Urbanization in Antalya

- Demonstrate urbanization in a designated area of Antalya using Remote Sensing methods (change detection) to assure the importance of live update status 24/7 in case of an unexpected earthquake.

Study Area: Antalya

population	year
1719751	2000
1978333	2010

In [6]:

```
from PIL import Image
img = Image.open('1.jpg')
img.show()
```

2. Landsat 5 image with 30m spatial resolution

- 29/08/2000 Data (RGB)

- 25/08/2010 Data (RGB)

In [7]:

```
img = Image.open('2.jpg')
img.show()
```

In [68]:

```
img = Image.open('3.jpg')
img.show()
```

Methodology

Process techniques: Supervised Classification (Maximum Likelihood Method) Thermal method
Tools:

Arcmap

Snap

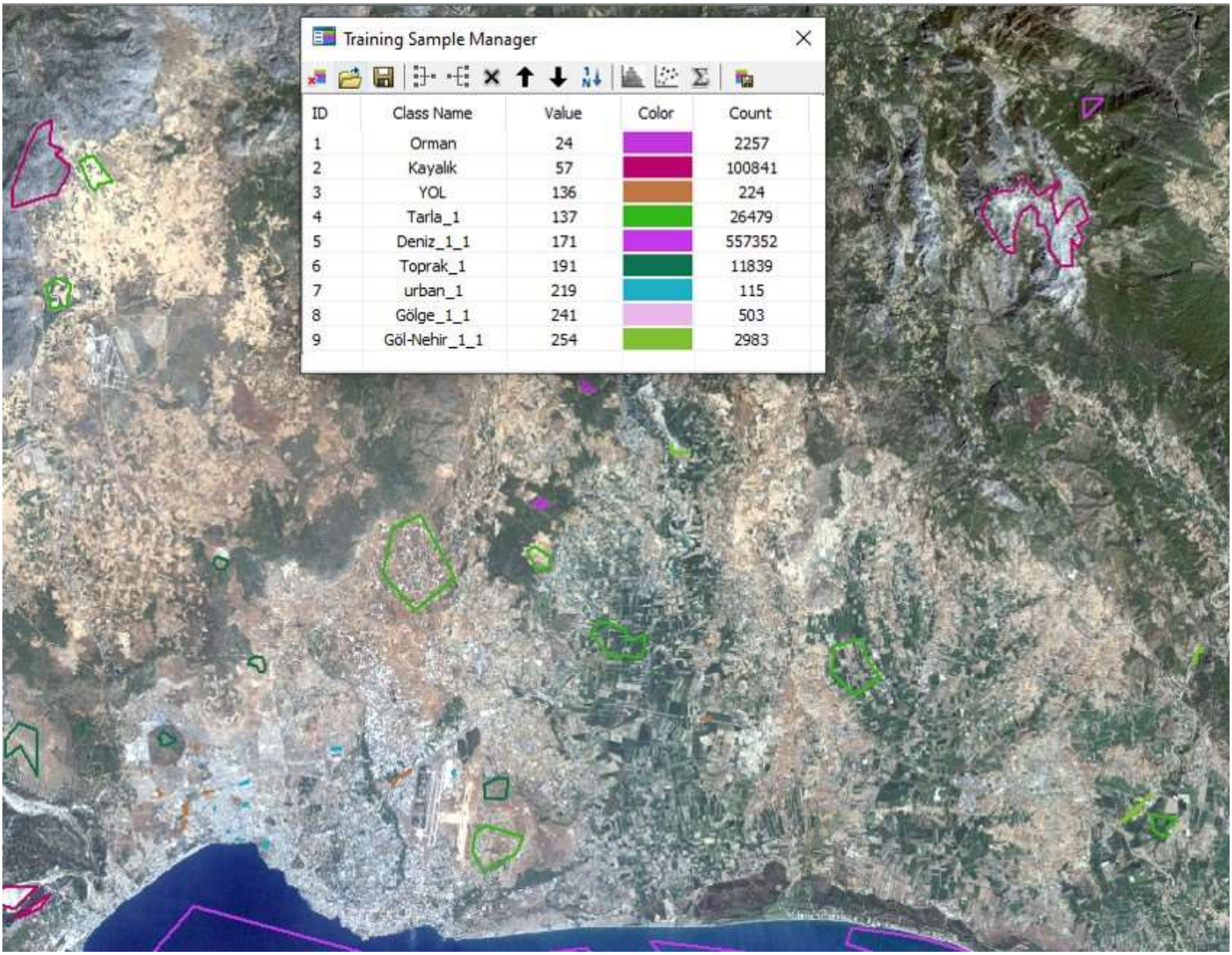
In [70]:

```
img = Image.open('4.jpg')
img.show()
```

