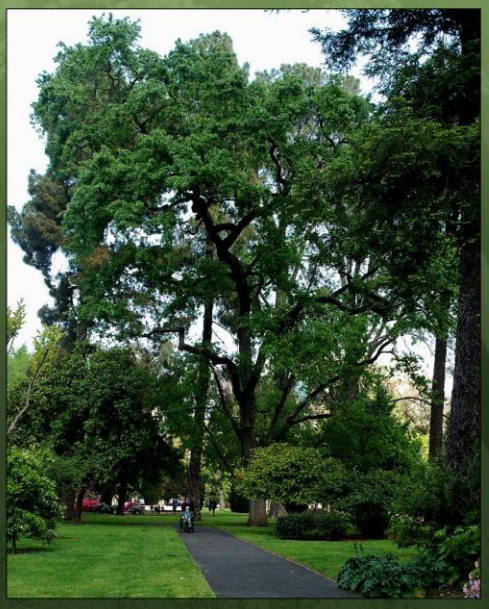
Capitol Park Trees: A Rare Asset

Paula J. Peper
Historical Environmental Research
ppeper@surewest.net
USFS Urban Ecologist (retired)
Center for Urban Forest Research

My presentation on our trees today is focused on their asset value, population dynamics and needs. This presentation is part of a study I conducted that included review of the current tree inventory and many walk-throughs of the park to examine the trees.
I look at trees as an asset, not just for their beauty but from the perspective of the services they provide to a community
I say rare asset because even today it is extremely rare to find so many varied tree species on such a small amount of acreage.

Ecosystem Services

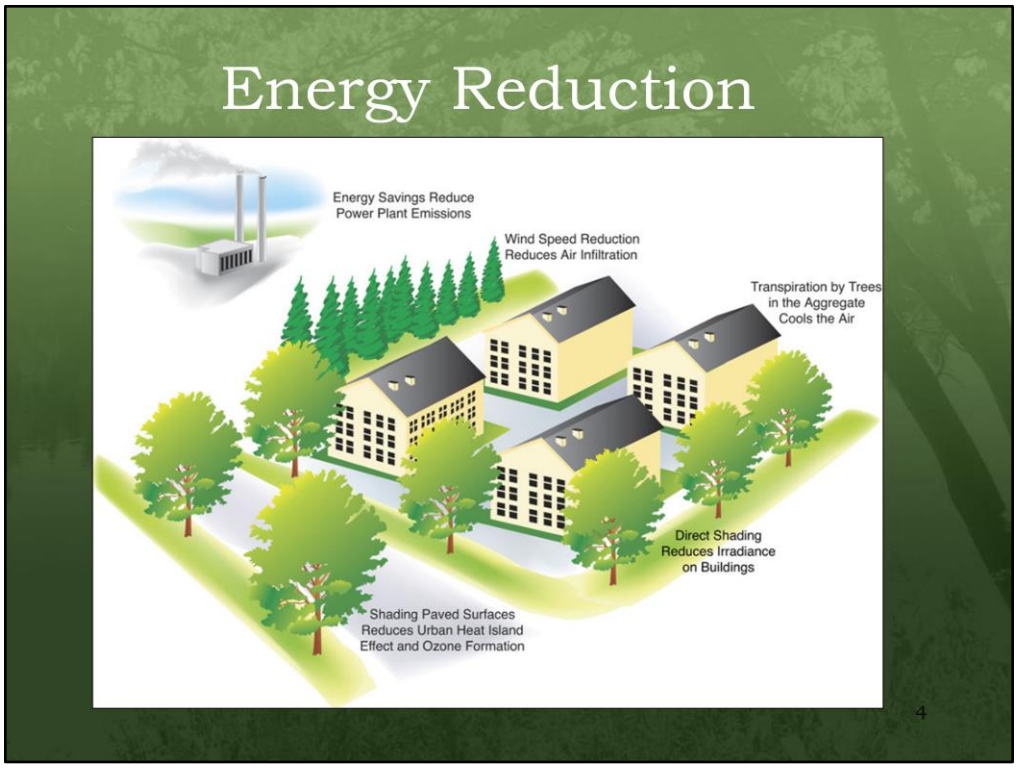
- Energy Savings
- Air pollutant removal
- Rainfall interception
- CO_2 capture & carbon storage
- Aesthetics/other



With the group of five scientists I've worked with over years, we've studied what we call the ecosystem services trees provide and that's what I'll report on today.

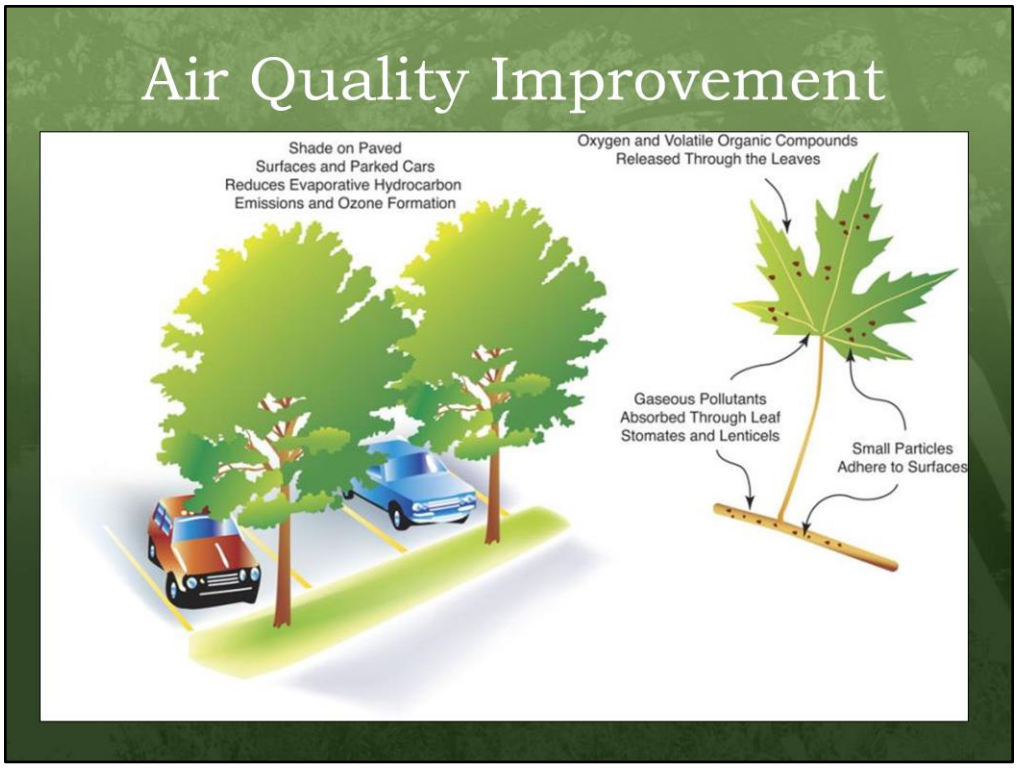
We've taken the research we conducted and turned it into tools that any one of you may download for free, explore and use.

For this study I used i-tree streets which assesses the structure, function and value of not only street trees, but also park trees.

