Michigan's Forest Inventory
Present and Future

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Michigan has an established forest industry

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Forest biomass can be used for energy

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Why biomass?
Because it can displace imported energy

The proportion of energy from imports

- 100% for coal and uranium
- 97% for petroleum
- 80% for natural gas

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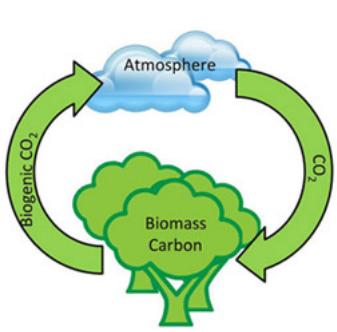
Why biomass?
Because atmospheric carbon is recycled



Biogenic carbon is part of a relatively rapid natural cycle that impacts atmospheric CO_2 only if the cycle is out of balance.

Fossil fuel combustion transfers geologic carbon into the atmosphere. It is a one-way process.

Image: http://www.wfpa.org/pages/biomasspolicy.html

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Can Michigan's forests meet all needs?
The answer starts with forest inventory

A stable, affordable feedstock supply

Biodiversity, wildlife, water and society

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How do we do a forest inventory?
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We could measure every tree …
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Forest Inventory and Analysis

- National Scope
- All owner classes
- Uses the same basic principles
- Cyclical

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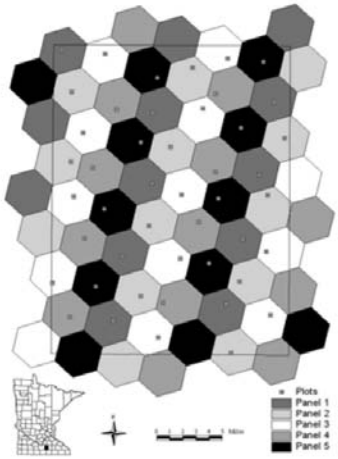
FIA divides the nation into hexagons



Phase 2 hexagons from Waseca Co. Minnesota and the selected Phase 2 plots for each cell by panel.

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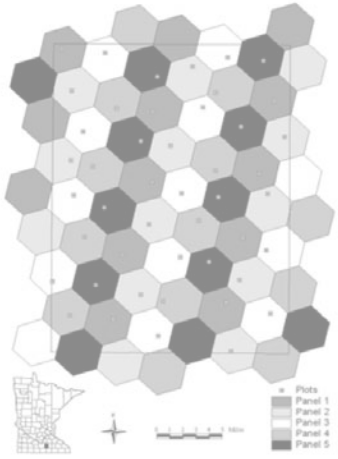
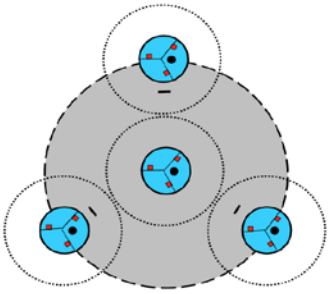
Within each hexagon is a 4-plot cluster



Phase 2 hexagons from Waseca Co. Minnesota and the selected Phase 2 plots for each cell by panel.

Phase 2/Phase 3 Plot Design



Subplot	24.0 ft (7.32 m) radius
Microplot	6.8 ft (2.07 m) radius
Annular plot	58.9 ft (17.95 m) radius
Lichens plot	120.0 ft (36.60 m) radius
Vegetation plot	1.0 m^2 area
Soil Sampling	(point sample)
Down Woody Debris	24 ft (7.32 m) transects

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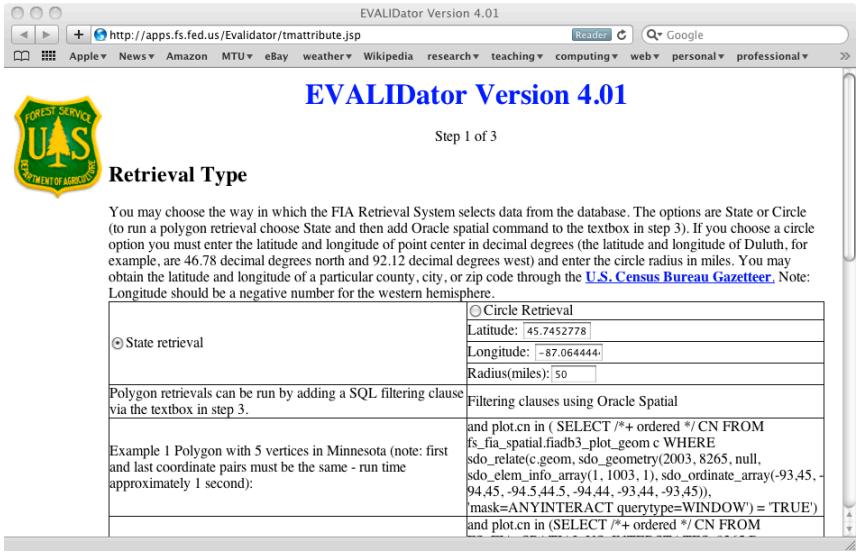
Data syntheses are publically available