In [71]:

```
img = Image.open('5.jpg')
img.show()
```

SUPERVISED CLASSIFICATION

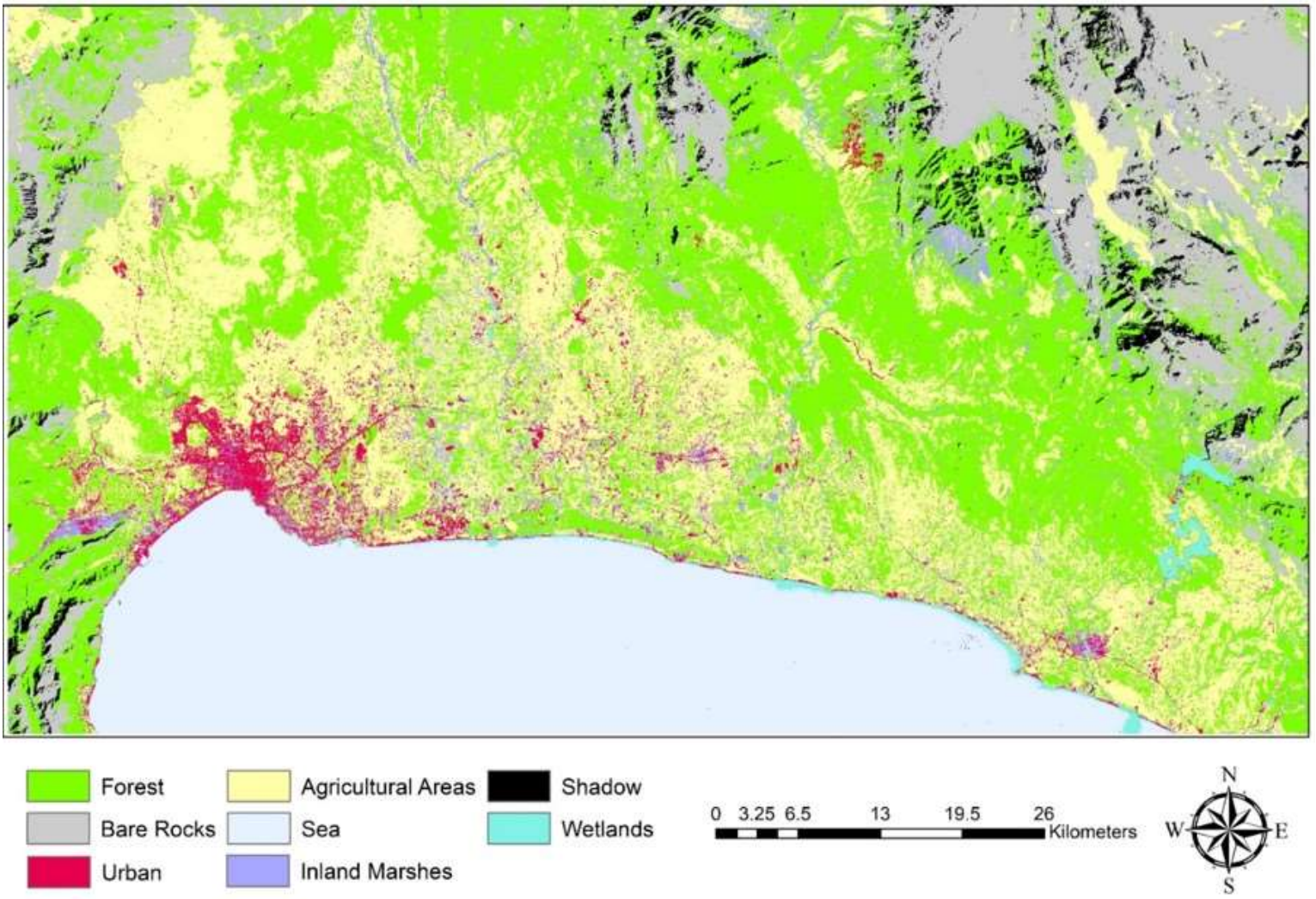