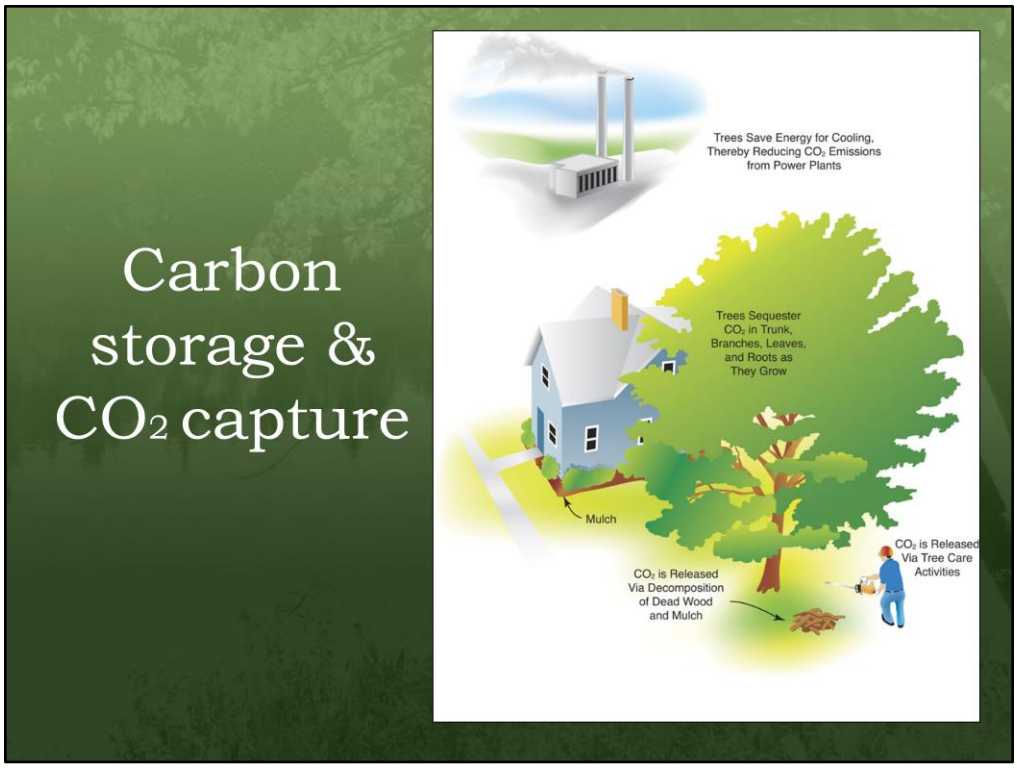


So how do trees reduce energy consumption?

The benefits assessed for park trees include energy reduction – trees save energy in various ways—from direct shading of buildings, to cooling the air through transpiration thereby reducing temperatures, shading paved surfaces, reducing wind speed and when we use air conditioning less due to these other cooling effects, less power is drawn and energy savings reduce power plant emissions, improving air quality

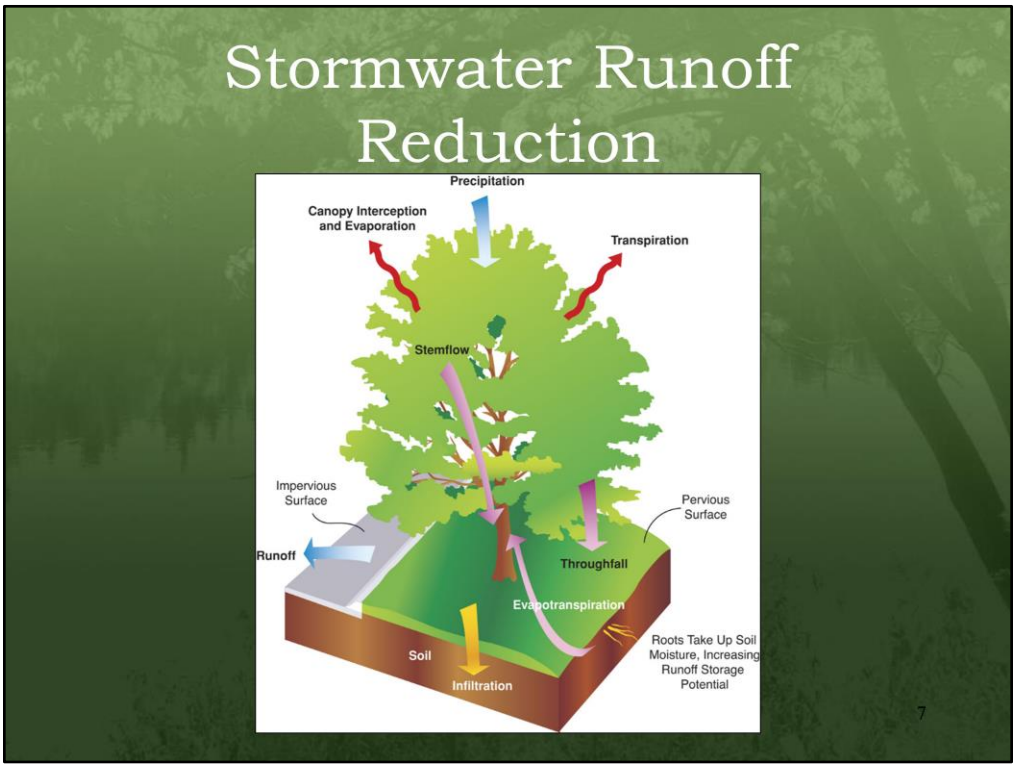


Absorb gaseous pollutants through leaves and filter small particles out of the air, converting the pollutants to produce oxygen and VOCs.



Trees capture and store carbon dioxide in their wood and leaves as they grow---in fact, if you remove the leaves from a tree, then dry out all that tree's wood, half the remaining weight is stored carbon.

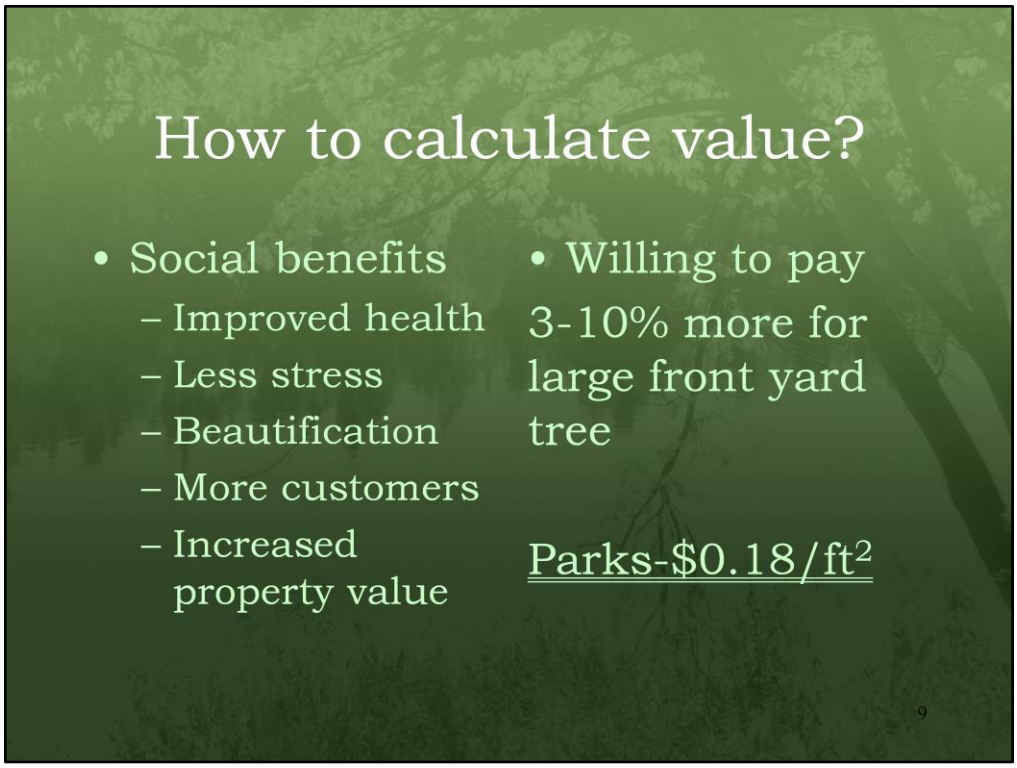
Of course, when trees die they decompose and release carbon dioxide unless you do as Assembly member Cooley did and arrange for the wood to be salvaged and turned into usable items like furniture—then it remains stored. Tree care activities also release carbon dioxide.



