BRIEF HISTORY OF GEOGRAPHICAL INFORMATION SYSTEMS

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Ian McHarg (1920-1981) the "Father of GIS…"

Ian L. McHarg was born and raised in Scotland. He came to the United States after World War II to get a master's degree in 1952

In 1954 he took a position as Professor of Landscape Architecture and Regional Planning at the University of Pennsylvania and came to be recognized worldwide for introducing ecological concerns into land planning from the mid-1960s onward. An ardent environmentalist and writer, he was one of the prime movers in organizing the first Earth Day in 1970. He was a partner in the landscape architecture and environmental planning firm Wallace, McHarg, Roberts and Todd.

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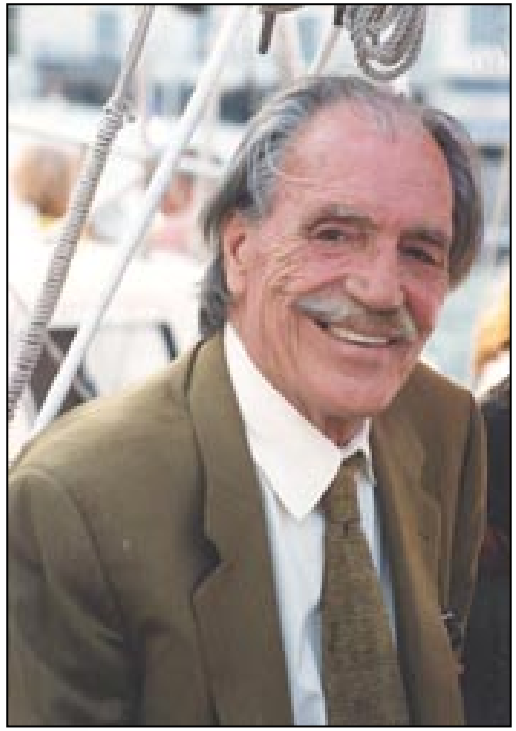

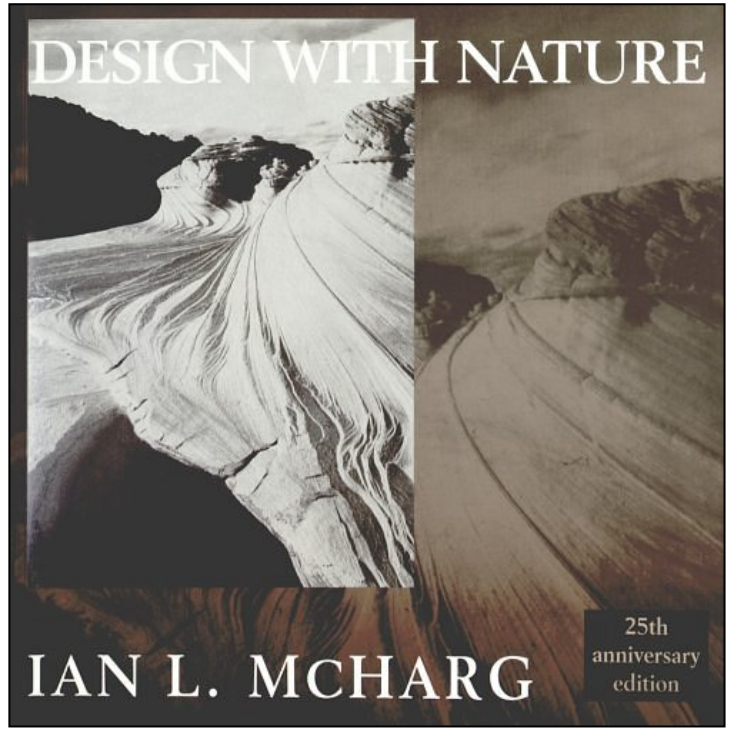

- **Ian McHarg (1920-2001) is credited with being the father of map overlays, which had a major impact on <u>Geographical Information Systems</u>**
- **He was a Professor of Landscape Architecture and Regional Planning at the University of Pennsylvania from 1954-2001**
- **He wrote *Design with Nature* in 1969**

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- **McHarg saw industrial centers as urban plight, filled with pollution that ultimately damaged one's soul as well as health**

McHarg felt that mass grading by engineers created sterile man-made environments devoid of aesthetic buffers in their rush to mass produce the maximum number of units in a minimum space. He felt hat this was inevitably unhealthy for society at large

Before (1971) and after (1977) development views of Deep Canyon in Los Angeles

- **Ian McHarg described engineers as those individuals… "*who, by instinct and training, were especially suited to gouge and scar landscape and city without remorse*"**

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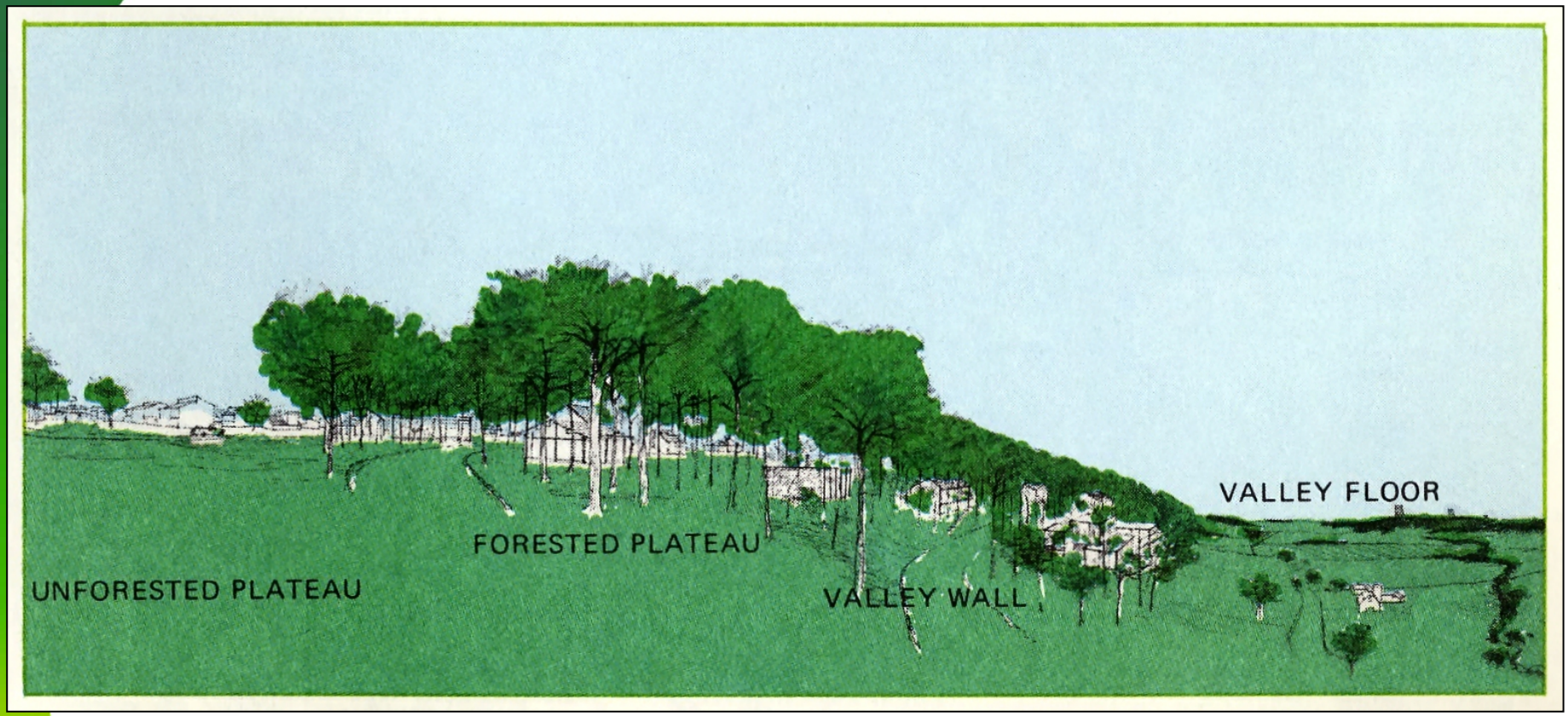

