IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 9, Issue 11 Ver. I (Nov. 2016), PP 33-40
www.iosrjournals.org

An Assessment of Nature and Extent of Crop Diversification Across Agro-Climatic Zones of Jammu and Kashmir: Spatial and Temporal Analysis

Mudasir Hassan Bhat[1], Prof. Md. Abdus Salam[2]

I. Introduction

Agricultural diversification is an important mechanism for economic growth. To meet the challenges of a globalizing market in agriculture as well as the growing and changing needs of the population, many countries in have undertaken crop diversification to enhance productivity and cultivate high value crop with positive outcome. These countries are gradually diversifying their crop sector in favour of high value commodities, especially fruits, vegetables and spices.Indian agriculture has been diversifying during the last two decades towards High-Value Commodities (HVCs) i.e., fruits, vegetables, milk, meat, and fish products.The pace has been accelerated during the decade of 1990s. HVCs account for a large share in the total value of agricultural production. In the post-Independence period, in the sixties and the seventies the area of food grains increased substantially due partly to their yield advantages created by irrigation expansion and Green Revolution technologies and partly to government policies pursued to encourage food production and eliminate food imports. As a result, there was a tendency towards cereal centered specialization. But, later when increased productivity of foodgrains, especially cereals, made it possible to allocate more area to other crops such as oilseeds with a severe supply shortage, the specialization tendency witnessed earlier has given room for overall crop diversification. Table1 presents a spatio-temporal assessment of crop diversification across major states in India using Simpson Index of Diversification. As shown in the Table 1 there are wide variations in diversification, with index value ranging from Index value of 0.425 to 0.510 for Assam and 0.874 to 0.904 in Karnataka for the year1982 to 2012, respectively.

The state of Jammu and Kashmir, with its varied and diversified geographic,agro-climatic and topographic features, has great potential for growth of agriculture and horticulture crops. But due to ongoing conflict, political instability and turmoil, the state has remained as one of the least studied geographical regions. In this regard, an attempt is made here to examine the nature and pattern of agriculture diversification in the state of Jammu and Kashmir[3] and across its districts and agro-climatic zones.

Table1. Simpson's Index of Diversification (SID) in major states of India.

States	1982	1992	2002	2012
Haryana	0.825	0.800	0.791	0.757
Himachal Pradesh	0.711	0.644	0.646	0.645
Punjab	0.749	0.660	0.634	0.612
Uttar Pradesh	0.833	0.779	0.760	0.733
Orrisa	0.600	0.610	0.600	0.540
Assam	0.425	0.489	0.480	0.510
Bihar	0.617	0.700	0.680	0.670
West Bengal	0.640	0.630	0.660	0.703
Madhya Pradesh	0.855	0.836	0.823	0.817
Gujarat	0.834	0.863	0.875	0.863
Maharashtra	0.795	0.797	0.819	0.838
Rajasthan	0.796	0.805	0.816	0.786
Andhra Pradesh	0.801	0.802	0.798	0.838
Karnataka	0.874	0.873	0.888	0.904
Tamil Nadu	0.768	0.767	0.785	0.819
Kerala	0.780	0.798	0.792	0.782
All India	0.83	0.88	0.90	0.89

Source: CMIE, and Indian Agricultural Statistics (Various Issues)

This paper is organized in the following manner. In the first section a general discussion is presented regarding the agro-climatic conditions of the state of Jammu and Kashmir that are supportive to the cause of

[1]Research Scholar, Department of Economics, Aligarh Muslim University Aligarh- India,
email: mudasirbhat85@gmail.com
[2] Professor, Department of Economics, Aligarh Muslim University Aligarh- India
[3]*Excluding the area under administration of China and Pakistan*

diversification and the existing opportunities that can be exploited for the purpose of development of an alternative source of revenue for the farmers of the state. The second section describes the sources of data and the methodology of work, the various indices of crop diversification that are used in calculating the extent of diversity. The diversity indices are calculated both at the state level and the district level for Jammu and Kashmir. These indices provide a clear idea about the changing trajectory of the agricultural sector and cropping pattern in the state. This is followed by a thorough analysis of the trends and agro-climatic zone wise analysis in relation to index value of diversification in crops in the state and conclusion is presented at the end.

