A spatio-temporal view of historical growth in downtown Phoenix, Arizona, 1915-1963

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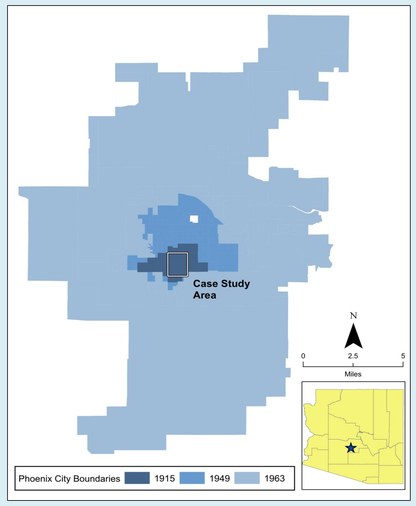
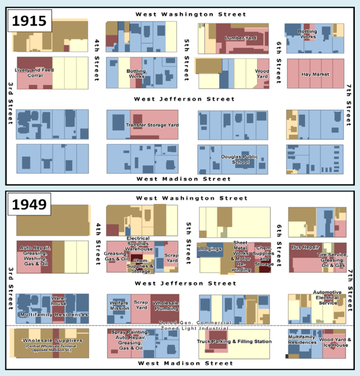
KEYWORDS
- Land use change
- Historical urban growth
- Space-time analysis
- Urban morphology

1.) Study Area: Downtown Phoenix



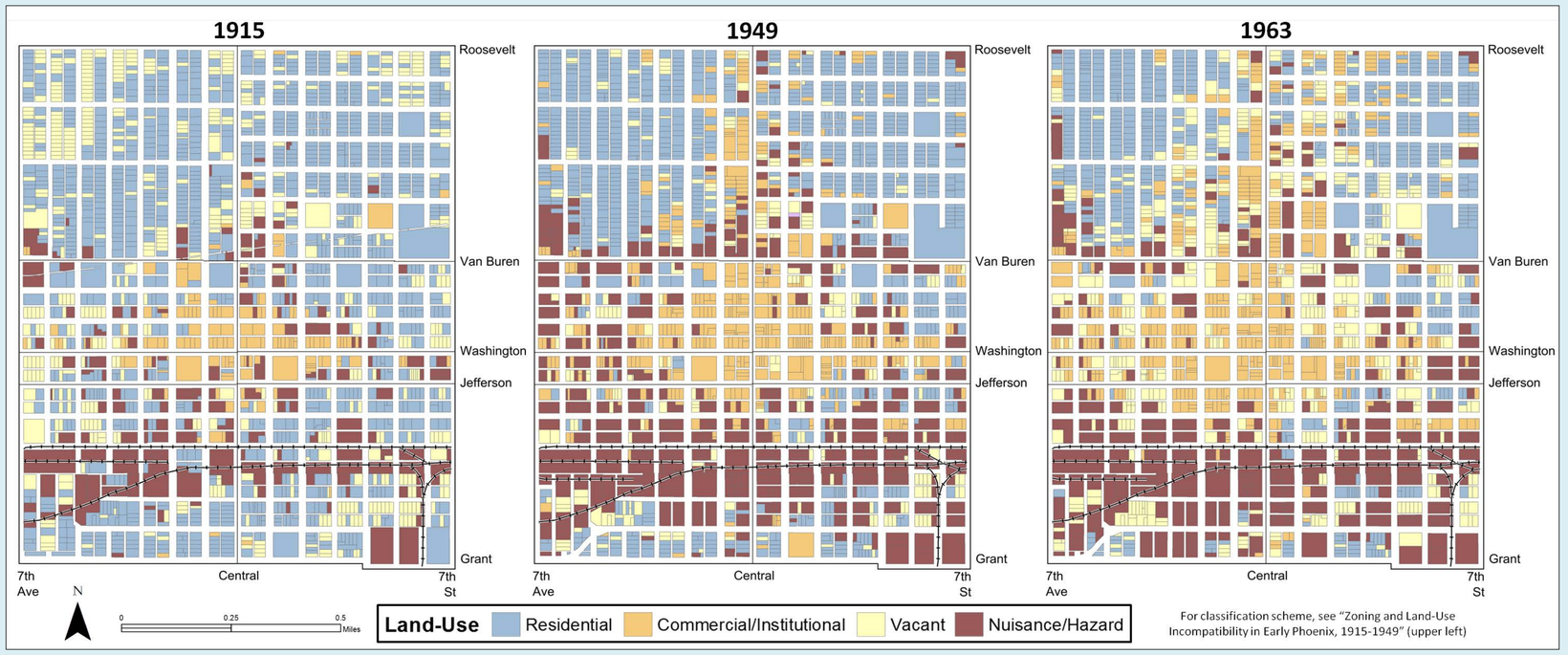
2.) Data digitized from Sanborn Fire Insurance Maps



