Circular 545

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Using Natural Enemies to Manage Pests

C. A. Boyles and P. G. Koehler

To Help You

As you use this publication, watch for words written in *italics*. Look in the glossary in the back for an explanation of these words.

Statement of Purpose

In the 1960's and 1970's, people began to worry about the harmful effects of *pesticides* and other poisons. Pesticides are needed to manage many pests of man, his crops and animals. To help protect soil, water and air (the *environment*), man no longer uses some pesticides.

Integrated Pest Management (IPM) is an effective, but less harmful way of managing pests of all kinds. An IPM user looks at the whole picture — the *pest*, the *host*, and the environment. Then following IPM methods, the user chooses one or several ways to manage the pest.

Most pesticides are made from the same materials as gas and oil. Gas and oil are also used to apply pesticides. Through IPM, wiser use of pesticides helps to save energy.

The purpose of this book is for you to learn the basic ideas of IPM. You may learn how to use natural enemies to manage pests safely, with less energy and lower costs.

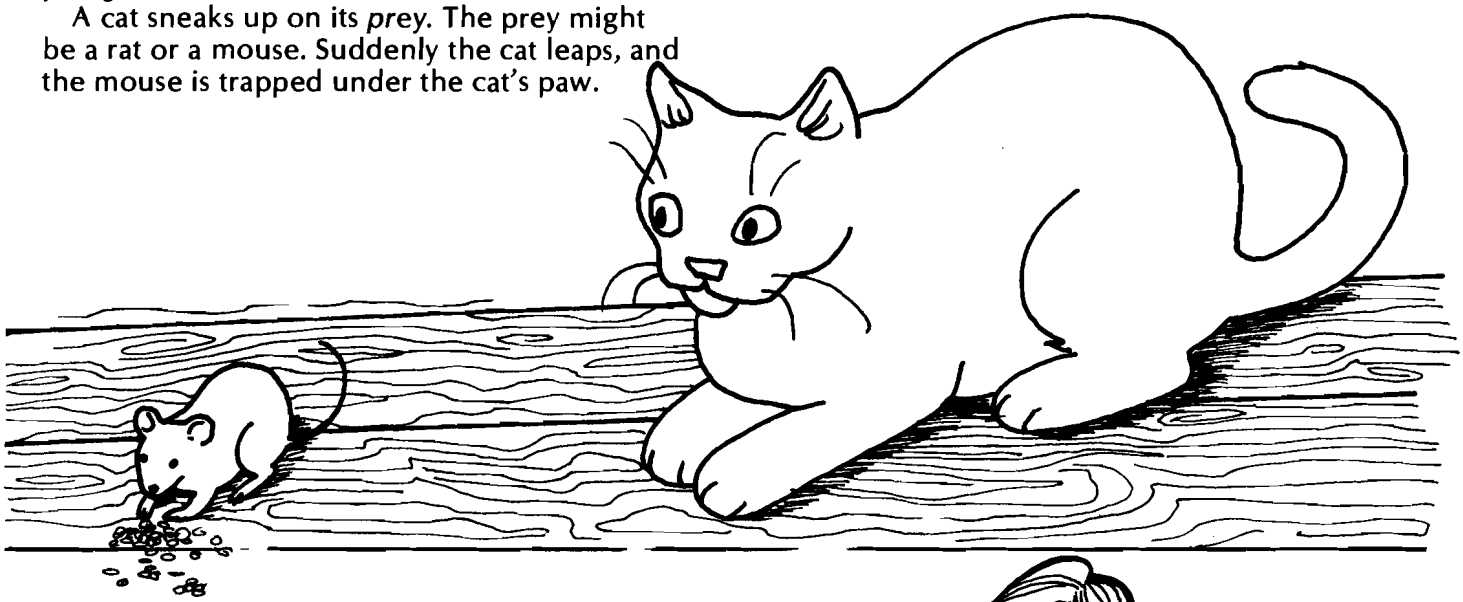
For more information, check these publications, available from your County Extension agent.

Pest Management — Where to Start? — Circular 548
All About Pests — Circular 543
Cultural Practices to Manage Pests — Circular 547
Spraying Away Pests — Circular 544
Plants Protected from Pests — Circular 546
The ABC's of IPM — Circular 549

Managing Pests Naturally

Have you ever watched the animals around you get their food?

A cat sneaks up on its *prey*. The prey might be a rat or a mouse. Suddenly the cat leaps, and the mouse is trapped under the cat's paw.



From man's point of view, the cat is doing something *beneficial* or good. It is helping to get rid of man's pests in a natural way.

Rats and mice may eat man's food. Sometimes they have diseases that may be passed on to man by fleas and filth.

Rats and mice are pests of man. The cat is the pest's *natural enemy*.

Using Natural Enemies — The Idea of Biological Control

Man can use natural enemies to help manage many pests. This is called biological control.

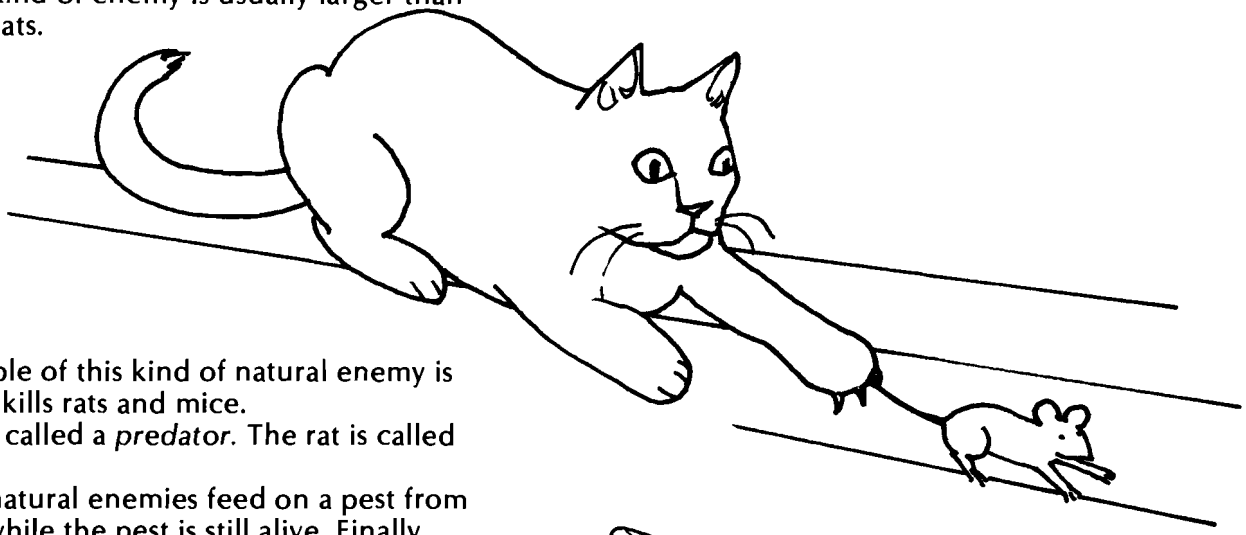
The idea of biological control is simple. One kind of *organism* is kept in balance by another kind of organism.

Many kinds of pests can be managed biologically. Insects can be managed by other insects or by diseases. Weeds can be managed by insects or by plant *pathogens*. Rodents can be kept in check by larger animals, such as cats and owls.

Three Kinds of Natural Enemies

Natural enemies may manage pests in one of three ways:

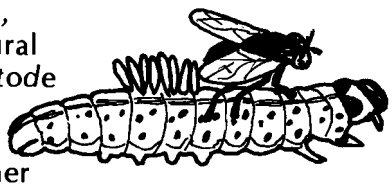
1. A natural enemy may kill a pest and then eat it. This kind of enemy is usually larger than the pest it eats.