Trees reduce runoff volume, peak flow, and flow duration. They slow down the flow and promote infiltration and evapotranspiration, also improving groundwater recharge and reducing the incidence of combined sewer overflow.

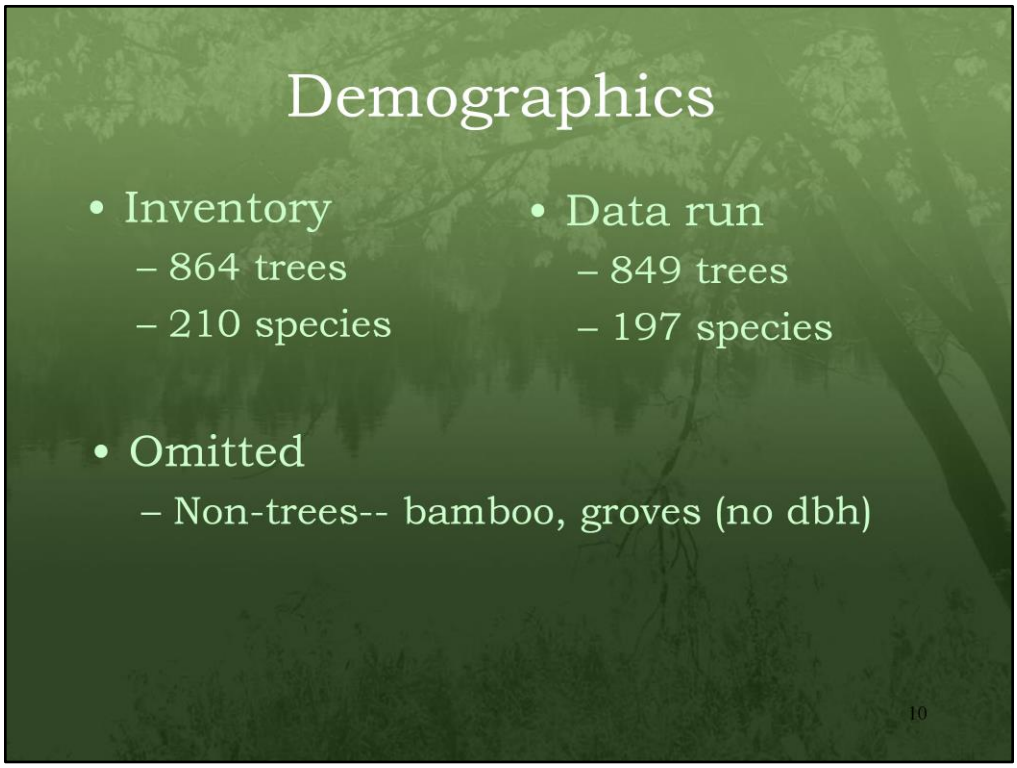
By doing these things they provide water quality improvements and reduced treatment costs.

The tough benefits to capture are the aesthetic benefits—how do we place an economic value on beauty?



How do we assess the social benefits we now know through research are associated with trees? There is science showing improved health, less stress, more customers where trees line streets along the fronts of shops, but no one has yet done the work to monetize those benefits.

The only solid research we had to go on were real estate studies showing that people were willing to pay 3-10% more for homes with large leafy front yard trees and homes adjacent to shaded parks. We used a conservative 1% increase and broke that down so we could calculate value based on the canopy cover or leaf area of a tree. So, the so-called aesthetic benefit for this study is based only on property value increase and is calculated at 18 cents per square foot of canopy cover.



Those are the benefits I calculated for park trees.

The inventory I received listed the park's 864 trees representing 210 species. I could run only 849 of these trees from 197 of the species because some were not trees per se like bamboo and others had no diameter at breast height recorded, like those listed as a grove of trees rather than individually.

Results for 849 trees
(Annual Benefits)

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	% of Total Tree Numbers	% of Total $	Avg. $/tree
Torrey pine	2.56	317.79	19.81	32.09	349.88	0.71	1.98	58.31
Giant sequoia	4.23	523.53	36.35	58.89	582.42	1.30	3.30	52.95
Deodar cedar	6.32	783.46	48.22	78.12	861.58	2.00	4.89	50.68
Coast redwood	17.20	2,131.28	117.76	190.77	2,322.05	7.07	13.17	38.70
Tulip tree	4.16	514.92	4.61	7.47	522.39	1.77	2.96	34.83
Canary island date palm	2.56	317.70	9.63	15.60	333.31	1.65	1.89	23.81
California white oak	1.84	228.01	3.43	5.55	233.56	1.30	1.32	21.23
Southern magnolia	5.29	655.38	44.40	71.93	727.31	4.36	4.13	19.66
Valencia orange	2.64	326.76	11.22	18.18	344.94	2.24	1.96	18.15
California buckeye	0.08	10.31	0.14	0.23	10.54	0.24	0.06	5.27
Windmill palm	0.12	14.48	0.84	1.37	15.84	0.71	0.09	2.64
Kousa dogwood	0.02	2.23	0.05	0.08	2.31	0.12	0.01	2.31

Here's an example of the results which come in huge spreadsheets detailing benefits by each species.

This is part of spreadsheet showing annual electricity and gas savings benefits for a few of the species.

Important to note that some trees are represented by many trees like coast redwood, while others have only one specimen; as a result it's important not just to look at the total electricity or total gas columns because those represent a value multiplied by the number of trees present, but to look at the Average $/tree column if you want to compare the benefits generated by each species.

