



SARGIS9



Applying the power of geospatial tools for NPS Emergency Services to

increase visitor safety

and

benefit rangers.

The National Park System

- An increase in visits by more than 23 million people from 2015
- Equates to 102% of US population visiting annually
- 1.4 million recreation hours in 2016
- \$18.6 billion spent by visitors

- The Organic Act of 1916

The purpose (of the NPS) is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

- NPS Management Policies, 2006

The saving of human life will take precedence over all other management actions as the Park Service





The National Park System

- An increase in visits by more than 23 million people from 2015
- Equates to 102% of US population visiting annually
- 1.4 million recreation hours in 2016
- \$18.6 billion spent by visitors

- The Organic Act of 1916

The purpose (of the NPS) is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

- NPS Management Policies, 2006

The saving of human life will take precedence over all other management actions as the Park Service strives to protect human life and provide for injury-free visits

Emergency Services Branch

- Emergency Medical Services (EMS)
- SAR (SAR)
- Incident Management Program
- Critical Incident Stress Management
- Public Safety Dispatch
- Emergency Management (EM)



331 Million Visitors (2016)



Emergency Services Branch

- Emergency Medical Services (EMS)
- SAR (SAR)
- Incident Management Program
- Critical Incident Stress Management
- Public Safety Dispatch
- Emergency Management (EM)



Enhancing Geospatial Tools for SAR Responders

- SARTopo: a great open-source SAR GIS tool that can be used across agencies.
- Tried using SARTopo NPS layer to view GRSA in response to an incident. The park was missing completely and it was evident this layer was not useful for SAR response.
- Goal is to increase visitor safety and the success of search and rescue by allowing the right tools to be put into the hands of our rangers.
- Accurate spatial data can mean the difference between



Open in SARTopo
30.2970, -127.7930
9R 0616071E 3352315N
---- ft WGS84

NPS Emergency Services



SARGIS9

Enhancing Geospatial Tools for SAR Responders

- SARTopo: a great open-source SAR GIS tool that can be used across agencies.
- Tried using SARTopo NPS layer to view GRSA in response to an incident. The park was missing completely and it was evident this layer was not useful for SAR response.
- Goal is to increase visitor safety and the success of search and rescue by allowing the right tools to be put into the hands of our rangers.
- Accurate spatial data can mean the difference between finding a person alive and never finding them at all.

Collaboration with SARTopo and RISD

- We reached out to the lead of the National Geospatial Program for NPS in the Resource Information Services Division (RISD).
- We were able to partner with Matt Jacobs to integrate an API for improved SAR response. This is the first time RISD has been able to offer this API to an outside entity.
- New, interactive layer shows park boundaries, trails, structures, etc.

