THE UNIVERSITY OF NEBRASKA–LINCOLN
LINCOLN, NEBRASKA 68508

OFFICE OF THE DEAN
FOR GRADUATE STUDIES, UN-L

September 27, 1974

NTIF, NASA Earth Resources Survey
Program Office
P. O. Box 33
College Park, Maryland 20740

Gentlemen:

Re: Proposal to evaluate the use of ERTS-1 imagery in mapping soil and range resources in the Sand Hills region of Nebraska (NASA Contract No. NAS5-21765)

Enclosed are two Xerox copies of a recent article from the "Nebraska Farmer" dealing with results obtained from the contract listed above.

Sincerely,

James V. Drew

James V. Drew
Dean

JVD:jsw

cc: Mr. G. R. Stonesifer

Enclosures

Satellite pictures can help guide Sandhills irrigation

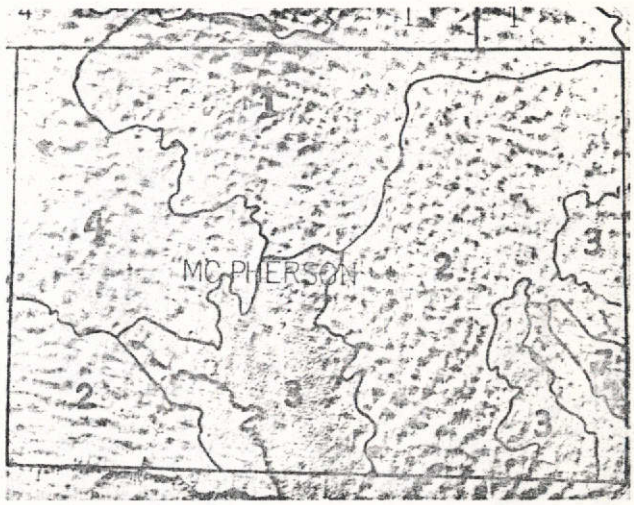
Outer space view may help protect developers from consequences of picking wrong center-pivot irrigation site

By DAVID T. LEWIS, LESLIE F. SHEFFIELD
PAUL M. SEEVERS AND JAMES V. DREW*

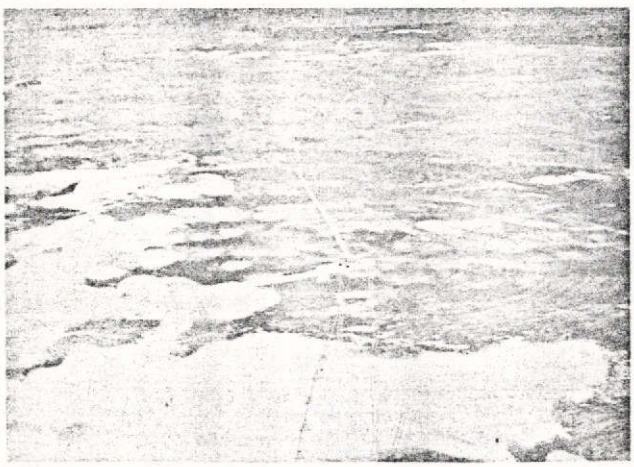
NOW PHOTOGRAPHY from a satellite 565 miles up may help guard against center-pivot irrigation development in the wrong places in the Sandhills.

What the satellite pictures can do that soils specialists on the ground won't be able to do for several years at least is give us a survey of the whole Sandhills area, identifying which areas are suited for center-pivot irrigation—and which areas aren't.

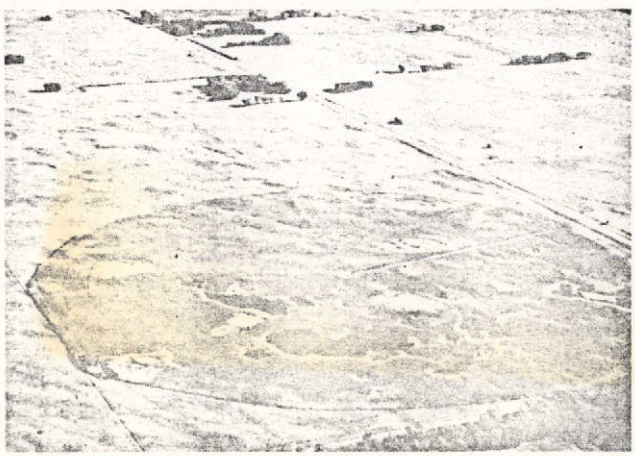
Soils scientists know that two general types of areas spell almost certain financial doom for center-pivot irrigation installations: (1) "choppy" sandhills and (2) wide, level subirrigated meadows.



McPherson county, as seen from ERTS-1 satellite . . . features in this picture of a 3- to 4-inch snow cover show where center-pivot irrigation is suitable and where it isn't. The areas (numbered in this picture) are identified in the story text.



Grim results . . . Blowouts such as those in this circle often occur under center-pivot systems which are installed in "choppy" sandhills areas. Blowouts spread as the sand blown from them covers and smothers neighboring vegetation.



Ponding has destroyed much of the area in this circle developed in a subirrigated meadow area. When water recedes, pond areas will be barren of vegetation, providing a "foothold" for blowouts.

Under center-pivot irrigation, in "choppy" sandhills, circles pockmarked by blowouts with sprinkler-tower wheels mired down in them are often the disappointing results for unwary developers. In the subirrigated meadows, ponding and drowned-out crops develop, leaving barren areas for blowouts to start when the water table recedes.

Of course, a landowner in the area probably doesn't need a satellite picture to show him where such areas are. And if he wants to get information on a prospective site for center-pivot irrigation, he can go to his local Soil Conservation Service office. His SCS man can give him the information he needs by visiting the site. Or if a soil survey map has been completed for the county, the SCS could use that to predict the suitability of the site for center-pivot irrigation.

