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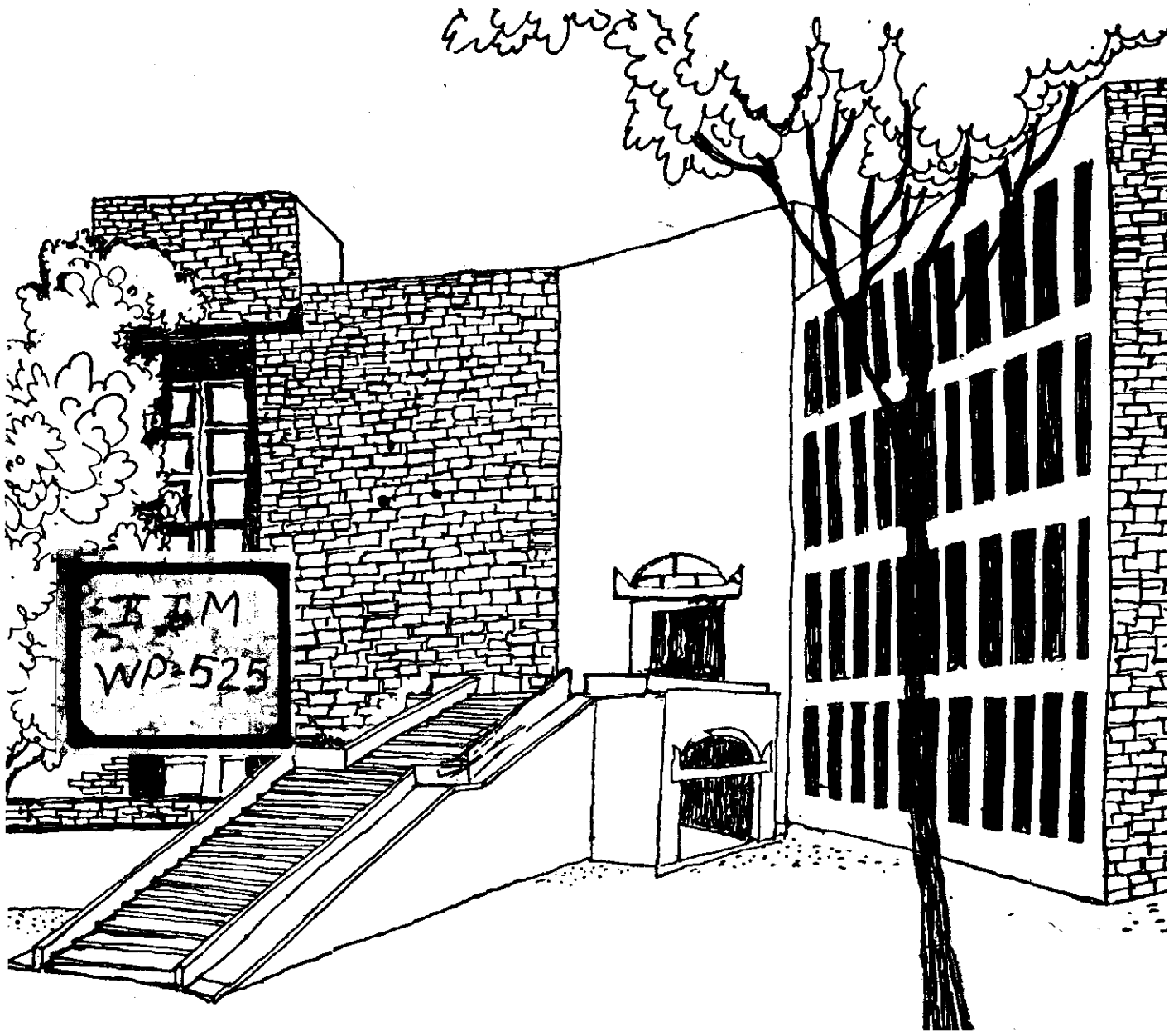

SOCIO-ECOLOGY OF LAND USE PLANNING IN SEMI-ARID REGIONS

By

Anil K. Gupta

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INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD-380015
INDIA

SOCIO-ECOLOGICAL PERSPECTIVE FOR LAND USE PLANNING IN SEMI-ARID REGIONS

Abstract

Land use planning in tropical developing countries has posed a tremendous challenge to planners owing to high ecological diversity. The problem is particularly complex in semi-arid regions where due to high degree of environmental uncertainty, the traditional land use practices have been evolved by farmers with a high degree of flexibility. Most of such intra and inter-Household resource adjustment strategies have involved simultaneous operations of farmers in several resource markets. Options of farmers in one market thus could not be analysed in isolation of constraints or opportunities in other markets.

In this paper, a new approach, termed socio-ecological, has been proposed to provide a perspective forlanduse planning which would be consistent with long term interests of ecological balance and short term interest of survival for the poor. This concept is fundamentally different from the traditional socio-ecological studies pursued by Park and Hawley.

Contention is that ecology defined the range of economic enterprises that had been found suitable for survival typically by different classes of farmer. Access to institution coupled with other public intervention influenced the scale at which these enterprises were operated by different classes.

After discussing socio-ecology of stress in semi-arid region, some of the traditional risk adjustment mechanism have been listed. Empirical evidence on land, livestock, tree and household energy management has been presented. Inter-play between ecological and market forces has been illustrated with the help of credit resource and land-transfer maps of a block of about 70 villages.

It is hoped that this approach would provide scope for generating land use options that widen the decision-matrix of poor and at the same time lead to better natural resource management. Finally, it is argued that policy intervention for redesigning institution and their access modes in backward regions - unable to attract market forces - is called for. This will enable poor to manage land, livestock, labour use linked with craft activities in semi-arid region in congruence with environmental needs.

SOCIO-ECOLOGY OF LAND USE PLANNING IN SEMI-ARID REGIONS

Anil K Gupta*

Context:

Small farmer households try to adjust with the risks inherent in semi-arid tropical agriculture through several intra and inter household Resource adjustment (HHRA) strategies having significant bearing on the land use options which we will argue, differ characteristically for different classes of farmers in various ecological contexts. Intra-HHRA strategies include multiple cropping, land fragmentation, simultaneous operation in land-livestock - craft - labour markets, seasonal shifts in energy use etc. Inter-HHRA include operations in tenancy, credit, labour markets besides asset disposal, contractual livestock management etc.

Decision making options of farmer in one market cannot be analysed in isolation of constraints and opportunities in other markets (Gupta, 1981; Bharadwaj, 1979; also see Figure 1 in appendix). Implications of above complexity for conceptualising the logic of survival mechanisms evolved historically by small farmers and labourers in different ecological contexts of arid and semiarid world have been investigated to varying degree (UNESCO MAB Report No. 6,9,10; Jodha 1983, 1978 Spitz 1980, Gupta 1981 a,b,c,d 1983; Torry, 1983; Simth 1982).

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* Professor, Central for Management in Agriculture, Indian Institute of Management, Ahmedabad.

Not all these researchers have used a framework which presupposes inter-penetrating or interlocked factor and product markets though they have all described strengths or weaknesses in risk adjustment capabilities of farmers with implications for resource use options that different social classes have.

We will try to present evidence from our enquiry into various aspects of small farmer household economy in semi-arid regions in western Haryana with implications for land use planning in similar conditions elsewhere in the world. We will many times go beyond data to speculate about various dimensions that have been neglected in various studies. We will first present the brief setting in which small and marginal farmers adjust with risks followed by identification of different dimension of land use. Lastly we will argue for developing new conceptual scheme to deal with problems of land use in dry regions for which current regional planning or farming systems framework prove highly inadequate. Five key questions that this paper tries to answer vis-a-vis farmers as well as planners' meanings of respective rationality are given in Appendix - 1. Central thrust of these questions is that if farmers don't respond to our supposedly scientific advice consistently and stubbornly in different parts of the world, rather than blaming them or their apathy to change, we should start questioning the very paradigm in which our advice package has emerged.

Part 1

Dry-Farming Household Economy: Socio-Ecology of a Sustained Stress

The regions where the market penetration has been minimal, the range of economic enterprises, we submit, is defined by the ecological context. The scale at which different classes of rural people would operate these enterprises given the risks inherent in such regions is determined by:

a) access to institutions, technologies, markets;

b) accumulated debt/savings due to previous droughts/losses/gains;

c) expectation of future uncertainties;

d) level of current diversification;

e) access to extended kinship structure or some other source of remittances or funding etc.

