United States
Department of
Agriculture

Forest
Service

North Central
Forest Experiment
Station

General Technical
Report **NC-124**

Evaluation of Resources at Risk from Wildland Fires

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1992 Folwell Avenue
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Manuscript approved for publication June 13, 1988
1988

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To properly allocate wildfire control resources among various wildland fire control districts of a State, it is necessary to estimate the value at risk from wildfire for each district and to compare them. We define value at risk as the value of resources (principally timber or structures) that can be damaged or destroyed by wildfire. Value at risk is always larger than net value change—the actual net loss or gain experienced as the result of wildfire. To estimate value at risk precisely would require careful examination of fire occurrence and value change data, normalized for variation in weather and protection effort, for the full range of wildland resources over a fairly long time. In most States, good records of the number and size class of wildfires and the acreage burned for counties and regions are available for a sufficient time span to make adequate estimates of fire activity, given past weather patterns and levels of protection effort. Records of value change have, however, always been sketchy. Recent studies (Crosby 1977, Marty and Barney 1981, Althaus and Mills 1982, Gorte and Baumgartner 1983) have identified the various value components, including non-market values, that can be affected by fire and have suggested methods to measure each. However, until these methods are implemented and better value change data are collected over at least several years, less precise methods must be used. At this point the limitations of existing value change data preclude the practical application of precise analyses of value at risk from wildfire. A precise analysis should be complete with measures of both market and non-market resource values and potential value changes (including beneficial ones) that fires may cause. We know what should be in a comprehensive model of value at risk, but are only beginning to collect the input necessary to develop accurate probability estimates for a wide range of possible events and outcomes. In the short term, the best possible use must be made of existing information. The objective of this paper is to show how existing information can be used to establish values for timber and structures and to assess the potential for large wildland fires in representative counties of northern lower Michigan. These values combined with an assessment of the potential for large fires can then be used to provide a preliminary indicator of where fire protection efforts should be concentrated.

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THE MICHIGAN FOREST FIRE ECONOMIC ANALYSIS

In 1984, the Forest Management Division of the Michigan Department of Natural Resources prepared an economic analysis (Siegle 1984) to help determine the preferred budget level for the Michigan Forest Fire Program. The analysis used the Initial Attack Assessment (IAA) model from the National Fire Management Analysis System (NFMAS) of the USDA Forest Service to develop cost plus net value change (C+NVC) options for 19 fire protection areas in the northern two-thirds of Michigan. Various budget levels (costs) were projected to result in certain value changes (NVC's) until a minimum C+NVC level was determined for each fire management analysis zone (FMAZ). The results showed that achieving the minimum C+NVC would require lower budgets in nine of the FMAZ's, higher ones in six, and no change in four, suggesting the need for reallocating some then existing budget funds among zones. Since then, all locations for which the minimum C+NVC was below the present budget in

1983 have lost additional personnel and no longer show that advantage. Still the analysis is useful in determining where to place "soon to be hired" personnel. This analysis incorporated the major elements of a good value at risk model. Fire history and weather records, as well as the presuppression (fixed) and actual initial attack suppression (variable) costs, were determined. Representative fires were chosen, and typical initial attack responses to them were developed. The cost element in the C+NVC function was well defined. However, although the analysis may have done a good job of projecting the acreages of various types of stands that would be killed or injured at alternative budget levels, a good historical record of NVC associated with given types of fires was not available. The analysts had to do the best they could at improvising estimates of the NVC of timber, improvements, recreation, and wildlife with bits and pieces of information from a variety of sources, including other States and the opinions of experienced researchers and fire managers.

