Forest Stewardship Council

FSC Guide

To integrated pest, disease and weed management in FSC certified forests and plantations

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The Forest Stewardship Council (FSC) is an independent, non-governmental, not for profit organization established to promote the responsible management of the world's forests. It provides standard setting, trademark assurance and accreditation services for companies and organizations interested in responsible forestry.

Products carrying the FSC label are independently certified to assure consumers that they come from forests that are managed to meet the social, economic and ecological needs of present and future generations.

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FSC welcomes comments on this report, which can be made at the FSC website (www.fsc.org).

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The guide draws substantially on the following previously published work:

Willoughby, I. *et al*. (2004). Reducing pesticide use in forestry. *Forestry Commission Practice Guide* **15**. Forestry Commission, Edinburgh, UK.

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ACRONYMS AND ABBREVIATIONS

FSC	Forest Stewardship Council
IPM	Integrated Pest, Disease and Weed Management
GUI	FSC Guidance Document
FSC-STD	FSC Standard
PAN	Pesticides Action Network

SUMMARY

This guide provides a generic framework for Integrated Pest, Disease and Weed Management (IPM) on Forest Stewardship Council (FSC) certified estates, which may include indigenous forests and plantations.

The guide contributes to the implementation of the FSC Pesticides Policy, the core elements of which are:

a) The identification and avoidance of 'highly hazardous' pesticides – use of which is only possible in exceptional circumstances;

b) Promotion of ‘non-chemical’ methods of pest management;

c) Appropriate use of any pesticides that are applied.

Use of the framework is not mandatory, or intended to be prescriptive, but adoption of its principles will assist managers in demonstrating that they have a strategy for reducing, minimising or eliminating the impact of any remaining pesticide use, as is required by FSC criterion 6.6. Furthermore, it will assist managers in preventing and minimising impacts from pests, diseases, fire and invasive plant introductions, with a primary reliance on prevention and alternative control methods, rather than the use of chemical pesticides.

Without following some form of IPM framework, it may be more difficult for managers to demonstrate they are meeting the requirements of Criterion 6.6 and 10.7.

Managers and experts are encouraged to develop locally or regionally specific strategies based on the principles contained in the generic framework.

Examples of a country strategy from which this generic framework is adapted, and a database of additional strategies for a range of individual pest, disease and weed problems from other regions across the world, are provided as resource to help managers develop their own regional specific strategies for current and future problems within the generic IPM framework.

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1. Background

Principle 6.6 of the FSC International Standard (FSC-STD-01-001, version 4-0) states:-

Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides. World Health Organisation class 1A and 1B pesticides, and chlorinated hydrocarbon pesticides, pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use, as well as any pesticides banned by international agreement, shall be prohibited. If chemicals are used, proper equipment and training shall be provided to minimise health and environment risks.

Principle 10.7 of the FSC International Standard (FSC-STD-01-001, version 4-0) states that measures shall be taken to prevent and minimise outbreaks of pests, diseases, fire and invasive plant introductions. Integrated pest management shall form an essential part of the management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides. Plantation management should make every effort to move away from chemical pesticides, including their use in nurseries. The use of chemicals is also covered in Criteria 6.6 and 6.7.

FSC Pesticides Policy, Guidance on Implementation (FSC-GUI-30-001) identifies pesticides classified by FSC as ‘highly hazardous’, which are prohibited in FSC certified management units unless specific derogation for their continued use is granted. The guidance goes on to recognise that further work is required on minimising pesticide use in FSC certified forests, and minimising risk when pesticides are used.

The FSC plantation review policy working group report of October 2006 recognised that pesticide use within many certified estates was a reality, and likely to remain so for the foreseeable future. The Group recommended that a consistent best practice integrated chemicals management approach was adopted, with the aim of achieving a progressive reduction in usage and a reduction in negative impacts on people and the environment.

This document provides a generic framework for integrated pest, weed and disease management that will enable managers to address the recommendation of the Plantations Review. The framework aims to facilitate managers in developing their own practical, economically viable strategies to replace, reduce or remove the use of pesticides (i.e. so called ‘3r’ strategies) used on their estates, which may include indigenous forest and plantations. The guidance also aims to help managers identify practices that would minimise the potential damage that could be caused to the environment and human health by both the pests, diseases and weeds themselves, as well as by any measures that might be adopted to control them. The framework can be used for developing reduced chemical strategies for managing all current and future pest, weed and disease problems facing managers in specific regions, but the development of alternatives is particularly important for those pesticides designated as ‘highly hazardous’ by the FSC.

