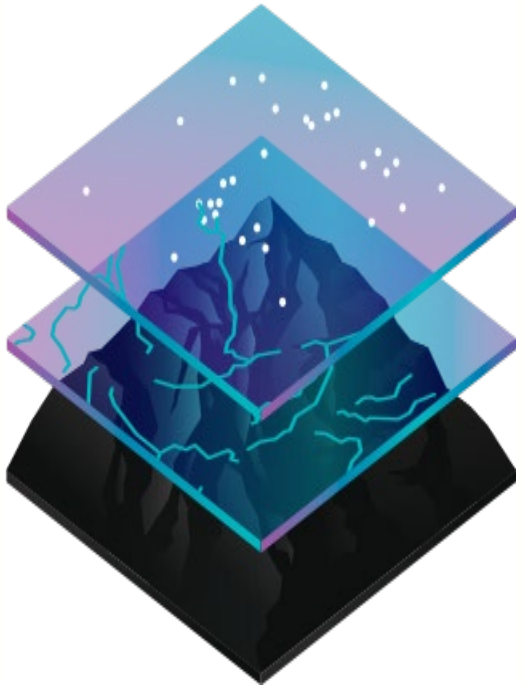
Statewide predictive cultural heritage model

Creating meaning for Michigan landscapes

IMAGIN 2022 – MACKINAC ISLAND
JUNE 5-7



Michigan Cultural Digital Mapping Project

PROJECT TEAM

USDA – NATURAL RESOURCES CONSERVATION SERVICE

MICHIGAN STATE UNIVERSITY

Project team – current & alumni

MCDM Project

MSU
- Amanda Tickner, PhD – MSU Libraries
- Jubin Cheruvelil, PhD – MSU & Nyaa Health Services
- Cadi Fung, PhD – U of Alabama
- Ben Dougherty, M.A. U of Michigan
- Jack Reidy – Student Assistant

USDA - NRCS
- Duane Quates, PhD – USDA NRCS
- Melissa Gutierrez, USDA NRCS
- Chris Valvano, PhD USDA NRCS

MSU RSGIS
- Erin Bunting, PhD MSU RSGIS
- Nicholas Weil, GISP MSU RSGIS

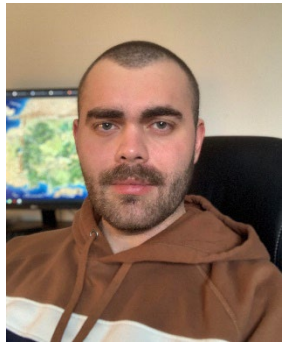
Alumni

*Charlotte Cable, PhD Independent contractor

*Daniel Xie, M.S. U of Michigan

*Aires Gonquela, MSU student



- National Historic Preservation Act (1966), Section 106
- Section 106 - accounts the effects of undertakings on historic properties and provides the Advisory Council on Historic Preservation (ACHP) with a reasonable opportunity to comment.
- Consult on the Section 106 process with SHPO, THPO, Indian Tribes, Alaska Natives, and Native Hawaiian Organizations

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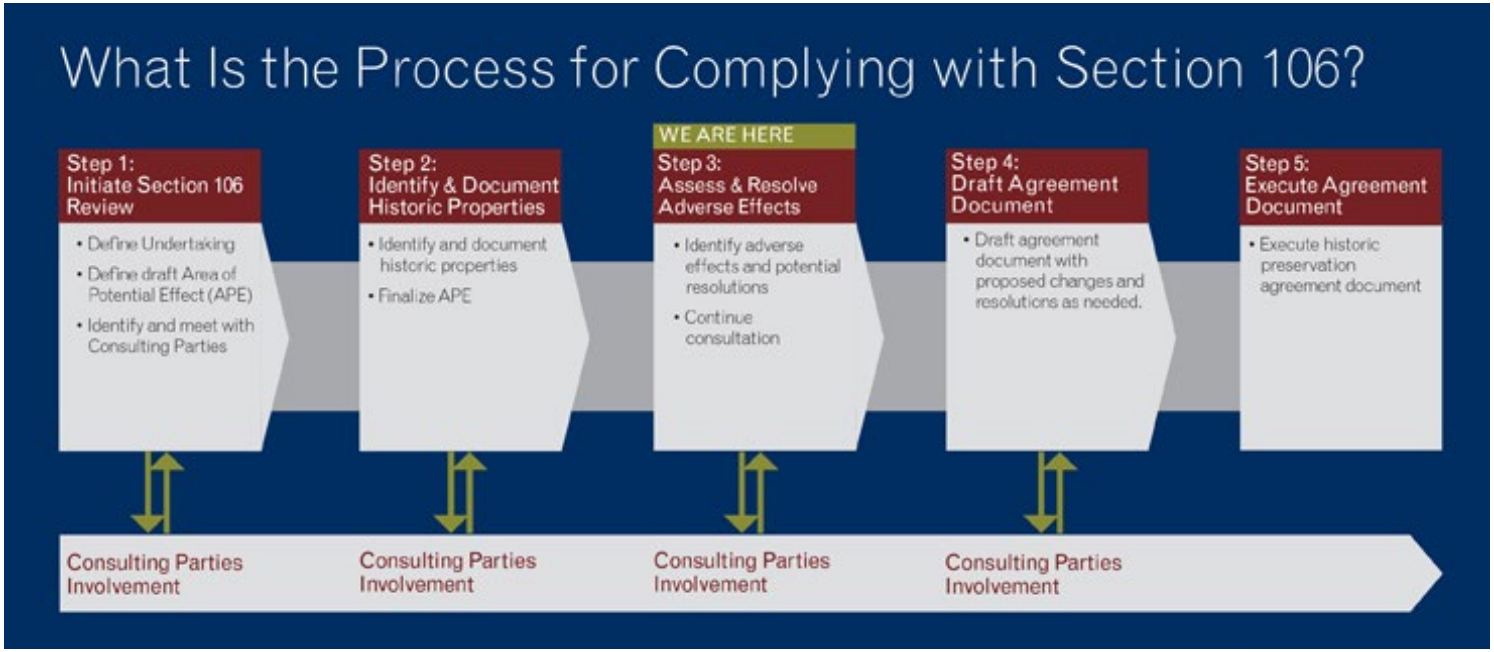

GSA.gov

Section 106 compliance

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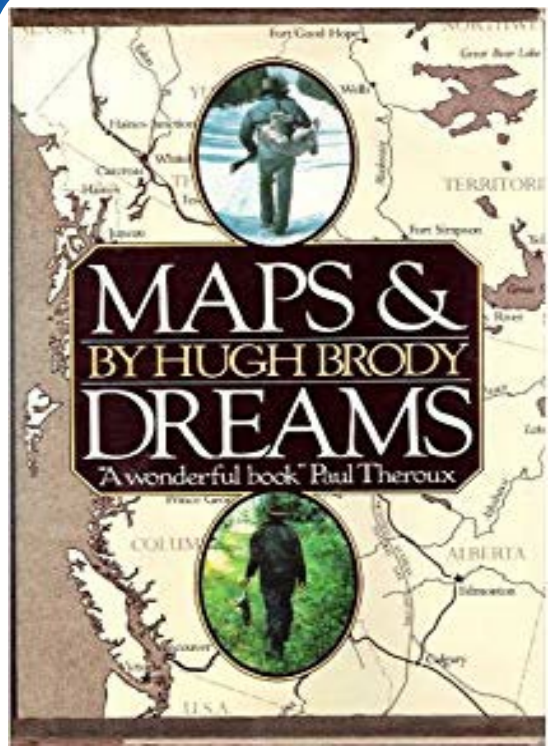

