

## Chapter 5 Change in Land-use and Land Cover

### Land-use and land cover from 1992 to 1998

The land-use and land cover changes from 1992 to 1998 were analysed using the data derived from the aerial photographs. The changes are summarised in Table 5 and shown in Map 19. Overall the area of agricultural land was reduced from 55% to 44% of the municipal total (a loss of 20% of the 1992 area), while the urban area increased from 10% to 21% of the municipal total (an increase of more than 100%). Forest land increased slightly from 23% to 26% of the municipal total, while the areas of recreation, industry, and mining showed slight decreases.

| <b>Table 5: Differences in distribution of land-use and land cover types</b> |           |       |           |       |           |      |
|--|-----------|-------|-----------|-------|-----------|------|
| TYPE   | 1992      |       | 1998      |       | Change    |      |
|  | Area (ha) | %     | Area (ha) | %     | Area (ha) | %    |
| <b>Urban areas:</b>  |           |       |           |       |           |      |
| High density (HD) residential area   | 80        | 4.5   | 94        | 5.3   | 14        | 0.8  |
| Medium density (MD) residential area   | 29        | 1.6   | 65        | 3.6   | 36        | 2.0  |
| Low density (LD) residential area  | 63        | 3.5   | 215       | 12.0  | 151       | 8.5  |
| <b>Agricultural land:</b>  |           |       |           |       |           |      |
| Steep (> 15°, Sslope)  | 323       | 18.1  | 305       | 17.1  | -18       | -1.0 |
| Medium slope (> 15°, Mslope)   | 76        | 4.2   | 42        | 2.4   | -34       | -1.9 |
| Flat cultivated (< 7°, FC) land  | 580       | 32.5  | 451       | 25.2  | -129      | -7.2 |
| Institution  | 52        | 2.9   | 57        | 3.2   | 5         | 0.3  |
| Forest   | 418       | 23.4  | 467       | 26.1  | 49        | 2.7  |
| Horticulture Research Centre (HRC)   | 21        | 1.1   | 21        | 1.1   | 0         | 0.0  |
| Water  | 18        | 1.0   | 20        | 1.1   | 2         | 0.1  |
| Stadium  | 5         | 0.3   | 5         | 0.3   | 0         | 0.0  |
| Recreation   | 19        | 1.1   |           | 0.0   | -19       | -1.1 |
| Industry   | 21        | 1.2   | 9         | 0.5   | -12       | -0.7 |
| Plantation   | 20        | 1.1   | 13        | 0.7   | -7        | -0.4 |
| Mining   | 31        | 1.7   |           | 0.0   | -31       | -1.7 |
| Others   | 31        | 1.7   | 24        | 1.3   | -7        | -0.4 |
| Total  | 1787      | 100.0 | 1787      | 100.0 |           |      |

There was a significant increase in low and medium density residential areas, which indicates the rapid urban growth in the municipality. The changes in high density areas were more in terms of building structures than in spatial expansion. Where there is no land available for further expansion, new buildings are constructed with more floors. The construction of such buildings is affecting the architectural harmony of the core area (Figure 33). The urban growth pattern is discussed in more detail in the following sections.



Figure 33: Building structures are changing in the high density core area

Table 6 shows the detailed land-use and land cover change analysis in the form of a matrix showing the change from one type of use to another. Flat cultivated (FC) land has been converted to low density (LD), medium density (MD), and some high density (HD) residential areas. Steep slope cultivated land and medium slope cultivated land have been converted to low density (LD) residential areas. Some steep, medium, and flat slope agricultural land have been converted to forest as have some recreational areas and other types of land use/cover.

