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Technical Memorandum

date February 19, 2013

to Nancy Clark; Barbara Sahm; Michael Li
Turnstone Consulting

from Chris Sanchez
Environmental Science Associates

subject Sequestration Study of Greenhouse Gases for SNRAMP

This Technical Memorandum is intended to provide an estimate of the greenhouse gas (GHG) sequestration and release potential related to implementation of the Significant Natural Resources Area Management Plan (SNRAMP). The SNRAMP would result in removal of non-native trees and their replacement with either native tree species or grasslands. These tree removal and replacement activities would occur at various restoration sites throughout the City of San Francisco as well as within the Sharp Park Natural Area (Sharp Park) in Pacifica, under the management of the San Francisco Recreation and Park Department. In addition, the SNRAMP outlines the City's program to propagate trees and plants at restoration sites throughout the City. Tree removal throughout San Francisco and in Sharp Park would result in initial CO_2 sequestration loss, whereas tree planting and planting of scrub, grasslands and herbaceous plants would result in carbon sequestration.

Methodology

The following analysis draws from a number of resources to estimate anticipated CO_2 sequestration gains and losses. These include the Urban Forestry Carbon Sequestration Workbook published by the U.S. Department of Energy,[1] the Center for Urban Forest Research Tree Carbon Calculator published by the U.S. Forest Service[2] , the *Good Practice Guidance for Land Use, Land Use Change and Forestry* published by the International Panel on Climate Change (IPCC)[3] and the CalEEMod emissions estimator Model supporting calculations.[4]

Trees have a relatively high rate of CO_2 sequestration potential. However, while the sequestration rate increases over a period of time (assumed to be approximately 20 years, based on professional practice), after that point the accumulation of carbon in biomass slows with age, and eventually is completely offset by losses associated with tree clipping, pruning, and occasional death (IPCC, 2003). Sequestration rates for grasslands and herbaceous plants, which grow quickly, were assumed to be static. This analysis applied tree age for Blue Gum (eucalyptus trees would be the predominant species removed) provided by San Francisco Recreation and Park Department to

[1] U.S. Department of Energy, Urban Forestry Carbon Sequestration Workbook, 2007

[2] U.S. Forest Service, Urban Forest Research Tree Carbon Calculator, 2005.

[3] International Panel on Climate Control, National greenhouse Gas Inventories Programme, *Good Practice Guidance for Land Use, Land Use Change and Forestry*, 2003.

[4] SQAQMD, CalEEMOd Appendix A, 2011.

determine increases and loses in CO_2. The Urban Forestry Carbon Sequestration Workbook was used to estimate increasing carbon sequestration of new tree plantings over a 20 year period. The Tree Carbon Calculator from the USFS was used as a source of sequestration rates for specific tree types to be removed as provided by San Francisco Recreation and Park Department.[5] The CalEEMod model supporting documentation provided the sequestration rates for grasslands.

Sequestration Losses and Gains from Tree Replacement in San Francisco

Data provided indicate that 3,443 trees would be removed in San Francisco over a 20 year period. While six species of tree were identified for removal, species-specific sequestration rates could not be identified for four of these species. However, the remaining two species (eucalyptus and pine) comprise over 96 percent of the trees to be removed. Consequently, sequestration rates for the remaining species were assigned to the known sequestration rates equally. Based on field data estimates provided by Hort Science[6], approximately 2,942 of these trees to be removed are Blue Gum trees greater than 20 years of age for which sequestration has been slowed and is assumed by IPCC Good Practice[7] to be offset by maintenance and mortality. Loss of sequestration from trees to be removed in San Francisco is presented in Table 1.

Over the same 20-year period that trees would be removed, new tree plantings would occur. These trees were assumed, based on data provided, to largely consist of California Live Oak. Consequently, these trees were assigned to the "medium hardwood" category in the Urban Forestry Carbon Sequestration Workbook. Carbon sequestration increases over time from replanting 3,448 trees are also presented in Table 1.

Table 1 - CO_2 Sequestration Losses and Gains from Tree Removal and Planting in San Francisco

Tree Removal – San Francisco	**Estimated CO_2 Losses (-) and Gains (+)**
Annual Sequestration loss (over 20 years)	- 54 MT CO_2/year
Tree Plantings – San Francisco	
Annual Sequestration gained (year 20)	+ 192 MT CO_2/year
Net sequestration gain at end of 20 year program =	+ 138 MT CO_2/year

Sequestration Losses and Gains from Tree Removal and Grassland and Scrub placement in Sharp Park

Data provided indicate that 15,000 trees would be removed in Sharp Park over a 20 year period. These tree species are almost entirely eucalyptus. Based on field data estimates provided by Hort Science[5], approximately 13,500 of these trees to be removed are Blue Gum trees greater than 20 years of age for which sequestration has been slowed and is assumed by IPCC Good Practice to be offset by maintenance and mortality. Loss of sequestration from trees to be removed at Sharp Park is presented in Table 2.

Over the same 20-year period that trees would be removed from Sharp Park, trees would be replaced with native grassland and coastal scrub. Replacement vegetation was assigned a grassland sequestration rate as provided in the CalEEMod emissions estimator model. A specific sequestration rate for coastal scrub was not available and all

[5] San Francisco Recreation and Park Department, Memorandum to Jessica Range of San Francisco Environmental Planning, November 27, 2012.

[6] Hort Science, Memorandum to Jessica Range, January 17, 2013.

[7] International Panel on Climate Control, National greenhouse Gas Inventories Programme, *Good Practice Guidance for Land Use, Land Use Change and Forestry*, 2003.

56 acres of replaced vegetation was assumed to be grassland for purposes of calculation. Carbon sequestration associated with planting approximately 56 acres of grasslands is also presented in Table 2.

Sequestration Gains from Annual Plantings of propagated plants and trees in San Francisco

Each year the Natural Areas Program propagates and plants over 10,000 plants in restoration sites throughout the City[5]. Each year these plantings mature and their GHG sequestration potential increases. Consequently, the plants, and particularly the trees, continue to increase their sequestration of CO_2 during the 20 year horizon of this analysis. Table 3 provides an estimate of this increase at the end of the 20 year planting window.