OBJECTIVES

- to propose a novel approach to empirically describe historic urban landscape changes
- to use historic parcel-level land use data from Phoenix to examine changes in urban morphology during the city's rapid period of expansion
- Linking land change process to observed land use pattern

4.) Four categories of land uses in downtown Phoenix as observed on a map:



3.) Sanborn maps aggregated into four land use categories

Land-Use Category	Examples of Uses
Residential (R)	Single- and two-family homes, apartments, boarding houses, lodgings, tenements, cabins, shanties, churches, schools, parks, clubs, home stables.
Commercial/Institutional (C)	Retail, restaurants, hotels, offices, neighborhood groceries, health services, government offices, public services, armories, hospitals.
Vacant/Parking (V)	Vacant parcels, parcels subdivided for residential use, parking lots, parcels containing vacant or damaged structures.
Nuisance/Hazard (N)	Warehouses, wholesale suppliers, lumberyards, scrap yards, transportation distribution facilities, light manufacturing, repair and maintenance facilities, automotive services and standalone parking garages, stables, paint shops, vet hospitals, blacksmiths, laundry and dry cleaning, upholstering, oil storage, mills, ice manufacturing and cold storage, chemical storage and manufacturing, steel manufacturing, electric power stations, iron works, rail yards, and railroad tracks.

RESEARCH QUESTIONS

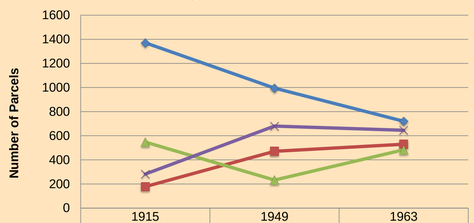
1. ***What landscape results from the changing composition of the downtown that accompanied postwar suburban dominance?***
2. ***To what extent is there homogenization or incompatibility of land use?***
3. ***How do nuisances and hazards become distributed as a city changes?***

FOUR METHODOLOGICAL APPROACHES:

1. Quantity disagreement: Parcel counts and transition matrices
2. Allocation disagreement: Pontius transition scores
3. Spatial Relationships: Join-Count Statistics
4. Spatial Markov Chain

1.) Quantity Disagreement

The changing composition of parcels in Phoenix:



	1915	1949	1963
Residential	1371	995	720
Commercial/Institutional	178	471	530
Vacant	547	232	483
Nuisance	282	680	645

1915 LU ↓	1949 LU → Residential	Comm/Inst	Vacant	Nuisance
Residential	**797** *58%* [574]	**180** *13%* [272]	**95** *7%* [134]	**299** *22%* [392]
Comm/Inst	**7** *4%* [74]	**150** *84%* [35]	**5** *3%* [17]	**16** *9%* [51]
Vacant	**174** *32%* [229]	**82** *15%* [108]	**112** *20%* [53]	**179** *33%* [156]
Nuisance	**17** *6%* [118]	**59** *21%* [56]	**20** *7%* [28]	**186** *66%* [81]

