VI. INDICES OF DROUGHT PRONENESS AND DROUGHT VULNERABILITY

One of the principal aims of this study is to construct a more holistic drought vulnerability index that takes into account ecological, socio-economic and production conditions. This is closely related to the second aim of this work, which is to evolve typologies that categorize blocks amenable to a similar matrix of interventions. Both these exercises in turn feed into the third aim of this work, namely to suggest a water policy for drought proofing in Chhattisgarh by identifying the more vulnerable areas and the underlying causes for drought proneness.

Before we proceed any further, we recapitulate three concepts that are used distinctively in this work in relation to categorisation—drought, drought vulnerability and drought proneness. A drought is defined as meteorological failure caused by a shortfall of precipitation in a given time period of more than a certain percentage, usually half in the sowing season. A drought prone area is one that has a rainfall history that indicates a high probability of experiencing meteorological drought. A meteorological drought may result in the drying up of groundwater, surface water and soil moisture. This is a hydrological drought. Meteorological drought may translate into crop failure, a condition defined as an agricultural drought. Drought vulnerability is defined as that property or characteristic of an area that increases the inherent or intrinsic probability of hydro-agricultural droughts, resulting in out-migration, crop failure, livestock distress, water shortage, etc. Several factors go into the making of a drought, including ecology, production conditions, socioeconomic conditions, etc. The ability of the people and the land to withstand rainfall, hydrological and even agricultural deficits depends to a large extent on their status preceding the event or series of events of rain shortfalls. This status is, in turn, determined by a large number of factors.

Therefore, a large number of variables together form the characteristic/defining features for the typologies or classification of blocks that are amenable for similar drought-proofing interventions. Rarely does any one single variable capture the essential features of any such socio-economic phenomena, but more so for an exercise such as this, which strides economic, ecological, climatic, social and demographic features. Most of the time in social science research a phenomena is partially explained by several variables and we have to measure a quality, such as drought-proofing requirements, through several related variables. Thus constructing a composite index may present a composite picture from properly chosen variables. In all typology formulation one always comes across situations where no single variable is sufficient to portray the complexity.

Once selected, the two main issues faced during compositing of variables are: a) removing biasness of scale and b) determination of weights for the variables.

In regional analysis usage of different variables with varying units/scales of measure is a common problem. Thus the process of making the data scale-free is essential to make the indicators comparable. Standardisation changes simultaneously the origin as well as the scale of measurement. The mean of all the standardized variables are equal to zero and the standard deviation is equal to one. Thus by standardization we lose information on disparity, which exists between the variables. Under this method the matrix of the sum of squares and cross products becomes the correlation matrix of the original variable. In our analysis the standardization method for making the data scale free the data set is carried out as in Principal Component Analysis (PCA). The biggest weakness of this method is its tendency to maximize weights on variables with maximum variance. Through standardization technique this factor will tend to be neutralised.

Thus the three main tasks in constructing a drought vulnerability index are identifying the variables, their standardization and assigning correct weights to them. While doing this, the interrelationship between variables must be kept in mind. This can be done with the help of the principal component analysis method of data reduction, the major problem of which is that it gives maximum weightage to those variables that have the highest variance. However, if care is exercised to ensure that the selection of variables is correct and the correlations within the selected group of variables is of the theoretically expected magnitude and direction, it is a very useful tool for constructing a composite index of this kind.

6.1 Ranking Of Blocks As Per Our Weightages

First, we constructed a drought vulnerability index by assigning weights to all the parameters that could, *ex ante*, influence drought vulnerability or the ability to withstand meteorological drought.

The indicators i.e., ecological, socio-economic and production system variables were selected on the basis of their impact on the extent of drought vulnerability and then weights were assigned to them. Care was taken to ensure that the values or magnitudes of the variables moved in the same direction with respect to drought vulnerability, i.e. if the value of the variable increases the drought vulnerability decreases and *vice versa*. Therefore, while features like irrigation, forest cover, etc. remained unchanged, and as irrigated area or forest cover increases *ceteris paribus* drought vulnerability should decline, we took the inverse of variables like percentage area left fallow or percentage Scheduled Caste population, etc. Based on this all the variables were suitably treated. The bias of scale was removed by standardising the data set by using the Z score method.

After standardization of the data set the individual weights of the variables were assigned and the Z scores of the variables were multiplied by these weights and row wise summation done to get the value of each indicator for the blocks separately. All the three cluster of indicators (i.e., ecological, production system and socio-economic) were again assigned relative weights, and the final composite value for each block was computed. The indicators were summed up row wise after multiplying the weights by the column.

Table 6.1: Variables and Weights for Ranking

<table>
<tr><th>Indicators</th><th>Variables</th><th>Individual weights in (%)</th><th>Cumulative Weights (%)</th><th>Gross Indicator weights (%)</th></tr>
<tr><td colspan="4">ECOLOGY</td><td rowspan="15">50</td></tr>
<tr><td rowspan="3">Rainfall</td><td>Inter spell duration gaps of greater than 8 days</td><td>10</td><td rowspan="3">30</td></tr>
<tr><td>Commencement of sowing rain 15-28 June</td><td>10</td></tr>
<tr><td>Normal annual rainfall (27-50 years)</td><td>10</td></tr>
<tr><td>Vegetation</td><td>Percentage of forest cover</td><td>15</td><td>15</td></tr>
<tr><td rowspan="4">Soil</td><td>Soil particle size</td><td>3.75</td><td rowspan="4">15</td></tr>
<tr><td>Soil depth</td><td>3.75</td></tr>
<tr><td>Soil drainage</td><td>3.75</td></tr>
<tr><td>Soil taxonomy</td><td>3.75</td></tr>
<tr><td rowspan="3">Landform and Drainage</td><td>Slope</td><td>6.67</td><td rowspan="3">20</td></tr>
<tr><td>Land forms</td><td>6.67</td></tr>
<tr><td>Drainage density</td><td>6.67</td></tr>
<tr><td rowspan="3">Geo - Hydrology</td><td>Parent Material</td><td>6.67</td><td rowspan="3">20</td></tr>
<tr><td>Estimated utilisable Ground water potential</td><td>6.67</td></tr>
<tr><td>Ground water level</td><td>6.67</td></tr>
<tr><td colspan="5">PRODUCTION SYSTEM</td></tr>
<tr><td rowspan="2">Agriculture system</td><td>Gross irrigated area as a proportion of gross cropped area</td><td>35</td><td rowspan="2">70</td><td rowspan="5">25</td></tr>
<tr><td>Gross cropped area as a proportion of the net sown area</td><td>35</td></tr>
<tr><td rowspan="3">Land use</td><td>Fallows as a proportion of the net sown area</td><td>10</td><td rowspan="3">30</td></tr>
<tr><td>Cultivable wastes as a proportion of the net sown area</td><td>10</td></tr>
<tr><td>Cultivable area as a proportion of net sown area</td><td>10</td></tr>
<tr><td colspan="5">SOCIO-ECONOMIC</td></tr>
<tr><td rowspan="2">Social</td><td>Proportion of non Scheduled Tribes and Scheduled Caste population</td><td>25</td><td rowspan="2">50</td><td rowspan="4">25</td></tr>
<tr><td>Percentage of people below poverty line</td><td>25</td></tr>
<tr><td rowspan="2">Economic</td><td>Work force participation ratio</td><td>25</td><td rowspan="2">50</td></tr>
<tr><td>Percentage of agriculture dependent population</td><td>25</td></tr>
</table>

The blocks were first ranked on the basis of the three indicators and then a cumulative rank was also evolved. In the first group of high drought vulnerability extent group of fifty blocks only twelve of them are covered by DPAP i.e., about 24 per cent coverage (Table 6.2).

Table 6.2: Ranking of Blocks According to Drought Vulnerability

Codes	BLOCK NAME	Rank_ Ecology	Rank_ Production	Rank_ Socio-economic	Rank_ cumulative	Extent of Vulnerability	Tribal Blocks	DPAP Blocks
113	Orchha	8	54	1	1	High	Tribal	Non DPAP
304	Katekaley	9	14	9	2		Non Tribal	Non DPAP
105	Bastanar	22	10	6	3		Tribal	Non DPAP
307	Asur	124	1	3	4		Non Tribal	DPAP
102	Londigura	16	32	14	5		Tribal	DPAP
303	Kuwakonda	35	6	26	6		Non Tribal	Non DPAP
103	Darbha	25	28	16	7		Tribal	Non DPAP
311	Gedam	46	3	32	8		Non Tribal	DPAP
701	Jashpur	13	2	73	9		Non Tribal	Non DPAP
305	Bheramgarh	113	4	5	10		Non Tribal	DPAP
1619	Shankargarh	2	69	63	11		Tribal	Non DPAP
308	Konta	92	20	2	12		Non Tribal	DPAP
1615	Ramchandr	34	49	8	13		Tribal	Non DPAP