An example of this kind of natural enemy is the cat that kills rats and mice.

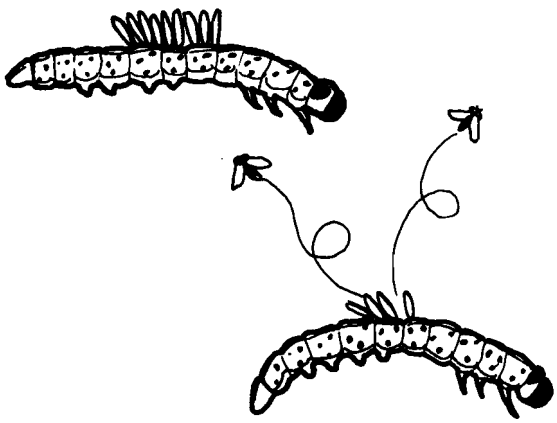
The cat is called a *predator*. The rat is called its prey.

2. Some natural enemies feed on a pest from the inside while the pest is still alive. Finally, this causes the pest to die. This kind of natural enemy is usually either an insect or a *nematode* (worm).



Some kinds of flies and wasps manage caterpillars in this way. The female fly lays her eggs on the caterpillar. When the eggs hatch, the fly *larvae* burrow into the caterpillar's body. The larvae eat the caterpillar's insides. The caterpillar gets weaker and weaker and finally dies. Then the fly larvae become *pupae*, and finally hatch into adult flies. The cycle can then happen again.

This kind of natural enemy is called a *parasite*.



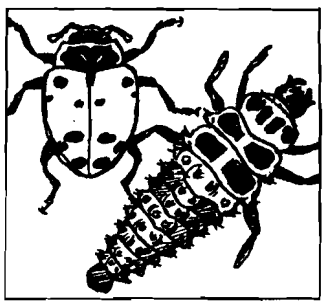
3. Some natural enemies *infect* organisms, including pests. These natural enemies are very tiny organisms. You probably could not see them without a microscope. But you can certainly see their effects.

This kind of natural enemy is called a pathogen. Pathogens give the pest a disease. The pests most often managed by pathogens are insects and weeds.

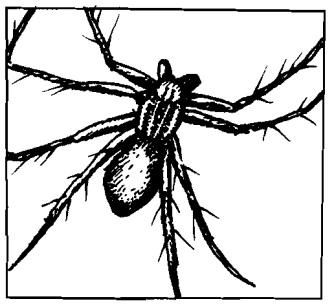
Caterpillars on vegetables are often treated this way. A bacteria called *Bacillus thuringiensis* can be sprayed on the plants. When caterpillars eat plants sprayed with this, they get sick and die.

There are many different kinds of natural enemies. Probably the largest group is the insect predators. These beneficial *species* help man manage the harmful insects. Here are some illustrations of a few beneficial insects. Learn to recognize these.