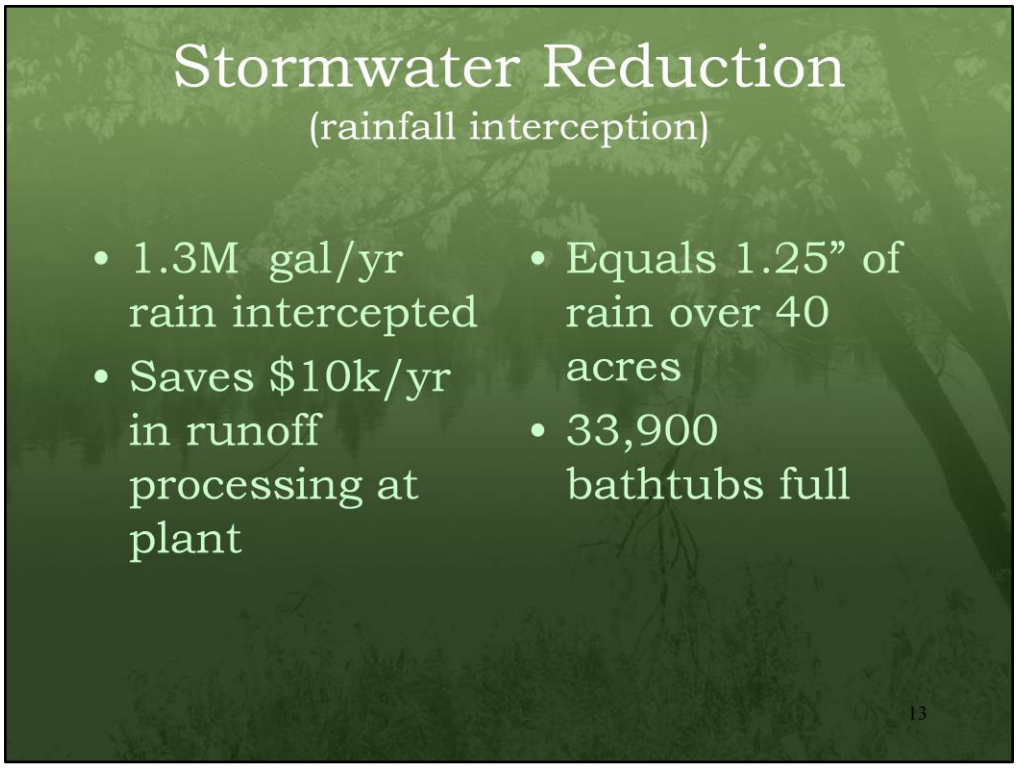
Energy Savings (849 trees)

- 135 MWh annual reduction of electrical energy
- Value: $17,630

- 1 MWh=330 homes for 1 hour
- 135 MWh will power 1,856 homes for 24 hours

12

For gas and electricity



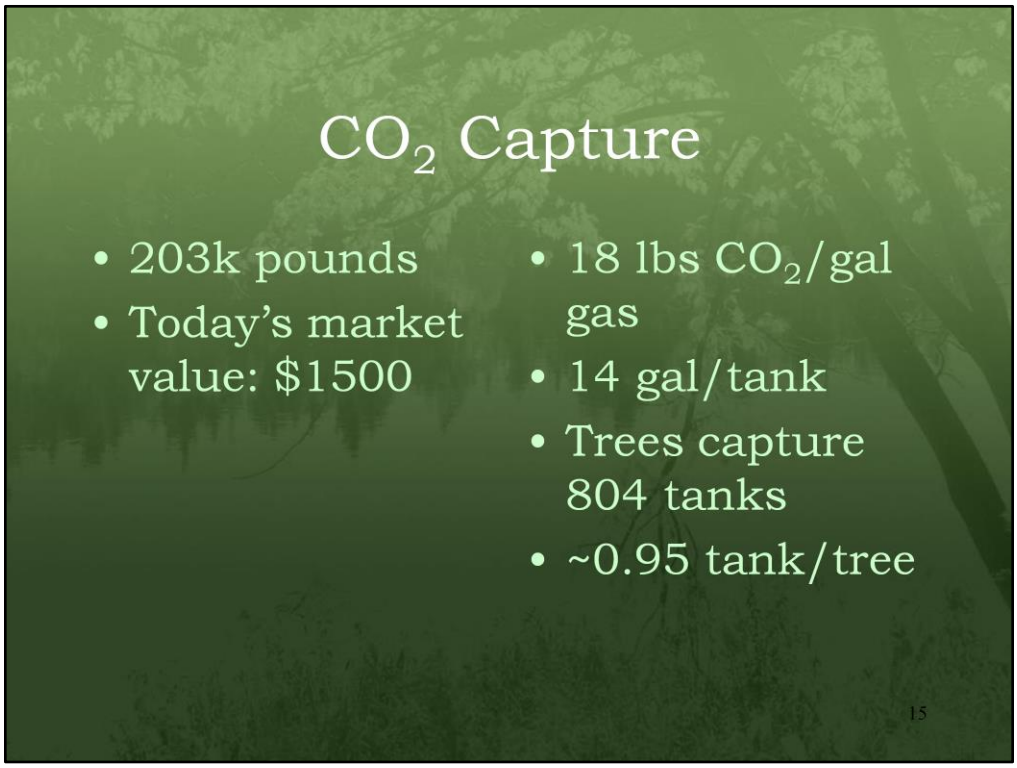
Stormwater reduction

Stored Carbon

- 4.1M pounds stored in woody biomass
- $30,940
- Half the weight of a tree's wood, if you dry that wood out is stored carbon

14

Stored Carbon



Carbon dioxide captured from the air

Other Benefits

- Air quality
  - 655 lbs/yr
  - $15k benefits
- Natural gas
  - 548 therms/yr
  - $888 benefit

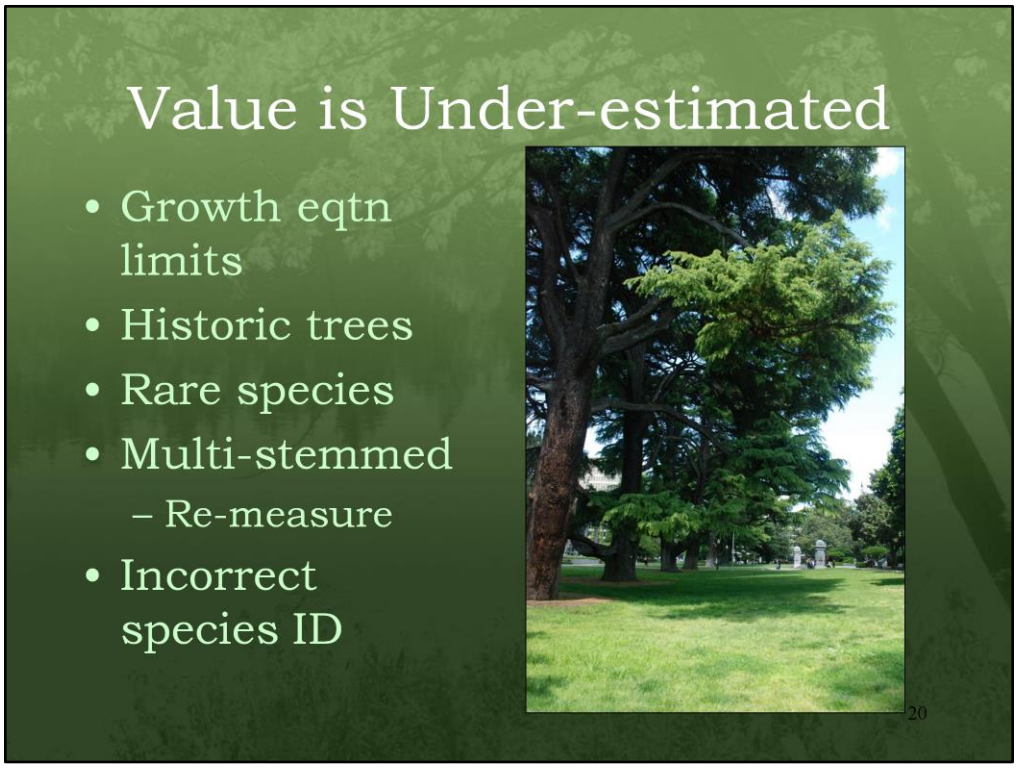
16

$83k is no doubt an underestimation given rare and historic species along with no ability to monetize items on the left

Final Benefits

Benefits	Total ($)
Energy	17,630
Carbon stored	30,943
CO2	1,520
Air Quality	15,187
Stormwater	10,022
Aesthetics/other	83,905
Total	**159,207**

Replacement value accounts for the long-term investment in trees now reflected in their number, stature, placement and condition. Based on the trunk formula method, this is the cost of replacing existing trees with trees of similar size, species and condition if all were destroyed, for example, by a catastrophic storm or a decision to remove trees for construction of buildings. I highlighted 3 north and south because these are the areas where trees could be removed for expansion of the east wing—they account for 24% or $1.4M of the total replacement value. **This is in my estimation a significant underestimation of the value given that there are many historic and rare trees in these areas, including civil war memorial trees**.