Codes	BLOCK NAME	Rank_ Ecology	Rank_ Production	Rank_ Socio-economic	Rank_ cumulative	Extent of Vulnerability	Tribal Blocks	DPAP Blocks
1608	Mainpat	14	50	29	14		Tribal	Non DPAP
702	Manora	21	15	46	15		Non Tribal	Non DPAP
1616	Balrampur	32	42	19	16		Tribal	Non DPAP
703	Bagicha	18	17	51	17		Non Tribal	Non DPAP
904	Bodla	1	100	67	18		Non Tribal	DPAP
104	Tokapal	67	26	13	19		Tribal	DPAP
301	Dantewada	37	8	54	20		Non Tribal	Non DPAP
1618	Kusmi	40	7	61	21		Tribal	Non DPAP
1605	Lundra	58	72	4	22		Tribal	Non DPAP
609	Dabhra	5	78	64	23		Non Tribal	Non DPAP
805	Durg Koda	54	5	62	24		Non Tribal	Non DPAP
112	Narayanpur	78	9	25	25		Tribal	Non DPAP
1607	Batauli	43	48	23	26		Tribal	Non DPAP
1414	Mainpur	4	86	71	27		Tribal	Non DPAP
1104	Khadgawan	118	13	12	28		Non Tribal	Non DPAP
1305	Lailunga	23	62	40	29		Non Tribal	Non DPAP
1415	Deobhog	10	90	43	30		Non Tribal	Non DPAP
708	Farsabaha	61	21	41	31		Non Tribal	Non DPAP
1606	Sitapur	52	64	31	32		Tribal	Non DPAP
306	Bhopal Patnam	123	18	17	33		Non Tribal	Non DPAP
107	Bakaband	88	27	24	34		Tribal	DPAP
106	Bastar	97	34	22	35		Tribal	DPAP
114	Makdi	105	53	11	36		Tribal	Non DPAP
312	Jagdalpur	80	11.5	47.5	37		Non Tribal	Non DPAP
707	Pathalgao	17	79	57	38		Non Tribal	Non DPAP
704	Duldula	66	24	56	39		Non Tribal	Non DPAP
108	Kondagaon	111	61	10	40		Tribal	DPAP
1617	Wadraf nagar	98	58	20	41		Tribal	Non DPAP
1307	Sarangarh	7	92	77	42		Tribal	Non DPAP
1306	Tamnar	47	29	74	43		Tribal	Non DPAP
706	Kasavel	65	30	58	44		Non Tribal	Non DPAP
1609	Surajpur	31	33	84	45		Tribal	Non DPAP
901	Pandariya	11	97	68	46		Non Tribal	DPAP
1304	Gharghoda	106	16	45	47		Non Tribal	Non DPAP
1613	Premnagar	130	39	18	48		Tribal	Non DPAP
1509	Manpur	44	40	75	49		Tribal	DPAP
1612	Ramanujnagar	59	65	50	50		Tribal	Non DPAP
1610	Odgi	114	68	15	51		Tribal	Non DPAP
1611	Bhaiyatha	48	44	70	52		Tribal	Non DPAP
1601	Rajpur	101	88	7	53	Medium	Tribal	Non DPAP
210	Marwahi	77	47	42	54		Tribal	Non DPAP
1614	Pratappur	94	51	38	55		Tribal	Non DPAP
208	Gourela(2)	69	76	44	56		Tribal	DPAP

Codes	BLOCK NAME	Rank_ Ecology	Rank_ Production	Rank_ Socio-economic	Rank_ cumulative	Extent of Vulnerability	Tribal Blocks	DPAP Blocks
1604	Udeypur	115	37	37	57		Tribal	Non DPAP
803	Sarana	26	67	90	58		Tribal	Non DPAP
1105	Bharatpur	103	36	52	59		Non Tribal	Non DPAP
1603	Lakhanpur	76	91	30	60		Tribal	Non DPAP
801	Kanker	33	43	100	61		Non Tribal	Non DPAP
1309	Dharmjaigarh	104	38	53	62		Non Tribal	Non DPAP
302	Bijapur	128	45	34	63		Non Tribal	DPAP
705	Kunkuri	50	63	87	64		Non Tribal	Non DPAP
804	Bhanupratap’ur	62	25	110	65		Non Tribal	Non DPAP
1308	Sarai Len	30	96	76	66		Tribal	Non DPAP
1205	Basna	55	93	59	67		Non Tribal	Non DPAP
1204	Saraipali	38	83	85	68		Non Tribal	Non DPAP
310	Chhindgar	142	19	35	69		Non Tribal	Non DPAP
1505	Chhuikhadan	3	116	112	70		Non Tribal	Non DPAP
109	Pharasgaon	141	46	21	71		Tribal	Non DPAP
111	Baderajpu	120	77	33	72		Tribal	Non DPAP
1301	Raigarh	70	55	89	73		Non Tribal	Non DPAP
101	Jagdalpur	140	11.5	47.5	74		Tribal	DPAP
110	Keshkal	84	71	60	75		Tribal	Non DPAP
506	Doundi	12	75	130	76		Tribal	DPAP
1507	Mohla	49	41	115	77		Tribal	DPAP
1410	Bilaigarh	24	87	97	78		Non Tribal	Non DPAP
1203	Pithora	60	81	80	79		Non Tribal	Non DPAP
1005	Kartala	93	59	69	80		Non Tribal	DPAP
1303	Kharsia	45	89	81	81		Tribal	Non DPAP
806	Antagarh	68	23	122	82		Non Tribal	Non DPAP
1103	Manendrag	134	56	36	83		Non Tribal	Non DPAP
1101	Sonhat	109	82	49	84		Non Tribal	Non DPAP
607	Jaijaipur	72	70	86	85		Non Tribal	DPAP
209	Gaurela (1)	127	73	39	86		Tribal	DPAP
802	Charama	19	74	128	87		Non Tribal	Non DPAP
608	Malkharod	82	80	72	88		Non Tribal	Non DPAP
1302	Pusaur	51	85	93	89		Non Tribal	Non DPAP
1412	Gariyaband	79	60	98	90		Tribal	Non DPAP
1004	Pali	116	66	79	91		Non Tribal	DPAP
207	Kota	74	104	66	92		Non Tribal	Non DPAP
807	Koyalibada	136	95	28	93		Non Tribal	Non DPAP
1102	Baikunthpur	132	57	78	94		Non Tribal	Non DPAP
1602	Ambikapur	107	112	27	95		Tribal	Non DPAP
606	Shakti	102	84	83	96		Non Tribal	Non DPAP
1001	Korba	119	35	105	97		Non Tribal	DPAP
206	Lormi	6	134	95	98		Non Tribal	Non DPAP
1508	Amba Chauki	42	99	125	99		Tribal	DPAP

Codes	BLOCK NAME	Rank_ Ecology	Rank_ Production	Rank_ Socio-economic	Rank_ cumulative	Extent of Vulnerability	Tribal Blocks	DPAP Blocks
1504	Khairagarh	20	114	118	100		Non Tribal	Non DPAP
903	Sahaspur	41	105	121	101	Low	Non Tribal	DPAP
309	Sukma	145	22	65	102		Non Tribal	DPAP
1409	Kasdol	29	117	103	103		Non Tribal	Non DPAP
604	Pamgarh	89	102	92	104		Non Tribal	Non DPAP
1506	Dongargarh	57	106	120	105		Non Tribal	Non DPAP
1202	Bagbahara	117	94	94	106		Non Tribal	Non DPAP
1503	Chhuriya	73	101	126	107		Non Tribal	DPAP
404	Sihawa (N)	36	132	96	108		Non Tribal	Non DPAP
1406	Bhatapara	39	130	104	109		Non Tribal	Non DPAP
605	Bamhnidih	122	98	107	110		Non Tribal	Non DPAP
510	Saja	27	110	135	111		Non Tribal	Non DPAP
1201	Mahasamund	56	122	113	112		Non Tribal	Non DPAP
902	Kawardha	63	124	102	113		Non Tribal	Non DPAP
1405	Simga	110	107	109	114		Non Tribal	Non DPAP
201	Bilha	95	129	88	115		Non Tribal	Non DPAP
512	Navagarh	75	127	101	116		Non Tribal	Non DPAP
202	Masturi	71	136	82	117		Non Tribal	Non DPAP
203	Takhatpur	53	123	127	118		Non Tribal	Non DPAP
1413	Chhura	138	103	106	119		Tribal	Non DPAP
601	Akaltara	126	109	114	120		Non Tribal	Non DPAP
204	Mungeli	87	133	91	121		Non Tribal	Non DPAP
502	Dhamdha	91	111	132	122		Non Tribal	Non DPAP
602	Baloda	137	108	99	123		Non Tribal	Non DPAP
511	Berla	85	113	133	124		Non Tribal	Non DPAP
504	Patan	28	128	142	125		Non Tribal	Non DPAP
1407	Balodabazar	131	120	116	126		Non Tribal	Non DPAP
1502	Dongargaon	83	118	138	127		Non Tribal	Non DPAP
603	Nawagarh	125	126	108	128		Non Tribal	Non DPAP
509	Bemetara	112	125	124	129		Non Tribal	Non DPAP
1003	Pondi	147	52	55	130		Non Tribal	DPAP
1002	Katghora	139	31	146	131		Non Tribal	DPAP
1501	Rajnandgaon	100	115	144	132		Non Tribal	Non DPAP
1403	Tilda	133	119	134	133		Non Tribal	Non DPAP
505	Sanjari Balod	15	142	137	134		Non Tribal	Non DPAP
1402	Arang	81	140	117	135		Non Tribal	Non DPAP
508	Dondilohara	96	135	131	136		Non Tribal	Non DPAP
205	Patharia	86	141	111	137		Non Tribal	Non DPAP
1408	Palari	108	138	119	138		Non Tribal	Non DPAP
1404	Abhanpur	99	137	136	139		Non Tribal	Non DPAP
501	Durg	90	131	145	140		Non Tribal	Non DPAP
403	Magarlod	129	145	123	141		Non Tribal	Non DPAP
1401	Dharsiwa	135	121	147	142		Non Tribal	Non DPAP

Codes	BLOCK NAME	Rank_ Ecology	Rank_ Production	Rank_ Socio-economic	Rank_ cumulative	Extent of Vulnerability	Tribal Blocks	DPAP Blocks
1411	Rajim	64	147	129	143		Non Tribal	Non DPAP
507	Gurur	121	143	140	144		Non Tribal	DPAP
503	Gunderdehi	144	139	141	145		Non Tribal	Non DPAP
401	Dhamtari	143	146	143	146		Non Tribal	Non DPAP
402	Kurud	146	144	139	147		Non Tribal	Non DPAP

Before we discuss the validity and features of the blocks identified as less or more vulnerable, let us first examine the drought vulnerability index we constructed using the 'principal component analysis method'.

