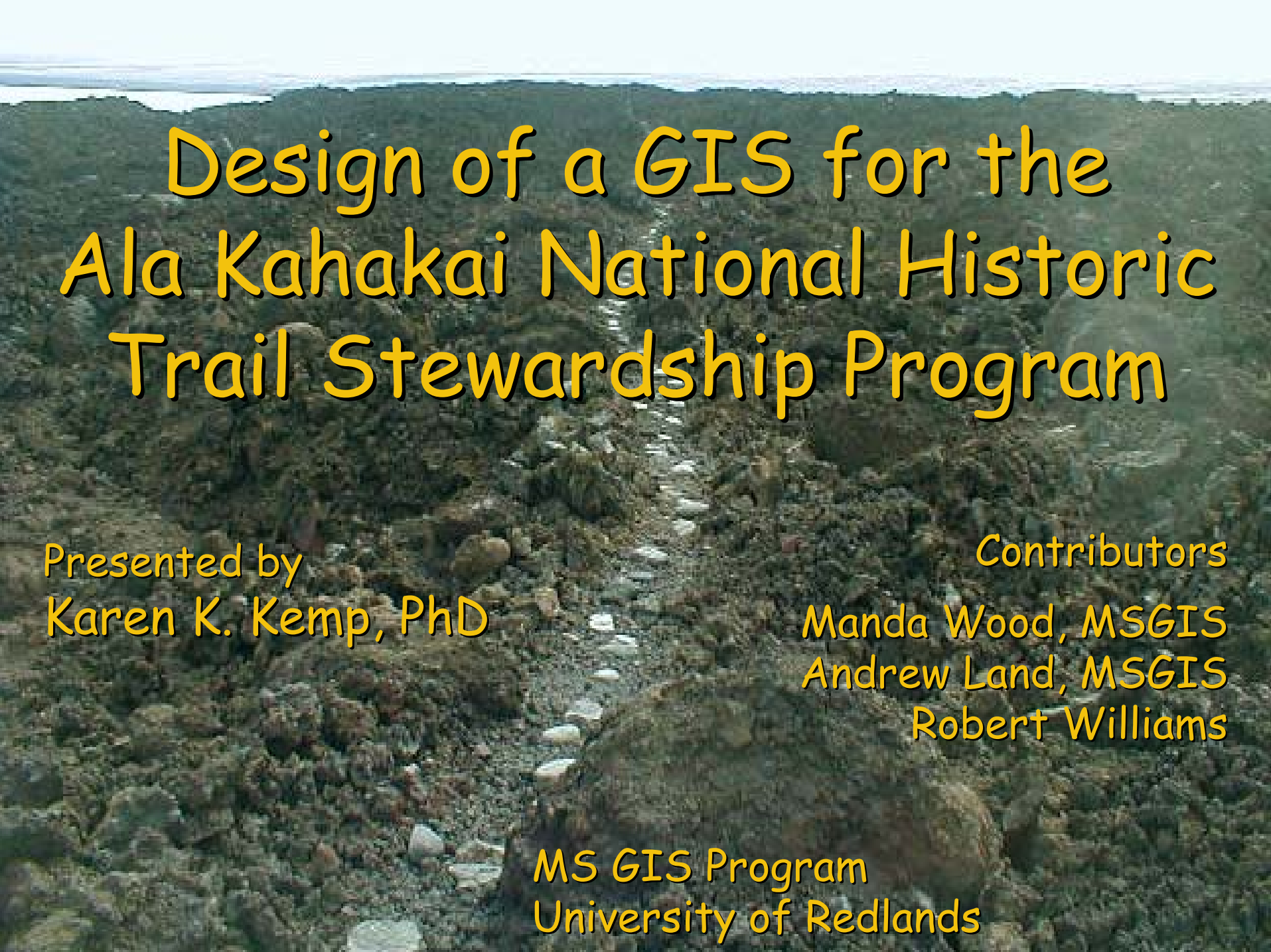
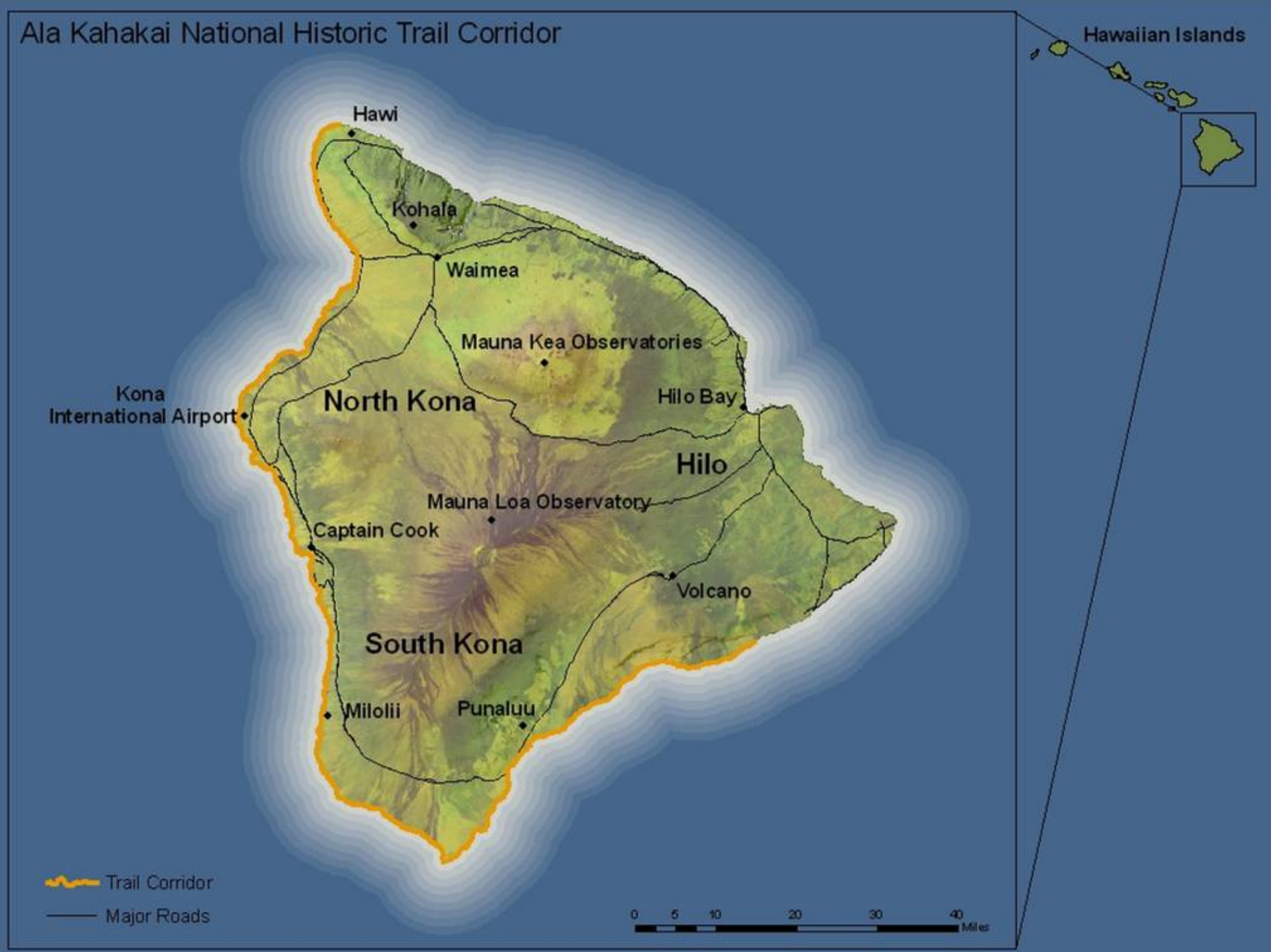


