

Spatial Plan Conformity to Tourism Activities in The Sarbagita Area of Bali Province

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Abstract

Bali has experienced significant tourism growth over recent decades, establishing tourism as a major driver of the regional economy. However, this development has also generated socio-cultural tensions, environmental degradation, and disparities in spatial utilization. Issues such as over-tourism, traffic congestion, community displacement, and cultural erosion highlight the challenges of achieving sustainable tourism development. In response, quality tourism has emerged as an alternative approach emphasizing tourist satisfaction, economic sustainability, and improvements in residents' quality of life. This study aims to evaluate the conformity between regional spatial plans and existing tourism development patterns in the Sarbagita metropolitan area, where rapid urbanization and tourism expansion have intensified spatial transformation. A quantitative spatial approach, grounded in regional growth and location theories, was employed through urban zone identification and spatial overlay analysis using primary and secondary data. The findings reveal that built-up land is predominantly concentrated in the southern and central corridors, with most land utilization conforming to the designated spatial plans. Nevertheless, spatial discrepancies remain, including undeveloped land designated for settlements and transportation, built-up areas within agricultural and buffer zones requiring further permit verification, and limited development encroachment into conservation zones. Tourism attractions and supporting facilities exhibit spatial concentrations corresponding to major built-up areas, although these associations do not establish causal relationships. These findings underscore the importance of strengthening spatial planning enforcement, controlling development in environmentally sensitive areas, and promoting quality tourism diversification based on regional carrying capacity. Such measures are essential to reducing spatial development disparities and supporting more balanced and sustainable tourism development in Sarbagita.

Keywords: sustainable tourism; spatial plan; spatial plan conformity; tourism activities; Bali



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INTRODUCTION

Background

Indonesian tourism is shifting towards a new paradigm that emphasizes sustainability and quality, prioritizing concepts of personalized, customized, localized, and small-scale. This shift responds to challenges posed by mass tourism, including environmental pressure, cultural change, and social inequality. Tourism development must be carefully designed and implemented to deliver lasting benefits for local communities, the environment, and the economy (Liburd et al., 2012). Ecotourism, as a form of sustainable tourism, is even considered capable of providing net benefits to the natural and social environments when managed with an approach that integrates sustainability principles (Buckley, 2003). With increased attention to the quality of life of local communities, their perceptions and satisfaction levels regarding aspects such as tranquility, public facilities, transportation, employment, and culture have become important indicators of community support for tourism (Woo et al., 2015). More recent work treats overtourism as a failure to balance the environmental, socio-cultural, and economic dimensions of sustainability (Mihalic, 2020) and places residents' quality of life at the centre of tourism research (Uysal et al., 2016).

In Bali, tourism has become the primary sector supporting the regional economy. However, the rapid growth of this sector has not always aligned with regional spatial planning. Uncontrolled growth exceeding regional carrying capacity has placed immense pressure on infrastructure, the environment, and the socio-cultural fabric of local communities. The overtourism phenomenon has accelerated spatial transformations inconsistent with land uses designated in the Regional Spatial Plan (RTRW), leading to sporadic urbanization, the conversion of productive agricultural land, and the development of tourism

accommodation outside designated zones (Chong, 2020; Suyadnya, 2022). This discrepancy indicates weak implementation of spatial policies and insufficient oversight of tourism-based development activities. Spatial planning and the interests of tourism investors have been identified as the main factors shaping the conversion of agricultural land to tourism use in Bali (Mahaendrayasa et al., 2024), and provincial rules have not been able to halt this conversion, partly because much farmland is privately owned (Sumadi, 2024).

The disparity between planning and tourism development implementation is also evident in the suboptimal functioning of spatial-use controls, including weak enforcement of zoning regulations and overlapping interests among sector actors. This is exacerbated by external investment triggering tourism gentrification, i.e., social and spatial changes in which large corporations begin to dominate strategic spaces and displace local communities from their homes (Gotham, 2005; Cocola Gant, 2015). The conversion of traditional residences into commercial spaces, such as hotels, villas, and cafes, erodes cultural identity and local social values. This process not only alters the area's character but also diminishes community attachment to their living spaces, ultimately lowering long-term quality of life (Pieroni & Naef, 2019).

High tourist density in Bali also causes increasingly complex environmental issues, such as traffic congestion, water and air pollution, increased waste, and a freshwater availability crisis (Sperling, 2020). Infrastructure limitations, inadequately considered in tourism planning, affect the comfort of both residents and tourists. One of the most affected areas is Kuta, which now suffers from severe environmental degradation and social pressure due to uncontrolled tourism growth. This situation demonstrates that spatial planning and management that are unresponsive to tourism dynamics can threaten the destination's sustainability.

Therefore, it is crucial to reevaluate the relationship between tourism development and spatial planning policies. Synchronization between the tourism sector and spatial plans is essential to ensure all forms of development remain within designated spatial function corridors. Without this integration, tourism risks becoming a destructive force, eroding local values, creating land use conflicts, and accelerating ecological and social degradation in major tourist destinations like Bali. The question is also timely: the provincial spatial plan for 2023–2043 has only recently been adopted, and it anticipates a revision of the Sarbagita urban-area plan (Bali Provincial Regulation No. 2/2023, Article 142). Evidence on where existing land use departs from the plan, and how this relates to the concentration of tourism, can therefore inform both the implementation of the provincial plan and that revision.

Existing studies of Bali have documented overtourism, tourism gentrification, and pressure on land and infrastructure (Chong, 2020; Suyadnya, 2022; Sperling, 2020). Studies of land-use change in and around Sarbagita show the scale of this pressure. Rimba et al. (2020) mapped land-cover change in Sarbagita from Landsat imagery and projected built-up expansion of up to 43% between 2015 and 2025, at the expense of agricultural land, open land, and forest. Sanjaya and Marsoyo (2019) overlaid land-use maps for 2003, 2011, and 2017 in North Kuta District and found rapid conversion of undeveloped land to built-up land after the designation of the Sarbagita urban area. Alina et al. (2025) overlaid 2024 land cover on the Denpasar spatial plan and on protected food-agriculture land, identifying 380.16 ha of food crop areas converted to built-up land and 205.63 ha of built-up land inside protected agricultural land. At provincial scale, Widhianthini et al. (2025) modelled rice-field loss and the role of subak institutions.

These studies leave two questions open. First, conformity with the spatial pattern plan has not been assessed across all

zones of the Sarbagita urban area: the studies either project or track land-cover change without reference to plan zones, or cover a single district, city, or land category, or are not spatially explicit about conformity. Second, to our knowledge none of them relates plan non-conformity to the concentration of tourism objects and facilities. This study addresses these gaps by combining a kernel density analysis of tourism objects and facilities with a GIS overlay of existing land cover on the Sarbagita spatial pattern plan. Its objective is to assess how far existing land cover conforms to the spatial pattern plan and to examine how the pattern of non-conformity relates spatially to the concentration of tourism activity. Because the analysis is spatial and cross-sectional, it describes association and does not identify causes.

The analysis is guided by regional growth and location theory. Growth pole theory (Perroux, 1955) and unbalanced growth theory (Hirschman, 1958) expect investment to concentrate in central nodes and to create linkages, or spread effects, to surrounding areas, whereas Myrdal (1976) describes backwash effects in which the core draws resources from the periphery. Location theory (Weber, 1909/1929; Lösch, 1944/1954) and central place theory (Christaller, 1933/1966) explain why firms and services cluster where markets are largest and why centres form a service hierarchy. In Indonesian spatial planning, a spatial pattern plan allocates land to functions, while a spatial structure plan sets the hierarchy of centres and networks (Jayadinata, 1999; Presidential Regulation No. 45/2011). These ideas are used to formulate expectations that the maps can examine: (i) tourism objects and facilities cluster in the central nodes designated by the Spatial Structure Plan; (ii) built-up land is concentrated in the same corridor; and (iii) built-up land outside built-up zones appears mainly in the surrounding peripheral districts. The maps can show whether these patterns hold spatially. They cannot, on their own, demonstrate resource or

investment flows between centre and periphery, so backwash and spread effects are treated here as interpretations rather than findings.

