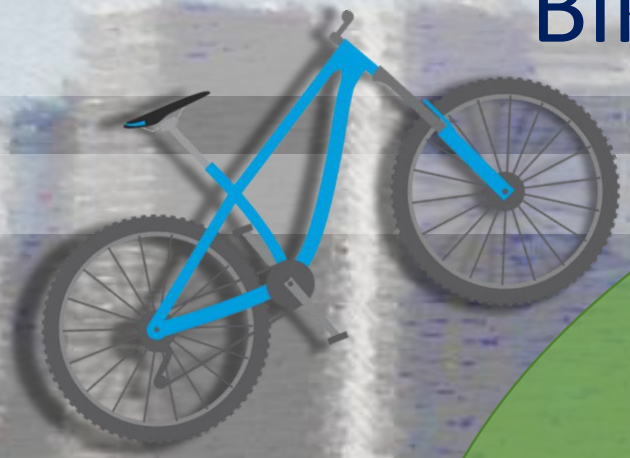
Geo-Enabling Mountain Bike Trail Maintenance:

Enhanced Stewardship of the Fountainhead Mountain Bike Trail through GIS Technology

Ruthann Ligon



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GIS-Pro 2016
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Toronto, Ontario Canada

Follow the Trail
Fountainhead Mountain Bike Trail
Trail Maintenance
Use Patterns
GIS Solution Design
Tools
Technology Options
How does it Work?
Successes & Challenges
Status Update & Impact
Future Plans

Fountainhead Mountain Bike Trail

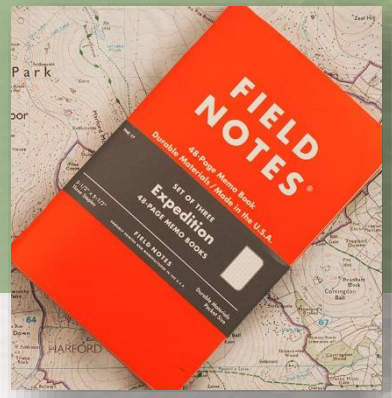
Approximately 15 miles of fast-paced single track with technical challenges for beginner, intermediate, and advanced mountain bike riders

Trail Maintenance

Primary Concerns:

- Erosion
- Water Drainage
- Maintenance of Trees
- Protect the environment and animal life
- Riders

Previous Trail Maintenance Process:



- Trail liaisons ride the trail and take notes
- Share information about their observations
- Plan trail work
- Organize volunteers for trail work day

Challenges to Trail Maintenance

Discuss observations
- Verbal communication of observations

Imprecise spatial reference
- Spatial reference from features
- Incorrect identification of locations

Paper Maps
- Take notes, erase, and reuse

No Historical Record
- Paper maps are reused
- No record of trail repairs
- Unable to evaluate the effectiveness of a repair

Logistics
- 15 miles of technical trail riding with limited access points
- Average >1.5 hours to ride
- Trail conditions
- Park hours
- Limited resources - all volunteer

