07′ 55″N and 12° 41′ 39″ N latitudes and 76° 15′ 43″ E and 79° 50′43″E longitudes. It is bounded on the west by Western Ghats, on the east by Eastern Ghats and North by the ridges separating it from the Thungabhadra and Pennar basins. The river at once entering the Tamil Nadu it enables the formation of two reservoirs namely Stanley Reservoir at the margins of Salem and Dharmapuri districts and Bhavani Sagar at Erode. The river flows SE drains the most of the districts of Tamil Nadu providing water for all domestic use and facilitating the agricultural practice depositing alluvium rich soil in flood plains eroded from the mountain ranges and irrigating the agricultural fields throughout the year enabling the cultivation of different Crops though out the year seasonally.

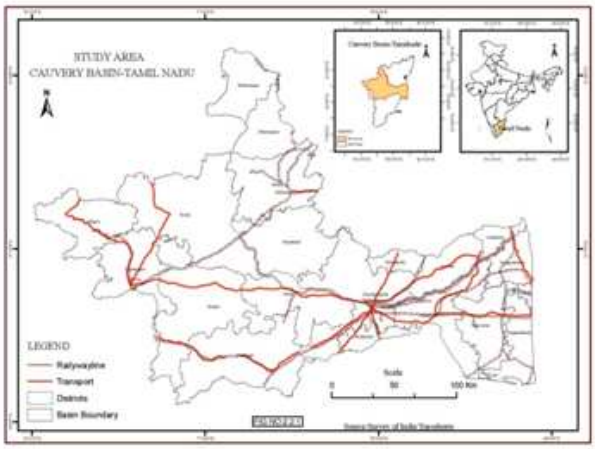

Figure 1: Study Area

METHODOLOGY

- Collection of Satellite data, Topographical maps, Rainfall, Temperature data and other collateral data for the study area.
- Preparation of base map, Drainage map on 1:250,000 scale using Survey of India Topographical Maps.
- Preparation of digital contour map and also creation of Digital Elevation Model and preparation of slope map using contours in ASTER.
- Pre field interpretation of Land use/Land cover maps using Topographical sheets on 1:250,000 scales.
- The Geology, Geomorphology, and land use of Tamil Nadu in Cauvery basin have been mapped using land sat band 4 FCC and ETM data on scale 1:25,000. Field checks and land use delineated through visual interpretation in the Tamilnadu Cauvery basin.
- The present study relies up on secondary data. The data were obtained from Geological Survey of India (GSI) Bangalore, and National Bureau of Soil Survey and Land Use Planning (NBSS) Bangalore, (SOI) Topographical Sheet on (1; 250,000), Landsat ETM 30 meter Resolution
- Technology used The technologies adopted for base map preparation and analysis are Erdas imagine 9.1 and Arc GIS 9.2

GEOMORPHOLOGY

The landscape is built up through uplift of volcanism. Denudation occurs by erosion and mass wasting, which produces sediments that is transported and deposited elsewhere within the landscape. The geomorphologic features identified from the study area are pediment / Pedi plain, plateau, hills, valley fill, flood plain, escarpment, denuded slope, and slopes on Deccan trap. Cauvery River created several of this features through erosion, and deposition work of it.

GEOLOGY

Cauvery basin forms a part of the South Indian Shield that preserves an early formed crust. In terms of rock types, metamorphic and igneous rocks predominate throughout the basin which marks major events of volcanism, Plutonism, metamorphism and sedimentation. Charnockites, high grade schists, migmatites, green stone belts and consolidated gneisses of Archean age are the most commonly found rocks. Southern part of the basin is characterized with laterised and ferruginous sandstone. Certain coastal areas also have conglomeratic sandstone, coralline limestone and shale. Around 38,000 sq km of the area in the basin is covered by hard rock and around 11,000 sq km by sedimentaries comprising mainly the delta portion. Major geological classification of the basin are Amphilbolite, Basic, ultramafic-rock, Oddanchattaram-anorthosite, Calc-granulate and limestone, Charnockite, Clay With limestone band, Closepet Granite, Epidote-hornblende gneiss, Fissile hornblende-biotite gneiss, Fluvial, Fluvio-marine, Fossiliferous limestone, Fuchsite-Kyanite-corundum-mica-schist, Garnet-biotite gneiss, Garnetiferious quartzofeldspathic gneiss, Granite, Granolite, Granite-Bodinayakkanur, Granite-Kiranur, Granite-Maruthamalai, Granite-Pollachi-Udumalpati, Dharapuram, Granite-Sillimanite-Graphite Gneiss, Granite-Tiruchengodu, Granite-Tiruttani, Granite-Trichy, Granitoid gneiss, Gypseous/sandy Clay With lenses of limestone, Gypseous/sandy Clay and sandstone, Hornblende-biotite gneiss, Kadavur anorthosite,

Laterite, Limestone marl and shale, Marine, Pink augen gneiss, Quartzite, River-water bodies, Sandstone, Sandstone With clay, Sandstone and Clays, Sandstone with clay intercalation, Shales, silt with bands of limestone, Sillimanite-Kyanite-corundum-mica-schist, Sittampundi anorthosite, Syenite Complex, Sivamalai, Syenite complex, jalakandapuram, Ultramafics, Ultramafics-chalk hills, limestone With Marl, pink migmatite, pyroxene granulite, syenite Complex, Purple conglomerate sandstone with Shale, Sandstone with bands of calcarious granitone, Shell limestone and calcarreous sandstone, ultramafic rocks Palladam, chinnandharapuram.

