# Mapping Urban Land Use in Lusaka City, Zambia

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## Introduction

- Urban Land Use (ULU) Mapping i.e. discriminating the built-up-area into different ULU types (e.g. residential, industrial, commercial, public etc.) remains a challenge due to spectral confusion in urban environments.
- The challenge is bigger in Sub-Saharan African (SSA) Cities due to their highly complex spatial structures and spectral mix-up.
- In this study, we developed an expert-based approach for mapping ULU in a developing SSA City of Lusaka, Zambia.

## Methodology

### Study Area
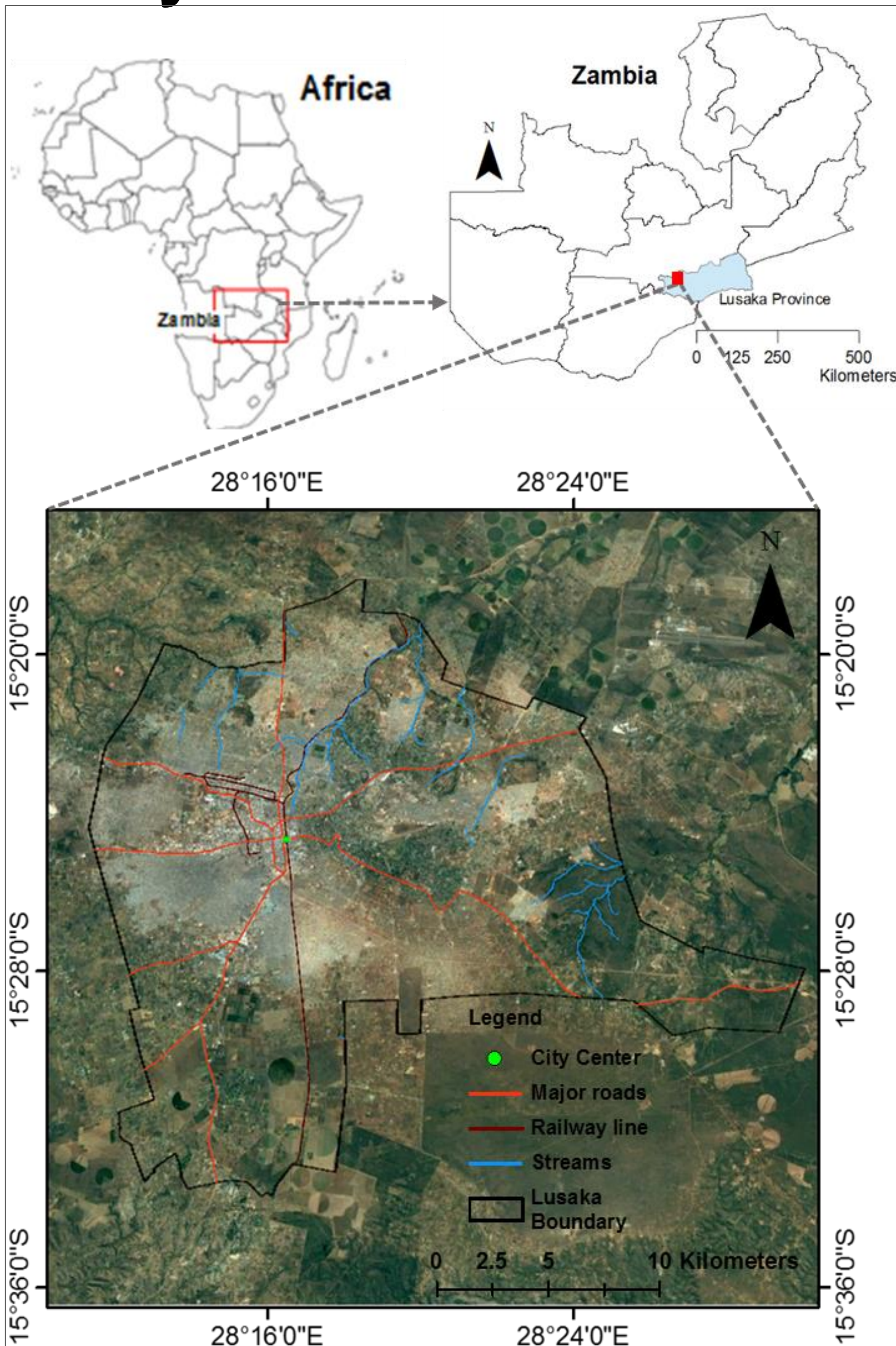


### Data

**Remote Sensing Data**
- Landsat imageries (TM and ETM+) (1990, 2000& 2010)
