CITY OF CARMEL-BY-THE-SEA
FOREST AND BEACH COMMISSION
MEETING AGENDA
Thursday, 11 June 2015
Tour of Inspection – 3:00 p.m.
Regular Meeting – 3:30 p.m.

City Hall, Council Chambers
East side of Monte Verde St. between Ocean & 7th Avenues
Carmel, California

CALL TO ORDER AND ROLL CALL

COMMISSION MEMBERS:

DAVID REFUERZO – CHAIR
KAREN FERLITO
KATHY BANG
MICHAEL CARTER
JEFF BARON

TOUR OF INSPECTION

Shortly after 3:00 p.m. the Commission will leave the Council Chambers for an on-site Tour of Inspection of all properties listed on this agenda. The Tour may also include projects previously approved by the City and not on this agenda. Prior to the beginning of the Tour of Inspection, the Commission may eliminate one or more on-site visits. The public is welcome to follow the Commission on its tour of the determined sites. The Commission will return to the Council Chambers at **3:30 p.m.** or as soon thereafter as possible.

1. E/ Santa Rita St., one north of Forest Theater.

ROLL CALL

PLEDGE OF ALLEGIANCE

APPEARANCES

Thank you for attending the meeting. Anyone wishing to address the Commission on matters not on the agenda, but within the jurisdiction of the Commission, may do so now. Please state the matter on which you wish to speak. Matters not appearing on the Commission's agenda will not receive action at this meeting but may be referred to staff for a future meeting. Presentations will be limited to three minutes, or as established by the Commission. Persons are not required to give their name or address, but it is helpful for speakers to state their name in order that the Secretary may identify them.

CONSENT AGENDA

1. Consideration of the minutes for the 14 May 2015 regular meeting. Page 1.

PUBLIC HEARING / APPLICATIONS

IF YOU CHALLENGE THE NATURE OF THE PROPOSED ACTION IN COURT, YOU MAY BE LIMITED TO RAISING ONLY THOSE ISSUES YOU OR SOMEONE ELSE RAISED AT THE PUBLIC HEARING DESCRIBED IN THIS NOTICE, OR IN WRITTEN CORRESPONDENCE DELIVERED TO THE FOREST AND BEACH COMMISSION, OR PRIOR TO DELIBERATION OF THE ITEMS ON THE TOUR OF INSPECTION/PUBLIC HEARING.

2. Consideration of an application to remove four coast live oaks (16", 8", 8", 10") for an addition to a single family residence. The applicant is Harlon Bradley and property owner is Donna Ikeda. Page 5.

ORDERS OF BUSINESS

2. Receive an update on the status of the beach fire project. No page.

3. Review and discuss the Mayor's request for a Forest and Beach Commission project for Carmel's 100 year anniversary in 2016. Page 17.

4. Review, discuss and make recommendations on the installation of artificial turf near trees. Page 18.

5. Report from the 2016 Arbor Day ad hoc committee. No Page.

REPORTS FROM STAFF AND COMMISSIONERS

6. Forester's report
   - A. May tree data. Page 47.
   - B. Council item updates.
   - C. Parks activities.
   - D. Beach activities.
   - E. Budget update.
   - F. Planning Commission activities.
   - G. Future agenda items.

ADJOURNMENT

Any writings or documents provided to a majority of the Forest and Beach Commission regarding any item on this agenda will be made available for public inspection in the Planning and Building Department located at City Hall, on Monte Verde between Ocean and 7th Avenues during normal business hours.

If there is not a special meeting, the next regular meeting of the Forest and Beach Commission will be:

9 July 2015
Tour of Inspection – as required
3:30 p.m. - Regular Agenda

The City of Carmel-by-the-Sea does not discriminate against persons with disabilities. The City of Carmel-by-the-Sea Telecommunication's Device for the Deaf /Speech Impaired (TDD) number is 1-800-735-2929.

AFFIDAVIT OF POSTING

I, Mike Branson, City Forester, for the City of Carmel-by-the-Sea, DO HEREBY CERTIFY, under penalty of perjury under the laws of the State of California, that the foregoing notice was posted at the Carmel-by-the-Sea City Hall bulletin board, at the Harrison Memorial Library on Ocean and Lincoln Avenues, the Carmel Post Office, and distributed to members of the media on June 8, 2015.

Dated this 8th, day of June 2015 at the hour of 1:30 p.m.

Mike Branson

Mike Branson
City Forester

CITY OF CARMEL-BY-THE-SEA
FOREST AND BEACH COMMISSION - MINUTES
THURSDAY, MAY 14, 2015

CALL TO ORDER AND ROLL CALL

COMMISSION MEMBERS PRESENT:	Kathy Bang Jeff Baron Michael Carter Karen Ferlito David Refuerzo – Chair
STAFF PRESENT:	Mike Branson, City Forester Paul Tomasi, Commander Leslie Fenton, Executive Assistant

TOUR OF INSPECTION

The Forest and Beach Commission did a walking tour of the street trees in the commercial district and the sidewalk project at the NE corner Dolores & 7^{th}.

ROLL CALL

PLEGE OF ALLEGIANCE

Members of the audience joined the Commission in the Pledge of Allegiance.

APPEARANCES

None

CONSENT AGENDA

1. Consideration of the minutes for the 9 April Regular meeting and 23 April 2015 Special meeting.

Commissioner CARTER moved **to approve the minutes for the 9 April 2015 Regular meeting and 23 April Special meeting**, seconded by BARON and **carried** by the following roll call vote:

AYES:	Bang, Baron, Carter, Ferlito, Refuerzo
NOES:	None
ABSTAIN:	None
ABSENT:	None

PUBLIC HEARING/APPLICATIONS

2. Consideration and review of a public sidewalk improvement project and possible removal of two Monterey pines (16", 12") and planting of three new trees on public property. The site is located on the northeast corner of Dolores St. and 7th Ave. The applicant and property owner is the City of Carmel.

Mike Branson, City Forester, presented the staff report. Chair Refuerzo opened the public hearing at 3:45 p.m. Rich Pepe and Diane Singer appeared before the Commission. There being no other appearances, the public hearing was closed at 3:53 p.m.

Commissioner FERLITO moved **to approve the removal of two (2) trees; the planting of three (3) new trees, preferably not Cedar; the planting of something, not necessarily a tree, in the area of the light pole; and that in the future the landscaping on Dolores Street between Ocean and 7th be looked at to see how the streetscape can be softened**, seconded by BANG and **carried** by the following roll call vote:

AYES:	Bang, Carter, Ferlito, Refuerzo
NOES:	Baron
ABSTAIN:	None
ABSENT:	None

ORDERS OF BUSINESS

3. Receive an update on the status of the beach fire project.

The four (4) appeals to City Council were denied and the "Final Local Action Notice on Coastal Permit" which included the Adopted Staff Report, Adopted Findings, Adopted Conditions and Site Plans was forwarded to the California Coastal Commission Central Coast District Officer for review. Once the Coastal Commission has acknowledged receipt of the document the 10-day appeal period will begin.

Chair Refuerzo opened the public hearing at 4:23 p.m. Linda Mayolo appeared before the Commission. There being no other appearances, the public hearing was closed at 4:24 p.m.

4. Review and discuss the Mayor's request for a Forest and Beach Commission project for the City 100 year anniversary in 2016.

Chair Refuerzo opened the public hearing at 4:47 p.m. There being no other appearances, the public hearing was closed at 4:47 p.m.

Staff was asked to find out if there is a budget for these projects. Commissioners asked to return to next month's meeting with ideas.

5. Review and recommendations on the public safety items in the shoreline and stairway reports.

Mike Branson, City Forester, presented the staff report. Chair Refuerzo opened the public hearing at 5:06 p.m. David Shonman appeared before the Commission. There being no other appearances, the public hearing was closed at 5:13 p.m

After further discussion, the public hearing was re-opened at 5:19 p.m. David Shonman appeared before the Commission. There being no other appearances, the public hearing was closed at 5:21 p.m.

Commissioner BARON moved **to recommend to Council that funds be allocated to fix the high priority items in the stairs report: #1 – item 1; #4 – item 1; #9 – item 1 and in regards to item 2 – keep Martin Way stairs as they look now, do not fix as detailed in report.**

Motion failed due to lack of a second.

Commissioner Bang re-cused herself from the vote due to her residence being located near one of the stairs recommended for repair.

Commissioner FERLITO moved **to recommend that the 5 points in the Forester's review of the public safety items in the Draft Shoreline Assessment report being addressed for repair in the FY 2015-2016 budget due to their immediate short term safety concerns**, seconded by REFUERZO and **carried** by the following roll call vote:

AYES:	Baron, Carter, Ferlito, Refuerzo
NOES:	None
ABSTAIN:	None
ABSENT:	Bang

REPORTS FROM STAFF AND COMMISSIONERS

6. Forester's Report

A. April tree data
- more trees were planted than removed last month
- stump removal continues
- tree tagging survey to be done in Fall

B. Council item updates
- proposed budget out
- deadline for questions is Friday, May 22, 2015

C. Parks activities
- park pathway and bike trail thru Rio Park moving forward

D. Beach activities
- Summer sand clean-up will begin after Memorial Day weekend
- Beach clean-up scheduled for Saturday, May 16, 10-12

E. Budget update
- see Council item updates

F. Planning Commission activities
- no update

G. Future agenda items
- review of tree service business license application

ADJOURNMENT

There being no further business to come before the Commission, the meeting was adjourned at 6:05 p.m.

____
Leslie Fenton, Executive Assistant

ATTEST:

____
David Refuerzo, Chair

MEMORANDUM

TO: Members of the Forest and Beach Commission

FROM: Mike Branson, City Forester

DATE: 5 June 2015

SUBJECT: Tree Removal (Private)
Block: 126 & Walker tract 3
E / Santa Rita St., one north of Forest Theater.
Applicant/Owner: Harlon Bradley / XXX

Site Condition:

The property is a 4000 sq. ft. lot with a small historic home built on it. The lot slopes downward from north to south and is adjacent to the Forest Theater. There are a total of 32 trees on the site including several large oaks, a variety of small ornamentals, and a couple of cypress trees.

Size and species of trees(s) requested for removal/pruning:

Remove four coast live oak (16", 8", 8", 10").

Health and condition of tree requested for removal:

The 16" and two 8" oaks are in poor condition or have structural problems. The 10" oak tree was rated as significant during the preliminary site assessment and is the primary subject of this application review. The tree appears healthy and without any significant insect, disease, or structural problems. The tree does lean to the southwest and the entire canopy is at the end of the trunk.

Previous requests and decisions:

None.

Reason for request - Description of Project:

The applicant is planning to build a small addition to the rear of the historic home. The new addition will enlarge the bedroom at the rear of the house and although it does not include the base of tree #17, the lean of the trunk extends into the proposed structure.

The importance of the tree(s) to the urban forest in the area:

The trees contribute to the lower canopy of the forest this neighborhood but the lot and the area around the site if fairly wooded so they are not particularly significant to the site overall.

Size and species of tree(s) that are to be preserved:

N/A

Impacts construction may have on trees that are to be preserved and suggested mitigation:

Standard tree protection requirements will apply.

Options:

1. Approve the application.
2. Do not approve the application.
3. Postpone consideration.

Staff Recommendations:

Option #1. Approve the application. A preliminary site assessment is performed by staff to provide guidance to persons interested in development of a property on any challenges, tree and otherwise, they may face. The significant tree in question was rated as significant during the site assessment. The initial tree evaluation is performed on an individual tree basis and does not consider how trees relate in total to the site. In staff's opinion, for this heavily wooded site, tree #17 is not significant to the site and should be allowed to be removed. Staff also recommends approval of the other trees requested for removal.

CITY OF CARMEL-BY-THE-SEA
PO DRAWER G
CARMEL, CA 93921
Ph: (831) 620-2010 FAX: (831) 620-2014

DATE: 6/8/15
FEE: $ 234.05
RECEIPT# 60935

APPLICATION FOR PERMIT TO REMOVE OR PRUNE TREES FOR THE PURPOSES OF CONSTRUCTION/DEMOLITION

Location of property: SANTA RITA 9 SE OCEAN
Block : 82 Lot: 20 APN # 010-043-009
Name of Property Owner: DONNA IKEDA Name of Applicant/Contractor: HARLAN BRADLEY

Mailing Address PO BOX 23
CARMEL CA 93921
Mailing Address: PO BOX 23
CARMEL CA 93921

Phone #: 831/229/8002 Phone #: 831-229-8202

WHO WILL BE REMOVING/PRUNING THE TREE(S): ______
(PLEASE NOTE IF TREE(S) ARE ON CITY OR PRIVATE PROPERTY)
Number, size and species of **tree(s)** to be removed: 4 TOTAL - 3 NON SIGNIFICANT OAKS - #24, 26, 29 PER S.A. 15-89 AND 1 SIGNIFICANT #17

Number, size and species of **limb(s)** to be removed ______

Number, size and species of **root(s)** to be removed: ______

Reason for removal or pruning:
MAKE ROOM FOR SMALL SINGLE LEVEL ADDITION @ REAR OF NW SF.

You will be notified in writing the date and time that your request is scheduled for a hearing. If you or your representative is unable to attend the hearing, your application will be tabled. You may reschedule by contacting the Secretary to the Forest and Beach Commission at (831) 624-3543. You may waive your right to speak at the hearing and authorize the Forest and Beach Commission to act on your request in your absence by signing on the following line: ______ Date: ______

A SITE PLAN **MUST** ACCOMPANY THIS APPLICATION AND **SHOW** THE FOLLOWING:

1. Location, size and species of ALL trees on the lot.
2. Location and species of tree(s)/limb(s) to be removed or pruned
3. Footprint of the structure/proposed structure.
4. Existing and proposed site coverage.
5. ALL areas that are to remain for landscaping and the total square feet of openspace.
6. Location of areas for tree replanting – The City has adopted Design Review Guidelines which include a minimum tree density per lot. Please review the attached Policy and indicate on the site plan where you intend to plant trees necessary to comply with this guideline.
7. Will excavation other than standard footings be required as part of your construction? ___ YES, X NO. If Yes, you **MUST** show the area of cut, its depth and total cubic yards to be removed.