METHOD

Based on the aforementioned background, the research problem formulated is: How does the spatial plan for the Sarbagita urban area align with the development of tourism activities? The research objective is to assess the conformity of existing land cover with the Sarbagita spatial pattern plan and to examine how non-conformity relates spatially to the distribution and density of tourism objects and facilities. This study employs a quantitative spatial analysis that combines a GIS overlay of land cover and planning data with a kernel density analysis of tourism objects and facilities. Kernel Density is a statistical method used to model and depict the spatial distribution of a phenomenon. It is commonly used in spatial analysis to determine the density distribution of a variable or event across a geographic area. The results are typically represented as a heatmap or continuous surface showing high or low density levels. This heatmap helps identify density patterns or concentrations, pinpoint significant density centers, and provide insights into the spatial distribution of the studied phenomenon, i.e., the density of tourism objects and facilities. Visitor density is not estimated, because a kernel surface based on attraction points represents attraction density unless location-specific visitor weights are available.

Data collection via web scraping extracts information from websites by automating the retrieval of data from HTML code. This method involves direct access to a website's source code to obtain structured data. This is supplemented by direct observation to assess the development conditions in the area. The following is the flowchart of the data processing methodology in this study.

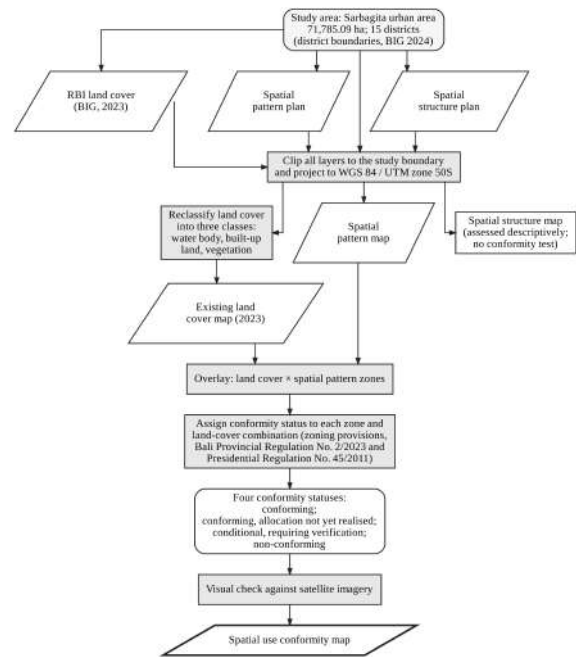


Figure 1. Spatial Data Processing Flowchart (Source: Author's analysis, 2025)

This flowchart outlines the methodology for determining spatial use conformity in the Sarbagita Area. The process begins with the study-area boundary (15 districts; BIG, 2024), to which all input layers are clipped. The Rupabumi Indonesia (RBI) land cover (BIG, 2023) is reclassified into three classes (water body, built-up land, and vegetation) to produce the existing land cover map for 2023. The spatial pattern plan is processed into a spatial pattern map, while the spatial structure plan is assessed descriptively and is not part of the conformity test. Existing land cover is then overlaid on the spatial pattern zones, and each combination of zone and land-cover class is assigned one of four conformity statuses based on the zoning provisions: conforming; conforming, allocation not yet realised; conditional, requiring verification; and non-conforming. The final output is the spatial use conformity map of the Sarbagita Area.

The study area is the Sarbagita urban area, covering 71,785.09 ha in 15 districts (*kecamatan*): Denpasar City (12,587.16 ha;

Denpasar Timur, Denpasar Utara, Denpasar Barat, and Denpasar Selatan), Badung Regency (30,654.98 ha; Abiansema, Mengwi, Kuta Selatan, Kuta Utara, and Kuta), Gianyar Regency (18,588.06 ha; Gianyar, Sukawati, Blahbatuh, and Ubud), and Tabanan Regency (9,954.88 ha; Kediri and Tabanan). District boundaries were derived by dissolving the indicative village/*kelurahan* boundaries of the Geospatial Information Agency (BIG, 2024), with district names and codes following the Minister of Home Affairs Decree No. 100.1.1-6117 of 2022 (Kementerian Dalam Negeri, 2022). The districts that make up the Sarbagita urban area follow the Sarbagita metropolitan planning area data of the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (Kementerian ATR/BPN, 2023). Areas were calculated in WGS 84 / UTM zone 50S (EPSG:32750), and all datasets were clipped to this boundary before any area calculation. Existing land cover for 2023 was compiled from the hydrography, built-environment, and vegetation layers of the Indonesian Topographic Map (Rupa-bumi Indonesia, RBI) at a scale of 1:50,000, obtained from the national geospatial portal of the Geospatial Information Agency (BIG, 2023), and clipped to the study boundary.

The RBI polygons, which BIG derives from satellite imagery, were re-grouped into three classes: water body (rivers, lakes, reservoirs, and other water within the boundary); built-up land (settlements, buildings, and other built-up facilities); and vegetation (all remaining land, including paddy fields, dryland agriculture, plantations, shrubs, forest, and grassland). No image classification was carried out by the authors: the three classes were derived from the RBI vector layers, so the handling of mixed land cover within mapped units follows the RBI source mapping, and the smallest mapped feature is set by the 1:50,000 scale. Land cover was not re-interpreted from imagery, and no independent accuracy assessment was carried out.

This is treated as a limitation. Bare land and beach sand were assigned to vegetation and land under construction to built-up land. Only inland water within the study area was classed as water body; marine and coastal waters were removed before areas were calculated. The planning data were the spatial pattern plan and the road network of the spatial structure plan from the Bali Provincial Spatial Plan (RTRW) (Bali Provincial Regulation No. 2/2023). The maps used are those annexed to the regulation, for the plan period 2023–2043. The published map (scale 1:250,000), compiled from SPOT 6-7 imagery (2020) and the BIG base map (2021), was digitised by the project mapping team and checked by overlaying it on the RBI base map and Google Earth imagery. From the structure plan, only the primary arterial, primary collector, and toll roads were used, as indicators of accessibility for tourism development.

The plan zones were clipped to the study boundary, and both planning layers and the land-cover layer were projected to WGS 84 / UTM zone 50S (EPSG:32750), with geometry errors (overlaps and slivers) repaired before the overlay. Because the plan (1:250,000) is coarser than the land-cover data (1:50,000), zone boundaries are generalised, so mismatches near zone boundaries may partly reflect map generalisation and digitising error rather than land-use change; results are therefore interpreted at the aggregate level. Tourism objects and facilities were extracted from Google Maps by web scraping in December 2024 (Google, 2024), using the Instant Data Scraper browser extension. Searches were run for the 15 districts using eight object categories (art gallery, tourist attraction, beach, historic building, museum, local craft centre, lake, and water park) and eight facility categories (warung, restaurant, café, villa, homestay, apartment, hotel, and souvenir centre), returning 1,156 object records and 2,975 facility records. For tourism objects, the unit of analysis is the tourism offering rather than the site: by

design, a site offering more than one type of attraction (for example, a lake with an attached tourist attraction) was recorded once for each type. Only exact duplicates (the same name, district, and category; 14 records) were removed, leaving 1,108 object records within the 15 districts at 986 sites, of which 101 carry more than one offering.

Sites with several offerings therefore carry more weight in the density surface, which is intended, because they concentrate more tourism activity. A further 34 object records, mostly beaches whose points fall just seaward of the land boundary, could not be assigned to a district but were retained in the kernel density analysis. For tourism facilities, the unit of analysis is the business: listings with the same name in the same district were merged (248 records), a listing retrieved under more than one category (for example, as both villa and homestay) was assigned to a single category by keywords in its name or, failing that, to the first category retrieved, and one record without a name was removed, leaving 2,711 facilities within the 15 districts and 15 records outside the boundary. Closed establishments could not be identified from the listings, and category errors in single listings were not corrected. To assess how completely the listings represent tourism businesses, the cleaned facility listings were compared with business counts published by Statistics Indonesia (BPS) for 2023, the most recent year available at district or regency level (BPS Kabupaten Badung, 2024; BPS Kabupaten Gianyar, 2024; BPS Kabupaten Tabanan, 2024; BPS Kota Denpasar, 2024).

