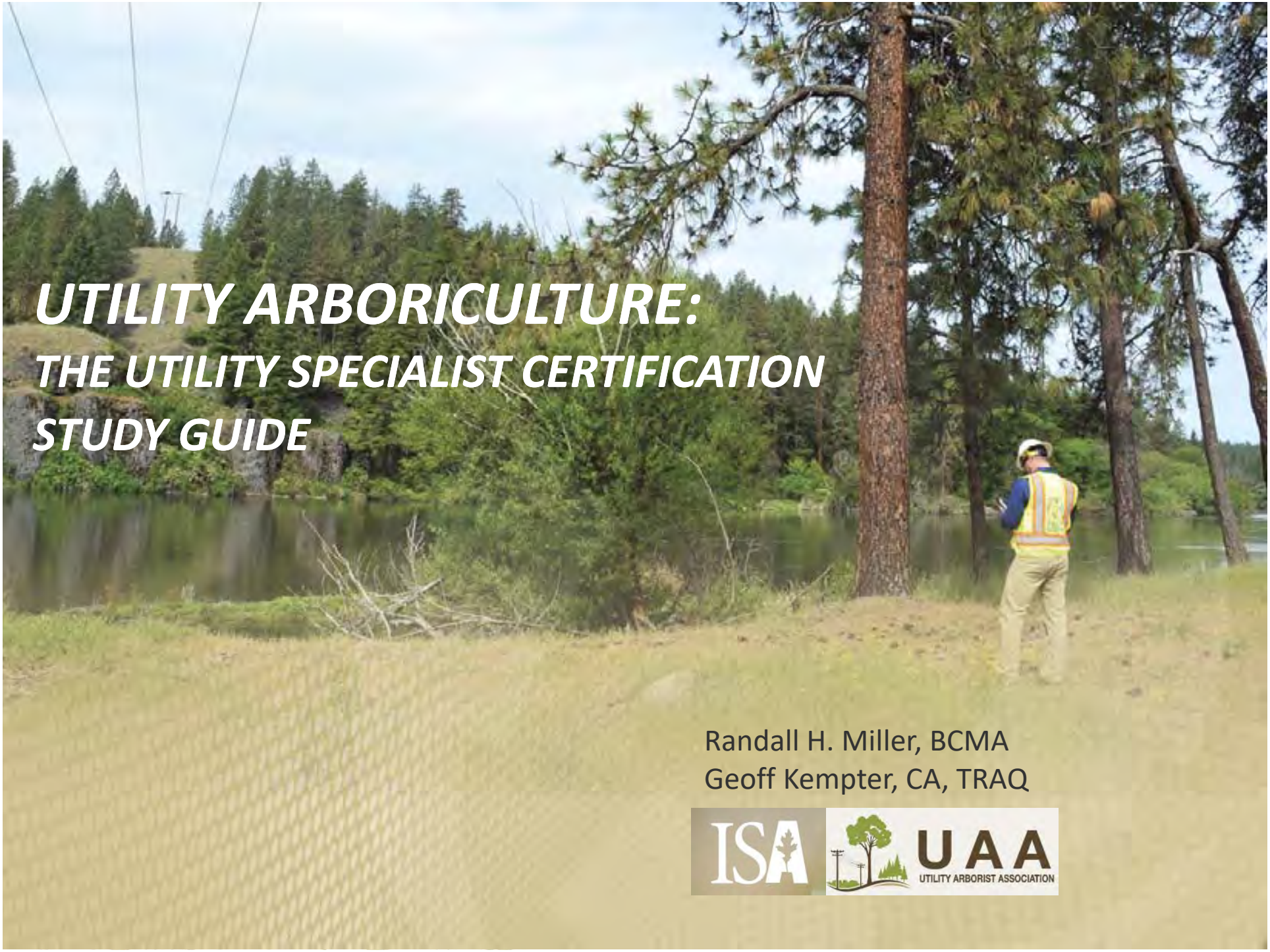


UTILITY ARBORICULTURE:
THE UTILITY SPECIALIST CERTIFICATION STUDY GUIDE

Randall H. Miller, BCMA
Geoff Kempter, CA, TRAQ

ISA
UAA
UTILITY ARBORIST ASSOCIATION

TREE FUND

Cultivating Innovation

INTRODUCTION

- A brief history and background of utility vegetation management (UVM) and the utility specialist credential
- An overview of the new study guide, and how it should be used.

CORRIDOR MANAGEMENT

Ancient Roman Road

The need for clear corridors goes back to the beginning of civilization.

Trees are a valuable resource, but they can be a problem when they grow in the wrong place, or fail catastrophically.

TELEGRAPH – MID 19TH CENTURY

Vegetation was maintained with little knowledge of modern utility arboriculture.

- No research, no standards or BMPs, no PPE, no credentials, no mechanization, no herbicides

By Samuel Calvert (**1828-1913)**
https://commons.wikimedia.org/w/index.php?curid=6854174

CONTROVERSY

From the beginning, there have been conflicts with tree owners and tree advocates.

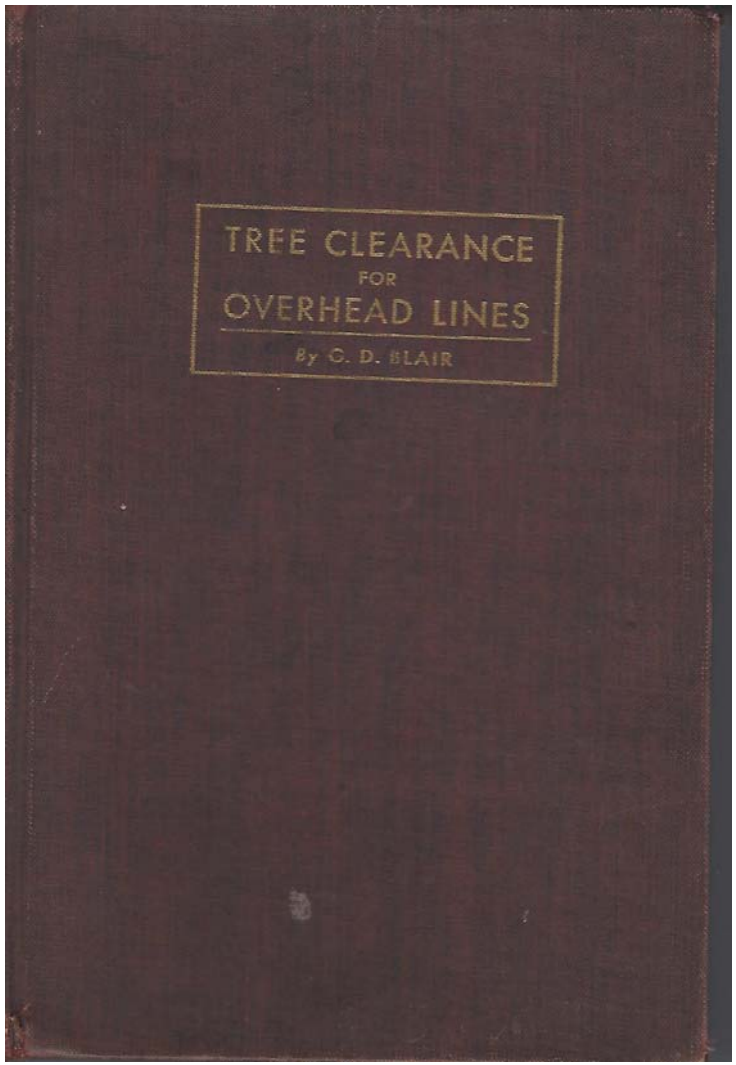
"…lopping of the branches of roadside trees, handled in the most ruthless way possible,…"

-Scotland, 1873

"…some of the finest oaks, elms and maples have been recklessly mutilated and disfigured….There is room enough in the world both for the trees and the wires…"

-Massachusetts, 1892

1940



TREE CLEARANCE

FOR

OVERHEAD LINES

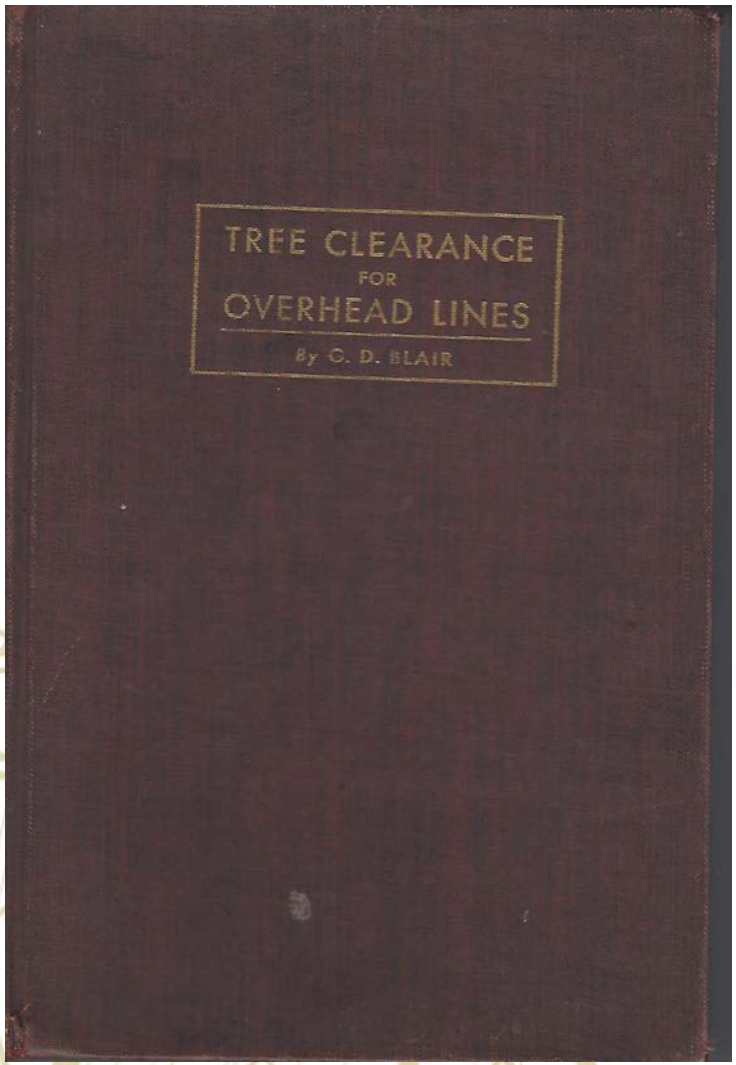
A Textbook of Public Utility Forestry

by

G. D. BLAIR
Chief Forester
Consumers Power Company, Jackson, Michigan

First Edition
ELECTRICAL PUBLICATIONS, INC.
360 N. Michigan Avenue, Chicago
1940

1940

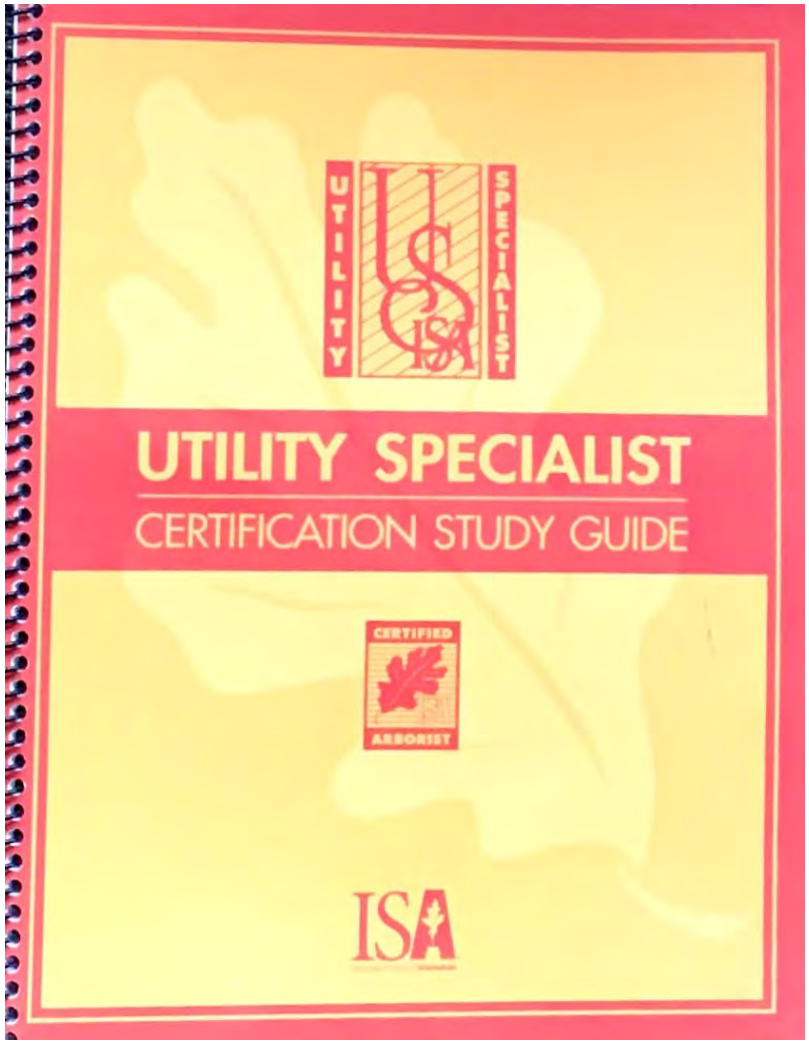


"Trees must be vigorous and beautiful; overhead line service must be continuous and dependable. In this measure of quality, each is essential to the happiness of civilized people."

1991 CERTIFIED ARBORIST

1997 CERTIFIED UTILITY SPECIALIST

2002



- 84 pages, 5 chapters:
  - Tree Biology and Pruning
  - Vegetation Management
  - Electrical Knowledge
  - Customer Relations
  - Emergency Response

VALUE AND IMPORTANCE OF UVM

UVM is critical for safe and reliable utility services

- >$5 billion annual spend
- >50,000 employed

  Workers, consultants, safety experts, managers, equipment operators, climbers, herbicide applicators, quality inspectors, customer relations specialists, researchers, suppliers, industry associations, and more.

- Professional credentials are needed

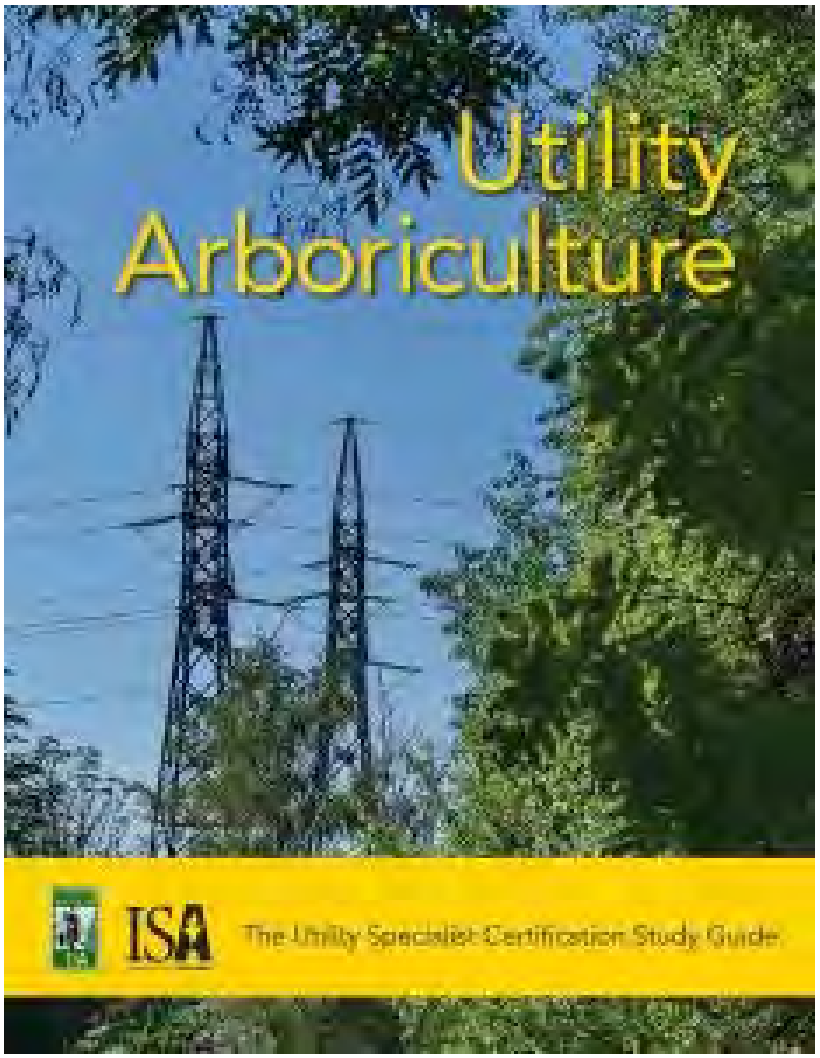
➢ *We are not "tree trimmers!"*

NEW TEXT BOOK AND STUDY GUIDE

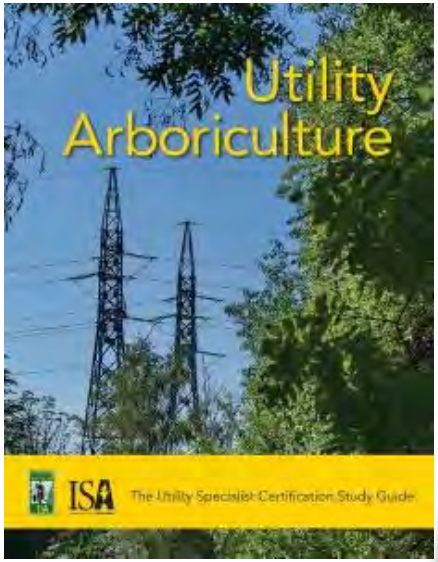
2007 ISA determines that a new guide is needed

- Study guide offered by the organization (ISA) should be independent from the test, to meet international standards for testing and certification
- Randall Miller (utility background) and Geoff Kempter (contractor background) are contracted to write a new guide

2018 new guide published



PARTICULARS



- A comprehensive textbook, to serve as a desktop reference for utility arborists as well as an aid for certification test preparation
- 280+ pages
- Peer reviewed
- Seven chapters, introduction, glossary and index

TABLE OF CONTENTS

3

Vegetation Management

OBJECTIVES

- Explain what to do in planning and implementing vegetation management
- Describe workload evaluation, including tree risk assessment
- Understand specific control methods
- Discuss herbicide and tree growth regulator toxicity
- Understand implementation of vegetation management

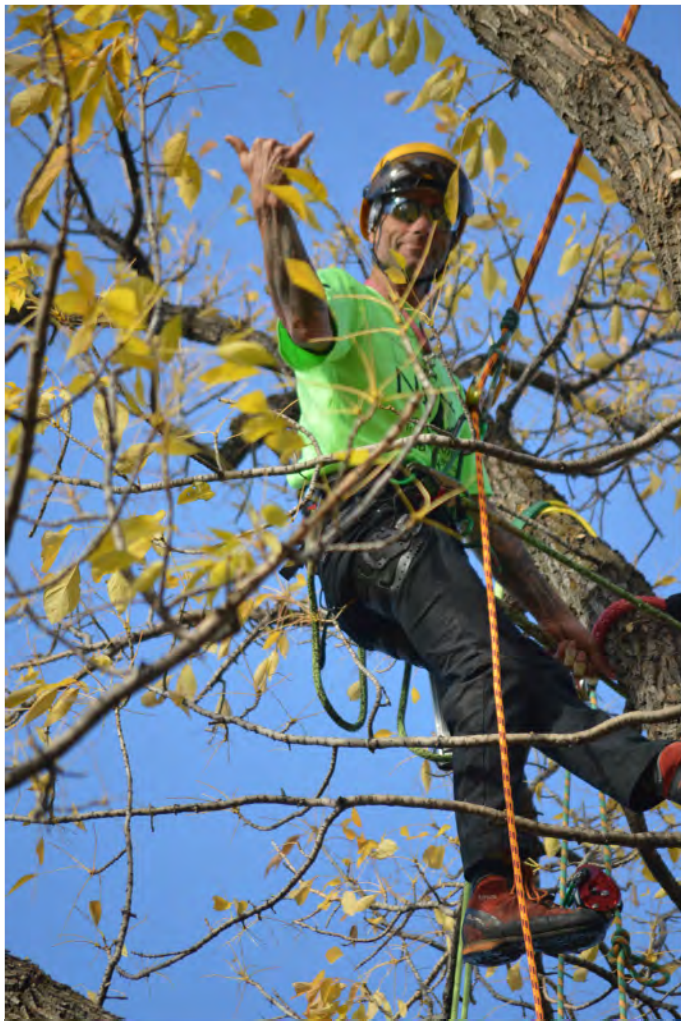
KEY TERMS

Action thresholds
Acute toxicity
Aerial application
AHAS inhibitors
Allelopathy
ALS inhibitors
ANSI A300 (Part 7)
Auxin transport inhibitors
Basil application
Brush cutters
Chronic toxicity
Closed chain of custody
Compatible
Comprehensive evaluations
Control methods
Corrosive
Cover type conversion
Cover type mapping
Cultural control
Dose
Early successional plant communities
EPSP inhibitors
Exposure
Fate in soil
Frill treatment
Global positioning
Hack and squirt
Half life
Hazard trees
Hendrix spacer
Herbicides
Herbicide sprayers
Graham cover type mapping
Incompatible
Initial clearing
Integrated vegetation management
ISA Integrated Vegetation Management Best Management Practices
Labels
LC_{50}
LD_{50}
IVM
LiDAR
Line Patrol
Mechanical control
Minimum vegetation clearance distance (MVCD)
Mode of action
Mutation
Non-damaging levels
Non-selective herbicides
Peripheral zone
Photosystem I inhibitors
Photosystem II inhibitors
Point Sampling
Poison
Pruning machines
Quadrant sampling
Qualified vegetation manager
Reversibility
Returnable, reusable (R/R) containers
Seed bank
Selective foliar application
Selective herbicides
Set objectives
Sheers
Side-pruning applications
Soil drench
Soil injection
Stakeholders
Stump application
Supply container
Synthetic auxins
Terrotogenicity
Toxicity
Tree growth regulators
Tree management hazard
Tree protection zone
Tree risk assessment
Trunk injection
Underground construction
Wire-border zone
Workload assessments

New guide

- Introduction
- Safety
- Program management
- Utility pruning
- IVM
- Electrical Knowledge
- Communication
- Storm Response
- Glossary
- References
- Index

I. SAFETY



Objectives

- Clarify employer and personal safety responsibilities
- Utilize behavior-based safety principles to decrease the likelihood of safety incidents
- Describe the potential injuries electricity can cause
- Practice electrical safety precautions
- Identify the elements of a safety culture

Safety

ACCIDENT VS. INCIDENT

- Accident
  - Passive
  - Relies on luck
- Prevention
  - Safety by design
  - Depends on a culture of safety

Safety

THE CASE FOR PREVENTION

- Everybody works to live
- There is no business worth asking people to sacrifice what they value most in life
- Taking chances with people and processes rightfully puts the business at risk
- Accidents cost profits and loose customers
- Workers have a moral responsibility to return home safely – to themselves, their families and society

Safety

WHY INCIDENTS HAPPEN

- Human error
- Willful violation of rules
- Maliciousness
- Equipment failure
- Act of nature

Safety

UNDERSTANDING HUMAN PERFORMANCE

- Recognize that people make mistakes
- Understand how errors occur
- Identify when errors most likely occur
- Utilize tools to reduce the number of errors and to mitigate the consequences when an error occurs

Safety

HOW ERRORS OCCUR

- Misinterpretation/sensory conflicts
- Inaccurate mental picture/pattern matching
- Inattention
- Limited attention resources
  - People can only simultaneously concentrate on 2-3 things
- Limited working memory
  - Most people can reliably remember only 3-4 items at a time (5-7 upper limit)

Safety

WHEN ERRORS OCCUR

- Under normal conditions, humans make an average of 5 errors an hour
- Under stressful, emergency or unusual conditions, humans make an average of 11 errors an hour

Safety

BEHAVIORAL-BASED PREVENTION

- Herbert Heinrich, 1930s
  - 88% of industrial a industrial accidents are caused by the unsafe acts of persons
  - Remainder are due to unsafe conditions
- Heinrich's methods have been questioned by modern scholars, but the basic concept should be understood

Safety

ACCIDENT (INCIDENT) PYRAMID

(FROM HEINRICH)

- Unsafe acts lead to -
- Close calls ("near misses") or minor injuries, which lead to –
- Reportable accidents, which lead to –
- Major injuries, which lead to –
- Fatalities

Ten Axioms of Industrial Safety

1. Injuries result from a series of factors, ending in an accident. Accidents (Heinrich's word) are consistently caused or permitted directly by an unsafe act, a mechanical or physical hazard, or both.
2. Unsafe acts of people are responsible for the overwhelming majority of incidents.
3. A person who suffers a disabling injury caused by unsafe acts has an average of over 300 close calls from serious injury due to the same unsafe act or mechanical hazard that resulted in the injury.
4. The extent of injuries is largely due to luck, but the incident is almost always preventable.
5. Four basic motives or reasons for unsafe acts (improper attitude, lack of knowledge or skill, physical unsuitability, and improper mechanical or physical environment) offer a guide to selecting effective preventative measures.
6. Four basic methods can be applied to accident prevention: engineering revision, persuasion and appeal, personnel adjustment, and discipline.
7. The most valuable methods of accident prevention should be consistent with the management techniques used to control quality, cost, and production.
8. Management has the best opportunity and ability to initiate the work of prevention, so it should assume that responsibility.
9. The supervisor or foreperson's influence is central to industrial accident prevention.
10. A humanitarian incentive for preventing injury is driven by two economic factors:
    a. Safety is efficient and unsafe acts are inefficient. The same lack of detail that leads to unsafe acts also leads to lapses in quality and productivity.
    b. The direct cost of industrial injuries for compensation claims and medical treatment is only 20 percent of the total costs that employers must pay.

(Heinrich et al. 1980)

Heinrich, H. W., D.C. Petersen and N.R. Roos. 1980. *Industrial Accident Prevention (5th Ed.). New York: McGraw-Hill Book Company*

Safety

MULTIPLE CAUSATION THEORY

- Workplace injuries have a number of contributing factors and causes, which randomly comingle
  - Unusual, non-routine work
  - Nonproduction activities
  - Sources of high energy (working around high voltage, at height, flammable liquids etc.)
  - Some construction activities

Safety

REVISED PYRAMID

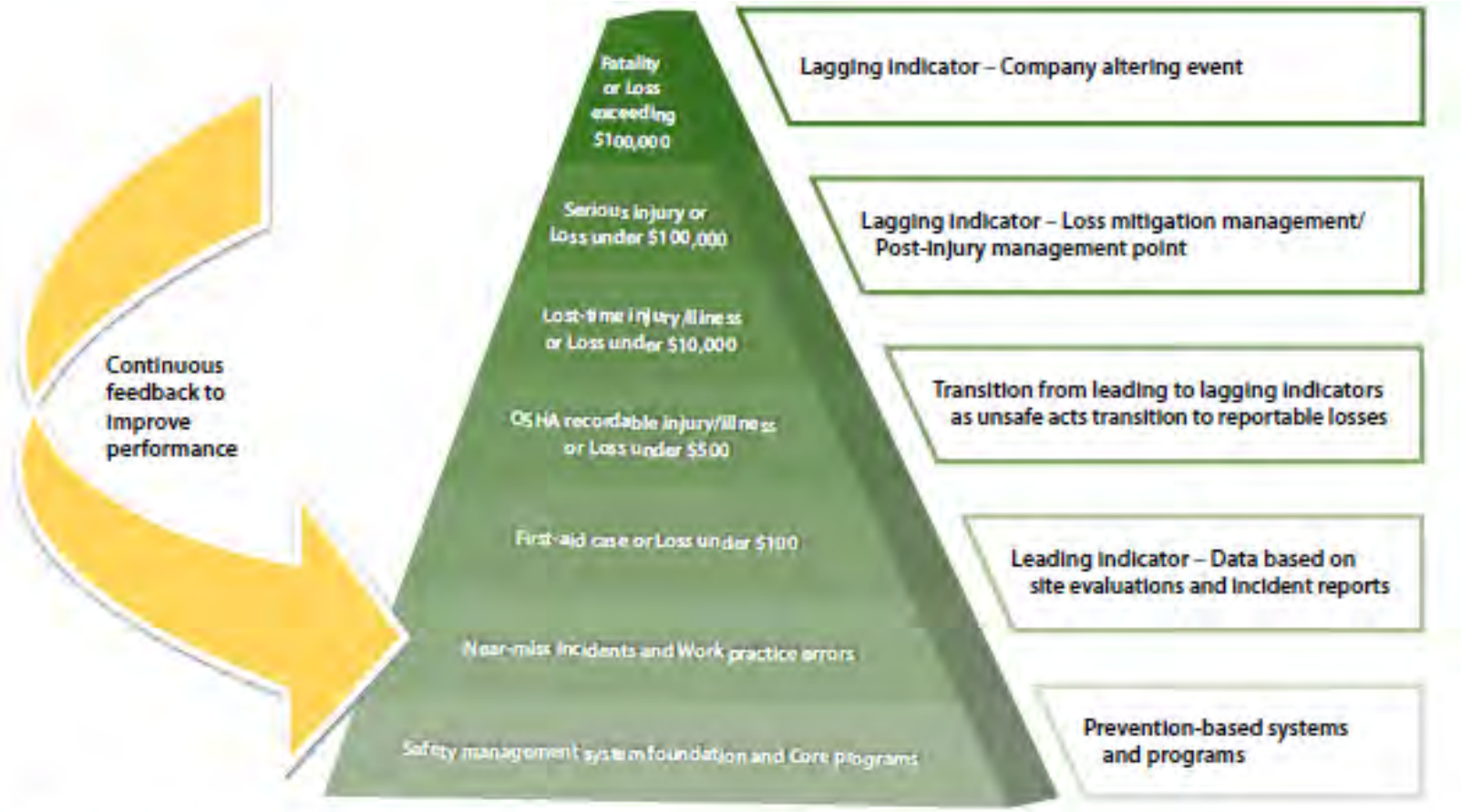


Figure 1.1 McClenahan's accident prevention pyramid. Values shown are U.S. dollars.
(Adapted, by permission, from J. McClenehan, Risk Management: Utilization of leading indicators in the continuous improvement cycle. TCI Magazine, November 2012. Based on an original diagram by H.W. Heinrich, Industrial Accident Prevention, 1950)

Safety

RISK MATRIX

Probability of Loss	Severity of Loss			
	Negligible	Marginal	Serious	Catastrophic
Improbable	Low	Low	Moderate	High
Occasional	Low	Moderate	High	Extreme
Probable	Low	Moderate	High	Extreme
Frequent	Moderate	High	Extreme	Extreme

Figure 1.2 Generic risk matrix.

