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Project Status Report

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Investigation of Remote Sensing Technology for Land Cover Acquisition

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To plan effectively, resource managers need current and cost-effective maps of the dynamic land cover/land use (LCU) types within the Upper Mississippi River System (UMRS) floodplain. In the past, the Upper Midwest Environmental Sciences Center (UMESC) produced these maps by interpreting 1:15,000-scale color-infrared aerial photographs to a 150-class, genus-based system. While this method generated land cover maps with unprecedented detail, it was time-consuming and expensive to do for the entire system. In 1998, this classification system was simplified to 31 classes that could still meet most analysis needs of UMRS resource managers. This significantly decreased the time needed to interpret photographs.

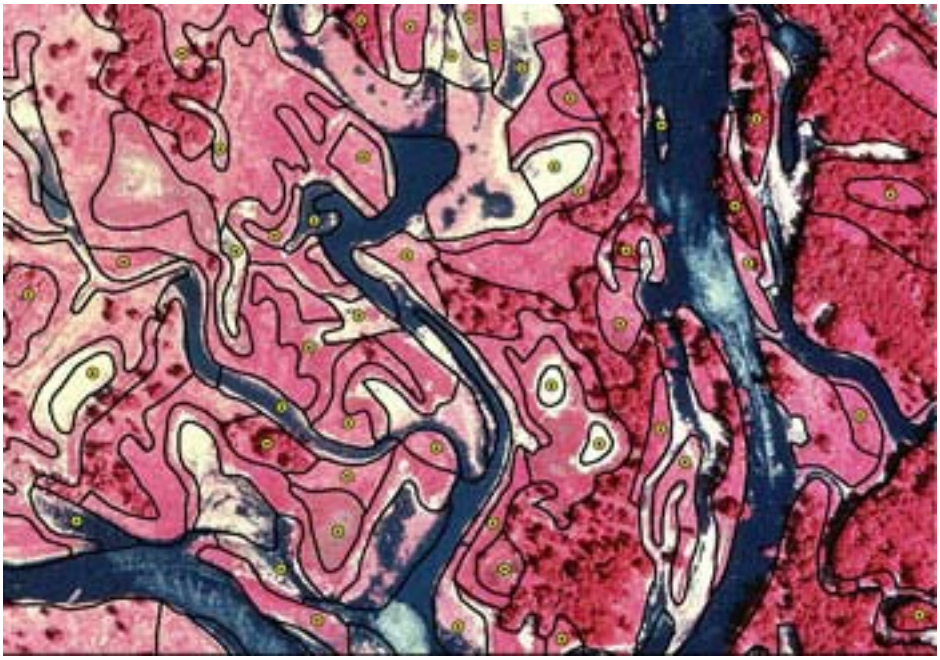
In this study, we are investigating whether efficiency can be further improved by changing the type of remotely sensed images (aerial photographs, satellite scenes) used to produce floodplain maps. We are evaluating three types of images. First, we are interpreting aerial photography at a scale of 1:24,000 to determine what is lost in accuracy and gained in efficiency when mapping at a smaller scale. We are also examining the use of high spatial resolution (4-m) data from a new commercial satellite (IKONOS). Finally, we will be evaluating an airborne hyperspectral sensor (airborne imaging spectrometer [AISA]). Hyperspectral sensors record energy over very narrow, but contiguous, ranges of the electromagnetic spectrum. When particular cover types have unique energy reflectance characteristics, computer algorithms can be used to help distinguish between them, allowing a more automated mapping process. The IKONOS and AISA sensors are designed to help discriminate between cover types that are either too limited in area or too similar in their reflectance characteristics to have been mapped by previous sensors.

We selected three representative areas within the UMRS floodplain, each about 100 km^2, as test sites for this study. These sites are portions of Pools 8 and 22 of the Mississippi River and a portion of La Grange Pool of the Illinois River. We acquired aerial photography at both 1:15,000 and 1:24,000 scales and IKONOS images for all three study sites in late summer or early fall 2000. The interpretation of the 1:15,000 photography was used as reference data against which the 1:24,000- and IKONOS-based maps could be compared.

