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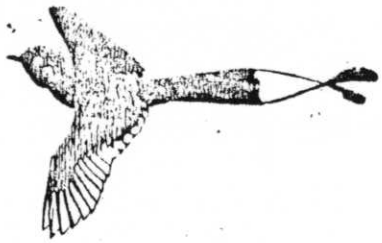

Fuel Consumption and Conservation Method In Urban Centres of Uttara Kannada

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1. INTRODUCTION

A study on consumption patterns of natural resources is essential for development and perspective planning of an ecosystem. Fuel for domestic use is among the first few essential commodities and even today, over 75 percent of people depend upon fuelwood (Swaminathan 1982). Therefore a study of fuel consumtion pattern is important.

For elucidating the patterns of energy use for domestic purposes both in rural and urban areas (Reddy et al) . While majority of the studies were conducted in areas far from the forests, there were very few accounts of the semiurban and rural areas of forest tracts in Western Ghats region of the peninsular india. In the townships, the utilization of commercial energy for domestic needs appear to be low and consequently exploitation of fuel wood resources continue to take place. Populations in these tracts rely largely on traditional fuelwood resources and to an extent on agricultural residue. Although this tradition of dependence on fuelwood is not altogether undesirable, a strategy should be evolved to conserve and enhance the fuel resources if this region continues to depend upon the scarce fuelwood resources .

There is an urgent felt need to turn our attention to Western Ghat regions which have intrinsically a greater potential to produce biomass by virtue of high annual rainfall (2000 to 5000 mm), its land-use, system of agriculture and animal husbandry rather than focus our attention only in the low rainfall tracts, with traditional bias for agriculture and animal husbandry. There have been no systematic study of fuel resources, its consumption and conservation taking into

account the fuel resources around such tracts; much less attention is paid in finding out as to how to augment fuel resources in urban and semiurban areas. It is with this goal, therefore, as part of our ecodevelopment programme in the high rainfall hilly regions of Uttara Kannada, we have attempted and sought to:

a) analyse the pattern of energy consumption, in the semiurban (town) areas of Uttar Kannada,

b) a quantitative analysis of household vegetation to assess their relative contribution to overall energy use and

c) suggest ways and means to conserve and augment the fuelwood resources aimed at ultimate self sufficiency in fuelwood in these localities.

To our knowledge, this is first such comprehensive attempt for the energy senerios of the hilly region of peninsular India.

2. METHEDOLOGY

Two semiurban areas, Sirsi at 600 m above sea level and Kumta on the coast were chosen which are typical of upghat and downghat townships in western Ghat regions in Uttara Kannada. Two typical villages, Bhairumbe and Unchagi at a distance of 12 and 4 km respectively from Sirsi and Kumta were chosen for comparision. Locations of these study areas is shown in Fig.1. The sampling consisted of covering 5 and 4 percent of households in Sirsi and Kumta respectively whereas 100 percent houses were surveyed in both the villages. A statistical random sampling of one house hold in every 20 houses was attempted in Sirsi and Kumta. At each household, quantitative information on vegetation, area available for vegetation,