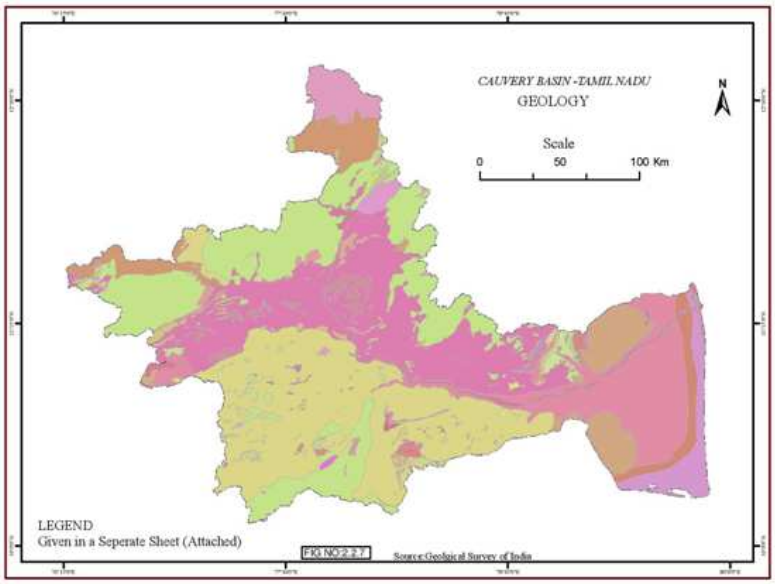

Figure 2: Geology

SOIL

The soils in Cauvery basin of Tamil Nadu are deep soils with increasing depth towards the coast. These soils have high clay content, low draining capacity, poor nitrate, poor phosphorus and high potassium and lime content. In the south eastern corner of the basin, some area is swampy which predominantly alluvial clay with poor drainage. The major types of soils present in the Cauvery basin are *Red Sandy*- soils distributed over the parts of Tanjore, Coimbatore, Nilgiris, Periyar, Dharmapuri, and Salem, *Loamy Organic*- in Coimbatore, *Reddish Brown* in Thanjavur, Tiruchim Salem, Periyar and Coimbatore, *Black* soils in Thanjavur & Coimbatore, *Sandy*- South Arcot, Alluvial *Clay* - Extreme south-east corner of the Cauvery basin of Tamil Nadu.

LAND USE LAND COVER

The land use and land cover analysis for Cauvery basin is carried out with the help of Landsat ETM+ images for the year 2006. The major 15 land use/ land cover types were extracted from this image. In the classification Crop land is having the higher proportion among which the irrigated cropland occupies 16909.99 sq.km (35.72%) and unirrigated crop land 8782.57sq.km (18.55%). area of about 1794.71sq.km (3.79%) is under plantation. The forest cover is 7972.49 sq.km which accounts for 16.84 % of the total study area.

Built up lands occupies 1013.16 sq.km (2.14%), the total water bodies are comprising 1022.00 sq.km (2.16%), fallow land having 3547.15 sq.km (7.49 %) and scrub land with 3303.49 sq.km (6.98 %), 156.46 sq.km of land is under

sand cover (0.33%), salt pan covering 69.16 sq.km (0.15%), marshy land 221.85 sq.km (0.47%), barren or hilly are 417.67 sq.km and gullied and ravenous covers 2056.96 sq.km (4.35 %) respectively. The other land use classes are mining land other unclassified land forms accounting 61.04 sq.km (0.13%). The result exposes that the Cauvery basin is dominating with the agricultural practices and next to that is the forest covered region.

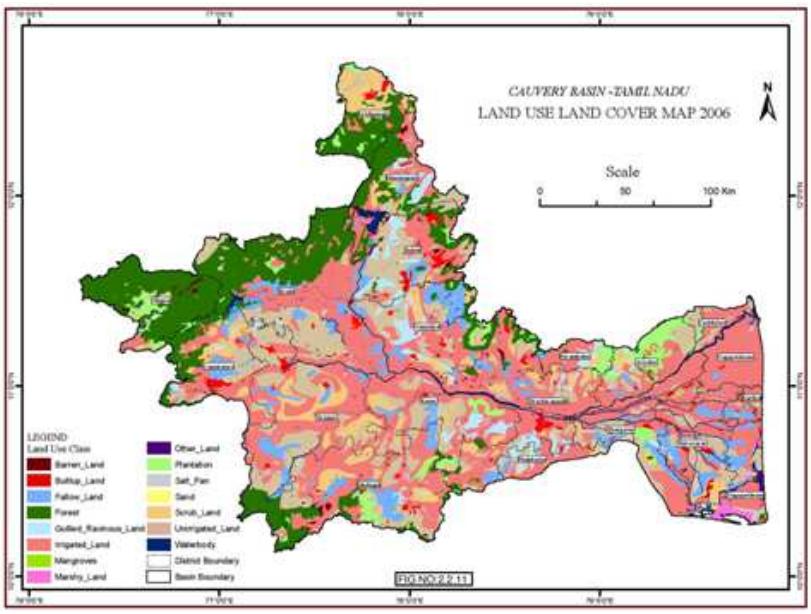

Figure 3: Land Use Land Cover Map-2006

LAND SUITABILITY FOR MAJOR CROPS IN CAUVERY BASIN

LAND SUITABILITY

Land suitability is the fitness of a given type of land for a defined use. The land may be considered in its present condition or after improvements. The process of land suitability classification is the appraisal and grouping of specific areas of land in terms of their suitability for defined uses.