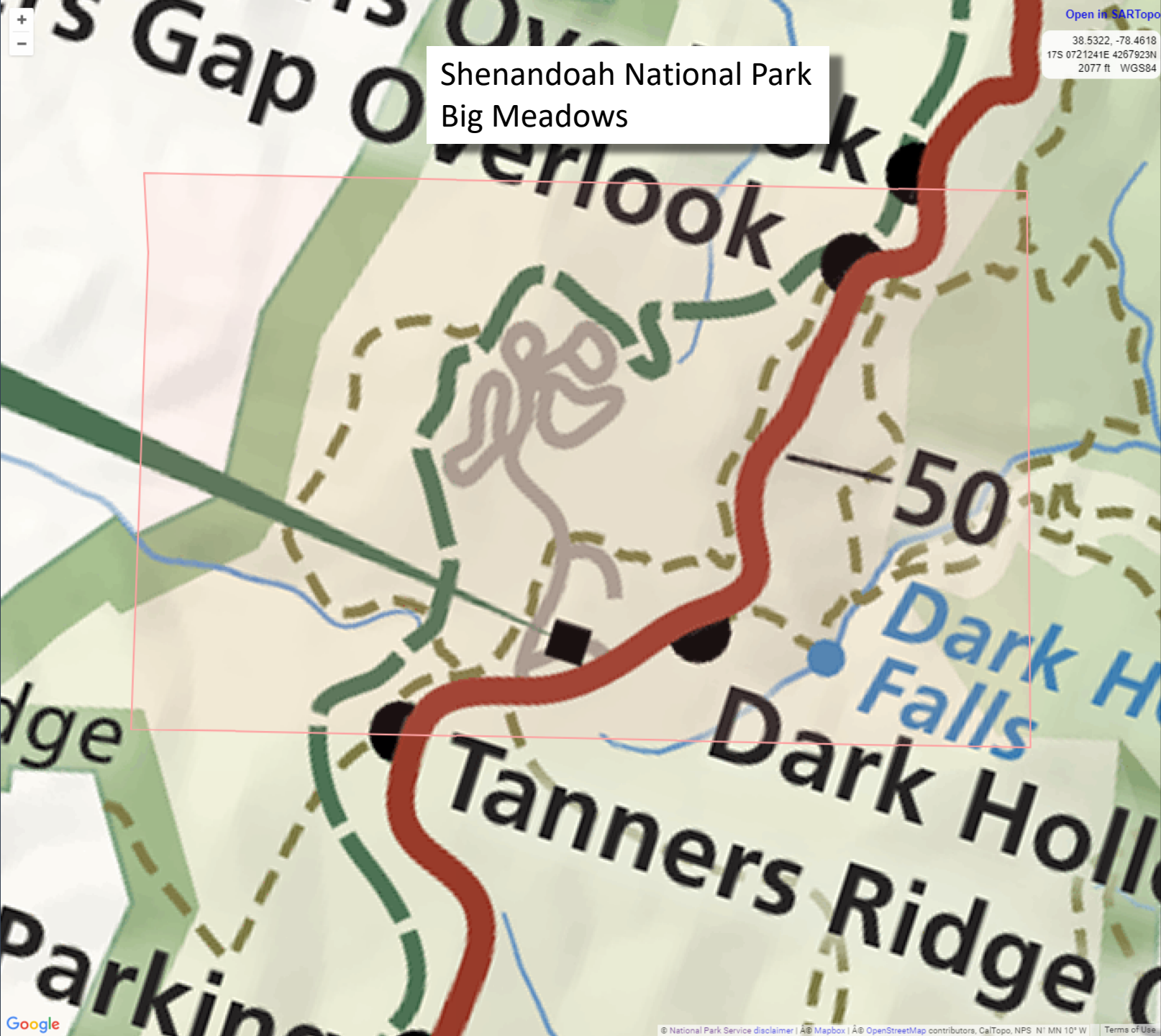
Current Collection

- Standard data collection form
- Form Fillable PDF
- Retained at the park level

Annual SAR Report

Current workflow for getting annual data on a national level:

- Parks store and manage paper SAR forms for every incident.
- Parks then aggregate data and send to regional office.
- Regional office aggregates data from all parks and sends to Washington Office.



Shenandoah National Park Big Meadows

Open in SARTopo
38.5322, -78.4618
17S 0721241E 4267923N
2077 ft WGS84

NPS Emergency Services



SARGIS9

Collaboration with SARTopo and RISD

- We reached out to the lead of the National Geospatial Program for NPS in the Resource Information Services Division (RISD).
- We were able to partner with Matt Jacobs to integrate an API for improved SAR response. This is the first time RISD has been able to offer this API to an outside entity.
- New, interactive layer shows park boundaries, trails, structures, etc.

Current Collection

- Standard data collection form
- Form Fillable PDF
- Retained at the park level

Annual SAR Report

Current workflow for getting annual data on a national level:

- Parks store and manage paper SAR forms for every incident.
- Parks then aggregate data and send to regional office.
- Regional office aggregates data from all parks and sends to Washington Office.
- Washington Office aggregates data into National Report.

Problems:

- Data quality
- Annual report asks for data not included in individual report.

2015 - 2016 Annual SAR Reports

- Now able to visualize data, but:
 - Time consuming to combine table data and turn into spatial data
 - Inconsistencies in reporting
 - Data quality/reliability?
- Need a better way

Example of data available with Park Tiles API Shenandoah National Park – Big Meadows

SARGIS9_2

Sign in with Google
More logins ...