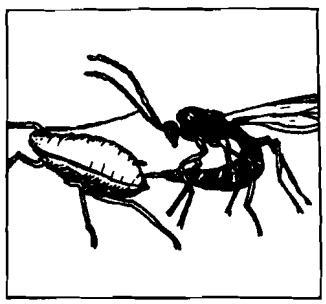
Beneficial Insects and Their Relatives



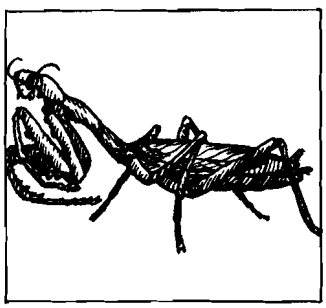
Ladybird Beetle and Larva



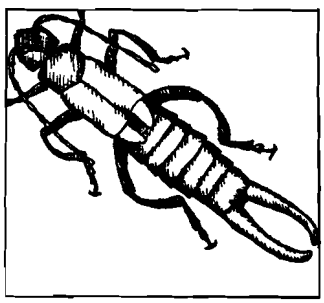
Garden Spider



Braconid Wasp Parasitizing Aphid



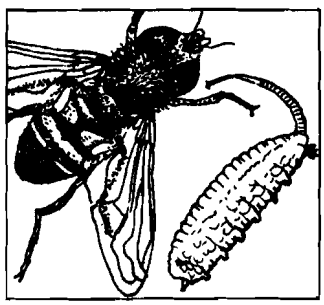
Praying Mantis



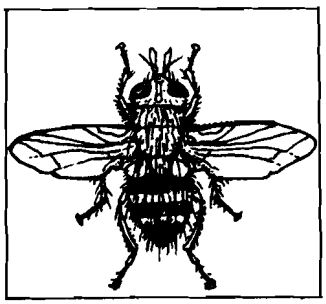
Earwig

Ground Beetle

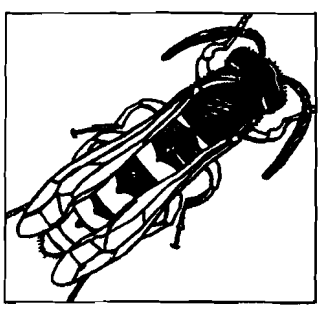
Tiger Beetle



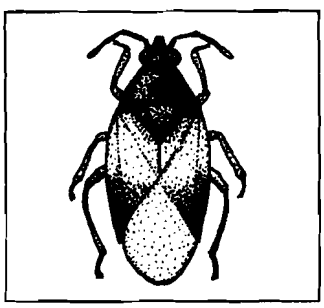
Syrphid Fly and Larva



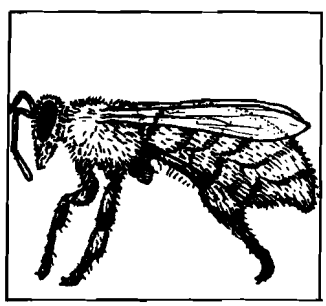
Tachinid Fly



Yellow Jacket Wasp



Predaceous Flower Bug



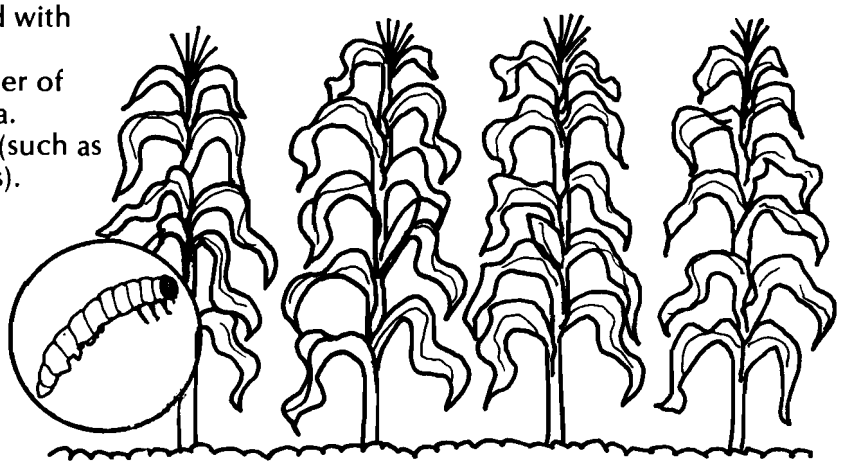
Honey Bee

Natural Enemies Work in Groups

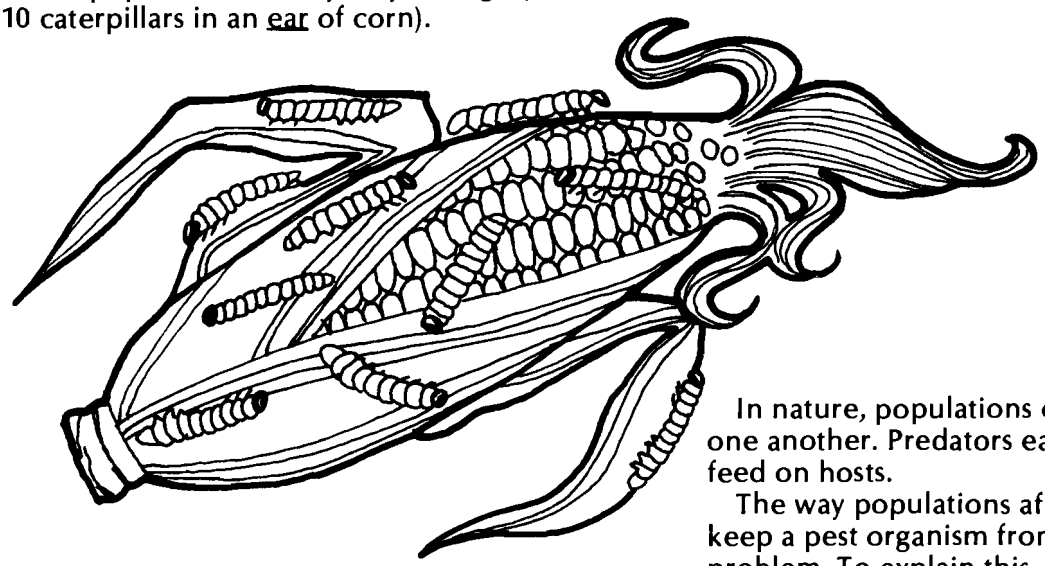
In nature, organisms exist in groups. These groups are called *populations.* A population is a group of organisms of the same kind. That is, they are all dogs, or cats, or horses, or house flies. Members of the group can breed with one another and have young.

Population *density* means the number of organisms of one kind in a known area.

The population density may be low (such as 10 caterpillars in an acre of corn plants).



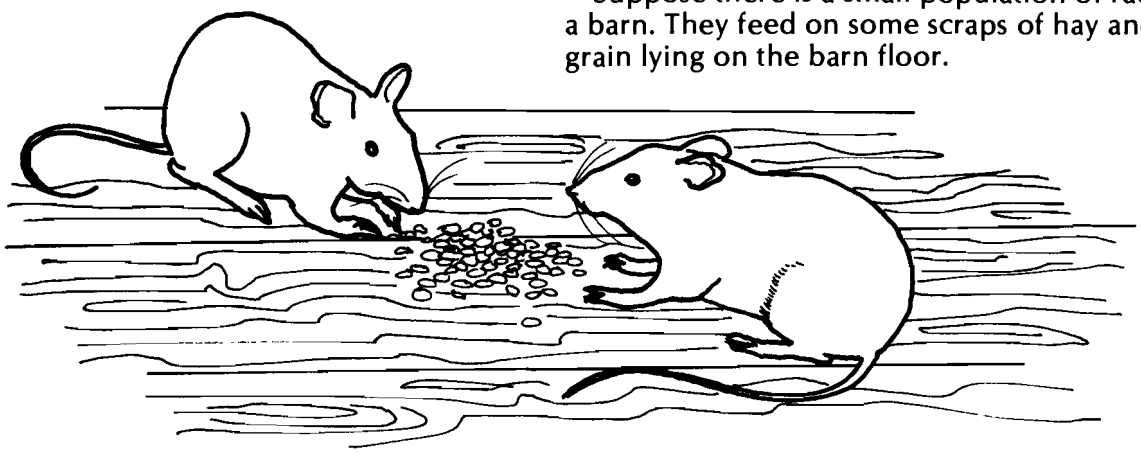
The population density may be high (such as 10 caterpillars in an ear of corn).

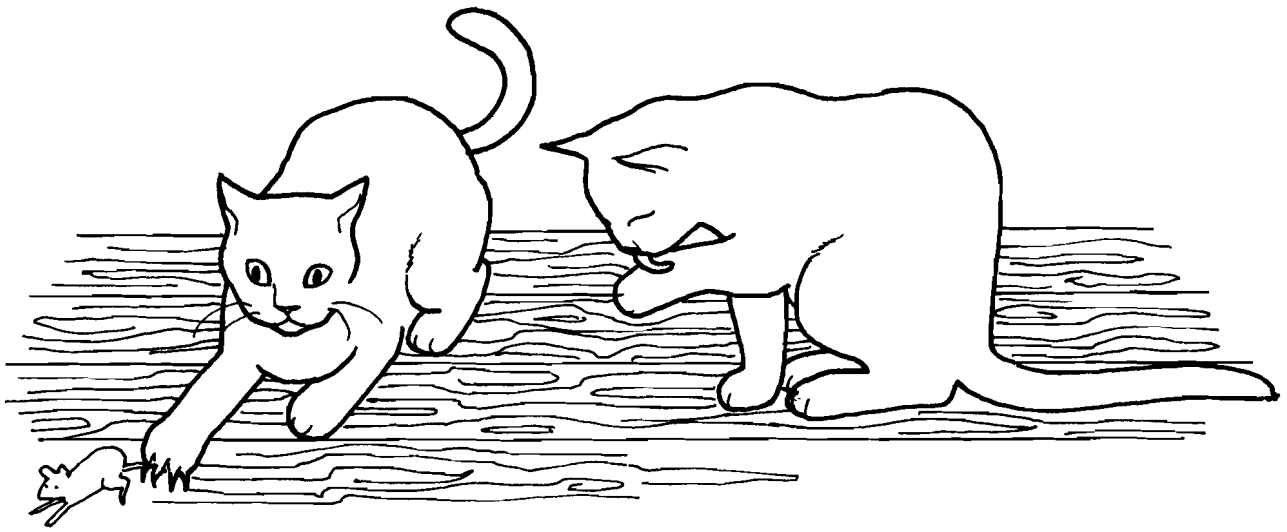


In nature, populations of organisms affect one another. Predators eat their prey. Parasites feed on hosts.

The way populations affect one another can keep a pest organism from becoming a problem. To explain this, let's talk about rats and cats in a barn.

Suppose there is a small population of rats in a barn. They feed on some scraps of hay and grain lying on the barn floor.





Suppose there are also two cats that live in the barn. They sometimes catch and eat a rat.

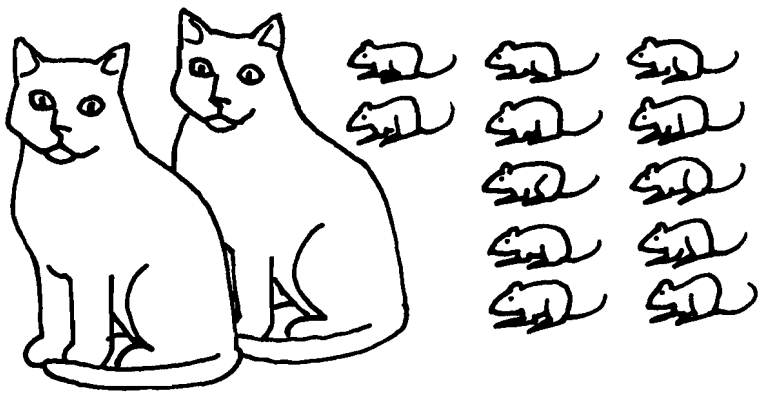
Because the cats do not have many rats to eat, they do not have many kittens. The kittens they do have may go away to live and hunt. So, the population of cats stays about the same.