McHarg's starting point was usually a physiographic section, like that shown here. He argued that "*form must not follow function, but must also respect the natural environment in which it is placed*." Note the placement of structures in the forested slopes which made them almost unnoticeable.

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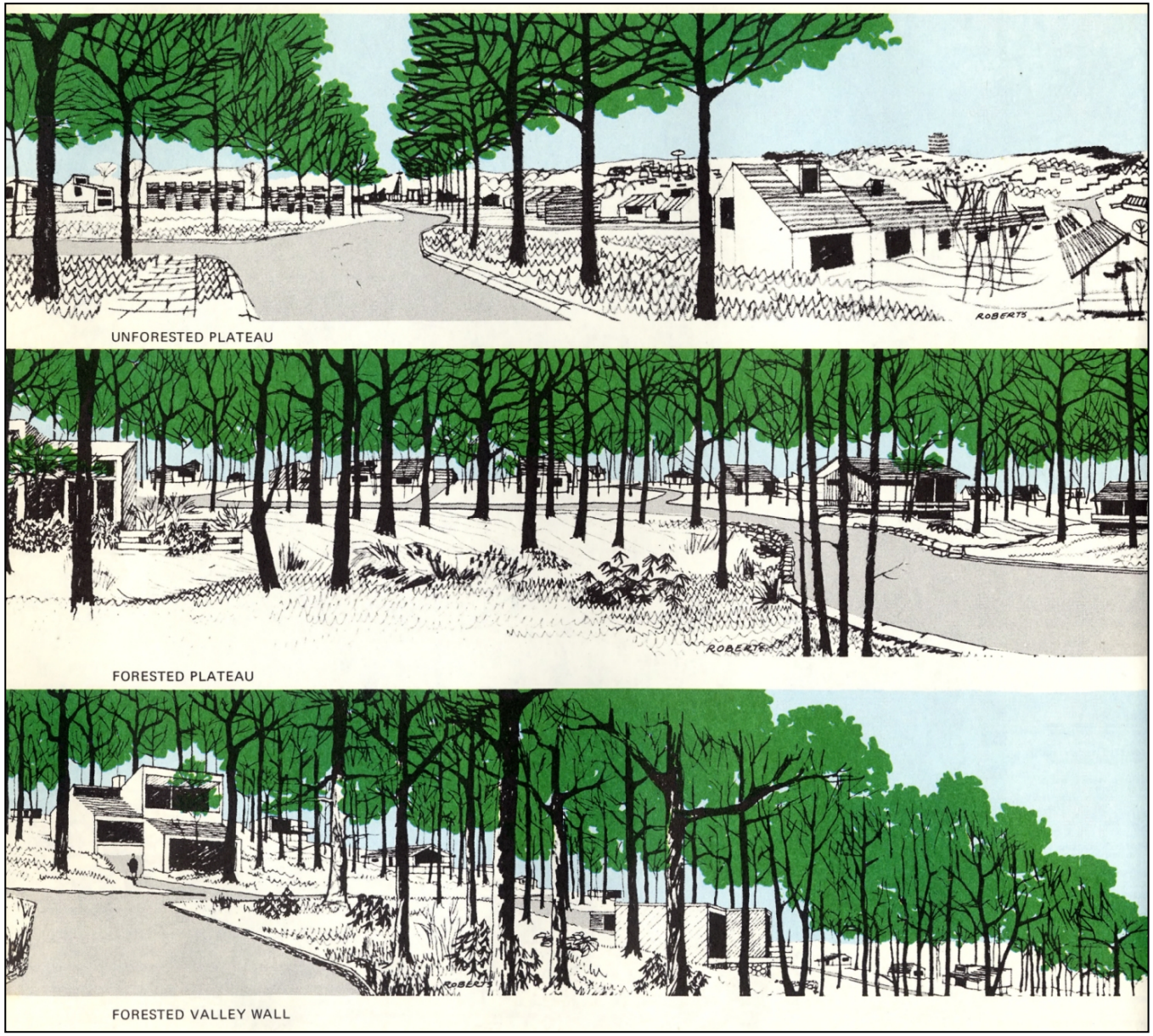

McHarg took landscape principles of aesthetics and applied these to maps

McHarg's <u>Basic Amenity Map</u> portrayed slopes with wooded cover as a valuable asset, akin to a city park. Earth sheltered structures could be constructed on the slopes if they were embedded into the rock with a minimal loss of tree cover. Hence the term "urban camouflage", or "designing with nature"