Design of a GIS for the Ala Kahakai National Historic Trail Stewardship Program

Presented by
Karen K. Kemp, PhD

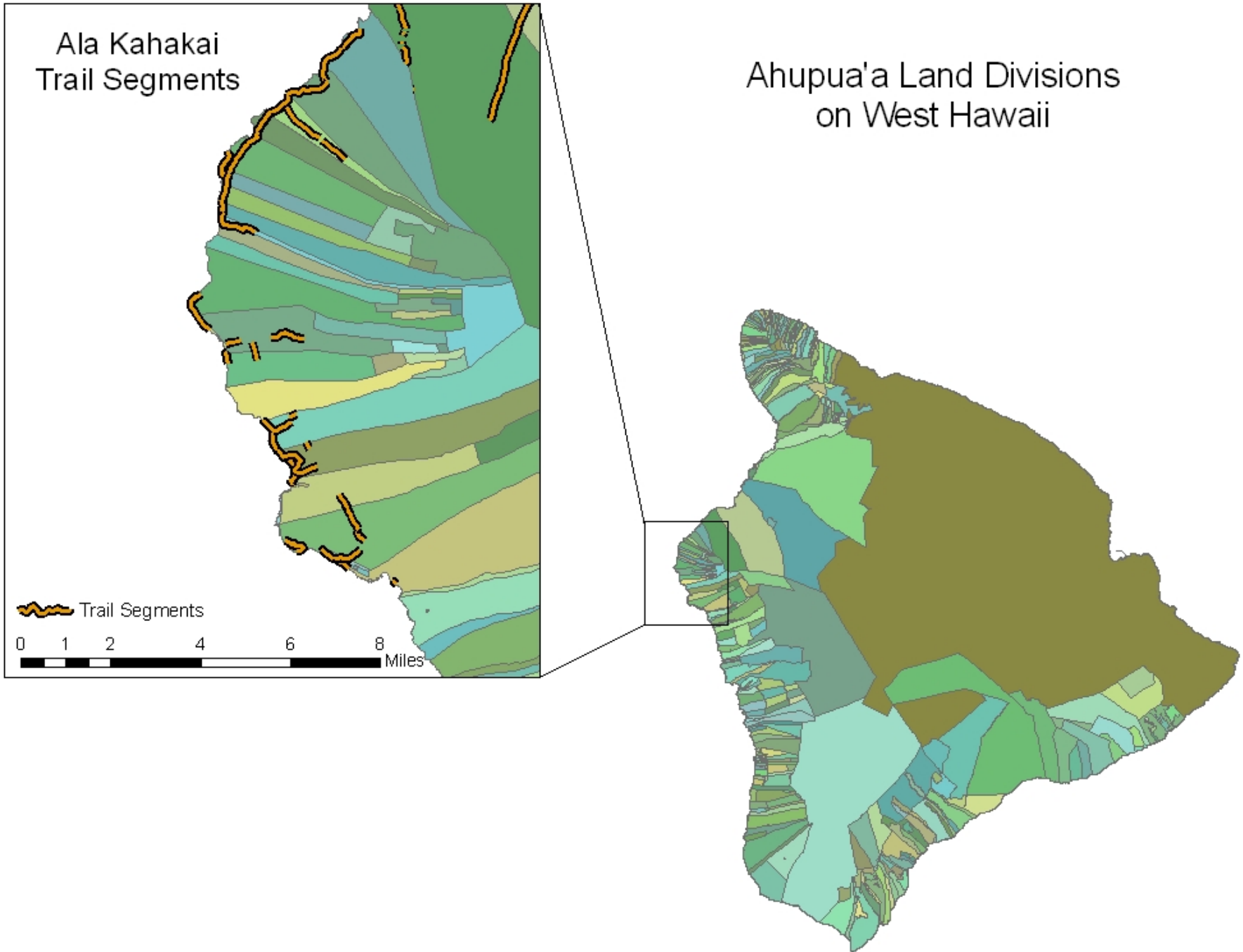
Contributors
Manda Wood, MSGIS
Andrew Land, MSGIS
Robert Williams

MS GIS Program
University of Redlands


Ala Kahakai National Historic Trail Corridor
Hawaiian Islands
Hawi
Kohala
Waimea
Mauna Kea Observatories
Kona
International Airport
North Kona
Hilo Bay
Hilo
Mauna Loa Observatory
Captain Cook
Volcano
South Kona
Milolii
Punaluu
Trail Corridor
Major Roads
0 5 10 20 30 40
Miles

Ala Kahakai National Historic Trail

- Established in 2000 to preserve, protect and interpret traditional Native Hawaiian culture and natural resources
- 175+ mile trail corridor along the west coast of the Island of Hawaii
  - Captures existing coastal trail and mauka-makai segments
  - Requires establishment of new trail segments
- Not yet open, completion of the comprehensive management plan is pending


Ala Kahakai
Trail Segments
Trail Segments
0 1 2 4 6 8
Miles
Ahupua'a Land Divisions
on West Hawaii

Cultural resources along the trail include:
several important heiau (temples),
royal centers,
kahua (house site foundations),
loko 'ia (fishponds)
ko`a (fishing shrines),
ki'i pohaku (petroglyphs),
holua (stone slide), and
wahi pana (sacred places).

Natural Resources include anchialine ponds, pali (precipices), nearshore reefs, estuarine ecosystems, coastal vegetation, migratory birds, native sea turtle habitat, and several threatened and endangered endemic species of plants and animals

Management of the AKNHT

- NPS requirements
  - Data and metadata protocols
  - Inventory and Monitoring Program
  - ArcGIS!
- AKNHT is not a "square park"
  - AKNHT has no land holdings
    - 85% of the land parcels traversed are privately owned
  - Requires identification of trail stewards as land managers

AKNHT Trail Stewardship Program

"One of our goals here at Ala Kahakai NHT is to develop demonstration inventory and monitoring (I&M) projects using GIS as a tool for the community-based management of cultural and natural features found along the trail and for the maintenance of the trail itself."