2. Examples of strategies in practice

Actual strategies developed through the use of the generic framework will be region specific. What might prove to be an effective approach in one particular country or region will not necessarily be appropriate or practical in another, due to variations in climate, geology, flora, fauna and societies. Therefore, this document does not attempt to provide prescriptive solutions to the wide range of pest, disease and weed problems likely to be encountered on FSC certified estates throughout the world. Nevertheless, it is recognised that the sharing of IPM strategies that have proved successful in helping to replace, reduce and remove the use of pesticides for specific problems in particular regions is likely to be of great assistance for managers in developing their own solutions to populate the generic framework. Two sources of examples may therefore be of assistance for managers in developing their own strategies:-

(i) Integrated country strategy

An example of one possible integrated country strategy, from which this generic framework has been developed, can be accessed by following the link:
http://www.forestry.gov.uk/forestry/infd-76lgsn

The Forestry Commission Practice Guide which can be freely obtained from the above link gives guidance on opportunities for reducing or eliminating pesticide use for all major pest, weed, disease and problems likely to be faced by managers in the United Kingdom, following the general principles of the generic integrated pest, weed and disease management framework. It also provides more detail on the principles underlying the generic approach outlined in this document.

(ii) International resource site

An international database of strategies for replacing, reducing and removing the use of pesticides for specific pest, disease and weed problems can be accessed at the following link: http://www.fsc.org/internationalpolicies.html, brochures > IPM Guide > FSC IPM resource database.xls.

The database provides an important resource of strategies found to be successful by managers in specific regions and countries. For managers in the same country or region some strategies may be directly applicable to their pest / weed disease problems. Other approaches may prove practical for adaptation to other local or national regions using the generic IPM framework, or provide the basis for further country specific research.

The database will be maintained and updated by FSC to reflect new strategies as they are developed internationally.

3. The Framework

Figures (1) – (3) provide the core of the generic IPM framework. The simplest way to use the framework is to complete the decision recording sheet (figure (3), by working through the decision keys (figures (1) and (2)), utilising the repository of example strategies from other regions as provided in the 'examples of strategies in practice' section above. Further background as to the rationale behind the generic framework, and its operation, is given below.

The nature of pest, disease and weed problems

Many organisms interact with trees, but it is only when they affect the forest in a way that is detrimental to a particular objective, for example timber production, or maintaining forest communities within the forest or on neighbouring land, that they become a pest or weed. In nature, most species are in balance, and it is relatively uncommon for the over exploitation of resources to take place. However, catastrophic influences such as wildfires, strong winds, snow storms, drought and floods, climate change, biosecurity incursions, or human interventions which favour one species over another, can change the prevailing natural balance, favouring organisms that can more easily exploit weakened plant resources. The introduction of new pests can be catastrophic to natural environments, particularly where similar species do not occur naturally, for example when mammalian species are introduced to areas where they are naturally absent. Climate change can increase the frequency and severity of natural disturbances, alter the range and nature of problem pests, weeds and diseases, and require the reappraisal of existing approaches to management and control. In highly disturbed ecosystems, whether due to natural causes or artificial intervention, further inputs may therefore become essential if forests and woodland are to be adequately protected or regenerated, and rapid interventions may need to be taken to prevent damage to neighbouring communities.

Origin of pest species

Damage to trees and woodlands can occur from both indigenous and introduced species. With indigenous species, it is often the impact of humans that has the most influence. For example, the sustainable harvesting of trees for timber production may favour invasive, light demanding plant species that prevent or delay the natural cycle of seedling regeneration, and hence require further inputs by humans to restore the natural balance. However, many of the most serious problems for indigenous trees have resulted from the movement of causal organisms from one part of the world to another. These organisms have not co-evolved with their new hosts, and the hosts may have limited or no effective defensive systems and may lack natural biological controls. Therefore preventing the arrival of a potentially damaging pest, pathogen or invasive plant species, and having detection systems in place to allow a rapid response to any potentially damaging introductions that do occur, will reduce or eliminate the need for more extensive interventions to be made later.

It should be remembered however that the movement of plant and animal species from different geographical regions has been taking place for centuries, and many introductions have made a vital contribution to the practice of sustainable agriculture and forestry throughout the world. In some regions, the introduction of better adapted species will form an important ele-

ment of any strategy to combat the damaging effects of future climate change. A blanket prohibition on the use of certain non indigenous plant and animal species will not always be the correct response in all situations.

