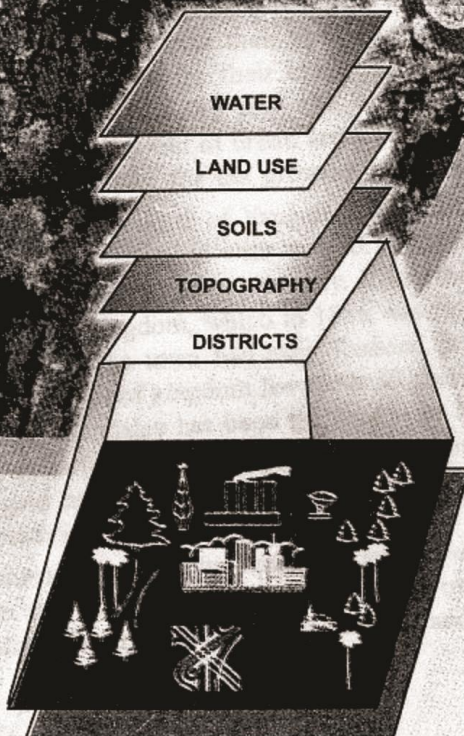
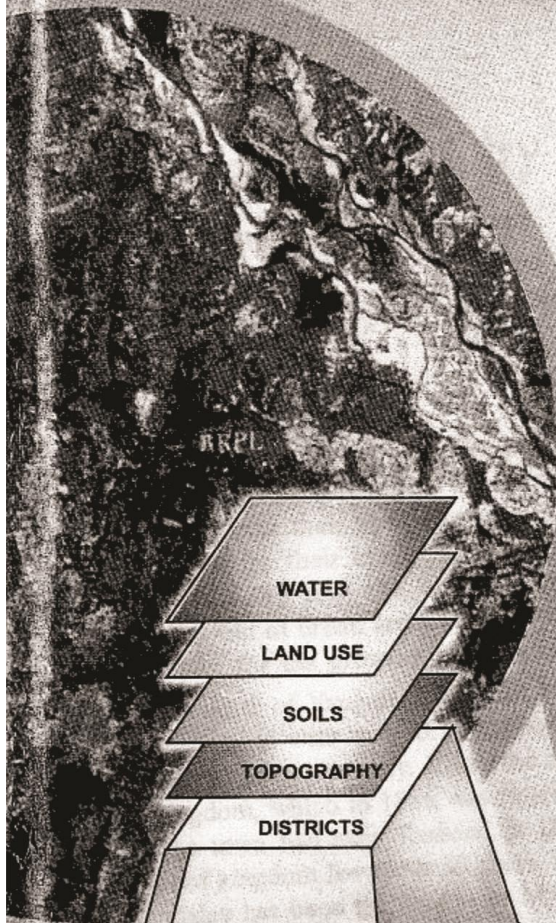




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Author	Dr. Nyo Nyo
Issue Date	

Readings in
**Environmental Challenges
Sustainable Development
Remote Sensing and GIS**

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Growth of Mandalay City :

An Environmental Assessment

A.S. Rayamane, Miss Nyo Nyo

Introduction

Cities in developing regions (countries) are growing faster than cities ever did in developed regions (countries). First, these cities are needed for their authority; second, are needed for their ability to sustain settings of sociability; third, they are needed for their ability to foster innovation¹. Because of the location of Mandalay city, the city has developed as sprawling, which is the spreading out of urban areas into surrounding rural areas as new houses are required for the growing population².