The term "land capability" is used in a number of land classification systems notably that of the Soil Conservation Service of the U.S. Department of Agriculture (Klingebiel and Montgomery, 1961). In the USDA system, soil mapping units are grouped primarily on the basis of their capability to produce common cultivated crops and pasture plants without deterioration over a long period of time. Capability is viewed by some as the inherent capacity of land to perform at a given level for a general use, and suitability as a statement of the adaptability of a given area for a specific kind of land use; others see capability as a classification of land primarily in relation to degradation hazards, whilst some regard the terms "suitability" and "capability" as interchangeable. Because of these varying interpretations, coupled with the long-standing association of "capability" with the USDA system, the term land suitability is used in this framework, and no further reference to capability is made.

LAND SUITABILITY CLASSES

Land suitability Classes reflect degrees of suitability. The classes are numbered consecutively, by Arabic numbers, in sequence of decreasing degrees of suitability within the Order. Within the Order Suitable the number of classes is not specified. There might, for example, be only two, S1 and S2. The number of classes recognized should be

kept to the Minimum necessary to meet interpretative aims; five should probably be the most ever used. If three Classes are recognized within the Order Suitable, as can often be recommended, the Following names and definitions may be appropriate in a qualitative classification:

Table 1

Class S1 Highly Suitable:	Land having no significant limitations to sustained application of a given use or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.
Class S2 Moderately Suitable:	Land having limitations which in aggregate are moderately severe for sustained application of a given use; the limitations will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on Class S1 land.
Class S3 Marginally Suitable:	Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Table 2

Class N1 Currently Not Suitable:	Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner.
Class N2 Permanently Not Suitable:	Land having limitations which appear so severe as to preclude any possibilities of successful sustained use of the land in the given manner.

LAND SUITABILITY SUBCLASSES

Land Suitability Subclasses reflect kinds of limitations, e.g. moisture deficiency, erosion Hazard. Subclasses are indicated by lower-case letters with mnemonic significance, e.g. S2m, S2e, and S3me. There are no subclasses in Class S1. The number of Subclasses recognized and the limitations chosen to distinguish them will differ in classifications for different purposes. There are two guidelines:- The number of subclasses should be kept to a minimum that will satisfactorily distinguish lands within a class likely to differ significantly in their management requirements or potential for improvement due to differing limitations. As few limitations as possible should be used in the symbol for any subclass. One, rarely two, letters should normally suffice. The dominant symbol (i.e. that which determines the Class) should be used alone if possible. If two limitations are equally severe, both may be given. Land within the Order Not Suitable may be divided into suitability subclasses according to kinds of limitation, e.g. N1m, N1me, N1m although this is not essential. As this land will not Be placed under management for the use concerned it should not be subdivided into suitability units.

LAND SUITABILITY UNITS

Land suitability units are subdivisions of a subclass. All the units within a subclass have the same degree of suitability at the class level and similar kinds of limitations at the subclass Level. The units differ from each other in their production characteristics or in minor aspects of their management requirement (often definable as differences in detail of their limitations). Their recognition permits detailed interpretation at the farm planning level. Suitability units are distinguished by Arabic numbers following a hyphen, e.g. S2e-1, S2e-2. There is no limit to the number of units recognized within a subclass.

CONDITIONAL SUITABILITY

The designation Conditionally Suitable may be added in certain instances to condense and simplify presentation. This is necessary to cater for circumstances where small areas of land, within the survey area, may be unsuitable or poorly suitable for a particular use under the management specified for that use, but suitable given that certain conditions are fulfilled. The possible nature of the conditions is varied and might relate to modifications to the Management practices or the input e of the defined land use (occasioned, for example, by localized phenomena of poor soil drainage, soil salinity); or to restrictions in the choice of crops (limited, for example, to crops with an especially high market value, or resistant to frost). In such instances, the indication "conditional" can avoid the need for additional classifications to account for local modifications of land use or local major improvements.

Conditionally suitable is a phase of the Order Suitable. It is indicated by a lower case letter c between the order symbol and the class number, e.g. Sc2. The conditionally suitable phase, subdivided into classes if necessary, is always placed at the bottom of the listing of S classes. The phase indicates suitability after the condition (e) has been met. Employment of the Conditionally Suitable phase should be avoided wherever possible. It may only be employed if all of the following stipulations are met:

- Without the condition(s) satisfied, the land is either not suitable or belongs to the lowest suitable class.
- Suitability with the condition(s) satisfied is significantly higher (usually at least two classes).

The extent of the conditionally suitable land is very small with respect to the total study area

SUITABILITY FOR THE MAJOR CROPS

According to in above mentioned the thematic layers were used to create the suitability map in study area. The evaluation of land for its suitability for specific crops is done by adaption of the frame work for land evaluation (FAO, 1976) as indicate that for the grouping of soil mapping units according to their suitability for Growing rice, Sugarcane, Groundnut, and Cotton, set of the land quality criteria were developed from soil and land requirements for each for each of the crops, and the mapping units were related according to the criteria. The rating of land for suitability crops is based on the nature, degree and number of limitation of the land for cultivation of the crops.

THE SUITABILITY CLASSES ARE

- S1-Highly Suitable, with No Limitation
- S2-Moderately Suitable, With Moderate Limitation
- S3-Marginally Suitable, With Sever Limitation
- N1-Currently Not Suitable
- N2-Permanently Not Suitable

Classes S2, and S3, were divided in to Subclasses based on the specific limitations, using the suffixes ‘S’ Soil depths’ T’ for soil texture ‘X’ for soil calcareousness/sodicity, ‘D’drainage, and ‘G’ for gravelliness/stoniness, land irrigability, water capacity.

