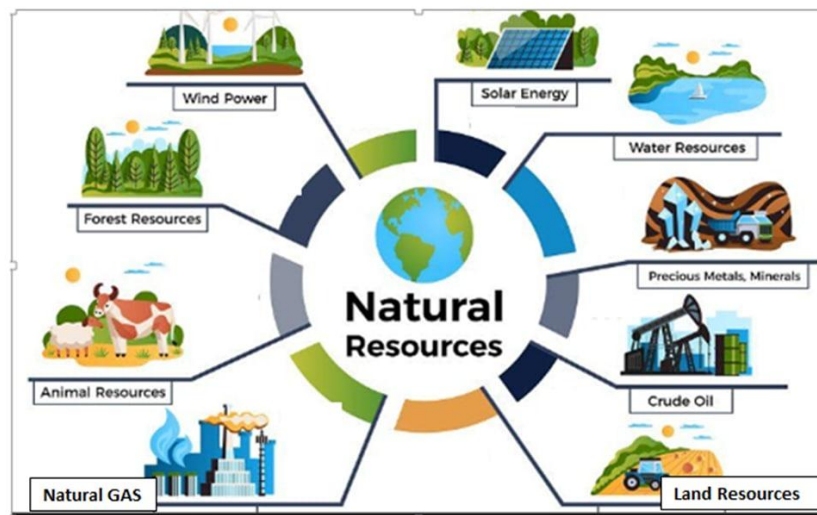


Natural Resource Conservation and Development

Level II

**Based on March 2022, Version1 Occupational
standard**



**Module Title: - Applying Forest Protection Strategies
and Practices**

LG Code: AGR NRC2 M06 LO (1-4) LG (26-29)

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Addis Ababa, Ethiopia

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Introduction to the Module

This module covers the knowledge, skills, and attitude required to apply the preventive and controlling mechanism to detect, protect and control forest pests, diseases, invasive species, and forest fires

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LG #26

LO#1- Apply disease and pest preventive and/or control mechanism

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Conducting disease and pest surveillance
- Assessment of disease and pest
- Identifying major diseases and pests
- Identifying pests and disease preventive techniques
- Applying pests and disease control mechanisms

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Conduct disease and pest surveillance
- How to assess disease and pest
- Identify major diseases and pests
- Identify pests and disease preventive techniques
- Apply pests and disease control mechanisms

Learning Instructions:

- 1) Read the specific objectives of this Learning Guide.
- 2) Follow the instructions described below.
- 3) Read the information written in the information Sheets
- 4) Accomplish the Self-checks
- 5) Perform Operation Sheets
- 6) Do the “LAP test”

Information Sheet 1

1.1. Conducting disease and pest surveillance

Disease and Pest: Those organisms that affect the normal growths of the forest abnormalities are caused by biotic and abiotic factors.

Forest Pest: Any living organism (plant or animal) that occurs where it is not wanted or that causes damage to forest or humans or other animals. Almost every part of the tree can serve as food for insects.

Disease is an abnormal state of an individual, be it animal or plant is referred to as disease, defined plant disease in the following words, “sustained physiological and resulting structural disturbances of living tissues and organs, ending sometimes in death.” A disease is a continuous process not a temporary one such as injury to a tree that may be caused by lopping or browsing. Moreover a disease is different from a symptom in the same way as fever is a symptom of disease and not the disease in itself. Forest pathology deals with the diseases of forest species and timber. Disease can be caused by abiotic (non-living) and biotic (living) factors.

Surveillance is an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures.

Monitoring and surveillance across a farm involves looking for and recording the presence, absence and population levels of pests.

The main objectives of disease and pest surveillance are:

- Disease and pests of quarantine importance
- Alien invasive species
- Disease and pests of economic and/or farming importance
- For the conduct of disease and pests risk analyses
- To establish disease and pests free areas
- To facilitate transparency in international trade in fulfillment of obligations as a signatory to the WTO Agreement

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The expected outputs of surveillance

- Develop a database on disease and pests presence/absence (current pest lists: national, regulated non-quarantine, quarantine)
- Illustrate the distribution of these disease and pests presence using Geographic Information Systems
- Illustrate and report on disease and pests free areas
- Provide disease and pests incidence and distribution information to assist in determining management strategies for pests and
- Promote transparency in trade thereby increased confidence with trading partners.

Conducting regular monitoring is a fundamental part of farm management practice and gives the best chance of spotting a new pest soon after it arrives.

➤ Pest surveillance is necessary for:-

A. Exotic pest eradication

Early detection of exotic pests improves the chance of eradication or containment within a region. However, if eradication or containment are not feasible, early detection in conjunction with contingency planning and preparedness by government and industry bodies (eg preparing emergency chemical registrations, permits for importation of biocontrol agents, awareness material and training in pest diagnostics), assists with a more rapid and effective response.

B. Market access

Export and interstate markets can require ‘evidence of absence’ data for exotic and some established pests that are of concern. The Australian plant production industries, in collaboration with governments, must prove through surveillance that pests of concern have been looked for and found to be absent.

C. Improved pest management

Management of established pests requires regular inspections to determine population levels to improve management decisions.

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D. Pest status information

Surveillance at the farm level contributes essential information to regional biosecurity efforts and ultimately to the national status (presence/absence) of a pest.

All pest (exotic and established) surveillance activities carried out on your property should be recorded. These records can be used in the response to a pest outbreak and provide support to industry surveillance activities.

1.2. Assessment of disease and pest

An assessment of the relationship between environmental factors and forest pests provides fundamental information on their occurrence and abundance, which is essential for decision making concerning management strategies.

Pests and diseases cause serious economic losses in yield and quality of forest. Thus, the detection and assessment of their symptoms is essential in the forest.

The process of diagnosing plant problems is like detective work in that it is investigative and systematic. By asking a series of questions, observing the surrounding environment, and keeping good records, one can decide if the problem is due to an insect, a disease or a non-living factor such as herbicide damage, too much water or pollution.

- **Diagnose of forest diseases and pest**

1. What tools are needed to assist with the diagnosis?

A compact shovel, hand lens (10-20X magnification), pocket knife, and notebook and pen are essential tools of the trade. A camera, sample bags (plastic not paper) for plant material, a small vial for insects, and a compact cooler or ice chest to store samples while you are in the field are also recommended.

2. What is the host plant?

Proper identification of the host plant species and variety provides a diagnostic perspective to common problems associated with the plant.

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3. What is normal for the plant?

Recognizing the normal (healthy) appearance of the plant species and knowing the natural life cycle of the plant species will help to determine whether or not a real problem exists. Each plant species has unique growth habits, seasonal growth rates, and color. Appearance can also vary with different cultivars of the same plant species. Comparing the affected plant to a healthy plant at the same growth stage will help you to identify abnormalities.

4. What is the pattern of damage?

The pattern of injury can be uniform or non-uniform depending on the nature of the problem. A random pattern of symptoms often indicates a plant disease. A uniform pattern within the plant population usually indicates a response to an environmental factor (abiotic disorder). If different plant species are affected it usually indicates an abiotic disorder and not a biotic disorder, as living organisms have a limited host range.

5. What are the symptoms and do you see any signs?

The quickest way to rule out an abiotic disorder is to observe signs of a insect, pathogen, or herbivore. Signs of insects include the insects or mite, webbing, or frass (Figure 1.1). Signs of pathogens include fungal strands (mycelium), fungal fruiting bodies, bacterial slime or ooze, and mold or mildew.

Symptoms can be the result of mechanical or physical injury, disease or insect damage. Symptoms of mechanical injury include broken stems, punctured leaves, uprooted plants, or bruised fruit. Common disease symptoms include blight, cankers, soft or dry rots, galls, leaf spots, wilt, yellowing (chlorosis), browning (necrosis) and mosaic or mottling patterns. Noting the progression of symptoms will provide valuable information as to whether or not the problem is biotic or abiotic.

Disease symptoms occur over time whereas most abiotic symptoms appear suddenly with no observable progression. Insect feeding damage and location of feeding are the most valuable clues in identifying injury due to insects. Chewing or rasping insects usually cause damage to an entire leaf or leaflet or generate holes near leaf margins. Leaf mining and rolling are caused by leaf miners. Sucking insects result in spotting, stippling, leaf curling or puckering. Boring insects bore inside the plants and feed on internal tissues.

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Figure 1.1. Symptoms of insect chewing on collard greens (left image). Examination of the underside of the leaves reveals signs of the problem (right image).

6. What are the site conditions?

A plant will thrive when it is planted in the correct hardiness zone, healthy soil, exposed to the correct amount of sunlight and moisture and fertility. Plants grown in poorly drained soils, compacted soil, low levels of organic matter and overly acidic or basic soils will exhibit symptoms similar to those caused by diseases. Knowledge of the optimal growing conditions for the plant species will help narrow down the cause of the injury. Knowing the history of the site will also provide clues to the cause of damage. Plants grown in a location with a history of flooding, exposure to industrial run-off materials, compacted soil due to construction or soil borne pathogens are more likely to be stressed and more susceptible to pathogen and insect damage.

7. What do surrounding plants look like?

It is important to observe the health of surrounding plants. If multiple plant species in the surrounding area exhibit the same symptoms as the problematic plants then an environmental factor is likely causing the problem. This is a good time to document recent or abrupt changes in environment conditions. Extreme temperatures, excessive rainfall or drought, hail, high winds, high ozone levels, and lightning can cause damage to plants that mimic disease or insect damage.

1.3. Identifying major diseases and pests

Any living organism (plant or animal) that occurs where it is not wanted or that causes damage to forest or humans or other animals. Almost every part of the tree can serve as food for insects, and some of the more common groups associated with damage to leaves, shoots, flowers buds, fruit, twigs, branches, stems and roots. Generally the species importance for forestry are contained in orthoptera, (grasshopper, crickets), (Hemiptera plant bugs, leafhoppers, scale insects, aphids, mealybugs, coleoptera (beetles), Isoptera (termites), Hymenoptera (sawflies, ants, wasps, bees), Lepidoptera (butterflies, moths) and Thysanoptera (thrips). Feeding habits vary greatly not only between but also within pest groupings.

1.3.1. Feeding Behaviors of Forest Insect Pest

- **Defoliation**

Insects that consume leaves or needles are classified as defoliators and are indicated by chewed, mined, or missing foliage. Damage from defoliating insects varies considerably with tree and insect species, feeding intensity, and the time of year that feeding occurs. Although the effects of most defoliating insects are insignificant, some may cause significant damage to individual trees.

A few defoliators are important forest pests that can kill trees across large landscapes during outbreaks. Most of the important defoliating insects in conifers are the larval stages of moths, butterflies, or sawflies. In hardwoods, beetle larvae and leaf-cutting bees are also damaging agents. Occasional defoliation is noted from other insects that tend to be more general feeders on rangeland, such as grasshoppers or adult scarab beetles.

Are insects which feed on leaf tissue, their activities resulting in complete or partial destruction of leaves. This feeding group also includes leaf-mining insects which feed within the leaf, just below the upper or lower surface, leaf tiers and leaf rollers which make shelter from leaves and graze these from within, and leaf skeletonizers which eat the leaf tissue between the networks of leaf veins.

- ✓ **Sap feeding**

Sap feeding insects suck liquid or semi liquid material from succulent parts of the host plant which can be leaves, stems, roots, fruit, flowers or even seed. Sap feeders affect tree vitality by

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extracting sap required for normal functioning of the plant, such as shoot extension and leaf expansion.

✓ **Bark and wood feeding**

Bark and wood-feeding forest insects are contained in four main orders: coleoptera (bark beetles, ambrosia beetles, longicorn beetles, bostrychid beetles, scarab beetles, weevils).

