

A Study on the Impact of Endosulfan on the Decline of Cashew Plantations in Kasaragod District of Kerala

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Abstract: *Kasaragod an agro - based district where majority is depend up on agriculture and related industries. The agricultural sector of Kasaragod district has witnessed a paradigm shift in the cropping pattern from edible crops towards non - edible crops, and from one non - edible crop to another depends on the benefits of emerging markets. These changes have caused severe challenges to the environment in the form of land degradation, groundwater depletion and chemical pollution. During 1985 the order of the first five crops in Kasaragod district was coconut, cashewnut, rice, rubber and pepper, in the descending order of shares to the total cropped area, but in 2015, it is changed in the form of coconut, rubber, arecanut, cashewnut and pepper. This shows a major shift from subsistence cropping to commercial cropping. The major reason for the change in land use pattern is the Plantation Corporation of Kerala has been aerially spraying the pesticide Endosulfan on the cashew plantation covering several villages in Kasaragod District over the past two and a half decades. This cause a decline in the loss of cashew plantation in this district. This paper attempts to study on the Impact of Endosulfan on the decline on Cashew plantations in Kasaragod district by using the robust methodology of GIS and Remote Sensing. From this study it shows the decline of Cashew plantations in the district has changed the land use.*

Keywords: Cashew plantations, Landuse, Endosulfan, Remote sensing

1. Introduction

The latter half of the last century was an era of intensive industrialization and use of modern technology and science in all aspects of human activities. The introduction of chemical farming saw growth in agricultural production but at a great cost to the environment and human health. Modern day forms of intensive crop based agriculture involve the use of mechanical ploughing, plastic mulches, chemical fertilizers, plant growth regulators or pesticides. It is associated with the increasing use of agricultural mechanization, which has enabled a substantial increase in production, but a dramatic increase in environmental pollution with agricultural chemicals. Human impact on biodiversity is significant, humans have caused the extinction of many species, including the dodo and, potentially, large megafaunal species during the last ice age. Though most experts agree that human beings have accelerated the rate of species extinction, the exact degree of this impact is unknown, perhaps 100 to 1000 times the normal background rate of extinction (May 1988).

Although the 'Green Revolution' brought about large gains in agriculture, its impact on human health included the farmers who used the technology, the people in the vicinity of farms and ultimately the end consumer. Agriculture which involves chemical inputs involves potential exposure to a wide range of respiratory toxins, many in concentrations higher than in other industries. Schenker, M. B (1998) noted that despite low rates of cigarette smoking, farmers have an increased prevalence of several acute and chronic respiratory diseases

The determined numbers of illnesses are the consequences of agricultural occupational exposures, and determine that the long - term adverse health effects are from agricultural exposures. Farmers have an increased prevalence of many

acute and chronic health conditions including cardiovascular and respiratory disease, arthritis, skin cancer, hearing loss, and amputations. Other health outcomes have been little studies in the agricultural workplace, such as stress and adverse reproductive outcomes. (Brackbill, Cameron, Behrens, 1994)

Kasaragod in Kerala is an agriculture oriented district and the leading crops are rice, coconut, arecanut, rubber, pepper, cashewnut, tapioca, ginger, banana and other plantains. They accounted about 92 percent of the gross cropped area. At present, the dominant crops are coconut, rubber, arecanut, cashewnut and pepper. Coconut, rubber and arecanut together constituted 80 percent of the total cropped area. Rubber is the second important crop while rice is in the sixth position. This transformation has demonstrated a shift from subsistence cropping to commercial cropping and leads to diversification in agriculture.

2. Aim of the Study

This study mainly focuses on the Impact of Endosulfan on the decline of Cashew plantations in Kasaragod district of Kerala, India.

3. Materials and Methods

The study is based on secondary source of data. The topographical sheets of Kasaragod district 48L/12, L/14, L/15, 48P/2, P/3, P/4, 48P/6 and 48P/7 is used to identify the cashew plantations. To show the changes the Landsat image for the year 2014 is used. The other sources of secondary data are various published reports of the Department of Economics and statistics and State Planning Board, Government of Kerala, Thiruvananthapuram. The secondary data were also collected from various printed and electronic

sources include books, journals, pamphlets, newspapers and websites.

Using Erdas engine and Arc GIS (10.3)) softwares mapping was done.