6.2 Ranking Using 'Principal Component Analysis' Method

Principal Component Analysis (PCA) is a branch of factor analysis. It is a technique evolved primarily to synthesize a large number of variables into a smaller number of general components, which retain the maximum amount of descriptive ability. Thus it creates such a Y vector that Y's relationships with X_1, X_2, X_3,…..X_m is maximum. Thus Y will be such that it has the maximum sum of squared correlations with the X_1, X_2, X_3,…..X_m.

$$r_{01}^2 + r_{02}^2 + \ldots\ldots r_{0m}^2 = Z$$

Thus it reduces indicators into components. PCA can only be applied when a reasonable degree of co-relation exists amongst the variables. A major problem of PCA is that a number of similar indicators result in groups of indicators pulling the other indicators in one direction.

6.3 Correlation Matrix

The first step is to look at the correlation matrix between some selected variables. The correlation matrix that tabulates the correlation between the variables selected by us gives coefficients whose direction ('causality') and strength ('significance') is in keeping with the picture that we have presented right through this study.

Table 6.3: Correlation Matrix

	GCA_ NSA	Fallow_ NSA	Per_ SC	Per_ ST	Por_ For	Per_ Irri_ 1991	Per_ Lit	%_ Agri_ L	Land Form	Parent Material	Particle Size	Soil Taxon	% _BPL	LGD	AARF
GCA_NSA	1.00	-0.38	0.39	-0.66	-0.47	0.72	0.59	0.42	0.55	0.49	0.65	0.56	-0.44	0.50	-0.41
Fallow_NSA	-0.38	1.00	-0.42	0.53	0.25	-0.43	-0.28	-0.49	-0.37	-0.42	-0.44	-0.34	0.01	-0.30	0.27
Per_SC	0.39	-0.42	1.00	-0.76	-0.56	0.49	0.44	0.48	0.58	0.61	0.54	0.50	-0.21	0.40	-0.32
Per_ST	-0.66	0.53	-0.76	1.00	0.68	-0.60	-0.72	-0.66	-0.72	-0.75	-0.76	-0.65	0.43	-0.51	0.45
Por_For	-0.47	0.25	-0.56	0.68	1.00	-0.43	-0.58	-0.44	-0.43	-0.45	-0.50	-0.61	0.38	-0.38	0.34
Per_Irri_1991	0.72	-0.43	0.49	-0.60	-0.43	1.00	0.49	0.41	0.51	0.43	0.53	0.57	-0.31	0.42	-0.27
Per_Lit	0.59	-0.28	0.44	-0.72	-0.58	0.49	1.00	0.56	0.45	0.45	0.51	0.56	-0.56	0.52	-0.29
%_Agri_L	0.42	-0.49	0.48	-0.66	-0.44	0.41	0.56	1.00	0.43	0.64	0.59	0.49	-0.19	0.37	-0.29
Land Form	0.55	-0.37	0.58	-0.72	-0.43	0.51	0.45	0.43	1.00	0.67	0.68	0.65	-0.31	0.39	-0.30
Parent Material	0.49	-0.42	0.61	-0.75	-0.45	0.43	0.45	0.64	0.67	1.00	0.67	0.54	-0.27	0.46	-0.34
Particle Size	0.65	-0.44	0.54	-0.76	-0.50	0.53	0.51	0.59	0.68	0.67	1.00	0.53	-0.23	0.36	-0.49
Soil Taxon	0.56	-0.34	0.50	-0.65	-0.61	0.57	0.56	0.49	0.65	0.54	0.53	1.00	-0.39	0.45	-0.23
%_BPL	-0.44	0.01	-0.21	0.43	0.38	-0.31	-0.56	-0.19	-0.31	-0.27	-0.23	-0.39	1.00	-0.34	0.25
LGD	0.50	-0.30	0.40	-0.51	-0.38	0.42	0.52	0.37	0.39	0.46	0.36	0.45	-0.34	1.00	-0.23
AARF	-0.41	0.27	-0.32	0.45	0.34	-0.27	-0.29	-0.29	-0.30	-0.34	-0.49	-0.23	0.25	-0.23	1.00

***Note*: Abbreviations**
GCA_NSA: Proportion of gross cropped area to net sown area; Fallow_NSA: Proportion of fallow land to net sown area; Per_SC: Percentage of Scheduled Castes in total population; Per_ST: Percentage of Scheduled Tribes in total population; Por_For: Proportion of geographical area under forests; Per_Irri_1991: Percentage of gross cropped area that is irrigated, 1991; Per_Lit: Percentage of literacy; %_Agri_L: Percentage of agricultural labourers; %_BPL: Percentage of BPL; LGD: Level of groundwater development; AARF: Annual average rainfall

6.4 Ethno-Demographic Profile

There are three observations of great significance, each confirming the thesis we propounded (in the beginning of the study) regarding the relationship between ethno-demographic, socio-economic and agro-ecological features.

The first is that the Scheduled Tribe population is concentrated in the most adverse agro-ecological settings in terms of landforms and soil characteristics. It is true that the forest cover in these areas is high and rainfall in the tribal blocks falling in the Bastar Division is also high. Outside of Bastar, the rainshadow areas are more often that not predominantly tribal. However, the level of development, captured by cropping intensity, irrigation, groundwater development and percentage literacy is very low. Though proportion of agricultural labourers is low in the high agriculture dependent workforce, poverty is higher. This indicates a large population of tribal cultivators-in-poverty. Poverty is more evenly spread out amongst the population.

The second is that the Scheduled Caste population is concentrated in the relatively more developed blocks that are characterised by greater landlessness and a higher proportion of agricultural labourers. Most ecological parameters (apart from forest cover and in some cases rainfall) are more conducive to stable and productive agriculture. The overall socio-economic development indices are positively correlated to the percentage of Scheduled Caste population. This indicates that Scheduled Caste populations are concentrated in the better-developed blocks. Poverty is more differentiated and restricted in most cases to the landless and marginal cultivators.

The third aspect that is easy to understand in light of the preceding discussion is that the correlation coefficient between percentage Scheduled Caste and percentage Scheduled Tribe population is negative and significant. These two deprived and marginalised sections of the population are spatially separated. As we shall see below, both are in poverty, but for different reasons and under different circumstances. Both require different solutions to mitigate their respective poverty and drought vulnerability.

In the case of the 'tribal cultivators in poverty', the cause falls under the broad rubric of 'state neglect' and in the case of 'assetless Scheduled Caste in poverty' in the plains the reason is dispossession, inequality and exploitation. In the case of difficult ecological regimes characterised by cultivator-poverty of tribal peasants, state investment in infrastructure and agricultural development suitable to the highly variable local conditions is the primary solution. In the case of the plains area where the Scheduled Castes dominate, drought distress is more unequally distributed, following the unequal distribution of assets, the primary one being land. In fact, landlessness and lack of off-farm employment are the reasons for high agricultural labour by the Scheduled Caste population and high outmigration from these areas. Here, the principal solutions will have to be employment generation and redistributive measures. Land reform and livelihood security through employment generation are most important to protect the vulnerable people. More effective coverage by the PDS and the Antyodaya schemes are of course concomitants.

6.5 Production System Characteristics

The three production system variables that we have selected are:

1) Gross cropped area as a percentage of net sown area. This reflects intensity of cropping.
2) Gross irrigated area as percentage of gross cropped area.
3) Level of groundwater development. This reflects the extent of utilisation of the groundwater potential.

From the correlation matrix it is clear that the cropping intensity (gross cropped area as a percentage of net sown area) is lower in areas with high concentration of Scheduled Tribe population; high forest cover and high annual average rainfall. This is in keeping with the thesis that areas of tribal concentration are underdeveloped in terms of the concomitants or preconditions for high cropping intensity, namely irrigation and level of groundwater development. In areas of higher forest cover land use intensities ought to be higher since less land is available for cultivation. However, the absence of public investment and the high incidence of poverty in these areas make it very difficult for private investment to emerge as the engine of economic growth in the absence of state-supported institutional credit. Low density of population facilitates the low land use intensities and extensive cultivation.

Cropping intensity is positively correlated to all the ecological parameters except annual rainfall and forest cover. The relationship with forest cover is easy to understand, if one remembers that the areas of high forest cover remain the highlands inhabited by tribal populations where public investment and irrigation remain low. The relationship with annual average rainfall is at first sight somewhat puzzling. After all, if rainfall is high, more water becomes available from this source, which should improve the chances of a second crop. Evidently, rainfall is necessary but not sufficient. Things become a little clearer if we look at the relationship between cropping intensity and annual rainfall not directly but by first looking at the regions where rainfall is high to see if they have the other prerequisites for intensive cultivation. The puzzle is solved the moment we do this. High rainfall is a feature of the southern districts of Bastar, Kanker and Dantewada. These are also areas of high run-off due to steeper slopes and more intense rainstorms. Despite this rich potential for micro-irrigation and soil-moisture enhancement through rainwater harvesting, state 'neglect' has resulted in under-development of irrigation and other infrastructure. Therefore, cropping intensity is low. Thus, the two ecological features that should encourage intensive agriculture—high forest area and rainfall—do not translate into the experience of higher cropping intensity because state intervention is inadequate.

The three production system related parameters are strongly and positively correlated confirming that the same factor(s) result in the development or underdevelopment of each. This factor is public investment. Therefore, irrigation intensity can be used as a proxy for all the three production system variables.

Irrigation intensity (gross irrigated area as a percentage of gross cropped area) is strongly and positively correlated with cropping intensity, which is a simple statement of the fact that *rabi* or the second crop is possible when irrigation is available. Irrigation facilities are more extensively available in the plains and valleys with better soils, lower forest cover and lower rainfall. These areas have lower Scheduled Tribe and higher Scheduled Caste population with higher literacy rates and lower poverty.

The sign or direction of causality remains the same for the level of groundwater development—low in tribal areas, high in the 'plains and valleys' with low Scheduled Tribe population. We have therefore taken cropping intensity as a proxy variable while constructing the composite drought vulnerability index.