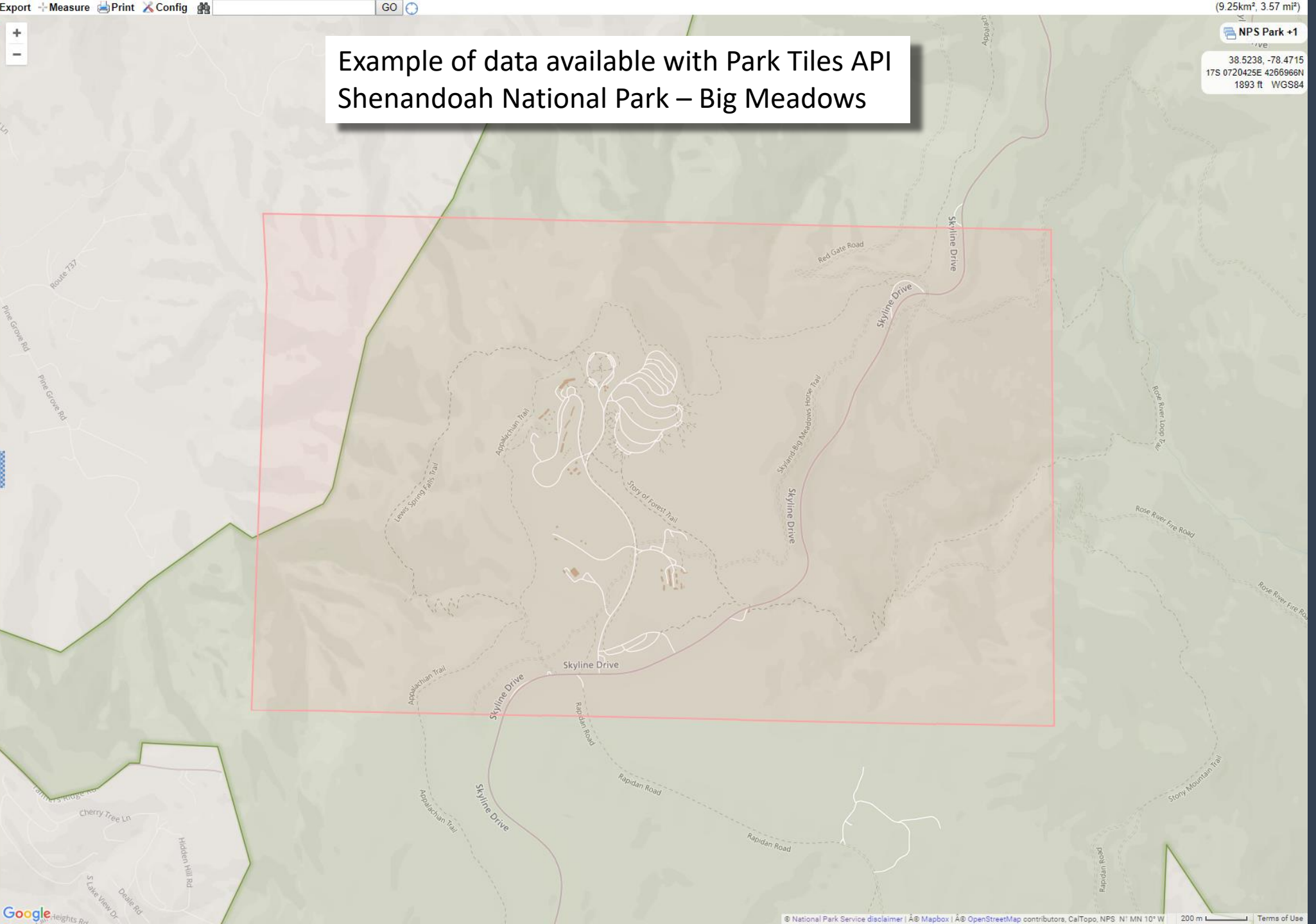
Map is read-only
Share this map

- Preset Layers**
- MapBuilder Topo
 - 7.5' Topo Maps
 - Forest Service
 - Aerial Topo Hybrid
 - Hybrid Satellite
 - Slope Angle Shading

Lines & Polygons

N/A

Bulk Ops



Emergency Services

National Park Service
U.S. Department of the Interior



NPS Emergency Services



SARGIS9

Search and Rescue Report - PAGE 1

Version 4.1
REV 2013

Use Tab to move between fields.

Park: Region: Major SAR?: Major SAR Number:

Incident Commander: Case Number: NP-

Park SAR Number: Day of Week:

Date of Notification: Time Notified (24 hour format)

Date Subject Contacted: Time Subject Contacted (24 hour format)

Location:

Coordinates:

Notification Method:

Incident Type: Contributing Factor- 1st:

Mutual Aid?: Contributing Factor- 2nd:

Subject Organization: Contributing Factor- 3rd:

Subject Activity: Rescue Method - 1st:

Incident Environment: Rescue Method - 2nd:

SAR Disposition: Rescue Method - 3rd:

Subject Info:	Age	Sex	Experience Level
Subject #1:	<input type="text"/>	<input type="text"/>	<input type="text"/>
Subject #2:	<input type="text"/>	<input type="text"/>	<input type="text"/>
Subject #3:	<input type="text"/>	<input type="text"/>	<input type="text"/>

Number Ill or Injured	Number <u>Not</u> Ill or Injured	Number of Fatalities	Number of Saves
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

The Following Items are Reported Only When Incidents Involve Searches For Lost Subjects

Search Type:

Linear Distance In Miles from PLS: (blank if unknown)

Vertical Direction from PLS:

Search Duration:

Current Collection

- Standard data collection form
- Form Fillable PDF
- Retained at the park level

Annual SAR Report

Current workflow for getting annual data on a national level:

- Parks store and manage paper SAR forms for every incident.
- Parks then aggregate data and send to regional office.
- Regional office aggregates data from all parks and sends to Washington Office.
- Washington Office aggregates data into National Report.

Problems:

- Data quality
- Annual report asks for data not included in individual report.

2015 - 2016 Annual SAR Reports

- Now able to visualize data, but:
 - Time consuming to combine table data and turn into spatial data
 - Inconsistencies in reporting
 - Data quality/reliability?
- Need a better way

SAR Workflow

- How do we create something new that collects better data and is easier to use?
- Integration/collaboration with other datasets





Annual SAR Report

Current workflow for getting annual data on a national level:

- Parks store and manage paper SAR forms for every incident.
- Parks then aggregate data and send to regional office.
- Regional office aggregates data from all parks and sends to Washington Office.
- Washington Office aggregates data into National Report.

Problems:

- Data quality
- Annual report asks for data not included in individual report.

2015 - 2016 Annual SAR Reports

- Now able to visualize data, but:
 - Time consuming to combine table data and turn into spatial data
 - Inconsistencies in reporting
 - Data quality/reliability?
- Need a better way

SAR Workflow

- How do we create something new that collects better data and is easier to use?
- Integration/collaboration with other datasets