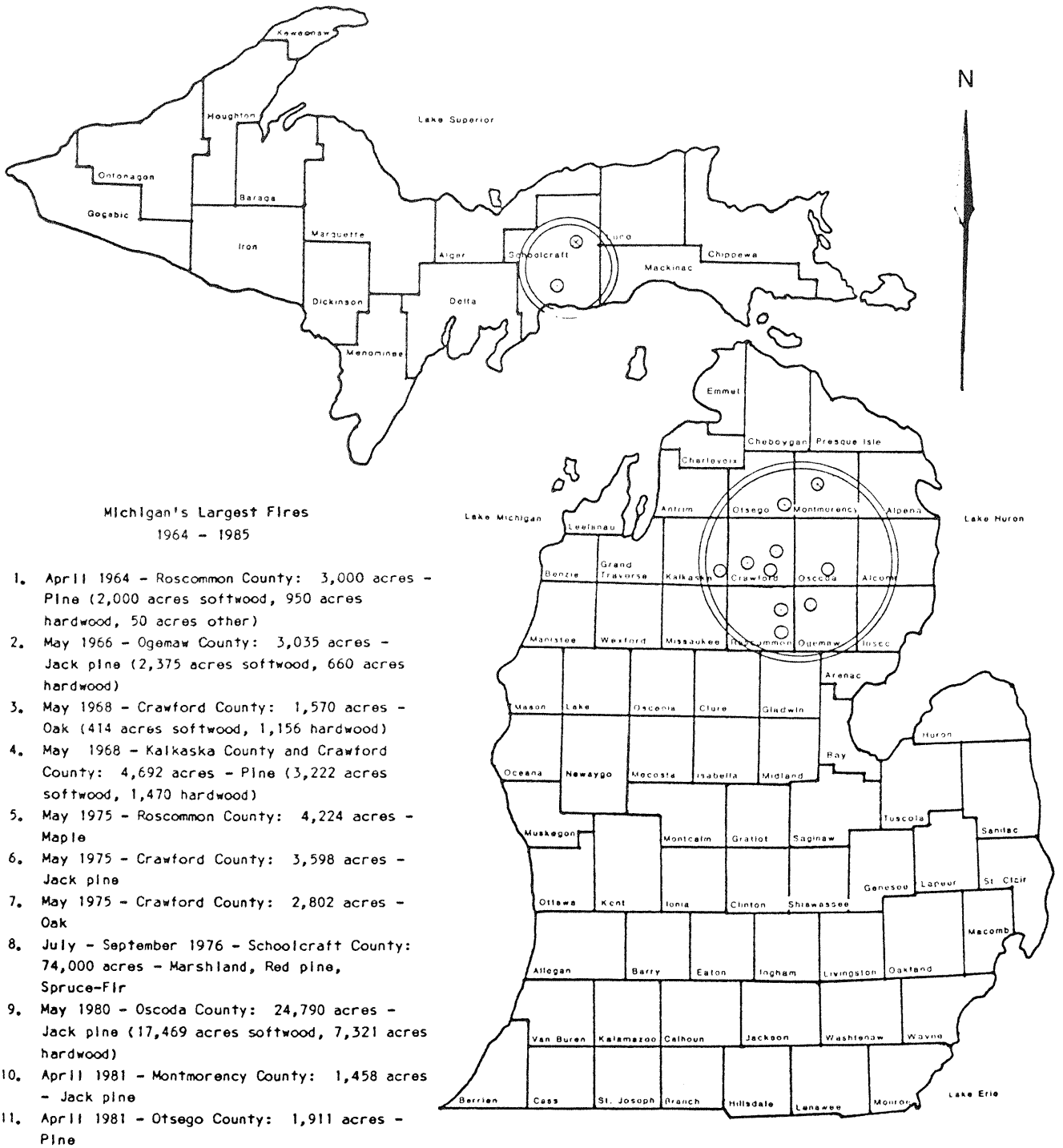
In 1985 a task force was appointed by the Chief of the Forest Management Division of the Michigan Department of Natural Resources to review the analysis and apply the results to see how the present allocation of fire protection effort would be affected. The task force found that the C+NVC analysis suggested funding levels and reallocations that agreed with its intuitive, collective judgment and that it could be used in allocating protection effort. The task force also suggested that the value change data should be improved and accumulated by using the best available appraisal methods when completing individual fire report forms. In retrospect, several sources of information can be identified and used to supplement the economic analysis until improved NVC data are collected for a sufficient number of representative individual fires.

TIMBER

In the Michigan Economic Analysis, timber resources were broadly grouped by species as mature or developing pine, jack pine, hardwood, or aspen. Statewide average values were estimated for each of the species-size groups and then weighted according to their proportion in a given protection unit to arrive at a "composite acre" value. This value is applied to each acre projected to burn in the protection unit, based on the 10-year fire history in the unit. This information can be supplemented with data from two Michigan forest surveys (Pfeifer and Spencer, n.d., Jakes 1982) to obtain a measure of timber volume change between 1966 and 1980 as well as an estimate of the present volume. Applying 1984 timber prices to both sets of survey data yields value change data (tables 1-6). The tables provide examples for Region 2 (the northern Lower Peninsula) as well as for five individual counties within the Region. The value and value change data are summarized in tables 7 and 8. One can quickly see from the tables that timber values (in 1984 dollars) have increased markedly in all five counties and in Region 2. Of the five counties, both Roscommon and Charlevoix had larger percent value increases per acre of commercial forest land than Region 2 as a whole. Clare, Crawford, and Cheboygan had somewhat smaller increases. Roscommon County, where timber value per acre of commercial forest land increased about 133 percent between 1966 and 1980, stands out as far above average.

Estimates of the timber value at risk from wildfire can also be made more accurate by examining fire history, particularly for the relatively few largest fires that account for a high percentage of the acreage burned and volume and value of timber damaged. Figure 1 shows the distribution by county of all fires more than 1,000 acres that occurred in Michigan during 1964-1985. It is clear that most of the largest fires occurred in a cluster of counties in the northern Lower Peninsula of Michigan and in one county in the Upper Peninsula. The Upper Peninsula case was the State's largest modern fire. It may be something of an aberration because it was discovered when small and watched for many days before being attacked aggressively, but belatedly, due to jurisdictional policy differences. In general, its large size seems to be the result of a highly unlikely combination of physical and institutional circumstances. Figure 1 also gives an idea of timber types most likely to be involved in the largest fires. Pines, especially jack pine, seem to be the most fire prone, but hardwoods are not exempt from large fires.