LAND SUITABILITY FOR RICE

Rice is stable food crop of the state. It is mainly depend on irrigation and is cultivated throughout the Cauvery basin mainly in low land valley canal and well irrigated areas, and deltaic plains, of Thanjavur, Thiruchirappalli, Pudukkottai, and District. The area presently under paddy cultivation is about 12.1% of the Total study area. Based on the suitability criteria developed from the available of mapping unit were grouped in to land suitability classes for rice.

Table 3: Suitable Class for Rice

No	Suitability Classes for Rice	Areas in sq km	Percentage (%)
1	Highly Suitable Land	5769.4	12.1
2	Moderately Suitable land	5801.2	12.2
3	Marginally Suitable land	950.4	2
4	Land not suitable	1120.5	2.3
5	Not Assessed	32824.5	69.2
6	Water Bodies	907.9	1.9
7	**Total**	**47374.1**	**99.7**

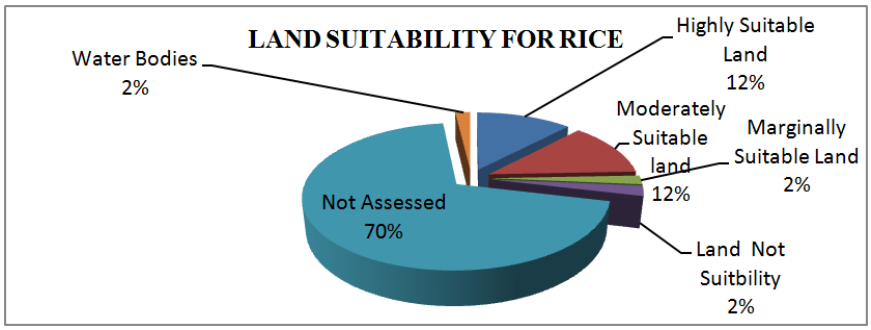

Figure 4: Land Suitability for Rice

According to the Table 3 in study area of Tamil Nadu, total area 47374sqkm about 12.1%highly suitable, but the sub classes have certain limitation for rice suitability mainly limitation Drainage, soil calcareousness reaction, Soil reaction for salinity, alkalinity and limitation of soil texture. More than 12.1 %high suitability for rice concentrated south easter part, Papanasm, Valagani, Needamangalam, Thiruaiyaur, Thanjavur, Kulathur, Tiruchirappalli, Thiruverambur, Dindigal, Srirangam, CoimbatoreNorth, Bhavani, Sathyamangalam, Hosur, etc. Only 12.2-2% Land moderately suitable and only 2.1% is marginally suitable because most of the basin sub group classes have to show that some sever limitation. They are limitation of calcareous, salinity, alkalinity, soil texture soil erosion, and limitation of the soil drainage, also soil depth etc. It mainly found along the river especially, Edapadi, Erode, Perunduraipondi, Gopichettipalayam, Avanasi, Salem, Pappireddipatti, Palladam, Tiruppur, Namakkal, Thuraiyur, Musiri, Dharamapuram, Palani, Manapparai, Athur, Thiruthurapondi, Vedasandur, Trichengode, Rasipuram, Paramathi, Sulur, Coimbatore south, and Pollachi, etc.

About 69.2-2.3% of the area not suitable for rice cultivation, due to the most of the soils sub classes comes under the very sever limitation, gullied erosion land rainfed areas, hill and rock land. It covers 33944sqkm, of the study areas, mainly the region are Vedaranyam, Kodavasal, Manachanalur, Kunnam, Sendurai, Krishnarayapuram, Vedasendur, Kangeyam, Perundurai, Sathyamangalam, Mettupalayam, Coonoor, Udhangamandalam, Gudalur, Athur, Oddanchatram, Nathan, Iluppur, Aravakurachi, various soil subclasses were not supported for growing crops, it have certain limitation for soil texture Soil depth, and limitation for the Soil gravelliness, Soil Calcareousness, and sever limitation for soil drainage and soil erosion

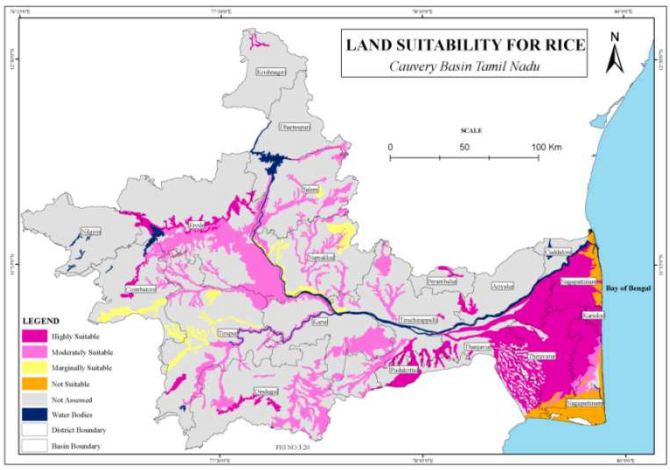

Figure 5: Land Suitability for Rice Map

LAND SUITABILITY FOR SUGARCANE

Sugarcane is an important major cash crop grown under irrigated condition in almost all part of the state. Sugarcane cultivation covers Thiruchirappalli and Salem district. The criteria and ratings used for grouping land unit into various suitability classes and sub classes were compiled. The suitability classification arrived by using above the criteria has 20 subclasses association. The description of the various suitability sub classes association.

