

CERTIFICATION AND A CERTIFICATION PROGRAM
FOR ARBORISTS AND TREE WORKERS IN THE PACIFIC NORTHWEST

By

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ABSTRACT

Certification is a means by which a professional agency or association gives recognition to an individual who has achieved a certain level of competence. Certification is often voluntary and indicates reserved title. Licensure, on the other hand, is legislated and indicates exclusive right to practice. There are both benefits and disadvantages to certification within the occupations and professions. Certification should be based on competency. Professional associations have a strong role to play in both certification and mandated continuing professional education.

A certification program for Arborists and Tree Workers in the Pacific Northwest introduces the International Society of Arboriculture, the professional association. In addition, the reasons for the program, its objectives, development, requirements, administration, publicity and its evaluation are presented.

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I. INTRODUCTION

The writer was charged with the task of preparing a voluntary certification program for Arborists and Tree Workers in the Pacific Northwest. Before this task could begin, a few questions were posed. For example: What is certification? What are the benefits, as opposed to the disadvantages of certification? How does certification differ from licensing? What is the role of the professional association in certification? What are the pros and cons of mandated continuing professional education? Once these questions were answered, then a certification program for Arborists and Tree Workers was developed.

The certification program for Arborists and Tree Workers in the Pacific Northwest will be discussed with regard to the reasons for certification, a model for planning the program, the sponsoring professional association, the objectives and development of the program. The requirements of the program, as compared to other existing certification programs for Arborists and Tree Workers, will be described. A discussion of how the program should be administered and publicized will be included. An evaluation of the program will be summarized.

II. DEFINITIONS

The definition of terms used provides an important beginning in any review. Certification is a term that is often used as a synonym for licensing. Accreditation is often used as a synonym for certification. Each term has a precise meaning. There are no standard definitions for accreditation, certification and licensing. The definitions following describe the nature, intent, and function of the terms when applied to the credentialing of individuals, occupations, or institutions. Accreditation is

the endorsement and public recognition of an institution or business enterprise that has met certain formal requirements of excellence in terms of service, facilities, standards and/or product quality as determined by peer groups, institutions or businesses. Accreditation can not apply to individuals. For example, a college or technical institute may be accredited but an instructor of the college or institute may not be accredited.

Certification is a non-governmental process with specific requirements for assessing and measuring an applicant's qualifications or competence.

Certification can be defined as:

...[a] regulatory regime under which persons with the requisite qualifications are certified by a body or agency as possessing those qualifications so that they can hold out this certification to the public as a signal that indicates achievement of a particular level of competence.¹

or

The process by which a non-governmental agency or association grants recognition to an individual who has met certain predetermined qualifications specified by that agency or association. Such qualifications may include: (a) graduation from an accredited or approved program; (b) acceptable performance in a qualifying examination or series of examinations; and/or (c) completion of a given amount of work experience.²

Certification is a means by which a professional society or agency gives recognition to a practitioner who has met certain predetermined standards. It is a voluntary mechanism by which an applicant can document his/her competency. Certification operates without the mandate of law. It is an internal self-regulating device administered by a professional society or agency as opposed to external control by government. Certifying agencies do not prevent uncertified practitioners from performing the same occupational tasks, but practitioners, not approved by the agency, may not present themselves to the public as "certified".³ In the health field in British Columbia, for example, biomedical engineers, environmental health technologists, and medical laboratory technologists, among others, are

certified.⁴ Outside the health field one may find dozens of certified occupations.

Licensure, on the other hand, is based on a law passed by a provincial or state legislature. The law makes it illegal for a practitioner to engage in the activities of an occupation or profession unless he/she has first been given permission to do so by a legally authorized board, agency or association. Licensure is based upon combinations of training, education, examination, and internship which, when successfully completed, allows the practitioner the legal right to engage in the occupation or profession. Licensing enables the government to control activities that might endanger the public's health, safety, or welfare. Only practitioners holding a licence are legally entitled to engage in the licensed activities, regardless of a practitioner's competence or qualifications. In British Columbia, there are many licensed occupations and professions; among them, licensed practical nurses, optometrists, pharmacists, physicians, physiotherapists and registered nurses.⁵

Certification does not restrict who may practice a profession, just who may label themselves "certified". Certification, because it is often voluntary, is a less rigid means of regulating an occupation or profession. Licensure, on the other hand, is strictly regulated and may reduce the number of practitioners in an occupation therefore restricting or limiting public choice of practitioners. Licensure is more often a requirement of those professions which, through their actions, may endanger the public health, safety or welfare.

III. BENEFITS OF CERTIFICATION

There are many benefits to the certification of individuals within an occupation - benefits to the public, the individual, employers, and to the sponsoring association as well.

Certification helps the public to identify qualified and competent practitioners. The public may be assured that service will be of a certain quality since a certification program provides a measureable assessment of the knowledge and competence that is usually needed to render quality service. Many certified occupations and professions subscribe to a Code of Ethics. Adherence to a Code of Ethics may again assure the public that the certified practitioner will perform his/her duties in accordance with that professional code. A certification program establishes a degree of creditability to the field and recognition from allied occupations as well as from the general public. The profession and the professional association indirectly benefit from the increased visibility generated by a certification program.

Career advancement of an individual, is one of the benefits of certification. Certification provides evidence to employers of qualification for a higher level position. Certification could be a deciding factor in hiring and initial placement as well. Certification and registration reinforces a professional image to both peers and superiors. Certification helps the practitioner evaluate his/her knowledge and skills in relation to others within the occupation. Certification attests to achievement, which improves self-esteem and encourages professional pride. The sense of accomplishment and recognition received, as the result of certification, is an important benefit to many individuals. Certification, in some cases, offers the opportunity for self-taught practitioners to obtain credentials.

Employers benefit from hiring and consulting certified practitioners

too. From the employer's viewpoint, certification credentials, held by a job applicant, provide a degree of assurance that the individual has certain basic skills and qualifications related to the advertised position. Certification does not guarantee that the individual will perform well in the job. Rather, because certification tests an individual's knowledge and skills over a wide range of situations, there is a greater chance that the certified applicant will perform the job satisfactorily. Employers, in addition, are eager to advertise the competence of their staff. Certification indicates to an employer that the individual has professional pride and is committed to personal growth, becoming in the long term, a more valuable and productive employee.

In summary, voluntary certification offers a flexible alternative to governmental regulation through licensing, which is often restricting, subject to political change and expensive. Certification provides an incentive for individuals to improve their skills because of the correlation between certification and the recognition, remuneration and prestige received. Certification also offers benefits to the individual's employer, the sponsoring association, and to the general public.

IV. DISADVANTAGES OF CERTIFICATION

Should there be certification of practitioners within the occupations and professions? Does every individual have the right to practice - or on the other hand, should the right to practice be restricted only to those who have met a set of given requirements? Certification is based on the concept that the general public can be protected from poor service if only those practitioners who are "certified" are allowed to advertise themselves as such. This may limit the choice of practitioners to the public, while at the same

time, further the interests of these same practitioners and their associations in their climb for social status and control over their occupations.

In most occupations and professions, it is the members from within who establish certification standards. Because of this, in some cases, certification requirements have been established which are not essential to the effective practice of an occupation, but which do limit who may or may not practice. In addition, educational requirements may be set which require training and skills exceeding those needed to provide good service. This increases both the time and expense of the education of the practitioner. The public is supposed to be one of the beneficiaries of certification, yet seldom are they a part of the team used to establish certification requirements.

Rockhill states:

In the United States, certification serves to: (1) define social class status; (2) sort and select out people for jobs or to join the ranks of the unemployed; (3) determine who will have access to knowledge; (4) increase public dependence upon the services of experts; (5) perpetuate a vast educational enterprise directed at turning out certificate-holders rather than educated individuals; and (6) limit our civil liberties as we are forced to submit to certain rituals or professional services which may not be of our choosing.⁶

Certification has been questioned as a means of determining competence by public groups, employees, even professional societies. Certification may attest to the competency of the individual but does not guarantee or assure quality performance. Several other disadvantages associated with voluntary certification are that decertification and disciplinary action are difficult to implement because the certification process is not mandated by law. In addition, the general public often do not have a clear understanding of certification and a program to improve public awareness can be very expensive and time consuming.

V. CERTIFICATION AND COMPETENCY

Certification and the issue of competency are closely intertwined. Since the purpose of certification is to improve the quality of service the public receives, not just to make it difficult for an individual to enter an occupation or profession, certification should be based on competency. Unfortunately, there are problems, such as, can initial competency be considered sufficient for lifelong practice, can competency itself be measured accurately, and if so, how?

Most credentialing agencies focus on competence at the time when the certificate is granted. Once certified, the practitioner is often not asked to sit further tests to show that he/she has maintained his/her competence. Often a practitioner may be certified for life, as long as membership dues are submitted. The exception is where continuing professional education forms a requirement of the initial certification process. Occasionally, a practitioner may lose his/her certificate if he/she has disobeyed the organization's Code of Ethics or other professional standard, but suspension or revocation of certificates is uncommon.

Within professional societies and from the public, there is concern regarding both initial and continuing practitioner competence. Is competence, defined as "possession of required skills, knowledge, qualifications, or capacity; ability to use skills to the level of efficiency required"⁷ being measured accurately? How is competence measured? Originally many occupations and professions required tests of actual performance. This method of assessing competence is costly, time consuming, and difficult to standardize.⁸ Performance or practical examinations are not often used in the professions to assess competence. Practical examinations are often used in the skilled trades and service occupations. Applicants of the North American Certificate

in Horticulture, for example, in addition to a written examination are required to sit a practical examination where they may be asked to prepare woody and herbaceous cuttings or to prepare a soil mix.⁹

Many boards of examiners have chosen to add to or replace direct observation of practitioner performance with an oral and/or written examination. An examination allows the assessment of a far wider range of knowledge and problem-solving abilities. Unfortunately, the possession of knowledge and skills does not mean a practitioner will use them. Certainly, if a practitioner does not have the knowledge and skill, he/she will not be able to use them, if needed. Therefore a test of knowledge and skills has some validity. For this reason, oral and written tests are used most often to test a practitioner's competence.¹⁰ Multiple-choice tests, simulations and direct observation of applicant behaviour among co-workers and others may be used to assess competency.¹¹

Multiple-choice tests are useful when there is a large group of applicants to be examined. Comprehension and the ability to use knowledge to solve problems can be assessed using multiple-choice questions. The knowledge base to be assessed must be carefully defined and test specifications written to help the designers of the questions. Instructional resources and test questions may be pre-tested with a sample group to detect weaknesses or ambiguities.

Simulations are often used in the health field as a means of assessing competence. Applicants are presented with an undiagnosed patient. Each applicant must evaluate the patient, and provide a diagnosis and treatment. Other assessment techniques include the direct observation of an applicant's behaviour in his/her normal work-day setting. In arboriculture a parallel procedure to assess tree workers is the requirement for a practical work climb and an aerial rescue manoeuvre. The assessment of competency via oral or

written examinations or practical examinations, such as the work climb, allows those applicants with little formal educational background, but who have the skills, knowledge and a professional attitude, to become certified.¹²

Good measurement of competence results from careful planning and administration of the examination. The examination must possess three qualities: (1) validity, (2) reliability, and (3) usability.¹³ Other qualities are useful but these three are the key elements. Validity refers to a test's truthfulness, reliability to its consistency, and usability to its practicality. Of these three qualities, validity is paramount. A valid test is truthful because it measures what the tester wants to measure. Sensibly, any examination which does not test what it is supposed to test is useless. Content validity, one category of validity, refers to the degree to which the test samples the subject matter in the area to be measured. The learning objectives, upon which the examination is based, are often those that deal with the mastery of facts, and therefore a close inspection of the test questions to see how closely they relate to the objectives, will provide an indication of content validity (see Appendix O). Reliability is the second important quality of a test. A reliable test is one that is sufficiently consistent so that if the test is administered several times to the same group, each individual in the group will receive a similar score each time. A third important characteristic of an examination is its usability. A test that is easy to administer, mark, and one that has a clear readable format has a high degree of usability.¹⁴

Certification and competence are closely related. Various methods can be used to measure competency reasonably well. These include practical examinations, oral and written tests, and observation of an applicant's behaviour in the work place. The instruments or tests used to measure competence should possess the three characteristics of validity, reliability

and usability.

VI. THE ROLE OF THE PROFESSIONAL ASSOCIATION

Almost every occupational group in our society is organized into one or more membership organizations. Each is interested in promoting the well-being of their membership. Many associations are organized nationally with smaller branches at the local level. In the health field in British Columbia, there are seventy such associations and societies serving audiologists and speech pathologists, chiropractors, dental assistants, dietitians, optometrists, podiatrists, public health inspectors and social workers, to name just a few.¹⁵

Professional societies or associations differ in strength, in the powers delegated to the local branch, and in their maturity and ability to organize and control membership. The influence of the professional association on its membership begins with the initial establishment of entry criteria into a profession, and continues throughout the practitioner's working life. More and more pressure has been placed on practitioners to keep current. This is reflected in the number of associations providing continuing professional education. Associations, until recently, have restricted continuing education to journal publication, short courses and annual training conferences. Today, many associations are actively involved in the continuing education needs of their members.¹⁶

Many associations have continuing education programs and voluntary certification examinations. Certification programs have been an important means of encouraging professional competence. No self-respecting occupation or profession can long avoid responsibility for setting at least minimal standards for those who practice.¹⁷

The professional associations have a responsibility to establish performance standards and to monitor the behaviour of their members in return for the status the occupation or profession accords to practitioners. A profession is partially delineated by its knowledge base and Code of Ethics. The membership voluntarily adopt the appropriate values of the occupation. If continued competence is not one of these values, the profession declines. Therefore the professional society must make education an important part of their organizational mandate.¹⁸

Problems organizing educational offerings within an association exist for many reasons. Association membership is voluntary and members may live in different areas, so maintaining communication and cohesiveness is awkward. Individual members lack a clear view of both the past and future of their organization and seldom know more than a handful of association members. These and other reasons may make it difficult for an association to gather members together to define educational objectives, or to plan for the long term.¹⁹ There are of course many exceptions, where far-flung associations have developed successful educational programs.

VII. MANDATORY CONTINUING PROFESSIONAL EDUCATION

The assumption that once a practitioner is certified and is therefore forever competent has been a major weakness in certification programs. It assumes that sufficient knowledge can be acquired before entering the occupational field and that practice will remain static. It has not been until recent years that continuing education has been encouraged or provided for as an integral part of long-term practice.²⁰

Mandatory professional continuing education can be defined simply as a mandatory requirement to participate in a prescribed number of hours of

continuing education, in a given time period, in order to retain licensure, certification or membership within a profession. Mandatory continuing education may be imposed upon the individual by the professional society or by a state or provincial licensing board. There are two fundamental questions with regard to mandatory continuing education: Does it in fact maintain or guarantee competence? and Does a professional need to be forced to maintain currency in the profession? In answer to the first question, Heinekey found that none of the studies he reviewed proved that mandatory continuing education had a beneficial effect on the individual's competence. He stated that mandatory continuing education does increase participation in continuing education, but participation alone does not guarantee competency. In addition there is a concern that mandated education will eventually result in poor learning opportunities as programs cater to the median needs of all participants.²¹

The second question centres on the very essence of what a professional is. Mandated continuing education may be considered by some individuals as an infringement of their basic rights and freedoms, especially since they are being forced to do something that as a professional they already know and accept as a responsibility. Rockhill maintains that a recertification requirement, within a certification program, which places emphasis on attendance at continuing education sessions such as training conferences and short courses, is not sufficient to maintain competence. All practitioners do not learn in the same way and may not be able to use the new knowledge they have acquired.²² Education does not guarantee learning, and the acquisition of knowledge or skills does not ensure a practice change. In addition, there is the doubtful assumption that the certification board or agency knows what is "good" for practitioners under their control, and that the agency is justified in compelling practitioners to participate in continuing education

in an attempt to protect the general public from incompetence.²³ Mandatory professional continuing education, suggests Darkenwald and Merriam, is neither a necessary nor an adequate method to maintain competence. Both Rockhill, Darkenwald and Merriam suggest that a more useful way to recertify practitioners is to periodically evaluate competence as it relates to job performance. Those practitioners who fail to show continued proficiency should not be recertified.

On the opposite side of the coin, Mattran suggests that mandated continuing education does not limit personal freedom and that professional competence can be maintained and improved. He suggests that mandated continuing education is really a form of self-discipline. In addition he suggests that continuing education can achieve increased professional competence, if the program is accessible, pertinent and attractive enough to encourage active learning, as opposed to just physical attendance.²⁴

As the reader can see, there are two views; one opposing mandated professional continuing education, and the other in favour of mandated continuing education as a means of maintaining and enhancing competence. The writer favoured the use of mandated continuing education as a requirement for certification of Arborists and Tree Workers for the following reason. There was insufficient evidence to prove or disprove that mandated continuing education (MCE) maintains competence. The writer felt that MCE should be given the benefit of the doubt. As to the criticism that it impinged on personal freedom, the writer agreed it may, but members of professional societies expect that along with the privileges that go with certification there may also be some personal compromise necessary to maintain that certification.

VIII. INTRODUCING A CERTIFICATION PROGRAM FOR ARBORISTS AND TREE WORKERS IN THE PACIFIC NORTHWEST

A. Reasons for Certification

There are two reasons certification of Arborists and Tree Workers is needed in the Pacific Northwest. The safety of individuals is one. Unit Eight in the Study Guide (see Appendix R) deals exclusively with safe work practices. An individual who has completed the program and become certified should be very safety conscious. Safe tree work is important to prevent death or injury to workers. For example, on February 23, 1988, a municipal tree pruner in Richmond, B.C. died as the result of injuries sustained while topping a tree. The coroner's inquest, convened to determine the cause of death, recommended that the Workers' Compensation Board co-operate with the Union of B.C. Municipalities and the Canadian Union of Public Employees to develop a tree pruner's safety and training course. Gordon Barstow, the supervisor of the deceased, said that if proper pruning procedures were used to top the fifty foot tree the accident would never have happened.²⁵ This death may have been avoided if municipal tree workers were required to participate in a safety-conscious certification program. This was the second fatality in recent years of a local tree worker.

The second reason certification is needed is to reduce the incidence of tree butchery. Tree work is one of the easiest businesses to get into. An individual may work for a tree care company for a few months, then buy a truck and a chainsaw, and voilà he/she is in business. Certification will not eliminate these fly-by-nights, but it will give the client a choice. A choice between a professional, Certified Arborist or a tree cutter. Examples of tree cutting abound in the Lower Mainland of British Columbia. Trees are topped, lopped and destroyed by inept and unknowledgeable individuals advertising

themselves as tree care companies. In fact, a tree that has been well pruned often draws no notice at all, while a poorly pruned tree, with its heavy stubs and disfigured crown, is evident for all to see. The Study Guide which describes the characteristics of good pruning, may encourage better practices in the field. Brian Fisher, a practising arborist, states:

We must not be so naive as to think certification will solve our problems, or that it will be so valuable a business tool that everyone will have to get one, or that if someone does become certified that they will necessarily start to practice good arboriculture. Certification will not create good tree work, but, it's a starting point. The more people we have who are prepared to learn about trees, the better our chances of improving quality.²⁶

Two simple reasons, then, for certification of Arborists and Tree Workers in the Pacific Northwest, to improve safety and arboricultural practices as a whole, and to prevent tree butchery.

B. Planning the Program

The writer chose to use Sork's basic planning model (see Appendix A) as an aid in planning this educational certification program. The model has six steps, with opportunity for evaluation and feedback at each step. In the first step the program planner analyzes the client system. The discussion of the professional association (Part C) which follows, provides an insight into the client system. In the second step, the planner identifies needs. Expedient planning occurred in the development of this certification program. Decisions were made within limited resources, so a time-consuming, formal needs assessment to generate information was not done. An informal needs assessment, in the form of numerous requests for a certification program from the membership of the Pacific Northwest Chapter, did occur. Certification also, was the major topic of discussion at several Annual General Meetings of

the organization and the membership is extremely supportive of and interested in beginning a certification program as soon as practical. In the third step of the model, the program planner develops objectives. A hierarchy of three types of objectives were developed for the certification program as described in Part D, Objectives of the program. In step four, the planner formulates the instructional plan. Part E, Development of the program, describes the instructional plan which was developed for the certification program for Arborists and Tree Workers. In step five, the planner formulates the administrative plan. Parts G and H describe the administration and marketing of the program. In the last step of Sork's basic planning model, the planner develops an evaluation plan.²⁷ The writer planned to use two evaluation methods. In the first, the Board of Directors and officers of the PNW Chapter were given draft copies of the Study Guide and a list of the certification requirements to review. They were each asked to suggest changes or revisions. The writer also developed two questionnaires (see Appendix P), an Expert Panel and a Pre-Test questionnaire. These were given to seven individuals. Part I summarizes the evaluation of the program by these evaluators.

Sork's basic six-step planning model provided a planning framework for this educational home-study program for Arborists and Tree Workers in the Pacific Northwest.

C. The Professional Association

The professional association for whom the following certification program was developed is the International Society of Arboriculture (ISA). Founded in 1924, the ISA is an international organization with a membership of approximately five thousand. Individual members represent all aspects of the planting, study, maintenance and preservation of ornamental shade trees. Within the membership are commercial, utility and municipal arborists,

scientists, parks and grounds managers, urban foresters, landscape architects, landscape appraisers, and educators.

The objectives of the ISA are numerous. For example, the society endeavours to promote and improve the practice of professional arboriculture. The ISA also encourages the public to plant and protect ornamental trees. The society subscribes to a Code of Ethics (see Appendix I) to encourage a consistent level of professional conduct. The organization also supports arboricultural research via the Memorial Research Trust.²⁸

Currently there are twenty-two chapters of the International Society of Arboriculture. Four of these are solely Canadian chapters: the Maritimes chapter, the Quebec chapter, the Prairie chapter (Alberta, Saskatchewan and Manitoba), and the Ontario chapter. Sixteen chapters are composed of American states. Two chapters, The Pacific Northwest and the Scandinavian chapter, are international. Members of the Pacific Northwest chapter may reside in Alaska, British Columbia, Washington or Oregon. Members from the Scandinavian chapter may be from Denmark, Finland, Iceland, Norway or Sweden. American chapters may be multi-state; for example, the Rocky Mountain chapter includes Colorado, Idaho, Montana, New Mexico, Wyoming and Utah. The Texas chapter is an example of a chapter that is composed of just one state. (See Appendix B for a summary of chapters.)²⁹ Members living in countries other than Canada, the United States or the Scandinavian countries, are designated members-at-large.

The International Society of Arboriculture, as is typical of many professional associations, recognizes the need for continuing education. The society publishes a monthly journal, the Journal of Arboriculture, which presents educational, technical and scientific articles. The ISA sponsors an annual international conference and papers presented at the conference are published in the Journal. The ISA also produces special publications available to the membership, and a listing of arboricultural abstracts

annually.

At the chapter level, the annual meetings encourage continuing professional education. In addition, the Western, Ohio, Illinois, New York, Penn-Del and Wisconsin chapters have a voluntary certification program for Arborists (see Appendix D). Three chapters, Western, Canada and Illinois have a voluntary certification program for Tree Workers (see Appendix C). The Pacific Northwest chapter for whom the following certification program was developed, is one of the smaller chapters.

D. Objectives of the Program

The objectives of the program were difficult to delineate. Boyle defines an objective as "an end toward which action is oriented, a condition or state of being to be reached. An objective reflects how the situation is to be changed, improved, or maintained."³⁰ Gagné and Briggs suggest an objective "reflect what the student will be expected to be able to do following the course."³¹ Both authors agree that an objective reflect some future state. The future state than an applicant may aspire to upon completion of the certification program is, hopefully, improved arboricultural practice.

The executive of the Pacific Northwest chapter provided little help in defining suitable objectives for the program. Some guidance was given by the chapter's constitution and by-laws, which state that the chapter establish and administer standards for arboriculture practice.³² This lack of organizational participation in the determination of objectives is not uncommon. In 1977 the American Society of Association Executives studied seventy-five trade and professional associations. Of the seventy-five associations, only slightly over one-half had written objectives for their continuing education functions. Almost all of the associations in the study

offered short-term learning activities for their members, but only one-third provided certificate, licensure or degree programs. In addition, the study found that the continuing education programs often competed with other association programs such as conferences and publications.³³

As suggested by Boyle, there are three levels of objectives when planning a program: society, program and instructional objectives.³⁴ The Pacific Northwest chapter's societal purpose or objective is to promote the conservation, preservation, and proper care of trees. Program objectives or goals are statements concerning specific areas that require improvement through education. Program objectives state what is to be achieved in the program.³⁵ The writer proposed the following program goals for the certification program for Arborists and Tree Workers:

- 1) To establish a meaningful standard for arboricultural practice in the Pacific Northwest;
- 2) To upgrade and improve the practice of professional arboriculture;
- 3) To encourage a high level of professionalism for members;
- 4) To gain increased recognition from allied fields;
- 5) To increase recognition from the public;
- 6) To provide a measureable assessment of knowledge and skill;
- 7) to give chapter members the incentive to improve their competency;
- 8) to provide individual recognition among peers;
- 9) to give the public a degree of assurance that a certified Arborist or Tree Worker has achieved fundamental skills and qualifications.

Instructional objectives specify what the applicant will be able to do after completing the certification program.³⁶ In Appendix R, Study Guide for Arborist and Tree Worker Certification Examinations, each of the ten study units presents a series of instructional objectives. For example, the Study Guide, on page nine states that the applicant, upon completion of the program,

will be able to "1) Diagram the morphology or structure of a root and the function of each part or 2) Summarize the types of roots that may occur on a mature tree, including the function and location of each type."

Boyle suggests that there are three benefits to writing objectives when planning a program. Clear and concise objectives give the program direction. Objectives help the planner select the type and extent of the learning activities. Objectives provide the planner with the learned performance, the criteria, and the conditions upon which the evaluation will be structured.³⁷ The use of objectives also encourages the applicant to do their own self-evaluation, because they can contrast their skills against a given standard.³⁸

The objectives of the certification program for Arborists and Tree Workers in the Pacific Northwest are three-tiered, with society, program and instructional objectives. These objectives are hierarchical and progress from general to more precise.³⁹ The specific benefits of preparing instructional objectives for the certification program were as follows. The learning objectives provided a clear and complete list of the knowledge that the applicant is required to master. This enables the applicant to focus his/her efforts. In addition, the instructional objectives provided the writer with the criteria upon which the test items were based (see Appendix O).

E. The Development of the Program

Rob Garrett, an arborist in the Seattle area, initiated early discussions concerning the development of a certification program for Arborists and Tree Workers in the Pacific Northwest. Garrett assembled an informal study group which met on December 1, 1983 and several times thereafter, to develop a proposed program outline. Also at this time, Marvin Black, President of the Pacific Northwest (PNW) chapter of ISA, appointed a committee to examine the potential for a chapter program. Committee members

reviewed the proposed program outline at a meeting held on March 23, 1984.⁴⁰ However, the resulting discussion paper was tabled and program development did not occur.

The Discussion Paper presented two alternatives for the structure and organization of a PNW chapter certification program. These were, a voluntary chapter certification program (reserved title certificate) or state and provincial licensure. The 1984 Review Committee suggested that a voluntary chapter program would be more appropriate. A legislated program or state and provincial licensure would be extremely difficult to coordinate across British Columbia, Alaska, Washington and Oregon. In addition, the PNW chapter would have to solicit tremendous professional support before such a legislated program would be feasible.⁴¹

Many American states or cities currently have licensure laws concerning Arborists. The states of Alabama, Connecticut, Louisiana, Maine, Maryland, New Jersey, New Hampshire, Oklahoma and Rhode Island are among those with licensure laws.⁴² Unfortunately, most of the state laws are difficult to administer and are not enforced due to understaffing. The State of Illinois, beginning in 1957, had a licensure law governing the examination and issuance of "Tree Expert" licences. This law was repealed in July of 1983 because it was unwieldy and uneconomical.⁴³ In addition the trend in many states, not just in Arboriculture but in other field, is toward deregulation. For example in Colorado, there is a "sunset" law which terminates all regulatory boards every six years and reinstates them only after a public review.⁴⁴ City tree ordinances or laws, as found in Bismark, North Dakota; Denver, Colorado; McPherson, Kansas; and Sioux Falls, South Dakota are usually enforced by the city forester. These laws effectively provide a register of arborists, but do not involve testing of competency.⁴⁵ The writer, in agreement with the 1984 Discussion Paper, decided to develop a voluntary certification program rather

than a state or provincial licenced program, after reviewing the above existing state and city licensing laws.