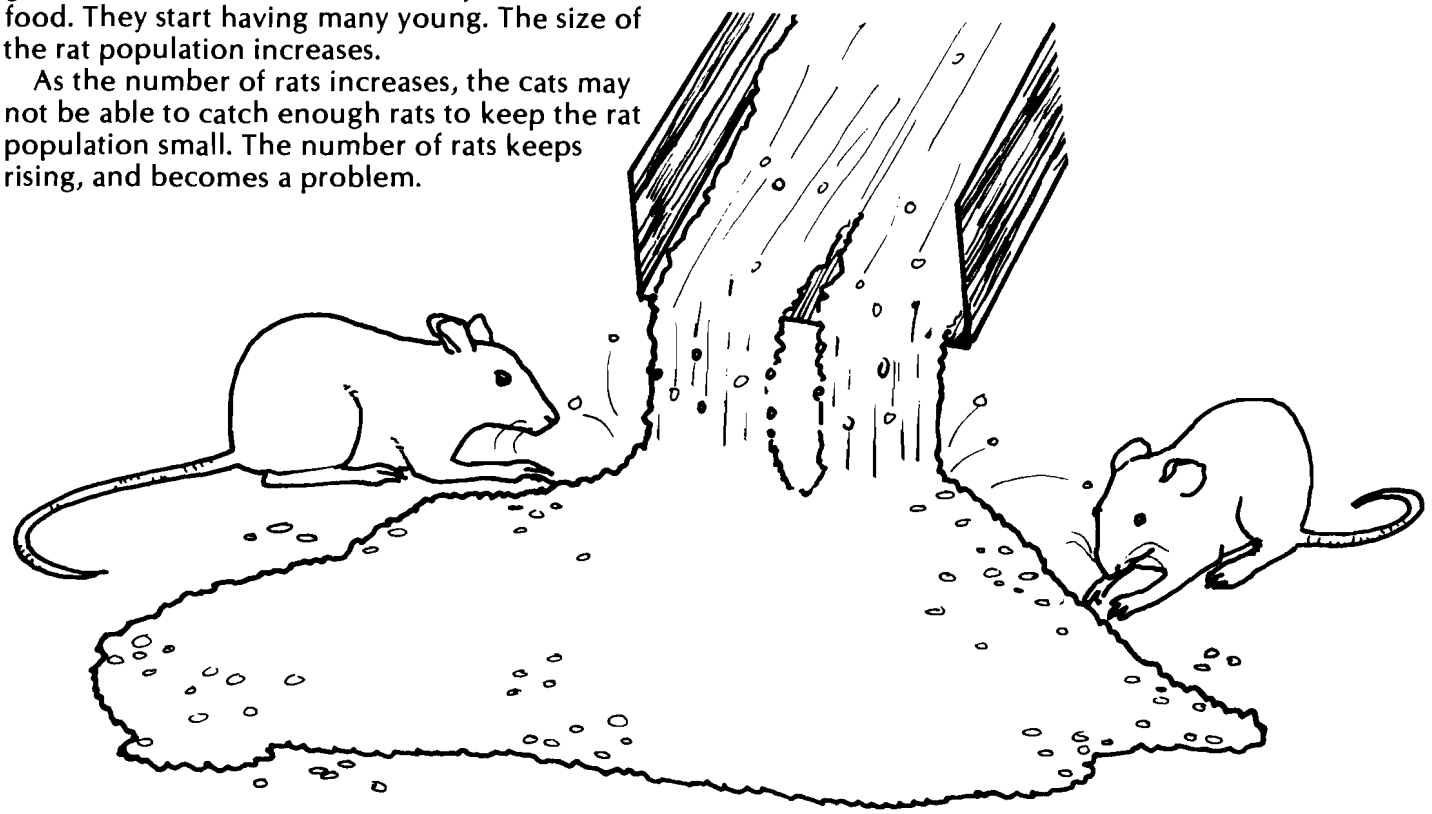
Because the rats do not have much to eat either, they do not have many young rats. Some of the rats that are born are soon eaten by the cats. The population of rats also stays about the same.

If conditions in the barn change, the populations of both rats and cats may change.

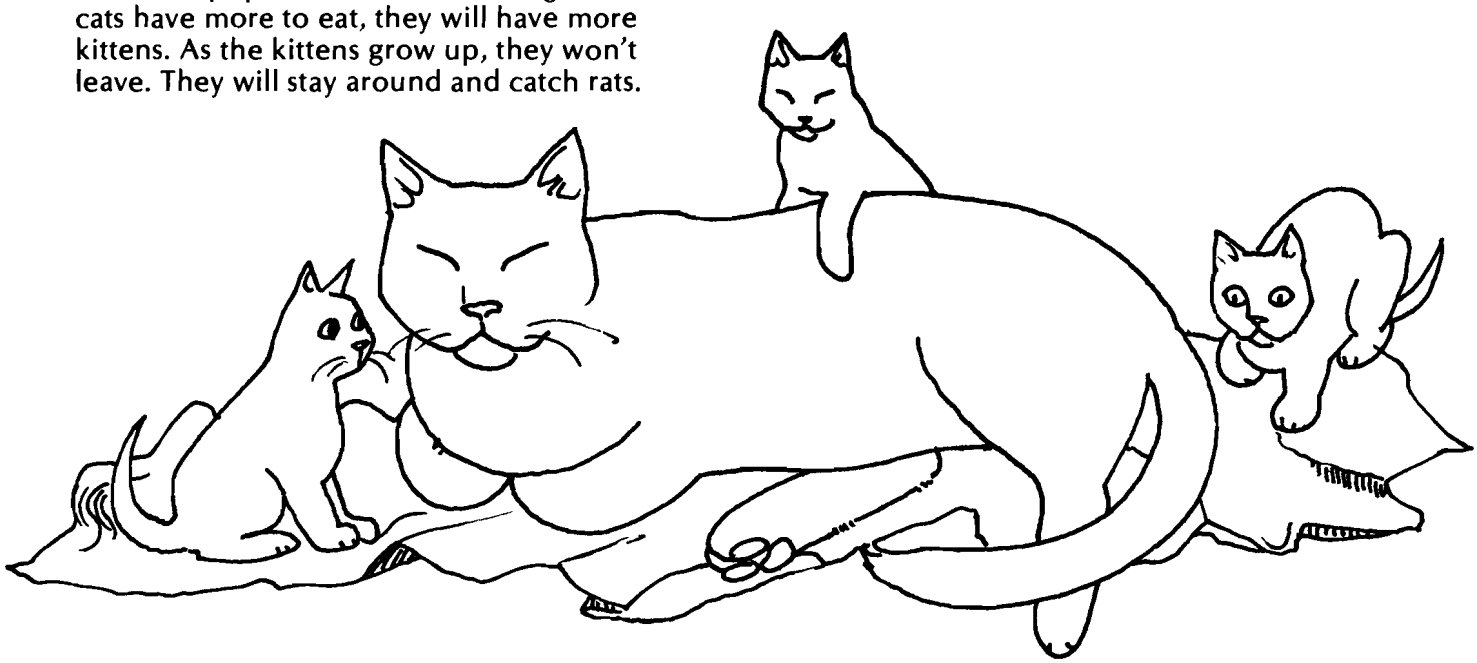
For example, the farmer may place a lot of grain in the barn. The rats suddenly have lots of food. They start having many young. The size of the rat population increases.

As the number of rats increases, the cats may not be able to catch enough rats to keep the rat population small. The number of rats keeps rising, and becomes a problem.