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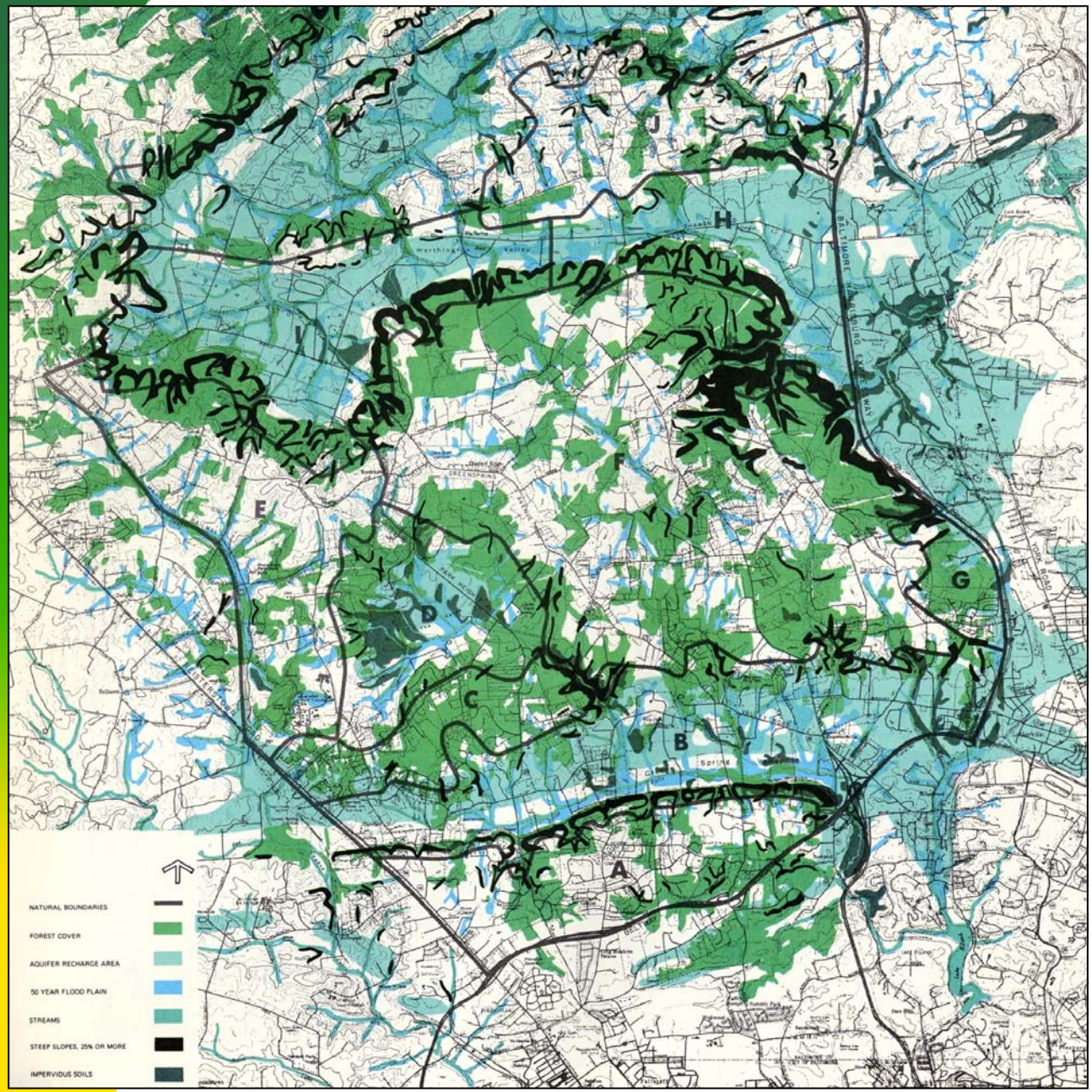
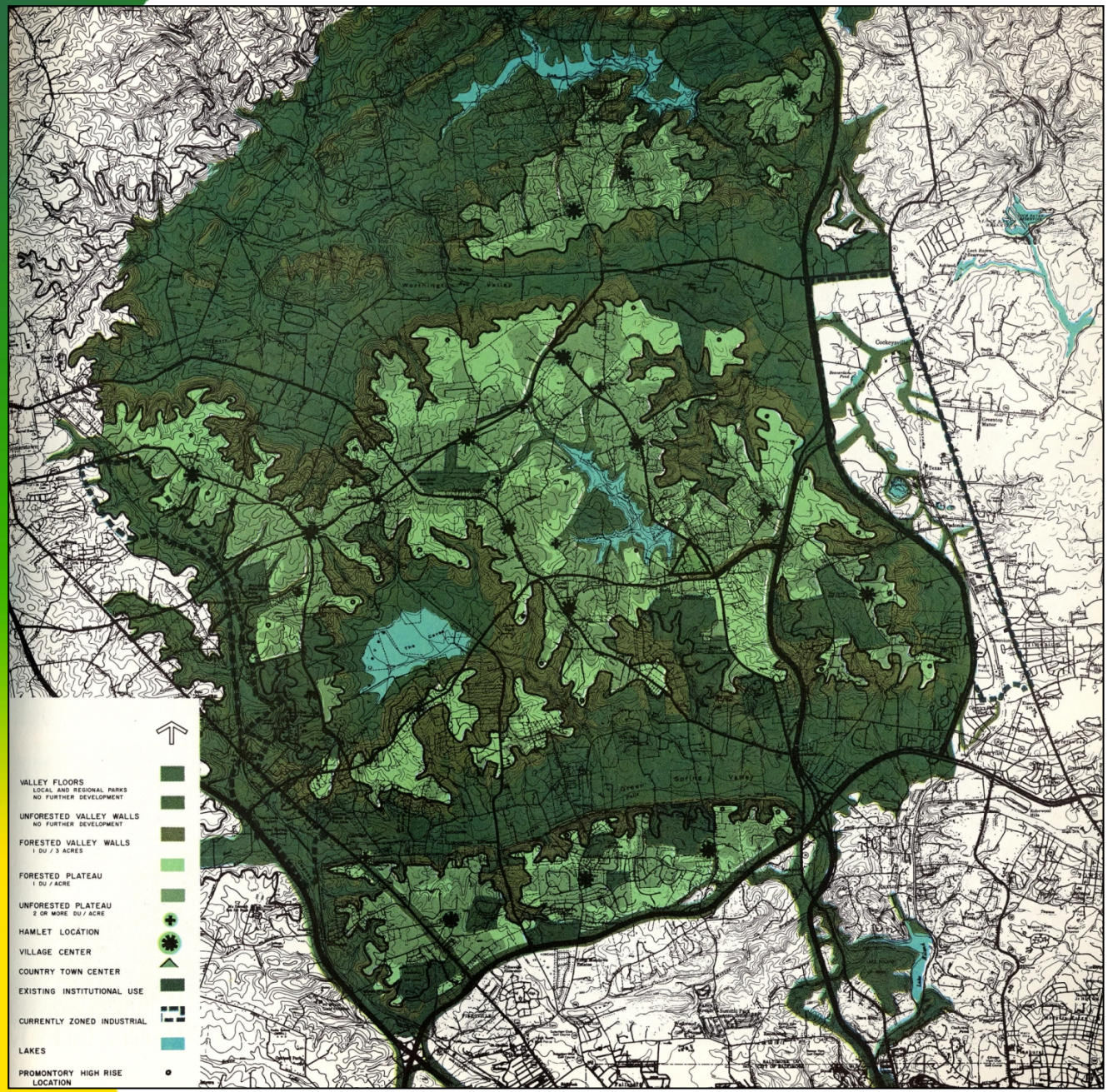
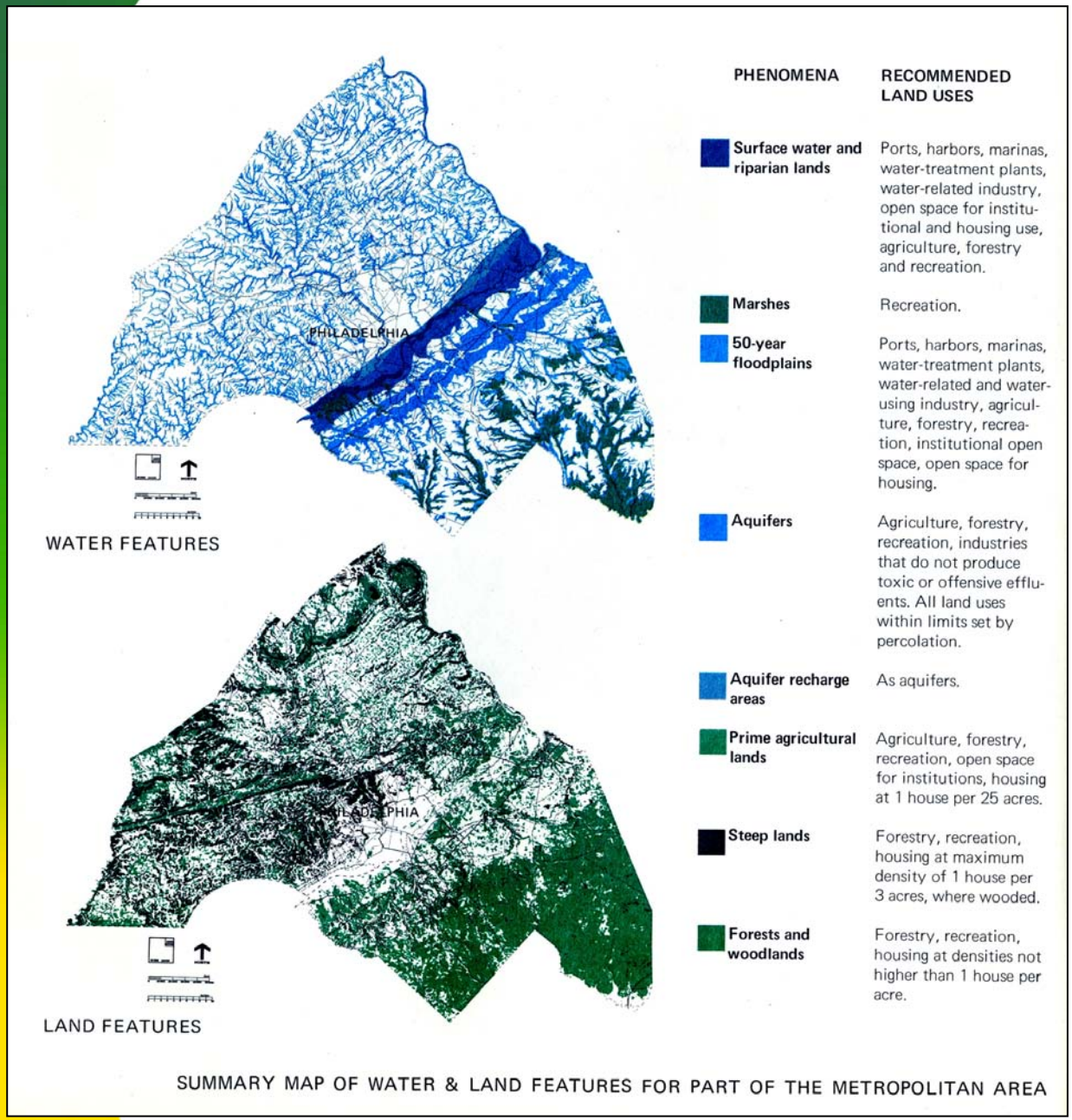