✓ **Shoot boring**

Shoot-or tip-boring insects cause the most damage when they attack the apical terminal or leader of the tree which result in irregular stem growth or multiple branching when secondary terminals take over dominance. Trees which have been attacked by such insects may have a stunted, bushy appearance, or at least malformed or forked boles, and their value for timber production can be greatly reduced or eliminated.

✓ **Fruit and seed boring**

Several different groups of insects attack the fruits, cones or seeds of forest trees, some, such as Torymid wasps, lay their eggs directly in to the seed of young cones and their larvae feed within the seed.

✓ **Gall forming**

Galls are unusual plant growths which develop as a result of abnormal cell division and/or cell enlargement following infestation of plants by organisms such as insects, mites and fungi.

✓ **Root feeding**

A wide range of insects feed on the roots of trees including white grubs, termites, and root weevils, larva of longicorn and buprestid beetles, and root aphids.

✓ **Steam and branch cutters**

Several insects groups damage trees by completely severing stems or branches in the case of some species of crickets and grasshoppers; such damage mostly occurs on nursery stock or newly planted trees.

1.3.2. Identifying forest diseases

Disease is defined as a sustained disruption in physiological or structural functions of a plant due to an attack by a pathogen that results in death, damage to cells or tissues, reduced growth or vitality, or economic losses. A disease is an interaction between a pathogen and its host that can only occur under certain environmental conditions. This can be demonstrated by the **disease triangle**, which visualizes disease as an interaction between three components: host, pathogen, and environment. If one of the three components is lacking, disease cannot occur.

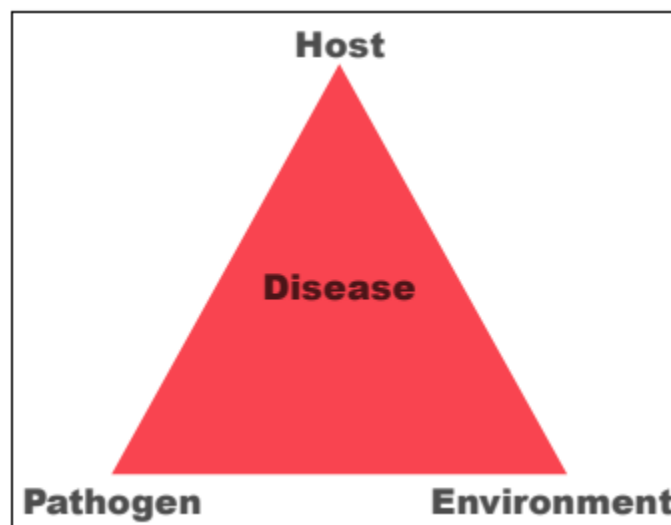


Figure: 1.2. Disease triangle

Visible effects of disease on plants are called symptoms. Any detectable change in color, shape, and/or functions of the plant in response to a pathogen or disease-causing agent is a symptom. Forest pathology deals with the diseases of forest species and timber. Signs of plant disease are physical evidence of the pathogen, for example, fungal fruiting bodies, bacterial ooze, or nematode cysts. Signs also can help with plant disease identification.

Classification of forest disease

- **On the basis of the nature of the causal agent**

1. Non- infectious disease\non parasitic disease

- ✓ This type of diseases is caused by non-living organisms.
- ✓ Could not be spread to others.

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- ✓ They are induced by unfavorable environmental condition of soil or air such as mineral deficiencies or excesses in the soil, low or high temperatures, improper water, oxygen and light relation.
- ✓ May also be caused by air pollution, nutrient deficiency, mineral toxicity, etc.
- ✓ These diseases may also be caused by mechanical injuries.

2. Infectious disease\Parasitic disease

- ✓ These are caused by the attack of some living agents called pathogens. The causal agents may be a plant or an animal or a virus.
- ✓ It can spread from diseased to healthy plants.
- ✓ In the case of a disease caused by a parasitic organism the diseased plant is called a host.
- ✓ The pathogen may subsist in whole or in part upon the living tissue of the host.
- ✓ Biotic factors include fungi, bacteria, virus, insects, mites, nematodes or parasitic plants

• Classification of diseases on the basis of symptoms

✓ Necrotic symptoms

These are the evidence of necrosis or death of affected tissue resulting in marked change of colour from yellowing through browning to graying when the tissue finally dies. Examples of this are leaf blight, bud blight; stem canker to mention a few.

✓ Atrophic

This is the slowing down in development of the affected plants parts resulting from subnormal cell division (hypoplasia). Dwarfing or stunted growth is an example. The causes could include; unfavorable environmental conditions, unfavorable soil condition, excess or deficiency of certain mineral elements.

✓ Hypertrophic

This is an overgrowth of all kinds which results from abnormal cell increase (excessive cell division).

- **Classification of diseases on the basis of parts affected**

- ✓ **Root diseases:**

As the name implies, they attack the root of trees. Examples include: damping off, root or butt or collar rot etc.

- ✓ **Stem diseases:**

These attack the tree trunks. Examples are stem canker, galls, dieback and wilts.

- ✓ **Foliage diseases:**

These primarily attack the leaves of both hardwood species and conifers and may extend their activities to the flowers, fruits and young twigs. Examples are; leave blight, twig blight, powdery mildew, leaf blisters etc.

1.4. Identifying pests and disease preventive techniques

Prevention consists of tactics designed to either reduce the probability of the occurrence of forest pest or disease or to create environmental conditions inhospitable for its buildup into damaging numbers. Regulatory, cultural or genetic tactics are examples of prevention strategies.

- **Regulatory tactics** are designed to prevent introductions of exotic pests and diseases and to prevent their spread once established. Examples include inspection of wood products and wooden containers at ports of entry to intercept pest species, conduct of pest risk analyses when new trade agreements are made and establishment of quarantine zones when a pest species is first discovered in a new location.
- **Cultural tactics** are designed to create conditions inhospitable for the development of damaging numbers of pests and diseases. These include matching tree species selected for planting to suitable growing sites, controlling stocking through intermediate harvests to maintain tree vigor and timely harvesting of plantations when they reach maturity. A drastic but sometimes necessary cultural approach is to simply eliminate a tree species from a plantation programme because of its high susceptibility to certain pests and diseases.

- **Genetic tactics** make use of varieties of host plants that are either more tolerant to damage or less palatable to the pest. Identification and testing of varieties of *Leucaenaleucocephala* and hybrids with other species of *Leucaena* for resistance or tolerance to the psyllid, *Heteropsyllacubana*, was a major line of investigation.

1.5.Applying pests and disease control mechanisms

Before choosing a control method(s):

1. Correctly identify the organism.
2. Assess the infestation and determine the potential economic damage.
3. Determine the available control methods.
4. Evaluate the benefits and risks of each method or combination of methods.
5. Are there threatened or endangered species or sensitive sites in the area to be treated?
6. Choose effective method(s) that will be least harm to humans and the environment.
7. Follow applicable local, state and federal regulations.
8. Correctly carry out the control practice(s) and keep accurate records so results can be evaluated

1.5.1. Forest insect pest control mechanisms

- ***Mechanical or Physical Management:*** Mechanical or physical control methods involve using barriers, traps, or physical removal to prevent or reduce pest problems. Tactics may include using row covers or trenches to prevent insects from reaching the crop, baited or pheromone traps to capture insects, or cultivation or mowing for weed control.
- ***Biological Management:*** Biological control is the deliberate use of the pest's natural enemies predators, parasites, and pathogens to reduce the pest population below damage levels. Biotic control comprises all such factors which tend to control the population of an organism (pest) through the activities of other organisms. The biotic factors, which play an important role in limiting the pest populations, are competition, parasitoids, predators and pathogens.

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- **Chemical Control:** When exploring chemical control options, you should select the lowest risk and most effective products. The key is to use pesticides in a way that complements rather than hinders other elements in the strategy and which also limits negative environmental effects. It is important to understand the life cycle of a pest so that the pesticide can be applied when the pest is at its most vulnerable – the aim is to achieve maximum effect at minimum levels of pesticide.
- **Integrated Pest Management (IPM):** Integrated Pest Management (IPM) is a comprehensive, environmentally sensitive approach of managing pests that includes a combination of strategies that pose the least hazard to people, property, and the environment. The simple philosophy is that control will be more effective, and resistance will be less likely to build up, when a range of measures is deployed against a pest. These measures can include cultural, mechanical or physical, biological, and chemical methods for managing the pest.

Some of the key components to a successful IPM program include the following:

- ✓ Identify current and potential pest species, their biology, and conditions conducive to the pest(s) (air, water, food, shelter, temperature and light).
- ✓ Understand the physical and biological factors that affect the number and distribution of pests and their natural enemies.
- ✓ Conserve natural enemies.
- ✓ Prevent, avoid, and monitor potential pest species.
- ✓ Establish “Action Thresholds” (such as a certain number of pests per acre) at which point an approved management strategy will be implemented.
- ✓ Review available tools and best management practices for the management of the identified pest(s).

Insecticides for Forest Pest Control

Insecticidal soaps are made from salts of fatty acids. When sprayed directly on vulnerable stages of soft-bodied insects, such as aphids and adelgids, they kill by damaging individual cells.

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Insecticide applications are rarely practical against forest insect pests. However, they may be useful in specific situations, such as limited infestations of an invasive species. Insecticidal soaps, horticultural oils, Bt-insecticides and systemic are common choices because they have very low potential to harm the environment, non-target species, and applicators.

Bt Insecticides (*Bacillus thuringiensis*) insecticides are protein toxins that are produced by a common soil bacterium. Many provide specific control of caterpillars without affecting other types of insects (beetles, sawflies, etc.). Bt insecticides disrupt the gut wall cells in the caterpillar digestive tract so a formulation of the insecticide must be sprayed on foliage that will be eaten by the caterpillars. Caterpillars stop feeding soon after eating the insecticide but usually do not die for several days. Bt insecticides work best against young caterpillars that are less than half-grown. These insecticides are relatively non-toxic to mammals and other animals.

Imidacloprid is the common name of a systemic insecticide that is used to control sap-feeding insects, such as the hemlock woolly adelgid. It is a nerve poison but it is much more toxic to insects than to warmblooded animals. Imidacloprid can be diluted in water and applied as a drench poured around the base of a tree, or injected into the soil. The insecticide is taken up by the roots and moved throughout the tree

1.5.2. Forest disease control

One of the prime objectives of forestry is to grow forest crops free from diseases and to obtain a profitable harvest. In the event of an outbreak of a disease, control measures that have to be adopted should be economically justifiable and ecologically sustainable.

A. Direct Measures to Control Forest Disease:

i. Sanitation:

Sanitation is the process that reduces or eliminates the initial inoculum from which the disease develops. Such inoculum may be present either on principal hosts or on collateral or alternate hosts. *Corliciumsalmonicolor*, the cause of pink disease, occurs on rubber and many other hosts and attacks Eucalyptus planted in sites under suitable conditions of development of the disease.

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Control by sanitation requires an early detection of the disease in the forest and taking suitable steps to remove the disease inoculum before it can spread the disease.

ii. Eradication:

Eradication may be done mechanically or through use of weedicides, thereby keeping the other host plant of economic importance free from the disease. In natural forests, fungi normally remain endemic. Root and butt rot fungi have restricted growth on roots but quickly colonise residual roots and stumps after clear-felling.

