RURAL DYNAMICS: A STUDY ON THE EXPLOITION AND PROTECTION OF THE RURAL RESOURCES IN A SOUTHERN PROVINCE OF CHINA

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ABSTRACT

In this paper we use system dynamics approach to build a policy lab. focusing on the exploition and protection of the rural resources in a southern province of china at first. Then we proceed, after validating the model thoroughly, model-based policy analyses.

THE BACKGROUND

Since the end of 1985, we have been engaging a research on the exploition and protection of the rural resources in a southern province of china. The main problem we confront is that the quality of the rural ecosystem was deteriorating a lot while the agricuture production was in a low level. The percentage of forest cover was decreasing from 55% in 1950s to 40% in 1980s. The area of soil erosion was increasing from 2000 kmu before the cultural revolution to 8000 kmu today. On the one hand the average annual income per capita is only about 150 yuan in the rural area, on the other this area is very rich in natural resources. After reading a lot of references, carrying on investigations on-the-spot and talking with the people concerned many times, we think it necessary to build a model for policy analyses. According to the following reasons, we utilise specially system dynamics approach.

- The exploition and protection of the rural resources involves various problems with different term.
- A wide range of society, economy and ecology must be considered in the model.
- A lot of relations between variables is nonlinear.

MODELING

Model purpose

In this paper, we want to build a policy lab. focusing on the following problems, mainly.

- How to develop the agriculture production while the quality of rural ecosystem won't deteriorate any more but shows some improvements.

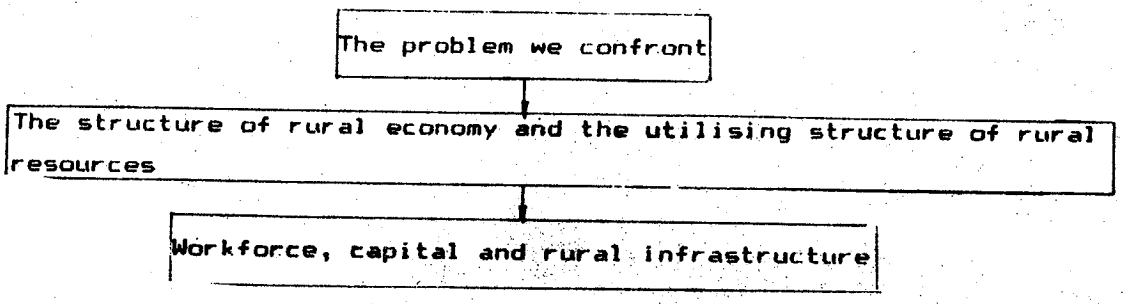
- How to utilise the limited capital and workforce to coordinate the development among agriculture,rural enterprises and rural infrastructure.

- Attempt to find a reasonable structure among farming, forestry, animal husbandry, fishery and side-occupations.

Then we can evalute various plans comprehensively on the model. All variables related to the exploition and protection of the rural resources must be involved in the model interactly. To identify the variables which are concerned in the model and the interacts between the different variables, we have to first draw out the boundary of the model.

System boundary

Owing to the fact that the problem we confront is relavant to natural resources, especially the agriculture resources, our attention is concentrated on rural area here only. In this paper we probe into, as figure 1 shows, the level of workforce, capital and rural infrastructure.



Next the variables of interest and the interacts between them can be defined as figure 2:

- Variables of interest
  - Protection variables
    - Shortage rate of rural domestic energy.
    - The percentage of forest cover.
    - The area of soil erosion and controled soil erosion.
  - Exploition variables
    - The area of farmland, grassland, forest-land and aquatic breed.
    - Output value of farming, forestry, animal husbandry, side-occupations and rural enterprises.
    - Rural infrastructure such as water conservancy, energy and transportation.
    - Population, capital.
- Interacts
  - Money interacts.
  - Workforce interacts.
  - The interacts between farming and animal husbandry.
  - The interacts between farming and rural infrastructure
  - The interacts between forestry and the quality of rural ecosystem
  - The interacts between soil erosion and the shortage rate of rural domestic energy

Causal-loop diagram

Figure 3 shows the causal-loop diagram of the model focusing on problem concerned. After that ,in the light of the data situation the causal-loop diagram will be translated to the flow diagram, and computer equations finally step by step. The variables hare are relatively aggregated. The variables and arrows in the diagram will be realised by detailed structure of physical flow and information flow.