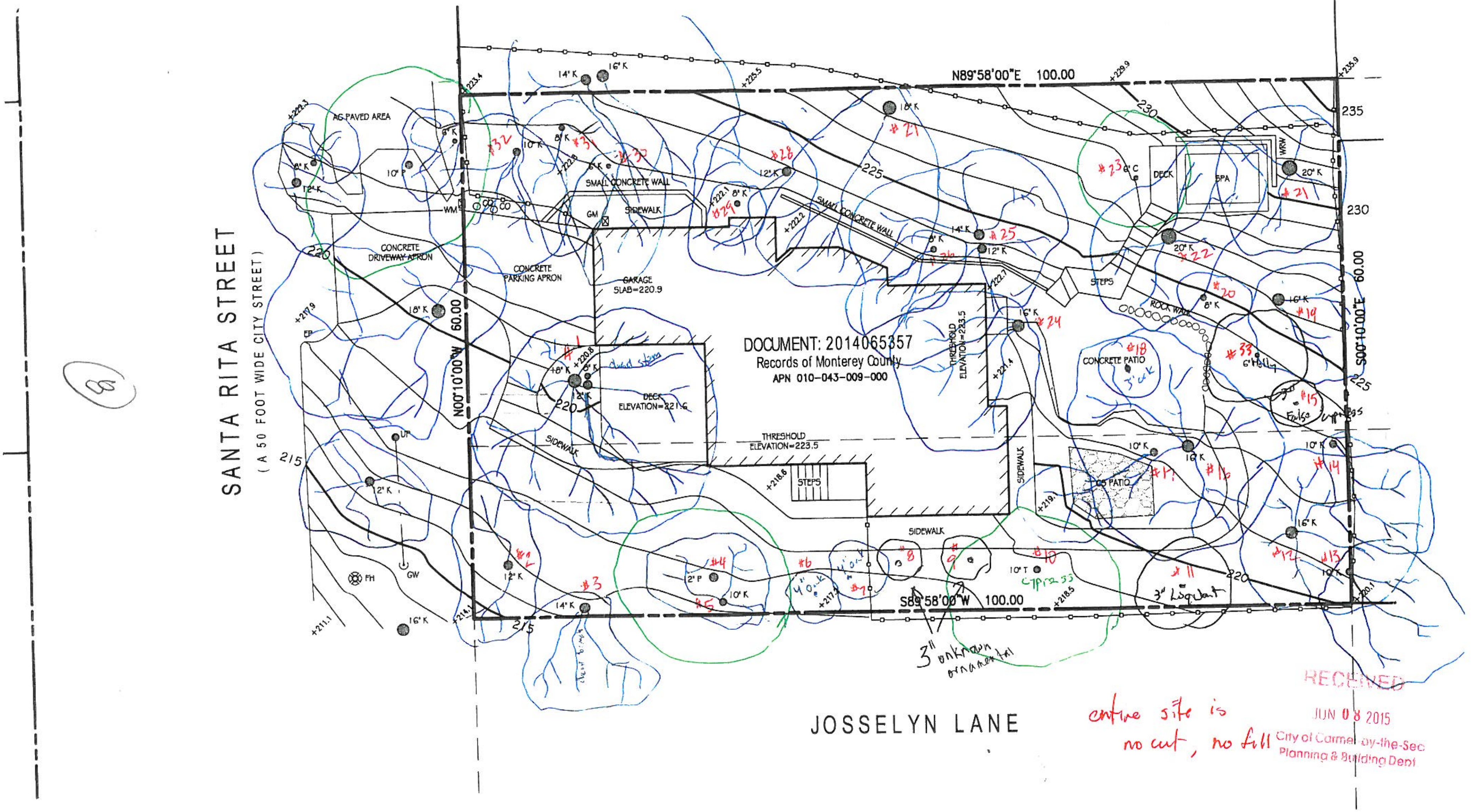
- In order to properly consider your application it is necessary that the footprint of your proposed construction be clearly defined on the lot and height poles are installed prior to the Commission's Tour of Inspection. Any decision of the Forest and Beach Commission is based on information submitted with this application. If the design is altered or the location of the structure changed, another application for a tree permit is required.
- **NO WORK IS PERMITTED** until you have received project approval through the Planning Commission and the issuance of a valid building permit. The Permit to remove trees must be posted on the job site when work is being performed.

Owner's Signature [signature] Date: 6/8/15
Agent for Owners: [signature] Date: 6/8/15

INCOMPLETE APPLICATIONS WILL BE RETURNED

RECEIVED
JUN 08 2015
City of Carmel-by-the-Sea
Planning & Building Dept.

(7)


SANTA RITA STREET
(A 50 FOOT WIDE CITY STREET)
JOSSELYN LANE
N89°58'00"E 100.00
S89°58'00"W 100.00
N00°10'00"W 60.00
S00°10'00"E 60.00
DOCUMENT: 2014065357
Records of Monterey County
APN 010-043-009-000
GARAGE SLAB=220.9
DECK ELEVATION=221.6
THRESHOLD ELEVATION=223.5
CONCRETE PATIO
SMALL CONCRETE WALL
CONCRETE DRIVEWAY APRON
CONCRETE PARKING APRON
AC PAVED AREA
SIDEWALK
STEPS
ROCK WALL
DECK
SPA
entire site is no cut, no fill
3" unknown ornamental
3" Loquat
Cypress
RECEIVED
JUN 08 2015
City of Carmel-by-the-Sea
Planning & Building Dept

(8)

Significant Tree Evaluation Worksheet

Block: 82 Lot(s): 20 Street Location: e/ Santa Rita St., 9 south of Ocean Ave. (Ikeda)

Part One: Initial Screening:

Complete Part One to determine if further assessment is warranted. Trees must pass all criteria in Part One to be considered significant or moderately significant.

A. Does the tree pose an above-normal potential risk to life and property?

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
YES																
NO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
YES																
NO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tree #	**33**															
YES																
NO	X															

Any tree with structural impairment likely to cause failure should be marked as unsafe and removed. Use page seven of this worksheet to document the safety risk. Trees that have limited and specific defects that can be remedied with selective pruning or other mitigation should be marked as safe and specific recommendations should be given to the owner for tree care. Such trees may still be assessed for significance.

B. Is the tree one of the following native species on the Carmel-by-the-Sea recommended tree list?

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Species	CO	CO	CO	MP	CO	CO	CO	OT	OT	MC	OT	CO	CO	CO	OT	CO
YES	X	X	X	X	X	X	X			X		X	X	X		X
NO								X	X		X				X	
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Species	CO	CO	CO	CO	CO	CO	MC	CO	CO	CO	CO	CO	CO	CO	CO	CO
YES	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
NO																
Tree #	**33**															
Species	OT															
YES																
NO	X															

MP – Monterey pine
BP – Bishop pine
CO – Coast live oak
CS – California sycamore
MC – Monterey cypress
CR – Coast redwood
CI – Catalina Ironwood
BL – Big leaf maple
OT – #8, #9 – unknown fruit tree; #11 – Loquat; #15 – false cypress; #33 - holly

(Note: Other species on the recommended tree list may be determined to be Significant Trees only if they are exceptional examples of the species. Such trees also must exhibit excellent health, form, vigor, and substantial size to rate an overall score of at least 7 points in Part Two of the assessment.)

C. Does the tree meet the minimum size criteria for significance?

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
YES	X	X	X	X	X					X		X	X	X		X
NO						X	X	X	X		X				X	
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
YES	X		X	X	X	X		X	X	X	X	X	X	X	X	X
NO		X					X									
Tree #	**33**															
YES																
NO	X															

	Diameter	Height
Monterey pine, Monterey cypress, Bishop pine, Coast redwood	4 inches @ dbh	15 Feet
Coast live oak – single trunk tree	6 inches @ dbh	N/A
Coast live oak – cluster or multi-trunk tree measured as an average diameter of all the trunks that reach breast height	6 inches @ dbh	N/A
California sycamore, Big leaf maple, Catalina ironwood	10 inches @ dbh	25 Feet

dbh = diameter at breast height or 4.5 feet above the adjacent ground surface

Part Two: Assessment For Tree Significance

For each of the criteria below assign points as shown to assess the tree. If any criteria score is zero the assessment may stop as the tree cannot qualify as significant or moderately significant.

D. What is the health and condition of the tree?

Tree #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
score	2	1	1	3	2	-	-	-	-	2	-	1	1	1	-	2
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
score	2	-	1	0	2	2	-	2	2	2	2	2	1	2	2	2
Tree #	**33**															
score	-															

0 points: The tree is heavily infested with pests or has advanced signs of disease that indicates the tree is declining and has very limited life expectancy.

1 point: The tree shows some pests or disease that impair its condition, but which does not immediately threaten the health of the tree. The tree may recover on its own, or with appropriate intervention.

2 points: The tree appears healthy and in good condition.

3 points: The tree shows excellent health, is free of pests and disease and is in very strong condition.

E. What is the overall form and structure of the tree?

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
score	2	2	1	3	2	-	-	-	-	2	-	1	1	1	-	2
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
score	1	-	2	0	2	2	-	1	2	1	2	2	1	1	2	2
Tree #	**33**															
score	-															

0 points: Prior pruning, disease or growth habit have left the tree deformed or unsound to an extent that it cannot recover or will never be a visual asset to the neighborhood or will likely deteriorate into a structural hazard.

1 point: The tree has poor form or structure but (a) can recover with proper maintenance or (b) it provides visual interest in its current form, and does not have structural defects that are likely to develop into a safety hazard.

2 points: The tree has average form and structure for the species but does not exhibit all the qualities of excellent form and structure.

3 points: The tree exhibits excellent form and structure. For all species there will be a good distribution of foliage on multiple branches with no defects. For conifers, the tree will have a single straight leader with balanced branching and with good taper. Oaks will exhibit a well-developed canopy with no suppressed branches. Oaks may be single-trunked or multi-trunked and will have a balanced distribution of foliage on each trunk/branch.

Part Two: Assessment For Tree Significance, continued

F. What is the age and vigor of the tree?

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
score	1	1	0	3	2	-	-	-	-	2	-	0	1	0	-	2
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
score	2	-	1	0	1	1	-	1	1	2	2	2	0	2	2	1
Tree #	**33**															
score																

0 points: The tree is over-mature or shows signs of poor or declining vigor such as die-back of major limbs or of the crown, small leaves/needles and/or minimal new growth.

1 point: The tree is mature but retains normal vigor and is likely to continue as a forest asset for a substantial period into the future.

2 points: The tree is young to middle age and shows normal vigor.

3 points: The tree is young to middle age and shows exceptional vigor.

G. <u>Are environmental conditions favorable to the tree?</u>

Tree #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
score	1	2	2	2	1	-	-	-	-	1	-	1	1	0	-	1
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
score	1	-	1	0	1	1	-	0	1	0	1	1	0	1	1	1
Tree #	**33**															
score	-															

0 points: The tree is crowded or has no room for growth to maturity. The tree has poor access to light, air or has poor soil for the species.

1 point: The tree has average environmental conditions including room for growth to maturity, access to light, air and soils suitable for the species.

2 points: The tree has room for growth to maturity with no crowding from other significant trees or existing buildings nearby. The tree also has excellent access to light, air and excellent soils for root development.

Part Three: Final Assessment

Please record the total points scored on pages two and three for each tree.

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total Score	6	6	4	11	7	-	-	-	-	7	-	3	4	2	-	7
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Total Score	6	-	5	0	6	6	-	4	6	5	7	7	2	6	7	6
Tree #	**33**															
Total Score	-															

A. Did all assessment categories in Part Two achieve a minimum score of 1-point?

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
YES	X	X		X	X	-	-	-	-	X	-		X		-	X
NO			X			-	-	-	-		-	X		X	-	
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
YES	X	-	X		X	X	-		X		X	X		X	X	X
NO		-		X			-	X		X			X			
Tree #	**33**															
YES	-															
NO	-															

B. Are there any other factors that would disqualify a tree from a determination of significance? (Explain any 'yes' answer)

No __X___ Yes _______

(Explanation)

NOTES:

Conclusion: Does The Tree Qualify As Significant Or Moderately Significant?

If the tree meets the species, size and safety criteria identified in Part One and scores at least one point under each of the criteria in Part Two, it shall be classified as Significant if it achieves a score of **6 or more points** or shall be classified as Moderately Significant if it achieves a score of **4 or 5 points**. Tree species not listed in Part One-B that meet other screening criteria in Part One may be classified by the City Forester as Significant if they score **at least 7 points**, or as Moderately Significant if they score **at least 4 points**. All other trees are classified as non-significant.

Tree #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SIGNIF	X	X		X	X					X						X
MOD SIGNIF													X			
NOT SIGNIF			X			X	X	X	X		X	X		X	X	
Tree #	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
SIGNIF	X				X	X					X	X		X	X	X
MOD SIGNIF			X						X							
NOT SIGNIF		X		X			X	X		X			X			
Tree #	**33**															
SIGNIF																
MOD SIGNIF																
NOT SIGNIF	X															

MEMORANDUM

TO: David Refuerzo, Chairperson
Members of the Forest and Beach Commission

FROM: Mike Branson, City Forester

DATE: 5 June 2015

SUBJECT: Review and discuss the Mayor's request for a Forest and Beach Commission project for Carmel's 100 year anniversary in 2016.

During the May regular meeting, the Commission discussed the Mayors request for the Forest and Beach Commission to recommend a project or projects for the 2016 Carmel centennial. Following discussion, Chairperson Refuerzo requested each Commissioner think of ideas for a project and to bring their ideas to the June meeting for further discussion and consideration.

The Commission proposal(s) as well as those from other commissions and organizations will be reviewed at a public workshop on July 6, 2015.

MEMORANDUM

TO: David Refuerzo, Chairperson
Members of the Forest and Beach Commission

FROM: Mike Branson, City Forester

DATE: 5 June 2015

SUBJECT: Review, discuss and make recommendations on the installation of artificial turf near trees.

Commissioner Ferlito has requested the Forest and Beach Commission review the installation of artificial turf in landscapes around the city. Her concerns are expressed in the attached email.

Installation of artificial turf has become more prevalent in light of California's current drought conditions and as a low maintenance, attractive feature in a home landscape. The process for installation is similar to the installation of a paver patio, with a compacted base and a sand layer beneath the turf product. The turf has small holes or slits that allow water and air to go through. A sample installation guide is attached.

Issues that may affect trees are soil compaction during installation, possible increase in soil temperatures, and a reduction in received precipitation and irrigation – particularly where a currently irrigated area is converted to artificial turf.

As noted above, a compacted base is required for proper installation. This process can lead to compaction of the soil below the base layer which can lead to roots dying and diminished space for new root growth. In full sun, several research trials have shown that artificial turf sports fields can have surface temperatures 30 to 50 degrees above the ambient air temperature. The same research also shows the high temperatures are only sustained for an inch or so into the base materials. In Carmel's climate and forested environment, the issue of soil temperature is probably not a major concern. Loss of irrigation or precipitation can be a concern for trees that have adapted to irrigation as their primary water supply. If this is the case, some alternative method of getting water to the tree may be appropriate.

As noted in Commissioner Ferlito's message, the Carmel Design Guidelines (attached) discourage lawns that are visible from the right-of-way. While artificial turf is not a lawn in the true sense of the word, it conveys the visual appearance of a lawn to the property and casual observer on the street.

I consider any installation of artificial turf in the landscape as site coverage, as opposed to landscaping with plant material and placement should be appropriate for the site conditions. Allowing artificial turf in the front yard should be determined by the Planning Commission. The Planning Commission is reviewing this subject during their regular meeting on July10, 2015.

Mike Branson

From: Karen FERLITO [ferlito@me.com]
Sent: Wednesday, May 27, 2015 1:04 PM
To: Mike Branson; Refuerzo David; Doug Schmitz
Subject: Artificial turf/lawn moratorium consideration

According to design guideline 10.3, lawns are considered inappropriate and are to be avoided. I have noticed several lawns around town and now even more artificial lawns being approved by the planning staff (over the counter) and being installed.

We do not know the long term implications of installing artificial turf over sensitive tree root systems. And, since natural lawns are to be avoided according to the design guidelines because it create a suburban look, it would seem that artificial lawns create the same look and would also need to be avoided on that basis.

Artificial turf may starve the tree roots of water, oxygen, etc. it may "heat up" the roots and cause tree failure. We just don't know all of the ramifications of installation of it. Therefore, I am formally requesting that consideration of a recommendation for a temporary moratorium on installation of both natural and artificial lawns be placed on the June agenda of the Forest and Beach Commission.

Thank you.

Karen Ferlito
Sent from my iPad.

