HOW DOES GENTRIFICATION CHANGE LOS ANGELES' URBAN FOREST?

Francisco Escobedo*, Christina Staudhammer**, Nathalie van Doorn*, Alyssa Thomas*, Erika Teach***

**USDA Forest Service, Pacific Southwest Research Station*

***University of Alabama; ***Davey Resources*

Los Angeles Center for Urban Natural Resources Sustainability
Rooted in Research

USDA U.S. FOREST SERVICE
Caring for the land and serving people
United States Department of Agriculture

What I'll do in this presentation

1. Define "gentrification", "displacement, and "green gentrification"
2. How green gentrification has been studied
3. Study of how urban forests in LA are related to gentrification
   - Approach
   - Methods
   - Preliminary results
4. Discuss findings

https://goop.com/city-guide/the-los-angeles-hipster-guide/

Gentrification

- "The transformation of a working-class or vacant area of a city into middle-class ("gentry") residential and/or commercial use" (R. Glass 1964).
- "….process of neighborhood change that includes economic change in a historically disinvested neighborhood by means of:
  - real estate investment and new higher-income residents moving in
  - demographic change… in terms of income level… education level or racial make-up of residents" (Urban Displacement Project website, 2021)"

Horte, O.S.; Eisenman, T.S. Urban Greenways: A Systematic Review and Typology. *Land* **2020**, *9*, 40.

Displacement

- What happens to individual people and/or communities when external forces make living there: *unaffordable, hazardous,* or *impossible* (Hartman et al., 1982).
- Direct displacement:
  - Rising housing costs, Eminent domain, Lease non-renewal, evictions, freeways
  - Housing vacated by low-income residents is not affordable to other low-income households
- Cultural displacement - When neighborhood attributes change so that residents may no longer feel a sense of belonging

Source: eglendalelac.org

Displacement versus Gentrification

Routine occurrence, but when it occurs alongside physical and/or social characteristics of the neighborhood, becomes an indicator of gentrification

Gentrification and displacement are two concepts that are often used interchangeably; but should be distinguished

Horte, O.S.; Eisenman, T.S. Urban Greenways: A Systematic Review and Typology. *Land* **2020**, *9*, 40.

Green Gentrification

- New or intensified urban social inequities that result from greening policies and interventions:
  - Greenways, parks, community gardens, ecological corridors, or green infrastructure, tree plantings
  - Examples: Boston Rose Kennedy Greenway, the New York High Line, the Philadelphia Rail Park, or the DC's 11th Street Bridge Park
  - Also been studied in Barcelona, Netherlands, Australia, Korea, etc

Iwan Baan, NPR.org

Bostonparksplaza.org

Localized interventions

"Green" Gentrification in the US

- Portland OR (Donovan et al., 2022)
  - Tree planting increased neighborhood gentrification; a 1% increase in tree cover associated with a $882 median housing price increase (6 years for a significant relationship to develop)
- Philadelphia PA (Heckert and Mennis et al. 2012)
  - Green space positively correlated with property price
  - Properties located on vacant lots converted into green spaces in moderately "distressed" and moderately income neighborhoods also witnessed higher increase in value in comparison with properties near untouched vacant lots
- Atlanta GA (Immergluck, 2009)
  - Housing values within 400 m of new green infrastructure spiked by 30 percent in comparison with similar properties 1.6 km away (includes light rail, greenspace, real estate).
- 10 US cities (Rigolon and Nemeth, 2020)
  - ".. new greenway parks with an active transportation component built in the 2008–2015 period triggered gentrification more than other park types
  - new parks closer to downtown tend to foster gentrification more than parks on a city's outskirts"

Green gentrification in other countries

- Utrecht Netherlands (Bockarjova et al., 2020)
  - 10 types of urban greening initiatives (urban parks, small green patch parks and blue infrastructure) found 20% housing price increase as compared with houses unaffected by the initiatives
- Barcelona Spain (Angeluovzki et al., 2018)
  - residents with bachelor's degree or higher increased by 28 % around a new local park against 8% increase for the district as a whole
- Melbourne Australia (Sharifi et al 2021)
  - "gentrification can cause urban greening. But no significant evidence that urban greening causes gentrification"