4. Study Area

Kasaragod district is the northern most district of Kerala state. It is world renowned for its coir and hand - loom products. Kasaragod is named after Kasaragod Town which is the administrative headquarters of the district. Kasaragod district lies between 12°12'N and 12°30' N latitude and 74°26'E and 74°52' E longitude. The district lies between the Western Ghats and the Lakshadweep Sea. The eastern part is hilly with small forest tracts.

It is bordered on the east by Kodagu and Dakshin Kannada districts of Karnataka state and in the north by Mangalore

taluk (Kannada district) of Karnataka state. On the west it is bordered by the Lakshadweep Sea, and in south by Kannur district (Kerala state). It has an average elevation of 19 meters (62 feet) and the landscape is dominated by the characteristic coconut palms accompanying hills and streams flowing into the sea. Kasaragod district comprises of a single revenue division. It has two taluks - Kasaragod and Hosdurg. There are four community development blocks, 38 Gramapanchayaths, and 127 villages in Kasaragod district.

The forests in the district covers an area of 110.71 sq. km. It comes under Kannur forest division. The forest of the district is of tropical moist deciduous type. They are found at an elevation of less than 750 metres with an with an annual rainfall of 2000 mm. Teak, Rosewood, Palms, Rubber, Bamboo, shrubs and bushes are the vegetation of the region. Cashew plantations are also seen in the hilly areas of the district

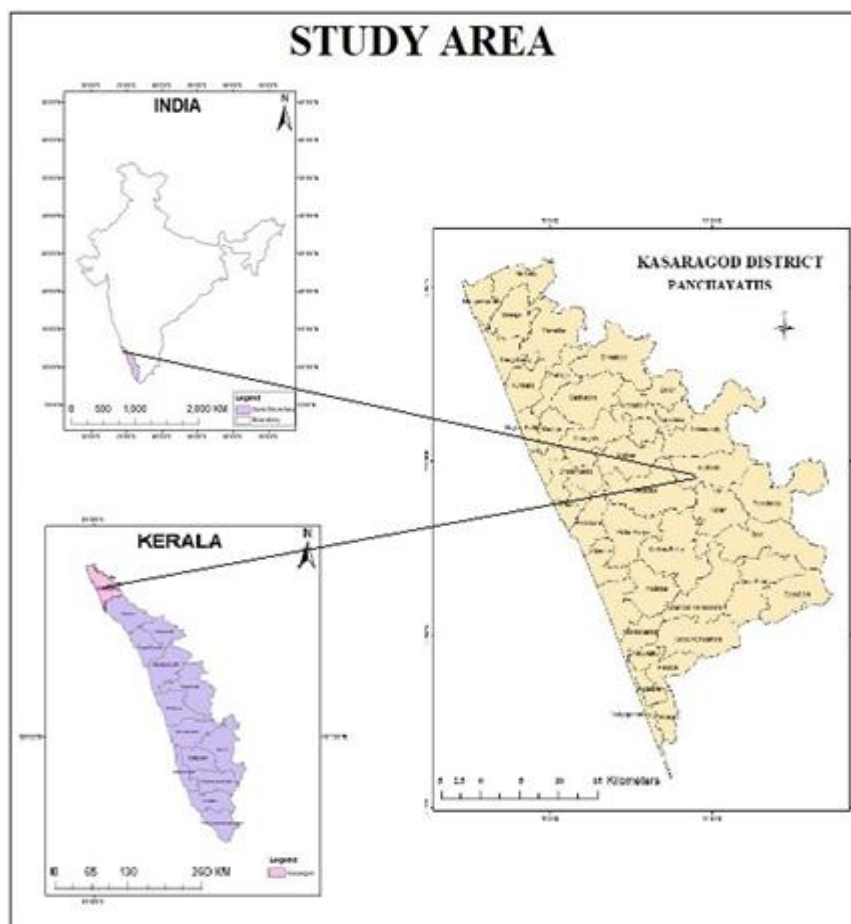


Figure 1: Location Map

5. Results and Discussions

Agricultural and horticultural crops are grown in Kasaragod. Coconut, cashew, paddy, arecanut, and pepper are the commonly cultivated crops. The largest area under cultivation is coconut. But this crop is facing severe crisis in view of sharp decline in price and the reduction in productivity due to the attack of an exotic pest mite – the Mandari. The second largest cultivation is rubber. Cashew is cultivated over an extent of 20448 hectares of land and in 2000 produced 28% of the state production. Pepper is mostly

