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Iowa's Forest Area in 1832: A Reevaluation[1]

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Concern for the reliability of the acreage data of Iowa's forest cover at the time of settlement prompted an investigation of authorship of the map of original forest cover, the county tabulation of forest area, and the technique used in area determination.

Remeasurement of the 1832-1859 General Land Office township maps from eight test counties confirms that transecting of the township lines was the technique used in 1935 by State Forester G. B. MacDonald. The results found in remeasurement differed from 1 percent to 50 percent for individual counties but tended to agree well enough in aggregate to make the earlier data acceptable.

However, rereading of the original survey notes suggests that an unknown but possibly sizable amount of land indentified as forest in 1832 to 1859 would not be considered forest in 1987.

INDEX DESCRIPTORS: Forest cover, original forest, forest inventory, Iowa's forests, General Land Office Survey.

The Original Forest Area of Iowa

The actual area of forest in Iowa at the time of settlement cannot readily be known. Concern for the reliability of the commonly accepted figure of 6,680,926 acres (2,703,734 hectares) is the subject of this paper.

The use of acres rather than hectares (1 hectare = 2.471 acres) in this paper stems from the fact that the unit of linear measurement in the original and subsequent land surveys of Iowa was the *Gunter chain*. The *chain*, as a unit of length, is 66 feet or 4 rods. Area computations utilized decimal conversions such that 10 square chains equalled 1 acre of 43,560 square feet. Section lines, 80 chains apart, provided for the subdivision and description of land before disposal of the public domain. Metric conversions as a computational artifice fail to portray the logic of the land surveys that preceded settlement.

Much has been made of the loss of woodlands in Iowa during the approximately 150 years that have elapsed since settlement. Observers who have attempted to trace the decline of the forests of Iowa since the 1830's have had to rely on best guesses as to the extent of the forest area before land clearning began. Pammel (1896) estimated that Iowa had perhaps "five to six million acres" of forest at the time of settlement. Aikman and Hayden (1938) suggested that 12 percent of the state was forested. Baker (1908) quoted estimates varying from one-seventeenth to one-fifth, but it wasn't until December 1935 that there were any data based on quantitative analysis of the original forest acreage. It was at this time that a map of Iowa's original forest cover (Figure 1) was published as part of Project 1033, the Iowa Forest and Wasteland Survey (Iowa State Planning Board, 1935a).

Although it has been assumed that State Forester G. B. MacDonald was the creator of Figure 1, it may be that this was only a modification of Shimek's map (Figure 2), which first appeared in 1899 (Shimek, 1899; Shimek, 1911). There are differences in the maps, but documentation of procedures involved in creating either of the maps is missing.

Although the development of the map of Iowa's original forest cover is imperfectly documented, the 1935 county-by-county data have been generally unquestioned, despite the fact that these did not appear in published form until considerably later (Davidson, 1961; Thomson and Hertel, 1981).

An undated typed report by State Forester Gilmour B. MacDonald, probably written in 1935 or 1936 but not acquired by the Iowa State University Library until 1942, is the first documented statement that describes the procedure by which the county data for forest cover were acquired:

> "...an effort has been made to secure as accurate information as possible relating to the original timbered areas of the state. In order to accomplish this, those in charge of this project have gone to the original survey records dating back to the period of 1831...and from these original surveys have prepared an accurate map showing the timbered areas of the state. This information is believed to be the most authentic data which is available and should indicate rather definitely the areas which made up the forests of Iowa at an early period.
>
> "It is quite probable that even as early as the period 1831-1852, some of the natural stands had already been cut, but the acreage as represented on the accompanying original timber survey map and in the tabulation below by counties should serve as a reasonably accurate index of the original timbered areas of the state." (MacDonald, undated)

There is little doubt that G. B. MacDonald was the instigator of the project that has given us the only worthwhile data about the extent of early forest acreage. However, the lack of any recorded statement of procedures or the identity of the one who actually directed the work raises questions concerning the reliability of these much-used data. Aikman and Hayden (1938) suggest that the General Land Office (GLO) surveyors themselves prepared a map of the entire state showing the original forest cover but there has been found no verification of such an unprecedented activity. The only other official reference to the procedures involved lies in a statement in the December 1935 (typed copy only) Supplementary Report by the Iowa State Planning Board and submitted to the National Resources committee by P. H. Elwood, Consultant: "Research based on land surveys between 1832 and 1859 culminated in the completion of an original forest cover map of the state. (See appendix)." The appendix is missing.

