Coastal monitoring and research to inform a regional sand management strategy along the Illinois Lake Michigan Coast

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History of Illinois Coastal Geology Research

- Decades of geologic research
- Research and monitoring hiatus since late 90s
- 2012 Illinois Coastal Management Program formally recognized
  - Science-based management, not regulatory
  - Prairie Research Institute and IDNR Interagency Agreement
    - ILLINOIS COASTAL SCIENCE INITIATIVE
      - Illinois State Geological Survey
      - Illinois Natural History Survey
IL Coastal Sand: Too little here, too much there

Challenges:
- No comprehensive coastal database
- No long-term coastal change monitoring program
- Lack of in-situ observations of hydrodynamic processes
- Geomorphic change and hydrodynamic processes not linked
- Shore protection structures need to be evaluated
- Lack of regional sediment transport/coastal evolution model
Geomorphologic Monitoring

- Initiate long-term coastal change monitoring program
- Compare past and present geomorphic change
Mapping nearshore sand

- Thickness and distribution of nearshore sand
- Helicopter Time-Domain Electromagnetic (HTEM) Surveys
- Compare with past data
  - Rate and magnitude of change
  - Lakebed undercutting
- Borrow sites and nearshore habitat

Photo courtesy: SkyTEM
Monitoring geomorphic change

- Rates and magnitude of beach, bluff, and nearshore change
  - Long-term and short-term monitoring
    - Quantify impacts from storms
    - Habitat loss
    - Post-nourishment/dredging/construction
    - Identify and protect vulnerable locations
    - Comparison with past data
    - Frequency and timing of regional data collection

- Methods
  - RTK-GPS and MBES
  - Photo monitoring- educational benefit
  - Citizen science- educational benefit
  - Near future: UAVs
Hydrodynamic Processes

- Fill data gaps
- Connect with geomorphic change measurements
Lake Michigan Physical Processes

Fluctuating Lake Levels

Storm waves and surge (overwash)

Nearshore Ice

Wind
Existing Hydrodynamic Observations

Lake Michigan

Illinois Coastal Management Zone

Monitoring Buoys

- Existing Sea Grant

- Reduced littoral sediment supply; rates and magnitudes unknown
- Erosion and overwash; loss of rare habitat
- Shoaling; constant dredging needed
- Erosion; loss of beach and habitat; costly nourishment and shore protection required
Proposed Hydrodynamic Observations
Connecting process and response

- What are the spatial and temporal patterns of change?
  - Regional vs. local management
  - Timescales of solutions

- How to incorporate coastal processes into management plans?
  - E.g. Lake level dynamics, storms
  - Timing of dredging, nourishment residence time
  - Now and future
Coastal modeling and assessments

- Vulnerability assessments
- Geomorphic and sediment transport models
Vulnerability assessments

- Identify vulnerable stretches of coastline—present and future
  - Prioritize and plan management actions

- Shore protection/infrastructure assessments

- Build regional resilience
  - Community-based assessments
  - Relationships with stakeholders
  - Regional Sand Management Work Group
    - Knowledge and data sharing
  - Interstate partnerships—WI and IN
Coastal Modelling Framework

- Analyze past data and studies
- Gather data (Hydro and geomorphic)
- Develop conceptual understanding of processes
- Refine existing models or develop new models
- Validate models with field data
- Forecasts of geomorphic change or sediment transport under different scenarios
- Inform management (scientific-basis for decision-making)

Green indicates effort is underway
Questions?