In fact, percentage Scheduled Tribes, percentage forests and average annual rainfall all move in the same direction in terms of their association with all other variables. They have a negative correlation with every variable except of course with each other. The qualification that must be made is that average annual rainfall has comparatively lower coefficient values. This is explained when we look at the distribution of tribal blocks in relation to rainfall. As already mentioned above, areas of high tribal concentration include two types of rainfall situations within rain-dependent Chhattisgarh:

(a) The rainshadow hilly areas of the Central Plains and the northern hills.
(b) The high rainfall areas of Bastar Plateau. Further, there are non-tribal low rainfall areas too.

Tribal domination in population is more strongly correlated to forest cover than it is to rainfall since they have been pushed out of the valleys and plains into the rainshadow hilly areas that form the ridges adjoining the central plains. Therefore, the weaker but similar relationship of ‘average annual rainfall’ and all the other variables is explained by this ‘aggregation problem’. We have taken the proportion of Scheduled Tribes as a proxy for rainfall and forests

The other group of variables that moves together is the production system variables (cropping intensity, irrigation intensity, groundwater development), landform and soil-related variables, the social development population variables (percentage literacy and percentage agricultural labour) and percentage Scheduled Castes. All these variables are of course positively correlated with each other. This adds substance to the thesis that Scheduled Caste populations—the second ethno-demographic group that is characterised by socio-economic deprivation—is located in the plains and valleys, where they constitute the large army of agricultural labourers. These areas are more developed in terms of the production system and literacy, and overall poverty is lower. The soils and terrain in these areas are better from the viewpoint of stable and productive agriculture. These variables are negatively correlated with the set of variables isolated earlier, namely percentage Scheduled Tribes, percentage area under forests and average annual rainfall.

Therefore, we find that in a composite index to identity more drought vulnerable areas our present selection of variables is analytically sound, and the correlations between the selected variables follows along expected theoretical lines and confirms the central thesis and our arguments. However, we also find that there are broad groups of variables that are similar in the direction and intensity of relationship with other distinct groups of variables. Our present selection (5_1) forms a composite index that can ‘explain’ 55.4 per cent of the total variance (Table 6.5).

The next obvious step is to select proxies and reduce variables to get a neater composite index that may ‘explain’ the total variance more. The following table shows the variables selected by us (Table 6.4).

Table 6.4: Variables in Drought Vulnerability Composite Index

Variables Selected in Drought Vulnerability Composite Index			
Ranks	**Socio-economic**	**Production System**	**Ecology**
Rank_5	Percentage Scheduled Tribes Percentage Scheduled Castes Percentage literacy Percentage agricultural labour	Cropping intensity Percentage area irrigated Level of groundwater development	Percentage forest cover Landform Soil parent material Soil particle size Soil taxonomy Annual average rainfall
Rank_ 6	Percentage Scheduled Tribes	Cropping intensity	Percentage forest cover Landform Soil parent material Soil taxonomy Annual average rainfall
Rank_7	Percentage Scheduled Tribes	Cropping intensity	Landform Soil taxonomy Annual average rainfall
Rank_8	Percentage Scheduled Tribes Percentage Scheduled Castes	Cropping intensity	Percentage forest cover Landform Soil parent material Soil taxonomy Annual average rainfall Landform
Rank_9	Percentage Scheduled Tribes Percentage Scheduled Castes Gini coefficient of land distribution	Cropping intensity	Percentage forest cover Landform Soil parent material Soil taxonomy Annual average rainfall Landform

Since the production system variables were forming a group displaying similar relationships with other variables, we retained only cropping intensity as the variable representing the production system. Soil taxonomy was similarly retained and represented all soil characteristics, while parent material was retained to represent rock characteristics. Along with annual average rainfall, landform and proportion of forest area, these represent ecology or rain, soil, terrain, vegetation and rock. Percentage Scheduled Tribes is the demographic variable that has been retained.

Table 6.5 Percentage of Total Variance Explained

	5-1	**5-2**	**6**	**7-1**	**7-2**	**8-1**	**8-2**	**9-1**	**9-2**
Percentage of total variance explained	55	62	60	62.6	79.4	58.5	69.2	58	68.3

Note: 5 is the selection 5 made by us and 5_1 and 5_2 are the weightages assigned as per the first and second factor loadings, respectively. A similar nomenclature is followed for 6,7 and 8.

The composite index that emerges from this selection can 'explain' 60 per cent of the total variance. If we further drop parent material, given its high correlation with soil taxonomy, and proportion area under forests, given its high correspondence with percentage Scheduled Tribes, the total variance 'explained' by the composite index becomes 63 per cent. This is analytically sound, too, since the grouping justifies selection of these proxy variables. The weightages generated by the second loading of the selection 7 can 'explain' almost 80 per cent of the variation, and so on (Table 6.5).

We have also used the Gini coefficient for measuring the inequality in land distribution as an additional variable. If we look at the correlation matrix, the Gini coefficient has the correct direction and degree of correlation with other variables in the composite index. Inequality in land distribution is higher in landforms falling in the 'plains and valleys' category (which are better suited to settled and stable cultivation). Concentration of landholding is higher in areas of more intensive and irrigated agriculture with better soils. Land is more evenly distributed in areas of middle peasant dominance, which are the areas of higher tribal concentration. In other words, the plains areas with a higher concentration of Scheduled Caste population and preponderance of agricultural labourers in the workforce are markedly more unequal when it comes to owning the most significant productive asset, namely land.

Table 6.6: Correlation Matrix

	GCA_ NSA	Per_S C	Per_ ST	Por_ For	Per_Irri_ 1991	Land Form	Soil Taxon	AARF	Gini coefficient
GCA_NSA	1.00	0.39	-0.66	-0.47	0.72	0.55	0.56	-0.41	0.53
Per_SC	0.39	1.00	-0.76	-0.56	0.49	0.58	0.50	-0.32	0.49
Per_ST	-0.66	-0.76	1.00	0.68	-0.60	-0.72	-0.65	0.45	-0.66
Por_For	-0.47	-0.56	0.68	1.00	-0.43	-0.43	-0.61	0.34	-0.42
Per_Irri_1991	0.72	0.49	-0.60	-0.43	1.00	0.51	0.57	-0.27	0.47
Land Form	0.55	0.58	-0.72	-0.43	0.51	1.00	0.65	-0.30	0.77
Soil Taxon	0.56	0.50	-0.65	-0.61	0.57	0.65	1.00	-0.23	0.64
AARF	-0.41	-0.32	0.45	0.34	-0.27	-0.30	-0.23	1.00	-0.25
Gini Coefficient	0.53	0.49	-0.66	-0.42	0.47	0.77	0.64	-0.25	1.00

***Note*: Abbreviations**
GCA_NSA: Proportion of gross cropped area to net sown area; Per_SC: Percentage of Scheduled Castes in total population; Per_ST: Percentage of Scheduled Tribes in total population; Por_For: Proportion of geographical area under forests; Per_Irri_1991: Percentage of gross cropped area that is irrigated; AARF: Annual average rainfall

The different selections gave rise to different weights and different ranks to the blocks. For each selection we took the first and second factors. This ranked the blocks into the more and less vulnerable ones.

We will categorize blocks both on the basis of drought proneness and drought vulnerability. There are two bases on which the selection of the composite index is to be done: the analytical or theoretical validity of the relative weights and their correspondence with the actual experience of drought. Therefore the first requirement is that the index gives a higher weightage to those variables, which in our view are better able to capture drought proneness, i.e. the predilection to suffer rainfall deficits; and drought vulnerability, i.e. the tendency to express distress on account of drought. The second requirement is that the composite index matches with the experience of drought distress, which in our case is the extent of drought induced migration and the extent of crop failure.

No single factor by itself is capable of determining vulnerability. If every other factor was to remain the same, ecological parameters should be fundamental in determining drought vulnerability. However, our study shows how two factors have emerged decisive in determining the persistence or undermining of ecology. These factors are 'development' and 'equity'. We further find that not surprisingly both these factors are related to the ethno-demographic profile of the workforce. The predominance of 'middle farmers' in the agriculture dependent population in the more equitable tribal areas in the hinterland is a contrast to the higher proportion of landless or marginal Scheduled Caste agricultural labourers in the more unequal plains areas.

Development too has a clearly ethno-demographic basis to the regions of its spread—areas of tribal concentration in the ecologically difficult terrains have suffered from state neglect, and public investment is the prime mover in the dispersal of development. Therefore, a higher weightage to variables that capture these causes of vulnerability is very important. Tribal areas, due to neglect, and Scheduled Caste areas, due to asset-lessness, would be more vulnerable to drought. The reasons for vulnerability emanating from these different sources are therefore different.

The areas marked by greater inequality in landownership and preponderance of Scheduled Caste agricultural labourers in the agriculture dependent population, where the incidence of poverty is more localized to this section, are typically a feature of the plains and valleys from where the original tribal population has been dispossessed. In such areas meteorological drought has an immediate impact on the Scheduled Caste labourers-in-poverty, whose food stocks are virtually non-existent at the family or community level, and who now find themselves without employment or means to cultivate their small holdings (if any). The immediate impact here is large-scale out-migration on account of food insecurity and low employment. Even in areas with irrigation, which are less vulnerable to immediate rain shortfall, the employment elasticity of production is very high and even small shortfalls result in large unemployment.

The tribal areas have more equal landownership and the agriculture-dependent population comprises predominantly cultivators with a large section of middle farmers. Non-timber forest produce is a very important fallback and source of supplementary family income and subsistence. However, unlike their Scheduled Caste brethren in the plains, the poverty afflicted people in the rugged hinterland are tribal cultivators. Here, drought pushes the marginal and small farmers out as distress migrants, and the agriculture, which is almost entirely rain-dependent, suffers through widespread crop failure. Often, vulnerability finds expression less as out-migration and more as crop failure.