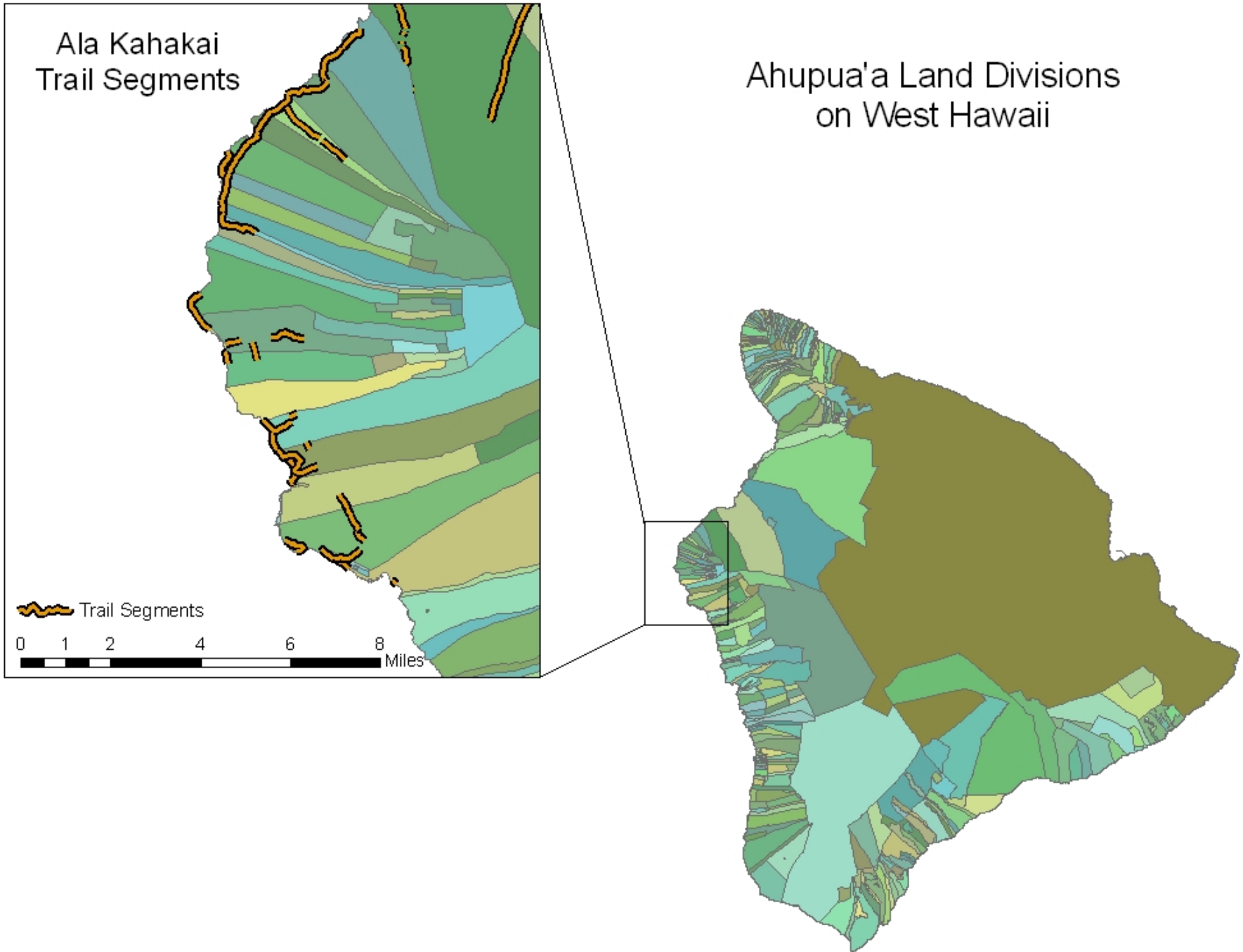
Aric Arakakai, Park Superintendent

Trail stewards

- May be
  - Families with traditional ties to the land divisions
  - Schools
  - Canoe clubs
  - Service clubs
  - Private land owners such as large resort hotels or developments.
- Each responsible for overseeing approximately 3 miles of trail
- Level of technical expertise and access to technology varies from none to expert

Management of the AKNHT

- NPS requirements
  - Existing data and metadata protocols
  - Inventory and Monitoring Program
  - ArcGIS!
- AKNHT is not a "square park"
  - AKNHT has no land holdings
    - 85% of the land parcels traversed are privately owned
  - Requires establishment of trail stewards as land managers
- To be managed using traditional methods as much as possible
  - Thus, trail segments for individual steward groups correspond to traditional ahupua'a land divisions

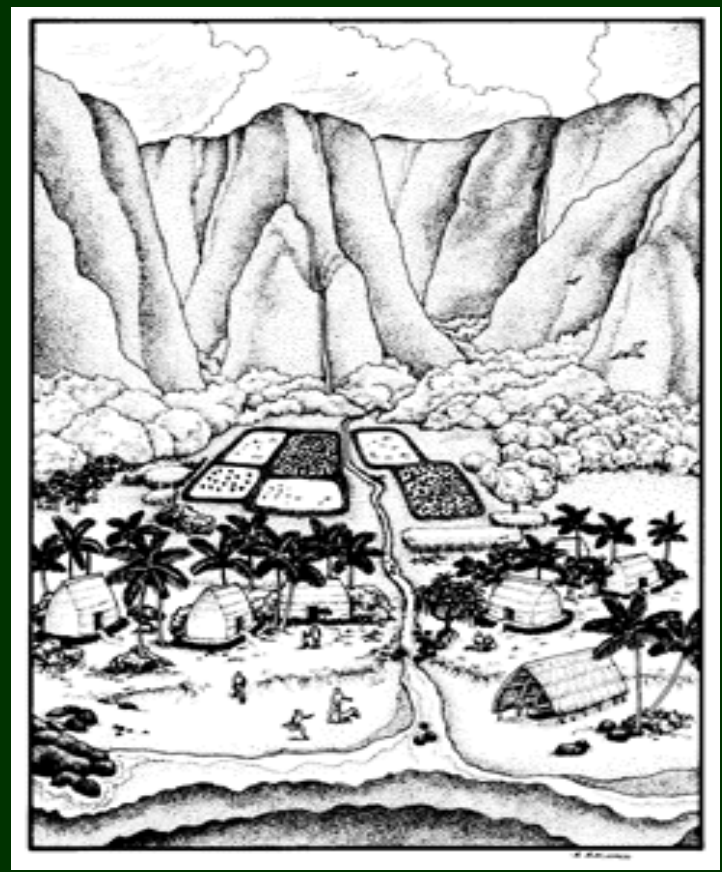

Ala Kahakai
Trail Segments
Trail Segments
0 1 2 4 6 8
Miles
Ahupua'a Land Divisions
on West Hawaii

Ahupua'a – "watersheds" of Hawaii

"As the native Hawaiians used the resources within their *ahupua'a*, they practiced *aloha* (respect), *laulima* (cooperation), and *malama* (stewardship) which resulted in a desirable *pono* (balance).

This is sound resource management where the interconnectedness of the clouds, the forests, the streams, the fishponds, the sea, and the people is clearly recognized."

(Carlos Andrade)



Hawaiian Science/Traditional knowledge

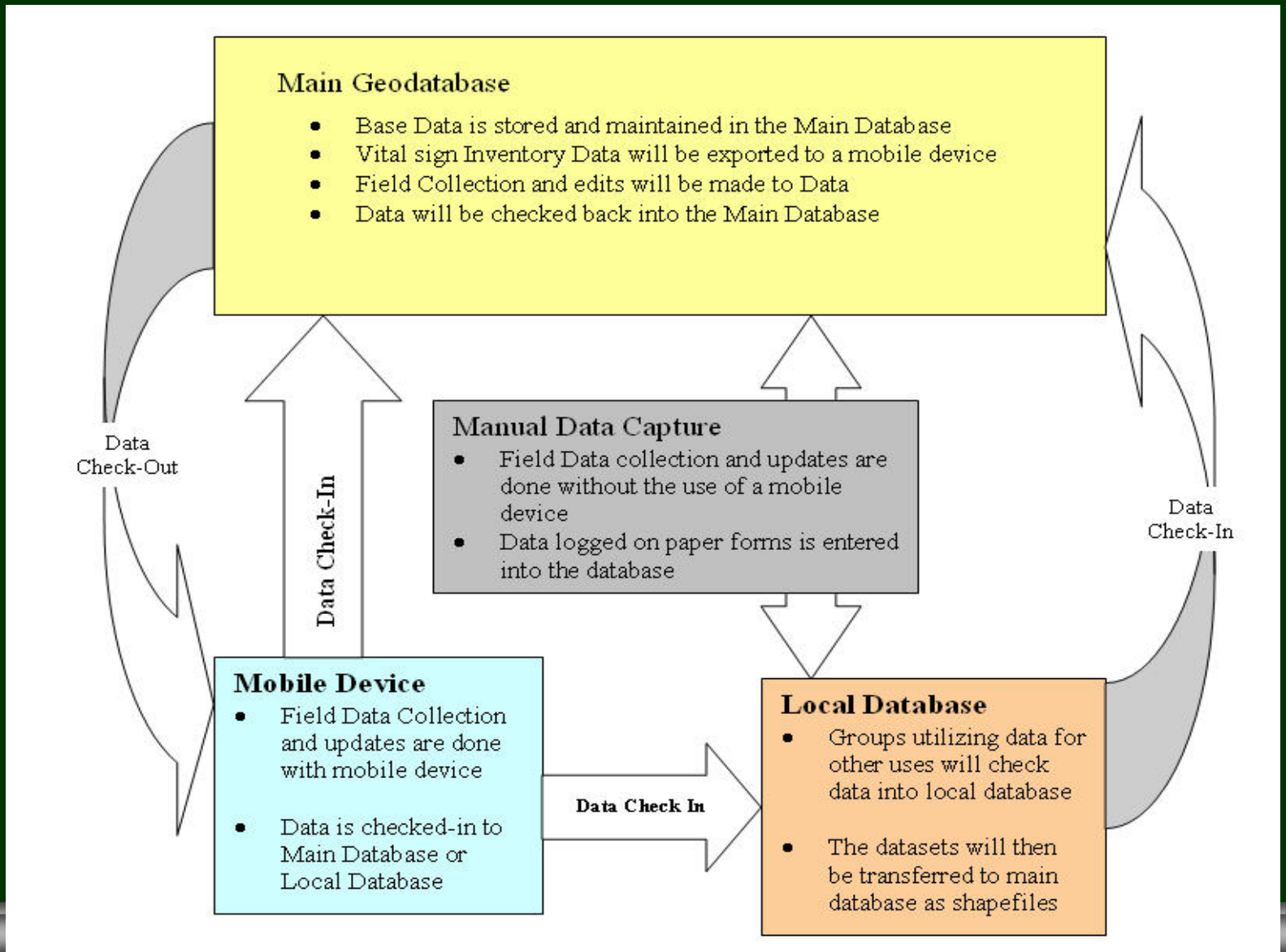
- Many *'ōlelo no'eau* (proverbs) take on the form of correlative statements, as in:
  - *Pua ka wiliwili, nanahu ka manō*
    - The wiliwili is blooming, the shark is biting