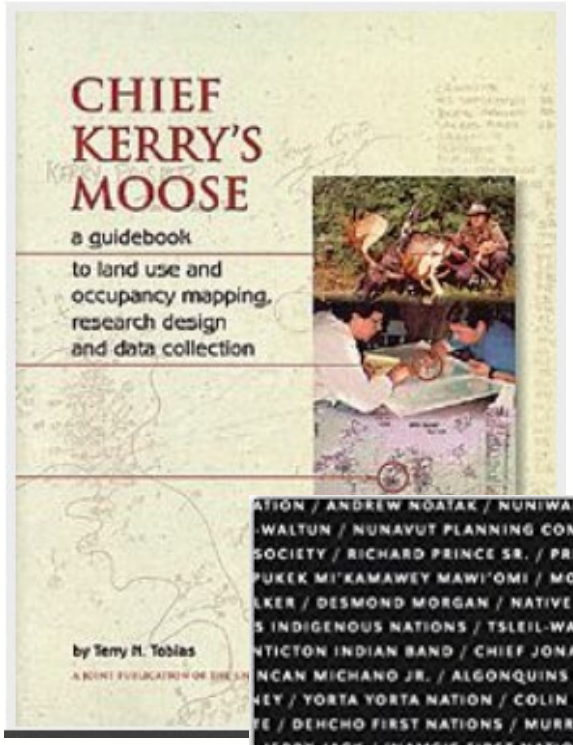

Maps and Dreams by Hugh Brody (1988), p. 167

Cultural Mapping

Sanilac Petroglyphs - Cass City, MI

MCDM Project

Mishipeshu - Agawa Bay, Ontario, Canada

Cultural Mapping

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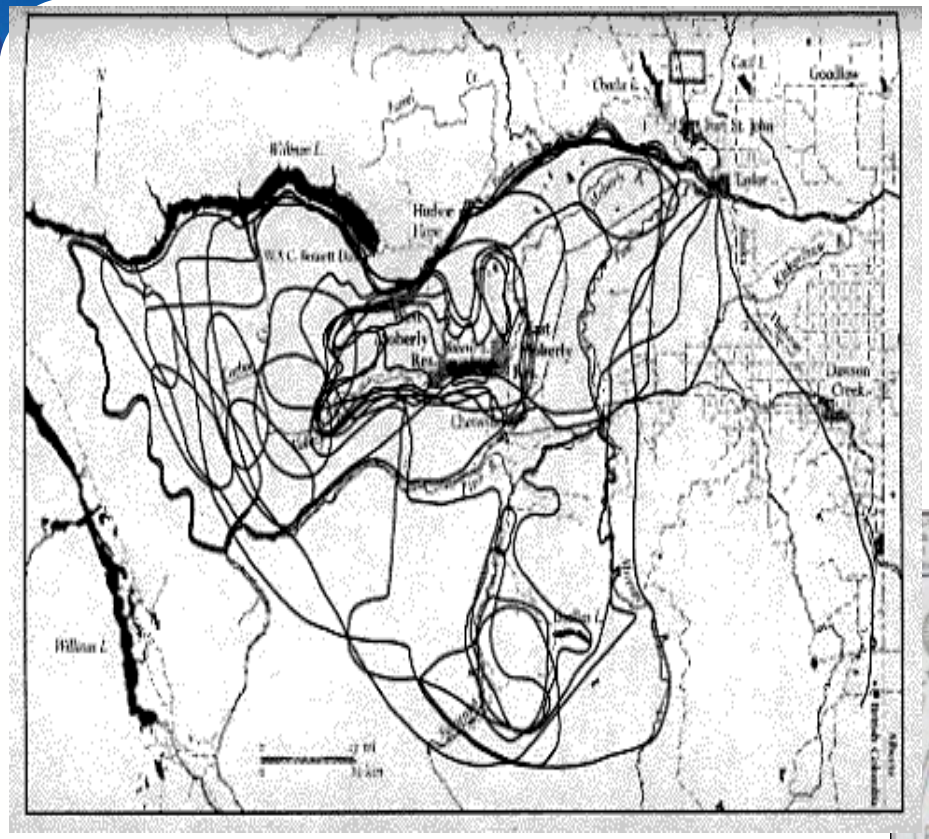
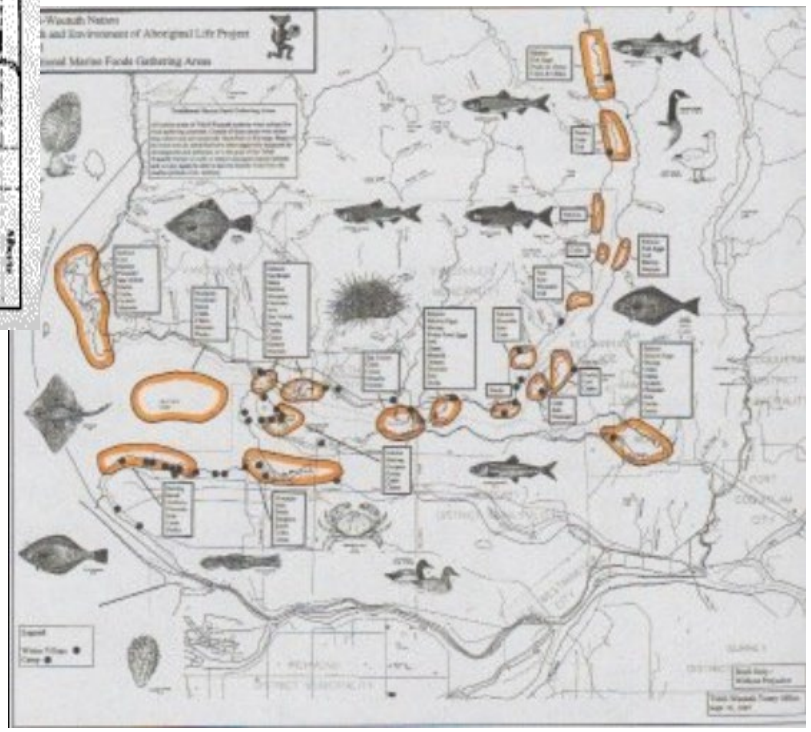
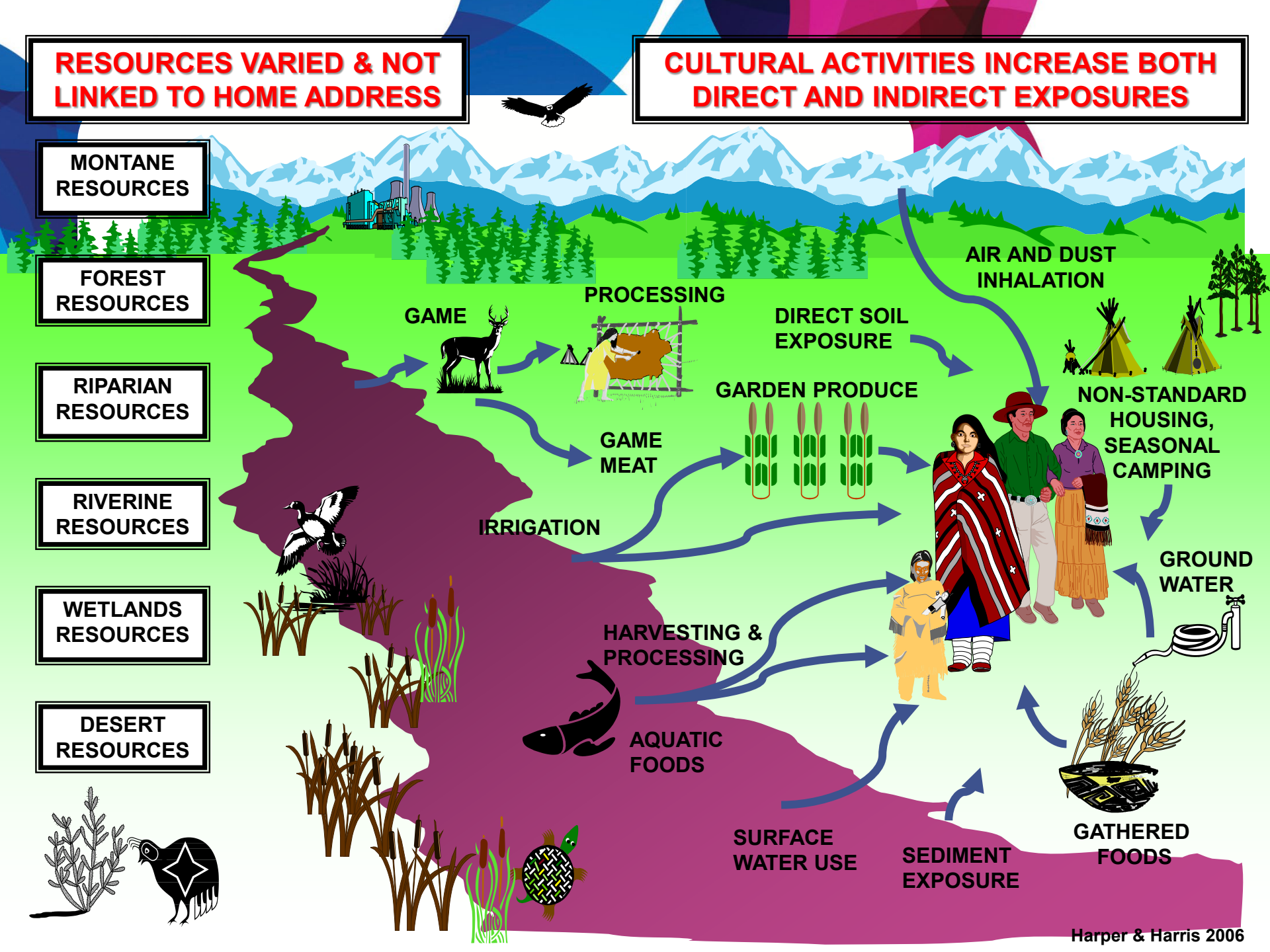
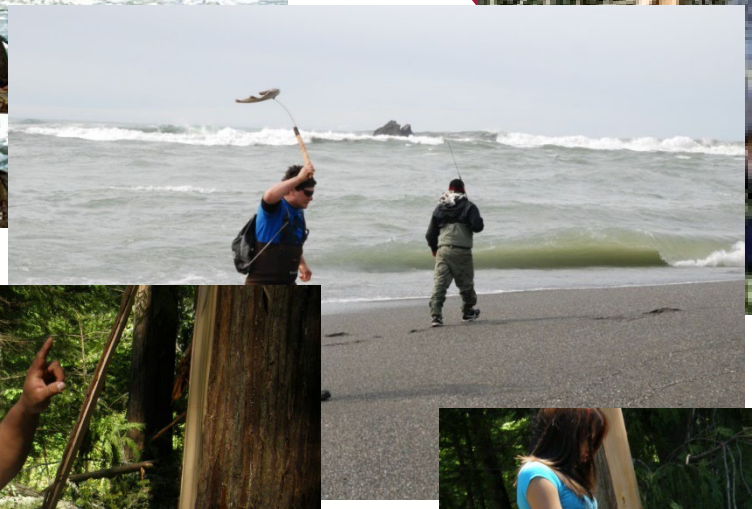