Adapted, by permission, from J. McClenehan, Risk Management: Utilization of leading indicators in the continuous improvement cycle. TCI Magazine, November 2012)

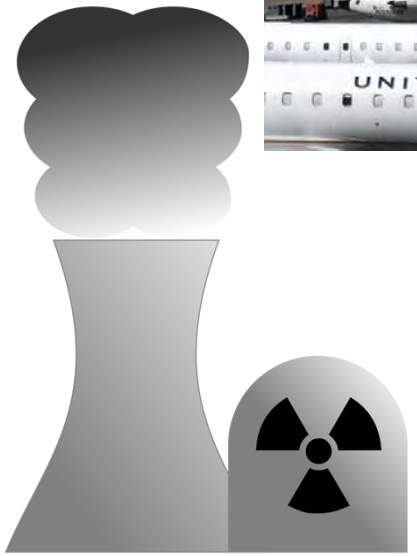
e.g. paper cut or chainsaw cut

Safety

HIGH RELIABILITY ORGANIZATIONS

Ruth Stein Photo

Geoff Kempter Photo



- Preoccupation with failure
  - (not an option)
- Reluctance to simplify
  - (investigate root causes)
- Sensitivity to operations
  - (know what is really happening)
- Commitment to resilience
  - (apply lessons learned)
- Deference to expertise
  - (who knows best?)

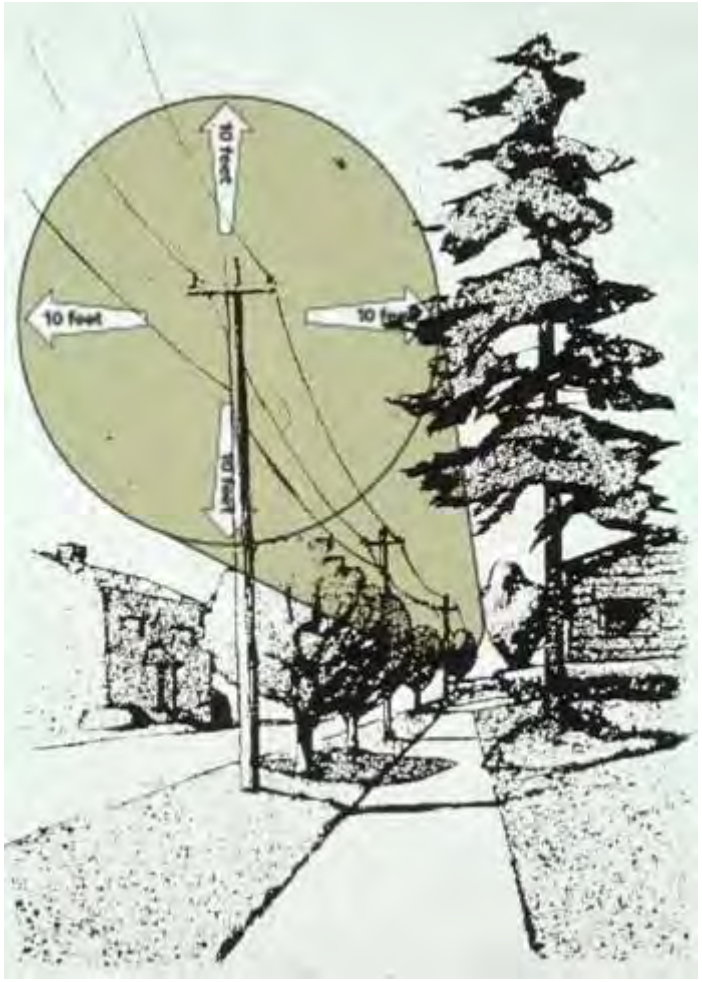
SAFETY

ANSI Z133

- Incidents not accidents
- Z133 & Electric safety standards
- Employers responsibilities
- Worker responsibilities
- Worker safety tools
  - Job briefing
  - Active listening
  - Procedure use and adherence
  - Self checking

Safety

ARBORICULTURAL WORKPLACE SAFETY REQUIREMENTS



- ANSI Z133
- OSHA 1910.269
- Work in conjunction with one another (except incidental line clearance arborist)
  - To work within minimum approach distances, a person must be trained and that training must be documented
  - Annex B Z133

Safety

GENERAL ELECTRIC SAFETY

- All employees shall be trained that electrical facilities shall be considered energized with potentially fatal voltages.
- Inspection by a qualified arborist to determine the presence of an electrical hazard.
- Climb on the side away from the conductors.
- Provisions for “not qualified”, “incidental line clearance” and “qualified line-clearance arborists” and “line-clearance trainees”.

Safety

ARBORIST CLASSIFICATIONS

- Qualified Arborist
  - Familiar with equipment and hazards and demonstrated ability in performance of special techniques
- Incidental line clearance
  - Tree work performed where an electrical hazard exists to the arborist, but the arborist is not working for the purpose of clearing space around the conductor on behalf of the utility that controls or operates the wires/lines.
  - Incidental line clearance clause is in conflict with OSHA
- Qualified line-clearance arborist
  - Familiar with the equipment and hazards in line clearance and has demonstrated the ability to perform the special techniques involved and who is working on behalf of he system owner/operator

Safety

ELECTRICAL HAZARD INSPECTION

- 4.1.5 *An inspection shall be made ay a qualified arborist to determine whether an electrical hazard exists before climbing, otherwise entering or performing work in or on a tree.*

Safety

FIELD TRAINING

Field training should be easily understood and acted on:

- Condense a message into a sound bite.
- Relate the information to your team
- Encourage dialog - ask questions about the information
  - What?
  - How ?
  - Why?

Safety

JOB BEHAVIOR OBSERVATIONS

KNOWING WHAT IS REALLY HAPPENING OUT THERE

- Targeted training programs that address "real" issues within an organization
- Training that can advance beyond compliance only-based required programs
- Training that can be geared toward operational efficiency and attainment of valuable results
- Data that can be combined with lagging-indicator data to strengthen employee development programs
- Provision of an early-warning system
- Provision of metrics for employee performance beyond the dollars and cents of a job

McClenahan, J. 2012. *Risk Management: Utilization of Leading Indicators in the Continuous Improvement Cycle.* Tree Care Industry. Volume XXIII, Volume 11: 68-72

Safety

SITUATIONAL AWARENESS

Conditions change, be prepared to adjust:

- Continual assessment of surroundings
- Be aware of changes in conditions or job scope
- Recognize changes in behavior

SAFETY

SAFETY PRECAUTIONS

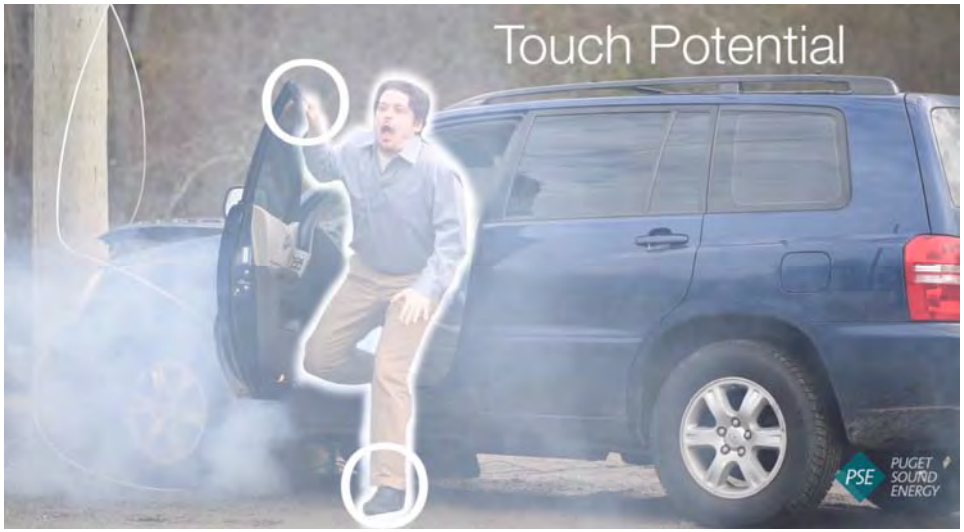
Wright Tree Service

- Job briefing
- Training
- Checklist
- Protective grounds

SAFETY

ELECTRIC SAFETY CONCEPTS

- Electric shock vs. electrocution
  - Injury severity
- Direct vs. indirect contact
- Touch and step potential
- Tree on line
- Downed lines
- Backfeed



https://www.youtube.com/watch?v=fLVzvMTgGDY
Puget Sound Energy

Safety
STEP POTENTIAL

https://www.youtube.com/watch?v=fLVzvMTgGDY
Puget Sound Energy

- Voltage differential between the feet of a person standing near an energized, grounded object.
- Exposes subject to electric shock or electrocution.

Safety

LINE DOWN

- Can fall across and energize fences, vehicles, metal buildings and other conductive objects.
- Can whip around causing physical or electric injury.

SAFETY

RISK ASSESSMENT

JOB BRIEFING

- Prioritize safety risk factors
- High reliability organizations

Generic Risk Matirix				
	Severity of Loss			
Probability of Loss	Neglible	Marginal	Serious	Catastrophic
Improbable	Low	Low	Moderate	High
Occasional	Low	Moderate	High	Extreme
Probable	Low	Moderate	High	Extreme
Frequent	Moderate	High	Extreme	Extreme

McClenahan, J. 2012. Risk management: Utilization of leading indicators in the continuous improvement cycle. *Tree Care Industry* XXIII(November):68-72.

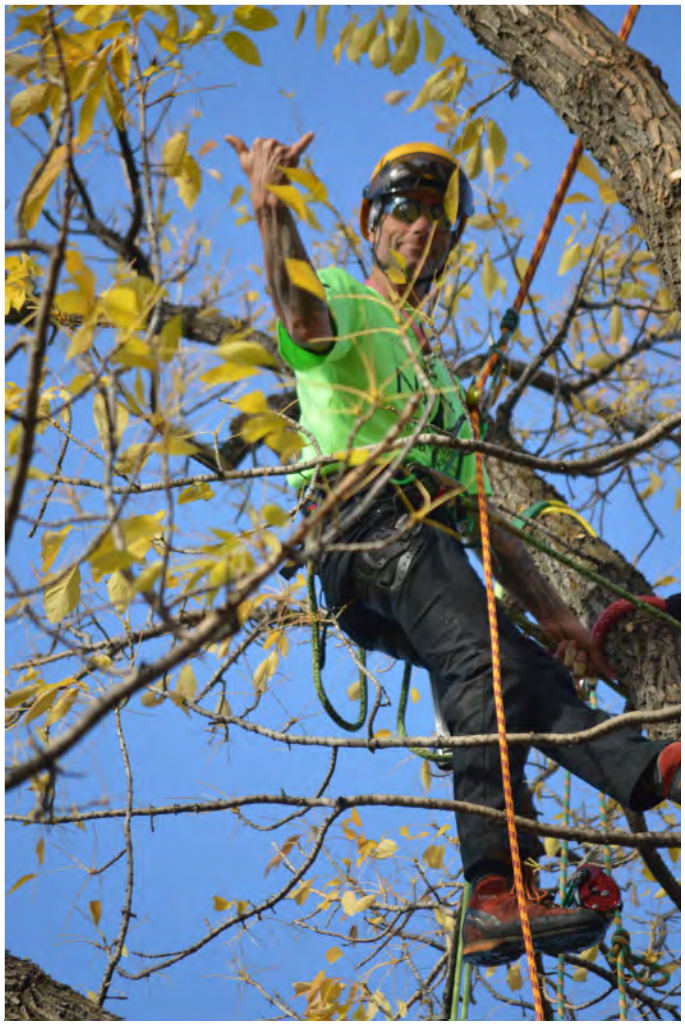
Safety

SAFETY COMMITTEES

- Should represent every level of the company
- Meet regularly: monthly/quarterly
- Utility and contractor should participate
  - At least share results
- Review training and education procedures
- Review close calls
- Investigate accidents
- Provide a setting in which labor and management can discuss safety issues and collaborate on solutions

Safety

SUMMARY



- Employers have a moral and legal responsibility to provide a workplace free of known hazards
- Workers have an obligation to honor work rules
- Electrical injuries are serious and high voltage contact is either fatal or life-altering
- Behavioral-based industrial safety principles focus on eliminating unsafe acts and conditions
- Creating a culture of safety involves every team member, and integrates employer and employee responsibilities and desires.

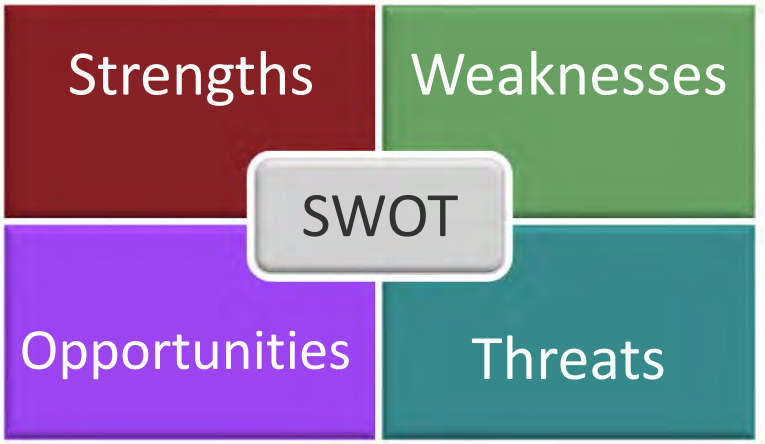
II. PROGRAM MANAGEMENT

Objectives

- Develop a strategic plan for a VM program
- Design work schedule plans that best achieve program goals and objectives
- Utilize project management techniques to execute project plans
- Prepare a utility vegetation management budget
- Execute contracts for vegetation management services based on needed services and budgets
- Implement a personnel management strategy that encourages high-performing staff

Program Management

PLANNNG



SWOT ANALYSIS

- Short and long term
  - Long-term = strategic
  - Short-term = tactical
- SWOT Analysis

Program Management

WORK SCHEDULING

- Cycle-based
- Predictive-maintenance
  - Focusing resources on areas of greatest need based on field conditions, facility priority, regulatory requirements, species composition or other factors
  - Just-in-time
    - Predictive modification of hot spotting
    - Thin margin of error
- Crisis management
  - Majority of work performed in reaction to undesirable conditions
  - Reactive
  - Inefficient

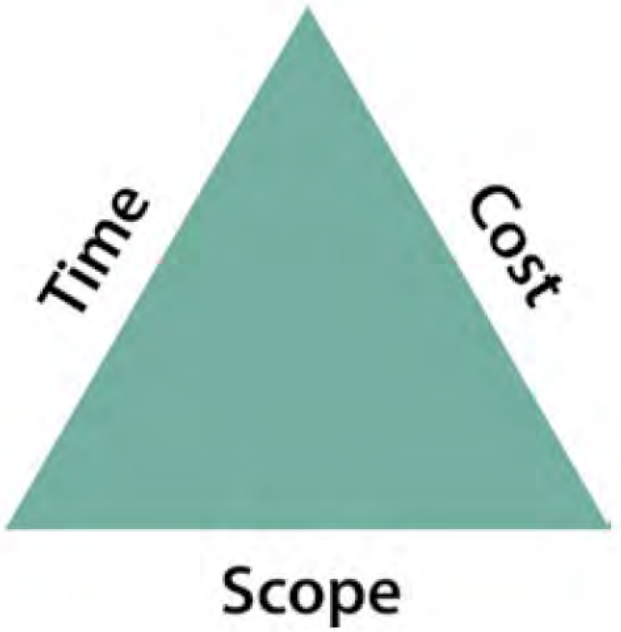
Program Management

PROGRAM MANAGEMENT CONCEPTS

- Triple constraint triangle

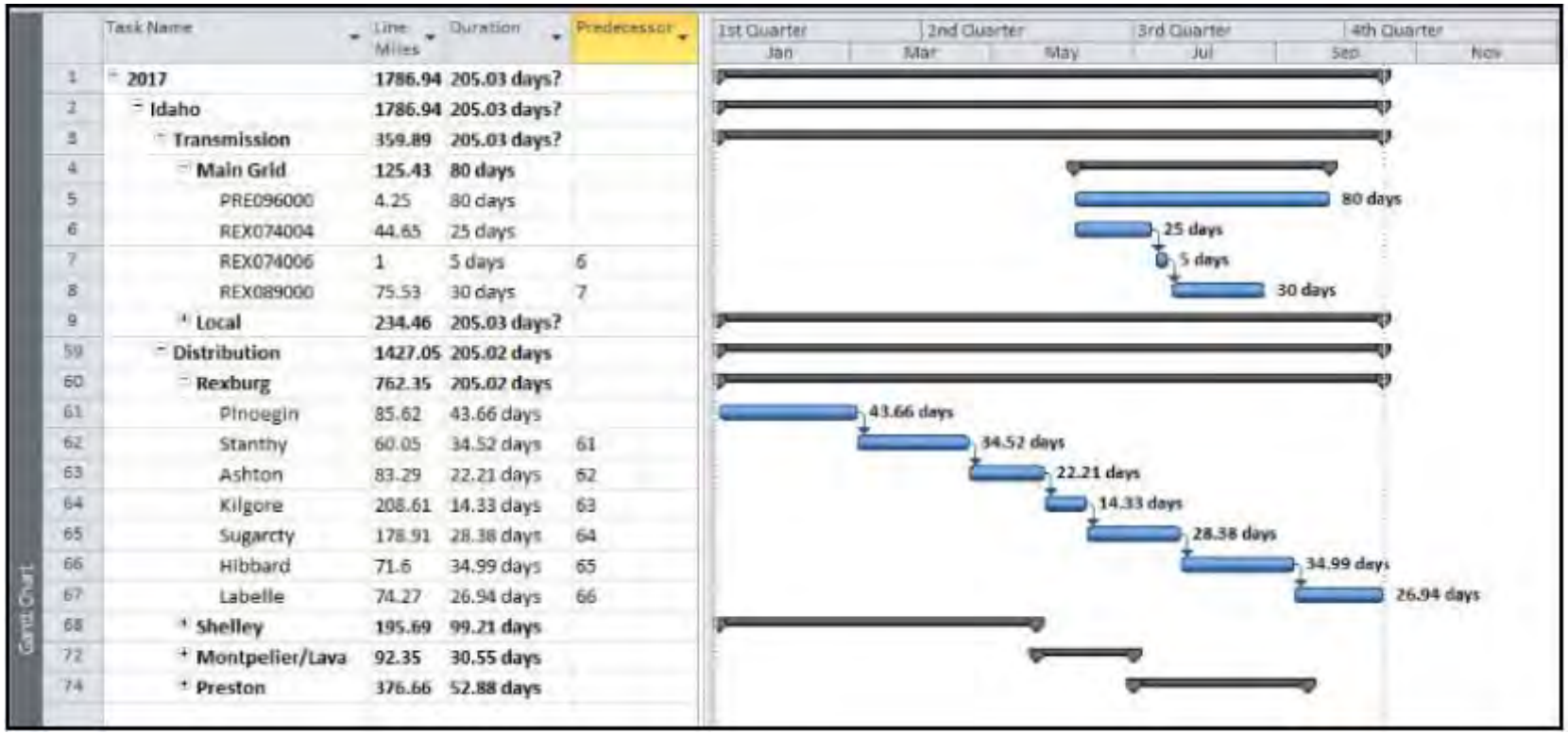
- Work breakdown structures
  - Prioritized outline of job components

- Dependencies
  - Relationships that dictate when tasks in the work breakdown structure begin and end
    - Mandatory
    - Discretionary
    - External



Program Management

GANNT CHARTS



- Horizontal bar chart plotted along a timeline
- Desired start and end date
- Project management visual aid

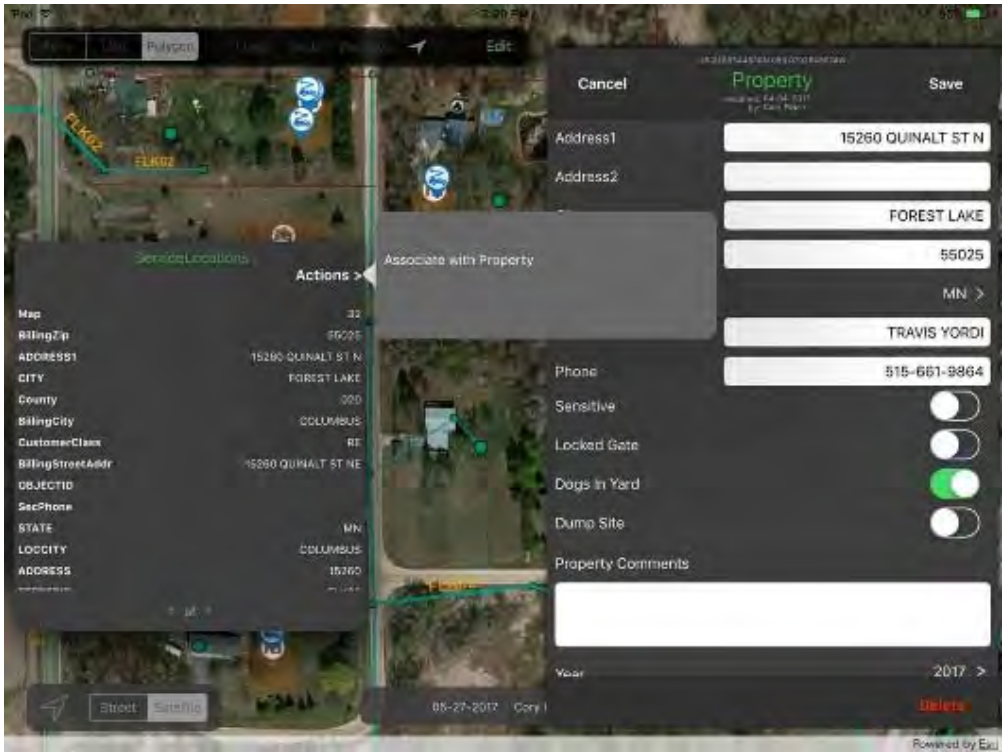
Program Management

WORK PLANNERS

- Must be familiar with all facets of VM
- “The face of the utility”
  - Greatest number of interactions with the public
  - Increase effectiveness of VM programs
- Can be utility employees or contracted

PROGRAM MANAGEMENT

WORK MANAGEMENT SYSTEMS



Terra Spectrum Technologies

- GIS-based
- Integrate multiple layers of data
- Coordinate data on conditions, inventories, patrols, outages, work history, ownership and other matters
- Can also be used in communicating with internal and external stakeholders

Program Management

BUDGETS

- Cost types
  - Cost centers v profit centers
  - Fixed costs v variable costs
- Preparation
- Capital vs. Operations & Maintenance
  - Line-item
  - Performance
  - Program
  - Zero-based
  - Entrepreneurial

Program Management

BUDGET PREPARATION

- Review strategic plan
- Determine whether resources are adequate for the budgetary period
- Review budgets and actual results for current year-to-date and prior year. Look for variances that could affect the upcoming fiscal year.
- Meet controller to determine how VM fits into overall processes
- Develop contingency plans for constraints
- Assign responsibility for the preparation of team or area budgets and deliver clear instructions

Program Management

CAPITAL VS OPERATING AND MAINTENANCE

- Capital
  - Outlays for relatively large sums invested over multiple years
  - Often used for purchase of fixed assets
- Operating & Maintenance
  - Line-item
  - Performance
  - Program
  - Zero-based
  - Entrepreneurial

Program Management

SIMPLE CASH VS ACCRUAL ACCOUNTING

- Simple cash
  - Expenditures booked when they are paid
- Accrual
  - Books costs when they are incurred

Program Management

CONTRACTING

Program Management

CONTRACTING

Chart 2.20.5.1

Contract Structure **2002**

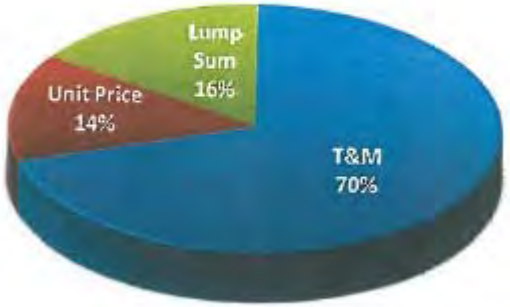


Chart 2.20.5.2

Contract Structure **2006**

- T&M
- Unit
- Firm Fixed
- Performance

Program Management

CONTRACT TYPE RISKS AND BENEFITS

Table 2.1 Contract risks and benefits.

Characteristics	Time and material	Unit price	Lump sum	Performance
Contractor risk	Low	High	High	Shared
Utility risk	High	Variable	Variable	Shared
Concern for productivity	Utility	Contractor	Contractor	Shared
Concern for quality work	Variable	Variable	Variable	Shared
Pay based on	Time	Work	Work	Work
Quality tied to payment	Sometimes	Sometimes	Sometimes	Yes
Safety	Contractor	Contractor	Contractor	Shared
Customer satisfaction	Shared	Utility	Utility	Shared
Utility reliability	Utility	Utility	Utility	Shared
Performance indicators	Utility	Shared	Shared	Shared
Storm response	Utility	Contractor	Contractor	Shared
Best practices/specialized equipment	Utility	Contractor	Contractor	Shared
Work planning	Utility/3rd party	Contractor	Contractor	Shared
Workforce stability	Shared	Utility	Utility	Shared
Work schedule	Utility	Contractor	Contractor	Shared
Cost management	Shared	Contractor	Contractor	Shared

Adapted from Orr 2007.

Table 2.2 Specification sections important to lump sum bidding.

Specification section	Description
Scope	• Provide written instructions delineated on maps. • Identify rights-of-way locations. • Describe all maintenance work within the project boundary. • Make work requirements as uniform as possible. Consider breaking areas such as rural and urban locations into separate units. • Create small work packages. Too large a project can restrict the number of bidders due to cash flow concerns, mobilization or demobilization costs, or increased labor and equipment demands. Too small a project can render it unattractive or unprofitable for potential vendors.
Notification	• Clearly establish responsibility for and characteristics of property owner notification (letter, personal contact, door hanger, phone call, etc.).
Clearance	• Objectively define requirements. • Start with concrete clearance limits and add modifiers. For example, less clearance may be allowed for major stems and branches or slow-growing trees. • Describe directional pruning. • Establish protocols for variation from required clearance requirements.
Slash disposal	• Chip and remove debris from urban sites, leaving firewood by request. • In rural areas, lop and scatter or blow chips, except in landscaped areas or where the property owner objects. It is the contractors' responsibility to obtain approval for blowing chips or lopping and scattering. If they fail to do so, it is their responsibility to make it right with the homeowner.
Reporting	• Project start and completion dates. • Establish requirements for record keeping and how often contractor contracts are required with the company. • Determine the frequency of invoicing and payment (such as percent completed). The final invoice should not be paid until the entire job is reviewed and accepted by the utility.
Exceptions	• Establish hourly time and material rates for unique situations (such as costly removals or storm response work).

Adapted from Goodfellow 1985.

Program Management

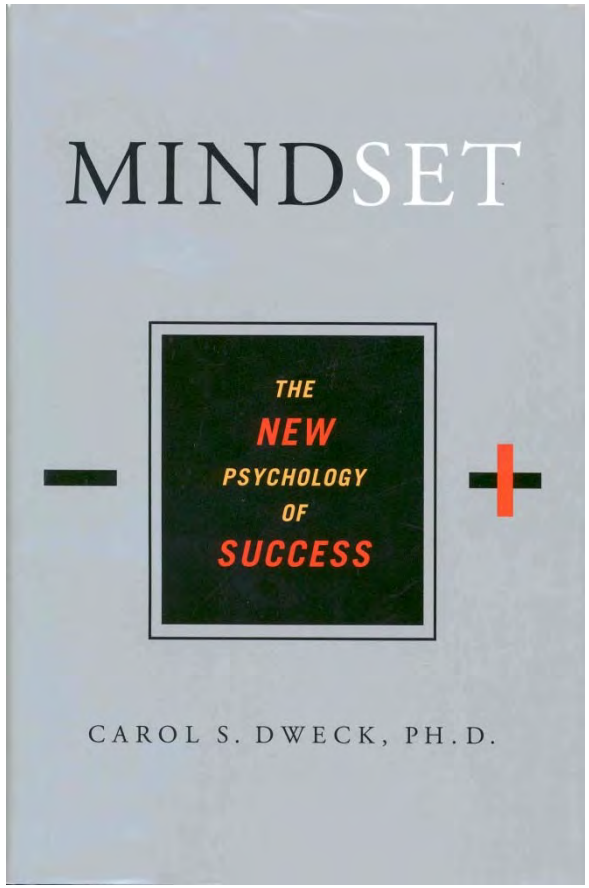
PERSONNEL MANAGEMENT

- Poor personal management skills spread negative emotions, disrupt performance and drive away the best and most ambitious
- Disrespectful treatment from superiors is the most common reason people leave a job
  - Pay is fifth

Program Management

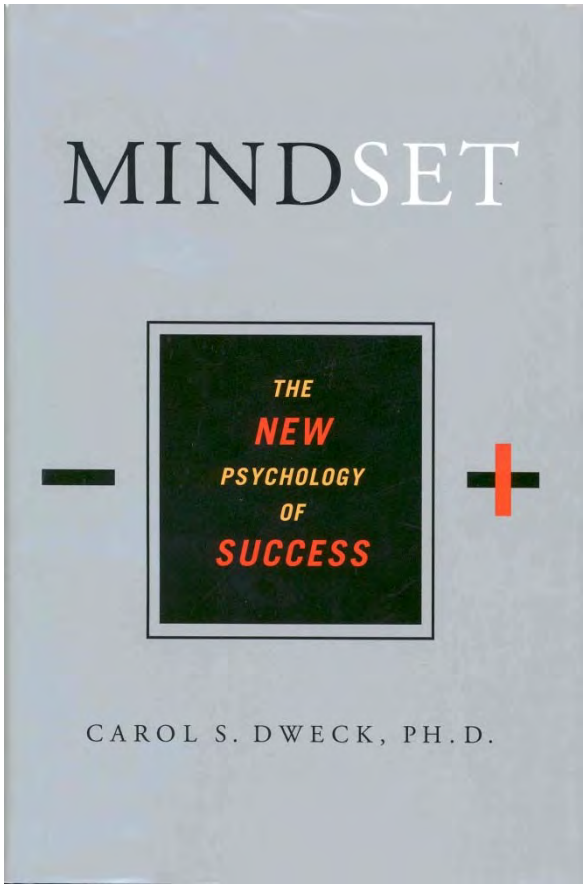
PERSONNEL MANAGEMENT

- Growth vs. Fixed mindset
- Emotional intelligence
- Performance monitoring and evaluation
- Bargaining unit



Program Management

MINDSET



- Fixed mindset
  - Attributes are inherited and cannot be improved through effort
  - Threatened by aptitude
  - Mistrustful, adversarial and given to micromanage
  - Disruptive management style
- Growth Mindset
  - Work and practice leads to improvement
  - Mentors and coaches
  - Highly functional programs

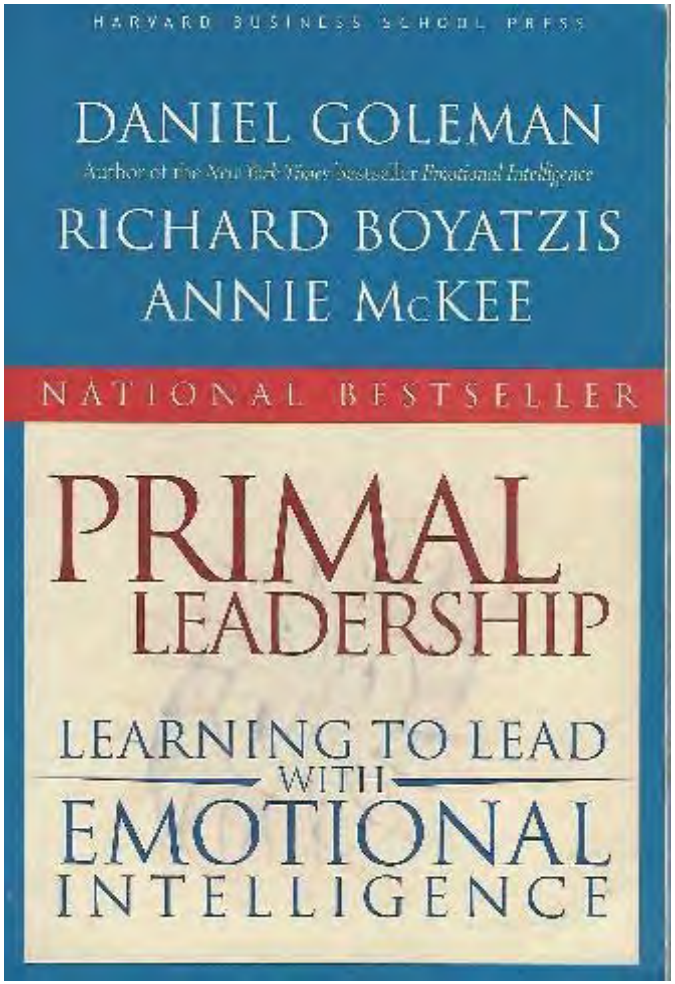
Program Management

RESONANT LEADERSHIP

- Lead by example.
- Listen aggressively
- Communicate purpose and meaning
- Create a climate of trust
- Look for results, not salutes
- Take calculated risks
- Build up your people
- Generate unity
- Improve your people's quality of life

Program Management

EMOTIONAL INTELLIGENCE



- Growth mindset and resonant leadership
- Domains
  - Self awareness
  - Self management
  - Social awareness
  - Relationship management

Program Management

MOTIVATORS AND DEMOTIVATORS

Table 2.3 Motivators and demotivators.