- The blooming season for wiliwili is at the end of the Kau wela (hot season) and before the rains of the Ho'oilo (wet season).
- This matches peak aggregations of sharks in shallow waters called "lālani kalalea" (rows of protruding fins) that occur at the same time.
- The practical consequence of prediction of shark behavior through a land phenomenon (blooming of a particular plant) is obvious. Long before you enter the water, you know to be watchful for sharks.

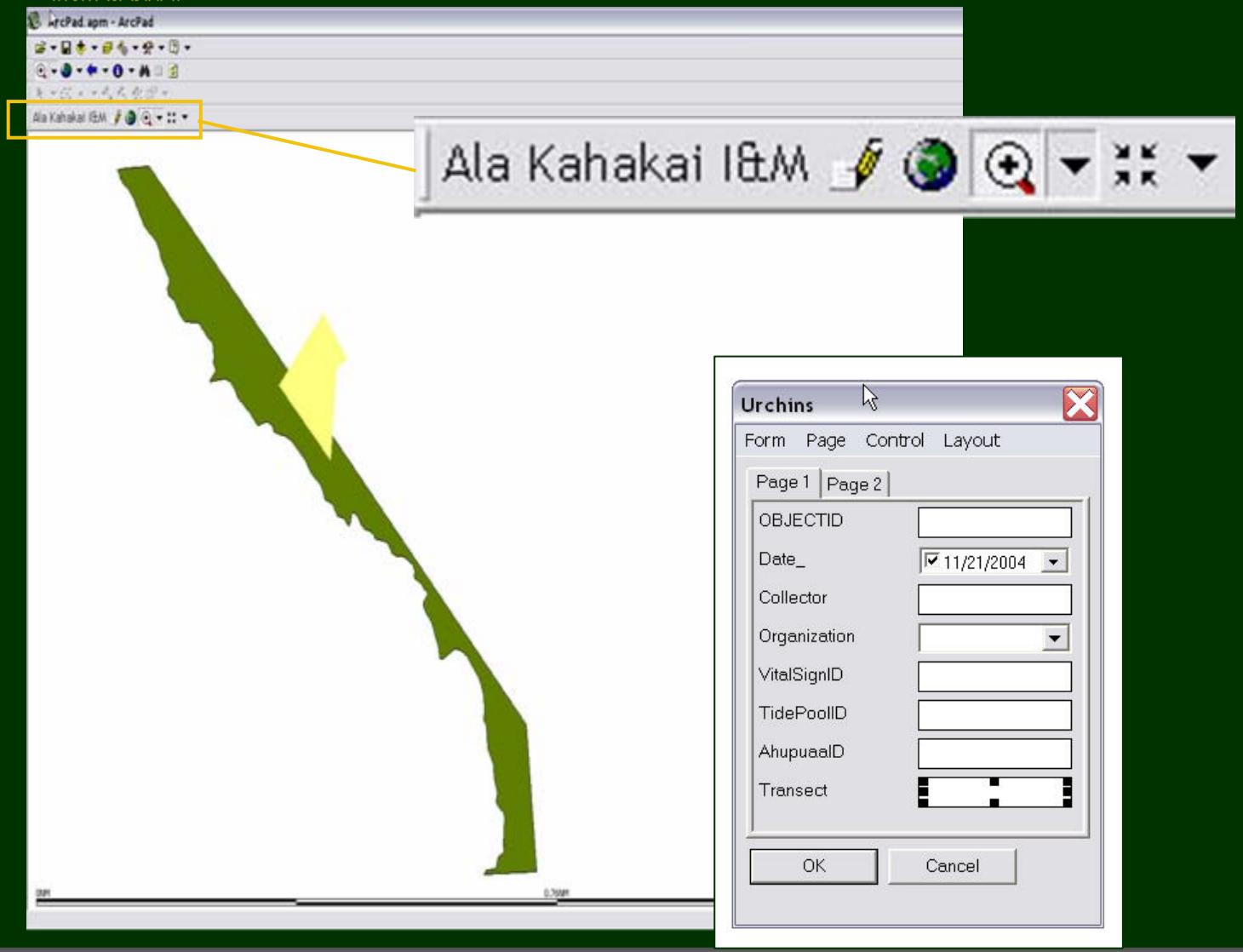
UR and AKNHT trail stewards

- UR is developing a GIS infrastructure to provide:
  - A trail steward geodatabase design that will
    - Manage data appropriate for NPS purposes and
    - Allow integration of Hawaiian and western science and cultural information
  - Structured data collection methods, standards and protocols to
    - Adhere to NPS standards and
    - Ensure quality control
  - Methods for remote upload and download of data
  - Hands-on GIS instruction and mentoring for stewards
- UR participants include MS GIS faculty and students, and the Redlands Institute

