



Weight and Veterans' Environments Study

Population and Housing Units in the Neighborhood: Weight and Veterans' Environments Study GIS protocol

Xiang W, Jones KK, Matthews SA, Zenk SN.



UIC Neighborhoods + Health

Overview

This protocol was used for American Community Survey (ACS) variables reported as total counts in a given administrative area, i.e., total housing units or total population in a block group, in order to identify the variable value for Euclidean buffers around participant locations.

Acknowledgements

This protocol was developed with grant support from the National Cancer Institute (R21CA195543) and the Department of Veterans Affairs (IIR 13-085), co-led by Shannon Zenk and Elizabeth Tarlov. Haytham Abu Zayd, Shubhayan Ukil, and Abby Klemp helped to edit the protocol for dissemination.

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Background

This document describes the work process for constructing housing and population density measures based on American Community Survey (ACS) variables, for Euclidean buffers around participant home geocodes.

Data

Sources

The data source is from American Community Survey (ACS) 5-year summary files.

Definitions

Housing variables definition and years

The ACS variables are available at both census tract and block group level. In order to be as sensitive as possible to spatial variation in density, we chose to use block group level data to create raster grids for the following:

1. Number of total housing units
2. Number of vacant housing units
3. Number of owner occupied housing unit

2 additional variables were created after linking to participant locations:

4. Number of occupied housing units (= total – vacant)
5. Number of renter occupied units (= occupied – owner occupied)

Cleaning

Create cell value for making grids

We generated a variable called “cell value” to populate each cell of the raster. In all grids measures, a cell is defined as a 30 by 30 meters square, or 900 sq meters. In the case of variables representing total units (i.e., dwelling units, people) in a given area, we distributed the total variable value over each cell in the block group, given the assumption that within each block group the units are distributed evenly. It is important to note that this assumption is a limitation in the process.

Stata code for this process is located in Appendix A.

What this DO file does:

- Calculate the 30x30 meter cell value from census block group housing value and census block area, based on the following formula:
Cell value for one block group = (housing variable value for this block group/total area in sq meters for this block group) *900

- For Housing variables, there are geography changes in each ACS year, so the changes are applied each year in the DO file script in order to join the cell value to the correct cells based on a 2010 vintage geography file in GIS
- Total housing units and vacant housing units are provided directly in ACS output. Owner occupied housing units is calculated with the following formula: $((\text{total housing units}) * (\text{percent occupied housing}) * (\text{percent owner occupied}))/10000$.

Decisions

Join cell value to GIS block group file

After the determination of cell values and the application of the crosswalk to identify correct geographic location of block groups that have changed number or boundaries, join to GIS census block group polygon file.

The join cell value to block group process and was done manually in the following steps:

1. Add the cell value .csv file in ArcMap, export it to a geodatabase as a table. Run “Add Attribute Index” tool to add index to “geoid10” field.
2. For each year of polygon file, run “Join Field” tool based on “geoid10” to join the Housing cell value data permanently to the block group GIS file.
3. After join is completed, use the block group polygon file that has the joined cell values, run “Add Attribute Index” tool to add index to “geoid10”, and all the cell value fields.
4. *This process needs to be run once for each cell value field:* Use the joined block group polygon, use cell value field as the value field, run “Polygon to Raster” tool. For the entire continental US with 30mX30m cells, this may take 2-5 hours for one raster.

The raster files derived from the above step 4 will be used as input to create the grids.

Housing grids generation process

Using the base raster files generated from the last step, the Python script in Appendix B creates the Housing grids for 400m and 1600m.

What this script does:

- This script needs to be run once for each year’s measure by changing the parameters
- Create 3 grids per buffer – 400m and 1600m. The 3 grids are 1) Total housing units, 2) total vacant housing units, 3) total owner occupied housing units

Software

The software used is ArcGIS 10.3.1 and Python 2.7.