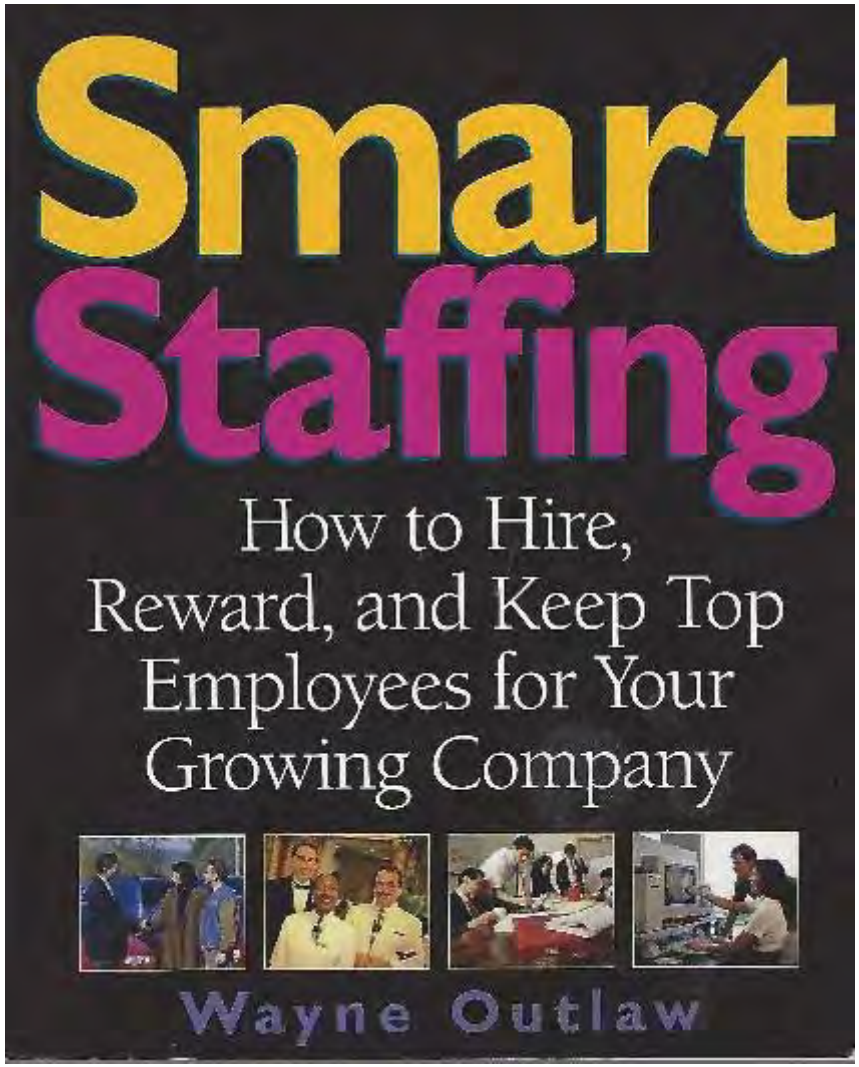
Motivators	Demotivators
Add fun and variety to routine	Create a politically charged atmosphere
Provide employees with input and choice on how to do their work	Leave expectations unclear
Encourage responsibility and provide leadership opportunities	Create needless rules
Promote social interaction and teamwork among employees	Hold unproductive meetings
Tolerate learning errors and avoid harsh criticism	Promote internal competition among employees
Promote job ownership	Withhold information employees need to perform their work
Develop goals and challenges for all employees	Provide criticism instead of positive feedback
Provide ample encouragement	Tolerate poor performance so top performers feel taken advantage of
Make appreciation part of your repertoire	Treat employees unfairly
Develop measurements that show performance increases	Underutilize employee capacity

Source: Spitzer 1995.

Program Management

PERFORMANCE APPRAISALS

- Should involve formal evaluations
  - Performance should not be a surprise, but a review of ongoing feedback
- Concentrate on strengths first, then move on to focus areas
- Promote a dialog between supervisors and subordinates about work quality, problem solving and where to improve
- Spotlight performance and avoid what might be perceived as personality flaws
- Establish new goals for the future



Program Management

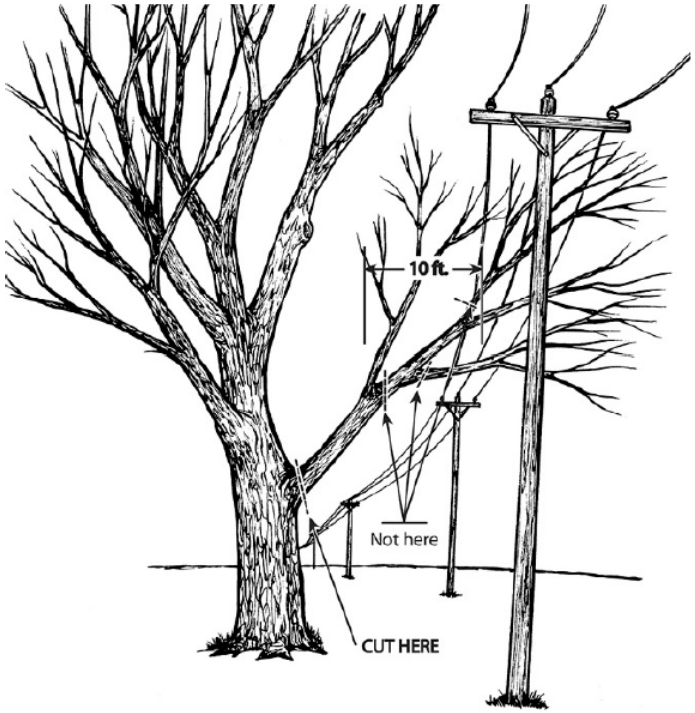
SUMMARY

- UVM is multifaceted and often complex
- Requires
  - Funding
  - An understanding of effective control measures
  - Program management
  - Knowledge of computers
  - Contracting
  - Personnel management

III. PRUNING

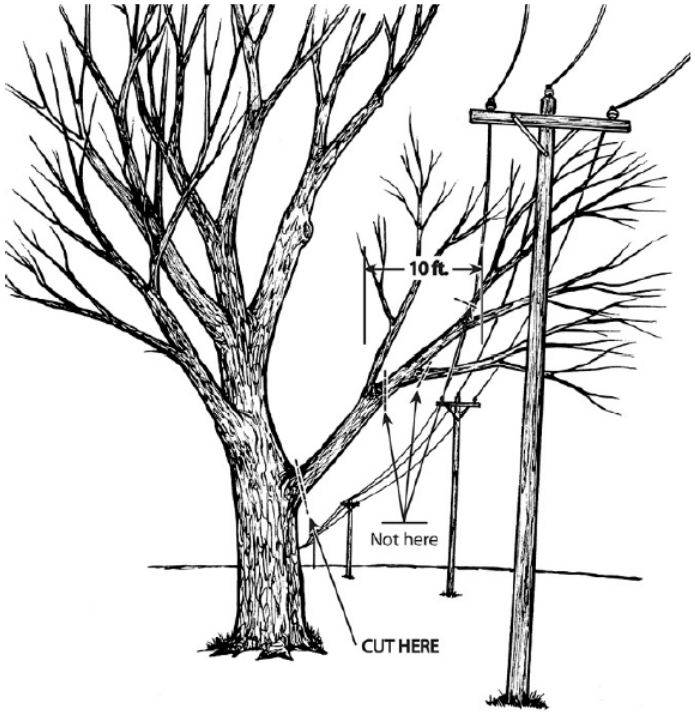
III. PRUNING

- Introduction
- Purpose of Utility Pruning
- Utility Pruning Overview
- Utility Pruning Objectives
- Pruning Intervals
- Palm Pruning
- Remote Forested Environments
- Summary



III. PRUNING
LEARNING OBJECTIVES

- Recognize the value of pruning
- Understand how trees affect rights-of-ways
- Prioritize utility targets in reducing risk
- Explain the benefits and limitations of maintaining clearance
- Know which kinds of pruning cuts and styles are appropriate
- Describe how tree structure and health may be affected by repeated utility pruning
- Explain directional pruning and why it is preferred
- Determine appropriate pruning intervals
- Understand where it is appropriate to use mechanical methods for utility pruning



CAN TREE PRUNING PREVENT TREE FAILURE?

Tree failures have an enormous impact on utility services.

When done properly, tree pruning can reduce risk of failure

UTILITY PRUNING

PURPOSE

Risk Reduction

- **Safety** – of the public and workers
- **Reliability** – of utility services

Compliance – with laws and regulations

Access – for maintenance, inspection, etc.

UTILITY PRUNING PURPOSE

UTILITY FOREST

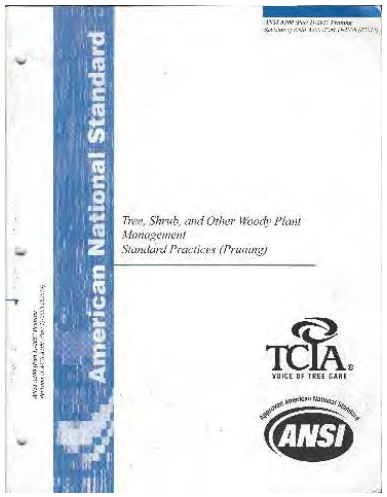
The population of trees that could now or in the future interfere with the operation of utility facilities.

These trees must be managed, by pruning, removal, growth regulation, or some combination of these treatments.

PRUNING

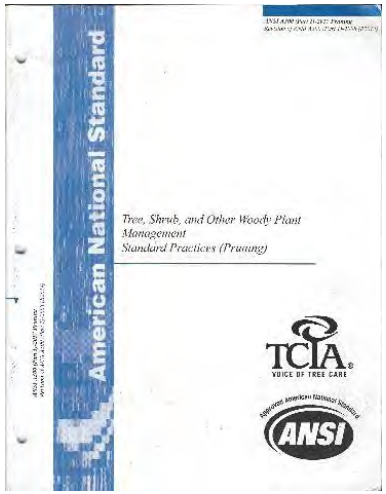
UTILITY PRUNING OVERVIEW

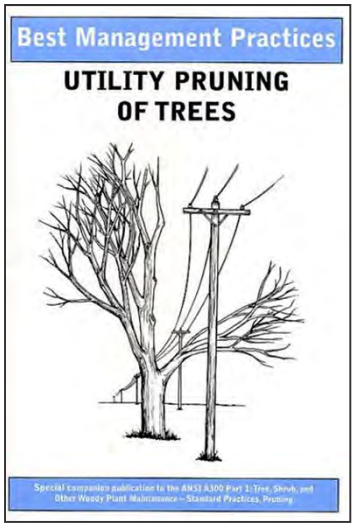
- Standards and best practices
- Pruning systems
- Pruning cuts
- Tree response to utility pruning
- Structural and directional pruning



UTILITY PRUNING STANDARDS AND BEST PRACTICES

- ANSI A300, Part 1, Pruning
- ANSI Z133, Safety Requirements
- ISA BMPs





ANSI STANDARDS FOR UTILITY ARBORISTS

Z133 *Safety Requirements*

- Since 1972, ISA Secretariat
- Provides safety criteria for tree work
- Applies to *employers and employees* in arboriculture
- Uses:
  - To develop effective safety training programs
  - By government to create safety regulations
- ➢ *Bottom line: Whatever you do, do it safely!*

A300 *Tree Care*

- Since 1995, TCIA Secretariat
- Defines standard practices for tree care
- Applies to *professional practitioners of arboriculture, including utilities*
- Uses:
  - To develop specifications, training programs and regulations as appropriate
- *Bottom line: Whatever you do, do it right!*

ANSI Z133 *SAFETY* ("THE Z")

- Is included *by reference* in ANSI A300 Tree Care Standards
  - Everything we do to comply with A300 MUST ALSO COMPLY WITH "The Z"
  - Including the electrical hazard
    - Minimum separation
    - Electrical properties

ANSI A300 TREE CARE STANDAR

- **Part 1, Pruning**

- Part 2, Soil Management (Fertilization)
- Part 3, Tree Support Systems
- Part 4, Lightning Protection
- Part 5, Management (During Construction)
- Part 6, Transplanting
- Part 7, Integrated Vegetation Management
- Part 8, Root and Root Zone Management
- Part 9, Tree Risk Assessment
- Part 10, Plant Health Care

ANSI A300 TREE CARE STANDARDS

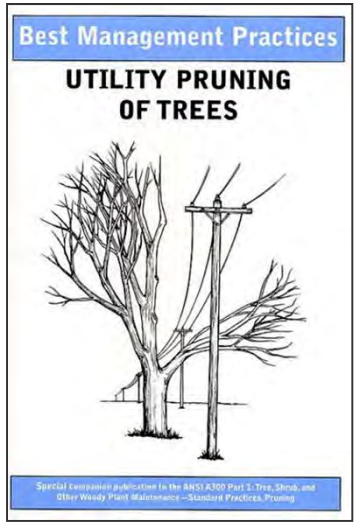
- Useful for professionals
  - Assumes knowledge and capability
  - Technical language
  - Not for public consumption
- Designed for flexibility
  - Because with trees, every situation is different
- Helps write specifications to improve the effectiveness of our work

ANSI A300 STANDARDS ARE NOT:

- **Specifications!**
  - Details must be specified such as size of branch, clearance distance, number of cuts, percent of crown, etc.
- **"How to" guides or BMPs**
  - Standards contain minimal words and descriptions

PRUNING BMPS

Provide details, explanations, illustrations, and instructions on how to properly prune trees



PRUNING

PRUNING SYSTEMS
IN UTILITY ARBORICULTURE

- Pollarding
- Topiary
- Natural
- Topping

PRUNING SYSTEMS – ANSI A300:

"A pruning system should be specified to achieve the desired long-term form of the plant"

Pruning System – "Process used to achieve the desired long term form of the plant."

PRUNING SYSTEMS

What are some pruning systems?

- **Bonsai** (not in A300)

PRUNING SYSTEMS

Pollarding:

A pruning system that maintains crown size by initial heading of branches on young trees, followed by removal of shoots to their point of origin at appropriate intervals without disturbing the resulting pollard head.

PRUNING SYSTEMS

Topiary

The combination of pruning, supporting, and training branches to orient a plant into a desired shape.

Hedging is a form of topiary

PRUNING SYSTEMS

“Natural”

“A natural system should maintain the characteristic growth pattern and adaptations of the plant.”

The majority of trees are pruned using the Natural System

PRUNING SYSTEMS

Natural

PRUNING SYSTEMS

Natural

PRUNING SYSTEMS

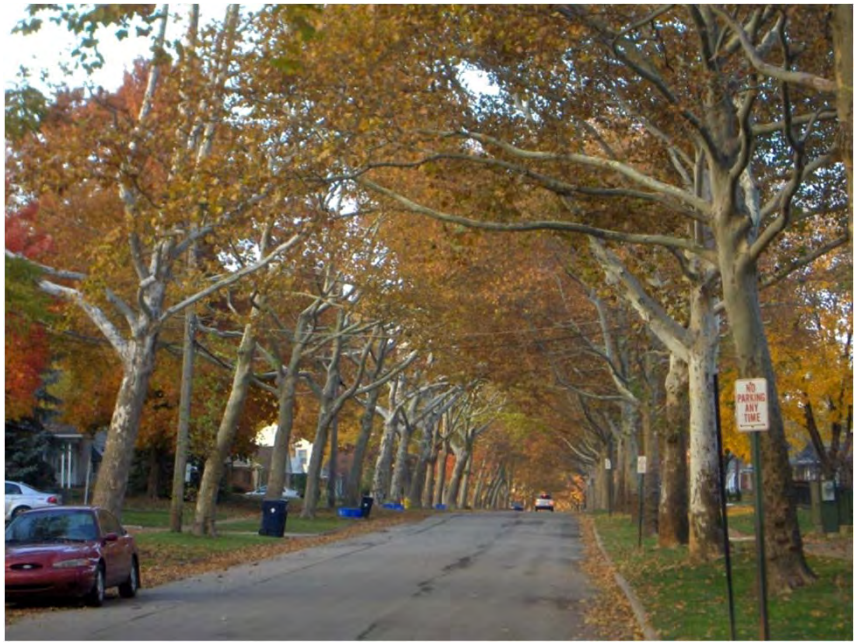
Natural

PRUNING SYSTEMS

NATURAL SYSTEM

"A natural system should allow for changes in appearance resulting from pruning when achieving certain specified objectives, such as:

- Raising crowns
- Crown or branch reduction
- Enhancing views



- Developing or improving structure
- Providing clearance
- Risk reduction "

Which one is “natural?”

PRUNING SYSTEMS

TOPPING (AKA “ROUNDOVER,” OR “HATRACK” *IS NOT A PRUNING SYSTEM!*

TOPPING

The discredited practice of stubbing all or part of the crown of a tree, without regard for tree health or structure, the location of lateral branches, or the expected response of the tree

TOPPING

SEVERELY DAMAGES TREES AND ENCOURAGES RAPID RE-GROWTH

- Ineffective
- Unprofessional
- Unacceptable

PRUNING

PRUNING CUTS

Quality of cuts is important!

Relatively small cuts are better for the tree

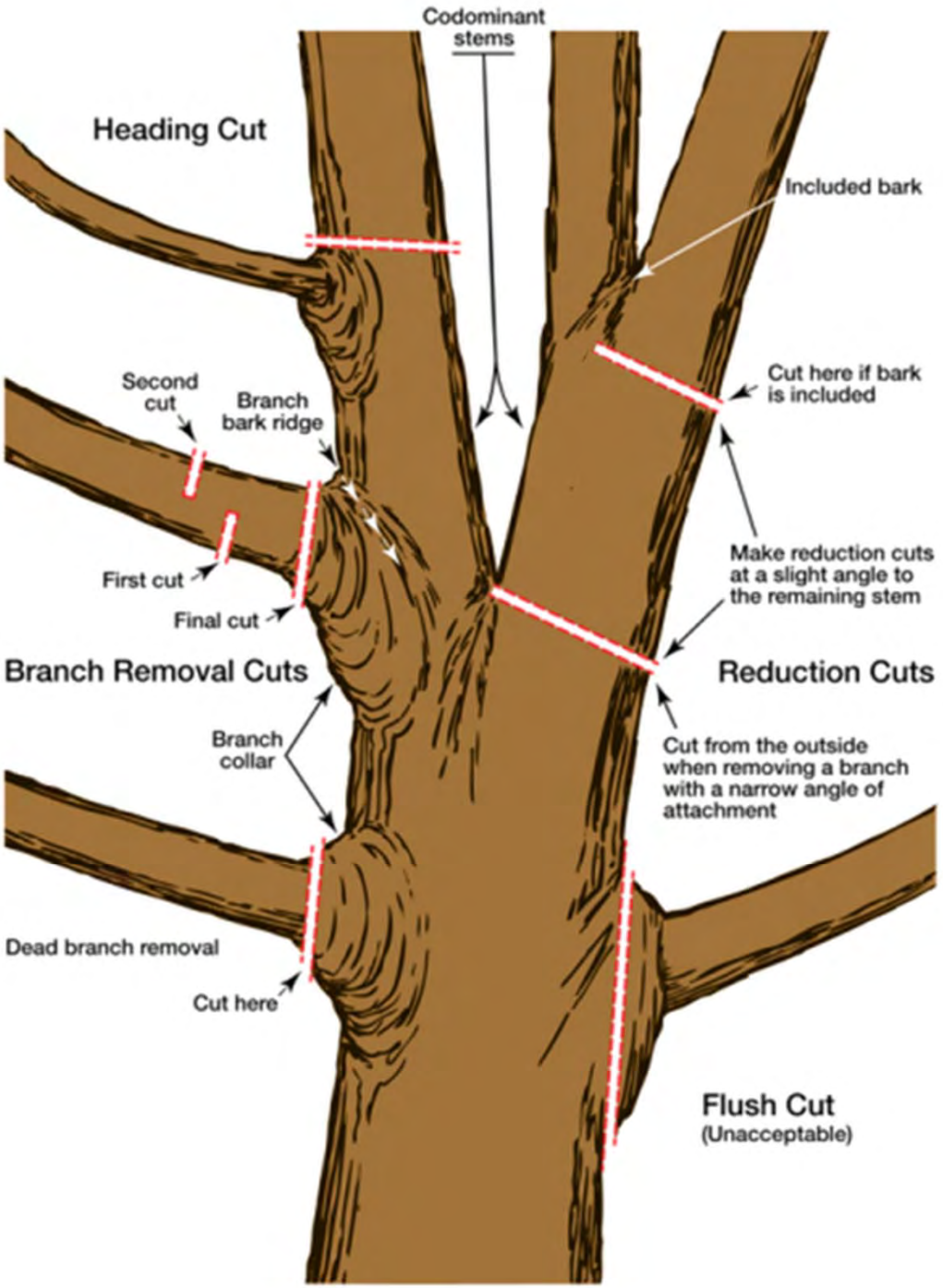
Poorly made cuts

- May introduce decay
- Promote unwanted growth
- Increase risk of failure
- Reduce effectiveness.

PRUNING

PRUNING CUTS

- Branch removal
- Reduction
- Heading
- Shearing

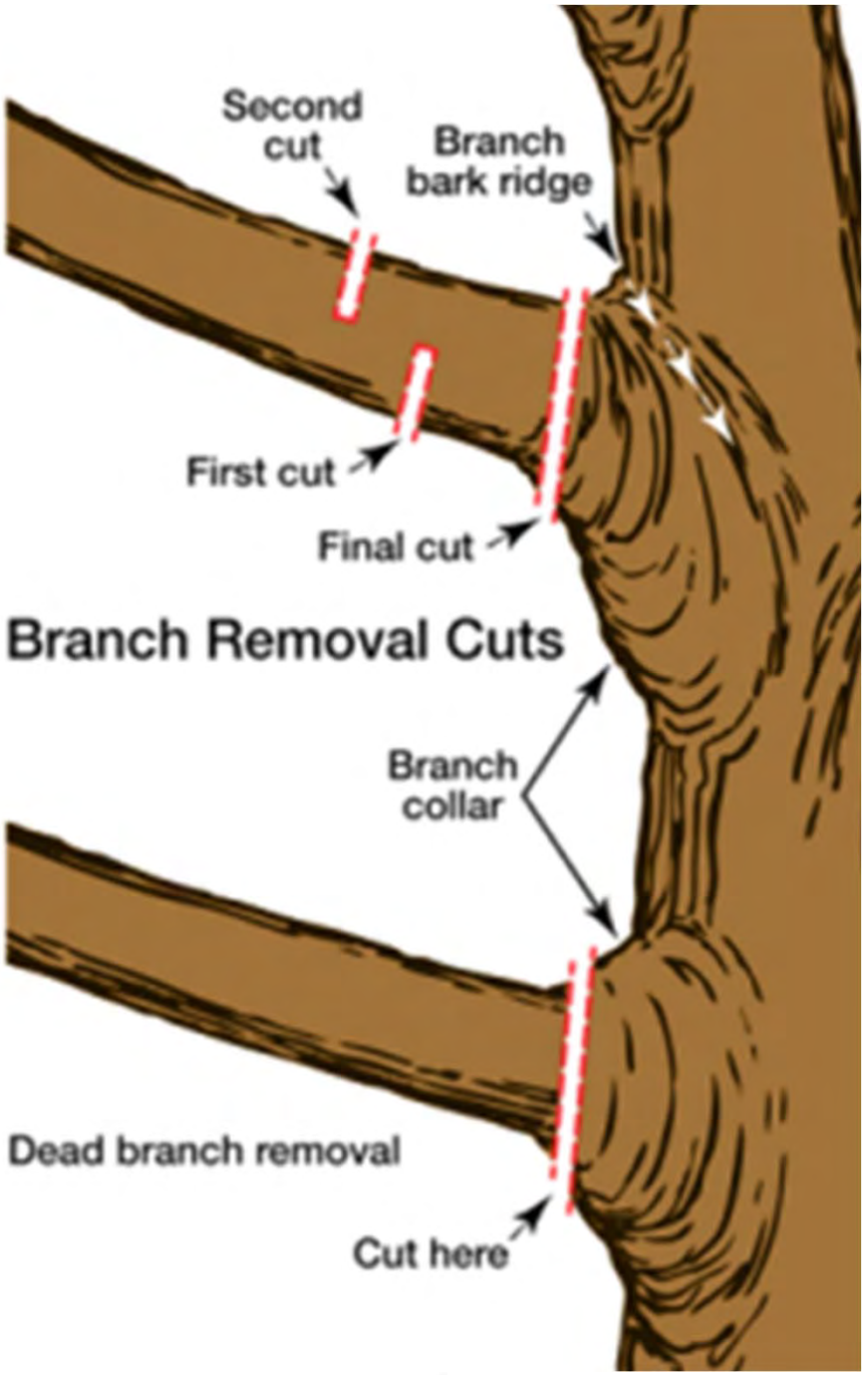


PRUNING

BRANCH REMOVAL CUT

Removes the smaller of two branches at a union or a parent stem, without cutting into the branch bark ridge or branch collar, or leaving a stub.

