TRIBAL GIS IN THE MOUNTAIN REGION: GEOSPATIAL TECHNOLOGIES AND TRIBAL CONSULTATION FOR ADAPTIVE PLANNING IN INTEGRATED RESOURCE MANAGEMENT

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FORMULATING THE PROBLEM

1. How can forest management protect ecosystems in face of climate change and the human use of natural resources?
2. How can forest management adapt to social, economic, and cultural conditions?
3. What role can communities play in informing adaptive forest management?
FORMULATING THE PROBLEM: CHANGING CLIMATE DRIVERS

US temperature change, 1900s – 2000s (NASA)

US precipitation change, 1900s – 2000s (NASA)
FORMULATING THE PROBLEM: CHANGING FIRE PATTERNS

Wildfires Reach a Major Milestone in 2015

1.0 million acres burned for first time on record


For more information, visit U.S. EPA’s “Climate Change Indicators in the United States” at www.epa.gov/climate-indicators.
FORMULATING THE PROBLEM: COMPLEX FEDERAL LAND USE
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All existing forest plans in the NFS are based on the 1982 Planning Rule plus amendments.

2000, transition provisions to develop, revise, and amend forest plans in the NFS.

2012, new Planning Rule for the NFS:
- Integrated and holistic approach to management: interdependence of ecological resources and processes, and of social, ecological, and economic systems.
- Collaborative and participatory approach to land management planning.
- Coordination of FS land management planning with equivalent planning efforts of federally recognized Tribes.
LEGAL FRAMEWORK: TRIBAL CONSULTATION

- National Historic Preservation Act (NHPA), 1966
- Archaeological Resources Protection Act (ARPA), 1979
- Executive Order 12875 (1993) – Enhancing the Intergovernmental Partnership
- Executive Order 12898 (1994) – Environmental Justice for Low Income & Minority Populations
- Executive Order 13007 (1996) – Indian Sacred Sites
- Executive Order 13084 (1998) – Consultation and Coordination with Indian Tribal Governments
- Executive Order 13175 (2000) – Consultation and Coordination with Indian Tribal Governments
- Executive Memorandum (2009) – Tribal Consultation
HUMAN DIMENSIONS PROGRAM AT RMRS: GOALS

- What changes in the environment do Tribal residents, both resource specialists and not, perceive in the Rocky Mountain region?
- How might future conditions affect indigenous values flowing from public lands?
- What are the best ways to protect these values across time?
- How local knowledge and indigenous science can inform FS management for the protection of coupled social-ecological systems?
HUMAN DIMENSIONS PROGRAM AT RMRS: PARTNERS
CASE STUDY: FLATHEAD INDIAN RESERVATION

Home to the Confederated Salish and Kootenai Tribes: Bitterroot Salish, Pend d'Oreille (Upper Kalispel), Kootenai.

Surrounded by the Flathead NF, Lolo NF, and Kootenai NF.
Selected Salish place names in the aboriginal territories of the Salish and Pend d’Oreille tribes (courtesy of CSKT).
CASE STUDY: FLATHEAD INDIAN RESERVATION

Pilot area: Jocko River basin

- Primitive Area (east).
- Adjacent to the Tribal Mission Mountains Wilderness (northeast), FS Rattlesnake Wilderness (southeast).
- Woodland, grassland, and riparian.
- Localized urban development along Highway 93.
METHODS: PARTICIPATORY GIS

Participatory Learning and Action practice by means of Geographic Information Systems and Science (G. Rambaldi et al., 2006. Participatory Spatial Information Management and Communication in Developing Countries)

PLA: Methods, attitudes and behavior to enable people to share, enhance and analyze their knowledge of life and conditions, and to plan, act, monitor, evaluate and reflect (R. Chambers, 2007)
METHODS: FUZZY GEOGRAPHY

Point, line and polygon abstractions are crisp data models that assume locations of phenomena are known with certainty.

Fuzzy data models allow the representation of phenomena that are vaguely or imperfectly known.
METHODS: MULTIMEDIA GIS

GIS with capacity to attach data in different formats (e.g. documents, images, tables) to locations in space.

Mapping Meanings (Map-Me) enables PGIS activities based on fuzzy and multimedia (text) data collection.
RESULTS: FUZZY PLACES AFFECTED BY ENVIRONMENTAL CHANGES
RESULTS: SYNTHESIS OF ENVIRONMENTAL CHANGE

Cell value = Number of participants that observed environmental alterations in the location.
RESULTS: CLUSTERING OF PLACES

• Similarity between fuzzy places were measured as the Jaccard similarity index.
• Fuzzy places were clustered based on their Jaccard distance, using the Ward hierarchical merging method.
RESULTS: CLUSTERING OF PLACES

1) Grassland
   Native preserved

2) Riparian
   Invasive tree and fish species

3) Forested hillsides
   Overgrown due to fire suppression. Pine beetle

4) Global scope
   Invasive species. Pine beetle

5) Tribal wilderness
   Overgrown due to fire suppression. Pine beetle

6) Upper Jocko
   Overgrown due to fire suppression

7) Low-urbanized
   Reduced wildlife due to over-developed, timber, grazing

8) Hills interfacing with rangeland
   Less tree diversity

9) Western sites
   Water quality worsen due to run-off
RESULTS: FILTERING OF ANSWERS BY COMMENTS

Synthesis of fuzzy places that include comments in support of reintroducing prescribed fire in the place.
RESULTS: FILTERING OF ANSWERS BY COMMENTS, DEMOGRAPHICS

Overgrown plant communities are observed

Application of prescribed fire is supported
DISCUSSION

- How can accuracy be measured in data that was collected through a Participatory GIS process?

- How can fuzzy geographic features be used in the practice of land management as usual?

- Who owns the data contributed through a PGIS process?
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