Table 2- CO_2 Sequestration Losses and Gains from Tree Removal and Grassland Planting in Sharp Park

Tree Removal – Sharp Park	**Estimated CO_2 Losses (-) and Gains (+)**
Annual Sequestration loss (over 20 years)	- 177 MT CO_2/year
Grassland Plantings – San Francisco	
Annual Sequestration gained (year 20)	+ 241 MT CO_2/year
Total Sequestration Gain (after 20 years)	**+ 64 MT CO_2/year**

Table3- CO_2 Sequestration Gains from Propagated Tree and Herbaceous Plant Planting in San Francisco

Tree Plantings	**Estimated CO_2 Losses (-) and Gains (+)**
Annual Sequestration gain (after 20 years)	+ 166 MT CO_2/year
Herbaceous Plant Plantings –	
Annual Sequestration gained (after 20 years)	+ 20 MT CO_2/year
Net sequestration gain at end of 20 year program =	**+ 186 MT CO_2/year**

Conclusion: Net Sequestration Changes Associated with the Implementation of the SNRAMP

At the end of the 20 year horizon window of the SNRAMP, there would be a calculated net gain of sequestration of approximately 388 MT of CO_2 per year. The primary contributing factor to this sequestration gain would be the removal of an aging eucalyptus tree population which would be replaced with much more efficiently sequestering tree and plant growth.

Tree Replacement in San Francisco Natural Areas

3443 tree would be removed in phases over the next 20 years, replaced with primarily native trees such as coast live oak, red alder, California buckeye, toyon, wax myrtle, and various willow trees.

Table 1 shows the trees proposed for removal by park and species

Table 1: Trees proposed for removal in SF:

	Eucalyptus	Pine	Cypress	Maytens	Tea	Acacia
	3269	50	54	10	4	56
Species specific data only for Eucalypyus & Pine>allot others evenly	3331	112				
# of trees with active sequestration (see below)	388.9	112				

All will be replaced by natives trees.
Coast live oak will be the most commonly planted replacement tree.

IPCC Good practice Guidance for Land Use and Forestry (2003) applies a 20 year window for calculating positive sequestration from trees.

Tree survey Results (Hort Science, 2013) :

Percentage of Blue Gum/Eucalypyus trees > 20 years =	90%
Number of Eucalyptus Trees with active positve sequestration =	326.9

TREE REMOVAL:

	Results:					
SF Tree:	Eucalyptus	Pine	Cypress	Matens	Tea	Acacia
CUFR Tree:	EUFI81 (Eucalyptus globulous)	PICO5 (Pinus contorta var. bolanderi)				
Sequestration Rate at 20 years =	260	163	N/A	N/A	N/A	N/A
kg CO2/tree/year =	118.00	74.23				
MT/tree/year =	0.12	0.07				
MT CO2 loss over 20 yrs:	46	8				

Sum MT CO2 loss over 20 years:	54	MT eCO2/yr
Loss of sequstration in each year	2.71	MT eCO2/yr

TREE REPLACEMENT: This calculation used data in a separate workbook: Urban Forestry Carbon Sequestration Workbook

Live Oak

# Trees	3448		
Tree type in Model:	Medium Hardwood		
Model has 15 year window			
Planting rate =	230 trees /year		
Total MT CO2 sequestered after 15 years=		178.18	MT eCO2
Total MT CO2 sequestered in Year 15 =		28.71	MT eCO2/yr
After 15 years annual increase =		2.79	MT eCO2/yr
Sequestration after 20 years =		192.13	

Sharp Park Vegetation Replacement

15000 tree would be removed in phases over the next 20 years, replaced with grassland or coastal scrub.

Table 1 shows the trees proposed for removal by park and species

Table 1: Trees proposed for removal in SF:

Eucalyptus	15000

IPCC Good practice Guidance for Land Use and Forestry (2003) applies a 20 year window for calculating positive sequestration from trees.

Tree survey Results (Hort Science, 2013) :

Percentage of trees > 20 years =	90%
Number of Trees with active positve sequestration =	1500

TREE REMOVAL:

	Results:		
SF Tree:	Eucalyptus		
CUFR Tree:	EUFI81 (Eucalyptus ficifolia)		
Sequestration Rate at 20 years =	260	lb CO2/tree/yr	
kg CO2/tree/year =	118.00		
MT/tree/year =	0.12		
Total MT CO2 loss over 20 yrs:	177		
Sum MT CO2 loss:	177		
Annual MT CO2 loss over 20 years =	8.85	MT eCO2/yr	

GRASSLAND REPLACEMENT:

Seuestration Rate =	4.31	MT CO2/acre	(Source CalEEMod, Appendix A;
Grassland acreage =	56	acres	
Sequestration =	241.36	MT eCO2/yr	

Planting in San Francisco Natural Areas

10000	plantings/yr	The number of plants the NAP propogates and plants in restoration sites throughout the City. Typically at least 200 of those plants being trees.
200	trees/yr	
9800	plants/yr	

TREE PLANTINGS: This calculation used data in a separate workbook: Urban Forestry Carbon Sequestration Workbook

# Trees		200	per year
Tree type in Model:	Medium Hardwood		
Model has 15 year window			
Planting rate =	200 trees /year		
Total MT CO2 sequestered after 15 years=		154.94	MT eCO2
Total MT CO2 sequestered in Year 15 =		24.96	MT eCO2/yr
After 15 years annual increase =		2.28	MT eCO2/yr
Total MT CO2 sequestered after 20 years=		166.34	MT eCO2

PLANTS

No data available for singular herbaceous plant types

deep-rooted prairie grasses, forbs and herbaceous perennials have been found to sequester as much as 1/3 of a ton of carbon per acre per year (Rice, 200

The above data from : http://www.plna.com/content.asp?pl=99&contentid=99

Sequestration rate for herbaceous plants =	0.33	Ton C/acre/year	
	1.22	Ton CO2/acre/yr	(based on C to CO2 conversion factor of 3.667 from Urban Forestry Carbon Seq
	1.11	MT CO2/acre/yr	

Convert plants to acres

Assume:	4	square feet (sf)/plant	
9800 plants =	39200	square feet	
	0.90	acre of planting/year	
Sequestration =	0.997	MT CO2/yr	
Sequestration after 20 years =	19.94	MT eCO2/yr	this is annual increase in sequestration that includes 20

2).

|uestration Workbook)

years of planting

Edwin M. Lee, Mayor
Philip A. Ginsburg, General Manager

MEMORANDUN

TO: Jessica Range, Environmental Planner, San Francisco Planning Department
FROM: Lisa Wayne, Open Space Manager, San Francisco Recreation and Park Department (SFRPD)
CC: Karen Mauney-Brodek, Deputy Director for Park Planning, SFRPD
DATE: November 27, 2012
RE: SNRAMP Tree Removal and Replacement

This memorandum provides additional detail on tree removal and replacement practices pursuant to the Significant Natural Resource Areas Management Plan (SNRAMP) and SFRPD's Natural Areas Program (NAP) current practices.

1. *Tree Removal:* The number and species of trees proposed for removal are detailed in the specific chapters of the SNRAMP and within SNRAMP Appendix F: Urban Forestry Statements. Appendix F of the SNRAMP explains how the number of trees to be removed from each Natural Area was determined, what defines a tree and other urban forestry practices. The number of trees to be removed from each Natural Area is also shown in Table 5 of the SNRAMP. Table 1 below, provides further detail on the species of tree proposed for removal under the SNRAMP. All tree removal proposed in the SNRAMP would be phased over 20 years.