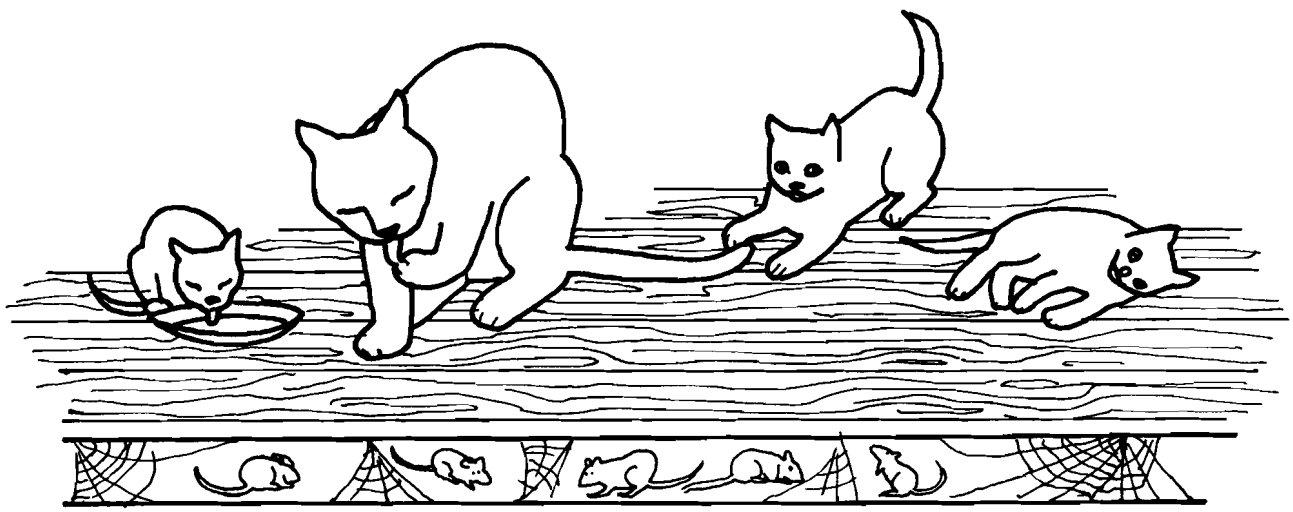


The cat population will also change. As the cats have more to eat, they will have more kittens. As the kittens grow up, they won't leave. They will stay around and catch rats.



After a while, the cats may start catching more rats than are being born. The rat population will get smaller and smaller. There will not be enough rats for the cats to feed on. Hungry cats will again start to leave the cat population. They will look for food somewhere else.

Soon the cat population and the rat population will stop changing. The cats will catch enough rats to keep the rat population small. The rats will have enough young rats to feed the cat population.



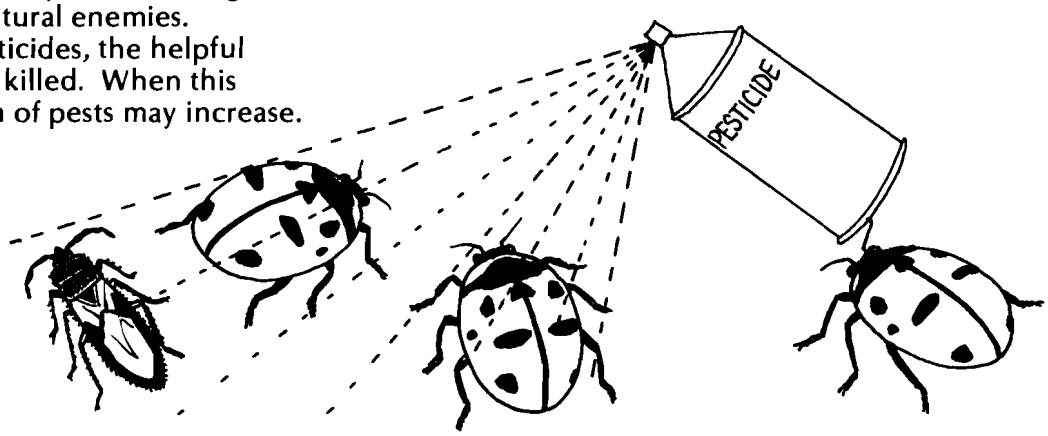
These ideas can be applied to any biological control situation. The pest can be rats or caterpillars. The natural enemy can be cats or flies. The natural enemy works the same way in both cases.

It is important to understand that the effect a natural enemy has on a pest is always changing. It depends on the population density of both the pest and the natural enemy.

How Man Can Use Biological Methods

Man can use biological methods in four ways:

1. The most important way to use biological methods is to protect natural enemies. Sometimes, in using pesticides, the helpful natural enemies may be killed. When this happens, the population of pests may increase.



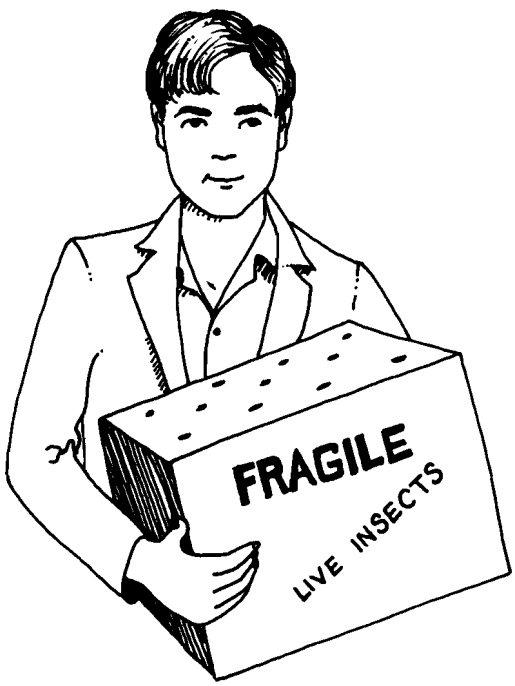
This is certainly not good. Therefore, we must try to avoid killing natural enemies with pesticides when possible.

Protecting natural enemies is called conservation.

2. Sometimes, there aren't enough natural enemies to manage the pests. Then more natural enemies can be released.

For example, suppose there are very many rats but only one or two cats. The cats will not be able to hold down the rats. The farmer can release many more cats to help get rid of the rats.

Managing pests by flooding them with natural enemies is called inundation.



3. Some of our pests have come from other parts of the world. They have accidentally been brought into this part of the country. Here they have become pests because they have no natural enemies.

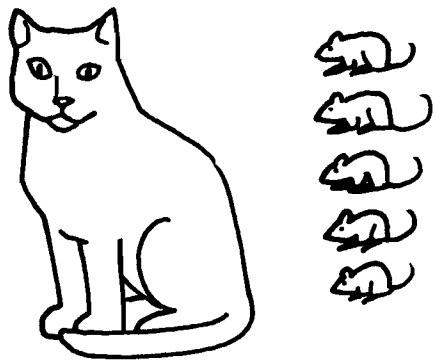
Scientists can look for natural enemies where the pest came from. Then they can bring the natural enemies to the pest.

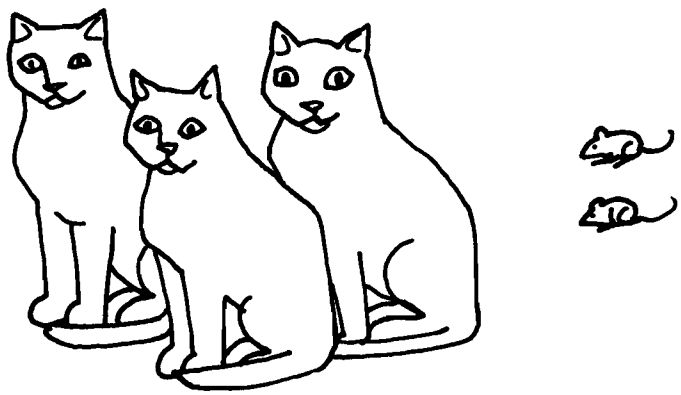
Bringing in a new natural enemy from another area is called importation. Scientists must be very careful when they import a natural enemy. They must be sure that the enemy will eat **ONLY** the pest. They must also know if any organisms will harm the imported enemy. Also, they should import only the natural enemy, and no other organisms.