Ethnographic Mapping


RESOURCES VARIED & NOT LINKED TO HOME ADDRESS
CULTURAL ACTIVITIES INCREASE BOTH DIRECT AND INDIRECT EXPOSURES
MONTANE RESOURCES
FOREST RESOURCES
RIPARIAN RESOURCES
RIVERINE RESOURCES
WETLANDS RESOURCES
DESERT RESOURCES
GAME
PROCESSING
AIR AND DUST INHALATION
DIRECT SOIL EXPOSURE
GARDEN PRODUCE
NON-STANDARD HOUSING, SEASONAL CAMPING
GAME MEAT
IRRIGATION
GROUND WATER
HARVESTING & PROCESSING
AQUATIC FOODS
SURFACE WATER USE
SEDIMENT EXPOSURE
GATHERED FOODS
Harper & Harris 2006

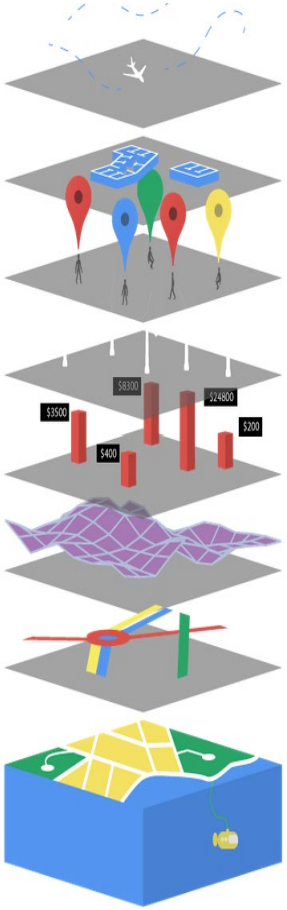




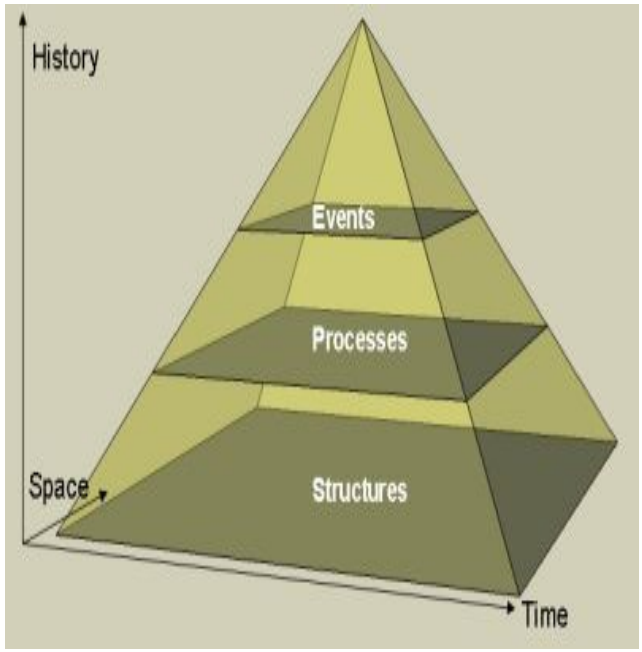



Lower Elwha Culture Program



Custom layer (private or public)

Base layer



MCDM Project

- specific time (season, year, date range)
- general time (decade, quarter century, etc.)
- frequency

WHEN
time period

- site type
- site use
- story / history

WHAT
activity

Confidence
Accuracy

WHERE
location

- placemark / path / polygon
- place name
- 'agent's language
- 'official' - local

WHO
person

- tribal name / language group
- person(s) who did the activity
- gender, age, family, etc.
- reference to documentation
- interview, bibliographic, etc.

Tobias 2009; Data Diamonds for Map Biography

Cultural data collection framework

- Framework – collaboration & engagement with repositories and Tribal communities

- Phase 1 – digitized and nondigitized atlases
- Phase 2 – direct to digital cultural land use/ behavioral mapping
- Phase 3 – a predictive model

- Data sharing and data sovereignty
- Repository and Tribal ownership of data
- Project implementers as technical assets for implementation
- Iterative and programmable model incorporating new data over time
- Secure and credentialed access

MCDM Project

Project design

- Michigan sources - township level maps, map libraries, universities, tribal agencies, intertribal agencies, private collections
- Non-Michigan sources - National Archives, Smithsonian, university map collections/ repositories/libraries, independent research libraries (i.e., Newberry Library), private collections
- Available map resources: cultural boundaries, and areas of interest
- Limit scope
  - Tribal service areas
  - Let data lead the way

MCDM Project

Phase 1-2 (map collections)

- In-person engagement with repositories
  - Detroit public libraries
  - Clarke Historical Library - CMU
  - Clark library – U of M
  - State of Michigan Libraries
  - US - National Archives
  - Chicago – Newberry library

- Data sharing and rights agreements
  - Share digitized content back with repository

- Take digital photography or scan in relevant maps and manuscripts
  - Flatbed scanner (larger than 11X17)
  - Mounted macro digital camera with remote trigger

- Metadata focus
- Data reference source

Phase 1& 2 (map collections)

MCDM Project

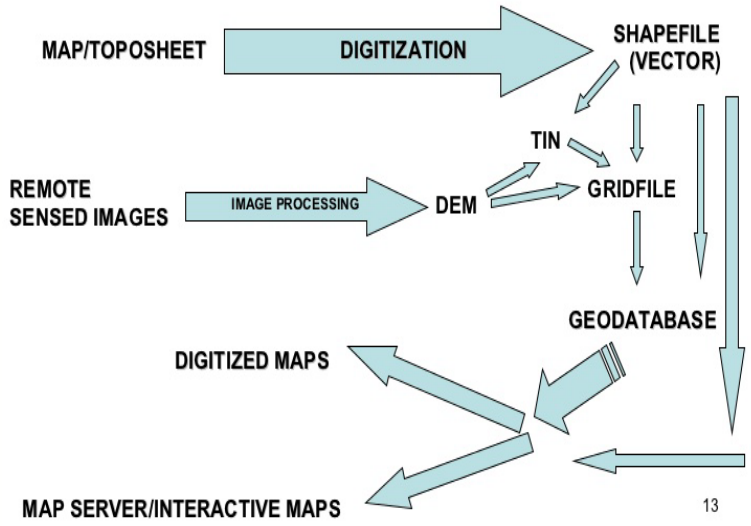
- Support tribal needs
  - GIS training for staff and community members
  - Develop community GIS knowhow
  - Direct education and data collection (tribal science)

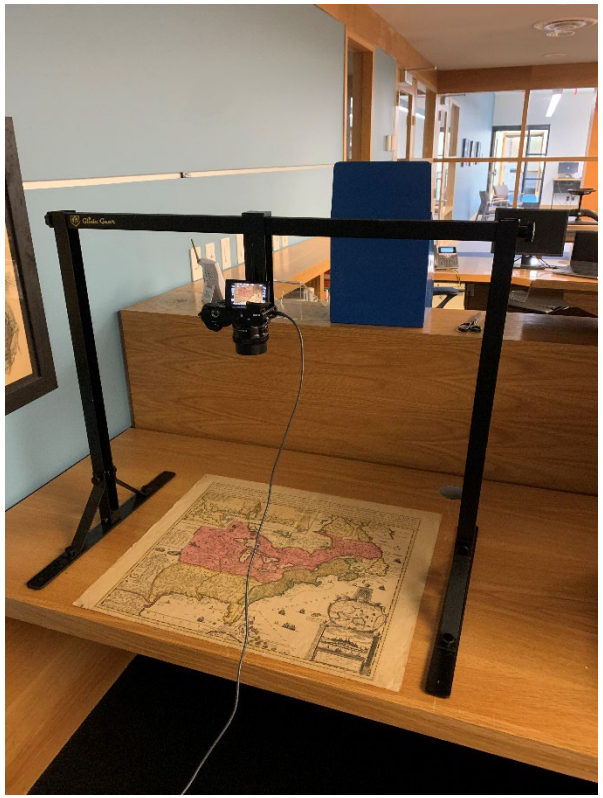
- Data sovereignty
  - Agreement with Tribes toward data privacy
    - IRB, MOU, and MOA
    - Privacy and respect
  - Tribal determined limits and guidelines
  - Delivery of compiled data to tribes

- QGIS workshop and data sharing
  - Mapping resources and skills building
  - Tribal community gathering & education
  - Tribal led implementation and presentation of data

MCDM Project

Phase 2-3 cultural data collection approach





Digitizing & georeferencing maps

PLEASE POST

Libraries
MICHIGAN STATE UNIVERSITY

GIS & MAPPING WORKSHOP

SPRING 2017

Introduction to QGIS:
Make a Simple Map with Vector Data

Monday, January 30 • 4:00–5:00p
Beaumont West Instruction Room, 2West

Learn the basics of QGIS, the free open source geospatial software—this workshop will demonstrate how to make a choropleth (color shaded) map and place graduated symbols on it, load shapefiles and .csv table files into QGIS, join data to spatial information and edit features.

