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Introduction

Journal of Environmental Biology is a broad-based, peer-reviewed, leading International Journal, and publishes original research papers dealing with all aspects of Environmental Sciences, Environmental Engineering, Environmental Pollution, Environmental Biotechnology, Toxicology, Forestry and related fields -- in English language. The Journal was started in year 1980 by Dr. R.C. Dalela, and is now rated as one of the leading research journals of the field, covered by most of the Abstracting and Indexing services of the world.

It is of special interest to: Toxicologists, Pharmacologists, Zoologists, Botanists, Ecologists, Microbiologists, Environmental Scientists, Biotechnologists, Industry R&D Organizations, and others engaged in Environmental Research.

The Journal is published bimonthly with six issues in a year: January, March, May, July, September, and November, and contains Research Papers, Short Communications and Review Papers. All the papers are reviewed by a panel of reviewers for their scientific merit. The manuscript decisions are solely based on the results of peer reviews, and in order to eliminate any bias, reviewers are sent the manuscripts with a blind title page.

Rankings

Current rankings of the Journal of Environmental Biology across various standard journal metrics are as follows:

Journal Metric	Current Ranking
SCImago Journal Rank indicator (**SJR**)	0.48
ISI Impact Factor	0.64
NAAS rating	6.00

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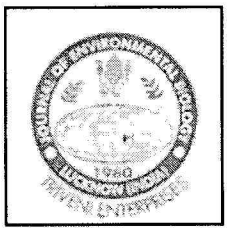

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Temporal changes of land use in asi river delta (Hatay, Southern Turkey)

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Abstract

Increasing non-ecological land use necessitates more efficient using and utilization of land by man. Therefore, in recent years studies on sustainable land use have gained momentum. In this study, temporal change in land use, mainly between years 1940 and 2010, in Asi river delta on Southern Turkey was covered. To this end, in addition to literature, topographical maps and satellite images from year 1940 and after were used. Also, data were collected through field studies and interviews. Collected data were evaluated from geographical viewpoint using Geographical information system (GIS) and Remote sensing (RS) methods. Unplanned settlement in delta has reached levels high enough to threaten agricultural fields. Especially great tendency shown by Samandag city and the villages around it towards expanding into delta is an indicator of this threat. In addition, uncontrolled sand mining and touristic facilities on the coastline are also indicators of wrong land use. In future, direction of settlement to slopes around the delta rather than lowlands will be a much more ecological approach.

Key words

Land use, Geographical information systems (GIS), Remote sensing (RS), Asi river delta (Hatay, South Turkey)

Introduction

Check (1)

Man has sheltered in suitable dens, caves and tree hollows in natural landscape since time immemorial. First surviving by gathering, later man discovered fire, and started hunting with stone tools and weapons. Thus, interfering with the landscape with fire and tools, man has created a cultural landscaping, albeit small in scale. Later, by invention of plough and beginning of agriculture man started settled life. This way, man has increased the level of interference towards landscape and expanded the borders of cultural landscaping (Palacios *et al.*, 2001). Therefore, it can be said man has carried on developing cultural landscaping in harmony with general natural landscape until industrial revolution. However, after industrial revolution, it is seen that man's interference in nature took an "exploit of nature" approach, and gave rise to a cultural

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Abstract

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Introduction

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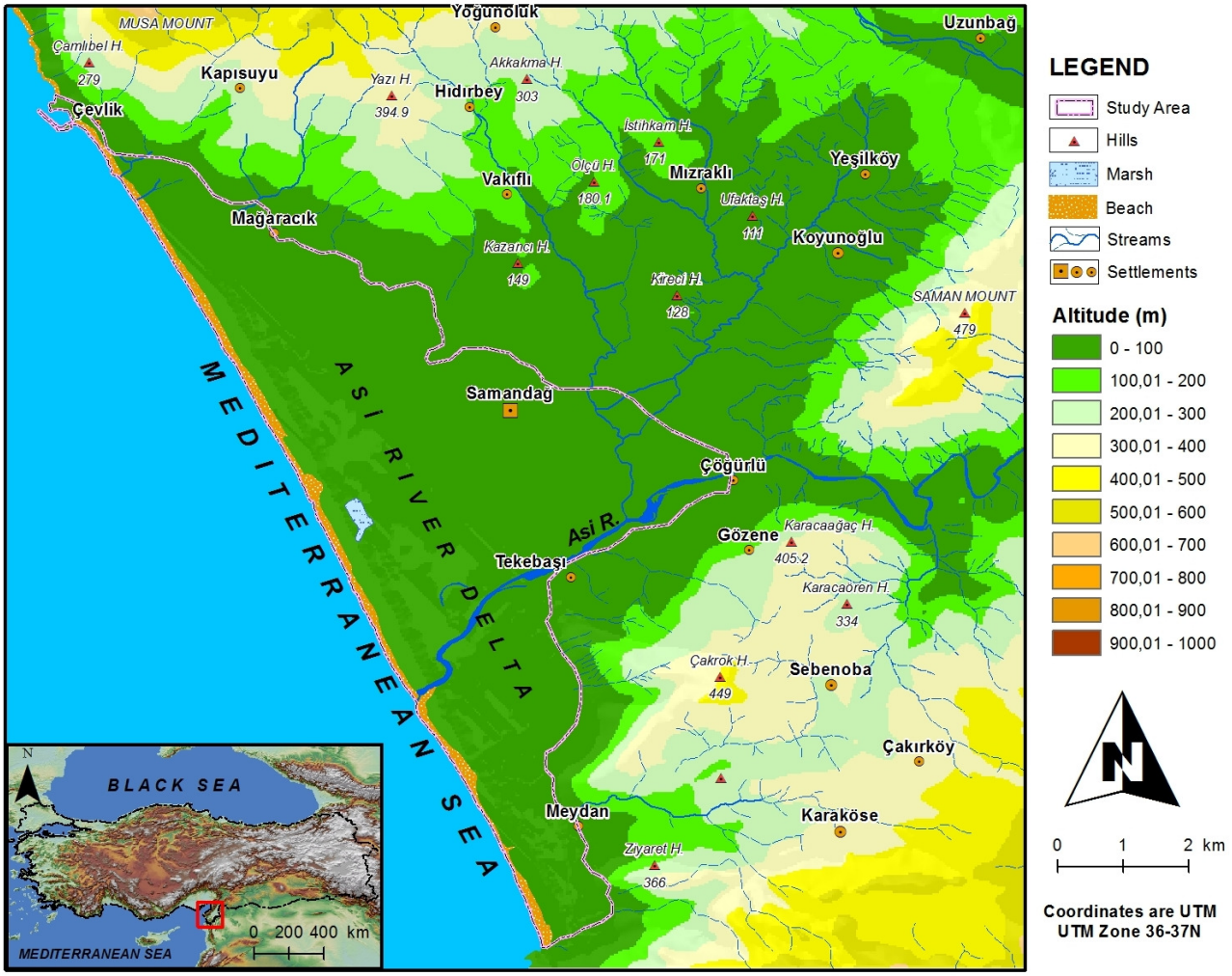

Fig. 1: Location map of Asi river delta



Fig. 2: A view from Asi river delta (north-south) (1- Keldag, 2- Kuseyr plateau, 3- Samandag city, 4- Delta plain, 5- Mediterranean Sea)

landscaping incompatible with natural landscape. This has brought many environmental problems together with it.

