Lack of South Caspian Habitat Conservation Network, A Serious Threat on Biodiversity (A Case Study in Guilan Province, North of Iran)

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Abstract: Iran, a 4-season land in the world, is located in semi-arid part of Asia. There are several geographical climates in this country, which are the main causes for the existence of diverse ecological conditions. In the north, where the Caspian Sea meets the land, there are three provinces. One of these, Guilan province, (the studied area) is located in the southwest of the Caspian with different geographical conditions.

Differences in altitude (3000 meter) and precipitation (1200 mm) are important causes for the development of several ecosystems (Fig. 1). These ecosystems include the sea, rivers, estuary, wetland, irrigation pond, hills, grasslands, mountains and Hyrcanian Forest. These ecosystems involve more than 200 species of birds (native and migratory), 65 species of mammals, 49 species of amphibians and 97 species of trees.

Since 1971, when the government of Iran established a new department for the environmental conservation, only 5 valuable habitats have been under management in Guilan province with 40089 ha of surfaces.

In proportion to the total surface of the province, 2.7 percent of the whole area is under the department's management. Meanwhile, IUCN announced that until the year of 2000 governments should include 10 percent of their countries as protected and under management areas, and that is their last chance to protect their biodiversity.

These 5 valuable under management habitats have surface areas of about 33050, 4500, 1230, 949 and 360 ha(s). Although the first one includes several ecosystems in habitat, others only focused on specific geographical areas.

Long distances between habitats, lack of integrity, local and special function for each habitat (most of them are wetlands), sediments and degradation in under management areas on the one hand, and urban development, pollution, poor people with low income, illegal hunting and fishing (picture 1), forest harvesting, lack of guarding, lack of budget and equipment, low public awareness and participation in non-management areas on the other hand are the main causes for the extinction of one species in the past few years. So, 17 species of mammals, 18 species of amphibians and 14 species of birds are in on the endangered species list in this area.

This study intends to show the current status of the nature in the area, to determine the main causes and the possible methodological problem solutions.

Key words:

Biodiversity, Conservation network, Threat, Caspian, Guilan. Habitat,

Introduction

Biodiversity is an important parameter of environmental health, which includes ecosystem, species and genetic diversity. Diversity in ecosystems and habitats are called ecological diversity, which is appearing by differences in ecological conditions. If there is a proper condition for habitat and ecosystem existence, species will have a high potential to be found there. Sufficient food, security and suitable condition in habitat are

the main reason for diverse species development.

During the last century, developing countries had many problems for their environment. They polluted their natural resources and alteration in the land use of their countries. These changed areas, that we called "habitats" are a place for many kinds and population of wildlife. Habitat destruction is the main cause for species losing in ecosystem and it's population decrease.

Obviously when ecosystem loses wildlife, the integrity of food chain and ecosystem life networks are endangered and in the near future, the gene pool is possibly going to change.

These actions have a series of effects on biodiversity, as well as on sensitivity to natural and mankind factors. Thus, it is necessary to conserve more and more the habitats and ecosystems with a network view. Because with this view, existence of species will be guaranteed for the future.

Introduction of Guilan Province

Guilan is one of the three provinces close to the Caspian Sea in the Iranian border. Its surface is 14711 Km^2 and its' population is 2241896 in 1996. Guilan is a part of Euro-Siberian world ecosystem diversity. Because of topographic and weather condition differences in the province, there are different kinds of ecosystem and species. The difference between the lowest and the highest land in this area is 3000m. The average rainfall is 1200 mm. These variable conditions provide good situation for different kinds of animals and plants in this area.

Method of the study

In this study, the current status of the habitats and ecosystems are compared with the scientific and ideal condition. By this comparison, current status and best condition will be compared and gaps will be appeared. So, harmful threats for habitats will be identified and suggestion will be proposed.

Biodiversity in Guilan province

Although genetic diversity studies are lacking, there is rich information about the ecosystem and species diversity in Guilan.

4-1- Ecosystem diversity

As mentioned before, there are several and different ecosystems in Guilan. These ecosystems include sea, estuary, rivers, wetland, mountains, forests, hills, land and grassland.