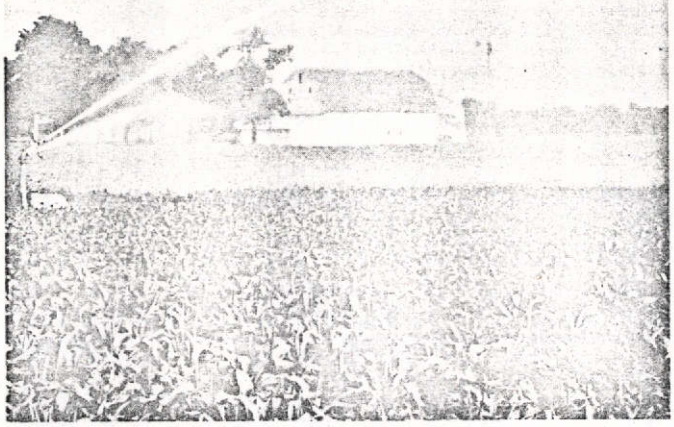
The trouble is, soil survey maps probably won't be completed in a number of counties for years. And that's where the satellite pictures come in: Giving a total picture of irrigation potential in the Sandhills.

Features in the high-flying images reveal the "choppy" sandhills and wide, level subirrigated valleys where center-pivot irrigation can take a toll on the land—and on the dreams and finances of unwary developers.

Until the soil surveys can be completed, the satellite pictures can help provide such people as government planners with an over-all inventory of where and how many of these areas are in the Sandhills. Possibly, these pictures will play a role in guiding unwitting developers from going into an unsuitable area for irrigation development, only to leave it riddled with blowouts and layers of sand over neighboring vegetation.

These pictures are from the Earth Resources Technology Satellite (ERTS-1). Research funded by the National Aeronautics and Space Administration at the University of Nebraska indicates that where detailed soil surveys are not available, a map made up by using images from ERTS can be used to predict the potential of an area for center-pivot irrigation.

The satellite passes over the Sandhills every 18 days. On each pass,/ *continued on page 40*



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. . Satellite pictures

images of the surface of the earth are made in four light-wave lengths. Those in the visible red wavelength are especially useful to show where the Gannett soils in the wet meadows are located. The comparatively lush vegetation in the wet meadows absorbs light in the visible red band more strongly than do the surrounding areas where vegetation is more sparse. When the images are processed, the wet meadows appear dark, while the surrounding drier soils appear light.

In winter, when there is snow on the ground and the sun is low on the horizon, shadows are produced which make it possible to see the hills and valleys more clearly. The accompanying ERTS picture shows McPherson county in January when 3 or 4 inches of snow were on the ground. Area 4 is the region of wet meadows, the Ganett poorly drained, subirrigated soils on which water ponding would be expected under center-pivot irrigation.

Area 3 is composed of Valentine soils that are on choppy topography. Here, near Birdwood Creek and in the southeastern part of the county, it is necessary to level a lot of land to put in a center pivot. There has been little success with center-pivot systems in areas such as this because of the looseness of the sand and danger of blowouts after leveling has been done.

Soils Are Well Drained

Areas 1 and 2 have the greatest potential for the development of center-pivot irrigation systems. In area 1, the Dunday soils are in the broad, dry valleys. Here in these valleys, topography is suitable and the soils are well drained. Leveling is not required, the soils are somewhat higher in organic matter, silt and clay than the Valentine soils. And the water table is deep enough so that it will not rise and cause ponding in the circle. However, the soil will still blow if it is not kept covered.

Careful management using such practices as minimum tillage and the maintenance of crop residue cover on the soil are essential to hold the soil in place. The hills that separate the valleys here are composed of Valentine soils that are choppy or rolling. Circles have been established in some places where part is in a suitable valley. But the system must climb over a ridge of Valentine soil to complete the rotation. The ridge is often shaped, leaving a hill of loose sand through which the system can't go without being towed. The partly leveled ridge remains dry, bare and exposed to the wind. There is no doubt that a severe blowout will result where this happens unless extensive measures are taken to prevent it.

The soils in Area 2 are Valentine rolling on the hills with finer textured Anselmo soils in some of the valleys. Much of this area is sometimes called the "hard sands." Center-pivot systems can function satisfactorily here if good judgment is used in their location and if conservation management practices are followed. If leveling is done or the soil surface left exposed, blowouts will probably result as in other places. The soils in some of the valleys have finer-textured layers within the rooting depth of most crops. Therefore they hold more water than the Valentine or Dunday soils. It is a good practice here to look at the soils to some depth in order to plan the amount of water that is needed to supply the needs of the crop.

Fine Textured Soils

The area shown as number 7 on the image is the "loess-sandhills border." Here there is a larger amount of finer textured soils and, at present, some dryland wheat is grown here. Some of this land has soils and topography suitable for irrigation, but some is very steep. There are also sand ridges where blowouts will occur if the land is left without cover.

A map showing soil associations over the Sandhills region in Nebraska is being prepared from ERTS imagery. In addition, McPherson, Hooker, and Thomas counties have detailed soil survey maps available. Grant and Logan counties will have them within a few years. If these maps and the information about the land they contain are used by those who plan to invest in center-pivot systems, it will be possible to select sites for these systems that give the sysems the best possible chance for success. Better suited sites will mean a better chance that the system will prove to be profitable for the owner and less chance that it will become a 135-acre circular blowout that can cover surrounding land with a smothering blanket of sand.

*Lewis and Drew are agronomists at the University of Nebraska. Sheffield is coordinator for the Irrigation Development Program at the University. And Seevers is research agronomist in the Remote Sensing Center at the University of Nebraska Conservation and Survey Division. ■