Landscape Design - Final Details Phase

Introduction to Landscape Design

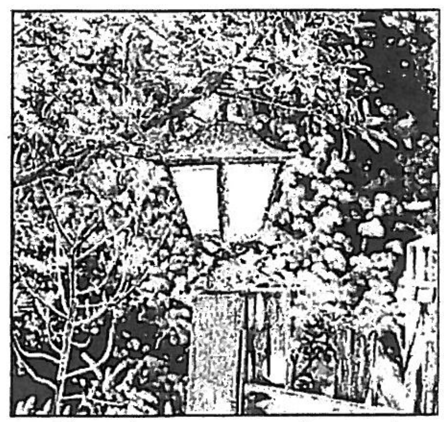
The traditional forest landscape is one of the most important features of the community. While each individual site has unique features, residents have consistently relied upon a simple palette of materials that have contributed to the City's forest character. The basic framework of the landscape consists of the plentiful stands of cypress, pine and oaks. Lower scale plants, including smaller trees, shrubs and flowers as well as steps, walls, and fences complete the landscape and are addressed in this section.

Fences, gates and low scale plantings combine with upper canopy trees to create the traditional landscape character of Carmel.

The dominant materials of the traditional planting palette are simple and limited. Leafy, low-growing species that are easy to maintain and relatively drought-tolerant should predominate.

High maintenance plants should be limited to active areas, such as courtyards and patios. These places are relatively private, either in the rear, to the side, screened by a garage, or if in the front, set well back from the street. This approach will reinforce the natural forest character of the City and knit the site design into the neighborhood context.

Within this overall landscape, individual details can serve as accents that provide interest while remaining subordinate to the neighborhood character. In fact, personal landscape designs are one of the most successful means of expressing creativity and individuality while remaining consistent with the basic forest image. Creative details on fence posts, in walkways and plant beds for example, appear throughout the community, giving unique identities to individual properties. This tradition should continue.



Details on fence posts contribute to the unique character of Carmel and using them is encouraged.

(21)

Policy P1-64
Establish landscaping standards to preserve the urban forest, and encourage gardens using native vegetation to maintain the natural character of open spaces in the residential areas.

Filtered views of homes from the street through trees and shrubs into a property are also a part of Carmel's landscape tradition. This is achieved by a combination of landscape elements, including multi-stem trees such as live oaks planted in the foreground, as well as open fences and leafy shrubbery.

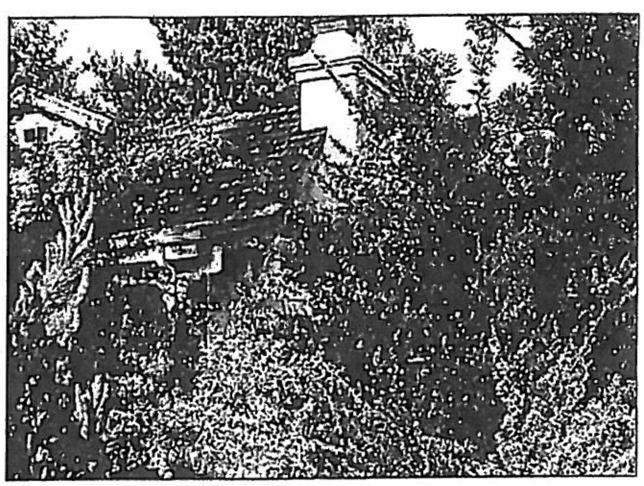
Exceptions to this strongly forested and filtered landscape do exist in some neighborhoods. For example, in some annexed neighborhoods the front yards are more formal and fewer trees exist. Larger plant massings often occur on properties here and evergreen shrubbery predominates.

To some extent, the landscape tradition also is different along portions of Scenic Road where small yards sometimes limit landscape arrangements, especially in front yards. In many cases, these sites have more lush landscaping right up to the street edge and, because views to the ocean are so important, there is less of a "filtering" through layers of plant materials.

These variations in the context of neighborhood landscape features should be documented on the preliminary site assessment and should be respected when preparing new designs.

Landscaping that creates a simple and natural design, blending with the urban forest and the public right-of-way is encouraged. Often, a site may already have well established plants and trees that achieve this result. Protecting these existing landscape resources during construction can give a project a settled, mature look immediately upon completion and is encouraged. This is most useful for parts of a site that are visible from the street.

Houses should appear nestled in the trees. Overall, the landscape should have an informal character, emphasizing foliage over flowers. Front yards should be informal gardens, rather than the traditional grass lawns seen in many other communities. These design traditions should be continued.



Open leafy shrubs provide filtered views of homes from the street.

10.0 Landscape Guidelines

Views of buildings that are filtered from the street because of the mix of shrubs and lower story trees are encouraged. This contributes to the "sense of discovery" that is a part of the Carmel design traditions and should be continued. In addition, other landscape elements should contribute to the urban forest image.

Ground covers are preferred in the right-of-way. Multi-stem trees also help filter views.

Objectives:

- To renew the urban forest
- To maintain the traditional foreground of simple, indigenous plantings
- To maintain a sense of informality and discovery along the street
- To maintain the traditional palette of plant materials
- To conserve water
- To reinforce a sense of visual continuity along the street

10.1 Provide for upper and lower canopy trees when designing the landscape.

- Provide adequate space around all trees required to be planted or preserved through the Design Concept Phase approvals.
- Add trees, consistent with the neighborhood context, to the site and public right-of-way when additional filtering or screening is desired.
- Trees that arch over the street contribute strongly to the character of some neighborhoods and should be preserved and supplemented where this character exists.
- Recognize and plan for the special needs of each tree when designing the landscape. For example, high water use plants are appropriate near redwoods but inappropriate near oaks. Grades around established trees should not be raised or lowered.

Plant Selection

10.2 Landscape plans that use native plants and other varieties accustomed to growing along the Central Coast are encouraged.

- Use plants that are similar in character to those established along the block and adjoining properties in order to reinforce a sense of visual continuity along the street, but avoid "copying" nearby landscape plans.
- In general, at least 75% of plant materials on a site should be drought-tolerant. (See section 17.24.180.D&E of the Municipal code.)

Green leafy ground covers are appropriate in the public right-of-way.

Flowering plants may be used to highlight a walkway.

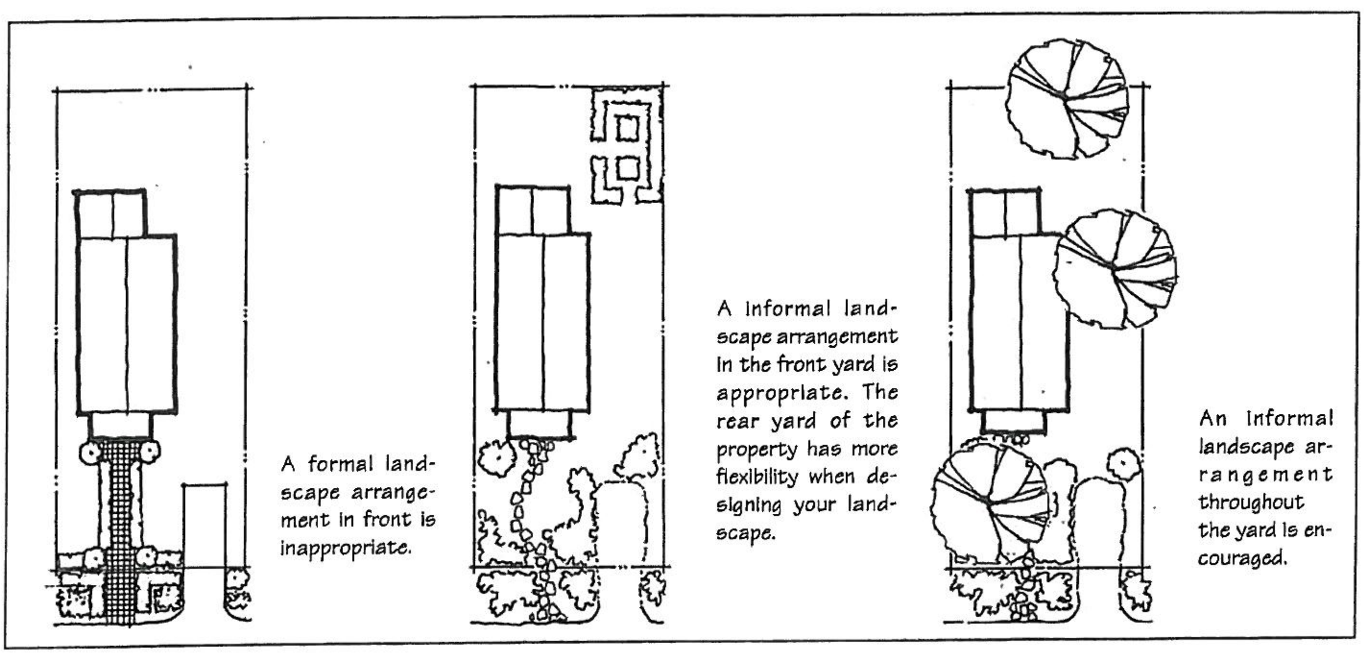
10.3 Planting in areas visible from the street or other public places should continue the forest character.

- Locate plants in relaxed, informal arrangements that are consistent with the urban forest character.
- Avoid formal, unnatural arrangements of plants and paving except in areas out of public view.
- Reserve the use of bedding plants and exotic flowering plants to small accents at walkways, entries or near special site features.
- Lawns visible from the street are inappropriate to the forest setting and should be avoided.

Landscaping in the public right-of-way

10.4 Plants in the public right-of-way should be predominantly green foliage plants, in keeping with the design traditions of Carmel.

- Leaving the right-of-way natural is encouraged.
- Naturalized landscaping consistent with the City's forest character may be added to the right-of-way and be designed to blend into landscaping on site to enhance the sense of open space.
- If planted, the use of native trees, ground covers and low shrubs is preferred.
- Avoid the use of bedding plants and exotic species in the public right-of-way.



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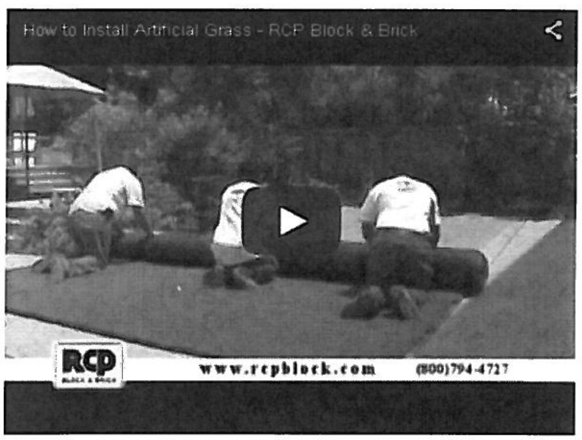
Installation: How to Install Artificial Turf

How to Install Artificial Grass & Turf

- **Questions Along the Way?** Give us a call and we can help!
- **View Artificial Grass Products**



Overview: Getting Started

Installing synthetic artificial turf is a great way to save money on your water bill while keeping a lush, green lawn all year long. Artificial turf requires minimal maintenance and is fairly easy to install. This installation guide will walk you through the steps involved to enjoying your new waterless lawn.

Required Tools

- Vibrating Plate Compactor
- Carpet Knife, Box Cutter, or Carpet Scissors
- Hammer
- Wheel Barrow, Shovels, Picks, Grading Rake (For demo and base preparation)
- Drop Spreader (For Turfill)
- Power Broom

Things to Keep in Mind While Installing

- Always stretch and install turf tight.
- Do not overlap seams.

- Always run grain of turf in same direction.
- For best look, point the grain of the turf in the direction from which the turf will be most often viewed. Example: For front yard installation, grain would point toward street. For back yard installation, grain would point toward house.

Step 1: Preparing the Base

One of the most important steps in the installation of your artificial turf is the preparation of the base. You want to make sure you use the proper base material, that is compacted properly, and that it is relatively smooth and even.

Excavate the Area:

Remove 3"-4" of existing sod and/or dirt. Be sure to set a rough grade for drainage. If irrigation system is present, cap and/or remove any sprinklers.

Base Fill:

Lay 3"-4" of either Class II Road Base or Decomposed Granite. Using a plate compactor, compact base to 90%. Be sure base surface is as level and smooth as possible. Create a slight grade for optimal drainage. (For Pets: Spread a layer of Turfresh on top of base at 1/2 lbs per sqft, and compact.

Step 2: Installing Weed Barrier

In order to prevent weeds from taking root and growing up through your artificial lawn, it is important to install a fabric weed barrier beneath the turf installation.

Weed Barrier:

Install weed barrier (fabric), overlapping seams 6"-12". Secure to base with 20D nails or landscape staples.

*Optional: If an area where soil shifts or pump when saturated with water, install weed barrier underneath base. By installing the barrier beneath the base, materials on top will retain better compaction integrity should such soil conditions exist

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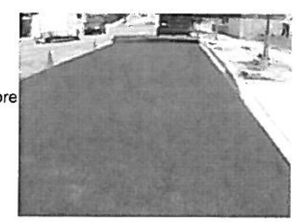
Step 3: Acclimate the Turf

When the artificial turf is delivered, it will come in rolls. Being shipped and stored in this manner for a duration of time will cause the turf to hold an odd shape. This step is important in re-defining the memory of the turf and making it easier to work with.

How to Acclimate the Turf:

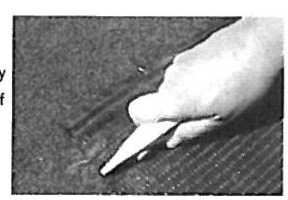


Turf should be rolled out at least 2 hours before installation. Exposure to the sun as well as being laid out flat allows the artificial turf to acclimate, making it more flexible and easier to work with.

Step 4: Position and Trimming

In this step, you will roughly position and trim the turf in preparation of final installation. This will give you a general idea as to how the sections of turf will lay out.

How to Position the Turf:



Remove all dirt and debris from surface of weed barrier prior to turf installation. Lay turf onto base and position where needed. When positioning, be sure to lay the turf pieces so the grain, or direction of the blades, on all pieces face in the same direction. This will help eliminate a patchy look and help hide seams.

How to Trim the Turf:

26

Using a razor knife, cut off salvage (the black and red part along the sides of the turf) - 3 stitches from the sides. Cut turf (cutting from the backside) to roughly fit in the desired area. It is a good idea to leave a bit of excess for any needed adjustments. This excess will be trimmed to fit during final positioning.

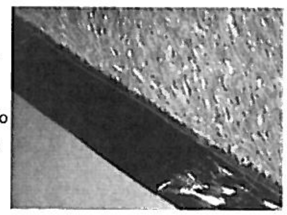
Step 5: Securing the Turf

Once the turf is laid out and roughly cut to fit, it is time to begin securing it to the base, making final fitting trims, and connecting the different sections.

How to Fit, Tighten, & Secure the Turf:

Fasten one end of the turf with 40D nails, spaced 3"-4" apart. Stretch turf tight, and fasten with nails as you move across to the opposite end. Trim any perimeter edges to fit. Place a nail every 3"-4" along the perimeters and every 12"-24" throughout the field. Be careful to not drive the nails too deep, as this will cause dips and divots. Also, avoid any blades or thatch catching under the nail heads.

How to Connect Turf Seams:



Where two pieces of turf meet, fasten together the seams using nails spaced 1"-2" apart. Seaming tape, such as Jiffy Seal, can also be used to secure seams. To apply seaming tape, apply tape lengthwise to bottom side of turf, leaving 3" stuck to turf and 3" hanging off. Lay turf back down (Tape should be sticky-side up - Do not peal away liner.) Secure opposite piece of turf to tape.
Be sure seams are tight and precise, and that the grain of your turf is all facing in the same direction.

Step 6: Filling the Turf

It is finally time to fill the turf with Turfill. This will give the turf weight as well as keep the blades of turf standing up.