The Caspian with Oligo-Mesotroph condition provides a good situation for different species existence. The Estuaries are important connections between the Caspian Sea and the rivers for fish migration, as well as Sturgeon fishes in Sefidroud River. There are more than 100 rivers that lead water from watershed areas to the Caspian Sea and the wetlands. These are living areas for fishes and migratory birds (picture 2).

There are three international wetlands in Guilan, which have several functions including cultural, economical, social, scientific and ecological. Many of natural phenomenon such as flood are controlled by the wetland. Another important function of wetland is its role in weather balance in the area.

There are many useful lands in Guilan for agricultural activities. 39.5% of total Guilan's population depends upon agricultural work and its related activities.

Forests distribute in 29-watershed area and start from seaside to top point of the mountain in 2800 m. Total surface area of forest is recorded 565000 ha in 2001. So, there are 224000 ha of grassland there.

The figure 2 is a demonstration of the areas under three categories in Guilan. In addition, pictures 3 and 4 demonstrate the distribution of areas in Guilan province.

Managed areas

40089 ha of total surface area of Guilan province, that is about 2.7 percent of the whole area, are under management. This managing program includes prevention of mankind activities.

Table 1 is the list of the areas.

Table 1

Row	Habitat's Name	Type of Management				Surface (ha)	Type of Ecosystem
		National Park	Wildlife Refugee	Conserved area	National & Natural Monument		
1	Lavandvil		+			949	Wetland & Seaside Forest
2	Selkeh		+			360	Wetland
3	Amirkelayeh		+			1230	Wetland
4	Siahkeshim			+		4500	Wetland
5	Lisar			+		33050	Mixed Ecosystem
6	Sosanchelcheragh				+	0.6	Rare Plant
7	Sarveharzavil				+	0.6	Old tree

Table 2

Row	Habitat's Name	Type of Ecosystem	Surface (ha)
1	Boojagh	Wetland	1500
2	Esteel	Lake	138
3	Sorkhankol	Wetland	800
4	Ezhdehabalouch	Irrigation pond	150
5	Naveasalem	Forest	5000
6	Eshkevarat	Mountain & grassland	40000
7	Deilaman & Dorfak	Forest & grassland	27000

Semi-managed areas

This is a large-scale management for different ecosystems in Guilan province. It is known as "Non-hunting area". The total surface of areas is 74588 ha which is 5.07% of the Guilan province. There isn't any kind of environmental management in this area except the prevention from hunting and shooting. In semi-management areas, forest harvesting and use of grassland are legal for Natural Resource Organization. Table 2 is the list of these area.

Non-management areas

These areas are not under environmental management and resources utilization is under national and public legislation. Total surface of these areas is 92.23 percent of Guilan.

4-2- Species diversity

As mentioned before, because several and different ecosystems exist, there are many kind of wildlife and aquatic organisms in Guilan.

Over 80 species of fishes (native and migratory), 270 species of birds (native and migratory), 65 species of mammals including Caspian Seal *Phoca caspica*, 49 species of amphibians, 97 species of trees and 12 species of reptiles are reported in this area by the scientists and researchers. Beside, in the Caspian region of Iranian border, there are 707 species of insects and fly, and 976 species of plants are reported until now (Fig. 3,4).

Statistics and characteristics of the area

Necessary statistics information needed for the current status of ecosystems is categorized into.

5-1- in non and semi-management areas

A -Population and household: The table below shows the population and number of houses during the 40 years (Fig. 5).

Year	1956	1966	1976	1986	1996
Province Population	999876	1293835	1581872	2081037	2241896
Number of household	Not available	224866	305300	415735	511202
Number of Houses	Not available	44900	100408	246829	447088
Population of the Rasht	Not available	143557	188957	616466	715096

B -Cities and villages : Number of cities and villages in the province increased during 35 years by population growth. (Fig. 6)

Year	1966	1982	1996	2001
Number of cities	10	31	40	45
Number of villages	Not available	Not available	2705	2892

C -Agriculture (Rice as the main production) : During the study the total surface of the main agricultural land (rice farm) remained constant, however, the consumption of chemical fertilizers increased a lot.
The statistics related to agriculture follows (Fig. 7, picture 5).