For food services (restaurants, cafés, and warung), the 319 listings in the five Badung study districts corresponded to about 6% of the 5,351 businesses recorded for Badung Regency, the 322 listings in Denpasar City to 22% of the 1,447 recorded for the city, and the 96 listings in Ubud to 8% of the 1,273 recorded for that district. Coverage was higher in the other

Gianyar districts (14% in Sukawati, 21% in Blahbatuh, and 34% in Gianyar) and approached or exceeded the BPS count in Kediri (83 listings against 120 businesses) and Tabanan (152 against 138). For accommodation (hotels, villas, homestays, and apartments), the 605 listings in the Badung study districts corresponded to 14% of the 4,370 accommodation businesses recorded for the regency. These comparisons are approximate: the BPS counts include food businesses that do not mainly serve tourists, the Badung figures cover the whole regency, including Petang District outside the study area, the Denpasar category also includes bars and caterers, and the two sources refer to different years.

The pattern is nevertheless consistent: coverage is lowest where tourism businesses are most numerous, probably because Google Maps returns a limited number of results for each search. The density surfaces therefore understate the concentration of tourism facilities in the core districts, so the contrast between the core and the periphery is likely larger than the maps show, and listing counts are not interpreted as totals of businesses. The density surfaces were computed from the listings before exact duplicates were removed (14 object and 249 facility records); because these are a small share of the records and mostly repeat listings at the same site, they are unlikely to change the density classes at district scale. Because the land-cover data refer to 2023 and the tourism listings to December 2024, tourism locations are interpreted against land cover that may predate them. This difference in reference dates is treated as a limitation.

Conformity was assessed by overlaying each land-cover class on the spatial pattern zone in which it falls. Each combination of zone and land-cover class was assigned one of four statuses based on the zoning provisions of Bali Provincial Regulation No. 2/2023 and the Sarbagita urban-area plan (Table 3): conforming, where the land cover matches the function allocated to the zone; conforming, allocation not yet

realised, where vegetation or water remains in a zone allocated to built-up use; conditional, requiring verification, where the land cover may be permitted or prohibited depending on the use and its permits; and non-conforming, where the land cover conflicts with the provisions of the zone. The zones in Tables 2–4 are the classes of the spatial pattern map annexed to Bali Provincial Regulation No. 2/2023, used without merging or simplification. The asymmetry between tourism and settlement zones follows the function assigned to each zone in the Sarbagita urban-area plan.

Presidential Regulation No. 45/2011 directs the Sarbagita urban area to function as an international-scale tourism centre with a Balinese cultural identity, to be achieved partly by conserving its natural and socio-cultural assets (Article 7). Its tourism zone is defined as the coastal and upland areas that have high tourism appeal (Article 59), and tourism is to be developed in integration with *subak*-based agriculture (Article 11). In this setting, beaches, water bodies, rice terraces, and other vegetated landscapes are themselves tourism attractions and form part of the function allocated to the zone, so vegetation and water within the tourism zone are treated as conforming. By contrast, the urban and settlement zones are allocated to built-up activity at high to medium intensity (Articles 57–58), so vegetation or water remaining there indicates an allocation not yet realised; it is not treated as a violation and is classed as conforming, allocation not yet realised, also because agriculture, plantations, and green open space are permitted in settlement zones and green open space in transportation zones (Bali Provincial Regulation No. 2/2023, Articles 96 and 97).

Part of this vegetation may also contribute to the minimum 30% green open space required across the area (Article 52), which the land-cover classes cannot distinguish. Treating all built-up land in the tourism zone as conforming does not test

building intensity, height (Article 71), or permitted-use limits, which are beyond the resolution of the land-cover data. The provincial plan designates Sarbagita as a National Activity Centre (Bali Provincial Regulation No. 2/2023, Articles 16–17), sets its delineation according to the national strategic-area plan (Article 76(3)), and defers to that plan in the Teluk Benoa area (Articles 38, 40, and 142); the Sarbagita urban-area plan (Presidential Regulation No. 45/2011, as amended by Presidential Regulation No. 51/2014) is therefore used to interpret the functions of the zones.

The zoning provisions show that some buildings are compatible with zones classed here as not designated for built-up use. In agricultural areas, existing settlements, irrigation structures, nature tourism, and socio-cultural and religious buildings are permitted, and settlement, agritourism, and limited tourism-support facilities are permitted with conditions, while conversion of protected sustainable food-agriculture land (LP2B) is prohibited (Bali Provincial Regulation No. 2/2023, Article 90); the Sarbagita plan likewise allows tourism and socio-cultural activities in its agricultural zone and requires at least 90% of the farmland in that zone to be designated as LP2B (Presidential Regulation No. 45/2011, Article 99). In coastal setbacks, tourism-support facilities, customary and religious buildings, and existing or permitted buildings are allowed with conditions (Bali Provincial Regulation No. 2/2023, Article 85).

In conservation areas, only limited management facilities and strategic infrastructure are allowed (Article 86). Built-up land in agricultural and buffer zones may therefore include permitted uses as well as possible violations, which the land-cover data cannot separate, so it is classed as conditional, requiring verification, whereas built-up land in conservation zones is more likely to conflict with the plan and is classed as non-conforming. The buffer zone corresponds to the class Kawasan

Penyangga in the legend of the provincial map. In the water body zone, water is classed as conforming, built-up land as non-conforming, and vegetation, which may be riparian or wetland vegetation, as conditional, requiring verification (Article 83). No field survey was carried out, and permit data were not used. Instead, the land-cover classes and the non-conforming areas were checked visually against satellite imagery. For the kernel density analysis, the Kernel Density tool in ArcMap was used; it applies a quartic kernel function (Silverman, 1986; Esri, n.d.). No population (weight) field was used, and tourist counts from BPS were not included, so the surfaces represent the density of listed tourism objects and facilities, not visitor numbers.

The surfaces were computed with the default output cell size of the tool (134 m for the object surface and 139 m for the facility surface), with density expressed per km², were clipped to the study boundary, and were divided into three classes (low, medium, and high) using natural breaks (Jenks). A fixed search radius of 1,300 m was used for both surfaces so that they can be compared directly. This distance, about 15–20 minutes on foot, corresponds to the scale of a tourism cluster or neighbourhood and is finer than the district scale at which the classes are interpreted. No edge correction was applied, so density near the outer boundary of the study area, particularly along the coast, may be underestimated. A sensitivity test with alternative search radii was not carried out. To limit dependence on the radius, the surfaces are interpreted only as three broad density classes at district scale, not cell by cell. The main high-density areas (Kuta, North Kuta, Denpasar, and Ubud) appear in both the object and the facility surfaces, which were computed from two separate point datasets, and coincide with the established tourism centres of southern Bali and Ubud.

RESULTS AND DISCUSSION

Tourism development in the Sarbagita metropolitan area exhibits rapid, complex dynamics. Based on the distribution map of tourism objects, web scraping results indicate that current tourist destination concentrations in Bali are dominated by South Bali, particularly Kuta, Legian, Seminyak, Jimbaran, Nusa Dua, Sanur, and Uluwatu, as well as the Ubud area in Gianyar. These regions are Bali's primary tourism magnets due to their comprehensive combination of attractions, ranging from beaches and culture to cuisine and modern lifestyle. Meanwhile, the Tabanan region is known for its nature-based tourism potential, such as Tanah Lot within the study area and Jatiluwih and the hills of Penebel outside it, although the density of tourism objects and facilities in the Tabanan study districts is lower than in Badung and Gianyar.

The flowchart above explains the steps to generate the distribution and density maps of tourism objects and facilities for the Sarbagita Area. The process starts by extracting listings from Google Maps using web scraping, producing tabular data (name, category, and coordinates) on tourism objects and facilities. These data are cleaned (same-name listings in the same district merged, one category assigned per listing, and records outside the study boundary set aside; see Method) and classified into tourism attractions and tourism business services, then converted into point data clipped to the study boundary. The points are used to produce distribution maps and, through kernel density analysis, density maps of tourism objects and facilities. Finally, the density maps are overlaid with the spatial pattern zones and the non-conforming areas to count tourism objects and facilities per zone, conformity category, and district, which is the basis for examining their spatial association with non-conformity.

This development aligns with the existing trend in Bali's tourism, showing a tendency for uneven spatial growth. Tourism economic activities remain highly concentrated in the southern part, the epicenter of hospitality, commerce, entertainment, and transportation. This area is the economic backbone of Bali Province, but also faces significant environmental and social pressures, including chronic congestion, declining groundwater quality, increasing

waste volumes, and the conversion of productive agricultural land to commercial uses (Chong, 2020; Sperling, 2020). This phenomenon illustrates that Bali's tourism success is inseparable from the risk of over development, which threatens environmental sustainability and regional carrying capacity. The following is the method for collecting tourism object distribution data via web scraping.