II. Scope of diversification

Situated between 320°17"_ N and 360° 58"_ N latitudes and 730° 26"_ E and 800° 30"_ E longitudes, the state of Jammu and Kashmir constitutes the northern most extremity of India. Jammu and Kashmir is basically an agrarian economy. The dependence of rural labour force on agriculture and allied activities is quite substantial as it directly or indirectly, supports about seventy per cent of population. As per Census 2011, 18.38 lakh persons comprising 15.92 lakh cultivators and 2.46 lakhs as agricultural labourers depend directly on Agriculture for their livelihood forming about 49 percent of the total working force (37.54 lakh persons). The climate of the state varies from tropical in Jammu plains to semi-arctic coldin Ladakh with Kashmir and Jammu mountainous tracts having temperate climaticconditions.

Table 2: Agro-climatic zones of Jammu and Kashmir

Agro-Climatic Zone	**Region**	**Main Crops Produced**
Temperate Zone	Entire Kashmir Valley, Parts ofPoonch, Rajouri, Doda, Kathua andUdhampur Districts of Jammu Division	Rice, oil seeds, Wheat,Pulses, Maize
Intermediate zone or Sub- Temperate (Mid Zone)	Parts of Kathua District, Parts of PoonchDistrict (Surankote), parts of RajouriDistrict (Rajouri and Kalakote), parts ofUdhampur District parts of Reasi, someportion of Doda District, Ramban and Kishtwar), besides minor locations inUri Tehsil of Baramulla District andKarnah Tehsil of Kupwara district.	Wheat, Pulses, Maize
Sub-tropical Zone	Jammu District , parts of Kathua district, parts of Rajouri district, parts of Udhampur district and lower areas of Reasi) , parts of Doda District (Ramban)	Wheat, Pulses, Rice
Arid Temperate Zone	Districts of Leh and Kargil	Small millets, Wheat, Fodders

Source: J&K Economic Survey-2014

The annual rainfall also varies from region to region with 92.6 mm in Leh,650.5 mm in Srinagar and 1115.9 mm in Jammu. A large part of the State forms part ofthe Himalayan Mountains. The State is endowed with varied agro climatic conditions for growing a varietyof crops (Hassan 1999).The favorable climatic conditions and fertile soil of the State provide immensescope for promotion of agriculture and allied sector. Moreover, this sector being labour intensive in nature provides employment opportunities to a huge number and contributes considerably towards the state economy. The state holds first position in the production of temperate fruits like apple. Live Stock is another pursuit having potential fordevelopment in the state in view of alpine pastures and other endowments bestowed by the nature. Some terrains of the State are hilly and mountainous. Rearing of live stock is best suited to these areas and plays an important role in promoting mountain farming.The agrarian nature of the State provides tremendous scope for promotion of allagriculture related sectors like, Mushroom development, apiculture, floriculture,fisheries, sericulture development etc.

Table 3: Land Use Statistics

PARTICULARS	UNIT	MAGNITUDE
Geographical area(2001)	Lakh sq. km.	1.01[4]
No. of operational holding Marginal Small Medium Large	Lakh	13.78 11.23 1.69 0.84 0.006
Average land holding(2005-06)	Hectare	0.67
Net area sown(2007-08)	Lakh hectare	7.34
Gross area sown (2007-08)	Lakh hectare	11.34
Gross area irrigated(2007-08)	Lakh hectare	4.63

Source: Agriculture Statistical Return(ASR), J&K

[4]*Excluding area of 120849 sq. km. under Administration of Pakistan and China*.

III. Data and Methodology

Sources of Data:

The study covers a period from 1955-56 to 2013-14. The data from 1955 to 2000 is analyzed at a periodic interval of 5 years and after year 2000 the data is analyzed on yearly basis. The reason for studying the span of this Period is availability ofmeaningful data from reliable sources. The data for this study has been collected from different Government published sources viz. Directorate of economics and statistics J&K. Economic review.Directorate of Horticulture J&K. Various reports of surveys by the Government of J&K.

