Landsat Benefit Analysis:
Study Overview

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Overview of Larger Study

- **Landsat Benefit Analysis:** Conduct an analysis of the benefits of moderate resolution imagery
  - Western Geographic Science Center (WGSC)
  - Policy Analysis and Science Assistance (PASA)
- 5 year effort (2006-2011)
- Survey of users of moderate resolution imagery (PASA)
- Risk assessment (WGSC): Estimate the economic value of moderate resolution imagery information

Study components

1. A review of the existing literature and macroeconomic analysis – RFF, WGSC

2. An in-depth survey of societal benefits – PASA

3. Case studies – WGSC, RFF

   Agricultural production

Societal Uses and Benefits of Moderate Resolution Imagery in the United States: A Survey Update

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Policy Analysis and Science Assistance (PASA)

- Multidisciplinary team of researchers
- Mission: integrate biological, social, and economic analyses to aid resource managers in decision making and resource management conflicts
- NR survey research expertise

Von Karman Vortices
(http://eros.usgs.gov/imagegallery/index.php/)

Survey Objectives

Better understand the uses of moderate resolution imagery, including those previously not captured or detailed

- **Identify and classify users**
- **Understand how and why imagery is being used**
- **Qualitatively and quantitatively measure societal benefits of this imagery**

Survey Components

- Phase I:
  - User assessment
    - Potential user identification
    - Refinement through snowball sampling
- Phase II:
  - User survey

Kamchatka Peninsula
(http://eros.usgs.gov/imagegallery/index.php)

Phase I: User Assessment

- Identify potential users of moderate resolution imagery, verify their use, elicit other users

- Why is this important?
  - Population of moderate resolution imagery users in the United States is unknown

Phase I: User Assessment

1. Identify potential individual users
   - Web search by state
   - Over 22,000 email addresses of potential users
2. Identify user groups
   - Web search yielded several user groups
     - GIS/remote sensing user groups
     - Small, local organizations
     - $\leq$ 1000 members
     - 261 groups

Phase I: User Assessment

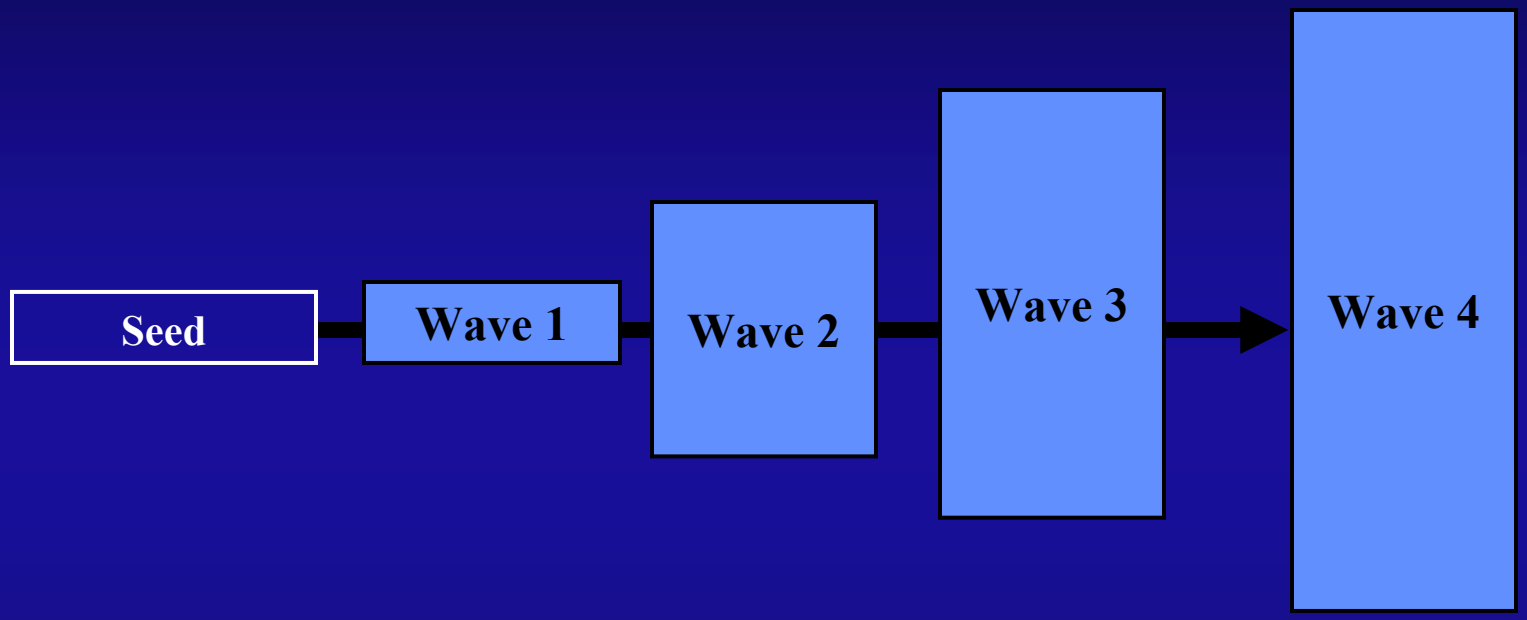
3. Web-based snowball sampling to verify users and elicit additional users