PARK AREA	PARK 1	PARK 2	Park 3	PARK 4	Park 5	PARK 6	PARK 7	PARK NAME	TOTALS
	AKR	IMR	MWR	NCR	NER	PWR	SER	United States Park Police - Aviation Section	
Page One - Left Column	Page 1 - Left	Page 1 - Left	Page 1 - Left	Page 1 - Left	Page 1 - Left	Page 1 - Left	Page 1 - Left	Page 1 - Left	Page 1 - Left
INCIDENT TYPE	Incident Type	Incident Type	Incident Type	Incident Type	Incident Type	Incident Type	Incident Type	Incident Type	Incident Type
Total Number of SAR Incidents inside park:	25	866	211	30	253	838	311	124	2658
Number of Incidents over \$500:	23	346	21	1	18	248	71	110	838
Number of Mutual Aid Incidents outside park:	7	82	50	12	33	122	79	48	433
INJURY/FATALITY/SAVE	Injury/Fatality/Save	Disposition	Disposition	Injury/Fatality/Save	Disposition	Disposition	Injury/Fatality/Save	Disposition	Injury/Fatality/Save
1 - Fatality	4	49	8	2	9	64	20	8	164
2 - Ill or Injured	15	563	89	10	58	283	131	35	1184
3 - Not Ill or Injured	12	725	249	13	96	550	296	55	1996
4 - Unfounded	1	25	11	4	13	24	24	37	139
5 - Save	6	207	44	4	27	186	83	23	580
TOTAL (Does Not Include Saves)	32	1362	357	29	176	921	471	135	3483
LOCATION TYPE	Location Type	Location Type	Location Type	Location Type	Location Type	Location Type	Location Type	Location Type	Location Type
1 - Lake	19	58	40	2	212	4	1	1	317
2 - Land	1	627	134	27	129	571	125	54	1686
3 - Ocean	1	1	1	1	96	53	63	1	215
4 - River	7	57	41	2	27	14	35	68	251
TOTAL	27	743	215	29	254	850	227	124	2469
SUBJECT AGE	Age	Age	Age	Age	Age	Age	Age	Age	Age
00 - 12 Years Old	1	57	40	1	39	31	29	10	207
13 - 19 Years Old	7	110	31	3	14	85	58	2	304
20 - 29 Years Old	10	195	68	2	19	180	99	20	590
30 - 39 Years Old	5	155	23	7	20	130	65	1	411
40 - 49 Years Old	6	166	39	5	17	67	46	3	348
50 - 59 Years Old	7	175	39	2	16	99	48	3	388
Over 60 Years Old	1	230	40	1	18	129	58	11	494
Unknown	127	127	75	8	133	196	39	67	645
Animal	1	1	1	1	1	6	5	2	16
TOTAL	36	1216	356	29	277	923	447	119	3403
SUBJECT SEX	Subject Sex	Subject Sex	Subject Sex	Subject Sex	Subject Sex	Subject Sex	Subject Sex	Subject Sex	Subject Sex
Male	29	671	178	23	65	513	271	51	1001
Female	7	455	119	6	55	307	150	40	1139
Unknown	1	108	56	1	157	103	18	26	469
Animal	1	1	2	1	1	6	5	2	17
TOTAL	36	1235	355	30	278	929	444	117	3424
Page One - Right Column	Page 1 - Right	Page 1 - Right	Page 1 - Right	Page 1 - Right	Page 1 - Right	Page 1 - Right	Page 1 - Right	Page 1 - Right	Page 1 - Right
PERSONNEL HOURS	Personnel Hours	Personnel Hours	Personnel Hours	Personnel Hours	Personnel Hours	Personnel Hours	Personnel Hours	Personnel Hours	Hours
NPS Programmed	1503.00	12679.13	1297.30	272.50	1154.50	25573.35	2269.50	247.40	44996.68
NPS Non-Programmed	916.00	14059.30	1073.75	59.50	1060.90	23102.22	2711.75	0.00	42983.42
Non-NPS	341	2715.75	3931.5	482	334.5	2277.8	3400.5	0.00	13483.05
TOTAL	2760.00	29454.18	6302.55	814.00	2549.90	50953.37	8381.75	247.40	101463.15



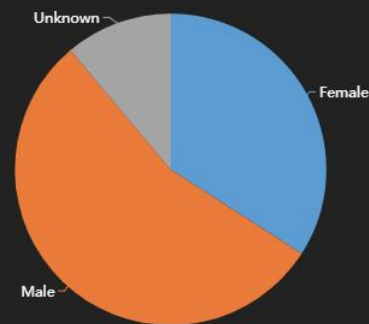
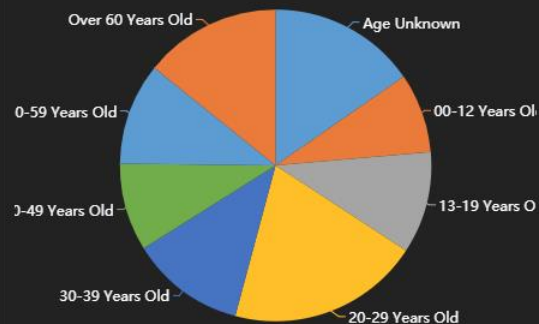
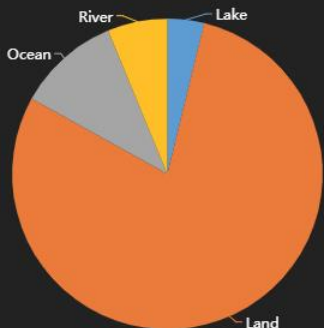
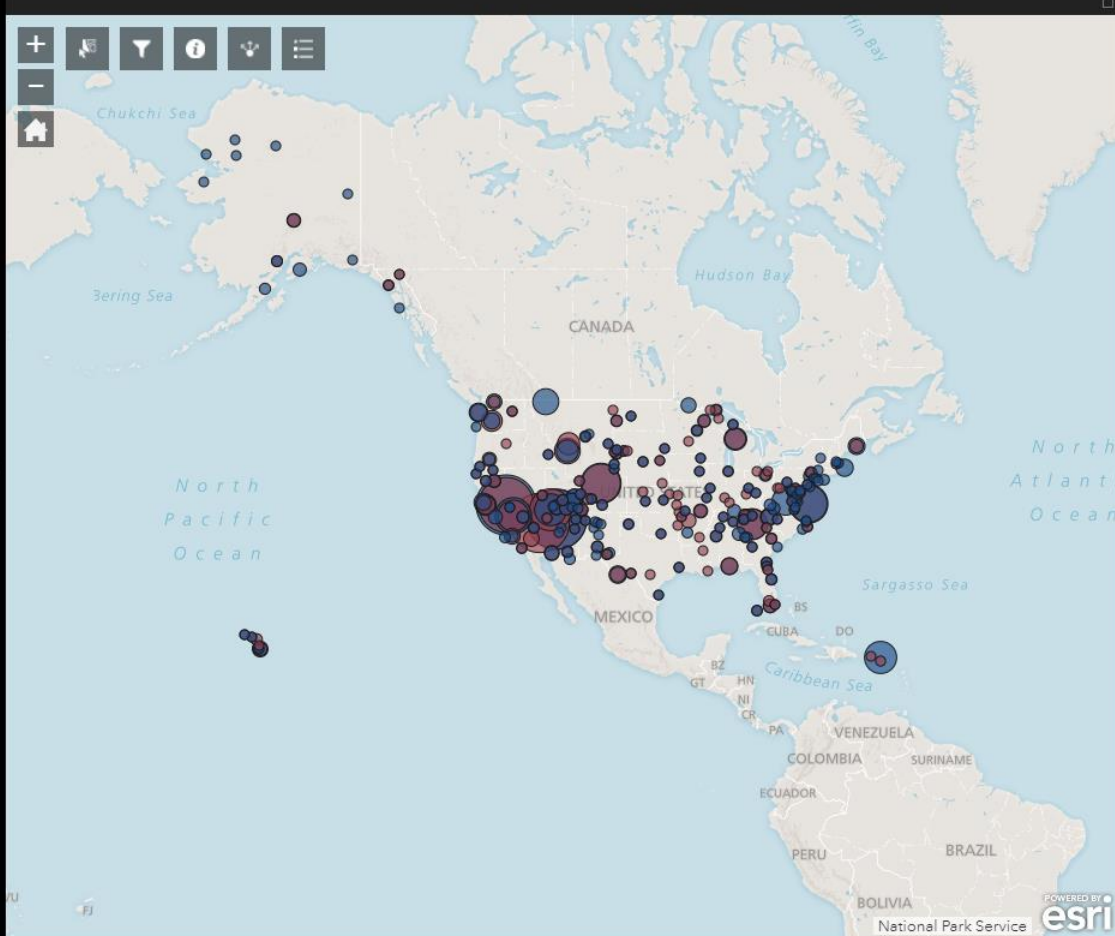
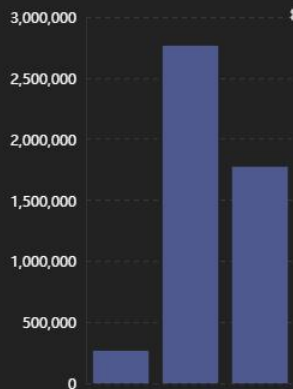
Reported SAR Incidents

