ERS Land Use Data for Policy Analysis: Past, Present, Future

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Overview

- Historical land use data development
- Themes for data development and analysis
- Examples of analysis
- Recent ERS land use analysis
- Future directions for data development and analysis

Francis J. Marschner

- These days we are used to seeing land use imagery from space, with computers receiving and collating billions of bits of data from satellites in a single pass over the continent.
- Francis Marschner, a USDA geographer in both the Bureau of Agricultural Economics (BAE) and Economic Research Service, went about it the hard way in the 1920s and 1930s.
- This pioneering work established the interdisciplinary approach to land use research in BAE and ERS that informed conservation and land development programs at the Federal and State level, and expanded cartographic methods for depicting economic and physical data.

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Using survey field notes, aerial photographs, and statistical compilations, Francis Marschner created the first authoritative medium-scale U.S. land use map in 1950. This version of the map, published in 1958, depicts twelve categories of land use, ranging from cropland and pastureland to desert and marshland.

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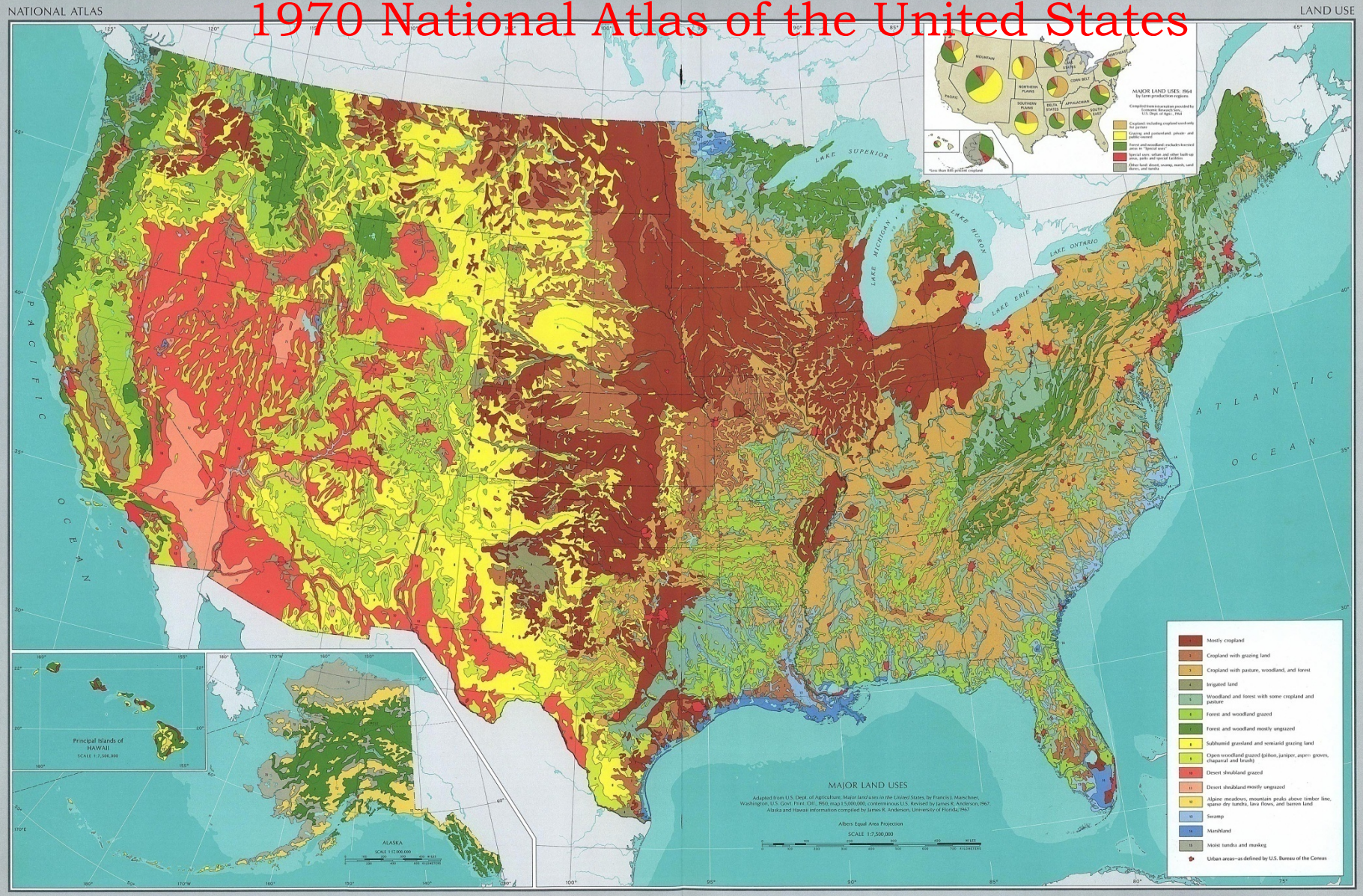
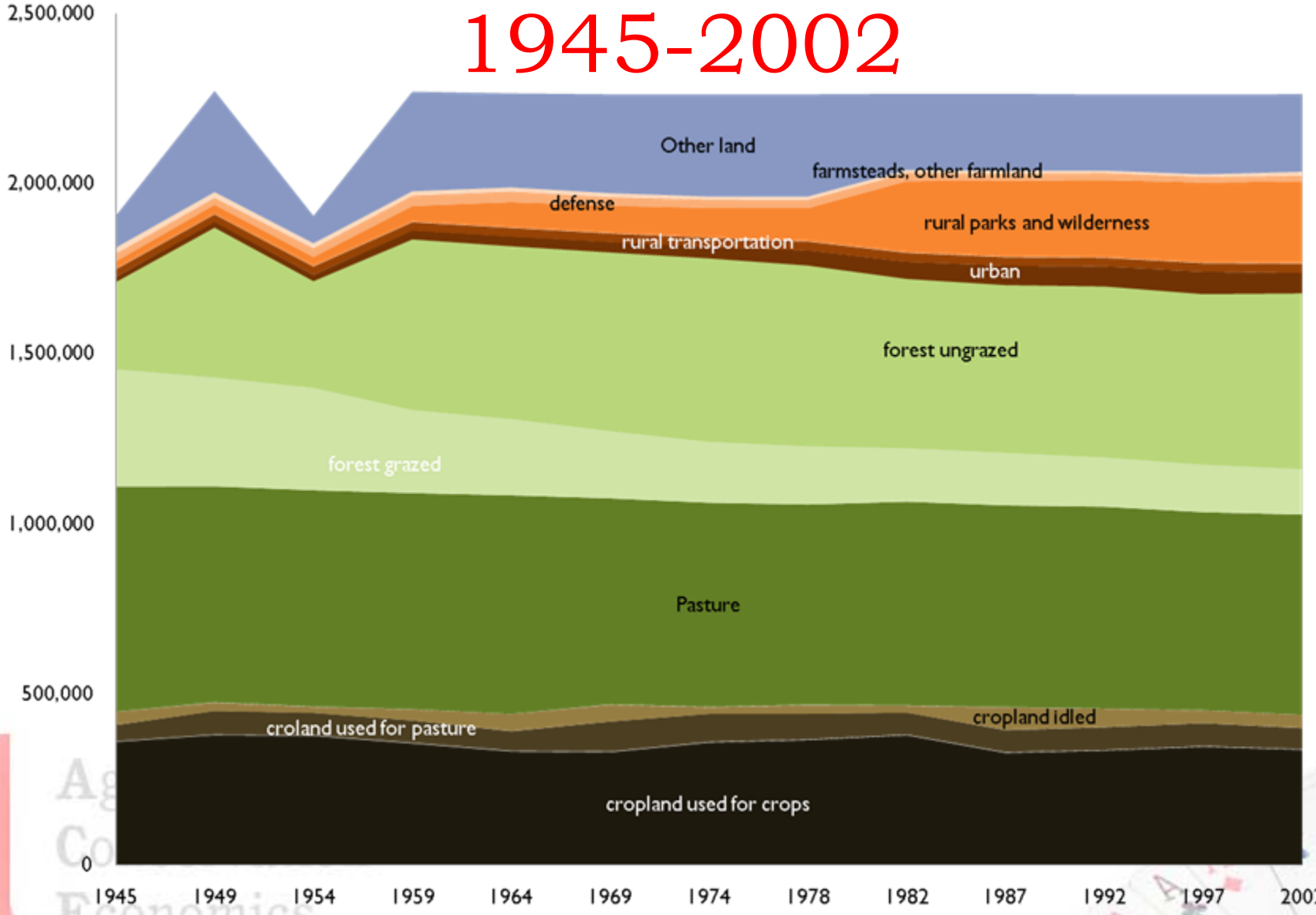
This version is from the
1970 National Atlas of the United States