grown in Kanhangad and Nileshwar block areas. The entire area under tobacco cultivation of the state is confined to this district between Kanhangad and Kasaragod particularly at Pallikara. In the coastal tract paddy, coconut, areca nut, cashew, vegetables and tapioca are cultivated. Wherever irrigation facilities are available paddy (first crop) banana and vegetables are cultivated. Generally paddy and coconut are cultivated in the entire belt. Cashew is largely grown in low fertile areas of the laterite hilly slopes. In the Eastern tract which comprises of forests and hilly areas, there is a

variety of timber with other plantations. The hilly areas are mostly used for crops like rubber, cashew and ginger.

5.1 Cashew Plantations

Cashew is cultivated on a large scale and many plantations are promoted by the Government of Kerala. The Cashew tree is a tropical evergreen tree that produces the cashew apple and cashew nut. It can grow as high as 14 meters (46ft), but the dwarf cashew growing up to 6 meters (20ft), has proved more profitable because of earlier maturity and higher yields.

In Kasaragod district there are three main cashew estates - Kasaragod estate, Cheemeni estate and Rajapuram estate. They are mostly located in the eastern part of the district. Kasaragod estate lies in the north east with a small portion in the west. Rajapuram estate lies in the east and Cheemeni estate lies in the extreme south. These three estates are spread over 20 villages. All the three estates include forests within them.

Map in the following page shows the location of Cashew Plantations in Kasaragod district

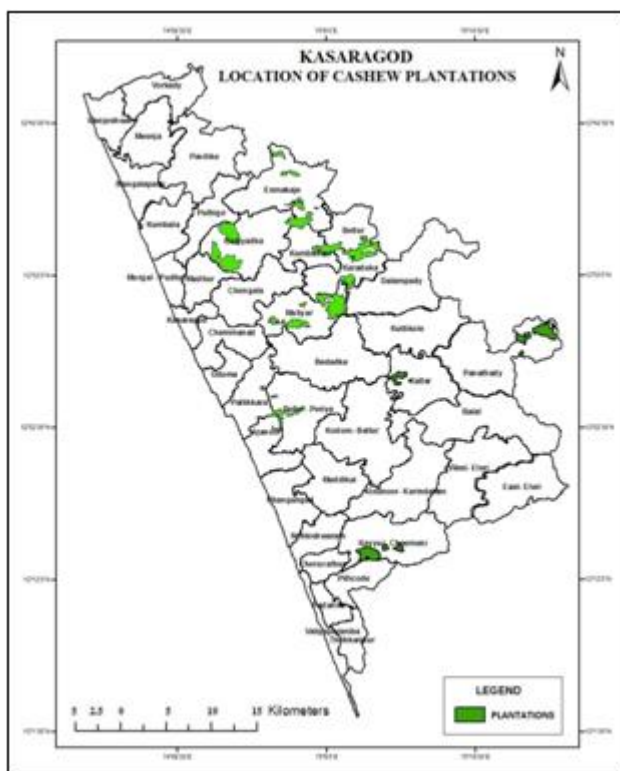


Figure 2: Location of Cashew Plantations in Kasaragod

5.1.1 Kasaragod estate:

Kasaragod Plantations covers an area of 2190.00 hectares. It is divided in to four major divisions - Muliya division (367.86 hectares), Perla Division (783.14 hectares), Adhur division (749.00 hectares), and Periya division (290.00 hectares).

Kasaragod estate lies mostly in Kasaragod Taluk and a small portion (Periya) lies in Hosdurg Taluk. Muliya, Adhur and Perla divisions lie in Kasaragod Taluk. Muliya division and Adhur division lies in Kasaragod block and Perla division

lies in Manjeshwaram block. Periya division lies in Kanhangad block in Hosdurg taluk. Kasaragod estate covers eight panchayaths - Enmakaje, Bellur, Karaduka, Kumbadaje, Muliya, Badiyadka, Pullur - Periya and Ajanoor.

There are four divisions in Kasaragod estate. The first three divisions are contiguous and the last Periya estate lies separated from these and is located in the south west.