Fire history statistics can be misleading in predicting future fires, as may be the case involving Michigan's largest fire in recent years, which under most circumstances would have stayed small. An absence of large fires could be the result of unusual weather conditions or of exceptionally effective prevention and initial attack activities. In this case fuels could be building up to the point where the future danger could be much higher than the past would indicate. Still, the historical record of large fires, when included with other data discussed in this paper, can help provide an improved estimate of value at risk. During 1964-1985, Crawford and Roscommon Counties had the highest incidence of large fires of any Michigan counties, standing apart even within the cluster of large fire-prone counties in the northern Lower Peninsula. Higher timber values in Roscom-



Michigan's Largest Fires
1964 - 1985

1. April 1964 - Roscommon County: 3,000 acres - Pine (2,000 acres softwood, 950 acres hardwood, 50 acres other)
2. May 1966 - Ogemaw County: 3,035 acres - Jack pine (2,375 acres softwood, 660 acres hardwood)
3. May 1968 - Crawford County: 1,570 acres - Oak (414 acres softwood, 1,156 hardwood)
4. May 1968 - Kalkaska County and Crawford County: 4,692 acres - Pine (3,222 acres softwood, 1,470 hardwood)
5. May 1975 - Roscommon County: 4,224 acres - Maple
6. May 1975 - Crawford County: 3,598 acres - Jack pine
7. May 1975 - Crawford County: 2,802 acres - Oak
8. July - September 1976 - Schoolcraft County: 74,000 acres - Marshland, Red pine, Spruce-Fir
9. May 1980 - Oscoda County: 24,790 acres - Jack pine (17,469 acres softwood, 7,321 acres hardwood)
10. April 1981 - Montmorency County: 1,458 acres - Jack pine
11. April 1981 - Otsego County: 1,911 acres - Pine
12. July 1983 - Schoolcraft County: 1,130 acres - Pine, Swamp

Figure 1.—*Michigan's largest fires, 1964-1985.*

mon County, together with the high incidence of large fires, reinforce the indication of high potential value at risk.

A third indicator of timber value at risk from wildfire is the spatial arrangement of forest cover in a given area. The possibility of large fires is limited to areas that have large continuous acreages of fire-prone timber types. Aerial photography and satellite imagery can show the continuity of fuels at various levels of resolution. Landsat cover type maps show that important county differences in the continuity of

coniferous and deciduous tree cover can easily be seen. These maps are produced in color and brilliantly show the continuity of forest cover as well as urban and built-up land, crop land, range land, inland water, forested and non-forested wetlands, and barren land.

Crawford County shows more or less complete continuous forest cover with coniferous types predominating. Roscommon County also shows extensive continuous forest coverage with roughly equal proportions of coniferous and deciduous species. Charlevoix County indicates a fragmented pattern of deciduous forest with much smaller areas of continuous cover. It seems clear that Roscommon and Crawford Counties have higher timber values at risk from wildfire than does Charlevoix, and that Roscommon County has the highest value at risk when the three factors of timber value per acre, large fire history, and continuity of forest cover are considered.

IMPROVEMENTS

Potential damage to improvements including structures and their contents, equipment, and ornamental trees should be included in an analysis of value at risk. Improvements are becoming an increasingly important component of value at risk as the area of rural-urban interface and the popularity of rural living increase in fire-prone areas. The Michigan Economic Analysis (Siegle 1984) developed a figure of $72.00 per acre as an average improvement damage cost per acre burned. This figure was used on a statewide basis. Data available from county tax records can show that variation in improvement values between counties and/or "protection areas" exist, and they can be used to provide another indicator of value at risk that should be considered along with factors affecting values at risk to timber. Table 9 provides data on the approximate equalized value of land and improvements in 1967 and 1985 for the five study counties in the northern Lower Peninsula. Although these figures do not isolate improvements, except for Roscommon County in 1985, they reflect large county differences in improvement values and rates of change. When used in conjunction with the factors for estimating values at risk to timber, they can improve the estimate of county or "protection area" variation in value at risk from wildfire. Table 9 indicates that Charlevoix and Roscommon Counties have the highest per acre values for land and improvements, and both have high timber values. Charlevoix County, however, has no recent history of large fires and a fragmented pattern of forest cover, which is primarily deciduous species. Roscommon County, on the other hand, has a record of large fires and a lot of continuous forest cover in fire-prone timber types. It continues to stand out as an example of high value at risk when improvement values enter the picture. Crawford County, with presently low, but rapidly increasing, per acre values for land and improvements, a record of large fires, and a very large area of continuous forest cover, shows a rapidly increasing value at risk.