- Google Earth Imagery

**Ancillary Spatial Data**
- Detailed roads network data
- Cadastral spatial data
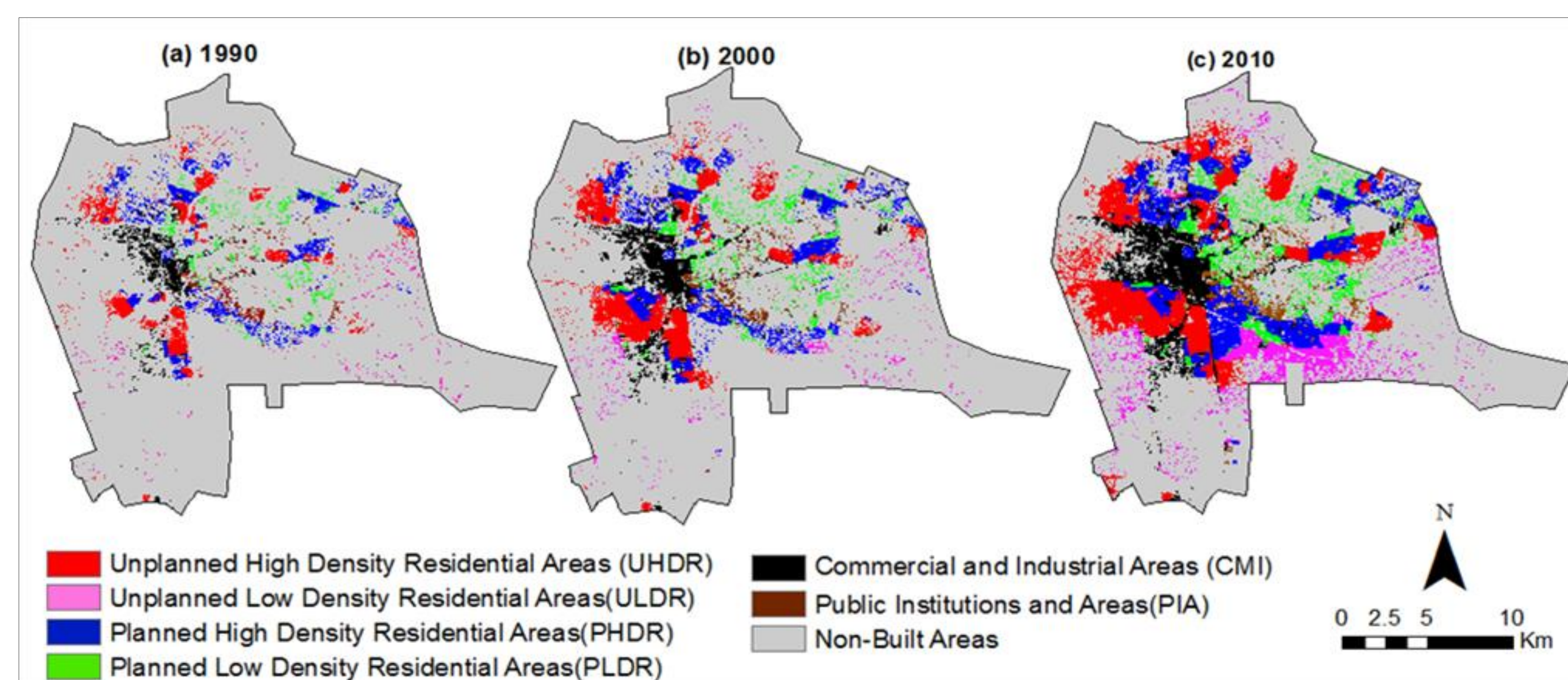- Detailed land use data

**Other Reference Data**
- 1985 topographic map (scale 1:50,000)
- 2004 partial Quick Bird imagery (0.6m resolution)
- Administrative boundary
- Urban development plans

### ULU Mapping Work Flow

- Expert-based approach integrating medium-resolution Landsat TM/+ETM data with detailed cadastral, land use and roads network data, Google Earth imagery and expert knowledge of the study area



**Note:** MLC refers to maximum likelihood classification. 6 classes refer to built-up, cropland, grassland, bareland, forest and water. RD refers to Residential Density

