

Patterns of Crop Concentration and Diversification of Kongu Uplands, Tamil Nadu, India

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ABSTRACT

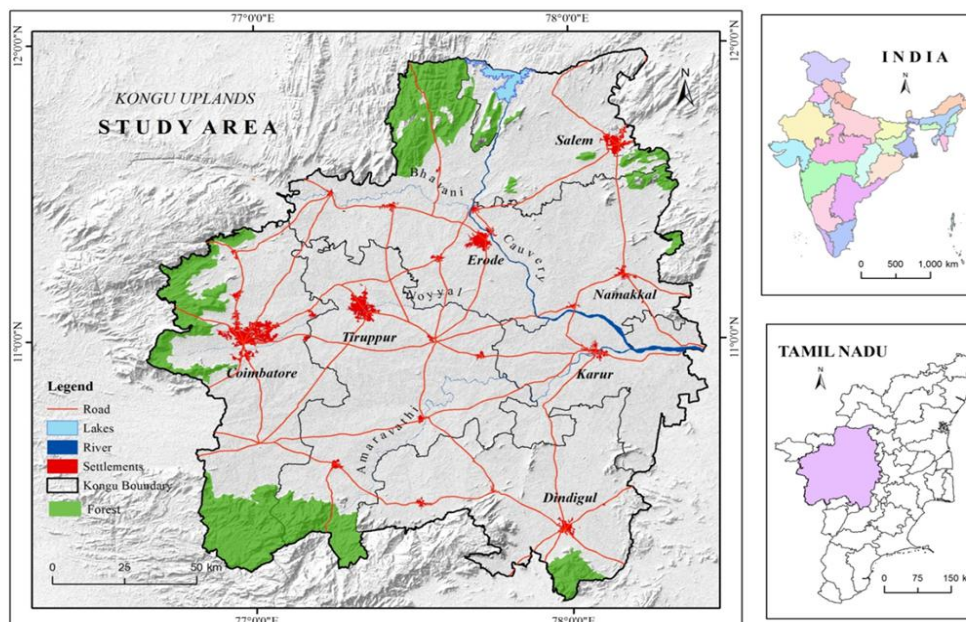
In the present study the spatial patterns of agricultural crops in Kongu Uplands has been outlined through the statistical techniques of crop concentration and diversification. The study is at block level which covers eighty-one blocks of eight Districts viz., Coimbatore, Tiruppur, Erode, Karur, Tiruchirappalli, Namakkal, Salem and Dindigul. The study area covers an area of approximately 26,000 sq. km. The statistical techniques plays significant role in assessing the dominating positions of crops in a particular area. Bhatia's Location Quotient method and Gibb's Martin's quantitative technique has been adopted for computing the crop concentration and the diversification index respectively. Jowar, Coconut, Ground Nut, Paddy, Maize, Fodder Crop and Sugar Cane are identified to be the highly concentrated crops in the study area in which jowar and Coconut covers large portions of the cropped land area. The crop diversification of seventy-five blocks is high, five blocks are moderate and one block is low, which clearly suggests that Kongu Uplands is highly diversified with crops.

1. Introduction

The primary purpose of this study on crop concentration and diversification is to understand the cropping pattern of a region. One among the classic studied on agricultural regionalization was the attempt of Bhatia (1965) who investigated the regional character of crop distribution in a quantitative manner (Gomathi and Kumaraswamy, 2016). In the geography of agriculture quantitative measures of crops is essential to facilitate the understanding of the physical and human interactions of a region (Jegankumar, 2015). Cropping pattern is the proportional area under various crops at a point of space and time (Priyadarshini and Aruchamy, 2014). The delimitation is carried out by drawing boundaries for regions

with statistical analysis such as clustering and deviations. Regionalization is the process of disintegrating region into sub regions based on some uniformity. The agricultural regionalization can be done with the quantitative measures of crop concentration and crop diversification (Vahitha, 2014). Crop concentration and diversification plays significant role in agricultural land use study. Crop concentration focuses on important crops those may be food crops as well as cash crops. The crop concentration according to the region varies with physiography, climate, soil, socio-economic factors and method of agriculture (Bhatia 1965). An effective land use planning for all anthropogenic activities can be done by understanding the cropping pattern of a region (Shyju and Kumaraswamy, 2017).