McCarg usually began with a <u>Physiographic Features Map</u>. This example compared forest cover, aquifer recharge, 50-yr flood plain, streams, slopes >25% and impervious soils in a master overlay.

In the early years these hybrid maps were constructed of acetate overlays on a cadastral base map.



- **McCarg's <u>Optimal Land Use Map</u> combined physiographic features with existing infrastructure, development and zoning restrictions which were weighted to the taste of local residents and regulatory boards.**



SUMMARY MAP OF WATER & LAND FEATURES FOR PART OF THE METROPOLITAN AREA

McHarg pioneered the use of map overlays to highlight intrinsic natural features, that commonly included flood zones, wetlands, woody vegetation stands, slopes, drainages, aquifer recharge zones, areas under cultivation and man-made features. Each asset could be assigned an arbitrary value, depending on societal input.

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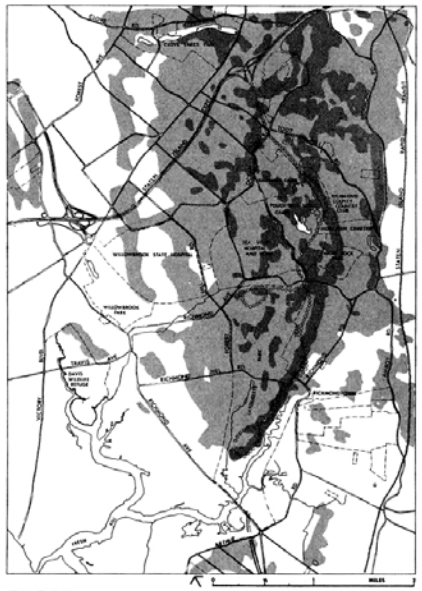