Appendix

Appendix A. Create cell value for making grids

Note: Script will need to be adjusted with project-specific file names and locations.

```
clear all
cap log close
set more off
```

```
*****
```

```
*This DO file allows the user to assign block groups population density per 900sq meters. This is necessary so that there can be a grid made 30mX30m cell size
```

```
*that has a population distribution such that the cells that make up a block group have the correct population. That grid can then be used with the focal statistics
```

```
*tool to create a separate grid with total population (estimated, assumption is that within block groups populations are distributed homogeneously) within all the different buffer sizes.
```

```
*This second grid can then be used, with map algebra, to combine the store counts into store density per population.
```

```
*****
```

```
*Block group populations must be combined with block group areas.
```

```
/*
```

```
*This is the Census 2010 population file
```

```
use {insert file location}, clear
```

```
merge 1:1 geoid10 using {insert file location}
```

```
*If some don't merge from the area file, here are some possible solutions. They may be AK, HI, PR, VI. In that case, it is fine, and get rid of them.
```

```
*drop if _merge==1
drop _merge
```

```
*Now you have total population and total area in square meters. Need the population density
per cell.  $\frac{\text{total population}}{\text{sq meters}} \times \frac{900 \text{ sq meters}}{1 \text{ cell}} = \frac{\text{population}}{\text{cell}}$ 
gen cellpop=(totalpopulation/bg_sqmeter)*900
```

```
*This output then has to be joined back in to the block group shapefile. Afterwards, the cell
population raster will be made using the Polygon to Raster tool. It cannot be exported to excel,
because it is too large.
```

```
export delimited using {insert file location}, replace
*/
```

```
**For ACS 5-year summary 2006-2010, center year 2008, use 2010 geographies, no geographic
changes.
```

```
use {insert file location}, clear
```

```
*merge another file to get complete housing variables
```

```
merge 1:1 geoid using {insert file location}
```

```
drop _merge
```

```
gen bg_ACS_2006_2010 = substr(geoid,8,19)
```

```
gen str blockgroup2010 = bg_ACS_2006_2010
```

```
rename blockgroup2010 geoid10
```

```
merge 1:1 geoid10 using {insert file location}
```

```
drop if _merge==2
```

```
*create # owner occupied housing
```

```
gen BG_ttl_ooh = BG_ttl_hu* BG_pct_oh* BG_pct_ooh/10000
```

```
*create cell value
```

```
* # total housing units
```

```
gen cell_ttl_hu=(BG_ttl_hu/BG_sqmeter)*900
```

```
* # vacant housing units
```

```
gen cell_ttl_vacant = (b25004e1/BG_sqmeter)*900
```

```
* # owner occupied housing units
```

```
gen cell_ttl_ooh = (BG_ttl_ooh/BG_sqmeter)*900
```



```
*drop state county tract blkgrp geoid name BG_ttl_hu BG_pct_vhu BG_pct_oh BG_pct_ooh
BG_OHU BG_OOH b25004e1 BG_ttl_ooh bg_ACS_2007_2011 blockgroupnumber
censustract2011 BG_sqmeter strlength zero _merge
keep geoid10 cell_ttl_hu cell_ttl_vacant cell_ttl_ooh
```

```
export delimited using {insert file location}, replace
```

```
clear
```

```
**For ACS 5-year summary 2007-2011, center year 2009, use 2010 geographies with 2011
geographic changes.
```

```
use {insert file location}, clear
```

```
*merge another file to get complete housing variables
```

```
merge 1:1 geoid using {insert file location}
```

```
drop _merge
```

```
gen bg_ACS_2007_2011 = substr(geoid,8,19)
```

```
drop if state == "02" | state == "60" | state == "66" | state == "15" | state == "72" | state ==
"78"
```

```
gen str blockgroup2010 = bg_ACS_2007_2011
```

```
gen str blockgroupnumber = substr(blockgroup2010,12,1)
```

```
gen str censustract2011 = substr(bg_ACS_2007_2011,1,11)
```

```
replace blockgroup2010 = "36053940101"+blockgroupnumber if censustract2011 ==
"36053030101"
```

```
replace blockgroup2010 = "36053940102"+blockgroupnumber if censustract2011 ==
"36053030102"
```

```
replace blockgroup2010 = "36053940103"+blockgroupnumber if censustract2011 ==
"36053030103"
```

```
replace blockgroup2010 = "36053940200"+blockgroupnumber if censustract2011 ==
"36053030200"
```

```
replace blockgroup2010 = "36053940300"+blockgroupnumber if censustract2011 ==
"36053030300"
```

```
replace blockgroup2010 = "36053940401"+blockgroupnumber if censustract2011 ==
"36053030401"
```

```
replace blockgroup2010 = "36053940403"+blockgroupnumber if censustract2011 ==
"36053030403"
```

```
replace blockgroup2010 = "36053940600"+blockgroupnumber if censustract2011 ==
"36053030600"
```

```
replace blockgroup2010 = "36053940700"+blockgroupnumber if censustract2011 ==
"36053030402"
```

```
*Oneida County, NY
```

```
replace blockgroup2010 = "36065940000"+blockgroupnumber if censustract2011 ==
"36065024800"
```

```
replace blockgroup2010 = "36065940100"+blockgroupnumber if censustract2011 ==
"36065024700"
```

```
replace blockgroup2010 = "36065940200"+blockgroupnumber if censustract2011 ==
"36065024900"
```

```
rename blockgroup2010 geoid10
```

```
merge 1:1 geoid10 using {insert file location}
```

```
drop if _merge==2
```

```
*create # owner occupied housing
```

```
gen BG_ttl_ooh = BG_ttl_hu* BG_pct_oh* BG_pct_ooh/10000
```

```
*create cell value
```

```
* # total housing units
```

```
gen cell_ttl_hu=(BG_ttl_hu/BG_sqmeter)*900
```

```
* # vacant housing units
```

```
gen cell_ttl_vacant = (b25004e1/BG_sqmeter)*900
```

```
* # owner occupied housing units
```

```
gen cell_ttl_ooh = (BG_ttl_ooh/BG_sqmeter)*900
```

```
*drop state county tract blkgrp geoid name BG_ttl_hu BG_pct_vhu BG_pct_oh BG_pct_ooh
```

```
BG_0HU BG_0OH b25004e1 BG_ttl_ooh bg_ACS_2007_2011 blockgroupnumber
```

```
censustract2011 BG_sqmeter strlength zero _merge
```

```
keep geoid10 cell_ttl_hu cell_ttl_vacant cell_ttl_ooh
```

```
export delimited using {insert file location}, replace
```

```
clear
```

