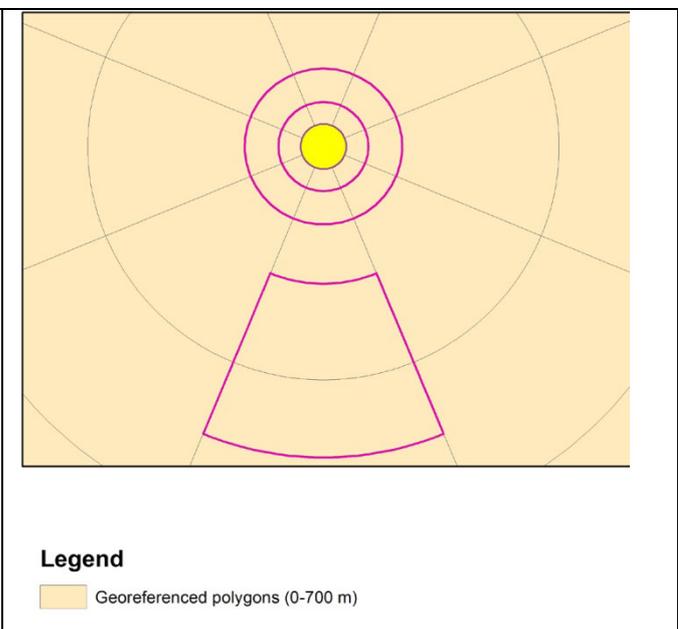
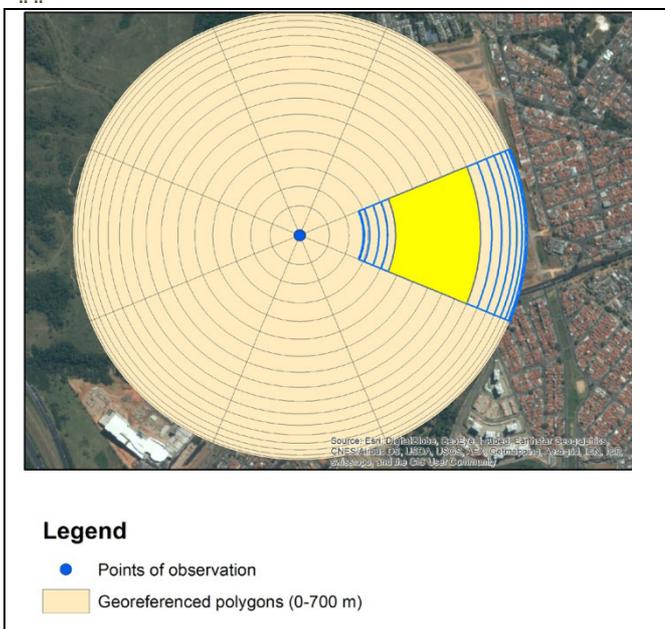


**Figure 3.3 Georeferenced polygons for all distance ranges: 0-6000 m (Amaraï site)**

**Figure 3.4 Georeferenced polygons for three first distance ranges: 0-700 m (Amaraï site)**



**Figure 3.5 Overlapping of the georeferenced polygons**

**Figure 3.6 Circular shape of the georeferenced polygons (with vertical angle to a bird equal to 90°)**

## Georeference of the registered birds through the polygon shape files

Transformation of ornithological object's georeference as points (in point shape file) to their georeference as polygon (in polygonal shape file) was conducted. Those polygons were entitled as the “*georeferenced polygons*”, their construction and georeference procedure was implemented in ArcGIS software through the several technical steps. This transformation allowed to take into account in analyses the uncertainty of geographical positions of each flying bird, caused by the interval character of the registered parameters<sup>1</sup>. A georeferenced polygon of each ornithological object can be interpreted as a region where a given ornithological object (i.e. all birds attributed to it) was located at the moment of registration.

The shapes of georeferenced polygons are defined by the geometry of a cycle with the observer in its center, which is caused by the specific of bird's census conduction from the viewpoints within radius of visibility. It was a sector truncated by two circumferences (when the vertical angle to a bird was 5-85°), and a circle (when the vertical angle to a bird was equal to 90°, i.e. bird was located exactly above the viewpoint)<sup>2</sup> (Figs. 3.3 - 3.6). The total number of georeferenced polygons is determined by sum of all possible combinations of intervals of registered parameters (18 – by vertical angle; 8 - by direction and 4 - by distance), and taking into account that the vertical angle equal to 90° produces a circular georeferenced polygon. Thus, the total number of georeferenced polygons is the following: for each viewpoint:  $(18*8*4) - (4*7) = 548$ ; for each airport:  $13 * 548 = 7124$ ; in total =  $7124*2 = 14248$ .

The georeferenced polygons superpose each other (Fig. 3.5), which is caused by the geometry of their construction and four distance intervals from a viewpoint to birds. The number of superposed polygons varies from three above the viewpoint to several dozen at the periphery of the studied zone.

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<sup>1</sup> The distance, vertical angle and direction parameters measured as interval of values allow to determine only a region (not a point) above which a bird was located at the moment of registration. A georeferenced polygon represents this region for each registered bird in GIS environment.

<sup>2</sup> When vertical angle to a birds was 90° it was no value of “direction to a bird” parameter, because the bird was located exactly above the observer. In this case the georeferenced polygon is a circle above the viewpoint with a radius equal to the distance to a bird.