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Landcover Assessment of Northern California Urban Areas Classified by Population and Environmental Attributes

Introduction

Urban Foresters have been working on increasing urban tree canopy for decades but how can we work on this task if we don't know our cities? As a Regional Urban Forester for the California Department of Forestry and Fire Protection (CAL FIRE), I always ask myself what cities in my territory are comprised of to determine what their needs might be and how I might be able to assist. This assistance can be related to CAL FIRE's Urban and Community Forestry (UCF) grant program as well as connecting organizations to facilitate community events and tree plantings, supplying technical information, and other ways to assist. CAL FIRE's UCF grant program, which funds planting thousands of trees annually, gives preference to projects in disadvantages communities (DAC), per the grant guidelines of the funding source. Based on the funding source, the grant program must allocate a certain amount of the grant budget to projects in DACs. Thus, it is important to know where the DACs are. In addition, how DACs differ from non-DAC communities of similar size when it comes to canopy cover and other land cover classes as well as services their trees provide was subject of this project.

Specifically, the questions this project aims to answer are:

1) Does land cover differ between communities with and those without DACs?
2) Does this vary by population size?

These questions were assessed specifically to the Northern California Inland territory.

Methodology

The i-Tree tool used to analyze the data was i-Tree Canopy. To create the needed shapefiles, a Community shapefile, which included population size, and a CalEnviroscreen shapefile were used. CalEnvironscreen is a tool, developed by the Office of Environmental Health Hazard Assessment (OEHHA), on behalf of the California Environmental Protection Agency (CalEPA), that incorporates data on the environment, for example ground and air pollution, as well as sociodemographics such as income and unemployment. For more information, see https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30. CalEnviroscreen assigns each census tract a CalEnviroscreen score and for our grant program a score of 76% or more is determined disadvantaged. If the majority of a project is located in or benefitting DAC census tracts (per AB 1550), the entire project qualifies as a DAC project. Thus, two sets of shapefiles for each population class were needed, one with communities that have DACs and one with communities that don't.

In ArcMAP, the community layer was first 'clipped' to only include those communities that are in the Northern California Inland territory as well as those with 2,500 or more in population as that identifies an urban area for the grant program (Fig.1). The next step was to 'clip' the CalEnviroscreen layer to those communities. Communities that included at least one census tract designated as DAC were then identified. Since that was a small number, 16 of my 142 communities, I manually added the data to the communities layer by adding a column and writing in 'DAC' or 'No_DAC'. The number of census tracts each community had was not relevant as the potential of a city to accommodate a DAC project was the important component.