**For ACS 5-year summary 2008-2012, center year 2010, use 2010 geographies with 2011 and 2012 geographic changes.

```
Use {insert file location}, clear
```

```
*merge another file to get complete housing variables
merge 1:1 geoid using {insert file location}
drop _merge
```

```
gen bg_ACS_2008_2012 = substr(geoid,8,19)
```

```
drop if state == "02" | state == "60" | state == "66" | state == "15" | state == "72" | state ==
"78"
```

```
gen str blockgroup2010 = bg_ACS_2008_2012
gen str blockgroupnumber = substr(blockgroup2010,12,1)
gen str censustract2012 = substr(bg_ACS_2008_2012,1,11)
```

```
*2011 changes:
```

```
replace blockgroup2010 = "36053940101"+blockgroupnumber if censustract2012 ==
"36053030101"
```

```
replace blockgroup2010 = "36053940102"+blockgroupnumber if censustract2012 ==
"36053030102"
```

```
replace blockgroup2010 = "36053940103"+blockgroupnumber if censustract2012 ==
"36053030103"
```

```
replace blockgroup2010 = "36053940200"+blockgroupnumber if censustract2012 ==
"36053030200"
```

```
replace blockgroup2010 = "36053940300"+blockgroupnumber if censustract2012 ==
"36053030300"
```

```
replace blockgroup2010 = "36053940401"+blockgroupnumber if censustract2012 ==
"36053030401"
```

```
replace blockgroup2010 = "36053940403"+blockgroupnumber if censustract2012 ==
"36053030403"
```

```
replace blockgroup2010 = "36053940600"+blockgroupnumber if censustract2012 ==
"36053030600"
```

```
replace blockgroup2010 = "36053940700"+blockgroupnumber if censustract2012 ==
"36053030402"
```

```
*Oneida County, NY
```

```
replace blockgroup2010 = "36065940000"+blockgroupnumber if censustract2012 ==
"36065024800"
```

```
replace blockgroup2010 = "36065940100"+blockgroupnumber if censustract2012 ==
"36065024700"
```

```
replace blockgroup2010 = "36065940200"+blockgroupnumber if censustract2012 ==
"36065024900"
```

```
*2012 changes:
```

```
*1. Numbering of 7 census tracts in Pima County, AZ is changes with no geography changes
```

```

        replace blockgroup2010 = "04019002701"+blockgroupnumber if censustract2012 ==
"04019002704"
        replace blockgroup2010 = "04019002903"+blockgroupnumber if censustract2012 ==
"04019002906"
        replace blockgroup2010 = "04019410501"+blockgroupnumber if censustract2012 ==
"04019004118"
        replace blockgroup2010 = "04019410502"+blockgroupnumber if censustract2012 ==
"04019004121"
        replace blockgroup2010 = "04019410503"+blockgroupnumber if censustract2012 ==
"04019004125"
        replace blockgroup2010 = "04019470400"+blockgroupnumber if censustract2012 ==
"04019005200"
        replace blockgroup2010 = "04019470500"+blockgroupnumber if censustract2012 ==
"04019005300"