How to Fill the Turf:

Once turf is tight and secure, power broom before in-filling to get the blades standing up as much as possible. Apply Turfill and/or Turfresh onto turf using a drop spreader. Apply in-fill as needed. If you don't have a spreader, shovels or wheel barrows can be used - Just be sure and spread the in-fill as evenly as possible. (Refer to product style for the amount of in-fill required)

Final Touch:

Power broom again to spread the fill around and work it into the turf. Broom as much as needed to work in the in-fill and get the blades standing straight up.

More Installation Guides:

- How to Install Artificial Grass
- How to Install Interlocking Concrete Pavers
- How to Install a Retaining Wall
- How to Install a Free Standing Landscape Wall
- How to Install Stone Veneer
- How to Build a Country Manor Radius Fire Pit
- How to Build a Country Manor Mailbox
- How to Build a 20"x20" Country Manor Column
- How to Build a Country Manor Column with Light Fixture
- How to Build a Country Manor Seating Bench
- How to Cut Concrete Units to Size
- How to Insert Keystone Pins
- How to Install Geogrid Reinforcement (Retaining Walls)

(27)

Tree Roots: Facts and Fallacies

Thomas O. Perry

A proper understanding of the structure and function of roots can help people become better gardeners.

Plant roots can grow anywhere—in the soil, on the surface of the soil, in the water, and even in the air. Except for the first formed roots that respond positively to gravity, most roots do not grow toward anything or in any particular direction. Root growth is essentially *opportunistic* in its timing and its orientation. It takes place whenever and wherever the environment provides the water, oxygen, minerals, support, and warmth necessary for growth.

Human activities, such as construction, excavation, and gardening, often result in serious damage to trees. In some cases, trees can be inadvertently injured by people who are trying to protect them. Indeed, people can kill trees in hundreds of ways, usually because of misconceptions about root-soil relationships, or because of a disregard of the basic functions that roots perform.

In order to maintain the health of cultivated trees and shrubs, it is necessary to understand the morphology and physiology of tree roots in relation to the aerial portions of the plant. For those who are responsible for maintaining the health of woody plants, this article examines some widely held misconceptions about roots. It describes the typical patterns of root growth as well as their locations and dimensions underground. It also describes the relationship of healthy roots to typical forest soils as well as the behavior of roots adapted to atypical circumstances—growing through deep sands, under pavements, down crevices, inside shopping malls, and in sewer lines.

The Relationship Between Roots and Other Parts of the Plant

The growth of a plant is an integrated phenomenon that depends on a proper balance and functioning of all parts. If a large portion of the root system is destroyed, a corresponding portion of the leaves and branches will die. Contrariwise, if a tree is repeatedly defoliated, some of its roots will die back. Proper functioning of roots is as essential to the processes of photosynthesis as are the leaves and other chlorophyll-bearing parts of the plant. Typical roots are the sites of production of essential nitrogenous compounds that are transported up through the woody tissues of the plant, along with water and mineral nutrients.

The fine feeder roots of a tree are connected to the leaves by an elaborate plumbing system consisting of larger transport roots, trunk, branches, and twigs. Many researchers have weighed and estimated the proportions of various plant parts. Weighing and counting every root tip and every leaf is a heroic if not impossible task, and careful sampling is essential to making accurate estimates. Sampling errors and variation among species produce variable results, but the biological engineering requirements of plants are apparently similar, and the relative proportions of both mature herbs and mature trees are of the same order of magnitude: 5 percent fine or feeder roots, 15 percent larger or transport roots, 60 percent trunk or main stem, 15 percent branches and twigs, and 5 percent leaves (Bray, 1963; White et al., 1971; Meyer and Gottsche, 1971).

A tree possesses thousands of leaves and hundreds of kilometers of roots with hundreds of thousands of root tips. The numbers, lengths, and surface areas of roots per tree and per hectare are huge. Plant scientists try to make the numbers comprehensible by talking about square units of leaf surface per unit of land surface—the "leaf area index." If both sides of the leaf are included, the leaf area index of a typical forest or typical crop is about 12 during the height of the growing season (Moller, 1945; Watson, 1947; and many modern texts on crop physiology).

The number of square units of root surface per unit of land surface, the "root area index," can be calculated from studies that report the number of grams of roots present in a vertical column of soil. Such data are determined, first, by taking core samples or digging out successive layers of soil and screening and sorting the roots and, second, by determining their average lengths and diameters as well as their oven-dry weights. The quantity of roots decreases rapidly with increasing depth in normal soils, so that 99 percent of the roots are usually included in the top meter (3 ft) of soil (Coile, 1937). A reasonable approximation for non-woody tissues is that the oven-dry weight is one-tenth of the fresh weight and that the density of fresh roots is very close to one. If one makes these assumptions for Lelbank's data (1974) for winter wheat (*Triticum aestivum*) and for Braekke and Kozlowski's data (1977) for red pine (*Pinus resinosa*) and paper birch (*Betula papyrifera*), the calculations indicate a root area index between 15 and 28. E. W. Russell's data (1973) are of the same magnitude, clearly indicating that *the surface of the root system concealed in the soil can be greater than the surface of the leaves!* Amazingly, this conclusion does not take into account the fact that nearly all tree roots are associated with symbiotic fungi (mycorrhizae), which functionally amplify the effective absorptive surface of the finer roots a hundred times or more.

The pattern of conduction between the roots and leaves of a tree varies between and within species. Injection of dyes and observation of their movement indicate that, in oaks and other ring-porous species with large diameter xylem vessels, a given root is directly connected to a particular set of branches, usually on the same side of the tree as the root (Zimmerman and Brown, 1971; Kozlowski and Winget, 1963). Death or damage to the roots of trees with such restricted, one-sided plumbing systems usually results in the death of the corresponding branches. Other tree species possess different anatomies in which dyes ascend in zigzag or spiral patterns, indicating that the roots of the tree serve all of the branches and leaves (Figure 1). Death or injury to the roots of such trees does not lead to a one-sided death in the crown of the tree. The anatomy of trees can vary within species, and the patterns of connection between the roots of most species are unknown. Sometimes the pattern can be detected by examining the pattern of bark fissures, which usually reflects a corresponding pattern in the woody tissues concealed beneath the bark. Knowledge of the pattern of conduction between roots and leaves is of practical importance in predicting the results of treating trees with fertilizers, insecticides, and herbicides, or in predicting the results of one-sided injuries to trees during construction.

Patterns of Growth and Development in Typical Soils

Early observations of tree roots were limited to examining the taproot and the larger roots close to the trunk of the tree or to examining the vertical distribution of severed roots exposed by digging trenches and pits (Busgen and Munsch, 1929; Coile, 1952; Garin, 1942; Bohm, 1979). Attempts to examine the depth and extent of the larger roots of an entire tree were not really possible until bulldozers, backhoes, front-end loaders, and fire pumps became available (Stout, 1956; Berndt and Gibbons, 1958; and Kostler et al., 1968). Unfortunately, most tree roots are less than one millimeter in diameter and are destroyed by the rough action of such heavy equipment.

Examination of the small non-woody roots of trees and their relationship to the larger roots requires years of study, infinite patience, and the gentle use of heavy equipment. Walter Lyford and his colleagues at the Harvard Forest in Petersham, Massachusetts, were among the first to combine tweezers and patience with bulldozers and haste to develop a comprehensive picture of the normal patterns of root development for trees growing in natural situations. The following description of the growth of tree roots is a synthesis of Lyford's published descriptions, the author's personal observations, and recent books on the subject (Kostler et al., 1968, Bohm, 1979; Torrey and Clarkson, 1975; R. S. Russell, 1977; E. W. Russell, 1973).

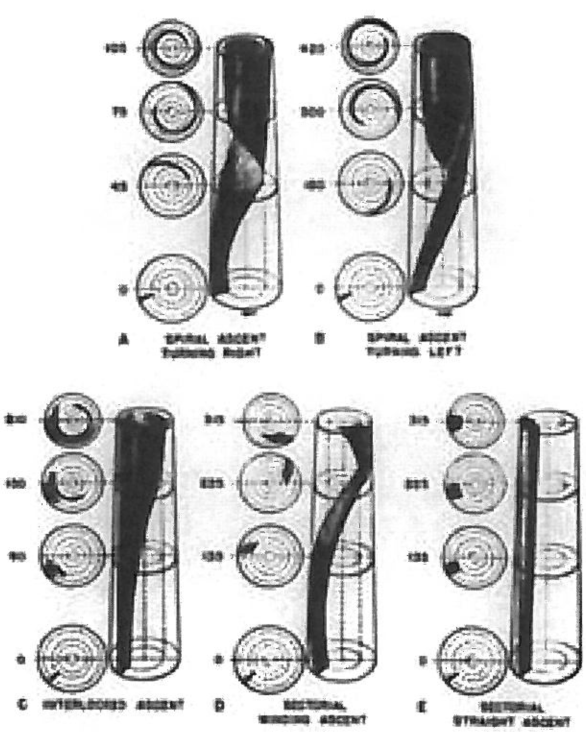


Figure 1. Five types of water-conducting systems in various conifers as shown by the tracheidal channels dyed by trunk injection. The numbers give the height in centimeters of the transverse section above injection. A Spiral ascent, turning right· Abies, Picea, Larix *and* Pinus *(Rehder's section 3,* Taeda*). B. Spiral ascent, turning left* Pinus *(Rehder's section 2,* Cembra*). C. Interlocked ascent:* Sequoia, Libocedrus *and* Juniperus. *D. Sectorial, winding ascent:* Tsuga *and* Pseudotsuga. *E. Sectorial, straight ascent.* Thuja *and* Chamaecyparis. *Oaks and many ring-porous species have a pattern similar to E. From Rudinski and Vite, 1959. Reprinted courtesy of the Boyce Thompson Institute for Plant Research.*

Tree roots vary in size from large woody roots 30 centimeters (12 in) or more in diameter to fine, non-woody roots less than 0.2 millimeters (0.008 in) in diameter. The variation in size from large to small, and the variation in categories from woody to non-woody, perennial to ephemeral, and absorbing to non-absorbing, is continuous. This continuous variation makes the sorting of roots into various categories arbitrary. Nonetheless, classification and sorting are essential to comprehending the pattern and integrated function of the total root system.

The first root, the *radicle*, to emerge from the germinating seed of some species, such as pines, oaks, and walnuts, sometimes persists and grows straight down into the soil to depths of 1 to 2 meters (3 to 6 ft) or more, until supplies of oxygen become limiting. If this "taproot" persists, it is usually largest just beneath the tree trunk and decreases rapidly in diameter as secondary roots branch from it and grow radially and horizontally through the soil. The primary root of other species, such as spruces, willows, and poplars, does not usually persist. Instead, a system of fibrous roots dominates early growth and development.

Between four and eleven major woody roots originate from the "root collar" of most trees and grow horizontally through the soil. Their points of attachment to the tree trunk are usually at or near ground level and are associated with a marked swelling of the tree trunk (Figure 2). These major roots branch and decrease in diameter over a distance of one to

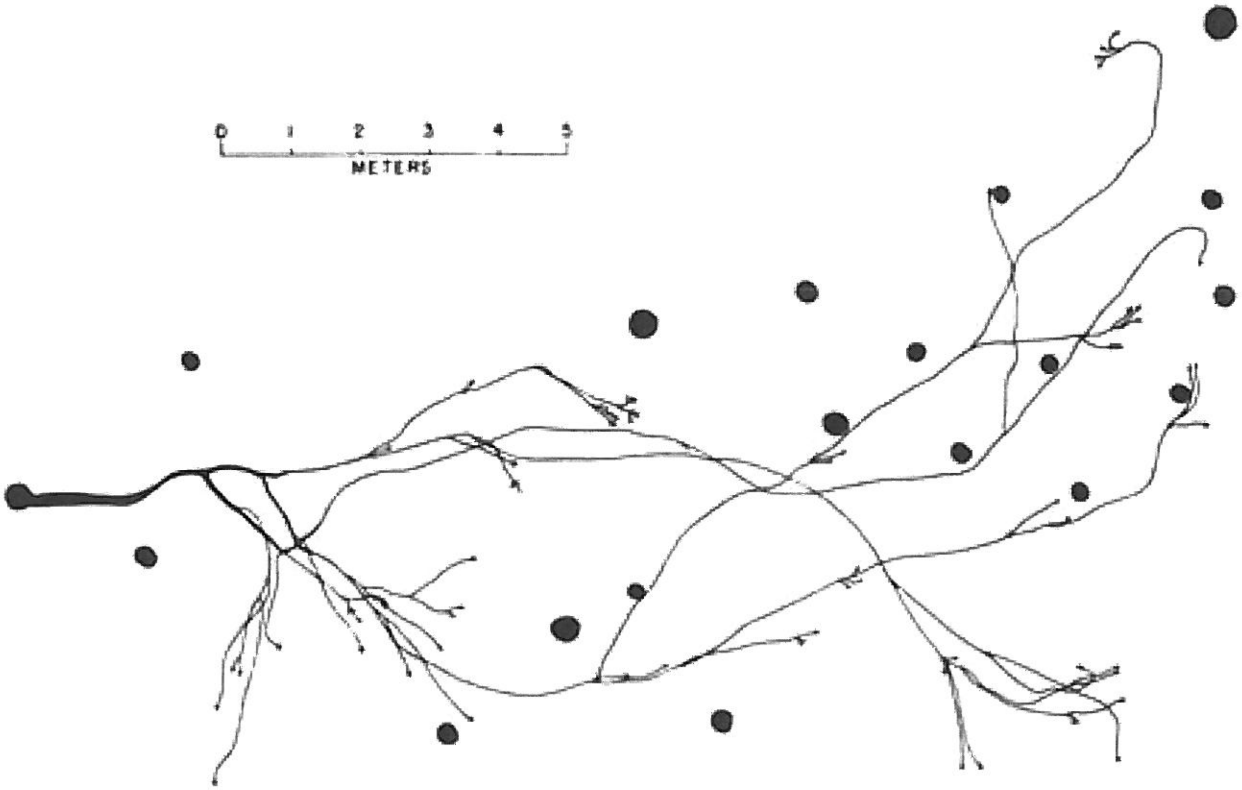


Figure 2. Plan-view diagram of the horizontal woody root system developed from a single lateral root of a red maple about 60 years old. Solid circles show the location of other trees in the stand. Arrows indicate that the root tips were not found; therefore these roots continued somewhat farther than is shown. From Lyford and Wilson, 1964.

four meters (3 to 15 ft) from the trunk to form an extensive network of long, rope-like roots 10 to 25 millimeters (.25 to 1 in) in diameter.

The major roots and their primary branches are woody and perennial, usually with annual growth rings, and constitute the framework of a tree's root system. The general direction of the framework system of roots is radial and horizontal. In typical clay-loam soils, these roots are usually located less than 20 to 30 centimeters (8 to 12 in) below the surface and grow outward far beyond the branch tips of the tree. This system of framework roots, often called "transport" roots, frequently extends to encompass a roughly circular area four to seven times the area delineated by an imaginary downward projection of the branch tips (the so-called drip line).

It is not uncommon to find trees with root systems having an area with a diameter one, two, or more times the height of the tree (Stout, 1956; Lyford and Wilson, 1964). In drier soils, pines and some other species can form "striker roots" at intervals along the framework system. These striker roots grow downward vertically until they encounter obstacles or layers of soil with insufficient oxygen. Striker roots and taproots often branch to form a second, deeper layer of roots that grow horizontally just above the soil layers where oxygen supplies are insufficient to support growth (Figures 3 and 4).