2. Study Area



Geographically the Kongu uplands is located in between 10°10'N to 12°10'N latitudes and 76°40'E to 78°25' E longitudes with an areal cover of 26,000 sq. km approximately (which is nearly one fifth of the total geographical area of the Tamil Nadu). It shares its borders with Kolli hills in the East, Nilgiri hills in the West, Stanley reservoir in the North and Kodaikanal hills in the South. It lies in the Southern parts of Deccan plateau which is the oldest formation in the Archaen period with geographical isolation and thus its physical setup differs from the other parts of the state. It shows an average elevation of 450m in the West and gradually decreases to 200m towards East approximately. Old crystalline and metamorphic rocks of Archaen age is the geological characteristics of Kongu Uplands. Kongu Uplands consists of 98, 335, 71 persons as per the Census of India, 2011, out of which the rural population consist of 69, 870, 82 persons. The total male and female population is 34, 420, 72 and 33, 644, 54 persons respectively. The Kongu Uplands is connected with developed transportation system that includes roadways, railways and airways. Kongu Uplands politically comprises of eighty-one blocks distributed in eight Districts of Coimbatore, Tiruppur, Erode, Karur, Tiruchirappalli, Salem, Dindigul, Namakkal in Tamil Nadu. The study area is shown in figure 1.

The crop concentration is worked out by using Bhatia's (1965) Location Quotient (LQ) method for the major crops in the study area. The delineation of crop diversification for each block has been done based on Gibbs Martin's Index (1962) of diversification. All the resultant outcomes have been represented in maps as well.

3. Data And Methodology

The cropping data for the period of 2015-2016 is collected data from District Statistical Office of each District. Kongu Upland's natural boundary has been demarcated with the help of 1: 2,50,000 Toposheets and Aster 30m DEM and Block maps were digitized from the Census Hand Book, 2011.

$$\text{Crop Concentration Index of 'p' Crop} = \frac{\text{Area of 'p' crop in the areal unit}}{\text{Area of all crops in the component areal unit}} \div \frac{\text{Area of 'p' crop in the entire region}}{\text{Area of all crops in the entire region}}$$

Higher the index values higher the crop concentration and lower the index values lower the crop concentration hence the index values are directly proportional to crop concentration. With the resultant index values the crop concentration of Kongu Uplands can be classified in to High, Moderate and Low. The concentration of the major crops of Kongu Uplands such as jowar, coconut, groundnut, paddy, maize, Fodder Crop and sugar cane are discussed in the following paragraphs.

The practice of cultivating more than one variety of crops in a given area in the form of crop rotation and intercropping is designated as crop diversification. It is supposed to be one of the most environmentally reasonable, cost effective and rational ways of decreasing suspensions in agriculture especially among

The crop concentration is the dissimilarities in the density of any crop in an area/region at a given point of time. The crop concentration in an area is largely influenced by its terrain, temperature, moisture and pedagogical conditions. It has a tendency to have high concentration in the areas of ideal agro-climatic conditions and the density declines as the geographical conditions become less conducive. Delineation of crop concentration region helps in determining the areas where a particular crop grows well even with the help of minimum inputs, and thus has great implication for agricultural development and planning. Crop concentration has its own advantage on cropping intensity and diversification in the process of determining the regional pattern of crop distribution. Available G-Return data from the Economics and Statistical Department with applicable statistical method can help to comprehend the clear picture of complex agricultural practices.

The location quotient technique has also been applied by geographers to find out the crop concentration. In this technique the regional character of crop distribution is investigated and determined, first by comparing the proportion of sown area under different crops and ranking them, and secondly, by relating the crop density in each of the component areal units of the region/country to the corresponding density of the region/country as a whole. It also helps to identify and differentiate areas that have some significance with regard to the crop distribution within the region. This method helps to compare and associate different crop distributions on a uniform scale, added it will facilitate for the full generalization of an area/region the formula is as follows:

smallholder farmers(Joshi 2005). Crop diversification tends to be agronomically stable, resistant and brings higher spatial and temporal biodiversity on the farm (Holling 1973; Joshi 2005). This resilience is chiefly because they are generally related with reduced weed and insect pressures, reduced requisite for nitrogen fertilizers (with leguminous crops), reduced erosion (because of the inclusion of cover crops), increased soil fertility and increased yield per unit area (Lin 2011). Crop Diversification is just the opposite concept of crop specialization. The crop diversification index is primarily used to identify the performance of crops over a period in a particular aerial unit. If higher the diversification index of an area larger the number of crops cultivated in that area and vice-versa. If the diversification index lesser, then greater will be the trend

towards specialization and emphasized more on one or two crops (Jasbir Singh, 2002). In the present study Gibbs and martin's method of crop diversification index (1962) is used in order to measure the extent of diversification in the cropping pattern in Kongu Uplands. The formula for finding out the crop diversification index is as follows:

$$\text{Index of Crop Diversification} = 1 - \frac{\sum x^2}{(\sum x)^2}$$

Where x = Total cropped area of each crop

If the index of diversification values is close to 1, then the diversification is relatively high and when the index value far from 1, then that area will have low diversification. If the total

Crop Concentration in Kongu Uplands

The patterns crop concentration of seven major crops viz., jowar, coconut, ground nut, paddy, maize, fodder crop and sugar cane in the region has been discussed in detail. The results show that there is direct relationship between physical setup.

Jowar

Jowar is the first ranking crop in the study area as whole as it occupies 17.25 % here. Uthukuli possess the largest land under jowar with 72.42sq. km. High concentration of jowar is identified in eighteen blocks, moderate concentration in thirty-three blocks and low concentration in thirty blocks rest of the blocks which shows that Jowar is moderately concentrated in Kongu Uplands.

Coconut

Coconut is the second ranking crop in Kongu Uplands with the percentage land share of 17.02. Anaimalai block possess the highest coconut concentration with a land cover of 20.85 sq. kmin the whole Kongu Uplands. The highest coconut concentration is observed in thirteen blocks, moderate in twenty five blocks; low in forty-three blocks. Here large number of area falls in the category of low coconut concentration.

Ground Nut

Ground nut have a land share of 59.47 sq. km in the whole Kongu which is 8.39 %. The highest concentration of ground nut is found in twelve blocks, the moderate concentration in thirty-five blocks and the lowest concentration in thirty-four blocks. Majority of the block falls in the moderate and low ground nut concentration categories.

Paddy

Paddy is also one of the major crops grown in Kongu Uplands which occupies 8.39 % of the total land area. Gobichettipalayam with 75.14 Sq. km is the largest contributor of paddy in Kongu Uplands. The highest paddy concentration is found in the fifteen blocks, moderate in twenty- five blocks and the low concentration is in forty-one blocks.

area of a region is specialized to one crop then the value will be zero. The following table shows the index values of each block.

4. Results and Discussion

Among these majority of the block shows lower paddy concentration.

Maize

Maize is also a major crop in Kongu Uplands with a percentage share of 7.09. Thoppampatti block is the largest contributor of maize with its 70.30 Sq. km falls in maize cultivation. The highest concentration of maize is found in fourteen blocks, the moderate concentration in twenty- four and the lowest concentration in forty-three blocks. The majority of crops here fall in low concentration category.

Fodder Crop

Fodder crop is an important crop which has a share of 4.49 % in Kongu Uplands. Nambiyur with 48.82 sq. km is the largest contributor of Fodder Crop in the study area. The high concentration of Fodder Crop is found in fourteen blocks; moderate in twenty- five blocks and lowest in forty- two blocks. These results show that fodder crop has low concentration in Kongu Uplands.

Sugar Cane

Sugar cane is also a major crop predominates in the study area with the percentage share of 4.44. Kabilarmalai with the land share of 59.52 sq. km is the block with the highest share of this crop. The highest concentration of sugar cane is identified in seventeen blocks, moderate concentration in forty- nine blocks and low concentration in fifteen blocks which shows that sugar cane is moderately concentrated in Kongu Uplands.

5. Diversification in Kongu Uplands

The crop diversification index calculated for the blocks in Kongu Uplands shows seventy- five blocks out of eighty- one falls under the category of high diversification index which shows an index value of >0.6. Five blocks has been moderately diversifies and only one block i.e., Annur is with 0.22 diversification index that comes under the category of low diversification index. Thus it is very obvious that the crops of Kongu Uplands are highly diversified in nature. Table 2 and figure 2 illustrates the crop diversification its detail.

