Landscape Change in the Bay Area
Using Historic Maps and Urban Modeling to Map the Impacts of Development

Jackie Bjorkman
Jim Thorne
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Map of Talk

1. Introduction
2. Historic landscape, Wieslander VTM Project
3. Comparing historic maps to current maps
4. Future landscape, UPlan Model
5. Future impacts of growth on current landscape
Introduction

- How has the landscape changed in the Bay Area?
- Losses? Gains?
- How will future growth further impact the landscape?
Wieslander VTM Project

• Conducted in the 1930s, led by Albert Wieslander

• Basis for much of current understanding of California Vegetation

• Surveyed about 1/3 of California
Four types of VTM data

- Vegetation Plots: 17,000
- Voucher Specimens, Jepson Herbarium: 25,000 specimens.
- Landscape Photos: over 3000
- Vegetation Maps, covering 1/3 of California
Digitization Efforts

- Obtain and scan tiles
- Obtain and scan topographic map
- Geo-register topo map and tiles
- Trace the vegetation polygons
- Attribute the species information
Santa Cruz Quad
Post-GIS
Attributed and Cross-walked for WHR Types
Study Area

- Roughly 2,750,900 acres
- Includes sections of Sonoma, Napa, Solano, Marin, Contra Costa, San Francisco, Alameda, San Joaquin, Stanislaus, San Mateo, Santa Clara and Santa Cruz counties
Quality of the VTM Vegetation Maps

- Taxonomic detail is high, better than most modern maps, strings of dominant species are provided.
- Spatial precision is moderate, non-systematic registration errors of up to 100 meters.
- Landscape-level detail is on the order of 3,500 polygons/30’ quad.
- CalVeg’s functional equivalent is 35,000 polygons/30’ quad, but the species info in CalVeg is much lower.
• Prepared Historic VTM Maps
• Clipped Modern CalVeg GIS maps to same extent
• Summarized several WHR types for each time period
• Created maps of several WHR types for visual comparison
## Winners...and Losers

<table>
<thead>
<tr>
<th>Veg Type</th>
<th>Historic Area (ac)</th>
<th>Current Area (ac)</th>
<th>Difference (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>106,018.7</td>
<td>625,199.6</td>
<td>519,180.9</td>
</tr>
<tr>
<td>Grass</td>
<td>556,693.7</td>
<td>750,260.7</td>
<td>193,567.0</td>
</tr>
<tr>
<td>Conifer</td>
<td>165,940.7</td>
<td>278,203.6</td>
<td>112,262.9</td>
</tr>
<tr>
<td>Oak</td>
<td>499,105.8</td>
<td>575,179.7</td>
<td>76,073.9</td>
</tr>
<tr>
<td>Riverine</td>
<td>4,968.7</td>
<td>15,842.2</td>
<td>10,873.5</td>
</tr>
<tr>
<td>Barren</td>
<td>10,401.7</td>
<td>13,433.6</td>
<td>3,031.9</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>6,783.7</td>
<td>9,613.9</td>
<td>2,830.3</td>
</tr>
</tbody>
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<tr>
<td>Agriculture</td>
<td>893,636.2</td>
<td>160,935.4</td>
<td>-732,700.8</td>
</tr>
<tr>
<td>Chaparral</td>
<td>285,935.0</td>
<td>207,067.4</td>
<td>-78,867.5</td>
</tr>
<tr>
<td>Water</td>
<td>124,099.1</td>
<td>115,180.6</td>
<td>-8,918.5</td>
</tr>
</tbody>
</table>

### Notes
- The table above shows the change in area for various vegetation types over time, indicating which types have increased or decreased in coverage. 
- Urban and Grass have experienced significant increases, while Chaparral and Oak have seen decreases.
### Some combined groups