Broadly speaking, what we are implying is that region endowed with say sheep, camels will not be predomenantly endowed with buffaloes or bullocks. The niche of sheep is characterized by poor soil, undulated topography, sparse vegetation, low ground water (even saline or brackish), etc. The buffaloes on the other hand would find shady plains with abundant water, green fodder, etc. favourable. Goat incidently being more adaptable can be found in hot as well as humid tropics. Most of the marginal and small farmers predominantly depend upon livestock but proportion of different species across size holding is subject to respective landuse practices and potential.

Land: Livestock Endowment

The findings of household survey* done in 1979-80 (a drought year) and followed up in 1982 are given below:

Table - 1

Land Holding	Cummulative % of No. of Household	% land owned	Cummulative Percentage of livestock ownership					
			Buff.	Cow	Bull	Camels	Sheep	Goat
LL	19	0	14	11	10	8	27	22
≤ 2.5	50	9.	41	41	40	34	63	52
≤ 5.0	72	26.	63	62	65	57	86	75
≤ 10.0	89	55	82	83	85	85	93	97
> 10.0	100	100	100	100	100	100	100	100

Key insights that emerge are:

a) livestock distribution in general is less skewed than land distribution,

b) within livestock, distribution of sheep is skewed in favour of landless and marginal farmers, goat is more or less proportional except that medium farmer have a greater share. Cows, buffaloes, bullocks and camels are skewed in favour of bigger farmers. Share of landless is least in Camel, followed by Bullock, cows and Buffaloes. Distribution of Camel is most skewed. The implications are that close grazers or Browsers (Sheep and Goat) are a source of major income to those whose land base is narrow and labour resource is wide. Separately it has been seen that average market value

*The survey was done after selecting 24 villages in a drought prone district of Haryana on the basis of ecological diversity and involved contacting 662 farmers. This is part of ongoing CMA project on small farms Household Economy in Semi-Arid regions.

> of different species if taken as proxy for managerial efficiency apart from comparative resource advantage, the poor landless and marginal farmers don't suffer any disadvantage as far as labour intensive (i.e. grazing responsive species like sheep and goat) livestock enterprises are concerned. However in case of camel, they have a small degree of disadvantage but in buffaloes and Bullock, they have definite disadvantage due to capital constraints.

The species which graze closely and can survive in most degraded land use conditions are maintained as well if not better by the poor landless and marginal farmer who own very little land and whose dependence on this source of income is very high. Land use options within a given semi-arid region, we thus submit, will be quite different for different classes of farmers having not only varying factor advantages but also different level of access to capital implying facilities like stall feeding or purchased fodder or own reserve of fodder grown directly or as crop residues.

Resource Conservation: Are poor the culprits?

The 'developmental planners' trained to offer advice without soiling their hands often consider poor affected most by the environmental degradation as the very reason for the same. We will briefly review some empirical evidence about the land use practices vis-a-vis density and distribution of trees mainly Jat (Prospics cenararia) and Kikar (Acacia sp) at different size holdings, irrigation levels and tenurial condition besides looking at fragmentation of holdings, seasonality effects etc.

Tree endowment

In different semi-arid regions, there are always found certain tree species which farmers religiously worship. The institutionalised devotion often symbolises the economic uses of such trees. In the area under study, Jat was one such tree which farmer never cut. Ownership distribution of trees given in Table 2 reveals that it is less skewed than land. Density of the trees is highest at the holding of marginal farmers and least at the level of big farmers. Even though differences were not very pronounced between marginal and medium farmers, it is noteworthy that big farmers had the lowest density of trees. The same when observed in different irrigation zone (Table 3) indicates very interestingly that density declines as the landsize increases in village having minimal irrigation whereas relationship reversed though not very strikingly in highest irrigation zone. In medium irrigation zone, marginal farmer have still the highest density though differences among other classes of farmer cease to be significant. The marginal farmers as well as small farmers in irrigated regions apparently to intensify their cultivation have considerably less density than bigger farmers in irrigated region. The marginal farmer tenants as shown in Table 4 had higher density than the nontenants and similar was the case with big farmer. As far as tenancy was guided by the limited resource use opportunities at lessee's level, the higher density probably indicated greater consciousness about conservation induced by constrained resources.

- Implications are that poor farmers are the richest conservator in dry regions much against the conventional wisdom.
- Further with increase in irrigation, the economic consideration overrule the ecological considerations.

Another clue to the above relationship can be found by analysing the fuel dependence in different ecological contexts as given in Table 5. The wood was major source of energy (51% of farmers reported wood) in dry region where as in irrigated regions, the wood and dung cakes and kerosene were also the sources on which many farmers were dependent.

Scenario which emerges can be summarised as follows:

Poor farmers in dry regions conserve their soil better than bigger farmer. They have higher tree density, use dung less for fuel and more for manure purposes (separately, analysis of application of Fertilizers and F.Y.M at holdings of different size and irrigation revealed that better endowed and irrigated farmers did not apply much F.Y.M). The dry marginal farmers were not cultivators primarily as seen earlier. They owned such livestock species in greater proportion which required mobility and dependence upon sparse vegetation. These farmers also had deficit in their household budget because of frequent crop failures as also livestock mortality. Such farmers turned into predominant livestock-men if the rains got delayed. Availability of wild grasses (like Moonj), hair/wool/skin of livestock and

abundance of labour but of physically less strong[1] members of family like women, old, inform children etc, resulted in sustinance of many craft activities like rope making, weaving etc.[2] The so called 'waste land' provided extremely valuable grasses fpr rope making, besides possibility of short distance grazing by children/old people. The seasonality of land use was significantly related to seasonality of labour use as we would see next.

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[1] The able bodied males often migrate out because of limited local work opportunities.

[2] Apart from labour, seasonality of labour also generated the possibility of keeping employed in lean seasons by concentrating on craft activities.

Table 2

Ownership Distribution of Trees

Farmer category	Cummulative % of HH reporting land	Cummulative % land	Cummulative % HH reporting trees	Jat Trees	Kikar	Total	Per/Acre Tree No.
Marginal farmers (2.5 acres)	39	9	31	11	10	11	2.1
Small ≤ 5 acres	65	17	59	27	27	28	2.3
Medium ≤ 10 acres	87	28	83	59	59	61	2.7
Big > 10 acres	100	100	100	100	100	100	2.0

Table - 3

Distribution of Trees in 3 Irrigation Zones

Farmer Category	Low Irrigation Block			Medium Irrig. Block			High Irrig. Block		
	Cumm. % of H.H.	Cumm. % of Tree	Per acre No. of Tree	Cumm% H.H.	Cumm.% Tree	Per acre No.of Tree	Cumm.% H.H.	Cumm.% Tree	Per acre
Marginal Farmers	28.5	9.9	3.5	39.8	14.8	3.4	25.3	9.0	1.5
Small	58.2	28.9	2.9	66.3	29.3	2.2	51.7	24.2	1.6
Medium	87.3	72.7	3.3	81.4	48.2	2.1	79.2	56.8	2.3
Big	100.0	100.0	1.7	100.0	100.0	2.3	100.0	100.0	2.0

Table 4

Land Holding	Tenant	Non Tenants
0.1 — 2.5	3.0	2.7
2.6 ≤ 5	2.0	2.4
5.1 ≤ 10	2.5	2.7
10.0-above	2.5	1.8

Tree Density per acre at farms of Tenants and non tenants of different size holding.

Table 5

	B_1	%	B_2	%	B_3	%
Dungcake	7	4	15	10	14	9
Wood	85	51	48	33	48	31
Kerosene	18	11	20	14	22	14
Oil & wood	36	21	2	—	23	14
Wood & Dungcake	20	12	60	42	49	31
No. of farmer Respondents	166		145		156	

Fuel use pattern in different Irrigation zones.

Seasonality

One of the key characteristics of above scenario is inherently high degree of seasonality in the production process. Land use pattern vary over years in semi-arid drought prone region depending upon the extent and timing of rainfall. Depending upon risk taking capacity different classes of farmer respond to first rains differently. Some perform sowing immediately after particularly when they have sufficient bullock power, others wait till second rains. Barah and Binswanger (1982) found that additional one bullock leads to a much larger increase in plot diversification rather than having additional family member or acre of land. Since crop diversification was inversly proportional to income instability, farmers constrained with draught power have lesser ability to diversify their cropping system. Our studies in Ahmednagar (Maharashtra), Kutch (Gujarat) and some other, semi-arid regions have shown a net decline in availability of bullock power during last 3 decades.

In cattle based economy, seasonality will also be reflected in milk production pattern which in turn varies in different ecological contexts. Studies have shown that the regions having poor soil fertility, scarce pastures have majority of cattle comprising infant bovines (Kataria, 1982). These region serve as breeding tract for cattle. Proportional return to labour during nonproductive early age of cattle are lesser than the returns during later period. Thus while planners

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assume, depending upon cattle population, a fixed proportion in milch on the basis of which income flows are worked out. Such a way of analysing seasonal income inflows is obviously faulty. The age composition also influences the disease resistance, mortality, feed uptake besides grazing patterns.