Methodology:There are quite a few measures of diversification; important ones include Herfindal Index, Simpson DiversityIndex, Ogive Index, Entropy and Modified Entropy Index. Each method has some special features and some limitations. Considering the objective of this study of assessing the extent of diversity the Bhatia's index, Simpson Diversity Index, Herfindhal index, Entropy and Modified Entropy Indexof diversification has been used.The nature of crop diversification is examined through changes in allocation ofland towards the cultivation of different cropsgrown over the year. Different diversity indices have been used to measure the degree of diversification taking place in the state.

Diversity Indicies:

The extent of crop diversification at a given point in time may be examined by using several indices. Few main indices are as following:

a) Bhatia's Method
c) Herfindahl Index (HI)
d) Transformed Herfindahl Index (THI)
e) Simpson Index(SI)
f) Entropy Index (EI)
g) Modified Entropy Index (MEI)

Among these indices, the HI, SI, Entropy and Modified Entropy index are widely used in the literature of agricultural diversification. All these indices are computed on the basis of proportion of grosscropped area under different crops cultivated in a particular geographical area.

a) Bhatia's Method

For the measurement of crop diversification Bhatia in 1965 developed a formula based on Gross Cropped Area (GCA). The formula has been expressed as:

Index of Crop Diversification = Percentage of Sown Area under *X* Crops
Number of *X* Crops

Where "*X"*crops are those crops that individually occupy 10% or more of the GCA in the area under study. The main advantage of this index of crop diversification is that it provides a relationship between the relative areal strength of the crops grown in a region. The larger number of crops having about 10% of the GCA, the higher is the crop diversification in the region. In fact, it is an indicator of multiplication of agricultural activities which obviously involve intense competition among various activities for space. The keener the competition, the higher the degree of diversification, and lesser the competition, greater will be the degree of specialization or mono-culture. Thereby, a high index value shows lesser diversification and increased specialization and a low index value shows higher diversification. Since Bhatia's index is an index of concentration, to avoid the confusion in measuring the diversification, we have transformed the Bhatia's index. The method for transformation is {1- (Index Vaue/100)}. This avoids confusion in measuring diversification. A higher value of transformed index implies higher diversification and lower value implies lesser diversification.

b) Simpson Index(SI)

Simpson's index is a measure of horizontal diversification. Horizontal diversification is the increase in the number of crops grown given the economical rationality of this expansion.This index has been worked out using the following formula:

SID = 1-(proportionate area of food grains in the gross cropped area)

In this index food grains has been taken because the proportionate area under food grains
(Cereals and pulses) are the highest. Thus the Simpsons index measures diversification away from the food grains.

c) Herfindahl Index (HI)

Herfindahl Index is computed by taking sum of squares of acreage proportion of each crop in the total cropped area. Mathematically, the index is given as below.$\mathbf{HI} = \{\sum_{i=1}^{n} \mathbf{P}i^2\}_{/\,\mathbf{N}}$

Where N is the total number of crops and P_i represents area proportion of the i^{th} crop in total cropped area. With the increase in diversification, the Herfindahl Index would decrease. This index takes a value one when there is complete concentration and approaches zero when diversification is perfect. Thus the Herfindahl Index is bounded by Zero and one. SinceHerfindahl index is the index of concentration, to obtain the index ofdiversification, it is subtracted from one to obtain index of diversification.This is known as ***Transformed HerfindahlIndex***i.e**. (THI= 1-HI)**. The transformed value of HI will avoid confusion to compare it with other indices. The value of transformed Herfindahl Index (1-HI) increases with the increase in diversification and assumes 0 (zero) value in case of perfect concentration i.e. when only one crop is cultivated. The transformed Herfindal index is the simplified form of Simpson Index.

d) Entropy Index (EI)

Entropy Index is an inverse measure of concentration and has been widely used to measure diversification(Shiyani and pandya, 1998).

The formula for computing Entropy index is as$EI = \sum_{i=1}^{N} P * logP_i$

Where, P_i standsfor proportion of area under i^{th} crop. The index would increase with increase in diversification and the upper value of index can exceed 'one' when the number of total crops is higher than the value of logarithmic base i.e 10. The value of index approaches Zero when there is complete concentration. When the number of crops is less than the value of logarithmic base, the value of index varies between Zero and One.

e) Modified Entropy Index (MEI) The Entropy index has limitation that it assumes no upper limit. The upper value of index can exceed 'one' when the number of total crops is higher than the value of logarithmic base. The Modified Entropy index overcomes this limitation of Entropy Index by shifting the base of the logrithm to the number of crops. Thus the index has a lower limit equal to Zero when there is complete concentration, and it assumes upper limit of One in case of perfect dispersion.