The large inoculum potential thus builds up and becomes a potential threat to susceptible hosts later planted in such areas. Control of root rot may be obtained by removal of residual stumps and roots prior to planting either by raising mechanised plantations or through extraction by physical means.

iii. Isolation Trenches:

Once a root disease establishes in forest, it spreads centrifugally from the infection centre to adjacent trees. For pathogens which do not have a free spread through the soil, the disease is mainly communicated to adjacent healthy plants through root contact or root graft. In such cases, the spread of the disease can be checked by isolating diseased plants by trenches.

iv. Chemical Control:

Chemical control of forest diseases is generally prohibitively expensive and, therefore, not practicable except probably in nurseries and plantations where the incidence of the disease and the damage are high. Fungicidal chemical may act as prophylactics in preventing infection. A systemic fungicide may be used and the chemical is distributed throughout the system of the host.

A fungicide will have its desirable effect if it attacks the pathogen at the weakest point in its life cycle and at the same time proves non-toxic to the host at the dosage used. The fungicide must adhere well to produce a lasting effect. For this, stickers as well as spreaders are added to the fungicide. To control a disease of aerial plant parts by a fungicide, the timing of application is

important. Mancozeb, Copper oxychloride, Carbendazim, Tridemorph and Triazoles are commonly used.

B. Indirect Measures to Control Forest Disease:

i. Choice and Improvement of Site:

Natural stands are adapted to the site they occupy. Such forests, therefore, generally grow healthy as long as the stands are properly managed. Suitable selection of site is important for plantations, particularly of exotics, which are far remote from their natural range of distribution. Good site is necessary for maintaining stand vigour to resist attack due to diseases.

An extreme case of species conversion may be seen in the high rainfall areas in Karnataka and Kerala States in South India where semi-evergreen and evergreen natural forests are clear-felled and planted with Eucalyptus. The situation becomes aggravated with large scale mortality in Eucalyptus due to pink disease resulting in large gaps in plantations.

ii. Choice of Species:

Natural forests have inherent slow growth and low productivity. Also, such forests are of mixed composition where only some species are economically valuable. Indigenous species are often not capable of making full economic use of the sites. Exotics should possess the ability to thrive in their new environment for which a great deal of care is needed in selection of suitable species. Plantations may be raised either pure or in mixer.

A pure stand is, however, ideal for a pathogen to build up to epidemic proportions since infection is direct and rapid from tree to tree. Mixed stands may be raised in plantations where the species can be in intimate, strip, group or block mixers. In using clonal stocks in planting, it is advisable to plant a number of clones in mixture and limit the area occupied by each clone.

iii. Silviculture and Management Practices:

Natural forests which are worked on sound silvicultural practices and properly managed, do not normally suffer from any serious disease. Fire, which is a regular feature in forests, is the

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principal cause of injury to trees through which decay fungi establish in the tree. In an uneven-aged stand, suppression may occur to a certain degree to the understory crop under the shade of dominants. In forest raised for timber, a high incidence of decay in the heartwood causes serious loss in yield of timber.

In stand with high incidence of decay, it is, therefore, advisable to lower the rotation age. Infestation by dwarf mistletoe is favoured by selective cutting while in cleared cutting, the infestation is less. A pure even-aged stand may suffer from injury due to frost and from excessive insolation resulting in sun scorch. An even-aged crop is also liable to wind damage which is accentuated by thinning and pruning.

iv. Cultural Practices:

Timely thinning with a view to provide spacing is therefore important as it increases plant vigour which in turn reduces damage from diseases. Diseased trees are likely to be randomly distributed for which reason thinning has to be irregular. On the contrary, stumps left after thinning in conifer stand may be colonised by *Fomesannosus*.

Such stumps serve as infection centers for spread of the disease in plantations. It is also done for trees in parks and avenues to remove dead and diseased limbs create openings for sun light or make clearance for overhead communication lines.

v. Biological Control:

Biological control involves the use of an innocuous organism to prevent attack by a pathogenic organism. Control of *Armillariamellea* root rot in tea bushes is possible. Likewise, colonisation of fresh conifer stumps soon after thinning by *Peniophoragigantea*, an innocuous fungus, prevents stumps colonization by the pathogen *Fomesannosus*.

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vi. Resistance Breeding:

Resistance is the ability of an organism to hinder the development of a disease. There may be active resistance where the host reacts to the attack by a pathogen or passive resistance due to qualities inherent in the host. A pathodeme is a host population in which all individuals have a given resistance in common, while a pathotype is a pathogen population in which all individuals have a given pathogenicity in common.

If in a series of inoculations, the amount of disease shows a differential interaction between pathodemes and pathotypes, the resistance and pathogenicity are called vertical, which involves mechanisms which are within pathogen's capacity for change. In the absence of any such interaction between pathodemes and pathotypes, the resistance is termed horizontal, where the mechanisms involved are beyond pathogen's capacity for change.

In vertical resistance, the inheritance is governed by single gene and, therefore, easy to manipulate in a breeding programme. Horizontal resistance is controlled by polygenes and, therefore, difficult to manipulate genetically. The effectiveness of horizontal resistance does not break down. Vertical resistance, however, is liable to breakdown.

The objective of disease resistance improvement is to select or breed trees to establish a host-parasite relationship to yield an economic harvest. The freedom from infection may either be due to escape or to inherent character in the presence of genes for resistance in the host or absence of gene for infectivity in the parasite.

The procedures for resistance breeding include selection of such disease-free individuals and testing their progenies by raising them in a heavily diseased area or through inoculations which will eliminate the escapers and ensure the heritability and selection of the resistance factor. Artificial inoculations, where massive spores or mycelium are used as inoculate; can be so severe that they assess only immunity and not relative resistance.

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This should, therefore, not be relied upon fully. During selection, due consideration should be given to other desirable characters in the tree necessary for tree improvement. Parents and progenies should be tested against all known biotypes of the pathogen by exposing to natural infection and to inoculation. The improved stock may be out planted providing means of testing at the same time resistance under different environmental conditions favourable for disease development.

Individuals that have not developed disease resistance can be salvaged during improvement cuttings. Further propagation of these trees may be done by establishment of grafts in seed orchards. Intra- specific crosses between the selected individuals may increase the degree of resistance in the progenies. Seed orchards yielding such progenies will thus form valuable basis for further propagation of a resistant stock.

Though genetic resistance has been recognized in a large number of forest tree species, remarkably little is known about the nature of host resistance. Hairiness in leaves can provide complete protection against some virus vectors such as jassids and whiteflies. In *Castanea*, high concentration of pyrogalllic tannins in the bark of genotypes resistance to *Endothiaparasitica* may be responsible for retarding the growth of the fungus. Enzymatic activity is responsible for resistance of oaks against *Microsphaeraalphiloides*.

A close correlation between bark moisture and disease development exists in canker diseases in trees, as in willow due to *Cryptodiaporthe*; in poplar due *Fusarium* and in western hemlock due to *Cephalosporium*. In absence of much data on the nature of host resistance, however, breeding forest trees for producing disease resistance clones is a potential way for disease control. In *Populus*, significant progress has been possible because of the variation in disease resistance between and within the natural species, wide range of genotypes and ease of vegetative propagation for purpose of clonal multiplication.

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Self-Check – 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Short Answer Questions

1. What is surveillance? (2pt)
2. What are the benefits of surveillance? (2pt)
3. Describe forest insect control methods? (2pt)
4. What is Integrated Pest Management (IPM)? (2pt)
5. What are the feeding habits of pest? (2pt)
6. Define disease triangle?(2pt)

Test II: Multiple choices (2 points each)

1. Which one of the following is the prevention method of forest pests and diseases?
 - A. Regulatory tactics
 - B. Cultural tactics
 - C. Genetic tactics
 - E. All
2. -----involves the use of an innocuous organism to prevent attack by a pathogenic organism.
 - A. Biological Control
 - B. Resistance Breeding
 - C. Cultural Practices
3. Which one of the following is the direct measure to control forest disease?
 - A. Sanitation
 - B. Choice and improvement of Site
 - C. Choice of Species
 - D. Silviculture and management practices

Note: Satisfactory rating – 18 points Unsatisfactory - below 18 points

You can ask your teacher for further explanation.

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Operation Sheet -1

Procedures of Assessing forest disease and pest

Materials needed

- Notebook and pen
- Pruning shears, Pruning saws and secateurs.
- Hooks, felling levers and tongs.
- Axes and hammers.
- Bush hooks and wedges
- Plastic bags
- Shovel
- Hand lens (10-20X magnification)
- Pocket knife

Procedures:

- Identify those tree species that have symptom of disease
- Identify type of pest and disease that affect that tree
- Apply recommended protection measure for that problem
- Prepare a report

LAP Test/ Job Sheet-1

Performance Test

Name..... ID.....

Date.....

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **6**hour. The project is expected from each student to do it.

Task 1: Perform the Assessment of forest disease and pest

LG #27

LO #2- Implement prevention and controlling program of invasive species

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Designing quarantine procedures
- Applying Guidelines prepared by appropriate personnel
- Supporting and conducting Community awareness creation
- Materials and facilities for quarantine
- Gathering Baseline information that helps in invasive prevention and control
- Identifying Invasive species based on international guidelines
- Apply control mechanisms for further expansion of invasive species
- Conducting assessment to the prevention and monitoring principles

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Design quarantine procedures
- Apply Guidelines prepared by appropriate personnel
- Support and conducting Community awareness creation
- Identify materials and facilities for quarantine
- Gather Baseline information that helps in invasive prevention and control
- Identify Invasive species based on international guidelines
- Apply control mechanisms for further expansion of invasive species
- Conduct assessment to the prevention and monitoring principles

Learning Instructions:

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1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet 2

2.1. Designing quarantine procedures

2.1.1. Introduction

Invasive (non-native) species are species that invades an area. Invasive species can change community structure, composition, and ecosystem processes on these lands in ways that may not be anticipated or desirable. Careful management can minimize these negative impacts. They can compete with and displace native plants, animals, and other organisms that depend on them alter ecosystem functions and cycles significantly, hybridize with native species, and promote other invaders. The good news is that many plant invasions can be reversed, halted or slowed, and in certain situations, even badly infested areas can be restored to healthy systems dominated by native species. In most instances this requires taking action to control and manage those invasive plants.

“Quarantine” Refers to checking for healthiness before taking to other areas. Quarantine is the name given to the regulations of a country imposing a period of time during which a ship arriving in port is forbidden to land freight or passengers because it is suspected of being infected with a contagious disease.

2.1.2. Conditions that lead to invasion

Quarantine procedures are designed to be followed during introduction of new species. Scientists propose several mechanisms to explain invasive species, including species-based mechanisms and ecosystem-based mechanisms. It is most likely a combination of several mechanisms that

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cause an invasive situation to occur, since most introduced plants and animals do not become invasive.

A. Species-based mechanisms

Species-based characteristics focus on competition. While all species compete to survive, invasive species appear to have specific traits or combinations of specific traits that allow them to out compete native species. Sometimes they just have the ability to grow and reproduce more rapidly than native species; other times it's more complex, involving a multiplex of traits and interactions.

Common invasive species traits include:

- ❖ The ability to reproduce both asexually as well as sexually
- ❖ Fast growth
- ❖ Rapid reproduction
- ❖ High dispersal ability
- ❖ Phenotypic plasticity (the ability to alter one's growth form to suit current conditions)
- ❖ Tolerance of a wide range of environmental conditions (generalist)
- ❖ Ability to live off of a wide range of food types (generalist)
- ❖ Association with humans
- ❖ Other successful invasions

Invasive species often coexist with native species for an extended time, and gradually the superior competitive ability of an invasive species becomes apparent as its population grows larger and denser and it adapts to its new location.



Figure 1.3. Lantana growing in abandoned citrus plantation

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- ✓ An invasive species might be able to use resources previously unavailable to native species, such as deep water sources accessed by a long taproot, or an ability to live on previously uninhabited soil types.

