

City of Calgary

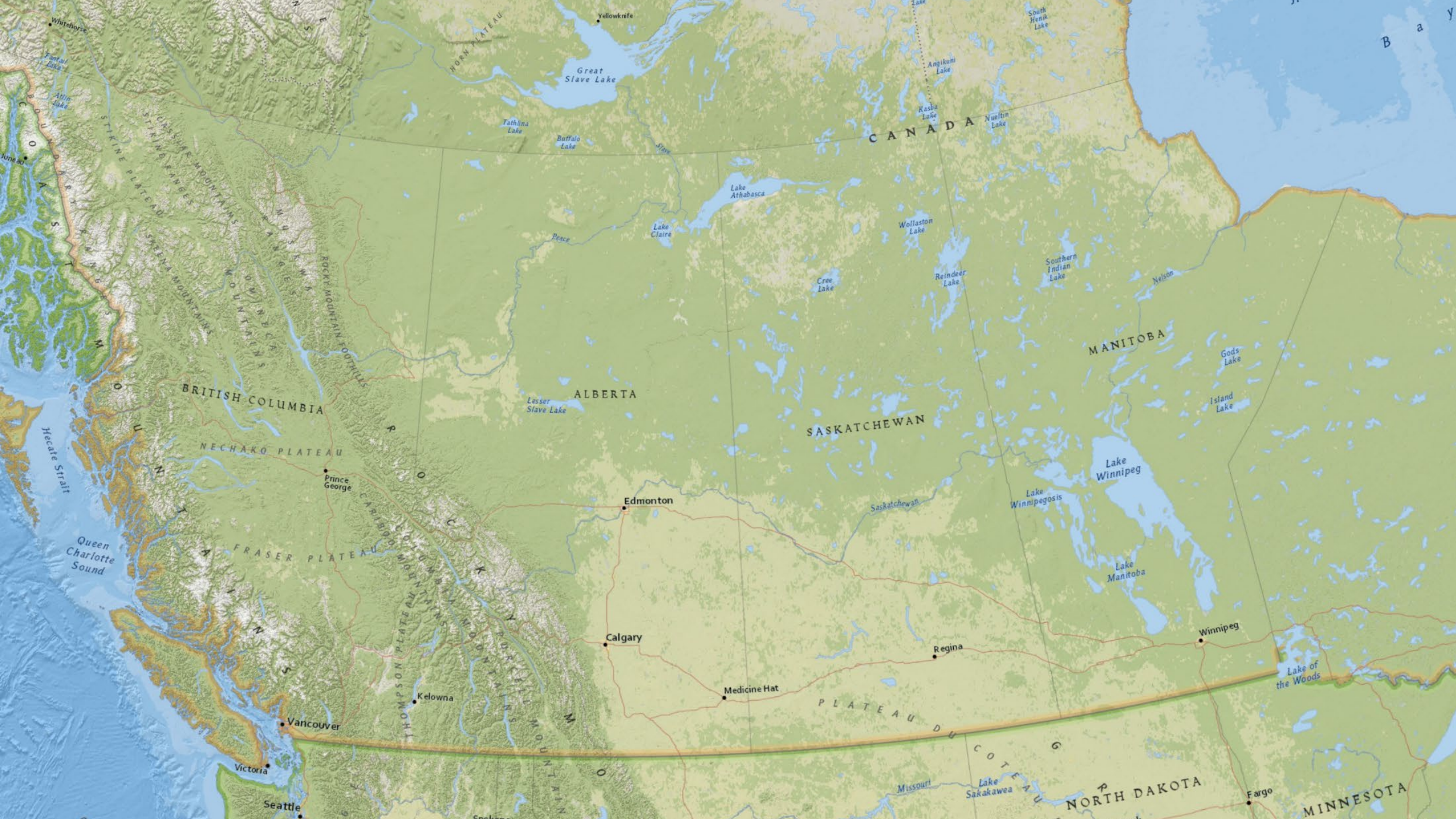
Canopy Modelling

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City Extent

Area: 848 km² (84,820 ha)

For context...

1.3 x City of Toronto (630 km²)

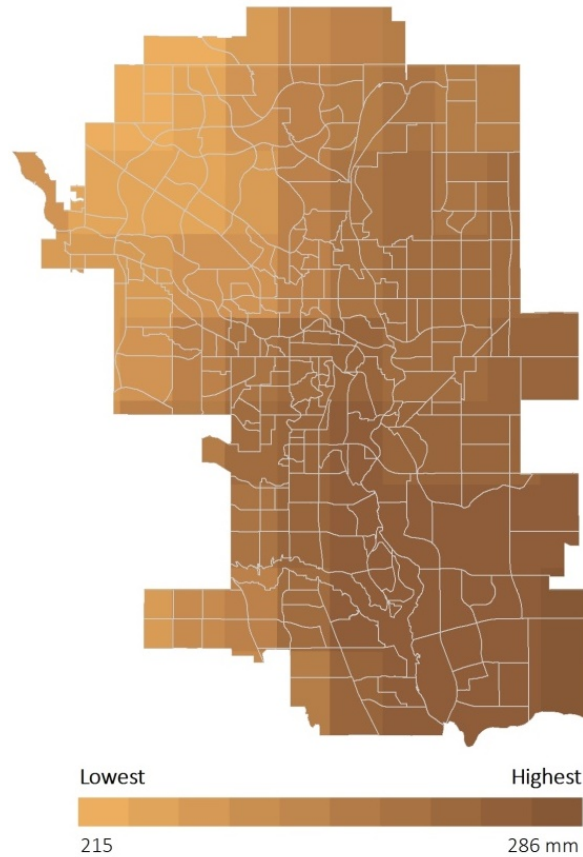
7 x City of Vancouver (115 km²)