SLOPE

SURFACE DRAINAGE

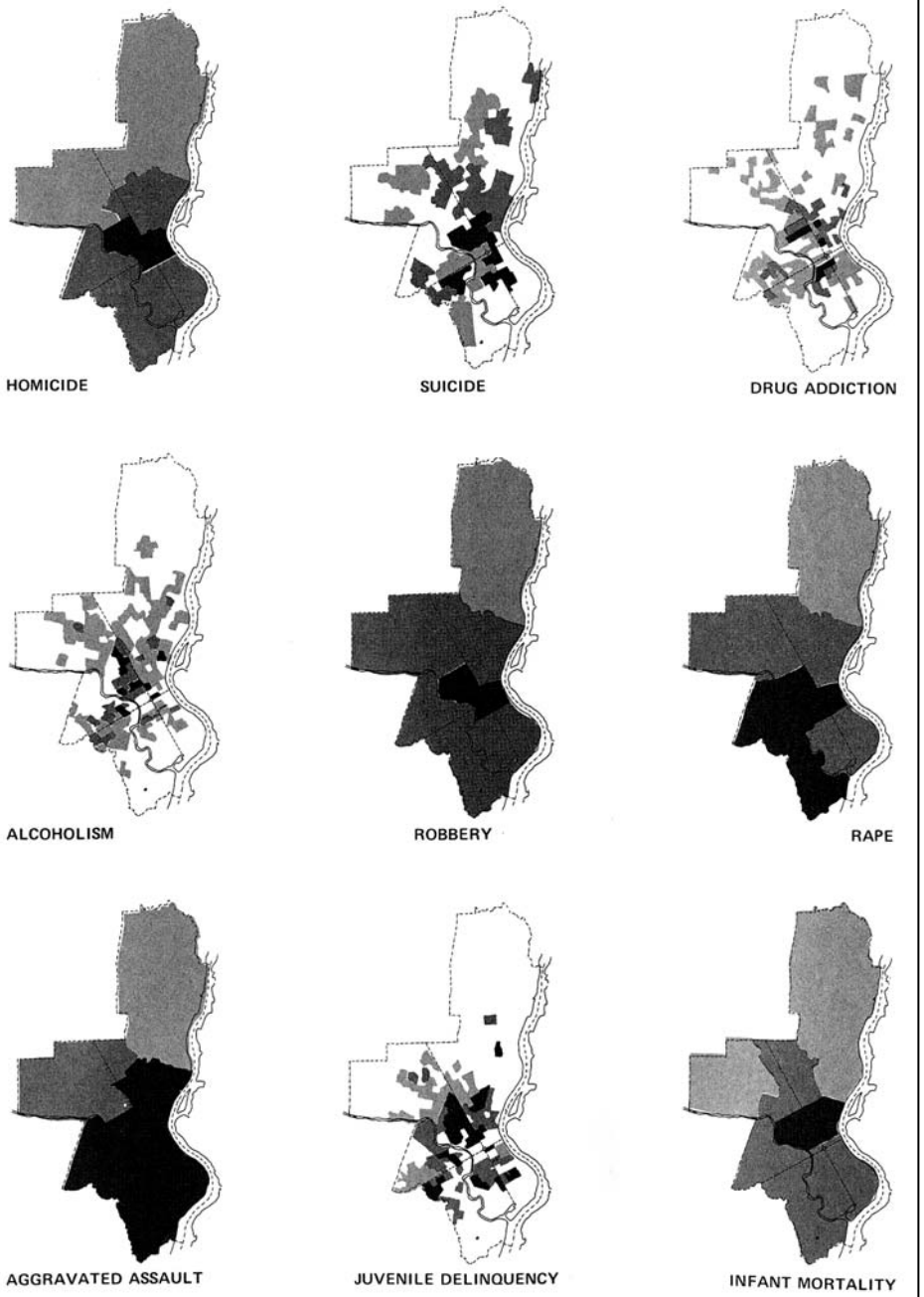
SOIL DRANAGE

BEDROCK FOUNDATION

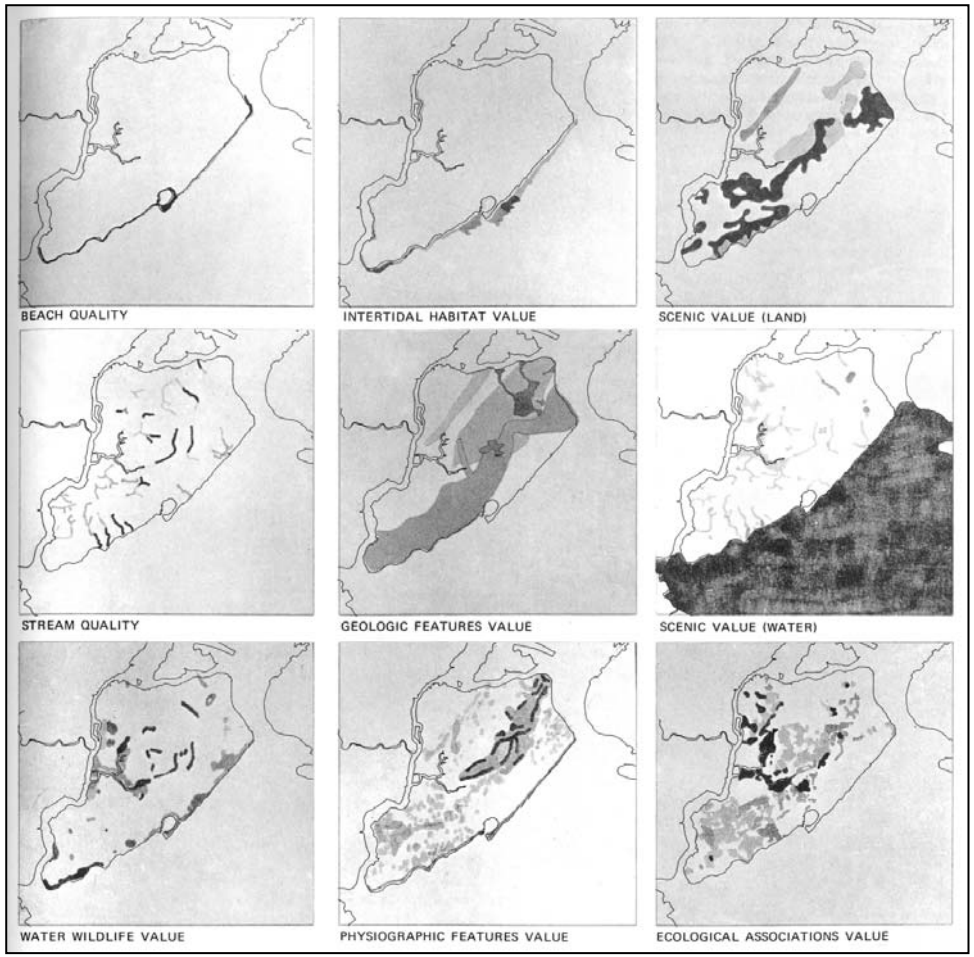
SOIL FOUNDATION

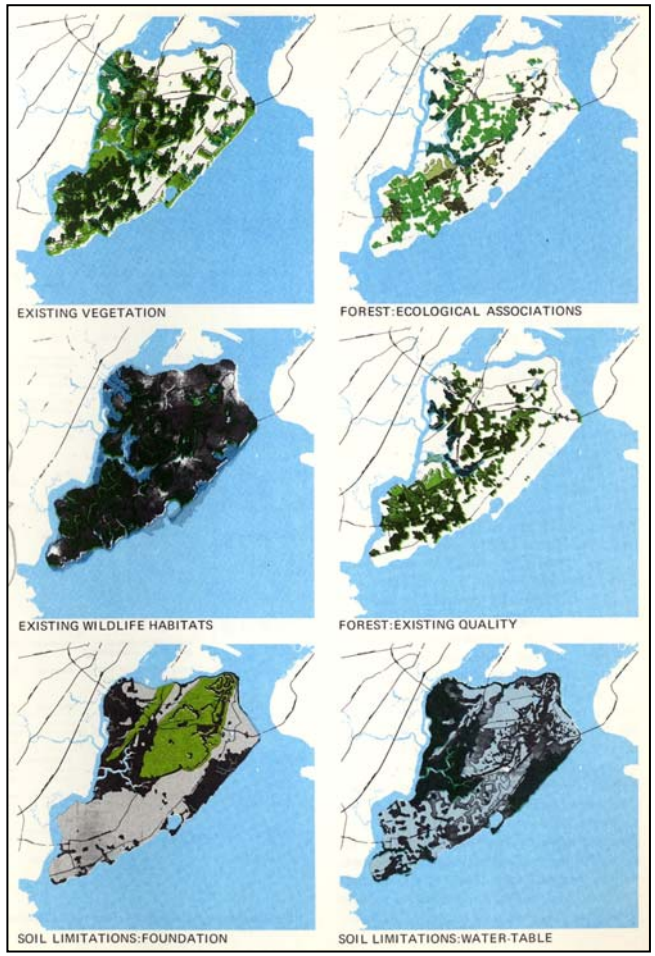
SUSCEPTIBILITY TO EROSION

Physiographic features were catalogued as separate maps. McHarg would then overlay these to create a composite map illustrating <u>physiographic obstructions.</u> Areas containing multiple features would appear as the darkest might be valued more than lighter colored areas.