The difficulties of hypothesizing the extent of Iowa's early forest cover are severalfold. Obviously, no one was on hand to make a statistical survey, and even the early census reports suffered from such vague or biased interpretations of what forest was that the recorded estimates of forest are essentially useless.

Better information comes from the notes of the surveyors of the General Land Office. In the 1831 and 1834 General Instructions (Dodds, 1943 pp 28, 33, 40, 41), the deputy surveyors were charged with "distinctly exhibiting" the outlines of prairies and swamps as these were crossed on surveyed section lines. The kinds and quality of timber and undergrowth named in order in which they predominated were to be listed in the survey notes. Land description was called for, by this statement: "at the end of every half mile, . . . , you will give a particular description of the face of the country . . .". Section lines, however, were a mile apart, and the delineation of the line separating forest from prairie was by no means clear-cut nor, in fact, was the

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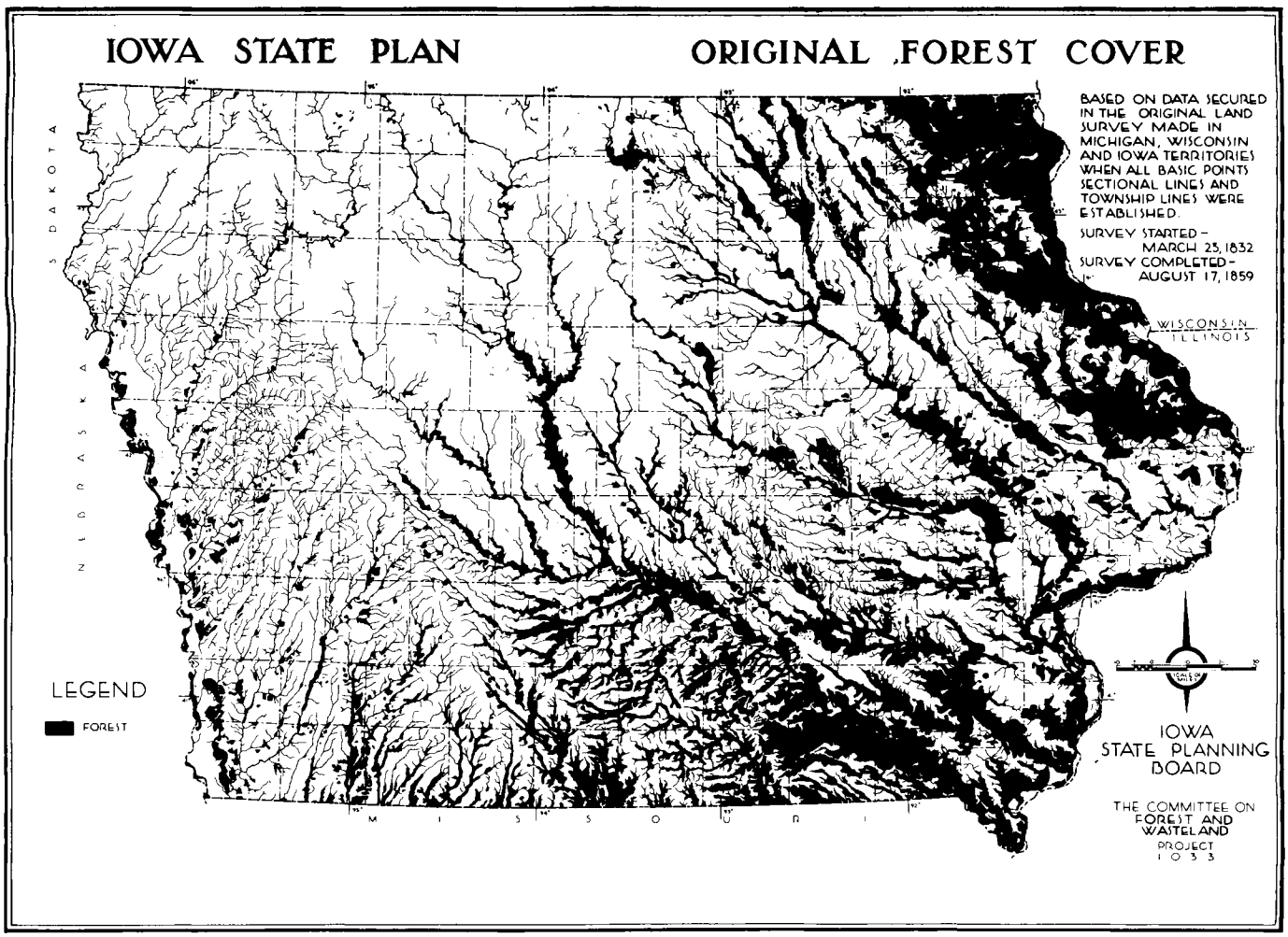