- Sampling process on Arcmap for year 2000 data

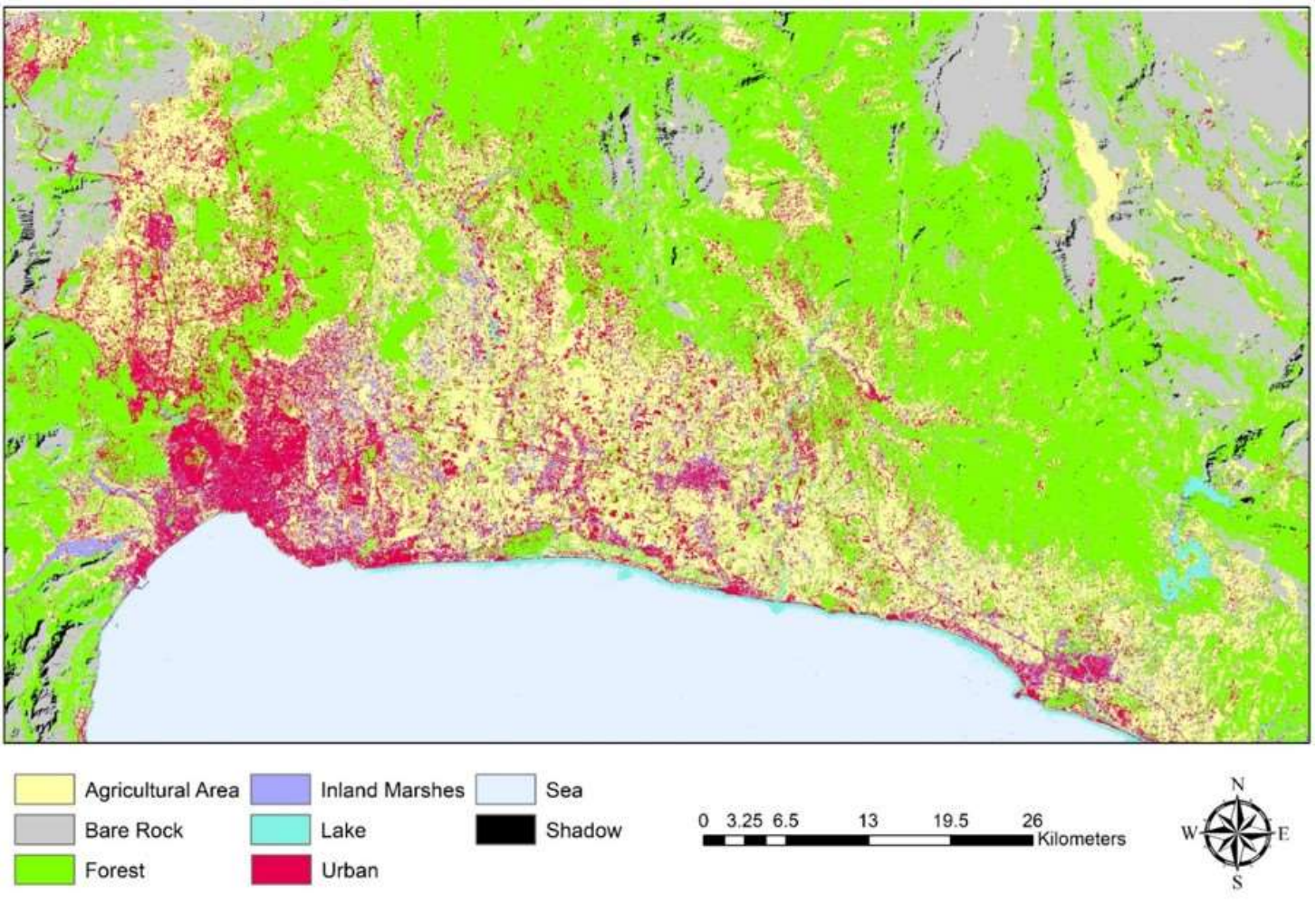
In [72]:

```
img = Image.open('6.jpg')
img.show()
```