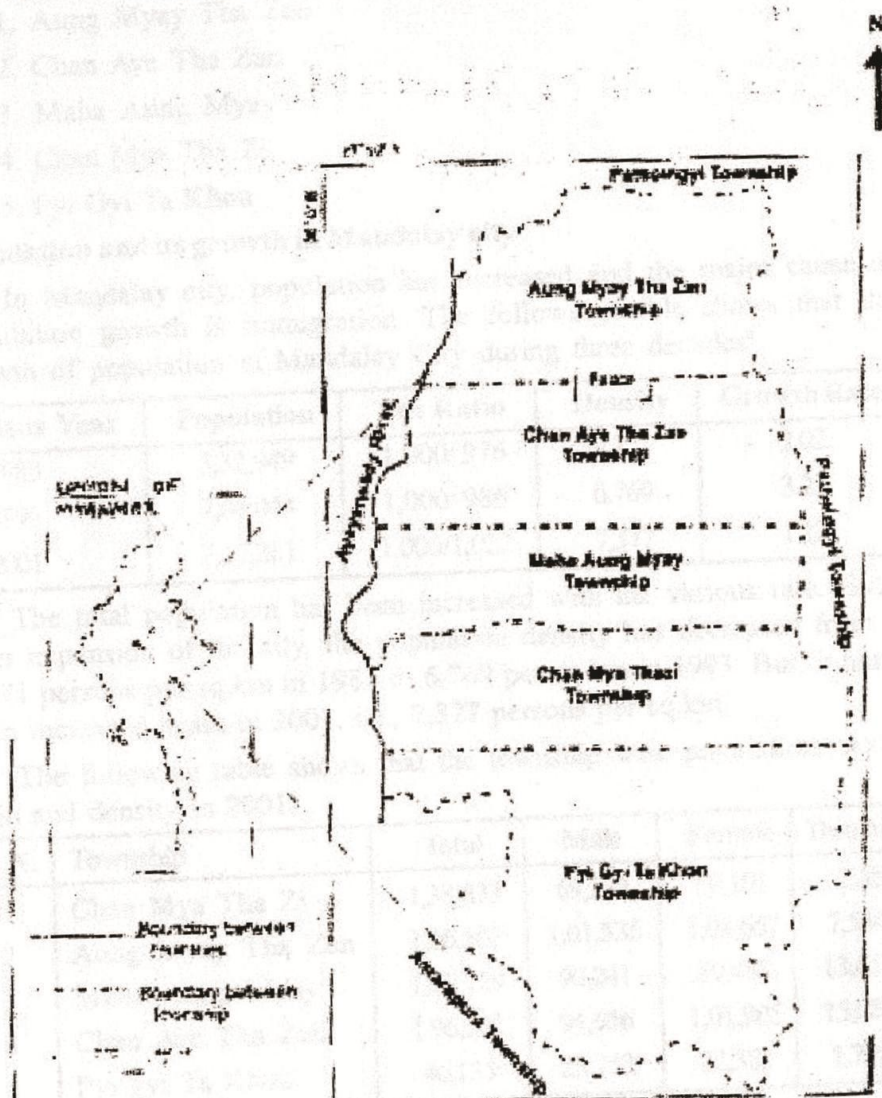
Mandalay, situated 668 km north of Yangon (Capital of Myanmar) on the east side of Ayeyarwady river, is with over 0.78 million inhabitants Myanmar's second largest and second capital city. It was the capital of the last, independent Burmese Kingdom, which in 1886 was finally conquered by British colonial forces. The town had been founded in 1857 by King Mindon, making it the capital of kingdom for about 30 years. For centuries under royal patron age, Mandalay has been the centre for Myanmar crafts and arts. The city is full of weavers, tapestry makers, wood carvers, stone masons, silver and gold smiths and bronze caster—all of whom still follow the time-honoured traditions of their forefathers³.

After British annexation, the city has been started enlarging as the shape of old palace and moat. Hence, today, it can be observed that the structure of residential quarters appeared in rectangular and square shapes.

Study area

Mandalay City lies at $21^{\circ} 59' N$ latitude and $96^{\circ} 6' E$ longitude. In 1983, the total geographical area of Mandalay City was 16,353 acres and in 1993, it has been increased to 25,693 acres by occupying nearby villages from Amarapura and Patheingyi townships. (Fig.1)

FIG.1
LOCATION OF MANDALAY CITY



Being located in the Dry Zone of Central Myanmar, Mandalay City experiences hot and dry climate. Monsoon winds carry very less amount of rain because of the rain shadow effect of Western Rakhine Range. Average annual rainfall is less than 1,016 mm. The highest temperature in the month of April or May is about 102° F and the coldest temperature is about 75° F in the month of December or January. It lies on the flat area of Mandalay-Kyaukse Plain, and only Mandalay Hill (230 m above sea level) is the highest location and prominent topography around city.

Data base

Secondary data has been collected from the various government offices like Land Record Department, M.C.D.C. (Mandalay City Department Committee) and Population Census.