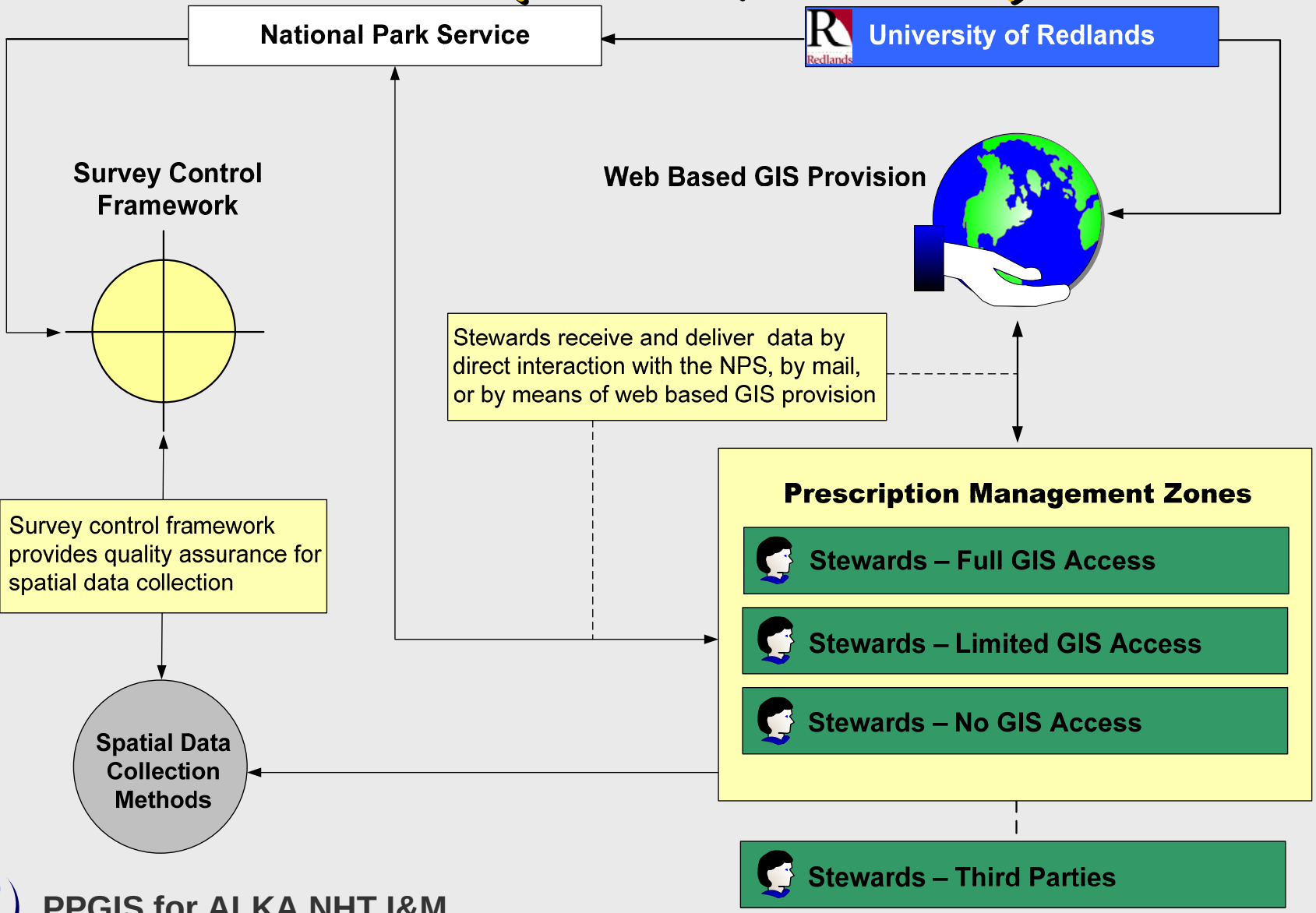
Mobile data collection (Wood, 2004)



ArcPad application



PPGIS/IMS (Land, 2005)



Low-End Process

- For user groups without access to Mobile Device
  - Field Data Collection with paper forms
  - Adding X,Y data to the Database

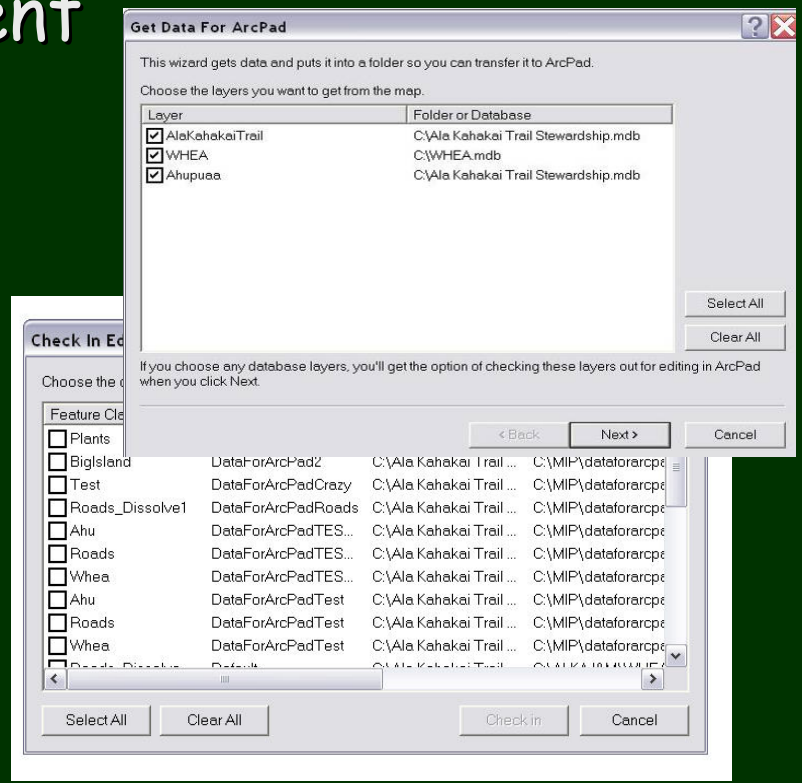
Plant Survey
Vital Sign Code: T6

Date:_____
Organization:_____
Collector:_____
Ahupua'a _____

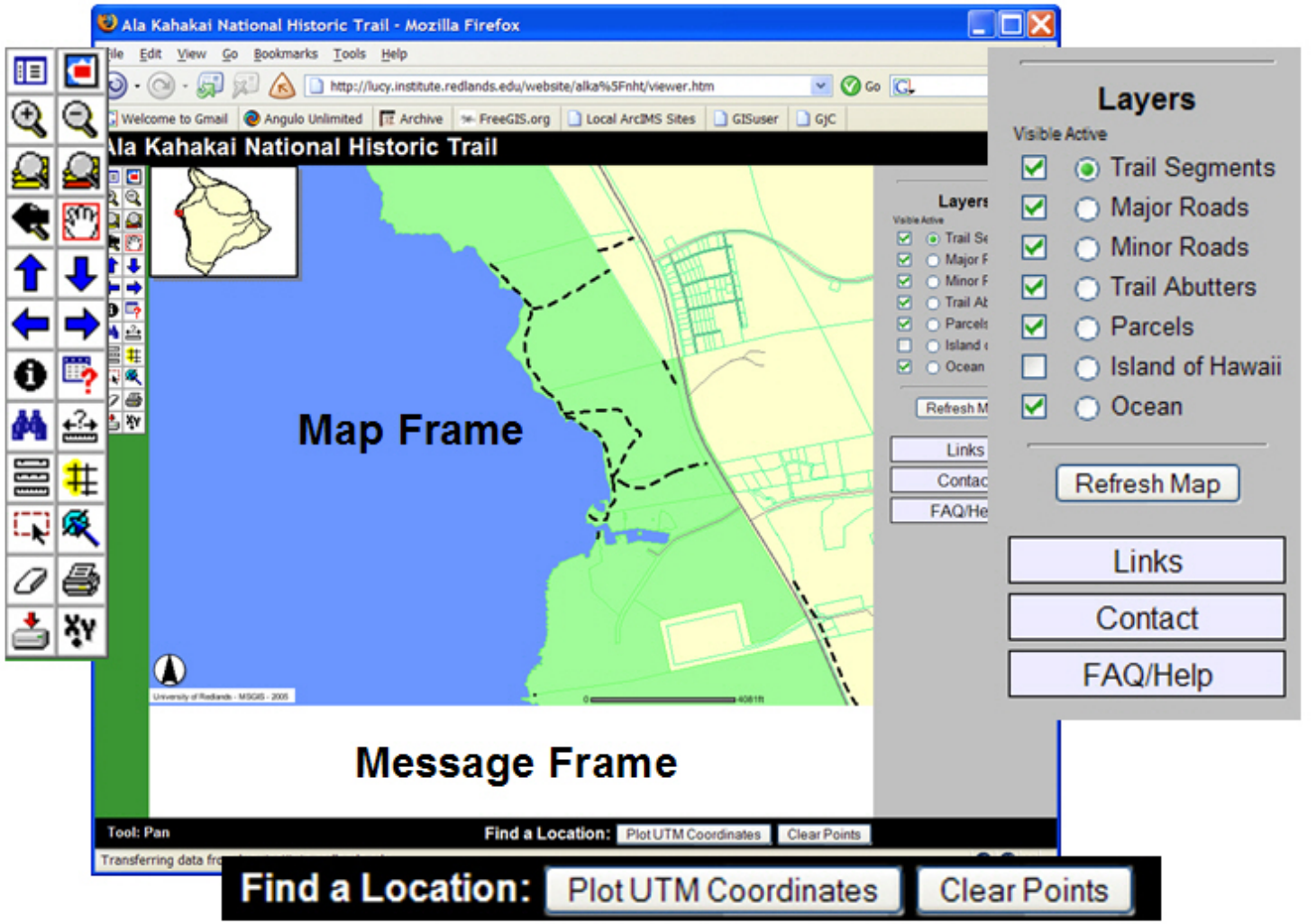
Plant Occurrence	Transect #	Species Code #	Health of Plant	Latitude	Longitude