B. Ecosystem-based mechanisms

- In ecosystems, the amount of available resources and the extent to which those resources are utilized by organisms determines the effects of additional species on the ecosystem. In stable ecosystems, equilibrium exists in the utilization of available resources. These mechanisms describe a situation in which the ecosystem has suffered a disturbance which changes the fundamental nature of the ecosystem.
- When changes occur in an ecosystem, like forest fires in an area, normal succession would favor certain native grasses and forbs. With the introduction of a species that can multiply and spread faster than the native species, the balance is changed and the resources that would have been used by the native species are now utilized by an invader. This impacts the ecosystem and changes its composition of organisms and their use of available resources. Nitrogen and phosphorus are often the limiting factors in these situations.
- Every species has a role to play in its native ecosystem; some species fill large and varied roles while others are highly specialized. These roles are known as niches. Some invading species are able to fill niches that are not utilized by native species, and they also can create niches that did not exist.
- When changes occur to ecosystems, conditions change that impact the dynamics of species interaction and niche development. This can cause once rare species to replace other species, because they now can utilize greater available resources that did not exist before, an example would be the edge effect. The changes can favor the expansion of a species that would not have been able to colonize areas and niches that did not exist before.

2.1.3 Impact

2.1.3.1 Biodiversity and Ecosystems impact

Invasive alien species may threaten native species as direct predators or competitors, as vectors of disease, or by modifying the habitat or altering native species dynamics, habitat loss as the lead cause of biodiversity loss.

Invasive species may out-compete native species, repressing or excluding them and, therefore,

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fundamentally change the ecosystem. They may indirectly transform the structure and species Composition of the ecosystem by changing the way in which nutrients are cycled through the ecosystem.

Entire ecosystems may be placed at risk through knock-on effects. Given the critical role biodiversity places in the maintenance of essential ecosystem functions, IAS may cause changes in environmental services, such as flood control and water supply, water assimilation, nutrient recycling, conservation and regeneration of soils.

Invasive may also affect native species by introducing pathogens or parasites that cause disease or kill native species. Among other things, both old and newly established IAS contribute to land degradation through soil erosion and the drawing down of water resources, reducing resources available to people and indigenous plants.

The leaves and branches of the black wattle are believed to have allelopathic properties – that is the chemical inhibition of growth and seed germination of other plants. Highly combustible, fire-tolerant alien plants may also alter the fire regime, and combined with competition for light, nutrients, water and space, this is believed to be an important factor in extinctions. Marine IAS is a growing problem in Africa’s coastal waters, estuaries and lagoons. Many of these introductions are related to sea vessels and aquaculture. *Hypneamusciformis*(hypnea) is red algae, originally from Trieste in Italy, and is now distributed throughout the world. It occurs in coastland, estuaries and marine habitats where it attaches to coral, stones or shells on sheltered tropical reef flats. Its success is related to its rapid growth rate, ability to epiphytize other algae and easy fragmentation.

2.1.3.2 Genetic pollution

Natural, wild species can be threatened with extinction through the process of genetic pollution. Genetic pollution is uncontrolled hybridization and introgression which leads to homogenization or replacement of local genotypes as a result of either a numerical or fitness advantage of the introduced species. Genetic pollution can bring about a form of extinction either through purposeful introduction or through habitat modification, bringing previously isolated species into contact. These phenomena can be especially detrimental for rare species coming into contact

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with more abundant ones where the abundant ones can interbreed with them, creating hybrids and swamping the entire rarer gene pool, thus driving the native species to extinction. Attention has to be focused on the extent of this problem, it is not always apparent from morphological observations alone. Some degree of gene flow may be a normal, evolutionarily constructive process, and all constellations of genes and genotypes cannot be preserved. However, hybridization with or without introgression may, nevertheless, threaten a rare species' existence.

2.1.3.3 Economic impacts

Invasive alien species are increasingly seen as a threat not only to biodiversity and ecosystem services, but also to economic development and human well-being. They reduce yields of agricultural crops, forests and fisheries, decrease water availability, cause costly land degradation, block transport routes and contribute to the spread of disease.

2.1.4. Recommended procedures for quarantine to new species control

Quarantine is one component of a production level biosecurity programme, which includes a set of standard operating procedures and is an essential part of good hatchery or farm management. It should include the following elements:

- Use of disease-free, invasive and healthy shrimp stocks;
- Use of quarantine areas for all incoming stock;
- Analysis of all incoming stock for disease and invasive species;
- Sterilization and maintenance of clean equipment and materials;
- Use of personal hygiene measures including washing of hands, feet and clothing;
- Knowledge of potential pathogens, the sources of risk and methods for their control and/or eradication;
- Development and use of stocks that are resistant to specific pathogens (SPR); and
- Maintenance of optimal environmental conditions within all phases of the facility.

2.2. Applying Guidelines prepared by appropriate personnel

We need to develop a guideline to conduct quarantine for specific species is important to effective management of invasive species, thereby reducing the negative impacts on their rich and fragile natural heritage, communities and livelihoods.

The guidelines aim to establish a comprehensive framework for all invasive species work, to address all problem areas and facilitate prioritization action, increase efficiency, increase cooperation and agencies. The guideline should;

These Guidelines aim to:

- Provide a comprehensive framework for invasive species management
- Address all problem areas and facilitate prioritization
- Increase action and improve implementation
- Increase efficiency and cooperation, reduce duplication
- Guide the work of international and regional agencies, including donors
- National invasive Species Strategies and Action Plans and individual agency plans
- Guide strategic and local fundraising.

Why produce the Guidelines?

The rate of movement of plants, animals and other organisms beyond their natural range is rising sharply, due to increased transport, trade and travel. Many species that are introduced to new places by people do not cause problems in their new locations, and many bring considerable benefits to people, including in agriculture, horticulture and forestry. However, ‘invasive species’ (often called pests, weeds and diseases) are plants, animals, disease agents and other organisms taken beyond their natural range by people, deliberately or unintentionally, and which become destructive to the environment or human livelihoods. They threaten biodiversity, natural resources, food security, economic development, human health, and ecosystem services such as water resources, nutrient cycles and erosion. Environmental changes caused by human activities can sometimes result in a native species similarly proliferating and becoming destructive. These ‘native invasive species’ must also sometimes be managed

Summary of the guideline

Raise Awareness on Biological Invasions at all Levels

Limited awareness and concern of the public is a major constraint to prevention and mitigation of impact of invasive species.

Integrate Invasive Species and Protected Area Management

Addressing invasive species protection requires strategic approaches, based on coordinated prevention as well as management measures. Dynamic nature of invasions calls for more proactive rather than reactive approaches to the issue, and to adaptive management.

Implement Site-Based Prevention Actions as a Priority

Prevention should be the first line of defense from invasions. Protected areas can do much in this respect, encouraging responsible behaviors by privates as well as enterprises, identifying most relevant vectors and pathways of invasion, or expected to arrive to their territories, and developing focused measures to reduce risks. Prevention should also be linked to early warning and rapid response.

Develop staff capacities for all aspects of invasive species management

Capacity and awareness of community officials and staff are crucial for applying most of the guidelines. Trained staffs are key to effective management, and can contribute to communicate to the visitors as well as to the general public

Set up rapid detection and prompt response framework

Early warning and rapid response is a key element of any strategic approach to invasions, as it is much more effective and cost effective than controlling invaders once they have established. It requires a coordinated framework for surveillance and monitoring activities, identification of invading species, assessment of risks, sharing of information, development of alarm lists and selection and enforcement of appropriate responses. Support by the public, and contingency action and funding are also very important

Manage invasive species beyond the protected area boundaries networks

The invasion of PAs often originates from the surrounding areas and this calls for a land scape perspective to planning. Establishment of buffer zones should be explored. To enhance prevention, PAs should cooperate with surroundings land owners and institutions, and lobby with competent authorities for implementing regulatory or voluntary measures to address activities such as forestry, horticulture, hunting, or botanical gardens

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Implement surveillance, monitoring and information exchange networks

Effective prevention and response to invasions – but also awareness – largely depend on knowledge basis. Information on the spread of invasive species, biological traits of the species, impacts, and available management alternatives are essential. Early warning and rapid response require effective surveillance and access to information to identify new invaders and screen the associated risks. PAs should thus give priority to collection, sharing and access to information, also exploring the involvement of visitors and volunteers in data collection.

2.3.Supporting and conducting Community awareness creation

The purpose community awareness creation was to determine how the public becomes aware of invasive species, as well as how people in different age groups learn or want to learn about invasive species. Invasive species education is important because what affects the ecosystems that we live in affects our daily lives as well. Non-native plants and animals can disrupt the food industry, agriculture, and natural resources such as waterways. The economic damage caused by such invasions can end up costing the average person extra time, money and resources to control or eradicate the invasive animal or plant.

This suggests that more efforts to educate citizens are needed, especially for youth who will be the next generation of caretakers for our ecosystems. Furthermore, we know that establishment of new invasive species in areas (or prevention) can be heavily influenced by the decisions and actions of the average citizen, negative effects on not only the economy, but also on natural habitats, which may disrupt outdoor activities or hobbies enjoyed by many. Although there is substantial research about the ecological and economic consequences of species invasions, the importance of education in promoting or preventing introduction and spread is only minimally understood.

School seems to be one of the main sources for learning about invasive species. This may be due to the fact that school can make use of a variety of **different mediums** such as TV, radio, social media and friends. Today some school classes and teachers have made an effort to include invasive species education within a curriculum.

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2.4. Materials and facilities for quarantine

Necessary materials and **facilities** are prepared to conduct the quarantine based on the requirements. Tools and equipments include tools that are used during an activity:

- Chemicals
- Safety equipments
- Technical manuals
- Document and information on OHS
- specifications and work instructions
- Approved assessment tools others

2.5. Gather Baseline information that helps in invasive prevention and control

Baseline information that helps in invasive prevention and control is gathered according to alien invasive control procedures. Baseline information on the distribution, abundance, dispersal mechanisms and impacts of invasive, as well as information on the abundance and distribution of native biodiversity, is essential for prioritizing species and sites for management, for planning effective management projects, for evaluating their success, and as a basis for monitoring the movement and changing impacts of invasive species.

Knowledge of the current status of invasive and of native biodiversity important for facilitating prioritization, planning, effective management, and monitoring change.

Baseline information can update and make available checklists of introduced and native species, introduction pathways and sensitive sites. It compile:-

- GIS databases and other information resources on native and introduced species, susceptible sites (i.e. sites with high exposure to invasives, such as ports, gardens, road verges) and sensitive sites (i.e. sites that might suffer high impact from invasives, such as protected areas and aquatic systems).
- Identify and document the pathways and vectors of introduction of invasive and potentially invasive species.
- Periodically review species and site inventories, identify gaps (ecosystems or taxonomic groups) and plan priority surveys.

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- Carry out priority surveys and update information resources.
- Publish and share species lists and other information locally and with including online and in the databases.

2.6. Identifying invasive species based on international guidelines

Understand priority invasive, including their biology and impacts important to develop effective management techniques.

Identifying species, sites and introduction pathways also important for immediate management action. It may also identify potential priorities for which further research is needed to confirm their importance, such as research on possible impacts. Effective management requires understanding the target species' ecology, population dynamics and dispersal mechanisms, which may need further research, while effective techniques for managing a species or pathway may not exist and will then need to be developed. Identification is needed to provide the knowledge required for effective management, while research on ecology and impacts of introduced species feeds back into prioritization.