Year	1987	1996	2001
Total Surface of Rice Farm	220000	230000	230000
Chemical Fertilizer's consumption (Ton)	64146	76605	100884.41

D -Industries : Although there are not many big industries in Guilan, the number of industries increased from 1970 to 2001. (Fig. 8)

Year	1970	1997	2001
Number of Industries	214	1826	2260

E -Mining : 31 years of statistical survey shows that the total number of mining stations increased from 23 in 1970 to 128 in 2001. (Fig. 9)

F -Roads : The roads network has increased rapidly since 1990. Now, It is possible to travel to any place and even reach the highest point of mountain in Guilan by car. The following table illustrates the total length of Guilan roads. (Fig. 10)

Year	1974	1987	1997	2001
Total Length of Roads in Guilan (Km)	1428	2902	6840	8164
Villages Access road in Guilan (Km)	Not available	Not available	Not available	6838.9

G - Solid Waste and Wastewater

The solid waste and wastewater production per person in Guilan is 0.9 Kg and 180 litter in 2001 according to the Department of Environmental Conservation (DOE).

H -Forest Harvesting and Watershed Management

There was a survey by air photography shows that there was 3.4 million ha of natural forest in the southern part of the Caspian in Iran in 1964. Meanwhile natural resource organization published the document showing the total surface of forest in the same area is 1.9 million ha in 1999 (Fig.11). In this year, total surface of forest was 565000 ha in Guilan.

Since many years ago, the government has prepared several plans for forest harvesting (picture 6). Now, total surface of area under plan is 377000 ha and for the rest they are going to provide plan and only 61000 ha is allocated to the forest reservation.

The grassland includes 224000 ha of total surface area and numbers of sheep in the grassland are 1.5 million, although the capacity of the grassland is only for 684000 sheep. Meanwhile they didn't study the wildlife needed for grazing in the grassland.

I -Unemployment and poverty

For several economic reasons, the number of people without job in on increase and the income of people are low. The gap between

total income per mount for each family is $80 US while poverty line is $170 US.

J -Exotic Species

Exotic species that come from other ecosystems and countries include conifer trees, *Mnemyopsis leidyi, Carassius auratus jibelio* and Azola in Guilan (pictures 7,8).

5-2- Under-management areas

Under-management areas in the province include aquatic and territorial ecosystems. Threats in territorial ecosystems are similar to threats in non-and semi-management areas, but those are too limited, forests harvesting and using from grassland are illegal.

A - Sedimentation and wetland depth decrease

A field survey during 30 years shows that wetland depth in Guilan has decreased. For example, Anzali international wetland depth changed from 11 to 3 meters in deepest point during the same time (Fig. 12).

B - Eutrophication

This phenomenon happens in water body of wetland in Guilan every year. Because of nutrient material entry to wetland via channels and rivers that come through several cities and villages, level of dissolved oxygen decreases and reaches to zero point. Every year millions of fishes die because of this phenomenon.

C - Wetland water level fluctuation

Water level fluctuation has several positive and negative actions for habitats. The causes for water level fluctuation in wetland have some natural processes such sea water level changes and some mankind cause like agricultural use and land use changing.

D - Exotic Species
See section 5-1-10.

6 - Discussion

The Lack of conservation network in habitats in Guilan is not only for its wrong distribution and limited existence, but also for the lack of habitat functions and threats to the biodiversity all around the province. It includes 3 parts as below.

The first one is inadequate function of the network's existence. Threats on biodiversity in under management part of conservation network are include exotic species, agricultural waste, and urban waste, miss management in watershed area, sedimentation, road construction (picture 9), over population, Eutrophication, water level fluctuation and land occupation.

Due to these threats many type and population of wildlife and aquatic organisms and ecosystem's parts are going to loss their proper function. So, the population of native species decreased.

The second is lack of existence of network parts. Although, due to above reasons, part's of habitats can not work properly, the distribution of network are inadequate.

Every year for migratory birds counting, experts survey 20 point in the province. 9 of 20 surveying points are including under-management areas and it covered 45 percent of province. Meanwhile these 20 points are distributed in 70 percent of the areas that can attract migratory birds. So, between the networks there isn't secure corridor for bird's safe flight during the day and the wintering season.

