Working Paper

Regional Development of Agriculture in the Black Triangle

Z. Kučera

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IIASA International Institute for Applied Systems Analysis □ A-2361 Laxenburg □ Austria
Telephone: +43 2236 71521 □ Telex: 079 137 iiasa a □ Telefax: +43 2236 71313

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1. Abstract

The permanent conflicts between agriculture and industry in the so called Black Triangle region caused necessary change in the production structure. The formed socialization of the productive basis made worse this situation, created the large-scale technologies on one hand, on the other hand it has been increasing soil degradation and the fluctuation of population in the country. The result and the main problem is, that nobody want to take care of the agriculture land. All together this means a high risk of soil and landscape degradation, cumulating problems in cities and ground water degradation. This study aimed to answer following main questions:

1. How is the current situation in agriculture.
2. What maximum production could be achieved through change to extensive technologies without causing any landscape and natural degradation.
3. Which policy measures could be used to change to a desirable structure

In the Black Triangle all the problems of current Czech agriculture become acute. The agriculture is now in transition. The privatization and transformation are already going. All agriculture enterprises must change the form from state and cooperative farm to private companies, cooperation's of land owners or family farm. This is very complicate situation and it takes a long time. This study should give a reaction to this process and be useful against future mistakes.

2. Current research problems

1. Question is **„How should agriculture be done in so difficult conditions in so problematic region,"** However we have over production in our country and all agriculture products could be imported from other regions or countries much cheaper. This are several reasons for doing agriculture production.

   - food production

   This is not so important function because of the possibility to import all food products. We have here also more or less built the infrastructure for food production and distribution and it will be more inefficient to import all food when is possible to produce from a regional market.

   - energy production

   The energy production of agriculture in whole Czech Republicis on the begining. Energy production could be in the future one of the possible towards for agriculture.

   - Landscape restoration

   In this area we can see much degraded land because of mining activities. Agriculture is one possible measure for re cultivation and revitalization of these huge territories.

   - keeping population density

   The next problem that can be solved with agrarian land use is the long term decrease of population density mainly in the country. After the second world war all German population was evacuate from the Czech Republic. This was the start of every year decreasing the number of inhabitant's. The followed industrial agriculture had never stopped this trend. After the shift to free market arrives a real danger to crush last stabilization's factors in the country.

   - stabilization of heavy metals in soil

   In this high industrialized area with the permanent atmospheric pollution of fly ash toxic substances cumulate in the soil and store in the soil complex. We have here worse amounts of heavy metals in forest soils but relatively low in agriculture soils. One possibility is that heavy metals are washing out to the ground water. Another possibility is stabilization of these toxic substances in deeper level of soil because of liming. This possibility to use direct measures for controlling and regulating of heavy metals in soil is from my point of view possible with agriculture land use only.

2. Question is what kind of production is possible and desirable. Which structure could have the agriculture enterprise in this region.
3. Question is what kind of policy should be used to establish this change in structure. How much will it cost. What kind of production form should be the best one for these conditions (State enterprise, private farm, holding company)

The formulating of these above questions is related to current problems in this region. This is mainly the future choice to new sustainable forms of agriculture. This shift should also solve the population and environmental problems. These problems all have relevance at the national level and are closely related to state agriculture policy. Very important to this approach is the link between economic and environmental aspects.

3. Description of agriculture in the region

3.1. Overview of Agriculture in the Black Triangle

The description of agriculture starts in 1930 where it was one of most important parts of social and economical structure in this area. The Black Triangle had the highest industrial and agriculture development in the Czech Republic. Mining activities have a long tradition in this region. The interactions between biological and industrial production took place a hundred of years there. The typical framework of family farms took place mostly in the Elbe basin with high fertility land. There was also highly developed agriculture in the Erzgebirge mountain. The agriculture in those times could be characterized as a sustainable production. One of the most important function in this time was the stabilization of human population in the country. The number of inhabitants went up every year. The nationality of inhabitants was mostly German mainly on Erzgebirge Mountain.

The development of this stabilization function of agriculture we can see on table 1. Already in this time we can divide the structure of land use in different part's accordance to production efficiency. The first one is the most effective and fertile land in the Elbe basin Characterize as high production efficiency. In this area is most intensive agriculture production mostly of crops' fields. The second one is the mountain's part of this area. This territory could be characterized with less production efficiency affected as special nature conditions (extreme temperature, low soil quality, etc.) The next factor that had a very important influence on the development is the nationality of the land owners. Almost all mountain farmers in the Erzgebirge and high percentage of agriculture enterprises in the Elbe basin were Germans.

The first change in this agriculture structure was made in the year 1939 with a turn out of Czech population. This could be on my point of view the start of total change in agriculture in the so called Black Triangle. Mostly stayed Czech farms uninhabited during the second world war and very few farmers came back.

The second big change was the turning out of the Germans population in the 1945. All those farms and sometimes whole villages stayed empty. The number of inhabitants had extreme decreases. New generation of people came to these boarders' areas were so called gold-diggers and they couldn't stabilize the fluctuation. This short-term profit orientation of those peoples break the creation of new agricultural. The old villages were plundered. The continuation of family farms and family land owners was interrupted because of these drastic seven years.