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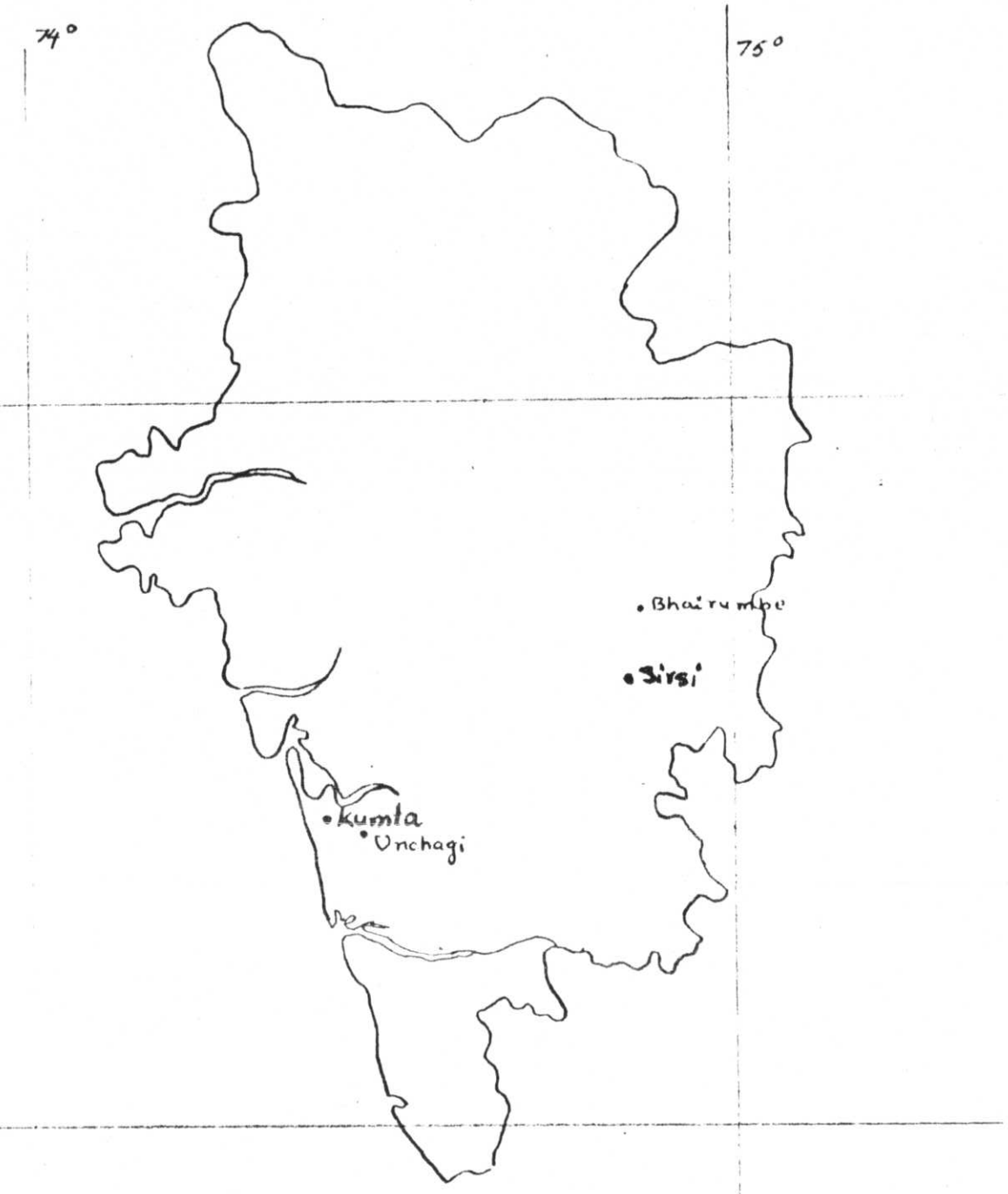


Fig 1 Study locations

monthly consumption of firewood, kerosene, electricity, LPG, biogas, agricultural residue were collected. In addition, form of fuel usage (cooking and bath water heating), type of stoves used and their efficiencies were also obtained. Animal holding information was also collected.

3. RESULTS

The demographic details of four centres chosen in this study are summarized table 1. The table gives percentage of houses sampled, population size, family size and human to cattle ratio. Average family size of both Sirsi and Bhairumbe in upghat region is higher than Kumta and Unchagi of the coast. Human to cattle ratio is high in towns compared to the villages .In table 2, the status of energy usage is given. Here, percentage of houses using AEH, biogas, fuelwood and kerosene are summarised. As is clear from the table, highest percentage of energy needs are met from fuelwood viz., 80 percent in Sirsi and 87 percent in Kumta. In the villages it is higher than 90 percent. While 12.98 percent of families own LPG in Sirsi, only 3.96 percent have LPG in Kumta. Such a difference in cooking gas usage within 60 km distance is not easy to visualize. One possible reason for this is the supply of gas cylinders from the nearest railway station. Kumta is 160 km away from Hubli, a railway junction, whereas Sirsi is 100 km away. Kerosene is mainly used for lighting and a small percentage of families,only about 4% use kerosene for cooking in towns.The percentage of houses without an electric connections does not vary much from towns to villages. This is primarily due to poverty. The economically weaker sections with thached houses have not got electricity even for lighting.In both the towns, our survey has

Table 1.

Town/Village	Sirsi	Kumta	Unchagi	Bhairumbe
Percent of houses sampled	5	4	100	100
No. of Houses sampled	407	126	63	62
Sample population	2701	940	363	425
Average family size	7.4	6.48	5.76	6.85
Human:Livestock	2.4:1	1.96:1	1.1:1	1.07:1
Human:Cattle	6.33:1	4.35:1	1.64:1	1.4:1

Table 2.