The zone of transition between sufficient and insufficient oxygen supply is usually associated with changes in the oxidation-reduction state and color of the iron in the soil

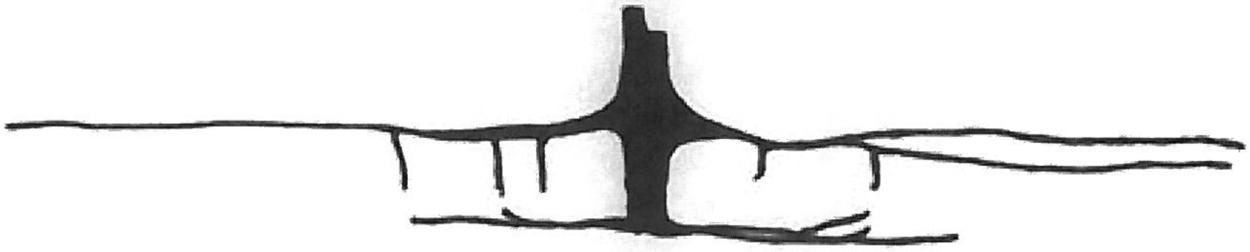


Figure 3. Drawing, not to scale, of framework system of longleaf pine tree grown in well-drained soil with a second layer of roots running in the soil layers where oxygen supplies become limiting.

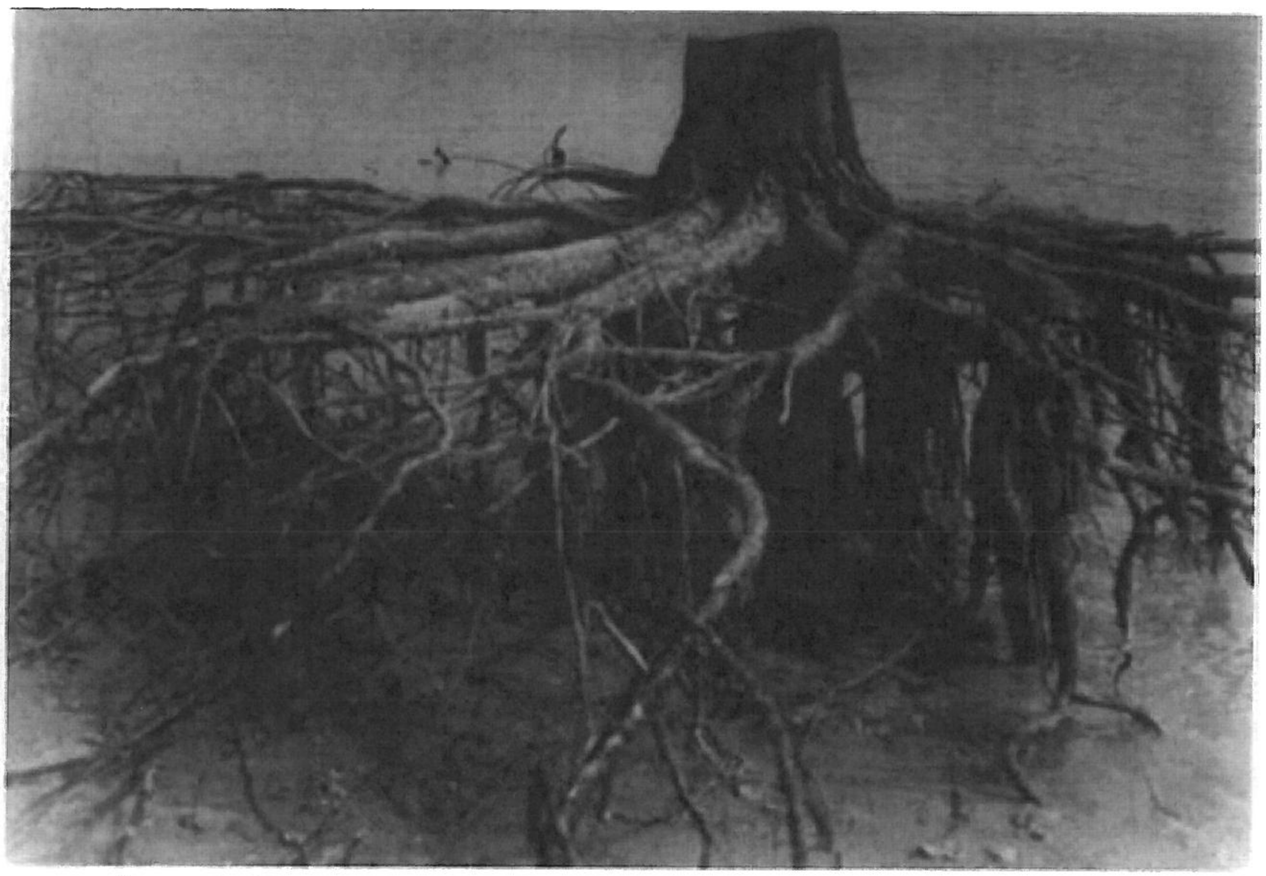


Figure 4. Photograph of framework roots of longleaf pine including striker roots, 90 percent of the surface root system has rotted and washed away, Kerr Lake, North Carolina.

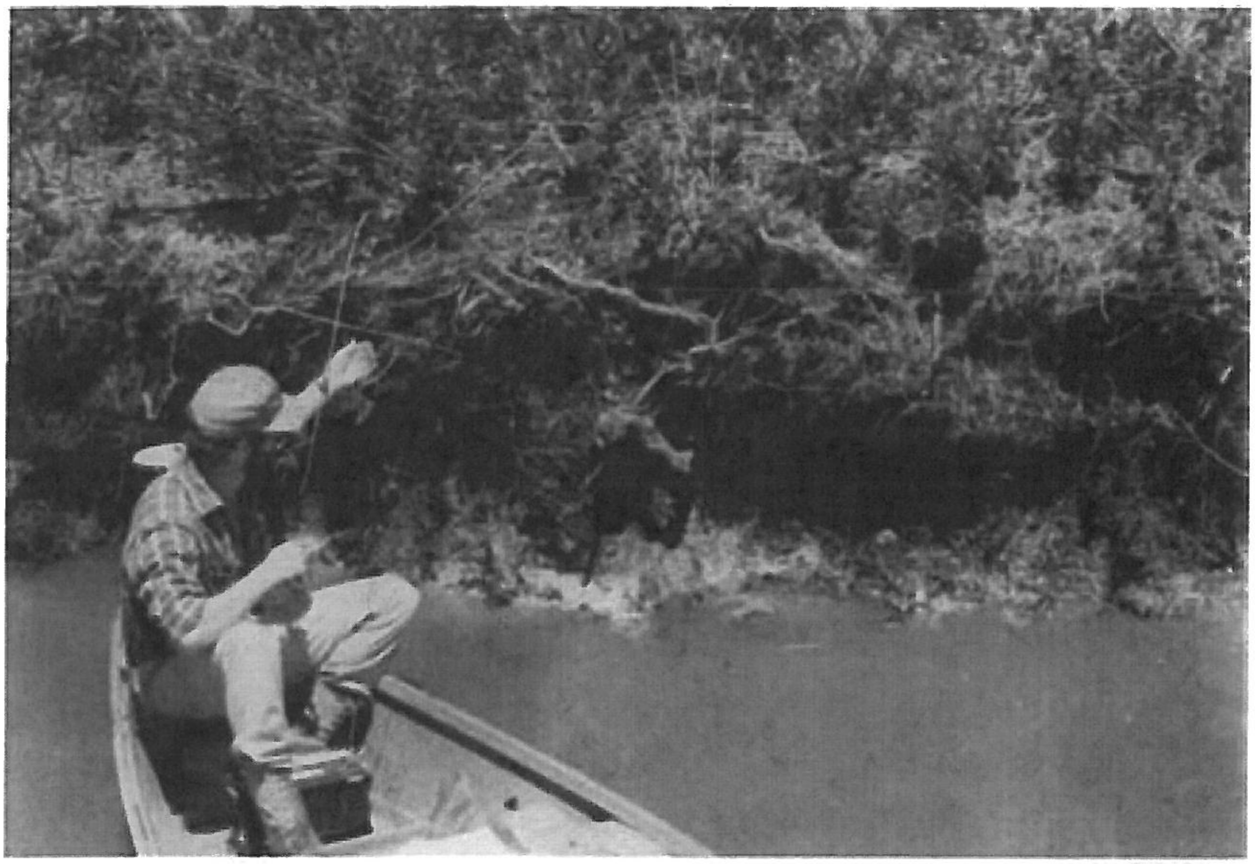


Figure 5. Mat of roots above the permanent water table exposed by digging a drainage canal, Green Swamp, North Carolina. A few species have specialized tissues containing air passages and specialized metabolisms that permit their roots to penetrate several feet below the permanent water table where little or no oxygen is available. Iron oxide deposits are typically associated with such roots

(from reddish-yellow to gray for example). Water can hold less than 1/10,000 the oxygen that air can hold, and limited supplies of oxygen are usually associated with wet soils. Drainage ditches in swamps reveal an impressive concentration of matted roots just above the permanent water table (Figure 5).

Feeder Roots

A complex system of smaller roots grows outward and predominantly upward from the system of framework roots. These smaller roots branch four or more times to form fans or mats of thousands of fine, short, non-woody tips (see Figures 6, 7, 8, and 9). Many of these smaller roots and their multiple tips are 0.2 to 1 millimeter or less in diameter and less than 1 to 2 millimeters long. These fine, non-woody roots constitute the major fraction of the surface of a tree's root system. Their multiple tips are the primary sites of absorption of water and minerals. Hence they are often called feeder roots.

Root hairs may or may not be formed on the root tips of trees. They are often shriveled and non-functional. Symbiotic fungi are normally associated with the fine roots of forest trees, and their hyphae grow outward into the soil to expand greatly the effective surface area of the root system (Figure 10).

The surface layers of soil frequently dry out and are subject to extremes of temperature and frost heaving. The delicate, non-woody root system is killed frequently by these fluctuations in the soil environment. Nematodes, springtails, and other members of the soil microfauna are constantly nibbling away at these succulent, non-woody tree roots (Lyford, 1975). Injury to and death of roots are frequent and are caused by many agents. New roots form rapidly after injuries, so the population and concentration of roots in the soil are as dynamic as the population of leaves in the air above, if not more so.

The crowns of trees in the forest are frayed away as branches rub against one another in the wind. One can easily observe the frayed perimeter of each tree crown by gazing skyward through the canopy of a mature forest. Such "shyness" is not seen below the ground. Roots normally extend far beyond the branch tips, and the framework root systems of various trees cross one another in a complex pattern. The non-woody root systems of different trees often intermingle with one another so that the roots of four to seven different trees can occupy the same square meter of soil surface (Figure 9). Injuries, rocks, or other obstacles can induce roots to deviate 90 degrees or more from their normal pattern of radial growth. These turnings and interminglings of roots make the determination of which roots belong to which tree extremely difficult. Furthermore, natural root grafts

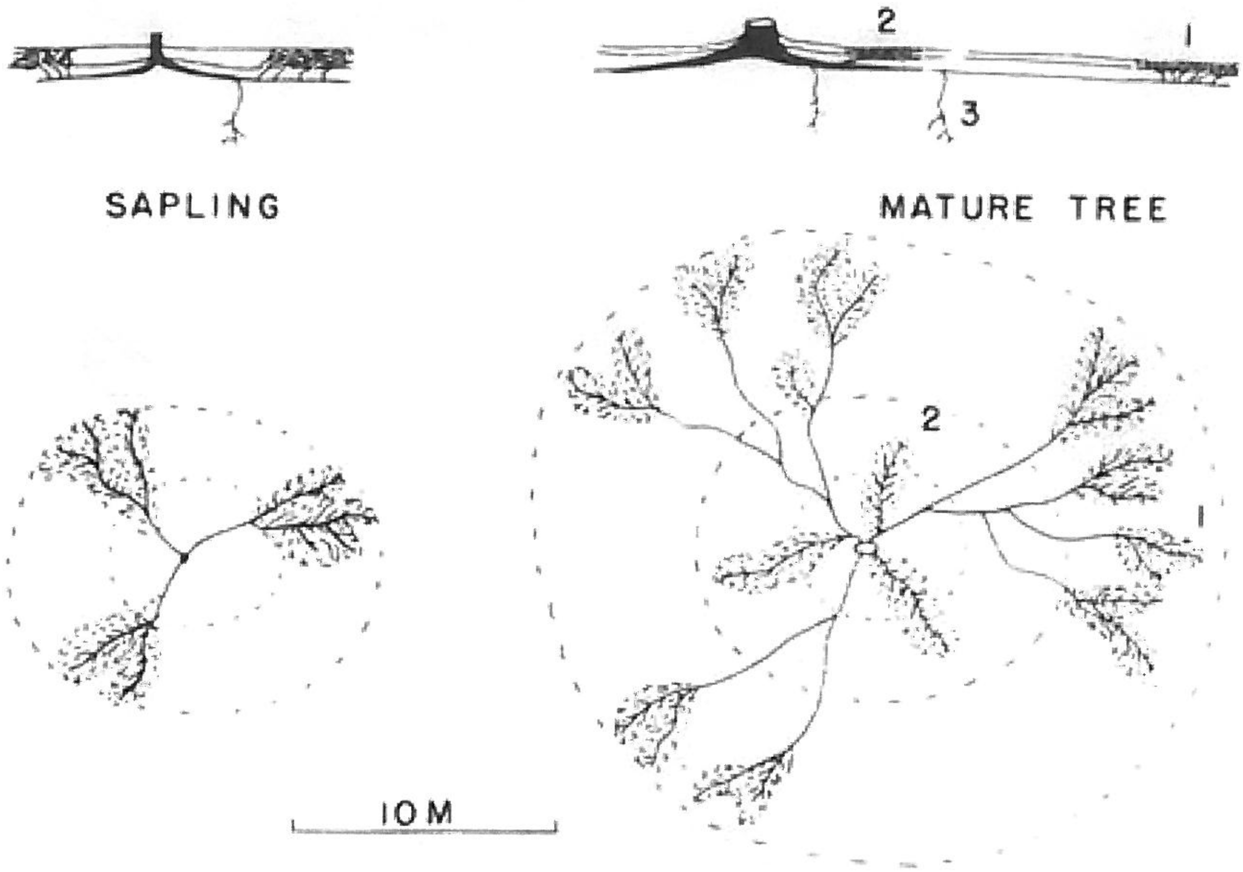


Figure 6. Schematic diagram showing reoccupation of soil area near the base of a mature tree by the growth of adventitious roots. 1) Root fans, growing from the younger portions of the woody roots, have extended to a distance of several meters from the tree 2) Root fans on adventitious roots have only recently emerged from the zone of rapid taper or root collar and now occupy the area near the base of the tree. 3) Vertical roots. From Lyford and Wilson, 1964.