```

```

*2. The deletion of Census 2000 tract 1370.00 is corrected in Los Angeles County, CA
replace blockgroup2010 = "060378002043" if bg_ACS_2008_2012 == "060371370002"
replace blockgroup2010 = "060379304011" if bg_ACS_2008_2012 == "060371370001"

```

```

rename blockgroup2010 geoid10
merge 1:1 geoid10 using {insert file location}

```

```

drop if _merge==2

```

```

*create # owner occupied housing
gen BG_ttl_ooh = BG_ttl_hu* BG_pct_oh* BG_pct_ooh/10000
*create cell value
* # total housing units
gen cell_ttl_hu=(BG_ttl_hu/BG_sqmeter)*900
* # vacant housing units
gen cell_ttl_vacant = (b25004e1/BG_sqmeter)*900
* # owner occupied housing units
gen cell_ttl_ooh = (BG_ttl_ooh/BG_sqmeter)*900

```

```

*drop state county tract blkgrp geoid name BG_tot_pop BG_tot_pop_me CT_tot_pop
CT_tot_pop_me CT_0pop CT_0popme BG_0pop BG_0popme bg_ACS_2008_2012
blockgroupnumber censustract2012 BG_sqmeter strlength zero _merge
keep geoid10 cell_ttl_hu cell_ttl_vacant cell_ttl_ooh

```

```

export delimited using {insert file location}, replace

```

```
clear
```

**For ACS 5-year summary 2009-2013, center year 2011, use 2010 geographies with 2011 and 2012 geographic changes. There are no additional geographic changes for 2013 that affect census tracts and block groups.

```
use {insert file location}, clear
*merge another file to get complete housing variables
merge 1:1 geoid using {insert file location}
drop _merge
```

```
gen bg_ACS_2009_2013 = substr(geoid,8,19)
*gen bg_ACS_2009_2013=geoid
*gen state= substr(geoid,1,2)
drop if state == "02" | state == "60" | state == "66" | state == "15" | state == "72" | state == "78"
```

```
gen str blockgroup2010 = bg_ACS_2009_2013
gen str blockgroupnumber = substr(blockgroup2010,12,1)
gen str censustract2013 = substr(bg_ACS_2009_2013,1,11)
```