The Michigan Department of Natural Resources is currently completing a study of improvement values in fire-prone areas, using a sample of individual properties. This will provide a more precise indicator of improvement values at risk from wildfire.

OTHER RESOURCES

Timber and improvement values are the most important components of value at risk and the easiest to estimate in dollar terms. The Michigan Economic Analysis (Siegle 1984) also estimated a value at risk for recreation in each of its "protection units," which consist of all or parts of one to four counties. These per acre values for the "protection units" could be estimated for individual counties to provide another indicator of value at risk on a county basis, or new data could be developed using the Michigan Economic Analysis methodology. It would be more difficult to aggregate the county data, used as value at risk indicators for timber and improvements in this paper, into DNR "protection units" because the "protection units" often include fractions of counties.

Wildlife values need not be considered at risk from wildfire. Information developed in pilot tests of the recently implemented fire effects appraisal system in Wisconsin (Baumgartner 1984) showed that the net economic effect on wildlife was beneficial on 341 of 345 Wisconsin fires and that a net loss occurred on only four. The Michigan Forest Fire Economic Analysis (Siegle 1984) estimated that wildfire impacts on wildlife in Michigan were beneficial on fires less than 100 acres and neutral for those more than 100 acres. Only in a few special circumstances, such as in waterfowl nesting areas in the spring, does wildfire have harmful effects on wildlife.

Data from Wisconsin and Michigan indicate that water quality and soil stability are rarely significantly affected by fires in these States. However, air quality can be affected. The potential impact of fire on air quality for a county generally depends on the number and size of cities and towns, important highways, and recreational developments. If information on these were collected, a subjective estimate of value at risk could be made.

Farm crops, usually hay, are sometimes affected by wildfires. Value at risk to crops could be estimated

using Census of Agriculture figures for county acreage in hay and the net value of expected yield (as estimated by county agents).

One other potential indicator of value at risk from wildfire is the cost of rehabilitating burned over forest land. This would differ from county to county depending on timber type and terrain. State forest managers could provide data on this indicator of value at risk. Rehabilitation costs may well be as important as timber and improvement losses.

SUMMARY

This report is intended to show how four types of information can be combined to give a preliminary idea of comparative value at risk from wildfire in five counties in northern lower Michigan. Of the four indicators, timber stumpage values are the most adequately estimated because they are based on a relatively recent timber inventory by the USDA Forest Service. These values account for most losses from wildfire in Michigan. Improvement values are less adequately represented and are growing in importance. This component of value at risk needs further study. The forest management division of the Michigan Department of Natural Resources is currently working to provide accurate estimates of improvement values associated with fire-prone areas. Using only the largest fires for a fire history base also has limitations because smaller fires associated with debris burning may have a larger per acre impact on improvements than the larger ones. More complete information on the spatial frequency and variability of wildfires could be assembled from Michigan wildfire records. The landcover class maps also give only a very general indicator of the continuous forest cover that allows a fire to become large. They too could be refined. Still, easily established rough value estimates for timber and improvements, the recent history of large fires, and the area occupied by continuous fire-prone land cover types can be used to indicate where fire control efforts should be concentrated. Fire managers could use their special knowledge and experience to refine the indicators and to vary the weight for each. They could also consider the potential for wildfire damage to non-market values particular to their jurisdictions.

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Table 1.--Region 2--Northern Lower Peninsula, Michigan, timber inventory

(1984 dollars)

Species	1966 Sawtimber			1980 Sawtimber		
	Volume[1]	Value	Total value[2]	Volume[3]	Value	Total value[4]
	Mbf	$/Mbf	Dollars	Mbf	$/Mbf	Dollars
SOFTWOODS						
White pine	494,100	66	32,610,600	811,402	66	53,552,532
Red pine	224,510	68	15,266,680	1,053,736	68	71,654,048
Jack pine	136,610	26	3,551,860	684,828	26	17,805,528
White spruce	78,360	20	1,567,200	121,852	20	2,437,040
Black spruce	20,460	20	409,200	41,690	20	833,800
Balsam fir	132,460	30	3,973,800	151,930	30	4,557,900
Hemlock	431,120	36	15,520,320	252,871	36	9,103,356
Tamarack	19,380	24	465,120	56,260	24	1,350,240
N. white cedar	420,100	36	15,123,600	653,206	36	23,515,416
Other softwoods	--	20	--	11,647	20	232,940
Total	1,957,100		88,488,380	3,839,422		185,042,800
HARDWOODS						
Select white oaks	335,600	160	53,696,000	572,193	160	91,550,880
Select red oaks	1,107,790	205	227,096,950	2,159,690	205	442,736,450
Other red oaks	511,410	40	20,456,400	488,102	40	19,524,080
Hickory	32,900	40	1,316,000	5,588	40	223,520
Yellow birch	54,610	75	4,095,750	77,578	75	5,818,350
Hard maple	896,230	108	96,792,840	1,188,575	108	128,366,100
Soft maple	667,170	69	46,034,730	1,450,072	69	100,054,968
Beech	594,180	64	38,027,520	389,470	64	24,926,080
Ash	285,600	177	50,551,200	487,434	177	86,275,818
Balsam poplar	353,430	66	23,326,380	353,766	66	23,348,556
Cottonwood	161,810	38	6,148,780	42,830	38	1,627,540
Bigtooth aspen	679,220	37	25,131,140	1,339,410	37	49,558,170
Quaking aspen	731,620	37	27,069,940	1,366,066	37	50,544,442
Basswood	549,110	124	68,089,640	834,836	124	103,519,664
Black cherry	74,270	--	--	172,403	--	--
Elm	1,025,510	62	63,581,620	44,130	62	2,736,060
Paper birch	262,270	46	12,064,420	233,758	46	10,752,868
Other hardwoods	29,460	40	1,178,400	36,859	40	1,474,360
Total	8,352,190		764,657,710	11,242,760		1,143,037,906
All Sawtimber	10,309,290		853,146,090	15,082,182		1,328,080,706
Pulpwood (cords)[5]	47,807,089	$5/cord	239,035,445	53,127,962	$5/cord	265,639,810
		Total value =	1,092,181,535		Total value =	1,593,720,516