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So what can FIA tell us about Michigan's Forest Inventory?

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Michigan's Forests are dominated by timberlands

Cover Type	Land Area (acres) Forestland	Timberland
Pine	1,981,000	1,868,000
Other Conifer	2,724,000	2,618,000
Oak/Mixed	3,877,000	3,829,000
ElmAshCot	2,055,000	2,019,000
MapBeeBir	5,839,000	5,666,000
AspBir	3,210,000	3,089,000
Other Hardwood	137,000	121,000
Nonstock	180,000	176,000
TOTAL	20,003,000	19,386,000

Source: FIA RSC=23 EVLAID=261001

About 97% of forested lands are classified as timberlands; that is, they are not otherwise administratively withdrawn from management.

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Definitions

- **Inventory** is the amount and location of the resource at the present time
- **Growth** is additions to the forest from growing trees
- **Mortality** is losses from trees that die of natural causes
- **Removals** are losses from harvesting or conversion
- **Net Growth After Removals** is the change in inventory
- **Availability** is the portion of the inventory that could be utilized
- **Potential Availability** is the amount available if the resource were managed according to its current demonstrated productive capacity, and if social, ecological, administrative, and technical constraints were managed to minimize their impact on utilization
- **Actual Availability** is somewhat to very much less

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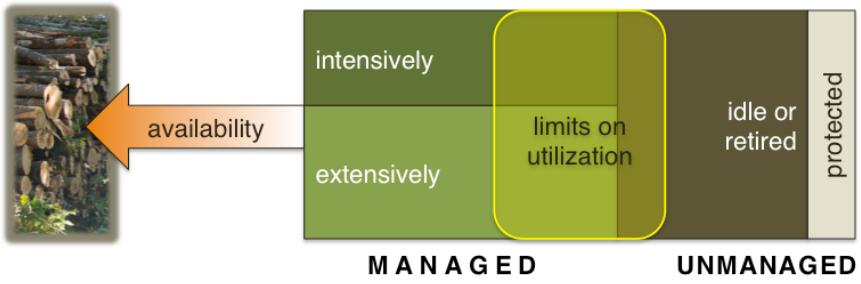
Availability is defined by many factors

Key constraints include

1. Biophysical: soils, cover, past management, planned management
2. Sociopolitical: land ownership, management behavior



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Inventory is the foundation

All data from FIA. Reported volumes are for timberlands; these are lands not administratively withdrawn from management (i.e., parks and protected areas).

	Land Area (acres)		Biomass	Volume	Annual Growth		
Cover Type	Forestland	Timberland	('000s tons)	('000s ft^3)	('000s ft^3)	ft^3/ac	tons/ac
Pine	1,981,000	1,868,000	69,037	3,514,481	96,671	52	0.78
Other Conifer	2,724,000	2,618,000	79,066	3,901,048	70,981	27	0.41
Oak/Mixed	3,877,000	3,829,000	177,340	6,390,228	189,492	49	0.74
ElmAshCot	2,055,000	2,019,000	81,057	3,162,807	79,952	40	0.59
MapBeeBir	5,839,000	5,666,000	297,618	10,927,202	209,291	37	0.55
AspBir	3,210,000	3,089,000	89,873	3,570,528	109,273	35	0.53
Other Hardwood	137,000	121,000	1,182	35,939	1,716	14	0.21
Nonstock	180,000	176,000	322	12,697	967	6	0.08
TOTAL	20,003,000	19,386,000	795,495	31,514,930	758,343	39	0.59

Source: FIA RSC=23 EVLAID=261001

Native forest productivity is modest at 0.59 tons/ac/yr, but over a large land area.