The challenge for managers is to respond to likely threats from potentially damaging or invasive species in the context of their own particular region, and a risk assessment should be made at a country or regional basis before any new potentially invasive species are introduced. Even if judged to be safe, after any introduction, the new species should be carefully monitored to ensure it does not subsequently become invasive, to help determine if any remedial action needs to be taken, for example to prevent wildings from plantation species invading indigenous forests. In addition, both international and country level legislation is in place to regulate the international movement of organisms posing phytosanitary risks or ecosystem threats, and regardless of forest estate certification requirements, these regulations and agreements must be complied with by forest managers. Further guidance on general principles for monitoring and responding to the threats posed by alien invasive species can be found at the FSC website http://www.fsc.org/internationalpolicies.html, brochures > IPM Guide > Invasive Species Supporting Document to FSC IPM Guide.

4. Responses to a pest, weed or disease problem

Figure 1 outlines the core decision key that can be applied to help determine the most appropriate method of responding to any pest, disease and weed problems in FSC certified forests, including indigenous forests and plantations.

The most appropriate response, which may often be to take no action, should be the one that reduces negative impacts on the forest and wider environment below acceptable thresholds, and that minimises impacts on human health and indigenous peoples. Impacts may arise both from the pest, disease or weed itself, as well as from any control measures that might be adopted to manage the problem.

It would be impossible to provide detailed guidance on the optimal management of all pests, diseases and weed problems likely to affect certified forests throughout the world. Therefore the decision key does not attempt to provide a definitive and prescriptive approach to Integrated Pest and Disease Management. Rather, the core decision key is a generic framework, a tool that can be applied using regional expertise and experience to develop more sustainable management approaches to dealing with pest, weed and disease problems.

Note that in using the framework, when dealing with familiar problems and situations, it may not always prove necessary to operate every step of the process in detail and complete a record form for every individual operational site. For example, it may instead be sufficient to use the framework at the commencement of a proposed annual control programme to determine the best approach for a group of very similar sites facing the same pest problem. The conclu-

sions drawn may continue to be applicable to that group of sites during the proposed period of operations, unless there are significant changes in the prevailing conditions, for example in site type, location, nature of pest infestation, control technology, climate etc.

The decision framework comprises three main steps.

1) Identify and quantify the problem

The actual or potential problem must be identified and quantified, to allow a prediction to be made of the likely consequences if the problem is not addressed.

Without an understanding of what the current or potential future causal agent is, it is impossible to judge what further action is required. An assessment of the nature of the pest, weed or disease problem, based upon its life cycle and role within the natural ecosystem, is the best way to judge likely current and future impacts. Correct identification therefore consists of understanding not only what the causal agent is, but also its population density and biology, life cycle and likely impacts.

Once likely impacts are determined, decisions can be made on whether any further action needs to be taken, or on the economic and environmental thresholds which might trigger the need to take action. For example, it may not be necessary to initiate control measures until a problem species exceeds a particular density threshold. Ongoing monitoring of key pests, diseases and weeds is therefore likely to be required in order for judgements to be made on when key thresholds for taking action have been reached.

A good understanding of the causal agent is also key to determining the range and combination of options that might potentially be used for its mitigation or control. For example, an understanding of an insect species life cycle can be vital in identifying the optimum timing for control measures.

Often the cause of ill health of trees is not obvious, or may be a result of a number of interrelated factors. Therefore when dealing with new or unfamiliar situations, it is advisable, if practicable, to obtain specialist advice before planning any management operations. Particular difficulties may arise if the problem is a new incursion to a region or country, and contact with specialists from the place of origin of the invading species should form part of the problem scoping exercise. However, it may not always be practical to engage in long term studies of a particular pest, weed or disease problem before deciding on the need for action. Managers should therefore endeavour to make use of the best available existing knowledge, be that through reference to published information, or contact with specialists such as researchers or other forest managers with relevant experience of similar situations, when planning management operations.

With familiar problems and situations, once the pest, disease or weed is identified, it may be sufficient to refer to existing guidance or historic management records to evaluate the likely future consequences for the forest if no further action is taken.