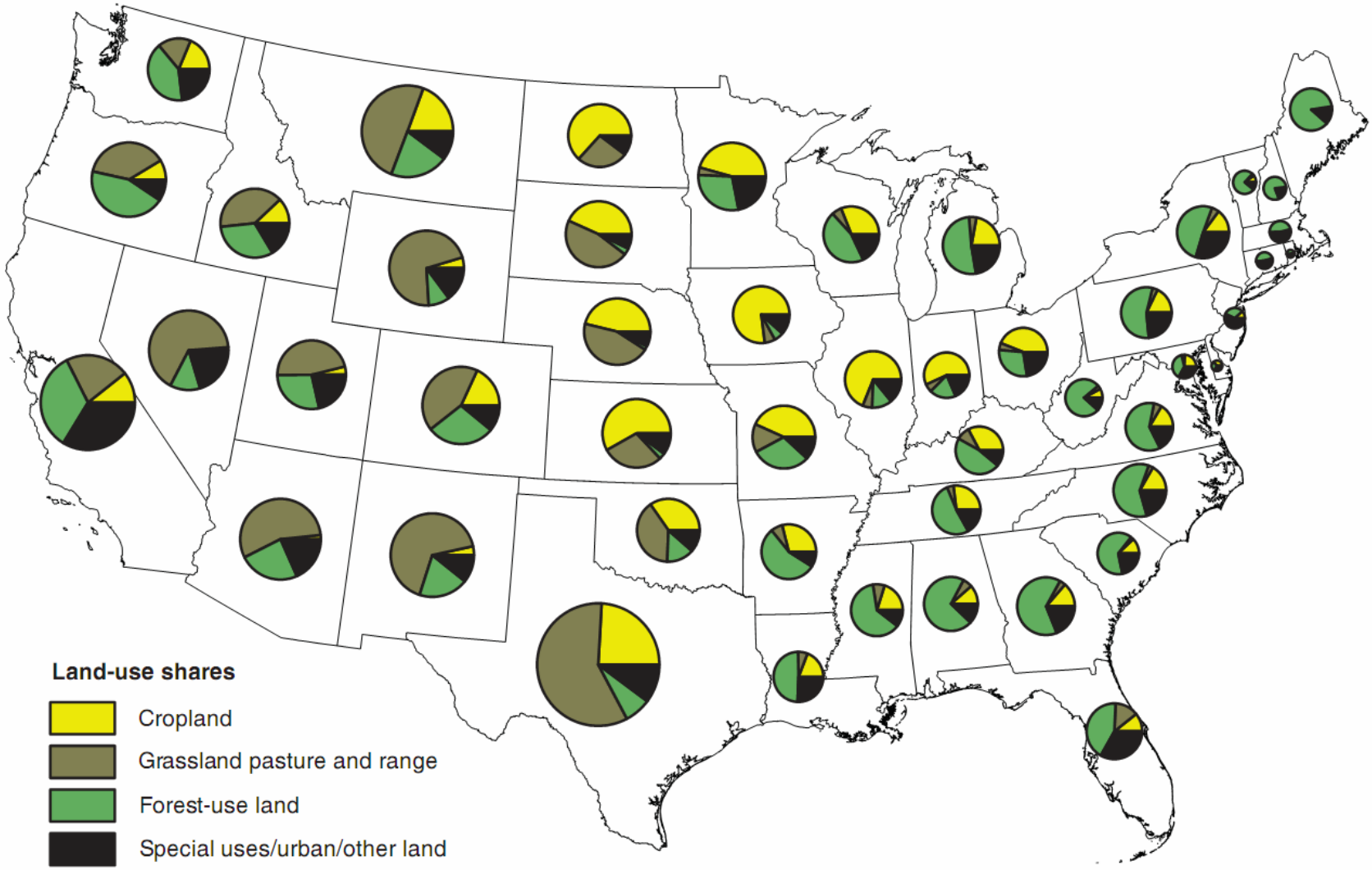
Major Uses of Land in the United States

- State-level statistics on land use encompassing the entire land area
- Land use, not land cover
- Every 5 years since 1945
- Incredibly, the only place in the U.S. government constructing such a series
- Key authors included Lawrence Reuss, Hugh Wooten, Tom Frey, Art Daugherty, Marlow Vesterby, Ruben Lubowski

