

USING GIS TO HIERARCHICALLY GENERATE AN ECOLOGICAL MONITORING GRID AT THE APPROPRIATE SPATIAL SCALE

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ABSTRACT

The Environmental Monitoring and Assessment Program (EMAP) of the Environmental Protection Agency developed a worldwide sampling grid to evaluate status, change and trends in the condition of ecological resources. The worldwide sampling grid is based on a truncated icosahedron where a single hexagon overlays the conterminous United States. The North American hexagon, made up of six equilateral triangles, was decomposed using the algebraic theory of groups. Under this theory, triangles can be decomposed in such a way as to maintain the triangular structure. The decomposition of triangles results in intensification of the sampling grid. In fact the EMAP sampling grid can be intensified by 3, 4, 7 or any multiple of these factors and maintain its original geometric properties. The EMAP base grid was based on a decomposition of the North American hexagon and had a density of one plot per 648.7 km² where grid points are isotropic and approximately 27.1 km apart. Each grid point represents a hexagonal area constructed using Thiessen polygons.

The EMAP sampling grid is robust and allows sampling at any spatial scale. The EMAP base grid is used by the USDA FS Forest Health Monitoring program (FHM). A 27x intensification is used by the USDA FS Forest Inventory and Analysis program (FIA). An important artifact of this sampling network is co-location of monitoring plots. For example, one in every 27 FIA plots is also an FHM plot. This gives a common basis for relating samples at different intensities. It can be intensified to give information at the state, national forest, watershed or other levels. GIS is a powerful tool that can generate and maintain such an ecological monitoring network. The FHM national office developed an ArcView[®] extension that allows users to intensify the EMAP base grid according to their needs. This is a review of EMAP sampling grid and three methods to decide on an intensification level. The methods are budget-based intensification, variability-based intensification, and area-based intensification. The analysis is presented on the state level. However, the ecological monitoring network and methods of intensification are applicable for industrial forests and research areas.