*2011 changes:

```
replace blockgroup2010 = "36053940101"+blockgroupnumber if censustract2013 == "36053030101"
replace blockgroup2010 = "36053940102"+blockgroupnumber if censustract2013 == "36053030102"
replace blockgroup2010 = "36053940103"+blockgroupnumber if censustract2013 == "36053030103"
replace blockgroup2010 = "36053940200"+blockgroupnumber if censustract2013 == "36053030200"
replace blockgroup2010 = "36053940300"+blockgroupnumber if censustract2013 == "36053030300"
replace blockgroup2010 = "36053940401"+blockgroupnumber if censustract2013 == "36053030401"
replace blockgroup2010 = "36053940403"+blockgroupnumber if censustract2013 == "36053030403"
replace blockgroup2010 = "36053940600"+blockgroupnumber if censustract2013 == "36053030600"
replace blockgroup2010 = "36053940700"+blockgroupnumber if censustract2013 == "36053030402"
```

*Oneida County, NY

```
replace blockgroup2010 = "36065940000"+blockgroupnumber if censustract2013 ==  
"36065024800"
```

```
replace blockgroup2010 = "36065940100"+blockgroupnumber if censustract2013 ==  
"36065024700"
```

```
replace blockgroup2010 = "36065940200"+blockgroupnumber if censustract2013 ==  
"36065024900"
```

*2012 changes:

*1. Numbering of 7 census tracts in Pima County, AZ is changes with no geography changes

```
replace blockgroup2010 = "04019002701"+blockgroupnumber if censustract2013 ==  
"04019002704"
```

```
replace blockgroup2010 = "04019002903"+blockgroupnumber if censustract2013 ==  
"04019002906"
```

```
replace blockgroup2010 = "04019410501"+blockgroupnumber if censustract2013 ==  
"04019004118"
```

```
replace blockgroup2010 = "04019410502"+blockgroupnumber if censustract2013 ==  
"04019004121"
```

```
replace blockgroup2010 = "04019410503"+blockgroupnumber if censustract2013 ==  
"04019004125"
```

```
replace blockgroup2010 = "04019470400"+blockgroupnumber if censustract2013 ==  
"04019005200"
```

```
replace blockgroup2010 = "04019470500"+blockgroupnumber if censustract2013 ==  
"04019005300"
```

*2. The deletion of Census 2000 tract 1370.00 is corrected in Los Angeles County, CA

```
replace blockgroup2010 = "060378002043" if bg_ACS_2009_2013 == "060371370002"
```

```
replace blockgroup2010 = "060379304011" if bg_ACS_2009_2013 == "060371370001"
```

```
rename blockgroup2010 geoid10
```

```
merge 1:1 geoid10 using {insert file location}
```

```
drop if _merge==2
```

*create # owner occupied housing

```
gen BG_ttl_ooh = BG_ttl_hu* BG_pct_oh* BG_pct_ooh/10000
```

*create cell value

* # total housing units

```
gen cell_ttl_hu=(BG_ttl_hu/BG_sqmeter)*900
```

* # vacant housing units

```
gen cell_ttl_vacant = (b25004e1/BG_sqmeter)*900
```

```

* # owner occupied housing units
gen cell_ttl_ooh = (BG_ttl_ooh/BG_sqmeter)*900

*drop state county tract blkgrp geoid name BG_tot_pop BG_tot_pop_me CT_tot_pop
CT_tot_pop_me CT_0pop CT_0popme BG_0pop BG_0popme bg_ACS_2009_2013
blockgroupnumber censustract2013 BG_sqmeter strlength zero _merge
keep geoid10 cell_ttl_hu cell_ttl_vacant cell_ttl_ooh

export delimited using {insert file location}, replace

clear

**For ACS 5-year summary 2005-2009, center year 2007, use 2000 geographies with 2009
geographic changes.

use {insert file location}, clear
*merge another file to get complete housing variables
merge 1:1 geoid using {insert file location}
drop _merge

rename geoid geoidlongstring
gen geoid = substr(geoidlongstring,8,19)

drop if state == "02" | state == "60" | state == "66" | state == "15" | state == "72" | state ==
"78"

merge 1:1 geoid using {insert file location}

drop if _merge==2

*create # owner occupied housing
gen BG_ttl_ooh = BG_ttl_hu* BG_pct_oh* BG_pct_ooh/10000
*create cell value
* # total housing units
gen cell_ttl_hu=(BG_ttl_hu/areasqm)*900
* # vacant housing units
gen cell_ttl_vacant = (b25004e1/areasqm)*900
* # owner occupied housing units
gen cell_ttl_ooh = (BG_ttl_ooh/areasqm)*900