At the present time, the writer is the sole designate to a certification sub-committee placed under the PNW chapter standards of Practice Committee, chaired by Robert Mazany.⁴⁶ The writer had the task of preparing a certification program, and this thesis is the result.

The development of the certification program for Arborists and Tree Workers in the PNW involved decisions by the writer in three major areas. These were the subject areas to be included, the components of the instructional plan including method and resources, and lastly, the evaluation.

The following subject areas were proposed by the writer for inclusion in the Pacific Northwest certification program.

Basic Biology:	Unit 1 - Tree Morphology, Anatomy and Physiology.
Related Subjects:	Unit 4 - Soil Management.
Practice:	Unit 2 - Tree Identification and Selection
	Unit 3 - Planting and Early Care
	Unit 5 - Pruning Concepts and Techniques
	Unit 6 - Wounds and Cavities
	Unit 7 - Cabling and Bracing
	Unit 9 - Diagnosing Common Tree Problems
	Unit 10 - Identifying Hazard Trees.
Safety:	{ Safe Work Practices
	{ Tree Climbing
	Unit 8 { Chainsaw Safety
	{ Mobile Equipment
	{ Brush Chipper Safety.
	(See Appendix R.)

This list incorporated all the subject areas suggested by Garrett, et.al.⁴⁷ with the exception of Meterology, Growth Regulators and the History of Arboriculture. The writer's justification for selecting these ten study units was as follows. The writer, with twenty years of horticultural experience, is regarded as knowledgeable among the membership of the Pacific

Northwest Chapter and so selection of subject areas was guided, in part, by an intuition of what was appropriate for inclusion. Standard arboricultural references were also consulted. For example, Dick Proudfoot, President of the Oregon Arborist Association, has hailed Arboriculture by Dr. Richard W. Harris and A New Tree Biology and A New Tree Biology Dictionary by Dr. Alex L. Shigo as the two most current reference "bibles" for the arborist.⁴⁸ The study units in the Study Guide (see Appendix R) rely heavily on Harris's book as the primary reference and Shigo's books as secondary references. The study units closely correspond to specific chapters in Arboriculture. For example, Unit One corresponds to Harris's Chapter Two, "Plant Growth and Form"; Unit Two is based on Harris's Chapter Three, "Plant Selection"; Unit Three corresponds to Chapters Two and Eight, "Plant Growth and Form" and "Planting"; Unit Four is based on Chapters Six, Eleven, Twelve, and Thirteen, "Planting Site: Soil", "Fertilization", "Irrigation", and "Soil Management"; Unit Five relies on Chapter Fourteen, "Pruning"; Units Six and Seven correspond to Chapter Sixteen, "Preventative Maintenance and Repair"; Unit Nine is based on Chapters Seventeen, Eighteen, Nineteen and Twenty, "Diagnosing Plant Problems", "Noninfectious Disorders", "Diseases", and "Insects and Other Related Pests". Of the twenty chapters in the text book Arboriculture, the acknowledged industry "bible", the Study Guide utilizes thirteen chapters as primary reference. Two study units, Safe Work Practices and Identifying Hazard Trees, are not discussed in Arboriculture. Safe Work Practices was included because safe operation of equipment and safe tree climbing techniques are of paramount importance in the Arboricultural industry. The study unit on Identifying Hazard Trees was included because arborists are often required to judge the potential for tree failure or fracture and the risk of injury to property, powerlines or people.

Two other chapters in the ISA, Western and Illinois Chapters, have

selected similar subject material for their certification programs. These two Chapters require the Certified Arborist to pass a written examination covering the following subject areas: Species Identification, Tree Anatomy and Physiology, Planting and Early Care, Soil Management, Pruning Applications and Concepts, Cabling, Bracing, Wounds and Cavities, Safe Work Practices, and Diagnosing Tree Problems. Other chapters have similar subject area requirements.

In summary, there were a number of reasons why the writer chose the subject areas included in the Study Guide. First was an intuition based on experience of what appropriate subject matter might be. Second was the desire to base the selection of subject material on a known and respected authority, such as Arboriculture. The third reason was to maintain consistency between chapters, in the event that a national certification scheme is offered by the international governing body (ISA). Lastly, the reason for the inclusion of a topic like Identifying Hazard Trees, was to provide for the growing need within the industry for practitioners who can readily evaluate trees for potential failure.

In the preparation of the instructional plan, the writer made decisions concerning the method of delivery and the resources to be used. This was an important part of the development of the certification program. The planners of continuing education have a vast array of instructional methods available to convey subject material. Workshops, short courses, institutes, conferences, seminars, symposiums, apprenticeships and home study are all examples of methods used in continuing education. Some methods are more appropriate for group learning while others are better used in individualized instruction. The use of an instructional resource such as the Study Guide (see Appendix R), which is sufficiently detailed and complete, is appropriate for the individualized home study method selected by the writer. The Study

Guide may be distributed easily through the mail or at an annual regional meeting. Applicants prepare for the certification examinations by reading the objectives listed at the beginning of each unit of the Study Guide. Then the applicant reviews the references given in the "Procedure" of the Guide, and attempts to answer the "Study Questions" and the "Sample Test Questions". "Additional References" are also included. The writer chose this format because it is a clearly ordered learning sequence. There are several advantages to using the Study Guide at home as compared to seminars or short courses. The first is the members of the Pacific Northwest chapter are geographically separated by hundreds of miles, making frequent gatherings difficult. An additional advantage to the home study method of instruction and the Study Guide, as the instructional resource, is that applicants may progress at their own rate. The prime disadvantage is that there is little opportunity for applicants to ask questions if difficulties arise. The writer, in preparing Appendix M (Source of References Letter), attempted to make the reference material required in the "Procedure" of the Guide more accessible to applicants.

There are many instructional methods and resources available. Since there is a broad spectrum of individual needs and styles of learning, several differing methods of instruction and resources would be desirable. The use of several different methods in a program adds variety and interest, and may maintain motivation. How, then, does the program planner select a few methods over the remaining dozens available? Ideally the planner should select a method (or methods) which provides the maximum applicant participation as time, budget and facilities allow.⁴⁹ With this in mind, the home study method and the Study Guide, as the instructional resource, were chosen. Both provide the most flexibility in terms of time and the limited available budget.

All the ISA chapters with certification programs in place utilize the

home study instructional method. Several offer, in addition, an examination preparation seminar one day prior to the written examination. Instructional resources range from the provision of a simple list of references, to a complete study guide, to a manual of sample examination questions, to a detailed study package (see Appendices G and H).

Evaluation is an important component in the development of a program. Houle states that evaluation is "...the determination of the extent to which an educational objective has been accomplished. Evaluation includes the two closely related processes of measurement and appraisal."⁵⁰ Measurement checks the extent to which individuals in a program have achieved the criteria of evaluation. The program and instructional objectives provide the criteria for evaluation. Appraisal includes a judgement of how well the objectives have been satisfied.

The Garrett Discussion Paper proposed that PNW certification applicants be evaluated in three ways: a written test, a practical test consisting of plant and problem identification and a work climb, plus the submission of three letters of recommendation and a review of the applicant's work. A review of an applicant's work might consist of an on-site evaluation by a member of the certification board or submission of a portfolio.⁵¹ The writer concurred with the first two, a written and practical test, but the third may cause problems. Hendricksen points out that the review of other practitioners' work may be counterproductive and present the opportunity for subjectivity and controversy.⁵² Rather than a review of work, the writer recommended a simple work history to verify the applicant's experience. Please see Part I for a complete discussion of the evaluation of the program.

Although first initiated in 1983, the development of a certification program for Arborists and Tree Workers in the Pacific Northwest has been a slow process. The decision to opt for voluntary certification, as opposed to

state or provincial licensure, was made after a review of the lack of success of existing state and city licensure laws. Decisions concerning the subject area, instructional method, resources and evaluation were important considerations in the development of the certification program.

F. Requirements of the Program

There are several general requirements which make up a professional certification program. These requirements primarily concern an applicant's knowledge and work experience. An examination requirement tests the applicant's understanding of the knowledge base required for professional competency. An experience requirement is usually met by a lengthy work period within the profession.⁵³ Appendices E and F summarize the requirements for the Certified Arborist and Certified Tree Worker as proposed by the writer. The proposed requirements are consistent with the Western and Illinois chapter requirements for Certified Tree Worker. The proposed requirements for Certified Arborists also correspond to both the Western and Illinois chapters.

The six requirements of work experience, a written examination, signing the Code of Ethics, chapter membership, proof of insurance, and recertification were considered during the design of the program. A decision was made by the writer to include work experience, an examination, the signing of the Code of Ethics, and recertification as the only requirements of the program. The following is a discussion of why the requirements for certification were proposed as they are listed in Appendices E and F.

Experience in arboriculture was proposed as a requirement of the program for both Tree Worker and Arborist certification. The rationale was that hands-on experience is necessary to enable the applicant to understand the knowledge presented in the Study Guide. If an applicant has only read about tree care practices, rather than working in and on trees, it is unlikely the

applicant would have sufficient skills to do the job properly. In addition, hands-on experience is critical for the safe operation of dangerous tools, such as chainsaws, brush chippers and stump grinders. An applicant could not be considered competent in the operation of these types of equipment unless they have read the operating instructions, watched demonstrations, and used the tools under many different conditions in the field under the direct supervision of a knowledgeable person. Work experience is an important requirement of certification. It enables the applicant to gain practical experience which will aid in his/her understanding of the material in the Study Guide. It enables the applicant to practice the safe operation of equipment.

The work experience proposed by the writer, for a tree worker, was eighteen months. Eighteen months was chosen over six or twelve for the following reasons. Six months is too short a time period. It is not one complete growing season. In addition, a six month period could be, for example, April to October. During this time period very little pruning occurs. Since pruning of trees is an important component of a tree worker's job, a six month work experience could conceivably not include any pruning. A twelve month work period for the tree worker is more realistic as the applicant would have the opportunity to work on trees through all four seasons. The applicant would have the opportunity to work in seasonally related tasks, such as pruning in the dormant season and pest and disease control in the spring and summer. More importantly, an eighteen month period allows the applicant to see the effects the pruning cuts, made in the spring, have on tree growth over the summer and into the succeeding spring. A six month or twelve month period does not allow this pruning effect feedback. In addition, an eighteen month period allows a longer period of time where it is more likely he/she will be exposed to a larger range of tree species growing

under many cultural conditions. Eighteen months also allows the tree worker sufficient time to be exposed to, to learn, to gain confidence in, and to practice the difficult skills of safe tree climbing and removal. The eighteen month period allows the applicant the opportunity to handle and practice operating chainsaws that are of different weights, and to practice using them on the ground, from a ladder, and in the tree on live, dead and decayed tree limbs under all weather conditions. The same comment can be made for other pieces of equipment.

In many small businesses the majority of tree work will include tree topping, pruning, spraying weeds, insects, diseases, dangerous tree removal and stump grinding on a regular seasonal basis. A project requiring cabling and bracing occurs infrequently. Therefore in a short work experience of six or even twelve months, it is unlikely that an applicant would be exposed to all aspects of tree care including cabling and bracing.

The experience in arboriculture required for Arborist certification is thirty-six months. Arborist certification is an advanced or more difficult level of certification. The arborist, as opposed to the tree worker, is meant to direct or supervise tree work, answer client questions, and make recommendations concerning trees. Arborist certification is for tree care supervisors, salesmen, diagnosticians and consultants. Arborists are also responsible for two additional areas of expertise; see Units Nine and Ten in the Study Guide (Diagnosing Tree Problems and Identifying Hazard Trees). Therefore the additional time period allows the applicant to gain supervisory experience. It allows the arborist more exposure to many different tree and shrub species, growing in diverse environments. It allows the applicant time to build a working file of weed, insect and disease problems and their remedies. The ability to accurately identify hazard trees requires the arborist to examine dozens of trees that have failed, due to different tree

defects under various conditions.

In summary, work experience provides the applicant the opportunity to encounter, observe and undergo the practical application of arboricultural theory. Thirty-six months allows an applicant a minimum amount of time in which to make recommendations concerning tree care, have them carried out and then observe the results over an extended growing period. Nelson states that the number of years required must not be arbitrary or discriminatory. He suggests asking whether or not an individual with fewer years experience would be just as qualified as those with greater experience.⁵⁴ In the case of an arborist, an applicant, in the writer's view, with two years' experience would not be as competent as one with three.

The arguments for the inclusion of a work experience requirement in the certification program and a rationale for the eighteen month (tree worker) and thirty-six month (arborist) time periods are given above. One argument against the experience requirement is that extensive, time-consuming, checking of references would be necessary in order to authenticate the experience references given. This argument was rejected by the writer since the number of applicants for each examination will generally be very small (four or five, up to ten to twelve per year).

Acceptable experience for either the tree worker or the arborist may be with a tree care firm, municipal parks department or utility firm, where the applicant is required to use the skills of a tree worker or arborist as the major component of his/her work. The writer felt that as wide an employer base as possible be allowed, to encourage as many individuals as possible to apply for certification. Work experience may be accumulated one employer to the next. It does not have to be consecutive. The writer felt some flexibility was warranted due to the seasonal nature of employment. Self-employed applicants may apply those hours with their own firms that are

directly related to arboriculture, toward the requirement. A maximum of six months credit (tree worker) or eighteen months (arborist) may be granted for arboricultural educational experience. For example, possession of a two-year, four-year, or advanced degree in landscape design, urban forestry, arboriculture, horticulture or a related field of study, plus a minimum of eighteen months experience in a professional tree care of other company would fulfill a combined education and work experience requirement for an applicant desiring to become a Certified Arborist. Nelson suggests that it is common practice to substitute higher education credits for work experience as part of the certification requirement.⁵⁵ Formal education alone is not sufficient to assure competency. The university or technical school graduate has a great deal to learn on the job. (A copy of the diploma or transcript must be submitted.)

The burden of proof of the work experience required is placed upon the applicant, and will be verified through his/her employer(s). The Certification Review Board (see Part G, Administering the Program) reserves the right to make the final decision concerning the eligibility of an applicant's work experience.

The second requirement for certification is that both the arborist and the tree worker pass a written examination with seventy percent pass required in five examination categories (see Appendix S for sample examination questions). An examination was required because there must be some means of rating or assessing the knowledge and comprehension of the applicant. A written examination was chosen over an oral one for several reasons. First, a written examination provides a document that can be kept on file. Secondly, the written format cancels out the influence of the tone, inflection or reading ability of an oral examiner. In addition, a written response is easier to mark consistently than an oral one. Oral examinations are time-

consuming and may result in low scores due to lack of practice on the part of the applicant. An oral examination gives poor comparative evaluation of applicants and of course there is no written record. The advantages of an oral examination are that it helps those applicants who fear written tests and eliminates bias against those whose reading skills may cause them difficulty.

One argument against a written examination is that it may test an applicant's reading ability as well as his/her knowledge or skill. This could be a problem if English is the second language of the applicant.

The multiple choice format was selected for the bulk of the exam questions for the following reasons. First, this format is quick and easy to mark, which is an important consideration when only one volunteer is available to grade the examination. Multiple choice tests are objective rather than subjective and can provide an extensive test sample of factual material. They can be designed so that they are very reliable and can be adapted to many instructional objectives. In addition, multiple choice tests can be subjected to item analysis and further refinement. Multiple choice tests can also be used to measure a variety of different levels of learning such as knowledge, comprehension and application. Multiple choice tests are considered to be the best and most versatile of the objective test forms. They minimize the guessing factor prevalent in true-false tests.⁵⁶ Some of the disadvantages to multiple choice questions are that it is difficult to prepare good questions to measure the analysis, synthesis and evaluation levels of learning. This last criticism was not considered a problem by the writer since the majority of the learning objectives in the Study Guide are in the knowledge, comprehension and application levels or domains of learning. In addition, another weakness of multiple choice questions is that they tend to over-emphasize memory learning.

The writer found the writing of the two hundred plus extra questions a

time-consuming task. The development of good test items was difficult. For example, the question itself must clearly, without ambiguity, state a problem. Unnecessary or unusual words should not be used. There should be one correct or best answer. The writer chose to use the best answer approach for the following reason. A question requiring the selection of the best answer implies that the choices given may include more than one correct answer, but only one will clearly be the most appropriate one. This increases the difficulty of the test. Of course all the wrong answer choices should be plausible with no grammatical clues. The length and form of all the answer choices should be similar. The location of the best answer, from question to question, should not follow a consistent pattern, but over all the questions there should be an equal distribution of correct A, B, C, and D choices. The certification examination has approximately fifty each A, B, C and D answers. Good multiple choice questions avoid the use of the negative. This is because it is more important for an applicant to know what a specific item of knowledge *is* rather than what it is not. The test question should include three to five alternative answers to minimize guessing. In addition, the option "none of the above" should be used infrequently, and "all of the above" should be avoided altogether since it is often the correct answer and makes the question too easy. An authority should be referred to when the test question contains controversial opinion. Lastly, each question should contain an independent problem which does not provide a clue to the answers of subsequent questions. (See Appendix S for sample examination questions.)

Some true-false questions were also included in the examination. The reasons the true and false questions were used are as follows. True-false questions can be used to measure both knowledge and comprehension levels of learning. They were easy to design and are useful in sampling a broad range of knowledge. Unfortunately the most obvious weakness of the true-false

question is that it encourages applicants to guess. Despite this weakness, a few true-false questions were used to add variety to the Arborist examination.

In writing about the certification program, the writer has made reference to the examination. In fact the writer designed a master examination of two hundred questions, all of which must be answered by the applicants desiring an Arborist's certification. Two additional exams of ninety questions each, labelled Tree Worker A and Tree Worker B were created as subsets of the master examination since the applicant desiring Tree Worker certification is not responsible for all of the instructional objectives presented in the Study Guide. The objectives that the tree worker is responsible for are marked by an asterisk in the Study Guide. Arborists, of course, are responsible for all instructional objectives. The master list or Arborist examination, is based on a representative selection of all the instructional objectives. (See Appendix Q, Policies and Procedures Manual, pp.6-8 for the examination guidelines for both arborists and tree workers.)

A decision was made by the writer to use seventy percent as the criterion for passing the examination. Seventy percent was selected because it is a compromise figure, since a portion of the examination is true-false and a portion multiple choice. In true-false tests, because the applicant has a fifty-fifty chance of guessing the answer, the average test difficulty level is normally seventy-five percent.⁵⁷ In a multiple choice test, which minimizes the guessing factor by providing four choices, the average test difficulty or the average percent of correct test responses may be less. Seventy percent is a reasonably high pass level which would indicate that the applicant has a sufficient grasp of the knowledge presented in the Study Guide. There is an argument that some sections such as Unit Eight, Safe Work Practices, because of the nature of the topic, should be marked at an eighty or ninety percent pass level. One authority stated that "the choice of cutoff

scores is generally subjective even after many tests had been administered and empirical data regarding actual test performance is available."⁵⁸ The writer selected a seventy percent pass for all five categories of the examination because seventy percent offers a moderately high standard and provides consistency throughout the categories of the examination.

The requirements for Tree Worker certification included a practical examination. A practical examination offers the Certification Review Board an opportunity to verify that an applicant can safely and efficiently throw a line into a tree, enter a tree, and reach two or three work stations in the outer canopy of the tree. The practical test also offers the Certification Review Board the opportunity to verify that an applicant can effect an aerial rescue of an "injured" climber. (See Appendix Q, pp.9-13 for the Rules, Scoring Procedure and Guidelines for the Practical Examination for the Tree Worker certificate.) One legal problem arises which has not been addressed by any chapter that currently has a practical examination. Who is legally liable if an applicant falls from a tree during the practical examination and kills or severely him/herself? The writer does not have the expertise to evaluate this very serious potential disadvantage to the requirement of a practical examination.

The third proposed requirement of the certification program was that an applicant must sign and adhere to the ISA Code of Ethics (see Appendix I). Signing the Code indicates that the applicant has read and understood the rules of conduct of the profession. If the applicant, once certified, does not obey the Code of Ethics, it gives the chapter just cause to suspend or revoke his/her certification.

A fourth requirement of certification in some chapters may be chapter membership. The requirement for membership limits those who may call themselves "certified" to chapter members, it simplifies administration

because members receive newsletters regularly which would inform them of recertification examination dates, or Study Guide updates or approved courses for recertification. Chapter members may also be easier to discipline if they are involved in an infraction of the Code of Ethics of the organization. On the other hand, if chapter membership is a requirement of certification, there is the potential legal ramification of restraint of trade, where membership becomes a limitation to the practising of that trade. The writer chose not to make chapter membership a requirement and therefore eliminated this potential problem.

A fifth requirement in some chapter certification programs may be proof of insurance for property damage and public liability. The argument for this requirement is that it may reduce chapter liability. It also offers the public an assurance that they may be protected against property damage by a Certified Arborist or Tree Worker. The arguments against the inclusion of proof of insurance in a certification program are as follows. First, once the applicant is certified it is difficult and time consuming to verify that insurance coverage was maintained after certification was granted. Also the chapter may accept some legal liability by stating in the promotional literature that Certified Arborists and Tree Workers are insured. The writer chose not to include proof of insurance as a requirement for three simple reasons. First, it was not within the writer's expertise to determine what constituted adequate insurance limits or coverage. Secondly, insurance conditions and limits differ from Canada to the United States and it would be difficult to devise a consistent scheme for applicants from British Columbia, Washington, Oregon or Alaska. Lastly, the administrative ability of the chapter is far too small to keep track of and update all certified personnel's insurance coverages.

The sixth requirement for both the tree worker and the arborist is

recertification. Pacific Northwest Chapter certification is valid for a three-year period. Certification may be renewed by either re-examination before the individual's certificate expires (unless other arrangements are made with the Certification Review Board before expiration) and paying a renewal fee, OR by attending eighteen hours (tree worker) or thirty-six hours (arborist) of approved seminars and educational programs within the three-year period and paying a renewal fee.

Eighteen hours was chosen for the tree worker as the minimum number of continuing education hours accepted because it approximates one and a half PNW training conferences. Since it is unlikely that an employer would give release time for a tree worker each and every year of the three-year period to attend the chapter training conference, a middle-of-the-road compromise was selected by the writer. Eighteen hours of seminars etc. works out to attendance at one annual conference and another short course or seminar.

The thirty-six hour minimum continuing education requirement was chosen for the arborist as it closely approximates attendance at one conference per year. Since the Arborist certification level is more appropriate for owner-operators, foremen of municipal parks systems and other supervisors and managers, these individuals should keep current by attending training conferences annually. A retest is an option for both the tree worker or arborist. This was selected by the writer, to allow some flexibility in case a certified individual is injured, laid off or financially unable to attend conferences or seminars and still wants to maintain his/her certification.

Proof of attendance at training conferences or seminars is required and must be submitted at the time application for recertification is made. Attendance at an annual training conference of the Pacific Northwest Chapter is equivalent to six hours credit per day attended, with a maximum total of twelve hours credit allowed per conference. Also accepted are the "Pro-Hort"

seminars relating to arboriculture, sponsored by the University of Washington's Center for Urban Horticulture. Three hours credit will be given to a half-day seminar (three to six hours in duration), and a maximum of six hours credit will be given to a day-long seminar (six plus hours). Local seminars sponsored by chapter members within British Columbia, Washington or Oregon will also qualify for three to six hours credit, depending whether they are half day or full day programs. Approval of additional seminars, courses, etc. is at the discretion of the Certification Review Board. Garrett suggested that Certified Arborists must demonstrate a continuing interest in the acquisition of new knowledge. He suggested that evaluation of this new knowledge might be in the form of re-testing and/or participation in the annual chapter training conference, field days or short courses.⁵⁹

In addition, college courses that are directly related to arboriculture and are taken in addition to original courses required to achieve a degree may qualify for a maximum twelve hours credit.

In the health fields, where an inept practitioner may seriously injure the public, recertification based on job competency and retesting, as opposed to participation in continuing education, is ideal. In arboriculture, injury to the public is less likely to occur. For this reason, and because the Pacific Northwest chapter has limited resources and administrative capability, the continuing education requirement for the proposed certification program was based, by the writer, solely on participation in continuing education.

The proposed certification program for the PNW contained several general requirements. A written examination, based on the instructional objectives, provided a means to measure the applicant's grasp of the knowledge base. Another requirement, work experience, was met by an eighteen (tree worker) or thirty-six (arborist) month work period. The applicant, as per the proposed requirements, must sign and uphold the ISA Code of Ethics. In addition,

recertification is required by re-examination or by attending a certain number of hours of approved education credits within the three-year period (see Appendices E and F).

The following is a comparison of the requirements for certification of other chapters in the ISA. With the exception of the Ohio and Illinois chapters, all of the ISA chapters with existing certification programs require an applicant to have work experience in arboriculture. The experience requirement varies from twelve, twenty-four to thirty-six months. All chapters have an examination requirement. Three chapters, Western (Certified Tree Worker), Penn-Del and New York chapters (Certified Arborist), require an oral examination. The six chapters currently offering certification for arborists all utilize a written examination with the majority requiring a seventy percent pass. The written examination format of multiple choice, true and false questions is used by most ISA chapters. Penn-Del and Illinois are the exceptions; Penn-Del requires fill-in-the-blank, paragraph and essay answers in addition to multiple choice and true and false answers, and Illinois also uses fill-in-the-blank questions. (See Appendix H; also see Appendix O, The policies and Procedures Manual, for the examination guidelines for the Pacific Northwest Chapter Arborist and Tree Worker certification.)

One Western chapter requires a practical examination for Tree Worker certification. The practical examination consists of two parts, a work climb, and an aerial rescue. (See Appendix O for the evaluation key for the practical examination for the PNW chapter Tree Worker certificate.) More than half of the chapters require applicants to sign the ISA Code of Ethics before certification is granted. More than half of the chapters do not require chapter membership as a requirement for certification. One chapter, Penn-Del, requires proof of insurance for property damage and public liability. All chapters require some form of recertification. The recertification

requirements vary widely from simply maintaining chapter membership, to attendance at one continuing education session per year, to attendance every three years at thirty-six hours of approved continuing education, to re-examination every three years (see Appendices C and D).

G. Administering the Program

A Pacific Northwest chapter certification program requires the development of a larger organizational structure within the chapter. Running the program will involve a significant level of management and record keeping. The writer proposed the creation of a Certification Review Board (CRB), composed of one member, each, from British Columbia, Washington and Oregon, who would have the primary responsibility for administering the program. This board would be appointed by the chapter president, and be chaired by a chapter officer or director. Primary functions of the CRB would include the following:

The day-to-day administration of the program, i.e.

- a) developing promotional materials such as the application brochure, the certification certificate and identification card (see Appendix J).
- b) promoting the program through articles in Pacific Northwest Trees, other magazines, letters to parks departments and extension agents (see Appendix L).
- c) mailing the Study Guide and other correspondence to applicants.
- d) establishing examination dates, organizing the examination venue, collecting plant samples, invigilating the examination, marking the written examination, setting up the practical examination, and arranging for judges, etc.
- e) record keeping of applications, confirmations, fees, other correspondence (see Appendix K).
- f) making recommendations to the Chapter Board of Directors regarding individuals certified.
- g) publishing lists of acceptable continuing education seminars that

qualify for recertification hours. (See Appendix Q for the administrative Policies and Procedures Manual.)