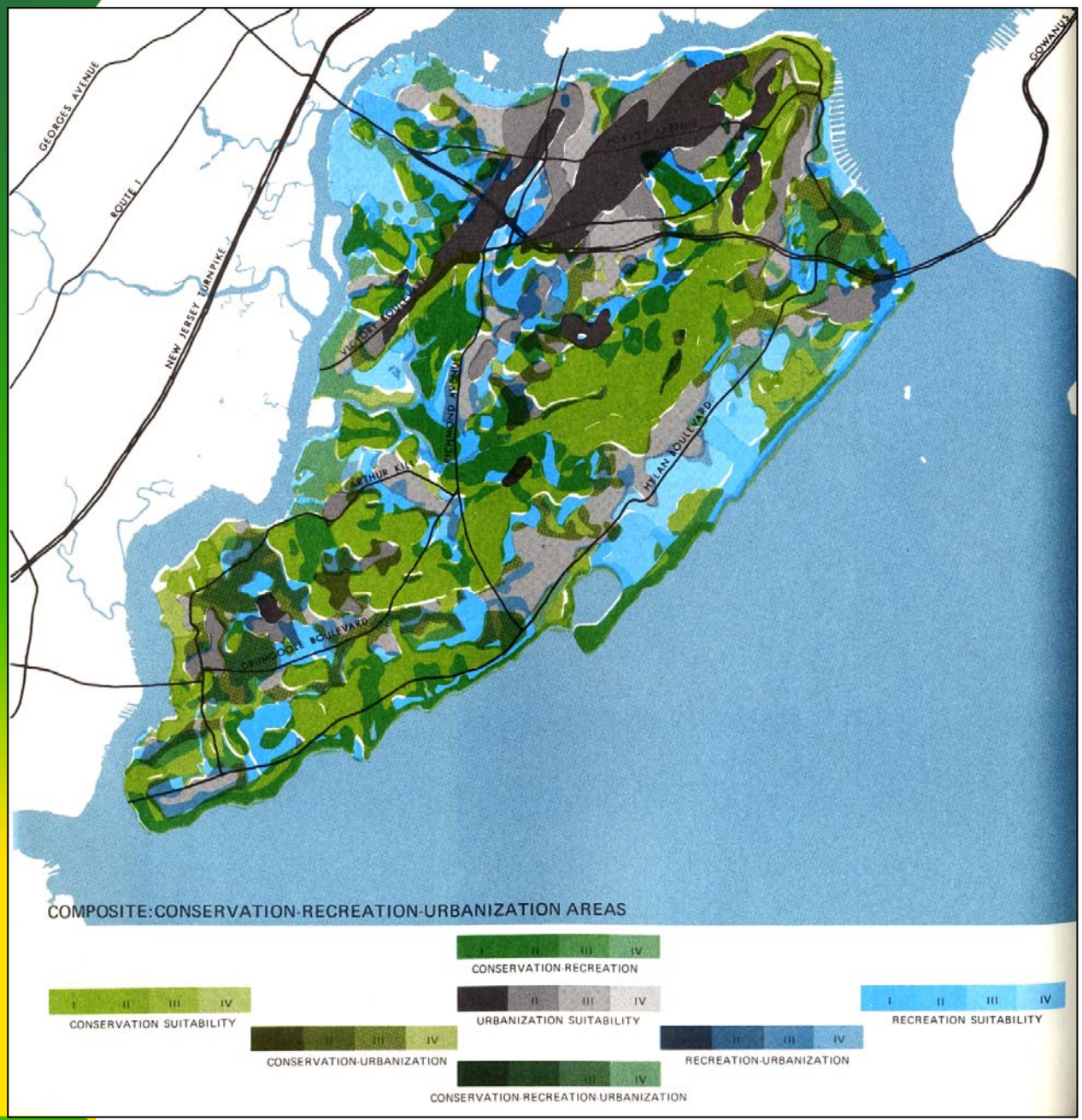


- **McHarg also demonstrated that a plethora of societal traits could be represented on maps as well, and overlain in much the same manner as composite physiographic obstructions. These tended to mimic property values.**



