GIS Spatial History of Tokyo

Loren Siebert

PhD, Urban Design and Planning, University of Washington
Assistant Professor, Geography and Planning, University of Akron
Visiting Researcher, National Institute of Japanese Literature
Postdoctoral Research Fellow, Japan Society for the Promotion of Science

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Integration of Research in Three Fields

Urban/Regional Form & Structure

GIS Spatial History of Tokyo

Japanese Spatial History

GIS & Remote Sensing
Goals and Basic Orientation of Project

Goals:
Use geographic information system to develop an interactive, multifaceted, comprehensive historical spatial database covering greater Tokyo area.

Develop practical methods for recording, visualizing, and interpreting regional spatial history in a GIS.

Orientation:
Data-driven rather than hypothesis-driven: Proceed from description to visual representation to interpretation.
Spatial and Temporal Scope of GIS

Spatial History of Tokyo

Frequent, detailed coverage of Tokyo and western suburbs

Coarser coverage of entire Kanto region

Now being expanded back into Edo period
Thematic Scope of GIS

Spatial History of Tokyo

Hydrological features
Shorelines, land reclamation, harbors
Rivers, canals, and moats

Administrative features
Conversion from provinces to prefectures
Establishment of villages, towns, cities, wards
Boundary changes, mergers, annexations

Population and density

Rail network
Company establishments, mergers, annexations
Rail line openings, multiple tracking, electrification
Rail station openings and service types and levels

Landscape
Land cover and land use
Landscape fragmentation
Historical topographic maps
1:50,000, 1:200,000 for each decade in 1900s; some 1:10,000 and 1:20,000 for late-Meiji period

Historical land use maps
1:200,000 and 1:25,000 for 1970s and 1980s

Population censuses
every five years for 1900s

Administrative chronologies
year, month, day for most post-1868 events

Rail chronologies
year, month, day for most post-1872 events

Shinpen Musashi Fudoki and Kuniezu
now being used for Edo-period mapping
Expansion of Land Area in Tokyo Bay in 1900s

Early years: New landfill islands were created along coasts to south and east.

Later years: More and larger islands were created further into bay.
Water $\rightarrow$ Land Transitions in Tokyo Bay in 1900s

Many areas had simple transitions:
Water $\rightarrow$ island
Water $\rightarrow$ mainland
Water $\rightarrow$ island $\rightarrow$ mainland

Some areas had complex transitions, such as:
Water $\rightarrow$ mainland $\rightarrow$ island

(Analysis based on once-per-decade 1:50,000 topographic maps)
Development of Enclosed Harbors in Tokyo Bay

Inner harbor was enclosed by 1930s.

Infill islands were later created in inner harbor.

Outer harbor was enclosed by 1980s.

Additional islands were created beyond outer harbor in 1990s.
Rerouting of Major Rivers North of Tokyo Bay

Arakawa originally flowed into Nakagawa then south to Tokyo Bay. Later, it was rerouted into Sumidagawa.

Tonegawa originally flowed into Nakagawa then south to Tokyo Bay. Later, it was rerouted to flow directly to Pacific Ocean to east.
Rerouting of Rivers at Head of Tokyo Bay in 1900s

Arakawa bypass for Sumidagawa was created in 1920s and 1930s.

Nakagawa and Edogawa bypasses were created in 1960s.
Effect of River Rerouting on Village, Town, and Ward Boundaries

Some villages and towns were split apart.

Some ward boundaries follow old channels.

Some ward boundaries follow new channels.
Conversion from Provinces to Prefectures in Kanto Region

Process occurred in stages from 1871 to 1893, with some minor boundary changes even later.

Some smaller prefectures were initially created, then later merged.

Only a few areas maintained or ended up with original boundaries.
Spatial Groups of Conversion from Provinces to Prefectures in Kanto Region

Province-to-prefecture changes in the Kanto region occurred in three spatial groups.