Fig. 1. Map of Iowa's original forest cover as constructed in 1935 for the Iowa Forest and Wasteland Survey.

definition of "forest" standardized. To complicate matters further, the surveyors did not begin the task of surveying until 1836, by which time there were already 10,564 non-native persons living in Iowa country. This number had increased to 23,242 two years later when land sales began (Lokken, 1942). Although land clearing and farming were theoretically prohibited until after the land was surveyed, there probably was an appreciable acreage of forest cleared prior to survey.

Procedures for Determining Forest Area

Assuming that the GLO surveyors' notes are the best authority for determining forest area at the time of settlement, several procedures can be used to make such measurements. 1) Because section corners had to be tied to nearby reference points, some ecologists have treated the quarter-section and section-corner bearing trees as sample points and have reconstructed the original plant cover from the relative prevalence of the different species used as bearing or witness trees. This can be done because the description of and distance to nearest trees are recorded in the survey notes. A difficulty arises, however, in that only trees of certain species, size classes, and vigor conditions could be selected as bearing trees. 2) The surveyors' notebooks recorded the distance along the section line from the starting section corner where entry into and exit from woodlands took place. Thus, it has been possible to transpose these forest boundaries onto a map and, from this, interpret the acreage. 3) A variation of method 2 arises from the utilization of the original plat map drawn by the surveyor (Figure 3) so that, either by planimetering or transecting the woodland stand, the area of forest in each township can be determined.

Which method was used in the Forest and Wasteland Survey is unknown and will remain so unless more detailed references are found. However, it is likely that the third procedure was the one used because of the availability of the plat maps and the familiarity of the procedure to mensurationists of that time.

Establishing Validity of Forest Area Data

Olson (1934) described, albeit sketchily, the use of 16 forestry students enrolled at Iowa State College to help in the Forest and Wasteland Survey. G. B. MacDonald, who was Department Head as well as State Forester, acquired funding under the Civil Works Administration to investigate the forested or eroded areas that might be incorporated into Purchase Units ultimately to be acquired by the U.S. Forest Service. On the chance that at least some of these men might have worked with the GLO forest cover maps, I wrote to all forestry graduates from the period of 1932 to 1938. Although several had very clear recollections of township and county inventories based on 1935 conditions, none apparently worked with the original survey data.

