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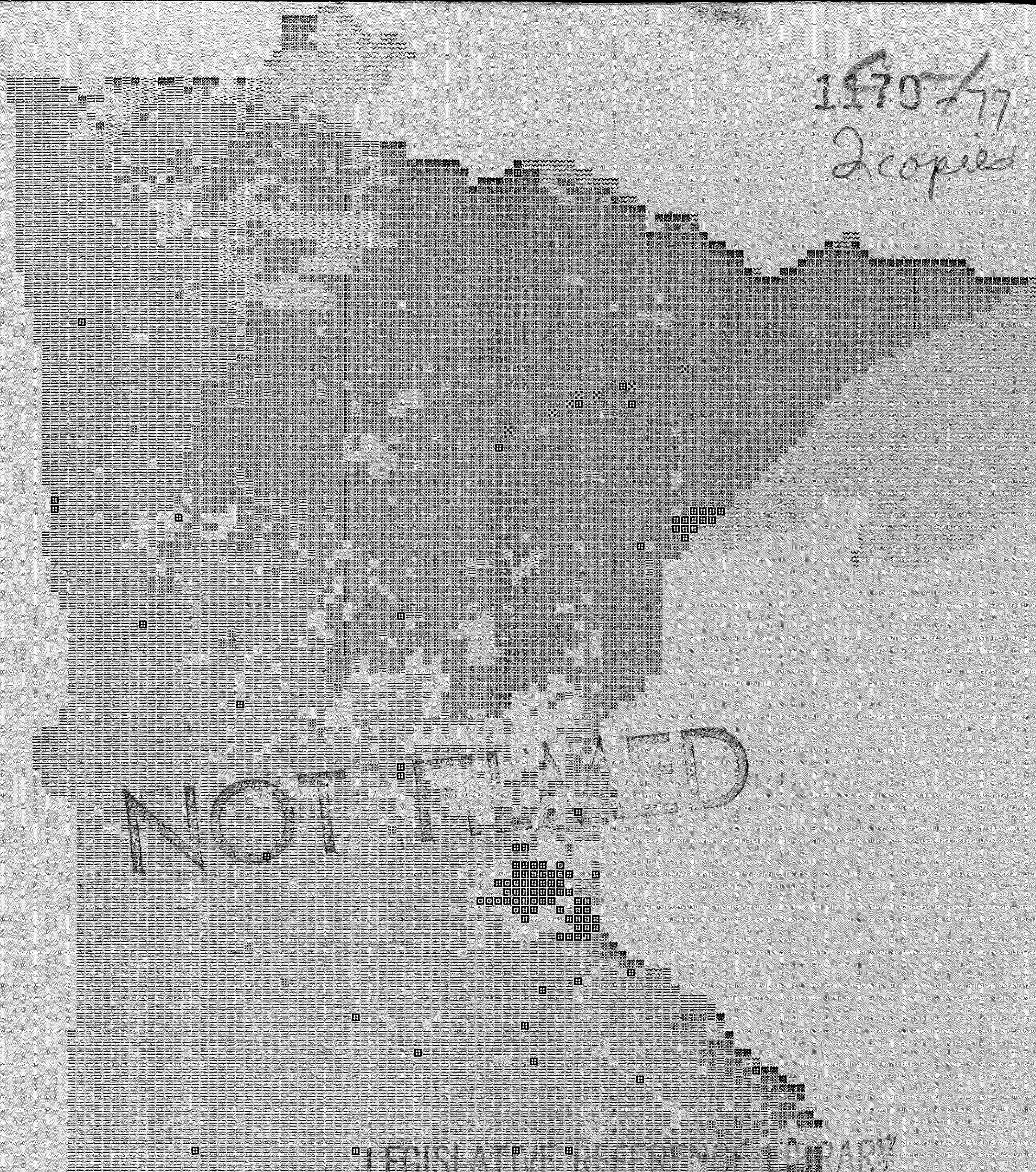

DNR LAND USE CLASSIFICATION PROJECT REPORT

5018

MINN

KIRK DAHL

JULY, 1975

UNIVERSITY OF MINNESOTA
CENTER FOR URBAN AND
REGIONAL AFFAIRS

STATE PLANNING AGENCY

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THE MINNESOTA LAND MANAGEMENT

INFORMATION SYSTEM STUDY

The Minnesota Land Management Information System (MLMIS) project is an endeavor of the Center for Urban and Regional Affairs (CURA) of the University of Minnesota and the State Planning Agency. Important contributions to the project have been made by other executive and legislative branches of state government, numerous University departments, and other institutions.

The primary goal of this project is to improve the quality of public-private sector land use decisions. The project is doing this by building a data bank containing information on physical resources, relative accessibility to market of these resources, and information on current land use, zoning, and ownership patterns.

Concurrent with the data collection effort is a research program that is using the collected data to simulate land use decisions and conflicts.

The present study was funded by Rockefeller Foundation Grant Number RF 72075, as part of the Lake Superior Project, Institute for Environmental Studies, University of Wisconsin.

DNR LAND USE CLASSIFICATION

PROJECT REPORT

To assist the Minnesota Department of Natural Resources (DNR) in meeting its land use classification objectives, the Minnesota Land Management Information System (MLMIS) has, under contract, evaluated the DNR classification scheme for Itasca County. With the help of the MLMIS data bank that contains information on the physical, locational, cultural, ownership, and use characteristics of the land, MLMIS constructed highly objective land use classifications which are largely independent of the DNR scheme. This report summarizes these classifications. No attempt has been made to recommend land disposition or management procedures.