The rapid population growth seen all over the world especially in recent years and the wrong use of lands have become the main factor for the destruction of environment (Erlich, 1988). The destruction of natural forces and the environment takes place in higher levels in developing countries than in developed countries depending on the level of knowledge and the population growth that is much more rapid (Feoli, 2002). Also the developments made in technology in the last few centuries have caused the humans to increasingly change the natural environment (Goude, 1990; Ekinci, 2004).

Mediterranean basin also has its share of negative results of the human activities lately. This basin has been subject to human effects for thousands of years and has been one of the areas where these effects have been felt intensively (Thornes, 1996; Tzatzanis *et al*., 2003; Irshad *et al.*, 2007; Efe, 2005; Efe *et al.*, 2008). In this study, the temporal change in the use of land in Asi river delta which comprises all of the settlement process in East Mediterranean basin mentioned above has been dealt with and evaluated in terms of sustainable land use.

Materials and Methods

Information on land use between Paleolithic age and 1930's was obtained from archeological digs, remains and literature as well as paleogeographical characteristics. Information belonging to 1930-1960 period was produced through literature, interviews and field studies. Land use data from more recent dates were obtained mainly from satellite images and field studies. The satellite images used (Landsat TM and ETM+) were dated on 24/08/1985, 01/10/1987, 22/06/2000 and 26/06/2007. Classification of satellite images was done with Erdas Imagine 8.7 program by supervised classification method. According to these, four land cover classes were determined as settlement area, agricultural field, forest area and open area (consists of unused areas like the areas where base rock is on the surface, non-vegetated areas, coasts, swamps *etc.*). After that, accuracy of classification was tested by field tests, topographical maps and digital maps. The data obtained through these steps were processed by ArcMap 9.2 program to form related maps.