Major Uses of Land in the U.S. 1945-2002



Shares of land in major uses, 48 contiguous United States, 2002

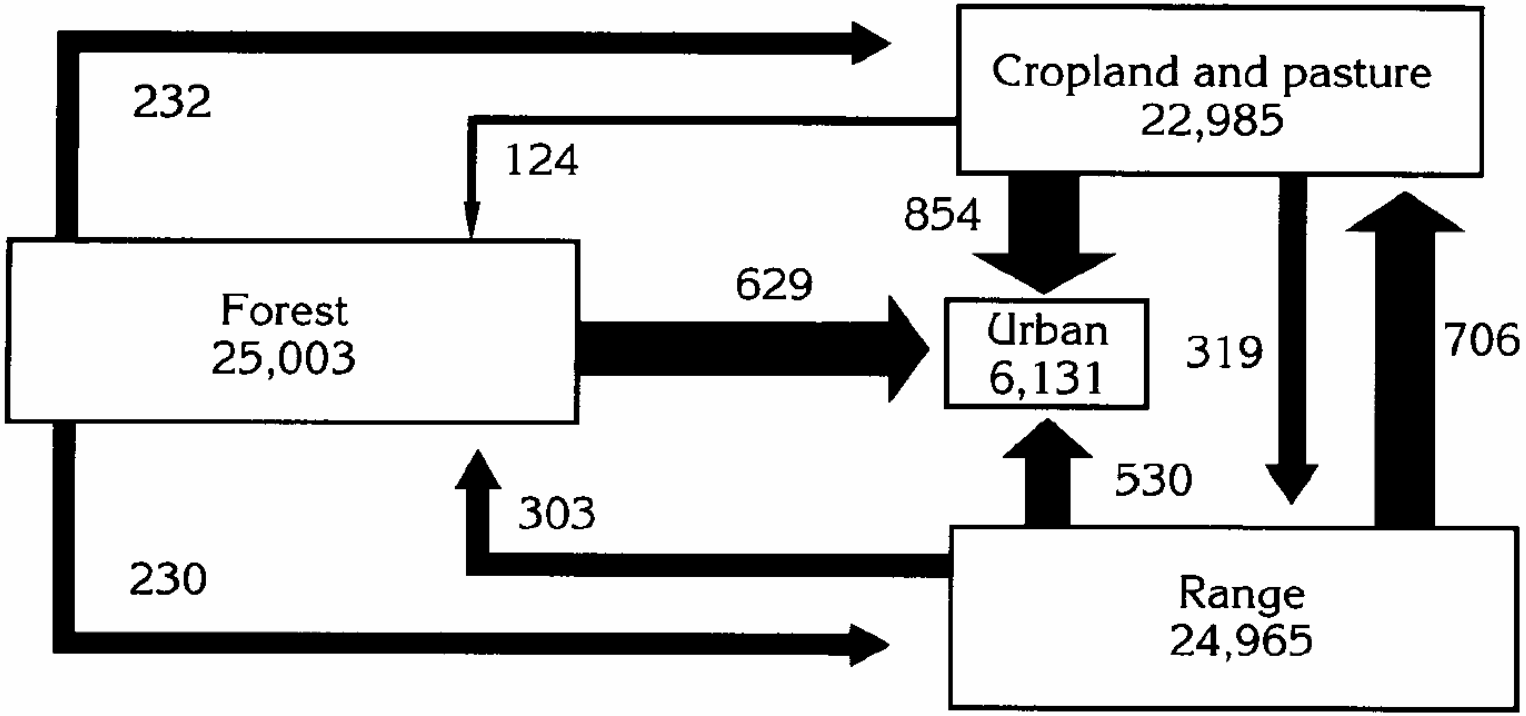


Dynamics of Land Use Change In Fast-Growth Counties

- Paired-point aerial photo studies of land use change in rapidly-growing counties
- Estimated rates of change in urbanization and adjustments to crop, pasture, and forest land
- 1960's and 1970's
- Suplanted with NRI-based analyses after 1982
- Key Authors: Bob Otte, Katherine Zeimetz, Marlow Vesterby, Ralph Heimlich

Shifts in Major Land Uses

Additions to cropland and pasture offset much of the loss to urban uses.



Numbers in boxes are thousands of acres in 1970; numbers along arrows are changes from 1970 to 1980 (thousands of acres). Cropland and pasture include feedlots, orchards, ornamentals, and other miscellaneous agricultural land. Forest includes wetland. About 250,000 acres of miscellaneous minor uses that converted to urban are not shown.

Source: Heimlich, Vesterby and Krupa, Urbanizing Farmland: Dynamics of Land Use Change in Fast-Growth Counties, AIB-629, September 1991