Town/Village	Sirsi	Kunta	Unchagi	Bhairumbe
Percentage of houses with AEH	10.8	8.7	0.0	1.0
Percentage of houses elctrified(non AEH)	65.47	52.38	60.0	68.0
Percentage of houses not electrified	23.70	38.90	40.0	31.0
Percentage of houses with cooking LPG gas	12.98	3.96	nil	nil
Percentage of houses with biogass	nil	nil	1.5	8.0
Percentage of houses using only kerosene for cooking	4.0	3.8	nil	nil
Percentage of houses depend on only wood	79.8	87.0	98.0	90.0

not shown the utilization of biogas as fuel. This is due to the low cattle to human ratio in towns. However in a more progressive village like Bhairumbe 8 percent of houses have installed biogas but in Unchagi, only 1.5 % of the houses have a biogas plant and the gas is used only for cooking. The total number of biogas plants in Uttara Kannada constituted only 1 percent of house holds. Therefore it is clear that fuelwood is the main source of domestic energy resource; over 75 percent of people in towns and over 90 percent in villages thus are dependent only on fuelwood for cooking and other uses.

(a) FUELWOOD CONSUMPTION PATTERN

The Per capita consumption of fuelwood in each of these centres was estimated from the actual quantity of fuelwood consumed over a period of one day .The results are summarized in table 3.In the towns it is 1.8 kg/day/person whereas in the two villages, it is about than 2.3 kg/day/person.2 kg/day/person is the average consumption of fuel wood for completely wood dependent families in the towns.This is lower than the consumption rate in the villages. This may be due to the fact that by and large, the people of towns buy wood and therefore are more careful in using this resource. Secondly, they buy firewood billets which is better quality fuel than the shrubs and agricultural residue.Consumption rate of kerosene and electricity in KWH units are given in table 3.The number of units of electricity consumed for lighting is only about 20 per month both in towns and villages.In the villages,no AEH connection are found.The per capita consumption of kerosene is higher in the towns than in the villages. An easy availabily of kerosene in the towns and also its use for cooking are the possible reasons .

Table 3. Fuel wood consuption pattern

Town/C.Village	Sirsi	Kumta	Unchagi	Bhairumbe
Fuelwood in kg/day/person	1.82 (1.97*)	1.79 (1.94*)	2.29	2.5
Electricity in units per family/month for lighting alone	21	23	18	20
Electricity in units per family/month(AEs)	187	130	nil	nil
Kerosene in litre/month/person	0.75	0.76	0.23	0.19

* Taking only those families using fire wood exclusively

The nature of fuelwood used in towns and villages vary quite widely. The types of fuel used in unchagi for example,showed 35 % wood,15 % agricultural residue and 50 % twigs , shrubs,roots,leaves etc,. However in the towns, the fuel wood is largely in the form of wood. An analysis of data showed that about 55 and 35 percent of fuel are needed for cooking and bathwater heating respectively. Thus 90 % of domestic fuel is consumed for these two only.Taking the population of Sirsi and Kumta towns from 1981 census and giving the normal growth of populations in this region as 2.2 %,the total population of these towns in 1985 is about 49000 and 24000 respectively. For this population, the total fuelwood , kerosene and electricity consumption were estimated. Since kerosene marketing is centraised , total consumption of kerosene per year was obtained from the data collected from the distributor for sirsi town. This value was compared with the results of sample survey.A quantity of 450600 litres of kerosene was distributed in Sirsi town in the year 1985.This value compares well with the quantity of kerosene as estimated from our survey (4410000 liters: an underestimate of only 2 percent). Even this could be accounted for by the roadside tea stalls and some hotels. Secondly the quantity of fuelwood sold in all the fuelwood depots was also obtained for the year 1985 for Sirsi town. Out of 32550 tonnes of fuelwood required for this town, only 13000 tonness were sold from the depots. This means only about 40 percent of the fuel need is accounted for by the forest depot and the rest is essentially made good by illegal extraction by head loaders and by others.

Table 4. Annual fuel wood and kerosene needs

Town/Village	Sirsi	Kumta	Unchagi	Bhairumbe
Total population	49000	24000	363	425
Total fuel wood required in tonnes/year	32550	16568	300	390
Total kerosene required in litres/year	441000	219000	1512	750
Total electricity in units from AEH/year	1604763	502666	--	--
Total electricity in units for light/year	1092464	535440	8164	10118