Table 4: Suitable Classes for Sugarcane

No	Suitability Classes Sugarcane	Areas in sq km	Percentage (%)
1	Highly Suitable	2,410.4	5
2	Marginally Suitable	3,142.4	6.6
3	Moderate Suitable	4,496.6	9.4
4	Not Relevant	32,734.5	69.1
6	Currently Not Suitable	2,568.5	5.4
7	Permanently Not Suitable	1,119.7	2.3
5	Water Bodies	907.9	1.9
8	**Total**	**47,380.0**	**99.7**

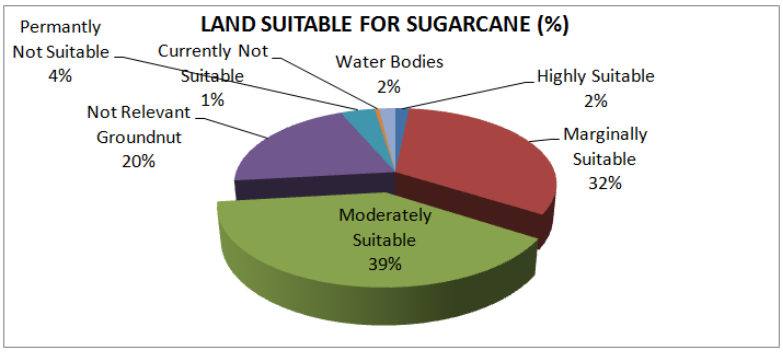

Figure 6: Land Suitable for Sugarcane (%)

About 5% of land is highly suitable and it covers 2410 sq.km of the study area. It associated near basin Thuriyur, Vazhapadi, Coimbatore North, Thiruchirappalli, Thiruvaiyar, Papanasam, Needamangalam, Oarthanadu, Mannarkodi, Pattukottai, Kodavasal, Krishnarayapuram, Kadavur. About 6.6-9.4% of land is marginally and moderately suitable for

sugarcane cultivation. It covers Paramathi, Trichengode, Thottiyam, Valangani, ThiruvarurKivelur, Thirukkuvalai, Tharangambadi, Kuthalam, Mailladudhurai, Kombakkonam, Tiruppur, Coimbatore South, Sulur, Edapadi, Palladam, Avanasi, Gobichettipalayam, Nammakal, Musiri Lalgudi, Ariyalur, Karur, Perambalur, Palani, Kulithalai, Srirangam, Athur, Nilakkottai, Sirkali, Karaikal, Nagapattinam.

Around 5.4-2.3% land is currently and permanently not suitable for sugarcane due to Calcareousness, in proper drainage, soil depth and severe limitation of texture and Gravelliness. It is observed in the central and south eastern part of the study area. It covers Erode, Gobichettipalayam, Mettur, Rasipuram, Dharapuram, Pappireddipatti and Vedaranyam. More than 69% of the area indicates that, they are not assessed for sugarcane cultivation, It is due to the topography, position, slope and economic factors. It covers the areas of Pennagaram, Palakkodu, Hosur, Denkanikottai, Sathyamangalam, Kotagiri, udhagamandalam, Gudalur, Coonoor, kodikanal, Mettupalayam, Perambalur, Kangayam, Perundurai, Sankari, and Omalur. The soil subclasses of this region are not supporting cultivation due to limitation in soil gravelliness, Soil calcareous, improper drainage and severe soil erosion.

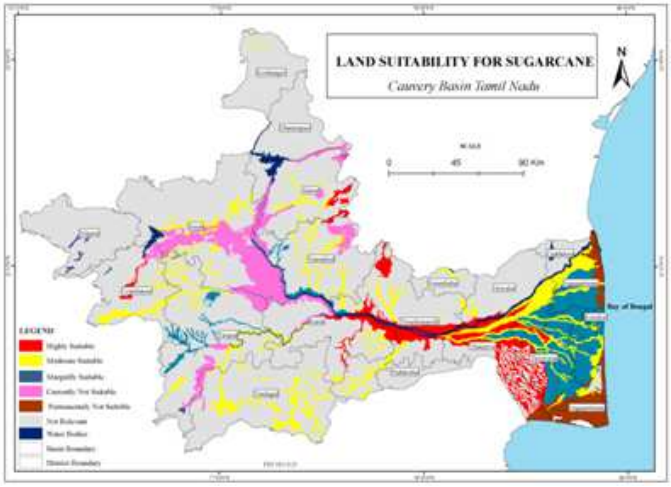

Figure 7: Land Suitability for Sugarcane Map

LAND SUITABILITY FOR GROUNDNUT

Groundnut is an important oilseed crop growing in Tamil Nadu Cauvery basin, mostly under rainfed condition. The important groundnut growing district is Pudukottai, Dharmapuri, North Arcot and Salem Coimbatore. Land suitability evaluation for groundnut is carried out based on the criteria developed available literature. The suitability grouping for groundnut has 26 sub classes association. The description of various sub classes associations with soil units.

