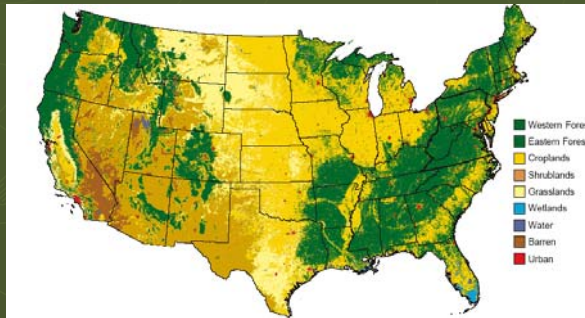


# USGS Anderson Land Classification Scheme



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Geography 581  
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. . . knowledge about land use and land cover has become increasingly important as the Nation plans to overcome the problems of **HAPHAZARD, UNCONTROLLED DEVELOPMENT, DETERIORATING ENVIRONMENTAL QUALITY, LOSS OF PRIME AGRICULTURAL LANDS, DESTRUCTION OF IMPORTANT WETLANDS, AND LOSS OF FISH AND WILDLIFE HABITAT.**

~ excerpt from Anderson, et. al. A Land Use And Land Cover Classification System for use with Remote Sensor Data. (1976).

## Land Use vs. Land Cover

Land use is what people do on the landscape:

- Agriculture
- Commerce
- Settlement
- Recreation

Land cover defines the material on the lands surface:

- Crops
- Water
- Forest
- Buildings

Land Cover is an excellent indicator of Land Use.

## Land Classification Standardization

- Increase Use of land base in the 1960's, led to an increase need for Legislatures, Government Agencies and Planners to have more current and accurate land use data.
- Land Cover/Use data often was not shared with other government and planning agencies.
- Data collected was often too specific to a project and not of use to other projects or at a later date.
- The different classification systems used made it difficult to be utilized in other studies.

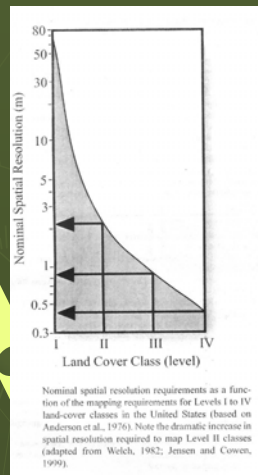
## Problems with Land Use Standardization

- Incomplete data coverages
- Changing definitions of categories.
- Changing methods by source agencies.
- Varying data age.
- Incompatible classification systems being used by agencies.

## Utilizing Remote Sensing for Classification Standards

- The minimum area which can be classified in a particular land cover or land use category is dependent on the scale and resolution of the remote sensor data.
- Land use requires interpretation of more elements of the image to determine classification: color, texture, shadow, pattern, association, shape, size, etc.
- Other data, such as topographic maps, road maps, and field studies are utilized when detail beyond the capacity of the remote sensor is needed.

# Spatial Resolution



Level Classification is dependent on spatial resolution of the image.

Maximum resolution needed:

- Level I: 80 meter
- Level II: 2.5 meter
- Level III: 0.9 meter
- Level IV: 0.45 meter

# Land Cover Classification Levels

## ➤ Level I: Global/Continental

- 1 Urban or Built-up Land
- 2 Agricultural
- 3 Rangeland
- 4 Forest Land
- 5 Water
- 6 Wetland
- 7 Barren Land
- 8 Tundra
- 9 Perennial Snow or Ice

## ➤ Level II: Biome/Region

Example: Agricultural

- 21 Cropland and Pasture
- 22 Orchards, Groves, Vineyard
- 23 Confined Feeding Operation
- 24 Other Agricultural Land

Example: Water

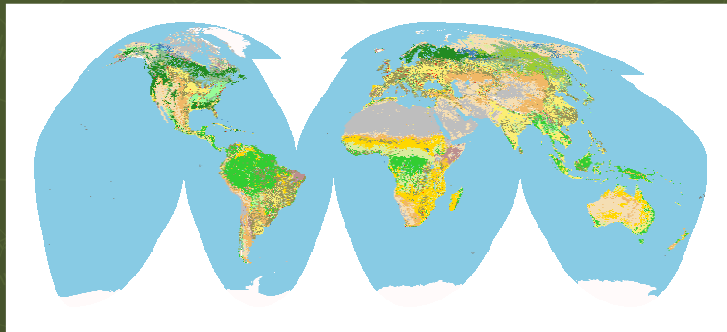
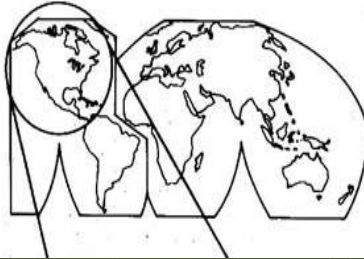
- 51 Streams
- 52 Lakes
- 53 Reservoirs
- 54 Bays and Estuaries