Table 1. Development of population density in the region

Number of inhabitants (in thousand)

Administration Units	1930	1950	1970	1980	1991
District Chomutov	147,8	85,4	103,7	118	124,2
Total Cities	62	47,5	76,3	95,4	105,4
Total villages	85,8	37,9	27,4	22,3	18,8
Erzgebirge mountain	44,1	14	9,1	8,2	6,6
District Most	127,4	101,2	117,2	117,3	120,2
Total Cities	80,5	71,6	88	91,1	99,8
Total Villages	46,9	29,6	29,2	26,2	20,4
Erzgebirge mountain	8,3	2	1,7	1,4	1,1
District Teplice	200,6	129,6	135,6	135,8	127,8
Total Cities	120,4	81	96,9	101,9	99,3
Total Villages	80,2	48,6	38,7	33,9	28,5
Erzgebirge mountain	6,8	1,6	0,9	0,7	0,5
District Ústí N.L	130,6	93,5	105,9	115,2	118
Total Cities	88,3	70,3	84,5	93,2	99,7
Total Villages	42,3	23,2	21,4	22	18,3
Erzgebirge mountain	7	1,9	1,7	1,5	1,2
District Sokolov	63,3	40,1	57,5	59,1	60,7
Total Cities	20	13,4	30,1	35,1	40,1
Total Villages	43,3	26,7	27,3	23,95	20,6
All districts of B.T	669,7	449,8	519,9	545,4	550,9
Total Cities	371,2	283,8	375,8	416,7	444,3
Total Villages	298,5	166	144	128,35	106,6
Erzgebirge mountain	66,2	19,5	13,4	11,8	9,4
Czech Republic	10673	8896	9808	10292	10299

The agriculture in Czech Republic has changed substantially over the last two or three decades.

The first stage of this changing is so called cooperation.

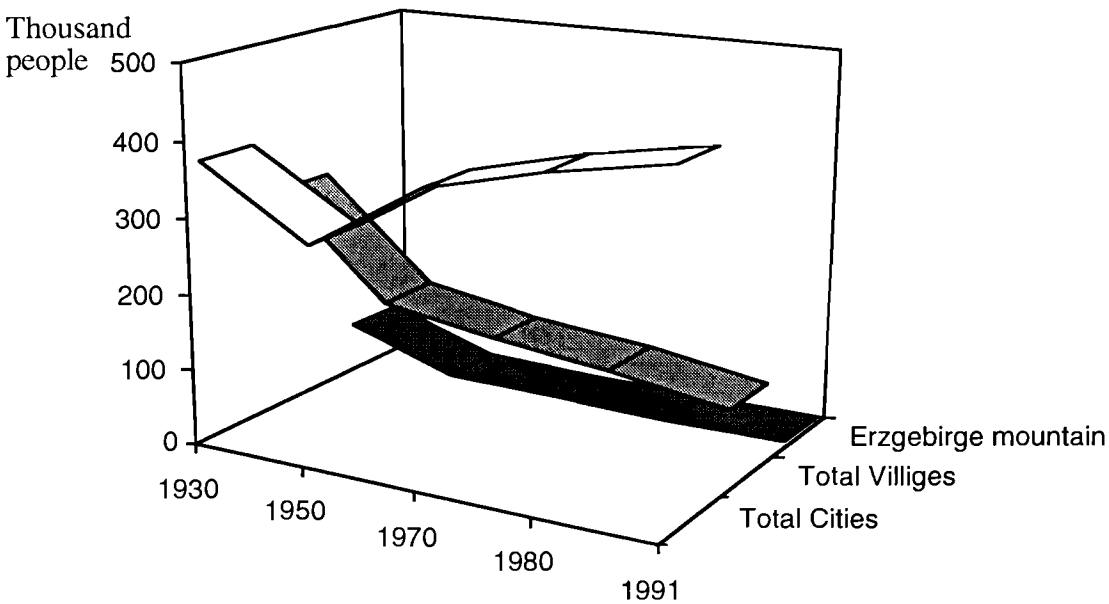
The relatively small farms in the post war period covered 43% of the total agriculture land area. The average size of farms was 10 ha. The small family farmers established cooperative farms with average acreage hundreds of hectares. This more less very effective cooperation system stayed only a short time.

Some of these cooperative enterprises were grouped together and built complexes on a scale several thousand hectares. 65,5% of the land are worked by cooperative and state farms, with an average size of among 2000 - 5000 ha. State farms were established in special hard natural conditions 'e.g.' mountains with average size about 5000 ha. A typical example of this time was the State Farm Most with almost 17000 ha. That was the second stage of socialistic development so called concentration. Although, this has had important impacts not only on the shift to new technologies and management system but

also on sociological and institutional Implicitions. The agricultural policy created a kind of subvention system so called differential rents. The land was divided in to many units concerning different natural conditions. For each this unit an accurate level of subventions in form of direct payment subsidies was given. The utilization of regionally specific conditions became a very important aspect.

The major goal set for agriculture was self-sufficiency in the main agricultural products. The research and policy never touched on the long-term development of natural resources and environmental problems. This stage of agricultural industry had extreme changes after the conversion to a market economy. The free market in agriculture, liberalization of all prices and inputs without any subsidies made most marginal region's agriculture production non-profitable. Major positions on the agriculture market has, new private, high profitable processing industry, with a monopolistic structure. They are in present time the main price makers on the food market. The very quick removal of subsidies (1989 - 4,2 %, 1993 - 0,8% of GNP) caused unprofitability of 56,6% agricultural enterprises (Ministry of Agriculture 1993). The going transition and restitution problems also play a big role on this state. The present situation in the Black Triangle issuing . We can not find any continuation and any tradition in land using. Because of aborted tradition and property rules of land owners is the amount of new private farms are very low. Special marginal conditions on the mountains and the any activities caused mostly unprofitability of main enterprises in the region and so opened the problems of non used and degraded land. This all problems could bee solved with change of the structure in agriculture only and continuing traditionally agriculture system.