```

```

rename geoid geoid10

*drop state county tract blkgrp geoid name BG_tot_pop BG_tot_pop_me CT_tot_pop
CT_tot_pop_me CT_Opop CT_Opopme BG_Opop BG_Opopme bg_ACS_2005_2009
blockgroupnumber BG_sqmeter strlength zero _merge
keep geoid10 cell_ttl_hu cell_ttl_vacant cell_ttl_ooh

export delimited using {insert file location}, replace

clear

**For ACS 5-year summary 2010-2014, center year 2012, use 2010 geographies with 2011,
2012, 2014 geographic changes. There are no additional geographic changes for 2013 that
affect census tracts and block groups.
use {insert file location}, clear
*merge another file to get complete housing variables
merge 1:1 geoid using {insert file location}
drop _merge

gen bg_ACS_2010_2014 = substr(geoid,8,19)

drop if state == "02" | state == "60" | state == "66" | state == "15" | state == "72" | state ==
"78"

gen str blockgroup2010 = bg_ACS_2010_2014
gen str blockgroupnumber = substr(blockgroup2010,12,1)
gen str censustract2014 = substr(bg_ACS_2010_2014,1,11)

*2011 changes:
replace blockgroup2010 = "36053940101"+blockgroupnumber if censustract2014 ==
"36053030101"
replace blockgroup2010 = "36053940102"+blockgroupnumber if censustract2014 ==
"36053030102"
replace blockgroup2010 = "36053940103"+blockgroupnumber if censustract2014 ==
"36053030103"
replace blockgroup2010 = "36053940200"+blockgroupnumber if censustract2014 ==
"36053030200"
replace blockgroup2010 = "36053940300"+blockgroupnumber if censustract2014 ==
"36053030300"
replace blockgroup2010 = "36053940401"+blockgroupnumber if censustract2014 ==
"36053030401"
replace blockgroup2010 = "36053940403"+blockgroupnumber if censustract2014 ==
"36053030403"

```



```
replace blockgroup2010 = "36053940600"+blockgroupnumber if censustract2014 ==
"36053030600"
replace blockgroup2010 = "36053940700"+blockgroupnumber if censustract2014 ==
"36053030402"
```

*Oneida County, NY

```
replace blockgroup2010 = "36065940000"+blockgroupnumber if censustract2014 ==
"36065024800"
replace blockgroup2010 = "36065940100"+blockgroupnumber if censustract2014 ==
"36065024700"
replace blockgroup2010 = "36065940200"+blockgroupnumber if censustract2014 ==
"36065024900"
```

*2012 changes:

*1. Numbering of 7 census tracts in Pima County, AZ is changes with no geography changes

```
replace blockgroup2010 = "04019002701"+blockgroupnumber if censustract2014 ==
"04019002704"
replace blockgroup2010 = "04019002903"+blockgroupnumber if censustract2014 ==
"04019002906"
replace blockgroup2010 = "04019410501"+blockgroupnumber if censustract2014 ==
"04019004118"
replace blockgroup2010 = "04019410502"+blockgroupnumber if censustract2014 ==
"04019004121"
replace blockgroup2010 = "04019410503"+blockgroupnumber if censustract2014 ==
"04019004125"
replace blockgroup2010 = "04019470400"+blockgroupnumber if censustract2014 ==
"04019005200"
replace blockgroup2010 = "04019470500"+blockgroupnumber if censustract2014 ==
"04019005300"
```

*2. The deletion of Census 2000 tract 1370.00 is corrected in Los Angeles County, CA

```
replace blockgroup2010 = "060378002043" if bg_ACS_2010_2014 == "060371370002"
replace blockgroup2010 = "060379304011" if bg_ACS_2010_2014 == "060371370001"
```

*2014 Changes

*Bedford City was absorbed into Bedford County, Virginia, and its 5-digit FIPS code has been eliminated.