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Cover types are not equal

Cover Type	Growth ('000s ft³/yr) Gross	Net	Removals ('000s ft³/yr)	Mortality ('000s ft³/yr)	Removal Fraction	Mortality Fraction
Pine	118,490	96,671	25,620	21,819	22%	18%
Other Conifer	115,557	70,981	22,537	44,576	20%	39%
Oak/Mixed	245,072	189,492	57,250	55,580	23%	23%
ElmAshCot	128,795	79,952	19,205	48,843	15%	38%
MapBeeBir	305,945	209,291	157,762	96,655	52%	32%
AspBir	173,146	109,273	56,070	63,873	32%	37%
Other Hardwood	3,142	1,716	1,445	1,426	46%	45%
Nonstock	2,029	967	9,856	1,062	486%	52%
TOTAL	1,092,176	758,343	349,745	333,833	32%	31%

Source: FIA Michigan 262007

Only 32% of the gross growth on UP forestlands is harvested each year. Essentially the same amount is lost to mortality.

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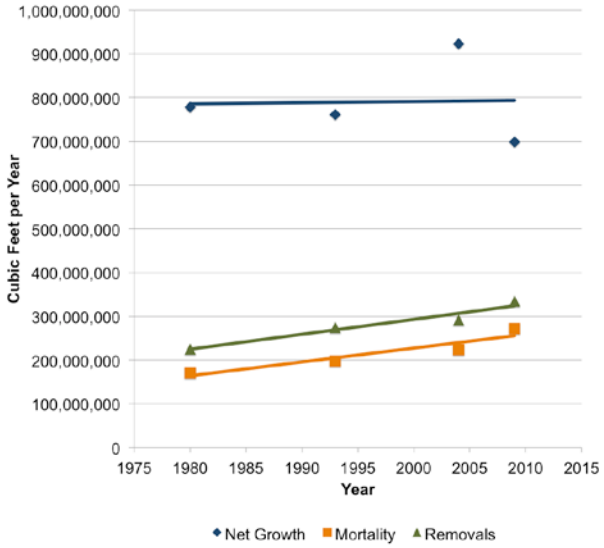
There is a large and persistent gap between growth and removals



Presently, we harvest about 35% of timberland growth each year

Notably, natural mortality each year is now equivalent to about 31% of timberland growth

Merchantable volume is only 75% of the tree. The rest is tops and limbs.

3,000,000 green tons

Source: USDA Forest Inventory and Analysis

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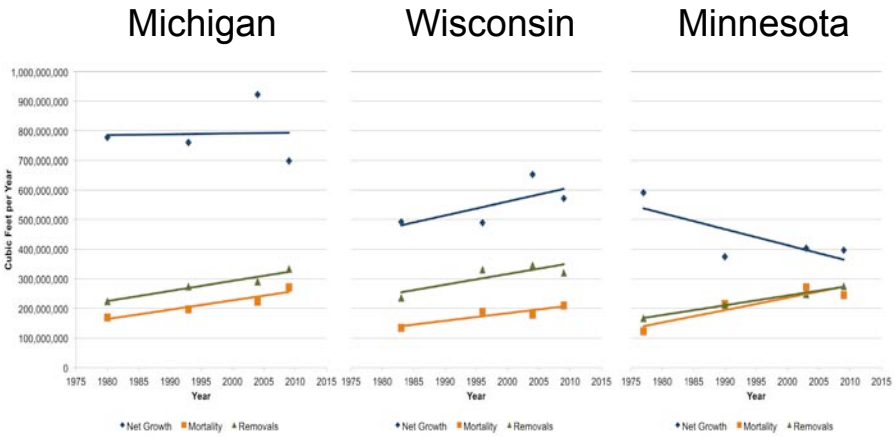
The comparison depends on perspective



Source: USDA Forest Inventory and Analysis

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Utilization varies by landowner class

Gross means growth on all trees; **Net** means growth less total inventory loss to mortality. Note that *net growth can be negative* even in healthy stands if the total volume in trees that die or are cut exceeds the volume increment on trees that are alive at re-measurement.

Owner Type	Growth ('000s ft³/yr) Gross	Net	Removals ('000s ft³/yr)	Mortality ('000s ft³/yr)	Removal Fraction	Mortality Fraction
Federal	138,283	91,467	22,826	46,817	17%	34%
State	217,095	137,995	74,782	79,100	34%	36%
Private	736,798	528,881	252,137	207,917	34%	28%
TOTAL	1,092,176	758,343	349,745	333,833	32%	31%

Source: FIA RSC=23 EVLAID=261001

The greatest utilization rate is on private lands, though it is not possible to determine if this is on corporate or non-industrial holdings.