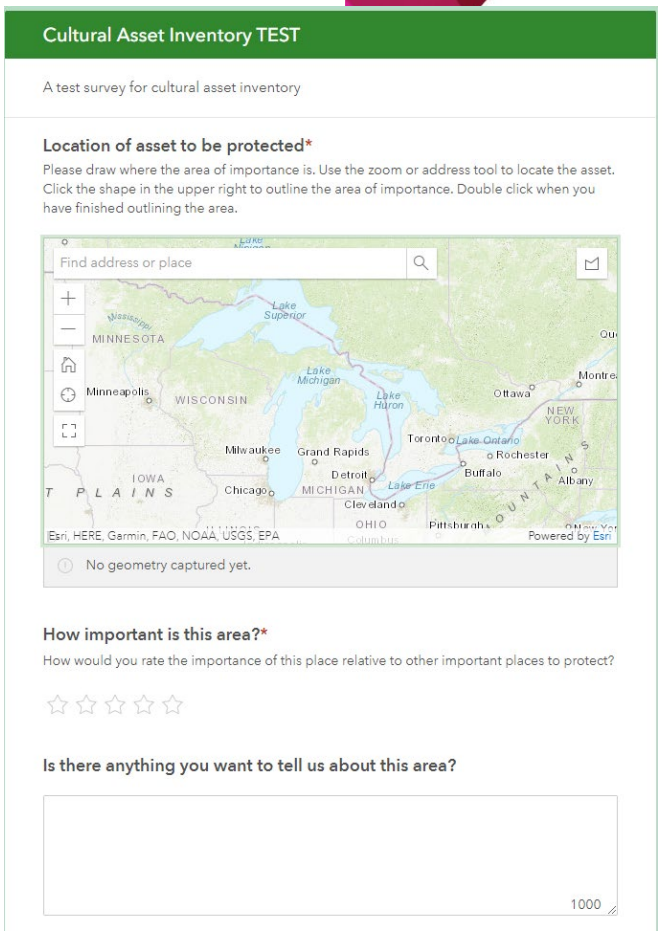
Workshops are free, but seating is limited. Reserve your place today!
bookings.lib.msu.edu

Questions? **Contact the Map Library at 517-884-6467.**

#MSULevents
lib.msu.edu

For parking information, please visit http://maps.msu.edu/interactive.
The Main Library is wheelchair accessible via the South entrance. Persons with disabilities may request accommodations by calling Lisa Denison at 517.884.6454 one week before an event. Requests received after that time will be met when possible.

MCDM Project



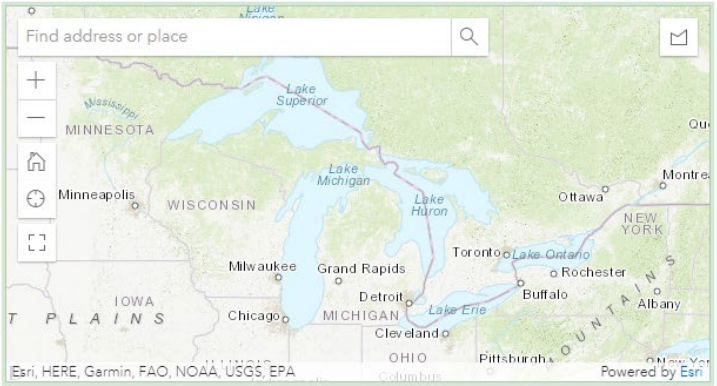
QGIS Workshop and Data Gathering

Cultural Asset Inventory TEST

A test survey for cultural asset inventory

Location of asset to be protected*

Please draw where the area of importance is. Use the zoom or address tool to locate the asset. Click the shape in the upper right to outline the area of importance. Double click when you have finished outlining the area.



No geometry captured yet.

How important is this area?*

How would you rate the importance of this place relative to other important places to protect?

☆ ☆ ☆ ☆ ☆

Is there anything you want to tell us about this area?

1000

What type of landuse is this?

- [ ] Hunting
- [ ] Fishing
- [ ] Gathering

Upload an image (optional)

1 Select image file (number of files allowed: 1 - 10)

Submit

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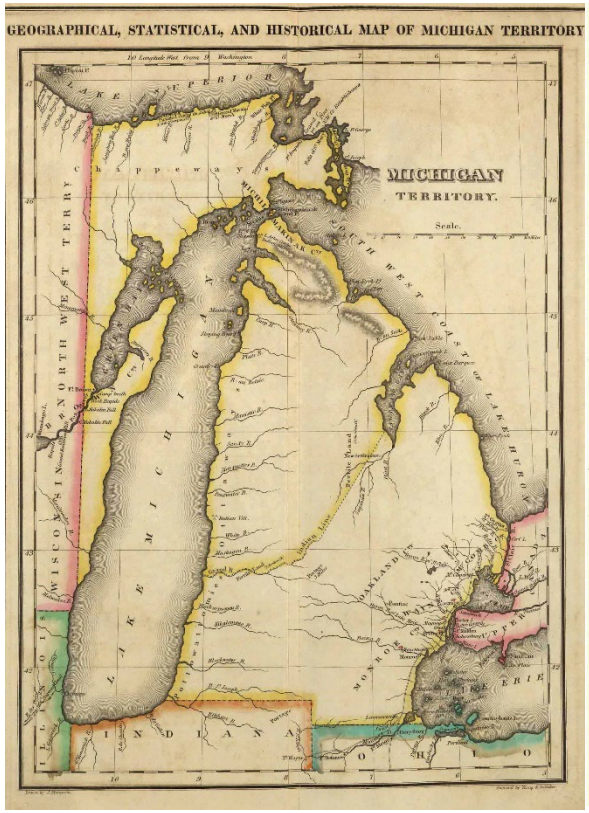
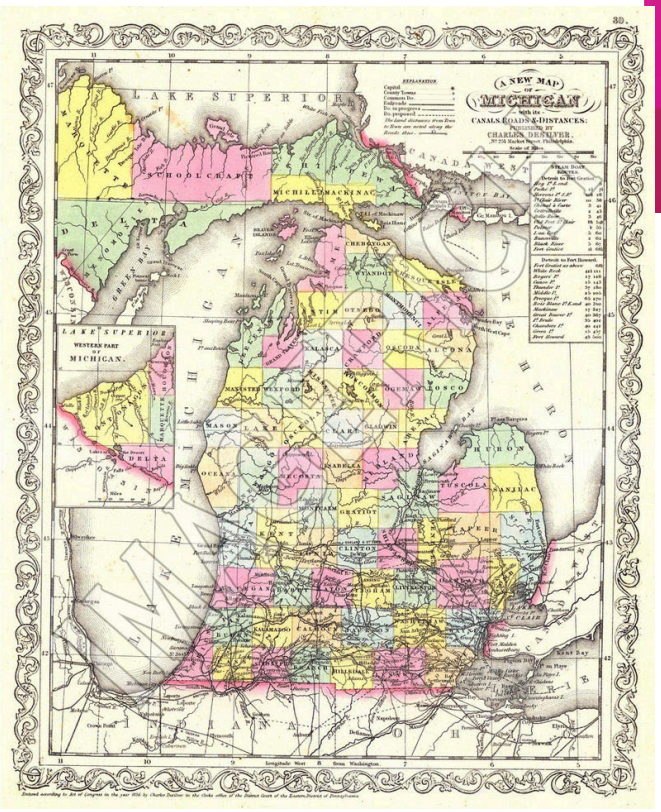
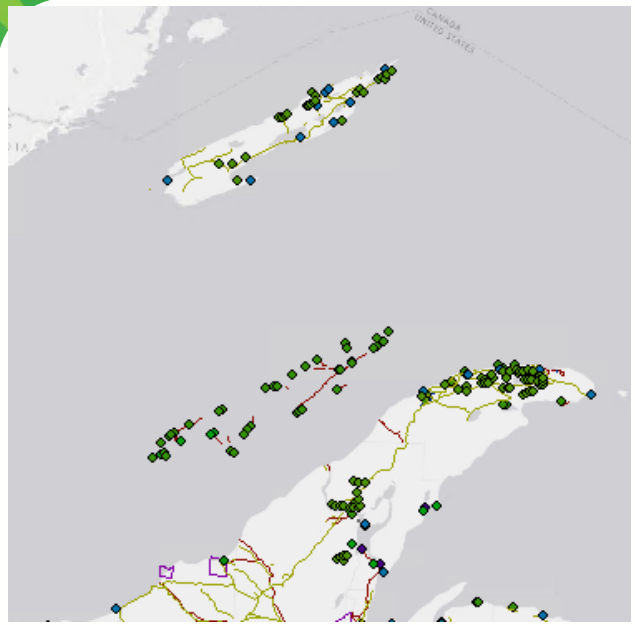