High-End Process

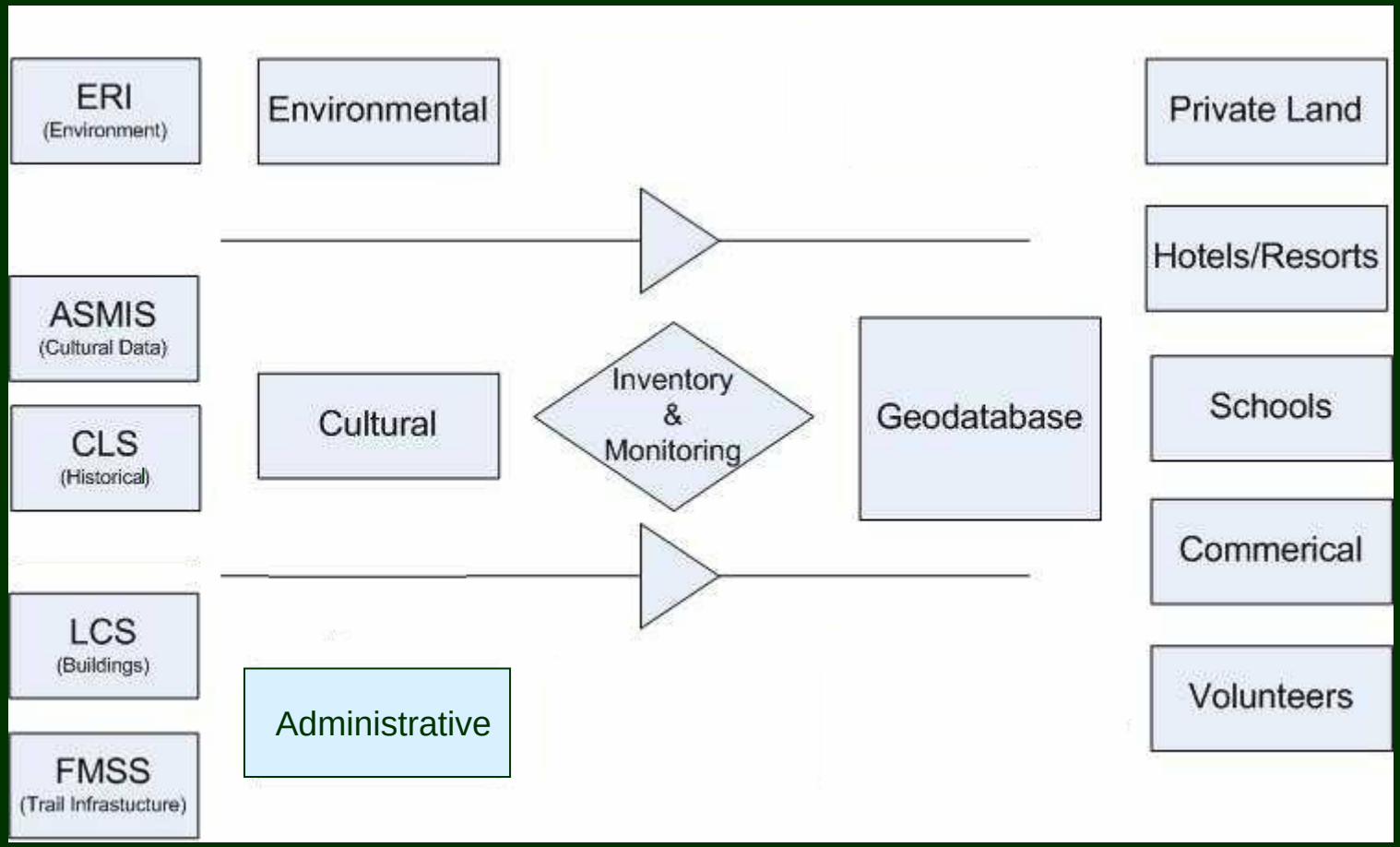
- For user groups with Mobile Device
  - Collection Assessment
  - Data Prep
  - Data Check-Out
  - Field Data Capture
  - Check-In