The resultant food insecurity is the same in both cases, but arises from different sources. In the case of the plains and valleys, the vulnerability is far more restricted in terms of the people who bear the brunt of it. In the tribal hinterland, vulnerability is more dispersed across the population. The irony of this different experience of drought-induced food and livelihood insecurity should not be lost on anyone: in the areas of greater equity, poverty too is more dispersed. In the areas of greater concentration, poverty too is concentrated to the landless and marginal agriculturists. This would be a banal statement except for the fact of a far higher incidence of poverty in the tribal middle and small cultivator dominated areas. Therefore, the poor are more dispersed across the landless, marginal, small and middle farmer categories in the tribal areas; a phenomenon that changes in the agriculture labour and marginal farmer dominated plains and valleys where the poor fall in the landless or small holder category and are most often members of the Scheduled Castes.

An important point to note from the discussion above is that 'extent of crop failure' and 'extent of out-migration' due to drought may not be correlated with each other. This may appear odd at first sight. After all, when the crop is doomed, and if few or no alternatives for income exist, people should migrate out in search of subsistence, especially in areas of high poverty. However, once we accept the importance of land distribution and equity as a variable that explains drought vulnerability, this puzzle of a lack of significant connectedness between extent of crop failure and extent of out-migration becomes clearer.

Tribal middle farmers whose crops fail may live with malnutrition and eke out subsistence from the forest and small stocks of previously grown coarse cereals. When they dominate the population, food and livelihood fragility may not express itself as dramatic population movement except by the lowest rungs, the poorest of the poor. In the areas marked by dominance of agricultural labourers and petty peasants, the story is different. Agricultural labourers with meager or no landholding have nothing to fall back on in times of distress. Even if the extent of crop failure in their areas is not very high relative to the hinterland, for the assetless poor this offers little solace since the gains of lesser agricultural vulnerability are unevenly distributed and accrue largely to the upper caste bigger cultivators.

Lest there be any misunderstanding, it bears repetition that landownership in the hinterland is not by itself a succor to ecological disasters like drought. This brings us to the seeming paradox in the correspondence between 'higher and more stable' rainfall with greater 'extent of crop failure'. It seems a bit counter-intuitive to have a situation of better rainfall conditions resulting in worse crop stability. However, the moment we include 'slopes and landform' or terrain in the reckoning, the paradox gets resolved. Drought vulnerable areas fall in a whole range of terrain — landform and slope — situations. The 'plains and valleys' are marked with lower rainfall, but the precipitation is retained due to the deeper alluvial and colluvial soils with lower gradient and run off. The 'undulating and rugged' Northern Hill and Bastar area may have a relatively higher and more stable rainfall pattern, but the steep gradient, high rainfall intensity on the shallower soils on hard rock strata result in high run off. The higher precipitation does not translate into higher retention on account of a higher ecological predisposition to rapid run off. These then are two circumstances of drought vulnerability: the lower rainfall in the drought-prone plains and the higher run off in the drought-vulnerable hills. There is yet another situation, namely the rainshadow areas in the hilly tribal tracts, marked by both high run off and 'low and variable' rainfall. This again points to very different causes and therefore requires different strategies for mitigation of drought.

Table 6.7: Correlations All Ranks

	R_ ECO	R_ PRO	R_ SOCIO	R_ CUM	R_5_1	R_5_2	R_6_1	R_7_1	R_7_2	R_8_1	R_8_2	Rg_8_1	Rg_8_2	R_9_1	R_9_2	R_9_3
R_ECO	1.00	0.08	0.05	0.46	0.10	0.12	0.11	0.15	0.46	0.02	0.44	0.06	0.57	0.05	0.27	0.54
R_ PRO	0.08	1.00	0.69	0.80	0.82	-0.04	0.78	0.83	-0.15	0.79	-0.18	0.78	-0.20	0.76	0.15	-0.02
R_SOCIO	0.05	0.69	1.00	0.82	0.78	0.07	0.73	0.74	-0.04	0.75	-0.09	0.76	-0.10	0.75	-0.05	-0.13
R_CUM	0.46	0.80	0.82	1.00	0.78	0.07	0.74	0.78	0.10	0.72	0.04	0.74	0.08	0.72	0.13	0.16
R_5_1	0.10	0.82	0.78	0.78	1.00	-0.10	0.97	0.94	0.00	0.96	-0.06	0.96	-0.10	0.95	-0.17	-0.02
R_5_2	0.12	-0.04	0.07	0.07	-0.10	1.00	-0.15	-0.14	0.43	-0.05	0.50	-0.06	0.33	0.00	0.35	-0.36
R_6_1	0.11	0.78	0.73	0.74	0.97	-0.15	1.00	0.96	0.01	0.97	-0.07	0.97	-0.09	0.95	-0.21	-0.03
R_7_1	0.15	0.83	0.74	0.78	0.94	-0.14	0.96	1.00	-0.07	0.94	-0.15	0.95	-0.13	0.92	-0.08	0.08
R_7_2	0.46	-0.15	-0.04	0.10	0.00	0.43	0.01	-0.07	1.00	0.02	0.98	0.04	0.92	0.13	-0.16	0.11
R_8_1	0.02	0.79	0.75	0.72	0.96	-0.05	0.97	0.94	0.02	1.00	-0.04	0.99	-0.11	0.99	-0.22	-0.11
R_8_2	0.44	-0.18	-0.09	0.04	-0.06	0.50	-0.07	-0.15	0.98	-0.04	1.00	-0.03	0.90	0.07	-0.05	0.09
Rg_8_1	0.06	0.78	0.76	0.74	0.96	-0.06	0.97	0.95	0.04	0.99	-0.03	1.00	-0.06	0.98	-0.23	-0.06
Rg_8_2	0.57	-0.20	-0.10	0.08	-0.10	0.33	-0.09	-0.13	0.92	-0.11	0.90	-0.06	1.00	-0.01	-0.01	0.34
R_9_1	0.05	0.76	0.75	0.72	0.95	0.00	0.95	0.92	0.13	0.99	0.07	0.98	-0.01	1.00	-0.25	-0.11
R_9_2	0.27	0.15	-0.05	0.13	-0.17	0.35	-0.21	-0.08	-0.16	-0.22	-0.05	-0.23	-0.01	-0.25	1.00	0.10
R_9_3	0.54	-0.02	-0.13	0.16	-0.02	-0.36	-0.03	0.08	0.11	-0.11	0.09	-0.06	0.34	-0.11	0.10	1.00

Note: R_ECO, SOCIO PRO and CUM are based on the weightages assigned by us, R_5_1 denotes the ranks based on the first factor of the fifth selection of va7riables, R_5_2 denotes the ranks based on the second factor of the fifth selection, and so on

In each of these situations, the interventions to mitigate drought vulnerability will need a different thrust. In fact in high run-off areas with good rainfall profile where there has been public investment in rainwater harvesting measures, drought vulnerability of cultivators has reduced. Since cultivators dominate the workforce, the phenomenon of 'cultivators in poverty' is checked.

Similarly, in the 'low and variable' rainfall areas with hard rock and high run-off, location specific soil moisture and groundwater conservation become critical. Where this has happened, drought vulnerability has been arrested. In the 'plains and valleys', the focus of irrigation support thus far, irrigation cannot by itself deliver. Massive public works programmes; off farm employment and land redistribution become crucial.

The first factor loadings give rise to a composite index and rankings that assign similar weightages to socio-economic, production system and ecological variables, whereas the second factor gives maximum weightage to rainfall variations. Further, the first factor weights give rise to a ranking that is closer to the one generated by us, and corresponds in particular with the ranking as per the socio-economic and production system variables.

We therefore have eight alternative rankings, all analytically sound, from which we have to select one. The ranking is done on the basis of the 8^{th} selection and second factor loading. Before we discuss why, let us examine how the different ranks correlate with each other.

The cumulative ranking generated by us is correlated to the ranking on the basis of the weights generated by the first factor, no matter which selection of variables is adopted. In other words, the weightages assigned by us without the assistance of the PCA give rise to a ranking, which has reasonable correspondence with the first factor in each selection. Besides the significant positive correlation with the cumulative index, the ranking based on the first factor loading are strongly correlated with each other, which is to be expected given the fact that we have selected proxy variables to represent clusters or groups of variables behaving similarly or moving in the same direction in relation to other clusters or groups. In other words, the ranking will not get significantly altered if we select the weights generated by the first factor of the 7^{th}, 8^{th} or 9^{th} selection of variables as the correlation coefficient of the ranks is 0.95 and 0.99 respectively. Similarly, the ranking will not get significantly altered if we select the weights generated by the second factor of the 7^{th}, 8^{th} or 9^{th} selection of variables, as the correlation coefficient of the ranks is 0.92 and 0.90 respectively

While the ranks based on the weights generated by the first factor are in no case significantly correlated one way or the other with the ranks based on the second factor loadings, the second factor loadings have a strong correspondence with each other. What this basically means is that the variable(s) that are awarded a high weight by the second factor are the same or similar for all selections. These are distinct from those that are similar for all the selections by the first factor loading and common to our weights as well. The obvious question that follows is what are these variables? How do we justify our preference for the ranking done by the second loading of variables in selection_8?

The following table presents the weightages assigned in the different factors by the PCA (Table 6.8). The first component in each case gives similar weights to production system variables like cropping intensity and irrigation intensity; ecological variables like soil, forest, landform, etc. with a relatively lower importance to average annual rainfall. The first component gives a higher weightage to Scheduled Tribe population and agricultural labourers when compared within the factor components and in comparison to the second factor. It is also important to note that the sign of the variables pertaining to rainfall and Scheduled Tribes are negative for the first factor. This implies that the first component gives a higher rank to blocks with a lower tribal population. When the Gini coefficient is included, the first component gives it a high weight, similar to all the other selected variables except rainfall, to which a lower weight is assigned.

