LOWER WISCONSIN RIVER VALLEY SOIL RESOURCES AND USE POTENTIALS

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The Wisconsin River flows for 90 miles (145 km) from the glacial end moraine at Prairie du Sac to the confluence with the Mississippi River at Prairie du Chien. This stretch is called the Lower Wisconsin River Valley of which the floor includes 145, 107 acres in area (227² mi; 587 km²). The valley floor consists of floodplain and a sequence of stepped natural terraces, only 10 percent of which, by area, are rock benches, the rest being of glacial outwash. The geomorphic history of these features has been discussed elsewhere (Hole et al., 1952; Musolf, 1970).

The westward to southwestward trend of this valley runs counter to the major flow of people and freight between Chicago and Twin Cities (Figure 1). “Nature-made highway” was the title assigned to the Fox–Wisconsin waterway by Whitbeck in 1915. The idea of improving the Lower Wisconsin River by local dredging and excavation of supplemental side canals was promoted by W. J. Nicodemus in an article in these Transactions in 1874, when a passage for steamboats to carry grain eastward was seen as a real need. Other more rapid means of transportation developed on land before this “improvement” could be accomplished, as was recognized by F. E. Williams (1921) who attributed “the passing of an historic waterway” to the directional trend mentioned above, to the shallowness that even impeded canoe passage, to frozen conditions in winter and to several other factors. The valley is relatively little trafficked even today and retains much of its natural beauty. It is a major “environmental corridor” (Lewis, 1964) which is attracting an increasing number of tourists from the vicinities of the three nearest urban centers (Figure 1). The floor of the Lower Wisconsin River Valley has five features that qualify it as an environmental corridor: water, wetlands, floodplain, sandy soils and escarpments at the edge of the terraces. The valley floor is bracketed by scenic wooded bluffs and ridges, themselves “corridors”, although peripheral to the specific emphasis of this study.

It is the purpose of this paper to report on the soil resources of the valley floor as a unit, and to suggest how a zoning ordinance might function on the basis of the detailed soil map in such a way as to avoid unwise land use in this unique area. We may look at the valley from the point of view of a hypothetical Lower Wis-
Wisconsin River Valley planning commission as it might begin with a soil inventory to assess the potentialities of this long, narrow strip of land, water and scenery with respect to agriculture, industry, recreation, wildlife, residences and esthetic enjoyment.

The data for the soil inventory have been collected over many years in the portions of six counties which the valley includes (Figure 2). The soil mapping has been done by soil scientists of the Soil Conservation Service and cooperating soil scientists of the University of Wisconsin. Musolf (1970) assembled the maps for the entire valley and measured on them the acreages of the 356 different soil phases that had been listed previously on a county basis (Robinson and Klingelhoeft, 1959; Robinson and Klingelhoeft, 1961; Slota and Garvey, 1961; Klingelhoeft, 1962). He also arranged the soil map information in a way suitable for incorporation into a zoning ordinance similar to that adopted in Buffalo County, Wisconsin (Buffalo County Zoning Committee, 1965).

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METHODS AND PROCEDURES

Field investigations were carried out by the senior author during the summers of 1962, 1965, and 1968. Natural river terraces and rock benches and land use patterns were mapped. The junior author was a participant in the soil mapping program in Richland and Grant Counties (Hole, et al., 1950; Hole, 1956) and in cooperative soil correlations in Iowa and Dane Counties.

Acreages of soil phases in the valley were determined by the "cut and weigh" method by which an analytical balance was used to determine actual weights of portions of the map. Care was taken to establish controlled conditions for these measurements. Calculation of proportionate areas of the map units on the basis of weight was done with the aid of a desk calculator. Acreages were summarized by towns and counties of the valley, and for the entire valley floor as a whole.

Versatility of the Lower Wisconsin River Valley and its Relation to Multiple Land Use Potential

The versatility of the valley is indicated by the variety of its soils which range from riverwash and peat to active sand dunes and level productive loams, all enclosed by steep bluffs, 300 to 500 feet (100 to 170 m) high. Sixty percent of the soils of the natural terraces, or about 56,000 acres (22,670 hectares) developed under
stands of tall prairie, 23 percent under forest and 17 percent under bog and marsh vegetation, as interpreted from soil profile characteristics. The valley walls stand about four and one-half miles (7.2 km) apart near the Cary end moraine at Prairie du Sac and near Lone Rock, and only one-half mile (0.8 km) apart near the confluence of the Wisconsin and Mississippi Rivers (Figure 2). The abundance of groundwater would make possible some industry (within the strict limits of modern environmental quality standards) and irrigated truck cropping, such as is already practiced on sandy and loamy soils. It is possible that sludge from Madison sewage treatment plants might be used to fertilize truck crop fields in the valley in northern Iowa County. The ribbon-like shape of the area, however, precludes development of large-scale commercial canning crop operations, which require roughly equidimensional clusters of numerous 160-acre blocks of level soils irrigable by self-propelled rotating sprinkler systems. The cultivable part of the valley floor is irregularly partitioned and interrupted by sinuous floodplain, railroads and highways, and old dune ridges. The valley offers scenic beauty and opportunities for outdoor recreation, coupled with production of vegetable crops and dairy products on a limited scale. Farmers’ roadside stands are familiar sights during the growing season. The village of Spring Green in Sauk County is a cultural center with a legitimate stage theatre that attracts visitors in the summer. State, county and private facilities for boating, camping, and a variety of forms of recreation are important to the economy of the area. The Lower Wisconsin River Valley contains much of scientific interest with respect to geology, geography, botany, zoology, ecology, archaeology and soil science.