| Table 6: Land use and land cover change matrix, 1992 - 1998 |             |      |     |      |        |        |      |      |        |     |       |         |          |            |        |           |         |
|---|-------------|------|-----|------|--------|--------|------|------|--------|-----|-------|---------|----------|------------|--------|-----------|---------|
|   | TYPE        | 1998 |     |      |        |        |      |      |        |     |       |         |          |            |        |           |         |
|   |             | HD   | MD  | LD   | Sslope | Mslope | FC   | Inst | Forest | HRC | Water | Stadium | Industry | Plantation | Others | Area (ha) | Percent |
| 1992  | HD          | 80   | 0   | 0    | 0      | 0      | 0    | 0    | 0      | 0   | 0     | 0       | 0        | 0          | 0      | 80        | 4.5     |
|   | MD          | 5    | 24  | 0    | 0      | 0      | 0    | 0    | 0      | 0   | 0     | 0       | 0        | 0          | 0      | 29        | 1.6     |
|   | LD          | 0    | 0   | 63   | 0      | 0      | 0    | 0    | 0      | 0   | 0     | 0       | 0        | 0          | 0      | 63        | 3.5     |
|   | Sslope      | 1    | 0   | 32   | 270    | 0      | 0    | 3    | 14     | 0   | 0     | 0       | 0        | 0          | 4      | 323       | 18.1    |
|   | Mslope      | 0    | 0   | 26   | 2      | 40     | 0    | 0    | 9      | 0   | 0     | 0       | 0        | 0          | 0      | 76        | 4.2     |
|   | FC          | 6    | 40  | 85   | 9      | 0      | 432  | 0    | 10     | 0   | 2     | 0       | 2        | 0          | 3      | 580       | 32.5    |
|   | Institution | 0    | 0   | 0    | 0      | 0      | 0    | 52   | 0      | 0   | 0     | 0       | 0        | 0          | 0      | 52        | 2.9     |
|   | Forest      | 0    | 0   | 8    | 2      | 2      | 2    | 0    | 403    | 0   | 0     | 0       | 0        | 0          | 1      | 418       | 23.4    |
|   | HRC         | 0    | 0   | 0    | 0      | 0      | 0    | 0    | 0      | 21  | 0     | 0       | 0        | 0          | 0      | 21        | 1.1     |
|   | Water       | 0    | 0   | 0    | 0      | 0      | 0    | 0    | 0      | 0   | 17    | 0       | 0        | 0          | 1      | 18        | 1.0     |
|   | Stadium     | 0    | 0   | 0    | 0      | 0      | 0    | 0    | 0      | 0   | 0     | 5       | 0        | 0          | 0      | 5         | 0.3     |
|   | Recreation  | 0    | 0   | 0    | 0      | 0      | 0    | 1    | 18     | 0   | 0     | 0       | 0        | 0          | 0      | 19        | 1.1     |
|   | Industry    | 0    | 0   | 0    | 2      | 0      | 12   | 0    | 0      | 0   | 0     | 0       | 7        | 0          | 0      | 21        | 1.2     |
|   | Plantation  | 0    | 1   | 0    | 0      | 0      | 0    | 0    | 1      | 0   | 1     | 0       | 0        | 13         | 4      | 20        | 1.1     |
|   | Mining      | 0    | 0   | 0    | 31     | 0      | 0    | 0    | 0      | 0   | 0     | 0       | 0        | 0          | 0      | 31        | 1.7     |
|   | Others      | 2    | 0   | 1    | 0      | 0      | 6    | 1    | 11     | 0   | 0     | 0       | 0        | 0          | 11     | 31        | 1.7     |
| Area (ha)   |             | 94   | 65  | 215  | 305    | 42     | 451  | 57   | 466    | 21  | 20    | 5       | 9        | 13         | 24     | 1787      |         |
|   |             |      |     |      |        |        |      |      |        |     |       |         |          |            |        | 1787      |         |
| Percent   |             | 5.2  | 3.7 | 12.0 | 17.1   | 2.4    | 25.3 | 3.2  | 26.1   | 1.1 | 1.1   | 0.3     | 0.5      | 0.7        | 1.3    | 100.0     | 100.0   |



Figure 34: Flat cultivated land being converted to residential use

## Urban growth analysis

Map 20 shows a more detailed analysis of the urban growth pattern with the new areas of low, medium, and high density housing added between 1992 and 1998. There was significant urbanisation within the municipality, with low density residential areas accounting for approximately three-quarters of the total urban growth (Table 7 and Figure 34).