2) Consider the control options

(i) Take no action

In many cases, particularly where insect pest and fungal diseases are concerned, the best approach may be to make a conscious and informed decision to take no further action other than monitoring the situation. This may be the case when there are no effective control measures, or when the economic cost or environmental or social impacts of such control measures outweigh the risk to the forest from taking no action, or where critical thresholds have not been exceeded. However, past experience may dictate that some form of management input is essential to maintain adequate growth and survival of trees, as is often the case when dealing with tree regeneration.

(ii) Avoid the problem

Given a good understanding of the nature of the pest, disease or weed agent, it may be possible to take action to avoid the current problem, or to prevent a potential problem occurring in the future.

Such an approach may be far cheaper, and involve fewer potentially damaging impacts on the environment and indigenous populations than taking remedial action.

Examples of strategies for avoiding the problem might be to prevent the import or spread of alien invasive species, maintaining healthy and vigorous stands through good silvicultural practice, selecting suitable tree species well matched to the site and capable of adaptation to future climate change, the use of resistant varieties, genotypes and species, maintaining adequate tree nutrition, and the adoption of alternative silvicultural systems. Further region specific examples are given in the links provided from the ‘examples of strategies in practice’ section.

(iii) Take remedial action

If it is not practical to take no action or avoid the problem, it may be necessary to consider remedial control measures. All remedial actions carry the risk of potential non target impacts. For example, mechanised weed cutting can lead to soil compaction and petrochemical pollution, and herbicides can kill non target plants and cause wider pollution if misused. Managers must therefore consider the potential negative impacts of all candidate control measures, and

adopt those that are both effective, but offer the least risk of harm to the environment, operators neighbouring communities and indigenous peoples.

3) Consider which remedial control measure is most suitable

(i) Non-chemical methods

For many pest, weed and disease problems non-chemical approaches exist, and these should always be considered first, before resorting to the use of pesticides. Non-chemical approaches should always be adopted as the preferred approach unless there is good evidence that they are likely to be impractical, ineffective, excessively costly or likely to cause more harm to the environment than the use of pesticides.

Examples of non-chemical remedial control measures include the use of cultivation, mulches or hand weeding for vegetation control, the use of sanitation felling to prevent the spread of newly introduced pests, or the use of natural enemies such as predators, parasites or pathogens for the biological control of damaging pests. Again, regional specific examples of non-chemical remedial control measures for use in this generic system are given in the links provided from the ‘examples of strategies in practice’ section.

(ii) Chemical methods

Only if all other non-chemical control options have been considered and shown to be impractical, ineffective, excessively costly or likely to carry the risk of causing more harm to the environment, operators and indigenous peoples, should the use of pesticides be countenanced. For some problems, the use of biopesticides based on naturally occurring pathogens may have been developed, and these usually offer far lower risk of harm than conventional pesticides based on synthetic molecules or natural products.

Often a thorough understanding of the nature and likely impacts of the potential problem, and the adoption of a combination of management approaches such as avoiding the problem or non-chemical remedial action, can help to reduce, even if it does not wholly eliminate, the need for chemical use. The use of a combination of non chemical approaches with, if proves necessary, one or more pesticides used at optimum timings, may prove more effective and have a lower risk of negative impacts than relying on the repeated use of a single pesticide. A thorough understanding of the nature and impacts of the causal agent, along with a consideration of the full range of potential solutions, is at the heart of an integrated approach to pest, disease and weed management.

If, as a last resort, synthetic pesticides need to be used, the aim should be to select the pesticide or combination of pesticides, application method, timing and pattern that are effective, but offer the least risk to humans and non target wildlife, insects, fungi, aquatic life and flora. Figure 2 provides a decision framework which may be useful for managers in selecting the least risk chemical option. The pesticide decision framework comprises four main steps.

1) Consider if there are any long term landscape scale planning or conservation designations that may limit the use of pesticides

This may require consultation with relevant National Authorities or other interested parties, and is best carried out on a periodic basis as part of the normal long term planning process for a site. In addition to the usual prevailing pesticide regulations and restrictions that may apply for a particular pest or weed control operation, this may indicate further broad areas of usage that may need to be limited.

2) Determine the range of potentially suitable pesticides and application methods (including adjuvants)

Pesticides must be effective at controlling the target pest / weed / disease, but not harmful to the crop species when using an appropriate dose rate and application method. Only pesticide products permitted under the relevant national approvals system should be used. Pesticides designated as 'Highly Hazardous' by the FSC cannot be used in FSC certified estates without specific derogation, regardless of prevailing national approvals system.