So, for territorial biodiversity support in the province there is only two conserved areas that located in the western part of the province. In this case there is not any supporting area in southern, eastern and central part of the Guilan. Although in eastern part there are two semi-management areas for prohibition from haunting, this is not guaranteeing the biodiversity support. In general view for species diversity support, it needed to support the ecosystems and its diversity.

Finally and the most important one are threats in non- and semi-managed areas. In these areas, there isn't a long adequate and proper plan for land use and the threats are too vary. A survey on population statistics in Guilan in the years of 1966, 1976, 1986 and 1996 show that in each period there is growth rate about 22.26, 31.55 and 7.72 percent. The profile of the population shows that the youngest people have more population. They are 14.4% in 10-14, 11.87% in 5-9 and 11.74% in 15-19 years old and other have less density (Fig. 13). In other hand ethics of living changed from past years. In 1966, 1976, 1986 and 1996 population of each family (folk) was 5.2, 5.18, 5.00, and 4.37 in the same time number of each family (household) in each separated house were 5.45, 3.04, 1.68 and 1.14 (Fig. 14). These

data describe that the people are going to make small and separated family. By this reason building more new houses in more lands will be increased and the number of cities from 10 in 1966 reaches to 45 in 2001. So, number of villages in the year of 2001, was 2864. This shows that we are going to develop cities in land and connect cities and villages to each other in order to make big cities like Tehran (picture 10). In this process we loss land for city and road construction and other human services. Although need of the food increase were obvious during the past years, the agricultural land didn't increase much according to statistics. In 1986 total surface for rice farm was 220000 ha and in 2001 there is 230000 ha. The differences is not too much but chemical fertilizers consumption has another and different story.

A survey on chemical fertilizer consumption volume in the same years shows that total use from 64146 ton in 1986 raised to 100884.41 ton in 2001. The main cause for this 57.27% growth is related to the harmful function of these chemical fertilizers to soil body and high consumption of these materials is the main problem for Eutrophication in aquatic ecosystem, and its related problems.

For the forest in Guilan department of the natural resource prepared several plans for 377000 ha of 565000 ha total surface (Fig.15). These plans will allow governmental and private companies to harvest trees and reforestation.

For these plans, department of the natural resources constructed more than 1300 Km, repaired 1800 Km and studied 1000 Km of forest roads (Fig. 16, picture 11). It can allow illegal haunter to reach to forest's wildlife for haunting. This will surround and limit the habitats. Wildlife those are too sensitive to man existence and habitat destruction will migrate to other places and will loss their population and diversity.

Total surface of grassland, 224000 ha had not changed, but number of cattle sheep increased a lot according to data and statistics from 1974. In 1974, there was only 1654 license for people to have 95000 sheep on grassland and now it reaches to 11834 license for 679704 sheep (Fig. 17,18). Although, it has small gap to reach to capacity of grassland but existence of 1.5 million of sheep describe that there is not good and effective enforcement in the grasslands and for wildlife usage they didn't separated places for grazing.

During past 31 years, mining hare increased from 23 active stations in 1970 to 128 in 2001. These include mountains and rivers mining station. Mining is possible to be harmful for habitat and wildlife. Mining can destroy the habitat in general and specially fish migration and change the physical and chemical situations of the water in watershed area and aquatic ecosystems. In the mountain, explosion and other mining related activities can disturb the wildlife, destroy the habitat and make pollution for soil and water.

Guilan has not a big and major industry except Chouka that products wood and paper. However number of small industries increased from 214 in 1970 to 2260 in 2001. Due to economic conditions, there was many problems regarded to waste water that it is controlled in the past 5 years.

Road networks increased too. Statistics describe that in years of 1974, 1987, 1997 and 2001 total length of road were 1428, 2902, 6840 and 8165 Km. These development are include 6838.9 Km of villages access road in all over the Guilan's area in 2001. This can make an access to wildlife and habitat, develop the target location, both side of the road in economic and social aspects and limits the habitats.

Solid waste (picture 12) and wastewater are another important threat on biodiversity. Surveys on solid and waste products show that each person produces 0.9 Kg of solid waste and 180 litter of wastewater per day. It describe that, every day people in all around the Guilan release 2017.7 ton of solid and 403541 cubic meter of wastewater into the nature. Meanwhile there is not any active treatment system for these environmental threat sources in the area.