4. Small numbers of a natural enemy can be released into an area where there are none. This will start a population of the enemy.

For example, a farmer may release a few cats in a barn where there are lots of rats. For a while, there will not be enough cats to manage the rats. But eventually the cat population gets larger. Then there will be enough cats to manage the rats.

Helping a population of natural enemies to get started in called inoculation.

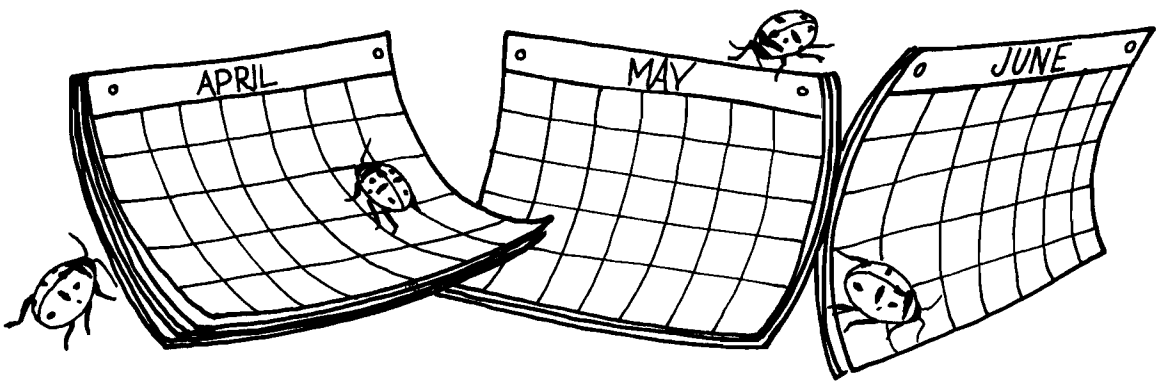




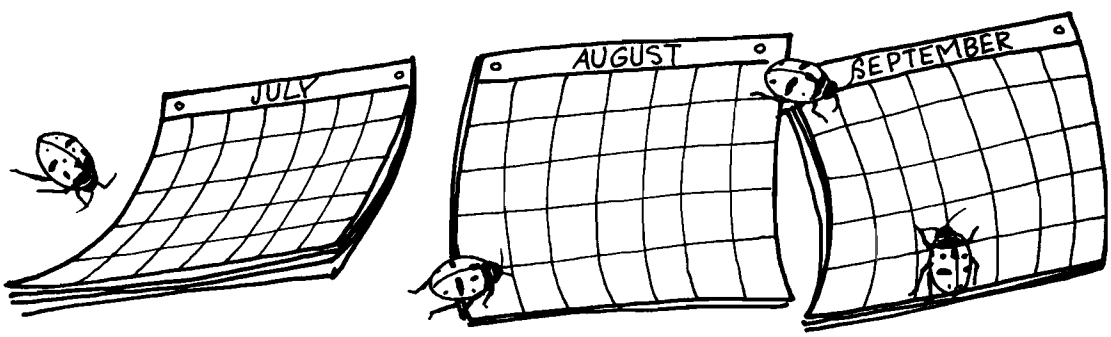
How Biological Methods Are Different

Biological methods are different from other pest management tools. These differences may be good or bad. It depends on the situation.

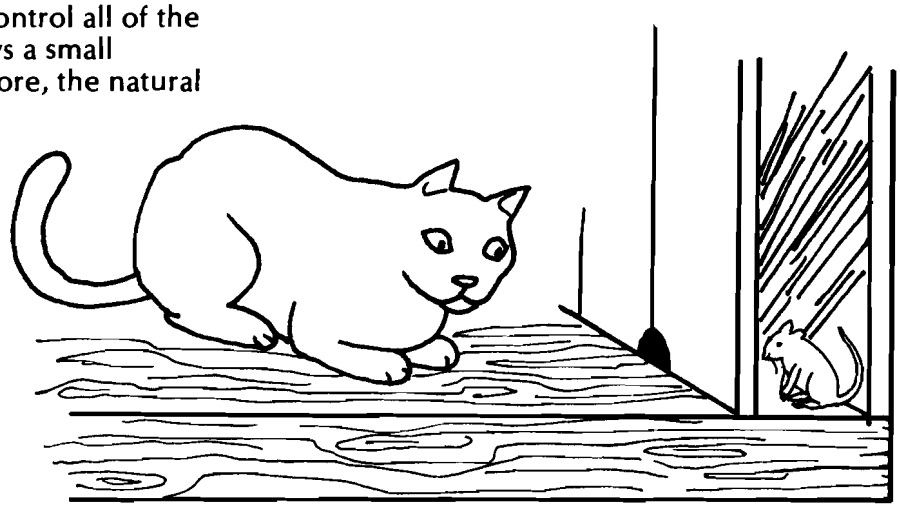
1. Natural enemies do not work as fast as pesticides do. It takes time for a natural enemy to control a pest.



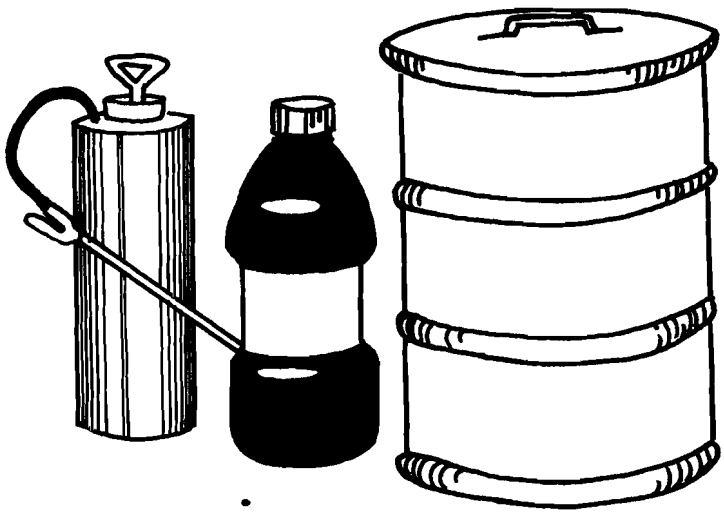
2. If a natural enemy does manage the pest, the natural enemy may keep on working for a long time.



3. Natural enemies do not control all of the pests in an area. There is always a small population of the pest. Therefore, the natural enemy always has food.

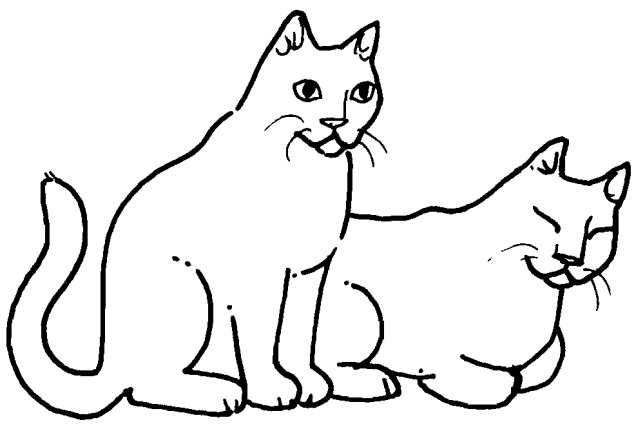


4. Most kinds of biological methods are harder to use than pesticides. They are also harder to *misuse* than pesticides because they are not poisons.



poisonous

Also, most biological methods do not require a lot of energy use to work well. So, biological methods of pest management help conserve energy.



non-poisonous

How Biological Methods Are Used in IPM

Biological methods are an important tool in an Integrated Pest Management program.