The formula for computing the Modified Entropy index isMEI =$\sum_{i=1}^{N} P$i * $\log_N P_i$

IV. Analysis of data

(a)Temporal Analysis

Diversification indices are calculated at the state level for the period 1955-56 to 2013-14. The data from 1955 to 2000 is available at a periodic interval of 5 years and after year 2000 the data is analyzed on yearly basis.For measuring the extent of diversification and change over the period of study, the Bhatia, HI, SI, EI and MEIindex are used.All these indices are computed on the basis of proportion of gross cropped area under different crops cultivated in a particulargeographical area. As Bhatia and Herfindal index are concentration indicies, a high index value shows lesser diversification and increased specialization and a low index value shows higher diversification. The Bhatia index value is between 25 and 26 being relatively low, implies a significant level of diversification in the state. Moreover as the Bhatia index provides a relationship between the relative areal strength of the crops grown in a region and as an indicator of multiplication of agricultural activities, it implies that there is significant degree of competition among various crops.Diversification over the period has also been measure by Simpson's Index, Herfindhals index, Entropy and Modified Entropy Index . As both Bhatia and Herfindhals are indices of concentration, both have been transformed to avoid the confusion and making them comparable. Thereby a higher valuesof transformed indices implies more diversification and low value implies lesser diversification. From the table it is seen that the indices values are high but there has been no significant change in value of indices over the entire period of study. The Herfindal and Simpson Index do not show any clear trend in index values. However the Modified Entropy Index, which overcomes the limitation of Entropy index by using a variable logarithmic base, shows a steady upward trend in the value of index from 0.764 to 0.824 implying an increase in diversification in the state over the period. The coefficient of variation is also relatively higher for Entropy and Modified Entropy indices in comparison to other indices.

Table 3: Indices of Crop Diversification at State Level from 1955-56 to 2000-01 in Jammu and Kashmir

	Concentration Indices		**Diversification Indices**			
YEAR	**Bhatia Index**	**Herfindhal Index (HI)**	**Transformed Bhatia Index**	**Simpson Index = 1-HI**	**Entropy Index**	**Modified Entropy Index**
1955-56	24.56	0.189	0.754	0.811	0.648	0.764
1960-61	25.27	0.201	0.747	0.799	0.654	0.774
1965-66	25.62	0.210	0.744	0.790	0.653	0.774
1970-71	25.55	0.206	0.744	0.794	0.667	0.788
1975-76	25.69	0.208	0.743	0.792	0.672	0.797
1980-81	25.38	0.208	0.746	0.792	0.692	0.818
1985-86	25.13	0.203	0.749	0.797	0.705	0.832
1990-91	25.46	0.205	0.745	0.795	0.705	0.834
1995-96	25.50	0.207	0.745	0.793	0.704	0.832

2000-01	25.57	0.210	0.744	0.790	0.696	0.824
Mean	25.373	0.2047	0.7461	0.7953	0.6796	0.8037
SD	0.3309	0.0062	0.0032	0.0062	0.0233	0.0274
CV of Index	1.304	3.038	0.439	0.782	3.428	3.412

Source: Calculated by the Author from various issues of Directorate of E&S Govt. of Jammu and Kashmir

However in absolute terms the coefficient of variations is very low, indicating that index values are almost constant over the entire period of study, implying that diversification process is almost stagnant. The reason can be either there is no scope for further diversification or the lack of initiative and policies for promoting diversification. However in depth study is required to identify the cause of stagnation in diversification over the period. The scope of diversification is limited by the agro-climatic conditions therefore a thorough analysis of diversification in various agro-climatic zones is taken up in the following section.The Table 4 given below shows the yearon year trend in diversification from year 2000-01 to 2013-14. Most of the indices value show that the diversification has slightly increased from 2000-01 to 2007-08 and slightly decreased onwards. The coefficient of variation is also very low for all indices.

