

Research on Delineating Urban Development Boundaries in Small and Medium-Sized Towns: A Case Study of Huangping County

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Abstract:As a key regulatory line within the “Three Zones and Three Lines” framework that balances ecological conservation and urban development, the urban development boundary aims to define the spatial scope for concentrated urban construction and functional enhancement within a specified period. This paper systematically analyzes the limiting factors of urban construction in Huangping County by reviewing current approaches to delineating urban development boundaries. It focuses on regional ecological resource endowments, current land use patterns, and the effectiveness of existing planning implementation, grounded in the “dual evaluation” framework (assessing resource-environmental carrying capacity and spatial development suitability) and the “dual assessment” framework (evaluating planning implementation and risk identification). Building on this foundation, the paper proposes development boundary delineation strategies from an urban planning perspective that balance ecological conservation with local economic development, aiming to provide reference for similar small and medium-sized towns.

Keywords: Urban Development Boundary; Master Plan; Conservation; Economic Development

In 2019, the General Office of the CPC Central Committee and the General Office of the State Council issued the “Guiding Opinions on Coordinated Delineation and Implementation of Three Control Lines in Territorial Spatial Planning,” clarifying the principles for delineating ecological conservation red lines, permanently protected farmland, and urban development boundaries. In 2023, the Ministry of Natural Resources issued the “Notice on Strengthening the Management of Urban Development Boundaries (Trial

Implementation),” further standardizing the management and implementation of urban development boundaries based on the delineation outcomes of the “Three Zones and Three Lines.” As a key control line within the national territorial spatial planning system, the urban development boundary serves as both a core tool for implementing spatial use controls and ensuring the balance between development and protection, and a vital measure for guiding orderly urban construction, curbing disorderly sprawl, protecting open spaces, and preserving the ecological environment.

1. Overview of Huangping County

Huangping County, a major town under the administration of Qiandongnan Miao and Dong Autonomous Prefecture, has a permanent population exceeding 240,000, qualifying it as a typical small-to-medium-sized town. The county is situated on the slope where the hilly terrain of central Guizhou transitions to the low mountainous hills of eastern Guizhou. Its topography slopes from northwest to southeast, with the northern part belonging to the foothills of the Wuling Mountains and the southern part to the Miao Mountains. The county hosts nature reserves, national scenic areas, and national forest parks, boasting high forest coverage and a robust ecological foundation. However, its terrain exhibits significant elevation differences—ranging from a maximum altitude of 1,367 meters to a minimum of 519 meters—with fragmented landforms and scarce flat land, imposing natural constraints on urban development space.

As Qiandongnan Prefecture's “One Core, Two Poles, Three Axes, Three Zones” urban spatial pattern gradually takes shape and the integration of the Kaili metropolitan area accelerates, Huangping County's locational advantages are increasingly evident. The current Huangping County Master Plan (2011–2030) is evolving from a “One City, Two Districts, Two Parks”

structure to a new spatial framework of “One City, One Belt, Two Districts, Five Clusters.” Against this backdrop, scientifically delineating urban development boundaries not only helps optimize the territorial spatial pattern, enhance land use efficiency, and promote intensive and resource-saving development, but also effectively guides healthy, orderly, and sustainable urban growth while strengthening the predictability and implementation stability of planning.

2. Background for Urban Development Boundary Delineation

2.1 Supporting Role of “Dual Evaluations” and “Dual Assessments”

“Dual Evaluations” and “Dual Assessments” form the crucial technical foundation for delineating urban development boundaries. “Dual Evaluations” focus on regional resource and ecological fundamentals, encompassing assessments of ecological conservation importance (e.g., water conservation, soil erosion prevention, biodiversity preservation), suitability for agricultural production, suitability for urban development, and resource-environmental carrying capacity. The “Dual Assessments” emphasize reviewing the effectiveness of existing planning implementation. By evaluating the scope of current built-up areas, idle land reserves, and industrial land performance, they identify issues and potential in planning implementation. This approach reserves reasonable flexibility for boundary delineation and provides precise direction for optimization and adjustment.

2.2 Constraint Mechanisms for Urban Development Boundaries

Development boundary delineation models are categorized into forward-derivation and backward-constraint approaches. The forward-derivation model involves analyzing the town's current development status, growth patterns, and development needs to determine land requirements. By integrating spatial structure and implementing proactive regulatory measures, it establishes an orderly development boundary. The backward-constraint model, conversely, identifies inviolable development thresholds through resource and environmental capacity analysis. It synthesizes various development demands, coordinates them

holistically, and delineates permissible and restricted construction zones within the urban development space.

3. Delineation of Huangping County's Urban Development Boundary

3.1 Delineation Criteria Based on “Dual Evaluation” and “Dual Assessment”

After compiling statistics on the town's current construction land, other existing construction land, and surplus construction land, the municipal-level “dual evaluation” results serve as the basis. These are cross-checked with provincial-level “dual evaluation” outcomes to identify suitable urban development zones within the region and analyze potential development spaces. Based on the data results, within the urban development area, there are areas designated as suitable for construction and areas unsuitable for construction according to the “dual evaluation.” In the terrain, urban space intertwines with agricultural space and ecological space, with highly overlapping functions. In some areas, urban space is even “surrounded” by permanently protected farmland and ecological protection red lines. Based on multi-factor evaluations of urban land resources, water resources, climate, environment, hazards, and locational advantages, the primary limiting factor for urban development in Huangping County is determined to be terrain slope. Considering the county's topographical undulations, slope direction, and elevation, areas within the urban development boundary with slopes between 0° and 25° are designated as suitable for construction, while areas with slopes exceeding 25° are classified as unsuitable.