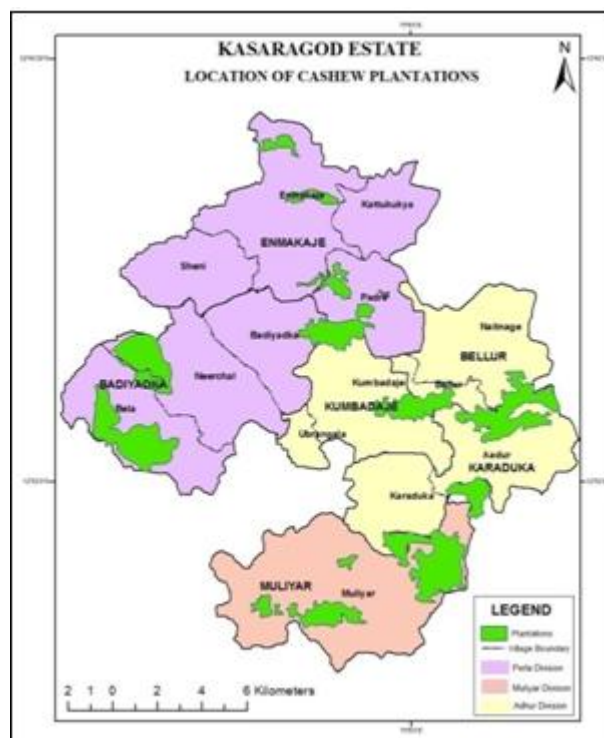


Figure 3: Location of Cashew plantations in Kasaragod Estate



Figure 4: Location of Cashew Estates in Periya Division

Part of the Perla division of Kasaragod estate lies in Badiyadka Panchayath. Badiyadka Panchayath has three villages - Badiyadka, Bela and Neerchal. Cashew plantations are located at Puthurkala. Neerchal village of Badiyadka Panchayath only a few cashew plantations are seen.

5.1.1.2 Periya Division

This division is in Kanhangad block in Hosdurgtaluk. Periya estate division is located in Kasaragod table land. It covers two Panchayaths - Pullur - periya and Ajanoor.

Periya division is divided in to seven blocks of cashew estates. Of these five blocks of estates - Kuniya, Pannikkunnu, Periya 1, Periya 2, and Panayal have cashew plantations. In the remaining two estate blocks - Pullur and Chittari, the cashew plantations have been converted into rubber plantations. Part of Periya 2 block has now been given to the Central University of Kerala. The Panayal cashew plantation block is near Periya village although it is in Pallikkara Panchayath. In Ajanoor Panchayath cashew plantations are not seen in here. Pullur and Chithari cashew estate divisions lie in Chitari village.

5.1.2 Rajapuram estate:

Rajapuram estate is in Kanhangad block in Hosdurg Taluk. Rajapuram estate was started in 1976. Earlier this region was covered by reserved forests. In 1976 the forest department

cleared some area and planted cashew. In 1977 these plantations came under the Plantation Corporation of Kerala. Plantation Corporation of Kerala took these estates on lease from the forest department. Rajapuram estate is located on the border with Coorg Grama Panchayath of Karnataka state.

Rajapuram estate covers two Panchayaths - Kallar and Panathady. The Plantations covers an area of 1526 hectares, and is divided in to 7 divisions - Payinikkara division, Panathur division, Kallapally division, Chettthukai division, Kattimala division, Kammadi division, Pokkimala division. Large acres of cashew estates are seen in this area. There are a large number of tribals works in these plantations.

5.1.3 Cheemeni estate:

Cheemeni estate is located in the Nileshwaram block of Hosdurg Taluk. Cheemeni estate covers an area of 980 hectares and covers the whole of Kayyur - Cheemeni Panchayath. This estate is divided in to three divisions and sixteen blocks.

Kayyur - Cheemeni Panchayath is divided in to four villages - Kayyur, Cheemeni, Timiri and Kalayikkode. The topography of this panchayath is undulating. Cashew estates are found mainly in Timiri