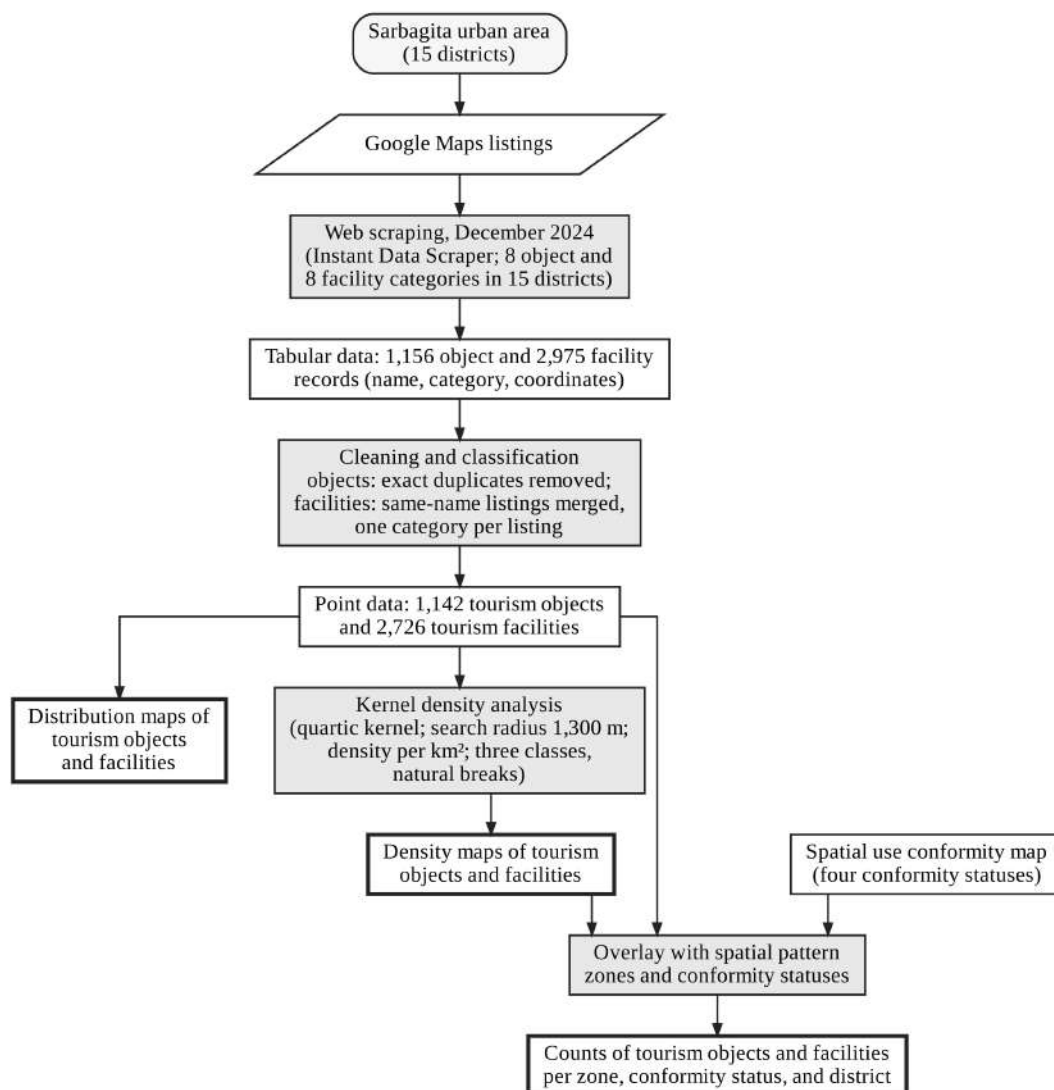
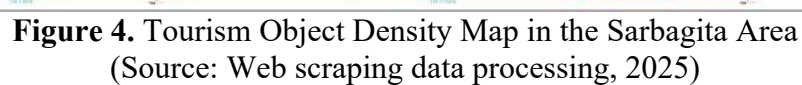


Figure 2. Flowchart of Data Collection and Density Analysis of Tourism Objects and Facilities in the Sarbagita Area (Source: Author's analysis, 2025)

The tourism infrastructure distribution map shows that the density of facilities such as hotels, villas, restaurants, cafes, and souvenir centers is very high along the

southern coastal corridor and in Denpasar. This infrastructure has grown rapidly in response to tourist market demand patterns.



The Tourism Object Density Map (Kernel Density) is the result of density analysis from the object distribution shown in Figure 3. This map no longer shows point-by-point locations but presents zoned areas with the highest to lowest concentrations of tourism objects using color gradation. Zones with high density (red) are concentrated in Denpasar City, Kuta and North Kuta in Badung Regency, and Ubud and Sukawati in Gianyar Regency (the center of cultural and boutique tourism), showing a high concentration of Tourism Attraction Objects (ODTW).

Figures 3 and 4 include tourism objects only (the eight object categories listed in the Method); accommodation, food, and souvenir services are mapped separately in Figures 5 and 6. South Kuta, which contains the Nusa Dua, Jimbaran, and Uluwatu areas, falls entirely in the low-density

class; this more likely reflects incomplete listing coverage and coastal points outside the land boundary than low tourism activity. Conversely, areas with medium and low density tend to be located further north. In medium-density zones, nature-based and daytrip ODTWs become dominant, with supporting infrastructure that is more moderate.

In contrast, in low-density zones of mountainous areas, existing tourism objects are very sparse and consist almost entirely of isolated natural or spiritual ODTWs. The density of tourism objects thus shows a similar spatial pattern to the density of infrastructure (Figures 5 and 6), which is consistent with a higher concentration of Tourism Business Services in denser areas, although this was not tested statistically.

Tourism Infrastructure

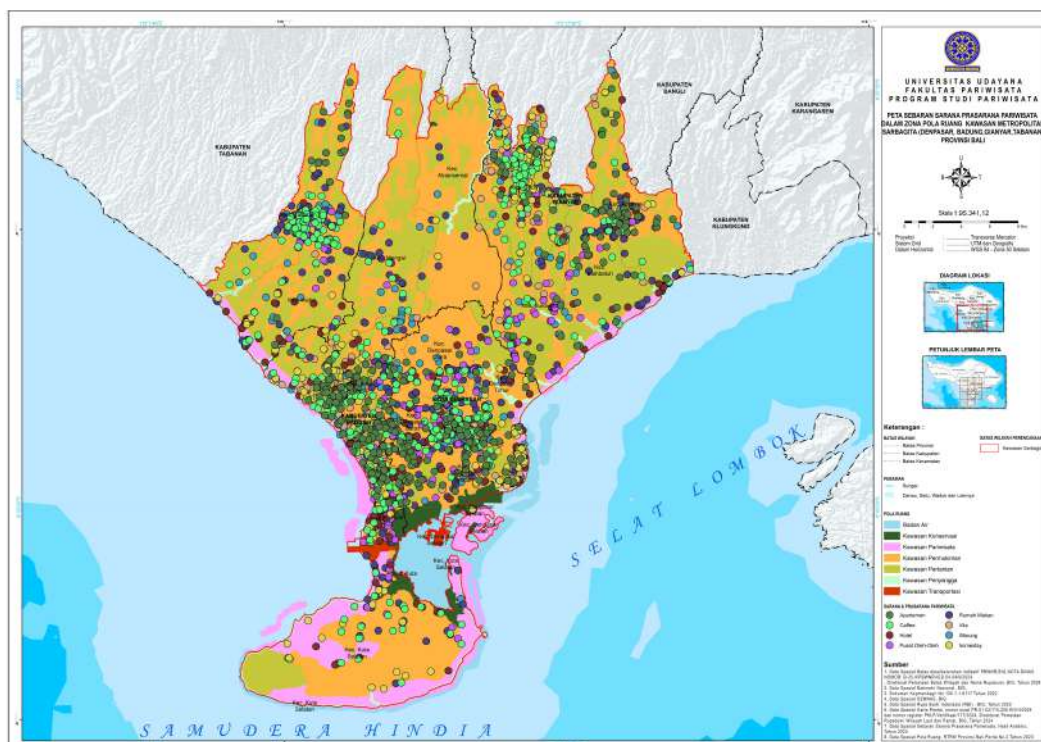


Figure 5. Tourism Infrastructure Distribution Map in the Sarbagita Area
(Source: Web scraping data processing, 2025)