Methodology

Simple methodology has been applied to know the expansion of city limits during three decades, i.e., 1983, 1993 and 2001.

Objectives

- To know what are the causes for the expansion of the city.
- To know how the city has developed and to which direction.
- To know the advantages and disadvantages of development of city.
- To know the problems of population growth in the city.
- To know the impact of population on environment.
- To know the improvement of transport system in the city.

Discussion

Careless fire broke out twice from the slum area and small scale-industries in the city, i.e., once during April 1977 and another one in July, 1983. Moreover, as Mandalay city is located in the plain area and well connected by road, rail and air, it has become a business and commercial centre for the entire country. Hence, many people from various parts of the country migrate to Mandalay city. Due to those reasons, the Government thought of shifting all slum families and private industries (small and medium scale) to the sub-urban areas. In 1993, the Government has cooperated with M.C.D.C. to expand the city to south and east directions, particularly to south portion. In the north of the city, most of the lands are cultivated lands. M.C.D.C. has occupied the followings villages from nearby townships (Amarapura and Pethingyi) to expand Mandalay City.

Patheingyi Township

1. Kankauk
2. Yemon taung
3. Aung Pin Le
4. Myayinanda
5. Htuntone
6. Kanthaya

Amarapura Township

1. Yadaw
2. Hteingone
3. Taungmyint
4. Takhondaing
5. Ngwe Dawkyigone
6. Thinpangone

Then, Mandalay city has been enlarged and re-organized into 5 townships, instead of 4, shown as below:

1. Aung Myay Tha Zan
2. Chan Aye Tha Zan
3. Maha Aung Myay
4. Chan Mya Tha Zi
5. Pyi Gyi Ta Khon

Population and its growth in Mandalay city

In Mandalay city, population has increased and the major cause of population growth is immigration. The following table shows that the growth of population in Mandalay City during three decades⁴.

Census Year	Population	Sex Ratio	Density	Growth Rate
1983	5,32,949	1,000/976	9,371	2.02
1993	7,04,044	1,000/986	6,769	3.21
2001	7,67,261	1,000/1,022	7,377	1.12

The total population has been increased with the various rate. But, after expansion of the city, the population density has decreased from 9,371 persons per sq.km in 1983 to 6,769 per sq.km in 1993. But, it has been increased again in 2001, i.e., 7,377 persons per sq.km.

The following table shows that the township wise population, sex ratio and density in 2001.

S. N.	Township	Total	Male	Female	Density
1	Chan Mya Tha Zi	1,38,833	69,232	69,101	5,585
2	Aung Myay Tha Zan	2,06,503	1,01,836	1,04,667	7,534
3	Maha Aung Myay	1,79,729	90,241	89,488	13,657
4	Chan Aye Tha Zan	1,96,561	94,656	1,01,905	15,085
5	Pyi gyi Ta Khon	46,135	23,752	22,383	1,799

Chan Aye Tha Zan is the most densely populated township with 15,085 persons per sq. km and it was followed by Maha Aung Myay Township with the density of 13,657. Because, CBD area and the Central Market are located in those townships and most of the trading business, company branches (local, national and international) are set up in those townships. Moreover, transportation and other communication facilities are more accessible in the heart of city. Pyi Gyi Ta Khon Township is the least dense populated area because it was newly founded in 1993. Sparse population can be observed in this township because the government has specified as industrial zone.

Sex ratio is not shown much change during three decades. In 2001, the sex ratio has changed, and the ratio of male has decreased because middle-aged males are left to capital city, i.e., Yangon and to abroad for getting jobs.

Almost 100 percent of the inhabitants are literate except children under age of 5.

Landuse and its changes in Mandalay city

The total geographical area of Mandalay city in 1983 was 66.20 sq.km and it has been increased to 104.01 sq.km in 2001, the net increase was 37.79 sq.km. Because of the growth of population, M.C.D.C. has occupied some village tracts from Amarapura and Pethingyi townships. Hence, the city has urbanized after 1993 by sprawling.

The landuse patterns for the years of 1983, 1993 and 2001 are shown in Table-I and Fig.II, slum areas and small and medium scale industries have been shifted to the outskirts of the city and, the area is known as Industrial New Town of Mandalay city and it is located in the Pyi Gyi Ta Khon Township.