Figure 2: Crop Concentration

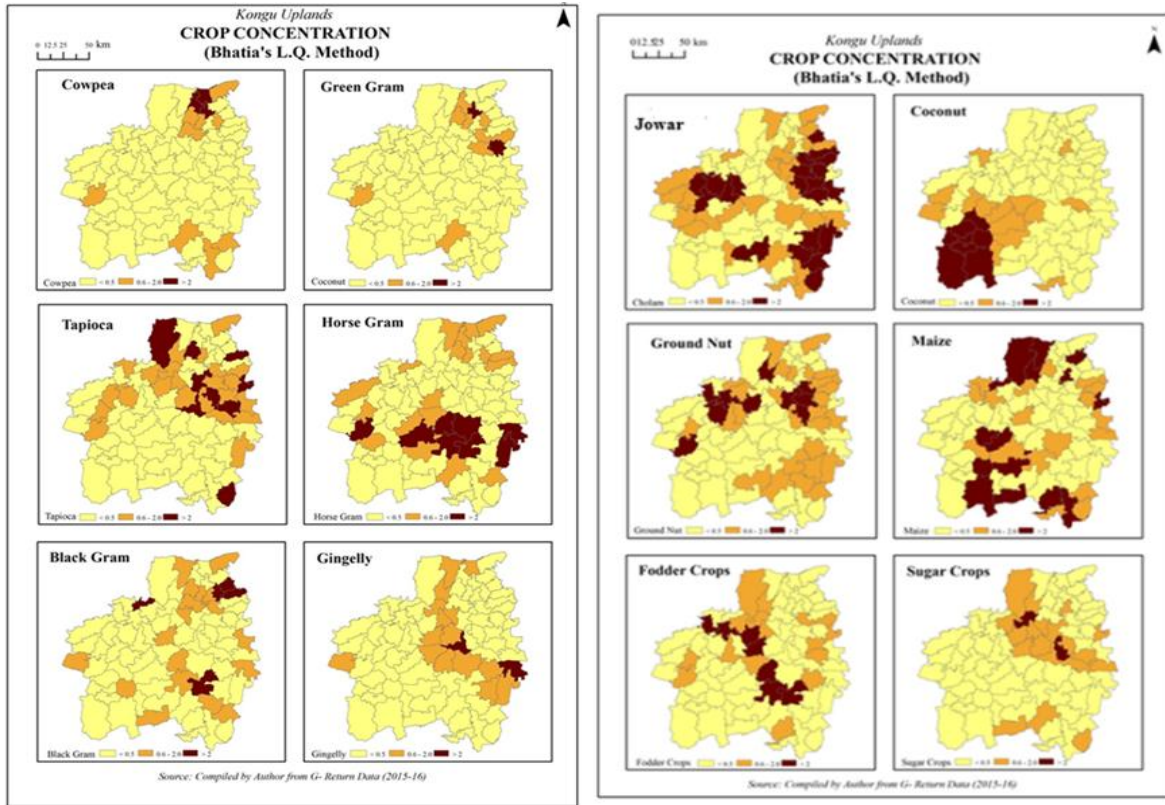


Figure 3: Index of Diversification

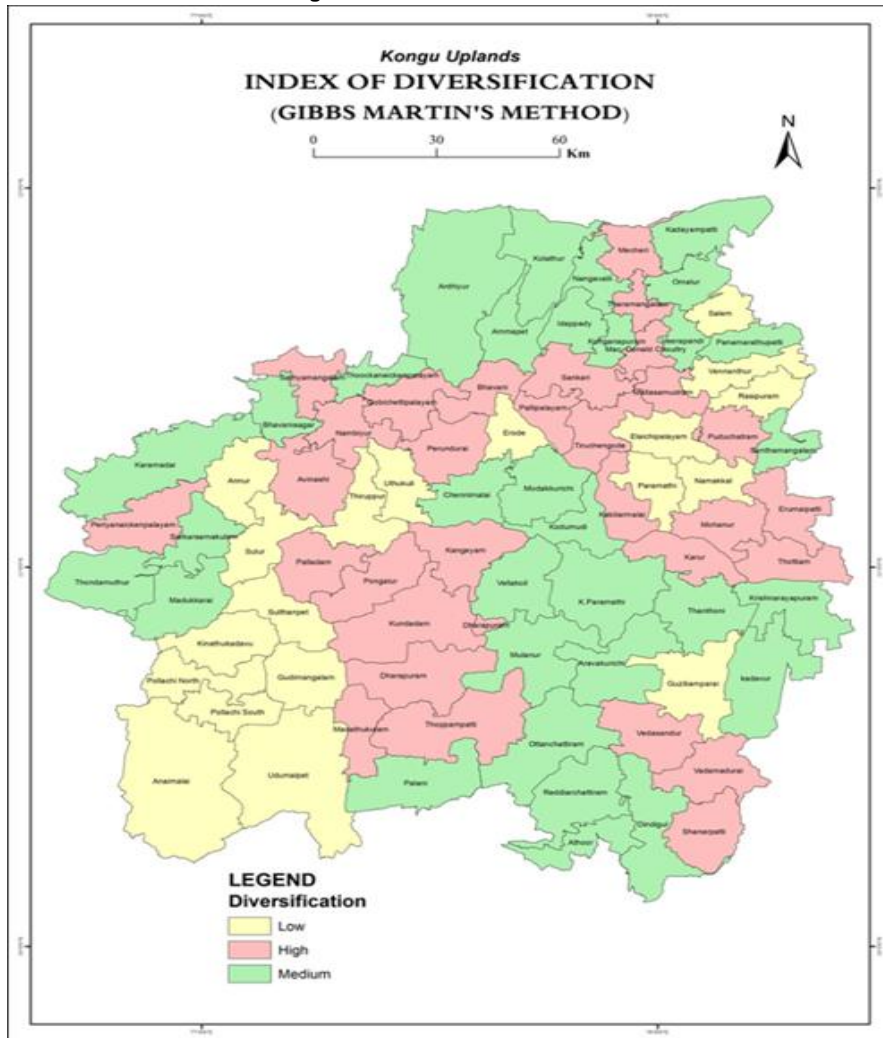


Table 1: Crop Concentration

Block Name	Jowar	Coconut	Ground Nut	Paddy	Maize	Fodder Crop	Sugar cane
Ammapettai	0	0.22	2.44	1.82	2.58	2.05	2.35
Anaimalai	0.13	4.3	0.69	0.83	0.01	0.42	0.1
Annur	2.44	0.54	0.43	0	0.47	0.51	0.51
Anthiyur	0	0	0.73	0.09	2.01	2.67	4.16
Aravakurichi	0.37	0.41	1.09	0.1	0.58	3.68	0.01
Athoor	1.02	1.67	0.12	1.38	0.75	0.1	0.01
Avinashi	1.89	0.66	3.24	0	0.23	0.5	0.58
Bhavani	0	0.24	0.76	3.43	1.26	2.11	5.15
Bhavanisagar	0	0.22	2.89	0.33	0.94	4.81	0.31
Chennimalai	0	0.79	0	2.64	1.08	5.62	2.24
Dharapuram	0.27	1.21	0.67	2.79	3.29	0.62	0.64
Dindigul	0.95	0.57	0.32	0.52	2.45	0.3	0.02
Edappadi	0.71	0.22	1.1	1.03	0.79	0.08	0.62
Elachipalayam	2.22	0.23	4.04	0	0.08	1	0
Erode	0	0.55	0.25	6.28	0.14	1.76	1.96
Erumaipatti	2.35	0.16	1.23	1.75	0.85	0.88	0.44
Gobichettipalayam	0	0.29	1.1	4.45	0.41	3.11	2.81
Gudimangalam	0.16	3.4	0.01	0	2.93	0.01	0
Guziliamparai	2.77	0.36	1.59	0.3	0.16	0.19	0.1