The major land use classes contributing to urban growth are shown in Table 8 and Map 21. In all three classes of residential area, growth has resulted mainly from conversion of flat cultivated land (Figure 35).

| Table 7: Urban growth types |              |                     |                    |
|-----------------------------|--------------|---------------------|--------------------|
| Urban growth type           | Total growth | All major roads (%) | Surfaced roads (%) |
| Percentage of all growth    | 100          | 79                  | 49                 |
| High density                | 7            | 7                   | 17                 |
| Medium density              | 20           | 15                  | 23                 |
| Low density                 | 74           | 77                  | 60                 |

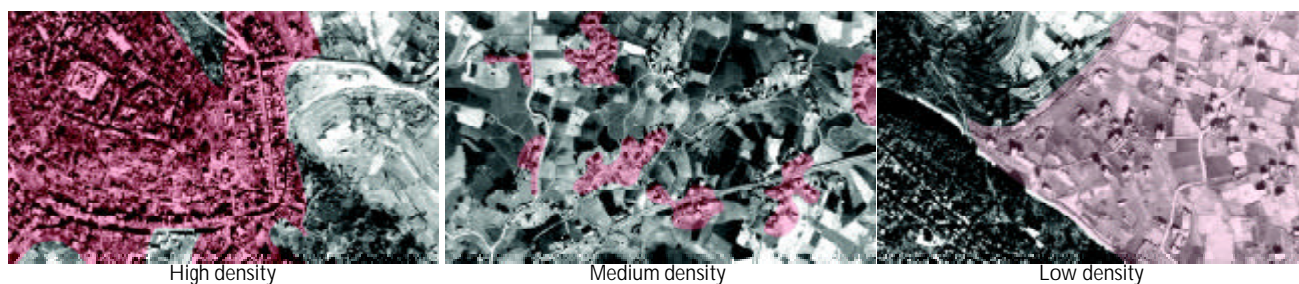


Figure 35: Urban growth patterns overlaid on IKONOS (1m PAN) image, 2001



Figure 36: Flat cultivated land within 100m of major roads is being converted to residential use

| Table 8: Urban growth area by contributing class |                         |              |             |
|--|-------------------------|--------------|-------------|
| Urban density type                               | Contributing class      | Growth (ha)  | % of total  |
| <b>High</b>                                      |                         | <b>13.4</b>  | <b>6.5</b>  |
|  | Steep slope cult. land  | 0.6          | 4.5         |
|  | Medium slope cult. land | 4.6          | 34.3        |
|  | Flat cult. land         | 6.2          | 46.3        |
|  | Forest                  | 0.1          | 0.7         |
|  | Other                   | 1.9          | 14.2        |
| <b>Medium</b>                                    |                         | <b>40.3</b>  | <b>19.7</b> |
|  | Steep slope cult. land  | 0.1          | 0.2         |
|  | Flat cult. land         | 40.2         | 99.8        |
| <b>Low</b>                                       |                         | <b>151.3</b> | <b>73.8</b> |
|  | Steep slope cult. land  | 31.6         | 20.9        |
|  | Medium slope cult. land | 26.1         | 17.2        |
|  | Flat cult. land         | 85.2         | 56.2        |
|  | Forest                  | 7.8          | 5.2         |
|  | Other                   | 0.7          | 0.5         |

## Urban growth versus accessibility

Roads are a major factor contributing to urban growth. Growth patterns depend on the distance from various types of road. To understand the nature of Kirtipur's growth pattern, the nature and pattern of urban growth within 100m of major roads was analysed in more detail (Map 22). About 79% of all growth took place within 100m of major roads (i.e. motorable surfaced and gravel roads), and 49% within 100m of surfaced roads (Table 7 and Figure 36). The proportion of high and medium density growth compared with low density growth was markedly higher near surfaced roads.

The major land use classes contributing to urban growth within 100m of surfaced roads are shown in Table 9. Flat cultivated land has been the main land type diverted to urban growth near to roads and almost the only type near to surfaced roads. Medium slope and steep cultivated land has been converted to a small extent close to gravel roads. The differences probably reflect the positioning of the roads.

| Table 9: Contributing classes by urban growth types within 100m of all major roads, and surfaced roads alone |                 |                |                 |                |                 |                |
|--|-----------------|----------------|-----------------|----------------|-----------------|----------------|
| Contributing classes   | High density    |                | Medium density  |                | Low density     |                |
|  | All major roads | Surfaced roads | All major roads | Surfaced roads | All major roads | Surfaced roads |
| Flat cultivated land   | 48              | 54             | 100             | 100            | 60              | 90             |
| Medium slope cultivated land   | 34              | -              | -               | -              | 16              | 6              |
| Steep slope cultivated land  | 5               | 6              | -               | -              | 19              | 2              |
| Medium dense residential area  | -               | 26             | -               | -              | -               | -              |
| Others   | 13              | 14             | -               | -              | 5               | 2              |
| Total  | 100             | 100            | 100             | 100            | 100             | 100            |

The trend indicates that in the future agricultural land, especially flat land, within 100m of surfaced or gravel roads has a high chance of being developed for settlement (Map 23). Figure 37 shows a typical example of such areas.