DNR contracted for MLMIS services in "developing new methods and procedures" to help DNR meet land use classification objectives, and to "demonstrate how additional data and information could be incorporated into the decision-making process." Contractual terms specifically called for a comparison of land use with the existing land classification, the development of a new classification from MLMIS data in a systematic and objective manner, an analysis of the similarities and differences between these classifications coupled with a check of the validity of each, and an assessment of the implications of using computer-generated data to simplify classification decisions.

HISTORY

The DNR's stated objective of the original classification was "to classify land by pre-determined criteria of best and highest land use to provide management decision-makers with information necessary to determine retention and management or disposition of public land in a manner to provide maximum benefit to the people." More simply stated, a soundly-based program for land management and disposition was desired, a program which first required a realistic assessment of the best uses for public lands. Following the initial land inventory, "resource management plans can be devised and executed which will benefit all residents and the land itself."

The so-called "Phase One" chore of sorting public lands into major use categories (e.g., urban development, agriculture, recreation and aesthetic, etc.) was delegated primarily to DNR and county foresters, under the justifiable assumption that these persons are perhaps the best qualified to assess the most desirable future uses for lands in their localities. Each forester was called upon to interpret all the physical, locational, and economic factors affecting each parcel of public land under his jurisdiction, and then to assign each parcel to one of the nine major use categories. (A parcel is a quarter-quarter section, nominally 40 acres.)

This classificaton procedure is workable but not ideal. The major problems appear to be: 1) the classification assignments are prone to considerable error, oversight, and bias, both personal and political; and 2) the value judgements and the significance assigned to each of the relevant factors depend upon the individual doing the classifying, and thus, on a statewide basis, the application of the classification criteria tends to be inconsistent, unsubstantiated, and undocumented.

Resulting directly from the above shortcomings, problems have been encountered in some areas in winning an endorsement of the classification from local governing agencies. The DNR and MLMIS have attempted to objectively evaluate the existing classification in one area-Itasca County- and have developed methods whereby lands can be classified on a well-defined, sound, factual basis virtually free of the vagaries of human influence.

The DNR, after acquiring a viable Phase One assessment and classification of lands, will proceed with Phase Two of the overall program, the development of ownership and administration patterns, and then move on to Phase Three, the implementation of balanced long-range resource management plans.

EXAMINATION OF DNR CLASSIFICATION

An early step in the evaluation of the existing DNR classification was the cross-tabulation of this classification data with the extensive MLMIS data for Itasca County. DNR Recommended Land Use, for example, was cross-tabbed with such variables as ownership, existing land use, water orientation, and zoning. The cross-tabs provided indications of: 1) classification criteria requiring additional study, and 2) errors, conflicts, and oversights in the data.

An example of a data conflict appeared in the cross-tab of Ownership vs. Recommended Use. The cross-tab revealed that 34 parcels of land in county parks (nearly three percent of the total county park land) were classified for use in mining operations. Another 22 parcels in county parks were classified for urban development. These conflicts were traced to poor definition of county parks in the MLMIS data bank. A dot-plot map of the mining-in-parks conflict was generated to locate the parcels in question; similar such maps can be produced at moderate cost to flag any other conflicts in DNR/MLMIS data.

Examples of other questionable classifications are: 365 parcels of unproductive forest land (classified by the 1962 United States Forest Survey) recommended for multiple use forestry; 27 parcels with lakeshore orientations recommended for mining operations; 31 parcels with an existing residential street grid classified for mining and another 12 classified for forestry; and two parcels classified for access to other public lands and yet recommended for exchange. Zoning conflicts also exist, such as the thirteen parcels recommended for mining operations in an area zoned residential. Knowing that potentially serious errors exist in the current DNR classification, a good second look at all parcels concerned is necessary before any land is subjected to actions under the Phase Two or Phase Three recommendations. Blind obedience to the existing DNR classification is not advised. (Not all classifications cited above are necessarily erroneous.)

Among the cross-tabs specifically requested by DNR for preparation and analysis was that of Recommended Use vs. Current Land Use. The cross-tab revealed a few apparent coding or data entry errors (e.g., forestry recommended in an existing urban area), but there were no shockers. Figures of interest include: 1) 38 out of 43 parcels recommended for part-time agriculture are now forested; 2) essentially all of the commercial gravel or peat deposits are in forested parcels; 3) 79 parcels classified for multiple-use forestry are fully covered by water; and 4) of the 15,686 parcels of state and county land in Itasca County, only seven (0.04%) were recommended for year-round agricultural occupancy.

Recommended use is not closely tied to current use, nor should the two be expected to be functions of each other. For example, a parcel is typically recommended for urban development on the basis of its location, topography, and soil characteristics; the current use of that land, be it mining, farming, pasture, or forestry, is of lesser significance. A parcel of recreational or aesthetic value should be exempted from urban development, many would say, but such an automatic classification rule fails to adequately recognize the supply-and-demand pressures of all competing land uses.

In a summary characterization of the existing DNR scheme, one must recognize the impact of subjective play in the classification guidelines (as stated on pages 12 and 13 of the Division of Lands and Forestry's Land Use Classification Manual). As expected and indeed desired, the classification is a blend of economic and physical factors, combined with a local viewpoint, experience, and an intuitive assessment of the future.

The DNR classification, in terms of practicality and workability, is certainly a useful tool. But it is a cumbersome and time-consuming process. A computer classification procedure can be a substantial benefit for shortening the task of arriving at a preliminary classification for later refinement by field personnel.

METHODOLOGY FOR COMPUTER CLASSIFICATION

The DNR specifically asked MLMIS to help develop new methods and procedures for classifying land and to "demonstrate how additional data and information could be incorporated into the decision-making process. Starting from a set of initial assumptions identical to those used by the foresters who drew up the original DNR classification, MLMIS has produced two new classifications from the vast quantities of data available in its data bank. Twenty-six clearly defined, quantifiable factors were used to develop each of these new classifications, as discussed below. Every effort was made to incorporate all relevant data into the classifications, and subjective judgements have been eliminated as much as possible. We believe these classifications to be the most objective and comprehensive currently available in the state, although no claim is made that they are necessarily the most valuable or workable.