The writer proposed the establishment of a certification authority named the Certification Review Board (CRB) for the following reasons. First, the administration of a certification program is a time-consuming task. To place this role onto the shoulders of an already over-burdened volunteer director or officer of the chapter as part of his/her duties would be unfair. Another reason to establish a Review Board was the writer's desire to maintain some administrative independence for the certification program from the parent chapter. The writer maintained that the Certification Review Board must have the right to make some policy decisions regarding certification without the approval of the Board of Directors and Officers of the chapter. However, it is the responsibility of the chapter board to provide general guidelines within which the Board of Review should operate. General guidelines such as setting the fees, approving the requirements for certification and the format of the Study Guide were the responsibility of the chapter Board of Directors and Officers. In addition, the chapter Board would be responsible for the composition of the Certification Review Board, the length of terms and appointment-reappointment policies, the procedure for removal of board members, and the policy for handling protests and appeals. On the other hand, the CRB should have the responsibility of defining the duties and responsibilities of each of the three members, the test content, the administration of the examination and the types of continuing education programs eligible for re-certification credits and other day-to-day administrative duties. The writer felt that the Chapter Board of Directors and Officers should provide only general guidelines, for the following reasons: 1) it would be extremely time consuming to pass all decisions regarding certification before the twelve-member Board of Directors; 2) the

Board of Directors and Officers lack a basic understanding of the certification process and may be less qualified to deal with the day-to-day administration of the program; 3) last, and perhaps most important, certification must be available to everyone in arboriculture not just chapter members. Applicants, outside the chapter, may not wish to become certified if it is perceived that their eligibility and final acceptance is ultimately the decision of the chapter directors and officers, who may be biased. To this end, it would be advisable if there were five members on the Certification Review Board; three chapter members, a fourth individual from an allied field and a fifth person who might be simply a member of the public. The two unbiased additional members would hopefully keep the other three members from establishing arbitrary rules and procedures.

The writer proposed that the Certification Review Board be appointed by the chapter president because the president is in a position to appoint a representative from each special interest group, contained in the chapter, these are municipal, utility, and commercial arboriculture including consulting arborists and research and education. In addition the president may ensure that one member is from each of the main geographical areas represented in the chapter. A free election of the three CRB members would be unlikely to produce a well-balanced group in terms of geographical distribution or membership in special groups. The chair of the CRB should be taken by a chapter officer or director to simplify communications between the chapter Board of Directors and the CRB.

The writer also proposed that the maximum term of appointment of a CRB member be two years for the following reasons. A term greater than two years would require a very large commitment of time and energy from a volunteer. It is quite likely that "burn out" would occur. Longer terms tend to promote dynasties. On the other hand, a shorter term of one year does not allow an

individual to get the feel of the job and valuable time spent orientating each member would be lost with each new appointment. A two-year term allows an individual to learn to do the job with maximum energy and minimum burn-out.

H. Publicizing the Program

One of the goals of the certification program for Arborists and Tree Workers is to provide the public with a means of identifying certified practitioners. A promotional letter (see Appendix L) sent to members of the horticultural community who often field questions and make recommendations to the public, may be useful. A press release for professional and/or trade magazines and newsletters would also be of service in alerting the horticultural community. Press releases for local newspapers and general readership magazines may be of value in making the public aware that such a program exists. A brochure for the general public, which Certified Arborists may hand out to prospective clients, garden clubs or other companies interested in certifying their employees may be of use too. Simple promotional and identifying items such as numbered wall certificates or plaques, numbered wallet identity cards, logos for stationary, truck decals and yellow page ads are also worthy of consideration.⁶⁰ All of the above promotional techniques aid the public in their search for a qualified and competent arborist or tree worker.

I. Evaluating the Program

The certification program has been evaluated in several ways. First, in October of 1988 the twelve officers and directors of the Pacific Northwest Chapter of the ISA were given copies of the draft Study Guide and a list of the requirements for certification. Each chapter officer was charged with reading through the Study Guide and certification requirements and offering to

the writer suggestions for changes and improvements. The suggestions for improvement from these individuals included the addition of reference material, such as the Oregon and Washington Industrial Health and Safety Code, references concerning chainsaw use and maintenance, and hazard tree identification. In addition, the group discovered a number of errors such as incorrect answers to the sample questions and typographical errors. These changes and additions, among others, were incorporated into a new draft of the Study Guide. On December 19, 1988, the officers and directors were again presented with the Study Guide and requirements for certification for their consideration. At that board meeting the following motions were made:

*"1. Move to accept the requirements for certification for Arborists and Tree Workers as outlined in the Policies and Procedures Manual."*⁶¹

This motion was passed with the following changes. The officers and directors agreed with and supported the requirements for certification as outlined in Appendices E and F with the exception of the requirement to sign the ISA Code of Ethics (see Appendix I). Their reason was quite simple. A member of the PNW Chapter, who became certified, already has signed the Code of Ethics upon originally joining the chapter. If a non-member becomes certified, signing the ISA Code of Ethics would have little meaning and if the Code was not upheld, what course of action could be taken against a non-member? To solve the problem in a round-about way, the officers and directors decided to give automatic membership in both the international and chapter organization if a non-member applicant successfully completes certification. The non-member applicant must pay more than double the member fee for the examination and Study Guide. This was felt to be adequate to pay for the development costs of the program and pay for international and chapter membership dues. The benefit of this procedure is the automatic increase in chapter membership.

The key is retaining these new members into the second and third years.

*"2. Move to accept the Study Guide as presented."*⁶²

This motion was passed with the following modification to the Study Guide.

Strike out all reference to the Code of Ethics.

*"3. Move to accept the administration of the program as outlined in the Policies and Procedures Manual."*⁶³

This motion was tabled pending a revision of the Policies and Procedures Manual. The directors and officers, in evaluating the Manual, agreed in principle to the majority of the policies with minor changes in wording and the addition of a few lines to clarify the intent of some paragraphs. The main reason this motion was not passed at this time was the concern of several officers concerning the format of the examinations. The suggestion was put forward to make the examinations open-book. Heated discussion ensued with several members strongly in favour of an open-book examination. The writer is strongly opposed to an open-book examination for the following reasons.

First, the entire planning process in developing the Study Guide and examination package was based on a non-referenced examination. Second, open-book examinations have a reputation of being relatively easy. For a certification program to have value, the requirements to gain that certification must be rigorous. No other ISA chapter offers an open-book examination. Both Western and Penn-Del experience a fifty percent failure rate. John Ward, Chairman of the CAPD (Certified Arborists of Pennsylvania and Delaware) states in the Journal of Arboriculture that "...the exams must be difficult enough to demand study or the program will not be worthwhile."⁶⁴

Thirdly, an open-book examination would set a precedent. How would the value of certification between a group who had access to references during the

test equate with a group who do not? If there is a very high failure rate, examination questions may be eliminated or redesigned to make the test easier, if required.

A fourth reason was based on educational theory. Briefly, there are three taxonomies which describe the objectives or behaviours found in the cognitive, affective or psychomotor domains. In the cognitive domain, there are six levels of complexity ranging from the knowledge level (simplest) to the evaluation level (most complex). Higher-level objectives are assumed to include, and be dependent upon the simpler cognitive skills. Each level of the cognitive taxonomy has unique characteristics as described below.

- 1) Knowledge level - requires the applicant to recognize or memorize facts or terminology.
- 2) Comprehension level - requires the applicant to understand the meaning of the facts and terminology.
- 3) Application level - requires the applicant to use the previously acquired information in a setting other than that in which it was learned.
- 4) Analysis level - requires the applicant to point out differences between facts and opinions, and to identify errors.
- 5) Synthesis level - requires the applicant to create or design something new.
- 6) Evaluation level - requires the individual to criticize or to judge the value or worth of something.⁶⁵

Based on this hierarchy, the writer designed the Study Guide so that an applicant must memorize some facts and terminology, understand the information presented, and be able to use or demonstrate knowledge and point out differences.

ALL of the objectives of the Study Guide are phrased to elicit the level of learning appropriate for that objective. For example, take objective one - Knowledge Level, page nine of the Study Guide (see Appendix R):

- *1. Describe the morphology of a root and the function of each part (*objective for both arborist and tree worker).

Describe is a verb along with others like, identify, define and name, that suggests the applicant memorize the parts and function of the root.

The corresponding study question is given on page ten of the Study Guide:

1. Define the terms listed below. Identify where the structures or cells are found and explain their primary function. root cap, root hair...etc.

The corresponding sample test question is on page twelve of the Study Guide.

1. Water and mineral elements are absorbed by the tree via which part of the root?
 - a) cap
 - b) palisade
 - c) hairs.

The corresponding real examination question is:

- What part of the root absorbs water and mineral elements?
- a) cap
 - b) hairs
 - c) meristem
 - d) pith
 - e) cortex.

All parts A-D relate to one another. They must for the examination to exhibit content validity. This is the most important component in the design of an exam. It refers to the degree in which the exam coincides with the instructional objectives which are to be measured in the test.

Comprehension or understanding is elicited by verbs like explain, distinguish, and summarize. Take objective eight, page fourteen of the Study Guide: "Distinguish unacceptable characteristics of nursery stock such as kinked and circling roots or injured bark." Here the applicant cannot just memorize the characteristics but must have some understanding of the problem.

The correlating study question five, page fifteen, is: "List five

reasons why nursery trees may be rejected prior to planting." There is no sample test question for this study question. The real examination question is: "Girdling roots typically exhibit what kind of root defect? a) sharply bent kinks, b) unilateral development, c) circling, horizontal growth, d) lack of flare." Again Parts A-D relate to one another.

The analysis level of learning is indicated by such verbs as distinguish, point out, and outline. Take objective eleven, page nine: "Outline the differences between heartwood and discoloured wood." Now the applicant must not only memorize the words and understand their meaning, but think about how the differences may be important.

There are no objectives in the Study Guide at the synthesis level, three at the evaluation level, indicated by verbs such as compare, contrast, and evaluate. The application level requires a demonstration or use of knowledge. This takes place in the practical work climb.

Each component of the Study Guide and examinations have been designed to reinforce each other. Each objective is stated in very specific language to elicit the level of learning desired. The writer ranked each learning objective, in the Study Guide, i.e. placed it in the knowledge, comprehension, application or analysis level of learning. The justification for placing an objective in one or another level of learning was based on the writer's ten years experience as a horticultural teacher.

Each study question reinforces the corresponding objective. The sample test questions and real test questions are all based on the objectives given. There are fifty-four sample test questions given in the Study Guide at the end of the units. Of these, twenty-eight have been reworded and used in the final examination. There are two hundred and twenty-seven study questions given in the Study Guide. Of these, one hundred and twenty have been reworded and used in the final examination.

The examination is in effect already "open book", in that by working diligently through all components the applicant already has all the questions and answers at his/her fingertips. To make the examinations truly "open book" would defeat the design of the complete educational package. On the other hand, Brian Fisher, Vice-President of the PNW Chapter and a commercial arborist in White Rock, B.C., had this to say about an open book examination, in his written evaluation of the overall certification program following the December 19th Board of Directors meeting: "Those who (like me) favour open book exams believe that knowing where to find information and knowing how to use it are equally important to that which is memorized. We believe that no casual bystander could pass a timed exam by using the reference materials, unless they had a previous interest and familiarity with the materials."⁶⁶ Mr. Fisher, in discussing objective one, page nine of the Study Guide, says:

In ten years as a practising arborist and five as a consulting arborist, I can think of no case where I needed either for business or professional reasons to have in memory the morphology of a root or the function of each part. This is an objective which Sue says should be memorized. For the educator or the nurseryman this is important. For the research individual or the plant pathologist it is vital. For the practising or consulting arborist, it is reference information, not needed on a day to day basis. Not that I object to a practising arborist being able to remember this information, but, if he/she does not have it in instant recall, it is not critical. Someone training with me, for instance, would have read about roots and the function of the various parts of the root. He/She would not have to know it by rote as a part of his/her job, but, I would expect them to know where to find the information if it were needed. The same applies to the scientific names of trees...our clients and the majority of the public with whom we interact want to talk about Red Maples not Acer rubrum, and day to day we never call a Douglas Fir a Pseudotsuga.⁶⁷

Mr. Fisher also stated in his letter, which evaluated the certification program, that he believed the Study Guide and program to be exceptionally good. He stated that it covers a wide range and has all the components of a good instrument to assess the level of interest and knowledge of a practising

arborist.

On one hand praise for the program, and on the other, strong criticism of some of the subject material and the method needed to retain the material. Mr. Fisher gives his support to an open book format because it does not entail memory work. There is an obvious difference in philosophy between Mr. Fisher and the writer. The writer's justifications for a closed book examination have already been given. In response to the selection of subject matter and the memorization of that material, the writer believes that every individual must at some point in his/her career make a serious effort to learn the basics of that field. In arboriculture, as in horticulture, those basics are plant morphology and the physiological processes of photosynthesis, respiration and water uptake. These are absolutely fundamental to an understanding of the plant world. How can anyone profess to comprehend the difficult concepts of compartmentalization or branch attachment unless these first stepping stones are mastered? The writer also suggests that memory or rote learning is required and appropriate some of the time. On the other hand, Mr. Fisher's point concerning the inapplicability of some of the subject matter does have merit. For example, Nelson stated that "...emphasis is placed on assessing competencies required to perform the job. Therefore, the basis for developing a defensible examination rests with a valid analysis of what the tasks to be performed and what are the skills, knowledge, and abilities required to do the job."⁶⁸ If, in fact, there are many parts of the subject material contained in the Study Guide which are not needed by a practising arborist on a day to day basis, then this may constitute a serious flaw in design.

Mr. Fisher suggested that in a closed book examination there will be more failures, applicants who drop out or do not write the test. The writer agrees. He suggested that the true judgement of the worth of the certification program is not the number of applicants who write the

examination, nor the number of failures, nor the number of new chapter members, but an increase in good arboriculture practice and a decrease in poor arboriculture practice in the Pacific Northwest. The writer wholeheartedly agrees.

*4. Move to accept the Tree Worker and Arborist Examinations.*⁶⁹

This motion was tabled pending further discussion of the open book issue and a separate evaluation of the examination by the Expert Panel (see Appendix P or the sample Expert Panel Questionnaire).

*5. Move to form a Certification Review Board.*⁷⁰

This motion was passed as read.

*6. Move to accept the fee schedule.*⁷¹

This motion was passed with two minor changes in the fee structure. A non-members examination only category for \$80 US was deleted; the non-members Examination and Study Guide category was increased from \$100 to \$150 US; and the non-members retake one category after failure was increased from \$10 to \$15 US.

7. Move to consider a revision of the Constitution and By-Laws of the Chapter, since they currently say nothing about the chapter's ability to grant, suspend or revoke certification.

This motion was passed as read.

The officers and directors of the chapter, in passing motions to accept the requirements for certification, the Study Guide, the fee schedule, and the formation of the Certification Review Board (albeit with minor changes), indicated to the writer that they have evaluated these components of the program and find them satisfactory.

A second way in which the certification program was evaluated was in a more formal manner. Several individuals, well respected within industry, were asked to complete a questionnaire for either a Certification Expert Panel or a Pre-Test Panel. The Expert Panel was asked to take the Study Guide and the examination (with answers) and examine them carefully with respect to thirteen questions (see Appendix P). Three individuals were asked to participate; all three responded with thoughtful and detailed evaluations. These individuals were: Dr. James Clark, Professor of Urban Horticulture, Seattle, Washington and former chapter officer, Mr. Barry Elliott, M.Sc., a former president and director of the PNW Chapter, and parks administrator, Municipality of Coquitlam, B.C., and Mr. Robert Mazany, consulting arborist and formerly a commercial arborist, PNW Chapter officer, Beaverton, Oregon. These three individuals were asked to participate, by the writer, for the following reasons. First they represent the geographical diversity of the PNW Chapter; second, they represent all four of the special interest groups, education, municipal, commercial and consulting arboriculture; and lastly, they were willing to take the time to answer the questionnaire carefully. The following is a summary of their comments.

The first five questions of the questionnaire concerned the Study Guide. All evaluators found the Study Guide very comprehensive. One stated that the learning objectives given in the Study Guide covered all the important areas of knowledge required by an arborist or tree worker. One possible additional study unit might be Plant Appraisal. Two evaluators stated that the knowledge base, as presented in the Study Guide accurately reflected what an arborist is required to know in everyday practice. One wrote that the Study Guide presents nothing that an arborist should not know but much more than they may ever use. One evaluator suggested that Unit Nine, Diagnosing Common Tree Problems, reflected the minimum level of knowledge required in this area. Two

evaluators agreed that the Study Guide contained a knowledge base adequate to ensure the understanding of correct tree care techniques by a tree worker. One evaluator suggested that the tree worker category concentrated on basic plant information. Another wrote that the knowledge base presented in the Study Guide was much more than the tree worker needed and that he/she may be intimidated by the Study Guide. One very positive point was that the Study Guide required the use and understanding of a precise arboriculture vocabulary. All three evaluators were generous in stating that they found no errors, omissions or weaknesses. One evaluator suggested six minor improvements. The writer agreed with five of the changes and these were implemented as follows. In Unit Two, Tree Identification and Selection, the following items were revised: the terms Angiosperms and Gymnosperms were added and the terms Coniferous and Deciduous deleted, and a learning objective and sample test questions were added to differentiate between these four terms. The section detailing flower colour and time was deleted as per the evaluator's suggestion that these items were too detailed for this program. The comment on page twenty-two of the Study Guide concerning tree and shrub fertilization was revised. The learning objectives and study questions concerning boron and soil salinity were deleted from Unit Four, Soil Management. On page eleven of the Study Guide the word glucose was changed to carbohydrates, in the interest of consistency. The sixth recommendation the writer did not agree with. The evaluator suggested that the British Standard Institute (BSI) Guidelines as related to Pruning would not be recognized as widely as the National Arborists Association (NAA) Standards. The reason the writer chose to use the BSI Standards was quite simple. The reference work for Unit Five, Pruning Concepts and Techniques, was Richard W. Harris's textbook Arboriculture: Care of Trees, Shrubs and Vines in the Landscape. This book discussed in detail the BSI Standards and just mentioned in passing

the NAA Standards. Two evaluators suggested that the Study Guide format be revised so that there is a very clear separation between those learning objectives meant for the tree worker and those meant only for the arborist. One evaluator felt this improvement would make it easier to find the study areas and reduce the anxiety of tree workers reviewing the Guide.

In answer to the last Expert Panel question, number five, all evaluators agreed that the Study Guide is current, comprehensive and challenging. The third made a comment concerning the format change as noted above, and the format of the Study Guide will be revised in the near future to better distinguish between the two levels of learning objectives. One suggested that the program would be equivalent to a two-year community college or technical school program in arboriculture. A last comment was that the program may be too difficult for some already working in arboriculture.

The evaluators were asked to review the examination as well. All three evaluators strongly agreed that there was a good correlation between the learning objectives in the Study Guide and the examination questions. One evaluator stated that this may be the strongest component of the Study Guide. (See Appendix O for a detailed listing of each learning objective and the related examination questions.)

The response to this questionnaire item was very gratifying. The question, "How well do the examination questions relate to the objectives found in the Study Guide?" was an attempt by the writer to determine the content validity of the examination. Content validity is the degree with which the test items correspond to the instructional objectives. The evaluators agreed there was high content validity. As to the examination's other two qualities, reliability and usability, the evaluators found the usability acceptable in that the test was clear and understandable. The reader may verify in Appendix S the clear format of the examination. The

writer chose to use a large typeface with a maximum of seven questions per page plus ample white space to facilitate reading of the questions. In addition, the writer believes the directions given in Appendix S to each applicant, to be reasonably clear. The division of the examination into five categories with the beginning and ending of each clearly marked was an attempt to make the test simple to use. Reliability or consistency is an important characteristic of a test too. Unfortunately the methods used to determine reliability require individuals to actually take the test. This was not possible for the certification examination, as a suitable population to test the test was not available to the writer.

One evaluator stated that not all the learning objectives were tested in the examination. The writer was aware of this. The learning objectives that are not tested were difficult to test using the multiple choice format.

The evaluators disagreed in their response to question two, pertaining to the examination. Two evaluators found the relative emphasis and coverage of the examination to be comprehensive, broad-ranging, and needing little refinement. The other evaluator suggested that there was a small over-emphasis in Morphology and Physiology, and an under-emphasis in Diagnosing Common Tree Problems. All evaluators agreed that the examination was challenging. The evaluators emphasized that to pass, the applicant would have to carefully review the Study Guide and reference material.

In general, all three evaluators agreed that the multiple choice answers of the examination questions were plausible, with the exception of eleven questions. The evaluators agreed that the questions were explicit and understandable with very few ambiguous or "tricky" questions. A few minor errors, omissions or weaknesses were pointed out by the evaluators. For example, one found an obviously incorrect answer and the other suggested that the test questions should consistently use PNW problems and practice. This

evaluator suggested a focus on root weevil, root rot, Anthracnose, etc. in the questions pertaining to Unit Nine, Diagnosing Common Tree Problems. The writer agreed and has revised the Study Guide to include more insect and disease problems relevant to the Pacific Northwest. The examination will be revised accordingly at a later date. One evaluator wrote that some layman's explanation of certain technical terms would make the examination questions more understandable. In addition, this evaluator suggested an "open book" examination format for at least the tree worker. The other two evaluators were strongly opposed to an "open book" format for the exam. In the final analysis, the evaluators agreed that upon working through the Study Guide and achieving seventy percent in each category, that the applicant should be certified as an Arborist or Tree Worker.

In addition to the Expert Panel, four individuals were asked to participate in a Certification Pre-Test Panel. Each evaluator was given a copy of the examination and asked to read each question carefully, as if they were actually taking the examination. The answers were not provided as they were to the Expert Panel. The Pre-Test Panel were asked to circle their answers if they wished, but the examination was not marked or graded. Each evaluator was asked to report any technical glitches, and as they worked through the examination to keep in mind three questions (see Appendix S). Three individuals filled in a questionnaire. The fourth responded verbally. The panel members were Susan Munro (B.Sc.A), editor of Pacific Northwest Trees, Chris Foxon, Assistant Superintendent, Vancouver School Board and former director of the PNW Chapter, Joseph Taffe (B.Sc.A) and James Muir (B.Sc.A), both Horticulture Instructors at the British Columbia Institute of Technology.

It was difficult assembling both an expert panel and a pre-test panel since many of the individuals the writer spoke to were planning to become

certified and therefore excluded themselves from the evaluation of the examination. Generally, the four Pre-Test panelists found the alternate multiple choice answers plausible; only one question was singled out for revision. One evaluator felt that some of the answers were debatable. The evaluators found the questions explicit and understandable. Eight questions were singled out for an irregular consistency in wording and one question was considered awkward. The last question of the questionnaire asked if there were any errors or omissions. Several typographical errors were noted as was the difference between the words "symptom" and "sign" in three questions concerning plant diagnosis. One evaluator suggested that additional questions on tree selection for difficult sites would be useful. One evaluator suggested that the examination was too lengthy. The writer would like to respond to that criticism with the following. Within limits, increasing the length of an examination has the effect of increasing reliability, providing that the items added are equal or better in quality to the existing test questions. There is a point of diminishing return where the test becomes so lengthy that the applicant becomes tired, bored or frustrated, all of which tend to reduce reliability.⁷² It is difficult at this point to determine whether the test is in fact too long and whether reliability will decrease because of its length, until the test is actually administered.

In addition to the Pre-Test Panel, Dr. Blackmore of the University of British Columbia Educational Measurement and Research Group evaluated the examination questions on two occasions and provided a number of valuable improvements. For example, he suggested the use of the question, rather than statement format, the use of four or five alternates rather than three, the deletion of "all of the above" or "none of the above" answers, and a simplification of sentence structure in the multiple choice questions.

In summary, the seven evaluators of the two panels provided valuable,

constructive criticism. In all cases, except as noted, the writer revised the Study Guide as suggested. The examination will be revised in the near future. The evaluators found no major problems, just a few minor revisions or errors. Overall the response from the evaluators was extremely positive and enthusiastic. Dr. Clark stated:

In general, I found Sue's effort to be excellent. She has developed a comprehensive study guide. The exam clearly follows the format and objectives of that guide. This is not to say that the program is elementary and the exam is easy. On the contrary, many in our Chapter will find it difficult. I am not unhappy or concerned about this, for I believe our program will meet its primary objective: to upgrade and enhance arboriculture practice in the region. I also believe the study guide reflects the level of information presented at meetings of our Chapter and related organizations.

Our goal as a Chapter should be to certify as many members as possible. But this does not mean that our certification program should be anything less than comprehensive and rigorous. I believe Sue's Study Guide is an excellent compromise in this regard. It is challenging, but very well-organized and easy to use.⁷³

Two of the three members of the Expert Panel agreed with the writer in that the examination should not be open book. One evaluator suggested that the focus should be on the quality of the program not on the ease of passage of the exam. Concern over the ability of some applicants in completing the program and passing a closed book examination could be minimized and eased by developing regional training sessions aimed at taking and passing the examination. Of the members of the Pre-Test Panel, two were opposed to an open book format, a third was ambivalent and the fourth undecided.

IX. SUMMARY

Certification is a process by which a professional agency or association gives recognition to a practitioner who has met a series of set qualifications or standards as determined by that agency or association.

Licensure and certification differ. Certification indicates reserved title, but uncertified practitioners may perform the same activities of the occupation as long as they do not present themselves to the public as certified. Licensure, on the other side of the coin, is legislated. The laws of the state or province make it illegal for an individual to engage in professional activities unless he/she has been granted authorization to do so by a legally constituted board or agency.

The general public, the individual practitioner, employees and professional associations benefit from certification. Certification enables the public to choose qualified practitioners. A certified individual may enjoy a certain status. Job promotions and salary increases may take place as a direct result of certification. Employers, who are anxious to advertise the competence of their staff, benefit from hiring certified practitioners. Professional associations, which promote high standards of performance among their membership, also benefit from certification. There are disadvantages to certification, as well. Certification, for example, may limit who may enter an occupation or profession.

Certification and the issue of competency go hand in hand. Competence, as it relates to job performance, should provide the basis for certification. Practical examinations, oral and written examinations, simulations and observation of an applicant's behaviour in the work place are among the methods used to measure competency.

Almost all occupational groups in our society are organized into one or

more membership organizations. These associations or societies have a responsibility to establish performance standards within their occupational groups. Many associations have established certification programs to set standards and encourage professional competence.

The assumption that once an individual is certified and therefore is forever competent has been a problem in certification. To overcome this, many associations include mandatory continuing professional education as a component of their certification programs. There are two opposing views to this practice. One view maintains that mandated continuing education is an infringement of personal freedom and no guarantee that learning or improved practice will result. The second view suggests that mandated continuing education does not limit individual liberty and that professional competence can be maintained and enhanced.

In planning the certification program, a program planning model was used as a guide. The program planning model (Sork's model), allowed the writer to approach the task at hand in an organized and systematic fashion.

The Pacific Northwest chapter of the International Society of Arboriculture, for whom the certification program has been developed, is one of the smaller chapters in the society. The one hundred and ninety members reside primarily in Washington and Oregon states, with a few members in Alaska and a larger group in British Columbia.

The objectives of the certification program may be grouped into society, program or instructional objectives. There were a number of benefits to using objectives in the planning of the program. Objectives helped the writer to choose the appropriate learning activities and provided the criteria upon which the evaluation was based.

The development of the certification program for Arborists and Tree Workers in the Pacific Northwest has taken a great deal of time. Many

planning decisions were made concerning the subject area, the instructional plan and the means of evaluation.

The requirements of the program as proposed by the writer and as accepted by the Board of Directors and Officers of the PNW Chapter are summarized in Appendices E and F. The certification program for Arborists and Tree Workers contains several general requirements including a practical examination, plus a written examination, as well as work experience. In addition, continuing professional education is an important requirement of the program.