/*

```
gen county2 = substr(bg_ACS_2010_2014,1,5)
gen noncounty2 = substr(bg_ACS_2010_2014,6,7)
replace blockgroup2010 = "51019"+noncounty2 if county2 == "51515"
```

*/

```
replace blockgroup2010 = "51515050100"+blockgroupnumber if censustract2014 ==  
"51019050100"
```

```
rename blockgroup2010 geoid10  
merge 1:1 geoid10 using {insert file location}
```

```
drop if _merge==2
```

```
*create # owner occupied housing  
gen BG_ttl_ooh = BG_ttl_hu* BG_pct_oh* BG_pct_ooh/10000  
*create cell value  
* # total housing units  
gen cell_ttl_hu=(BG_ttl_hu/BG_sqmeter)*900  
* # vacant housing units  
gen cell_ttl_vacant = (B25004e1/BG_sqmeter)*900  
* # owner occupied housing units  
gen cell_ttl_ooh = (BG_ttl_ooh/BG_sqmeter)*900
```

```
keep geoid10 cell_ttl_hu cell_ttl_vacant cell_ttl_ooh
```

```
export delimited using {insert file location}, replace
```

```
clear
```

Appendix B. Housing grids generation

Note: Script will need to be adjusted with project-specific file names and locations.

```
#housing grids generation
#only need 400m and 1600m
import arcpy, time
from arcpy.sa import *

in_workspace = {insert file location}
out_workspace = {insert file location}
arcpy.env.workspace = in_workspace
arcpy.env.extent = "-2493045.0 -1429501.25 2342655.0 1703218.75"
arcpy.env.overwriteOutput = True
arcpy.CheckOutExtension("Spatial")

start = time.time()

#set focal statistics variables

neighborhood_400 = NbrCircle(400, "MAP")
neighborhood_1600 = NbrCircle(1600, "MAP")

# total housing units
# Set focal statistics variables
lyr_ttl_hu = "Total_hu_2012"
arcpy.MakeRasterLayer_management("ttl_hu_2012", lyr_ttl_hu)
inRaster = lyr_ttl_hu
# Execute FocalStatistics
outFocalStatistics = FocalStatistics(inRaster, neighborhood_400, "SUM", "")
outFocalStatistics.save(out_workspace+"Housing_2012_ttl_hu_400m")
print inRaster
outFocalStatistics = FocalStatistics(inRaster, neighborhood_1600, "SUM", "")
outFocalStatistics.save(out_workspace+"Housing_2012_ttl_hu_1600m")
print inRaster
end = time.time()
print str((end-start)/60)+" minutes"

# total owner occupied housing units
# Set focal statistics variables
lyr_ooh_hu = "Total_ooh_2012"
arcpy.MakeRasterLayer_management("ttl_ooh_2012", lyr_ooh_hu)
inRaster = lyr_ooh_hu
```

```

# Execute FocalStatistics
outFocalStatistics = FocalStatistics(inRaster, neighborhood_400, "SUM", "")
outFocalStatistics.save(out_workspace+"Housing_2012_ooh_400m")
print inRaster
outFocalStatistics = FocalStatistics(inRaster, neighborhood_1600, "SUM", "")
outFocalStatistics.save(out_workspace+"Housing_2012_ooh_1600m")
print inRaster
end = time.time()
print str((end-start)/60)+" minutes"

# total vacant housing units
# Set focal statistics variables
lyr_vct_hu = "Total_vct_2012"
arcpy.MakeRasterLayer_management("ttl_vct_2012", lyr_vct_hu)
inRaster = lyr_vct_hu
# Execute FocalStatistics
outFocalStatistics = FocalStatistics(inRaster, neighborhood_400, "SUM", "")
outFocalStatistics.save(out_workspace+"Housing_2012_vct_400m")
print inRaster
outFocalStatistics = FocalStatistics(inRaster, neighborhood_1600, "SUM", "")
outFocalStatistics.save(out_workspace+"Housing_2012_vct_1600m")
print inRaster
end = time.time()
print str((end-start)/60)+" minutes"

```