Some of the overall guidelines followed in developing the DNR and MLMIS classifications are: 1) reflect DNR policy as much as possible; 2) assume a continuing rise in population and a continuation of the trend, although on a lesser scale, of population shifts from rural to urban areas; 3) retirement of low-quality agricultural lands in favor of more intensive farming on better lands; 4) assume a populace with increased income, leisure time, mobility and demand for public recreational facilities; 5) remedies to the problem of deteriorating wildlife habitat must be sought; 6) the demand for forest products continues to increase; 7) surface and subsurface rights to state and county lands in zones of high mineral potential are to be retained by the state; and 8) public lands on meandered lakes, rivers, and "other public water" are to be withheld from sale, in accordance with state law. For purposes of the MLMIS classifications, the additional assumption was made that it is more desirable to be faced with a liberalization of a too conservative classification than to be forced into paring down a overly liberal classification. In other words, a given parcel must appear to be very well suited to a particular use before it is recommended for that use. Also, MLMIS did not consider zoning restrictions, since zoning restrictions are typically assigned by the county and are not necessarily based upon DNR's determination of best use. Zoning is the cart, not the horse.

Two classifications were prepared rather than just one, out of recognition that the determination of best use for a parcel of land is largely dependent upon one's point of view. A realignment of priorities and a shift of values can and does result in different classifications based on the same set of initial facts. The most subjective influence upon a computer-generated classification is the establishment of priorities and values, at the moment a necessarily human function. The two classifications are the Recreation/Aesthetic/Conservation scheme and the Agriculture/Urban /Taxbase scheme. The values and priorities assumed for each of these schemes are obvious from the titles. A given parcel of land with outstanding recreational characteristics which is also prime land for urban development would, under the first scheme, be classified as recreational, whereas under the assumptions of the second scheme it would be recommended for urban development.

Land classification by computer presents three problems of: 1) determinig which factors are relevant and what is the relative importance of each; 2) combining the data and determining which combinations of characteristics qualify a given parcel for a particular land use; and 3) resolving conflicts when parcels of land are suited to more than one use.

Relevant factors to be considered in classifying land for conservation purposes, for example, include soil, vegetative cover, water, drainage, aesthetic value, and relative abundance of other conservation lands in the vicinity. In some cases, the MLMIS data bank was tapped to bring additional factors into consideration, such as septic tank disposal problems, groundwater contamination hazards, and high flooding hazards. In other cases, the MLMIS data was deficient, as revealed, for example, by our inability to accurately pinpoint the location of commercially harvestable peat deposits. Shortcomings and recommendations will be discussed later.

Subjectivity creeps in when one attempts to determine which combinations of characteristics, in which proportions, qualify a given parcel for a particular land use. For purposes of this classification study, opinions were sought from both within and outside the University, and those persons most qualified to make a suitability determination were asked to do so. Note that while the result is currently our best effort at establishing suitability criteria and land use recommendations, MLMIS has not yet completed its analysis of any suitability criteria and does not at this stage advise land use decision-making in the field based solely upon this study.

The final classification problem, that of resolving designated use conflicts, was handled by the computer through a filtering or drop-out process. Each parcel was tested against the criteria which must be met for inclusion in the class of highest priority. Those that passed the test were given that classification; those that failed were tested for possible assignment to the next highest priority class. At each priority level, some parcels were filtered off, until finally a residual class remained that was composed of parcels which did not meet all of the criteria for any one of the other classes.

Parcels in the residual class cannot logically be assigned to the lowest priority land class. For example, if urban development is of highest priority and wildlife lowest, a parcel that just misses being classed for urban development and which filters down into the residual class is very likely one quite unsuited to wildlife production. Less stringent tests might turn up a more definitive use for these residual parcels.

The ranking schemes for both classifications are shown below, together with the MLMIS level numbers used for each class:

Rank	Rec/Aesthet/Conserv		Ag/Urban/Taxbase	
	Level	Class	Level	Class
Highest	4	Mining facilities	4	Mining facilities
	8	Gravel deposits	8	Gravel deposits
	9	Water access	9	Water access
	10	Other access	10	Other access
	5	Recreation	1	Urban development
	7	Game and Fish	2	Agriculture
	6	Multi use forestry	3	Ag, part-time
	1	Urban development	5	Recreation
	2	Agriculture	6	Multi use forestry
Lowest	3	Ag, part-time	7	Game and Fish
Residual	11	Residual	11	Residual

Note that the four highest priority classes for both schemes are identical. This is in keeping with a DNR guideline calling for a clear indication of those lands which have mining, gravel, or access value. A parcel of land which has potential for mining, for example, should be filtered off early in the filtering process even though it may also be well suited to some other competing land use, such as urban development. Flagging the mining, gravel, and access parcels early in the filtering process provides an indication of the maximum number of parcels which may be devoted to these uses, as desired by DNR. In many cases, the recommended uses become deferred uses, with competing land uses taking on short-term primary importance or perhaps sharing in a multiple-use arrangement.

Ranking of the remaining classes is more or less intuitive. The rankings shown attempt to represent those which might be selected by two different land use factions on opposite ends of the conservation vs. taxbase continuum, the rankings being determined and approved jointly by the DNR and MLMIS. It is a relatively simple matter to juggle the rankings so as to maximize the number of parcels recommended for any particular use.