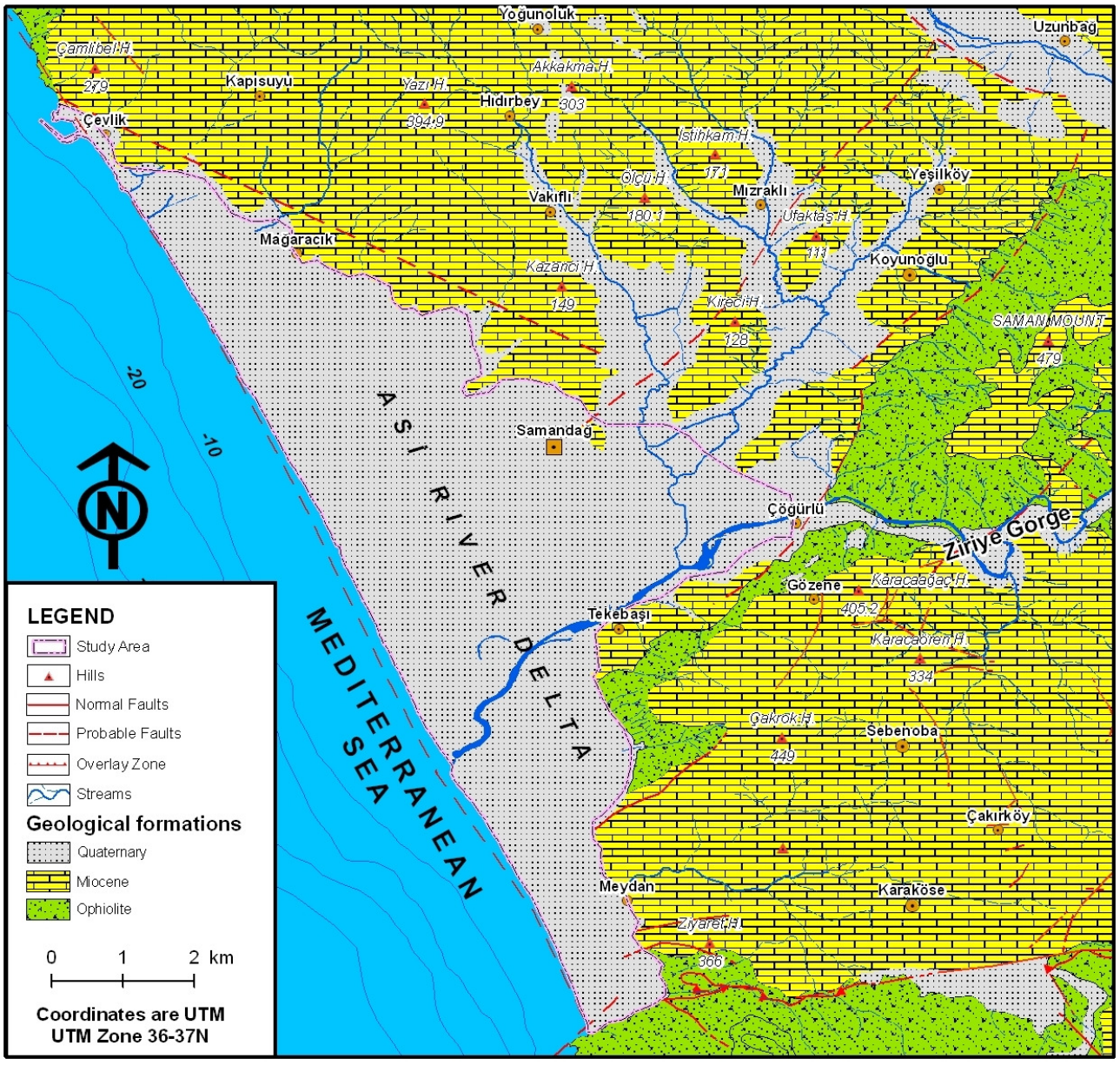

Fig. 3: Geological map of Asi river delta and its surroundings

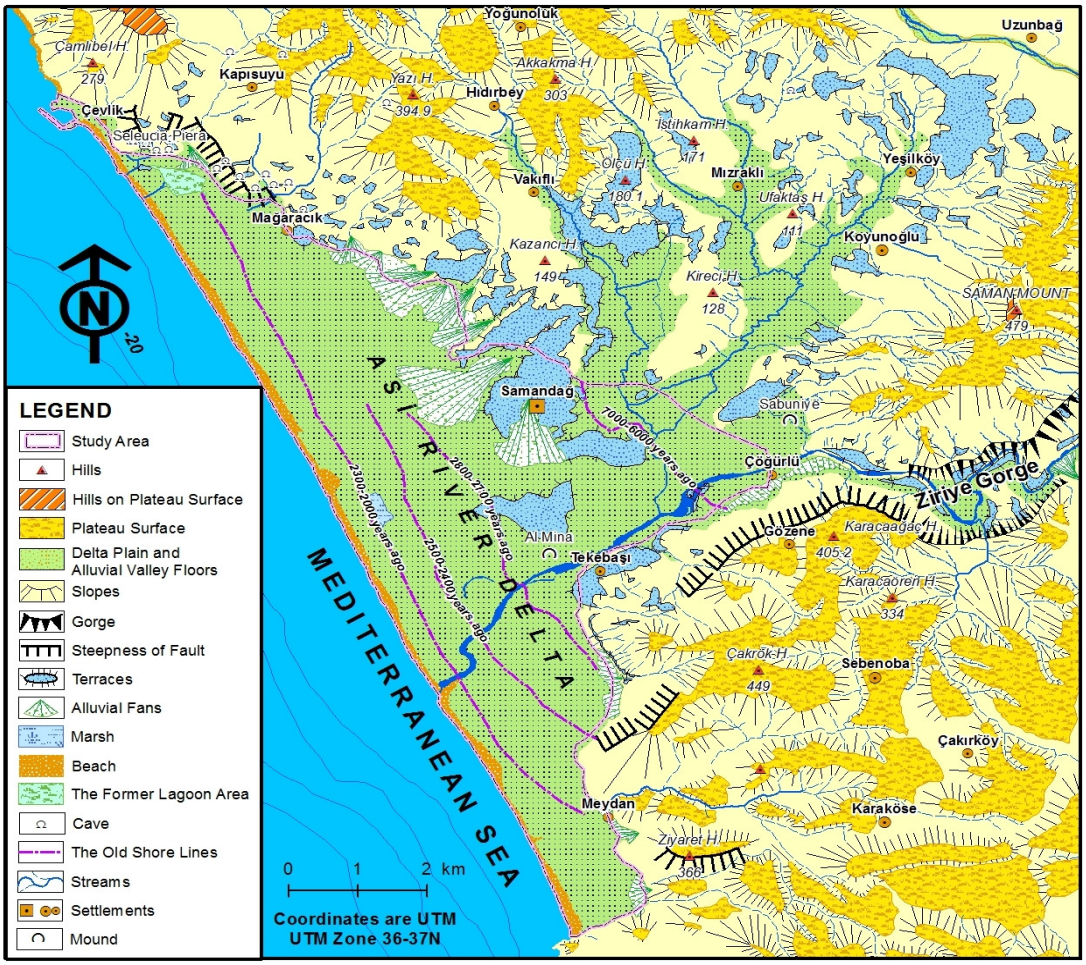

Fig. 4: Geomorphological map of Asi river delta and its surroundings

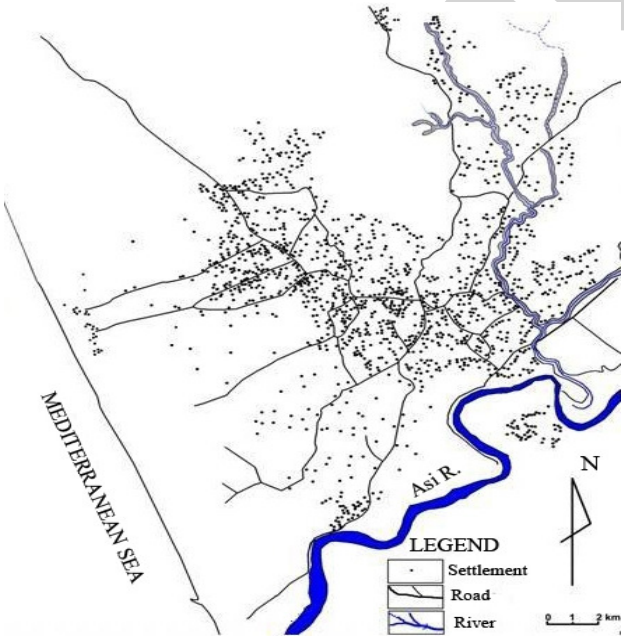

Fig. 5: Settlement pattern of Samandag in 1960.

Results and Discussions

General characteristics of Asi river delta: Asi river delta which is in borders of Hatay province forms the delta plain in southernmost of Turkey. The plain is surrounded by Mt. Musa forming southernmost tip of Amanos mountain range at the north, Mt. Saman and Mt. Ziyaret in the east and Keldag (Mt. Kilic) in the south and on the west, the plain is bordered by Mediterranean sea (Fig. 1).

The Asi river forming the delta, heads out of its source at Lebanon mountains and passes Syrian lands following graben area formed by Dead sea fault line to the north. The river enters Turkey border nearby Esrefli village. After keeping its northward flow through Amik plain, the river heads toward south-southwest with an arch. Showing a wide flow base in Amik plain, the river follows a distinctive valley in Antakya-Samandag Graben after passing Antakya, and passing Ziriye Gorge between Mt. Saman and Mt. Ziyaret flows into Mediterranean sea at southwest of Samandag. The river forms a triangular delta at this flow out point by it sediments content with the long edge of triangle resting on coastline. The northwest-southeast length of this delta is approximately 15 km and east-west width is approximately 6 km (Fig. 2).