5,389

NOTE: The statistics shown here reflect only what was reported by parks, and update as the map is moved or zoomed in and out.

SAR Operations Cost

Infographic on reported Operation Hours located in the second tab in this window.



SARGIS9

2015 - 2016 Annual SAR Reports

- Now able to visualize data, but:
 - Time consuming to combine table data and turn into spatial data
 - Inconsistencies in reporting
 - Data quality/reliability?
- Need a better way

SAR Workflow

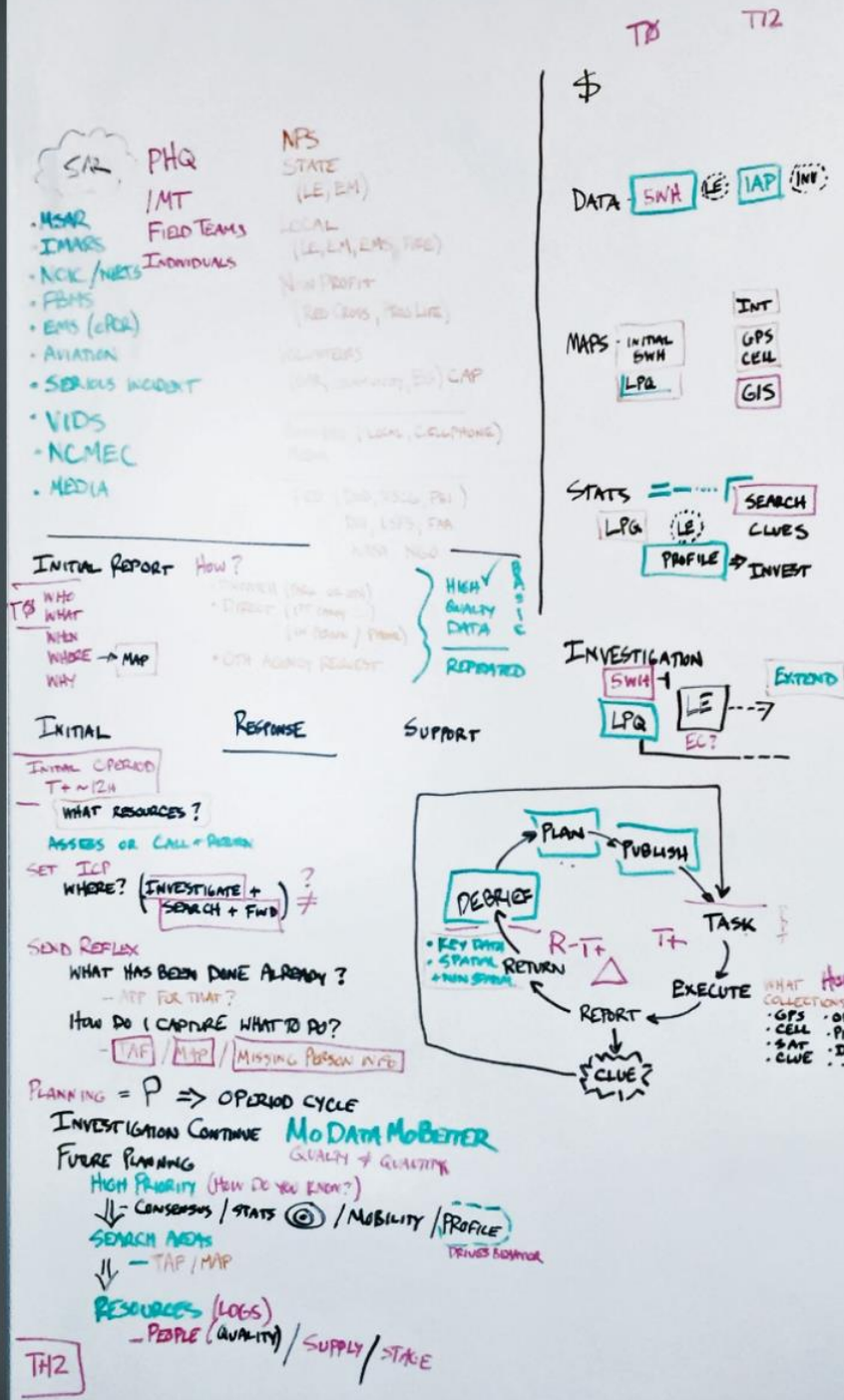
- How do we create something new that collects better data and is easier to use?
- Integration/collaboration with other datasets