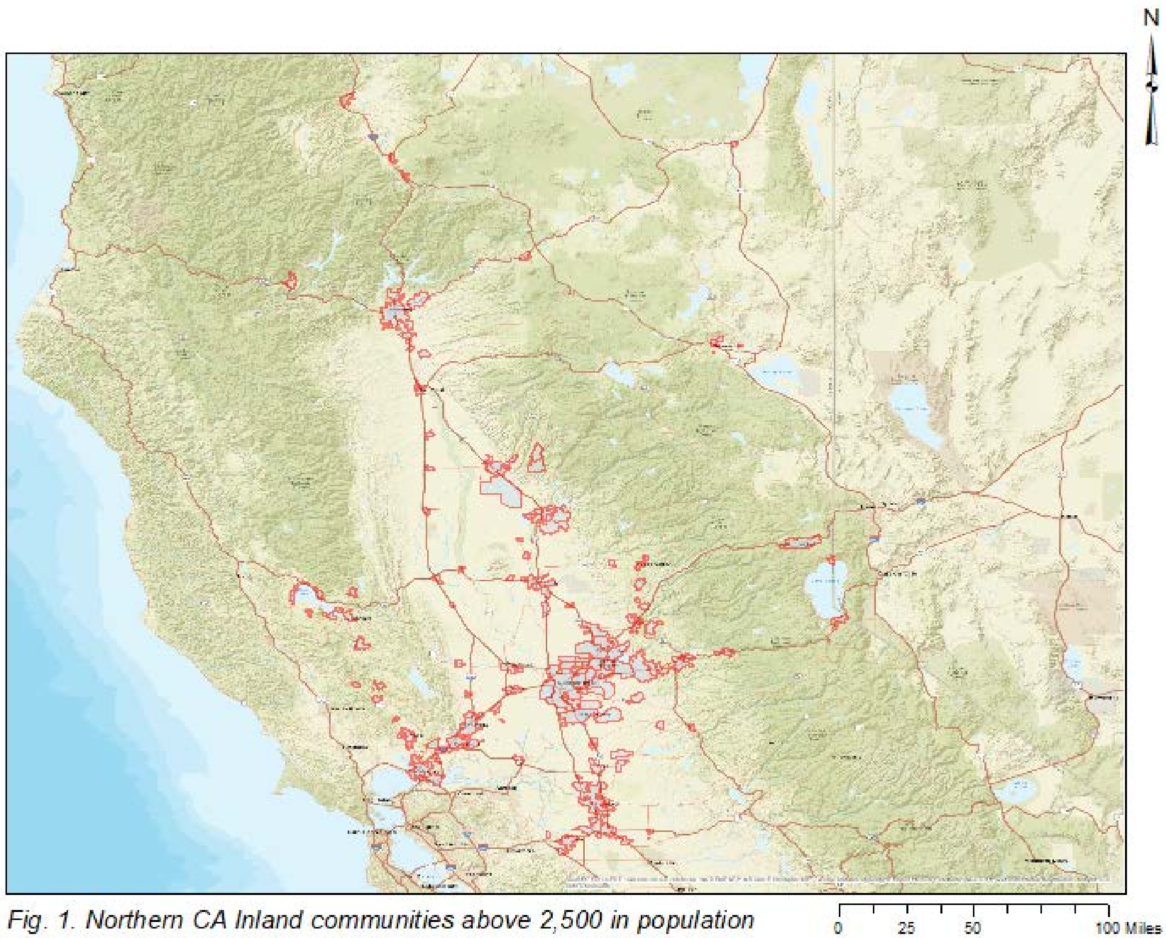

Fig. 1. Northern CA Inland communities above 2,500 in population

Next, cities were selected by population class from the communities layer. To ensure that each class has at least two DAC and No_DAC communities, the population classes were chosen to be 2,500-10,000; 10,001-20,000, 20,001-70,000, and >70,001. Of the 142 cities in my territory, 16 included census tracts with a CalEnviroscreen 3.0 score of above 75% (table 1).

Table 1. Cities in the CAL FIRE Urban and Community Forestry Program's Northern California Inland territory above 2,500 in population

Pop class	DAC	No_DAC
<10,000	2	72
10,001-20,000	4	24
20,001-70,000	5	21
>70,001	5	9

The final step was to run i-Tree Canopy for each of the eight shapefiles. The land cover classes used were tree/shrub, herbaceous/grass, buildings, other impervious, water, and soil/bare ground. To keep the standard error low enough, 250 points were analyzed for each shapefile.

Results and Discussion

For all eight i-Tree Assessments, the assessment of 250 random points resulted in a standard error of 3.15% or less for each land cover class. However, it should be noted that the area included in each group varied significantly potentially leading to a higher level of uncertainty. To determine the degree would require further analysis.

When comparing DAC and No_DAC communities of the same population class (Fig. 2), the data show that DACs have lower canopy cover. For DACs it varies between 5% and 16% while it is between 22% and 35% for No_DACs (Fig. 2). Interestingly, the lowest tree cover was found for the DAC 10-20,000 in population class, not the largest population class which one might expect. The DAC with the highest population averaged 14% in canopy cover while the same population class without DACs averaged 22%.

Similarly, the impervious surfaces (buildings and other impervious surfaces combined) vary from about 25% for the smallest population class to over 40% for the largest for DACs and 9% to about 36% for No_DACs.

Grass/herbaceous and bare soil, combined, was the largest land cover class for all groups. It was 42% for DAC >70,000 in pop and 39% for the No_DAC counterpart. Generally speaking, DAC communities had larger areas of grass/herbaceous/soil than their No_DAC counterpart. This may mean that there is more agriculture and orchards within city limits. It may also mean that there is more potential for tree plantings.

Challenges and Uncertainties

Besides the already mentioned variability in land area included in each group, another challenge was to discern grass/herbaceous from bare soil. In California, water is the limiting factor and depending on during which season aerial images are taken, an area might visually seem like bare soil and it is in fact grass or herbaceous. One way to avoid this would be the combine bare soil, grass, and herbaceous into one land cover class. Another challenge is agricultural land that supports the combination of said land cover classes as, depending on season, it may be vegetated or not.

In future assessments, it might make sense to focus on tree/shrub, Buildings, other impervious, water, plantable pervious (grass/herbaceous, bare soil), and non-plantable pervious (agriculture, orchards, or areas too small to accommodate a tree).