Table 6.8 Component Matrix

	5_1	5_2	6_1	7_1	7_2	8_1	8_2	8_g_1	8_g_2	9_1	9_2
GCA_NSA	0.771496	0.233245	0.768378	0.813594	-0.06426	0.784755	-0.05104	0.776134	-0.11999	0.778741	0.495863
Per_SC	0.741348	-0.18992				0.763323	0.024917	0.751812	-0.04449	0.766588	-0.42712
Per_ST	-0.93399	0.102083	-0.92017	-0.89849	-0.0084	-0.91565	0.039066	-0.91166	0.07861	-0.91167	0.169093
Por_For	-0.71363	-0.09408	-0.73743			-0.7431	0.009875	-0.72104	0.158282	-0.74334	0.32067
Per_Irri_1991	0.716106	0.309455				0.759131	0.15012	0.743619	0.011599	0.768533	0.464062
Per_Lit	0.746047	0.308098									
Per_Agri_L	0.70802	-0.14712									
Land Form	0.777271	-0.12909	0.819169	0.841991	0.235643	0.793307	0.162293	0.823879	0.260524	0.800871	-0.03838
Parent Material	0.786974	-0.27242	0.797259								
Partical Size	0.818986	-0.2836									
Soil Taxon	0.770266	0.243942	0.800758	0.805812	0.360201	0.797008	0.305752	0.805036	0.253161	0.814361	0.009693
LGD	0.614263	0.394943									
AARF	-0.48997	0.493388	-0.52282	-0.55097	0.805725	-0.50313	0.839258	-0.48069	0.785313		
Gini coefficient								0.77845	0.33758		

Abbreviations:
GCA_NSA: Proportion of gross cropped area to net sown area; Per_SC: Percentage of Scheduled Castes in total population; Per_ST: Percentage of Scheduled Tribes in total population; Por_For: Proportion of geographical area under forests; Per_Irri_1991: Percentage of gross cropped area that is irrigated, 1991; Per_Lit: Percentage of literacy
Per_Agri_L: Percentage of agricultural labourers; LGD: Level of groundwater development;
AARF: Annual average rainfall

The second components are not in any case significantly correlated to our index, and award a higher and positive weightage to rainfall. This implies that as the value of the variable increases, so does the rank by the second component.

We therefore demarcate the first component based index by the 5th selection as the composite index of drought vulnerability and the second component of the 8th selection as the composite index of drought proneness. As per our earlier discussion it should be clear that it would make little difference which of the first components is selected given the neat correspondence between them, and the second components too correspond after the 7th selection, though not earlier.

Table 6.9: Correlation of Ranks with Variables

	R_ Eco	R_ Pro	R_ Socio	R_ Cum	R_ 5_1	R_ 5_2	R_ 6_1	R_ 7_1	R_ 7_2	R_ 8_1	R_ 8_2	Rg_ 8_1	Rg_ 8_2	R_ 9_1	R_ 9_2	R_ 9_3	GCA_ NSA	Per_ SC	Per_ ST	Por_ For	Per_ Irri_ 1991	Land Form	Soil Taxon	AARF
R_ Eco	1.00	0.08	0.05	0.46	0.10	0.12	0.11	0.15	0.46	0.02	0.44	0.06	0.57	0.05	0.27	0.54	0.14	0.02	-0.09	0.31	0.17	0.39	0.28	0.28
R_ Pro	0.08	1.00	0.69	0.80	0.82	-0.04	0.78	0.83	-0.15	0.79	-0.18	0.78	-0.20	0.76	0.15	-0.02	0.80	0.53	-0.80	-0.50	0.65	0.56	0.57	-0.49
R_Socio	0.05	0.69	1.00	0.82	0.78	0.07	0.73	0.74	-0.04	0.75	-0.09	0.76	-0.10	0.75	-0.05	-0.13	0.65	0.45	-0.77	-0.60	0.53	0.55	0.55	-0.43
R_Cum	0.46	0.80	0.82	1.00	0.78	0.07	0.74	0.78	0.10	0.72	0.04	0.74	0.08	0.72	0.13	0.16	0.71	0.47	-0.76	-0.39	0.60	0.67	0.62	-0.31
R_5_1	0.10	0.82	0.78	0.78	1.00	-0.10	0.97	0.94	0.00	0.96	-0.06	0.96	-0.10	0.95	-0.17	-0.02	0.72	0.73	-0.93	-0.71	0.65	0.72	0.71	-0.51
R_5_2	0.12	-0.04	0.07	0.07	-0.10	1.00	-0.15	-0.14	0.43	-0.05	0.50	-0.06	0.33	0.00	0.35	-0.36	0.16	-0.21	0.15	-0.08	0.27	-0.16	0.18	0.45
R_6_1	0.11	0.78	0.73	0.74	0.97	-0.15	1.00	0.96	0.01	0.97	-0.07	0.97	-0.09	0.95	-0.21	-0.03	0.71	0.70	-0.91	-0.74	0.59	0.77	0.74	-0.53
R_7_1	0.15	0.83	0.74	0.78	0.94	-0.14	0.96	1.00	-0.07	0.94	-0.15	0.95	-0.13	0.92	-0.08	0.08	0.75	0.66	-0.90	-0.63	0.61	0.79	0.72	-0.60
R_7_2	0.46	-0.15	-0.04	0.10	0.00	0.43	0.01	-0.07	1.00	0.02	0.98	0.04	0.92	0.13	-0.16	0.11	-0.07	0.09	-0.02	-0.08	0.10	0.26	0.38	0.72
R_8_1	0.02	0.79	0.75	0.72	0.96	-0.05	0.97	0.94	0.02	1.00	-0.04	0.99	-0.11	0.99	-0.22	-0.11	0.71	0.74	-0.91	-0.80	0.66	0.71	0.75	-0.52
R_8_2	0.44	-0.18	-0.09	0.04	-0.06	0.50	-0.07	-0.15	0.98	-0.04	1.00	-0.03	0.90	0.07	-0.05	0.09	-0.08	0.05	0.05	-0.03	0.18	0.17	0.31	0.76
Rg_8_1	0.06	0.78	0.76	0.74	0.96	-0.06	0.97	0.95	0.04	0.99	-0.03	1.00	-0.06	0.98	-0.23	-0.06	0.70	0.74	-0.92	-0.77	0.64	0.75	0.75	-0.51
Rg_8_2	0.57	-0.20	-0.10	0.08	-0.10	0.33	-0.09	-0.13	0.92	-0.11	0.90	-0.06	1.00	-0.01	-0.01	0.34	-0.09	0.00	0.06	0.13	0.05	0.30	0.27	0.69
R_9_1	0.05	0.76	0.75	0.72	0.95	0.00	0.95	0.92	0.13	0.99	0.07	0.98	-0.01	1.00	-0.25	-0.11	0.70	0.75	-0.91	-0.81	0.67	0.72	0.77	-0.42
R_9_2	0.27	0.15	-0.05	0.13	-0.17	0.35	-0.21	-0.08	-0.16	-0.22	-0.05	-0.23	-0.01	-0.25	1.00	0.10	0.39	-0.43	0.25	0.46	0.36	-0.09	-0.10	0.00
R_9_3	0.54	-0.02	-0.13	0.16	-0.02	-0.36	-0.03	0.08	0.11	-0.11	0.09	-0.06	0.34	-0.11	0.10	1.00	-0.10	0.24	-0.06	0.53	-0.03	0.43	-0.09	0.05
GCA_NSA	0.14	0.80	0.65	0.71	0.72	0.16	0.71	0.75	-0.07	0.71	-0.08	0.70	-0.09	0.70	0.39	-0.10	1.00	0.39	-0.65	-0.47	0.72	0.55	0.56	-0.41
Per_SC	0.02	0.53	0.45	0.47	0.73	-0.21	0.70	0.66	0.09	0.74	0.05	0.74	0.00	0.75	-0.43	0.24	0.39	1.00	-0.76	-0.56	0.49	0.58	0.50	-0.32
Per_ST	-0.09	-0.80	-0.77	-0.76	-0.93	0.15	-0.91	-0.90	-0.02	-0.91	0.05	-0.92	0.06	-0.91	0.25	-0.06	-0.65	-0.76	1.00	0.68	-0.60	-0.72	-0.65	0.45
Por_For	0.31	-0.50	-0.60	-0.39	-0.71	-0.08	-0.74	-0.63	-0.08	-0.80	-0.03	-0.77	0.13	-0.81	0.46	0.53	-0.47	-0.56	0.68	1.00	-0.43	-0.43	-0.61	0.34
Per_Irri_1991	0.17	0.65	0.53	0.60	0.65	0.27	0.59	0.61	0.10	0.66	0.18	0.64	0.05	0.67	0.36	-0.03	0.72	0.49	-0.60	-0.43	1.00	0.51	0.57	-0.27
Land Form	0.39	0.56	0.55	0.67	0.72	-0.16	0.77	0.79	0.26	0.71	0.17	0.75	0.30	0.72	-0.09	0.43	0.55	0.58	-0.72	-0.43	0.51	1.00	0.65	-0.30
Soil Taxon	0.28	0.57	0.55	0.62	0.71	0.18	0.74	0.72	0.38	0.75	0.31	0.75	0.27	0.77	-0.10	-0.09	0.56	0.50	-0.65	-0.61	0.57	0.65	1.00	-0.23
AARF	0.28	-0.49	-0.43	-0.31	-0.51	0.45	-0.53	-0.60	0.72	-0.52	0.76	-0.51	0.69	-0.42	0.00	0.05	-0.41	-0.32	0.45	0.34	-0.27	-0.30	-0.23	1.00

Abbreviations:
GCA_NSA: Proportion of gross cropped area to net sown area; Per_SC: Percentage of Scheduled Castes in total population; Per_ST: Percentage of Scheduled Tribes in total population; Por_For: Proportion of geographical area under forests; Per_Irri_1991: Percentage of gross cropped area that is irrigated, 1991, AARF: Annual average rainfall