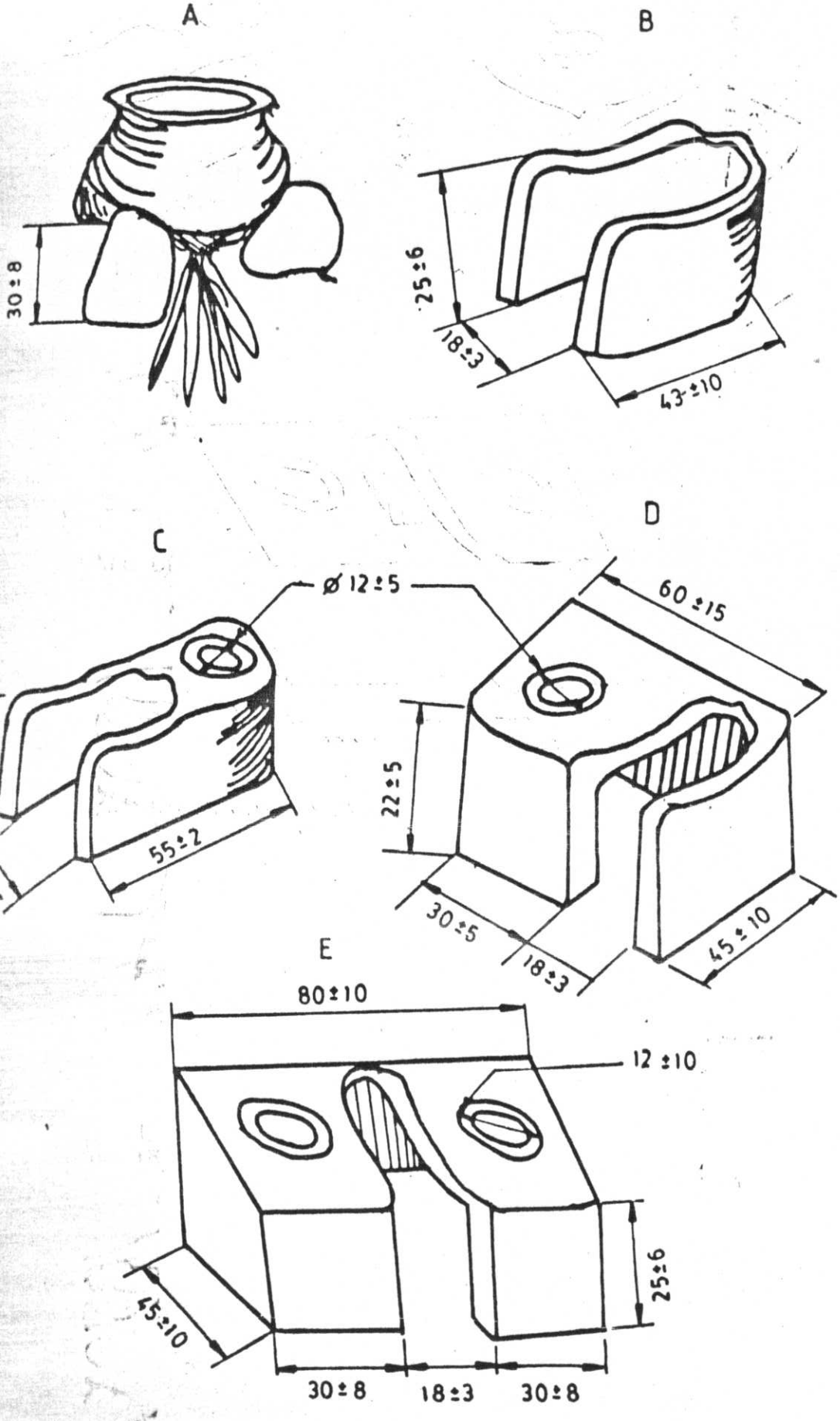
The scene is similar in Kumta. Here also only 42 percent of the fuel need was met through government depots and the rest was made good by collection through head loaders.

In Unchagi,while 15 percent of fuel comprises of agricultural residues of coconut and areca products, 50 percent of the fuel is being obtained from the nearby minor forests which is mainly in the form of shrubs and roots, and the remaining 35 percent from the billets extracted from the reserve forest. In essence, only 35% of the total fuelwood needs is accounted for by the forest department through authorised permits.

Unlike Unchagi, Bhairumbe is a village almost self sufficient in fuel resources. The type of fuel is in the form of small wood, sticks and agricultural residues.

b) WOOD BURNING STOVES

Since we had an idea of employing fuel efficient wood burning stoves to conserve fuel,the data on the types of wood burning stoves and their efficiencies were also collected. For efficiency, water boiling test has been employed [Hegde 1986]. In fig 2(a) the type of wood burning stoves for cooking is described. In Fig 2(b) types of bath water heating stoves are described. The heat utilization efficiency of each of the type is also obtained. The efficiency values are on average of atleast 5 measurements in each of these stoves. In table 5, percentages of different types of stoves in use in towns as well as villages (before 1984) are given. As can be seen from this table, most of the houses in town the as well as the villages have stoves of efficiency less than 15 percent. This is also true of bath room stoves.However, in Sirsi town 12 % bath room stoves have a chimney with an efficiency of about 20 percent.