K.Paramathy	1.68	0.48	0.55	0.47	1.47	0.28	0.03
Kabilarmalai	1.04	0.51	0.99	0.56	0.44	0.49	7.97
Kadavur	1.96	0.19	1.25	1.2	0.21	0.09	0.25
Kadayampatti	0.82	0.24	1.03	0.73	0.09	0.24	0.91
Kangeyam	1.85	1.4	0.12	1.21	0.1	2.22	0.64
Karamadai	1.21	0.77	0.1	0	0.43	0.15	0.14
Karur	0	1.55	0.08	0.96	0.01	0.11	3.49
Kinathukadavu	1.06	3.46	0.34	0	0.21	0.08	0
Kodumudi	0	0.68	0.65	2.58	0.49	1.07	3.22
Kolathur	1.14	0.08	1.29	0.89	2.25	0.35	0.13
Konganapuram	0.94	0.13	2.11	0.33	0.34	0.05	0.09
Krishnarayapuram	1.18	0.2	0.33	2.15	0.11	0.78	0.64
Kundadam	0.68	2.42	0.09	0.05	1.64	0.79	0
Madathukulam	0	1.69	0.1	2.17	3.1	0.11	3.65
Madukkarai	1.06	2.36	0.41	0	0.34	0.33	0.12
Magudanchavadi	1.12	0.14	2.71	0.17	0.02	2.37	0.21
Mallasamudram	2.09	0.18	2.75	0.2	0.38	1.85	0.15
Mecheri	0.06	0.36	0.36	0.12	0.01	0	0.17
Modakurichi	0	0.94	0.24	2.44	0.21	0.92	3.12
Mohanur	2.01	0.45	1.28	0.81	0.48	1.94	1.89
Mulanur	0.5	0.5	0.72	0.09	1.34	5.19	0.01
Namakkal	3.19	0.34	1.01	0.11	0.55	2	0.28
Nambiyur	0	0.22	3.78	0.51	1.15	6.57	0.8
Nangavalli	0.51	0.71	0.37	0.06	0.03	0.15	0.04