I believe the value is significantly under-estimated for several reasons.

1. I did the research across the US, measuring over 17,000 trees to create the growth equations that run i-Tree Streets. I know that we never measured trees that have grown as large and old as many species in Capitol Park, so the growth is capped at a level that makes these trees smaller than they actually are. Thus, the benefits are also capped.
2. I have no way to factor in the additional value of historic and rare species.
3. A number of trees in the inventory were multi-stemmed with all the diameters of those stems added together to form one diameter---which would grossly over-estimate tree size, so in order to err on the side of underestimation, I reduced those measurements by 2/3rds
4. There are a couple of cases where trees were not identified correctly in the inventory—something I realized later while walking through the park. If correctly identified those trees would have higher benefits associated because of their species.

So, if I were asked to come in and assess some of the issues facing this park, I'd ask a few questions---what's the goal?

Does the legislature want to maintain it as it was established by its originators as a park with unique arboretum diversity?

If so, the park is facing challenges in the difficulty of finding replacements. Unlike in the 1800s, trees native to other countries must be quarantined today, if allowed in at all. US propagators need to be brought on board and we have tree production nurseries capable of that.

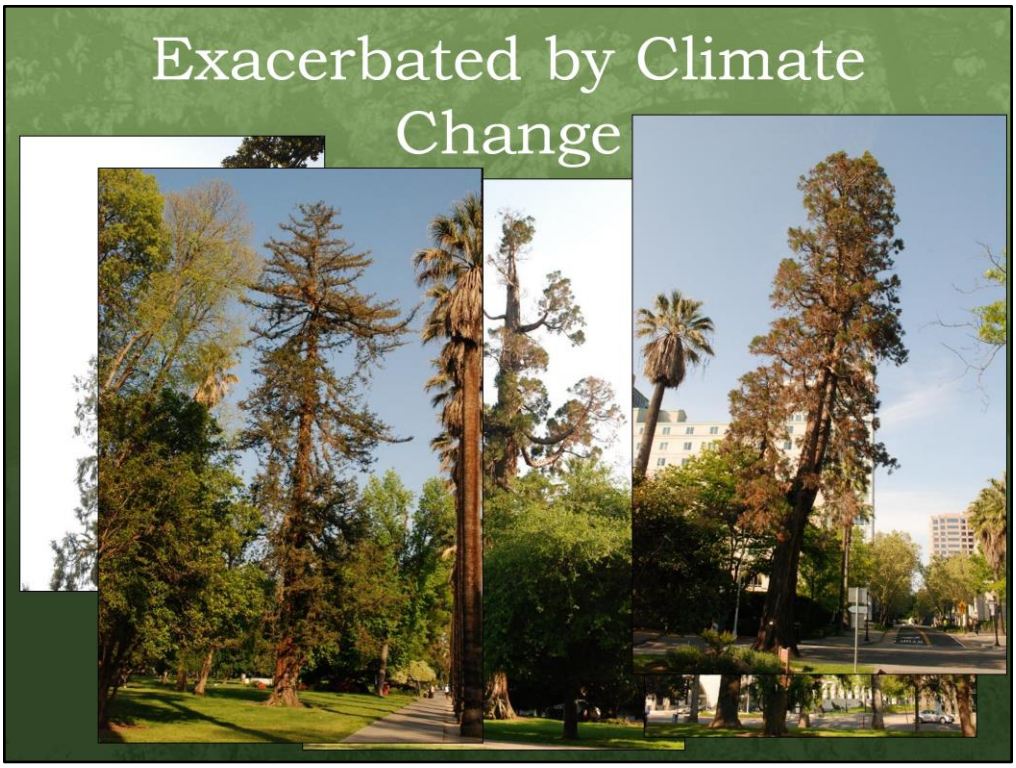
What you have now is a fragile resource since nearly half the species are represented by only 1 tree and another 66 by only 2.

On top of that, the park crew is dealing with many issues, many from long, long ago, some more recent. Budget and hiring freezes over the years meant the trees often were not properly cared for—the tree on the left should have been structurally pruned when young so it would not have that co-dominant (v-shaped) trunk at the top. Where those two branches connect is a weak point, subject to branch failure. The only way today's tree crew could try to insure that wouldn't happen was to take a lot of weight off the top of the tree by topping it, something we would normally never do because it opens the tree up to possible disease and the new sprouting branches are also weak and must be evaluated regularly.

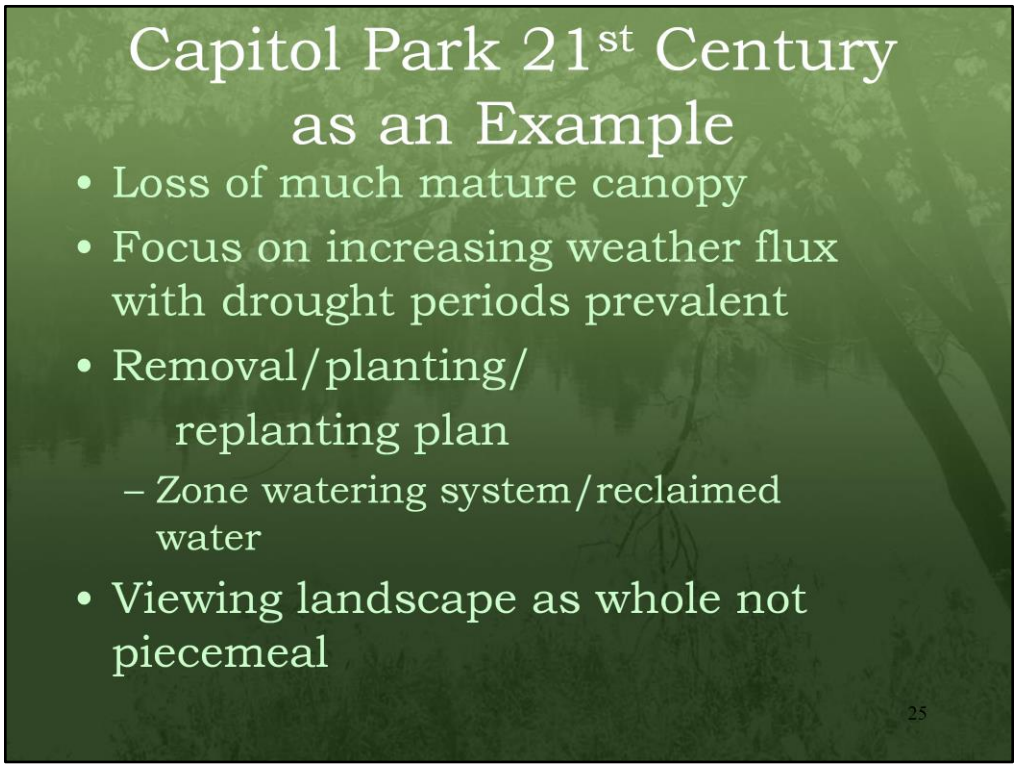
The elm in the middle again has a co-dominant trunk plus heart rot from what appears to be an old branch removal or failure wound.