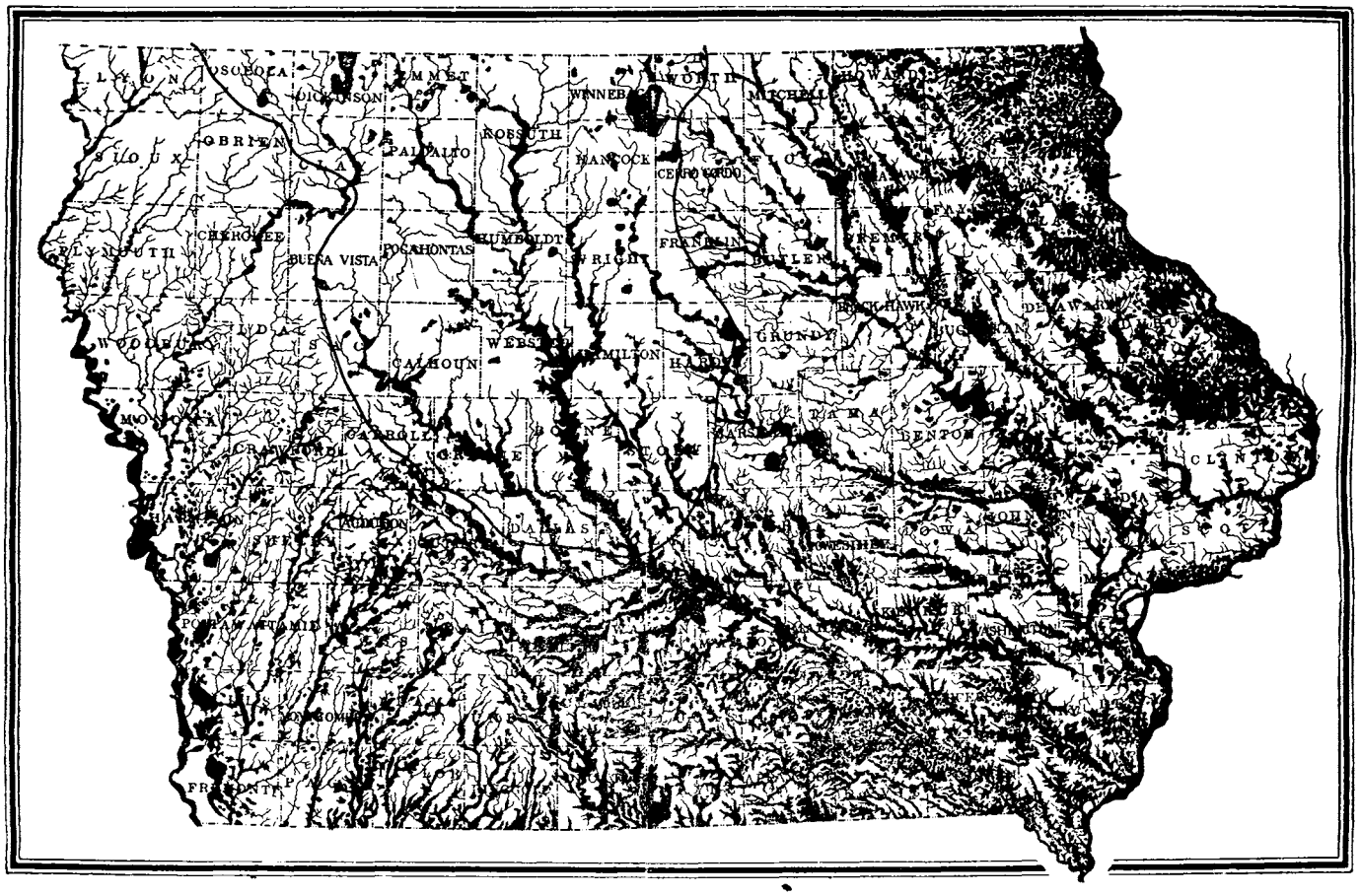

PLATE XIV—Map of Iowa, Showing Original Forest Area and the border of the lobe of the Wisconsin Drift.

Fig. 2. Map of Iowa's original forest cover as visualized by Shimek in 1899.