NOTE: ALL DIMENSIONS IN CM

Fig 2a

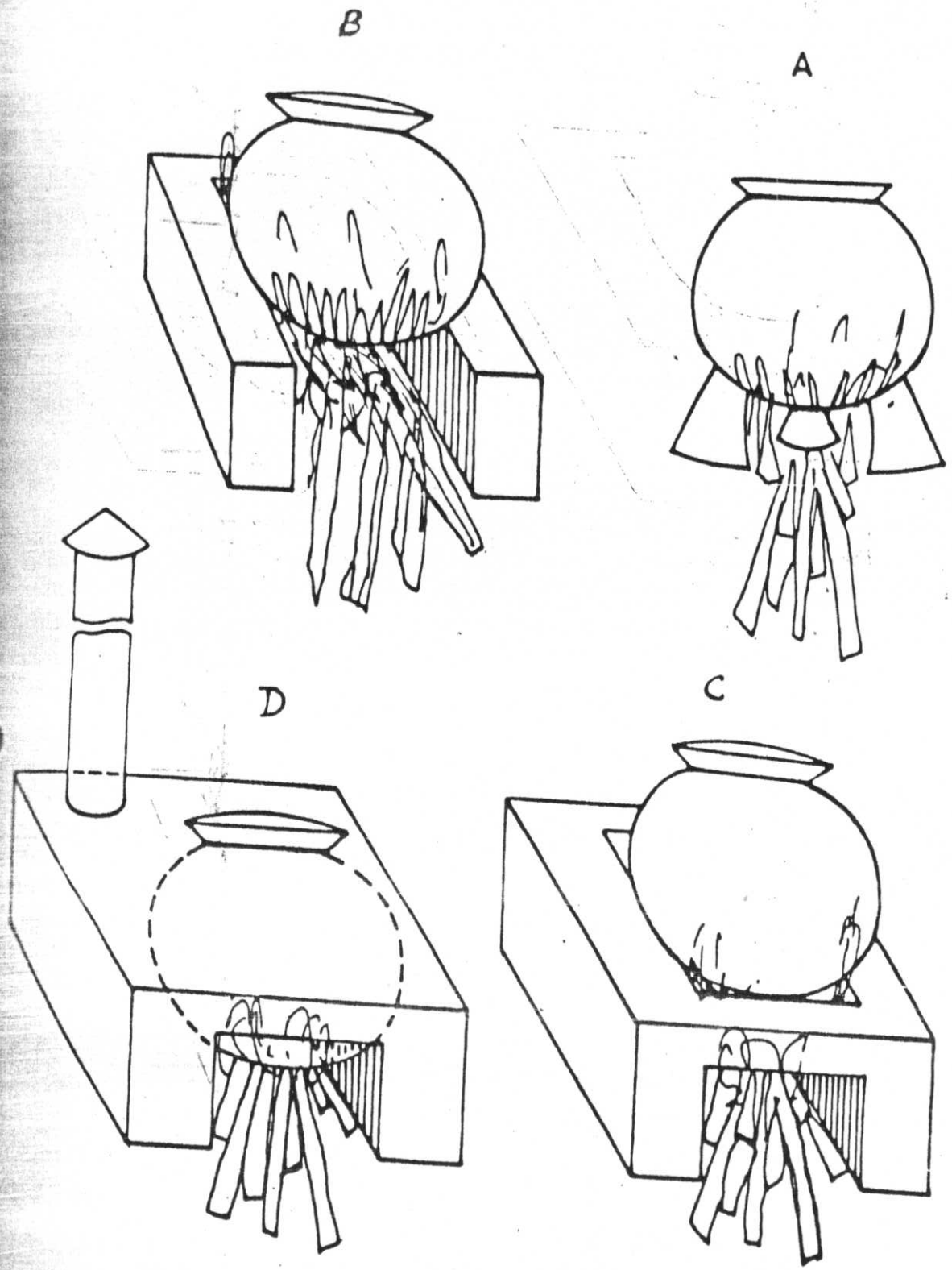


Fig 2b

Table 5.

Type of stove	Efficiency	Percentage of houses having different types of stoves			
		Sirsi	Kumta	Bhairumbe	Unchagi
Cooking stoves					
A	10-12%	2	23	2	50
B	15-18%	59	48	44	20
C	15-20%	12.4	14	40	28
D	16-20%	7	5	-	-
Electricity		2	4	-	-
Gas		13	4	8	2
For bath					
A	9-10%	2	29	30	35
B	14-15%	79	64	60	55
C	15-16%	2	2	5	5
D	20-21%	12	3	4	-
Electricity		4	2	-	-