- Eliminate reentering data in multiple locations
- Automatic aggregation for Annual SAR Report
- Field collection for better understanding of where, why, how SARs occur in NPS

A Delay from Mother Nature

- Hurricanes Harvey, Irma, and Maria moved through NPS lands affecting dozens of units and hundreds of employees and their families.
- Deployed to Texas and Florida to coordinate hurricane response and the movement of NPS personnel and



SARGIS9

SAR Workflow

- How do we create something new that collects better data and is easier to use?
- Integration/collaboration with other datasets



- Eliminate reentering data in multiple locations
- Automatic aggregation for Annual SAR Report
- Field collection for better understanding of where, why, how SARs occur in NPS

A Delay from Mother Nature

- Hurricanes Harvey, Irma, and Maria moved through NPS lands affecting dozens of units and hundreds of employees and their families.
- Deployed to Texas and Florida to coordinate hurricane response and the movement of NPS personnel and resources for the affected areas.
 - Nearly 900 personnel deployed with IMT for the three events
 - Teams still rotating in the Caribbean
- Opportunity to utilize GIS (Survey123, web maps, applications, dashboards) in hurricane response
 - Tracking the storms, locating NPS units in probability cone to best prepare for severity of storm
 - Tracking deployment of NPS resources
 - Facility damage assessments (FMSS)
 - Compiling post-storm imagery for initial damage



A Delay from Mother Nature

- Hurricanes Harvey, Irma, and Maria moved through NPS lands affecting dozens of units and hundreds of employees and their families.
- Deployed to Texas and Florida to coordinate hurricane response and the movement of NPS personnel and resources for the affected areas.
 - Nearly 900 personnel deployed with IMT for the three events
 - Teams still rotating in the Caribbean
- Opportunity to utilize GIS (Survey123, web maps, applications, dashboards) in hurricane response
 - Tracking the storms, locating NPS units in probability cone to best prepare for severity of storm
 - Tracking deployment of NPS resources
 - Facility damage assessments (FMSS)
 - Compiling post-storm imagery for initial damage assessments in Caribbean
 - Identifying and analyzing displaced vessels within our boundaries to predict effects on cultural and natural resources
 - Providing map products for Caribbean and helping locate unaccounted employees

Hurricane Maria Imagery

Much of the Caribbean still remains in emergency stabilization mode, but initial damage assessments were possible immediately following the hurricanes to locate structures that were destroyed or majorly damaged. NOAA imagery provided intel on which area of the Caribbean parks are affected. Facility management (FMSS) teams followed later once logistics were able to support them.

Survey123 for FMSS

- The results of using GIS and creating incident response workflows while in the incident generated many learned lessons that will be transferred to new SAR data collection:

Incident Map Category 5 Hurricanes Irma and Maria NPS Parks

Hurricane Maria
September 18 - 25, 2017

- 50 NPS Units Affected
- Hurricane Irma: 185 mph maximum sustained winds
- Hurricane Maria: 175 mph maximum sustained winds

Hurricane Irma
August 31 - September 11, 2017

Hurricane Irma Track
Hurricane Maria Track

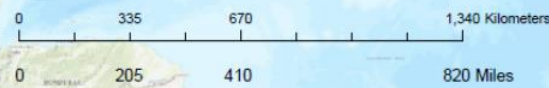
Hurricane Intensity

- Tropical Depression (≤ 39 mph)
- Tropical Storm (39 - 73 mph)
- Category 1 (74 - 95 mph)
- Category 2 (96 - 110 mph)
- Category 3 (111 - 129 mph)
- Category 4 (130 - 156 mph)
- Category 5 (≥ 157 mph)

Hurricane Wind Intensity

- Tropical Storm Force
- Strong Tropical Storm Force
- Hurricane Force

- NPS Units - Remained Open
- NPS Units - Affected/Closed



Prepared by
Intermountain IMT
Oct 01, 2017
1747 hrs





- 1
- 2
- 3
- 4
- 5

**VIIS, St. John
Maho Bay**

Assessing and clearing damage will be difficult in St. John due to examples like this. Large debris washed up onto the roads during the hurricanes.



Hurricane Maria Imagery

Much of the Caribbean still remains in emergency stabilization mode, but initial damage assessments were possible immediately following the hurricanes to locate structures that were destroyed or majorly damaged. NOAA imagery provided intel on which area of the Caribbean parks are affected. Facility management (FMSS) teams followed later once logistics were able to support them.