In Botswana, impact of seasonality on water use in areas where land was communally controlled has been meticulously studied (Roe and Fortmann 1982: 10-20). Seasonal cycle of rainfall is found to determine

> "which sources (ephemeral water and rechargeable ground water supplies) contain water. The beginning of cropping activities generally coincides with the first month of the rainy season. This agricultural season, in turn, affects where people are and the nature of their water needs. This is to say that water use in a given locality varies by season because of the change in residence, related to the agricultural calendar. This seasonal change in residence also determines who might be expected to use or manage water at a given location. Those who are not at a location clearly will not be involved. Finally, the seasonal availability of pasture affects where cattle can be herded and hence, where there is a demand for livestock water" (1982:10).

Several other implications of seasonality have been worked out in above study such as follows:

(1) Since the notion of a household as an unified social and economic unit sharing the same dwelling place does not hold true for many families, "the unit of production for the family may not be the same as its unit of consumption".

Mutual sharing of labour, bullocks (called as irjik in Maharashtra) and several other self help strategies have emerged largely to ensure minimum return to maximum households. Undoubtedly many of the 'modern' interventions positively weaken these efforts. Many times ignoring age and sex composition of population besides seasonal flows of labour leads to designing intervention that founder because of labour constraints in what is generally considered a labour-surplus economy.

(ii) Even though rains in Botswana start in October, or November, one found many households starting plowing in December largely due to lack of timely access to draught power.

(iii) Even the oxen available in the region are typically in poorer health condition due to preceding fodder stress period.

(iv) Malnutrition, diseases, and seasonal food shortages reduced proportion of healthy children in the month before harvest reducing thereby labour at household level for harvesting, threshing, etc.

(v) High proportion of dry cattle also influenced by grazing stress prior to breeding whereas weight gains are said to improve breeding performance.

'Seasonality index' (Walsh, 1980 in Chambers et al, 1981) has been suggested as one indicator to get some broad idea about the nature of seasonality. It is the "sum of the absolute deviations of mean monthly rainfall from the overall mean, devided by mean annual rainfall." In theory, this index can vary between 0.00 (if all months have equal amounts of rain) and 1.83 (if rain is concentrated in a single month). However it does not take temporal variations into account, neither the unimodal or bimodal nature of rainfall is indicated While methods can be refined to develop sufficient precision in generating additional information about seasonality characteristics of an ecological region, it is important to note here that land use options vitally depend upon seasonality of livestock, human and plant growth cycles, health and energy balance.

One of the important implication of seasonality is the planning

of public works which are often stopped at the on-set of rains, when nutrition requirement are highest. Temporal coexistance of poverty and unemployment has been disputed (Chambers et al, 1981:229). In deficit budget households, expecting savings from income in slack season to suffice for needs in sowing season are not justified. Various related dimensions regarding role of moneylender, access to food distribution network, and control over markets etc. need to be looked into.

Linkage of public works with soil conservation work has been suggested many times. Concept of land army which can mobilize rural unemployed into a disciplined work force for executing public projects has been experimented in Karnataka.

However, what has to be appreciated still is the need for devising organic linkages between employment generation programmes, specific soil-water conservation requirements of a region, and organization of people who, because of seasonal nature of economy and uncertainty of employment, many time migrate away. Paradox is that many times labour has to be imported from other regions for developmental tasks. One should not interpret disinclination of local people to work on short term public works as a sign of their irrationality or apathy. Many times to honour long term work contracts or informal understandings, labourers prefer to lose in short run (by way of lesser wages in work elsewhere compared to the wages available under public works). Land use development plans involving massive labour input should certainly take this into account. Many times participation in development of infra-

structure may itself be some guarantee of sustaining and protecting the infrastructure in future. We will see next how to deal with the problem of fragmentation. It is said that high fragmentation leads to loss of time in travelling from one plot to another at the time when not enough scope exists for delay in say, sowing.

Fragmentation of Land

Consolidation of land generally is considered one of essential prerequisites for land use planning. It is seldom recognised that fragmentation of holding institutionalised through an inheritance system[3] in the dry regions is an effective device to deal with the uncertainty of rain fall apart from a mechanism to ensure that every body got share in plots of varying fertility.

Field diversification (multiple cropping) has been found to be positively correlated with land fragmentation. Both the mechanisms have been seen to dampen income fluctuations in SAT region (Walker, Singh, Jodha, 1983). However in a recent study in western Haryana we found that average number of plots per household (Scatter index) increased with increase in landholding size. Farmers have 2.5,5, 10 and more than 10 acres of land had average number of plots as 1.45, 1.86, 2.28 and 2.38 respectively. Apparently, even this insurance (through increased probability of rain falling on atleast one of the

[3] (Whenever a person dies, various plots of his land are sub-divided amongst all the heirs. So, if a person has 3 plots and three sons, then each plot is devided into three parts)

plots scattered widely) is not available to marginal and small farmers in greater proportion. We also found that there was not a very significant difference among different classes of farmers as far as proportion of land under different fertility levels was considered except that small farmers had comparatively more of the inferior quality land.

Consolidation of land did not bestow an advantage also when house hold economy was largely livestock based and distribution of land vis-a-vis quality was not yet favourable to better off farmers. It was quite likely that if consolidation was done, as was the experience in better endowed regions, bigger farmers would most certainly manage to get more fertile soil (scarce as it is already).

The issue still remains that if watershed basis of land use planning requiring wider public participation is to succeed, which pattern of land holding distribution (consolidated vis-a-vis scattered) offered greater opportunity for 'collective consciousness' to emerge among stratified peasant societies. Perhaps fragmentation would lead to everybody having to be concerned with every or most micro-watersheds around village. The mutual dependence and not individual independence have been seen historically to influence emergence of collective action (Gupta, 1983).

Another way of dealing with the problem is to assume that during consolidation, every farmer would be given scaled up proportion of infertile land. Perhaps in Bundelkhand region (UP) an experiment on these lines was tried years ago (Sheth 1983). However such an assumption to hold ground would require a very strong political commitment to land reforms.

We have discussed some neglected aspects of socio-ecology of stress that marginal farmers face in semi-arid region. We would deal with the management options in next part which enable ecologically sustainable and socially desirable land use planning. It may be mentioned at the outset that political-economy of land use requires that purely technocratic solution for landuse management should be discredited. While resource conservation may not be entirely a 'prisoners' dillema' game theoretic situation, the history of collectivities which have survived the onslought of markets suggests the importance of an assurance to be provided by state. That the enriched resources though conservation will not be exploited by the priveleged few or other free riders to the detriment of poor majority must be guaranteed. Putting it simply, the technocratic solution might suggest sacrifice by some to gain others, the ability of freers however to identify with the interest of gainers would depend much upon how state strengthens their survival mechanisms.[4]

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[4]Shri JS Bali in his earlier writing on "Operation Watershed Management" had impressed upon the need for linking up Public work program and other employment generating intervention with watershed development in areas where closure might lead to decline in employment. He also suggested the concept of Agro-Industrial watersheds.

Interface between ecological and market forces

Ecological forces imply the interplay of man and bioltic factors with the given technology leading to varying levels of surplus generating potential for different classes of farmers. The rate of accumulation will however depend to a great extent upon intensity of land use. Soil fertility, ground water quality, topography etc. place outer limits to the land use potentialities. The market forces recognize the local regions of higher capital accumulation and try to integrate them with distant and larger markets widening thereby the decision making option of surplus producers. Those who do not produce surplus not only are neglected by market forces but are also disadvantaged as far as their ecological endowment is concerned. Emergence of land market implying increase in land values and availability of surpluses with some people for investment in land together with worsening of stress for some who have to sell their lands has serious implications for land use planning. The more land in a village is owned by people residing in other villages, lesser are the changes of emergence of a common interest in conservation of natural resource endowment at village level. Further, the role market plays in terms of intensifying land use even in the region where either because of salinity or otherwise, extensive use should be practiced, also necessitates that policies of land use are not explored in isolation of policies for market penetration.

We illustrate the above scenario by taking example of one block of Mahendragarh District of Haryana where we have mapped the way banks autonomously and independently have extended credit for different purposes to different villages. This reflects the operation of 'invisible hand' which allocates resources only to the regions where current level of surplus generation and accumulation is high. The resources map presented next provides details of the endowment (live-stock, irrigation, and mechanization) together with the flow of credit for each resource in the village from all the banks. The idea is to see the match or lack of it between portfolio of enterprises which nature had enabled men to evolve historically in a given context and the portfolio of the Banks (institution work on market principles of catering to the registered demand, except for certain purposes for which state government officials at district level mobilises demand and forward applications of prospective beneficiaries to Bank for disburse-ment)[5].