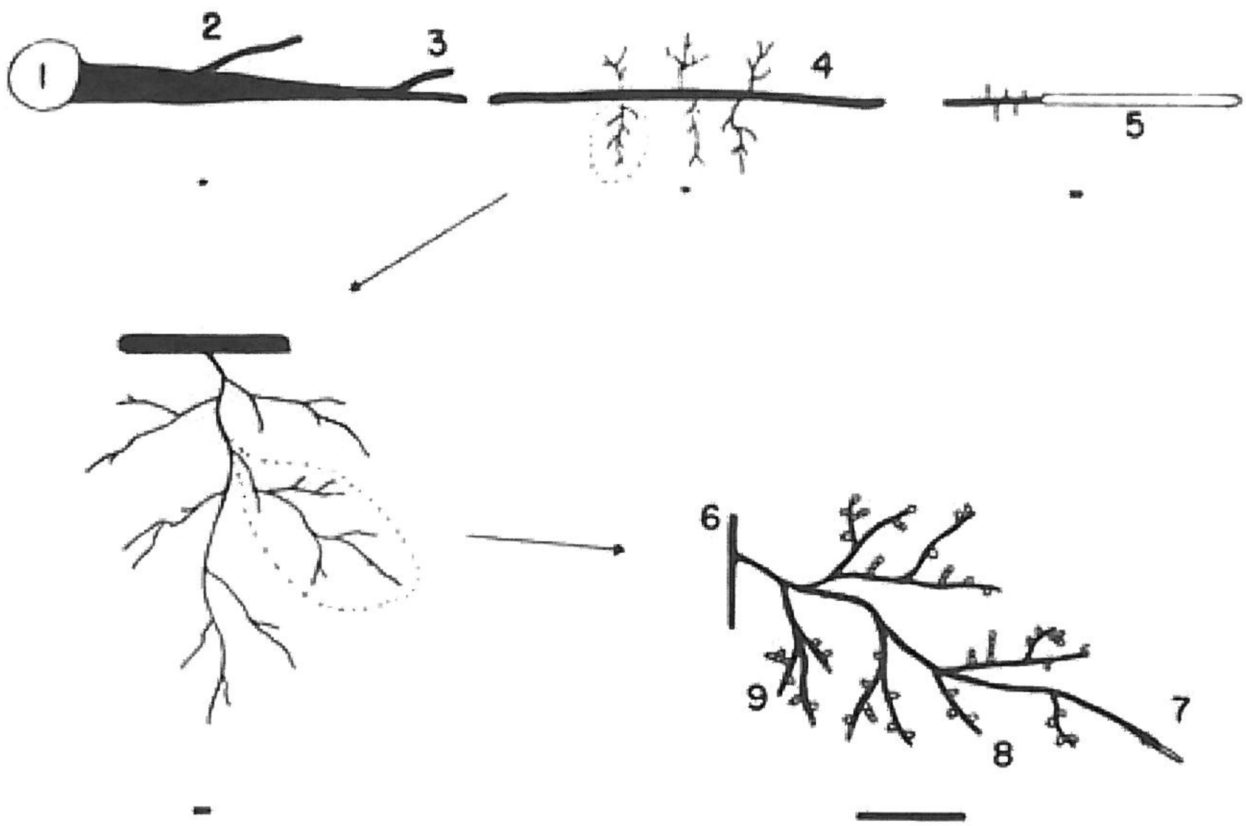


Figure 7. Schematic diagram showing woody and non-woody root relationships. 1) Stem. 2) Adventitious roots in the zone of rapid taper. 3) Lateral root. 4) Non-woody root fans growing from opposite sides of the rope-like woody root. 5) Tip of woody root and emerging first order non-woody roots. 6) Second and higher order non-woody roots growing from the first order non-woody root. 7) Uninfected tip of second order non-woody root with root hairs. 8) Third order non-woody root with single bead-shaped mycorrhizae. 9) Fourth order non-woody root with single and necklace-beaded mycorrhizae. The horizontal bar beneath each root section represents a distance of about 1 centimeter. From Lyford and Wilson, 1964.

commonly occur when many trees of the same species grow together in the same stand.

In summary, large woody tree roots grow horizontally through the soil and are perennial. They are predominantly located in the top 30 centimeters (12 in) of soil and do not normally extend to depths greater than 1 to 2 meters (3 to 7 ft). They often extend outward from the trunk of the tree to occupy an irregularly shaped area four to seven times larger than the projected crown area. Typically, the fine, non-woody tree roots grow upward into the litter and into the top few millimeters of the soil, are multiple-branched, and may or may not be ephemeral.

Why Roots Grow Where They Do

Roots grow where the resources of life are available. They do not grow toward anything. Generally they cannot grow where there is no oxygen or where the soil is compacted and hard to penetrate. In most soils, the number of soil pores, and the consequent availability of oxygen, decreases exponentially with depth below the surface, the amount of clay, and the resistance to penetration (hardness).

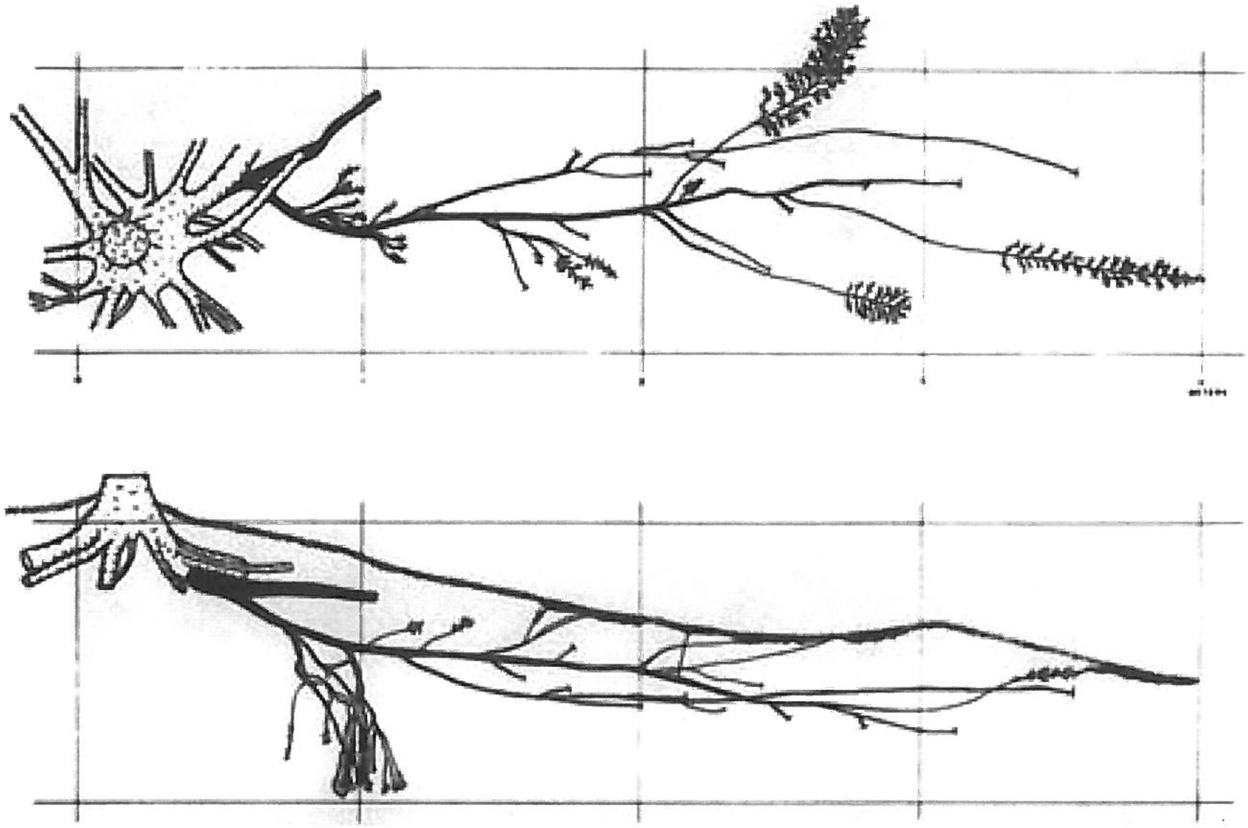


Figure 8. Scale diagrams of horizontal, woody, third order lateral roots of red oak, Quercus rubra. *Emphasis is on the roots that return to the surface and elaborate into many small-diameter non-woody roots in the forest floor. Top view (above), side view (below). The squares are 1 meter on a side. From Lyford, 1980.*

Frost action and alternate swelling and shrinking of soils between wet and dry conditions tend to heave and break up the soil's surface layers. Organic matter from the decomposing leaf litter acts as an energy supply for nature's plowmen—the millions of insects, worms, nematodes, and other creatures that tunnel about in the surface layers. The combined effect of climate and tunneling by animals is to fluff the surface layers of an undisturbed forest soil so that more than 50 percent of its volume is pore space. Air, water, minerals, and roots can penetrate this fluffy surface layer with ease. The decomposing leaf litter also binds positively charged cations (e.g., Ca^{++}, K^{+}, Mg^{++}) and functions to trap plant nutrients and prevent their leaching into the deeper layers of soil. Soil analyses show that the greatest supplies of materials essential to plant life are located in the very surface layers of the soil, and, predictably, this is where most of the roots are located (Woods, 1957; Hoyle, 1965).

Variations in Soil Conditions

Roots are most abundant and trees grow best in light, clay-loam soils about 80 centimeters deep (3 ft) (Coile, 1937, 1952). Conversely, root growth and tree growth are restricted in shallow or wet soils, or in soils that are excessively drained. Roots can and do grow to great depths—10 meters (33 ft) or more—when oxy-

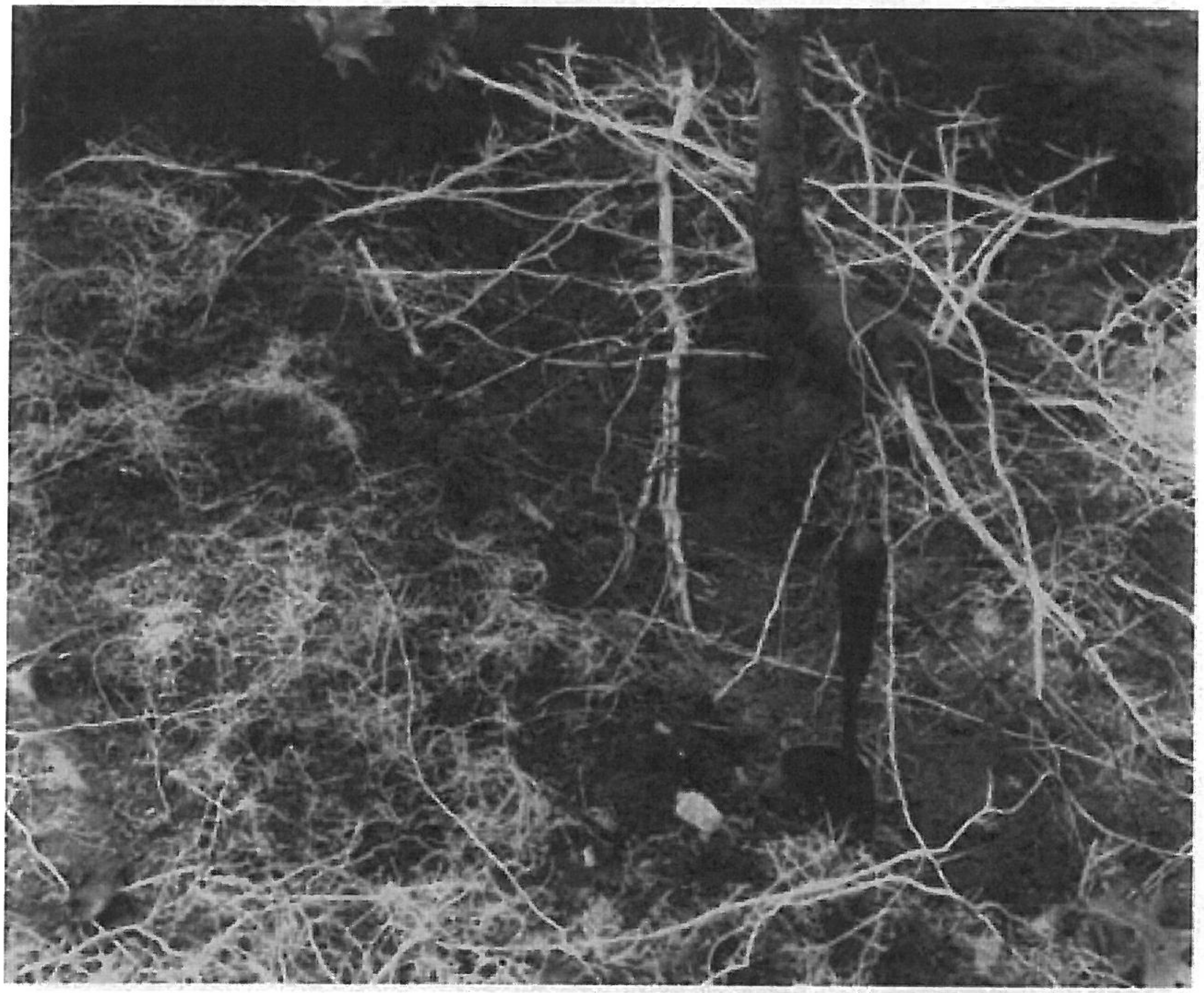


Figure 9. Photograph of roots intermingling in the soil. Mixed hardwood stand, Harvard Forest, Petersham, Massachusetts. The roots in front of the trowel were exposed by careful brushing and pulling away of the litter. The roots in the background were exposed by digging down and destroying the fine surface roots in the process. The roots have been sprayed with whitewash to make them stand out. Photo by T. O. Perry.

gen, water, and nutrients are available at these depths. Tree roots can grow down several meters in deep, coarse, well-drained sands. However, in these cases, overall plant growth is slow, and trees tend to be replaced by shrubs on topographies and soils that are drained excessively.

Adapting to their situation, pines and other trees tend to develop a two-layered root system in the deep sands of the Southeast and other similar sandy locations. They form a surface layer of roots that absorbs water and nutrients made available by the intermittent summer rains, and a deep, second layer of roots that allows survival under drought conditions.

Some soils of the western United States are geologically young and unstructured, originating primarily from the downward movement of eroded particles of rock. Such deposits can form a layer 10 meters (33 ft) or more deep and are extremely dry, especially on the western

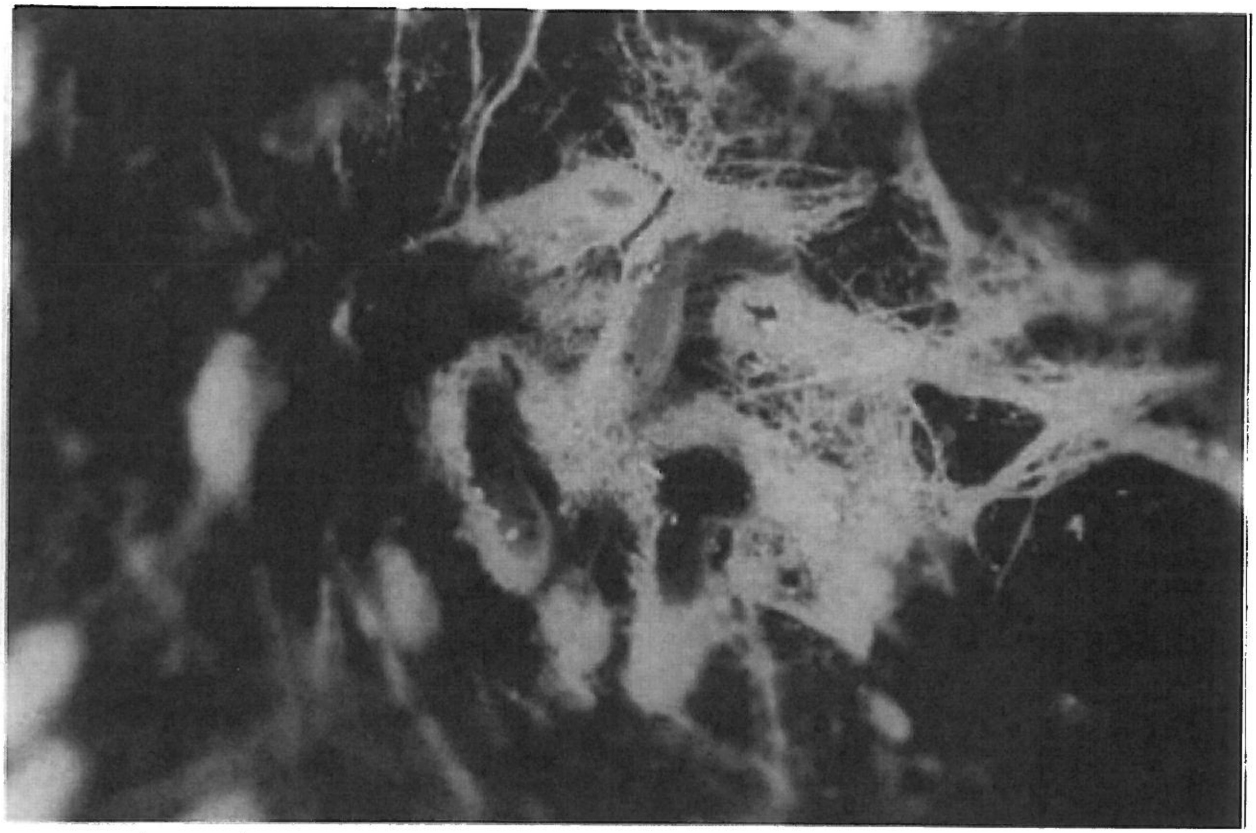


Figure 10. Photograph of root tips growing in the litter of a mixed hardwood forest. The mycorrhizae extend out from the root tips to expand greatly the functional absorptive surface area of the roots they are attached to. Root diameters about 0.5 mm. Photo by Ted Shear, North Carolina State University.

slope of the Sierras where summer rains are light and infrequent. Most water in the soils of this region originates from winter rains and snowmelt that travel along the surface of the unbroken bedrock that lies below the soil layer. Seedling mortality in such climates is extremely high, and years with sufficient moisture to permit initial survival are infrequent. Growth takes place predominantly in the early spring, and those trees that manage to survive and grow in the area are characterized by a taproot system that plunges down and runs along the soil-rock interface. Deep cuts for superhighways sometimes reveal these roots 15 meters (50 ft) or more below the surface.

