V. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Land cover change in image classification analysis can be divided into two, seasonal and annual change. Agricultural land and deciduous forest change seasonally as can be seen clearly in 1989 and 1993 Landsat TM+ images. The most clearly point in 2003 Landsat ETM satellite image is permanent change or annual change because of deforestation which is caused by agricultural intensification and settlement increase.

According to figure (4.5), comparisons between the classification of Landsat TM+ and ETM+ images for the year 1989, 1993, 1998 and 2003 could be concluded as follows.

- The agricultural area is in barren land condition according to the cropping schedule. Most of the barren land is intended for agriculture purpose in 1989 and 1993.
- For 2003, most of the forest areas and agricultural areas such as paddy fields and plantations are converted to residential and industrial area.
- Secondary forest (reforestation) changed to bush land because of deforestation and population increase between 1993 and 2003.

From the comparison between four different periods of land cover (2003, 1998, 1993 and 1989) and the analysis could be made conclusions. The decrease of area in percentage was more than five percent for paddy fields and secondary forest areas between year 2003 and year 1998 land cover type. At the same time
The increase in industrial and settlement areas was approximately 10 to 15 percent from 1998 to 2003.

The comparison between 1989, 1993, 1998 and 2003 soil loss rate due to erosion, there are two ways in approaching the change of soil erosion analysis: absolute and relative value of soil loss. The absolute soil loss value refers to the quantity of soil loss change while the relative value of soil loss refers to the quality or percentage of soil loss change.

- The potential for absolute soil loss in Bandung regency for the districts of Batujajar, Padalarang, Pagalenjan, Gununghalu, Pacet, Kertasari and Arjasari are described. In those districts the total soil loss areas was more than 50,000 hectare.

- The potential for relative soil loss districts are Cisarua, Padalerang, Batujajar, Lembang, Cililin, Gununghalu, Pangalengan, Pacet and Pasirjambu districts. In those areas the soil loss rate was more than (30 ton/ha/yr). Very severe erosion occurring in some areas, while the soil loss rate was more than (90 ton/ha/yr) in those districts.

- The comparison of erosion rate in Bandung regency was based on four different land use scenario (2003, 1998, 1993 and 1989), there was less than 1 percent of very high and high erosion rate in the whole study area. Moderate and light erosion area significantly increased from 5 to 10 percent during 1998 and 2003 (Appendix-14).

In relation to the future management point of view based on Forest Stewardship Council “High Conservative Value (HCV) Principles 9” and the
combination of “FAO Land Capability Mapping and Mekong Commission's Watershed Mapping”, some specific conclusions are drawn as follows:

Conservative forest area in Pangalengan, Pasirjanbu, Gununghalu, Kertasari, Arjasari and Pacet districts which location have more than 40 percent slope gradient must be maintained as highly conservative value forest area that comprise in (HCVF 4.2) as shown in the figure(5.1).

Areas not well covered by forest vegetation and also having slope of well over 40% need to be reforested. Land cover like plantations established here cannot be harvested for human use. These areas are suitable for watershed plantations and natural regeneration area.

According to the conclusion from four different periods of soil loss by erosion in study area, there was 1825 hectar of land area was need to be considered as critical as rehabilitant area for soil conservation was identified. In that area the slope percent more than 25 percent and continuously suffered the high erosion rate (60 to 75 tons/ha/yr) and very high erosion rate (more than 75 tons/ ha/yr) as shown in figure (5.1). The detail location of rehabilitant area was shown in Appendix-15. Those areas are necessary to be selected for establishing forest plantations. Community forestry sites, which will be using clear-felling practices, can be selected from such areas.

Established or permanent agriculture areas like Lembang and intensified residential and industrial area in Cililin and Batujajar are difficult to reclaim under forestland. If they are on areas over 25% slopes, there exists erosion danger. These areas are suitable for sound soil conservation practice such as agro-forestry practices, contouring, standard mulching practices and homestead garden.
Fig. 5.1: Land Degradation Management based on Erosion Potential

Legend
- Conservation Area
- In Slope > 40%
- Rehabilitation Area
- Area with Slope > 25%
- Area with Slope > 40%
- Study Area Border
- District Capital

Legend
- In Slope > 40%
- Rehabilitation Area
- Area with Slope > 25%
- Area with Slope > 40%
- Study Area Border
- District Capital

Land Degradation Management Map

Fig. 5.1: Land Degradation Management based on Erosion Potential
5.2. Recommendations

Landsat Thematic Mapper and Enhanced Thematic Mapper data provide excellent ways for discriminating natural and man-made features mapped at 1:50,000 scales. Therefore, it should be recommended for land cover classification of land use planning. Further research should be conducted on sediment loading rate in Lake Saguling and along the water way of Citarum River. There are some hard decisions for farmers to make in preserving soil from land degradation. Soil conservation is critical to creating sustainable environment. The heavy doses of pesticides effect the sustainable environment. Further research can be done considering the effect of pesticide on land degradation. The future steps should be taken of land use and their interrelationship with land management decisions and resource policies to develop projections of future land use and management decision outcomes under a range of economic, environmental, and social scenarios.