You learned about all of the IPM tools in **Pest Management — Where to Start — Circular 548.**

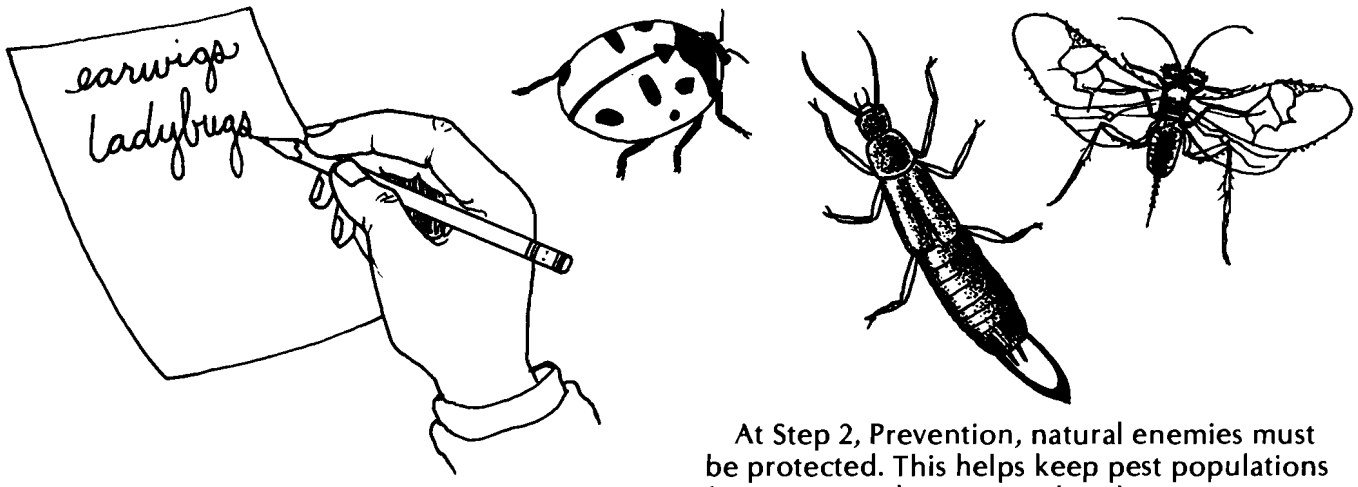
Biological methods
Mechanical methods
Physical methods
Regulatory methods
Chemical methods
Cultural practices
Host resistance methods

In **Pest Management — Where to Start,** you also learned about the six-step IPM process:

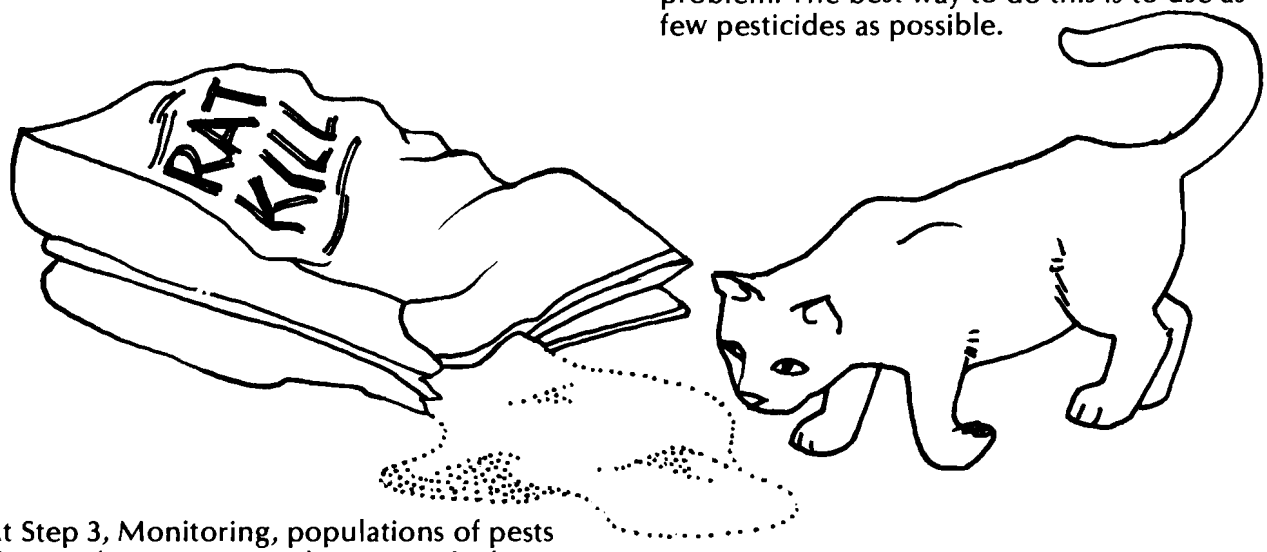
Step 1. Identification
Step 2. Prevention
Step 3. Monitoring
Step 4. Prediction
Step 5. Decision
Step 6. Evaluation

Biological methods are used at several steps in an IPM program.

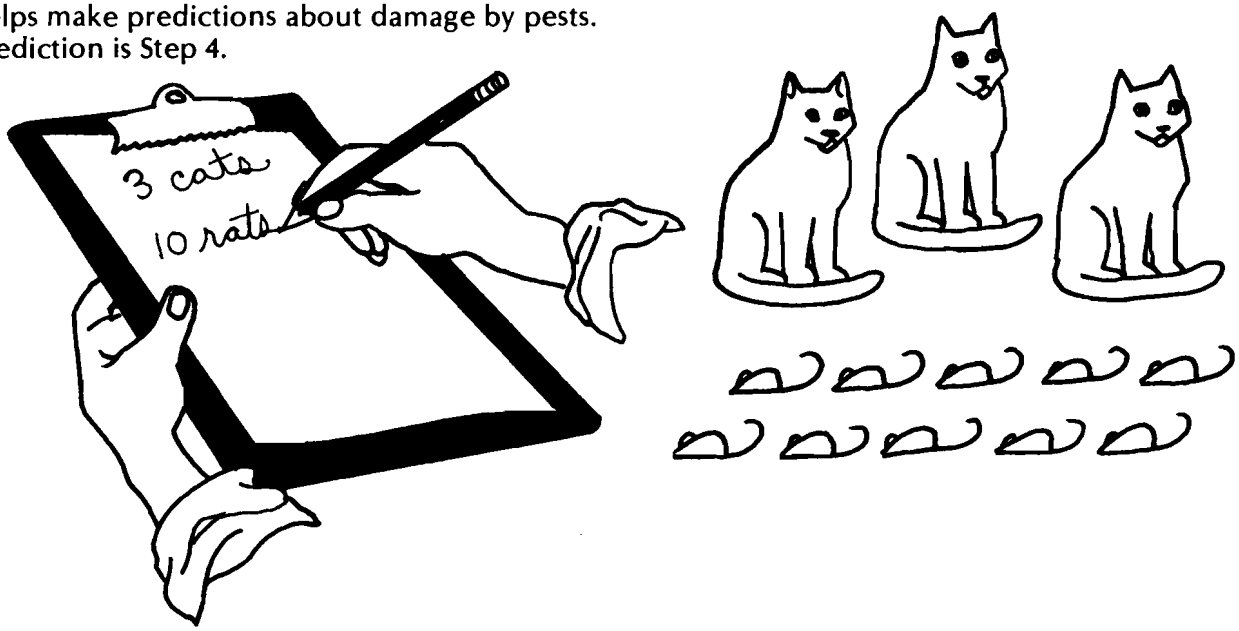
At Step 1, Identification, natural enemies must be identified.