Oddanchathram	1.09	0.64	0.39	0.03	3.83	0.27	0.05
Omalar	1.14	0.17	1.68	0.97	0.1	0.05	2.53
Palani	0.27	0.9	0.08	3.36	2.68	0	1.45
Palladam	0	1.61	0	4.86	2.03	0.11	0.02
Pallipalayam	1.2	0.16	1.61	3.61	0.11	0.67	2.74
Panamarathuppatti	1.74	0.33	0.98	0.82	0.51	0.63	0.26
Paramathi-Velur	2.49	0.36	2.69	0.1	0.08	0.31	1.76
Periyanaickenpalayam	1.47	2.07	0.01	0	0.39	0.31	0.32
Perundurair	0	0.26	2.94	2	0.44	5.71	2.12
Pollachi North	0.57	4.43	0.68	0	0.05	0.03	0.01
Pollachi South	0.61	4.28	0.24	0	0.3	0	0
Pongalur	1.13	2.49	0.02	0	2.14	0.3	0
Puduchatram	2.16	0.08	1.79	0.01	0.68	0.51	0.09
Rasipuram	2.85	0.06	1.48	0.07	1.2	1.5	0.03
Reddiarchatram	0.56	0.72	0.23	0.24	3.86	1.28	0.03
Salem	3.01	0.37	0.33	1.78	0.06	0.01	0.22
Sanarpatti	1.54	0	0.22	0.47	0.24	0.16	0.04
Sankari	1.03	0.24	1.87	2.53	0.4	1.95	0.93
Sarkar Samakulam	0	2.75	0	0	0.75	0.37	0.43
Sathyamangalam	0	0.25	0.05	0.94	2.39	1.65	2.74
Senthamangalam	2.13	0.21	0.67	0.68	1.12	0.41	2.55
Sultanpet	0.83	3.76	0	0	1.46	0.36	0
Sulur	2.56	2.24	0	0	0.56	0.64	0.11
Thanthoni	1.85	0.4	1.02	1.33	0.07	2.8	0.2
Tharamangalam	0.66	0.08	0.67	0.15	0.04	0.53	0.05
Thiruppur	3.32	0.88	0.83	0	0.29	1.63	0.01
Thondamuthur	0.4	1.98	0.22	0.2	0.41	0.2	0.4
Thoppampatti	1.11	0.57	0.95	0.44	2.92	0.24	0.34
Thottiyam	2.29	0.21	1.19	1.94	0.29	0.21	0.46
Thukkanaickenpalayam	0	0.31	0.23	4.67	0.73	0.61	2.5
Tiruchengode	1.22	0.25	3.07	0.13	0.03	0.41	2.04
Udumalpettai	0.15	3.07	0.09	0.51	1.96	0.05	1.07
Uthukuli	3.7	0.34	1.82	0	0.21	0.62	0.01
Vadamadurai	1.98	0.59	1.09	0.52	0.88	0.11	0.01
Vedasandur	2.42	0.54	2.06	0.4	0.57	0.1	0
Veerapandi	1.63	0.44	1.39	0.41	0.06	0.19	0.23
Vellakoil	0.47	1.24	0.25	2.19	0.31	3.97	1.15
Vennandur	2.76	0.24	1.03	0.52	1.44	0.95	0.2