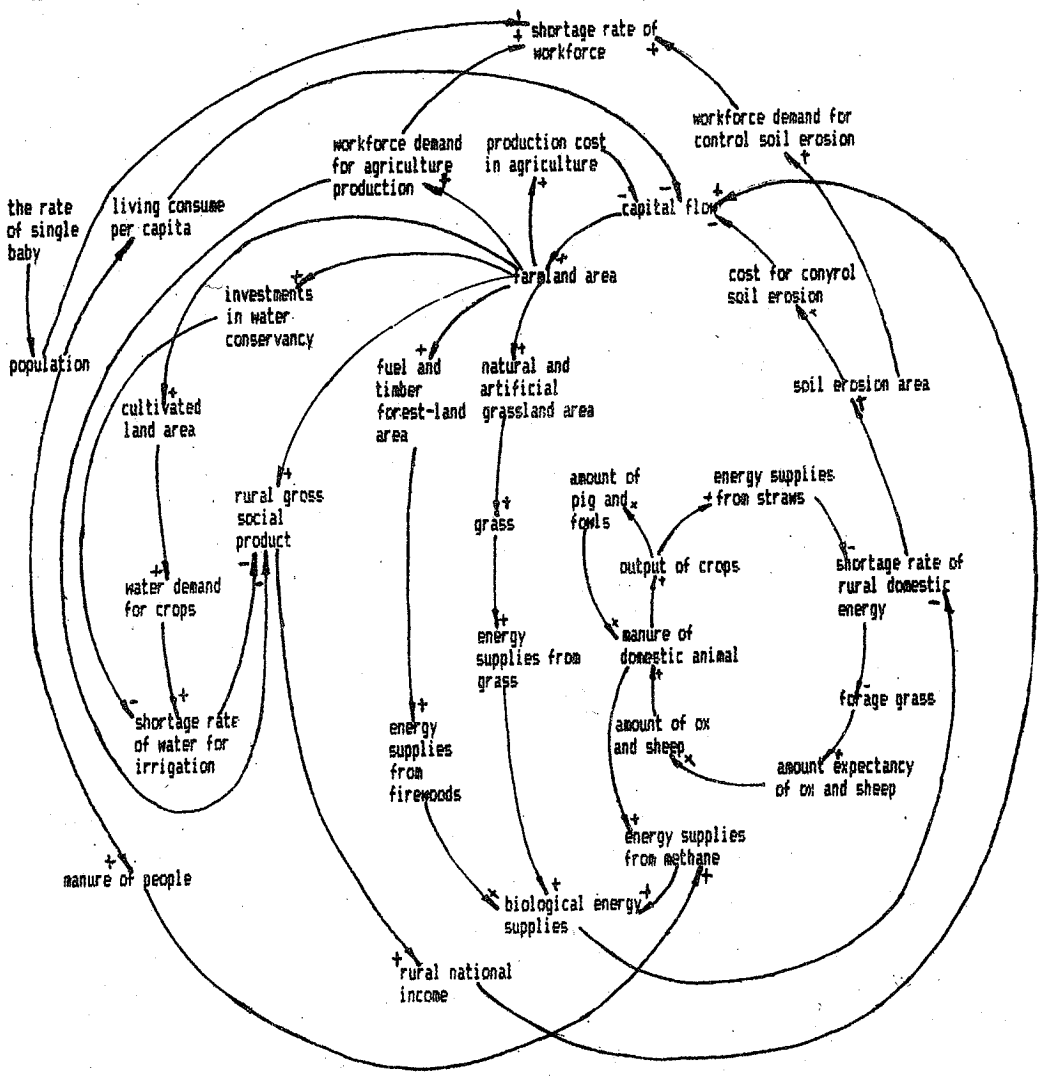


figure 3

Overal structure of the model

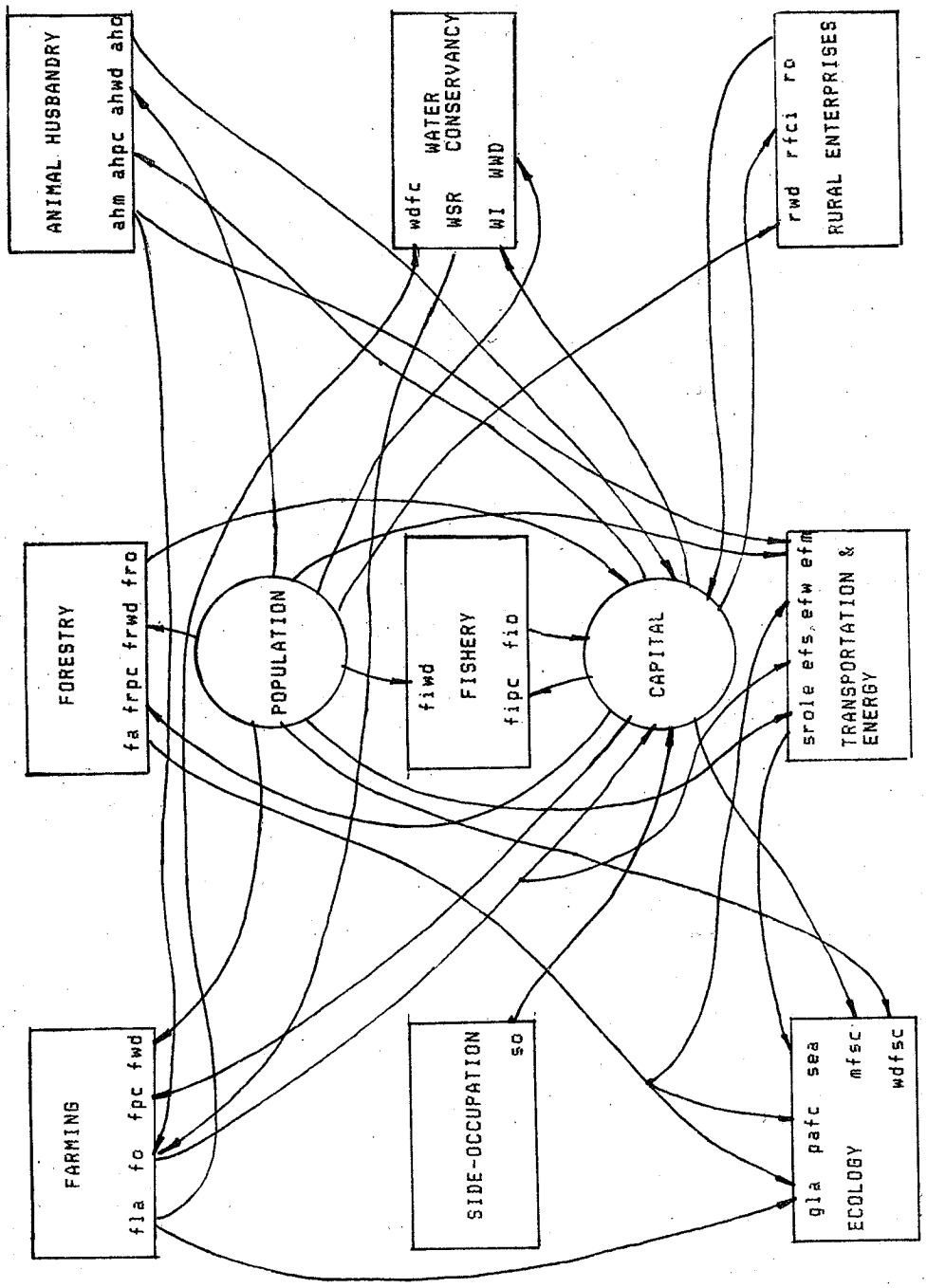


figure 4

FLA ---farmland area.
FO ---farming output value.
FPC ---farming production cost.
FWD ---farming workforce demand.
FA ---forest-land area.
FRPC---forestry production cost.
FRWD---forest workforce demand.
FRO ---forestry output value.
AHM ---manure of animal husbandry.
AHPC---animal husbandry production cost.
AHWD---animal husbandry workforce demand.
AHO ---animal husbandry output value.
SO ---side-occupations output value.
FIPC---fishery production cost.
FIWD---fishery workforce demand.
FIO ---fishery output value.
WDFC---water demand for crops.
WSR ---shortage rate of water for irrigation.
WI ---investment in water conservancy.
WWD ---workforce demand for water conservancy construction.
GEA ---grassland area.
PAFC---percentage of forest cover.
SEA ---soil erosion area.
SROL---shortage rate of domestic ennergy.
EFS ---energy supplies from straws.
EFW ---energy supplies from fire-woods.
EFM ---energy supplies from methane.
RWD ---workforce demand of rural enterprises.
RFCI---annual investments in rural enterprises.
RCO ---output value of rural enterprises.