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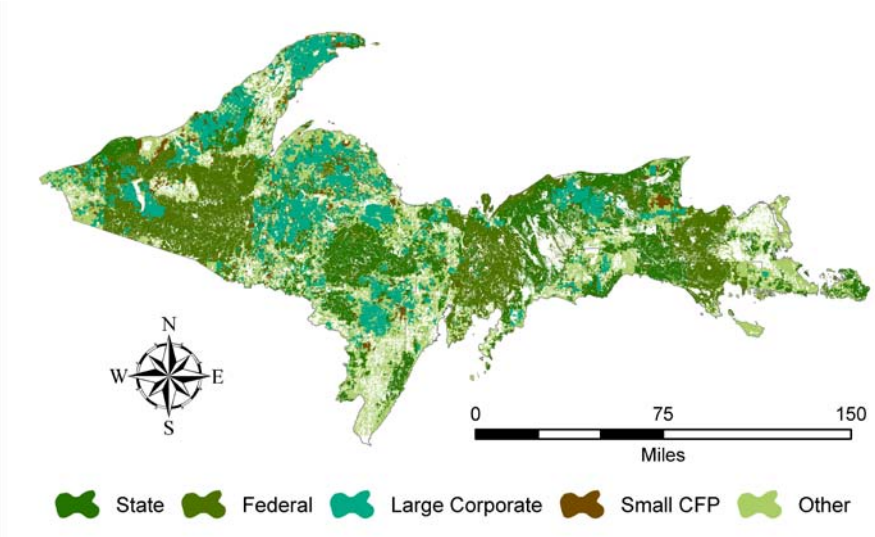
How do we ask questions at scales that matter when talking about new projects?



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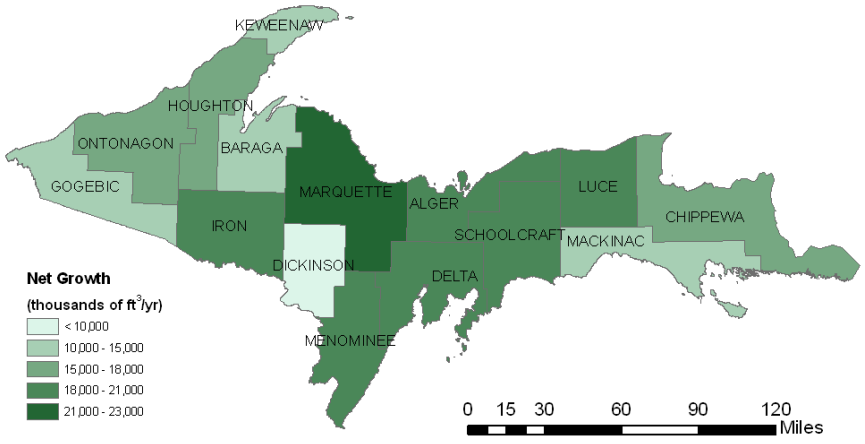
Public FIA tools provide limited spatial resolution



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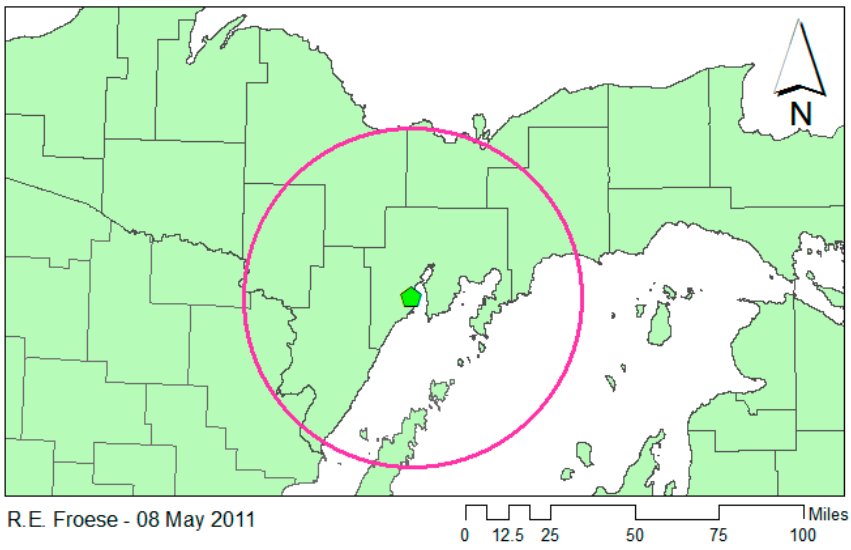
Consider e.g. a proposal at Escanaba