3) Assess the possible non target effects of the remaining potential pesticides

In general, assuming that all legal requirements have been met, the aim should be to select the most selective, least hazardous pesticide or combination of pesticides, application method and pattern that pose least risk of harm to humans, and non target wildlife, insects, fungi, aquatic life and flora. However, this choice should be consistent with achieving effective control of the pest or weed. Even if a specific derogation has been granted, the presumption should be that those pesticides designated as 'Highly Hazardous' by the FSC should only be used as a last resort after all other non-chemical and chemical approaches have been considered. A full list of pesticides designated as 'highly hazardous' by FSC is available at http://www.fsc.org/internationalpolicies.html, guidance documents > FSC GUI 30 001 V2 0 EN FSC Pesticides Policy Guidance 2007 .pdf > Annex II.

The most important information on the relative hazard of each pesticide is contained in individual product labels and in safety data sheets available from manufacturers. Additional country specific guidance collating information on individual pesticide characteristics is also available from a variety of sources, for example the Pesticides Action Network (PAN) pesticides database (www.pesticideinfo.org/), the UK Forestry Commission Practice Guide on reducing pesticide use (http://www.forestry.gov.uk/forestry/infd-76lgsn) or the US National Pesticides Information Centre (www.npic.orst.edu/index.html) but many other equally good sources of information exist. For each proposed application site users should systematically consider the likely effects of the proposed application on operators, the aquatic environment, the local environment, neighbours and forest users including indigenous populations, then prioritise the site specific risk and hence the relative importance of specific pesticide characteristics. For example, in a relatively arid area close to a human settlement, a pesticide's effect on aquatic habitats may be less important than its risks to forest users. Consideration of the application

method and timing is as important as pesticide selection when aiming to minimise risk of non target impacts.

4) Select a suitable pesticide and application method

Based on the above assessment, it should now be possible to identify a pesticide, application method and pattern that is effective and economic, but poses the least risk to humans, and any non target wildlife, insects, fungi aquatic life and flora present throughout the full period of usage. If it has not been possible to identify a suitable pesticide and application methodology, the practicalities of using a previously rejected non-chemical method may need to be reconsidered.

5) Safe use of pesticides

Legislation detailing the legal requirements for the safe use of pesticides will vary from country to country and between regions. It is therefore vital that users are fully aware of national legislation, controls, and codes of practice, and they must comply with all relevant requirements. The product label usually provides the key source of information on the safe use of any pesticide.

The following elements are indicative of good practice when using pesticides, however it is important to note that **the specific requirements of national regulation should take precedence in all situations**:-

- Pay careful attention to choice of appropriate application rate, applicator, application method, timing, volume rate, calibration, droplet size, nozzle type and dilution rate.

- Ensure operators have the correct training for, and information on, the pesticide they are being asked to use, and are adequately protected from the harmful effects of the pesticide by carrying out a risk assessment, and using its results to provide appropriate procedures, engineering controls and personal protective equipment.

- Ensure local communities and forest users are adequately informed of pesticide use where it may be harmful, for example through the erection of suitable warning notices.

- Ensure weather conditions are appropriate at the time of spraying.

- Aerial spraying can be of especial concern due to the potential for spray drift to cause contamination of homes and local drinking water catchments. Therefore, before any aerial spraying takes place, it is particularly important to address all the factors listed above, including ensuring all possible practical steps are taken to avoid drift or overspraying of homes and their immediate local drinking water catchments.

- Take particular care when handling undiluted pesticides, as it is spillages at this stage that probably presents the greatest risk of environmental damage.

- Dispose of washing water, unused pesticides and used containers carefully and without harming the environment.

- Store and transport pesticides safely.

6) Record Keeping

In addition to the requirements of national regulation, users should as a minimum consider adopting the following elements of good practice when keeping records of pesticide use:-

- Retain a record of the risk assessment for operator safety, detailing the processes to be followed in carrying out the pesticide application, following appropriate legislation or guidelines.

- Record the quantities and name of pesticide used, application methodology, who made the application, where and when the pesticide was applied, and the prevailing weather conditions. Based on this information, in the future, certified estates may be asked to submit to a simple, summary annual pesticide return for each active ingredient used – see http://www.fsc.org/internationalpolicies.html, brochures > IPM Guide > Recording Sheet for Annual Use of Pesticide.pdf.

- Record any disposals or spillage (and the action taken to prevent pollution).