MODEL VALIDITY

Sensitivity analyses

The basic assumption of system dynamics approach is that the system behavior comes from the feedback structure of the system. So it is very important to judge whether the structure of model is catched proply or not. Sensitivity analyses, although without sufficiency, may be after all be one way of structure validity. Here,the sensitivity from some coupling variables is analysed.

A.Multiple crop index

ORIGINAL TFZI=2.0665/2.0800/2.0738/2.0220/2.0142/1.9853

PRESENT TFZI=2.1000/2.0000/1.9700/2.0000/2.0600/1.9000

obs	FLZOO	FLZOP	FLZOS	FAOO	FAOP	FAOS
1981	478.8100	486.5700	0.999700	899.6000	909.4000	0.672000
1982	522.2400	502.1600	0.999700	969.7000	945.6000	0.646200
1983	559.9600	531.9300	1.000100	1012.100	978.4000	0.665200
1984	588.3800	581.9700	1.001300	1121.600	1113.300	0.680100
1985	630.6300	644.9700	1.000000	1200.000	1218.300	0.670700
1986	616.2500	589.7700	1.000100	1255.900	1221.100	0.644900
1987	612.3300	600.0800	1.000300	1379.000	1361.400	0.638166
1988	632.3300	619.6800	1.000300	1403.700	1386.200	0.623376
1989	652.5500	639.5000	1.000000	1430.000	1412.500	0.611911
1990	656.7800	643.6500	0.999600	1475.400	1457.500	0.606638
1991	661.2400	648.0200	0.999600	1527.300	1509.000	0.599120
1992	662.9600	649.7000	1.000100	1571.200	1552.900	0.582377
1993	664.4600	651.1700	1.000100	1622.600	1604.300	0.563928
1994	663.8600	650.5800	1.000200	1681.100	1662.900	0.541331
1995	663.2400	649.9800	0.999600	1752.100	1733.900	0.519395
1996	661.0200	647.8000	1.000000	1845.200	1826.900	0.495898
1997	658.7900	645.6100	1.000300	1955.400	1937.100	0.467954
1998	655.1900	642.0800	1.000400	2085.500	2067.200	0.438761
1999	651.5700	638.5400	0.999900	2245.000	2226.700	0.407589
2000	647.7700	634.8100	1.000400	2440.900	2422.600	0.374872
2001	643.9500	631.0700	1.000100	2682.200	2663.900	0.341151

figure 5

TFZI ---multiple crop index

FLZOO---original output value of food crops

FLZOP---present output value of food crops

FAOO ---original output value of agriculture

FAOP ---present output value of agriculture

FLZOS---sensitivity of food crops output value

FAOS ---sensitivoty of agriculture output value

B.Multiplier from animal husbandry to food crops

ORIGINAL TYXI=0.0900/1.0000/1.0200/1.1000/1.1500

PRESENT TYXI=0.0950/1.0000/1.0500/1.0800/1.1000

obs	YLZOO	YLZOP	YLZOS	YAOO	YAOP	YAOS
1981	478.8100	478.8100	0.000000	899.6000	899.6000	0.000000
1982	522.2400	521.7900	0.023745	967.7000	969.3000	-0.045560
1983	559.9600	559.5700	0.019193	1012.100	1011.300	0.021781
1984	588.3800	587.1800	0.056201	1121.600	1120.400	0.029481
1985	630.6300	628.0500	0.112736	1200.000	1197.400	0.059704
1986	616.2500	612.7600	0.156057	1255.900	1252.400	0.076794
1987	600.0800	597.1000	0.136845	1361.400	1358.400	0.060722
1988	619.6800	616.9400	0.121842	1386.200	1383.400	0.055659
1989	639.5000	636.6600	0.122376	1412.500	1409.700	0.054625
1990	643.6500	640.5700	0.131861	1457.500	1454.400	0.058609
1991	648.0200	644.4800	0.150534	1509.000	1505.500	0.063914
1992	649.7000	645.8100	0.164988	1552.900	1549.000	0.069205
1993	651.1700	647.0000	0.176463	1604.300	1600.100	0.072142
1994	650.5800	646.1300	0.188484	1662.900	1658.400	0.074569
1995	649.9800	645.2300	0.201376	1733.900	1729.200	0.074696
1996	647.8000	642.7700	0.213963	1826.900	1821.900	0.075417
1997	645.6100	640.3000	0.226641	1937.100	1931.700	0.076817
1998	642.0800	636.5000	0.239475	2067.200	2061.600	0.074646
1999	638.5400	632.7000	0.252021	2226.700	2220.900	0.071777
2000	634.8100	628.7400	0.263488	2422.600	2416.600	0.068247
2001	631.0700	624.7800	0.274654	2663.900	2657.600	0.065166

