**Georgia Disasters II**

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

**Project Team**

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**Project Overview**

***Project Synopsis:***
Heirs property is a shockingly common legal issue, wherein a piece of property without an executed will is bequeathed evenly amongst potential heirs. In the flooding afterHurricane Irma, heirs property owners found themselves unable to access federal relief funds from FEMA due to the status of their property title. In collaboration with The Georgia Property Law Center, the DEVELOP team used Earth observations to identify areas with high likelihood of heirs properties as well as areas most heavily impacted by flooding.

***Abstract:***

Heirs property owners are especially vulnerable to natural and manmade disasters. This group of people have inherited property left with no clear title and thus have unclear group ownership with the other legal owners, which are all spouses, children, etc. After Hurricane Irma made landfall in Georgia in September of 2017, heirs property owners were more likely to be denied access to federal relief due to the legal status of their property title. To observe how this group was impacted by Hurricane Irma, the NASA DEVELOP team partnered with The Georgia Heirs Property Law Center (The Center), a non-profit law firm that works with heirs properties owners. The team used computer assisted mass appraisal (CAMA) data to identify likely heirs property owners. This map was cross referenced with a flood map produced with surface reflectance and backscatter imagery from Landsat 8 OLI, Sentinel-2 MSI, and Sentinel-1 C-SAR, sensors to identify communities in need of relief or assistance. The flood extent maps were validated against United States Geological Survey Hurricane Irma High Water Mark *in situ* data taken the same day Irma crossed into Georgia. To further evaluate the impacted group, the team correlated the flood and heirs property likelihood maps to FEMA denials based on issues with titles. The team’s end products were handed off to the Georgia Heirs Property Law Center for use in community outreach and educational materials as well as to help direct where The Center prioritizes its limited legal resources.

***Key Terms:*** CAMA, Hurricane Irma, heirs property, ACS, FEMA, flood extent, HYDRAFloods

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

***Study Location:*** 15 selected counties: Berrien, Camden, Charlton, Chatham, Coffee, Cook, Crisp, Dougherty, Glynn, Liberty, McIntosh, Thomas, Turner, Wilcox, Worth Counties, GA

***Study Period:*** January2012 to September 2017

***Community Concerns:***

* Hurricane Irma caused over $54 million of damage to properties and businesses in Georgia, leaving many Georgia residents in difficult economic and living situations.
* An unclear title for an heirs property limits the owners’ ability to receive federal, state, and local relief aid. Additionally, owners face challenges receiving loans, filing insurance claims, or selling the property. If an heirs property owner were to pay for a repair with their own funds and lack of consent from other co-owners, then they could be sued by any of the other owners. Therefore, these properties are more likely to become uninhabitable post-disaster.
* Potential heirs properties in Georgia make up over $2.5 billion dollars in property value. Many of these property values diminished after Hurricane Irma due to the landowners’ inability to recover the property. Blighted properties also diminish the surrounding communities’ value.
* Due to an increasing risk of coastal flooding and historic weather events, homeowners, and heirs property owners more specifically, are at risk of further property damage and destruction.
* Heirs property owners also tend to be located in historically disenfranchised communities, such as hubs for the TransAtlantic Slave Trade, minority communities during Jim Crow, and agricultural areas where land-stealing and lax property laws are common. A significant portion of our study area is in these communities, such as the Gullah-Geechee Historic Corridor.

***Project Objectives:***

* Refine the Landsat 8 and Sentinel-2 flood extent maps and validate flood against the USGS *in situ* data
* Filter and analyze CAMA data for all 15 counties in the study area in order to identify probable heirs property parcels
* Create a bivariate map that shows concentration of flood extent and probable heirs properties compared to one another for each county
* Produce maps correlating probable heirs property distribution with FEMA relief denials based on title issues

***Previous Term:*** Fall2022 (Georgia – Athens) – Georgia Disasters

**Partner Overview**

***Partner Organization:***

|  |  |  |
| --- | --- | --- |
| **Organization** | **Contact (Name, Position/Title)** | **Partner Type** |
| **Georgia Heirs Property Law Center** | Delene Porter, Chief Operating Officer; Skipper StipeMaas, Executive Director; Tiffany Reed, Program & Grants Coordinator | End User |

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

The Georgia Heirs Property Law Center assists the consolidation of heirs properties in the legal process to have undisputed ownership. The Center does this through estate planning, asset-based pedagogy, and community outreach. They have also acquired a grant with the Georgia Department of Community Affairs (DCA) for disaster mitigation efforts. Their work is concerned with Georgia property law and the title policies of home-repair and disaster relief programs at federal, state, and local levels. The Center does not make environmental science investigations on natural disaster events. The Center was not previously familiar with NASA Earth observations; this research is their first foray into remote sensing.