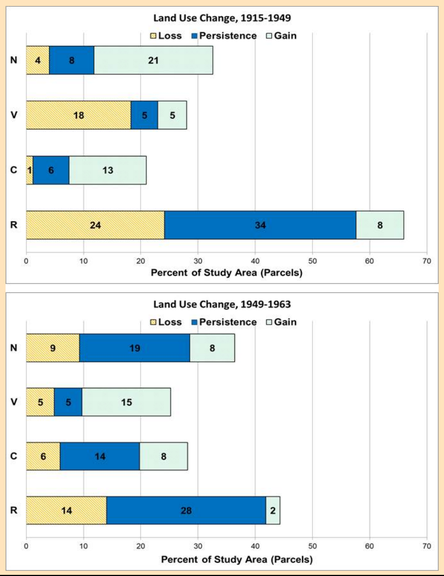
1949 LU ↓	1963 LU → Residential	Comm/Inst	Vacant	Nuisance
Residential	**661** *66%* [301]	**78** *8%* [222]	**189** *19%* [202]	**67** *7%* [270]
Comm/Inst	**25** *5%* [143]	**330** *70%* [105]	**57** *12%* [96]	**59** *13%* [128]
Vacant	**23** *10%* [70]	**34** *15%* [52]	**115** *50%* [47]	**60** *26%* [63]
Nuisance	**11** *2%* [206]	**88** *13%* [152]	**122** *18%* [138]	**459** *68%* [184]

Number of parcels (Bold)
Percent of row (Italics)
[Expected Value] (brackets)

The outcome of the changes – deviations from expectations are emphasized.

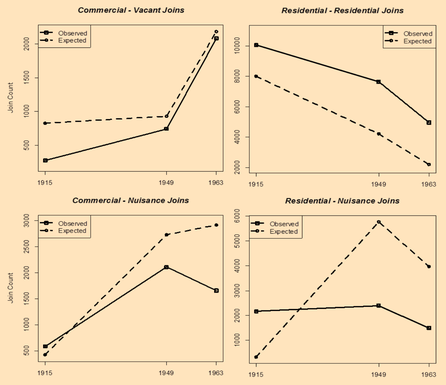
2.) Allocation Disagreement

A graphical representation of Pontius' loss, persistence, and gain metrics observed from the perspective of a land use category. For example, nuisance properties in 1915 represent 12% of the total parcels in 1915: 4% of the total distribution represents parcels that were to become something else by 1949, while 8% represents parcels that persist as nuisance over 1915-1949. Similarly, nuisance properties represented 29% of the total parcels in 1949: the 8% that persisted, plus the 21% representing nuisance parcels that were something else in 1915 (gain) (see Pontius 2004).



3.) Join-Count Autocorrelation

Neighbors are defined as parcels within 200 feet. How many instances are there of Type x parcels and Type y parcels being neighbors? How does this change over time? Selected join counts show actual (observed) values and expected values based on the number of parcels in each category, their shapes, and the assumption that they are randomly arranged.



4.) Spatial Markov Chains

A transition matrix is decomposed based on the composition of a parcel's neighbors. Select results shown (1949-1963), indicating that: (1) parcels are more likely to stay the same if their neighbors are like them, and (2) parcels are more likely to become like their neighbors than if they were in different surroundings

Transition Type	Staying Probability: Similar Neighbors	Staying Probability: Overall
R → R	71%	66%
C → C	77%	70%
V → V	43%	50%
N → N	72%	68%

Transition Type	Homogenization Probability: Similar Neighbors	Homogenization Probability: Overall
i → R	16%	4%
i → C	24%	10%
i → V	42%	17%
i → N	24%	11%

KEY FINDINGS:

1.) By 1963, the morphology of downtown is characterized by commercial areas interspersed with vacancy:
- ***Current legacies are a remnant of postwar-era changes***
- ***The "tale" of downtown decline is more complex than a retail exodus: vacated former residential parcels appear to be significant***

2.) Strong evidence of homogenization – a parcel's neighbors are increasingly likely to be of the same land use type

3.) Though the city was seen as "emptying out," it still shows evidence of order, as the amount of residential and commercial parcels near nuisance/hazard actually declines significantly

This empirical, spatio-temporal approach provides a new way to describe the street-level changes taking place in a rapidly growing, postwar, sunbelt metropolis.

Central Arizona-Phoenix Long-Term Ecological Research
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Data Sources

ProQuest Digital Sanborn Maps Database, ASU Map Collection, ASU GIS Data Repository, ASU Government Library, City of Phoenix Planning and Development Department

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