Table 4: Indices of Crop Diversification at State Level from 2000-01 to 2013-14 in Jammu and Kashmir

Year	Herfindhal Index	Simpson Index	Entropy Index	Modified Entropy Index
2000-01	0.210	0.790	0.696	0.824
2001-02	0.205	0.795	0.710	0.834
2002-03	0.194	0.806	0.705	0.836
2003-04	0.206	0.794	0.706	0.835
2004-05	0.201	0.799	0.708	0.837
2005-06	0.204	0.796	0.708	0.837
2006-07	0.201	0.799	0.711	0.839
2007-08	0.198	**0.802**	**0.714**	**0.848**
2008-09	0.199	0.801	0.695	0.822
2009-10	**0.202**	0.798	0.708	0.840
2010-11	0.201	0.799	0.680	0.804
2011-12	0.201	0.799	0.686	0.813
2012-13	0.198	0.802	0.691	0.816
2013-14	0.198	0.802	0.691	0.816
Mean	0.2012	0.7987	0.7006	0.8286
SD	0.0040	0.0040	0.0106	0.0127
CV of Index	2.001	0.504	1.514	1.537

Source: Calculated by the Author from various issues of Directorate of E&S Govt. of Jammu and Kashmir.

(b) Spatial Analysis

The spatial analysis of diversification in the state of Jammu and Kashmir is carried out with district as geographical unit.At the district level Herfindal, Simpson, Entropy and Modified entropy index of diversification has been calculated for the year 2007-08 and 2012-13. As seen in Table 5, there are wide fluctuations in the value of all the indices across districts.

Table 5: Diversification Indices at District Level

District	**Herfindal Index**		**Simpson Index**		**Entropy Index**		**ModifiedEntropy Index**	
	2007-08	**2012-13**	**2007-08**	**2012-13**	**2007-08**	**2012-13**	**2007-08**	**2012-13**
Anantnag	0.228(20)	0.229(21)	0.772(3)	0.771(2)	0.683(5)	0.699(3)	0.877(1)	0.828(1)
Kulgam	0.388(6)	0.266(17)	0.612(17)	0.734(6)	0.681(6)	0.665(7)	0.877(1)	0.735(8)
Pulwama	0.205(21)	0.198(21)	0.795(2)	0.802(1)	0.749(2)	0.776(2)	0.749(5)	0.779(4)
Shopian	0.566(1)	0.564(1)	0.434(22)	0.436(22)	0.394(22)	0.395(22)	0.465(21)	0.467(22)
Srinagar	0.300(13)	0.325(11)	0.700(10)	0.675(12)	0.754(1)	0.595(11)	0.677(10)	0.596(18)
Gandarbal	0.282(17)	0.24718)	0.718(6)	0.753(5)	0.641(8)	0.693(4)	0.756(4)	0.763(5)
Budgam	0.269(19)	0.268(16)	0.731(4)	0.732(7)	0.684(4)	0.673(6)	0.684(8)	0.648(15)
Baramulla	0.286(16)	0.300(13)	0.714(7)	0.700(10)	0.604(10)	0.560(15)	0.630(11)	0.657(13)
Bandipora	0.289(14)	0.241(20)	0.711(9)	0.759(3)	0.639(9)	0.830(1)	0.757(3)	0.827(2)
Kupwara	0.415(5)	0.388(8)	0.585(18)	0.612(15)	0.446(20)	0.460(18)	0.574(16)	0.762(6)
Leh	0.320(12)	0.502(2)	0.680(10)	0.498(20)	0.579(11)	0.619(10)	0.686(6)	0.795(3)
Kargil	0.172(22)	0.243(19)	0.828(1)	0.757(4)	0.476(18)	0.593(13)	0.611(13)	0.750(7)
Jammu	0.370(8)	0.333(10)	0.630(15)	0.667(13)	0.574(13)	0.595(11)	0.592(15)	0.661(12)
Samba	0.288(15)	0.298(14)	0.712(8)	0.702(9)	0.691(3)	0.684(5)	0.720(6)	0.712(10)
Udhampur	0.345(10)	0.352(9)	0.655(13)	0.648(14)	0.572(14)	0.561(14)	0.547(18)	0.562(19)
Reasi	0.456(3)	0.428(5)	0.544(20)	0.572(18)	0.459(19)	0.443(7)	0.456(22)	0.488(20)
Doda	0.449(4)	0.453(4)	0.551(19)	0.547(19)	0.543(15)	0.546(16)	0.600(14)	0.606(17)
Kishtwar	0.323(11)	0.323(12)	0.677(12)	0.677(11)	0.595(11)	0.646(9)	0.684(8)	0.674(11)
Ramban	0.494(2)	0.491(3)	0.506(21)	0.509(20)	0.446(20)	0.459(3)	0.528(20)	0.656(14)