22 x City of Melbourne (38 km²)

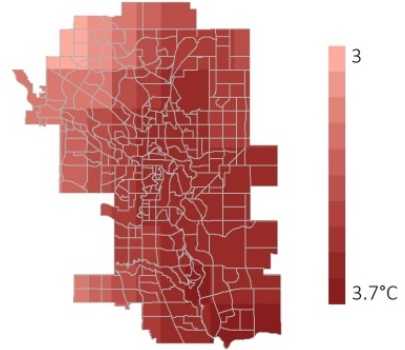


Climate

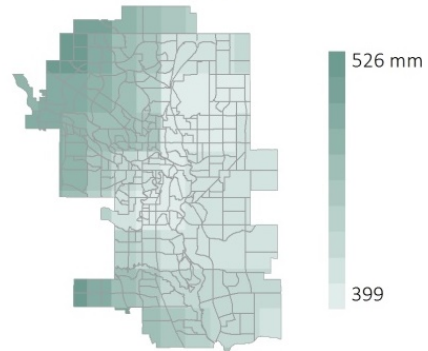
CLIMATIC MOISTURE DEFICIT



Mean Average Temperature



Mean Average Precipitation

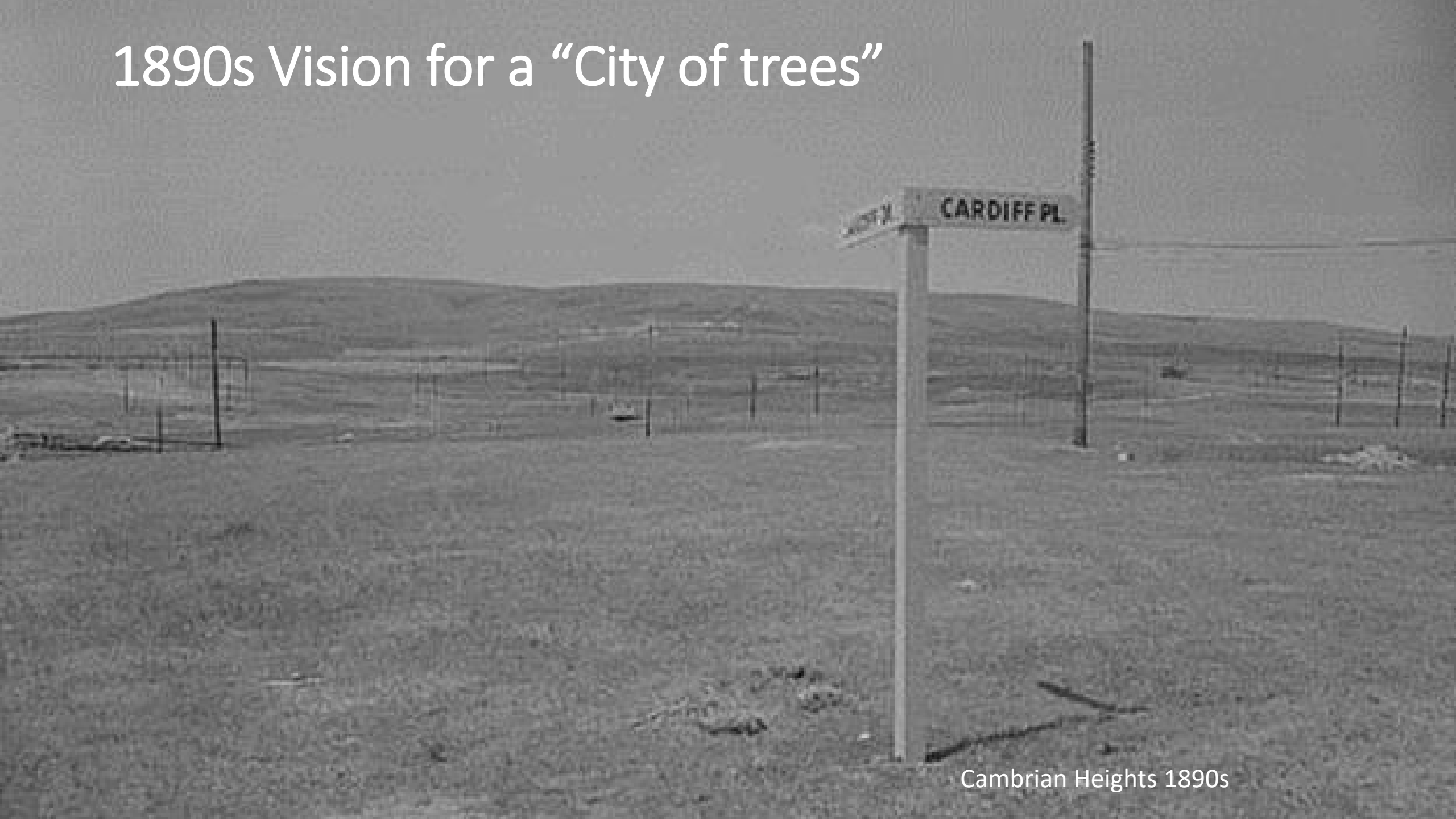


HYDROLOGY + NATURAL SUBREGIONS



1890s Vision for a “City of trees”

1890s Vision for a “City of trees”

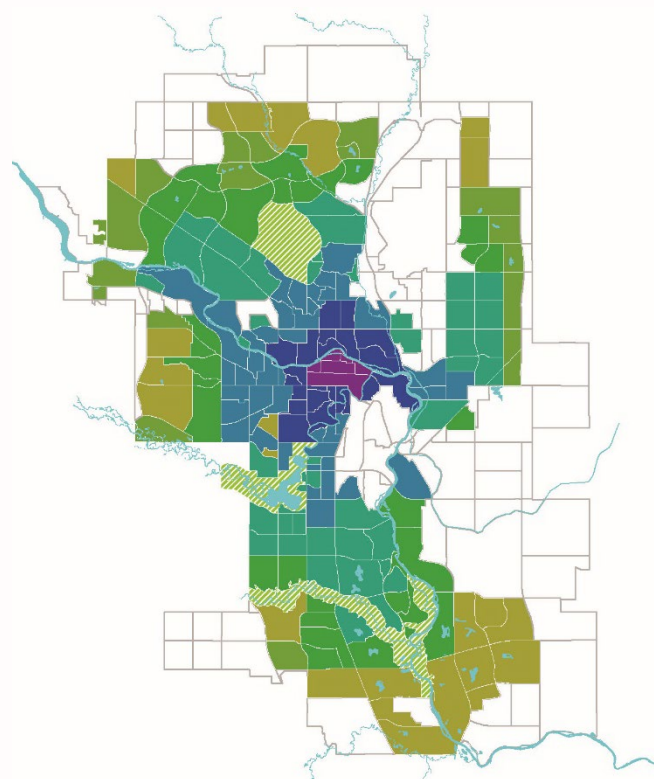


Cambrian Heights 1890s



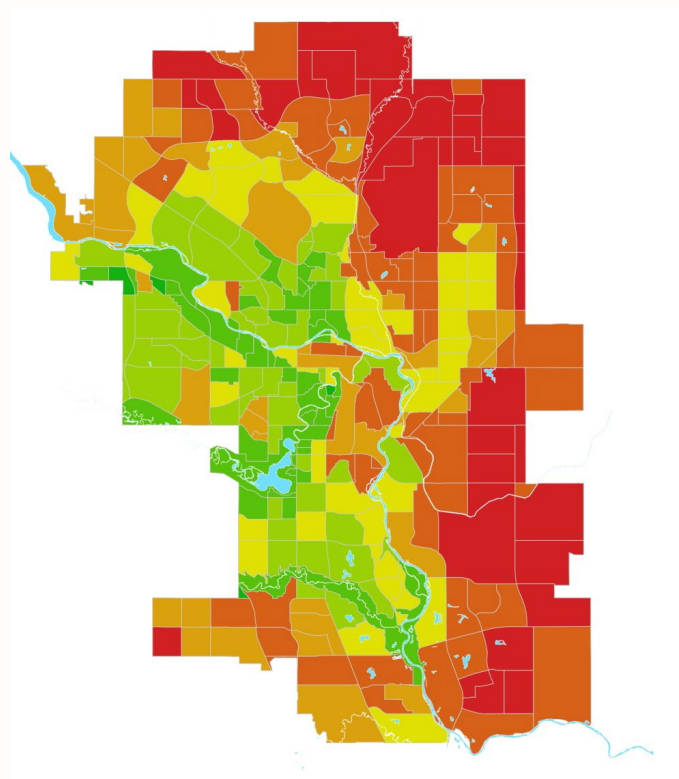
Tree Planting Legacy

Time of Development



pre - 1950s	1950s	1960s - 1970s
1980s - 1990s	2000s	building out

Tree Canopy



URBAN TREE CANOPY						
<1%	1-5%	6-10%	11-15%	16-20%	21-40%	> 40%

Driving Strategies



- Parks Urban Forest Strategic Plan
 - Goal: Sustainable urban forest and a tree canopy goal of 20% (growing at 1% per decade)
- Council Priority of 'a healthy and green city'
 - Indicator: Canopy cover

City of Calgary Canopy Today

8.2%





Some context



To meet its 20% canopy target by 2,140, Calgary needs to:

- Add 85 ha of canopy every year
- Plant enough trees to compensate for canopy lost

City	Canopy Cover (%)	Canopy Cover (ha)	Canopy Target (%)	Canopy Cover Increase Needed (ha)	Annual Increase Needed (ha)
Calgary	8%	~7,000	20% (y2140)	10,000	85
Toronto	27%	~17,000	40% (y2062)	8,000	160
Vancouver	18%	~2,000	22% (y2050)	500	12
Melbourne	11%	~400	40% (y2040 public only)	190	16

The questions...