**Level I: Global**

AVHRR

MODIS

resolution: 250 m to 1.1 km



**Level II: Continental**

AVHRR

MODIS

Landsat Multispectral Scanner

Landsat Thematic Mapper

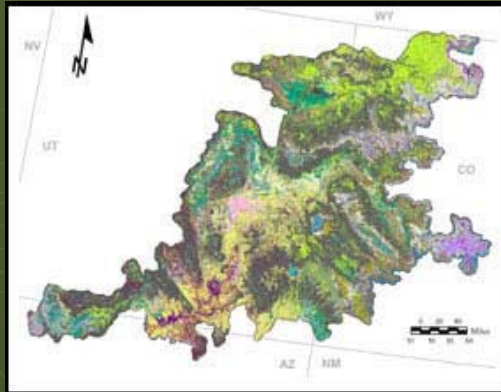
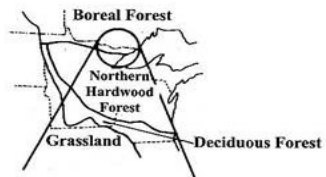
resolution: 80 m to 1.1 km



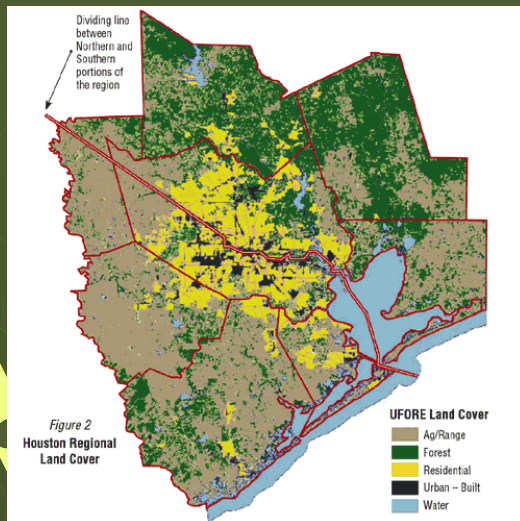
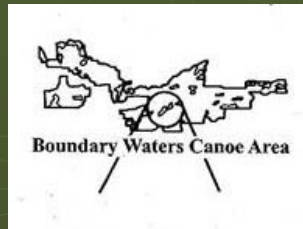
**Generalized  
Vegetation  
Classification**

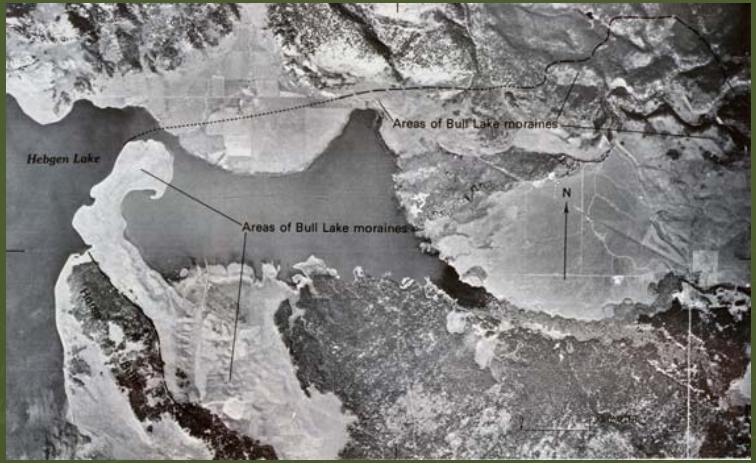


**Level III: Biome**  
 Landsat Multispectral Scanner  
 Landsat Thematic Mapper Plus  
 Synthetic Aperture Radar  
*resolution: 30 m to 80 m*

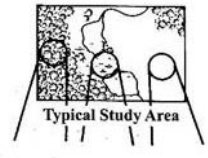


**Level IV: Region**  
 Landsat Thematic Mapper  
 SPOT  
 High Altitude Aerial Photography  
 Synthetic Aperture Radar  
*resolution: 3 to 30 m*

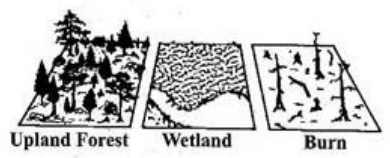




**Level V: Plot**  
 Stereoscopic Aerial Photography  
 IKONOS  
 QuickBird  
 resolution: 0.25 to 3 m



**Level VI: *In situ* Measurement**  
 Surface Measurements  
 and Observations



## USGS Land Cover – Historical Milestones

### 1970s

Anderson et al., System for Land Use and Land Cover Classification  
Conterminous United States Mapped Using Aerial Photography