Figure.1. Development of inhabitants at several parts of the region



3.2. Current situation

Total standard of agricultural production in the above area is very low, predominant of extensive character. That is owing to specific conditions in the above area, especially climatic, field, soil and economic production conditions.

The agricultural production affects especially water-economics, mining and

recreation activities and interests.

The absence of labors, the influence of industry exhalation and the unsuitability of great agricultural business in this area make things unfavorable.
In this study are present data of 19 agricultural business managing in special-interest area (data of June 1992). The special-interest area is now cultivation 364 932 ha of agricultural soils, from the 250 252 ha of arable land, the remainder are meadows and pastures.

In the last 40 years they realized lot of unsuitable agrotechnic measures. Such as the insensitive consolidating of pieces of land, without the regard to configuration of ground, excessive increasing of meadow and grazing land, and sowing of culture with a small effect from water erosion.

Heavy mechanization unsettled in sizable extent the structure of soil and the infiltration abilities of soil made worse. The system of large-scale fields affected insufficiency usually without drains and without reinforcing. Concentrating the outlet of precipitation could be often basis of erosion and of ravines. Intensive use of fertilizers and agrochemicals and their unsuitable time and capacity application contribute with erosion processing to contaminating of water sources. The consumption of industry fertilizers on 1 ha in the clear nutriment is trade-of about water-economic interest and about losses of nutriments. The hectare decrees of products are altogether low and are influenced except natural condition likewise of losing at the production. Other influences are for example storing of unsuitable agrotechnic, of ground configuration, etc. Contemporary conditions of animal production is characteristic of low milk yield with relative small all-surface weighing on agricultural soil.

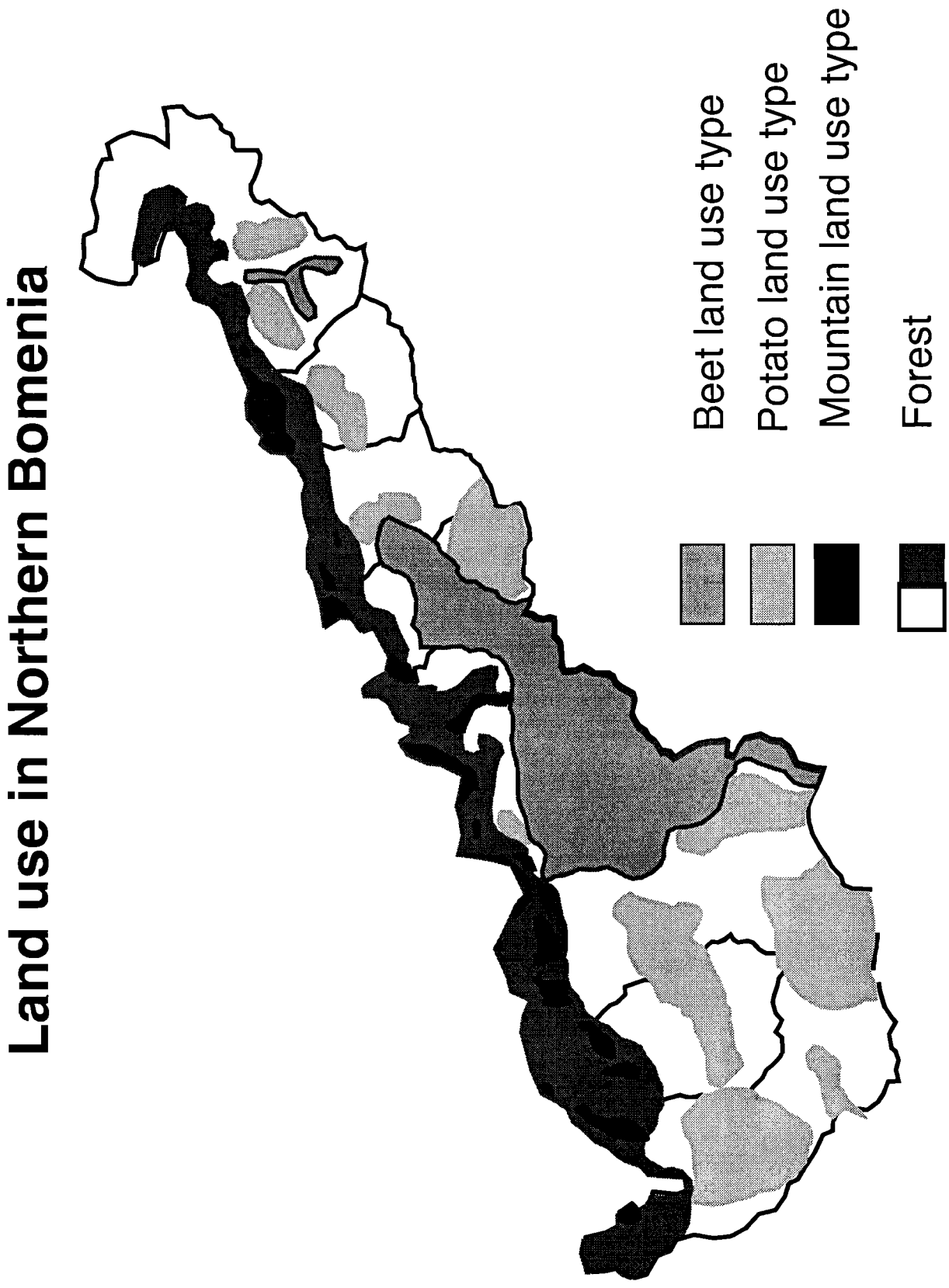
Breeding is often concentrated to the large-capacity objects which are for concrete conditions unsuitable. These objects among others complicate the suit of privatization of agriculture and make worse the conditions of changing its ecologization. In plant production is regular diversify of products on arable land is important. It is the basis for good employing of natural and economic conditions.