(Source: Computed by Author from G-Return Data, 2015-16)

Table 2: Crop Diversification

Block Name	Index	Block Name	Index	Block Name	Index
Ammalpettai	0.88	Kodumudi	0.87	Pongalur	0.75
Anaimalai	0.55	Kolathur	0.90	Puduchatram	0.76
Annur	0.22	Konganapuram	0.90	Rasipuram	0.72
Anthiyur	0.89	Krishnarayapuram	0.89	Reddiarchatram	0.88
Aravakurichi	0.91	Kundadam	0.79	Salem	0.70

Athoor	0.86	Madathukulam	0.81	Sanarpatti	0.80
Avinashi	0.80	Madukkarai	0.79	Sankari	0.89
Bhavani	0.85	Magudanchavadi	0.87	Sarkar Samakulam	0.75
Bhavanisagar	0.86	Mallasamudram	0.80	Sathyamangalam	0.90
Chennimalai	0.92	Mecheri	0.84	Senthamagalamb	0.83
Dharapuram	0.84	Modakurichi	0.86	Sultanpet	0.56
Dindigul	0.91	Mohanur	0.83	Sulur	0.66
Edappadi	0.93	Mulanur	0.88	Thanthoni	0.85
Elachipalayam	0.73	Namakkal	0.67	Tharamangalam	0.83
Erode	0.72	Nambiyur	0.80	Thiruppur	0.64
Erumaipatti	0.79	Nangavalli	0.86	Thondamuthur	0.85
Gobichettipalayam	0.82	Oddanchathram	0.86	Thoppampatti	0.89
Gudimangalam	0.62	Omalur	0.88	Thottiyam	0.78
Guziliamparai	0.74	Palani	0.85	Thukkanaickenpalayam	0.80
K.Paramathy	0.86	Palladam	0.76	Tiruchengode	0.83
Kabilarmalai	0.82	Pallipalayam	0.84	Udumalpettai	0.70
Kadavur	0.85	Panamarathupatti	0.88	Uthukuli	0.56
Kadayampatti	0.93	Paramathi-Velur	0.75	Vadamadurai	0.84
Kangeyam	0.81	Periyanaickenpalayam	0.80	Vedasandur	0.78
Karamadai	0.87	Perundurair	0.83	Veerapandi	0.87
Karur	0.81	Pollachi North	0.42	Vellakoil	0.87
Kinathukadavu	0.61	Pollachi South	0.45	Vennandur	0.74

(Source: Computed by Author from G-Return Data, 2015-16)

6. Conclusion

The cropping pattern of Kongu Uplands has been analyzed through the methods of crop concentration, and crop diversification. The study reveals that there are nineteen crops widely cultivated in the study area. Among these banana, jowar, coconut, cow pea, Fodder Crop, green gram, ground nut, maize, paddy, sugar cane and wheat are the first ranking or highly concentrated crops in Kongu Uplands. The crop diversification index calculated through Gibbs and Martin's

method indicates that large majority of seventy- five blocks out of eighty one in the study area is highly diversified. Only five blocks come under moderate crop diversification and only one block comes under low diversification. Thus there is wide scope of cultivating a number of crops through crop rotations and intercropping. More application of manures, crop rotation, intercropping and drip irrigation are the effective measures to that develops the soil health, facilitates the minimum water use and reduce water pollution.

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