Our Common Ground

Iowa Department of Natural Resources

Iowa Geological Survey
Resource Information Fact Sheet 2006-1

Using LiDAR to Scan Iowa from Aircraft

1) What is LiDAR?

- "Light Detection and Ranging"
- Process of scanning the earth with lasers from an aircraft to obtain accurate elevations.
- Similar to sonar (depth finder) i.e., time of travel is method of measuring distance.

2) What is being proposed by Iowa Dept. of Natural Resources (IDNR)?

- Obtain LiDAR coverage and accompanying aerial photography for the entire state of Iowa over a 4-year period.
- Process LiDAR data, develop elevation maps for all Iowa counties, and make these maps and aerial photography available for public use over the Internet.
- Delineate floodplain boundaries for Iowa rivers and streams.

3) How accurate is LiDAR?

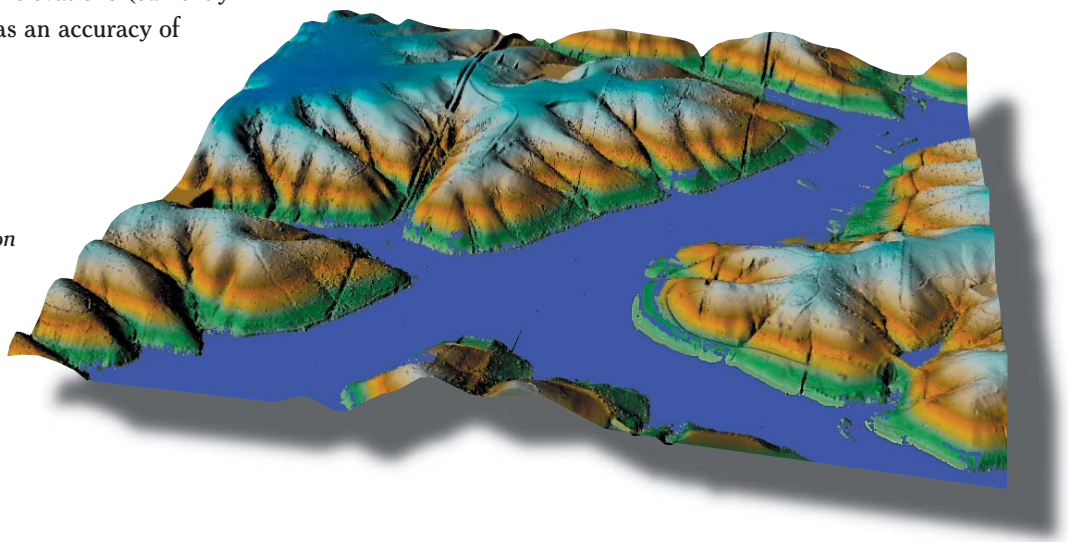
- Proposed project will generate elevation data which is within 8 inches of actual elevations (currently available statewide data has an accuracy of ± 5 feet).
- Data will support development of 2-foot contours that meet national map accuracy standards and Federal Emergency Management Agency (FEMA) requirements.
- Data points used to generate elevation data will be spaced an average of 5 feet apart or less.

5) When would the data be collected?

- Proposing to cover 1/4 of the state every year for four years (2007- 2010).
- Spring, soon after snowmelt, is the ideal time.
  - No tree canopy to obscure mission.
  - Dense vegetation (grasses) are matted down from snow.
- Desired start date is spring 2007.
- Schedule will be adjusted as funding sources dictate.

6) How will the data be made available?

- The data will be made available at no cost from a state website, in various formats, for all Iowans.
- Goal is to have data available on website within one year of collection.



Color-enhanced LiDAR view over Lake Darling, Washington County. Elevation is exaggerated.