Poverty, low income and inadequate people's environmental ethics are the main cause for the harvesting from different kind of natural resources including wildlife and habitat's parts.

Exotic species that introduced from other ecosystems and countries made many problems for habitats and species. Food competition, habitat destruction (picture 13,14) decreases in native wildlife population, chemical and physical conditions changing and destroying of ecological regulation are the main functions of exotic species in the province.

7 - Conclusion

As mentioned in the forgoing the ecosystems and its parts can't support the biodiversity in non-, semi and under-management areas. For these reasons, the latest survey in Guilan published by DOE-Guilan provincial office in Rasht determined that one aquatic species, *Salmo trutta caspius,* removed from Guilan rivers and is very rare now. So, 17 species of mammals, 14 species of birds are on endangered list of the region. A non-official report says that 4 species of fishes are on endangered list.

Obviously when there is no complete network in its existence and distribution and recover ecosystem parts, it is possible to lose more species. Therefore we need to solve the problems including decreasing on threats and establishment of the network for species diversity and its development. Ecosystem networking activities that those should be based on species behavior, biological and ecological characteristics can only do these actions. To reach these goals, the following actions should be taken.

1. Land use-planning program all around the province and its watershed area.
2. Population controlling.
3. Revising on natural resource using plan and projects.
4. Increasing in public awareness level and the encouragement of their participation.
5. Study, establishment, development, rehabilitation and recovery of the habitat conservation network.
6. Solid waste and wastewater management.
7. The replacement of chemical fertilizers by organic ones and development of the biological method for diseases control.
8. Quarantine plan preparation for native species conservation from exotic ones.
9. Mining is necessary for development and could be on mountain with environmental regulations and the ban of harvesting from rivers.
10. More environmental control by DOE and the start of monitoring and surveying plans and programs.

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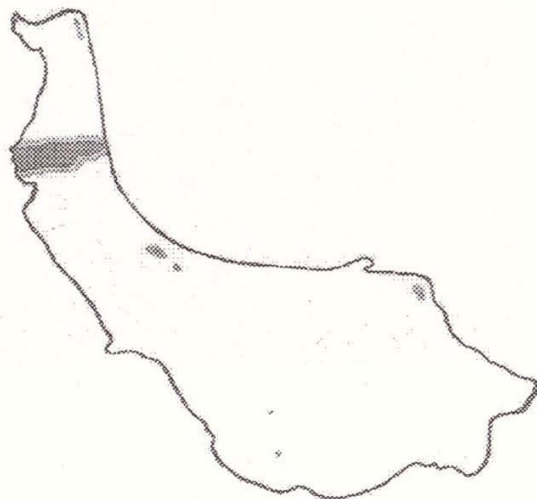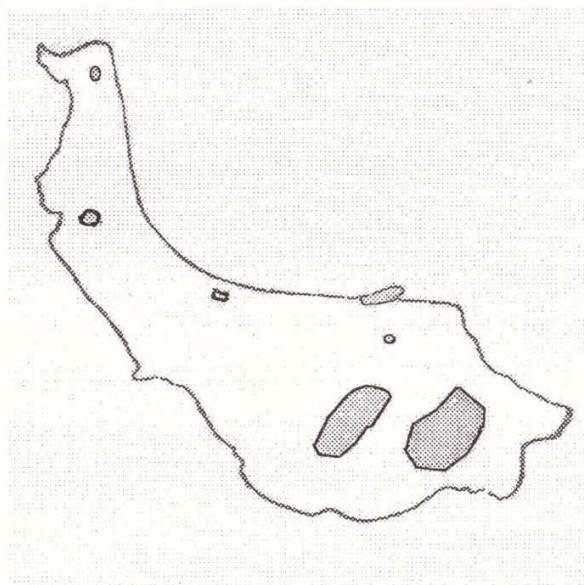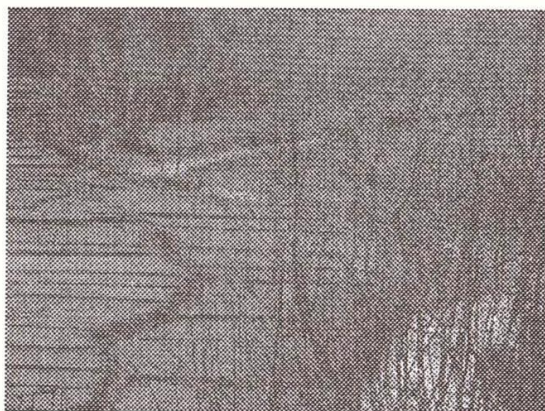
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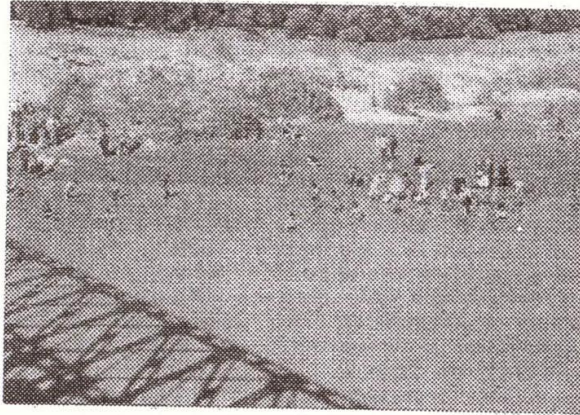
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Illegal fishing in rivers
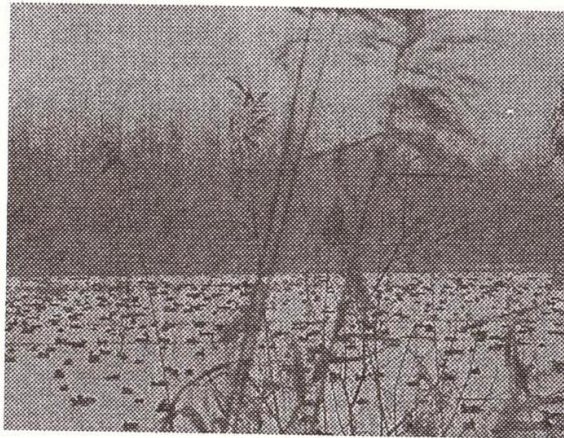
Picture 2
Birds igration