Several local LA studies

- Can human infrastructure combat green gentrification?: ethnographic research on bicycling in Los Angeles and Seattle; AE Lugo - Sustainability in the Global City, 2015
- A Greener Los Angeles: Assessing Equity in Park Investment and Green Gentrification, Master's Thesis A Rocha, 2019

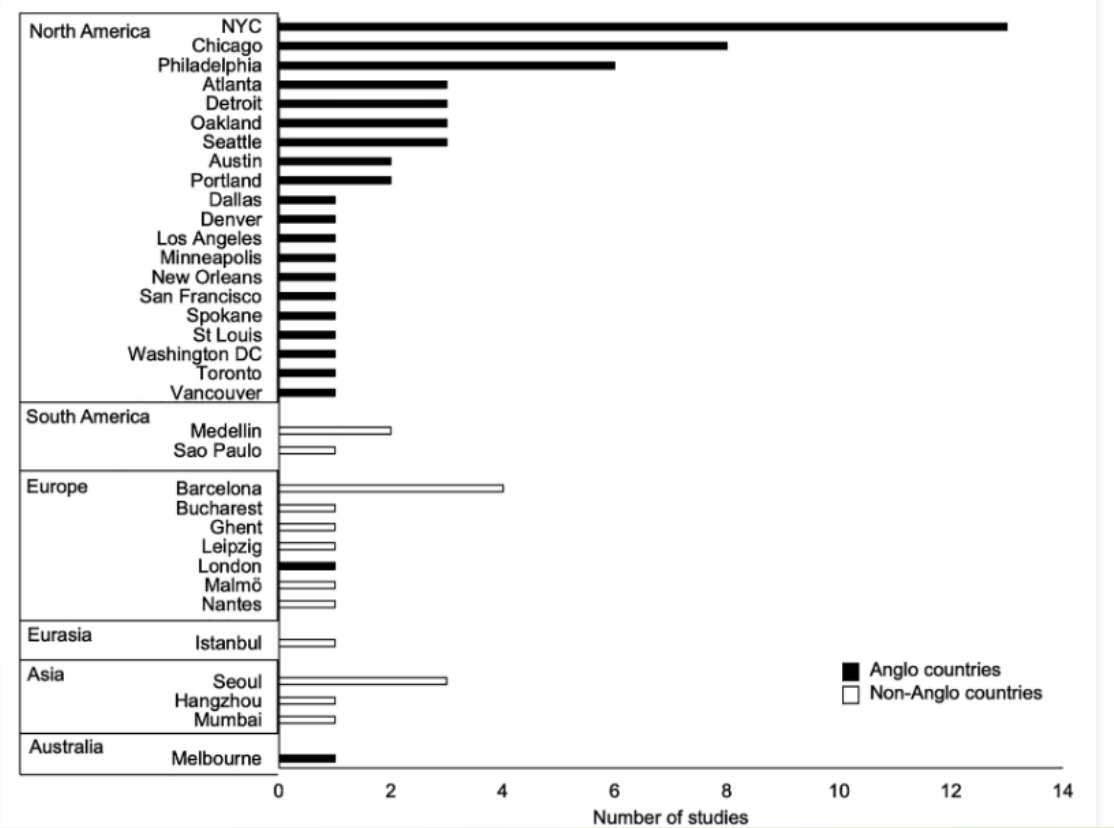
Chapter

Bring on the yuppies and the guppies! Green gentrification, environmental justice, and the politics of place in Frogtown, L.A.