3.2.1 Production conditions

Long-term summary of rainfalls is more the 800 mm and long-term yearly average temperature is about 5°C. As soil types we have here mostly distric cambisols, then gleyic luvisols, podzols and wetlands. There are several soil types mainly with higher acidity and low amount of organic matter. For agriculture production it is also important, that rivers Libnický potok, Rolava, Křímovský potok, Bílina Loupnice, Bílý potok, Přísečnice, Černá voda, Flájský potok a Černá are water preservations. This mean, that agriculture production around this rivers should be more less limited. Most of the region is in potato production and almost the same part in mountain production type. In the mountain production type all subtypes take place. Subtype mountain agriculture has a prevalence of shallow sandy soils and subtype on deeper and heavy soils. The whole region can be divided to 3 main land use types.

Mountain and under mountain land use type - light, sandy, relatively shallow or middle
Potato land use type - middle fertile, sandy soils, optimal is potato production
Beet land use type - Fertile sandy type, optimal land use beet, crops

Figure 2. Land use types in the Czech part of Black Triangle



The production conditions are more influenced by recreation and mining activities, etc. The underemployment is also unfavorable. The nearness to the German boarder is an opportunity for many workers to take a higher salary and better work conditions in Germany. The situation in agriculture describes the number of 30 - 40 ha per agriculture worker. In some parts with extreme conditions it is perhaps 106 ha per worker (Nová Ves v Horách).

3.2.2. Intensity indicators

The North Bohemia region, which was chosen for experimental design of further agricultural development, covers an area of 254 682, 4 hectares.

The degree of the agricultural production intensity of the region can be characterized by certain intensity indicator.

Table 2. Intensity indicators of Northern Bohemia

1. Agricultural land in total:	364 932 ha
of which arable land is:	250 252 ha
2. Consumption of pure N,P,K nutrients (kg /ha)	59,84 kg (1992 - 170,4 kg)
3. Percentage of irrigated arable land	0,5 %
4. Cattle density (heads per 100 ha):	73 pcs
5. Milk production (liter/ha):	733 l
6. Meat production per inhabitant of the region:	127 kg
7. Average annual milk yield per cow:	3 348 l
8. Average annual egg yield of one hen:	228 pcs
9. Crops production per inhabitant of the region:	0,77 t
10. Population of the region	550 926

As explained above we may see some important relations in the regional agriculture structure. On one hand the intensity indicators very high. For example the consumption of N, P, K nutrients in 1992 was more then two times the average from Czech Republic (C. R 86,1 kg poor nutrient's /ha). Also other indicators like meat production per inhabitant shows very high concentration of meat pork production. Average acreage of crops in the region is 49,37 % in C. R only 37,3%. On the other hand the output values or the yields are relatively low because of these special environmental and natural conditions.