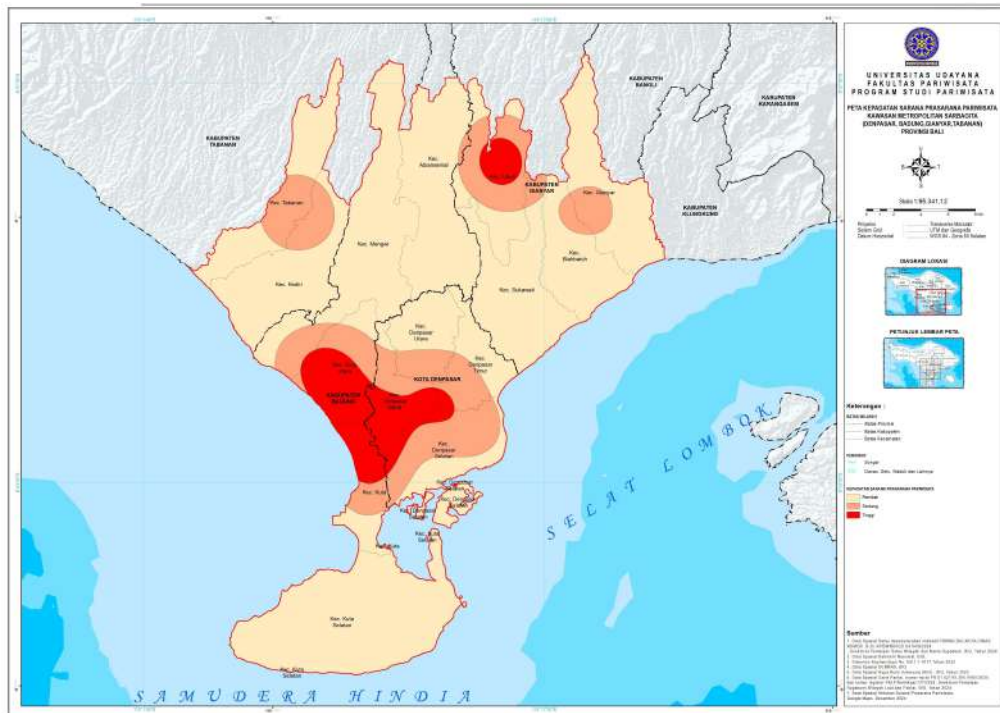


Figure 6. Tourism Infrastructure Density Map in the Sarbagita Area
(Source: Web scraping data processing, 2025)

Geospatial analysis of the SARBAGITA Area reveals a closely similar spatial pattern (compared visually; no correlation coefficient was calculated) between the distribution of tourism attractions and the density of Tourism Facilities and infrastructure, as indicated by Kernel Density modeling. Zones with the highest density are concentrated in Badung Regency (Kuta and North Kuta Districts), Denpasar City (West Denpasar District), and Gianyar Regency (Ubud District), which is consistent with an infrastructure-oriented integrated tourism development model. Functionally, Kuta and Seminyak serve as Global Tourism Service Centers, characterized by high concentrations of accommodation (hotels and villas) and restaurants, underscoring their role as primary "capacity centers". Meanwhile, Ubud District reflects an agglomeration more focused on cultural and wellness tourism, supported by a concentration of facilities catering to long-stay tourism.

This similarity has spatial implications: the high-density areas are likely to have experienced intense land-use

intensification, which would make them more vulnerable to environmental carrying capacity issues and potential spatial use deviations if development remains uncontrolled. Conversely, peripheral areas in northern Tabanan and Badung show a clear development gap. Despite having scattered natural and cultural ODTW, the low density of Tourism Facilities and infrastructure indicates a lower concentration of tourism development. Whether this reflects spare capacity cannot be determined from density alone, and any diversification should follow a carrying-capacity assessment. Such an assessment would help prevent replication of the excessive agglomeration model seen in core zones. Here, diversification should be interpreted not merely as adding ODTW types but as a spatial strategy to distribute tourism economic activities through selective, locally characteristic infrastructure development. Therefore, planning should strive to maximize the specific ODTW potential in these peripheral areas while preserving environmental carrying capacity and ensuring supporting infrastructure development does

not compromise non-tourism land functions, such as agriculture and green open spaces.

Land Use

Analysis of existing land use in the Sarbagita Area, covering the 71,785.09 Ha study area (Table 1), confirms anthropogenic dominance over natural land cover. Operationally, this signifies the supremacy of land functions altered or created by human activity (built-up land) over original ecological systems (vegetation). Quantitatively, this dominance comprises Built-Up Land of 36,884.90 Ha (51.4%), exceeding the Vegetation area of 34,720.19 Ha (48.4%).

Table 1. Land Use Area of Sarbagita Area

Land Use	Total (Ha)
Water Body	180.00
Built-Up	36,884.90
Vegetation	34,720.19
Grand Total	71,785.09

Source: RBI spatial map data processing, 2023.

Spatially, built-up land is concentrated in the southern and central parts of the area, forming a dense corridor that encompasses all of Denpasar City and the South Badung coastal areas, including Kuta and South Kuta Districts, and extends linearly to Gianyar, including cultural centers like Ubud District. This pattern coincides with the clustering of tourism objects and facilities described above. The Vegetation category shows spatial contrast, primarily concentrated in northern areas with mountainous topography, especially in Tabanan.

Built-up land now covers more than half of the area (51.4%). This is a snapshot of 2023 land cover, not a conversion rate, because no earlier land-cover map was compared. This condition points to the need for strict spatial policy, particularly to secure the remaining vegetation cover and Water Bodies (180.00 Ha) to maintain environmental carrying capacity and mitigate ecological risks amid ongoing development pressure.

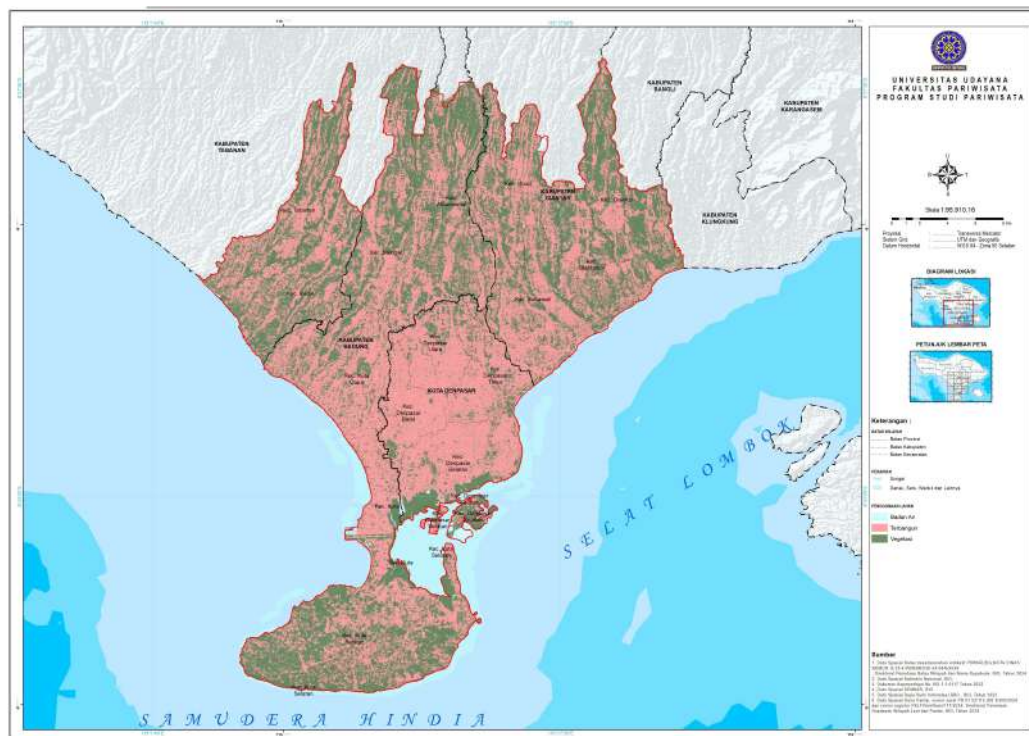


Figure 7. Land Use Map of Sarbagita Area
(Source: RBI spatial map data processing, 2023)