Figure 6

TYXI ---multiplier

YLZOO---original output value of food crops

YLZOP---present output value of food crops

YLZOS---sensitivity of food crops output value

YAOO ---original output value of agriculture

YAOP ---present output value of agriculture

YAOS --- sensitivity of agriculture output value

C.The ratio bftween forage and fuel

ORIGINAL TCNR=1.0000/0.4500/0.3200/0.2000/0.1000/0.0000

PRESENT TCNR=1.0000/0.4250/0.3000/0.2100/0.1050/0.0000

obs	NYDQBO	NYDQBP	NYDQBS	OCLO	OCLP	OCLS
1981	0.203820	0.188450	1.362908	373.6000	373.6000	0.000000
1982	0.194480	0.180900	0.332696	383.0000	380.0000	0.141567
1983	0.201690	0.196790	0.439088	393.5000	389.9000	0.165348
1984	0.214160	0.205670	0.716487	412.4000	408.6000	0.166534
1985	0.220500	0.212400	0.663920	438.4000	434.1000	0.177270
1986	0.233320	0.226180	0.553077	478.2000	473.8000	0.166297
1987	0.194230	0.186900	0.682067	526.4000	504.2000	0.762214
1988	0.174540	0.171380	0.327214	562.2000	547.7000	0.466140
1989	0.166040	0.162140	0.424514	630.7000	618.3000	0.355336
1990	0.157930	0.154170	0.430291	685.9000	673.4000	0.329373
1991	0.150520	0.146920	0.432263	727.6000	715.5000	0.300560
1992	0.148040	0.144570	0.423633	757.5000	745.8000	0.279153
1993	0.143970	0.140610	0.421800	772.8000	761.5000	0.264271
1994	0.139460	0.136220	0.419890	782.6000	771.6000	0.254034
1995	0.134220	0.131120	0.417431	790.4000	779.7000	0.244668
1996	0.128010	0.125070	0.415090	797.5000	787.3000	0.231158
1997	0.088760	0.086350	0.490726	818.7000	809.6000	0.200890
1998	0.059660	0.057930	0.524085	889.5000	882.9000	0.134102
1999	0.031810	0.030740	0.607938	971.3000	967.1000	0.078151
2000	0.004360	0.003950	1.699562	1052.200	1050.000	0.037788
2001	-0.022680	-0.022440	0.191253	1131.200	1130.900	0.004792

figure 7

TCNR ---ratio between forage and fuel

NYDQBO---original shortage rate of rural domestic energy

NYDQBP---present shortage rate of rural domestic energy

OCLO ---original amount of ox

OCLP ---present amount of ox

NYDQBS---sensitivity of rural domestic energy shortage rate

OCLS ---sensitivity of ox amount

D.Expected amount of pig and domestic fowls supported by the output value of food crops per capita

ORIGINAL EPCLP=10.478E03 EJQCLP=42.758E03

PRESENT EPCLP=10.178E03 EJQCLP=41.758E03

obs	PCLO	PCLP	PS	JQCLO	JQCLP	JQS
1981	1316.000	1280.000	0.955443	4490.900	4390.900	0.952103
1982	1323.900	1293.000	0.815196	4587.700	4486.900	0.939473
1983	1300.200	1278.300	0.588288	4693.100	4589.900	0.940239
1984	1339.700	1298.600	1.071500	5022.100	4900.100	1.038704
1985	1535.900	1485.700	1.141562	5727.200	5598.700	0.959352
1986	1865.400	1821.300	0.825704	7095.000	6950.900	0.868419
1987	1876.400	1825.700	0.943716	7327.900	7167.800	0.934178
1988	1813.600	1761.400	1.005280	7193.200	7025.400	0.937443
1989	1771.700	1721.000	0.999483	7160.000	6992.600	0.999677
1990	1761.800	1711.500	0.997172	7184.800	7016.900	0.999202
1991	1777.200	1726.400	0.998355	7252.200	7082.600	0.999939
1992	1806.400	1754.700	0.999621	7371.900	7199.500	0.999942
1993	1845.800	1792.900	1.000989	7532.500	7356.400	0.999627
1994	1884.500	1830.500	1.000820	7690.500	7510.600	1.000216
1995	1919.200	1864.300	0.999101	7632.400	7649.200	0.094118
1996	1949.800	1893.900	1.001337	7956.900	7770.800	1.000046
1997	1976.400	1919.800	1.000229	8065.400	7876.800	0.999847
1998	2003.600	1946.300	0.998852	8176.700	7985.500	0.999833
1999	2027.000	1969.000	0.999384	8272.200	8078.800	0.999663
2000	2045.200	1986.700	0.999030	8346.200	8151.100	0.999508
2001	2061.100	2002.100	0.999798	8411.100	8214.500	0.999418

figure 8

EPCLP ---amount expectancy of pig

EJQCLP---amount expectancy of domestic fowls

PCLO ---original amount of pig

PCLP ---present amount of pig

JQCLO ---original amount of domestic fowls

JQCLP ---present amount of domestic fowls

PS ---sensitivity of pig amount

JQS ---sensitivity of domestic fowl amount

As a result all sensitivities are below 2, 82% of which are below 1.

Historical data examine

Here, we examine the behavior of 17 basic variables historically.

VARIABLES \ TIME		1981	1982	1983	1984	1985	1986
CULTIVATED LAND AREA (E3*mu)	ACTUAL	5893.9	5886.0	5861.6	5846.9	5827.5	5800.3
	FITTED	5893.9	5881.6	5861.2	5842.1	5828.4	5807.4
	RE.ERROR	0 %	0.087%	0.007%	0.082%	-0.02%	-0.12%
LAND FOR FOOD CROPS AREA (E3*mu)	ACTUAL	8581.1	8690.9	8715.7	8695.8	8675.5	8521.3
	FITTED	8550.1	8691.5	8739.3	8263.2	8699.1	8537.6
	RE.ERROR	0.361%	0.007%	-0.27%	0.835%	-0.27%	-0.19%
LAND FOR INDUSTRIAL CROPS AREA (E3*mu)	ACTUAL	704.1	818.5	816.9	797.1	915.2	1032.7
	FITTED	700.3	818.4	850.8	796.2	915.7	1034.2
	RE.ERROR	0.539%	0.012%	-4.15%	0.129%	-0.05%	-0.15%
LAND FOR GARDEN CROPS AREA (E3*mu)	ACTUAL	106.43	145.37	175.54	175.41	168.68	175.58
	FITTED	106.43	144.60	170.20	172.38	167.75	177.89
	RE.ERROR	0 %	1.070%	3.041%	1.732%	0.512%	-1.20%
AQUATIC BREED AREA (E3*mu)	ACTUAL	278.65	304.03	315.73	330.81	344.28	379.61
	FITTED	278.65	300.08	313.43	326.97	349.83	390.37
	RE.ERROR	0 %	1.320%	0.729%	1.610%	-1.61%	-2.84%
FIXED CAPITAL (E4*yuan)	ACTUAL	55.29	61.03	64.74	71.71	84.68	98.13
	FITTED	55.29	60.71	64.72	73.27	85.62	95.94
	RE.ERROR	0 %	1.670%	0.395%	-2.17%	1.110%	-0.82%
AMOUNT OF OX (E3*head)	ACTUAL	373.67	390.95	391.76	411.07	431.25	471.20
	FITTED	373.67	383.03	393.50	412.44	438.44	478.15
	RE.ERROR	0 %	2.031%	-0.44%	-0.33%	-1.67%	-1.48%
AMOUNT OF PIG (E3*head)	ACTUAL	1316.0	1330.1	1298.3	1314.6	1403.4	1505.5
	FITTED	1316.0	1323.2	1310.2	1316.5	1417.3	1547.5
	RE.ERROR	0 %	0.467%	-0.42%	-0.15%	-0.99%	-2.99%