2. *Tree Replacement in San Francisco Natural Areas:* In San Francisco, all trees that are proposed for removal would be replaced, although not necessarily within the same location or with the same species. A total of 3,448 trees would be removed in phases over 20 years and replaced with primarily native trees such as coast live oak, red alder, California buckeye, toyon, wax myrtle, and various willow trees (e. g., arroyo, shining, or yellow willow). Some non-native trees that provide high value habitat for wildlife may also be planted as replacement trees including Douglas fir, pines and other non-invasive conifers. The species that would be planted at a location would depend upon the particular habitat needs and ecosystem suitability. It is anticipated that coast live oak trees would be the most commonly planted replacement tree.

3. *Vegetation Replacement at Sharp Park Natural Area*: At Sharp Park, a total of 15,000 invasive trees, primarily blue gum eucalyptus, will be removed and replaced over 20 years with native grassland or coastal scrub such that all areas are restored with dense vegetative cover. It is anticipated that most of the 56 acres would be replanted with coastal scrub species.

4. *Planting in San Francisco Natural Areas*: Each year, the NAP propagates and plants over 10,000 plants in restoration sites throughout the City. Typically at least 200 of those plants being trees. Attached are four years of plant inventories from 2009 to 2013 that detail the plants that have been propagated and planted by NAP.

Table 1: Trees proposed for removal by park and species

Natural Area	Trees to be Removed by Species						Total trees to be removed
	Eucalyptus	Pine	Cypress	Maytens	Tea	Acacia	
Balboa	0	0	0	0	0	0	0
Bayview Park	506	5	0	0	0	0	511
Bernal Hill	0	0	0	0	0	0	0
Billy Goat Hill	0	0	0	0	0	0	0
Brooks Park	0	0	3	0	0	0	3
Buena Vista Park	10	0	0	0	0	0	10
Corona Heights		15	0	0	0	0	15
Dorothy Erskine	14	0	0	0	0	0	14
Duncan- Castro	0	0	0	0	0	0	0
Edgehill Mountain	0	0	0	0	0	0	0
Everson/Digby	0	0	0	0	0	0	0
Fairmount Park	0	0	0	0	0	0	0
Glen Canyon / O'Shaughnessy Hollow	120	0	0	0	0	0	120
Golden Gate Heights	0	0	0	0	0	0	0
Golden Gate Park/ Oak Woodlands	12	0	0	10	4	56	82
Grandview Park	4	0	1	0	0	0	5
Hawk Hill	0	0	0	0	0	0	0
India Basin	0	0	0	0	0	0	0
Interior Greenbelt	140	0	0	0	0	0	140
Kite Hill	0	0	0	0	0	0	0
Lake Merced	134	0	0	0	0	0	134
Lakeview/Ashton Mini Park	0	0	0	0	0	0	0
McLaren Park	759*	20*	30*	0	0	0	809
Mount Davidson	1570*	10*	20*	0	0	0	1600
Palou-Phelps	2	0	0	0	0	0	2
Pine Lake	0	0	0	0	0	0	0
Rock Outcrop	0	0	0	0	0	0	0
Tank Hill	0	0	0	0	0	0	0
Twin Peaks	0	3	0	0	0	0	3
15th Ave Steps	0	0	0	0	0	0	0
Sharp Park	14,800*	50*	150*	0	0	0	15,000

* Represents an estimate of species distribution

Edwin M. Lee, Mayor
Philip A. Ginsburg, General Manager

ATTACHMENT:

NAP Plant Inventories 2009 to 2013

Propagation Request and Inventory --2009/2010

	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Abronia latifolia																		
Acaena pinnatifida var. californica																		
Achillea millefolium	50	70	150	80	200	48	130	20	150	21	70	10	400	139	350	110	50	29
Aesculus califonica		15	2	5			3	2		22	2	15		37	7	22	-7	15
Alnus rubra	30	160		33				5					30	160		38	30	122
Amelanchier pallida					40	16		5					40	16		5	40	11
Anaphalis margaritacea			10	35		45		10						45	10	45	-10	
Angelica hendersonii				10	16								16			10	16	-10
Aquilegia formosa	1				50	14	40					10	51	14	40	10	11	4
Arctostaphylos crustacea ssp. Crustac		1												1				1
Arctostaphylos tomentosa ssp. Crusta		1												1				1
Aristolochia californica		10		10		15								25		10		15
Armeria maritima ssp. californica																		
Artemisia californica	50		15	50	94			35		141	25	55	144	141	40	140	104	1
Artemisia douglasiana		16		10			15							16	15	10	-15	6
Artemisia pycnocephala		49	15	35										49	15	35	-15	14
Aster chilensis	200	12	120	50	21	33	50	15	175	104	30	10	396	149	200	75	196	74
Athyrium filix-femina var. cyclosorum			20	5		45		10						45	20	15	-20	30
Baccharis pilularis	360	45	85	45	100	40	60	30		40		35	460	125	145	110	315	15
Baccharis pilularis ssp. consanguinea			15	50				20	30	70	20		30	70	35	70	-5	
Calamagrostis nutkaensis					150		55						150		55		95	
Cardamine californica var. integrifolia					2		30				20		2		50		-48	
Carex obnupta						8								8				8
Castilleja wightii	10		50	25									10		50	25	-40	-25
Ceanothus thyrsiflorus	16	188	50	45			10	15			10	52	16	188	70	112	-54	76
Chlorogalum pomeridianum						14	5	5	15			5	15	14	5	10	10	4
Cirsium occidentale var. californicum	15		25										15		25		-10	
Cirsium occidentale var. occidentale		12												12				12
Cirsium quercetorum									25	10	25		25	10	25			10
Cornus sericea ssp. sericea	60	26	35	5								5	60	26	35	10	25	16
Danthonia californica var. americana	18		10										18		10		8	
Delphinium californicum									25		25		25		25			
Dichelostemma capitatum			10		10		10						10		20		-10	
Disporum hookeri					8	1	1						8	1	1		7	1
Dudleya farinosa																		
Elymus glaucus			35		35		10		50		55		85		100		-15	
Elymus multisetus									50		50		50		50			
Ericameria ericoides		45		45										45		45		
Erigeron glaucus	300	12	350										300	12	350		-50	12
Eriogonum latifolium	37		60		200	57	165	15					237	57	225	15	12	42
Eriophyllum confertiflorum	1				1	20	22						2	20	22		-20	20
Eriophyllum confertiflorum var. confertif																		