Maximum Likelihood Classification Method


Forest
Bare Rocks
Urban
Agricultural Areas
Sea
Inland Marshes
Shadow
Wetlands
0 3.25 6.5 13 19.5 26
Kilometers
N
W
E
S

- 2000


Agricultural Area
Bare Rock
Forest
Inland Marshes
Lake
Urban
Sea
Shadow
0 3.25 6.5 13 19.5 26
Kilometers
N
W
E
S

- 2010

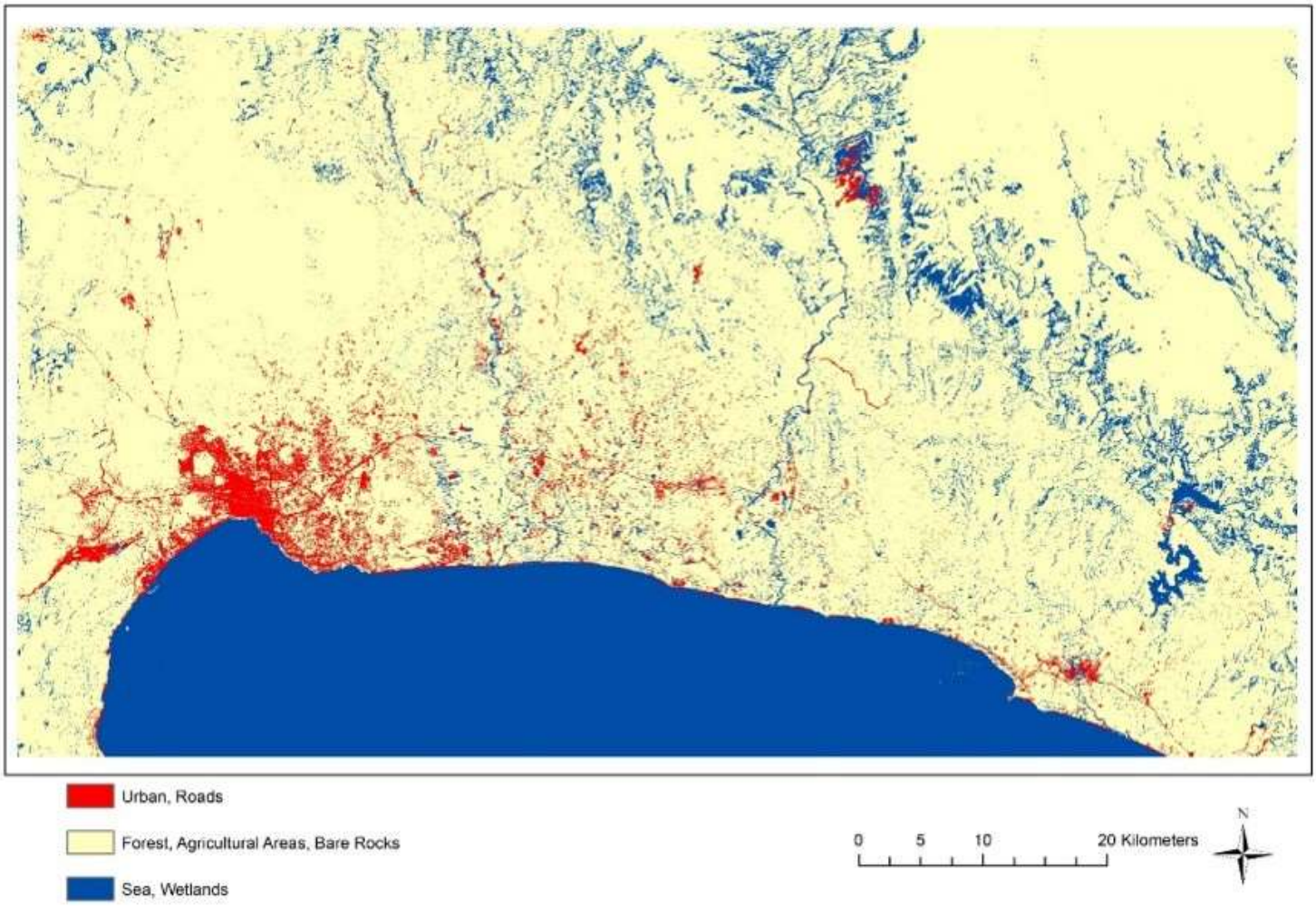
In [73]:

```
img = Image.open('7.jpg')
img.show()
```