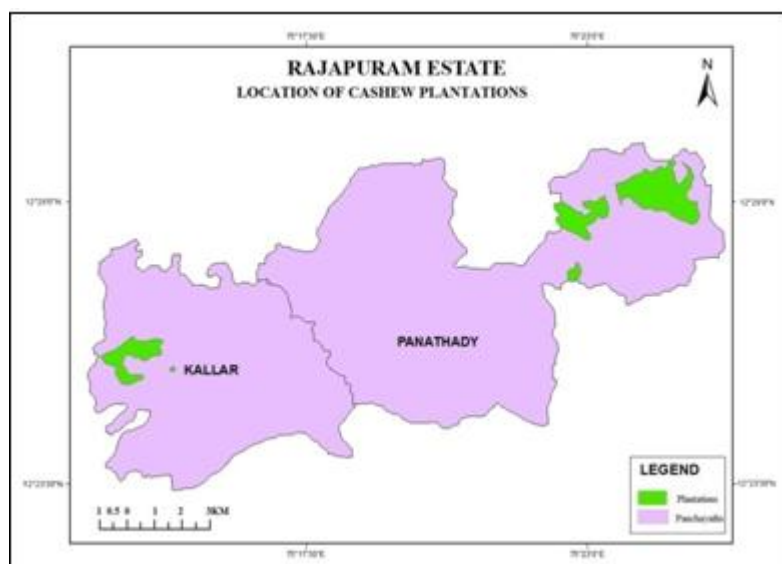


Figure 5: Location of Cashew plantations in Rajapuram estates

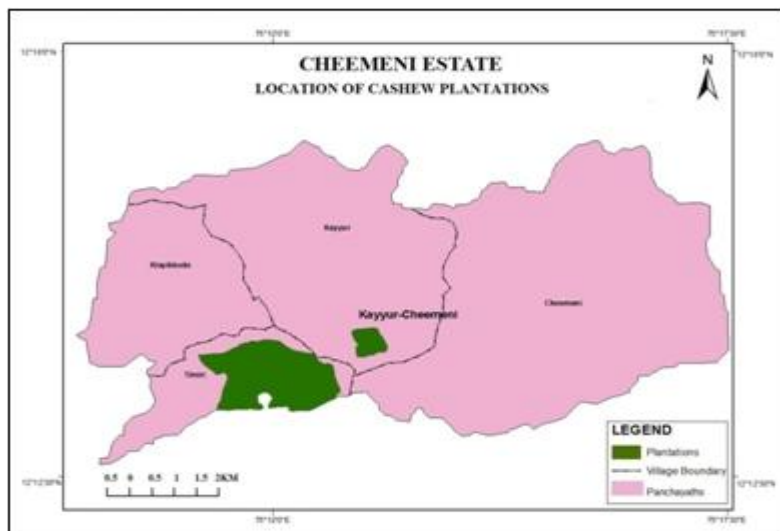


Figure 6: Location of Cashew plantations in Cheemeni estates

5.2 Impact of Endosulfan on the change of landuse pattern of Kasaragod district:

In Kasaragod district large tracts of forests were cleared to make way for the cashew plantations. Subsequent to this there was a large infestation of tea mosquitoes which affected the cashew plantations. Tea mosquitoes affect the buds of the cashew trees and adversely affect the yield of the trees. The persistent organo polluter Endosulfan was extensively and repeatedly used in the Cashew plantations of Kasaragod District to control tea mosquitoes.

The Plantation Corporation of Kerala has been aerially spraying the pesticide Endosulfan on the cashew plantation covering several villages in Kasaragod District over the past two and a half decades. The aerial spraying of Endosulfan over the cashew plantations in Kasaragod was started in 1976 after some trials in the Plantation Corporation of Kerala cashew estates. The intensive spraying of the pesticide began in 1976 and continued until 2000.

From 1981 the plantations were regularly sprayed three times a year. Because of the large size of the cashew trees, the pesticide Endosulfan was sprayed aerially by helicopters. The aerial spraying was also done to save labour cost as it is

estimated that one day aerial spraying can save about 500 man days.

The changes experienced in cropping pattern created aim balance in the cropping system. It has a serious economic and environmental impact on the agricultural sector and the sustainable development of the agrarian economy. Changing cropping pattern and the continuous use of pesticides and chemical fertilizers impacted in the fertility of soil.

Table 1: Land use pattern in the Kasaragod District

Category	Area (in Hectares)
Gross cropped area	155789
Net cropped area	144872
Cropping intensity	107
Land put to non agricultural uses	26164
Current Fallow (up to 1 yr)	2435
Other fallow land (1 to 5 yrs)	2449
Cultivable waste	9423

Source: Computed from Agricultural Statistics (2016 - 17), Department of Economics and Statistics, Govt. of Kerala, Thiruvananthapuram.