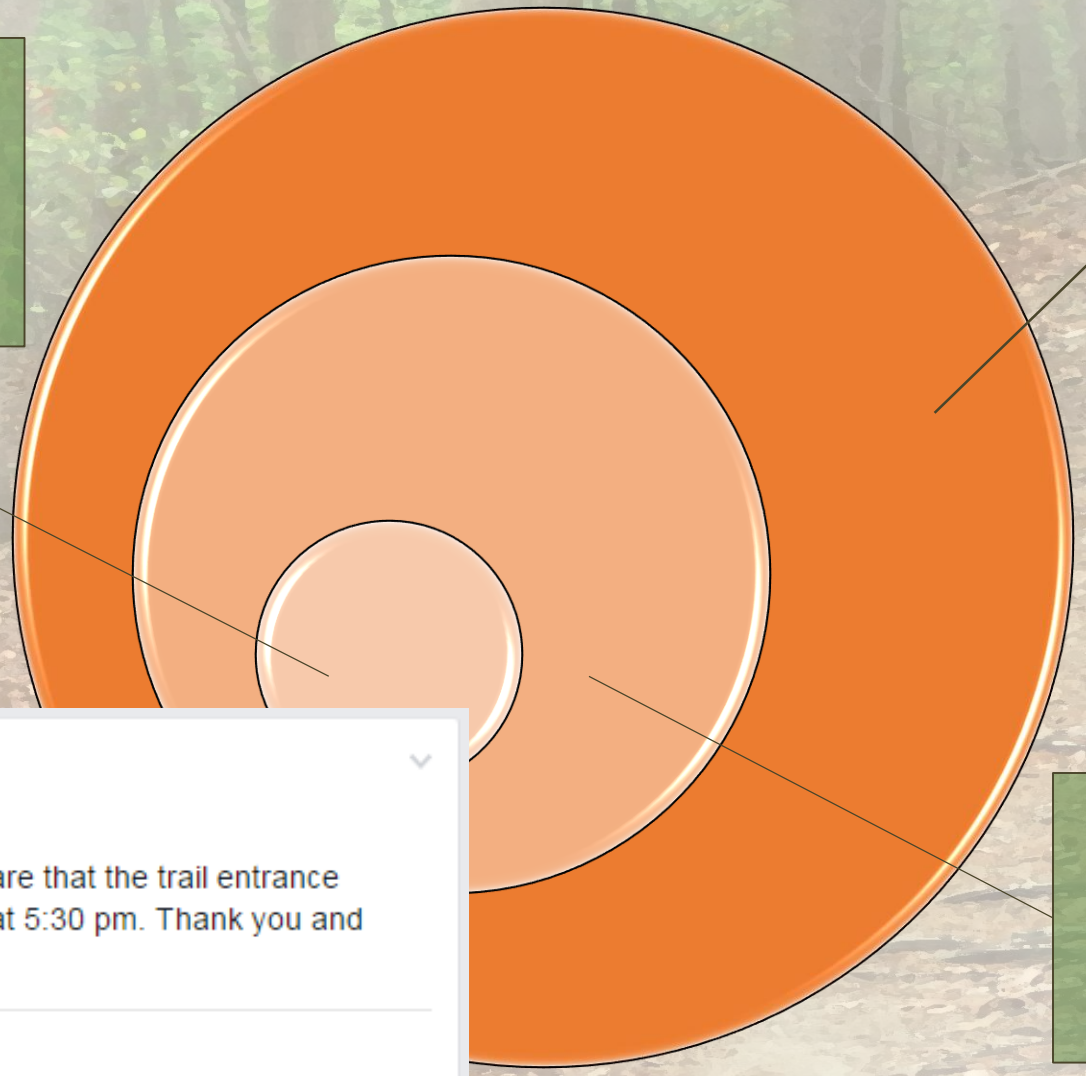
Use Patterns: Health and Fitness

Mountain Biking:

Trail Status, Conditions, Ratings

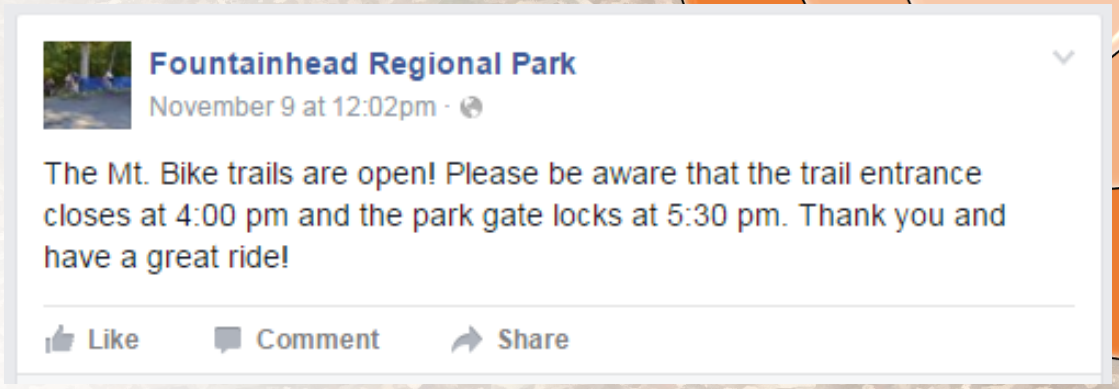
Health and Fitness:

Workouts and Stats

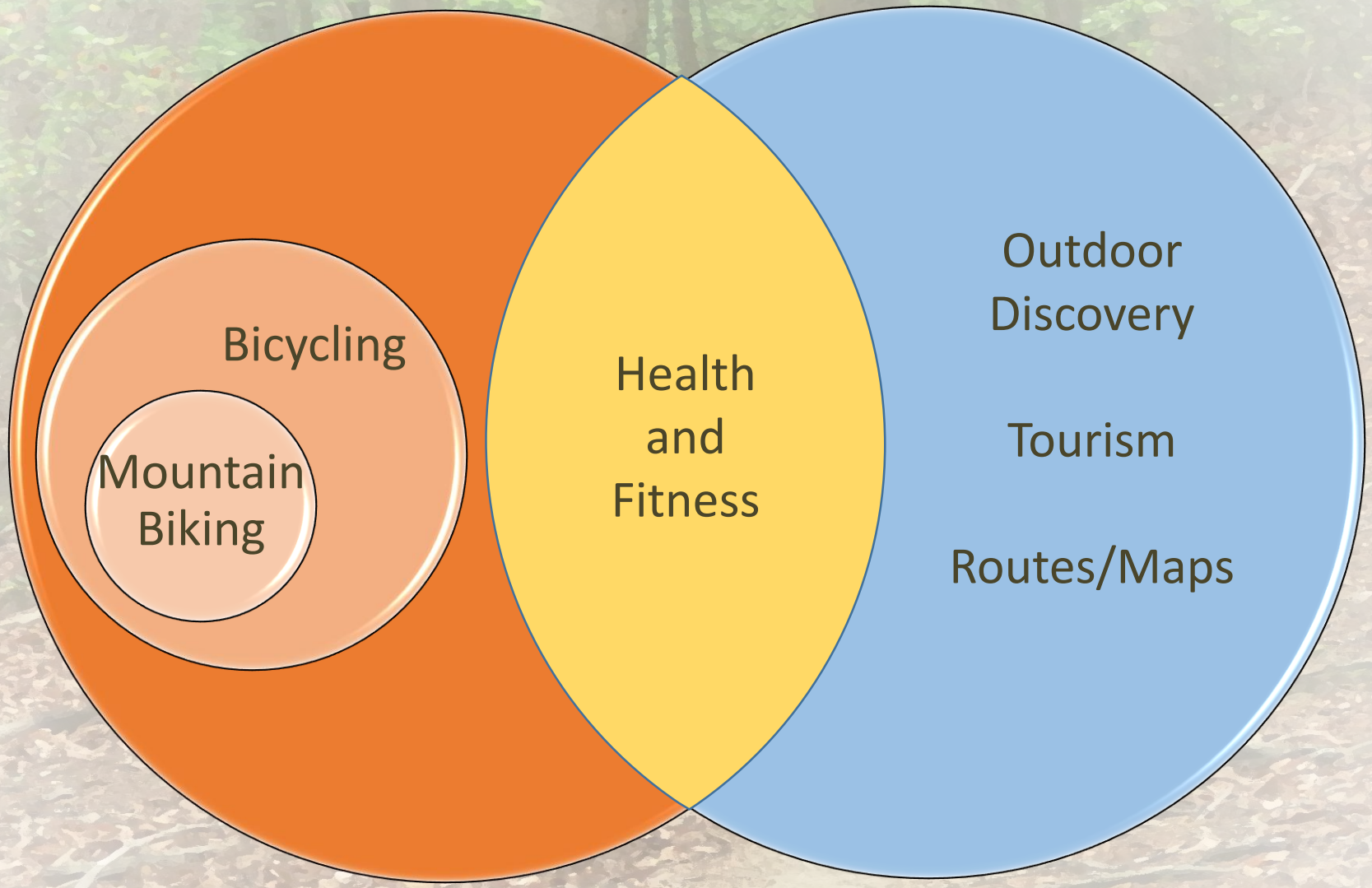


Bicycling:

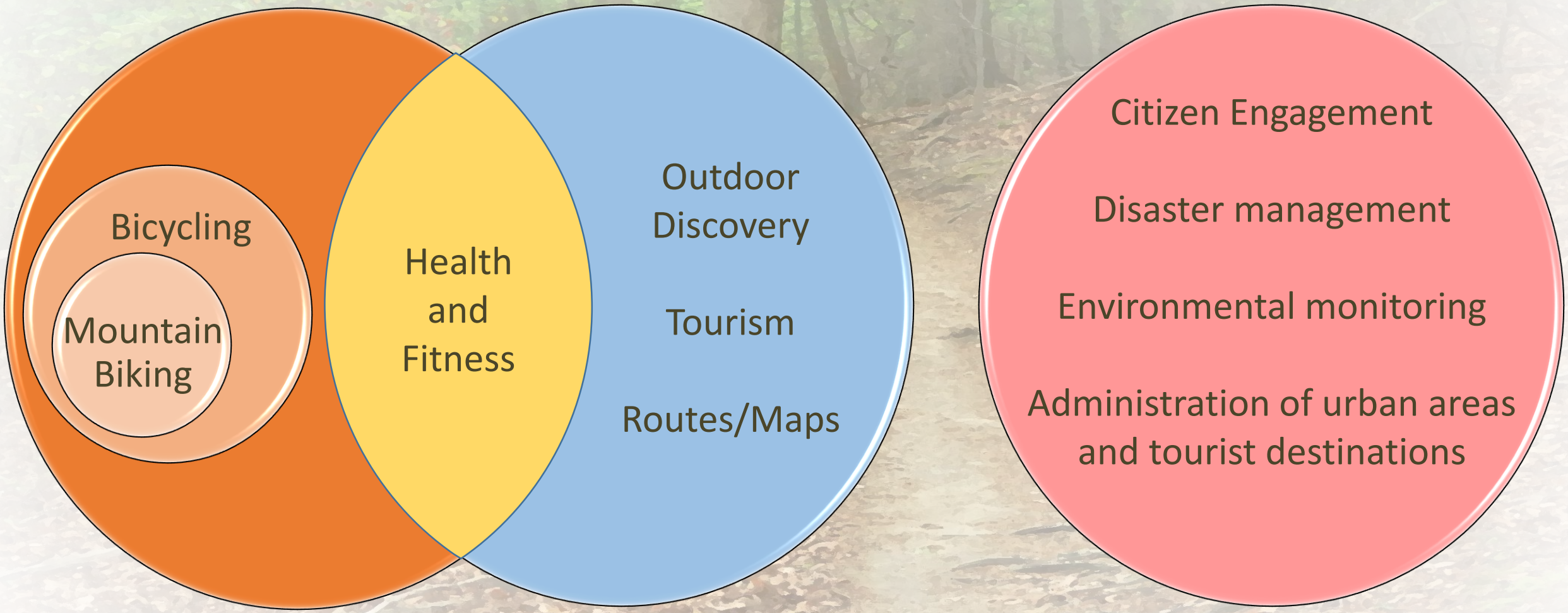
Route, Elevation, Grade, Distance, Time, and Speed



Use Patterns: Outdoor Recreation



Use Patterns: Citizen Engagement



GIS Solution Design

Mountain Bike Trail Maintenance GIS

Motivations:

- Personal Connections
- Achievement
- Information Sharing
- Activism

A GIS Solution: Components

Monitoring the Trail:

- Mobile application
- Field data collection
- Georeferenced photos with maintenance category

Planning and Evaluating Trail Maintenance:

- Web application
- Visualization
- Planning
- Data Analysis

Created with Esri Maps - http://esri.com

GIS Design: Objectives

Data Collection

- Make data collection process more efficient
- Timely and accurate information sharing

Trail Maintenance

- Create a mechanism for planning and tracking maintenance
- Make it easier to organize volunteers to conduct maintenance

Record Keeping

- Develop a record keeping mechanism
- Create tools to mine data

GIS Design: Factors and Considerations

Technology

Development Environment

Time

Data Collection

User Experience

Cost

GIS Maintenance

Future Development

Tools

Data Preparation • Integration

ArcMap

Web Application Development

Web App Builder

Field Data Collection

Collector

ArcGIS Online

Hybrid

ArcServer and Portal

Data Storage • Hosting • Deployment

Option #1: ArcGIS Online

Esri's hosted cloud environment for data storage, visualization, analytics, and development.

Capabilities:

- No system maintenance on hosted environment
- Security
- Easy to use, collaborative environment
- Fully integrated GIS tools
- Data storage accessible from the field
- Provides basemaps for reference
- Support
- Future Development

Constraints:

- Learning the platform and adapting to the changes
- No data versioning
- Collaboration at a cost
- Figuring out multiple account types
- Geoprocessing Services

Option #2: Hybrid Server and ArcGIS Online

Data is stored on an EC2 instance hosted by Amazon Web Services.
The data is managed in ArcServer.