Survey123 for FMSS

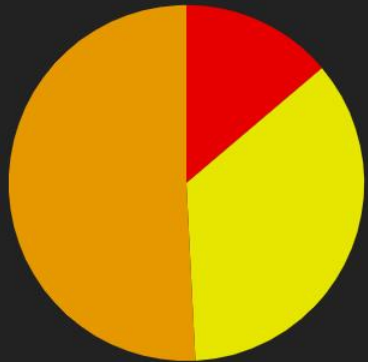
- The results of using GIS and creating incident response workflows while in the incident generated many learned lessons that will be transferred to new SAR data collection:
 - Majority of assessors were able to immediately pick up phone and use Survey123 and submit results
 - Some did not want to waste battery by using GPS, so points were not in right location
 - Need job aids, opportunities for training, technical support to eliminate need for data clean up
 - Need standardized terminology definitions and symbology
 - How to design the data collection prior to implementation so that it can be visualized the way we want it afterwards?
 - Data collection that will tell a story of what is happening

Survey123 for Displaced Vessels

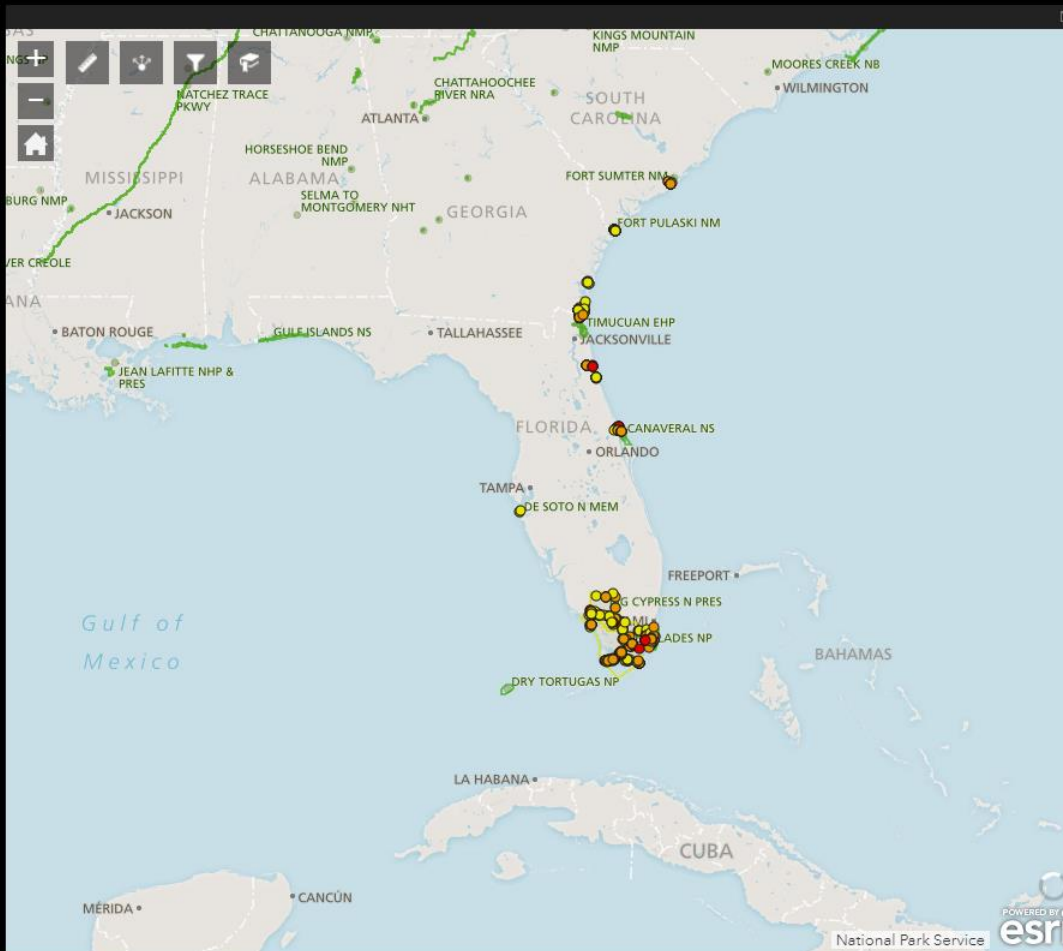
- Ability to test accuracy of GPS on handheld device in offline environment
 - Used in airplane mode in Florida, St. John, St. Croix, and St. Thomas
 - Data collected while on boat; most points were within 0-3m of what is shown on imagery from 9/15/2017.

565

Total Assessments

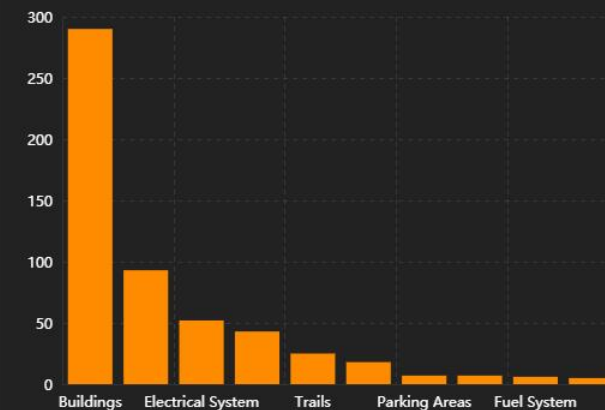


Critical Minor Serious



\$ 64,279,000

Total Estimated FMSS Costs



SARGIS9

Survey123 for FMSS

- The results of using GIS and creating incident response workflows while in the incident generated many learned lessons that will be transferred to new SAR data collection:
 - Majority of assessors were able to immediately pick up phone and use Survey123 and submit results
 - Some did not want to waste battery by using GPS, so points were not in right location
 - Need job aids, opportunities for training, technical support to eliminate need for data clean up
 - Need standardized terminology definitions and symbology
 - How to design the data collection prior to implementation so that it can be visualized the way we want it afterwards?
 - Data collection that will tell a story of what is happening

Survey123 for Displaced Vessels

- Ability to test accuracy of GPS on handheld device in offline environment
 - Used in airplane mode in Florida, St. John, St. Croix, and St. Thomas
 - Data collected while on boat; most points were within 0-3m of what is shown on imagery from 9/15/2017.

What's next?