Propagation Request and Inventory --2009/2010

	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Eriophyllum staechadifolium	25		35	5		23							25	23	35	5	-10	18
Festuca californica					100		100						100		100			
Festuca rubra			70	40					150	40	80		150	40	150	40		
Fragaria chiloensis	48		48										48		48			
Fragaria vesca					68		65						68		65		3	
Gaultheria shallon					35		10						35		10		25	
Heracleum lanatum	12	90	25		2	40	10	15		5	20	5	14	135	55	20	-41	115
Heteromeles arbutifolia		22	10	25	2	21		5	16				18	43	10	30	8	13
Heuchera micrantha					200		30						200		30		170	
Holodiscus discolor		13		5			10	5						13	10	10	-10	3
Hordeum brachyantherum									50		30		50		30		20	
Horkelia californica					100		80						100		80		20	
Iris douglasiana	11	16	25	15	12	90	10		22		25		45	106	60	15	-15	91
Iris longipetala									311		75		311		75		236	
Juncus effusus var. brunneus			10		65						50	10	65		60	10	5	-10
Juncus patens	45		50		120						50		165		100		65	
Leymus xvancouverensis		10		10										10		10		
Lomatium caruifolium									8				8				8	
Lomatium dasycarpum									1				1				1	
Lonicera hispidula var. vacillans						4				4				8				8
Lonicera involucrata	130	80	35	10		5	5			45	10	5	130	130	50	15	80	115
Lotus scoparius		15	20						60		55		60	15	75		-15	15
Lupinus albifrons var. collinus					110		174			8			110	8	174		-64	8
Lupinus chamissonis	37	49	20	45									37	49	20	45	17	4
Lupinus formosus var. formosus					60		141						60		141		-81	
Lupinus variicolor							175								175		-175	
Melica californica					75	61	130	35		40	20		75	101	150	35	-75	66
Melica torreyana					25	25	25	25					25	25	25	25		
Mimulus aurantiacus	250	120	145	160	150	19	90	45	100	470	50	55	500	609	285	260	215	349
Mimulus cardinalis					48						25		48		25		23	
Monardella villosa					10		25		90	40			100	40	25		75	40
Myrica californica	80	100		33								15	80	100		48	80	52
Nassella pulchra			10		50	46	115		150		40		200	46	165		35	46
Oemleria cerasiformis		20	5	30	45	80	40	5					45	100	45	35		65
Pentagramma triangularis					6								6				6	
Perideridia kelloggii						32				20	55			52	55		-55	52
Phacelia californica	1	40	25		65	140	150	15					66	180	175	15	-109	165
Polypodium californicum										12				12				12
Polystichum munitum	25			85	120	455	60			48		50	145	503	60	135	85	368
Prunus ilicifolia							5	20		60		15		60	5	35	-5	25
Pteridium aquilinum var. pubescens		3						5						3		5		-2
Quercus agrifolia		60		15		51	3	17		15				126	3	32	-3	94

Propagation Request and Inventory --2009/2010

	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	**LUKE**	**GAL**
Ranunculus californicus							20		65		25		65		45		**20**	
Rhamnus californica	50	35	45	85	145	75	15	20	359	35	25	40	554	145	85	145	**469**	
Rhamnus crocea					3								3				**3**	
Ribes menziesii					1								1				**1**	
Ribes sanguineum var. glutinosum		5	80	50	225	240	70				25	20	225	245	175	70	**50**	**175**
Rosa californica	6	49		25									6	49		25	**6**	**24**
Rosa gymnocarpa							15								15		**-15**	
Rubus parviflorus	100	63	50	25			25						100	63	75	25	**25**	**38**
Rubus ursinus	6		10	10									6		10	10	**-4**	**-10**
Salix lasiolepis										20				20				**20**
Salix lucida ssp. lasiandra								10								10		**-10**
Salvia spathacea										14	10			14	10		**-10**	**14**
Sambucus mexicana		44								11				55				**55**
Sambucus racemosa var. racemosa			25	15	100	25							100	25	25	15	**75**	**10**
Satureja douglasii									16			25	16			25	**16**	**-25**
Scrophularia californica	100	159	110	140	21	40		10	150	218	50	25	271	417	160	175	**111**	**242**
Sedum spathulifolium					21					3			21	3			**21**	**3**
Senecio aronicoides											20				20		**-20**	
Sidalcea malvaeflora					37		89		182	3	30		219	3	119		**100**	**3**
Silene scouleri ssp. grandis									50		25		50		25		**25**	
Silene verecunda ssp. verecunda					32	28	25						32	28	25		**7**	**28**
Sisyrinchium bellum										65	65			65	65		**-65**	**65**
Solanum umbelliferum																		
Stachys ajugoides var. ajugoides						7						10		7		10		**-3**
Symphoricarpos albus var. laevigatus		22		5										22		5		**17**
Tellima grandiflora					138		65						138		65		**73**	
Triteleia laxa			10		9		20		12		10		21		40		**-19**	
Vaccinium ovatum						21	30			5				26	30		**-30**	**26**
Viola pedunculata							25		45		10		45		35		**10**	
Woodwardia fimbriata					6								6				**6**	
Wyethia angustifolia		6					20				20			6	40		**-40**	**6**
	2,074	1,683	1,920	1,371	3,133	1,884	2,478	419	2,357	1,589	1,232	472	7,564	5,156	5,630	2,262	**1,934**	**2,894**

Propagation Request and Inventory --2010/2011

	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Abronia latifolia																		
Achillea millefolium	350	40	24	58	400	60	220	10			35	15	750	100	279	83	471	17
Aesculus californica		6		3				5		22		2		28		10		18
Agoseris grandiflora		38										5		38		5		33
Allium dichlamydeum							45		2		10		2		55		-53	
Alnus rubra	305	132											305	132			305	132
Amelanchier pallida					45	17		25					45	17		25	45	-8
Anaphalis margaritacea		40		30				15						40		45		-5
Angelica hendersonii					16								16				16	
Aquilegia formosa					125	14	20				10		125	14	30		95	14
Arabis blepharophylla					290		20						290		20		270	
Arctostaphylos tomentosa ssp. Crusta		1												1				1
Aristolochia californica		34		15		5		5						39		20		19
Artemisia californica				10		101	30	30	9	9	35	15	9	110	65	55	-56	55
Artemisia douglasiana		19		10			10	10						19	10	20	-10	-1
Artemisia pycnocephala	20	191		30									20	191		30	20	161
Aster chilensis	139	48	10	24		12	25	10	25	35	10	25	164	95	45	59	119	36
Athyrium filix-femina var. cyclosorum		3				11				3				17				17
Baccharis pilularis	90			35		14	10	15	19	39	10	10	109	53	20	60	89	-7
Baccharis pilularis ssp. consanguinea				10				10	19	38			19	38		20	19	18
Calamagrostis nutkaensis					20	78	20						20	78	20			78
Cardamine californica var. integrifolia							10				10				20		-20	
Carex obnupta										6				6				6
Castilleja wightii	80		25	10									80		25	10	55	-10
Ceanothus thyrsiflorus		89		75			5	33			15	15		89	20	123	-20	-34
Cirsium occidentale var. californicum		14	25											14	25		-25	14
Cirsium occidentale var. occidentale																		
Cirsium quercetorum									3	8		10	3	8		10	3	-2
Cornus sericea ssp. sericea	140	20									5		140	20	5		135	20
Corylus cornuta var. californica	5	7		5									5	7		5	5	2
Danthonia californica var. americana		12	10							13				25	10		-10	25
Delphinium californicum									25		10		25		10		15	
Disporum hookeri					60	1	5						60	1	5		55	1
Elymus glaucus		20							50	26		10	50	46		10	50	36
Elymus multisetus									25	20	10	10	25	20	10	10	15	10
Ericameria ericoides	100			35			15						100		15	35	85	-35
Erigeron glaucus	100	121		78			50						100	121	50	78	50	43
Eriogonum latifolium	10	60	10		125	25	140	10					135	85	150	10	-15	75
Eriophyllum confertiflorum						7		10						7		10		-3
Eriophyllum staechadifolium		80		30										80		30		50
Erysimum franciscanum	50	80		10									50	80		10	50	70
Festuca californica					50	20	45						50	20	45		5	20

