Use Case: Green Infrastructure AI Assistant in Skopje, North Macedonia

Overall Objective

A GenAI Green Infrastructure Assistant that reads and interprets unstructured permit documents, technical drawings, and plans from multiple departments, mostly in Macedonian, and helps keep Skopje's Green Cadastre (an urban green space inventory) up to date with accurate vegetation data, subject to expert review, ultimately safeguarding green infrastructure, helping to mitigate urban heat-island effects, and protecting biodiversity as the city grows.

Rationale

Skopje is growing fast. New housing, roads, and infrastructure are necessary, but that growth can come at the cost of trees and green space, driving up summer heat, worsening air quality, and reducing biodiversity. These effects are felt the most in the city's low-tree-coverage neighbourhoods, already located in densely built areas.

To mitigate these issues, Skopje has invested in strong digital foundations for tracking its green infrastructure: the Green Cadastre, maintained by Public Enterprise (PE) Parks and Greenery, alongside an urban heat-island map and a biotope map. However, it has proven hard to keep the Cadastre accurate, as much of the information needed to keep it up to date, such as tree removals, replacement planting and landscaping measures, sits in construction permits, urban plans and project files held across departments, municipalities and public enterprises. Bringing this data together would let the Cadastre reflect what's happening on the ground as it happens, rather than relying on staff to manually reconcile records from multiple sources. Ultimately, this would help the city safeguard its green infrastructure and make better-informed decisions as it continues to grow.

Personas

- **Municipal Representative:** Elena, 44, works at PE Parks and Greenery, where she is responsible for keeping Skopje's Green Cadastre up to date. But the information she needs, on tree removals, replacement planting, and landscaping measures, is generated by permits issued in other city departments. It reaches her as technical drawings, Bills of Quantities and permit files, which she has to review one at a time. This high volume of manual review leaves little time to keep the Cadastre as current as she'd like. She wants a faster way to identify changes, check the evidence, and prepare updates for approval, so she has an accurate, up-to-date overview of the city's green infrastructure, not just records of individual permits handled one at a time.

- **Resident:** Vesna, 61, lives in a densely built neighbourhood in central Skopje with very little tree cover. Summers have become noticeably hotter on her street. She'd like to see more trees and green space nearby, partly for the shade, but also because she's noticed other parts of the city getting greener while hers hasn't. She has no reliable way to find out whether planned developments near her include replacement planting, whether planting commitments have actually been carried out, or whether her neighbourhood is even being considered for future greening investment.

Key Features (Minimum Viable Product)

- **Document Extraction:** Uses GenAI to read and interpret construction permits, tree-removal approvals, landscaping plans, and other documents, including scanned PDFs and Word files, mostly in Macedonian. It extracts structured information on existing trees, approved removals, planned planting, and related obligations. CAD support will be tested on representative files before it is confirmed.

- **Location Matching and Proposed GIS Updates:** Connects extracted information to locations and existing Cadastre records and proposes georeferenced updates, showing uncertainty where a match is incomplete.

- **Plain-Language Query:** Lets PE Parks and Greenery staff ask questions in everyday language, such as “what replacement planting is planned near this site?”, and get answers drawn from the Cadastre and reviewed documents, with links to the source evidence.

- **Expert Review Workflow:** Shows the source document and relevant evidence for each finding, allows corrections, and requires approval by an authorised staff member before

any official Cadastre update. The tool makes no autonomous permitting or enforcement decisions.

Optional Features

- **Cumulative Impact Summaries:** Generates a textual summary combining Cadastre data with heat-island and biotope layers to flag where tree or green-space loss is concentrated, or where compensatory planting looks insufficient. Basic summaries of reviewed pilot cases could be tested earlier if the data allows.
- **Priority Greening Map:** A layer recommending priority locations for new planting based on combined heat, biodiversity, and green-access data.
- **Cross-Municipality View:** Extending coverage to the municipalities within the wider Skopje agglomeration.

Target User

Staff responsible for urban greenery and Green Cadastre records in the City of Skopje and PE Parks and Greenery. They will check the information extracted from documents, verify locations, and review proposed updates before they are approved. Planning, permitting, and GIS staff will also contribute to and use the information. The exact team and role responsible for approving Cadastre updates is still to be confirmed.

No public-facing application is planned in this first version. Residents will benefit indirectly, through better greenery management and clearer information on planting.

Expected Benefits

- **Up-to-Date Green Cadastre:** Less lag between what's approved on paper and what the Cadastre reflects.
- **Less Manual Document Review:** Frees specialist staff time for planning, monitoring and enforcement rather than document reconciliation.
- **Evidence-Targeted Greening Investment:** Compensatory planting and new investment can be directed to the highest-need areas.
- **More Transparent Decisions:** Clearer evidence trail for why greening decisions were made where they were.

Indicative Data Types Needed

- Green Cadastre GIS records of trees and green areas. A public GIS service exists, but the project extract, current coverage, update date, and export format need confirming.
- Urban heat-island and biotope data. A public heat-island service and published biotope maps provide background, but the underlying files, dates, access and reuse conditions need confirming.
- Construction permits, tree-removal and pruning approvals, landscaping approvals and urban plans, held in administrative databases, searchable and scanned PDFs, Word files and paper archives. Sample files and any redaction requirements need confirming.
- Technical documentation, including CAD drawings, landscaping plans, engineering drawings, Bills of Quantities, spreadsheets and photographs. A representative sample and an inventory of file types are needed.
- Planting and field verification records, such as planting records, site reports and photographs, where available.

Records are primarily in Macedonian, with some in Albanian and technical terminology in English; data quality, completeness and interoperability will need an initial audit before implementation. The project will start with representative documents and spatial records for a selected pilot area. Exact files, formats, coverage, and access arrangements will be confirmed with the responsible departments and PE Parks and Greenery. Where direct access isn't possible, data can be shared through secure extracts or supervised access, subject to institutional approval. Public sources can help teams get oriented but do not replace the agreed project data package.

Useful Links

- City of Skopje environmental website (background on the Green Cadastre)
- Green Cadastre portal (sign-in required for the full application)
- City of Skopje Greenery Plan 2025-2027 (in Macedonian), including the biotope mapping carried out in 2022

This Use Case is subject to change through the GenAI for Good Challenge phases as collaboration shapes preparation for piloting and implementation.