**ULU Classes**
1. Unplanned High Density Residential (UHDR)
2. Unplanned Low Density Residential (ULDR
3. Planned High Density Residential (PHDR)
4. Planned Low Density Residential (PLDR)
5. Commercial and Industrial (CMI)
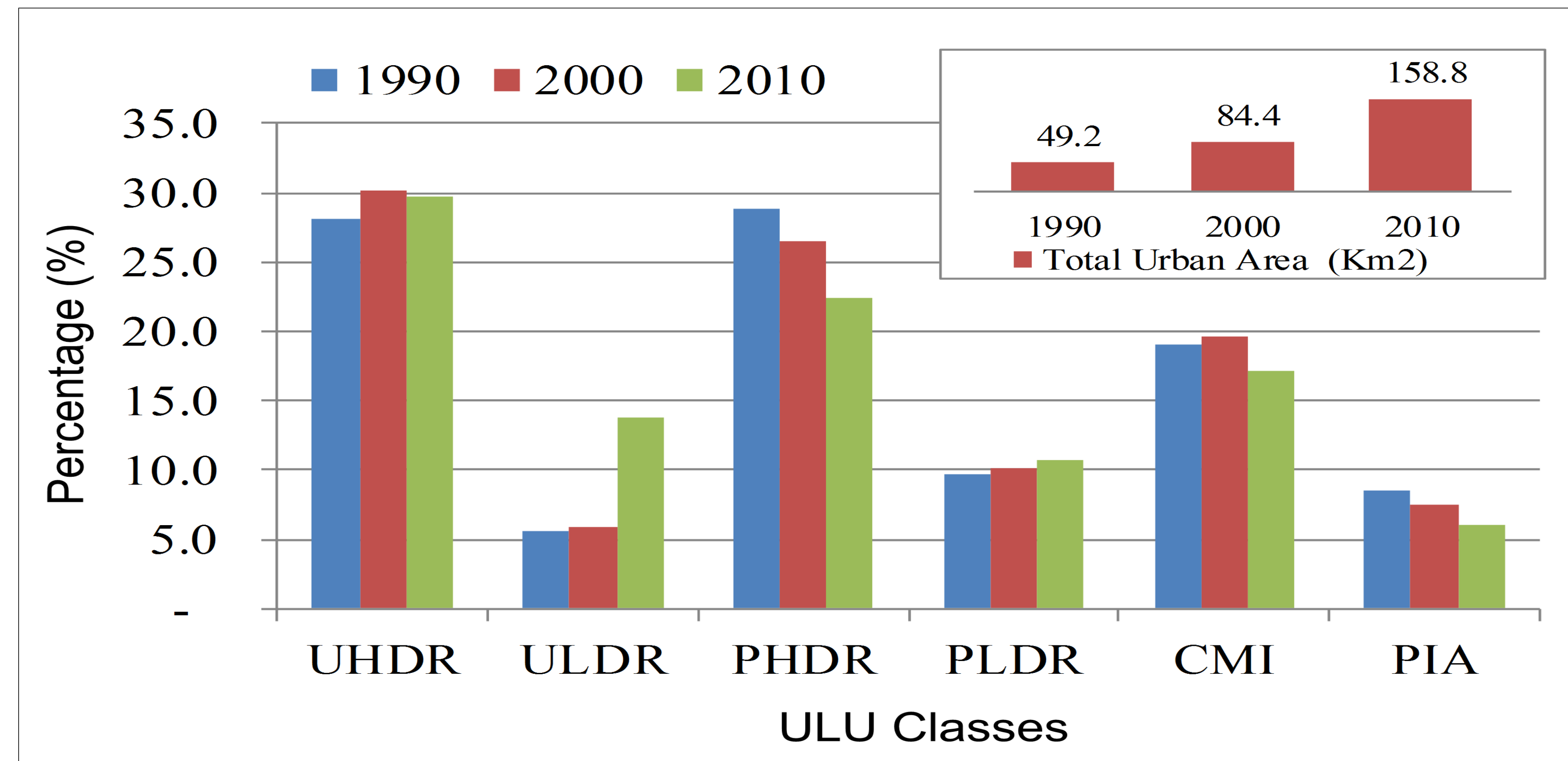6. Public Institutions and Areas(PIA)