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	**LUKE**	**GAL**
Festuca rubra		26		34			25		100	14	15		100	40	40	34	**60**	**6**
Fragaria chiloensis	149	6	12	60									149	6	12	60	**137**	**-54**
Fragaria vesca					22								22				**22**	
Fritillaria affinis					4								4				**4**	
Garrya elliptica						60								60				**60**
Gaultheria shallon					37		30						37		30		**7**	
Grindelia hirsutula							10								10		**-10**	
Heracleum lanatum	12	50				11	35	5			15		12	61	50	5	**-38**	**56**
Heteromeles arbutifolia				35				2		37				37		37		
Heterotheca sessiliflora ssp. bolanderi										9		5		9		5		**4**
Heuchera micrantha					250		20						250		20		**230**	
Holodiscus discolor		3		5		7	20	25		180				190	20	30	**-20**	**160**
Hordeum brachyantherum									90		30		90		30		**60**	
Horkelia californica					70		40						70		40		**30**	
Iris douglasiana	13	32		10	37	40	50	37			15		50	72	65	47	**-15**	**25**
Iris longipetala										225		20		225		20		**205**
Juncus effusus var. brunneus	25			25					50	80	10		75	80	10	25	**65**	**55**
Juncus lesueurii				48												48		**-48**
Juncus patens					28	30					10		28	30	10		**18**	**30**
Koeleria macrantha					50		50						50		50			
Leymus xvancouverensis		46		48										46		48		**-2**
Lomatium caruifolium						4								4				**4**
Lomatium dasycarpum									3				3				**3**	
Lonicera hispidula var. vacillans						5								5				**5**
Lonicera involucrata	100	149									5		100	149	5		**95**	**149**
Lotus scoparius									1				1				**1**	
Lupinus albifrons var. collinus					225		140			7	10		225	7	150		**75**	**7**
Lupinus chamissonis		62		65										62		65		**-3**
Lupinus formosus var. formosus					85		140		22		10		107		150		**-43**	
Lupinus variicolor					510		160						510		160		**350**	
Melica californica						5				20		15		25		15		**10**
Melica torreyana						5								5				**5**
Mimulus aurantiacus		36		75		96	70	40		51	35	25		183	105	140	**-105**	**43**
Mimulus cardinalis											10				10		**-10**	
Mimulus guttatus					14								14				**14**	
Monardella villosa					6	1	30			85		30	6	86	30	30	**-24**	**56**
Myrica californica	50	30									5	5	50	30	5	5	**45**	**25**
Nassella pulchra			10			40		30	50	13		15	50	53	10	45	**40**	**8**
Oemleria cerasiformis				45	36	132		15					36	132		60	**36**	**72**
Pentagramma triangularis					104	3							104	3			**104**	**3**
Perideridia kelloggii						15	5					15		15	5	15	**-5**	
Phacelia californica		20		20	400		130	10					400	20	130	30	**270**	**-10**

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Polygonum paronychia	22	15		15									22	15		15	22	
Polypodium californicum						46								46				46
Polystichum munitum				175	360	279		35				30	360	279		240	360	39
Prunus ilicifolia				15				5		26				26		20		6
Pteridium aquilinum var. pubescens				10				5								15		-15
Quercus agrifolia		134		18		36		7		30				200		25		175
Ranunculus californicus									29				29				29	
Rhamnus californica	12	17	10	90		123	13	35	50	319	20	15	62	459	43	140	19	319
Rhamnus crocea						7								7				7
Ribes divaricatum				15												15		-15
Ribes malvaceum																		
Ribes menziesii		1												1				1
Ribes sanguineum var. glutinosum				75	420	214	5	5			25		420	214	30	80	390	134
Rosa californica	5	21		5									5	21		5	5	16
Rosa gymnocarpa		1					20							1	20		-20	1
Rubus parviflorus	100	40		40									100	40		40	100	
Rubus ursinus	3		24										3		24		-21	
Salix lucida ssp. lasiandra										10				10				10
Salvia spathacea										45		30		45		30		15
Sambucus mexicana		39						3						39		3		36
Sambucus racemosa var. racemosa				10	200	18		8	100		10		300	18	10	18	290	
Satureja douglasii					21						10		21		10		11	
Scrophularia californica				132		74	10	10		188	35			262	45	142	-45	120
Sedum spathulifolium					30								30				30	
Senecio aronicoides											5				5		-5	
Sidalcea malvaeflora					37		75	20		78		15	37	78	75	35	-38	43
Silene scouleri ssp. grandis					6				7		10		13		10		3	
Silene verecunda ssp. verecunda																		
Sisyrinchium bellum		40			200			40	200		25	15	400	40	25	55	375	-15
Solanum umbelliferum										9				9				9
Solidago sp.							10								10		-10	
Stachys ajugoides var. ajugoides											10				10		-10	
Symphoricarpos albus var. laevigatus				5	10	13							10	13		5	10	8
Tellima grandiflora					46								46				46	
Triteleia laxa							10								10		-10	
Vaccinium ovatum					180		10	5					180		10	5	170	-5
Viola adunca							20								20		-20	
Viola pedunculata							10		12		10		12		20		-8	
Woodwardia fimbriata						10		20						10		20		-10
Wyethia angustifolia							10		4				4		10		-6	
	1,880	1,823	160	1,543	4,519	1,639	1,818	550	895	1,645	490	352	7,294	5,107	2,468	2,445	4,826	2,662