- How many trees does Calgary need to plant annually...
 - On public land?
 - On private land?
 - To compensate for tree mortality?
 - To grow the canopy by 85 ha per year?
- How many opportunities are there to plant new trees?

Urban Forest Canopy Growth Model

[Click to Change Model Parameters](#)

ENTER Years Modeled

120

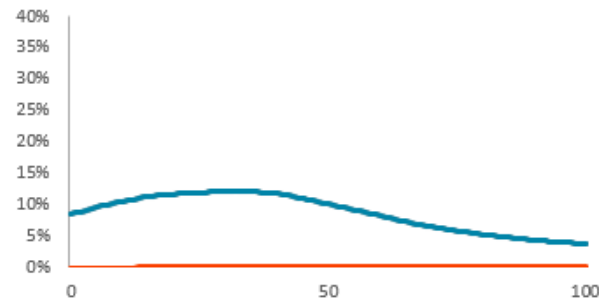
[Save or Load Scenario](#)

Ownership	Land use	Area of land use (m2)	2015 canopy area (m2)	2015 canopy percent (of land use)	ENTER new + replacement trees planted per year	Total estimated opportunities (new trees)	Estimated replacement trees (annual)	Estimated future canopy area (m2)	Estimated future canopy percent
Public	Roads (right of way)	145,706,562	10,250,636	7.0%	0	77,000	1,900	1,306,448	0.9%
	Parks and community reserves	60,291,195	11,410,178	18.9%	0	28,000	2,100	1,454,232	2.4%
	Recreational (uncommon land use)	14,040	569	4.1%	0	-	-	73	0.5%
	Schools	11,225,910	481,949	4.3%	0	3,000	-	61,425	0.5%
	Golf courses	11,711,616	1,836,272	15.7%	Not modelled			1,836,272	15.7%
	Urban nature	19,639,205	5,364,342	27.3%	Not modelled			5,364,342	27.3%
Private	Industrial	51,577,409	1,152,871	2.2%	0	-	200	146,934	0.3%
	Institutional	6,099,620	708,189	11.6%	0	4,000	100	90,259	1.5%
	Commercial	16,249,003	539,320	3.3%	0	8,000	100	68,737	0.4%
	Core commercial	681,933	24,796	3.6%	0	100	4	3,160	0.5%
	Residential - high density	1,231,905	90,503	7.3%	0	1,300	10	11,535	0.9%
	Residential - medium density + mixed use	23,073,090	2,628,995	11.4%	0	23,000	400	335,067	1.5%
	Residential - low density	159,021,532	22,734,429	14.3%	0	220,000	4,200	2,897,513	1.8%
	Major infrastructure	52,048,994	1,213,103	2.3%	0	32,000	200	154,611	0.3%
	Transportation + utility corridor	44,059,314	1,519,299	3.4%	1	31,000	200	196,702	0.4%
	Future urban development	169,945,258	5,244,408	3.1%	Not modelled			5,244,408	3.1%
	Direct control	54,615,134	4,394,257	8.0%	Not modelled			4,394,257	8.0%
	No designated land use	7,127,139	143,456	2.0%	Not modelled			143,456	2.0%
	Water	18,221,609	87,875	0.5%	Not modelled			87,875	0.5%
	PUBLIC	248,588,528	29,343,947	11.8%	-	108,000	4,000	10,022,792	4.0%
	PRIVATE	603,951,941	40,481,501	6.7%	1	319,400	5,414	13,774,513	2.3%
TOTAL CITY		852,540,469	69,825,448	8.2%	1	427,400	9,414	23,797,305	2.8%

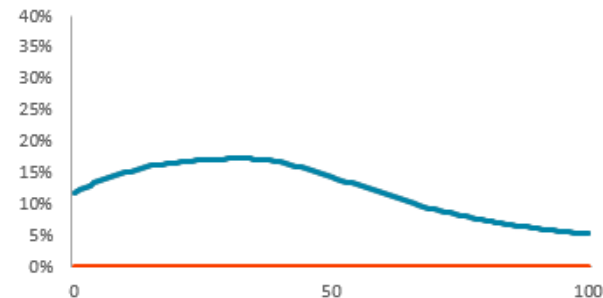


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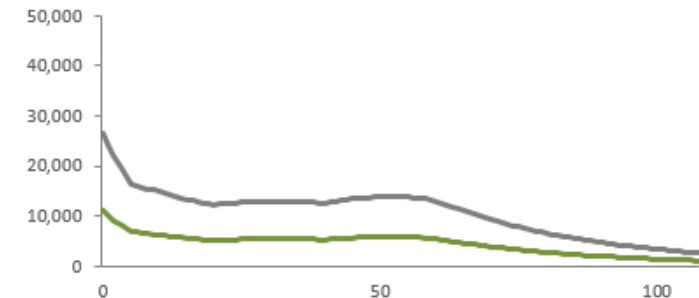
Canopy Projection: Total City