Kathua	0.270(18)	0.282(15)	0.730(5)	0.718(8)	0.644(7)	0.653(8)	0.621(12)	0.721(9)
Rajouri	0.350(9)	0.418(6)	0.650(14)	0.582(17)	0.520(16)	0.448(20)	0.544(19)	0.469(21)
Poonch	0.381(7)	0.394(7)	0.619(16)	0.606(16)	0.510(17)	0.485(17)	0.562(17)	0.622(16)
CV of Index	**28.36**	**29.12**	**14.51**	**15.19**	**17.48**	**19.15**	**17.73**	**16.19**

Source: Calculated by the Author from various issues of Directorate of E&S Govt. of Jammu and Kashmir. *The values in parenthesis show the Rank of each district*.

The indices value show that the Anantnag, Kulgam and Pulwama at the top of diversification with interchanging positions across indices. The district of Shopian is the least diversified in all index values. As already mentioned Herfindal is an index of concentration, a high index value shows lesser diversification and increased specialization and a low index value shows higher diversification. Simpson's Index, which is a measure of horizontal diversification with the index value varying between zero and one, Zero implies complete specialization and oneimplies complete diversification. The index value shows Shopian as the least diversified district, followed by Rajouri, Reasi, Udhampur and Poonch districts.

Table 6: Top Five and Bottom Five Districts in Diversification

Top Five Districts ↓	Modified Entropy Index 2007-08	2012-13	Bottom FiveDistricts ↓	Modified Entropy Index 2007-08	2012-13
Pulwama	0.749(5)	0.779(4)	Reasi	0.456(22)	0.488(20)
Anantnag	0.877(1)	0.828(1)	Shopian	0.465(21)	0.467(22)
Kulgam	0.877(1)	0.735(8)	Rajouri	0.544(19)	0.469(21)
Bandipora	0.757(3)	0.827(2)	Udhampur	0.547(18)	0.562(19)
Gandarbal	0.756(4)	0.763(5)	Poonch	0.562(17)	0.622(16)

Value in brackets indicates Rank

It is to be noted that the diversification indicesonly give an extent of diversification and do not provide any explanation for the variation in diversity across districts. For a better understanding of variations, the diversification needs to be analyzed in relation with the agro-climatic conditions, which influence the nature and extent of diversification. In this regard a separate section below discusses the diversification in relation with agro-climatic conditions.

Diversification towards High value crops or Diversification away from Cereals:

As already mentioned the diversification indicesonly give an extent of diversification. It only indicates the spread or concentration in the cropping pattern. In order to assess the nature of crop diversification, we have calculated the diversification towards high value crops across districts in Jammu and Kashmir for the year 2007-08 and 2012-13. As most of the districts had large proportions of area under cereals or food crops, the diversification towards high value crops provides and assessment ofnature of crop diversification. The diversification towards high value crops including fruits, vegetables oilseeds etc. is given by

D_{HVC*} = 1- (proportionate area of food grains in the gross cropped area)

HVC- High Value Crops , Foodgrains = Cereals + Pulses*

The Index value ranges from zero to one. A higher value of D_{HVC} with index values implies that more of the area is under high value crops and vice-versa.