Value per commercial forest land acre:
$1,092,181,535/6,994,000 acre = $156.16/acre

Value per commercial forest land acre:
$1,593,720,516/6,694,900 acres =
$238.05/acre

[1] Pfeifer, Ray E.; Spencer, John S., Jr. No date. The growing timber resources of Michigan: Northern Lower Peninsula. Lansing, MI: Michigan DNR. 112 p.

[2] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[3] Jakes, Pamela J. 1982. Timber resources of Michigan's Northern Lower Peninsula, 1980. Resour. Bull. NC-62. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 120 p.

[4] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[5] Conversion factors: 1 cubic foot = 5.74 board feet; 1 cord = 79 cubic feet of wood.

Table 2.--Charlevoix County, Michigan, timber inventory

(1984 dollars)

Species	1966 Sawtimber			1980 Sawtimber		
	Volume[1]	Value	Total value[2]	Volume[3]	Value	Total value[4]
	Mbf	$/Mbf	Dollars	Mbf	$/Mbf	Dollars
SOFTWOODS						
White pine	11,010	66	726,660	25,044	66	1,652,904
Red pine	4,160	68	282,880	14,378	68	977,704
Jack pine	850	26	22,100	2,276	26	59,176
White spruce	1,560	20	31,200	14,936	20	298,720
Black spruce	320	20	6,400	1,111	20	22,220
Balsam fir	3,590	30	107,700	3,803	30	114,090
Hemlock	19,680	36	708,480	8,540	36	307,440
Tamarack	490	24	11,760	833	24	19,992
N. white cedar	14,300	36	514,800	30,721	36	1,105,956
Other softwoods	--	20	--	--	20	--
Total	55,960		2,411,980	101,642		4,558,202
HARDWOODS						
Select white oaks	6,390	160	1,022,400	--	160	--
Select red oaks	26,220	205	5,375,100	11,494	205	2,356,270
Other red oaks	6,330	40	253,200	--	40	--
Hickory	2,050	40	82,000	--	40	--
Yellow birch	1,870	75	140,250	11,662	75	874,650
Hard maple	45,510	108	4,915,080	97,973	108	10,581,084
Soft maple	18,090	69	1,248,210	19,884	69	1,371,996
Beech	32,460	64	2,077,440	30,002	64	1,920,128
Ash	10,970	177	1,941,690	28,384	177	5,023,968
Balsam poplar	8,970	66	592,020	9,081	66	599,346
Cottonwood	4,750	38	180,500	--	38	--
Bigtooth aspen	19,970	37	739,890	30,652	37	1,134,124
Quaking aspen	19,940	37	737,780	56,993	37	2,108,741
Basswood	24,660	124	3,057,840	65,258	124	8,091,992
Elm	34,510	62	2,139,620	3,967	62	245,954
Paper birch	7,040	46	323,840	41,504	46	1,909,184
Black cherry	3,810	--	--	--	--	--
Other hardwoods	990	40	39,600	--	40	--
Total	274,530		24,866,460	406,854		36,217,437
All Sawtimber	330,490		27,278,440	508,496		40,775,639
Pulpwood (cords)[5]	1,359,810	$5/cord	6,799,050	1,704,974	$5/cord	8,524,870
		Total value =	34,077,490		Total value =	49,300,509

Value per commercial forest land acre:
$34,077,490/161,700 acre = $210.75/acre

Value per commercial forest land acre:
$49,300,509/138,600 acres = $355.70/acre

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[4] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[5] Conversion factors: 1 cubic foot = 5.74 board feet; 1 cord = 79 cubic feet of wood.