By Esther G. Kim

2022 State of the art review on Green Gentrification studies

- 67 articles from across the globe
- *Little attention has been paid to the influence of greening characteristics/functions and non-greening factors on gentrification;*
- *Despite being the main concern of green gentrification, displacement has not been well-documented*
- *Mechanisms through which greening leads to gentrification are not well understood, particularly on the demand side*
- Quinton, J., Nesbitt, L. and Sax, D., 2022. How well do we know green gentrification? A systematic review of the methods. Progress in Human Geography, p.03091325221104478



State of the art in Green Gentrification studies

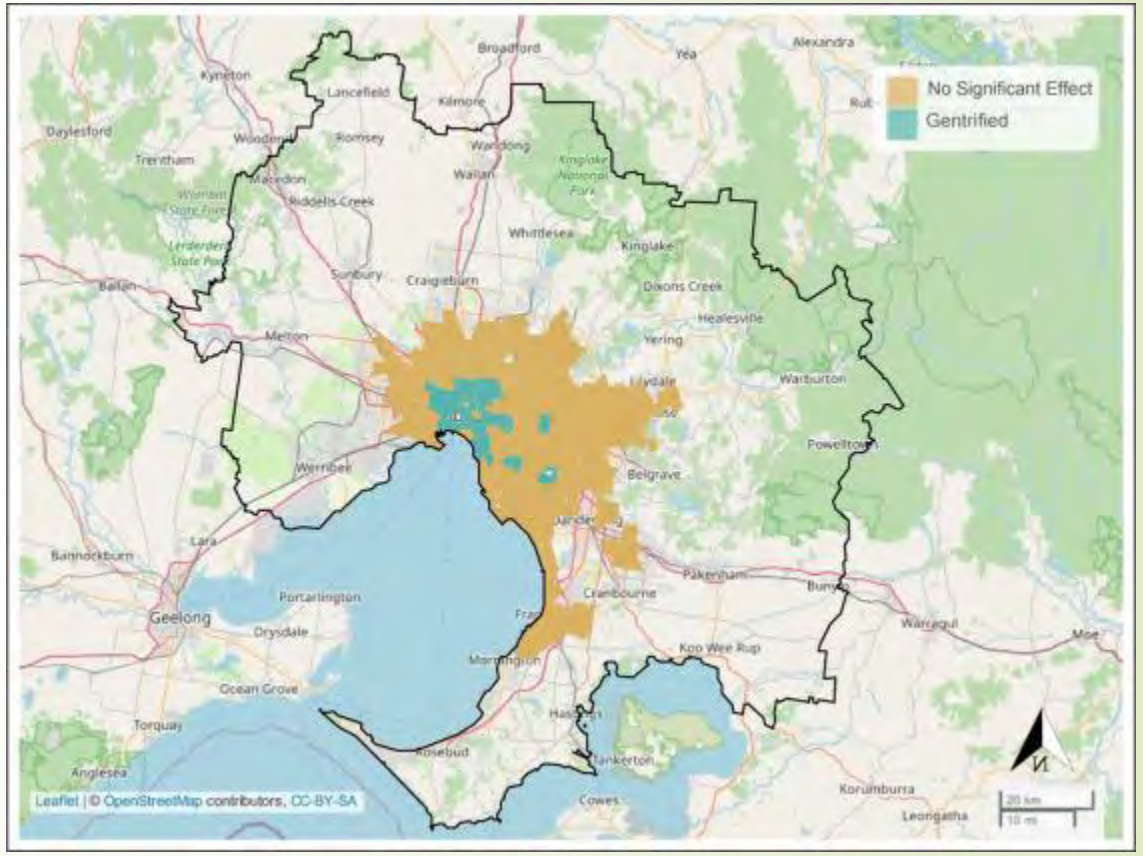
- Most studies focus on parks, greenways, gardens or street trees and tree cover
- Most use remote sensing or qualitative methods
- Few analyze changes over times and mostly focus on neighborhoods
- Few analyzed urban forest structure, composition, diversity, and other socioeconomic and demographic drivers

Observations	Greenspace users	11
	Meetings	6
	Site	9
	Other	2
Total		23
Spatiotemporal analysis	Correlation analysis	3
	Difference-in-differences	3
	Geographically weighted regression	2
	Hedonic models	3
	Hotpot analysis	3
	Spatial autoregressive models	3
	Other	8
Total		22

Quinton, J., Nesbitt, L. and Sax, D., 2022. How well do we know green gentrification? A systematic review of the methods. Progress in Human Geography, p.03091325221104478

Melbourne Aust. (Sharifi et al., 2021)