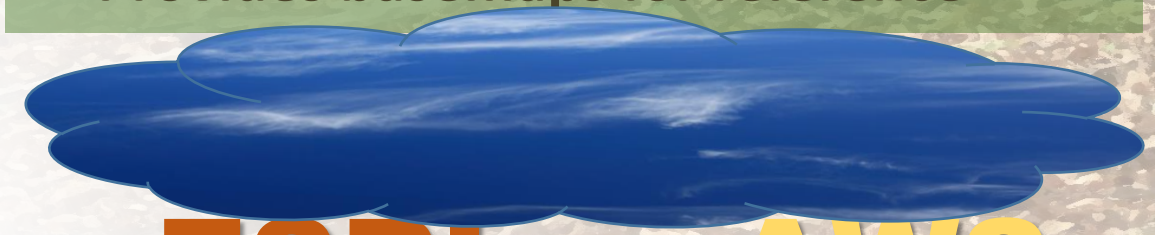
ArcGIS Online provides a gateway. Data is published to ArcGIS Online where is served out through a hosted web application.

Capabilities:

- Data management with versioning
- Limited system maintenance
- Security
- Integrated GIS tools
- Data storage accessible from the field
- Provides basemaps for reference

Constraints:

- Duplicate functionality for data storage
- Multi-step data publication process
- Limited support for non-standard solution
- Geoprocessing Services
- Software maintenance
- Cost



Option #3: ArcServer and Portal on Amazon Web Services

Data and web application is stored on an EC2 instance hosted by Amazon Web Services. The data is managed in ArcServer. Portal is the internet gateway, exposing the web application to the internet and accepting data updates from the field.

Capabilities:

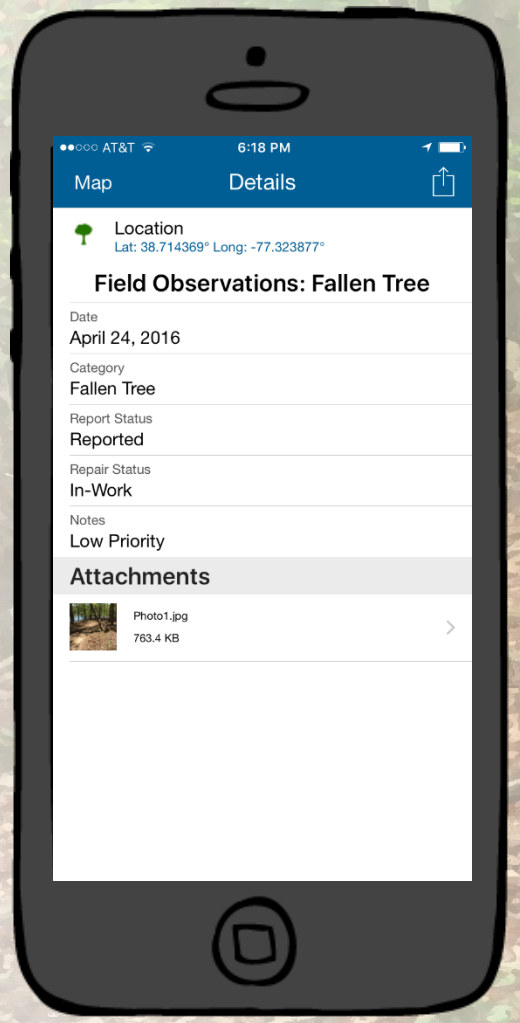
- Data management with versioning
- Managed infrastructure
- Complete system ownership
- Data storage accessible from the field
- Geoprocessing Services

AWS GIS Tech

Constraints:

- Limited support for non-standard solution
- Tool integration
- Multiple vendors
- Software Maintenance
- Security
- Cost
- Future Development

How does it work?