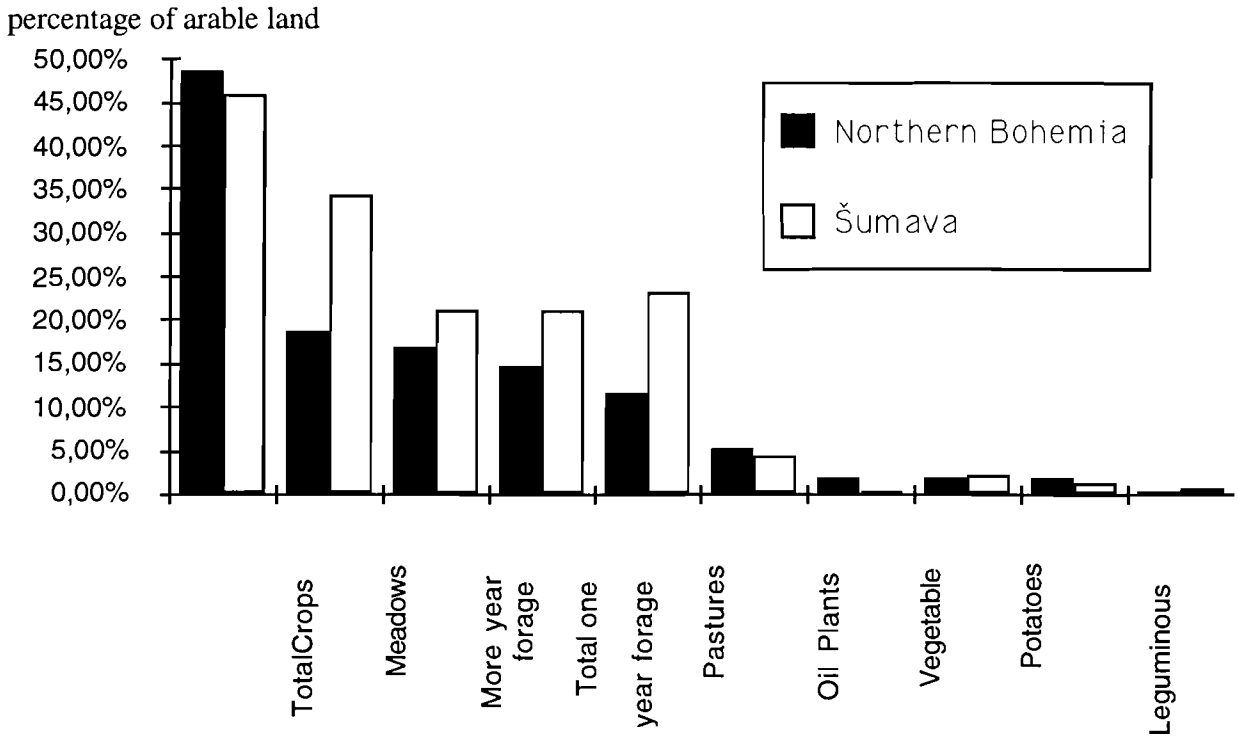
3.2.3. Land use in Northern Bohemia

Table 3. Land use in Northern Bohemia basin

Plants	Acreage	Yield	Yield/ha	% of arable
	(ha)	(t)	(t)	land
Wheat	61451	222844	3,485	24,56%
Rye	5606,61	17513,6	3,12	2,24%
Barley	49690,65	164076,5	3,29	19,86%
Oats	4547,66	13779,3	3,03	1,82%
TotalCrops	123550,36	425688,7	3,45	49,37%
Leguminous	4267,78	7036,9	1,65	1,71%
Potatoes	4387,23	82443	18,79	1,75%
Foot beet	919,49	36337,9	39,52	0,37%
Food maize	26902,35	725843,6	26,98	10,75%
Total one year forage	37256,23	18722,1	23,93	14,89%
More year forage	42716,15	221951,9	5,2	17,07%
Oil Plants	13029,09	25840,8	1,98	5,21%
Flax	416,49	610	1,46	0,17%
Vegetable	4744,69			1,90%
Arable irigated land	1825,7			0,73%
			% of Total land	
Meadows	47132,94			6,04%
Pastures	29446,86			3,78%
Arable Land	250252			32,09%
Agriculture Land	364932			46,79%
Forestry Land	269114			34,51%
Water Areas	14072			1,80%
Land total	779907			100,00%

The above figures show that almost one half of the area is covered with forest, especially the mountain part . There is also a relatively high percentage of arable land. Most of this production take place on the fertile land in the basin mainly for crops. Typical for this region are even less yields. This affects make than one factor. Here play together natural and environmental conditions, technologic factor and above all agriculture management problems.

Figure 3. Comparison in land use between Northern Bohemia and Šumava Mountain



3.3. Environmental problems

The first reports about the damaging of vegetation by polluting the atmosphere were as early as the end of 19 century.

After the year 1959, all forest complexes on ridges of Erzgebirge mountain were complete damaging. By damaging the forest complexes of water-economic, recreation and hygienic forest functions are distressed.

At the same time a fossil fuels are burn, which are guides of emission of sulfur, nitrogen, carbon and emission of trace element, for instance heavy metals, etc. The maximal pollution was in the 70 ths.

In present time the tendency is going slowly better, because of filters and fluid cauldrons install of during last years. In principle the whole basin is still polluted from industry emissions mostly SO_2. In 1987 the average concentration of SO_2 in the district Most 150 mg/m^3, in district Teplice 130 mg/m^3, in district Usti n. L 120 mg/m^3, in Sokolov 90 mg/m^3 and in district Cheb 100 mg/m^3. In 1990 are the results a bit lower: district Most 79 mg/m^3, Teplice 88 mg/m^3, Cheb 25 - 50 mg/m^3.

The ecological risk influenced mainly plant production. Lower intensity of growth is especially on grass as well as more year forage. Because of SO_2 pollution's out from important kinds of grass and decreases the growth of biomass. Damages to plants are not related to average but marginal concentration: by about two times current concentration of SO_2 decreases the growth about 20%, by more then three times decrease the growth more then 40%, by crops isn't conclusive decrease of grow (Janeček 1966). Dangers of acid substances in the air are increasing with air humidity. Acid rain influences not only leaves

but is going in soil where lost several fixed chemical substance's `e.g.` heavy metals. The main contamination of heavy metal in the basin is through air in form of fly ash deposition. Contamination is mainly detected by plants with larger leaves. (Tab 3) It is a little surprise that the contents of most toxic heavy metals like As, Cd, Pb, Hg, are on average level. Even by plants usual cumulating heavy metals as well as Alfalfa and clover. Some differences in results may be caused from the fact that pollution is mostly on the surface of plants and with manipulating are going down.

Table 4. Results of analyses of heavy metal contents in clover-grass (VÚHU č. H 50 125 003-08-07----120/90)

			(Contents in $\mu g.g^{-1}$ dry matter)				
clover-grass	Hg	As	Cd	Pb	Al	Cu	Zn
Recultivation Merkur 1988	0,029	0,646	0,045	0,66	2520	13,1	33,5
Recultivation Merkur 1989	0,027	0,41	0,035	1,04	424	12,1	38,4
H. Jiřetín 1988	0,017	0,401	0,032	1,00	221	11,6	37,6

These results are in order with the norm for animal food. Figure for fresh food should be still 60 - 70% lower then in table.