**Earth Observations & End Products Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **Sentinel-1 C-SAR** | Backscatter | HYDRAFloods was used with backscatter to analyze Hurricane Irma flood extent. |
| **Sentinel-2 MSI** | Top-of-Atmosphere Reflectance | HYDRAFloods was used with top-of-atmosphere reflectance to analyze Hurricane Irma flood extent. |
| **Landsat 8 OLI** | Surface Reflectance | HYDRAFloods was used with surface reflectance to analyze Hurricane Irma flood extent. |

***Ancillary Datasets:***

* Georgia Counties, Computer Assisted Mass Appraisal (CAMA) – Identification of parcels as probable heirs properties
* TIGER/Line Shapefile, 2019, State, Georgia, Current County Subdivision State-based – Provide geographic context restrict data to the study area in map layouts
* MERIT Hydro: Global Hydrography Digital Elevation Model (DEM) – Used with HYDRAFloods to refine SAR imagery to the nearest drainage point
* U.S. Geological Survey 3D Elevation Program (3DEP) – Used with HYDRAFloods to refine SAR imagery to more region-specific data
* European Commission’s Joint Research Center (JRC) Yearly Water History Dataset – Acts as referential surface water to determine flood extent against
* The Community Development Block Grant Disaster Recovery (CDBG-DR) Program Map – Provide geographic context to the identified heirs properties
* HVRI Social Vulnerability Index (SoVI) - Identifies demographics socially vulnerable to natural disasters to compare to the distribution of heirs property
* USGS *in situ* High Water Mark Hurricane Irma Event data – Validated remotely sensed flood extent to this dataset
* National Weather Service United States Country Shapefile – Masked flood extent with this shapefile to remove flood pixels that appeared in the ocean

***Modeling:***

* HYDRAFloods (Contact: Dr. Marguerite Madden, University of Georgia) – To create flood extent maps with the identification of water in remotely sensed imagery

***Software & Scripting:***

* Google Earth Engine Python API – Download and pre-process satellite imagery
	+ HYDRAFloods – Create flood extent maps
* Google Earth Engine Python API – Heirs Property
	+ Pandas – Data frame methods for reading and cleaning CAMA data
* ArcGIS Pro v10.8.2 – Validate flood, format flood extent maps, format heirs property maps, create a bivariate map of both flood and heirs properties likelihood, and other overlays with socioeconomic data

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Earth Observations Used**  | **Partner Benefit & Use** | **Software Release Category** |
| **Maps of Hurricane Irma Flood Extent** | Landsat 8 OLISentinel-1 C-SARSentinel-2 MSI | The Center will use flood extent maps to help develop disaster mitigation plans, with regards to natural disaster vulnerability. | N/A |
| **Probable Heirs Property Parcel Table and Maps Correlating with Social Vulnerability Index** | N/A | The Center will use maps of probable heirs properties to refine and focus their education and outreach efforts. | N/A |
| **Bivariate Map of Flood Extent from Hurricane Irma and Probable Heirs Property Percentages** | Landsat 8 OLISentinel-1 C-SARSentinel-2 MSI | The Center will use this map to help develop disaster mitigation plans and identify communities vulnerable to natural disasters. | N/A |
| **Bivariate Map of Probable Heirs Property Percentages and Title Difficulty Based FEMA Denials** | N/A | The Center will use this map to help develop disaster mitigation plans and policy advocacy with regards to providing support to heirs property owners after a natural disaster. | N/A |

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

The end products will be used by The Center for educational materials and to increase awareness during outreach to community leaders and members. There are, as of our writing, still people contacting the DCA for disaster relief from Hurricane Irma and other natural disasters that occurred years ago. Many are redirected to The Center to receive legal assistance as part of their collaboration. NASA Earth observations in conjunction with an indexed identification of potential heirs properties will help The Center identify communities that are most vulnerable to natural disasters. This research could also inform future decisions and policy recommendations to consider heirs property owners in disaster relief efforts where they are, rarely if ever, prioritized.

**References**

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