- Used LANDSAT, Corelogic, Census
- Gentrification can cause urban greening
- Urban greening is not a driver of gentrification
- *Change in urban greenness and displacement of lower income households, is more likely to depend on ongoing income growth*



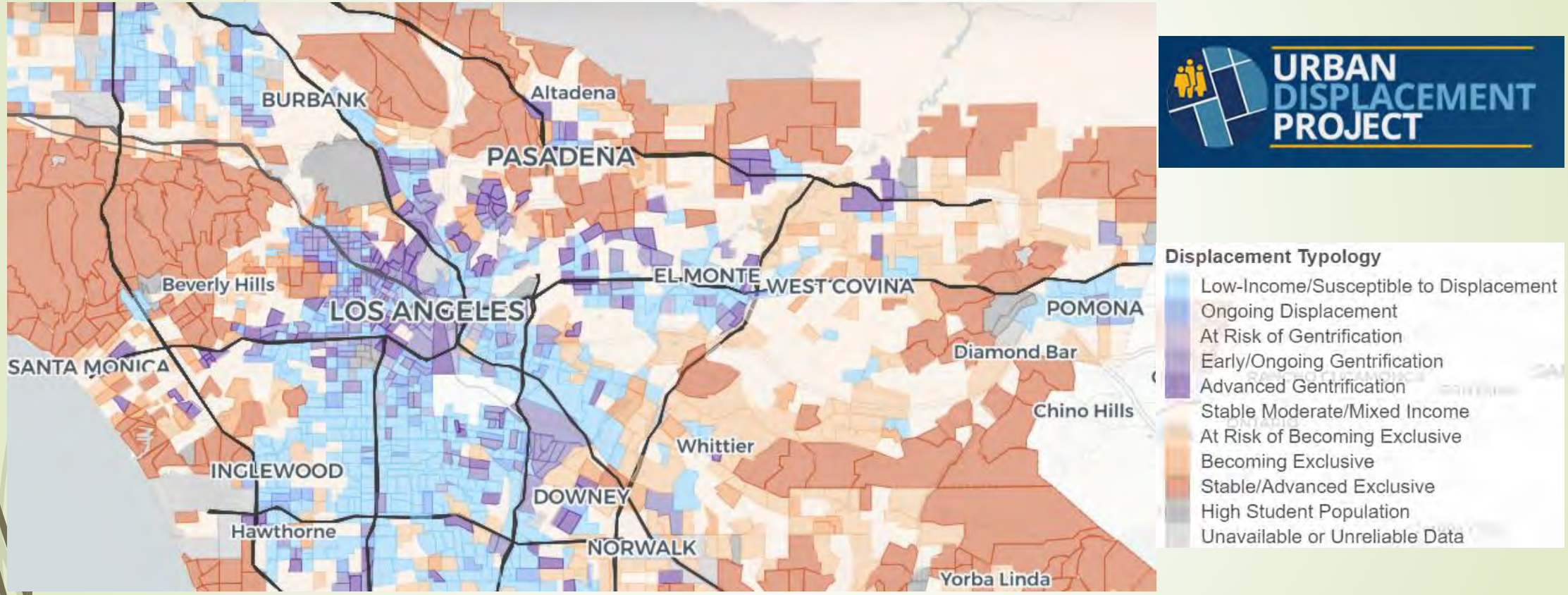
Sharifi, F., et al., 2021. Green gentrification or gentrified greening: Metropolitan Melbourne. Land Use Policy, 108, p.105577

Research questions

1. Has urban forest structure and composition changed in areas classified as gentrification/displacement versus other areas?
2. Are areas with the greatest "negative" changes in urban forest structure/composition occurring in displacement/gentrification areas?
3. Does urban forest structure change (i.e., predict) displacement and gentrification?