Table 6.10: Drought Prone and Drought Vulnerable Ranks of Blocks Using Composite Index of Drought Proneness (DPI) and Composite Index of Drought Vulnerability (DVI)			
		DVI	**DPI**
101	Jagdalpur	84	128
102	Londigura	31	76
103	Darbha	25	103
104	Tokapal	63	112
105	Bastanar	5	108
106	Bastar	61	118
107	Bakaband	65	116
108	Kondagaon	15	67
109	Pharasgaon	14	117
110	Keshkal	19	87
111	Baderajpur	12	107
112	Narayanpur	20	39
113	Orchha	10	74
114	Makdi	6	96
201	Bilha	134	79
202	Masturi	140	132
203	Takhatpur	125	93
204	Mungeli	137	21
205	Patharia	127	60
206	Lormi	118	14
207	Kota	95	32
208	Gourela-2	62	24
209	Gaurela-1	71	35
210	Marwahi	68	25
301	Dantewada	24	56
302	Bijapur	8	126
303	Kuwakonda	7	100
304	Katekaleyan	16	92
305	Bheramgarh	1	70
306	Bhopal Patnam	27	129
307	Asur	4	94
308	Konta	3	53
309	Sukma	9	89
310	Chhindgarh	23	135
311	Gedam	11	75
312	Jagdalpur	59	109
401	Dhamtari	135	119
402	Kurud	145	99
403	Magarlod	112	83
404	Sihawa (Nagri)	79	45
501	Durg	144	84

Drought Prone and Drought Vulnerable Ranks of Blocks Using Composite Index of Drought Proneness (DPI) and Composite Index of Drought Vulnerability (DVI) (contd.)			
		DVI	**DPI**
502	Dhamdha	126	54
503	Gunderdehi	130	146
504		138	41
505	Sanjari Balod	114	11
506	Doundi	89	3
507	Gurur	143	142
508	Dondilohara	104	36
509	Bemetara	132	55
510	Saja	122	27
511	Berla	128	33
512	Navagarh	121	37
601	Akaltara	117	138
602	Baloda	110	145
603	Nawagarh	139	133
604	Pamgarh	133	95
605	Bamhnidih	113	114
606	Shakti	92	106
607	Jaijaipur	111	64
608	Malkharoda	109	140
609	Dabhra	108	73
701	Jashpur	29	141
702	Manora	21	130
703	Bagicha	36	47
704	Duldula	45	131
705	Kunkuri	50	144
706	Kasavel	37	120
707	Pathalgaon	38	82
708	Farsabahar	49	124
801	Kanker	66	16
802	Charama	75	10
803	Sarana(Narharpur)	64	12
804	Bhanupratappur	28	136
805	Durg Kodal	17	139
806	Antagarh	18	137
807	Koaliboda	2	147
901	Pandariya	99	4
902	Kawardha	116	49
903	Sahaspur Lohara	105	2
904	Bodla	73	1
1001	Korba	70	127
1002	Katghora	93	125
1003	Pondi	40	26
1004	Pali	77	91

Drought Prone and Drought Vulnerable Ranks of Blocks Using Composite Index of Drought Proneness (DPI) and Composite Index of Drought Vulnerability (DVI) (Contd.)			
		DVI	**DPI**
1005	Kartala	80	111
1101	Sonhat	42	17
1102	Baikunthpur	82	62
1103	Manendragarh	47	58
1104	Khadgawan	48	77
1105	Bharatpur (Janakpur)	34	29
1201	Mahasamund	101	101
1202	Bagbahara	87	88
1203	Pithora	85	78
1204	Saraipali	103	61
1205	Basna	91	57
1301	Raigarh	100	110
1302	Pusaur	115	68
1303	Kharsia	96	51
1304	Gharghoda	60	143
1305	Lailunga	67	72
1306	Tamnar	78	85
1307	Sarangarh	106	48
1308	Sarai Lengha [Baram kola]	107	115
1309	Dharmjaigarh	43	122
1401	Dharsiwa	142	123
1402	Arang	146	134
1403	Tilda	131	90
1404	Abhanpur	147	71
1405	Simga	123	46
1406	Bhatapara	119	97
1407	Balodabazar	136	102
1408	Palari	141	81
1409	Kasdol	81	6
1410	Bilaigarh	98	15
1411	Rajim	129	98
1412	Gariyaband	44	65
1413	Chhura	83	23
1414	Mainpur	52	5
1415	Deobhog	97	20
1501	Rajnandgaon	124	86
1502	Dongargaon	120	69
1503	Chhuriya	94	9
1504	Khairagarh	102	22
1505	Chhuikhadan	86	18
1506	Dongargarh	90	38
1507	Mohla	53	7
1508	Amba Chauki	88	13

Drought Prone and Drought Vulnerable Ranks of Blocks Using Composite Index of Drought Proneness (DPI) and Composite Index of Drought Vulnerability (DVI) (Contd.)			
		DVI	**DPI**
1509	Manpur	22	34
1601	Rajpur	39	42
1602	Ambikapur	54	121
1603	Lakhanpur	55	43
1604	Udeypur	58	104
1605	Lundra	51	80
1606	Sitapur	46	66
1607	Batauli	32	52
1608	Mainpat	26	30
1609	Surajpur	72	8
1610	Odgi	33	31
1611	Bhaiyathan	76	44
1612	Ramanujnagar	74	59
1613	Premnagar	41	50
1614	Pratappur	56	105
1615	Ramchandrapur	69	40
1616	Balrampur	30	63
1617	Wadraf nagar	57	113
1618	Kusmi	13	28
1619	Shankargarh	35	19

6.6 *Validation*

In the preceding section we have distinguished between drought proneness and drought vulnerability and established the analytical soundness of our own composite index as well as the indices generated by us using the 'principal component analysis' method. As a note of caution, we must state that the entire issue is of assigning the correct weightages to identify drought prone or vulnerable blocks. When we increase the relative weightage of the ecology parameters we move closer to the ranking on the basis of the second components. When we increase the weightages of the production system and socio-economic factors, we move towards the ranking as per the first factor loading.

In this section, we further explore our contention that an equal or similar weightage to socio-economic, ecological and production variables captures vulnerability arising from any one or a combination of mutually reinforcing factors. A high weightage to rainfall (with or without consideration of slope, landform, soil depth and texture, geology and other determinants of run off) should capture proneness to drought. It should of course be obvious that in the absence of meteorological drought, or inappropriate distribution of rainfall, the drought vulnerability will remain dormant. However, the fragility of livelihoods will express itself as high poverty, poor health, malnutrition, low productivity, etc.

In the light of this, let us attempt to see how our index matches with the distress on account of drought. We have two sets of data that are available to capture extent of drought distress: crop failure reports of three consecutive droughts for each Tahsil (they are not compiled at the Block level) and out-migration on account of natural disasters. In the case of crop failure, we have added up the area affected by more than 25 per cent loss of standing crop and divided this by the net sown area. Similarly, we have calculated migrants as a population of total workers.

Before we proceed, the political contestation that underpins both these data sets must be understood. On the one hand, we have influential pressures exerted by farmers who are confident of garnering the benefits of crop failure for themselves, or politicians who can swing populist support by declaring high crop failure. In other words, there is an entire politics of contestation behind the regions, the timing and the extent of crop failure declared, and often this has less to do with actual distress and more with the power wielded by the local MLA or influential farmers, if any. Farmer's organizations do offer an important countervailing force, whose success depends on their bargaining power.

In the case of migration data, the migrant is supposed to register with the *panchayat* before leaving but migrants leave without official intimation. Also, out-migration is viewed as a failure of drought relief and therefore a black mark against the administration. For both these reasons, underreporting is rampant. The aim is therefore usually to suppress this data locally. However, the one place where the data has fewer reasons to be biased are the documents prepared by the state government where they ask for Central assistance to cope with the drought. This data is however at the district level.

We used the Tahsil level data and categorized blocks into 5 ranges, with the rising numerical value indicating higher extent of outmigration or crop failure. Drought prone areas will have different degrees of vulnerability, and the two indices need not and in fact do not move together. In other words, the lack of correspondence between proclivity to drought and suffering from its consequences is not surprising. The first exercise we did was to correlate drought proneness with these indicators of distress, and drought vulnerability with these indicators of distress.

Table 6.11: Correlation of Ranks and Variables for Validation

	R_ Cum	R_ 5_1	R_ 8_2	GCA_ NSA	Per_S C	Per_S T	Por_F or	Per_ Irri_ 1991	Land Form	Soil Taxon	AARF	Crop Failure	Out_ migration	Drainage Density	Rice Yield
R_Cum	1	0.78	0.04	0.71	0.47	-0.76	-0.39	0.6	0.67	0.62	-0.31	-0.49	-0.39		
R_5_1	0.78	1	-0.06	0.72	0.73	-0.93	-0.71	0.65	0.72	0.71	-0.51	-0.59	-0.3		
R_8_2	0.04	-0.06	1	-0.08	0.05	0.05	-0.03	0.18	0.17	0.31	0.76	-0.47	-0.31		
GCA_NSA	0.71	0.72	-0.08	1	0.39	-0.65	-0.47	0.72	0.55	0.56	-0.41	-0.51	0.56		
Per_SC	0.47	0.73	0.05	0.39	1	-0.76	-0.56	0.49	0.58	0.5	-0.32	-0.42	0.68		
Per_ST	-0.76	-0.93	0.05	-0.65	-0.76	1	0.68	-0.6	-0.72	-0.65	0.45	0.74	0.18		
Por_For	-0.39	-0.71	-0.03	-0.47	-0.56	0.68	1	-0.43	-0.43	-0.61	0.34	0.84	0.23		
Per_Irri_1991	0.6	0.65	0.18	0.72	0.49	-0.6	-0.43	1	0.51	0.57	-0.27	-0.72	0.18		
Land Form	0.67	0.72	0.17	0.55	0.58	-0.72	-0.43	0.51	1	0.65	-0.3	-0.67	0.45		
Soil Taxon	0.62	0.71	0.31	0.56	0.5	-0.65	-0.61	0.57	0.65	1	-0.23	-0.43	0.35		
AARF	-0.31	-0.51	0.76	-0.41	-0.32	0.45	0.34	-0.27	-0.3	-0.23	1	-0.21	-0.23		
Crop Failure	-0.49	-0.59	-0.47	-0.51	-0.42	0.74	0.84	-0.72	-0.67	-0.43	-0.21	1	0.31		
Outmigration	-0.39	-0.3	-0.31	0.56	0.68	0.18	0.23	0.18	0.45	0.35	-0.23	0.31	1	0.79	-0.76
Drainage Density												0.79	-0.23	1	0.53
Rice Yield												-0.76	0.53	-0.23	1