- Record the decision process and rationale for selecting a chemical or non-chemical method.

- Archive the records so they can be accessed at a later date.

Figure 3 provides an example decision recording form, based on the generic framework outlined above, that can be used by managers to record their strategy for eliminating, reducing, and minimising the impact of any remaining pesticide use. Note that it may not always be necessary to use this form for every individual control operation. It may instead be sufficient to record the decision process for a group of similar sites at the commencement of a proposed annual control programme, assuming no significant changes to site, pest, disease or weed problem, or control technology, occur during the proposed period of operations.

List of Figures

Figure 1: Core decision key

Use this key to fill in Stage 1 of the recording sheet.

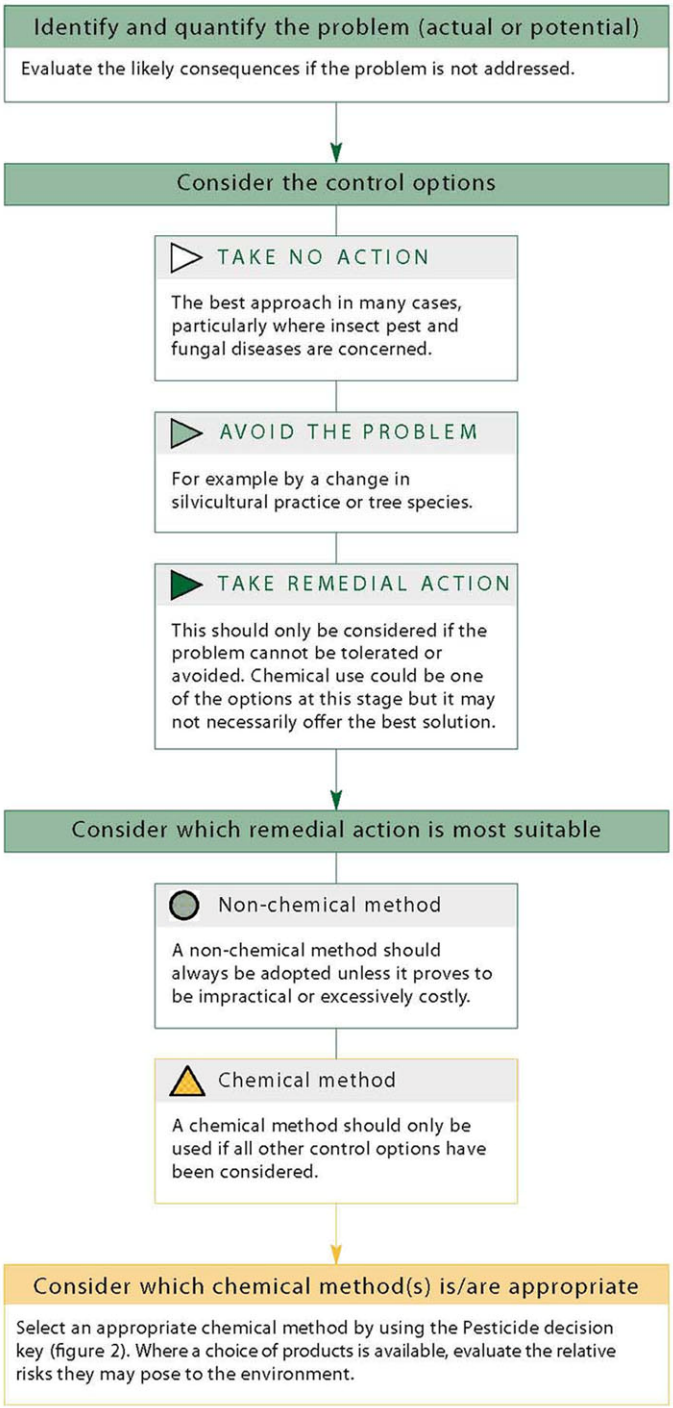

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Figure 2: Pesticide decision key

Use this key to fill in Stage 2 of the recording sheet.