AMOUNT OF SHEEP (E3*head)	ACTUAL	1436.0	1314.0	1215.0	712.0	903.0	1482.1
	FITTED	1436.0	1372.2	1125.1	751.0	879.9	1509.7
	RE.ERROR	0 %	-4.43%	-7.40%	-5.48%	-2.57%	-1.87%
OUTPUT VALUE OF FOOD CROPS (E4*yuan)	ACTUAL	479.45	529.87	539.92	600.13	624.90	618.66
	FITTED	478.81	522.24	559.96	588.38	630.38	616.25
	RE.ERROR	0.134%	1.440%	-3.71%	1.960%	-0.92%	0.391%
OUTPUT VALUE OF INDUSTRIAL CROPS (E4*yuan)	ACTUAL	21.653	30.347	30.342	29.216	35.916	56.180
	FITTED	21.710	27.825	34.481	30.255	35.712	56.364
	RE.ERROR	0.263%	8.310%	-3.75%	-3.56%	0.568%	-0.33%
OUTPUT VALUE OF FORESTRY (E4*yuan)	ACTUAL	71.38	99.98	84.40	83.98	92.52	109.20
	FITTED	71.56	101.35	82.98	85.88	92.09	109.12
	RE.ERROR	-0.25%	-1.37%	2.390%	-2.26%	-0.47%	-0.07%
OUTPUT VALUE OF ANIMAL HUSBANDRY (E4*yuan)	ACTUAL	128.27	128.44	133.44	129.92	148.02	160.97
	FITTED	127.27	128.66	127.95	131.49	143.12	160.81
	RE.ERROR	0.780%	-0.02%	4.041%	-1.21%	3.311%	0.584%
OUTPUT VALUE OF RURAL ENTERPRISES (E4*yuan)	ACTUAL	122.75	128.62	134.52	166.66	200.23	130.75
	FITTED	122.74	135.52	140.33	170.57	202.41	237.44
	RE.ERROR	-0.08%	-5.37%	-4.32%	-2.35%	-1.09%	-2.89%
OUTPUT VALUE OF AGRICULTURE (E4*yuan)	ACTUAL	902.30	1042.6	1090.9	1133.4	1155.8	1217.8
	FITTED	899.60	969.70	1012.1	1121.1	1200.0	1255.9
	RE.ERROR	0.301%	7.001%	7.210%	1.042%	-3.82%	-3.13%
FOREST-LAND AREA (E4*mu)	ACTUAL	15.82	16.30	16.78	17.46	17.90	18.54
	FITTED	15.82	16.30	17.46	17.84	17.97	18.52
	RE.ERROR	0 %	-0.63%	-6.36%	0.229%	-0.41%	0.113%
POPULATION (E3*person)	ACTUAL	3796.7	3861.9	3921.0	3961.1	4002.9	4056.6
	FITTED	3796.7	3854.8	3915.7	3979.0	4044.8	4112.8
	RE.ERROR	0 %	0.184%	0.135%	-0.45%	-1.05%	-1.395

NOTE: RE.ERROR MEANS RELATIVE ERROR

figure 9

As figure 9 shows, 4.9% of the relative error are between 5%—8%. 16.7% of that are between 2%—5%. 78.4% of that are below 2%.

POLICY ANALYSES

Tow scenarios

Scenario 1

Policy assumptions:

1. Don't exploit rural resources any more.
2. The output value per mu of crops, the comprehensive transfer rate of rural domestic energy, the policy of family planning and annual investments in rural enterprises maintain the state of 1985.

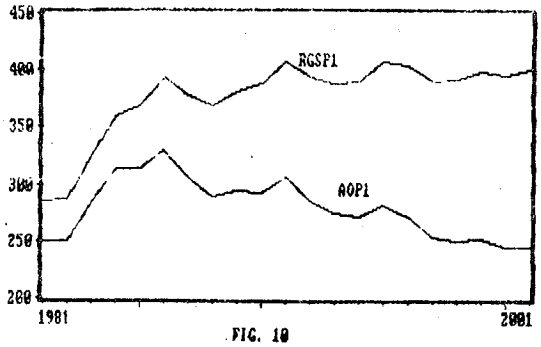


FIG. 10

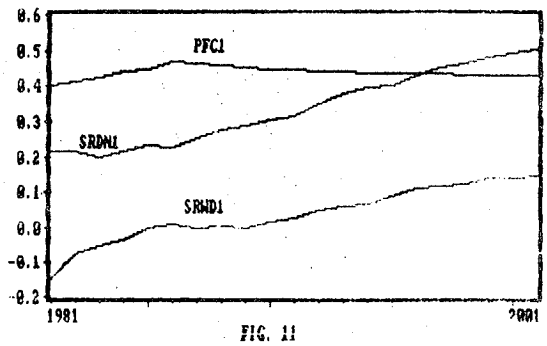


FIG. 11

Economic targets:

The agriculture output value per capita AOP1 will be increasing from 249.24 yuan in 1980 to 307.14 yuan in 1990, but decreasing to 243.91 yuan in 2000 again. The rural gross social product per capita RGSP1 will be increasing from 284.19 yuan in 1980 to 400.29 yuan in 2000 (figure 10).