Abbreviations:
GCA_NSA: Proportion of gross cropped area to net sown area; Per_SC: Percentage of Scheduled Castes in total population; Per_ST: Percentage of Scheduled Tribes in total population; Por_For: Proportion of geographical area under forests; Per_Irri_1991: Percentage of gross cropped area that is irrigated, 1991; AARF: Annual average rainfall

Three or four interesting observations can be made:

1) The strong negative correlation between ‘landform’ and ‘crop failure’, indicating higher crop failure in more rugged topography
2) The strong positive correlation between proportion of tribal population and ‘crop failure’, indicating higher crop failure in tribal areas
3) The strong positive correlation between outmigration and percentage Scheduled Castes.
4) The weak negative correlation between landform and outmigration.
5) The very insignificant correlation between outmigration and crop failure, for which reason we did not attempt a composite index.
6) The high positive correlation between drainage density (an indicator of run off rates) and crop failure.
7) The high negative correlation between yield and crop failure

The picture the data confirms is one of high rain-dependence in the tribal areas, in areas of both ‘good’ and ‘poor’ rainfall profiles. This is for three reasons: one, the high run off rates in many of the good rainfall areas; two, the low investment in irrigation and concomitants; three, of course, the lower and more unstable rainfall in the rainshadow areas. The problem of drought in Chhattisgarh is less rainfall inadequacy except in a few pockets. The problem is of development initiatives for appropriate water and land management. The rain-dependent middle peasant dominated upland cultivation situations suffer from low and variable productivity and stabilizing agriculture and production becomes the priority. The problem in the plains is out-migration by the dispossessed.

While we have discussed most of the features in the course of the discussion, the one result we want to discuss is the negative correlation between yields and crop failure. The reason for this is that the same factors that causes low yields and cause high crop failure: the lack of protective irrigation and other concomitants to increase and stabilize productivity.

We were initially nonplussed and demoralized by the weak correlation between the DVI, the DPI and the 'extent of crop failure' and the 'extent of out-migration'. It did seem a bit of an anomaly, to say the least, and we were not greatly satisfied by the undoubted wisdom behind the plea of faulty data. Given the fact that all drought prone areas need not be drought vulnerable, we decided to take a subset of those blocks which were high to medium in terms of drought vulnerability and were also high to medium ranging in the drought proneness listing. We therefore took the overlap.

We then tried to see how these blocks behaved in terms of crop failure and out-migration. The results are now less counter-intuitive. The selection itself results in a high positive correlation between DVI and DPI, as well as a significant negative correlation between both DVI and DPI and migration and crop failure. This could also serve as the list of blocks requiring immediate attention from the state for drought proofing.

Table 6.12: Correlation Matrix Of Blocks Falling In Overlap Between High And Medium Priority By DVI And DPI

	DVI (selection)	DPI (selection)	Crop Failure	Out-migration
DVI (selection)	1	.75	-.85	-.78
DPI (selection)	.75	1	-.78	-.86
Crop Failure	-.85	-.78	1	.43
Out-migration	-.78	-.86	.43	1

Table 6.13: High and Medium DV and DP Priority Drought Proofing Blocks

102	Londigura	DPAP
108	Kondagaon	DPAP
110	Keshkal	
112	Narayanpur	
113	Orchha	
114	Makdi	
207	Kota	
208	Gourela-2	DPAP
209	Gaurela-1	DPAP
210	Marwahi	
301	Dantewada	
302	Bijapur	DPAP
304	Katekaleyan	
305	Bheramgarh	DPAP
307	Asur	DPAP
308	Konta	DPAP

Table 6.13: High and Medium DV and DP Priority Drought Proofing Blocks (contd.)		
309	Sukma	DPAP
311	Gedam	DPAP
404	Sihawa (Nagri)	
506	Doundi	DPAP
507	Gurur	DPAP
510	Saja	
511	Berla	
703	Bagicha	
707	Pathalgaon	
801	Kanker	
802	Charama	
803	Sarana(Narharpur)	
901	Pandariya	DPAP
903	Sahaspur Lohara	DPAP
904	Bodla	DPAP
1001	Korba	DPAP
1002	Katghora	DPAP
1003	Pondi	DPAP
1004	Pali	DPAP
1005	Kartala	DPAP
1101	Sonhat	
1102	Baikunthpur	
1103	Manendragarh	
1104	Khadgawan	
1105	Bharatpur (Janakpur)	
1202	Bagbahara	
1203	Pithora	
1204	Saraipali	
1205	Basna	
1303	Kharsia	
1305	Lailunga	
1306	Tamnar	
1409	Kasdol	
1410	Bilaigarh	
1412	Gariyaband	
1413	Chhura	
1414	Mainpur	
1415	Deobhog	
1501	Rajnandgaon	
1502	Dongargaon	
1503	Chhuriya	DPAP
1504	Khairagarh	
1505	Chhuikhadan	
1506	Dongargarh	
1507	Mohla	DPAP
1508	Amba Chauki	DPAP

Table 6.13: High and Medium DV and DP Priority Drought Proofing Blocks (contd.)		
1509	Manpur	DPAP
1601	Rajpur	
1603	Lakhanpur	
1605	Lundra	
1606	Sitapur	
1607	Batauli	
1608	Mainpat	
1609	Surajpur	
1610	Odgi	
1611	Bhaiyathan	
1612	Ramanujnagar	
1613	Premnagar	
1615	Ramchandrapur	
1616	Balrampur	
1618	Kusmi	
1619	Shankargarh	

Note: DPAP denotes blocks selected under the Drought Prone Areas Programme.

In conclusion, it is important to identify blocks falling under the DPAP list that have not been selected by our method and offer possible explanations for this.

Table 6.14: DPAP Blocks Excluded From Our Selection		
	Jagdalpur	DPAP
	Tokapal	DPAP
	Bastar	DPAP
	Bakaband	DPAP
	Jaijaipur	DPAP

As we can see, four of the excluded blocks fall within one District, namely Bastar. It was not clear to anybody in the District itself as to why these had been included. These blocks had very high run off rates and drainage densities. But they were not areas that the local administration identified as drought prone.

In the following table we present the ecological typologies that categorize blocks amenable to a similar matrix of interventions. This would help categorizes the areas requiring immediate attention into a range of typologies (see chapter 4).

Table 6.15: Typology of Blocks Requiring Priority Drought Proofing

Dist. Name	Block ID	Block Name		F-TYPO
Bastar	102	Londigura	DPAP	3
	108	Kondagaon	DPAP	6
	110	Keshkal		1
	112	Narayanpur		1
	113	Orchha		1
	114	Makdi		5
Bilaspur	207	Kota		5
	208	Gourela-2	DPAP	4
	209	Gaurela-1	DPAP	4
	210	Marwahi		6
Dantewara	301	Dantewada		1
	302	Bijapur	DPAP	7
	304	Katekaleyan		3
	305	Bheramgarh	DPAP	7
	307	Asur	DPAP	7
	308	Konta	DPAP	6
	309	Sukma	DPAP	3
	311	Gedam	DPAP	3
Dhamtari	404	Sihawa (Nagri)		3
Durg	506	Doundi	DPAP	4
	507	Gurur	DPAP	5
Jashpur	703	Bagicha		3
	707	Pathalgaon		1
Kanker	801	Kanker		1
	802	Charama		1
	803	Sarana (Narharpur)		1
Kawardha	901	Pandariya	DPAP	4
	903	Sahaspur Lohara	DPAP	2
	904	Bodla	DPAP	4
Korba	1001	Korba	DPAP	7
	1002	Katghora	DPAP	5
	1003	Pondi	DPAP	1
	1004	Pali	DPAP	6
	1005	Kartala	DPAP	6
Korea	1101	Sonhat		4
	1102	Baikunthpur		1
	1103	Manendragarh		1
	1104	Khadgawan		6
	1105	Bharatpur (Janakpur)		1
Mahasamund	1202	Bagbahara		3
	1203	Pithora		3
	1205	Basna		1

Table 6.15: Typology of Blocks Requiring Priority Drought Proofing(Contd)

Raigarh	1303	Kharsia		5
	1305	Lailunga		3
	1306	Tamnar		3
Raipur	1409	Kasdol		3
	1410	Bilaigarh		2
	1412	Gariyaband		7
	1413	Chhura		1
	1414	Mainpur		7
	1415	Deobhog		6
	1503	Chhuriya	DPAP	5
	1505	Chhuikhadan		7
	1506	Dongargarh		5
Rajnandgaon	1507	Mohla	DPAP	3
	1508	Amba Chauki	DPAP	2
	1509	Manpur	DPAP	7
Surguja	1601	Rajpur		1
	1603	Lakhanpur		4
	1605	Lundra		1
	1606	Sitapur		1
	1607	Batauli		1
	1608	Mainpat		1
	1609	Surajpur		3
	1610	Odgi		4
	1611	Bhaiyathan		3
	1612	Ramanujnagar		1
	1613	Premnagar		7
	1615	Ramchandrapur		1
	1616	Balrampur		1
	1618	Kusmi		1
	1619	Shankargarh		1

Table 6.16: Typology of DPAP Blocks Excluded From Our Selection

Dist. Name	Block ID	Block Name	Final Typology
Bastar	101	Jagdalpur	6
	104	Tokapal	4
	106	Bastar	4
	107	Bakaband	6
Janjgir Champa	607	Jaijaipur	5