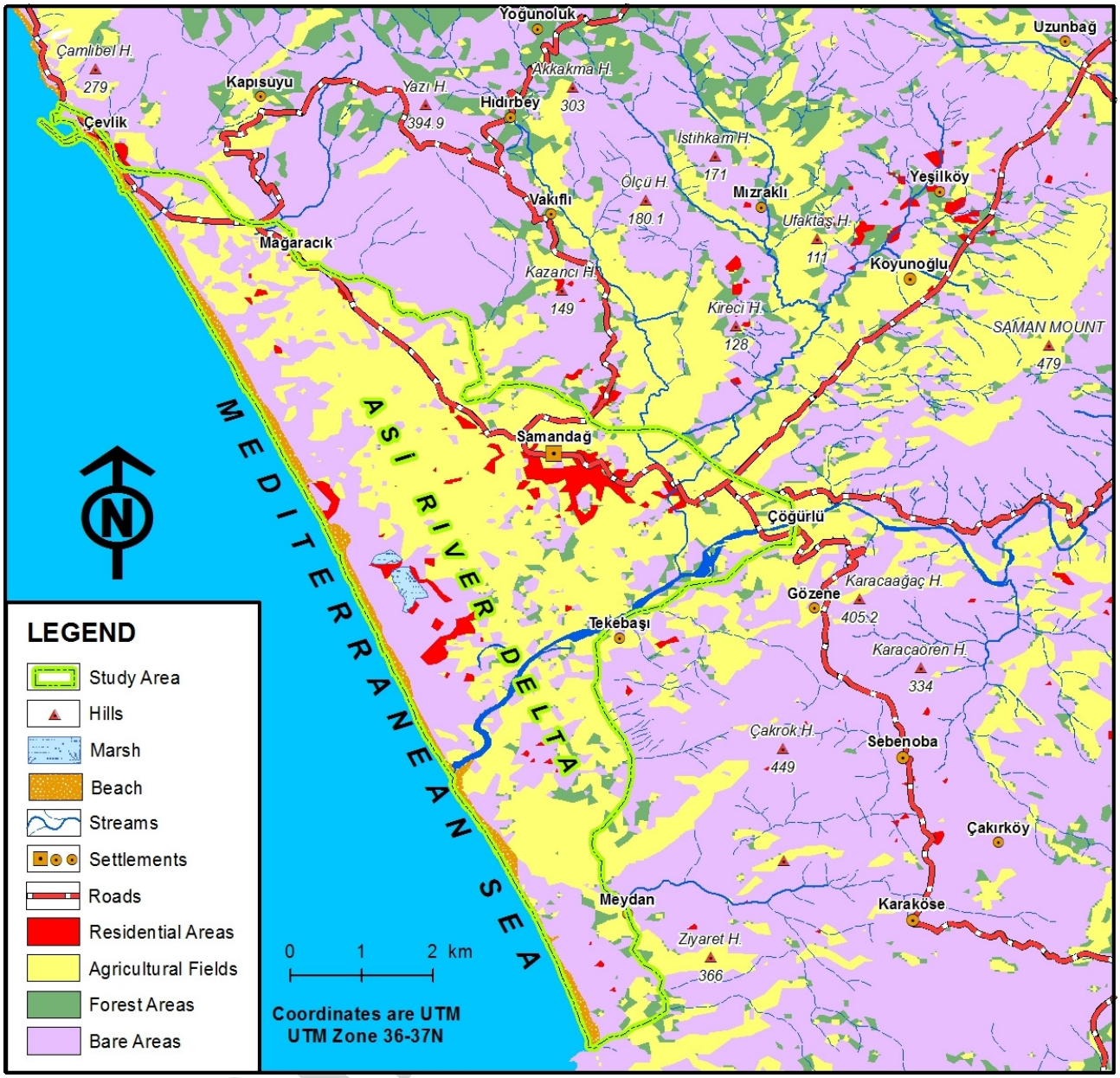

Fig. 6: Land use map of Asi river delta in 1987

Amanos mountains surrounding Asi river delta from the north carry both anticlinal and horst characteristics and are based on Paleozoic units. However, the base of Mt. Musa just north of the delta is formed by Upper Cretaceous period allochthonous ophiolites (mainly serpentines). Over that are Miocene (Helvetian) limestone layers plunging under younger sediments towards southeast with 15-25° inclinations (Fig. 3). Many caves with evidence Paleolithic settlement have developed on the fault line vertical formed by northwest facing layer front of these lime stone layers (Erol, 1963).

Base of Keldag Mt. Ziyaret to the southeast of the delta is formed by Mesozoic limestone and Upper Cretaceous ophiolites. Over these are limestone, claystone, marl and gypsum from Miocene period. On passage from the delta to Keldag Mt. Ziyaret ridge layer verticals of younger fault lines and limestone layer almost exhibit a stair pattern (Fig. 3).

To east and northeast of the delta, Antakya-Samandag Graben which also include Asi river is mainly formed of Pliocene sandstone, marl, claystone and conglomerate patterns.

Quaternary units cover quite a wide area along the delta zone, bases of streams flowing into the delta and lower slopes ridges surrounding the delta. These units consist of alluvium, slope detritus and alluvial cones.



Fig. 7: Units in and around Yesilada district. (1: Asi river, 2: Yesilada district, 3: Detached bend, 4: Samandag settlement, 5: Agricultural fields, 6: Non-agricultural fields)