Table 5. Results of analyses of heavy metal contents in alfa-alfa

			(Contents in $\mu g.g^{-1}$ dry matter)				
Alfalfa	Hg	As	Cd	Pb	Al	Cu	Zn
Recultivation Merkur	0,018	0,173	0,033	0,42	295	13,8	44,9
Recultivation Březno	0,02	0,18	0,089	0,2	212	16,4	48,2
Lovosice	0,018	0,32	0,028	0,19	128	5,3	25
Dřemčice	0,019	0,173	0,015	0,22	144	6,3	25
Rábí u Netolic	0,008	0,173	0,015	0,22	144	6,3	25

From these figures we may see that contamination in Northern Bohemia is higher then in South Bohemia. Mainly from Cd, As and Al is.
Concerning air contamination and yield it is definitely possible to produce crops and energy plants in this region (Janeček 1966, Petříková 1990). Livestock production cause this atmospheric deposition of fly ash contamination of food. This contamination is mostly never over the norm for food plants. Content of heavy metals in meat is also under the limit but the amount in liver and kidney mostly over the norm.

Table 6. Contents of heavy metal in crops and food in several districts in Northern Bohemia

Content of Heavy Metals in crops and food plants — Beneš 1990

	Crops				
	District				
	Chomutov **n=8**	Most **n=6**	Teplice **n=6**	Ústí n.L **n=4**	Děčín **n=23**
As	`0,06 (16)	0,06 (20)	0,05 (0)	0,05 (0)	0,05 (0)
	``0,05 - 0,07	0,05 - 0,07	0,05 - 0,08	0,05	0,05
Be	0,01 (20)	0,01 (25)	0,01 (0)	0,005 (0)	0,005 (0)
	0,005 - 0,008	0,005 - 0,009	0, 01	0,005	0,005
Cd	0,06(101)	0,007 (88)	0,04 (41)	0,05 (71)	0,05 (45)
	0,06 (16)	0,06 (20)	0,05 (0)	0,05 (0)	0,05 (0)
Cu	0,05 - 0,07	0,05 - 0,07	0,05 - 0,08	0,05	0,05
	0,01 (20)	0,01 (25)	0,01 (0)	0,005 (0)	0,005 (0)
Hg	0,005 - 0,008	0,005 - 0,009	0, 2	0,005	0,005
	0,06(101)	0,007 (88)	0,04 (41)	0,05 (71)	0,05 (45)
Pb	0,06 (16)	0,06 (20)	0,05 (0)	0,05 (0)	0,05 (0)
	0,05 - 0,07	0,05 - 0,07	0,05 - 0,08	0,05	0,05
Zn	0,01 (20)	0,01 (25)	0,01 (0)	0,005 (0)	0,005 (0)
	0,005 - 0,008	0,005 - 0,009	0, 3	0,005	0,005
	Food plants				
	District				
	Chomutov n=23	*Most n=19*	*Teplice n=27*	*Ústí n.L n=19*	*Děčín n=13*
As	0,07 (84)	0,09 (129)	0,085 (85)	0,09 (110)	0,07 (35)
	0,05 - 0,3	0,05 - 0,49	0,05 - 0,88	0,05 - 0,45	0,05 - 0,13
Be	0,01 (112)	0,03 (64)	0,037 (166)	0,02 (247)	0,02 (66)
	0,005 - 0,05	0,015 - 0,098	0,008 - 0,28	0,005 -0,24	0,005 - 0,037
Cd	0,1 (99)	0,12 (93)	0,126 (90)	0,07 (84)	0,07 (94)
	0,07 (84)	0,09 (129)	0,085 (85)	0,09 (110)	0,07 (35)
Cu	0,05 - 0,3	0,05 - 0,49	0,05 - 0,88	0,05 - 0,45	0,05 - 0,13
	0,01 (112)	0,03 (64)	0,037 (166)	0,02 (247)	0,02 (66)
Hg	0,005 - 0,6	0,015 - 0,99	0,008 - 0,29	0,005 -0,25	0,005 - 0,38
	0,1 (99)	0,12 (93)	0,126 (90)	0,07 (84)	0,07 (94)
Pb	0,07 (84)	0,09 (129)	0,085 (85)	0,09 (110)	0,07 (35)
	0,05 - 0,3	0,05 - 0,49	0,05 - 0,88	0,05 - 0,45	0,05 - 0,13
Zn	0,01 (112)	0,03 (64)	0,037 (166)	0,02 (247)	0,02 (66)
	0,005 - 0,7	0,015 - 0,100	0,008 - 0,30	0,005 -0,26	0,005 - 0,39

(` average figures, `` maximum and minimum, () variance)

Important role of the pollution's factor plays also the agriculture self. The damaging of ground water and contamination of cadmium are as well some results of industrial agriculture. For the estimation of damage and food contamination the consumption of fertilizers in the territory is important.