Therefore, having no other way of verifying the accuracy or even the methodology leading to the data and map of "Original Forest Cover," I acquired the township plat maps as enlargements from microfilm from the State Historical Archives. With eight counties as a sample, the forest area was measured and recalculated to determine the degree of correspondence with G. B. MacDonald's county data.

For calculating forest acreage I utilized the line-intercept method and measured on each township plat map the total length of the seven surveyed north-south section lines and then, on these same lines, the length of line that fell within the forest boundaries drawn by the original surveyor. The percentage of the total length of the seven lines that were covered by forest was then multiplied times the area of the township as recorded by the GLO surveyor on the plat map.

To verify the reliability of the 7-line transect procedure, 12 townships in Jones County were remeasured by using a 13-line transect pattern as well as planimetering the area of forest inside the boundaries. By planimetering, after establishing the scale of the plat map, the forest of these 12 townships covered 35.2 percent of the land area as opposed to 35.7 percent by using 13 transect lines. These results seem adequately matched by the 7-line transect method, which gave a result of 36.0 percent. Further refinement than the 7-line transect seems unnecessary given the twofold difficulty in making a decision as to which side of a drawn boundary line was forest rather than prairie and the equal uncertainty that the forest so enclosed was actually forest as we would now define it.

The acreages obtained by the line-transect methods for the eight counties and the acreages given by MacDonald are listed in Table 1. It is interesting to notice in Table 1 that the acreage of townships, as recorded from the original survey notes and summed to provide county areas, differs from current Bureau of Census figures. Although there are discrepancies between the two sets of data for individual counties, the portion of the eight test counties that was considered forest in the 1935 Forest and Wasteland Survey was 41.9 percent. My remeasurement resulted in 40.7 percent. There seems to be adequate agreement between the two data sets.

Sources of Error in Determining Forest Area from GLO Notes

Although it is unlikely that the 1935 procedures could have been improved appreciably, there is abundant reason to suspect that the original GLO survey notes can provide only an imperfect (albeit best available) data source. Some of the errors arise from the plat maps themselves and the difficulty the surveyors encountered in transposing field observation to maps. For example:

- Transect lines a mile apart provided a frail framework for the mapper as he attempted to establish stand boundaries.
- The demarcation of the exact boundary separating woodland from prairie or marsh was difficult for the surveyor, and for any mapper, because of the gradual shift of one vegetation type into another.
- Field notes are often incomplete and flawed with errors that would either go undetected or would be ignored because the vastness of the surveying project and the low budget allocated to the contract surveyors prohibited correction.