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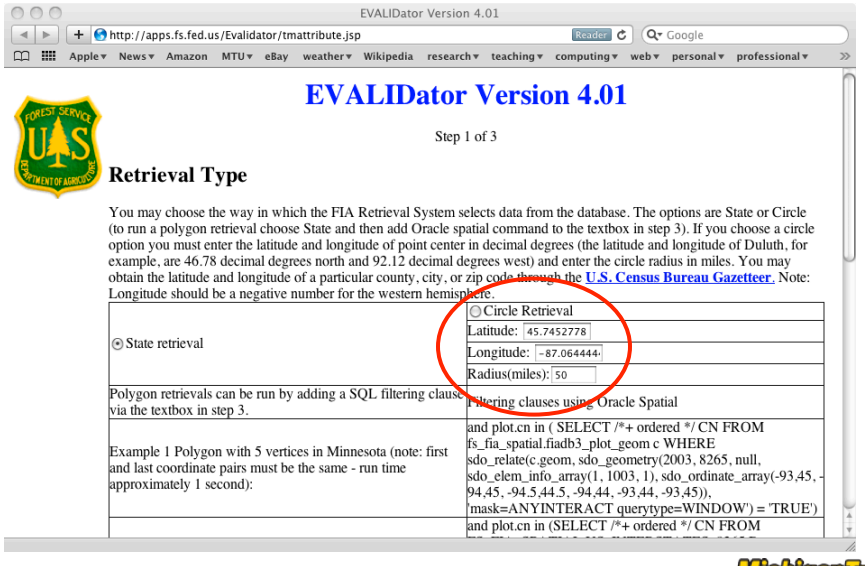
The public interface can provide large area estimates



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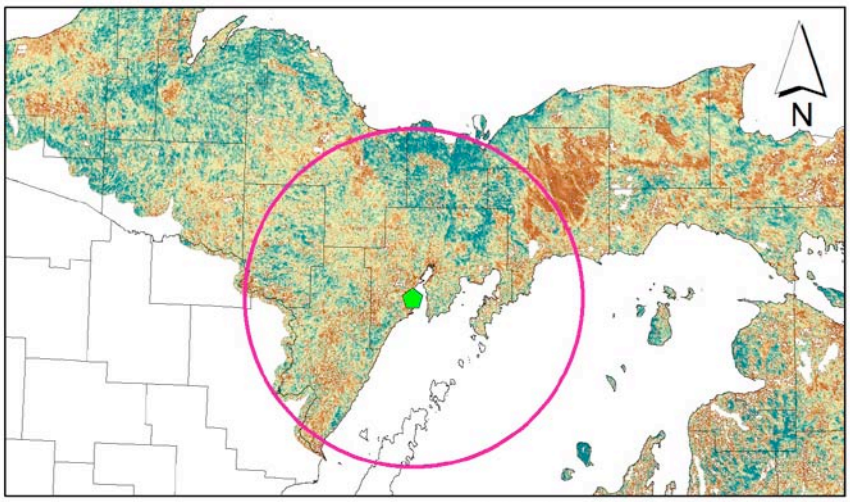
An alternative is to spatially interpolate



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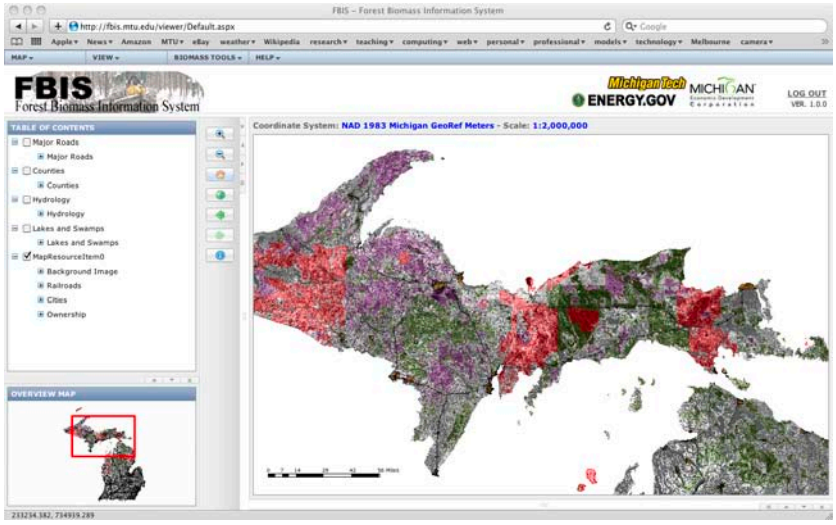
Forest Biomass Information System



This material is based upon work supported by the Department of Energy under award number DE-EE-0000280.