In ecological management, based on Huangping County's conservation and development bottom lines, efforts will be strengthened to protect natural resources and restore ecosystems, including rivers, reservoirs, mountain ponds, and areas affected by rock desertification. Optimal adjustments will be made for regions with unsuitable conditions.

For overlapping areas between unsuitable urban construction zones identified in the “dual evaluations” and existing construction land within the delineated urban development boundary as per the Third National Land Survey, the following principles apply: When conflicts arise among the three control lines, the urban development boundary should avoid

encroaching on important ecological functions, minimize or avoid occupying permanent basic farmland, and incorporate land uses and demands already included in legitimate plans into the development boundary.

Based on Huangping County's Master Plan (2011–2030), it has played a positive role in implementation, effectively guiding the construction of county-level towns, industrial parks, major projects, and infrastructure. From a regional development perspective, Huangping County must leverage its locational advantages to promote rational urban layout and continuous improvement of urban functions. Possessing unique resource conditions while maintaining rapid economic growth, the county is an indispensable component in building the Qiandongnan Economic Circle.

3.2 Methodology for Defining Huangping County's Urban Development Boundary

Under the “One City, One Belt, Two Zones, Five Clusters” master plan, Huangping County has seen gradual urban expansion and sustained economic growth. Current urban development exhibits strong land expansion demands. Logically, a forward-looking approach to defining development boundaries better aligns with Huangping's economic growth and land requirements.

Concurrently, Huangping County features complex topography, situated at the transition zone between the hilly terrain of central Guizhou and the low mountains and hills of eastern Guizhou. With an elevation difference exceeding 800 meters across the county, flat land is fragmented and scarce. Urban spatial development is severely constrained by topography, often presenting elongated, clustered, or bead-like distribution patterns. Except for the relatively concentrated construction land in the central urban area, other townships are distributed along river valleys and mountain valleys, with narrow and elongated development spaces that struggle to form the minimum enclosed area of 30 hectares. Under these circumstances, a reverse constraint model should be used for boundary delineation.

In summary, Huangping County is both an economically rapidly developing township and possesses significant ecological value. Therefore, in delineating its urban development boundary, it must accommodate future urban growth while respecting economic development patterns and

meeting ecological conservation needs. Neither a purely forward-derivation nor a reverse-constraint approach alone can address Huangping's practical circumstances. The county's urban development boundary requires exploring a control line suitable for its development by combining forward and reverse approaches.

Based on the results of the national land spatial suitability evaluation, ArcGIS spatial analysis software was used to identify relevant ecological spaces. After processing fragmented patches, the enclosed area was delineated as the urban development boundary for Huangping County. In implementing reverse constraints: First, in accordance with national regulations, reverse constraints for urban development boundary delineation were strengthened. Through coordination with county departments regarding water source protection zones, public forest distribution areas, scenic area first-level protection zones, and historical and cultural burial zones, the development boundary avoided all relevant restrictive conditions without conflict. Second, the development boundary did not breach ecological protection or water resource carrying capacity thresholds, nor did it encroach upon high-risk geological hazard zones such as unstable slopes, landslide-prone areas, subsidence zones, or mining subsidence areas. Based on transportation accessibility and geographical advantages, existing built-up areas, ongoing construction sites, and approved project sites within the urban development boundary were incorporated into suitable construction zones. Within the existing ecological red line boundaries, suitable construction zones within the red line area have been excluded from the urban development boundary. Consequently, the delineated urban development boundary is primarily located within suitable construction zones, with scattered unsuitable areas capable of meeting urban land development conditions through engineering measures.

Finally, within the scale and spatial structure defined by the current master urban plan, existing contiguous built-up areas requiring inclusion should be incorporated into the concentrated development zone of the urban development boundary. Areas not yet developed but still aligned with the city's strategic development direction as assessed in spatial planning should also be included in the concentrated development zone. Areas not

developed but inconsistent with current development directions should be considered for inclusion in the flexible development zone.

4. Effective Strategies and Considerations for Delineating Small and Medium-Sized Town Development Boundaries

As a crucial component of national territorial spatial planning, the town development boundary serves not only as a key tool for optimizing land use structures and enhancing spatial governance efficiency but also as a vital mechanism for coordinating human-land relations, safeguarding ecological security, and implementing ecological civilization strategies. Its core value lies in comprehensively analyzing new urban settlements tailored to Guizhou's mountainous terrain across six dimensions: urban geographic location, natural conditions, transportation infrastructure, urban service facility placement, socioeconomic factors, and policy guidance. This holistic assessment determines urban development directions, guiding the layout of new urban construction land within development boundaries.

It also scientifically assesses the physical limits of urban development by identifying restrictive spatial elements such as ecological red lines, historical and cultural district protection lines, basic farmland, key ecological conservation areas, regions unsuitable for urban construction, and flood-prone zones. Furthermore, it guides the transformation of urbanization from “incremental expansion” to “stock development” and “intrinsic enhancement.” Therefore,

effectively identifying the value of ecological resources and implementing ecological conservation measures are essential for achieving balanced urban development and protection, thereby advancing ecological civilization construction.

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