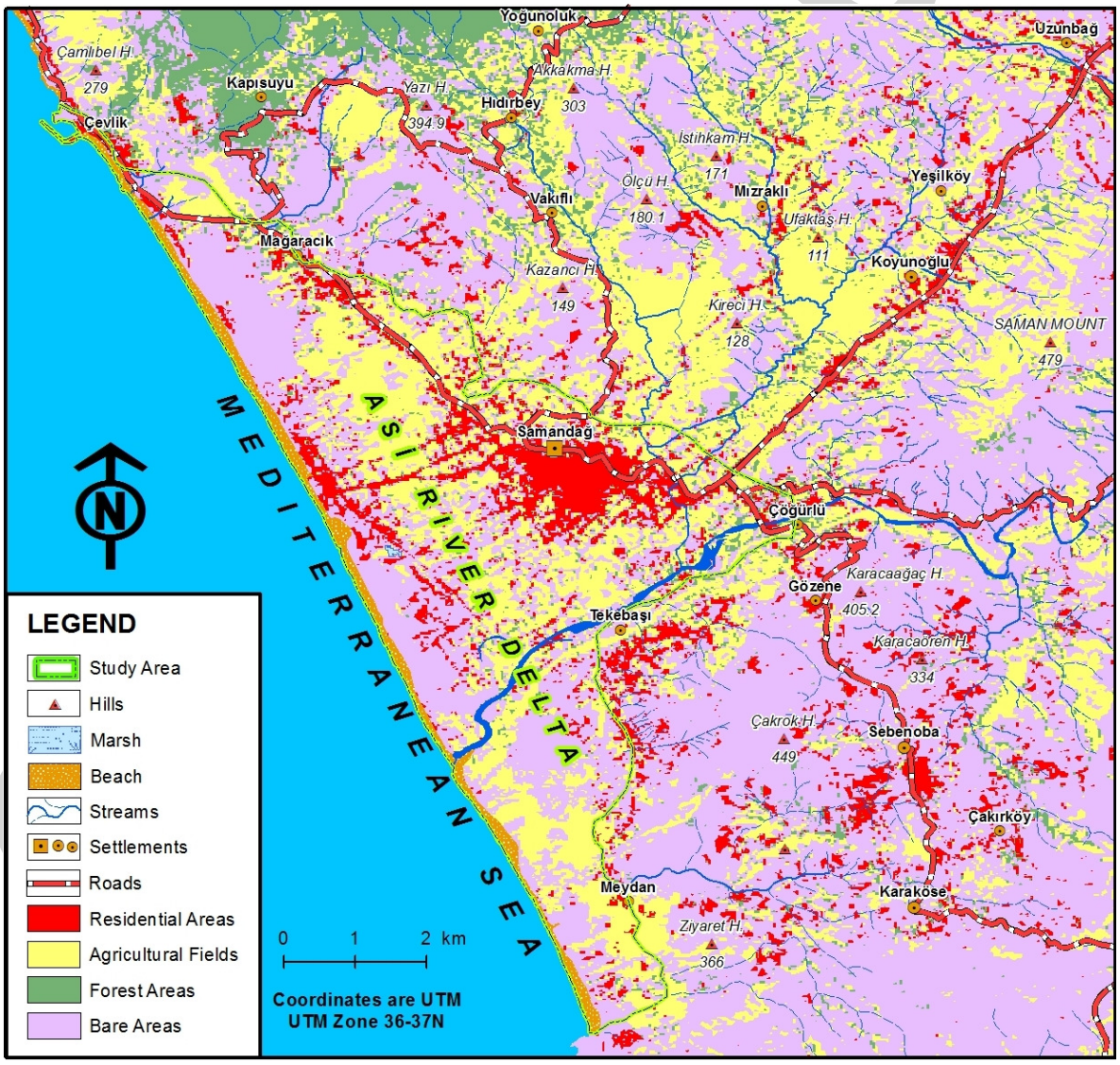

Fig. 8: Land use map of Asi river delta in 2000

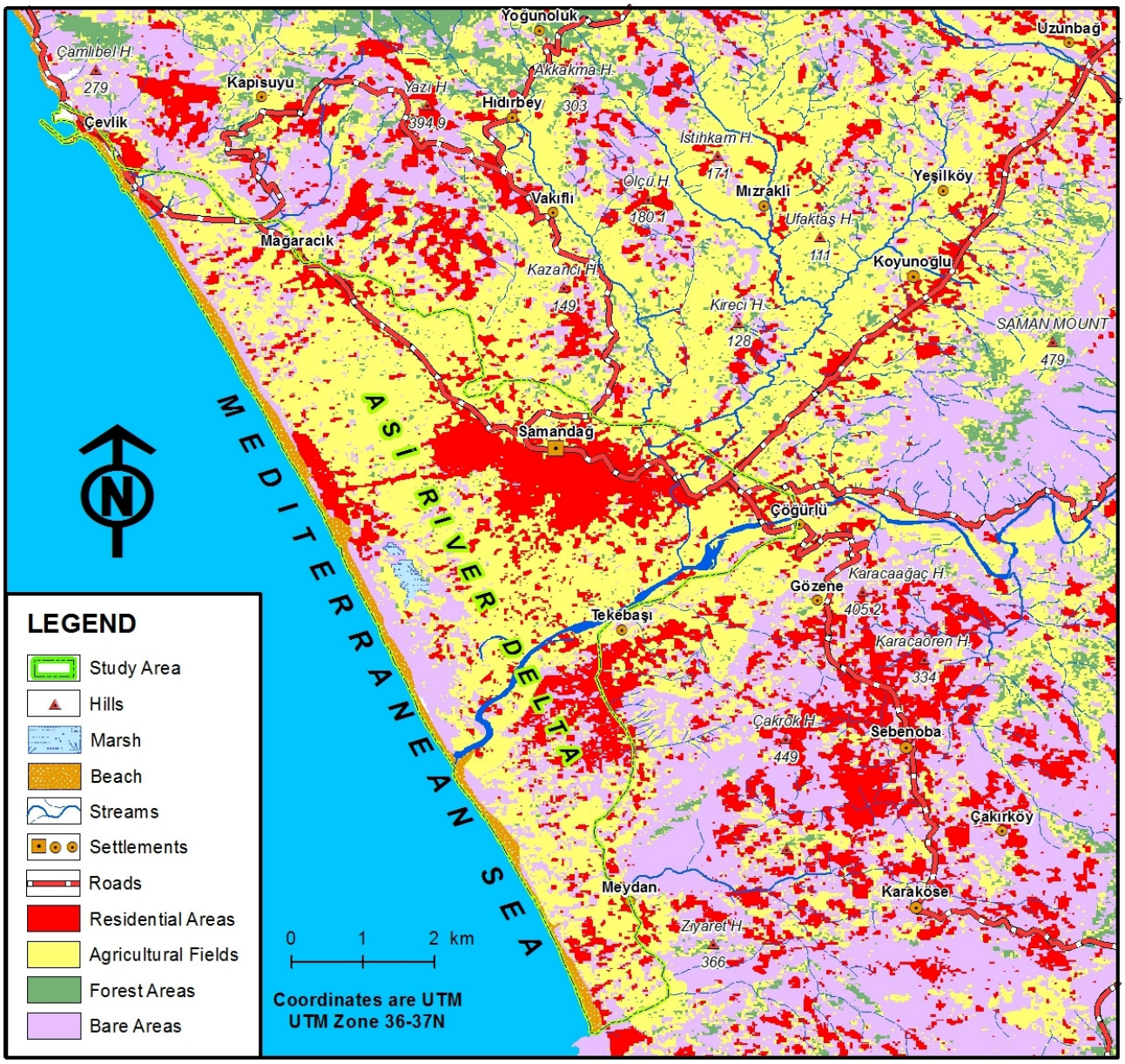

Fig. 9: Land use map oa Asi river delta in 2007

It can be said that tectonic is determinative in formation and shaping of the area containing the delta. A sheer vertical connects sea and Amanos mountains (Mt. Musa) north of the delta. This straight and steep slope with northwest-southeast bearing indicates a fault line reaching up to the north of Samandag by very nearly vertically intersecting ridge axis and Antakya-Samandag Graben at the northeast of the plain (Fig. 4). Again, the connection between Antakya-Samandag Graben and the delta has a steep inclination. At this sea-facing edge of the graben, Neogene units are suddenly interrupted on a single line. This indicates connection from graben to the delta is faulted. In addition, Keldag Mt. Ziyaret to the southeast of the delta is also separated from plain base with fault verticals and high slopes (Erol, 1963; Öner, 2008). The fault lines in question forms a tectonic depression in which Asi river delta has developed. By accumulating its sediments content in this depression after its passage through Ziriye Gorge, Asi river has formed the delta we see today (Fig. 4).