Table 6. Consumption of fertilizers in Northern Bohemia (1992/93)

Fertilizers	Total amount (t)	Per ha (kg)
Limestone	6 334,1	17,35
Ammoniac fertilizers	11077,8	30,35
Phosphorous fertilizers	2 360,6	6,46
Potash fertilizers	2 075,3	5,68

4. Change in agriculture structure

4.1 Possible production toward

One of the most important problems seems to be the decrease of employers in agriculture enterprises in the region. The decrease in district Sokolov in 1991 was from 2200 workers to 550 in 1992. The recommendation of possible technology must concern this situation. The Ministry of agriculture creates a plan of revitalization of the Sokolov basin.
In present time because of the privatization process, and the main large enterprises are divided to some private units. In this process it should be supported create a new infrastructure of processing industry and distribution. Also it is necessary for helping to further little family farms mainly in the mountains. It is also urgent to improve common land use techniques. All products and plant's mast in agree to current climatic and topographic conditions. With concerning facts that were explained above seems to be possible to produce there:

crops (for regional market only)
rape
potatoes (for self consumption only)
maize for silage
forage plants (clover, alfa alfa, grass)
flax

What is important here are also following sowing process rules:

a) after fall crops should follow spring barley for grain and food plants
b) clover should be sowed only in the mixture
c) preferring of more year forage
d) after spring barley for grain it is possible to produce potatoes or other root-crops

Generally we are expecting further decrease of arable land and an increase of meadows and pastures. This should be mainly on areas with high erosion risk. This grass grows can perhaps play the role of water and biologic function as well as former forest zone. In this historically short period, could be on some damaged places the, growing grass is the only stabilization factor from water and wind erosion. In the soil it is necessary in the log-run to increase the amount of organic matter. As fertilizers could be used in emission zone lime only because of elimination of acid rain influence (50 kg per ha). Also important seems to be the use of compost instead of manure for improving of biological activity in soils (40 -50

tones per hectare). In water preservation zones green manure can be used. In sowing process it is necessary to keep crops on the maximal level 45 % of arable land. In emission zones is recommended to produce crops as an animal food only. The potatoes are very sensitive to acid rain and then it will be possible just to keep potato production on the self consumption level. The economic effect seem to be play a second role in the region. The first aim of agriculture will be in the future stabilization of agriculture landscape perhaps to enrich the area of new structures.

4.1.1. Bioenergy plants

The advantage of bioenergy plants is the transition and storing of sun energy in employed form. In current time is the research focused in several important directions. At first, there are oil plants in European countries mainly rape oil for producing biofuel. The second aim of research is production of bioethanol from several plants containing sugar and starch as substitution for petrol. Third and fort possibilities to take bioenergy is the biomass production. The biomass could be use for production of biogass or direct combusting.

Biofuel
Rape (Brassica oleacea) is traditional source of oil for the oil industry and for the grocery. By esterification of rape oil it is possible acquire metylester, which has nearly the quality of diesel or lubricating oil.

In addition, at the cold pressing arise the nutritious groats. Biofuel and biolubricants of rape are the matters "ecological clean" and by their escape, this damage neither soils nor water source.

At the petty smaller (95 %) energetic contents of biofuel (comparison with motor diesel) decrease the emissions of sulfur oxide almost to zero values and the motor smoke is half.

The quantity of carbon oxygen (C02) in exhalation reply to quantity that is holding at the photosynthesis. In comparison to fossil fuel contribute to hot-house effect only slight. Using of rape metylester as driving fuel for tractors and agricultural machines with diesel motor need not construct changes.

Growing of rape has in Czech Republic very good standard. Average yields of seeds 3 t/ha registers our country between the first countries (together with Great Britain, France, Germany, Denmark and Poland). At the present is a share of rape perhaps 3,2% of sowing area, while in other countries is one twice, even a number of times bigger. In specialist's opinion, is possible the growing areas of rape to increase more then 50%.

Growing of rape is advantages from ecological points of view also, because the plant by her system of roots and by vegetation cover decreases the extent of soil erosion and contamination of water sources. At the same time, the culture good valorizes organic fertilizers 'e.g.' composts of organic wastes, etc.

Program of production and using of biofuel for Northern Bohemia basin
(Summary of materials of STZ - Oil industry, Prague, September 1991.)

The aim of the program is to determine the efficient production of standpoint national-

economic, ecological, agriculture-grows, production-technical, economic and trade marketing. Result's determine the real and needful extent of production and using of biofuel in North Bohemia basin and to give the bases for other Czech regions.
The project includes a increasing of rape growing in regions Usti nad Labem and Děčín. At the present the rape fills 5 739 ha of total 105 192 ha, which is 5,5 %. At the enlarging of area on 8 000 ha (it is 7,6 % of total arable soil) it is possible to produce 22 000 t of rape, that is increasing about 6 500 t/years, which will be us for biofuel production.
The purpose is verify the maximum of area for rape growing (mainly on recultivate areas), about 13 % of the arable soil (13 700 ha), with production 370 000 t of rape seed. The constituent of this project will be monitoring the quality of oils and groats for the standpoint of contamination with hard metals.

The project propose is practical to verify increasing contents of rape groats in animal support (about 5000 t/years) and acquiring of bases for their maximum using. The processing of rape seed and production of oil and groats is proposed in enterprise STZ Usti nad Labem, where is capacity of rape seed processing 240 000 t/years and production of oil about 100 000 t/years.
Right now is biofuel produced in enterprise Chemopharma, with capacity 3000 t/year.

Bioethanol

This is an alcohol produced from plants containing sugar as well as crops, potato's, beet, etc. Ethanol is at first a substitution for petrol. It is useful as a mix with petrol or poor as potential fuel. For using this new fuel it is necessary to have special car engines. In the EC countries is regulated by ethanol and petrol rule with rules' 85/536. In agree with this rules is possible to mix 5% of ethanol. An advantage of this combination is that the standard engines can use this fuel without any modification.