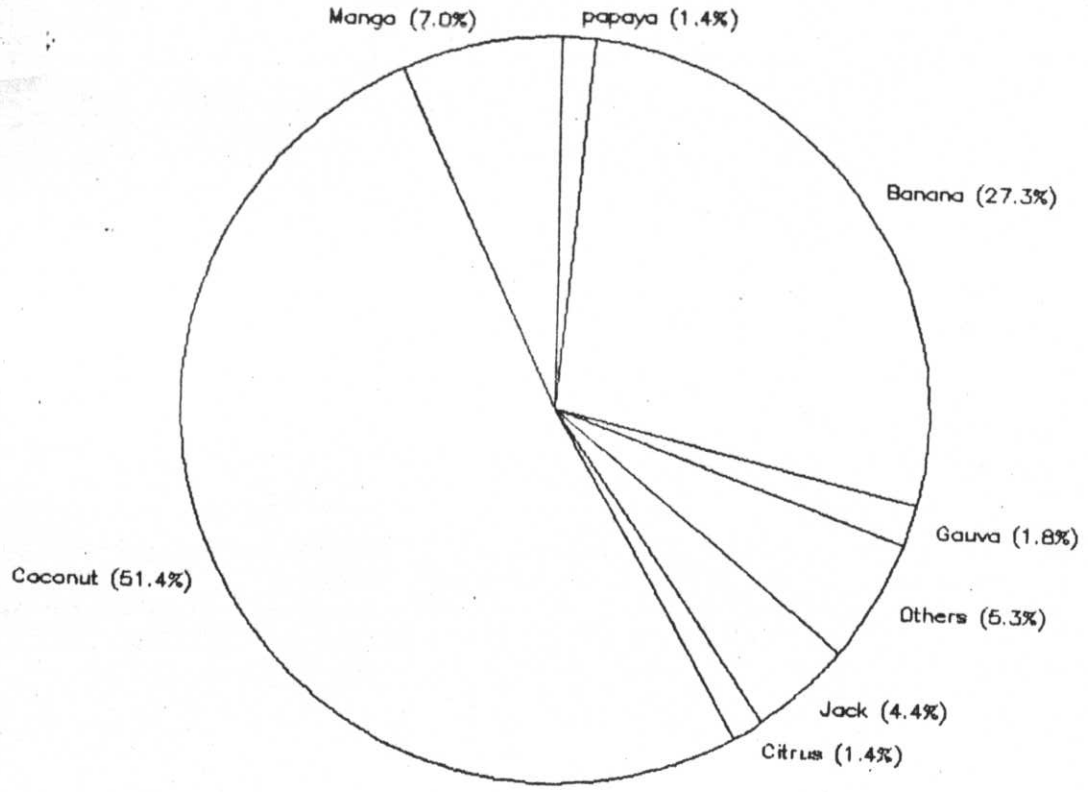
* Types of stove A,B,C,D as in Fig. 2(a) & 2(b)

c) VEGETATION COVER

Bhairumbe has still substantial area under tree cover even today.Two types of vegetation are found one is agroforestry, with areca and coconut gardens in about 15 percent area with an annual biomass productivity of 10to 12 tonnes/ha;secondly, the minor forest and betta land with reasonable tree cover in 45% of area with 5-8 tonne/ha productivity. There is an effort to raise forest plantation from the forest department in the 120 ha of minor forest area. The plantation has been completed in July 1986. Annual fuelwood production from these two sources can meet the requirement of this villages provided consumption is brought down by about 30 percent using fuel efficient stoves. Unchagi has about 50 ha of minor forest which can hardly yield 1- 1.5 tonnes of biomass per year.The extraction rate is higher than the productivity and thus,presently the minor forest land is essencially degraded.However there is a good potential of growth, for only 20 years ago most of this land was a thick forest.About 30 ha of privately owned betta land has tree cover to the extent of 70-100 trees per ha. 10 ha of land is areca and coconut garden.50 ha is a paddy field.A crude estimate of no of tree/ per person is 50.Inspite of this there is fuel shortage in this village.The vegetation cover in the minor forest and increasing vegetation in the betta land can make this village self sufficient in fuel needs.

Types of vegetation in Kumta and Sirsi towns are shown in figure 3.Kumta is on the west coast and easily grown vegetation is coconut tree.51% percent of houses have coconut trees in this town. 5 % of the houses do not have any vegetation. vegetation along the roadsides is

