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Bighorn Sheep Hunt Planning Map – Project Approach

This project builds an interactive, web-based mapping application to support planning and in-field use for a bighorn sheep hunt within an unfamiliar hunting district. The solution emphasizes a scalable, programmatic workflow for data acquisition, standardization, and processing, while maintaining a clean and intuitive user experience. The entire pipeline is driven by a config.yaml file that determines where source data is collected and what stages are executed. This allows the system to be reused across districts or species with minimal effort. The project can be broken down into the following stages: data collection, processing, and UI integration (ETL).

The data collection stage begins with identifying which datasets are necessary to support informed hunting decisions. The most important factors for a new hunter involve understanding regulations, access, terrain characteristics, land cover, and habitat insights. Data included in the project are public and private land information, roads and trails, water, NAIP imagery, terrain derivatives, species distribution, and a derived habitat suitability index. All datasets are retrieved programmatically by querying ArcGIS REST endpoints using the hunting district bounding box. Elevation data is acquired through the USGS' TNM Access API. This automated process ensures reproducibility and scalability, requiring only an update to the config file to support additional areas.

Once raw data has been acquired, it undergoes a standardization and processing phase. First, field_mappings.json is used to normalize the data, renaming source-specific columns and mapping attribute values to more legible terms. Next, the data is validated against layer_schema.json, which defines the target schema. This step enforces the target CRS, filters out any fields not explicitly defined in the schema, and ensures data types are correct. Geometries are standardized at this stage by dissolving lines and polygons by name, and ensuring all data is in a consistent CRS. Further data processing includes deriving slope metrics from the terrain data, and a habitat suitability index that integrates slope and distance to water as favorable habitat, and proximity to roads as a proxy for hunting pressure. This index is useful to supplement the MT FWS species distribution data by providing further spatial context to the landscape.

The final stage integrates the processed data into a web application built with React, Mapbox GL, and Tailwind CSS with help from Anthropic's Claude LLM. Emphasis was placed on usability across both desktop and mobile devices. Layers and labels are toggleable, styled for readability, and labels are set to display with zoom levels in mind. Each feature on the map is queryable with a click and displays its information to the user with a popup window. Another key feature of the UI was implementing Mapbox's 3D terrain, giving the user context to the terrain that simple contours may not achieve. A measuring tool was also added that toggles between miles and yards, allowing users to gain insight into hiking distances, as well as shot distances.

Several insights emerged throughout development. Species distribution data alone does not provide sufficient resolution for effective planning without additional context. Proximity to water and the presence of escape terrain influence habitat clustering, while distance from roads acts as a way to model hunting pressure and habitat disturbances. Another key component in a habitat analysis would be vegetation types and land cover. Additionally, programmatic data acquisition and schema standardization substantially improve scalability and long-term maintainability, especially when many different sources are used.