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Achillea millefolium	100	444	115	376	200		260				55		300	444	430	376	-130	68
Aesculus californica										39				39				39
Allium dichlamydeum					90		10		100		10		190		20		170	
Alnus rhombifolia																		
Alnus rubra	20	126										5	20	126		5	20	121
Amelanchier pallida					46	53		15					46	53		15	46	38
Anaphalis margaritacea		18	25		32	14	20	20					32	32	45	20	-13	12
Angelica hendersonii						16								16				16
Aquilegia formosa						76		25						76		25		51
Arabis blepharophylla					96		25						96		25		71	
Arctostaphylos tomentosa ssp. Crusta		1												1				1
Aristolochia californica		24		10		6								30		10		20
Artemisia californica		20	30	20		62		55		62	5	45		144	35	120	-35	24
Artemisia douglasiana	1		10								10		1		20		-19	
Artemisia pycnocephala		164	10	100										164	10	100	-10	64
Aster chilensis	2	74	60		139	60	30	75	28		5	30	169	134	95	105	74	29
Athyrium filix-femina var. cyclosorum						12								12				12
Baccharis pilularis	38	33	20	65	58	120	15	65		20	20	25	96	173	55	155	41	18
Baccharis pilularis ssp. consanguinea		20	10	20				10	25				25	20	10	30	15	-10
Bromus carinatus ssp. carinatus																		
Calamagrostis nutkaensis																		
Calystegia purpurata ssp. purpurata	36		40										36		40		-4	
Camissonia cheiranthifolia	145		100										145		100		45	
Cardamine californica var. integrifolia							20		25				25		20		5	
Castilleja wightii	78		50										78		50		28	
Ceanothus thyrsiflorus	9	125	15	20				35	2	23		50	11	148	15	105	-4	43
Chlorogalum pomeridianum						15		10	15				15	15		10	15	5
Cirsium occidentale var. californicum	20		65										20		65		-45	
Cirsium quercetorum						3	10				15			3	25		-25	3
Cornus sericea ssp. sericea		164								20		5		184		5		179
Corylus cornuta var. californica		33		5										33		5		28
Danthonia californica var. americana		10							31		20		31	10	20		11	10
Delphinium californicum											10				10		-10	
Dichelostemma capitatum					7								7				7	
Disporum hookeri					38	7							38	7			38	7
Dodecatheon hendersonii					2		10		12				14		10		4	
Dryopteris arguta						2								2				2
Dudleya farinosa	86		70										86		70		16	
Elymus californicus																		
Elymus glaucus					10						5		10		5		5	
Ericameria ericoides		37		35										37		35		2
Erigeron glaucus	180	162	75	149	44		20						224	162	95	149	129	13

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Eriogonum latifolium	89	401		380	33		40	20			20		122	401	60	400	62	1
Eriophyllum staechadifolium	12		15	10									12		15	10	-3	-10
Erysimum franciscanum	100		25										100		25		75	
Festuca rubra	10		45						220		75		230		120		110	
Fragaria chiloensis	161		125										161		125		36	
Fragaria vesca					16								16				16	
Garrya elliptica					1	49		7					1	49		7	1	42
Gaultheria shallon						3								3				3
Grindelia hirsutula var. maritima					75		25						75		25		50	
Grindelia maritima																		
Heracleum lanatum	12	18					10	15			15		12	18	25	15	-13	3
Heteromeles arbutifolia				5		15	3	5			2			15	5	10	-5	5
Heuchera micrantha					15		10						15		10		5	
Holodiscus discolor	3			10		145		30					3	145		40	3	105
Hordeum brachyantherum									50		10		50		10		40	
Horkelia californica					50		20						50		20		30	
Iris douglasiana		80	100		7	6	40	30					7	86	140	30	-133	56
Iris longipetala						17				174		60		191		60		131
Juncus effusus var. brunneus					150						10		150		10		140	
Juncus effusus var. pacificus			15												15		-15	
Juncus lesueurii			20												20		-20	
Juncus patens					25						10		25		10		15	
Juncus phaeocephalus						2								2				2
Koeleria macrantha					7								7				7	
Leymus xvancouverensis		9	20											9	20		-20	9
Lomatium caruifolium										4				4				4
Lonicera hispidula var. vacillans	15					4							15	4			15	4
Lonicera involucrata	103	26										5	103	26		5	103	21
Lotus scoparius	50												50				50	
Lupinus albifrons var. collinus							40		50				50		40		10	
Lupinus chamissonis	70	280		305									70	280		305	70	-25
Lupinus formosus var. formosus							120		175				175		120		55	
Lupinus variicolor					45		110						45		110		-65	
Melica californica					50						5		50		5		45	
Melica torreyana						10								10				10
Mimulus aurantiacus		520	35	380		197	85	105	46	88	80	25	46	805	200	510	-154	295
Monardella villosa					45	20	40		45			10	90	20	40	10	50	10
Myrica californica		34										2		34		2		32
Nassella pulchra					200		150				10		200		160		40	
Oemleria cerasiformis				15		107		30						107		45		62
Pentagramma triangularis					53								53				53	
Pentagramma triangularis ssp. triangul																		

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL
Perideridia kelloggii					55		10				25		55		35		20	
Phacelia californica	150			100	138	100	100	45					288	100	100	145	188	-45
Polygonum paronychia	28		40										28		40		-12	
Polypodium californicum						18								18				18
Polystichum munitum				130	160	340		20					160	340		150	160	190
Prunus ilicifolia										8				8				8
Pteridium aquilinum var. pubescens							10								10		-10	
Quercus agrifolia		180		5		31		2		35				246		7		239
Rhamnus californica	7	5		85	42	31		65	20	237	20	30	69	273	20	180	49	93
Rhamnus crocea						7								7				7
Ribes divaricatum			15												15		-15	
Ribes malvaceum										22				22				22
Ribes menziesii		4												4				4
Ribes sanguineum var. glutinosum		202		75			15	45						202	15	120	-15	82
Rosa californica	100	8		10									100	8		10	100	-2
Rosa gymnocarpa	50	2				7							50	9			50	9
Rubus parviflorus		70		5	3								3	70		5	3	65
Rubus ursinus			25		3								3		25		-22	
Salix lucida ssp. lasiandra		10												10				10
Salvia spathacea										5				5				5
Sambucus mexicana		37							23		5		23	37	5		18	37
Sambucus racemosa var. racemosa		5		5	80				75				155	5		5	155	
Satureja douglasii					48	10			10				58	10			58	10
Scrophularia californica	85		70		100	40	105			39	25		185	79	200		-15	79
Sedum spathulifolium					30		25						30		25		5	
Sidalcea malvaeflora					94		40				5		94		45		49	
Silene scouleri ssp. grandis									9		10		9		10		-1	
Silene verecunda ssp. verecunda					222		20						222		20		202	
Sisyrinchium bellum					20		25		200		30		220		55		165	
Solanum umbelliferum										23				23				23
Solidago californica							20								20		-20	
Solidago spathulata ssp. spathulata	100		100										100		100			
Symphoricarpos albus var. laevigatus		10		5		22	10							32	10	5	-10	27
Tanacetum camphoratum	106		50										106		50		56	
Tellima grandiflora					32		30						32		30		2	
Triteleia laxa					15		10				10		15		20		-5	
Vaccinium ovatum						194								194				194
Viola adunca	6				2	10		20					8	10		20	8	-10
Viola pedunculata					15		10		59		15		74		25		49	
Woodwardia fimbriata					4								4				4	
Wyethia angustifolia					10		10			20		20	10	20	10	20		
	1,972	3,356	1,395	2,325	2,607	1,831	1,553	749	1,220	819	537	312	5,799	6,006	3,485	3,386	2,314	2,620