If ecological balance has to be sustained, it is necessary that specie mix of livestock and diversified cropping and craft system are simultaneously supported. But will market forces aim at such an allocation of resources? The time frame in which market discounts its returns and in which marginal people workout their benefits and

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[5] This portion is based on author's separate detailed investigation in field of rural credit and support system in drought prone regions.

cost are widely different. The pattern in play of market forces is demonstrated below:

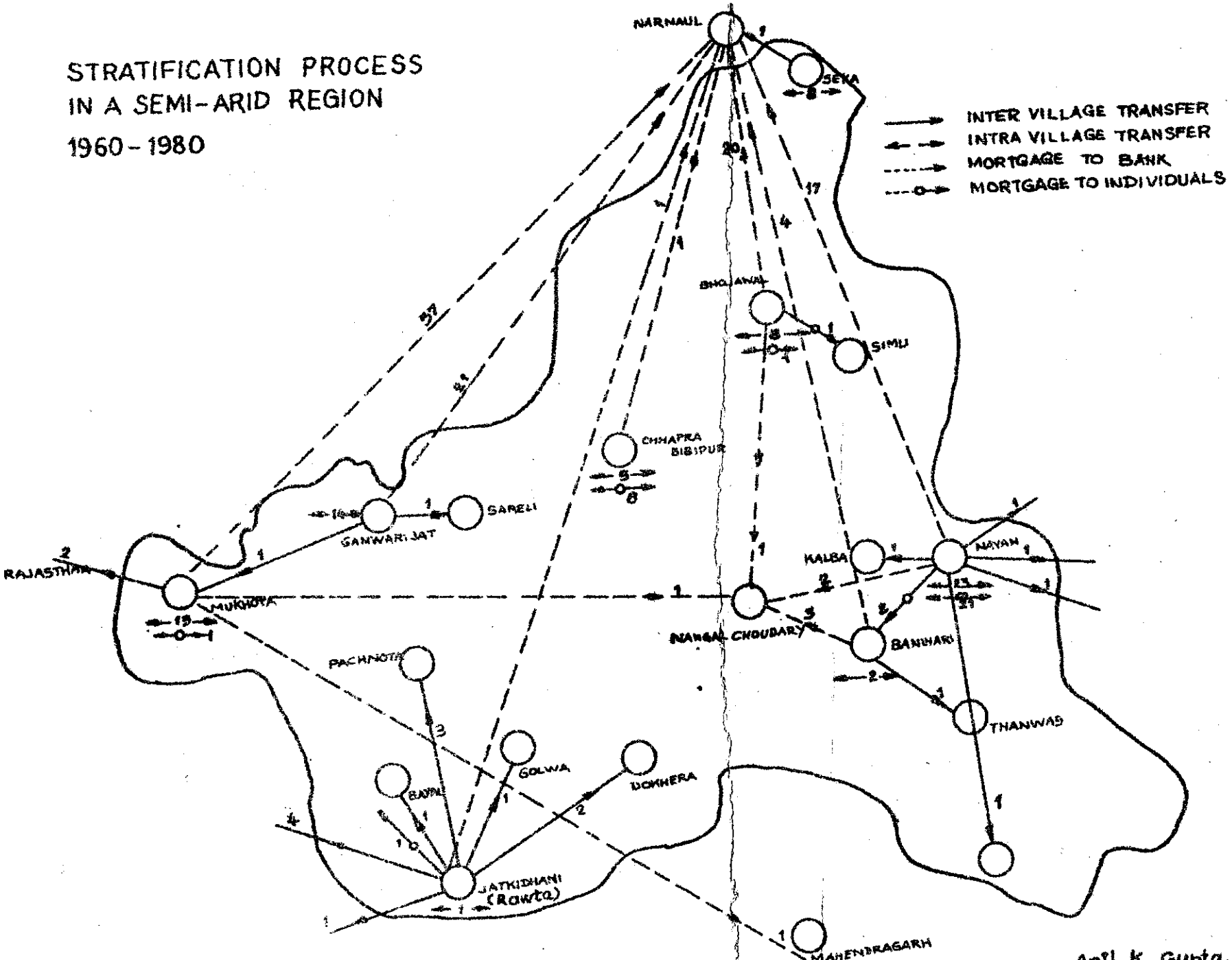
Institutional Credit Portfolio(Ref. Map 1 given in Annexure)

One notes conspicious neglect of eastern part of the block by most agencies while northern and western-south parts are heavily funded. There are villages where as many as five banks have tried to perceive demand and respond to it, while there also are villages where not even a single loan has been given. How does one explains such a fine demarcation of surplus generating regions by agencies which have no systematic data base on environmental resources. Even public institutions by following the dictates of market reinforce the imbalances. The portfolio also has been separately seen to be heavily biased towards cattle neglecting say sheep, goat.

Resource Endowment

When we view the endowment profile of the same block, one does not find that regions having been ignored are totally devoid of resources, though indeed the resources like irrigation - generating possibilities of intensive agriculture are, limited or absent. The ecological context of neglected and bypassed pockets is characterized by undulated topography, poor soils, small pockets of forests with hillocks interspersed. Credit has flown with water. Water quality map reveals that some of the villages which have received credit forirrigation have sodic water having implications for soil productivity that may go down due to

STRATIFICATION PROCESS IN A SEMI-ARID REGION 1960-1980



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accumulation of salts which already are higher. Thus market forces convert disparity in resources that enable higher rate of return in short run into an economic disparity.

Apart from the concentration of market resources in already better endowed region, one also notices that credit for even those purposes which abounded in drier parts of the blocks (like sheep) has gone more to the regions where scope for sheep is limited. The excessive financing for cattle has a direct bearing on availability of pastures for sheep and goat. While sheep cannot eat taller grasses, the cattle can eat even smaller grasses. When pastures remain constant, increase in cattle population cuts into the share of sheep and gain of one community becomes loss of another. Sustainance and restoration of ecological balance which is a result of efficient land use depends thus to a great extent how the market forces are guided for regulated by state.

Land Transfers

Interestingly the map of land transfers (see Annexure) based on study of 8 differently located villages in same block reveals a very characteristic relationship between ecological context, rate and scale of capital accumulation and market penetration. The villages having primarily pastoral economy with unimodal seasonality of agriculture have predominantly only inter-village transfers i.e. farmers from neighbouring better endowed region were buying land and within such villages, not much differentiation was taking place. The irrigated villages had both intra-inter village transfers indicating

buyonancy of local land market, higher degree of differentiation and stratification.

What are the implications of the interface between ecological and market forces for devising land use policies?

1) The ownership of land by farmers residing at distance often leads to leasing out of such plots by farmers to other farmers or labourers. Tenancy legislations have led to a practice whereby lessor change the lessee every other year lest the tenant staked claim to title of land. The result is that application of F.Y.M. on such fields is likely to be much lesser than owned fields. Tenancy induced by other factors could also have similar implications. Short-term institutional structure of lease market and long term interest of soil fertility do not always match. There are ofcourse few cases where irrigation is available on the leased out land. Under such cases lessor sometime finance the inputs use and thus ensures a minimum fertility enrichment of soil. As mentioned before, once the ownership passed into different lands located at a distance, development of collective consciousness so necessary for communal control or norms for resource conservation may become more difficult.

2) The increase in land values consequent to intensification of agriculture has far reaching implication for social structure. Without going deep into it, we may mention that given the

propensity of government not to recover developmental charges for soil conservation (even though same are debited to individual beneficiaries land revenue accounts) the likely pay off from watershed development will be highly location specific and vary amongst different classes. To what extent cooperation can be invoked in a developmental process with variegated pay off from a common good remained an issue for exploration.

3) 'Growing crops in dry regions and trees in irrigated region', as an eminent economist puts it, was the greatest irony of the current resource development strategy. While subsistence requirements necessitate that farmers do grow some essential food crops, at the same time weak public distribution system and poor market infrastructure further constricted the options of poor farmer. The silvi-pastoral system, as another contribution (Prof. Tirath Gupta, 1983) in this workshop brings out, has larger relevance. It was an approach which might not lead to wide differences in land values also as long as commercial plantations with public support were discouraged.

4) The introduction of technologies which were capital intensive might intensify differentiation and stratification of peasantry in dry regions. There was a need therefore to have a tier of

technologies (Sanghi and Krishnamoorthy, 1983) as distinct from package approach requiring all inputs in a given proportion in synchronous manner.