The program should be administered by a board appointed by the chapter president. The functions of this Certification Review Board should include the day to day administration of the program, in addition to administration of the examination.

Publicizing the program is important too. Promotional letters, press releases, stationary and truck logos are means of increasing the general public's awareness of the program.

Evaluation of the program occurred in two ways. The twelve officers and directors of the chapter were asked to submit their suggestions for changes and improvements concerning the Study Guide and certification requirements to the writer. Helpful criticism resulted from this process and revisions and additions were made to the Study Guide. The program was also evaluated by members of two panels, an Expert Panel and a Pre-Test Panel. These evaluators were asked to work through either the Study Guide and examination (with answers) or just the examination, and fill in a questionnaire. The results from these two panels were overwhelmingly positive in their evaluation of the certification program.

X. FOOTNOTES

¹Department of National Health and Welfare, Professional Regulation: A Staff Study of Accountancy, Architecture, Engineering and Law in Ontario, quoted in Guidelines for the Certification of Audiologists and Speech Language Pathologists in Canada (Ottawa, ON: Author, 1985), p.xii.

²National Center for Health Education, Report on Licensure and Related Health Personnel Credentialing, quoted in Initial Role Delineation for Health Education: Final Report (San Francisco, CA: Author, 1980), p.3.

³Benjamin Shimberg, "What is Competence? How Can it be Assessed?" in Power and Conflict in Continuing Professional Education. Milton R. Stern (ed.), (Belmont, CA: Wadsworth Inc., 1983), p.17.

⁴Joan S. Britt, Accreditation Certification and Licensure of Health Manpower in British Columbia (Vancouver, BC: Division of Health Services, Health Sciences Centre, University of British Columbia, 1977), p.34.

⁵Ibid.

⁶Kathleen Rockhill, "The Mystique of Certification, Education and Professionalism: In Service of Whom?" in Certification, Credentialing, Licensing and the Renewal Process. James S. Long and Roger Boshier (eds.), (Moscow, ID: News Review Publishing Co., 1976), p.8.

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¹⁰Shimberg, "What is Competence?", p.22.

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¹⁶Barbara V. Williams and Jean A. Huntley, "The Role of the Professional Association in Continuing Education, " in Preston P. LeBreton, et.al. (eds.), The Evaluation of Continuing Education for Professionals: A Systems View (Seattle, WA: Continuing Education, University of Washington, 1979), p.43.

¹⁷Gordon G. Darkenwald and Sharon B. Merriam, Adult Education: Foundations of Practice (New York, NY: Harper and Row, Publishers, 1982), p.235.

¹⁸Lillian Hohmann, "The Professional Associations, How can the Professional Association and Other Providers Best Interact?", in Harold J. Alford (ed.), Power and Conflict in Continuing Education Survival and Prosperity for All (Belmont, CA: Wadsworth Publishing Company, 1980), p.86.

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²⁰Rockhill, "Mystique of Certification", p.12.

²¹Marshal J. Heinekey, "Mandatory Continuing Education: Is it the Way to Go," Tech-Can, Newsletter of the Canadian Council of Engineering Technicians and Technologists, Vol.6, No.3, Fall 1984.

²²Rockhill, "Mystique," p.12.

²³Darkenwald, "Adult Education", p.241.

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²⁵"Safety training boost sought," by Diane Stranberg, Sunday Richmond Review, 15 January 1989, p.1.

²⁶Brian Fisher, Vice-President, PNW Chapter, White Rock, B.C., Correspondence, February, 1989.

²⁷Thomas J. Sork, "Sork's Basic Planning Model", Lecture Handout for Program Planning Theory 514, University of British Columbia, 1984.

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³⁰Patrick G. Boyle, Planning Better Programs (New York, NY: McGraw-Hill Inc., 1981), p.195.

³¹Robert M. Gagné and Leslie J. Briggs, Principles of Instructional Design (New York, NY: Holt, Rinehart and Winston Inc., 1974), p.77.

³²International Society of Arboriculture, Pacific North West Chapter, Constitution and Bylaws (typewritten), (n.d.).

³³Hohmann, "The Professional Associations", pp.87-89.

- ³⁴Boyle, Planning Better Programs, p.199.
- ³⁵Ibid., p.199.
- ³⁶Ibid., p.200.
- ³⁷Ibid., p.195.
- ³⁸Robert J. Kibler and Ronald E. Basset, "Writing Performance Objectives," in L.J. Briggs (ed.) Instructional Design (Englewood Cliffs, NJ: Educational Technology Publications, 1977), p.82.
- ³⁹Boyle, Planning Better Programs, p.199.
- ⁴⁰Rob Garrett, George Harrison, James Clark, and Steve Nord, "A Certified Arborists Program for the Pacific Northwest," Discussion Paper (typewritten), (Seattle, WA, 1985), p.1.
- ⁴¹Garrett, "A Certified Arborists Program", p.4.
- ⁴²Sue B. Simpson, "ISA Texas Chapter Proposed Certification Program," Journal of Arboriculture 11 (May 1985):143.
- ⁴³John R. Hendricksen, "Illinois Arborist Certification," Journal of Arboriculture 11 (February 1985):48.
- ⁴⁴Hohmann, "Professional Associations", p.85.
- ⁴⁵Simpson, "Texas Chapter", p.143.
- ⁴⁶Scott Plamondon, "Chapter Committees," Pacific Northwest Trees 8 (December 1987):12.
- ⁴⁷Garrett, "A Certified Arborists Program", p.11.
- ⁴⁸Dick Proudfoot, "letter" Pacific Northwest Trees 9 (Number 4, 1988): 16-17.
- ⁴⁹Susan M. Murray, "Formulating the Instructional Plan," (Term Paper for Program Planning Theory 514, 1984), pp.10-11.
- ⁵⁰Cyril Houle, The Design of Education (San Francisco, CA: Jossey-Bass, 1972), p.231.
- ⁵¹Garrett, "A Certified Arborists Program", p.13.
- ⁵²Hendricksen, "Illinois Arborist", p.49.
- ⁵³Denis T. Raihall, "Maintaining the Competence of Chartered Life Underwriters Through Recertification: Issues, Trends and Projections," in Preston P. LeBreton (ed.) The Evaluation of Continuing Education for Professionals: A Systems View (Seattle, WA: Continuing Education, University of Washington, 1979), p.78.

⁵⁴William R. Nelson, "A Survey and Assessment of Voluntary Certification," Report prepared for the Illinois Landscape Contractors Association, Urbana, Il., August 1981.

⁵⁵Ibid., p.56.

⁵⁶John A. Green, Teacher-Made Tests, p.76.

⁵⁷Ibid., p.63.

⁵⁸Nelson, "A Survey," p.71.

⁵⁹Garrett, "A Certified Arborists Program", p.14.

⁶⁰International Society of Arboriculture, Western Chapter, Certification Committee Report, May 1984 and 1985, (Typewritten), May 17, 1985.

⁶¹Susan M. Murray, "Certification Report," submitted to the Pacific Northwest Chapter of ISA, Board of Directors Meeting December 19, 1988, Seattle, WA.

⁶²Ibid.

⁶³Ibid.

⁶⁴John Ward, "Certification Program of the Penn-Del Chapter," Journal of Arboriculture II (5 May 1985): 148.

⁶⁵Tom Kubiszyn and Gary Borich, Educational Testing and Measurement Classroom Application and Practice (Glenview, Il: Scott, Foresman, 1987), pp.55-57.

⁶⁶Brian Fisher, Vice-President, PNW Chapter.

⁶⁷Ibid.

⁶⁸Nelson, "A Survey," p.63.

⁶⁹Murray, "Certification Report".

⁷⁰Ibid.

⁷¹Ibid.

⁷²Green, Teacher-Made Tests, p.148.

⁷³Dr. James Clark, University of Washington, Seattle, WA: Correspondence, 23 January 1989.

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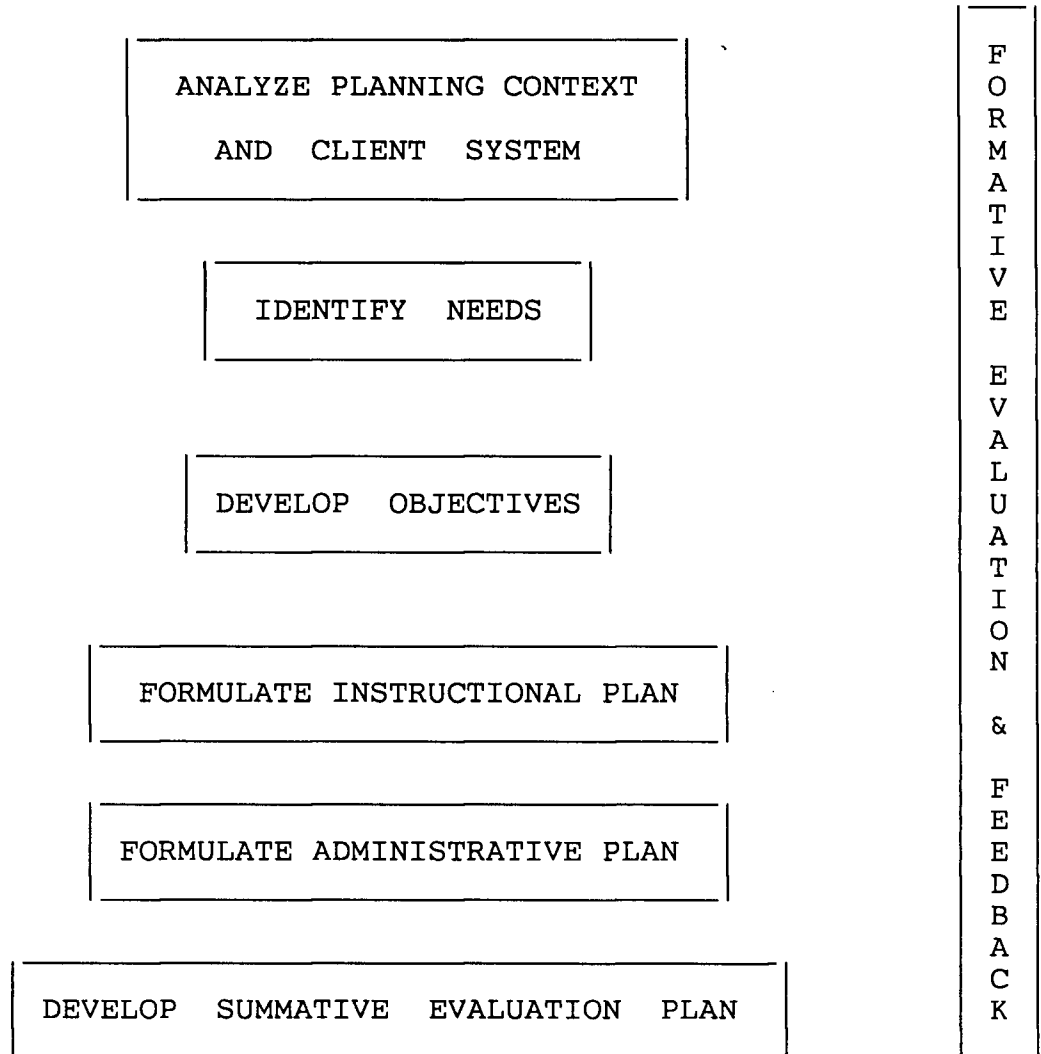
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APPENDIX A
SORK'S BASIC PLANNING MODEL



Source: Sork, Thomas J. Program Planning and Evaluation.
Department of Administrative, Adult and Higher Education
University of British Columbia, 1984.

APPENDIX B

INTERNATIONAL SOCIETY OF ARBORICULTURE CHAPTER SUMMARY

CHAPTER NUMBER	NAME	EST'D	1988 NUMBER OF MEMBERS	CERTIFICATION PROGRAMS IN PLACE		
					ARBORIST	TREEWORKER
1	Ohio	1942	235	Yes	X	
2	Southern	1942	390	No		
3	Western	1942	588	Yes	X	X
4	Midwestern	1946	223	No		
5	ISA Canada	1950	168	Yes		X
6	Pennsylvania-Delaware	1960	256	Yes	X	
7	New England	1964	404	No		
8	New Jersey	1974	99	No		
9	Indiana	1974	83	No		
10	Kentucky	1974	45	No		
11	Rocky Mountain	1975	152	No		
12	Michigan	1977	132	No		
13	Quebec	1977	87	No		
14	Mid-atlantic	1978	215	No		
15	Texas	1978	189	No		
16	New York	1978	207	Yes	X	
17	Pacific Northwest	1980	190	No		
18	Wisconsin	1980	115	Yes	X	
19	Illinois	1983	233	Yes	X	
20	Prairie	1987	60	No		
21	Scandinavian	1988	92	No		

Members at Large: 77

TOTAL MEMBERSHIP: 4670

Sources: International Society of Arboriculture (ISA),
1988 Yearbook, Urbana, Illinois, 1988
Allison, B., Fusco, B., Hawthorne, J.,
Kruidener, W., Lilly, S., Ward, J.
Interviews and Correspondence: May, June,
December 1988.

APPENDIX C

COMPARISON OF THE REQUIREMENTS OF THREE CHAPTER
VOLUNTARY CERTIFICATION PROGRAMS

A. Requirements for the Certified Tree Worker	Chapter and Date First Exam Given		Proposed
	Western 1984	Canada 1987	PNW
1. <u>Experience in Arboriculture Required:</u>	Yes	Yes	Yes
a) 18 months	X		X
b) 36 months (up to 24 months educational experience may be included)		X	
2. <u>Examination Required:</u>	Yes	Yes	Yes
a) Oral examination - 70% pass required	X	X	
b) Written examination - 70% pass required	X	X	X
c) Practical examination - 70% pass required	X	X	X
3. <u>Required to Sign & Uphold ISA Code of Ethics:</u>	Yes	Yes	Yes
4. <u>Chapter Membership Required:</u>	No	Yes	No
5. <u>Proof of Insurance for Property Damage and Public Liability Required:</u>	No	No	No
6. <u>Recertification Required:</u>	Yes	Yes	Yes
a) Renew every three years by attending 18 hours of approved continuing education.	X		X
b) Renew every three years by attending 24 hours of approved continuing education.		X	
c) Renew every three years by re-examination.			X

Sources:

International Society of Arboriculture (ISA), Canada Chapter,
 "Tree Worker Certification Program", Willowdale, Ont., 1987.
 ISA, Western Chapter, "Certification Application", St. Helena, Cal., n.d.

APPENDIX D

COMPARISON OF THE REQUIREMENTS OF SEVEN
VOLUNTARY CHAPTER CERTIFICATION PROGRAMS

B. Requirements for the Certified Arborist	Chapter and Date First Exam Given						Proposed
	Penn -Del 1981	West'n 1984	Ill. 1986	N.Y.	Wisc. 1988	Ohio 1989	PNW 1989
1. <u>Experience in Arboriculture Required:</u>	Yes	Yes	No	Yes	Yes	No	Yes
a) 12 months (or one year of education)					X		
b) 24 months	X						
c) 36 months		X					X
2. <u>Examination Required:</u>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
a) Oral examination - 70% pass required - 75% pass required	X			X			
b) Written examination - 70% pass required - 75% pass required	X	X	X	X	X	X	X
c) Practical Examination - 70% pass required (work climb)							
3. <u>Required to Sign and Uphold the ISA Code of Ethics:</u>	No	Yes	Yes	Yes	No	No	Yes
4. <u>Chapter Membership Required:</u>	Yes	No	No	Yes	No	No	No
5. <u>Proof of Insurance for \$10,000 Property Damage and \$100,000 Public Liability Required:</u>	Yes	No	No	No	No	No	No
6. <u>Recertification Required:</u>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
a) Renew certification each year by attending one approved continuing education session per year.	X						
b) Renew certification every three years by attending 36 hours of approved continuing education.		X	X				X
c) Renew certification every three years by attending 3 credits of approved continuing education (1 credit of undetermined length).							
d) Renew certification every three years by re-examination.					X	X or X	X
e) Retain certification by maintaining Chapter membership.				X			
f) Annual Renewal Fee charged.		X					

Appendix D Cont'd...

Sources:

International Society of Arboriculture (ISA), Canada Chapter,
"Tree Worker Certification Program", Willowdale, Ont., 1987.
ISA, Illinois Chapter, "Certification for Arborists and Tree
Workers Requirements and Application", Chicago, Ill., 1986.
ISA, Ohio Chapter, "Ohio Arborist Certification Program", Newark, Ohio, n.d.
ISA, Western Chapter, "Certification Application", St. Helena, Cal., n.d.
Allison, B., Fusco, B., Hawthorne, J., Lilly, S., Ward J.,
Interviews and Correspondence: May, June, December 1988.

APPENDIX E

REQUIREMENTS OF THE PACIFIC NORTHWEST
CERTIFICATION PROGRAM - CERTIFIED TREE WORKER

	Proposed by Writer	Accepted Dec.19/88 by PNW Officers and <u>Directors</u>
1. Experience in Arboriculture Required:	Yes	Yes
a) 18 months		
2. Examination Required:	Yes	Yes
a) Written examination - 70% pass required		
b) Practical examination - 70% pass required		
3. Required to Sign and Uphold the ISA Code of Ethics:	Yes	No
4. Membership in Chapter Required:	No	No
5. Proof of Insurance for Property Damage and Public Liability Required:	No	No
6. Recertification Required:	Yes	Yes
a) Renew every three years by attending 18 hours of approved continuing education.		
b) Renew every three years by re-examination.		
c) Renewal fee charged.		

APPENDIX F

REQUIREMENTS OF THE PACIFIC NORTHWEST
CERTIFICATION PROGRAM - CERTIFIED ARBORIST

	Proposed by Writer	Accepted Dec.19/88 by PNW Officers and <u>Directors</u>
1. Experience in Arboriculture Required:	Yes	Yes
a) 36 months		
2. Examination Required:	Yes	Yes
a) Written examination - 70% pass required		
3. Required to Sign and Uphold the ISA Code of Ethics:	Yes	No
4. Membership in Chapter Required:	No	No
5. Proof of Insurance for Property Damage and Public Liability Required:	No	No
6. Recertification Required:	Yes	Yes
a) Renew every three years by attending 18 hours of approved continuing education.		
b) Renew every three years by re-examination.		
c) Renewal fee charged.		

APPENDIX G

COMPARISON OF TWO EXISTING CERTIFICATION PROGRAMS
AND THE PNW PROGRAM FOR THE CERTIFIED TREE WORKER

	Chapter and Date First Exam Given		
	Western 1984	Canada 1987	PNW 1989
A. <u>Instructional Method:</u>			
a) Home Study	X	X	X
b) Examination Preparation Seminar	X	X	X
B. <u>Instructional Resources:</u>			
a) Study Guide*	X	X	X
b) Number of Questions on Oral or Written Examination	Oral 25	15 Oral Written 50	Written 90
c) Time Allowed for Oral or Written Examination (Hours)	No Reason- able Limit		3.0

*Study Guide: The study guide contains a series of chapters. Each chapter contains a list of learning objectives and a list of selected readings. The applicant reviews the readings, then answers a selection of study questions. Once the applicant has mastered the study questions, there is a sampling of test questions with answers. The study guide is a complete learning resource.

Sources:

International Society of Arboriculture (ISA), Canada Chapter,
 "Tree Worker Certification Program", Willowdale, Ont., 1987.
ISA, Western Chapter, "Certification Application", St. Helena, Cal., n.d.

APPENDIX H

COMPARISON OF SIX EXISTING CERTIFICATION PROGRAMS
AND THE PNW PROGRAM FOR THE CERTIFIED ARBORIST

	Chapter and Date First Exam Given						
	Penn -Del 1981	West'n 1984	Ill. 1986	N.Y.	Wisc. 1988	Ohio Sprg 1989	PNW 1989
A. <u>Instructional Method:</u>							
a) Home Study	X	X	X	X	X	X	X
b) Examination Preparation Seminar	No	X	X	?	?	X	X
B. <u>Instructional Resources:</u>							
a) List of References	X			X			
b) Study Guide*		X		X			X
c) Manual of Sample Questions with Bibliography			X				
d) Study Package**					X	X	
C. <u>Written Examination Format:</u>							
a) Multiple Choice	X	X	X		X	?	X
b) True and False	X	X		X	X	?	X
c) Matching		X					
d) Fill in the Blanks	X		X				
e) Paragraph Answers	X						
f) Essay	X						
D. <u>Number of Questions on Examination:</u>	55	200	400	?	200	?	200
E. <u>Time Allowed for Written Examination (Hours):</u>	No Rea- son- able Limit	3.5	4.0	?	3.0	?	3.5

*Study Guide: The study guide contains a series of chapters. Each chapter contains a list of learning objectives and a list of selected readings. The applicant reviews the readings, then answers a selection of study questions. Once the applicant has mastered the study questions, there is a sampling of test questions with answers. The study guide is a complete learning resource.

Appendix H Cont'd...

****Study Package:** The study package for the Ohio Chapter, for example, includes the book Ohio Trees, a tree worker manual, the National Arborist Association Standards, the American National Standards Institute's Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees and for cutting brush (ANSI Standard Z133.1), three Ohio State publications, 35 horticultural fact sheets, sample questions and study guide.

Sources:

- ISA, Illinois Chapter, "Certification for Arborists and Tree Workers Requirements and Application", Chicago, Ill., 1986.
- ISA, Ohio Chapter, "Ohio Arborist Certification Program", Newark, Ohio, n.d.
- ISA, Western Chapter, "Certification Application", Examination Guidelines - Arborist, Examination Guidelines - Tree Worker, St. Helena, Cal., n.d.
- Allison, B., Fusco, B., Hawthorne, J., Lilly, S., Ward, J., Interviews and Correspondence: May, June, December 1988.

APPENDIX I

CODE OF ETHICS
INTERNATIONAL SOCIETY OF ARBORICULTURE
PACIFIC NORTH WEST CHAPTER

The Arborist:

1. Will utilize personal knowledge and skills for the greatest good to society.
2. Will advance arboriculture by exchanging knowledge with other arborists and supporting arboricultural associations, publications, schools of instruction, and plant research agencies.
3. Will be truthful in oral or written statements concerning the services qualified to offer and the plant benefits that may be expected therefrom, and will not advertise as certified or licensed or as insured unless the extent of coverage is clearly stated.
4. Will discourage the promotion and use of techniques, methods, and materials that have not been adequately tested and approved for arboricultural use by reputable plant scientists. Should an unproven material still appear to be best, the client will be completely advised.
5. Will base all expert testimony on adequate knowledge of the subject and substantiated facts and render an opinion according to honest convictions.
6. Will refrain from expressing, either orally or in writing, an opinion on a technical subject unless informed concerning the matter, and will not distort or withhold relevant data to substantiate a point of view.
7. Will be loyal to clients or to the employing organization and will faithfully perform work assignments.
8. Will, if a technical judgement in arboricultural matters is overruled by a non-technical authority, present clearly the consequences that may be expected to occur as a result of deviating from the procedure and policies which are believed to be correct.
9. Will not, if employed as an arborist in public capacity, compete unfairly with arborists in private business or recommend one arborist in private business above others in the community where all are equally qualified and available.
10. Will avoid making unfounded statements which, in any way, might injure the professional reputation of another arborist.
11. Will not reduce a quoted fee for a specific job if informed of a lesser fee by another arborist for the same job.

Appendix I Cont'd...

12. Will refrain, if engaged in the private practice of arboriculture, from reviewing the work of another private arborist for the latter's employer, but will refer the review to a qualified person not engaged in private arboriculture.
13. Will not offer employment to an employee of another arborist without the latter's knowledge, but will instead endeavor to train men where possible.
14. Will uphold the principle of appropriate and adequate compensation for those engaged in arboricultural work, as an essential to the maintenance of high standards of arboricultural endeavor.
15. Will conduct all matters relating to technical arboricultural activities, business operations, and civil responsibilities in a manner that will further the status of arboriculture as a respected profession.

I hereby agree to abide by the International Society of Arboriculture Code of Ethics for Arborists in all matters relating to technical arboricultural activities, business operations and civil responsibilities; furthermore I will so conduct myself as to further the status of arboriculture as a respected profession.

Name _____
(print)

(signature)

(date)

Source: ISA 1988 Yearbook, Urbana, Ill., ISA, 1988.

APPENDIX J

CERTIFICATION FOR ARBORISTS AND TREE WORKERS
BROCHURE AND APPLICATION

Source: ISA, Western Chapter, "Certification Application",
St. Helena, California, n.d.

INTRODUCTION

Anyone can take the Arborist or Tree Worker Certification examination. The program is not restricted to members of the Pacific Northwest (PNW) Chapter of the International Society of Arboriculture. Anyone working as an Arborist or Tree Worker is encouraged to become certified.

PURPOSE

To establish a meaningful standard of quality in arboricultural work.

To provide the public with a means for identifying competent arborists.

To promote and encourage continuing education in arboriculture.

BENEFITS

Companies may advertise that they employ Pacific Northwest Chapter Certified Arborists and Tree Workers. Employers may expect a certain level of expertise from prospective employees that have been certified.

Individuals who pass the certification examination will receive a certificate and an identification card recognizing them as a PNW Certified Arborist and/or Tree Worker. A list of currently certified Arborists will be made available to the public, city governments and contractors wishing to hire certified personnel.

PROCEDURE

Complete and return the attached application form along with the fees. If ordered, a Study Guide will be mailed to you along with a schedule of exam dates. The Study Guide, which covers the subject material, lists references and basic arboricultural texts, most of which are available at your local college library. Work through the Study Guide carefully. Pre-exam seminars will be scheduled to help applicants prepare for the exam.

REQUIREMENTS

Certified Tree Worker

18 months experience in arboriculture

Pass a written examination covering:

Tree Identification
Tree Morphology, Anatomy and Physiology
Planting, Early Care and Soil Management
Pruning Concepts and Techniques
Safe Work Practices
Cabling, Bracing, and Wounds

Pass a practical examination covering:

Climbing Skills
Aerial Rescue Procedures

Renew every three (3) years by retesting or by attending 18 hours of approved educational sessions.

Certified Arborist

36 months experience in arboriculture

Pass a written examination covering:

Tree Identification
Tree Morphology, Anatomy and Physiology
Planting, Early Care and Soil Management
Pruning Concepts and Techniques
Cabling, Bracing, Wounds and Cavities
Safe Work Practices
Diagnosing Common Tree Problems
Identifying Hazard Trees

Renew every three (3) years by retesting or by attending 36 hours of approved educational sessions.

EXAMINATIONS

Written and practical examinations are held at least once each year, in conjunction with the PNW Chapter Regional Meeting.

Study sessions are held prior to the examinations.

APPLICATION FOR CERTIFICATION EXAMINATION

Applying for: Certified Tree Worker Certified Arborist

Name Last First Middle Initial

Address Phone (.....)

City/State/Prov. Zip/Postal Code

WORK EXPERIENCE: Must be able to verify years experience required for Certification.

Company Name (Current) Position:

Address Zip/Postal Code

Phone (.....) Dates Employed: to Supervisor:

Company Name Position:

Address Zip/Postal Code

Phone (.....) Dates Employed: to Supervisor:

(Attach Separate Sheet if Necessary) (Application Continued on Other Side)

APPENDIX K

ACKNOWLEDGEMENT OF APPLICATION

Source: ISA, Western Chapter, "Letter of Confirmation",
St. Helena, California, 1987.

APPENDIX L

PROMOTIONAL LETTER

Source: ISA, Western Chapter, "Letter to Horticulture
and Farm Advisors", St. Helena, California, 1986

APPENDIX M

SOURCE OF REFERENCES LETTER

Dear Certification Applicant,

Following is a source list for the reference material given in the procedure sections of the Study Guide.