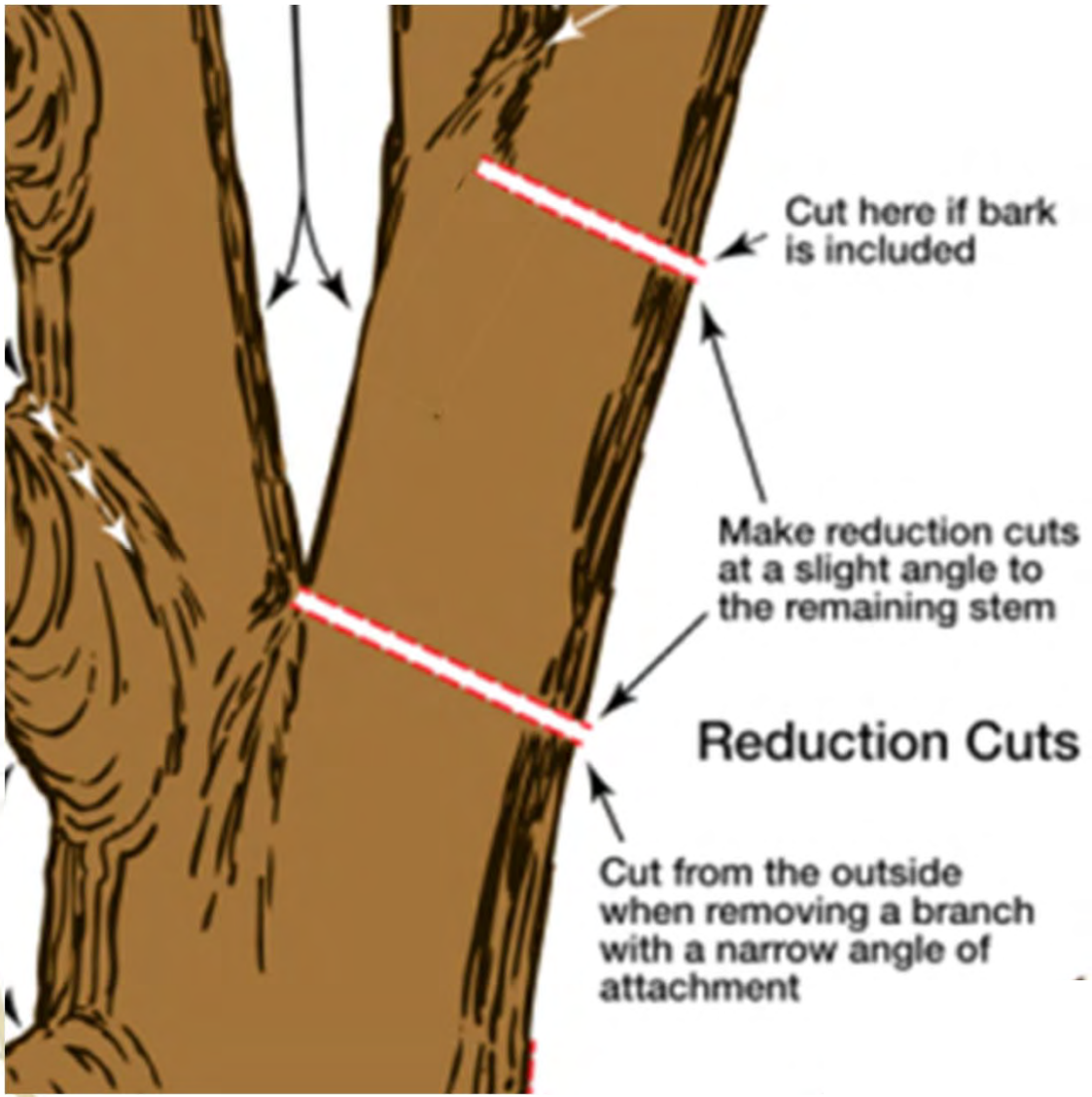
Precut large branches



PRUNING

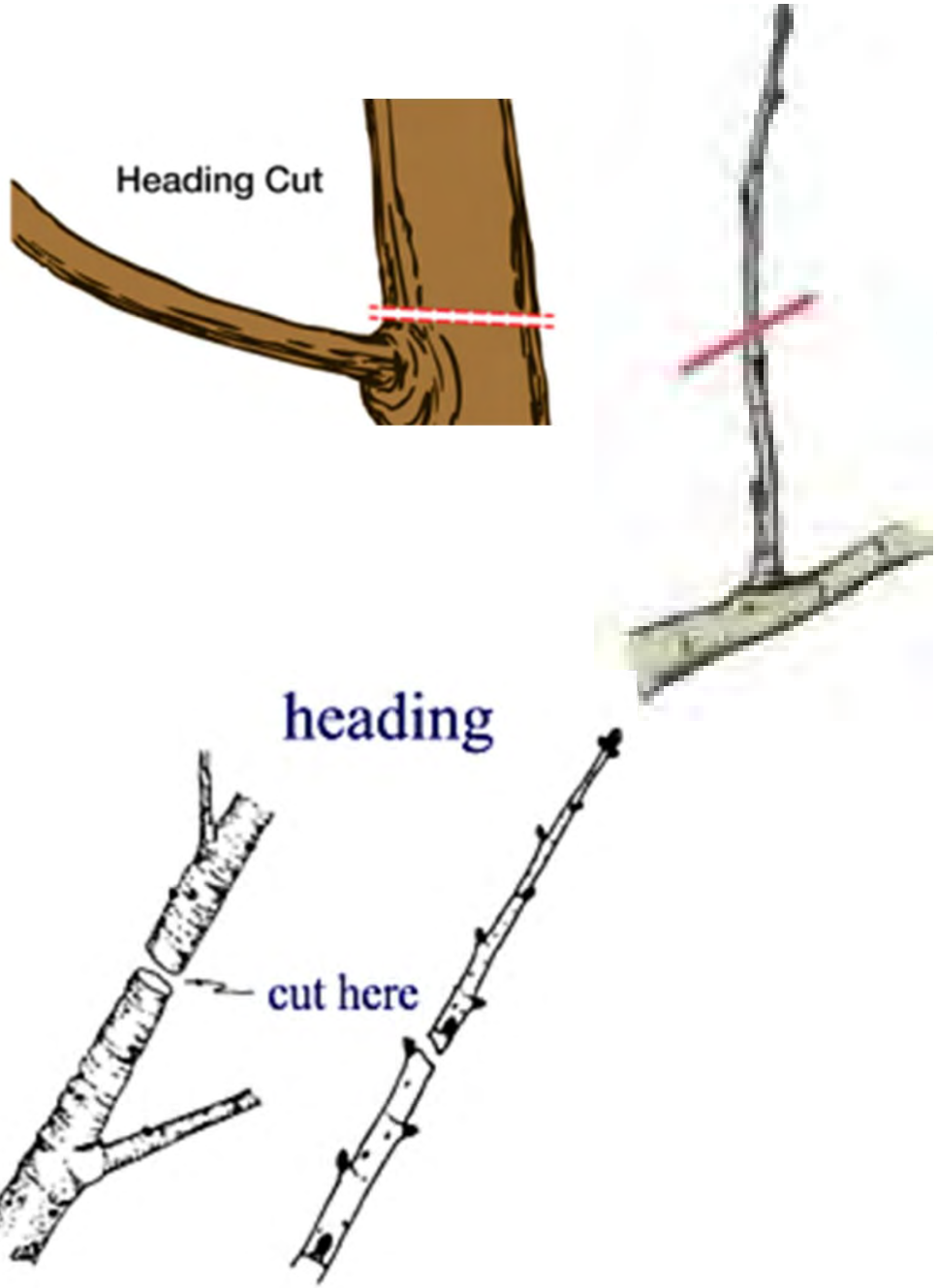
REDUCTION CUT

Removes the larger of two or more branches or stems, or one or more codominant stem(s), to a live lateral branch, typically at least one-third the diameter of the stem or branch being removed.



PRUNING
HEADING CUT

Removes a branch or stem between nodes (leaving a stub), to a bud, or to a live branch typically less than one-third the diameter of the branch or stem being removed.



Colorado State University

University of Florida

PRUNING

WOUND TREATMENTS

Not necessary, unless in response to a specific threat against which such treatments are known to be effective—for example, when pruning oak trees when and where they are susceptible to oak wilt

Wounds should close evenly from all sides

PRUNING

TREE RESPONSE TO UTILITY PRUNING

Amount and rate of growth are affected by:

- Species
- Location, size and quality of cuts
- Amount removed and relative tree vitality
- Site factors, e.g. growing conditions

Adjust pruning accordingly

PRUNING

STRUCTURAL AND DIRECTIONAL PRUNING

Every tree is different
Adjust approach based on:

- Tree age
- Species/cultivar form
- Mature size and shape
- Past pruning practices
- Expected response

PRUNING

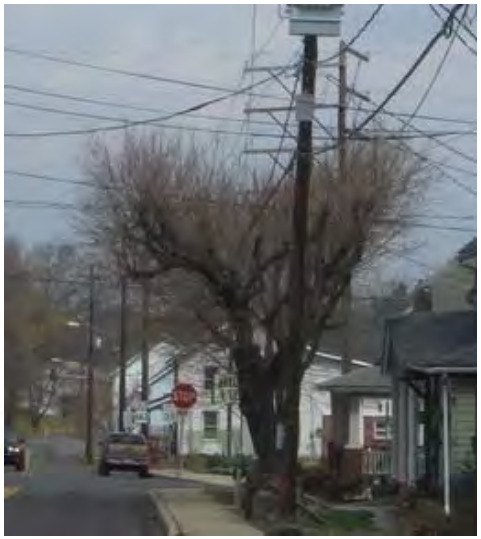
STRUCTURAL AND DIRECTIONAL PRUNING

A tree with a spreading (decurrent) habit adjacent to overhead lines is likely to require more pruning than a similarly placed tree with an upright growth (excurrent) pattern.

PRUNING

STRUCTURAL AND DIRECTIONAL PRUNING

Over time, basic tree structure can be modified to reduce risk to facilities



Topping causes heavy sprout growth

Directional pruning reduces sprout growth

PRUNING

UTILITY PRUNING OBJECTIVES

Risk reduction

- Far more interruptions are caused by tree and branch failure than trees growing into lines

Clearance

- Clearance distances should reflect tree characteristics

Maintain structure

- To minimize risk
  - Directional pruning
  - Managing overhang

PRUNING

RISK REDUCTION

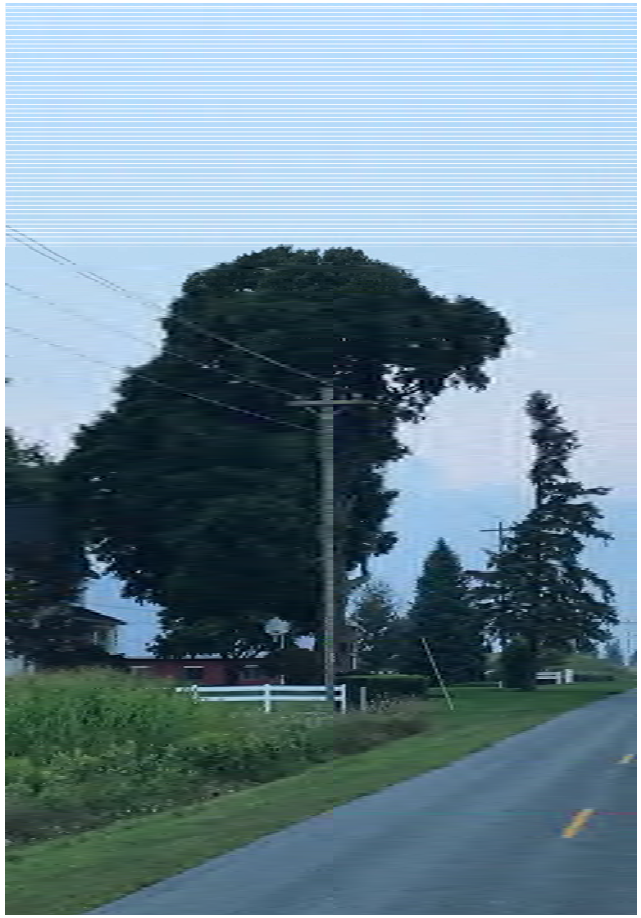
- Dead or declining
- Broken or partially failed, due to an earlier injury
- Adventitious, (arose as sprouts, e.g., from old pruning wounds)
- More upright or codominant, especially when included bark is present at the branch union
- Overextended or poorly tapered, especially with heavy loads toward the distal end (e.g., lion tailing)
- Showing significant defects that compound any of the above, such as large cavities or decay

PRUNING

CLEARANCE

Amount of clearance depends on many factors:

- Priority of the facility (e.g. voltage, overcurrent protection, number/type of customers, etc.)
- Facility construction (e.g. pole height, crossarms, vertical, bundled, tree wire, sag, etc.)
- Planned maintenance interval
- Position of the tree
- Typical weather patterns
- Individual tree characteristics (e.g., species, condition, growth rate, wood strength, size/shape, response to pruning, and other factors)
- Site factors, such as trees, buildings, terrain, soil, and other features that contribute to the shape, growth rates, or stability of trees



PRUNING

MANAGING OVERHANGING BRANCHES

- Whether to remove, or reduce and maintain overhang, depends on:
  - Line priority
  - Tree species and condition, including branch length and size
  - Susceptibility to storms
  - Community norms
- Removing all overhang is costly, and is not always necessary.
- Overhanging branches can be managed by reducing branch length and removing dead and weakly attached branches

PRUNING

PRUNING INTERVALS

- Determining optimum maintenance intervals
- Incorporating tree growth regulators
- Reclaiming overgrown facilities

PRUNING

RECLAIMING OVERGROWN FACILITIES

Stedman and Brockbank 2012

Utility	Length of optimum clearance cycle	Relative cost* to prune trees at a site that is				
		At optimum time**	1 year past optimum	2 years past optimum	3 years past optimum	4 years past optimum
A	5 Years	$1.00	$1.23	$1.43	$1.59	$1.69
B	5 Years	$1.00	$1.21	$1.39	$1.53	$1.64
C	6 Years	$1.00	$1.16	$1.30	$1.40	$1.47

Cost of Deferred Maintenance

This chart shows that it costs more to prune trees past the optimum clearance cycle. These figures do not include:

- Costs of repairing damage caused by trees, or
- Economic costs of service interruptions.

In addition, to stay on cycle will require more resources due to the extra growth that must be continually removed.

PRUNING

PRUNE OR REMOVE?

PRUNING

PRUNE OR REMOVE?

PRUNING

PALM PRUNING

PRUNING

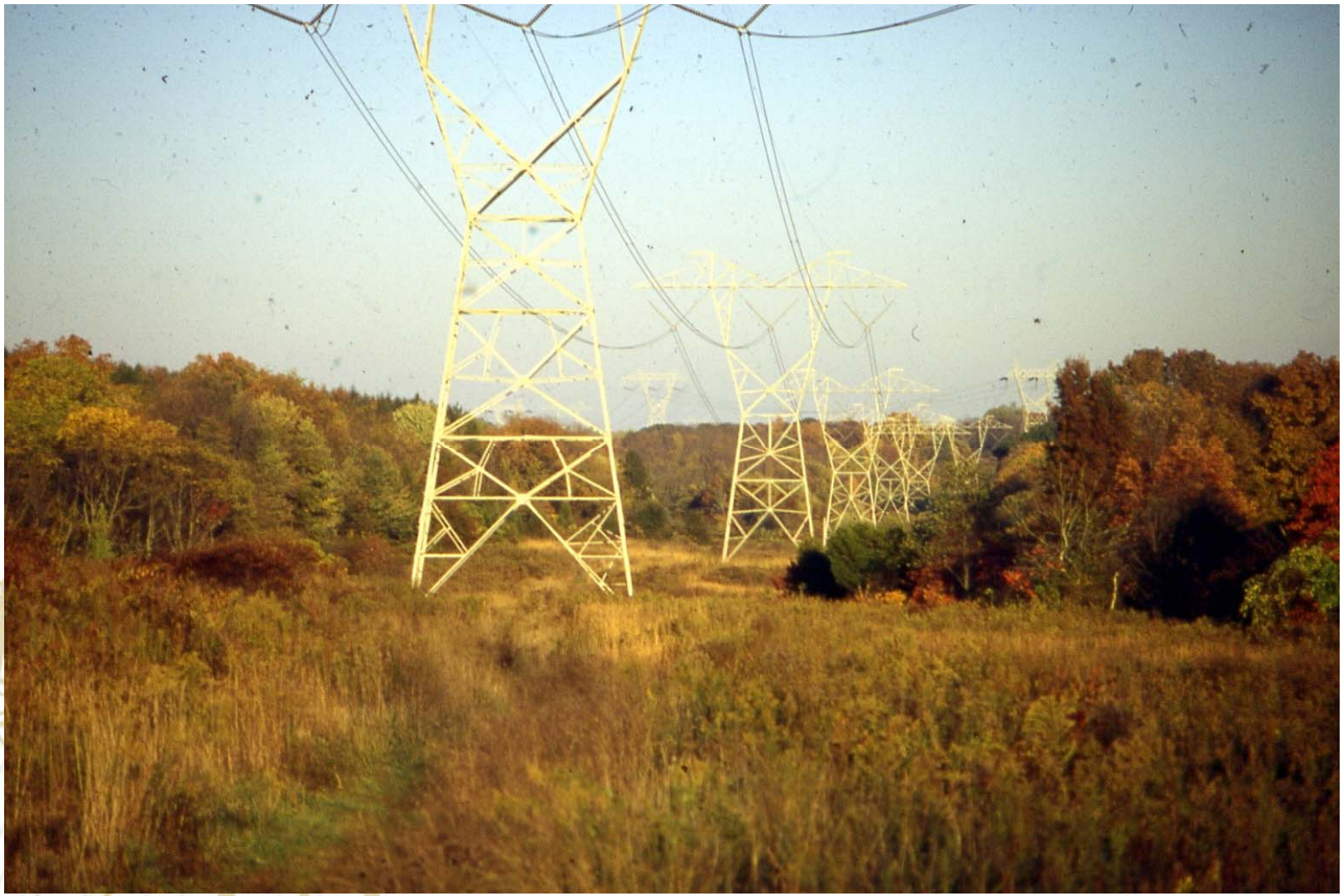
REMOTE/RURAL ENVIRONMENTS

- Mechanical Pruning
- Chemical Pruning
- Limited use of climbing spurs allowed

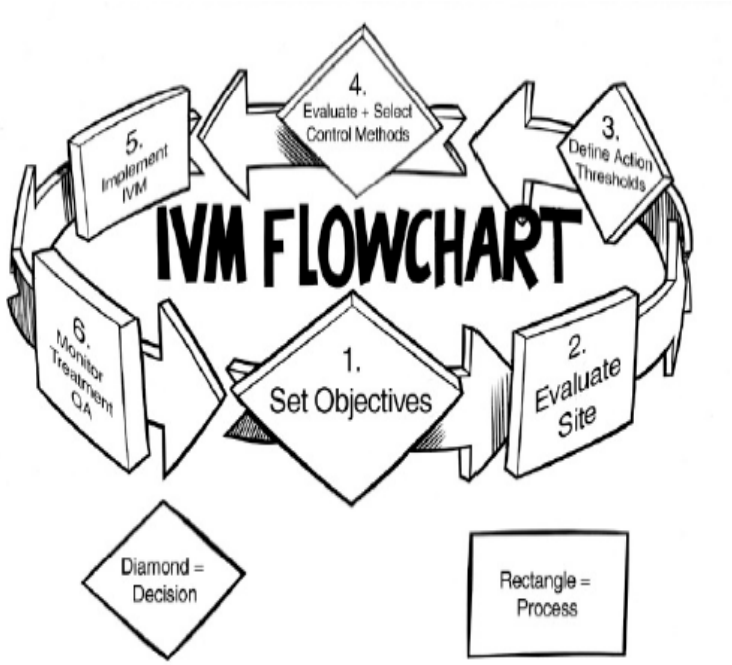
SUMMARY - PRUNING

- Utility pruning reduces risk
  - Safety, reliability, compliance, access
- Follow industry standards and best practices
- Specify a pruning system (usually “natural”}
- Specify proper cuts, appropriate for the situation
  - Direct growth away from facilities
  - Anticipate tree response to pruning
  - Develop tree structure to minimize interference
- Remove trees that pose excessive risk
- Reserve mechanical methods for remote/rural locations

IV. IVM



IV. IVM



- Set IVM objectives based on the intended purpose of the site and available resources
- Evaluate the site to assess field conditions
- Compile and select from a broad array of treatment methods
- Identify engineering alternatives in vegetation management
- Implement and monitor a vegetation management plan and efficacy of treatments
- Describe key chemical properties of herbicides used in vegetation management

IVM

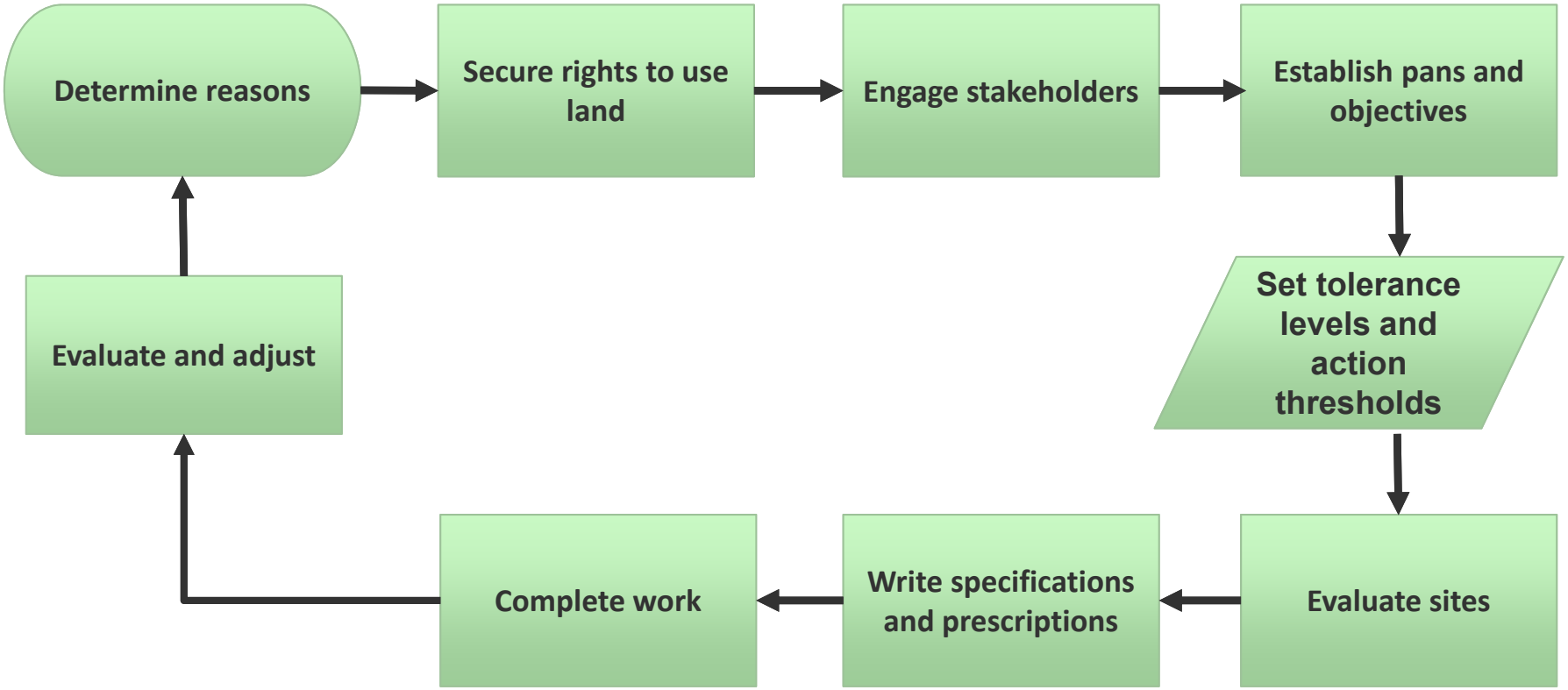
ANSI A300

- *American National Standard for Tree Care Operations. Part 7 - Integrated Vegetation Management a. Electric Utility Rights-of-way (2012)*

- *2018 Revision:*

  Integrated Vegetation Management

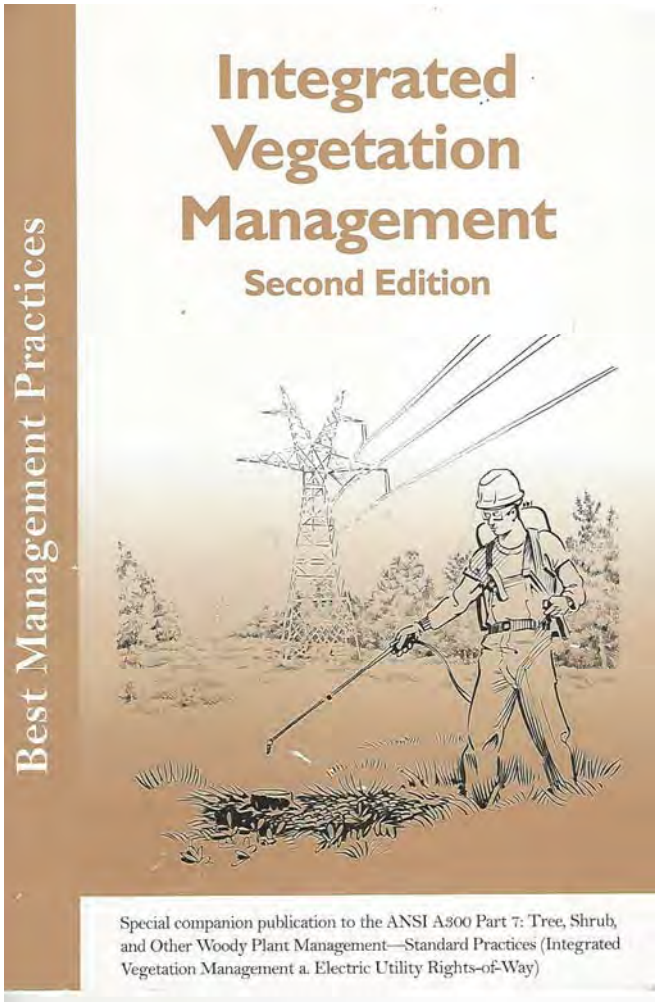
ANSI A300 PART 7 (2018) FLOW CHART



IVM

IVM BMP

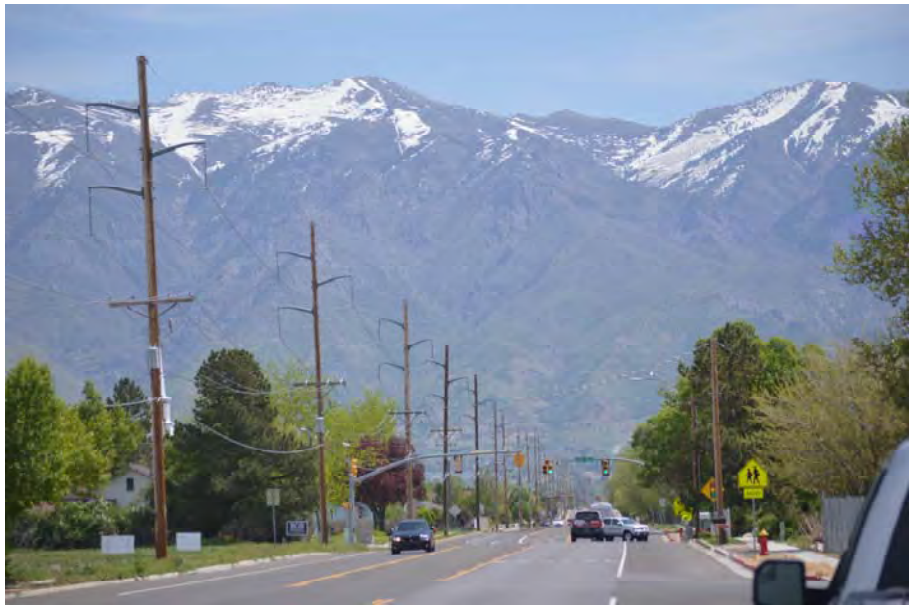
- IVM definition: System of managing plant communities in which managers set objectives, identify compatible and incompatible vegetation, consider tolerance levels and action thresholds, and evaluate, select, and implement the most appropriate treatment meth or methods to achieve their established objectives



IVM

ATTRIBUTES

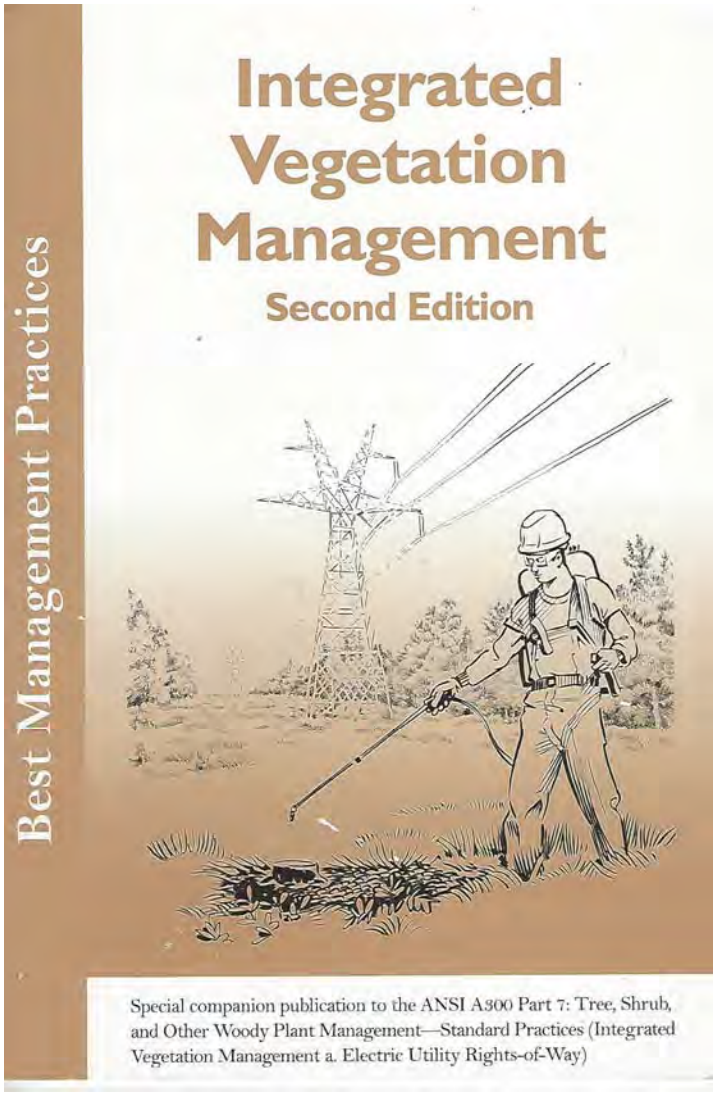
- Balances
  - Control
  - Costs
  - Public Health
  - Environmental Quality
- Long term goal: Convert rights-of-way from tall-growing plant species to stable, low-growing plant communities



IVM

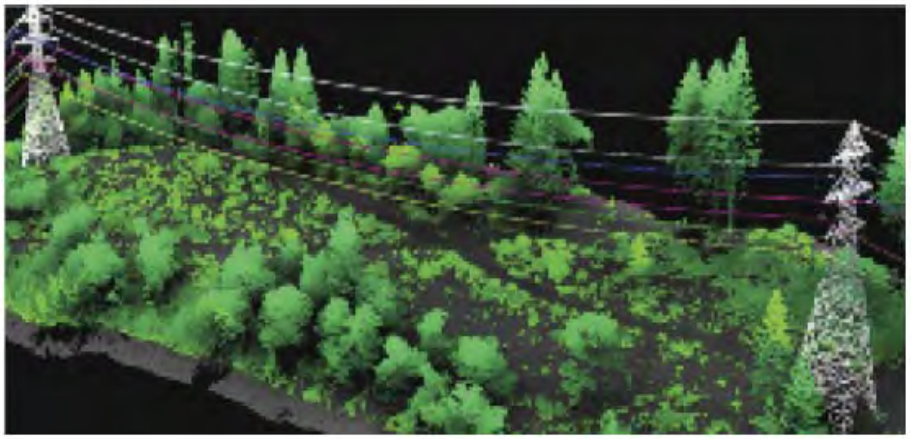
IVM BMP

- Choice of control methods is based on effectiveness, environmental impact, site characteristics, safety, security and economics
- Founded on Integrated Pest Management Principles



IVM

SITE EVALUATION



- Comprehensive evaluation
- Surveys (partial evaluation)
  - Quadrant sampling
  - Point sampling
- Establish tolerance levels (action thresholds)

IVM

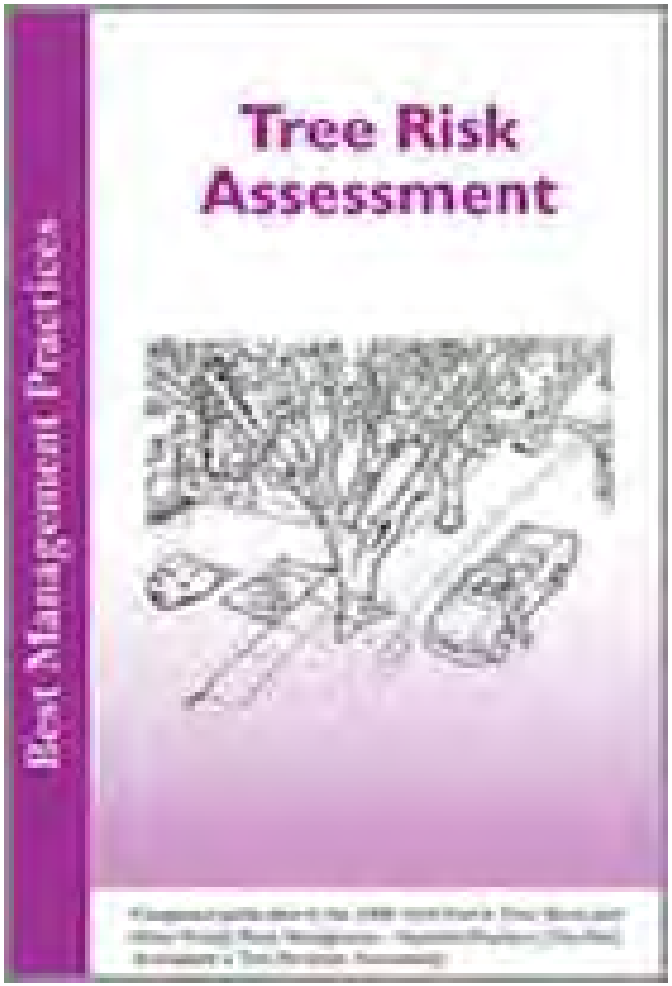
SITE EVALUATION

- Site Factors
  - Facility type
  - Ownerships (land use)
  - Topography
  - Environmental factors (riparian areas, T&E)
  - Other considerations

IVM

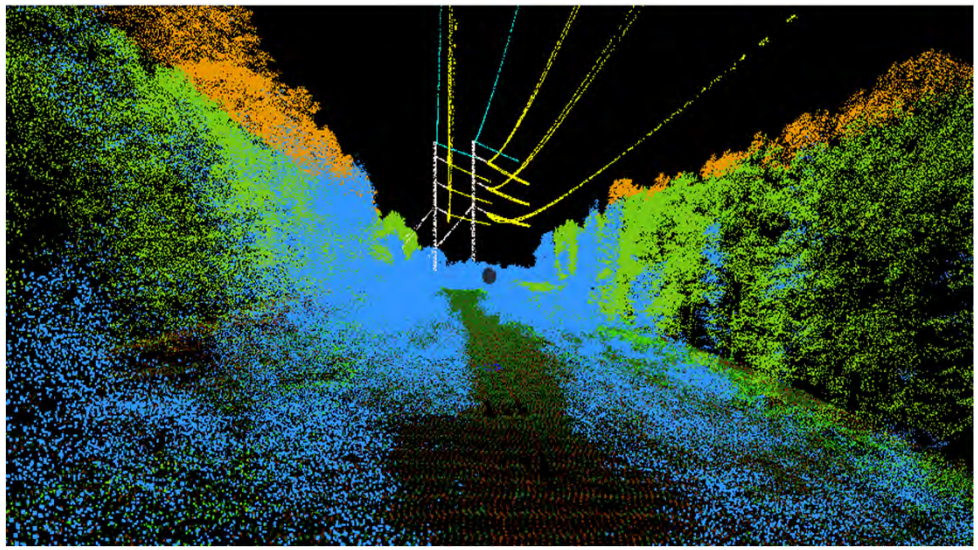
ISA BEST MANAGEMENT PRACTICES:
TREE RISK ASSESSMENT

- Level 1: Limited visual assessment
  - ID trees that have an imminent or probable likelihood of failure
- Level 2: Basic assessment
  - 360-degree ground-based visual inspection of the above-ground portion of a tree and its surrounding site to identify structural defects that could affect utility facilities.