Objective scientific analysis of urban forest -gentrification relationships across the City of LA

Where is Gentrification and Displacement occurring in Los Angeles

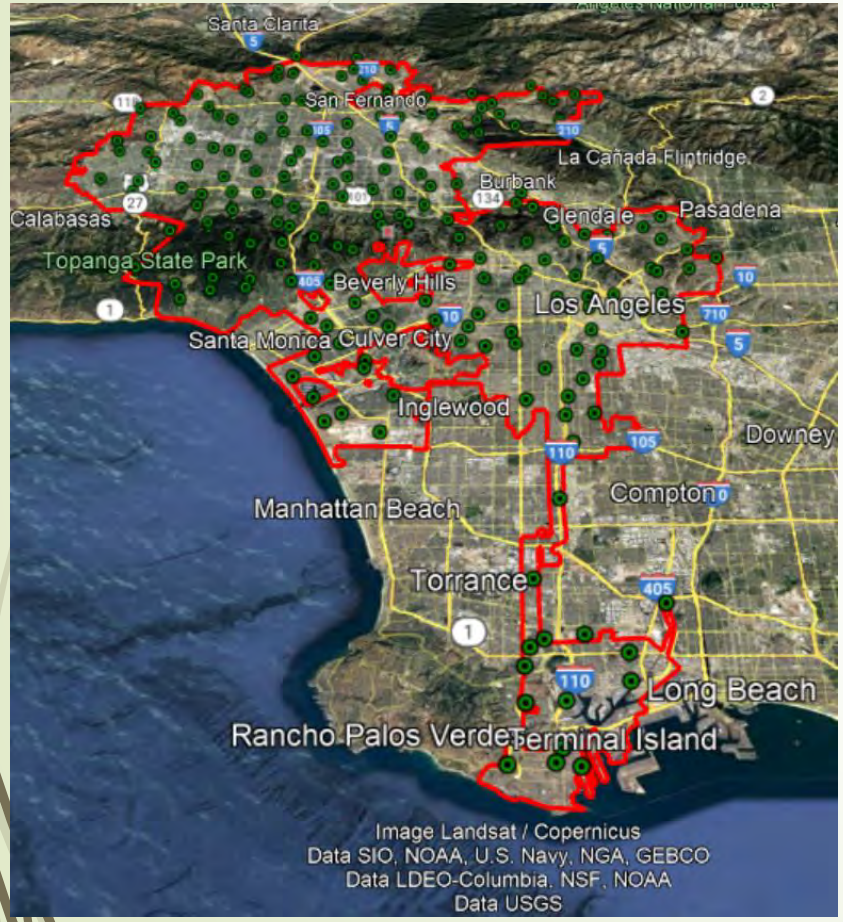


https://www.urbandisplacement.org/maps/los-angeles-gentrification-and-displacement/

Categories we analyzed in Los Angeles

Gentrification categories	Original Typology	Description	No Sites
Displacement	Low-Income/ Susceptible to Displacement	When residents can no longer afford to remain in their homes due to rising housing costs. Residents may also be forced out by lease non-renewals, evictions, eminent domain, or physical conditions that render homes uninhabitable as investors await redevelopment opportunities.	27
	Ongoing Displacement		5
Gentrification	At Risk of Gentrification	Process of neighborhood change that includes economic change in a historically disinvested neighborhood —by means of real estate investment and new higher-income residents moving in – as well as demographic change – not only in terms of income level, but also in terms of changes in the education level or racial make-up of residents.	0
	Early/Ongoing Gentrification		8
	Advanced Gentrification		9
Stable	Stable Moderate/Mixed Income		32
Exclusive	At Risk of Becoming Exclusive	Areas of high income, high priced real esate	14
	Becoming Exclusive		2
	Stable/Advanced Exclusive		51
Students/ unreliable	High Student Population		4
	Unavailable or Unreliable Data		12

164 random 10th acre ECO plots (Measured in 2007 & 2017)



Nowak, D.J., Robert III, E., Crane, D.E., Weller, L. and Davila, A., 2011. Assessing urban forest effects and values, Los Angeles' urban forest. *Resour. Bull. NRS-47. Newtown Square, PA: US Department of Agriculture, Forest Service, Northern Research Station. 30 p.*, *47*, pp.1-30.