When carrying out research on the impacts, ecology, biology, introduction pathways and management of invasive species and poorly known introduced species we include the following:-

- Develop regional and national invasive species research plans based on objective of identifications.
- Investigate the ecology, biology, population dynamics and introduction of priority invasive species.
- Investigate the ecology and the current and potential impacts of introduced species whose impacts are unconfirmed but suspected to be serious.
- Review available management techniques for invasive species, test existing techniques and develop new ones where necessary for effective management.
- Develop innovative control methods.

✓ *Some examples of invasive species are:*



Lantana



Barbed Goat grass (*Aegilops triuncialis*)



Knap weed *Centaurea diffusa*

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- *Bromus tectorum*
- Monterey Cypress
- Brown tree snake (*Boigairregularis*)
- Chinese mitten crab (*Eriocheirsinensis*)
- Freshwater zebra mussels

2.7. Apply control mechanisms for further expansion of invasive species

Invasive species are an international problem, so their effective management on islands requires coordinated action by international and government agencies, NGOs, the private sector and local communities.

Control of non-indigenous invasive species aims for the long-term reduction in density and abundance to below a pre-set acceptable threshold. The harm caused by the species under this threshold is considered acceptable with regard to damage to biodiversity and economy.

Mechanical, chemical and biological control, habitat management, and a combination of methods are all used successfully in controlling population levels of invasive species. In many cases a cost-effective combination of appropriate measures may be put together in a sustainable way so as to minimize side effects.

1. Mechanical control methods

- Mechanical treatments are usually the first ones to look at when evaluating an invasive plant removal project. These procedures do not require special licensing or introduce chemicals into the environment. They do require permits in some situations, such as wetland zones. Mechanical removal is highly labor intensive and creates a significant amount of site disturbance, which can lead to rapid reinvasion if not handled properly.
- Cutting and pulling invasive species are the most common methods of mechanical control. While they can be effective for certain invasive species, others respond by putting out more sprouts, which makes the problem worse.

Cutting - a plant before its fruits mature can reduce its seed production. For example, cutting in mid-summer can be used to stop seed production in Asiatic bittersweet (*Celastrus orbiculatus*) vines. However, for cutting or mowing to effectively control the overall vigor and spread of an invasive plant population, it must be done several times during the growing season (June through

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September) and repeated for many years. Often, cutting is practical only when it can be integrated into an existing field mowing plan.

Pulling: Pulling plants out of the ground can be effective on species that have shallow roots and that do not reproduce through root suckering. For example, it is often possible to pull out most of the root system of glossy buckthorn (*Frangula alnus*) and garlic mustard (*Alliaria petiolata*). Some sprouting might occur, but reasonable control may be achieved. By contrast, species such as Asiatic bittersweet and Japanese knotweed (*Polygonum cuspidatum*) have extensive root systems that are hard to remove and that resprout vigorously from small sections of root left in the ground. While it is hard to control these species through pulling, if one comes across small, satellite populations of Asiatic bittersweet or other species, it may be worth the time to pull them out to reduce the plant's vigor.

- One downside of pulling is that it disturbs the soil, which may provide a seed bed for other invasive plants to become established. Pulling of plants can be aided by the Weed Wrench, a metal lever that grabs the base of small trees and shrubs.

2. Chemical control methods

✚ Herbicides are among the most effective and resource-efficient tools to treat invasive species. Most of the commonly known invasive plants can be treated using only two herbicides—glyphosate (the active ingredient in Roundup and Rodeo) and triclopyr (the active ingredient in Brush-B-Gone™ and Garlon™).

✚ Glyphosate is non-selective, meaning it kills everything it contacts. Triclopyr is selective and does not injure monocots (grasses, orchids, lilies, etc.). Read labels and follow directions precisely for both environmental and personal safety. These are relatively benign herbicides, but improperly used they can still cause both short- and long-term health and environmental problems. Special aquatic formulations are required when working in wetland zones. You are required to have a state-issued pesticide applicator license when applying these chemicals on land you do not own.

Common herbicide application methods

The method one uses to apply herbicide depends on such factors as target species, site characteristics, herbicide type, and time of year. The most common herbicides used for invasive plant control are systemic herbicides such as glyphosate (e.g., Roundup) and triclopyr (e.g., Garlon), although other herbicides are available and are preferred in some cases.

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Foliar spray

- Foliar application of herbicides entails spraying the leaves of target plants during the growing season with a low concentration of herbicide (0.75–3%) in water. Marking dyes, anti-drift formulations, and surfactants should be added in accordance with the pesticide label. The spray can be applied with a hand-powered, backpack sprayer or larger, motorized sprayers. In addition to protective equipment specified on the pesticide label, eye protection and chemical resistant gloves should be worn at all times.

Cut stump method

- The cut stump method is time consuming, but it is very selective. It should be used near sensitive, desirable vegetation and on target plants that cannot be foliar sprayed without a high risk of drift (e.g., tall shrubs, trees, or vines). The general period for this activity is from early July through November, although there is some evidence that fall application is more effective
 - Basal spray**
- The basal-spray method involves the application of an oil-based herbicide and oil dilutants to the bottom portion of a plant's stem. The oil penetrates the plant's bark and carries the herbicide into the cambium for translocation to the roots. Basal treatments generally are applied using a sprayer at low pressure with a marking dye. The concentration of herbicide in oil is dependent on the product being used and the application type. Consult pesticide labels for treatment methods and mixture instructions.
- The basal-spray method is similar to cut-stump application in that it is highly selective and may be used from early July through December. It tends to be faster than cut-stump because cutting is not required, but may require the application of more active ingredient. Basal spray formulations can also be applied to cut stump that have begun to re-sprout.

3. Biological controls

Biological controls use plant diseases or insect predators, typically from the targeted species' home range. Several techniques may be effective in controlling a single species, but there is usually one preferred method.

4. Restoration/Replanting

Following the removal of invasive plants, the site should be evaluated for the vigor, density, and diversity of established native plants. Many native plants might survive the initial control, new

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ones may seed in, or seeds may germinate from the seed bank. In many cases, however, it is often necessary to replant native species to ensure that the site's growing species occupied; otherwise invasive species will re colonize the site. Restoring a site with the original array of native species can be quite expensive and time consuming. In very sensitive sites with rare plant or wildlife species such an expense may be warranted. Often, though, the main goal of replanting is to quickly occupy growing space after control with fast-growing or easy-to-establish native species that grow in a range of conditions. Select native species that are appropriate for the site.

2.8. Conduct assessment to the prevention and monitoring principles

The preparation of a preliminary assessment based on existing information, which can be accessed from various sources (literature, databases, etc.), will provide an important document on which to base the initiative, as well as a source for comparison later in the process.

The crucial **information-gathering activities for this preliminary assessment** include:

- Preparation of an inventory of existing invasive species problems and their known environmental and economic impacts locally, and also impacts reported elsewhere.
- Check databases to see if any invasives are in your country or region which are considered serious invasives elsewhere, and consider what kind of impact they might have in your country.
- Besides threats to biodiversity, consideration should be given to threats to ecosystems services, agriculture, forestry, health, and trade. Inclusion of these threats will be particularly important, not only in building a better case but also in identifying stakeholders.
- Take into account the various human dimension aspects of invasive species.
- Pay attention to ecosystems that are particularly vulnerable and to endangered species and their habitats.
- Identify major pathways for potential future introductions of non-indigenous species, in particular for species known to be pests under similar conditions elsewhere.
- Economic analyses are an important and recommended tool as a basic component of an invasives strategy.

The **final assessment document** should include:

1. **Situation analysis** - a clear and concise summary of the status of the invasive problem including a statement of the problem, objectives, and strategic options for achieving objectives.
2. **Summaries of interviews** with representatives from each group of stakeholders to understand their particular perspective on or interest in the invasive problem.
3. **An assessment of the potential for partnerships** among stakeholders to address the invasives issue (e.g. areas of specific interest, funding possibilities, complementary resources).
4. **Key issues** - the problems and opportunities that will be encountered in addressing the invasive threat (specific for each group). These issues are identified in the assessment and will be addressed by the marketing strategies. It is important to clearly define what can be done on the supply, demand and policy levels to control the problem; and, which stakeholders can potentially have an impact by taking certain actions. These stakeholders will be your target group. All other groups that might influence the behavior of these stakeholders become channels through which you can reach your target group.
5. **Potential channels** of communication and influence on stakeholders (interpersonal, electronic, mass media, public relations).
6. **A comprehensive list of recommendations** and potential strategies drawing on outside technical assistance, if necessary.

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Self-Check – 2	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Short Answer Questions

1. Describe the word “Quarantine”? (2pt)
2. Describe the word invasive (non-native)? (2pt)
3. Write at least four elements of recommended procedures for quarantine of new species.
(2pt)
4. What is the aim of control of non-indigenous invasive species?(2pt)

Test II: Multiple choices (2 points each)

1. Which one of the following is **not** the *Common trait of invasive species*?
A. High dispersal ability
B. Intolerance of a wide range of environmental conditions
C. Rapid reproduction D. Fast growth
2. Which one of the following is control mechanism of invasive species?
A. Mechanical control B. Chemical controlC. Biological control D. All
3. Effective managementof invasive species requires
A. Understanding the target species’ ecology
B. Understanding population dynamics of species
C. Understanding dispersal mechanisms of species
D. All

Note: Satisfactory rating - 14 points Unsatisfactory - below 14 points

You can ask your teacher for further explanation.

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LG #28

**LO #3-Implement fire prevention
and controlling program**

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- OHS, legislative and organizational requirements
- Identifying Smoke and current position in the field
- Locating the current position on map
- Establishing and maintaining communication with others
- Communication equipment and safe working practice
- Location of own position and sightings
- Recording Sighting details
- Identifying situations requiring specialist advice

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- OHS, legislative and organizational requirements
- Identify Smoke and current position in the field
- Locate the current position on map
- Establish and maintaining communication with others
- Communication equipment and safe working practice
- Location of own position and sightings
- Record Sighting details
- Identify situations requiring specialist advice

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet 3

Introduction

Fire is both a friend and an enemy of the forest. It is a friend because fire is the natural force that cleans debris consisting of dead trees and plant materials from the forest floor. A wildfire also known as a forest fire is an uncontrolled fire often occurring in wild areas, but which can also destroy houses or agricultural resources. A wildfire differs from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to change direction unexpectedly, and its ability to jump gaps such as roads, rivers and fire breaks. Wildfires are characterized in terms of the cause of ignition, their physical properties such as speed of propagation, the combustible material present, and the effect of weather on the fire. The damage from forest fire is of high magnitude to timber, firewood, bamboo, fuel wood etc. This can be measured but there is invisible damage, like, loss in regeneration, loss in size quality, loss in nutrients, adverse impact on ecosystem etc cannot be measured. Forest fire damage is more in drier climatic condition. The damage may cause reduction in value of timber, effect on stand composition, Vulnerability to diseases and pests after the fire, deteriorating or improvement of site etc.

Types of forest fire

- The types of fire determined largely by the kinds of fuels that are presents and the level at which the fire burns. Three types of forest fire:
 1. **Ground fires**_ Ground fires in dry organic matter in swamps will often burn out much larger areas beneath the surface than is visible from above ground, creating potentially hazardous situations for people walking through the areas after a fire.
 - ✓ It spreads slowly and difficult to detect.
 2. **Surface fires**
 - ✓ Surface fires propagate through fuels less than two meters high, which are commonly small trees, shrubs, herbaceous vegetation, fallen leaves, pine needles, and woody litter.
 - ✓ Burns surface fuels consisting of the dry layers of twigs, dead branches, grass and leave that lie of the soil surface.