IVM

LiDAR



IVM

SET OBJECTIVES

- Outcomes based on site factors:
  - Line voltage
  - Construction type
  - Land use
  - Environmental conditions
  - Topography
  - Other factors

IVM

TOLERANCE LEVEL AND ACTION THRESHOLDS

Jay Neil, PacifiCorp

- **Tolerance level:** maximum incompatible plant pressures (species, density, height, location, or condition) allowable before unacceptable consequences develop (e.g. NERC violation)

- **Action thresholds:** vegetation pressures where vegetation management treatments should occur to prevent conditions from reaching tolerance levels (e.g. height, species, stem density, etc)

IVM

EVALUATE AND SELECT TREATMENT METHODS

- Importance and type of facility
- Vegetation clearances
- Workloads
- Growth rate of predominant vegetation,
- Geography,
- Accessibility
- Time elapsed since the last scheduled work

IVM

TREATMENT METHODS

- Manual
- Mechanical
- Cultural
- Biological
- Chemical

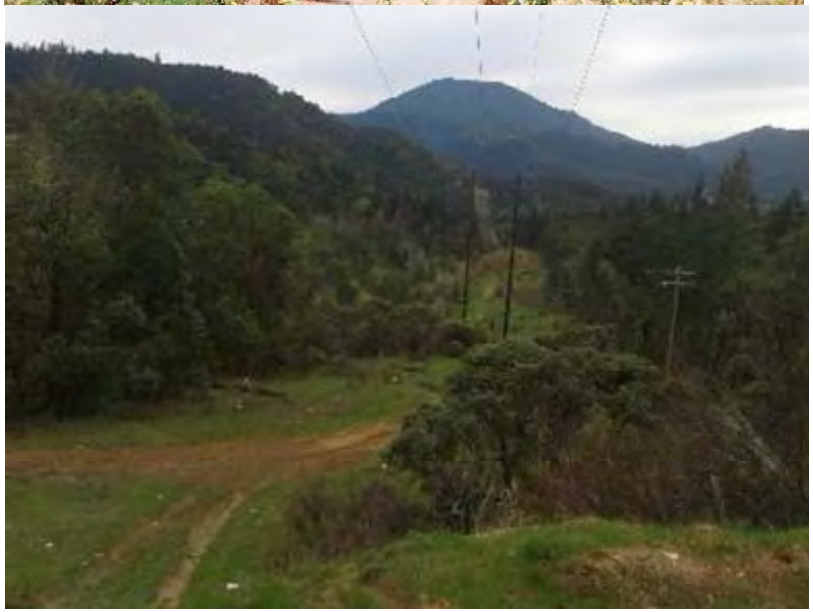
Dylan Evans, PacifiCorp

IVM

ROW RECLAMATION

IVM

CHEMICAL METHOD



- Properties:
  - Toxicity: relatively nontoxic to slightly toxic
  - Soil properties
  - Half life
  - Soil properties' influence on persistence
- Mode of action
  - ALS or AHAS inhibitors, synthetic auxins, photosystem I or photosystem II inhibitors and EPSP inhibitors

IVM

CHEMICAL APPLICATION METHODS

- Individual plant
  - o Stump
  - o Basal
  - o Selective foliar
- Areal
- Broadcast

Jay Neil, PacifiCorp

IVM

COVER TYPE CONVERSION

Richard Byrnes

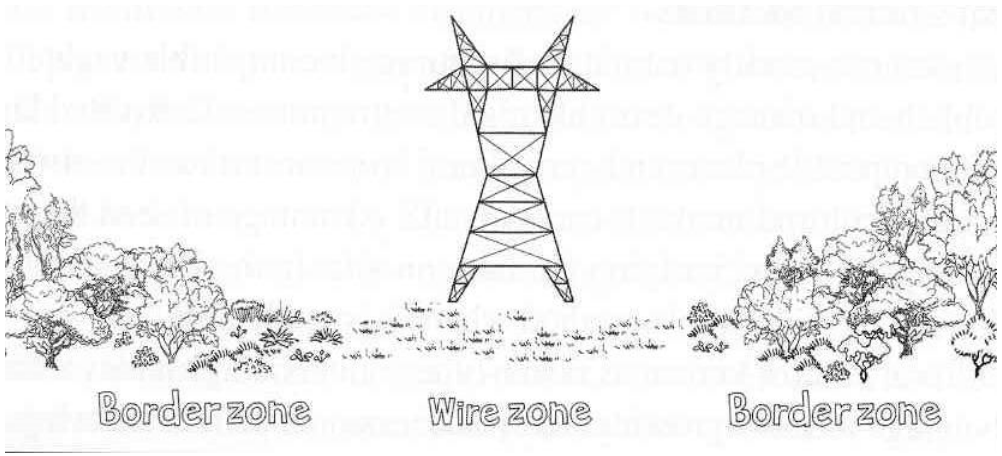
Kristin Wild Asplundh Tree Experts

- Chemically-facilitated biological control
  - Replace incompatible plant community with one comprised of species that will never interfere with the facility in its lifetime

IVM

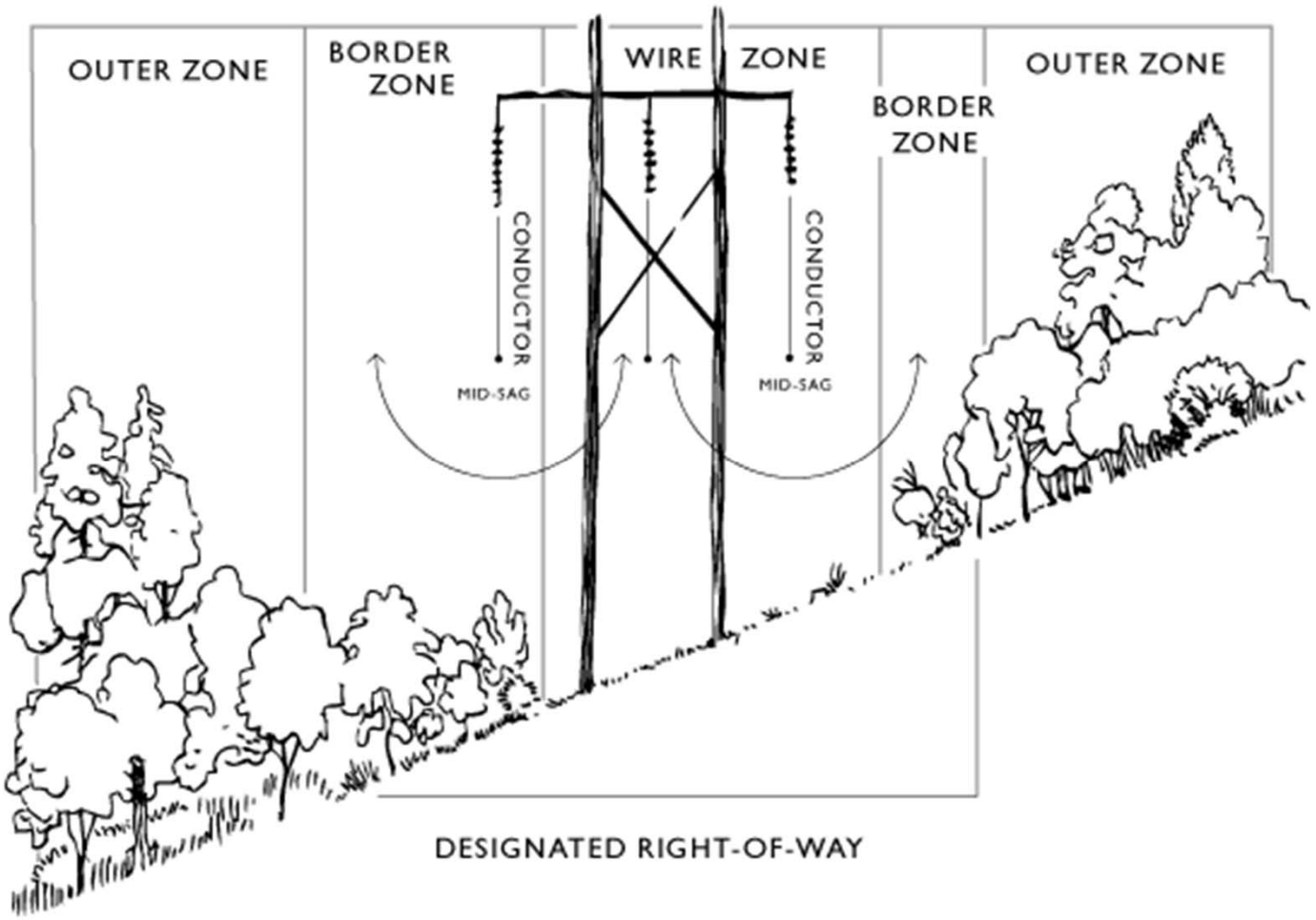
WIRE ZONE-BORDER ZONE

- Establish compatible, stable plant communities.
- Enhance wildlife habitat (meadow species, edge species and forest species).



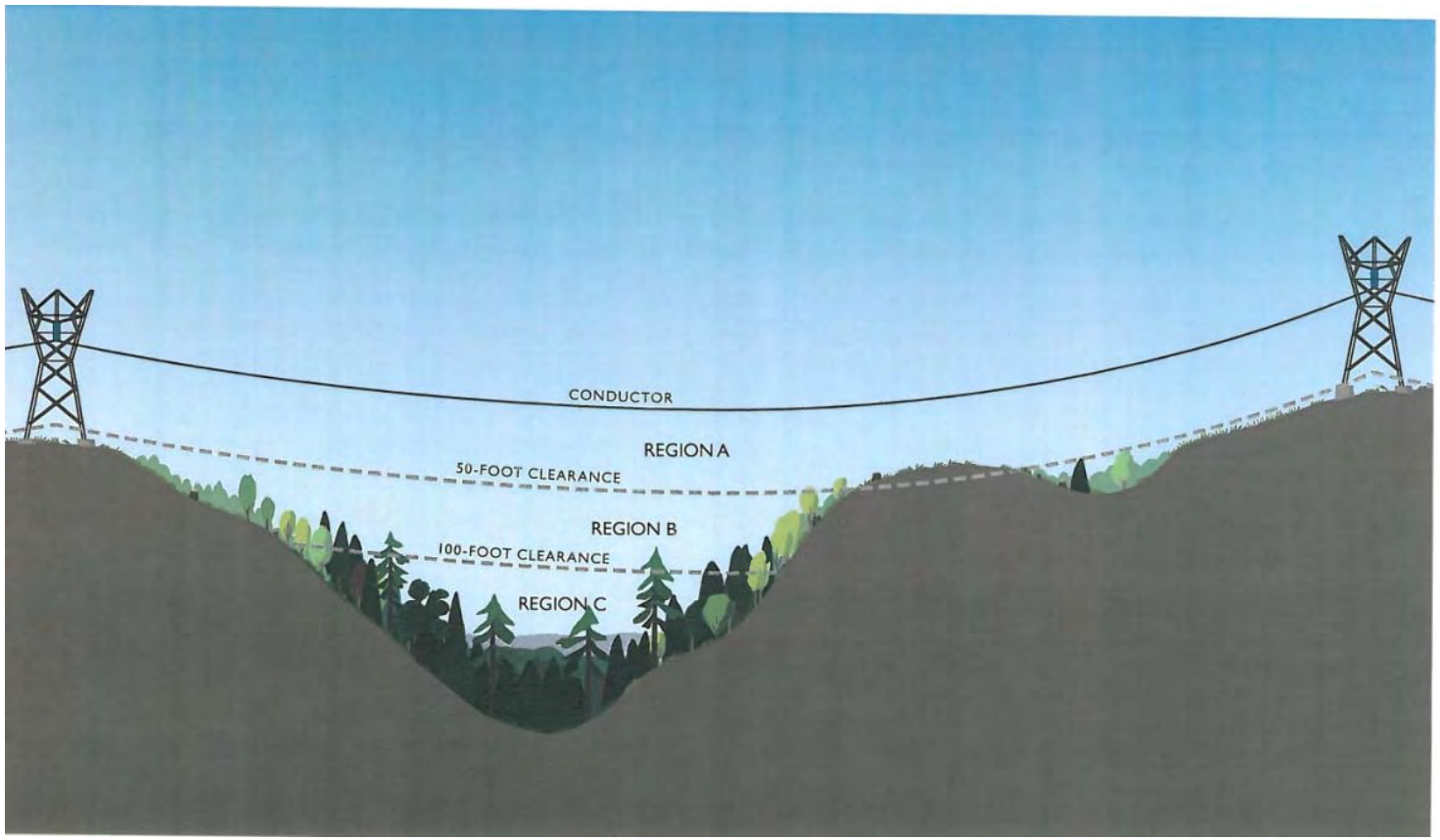
IVM

SIDE SLOPE



IVM

WIRE HEIGHT ADJUSTMENTS



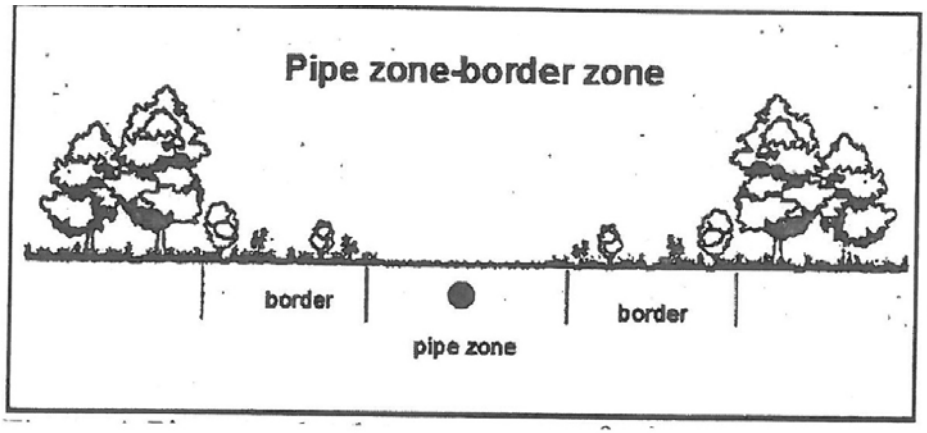
IVM

CLOSED CHAIN OF CUSTODY

- Container cycle: supply containers are returned, refilled and reused.
- Integrity cycle: Closed connections at the transfer points between supply containers, mix tank and application equipment.
- Documentation cycle: A container tracking system that establishes an auditable record documenting movement of herbicides and containers.
- Herbicide cycle: Use of customer blends containing the required active ingredient and adjuvants.

IVM

PIPE ZONE-BORDER ZONE



- Safety
- route identification
- testing
- encroachments
- Maintenance
- inspection (particularly aerial and ground patrol needed for leak detection)

IVM

MONITOR AND QUALITY ASSURANCE

- Documented procedure for ensuring that work is completed according to specifications and industry standards
- Generate a culture of quality that gets incorporated into work practices at every step
  - Not a “gotcha” program.

IVM

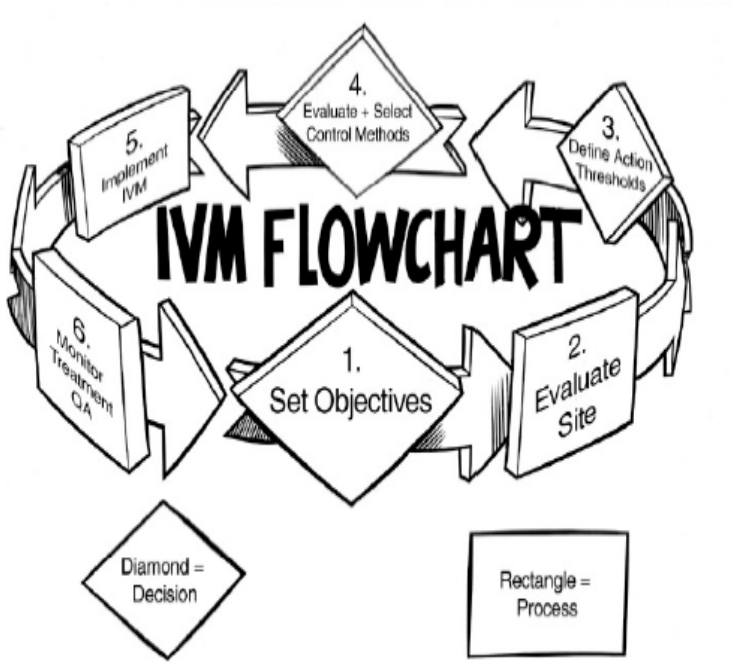
Maintained Rights of Way are not Sacrifice Areas

- Right-of-way Stewardship Council Accreditation

http://www.rowstewardship.org/integrated_vegetation_management

ROW Stewardship Council

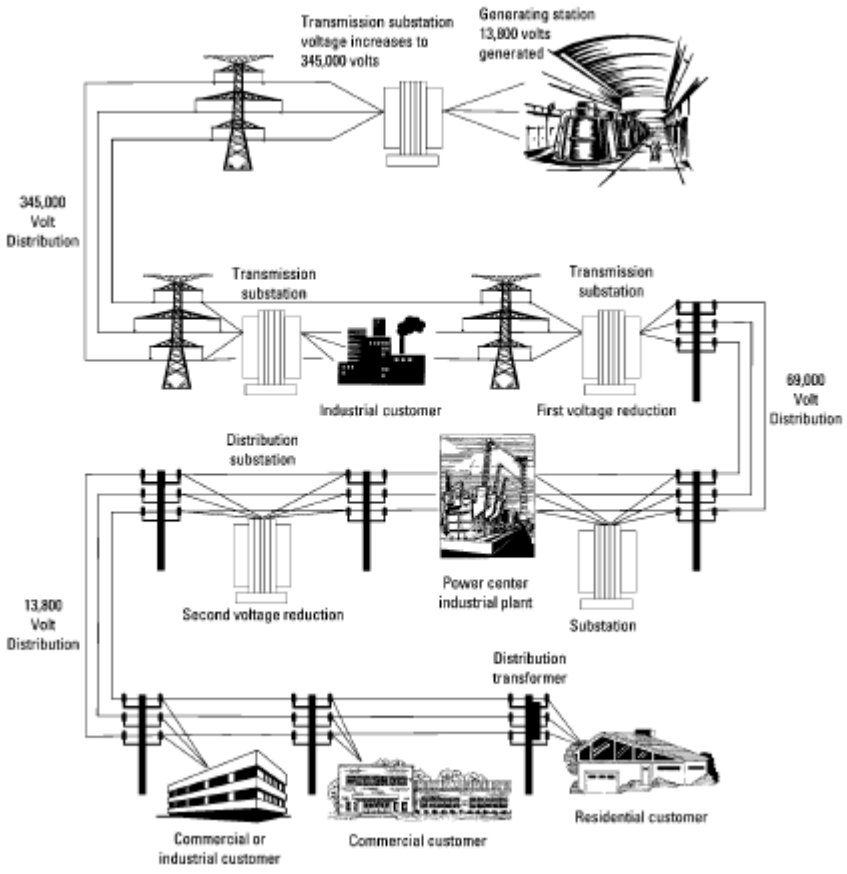
IVM SUMMARY



- IVM is an ecosystem-based, systematic process of modifying plant communities and controlling incompatible vegetation on a site based in IPM
- IVM includes manual, mechanical, chemical, biological and cultural methods
- Cover type conversion is preferred
- Best practices work with nature, rather than against it

V. ELECTRICAL KNOWLEDGE

V. ELECTRICAL KNOWLEDGE



- Communicate using appropriate electrical terminology
- Explain the electrical system from powerhouse to customer
- Describe basic functions of common electrical system hardware
- Identify vegetation conditions that could cause service interruptions
- Perform work around electrical hazards according to applicable standards

Electrical Knowledge

THOUGHT

- Electricity is the only commodity that is produced, transported, distributed and consumed in the same instant.

Electrical Knowledge

ELECTRIC FUNDAMENTALS

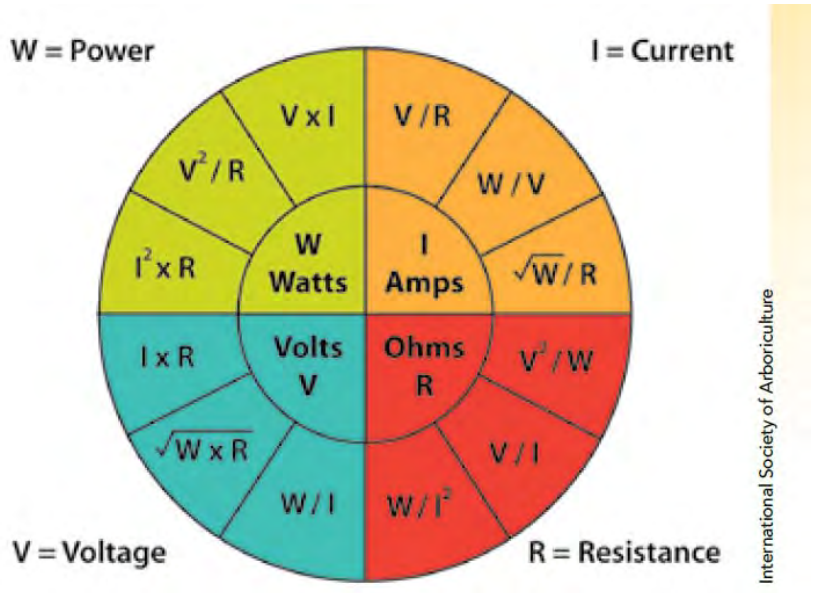


Figure 5.1 Ohm's law circle diagram.

- **Volts:** measure of electrical force – analogous to pressure
- **Amps:** measure of current – analogous to liters of water per minute
- **Watt:** measure of electric power – one watt flowing at one amp
- **Resistance:** opposition to current flow – measured in ohms
  - **Impedance:** resistance + inductive reactance + capacitive reactance

ELECTRICAL KNOWLEDGE

GENERATION

- Fossil Fuel and Nuclear Steam Turbine
- Renewable
  - Hydroelectric
  - Wind
  - Solar
  - Geothermal
  - Ocean current

Electrical Knowledge

ELECTRICAL FACILITIES

- Transmission/distribution/secondary voltages
- Distribution Wye vs. Delta construction
- Phase-to-phase and phase-to-neutral voltages
- Wires (copper, ACSR)
- Underground cable

Electrical Knowledge

CLASSES OF LINES

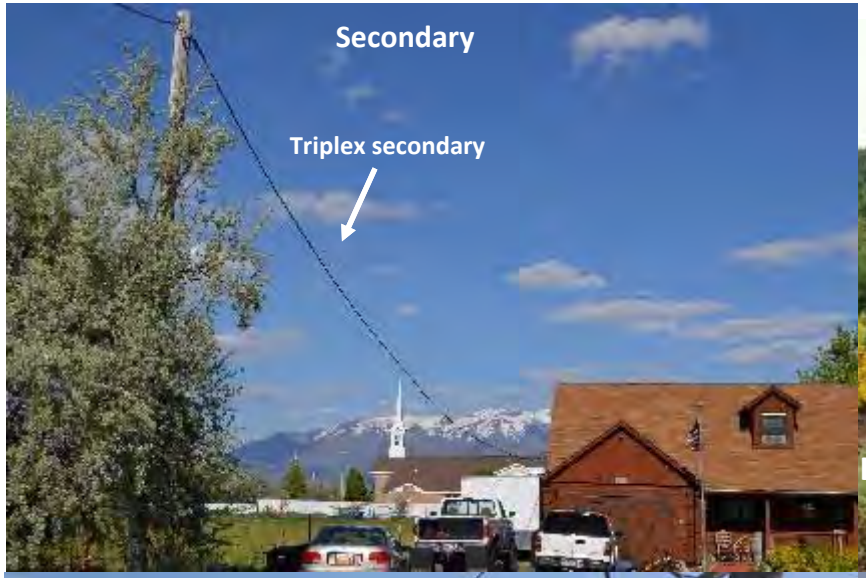


Table 5.1 Common voltage classifications.

Designation	Voltage
Extra-high transmission voltage	345 kV–765 kV
Transmission voltage	115 kV–230 kV
Subtransmission voltage	23 kV–115 kV
Distribution voltage	2.4 kV–23 kV
Secondary or customer voltage	120 V–240 V

Source: Abbott, Dubish, and Rooney 2005.

Electrical Knowledge

EQUIPMENT

- **Switches:** help manage the electrical network - manually operated and not designated for line protection

Figure 5.23 Disconnect switches.

Figure 5.24 Open airbrake switches.

Electrical Knowledge

CIRCUIT PROTECTION
CIRCUIT BREAKERS

Figure 5.25 Circuit breakers.

- Minimize duration of electrical safety risks
- Reduce equipment exposure to potentially damaging voltages or current
- Limit the number of customers without power during an outage
- Open and re-energize circuits during transient faults

Electrical Knowledge

AUTOMATIC LINE RECLOSERS

- Prevent unnecessarily long outages
- In response to faults, reset two or three times quickly over set period of time (often within seconds) before opening permanently
- Permanent operation is called a lockout

Electrical Knowledge

LINE SECTIONALIZER

- Isolate line sections or protective zones to limit the number of customers out of service
- Coordinate with automatic line reclosers - cut off current when an upstream recloser operates, but before it locks out
- Isolates fault beyond the sectionalizer. There might be several sectionalizers on a circuit

Electrical Knowledge

FUSES AND CUTOUTS

- Cutouts are fuses designed to operate above 600 V
- Simplest short circuit protection
- The farther from substation, the more sensitive the fuse

Electrical Knowledge

LIGHTNING

- Protect against voltage surges caused by lightening and flashover faults that would otherwise damage equipment and interrupt service.
- Channel excessive current to ground

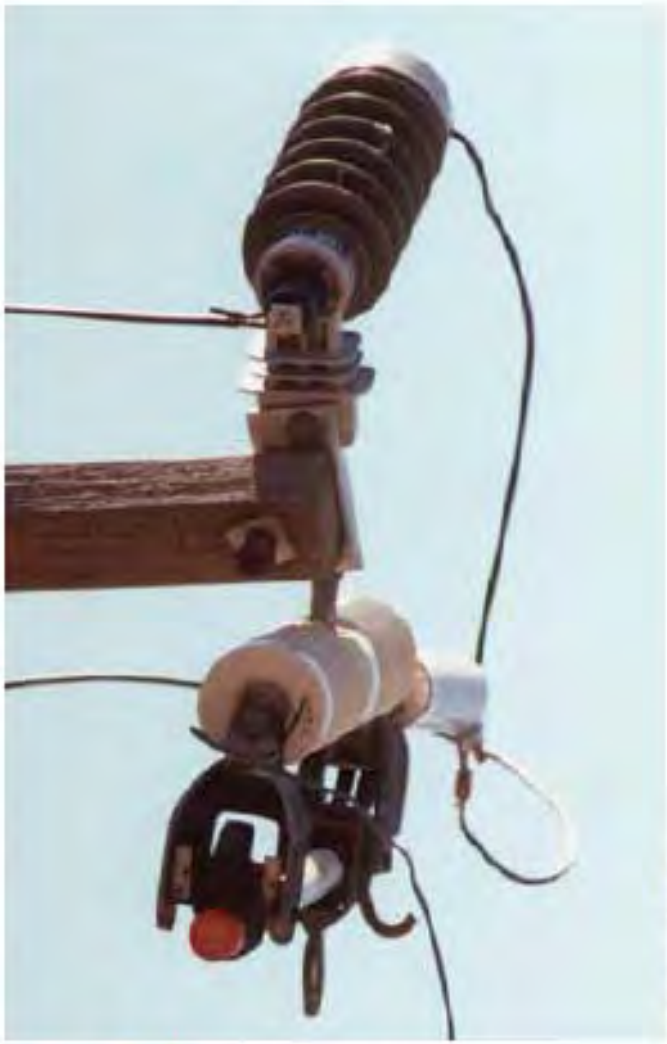


Figure 5.29 Lightning arrester.

Electrical Knowledge

TRANSFORMERS

- Step up or step down voltage through inductance
  - Depending on intended direction of the system
- Flow in an unintended direction is back feed
- Tuns ration = voltage ratio

Electrical Knowledge

POWER CONSISTENCY: VOLTAGE REGULATOR

- Correct voltage irregularities
- Usually have three bushings and a gauge
- Function like adjustable transformers, increasing or decreasing circuit voltage as needed

Electrical Knowledge

POWER CONSISTENCY: CAPACITORS

Figure 5.34 Three-phase capacitor bank.