- Advantages:
  - Good for unknown, or hard to reach populations
  - Quick and cost-effective
  - Can trace social networks
- Disadvantages:
  - Isolated individuals can be missed
  - Final sample may not be random
  - More difficult to calculate population size and other statistics
- To increase randomness:
  - Begin with contacts from many sources
  - Have a large sample derived from many waves

(Atkinson & Flint, 2001; Blanken et al., 1992; Faugier & Sargeant, 1997; Tsvetovat, 2006)

USGS

Stages in the Snowball Sampling



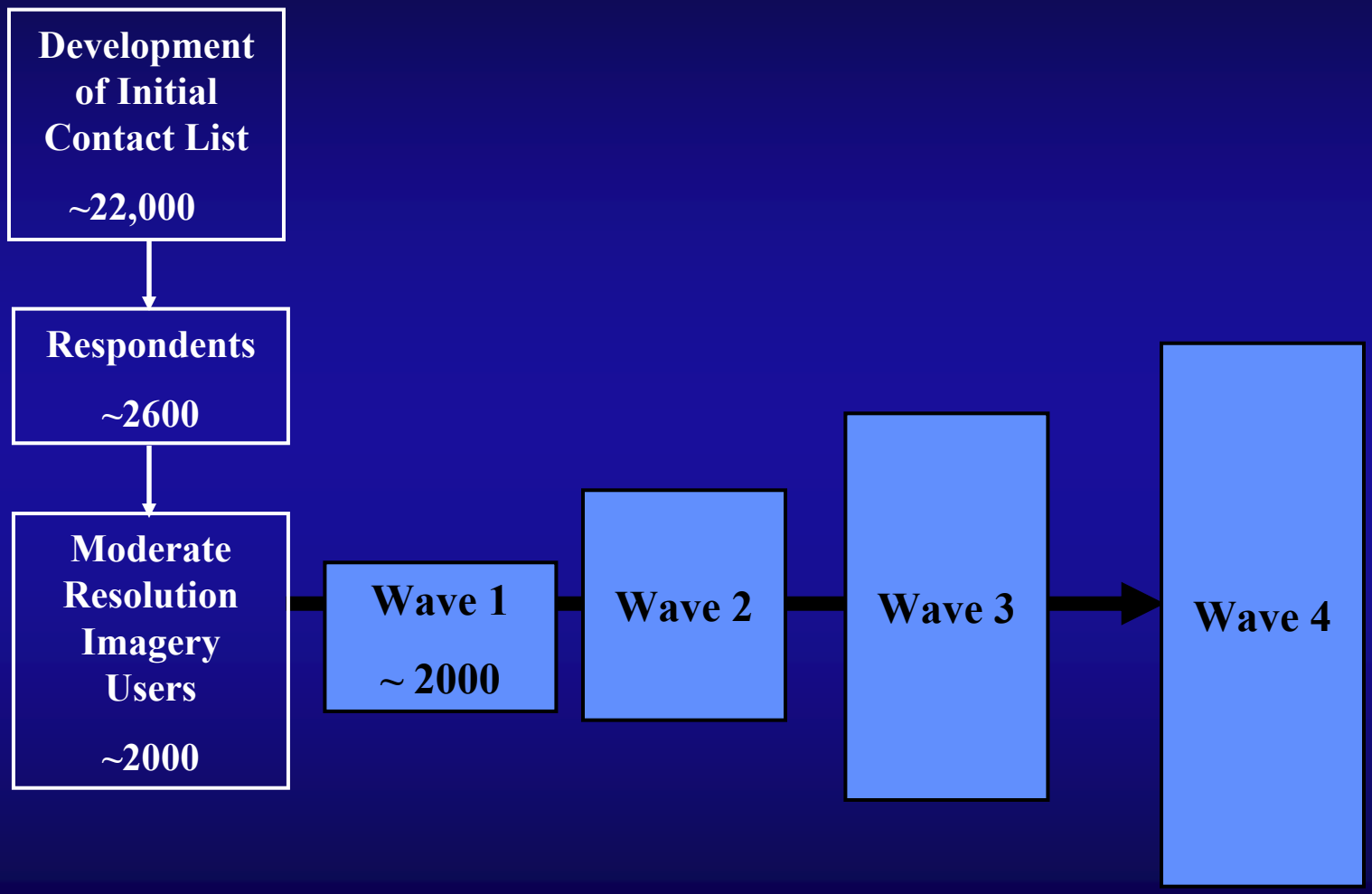
Seed sends names of three contacts (Wave 1)