At Step 2, Prevention, natural enemies must be protected. This helps keep pest populations from growing large enough to become a problem. The best way to do this is to use as few pesticides as possible.

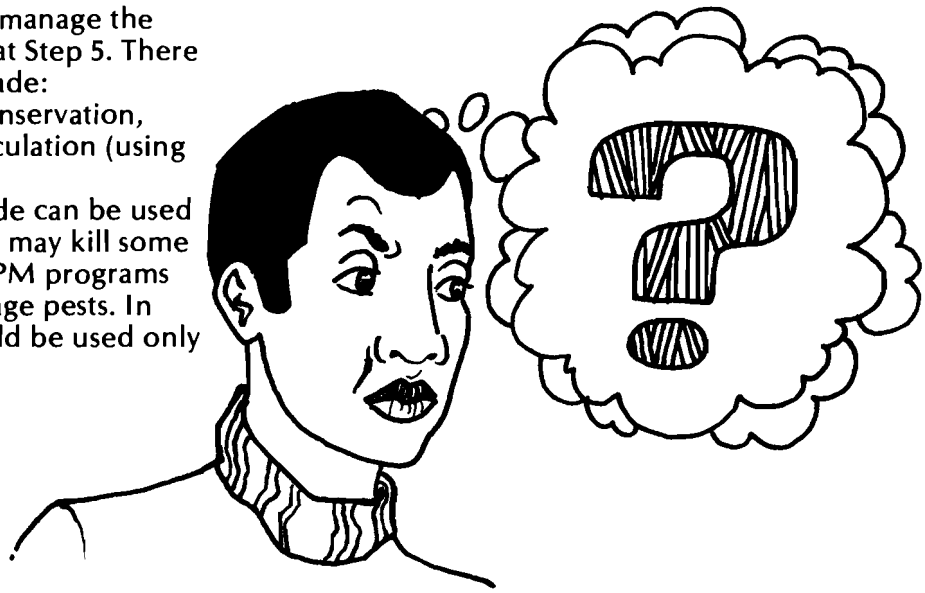


At Step 3, Monitoring, populations of pests and natural enemies must be counted. This helps make predictions about damage by pests. Prediction is Step 4.



If the natural enemies do not manage the pests, a decision must be made at Step 5. There are three choices that can be made:

1. Help natural enemies by conservation, importation, inundation, or inoculation (using biological methods).
2. Apply a pesticide. A pesticide can be used to kill the pest. Unfortunately, it may kill some natural enemies as well. Many IPM programs rely on natural enemies to manage pests. In these programs, pesticides should be used only as a last resort.



3. Do nothing. The cost of either helping the natural enemy or applying a pesticide may be too high. If so, a decision may be made to do nothing.

Using IPM Tools Together

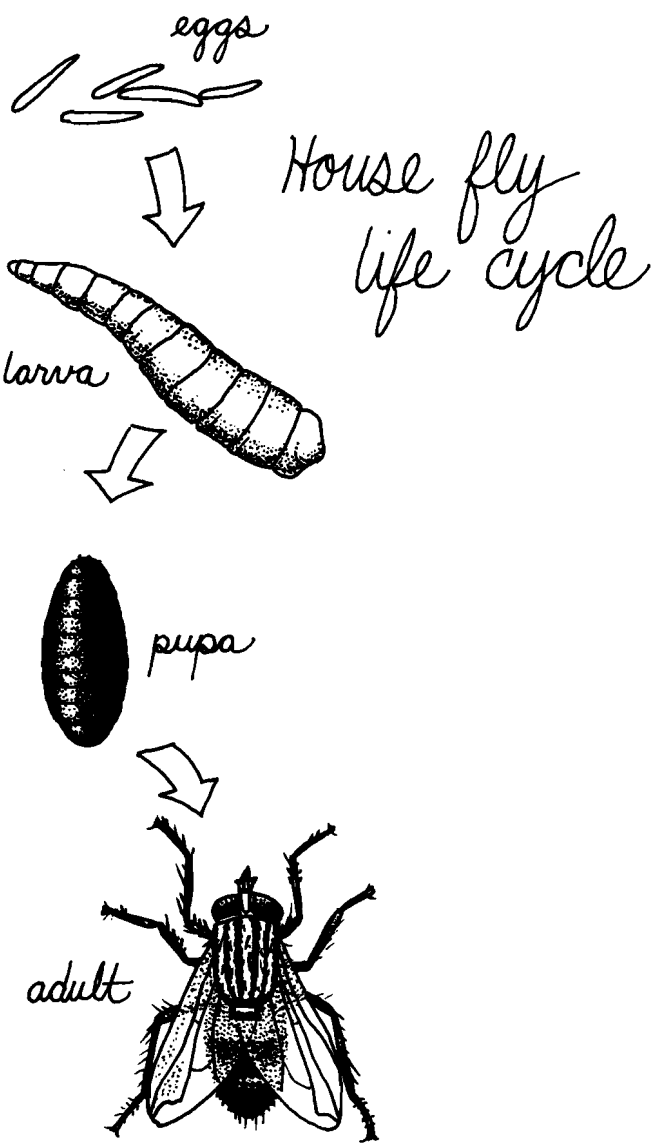
When beginning an IPM program, a homeowner or producer needs to consider this. How will the different tools of pest management affect each other? Using a natural enemy will not affect how the other tools of IPM work. The other tools of IPM, though, will affect how well a natural enemy manages a pest.

Glossary

1. Beneficial — Helpful; something that is good, or that helps something else.
2. Density — The population in a known area.
3. Environment — Surroundings, including anything that affects man, other animals or plants.
4. Host — Any plant or animal that shelters or gives a home to a parasite or other natural enemy.
5. Infect — To contaminate as to cause disease.
6. Larva — One stage in the life of some insects. A larva hatches from an egg. When it has grown as large as it is going to, it becomes a pupa, and then an adult. Some kinds of larvae are caterpillars, or maggots, or grubs.
7. Misused — Used wrongly or improperly.
8. Natural enemy — An organism that kills and eats, or lives on another organism.
9. Nematode — A tiny worm-like organism that lives in the soil and damages the roots of plants. Nematodes may live in the soil, in water, in animals, or in plants.
10. Organisms — Living things; includes all animals and plants.
11. Parasites — An animal or plant that lives on or in another organism, from which it gets food and shelter. In IPM, a natural

enemy that kills pests. Parasites are usually smaller than the pests. Example: fly maggots eating large caterpillars.

12. Pathogen — Very tiny organism that causes a disease. The three types of pathogens are fungi, bacteria, and viruses.
13. Pest — An organism that hurts something or is bad for something that belongs to man. A pest may be an insect, a plant, an animal, a disease, or any other kind of organism.
14. Pesticides — Poisons that are used to kill organisms that man regards as pests. Insecticides kill insects. Herbicides kill plants. Fungicides kill fungi.
15. Population — A group of organisms, all of the same species, that lives in an area. They are capable of reproducing.
16. Predators — Natural enemies that kill and eat pests. Predators are usually larger than pests. Example: cat = predator, mouse = pest.
17. Prey — An organism that a predator catches and eats.
18. Pupa — One stage in the life of some insects. Some pupae are also called cocoons. A pupa is the "resting" stage in the insect's life. An adult insect will hatch from it. Pupae — Plural of pupa.
19. Species — One kind of plant or animal; a group of plants or animals that are alike. Man is one species. Dogs are one species. One species may have different varieties. For instance, German Shepherd and Doberman are varieties of dogs.



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