The sequoia on the right is in decline. Many conifers continue to suffer from the drought. More on that later.

There are past and current issues---Hat-racking a tree, that ginkgo on the left should not have been pruned that way—not even close to the ANSI standards for tree pruning. Newly planted trees must have their nursery pot stakes removed immediately after out-planting and then re-staked correctly. Leaving the stake on along with tightly wound tape will girdle the tree this year, prohibit bud development for branching on that side of the tree and end result is a lopsided tree prone to failure in future planting new replacement trees without re-staking correctly—will girdle the tree this year, prohibits bud development for branching on that side of the tree and end result is a lopsided tree prone to failure in future. Then, like the tree on the right, there are trees that were planted too close to other large growing trees, or under the trees. Some species do well under other trees, but ones like this do not.



And all of this is exacerbated by drought and a not very educated approach to water reduction by our governor. Conifers are suffering significantly from the instant water change and they make up nearly 30% of the tree population. Although we had a great winter this year, some of these trees will not recover. I expect more failures.

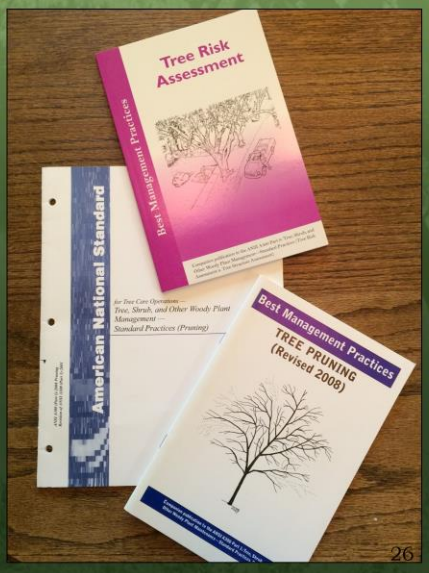


Capitol Park can be an example of how to deal with landscapes dealing with drought and climate change. But if you want a park people can love as much as they love this park—you cannot plan it based on governor tenures and the issue of the day ---you have to look long term. Develop an actual plan that recognizes we are going to lose much of the mature tree canopy through the next 10-50 years. Develop a plan that incorporates the Best Management Practices shown on the following slides.

This park should have a tree management plan in place that includes, at a minimum, the following items – a removal, planting and replacement plan including resources for propagating rare trees using current trees as a seed or tissue resource. The planting plan should work toward grouping trees by water needs and at the effect of reclaimed water mixes on our unique species—so monitoring that is also important on a tree-by-tree basis. We need to start viewing the landscape as a whole, not piecemeal. And we need to stop planting extremely water-hungry trees like redwoods and river birch.

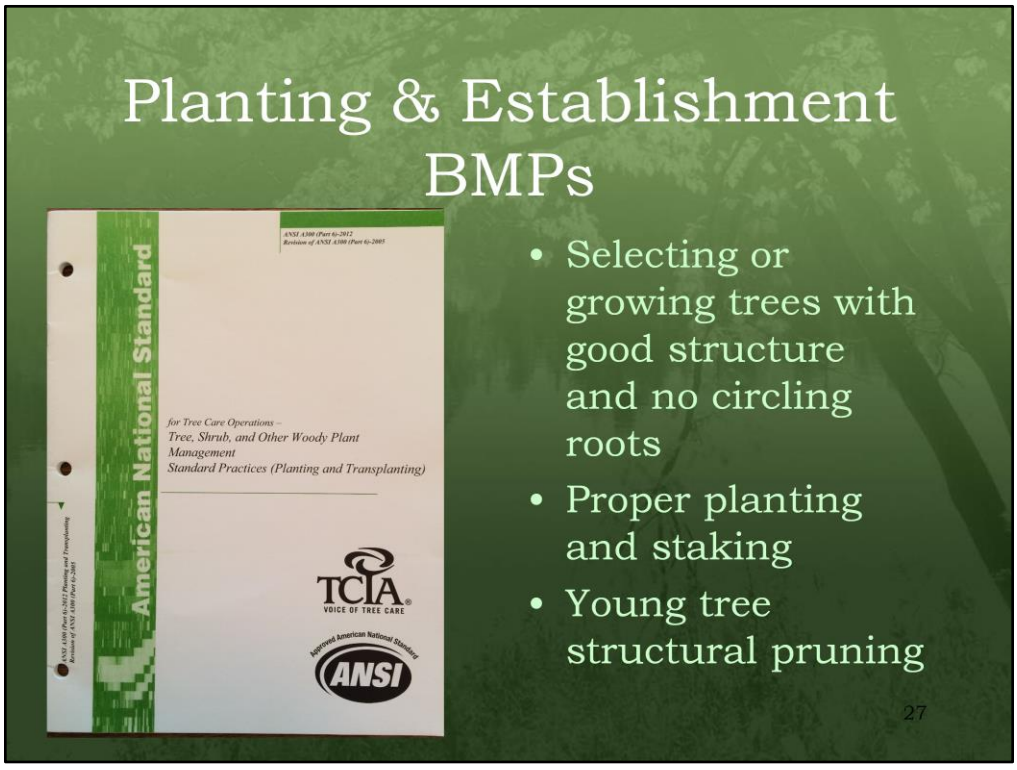
Systematic Risk Assessment & Pruning Program

- Minimize reactive tree care
- Based on species needs
- Zone/section based for efficiency
- CHP coordination