Paired-Point Aerial Photo Analysis

WE COMPARED LAND USES OF FAST-GROWTH COUNTIES AT THE SAME POINT ON AERIAL PHOTOGRAPHS TAKEN ON DIFFERENT DATES

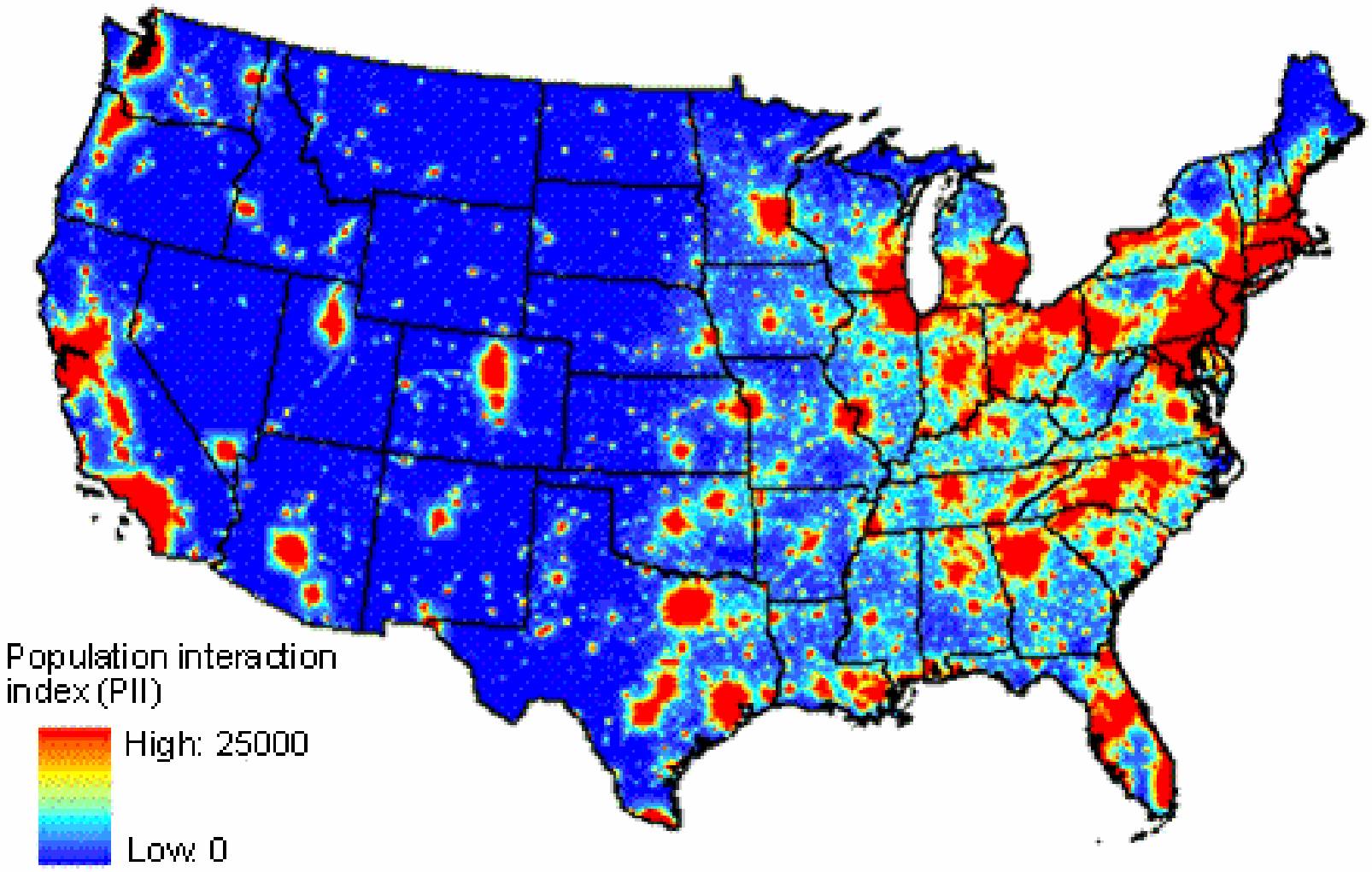
In Clackamas County,
Oregon,
June 25, 1970

In Clackamas County,
Oregon,
April 30,1980

Urban Proximity Surfaces

- Delineated zones of urban influence from surfaces of population and accessibility to population
- Analyzed the effect of urbanization on farmland and farmland values using maps of population accessibility
- Key authors: Charles Barnard, Vince Breneman

Population interaction index (PII), 2000



Source: ERS analysis of 2000 census of population block data.

Integrated Spatial Samples

- Base is NRI spatial sample of PSUs and points
- Associated soils data (SOILS5, NASIS, etc) including potential crop, forage, and forestry yield
- Built on economics (yield x area price – area cost of production)
- Built on environmental implications (models of sheet and rill and wind erosion, surface water runoff, groundwater leaching, etc.)
- Key authors: Ralph Heimlich, Tim Osborn, Margaret Maizel, George Muehlbach, Bob Kellogg, Roger Claassen