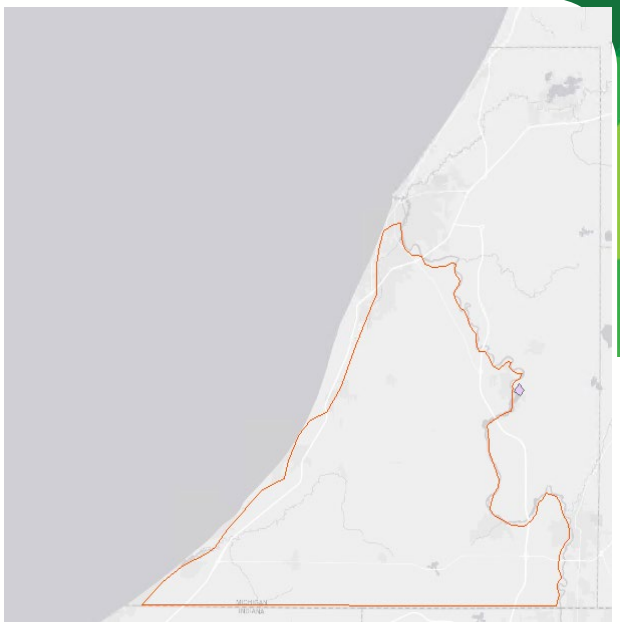
Michigan 1836

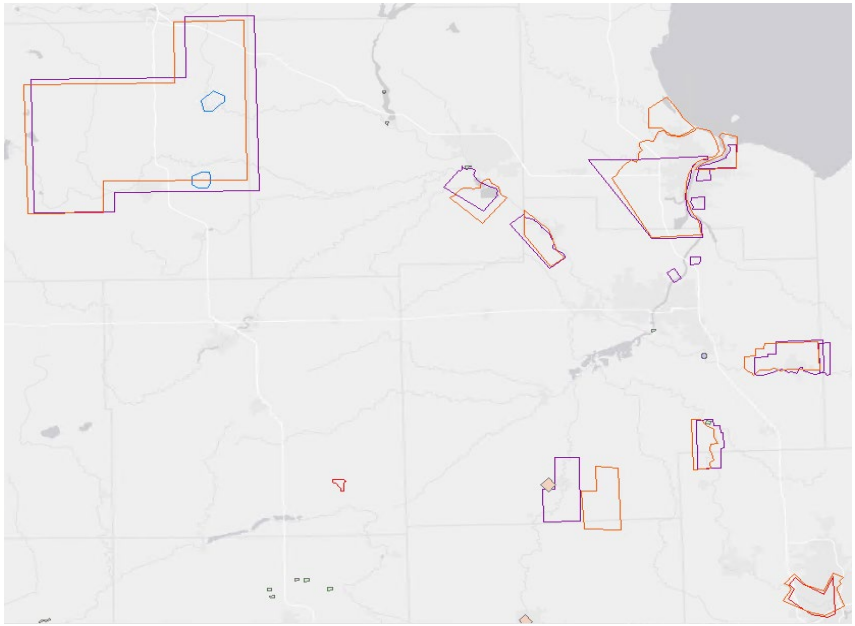


Michigan 1856

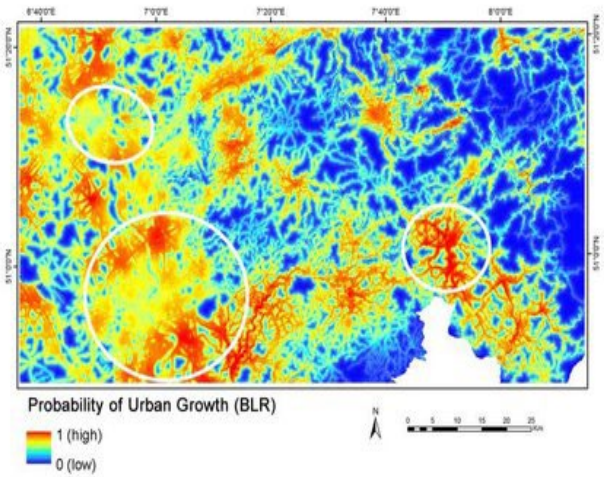
Maps & contexts

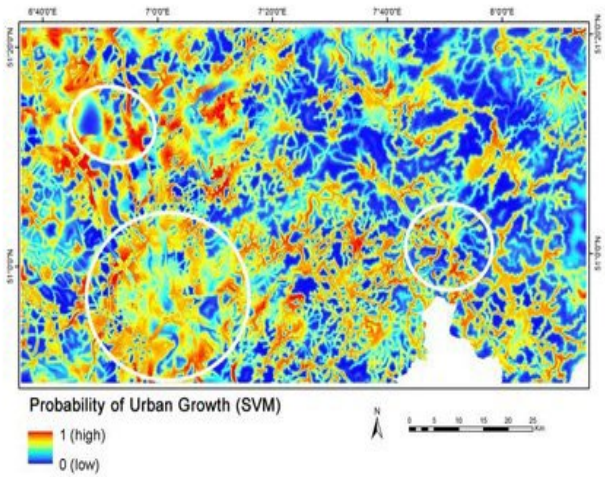


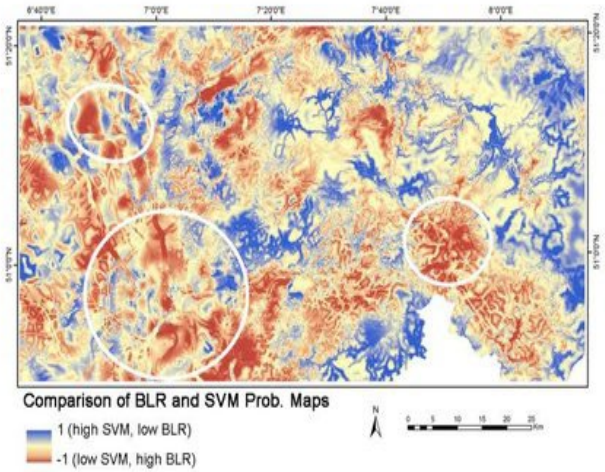




MCDM Project







MCDM Project

Predictive modeling

Co-creating a predictive model

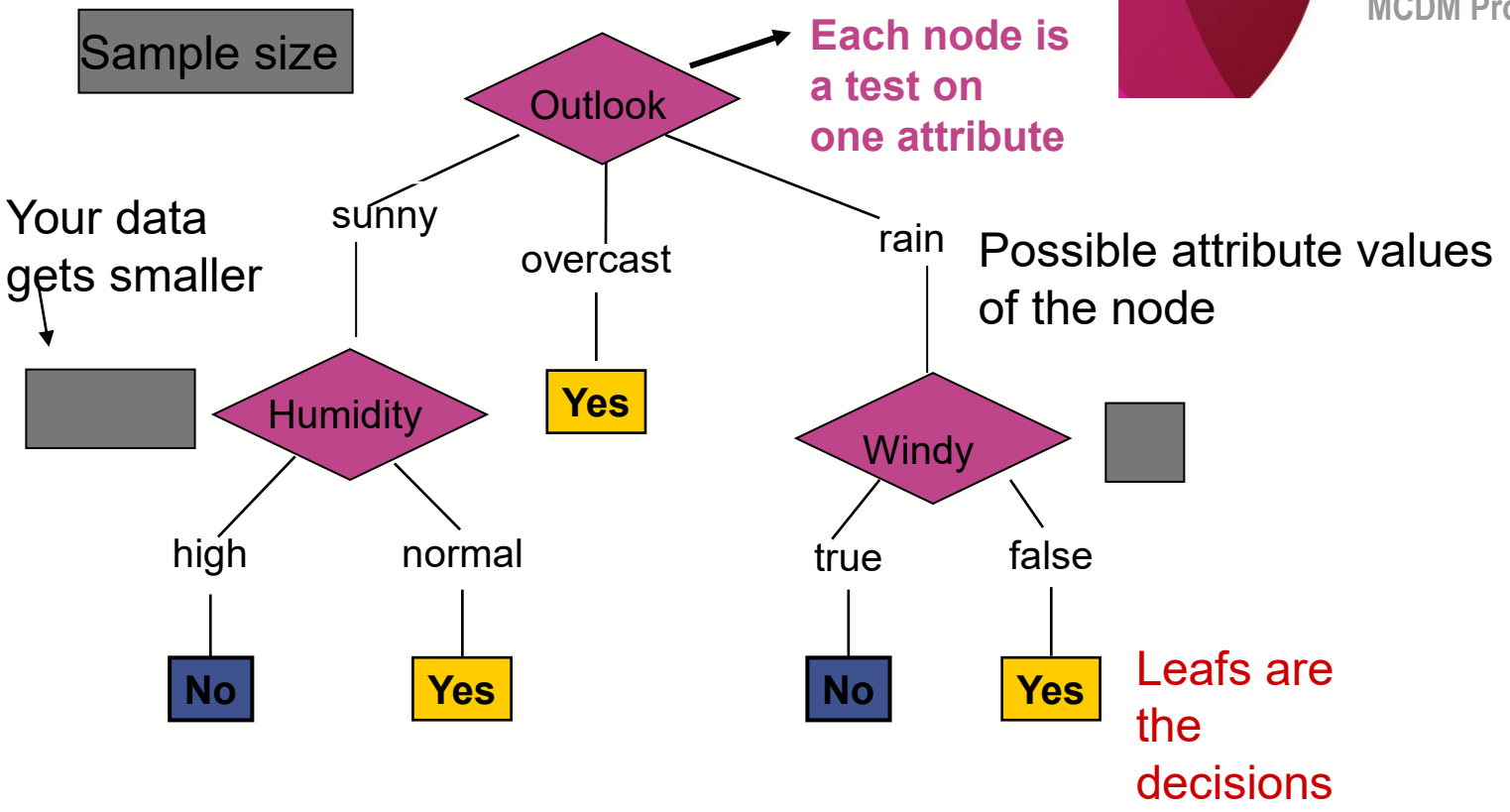
MCDM Project

Step 1 – Historical framework
Provide historical heritage data collected
Characterize and categorize historical features

Step 2 – Behavioral framework
Provide determinations about cultural behavior based on existing cultural models and what we know about Michigan archaeology and ethnography.