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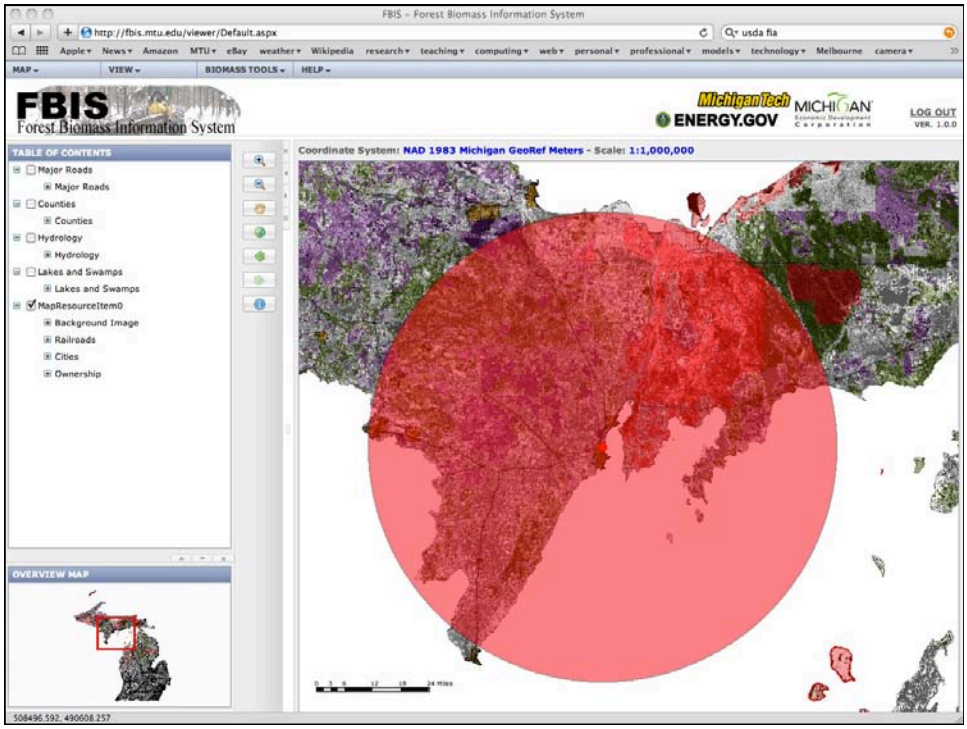
FBIS – Forest Biomass Information System
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MAP VIEW BIOMASS TOOLS HELP