Table 7: Diversification Index at District in 2007-08 and 2012-13 in Jammu and Kashmir

S. NO.	**District**	***Diversification towards High value crops*-D_{HVC}**			
		2007-08	**RANK**	**2012-13**	**RANK**
1	Anantnag	0.466	4	0.458	4
2	Kulgam	0.366	5	0.445	5
3	Pulwama	0.597	3	0.596	2
4	Shopian	**0.919**	1	**0.911**	1
5	Srinagar	0.637	2	0.542	3
6	Gandarbal	0.349	7	0.401	7
7	Budgam	0.309	9	0.367	8
8	Baramulla	0.318	8	0.310	9
9	Bandipora	0.222	11	0.226	10
10	Kupwara	0.103	14	0.151	11
11	Leh	0.248	10	0.118	12
12	Kargil	0.365	6	0.434	6
13	Jammu	0.078	15	0.061	18
14	Samba	0.122	12	0.102	13
15	Udhampur	0.044	18	0.044	19
16	Reasi	**0.028**	22	0.027	21
17	Doda	0.067	17	0.092	14
18	Kishtwar	0.032	20	**0.020**	22

19	Ramban	0.034	19	0.086	16
20	Kathua	0.111	13	0.092	14
21	Rajouri	0.030	21	0.030	20
22	Poonch	0.078	15	0.063	17
	CV of Index	**94.98**		**93.82**	

The value of indices in Table 5 and Table 7 together provides an explanation and nature of crop diversification. As Table 5 shows the Shopian with the highest value concentration index, the index value for the district in table 7 shows that the concentration is towards production of High Value crops. The concentration is opposite to that of food crops and the district has specialized in production of HVC. The other districts such as Rajouri , Poonch, Ramban, Reasi etc. with lower diversification indices have lower D_{HVC} implying that these have are not concentrated to HVC but to some crops. The statistics reveal that more than fifty percent of the total area sown in these districts is under maize cultivation and are thus highly concentrated. The other districts that rank higher on diversification indices have higher value of D_{HVC}index, implying that besides food crops these districts also have diversified towards high value crops.

Agro-climatic conditions and diversification in Jammu and Kashmir:

The state of Jammu and Kashmir comprises of four agro-climatic zones as shown in Table 2. From the table it can be seen that the diversification indices are relatively higher for districts in the Temperate zone and relatively lower for districts in the Sub-Temperate zone. Implying that districts in Sub-Temperate zone are relatively less diversified than districts in temperate zone. This leads to conclusion that apart from many other factors that determine the diversification, the climatic conditions, rain fall, soil type, humidity also have impact on the extent of diversification. Infact climatic acts as pre-condition for explaining the rationality of diversification and must be taken into consideration while measuring the extent of horizontal diversification. Any attempt of diversification which is not supported by the agro-climatic conditions would result in higher opportunity cost and cannot be economically rationale. The tables below show that within a agro-climatic zone the coefficient of variation in value of diversification indices is very low, indicating that agro-climatic conditions play and important role in diversification.

Table 7: Agro-climatic conditions and diversification in **Temperate Zone**

DISTRICTS	HI	SI	EI	MEI
Anantnag	0.229	0.771	0.699	0.828
Kulgam	0.266	0.734	0.665	0.735
Pulwama	0.198	0.802	0.776	0.779
Srinagar	0.325	0.675	0.595	0.596
Gandarbal	0.247	0.753	0.693	0.763
Budgam	0.268	0.732	0.673	0.648
Baramulla	0.300	0.700	0.560	0.657
Bandipora	0.241	0.759	0.830	0.827
CV of Index	15.467	**5.413**	12.775	11.881

Table 8: Agro-climatic conditions and diversification in **Sub- Temperate Zone**

District	HI	SI	EI	MEI
Reasi	0.428	0.572	0.443	0.488
Doda	0.453	0.547	0.546	0.606
Ramban	0.491	0.509	0.459	0.656
Rajouri	0.418	0.582	0.448	0.469
Poonch	0.394	0.606	0.485	0.622
CV of Index	8.460	**6.561**	8.873	14.804

Table 9: Agro-climatic conditions and diversification in **Sub-Tropical Zone**

District	HI	SI	EI	MEI
JAMMU	0.333	0.667	0.595	0.661
Udhampur	0.352	0.648	0.561	0.562
Kishtwar	0.323	0.677	0.646	0.674
Samba	0.298	0.702	0.684	0.712
Kathua	0.282	0.718	0.653	0.721
CV of Index	8.767	**4.080**	7.828	9.509

Table 10: Agro-climatic conditions and diversification in **Cold Arid Zone**

District	HI	SI	EI	MEI
Leh	0.502	0.498	0.619	0.795
Kargil	0.243	0.757	0.593	0.750
CV of Index	49.165	29.185	**3.033**	4.119