Being an urbanized area, the land under forest, cultivable wasteland, the land under mining, pasture and fallow land are not found in landuse pattern. The area under cultivation and unclassified area are also less noticed. In 2001, total cultivated area from the townships of Aung Myay Tha Zan, Maha Aung Myay, Chan Mya Thazi, and Pyi Gyi Ta Khon have been converted into the land for residential and industrial purposes. Hence, now-a-days, no crop land can be seen in the area of Mandalay City.

According to Table-I, the pattern of general landuse can be classified into two major groups, i.e., cultivated land and uncultivated land. The land under rail line, road, canal, lake, factory, residential land, air field, sacred land and cemetery, and unclassified land are included. After expanding of the city, the landuse for each category has been also increased in 1993. But, in 2001, the total geographical area is same as it was in 1993.

Table-1
Mandalay City General Landuse Pattern and its changes in 1983, 1993 and 2001

	Uncultivated Land											Total Geographical Area
	Cultivated											
	Land	Rail Line	Road	Canal	Lake	Factory	Residential Area	Airfield	Scared Land and cemetery	Unclassified Land		
1983												16,353
Acres	1,973	124	324	241	265	343	12,588	373	122	-		
%	12.06	0.76	1.98	1.47	1.62	2.10	76.98	2.28	0.75			
1993												Acres
Acres	474	2,168	435	617	1,966	12,922	217	4,758	86	25,693		
%	8.00	1.84	8.41	1.69	2.41	7.66	50.29	0.84	18.52	0.33		
2001												25,693
Acres	-	474	2,162	435	617	2,460	14,472	131	4,807	135		
%		1.84	8.41	1.69	2.41	9.57	56.33	0.51	18.71	0.53		

During 1983, the land used for residential purpose was the highest amount of landuse, i.e., 76.98% of the total area. In this category of landuse, the land which has been used for educational, recreational, health, etc. are also included. After expansion of the city, the land under residential purpose was 50.29% (12,922 acres) of the total area in 1993 and 56.33% (14,472 acres) in 2001. Landuse for factories has been also increased; it was 7.65% (1,966 acres) in 1993 and increased to 9.57% (2,460 acres) in 2001. International airport has been started to construct in Ta-Da-U Township, hence, the land under airfield has decreased, 0.5% of the total area in 2001. The land used for pagodas and monasteries are under the sacred landuse category. It has also increased to a little extent. The Government has cleared out the slum families; hence some area of monastery has been reappeared.

Fig. II
Changing Landuse Scenario in Mandalay City

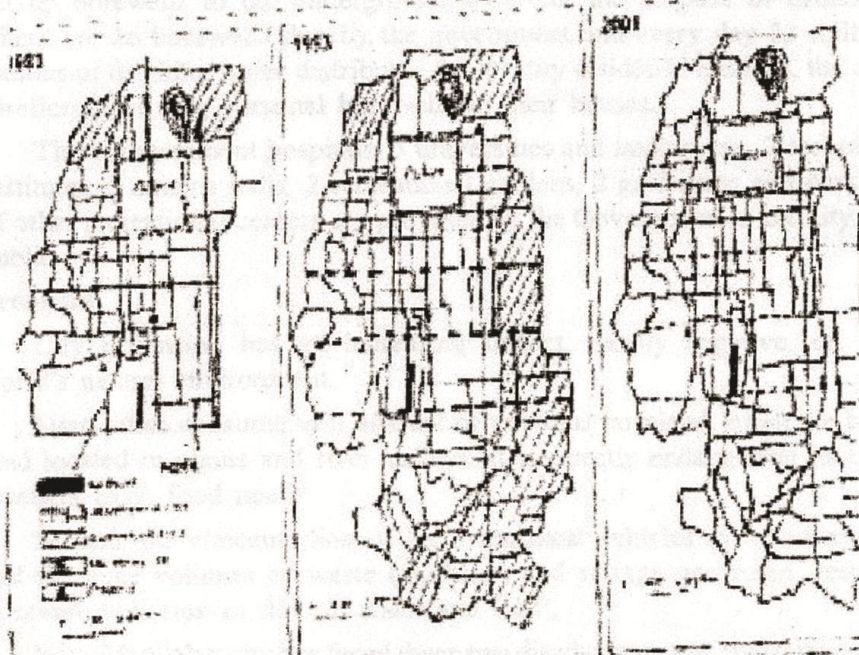


Table-2
Mandalay City General Landuse Pattern and its changes in 1983, 1993 and 2001