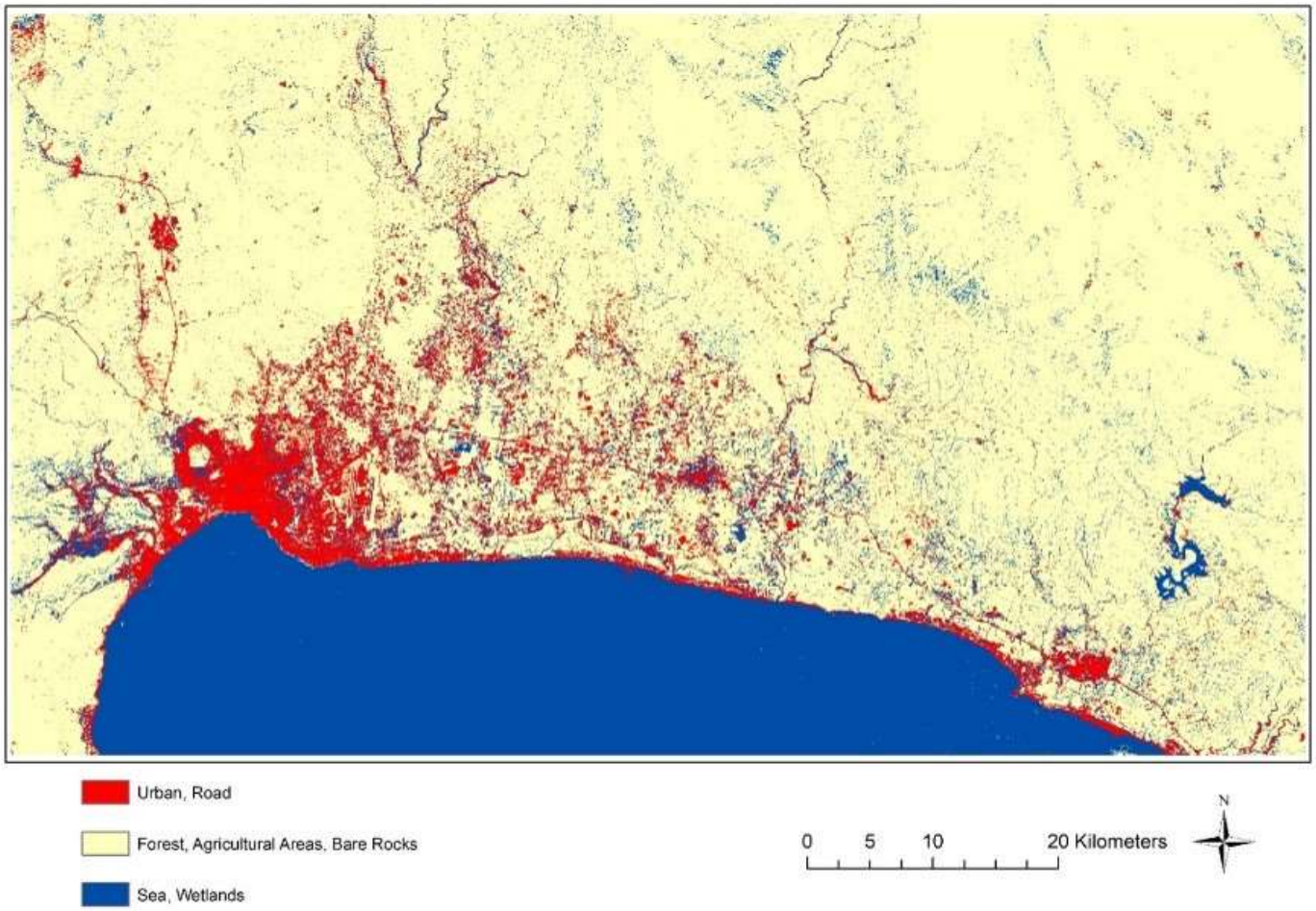
In [74]:

```
img = Image.open('8.jpg')
img.show()
```