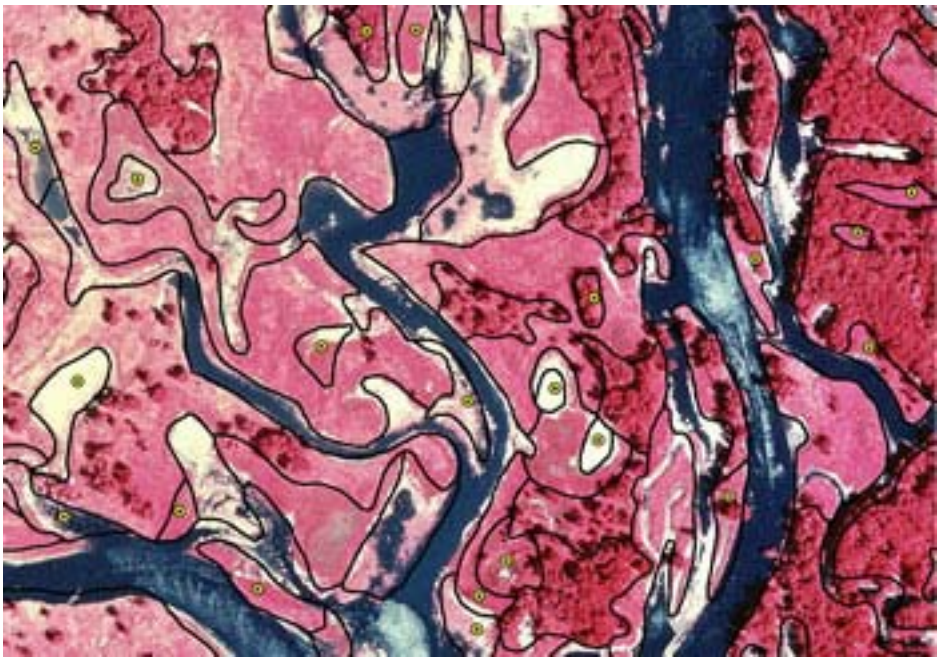
Initial results indicated that the map based on 1:24,000 scale photography agreed with the reference data 55% of the time. The reference data was interpreted using a 1-acre minimum mapping unit (MMU), while an MMU of about 2 acres was used when interpreting the smaller-scale photography (Figure). Agreement between the two maps increased significantly (to 71% overall) when reference polygons smaller than 2 acres were excluded. The IKONOS classification agreed with the reference map 34% of the time. Accuracy or levels of agreement, such as these, are coarse metrics and should be viewed as relative measures. Reference data are rarely 100% accurate. In addition, inherent differences between photo-interpretation and automated classification make the two processes difficult to compare. However, these early results indicate that smaller scale aerial photography is more suitable than high-resolution satellite data for mapping the current LCU types.

Hyperspectral (AISA) and reference data (1:15,000 scale aerial photography) were acquired for the study area in Pool 8 in August 2001. Classification of the hyperspectral data will be done by a private contractor and assessed by the UMESC in late spring 2002.

All phases of this study will be incorporated into a single report in summer 2002. The report will address the strengths and weaknesses of each approach, discuss probable causes of error, and recommend the most efficient process for mapping the UMRS floodplain.



(*a*)



(*b*)

Figure. These are examples of photo-interpretation polygons at 1:15,000 (*a*) and 1:24,000 (*b*) scales. The yellow dots mark land cover/land use (LCU) polygons that were less than 2 acres. While this is less than the prescribed minimum mapping unit of the 1:24,000 scale photo interpretation, some obvious LCUs less than 2 acres were still delineated at this scale. Typically, however, at 1:24,000 scale these polygons are lumped into larger and more generally described vegetation units.

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