Table 3.--Cheboygan County, Michigan, timber inventory

(1984 dollars)

Species	1966 Sawtimber			1980 Sawtimber		
	Volume[1]	Value	Total value[2]	Volume[3]	Value	Total value[4]
	Mbf	$/Mbf	Dollars	Mbf	$/Mbf	Dollars
SOFTWOODS						
White pine	27,970	66	1,846,020	44,688	66	2,949,408
Red pine	10,470	68	711,960	65,438	68	4,449,784
Jack pine	7,540	26	196,040	20,651	26	536,926
White spruce	5,880	20	117,600	36,888	20	737,760
Black spruce	1,680	20	33,600	2,975	20	59,500
Balsam fir	8,840	30	265,200	17,187	30	515,610
Hemlock	20,200	36	727,200	13,349	36	480,564
Tamarack	1,060	24	25,440	4,069	24	97,656
N. white cedar	25,480	36	917,280	60,703	36	2,185,308
Other softwoods	--	20	--	--	20	--
Total	109,120		4,840,340	265,948		12,012,516
HARDWOODS						
Select white oaks	12,340	160	1,974,400	1,783	160	285,280
Select red oaks	40,340	205	8,269,700	30,142	205	6,179,110
Other red oaks	19,560	40	782,400	1,848	40	73,920
Hickory	880	40	35,200	--	40	--
Yellow birch	3,010	75	225,750	4,337	75	325,275
Hard maple	31,690	108	3,422,520	48,252	108	5,211,216
Soft maple	34,970	69	2,412,930	24,600	69	1,697,400
Beech	19,350	64	1,238,400	21,656	64	1,385,984
Ash	12,590	177	2,228,430	13,395	177	2,370,915
Balsam poplar	20,210	66	1,333,860	22,722	66	1,499,652
Cottonwood	6,660	38	253,080	--	38	--
Bigtooth aspen	31,430	37	1,162,910	61,771	37	2,285,527
Quaking aspen	36,220	37	1,340,140	129,876	37	4,805,412
Basswood	21,060	124	2,611,440	84,727	124	10,506,148
Elm	50,430	62	3,126,660	1,150	62	71,300
Paper birch	14,280	46	656,880	18,981	46	873,126
Black cherry	2,660	--	--	--	--	--
Other hardwoods	1,340	40	53,600	878	40	35,120
Total	359,020		31,128,300	466,118		37,605,385
All Sawtimber	468,140		35,968,640	732,066		49,617,901
Pulpwood (cords)[5]	2,293,835	$5/cord	11,469,175	3,020,620	$5/cord	15,103,100
		Total value =	47,437,815		Total value =	64,721,001

Value per commercial forest land acre:
$47,437,815/337,200 acre = $140.68/acre

Value per commercial forest land acre:
$64,721,001/366,600 acres = $176.54/acre

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[2] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[3] Jakes, Pamela J. 1982. Timber resources of Michigan's Northern Lower Peninsula, 1980. Resour. Bull. NC-62. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 120 p.

[4] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[5] Conversion factors: 1 cubic foot = 5.74 board feet; 1 cord = 79 cubic feet of wood.

Table 4.--Clare County, Michigan, timber inventory

(1984 dollars)

Species	1966 Sawtimber			1980 Sawtimber		
	Volume[1]	Value	Total value[2]	Volume[3]	Value	Total value[4]
	Mbf	$/Mbf	Dollars	Mbf	$/Mbf	Dollars
SOFTWOODS						
White pine	15,191	66	1,002,540	25,564	66	1,687,224
Red pine	6,650	68	452,200	14,619	68	994,092
Jack pine	1,580	26	41,080	27,530	26	715,780
White spruce	2,290	20	45,800	--	20	--
Black spruce	590	20	11,800	--	20	--
Balsam fir	4,340	30	130,200	1,453	30	43,590
Hemlock	15,570	36	560,520	844	36	30,384
Tamarack	730	24	17,520	4,833	24	115,992
N. white cedar	12,730	36	458,280	12,365	36	445,140
Other softwoods	--	20	--	--	20	--
Total	59,670		2,719,940	87,208		4,032,202
HARDWOODS						
Select white oaks	9,420	160	1,507,200	42,295	160	6,767,200
Select red oaks	32,250	205	8,062,500	112,577	205	23,078,285
Other red oaks	12,240	40	489,600	34,620	40	1,384,800
Hickory	1,190	40	47,600	1,224	40	48,960
Yellow birch	2,170	75	162,750	--	75	--
Hard maple	36,840	108	3,978,720	7,863	108	849,204
Soft maple	32,100	69	2,214,900	49,525	69	3,417,225
Beech	23,500	64	1,504,000	5,516	64	353,024
Ash	11,560	177	2,046,120	7,143	177	1,264,311
Balsam poplar	12,660	66	835,560	5,207	66	343,662
Cottonwood	7,600	38	288,800	2,085	38	79,230
Bigtooth aspen	26,720	37	988,640	61,966	37	2,292,742
Quaking aspen	29,940	37	1,107,780	42,130	37	1,558,810
Basswood	24,620	124	3,052,880	2,140	124	265,360
Black cherry	3,050	--	--	3,660	--	--
Elm	44,810	62	2,778,220	--	62	--
Paper birch	8,470	46	389,620	5,440	46	250,240
Other hardwoods	1,250	40	50,000	1,068	40	42,720
Total	320,390		29,504,890	384,459		41,995,773
All Sawtimber	380,060		32,224,830	471,667		46,027,975
Pulpwood (cords)[5]	1,639,848	$5/cord	8,199,240	1,476,151	$5/cord	7,380,755
		Total value =	40,424,070		Total value =	53,408,730