V. Conclusion

Agricultural diversification is an important mechanism for economic growth. The state of Jammu and Kashmir overall shows a high level of diversification as measured by theseIndices but theprocess as analyzed on time series basis is somewhat stagnant. The pace of diversification has almost come to halt. Moreover the degree of diversification is not evenly distributed over the districts. While some of the districts are picking up diversification quite rapidly others are lagging far behind. When the districts are classified on agro-climatic conditions, the districts in temperate zone show fairly higher level of diversification and the districts in sub-tropical and sub-temperate zone are the least diversified. This leads to the conclusion that apart from other factors that determine the extent and pace of diversification, agro-climatic conditions are an important determinant of diversification. Infact these conditions are basic in determining economic rationality of expansion and diversification. The state level or district level analysis of data provides a macro view of diversification in the state. However the decisions to diversify are taken a household level or micro level. To understand the dynamics of process of diversification at micro level and analyze the various factors that provide stimulus to the process of diversification, study at the primary level is required, where household decisions to diversify can be analyzed given the various opportunitiesand constraints involved in the process. Further the non-availability of reliable secondary data does not permit us to measure the vertical diversification towards non-farm based activities such as fishing,poultry, dairy,agro- processing industries etc. which have emerged as strongly in the past decade. The state of Jammu and Kashmir commonly referred as the *consumer state* for its imports from other states, these non-farm based industries are increasingly providing employment to skilled and educated people in the state thereby reducing the dependency and providing for the self-sufficiency in the state.

Refrences

[1] Vyas. (1996). "*Diversification in agriculture, Concept Rationale and Approaches*"Indian Journal of Agriculture Economics, vol. 51, No. 4, Oct-Dec , pp. 636-643.

[2] Hasan, B "*Rainfall Climatology of Jammu and Kashmir State, India*" (1999).*Drought Network News (1994-2001).*Paper 44. http://digitalcommons.unl.edu/droughtnetnews/44

[3] PingaliandRosegrant(1995). "*Agricultural Commercialization and Diversification: processes and policies*". International Rice Research Institute, the Philippines, and International Food Policy Research Institute, Washington, DC, USA, Food Policy, Vol. 20, No. 3, pp. 171-185, 1995

[4] Dillon H.S. and A. Suprapto.(1992). "*Agricultural diversification in Indonesia*".InBriefs prepared for a seminar. Southeast Asia agriculture in transition:Implication for food policy. International Food Policy Research Instituteand Department of Agriculture, Republic of Indonesia. Jakarta,September 10-11, 1991. International Food Policy Research Institute,Washington, D.C.

[5] Rosegrant, M.W. and P. B.R. Hazell, (1999)."*Rural Asia Transformed: The QuietRevolution*". International Food Policy Research Institute, Washington,D.C.

[6] Timmer, P. (1992). "*Agricultural diversification in Asia: Lesson from the 1980sand Issues for the 1990s*. In Agricultural diversification in monsoon Asia.Report of a study meeting 18-232 January, 1993. Tokyo, Japan: AsianProductivity Organization

[7] Huang, J. and H. Bouis 1995.*Structural changes in the demand for food in Asia: Food, Agriculture, and the Environment*. Discussion Paper 11.Washington, D.C. International Food Policy Research Institute

[8] Kumar, V. (1998), *"Study meeting on changing food demand and agriculturaldiversification*. Country paper STM-06-98 (November). New Delhi:Government of India.

[9] Lin, R.M. (1998)"*Study meeting on changing food demand and agricultural diversification*", Country paper STM-06-98 (November). Kuala Lumpur:FMalaysian Agriculture Research and Development Institute (MARDI

[10] Timmer, P. 1992: "*Agricultural Diversification in Asia: Lesson from the 1980s and Issues for the 1990s*" in Agricultural Diversification in Monsoon Asia (Report of a Study meeting, Asian Productivity Organization, Tokyo, January 18-23, 1993)

[11] Jha, Kumar and Mohanty, (2000)"*Pattern of Agricultural Diversification in India*".Working Paper Series No.E/302/2009, Institute of Economic Growth, New Delhi.

[12] Haque. T., (1996), '*Small Farm Diversification: Problems and Prospects'*, NCAP, New Delhi.