1. American National Standard for Tree Care Operations ANSI Z133.1-1988

International Society of Arboriculture
Leal Park
303 W. University
P.O. Box 908
Urbana, Il. 618801 U.S.A.
(217) 328-2032

\$ 6.00 U.S.

2. Native Trees of Canada by Hosie

Canadian Government Publishing Centre
Ottawa, Ontario K1A 0S9

\$ 17.95 CDN in Canada
\$ 21.55 outside Canada

or your local book seller

plus \$1.55 shipping

3. A New Tree Biology, plus A New Tree Biology Dictionary by Shigo

Shigo and Trees, Associates
4 Denbow Road
Durham, N.H. 03824-3105 U.S.A.
(603) 868-7459

\$ 61.00 U.S. for both or
\$ 63.00 U.S. for Canadians
includes shipping

4. Tree Hazards in Recreation Sites by Wallis et al

Pacific Forestry Centre
506 West Burnside Road
Victoria, B.C. V8Z 1M5
(604) 388-0600

Free in Canada

APPENDIX N

CERTIFICATION REPORT

Certification Report

submitted by Susan M. Murray, P.Ag.
December, 1988

The Study Guide and both the Arborist and Tree Worker Examinations are now in their final form. Please destroy the draft copies distributed at the last meeting.

The Board of Directors should consider and give approval, at this time, or at a subsequent meeting, to the following motions:

1. *Move to accept the requirements for certification for Arborists and Tree Workers as outlined in the Policies and Procedures Manual.*
2. *Move to accept the Study Guide as presented.*
3. *Move to accept the administration of the Program as outlined in the Policies and Procedures Manual.*
4. *Move to accept the Tree Worker and Arborist Examinations.*
5. *Move to form a Certification Review Board.*
6. *Move to accept the following fee schedule: (all fees in U.S. dollars)*

	<u>Members</u>	<u>Non-Members</u>
Examination only	\$ 50.00	\$ 80.00
Study Guide only	20.00	20.00
Exam and Study Guide	70.00	100.00
Retake one category (after failure)	10.00	10.00
Retake entire exam (after failure)	25.00	50.00
Recertification	25.00	25.00

(Based on comparison of 5 other Chapters' fee schedules.)

7. *Move to consider a revision of the Constitution and By-Laws of the Chapter, since they currently say nothing about the Chapter's ability to grant, suspend or revoke certification.*

APPENDIX O

CORRELATION BETWEEN INSTRUCTIONAL OBJECTIVES
FOUND IN THE STUDY GUIDE AND
EXAMINATION QUESTIONS TO CONFIRM CONTENT VALIDITY

Correlation Between Unit Objectives in the Study Guide and Arborist Examination Questions

Unit 1 - Tree Morphology, Anatomy and Physiology

Objectives - Questions

1	-	1
2	-	2
3	-	3,4
4	-	5,6
5	-	9
6	-	8
7	-	10
8	-	11,12
9	-	13,14,15
10	-	16

Objectives - Questions

11	-	17
12	-	18,19,20
13	-	19
14	-	21,22,23
15	-	24,25,26,27
16	-	28,29
17	-	32
18	-	7
19	-	none
20	-	33
21	-	30,31,32

Unit 2 - Tree Identification and Selection

Objectives - Questions

1	-	41-50
2	-	41-50
3	-	35
4	-	36
5	-	34

Objectives - Questions

6	-	39
7	-	40,38
8	-	37
9	-	37,38,40

Unit 3 - Planting and Early Care

Objectives - Questions

1a	-	141,142
b	-	none
c	-	143
d	-	145
e	-	none
f	-	144
g	-	none

Objectives - Questions

2	-	146
3	-	none
4	-	147
5	-	148

- 2 -

Unit 4 - Soil Management**Objectives - Questions***Fertilization*

- 1 - 149, 150, 151, 152
- 2 - 156
- 3 - none
- 4 - 153
- 5 - 155
- 6 - 154
- 7 - 156
- 8 - 157
- 9 - none
- 10 - 155
- 11 - none

Cultivation

- 1 - 158
- 2 - none
- 3 - 159
- 4 - 160, 161, 162, 163

Objectives - Questions*Irrigation*

- 1 - 164
- 2 - 165
- 3 - none
- 4 - 166
- 5 - 167
- 6 - 168
- 7 - none
- 8 - 169
- 9 - 170

Unit 5 - Pruning Concepts and Techniques**Objectives - Questions**

- 1 - 100
- 2 - 55, 86, 88, 92, 99
- 3 - 56
- 4 - 63
- 5 - 65, 89, 93, 94
- 6 - 70, 73, 74-79, 84
- 7 - 71, 72
- 8 - 91
- 9 - 68, 69
- 10 - 66, 67, 85

Objectives - Questions

- 11 - 57, 96
- 12 - 58, 59, 60, 61, 62
- 13 - 64
- 14 - 51, 54, 80, 83, 87
- 15 - 52, 53
- 16 - 95
- 17 - 81, 82
- 18 - 90
- 19 - 97, 98

- 3 -

Unit 6 - Wounds and Cavities**Objectives - Questions**

- 1 - 178
- 2 - 172, 176, 177
- 3 - 171

Objectives - Questions

- 4 - 173, 174
- 5 - 181
- 6 - 179, 180

Unit 7 - Cabling and Bracing**Objectives - Questions**

- 1 - none
- 2 - none
- 3 - none
- 4 - 101
- 5 - none
- 6 - 104
- 7 - 105, 106
- 8 - 107, 110

Objectives - Questions

- 9a - 108
- b - 102, 103
- c - none
- d - none
- 10 - none
- 11 - 109
- 12 - none

Unit 8 - Safe Work Practices**Objectives - Questions***Personal Safety*

- 1 - 111
- 2 - 113, 114
- 3 - 115
- 4 - none
- 5 - 112, 115

Objectives - Questions*Tree Climbing*

- 1 - none
- 2a - 120
- b - 116, 117, 121
- 3 - none
- 4a - 119
- b - none
- c - none
- d - 118
- 5 - none

- 4 -

Safe Work Practices Continued...

Objectives - Questions

Chain Saw Safety

- 1 - none
- 2 - 122
- 3 - none
- 4 - none
- 5 - 123, 124
- 6 - 123
- 7 - 127
- 8 - 126
- 9 - 125
- 10 - 128
- 11 - none
- 12a - 124
- b - none
- c - none
- d - none
- e - none

Brush Chipper Safety

- 1 - 134, 137, 138, 140
- 2 - none
- 3 - none

Objectives - Questions

Mobile Equipment

- 1 - none
- 2a - none
- b - none
- c - 133
- d - 130
- e - none
- f - none
- g - none
- 3 - 129
- 4 - none
- 5 - 131
- 6 - none
- 7 - 132

- 4 - 136
- 5 - 135
- 6 - 139

- 5 -

Unit 9 - Diagnosing Common Tree Problems**Objectives - Questions**

1 - none
 2 - none
 3a - 182
 b - none
 c - 183
 d - none
 e - none
 f - none
 g - none
 h - none
 i - none
 4a - 184
 b - 185
 c - none
 d - none
 e - none
 f - none
 g - none
 h - none
 i - none

Objectives - Questions

5a - 189
 b - 186
 c - none
 6a - 193
 b - 190
 c - 192
 d - 175
 7a - none
 b - none
 c - 187
 d - none
 e - 188
 f - none
 g - 191

Unit 10 - Identifying Hazard Trees**Objectives - Questions**

1 - none
 2 - none
 3 - none
 4 - 199, 200

Objectives - Questions

5 - 197, 198
 6 - 194, 195
 7 - 196

APPENDIX P

SAMPLE EXPERT AND PRE-TEST PANEL QUESTIONNAIRES

December 1988
Susan M. Murray, P.Ag.

EXPERT PANEL

ARBORIST AND TREE WORKER STUDY GUIDE AND EXAMINATIONS

Thank you for agreeing to participate on this Certification Expert Panel. The purpose of the panel is to evaluate the Study Guide and the Examinations so that their strengths and weaknesses can be ascertained. The comments and critique that you make will help to improve and refine the Study Guide and Certification Examinations. Please specify changes or make comments in the spaces provided below.

STUDY GUIDE

1. How comprehensive do you consider the Study Guide to be? Are there additional units or learning objectives required? If so, what might they be?

.....

.....

.....

.....

2. How well does the knowledge base, presented in the Study Guide, reflect what an arborist is required to know in everyday practice?

.....

.....

.....

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3. How well does the knowledge base, presented in the Study Guide, reflect what a tree worker is required to know in everyday practice?

.....

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4. What errors, omissions or weaknesses have you found in the Study Guide? Please circle the errors found. Omissions and weaknesses can be specified below.

.....

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.....

5. Do you have any additional comments concerning the Study Guide?

.....

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EXAMINATION

1. How well do the Examination questions relate to the objectives found in the Study Guide? Please list those questions which do not relate.

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2. Please comment on the relative emphasis and coverage of the Examination questions.

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3. Please comment on the level of difficulty of the Exam.

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4. Are each of the alternate multiple choice answers, a - e, plausible? If not, please specify.

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5. How explicit and understandable do you consider the Examination questions to be? Please specify those questions that are vague, ambiguous or difficult to understand.

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6. What errors, omissions or weaknesses have you found in the Examination? Please specify.

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7. Do you have any additional comments concerning the Examination?

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8. Do you agree that upon working through the Study Guide and achieving 70 percent in each category that the applicant should be certified as an arborist or tree worker? If you do not agree, please specify why.

.....

.....

.....

.....

Thank you.

December 1988
Susan M. Murray, P.Ag.

PRE-TEST PANEL

Thank you for agreeing to participate on this certification pre-test panel. The comments and critique that you make will help to improve and refine the Certification Examinations. Please take your time and carefully read each question as if you were writing the examination. Circle your answers if you wish; the examination will not be marked or graded. Please note beside each question affected any technical glitches. Ask yourself the following questions as you work your way through the examination.

1. Are each of the alternate multiple-choice answers, a - e, plausible? If not please specify.

.....

.....

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.....

2. Are the questions explicit and understandable? Watch for confusing phrases or a mismatch between the question and the answers provided (i.e., a - e).

.....

.....

.....

.....

3. Are there any errors or omissions?

.....

.....

.....

.....

Thank you.

APPENDIX Q

POLICIES AND PROCEDURES MANUAL



PACIFIC NORTHWEST CHAPTER
INTERNATIONAL SOCIETY OF ARBORICULTURE
ARBORIST AND TREE WORKER CERTIFICATION PROGRAM

POLICIES AND PROCEDURES MANUAL

(Revised February 1, 1989)

**Pacific Northwest Chapter
International Society of Arboriculture
Arborist and Tree Worker Certification Program**

Introduction

The Arborist and Tree Worker Certification Program is sponsored and administered by the Pacific Northwest (PNW) Chapter of the International Society of Arboriculture (ISA). The Program is governed by the Board of Directors of the PNW Chapter and a Certification Review Board. The Certification Review Board, appointed by the Chapter President, is composed of three Chapter members, one each from British Columbia, Washington and Oregon, and is chaired by a Chapter officer or director.

The Program was officially established in 1989 with the printing of the first edition of the PNW Chapter Study Guide. Anyone can take the certification examinations. The Program is not restricted to the members of the PNW Chapter of the ISA. Anyone working as an Arborist or Tree Worker in the Pacific Northwest is encouraged to become certified. The Program is not in any way connected with any agency of government, but is solely and exclusively a voluntary program sponsored by the Pacific Northwest Chapter of the ISA.

Purposes of the Program

The purposes of the Program are to:

- 1) establish a meaningful standard of quality in arboriculture work;
- 2) improve the knowledge and skills of practicing arborists;
- 3) provide the public with a criterion for choosing an arborist; and,
- 4) encourage continuing education in arboriculture.

Requirements for Certification

Certified Tree Worker

- 1) 18 months experience in arboriculture
- 2) Pass a written examination covering:
 - Tree Identification
 - Tree Morphology, Anatomy and Physiology
 - Planting, Early Care and Soil Management
 - Pruning Concepts and Techniques
 - Safe Work Practices
 - Cabling, Bracing and Wounds
- 3) Pass a practical examination covering:
 - Climbing Skills
 - Aerial Rescue Procedures
- 4) Renew every three (3) years by attending 18 hours of approved educational sessions or by re-examination.

Certified Arborist

- 1) 36 months experience in arboriculture
- 2) Pass a written examination covering:
 - Tree Identification
 - Tree Morphology, Anatomy and Physiology
 - Planting, Early Care and Soil Management
 - Pruning Concepts and Techniques
 - Safe Work Practices
 - Cabling, Bracing and Wounds and Cavities
 - Diagnosing Tree Problems
 - Identifying Hazard Trees
- 3) Renew every three (3) years by attending 36 hours of approved educational sessions or by re-examination.

Experience Requirement

Each certification applicant must obtain either 18 (Tree Worker) or 36 (Arborist) months of work experience in arboriculture, where the individual is required to use the skills and knowledge of an Arborist or Tree Worker as the major component of his or her work. Work experience may be accumulated among more than one employer. The burden of proof of the work experience required is placed upon the applicant, and will be verified through his or her employer(s). Self-employed applicants may apply those hours within their own firms, that are directly related to arboriculture work, towards the 18- or 36-month experience requirement. A maximum of 6 months credit (Tree Worker) or 18 months (Arborist) may be granted for arboricultural educational experience.

For example, possession of a 2-year, 4-year or advanced degree in landscape design, urban forestry, arboriculture, horticulture or a related field of study, plus a minimum of 18 months experience in a professional tree care company, would fulfill a combined education and work experience requirement for an applicant desiring to become a certified Arborist. (A copy of the diploma or transcript must be submitted.)

The Certification Review Board reserves the right to make the final decision concerning the eligibility of an applicant's work experience.

Procedures of the Certification Program

Examinations

Written and practical examinations are scheduled once a year, in conjunction with the PNW Chapter Annual Training Conference. Additional examinations may be scheduled at any reasonable location, at the discretion of the Review Board.

The written certification examinations are derived from the current addition of the Study Guide which may be purchased from the Certification Review Board.

The Certified Arborist Examination is a timed exam, made up of five categories (see page 6 herein). The written Certified Tree Worker Examination is also a timed exam composed of five categories (see page 7 herein). The practical Tree Worker Examination is designed to judge an applicant's safe use, balance and proficiency with a rope and saddle (see page 9 herein).

After examinations are completed, they will be marked by the Certification Review Board members within three weeks and the results returned to the applicants by mail. Those individuals who do not pass will be permitted to re-test at a lower fee. The examination, or categories of it, may be taken again at any scheduled examination time, or at the discretion of the Certification Review Board. Files on individuals who do not pass the examination are maintained by the Certification Review Board for a period of two calendar years from the time of the last testing. Once two years of inactivity have passed, they are discarded. If, after that time, the individual would like to take the Tree Worker or Arborist certification examination again, he or she will be required to pay the regular (full) examination fee.

Individuals who pass the certification examination will receive a certificate and identification card, recognizing them as Pacific Northwest Chapter Certified Arborists or Tree Workers. Non-members who become certified will receive a one year membership in the I.S.A. and P.N.W. Chapter.

Maintaining Certification

Pacific Northwest Chapter certification is valid for a three-year period. Certification can be renewed by either re-examination before the individual's certificate expires (unless other arrangements are made with the Certification Review Board before expiration) and paying a renewal fee, OR by attending 18 hours (Tree Worker) or 36 hours (Arborist) of approved seminars and educational programs within the three-year period and paying the renewal fee.

Proof of attendance is required. Attendance at an Annual Training Conference of the Pacific Northwest Chapter is equivalent to 6 hours credit per day attended, with a maximum total of 12 hours credit allowed per conference. Also accepted are the "Pro-Hort" seminars relating to arboriculture, sponsored by the University of Washington's Center for Urban Horticulture. Three hours credit will be given to a half day seminar (3-6 hours in duration), and a maximum of 6 hours credit will be given to a day-long seminar (6+ hours). Local seminars sponsored by Chapter members within British Columbia, Washington or Oregon will also qualify for 3 or 6 hours credit, depending whether they are half day or full day programs. Approval of additional seminars, courses etc. is at the discretion of the Certification Review Board. A list of other approved functions will be made available from time to time.

In addition, college courses that are directly related to arboriculture and are taken in addition to original courses required to achieve a degree may qualify for a maximum 12 hours credit. Credit to be granted at the discretion of the Certification Review Board.

For recertification of those individuals who are certified as both an Arborist and a Tree Worker, 36 hours minimum of approved seminars shall suffice.

Fees

Fees for the Program shall be set from time to time by the PNW Chapter Board of Directors.

Suspension and Revocation of Certification

The Board of Directors of the Pacific Northwest Chapter shall have the authority to suspend or revoke the certification of any individual granted certification by the Chapter. In conducting such proceedings, the Board of Directors shall observe principles of natural justice, and due process, and will afford to the individual 1) reasonable notice of the charges against him or her, 2) a fair notice of a hearing upon such charges, 3) fair opportunity to hear evidence and confront and cross-examine witnesses, 4) fair opportunity to refute the charges, and 5) a hearing before the Board of Directors of the Pacific Northwest Chapter of the International Society of Arboriculture.

PACIFIC NORTH WEST CHAPTER ISA CERTIFICATION
EXAMINATION GUIDELINES - ARBORIST

116

Arborist Examinations

1. The examination will consist of 200 multiple choice and true/false questions.
2. A score of seventy percent in each of the following categories shall be considered a pass.

Category I - 50 questions (10 questions will be specimen identification)
Tree Morphology, Anatomy and Physiology
Identification and Selection

Category II - 50 questions
Pruning

Category III - 40 questions
Cabling and Bracing
Safe Work Practices

Category IV - 30 questions
Planting and Early Care
Soil Management

Category V - 30 questions
Wounds and Cavities
Diagnosis of Tree Problems
Identifying Hazard Trees

3. If an applicant fails in more than 1 category, the entire exam shall be taken again. If an applicant fails in only 1 category, he/she must retake that category.
4. A person may retake the examination as many times as he/she wishes.
5. Examinations will not be returned.
6. Exams will be held from 8:30 a.m. - 12:00 noon on the morning following the Pacific Northwest Chapter Training Conference, unless otherwise specified in your confirmation.
7. A study session will be held the evening prior to the examination. You will be notified of the session's location in your confirmation.
8. A list of tree species is included in your Study Guide (see Lists A and B). Fresh specimens from ten of these tree species will be at the examination for you to identify. Species shall be identified by both common and scientific names.
9. Applicants desiring to be certified as both an Arborist and a Tree Worker shall pass both the Arborist examination and the Tree Worker practical examination.

Source: ISA, Western Chapter, "Arborist Examination
Guidelines", St. Helena, California, n.d.

PACIFIC NORTH WEST CHAPTER ISA CERTIFICATION
EXAMINATION GUIDELINES - TREE WORKER

Tree Worker Examinations

1. The examination will consist of 90 multiple choice and true/false questions.
2. A score of seventy percent in each of the following categories shall be considered a pass:

Category I - 25 questions (10 questions will be specimen identification)
 Tree Morphology, Anatomy and Physiology
 Tree Identification and Selection

Category II - 25 questions
 Pruning

Category IV - 15 questions
 Planting and Early Care
 Soil Management

Category III - 20 questions
 Safe Work Practices
 Cabling and Bracing

Category V - 5 questions
 Wounds

3. If an applicant fails in more than 1 category, the entire exam shall be taken again. If an applicant fails in only 1 category he/she must retake that category.
4. A person may retake the examination as many times as he/she wishes.
5. Examinations will not be returned.
6. Exams will be held from 8:30 a.m. - 2:30 p.m. on the morning following the Pacific Northwest Chapter Training Conference, unless otherwise specified in your confirmation.
7. A study session will be held the evening prior to an exam. You will be notified of the session's location in your confirmation.
8. A list of tree species is included in your Study Guide (see List A only). Fresh specimens from ten of these tree species will be at the examination for you to identify. Species may be identified by common or scientific names.

Tree Worker Exam Guidelines Cont'd...

9. The Practical Examination shall consist of two parts:

- a) A work climb in which the Tree Worker shall throw a line into the tree, enter the tree, and reach two (2) or three (3) work stations in the outer canopy of the tree.
- b) An aerial rescue of an "injured" climber, using a rope and saddle.

10. The Tree Worker shall be tested on his ability to move safely and efficiently in the tree.

11. Hooks or climbing spurs shall not be used during practical examinations. All equipment shall be furnished by the climber. Equipment shall meet ANSI Standards.

12. A score of seventy percent shall be required to pass the practical examination.

Source: ISA, Western Chapter, "Tree Worker Examination Guidelines", St. Helena, California, n.d.

**RULES, SCORING PROCEDURES AND GUIDELINES FOR THE
PRACTICAL EXAMINATION FOR THE TREE WORKER CERTIFICATE**

Rules

1. The Work Climb is designed to judge an applicant's safe use, balance and proficiency with rope and saddle. It is timed to assess overall productivity only.

Judges for the Work Climb are selected by the Certification Review Board for their expertise. They will judge applicants in the Work Climb on such things as safety, skill, technique and poise. There will be two (2) Work Climb judges.

2. Pre-crotched climbing lines shall only be permitted if the Work Climb tree is too large to permit the efficient placement of a line by each applicant. A crotch 12m (40 ft.) to 18m (60 ft.) from ground level will be designated as the tie-in point.
3. A time limit for the Work Climb shall be established and announced prior to the beginning of the test. Timing begins from the moment the applicant throws his or her throwline, climbing line or starts climbing the tree. Timing stops when the climber returns to the ground.
4. From the judge's signal "Go", the applicant shall enter the designated work area. From this area they shall either climb a pre-crotched rope or set his or her own line (throw lines and weights allowed) and enter the tree using the Footlock, Body Thrust or Shinnny methods.
5. Work Climb applicants shall wear the minimum equipment of a hard hat, handsaw, tree worker's safety saddle, work clothing, boots and safety strap flipline or safety rope. The judges shall have the final decision as to the suitability of a piece of equipment.
6. From the tie-in point, the applicant shall proceed to one, two or three work stations within the tree signified by bells or some other visible marker. Each applicant may choose his or her route and order in which to approach the work stations. One work station may be installed as a pole pruner station.

Scoring the Work Climb:

The judges shall score the applicant's moves through the ascent, work stations and decent. A weight may be installed at one work station. If the applicant causes the weight to touch the ground, five (5) points will be deducted for that particular station. (See attached Judging Guidelines.)

Failure to complete the test within the specified time limit will result in failure. The applicant will be called to the ground by the judges if the applicant violates the time limit.

Judging Guidelines (Work Climb):

1. Climb & Dismount (Footlock)

- a. Is the length of bight proper in relation to the applicant's physical height?
- b. Is there equal use of arms and legs?
- c. Is the rope secure around the boot and heel?
- d. Does the applicant spin excessively?
- e. Is the dismount a free, easy, smooth motion?
- f. Was the tie-in easy and did the applicant safety off?
- g. Was there slack in the rope or did it remain taut?
- h. Did the knot slip or was it secure?

2. Climb & Dismount (Body Thrust)

- a. Is the applicant using the full length of his or her arms and is there a rhythmic motion?
- b. Does the applicant assist him/herself with the use of the feet?
- c. Is the hand hold secure?
- d. Are the feet being used to prevent spinning and a steady move upward?
- e. Review items e, f, g, h, under #1 footlock.

3. Re-Crotching

- a. Was the method free and easy or did the applicant struggle?
- b. Was the applicant in an appropriate position for re-crotching?
- c. Was the re-crotch in a proper location in relation to the work stations?
- d. Was re-crotching necessary or excessive?

4. Positioning for Work

- a. Did the applicant show good confidence in his or her rope and knots?
- b. Was the applicant in complete control of his or her moves?
- c. Was he or she off balance? If so, to what degree?
- d. Was the rope taut when necessary?
- e. Was the use of the taut-line hitch smooth and easy?
- f. Was the taut-line hitch secure?
- g. If free climbing, was 3-point contact obvious?

5. Descent After Last Work Station

- a. Was the use of the taut-line hitch smooth?
- b. Did the rope feed smoothly through the knot?
- c. Did the applicant land squarely and balanced?

6. Shinnying - This method of movement in the tree is often used by the applicants and has been questioned by the judges as to whether or not it is a safe practice without the use of a safety line. Obviously, there are many diverse opinions concerning the safety of shinnying which is best left to the discretion of the judges.

- a. Length of shinny 1.5m (5 ft.), 3m (10 ft.), 4.5m (15 ft.)?
- b. Method - one leg pushing from one side of the tree trunk, the other leg pulling from the opposite side.
- c. Was the shinny strong and smooth without any slipping?
- d. Generally, was the shinny performed in a safe and efficient manner?
- e. Did the applicant maintain 3-point contact at all times?

AERIAL RESCUE TEST - Rules, Scoring Procedures, Judging Guidelines **- One Applicant**

This is a simulated one-applicant rescue event. It is designed to test the climber's ability to bring an injured worker to the ground quickly and efficiently.

Rules:

1. A simulated injured climber (dummy) shall be pre-installed in a tree 6m (20 ft.) - 12m (40 ft.) above ground level with saddle and climbing rope secured with a taut-line hitch.
2. The clock shall start when the climber (rescuer) touches his or her climbing rope, throwline or begins the ascent to the injured.
3. The simulated injured climber's climbing line shall not be cut (at the taut line hitch) in the process of bringing the simulated injured climber down.
4. The clock shall stop when the simulated injured climber is fully laid out on the ground.
5. The judges may stop this event at any time if an unsafe practice is observed.
6. The judge shall shout "abort" or "scratch" if an unsafe practice is observed.

Judging Guidelines One-Applicant Aerial Rescue:

In this event there are basically five tasks to consider in judging as follows: (see scoring explanation)

1. The climber's method of ascending the tree. Consider and judge 1, 2 or 3 points.
 - a. Was the climb smooth and safe?
 - b. How did the climber get the climbing rope or throwline into the tree?
Efficiently? Quickly?

2. Climber's tie in position.
 - a. Was the tie in position proper in relation to the position of the injured?
 - b. Is the climber's rope clear of the injured person's climbing line?
 - c. Was there any wasted motion or move?
3. Examination of the injured.
 - a. Did the climber appear to check for potentially hazardous surroundings?
 - b. Did the climber check for breathing?
 - c. Cuts or bleeding?
 - d. Broken bones?
 - e. Other?
4. Climber's method of descending to the ground with the injured.
 - a. Was the descent smooth?
 - b. Did the climber control the position of the injured during the descent?
5. Touch down of the injured.
 - a. Was the touch down gentle?
 - b. Was the injured allowed a flat touch down?

Source: ISA, Western Chapter", Work Climb Event Rules,
Scoring Procedures and Judging Guidelines",
St. Helena, California, 1987.

APPENDIX R

STUDY GUIDE FOR PACIFIC NORTHWEST CHAPTER
ARBORIST AND TREE WORKER CERTIFICATION

STUDY GUIDE
FOR
ARBORIST AND TREE WORKER
CERTIFICATION EXAMINATIONS



Susan M. Murray, Editor

Published By:

**PACIFIC NORTHWEST CHAPTER,
INTERNATIONAL SOCIETY OF ARBORICULTURE**

ACKNOWLEDGEMENTS

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**PACIFIC NORTHWEST CHAPTER
INTERNATIONAL SOCIETY OF ARBORICULTURE
CERTIFICATION PROGRAM**

The Pacific Northwest Chapter of the International Society of Arboriculture (ISA) has prepared a Voluntary Certification Program for Arborists and Tree Workers. The goal of the program is to improve the standard of workmanship within the profession. It will also enable the members of the public to identify proficient arborists. Certification, in the Pacific Northwest Chapter, will eventually go hand in hand with a public information campaign.

The program includes two levels of certification: Certified Tree Worker, the first level, requires 18 months of arboricultural work experience, passing a written and a practical examination. The certificate must be renewed every three years by re-examination or by 18 hours of attendance at accredited seminars, workshops, conferences or training during the three-year period.