Canopy Projection: Public Land



Estimated Annual Removals



Canopy Size | Age Distribution | Mortality Rate | Size at Maturity |

Controls Growth Rate and Ultimate Canopy Area

	Canopy area (m2)*:	Calgary default values
New trees (years 1 - 5)	<input type="text" value="7"/>	7
Young trees (years 6 - 20)	<input type="text" value="15"/>	15
Semi-mature trees (years 21 - 40)	<input type="text" value="64"/>	64
Mature trees (years 41 - 60)	<input type="text" value="121"/>	121
Old trees (>60 years)	<input type="text" value="140"/>	140

*** This value should represent the average canopy area for trees in this size class**

Refresh Form

Done

Canopy Size | **Age Distribution** | Mortality Rate | Size at Maturity |

Controls Age Distribution in the Current Population

	% of canopy*:	Calgary default values	Approximate % of tree population*
New trees (years 1 - 5)	<input type="text" value="2"/>	2	12
Young trees (years 6 - 20)	<input type="text" value="17"/>	17	48
Semi-mature trees (years 21 - 40)	<input type="text" value="39"/>	39	26
Mature trees (years 41 - 60)	<input type="text" value="29"/>	29	10
Old trees (>60 years)	<input type="text" value="13"/>	13	4
Totals	100	100	100

*** These values will not update until the form is refreshed**

Refresh Form

Done

Canopy Size | Age Distribution | Mortality Rate | Size at Maturity |

Controls rate of loss

	What % of trees don't survive in each age class?	Calgary default values	Equivalent annual mortality %*
New trees (years 1 - 5)	<input type="text" value="20"/>	35	4
Young trees (years 6 - 20)	<input type="text" value="25"/>	25	1.7
Semi-mature trees (years 21 - 40)	<input type="text" value="20"/>	20	1
Mature trees (years 41 - 60)	<input type="text" value="20"/>	20	1
Old trees (>60 years - assumes death by 90)	<input type="text" value="100"/>	100	3.3
Overall annual mortality rate (%)			1.5
Mean life expectancy (years)			67

* These values will not update until the form is refreshed

Refresh Form

Done

Canopy Size | Age Distribution | Mortality Rate | **Size at Maturity**

Controls Ultimate Size

	% of Population*:	Calgary default values
Small at maturity (won't exceed 40 cm dbh)	10	10
Medium at maturity (won't exceed 60 cm dbh)	20	20
Large at maturity*	70	70

*** This value will not update until the form is refreshed**

Refresh Form

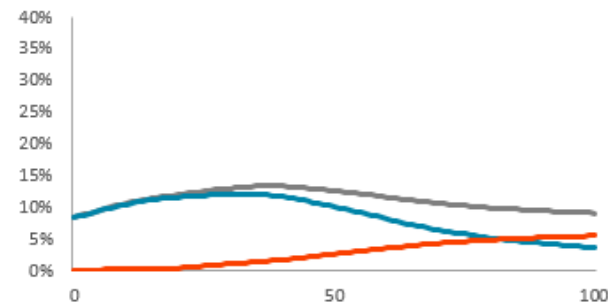
Done

Ownership	Land use	Area of land use (m2)	2015 canopy area (m2)	2015 canopy percent (of land use)	ENTER new + replacement trees planted per year	Total estimated opportunities (new trees)	Estimated replacement trees (annual)	Estimated future canopy area (m2)	Estimated future canopy percent
Public	Roads (right of way)	145,706,562	10,250,636	7.0%	2850	77,000	3,700	11,234,800	7.7%
	Parks and community reserves	60,291,195	11,410,178	18.9%	3150	28,000	4,100	12,427,773	20.6%
	Recreational (uncommon land use)	14,040	569	4.1%	0	-	-	73	0.5%
	Schools	11,225,910	481,949	4.3%	0	3,000	-	62,018	0.6%
	Golf courses	11,711,616	1,836,272	15.7%	Not modelled			1,836,272	15.7%
	Urban nature	19,639,205	5,364,342	27.3%	Not modelled			5,364,342	27.3%
Private	Industrial	51,577,409	1,152,871	2.2%	300	-	300	1,192,115	2.3%
	Institutional	6,099,620	708,189	11.6%	150	4,000	200	613,012	10.0%
	Commercial	16,249,003	539,320	3.3%	150	8,000	100	591,281	3.6%
	Core commercial	681,933	24,796	3.6%	6	100	8	24,066	3.5%
	Residential - high density	1,231,905	90,503	7.3%	15	1,300	20	63,834	5.2%
	Residential - medium density + mixed use	23,073,090	2,628,995	11.4%	600	23,000	800	2,425,826	10.5%
	Residential - low density	159,021,532	22,734,429	14.3%	6300	220,000	8,300	24,844,489	15.6%
	Major infrastructure	52,048,994	1,213,103	2.3%	300	32,000	400	1,199,865	2.3%
	Transportation + utility corridor	44,059,314	1,519,299	3.4%	300	31,000	400	1,239,267	2.8%
	Future urban development	169,945,258	5,244,408	3.1%	Not modelled			5,244,408	3.1%
	Direct control	54,615,134	4,394,257	8.0%	Not modelled			4,394,257	8.0%
	No designated land use	7,127,139	143,456	2.0%	Not modelled			143,456	2.0%
	Water	18,221,609	87,875	0.5%	Not modelled			87,875	0.5%
	PUBLIC	248,588,528	29,343,947	11.8%	6,000	108,000	7,800	30,925,278	12.4%
	PRIVATE	603,951,941	40,481,501	6.7%	8,121	319,400	10,528	42,063,751	7.0%
TOTAL CITY		852,540,469	69,825,448	8.2%	14,121	427,400	18,328	72,989,030	8.6%