We will discuss in last section the conceptual scheme in which precise land use planning strategies can be worked out. It may be worthwhile to reiterate here that self provisioning farmers can not pass on the shock effect of environmental fluctuations to buyers of their outputs or sellers of inputs unlike commercial firms (Jodha and Mascarenhas, 1983). They are vulnerable to even milder fluctuation and their homeostatic responses have been considerably weakened over time (Jodha, 1983; Spitz, 1979; Gupta, 1981). The risk, resources and skills thus become three fulcra on which a viable land use policy involving people intimately in design and execution of strategy can be worked out.

Risk: Resource: Skills vis-a-vis Land Use Planning

We have already discussed that ecological condition define the specific mix of enterprises that evolves in a given region. The risk component of different mixtures will be different. The relationship between average mean income and fluctuation around the income or outputs can be studied with the help of following mean-variance matrix (Gupta, 1981).

		Mean: High	Mean: Low
Variance	High	HVHM	HVLM
	Low	LVHM	LVLM

Any region for which land use planning strategy has to be worked out can be divided into different zones having varying degree of risk vulnerability at given level of technology. There are many methods of computing these regions or zones.

1. Scarcity Index - this method was recently developed by taking into account annawari (assessment of production with highest category having 16 annas in a rupee and lowest 0 or 4 annas for each village for last ten or 20 years. After calculating mean and standard deviation, one could classify villages in to different zones.

2. By taking the enterprise mix, mortality rate of livestock species, probability of crop failures the likely losses could be estimated in different regions. There is always a relationship between crop species and animals species found in any given region. The covariance between animal and crop failures if evidenced in some regions will indicate higher fluctuation than say, contravariance.

3. Composite index of seasonality, soil fertility, topography and stability in production system could be worked out through rotated factor analytic methods. Factor score of each village

on a factor having variables like poor soil fertility, undulated topography and unimodal seasonality would also indicate instability in production and thus higher risk. Factor scores could be rotated again through the same method to get mutually independent homogeneous sets of villages.

Having identified zones of different risk potential, the next strategy should be to identify current mechanisms by which farmers' adjust with risk, i.e., the search for skills and resource base. The 'fire fighting' strategies should be distinguished from 'fire prevention' or Ex-ante strategies. Several variables which will need to be taken into account among others are, mining-lease rights, control of common grazing land, access to government lands, public distribution system for food, fodder and fuel, availability of draught power, technology of craft goods production, market development for currently underutilized resources etc.

The mining rights often are alloted to local richer people or outside business interest rather than to labour associations (I am avoiding the word 'cooperatives' due to the exploitative connotation it carries). The common lands of villages are many times auctioned to highest bidder for cultivation purposes to augment village income which in some states entitles the village panchayats to receive corresponding matching grant from state government. Sometimes to prevent harijans (low caste poor landless people) from grazing their cattle on

village common lands, the panchayats handover the better pasture lands to forest department for afforestation. With increased stress, vulnerability of poor also increases. Their cattle stray at times into the fallow fields inviting violent attacks. The extraordinary spurt in dry fodder prices in recent pre-rabi harvest years has led to not only disposal oflivestock by many but also to more intensive grazing. Widespread violence around grazing lands - is likely to emerge in drought prone regions if adequate attention is not given to dry fodder availability which is intimately linked with landuse policies (Gupta, 1983).

The employment in mining activities could, by providing minimum income, create an environment in which poor could think of planing a longer term resource use strategy.

Many of the craft activities as mentioned earlier if supported would directly lead to resource conservation and better land use management, e.g. Agave is one of the most hardy thorny plants grown in semi-arid tropics. Many industrial uses of this plant besides fibre, wax etc. provide scope for large scale plantation of agave supported by an industrial unit whose management must be dispersed amongst agricultural and industrial workers. An experiment at Ungra (Bangalore) is presently being pursued on similar lines by KCST/IIS/IIMB. Alienating design of developmental strategies from resources, skills and aspiration of poor people will neither help the programmes objectives nor of course the people.

Very often privatization of common land is suggested as a solution to the management of degraded 'waste' lands. The condition of privately owned uncultivable waste is ignored which was no better than communal waste lands. As Jodha (1983) rightly suggested, most developmental efforts hinged on imported resources like water, relief and neglected local resources-use possibilities. We are arguing that flow of external resources at the time of distress only reduce the effectiveness of any investment in infrastructure. But at the same time, there is a great need for flow of public resources to regions whose capacities to attract market forces is highly limited. One could not advocate self-help for poor regions and state help directly and indirectly for developed region.

Administrative reform

Land use planning cuts across different disciplines organised around sectoral lines. The budgetary procedures are such that if a contractor had been awarded three different work contracts at different location having no dependency among them, the accounting procedures required in some states that bills of one work must be produced before starting another work. In other words, financial system designed to deal with sequential fund flow pattern will need to be recast to deal with simultaneous fund flow patterns. The officials at local level ofcourse devise ingenious ways of getting around such complexities.

The standardization of expenditure norms per acre for soil conservation work posed another serious problem. While it is recognized

that because of ecological diversity, the treatment design and costs would vary a great deal within a small region, the administrative norms were observed rather too conservatively (Gupta, 1982).

Development of pasture land by organizing cooperatives in India (Gupta, 1981) and Africa (Doornbas and Lofchie, 1973) has revealed the scope that exists for existing village elite to monopolize the resources. While things have been worse in Ankole and such other places in Africa, in India the experience has been mixed. The water harvesting structure, devised on the basis of pasture plot treated as a micro watershed, proved effective in many places. The cost of iron fencing of 100 ha. pasture development plots and protecting the same through posting of a guard has however provod to be highly costly in case of sheep and pasture development cooperatives. The issue also is, how much of degraded land can be developed by closing and at such a high cost? Scope of pasture development on private lands is an under explored issue. Some work was initiated in this regard in Rajasthan.

There appears to be no alternative but to involve poorer people organically in any land use planning exercise. However no technology which looked at only land or crop or livestock or only craft would succeed in such regions while farmers have historically evolved quite fascinating land use practices like pauta* involving mix of crop and livestock

*In Akola taluka of Ahmednagar district we were told about this practice in which farmers in slopy regions followed the natural drainage as imprinted by first rain., collected top soil of entire field and deposited it on one tenth of total plot. Then a trench was dug around the plot connecting it to the drain of next field and following from natural drainage. Without any official support, farmers had devised this system where by they grew potato on raised plot and grasses on the remaining field.

development objective. The management experts including technological experts have yet to learn the science of analysing multi-market multi-enterprise household economy.

Regional Planning Policy:

Heavy reliance on growth centre model for planning concentrated facilities at different levels of population hierarchy seems highly misplaced facilities which did not have any direct and organic relationship between them, (say a veterinary hospital and a school or post office or cooperative society) were located at the same place increasing thereby control of elite in these village over such resources. The population coverage norms also are not distinguished amongst high population density (p.d) regions and low p.d. regions leading to imbalances in infrastructure. It is ignored that cost of providing equal access in low p.d. regions is very high. By not consciously taking such cost into account, farmer's ability to improve technological level is not strengthened, e.g. a bank branch per 17000 people is an uniform norm for regions with high p.d. as well as low p.d. implication is that investments having long gestation, requiring bank support, would suffer because of lower base of infrastructure itself. Land use policy thus is linked with regional planning policy vis-a-vis location of various infrastructure (Gupta 1979).

To summarise a paper of this type covering a wide ground is difficult. We may emphasize few key issues.

a) Inter-penetrating nature of credit, product, labour markets necessitated that in semi-arid regions, such options of landuse are pursued that minimized risks and maximized existing endowment and market advantages of the poorer farmers.

b) Historically, to deal with ecological diversity, farmers had evolved multi-enterprise house hold economic system. While watershed projects required a perspective in which all the aspects of local needs were matched with land capability, however the administrative structure precluded any multi-enterprise focus of intervention.

c) Poor were not the reasons of land degradation, they were the victims. Policies that subsidised everybody would have limited success because not every body suffered equally from environmental fluctuations or degradation.

d) While it is often said that poor have idle labour and so labour intensive technologies are expected to be accepted more easily, the seasonality of labour use, deficit in food and nutrition, migration obligations are ignored despite the fact that they often constrain labour supply when it is needed most at farmers' fields.

e) Any developmental investment on land would increase its value and un-freeze the land market, Governments have

neglected this issue in most countries. Studies also have shown that post irrigation land market is characterized by smoothening of inter-month differences in transactions i.e. round the year transaction take place while in dry region the same are concentrated in the season when buyers (the Rabi cultivators) have money and sellers (generally the kharif cultivators) have the need for money. Land use planning thus got linked with production and consumption pattern. The production unit is also not always the same as consumption unit.

f) On one hand there is a need to systematically study and catalogue the land use practices and their rationals (whether it is shifting cultivation or pauta system), on the other hand land use planners need to learn anthropology of farmers' household decision making system. Experts from different disciplines should be involved while planning land use policies so that resources, skills of poor and risk effects of various interventions are worked well in advance rather than complaining later that farmers were (ir) rationally resisting change.

g) There is no substitute to involvement of people who will rationally and justifiably continue not to cooperate till the framework in which we devise interventions is basically altered (Gupta 1983).