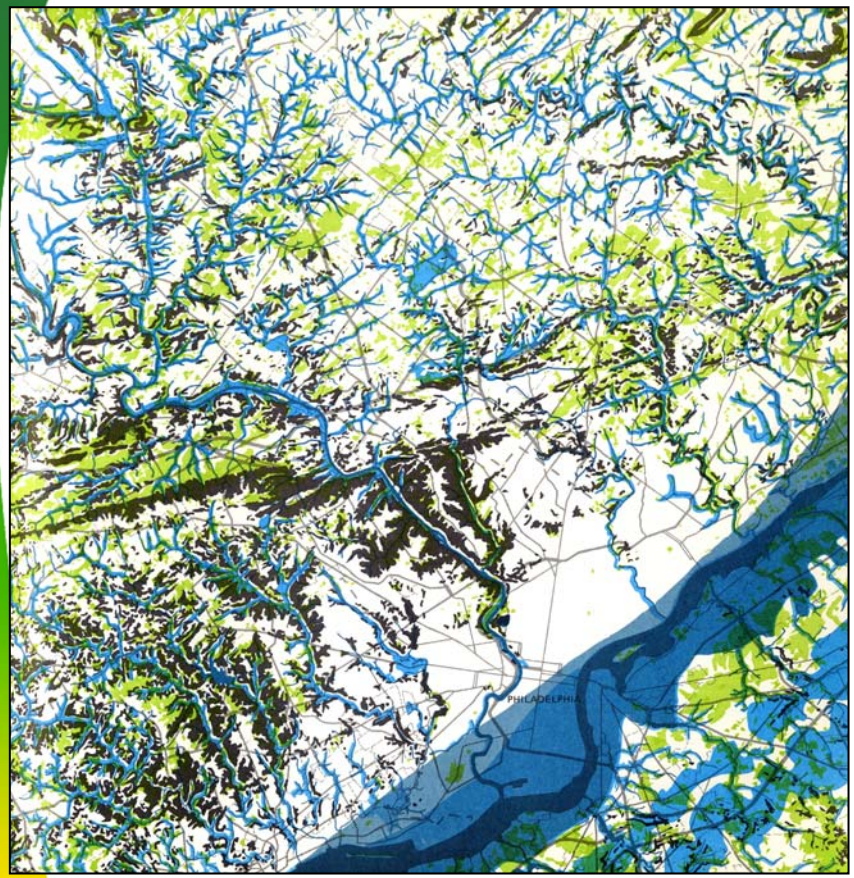


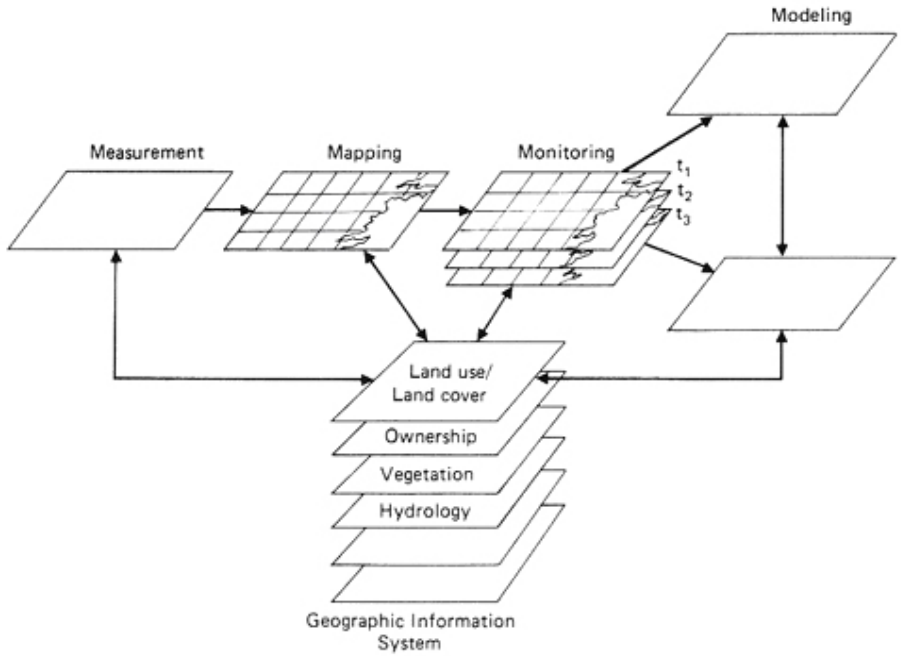
- **McHarg's map overlay method gained national recognition in a consulting project for a 5-mile stretch of the controversial Richmond Parkway on Staten Island in 1968**



- **McHarg's hybrid map included ecological, political and aesthetic rankings that were combined with physical attributes to select a transportation corridor that would have the least impact on the residents**

McHarg's Map Layering Concept





McHarg's four M"s: Measurement, Mapping, Monitoring and Modeling. GIS allows a limitless combination of mapable attributes to be arbitrarily weighted and electronically combined to create hybrid "maps"; which are simply spatial representations using the Earth's surface as their datum

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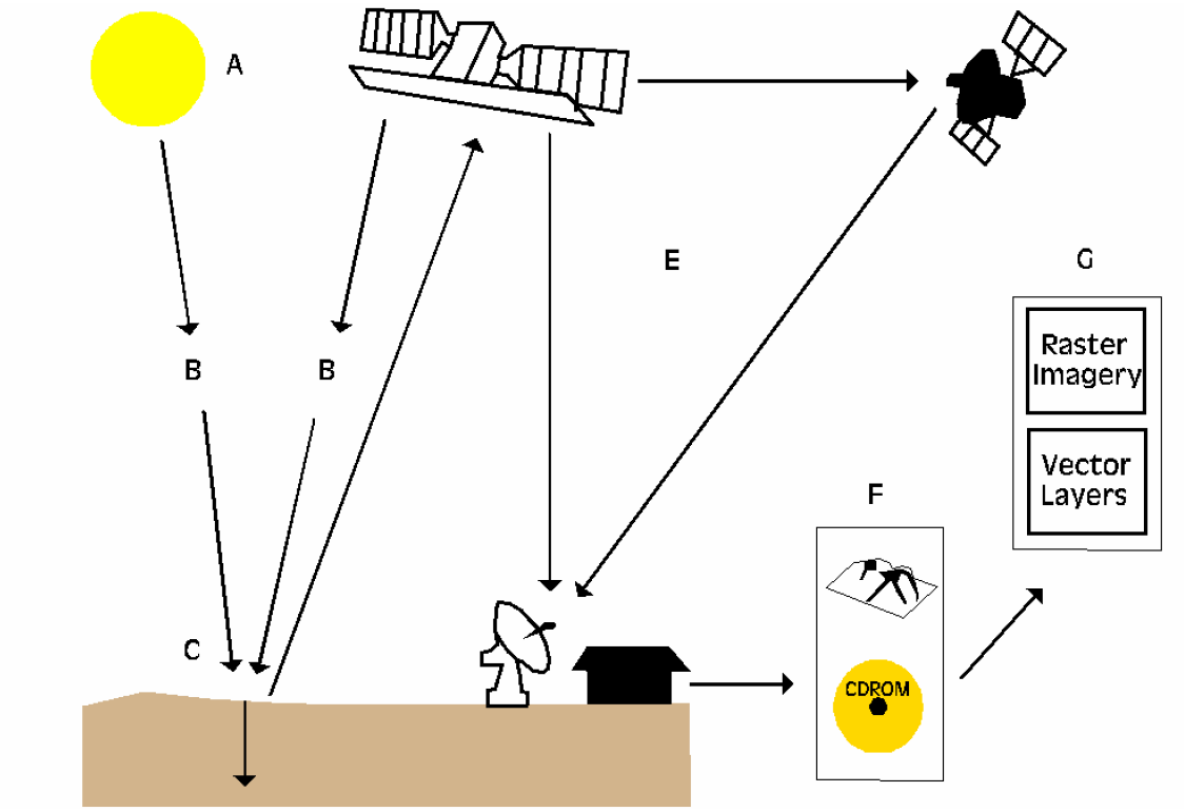
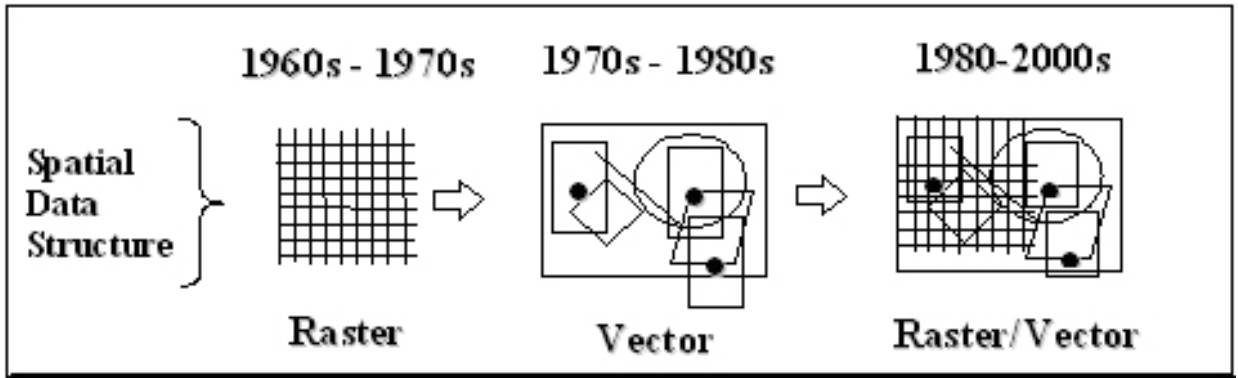