- Hold and slowly release voltage
- Use
  - Boost voltage
  - Eliminate sparks
  - Smooth the flow of direct current
  - Protect against momentary voltage deficiencies

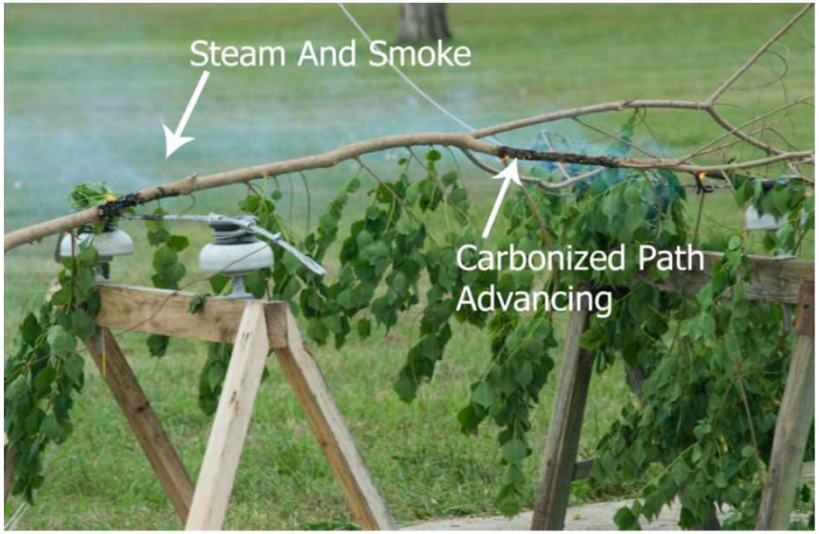
ELECTRICAL KNOWLEDGE

HOW TREES CAUSE OUTAGES

- Failure modes:
  - Mechanical
  - Electrical Short Circuits
    - Voltage gradient
    - Stem diameter
    - Species

Electrical Knowledge

OUTAGE PROGRESSION



Don Russell photos

"BURNERS"

- Apical meristems desiccate at microamp levels
- Do not contact the line and growth alone does not cause outages

Figure 5.36 Tree that has been electrically "trimmed."

Electrical Knowledge

NEW ZEALAND VEGETATION MANAGEMENT LAW

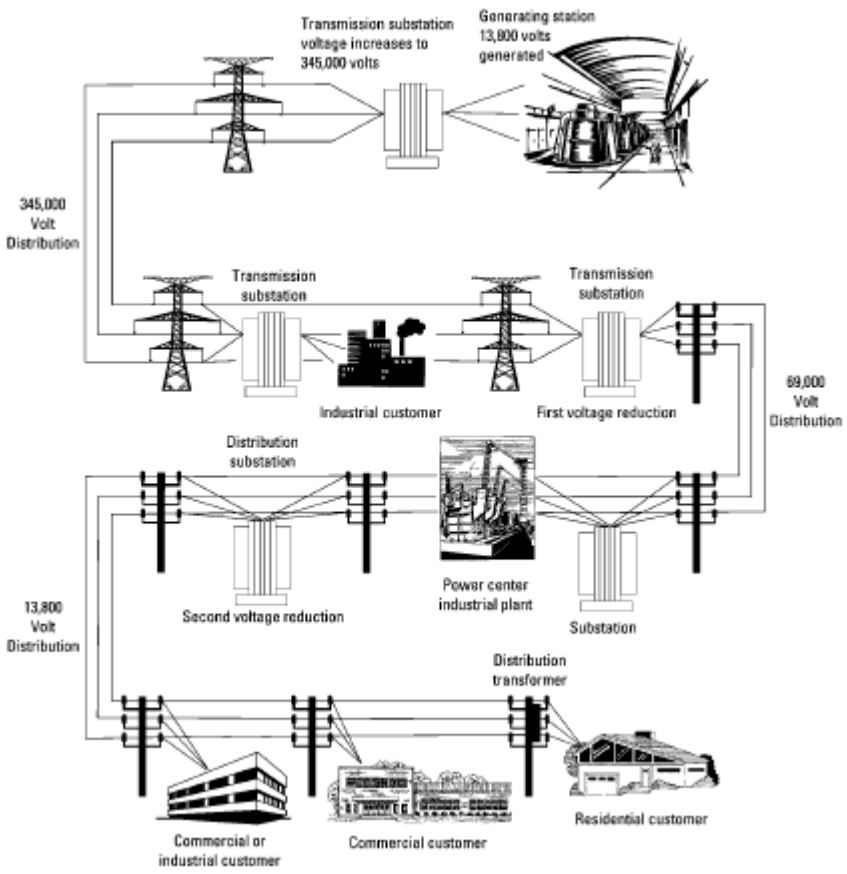
Tree owner is responsible for maintaining clearance, and is liable for any damage caused.

Table 5.3 New Zealand tree clearance requirements.

Voltage	Notice zone	Growth limit zone
66 kV+ (high voltage)	5.0 m (16.4 ft)	4.0 m (13.1 ft)
33–65 kV (high voltage)	3.5 m (11.5 ft)	2.5 m (8.2 ft)
11–32 kV (high voltage)	2.6 m (8.5 ft)	1.6 m (5.3 ft)
400 V/230 V	1.5 m (4.9 ft)	0.5 m (1.6 ft)

Source: New Zealand Government Parliamentary Counsel Office. Electricity (Hazards from Trees) Regulations 2003.

ELECTRICAL KNOWLEDGE SUMMARY



- Electricity is the only commodity that is produced, transported delivered and consumed in the same instant
- Electricity fundamentals include voltage, amps, watts conductivity, resistance and other elements
- Electric systems begin at power plants and finally deliver power to customers
- Switches manage the distribution network
- Overcurrent protective devices are strategically placed to minimize the portions of a circuit that are out of power due to a fault
- Outages are caused by mechanical failure and electrical short circuits

VI. STORM PREPARATION AND RESPONSE

VI STORM PREPARATION AND RESPONSE

STORM PREPARATION AND RESPONSE
OVERVIEW

- Identify sources of risk from storms
  - Types and intensities of storms likely to occur
  - Likely patterns of tree damage and failure
- Anticipate storm damage and mitigate with proactive maintenance
  - A well-maintained system will fare better when storms strike
- Plan and prepare for various types of storm responses
- Execute storm responses, including contingencies and logistical considerations
- Consider unique storm safety considerations
- Develop strategies for handling news media, social media, and public relations
- Incorporate “lessons learned” into preparations for future responses

STORM PREPARATION AND RESPONSE

DISASTER MANAGEMENT CYCLE

Storm response is a continuous process.

Organization of storm response should fit within the Incident Command System (ICS) best practices for emergency management

STORM PREPARATION AND RESPONSE

UTILITY ARBORISTS SKILLS ARE ESSENTIAL WHEN STORMS STRIKE

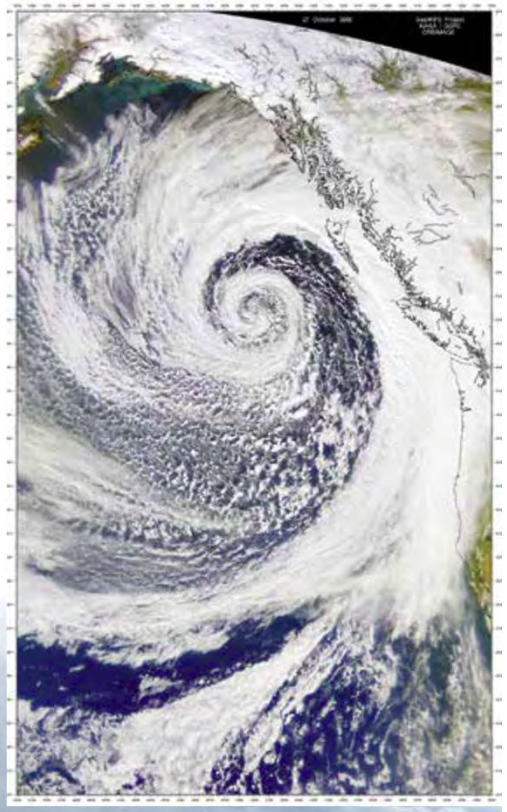
- Utility arborists provide access to stricken areas and assist in restoring essential services
- Storm-related electric service interruptions cost the economy $25-70 billion/year
- Skilled arborists are in short supply following storms, which necessitates a system for organizing and deploying crews from unaffected areas.

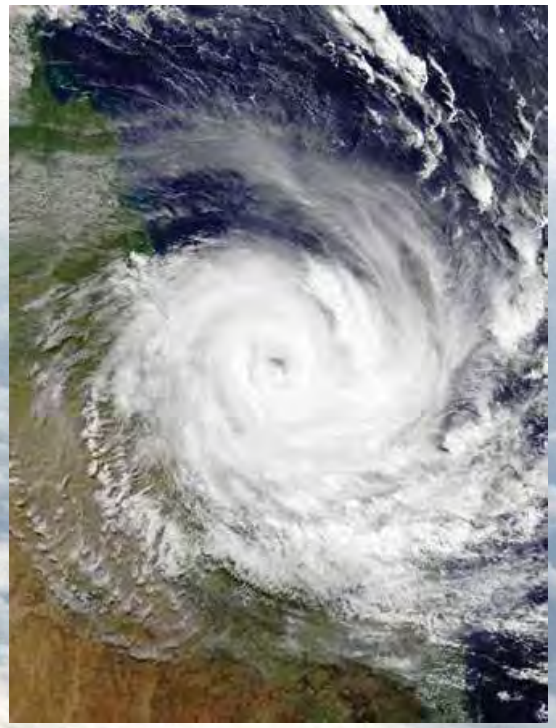
STORM TYPES

Cyclones

- Large, complex systems that travel and cover long distances
- Hurricanes, typhoons, tropical storms, tropical cyclones
- Extratropical cyclones
- Can be forecasted many days in advance

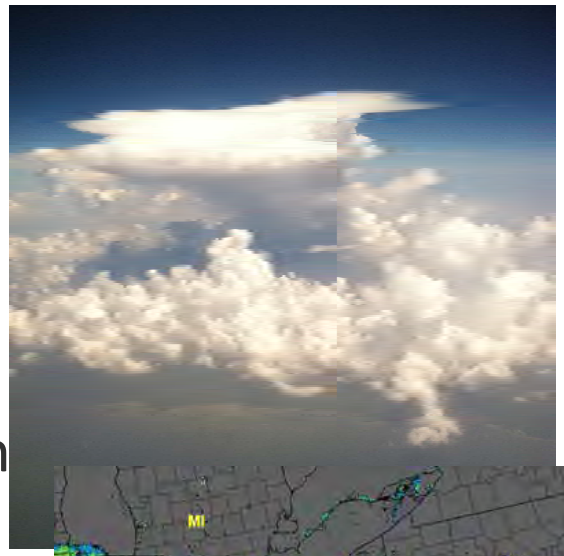
Cyclones spin counterclockwise in the Northern Hemisphere…





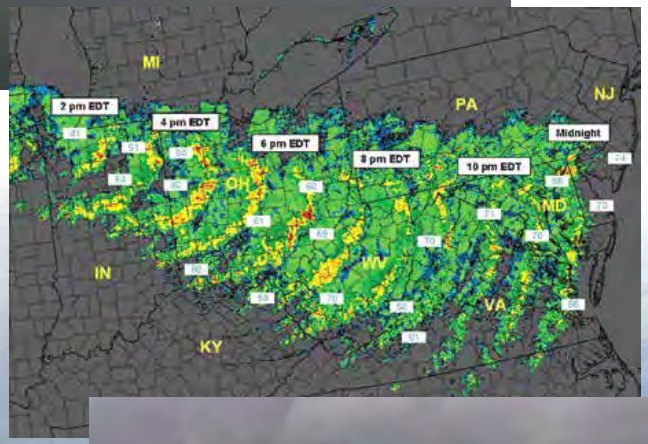
…and clockwise in the Southern Hemisphere

STORM TYPES



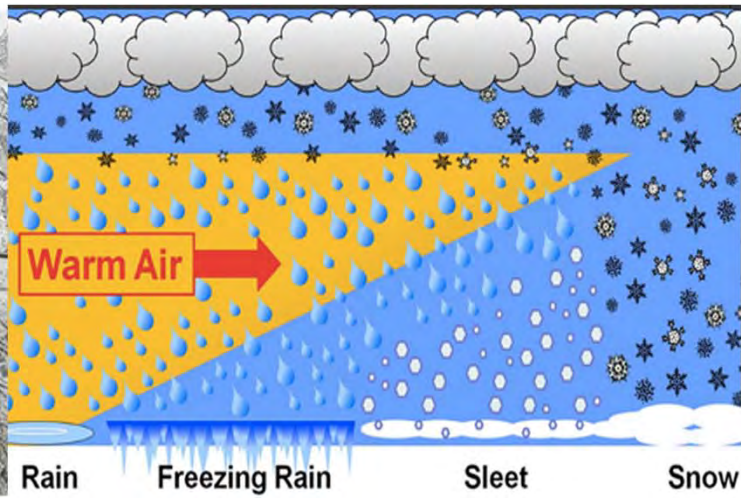
Thunderstorms

- Can be isolated or part of a larger, cyclonic system
- Difficult to forecast precisely in advance



- Derechos
  - Complex of thunderstorms traveling hundreds of miles
  - Widespread destruction
- Tornados
  - Localized extreme destruction

STORM TYPES

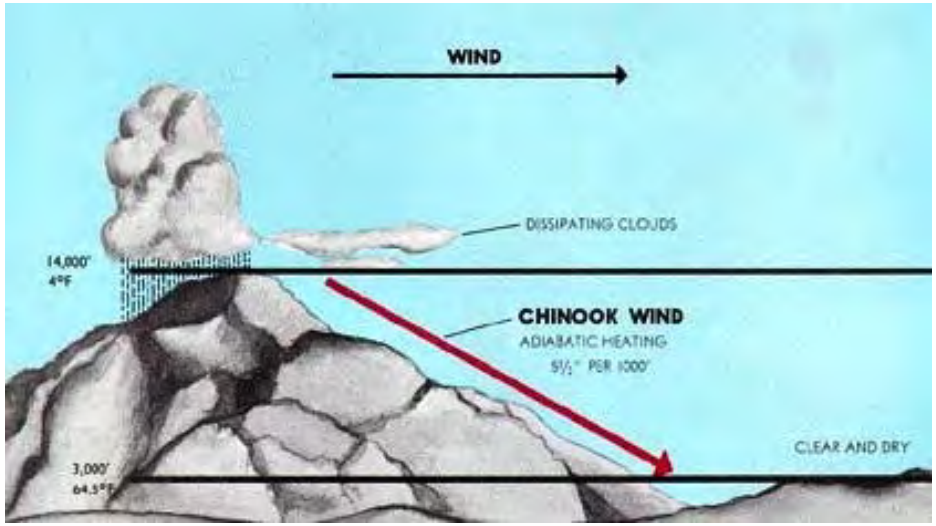


Winter storms

- Freezing rain

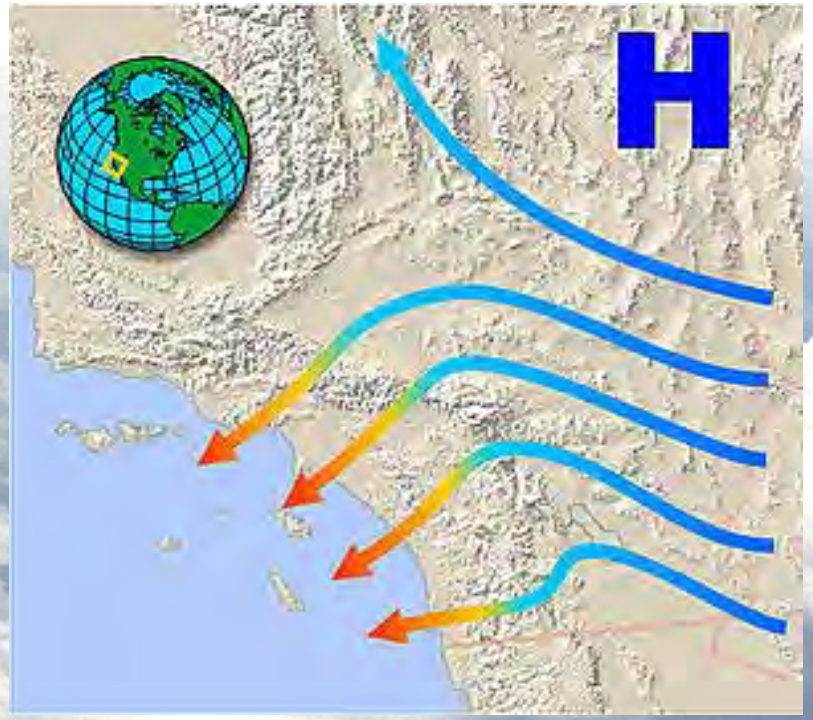
- Heavy wet snow

STORM TYPES



Local high-wind phenomena

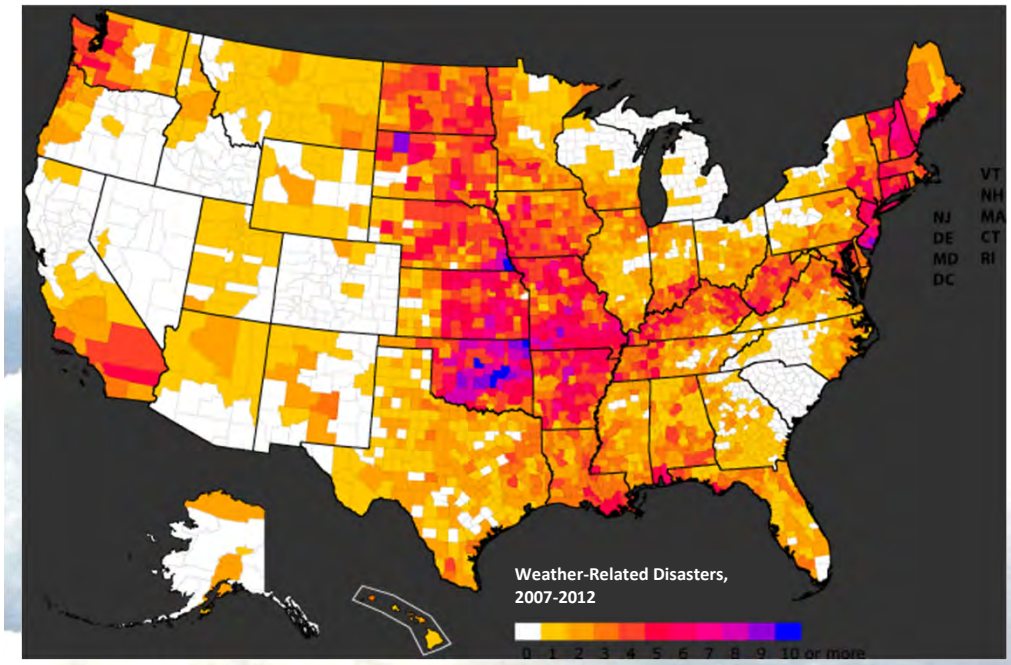
- E.g. Chinook
  - Western mountains

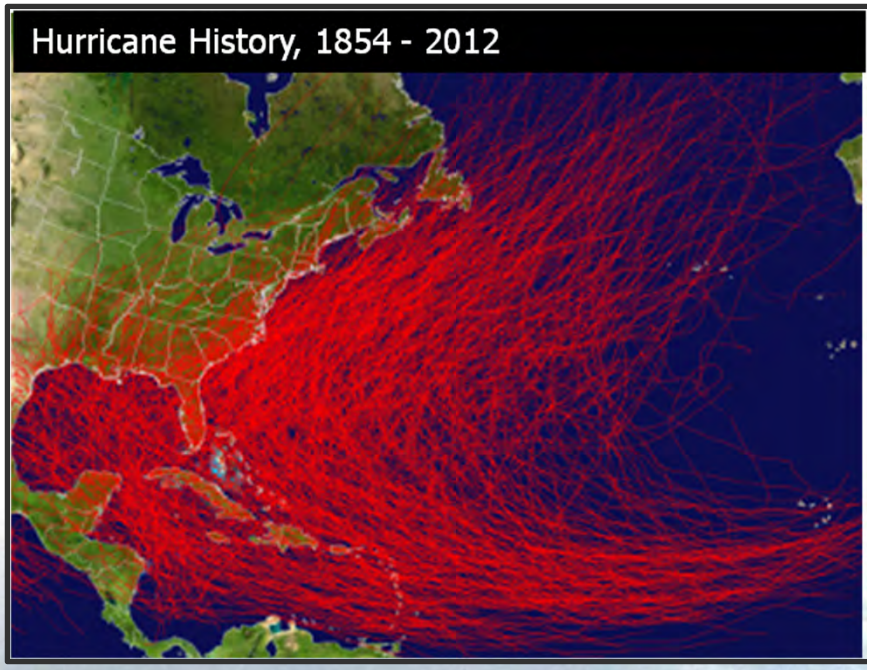


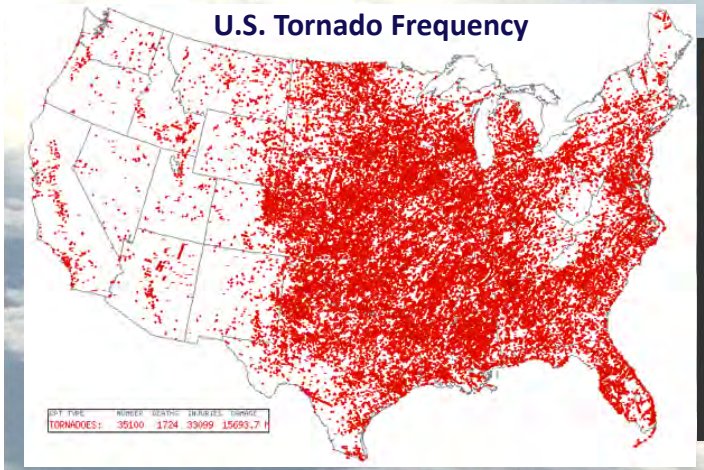
- Santa Ana
  - California

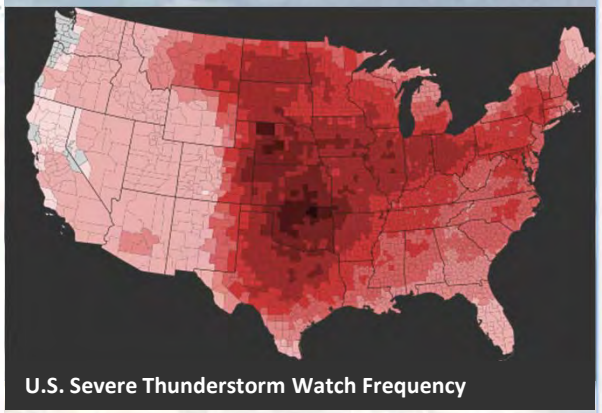
RISK IDENTIFICATION

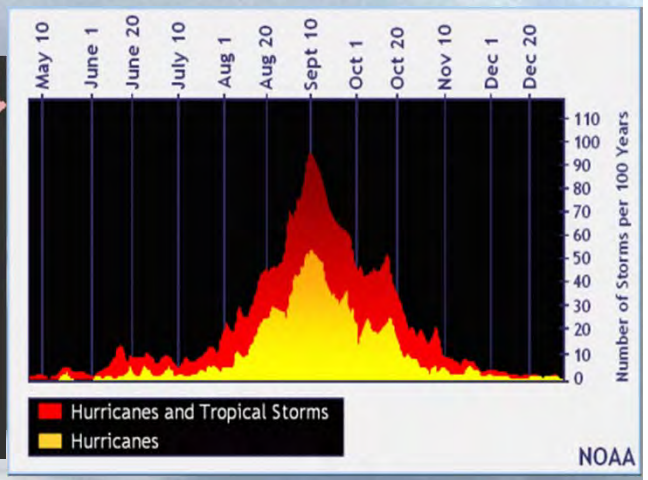
STORM TYPE AND FREQUENCY IS A FUNCTION OF SEASON AND GEOGRAPHIC LOCATION







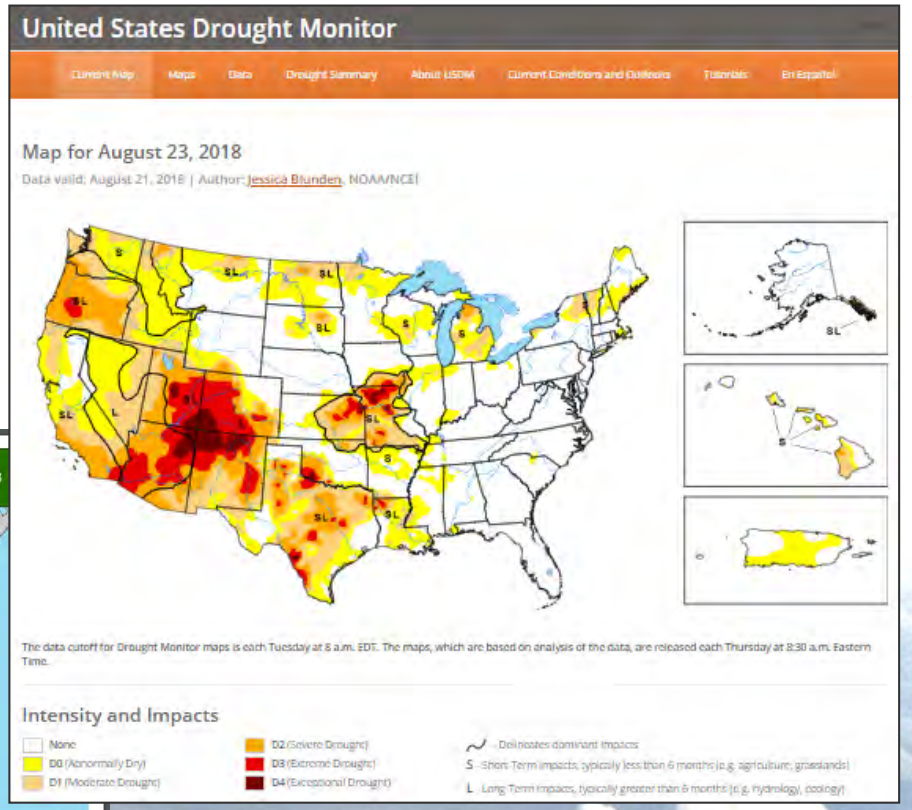


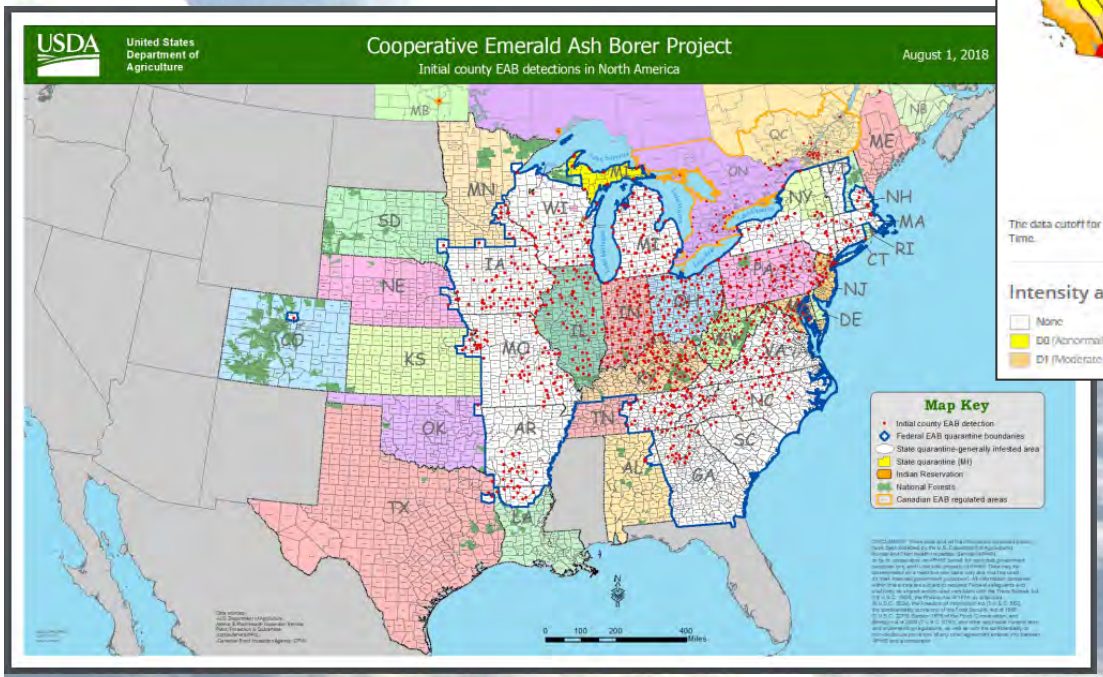


RISK IDENTIFICATION

STORM VULNERABILITY IS ALSO AFFECTED BY OTHER ENVIRONMENTAL FACTORS THAT INCREASE TREE FAILURES, E.G.