<table>
<thead>
<tr>
<th>WHR Groups</th>
<th>Historic Area (km²)</th>
<th>Current Area (km²)</th>
<th>Difference (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Lands (AGR, CRP, AGS)</td>
<td>4771.15462</td>
<td>2981.897169</td>
<td>-1789.257451</td>
</tr>
<tr>
<td>Chaparral (CRC, MCH, CPC)</td>
<td>788.7489309</td>
<td>540.0407129</td>
<td>-248.708218</td>
</tr>
<tr>
<td>Blue Oak (BOW, BOP)</td>
<td>679.5707195</td>
<td>613.9465908</td>
<td>-65.62412864</td>
</tr>
<tr>
<td>Hardwoods (MHC, MHW)</td>
<td>649.358115</td>
<td>674.0762137</td>
<td>24.71809868</td>
</tr>
<tr>
<td>Other Oaks (COW, VOW)</td>
<td>755.7511393</td>
<td>998.6196699</td>
<td>242.8685306</td>
</tr>
</tbody>
</table>
Landscape Transition

Area Converted (ac)

Historic Veg Type

Current Veg Type

- Riparian
- Conifer
- Grassland
- Chaparral
- Oak
- Water
- Urban
- Unknown
- Eucalyptus
- Barren
- Agriculture
Chaparral

Historic Chaparral

Current Chaparral
Historic Chaparral Change
Urban

Historic Urban Extent

Current Urban Extent
Agricultural/Working Landscapes

Historic Working Landscapes Extent

Current Working Landscapes Extent
• Historic Agricultural Land
• Modern Urban Land
Urban Conversion

- **377,883** acres of urban conversion
- **300,000** acres of overall development
- **350,000** acres of potential development
- **400,000** acres of completed development

**Area Lost to Development (ac):**
- Agriculture: 1,129
- Barren: 3,015
- Eucalyptus: 24,787
- Unknown: 97,172
- Urban: 24,970
- Water: 17,843
- Oak: 5,688
- Chaparral: 69,439
- Grassland: 2,202
- Conifer: 1,206
- Riparian: 0

**Historic Vegetation Type:**
- Agriculture
- Barren
- Eucalyptus
- Unknown
- Urban
- Water
- Oak
- Chaparral
- Grassland
- Conifer
- Riparian
Future Growth: UPlan

• A land use model that projects urban growth
• Uses a combination of demographic inputs and geographic layers that are thought to influence where building occurs
• Developed at UC Davis in 2001
• Currently used by 24 counties for urban planning, general plan updates or blueprint planning processes
2050 Base Case Scenario Footprint

- 261,452 acres
- 7 Land Use Types: Commercial High, Commercial Low, Industrial, Residential High, Medium, Low and Very Low
Current Land at Risk

Urban Conversion

Historic Vegetation Type

Area Lost to Development (ac)

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Urban Conversion 2050

Existing Vegetation Type

Area Lost to Development (ac)

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<th>Vegetation Type</th>
<th>Area Lost (ac)</th>
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<tbody>
<tr>
<td>Agriculture</td>
<td>142,091</td>
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<tr>
<td>Barren</td>
<td>43,162</td>
</tr>
<tr>
<td>Chapparal</td>
<td>825</td>
</tr>
<tr>
<td>Conifer</td>
<td>1,075</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>28,061</td>
</tr>
<tr>
<td>Grassland</td>
<td>24,787</td>
</tr>
<tr>
<td>Oak</td>
<td>1,206</td>
</tr>
<tr>
<td>Riparian</td>
<td>26,391</td>
</tr>
<tr>
<td>Urban</td>
<td>7,944</td>
</tr>
<tr>
<td>Water</td>
<td>1,683</td>
</tr>
</tbody>
</table>

Historic Vegetation Types:
- Agriculture
- Barren
- Eucalyptus
- Unknown
- Urban
- Water
- Oak
- Chapparal
- Grassland
- Conifer
- Riparian

Existing Vegetation Types:
- Agriculture
- Barren
- Chapparal
- Conifer
- Eucalyptus
- Grassland
- Oak
- Riparian
- Urban
- Water
Thank you for your attention!

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