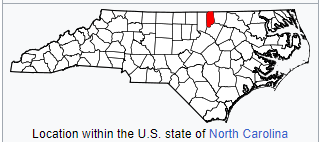
**Proposed Workflow for Comparing Forest Health of Heir’s to Non-Heir’s Properties**

**in Vance County, North Carolina**

This workflow for comparing the forest health of heirs’ properties (HPs) and non-heirs’ properties (non-HPs) will be piloted for Vance County, North Carolina because it has a black population of at least 50% and percent black in the Black Belt is typically correlated with HPs (Dobbs and Johnson Gaither 2023). According to the U.S. Census Bureau, Vance County has an estimated population size of 42,301 as of July 2023, with 51.6% Black or African American, 44.5% White, and 9.0% Hispanic or Latino. It is approximately 696 km2 (269 mi2) in size and located along the northern boundary of North Carolina (Wikipedia.org).

It is understood that this proposed workflow for Vance County may need to be revised, but once it is finalized it is anticipated that it can be repeated for all North Carolina counties. In this document, the term HP refers to parcels that have the potential to be HPs based on a protocol developed by [Pippin, Jones, and Johnson Gaither (2027)](https://www.fs.usda.gov/research/treesearch/55263), refined by [Dobbs and Johnson Gaither, 2023](https://srdc.msstate.edu/sites/default/files/2023-06/dobbs_johnson-gaither_pre-print-manuscript-6.5.23.pdf), and later modified by C. Johnson Gaither using SAS code.



[Vance County, North Carolina - Wikipedia](https://en.wikipedia.org/wiki/Vance_County,_North_Carolina)

**Data Collection:**

* Obtain aerial imagery acquired by the USDA National Agricultural Imagery Program (NAIP) for Vance County. Most recent dates appear to be June and September 2022 with new 2024 imagery currently being flown ([National Agriculture Imagery Program - NAIP Hub Site (arcgis.com)](https://naip-usdaonline.hub.arcgis.com/).
* Obtain parcel data of potential HPs (Title: HP\_Properties\_NC), created by Dr. Johnson Gaither and described in HP\_Properties\_NC\_ReadME.docx. Subset HP parcels of Vance County.
* Obtain 2022 tax parcels for NC to identify Non-HP parcels that are adjacent to or near HPs that are comparable in size and forest characteristics.
* Obtain data to identify residential parcels for NC. The exact form of this data will vary by county.
* Obtain the most recent data from the USDA Forest Service’s Forest Inventory Analysis (FIA) that are available to the public. FIA data for 2022 are listed as available for download from the USFS [SRS - Forest Inventory and Analysis-4801 - Welcome! (usda.gov)](https://www.fs.usda.gov/srsfia/data_center/index.shtml). It is understood that approximate coordinate locations of publicly available FIA data are not the precise locations of the plot centers. The true plot centers have been shifted and, in some cases, swapped, to ensure the privacy of private landowners (Lister et al. 2005, Burrill et al. 2023). Information collected for FIA plots such as forest type, age, density, etc. will be used as ground truth data to correlate with NDVI values indicating vegetation health.
* Dr. Johnson Gaither suggests we talk to James Williams with the [Center for Heirs' Property Preservation](https://www.heirsproperty.org/who-we-are/) about on the ground differences between HPs and Non-HPs because it would be helpful in the attempt to identify comparable Non-HPs and for selecting the most appropriate FIA metrics to discern ‘health.’ She can arrange a call with James.

**Data Analysis:**

* The vegetation index, Normalized Difference Vegetation Index (NDVI), will be computed from the NAIP imagery for an area surrounding Vance County.
* The protocol for identifying “similar” Non-HPs may need to be adjusted, but to begin we will buffer the outer boundary of HP parcels by a distance. e.g., 1 mi., that is suitable for identifying comparable forest patches. This distance may be appropriate because publicly available FIA plot locations are intentionally shifted (i.e., fuzzed) “… within 0.5 mile for most plots and up to 1.0 mile on a small subset of them” ([The Forest Inventory and Analysis Database User Guide (NFI) | US Forest Service Research and Development (usda.gov)](https://www.fs.usda.gov/research/understory/forest-inventory-and-analysis-database-user-guide-nfi). The most recent National Land Cover Data set (NLCD 2021) at 30-m spatial resolution and produced by the U.S. Geological Survey (USGS) will be used to filter forested parcels within the 1-km buffer of HPs ([National Land Cover Database (NLCD) | U.S. Geological Survey (usgs.gov)](https://www.usgs.gov/node/279743). Further filtering will include factors such as parcel size, public lands with state or federal forest management, potential corporate parcels and similar elevation. HP parcels will undergo the same filtering to ensure the paired HP and Non-HP parcels are comparable.
* The boundaries of HP parcels paired with similar Non-HP parcels will be overlaid with the NDVI raster layer to extract summary statistics such as mean, standard deviation, minimum and maximum NDVI values per parcel.
* Statistical analysis to compare NDVI values of two groups, HPs and Non-HPs, such as the paired samples t-test, will be used to determine if forest health in HPs as measured by NDVI is significantly lower or greater than or equal to the forest health of Non-HPs.
* Publicly available FIA plots within Vance County will be overlaid with paired HP and Non-HP parcels to further characterize forest stands within these parcels. The FIA data provide ground-based information on forest stands within these parcels. Since the precise locations of the FIA plots are not available, the USFS will need to repeat this step with accurately located FIA plot data.
* Statistical analysis to compare ground-based data from FIA plots falling within two groups, HPs and Non-HPs, such as the paired samples t-test if the data are determined to be normally distributed. The results will determine if forest stand characteristics in HPs are significantly different from forests in Non-HPs.

**Output Products:**

* Summary statistics describing NDVI values spatially correlated with HP and comparable Non-HP parcels in Vance County, North Carolina.
* Summary statistics describing ground-based forest stand characteristics within HP and comparable Non-HP parcels in Vance County, North Carolina, understanding these results are inaccurate. They only represent analysis results that might be obtained from repeating the protocol with data from accurately located FIA plots.
* A workflow protocol in ArcGIS Pro that could be used by the USFS to repeat this analysis for other counties in North Carolina with accurate FIA data.

**References:**

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