Step 3 – Employ bootstrapping sampling approach to determine the probabilities matching historical and behavioral data sets. Identify variable priority and importance to create a predictive model of heritage sites

Anatomy of a decision tree



MCDM Project

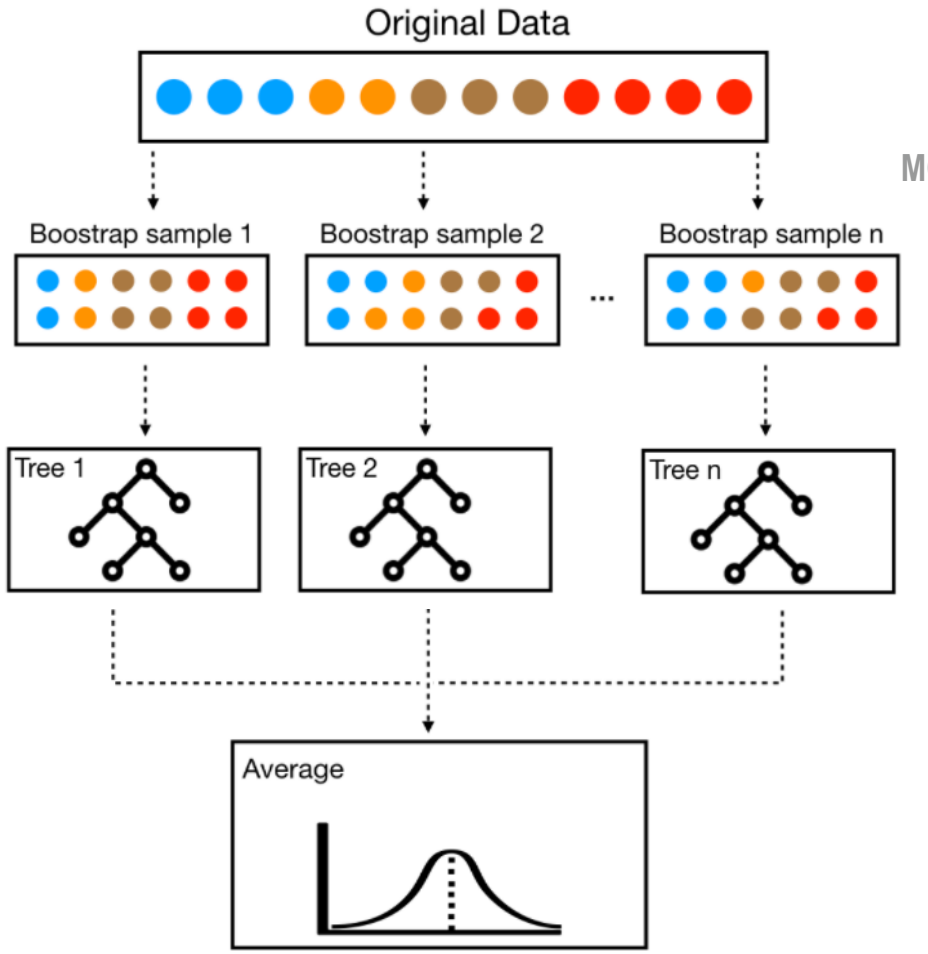
Bagging :
Bootstrap Aggregating

1. Sample records with replacement (aka "bootstrap" the training data)

Sampling is the process of selecting a subset of items from a vast collection of items.
Bootstrap = Sampling with replacement. It means a data point in a drawn sample can reappear in future drawn samples as well.

2. Fit an overgrown tree to each resampled data set

3. Average predictions



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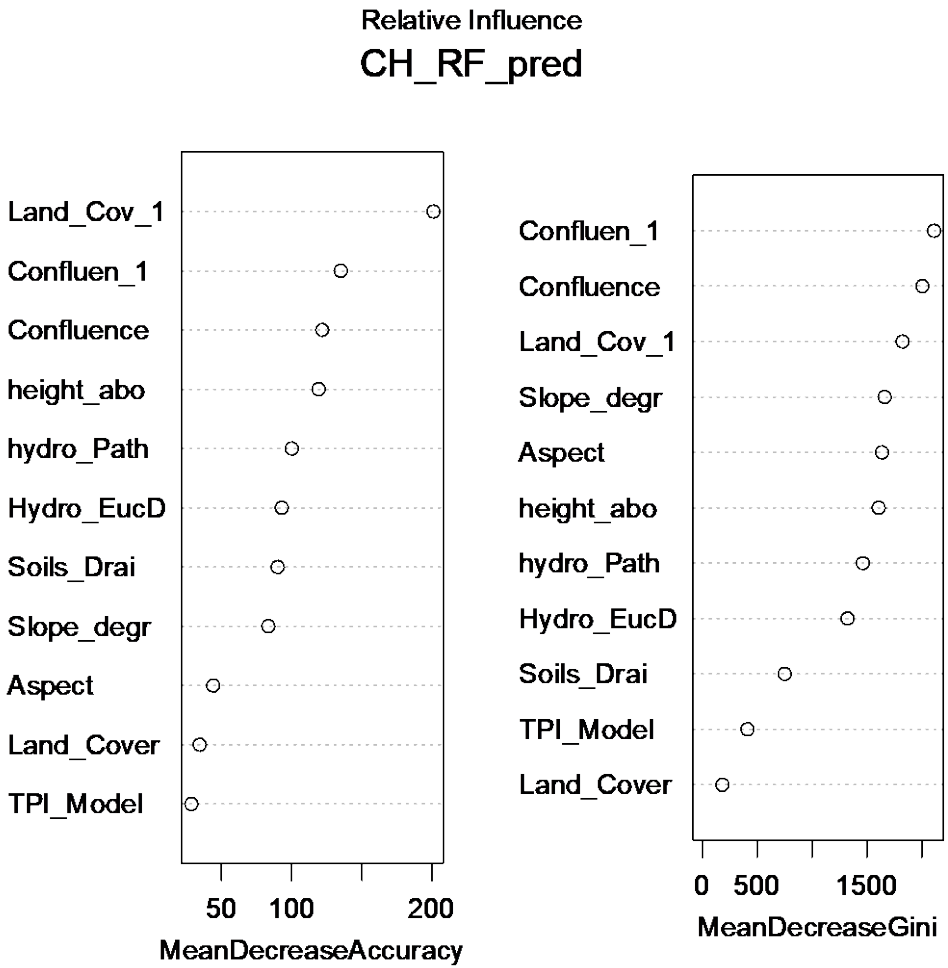
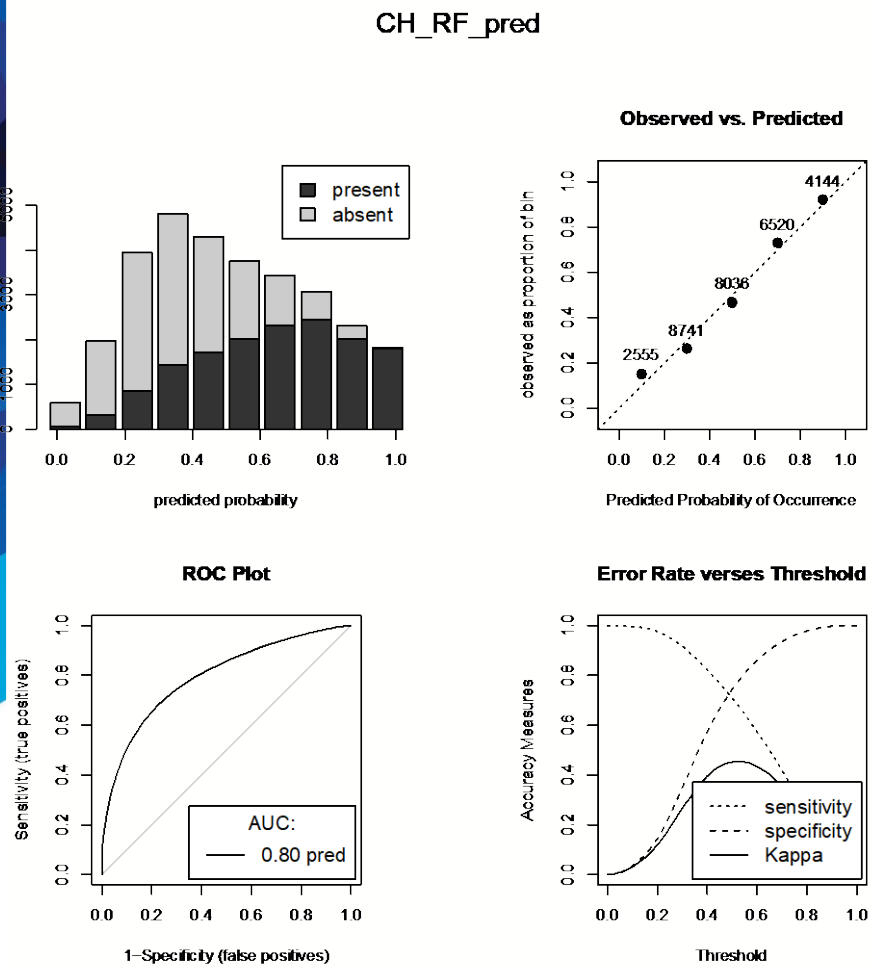
Variable Importance