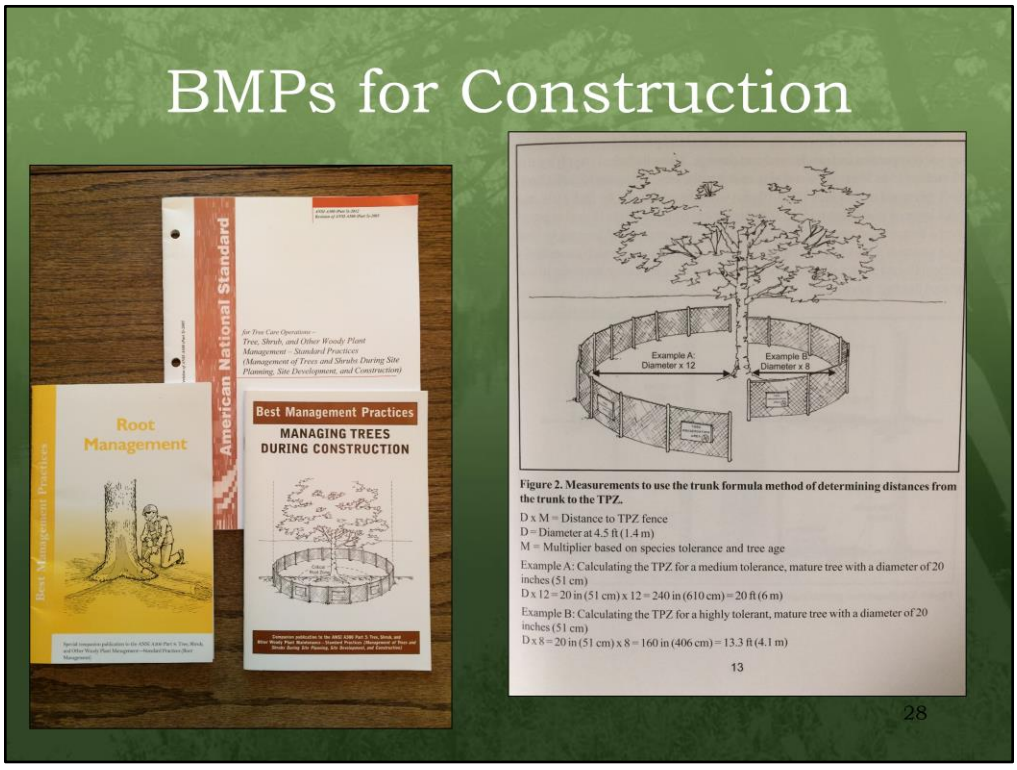


26

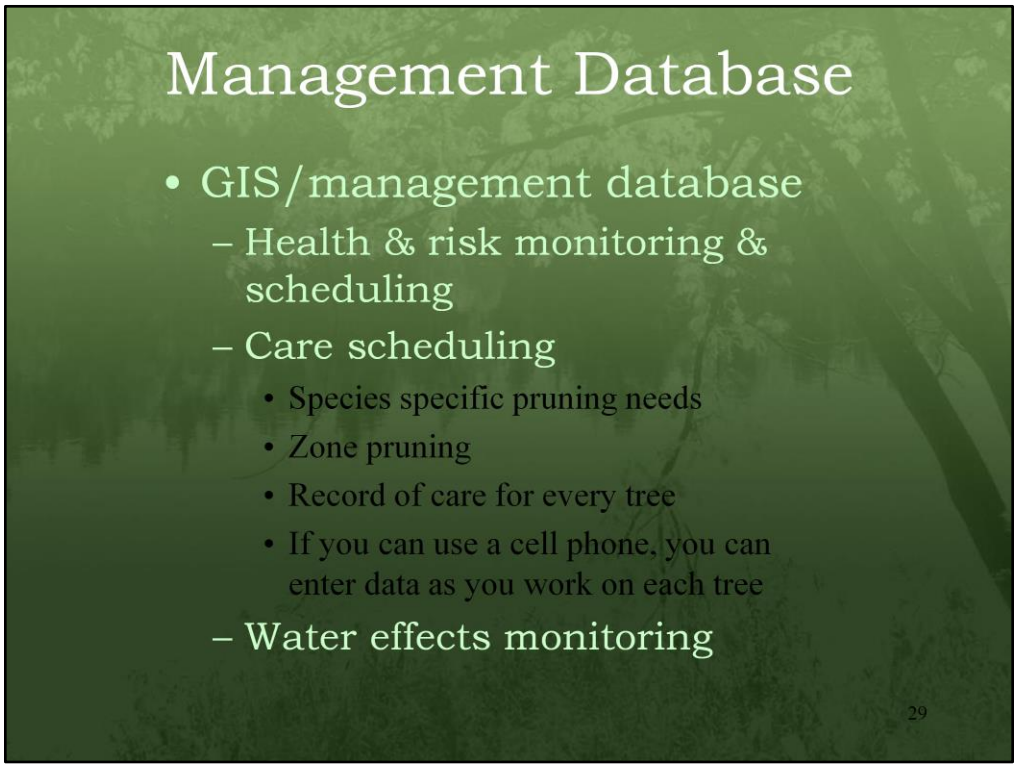
Incorporate today's Best Management Practices. There should be an annual assessment by a certified arborist whose directions for pruning should be followed



Best management strategies for growing, planting and establishment must be used



During construction, the best management practices for construction should be followed---and that is NOT simply placing a barrier at the dripline of a tree—it should be calculated using the ANSI standard methods



The best management involves knowing what you have at all times---a working inventory that can be updated every time a tree is pruned. You can call up a tree, see its age and all the work that has been associated with that tree.

Need an overall management plan that looks into the next 50 years at a minimum.

The plan should incorporate today's tree care and planting best management practices—available to all through a series of publications and training seminars.

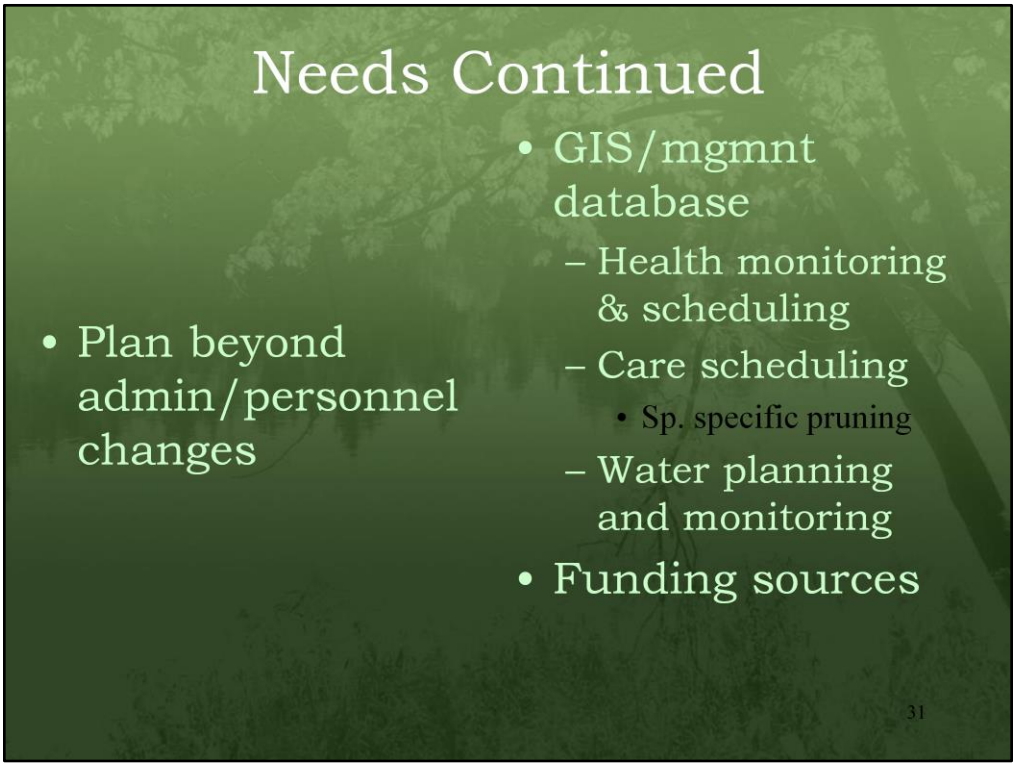
Along with removal and replacement, a list of salvage operations should be included delineating each company's specialties and having them on contract (costs less to set these contracts up ahead of time than it does to do it on an emergency basis).

Need a drought plan now---so that the trees undergo slow, systematic water reductions to wean them from needing as much water while maintaining their health---such a plan can be an educational resource for all citizens in California who have their own trees.

Something in the park is always under construction and I do not see current Best Management Practices for protecting trees during construction being followed—so root systems of the trees are being impacted which will cause future problems re tree growth and health.