Spatial Plan of the Sarbagita Area

Analysis of the Sarbagita Area Spatial Pattern Plan shows allocations that give priority to settlement and tourism functions, which is consistent with accommodating the existing economic concentration. Quantitatively, Settlement Areas (39,187.74 Ha) and Tourism Areas (6,107.72 Ha) together account for 63.10% of the study area (Table 2). This suggests that the plan is designed to accommodate and expand the development pace in the southern and central core zones (Denpasar City and Badung Regency). This concentration aligns with the identified patterns of agglomeration of tourism objects and facilities. At the same time, Conservation Areas are allocated only 1,317.22 Ha (1.8% of the area), located in South Denpasar, South Kuta, Kuta, and Abiansemal. Whether this is insufficient cannot be judged without a stated benchmark, and ecological functions are also protected through other zones (buffer and agricultural zones). The 30% standards that apply in Bali refer to areas with a protective function across the province's land area (Bali Provincial Regulation No. 2/2023, Article 9) and to green open space in urban areas, of which at least 20% must be public (Article 9; Presidential Regulation No. 45/2011, Articles 11 and 52); neither sets a minimum share for conservation zones within an urban area. The conservation-zone total is therefore reported descriptively and is not taken as evidence that the plan provides too little ecological space.

This zoning pattern is reinforced by the Spatial Structure Plan, which establishes a highly centralized service hierarchy configuration. Denpasar City and Badung Regency are designated as regional central nodes (gateways), supported by concentrations of vital infrastructure and axial transportation networks, which may reinforce development polarity and

attract investment to the already dense southern region; investment flows were not measured in this study. Although the Sarbagita RTRW normatively establishes clear spatial functional divisions, designating southern areas as tightly controlled international tourism centers and central/western areas directed towards sustainable nature tourism, the extent to which existing land use follows these divisions is examined below through the conformity analysis. The conformity of the spatial structure was assessed only descriptively (Figure 9): planned and existing road networks or service nodes were not compared, so structural conformity is not evaluated here. Of the 387 villa listings, 320 lie outside tourism zones: 243 in settlement zones, where tourism is a permitted use, 72 in agricultural zones, and 5 in buffer zones (see the overlay of tourism points below). Collectively, the combination of extensive settlement and tourism allocation (Spatial Pattern Plan) and the strengthening of existing service centers (Spatial Structure Plan) may add to non-conformity in areas where built-up land already exceeds 50% of the area. This necessitates policy interventions that selectively direct infrastructure investment to service nodes in peripheral regions to promote sustainable diversification.

Table 2. Spatial Pattern Plan Area of Sarbagita Area

Spatial Pattern	Area (Ha)
Conservation Area	1,317.22
Tourism Area	6,107.72
Residential Area	39,187.74
Agricultural Area	22,953.31
Buffer Area	1,743.57
Transportation Area	475.52
Total	71,785.09

Source: Bali Provincial Spatial Plan (RTRW) map, data processing.

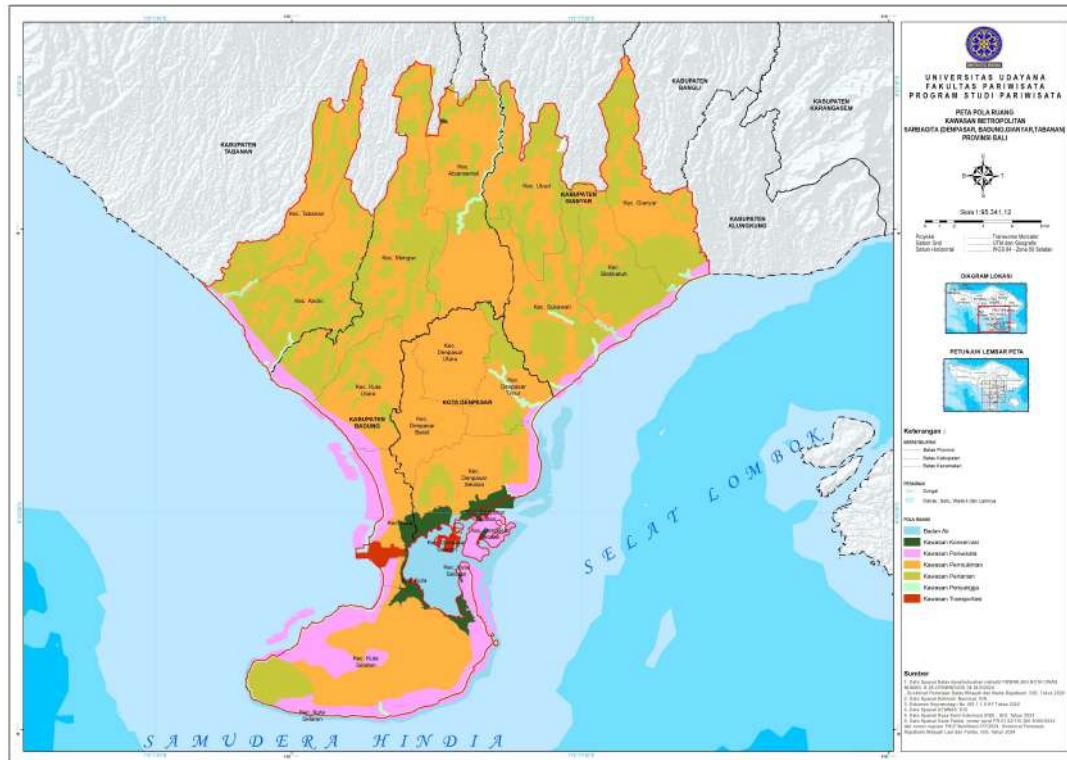


Figure 8. Spatial Pattern Map of Sarbagita Area
(Source: Bali Provincial Spatial Plan (RTRW) map, data processing)



Figure 9. Spatial Structure Map of Sarbagita Area
(Source: Bali Provincial Spatial Plan (RTRW) map, data processing)

Spatial Use Conformity

Applying the status matrix (Table 3) to the overlay (Table 4; Figure 10) shows that 45,236.75 Ha (63.02%) of the study area conforms to the spatial pattern plan and is classed as conforming. A further 16,037.12 Ha (22.34%) is vegetation or water retained in zones allocated to settlement or transport and is classed as conforming, allocation not yet realised, rather than as a violation, and part of it may serve as green open space. Built-up land in agricultural and buffer zones, 10,358.35 Ha (14.43%), is classed as conditional, requiring verification: these zones permit some buildings, such as existing settlements,

agritourism, and tourism-support facilities, with or without conditions (Bali Provincial Regulation No. 2/2023, Articles 85 and 90), so whether this land conflicts with the plan can be settled only by checking permits, which broad land-cover classes cannot show. Only 152.87 Ha (0.21%), built-up land in conservation zones, is classed as non-conforming. The water body zone of the provincial map has no area within the study boundary. About one-seventh of the area therefore requires verification and very little clearly conflicts with the plan, so the overlay should not be read as a direct measure of enforcement failure.

Table 3. Conformity Status by Spatial Pattern Zone and Land Cover

Spatial pattern zone	Water body	Built-up	Vegetation	Basis
Water Body	Conforming	Non-conforming	Conditional, requiring verification	Regional Regulation 2/2023, Art. 83
Conservation Area	Conforming	Non-conforming	Conforming	Regional Regulation 2/2023, Art. 86
Tourism Area	Conforming	Conforming	Conforming	Regional Regulation 2/2023, Art. 95; Presidential Regulation 45/2011, Arts. 7, 59
Residential Area	Conforming, allocation not yet realised	Conforming	Conforming, allocation not yet realised	Regional Regulation 2/2023, Art. 96; Presidential Regulation 45/2011, Arts. 52, 57–58
Agricultural Area	Conforming	Conditional, requiring verification	Conforming	Regional Regulation 2/2023, Art. 90; Presidential Regulation 45/2011, Art. 99
Buffer Area	Conforming	Conditional, requiring verification	Conforming	Regional Regulation 2/2023, Art. 85; Presidential Regulation 45/2011, Arts. 11, 71
Transportation Area	Conforming, allocation not yet realised	Conforming	Conforming, allocation not yet realised	Regional Regulation 2/2023, Art. 97

Note: Regional Regulation 2/2023 = Bali Provincial Regulation No. 2/2023.