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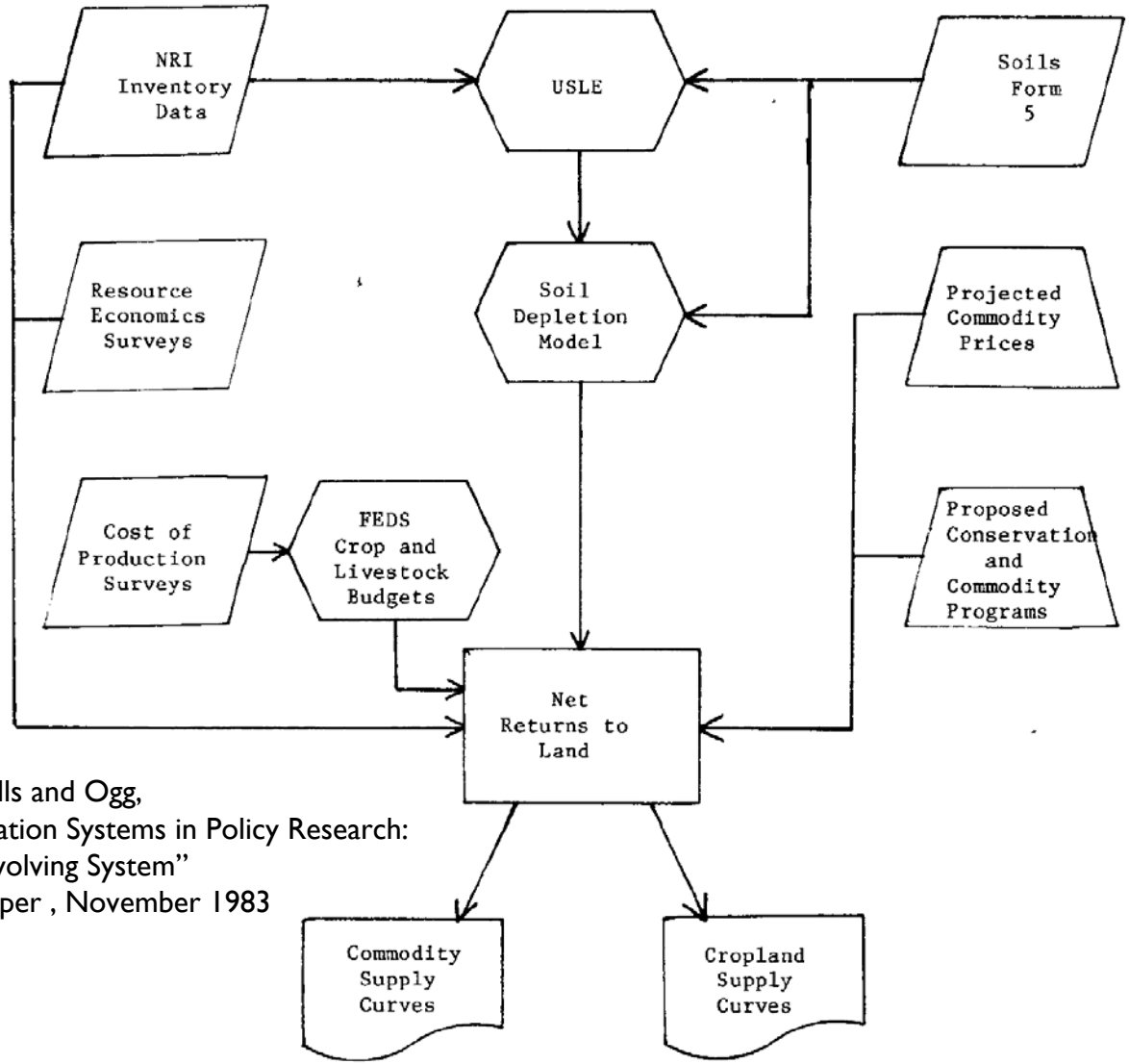
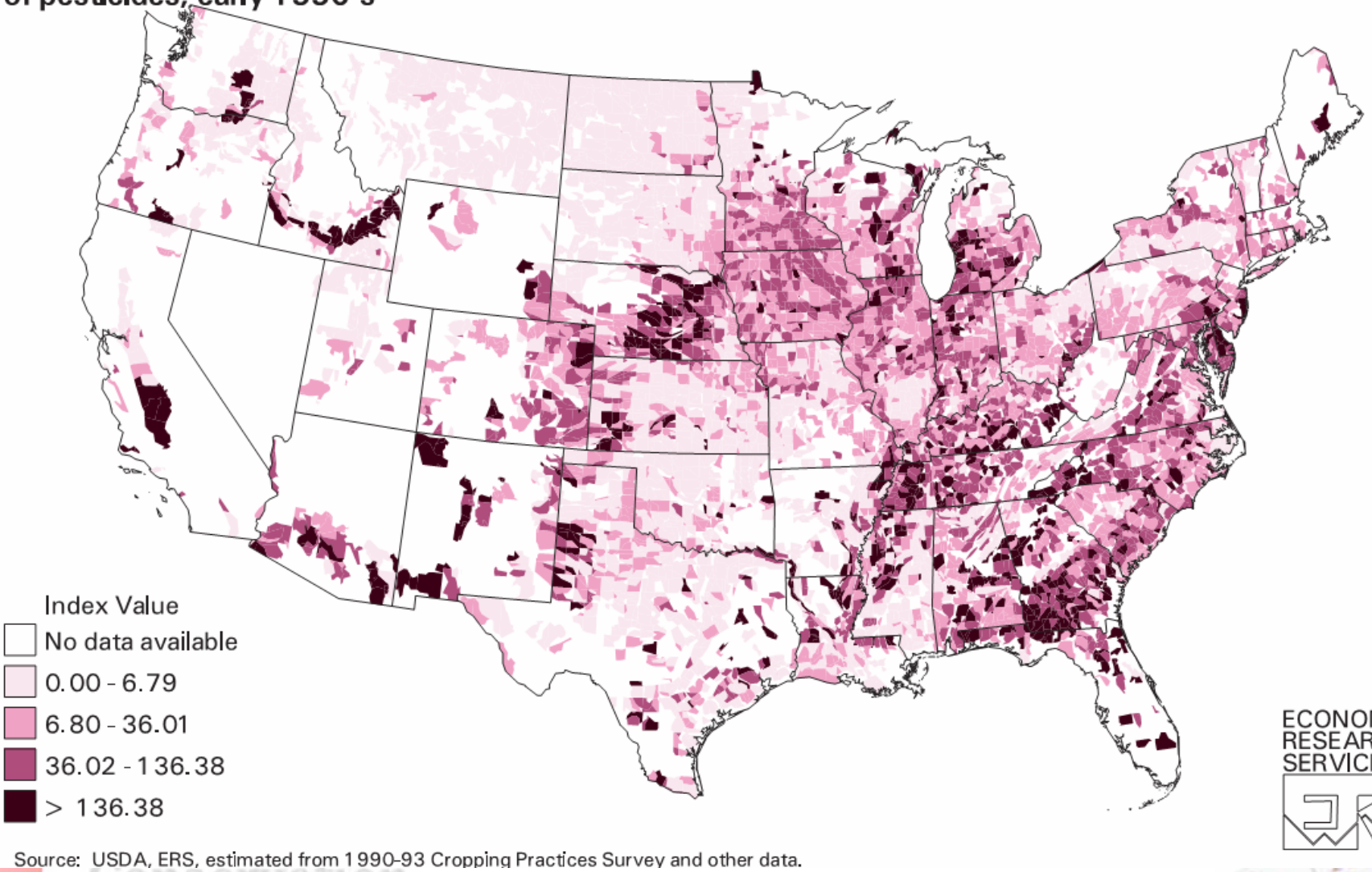
System Components and Data Flow for Cropland Supply Response Analysis