Some trees, like longleaf pine (*Pinus palustris*), have made special adaptations to insure survival and growth on sands and other deep soils. During the initial stage of establishment, the tops of longleaf pine seedlings remain sessile and grass-like for four or more years while the root system expands and establishes a reliable supply of water. Only then does the tree come out of the "grass stage" and initiate height growth.

Spruces, willows, and other species grow characteristically on wet sites where oxygen supplies are very limited. Their root systems tend to be shallow and multi-branched. Tupelo, cypress, and other species of the swamps and flood plains have evolved specialized anatomies that permit conduction of oxygen 30 centimeters (12 in) or more below the surface of the water and special metabolisms that eliminate alcohols, aldehydes, and other toxic substances produced when fermentation replaces normal respiratory metabolism. Many such flood-plain species can survive the conditions of low soil oxygen that result from several months of flooding (Hook et al., 1972).

Other species, particularly cherries and other members of the rose family, are especially sensitive to conditions where oxygen supplies limit growth. Cherry roots contain cyanophoric glucosides, which are hydrolized to form toxic cyanide gas when oxygen supplies are limited (Rowe and Catlin, 1971). Flooding that lasted less than 24 hours killed most of the Japanese cherry trees around Hains Point in Washington, D.C., following Hurricane Agnes in 1973. Sediment buildup, which in some locations exceeded 20 centimeters (8 in), also contributed to this mortality.

There are important genetic differences in the capacity of tree species and varieties to tolerate variations in soil chemistry, soil structure, or oxygen supply (Perry, 1978). The distribution of trees in the landscape is not random. There is no such thing as a "shallow-rooted" or a "deep-rooted" species of tree. On the one hand, the roots of flood-plain species such as cypress, tupelo, maple, and willow, which are generally thought of as "shallow," will grow deep into the soil and down sewer lines if oxygen and water supplies are adequate. On the other hand, the roots of pines, hickories, and other upland species, which are generally thought of as "deep," will stay close

Figure 11. Roots growing in the crevices between bricks. There was no oxygen below the bricks that overlaid a compacted clay soil on the North Carolina State University campus. Tree roots commonly follow cracks, crevices, and other air passages underneath pavement. Photo by T. O. Perry.

to the surface if the soil is too compact, or if oxygen supplies below the surface are limited.

Roots grow *parallel* to the surface of the soil so that trees on slopes have sloping root systems that actually grow uphill. In search of nutrients, roots often grow along cracks, crevices, and through air spaces for unbelievable distances under the most impermeable pavements and inpenetrable soils (Figure 11). Roots commonly grow down the cracks between fracture columns ("peds") in heavy clay soils they could not otherwise penetrate.

Temperatures and Tree Roots

The roots of trees from temperate climates, unlike their shoots, have not developed extreme cold tolerance. Whereas the tops of many trees can survive winter temperatures as low as -40 to -50 degrees C (-40 to -60 F), their roots are killed by temperatures lower than -4 to -7 degrees C (20 to 25 F) (Beattie, 1986). In areas that experience severe cold, such as northern Europe or Minnesota, a good snow cover or a layer of mulch can often prevent the ground from freezing completely during the winter (Hart, Leonard, and Pierce, 1962). By repeatedly digging up, measuring, and then reburying them, researchers have observed that roots can grow throughout the winter—whenever soil temperatures are above 5 degrees C (40 F) (Hammerle, 1901; Crider, 1928; Ladefoged, 1939).

One of the subtle impacts of raking leaves in the fall is that it exposes roots to destructive winter air temperatures that they would ordinarily be insulated from by the layer of leaves. Similarly, the potted trees so common in the central business districts of northern cities seldom survive more than a few years because their roots are exposed to air temperatures that are substantially lower than those of the soil. Skilled horticulturists are careful to move potted perennials to sheltered locations where they will be insulated from the full blast of winter.

Contrariwise, soil surface temperatures in summer are often hot enough to "fry an egg," as newspapers boastingly report. Such temperatures, which can be as high as 77 degrees C (170 F), also fry plant roots. Fortunately, most soil temperatures decrease rapidly with depth, and roots only a few millimeters below the surface generally survive, particularly if an insulating layer of mulch is present. As in the case of freezing temperatures, plants growing in containers are more susceptible to heat damage because of the lack of insulation. Roots, like shoots, grow most rapidly when temperatures are moderate—between 20 and 30 degrees C (68 and 85 F) (Russell, 1977).

Misconceptions about Tree Roots and the Practical Consequences

The rope-like roots at or near the surface of the soil have been obvious to diggers of holes for fence posts and ditches for thousands of years, as obvious as Galileo's "shadow of the earth on the moon." However, trees can become huge—larger than the largest whale—and very few human beings have had the privilege of actually seeing even a small fraction of the root system of an entire tree. Illustrations in textbooks, in natural history books, and in manuals of landscape architecture or of tree care are usually the creations of artistic imaginations and highly inaccurate (Figure 12).

An insurance company, hearing of Walter Lyford's work on tree roots, wanted to develop an idealized picture of tree roots, penetrating the depths of the soil and securely anchoring the tree in an upright position, as the symbol of the security its customers would achieve by purchasing its insurance. The company commissioned an artist to visit Lyford and examine his findings in order to prepare a logo of tree roots for its advertising campaigns. The projected logo and advertising scheme were never started because it is impossible to portray an entire tree with its roots accurately on the page of a typical textbook.

As an example, take a healthy, open-grown oak tree, 40 years old, with a trunk 21 meters (70 ft) tall and 0.6 meters (2 ft) in diameter. The spread of the branches of such an open-grown tree is rarely less than two-thirds of the

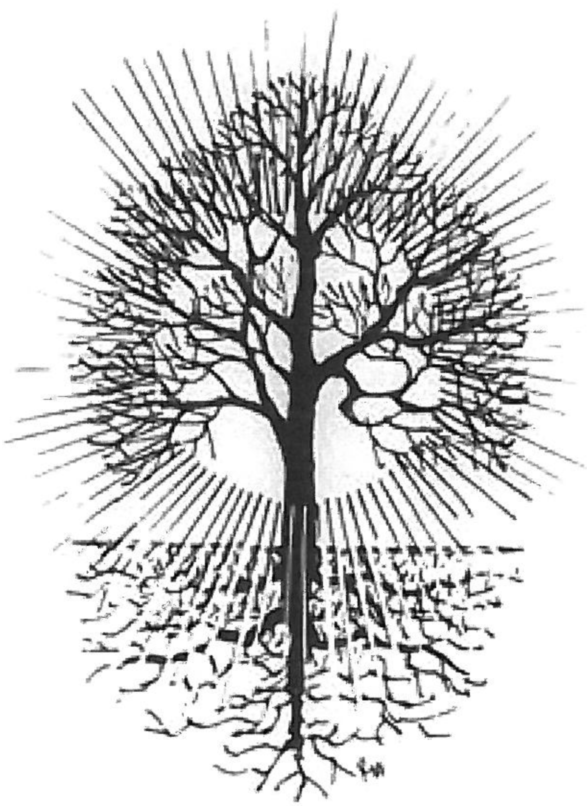


Figure 12. Roots do not grow as this artist's conception indicates. Inaccurate illustrations like this one have led to harmful practices in the management of trees in both forest and urban situations. Illustration from a brochure produced by the Society of American Foresters.

height of the tree and is often equal to or greater than the height. The root system of such a tree usually extends more than 9 meters (30 ft) beyond the tips of the branches, generally forming a circle with a diameter two or more times the height of the tree. The problems of scale are overwhelming and can be appreciated by examining Figures 13 and 14.

A significant portion of the root system of all trees in all soils is concentrated in the top few centimeters of soil. Tree roots grow right into the litter layer of the forest, in among the grass roots of suburban lawns, and in the crevices of the bricks, concrete, and asphalt of the urban landscape (Figures 11 and 15). For this reason, fertilizer broadcast on the surface of the soil is immediately available to tree roots. It does not have to move "down" into the soil. Even the reportedly immobile phosphates are readily available to tree roots. Careful research has failed to show any differences in the response of trees to fertilizer placed in holes versus that broadcast on the soil surface (Himelick et al., 1965; van de Werken, 1981).

Foresters broadcast fertilizers on millions of acres of land and achieve rapid and large returns on their investments. *Except for where slow-release fertilizers are used for special effects, there is no justification for "tree spikes" or other formulations of fertilizer in holes bored in the ground or for fertilizer injected into the soil.* The root systems of one-year-old seedlings can take up nutrients ten or more feet from their trunks. The absorbing roots of larger trees commonly extend from their trunks to twenty feet beyond their branch tips. The tree will benefit from having fertilizer broadcast over this entire area.

Herbicides and other chemicals should be used only with extreme care near trees and shrubs since their roots extend far beyond the tips of the tree's branches. When they grow in a lawn, trees can be thought of as "broad-leaved weeds" and application of the common lawn herbicide dicamba (also called "Banvel®") by itself, in combination with other herbicides, or in combination with fertilizers can injure trees. This chemical or its formulations, when improperly applied, can distort and discolor leaves and even defoliate and kill trees. Several tree and lawn-care companies are selling these chemicals mixed with fertilizer at home garden centers or are applying the chemical on a contract basis. Improper use of dicamba will distort the leaves of oaks and sycamores and defoliate and kill more sensitive trees like yellow poplar.

"Roundup®" (glyphosate) herbicide and its formulations are supposedly inactivated when they hit the soil or dirty water, but they do not have to actually penetrate the soil to interact with tree roots growing in a litter layer, lawn, or mulch. Dogwoods and other trees can show extreme leaf distortion and crown dieback even when herbicides do not strike the green portions of their trunks or their foliage. Since tree roots often grow in cracks and crevices of pavement, applications of sterilants and herbicides to kill weeds in these situations can inadvertently kill trees 20 meters (60 ft) or more away from where they are applied (Figure 15).

Remember, natural root grafts are common among trees of the same species, meaning that herbicides applied to kill one tree can flash back along root grafts to kill trees that were not treated. In addition, many trees, such as poplars, sweet gum, and American beech, send up sprouts from their roots that can be damaged when an herbicide is translocated from a treated stem through the root system to an untreated stem.

In larger residential lots, say roughly 32 meters wide by 45 meters deep (105 ft by 150 ft), the roots of a large tree will commonly occupy the entire front or back yard and

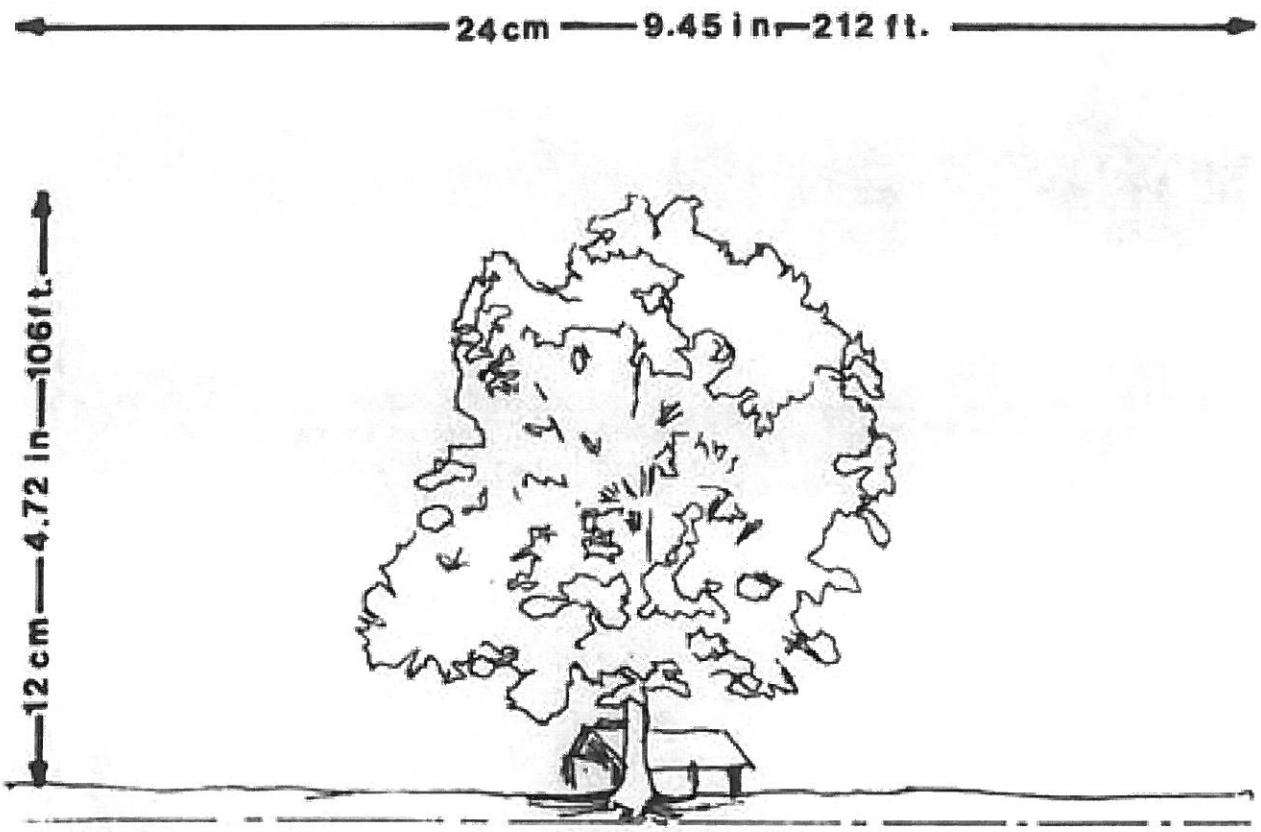


*Figure 13. Scale drawing of Memorial Oak Tree (*Quercus alba*), Schenck Forest, North Carolina State University. The original drawing was made by tracing the projected image of the tree (Figure 14) onto a piece of paper with a pen that produced a line 0.2 millimeters thick, the thinnest line that can be reproduced in most publications. The original drawing was 24 centimeters wide (9.5 in) and represents a typical root spread of 65 meters (212 ft). The Schenck Oak is about 33 meters tall (106 ft) and is represented on the vertical axis as 12 centimeters (4.7 in). The original drawing represented a 274-fold reduction in the actual height of the tree. Most branches and 90 percent of the tree roots would not be visible if drawn to this scale. Indeed the width of a typical white oak leaf would be about the thickness of the lines in the drawing, and most of the roots would be located in the soil layer represented by the thickness of the line representing the soil surface. The dash-dot line is located 1.5 meters (5 ft) below the surface and very few if any roots would penetrate beyond this depth in a representative soil.*