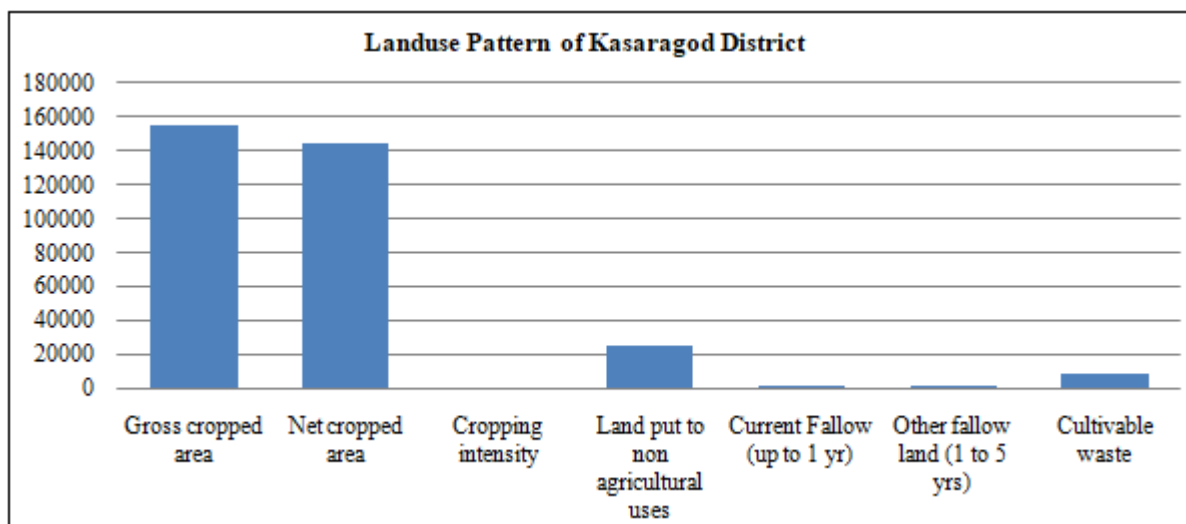


Figure 7: Current Land use pattern of Kasaragod

Diversification in agriculture implies a shift from farm to non - farm activities, and shift from less profitable crop to more profitable crop by using resources in varied but complementary activities. Crop diversification is mainly due to competition among the growing crops in a region, higher the competition leads to the high magnitude of crop diversification and vice versa. To analyze the extent of crop diversification in the district, the status of land utilization pattern and rank of each crop in the total cropped area are examined and is shown in the following Table. From the table it shows that during 1985 the order of the first five crops was coconut, cashewnut, rice, rubber and pepper, in the descending order of shares to the total cropped area changed to coconut, rubber, arecanut, cashewnut and pepper. Rubber came to the second position by pushing rice to the sixth.

Table 2: Rank of each crop in the Total Cropped Area in the Kasaragod district Crops

Crop	1985	1990	1995	2000	2005	2010	2015
Rice	3	4	5	5	6	6	6
Coconut	1	1	1	1	1	1	1
Arecanut	6	5	4	4	4	3	3
Rubber	4	3	3	2	2	2	2
Pepper	5	6	6	6	5	5	5
Cashew nut	2	2	2	3	3	4	4
Ginger	7	7	7	7	7	7	8
Banana and other plantains	8	8	8	8	8	8	7

Source: Computed from (i) Statistics for planning (various issues), Department of Economics and Statistics, Govt. of Kerala, Thiruvananthapuram. (ii) Economic Review (various

issues), State Planning Board, Govt. of Kerala, Thiruvananthapuram.

Cashew is often regarded as 'poor man's crop and rich man's food' and is an important cash crop and highly valued nut in the global market. The area under cashew cultivation is the highest in India. The cashew industry supports the livelihood of cashew farmers, provide numerous employment opportunities and improve returns through global trade. But after Endosulfan tragedy the Cashew one of the most important crop of the district has come to 4th position. This has reduced the employment opportunity of many especially women in the district.