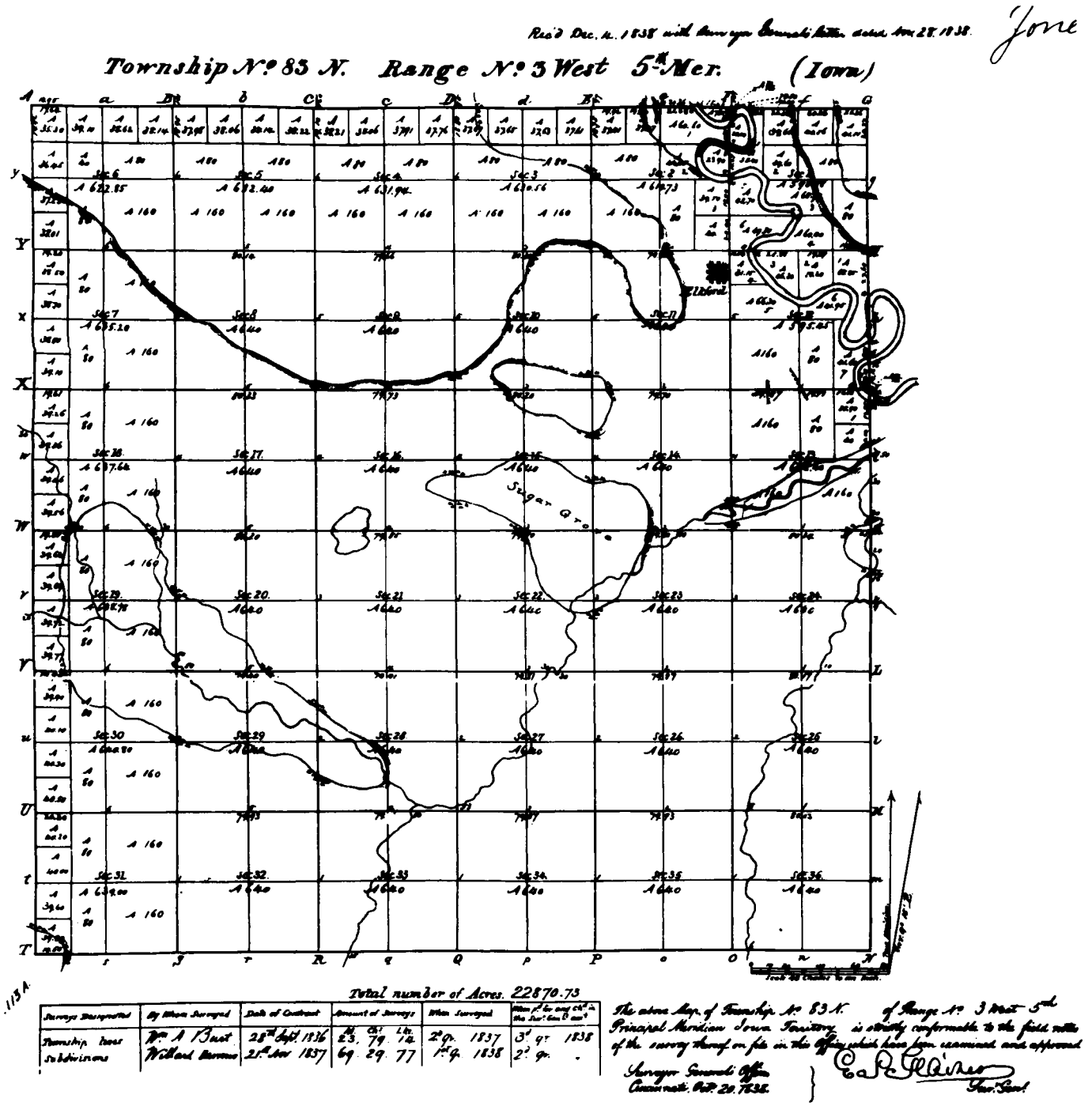

Fig. 3. A township plat map as drawn from original field notes by General Land Office surveyors in 1838.

– Lacking any specific definition of "forest" or a directive to draw in boundary lines for forest, almost everything that was not prairie or swamp was called forest if there was woody, perennial vegetation of any sort present.

On November 8, 1837, Deputy Surveyor Hervey Parks described T9ON; R2W in Dubuque County as follows:

"This is a rich rolling Township of land, a small proportion of which is prairie, but principally verry (sic) lightly timbered with small bur oaks with the exception of the N.W. corner which is tolerably well timbered with W. B. and Bur oak, sugar, ash, elm, lynn, ironwood &c and extremely hilly particularly about the corners of section 5. 6. 7. 8. In conclusion there is a great want of timber nearly throughout the Township for Agricultural purposes".

This is a township that measured out to be 88.6 percent forested.