Propagation Request and Inventory --2012/2013

	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	**LUKE**	**GAL**
Achillea millefolium		8	10	30	50	92	40	30					50	100	50	60		**40**
Aesculus californica								5		60		15		60		20		**40**
Allium dichlamydeum					177				286				463				**463**	
Alnus rubra		52						5				7		52		12		**40**
Amelanchier pallida						88		35						88		35		**53**
Anaphalis margaritacea						78		25						78		25		**53**
Angelica hendersonii					6			25					6			25	**6**	**-25**
Aquilegia formosa												20				20		**-20**
Aristolochia californica		10		10										10		10		
Armeria maritima ssp. californica	80	20		20									80	20		20	**80**	
Artemisia californica		65		15		140		53		40		35		245		103		**142**
Artemisia douglasiana	1	24										10	1	24		10	**1**	**14**
Artemisia pycnocephala		265		260										265		260		**5**
Aster chilensis	56			20		45		10		35		10	56	80		40	**56**	**40**
Aster radulinus									2				2				**2**	
Athyrium filix-femina var. cyclosorum						7								7				**7**
Baccharis pilularis	94	96		97	12	49		42		25		25	106	170		164	**106**	**6**
Baccharis pilularis ssp. consanguinea		20							175				175	20			**175**	**20**
Berberis pinnata					1								1				**1**	
Bromus carinatus ssp. maritimus																		
Camissonia cheiranthifolia		50		40										50		40		**10**
Camissonia ovata									158				158				**158**	
Cardamine californica var. integrifolia					2		20		8				10		20		**-10**	
Carex obnupta										30				30				**30**
Castilleja wightii	19		50	20									19		50	20	**-31**	**-20**
Ceanothus thyrsiflorus	15	38		32				5				20	15	38		57	**15**	**-19**
Chlorogalum pomeridianum					15								15				**15**	
Chlorogalum pomeridianum var. divaric																		
Cirsium occidentale var. californicum	45	7	50	5									45	7	50	5	**-5**	**2**
Clarkia rubicunda																		
Cornus sericea ssp. sericea		25						10		125		60		150		70		**80**
Corylus cornuta var. californica		24		30				15						24		45		**-21**
Delphinium californicum									119	8	25		119	8	25		**94**	**8**
Dichelostemma capitatum					196								196				**196**	
Disporum hookeri						30		10						30		10		**20**
Dodecatheon clevelandii ssp. patulum									13				13				**13**	
Dodecatheon hendersonii									98				98				**98**	
Elymus glaucus									5		5		5		5			
Ericameria ericoides		65		89										65		89		**-24**
Erigeron glaucus	115	107		87				20					115	107		107	**115**	
Eriogonum latifolium	50	140		87			40	5			10	10	50	140	50	102		**38**
Eriophyllum confertiflorum								5								5		**-5**

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	**LUKE**	**GAL**
Eriophyllum staechadifolium		100		15										100		15		**85**
Erysimum franciscanum	5	60	5	20									5	60	5	20		**40**
Eschscholzia californica																		
Festuca californica						40		15						40		15		**25**
Festuca rubra		70		50						30	30			100	30	50	**-30**	**50**
Fragaria chiloensis	20	61		80									20	61		80	**20**	**-19**
Fragaria vesca					24			24					24			24	**24**	**-24**
Fritillaria affinis					1								1				**1**	
Garrya elliptica					18	39		40					18	39		40	**18**	**-1**
Gaultheria shallon						4								4				**4**
Gnaphalium californicum						40								40				**40**
Gnaphalium canescens ssp. beneolen																		
Heracleum lanatum		110		45				40				5		110		90		**20**
Heteromeles arbutifolia	8	40		23				5					8	40		28	**8**	**12**
Heuchera micrantha					15								15				**15**	
Holodiscus discolor				51		91		40				5		91		96		**-5**
Hordeum brachyantherum								155		146				146		155		**-9**
Horkelia californica						20		15						20		15		**5**
Iris douglasiana	725	223		10	650	180		150				100	1,375	403		260	**1,375**	**143**
Iris longipetala										24				24				**24**
Juncus effusus var. brunneus		50						30				20		50		50		
Juncus lesueurii		20		20										20		20		
Juncus patens	41												41				**41**	
Lasthenia californica																		
Leymus xvancouverensis		26		20										26		20		**6**
Lonicera hispidula var. vacillans		72		40	4	3							4	75		40	**4**	**35**
Lonicera involucrata	50	36						85		52		22	50	88		107	**50**	**-19**
Lotus scoparius		6		25										6		25		**-19**
Lupinus albifrons var. collinus					50		80						50		80		**-30**	
Lupinus arboreus																		
Lupinus bicolor																		
Lupinus chamissonis		115		109										115		109		**6**
Lupinus formosus var. formosus							160		257				257		160		**97**	
Lupinus variicolor					11		40						11		40		**-29**	
Mimulus aurantiacus	130	134		44				45				10	130	134		99	**130**	**35**
Monardella villosa					27	40		40		10		10	27	50		50	**27**	
Myrica californica		32						5						32		5		**27**
Nassella pulchra					200		100				10		200		110		**90**	
Oemleria cerasiformis				15		25		5				5		25		25		
Oenothera elata ssp. hookeri																		
Pentagramma triangularis					50								50				**50**	
Perideridia kelloggii					42						10		42		10		**32**	