Certified Arborist, the second level of certification, requires three years of arboricultural work experience and passing a written examination. The certificate must be renewed every three years by re-examination or by attending 36 hours of accredited seminars, workshops, conferences or training during the three-year period. The two levels differ by the number of months of work experience needed and the subject matter presented in the examination.

HOW TO USE THIS STUDY GUIDE

This Study Guide has been developed to help aspiring Tree Workers and Arborists to prepare for the certification examination. It includes ten units.

Research in the last twenty-five years has given us a clearer perception of trees and their response to pruning and cultural practices. This has led to improved arboricultural techniques. Every effort has been made to include the results of current research in this Study Guide. The adoption of new techniques will create a higher standard of workmanship in the tree care industry.

To use the Study Guide:

1. Read the Objectives of each chapter.
2. Read the references given in the Procedure. Test questions are based on the reference material listed in the Procedure at the beginning of each unit. Of course, work experience is fundamental to a full understanding of the subject material presented in the references.
3. Answer the Study Questions as completely as possible. Make sure you understand the concepts and principles involved.
4. Attempt the Sample Test Questions.

5. Read the references given in "Additional Reading" which interest you. These readings are not required but may assist if problems arise in the assigned reading, and will increase your understanding of the concepts involved.
6. Make sure you understand the meaning of all the terms used in the unit readings or study questions.

***Note:** Objectives and Study Questions for Tree Workers are listed with an (*).
All Objectives and Study Questions shall be studied by Arborists.

REFERENCE MATERIAL

Each unit of the Study Guide includes a list of references. The reference material is required reading. All the reference material mentioned in the procedure section of each unit is given below.

American National Standard for Tree Care Operations. ANSI Z133.1 - 1988. New York, N.Y.: American National Standards Institute Inc.

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Washington Industrial Health and Safety Code. Olympia, Wa.: Washington Industrial Health and Safety Administration.

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Chainsaw Safety Manual. n.d. Waiblingen, West Germany: Andreas Stihl.

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Watson, G.W. 1988. Organic Mulch and Grass Competition Influence Tree Root Development. Volume 14, No.8:200-203.

Whitcomb, Carl E. 1981. Response of Woody Landscape Plants to Bermuda Grass Competition and Fertility. Volume 7, No. 7:191-194.

ARBORETA, BOTANICAL GARDENS AND PARKS USEFUL FOR PLANT IDENTIFICATION

British Columbia:

The University of British Columbia Botanical Garden, Vancouver.
Van Dusen Botanical Display Garden, Vancouver.
Beacon Hill Park, Victoria.
Royal Roads, Hatley Park, Victoria.

Oregon:

Berry Botanic Garden, Portland.

Washington:

Washington Park Arboretum, Seattle.

IMPORTANT NOTICE:

The Pacific Northwest Chapter does not endorse or recommend any brands or makes of tree care equipment. The use of brand names is purely coincidental and is based solely on the availability of information concerning those brands at the time and place of production of this study guide.

UNIT 1

TREE MORPHOLOGY, ANATOMY AND PHYSIOLOGY

INTRODUCTION

An understanding of tree morphology, anatomy and the physiological processes by which growth occurs will give the arborist a clearer picture of how arboricultural practices affect tree performance and vigor.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Describe the morphology or structure of a root and the function of each part.
- *2. Summarize the types of roots that may occur on a mature tree, including the function and location of each type.
3. Describe the general anatomy of a leaf and the function of the major cells.
- *4. Describe the structure of a dormant twig.
5. Describe the general anatomy of a woody stem and the function of the major parts.
6. Explain the basic structure of the vascular system of a tree and the function of each part.
- *7. Explain how a branch is attached to the trunk (see Shigo) and how this affects conduction of water and elements.
- *8. Explain where compression and tension wood are formed and what their function is.
- *9. Outline the differences between heartwood and sapwood.
- *10. Describe the role of the root-fungus association called mycorrhiza in the absorption of elements.
11. Outline the differences between heartwood and discolored wood.
- *12. Outline the differences between an excurrent and a decurrent or delinquent branching habit in trees and how it influences pruning. Identify examples of each growth pattern.
13. Point out the differences between apical dominance and apical control.
14. Summarize the CODIT model or compartmentalization of decay in trees.

15. Summarize the purposes and products of photosynthesis and respiration.
16. Explain the mechanism and identify the cells by which photosynthetic products are translocated from the leaves to the rest of the plant.
17. Explain the process of transpiration.
- *18. Point out the differences between different kinds of shoots such as water sprouts and suckers.
19. Summarize the differences between a tree with co-dominant stems and one with a large trunk-small branch configuration.
20. Explain the effects of environmental influences such as sunlight on transpiration.
21. Explain the mechanism and identify the cells by which water is transported throughout the plant.

PROCEDURE

1. Read Arboriculture, Harris, *Chapter 2 and pp.151-155;
pp.497-498
2. Read Botany, Ray et al., *Chapter 3, pp.36-42
Chapter 6, pp.103-105
Chapter 7, pp.118-123
Chapter 8, pp.135-138
Chapter 9, pp.147-149
Chapter 10, pp.161-175
Chapter 13, pp.223-236
3. Read A New Tree Biology, Shigo, *Chapter 10
*Chapter 12
Chapter 17
4. Refer to A New Tree Biology Dictionary, Shigo, as required.

STUDY QUESTIONS

1. Define the terms listed below. Identify where the structures or cells are found in a tree and explain their primary function.

*bundle scar	cork	epidermis
*terminal bud	guard cell	co-dominant stem
*bud scale scar	xylem	branch collar
vascular cambium	phloem	walls one, two, three & four
*root cap	pith	barrier zone
*root hair	cortex	tracheid
*heartwood	*sapwood	sieve tube
stomate	*lateral root	vessel
*reaction wood	palisade cell	fiber cell

*compression wood	*internode	sieve plate
*tension wood	*node	
*epicormic branch	*sinker root	
*water sprout	*annual growth ring	
apical meristem	chlorophyll	
*bark	*sucker	
*latent bud	*heart root	

- *2. What is the branching pattern of a tree with an excurrent growth habit, a decurrent growth habit?
- *3. How deep do the roots of most plants, including large trees, grow?
- *4. What are the four types of roots that may occur in a mature tree? Where are these roots located in relation to the soil surface?
5. What are the cellular components of the vascular system?
- *6. How does girdling a stem kill a tree?
- *7. Where does compression wood develop in conifers? What is its function?
- *8. Where does tension wood form in deciduous trees? What is its function?
9. What are stomates and by what mechanism do they open and close?
10. What are the environmental conditions which increase the rate at which transpiration occurs?
- *11. Why are water sprouts easily disconnected from a trunk?
12. Which component of the vascular system enables the translocation of photosynthates from the leaves to the rest of the tree?
13. What is the overall equation for the photosynthetic formation of carbohydrate?
14. What is the source of the carbon dioxide (CO₂) required in photosynthesis?
15. What is the ultimate energy source for the photosynthetic process?
16. Why is respiration an important physiological process?
17. How does the transport of water in the xylem occur?
18. What is transpirational pull?
19. How does the cohesion-tension theory of water transport explain the successful movement of water from the roots to the leaves?
20. What is the difference between apical dominance and apical control?
21. What is the process of CODIT?

22. Summarize the compartmentalization of decay in trees, identifying the location, cells which form them and the relative strengths of walls one through four.

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. Water and mineral elements are absorbed into the tree via which part of the root?
- a) cap b) palisade cells c) hairs
2. Photosynthesis is a process whereby carbon dioxide and water are chemically joined to produce what compound?
- a) mesophyll b) carbohydrate c) phosphorus
3. What is the role of the layer of cutin and waxes which is secreted onto the epidermis of the leaf?
- a) restricts the evaporation of water
b) produces chloroplasts
c) opens and closes the stomates
4. Which of the cells listed below form part of the vascular system?
- a) xylem b) epidermal c) palisade
- *5. An excurrent tree has a single dominant leader, with shorter lateral branches. One example is an *Acer rubrum* or Red Maple.
- True False

ANSWERS: 1 - c; 2 - b; 3 - a; 4 - a; 5 - False.

ADDITIONAL READING

PERIODICALS

Journal of Arboriculture

Chaney, W.R. 1986. Anatomy and Physiology Related to Chemical Movement in Trees. Volume 12, No. 4:85-91.

Perry, Thomas O. 1982. The Ecology of Tree Roots and the Practical Significance Thereof. Volume 8, No. 8:197-211.

Santamour, F.S. 1987. Building Walls and Breaching Walls: Truth and Consequences in Wound Compartmentalization. Volume 13, No.11:262-266.

Wargo, Philip M. 1983. Effects and Consequences of Stress on Root Physiology. Volume 9. No. 7:173-176.

UNIT 2

TREE IDENTIFICATION AND SELECTION

INTRODUCTION

Tree identification is important to the arborist. Knowing the identity of a tree allows the arborist to accurately assess a tree's suitability to a particular site. Tree identity helps determine pruning and other cultural practices such as insect and disease control. It is also useful to be able to select in the nursery bare-root or container-grown trees which will survive and perform well in the landscape.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Identify, using both scientific and common names, the twenty-five trees of List A that are commonly found growing in the Pacific Northwest.
2. Identify, using both scientific and common names, an additional twenty-five trees found in List B that are commonly found growing in the Pacific Northwest.
- *3. Describe characteristics of the trees from List A including mature height, spread and habit of growth.
4. Describe characteristics of the trees from List B including mature height, spread and habit of growth.
- *5. Explain what a scientific name is, why they are used and how they are correctly written.
- *6. Outline the differences between bare-root, balled and burlapped and container-grown nursery stock.
7. Distinguish desirable characteristics of nursery stock such as adequate trunk taper, caliper, crown configuration and a moderate top-to-root ratio.
8. Distinguish unacceptable characteristics of nursery stock such as kinked and circling roots or injured bark.
9. Explain which plant features may or may not be desirable when selecting trees.
- *10. Explain the differences between the following terms: angiosperm, gymnosperm, coniferous and deciduous.

PROCEDURE

- *1. Read Arboriculture, Harris, Chapter 3.

- *2. Read Manual of Woody Landscape Plants, Dirr, pp. 23-26 and as required.
- *3. Read Native Trees of Canada, Hosie, as required for tree identification.
- *4. Read Trees of North America and Europe, Phillips, as required for tree identification.
- *5. Visit a botanical garden or arboretum in your area.

STUDY QUESTIONS

- 1. Explain when flowers or fruit in a landscape tree may or may not be desirable.
- *2. Summarize the information required under the headings below for the trees in List A.
 - a) leaf description
 - b) bark description
 - c) mature height, spread and habit of growth
 - d) dormant twig characteristics
- 3. As above, but for trees given in List B.
- 4. What can be done through plant selection to reduce surface rooting of street trees in turf, curb or sidewalk areas?
- 5. List five reasons why nursery trees may be rejected prior to planting.

*Tree Study List A

Scientific Name

Common Name

Gymnosperms:

- | | |
|------------------------------------|------------------------|
| 1. <i>Cedrus atlantica</i> | Atlas Cedar |
| 2. <i>Cedrus deodara</i> | Deodar Cedar |
| 3. <i>Chamaecyparis lawsoniana</i> | Lawson's False Cypress |
| 4. <i>Ginkgo biloba</i> | Maidenhair Tree |
| 5. <i>Picea abies</i> | Norway Spruce |
| 6. <i>Pinus nigra</i> | Austrian Pine |
| 7. <i>Pinus sylvestris</i> | Scot's Pine |
| 8. <i>Pseudotsuga menziesii</i> | Douglas Fir |
| 9. <i>Thuja plicata</i> | Western Red Cedar |
| 10. <i>Tsuga heterophylla</i> | Western Hemlock |

Scientific NameCommon Name**Angiosperms:**

11. <i>Acer macrophyllum</i>	Bigleaf Maple
12. <i>Acer platanoides</i>	Norway Maple
13. <i>Acer rubrum</i>	Red Maple
14. <i>Aesculus hippocastanum</i>	Common Horsechestnut
15. <i>Betula pendula</i>	European White Birch
16. <i>Catalpa speciosa</i>	Western Catalpa
17. <i>Cornus nuttallii</i>	Pacific Dogwood
18. <i>Fagus sylvatica</i>	European Beech
19. <i>Liquidambar styraciflua</i>	American Sweet Gum
20. <i>Liriodendron tulipifera</i>	Tulip Tree
21. <i>Platanus x acerifolia</i>	London Pine
22. <i>Prunus serrulata</i>	Japanese Cherry
23. <i>Quercus rubra</i>	Red Oak
24. <i>Sorbus aucuparia</i>	European Mountain Ash
25. <i>Tilia cordata</i>	Littleleaf Linden

Tree Study List BScientific NameCommon Name**Gymnosperms:**

1. <i>Araucaria araucana</i>	Monkey Puzzle Tree
2. <i>Cryptomeria japonica</i>	Japanese Cedar
3. <i>x Cupressocyparis leylandii</i>	Leyland Cypress
4. <i>Metasequoia glyptostroboides</i>	Dawn Redwood
5. <i>Picea pungens</i>	Colorado Spruce
6. <i>Pinus contorta</i>	Shore Pine
7. <i>Pinus wallichiana</i>	Himalayan White Pine
8. <i>Sequoia sempervirens</i>	Redwood
9. <i>Sequoiadendron giganteum</i>	Giant Sequoia

Scientific NameCommon Name**Angiosperms:**

10. <i>Acer circinatum</i>	Vine Maple
11. <i>Acer palmatum</i>	Japanese Maple
12. <i>Albizia julibrissin</i>	Silk Tree
13. <i>Alnus oregona</i>	Red Alder
14. <i>Carpinus betulus</i>	European Hornbeam
15. <i>Cercidiphyllum japonicum</i>	Katsura Tree
16. <i>Cercis siliquastrum</i>	Judas Tree
17. <i>Cornus florida</i>	Flowering Dogwood
18. <i>Davidia involucrata</i>	Dove Tree
19. <i>Fraxinus ornus</i>	Flowering Ash
20. <i>Gleditsia triacanthos</i>	Honey Locust
21. <i>Koelreuteria paniculata</i>	Golden Rain Tree
22. <i>Magnolia x soulangiana</i>	Saucer Magnolia
23. <i>Populus nigra cv Italica</i>	Lombardy Poplar
24. <i>Quercus palustris</i>	Pin Oak
25. <i>Robinia pseudoacacia</i>	Black Locust

SAMPLE TEST QUESTIONS

Circle the best answer.

*1. Which one of the following best describes a Gymnosperm?

- a) plant having naked seeds
- b) plant producing spores
- c) plant bearing a palmately compound leaf

2. Which one of the following best describes an Angiosperm?

- a) plant producing a coniferous fruit
- b) plant having seeds borne within a pericarp
- c) plant bearing needle or scale-like foliage

*3. A pine tree usually has two or more needles attached to twigs in bundles or fascicles, whereas the needles of a spruce are attached singly to the branchlet.

True

False

*4. Which one of the following scientific names is correctly written?

a) *Pinus Nigra*

b) *pinus nigra*

c) *Pinus nigra*

ANSWERS: 1 - a; 2 - b; 3 - True; 4 - c.

ADDITIONAL READING

BOOKS AND MANUALS

Chaster, G.H., Ross, D.W. and W.H. Warren. 1988. Trees of Greater Victoria: A Heritage. Victoria, B.C.: Heritage Tree Book Society.

The Hillier Colour Dictionary of Trees and Shrubs. 1982. New York, N.Y.: van Nostrand Reinhold.

Meakin Poor, J. 1984. Plants That Merit Attention. Volume 1 - Trees. Portland, Or.: Timber Press.

ARBORETA, BOTANICAL GARDENS AND PARKS USEFUL FOR PLANT IDENTIFICATION

British Columbia:

The University of British Columbia Botanical Garden, Vancouver.
Van Dusen Botanical Display Garden, Vancouver.
Beacon Hill Park, Victoria.
Royal Roads, Hatley Park, Victoria.

Oregon:

Berry Botanic Garden, Portland.

Washington:

Washington Park Arboretum, Seattle.

UNIT 3

PLANTING AND EARLY CARE

INTRODUCTION

The importance of correct planting techniques and the initial care received by newly-transplanted trees and shrubs should not be underestimated. Success in transplanting trees and shrubs from a controlled nursery environment into the landscape requires preparation of the planting hole, removal of twine and burlap wrapping, initial pruning and occasionally, staking.

OBJECTIVES

Be able to, without references notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Explain the importance of the following:
 - a. Proper handling of plants prior to planting.
 - b. Preparing the planting hole.
 - c. Setting the plant in the hole.
 - d. Removing twine and burlap wrapping around the base of the tree or shrub.
 - e. Backfilling the hole.
 - f. Pruning.
 - g. Care following planting.
- *2. Point out the differences in growth characteristics between a staked and an unstaked tree.
- *3. Explain what type of staking a tree may require.
- *4. Explain how to stake a tree, depending on its requirement for:
 - a) protection b) root anchorage c) trunk support
- *5. List two injuries caused by improper staking.

PROCEDURE

- *1. Read Arboriculture, Harris, Chapter 2, pp.31-33 and Chapter 8, pp.208-226.

STUDY QUESTIONS

- *1. How should deciduous, bare-root trees be handled in between digging in the nursery and planting in the landscape?
- *2. What precautions should be taken in handling container-grown plants between the nursery and planting?
- *3. What problem may be encountered by digging planting holes deep to "loosen" the soil? How can this problem be minimized?
- *4. Should back-fill soil be amended? Why?
- *5. How can "glazing" the sides of the planting hole be minimized?
- *6. How should the roots of plants be handled prior to placing them in the planting hole?
- *7. Explain three considerations when deciding how to orient a tree in the planting hole.
- *8. What problem occurs when burlap wrapping is left exposed to the air once the plant has been placed into the planting hole?
- *9. Why is it best to irrigate newly planted trees?
- *10. What pruning, if any, should be done at planting? Why?
- *11. If fertilization appears necessary, how and when should it take place?
- *12. Compare and contrast the growth characteristics of a staked versus an unstaked tree.
- *13. How can the height of the support be determined when support staking is required?
- *14. Discuss three reasons why a tree may require staking.

SAMPLE TEST QUESTIONS

Circle the best answer.

1. What is the most important reason to prune a young tree at planting?
 - a) To balance the top and root growth.
 - b) To begin developing tree structure.
 - c) To invigorate the young tree.

ANSWER: 1 - b.

ADDITIONAL READING

BOOKS AND MANUALS

Himelick, E.G. 1981. Tree and Shrub Transplanting Manual. Urbana, Il.: International Society of Arboriculture.

Whitcomb, Carl E. Establishment and Maintenance of Landscape Plants. 1987. Stillwater, Ok.: Lacebark Publications.

PERIODICALS

Journal of Arboriculture

Fraedrich, S.W. and D.L. Ham. 1982. Wood Chip Mulching Around Maples: Effect on Tree Growth and Soil Characteristics. Volume 8, No. 4:85-89.

Kramer, P.J. 1987. The Role of Water Stress in Tree Growth. Volume 13, No. 2: 33-38.

Krizek, D.T. and S.P. Dubik. 1987. Influence of Water Stress and Restricted Root Volume in Growth and Development of Urban Trees. Volume 13, No. 2:47-55.

Kozlowski, T.T. 1987. Soil Moisture and Absorption of Water by Tree Roots. Volume 13, No. 2:39-46.

Van de Werken, Hendrik. 1981. Fertilization and Other Factors Enhancing the Growth Rate of Young Shade Trees. Volume 7, No. 2:33-37.

Watson, G.W. and E.B. Himelick. 1982. Root Distribution of Nursery Trees and Its Relationship to Transplanting Success. Volume 8, No. 9:225-229.

Whitcomb, Carl E. 1981. Response of Woody Landscape Plants to Bermuda Grass Competition and Fertility. Volume 7, No. 7:191-194.

UNIT 4

SOIL MANAGEMENT

FERTILIZATION

INTRODUCTION

Fertilization of woody plants is a time-honored horticultural practice. However, it may or may not be justified. Whether fertilization is required depends on the plant, the nutrient status of the soil, and the amount of growth required. Shallow-rooted plants such as turf, bedding plants and ground covers may require fertilization, while trees and shrubs may not.

This unit should provide an understanding of soil-nutrient-plant relationships, the techniques used to determine nutrient requirements, and the means to correct nutrient deficiencies.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

1. Explain the influence of the more important physical and chemical properties of soil on the availability of nutrients and therefore the growth of trees and shrubs.
2. Explain what form(s) of nutrients are absorbed by roots.
3. Evaluate the adequacy of methods used to determine the need for additional nutrients.
- *4. Identify the deficiency symptoms associated with nitrogen, phosphorus, potassium, and iron.
- *5. Explain the treatments for each of the above deficiencies, including the method of application and timing.
6. Point out the differences between the chemical forms of different nitrogen fertilizers and their effects on nutrient availability.
- *7. Summarize the benefits of applying: inorganic or organic sources of nutrients, complete fertilizers, and slow-release fertilizers.
- *8. Explain how the nutrient levels in a complete fertilizer are expressed.
- *9. Explain the advantages and disadvantages of applying fertilizer via surface application, soil incorporation, foliar sprays and trunk injection.

10. Summarize the measures that can be taken to minimize pollution by fertilizers.

PROCEDURE

- *1. Read Arboriculture, Harris, Chapter 3, pp.141-151 and Chapter 11.
- *2. Read Supplementary Discussion which follows.

Supplementary Discussion

The above assigned reading can be summarized by the following. In many landscape plantings nitrogen is the only element which may be deficient. Nitrogen can be applied to the soil surface and, in the nitrate or urea form, will move into the soil during irrigation.

In alkaline (high pH) soil, iron may be deficient.

Because of leaf and twig fall and decomposition, original surface soil is more fertile than deeper soil.

STUDY QUESTIONS

1. Which chemical soil property determines soil fertility? How?
2. How does the pH of the soil influence plants? What is the soil pH range considered satisfactory for most plants?
3. In what form(s) are nutrients absorbed by roots?
4. Why may a shrub respond differently to two different fertilizer products with the same nitrogen content?
- *5. Compare inorganic and natural organic sources of fertilizers for use in landscape settings.
6. Summarize three methods used to determine fertilizer needs for landscape plants. What are the problems of each method used?
7. What are the common chemical forms of nitrogen used as fertilizers? Do these forms influence how they might be used? How?
- *8. What is the simplest effective way to apply nitrogen fertilizer? Why?
- *9. Compare the symptoms of nitrogen and iron deficiencies of broadleaved shrubs.
- *10. What is a "complete" fertilizer? Discuss the value of a complete fertilizer for use on trees.
- *11. How are the nutrient levels of a complete fertilizer expressed?

- *12. If needed, how would you apply potassium?
- *13. What are some of the advantages of using a slow release fertilizer in the landscape?
- *14. Outline the advantages and disadvantages of applying fertilizer via surface application, putting it into drilled holes, liquid injection, foliar sprays, and trunk injection.
- *15. Of what importance is time of application of nitrogen fertilizers?
- *16. Describe control measures for iron deficiency.
- 17. Explain fertilizer pollution by nitrogen and phosphorus in a landscape setting near a stream or lake.

SAMPLE TEST QUESTIONS

1. Fill in the blanks:

- a) In poorly drained soils, a _____ (low, high, neutral) pH may reduce the availability of iron and manganese.
- b) Nitrate ions are _____ (weakly, strongly) adsorbed by soil colloids.

2. True or False (T or F):

- _____ a) Root absorption of nutrients is generally passive, that is, elements are absorbed in proportion to their concentration in the soil or soil solution.
- _____ b) Soil analysis can more accurately reflect the toxicity levels of soil chemicals than the nutrient status.
- _____ c) A plant with yellowish leaves in the spring which become green during the growing season, and normal length shoots of small diameter, is exhibiting typical nitrogen deficiency symptoms.

3. True or False (T or F):

- _____ a) The three nutrients in a "complete fertilizer" are always listed in the same order on the label, but are not necessarily the same chemical formulation.
- _____ b) One of the benefits of applying phosphorus to trees in most soils is the stimulation of root growth.

ANSWERS:

1(a) - high;	1(b) - weakly	
2(a) - false;	2(b) - true;	2(c) - false
3(a) - true;	3(b) - false	

ADDITIONAL READING

BOOKS

Whitcomb, Carl E. 1987. Establishment and Maintenance of Landscape Plants. Stillwater, OK.: Lacebark Publications.

PERIODICALS

Journal of Arboriculture

Van de Werken, Hendrik. 1981. Fertilization and Other Factors Enhancing the Growth Rate of Young Shade Trees. Volume 7, No.2:33-37.

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IRRIGATION AND DRAINAGE

INTRODUCTION

Water is of paramount importance to all living things. In plants, water plays an important role in photosynthesis. It provides a solvent for nutrient and carbohydrate movement within plants. Transpiration cools plants. Water is vital, yet too much water can be detrimental.

This unit will present information on the practices of irrigation and drainage.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

1. Explain the following terms:

Evapotranspiration	(ET)
Field capacity	(FC)
Permanent wilting point	(PWP)
Available moisture	
Infiltration	

2. Summarize the factors which influence evapotranspiration.
3. Describe the uses and limitations of the different ways to determine when to irrigate landscape plants.
4. Explain how to roughly estimate moisture adequacy by feeling the soil.
- *5. Compare and contrast the methods of applying water to landscape plants via:

Basin	Sprinkler
Furrow	Drip irrigation

6. Explain the advantages of minimum irrigation of landscape plants where less water is applied than is evapotranspired.
7. Explain how antitranspirants reduce transpiration, the problems associated with their use, their effectiveness, and their most promising uses.
- *8. Describe the methods used to improve drainage in an existing landscape planting.

PROCEDURE

1. Read Arboriculture, Harris, Chapter 6, pp.155-162 and Chapter 12.

STUDY QUESTIONS

1. What do the following terms mean?

Evapotranspiration	(ET)
Field capacity	(FC)
Permanent wilting point	(PWP)
Available moisture	
Infiltration	

- *2. Describe the following irrigation methods: Basin; Sprinkler; Furrow; and Drip irrigation.
- *3. What are the main advantages and disadvantages of drip irrigation for landscape plantings?

4. Outline the methods to estimate when to irrigate by: observing plants, feeling the soil, using tensiometers, using electrical resistance meters, estimating evapotranspiration (ET), and measuring foliage temperatures.
5. What are some of the advantages of minimum irrigation where it can be practiced?
- *6. Explain "water-jetting" of landscape trees.
7. In what ways can antitranspirants reduce transpiration and what are their most promising uses?
- *8. Describe the methods used to improve soil drainage in an existing landscape planting.

SAMPLE TEST QUESTIONS

*1. True or False (T or F):

- _____ a) An irrigation basin that allows more water to enter the soil near the water inlet than across the basin, can be given more uniform water distribution by reducing the flow into the basin.
- _____ b) Drip irrigation usually uses more water for a given area than does a sprinkler because of the frequent and long periods of drip application.
- _____ c) Sprinkler or drip, compared to basin, application of water is preferred in mulched shrub plantings.

2. Fill in the blank:

Factors outside the plant which influence the rate of transpiration include: i) soil moisture, ii) temperature, iii) sunlight, and iv) _____.

3. True or False (T or F):

- _____ a) The duration of antitranspirant effectiveness depends, in large measure, on plant vigor.
- _____ b) The temperature of leaves exposed to the sun compared to that of shaded leaves can be used to determine when to irrigate.

ANSWERS

1(a) - False; 1(b) - False 1(c) - True
 2 - Humidity, Wind or Radiation;
 3(a) - True; 3(b) - True

ADDITIONAL READING

BOOKS

Whitcomb, Carl E. 1987. Establishment and Maintenance of Landscape Plants. Stillwater, OK.: Lacebark Publications.