Ecological targets:

The percentage of forest cover PFC1 has been increasing from 40% in 1980 to 47% in 1985, but will be 43% only up to 2000. The shortage rate of rural domestic energy SRDN1 will be increasing from 21% in 1980 to 50% in 2000 (figure 11). Because of the fact that the supplies of rural domestic energy amount to the reasonable exploitions of biological energy, the shortage of rural domesti

energy will result in the deterioration of the rural ecosystem quality. The soil erosion area SEA1 will be increasing from 3162 kmu in 1980 to 18089 kmu in 2000 (figure 12). The annual cost for control soil erosion CCSE1 will be 226110 kyuan in 2000, almost amount to the total annual production cost in agriculture PCIA1 in 2000 (figure 13).

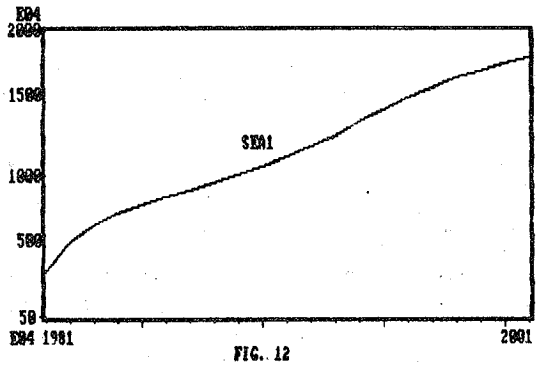


FIG. 12

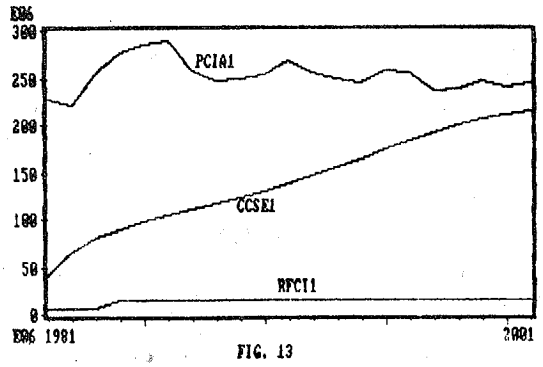


FIG. 13

The shortage rate of workforce SRWD1 will be increasing from 14.85% to 14.42% in 2000 (figure 11). Qwing to the fact that the workforce demand per mu here is derived from the average workforce demand of the period 1980—1985, agriculture production would be held up if the productivity wouldn't increase any more.

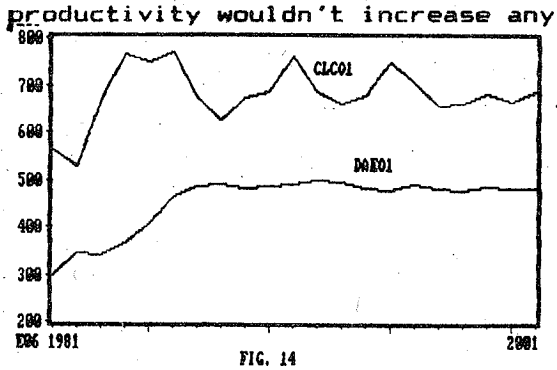


FIG. 14

CLCO---output value of cultivated land crops

DAEO---output value of diversified agriculture economy

In a word, under scenario 1 the quality of rural ecosystem will be deteriorating and the rural economy will be held up. Moreover, the unreasonable economic structure won't be changed any more (figure 14). Thereforce, it is necessary to exploit and protect the rural resources.

Scenario 2

Policy assumptions:

1. The exploition plan, derived from the long-term programme for this district, will be taken as a policy.
2. The comprehensive transfer rate of rural domestic energy will be increasing from 13.2% in 1980 to 34.4% in 2000.
3. The policy of family planning, that the rate of single baby is 60%. will be accepted step by step in 2000.

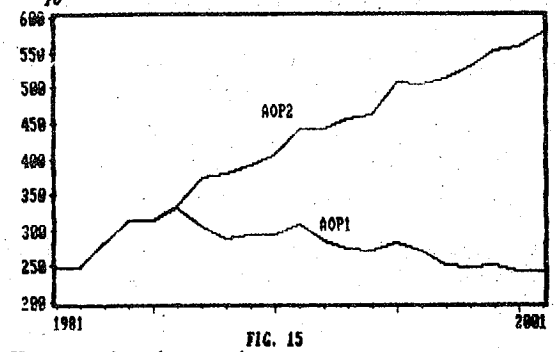


FIG. 15

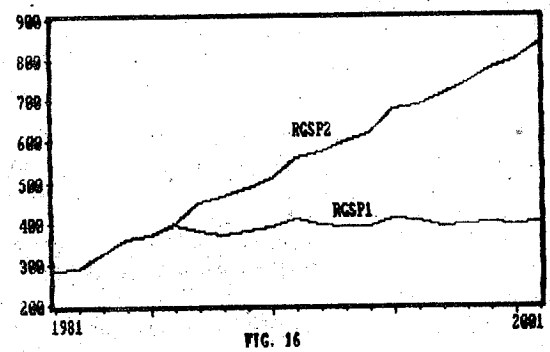


FIG. 16

Economic targets:

The output value of agriculture per capita AOP2 in 1990 will be 439.95 yuan, which increase by 80% as compared with that in 1980. The rural gross social product per capita RGSP2 in 1990 will be 557.57 yuan, which increase by 96% as compared with that in 1980. By 2000, the output value of agriculture per capita AOP2 will be 578.31 yuan, a more than 132% increase over 1980 and the output value of rural gross social product RGSP2 will be 833.20 yuan, a more than 193% increase over 1980 (figure 15,16). The unreasonable structure of rural economy will be improved some more. The output value of diversified agriculture economy DEA02 will began greater than the output value of the cultivated land crops CLC02 since 1991 (figure 17). Although the production cost in agriculture under scenario 2 PCIA2, which is 161% over that under scenario 1 PCIA1 in 2000, will be greater than the PCIA1, the output value A02 will increase more than the production cost in agriculture PCIA2 (figure 18,19). Moreover the capital flow under scenario 1 CF1 will be decreasing until 2000 while that under scenario 2 CF2 will began increasing since 1993 and be greater than zero in 1999 (figure 20). In other words, the strenth of rural economy will be enhancing step by step since 1993 and the external debts for agriculture production will be cleared off in 1999.