As mentioned earlier, it is a ticklish problem to determine the characteristics which give land value for a particular use. In a few cases, a weighting or merit factor for each of several relevant characteristics was assigned such that a logical formula could be used to help draw the line between "recommended" and "not recommended" for a given use. Below is a list of the general characteristics possessed by each parcel in the land use categories indicated:

Level	Class	Characteristics
1	Urban	Located within selected MCD's (villages and sizeable towns) and few, if any, building limitations (septic tank problems, flood hazards, etc.)
2	Agricultural	Good road density, located near other cultivated or open lands, high value of products sold, short distance to other places.
3	Ag, part-time	Same as above, but less stringent.
4	Mining	Mineral lease or mineral potential, as indicated by parcel having been classified for mining by DNR.
5	Recreation	Located within existing state park, or has high amenity value due to its vegetative cover, topography, and water orientation.
6	Mult. use forest	Highly productive soil type, good road density, good accessibility to saw or pulp mills, not currently cultivated.
7	Game and Fish	Potholes, game preserves, and other lands chosen for use as wildlife areas in original DNR classification.
8	Gravel	Gravel pits and commercial deposits recognized in original DNR classification.
9	Water access	Located on an island, or a parcel with road access which also touches a lake or permanent river or stream.
10	Other access	All parcels recognized as having access value and classified as such by DNR, less those in level 9.
11	Residual	All other parcels.

The data used to assign parcels to these classes is adequate but not complete. Like the gambler and his money, more is never enough. More information is needed in the MLMIS data bank with regard to water table, commercial peat deposits, game and fish production and harvest potentials, mineral resources, and demands for various land uses. Techniques for manipulating and mapping data on "clustered" parcels would also have been handy. With additional data, more specific land uses could be recommended. To provide the maximum amount of fine-tuning of a more detailed classification, MLMIS data variables should have as many different gradations or levels as are justified by the accuracy of the data.

Maps for second-highest recommended land use were not run but could be prepared using the methods outlined in this paper. DNR second-highest use data is not stored in the MLMIS data bank.

The classification criteria used in preparing the recommended use maps for Itasca County are not necessarily applicable elsewhere. For example, because the land in Itasca County is generally only of marginal suitability for agricultural purposes, the standards by which parcels were recommended for agriculture are not high. In the southern part of Minnesota, however, where good agricultural land is abundant, parcels meeting only the minimal standards established for farm lands in Itasca County should most certainly first be considered for alternative uses.

At least two additional recommended use categories would have been added to each of the MLMIS classifications had sufficient data been available. One, commercial peat deposits, was rejected after an investigation revealed that even commercial producers themselves are unable to assess their future demand for peat lands. It is likely that only a small portion of Minnesota's three million acres of peat will ever be harvested, and enough peat lands are now privately owned or leased to handle the demand for the foreseeable future. Also, there are apparently no peat deposits of current commercial significance in Itasca County.

The second classification desired, but not created, was that of lands recommended for wild rice production. A paucity of data was the reason. The primary requirements for wild rice production are vast quantities of water, poorly-drained soils, and low relief. Data on the availability of surface water is not available for most streams, nor is there a systematic assessment of committed water and water appropriations. Groundwater availability is also only roughly known, and local variation is too severe to state meaningful water withdrawal rates. Furthermore, the economics of wild rice production are poorly known. The allocation of hundreds of acres of state land for this type of agriculture is not necessarily justifiable. Despite all these drawbacks, an attempt was made to locate possible sites for wild rice production based solely upon soil type and geomorphic region (relief). Better than 20% of all parcels in Itasca County met the soil and relief requirements, far too large a number to be useful in intelligent land management planning.

RESULTS AND CONCLUSIONS

Despite all the limitations, a good deal of information is available from the two final MLMIS Land Use Classification Maps. (These maps, along with a map of the original DNR Land Use Classification are found in the Appendix to this report.) A comparison of the two maps reveals that they are nearly identical. Six of the ten defined land use categories differed in rank by three or more positions from one classification scheme to the other, and yet the final maps show that 97.5% of all DNR-administered parcels maintain the same classification in both schemes. One might conclude that, assuming suitable classification criteria have been used, nearly every parcel under consideration in Itasca County is rather well suited to a particular land use. A juggling of priorities cannot alter the material facts.

The maps clearly show where parcels recommended for a particular land use are clustered. Large clusters of land recommended, say, for multiple use forestry are highly amenable to inclusion in "management units," whereas an isolated parcel similarly classified might be difficult to manage effectively and possibly should be considered for an alternative use, exchange, or sale.

The parcel totals for each level of each classification scheme are listed below:

Level	Description	MLMIS Ag/Urban/Taxbase	MLMIS Rec/Aesthet/Cons	DNR
1	Urban	40	4	40
2	Agriculture	79	7	7
3	Ag, part-time	3	3	43
4	Mining	165	165	165
5	Recreation	462	464	818
6	Forestry	6362	6272	13478
7	Game and Fish	656	852	992
8	Gravel	29	29	29
9	Access	466	466	134
10	Land access	102	102	-
11	Residual	7342	7342	-
12	Fed or private	31347	31347	31347

An examination of the above reveals that the DNR scheme looks upon recreational and conservation land uses even more favorably than does the

MLMIS scheme which supposedly maximizes such classifications. The urban and agriculture classification totals are not markedly different and are, unexpectedly, identical in some cases. Also, combining levels 9 and 10, more than four times as much land was set aside for access purposes in the MLMIS schemes as was similarly classified by the DNR.