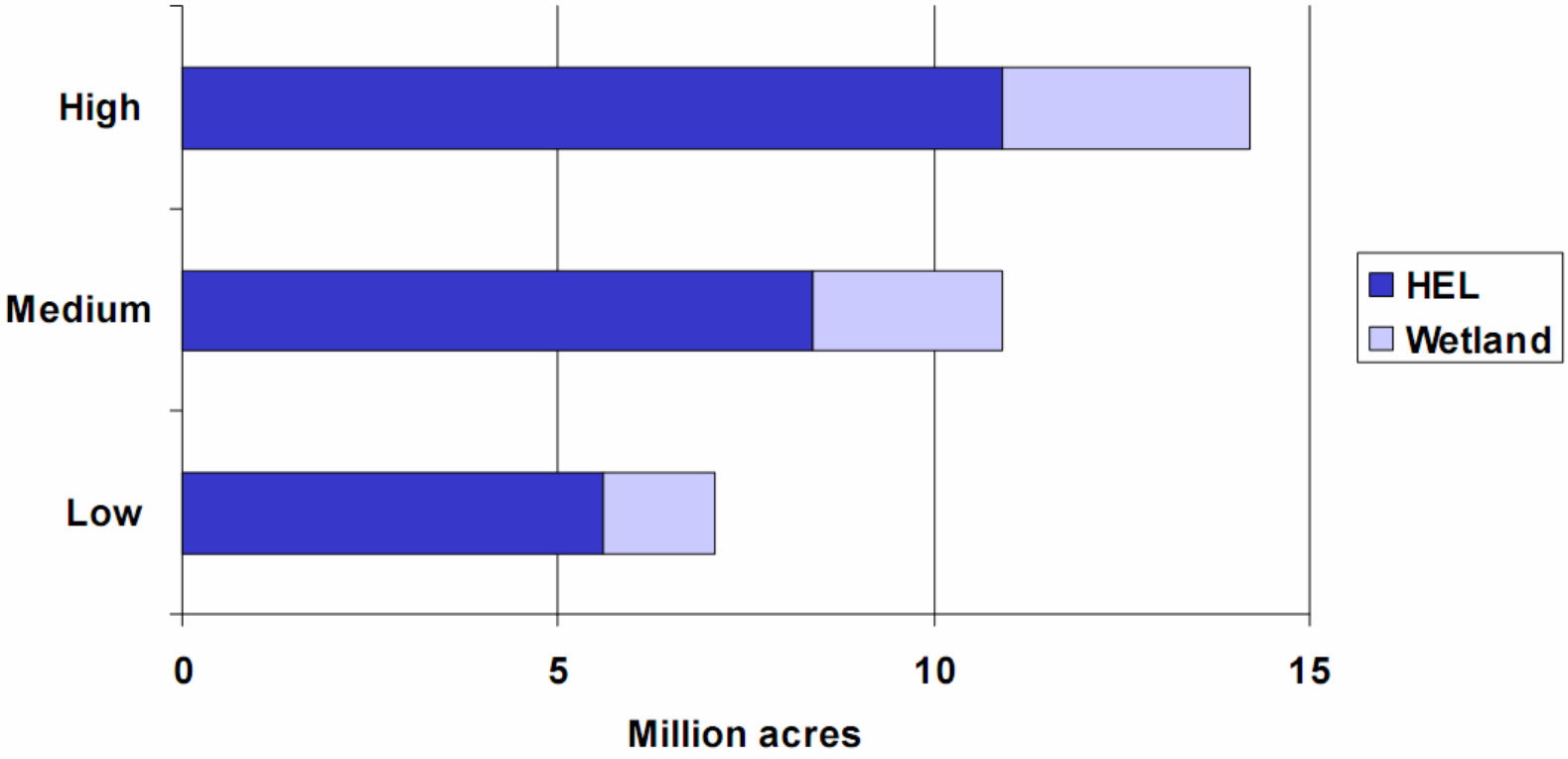
Source: Heimlich, Bills and Ogg,
"Geographic Information Systems in Policy Research: Examples from an Evolving System"
SWCS Presented Paper , November 1983

Figure 2.2.4--Groundwater vulnerability index for pesticides weighted by persistence and toxicity of pesticides, early 1990's



Source: USDA, ERS, estimated from 1990-93 Cropping Practices Survey and other data.