Wave 1 respondents each send the names of three contacts (Wave 2)

Each wave provides exponentially more contacts

USGS

Stages in the Snowball Sampling



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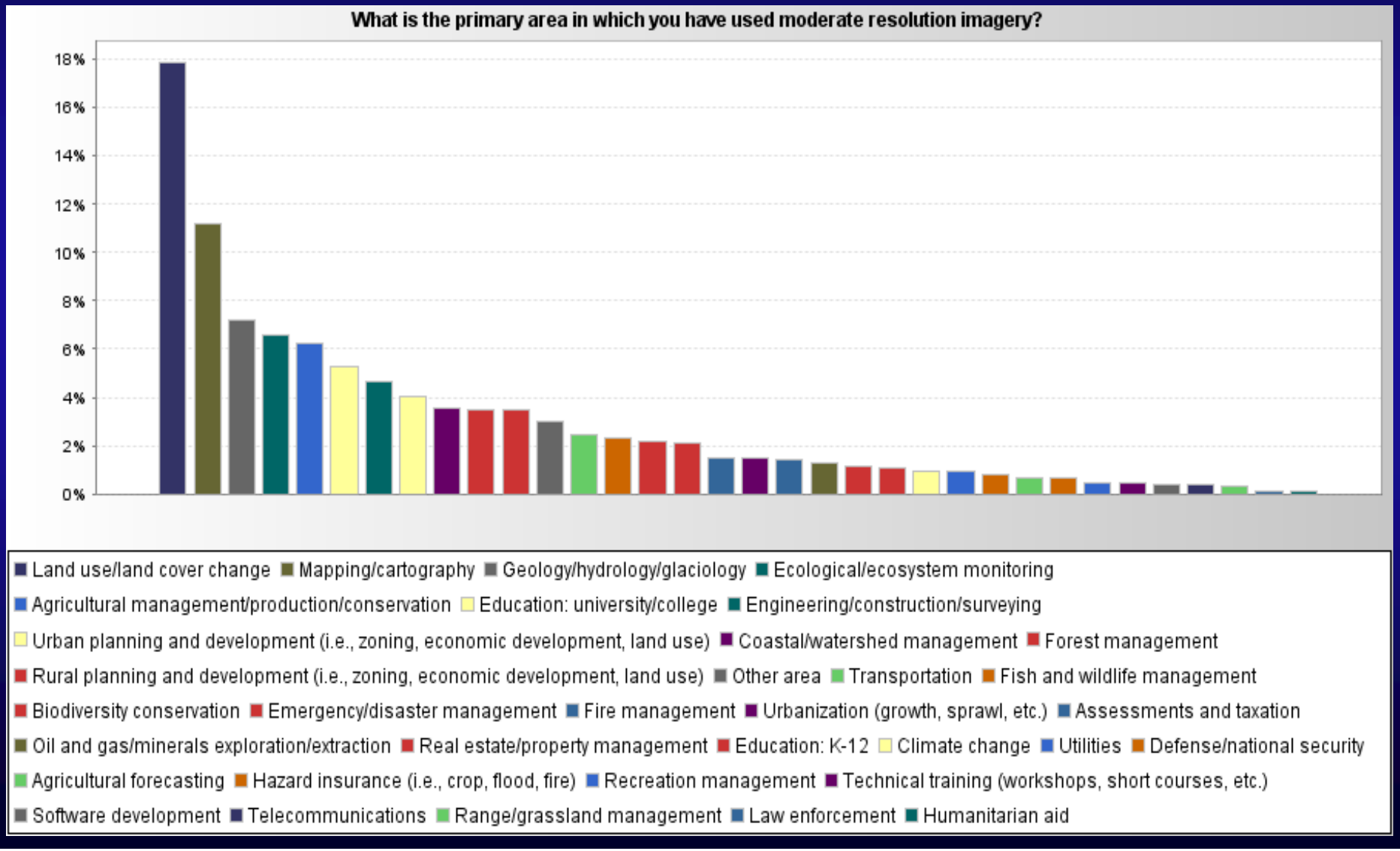
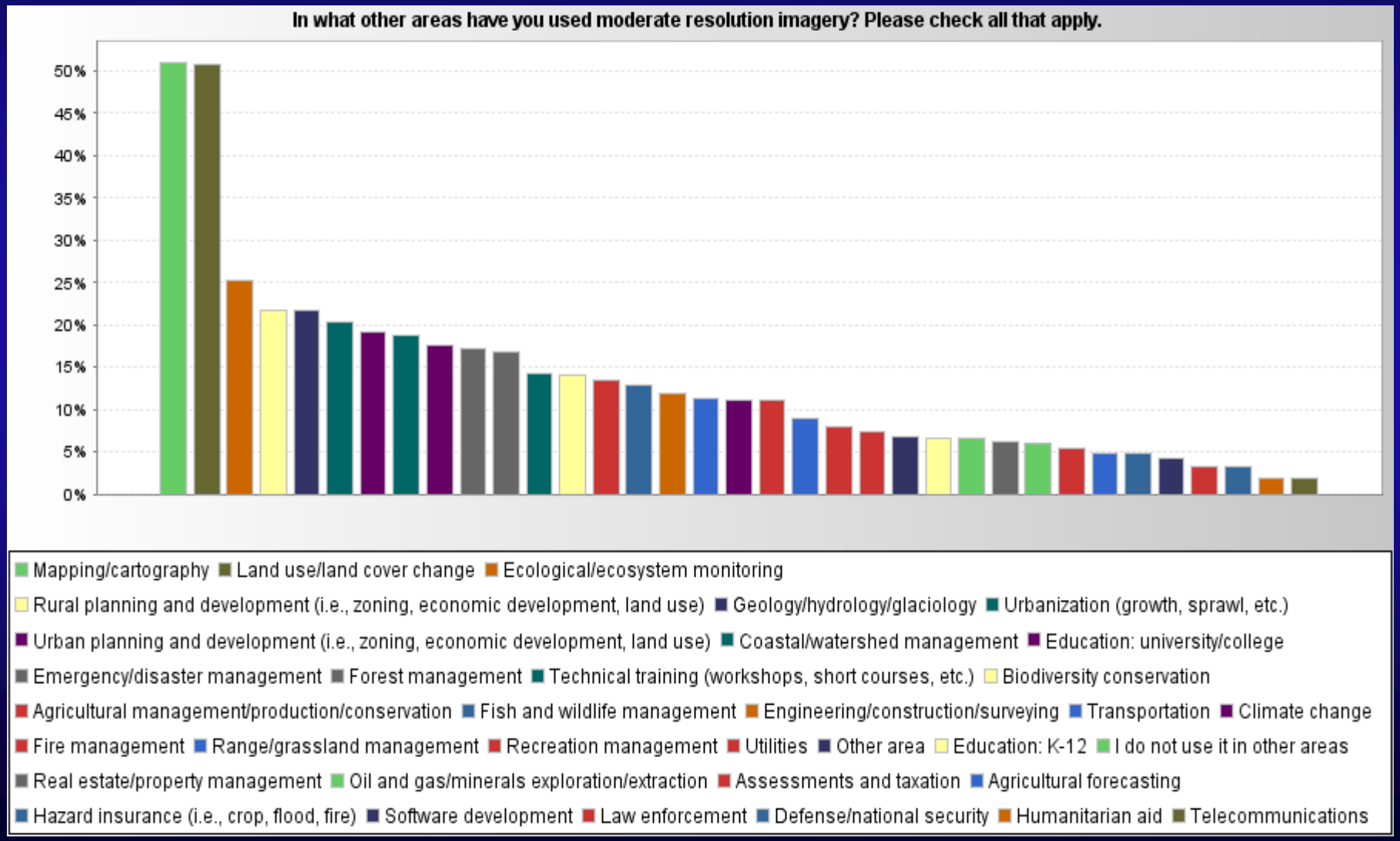
Phase I: User Assessment
Verification of Application