Change from 2007 – 2017 (n 164 plots)

- Tree density (per ha)
- Basal area (m2 ha-1)
- Street tree density (per ha)
- Leaf area (m2 ha-1)
- Leaf Biomass (kg ha-1)
- Average DBH (cm)
- Height (m)
- Average Crown Width (m)
- # Species per plot
- Average Shannon Index
- Average Simpson Index
- C Storage (kg ha-1)
- C Sequestration (kg yr-1)
- Ground covers
- Tree and shrub cover

Nowak, D.J., Robert III, E., Crane, D.E., Weller, L. and Davila, A., 2011. Assessing urban forest effects and values, Los Angeles' urban forest. *Resour. Bull. NRS-47. Newtown Square, PA: US Department of Agriculture, Forest Service, Northern Research Station. 30 p.*, *47*, pp.1-30.

Other Data

- 2010 and 2017 US Census Bureau American Community Survey tracts
  - Median family income, bachelor's degree, race, rentals vs ownership
- Corelogic property value data
  - Assessed and market values at parcel level
- CalEnviroscreen 3.0
  - Exposures to pollutants, adverse environmental conditions, socioeconomic factors and prevalence of certain health conditions
- Environmental characteristics
  - Soil types, LA County Tree Canopy viewer Project, Road/building density

United States® Census Bureau

CoreLogic

CalEnviroScreen

Methods

- Matched ECO plots and individual trees & QA/QC on plot/tree data
- Eliminated ECO plots with 0 trees = 164 plots
- "Attributed" plots in GIS with Census, Corelogic, and other data
- Different statistical analyses for different metrics according to gentrification categories:
  - Analysis of Variance, Kruskall-Wallis tests, Chi-Square test for Independence, Likelihood Ratio Chi-Square, and Mantel-Haenszel Chi-Square, Gernalized linear mixed models, Nonmetric Multidimensional Scaling plots using Raup-Crick dissimilarity metric

1. Statistical difference between gentrification categories
2. Can urban forest metrics 'predict' gentrification class

Socioeconomic and Environmental Conditions

- Greater decreases in the %Hispanic/Latino in Gentrification areas versus Exclusive and Stable categories,
  - Greater increases in the %white in Gentrification versus that of Exclusive, Displacement and Stable
- Greater increases in the Bachelor degrees in Gentrification areas versus that of Exclusive and Displacement
- Changes in rent in Exclusive areas were significantly greater than in Displacement, Gentrification and Stable areas
- Canopy, shrub, and soil covers decreased with increasing CalEnviroscreen values.
  - Building, road, and paved covers increased with increasing CalEnviroscreen values.