Call in the professionals who have been used to evaluate reclaimed water impacts and develop plans for huge parks here in California—companies like HortScience, Inc.

The plan should include an integrated pest management component so that insect and disease issues are nipped at their beginning.



There are many tools available today to help city and park tree managers track the planting, risk assessment and maintenance on every tree. Capitol Park does not have this—there is no one database available for this still. These programs allow a tree crew member to walk up to a tree, make his or her health/risk assessment, enter it and photos of the tree and issues using a smartphone. Managers can then look at all the risk assessments and prioritize work to be done.

The programs also allow for monitoring effects of irrigation reduction, type of irrigation, etc.

A tree management plan works because it plans past administrative and personnel changes—it helps insure continuity in maintaining and caring for the resource to encourage a good canopy cover and, thus, a steady flow of benefits to the public

In California, we have many of the world's experts in tree care and management. Some may even be willing to volunteer expertise. Some of the best plans I've seen or been involved with developed plans by figuring out the components they needed and assigning sections to specialized advisory groups—experts in particular fields.

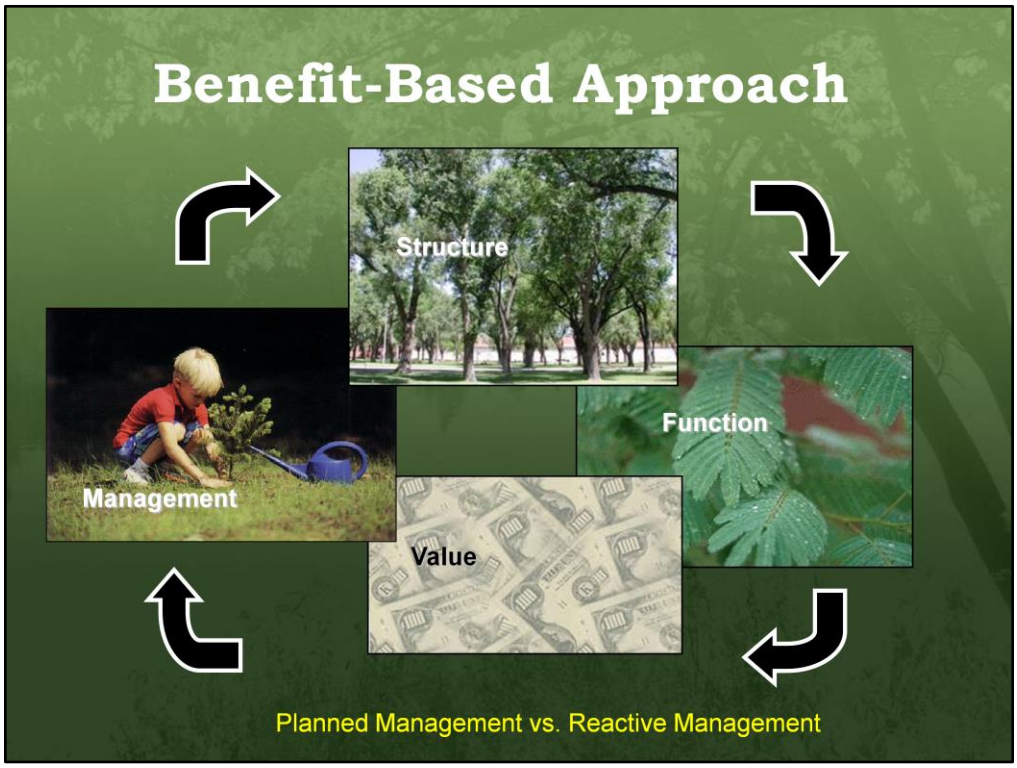
Experts cont.

- Root research & management
  - Larry Costello, Jim Clark, Nelda Matheny, John Lichter
- Salvage and reclaim
  - A-Plus Tree, California Urban Lumber, Hunski Hardwoods….
- Construction protection
  - See root research
- Asset measurement & valuation
  - Peper, Davey Research, others

33

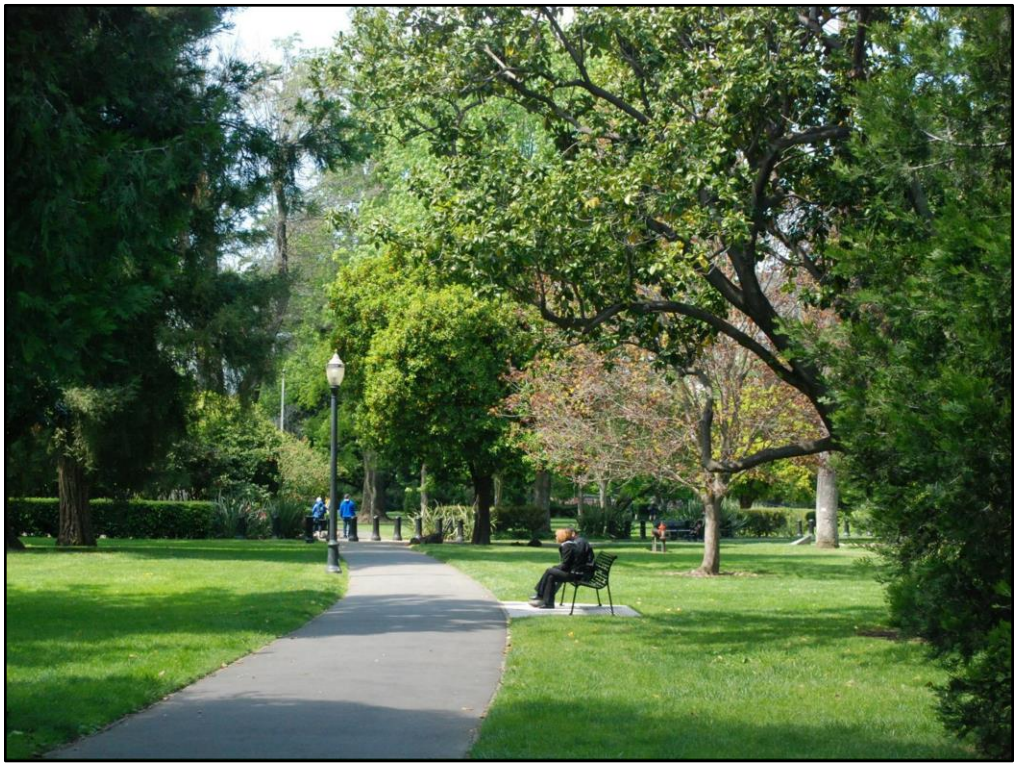
Management plans aren't created in a week. It can take 1-5 years to develop and implement the plan and it can be accomplished in segments.

First, Les Strike and Mike Nielson should be the go-to people regarding short term needs and helping teams that include the DGS landscape architect and other specialists to develop long term needs



Planned management vs. reactive management.

To maintain long-term benefits, we have to know the structure of our park forest---the species, the diversity, the condition—when we know that we can determine the function of the trees by species and assess a value. Once we know the value it becomes a baseline by which managers can seek to either maintain or improve the structure of the forest for the future. This planning always costs less than reactive management where we aren't really looking to the future, but always putting out fires—dealing with tree and limb failures, popping in a new tree here or there and so forth.



Ultimately, the goal for this unique California park, visited by millions, should be to insure its presence, its beautiful shade and all the associated benefits through time at less overall cost.