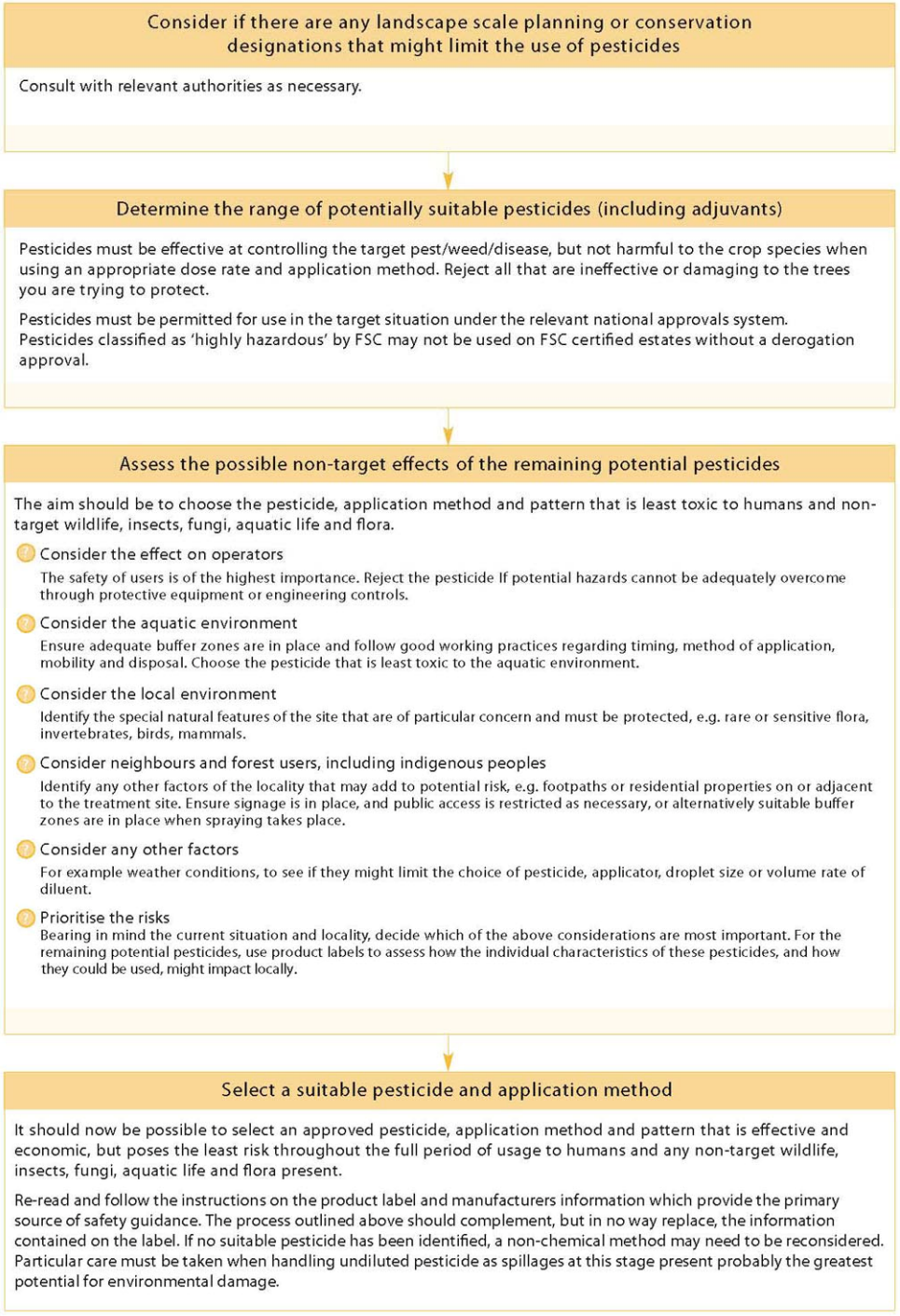

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Figure 3: Decision recording sheet

Completed by: ..... Date: .....

Site name: ..... Compartment name/no.: .....

STAGE 1: use Core decision key

What is the problem and what are the likely consequences if the problem is not addressed?

Which control option is most suitable?

TAKE NO ACTION | AVOID THE PROBLEM | TAKE REMEDIAL ACTION(S)

Continue to next step

Tick as appropriate and note reason for choice.

Which remedial action(s) is most suitable?

Non-chemical method(s) | Chemical method(s)

Continue to Stage 2

Tick as appropriate and note reason for choice. Record why a non-chemical method is unsuitable. Often a combination of methods will be the most appropriate solution.

STAGE 2: use Pesticide decision key

Which chemical method(s) is most suitable?

Note reason for choice.

If no suitable pesticide can be identified, a non-chemical method may need to be reconsidered.

Archive this sheet in a safe place for future reference.

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