In formation and development of Asi river delta eustatic movement had an effect as well as tectonic movements. Sea level changes at Pleistocene and Holocene can be seen from marine terracing on and behind the delta. As a result of +2.5 m rise in sea level connected to Flandrien transgression (Erol, 1963) after last glacial age (Würm) epoch delta plain have been flooded and coast line progressed up to the area between Sabuniye and Al Mina mounds. Thus, area of Asi river delta has been transformed into a gulf at the beginning of Holocene. Starting from middle Holocene, Asi river and small streams around the delta have forced the coastline



Fig. 10: Land use in south section of Asi river delta (1: Vacation complex, 2: Orchard and Garden areas,3: Abandoned vacation complex, 4: Greenhouses)

back towards the sea by filling shallow coast zone of this gulf with their sediment content and caused the delta's shaping process into its present shape (Öner, 2008). While on the one hand delta area was being filled with sediments during this process, on the other hand a littoral cordon with a height of 2-3.5 m and a width of 150-200 m has developed behind the present 50-150 m wide coast line. This current littorel is totally formed a product of marine accumulation (Erol, 1963). The lagoon area formed behind the coast line has been terrastrialized by sediment filling and elevated by sysmotectonic movements to form the present delta plain. The sysmotectonic event between 800 and 500 B.C. has distorted and elevated the shoreline from 1.2 m to almost 2.2 m in south and from 1.7 m to 2.2 m in north. In addition, a sysmotectonic movement that took place in 526 A.D. has caused the shoreline to elevate a uniformly 0.7-0.8 m (Pirazzoli *et al*., 1993). Passing through the lagoon which was terrastrialized as defined above, the Asi river has developed an accumulation plain around its bed. Bed changes on Asi river were observed from time to time on this stream accumulation plain. Also, alluvial cones and fans of various sizes formed by streams flowing down the slopes surrounding the delta was observed (Fig. 4).

Another significant characteristic of Asi river delta is the fact that the delta has not progressed into sea much. Shoreline is observed to have a straight lay except at river mouth area and delta is observed to develop towards north asymmetrically. Two factors affect this condition. First of these is the fact that delta is developing in a tectonic depression area formed by fault lines. Since Asi river and small streams around the delta have filled this depression area with their sediment content first, the delta has not been able to develop much towards the sea. Second reason is the flow caused by prevailing winds among the shoreline. Annual prevailing wind direction at Samandag is southwest. However, in winter, prevailing wind direction changes to northeast, while it stays toward southwest in other seasons (Korkmaz, 2009). Southwest directed winds mainly blowing from sea to land causes a northwest directed flow at the shoreline (Erol, 1963). As a result of this, sediment content of Asi river is carried not towards the sea, but to north, towards Çevlik area. Thus, the delta presents an asymmetrical development towards north of Asi river.

Temporal changes of land use in Asi river delta: From Paleolithic period to present day, Asi river delta has presented a lively and productive settlement area. Delta's climate, geopolitical characteristics and geomorphologic development are factors in this situation as well as its unique position forming a passage point between Anatolia, Levant shores, North Syria-Mesopotamia and Aegean area. In connection to this, various land uses have been observed in the delta at different times. Land use at delta is studied by dividing the timeline into periods like Paleolithic to Archaic, Ottoman, 1930-60, 1960-90, 1990-2000, 2000-2010.

Paleolithic to Archaic period: First evidence of human life in the vicinity of delta is seen north of Magaracik village, in caves carved out from Helvetian limestone Pleistocene fault line vertical by waves of Mediterranean sea (Fig. 3). The evidence from Paleolithic period shows that in prehistoric times these south and sea-facing caves were ideal settlement areas (Erol, 1963).

First settlement in the area started in Bronze age. Sabuniye mound in the borders of today's Sutasi village was the oldest settlement (Middle and Late Bronze age) (Yener *et al*., 2000; 2002). Even at the period when the sea had intruded into delta the most in the middle holocene, shoreline had stayed behind this area (Fig. 4). Thus, Sabuniye mound is not a shore settlement, but a settlement found in close proximity with shore, Asi river and Asi river's mouth. This location of the mound has enabled the people who lived here to control passage to upcountry from Mediterranean Sea, to benefit from the forests of higher regions, to fish and hunt in fresh and salt water and shore marshes, and to perform agricultural activities on the delta (Öner, 2008).

Located near Asi river 1.6 km inland on the delta, Al Mina (8th B.C to 4th A.D.) is an important harbour settlement since Iron age (Pamir, 2009). The fact that Al Mina is a harbour settlement also indicates that at that period the shoreline was passing through this point (Fig. 3). However, losing its proximity to shore by expansion of delta plains and its proximity to river by a possible riverbed change, Al Mina has lost its importance (Öner, 2008).

Another old settlement in vicinity of the delta is Seleucia Pieria (4th B.C. – 5th A.D.). This settlement was founded in 300 B.C. by Seleukos, the first capital of Seleukid kingdom at the northern tip of delta, on a mountain slope of limestone. In Hellenistic and Rome periods, Seleucia had gained prominence as a harbour city (Yener *et al*., 2000; 2002). Today in ruins, this harbour developed in parallel to development of the city and delta (Fig. 3). Antic harbour was arranged as a close port by enclosure of marine environment by ramparts. Sea connection from the harbour was provided by a harbour mouth at the southwest corner. Kapisuyu stream flowed into the antic harbour area which is 250 m inland today. The sediment content of this stream and waves caused the harbour to become shallow and cut off its connection to sea. In response to this, first harbour mouth was closed and a new canal opened to the north of harbour to keep connection with the sea. When it was seen that this too did not prevent the harbour from getting shallow, Kapisuyu stream was discharged to today's Çevlik area by construction of tunnels, canals and interception screens between years 62 A.D. and 74 A.D. when required a lot of effort at that period. It was seen that total length of these tunnels and canals was 716 m, with a width of 6.1-7 m, and the interception screens were constructed with 2 m width and 14 m height. 130 m of tunnel was built by excavation of base rock and canals were built by shallowing the base and building walls on the sides. When none of these efforts could stop harbour from getting shallow, a new open port was built at Çevlik. Whereupon, the open port was used for large vessels' docking and closed port was started to be used for smaller vessels (Yener *et al*., 2002). Despite all efforts, Seleucia Pieria port became obsolete starting from 5th A.D. century as a result of territorialization it suffered constant expansion of Asi river delta and sysmotectonism. Today, central areas of antic port have become marshlands and these lands have been turned into agricultural field by locals by soil filling.

Other than the oldest settlements above, 52 other archeological settlements were found during archeological ground surveys. Most of these settlements consist of Roman and Byzantine period farm settlements and rock tombs connected to these on the slopes facing the delta (Yener *et al*., 2002).