PERIODICALS

Journal of Arboriculture

Kramer, P.J. 1987. The Role of Water Stress in Tree Growth. Volume 13, No.2:33-38.

Krizek, D.T. and S.P. Dubik. 1987. Influence of Water Stress and Restricted Root Volume on Growth and Development of Urban Trees. Volume 13, No.2:47-55.

Kozlowski, T.T. 1985. Soil Aeration, Flooding, and Tree Growth. Volume 11, No.3:85-96.

Kozlowski, T.T. 1987. Soil Moisture and Absorption of Water by Tree Roots. Volume 13, No.2:39-46.

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CULTIVATION

INTRODUCTION

Soil surfaces may be protected and maintained in one of three ways: with ground cover plants; by clean cultivation or chemical weed control; or with mulches. Mulches help to retain soil moisture, reduce soil erosion and weed competition.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Summarize the effect of turf and ground cover plants around trees.
- *2. Explain the purposes and disadvantages of cultivation and chemical weed control.

- *3. Distinguish between the action of contact, translocated, selective, and fumigant herbicides and when each should be used.
- *4. Point out the advantages and disadvantages of mulching, the basis for selecting a mulch material, and management practices.

PROCEDURE

1. Read Arboriculture, Harris, Chapter 13.

STUDY QUESTIONS

- *1. What are the advantages of keeping turfgrass at least twelve inches (30 cm) from the trunks of young trees?
- *2. What are the primary purposes of cultivating soil in landscapes?
- *3. Why should cultivation be eliminated or kept to a minimum?
- *4. Distinguish between contact, translocated, selective, and fumigant herbicides. When would you use each one?
- *5. List five benefits of mulching the soil in a shrub bed.
- *6. What are five problems associated with the use of mulches around plants?

SAMPLE TEST QUESTIONS

- *1. Match the appropriate type of herbicide with each of the following statements. A type of herbicide can only be used once.

_____ a) Used before planting a shrub bed to free it of weeds and weed seeds.	A. Contact
_____ b) Will only kill plant parts to which it is applied.	B. Selective
_____ c) Kills broadleaved plants in turfgrass.	C. Fumigant
_____ d) Effective on perennial weeds.	D. Pre-emergent
	E. Translocated
- *2. A four-inch (10 cm) thick, coarse organic mulch in a shrub planting on a sandy loam slope will improve moisture relations in the planting by:
 - a) reducing runoff, b) condensing dew and soil vapor under high radiation conditions, and
 - c) _____
 - d) _____

e) _____

ANSWERS

- 1(a) - Fumigant; 1(b) - Contact; 1(c) - Selective; 1(d) - Translocated
- 2(c) - Reducing surface evaporation
- 2(d) - Reducing weeds
- 2(e) - Water infiltrates near where applied

ADDITIONAL READING

MANUALS

Pacific Northwest Weed Control Handbook. 1989. Corvallis, Or.: Extension Services of Oregon State University, Washington State University, and the University of Idaho.

PERIODICALS

Journal of Arboriculture

Fraedrich, S.W. and D.L. Ham. 1982. Wood Chip Mulching Around Maples: Effect on Tree Growth and Soil Characteristics. Volume 8, No. 4:85-89.

Watson, G.W. 1988. Organic Mulch and Grass Competition Influence Tree Root Development. Volume 14, No. 8:200-203.

Whitcomb, C.E. 1981. Response of Woody Landscape Plants to Bermuda Grass Competition and Fertility. Volume 7, No. 7:191-194.

UNIT 5

PRUNING CONCEPTS AND TECHNIQUES

INTRODUCTION

Pruning is one of the oldest horticultural treatments. Pruning is a valuable tool, used to increase fruit and flower production, to improve the characteristics of timber-producing trees, to improve the structural strength of fruit and ornamental trees, and to promote healthy, visually appealing landscape plants.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. List five reasons why plants are pruned.
- *2. Identify the location for a correct pruning cut using the Natural Target pruning method. Describe what a proper cut will look like after one growing season. Describe the negative consequences of leaving a stub.
- *3. Explain how young and mature plants respond to pruning.
- *4. Explain the relationship of the branch bark ridge to decay.
- *5. Explain how included bark and co-dominant stems affect pruning, stem strength and decay.
- *6. **Summarize in detail** the practices of *cleaning out*, *crown thinning*, *crown reduction*, *crown restoration*, and *lifting the crown*. (British Standards Institution)
- *7. Explain the precautions required to prevent the spread of disease while pruning.
- *8. Explain the differences between callus, branch and trunk collars.
- *9. Explain why young trees need training and how to best structure their branches.
- *10. Summarize the benefits of leaving temporary branches. Summarize how to develop adequate vertical spacing and radial distribution of the branches.
- *11. Describe the relationship between top pruning and root growth.
- *12. Summarize how the timing of pruning affects plant growth as well as flower and fruit production.
- *13. Summarize why wound dressings have not proven effective in preventing decay in trees.

- *14. Point out the difference between the technique used and plant response to heading and thinning cuts. Explain what flush cut, drop crotch, pollarding and topping cuts are and the consequences of each type of cut.
- *15. Point out the difference between the two types of pruning shears and how to use the least effort when making a close cut.
- *16. Explain how to remove branches larger than two inches (5 cm) without tearing the bark.
- *17. Summarize the problems associated with "topping" cuts.
- *18. Explain the characteristics of a tree which add to the structural strength of the trunk and scaffold branches.
- *19. Explain how to prune both whorl and random branching conifer species.

PROCEDURE

- *1. Read Arboriculture, Harris, Chapter 14.
- *2. Read A New Tree Biology, Shigo, Chapters 12, 13, 33, 34, 35 and 41.

STUDY QUESTIONS

- *1. Define the terms listed below. Identify where the structures are found in a tree and explain their primary function.

branch bark ridge
temporary branches
scaffold branches
leader
crown
branch collar
trunk collar

callus collar
callus tissue
included bark
protection zone
whorled branching
random branching
stub

- *2. Describe the pruning cuts listed below. Explain the advantages or disadvantages of each type.

flush
topping
pollarding
heading back
thinning out

drop crotching
dehorning
pinching
shearing
stubbing

- *3. What parts should be pruned from a vigorous, healthy mature tree?

- *4. Where should a normal pruning cut be made and how does the position of the cut relate to the possibility of decay?
- *5. Describe the steps required to remove a long or heavy limb. What problems result from not taking these steps?
- *6. What is the tree's response to "topping" cuts?
- *7. What is the probable long-term effect of topping?
- *8. What are the steps involved in retraining a tree which has been severely topped?
- *9. When thinning-out a limb or leader, what is the minimum size lateral branch (in relation to the limb or leader) to which the cut should be made?
- *10. How can pruning help develop or discourage fruit and flower production?
- *11. What is the effect of crown thinning on the branches and roots of a tree?
- *12. What is meant by *cleaning out* (BSI) a tree? How does cleaning a tree guard against disease and pests?
- *13. What is *crown thinning* (BSI)? When is it advisable to thin a crown? What is a thinning cut?
- *14. Explain *crown reduction* (BSI). What maintenance problems can result?
- *15. What is *crown restoration* (BSI) or renewal? When is this practice called for?
- *16. What is accomplished by *crown lifting* (BSI)?
- *17. Why is it important to keep one-half of the foliage on the lower two-thirds of the trunk, particularly in young trees?
- *18. What is the objective of pruning a young landscape tree?
- *19. What benefits are achieved by leaving low branches on a young tree?
- *20. What is the effect of pruning a newly planted bare-root tree "to balance root loss"? Why is it often better not to prune trees for this reason?
- *21. Explain scaffold limb development.

BSI (British Standards Institution)

*22. What considerations must be made for structural development of young trees related to:

- a) mature size and use in the landscape, i.e., shade, screen, fruit, specimen;
- b) use of space around tree re: streets, sidewalks, views;
- c) future maintenance.

*23. Explain the advantage of using a hooked anvil type hand pruner or lopper.

*24. What does time of year a tree is pruned have to do with:

- a) bark tearing
- b) plant invigoration
- c) size reduction
- d) corrective pruning
- e) callus development
- f) cold injury
- g) flowering

*25. What precautions should be considered when pruning a tree with an infectious disease?

*26. Why is it unnecessary to paint pruning cuts and other wounds with wound dressing?

SAMPLE TEST QUESTIONS

Circle the best answer.

*1. Where must pruning cuts always be made outside of?

- a) abscission layer
- b) annual ring
- c) branch bark ridge

*2. What does the leaving of lower small branches on a young tree help to do?

- a) Increase trunk taper.
- b) Protect the trunk from summer branch drop.
- c) Reduce insect infestations.

*3. Why is it important to leave one-half of the foliage of the tree on the lower two-thirds of the trunk?

- a) Reduces insect infestations.
- b) Increases trunk caliper.
- c) Reduces height growth.
- d) Increases wind stability.

*4. A strong scaffold branch structure is best developed when a tree is young.

True False

*5. A tree may grow too large for a given site. How should size control be accomplished?

- a) Crown restoration.
- b) Topping.
- c) Stopping or reducing phosphorus fertilization.
- d) Crown reduction.

ANSWERS: 1 - c; 2 - a; 3 - d; 4 - True; 5 - d.

ADDITIONAL READING

BOOKS AND MANUALS

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UNIT 6

WOUNDS AND CAVITIES

INTRODUCTION

Wounds on trees may be the result of normal branch drop, improper pruning, equipment damage, injections, vandalism, or damage by animals and birds. A few small to moderate wounds inflicted on healthy trees are usually of little consequence. Large wounds or those occurring on trees of low vigor or of low resistance to decay can become discolored, begin to decay, and may develop into a cavity. Correct tree care practices can prevent wounds or keep them from becoming troublesome.

This unit will present information concerning tree wounds and a tree's response to being wounded. Treatment of tree wounds and cavities will be discussed.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Summarize compartmentalization with regard to wounding and explain its importance to decay caused by wounds.
- 2. Explain how decay caused by wounds can be detected and minimized.
- *3. Explain factors that affect wounds and wound closure.
- *4. Summarize how wounds should be treated.
- 5. Explain how cavities develop and the likelihood that they will continue to expand into wood formed after the initial wound occurred.
- 6. Summarize how cavities in tree trunks should be treated.

PROCEDURE

- *1. Read Arboriculture, Harris, Chapter 2, pp.25-27; Chapter 14, pp.390-392; Chapter 16, pp.496-514.
- 2. Read A New Tree Biology, Shigo, Chapters 38, 39, 40 and 41.

STUDY QUESTIONS

- *1. Why is a tree described as being highly compartmented?
- *2. Describe the compartmentalization process that takes place in a healthy tree following wounding.
- *3. What determines a tree's ability to compartmentalize wounds?
- *4. How should pruning cuts be positioned to minimize any decay that may occur?
5. What are the ways that decay can be detected?
- *6. What factors will hasten callusing of a wound?
- *7. How should injections be made into tree trunks to minimize injury and the possibility of decay?
- *8. How should wounds through the bark be shaped?
- *9. From the tree's standpoint, why is it not advisable to dress (paint) wounds? For what reason would painting a tree wound be acceptable?
10. Why are termites and ants seldom a problem in cavities?
11. Of what value is the callus roll that may form at the edges of a cavity?
12. How can you determine the extent of a cavity?
13. What may be the problem if wall four is violated when checking for decay, cleaning a cavity or injecting pesticides?
14. As far as tree health is concerned, what is most important if a cavity is to be cleaned?
15. Why should most cavities not be filled?
16. If cavities are to be filled, what are two materials that would be most satisfactory?
17. What is the best way to handle a tree that has:
 - a) a fairly small cavity?
 - b) an extensive trunk cavity?

SAMPLE TEST QUESTIONS

1. Match the tissue on the right with the correct description on the left.

- | | |
|--|------------------------------------|
| _____ a) The strongest barrier against decay in wood present at the time a trunk is wounded. | A. Vertical conducting wood |
| _____ b) The weakest barrier against decay. | B. Xylem rays |
| _____ c) The weakest barrier against physical stress and strain. | C. Wood formed soon after wounding |
| _____ d) The strongest barrier against decay. | D. Springwood in xylem |

*2. True or False (T or F):

- _____ a) Pruning cuts should be made inside the branch bark ridge to minimize the possibility of decay occurring in the main trunk.
- _____ b) Wounds need only be traced in order to remove loose bark.
- _____ c) Wound paints should be used to minimize infection.
- _____ d) The callus roll at the edges of a cavity can add to the structural strength of the wood around the cavity.

ANSWERS:

1(a) - B; 1(b) - A; 1(c) - C; 1(d) - C
2(a) - F; 2(b) - T; 2(c) - F; 2(d) - T

ADDITIONAL READING

BOOKS

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PERIODICAL

Journal of Arboriculture

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UNIT 7

CABLING AND BRACING

INTRODUCTION

Cabling and bracing are used to preserve landscape trees and to prevent extensive damage from occurring when trees do fail.

Cabling is an important and useful tool that every arborist should be familiar with. It is necessary to know and understand the limits of cabling systems. This knowledge enables the arborist to judge when a cabling system may not be appropriate.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

1. Explain when a tree may require cabling or bracing.
2. Summarize the limitations of cabling systems.
3. Explain the necessity of preceding cabling work by thinning the tree to be supported.
4. Summarize the different cabling systems and point out when each is used.
5. Describe the materials used in cabling and their specific purposes.
6. Compare and contrast the use of forged or cast eye bolts and lag eyes over bent or formed eye bolts.
- *7. Explain how to properly install bolts, lags and cables in trees.
8. Summarize how wounds caused by cabling and bracing can be made to minimize tree injury.
9. Explain how to correctly cable or brace:
 - a) weak or split crotch
 - b) weak or heavy horizontal limb
 - c) decayed limbs
 - d) multi-stemmed trees.
10. List the reasons for propping trees.

11. Explain the methods and materials with which trees or limbs are propped, and the advantages and disadvantages of each.
12. State how often cabling and propping systems must be inspected.

PROCEDURE

1. Read Arboriculture, Harris, Chapter 16, pp.481-496.
2. Read A New Tree Biology, Shigo, Chapter 43.

STUDY QUESTIONS

1. Under what circumstances might cabling a tree be recommended?
2. Is the purpose of cabling primarily to hold trees together or to assist in supporting weak branches?
3. How often should cabling and propping systems be inspected?
4. Why is cabling preceded by crown (canopy) thinning a tree?
5. What is a simple, direct cabling system and when is it used?
6. What is a triangular system, when is it used, and how do the cables restrict movement in the tree?
7. What is a box cable system? When is it used, and how do the cables restrict movement in the tree?
- *8. Where should a cable be attached in the tree relative to the crotch of the limb being supported? At what angle should a cable be placed relative to a crotch?
- *9. When supporting a horizontal branch, how should the cable be attached and at what angle?
- *10. Describe the following materials and their specific uses in cabling:

a) eye bolts	e) pre-formed cable tree-grip
b) lag screw hooks	deadends
c) thimbles	f) through-bolts
d) washers and nuts	g) wood screw rod
11. What are the advantages of forged or cast eye bolts and lag eyes over bent or formed eye bolts?
12. Why are diamond shaped washers no longer recommended when installing bolts in trees?

- *13. What size holes should be drilled for lags? For bolts?
- *14. At what angle should lags and bolts be inserted into tree limbs?
- *15. Why should lags and bolts be in direct line with the cables attached to them?
- *16. Explain the importance of balancing the relative strengths of the bolting and the cabling materials in a cabling system.
- 17. Explain the use of seven-strand cable, and extra high strength cable.
- *18. What is the proper way to eye splice seven-strand cable during installation?
- *19. What are pre-formed tree-grip deadends? How and when are they used in cabling trees?
- *20. Why are cable bolts (U-bolts) not recommended for attaching cables to trees?
- 21. Under what conditions are turnbuckles considered to be a weak link in cabling systems, and why?
- 22. When are threaded wood screw rods used in trees?
- 23. In what situations are through-bolts recommended over threaded wood screw rods, and why? In what situations are threaded rod bolts recommended over through-bolts, and why?
- 24. When gusty winds are a factor, where should rods be placed to provide the greatest stability for a weak crotch?
- 25. What considerations should be taken into account when propping trees?
- 26. What is the importance of movement within a limb or trunk in developing its strength?
- 27. Point out the advantages and disadvantages of using the following materials for propping limbs or trees:
 - a) metal props
 - b) wood props
 - c) curved cradles or forks
 - d) through-bolts.

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. When installing lag screws and cables, care should be taken to make sure the cable is in line with the screw.

True

False

*2. When cabling a limb which is decayed, what is the proper hardware to use called?

- a) J-lag screws
- b) Threaded rods
- c) Forged eye bolts

3. What shape should the washers be when installing through-bolts?

- a) round
- b) diamond
- c) square

ANSWERS: 1 - True 2 - c 3 - a

ADDITIONAL READING

BOOKS AND MANUALS

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UNIT 8

SAFE WORK PRACTICES

PERSONAL SAFETY

INTRODUCTION

SAFETY BEGINS AND ENDS WITH THE TREE WORKER. The goal of safety in tree work is to recognize the hazards inherent in the equipment used and the many operations required to maintain the health of trees.

Basic to all operations in tree care is the Tree Worker. Considering the Tree Worker as the most important tool, this section of safety devotes itself to the care and maintenance of you--the Tree Worker.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Explain what parts of the body are under the most stress in tree care and how to avoid injury during normal working procedures.
- *2. Describe the types and characteristics of both clothing and personal protective equipment essential to safety.
- *3. Explain how proper nutrition and care of the body is as essential to personal safety as clothing and other safety practices.
- *4. Identify laws that have been written for the protection of the Tree Worker and the employer (or employee). Explain how these laws apply to you and your employer (or employees).
- *5. Describe the symptoms of and means to prevent and treat heat exhaustion and muscle cramps.

PROCEDURE

- *1. Read Operating and Safety Instructions for each of the following pieces of equipment: chain saw; brush chipper; aerial lift; stump grinder.
- *2. Read a basic First Aid book (see heat exhaustion and muscle cramps).

- *3. Read American National Standard for Tree Care Operations, ANSI Z133.1-1988, American National Standards Institute Inc. (see Appendix of the Standard, too).
- *4. Read the British Columbia Industrial Health and Safety Regulations (13.21, 13.93 and Section 14), the Oregon Occupational Safety and Health Code, or the Washington Industrial Health and Safety Code.

STUDY QUESTIONS

- *1. Identify the limitations of the back in lifting and describe how to lift heavy objects to avoid back injury.
- *2. Describe the symptoms of heat exhaustion, how to prevent and treat it.
- *3. What causes muscle cramps? What can be done to prevent them and how are they treated?
- *4. When should eye protection be worn?
- *5. When and what type of hearing protection should a tree worker wear?
- *6. Explain why proper clothing is essential to safety. Describe proper or adequate clothing under:
 - a) mild weather conditions
 - b) cold conditions
 - c) hot conditions.
- *7. Name three qualities of a proper work boot for tree work.
- *8. What is an approved hard hat? When does a tree worker wear a hard hat and when is one not worn?
- *9. Know the advantages and disadvantages of wearing gloves. Name three tree care operations that require the use of gloves.
- *10. Describe the importance of proper nutrition to safety.
- *11. What constitutes an adequate lunch?
- *12. Name the best liquids for consumption during heavy work in hot weather.
- *13. Will coffee or other caffeine-containing drinks increase energy and quench thirst?
- *14. Describe the effect nicotine has on circulation and how this may relate to safety as a tree worker.
- *15. Name the effects of sleep deprivation on the body's system.
- *16. Name three effects that alcohol has on the body's system.

- *17. Explain the importance of "warming up" before climbing or lifting.
- *18. Describe the characteristics of an appropriate saddle belt or safety belt used when climbing a tree.
- *19. How serious does an injury have to be for it to be reported to your foreman, supervisor or employer?
- *20. Why should every employee know the name, address and phone number of the emergency treatment centers in their area?
- *21. What is Workers' Compensation? Who is required to carry it?

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. Ear muffs and ear plugs are approved hearing protection devices.

True

False

- *2. What is the work situation that would most require the use of a hard hat?

- a) Climbing.
- b) Groundman during a removal.
- c) Chipping brush.
- d) During all tree care operations, regardless of duty.

- *3. While sharpening your chainsaw, you slip and cut your finger on the chain. You take a bandaid from the first aid kit on the truck and finish the day. It is no big deal and will heal without any problem. Should you report it or forget it because you are not hurt badly?

a) report it

b) forget it.

ANSWERS: 1 - True; 2 - b; 3 - a.

ADDITIONAL READING

BOOKS AND MANUALS

Back Talk. 1987. Richmond, B.C.: Workers' Compensation Board of British Columbia.

Fallers' and Buckers' Handbook. 1981. Richmond, B.C.: Workers' Compensation Board of British Columbia.

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TREE CLIMBING

INTRODUCTION

Safe work methods must integrate physical work tasks and safety training. Tree workers readily identify with work tasks as opposed to what often becomes a separate program of safety training. Physical work tasks and safety are synonymous and must not be separated. As an example, climbing a tree is a work task; how to enter the tree is a method that involves safety. It is effective training in job planning and controlling of methods that reduces accidents. If workers are trained to plan and control, they are essentially managing their work methods. *ACCIDENTS ARE UNPLANNED EVENTS THAT ARE USUALLY THE RESULT OF HUMAN ERROR AND ATTITUDE.* By emphasizing personal planning and control in the work environment, human error will be minimized.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Identify the six most commonly used methods of entering a tree.
- *2. Distinguish obscure and obvious hazards and safety precautions to take during tree entry and climbing.
 - a) Tree entry - footlocking, body thrust, aerial lifts, free climbing, spurs, ladders.
 - b) In tree movement - tie-in location, reties and transfers, rigging of bull ropes, chain saws and other small tools.
- *3. Describe the minimum requirements for proper storage, size, breaking strength and durability of climbing ropes.
- *4. Summarize basic procedures for working around electrical hazards.
 - a) Name whom to call.
 - b) Define an energized conductor (hot wire).
 - c) Identify a high-voltage line and its approximate voltage.
 - d) Point out the difference between direct and indirect contact of conductors.

*5. Explain how to rescue an injured climber:

- a) using rope and saddle
- b) using an aerial device
- c) when contact with an electrical conductor has been made.

PROCEDURE

Very few references exist on the topic of tree climbing and safety. To assist the student, answers are provided for the study questions. Further reading of reference material and on-the-job training will be necessary, however, to answer all questions correctly.

- *1. Read American National Standards for Tree Care Operations, ANSI Z133.1-1988, American National Standards Institute Inc.
- *2. Read the British Columbia Industrial Health and Safety Regulations (14.30, 14.50, 24.08), the Oregon Occupational Safety and Health Code or the Washington Industrial Health and Safety Code (see Tree Trimming Near Energized Conductors).

STUDY QUESTIONS

*1. Identify the six most commonly used methods of entering a tree.

- a) high lifts (mechanical aerial devices)
- b) footlocking (rope climbing)
- c) body thrust (pulling oneself up)
- d) tree climb (climbing limbs)
- e) spurs (using tree climbing spurs)
- f) ladders (using ladders to enter the tree).

*2. What are the obscure and obvious hazards associated with each tree entry method?

Obscure - All entry methods (Remember, accidents are unplanned events. It's usually those obscure hazards that cause safety problems.):

- a) use of improper personal and mechanical equipment
- b) lack of pre-job planning and control plan for hazards
- c) lack of mental alertness
- d) fatigue: lack of physical conditioning and training
- e) not warming up prior to climbing.

Obvious - Hazards associated with the six most popular methods of tree entry:

- a) Aerial lifts - electrical conductors, unstable surface for outrigger pads, hydraulic leaks, weak cables, lack of safety line in the bucket, improper bucket entry from the tree, lack of aerial rescue procedure.
- b) Footlock - improper size rope, obstructions or sharp stubs, brush and limbs, electrical conductors, difficulty in dismounting the rope, lack of training in on-rope methods.
- c) Body thrust - improper size rope, improper rope angle, obstructions of sharp stubs, brush and limbs, electrical conductors, difficulty in dismounting on a limb, lack of assistance from ground worker.
- d) Free climb - loose or slippery bark, weak limbs, sharp stubs, decayed trunk areas, electrical conductors, improper body weight distribution, improper clothing.
- e) Spurs - improper shank length, dull shanks, weak straps, climbing around limbs, unsnaps and resnaps with tag and climbing lines, loose bark, obstructions, sharp stubs, brush nails, wire and electrical conductors.
- f) Ladders - electrical conductors, unstable ground surface, uneven ground surface, ladder to limb angle.

*3. What are the hazards associated with an improper tie-in location?

- a) The tie-in location should be at a height of at least three times the distance out from the trunk of the tree. This is known as the work area ratio.
- b) A minimum rope angle from the tie-in location to work area causes balance problems for the climber.
- c) Recovery time from a slip-off of a limb is usually not adequate to hit the trunk feet first if the rope angle is not proper or at about a three to one ratio.

*4. What are the hazards associated with reties and location changes in the tree?

- a) The climber must never be untied. A safety or flip line must be used when retieing and recrotching the climbing line.

*5. What are the hazards associated with the use of bull ropes in the tree?

- a) Bull rope may cross over the climbing line when roping off limbs.
- b) Narrow crotch that may cause the bull rope to hang up.
- c) Improper selection of knots.
- d) Communication problems with the ground worker.
- e) Improper size bull rope.

- *6. What are the hazards associated with the use of a chain saw in the tree?
- a) Chain saws that weigh more than fifteen pounds (6.8 kg) and are not supported by a separate line.
 - b) Improper footing or position when starting the saw.
 - c) Improper adjustment of idling speed.
 - d) Kickback of saw.
- *7. What are the hazards associated with electrical conductors?
- a) Direct contacts b) Indirect contacts c) Lack of job planning
- *8. What steps are taken when performing an aerial rescue using a rope and saddle?
- *9. What steps are involved in rescuing an injured worker who is in an aerial lift bucket?
- *10. What steps are taken to rescue a worker who has contacted an electrical conductor and is unconscious in the tree?

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. What do you do before entering any tree?
- a) Identify potential hazards.
 - b) Throw a climbing rope into the tree.
 - c) Safety check tree entry equipment.
- *2. What do you do next?
- a) Identify potential hazards.
 - b) Check the gas in the chain saw.
 - c) Safety check tree entry equipment.
- *3. Which one of the following is an obscure safety hazard?
- a) Vehicular traffic is heavy.
 - b) Lack of pre-job planning and control plan for hazards.
 - c) Pedestrian traffic is heavy.
 - d) Many children are playing in work area.

- *4. What is the most important safety precaution used in tie-in transfers or reties in the tree?
- a) Allow for free movement.
 - b) Remain tied-in.
 - c) Be able to shinny.
- *5. What type of hazard is created by an improper rope angle from tie-in location to work area?
- a) The taut line hitch slips.
 - b) Too much slack in the climbing line.
 - c) Balance problems for the climber.
 - d) The ground worker cannot reach the rope.
- *6. Whom do you call first when working around electrical conductors?
- a) The systems operator.
 - b) Workers' Compensation.
 - c) Your employer.

ANSWERS: 1 - a; 2 - c; 3 - b; 4 - b; 5 - c; 6 - a.

ADDITIONAL READING

BOOKS AND MANUALS

Bridgeman, P.H. 1976. Tree Surgery. London, England: David and Charles.

Yeatman, C.W. and T.C. Hieman. Safe Tree Climbing in Forest Management. Fisheries and Environment Canada. Forestry Service - Technical Report 24.

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CHAIN SAW SAFETY

INTRODUCTION

The chain saw is as basic to modern tree care as the rope and saddle. Modern chain saw technology has reduced the saw weight considerably and, simultaneously, has increased power. Automatic oiling of the chain, and a reduction in vibration are important design improvements.