Table 5: Suitable Classes for Groundnut

No	Suitability classes Groundnut	Area in sq km	Percentage (%)
1	Highly Suitable	777.9	1.6
2	Marginally Suitable	15,277.5	32.2
3	Moderately Suitable	18,577.3	39.2
4	Not Relevant Groundnut	9,639.4	20.3
5	Permanently Not Suitable	1,933.7	4
6	Currently Not Suitable	276.0	0.5
7	Water Bodies	907.9	1.9
8	**Total**	**47,113.7**	**99.2**

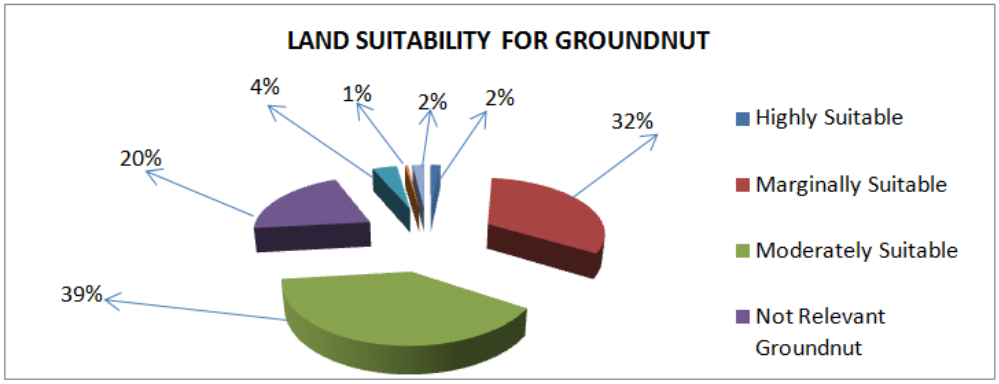

Figure 8: Land Suitability for Groundnut

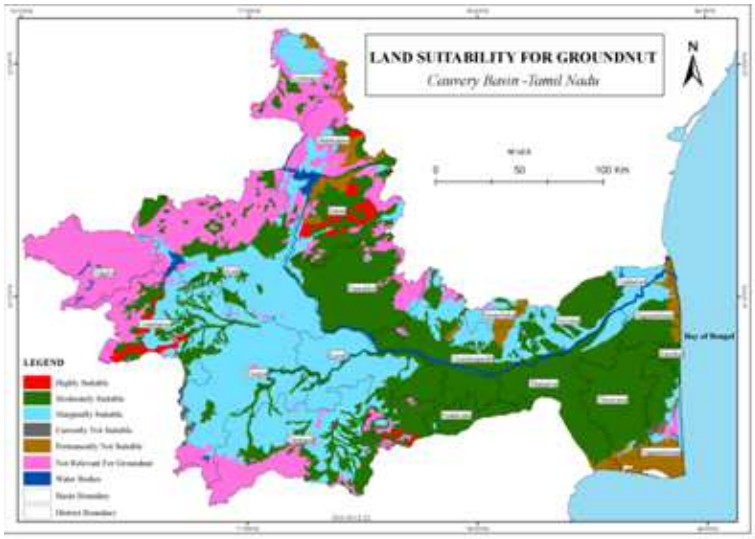

Figure 9: Land Suitability for Groundnut Map

That in the study area highly suitability land dominates in only 1.6% because the subclasses limitation, mainly Erosion problem, soil depth, calcareousness, soil gravelliness, and salinity sodicity. It indicates that groudnuts is grown in north and north western part of the area omalur, Salem, Edapadi, Sulur, Coimbatore South, and North.

Marginally and moderately suitable land is about 39-32% of the area, it occurs south and north east and south west, the area is Kulithalai, srirangam, Thiruverambur, Tanjavur, Valangani, Thiruvaur, Needamangalam, Oarthanadu, Mannargudi, Thiruthuripondi, Pattukottai, Ilappur, Thottyam, Musiri, Manachandur, Ariyalur, Sendurai, udayarpalam, Kuthalam, Kumbakkonam, Namakkal, Gangavalli, Natham, Tiruppur, Palani, Athur, Nilakottai, Kulithalai, Palladam, Mettapalayam, Sulur, Karur, Aravakurachi and Denkanikottai Only 4. % land is currently and pernmently not suitable land for Groundnut cultivation, due to the degree of limitation of the subclasses. It is observed in Pollachi, Thirukkuvali, penagaram, Mettur, Edapadi, Kunnam, Vedaranayam. More than 20.3% of the study area is not reverent for groundnut, because of the bad topography, soil erosion and drainage problem.

It covers 276 sq.km and is mainly found in south, north and North West part Gudalur, Kotagiri, Coonoor, Mettupalayam, Udhagamandalam, Sathyamangalam, kollegal, Palakkodu, Krishnagiri, Rasipuram, Dharapuram, Kodikanal, Athur, Dindigul, Manappari, Udumalaipettai, and Kivelur, Thuraiyur etc. The various soil subclasses were not supported for growing crops, it have certain limitation for soil texture Soil depth, and limitation in Soil gravelliness, Soil

Calcareousness, and sever limitation for soil drainage and soil erosion etc

LAND SUITABILITY FOR COTTON

Cotton is the one of the important major cash crop of the Cauvery basin in Tamil Nadu. The criteria and ratings used for evaluation were compiled from the literature for cotton there are 30 sub classes association were arrived based on the Evaluation of the done the study area.