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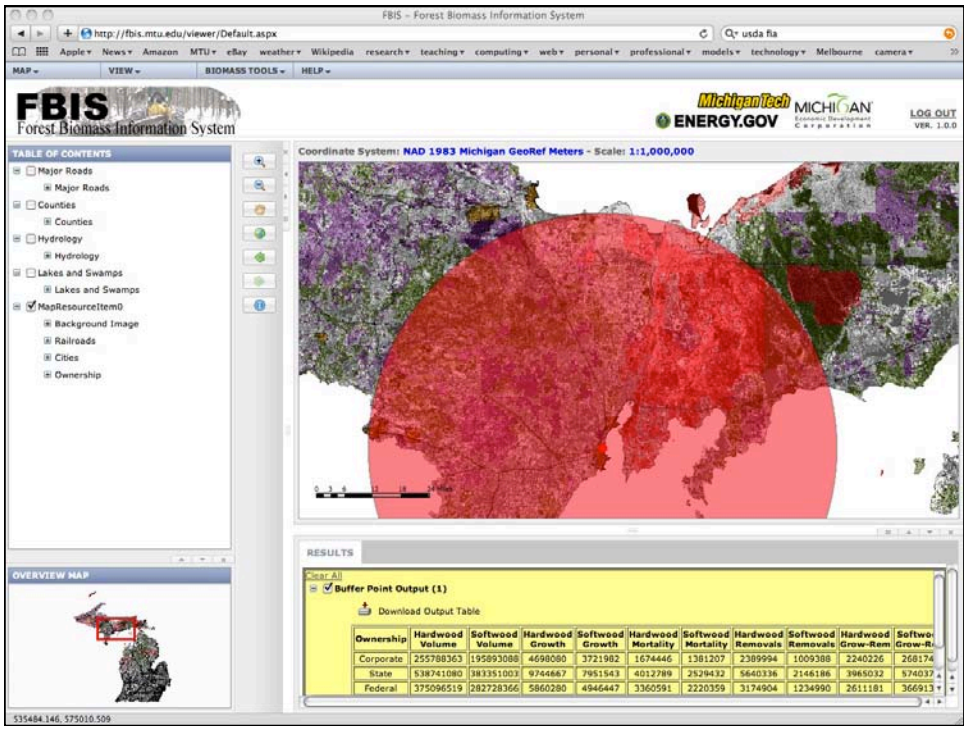
FBIS – Forest Biomass Information System
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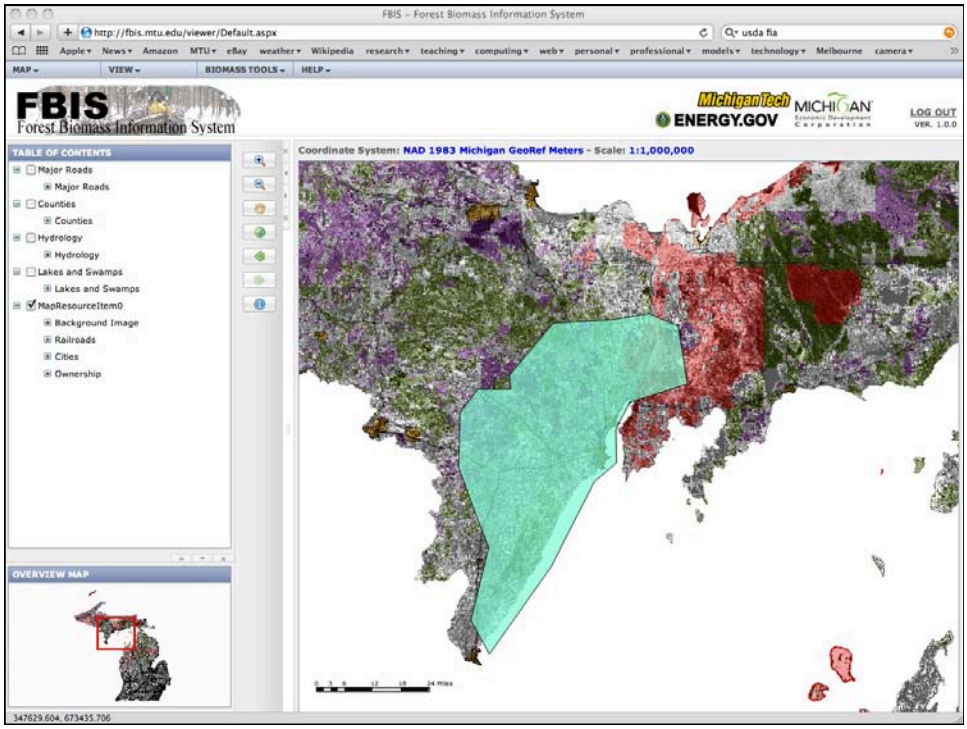

