**Georgia Disasters**

*Evaluating the Impacts of Hurricane Irma on Georgia Heirs Property Owners Using NASA Earth Observations*

**Project Team**

***Project Team:***

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**Project Overview**

***Project Synopsis:***

The State of Georgia received disaster recovery funding to assist people affected by Hurricane Irma in 2017. However, some Georgia heirs property owners did not get compensation due to complications with property titles. The NASA DEVELOP team partnered with the Georgia Heirs Property Law Center to create flood extent maps and identify potential heirs properties by using NASA Earth observations. The end products will help Georgia Heirs Property Law Center visualize the relationship between flood extent, structural damage, property data, and socioeconomic data. The partner will use this information as a case study to make sure heirs property owners are considered in future disaster relief.

***Abstract:***

In September 2017, Hurricane Irma made landfall in southern Georgia, causing severe flooding and widespread destruction. Disaster recovery programs were inaccessible for heirs property owners due to title difficulties. The NASA DEVELOP team worked in partnership with The Georgia Heir Property Law Center (The Center) to identify potential heirs properties impacted by Hurricane Irma. We created flood extent maps, a socioeconomic overlay, and identified potential areas of structural damage. We utilized surface reflectance data from Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Landsat 8 Operational Land Imager (OLI), and Sentinel-2 MultiSpectral Instrument (MSI), and also backscatter data from Sentinel-1 C-band Synthetic Aperture Radar (C-SAR). We produced flood extent maps by consolidating these Earth observations in NASA SERVIR’s Hydrologic Remote Sensing Analysis for Floods (HYDRAFloods) tool in Google Earth Engine (GEE). To produce a socioeconomic overlay, we used Computer Assisted Mass Appraisal (CAMA) data to identify areas of heirs properties likelihood. To identify potential structural damage, we used optical imagery data from PlanetScope and RapidEye. Our flood extent map results found that backscatter data were more reliable than surface reflectance, resulting in mainly coastal flooding. With these maps, we created a socioeconomic overlay for Camden County. Lastly, we found only nine potential instances of structural damage in Albany, Doughtery County. These end products will allow The Center to make informed decisions about the allocation of funds for heirs property disaster assistance.

***Key Terms:*** Hurricane Irma 2017, HYDRAFloods, CAMA, flood extent maps, heirs property owners

***National Application Area Addressed:*** Disasters

***Study Location:*** Berrien, Camden, Charlton, Chatham, Coffee, Cook, Crisp, Dougherty, Glynn, Liberty, McIntosh, Thomas, Turner, Wilcox, and Worth counties, GA

***Study Period:*** January 2017-September 2022

***Community Concerns:***

* Hurricane Irma left $54.7 million of property damage in its wake, affecting many Georgia residents.
* An heirs property is a property that has group ownership of every decedent of a deceased person without a deed or will, resulting in an unclear state of ownership.
* The absence of a clear title to the land can disqualify heirs property owners from many types of federal, state, and local disaster relief grants. Owners are unable to receive loans, file insurance claims, sell the property, or receive aid for home repairs. Oftentimes, this results in the property becoming “blighted,” which is defined as property that is uninhabitable or unsafe.
* With more than $2 billion dollars of potential heirs property value across the State of Georgia, much of this wealth is inaccessible for owners due to the nebulous legal nature of the properties. This gap in wealth was exacerbated by Hurricane Irma because heirs properties are unlikely to recover from a disaster, further devaluating the property.
* Furthermore, due to the increasing risk of coastal flooding and extreme weather events, the likelihood of further property destruction looms large, raising concerns for heirs property owners.

***Project Objectives:***

* Generate flood extent maps in HYDRAFloods using surface reflectance and backscatter data
* Create structural damage maps using high resolution imagery from PlanetScope
* Preprocess socioeconomic CAMA data to identify potential heirs properties within one county

**Partner Overview**

***Partner Organization:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **Contact (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| **Georgia Heirs Property Law Center** | Skipper StipeMaas, Executive Director; Delene Porter, Chief Operating Officer; Tiffany Reed, Program and Grants Coordinator | End User | No |

***Decision-Making Practices & Policies:***

The Georgia Heirs Property Law Center specializes in clearing and consolidating heirs property titles through estate planning, asset education, and outreach. The property law that defines heirs property is managed at a state level, but other programs, such as FEMA disaster relief, local home repair funds, or state grants are managed according to federal, state, and local policy. Many disaster relief programs require that a clear title is presented in order to receive assistance funds. The Center works with heirs property owners to not only obtain the necessary relief, but to help facilitate the management of the property. Recently, the Center received a grant to partner with the Georgia Department of Community Affairs to provide legal services to heirs property owners recovering from Hurricane Irma. The grant also funds disaster mitigation planning efforts to ensure heirs property owners are considered in future disaster relief and outreach to inform potentially vulnerable communities. The end user is not familiar with NASA Earth observations.