Averages in 2007 and 2017

Gentrification category	Displacement	Displacement	Exclusive	Exclusive	Gentrification	Gentrification	Stable	Stable
Year	**2007**	**2017**	**2007**	**2017**	**2007**	**2017**	**2007**	**2017**
N Plots	**32**	**32**	**67**	**67**	**16**	**16**	**32**	**32**
Tree density (per ha)	28.1 +/- 6.7	36.7 +/- 9.3	46.3 +/- 7	46.3 +/- 7.9	31.3 +/- 12.8	29.7 +/- 9.5	29.7 +/- 8.4	35.2 +/- 9.7
Basal area (m2 ha-1)	3.2 +/- 0.9	3.7 +/- 0.8	4.8 +/- 0.7	6 +/- 1	3.7 +/- 2	4.8 +/- 2.1	2.4 +/- 0.6	2.6 +/- 0.7
Street tree density (per ha)	15.6 +/- 3.7	13.3 +/- 3	11.9 +/- 2.3	17.9 +/- 3.3	9.4 +/- 4.5	9.4 +/- 4.5	11.7 +/- 5.1	14.8 +/- 5.6
C Storage (kg ha-1)	10199 +/- 2887	13088 +/- 3635	13026 +/- 2043	17574 +/- 3077	10169 +/- 6554	12122 +/- 6147	6576 +/- 2230	6292 +/- 1774
Gross C Sequest (kg yr-1)	598 +/- 157	654 +/- 144	1043 +/- 140	1001 +/- 143	454 +/- 186	516 +/- 165	483 +/- 120	440 +/- 115
Leaf area (m2 ha-1)	5737 +/- 1538	3849 +/- 919	9386 +/- 1634	5706 +/- 959	4036 +/- 1539	4158 +/- 1587	4147 +/- 1293	2859 +/- 744
Leaf Biomass (kg ha-1)	460 +/- 121	322 +/- 77	710 +/- 132	471 +/- 96	315 +/- 125	335 +/- 132	282 +/- 82	208 +/- 57
# Species per plot	0.81 +/- 1	0.94 +/- 1.13	1.27 +/- 1.34	1.22 +/- 1.28	0.81 +/- 0.98	0.81 +/- 0.98	0.75 +/- 1.11	0.78 +/- 1.1
Average DBH (cm)	35.9 +/- 16.5	37.7 +/- 17.8	35.4 +/- 17.4	38.5 +/- 18.4	30.9 +/- 25	40.7 +/- 21.5	32.4 +/- 9.6	30.8 +/- 16.6
Average Height (m)	9.4 +/- 3	9.4 +/- 4	9.1 +/- 3.8	9.3 +/- 3.8	7.6 +/- 4	8.7 +/- 3.6	8.5 +/- 2.3	7.9 +/- 3.1
Average Crown Width (m)	8.2 +/- 3.9	7.3 +/- 3.5	7 +/- 2.9	6.8 +/- 3	6.6 +/- 2.4	7 +/- 2.4	6.3 +/- 1.9	5.8 +/- 2.3
Average Shannon Index	0.36 +/- 0.45	0.4 +/- 0.49	0.44 +/- 0.5	0.47 +/- 0.51	0.37 +/- 0.4	0.37 +/- 0.41	0.44 +/- 0.48	0.49 +/- 0.44
Average Simpson Index	0.76 +/- 0.28	0.75 +/- 0.29	0.73 +/- 0.29	0.71 +/- 0.3	0.75 +/- 0.27	0.75 +/- 0.27	0.72 +/- 0.29	0.69 +/- 0.27

Some findings

- ✓ *very little change in tree density, street tree density, tree heights and diversity metrics over the time period*
- ✓ *Stable areas experienced no significant changes in any forest structure metrics*
- ✓ *More increase in street trees in Exclusive relative to other categories, but with a weak p-value (p=0.10).*
- ✓ *Increase in tree density in Displacement areas was larger than that of Exclusive*
- ✓ *Species distributions were not really different by year, but there were significant differences among gentrification types*

Changes from 2007-2017

2017 vs 2007 Change	Displacement	Exclusive	Gentrification	Stable	Students/unreliable
Tree density (per ha)	8.6 +/- 6.5	0 +/- 5.1	-1.6 +/- 9.5	5.5 +/- 4.3	12.5 +/- 12.5
Basal area (m2 ha-1)	0.5 +/- 0.6	1.2 +/- 0.6	1.1 +/- 0.5	0.2 +/- 0.3	0.3 +/- 0.2
Street tree density (per ha)	-2.3 +/- 1.7	6 +/- 2.6	0 +/- 0	3.1 +/- 2.4	1.6 +/- 1.6
C Storage (kg ha-1)	2889 +/- 2901	4549 +/- 1788	1953 +/- 1312	-284 +/- 1889	416 +/- 699
Gross C Sequest (kg yr-1)	56 +/- 94	-41 +/- 74	62 +/- 155	-42 +/- 43	106 +/- 90
Leaf area (m2 ha-1)	-1889 +/- 908	-3680 +/- 1080	122 +/- 494	-1288 +/- 866	-9174 +/- 8684
Leaf Biomass (kg ha-1)	-139 +/- 78	-239 +/- 75	19 +/- 41	-74 +/- 54	-1242 +/- 1174
# Species per plot	0.13 +/- 0.55	-0.04 +/- 0.81	0 +/- 0.37	0.03 +/- 0.65	0.19 +/- 0.75
Average DBH (cm)	2.7 +/- 13.1	2.1 +/- 12.5	9.8 +/- 11.8	-1.5 +/- 11.9	-10.5 +/- 16.5
Average Height (m)	-0.1 +/- 2.7	-0.2 +/- 2.8	1.1 +/- 2.5	-0.5 +/- 2.3	-2.7 +/- 4.3
Average Crown Width (m)	-1 +/- 2.9	-0.4 +/- 2.6	0.5 +/- 2.8	-0.6 +/- 2	-9.3 +/- 5.4
Average Shannon Index	0.06 +/- 0.4	0.01 +/- 0.38	0 +/- 0.14	0.04 +/- 0.55	0.56 +/- 0.79
Average Simpson Index	-0.03 +/- 0.25	0 +/- 0.22	0 +/- 0.04	-0.03 +/- 0.35	-0.31 +/- 0.43