7) What are the total costs associated with the LiDAR project? (estimated $5.86 million)

- One year ago the best prices were around 50 cents per acre.
- U.S. Geological Survey (USGS) recently negotiated a sole source contract with a vendor that states are eligible to contract with for the LiDAR project.
  - Under this contract Iowa (IA) could be flown for 8.5 cents per acre.
    - 36,000,000 acres in IA x $0.50 = $18 million.
    - 36,000,000 acres in IA x $0.085 = **$3.1 million**.
- High-resolution photography (necessary complement to LiDAR for completing data processing and development of detailed elevation maps) ~ $1.5 million.
- Infrastructure necessary to store and distribute data over website ~ $200,000.
- Data handling, acceptance, quality control, distribution, etc. ~ $520,000.
- Project administration/coordination ~ $140,000.
- Delineation of floodplains ~ $400,000.
- Funds would be allocated over the 4-year period as data are delivered to the state.

8) What are some uses of LiDAR data?

LiDAR will allow planners to greatly reduce and supplement field survey requirements for many Iowa businesses and agencies. Examples include:

- Reduction of many infrastructure planning costs
  - Roadway siting, planning, and estimating
  - Utility line siting, planning, and estimating
  - Construction site planning and estimating
  - Soil conservation structure (terraces, sediment ponds, etc.) planning and estimating
- Risk assessment
  - Floodplain and flood insurance mapping
  - Erosion potential measurements and modeling
  - Emergency management and response planning
    - Dam breach inundation areas
    - Levee analysis
    - Spill routing
- Evaluating alternative infrastructure options
  - Utility lines
  - Roadways
  - Stormwater facilities
  - Pipelines
- Permit process improvement
  - Animal feeding operation siting with regards to floodplains and slope
  - Air emission permitting
  - Floodplain permitting for industrial/residential construction
- Education/research
  - Environmental science
    - Watershed modeling
    - Runoff modeling
    - Conservation practice performance
    - Watershed delineation
  - Engineering
    - Construction site planning
    - Development/use of automated planning tools
  - Development of new technologies – potential for yet unimagined applications

9) Who is going to do the work?

- USGS will contract to obtain LiDAR and photographic data.
- IDNR will coordinate the data collection project with USGS.
- IDNR will assume the responsibility of processing and serving the data via the Internet to Iowans.

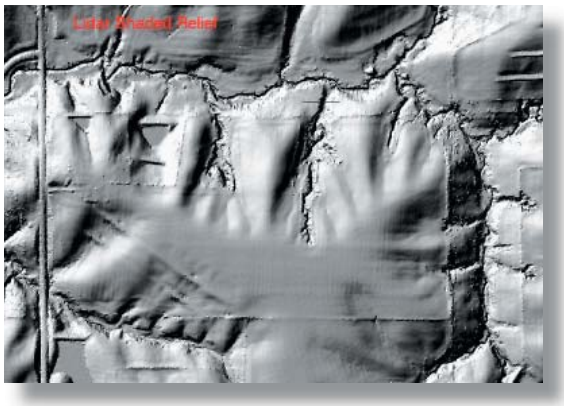
10) What are the funding alternatives?

- → Legislative appropriation ($1.5 million for 4 years)
- → Public/private partnerships to raise funds – color infrared (CIR) model
- → Federal funding sources
- → Combination of any of the above

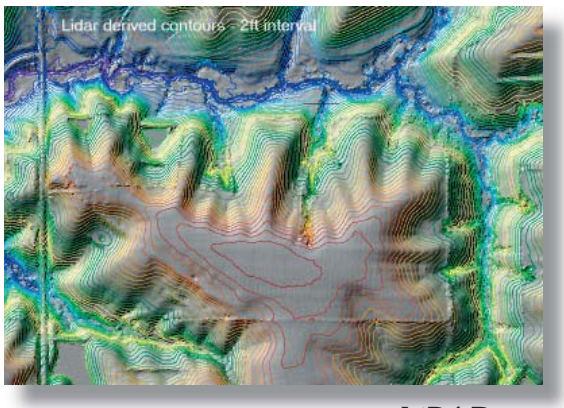
An example of LiDAR data can be seen on our interactive mapping website at **www.iowadnr.com**