Phase I: User Assessment
Verification of Application



Phase II: User Survey

- Review of previous surveys
  - EROS (2007)
  - ASPRS (2006)
  - Executive Office of Science and Technology Policy Survey (2004)
  - NASA (2001)
- Limitations of previous surveys
  - Results were not generalizable to the population of moderate resolution imagery users
    - None used a random sample
  - Most were technical in nature and did not ask about the benefits or value of the imagery (ASPRS being the exception)

How will this survey be different?

- Who is being surveyed?
  - A wider array of users, including end users of Landsat products
  - Other studies have surveyed only specific groups of users (i.e., purchasers of Landsat imagery)
- What is being asked?
  - Focus on new and unique uses
  - Societal benefits – not just monetary
  - Not focusing on technical aspects of the satellite

Categories of Questions for Survey

- Identify and classify users
- Document uses
- Document value and benefits of imagery

Identify and Classify Users

- Use of moderate resolution imagery
  - If no, determine reason and use of other types of imagery
  - If “don’t know,” provide more extensive definition and examples to clarify
- Type of organization (i.e., government, private, non-profit)
- Type of user (i.e., supplier, processor, end user)
- Where and how often imagery is obtained
- Demographics

Document Uses of Imagery

- Applications of imagery
- Scale of projects (i.e., local, regional, national, global)
- Use of imagery in decision making
- New uses of imagery in the past 5 years
- Possible uses of imagery in the next 5 years