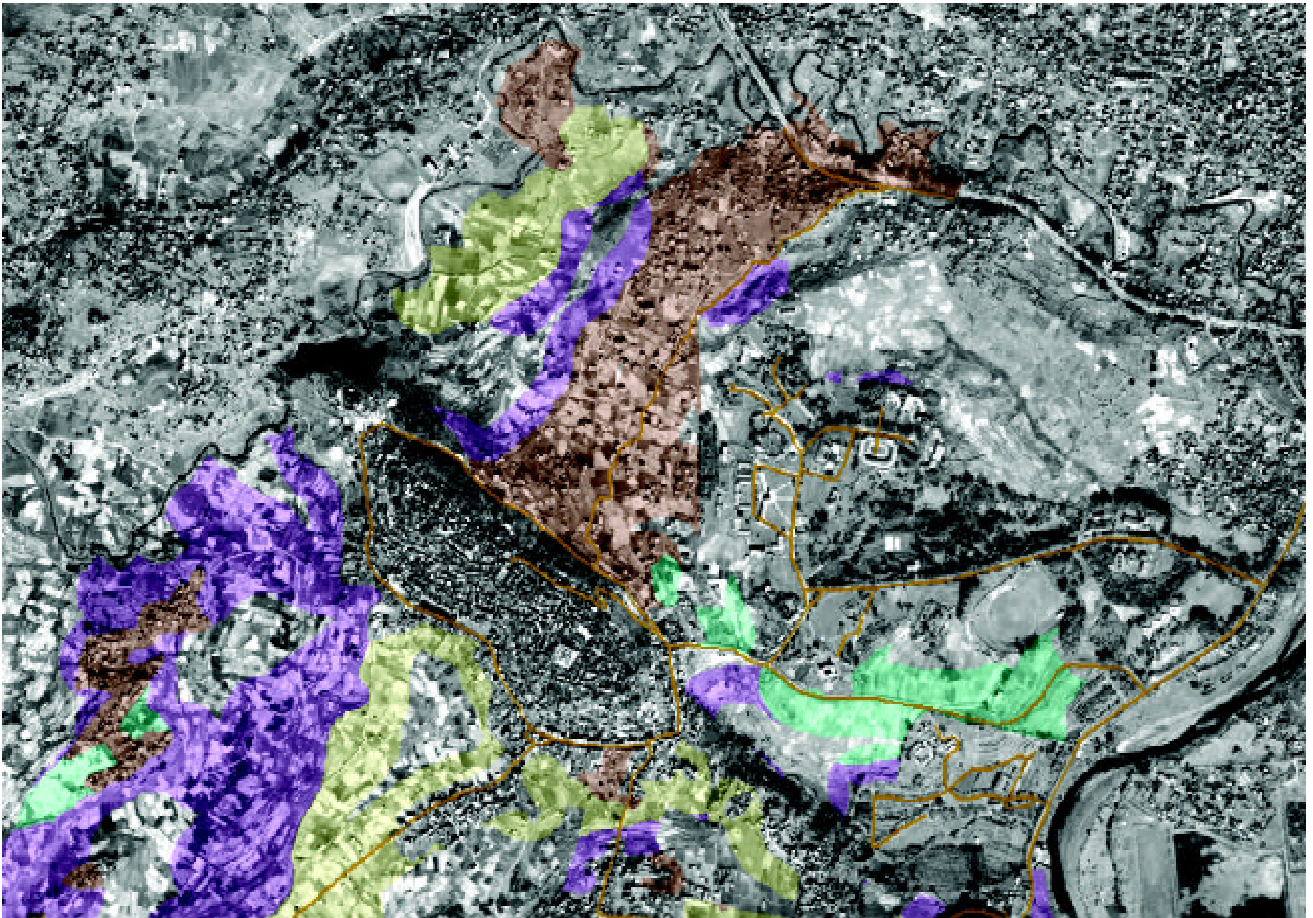


Figure 37: Areas with a high potential of being diverted to residential use