Vegatation Cover for Kumta



Vegatation Cover for Sirsi

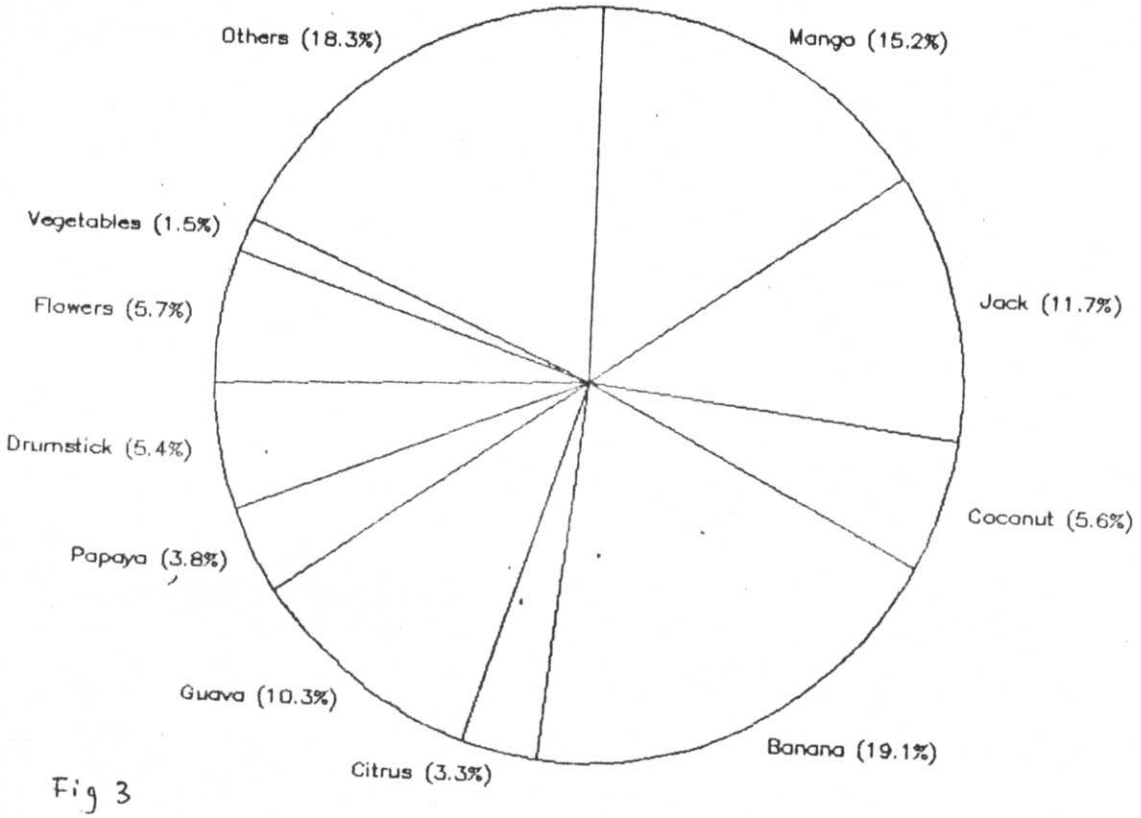


Fig 3

not common due to narrow lanes.even the national highway no 17 passing through town has not been covered with road side trees under social forestry scheme.The number of trees per person is 2.Vegetation cover around Kumta within 10 km radius is also sparce.There is 1160 ha of barren land which has a good potential for vegetation growth.

Vegetation cover in sirsi town is even lower than that of Kumta. The vegetation is largely of fruit trees although 35 percent of trees account for coconut. The number of trees per person in Sirsi is just 1.35 as against 2 in Kumta . There is 480 ha of fallow land around Sirsi within 10 km which has high potential of vegetation growth.

4. DISCUSSION

(a) Problems in the year 2000.A.D.

Population of Sirsi and Kumta towns are going to be 62000 and 30000 respectively in the year 2000 AD.Assuming the number of LPG users will be doubled, about 20 % of families will be using gas in Sirsi and about 10 percent of population in Kumta town. The number of houses getting AEH connection will not be increasing due to the present policy of the Government of Karnataka.Taking the accute shortage of electricity even for water pumpsets in Karnataka,electricity is not going to be available for cooking and bath-water heating.Even after assuming 25% increase in kerosene usage 75% of population still be dependent on fuelwood in these towns by the year 2000 A.D. of Therefore,it is very important to consider how to supply fuelwood on a sustainable basis to the towns without further depreding the forest land.

Increase in the population of towns is a phenomenon in India and this population is continuing to depend upon the fuelwood. Sirsi town

alone needs 35000 tons/year at present which will go up to 40000 tons/year by 2000 A.D.This essentially means feeding area should also increase which is not impossible.Therefore, increasing the productivity of the forest and also raising forestry in the free area available around Sirsi seem to be the possible solution.

The situation is similar in Kumta town and the solution should be very similar.In the villages,however,due to high priority of rural development ,minor forest areas are getting afforested and even under the present effort it is likely that Bhairumbe and Unchagi will have plantation programmes in the next 2 - 3 years.

b. Fuelwood Conservation

80% of the houses in Unchagi and Bhairumbe villages have now got installed fuel efficient ASTRA-Ole for cooking and Hosa Bachala-ole for bath water heating.A careful study of fuel saving in Unchagi (Hegde et al 1986) clearly showed that 31% of the fuelwood can be saved in this ASTRA-OLE .This is an evaluation over a period of one year.50% of the fuelwood can be saved in bath water heating Bachala-ole.Thus, nearly 40% of cut wood which were obtained from the reserve forest area is not transported now.