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- ✓ It uses all materials located immediately above the grounds.
- ✓ It moves quickly across the surface of the ground.

3. Crown fires

- ✓ Burns e.g. green part, dead materials include tree branches, foliage, shrubs, moss, lichens & spreads in or at the crown of trees.
- ✓ Ignition of fuels located more than six feet above the ground in the mid to upper canopy of the forest.
- ✓ Move very fast and cause heavy damage on timbers.
- ✓ The crown fires are deadly and occur mostly in combination with surface fire. The crown fire starts initially as surface fire but due to strong wind developed in to crown fire and leaps from one tree to another.
- ✓ The crown fires occur mostly in conifers forests. It is rare in broad leaf forests because the green leaves of hard woods are not easily ignited.
- ✓ There are two types of crown fires; low crown fire and high crown fire. The low crown fire destroys lower branches of big trees where as small trees are completely destroyed.
- ✓ High crown fire destroys everything on its way.

Causes of forest fire

- The cause of forest fire broadly classified in to two factors.

A. Natural factors

- ✓ It is non-preventable
- ✓ Some of the main natural factors are lighting and volcanic eruption, friction or sparks caused by coiling stones, rolling of rocks.

B. Human factors

- ✓ Most forest fires, other than those caused by natural factors are caused by human activities.
- ✓ Carelessness and ignorance of different activity by man like failure to put out campfires, cigarettes, and matches before leaving or discarding them in the forest, are leading cause of fire.

A. Accidental causes

- In these, there is no intension of setting fire to forests, yet due to negligence, accident

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or over sight, a forest fire may occur. This fire called accidental fire.

- These include;
 - ✓ When camp fires are not properly extinguished.
 - ✓ Travelers and villagers may carelessly throw unextinguished matches and cigarettes in the forest.

B. Intentional causes;

This category includes causes in which the intension is to set fire to the forest. This fire is known as incendiary fire. Incendiaries – forest fires which deliberately started by people.

The reasons may include:

- To initiate good grass growth-to improve grazing for livestock
- To hunt for wild animals and honey collection
- Prescribed burns- fire started in an established forest for the purpose of removing vegetation and fuel from the forest floor, eliminating trees that are affected by disease or insects.

Factors determining the rate of spread of fire;

- The nature of the forest combustion materials
- The prevailing wind velocity, relative humidity and change in weather conditions
- The nature of the weather conditions
- Obstacles in the path of the adjoining fire, such as evergreen belts, rivers and streams

Negative impacts of forest fire

- Injures as a result of fire:
 - i. Injures to living trees and merchantable timber
 - ✓ This leading to weaken a tree and expose to insect and pathogen attack.
 - ii. Injures to soils and H₂O bodies.
 - ✓ Burning of organic materials
 - ✓ Burning of vegetation which causes erosion to soil.
 - ✓ The eroded soil causes silting to H₂O reservoirs.
 - ✓ Stream channels harbor sediment eroded from land.
 - iii. Injuries to wildlife.

- Kills many animals and birds genetic erosion.
 - Wood ash washed to ward lake or reservoirs are toxic to fishes
- iv. Injuries to recreational values
- ✓ Destruction of wild life and plant reduce attraction of tourists (reduction of income)
- v. Injury to productive power of the forest ecosystems
- Kill important and valuable trees.

3.1. OHS, legislative and organizational requirements

is provides basic and more detailed information on the dangers to human health and safety posed by some forest activities and identifies measures that can be taken to mitigate these.

Workers may be subject to extreme heat and cold. High temperatures reduce work capacity and may lead to heat stress and dehydration. The risk can be reduced by, for example, the provision of sun shelters, the regular intake of water and the judicious use of rest periods, and by undertaking the heaviest work in the coolest work hours. Cold weather can reduce dexterity, blood flow, muscle strength and balance. Regular food intake, adequate clothing and sufficient facilities for drying clothes can reduce the risk to human health posed by cold weather.

To be stay safe in a forest fire:

- Make a fire safe zone around your house.
- Clean flammable vegetation and debris from at least 30 feet around the house and any outbuildings; Prune away the lower limbs of evergreens that are within the fire safe zone.
- Use fire resistant materials;
- Make sure firefighters can find and access your place
- Keep smoke outside.
- Reduce your smoke exposure by wearing a respirator devices
- Pay attention to any health symptoms if you have asthma, heart disease, or are pregnant.

Government health and safety regulations represent minimum requirements. In almost all cases, organizations will exceed these regulations with rules or procedures that are specific to the organization, the work being done, the equipment used, etc.

We need rules and regulations to protect the health and safety of workers, but there are dangers in having either too few or too many rules. Too few rules may be interpreted as a sign that health

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and safety are not important, or that common sense is all that is required to achieve them. Too many rules may be seen as not treating workers as thinking adults and makes enforcement of all rules less likely.

An adequate firefighting organization and management system for fire suppression does not exist in Ethiopia. There are no trained and equipped personnel for firefighting and the prevention is mainly through the mobilization of the farming communities. The weak institutional setup of the sector at all levels to monitor all forested areas and implement preventive measures has limited the prevention mechanisms to be traditional.

There is neither forest policy nor forest fire policy in place. There is no management plan for the remaining forest resources and no systematic fire management structure at any level except forest fire control committees which is not operational mainly due to lack of financial allocation.

3.2. Identifying Smoke and current position in the field

3.2.1. Identifying smoke

Forest fire smoke is a mixture of small particles, gases and water vapor. It may contain:

- Fine particulate matter
- Carbon monoxide
- Carbon dioxide
- Nitrogen oxides
- Sulfur oxides
- Volatile organic compounds
- Formaldehyde

These small particles can cause burning eyes, runny nose, scratchy throat, headaches and illness (i.e., bronchitis). They can also worsen chronic heart and lung disease (i.e., asthma, emphysema and COPD). Avoid breathing smoke if you can help it.

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3.2.2. Eight Tips for Protecting Yourself from fire Smoke:

If possible, limit your exposure to smoke. Here are eight tips to help you protect your health:

- Pay attention to local air quality reports when a forest fire occurs in your area, watch for news or health warnings about smoke. Pay attention to public health messages and take extra safety measures such as avoiding spending time outdoors.
- Pay attention to visibility guides if they are available, although not every community measures the amount of particles in the air, some communities have guidelines to help people estimate air quality based on how far they can see.
- If you are told to stay indoors, stay indoors and keep your indoor air as clean as possible. Keep windows and doors closed unless it is very hot outside. Run an air conditioner if you have one, but keep the fresh-air intake closed and the filter clean to prevent outdoor smoke from getting inside. Seek shelter elsewhere if you do not have an air conditioner and it is too warm to stay inside with the windows closed.
- Use an air filter. Use a freestanding indoor air filter with particle removal to help protect people with heart disease, asthma or other respiratory conditions and the elderly and children from the effects of wildfire smoke. Follow the manufacturer's instructions on filter replacement and where to place the device.
- Do not add to indoor pollution. When smoke levels are high, do not use anything that burns, such as candles and fireplaces. Do not vacuum, because vacuuming stirs up particles already inside your home. Do not smoke tobacco or other products, because smoking puts even more pollution into the air.
- Follow your doctor's advice about medicines and about your respiratory management plan if you have asthma or another lung disease or cardiovascular disease. Call your doctor if your symptoms worsen.
- Do not rely on dust masks for protection. Paper "comfort" or "dust" masks commonly found at hardware stores trap large particles, such as sawdust. These masks will not protect your lungs from smoke. An "N95" mask, properly worn, will offer some protection. If you decide to keep a mask on hand,
- Avoid smoke exposure during outdoor recreation. Wildfires and prescribed burns fires that are set on purpose to manage land can create smoky conditions. Before you travel to a park or forest, check to see if any wildfires are happening or if any prescribed burns are planned.

Firefighters must identify smoke sensitive areas/positions such as communities, hospitals, highways and areas already in nonattainment for particulate matter or ozone, and use appropriate mitigation and evaluation techniques to minimize smoke impacts. Weather, climate, and air quality monitoring data are used by fire managers to customize smoke management techniques as needed. These data can also help local health departments' alert citizens about the effects of smoke and where it may travel.

The maximum distance to which a small smoke column can be seen depends more on the clearness contrast between smoke and its background than the color contrast. Although it is more unpleasant and fatiguing for the human vision to inspect a landscape against the sun, the observation under these conditions is more effective.

3.2.3. Other factors affect smoke detection

- The wind tilts and disperses the fume of starting fires; this complicates the localization;
- The height and the density of the forest cover influence the appearance time of the smoke into the sight of the observer.
- The sight (visibility) range limit will in general be fixed between 20 and 25 km, but can also be reduced to 10 km for zones with bad visibility conditions (fog, clear background, etc.).

When wildfires are expected to create smoky conditions, people can pursue a number of strategies to reduce their exposure. Those with moderate to severe heart or lung disease might consider staying with relatives or friends who live away from the smoke during the fires. If smoke is already present in substantial quantities, such individuals may want to evaluate whether they might actually experience greater exposure during evacuation than staying at home and using other precautions described above. If smoke levels increase to very unhealthy or hazardous levels, it may be appropriate for some individuals to stay in a clean room in the home, relocate temporarily to a cleaner air shelter, or to leave the area entirely if it is possible and safe to do so.

3.2.4. Methods of control fire hazard

1. Firefighting with water

Water is perhaps the most common material used for firefighting since earliest times because of its high capacity to absorb heat.

2. Firefighting with earth - Earth (including mud or sand) is a good material for controlling and extinguishing forest fire as it cuts off the supply of oxygen to the fire.

3. Firefighting with chemicals

✓ Fire control (or firefighting)

Consists of depriving a fire of fuel (Reducing Agent), oxygen (Oxidizing Agent), heat and/or the chemical chain reaction that are necessary to sustain itself or re-kindle (also known as the four components of the *fire tetrahedron*). Firefighters are equipped with a wide variety of equipment to accomplish this task. Some of their tools include ladder trucks, pumper trucks, tanker trucks, fire hose, and fire extinguishers. Very frequent training and refresher training is required.

✓ Firefighting equipment

- 1. Rakes** – these have been purchased to provide a basic hand tools Mc lead tools
- 2. Shovel** – is use fuel firefighting tools and should supplement the Mc lead tools.
- 3. Brush hook**- can be very useful for clearing a line through heavy under growth .the recommended types should have a long handled and a curved blade, 12-15 inches long by 3 inches wide, and sharpened both side.
- 4. Axes** – a necessary piece of equipment
- 5. Water bags**- personal water bags should be carried out by each tanker.
- 6. Miscellaneous tools**- a locked tools box containing hammer, pliers, wire cutters, shifting spanner, files, and sharpening stone.
- 7. Firefighting chemical** – ammonium, ammonium sulphate, with corrosion inhibitors and thickening agent added are manufactured.
- 8. Water tanker** – tanker with 200 capacities should be used for initial attack. These tankers may be equipped with tanks and pumping equipment which can be removed but they should be fitted up at the start of the fire season and remain as a single purpose vehicle throughout the fire season.

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3.2.5. Steps to control fire hazards in your workplace

Follow these steps to reduce the fire risk in your workplace:

1. Identify fire hazard in your workplace, e.g. presence of ignition sources (heaters, lighting, electrical equipment, etc.) and fuel (packaging, plastics, rubber, petrol, chemicals, etc.).
2. Assess the risks posed by the hazards that you've identified – this will determine which hazards need the most urgent attention.
3. Put measures in place to control the risks – the hierarchy of control is a useful tool to use here, e.g. eliminate work processes that could generate an explosive atmosphere, service and clean all machinery as recommended by manufacturers, switch off electricity points when the business is unattended, remove waste material (e.g. fuel) that could act as fuel, store and dispose of flammable substances correctly.
4. Monitor the hazards and review the controls – this will ensure that the controls are minimizing the risks effectively.