Interestingly, more land was actually recommended for forestry under the Ag/Urban/Taxbase scheme than under the Rec/Aesthetic/Conservation scheme. This is due to the relative rankings of wildlife and forestry. While the Taxbase scheme allocated 90 more parcels to forestry than did the Conservation scheme, the Conservation scheme set aside 196 more parcels for wildlife, than did the Taxbase scheme, giving the combined classifications of forestry and wildlife a 106-parcel advantage in the Conservation scheme. The reason for ranking forestry ahead of wildlife in the filtering process for the Taxbase scheme is that the person interested in healthier tax ledgers is likely to favor forestry over wildlife uses, while a conservation-minded person might have opposing views.

If all the parcels in the MLMIS residual class are included in the multiple-use forestry category (not an unlikely final use for these lands), the forestry class totals are comparable. And if the access lands are not differentiated from the recreational lands, as indeed it is difficult to do in an entirely logical fashion, the totals in the combined categories are again comparable. While individual parcels may assume different recommended uses in each of the different classification schemes, the amount of land allocated to each use stays quite constant.

The crosstabs are remarkably similar, too. Crosstabs pitting one classification scheme against another show the amount of land which changes classification from one scheme to the other. For the two MLMIS schemes, all parcels in levels 3, 4, and 8-12 were classified identically in both schemes. A crosstab of the remaining levels is shown below.

AG/URBAN/TAXBASE

REC/AESTHET/CONSERV Level	1 - Urban	2 - Agr	5 - Recr	6 - Forest	7 - Wildlife	Totals
1 - Urban	4	0	0	0	0	4
2 - Agr	0	7	0	0	0	7
5 - Recr	0	2	462	0	0	464
6 - Forest	36	62	0	6174	0	6272
7 - Wildlife	0	8	0	188	656	852
Totals	40	79	462	6362	656	

Crosstabs of the DNR classification vs. each of the MLMIS schemes are shown on the following page. Note that 19 parcels originally classified by the DNR for forestry were recommended for urban development in the Ag/Urban/Taxbase scheme, while on the other hand, 21 parcels classified for urban development by the DNR were recommended for forestry in the Rec/Aesthetic/Conservation scheme. Also note the significant amount of land taken from the DNR's wildlife category and assigned to forestry and agricultural uses under the Ag/Urban/Taxbase scheme.

DNR RECOMMENDED USE

AG/URBAN/TAXBASE

Level	1 - Urban	2 - Agr	3 - Agr, p.t.	4 - Mining	5 - Recr	6 - Forest	7 - Wildlife	8 - Gravel	9 - Access	Totals
1 - Urban	21	0	0	0	0	19	0	0	0	40
2 - Agr	1	1	0	0	2	66	9	0	0	79
3 - Agr, p.t.	0	0	0	0	0	3	0	0	0	3
4 - Mining	0	0	0	165	0	0	0	0	0	165
5 - Recr	0	2	0	0	117	268	75	0	0	462
6 - Forest	2	0	23	0	206	5943	188	0	0	6362
7 - Wildlife	0	0	0	0	0	0	656	0	0	656
8 - Gravel	0	0	0	0	0	0	0	29	0	29
9 - Access	4	2	2	0	123	239	64	0	32	466
10 - Land access	0	0	0	0	0	0	0	0	102	102
11 - Residual	12	2	18	0	370	6940	0	0	0	7342
Totals	40	7	43	165	818	13478	992	29	134	

DNR RECOMMENDED USE

REC/AESTHETIC/CONSERVATION

Level	1 - Urban	2 - Agr	3 - Agr, p.t.	4 - Mining	5 - Recr	6 - Forest	7 - Wildlife	8 - Gravel	9 - Access	Totals
1 - Urban	3	0	0	0	0	1	0	0	0	4
2 - Agr	0	1	0	0	2	4	0	0	0	7
3 - Agr, p.t.	0	0	0	0	0	3	0	0	0	3
4 - Mining	0	0	0	165	0	0	0	0	0	165
5 - Recr	0	2	0	0	117	269	76	0	0	464
6 - Forest	21	0	23	0	206	6022	0	0	0	6272
7 - Wildlife	0	0	0	0	0	0	852	0	0	852
8 - Gravel	0	0	0	0	0	0	0	29	0	29
9 - Access	4	2	2	0	123	239	64	0	32	466
10 - Land access	0	0	0	0	0	0	0	0	102	102
11 - Residual	12	2	18	0	370	6940	0	0	0	7342
Totals	40	7	43	165	818	13478	992	29	134	

In the MLMIS schemes, parcels were assigned to level 9 (water access) on the basis of being in contact with a lake, river, or permanent stream and simultaneously having road access, or else on the basis of being located on an island. The crosstabs show that many of these parcels were assigned to a different and less passive use category by the DNR. The serious user of a computer classification system should consider running the access parcels through the filtering system separately, arriving at a more definitive use for these lands but nevertheless paying attention to their original inclusion in the access class when drawing up final management and disposition plans.

In summary, MLMIS believes it is capable of producing the most rapid, systematic, and objective land classification in the state. A classification generated by computer is also capable of rapid modification and updating so as to keep in step with changing conditions, philosophies, and priorities. The main limitations of the MLMIS system are: 1) data are not available for some factors which should be considered, 2) exact specifications of which criteria make a given parcel suitable for a particular use have not been established, and 3) demand, both present and future, for competing land uses is virtually ignored in this system at present. Also, no guarantee of the viability of the computer classification can be offered, as no field-check work has been performed.

The computer has not been used to help resolve the Phase Two and Phase Three problems of developing ownership and administration patterns and instituting management plans. These issues are intimately associated with land management goals, demands, and available time frame, thus making the existing computer system about as helpful as a straight-jacket in helping to solve them.

The time element should be a more visible factor in land classifications. Whereas certain land may be well suited to long-term forest management, for example, short-term land management programs might better put these lands to a different use. While time frame is not critical to all land management practices in Itasca County, it should be considered for such uses as forestry, wildlife, agriculture, recreation, and urban development.