Created with Balsamiq - www.balsamiq.com

Photo, Location, Category, Timestamp

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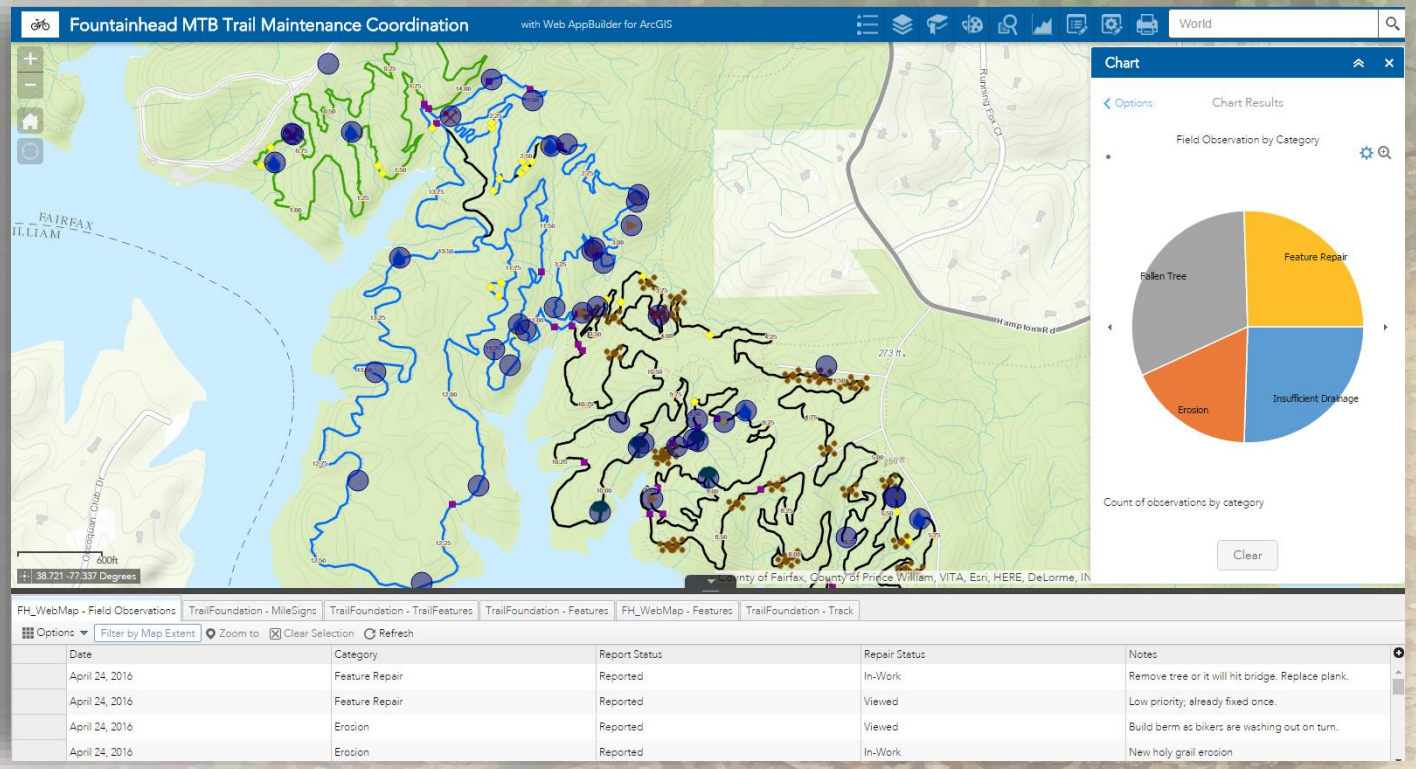
Field Data Collection

How does it work?