- Partnering with RISD and other NPS GIS communities
- Integration with IMARS
- Eliminating paper and the process of Annual SAR Reports

Better Data, Better SAR

- An increase in analytic data will increase PSAR Efforts
- Contributions to International Search and Rescue Incident Database (ISRID)



SARGIS9

- Need standardized terminology definitions and symbology
- How to design the data collection prior to implementation so that it can be visualized the way we want it afterwards?
- Data collection that will tell a story of what is happening

Survey123 for Displaced Vessels

- Ability to test accuracy of GPS on handheld device in offline environment
 - Used in airplane mode in Florida, St. John, St. Croix, and St. Thomas
 - Data collected while on boat; most points were within 0-3m of what is shown on imagery from 9/15/2017.

What's next?

- Partnering with RISD and other NPS GIS communities
- Integration with IMARS
- Eliminating paper and the process of Annual SAR Reports

Better Data, Better SAR

- An increase in analytic data will increase PSAR Efforts
- Contributions to International Search and Rescue Incident Database (ISRID)
- Ability to address cases still outstanding
- Collaboration with other agencies

129,881

general contacts made last year

28,991

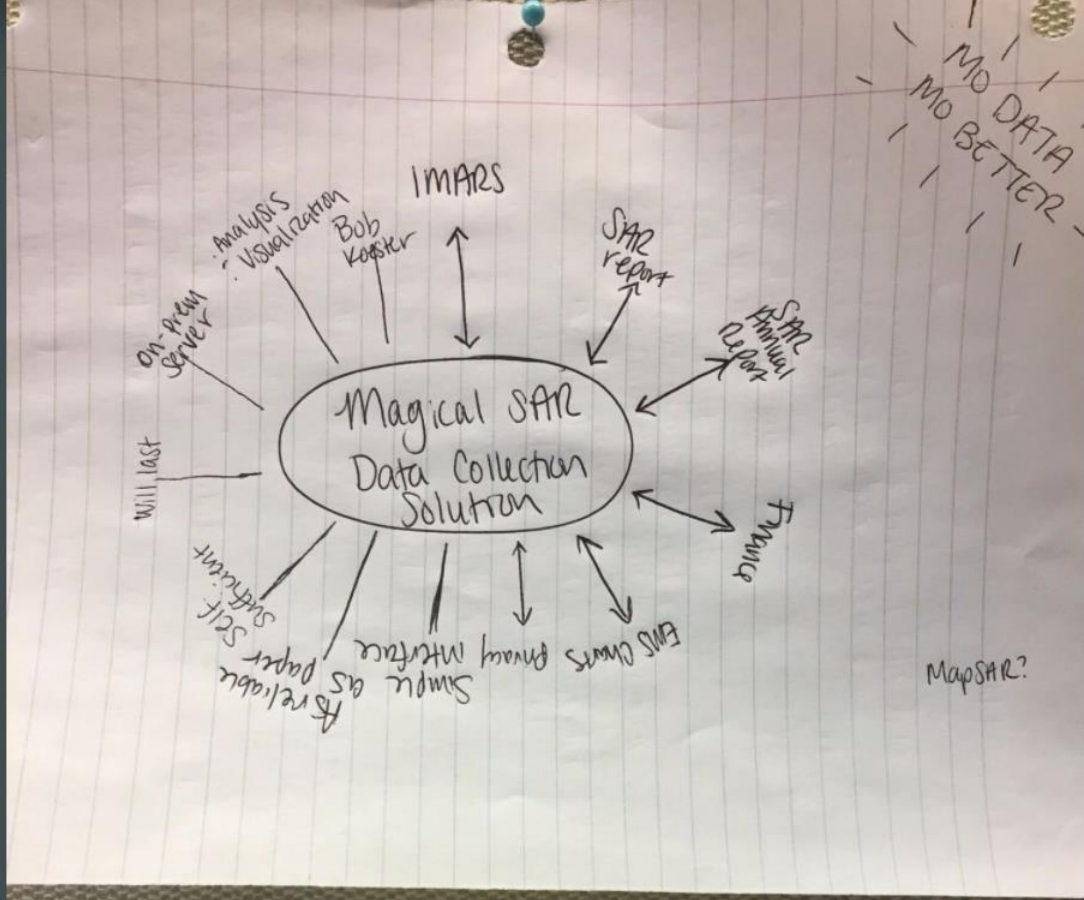
preventive actions taken in 2016

Grand Canyon PSAR Statistics. Source: <https://www.grandcanyon.org/our-work/success-stories/psar/>

Unmanned Aerial Systems (UAS)

- Used during Hurricane Harvey recovery
- NSARC White Paper





SARGIS9

- Need standardized terminology definitions and symbology
- How to design the data collection prior to implementation so that it can be visualized the way we want it afterwards?
- Data collection that will tell a story of what is happening

Survey123 for Displaced Vessels

- Ability to test accuracy of GPS on handheld device in offline environment
 - Used in airplane mode in Florida, St. John, St. Croix, and St. Thomas
 - Data collected while on boat; most points were within 0-3m of what is shown on imagery from 9/15/2017.

What's next?

- Partnering with RISD and other NPS GIS communities
- Integration with IMARS
- Eliminating paper and the process of Annual SAR Reports

Better Data, Better SAR

- An increase in analytic data will increase PSAR Efforts
- Contributions to International Search and Rescue Incident Database (ISRID)
- Ability to address cases still outstanding
- Collaboration with other agencies

129,881	28,991
general contacts made last year	preventive actions taken in 2016

Grand Canyon PSAR Statistics. Source: <https://www.grandcanyon.org/our-work/success-stories/psar/>

Unmanned Aerial Systems (UAS)

- Used during Hurricane Harvey recovery
- NSARC White Paper