**Earth Observations & End Products Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter** | **Use** |
| **Landsat 8 OLI** | Surface reflectance | Surface reflectance data were used in HYDRAFloods to analyze Hurricane Irma’s flood extent.  |
| **Landsat 7 ETM+** | Surface reflectance | Surface reflectance data were used in HYDRAFloods to analyze Hurricane Irma’s flood extent.  |
| **Sentinel-2 MSI** | Surface reflectance | Surface reflectance data were used in HYDRAFloods to analyze Hurricane Irma’s flood extent. |
| **Sentinel-1 C-SAR** | Backscatter  | Backscatter data were used in HYDRAFloods to analyze Hurricane Irma’s flood extent. |
| **PlanetScope**  | Surface reflectance | PlanetScope provided high resolution imagery to investigate if blue tarped roofs and structural damage could be identified.  |

***Ancillary Datasets:***

* Georgia Counties, Computer Assisted Mass Appraisal (CAMA) – Estimate percent probability that a parcel is heirs property
* TIGER/Line Shapefile, 2019, State, Georgia, Current County Subdivision State-based – Provide geographic context to end products
* US Census Bureau American Community Survey (ACS) 2019 – Incorporate County level socioeconomic metrics
* MERIT Hydro: Global Hydrography Digital Elevation Model (DEM) – Utilize in HYDRAFloods to refine SAR imagery to the nearest drainage point
* U.S. Geological Survey 3D Elevation Program (3DEP) – Utilize in HYDRAFloods to refine SAR imagery to more region-specific data
* European Commission’s Joint Research Center (JRC) Yearly Water History Dataset – Utilize in HYDRAFloods to mask permanent waterbodies
* The Community Development Block Grant Disaster Recovery (CDBG-DR) Program Map – Provide geographic context to the project

***Modeling:***

* HYDRAFloods (Contact: Dr. Marguerite Madden, University of Georgia) – Visualize hurricane damage to Georgia heirs property owners

***Software & Scripting:***

* Google Earth Engine Python API – Download and pre-process satellite imagery
	+ HYDRAFloods – Create flood extent maps
* ArcGIS Pro v10.8.2 – Format flood extent maps, overlay socioeconomic data with flood extent

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product** | **Earth Observation Used** | **Partner Benefit and Use** | **Software Release Category** |
| **Hurricane Irma Flood Extent Map** | Landsat 8 OLILandsat 7 ETM+Sentinel-2 MSISentinel-1 C-SAR | The Georgia Heirs Property Law Center will use flood extent maps to visualize damage to Georgia property owners in educational materials and identify areas of potential outreach.  | N/A |
| **Hurricane Irma Structural Damage Map** | PlanetScope | The Georgia Heirs Property Law Center will use structural damage maps to visualize damage to Georgia property owners in educational materials and identify areas of potential outreach. | N/A |
| **Heirs Property Owner Impact Data Tables & Maps** | Landsat 8 OLILandsat 7 ETM+Sentinel-2 MSISentinel-1 C-SARPlanetScope | The Georgia Heirs Property Law Center will use heirs property owner impact data tables and maps as a case study to incorporate in their disaster mitigation planning efforts. Specifically, it will identify areas of outreach for one county, Camden County, and visualize Hurricane Irma’s impact for educational materials.  | N/A |

***Product Benefit to End User:***

The Center has received funding from the Georgia Department of Community Affairs for Disaster Mitigation Planning efforts for heirs properties. The Center will use this research as a case study to identify where heirs property owners were affected by a natural disaster. The flood extent maps, socioeconomic overlays, and data tables will be used to visualize damage to GA heirs property owners in educational materials and to identify areas of potential outreach. This product will inform their work on securing and preserving property rights of low-moderate income Georgians.

***Project Continuation Plan:***

The first team will hand off the flood extent maps, methodology for preprocessing CAMA data for Camden County, and the potential structural damage map for Albany, Doughtery County. The second term team will focus on refining and overlaying the first term’s flood extent and structural damage maps with the ACS and CAMA data to better understand the impact of Hurricane Irma on Georgia heirs property owners. This team will also incorporate FEMA denial data pre-processed by the Washington Post to analyze potential inequalities of disaster relief funding.

**References**

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