- Drought
- Insect/disease infestation
  - E.g. emerald ash borer

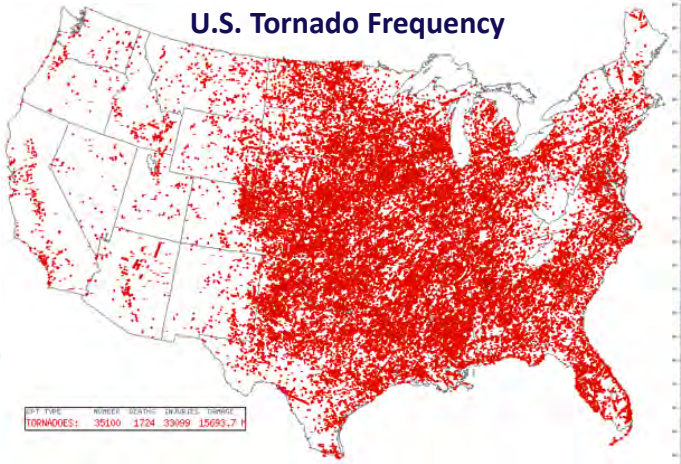


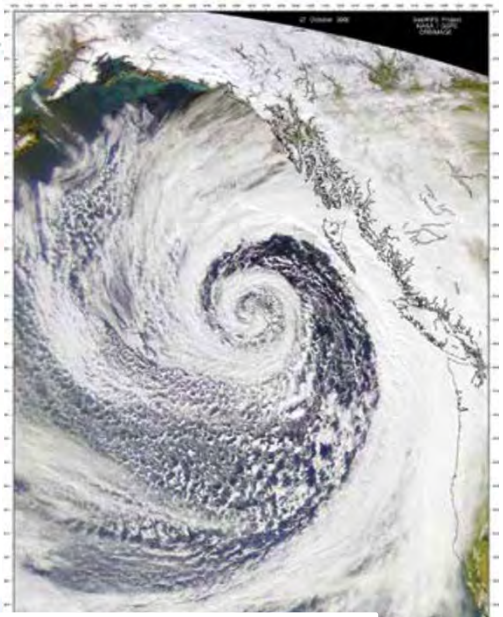


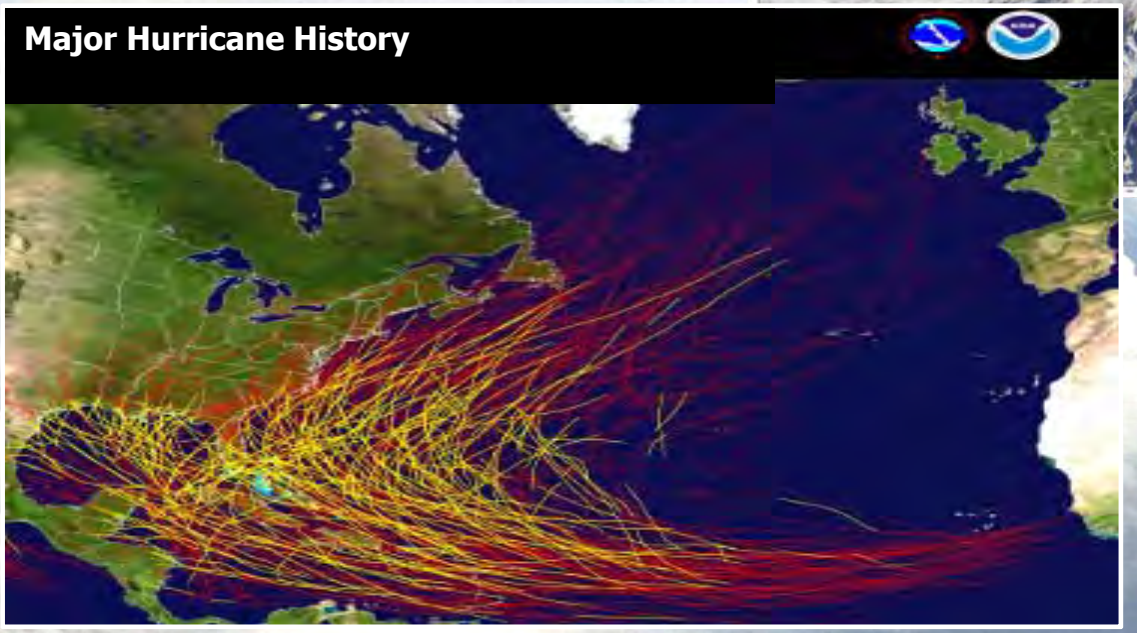
STORM PREPARATION AND RESPONSE: RISK IDENTIFICATION

STORM TYPES

Be aware of the types of storms likely to strike in your area, and plan accordingly







RISK IDENTIFICATION

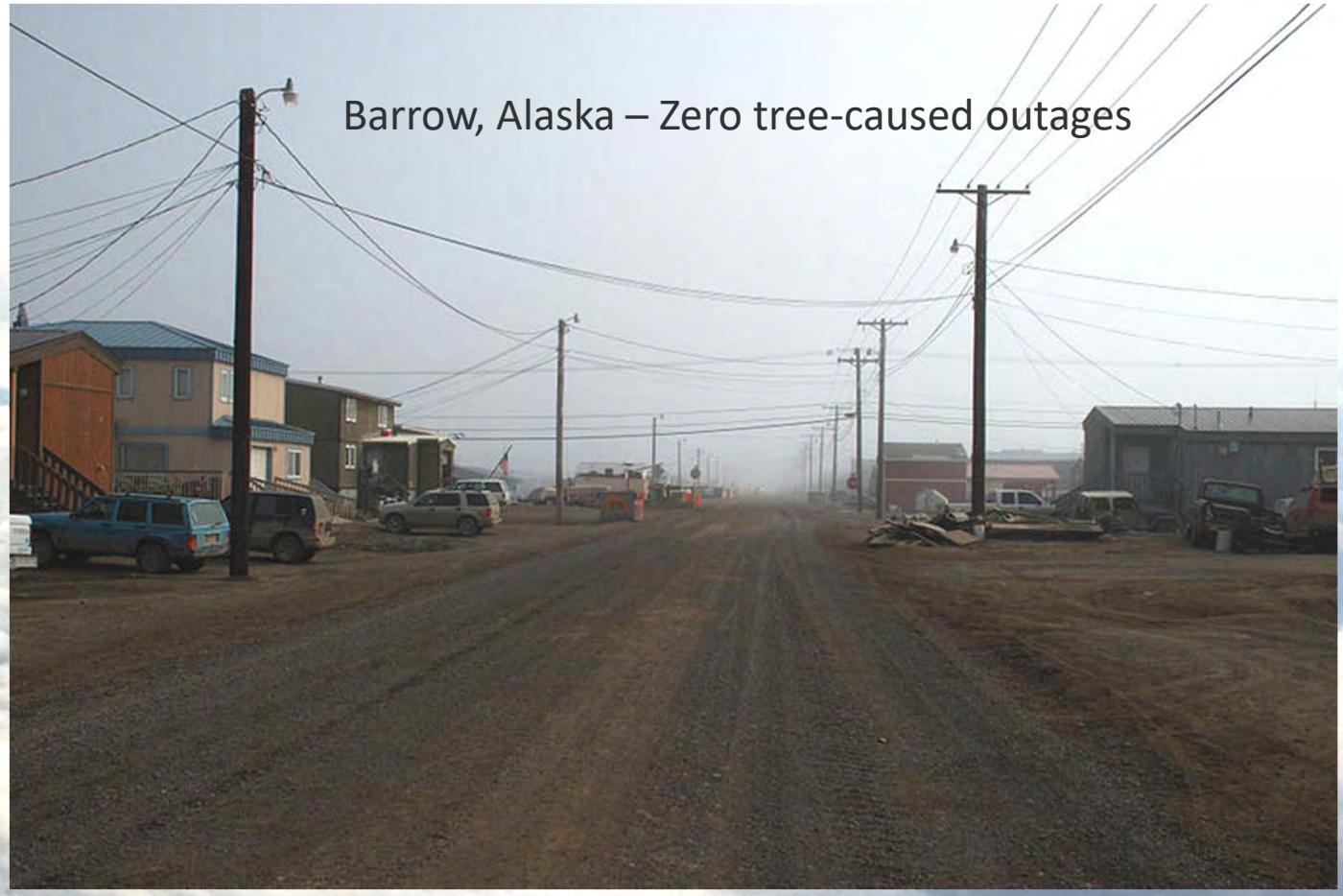
CONDITION OF EXISTING UTILITY INFRASTRUCTURE

- Primarily an engineering function
- Compounded by condition of trees and maintenance regimen

RISK IDENTIFICATION

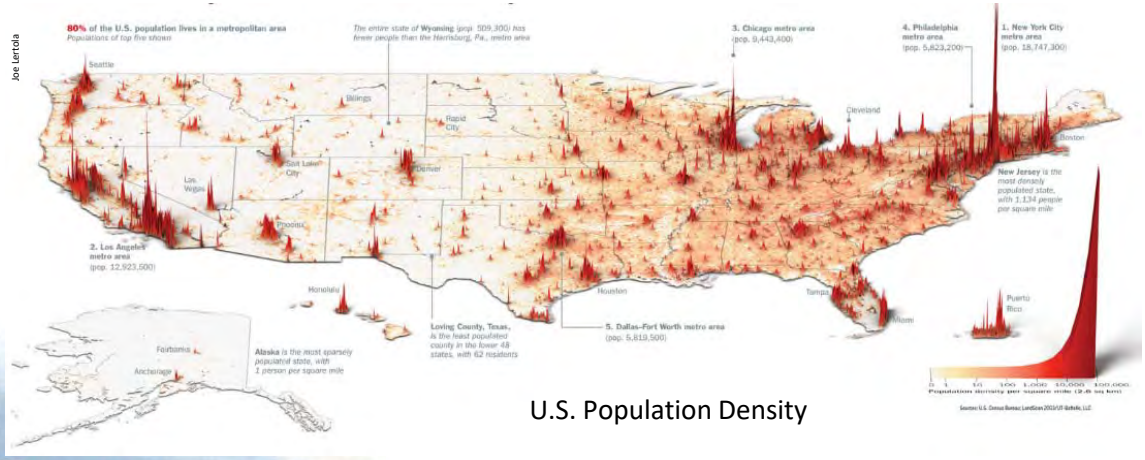
PRESENCE OF TREES THAT CAN STRIKE UTILITY FACILITIES IF THEY FAIL

- This is a given for **almost** all utilities



RISK IDENTIFICATION

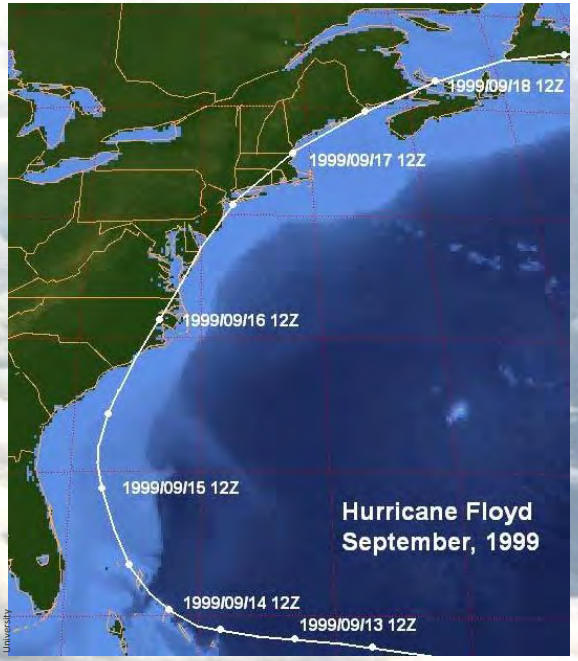
AVAILABILITY OF ASSISTANCE

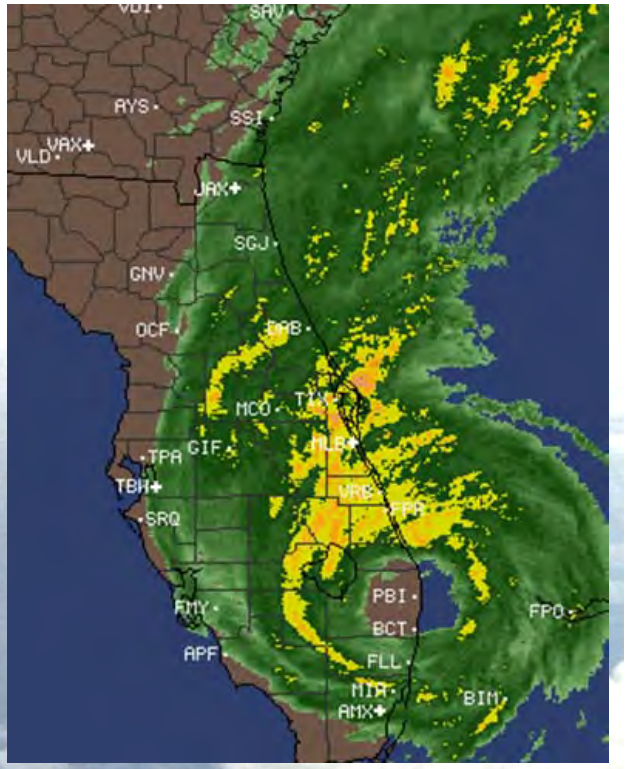


U.S. Population Density

Some areas are close to help, others are isolated

By the time storms reaches Maine or the Canadian Maritimes, available resources are already committed



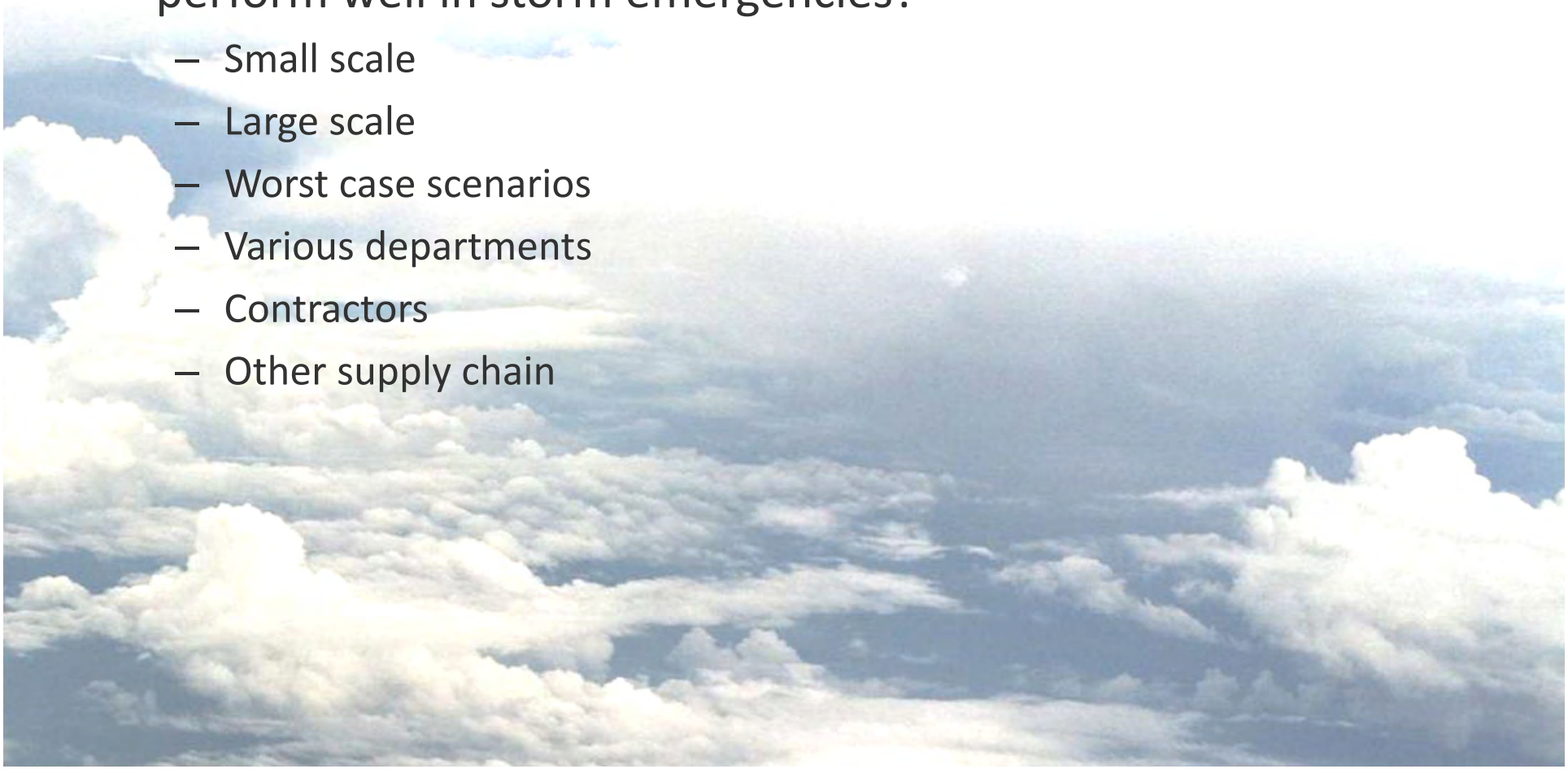


Nothing is close to South Florida!

RISK IDENTIFICATION

INSTITUTIONAL READINESS

- Does the organization have the capability to perform well in storm emergencies?
  - Small scale
  - Large scale
  - Worst case scenarios
  - Various departments
  - Contractors
  - Other supply chain



STORM RISK ASSESSMENT

RISK ASSESSMENT

TREES ADAPT…

Based on wind, snow, ice and other conditions typical of the local climate and site

US Navy

RISK ASSESSMENT

STORM CONDITIONS INCREASE LOADS, LEADING TO FAILURE AT THE WEAKEST POINTS

RISK ASSESSMENT

STORM CONDITIONS INCREASE LOADS, LEADING TO FAILURE AT THE WEAKEST POINTS.

- Loads can be accumulated rain, snow or ice, and of course, wind.

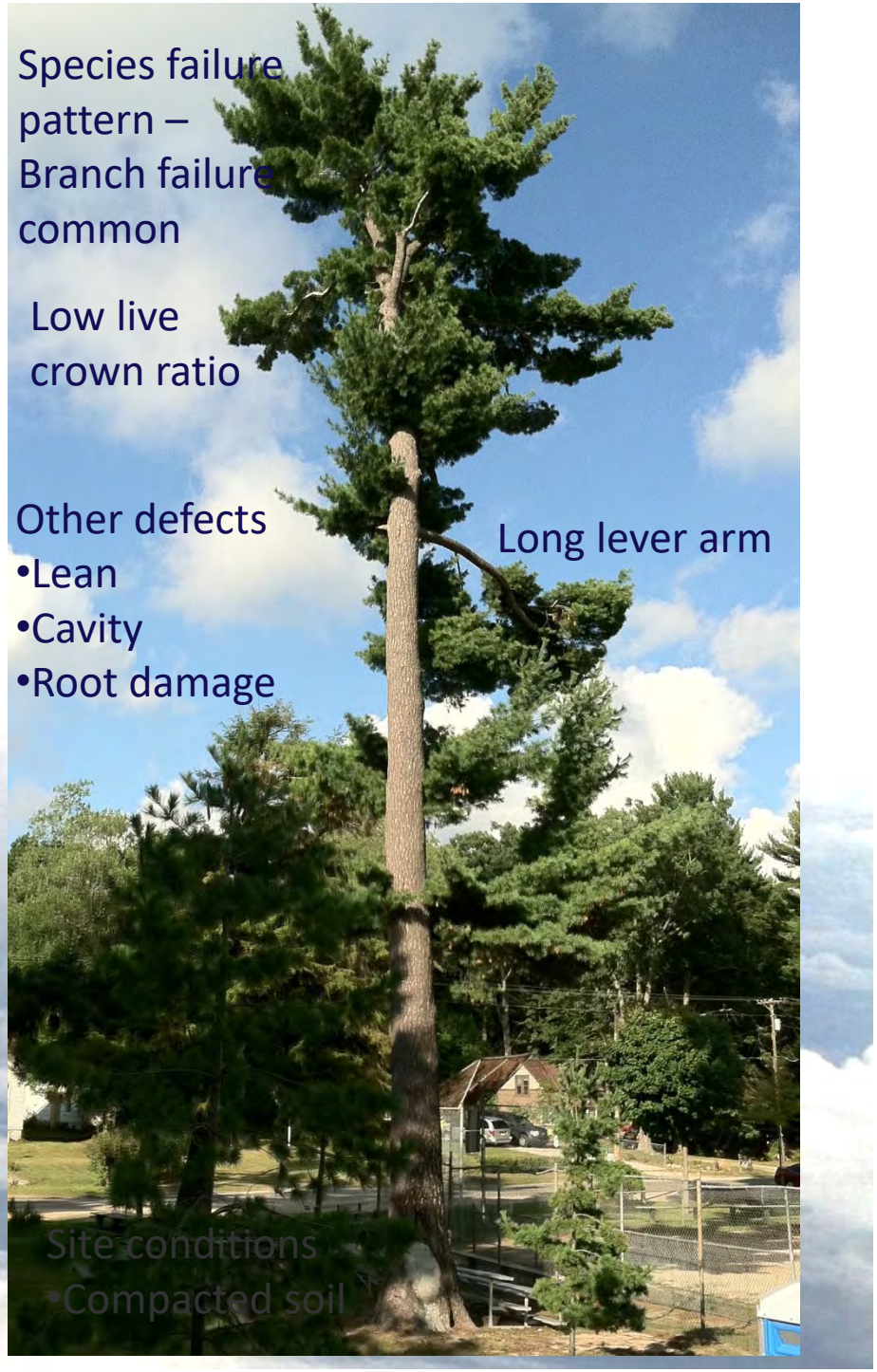
RISK ASSESSMENT

CONDITION OF TREES

Tree characteristics can affect storm failure potential:

- Typical species form and wood strength
- Defects such as weak branch attachments, leans, cavities, etc.
- Site conditions

A large percentage of over-mature trees on a system increases risk



RISK ASSESSMENT

AS WIND SPEEDS INCREASE, LOADS ON TREES INCREASE EXPONENTIALLY, *MAKING FAILURE INEVITABLE*

E.g.:

- 40 mph – windy day, failure of only especially weak trees and branches
- 80 mph – many branch failures, some "healthy," trees fail
- 160 mph – total devastation – all trees down or damaged beyond repair

RISK ASSESSMENT

AS WIND SPEEDS INCREASE, LOADS ON TREES INCREASE EXPONENTIALLY, *MAKING FAILURE INEVITABLE*

Joplin, MO, 2011

Charlie Riedell, AP

RISK MITIGATION

IMPACT OF STORMS CAN BE MITIGATED BY:

- Assuring VM Program effectiveness :
  - –Adequate funding
  - –Use of best practices
    - Pruning
    - IVM
    - Appropriate maintenance cycle
    - Proactive tree risk assessment; i.e., identifying, pruning and removing trees and branches more likely to fail in typical storm conditions

PRE-COORDINATION AND PREPARATION

- Chain of Command
- Emergency Operations Center
- Communications Check
- Practice Drills
- Inform employees of expectations
- Identify Suppliers and Pre-negotiate Terms
- Monitor Conditions and Pre-mobilize
- Releases of Personnel and Equipment

PRE-COORDINATION AND PREPARATION

ESTABLISH A CLEAR CHAIN OF COMMAND

- Know who is in charge of the response
  - Include alternates with their contact information
  - Allows interaction with other utilities and authorities such as FEMA and the Incident Command system (ICS)
- According to FEMA:
  - ICS provides “a common organizational structure, designed to enable effective and efficient incident management.”
  - As providers of essential services, utilities are often included in ICS plans.

PRE-COORDINATION AND PREPARATION

EMERGENCY OPERATIONS CENTER (EOC)

- Monitor conditions and communicate decisions
- Include:
  - Reliable communications
  - Weather monitoring
  - Continuity plans, backup power
  - Work stations for personnel
- Consider mobile offices for field supervision

PRE-COORDINATION AND PREPARATION

PRE-STORM COMMUNICATIONS CHECK

- Ensure that internal and external contact information for essential personnel is up-to-date
- Identify key personnel from external organizations, such as
  - Utilities
  - Contractors
  - Support services
  - Suppliers
  - Government personnel at the federal, regional, and local levels.
- Check labor contracts for clauses that could affect storm operations

PRE-COORDINATION AND PREPARATION

PRACTICE DRILLS

- Call suppliers of services and supplies, including housing
- Consider types and paths of storms (consider multiple storms)
- Seasonal concerns (e.g. clothing, lights, tire chains, etc.)
- Estimated response times (consider effect of storm)
- Routes (account for trucks, weather etc.)
- Locations of staging areas
- Contingencies for power outages, communications, displaced residents, and availability of food, housing, fuel, etc.
- Test alternative communications, e.g. radios or satellite phones

PRE-COORDINATION AND PREPARATION

IDENTIFY SUPPLIERS AND PRE-NEGOTIATE TERMS

- Reduces confusion and disputes during actual storms
- Allow some flexibility:
  - Rates vary between regions, even in the same company
  - Incoming personnel receive the higher of either home pay rates or established local rates
  - Honor existing contract agreements of incoming workers
- Specialty emergency service providers, e.g.
  - Food and housing (e.g. large tents, trailers, food, shower, sanitation, security)
  - Extra tools, spare parts, clothing, lights, or other materials
  - Specialized equipment
  - Mobil fueling services
  - Entertainment

PRE-COORDINATION AND PREPARATION

PRE-MOBILIZATION

- Personnel who could be involved should
  - Monitor weather conditions daily
  - Be prepared to respond on short notice.
- Supervision should
  - Keep employees informed
  - Go over checklists (details, supplies, etc)
- Coordinators should stay in contact with their counterparts at utilities, government agencies, or contractors.
- If the storm passes or strikes another area…
  - Remain prepared to respond as needed

PRE-COORDINATION AND PREPARATION

RELEASES OF PERSONNEL AND EQUIPMENT

- Request when needed, release when able
- Use established chains of command
- Include in requests, or confirm when sending:
  - Number of personnel and type of equipment
  - Preferred time of arrival
- Be realistic in estimating response times
- Be prepared for long response times for large regional storms

PRE-COORDINATION AND PREPARATION

RELEASES OF PERSONNEL AND EQUIPMENT

"Mutual Assistance Programs" are pre-negotiated storm response agreements between utilities that often include contract tree crews and equipment.

- Contractors should be informed of any obligations that apply to them under such arrangements.
- Contractors should receive timely notice when threats have passed, so that resources can be made available outside of the mutual assistance program if needed.

RESPONSE

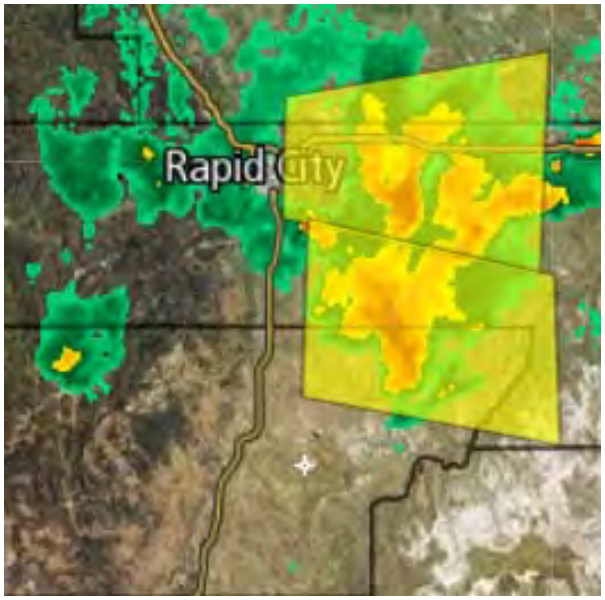
RESPONSE

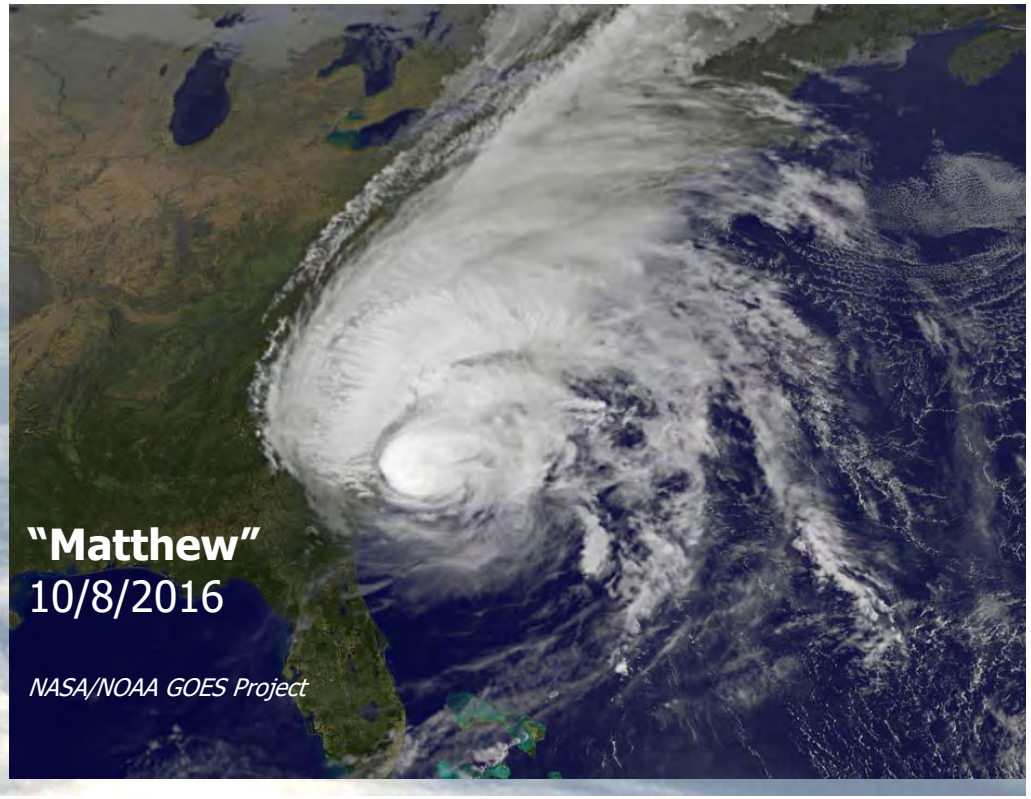
The Crew

RESPONSE

Types of Storm Response

- Small-scale/local
  - Most common
  - Cumulatively very important
  - Requires response rules in contracts
- Large-scale

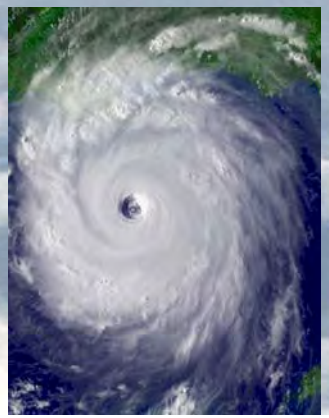


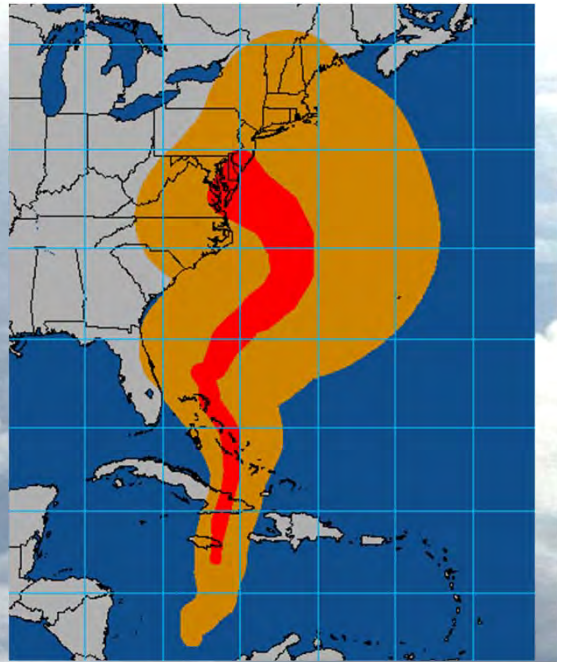


LARGE-SCALE RESPONSE

A safe and effective large-scale response requires:

- Staging areas
- Accommodations for adequate food and rest
- Roadworthy equipment with a full complement of tools
- Plenty of fuel
- Backup supplies
- Reliable communications
- Specialized personnel, e.g. work planners and safety specialists
- Experienced management
- Professional employees, with a positive attitude and a commitment to work safely





LARGE-SCALE RESPONSE

- Housing and Feeding Personnel
- Prestaging resources in advance of a large storm
- Sending
- Receiving

LARGE-SCALE RESPONSE

HOUSING AND FEEDING PERSONNEL

- Hotels
  - May be limited
- Temporary accommodations
  - Tents
  - Sleeping trailers

➢ Never request crews if they cannot be adequately accommodated

LARGE-SCALE RESPONSE

ADVANTAGES AND DISADVANTAGES OF STAGING ALL CREWS IN ONE AREA:

Advantages

- Ease of supervision (start/ stop times, communications, maintenance, security, etc)
- Economies of scale
- Comfort – facilities can be heated or air conditioned, even when utility services are not functioning

Disadvantages

- Finding suitable locations
- Inefficiencies and less flexibility as work locations change
- Cost – less useful for short-term or smaller-scale responses.