Notes from numerous interior section lines in Jones County suggest that the interiors of the 1832-1859 forests were unimpressive. The following excerpts from section line notes provide descriptions:

T83N, R2W
— E between S1-S2
23.00 ch Leave barrens and enter prairie
— N between S22 and S23
38.00 ch Barrens E and W (Barrens was the name applied to scattered trees)
40.00 ch Set ¼ sec post
Bur oak 4" (These are bearing trees and, although small in diameter, are the best available)
Bur oak 3"
— E between S-2 and S-11
39.96 ch Set ¼ sec post
B. oak 3"
B. oak 6"
Timber B. oak Barrens
T85N; R2W
— 80.00 ch Set post at corner 10.11.14.15
Roling 2nd rt — Soil Timber
W. Red. Br. Oak. Aspin undergrowth
W. Thorn, shumek, hasle

There were also instances where the line notes disagreed with the completed plat map. The notes for T85N; R2W show only "first rate prairie" for the line between Sections 32 and 33 despite the presence on the map of a distinct forest/prairie boundary.

Detailed reading of the survey notes casts considerable doubt upon both the definition of the forest then existing and the exact positioning of the forest boundary lines.

It is apparent that the forests at the time of settlement were often as Dr. Macbride described them (1895, 1897):

> ". . . the trees were for the most part scattered. As far as trees were concerned, one could drive or ride anywhere through the primeval woods of Iowa, except, perhaps, immediately along the borders of streams. The greater number of trees were old; they were low, often scrubby, storm-tossed, often scarred by fire, of little value. In fact, it is believed by some that prior to 1850 the forest in Iowa, such as it was, was actually retreating, dying out, before the stress of fire and storm."

It seems likely in retrospect that there was less forest acreage in Iowa at the time of settlement than the 19 or 20 percent commonly quoted. Baker (1908) commented:

> ". . . a careful compilation of available records and observations in the field indicates that a little more than ⅞ of the surface was prairie leaving less than ⅛ for the forest area, which, however, included the thickets bordering streams, and the scrub oak thickets in various parts of the state, which should scarcely be dignified by being called forests".

CONCLUSION

Although lacking absolute proof, I believe the evidence indicates that the map of the "Original Forest Cover" of Iowa at the time of settlement was the work of State Forester G. B. MacDonald as part of the Forest and Wasteland Survey in 1935. The map does agree closely with the one presented by Shimek in 1899. The technique used for obtaining the acreage figures probably was one of transecting along section lines on the township plat maps drawn by the General Land Office surveyors during the period from 1832 to 1859.

Although it is likely that the technique of transecting the GLO plat maps yielded the best information now available concerning the original forest acreage, and that it captured the condition of forest cover as the surveyors saw it, there is reason to doubt that the forest boundaries drawn at the time of survey would satisfy today's ecologist, forester, farmer, tax assessor, or surveyor. The distinction between forest and prairie and wetland may well have been more vague than we can now imagine and the acreage of forest at the time of settlement less than presently supposed.

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Table 1. Comparison of areas of 1832-1859 forest for eight test counties as calculated by Forest and Wasteland Survey in 1935 and remeasured in 1986.

County	Total Land Area		Original Forest	
	1970 Bureau of Census[a]	Original Survey [b]	Forest and Wasteland	Remeasured 1986[d]
	Acres and (Percent)[c]			
Allamakee	406,800	411,275	376,220 (91.5)	370,866 (90.2)
Clayton	498,800	487,780	366,340 (75.1)	354,431 (72.7)
Dubuque	391,800	386,075	201,825 (52.3)	244,748 (63.4)
Jones	374,400	366,190	136,705 (37.3)	124,330 (34.0)
Boone	366,700	365,427	62,080 (17.0)	57,055 (15.6)
Clarke	274,500	275,475	55,560 (20.2)	41,807 (15.2)
Guthrie	381,400	382,933	44,032 (11.5)	31,488 (8.2)
Adair	364,200	367,586	32,768 (8.9)	13,575 (3.7)
TOTAL	3,058,600	3,042,741	1,275,530 (41.9)	1,238,300 (40.7)

[a] Land area varies from one census to another; 1970 census was basis for 1974 U.S. Forest Service Survey of Iowa

[b] The sum of township acreages as listed on GLO plat maps of 1832-59

[c] Percentages are based on acreages from original GLO Survey

[d] Areas result from transecting forest cover on seven lines per township with acreages summed for each county