Table 3: Shows the Cropping pattern change of Cashew in Kasaragod District

1985 - 86	20.58
1990 - 91	17.46
1995 - 96	15.57
2000 - 01	13.27
2005 - 06	11.67
2009 - 10	7.52

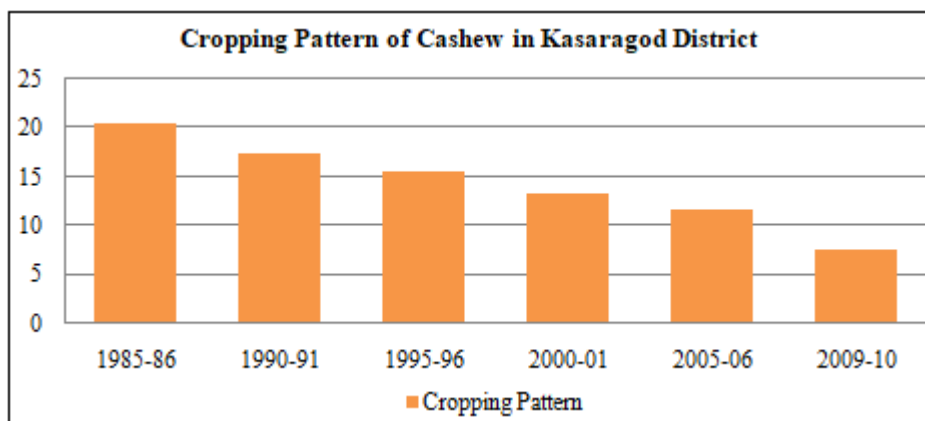


Figure 8: Cropping pattern of Cashew in Kasaragod District

The figure 8 shows the cropping pattern of Cashew in Kasaragod District. After 1990's the controversy on the usage of 'endosulfan' has started and it started a decline in the cashew plantations. People residing in the villages near or within the plantation have felt that they are affected by different kinds of illnesses. In 2002 the government has officially banned the pesticide Endosulfan in Kasaragod after that it shows a decline in the cashew productions in the District.

The aerial spraying of Endosulfan occurred over 11 Grama panchayaths in Kasaragod district - Ajanur, Badiyadka, Bellur, Enmakaje, Kallar, Karaduka, Kayyur - Cheemeni, Kumbadaje, Muliya, Panathady, and Pullur - Periya Panchayaths. The residues of the pesticide that was sprayed

found its way into the water and soil. Studies carried out by the Centre for Water Resource Development and Management, Kerala found that toxic residues of Endosulfan in the sediment and soil samples taken in the affected areas of Kasaragod were found to persist in the soil for a period of 1.5 to 2 years. The aerial spraying of Endosulphan on cashew plantations mixed with air, water and soil had polluted the environment which caused multiple health issues to human beings and animals like cancer, cerebral palsy, locomotors disabilities, mental retardation, deaf and dumb, vision problems, skin disorders and other anomalies. The analysis revealed the severity of the issue among farmers in the Kasaragod district. The people filed case against plantation cooperation for the increase in the number of health issues in the district.

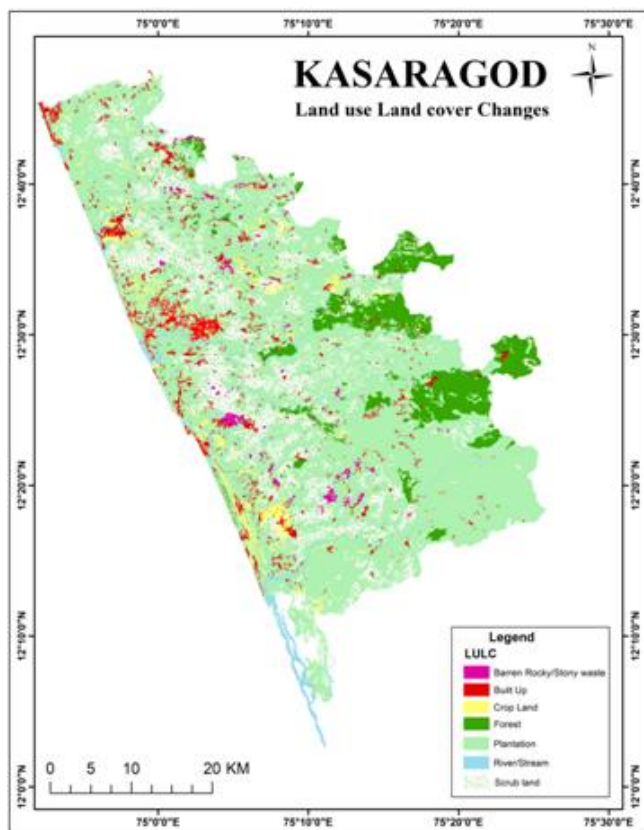


Figure 9: Landuse /Landcover of Kasaragod

Health problems which are complex, rare and no way to deal by local health facilities had been reported. It includes cancer, cerebral palsy, locomotors disabilities, mental retardation, deaf and dumb, vision problems, skin disorders and other anomalies. Still now cases are reported the panchayaths where cashew plantations were seen. Large numbers of victims are in the same eleven panchayaths of the district where cashew plantations are seen.