Source: Author's analysis, 2025

Spatially, the largest area classed as conditional, requiring verification, is the Built-Up Land within planned Agricultural

Areas, reaching 9,584.62 Ha. This conflict is concentrated in transitional and agrarian regions, led by Mengwi (2,073.57 Ha),

Kediri (1,303.82 Ha), and Sukawati (1,168.51 Ha), followed by Tabanan, Blahbatuh, Gianyar, and Ubud (about 730–830 Ha each), which are normatively designated as green belts and food buffers. This pattern is consistent with pressure for peripheral settlement and tourism infrastructure development, possibly linked to high land prices in city centers, but the overlay maps only where mismatch occurs: land prices, development timing, investor behavior, and displacement were not measured, so these explanations remain interpretations. Part of this built-up land may also be permitted under zone provisions or may pre-date the plan, which the land-cover overlay cannot distinguish. Meanwhile, there are 15,875.32 Ha of Vegetation area within regions planned for settlements. This phenomenon is found mainly in Abiansemal (3,030.54 Ha) and South Kuta (2,965.65 Ha) and, to a lesser extent, in Mengwi, Tabanan, Gianyar, and Kediri and is still in a transitional development phase.

Although this area does not yet realise the settlement allocation, it can be interpreted positively as a remaining reserve of Green Open Space (RTH). This dual pattern points to implementation challenges. On the one hand, planned agricultural land contains substantial built-up land; on the other, settlement allocations are not fully realized, providing a final opportunity for policy intervention to secure RTH before total conversion occurs. Nonetheless, the 152.87 Ha of Built-Up Land within Conservation Areas, mostly in South Denpasar (82.41 Ha) and Kuta (46.75 Ha), are classed as non-conforming: they are likely violations of protected zones and warrant verification. Collectively, the map shows that built-up land outside its designated zones occurs in agrarian regions, while tourism objects and facilities cluster in core zones; it does not isolate tourism from other urban drivers. This points to the need for corrective policies to safeguard agricultural land in the peripheral districts of Badung, Tabanan, and Gianyar, alongside enforcement of regulations in conservation zones.

Table 4. Spatial Use Conformity Area and Status of Sarbagita Area

Spatial Pattern	Land Use	Area (Ha)	Status
Conservation Area	Water Body	52.38	Conforming
Conservation Area	Built	152.87	Non-conforming
Conservation Area	Vegetation	1,111.97	Conforming
Total Conservation Area (Ha)		1,317.22	–
Tourism Area	Water Body	101.24	Conforming
Tourism Area	Built	2,747.52	Conforming
Tourism Area	Vegetation	3,258.96	Conforming
Total Tourism Area (Ha)		6,107.72	–
Residential Area	Water Body	17.09	Conforming, allocation not yet realised
Residential Area	Built	23,295.33	Conforming
Residential Area	Vegetation	15,875.32	Conforming, allocation not yet realised
Total Residential Area (Ha)		39,187.74	–
Agricultural Area	Water Body	0.14	Conforming
Agricultural Area	Built	9,584.62	Conditional, requiring verification
Agricultural Area	Vegetation	13,368.55	Conforming
Total Agricultural Area (Ha)		22,953.31	–
Buffer Area	Water Body	2.96	Conforming
Buffer Area	Built	773.74	Conditional, requiring verification

Spatial Pattern	Land Use	Area (Ha)	Status
Buffer Area	Vegetation	966.87	Conforming
Total Buffer Area (Ha)		1,743.57	–
Transportation Area	Water Body	6.19	Conforming, allocation not yet realised
Transportation Area	Built	330.81	Conforming
Transportation Area	Vegetation	138.52	Conforming, allocation not yet realised
Total Transportation Area (Ha)		475.52	–
Total (Ha)		71,785.09	–

Source: Author's analysis, 2025

Note: Status follows the matrix in Table 3. Totals by status: conforming, 45,236.75 Ha (63.02%); conforming, allocation not yet realised, 16,037.12 Ha (22.34%); conditional, requiring verification, 10,358.35 Ha (14.43%); non-conforming, 152.87 Ha (0.21%). The water body zone of the provincial map has no area within the study boundary. Totals may differ by 0.01 Ha because of rounding.

Results integrating tourism activity development against the RTRW show that tourism agglomeration and non-conformity with the spatial pattern plan coincide in parts of the Sarbagita Area. The overlay does not establish a causal relationship between the two. Anthropogenic dominance, interpreted as the supremacy of human activity over natural systems, is evident in the 51.4% built-up share, which is concentrated in the southern and central parts of the area where tourism objects and facilities also cluster. Because the built-up class includes all urban uses (residential, commercial, public, and tourism-related), this proportion cannot be attributed to tourism alone. Without evidence on timing and competing drivers, the overlay cannot show that tourism caused the changes or was the most important driver.

Overlaying the tourism points on the spatial pattern zones and the conformity classes (Figures 11 and 12) links tourism activity directly to the conformity results; for this step, all 1,142 object and 2,726 facility records, including points just beyond the land boundary, were assigned to the adjacent zone. Of the object records, 805 (70.5%) lie on land classed as conforming, 76 (6.7%) on land classed as conforming, allocation not yet realised (vegetation in settlement zones), 251 (22.0%) on land classed as conditional, requiring

verification, and 10 (0.9%) on land classed as non-conforming. The conditional objects are in buffer zones (175, of which 105 are beaches and 39 attractions along the coast) and in agricultural zones (76, mainly art galleries, historic buildings, and attractions); because these zones permit tourism and cultural uses, some with conditions (Bali Provincial Regulation No. 2/2023, Articles 85 and 90), these points show where permitted-use checks are needed rather than confirmed violations. Of the facility listings, 2,339 (85.8%) lie on land classed as conforming, 99 (3.6%) on land classed as conforming, allocation not yet realised, 283 (10.4%) on land classed as conditional, requiring verification (247 of them in agricultural zones), and 5 (0.2%), all in conservation zones, on land classed as non-conforming.

Accommodation (1,315 listings) lies mostly in settlement zones (909, 69.1%), where tourism is a permitted use under the Sarbagita plan (Presidential Regulation No. 45/2011, Articles 57–60), and only 216 (16.4%) in tourism zones; 171 (13.0%), including 72 of the 387 villas, lie in agricultural zones and 19 in buffer or conservation zones. At district scale, facilities in agricultural zones are concentrated in Ubud (82) and North Kuta (41), two of the four districts where facility density is highest, whereas the share of facilities on

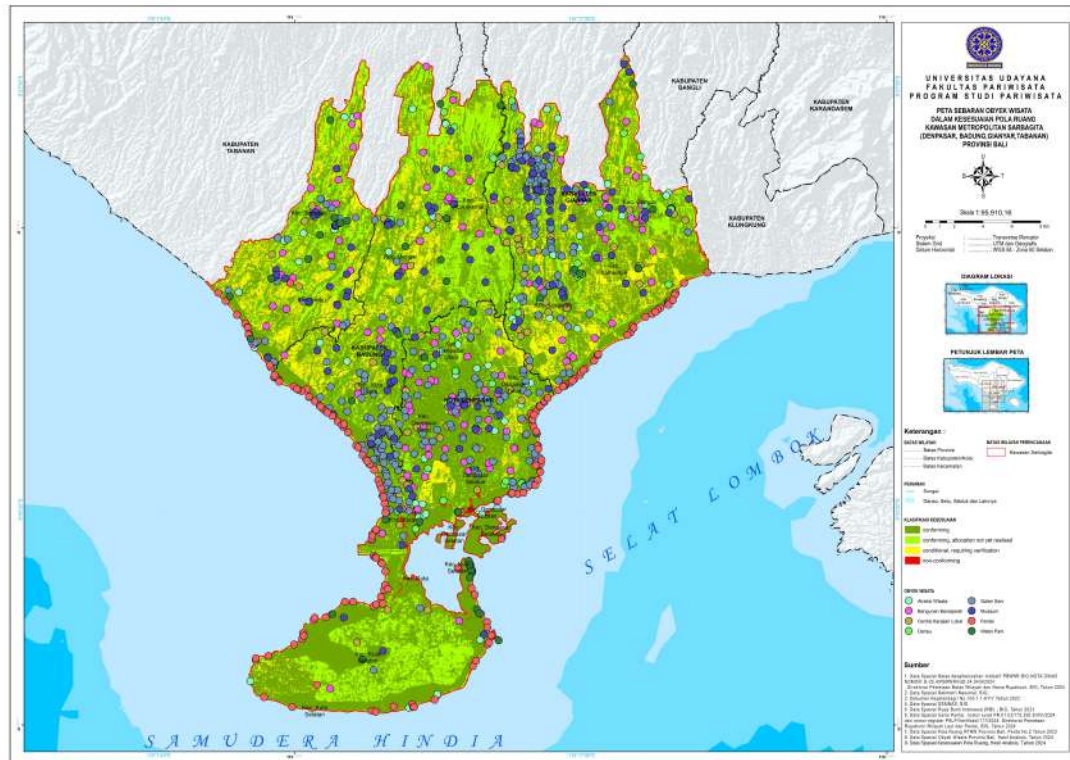


Figure 11. Tourism Objects and Spatial Use Conformity in the Sarbagita Area
(Source: Map data processing, 2025)