- **Raster and vector data files emanate from differing methods of data collection and creation. Raster data files handle complex curvature typical of natural features while vector files favor linear, man-made features.**

SPATIAL DATA MODELS



Computer	*Mainframe*	*PC - XT*	*Pentium 4*
Cost:	High	High	Low
Memory:	Low	Medium	High
Processing:	Low	High	High

- **GIS has evolved with computing technology. Today, raster and vector data can be combined with increasingly sophisticated digital imagery, manipulating large data files**

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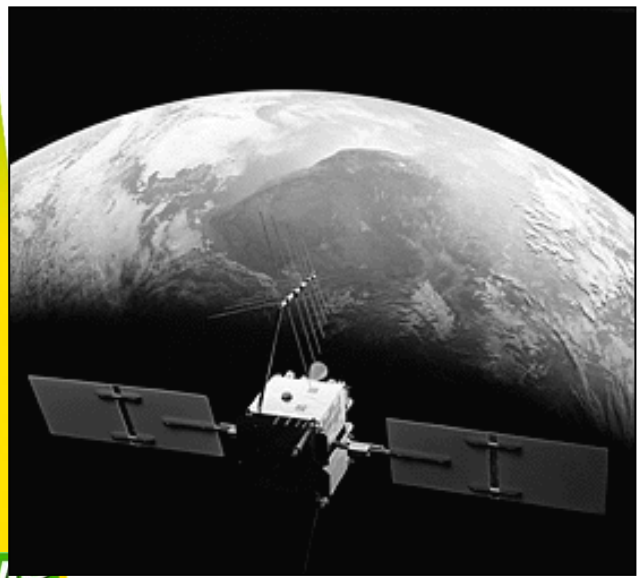
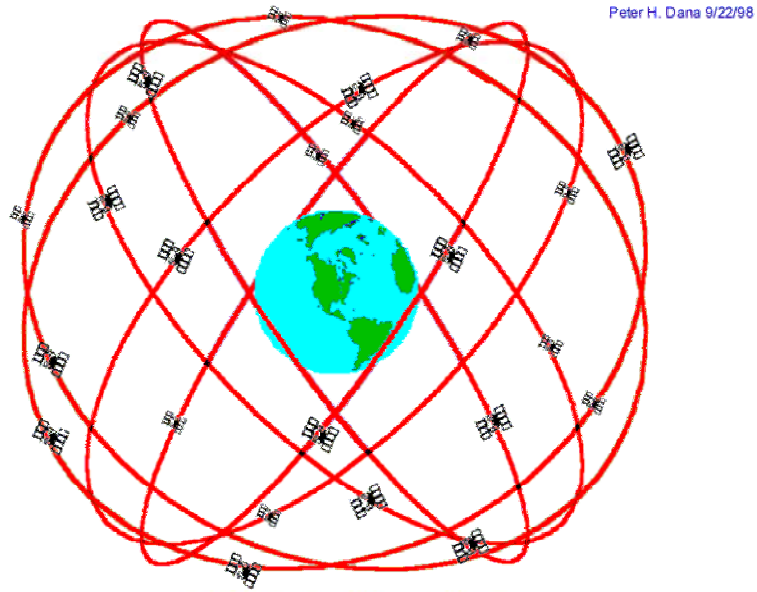
GLOBAL POSITIONING SYSTEM

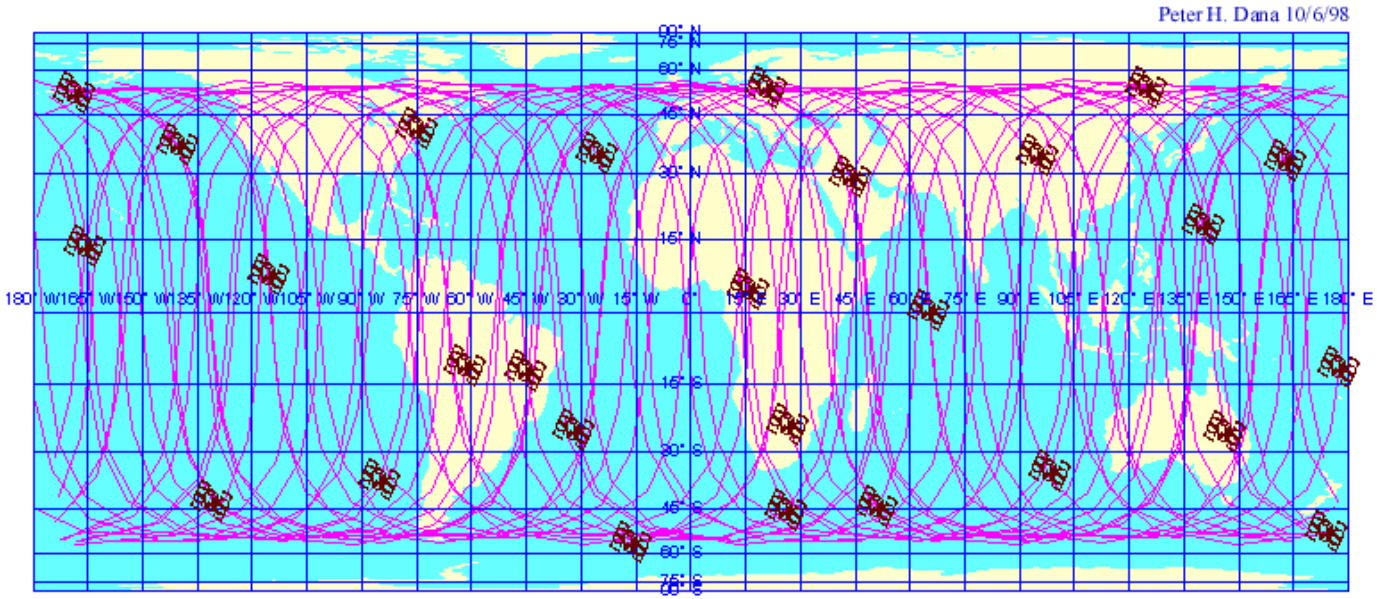




GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

Navstar launched in 1982; requires a minimum of 18 operable satellites, 6 in 3 orbital planes spaced 120 degrees apart at 12, 660 miles

Contact with 5 to 8 satellites required to provide fix



Global Positioning System Satellites and Orbits
for 27 Operational Satellites on September 29, 1998
Satellite Positions at 00:00:00 9/29/98 with 24 hours (2 orbits) of Ground Tracks to 00:00:00 9/30/98

- By March 1994 all 24 satellites were orbiting Earth.
- In May 2000 NOAA turned off selective availability, allowing public to receive GPS fixes within < 10 m under good conditions
- Worldwide, GPS industry nets $16 billion annually
- GPS allows inexpensive location fixing using hand-held receivers and palm pilots, with electronic data transfer

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