Significant Changes from 2007-2017

- ✓ *Displacement: significantly less leaf area and leaf biomass in 2017 vs 2007*
- ✓ *Exclusive: significantly more basal area, street tree density and C storage 2017 over 2007, but significantly less leaf area and leaf biomass.*
- ✓ *Gentrification: significantly more basal area and larger DBH trees 2017 over 2007*

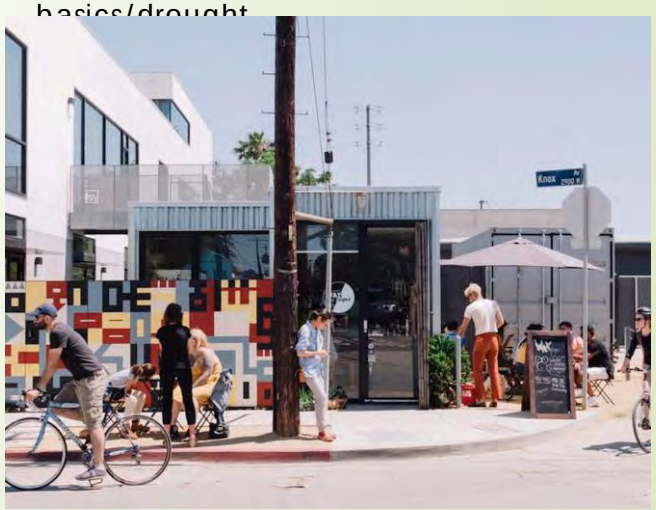
2 models of what "socioecological" metrics predict gentrification?

- Gentrification category predicted by: Population density, % Black, % White_2010, Change in housing value, Median family income, housing density % building, % tree canopy (78% correct; 10 of 16 gentrified plots predicted)
  - significantly more likely to be displacement with lower canopy cover
  - significantly more likely to be gentrification with lower canopy cover
- Gentrification predicted by: Population density, Change in housing value, Median family income, % change in Whites, % Asian, Carbon storage, % building, % tree canopy (93% correct; 11 of 16 gentrificed plots predicted)

Putting Findings in Perspective

- UCLA found that the number of gentrified Census tracts in Los Angeles County increased by 16% between 1990 and 2015.
- Los Angeles County exhibited 10% of tracts classified as At Risk of Gentrification, Early/Ongoing Gentrification, or Advanced Gentrification.
- 5% of tracts were not gentrifying but experienced Ongoing Displacement of Low-Income Households
- California experiences historical droughts in 2007-2009 and 2012-2016

https://water.ca.gov/water-basics/drought



https://goop.com/city-guide/the-los-angeles-hipster-guide/

Other limitations

- The i-Tree ECO "one plot size fits all" approach to urban forestry really prevents us from saying much in these areas where trees are sparse.
- Confirmed unequal distribution tree structure across these categories.
- Policies/sociopolitical phenomenon (i.e., redlining or gentrification) are too complex to predict
- Time and Site conditions matter (pruning for infrastructure, ordinances, mortality/removal, homeowner maintenance, and sampling during wet/dry periods

Conclusions

Often these are issues of Environmental justice, social justice, and socioeconomic inequities, however:

- "Gentrification" is influenced by many other factors besides trees
  - This has been the conclusion in other studies (Australia, Spain and US)
- There were urban forest difference among gentrification categories
- No evidence that tree structure and composition drive gentrification
- Percent tree canopy seems to be *an* indicator (possibly tree size) to identify area associated with these changes (alongside socioeconomics)

Questions?

Email: Francisco.Escobedo@usda.gov

Thank you!