Fig. 6.3.3--Potentially convertible acreage of wetland and highly erodible land (HEL) High-, medium-, and low- price scenarios*



*High-, medium-, and low-price scenarios correspond to projections for 2004, 2001, and 1999, respectively, from *USDA Agricultural Baseline to 2007*, February 1998.

Source: USDA, Economic Research Service

Recurring Policy Questions

- Where will land for expansion come from?
- What land will leave production in contraction?
- What environmental and economic consequences from expansion/contraction?
- What crops/farm types affected?
- Interaction with policies?

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Federal money prods farmers to plow up grasslands -- GAO (09/18/2007) Allison Winter, *E&ENews PM* reporter

- Federal subsidies have encouraged U.S. farmers to plow up millions of acres of grasslands and convert them to row crops, according to a new report released today by the Government Accountability Office.
- The report found that farm program payments are an "important factor" in producer decisions to convert grasslands. In response, Senate Agriculture Committee Chairman Tom Harkin (D-Iowa) said he intends to include a requirement in the new farm bill that would cut off federal support for anyone who plows up prairies.
- "We need to have farm policy that protects farmers and the environment from unintended consequences," Harkin told reporters today.
- Currently, farmers can receive crop subsidies, crop insurance and disaster payments for crops planted on former grasslands. Harkin wants to cut off all three of those in his "sodsaver" requirement in the farm bill. The House-passed farm bill has a less stringent measure that would cut off only crop insurance.

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Land Use versus Land Cover

- Land cover observable with remote sensing
- Land use and cover may be identical (e.g., urban development)
- Same cover may have many uses (e.g., forest for timber production, wilderness, rural homesites)
- Use may be inferred, but may be indeterminate without surveying landowners
- Most desirable data is a matrix of cover and use

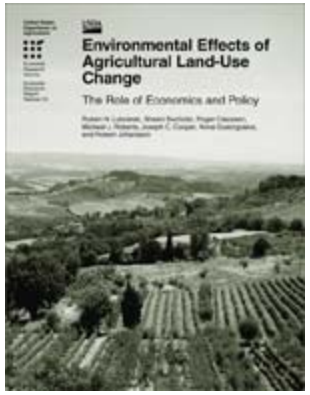
Integrated Data Sets

- Land use/cover is insufficient for analysis
- Need additional characteristics
  - Physical-soils, hydrology, slope, etc.
  - Economic-ownership, farm type or organization, values, rents, etc.
- Separate data bases for physical, economic characteristics not useful
- Best dataset would be integrated geographically (e.g., use of GIS data sets)

Examples of Analysis

- Estimating the extent and economics of "sodbusting" from 1975-81, including influence of commodity program payments
- Estimating the effect of HEL and Swampbuster provisions on conversion and wetland drainage
- Simulating CRP enrollment and post-CRP conversion
- Investigating changes in cropland quality from urban conversion in metropolitan areas
- Analyzing changes in the rate of urbanization of farmland over time
- Estimating the effect of commodity payment on land values, accounting for urban proximity effect

Recent ERS Land Use Work



- **Environmental Effects of Agricultural Land-Use Change: The Role of Economics and Policy,** ERR-25, August 2006
  - NRI for land use change and integrated physical and economic characteristics

- **The Conservation Reserve Program: Economic Implications for Rural America,** AER-834, October 2004
  - NRI for predicting post-CRP land use change and environmental and economic impacts

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Recent ERS Land Use Work (cont.)

- **Environmental Compliance in U.S. Agricultural Policy: Past Performance and Future Potential,** AER-832, May 2004
  - Linked NRI erosion and land use data and ARMS data on economics
- **Development at the Urban Fringe and Beyond: Impacts on Agriculture and Rural,**AER-803, June 2001
  - Used NRI to identify and value cropland in proximity to urbanization to estimate cost of development rights purchase
- **Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape,** AER-794, January 2001
  - Estimated policy impacts using NRI and ARMs

Future Data Development

- More direct use of remotely sensed data on land cover
- Incorporation of USDA Common Land Unit (CLU) data on ownership
- Better integration of land use, economic and physical data (remote sensing, ARMS, NRI, NASIS)
- Extension of spatially-sampled data series (NRI point data after 1997)
- Extension of MLU data to county level for 1997-2002 and beyond

Future Land Use Analysis

- Crop supply response and adjustment to bio-energy development, including environmental implications
- Continuing analysis of urbanization's impact on agricultural land resources
- Impact of expanded subsidized risk management policies on agricultural land use
- Incorporating more point-based simplified environmental process models
- Incorporating more point-based simplified normative economic models

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