Unfortunately, if the chain saw is not used by a competent worker who, through training, has learned the necessary handling skills, the user will be exposed to serious injury, either from losing control of the falling tree or the saw itself. Central to the theme of this section is the concept that *THERE IS NO SUCH THING AS A MINOR CHAIN SAW WOUND*. The best treatment for chain saw injury is **PREVENTION**.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Describe the major parts of a chain saw and their functions.
- *2. Describe the proper way to carry a chain saw:
 - a) on level ground
 - b) uphill
 - c) by vehicle.
- *3. Describe the kinds of clothing and other protective gear which should be worn when working with a chain saw.
- *4. Explain how to safely start a chain saw.
- *5. Explain what is meant by "kickback". What causes it, and how can it be avoided?
- *6. Summarize the importance of correct chain saw maintenance and what is involved in such maintenance.
- *7. Explain how to properly sharpen a chain. Explain the purpose and function of cutter teeth and the depth gauge.
- *8. Summarize the basic procedure for a simple felling task, including the sequence and the names and purpose of the cuts made.
- *9. Summarize how tension wood and compression wood might affect safe bucking procedures.
- *10. Identify when chain saws should be supported from a separate line when working in a tree.
- *11. Describe the proper method to buck logs lying on a slope.
- *12. Explain the following terms:
 - a) a safe wedge
 - b) saw vibration
 - c) chain tension
 - d) spark arrester muffler
 - e) compression release

PROCEDURE

- *1. Read operating and safety instructions for a chain saw (owner's manual).
- *2. Read American National Standards for Tree Care Operations, ANSI Z133.1-1988, American National Standards Institute, Inc.
- *3. Read the British Columbia Industrial Health and Safety Regulations (14.04 and 16.130), the Oregon Occupational Safety and Health Code or the Washington Industrial Health and Safety Regulations (see Chainsaws).

STUDY QUESTIONS

- *1. Describe the main parts of a chain saw.
- *2. Describe the proper way to carry a chain saw.
 - a) on level ground b) uphill c) in a vehicle
- *3. Describe the function and necessity of hearing protection.
- *4. When is the use of protective leg devices required?
- *5. List proper clothing for use with a chain saw in fair weather.
 - a) head gear b) clothing c) footwear
- *6. What is meant by "drop starting"?
- *7. Describe the safe procedure for starting a large chain saw.
- *8. Where is the thumb put in relationship to the forward handle on a chain saw?
- *9. What is "kickback"?
- *10. Why should gloves be worn when sharpening a chain?
- *11. Name a material that makes a safe wedge for use with a power saw.
- *12. What effect can excessive saw vibration have on the operator?
- *13. Explain the importance of proper chain tension.
- *14. Explain the hazards inherent with use of a dull or improperly sharpened chain.
- *15. Explain the purpose of a spark arrester muffler.
- *16. When should power saws be supported from a separate line when working aloft?
- *17. Describe some daily procedures for chain saw maintenance.

- *18. When bucking logs on a slope, on which side should the worker stand: uphill or downhill?
- *19. What is a compression release?
- *20. What is the function of the depth gauge on the chain?
- *21. What is the "face cut" in falling a tree? (felling notch)
- *22. What is the "back cut" in falling a tree? (felling cut)
- *23. Where is the "hinge" located when falling a tree?

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. It is acceptable when using a chain saw weighing less than fifteen pounds, (6.8 kg) to hang it from the climbing saddle via a saw lanyard.

True
False
- *2. What is the name of the first cut made when falling a tree?

a) back
b) face
c) hinge
- *3. When bucking logs on a slope, a worker should stand downhill from the logs.

True
False

ANSWERS: 1 - True; 2 - b; 3 - False.

ADDITIONAL READING

MANUALS

Chainsaw Safety Manual. n.d. Waiblingen, West Germany: Andreas Stihl.

Fallers' and Buckers' Handbook. 1981. Richmond, B.C.: Workers' Compensation Board.

Oregon Sawchain Maintenance and Safety Manual. 1986. Guelph, On.: Omark Canada.

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MOBILE EQUIPMENT

INTRODUCTION

Tree care is an increasingly mechanized profession. Mobile equipment greatly increases production and reduces the worker's physical effort. The goal in safe operation of mobile equipment is an understanding of how it works and what must be done to maintain control.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Identify the standard that requires all equipment, regardless of type, to be equipped and operated in compliance with manufacturer's operating instructions.
- *2. Explain the safety precautions needed for the following:

a) exposed drive belts and gears	e) storage of equipment
b) mufflers and exhaust pipes	f) storage of gasoline and oil
c) aerial lift equipment	g) unmanned vehicles
d) detection of hydraulic leaks.	
- *3. Describe the procedure used to back and park trucks and trailered equipment.
- *4. Describe the proper way to secure parked and unattached trailered equipment.
- *5. Explain the safety procedures for setting up hoisting or lifting equipment.
- *6. Explain why manufacturers' recommended maintenance procedures should be followed.
- *7. Explain how to determine what the maximum capacity of a crane or aerial lift is.

PROCEDURE

- *1. Read operating and safety instructions for an aerial lift device (owner's manual).
- *2. Read American National Standards for Tree Care Operations, ANSI Z133.1-1988, American National Standards Institute, Inc.
- *3. Read the British Columbia Industrial Health and Safety Regulations (sections 26 and 32.36), the Oregon Occupational Safety and Health Code or the Washington Industrial Health and Safety Regulations (see Mobile Equipment: Elevating Work Platforms).

STUDY QUESTIONS

- *1. Should exposed drive belts and pulleys or gears be guarded, and why?
- *2. Why should trucks with obscured rear vision or trucks backing trailered equipment be moved only with outside guidance?
- *3. How should equipment and material be stored on a truck for transportation? Why should ropes and gasoline be stored in separate compartments?
- *4. How does a worker determine what the maximum lifting capacity of a crane or aerial lift is?
- *5. When, where and how are outrigger feet and pads to be used for safe operation of an aerial lift device?
- *6. Is it a safe practice to locate hydraulic leaks by feeling for them with your hands? Why?
- *7. Why should ignition keys be removed from equipment when left unattended?
- *8. What is the proper procedure for parking unattached trailered vehicles?

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. You are putting tools away at the end of the day. The tool boxes are such that they go up with the bed when the truck dumps. Where do you put the gas and oil?
 - a) In the front box with the ropes.
 - b) By itself in the rear lowest box.
 - c) In the cab of the truck.

- *2. It is acceptable to back a chipper down a driveway without guidance if the truck is equipped with large mirrors on both sides.

True

False

- *3. You are using a hydraulic pruner in the aerial lift. You notice a pin hole leak in the hose. Since it is such a small leak, you put your hand over it to see if it is under pressure.

True

False

ANSWERS: 1 - b; 2 - False; 3 - False.

ADDITIONAL READING

MANUALS

Manual for Aerial Lift Operation, Maintenance, Installation, Parts. n.d. Chalfont, Pa.: Asplundh Manufacturing Division, Asplundh Tree Expert.

* * * * *

BRUSH CHIPPER SAFETY

INTRODUCTION

Brush chippers, like chain saws, are a tremendous boon to tree care. They also have the potential to maim and/or kill. Knowledge and understanding are the keys to safety. *NOTHING IS SAFE IF IT IS MISUSED.*

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

- *1. Summarize the basic rules of safety which apply to chipping machines that are unattended, prior to start-up and during operation.
- *2. Explain the function and purpose of traffic cones and signs and their proper use.

- *3. Describe the proper way to attach a chipper (or any trailered vehicle) to a truck.
- *4. Describe when eye protection is required during chipper use.
- *5. Describe the correct position and tools for the operator to assume and use when feeding a brush chipper.
- *6. Explain how to inspect chipper blades and general safety procedures to follow when changing chipper blades.

PROCEDURE

- *1. Read operating and safety instructions for a brush chipper (owner's manual).
- *2. Read American National Standard for Tree Care Operations, ANSI Z133.1-1988, American National Standards Institute, Inc.
- *3. Read the British Columbia Industrial Health and Safety Regulations (sections 16.126, 16.130, and 52), the Oregon Occupational Safety and Health Code, or the Washington Industrial Health and Safety Regulations (see Traffic Control and Mobile Chippers).

STUDY QUESTIONS

- *1. When should traffic cones be used to define a work area? How should they be placed?
- *2. When should eye protection be worn when using a chipper?
- *3. What is the safest position for the operator to assume when feeding a brush chipper?
- *4. Why should chipper blades be covered by a guard during blade changing?
- *5. With what parts of the body may the operator touch the feed table during chipping operations?
- *6. What should the operator use to push brush through the chipper? Will a pitchfork or scoop shovel work?

SAMPLE TEST QUESTIONS

Circle the best answer.

- *1. When hooking safety chains from the chipper to the truck, the chains should be crossed underneath the tongue to form a cradle.
- True False
- *2. You are chipping maple brush and the brushy ends keep catching on the sides of the hopper without going through the rotor. What do you do to push the brush through?
- a) Use your hands.
 b) Use a forked stick about four feet (1.2 m) long, or the next long piece of brush.
 c) Use a pitchfork, broom or aluminum scoop shovel very carefully.
- *3. A blade guard is vital when installing sharp blades but not necessary when removing dull blades, since they can't hurt you anyway.
- True False

ANSWERS: 1 - True; 2 - b; 3 - False.

ADDITIONAL READING

MANUALS

Brush Bandit Brush Chipper Operating and Parts Manual. n.d. Chalfont, Pa: Asplundh Manufacturing Division, Asplundh Tree Expert.

Eger Beaver Operating Manual. n.d. Winn, Mi.: Morbark Industries.

Whisper Chipper Operation, Maintenance and Repair Parts Manual. n.d. Chalfont, Pa.: Asplundh Manufacturing Division, Asplundh Tree Expert.

UNIT 9

DIAGNOSING COMMON TREE PROBLEMS

INTRODUCTION

Determining the cause of tree problems requires close observation of symptoms and considerable training and experience. It begins with simple observation of a well-known problem of a specific tree and ends with a thorough understanding of the complexities which may befall a tree in its location. Diagnosing plant problems is a skill that is never completely mastered.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

1. List tools necessary to properly diagnose tree problems.
2. Prepare a diagnostic checklist.
3. Describe symptoms and recommendations for the following problems related to the soil or roots:
 - a) impervious soil coverings and fill soils
 - b) poor drainage
 - c) gas injury
 - d) loss of roots
 - e) drought
 - f) girdling roots
 - g) leaf scorch
 - h) leaf chlorosis
 - i) animal damage
4. Describe the symptoms and recommendations for the following non-infectious disorders:
 - a) air pollutants
 - b) herbicide injury
 - c) salt injury
 - d) injury from chemical sprays
 - e) lawnmower injury
 - f) vandalism
 - g) staking problems
 - h) ice and wind damage

5. Identify the symptoms of some diseases NOT specific to one kind of plant, such as:
 - a) Verticillium wilt b) Armillaria root rot c) powdery mildew
 - d) Phytophthora root rot e) Anthracnose f) scab

6. Identify the symptoms of some insect problems NOT specific to one kind of plant, such as:
 - a) scales b) aphids c) mites d) root weevils
 - e) caterpillars f) wood borers g) cypress tip moth

7. Identify and compare the symptoms of some of the more common problems of trees and shrubs. Examples:
 - a) leaf spots
 - b) crown gall
 - c) fire blight
 - d) brown rot
 - e) wetwood/slime flux
 - f) viral diseases
 - g) mistletoes

PROCEDURE

1. Read Arboriculture, Harris, Chapters 17, 18, 19 and 20.
2. Pacific Northwest Disease Control Handbook. 1989. Extension Services of Oregon State University, Washington State University, and the University of Idaho.
3. Pacific Northwest Insect Control Handbook. 1989. Extension Services of Oregon State University, Washington State University, and the University of Idaho.
or
Nursery, Greenhouse Vegetable and Ornamental Production Guide for Commercial Growers. October 1988. Text by B.C. Ministry of Agriculture and Fisheries, co-sponsored by the Crop Protection Institute of Canada (B.C. Council) and co-published by Coast Agri Fertilizers Ltd. Crop Products Division.

STUDY QUESTIONS

1. Describe several procedures (activities) which should be undertaken before the problem tree is inspected.
2. Describe differences between symptoms of problems caused by disease and those caused by insects.
3. How might changes in grading or topography affect a tree?

4. Describe the symptoms of phenoxy-herbicide contamination.
5. Describe the danger of making a quick diagnosis when one problem is very obvious.
6. When would a Verticillium wilt problem be suspected?
7. How do the symptoms of Phytophthora root rot differ from those of *Armillaria mellea*?
8. Describe how you would know if the cause of the problem was due to one of the following:
 - a) aphids
 - b) scales
 - c) root weevils
 - d) leaf scorch
 - e) powdery mildew
 - f) Anthracnose
 - g) tightly staked tree
 - h) soil compaction
 - i) mite injury on leaves/needles

SAMPLE TEST QUESTIONS

Circle the best answer.

1. A soil auger, pocket knife, hand lens and a shovel are essential tools to aid in diagnosing tree problems.

True
False
2. What is the first question to ask when a tree problem occurs?
 - a) What kind of tree is it?
 - b) Where is the tree located?
 - c) How old is the tree?
3. What is an important way to determine whether growth is normal as compared with a non-affected tree?
 - a) Length of last year's shoots.
 - b) Appearance of the bark.
 - c) Angle of the branches.
4. The presence of exit holes, frass and engraving indicate the presence of which problem?

a) insect
b) disease
c) environmental

5. Which one of the following could cause a non-infectious disorder to occur?

- a) root weevils
- b) nutrient excesses
- c) Phytophthora root rot

6. Bleached outer foliage on the upper and southwest side of some plants is often caused by Anthracnose.

True

False

ANSWERS: 1 - True; 2 - a; 3 - a; 4 - a;
 5 - b; 6 - False

ADDITIONAL READING

BOOKS AND MANUALS

Agrios, George N. 1988. Plant Pathology. 3rd ed. New York, N.Y.: Academic Press.

Bega, Robert V., Tech. Coord. 1979. Diseases of Pacific Coast Conifers. USDA Forest Service, Agricultural Handbook No. 521.

Blanchard, Robert O. and Terry A. Tattar. 1981. Field and Laboratory Guide to Tree Pathology. New York, N.Y.: Academic Press.

Foster, R.E. and G.W. Wallis. 1974. Common Tree Diseases of British Columbia. Ottawa, On.: Canadian Forestry Service.

Furniss, R.L. and V.M. Carolin. 1977. Western Forest Insects. Washington, D.C.: USDA For. Service, Misc. Publication No. 1339.

Hepting, George H. 1971. Diseases of Forest and Shade Trees of the United States. Washington, D.C.: USDA For. Serv. Agricultural Handbook No. 386.

Johnson, Warren T. and Howard H. Lyon. 1988. Insects That Feed on Trees and Shrubs, An Illustrated Practical Guide. 2nd ed. Ithaca, N.Y.: Cornell University Press.

Manion, P.D. 1981. Tree Disease Concepts. Englewood Cliffs, N.J.: Prentice Hall.

Phillips, P.H. and D.A. Burdakin. 1982. Diseases of Forest and Ornamental Trees. London, England: MacMillan.

Pirone, P.P. 1978. Diseases and Pests of Ornamental Plants. 5th ed. New York, N.Y.: John Wiley.

Recognition and Life History of the Major Insect and Mite Pests of Ornamental Shrubs and Shade Trees of British Columbia. 1974. Victoria, B.C.: Province of B.C., Department of Agriculture.

Sinclair, W.A., Lyon, H.H. and W.T. Johnson. 1987. Diseases of Trees and Shrubs. New York, N.Y.: Cornell University Press.

Tattar, Terry A. 1978. Diseases of Shade Trees. New York, N.Y.: Academic Press.

PERIODICALS

Journal of Arboriculture

Allen, D.C. 1984. Environmental Effects of Insect Defoliation. Volume 10, No. 4:97-103.

Anderson, J.L., Campana, R.J., Shigo, A.L. and W.C. Shortle. 1985. Wound Response of *Ulmus americana* - Results of Chemical Injection in Attempts to Control Dutch Elm Disease. Volume 11, No. 5:137-142.

Houston, D.R. 1985. Dieback and Declines of Urban Trees. Volume 11, No. 3:65-69.

Kozlowski, T.T. 1985. Soil Aeration, Flooding, and Tree Growth. Volume 11, No. 3:85-96.

Kozlowski, T.T. 1985. Tree Growth and Response to Stress. Volume 11, No. 3:97-111.

Kozlowski, T.T. 1986. The Impact of Environmental Pollution to Shade Trees. Volume 12, No. 2: 29-32.

Moorman, G.W. 1985. Scheduling Woody Ornamental Plant Disease Management. Volume 11, No. 1:22-24.

Wargo, Philip M. 1981. Defoliation and Secondary-Action Organism Attack: With Emphasis on *Armillaria mellea*. Volume 7, No. 3:64-69.

UNIT 10

IDENTIFYING HAZARD TREES

INTRODUCTION

Any tree or part of a tree that is a high risk upon failure or fracture for damage or injury to property, powerlines or people is a hazard tree. *A TREE DOES NOT HAVE TO BE HEAVILY DECAYED TO BE A HAZARD TREE.* Trees and their parts fail in one of three ways: they may overturn at the roots; the branches may fracture; or the trunk may fail.

OBJECTIVES

Be able to, without reference notes, answer correctly seventy percent of the test questions based on the following objectives:

1. Define what constitutes a hazard tree.
2. Describe the three basic ways a tree and its parts may fail.
3. Describe four ways live branches may fall from trees.
4. Summarize the non-pathological causes of tree failure.
5. Summarize the pathological causes of tree failure.
6. Describe the warning signs that indicate potential branch failure.
7. Describe the warning signs that indicate potential trunk failure.

PROCEDURE

1. Read A New Tree Biology, Shigo, Chapters 14, 34, 35, 36 and pp.553-554.
2. Read A New Tree Biology Dictionary, Shigo, p.53.
3. Read Tree Hazards in Recreation Sites of British Columbia, Wallis, Morrison and Ross.

STUDY QUESTIONS

1. What is a hazard tree?
2. Describe the three basic ways a tree may fail.
3. Why might a recent edge tree be a potential hazard tree?

4. Why are cracks a major indicator of a potential hazard tree?
5. Why are vertical cracks, especially when they are in opposite sides of a tree, indicators of serious trouble?
6. What are some examples of the non-pathological causes of tree failures?
7. What are some examples of the pathological causes of tree failures?

SAMPLE TEST QUESTIONS

Circle the best answer.

1. Recent edge trees are susceptible to root, trunk and branch failure.

True
False
2. Which one of the following is a non-pathological cause of tree failure?

a) dwarf mistletoe
b) canker
c) forked stems

ANSWERS: 1 - True; 2 - c.

ADDITIONAL READING

BOOKS

Robbins, Katharine. 1986. How to Recognize and Reduce Tree Hazards in Recreation Sites. NA-FR-31. North East Region U.S.F.S.: U.S. Forest Service.

PERIODICALS

Journal of Arboriculture

Shigo, Alex L. 1989. Branch Failures: A Closer Look at Crack Drying. Volume 15, No.1:11-12.

APPENDIX S

SAMPLE EXAMINATION QUESTIONS

**PACIFIC NORTHWEST CHAPTER
INTERNATIONAL SOCIETY OF ARBORICULTURE
ARBORIST CERTIFICATION EXAMINATION**

196

Candidate Name:

Address:

Telephone: Date:

Guidelines

1. This examination consists of 200 multiple choice and true/false questions.
2. A score of at least 70% in each of the following categories is required to pass this examination:

Category I - 50 questions (10 questions are specimen identification)
Tree Morphology, Anatomy and Physiology
Tree Identification and Selection

Category II - 50 questions
Pruning

Category III - 40 questions
Cabling and Bracing
Safe Work Practices

Category IV - 30 questions
Planting and Early Care
Soil Management

Category V - 30 questions
Wounds and Cavities
Diagnosing Common Tree Problems
Identifying Hazard Trees

3. Time allowed 3.5 hours.

Instructions

1. **Circle** the best answer, from the multiple choice alternatives given, directly on the examination sheet.
2. **Circle** true or false directly on the examination sheet.

Examination Designed
by Susan M. Murray, P.Ag.

CATEGORY I**Tree Morphology, Anatomy and Physiology
Tree Identification and Selection**

1. What part of the root absorbs water and mineral elements?
 - a) cap
 - b) hairs
 - c) meristem
 - d) pith
 - e) cortex

2. What is the name of the root on a mature tree which grows downward providing stability to the tree canopy?
 - a) heart
 - b) primary
 - c) fibrous
 - d) adventitious

3. Which one of the following is a part of the mesophyll of a leaf?
 - a) parenchyma
 - b) guard cell
 - c) cuticle
 - d) stomata

4. Which one of the following cells is a part of the vascular tissues of a leaf?
 - a) epidermis
 - b) palisade
 - c) phloem
 - d) chloroplast

5. Which one of the following best describes a dormant terminal bud?
 - a) inactive bud on a one-year-old twig
 - b) inactive bud that is two years old
 - c) inactive bud that is three years old
 - d) inactive accessory bud

6. Which one of the following structures is found on a dormant shoot?
 - a) latent or suppressed axil
 - b) pedicel
 - c) radicle
 - d) bundle scar
 - e) receptacle

CATEGORY II**Pruning**

51. When two identical trees are pruned in early summer, one by heading back and one by thinning, at the end of the growing season what would the thinned tree exhibit?
- a) greater new shoot growth
 - b) slower callus formation
 - c) more leaf chewing pests
 - d) less new shoot growth
52. When selecting hand pruners, what do you look for to enable you to make a good pruning cut?
- a) a strong return spring
 - b) a broad hand anvil that will not chip
 - c) a curved or hooked anvil
 - d) insulated handles for winter tree work
53. Where should the anvil or stationary part of pruning shears be placed in relation to the branch when pruning small trees?
- a) on the upper side
 - b) on the lower side
 - c) it does not really matter
54. What type of cut is the removal of a lateral branch to its point of origin called?
- a) orchard
 - b) heading
 - c) thinning
 - d) shearing
55. Where is a proper pruning cut located in relation to the branch bark ridge?
- a) close to its outer edge
 - b) close to but inside it
 - c) through it
 - d) into the center of it
56. What is the response of a young plant to pruning?
- a) the top and roots will be larger than if the plant had not been pruned
 - b) there will be more stored carbohydrates
 - c) the plant will have a larger total leaf area for photosynthesis
 - d) dwarfing may occur

CATEGORY III**Cabling and Bracing
Safe Work Practices**

101. Which one of the following cabling systems joins the large branches of a multistem tree and allows a limited range of movement of the individual limbs?
- a) triangular
 - b) simple direct
 - c) rotary
 - d) multiple direct
102. Where should a cable be attached in a tree relative to the crotch of the weak horizontal branch being supported?
- a) 1/3 of the branch's length from the crotch
 - b) 2/3 of the branch's length from the crotch
 - c) 1/4 of the branch's length from the crotch
 - d) 1/2 of the branch's length from the crotch
103. When supporting a heavy horizontal limb, at what angle should the cable be attached?
- a) the cable and limb should form an angle of at least 30 degrees
 - b) the cable and limb should form an angle of at least 45 degrees
 - c) the cable and limb should form an angle of at least 60 degrees
 - d) the cable and limb should form an angle of at least 90 degrees
104. What is the advantage of drop-forged eye bolts over formed eye bolts?
- a) greater tensile strength
 - b) greater compressive strength
 - c) greater resistance to contraction stresses
 - d) greater resistance to rusting
105. What size holes should be drilled for lag screws in comparison to the lag diameter?
- a) 1/2 inch (12.5 mm) smaller
 - b) 1/4 inch (6.25 mm) smaller
 - c) 1/8 inch (3 mm) smaller
 - d) 1/16 inch (1.5 mm) smaller

CATEGORY IV**Planting and Early Care
Soil Management**

141. Which part of a deciduous, container-grown tree being held for planting is the most sensitive to the sun?
- a) branches
 - b) bark
 - c) trunk
 - d) rootball
142. In what condition should the tops of bare-root trees be maintained prior to planting?
- a) dormant
 - b) actively growing
 - c) just beginning to grow
 - d) senescent
143. How deep should trees be planted in a clay loam soil as compared to their depth, as previously grown in the nursery?
- a) the same depth
 - b) slightly higher
 - c) slightly lower
144. Which one of the following is the best reason to prune newly planted trees, in an irrigated setting, at planting?
- a) to reduce the top in relation to the reduced root system
 - b) to stimulate tree growth
 - c) to improve tree structure
 - d) to reduce the number of terminals to encourage root growth
145. When planting a balled and burlapped (B & B) tree, what is the best reason to remove or bury the burlap sack so it does not protrude above the soil surface?
- a) it interferes with the movement of surface runoff
 - b) while the micro-organisms decompose it, the sack competes with the tree for nitrogen
 - c) it acts like a wick, drying the soil under the ball
 - d) it is unattractive

CATEGORY V**Wounds and Cavities
Diagnosing Common Tree Problems
Identifying Hazard Trees**

171. Rapid callusing, which is important to wound closure, occurs under which one of the following conditions?
- a) wound is large with a pointed apex
 - b) wound is wide with few peninsulas of live bark
 - c) wound is located directly above a vigorous root
 - d) wound is located below a sunken spot on the trunk
172. How can tree wounds and decay resulting from the injection of chemicals be minimized?
- a) make holes moderately wide and deep
 - b) drill holes annually
 - c) drill subsequent holes directly above old holes
 - d) drill holes at the groundline
173. A thin coat of asphalt wound dressing is normally applied for what reason?
- a) improves appearance
 - b) prevents the development of discolored wood
 - c) speeds wound closure
 - d) blocks infection by pathogens
174. Trees that have been girdled may be repaired using what technique?
- a) cleft grafting
 - b) chip budding
 - c) bark implants
 - d) T grafting
175. Bead-like galls on the roots of plants in combination with leaf chlorosis indicates damage by which pest?
- a) nematodes
 - b) Japanese beetle grubs
 - c) gall wasps
 - d) Japanese beetle adults

**PACIFIC NORTHWEST CHAPTER
INTERNATIONAL SOCIETY OF ARBORICULTURE
TREE WORKER CERTIFICATION EXAMINATION A**

Candidate Name:

Address:

Telephone: Date:

Guidelines

1. This examination consists of 90 multiple choice and true/false questions.
2. A score of at least 70% in each of the following categories is required to pass this examination:

Category I - 25 questions (10 questions are specimen identification)
Tree Morphology, Anatomy and Physiology
Tree Identification and Selection

Category II - 25 questions
Pruning

Category III - 20 questions
Cabling and Bracing
Safe Work Practices

Category IV - 15 questions
Planting and Early Care
Soil Management

Category V - 5 questions
Wounds

3. Time allowed 2 hours.

Instructions

1. **Circle** the best answer, from the multiple choice alternatives given, directly on the examination sheet.
2. **Circle** true or false directly on the examination sheet.

Examination Designed
by Susan M. Murray, P.Ag.

CATEGORY I**Tree Morphology, Anatomy and Physiology
Tree Identification and Selection**

1. What part of the root absorbs water and mineral elements?

B a) cap
 b) hairs
 c) meristem
 d) pith
 e) cortex

2. What is the name of the root on a mature tree which grows downward providing stability to the tree canopy?

A a) heart
 b) primary
 c) fibrous
 d) adventitious

3. Which one of the following best describes a dormant terminal bud?

A a) inactive bud on a one-year-old twig
 b) inactive bud that is two years old
 c) inactive bud that is three years old
 d) inactive accessory bud

4. Which one of the following structures is found on a dormant shoot?

 a) latent or suppressed axil
 b) pedicel
 c) radicle
D d) bundle scar
 e) receptacle

5. What are fast-growing, vertical shoots that originate above the ground or graft union called?

 a) spurs
 b) suckers
C c) water sprouts
 d) offsets
 e) runners

6. In the branch attachment model developed by Shigo, the trunk tissues from above the branch connect with the branch.

F True False