Visualizing • Planning • Analysis

Successes and Challenges

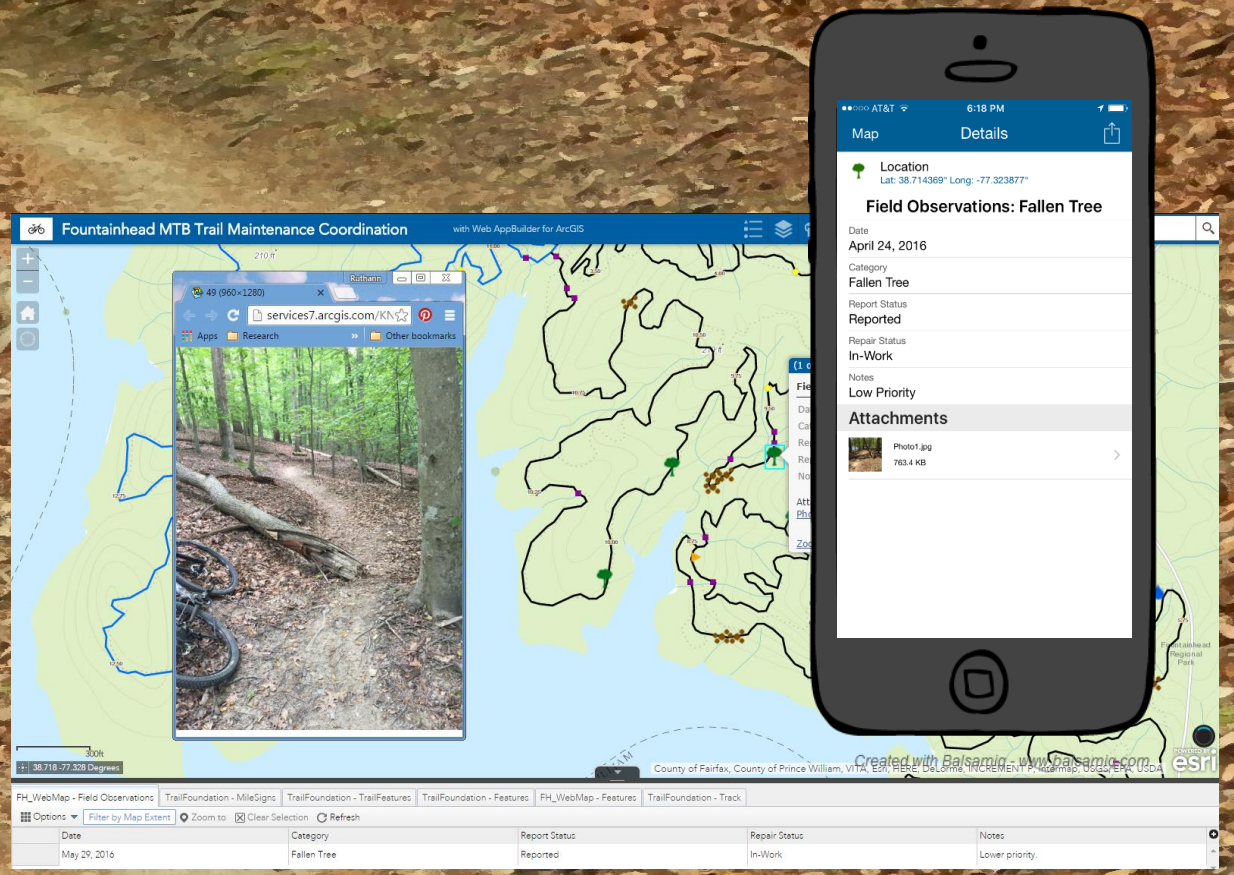
Technology
- Agile and quick development process

In their Hands
- Easier to explain
- Revealed the potential and possibilities

Customer Relationship
- Motivating
- Challenging to manage

Access
- Lots of options
- School and Non-profit program

Support
- Popular technology
- Responsive user community



Status Update and Impact

Functioning GIS for collecting base data as well field data for use in trail maintenance

- In-use spring, summer, and fall
- Supported 5 trail maintenance days
- Obtained funding from MORE to continue the development and use of the GIS

Registered for Esri's Non-Profit program:

ArcMap and ArcGIS Online organization accounts

- More efficient trail maintenance, reduced level of effort for trail liaisons
- Increased ability to assess trail maintenance through accurate and timely data collection
- Improved trail maintenance through targeted maintenance efforts and efficient use of volunteers, tools, and materials
- Modified trail maintenance strategy by subdividing the labor and improving navigation between repairs

Down the trail: Future Development

Application Development:

- Integrate Survey 123 into the design for trail maintenance days
- Data collection on the Bull Run Occoquan Trail (BROT)

Fit-for-Use Testing:

- Collect quality and quantitative data how the GIS has affected trail maintenance
- Discuss project with MORE and IMBA to integrate additional trails

What does that mean for MORE and IMBA?

- Analyze the level of effort for trail maintenance
- Understand types of repairs and costs
- Assess trail sustainability
- Advocate with data

Questions, Comments, Suggestions?

Thank you for listening and for the feedback

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