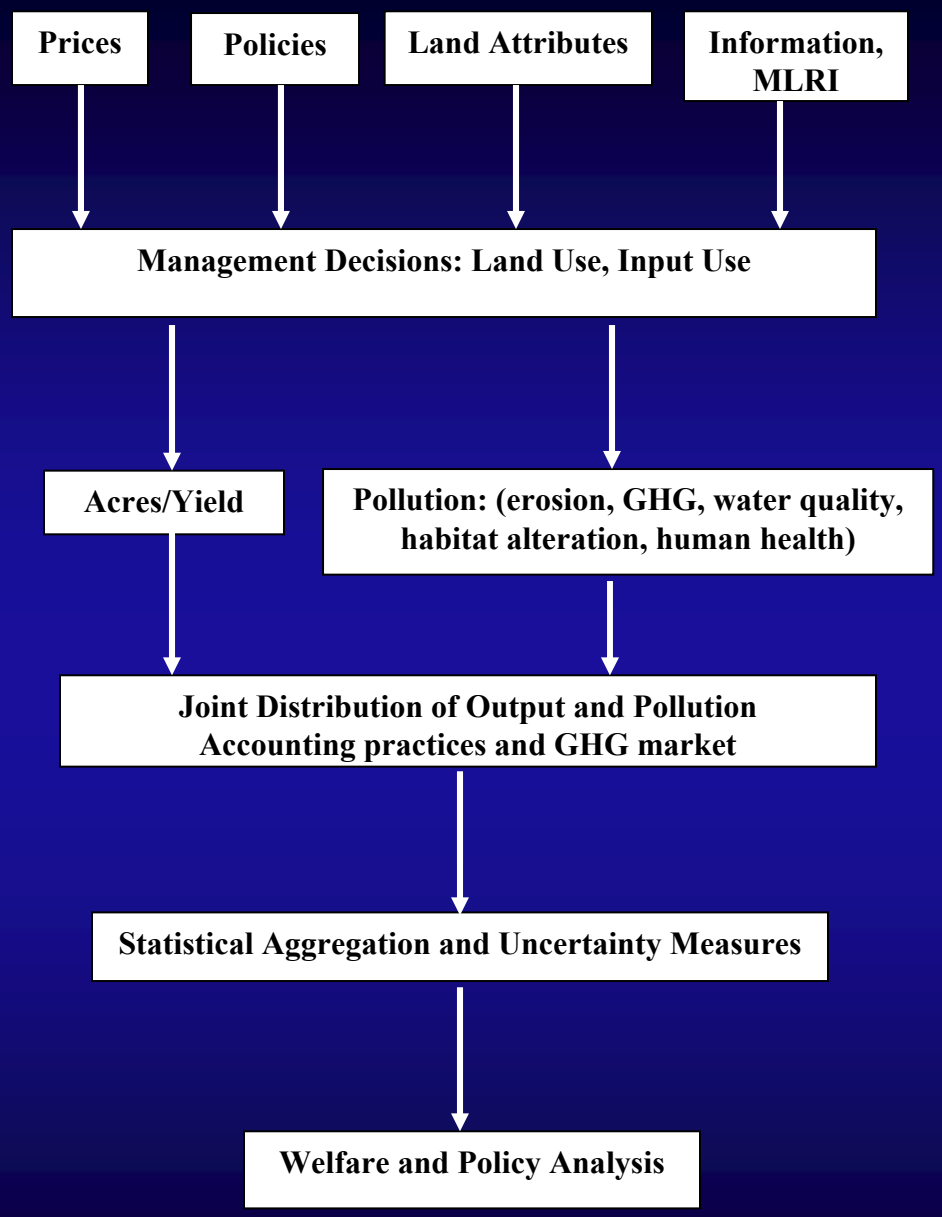
Document Value and Benefits of Imagery

- Importance of and satisfaction with imagery attributes
- Advantages of using moderate resolution imagery over other data/methods
  - Repercussions from loss of access to moderate resolution imagery
- Limitations of currently available imagery
- Willingness to pay for imagery
- Value of information provided by imagery

Economic decisions with estimation risk: a regional-scale agricultural example

- What land is allocated where?
- What will be the ramifications?
- How much GHG emissions?
- How is better satellite information involved?
- Does MLRI reduce ambiguity?

Conflict and unanticipated consequences among agricultural, energy, and environmental policies



Agricultural Case Study:

- Economic Models
- Physical Models
- Estimates and Accounting
- Policy Analysis

Adapted from Antle and Just, 1991

Agriculture case study: 3 easy pieces

Microeconomic model

Agricultural + GHG production ➔ Total economic value

The farm produces the joint product of corn and GHG emissions

Regional portfolio model: societal risk and return of land allocation

Societal expected return and risk of investment

The regional portfolio is a statistical and visual representation of land use

Value of MLRI: economic benefit of resolving spatial and temporal uncertainty

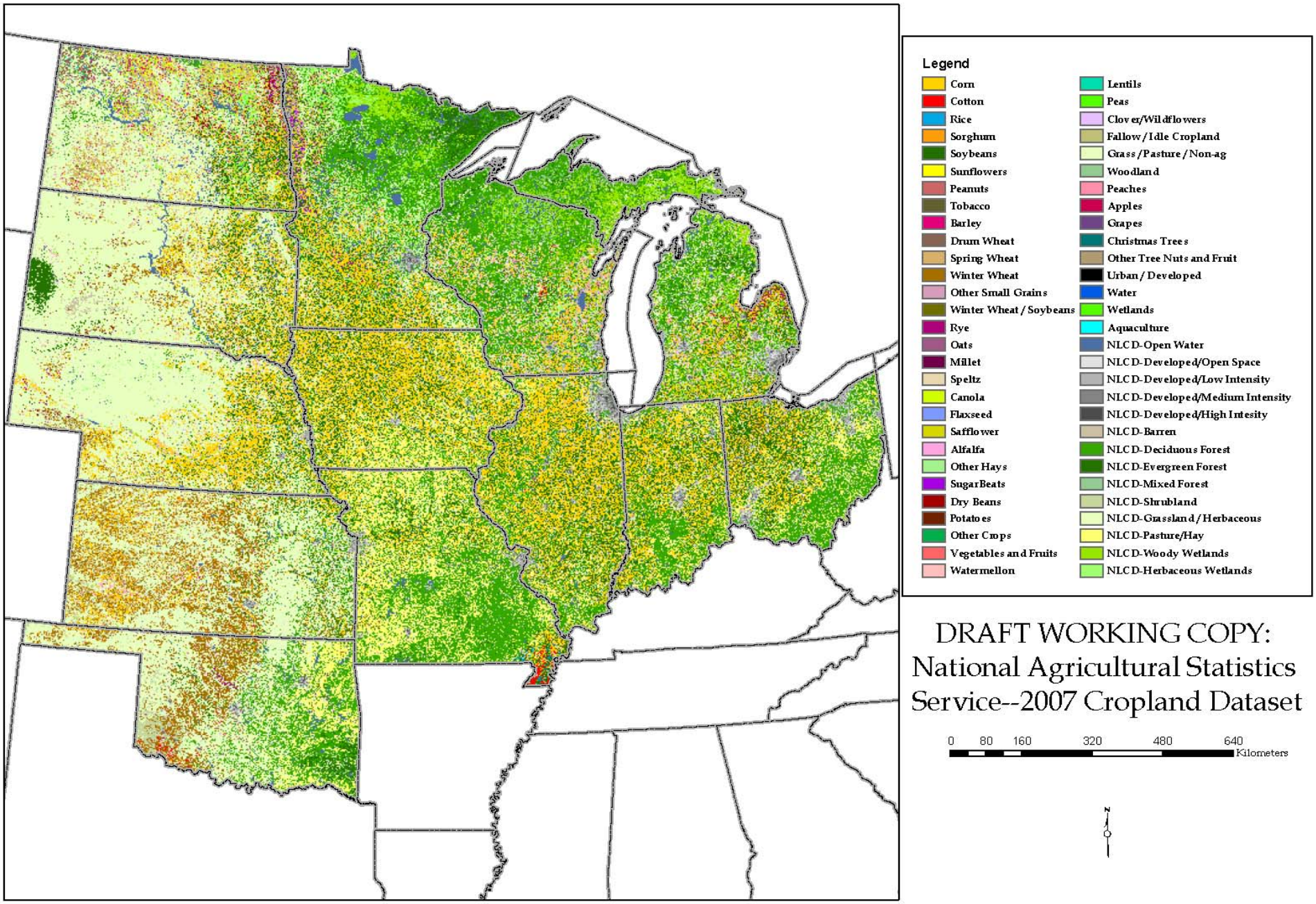
Bayesian approach to revised production and emission forecasting and reduced market and regulatory uncertainty

VOI arises from more informed crop planting and management decisions

USGS

Model input details

- Price: crop yields (corn), production inputs, other commodities (food and fuel)
- Policies: Extensive and Intensive
- Land Attributes: soil properties, nutrients, moisture endowments, slope, land cover
- Information and MLRI: prior years, production technology, spatial and temporal variability, monitoring of policies/landscapes



Notes: Cellsize is 56 meters. Satellite Source is the Indian AWiFS,
with ancillary data including MODIS, USGS NED and NLCD, and USDA's Common Land Units.

Date: June 10th, 2008