Joined Classes Classification



- 2000



- 2010

In [75]:

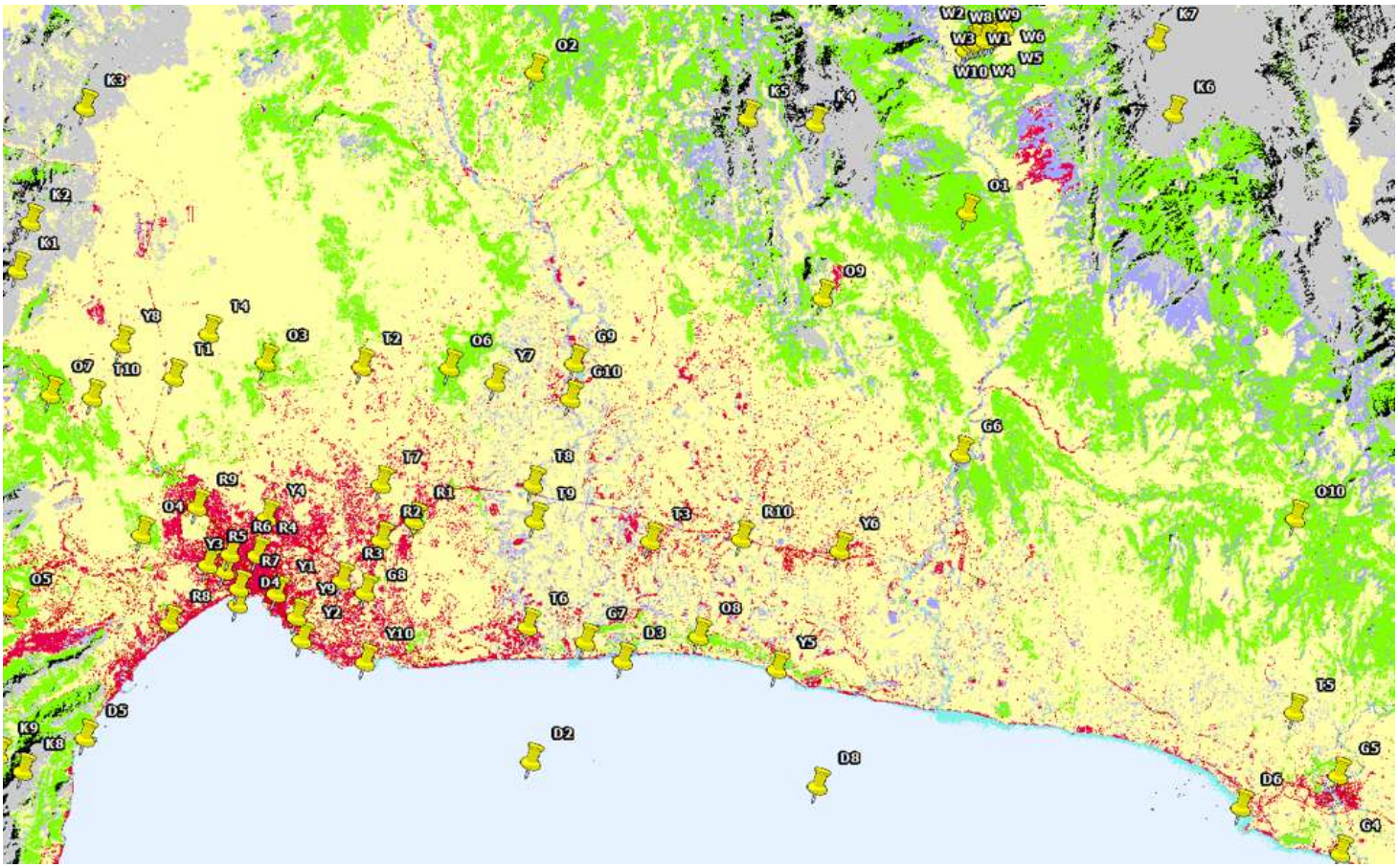
```
img = Image.open('9.jpg')
img.show()
```