Town Ship	Year	Cultivated										Uncultivated Land				Total Geographical Area
		Land	Rail Line	Road	Canal	Lake	Factory	Residential Area	Airfield	Scared Land and cemetery	Unclassified Land					
Aung Myay Tha Zan	1993	278	62	566	256	105	134	2,446	86	2,756	83	6,770				
	2001	-	62	566	256	105	204	2,640	-	2,805	132	6,770				
	Change	-4.11%	-	-	-	-	+ 1.06%	+2.87%	-1.28%	+0.72%	+0.72%	-				
Chan Aye Tha Zan	1993	186	159	255	42	23	3	2,294	-	256	-	3,218				
	2001	-	159	255	42	23	86	2,397	-	256	-	3,218				
	Change	-5.78%	-	-	-	-	+2.58%	+3.20%	-	-	-	-				
Maha Aung Myay	1993	338	11	558	16	54	91	1,754	-	426	3	3,251				
	2001	-	11	558	16	54	126	2,057	-	426	3	3,251				
	Change	-10.40%	-	-	-	-	+1.05%	+9.32%	-	-	-	-				
Chan Mya Thi zi	1993	850	140	345	67	387	-	3,808	131	393	-	6,121				
	2001	-	140	345	67	387	-	4,658	131	393	-	6,121				
	Change	-13.89%	-	-	-	-	-	+13.89%	-	-	-	-				
Pyi Gyi Ta Khon	1993	404	102	438	54	48	1,740	2,620	-	927	-	6,333				
	2001	-	102	438	54	48	2,044	2,720	-	927	-	6,333				
	Change	-6.38%	-	-	-	-	+4.80%	+ 1.58%	-	-	-	-				

Table-II shows that, township wise general landuse pattern for the years 1993 and 2001 and its change. According to this table, Aung Myay Tha Zan township is the largest township in the city and it occupies 26.35% of the city area. It was followed by Pyi Gyi Ta Khon Township (24.65%), Chan Mya Tha Zi (23.83%), Maha Aung Myay (12.65%) and Chan Aye Tha Zan (12.52%). In every township, the land under residential quarters occupies the highest portion of the respective total area and it was followed by landuse for industries and factories.

Findings

When the city has developed, the land scenario has been totally changed in Mandalay city. First of all, very less amount of cultivated land has been converted into other categories of landuses. The sub-urban area has been used mainly for industrial purpose. For all slum families, M.C.D.C. has arranged to construct two or three stories apartments. These slum families can reside in pucca or semi-pucca layouts instead of huts. Hence, the problem of the careless fire has been solved.

Because of the growth of population and city expansion, M.C.D.C. has set up borewells to tap underground water for the purpose of drinking. There are 26 borewells dug by the government and every day 23 million gallons of drinking water distributed for the city residents. Besides, the city dwellers have dug personal borewells in their houses.

Three government hospitals, 5 universities and institutions, 2 technical institutes, 5 cinema halls, 2 recreational gardens, 2 golf clubs and number of other recreational centers are provided by the Government in the city for public.

Problems

City expansion has an increasing impact, mostly negative, on the world's natural environment.

First, cities consume vast amount of previous farmland, often the best land located in plains and river valleys. It is directly endangering its city dwellers basic food need.

Second, the concentration of factories, most vehicles in urban areas, and the huge volumes of waste (Garbage) and sewage generated, results in severe pollution of the air, water and land⁵.

Now, Mandalay city has faced those two disadvantages of environmental hazards. Moreover, if the city further expands in future, most of the high productivity paddy land will be disappeared and converted into residential land. At that time, the problem of basic food shortage will definitely come out for the city's dwellers.