Some of these groups also included provinces outside the Kanto region.

<table>
<thead>
<tr>
<th>Provinces</th>
<th>Prefectures</th>
<th>Provinces (recompiled)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Part 1871 1878 1888* 1893 - Present</td>
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<td>Central Kanto and Eastern Tokai Group</td>
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<tr>
<td>Musashi</td>
<td>NE SAITAMA</td>
<td>SAITAMA Musashi</td>
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<td>NW IRUMA</td>
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<td>W SHIZUOKA</td>
<td>SHIZUOKA Suruga</td>
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<td>W ASHIGARA</td>
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<tr>
<td>Izu Main</td>
<td>SHIZUOKA</td>
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<tr>
<td>Suruga</td>
<td>All SHIZUOKA</td>
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<tr>
<td>Totomi</td>
<td>All HAMAMATSU</td>
<td></td>
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</tbody>
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Eastern Kanto Group

| Awazu All       | KISARAZU CHIBA (and below) | Awazu |
| Kazusa All      | INBA                       | Kazusa Shimoso |
| Shimoso Ctrl NW  | NIIHARI IBARAKI (and below) | Shimoso |
|                 | E CHIBA (and above)        |        |
| Hitachi S N     | IBARAKI IBARAKI (and above) | Hitachi |

Northern Kanto Group

| Kozuke Main     | GUNMA GUNMA Kozuke        |
|                 | E TOCHIGI                 |
| Shimotsuke W E  | TOCHIGI TOCHIGI Shimotsuke |
Mapping of Edo-Period Villages and Towns of Southern Musashi Province

Villages and towns from Shinpen Musashi Fudoki and Musashi Kuniezu have been located based on Meiji maps. Ome area in western Tokyo is shown here.

“Ome” topographic map sheet, 1909, 1:50,000, Geographical Survey Institute of Japan
Villages, Towns, and **Gun** in Southern Musashi Province in Edo Period

Adachi, Ebara, Katsushika, Tama, Toshima, and parts of Niiza became Tokyo.

Tachibana, Kuraki, and Tsuzuki became part of Kanagawa.

MAPPED FROM Shinpen Musashi Fudoki and Musashi Kuniezu

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Villages, Towns, and Ryo in Southern Musashi Province in Edo Period

Some ryo spanned more than one gun.

Some ryo had outlying villages and towns.

Southern Musashi contained 29 ryo.

Note: Some colors on map are repeated.
Spatial Sequences of Village and Town Listings in Shinpen Musashi Fudoki

Each polyline shows linked locations of villages and towns listed in one volume of Shinpen Musashi Fudoki. Complexity of spatial sequences adopted by compilers is revealed by zigzags and crossing of lines.
Change to Town Status in Tokyo and Kanagawa

Areas surrounding Tokyo city became towns in 1910s and 1920s.

Many areas in internal parts of prefectures became towns in 1940s.

Many mountain areas became towns in 1950s.
Change to City Status in Tokyo and Kanagawa

Core areas of Tokyo and Yokohama had city status before 1900.

Both cities expanded in 1920s–1930s.

Many Kanagawa coastal cities formed in 1940s.

Many inland suburban cities formed in 1950s, 1960s, and 1970s.
Change to Ward Status in Tokyo and Kanagawa

Original wards of Tokyo existed before 1900.

Yokohama was divided into wards in 1920s.

Tokyo and Yokohama annexed areas into new wards in 1930s.

Kawasaki was divided into wards in 1970s.
Annexation Patterns in Tokyo and Kanagawa

Some areas maintained their original boundaries.

Some areas annexed surrounding areas in star-like historical pattern.

Some areas had complex histories of consolidation followed.
Urbanization Sequences in Tokyo and Kanagawa

Some areas followed normal progression from village to town to city (and sometimes to ward).

Some areas skipped one or two stages.