In [76]:

```
img = Image.open('10.jpg')
img.show()
```

Accuracy Assesment

- Control Points on Google Earth for year data



- Control Points on Arcmap for year data

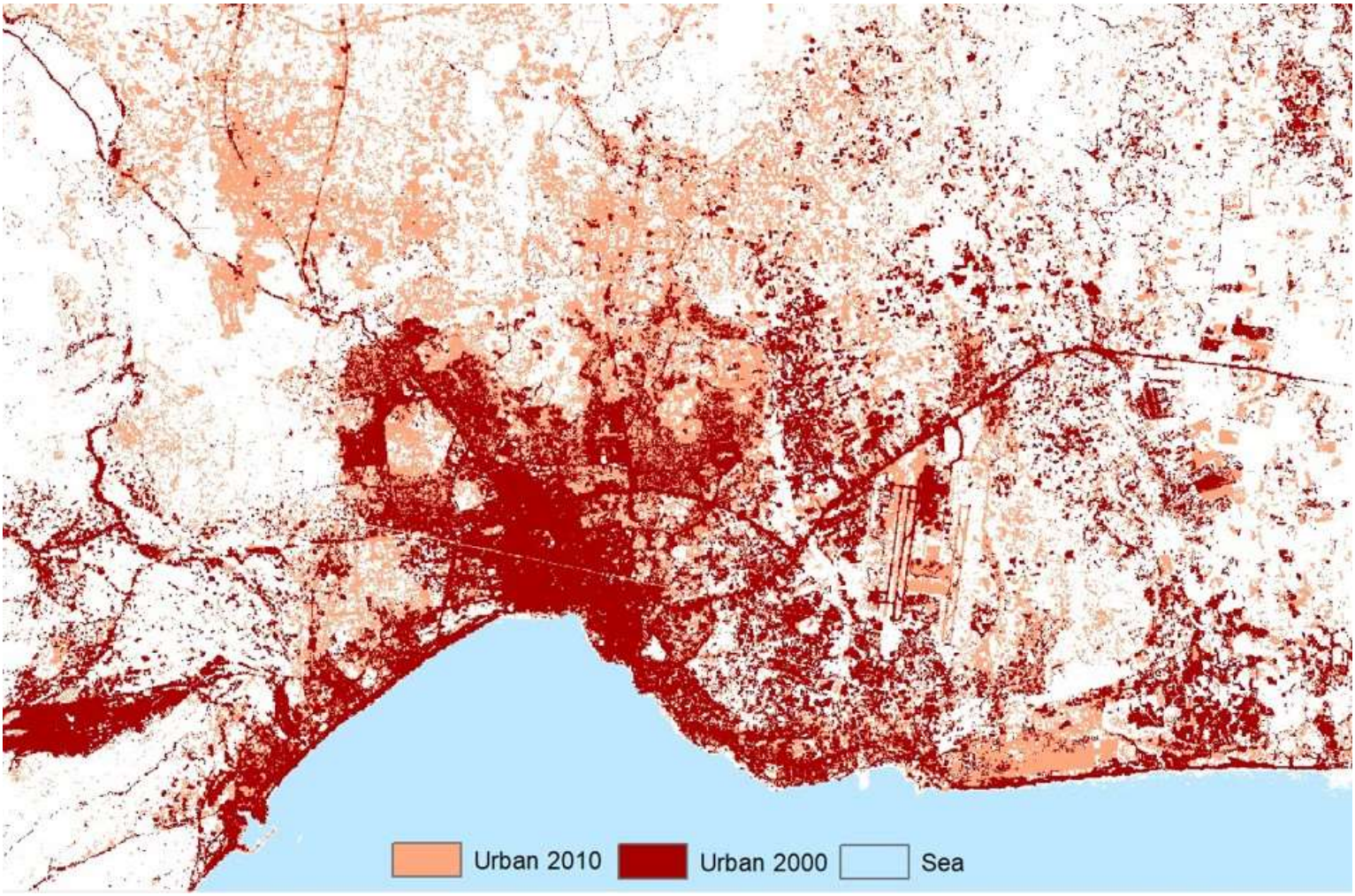
In [78]:

```
img = Image.open('11.jpg')
img.show()
```