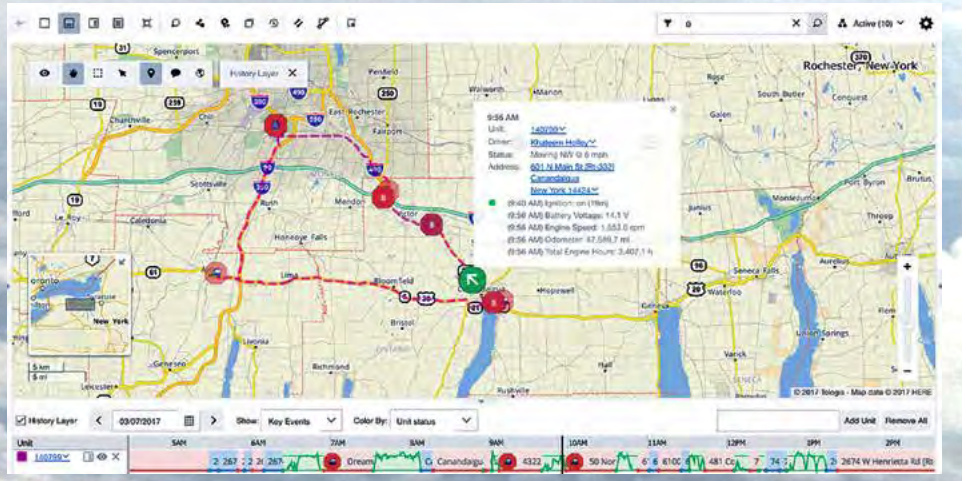
LARGE-SCALE RESPONSE
ADVANCE STAGING

Ahead of a large storm there may be time to pre-stage crews. Consider:

- Expected severity, type of damage and number of customers likely affected
- Reliability of weather forecasts
- Available resources on-hand
- Time required to assure safe transit of incoming crews
- Availability of useful staging areas out of the path of powerful storms

LARGE-SCALE RESPONSE
SENDING

- Send crews prepared to work for an extended time in expected conditions
- Provide complete rosters of personnel
- Use routes suitable for commercial vehicles
  - Don’t convoy – use electronic routing (paper maps as backup)
  - Monitor with GPS
- Backup communications



LARGE-SCALE RESPONSE
RECEIVING

Be prepared for incoming crews:

- Provide adequate food and rest, or they may be more of a liability than an asset
- Provide work assignments.

➢ *Crews come prepared to assist. It is hard on everyone (and bad PR) if they are just standing around.*

EMERGENCY DECLARATIONS

Federal, state, provincial or local government declarations may include suspension of:

- Licensing or permit requirements
- Certain commercial driver requirements (e.g., limits on hours of service)
- Collection of taxes and fees on responding trucks and other equipment
- Traffic rules, especially in evacuation areas
- International border crossing protocols

Utilities may declare emergencies alone , but without the above provisions.

STORM RESPONSE

SPECIAL SAFETY CONCERNS

- Working long hours, leading to fatigue
- Working away from home for extended time
- Working in difficult or unusual conditions
- Electrical hazard communication protocol (backfeed, grounding, etc)
- Animals and insects displaced by the storm
- Different kinds of trees and other vegetation
- Wood under tension
- Driving

MEDIA RELATIONS DURING STORM RESPONSE

- Traditional media – newspapers, radio, TV
  - National and local
- Bloggers
- Social media
  - Someone is always watching and posting
  - One small mistake can go "viral" and undermine the efforts of thousands

MEDIA RELATIONS DURING STORM RESPONSE

Examples of acceptable employee responses to questions:

- “We are glad to be here to help”
- “It will be safer when we get these trees out of the way”
- “We’re doing the best we can under the circumstances”
- “You’d better ask my boss about that – here’s a phone number”
- “For your safety, please stay out of the work area”

WINDING DOWN A RESPONSE

Releasing Crews

- Ensure crews are well-rested prior to releasing for a long drive
- Remember that other areas may still require assistance

Arriving Home Safely

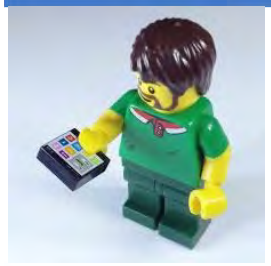
- Be aware of regulations
- Share driving as appropriate

INCORPORATING LESSONS LEARNED

- Storm responses reveal strengths and weaknesses
- Following incidents, hold stand-downs as necessary during the response
- Following storms, conduct debriefing sessions to identify areas to improve

SUMMARY – STORMS

- Storm response is a continuous process
- Identify risk
  - Storm types
  - Condition of trees
  - Condition of system
  - Availability of assistance
- Plan and prepare
  - Rehearse, contingencies, chain of command
- Send and receive
  - Housing and feeding
  - Adequate staging areas
- Special safety considerations
- Incorporate lessons learned



VII Communications

Communications

LEARNING OBJECTIVES

- Explain how vegetation management activities can influence customers' perception of the utility brand.
- Recognize different stakeholder interests in utility vegetation management.
- Differentiate the roles of public relations, customer relations, and customer service.
- Describe various communication methods for interacting with the public.
- Use effective communication techniques when talking with customers to ease their concerns.

The work of utility arborists is on display for all to see.

The work of utility arborists is on display for all to see.

Importance of Customer Communications

Typical VM employees have thousands of public interactions over the course of a year:

- Working on customer properties
- Phone calls
- Answering questions
- Knocking on doors
- Controlling traffic
- Driving

For each 100 employees…

x 20 interactions/day

x 250 working days/year

= **500,000** customer contacts/year

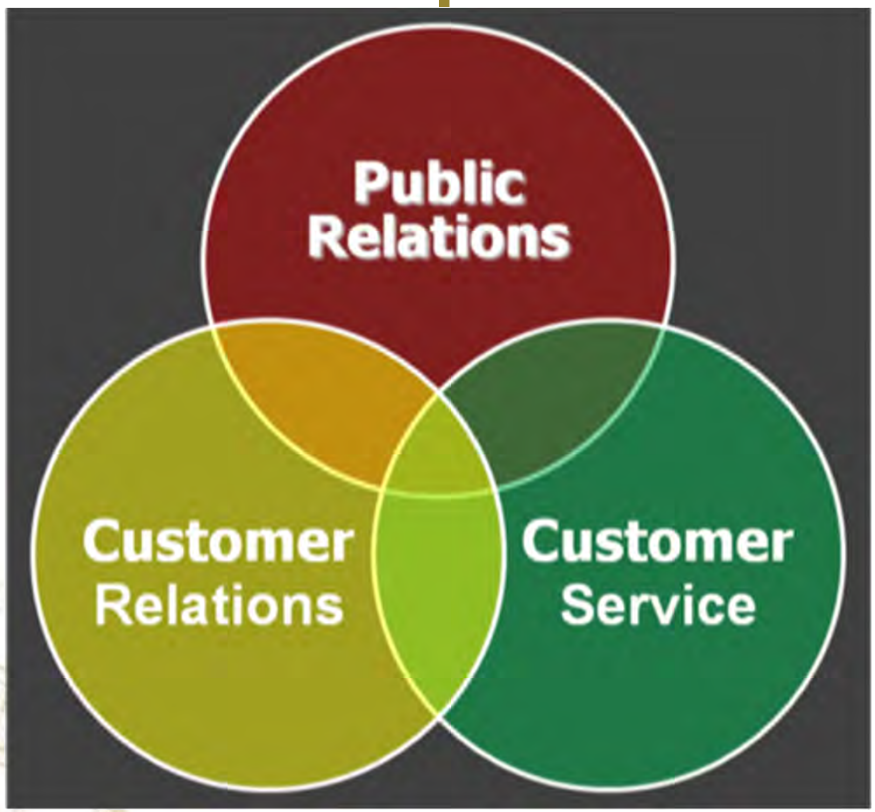
Do we make a good impression?

- Public Relations
- Customer Relations
- Customer Service

General Responsibility:

Public Relations: -Strategic	Corporate office: public perception, advertising, social media, press releases, messaging, etc.
Customer Relations: -Interfacing	Foresters, work planners, GFs, and crews: Developing customer relationships
Customer Service: -Getting the job done	Crews, foresters, GFs, QA/QC: Getting the job done, follow-up, keeping commitments

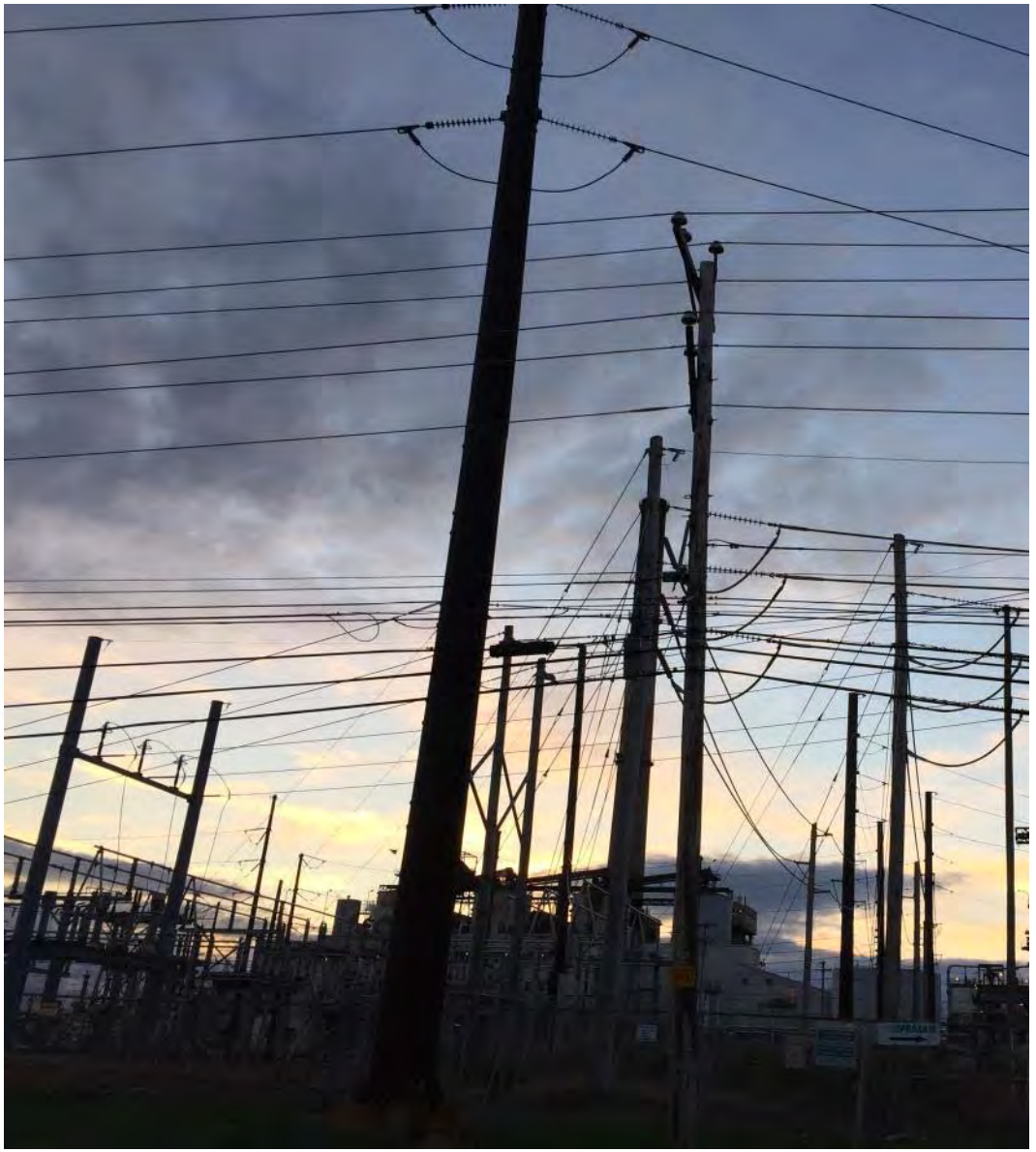
Public relations, customer relations and customer service overlap :



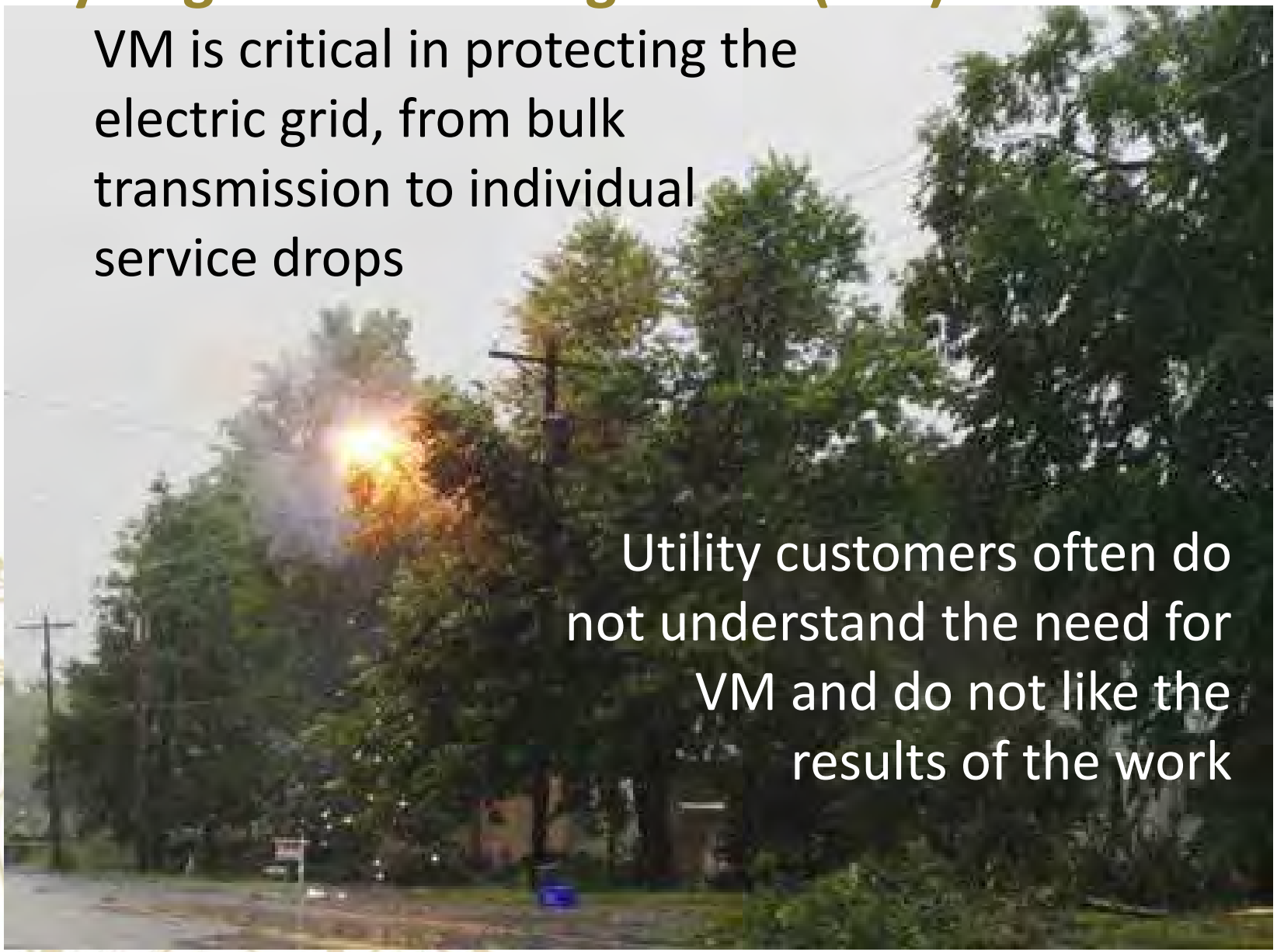
Poor customer relations and customer service makes everyone look bad!

Most utilities are regulated monopolies

Customers have little choice about service providers and how maintenance is scheduled and performed



Utility Vegetation Management (VM) “Disconnect”



VM is critical in protecting the electric grid, from bulk transmission to individual service drops

Utility customers often do not understand the need for VM and do not like the results of the work

Do customers complain?

Utilities get plenty of complaints

However, customers most often complain to other customers!

- On social media, or just talking to friends and neighbors

Unresolved complaints…

- Result in negative expectations about utility VM
- And potentially negative media attention
- And a negative effect on the utility brand

Utility VM Stakeholders

Utility VM Stakeholders

- Internal and external stakeholders in utility vegetation management programs should be identified, and good relationships should be established
  - *Listen to and understand various stakeholder interests*
- Use targeted messaging to improve communication with various stakeholder groups

Internal Stakeholders

Utility VM personnel, e.g.

- Managers
- Forestry Staff

Contractor VM personnel, e.g.

- Work planners
- Workers
- Auditors

Other utility departments with influence over VM, e.g.

- Executive
- Finance
- Purchasing
- Line dept.

Utility owners

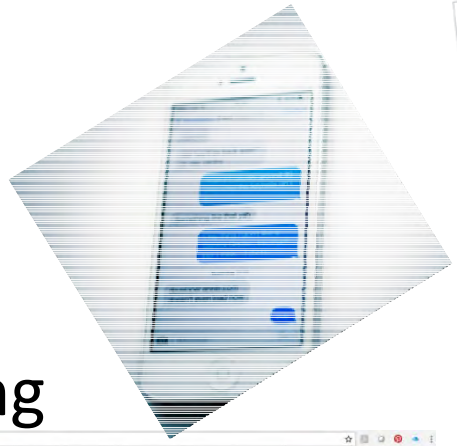
- Stockholders (IOUs)
- Co-op members
- Governments (e.g. munis)

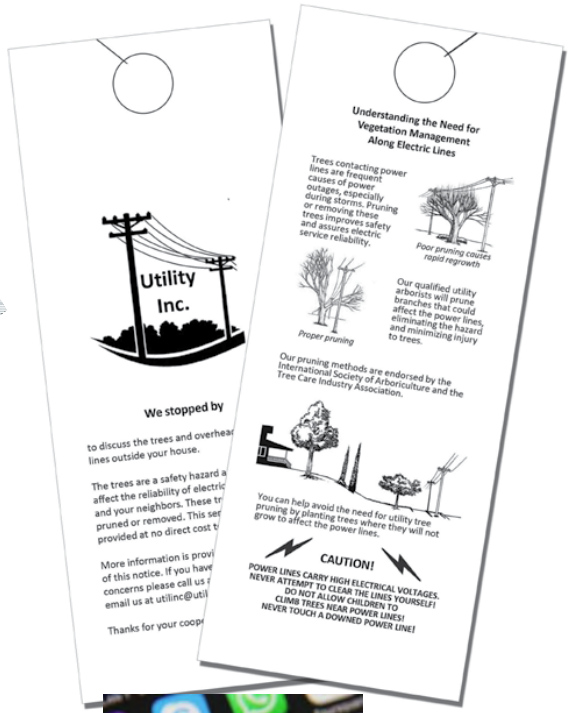
External Stakeholders

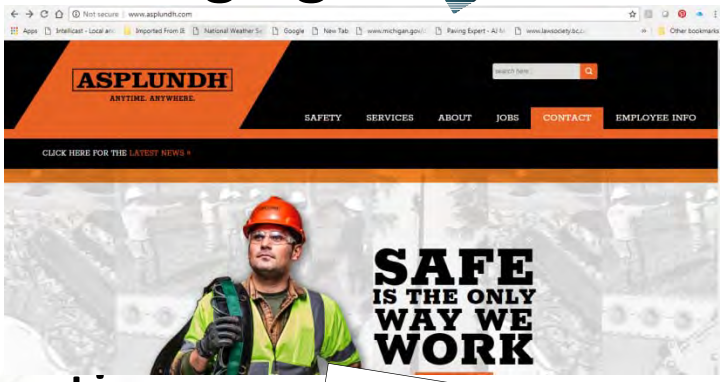
- Utility customers
  - Residential
  - Commercial
- Communities
- Property owners
- Media outlets
- Regulators
- Suppliers
- Environmental groups
- Land management agencies

Outreach Methods

- Printed materials
- Email and text messaging
- Websites
- Social media
- Press releases
- Community meetings







Examples of targeted messaging for external stakeholders

Stakeholder	Information provided	Suggested formats
Customer or landowner	Basic information about the work; why and when it will be performed	Brochure, email, text message, site visit, social media
City arborist	Neighborhoods affected, project overview, work specification	Email, meeting
Local government or community group	Project overview, purpose, schedule	Public meeting, brochure, email, social media
Environmental organization	Purpose of work, environmental benefits, opportunities for partnerships	Email, meeting, site visit
Media outlet	Project overview, benefits, sample script	Press release, email, social media, public meeting
Government regulator	Project overview, costs, benefits to ratepayers	Letter, email, meeting

Talking With Customers

- Make a good first impression
- Have a good attitude
- Communicate benefits
- Operate with integrity
- Practice “active listening”
- Phone etiquette
- Dealing with angry customers

Talking with Customers

Make a Good First Impression

Customers judge you by the first things they see and hear:

- Offensive clothes, hats, stickers, foul language, name calling, etc.

Talking with Customers

Make a Good First Impression

Customers judge you by the first things they see and hear:

- Offensive clothes, hats, stickers, foul language, name calling, etc.
- Professional behavior, respect for customer's property
- Equipment clean and well maintained
- Jobsite organized, cones and signs placed correctly, PPE in use

Talking with Customers

Have a Good Attitude

Attitude is contagious:

- *A good attitude helps people feel positive*

- *A bad attitude brings people down*

Talking with Customers

Communicate Benefits

Tell customers why the work is needed and how they will benefit:

- *Safety* – High voltage lines, risk of fire
- *Service reliability* – To individual customers, neighborhoods, businesses, communities
- *Reduced threat from storms!*
- *State law requirements*
  - Safe and reliable service, compliance

Talking with Customers

Operate with Integrity

Follow the law and basic ethical principles

Everyone's reputation is at stake – employee, company, utility, industry

- Never take advantage of a customer
- Report misconduct
- Do not misrepresent what will happen on the customer's property
- Follow up on commitments
- Show up on time
- Return phone calls
- Keep records of names, dates, and any commitments.

Talking with Customers

Active Listening

Improves understanding by:

- Listening to the customer
- Repeating back their key points

This shows them that they have be heard.

Advantages:

- Helps avoid escalation or arguments
- Encourages discussion, which improves understanding on both sides.

Active Listening:

Provide Good Answers to Questions

- A common reason for customer dissatisfaction is an employee's inability to answer basic questions
- When a customer asks a question, they deserve a good answer.
- Questions should be viewed as an opportunity to inform and explain

Talking with Customers

Use Friendly Language

Consider how you prefer to be spoken to as a customer on your own property.

Avoid:

- You *can't*
- You *have to*
- You *must*
- You *should*

Talking with Customers

Use Friendly Language, e.g.

You have to let us cut your trees …

It will be safer if we get those trees clear of the lines…

We can't remove that tree

We can clear the lines, but we aren't going to be able to remove all of the trees

You need to let us get rid of that tree

The best thing to do is to remove that hazardous tree

You should get out of the way and let us do our jobs!

I understand this is difficult, but it will be best if we move forward with this project.

Talking with Customers

Avoid Jargon

- Acronyms like GFs, CUFs, PIs, etc
- Industry words like “line clearance” and “three-phase”
  - “We’ll bring in a bucket to clear the conductors.”

    (A bucket is a pail, and a conductor runs a train)
  - “That’s a three-phase 24kV line.”

    (Phase 1 - the truck pulls up, phase 2 - 24 guys line up, phase 3?)
- Use basic terminology, e.g.:
  - Supervisor, lift truck, high-voltage, safe distance between trees and power lines, etc.

Talking with Customers

Emphasize that this work is a service for THEM!

- For THEIR safety
- To protect THEIR property
- For the reliability of THEIR service

Do not say that this service is to:

- "Protect the lines" *(from your lousy trees!)*
- "Prevent damage to utility property" *(because of your lousy trees!)*

Dealing with Angry Customers

Dealing with Angry Customers

MOST IMPORTANT:

Stay cool

- Make every effort to remain calm.
- Never argue with an angry customer.
- Stay in charge of your emotions and the situation.
- Do not allow the customer to anger you, no matter what the customer says or does.
  - *If you lose your temper you lose.*

Recognize the customer's feelings

- Demonstrate genuine concern.
- Make statements that you understand ("I hear what you're saying…")
- *But don't give in if you are right!*

Recognize the customer's feelings

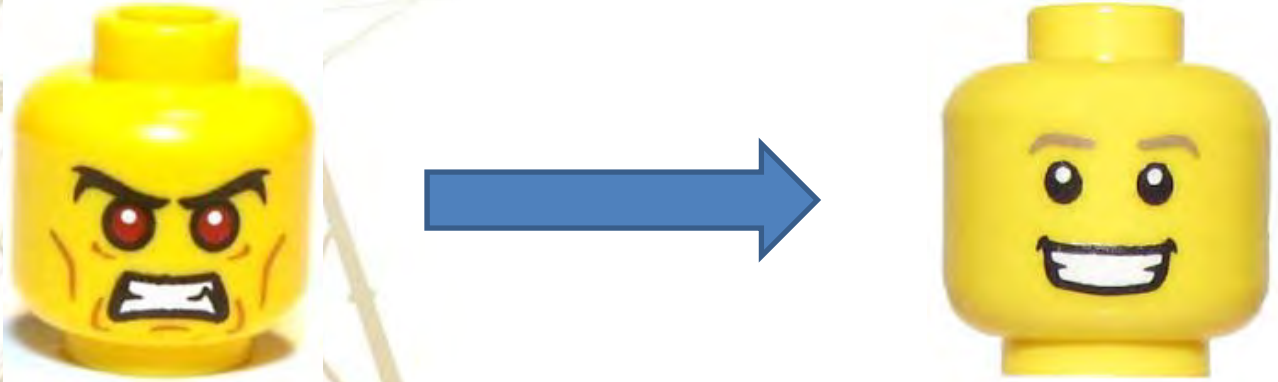
Let the customer blow off steam

- Do not "throw gas on the fire," e.g.
  - Don't say "*calm down now, you're getting too excited*" or "*it's really nothing to get upset about*."
- Understand that the customer is angry and will take time to calm down.
  - ➢ *If you don't make the situation worse!*

Acknowledge errors

Mistakes will happen!

- Correcting a mistake can turn a bad situation into a success.
- *Fixing problems and following up to make sure the customer is satisfied is great customer service!*



Know when to quit

- If the discussion has no chance of improving the situation
- If you feel threatened in any way
- If necessary, quietly and quickly leave the property
- Safety First!
  - ➢ *Do not risk your safety!*

Communications

Summary

Vegetation management is often misunderstood due to:

- Lack of public understanding
- A largely contracted workforce with high turnover rates
- High short-term cost and long-term return on VM investment
- Cultural separation of VM from the engineering and finance oriented utility industry

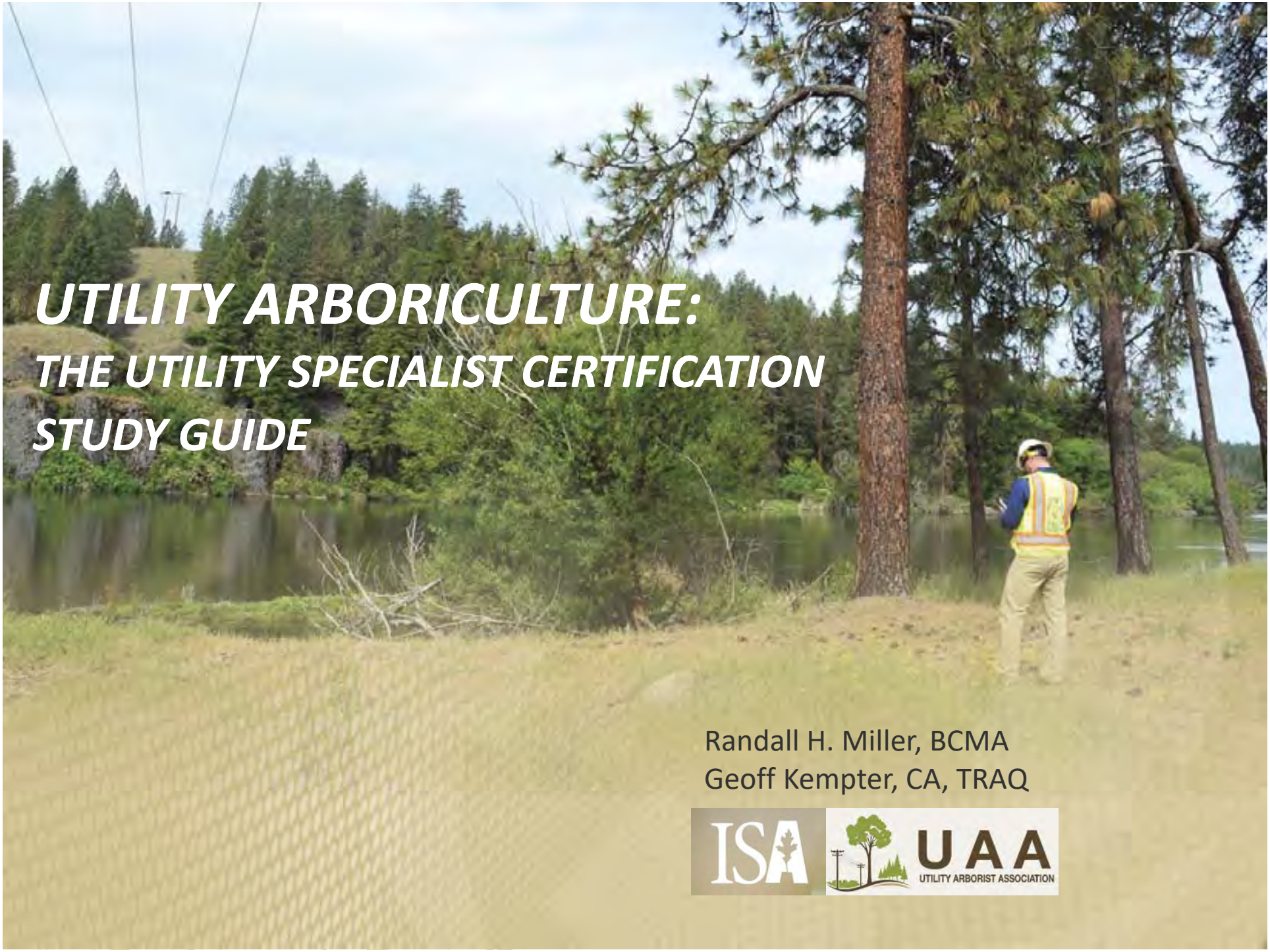
To Improve communication, job satisfaction and overall program performance:

- Use targeted communications for various stakeholders
- Use a variety of communications media
- Train front-line personnel in basic customer relations skills

UTILITY SPECIALIST STUDY GUIDE

SUMMARY

- Utility specialist certification dates from 1997 and the first study guide from 2002. The second revision had its genesis in 2008.
- The new study guide is not only intended as a study guide, but also a reference for practitioners and a textbook for students.
- Chapters provide detail on safety, program management, pruning, IVM, storm preparation and communication.



UTILITY ARBORICULTURE:
THE UTILITY SPECIALIST CERTIFICATION STUDY GUIDE

Randall H. Miller, BCMA
Geoff Kempter, CA, TRAQ

ISA
UAA
UTILITY ARBORIST ASSOCIATION