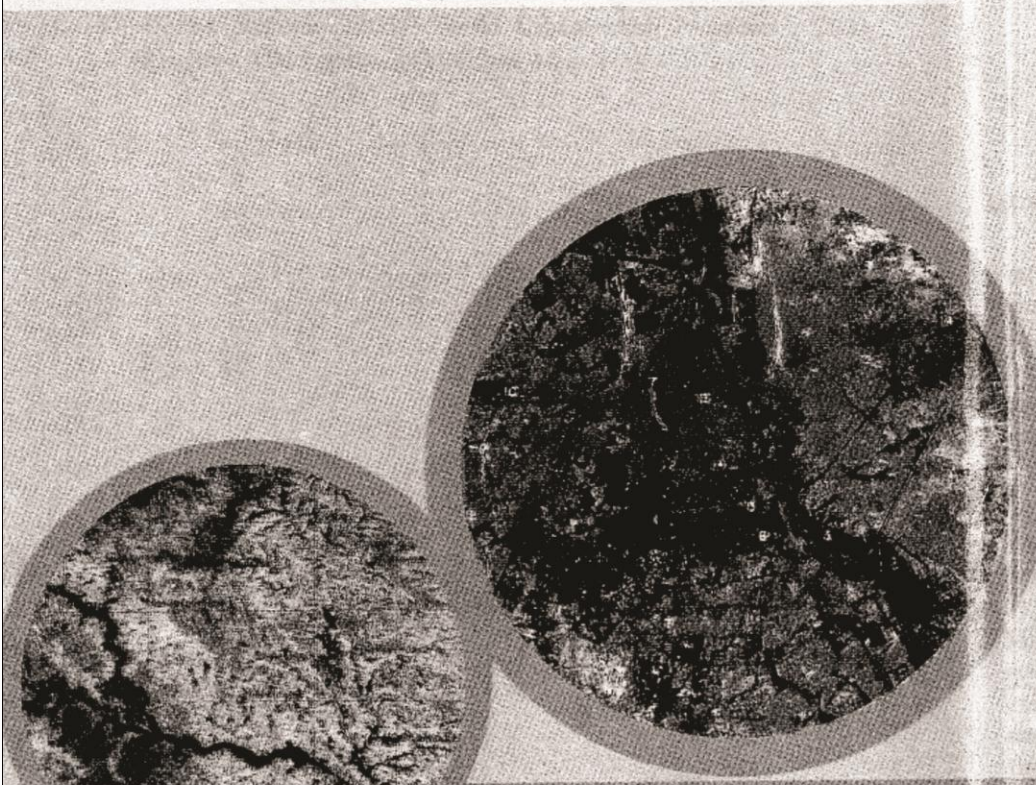
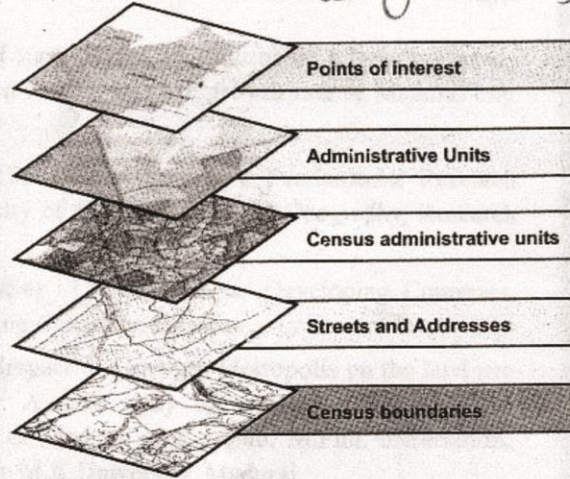
Conclusion

On the contrary, the capital city Yangon, Mandalay City has not grown from a smaller settlement to town proportions. It was set up in an open area, because, according to an ancient prophecy, in that particular place a town would come into existence on occasion of the 2400th Jubilee of Buddhism. As the seat of Myanmar's last Kingdom, Mandalay remains an important spiritual center with numerous old monasteries and unique pagodas. Hence, Mandalay is a showcase for Myanmar art and architecture of the 19th century. It is a bustling commercial centre and has links to all parts of the country by rail, road, river and air. The population has increased in the city; hence, the city has to be expanded for the growth of population. It can be estimated that about 0.8 million people are inhabited in the city in 2003. Along with the growth of population, food and water security has to be provided to the city dwellers. Hence, M.C. D.C. has arranged to solve the problems of shortage of water and food.

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