### 1980s

75% of the State of Alaska Was Mapped Using Landsat Satellite Data

### 1990s

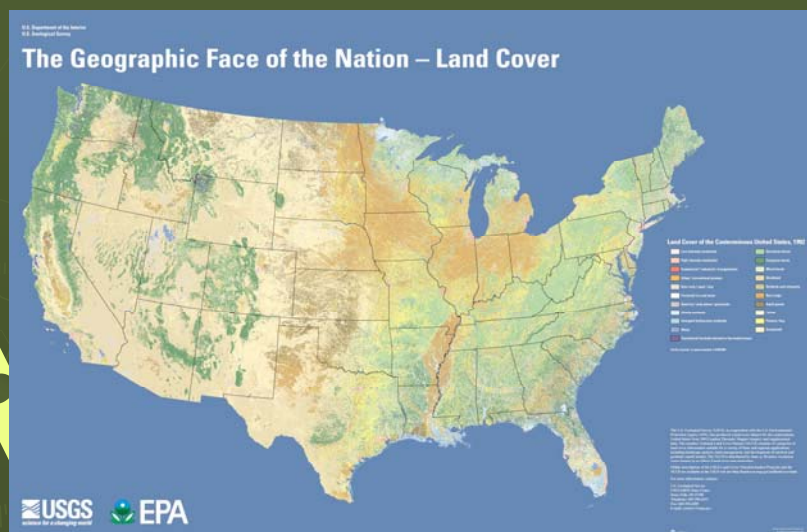
Multi-resolution Landscape Characterization Consortium (MRLC) Formed  
with Environmental Protection Agency (EPA), National Oceanic and  
Atmospheric Administration (NOAA), and US Forest Service (USFS).  
First 1-km Global Land Cover Characteristics Database Completed  
Land Cover and Vegetation Databases of the U.S. Using Landsat  
Thematic Mapper Data Completed  
Gap Analysis National Vegetation Mapping Initiated

### 2000s – New Directions

Systematic Assessment of National Land Use Dynamics  
Operational Baseline Mapping of Land Cover Characteristic



## National Land Cover Dataset



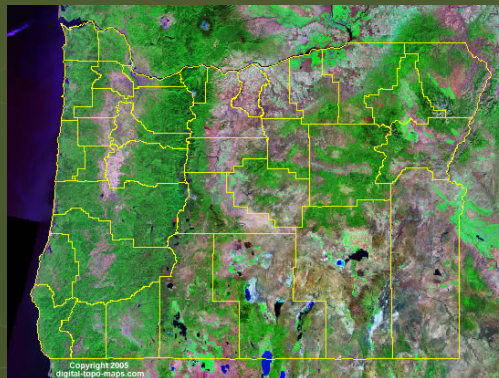


Land Cover Classes - Units in Square Miles	State Totals
11 Water	51942
12 Perennial Ice Snow	587
21 Low Intensity Residential	31697
22 Hi Intensity Residential	8129
23 Commercial/Industrial/Transportation	17549
31 Bare Rock	42640
32 Quarries/ Mines	2584
33 Transitional	19162
41 Deciduous Forest	360088
42 Evergreen Forest	387920
43 Mixed Forest	131850
51 Shrubland	546713
61 Orchards/ Vineyard	6587
71 Grasslands/Herbaceous	479074
81 Pasture/Hay	279527
82 Row Crops	379811
83 Small Grains	102998
84 Fallow	27667
85 Urban/Recreational Grasses	6967
91 Woody Wetlands	85412
92 Emergent/Herbaceous Wetlands	37982
State/Region Total	3006887

NLCD 1992	RED	GRN	BLUE
11	110	127	177
12	255	255	255
21	253	229	228
22	247	178	159
23	229	86	78
31	210	205	192
32	175	175	177
33	83	62	118
41	133	199	126
42	56	129	78
43	212	231	176
51	220	202	143
61	187	174	118
71	253	233	170
81	251	246	93
82	202	145	70
83	121	108	74
84	244	238	202
85	240	156	54
91	200	230	248
92	100	179	213

## Oregon Land Cover Standard

- Resolution Standards:
  - Statewide/Regional = 30 m
  - Basin/Ecoregion = 10 m
  - Watershed/County = 4 m
  - Local/Site = 0.5 m
- Three Levels of Classification:
  - Example:
    - 600. Non-Natural Woody
    - 610. High Structure Agriculture
    - 881. Orchards
    - 882. Berries/Vineyard
    - 883. Christmas Trees
    - 884. Nurseries
    - 620. Non-native/exotic invasive



## Resources

- Anderson, James R., Ernest E. Hardy, John T. Roach, and Richard E. Witmer. 1976. *A Land Use and Land Cover Classification System For Use With Remote Sensor Data*. USGS Professional Paper 964. A revision of the land use classification system as presented in the USGS Circular 671.
- Anderson, James R. and Ernest E. Hardy. 1973. *A Land Use Classification System For Use With Remote-Sensor Data*. Laboratory for Applications of Remote Sensing. Purdue Research Foundation.
- Framework Implementation Team: Land Use – Land Cover Subcommittee. December 2006. *Oregon Land Cover Standard*. Endorsed by the Oregon Geographic Information Council
- Jensen, John R. 2005. [Introductory Digital Image Processing: A Remote Sensing Perspective](#). 3<sup>rd</sup> Edition. Pearson Prentice Hall, New Jersey.
- Barnes, Christopher. Land Cover Institute Specialist, science Applications International Corporation (SAIC). <http://landcover.usgs.gov>
- Bosworth, Mark. GIS Program Manager, Metro.
- [www.landfire.gov](http://www.landfire.gov); [www.epa.gov](http://www.epa.gov); [www.houstonregionalforest.org](http://www.houstonregionalforest.org)