Once this issue has become so serious in the state, the plantation cooperation's has replaced the cashew with rubber in few panchayats and in other regions it has been left as scrub land. The following map shows the Land use land cover changes of Kasaragod in 2014 - 15. From the map it is clearly visible that most of the scrub lands where cashew plantation estates in Kasaragod district during the 1970's. After 1999 government started replacing the cashew to rubber.

6. Conclusion

Kasaragod is mainly an agro - based district and a major portion of the labour force is working in agriculture and related industries. During 1985 - 86 the order of the first five crops in Kasaragod district was coconut, cashewnut, rice, rubber and pepper, in the descending order of shares to the total cropped area; but in 2015, it is changed in the form of coconut, rubber, arecanut, cashewnut and pepper. This change in cropping pattern reflects shift from subsistence cropping to commercial cropping.

Pesticide use has become a major factor in the agricultural sector today, it is therefore recommended to make more awareness about the dangers of pesticide use and emphasis

laid on use of protective gear if and when applied. The nearby villagers should be informed of the time of spraying and necessary precautions to be taken during the time of spraying. Agricultural Organizations and Scientific Research bodies should carry out more detailed studies in the affected area of Kasaragod District as not much scientific documentations were published on this issue. The Government should promote and encourage more organic farming practices and integrated pest management systems on their own plantations.

References

- [1] Glotfelty, J., Schomburg, J., (1989). Volatilization of pesticides from soil in Reactions and Movements of organic chemicals in soil. In: Sawhney BL, Brown K, editors. Madison, WI: *Soil Science Society of America Special Pub*;
- [2] Harikumar. A: Rubber erasing cashew plantations in Kannur, Kasaragod state trends, *The Hindu*, <http://www.hindu.com/2008/09/15/stories/2008091553590400.htm>
- [3] May, J. M. (1950). *Medical geography: Its methods and objectives*, *AGeographical Review* (1958). *The ecology of human disease: Studies in medical geography*. New York: MD Publications
- [4] N. Karunakaran, "Crop Diversification for Sustainable Agriculture", Pointer Publishers, 2015. [13]
- [5] N. Karunakaran, "Crop Diversification and Chemical Pollution", Archers and Elevators Publishing House, 2016. [14]
- [6] N Karunakaran: Crop Diversification, Chemical Pollution and Endosulphan Tragedy of Kasaragod District In Kerala ICTACT Journal On Management Studies, February 2017, Volume: 03, Issue: 01
- [7] Neethu V. V et al (2018) 'Geospatial Assessment of Common Illness Due to Endosulfan in Periya Estate, Kasaragod District, Kerala, India', *International Journal of Current Advanced Research*, 07 (9), pp.15687 - 15691. DOI: [http://dx. doi. org/10.24327/ijcar.2018.15691.2873](http://dx.doi.org/10.24327/ijcar.2018.15691.2873)
- [8] S. N. Goswami and O. Challa, "Indian Land Use Scenario: An Overview", *Agricultural Situation in India*, Vol.60, No.12, pp.783 - 805, 2004. [6] Monitoring Endosulphan Residues in the Panchayaths of Kasaragod District, Available at: http://www.cseindia.org/userfiles/endo_report1.pdf.
- [9] Straathoff, H (1986). Investigations on the phytotoxic relevance of volatilization of herbicides. *Mededelingen van de FaculteitLandbouwweten - schappen. Rijksuniversiteit Gent* 51 (2A): 433 - 8
- [10] THANAL Conservation Action and Information Network, Thiruvananthapuram, Keralam, India (Oct 2001). Preliminary findings of the survey on the impact of aerial spraying on the people and the ecosystem: Long Term Monitoring – The Impact of Pesticides on the People and Ecosystem (LMIPPE).
- [11] V. V. Neethu, R. Miriam., "A Geographic Study on The Role of Physiography In The Incidence of Illnesses Related To Endosulfan In Kasaragod District, Kerala, India" *IJSRR* 2018, 7 (4), 1812 - 1829.