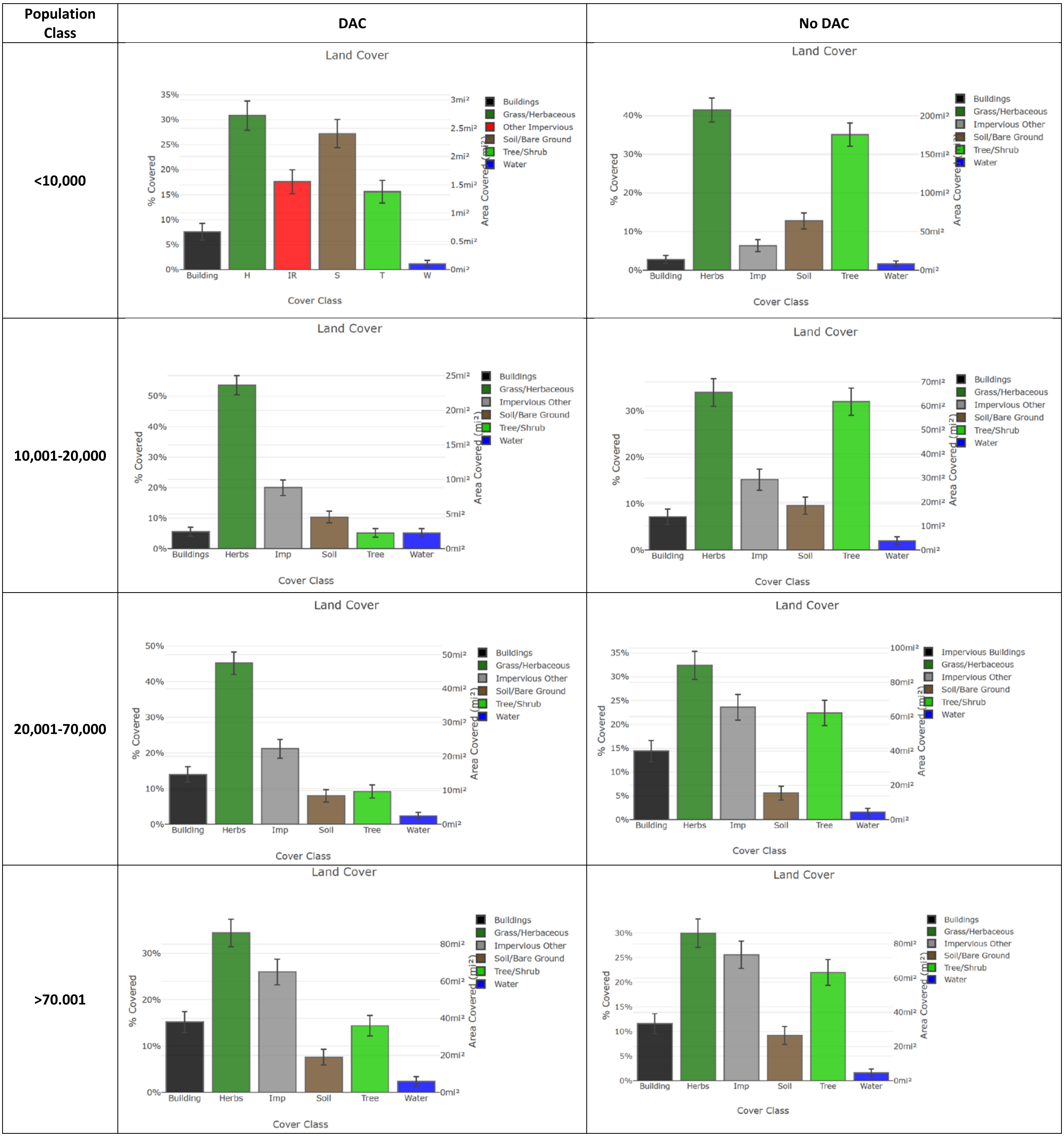

Fig. 2. Land cover class distribution for communities that have disadvantaged communities (left) and those without DACs (right) by population class.

Removed annually	DAC <10,000	No DAC <10,000
Carbon	$205,282	$26,228,965
Carbon Monoxide	$664	$84,866
Nitrogen Dioxide	$1,202	$153,619
Ozone	$55,219	$7,055,332
PM10	$37,816	$4,831,795
PM2.5	$115,601	$14,770,396
SO_2	$181	$23,133

Removed annually	DAC 10-20,000	No DAC 10-20,000
Carbon	$341,610	$9,207,750
Carbon Monoxide	$1,105	$29,792
Nitrogen Dioxide	$2,001	$53,928
Ozone	$91,890	$2,476,794
PM10	$62,930	$1,696,214
PM2.5	$192,372	$5,185,188
SO_2	$301	$8,121

Removed annually	DAC 20-70,000	No DAC 20-70,000
Carbon	$1,441,826	$9,266,681
Carbon Monoxide	$4,665	$29,983
Nitrogen Dioxide	$8,445	$54,273
Ozone	$387,837	$2,492,646
PM10	$265,607	$1,707,070
PM2.5	$811,940	$5,218,374
SO_2	$1,272	$8,173

Removed annually	DAC >70,000	No DAC >70,000
Carbon	$5,369,174	$9,435,023
Carbon Monoxide	$17,372	$30,528
Nitrogen Dioxide	$31,446	$55,259
Ozone	$1,444,255	$2,537,928
PM10	$989,087	$1,738,081
PM2.5	$3,023,559	$5,313,173
SO_2	$4,735	$8,321

of each community

DAC <10,000

- trees mostly in orchards
- water mostly industry/ag (irrigation ponds/water treatment etc)
- challenges: herbs/grass and soil hard to distinguish; agriculture depends on season (green or bare soil)

DAC 10,000-20,000