Socio-ecology of stress in semi-arid region requires basically a different approach than used in irrigated plains. Not only the decision-making framework of farmers differ, but also the interface between farmers' resources, ecological context and market forces is different in these region. Planning for land use essentially is planning for land-labour-livestock-craft economy. However the administrative reorganization so vital for systematic land use planning by involving people at all stages of design and implementation will require a tremendous amount of lobbying at various levels.

The poor dry farmers and landless labour typically lack access to the decision making platform at all the levels. While market coordinates the expectation of people and supply of goods and services in better endowed regions, who will coordinate and how, the administrative lines of sectoral specialists at village level. Can sectoral departmental structure serve the organizational need for land use planning in semi-arid regions? How do we develop land use strategies that begin with the analysis of socio-ecology of stress in dry regions rather than dealing with them in residual fashion?

Appendix - 1

Five questions about farmers

1. Why don't farmers destock the livestock herd even when when carrying capacity of the land has been exceeded?

2. Why don't farmers agree to consolidate their fragmented holdings to use new technology better?

3. Why don't farmers invest in land levelling, soil conservation and water harvesting when it is 'so' useful?

4. Why don't farmers intensify input use, perform sowing in critical time and perform other operations to maximise use of scarce rainfall?

5. Why don't farmer just move away from the village so that non-viable holdings are eliminated?

Five questions to Planners

1. Why do you seek solutions-technical, institutional, economic - to farmers' problem in uni-enterprise mode when household economy of farmer in dry region is multi-enterprise? Can land use planning be divorced from planning for livestock - craft - labour use in dry region?

2. Can allocation of resources in low population density (PD) regions be organised on same principles as in high PD regions - is it merely a problem of scale?

3. Why do resources provided by public institutions like credit reinforce short term market interest and impair already fragile ecological balance? Why does not portfolio of institutions match with portfolio of natural resource endowment in a given region?

4. Can planning for use of land (a private property) be ever successful without involvement of people? Will individual rationality be compatible with or lead to collective irrationality? When ecological imbalance and land degradation does not affect rich and poor alike, will they have equal stakes in its conservation ?

5. Why do planners perceive problems of dry regions through filters developed in irrigated regions?

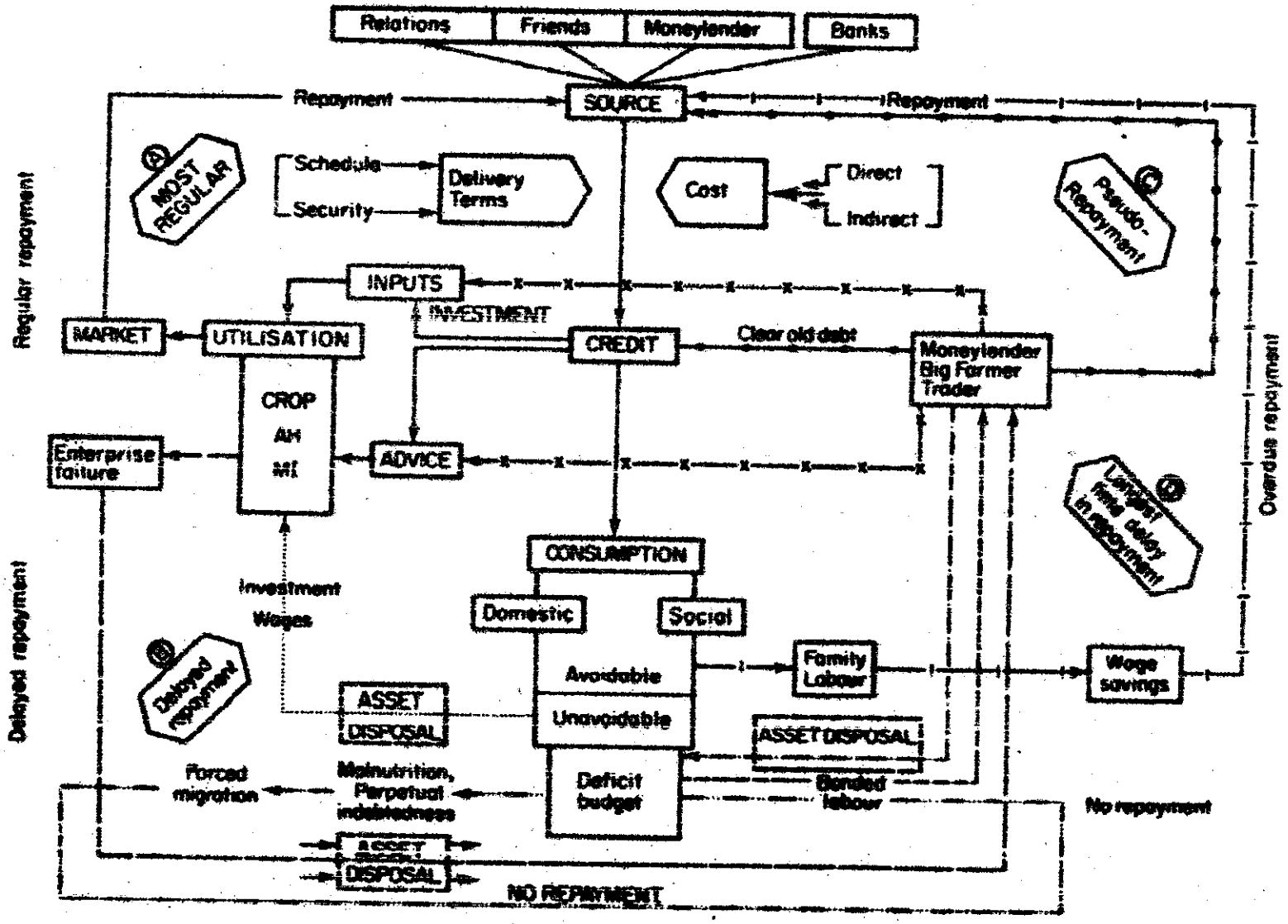

Fig. 1. Small farmer: credit constraints—repayment behaviour.