3. 2.Establishing and maintaining communication with others

An effective high quality communications network allows a good communication and coordination between the various actors of fire prevention and suppression. If well organized, it allows reducing delay times until initial attack. The transmissions system for information generally used for forest fire protection is the radio operator system.

However, a particular telephone network is sometimes also used.

3.3. Locating the current position on map/plan

The success of a fire use program is in large part dependent on a solid foundation set in clear and concise planning. The planning process results in specific goals and measurable objectives for fire application, provides a means of setting priorities, and establishes a mechanism for evaluating and refining the process to meet the desired future condition. It is an ongoing process, beginning months or even years in advance of actual fire use, with plans becoming increasingly specific as the day of the burn approaches.

Items commonly addressed in the fire management plan are:

- Background information on the area, such as topography, soil, climate and fuels
- Applicable fire laws and regulations, including any legal constraints
- Fire history of the area, including the natural fire regime, and recent fire occurrence or use
- Map illustrating fuels distribution, treatment units, smoke sensitive areas, etc

➤ **Mapping of Fire sensitive areas**

Mapping/locating forest fire-sensitive areas are identifying areas where elements and factors causing fires are available in a sufficient amount to start fire. Characteristics of these areas are:

- Availability of potential fuel
- Human activities using fires
- Long drought

Forest fire-sensitive areas and the results are drawn in a sketch or a simple map. The sketch is used as a base in forest fire prevention plan. The checklist below is useful for identification:

Checklist for fire-sensitive areas:

- a) Why do fires frequently occur?
- b) Where do the fires happen?
- c) What activities are done?
- d) Where the activities are done?
- e) How often the activities are done?
- f) What natural factors caused the fires?
- g) When do the fires usually happen?
- h) What months do dry season usually take place?

➤ **People Mobility map**

This map shows location of people activities and frequency of mobility in their daily life that could influence the emergence of fires. This is done by collecting information (direct information or interview) on local people and outsiders' daily activities to estimate the fire sensitivity.

Output of information

- Where do people go to do their activities?
- What kind of activities do people have and how often?

Steps:

- Explain about local people and outsiders' mobility to know where they go.
- In a flip chart, draw position showing where people live.
- People mobility can be drawn with the help from local people.
- Put arrow to show people activity.

The number of arrow shows frequency of mobility in a certain activity.

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3.4 Communication equipment and safe working practice

The transmissions system for information generally used for forest fire protection is the radio operator system. However, a particular telephone network is sometimes also used. In any transmission network, the quality of the procedures and their precise definition are essential, so that only information circulates that is necessary, clear, precise, and concise.

1.4.1. MICRO Communication System

The MICRO Communication System from enables rescue personnel to communicate over commercially available radios. Attach it to a full facemask (open mode) or put it inside a protective suit (covered mode).

Features & Benefits of the MICRO Communication System

- Enables over-the-air communication with any commercially available radio
- Provides optimal speech communication
- Robust yet lightweight
- Works with or without a mask

3.4.1.1 Radio

Choice of the Frequencies

The most used frequencies vary from 30 MHz (low frequencies) to 3 000 MHz (very high frequencies). The waves having the lowest frequencies have the best direct carrying distance but they are less easily reflected and less penetrating.

Types of Networks

Simplex network: it functions only on one frequency (emission and reception) and does not require a relay. The installation cost of such a network is reduced, but the range of the communications is very limited by the relief. In practice, the network simplex is used only in complement of another communication system (e.g., Tunisia, Syria).

Duplex network: emission and reception can simultaneously take place on two different frequencies constituting a channel. This type of network makes it possible to establish communications between a central station and several private radio stations. However, the latter cannot communicate directly between them and must always pass by the central station.

Semi-duplex network: emission and reception are done successively on two different frequencies, by means of a relay which reverses the frequencies. The advantage of this type of network is to ensure a permanent and optimal cover of the territory, insofar as the relays are established judiciously. However, the installation cost of such a system is comparatively much higher, and there remain obscured zones in which the communication is impossible.

Network Hardware

Automatic relays

These are stations which retransmit the frequencies that they receive. They are necessary as soon as the area to cover is too big or that the relief is too steep. For semi-duplex networks, automatic relays must function in duplex, in order to retransmit immediately the received emissions.

Stations

Stationary radios: in general stationary and powerful equipment is linked to offices, (with an antenna on the roof of the building), they are the main points of the exploitation of the network.

Mobile radios: with a power of 10 to 15 Watts, these mobile stations can be installed in a vehicle and be fed by the battery of this one.

Portable radios: they have the advantage of being light and easily to operate, therefore they are very practical on the ground; their principal weakness is the power limitation (2 to 5 Watts),

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which makes them much less powerful than from mobile stations. Provided with an autonomous battery, they cannot function more than 24 hours.

Design of A Semi-Duplex Network

Installation of an automatic relay

The range of the relays is in general approximately 30 km. It can be much more significant if the relay is located on a high point.

The relays will be established in order to:

- To cover with a minimum of relay the greatest possible area (a cover of 95 % must be regarded as excellent). The relays will be established on high points.
- Minimize the installation costs (access, energy supply). There is an advantage if there exists a certain overlapping of zones covered by the relays, because that provides some security in the event of breakdown of one of them.

3.4.1.2. Telephone

Telephone Network

The national telephone network can be used to transmit information, but its use for the surveillance remains generally limited, because it can saturate very quickly in the event of significant fire risks. A specialized telephone network can supplement the radio operator network. E.g., in Cyprus, the forest service has its own telephone network with a manual switching standard, effective and free of charge except for maintenance costs. This network connects the various forest units, divisions to the lookout towers. Moreover, phone terminals connected to the forest office are at the disposal of the public in the forest, and particularly close to picnic areas.

Mobile Phones

This mode of communication is increasingly used by persons in charge of forest fire protection. However, it does not ensure a total coverage of the territory. Moreover, the operational standard can sometimes be saturated at the time of a fire occurrence.

Call Free Number

A call free number can be placed at the disposal of the public

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3.5. Communication equipment and safe working practice

An effective high quality communications equipment's allows a good communication and coordination between the various actors of fire prevention and suppression. If well organized, it allows reducing delay times until initial attack.

The transmissions system for information generally used for forest fire protection is the radio operator system. However, a particular telephone network is sometimes also used.

In any transmission network, the quality of the procedures and their precise definition are essential, so that only information circulates that is necessary, clear, precise, and concise.

Firefighter communication equipment is designed to give firefighters or rescue professionals comfort and good mobility whilst making sure that the firefighting crew is in contact with each other and the firefighting crew commander at all times. Good communication skills at an incident are essential for successful management of a rescue or fire and the correct equipment is an essential part of assisting with firefighter communication.

At Fire Product Search we care about you and your fire and rescue team's safety and protection. That's why we proudly list only the highest rated, highest quality firefighter communications equipment from industry trusted brands. The communication equipment is all made and designed using the latest technological advances, innovations, and materials. When it comes to finding the latest firefighter personal communication gear for your fire and rescue teams choose Fire Product Search.

Hearing Protection & Communication Headsets

Integrated communication headsets specifically designed for the Hearing Protection & Communication Headsets. These state-of-the-art accessories **enable firefighters to communicate more efficiently than ever, even in tough and noisy environments.** This headsets have optimal integration inside the helmet approved headsets for use with radios, Noise cancelling, boom microphone and bone conductive versions available, Communication headsets, 1 or 2 loudspeakers, Hearing protection headsets and Surrounding noise awareness with level dependent functionality.

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3.6. Location of own position and sightings

Effective fire control begins with a field survey and map to identify the areas or location at risk, delineate them, and define and improve the barriers or firebreaks that may limit fire spread. Natural barriers include rivers, lakes, ridge tops, and tracts of bare land. Artificial barriers can be roads, railways, canals, and power-line tracks, but usually extra firebreaks must be cut to link these and provide wider gaps that fire cannot readily jump.

Sometimes the soil is left bare and cultivated only at intervals to check invasion by weeds. Usually it is sown with an even crop of low perennial grasses or clovers and kept short by mowing or grazing. This checks soil erosion, provides an evergreen fireproof surface, and allows access on foot, by car, or in an emergency by fire-fighting trucks. Surfaced roads, serving also for lumber haulage and access for recreation, are of critical importance in firefighting. Signposts are needed to guide fire crews unfamiliar with the woods and to mark water supplies and rendezvous points.

Aircraft are used to detect fires position and to carry out reconnaissance of known fires. Aerial surveillance has probably been most successful in detecting lightning caused fires and is most often employed in areas of relatively low value lands and inaccessible areas. An aircraft is essentially a moving fire tower, and the problems of detection that apply to a tower also apply to an aircraft; however, new developments in remote control television, high resolution photography, heat sensing devices, film, and radar make fire detection by aircraft and satellite more efficient and location more accurate. Satellites provide a rapid means of collecting and communicating highly precise information in fire detection, location, and appraisal.

Once a fire position has been detected, the next step is fire suppression. The first job is to stop or slow the rate of spread of the fire, and the second job is to put it out. The aim of suppression is to minimize damage at a reasonable cost. This does not necessarily mean the same thing as minimizing the area burned, but it is a major goal. Suppression is accomplished by breaking the “fire triangle” of fuel, temperature, and oxygen by robbing the fire of its fuel (by physically removing the combustible material or by making it less flammable through application of dirt, water, or chemicals); by reducing its temperature (through application of dirt, water, or

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chemicals and partial removal or separation of fuels); and by reducing the available oxygen (by smothering fuels with dirt, water, fog, or chemical substances).

The **delineation of location** also is determined by various considerations:

- Mapping of the fire danger (risk and vulnerabilities), and in particular the ignition risk.
- Analysis of the firefighting constraints (topography, distance to fire centers, forest fire protection equipment, etc.).
- Analysis of alternative means of alarming (fire reporting). An effective vigilance by the population in certain zone (revealed, for example, by the study of filed fire reports) allows accepting a less dense coverage of this zone, especially when this economies on needed investments (villages located at the end of steep-sided valley where the visibility from lookout towers is difficult).

3.7. Recording Sighting details

➤ Recording environment details

Forests are the protectors of earth's ecological balance. Unfortunately, the forest fire is usually only observed when it has already spread over a large area, making its control and stoppage arduous and even impossible at times. The result is devastating loss and irreparable damage to the environment and atmosphere (30% of carbon dioxide) in the atmosphere comes from forest fires), in addition to irreparable damage to the ecology (huge amounts of smoke and carbon dioxide) in the atmosphere). Among other terrible consequences of forest fires are long-term disastrous effects such as impacts on local weather patterns, global warming, and extinction of rare species of the flora and fauna.

Areas destroyed by these fires are large and produce more carbon monoxide than the overall automobile traffic. Monitoring of the potential risk areas and an early detection of fire can significantly shorten the reaction time and also reduce the potential damage as well as the cost of firefighting. Known rules apply here: 1 minute—1 cup of water, 2 minutes—100 litres of water, 10 minutes—1,000 litres of water.

The objective is to detect the fire as fast as possible and its exact localization and early notification to the fire units is vital. This is the deficiency that the present Invention and site

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details attempts to remedy, by means of detection of a forest fire at the very early stage, so as to enhance or ensure the chance to put it out before it has grown beyond control or causes any significant damage.