## Objective(s)

To map the ULU of Lusaka City, Zambia over time (1990 -2010) using remote sensing and GIS techniques
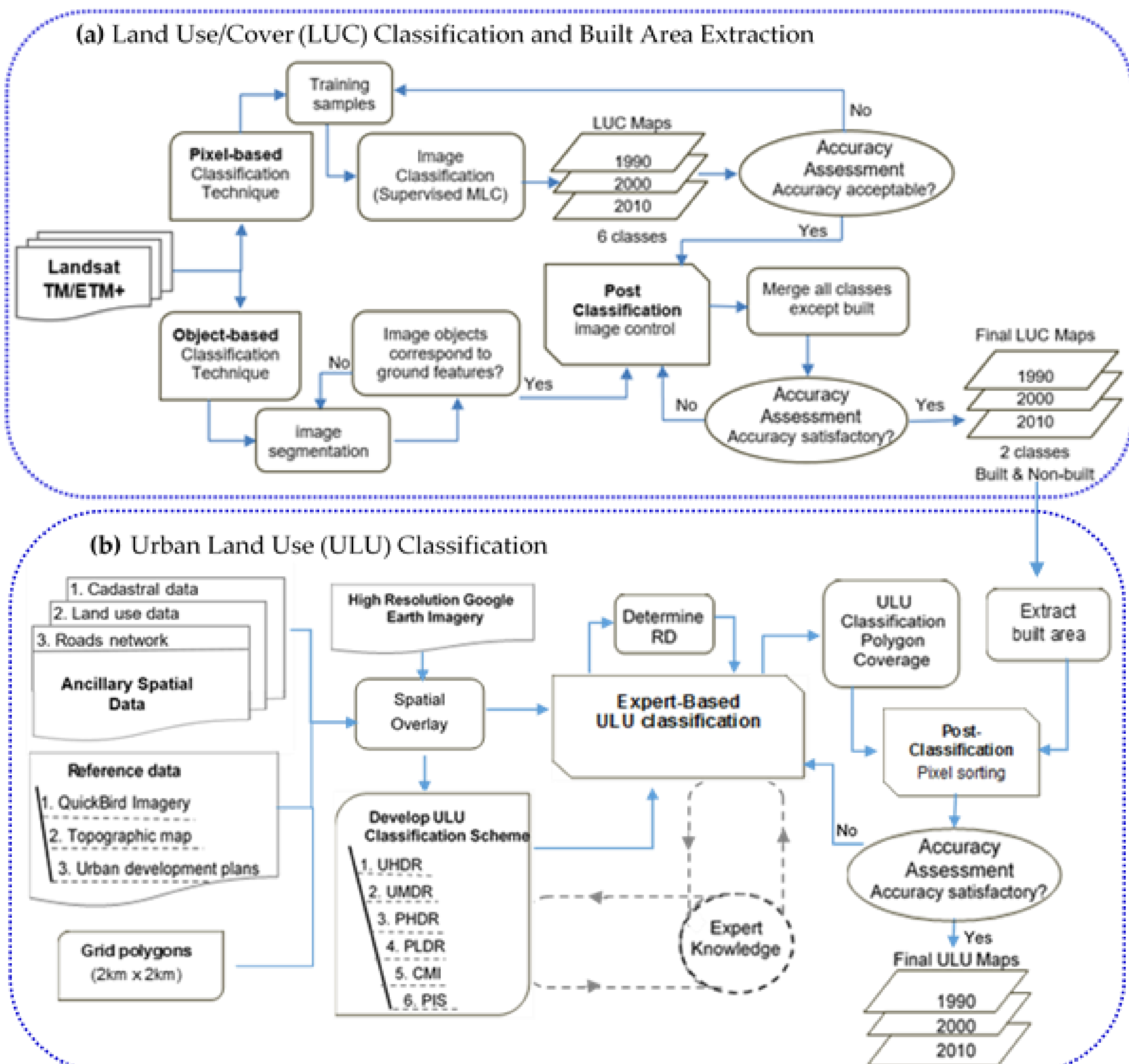
## Results

### ULU Maps



### ULU Changes



### Performance of ULU Mapping Approach

- LUC classification accuracies were 89.2%, 91.3% and 93.0% for 1990, 2000 and 2010 respectively - built-up area was accurately identified and extracted
- Accuracy of final ULU maps ranged from 91.2% to 92.8%, above the recommended minimum standard of 85%.

### Challenges and Limitations

- Expert knowledge requirement limit use of approach by non-experts
- Limited to local and regional scales due to huge time consumption and increased potential for error at larger scales
- Ancillary data unavailable, especially in developing countries

## Conclusion

- Overall, the proposed approach shows good potential for ULU classification at local and regional scales.
- Our approach provides a new insight for ULU mapping especially for complex urban environments in third world urban cities (e.g. SSA)
- The study has also revealed some interesting results relevant to land use policy makers and urban development planners.