The Soil Resources

On the valley floor are nearly one hundred different types of soil and miscellaneous land units. These are subdivided into the 356 soil phases on the basis of slope, degree of erosion and landscape position. The intricate pattern of these soils lies on major geomorphic units (Figure 2) as follows. Floodplain soils account for 35 percent of the area. These include alluvial land and riverwash (81.5%), peat and muck (11.5%) and marsh (7%). Twenty-six acres of cherty alluvial land are the result of recent flood deposits by tributary streams. Terraces, mostly made of glacial outwash, occupy the remaining 65 percent of the area, including six small rock terraces in the lower half of the valley. Escarpments, usually less than 25 feet in height, commonly mark boundaries between flood plain soils and terrace soils, and between terraces of different levels.

Soils information plotted in Figure 3 shows that the valley floor is predominantly level to gently sloping, only slightly to
moderately eroded, naturally excessively drained (drouthy) to well drained, sandy in texture and fourth class in land use capability. Bimodal features of the soils are 1) presence of both excessively and poorly drained soils, and 2) presence of both sandy and silty soils. Figures 4 through 6 illustrate soil ratings on major terrace levels.

The silty soils are derived from loess (and their derivatives) largely deposited during the period 29,000 years before present (Hogan and Beatty, 1963) to the time of post-Cary loess deposition. This later deposition was probably between 14,000 and 6,000 years before present judging by pedogenic analyses by Allan and Hole (1968). The sand of the valley floor was deposited by meltwater from Valderan glacial ice about 9,000 years ago, and wind has redistributed it as dunes and valley fills both southward (as Chelsea sand in Grant County) and northeastward (Plainfield in Richland County) (Hole, 1956; and Hole, et al., 1950). Some of the loams of the terraces appear to be admixtures of the sand and overwash of silt from tributary valleys. The mixing was probably by biotic agents, particularly ants (Baxter and Hole, 1967).

The soils of the natural terraces differ from the valley floor as a whole in being a little more sloping and eroded, sandier, drouthier, and very slightly higher in land use capability, according to the Soil Conservation Service system of rating. An experimental numerical productivity rating of soil used by Musolf (1970) in the Lower Wisconsin River Valley gave the Plainfield loamy sand a rating of 39, the Sparta loamy fine sand 57, the Dakota
sandy loam 75, the Richwood silt loam 97 (near the maximum possible rating), and all the soils of the valley an average of 61, as compared with a rating of 90 for the upland prairie (Argiudoll) soil landscape of southern Grant County near Cuba City. It is true that with irrigation and fertilization the sands of the valley terraces could be brought up to the equivalent of the Dakota loam in productivity. But the dissection of the soil bodies into narrow strips, already referred to, precludes development of significant crop units. The relatively low natural agricultural productivity of the soils of the valley still dictates an emphasis on multiple land use with special attention to recreational activities and forestry.

Suggested Use of the Detailed Soil Survey for Zoning Purposes in the Lower Wisconsin River Valley

A well designed zoning ordinance makes possible the avoidance of objectionable land uses, such as misplacement of non-farm rural homes on soils incapable of accepting septic system effluent and and construction of hunting and fishing shacks on floodplains (Yanggen et al., 1966). Primary rural land use districts may be set up, as was done in Buffalo County (Buffalo County Zoning Committee, 1965) under six headings: agricultural, residential,
Figure 5. Intermediate terrace, 1 3/4 miles west of Mazomanie, Dane County: Sparta loamy fine sand; S.C.S. land capability—Class IV-s; Soil productivity rating—57.

Figure 6. High terrace, 1 mile northwest of Wauzeka, Crawford County: Fayette silt loam, uplands; S.C.S. land capability—Classes III-e and IV-e; Soil productivity rating—75 and 48.
recreational, commercial, industrial and floodplain. These districts are related rationally to specific parcels of land by using the detailed soil map as the zoning map, with four interpretive overlay maps on it showing four soil districts: steep soils, wet soils, floodplain soils and suitable soils. The suitable soils are further subdivided into sandy soils, medium-textured soils and clayey soils so that lots may be made large enough for adequate on-lot sewage disposal. Musolf (1970) has grouped the soils of the Lower Wisconsin River Valley in this manner and has shown that the area can be zoned under a uniform system. Musolf’s overlay grouping (too voluminous for reproduction here) is suitable for use with the Buffalo County Ordinance and detailed soil maps which are published for Crawford, Grant, Iowa and Richland Counties. Incorporation of a detailed official soil map into a zoning scheme makes decisions about use of most parcels of land clear-cut and unclouded by conflict of opinion. Where serious questions are raised, additional field checking by soil scientists can quickly lead to a satisfactory solution. Advantages of the use of the soil survey in zoning outweigh the disadvantages (Yanggen et al., 1966).

**SUMMARY**

Since the exploratory canoe trip along the Lower Wisconsin River Valley in 1673 by Père Jacques Marquette and Louis Joliet, European and American settlers have replaced the Indian occupants, exploited the forests and prairies and, in succession, practiced wheat, hop, corn-hog, dairy and truck crop farming. Development of the Lower Wisconsin River as a main transportation route never materialized. Erosion control practices, planting of trees in shelterbelts and plantations, and protection of woodlands from grazing have resulted from a growing awareness by the inhabitants of the need for soil and water conservation and from technical assistance provided to land operators by the Soil Conservation Service and the College of Agricultural and Life Sciences working through cooperative Extension. Recreational activities and residential developments have been increasing in the area. Recent elevation of standards for the protection of quality of water and other components of the environment, and an increasing appreciation of the scientific, esthetic and recreational values of this principal environmental corridor of Wisconsin point to the need for a practical land use zoning system in the valley. It is advantageous to base the zoning on the detailed soil maps that are now available, along with interpretive overlay maps and zoning directives that regulate land use according to site characteristics.
LITERATURE CITED


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