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A Rich and Heterogeneous Fleet Vehicle Routing Problem for Fuel Lane Management and Wildfire Prevention

Wildfires pose a significant threat to ecosystems, frequently having detrimental effects on the environment and the economy. One of the main reasons for their ignition and propagation is the abundance of unmanaged vegetation, particularly close to linear infrastructures. Countries prone to these hazards have established fuel lane management strategies to mitigate fire risks. Fuel lane management has received special attention in Portugal, as it has particularly low productivity and performance in forest management operations.

This project addresses these problems by developing a model for fuel lane management operations, integrating heuristics, namely *Adaptive Large Neighborhood Search* (ALNS). The plan schedules the allocation of specific machines to different plots over multiple periods, considering operational and environmental costs. The available machines are heterogeneous thus, for different area types, they provide different productivity, which leads to varying service times. Additionally, this problem can be characterized as a Vehicle Routing Problem (VRP) with a limited heterogeneous fleet, making it essential to determine optimal assignments that balance effectiveness and efficiency. Unlike traditional VRP models, whose main objective is to minimize travel costs, this problem incorporates additional constraints related to the fire risk of each plot. Fire risk is crucial in determining the priority of clearing operations, even if this results in a less efficient route.

This research focuses on a case-study in Portugal, exploring the best routes for forest plot clearing operations that satisfy both operational demands and the environmental context of the region.

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