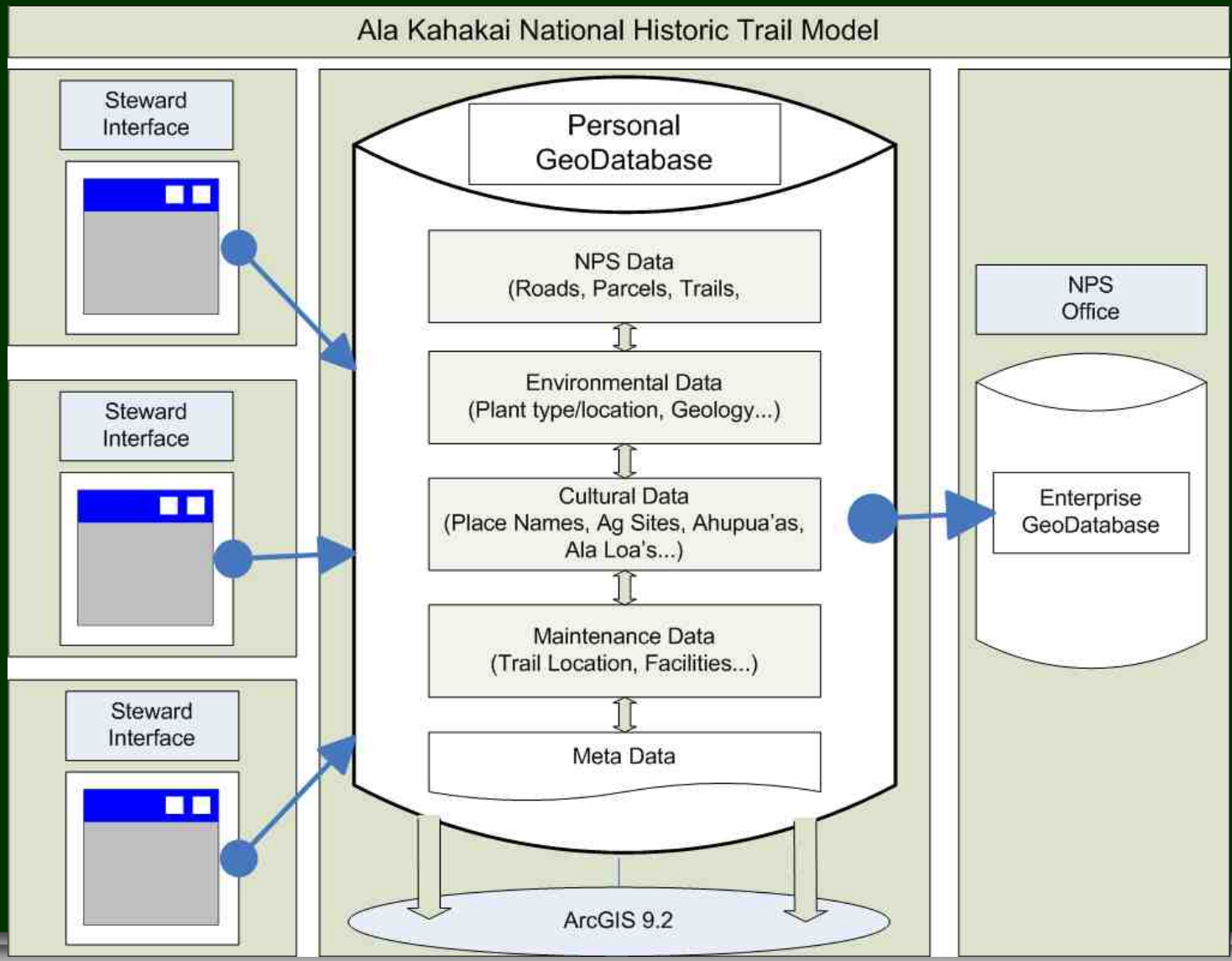
AKNHT IMS Site



NPS databases/AKNHT stewards (Williams, 2006)



AKNHT Geodatabase



AKNHT Stewards Data Program

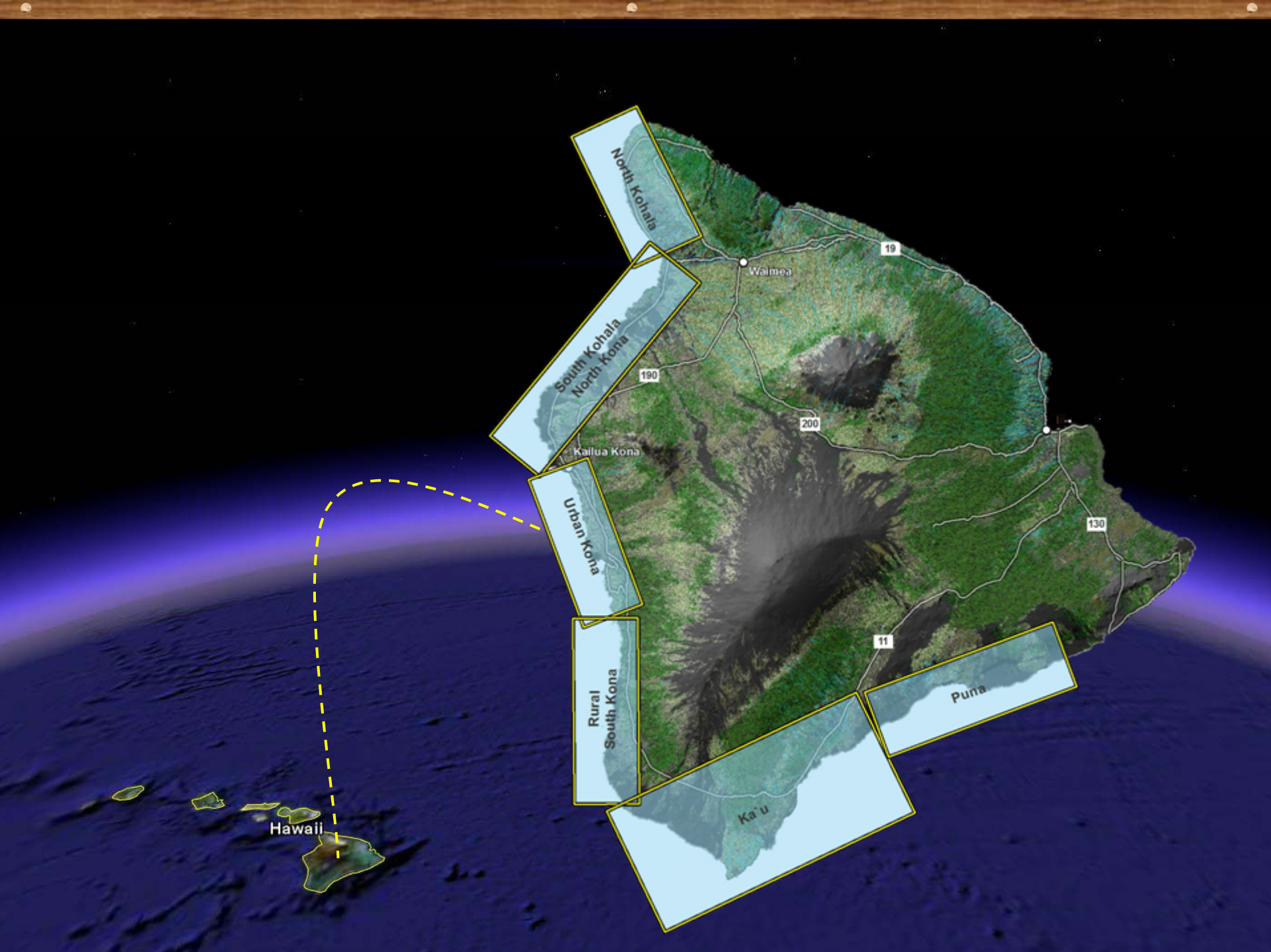
- Stewards collect and manage data according to standards and protocols
- Stewards own their collected data
  - Share only data they wish for NPS use and, possibly, for public access
- Manage all data in consistent format for current or future integration
- For those with GIS, a common geodatabase model is used by each steward group

Challenges

- Designing data collection protocols and systems that
  - Ensure data collected will be useful for park management
  - Can be used by stewards with various levels of expertise and technology
  - Ensure individual steward groups have ownership of their data
- Representing Hawaiian science and culture values and culturally significant places
- Integrating Hawaiian science "data" with Western science data.

What's next?

- Working with UR's Redlands Institute to
  - Design and implement a GI Infrastructure integrating Hawaiian Science and Western Science to support research and education activities Island-wide with Kohala Center as an extension of the AKNHT project


North Kohala
South Kohala
North Kona
Urban Kona
Rural South Kona
Ka`u
Puna
Waimea
Kailua Kona
19
190
200
130
11
Hawaii

Questions? Comments?

Kohala Center

- The Kohala Center uses its unique island setting as a living laboratory and classroom to generate new knowledge about global ecological phenomena and provide systemic solutions to global environmental challenges, so that communities on the island and around the world can thrive -- economically, socially, and culturally.
- By consciously operating at the intersection of culture, science, and community, The Kohala Center understands that its collaborative work will sustain the Island of Hawai'i, as well as develop knowledge that will be of value to the world as a whole.
- Residents of Hawai'i Island understand that research and education are key to understanding how to develop the Island's economy in ways that are ecologically sound and culturally respectful. By operating a premier center for applied scientific education and research, The Kohala Center is dedicated to helping Hawai'i Island residents preserve and enhance the intellectual, cultural, and natural assets of the Island and thoughtfully address the challenges noted above.