Picture 3
Fully managed area

Picture 4
Semi-managed area

Picture 5
Agricultural activities
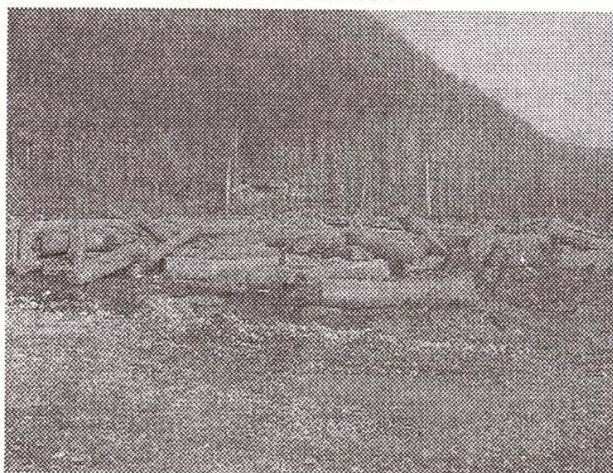
Picture 6
Forest harvesting

S.L : 23 cm
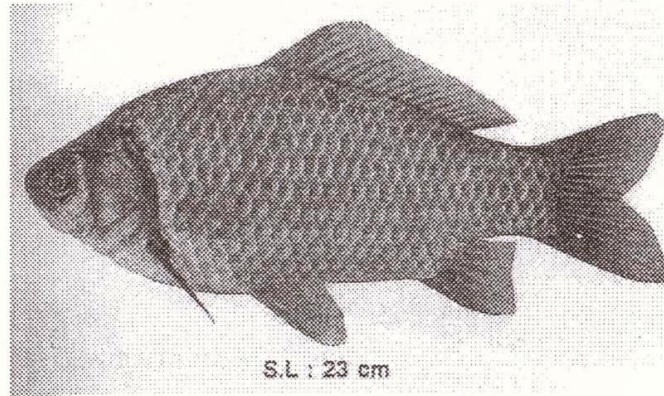
Picture 7
Carassius auratus jibelio
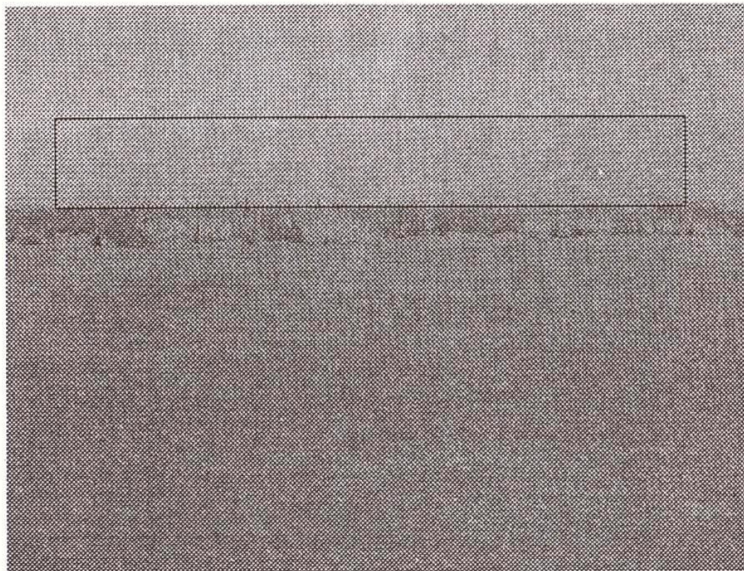
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Azola
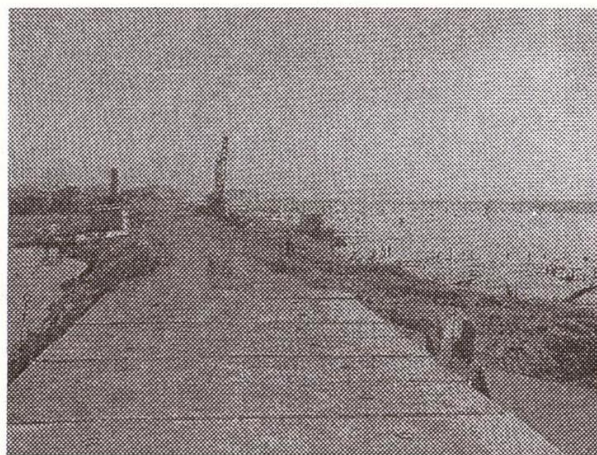
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Road construction
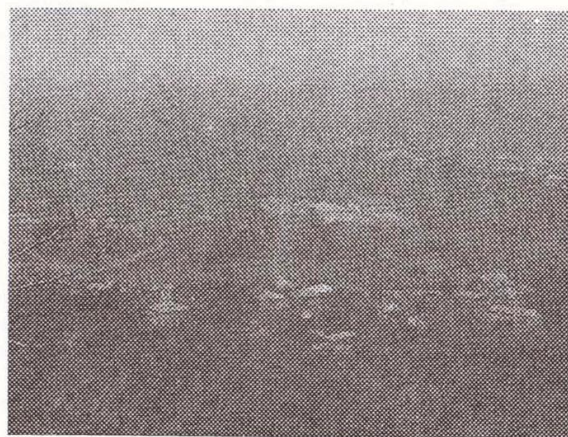
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Development of cities
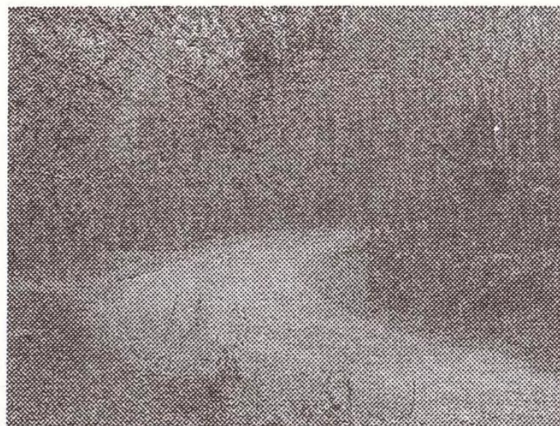
Picture 11
Forest access road

Picture 12
Solid waste

Picture 13
Land use change

Picture 14
Land use change