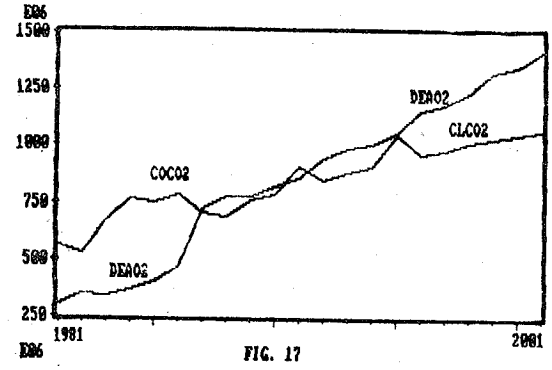


FIG. 17

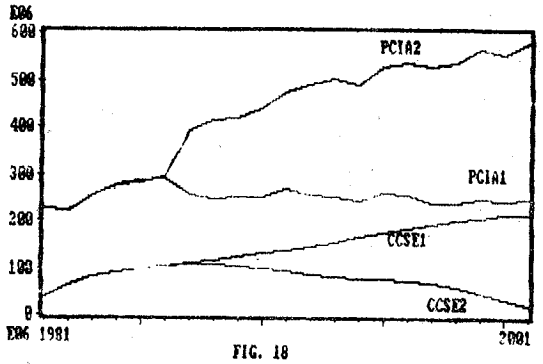


FIG. 18

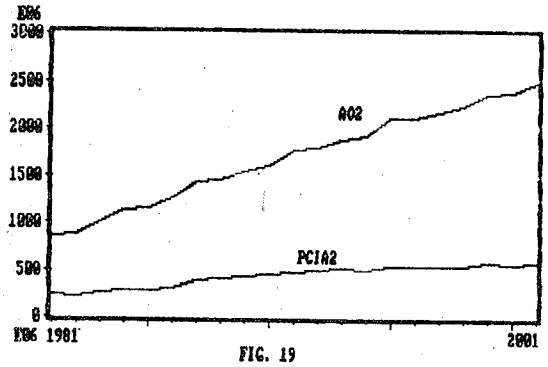


FIG. 19

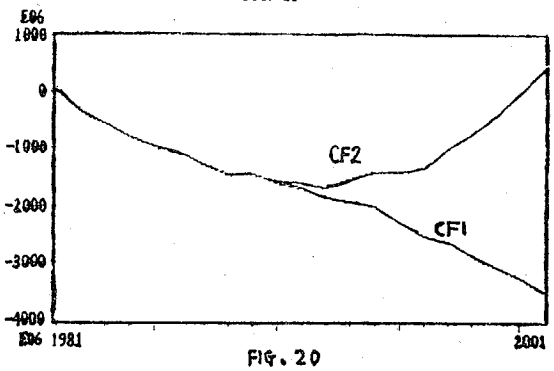


FIG. 20

Ecological targets:

The percentage of forest cover PCF2 will be increasing from 40% in 1980 to 54.74% in 2000 (figure 21). Owing to the fact that the comprehensive transfer rate of rural domestic energy SRDN2 will be increasing some more and the additional area of fuel forest will be exploited, so the shortage problem of rural domestic energy will be disappeared in 2000 (figure 22,23). Moreover, the soil erosion area will be decreasing from 8308 kmu in 1985 to 1632 kmu in 2000 (figure 23). The annual cost for control soil erosion CCSE2 will be decreasing since 1987, which will be 22910 kyuan only in 2000(figure 18).

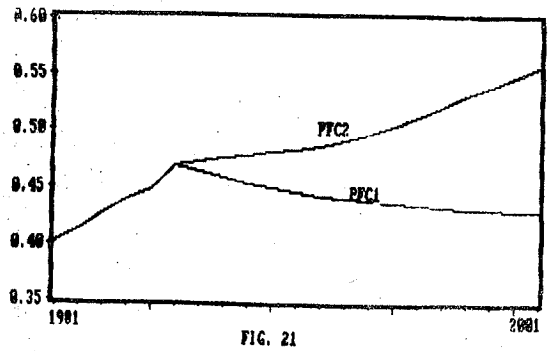


FIG. 21

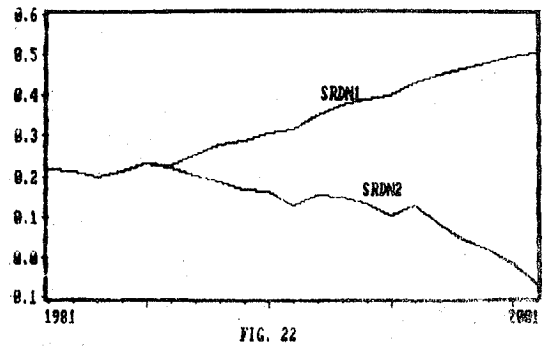


FIG. 22

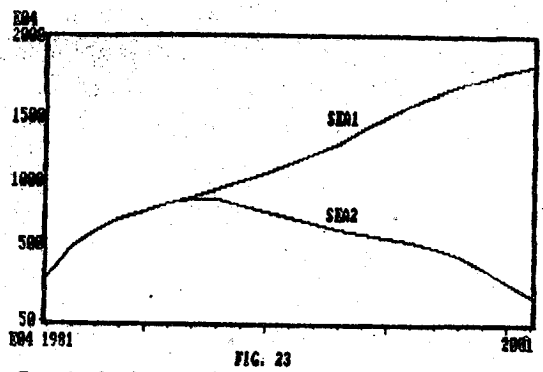


FIG. 23

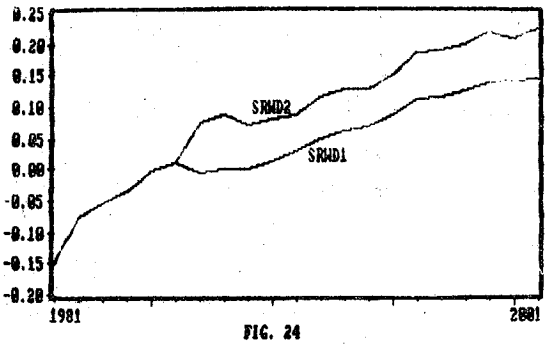


FIG. 24

Social targets:

Under scenario 2 the shortage problem of workforce will be serious more and more. The shortage rate of workforce SRWD2 will be increasing from -14.85% in 1980 to 22.34% in 2000 (figure 24).