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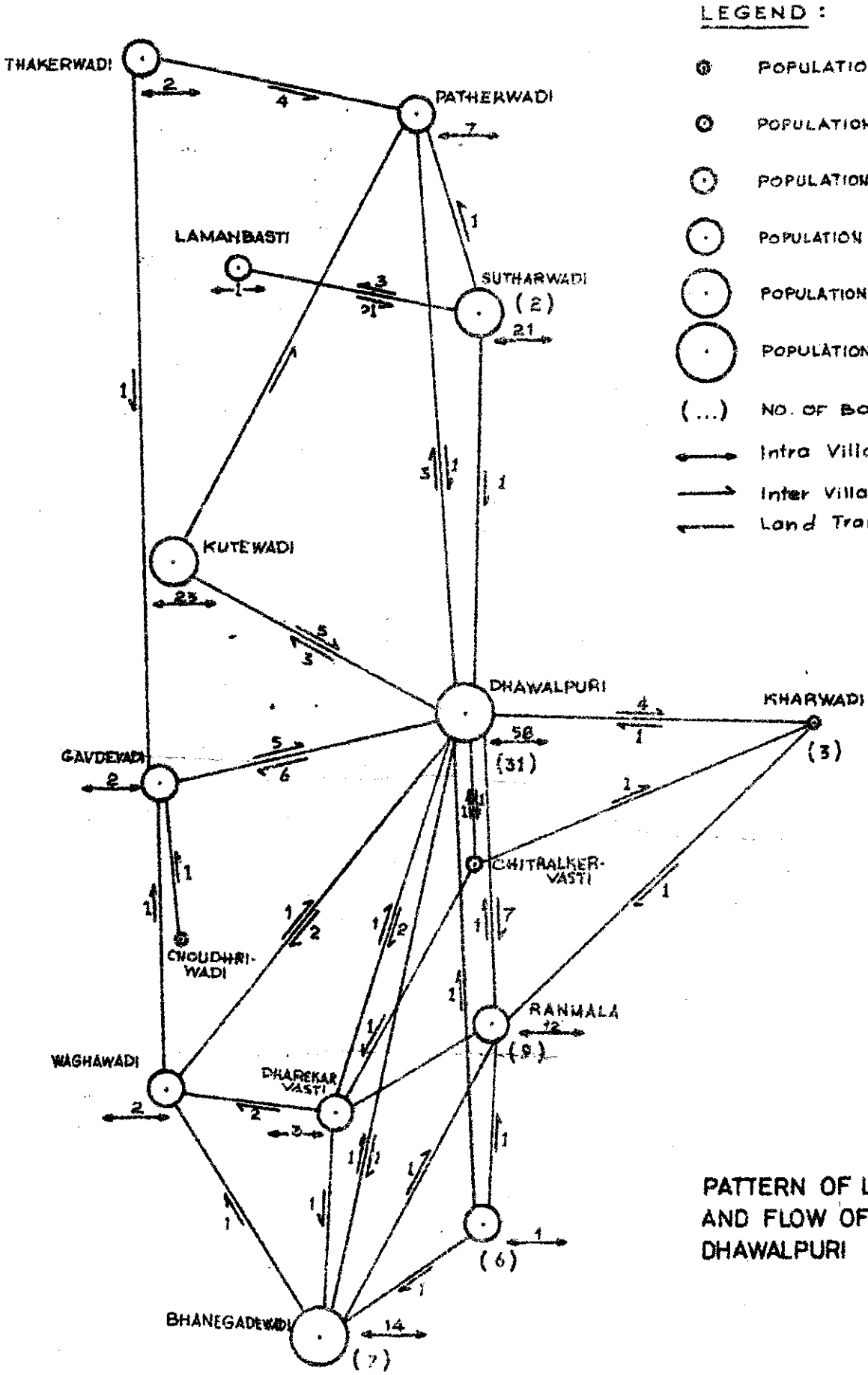
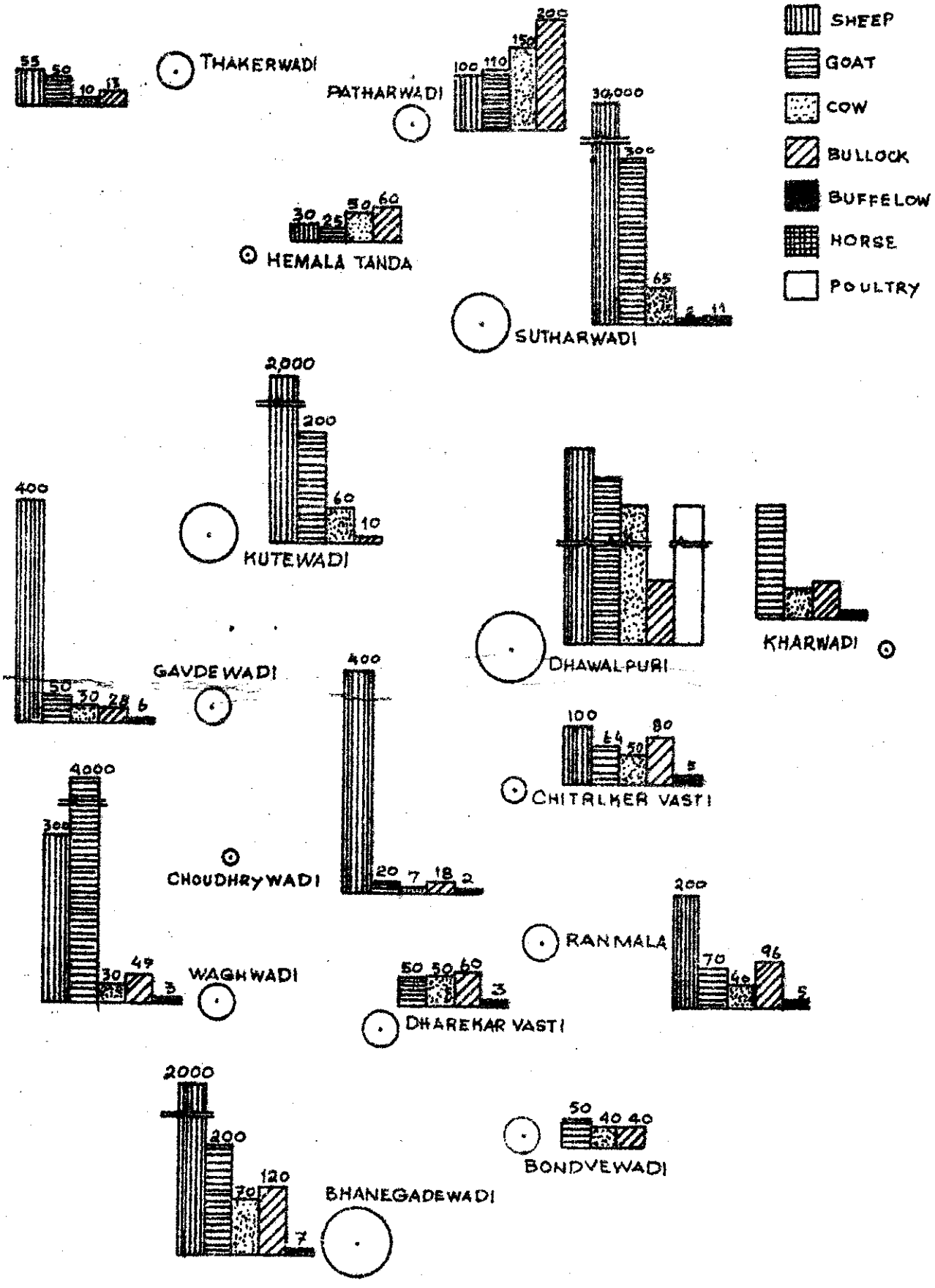