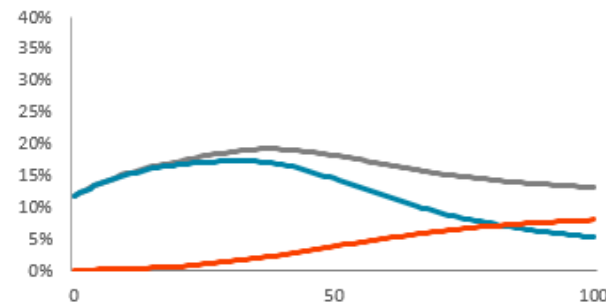


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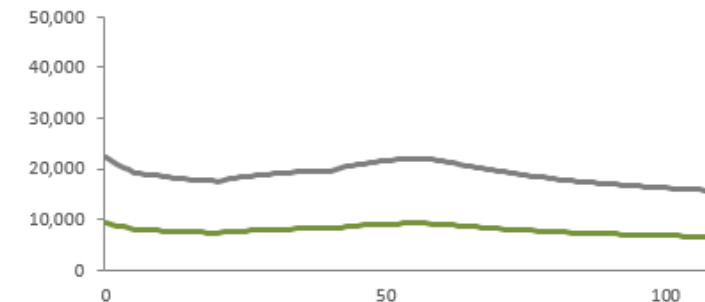
Canopy Projection: Total City