Hence, under scenario 2 the quality of rural ecosystem will be improved and the rural economy will be developed some more. But the shortage problem of workforce would become the main barrier for exploiting and protecting the rural resources further if the productivity wouldn t be increased any more.

Look forward to the 21st century

To cope with the problem with long term, such as the problem of population in which the term is about 70 years, it is necessary to look forward to the 21st century.

Situation 1: the policy of family planning will maintain the state of 1985 i.e. the rate of single baby is always 30.04%.

Situation 2: The rate of single baby will be controled to a level 60% progressively in 2000.

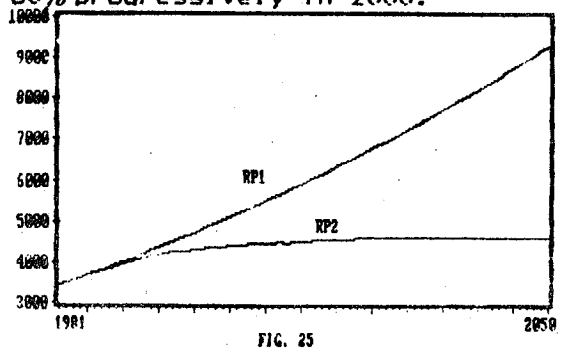


FIG. 25

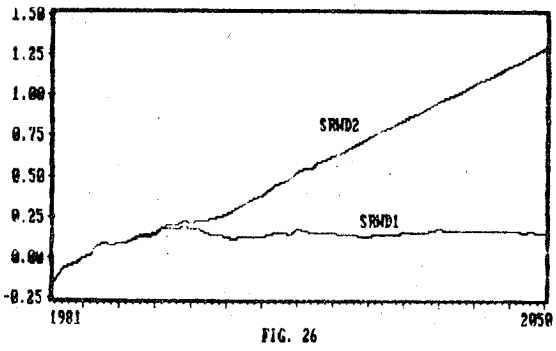


FIG. 26

As figure 25 shows, there is almost no deference between the rural population under situation 1 RP1 and that under situation 2 RP2 in 2000, but up tp 2050 the rural population under situation 1 will be 116% over that under situation 2. Because of the fact that the rural population increases greatly, so the output value of agriculture per capita under situation 1 AOP1 will be decreasing since 2005 (figure 26). The shortage rate of rural domestic energy under situation 1 SRDN1 will be increasing since 2015 again (figure 29). The soil erosion area, which would disappear in 2010 originally, will be increasing since 2021 because of the fact that the shortage problem of rural domestic energy will have been serious again since 2015 (figure 30).

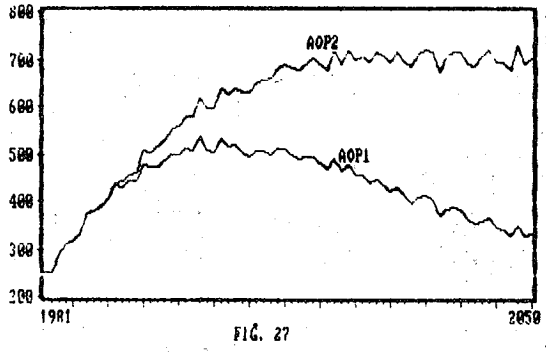


FIG. 27

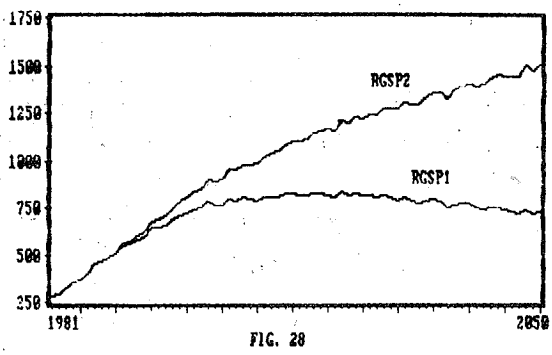


FIG. 28

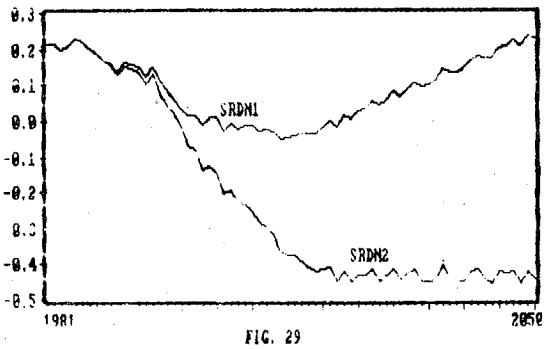


FIG. 29

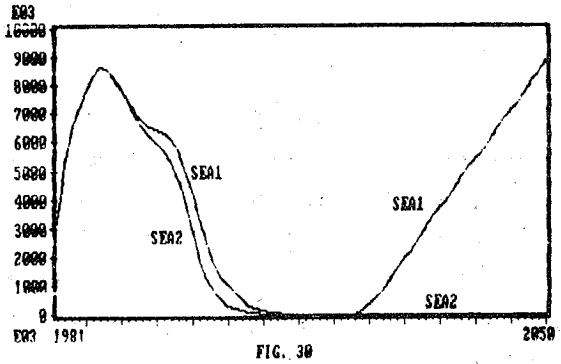


FIG. 30

As has been discussed, it is very important to consider comprehensively the trade-off between the shortage problem of rural domestic energy and that of workforce.

THE END

Our purpose is not only to set force a final policy recommendations by ourselves. The policy analyses here just cast a brick to attract jade. The further analyses will be proceeded together with the clients.

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