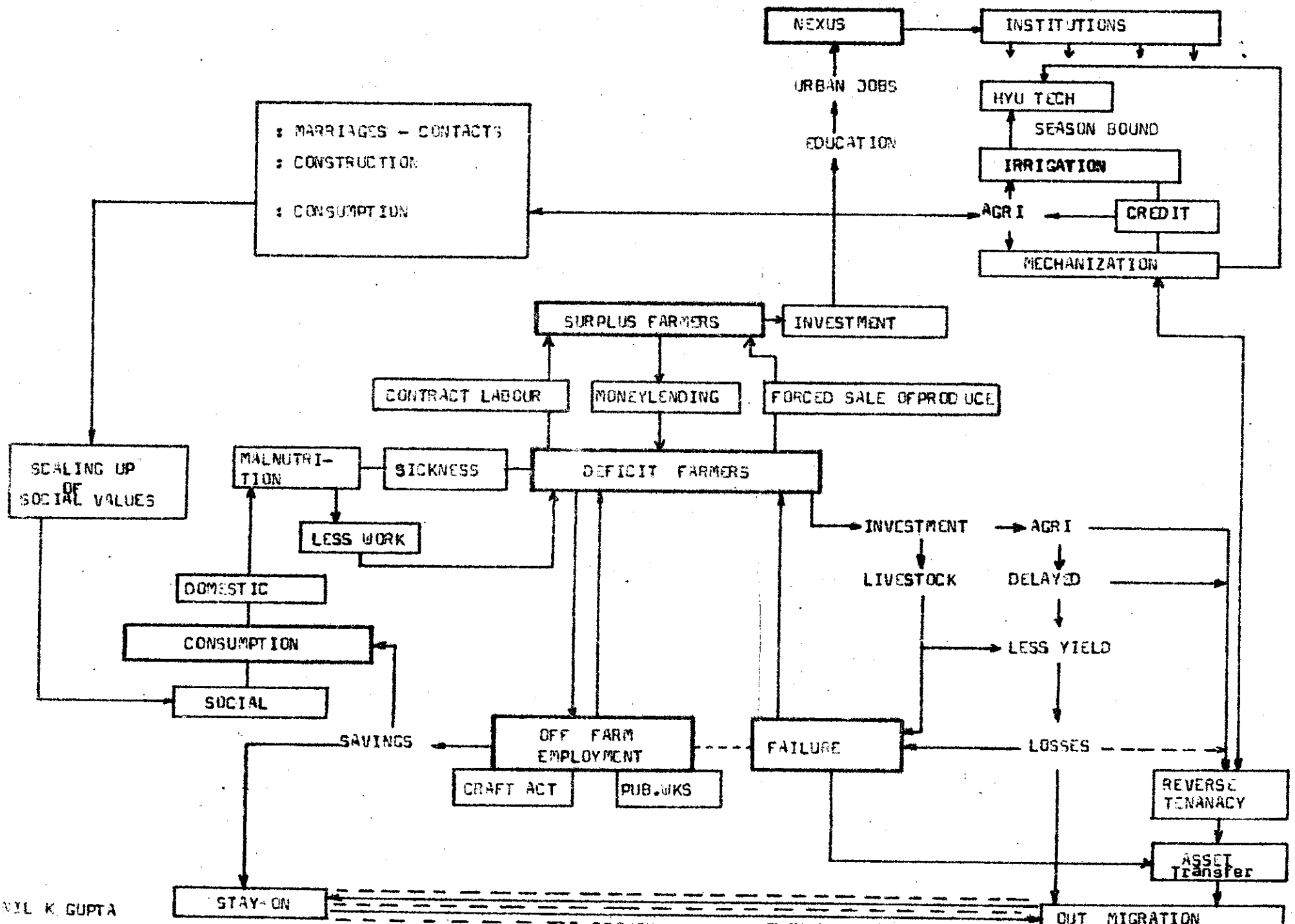
PATTERN OF LAND TRANSFER
AND FLOW OF FORMAL CREDI
DHAWALPURI IT'S HAMLETS

Fig. 2. SPATIAL SCATTER OF LIVESTOCK PATTERN



STAYING-ON PROCESS

Figure-6



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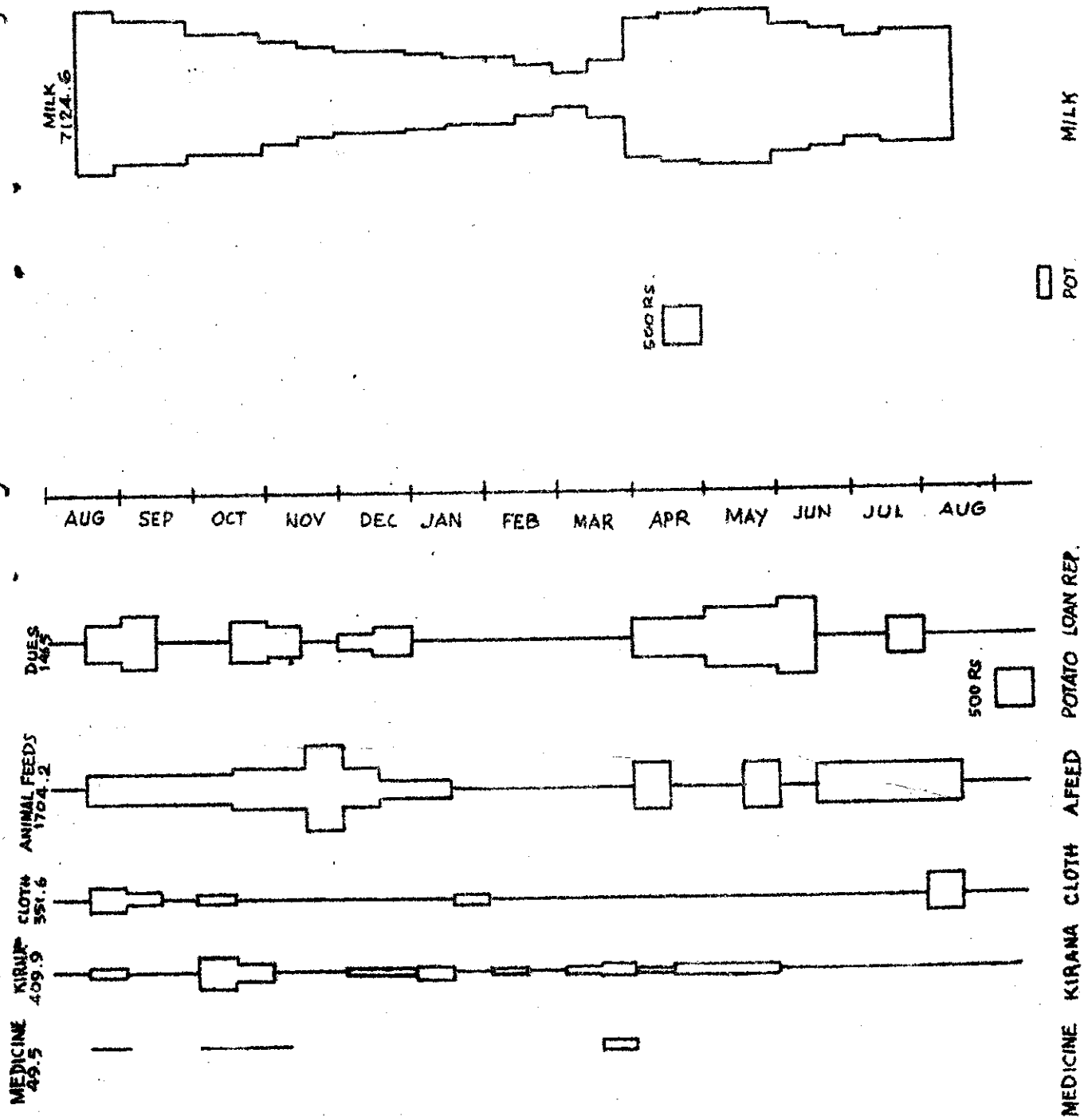
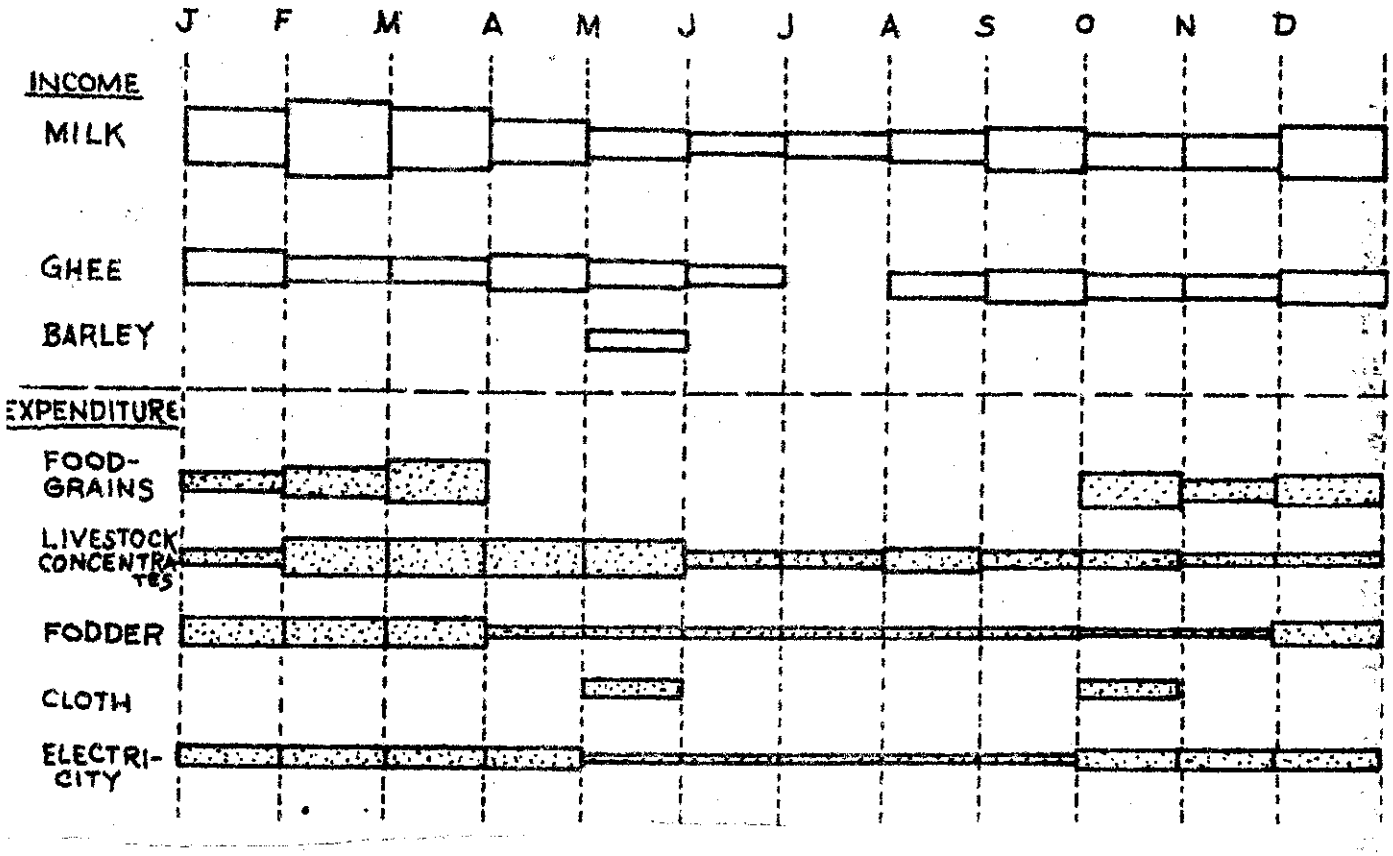


CASH FLOW OF DAIRY FARMER (AKOLA)



INTERNAL RESOURSE MANAGEMENT OF A SMALL FARMER

Anil K. Gupt

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