There are a number of Sighting detailsdetection and monitoring systems used by authorities. These include **observers in the form of patrols or monitoring towers, aerial and satellite monitoring** and **increasingly promoted detection and monitoring systems based on optical camera sensors**, and **different types of detection sensors or their combination**. Before any choice of building sites for the fire watchtowers, it is important to study the area in order to be able to delimit the zones to be covered by the network.

A sustainable success in the combat against forest fires requires the investigation and analysis of fire origins. The knowledge of the causes allows a better targeting of actions to be initiated for fire prevention (information, awareness raising, risk analysis, regional planning, etc.), and to limit possible criminal acts by bringing culprits effectively to trial.

➤ **Sighting details important to:**

- To evaluate a danger, is to assess both fixed and variable factors of the fire environment that determine the ease of ignition, rate of spread, difficulty of control
- To forecast a danger, is the effort to determine a period of time when the phenomenon could occur.
- The fire danger varies in time in accordance with weather and vegetation conditions. This is the temporal forecast ofthe danger.

The fire danger is not homogeneous for the whole territory. Its intensity depends of natural environmental conditions and the land use. The spatial evaluation takes this aspect of fire danger into consideration.

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3.8. Identifying situations requiring specialist advice

- **Seeking assistant**

Fire suppression often requires the mobilization of many fire fighters. The local population participates sometimes in the firefighting. However, it is necessary that personal specialized in firefighting is responsible for the fire operations. This personal indeed has a good knowledge of fire suppression, has specific equipment, is organized in operational command structures and develops a firefighting strategy adapted to the fire context.

Forest fire suppression requires **two types of assistants**:

- Specialists (professional firefighters and foresters).
- Local population.

- **Specialized personal**

Varying in different countries, various actors intervene for forest fires suppression:

- ✓ The professional firefighters, who also intervenes on urban fires,
- ✓ The foresters, who fight only, forest fires.
- ✓ The specialized personnel receive training.

- **Local population (not specialized personnel)**

In some countries, the local population takes an active part in firefighting in an obligatory or spontaneous way.

- **Volunteer associations**

Sometimes, forest workers, for example those working in forest exploitation or cork harvesting, are called in to support firefighting activities. However, the involvement of the local population must be limited because people are not trained and their equipment is often rudimentary. They generally have no protective equipment.

- **Reinforcements:**

When a fire size increases and becomes uncontrollable, other types of personnel can intervene as reinforcements.

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However, in Ethiopia, the management of forest fires has been poorly organized and uncoordinated. There is no formal unit /institution which are responsible for forest fire management. It is one of the several responsibilities of the Forestry and Wildlife Technology and Regulatory Team within the ministry of agriculture at the federal level and bureau of agriculture at the regional levels. At the federal level, forest protection, including fire issues falls within the responsibilities of the Forest and Wildlife Conservation and Development Team of the ministry of agriculture. At the regional levels, the regional Bureau of agriculture Development is responsible for forest fire protection. However, there is no special force for fire management. It is only activated when there are emergency fire outbreaks. In such cases, both the urban and rural communities are mobilized. There are no especially trained personnel, equipment and financial resources. There is no trained crew or organization for forest firefighting. People are mobilized without training in firefighting and fire fighter safety.

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Self-Check – 3	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Short Answer Questions (2points each)

1. What is forest fire? (2pt)
2. How can we safe in forest fire? (2pt)
3. What are the effects of smoke? (2pt)
4. What are the factors affect smoke detection? (2pt)
5. Describe the communication systems of fire prevention and suppression. (2pt)
6. What are the types of networks to fire prevention and suppression? (2pt)
7. What are the characteristics of fire sensitive areas? (2pt)
8. What is People Mobility map? (2pt)

Note: Satisfactory rating - 16points Unsatisfactory - below 16 points

Operation Sheet -3

- Undertake landscape assessment to develop a fire protection strategy

Materials and equipmentsneeded:

- Rakes
- Shovel
- Brush hook
- Axes
- Water bags
- Miscellaneous tools
- Firefighting chemical
- Water tanker

Procedures:

- ◆ Identify fire hazard in your workplace,
- ◆ Assess the risks posed by the hazards that you've identified – this will determine which hazards need the most urgent attention.
- ◆ Put measures in place to control the risks
- ◆ Monitor the hazards and review the controls
- ◆ prepare a report

LAP TEST-3

Performance Test

Name..... ID.....

Date.....

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **6**hour. The project is expected from each student to do it.

Task 1 Perform forest fire protection

LG #29	LO #4-Record and report information
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Instruction sheet
<p>This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:</p> <ul style="list-style-type: none"> • Recording, documenting and reporting disease and pest assessment result • Recording and relaying relevant information and conditions • Recording and reporting fire detecting processes and outcomes <p>This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:</p> <ul style="list-style-type: none"> • Record, document and report disease and pest assessment result • Record and relay relevant information and conditions • Record and report fire detecting processes and outcomes
Learning Instructions:
<ol style="list-style-type: none"> 1. Read the specific objectives of this Learning Guide. 2. Follow the instructions described below. 3. Read the information written in the information Sheets 4. Accomplish the Self-checks

Information Sheet 4

4.1 Recording, documenting and reporting disease and pest assessment result

Forests are complex ecosystems that provide a variety of valuable products, such as timber, fuel wood, fibre and non-wood forest products, and contribute to the livelihoods of rural communities. They also provide vital ecosystem services, such as combating desertification, protecting watersheds, maintaining biodiversity, and enhancing carbon sequestration, and play an important role in preserving social and cultural values.

It is critically important to protect these valuable resources from disturbances such as fire, pollution, invasive species, insects and diseases. While they are integral components of forest ecosystems, insects and diseases have considerable influence on the health of forests, trees outside forests and other wooded lands. They can adversely affect tree growth, vigour and survival, the yield and quality of wood and non-wood products, wildlife habitat, recreation, aesthetics and cultural values. Forest insect pests and diseases may also result in the limitation of plantation programmes, the abandonment of a given tree species and the necessity to clear cut large areas dominated by infested trees.

Forests need to be managed so that the risks and impacts of unwanted disturbances are minimized. Measures to protect forests from insect pests and diseases are an integral part of sustainable forest management. The importance of considering the impacts of insect pests and diseases on forests and the forest sector has been recognized for some time.

Effective pest management requires reliable information – information on the pests themselves, their biology, ecology, and distribution, their impacts on forest ecosystems and possible methods of control. While much qualitative information on insect pests and diseases exists at local, national and even regional scales, little comprehensive, quantitative information is available at the global level. Typically more information is available on pests of trees in industrialized rather than non-industrialized countries and also for pests of trees grown in commercially valuable planted forests (which include plantation forests and planted semi-natural forests) compared to

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pests in naturally regenerated forests. Virtually nothing is known of the pests associated with those trees harvested from naturally regenerated forests, at least in the tropics.

Collecting forest health information

Gathering information, recording, documenting and reporting disease and pests is important to obtain an ever more complete picture of forest health. The following activities are some examples that have helped contribute to closing the information gap regarding forest health.

With the cooperation of experts compiled data on the impact of insect pests and disease outbreaks was designed to document, analyses and make current information about forest health available at the country level in order to increase awareness of the severe problems related to insect pests and diseases worldwide and to provide up to date information for policy and forest management planning.

A database on the incidence and extent of insect pests and diseases affecting forests over time was created and subsequently tested and a critical economic review of its contents was then carried out.

4.2 Recording and relaying relevant information and conditions

Relevant information is data that can be applied to solve a problem. This is a particular issue when protecting fires and controlling forest pests and disease. Finding accurate and up to date information about the potential forest fire, disease and pests is something important that is crucial for the success of the product.

There should be systematic and accurate reporting on forest fire, forest disease and pests. There should be reliable statistical data on occurrence of wildfires, areas burned and losses, forest disease and pests should available. We have to accurate information on annual fire, forest disease and pests extent available. The systematic reporting on forest fire, forest disease and pests data permitting any analysis of causes, risks and the extent of damage for wildfire, forest disease and pests. There should be efficient communication system to transmit the information to the appropriate organ.

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There should be formal fire detection, forest disease and pests and reporting system and these are usually reported by telephone if it is at all available. There should be existing fire danger rating system and the application of early warning systems for forest fire management at local, regional and national levels are not in place. Site specific fire weather, forest disease and pests forecasts should be available either. The communication system should be transmitted the information to the responsible office.

Quantitative and qualitative information and data on forest fire, disease and pests for meaningful planning should be available. There should be an inbuilt early warning system established at national level to be used as a source of information and take precaution. Human resources capability both in terms of training and equipment, Low levels of awareness at all levels, which impacted the institutions to lack adequate resources and support.

Fire, disease and pests information system such as the acquisition, management and dissemination of appropriate information to the users has to be prepared. There should also be capacity to report fire outbreaks instantly, including networking for the detection and reporting of fire location and characteristics.

The development agents of the ministry of agriculture should provide relevant information to the farmers around their stations on the impacts of wildfire on the forest resources, pests and disease and its relation to the production system. They are informed and up dated on the possible causes of fire and on precautions to be taken during the dry season.

4.3 Recording and reporting fire detecting processes and outcomes

4.3.1. Fire detection

It is essential to set up an effective surveillance network which allows reducing the time between the ignition and the detection of the fire. It focuses particularly on all activities which can cause a fire. The surveillance is based on the combination of various observations and detection means; it could be:-

- Mobile or fixed,
- Terrestrial or

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- Aerial.

The combination of the surveillance and the first intervention, performed by the same team having terrestrial or adequate aerial support, proves particularly effective for quick intervention on a starting fire during days at very high risk.

4.3.2. Fixed observation

It is preferable that the fixed observation is ensured based on specific infrastructures: fire lookout towers. The absence of these installations renders the surveillance more difficult. The tower must be located on open high point with a good visibility on the surrounding area. Their number can be variable, in particular according to the topography which can strongly limit the visibility, but essence is to ensure the best possible surveillance coverage of the territory. These towers must be protected from fire (undergrowth clearing, watering system).

The surveillance quality of a watchtower network depends mainly on three factors:

- The location of the stations;
- The equipment specifications (technical quality and equipment of the stations);
- Rules for safeguarding the network efficiency (quality of the personnel, work specifications).

4.3.3. Terrestrial mobile observation

A terrestrial mobile observation supplements usefully the surveillance from fixed lookouts. They are patrols on foot, bicycle, horse, or vehicle. Their role is the fire detection, education of the public, control of human activities which can increase the fire risk, enforcement, and dissuasion. The patrols have a radio to inform the responsible organization. In the case of equipped patrols, the patrols carry tools for a first intervention (water tanks, motor-driven pumps, etc.). The effectiveness of the initial attack depends not only on early detection, but also of the quality of the alarm message. The patrols are more effective than untrained volunteers if its personnel are professional and have a basic knowledge of fire behavior. The alarm message then has much more of detailed information (slope, vegetation, smoke column, necessary firefighting equipment, etc.).

4.3.4. Aerial observation

There exist two types of surveillance using aerial platforms:

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- **Aerial reconnaissance.** The airplane has only the task of detecting fires and to alert the firefight services;
- **Aerial reconnaissance with water tanks.** The planes have a water tank and combine surveillance and initial attack. These reconnaissance planes (e.g., Tracker S2F) are equipped with a small water tank and able to intervene directly on the fire immediately after detection. This type of surveillance remains little developed in the Mediterranean basin. The reserves come from the inherent cost of this detection system. The armed aerial reconnaissance is nevertheless very useful for the zones that are not accessible on the ground.

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Self-Check 4	Written Test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Task I: Short Answer Questions

1. Discuss the various observations and detection means? (10pt)

Note: Satisfactory rating - 5 points and Unsatisfactory - below 5 points

You can ask your teacher for further explanation.

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