Value per commercial forest land acre:
$40,424,070/229,000 acre = $176.52/acre

Value per commercial forest land acre:
$53,408,730/215,700 acres = $247.61/acre

[1] Pfeifer, Ray E.; Spencer, John S., Jr. No date. The growing timber resources of Michigan: Northern Lower Peninsula. Lansing, MI: Michigan DNR. 112 p.

[2] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[3] Jakes, Pamela J. 1982. Timber resources of Michigan's Northern Lower Peninsula, 1980. Resour. Bull. NC-62. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 120 p.

[4] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[5] Conversion factors: 1 cubic foot = 5.74 board feet; 1 cord = 79 cubic feet of wood.

Table 5.--Crawford County, Michigan, timber inventory

(1984 dollars)

Species	1966 Sawtimber			1980 Sawtimber		
	Volume[1]	Value	Total value[2]	Volume[3]	Value	Total value[4]
	Mbf	$/Mbf	Dollars	Mbf	$/Mbf	Dollars
SOFTWOODS						
White pine	17,350	66	1,145,100	20,658	66	1,363,428
Red pine	7,640	68	519,520	73,930	68	5,027,240
Jack pine	16,270	26	423,020	100,801	26	2,620,826
White spruce	2,150	20	43,000	--	20	--
Black spruce	460	20	9,200	2,536	20	50,720
Balsam fir	3,050	30	91,500	1,298	30	38,940
Hemlock	7,790	36	280,440	5,038	36	151,140
Tamarack	740	24	17,760	1,467	24	35,208
N. white cedar	9,070	36	326,520	2,834	36	102,024
Other softwoods	--	20	--	222	20	4,440
Total	64,520		2,856,060	208,784		9,393,966
HARDWOODS						
Select white oaks	19,720	160	3,155,200	13,968	160	2,234,880
Select red oaks	57,580	205	11,803,900	105,148	205	21,555,340
Other red oaks	36,990	40	1,479,600	12,075	40	483,000
Hickory	400	40	16,000	--	40	--
Yellow birch	1,390	75	104,250	--	75	--
Hard maple	16,490	108	1,780,920	7,858	108	848,664
Soft maple	14,330	69	988,770	4,482	69	309,258
Beech	11,040	64	706,560	6,515	64	416,960
Ash	6,290	177	1,113,330	882	177	156,114
Balsam poplar	8,000	66	528,000	2,061	66	136,026
Cottonwood	3,810	37	144,780	--	38	--
Bigtooth aspen	17,440	37	645,280	22,958	37	849,446
Quaking aspen	18,630	37	689,310	8,361	37	309,357
Basswood	12,230	124	1,516,520	18,236	124	2,261,264
Black cherry	2,080	--	--	--	--	--
Elm	21,010	62	1,302,620	--	62	--
Paper birch	6,920	46	318,320	12,656	46	582,176
Other hardwoods	670	40	26,800	--	40	--
Total	255,020		26,320,160	215,200		30,142,485
All Sawtimber	319,540		29,176,220	423,984		39,536,451
Pulpwood (cords)[5]	1,792,911	$5/cord	8,964,555	1,966,848	$5/cord	9,834,240
		Total value =	38,140,775		Total value =	49,370,691

Value per commercial forest land acre:
$38,140,775/303,600 acre = $125.63/acre

Value per commercial forest land acre:
$49,370,691/272,900 acres = $180.91/acre

[1] Pfeifer, Ray E.; Spencer, John S., Jr. No date. The growing timber resources of Michigan: Northern Lower Peninsula. Lansing, MI: Michigan DNR. 112 p.

[2] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[3] Jakes, Pamela J. 1982. Timber resources of Michigan's Northern Lower Peninsula, 1980. Resour. Bull. NC-62. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 120 p.

[4] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[5] Conversion factors: 1 cubic foot = 5.74 board feet; 1 cord = 79 cubic feet of wood.