Propagation Request and Inventory --2012/2013

	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	**LUKE**	**GAL**
Phacelia californica	10			34		69	40	25				10	10	69	40	69	**-30**	
Phacelia distans																		
Phacelia malvifolia																		
Plantago erecta																		
Polygonum paronychia		20		5										20		5		**15**
Polypodium californicum						4		2						4		2		**2**
Polystichum munitum				400		376		25				10		376		435		**-59**
Prunus ilicifolia				8						8				8		8		
Pteridium aquilinum var. pubescens		3												3				**3**
Quercus agrifolia	35	146		131		24		5	27			15	62	170		151	**62**	**19**
Rhamnus californica	10	4		95		69				86		60	10	159		155	**10**	**4**
Rhamnus crocea					6	6		5					6	6		5	**6**	**1**
Ribes divaricatum				15												15		**-15**
Ribes malvaceum										19		20		19		20		**-1**
Ribes menziesii	5	1											5	1			**5**	**1**
Ribes sanguineum var. glutinosum		76		50		52		35				35		128		120		**8**
Rosa californica	3	90				9		30					3	99		30	**3**	**69**
Rosa gymnocarpa		5		24		12								17		24		**-7**
Rubus parviflorus		31		15				25						31		40		**-9**
Rubus ursinus				95	130	70							130	70		95	**130**	**-25**
Salix lucida ssp. lasiandra		6												6				**6**
Salvia spathacea								20		26				26		20		**6**
Sambucus mexicana		7		15										7		15		**-8**
Sambucus racemosa var. racemosa				112		130		40				20		130		172		**-42**
Satureja douglasii					80	15		5				10	80	15		15	**80**	
Scrophularia californica		40		40		20		10						60		50		**10**
Sedum spathulifolium					25		20						25		20		**5**	
Sidalcea malvaeflora										20	10			20	10		**-10**	**20**
Silene scouleri ssp. grandis									9				9				**9**	
Silene verecunda ssp. verecunda					42		50						42		50		**-8**	
Sisyrinchium bellum									50		10		50		10		**40**	
Solanum umbelliferum										3				3				**3**
Solidago spathulata ssp. spathulata	65	65		65									65	65		65	**65**	
Symphoricarpos albus var. laevigatus		4			120			5					120	4		5	**120**	**-1**
Symphoricarpos mollis								15								15		**-15**
Tanacetum camphoratum		100		90										100		90		**10**
Tellima grandiflora				80				10				12				102		**-102**
Triteleia laxa					98								98				**98**	
Vaccinium ovatum						101		50						101		50		**51**
Viola adunca					6	6	60			5			6	11	60		**-54**	**11**
Viola pedunculata									46				46				**46**	
Woodwardia fimbriata	35							5	24	10		8	59	10		13	**59**	**-3**

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	ZONE 1				ZONE 2				ZONE 3				TOTALS				DELTA	
	INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS		INVENTORY		REQUESTS			
Species	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	LUKE	GAL	**LUKE**	**GAL**
	1,617	2,769	115	2,683	2,058	1,974	650	1,306	1,277	762	110	589	4,952	5,505	875	4,578	**4,077**	**927**

Memorandum

DATE: January 17, 2013

TO: Jessica Range, SF Planning Department

FROM: Jim Clark

SUBJECT: Age of blue gum in San Francisco's Natural Area Parks

As coordinator for the environmental analysis for the Significant Natural Resource Area Management Plan proposed by San Francisco Rec and Park, you asked if I could provide an estimate of the percentage of blue gums (*Eucalyptus globulus*) in these forests that are at least 20 years or older.

Blue gums in Natural Area parks

I have assessed over 800 blue gums in Pine Lake, Glen Canyon, Mount Davidson and McLaren Parks (Table 1). My work focused on trees adjacent to areas of high use such as streets, playgrounds, adjacent properties and parking lots. The assessment was limited to tree 6" or greater in diameter. I examined 675 trees with one stem and 146 with 2 or more stems.

Table 1. Diameter distribution and condition of blue gum. Pine Lake, Glen Canyon, McLaren and Mount Davidson. Recreation & Park Department. San Francisco CA.

Diameter Class (in.)	Condition					Avg. Condition	No. of Trees
	Dead	Poor	Fair	Good	Excel-lent		
<10	--	24	1	--	--	1.8	25
10 to 19	--	151	45	12	--	2.2	208
20 to 29	--	72	76	25	8	2.8	181
30 to 39	--	41	66	30	3	2.9	140
40 to 49	--	11	40	21	2	3.2	74
50 to 59	--	1	13	13	1	3.5	28
60 to 69	--	--	8	7	--	3.5	15
70 to 79	--	1	1	--	--	2.5	2
80 to 89	--	--	--	1	--	4.0	1
90 & >	--	--	1	--	--	3.0	1
Multistem	--	46	84	16	--	2.8	146
Total	**--**	**347**	**335**	**125**	**14**	**2.7**	**821**

Condition rating: 0 = dead. 1=poor. 5=excellent.
Trees with more than one stem were categorized as multistem.

HortScience, Inc. | 325 Ray Street | Pleasanton, CA 94566
phone 925.484.0211 | fax 925.484.5096 | www.hortscience.com

Among the 675 trees with one stem, approximately 33% were less than 20" in diameter. Almost half of the trees were between 21" and 40" while about 18% were larger than 40". In these four parks, trunk diameters varied from 6" to 90". Tree condition was poorer in small diameter trees.

In general the blue gum stands I examined were a mix of large diameter, tall dominant trees, smaller diameter codominant and intermediate trees and small diameter suppressed individuals. In some cases, small diameter trees were present along the edge of the stand.

All stands had a large variation in trunk diameter. Although I made no measurements, tree height appeared to vary just as widely. I think that all of the trees were planted at the same time. Some grew faster than others, becoming large and dominant. Because blue gum is intolerant of shade, slow growing trees became less vigorous and remained small in size.

Blue gum stands

Stands of blue gums in San Francisco were created by planting. McBride and Froehlich (1984) noted that almost all of the older blue gum stands in San Francisco were even-aged, established in a brief period in the late 1800s and early 1900s. It is likely that some blue gum stands in San Francisco parks including Glen Canyon, McLaren, Mount Davidson and Pine Lake Parks were planted after this time.

I did not observe, however, any recent plantings of this species. All of the stands I observed were mature in development.

Historical photos viewed on Google Earth illustrate overall patterns of vegetation. For the four Natural Area Parks, it is clear that vegetation was well-established by 1993. This would suggest that the large majority of blue gums are over 20 years old.

Blue gum can reproduce by both seed and root sprouts. McBride and Froelich noted the absence of seedling development and the presence of root sprouts in their assessment of old blue gum stands in Golden Gate Park, Mountain Lake Park and the Presidio. I don't know if the small diameter trees I observed at the edge of some stands were sprouts or seedlings. Whatever their origin, such small trees were not common.

Given my observations of blue gum in Glen Canyon, McLaren, Mount Davidson and Pine Lake Park, I estimate that at least 90% are more than 20 years old.

Please contact me with any questions.

McBride, J. and D. Froehlich. 1984. Structure and condition of older stands in parks and open space areas of San Francisco CA. *Urban Ecology*. 8: 165-178.