Variable Importance

- Mean Decrease in Accuracy:
  - The decrease in accuracy from permutating the values in each feature.
- Mean Decrease in Gini:
  - the average (mean) of a variable's total decrease in node impurity, weighted by the proportion of samples reaching that node in each individual decision tree in the random forest.
  - This is effectively a measure of how important a variable is for estimating the value of the target variable across all of the trees that make up the forest.
  - A higher Mean Decrease in Gini indicates higher variable importance.





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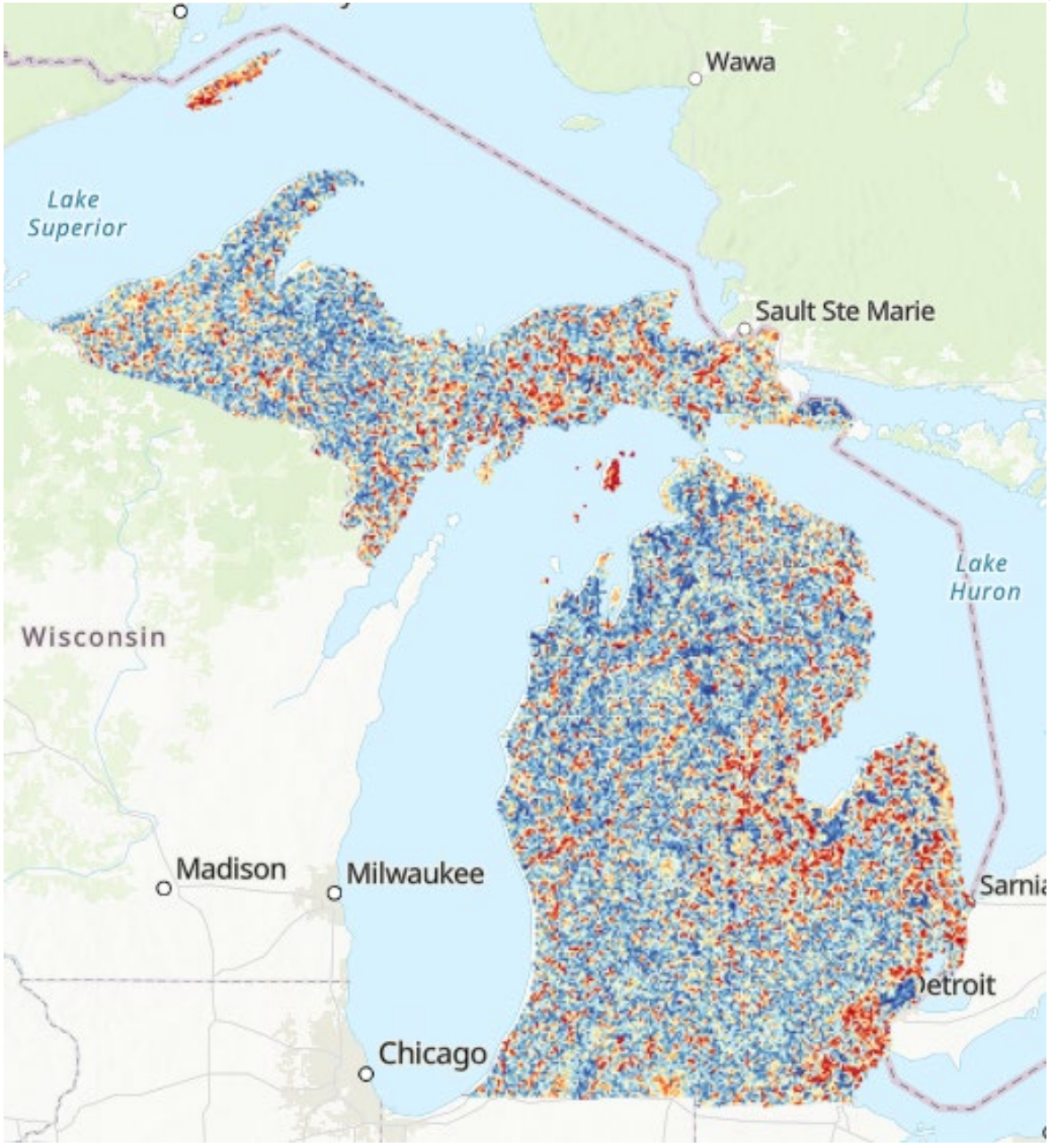
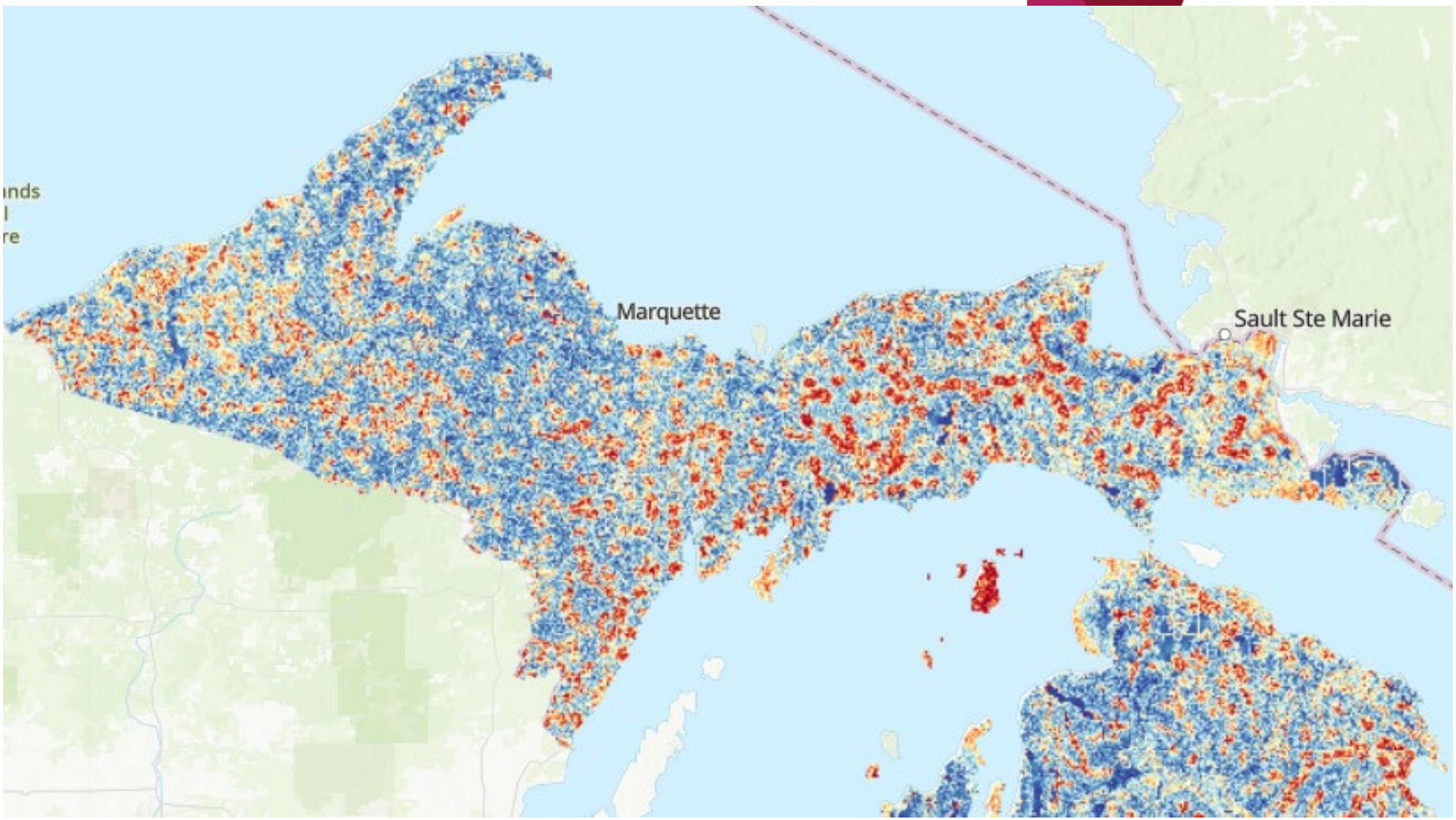
- AUC=closer to 1 the better the model.
- AUC=under .5 model needs to be completely reworked. AUC is equivalence to the change that a randomly chosen plot with an observed value of presence will have a predicted probability higher than that of a randomly chosen plot of absence.