Ottoman period: After Seleukids left the limelight of history by terratorialization of Seleucia Pieria port, Antic city had lost its importance and existed as a village settlement on a marine terrace south of its original location until the beginning of 20th century. This settlement obtained municipality organization under the name Süveydiye in 1909 and kept its township status until 1948. Settlement was under French rule between 1918 and 1938, and joined Turkey at in 1939. Süveydiye became a county in 1948 and its name was changed to Samandag.

No detailed information could be found on land use in Asi river delta during Ottoman period. However, information on population and silk farming could be found. According to this, Süveydiye was a small village in 16th century. Based on military records Süveydiye had 25 and Zeytuniye (Cemal Gürsel district today) had 52 households in this period (Cakar, 2003). In consideration of population, Süveydiye had a population of 136% and Cüdeyde village (today Cigdede district of Samandag) between Samandag and Magaracik had a population of 67% (Kuscu, 2008).

1930-60 period: While the early settlements were mainly situated on alluvial cones and fans among delta margin, after 1930's settlements started to expand toward delta area. On the delta plain, olive groves and grain farming was evident on the areas without irrigation. However, since water from Asi river could be easily carried to delta plain by water wheel and wooden gullies called "zikir" a great portion of plain was irrigated. In irrigated fields vegetable and fruit farming was carried out, which brought more income than grain. Also, at the perimeter of vegetable and fruit gardens in the inland sections of the delta mulberry trees were planted and houses were starting to be built among these gardens (Turkmen, 1937). In connection to these mulberry groves silk farming activities were carried out. In this period, old riverbed areas and detached bends filled by water and surrounded by reeds and wattles are evident. Again another type of unused land in the delta in this period was vegetation covering old shoreline and small marsh and reed zones right behind it.

The most distinctive change of land use in delta in 1930-60 period was the beginning of expansion toward the delta area and shoreline. However, Samandag settlement pattern in this period was observed to be infrequent and quite separated (Fig. 5). In this,

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Table - 1: Land use categories and percents from 1987 to 2007 in Asi river delta

Land use	1987		Change (%)	2000		Change (%)	2007		Total change (%)
	km^2	%		km^2			km^2	%	
Residential areas	1.3	4.3	12.7	5.1	17	6.7	7.1	23.7	19.3
Agricultural fields	18.2	60.7	-25.7	10.5	35	21.3	16.9	56.3	-4.3
Forest areas	0	0.0	3.0	0.9	3	-1.7	0.4	1.3	1.3
Bare areas	10.5	35.0	10.0	13.5	45	-26.3	5.6	18.7	-16.3
Total	30.0	100.0		30.0	100.0		30,0	100.0	

the predominant economic activity agriculture was also a factor. Especially, the settlements in the gardening areas were built inside these gardens where the economic activities were conducted. In the following periods settlement areas expanded vertically into empty spaces between these settlements instead of expanding towards the perimeter. In addition, in this period stream flood plains and alluvial cones were mainly used for vegetable-fruit gardening and other areas were used for field farming.

1960-90 period: According to a map compiled from 1987 satellite images it is evident that settlements in Asi river delta have not distinctively changed except Samandag (Fig. 6). It is remarkable that no new settlements are being built between Samandag City and Deniz and Yenimahalle districts. However, Samandag municipality has opened Deniz district to occupational construction by parcellation at 1960. Previously, a very small number of buildings were present in this area which also included municipality beach. After the parcellation a great increase was observed in construction of settlements, hotels, and public and private recreation facilities. Thus, in a short time open spaces between buildings on the two sides of the avenue that was opened parallel to shoreline and the area around this avenue was covered with settlements. In addition to this, by introduction of residents to different societies and cultures by work stays abroad and resulting rise in their economical status especially after 1975 caused a wide development in Samandag city, especially in Atatürk district. However, settlements like Tekebasi, Sutasi, Gözene, Meydan, Magaracik and Cevlik were observed as quite constricted area wise in this period.

Largest part in 1987 land use map of the delta was covered by agricultural fields. In this period, irrigated lands have expanded thanks to new irrigation facilities that entered service in 1987. Waters drawn from Asi river by Sutasi, Çögürlü and Kusalani pumping stations were distributed over plain by canals (Altinparmak, 2008). Vegetable and fruit was predominant in these irrigated areas. However, in this period a distinctive increase in greenhouse cultivation was observed.

Another striking characteristic in 1987 land use map was a 250-500 m large empty space between the old shoreline and agricultural fields. Since the ground water level was high and small marshes are seen in patches, this area was covered by reeds. Reeds were thick along north side of Asi river but quite scarce along the south side. The reeds in question were previously predominantly used in basket production, however today they are mostly put to use in ney production. In addition, these reeds prevents the sand and salt water carried by winds blowing from over the sea to reach agricultural fields.

Asi river's bed on the delta was altered after the flood of 1964. Afterwards, with the General Directorate of State Hydraulich Works (DSI) arrangements the river has been set into its current bed. Yesildag district has lost its connection to Tekebasi town after bed alteration and placed under Samandag jurisdiction to keep its physical integrity and prevent administrative problems (Fig. 7).

Other than these, sand mining businesses concentrating on seaside areas of the delta, old shoreline and beach areas are worthy of consideration (Ozaner, 1993). Sand mines operating under permits given by Special Provincial Administration have increased shore erosion and damaged ecosystem of shore in addition to visual pollution.

1990-2000 period: In this period settlements continued their expansion. According to land use map compiled from satellite images of year 2000 greatest expansion was observed at Samandag (Fig. 8). Especially gaining momentum after 1990, this expansion is most evident at Deniz and Yenimahalle districts. The open area between these districts and Samandag city center is completely filled. 5000 workers going abroad for work from Samandag city had an effect on this caliber of expansion in the settlement. It is observed that these workers either repaired their old houses or built new ones, and added a work place to their property (Kuþçu, 2008: 32). However, touristic facilities (hotels, diners-restaurants, cafes, etc.) and second settlements built in Deniz district for its close proximity to the beach also had an effect in expansion of settlement in this district. New settlements were built mostly in the gardens on plain, especially following the rise of greenhouse gardening. This way, greenhouse cultivation that required a lot of workmanship could be carried out with instant access and more efficiently, without any need for salaried workers. At the same time, non-greenhouse vegetable cultivation was also carried out around these houses.

The change in settlement pattern was not only observed in downtown area but also around Tekebasi, Sutasi, Meydan, Magaracik and Çevlik settlements (Fig. 8). The expansion in settlements was parallel to the population increase in the settlements in question. However, expansion of settlements on shoreline was not caused solely by population increase. Construction of summer homes, touristic and recreational facilities in this area also had an effect on the expansion. Also, the sand mining businesses along the shoreline kept operating illegally despite the bans placed in this period.