The ability of MLMIS to map the final classification is not particularly helpful in resolving the Phase One problem. It is however, assumed to be a very valuable tool for the remainder of the classification program.

Looking at individual classifications, the following specific deficiencies should be considered: 1) Lands are chosen for or rejected from inclusion in the recreation class without regard for possible natural springs, swimming beaches, cultural features, waterfalls, etc.; 2) Criteria favorable to wildlife production or harvest are only weakly considered here, and the outlook for more definitive suitability criteria being established is uncertain; 3) The number of parcels recommended for agriculture could be easily increased if current land use is not considered relevant; 4) The residual class is just too big. This last problem is simply a function of the "entrance requirements" for each class being as stiff as feasible, and the remedy is obvious. One should also consider the usefulness of field-checking in resolving special case problems as well as verifying the usefulness of the computer classification process.

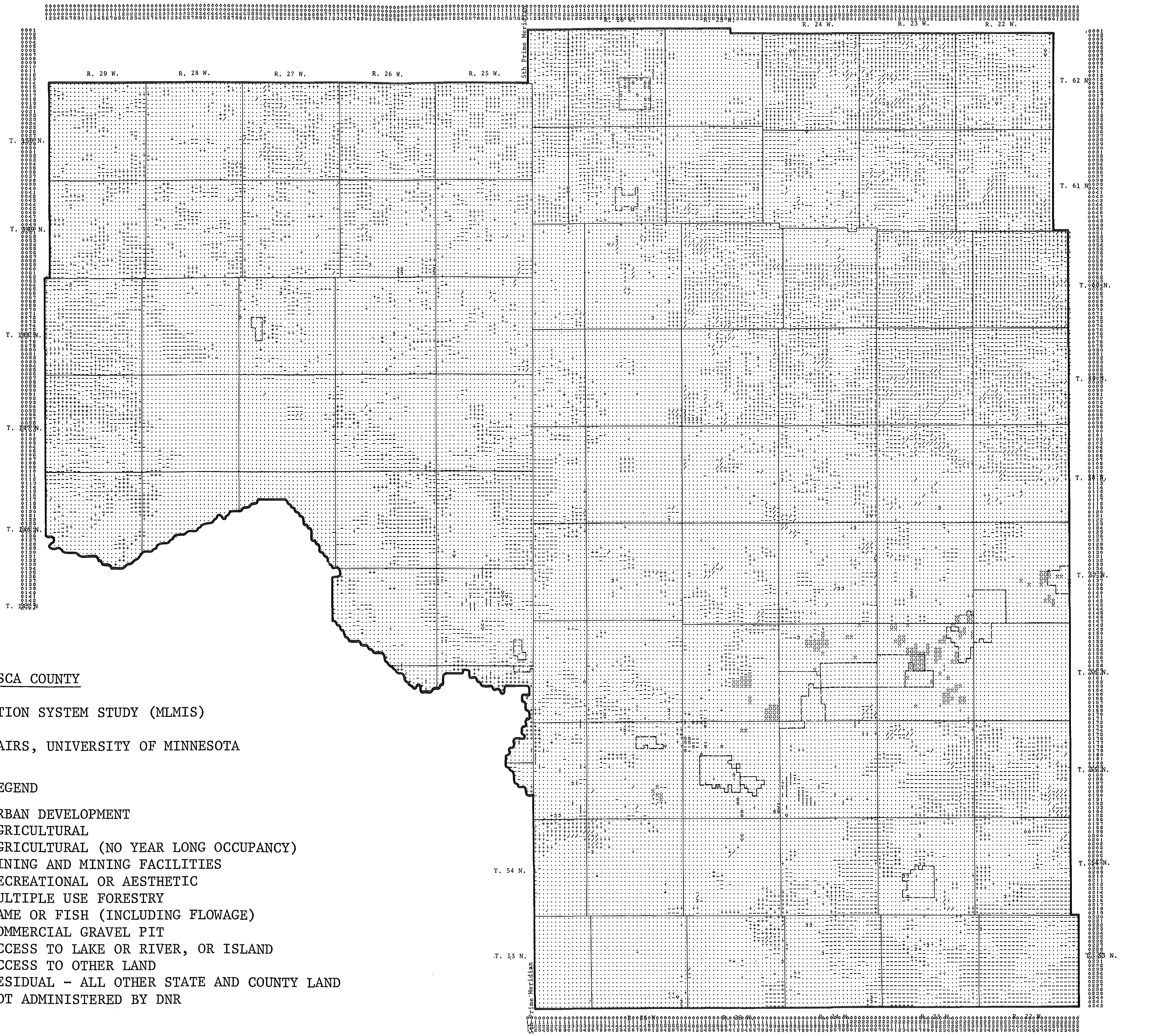
We believe the two computer classifications developed in this study are highly useful tools due to the high objectivity obtained, to the exclusion of marginal lands from any of the use categories, and to the short amount of time needed for completion. Additional classifications based on very different initial assumptions and priorities are also possible. More detailed classifications are currently concoctable, and it should be possible to fashion some rather elaborate classifications in the future as additional data and new computer routines become available.