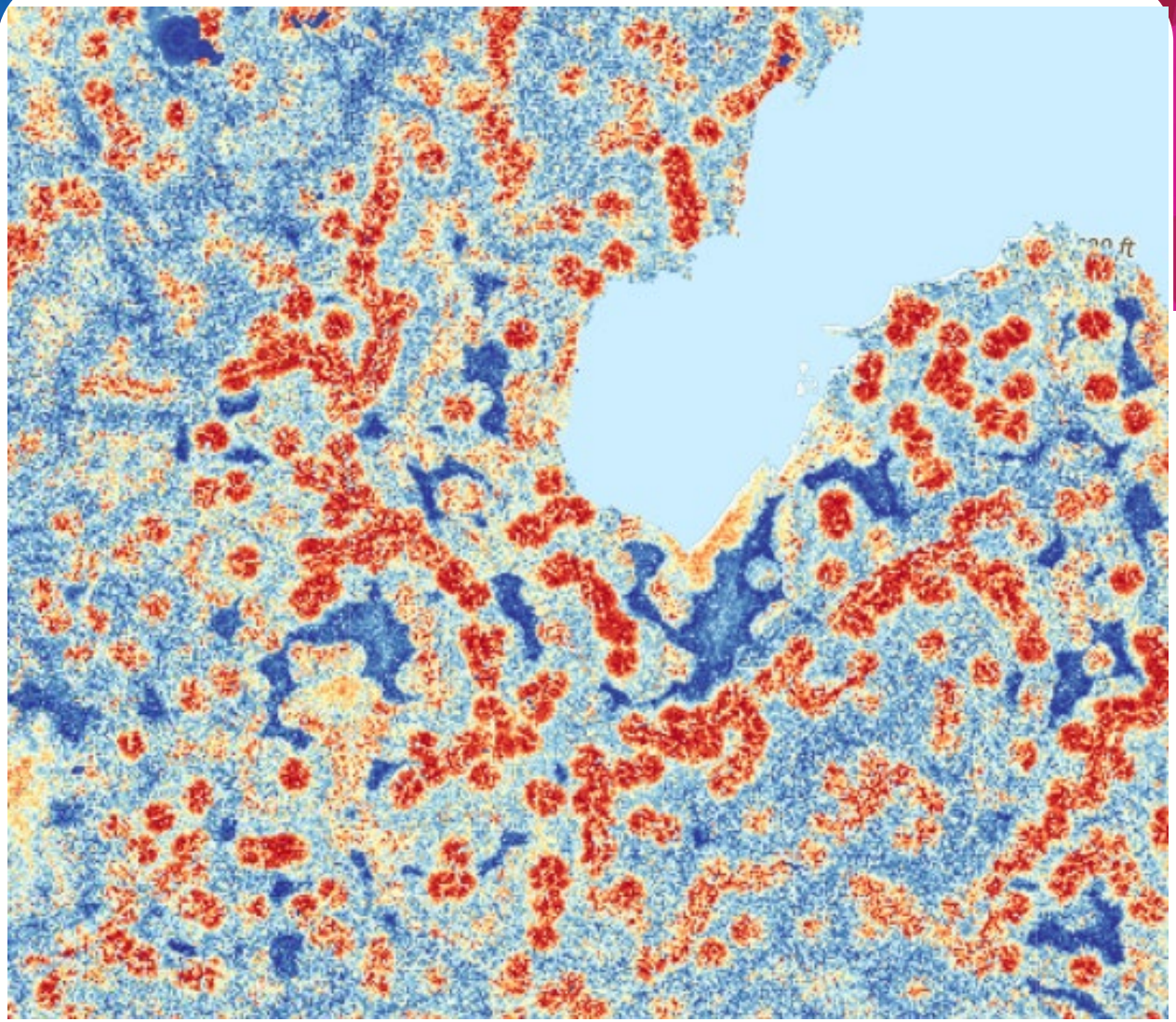


MCDM Project

Michigan heritage probabilities

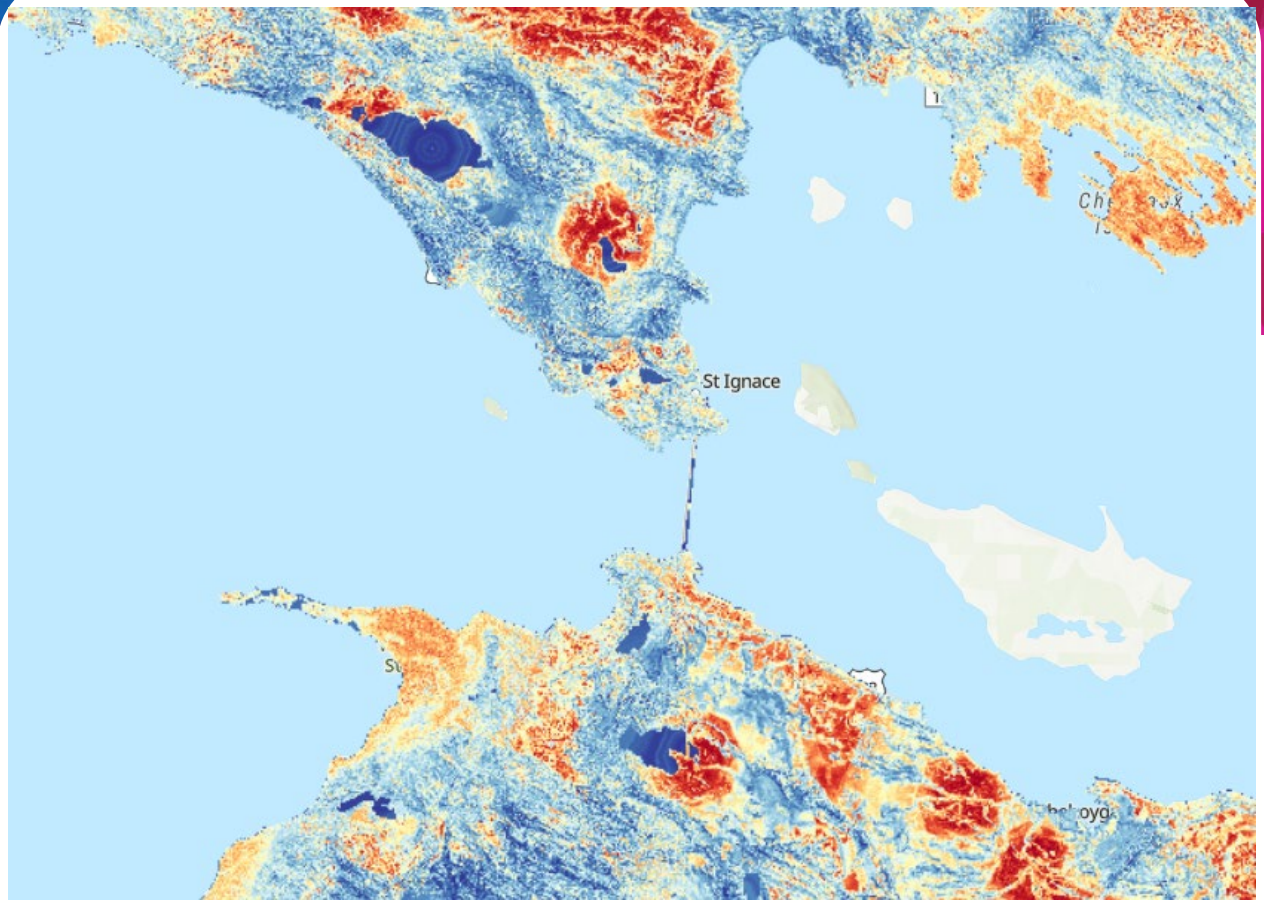
Michigan Upper Peninsula heritage probabilities





MCDM Project

Saginaw watershed heritage probabilities



MCDM Project

Mackinac Straights heritage probabilities

Learnings

MCDM Project

- All of Michigan is an Indigenous landscape
- Cultural behaviors -> features
  - historical and contemporary
- Hidden landscape requires lived experience data
- Role of archaeological, lidar data

- Hosting and access
- Ground truthing?
- Next steps
  - Iterate the process - data collection; digitization and model creation
  - Make dataset accessible to tribal communities
  - Provide secure access to credentialled individuals

Observed patterns on predictive model

- Cultural interaction spheres
- Climatic regime – biotic province density

- Travel networks
  - River transport
  - Trade & exchange network
  - Regional interaction

- Resource zones
  - Wetland and riparian areas
  - Buffer zones and edge effects

- Horticultural potential
- Palimpsest effect

Thank you

IMAGIN 2022 – MACKINAC ISLAND

Questions & Comments

MCDM Project

NYAA
PUBLIC AND ENVIRONMENTAL HEALTH
Nyaahealth.org

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LIBRARIES

https://lib.msu.edu/maps/