Table 6.--Roscommon County, Michigan, timber inventory

(1984 dollars)

Species	1966 Sawtimber			1980 Sawtimber		
	Volume[1]	Value	Total value[2]	Volume[3]	Value	Total value[4]
	Mbf	$/Mbf	Dollars	Mbf	$/Mbf	Dollars
SOFTWOODS						
White pine	20,080	66	1,325,280	54,771	66	3,614,886
Red pine	6,280	68	427,040	92,722	68	6,305,096
Jack pine	8,060	26	209,560	48,423	26	1,258,998
White spruce	4,610	20	92,200	--	20	--
Black spruce	1,100	20	22,000	776	20	15,520
Balsam fir	6,780	30	203,400	5,359	30	160,770
Hemlock	12,230	36	440,280	434	36	15,624
Tamarack	770	24	18,480	1,533	24	36,792
N. white cedar	22,510	36	810,360	51,881	36	1,867,716
Other softwoods	--	20	--	--	20	--
Total	82,420		3,548,600	255,899		13,275,402
HARDWOODS						
Select white oaks	15,030	160	2,404,800	32,579	160	5,212,640
Select red oaks	48,300	205	9,901,500	186,523	205	38,237,215
Other red oaks	26,390	40	1,055,600	1,414	40	56,560
Hickory	510	40	20,400	--	40	--
Yellow birch	1,480	75	111,000	1,009	75	75,675
Hard maple	17,440	108	1,883,520	--	108	--
Soft maple	17,670	69	1,219,230	43,345	69	2,990,805
Beech	10,990	64	703,360	--	64	--
Ash	7,200	177	1,274,400	9,775	177	1,730,175
Balsam poplar	14,450	66	953,700	7,329	66	483,714
Cottonwood	5,130	38	194,940	--	--	--
Bigtooth aspen	21,510	37	795,870	57,657	37	2,133,309
Quaking aspen	24,040	37	889,480	67,189	37	2,485,993
Basswood	11,970	124	1,484,280	8,933	124	1,107,692
Black cherry	1,680	--	--	--	--	--
Elm	25,130	62	1,558,060	--	62	--
Paper birch	10,440	46	480,240	--	46	--
Other hardwoods	1,010	40	40,400	8,674	40	346,960
Total	260,370		24,970,780	424,427		54,860,738
All Sawtimber	342,790		28,519,380	680,326		68,136,140
Pulpwood (cords)[5]	1,825,323	$5/cord	9,126,615	2,375,178	$5/cord	11,875,890
		Total value =	37,645,995		Total value =	80,012,030

Value per commercial forest land acre:
$37,645,995/269,900 acre = $139.48/acre

Value per commercial forest land acre:
$80,012,030/246,700 acres = $324.33/acre

[1] Pfeifer, Ray E.; Spencer, John S., Jr. No date. The growing timber resources of Michigan: Northern Lower Peninsula. Lansing, MI: Michigan DNR. 112 p.

[2] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[3] Jakes, Pamela J. 1982. Timber resources of Michigan's Northern Lower Peninsula, 1980. Resour. Bull. NC-62. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 120 p.

[4] Norris, F. W. 1984. Timber Mart-North: Michigan. Stumpage Price Mart. 4(1): 4 p.

[5] Conversion factors: 1 cubic foot = 5.74 board feet; 1 cord = 79 cubic feet of wood.

Table 7.--Timber value 1966 and 1980

(In 1984 dollars)

Region or County	1966	1980	Percent increase
N. Lower Peninsula	$1,092,181,535	$1,593,720,516	46
Clare	40,424,070	53,408,730	32
Charlevoix	34,077,490	49,300,509	45
Cheboygan	47,437,815	64,721,001	36
Crawford	38,140,775	49,370,691	30
Roscommon	37,645,995	80,012,030	113

Table 8.--Timber value/acre of commercial forest land 1966 and 1980

(In 1984 dollars)

Region or County	1966	1980	Percent increase
N. Lower Peninsula	$156.16	$238.05	52
Clare	176.52	247.61	40
Charlevoix	210.75	355.70	69
Cheboygan	140.68	176.54	25
Crawford	125.63	180.91	44
Roscommon	139.48	321.33	133

Table 9.--Approximate equalized value of land and improvements

(In 1985 dollars)

County	1967		1985		Percent increase
	Total value	Per acre	Total value	Per acre	
Clare	$266,678,501[1/]	$729.83	$277,021,007	$ 743.27	2
Charlevoix	199,507,075	752.57	386,814,575	1,459.13	94
Cheboygan	177,668,700	385.23	301,172,020	653.02	70
Crawford	71,577,911	199.21	186,424,357	518.85	160
Roscommon	155,350,823[2/]	465.96	344,468,298	1,033.20	122
Roscommon--Improvements only	. . . .		154,790,952	464.28	--

1/ 1974 value

2/ 1966 value

Baumgartner, David C.; Marty, Robert J.
1988. Evaluation of resources at risk from wildland fires. Gen. Tech. Rep. NC-124. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 12 p.

Shows how existing information can be used to draw inferences about the distribution of values at risk from wildfire in Michigan, using example counties from the northern Lower Peninsula.

KEY WORDS: Fire damage, Michigan, value at risk.

FINDING OUT AND TELLING

Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it--in short, "finding out and telling." As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager to meet these challenges while protecting the environment is what research at North Central is all about.

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