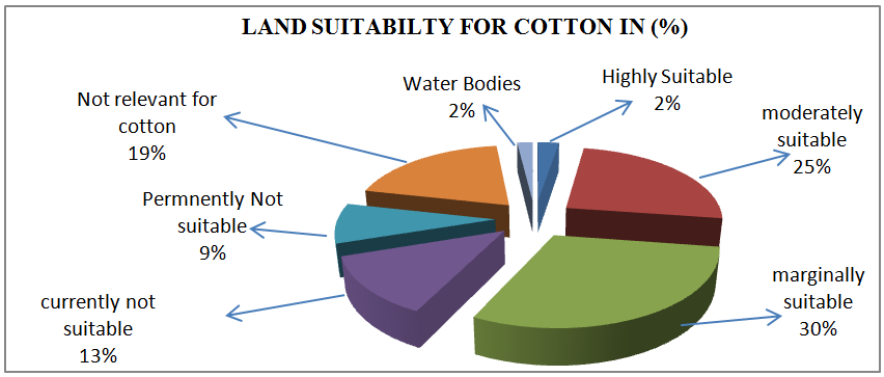

Figure 10: Land Suitability for Cotton in (%)

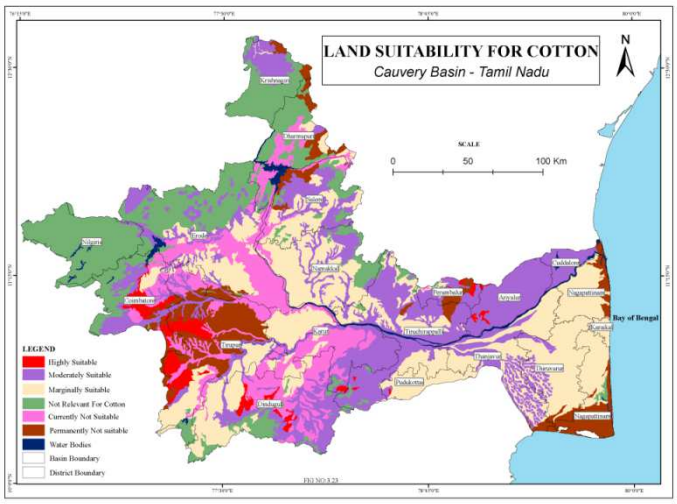

Figure 11: Land Suitability for Cotton Map

Table 6: Suitable Classes for Cotton

No	Suitability Classes for Cotton	Areas sq km	Percentage (%)
1	Highly Suitable	1,277.4	2.6
2	moderately suitable	11,700.4	24.6
3	marginally suitable	14,134.3	29.8
4	currently not suitable	5,981.2	12.6
5	Permanently Not suitable	4,116.4	8.6
6	Not relevant for cotton	9,279.3	19.5
7	Water Bodies	907.9	1.9
8	**Total**	**47,397**	**99.6**

The evaluation shows that, about 2.6% area is highly suitable for cotton cultivation. It covers 1277.4 sq.km and is mainly found in south and south east, western part of the basin in there are Oddanchadram, Dindigul, Athur, Manappari,

Madathukulam, Coimbatore North, Ariyalur. But various soil subclasses were not supported for growing crops, it have limitation for soil texture Soil depth, and limitation for the Soil gravelliness, Soil calcareousness, and sever limitation for soil drainage and soil erosion etc. more than 24.5-29.8% of the area not suitable for cotton cultivation. It covers 25830 sq.km of the study area and distributed over north east south, and south west partially central portion of the basin. Mainly Udumalaipettai, Kodikanal, Palani, Athur, Natham, Aravakurachi, Karur, kulithlai, Srirangam, Tiruchirappalli, Thiruviyaru, Thottyam, Namakkal, Kulathur, Gandarvakottai, ThanjavurPapanasam, Valangani, Needumangalam, oarthanadu, Mannarkudi, Pattukottai, Kombakonam, Nannilam, Nagapattinam Kuthalam, Mayiladuthurai, Tharamgabadi, sirkali, Chidambaram, Manachandular, Paramathi, Gobichettipalam, Tiruchengodu, Rasipuram, Gangavalli, Edapadi, Omalur, and Dharamapuri, Hosur. About 12.6-8.6% area is permanently and not currently suitable for cultivated for cotton because the soil sub classes have a sever limitation for soil fertility and limitation for soil depth as well as soil texture, etc. This kind of land covered (10097sqkm), especially Krishnagiri, Palakkodu, Dharapuram, Mettur, Kangeyam, sulur, Vadaranyam, Thiruthuraipondi, Erod, Gobichettaipalayam, Avanasi, Krishnarayapuram, Kadaur, Nilakkodi, and Dharapuram. Especially 19.5% is not relevant for the cotton cultivation due to mostly of the land was hilly rock, and gullied erosion land. About (92793sqkm) to covered the study area, coonoor, Kotagiri, Mannarkadu, Coimbatore, south, Peramalur, Sathyamangalam, Salem, Bhavani, Kollegal Rasipuram, Denkanikottai etc.

CONCLUSIONS

The stability of agriculture over an area depends upon the cropping pattern prevailing there. “Cropping pattern means the proportion of area under different crops at given point of time”. Cropping pattern is however, a dynamic concept and it changes in space and time. Cropping pattern of the regions is closely influenced by the geo-climatic, socio economic and political factors. The physical environment imposes limits on the growth and distribution of plants and animals. Depending on the geo-ecological conditions and availability of irrigation, the cropping patterns vary from region to region. In those regions where the physical diversity is less, the cropping patterns are less diversified and vice versa. In addition to physical environment, the land ownership the land tenancy, size of holding and fields also influence the cropping patterns. A farmer with small holding prefers the cultivation of labour intensive crop, while a large holding farmer goes for the capital intensive agricultural practices.

The analysis is done taking different aspects. Fundamental to any study of a cropping pattern is the spatial distribution of individual crops. Therefore, it is analyzed in detail as a first part. The spatial distribution exhibits that a few crops are more significant than the others in particular districts. Therefore it is logical to analyze the ranking of crops, which is done in second part. In the third part of analysis, an attempt is made to identify the crop combinations. The last analysis is to identify the index of crop diversification to explain the relative agricultural potential of the districts.