A P P E N D I X

A. Map, MLMIS Ag/Urban/Taxbase Classification

B. Map, MLMIS Rec/Aesthetic/Conserv Classification

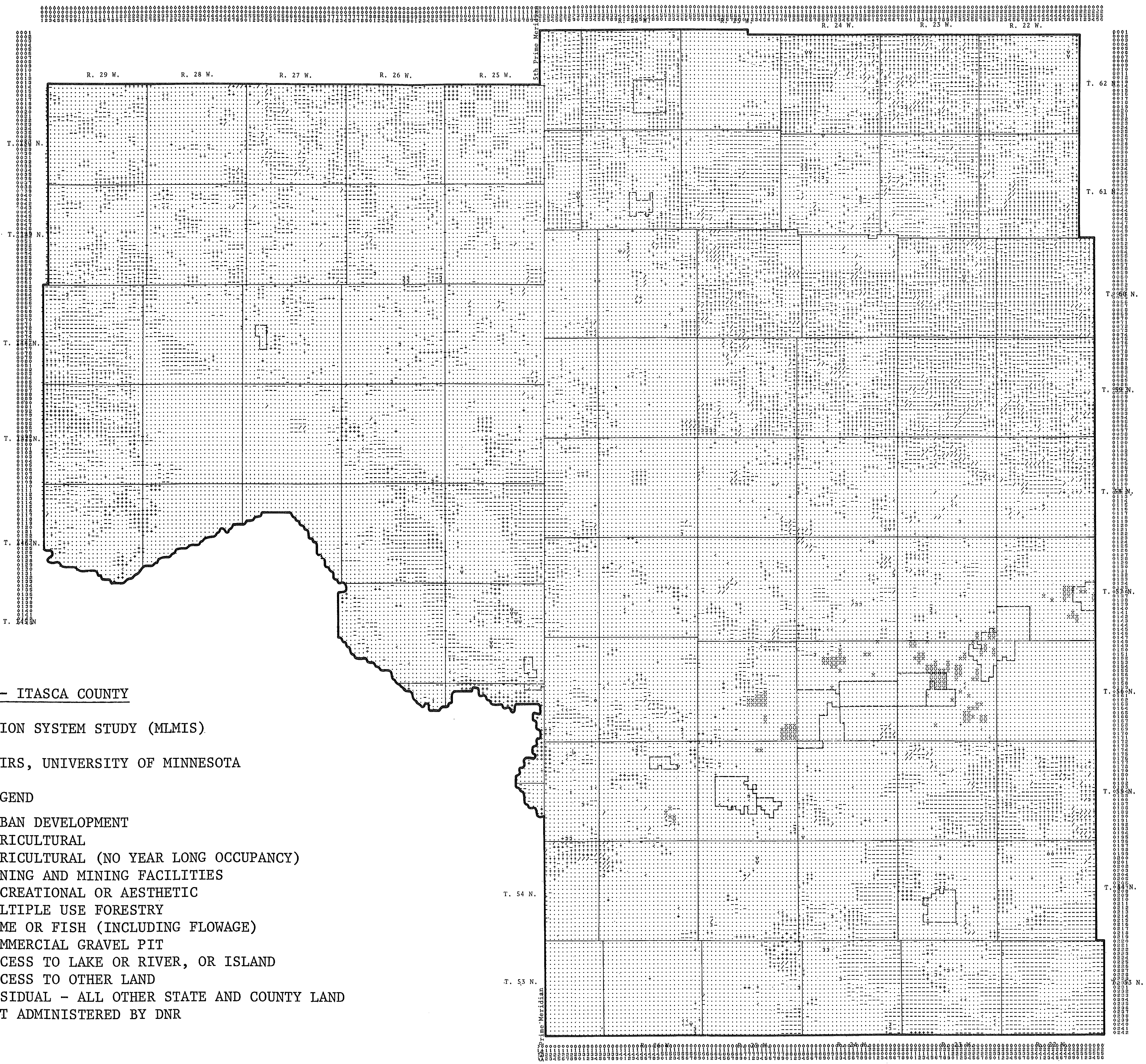
C. Map, Original DNR Land Use Classification



AGRICULTURAL-URBAN-TAX BASE - ITASCA COUNTY

MINNESOTA LAND MANAGEMENT INFORMATION SYSTEM STUDY (MLMIS)
MINNESOTA STATE PLANNING AGENCY
CENTER FOR URBAN AND REGIONAL AFFAIRS, UNIVERSITY OF MINNESOTA