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Expansion of settlement areas in delta plain also caused agricultural fields to shrink (Fig. 8). This situation was observed most severely at settlements like Sutasi, Çögürlü, Tekebasi with very little agricultural fields. Increasing decrease in agricultural fields caused about 1,500 young people to go abroad to find jobs each season.

2000-2010 period: The most distinctive change in land use of delta in this period was shrinkage of agricultural fields while settlement areas kept expanding (Fig. 8 and 9). According to 2007 land use map, Samandag settlement area reached 1929.9 ha. 315 ha of this (16.3%) is high concentration settlement area, and settlement pattern was observed to be concentrated on central areas and rares out towards outlying areas. However, 549 ha of the settlement areas and agricultural fields were concentrically placed.

Expansion of settlement areas and decrease in agricultural fields compelled people to find alternative agriculture areas. Thus, an increase in agricultural fields at delta shoreline and the perimeter of delta was observed in the map compiled from satellite images of year 2007. Big parts of the empty area of the delta between beach and agricultural fields were reclaimed for agriculture. A similar case can be observed around Asi river bed, in vicinity of Çevlik and Meydan village (Fig. 10). The fact that agricultural fields opened in the northern part of the basin spread in unfavour of forest lands brought with it the decrease in forestland in the period of 2000-2010. These newly reclaimed lands were predominantly used for vegetable cultivation.

Another alternative agricultural field type was reclaimed by terracing the slopes surrounding the delta. Efforts were being made to render these narrow fields more productive by carrying more fertile soil from surrounding areas to these terraces. This method has gained momentum after the year 2000, and is being observed on many fields of surrounding delta. Recently, greenhousing also started on these areas previously used for gardening and vegetable cultivation.

Asi river delta, in last 23 years has experienced a rapid change. The largest change has been observed at the settlement areas. Settlement areas increased by 19.3 % from 1987 to 2007. However, other land uses types did not change much (Table 1, Fig.10).

On and around Asi river delta, where human life existed from Paleolithic period to present day, various land use forms have appeared dependent on climate, geological characteristics and geomorphologic development as well as geographical location. By the time eventhough changes to the pattern of land use, antropogenic pressure on the delta, especially settlement, has permanently increased.

To free the delta from this intense settlement pressure, settlement priority has to be directed to the slopes and slope sides among the perimeter of the delta. Also the settlement on the shoreline has to be brought into compliance with shore laws. Even planning and implementation of land use on the delta in accordance with these two criteria alone will provide a more ecological land use profile.

References

Altinparmak, M.: The importance of selecting the location for the pumping irrigation facilities and impacts on the rerformance: Misis, Erdemli, Samandag, Adana: 5th World Water Form Regional Process (2008).

Anomymous: Samandag municipality: Samandad revision construction plan, Analitic Etude, (1989).

Cakar, E.: 15th century in the Halep province (1516–1566), Elazig: Middle East Research Centre Press Nu.:1, (2003).

Efe, R.: Land degradation in Taurus mountains (Southern Turkey). European Geosciences Union, 2nd General Assembly, 24-29 April 2005, Wien, Austria. EGU-*Geophy. Res. Abstracts*, **7**, 922 (2005).

Efe, R., A. Soykan, S. Sönmez and I. Cürebal: Quantifying the effect of landuse change on olive tree cultivation in the vicinity of Edremit between 1979 and 2006 using GIS and RS techniques. *Fresenius Environ. Bull.,* **17,** 696-704 (2008).

Erlich, P.R.: The loss of diversity: Causes and consequences, biodiversity, Washington, DC.: National Academic Press (1988).

Erol, O.: Geomorphology of Asi river delta and quaternary sea river terraces, Ankara University, Language and History-Geography Faculty Press 148 (1963).

Feoli, E., L.G. Vuerich and W. Zerihun: Evaluation of environmental degradation in Northern Ethiopia using GIS to integrate vegetation, geomorphological, erosion and socio-economic factors. *Agric. Ecosys. Environ.*, **91**, 313-325 (2002).

Goude, A.: The human impact on the natural environment, Oxford: Basil Blackwell (1990).

Irshad, M., M. Inoue, M.A. Faridullah, H.K.M. Delower and A. Tsunekawa: Land desertification : An emerging threat to environment and food security of Pakistan. *J. Appl. Sci.*, **1**, 7 (2007).

Korkmaz, H.: Local climate impacts of lake Amik, Antakya: Mustafa Kemal University Publ. No: 22 (2009).

Öner, E.: Alluvial geomorphology and paleogeographical studieson the Asi (Orontes) delta plain (Antakya/HATAY). *Aegean Geograp. J.*, **17**, 1-25 (2008).

Ozaner, S.: Research of coastal erosion in Anamur-Kazanli (Mersin) and Samandag (Antakya) shores, Ankara: TÜBITAK DEBAG Project No. 62 (1993).

Palacios, M.R., B.J. Mabry, F. Nials, J.P. Holmlund, E. Miksa and O. Davis: Early irrigation systems in southestern Arizona: The ostracode perspective. *J. South Am. Earth Sci.*, **14**, 541-555 (2001).

Pamir, H.: Urbanization process in Hatay from Alalakh to Antioch, Mustafa Kemal University. *J. Soc. Sci. Inst.*, **6**, 12, 258-288 (2009).

Pirazzoli, P.A., J. Laborel, J.F. Saliege, O. Erol, I. Kayan and A. Person: Holocene raised shorelines on the Hatay coasts (Turkey): Palaeoecological and tectonic implications, (Trans.: I. Kayan), *Aegean Geograp. J.*, **7**, 43-77 (1993).

Thornes, J.: Desertification in the Mediterranean. *In*: Mediterranean desertification and land use (*Eds*.: J. Brandt ve J. Thornes). Chichester: Wiley. pp. 1-12 (1996).

Türkmen, A.F.: Extended Hatay History, Istanbul (1937).

Tzatzanis, M., T. Wrbkan and N. Sauberer: Landspace and vegetation responses to human impact in sandy coasts of Western Crete. *Greece J. Natssss Conserv*., **11**, 187-195 (2003).

Yener, A., T. Harrison and H. Pamir: Tell Atchana, The Oriental Institute 2001-2002 Annual Report, 13-19. Chicago: The Oriental Institute, **2**, 289-302 (2002).

Yener, K.A., C. Edens, T.P. Harrison, J. Verstraete and T. Wilkinson: The Amuq valley regional project 1995-1998. *Am. J. Archael.*, **104**, 163-220 (2000)

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