Color infrared photography – 2002

Shaded relief view with currently available elevation data

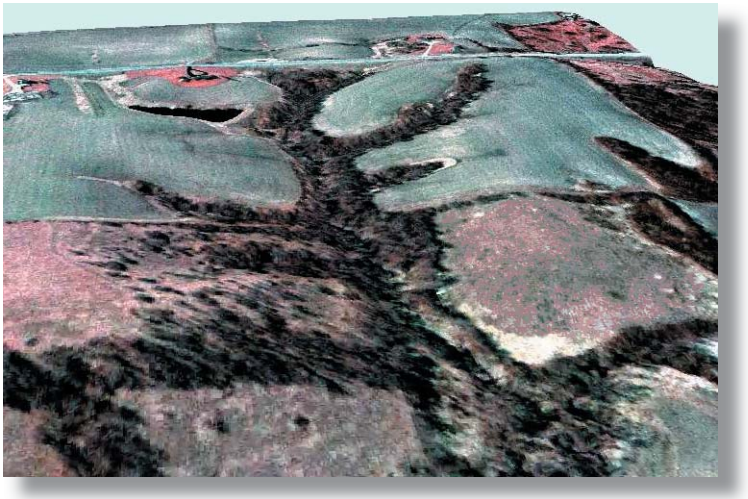


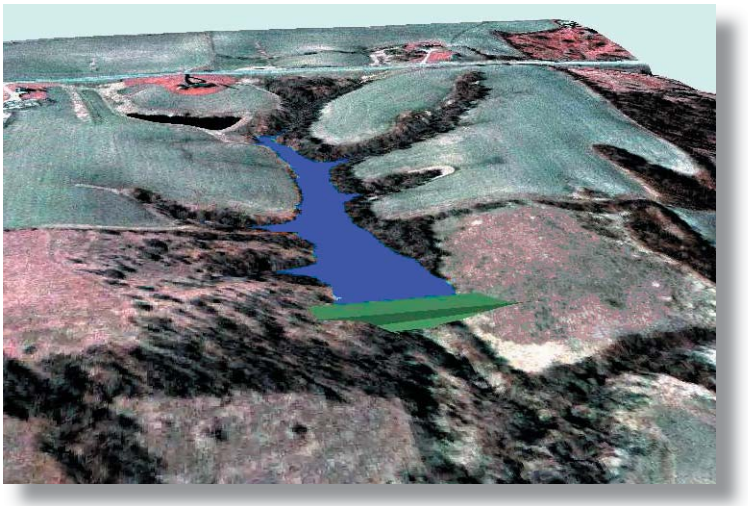
Shaded relief view with LiDAR *based elevation data*