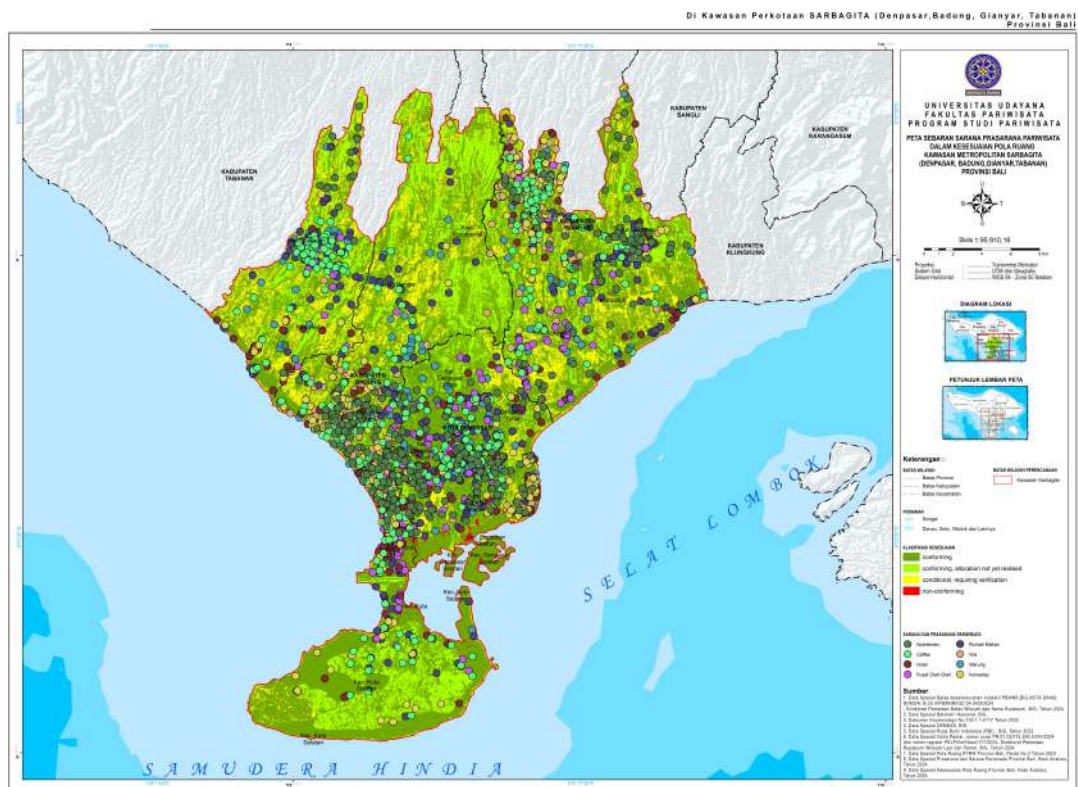


Figure 12. Tourism Facilities and Spatial Use Conformity in the Sarbagita Area
(Source: Map data processing, 2025)

CONCLUSION

This research shows a mismatch between plan and land cover in the Sarbagita Area: the Regional Spatial Plan (RTRW) allocates land and service nodes in a pattern that coincides with the concentration of tourism, while about one-seventh of the area has a conformity status that depends on permits and only a small part clearly does not conform to the spatial pattern plan. In answer to the research question, 63.02% of the area (45,236.75 Ha) conforms to the spatial pattern plan, and 22.34% (16,037.12 Ha) is vegetation or water in zones allocated to settlement or transport, an allocation not yet realised rather than a violation. Built-up land in agricultural (9,584.62 Ha) and buffer zones (773.74 Ha), together 14.43%, is conditional: these zones permit some buildings, so its conformity depends on permits. Only 0.21% (152.87 Ha), built-up land in conservation zones, does not conform. Tourism objects and facilities are densest in southern Badung and central Gianyar, where built-up land is also concentrated. Overlaying tourism points on the plan shows that most tourism objects (70.5%) and facilities (85.8%) lie on land that conforms to its zone; conditional facilities are mainly in agricultural zones, concentrated in Ubud and North Kuta, and form a larger share of facilities in peripheral districts.

Theoretically, the RTRW is consistent with the concepts of development polarity (Perroux, 1955) and unbalanced growth (Hirschman, 1958) through its centralized hierarchy in Badung Regency and Denpasar City. This hierarchy may reinforce the existing tourism economic agglomeration, which location theory attributes to efforts to maximize markets (Lösch, 1944/1954) and profit. However, reinforcing this centralized pattern may make the RTRW more accommodating of existing agglomeration patterns than corrective. One possible interpretation is a backwash effect (Myrdal, 1976). Built-up land within planned agricultural zones in peripheral

regions could reflect development pressure moving outward from the core. This study mapped land cover and plan conformity only and did not measure resource or investment flows, so backwash and spread effects are not demonstrated here and are offered as a hypothesis for further research.

These findings are consistent with Richardson's (1979) critique of the growth pole strategy's implementation in developing countries, which often fails to balance polarization and instead worsens inequality and spatial-use conflicts, although this study did not test that critique directly. Therefore, policy attention should focus on (i) verifying and, where confirmed, correcting built-up land in planned agricultural zones, notably in Mengwi, Kediri, and Sukawati, and in conservation zones (152.87 Ha), through the provincial and regency or city spatial-planning and permit-issuing authorities; and (ii) considering structured diversification outside core agglomeration zones. Diversification is a proposal rather than an outcome demonstrated by these maps: before any peripheral infrastructure is developed, carrying-capacity checks of agriculture, water resources, and protected areas, and local community participation, are needed to ensure that pressure on these resources does not increase. Such a policy would aim to strengthen spread effects (Myrdal, 1976) and more balanced linkages (Hirschman, 1958) to mitigate spatial conflicts and support more equitable regional growth.

This study has limitations. Google Maps listings favor visible commercial establishments, so tourism coverage may be incomplete; for example, only eight hotels were retrieved in South Kuta, which contains the Nusa Dua and Jimbaran resort areas, and compared with BPS business counts the listings covered only about 6–22% of food-service businesses in Badung, Ubud, and Denpasar. Land cover is classified into three broad classes that cannot distinguish permitted from prohibited buildings or agricultural land from other vegetation. The land-cover data (2023) and

tourism data (December 2024) come from different dates. The spatial pattern plan was digitised from a 1:250,000 map and overlaid on 1:50,000 land-cover data, so zone boundaries are generalised and mismatches near zone boundaries may reflect map generalisation and digitising error rather than land-use change. Results were checked only visually against satellite imagery; no field validation or independent accuracy assessment was carried out. The kernel density surfaces depend on the chosen search radius, and their sensitivity to alternative radii was not tested. The analysis compares a single date and has no temporal or causal comparison. Accordingly, the conditional (14.43%) and not-yet-realised (22.34%) areas indicate a mismatch between plan and land cover and are not, by themselves, evidence of enforcement failure, and the spatial association between tourism and built-up land does not show that tourism drove land conversion.

AI USE STATEMENT

No artificial intelligence (AI) tools were used in the preparation, writing, editing, or analysis of this manuscript. The authors take full responsibility for the originality, accuracy, integrity, and credibility of all data and content presented in this paper.

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