REFERENCES

1. **Addeo, G., (**2001). Land and water quality for sustainable and precision farming, I World Congress on Conservation Agriculture, Madrid.
2. **Anderson, L.T.** (1987). Seven methods for calculating land capability/suitability, Planning Advisory Service (PAS) Report No. 402.
3. **Rasheed S., Venugopal. K** (2009). Land Suitability Assessment for Selected Crops in Vellore District Based on

Agro-ecological Characterisation, Indian Society, Remote Sensing Vol 37: pp 615–62

4. **Ghaffari A., Mirghasemi S.A. (**2000.**).** Assessing land suitability for crop production in the Karkheh River Basin, Iran, Geographer p. (14).
5. **Papan p., Boroomand Nasab.S** (2009) Qualitative Evaluation of Land Suitability For Principal Crops in the West Shoush Plain, Southwest Iran, Bulgarian Journal of Agricultural Science, Vol 15, pp 135-145.
6. **Suliman** (2010). A Developed GIS-based Land Evaluation Model for Agricultural Land Suitability Assessments in Arid and Semi Arid Regions, Research Journal of Agriculture and Biological Sciences, Vol 6 pp 589-599,
7. **Santiago Lo´ pez., Rodrigo Sierra (2010).** Agricultural change in the Pastaza River Basin: A spatially explicit model of native Amazonian cultivation, Applied Geography Vol 30 pp355–369
8. **Rejaur Rahman S. K., Saha (**2009**)**. Spatial Dynamics of Cropland and Cropping Pattern Change Analysis Using Landsat TM and IRS P6 LISS III Satellite Images with GIS, Geo-spatial Information Science Volume 12, pp 123-134
9. **Beek, K. J., P. A.** (1987). Quantified land evaluation procedure, Proceedings of the international workshop on quantified land evaluation procedures held in Washington, DC 27 April - 2 May 1986". International workshop on quantified land evaluation procedures, Washington, DC.
10. **Belton, V. and T. Gear** (1983). On a short-coming of Saaty's method of Analytical Hierarchies, Omega Vol 11: page no 228-230.
11. **Ceballos-Silva A and Lopez-Blanco. J** (2003). Delineation of suitable areas for crops using a Multi-Criteria Evaluation approach and land use/cover mapping: a case study in Central Mexico, Agricultural Systems Vol 77: Page 117-136.
12. **Nouri.J and Sharifipour R**. (*2004*) Ecological Capability Evaluation of Rural Development by Means of GIS, Iranian J Environment Health Science Eng**,** Vol.1, No.2, pp.81-90
13. **Thorne D.W. and Peterson H.B.**, (1949) Irrigated Soils, their fertility and Management, New York The Blackstone Company, Inc. Toronto.
14. **Diamond, J.T., and Wright J.**.. (1988.) Design of an integrated spatial information system for multi objective land use planning, Environment and Planning B: Planning and Design vol 15: pp205–220
15. FAO 2003. Theoretical framework for land Evaluation, Geoderma vol 72: pp165-190
16. FAO1976. A framework for land evaluation. Soils Bulletin, No. 32.FAO Rome. pp 62
17. **Foote, K. E. and Lynch. M,**(1996). Geographic information systems as an integrating technology, context, concepts and definition. University of Texas, Austin.
18. **Ghafari, A,Cook H. F and Lee H. C,**(2000). Integrating climate, soil and crop information: a land suitability study using GIS. 4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects and Research Needs, Banf, Alberta.

19. **Hopkins, L.D.** (1977). Methods of generating land suitability map, a comparative evaluation. Journal of American Institute of Planners. Vol 43: pp 386–400.

20. **Jankowski, P.** (1995). Integrating geographical information systems and multiple criteria decision making methods, international Journal of geographic Information System Vol 3: pp251 273.

21. **Jiang, H. and Eastman J. R.** (2000). Application of Fuzzy Measures in Multicriteria evaluation in GIS, International journal of Geographic Information Science Vol 14: pp 73- 184.

22. **Kangas, J.** 1992. Multiple-use planning of forest resources by using the Analytic Hierarchy Process, Scand. Journal of Forest Research. Vol 7: pp 68-259.

23. **Kangas, J.** 1993. A multi-attribute preference model for evaluating the reforestation alternatives of a forest stand, Forest Ecology and Management. Vol 59: pp 88-271.

24. **Klingebiel, A.A. and Montgomery, P.H**. (1961) Land-capability classification, Agricultural Handbook 210, Soil Conservation Service. U.S. Govt. Printing Office, Washington, D.C. 21 pp.23-43

25. **Lai, S.** (1995). A preference-based interpretation of AHP. Omega Vol 23: pp 453-462.

26. **Leingsakul, M., S. Mekpaiboonwatana, P. Pramojanee, K. Bronsveld and Huizing.H** (1993). Use of GIS and remote sensing for soil mapping and for locating new sites for permanent cropland -a case study in the highlands of northern Thailand. Geoderma Vol 60: pp 293-307.

27. **Lillesand T.M and Keffer R.W**, 2000; Remote sensing and image interpretation, 4th edition, John Wiley and Sons, Inc, New York.

28. **Malczewski, J.** (1999). GIS and Multicriteria decision Analysis. John Wiley &Sons, Inc, New York.

29. **Marble, D. H., Calkins H. W. and Pequet D.J,** (1984). Basic Readings in Geographic Information Systems. Williamsville, NY.