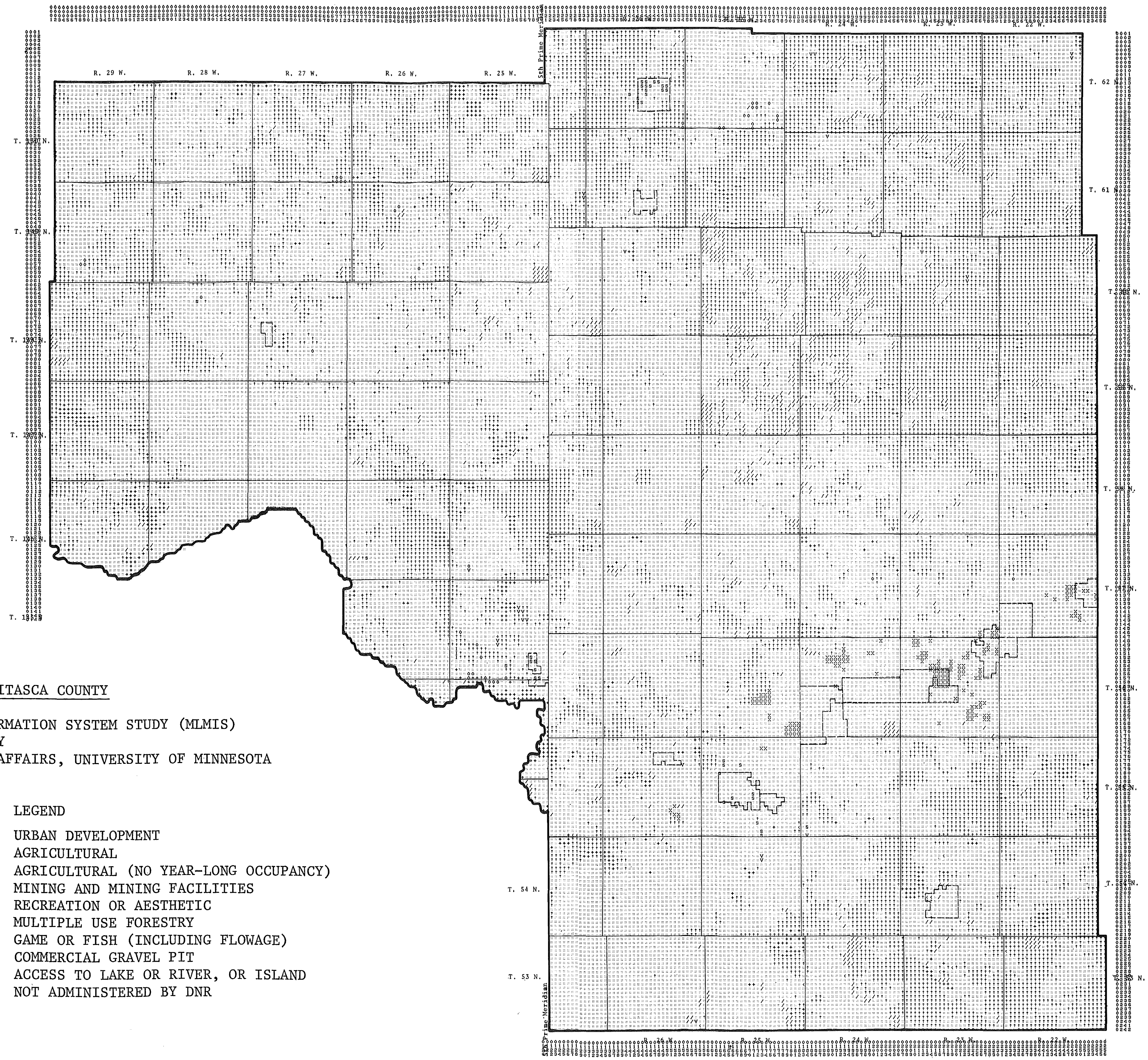
FREQUENCY		LEVEL	SYMBOL	LEGEND
40	0.0%	1	SSS	URBAN DEVELOPMENT
79	0.1%	2	III	AGRICULTURAL
3	0.0%	3	000	AGRICULTURAL (NO YEAR LONG OCCUPANCY)
168	0.3%	4	XXX	MINING AND MINING FACILITIES
466	0.9%	5	///	RECREATIONAL OR AESTHETIC
6392	13.5%	6	↑↑↑	MULTIPLE USE FORESTRY
657	1.3%	7	+++	GAME OR FISH (INCLUDING FLOWAGE)
29	0.0%	8	VVV	COMMERCIAL GRAVEL PIT
468	0.9%	9	<<<	ACCESS TO LAKE OR RIVER, OR ISLAND
102	0.2%	10	333	ACCESS TO OTHER LAND
7372	15.6%	11	---	RESIDUAL - ALL OTHER STATE AND COUNTY LAND
31454	66.5%	12	...	NOT ADMINISTERED BY DNR



RECREATION-AESTHETIC-CONSERVATION - ITASCA COUNTY

MINNESOTA LAND MANAGEMENT INFORMATION SYSTEM STUDY (MLMIS)
MINNESOTA STATE PLANNING AGENCY
CENTER FOR URBAN AND REGIONAL AFFAIRS, UNIVERSITY OF MINNESOTA

FREQUENCY		LEVEL	SYMBOL	LEGEND
4	0.0%	1	SSS	URBAN DEVELOPMENT
7	0.0%	2	III	AGRICULTURAL
3	0.0%	3	000	AGRICULTURAL (NO YEAR LONG OCCUPANCY)
168	0.3%	4	XXX	MINING AND MINING FACILITIES
468	0.9%	5	///	RECREATIONAL OR AESTHETIC
6302	13.3%	6	†††	MULTIPLE USE FORESTRY
853	1.8%	7	÷÷÷	GAME OR FISH (INCLUDING FLOWAGE)
29	0.0%	8	VVV	COMMERCIAL GRAVEL PIT
468	0.9%	9	<<<	ACCESS TO LAKE OR RIVER, OR ISLAND
102	0.2%	10	333	ACCESS TO OTHER LAND
7372	15.6%	11	===	RESIDUAL - ALL OTHER STATE AND COUNTY LAND
31454	66.5%	12	...	NOT ADMINISTERED BY DNR



ORIGINAL DNR CLASSIFICATION - ITASCA COUNTY

MINNESOTA LAND MANAGEMENT INFORMATION SYSTEM STUDY (MLMIS)
MINNESOTA STATE PLANNING AGENCY
CENTER FOR URBAN AND REGIONAL AFFAIRS, UNIVERSITY OF MINNESOTA

FREQUENCY		LEVEL	SYMBOL	LEGEND
40	0.0%	1	$$$	URBAN DEVELOPMENT
7	0.0%	2	III	AGRICULTURAL
43	0.0%	3	000	AGRICULTURAL (NO YEAR-LONG OCCUPANCY)
168	0.3%	4	XXX	MINING AND MINING FACILITIES
823	1.7%	5	///	RECREATION OR AESTHETIC
13538	28.6%	6	↑↑↑	MULTIPLE USE FORESTRY
994	2.1%	7	+++	GAME OR FISH (INCLUDING FLOWAGE)
29	0.0%	8	VVV	COMMERCIAL GRAVEL PIT
134	0.2%	9	<<<	ACCESS TO LAKE OR RIVER, OR ISLAND
31454	66.5%	12	:::	NOT ADMINISTERED BY DNR