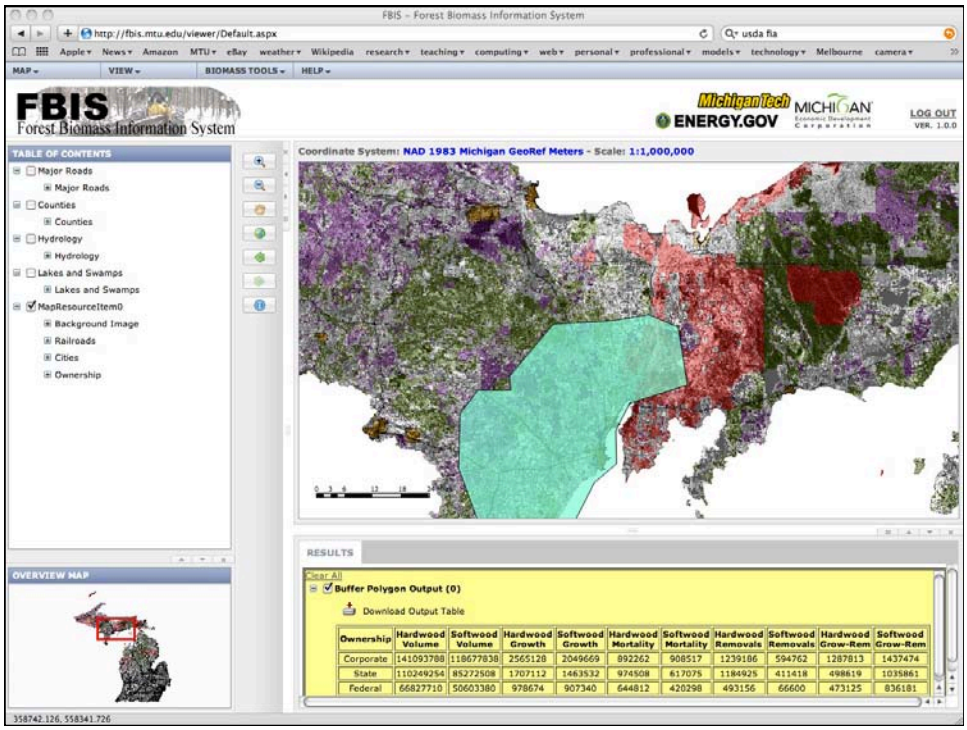

Ownership	Hardwood Volume	Softwood Volume	Hardwood Growth	Softwood Growth	Hardwood Mortality	Softwood Mortality	Hardwood Removals	Softwood Removals	Hardwood Grow-Rem	Softwood Grow-Rem
Corporate	141093788	118677838	2565128	2049669	892262	908517	1239186	594762	1287813	1437474
State	110249254	85272508	1707112	1463532	974508	617075	1184925	411418	498619	1035861
Federal	66827710	50603380	978674	907340	644812	420298	493156	66600	473125	836181

But what about the difference between inventory and availability?

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Availability depends on multiple factors

Geographic Region			
Covertype			
Ownership Category			
Family Private Forest	**Institutional Private Forest**	**National Forest**	**State Forest**
net annual growth	net annual growth	net annual growth	net annual growth
historic harvest trends	historic harvest trends	historic harvest trends	historic harvest trends
levels given proportion owners say they would be willing to harvest	estimated harvest levels	planned harvest levels	planned harvest levels
levels given increase harvests from landowner incentives	variations of estimated harvest levels	potential harvest with release of selected administrative constraints	potential harvest levels with key limiting factors removed

Courtesy Karen Potter-Witter, MSU

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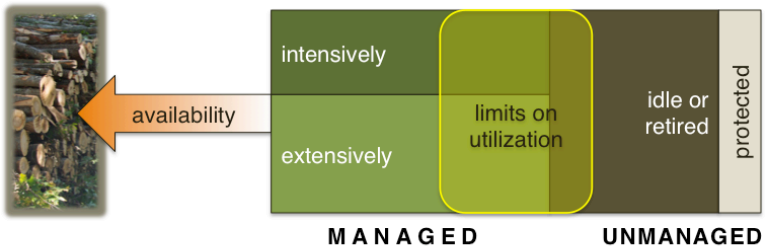

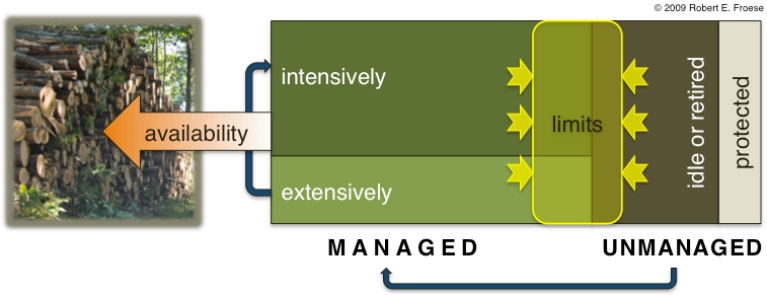

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In Summary

Inventory and availability are critical policy and management needs

There is a large and persistent gap between growth and removals

Landowner behavior is key to determining availability

FBIS
Forest Biomass

FBIS is a new inventory tool that allows sophisticated spatial analysis of forest resources

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