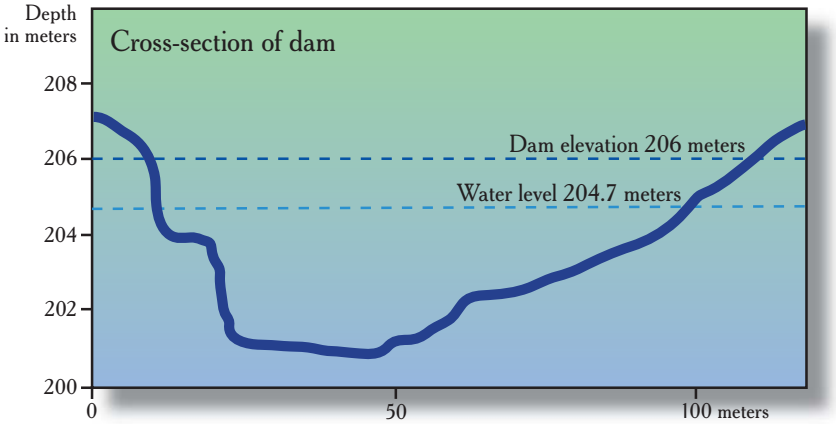


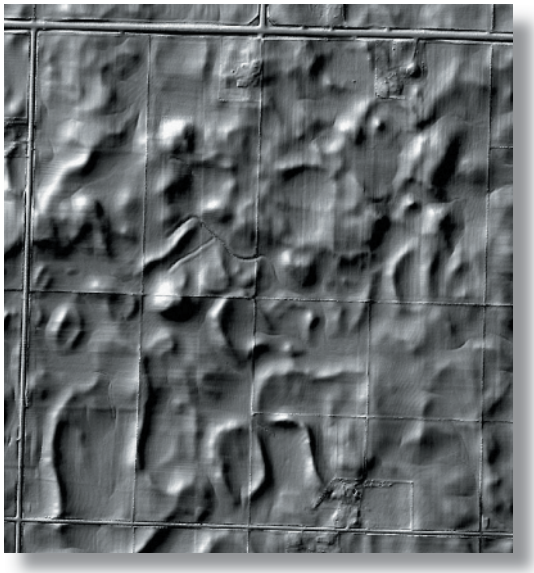
Contours (2-foot intervals) derived from LiDAR

Four data samples for one area of the Lake Darling watershed are shown to the left. Digital aerial photographs (below) are draped over LiDAR elevation coverage of a gully in the Lake Darling watershed. A proposed dam, designed to stop sediment from moving to the lake, was incorporated into the second photo. A cross-section of the proposed dam is shown at the bottom.



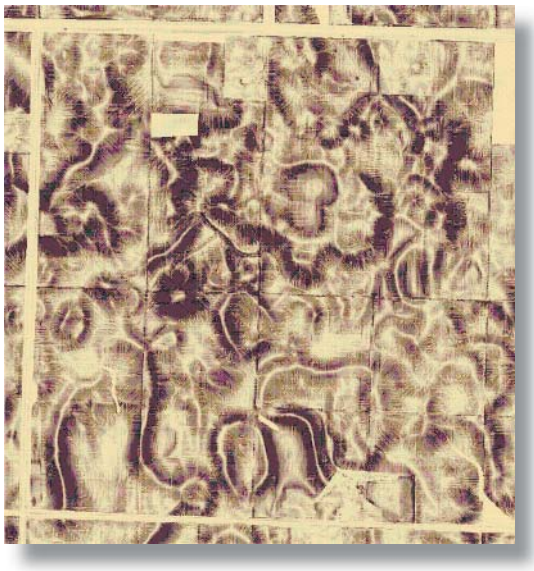




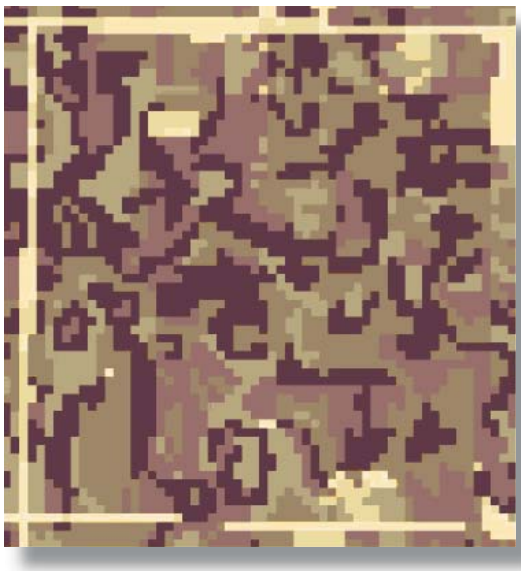


Shaded relief image using LiDAR derived elevation for an area near West Okoboji Lake, Dickinson Co.

Color infrared image of the same area, showing land cover.



Potential for sheet and rill erosion in the same area. Darker areas indicate higher erosion potential. Computed with the Revised Universal Soil Loss (RUSLE) equation using slopes based on LiDAR elevation data.



Potential for sheet and rill erosion, computed using slopes derived from currently available elevation data. Resolution (above) is much less detailed than slopes using LiDAR elevation data (left).

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