In [80]:

```
img = Image.open('12.png')
img.show()
```

Both 2000 and 2010 years classified image



- Referenced Data (2000)

		Referenced Data (2000)									
		Agricultural Area	Urban	Forest	Wetlans	Sea	Road	Bare Rock	In.Marsh.	SumofRow	User Acc
Classified Data (2000)	Agricultural Area	9	1	0	0	0	0	0	0	10	90%
	Urban	4	6	0	0	0	0	0	0	10	60%
	Forest	2	0	8	0	0	0	0	0	10	80%
	Wetlands	1	1	0	7	0	0	0	1	10	70%
	Sea	0	0	0	1	9	0	0	0	10	90%
	Road	0	2	0	0	0	7	0	1	10	70%
	Bare Rock	0	0	0	0	0	0	10	0	10	100%
	In.Marsh.	0	1	0	0	0	0	0	9	10	90%
	SumofCol	16	11	8	8	9	7	10	11	80	
	Producer Acc	56.25%	54.55%	100%	87.50%	100%	100%	100%	81.82%		

Total Accuracy = 81.25 % Kappa = 78.77%

- Referanced Data (2010)

		Referanced Data (2010)									
		Agricultural Area	Urban	Forest	Wetlans	Sea	Road	Bare Rocks	Inland Mashes	Sum of Row	User Accuracy (%)
Classified Image	Agricultural Area	5	1	4	0	0	0	0	0	10	50
	Urban	0	9	0	0	0	1	0	0	10	90
	Forest	1	0	9	0	0	0	0	0	10	90
	Wetlands	0	1	0	6	0	0	0	3	10	60
	Sea	0	0	0	0	10	0	0	0	10	100
	Road	0	1	0	0	0	8	1	0	10	80
	Bare Rocks	0	0	0	0	0	0	10	0	10	100
	Inland Mashes	0	2	0	2	0	0	0	6	10	60
	Sum of Coloum	6	14	13	8	10	9	11	9	80	
	Producer Accuracy (%)	83.3333	64.2857	69.2308	75	100	88.8889	90.9091	66.6667		

Total Accuracy = 78.75% Kappa = 75.71%

In [81]:

```
img = Image.open('13.jpg')
img.show()
```

In [82]:

```
img = Image.open('14.jpg')
img.show()
```

In [83]:

```
img = Image.open('15.jpg')
img.show()
```

Statistical Results

- *Table of Classes by Years.*
- *Urban Area and Road Change by Years.*

2000

	OBJECTID *	Value	Count	Feature	AREA_SKM
	4	137	2745238	Agricultural Areas	2470.586986
	2	57	1088652	Bare Rocks	979.736352
	1	24	964085	Forest	867.631824
	9	255	390513	Inland Marshes	351.443604
	3	136	54326	Road	48.890883
	5	171	1143398	Sea	1029.005215
	7	241	146361	Shadow	131.718118
	6	219	161226	Urban	145.095929
	8	254	40275	Wetlands	36.245634

2010

	OBJECTID *	Value	Count	Name	Area
	4	37	1429734	Agricultural Area	1286.7606
	5	64	923481	Bare Rock	831.1329
	2	11	2306967	Forest	2076.2703
	7	86	214076	Inland Mashes	192.6684
	6	75	87098	Lake	78.3882
	9	109	41728	Roads	37.5552
	1	1	1129548	Sea	1016.5932
	3	25	52798	Shadow	47.5182
	8	98	548644	Urban	493.7796

In [84]:

```
img = Image.open('16.jpg')
img.show()
```

In [85]:

```
img = Image.open('17.jpg')
img.show()
```

CONCLUSION

- *Remote sensing live version is needed due to the number of urban increasing by time and to the risk of having an earthquake,however, this operation is located at a very high financial cost.*