Citizen science

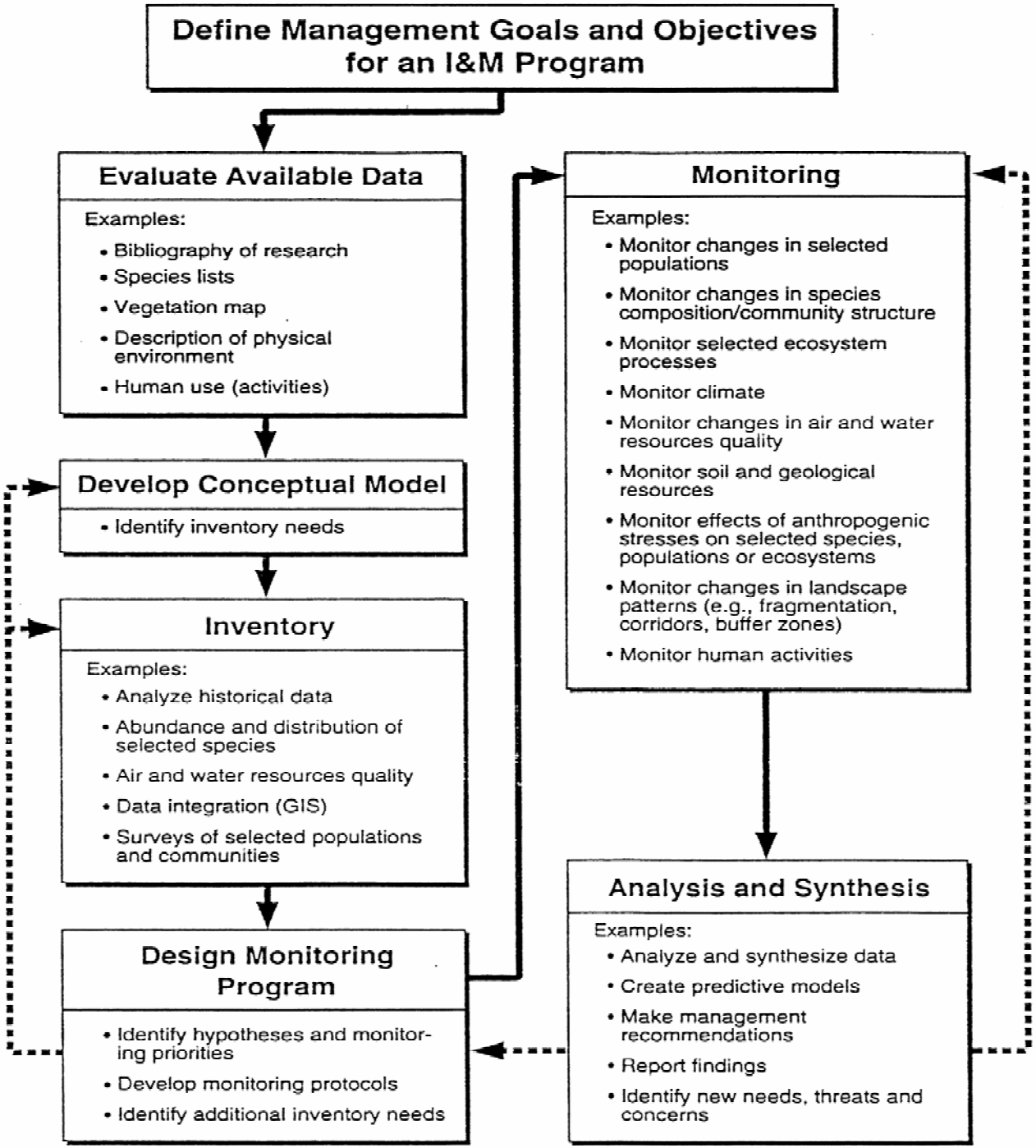
- Organizations
  - GLOBE
  - Audbon
  - Society for Amateur Scientists
- Tools
  - Protocols
  - Datasheets

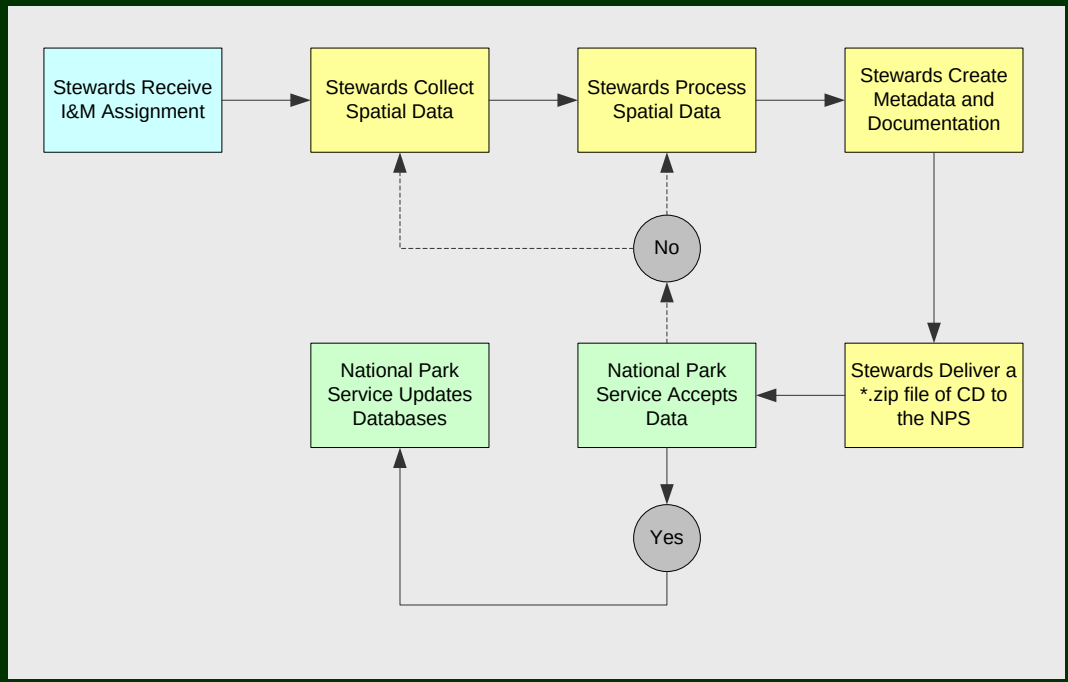
Purpose of Inventories

- Document the occurrence, location, and current condition of the physical habitat and major associated taxa.
- Identify locally rare or threatened and endangered species, locating fragile (or rare) ecosystems and potential "indicator species".
- Assess the full range of populations, ecosystem components, processes, and stresses from which to sub-sample for later long-term monitoring.

Purpose of Monitoring

- Determine compliance with environmental standards.
- Evaluate impacts of visitor and management activities.
- Long-term studies are also undertaken in response to detected or anticipated human impacts on natural resources.


Define Management Goals and Objectives for an I&M Program
Evaluate Available Data
Examples:
• Bibliography of research
• Species lists
• Vegetation map
• Description of physical environment
• Human use (activities)
Develop Conceptual Model
• Identify inventory needs
Inventory
Examples:
• Analyze historical data
• Abundance and distribution of selected species
• Air and water resources quality
• Data integration (GIS)
• Surveys of selected populations and communities
Design Monitoring Program
• Identify hypotheses and monitoring priorities
• Develop monitoring protocols
• Identify additional inventory needs
Monitoring
Examples:
• Monitor changes in selected populations
• Monitor changes in species composition/community structure
• Monitor selected ecosystem processes
• Monitor climate
• Monitor changes in air and water resources quality
• Monitor soil and geological resources
• Monitor effects of anthropogenic stresses on selected species, populations or ecosystems
• Monitor changes in landscape patterns (e.g., fragmentation, corridors, buffer zones)
• Monitor human activities
Analysis and Synthesis
Examples:
• Analyze and synthesize data
• Create predictive models
• Make management recommendations
• Report findings
• Identify new needs, threats and concerns


Stewards Receive I&M Assignment
Stewards Collect Spatial Data
Stewards Process Spatial Data
Stewards Create Metadata and Documentation
No
National Park Service Updates Databases
National Park Service Accepts Data
Stewards Deliver a *.zip file of CD to the NPS
Yes