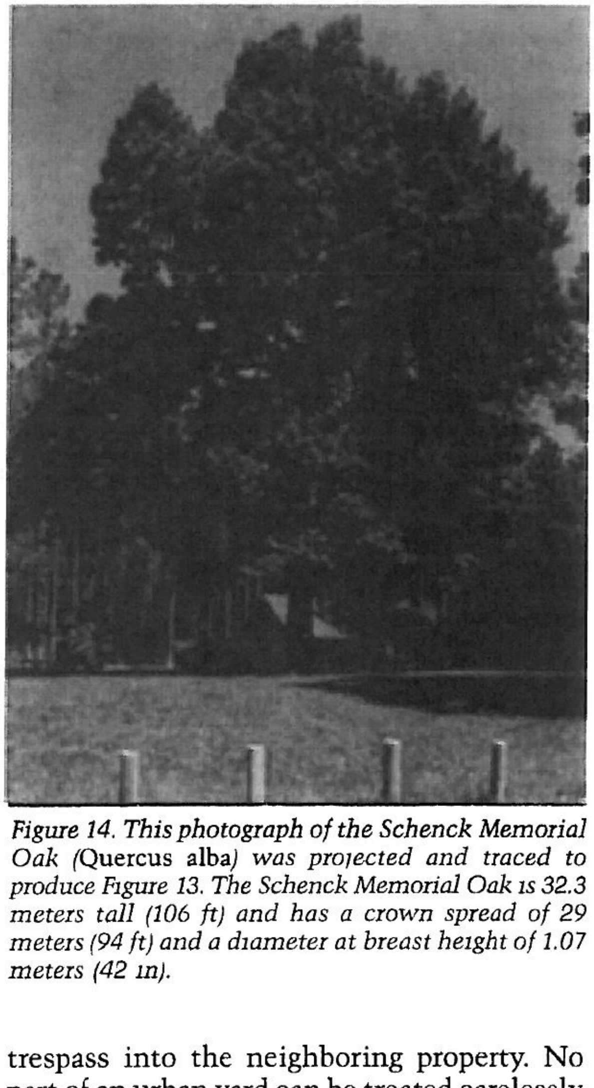


*Figure 14. This photograph of the Schenck Memorial Oak (*Quercus alba*) was projected and traced to produce Figure 13. The Schenck Memorial Oak is 32.3 meters tall (106 ft) and has a crown spread of 29 meters (94 ft) and a diameter at breast height of 1.07 meters (42 in).*

trespass into the neighboring property. No part of an urban yard can be treated carelessly with herbicides. Care must also be taken in disposing of toxic chemicals, deicing salts, old crankcase oil, and high-strength detergents. Careless disposal of chemicals and improper use of herbicides are among the most common causes of tree death in urban areas.

Soil Compaction

The largest single killer of trees is soil compaction—compaction from excessive use of city parks by people, from excessive grazing by livestock (including zoo animals)—and even from the feeding activities of pigeons, whose small feet exert more pressure per square centimeter than heavy machines. Trees are also killed by compaction from construction equipment and by compaction from cars in unpaved parking areas. Compaction closes the pore spaces that are essential to the absorption of water and oxygen and hardens all but the sandiest of soils so that roots cannot penetrate them, even when oxygen supplies are adequate (Patterson, 1965).

Excessive use of mulch can induce fermentation, immobilize nutrients, and cut off the oxygen supply, thereby killing trees. Use of broad expanses of plastic, either as a surface covering or under a layer of organic mulch or stone, is a sure way to cut off oxygen and kill trees. As an alternative, porous landscape fabrics, which permit water and air to penetrate the soil, are a vast improvement over plastic.

The maximum leaf area index that a normal ecosystem can support is about 12, when both surfaces of the leaf are counted. The corresponding maximum root area index is between 15 and 30. A large planting of lawn, annuals, or shrubs underneath existing trees often results in a reduction in the root and leaf area indexes of the trees. Gardening under trees—planting lawns, daffodils, liriope, or azaleas and rhododendrons—tears up tree roots and will produce a corresponding death of twigs and branches in the crown of the tree. Surprisingly, turning over the soil when gardening is another common cause of tree death in urban situations. Gardeners should be aware of the biological compromises that need to be made in order to achieve the proper balance between trees and garden plants.

It should be obvious by now that any earth moving or regrading that cuts or buries tree roots will result in the death of a corresponding portion of the branches in the tree. Unfortunately, this simple fact is often ignored when utility lines, parking lots, or even irrigation lines are being installed. Smearing six inches of clay from the mineral soil layer over the root system of an established tree or covering its roots with pavement can be as lethal as cutting it down with a chain saw.

When a new house is constructed, the yard may have six different trench lines cut from

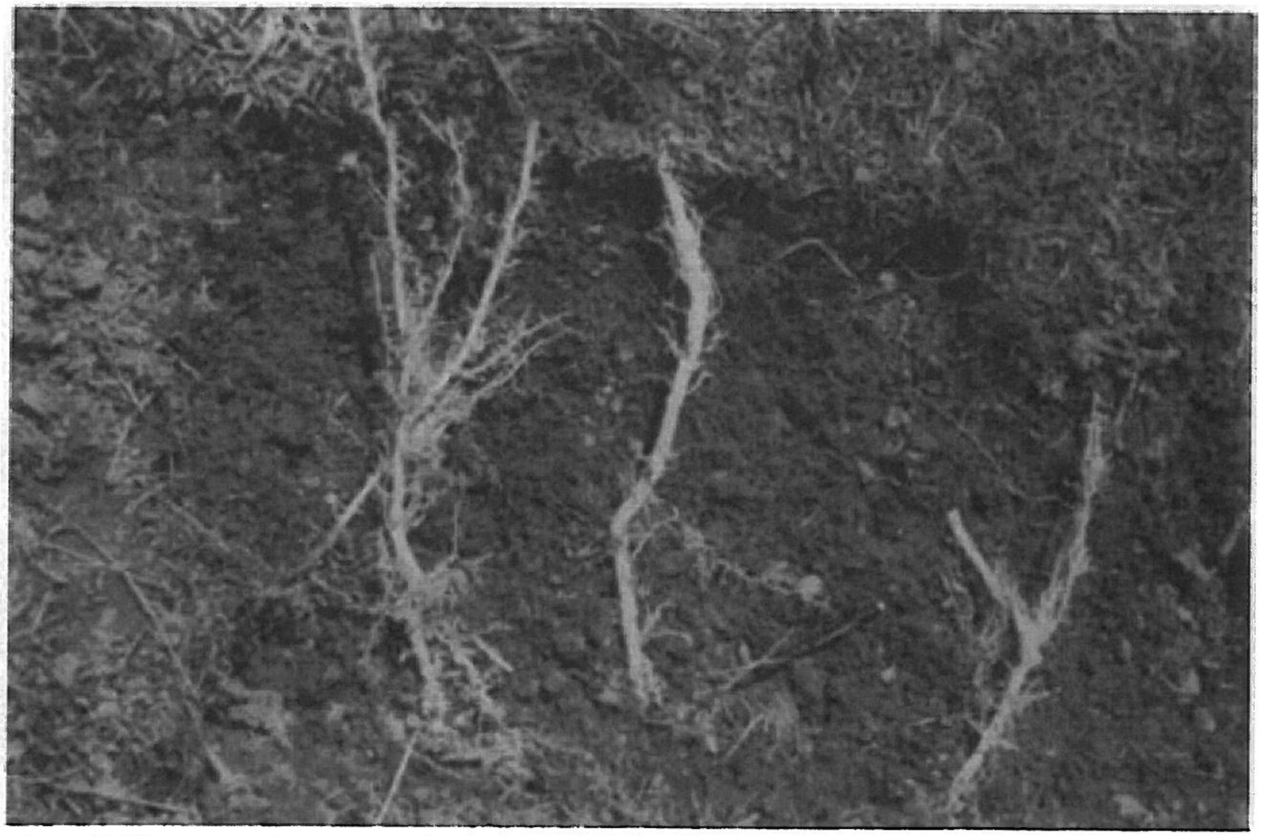


Figure 15. Many roots of trees grow closely intermingled with grass roots in the few top centimeters of a lawn. Therefore fertilizers and herbicides do not have to move down into the soil in order to affect trees.

the street to the house—for water, sewer, electricity, telephone, gas, and cable television. Over 90 percent of the pre-existing tree roots in the front yard are destroyed during construction and utility-line installation. In addition, the soil structure of the entire lot is usually completely destroyed by heavy equipment and the spreading of excavated heavy soil on top of undisturbed soil. The proud new homeowners are left to figure out for themselves why all their trees have severe crown dieback and continue to decline (or die) for a decade or more after they have moved in.

Saving Trees

People often try to save trees under impossible circumstances. The root systems of a large tree often occupy the entire building site, and it is impossible to complete construction without damaging some or all of its roots. By tunneling or concentrating utility-line installations in a single trench, this damage can be minimized. Careful watering and thinning of the tree crowns to compensate for root losses can buy time until new roots can be produced.

It is often wiser and cheaper to accept a bad situation and cut down a tree before construction begins rather than to try to preserve a large specimen in the middle of a construction site. Performing tree surgery after construction is complete—and crown dieback is obvious—will be more expensive and may be too late to save the tree. Planting a young, vigorous sapling after construction is completed not only may be more cost effective but also may provide greater long-term satisfaction.

In urban situations, soil compaction and limited oxygen supplies are the major restraints to growing trees in city parks and in highly paved areas. Inadequate supplies of water are usually secondary to these two fundamental problems. In terms of surviving these conditions, trees adapted to swamps and flood-prone areas, where soil oxygen tensions are normally low, often perform the best. Indeed, most of our common street trees, including pin oak, willow oak, sycamore, silver maple, and honey locust are flood-plain species that can thrive in compacted, urban soils. Different trees grow on different sites in nature, and it is unreasonable to expect species adapted to well-drained upland or sloping topography to possess roots that would grow well in the compacted soils of a heavily used recreation area or in areas with extensive pavement.

There are hundreds of ways to kill or injure trees. They range from zapping them with laser beams (as in the Omni shopping mall of Atlanta) to girdling them with the grinding tugs of dogs chained outside of college classrooms. Many tree deaths are accidental and involve misconceptions about the structure and function of tree roots. Why else would the City of New Orleans keep a rhinoceros caged on the root system of its symbolic Centennial Oak? Why else would the State of North Carolina use a ditch-witch in late June to install an irrigation system among the stately trees of the old Capitol building? Why else would the National Capital Parks in Washington, D.C., allow rows of newly planted, eight-inch-caliper trees in front of the new Aerospace Center to remain unwatered while the need for irrigation was recognized and supplied to trees on the mall across the street?

People must know where tree roots are located and what they require if healthy trees are to become a gratifying part of the urban environment.

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47

City Trees Removed (upper/lower)		MAY	YTD	2014
		4(3/1)	64(47/17)	142
se Santa Fe & 4th	28" Monterey pine			
Nw 6th & Lincoln (1st Murphy Park)	20" Monterey cypress			
w/ Casanova bet Ocean & 4th	14" Monterey pine			
e/ Casanova bet. Ocean & 4th	12" acacia			

City Trees Planted (upper/lower)		MAY	YTD	2014
		20(13/7)	57(25/32)	39
n/ ocean bet. Lincoln & Monte Verde	5 gal. Canary Island pine			
w/ San Carlos bet. Ocean & 7th	5 gal. Monterey pine			
s/ 11th bet Camino real & Carmelo	5 gal. Monterey cypress			
s/ ocean bet. Dolores & lincoln	5 gal. Canary Island pine			
e/ San Carlos bet 6th & Ocean	15 gal. oak			
w/ Junipero bet Ocean & 7th	5 gal. Monterey pine			
s/ 7th bet. Junipero & Mission	15 gal. oak; 5 gal. Canary Island pine			
sw 8th & Junipero	1 gal. oak			
w/ Junipero bet 8th & 9th	2 - 1 gal. Monterey pines; 1 gal. oak			
ci Junipero bet Ocean & 7th	1 gal. Monterey pine			
ci Junipero bet. 7th & 8th	2 - 1 gal. Monterey pines			
ci Junipero bet. 9th & 10th	5 gal. Monterey pine			
ci Junipero bet 10th & 11th	1 gal. Monterey pine			
ci Junipero bet 11th & 12th	1 gal. oak			
e/ Dolores bet. 7th & 8th	15 gal. Pistache; 15 gal. Island oak			

Private Removal Permits (upper/lower)		MAY	YTD	2014	Private Planting Requirements
		9(13/4)	45(34/32)	114	
w/ Casanova bet. 4th & Ocean	28", 24" Monterey pines				2 - 5 gal. upper canopy
w/ Santa Rita bet. 2nd & 3rd	20", 24" Monterey pines				5 gal. upper canopy
w/ Santa Rita bet. 1st & c.l.	16", 25", 36" blue gum eucalyptus				15 gal. lower canopy
e/ San Carlos bet. 13th & Santa Lucia	30" Monterey pine, 10" oak				5 gal. upper canopy
e/ Dolores bet. Vista & 1st	30", 35" Monterey pines				
w/ Mission bet. 11th & 12th	12" Monterey pine				
ne Lopez & 4th	2- 10" black acacias				
e/ Casanova bet. Palou & 2nd	32", 21" Monterey pines				
e/ Camino Real bet. Ocean & 4th	16" oak				5 gal. upper canopy

Private Planting Requirements	MAY	YTD	2014
	5(5/1)	13(11/5)	49

Construction Permits (remove/prune)		MAY	YTD	2014	Construction Planting Requirements
		3(1/7)	7(3/12)	15	
w/ Casanova bet. 11th & 12th	14" redwood				48" box upper canopy
w/ Camino Real bet. 12th & 13th	18" black acacia; 9", 8", 6" holly; 12" oak				1 gal. pine; 8 - 5 gal. oaks
s/ 11th bet Torres & MTNP	20", 12" oaks				24" box oak

Construction Planting Requirements	MAY	YTD	2014
	3(2/9)	6(4/10)	9

Private Pruning Permits		MAY	YTD	2014
		1	9	20
e/ San Carlos bet. 13th & Santa Lucia	2 - 8" black acacia limbs			

Trees Under Care

City watered	130
City irrigated	12
Private watered	4

City Pruning by contractors			
level I - total tree	1	30	227
level II - hazard /emergency	2	6	24
level III - specific purpose	0	2	17

Construction Finals	Planted
e/Guadalupe bet 5th & 6th	5 gal. upper canopy

Contracts

Iverson Tree Service - removal of 21 trees, 16 stumps