Combustion of plants

The burning of plants is very closed to the combustion of wood. The good is you can use the total energy build of photosynthesis. Plants suitable for combustion have higher content of dry matter more then 50%. Fast growing wood, crops, etc can also be used. This is an ideal potential production for region like Black Triangle. We have here potential producers, farmers. They necessarily need to change production. We have here also the potential demand of households they should necessarily shift from coal to other possible hitting. The creating of new infrastructure and new market will be certain be difficult and take a very long time. Perhaps it should be noticed that changes are not possible without certain governmental policy and support.

4.1.3 Agroforestry

One of the possible ways of revitalization seems to be the so called system Agroforestry. It should be a system where there are periodical change of energy wood and pastures. The best system for this region should be the Scandinavian model of extensive beef cattle. Possible breeds for this kind of production are recommended with collaboration of University of South Bohemia Galloway and Highland. Follow could be feasible else extensive breeds Luing and Welsh Black. All these extensive breeds have certain

advantages for this kind of production. Above all it is:
- non problem birthing
- excellent mother characters
- attractive appearance
- breeding without stables in higher places could be only simple shelter.
- non demanding for food quality
- non selective pasturing
- hard constitution with resistance for extreme weather conditions
- excellent meat quality
- high quality of leather

In this extensive breeding system is possible to have also other breed's `e.g.` Hereford, Aberdeen Angus and Limusine.

Galloway

Is one of the most old beef breeds in Great Britain. Originally this breed is from South Scotland. Breeding goal was since hundred years excellent meat production and efficiency in pasture. The breed has strong constitution, lives in extreme hard climate conditions (-30°C and more). Standard greatness for cows is 450 - 500 kg for bulls 600 - 800 kg l. w. Animals are genetic unhorny. Hair is mostly black, black-brown also mahogany. It is very adaptable for natural conditions. In comparison to other beef breeds is little precocious (reproduction age started in 24 months). The cows have very well maternal instincts and periodic undifficult calving. Meat has excellent dietetic quality. Compared to other beef breeds could be Galloway intensive fatten without undesirable storing of fat.

In the 1991 Czech Republic imported 9 cows from Germany and next ones in the 1992. This drove is placed in the Research Institute of breeding cattle breeds in Rapotín. The University of South Bohemia is doing a research about use the Galloway breed as possible beef production in Šumava mountain. The results of research done by University of South Bohemia lead to the conclusion, that the breed Galloway could be used as well as substitution in Czech Mountains.

Highland

As further example of beef cattle is Highland. Originally is the breed coming from North West Scotland and they are trying out also in Šumava Mountain. Main product is lean and marble meat. The animals like well the older grass. In fall they store fat under skin for the winter. The care about the drove is reduced only to the control.

Other breeds are more or less used in several parts of Czech Republic. Most of them are still tested for adaptability to those special conditions. All of them are middle or little with and precocious development of the body. Primary product is meat and secondary often the hide. The breeding is always extensive pastures. Some breeds could be used for combination breeding to improve meat production.

5. Conclusion

Recapitulating, we have seen that the changes to the current situation are necessary. We

have also seen possible ways to changes and possible substitution products can be produce there. The other question that remains to be answered is: How can we do it and which measures should be used to support this change. The answers may be very differed. Let me show just some possible ways.

The most important is from my point of view the organization and the governmental support. The firs possible way for realizing and revitalizing of the landscape is following the farmers rule: Who has damaged should pay. That means some more less conserving process with agriculture farms as well as tenders their first work will be taking care of the landscape. This is an agreeable program and relatively good, mainly for high damaged area like spoil banks and recultivations. But from my opinion it is not possible to make something like a natural park on the whole Northern Bohemia.

The second way is establishing state farms not direct is dependent on making profit. They can as much as stabilize the mountain parts, not so valuable for intensive production. In this kind of organization can be realized the production and the environmental aims together. Also one advantage is the direct control under the State institutions. On the other hand we had already tried this character of organization and the results were very bad. The lower efficiency and lower quality of the work seem to be a real problem of these State farms. But both those characters are dependent on the quality of the farm management and of environmental and agricultural education.

The third possible organization is generally based on private companies. The new private companies, cooperation farms and family farms can be stimulated trough such rather direct payment to some environmental activity. Each unit can produce some limited production and get direct governmental subsidies. The production towards could be stimulated to desirable production (rape, sheep's, etc.) The disadvantage is that the infrastructure and services are not yet in the mountain villages. You can not have a telephone, there are not doctors or other health services, no schools or the cultural facilities. It will take a long time to do that. From that point of view it is not so interesting for agriculture family to begin farming mainly in the mountain area. The next problem that will take time to solve it is the land owner relations. From opinion have all these ways some good and some bad. All of them are really good solution for some parts of those areas. For the mountain part seem to be good keep the state enterprises. For damaged area the first solution and for other not so difficult parts just stimulate current farms to use desirable technologies and products. That means not only for the Black Triangle but also for other parts of the Czech republic and several countries have same problems. For the future it is necessary to complete this study with as well as production side also the side of consumption. That means the description of and estimation of regional market capacity. Also is important modeling and optimizing the regional model concerning the emission and natural conditions. Of course those all proposals must be complemented with policy certain regional measures. All this complex approach to the regional problem will take place in my PhD thesis as well as comparison between other marginal regions like Šumava Mountain.

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