A few areas experienced reversal of status.
Urbanization Zones in Tokyo and Kanagawa

1 = Villages and towns directly added to Tokyo and Yokohama as wards

2 = Suburban cities with sequential transitions

3 = Mountain-edge cities that directly annexed surrounding villages
Historical Trends of Administrative Unit Change in Tokyo Prefecture

Change in Number of Units by Type

Change in Total Area by Type

(Izu islands not included)
Historical Trends of Administrative Unit Change in Kanagawa Prefecture

Change in Number of Units by Type

Change in Total Area by Type

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Population Change in Tokyo Prefecture, 1920–1925

Redistribution of population from shitamachi area to new suburbs after Great Kanto Earthquake of 1923

Development of new suburban rail lines
Population Change in Tokyo Prefecture During World War II

First years (1940–1944):
Shift from city to central lowland areas of prefecture

Final year (1944–1945):
Many deaths in city, as well as shift from city to more-distant hill and mountain areas in prefecture (and elsewhere)
Growth of Areas Served by Rail in Tokyo

One-kilometer zones around rail stations reveal spatial density of areas served at start of decade.

Blue lines = prefectural boundaries at time shown
Rail Network Growth vs. Administrative Status (1920–1925)

Most towns and cities in Tokyo and Kanagawa prefectures were served by rail stations.

Only a few villages were served by rail stations.
Rail Network Growth vs. Administrative Change (1920–1925)

Many new stations opened in areas around Tokyo that became towns between 1920 and 1925.
Rail Network Growth vs. Population Change (1920–1925)

Many new stations opened in areas of high population growth in Tokyo’s new suburbs.
Infill Rail Stations in Tokyo Area

“Infill stations” are new stations interspersed between older stations to serve intermediate areas.

Most early lines had stations spaced far apart, with later infill.

Most newer lines opened with closely spaced stations.
“One Seat”
Direct Rail Service to Downtown Tokyo

Suburban commuter rail lines and Tokyo subway system developed interline through service to eliminate need for transferring.
In 1945, Musashino company acquired Seibu company and adopted Seibu’s name.
Seibu Railway: Geographic Lineage

Lines are listed in order of company formation.
Rail Lines or Companies Named After Old Provinces vs. Modern Prefectures

Province-based line/comp. names: Many lines throughout region

Prefecture-based line/comp. names: Fewer lines, centered on Tokyo

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Historical Trends of Rail Line Names

Rail Line Names: All Types

Rail Line Names: Province vs. Prefecture vs. Capital

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Rail Stations Named After Old Provinces vs. Modern Prefectures

Province-based station names: Many stations throughout region

Prefecture-based station names: Only a few stations
Popular Rail Station Names in Tokyo Area

Many station names include “Terrace”, “Heights”, or “Hills”. Others include “Park” or “Amusement Park”.

Sometimes, original names based on old villages or towns were changed to create image of residential or recreational amenity.
Landscape Fragmentation in Tama Area of Tokyo Prefecture

Polygons represent fragmentation by roads, rivers, and rail lines during 1900s.

“Fragmentation” is based on features shown in once-per-decade series of 1:50,000-scale topographic maps.
Spatial relationships among various historical geographic and related spatial phenomena can be recorded, visualized, and interpreted.

Both qualitative analysis using human pattern-recognition skills and quantitative analysis using underlying spatial geometry are possible.

Metadata about data sources can be recorded for each entry or group of entries, then used to reveal uncertainties in visualizations and interpretations.

GIS database structure encourages researcher to attempt to find missing information and resolve conflicts.
Contact Information

Loren Siebert
PhD, Urban Design and Planning
University of Washington

Assistant Professor, University of Akron, USA

Currently working with Dr. Koichi Watanabe at the National Institute of Japanese Literature in Tokyo under a fellowship from the Japan Society for the Promotion of Science

Best email in 2002-2003 academic year:
siebertloren@aol.com

Best email thereafter: siebert@uakron.edu