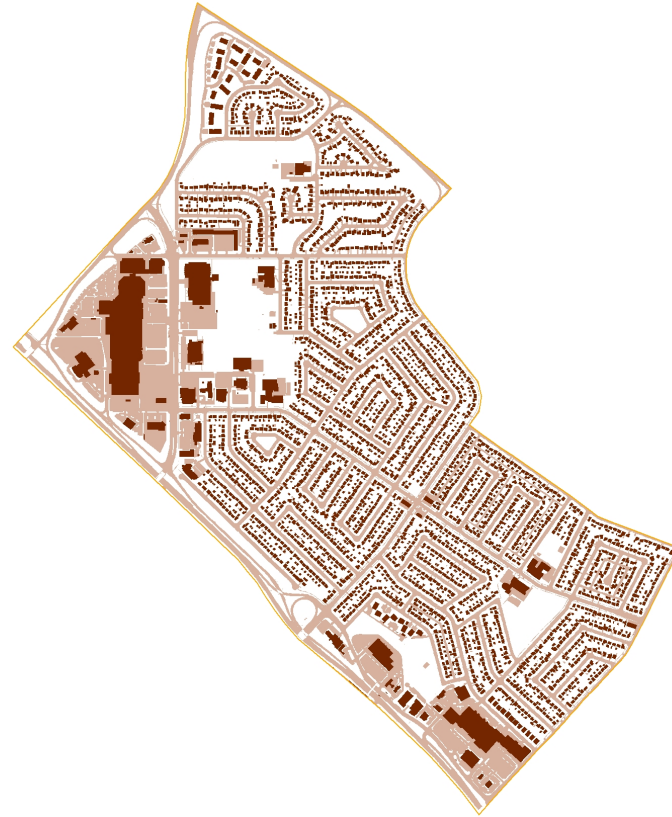
Canopy Projection: Public Land



Estimated Annual Removals



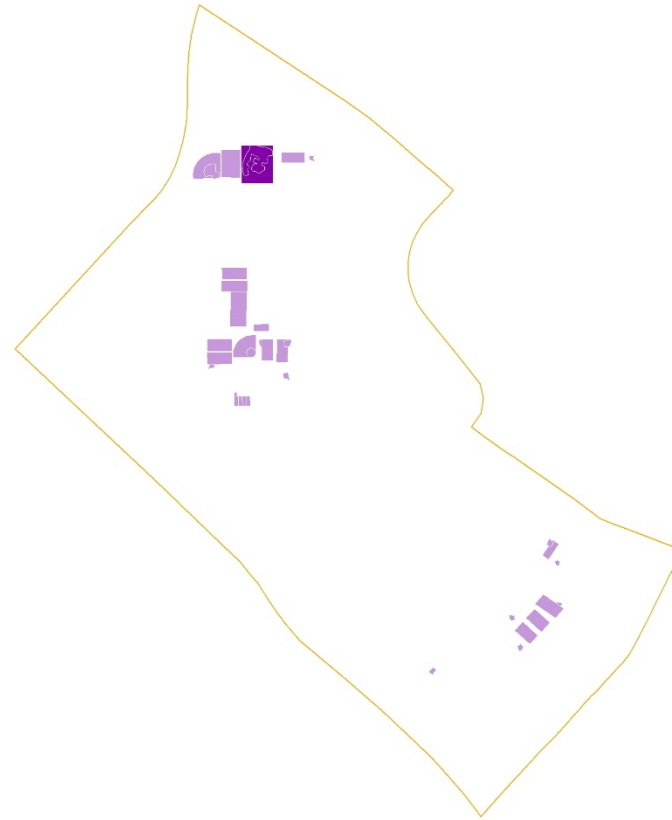
Understanding the Opportunities



■ Buildings +
■ Pavement

50% | 145 ha

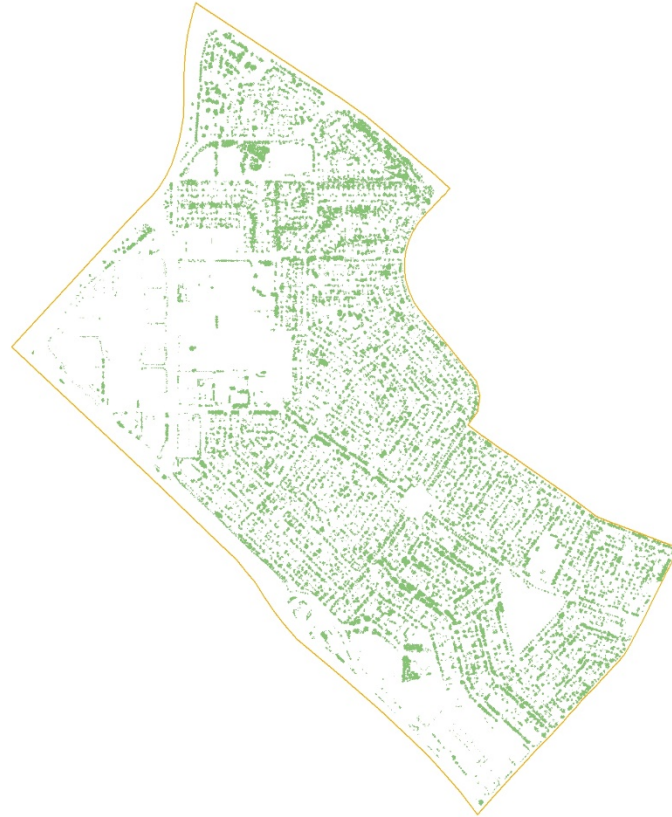
Understanding the Opportunities



■ Natural Habitat +
■ Sports Fields

3% | 9 ha

Understanding the Opportunities



Existing Canopy

17% | 50 ha

Understanding the Opportunities



Understanding the Opportunities



Scenario Manager

?

×

Scenarios:

All opportunities planted (scenario 1)
No planting (scenario 2)
Limited public land planting (scenario 3)
Limited private land planting (scenario 4)
Planting opportunities only over 120 years
Replacement Only
Planting opportunities + replacements over 120 years

^
v

Add...

Delete

Edit...

Merge...

Summary...

Changing cells:

Comment:

Created by Amelia on 9/30/2018

Show

Close

Urban Forest Canopy Growth Model

Click to Change Model Parameters

ENTER Years Modeled

120

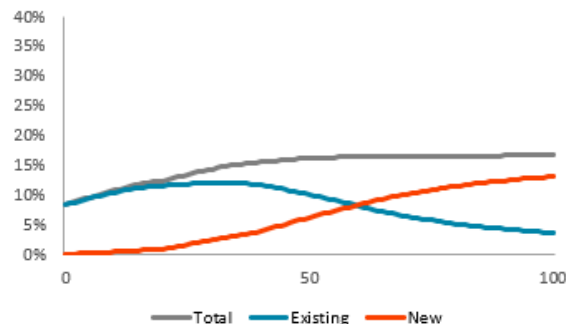
Save or Load Scenario

Ownership	Land use	Area of land use (m2)	2015 canopy area (m2)	2015 canopy percent (of land use)	ENTER new + replacement trees planted per year	Total estimated opportunities (new trees)	Estimated replacement trees (annual)	Estimated future canopy area (m2)	Estimated future canopy percent
Public	Roads (right of way)	145,706,562	10,250,636	7.0%	7000	77,000	6,300	25,673,491	17.6%
	Parks and community reserves	60,291,195	11,410,178	18.9%	4000	28,000	3,800	15,385,095	25.5%
	Recreational (uncommon land use)	14,040	569	4.1%	0	-	-	73	0.5%
	Schools	11,225,910	481,949	4.3%	50	3,000	-	235,978	2.1%
	Golf courses	11,711,616	1,836,272	15.7%	Not modelled			1,836,272	15.7%
	Urban nature	19,639,205	5,364,342	27.3%	Not modelled			5,364,342	27.3%
Private	Industrial	51,577,409	1,152,871	2.2%	0	-	-	148,354	0.3%
	Institutional	6,099,620	708,189	11.6%	20	4,000	-	160,715	2.6%
	Commercial	16,249,003	539,320	3.3%	10	8,000	-	104,193	0.6%
	Core commercial	681,933	24,796	3.6%	10	100	9	37,983	5.6%
	Residential - high density	1,231,905	90,503	7.3%	20	1,300	20	81,230	6.6%
	Residential - medium density + mixed use	23,073,090	2,628,995	11.4%	1800	23,000	1,600	6,600,869	28.6%
	Residential - low density	159,021,532	22,734,429	14.3%	19000	220,000	17,200	69,030,361	43.4%
	Major infrastructure	52,048,994	1,213,103	2.3%	2000	32,000	1,700	7,114,510	13.7%
	Transportation + utility corridor	44,059,314	1,519,299	3.4%	20	31,000	-	265,091	0.6%
	Future urban development	169,945,258	5,244,408	3.1%	Not modelled			5,244,408	3.1%
	Direct control	54,615,134	4,394,257	8.0%	Not modelled			4,394,257	8.0%
	No designated land use	7,127,139	143,456	2.0%	Not modelled			143,456	2.0%
	Water	18,221,609	87,875	0.5%	Not modelled			87,875	0.5%
	PUBLIC	248,588,528	29,343,947	11.8%	11,050	108,000	10,100	48,495,251	19.5%
	PRIVATE	603,951,941	40,481,501	6.7%	22,880	319,400	20,529	93,413,302	15.5%
TOTAL CITY		852,540,469	69,825,448	8.2%	33,930	427,400	30,629	141,908,553	16.6%

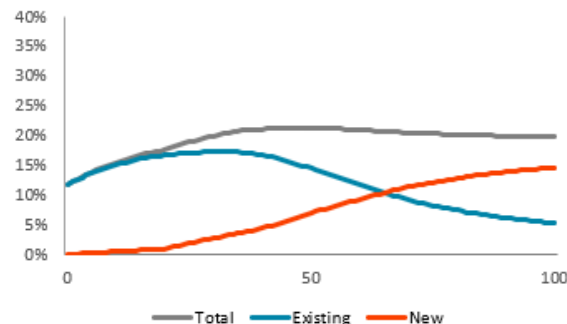


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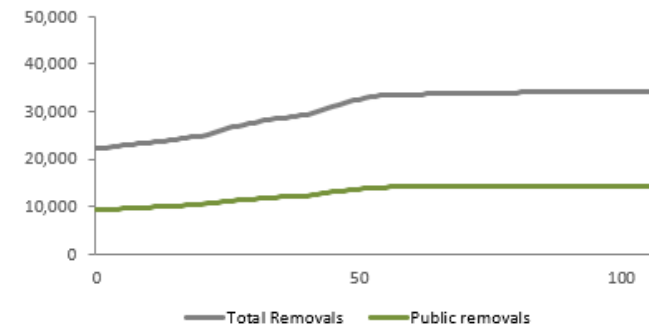
Canopy Projection: Total City



Canopy Projection: Public Land



Estimated Annual Removals



Public planting rates

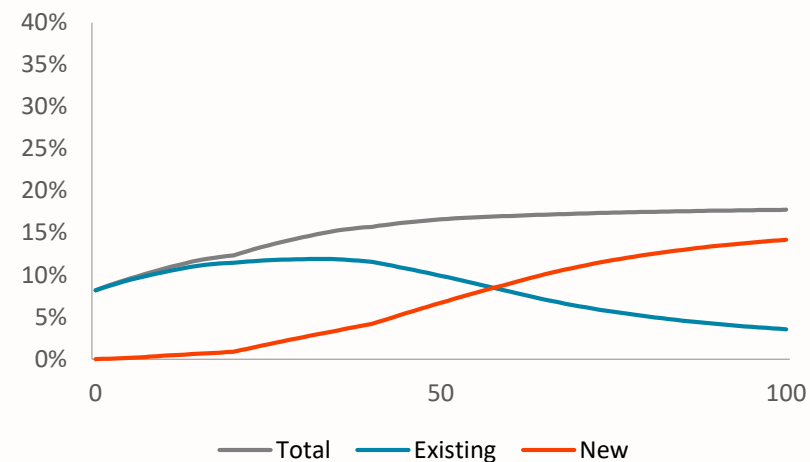
Assess budget implications:

- Maintain current 8% cover: plant 6,000 trees per year
- Reach 17% canopy (all current opportunities plus replace): plant 11,000 trees per year
- Reach 20% canopy (all current opportunities plus new development): plant ~14,000 trees per year

Model Parameters

Canopy Size | Age Distribution | Mortality Rate | Size at Maturity

Canopy Projection: Total City





Thank you!