Usage of agricultural residue in the Unchagi as well as in Bhairumbe has been doubled since the stove works at higher efficiency.Drawing lessons from this,a plan to save fuelwood in towns is suggested taking into consideration the financial implications in addition to ecosystem development.

Sirsi town:as of 1985.
Total number of families
using wood as fuel 5000

Investment needed for construction of

bathroom and ASTRA stoves =(100 + 135)*5000

=Rs 11,75000

Cost that can be recovered

through fuel saving =Rs 11,20,000

(taking overall only 30%

saving of fuel and at a

rate of Rs 80 per ton)

At present in Uttara Kannada,Ks 80 is the government rate per ton of wood.For above calculation this is taken into account.This clearly shows that in just one year, total investment can be recovered. The money for this could also come throuhg selling the saved wood at Rs. 400 per ton elsewhere. This fact is often ignored. In addition our, study has shown that 40 percent of people buy wood from depot. The other sector collect free of cost, or transport illegally'.Therefore atleast 40 % of families are likely to pay 50% of the cost for construction of the stove as is seen in our programme of dissemination of ASTRA Ole even in villages. In fact over 60% of the

houses having ASTRA Ole have fully paid for construction and therefore the revised investment can be as follows

Number of families likely to pay 50% of the cost	= 2000
Cost for construction in these houses	= Rs. 235000.00
Cost for construction in 60% of houses with full subsidy	= Rs. 705000.00
Total investment	= Rs. 940000.00

Thus with Rs. 9,40,000 investment at the present cost,14,000 tonnes of fuelwood can be saved. This also needs infrastructure and organisational facilities. However, this also provides employment opportunities. Threrfore overall there is a net gain.

Such an argument extended to Kumta and other 9 towns of Uttar Kannada gives simply a very high figure of saving of fuelwood. Unless in one or two towns the plan is fully implemented,it is a futile excercise to compute numbers.It may also look a commonsense but the experience gained in the villages of Uttar Kannada (Unchagi,Kotegudde,Bhairumbe,Sirsimakki etc.),wherein of 30 % fuelwood in the form of cutwood has been saved. The experience of villages can be extended to the towns.

(c) Green belts around the towns

While there is a massive programme of afforestation around the villages and fallow lands and also,in big cities such as Bangalore,Delhi etc. there is no plan to grow green belt around the towns. The large number middle level townships are the major draines of forest resources as is found in this study. Therefore a plan to augment fuel resources is essential through creation of vegetation around the towns.

As has been stated earlier,at least 480 ha of land in Sirsi is in the possession of forest department are totally denuded.They can be planted with fast growing species. By giving water at least once in six to eight days during the first year, increases with growth rate of plant is found in general. It is a simple observation that the city lanes covered with plants are watered and in just 3 years foliages are available to the poor man for collection. If this is possible to implement in the forest land too,then it is possible to raise plants on barrren land which can yield the biomass of 8-10 tonnes per ha per year.

Electricity connections (AEH) for bath water heating is the lowest form of utilization of electrical energy.If even 30% of the presently utilized electrical energy is convered to exerzise by pumpsets,which can be used to water the barren lands, it is conceivable to supply water for plants. This is a new step in a development programme.Before even trail watering in the form of drip ols is considered as non wokable idea. Cost of raising plants per hectare is about Rs. 3000 and an additional cost of Rs. 1500 for watering would mean Rs. 16,80000.00 investment for 480 hectares.This clearly shows that saving fuel through a conservation programme is a better immediate alternative although plantations are equally important considering the long term solutions. 480 hectares can easily yield 4000 tonnes of fuel on a sustainable basis after 8-10years. This gives a growing time for the rest of the area from which wood is being extracted presently.

(d) Agroforestry

Encouragement of growing trees in the empty spaces of individual compound can also serve some purpose in this venture. The house plinth area to empty area is found to be 1 : 3 with average plinth area of 400 sq.ft per family. This means 1200 sq. ft area is avilable. Leaving 50% of area for vegetable garden and other purposes, the other 50% can be made use of. Fruit trees,coconut trees are the type of plants that are desired by considering people's need. Supply of seedling and special incentives by the forest department can be easily done.Horticultural department can be of help in this direction. Investment should be for raising the seedlings, distribution and counselling.

There is sufficient effort in the villages towards this agroforests and therefore no further investment needed in these villages in this programme.

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